Lake Powell Pipeline

Preliminary Draft
Biological Assessment

March 2019

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Table of Contents

Tables

Figures

Appendices

Appendix A – Noise Buffer Zone Maps
Appendix B – Avian Survey Report, Lake Powell Pipeline Project, January 2010
Appendix C – Draft Lake Powell Pipeline Project, Avian Survey Report, September 2010
Appendix D – Draft Lake Powell Pipeline Project, Mojave Desert Tortoise Survey Report, September 2010
Appendix E – Nesting Raptor Survey Report

Abbreviations and Acronyms

AGFD	Arizona Game and Fish Department
Alt.	Alternate
AMSL	Mean Sea Level
BA	Biological Assessment
BLM	Bureau of Land Management
BMP	best management practice
BPS	Booster Pump Station
CWA	Clean Water Act
dBA	A-weighted decibel
ECOS	Environmental Conservation Online System
EEI	Edison Electrical Institute
EIS	Environmental Impact Statement
ESA	Endangered Species Act
FCR	field contact representatives
FERC	Federal Energy Regulatory Commission
FR	Federal Register
GAP	Gap analysis of species distribution
GIS	Geographic Information System
GPS	Global Positioning System
HCP	Habitat Conservation Plan
HDMS	Heritage Data Management System
HS	Hydro Generating Station
KCWCD	Kane County Water Conservancy District
kV	Kilovolt
LPP	Lake Powell Pipeline
MOU	Memorandum of Understanding
MW	megawatt
Reclamation	Bureau of Reclamation
ROW	Right-of-way
SITLA	Utah School and Institutional Trust Lands Administration
SWPPP	stormwater pollution prevention plan
UBWR	Utah Board of Water Resources
UCDC	Utah Conservation Data Center
UDWRe	Utah Division of Water Resources
USFWS	U.S. Fish and Wildlife Service
WCWCD	Washington County Water Conservancy District

Chapter 1
Proposed Action

The Lake Powell Pipeline Project (LPP) would deliver Utah's Colorado River water from Lake Powell to southwest Utah via a system of pipeline and penstock segments. The Proposed Action would deliver 86,249 acre-feet of municipal and industrial use water to the following water conservancy district service areas:

- Washington County Water Conservancy District (WCWCD) would receive 82,249 acre-feet annually.
- Kane County Water Conservancy District (KCWCD) would receive up to 4,000 acre-feet annually.

Construction of the LPP will require permits from multiple federal agencies. These permits will: allow access to and use of lands and resources administered by the Bureau of Land Management (BLM), National Park Service (NPS), and Bureau of Reclamation (Reclamation); authorize a new source of hydroelectric power under the authority of the Federal Energy Regulatory Commission (FERC); and allow for construction of the LPP and the Lake Powell Intake under the Clean Water Act (CWA) and the Rivers and Harbors Act.

The proposed LPP Project triggers a need for federal action on the part of each of the involved agencies.

- The BLM's need for federal action arises from its responsibility under Section 501 of the Federal Land Policy and Management Act of 1976 and other laws to respond to the Utah Board of Water Resources' (UBWR) right-of-way (ROW) request.
- The NPS's need for federal action arises from its responsibility to administer land use authorizations and its authority to grant ROWs for water conduits under 36 C.F.R. §§14.1-14.96.
- Reclamation's need for federal action arises from its responsibility under Federal Reclamation Law and 43 C.F.R. Part 429, Subpart C to respond to UBWR's request for a ROW license agreement, and its request for a long-term water service or exchange contract.
- Under sections 4(e) and 10(a) of the Federal Power Act, the FERC must decide whether to issue a license to the UBWR for the proposed hydroelectric developments.
- The U.S. Army Corps of Engineers need for action stems from its obligations under section 404 of the CWA and section 10 of the Rivers and Harbors Act.

1.1 Pipeline and Ancillary Facilities

The Proposed Action consists of five systems: **Water Intake, Water Conveyance, Hydro, KCWCD, and Transmission Line** (see Figure 1-1).

The **Water Intake System** would pump Lake Powell water via submerged horizontal tunnels and vertical shafts into the LPP. The intake pump station would be constructed and operated adjacent to the west side of Lake Powell, approximately 2,000 feet northwest of Glen Canyon Dam in Coconino County, Arizona. An enclosed pump station building would house vertical turbine pumps with electric motors, electrical controls, and other equipment at a ground level elevation of 3,745 feet above mean sea level (AMSL).

The **Water Conveyance System** would convey water diverted from Lake Powell at the Intake System through a buried 69-inch diameter pipeline for about 51 miles, parallel with U.S. Highway 89 in Coconino County, Arizona and Kane County, Utah, to a buried regulating tank (High Point Regulating Tank-2) along U.S. Highway 89 at ground level elevation 5,691 feet AMSL. The pipeline would be a line of connected pipes used for carrying water over a long distance. Figure 1-2 shows the LPP Water Intake and Water Conveyance systems. The High Point

Regulating Tank-2 would be the LPP topographic high point (Figure 1-2). The pipeline would be sited within a utility corridor established by Congress in 1998 that extends 500 feet south and 240 feet north of the U.S. Highway 89 centerline on public land administered by the BLM. Figure 1-3 shows the typical 100-foot-wide right-of-way and 50-foot-wide temporary construction easement for the water conveyance system pipeline, adjacent to and away from the highway.

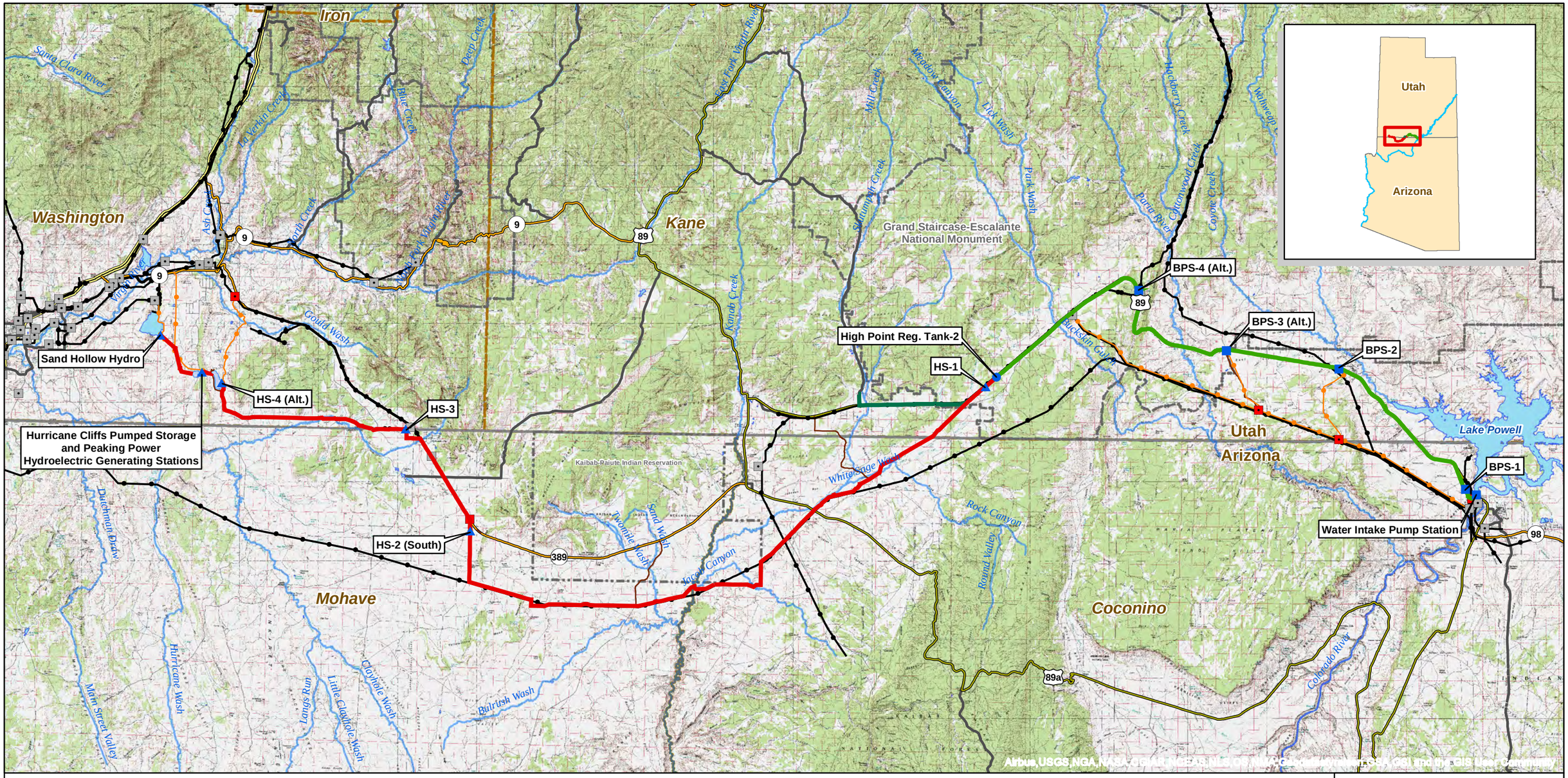
Four booster pump stations (BPS) along the pipeline would pump water to the high point regulating tank. Each BPS would house vertical turbine pumps with electric motors, electrical controls, and other equipment. Additionally, each BPS site would have a buried forebay tank, buried surge tanks, pig retrieval and launching stations, and a surface emergency overflow detention basin. BPS-1 would be located within the Glen Canyon National Recreation Area adjacent to an existing Arizona Department of Transportation maintenance facility, along a segment of abandoned highway, west of U.S. Highway 89. The BPS-1 site would cover about six acres and be surrounded by security fencing.

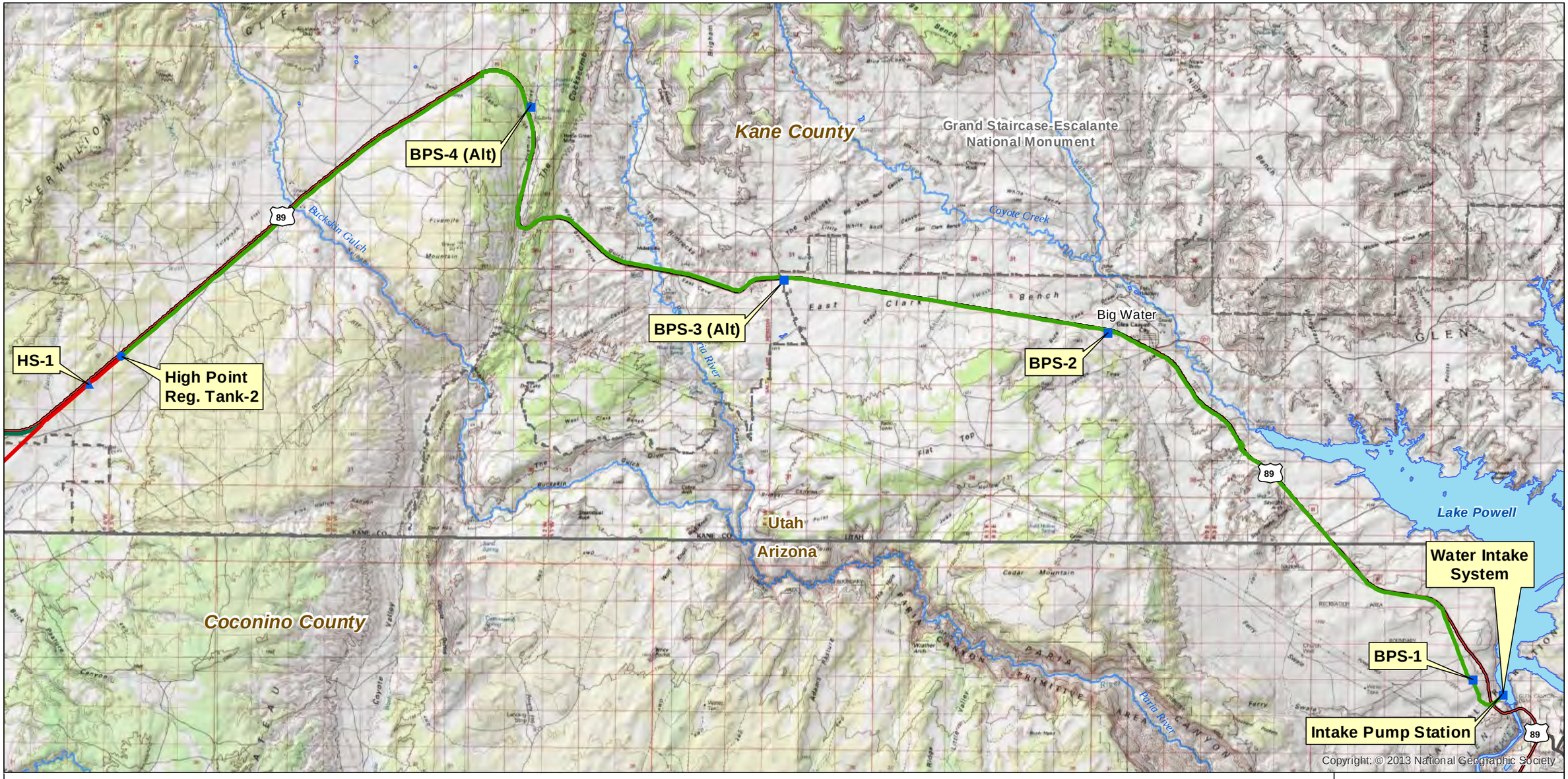
BPS-2 would be on land administered by Utah School and Institutional Trust Lands Administration (SITLA) near Big Water, Utah, on the south side of U.S. Highway 89. The BPS-2 site would cover about five acres and be surrounded by security fencing.

BPS-3 (Alternate or Alt.) would be on land administered by the BLM Kanab Field Office on the south side of U.S. Highway 89, within the Congressionally-designated utility corridor. The BPS-3 (Alt.) site would cover about five acres and be surrounded by security fencing.

BPS-4 (Alt.) would be located on private land east of U.S. Highway 89 and west of the Cockscomb geologic feature (Figure 1-2). The BPS-4 (Alt.) site would cover about six acres and be surrounded by security fencing. The proposed pipeline alignment west of the Cockscomb geologic feature would be situated adjacent to the south boundary of the Congressionally-designated utility corridor.

The proposed pipeline alignment would continue parallel to U.S. Highway 89 to the buried High Point Regulating Tank-2 at 5,691 feet AMSL, which would be the topographic high point of the LPP (Figure 1-2). The Water Conveyance System would terminate at High Point Regulating Tank-2. The buried High Point Regulating Tank-2 would cover about four acres and be surrounded by security fencing.


Iron
Washington
Kane
Mohave
Coconino
Utah
Arizona
Grand Staircase-Escalante National Monument
Kaibab-Paiute Indian Reservation
Lake Powell
Sand Hollow Hydro
HS-4 (Alt.)
HS-3
HS-2 (South)
High Point Reg. Tank-2
HS-1
BPS-4 (Alt.)
BPS-3 (Alt.)
BPS-2
BPS-1
Water Intake Pump Station
Hurricane Cliffs Pumped Storage and Peaking Power Hydroelectric Generating Stations
Santa Clara River
Virgin River
Gould Wash
Buckskin Gulch
White Sage Wash
Sand Wash
Rock Canyon
Round Valley
Colorado River
Dutchman Draw
Hurricane Wash
Main Street Valley
Langs Run
Little Clayhole Wash
Clayhole Wash
Bulrush Wash
Deep Creek
Blue Creek
Meadow Canyon
Kanab Creek
Park Wash
Coyote Creek
Cottonwood Creek
Hackberry Creek
Water Conveyance System
Hydro System - Proposed Action (Penstock Segment)
KCWCD Alternative
Project Transmission Lines
Existing Transmission Lines
Project Pump Station
Project Regulating Tank
Project Hydro Station
Substation
Proposed Substation
Interstate
US Highway
ST Highway
Hwy
Major Road
Access Roads
Hurricane Cliffs Forebay/Afterbay
Lakes & Reservoirs
Major Rivers & Streams
National Park/Monument
Tribal Lands
State Boundaries
County Boundaries
FERC Project Number: 12966-001
BLM Serial Numbers: AZA-34941 UTU-85472
N
0 2.25 4.5 9 13.5 18 Miles
Lake Powell Pipeline Project
Spatial Reference: UTM Zone 12N, NAD-83
UDWRe Figure 1-1 Stantec
Lake Powell Pipeline Proposed Action



- Project Pump Station
- Project Regulating Tank
- Project Hydro Station
- Water Conveyance System
- South Variant Alternative
- KCWCD Alternative
- Interstate
- US Highway
- ST Highway
- Hwy
- Major Road
- Major Rivers & Streams
- Lakes & Reservoirs
- National Park/Monument
- State Boundaries

FERC Project Number:
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UTU-85472

N

0 0.5 1 2 3 4 Miles

Lake Powell Pipeline Project

Spatial Reference: UTM Zone 12N, NAD-83

UDWRe **Figure 1-2** Stantec

Intake and Water Conveyance System

Figure 1-3 shows the typical ROW for the hydro system penstock adjacent to, and away from, the highway. Four in-line hydro generating stations (HS-1, HS-2 [South], HS-3, and HS-4 [Alt.]), with substations located along the penstock, would generate electricity and help control water pressure in the penstock. Each in-line hydro station would consist of a building housing the generator units, an afterbay reservoir, retention basin, pig retrieval and launching stations, switchyard, and maintenance parking area, all surrounded by perimeter security fencing.

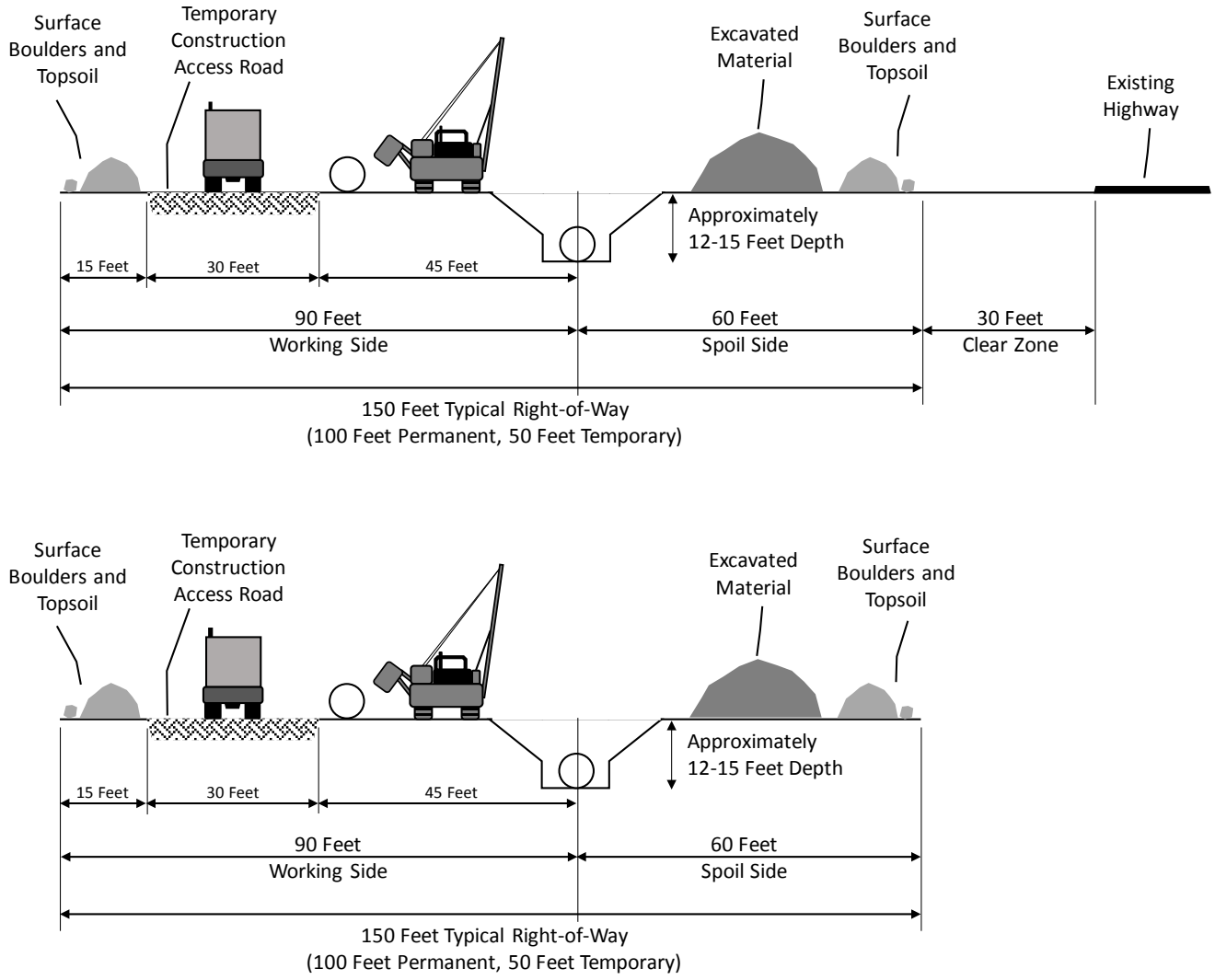


Figure 1-3
Pipeline and Penstock Right-of-Way

The **Hydro System** would convey the water from High Point Regulating Tank-2, at a topographic high point in the LPP with ground level elevation 5,691 feet AMSL, for about 87.5 miles through a buried 69-inch diameter penstock in Kane and Washington counties, Utah, and Coconino and Mohave counties, Arizona, to Sand Hollow Reservoir near St. George, Utah (Figure 1-4). A penstock is an enclosed pipe that delivers water to hydroelectric turbines.

A short penstock segment would convey the water to HS-1. This in-line hydro station would generate up to one MW of electricity at a site along U.S. Highway 89, and the penstock would continue west along U.S. Highway 89. The HS-1 site would cover about five acres.

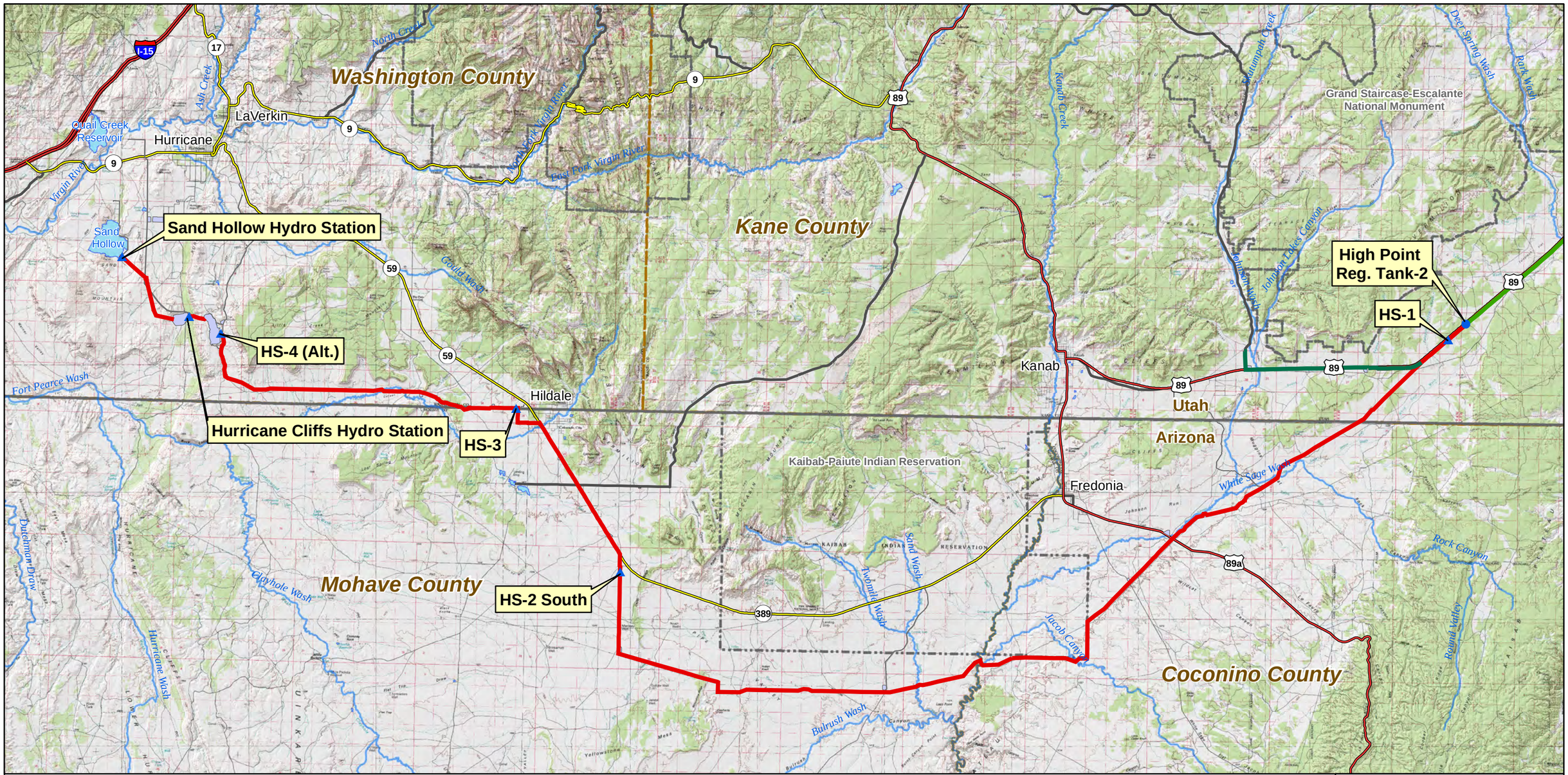
The penstock alignment would turn south from U.S. Highway 89 through private land and BLM-administered public lands into White Sage Wash. It would continue across White Sage Wash and then parallel Navajo-McCullough Transmission Line, crossing U.S. Highway 89 Alt. and Forest Highway 22 toward the southeast corner of Kaibab-Paiute Indian Reservation. The penstock alignment would run parallel to and south of the Kaibab-Paiute Indian Reservation south boundary, crossing Kanab Creek and Bitter Seeps Wash. It would continue across Moonshine Ridge and Cedar Ridge to Yellowstone Road. At this point, the penstock alignment would run north along Yellowstone Road to Arizona State Route 389 west of Kaibab-Paiute Indian Reservation. HS-2 (South) would be located west of Kaibab-Paiute Indian Reservation on private land east of Yellowstone Road. HS-2 (South) would generate up to 1 megawatt (MW) of electricity. The HS-2 (South) site would cover about five acres. The penstock alignment would continue northwest along the south side of Arizona State Route 389 past Colorado City to Hildale City, Utah, and HS-3. HS-3 would be located on private land west of Hildale City, Utah, north of and adjacent to Uzona Road. HS-3 would generate up to 1 MW of electricity. The HS-3 site would cover about five acres. A turnout for future delivery of 13,249 acre-feet of WCWCD's allocation of LPP water to Apple Valley would be located immediately west of HS-3.

The penstock alignment would follow Uzona Road west through Canaan Gap and south of Little Creek Mountain, turning north to HS-4 (Alt.) above the proposed Hurricane Cliffs forebay reservoir. HS-4 (Alt.) would be located on about three acres of public land administered by the BLM. HS-4 (Alt.) would generate up to 1.7 MW of electricity and would discharge into the forebay reservoir.

The forebay reservoir would be contained in a valley between two dams (south and north), maintaining active storage of 11,255 acre-feet of water. The forebay reservoir and two dams would cover about 500 acres of public land administered by the BLM and would be surrounded by security fencing. A low-pressure tunnel would convey the water to a high-pressure vertical shaft in the bedrock forming the Hurricane Cliffs, connected to a high-pressure tunnel near the bottom of the Hurricane Cliffs. The high-pressure tunnel would connect to a penstock conveying the water to a 35 MW peaking power hydroelectric generating station and a 300 MW pumped storage hydroelectric generating station.

The Hurricane Cliffs hydroelectric generating stations and tailrace channel would cover about 50 acres of public land administered by the BLM and would be surrounded by security fencing. The tailrace channel would discharge into an afterbay reservoir with 3,551 acre-feet of operating capacity, which is contained by a single dam in the valley below the Hurricane Cliffs. The afterbay reservoir and dam would cover about 200 acres of public land administered by the BLM and would be surrounded by security fencing.

Water would be released from the forebay reservoir through the hydro generating system to meet peak power demands. Water would be pumped from the afterbay reservoir into the forebay reservoir during periods of off-peak power demand. The forebay and afterbay reservoirs would not be open to public access because the water levels would fluctuate rapidly during daily operations. A low-pressure tunnel would convey the water northwest from the afterbay reservoir to a penstock, continuing to the Sand Hollow Hydro Station, which would generate up to 4.2 MW of electricity. The Sand Hollow Hydro Station would be located on land owned by WCWCD and


Washington County
Kane County
Mohave County
Coconino County
Utah
Arizona
Sand Hollow Hydro Station
HS-4 (Alt.)
Hurricane Cliffs Hydro Station
HS-3
HS-2 South
High Point Reg. Tank-2
HS-1
Hurricane
LaVerkin
Hildale
Kanab
Fredonia
Sand Hollow
Quail Creek Reservoir
Fort Pearce Wash
Kaibab-Paiute Indian Reservation
Grand Staircase-Escalante National Monument
I-15
9
17
59
89
389
89a
Project Pump Station
Project Regulating Tank
Project Hydro Station
Hurricane Cliffs Forebay/Afterbay
Lakes & Reservoirs
Water Conveyance System
Hydro System, South Variant Alternative
KCWCD System
Interstate
US Highway
ST Highway
Hwy
Major Road
National Park/Monument
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State Boundaries
County Boundaries
Major Rivers & Streams
FERC Project Number: 12966-001
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N
0 1 2 4 6 8 Miles
Lake Powell Pipeline Project
Spatial Reference: UTM Zone 12N, NAD-83
UDWRe
Figure 1-4
Stantec
Lake Powell Pipeline Hydro System

cover about five acres adjacent to Sand Hollow Reservoir. The LPP water would discharge from the Sand Hollow Hydro Station into the existing Sand Hollow Reservoir.

The **KCWCD System** would convey water diverted from Lake Powell through the LPP. The pipeline would begin on BLM land on the south side of U.S. Highway 89 and continue for about eight miles through a buried 24-inch diameter pipeline in Kane County, Utah, near the mouth of Johnson Canyon. The pipeline would parallel the south side of U.S. Highway 89 across Johnson Wash and then run north for 5,000 feet to the mouth of Johnson Canyon (Figure 1-4).

1.2 Transmission Lines

Transmission line alignments have been identified to transmit electric power to pump stations in the Water Intake and Water Conveyance systems, and to transmit electric power generated by hydroelectric stations in the Hydro System. The transmission lines that would serve the Water Intake and Water Conveyance systems are located in the east half of the LPP. The transmission lines that would serve the Hydro System are located in the western half of the LPP.

The proposed new **Water Intake Transmission Line** would begin at Glen Canyon Substation and run parallel to U.S. Highway 89 for about 2,500 feet to a new switch station, cross U.S. Highway 89 at the Intake access road intersection, and continue northeast to a new electrical substation on the Intake Pump Station site. This 69 kilovolt (kV) transmission line would be 0.9 mile long in Coconino County, Arizona (Figure 1-5).

The proposed new **BPS-1 Transmission Line** would begin at the new switch station located on the south side of U.S. Highway 89 and parallel the LPP Water Conveyance System alignment to a new electrical substation on the BPS-1 site west of U.S. Highway 89. The 69 kV transmission line would be about one mile long in Coconino County, Arizona (Figure 1-5).

The proposed new **Glen Canyon to Buckskin Transmission Line** would consist of a 230 kV transmission line from the Glen Canyon Substation to the Buckskin Substation, running parallel to the existing 138 kV transmission line. This transmission line upgrade would be about 36 miles long through Coconino County, Arizona, and Kane County, Utah (Figure 1-5).

The existing **Buckskin Substation** would be upgraded as part of the proposed project to accommodate the additional power loads from the new 230 kV Glen Canyon to Buckskin transmission line. The substation upgrade would require an additional five acres of land adjacent to the existing substation in Kane County, Utah (Figure 1-5).

The existing **Paria Substation** would be upgraded as part of the proposed project to accommodate the additional power loads to BPS-4 (Alt.). The substation upgrade would require an additional two acres of privately-owned land adjacent to the existing substation in Kane County, Utah (Figure 1-5).

The proposed new **BPS-2 Transmission Line** would consist of a new three-ring switch station along the new 230 kV Glen Canyon to Buckskin Transmission Line, a new transmission line from the switch station to a new substation west of Big Water, and a connection to BPS-2 substation in Kane County, Utah. The new transmission line would parallel an existing distribution line that runs northwest, north, and then northeast to Big Water. This new 138 kV transmission line alignment would be about seven miles long across SITLA-administered land, with a 138 kV connection to a new electrical substation on the BPS-2 site (Figure 1-5).

The proposed new **BPS-3 (Alt.) Transmission Line South** would consist of a new three-ring switch station along the new 230 kV Glen Canyon to Buckskin Transmission Line, and a new transmission line from the switch station north along an existing BLM road to a new electrical substation on the BPS-3 (Alt.) site within the

Congressionally-designated utility corridor. This new 138 kV transmission line alignment would be about 5.9 miles long in Kane County, Utah (Figure 1-5).

The proposed new **BPS-4 (Alt.) Transmission Line** would begin at the upgraded Paria Substation and run north to a new electrical substation on the BPS-4 (Alt.) site. This 69 kV transmission line would be about 0.4 mile long in Kane County, Utah (Figure 1-5).

The proposed new **HS-1 Transmission Line** would begin at the new HS-1 and tie into the existing 69 kV transmission line along U.S. Highway 89 from the Buckskin Substation to the Johnson Substation. The HS-1 69 kV transmission line would be about 400 feet long in Kane County, Utah (Figure 1-6).

The proposed new **HS-2 (South) Transmission Line** would connect the HS-2 hydroelectric station and substation to an existing 138 kV transmission line paralleling Arizona State Route 389. This new 34.5 kV transmission line would be about 0.9 mile long in Mohave County, Arizona (Figure 1-6).

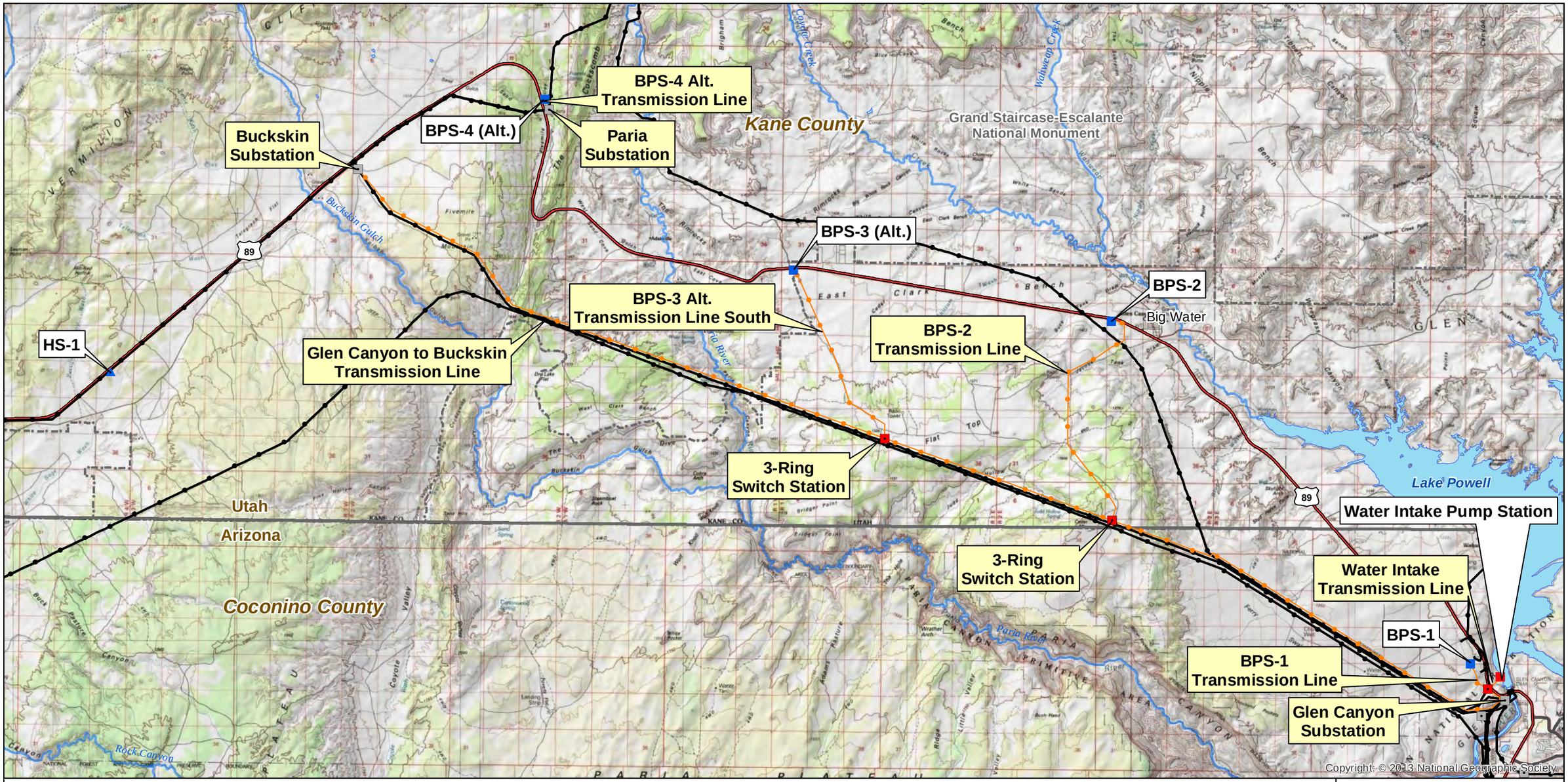
The proposed new **HS-3 Transmission Line** would connect the HS-3 hydroelectric station and substation to the existing Twin Cities Substation in Hildale City, Utah. The new 12.47 kV transmission line would be about 0.6 mile long in Washington County, Utah (Figure 1-6).

The proposed new **HS-4 (Alt.) Transmission Line** would connect the HS-4 (Alt.) hydroelectric station and substation to an existing transmission line parallel to Utah State Route 59. The new 69 kV transmission line would be about 7.5 miles long in Washington County, Utah (Figure 1-6).

The proposed new **Hurricane Cliffs Afterbay to Sand Hollow Transmission Line** would consist of a new 69 kV transmission line, which would run northwest from the Hurricane Cliffs peaking power plant and substation to the Sand Hollow Hydro substation. This new 69 kV transmission line would be about 4.9 miles long in Washington County, Utah (Figure 1-6).

The proposed new **Hurricane Cliffs Afterbay to Hurricane West Transmission Line** would consist of a new 345 kV transmission line, running from the Hurricane Cliffs pumped storage power plant northwest and then north to the planned Hurricane West 345 kV substation. This new 345 kV transmission line would be about 10.9 miles long in Washington County, Utah (Figure 1-6).

The proposed new **Sand Hollow to Dixie Springs Transmission Line** would consist of a new 69 kV transmission line, running from the Sand Hollow Hydro substation around the east side of Sand Hollow Reservoir and north to the existing Dixie Springs Substation. This new 69 kV transmission line would be about 3.4 miles long in Washington County, Utah (Figure 1-6).



- Project Intake Pump Station
- Project Pump Station
- Project Hydro Station
- Substation
- Proposed Substation
- Project Transmission Lines
- Existing Transmission Lines
- Interstate
- US Highway
- ST Highway
- Hwy
- Major Road
- Lakes & Reservoirs
- Major Rivers & Streams
- National Park/Monument
- State Boundaries

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12966-001
BLM Serial Numbers:
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UTU-85472

N

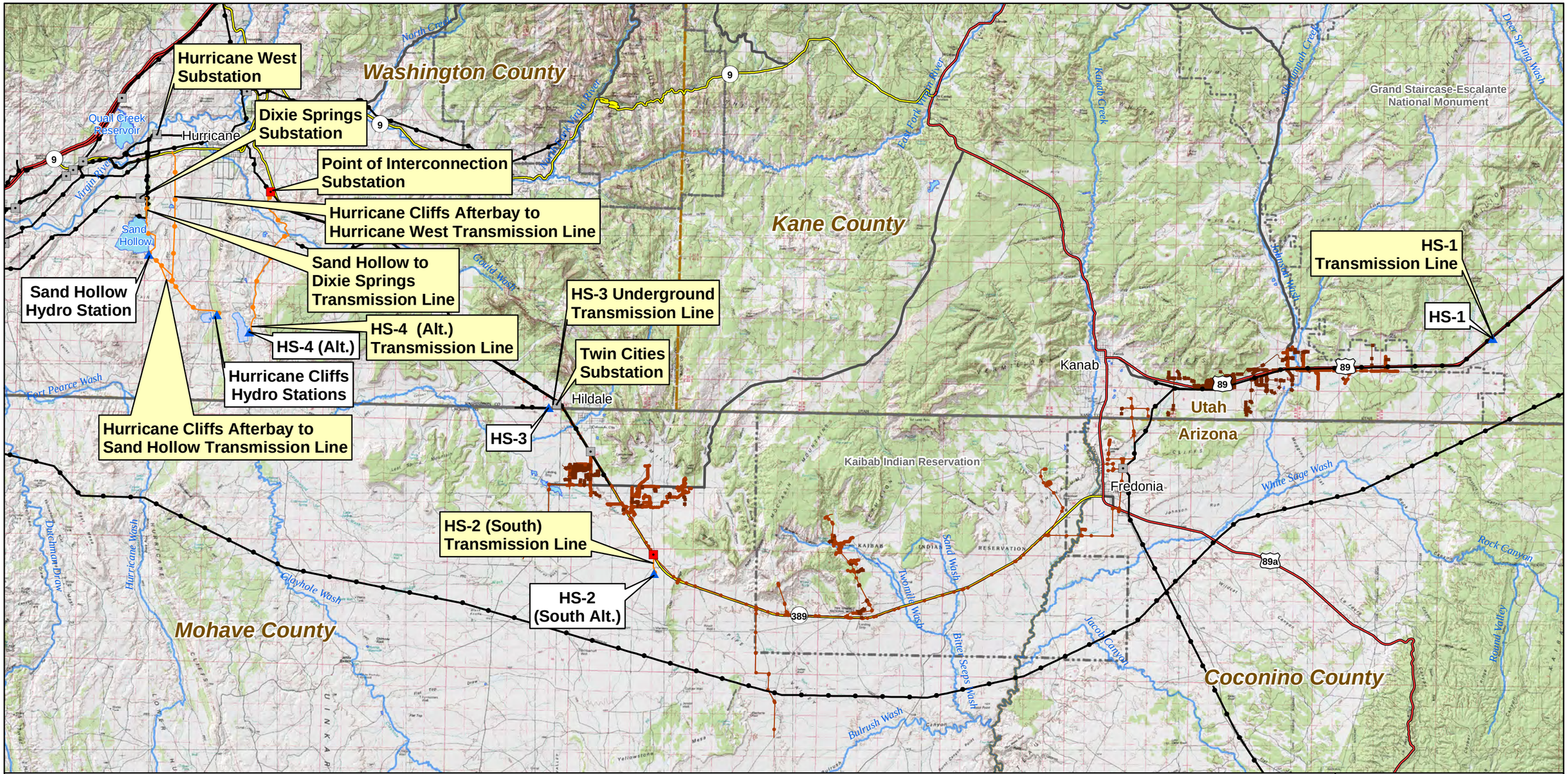
0 0.5 1 2 3 4 Miles

Lake Powell Pipeline Project

Spatial Reference: UTM Zone 12N, NAD-83

UDWRe **Figure 1-5** Stantec

Lake Powell Pipeline
Proposed Transmission Lines East



Project Hydro Station
Substation
Proposed Substation
Project Transmission Lines
Existing Transmission Lines
Existing OH Primary Line
Existing UG Primary Line
Hurricane Cliffs Forebay/Afterbay
Lakes & Reservoirs
Major Rivers & Streams
Interstate
US Highway
ST Highway
Hwy
Major Road
National Park/Monument
Tribal Lands
State Boundaries
County Boundaries

FERC Project Number: 12966-001
BLM Serial Numbers: AZA-34941 UTU-85472

N

0 1 2 4 6 8 Miles

Lake Powell Pipeline Project

Spatial Reference: UTM Zone 12N, NAD-83

UDWRe **Figure 1-6** Stantec

Lake Powell Pipeline Proposed Transmission Lines West

Chapter 2
Methodology

2.1 Consultation History

In March 2008, the Utah Division of Water Resources (UDWRe) as the non-federal representative designated by the FERC, initiated informal consultation with U.S. Fish and Wildlife Service (USFWS) to identify protected species and their habitats that may occur within the action area. The following list summarizes UDWRe's ongoing informal consultation with USFWS coordinating the determination of biological effects for the LPP:

- May 3, 2007, UDWRe/USFWS – UDWRe meeting with USFWS to inform them the LPP will be submitted to FERC for a License under the Integrated Licensing Process.
- November 16, 2007, UDWRe/USFWS – UDWRe transmittal letter and copy of Preliminary Permit Application for LPP filed with FERC.
- March 3, 2008, UBWR/FERC – UBWR requested to be FERC's non-federal representative for carrying out informal consultation pursuant to Section 7 of the Endangered Species Act (ESA).
- March 3, 2008, UDWRe – UDWRe sent a letter to USFWS regarding Notice of Intent and Preliminary Application Document filing with FERC, and requesting clarification on which USFWS region would take the lead on the LPP.
- April 17, 2008, USFWS/UDWRe – USFWS sent a letter to UDWRe with a response to the letter dated March 3, 2008, stating that the USFWS Mountain-Prairie Region will be the lead regional office for the LPP.
- May 5, 2008, FERC – In their May 5 Notice of Intent, FERC designated UBWR as their non-federal representative for carrying out informal consultation pursuant to Section 7 of the ESA.
- June 9, 2008, USFWS – USFWS participated in day one of the two-day FERC site visit along LPP alignments.
- June 10, 2008, USFWS – USFWS participated in a public scoping meeting on the LPP held in Kanab, Utah.
- July 17, 2008, USFWS – USFWS submitted study requests and identified potential LPP effects on fish and wildlife resources to FERC.
- July 29, 2008, USFWS/FERC/UDWRe – USFWS declined to be a cooperating agency on the LPP and stated they wish to preserve their ability to intervene in the licensing process, should it be necessary.
- November 19, 2008, USFWS – USFWS submitted additional study requests and identified potential LPP effects on fish and wildlife resources to FERC.
- January 8, 2009, USFWS – USFWS submitted additional study requests and identified potential LPP effects on fish and wildlife resources to FERC.
- January 21, 2009, FERC/UBWR – FERC approved UBWR's revised study plan for the proposed development of the Lake Powell Hydroelectric System. Biological field surveys to be conducted by Logan Simpson Design, Inc. within the action area in 2009 and 2010 included southwestern willow flycatcher, western yellow-billed cuckoo, Mojave desert tortoise, special status plants, and avian species (including raptors).
- March 10, 2009, USFWS/FERC/UDWRe/NPS/BLM/Reclamation – USFWS sent a letter providing a list of the threatened and endangered species and critical habitats that may occur in the LPP action area.

- April 22, 2010, UDWRe/USFWS/BLM/Kaibab Band of Paiute Indians/FERC – UDWRe meeting and presentation of LPP field study results regarding special status plant, aquatic, and wildlife species along alignments.
- July 14, 2010, UDWRe/USFWS –UDWRe requested updated lists for threatened and endangered species, candidate species for listing, and critical habitats that may occur in the LPP action area or be affected by LPP activities.
- August 5, 2010, USFWS/UDWRe – On August 5, 2010, USFWS replied to the request letter dated July 14, 2010, stating that no new listings were added to the list of threatened and endangered species nor were any critical habitat designations added; however, USFWS stated greater sage-grouse was designated as a candidate for listing and two plant species (Pipe Springs cryptantha and Morton wild buckwheat) received positive 90-day findings for listing.
- March 14, 2011, UDWRe/USFWS – On March 14, 2011, UDWRe filed initial draft Study Reports with FERC and sent copies of the initial draft Study Reports to USFWS for review prior to Initial Study Report meetings.
- March 23, 2011, UDWRe/USFWS – UDWRe presented summaries of the initial draft Study Reports for the LPP at the Initial Study Report Meeting held in Salt Lake City, attended by USFWS.
- April 29, 2011, UDWRe/USFWS – UDWRe met with USFWS to present Virgin River Daily Simulation Model results, and Reclamation modeling results of Lake Powell inflows, elevations, outflows, Glen Canyon Dam releases, and water quality, with regard to the LPP.
- May 9, 2011, USFWS/UDWRe/FERC – USFWS provided review comments on the initial draft Study Reports for the LPP to FERC and UDWRe.
- July 28, 2011, UDWRe/FERC/USFWS – UDWRe filed responses to comments on the initial draft Study Reports and Initial Study Report meetings with FERC. A copy of the responses to comments was sent by UDWRe to USFWS.
- August 8, 2011, UDWRe/USFWS – UDWRe and USFWS met on August 8, 2011, to discuss Virgin River Daily Simulation Model results and UDWRe's responses to USFWS review comments on the initial draft Study Reports.
- January 3, 2013, UDWRe/USFWS – UDWRe requested updated lists for threatened and endangered species, candidate species for listing, and critical habitats that may occur in the LPP action area or be affected by LPP activities.
- February 4, 2013, USFWS/UDWRe – USFWS replied to the request letter dated January 3, 2013, stating that no new listings were added to the list of threatened and endangered species but that designated critical habitat for southwestern willow flycatcher was updated on January 3, 2013, and that USFWS published Proposed Rules to list two plant species as endangered (Fickeisen palins cactus and Gierisch mallow) and concurrently proposed designated critical habitat for these species as well.
- October 28, 2015, USFWS – USFWS participated in a special meeting of the Virgin River Program Technical Committee regarding the LPP and Virgin River flows. UDWRe presented Virgin River Daily Simulation Model results regarding LPP return flows, Indicator of Hydrologic Alteration modeling results, and Dundee Hydrological Regime Alteration Method modeling results. These models demonstrated the LPP would have no measurable flow changes on Virgin River flows between existing conditions (no LPP) and full use of LPP water.
- December 1, 2015, UDWRe/USFWS – UDWRe sent USFWS a transmittal letter and copy of the Preliminary Licensing Proposal filed with FERC on December 1, 2015, for a 90-day review and comment period. Data, information, and analyses presented in the Preliminary Licensing Proposal and revised draft

Study Reports covered federally listed, proposed, and candidate species; and designated and proposed critical habitats previously identified by USFWS.

- December 18, 2015, UDWRe/USFWS – UDWRe sent USFWS a transmittal letter and copy of the LPP revised draft Visual Resources Study Report for a 90-day review and comment period.
- February 29, 2016, USFWS/FERC/UBWR – USFWS submitted a cover letter and their review comments on the LPP Preliminary Licensing Proposal and revised draft Study Reports, including comments on ESA-listed, proposed, and candidate species; and designated and proposed critical habitats.
- April 30, 2016, UBWR/FERC – UBWR filed the LPP Final License Application and a preliminary draft Biological Assessment (BA) with FERC.
- May 2, 2016, UDWRe/FERC/USFWS/BLM/NPS/Reclamation – UDWRe sent USFWS, BLM, NPS, and Reclamation a transmittal letter and copy of the LPP Final License Application, final Study Reports, and preliminary draft BA.
- June 1, 2016, UBWR/FERC/USFWS/BLM/NPS/Reclamation – UBWR filed an updated preliminary draft BA with the supplemental FERC filing and provided copies of the document to USFWS, BLM, NPS, and Reclamation.
- June 2, 2016, UBWR/FERC – FERC's ESA Lead, Alan Mitchnick, assumes the lead for the development of the BA in preparation for submittal to USFWS with a draft Environmental Impact Statement (EIS), as well as any further formal ESA Section 7 consultation efforts for the LPP.
- November 29, 2017, UDWRe/USFWS – UDWRe and USFWS met in Salt Lake City, Utah to discuss USFWS comments on the LPP Final License Application.
- April 16, 2018, UDWRe/USFWS – UDWRe and USFWS met in Denver, Colorado, to address whether the project would induce growth and other issues.
- October 31, 2018, UDWRe/USFWS – UDWRe sent USFWS a revised preliminary draft BA.
- November 14, 2018, UDWRe/USFWS – UDWRe and USFWS had a conference call to discuss the revised preliminary draft BA.
- November 29, 2018, UDWRe/USFWS – UDWRe and USFWS had a conference call to discuss the 2018 Mojave desert tortoise survey protocols and conservation guidelines.

2.2 Action Area

The action area includes the following:

- Corridors (approximately 150 feet wide) along the areas directly affected by construction of pipelines and associated features (pressure valves and drains), access roads, new or upgraded transmission lines and associated features (transformers, switch stations), pump stations and associated features (parking lots, forebays, afterbays) generation stations and associated features (parking lots, transformers, switch stations), construction laydown areas, and reservoirs and associated features (dikes, overflows);
- Areas affected by noise and human activity that may impact wildlife habitat values, wildlife population behavior, or migration corridors; and

- Rivers, streams, reservoirs, springs and associated riparian vegetation that could experience flow alteration, water level changes, and/or water quality changes from baseline conditions under LPP construction and operation.

Maps of noise impact areas are included in Appendix A. Detailed maps of project features and facilities are presented in Chapter 1.

2.3 Data Used

Targeted field studies were performed in 2010 to determine the presence of federally listed wildlife species, including southwestern willow flycatcher, (*Empidonax trailii extimus*) (LSD 2010a, 2010b), yellow-billed cuckoo (*Coccyzus americanus*) (LSD 2010a, 2010b), and Mojave desert tortoise (*Gopherus agassizii*) (LSD 2010c).

Surveys for special status plants were conducted from April through mid-September 2009 and from mid-April through July 2010 (LSD 2016).

No original field work, sampling, surveys or other site-specific investigations were performed for aquatic species.

Existing range and occurrence data for listed species were derived from digital databases where available: the USFWS Critical Habitat Portal, USFWS Environmental Conservation Online System (ECOS), the Utah Conservation Data Center (UCDC) (2010a), the Arizona Game and Fish Department (AGFD) Heritage Data Management System (HDMS) Geographic Information System (GIS) Database, and available scientific literature. Vegetation community data (UBWR 2016a) and topographic elevation data (Google Earth) were also utilized to determine the potential occurrence of listed species.

2.4 Effects Analysis Methodology

2.4.1 Federally Listed Species

Occurrence data for federally listed plant and wildlife species were derived from the targeted field surveys (LSD 2010a, 2010b, 2010c, 2016), the Utah GIS database (AGRC 2010), USFWS ECOS (accessed 2016), and the AGFD HDMS GIS database (AGFD 2010). Species observations in field studies within the temporary or permanent disturbance corridors or historic recorded occurrence data from GIS databases were related to GIS shapefiles of temporary, permanent and noise construction disturbance for LPP features. The results of surface water resource and surface water quality modeling of the proposed LPP were used to estimate the potential effects on listed aquatic species and their habitats.

The baseline conditions of listed aquatic species and their habitats were determined from the compiled data and information, and potential effects were determined by assessing the intensity, duration and magnitude of changes associated with the Proposed Project. Information was developed to evaluate specifically the effects of the Proposed Project on survival and recovery of federally listed species; and effects and possible conservation measures and mitigation for listed species. Designated critical habitats for listed species were analyzed using GIS to integrate the compiled baseline data, information, and potential project effects on vegetation communities, wildlife resources, wetland and riparian resources, surface water resources, surface water quality, groundwater resources, and aquatic resources.

The potential for unavoidable adverse impacts was evaluated following application of conservation measures and mitigation measures to avoid, minimize, or reduce effects on listed species and their habitats.

2.4.2 Critical Habitats

Designated critical habitats (USFWS 2010f; USFWS ECOS, accessed 2016) were analyzed by GIS to determine where temporary, permanent, and noise disturbance on critical habitats could occur. Where possible, areas of disturbance were calculated for each type of disturbance.

2.4.3 Induced Growth

Under the final ESA Section 7 Consultation Handbook (USFWS 1998), actions that potentially could be interrelated or interdependent to the primary action must satisfy the "but for" test. In order to determine whether induced growth is an interrelated or interdependent action, the "but for" test must determine whether induced growth effects would occur in areas that could affect ESA-listed species and could be tied directly to the LPP project. Projected growth in Washington County is based on past and current trends in growth and local land use planning (USBR 2016b). In 2017 alone, thousands of acres were slated for development under contracts with SITLA in the southern reaches of the City of St. George. Development in this area is planned to go forward whether or not the LPP Project is constructed. Current development is occurring within areas already served by existing infrastructure and water sources. Accordingly, no indirect/induced growth effects can be identified that would satisfy the "but for" test. Any effects of the LPP are remote and speculative and therefore cannot be considered reasonably certain to occur and are not evaluated in this BA.

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Chapter 3
Affected Environment (Baseline Conditions)

3.1 Species Considered

The USFWS initially identified eight federally listed and two candidate wildlife species to be included in the analysis of effects of the LPP (USFWS letter 3/16/2009, confirmed 8/5/2010 with addition of greater sage-grouse). In October 2013, the USFWS determined that the western distinct population segment of the yellow-billed cuckoo (*Coccyzus americanus*), previously a candidate species in the considered species list, warranted threatened status under the ESA (USFWS 2014a), and in November 2014, the USFWS proposed critical habitat for this segment of the yellow-billed cuckoo, including a portion approximately 7.5 miles west of the LPP action area at Sand Hollow Reservoir (USFWS 2014b). This change resulted in nine listed and one candidate wildlife species.

The list of wildlife species was further revised by USFWS per the following:

- In 2015, the USFWS determined that the greater sage-grouse did not warrant listing under the ESA.
- In 2017, the USFWS delisted the Hualapai Mexican vole (*Microtus mexicanus hualpaiensis*) by concluding the species is not a distinguishable subspecies of Mexican vole.

Of the remaining eight species, four are not evaluated further in this BA because the action area is not within the geographic range or no suitable habitat is present in the action area.

The USFWS also identified eight fish species listed under the ESA as potentially occurring within the action area (USFWS letter 3/16/2009 [USFWS 2009b]; confirmed on 8/5/2010 [USFWS 2010a]). The bonytail chub, humpback chub, and razorback sucker have the potential to occur in the action area and are evaluated in this BA. Virgin river fishes (Virgin River chub and woundfin) are not evaluated in this BA because the Virgin River is outside the action area. The proposed action terminates in Sand Hollow Reservoir, an off-stream reservoir, and would not affect Virgin River flows. Also, molluscicides and 25-50 micron filters would be used on each pump discharge pipe to remove biological materials (including residual dead mussel veligers) that pass through the fish screens and intake tunnels. Invasive mollusks would therefore not enter the WCWCD system. The other three species are not evaluated further in this BA because the proposed action is outside of the species' range.

Fourteen plant species listed under the ESA as threatened, endangered or candidate species were identified by USFWS as potentially occurring within the general vicinity of the LPP. It was determined that the geographic range for six of these species falls outside the action area, so these species were not evaluated in this BA. Surveys were conducted for the remaining eight plant species and seven of the eight species were not found, so these species were excluded from further evaluation in this BA.

Table 3-1 summarizes the threatened, endangered and candidate species for the counties affected by the LPP pipeline and transmission line alignments, access roads, and staging areas. Table 3-1 also identifies the species with the potential to occur in the action area. The listing history, distribution, life history and ecology, and critical habitat, if designated, for species that have the potential to occur within the action area are discussed in Section 3.2.

Table 3-1
Federally Listed Threatened, Endangered or Candidate Species by County

Common Name	Scientific Name	Listing Status[1]	State	County	Potential to Occur
Mammals					
Utah Prairie Dog	*Cynomys parvidens*	E	Utah	Washington	No, project is outside of range
Birds					
Mexican spotted owl[2]	*Strix occidentalis lucida*	T	Utah Arizona	Kane, Washington Coconino, Mohave	Yes
Southwestern willow flycatcher[2]	*Empidonax traillii extimus*	E	Utah Arizona	Kane, Washington Coconino, Mohave	Yes
Yellow-billed cuckoo[3]	*Coccyzus americanus*	T	Utah Arizona	Kane, Washington Coconino, Mohave	Yes
Yuma clapper rail	*Rallus longirostris yumanensis*	E	Arizona	Mohave	No, no suitable habitat is present
Reptiles					
Mojave desert tortoise[2]	*Gopherus agassizii*	T	Utah Arizona	Washington Mohave	Yes
Amphibians					
Relict leopard frog	*Rana onca*	C	Arizona	Mohave	No, no suitable habitat is present
Invertebrates					
Kanab ambersnail	*Oxyloma haydeni kanabensis*	E	Utah Arizona	Kane Coconino	No, no suitable habitat is present

Table 3-1
Federally Listed Threatened, Endangered or Candidate Species by County

Common Name	Scientific Name	Listing Status[1]	State	County	Potential to Occur
Fish					
Apache trout	*Oncorhynchus apache*	T	Arizona	Coconino	No, project is outside range
Bonytail chub[2]	*Gila elegans*	E	Utah Arizona	Kane Mohave[2]	Yes
Colorado pikeminnow	*Ptychocheilus lucius*	E	Utah	Kane	No, project is outside range
Humpback chub[2]	*Gila cypha*	E	Utah Arizona	Kane Coconino[2], Mohave[2]	Yes
Little Colorado spinedace	*Lepidomeda vittata*	T	Arizona	Coconino	No, project is outside range
Razorback sucker[2]	*Xyrauchen texanus*	E	Utah Arizona	Kane Coconino[2], Mohave[2]	Yes
Virgin River chub[2]	*Gila seminuda (=robusta)*	E	Utah Arizona	Washington[2] Mohave[2]	No, project is outside range
Woundfin[2]	*Plagopterus argentissimus*	E, EXPN	Utah Arizona	Washington[2] Mohave[2]	No, project is outside range
Plants					
Arizona cliffrose	*Purshia subintegra*	E	Arizona	Mohave	No, project is outside range
Brady pincushion cactus	*Pediocactus bradyi*	E	Arizona	Coconino	No, project is outside range
Dwarf bearpoppy	*Arctomecon humilis*	E	Utah	Washington	No, no suitable habitat is present
Fickeisen plains cactus	*Pediocactus peeblesianus* var. *fickeiseniae*	C	Arizona	Coconino, Mohave	No, no suitable habitat is present

Table 3-1
Federally Listed Threatened, Endangered or Candidate Species by County

Common Name	Scientific Name	Listing Status[1]	State	County	Potential to Occur
Gierisch globemallow	*Sphaeralcea gierischii*	C	Utah Arizona	Washington Mohave	No, no suitable habitat is present
Jones cycladenia	*Cycladenia humilis* var. *jonesii*	T	Utah Arizona	Kane Coconino, Mohave	No, no suitable habitat is present
Kodachrome bladderpod	*Lesquerella tumulosa* syn. *Physaria rubicundula* var. *tumulosa*	E	Utah	Kane	No, project is outside range
Navajo sedge[2]	*Carex specuicola*	T	Utah Arizona	Kane Coconino	No, project is outside range
Paradox (Holmgren) milkvetch[2]	*Astragalus holmgreniorum*	E	Utah Arizona	Washington Mohave	No, no suitable habitat is present
San Francisco Peaks ragwort[2]	*Packera franciscana* syn. *Senecio franciscanus*	T	Arizona	Coconino	No, project is outside range
Sentry milkvetch	*Astragalus cremnophylax* var. *cremnophylax*	E	Arizona	Coconino	No, project is outside range
Shivwits milkvetch[2]	*Astragalus ampullarioides*	E	Utah	Washington	No, no suitable habitat is present
Siler pincushion cactus	*Pediocactus sileri*	T	Utah Arizona	Kane, Washington Coconino, Mohave	Yes
Welsh's milkweed[2]	*Asclepias welshii*	T	Utah Arizona	Kane Coconino	No, no suitable habitat is present

Notes:

[1] T = threatened, E = Endangered, EXPN = Experimental, Non-Essential; C = Candidate.

[2] Critical habitat designated for this species.

[3] Critical habitat is proposed for this species.

Source:

USFWS species listing letters 3/16/2009 and 8/5/2010; USFWS IPaC 3/4/2016.

3.2 Species Potentially Occurring in Action Area

3.2.1 Mexican Spotted Owl

3.2.1.1 Listing History and Status

The USFWS listed the Mexican spotted owl (*Strix occidentalis lucida*) as threatened on March 16, 1993 (58 Federal Register [FR] 14248) without critical habitat, effective April 15, 1993. A final rule designating critical habitat for the Mexican spotted owl was published on June 6, 1995 (60 FR 29914). As a result of several court rulings, the USFWS removed critical habitat designation for the Mexican spotted owl on March 25, 1998 (63 FR 14378). On March 13, 2000, the USFWS was again ordered to propose critical habitat within 4 months of the court order and to complete a final designation by January 15, 2001. The USFWS designated approximately 4.6 million acres of critical habitat for the Mexican spotted owl in Arizona, Colorado, New Mexico and Utah on federal lands. (66 FR 8530, February 1, 2001). The critical habitat designation was revised with a final rule published on August 31, 2004 (69 FR 53181), effective September 30, 2004**.**

3.2.1.2 Distribution

Mexican spotted owls range widely across Utah, Colorado, New Mexico and Arizona and in extreme western Texas in disjunct populations (USFWS 2010b). Designated critical habitat for spotted owl occurs approximately 3.4 miles north of the LPP near the community of Colorado City and approximately 2.5 miles north of the LPP along U.S. Highway 89 at the Cockscomb. Owl foraging habitat includes a wide variety of forest conditions, canyon bottoms, cliff faces, tops of canyon rims, and riparian areas. Spotted owls foraged more frequently in unlogged forests containing uneven-aged stands of Douglas-fir and white fir, with a strong component of ponderosa pine, than in managed forests, but they may forage in adjacent pinyon-juniper woodlands. Mexican spotted owls would potentially use a small portion of the action area near the designated critical habitat for limited foraging or dispersement, but due to the lack of suitable nesting substrate, are not likely to nest in the action area. Dispersing juveniles can travel up to approximately 57 miles from nest sites, although most remain in close proximity to natal sites (Ganey et al 1998).

3.2.1.3 Life History and Ecology

Mexican spotted owls nest, roost, forage, and disperse in a diverse assemblage of biotic communities. Spotted owls nest and roost primarily in closed-canopy forests or canyons. Mixed-conifer forests are commonly used throughout most of the range, which may include Douglas-fir and/or white fir, with co-dominant species including southwestern white pine, limber pine, and ponderosa pine. The understory often contains the above coniferous species, as well as broadleaved species such as Gambel oak, maples, box elder, and/or New Mexico locust. In the northern part of the range, including southern Utah, southern Colorado, and far northern Arizona and New Mexico, owls occur primarily in rocky canyons. They nest in these areas on cliff ledges, in stick nests built by other birds, on debris platforms in trees, and in tree cavities (USFWS 2010b). Mexican spotted owls are also found in canyon habitat dominated by vertical-walled rocky cliffs within complex watersheds including tributary side canyons (Gutierrez and Rinkevich 1991). Forests used for roosting and nesting often contain mature or old-growth stands with complex structure, are typically uneven-aged, multistoried, and have high canopy closure. A wider variety of trees are used for roosting, but Douglas-fir is the most commonly used species (USFWS 2010b). Mexican spotted owls may migrate to lower-elevation pinyon juniper habitat in winter (BNA 2010). Foraging is nocturnal; the spotted owl is a “perch and pounce” predator, taking prey from either the ground or trees (BNA 2010). Prey sources include small forest mammals, mainly woodrats, mice, voles and rabbits, but spotted owls occasionally prey on bats (BNA 2010). If prey is abundant, spotted owls will cache surplus kills for later use (BNA 2010).

Pair formation begins in February and March, with nesting and egg laying beginning in late March through April (BNA 2010). Spotted owls do not build their own nest but rather utilize naturally occurring nest sites or nests built by other animals. Nests are located in tree cavities or ledges (BNA 2010). Mexican spotted owls lay one to three eggs and may produce a second clutch if the first is lost. Incubation is about 1 month. Owlets hatch generally in early May and fledge at 4 to 5 weeks (USFWS 2010b). They forage independently by late August or early September, after which parents avoid further contact (BNA 2010).

Primary threats to Mexican spotted owls are loss of habitat from fire, logging or development. Human activity (hiking, shooting, off-road vehicles) near nesting or roosting sites may cause abandonment (USFWS 2010b).

3.2.1.4 Designated Critical Habitat

Mexican spotted owl Critical Habitat Unit CP-10 is designated in northern Arizona in the Kaibab National Forest, Grand Canyon National Park and Marble Canyon National Monument (USFWS 2010c). All of Unit CP-10 is more than 15 miles south of the LPP. Mexican spotted owl Critical Habitat Unit CP-12 is designated in Utah in Grand Staircase-Escalante National Monument north of the Cockscomb; the LPP is more than 2.5 miles south of Unit CP-12. Critical Habitat Unit CP-11 includes Zion National Park east of Interstate 15 and north of Utah State Routes 9 and 17.

3.2.2 Southwestern Willow Flycatcher

3.2.2.1 Listing History and Status

The southwestern willow flycatcher (*Empidonax traillii extimus*) is listed as endangered (60 FR 10694, February 27, 1995) with critical habitat (50 CFR 60886, October 19, 2005). A 5-year review of the species was announced in 2008 (73 FR 14995, March 20, 2008).

3.2.2.2 Distribution

The range of the southwestern willow flycatcher is primarily in Arizona, New Mexico, Nevada and southern California. The Virgin River corridor in extreme southwestern Utah and northwestern Arizona is also a potential habitat area (USFWS 2010d). The southwestern willow flycatcher may occur within the cumulative total of 85.7 acres of riparian habitat that occurs in small patches along the approximately 3,000 acre route of the LPP at stream and wash crossings. Crossings in the action area include Blue Pool Wash, Paria Wash, Buckskin Gulch, White Sage Wash, Johnson Wash South, Kanab Creek, Bitter Seep Wash, Short Creek Wash, and Short Creek at Canaan Gap.

3.2.2.3 Life History and Ecology

The southwestern willow flycatcher nests and forages in dense riparian habitats along streams, rivers, lakesides, and other wetlands. Some of the more common plant species used for nesting are willow, box elder, tamarisk, Russian olive, buttonbush, cottonwood, and mesquite. Nests are found in dense thickets of these and other plants species that are about 13-23 feet in height. According to the *Southwest Willow Flycatcher Recovery Plan* (USFWS 2010e), "suitable habitat conditions are generally dense, mesic riparian shrub and tree communities 0.1 hectare (10,764 square feet) or greater in size within floodplains large enough to accommodate riparian patches at least 10 m wide (measured perpendicular to the channel)." Migration habitat is believed to primarily occur along riparian corridors. Utilized habitat occurs at elevations below 8,500 feet AMSL.

The southwestern willow flycatcher arrives on breeding grounds in late April to early May. Nesting begins in late May and early June, with fledging from late June to mid-August. It typically lays 3-4 eggs per clutch at 1-day intervals, and eggs are incubated by the female for about 12 days. Young birds fledge 12-13 days after hatching. Typically, the flycatchers only raise one brood per year; however, some pairs will raise a second brood after a nest

failure (USFWS 2010d). Flycatchers are insectivores and capture their prey on the wing. Southwestern willow flycatchers winter in Mexico and Central America, migrating south from the United States by the end of September (USFWS 2010d).

Loss or degradation of dense riparian nesting habitat is the primary threat to the species (USFWS 2010d).

3.2.2.4 Designated Critical Habitat

Southwestern willow flycatcher critical habitat has been designated along the Virgin River in northwestern Arizona and southwestern Utah (Virgin Management Unit) (USFWS 2010d; USFWS 2010e). This habitat extends from approximately 6.9 miles north of the headwaters of Lake Mead in Nevada to a point approximately 1.4 miles north of the Washington Fields Diversion in Utah (USFWS 2010f). The LPP is approximately 3.5 miles from the stream segments designated as critical habitat within the Virgin Management Unit of the Lower Colorado Recovery Unit, and the Paria River north of U.S. Highway 89, of the Powell Management Unit, crosses the LPP (USFWS 2013). In January 2013, based on the physical or biological features and habitat characteristics required to sustain the species' life-history processes, the USFWS determined that the primary constituent elements of southwestern willow flycatcher habitat are as follows:

1. Primary Constituent Element 1—Riparian vegetation. Riparian habitat along a dynamic river or lakeside, in a natural or manmade successional environment (for nesting, foraging, migration, dispersal, and shelter) that is comprised of trees and shrubs (that can include Gooddings willow, coyote willow, Geyer's willow, arroyo willow, red willow, yewleaf willow, pacific willow, boxelder, tamarisk, Russian olive, buttonbush, cottonwood, stinging nettle, alder, velvet ash, poison hemlock, blackberry, seep willow, oak, rose, sycamore, false indigo, Pacific poison ivy, grape, Virginia creeper, Siberian elm, and walnut) and some combination of:

    a. Dense riparian vegetation with thickets of trees and shrubs that can range in height from about 2 to 30 m (about 6 to 98 ft.). Lower-stature thickets (2 to 4 m or 6 to 13 ft. tall) are found at higher elevation riparian forests and tall-stature thickets are found at middle and lower-elevation riparian forests;

    b. Areas of dense riparian foliage at least from the ground level up to approximately 4 m (13 ft.) above ground or dense foliage only at the shrub or tree level as a low, dense canopy;

    c. Sites for nesting that contain a dense (about 50 percent to 100 percent) tree or shrub (or both) canopy (the amount of cover provided by tree and shrub branches measured from the ground);

    d. Dense patches of riparian forests that are interspersed with small openings of open water or marsh or areas with shorter and sparser vegetation that creates a variety of habitat that is not uniformly dense. Patch size may be as small as 0.1 hectares (0.25 acres) or as large as 70 hectares (175 acres).

2. Primary Constituent Element 2—Insect prey populations. A variety of insect prey populations found within or adjacent to riparian floodplains or moist environments, which can include: flying ants, wasps, and bees (*Hymenoptera*); dragonflies (*Odonata*); flies (*Diptera*); true bugs (*Hemiptera*); beetles (*Coleoptera*); butterflies, moths, and caterpillars (*Lepidoptera*); and spittlebugs (*Homoptera*).

3.2.3 Yellow-billed Cuckoo

3.2.3.1 Listing History and Status

The yellow-billed cuckoo (*Coccyzus americanus*) in the western United States was accorded candidate species status on July 25, 2001 (66 FR 38611). The USFWS determined that although listing was warranted, it was precluded by higher-priority listing actions. In October 2015, the USFWS determined that the western distinct

population segment of the yellow-billed cuckoo warranted threatened status under the ESA and therefore implemented federal protections provided by the ESA for this segment. On August 15, 2014, the USFWS announced a proposal to designate critical habitat for this segment of the yellow-billed cuckoo under the ESA. In November 2014, the USFWS reopened the comment period of the proposed rule to allow the USFWS to accept and consider additional public comments on the proposed designation of critical habitat for the yellow-billed cuckoo. Critical habitat is currently proposed for the western distinct population segment.

3.2.3.2 Distribution

The yellow-billed cuckoo is widely but sparsely distributed across the United States west of the Rocky Mountains (USFWS 2010g) because of its specific riparian habitat requirements. It is infrequently seen in Utah. Two remote observations are documented in the UCDC GIS database—1939 and 1981 in Washington County near what is now Sand Hollow Reservoir (UCDC 2010a and 2010b). In Arizona, recorded occurrences are over 150 miles south of the LPP (AGFD 2010). Suitable habitat also exists at the Virgin River/Beaver Dam Wash confluence north of Mesquite, Nevada. The yellow-billed cuckoo may occur within the cumulative total of 85.7 acres of riparian habitat that occurs in small patches along the approximately 3,000 acre route of the LPP at stream and wash crossings. Crossings in the action area include Blue Pool Wash, Paria Wash, Buckskin Gulch, White Sage Wash, Johnson Wash South, Kanab Creek, Bitter Seep Wash, Short Creek Wash, and Short Creek at Canaan Gap.

3.2.3.3 Life History and Ecology

Yellow-billed cuckoo is a medium-sized bird classified in the family *Cucilidae*, containing cuckoos, roadrunners and anis in North America (Sibley 2001). East of the Rocky Mountains, yellow-billed cuckoo breeding range covers most of the United States. West of the Rocky Mountains, its breeding range is spotty and restricted to riparian areas with specific habitat characteristics of a tall overstory of mature trees, particularly cottonwoods and willows, and a dense understory of shrubs and small trees (Sibley 2001; Wiggins 2005). Ideally, riparian habitat should provide a contiguous area of at least 15 acres (Wiggins 2005) to 25 acres (Sibley 2001) with overstory from 5 to 30 meters and understory of 1 to 6 meters in height. Food sources are primarily slow-moving insects and caterpillars, especially tent caterpillars in the east.

Yellow-billed cuckoos arrive at their breeding territories relatively late compared to other songbirds, generally in late May, and migrate south as early as August (Wiggins 2005). Breeding is stimulated by an abundant local food supply, and the breeding cycle is extremely rapid—17 days from egg laying to fledging (BNA 2010). Clutch size varies from 1 to 5 eggs, and cuckoos are both intraspecific and interspecific brood parasites. Yellow-billed cuckoo southern migration is to South America.

Factors of decline of the species are most closely related to loss of adequate areas of contiguous riparian habitat, although some unquantified impacts from pesticides and decline of insect food sources could contribute to the species' decline (Wiggins 2005). Cuckoos appear sensitive to human disturbance and may abandon the nest during incubation if disturbed (Wiggins 2005).

3.2.3.4 Proposed Critical Habitat

The USFWS proposed to designate critical habitat for the western distinct population segment of the yellow-billed cuckoo in August 2014 (79 FR No. 158, August 15, 2014). Approximately 546,335 acres were proposed for designation as critical habitat in Arizona, California, Colorado, Idaho, Nevada, New Mexico, Texas, Utah, and Wyoming. Proposed critical habitat in Utah includes Critical Habitat Unit UT-8, which is composed of a portion of the Virgin River in the vicinity of St. George in Washington County. Critical Habitat Unit UT-8, which is 1,390 acres in extent and a 13-mile-long continuous segment, occurs within the Virgin River corridor from the Atkinville Wash confluence, extending north along the river corridor to the confluence with Mill Creek. Approximately 1,352 acres, or 97 percent, of Critical Habitat Unit UT–8 are privately owned; 6 acres, or less than 1 percent, are on state-owned land managed by the Utah Division of Forestry, Fire, and State Lands; and 32 acres, or 2 percent, are on federally owned land managed by BLM. This unit has been consistently occupied by western

yellow-billed cuckoos during the breeding season. The site also provides migratory stopover habitat for western yellow-billed cuckoos moving farther north. Primary constituent elements of yellow-billed cuckoo habitat that the USFWS has proposed are as follows:

1. Primary Constituent Element 1— *Riparian woodlands*. Riparian woodlands with mixed willow cottonwood vegetation, mesquite-thorn forest vegetation, or a combination of these that contain habitat for nesting and foraging in contiguous or nearly contiguous patches that are greater than 325 ft. in width and 200 acres or more in extent.

2. Primary Constituent Element 2—*Adequate prey base*. Presence of a prey base consisting of large insect fauna (for example, cicadas, caterpillars, katydids, grasshoppers, large beetles, dragonflies) and tree frogs for adults and young in breeding areas during the nesting season and in post-breeding dispersal areas.

3. Primary Constituent Element 3—*Dynamic riverine processes*. River systems that are dynamic and provide hydrologic processes that encourage sediment movement and deposits that allow seedling germination and promote plant growth, maintenance, health, and vigor (e.g. lower gradient streams and broad floodplains, elevated subsurface groundwater table, and perennial rivers and streams).

3.2.4 Mojave Desert Tortoise

3.2.4.1 Listing History and Status

The Mojave population (*Gopherus agassizii*) of the desert tortoise (all desert tortoises north and west of the Colorado River) was listed as threatened in 1990 (55 FR 12178, April 2, 1990) with critical habitat designated in 1994 (59 FR 5820, February 28, 1994). A recovery plan was adopted in June 1994 and a draft recovery plan revision was released for comment in 2008 (USFWS 2010h; USFWS 2011). Washington County, Utah, contains the Upper Virgin River Mojave Desert Tortoise Recovery Unit. A Washington County Habitat Conservation Plan (Washington County Commission 1995) was approved by USFWS in 1996 (USFWS 2011). Although the Habitat Conservation Plan (HCP) technically expired in 2016, 20 years after its adoption, the USFWS has stated that because its review of the HCP renewal request has extended beyond the expiration date, Washington County may continue the activities authorized by the existing permit until the USFWS has acted on the permit renewal request, per 50 CFR 13.22 (USFWS 2015).

The HCP established a multi-pronged approach for habitat conservation in Washington County which serves as the primary mitigation for an estimated level of incidental take of 12,264 acres of primarily low-density habitat on non-federal and non-Tribal lands in the County. The HCP compensated for the lost habitat with the enhanced quality of the protected habitat combined with the proposed mitigation. All non-reserve State and private lands are included in the provisions of the HCP. The HCP identifies three categories of lands covered by its take provisions:

- Non-reserve, identified desert tortoise habitat consists of areas within the known range of the Mojave desert tortoise in Washington County where tortoises or other evidence of tortoise occupation have been found. Take is likely to occur in these areas.
- Non-reserve, potential desert tortoise habitat consists of areas that theoretically could support desert tortoises but have shown no evidence of tortoise occupation. This habitat will not count against incremental take acreage; however, if tortoises should be discovered and removed from these areas because of proposed development or other changes in land use, the removed animals would count against the incidental take total of the permit.
- Non-reserve, non-habitat areas are lands unlikely to support desert tortoises. While the probability of finding endemic tortoises in non-habitat areas is very low, these areas are included under the incidental take permit because the County recognizes that a desert tortoise may be found anywhere. This possibility

exists because of the historical use of the desert tortoise as pets and the ease of transporting the animal. The take permit is therefore necessary in all non-reserve areas to resolve the potential for conflict.

Accordingly, the HCP and incidental take permit provide for incidental take of Mojave desert tortoise on an estimated 350,000 acres of private and state school trust lands in Washington County, Utah. These 350,000 acres consist of all the private and state school trust lands in the County outside of the proposed reserve and outside areas of the Beaver Dam Slope designated as Mojave desert tortoise habitat.

Federal and Tribal lands are not covered by the HCP; therefore, any effects on the desert tortoise on federal and Tribal lands will be analyzed through the Section 7 consultation process.

3.2.4.2 Distribution

The Mojave population of the desert tortoise occupies habitat in southern California, southern Nevada, northern Arizona, and southern Utah. The Upper Virgin River Recovery Unit, located immediately north of St. George, Utah, is the northernmost occupied habitat of the desert tortoise (USFWS 2010f). Desert tortoise would potentially occur along the westernmost 12 miles of the proposed LPP route, near St George, Utah.

3.2.4.3 Life History and Ecology

Desert tortoises occupy a variety of habitats from flats and slopes dominated by creosotebush scrub at lower elevations to rocky slopes in blackbrush and juniper woodland ecotones at higher elevations. Desert tortoises occur from below sea level to an elevation of 2,225 meters (7,300 feet AMSL) (USFWS 2010h). Throughout most of the Mojave desert, tortoises occur most commonly on gently sloping terrain with sandy gravel soils and where there is sparse cover of low-growing shrubs, which allows for the establishment of herbaceous plants. Soils must be friable enough for desert tortoises to dig burrows but firm enough so that burrows do not collapse. Typical tortoise habitat in the Mojave desert has been characterized as creosotebush scrub where precipitation ranges from 5 to 20 centimeters (2 to 8 inches) annually, the diversity of perennial plants is relatively high, and production of ephemerals is high (USFWS 2010h).

Desert tortoises may live 50 or more years in the wild. Their diet consists primarily of wildflowers, grasses and cacti. Desert tortoises derive almost all their water intake from the plants they eat. A large urinary bladder can store over 40 percent of the tortoise's body weight in water, urea, uric acid, and nitrogenous wastes. During periods of sufficient rainfall tortoises drink from temporary rain pools. A common defensive behavior when molested or handled is to empty the bladder, leaving the tortoise at a considerable disadvantage during dry periods (USFWS 2010h).

Reproduction begins between ages 12 to 20 years, with clutch sizes of 1 to 14 eggs. In years with low rainfall, females may lay few to no eggs. Females can store sperm for 5 years or longer, meaning they can reproduce for several years after mating. Nests are built and eggs are laid in late spring or early summer. The hatchlings appear in 90 to 120 days. The mother leaves the nest, so once the hatchlings appear, they must survive on their own (USFWS 2010h).

Tortoises depend on bushes for shade and protection from predators such as ravens and coyotes. Many tortoises live in burrows to escape the temperatures of cold winters and very hot summers. The spring and summer burrows vary from 18 inches to 5 feet long but may only be a few inches from the surface. Winter burrows tend to be about 8 feet long and may be 2 to 3 feet from the surface. They often share burrows and may use multiple burrows scattered across the landscape. Tortoises hibernate for up to 9 months each year, becoming most active from March to June and September to October. When young, they seldom venture more than 150 feet from their burrow. As they get older, they may go as far as 0.75 mile in a day and use a network of burrows. In the most densely populated areas, there may be one tortoise per 2.5 acres; however, typically, tortoise densities are closer to one tortoise per 100 acres (USFWS 2010h).

The tortoise population in the area of St. George, Utah, is at the extreme northeastern edge of the species' range and experiences long, cold winters (about 100 freezing days) and mild summers during which the tortoises are continually active. In this habitat, the animals live in a complex topography consisting of canyons, mesas, sand dunes, and sandstone outcrops where the vegetation is a transitional mixture of sagebrush scrub, creosotebush scrub and blackbrush scrub in a sandy-soil community. In this area, desert tortoises often use sandstone and lava caves instead of burrows, travel to sand dunes for egg laying, and use still other habitats for foraging. In contrast to populations at more distant parts of the range, two or more desert tortoises often use the same burrow (USFWS 2010h).

Major threats to the Mojave population of the desert tortoise include land development, grazing, human activities (hiking, off-road vehicles), wildfire, predation (ravens, coyotes) and disease (USFWS 2010h).

3.2.4.4 Designated Critical Habitat

The Mojave population of the desert tortoise was listed due to the effects of habitat conversion activities (e.g., urban development, mining, military activities, waste disposal sites, energy development, and road construction), habitat modification activities (e.g., off highway vehicle activities, utility corridors, grazing, changes in land use designations), predation, Upper Respiratory Disease Syndrome, collecting, or vandalism on tortoises (55 FR 12178, 12183).

The Mojave desert tortoise Upper Virgin River Recovery Unit Critical Habitat Unit includes approximately 54,600 acres of the 62,000-acre Red Cliffs Desert Reserve that was established in 1996 by Washington County, Utah (Washington County Commission 1995). The section of the Reserve east of Interstate 15 and immediately north of the city of Hurricane, known as the Hurricane Cinder Knolls, is the area closest to Project corridors (USFWS 2010f). LPP surveys for Mojave desert tortoise were performed on private land, SITLA-administered land, and federally-administered land. Surveys on private land were performed on 2,035 acres of occupied habitat and 2,140 acres of unoccupied habitat. Un-surveyed habitat considered consisted of 2 acres in Red Cliffs Desert Reserve and 3,230 acres of private land. Surveys on SITLA-administered land were performed on 75 acres in Take Area 10,102 acres of occupied habitat and 716 acres of unoccupied habitat. Un-surveyed habitat considered consisted of 351 acres of SITLA-administered land. Surveys on federally-administered land were performed on 2,765 acres of occupied habitat, and 4,770 acres of unoccupied habitat. Un-surveyed habitat considered consisted of 9 acres in Red Cliffs Desert Reserve and 1 acre of federally-administered land.

The HCP has defined "incidental take areas" that are designated Mojave desert tortoise habitat outside of the Reserve boundaries; any development or habitat disturbance within an incidental take area must be coordinated with the Desert Reserve administration (Red Cliffs Desert Reserve 2011a). Take Area 10, South Hurricane, consists of 87 acres on SITLA-administered land and covers part of the proposed Hurricane Cliffs afterbay (Red Cliffs Desert Reserve 2011b). The incidental take permit is a county-wide take permit for desert tortoises, so take may occur anywhere in Washington County outside the Reserve (excluding the Beaver Dam Slope) on unincorporated county land and where a city has passed the HCP Impact Fees Ordinance. The HCP process has identified areas where incidental take is most likely to occur, totaling 12,264 acres.

3.2.5 Bonytail Chub

3.2.5.1 Listing History and Status

Bonytail chub was listed under the federal ESA in 1980 (45 FR 27713), with a final determination of critical habitat on March 21, 1994 (59 FR 13374). The bonytail chub is listed as endangered under the federal ESA and by the State of Utah. Its Natural Heritage Status in Utah is S1 (critically imperiled). The Bonytail Chub Recovery Plan was approved on May 16, 1984, with a revised plan approved September 4, 1990 (USFWS 1990a). An amendment to the recovery goals was approved in 2002 (USFWS 2002a).

3.2.5.2 Distribution

A small number of wild adult bonytail chub exist in Lake Mohave on the main stem Colorado River of the Lower Colorado River Basin (i.e., downstream of Glen Canyon Dam), and there are small numbers of wild individuals in the Green River and upper Colorado River sub-basins of the Upper Colorado River Basin (USFWS 2002a).

3.2.5.3 Life History and Ecology

Currently no self-sustaining populations of bonytail chub exist in the wild, and very few individuals have been caught throughout its range (USFWS 2002a). The bonytail chub is considered adapted to main stem rivers where it has been observed in pools and eddies. Similar to other closely related *Gila* sub-species, bonytail chub in rivers probably spawn in spring over rocky substrates, while spawning in reservoirs has been observed over rocky shoals and shorelines. There are no documented collections of bonytail chub from the action area.

3.2.5.4 Designated Critical Habitat

The USFWS designated seven reaches of the Colorado River system as critical habitat for the bonytail chub in March 1994 (59 FR 13374). These reaches total 499 kilometers (312 miles) as measured along the center line of the subject reaches. This represents approximately 14 percent of the historical habitat of the species. Critical habitat for the bonytail chub is designated for portions of the Colorado, Green, and Yampa Rivers in the Upper Basin and the Colorado River in the Lower Basin. Critical habitat encompasses the Colorado River from Hoover Dam to Davis Dam and another section of the Colorado River from the northern boundary of Havasu National Wildlife Refuge to Parker Dam including Lake Havasu in Mohave County, Arizona. Additional critical habitat is located in Colorado, Utah, Nevada, and California.

3.2.6 Humpback Chub

3.2.6.1 Listing History and Status

The humpback chub is listed as “endangered” under the federal ESA and by the State of Utah. This species was first included in the List of Endangered Species issued by the Office of Endangered Species on March 11, 1967 (32 FR 4001) and was considered endangered under provisions of the Endangered Species Conservation Act of 1969 (16 U.S.C. 668aa). The humpback chub was included in the United States List of Endangered Native Fish and Wildlife issued on June 4, 1973 (38 FR No. 106), and it received protection as endangered under Section 4(c)(3) of the original ESA of 1973. The final rule for determination of critical habitat was published on March 21, 1994 (59 FR 13374). Its Natural Heritage Status in Utah is S1, critically imperiled. Recovery goals for humpback chub, which amend and supplement the 1990 Recovery Plan (USFWS 1990b), were finalized in 2002 (USFWS 2002b) and revised in 2009 (USFWS 2009a).

3.2.6.2 Distribution

Six extant populations are known: the first five populations are in the Upper Colorado River Basin (i.e., upstream of Glen Canyon Dam), and the sixth population is in the Lower Colorado River Basin (USFWS 2002b). Populations of humpback chub occur in the Little Colorado and Colorado rivers in the Grand Canyon, Black Rocks area of the Colorado River, Westwater Canyon, Cataract Canyon, Desolation/Grey Canyon, and Yampa Canyon (Valdez and Clemmer 1982, USFWS 1990b, USFWS 2002b). The largest population in the upper basin is in Westwater Canyon, with an estimated population size of about 2,400 adult fish. Humpback chub are currently rare in the Yampa River and in Cataract Canyon (Finney et al. 2004, McAda 2004, Jackson 2004a, 2004b, and Utah Division of Wildlife Resources 2004). Humpback chub in the lower Colorado River basin occurs in the Colorado River in Marble and Grand canyons, and in the lower ten miles of the Little Colorado River, constituting the Grand Canyon population, which also represents the lower basin recovery unit (USFWS 2002b).

In Grand Canyon, numbers of adult fish appear to have increased from about 4,500 to 5,700 in 2001 to an estimated 5,300 to 6,700 in 2006 (USGS 2007).

3.2.6.3 Life History and Ecology

Populations of humpback chub are restricted to deep, swift, canyon-bound regions of the mainstem and large tributaries of the Colorado River Basin (USFWS 2002b). Adults require eddies and sheltered shoreline habitats maintained by high spring flows (USFWS 2002b). Young fish require low-velocity shoreline habitats, including eddies and backwaters, that are more prevalent under base-flow conditions (USFWS 2002b). Humpback chub are typically omnivorous with a diet consisting of insects, crustaceans, plants, seeds, and occasionally small fish and reptiles. They appear to be opportunistic feeders, capable of switching diet according to available food sources, and they ingest food items from the water's surface, mid-water column, and river bottom.

3.2.6.4 Designated Critical Habitat

Seven reaches of the Colorado River System were designated as critical habitat for the humpback chub over a total river length of 379 miles in the Yampa, Green, Colorado, and Little Colorado rivers in Arizona, Colorado and Utah. Designated reaches in the lower basin are the lower eight miles of the Little Colorado River and from RM 34 (Nautiloid Canyon) to RM 208 (Granite Park) along the Colorado River.

3.2.7 Razorback Sucker

3.2.7.1 Listing History and Status

The razorback sucker was first proposed for listing under the ESA on April 24, 1978, as a threatened species, but was later withdrawn for technical reasons. In March 1989, the Fish and Wildlife Service was petitioned by a consortium of environmental groups to list the razorback sucker as an endangered species. The Fish and Wildlife Service made a positive finding on the petition in June 1989, which was published in the Federal Register on August 15, 1989. A final rule was published on October 23, 1991, with an effective date of November 22, 1991 (56 FR 54957). Critical habitat was designated on March 21, 1994 (59 FR 13374). The Razorback Sucker Recovery Plan was released in 1998 (USFWS 1998). Recovery Goals were approved in 2002 (USFWS 2002c). Its Natural Heritage Status in Utah and Arizona is S1, critically imperiled.

3.2.7.2 Distribution

Historically, razorback sucker were widely distributed in warm-water reaches of larger rivers of the Colorado River Basin from Mexico to Wyoming (USFWS 2002c). The species is endemic to the Colorado River Basin of the southwestern United States (USFWS 2002c). Razorback sucker are currently found in small numbers in the Green River, upper Colorado River, and San Juan River sub-basins; lower Colorado River between Lake Havasu and Davis Dam; reservoirs of Lake Powell, Lake Mead and Lake Mohave; in small tributaries of the Gila River sub-basin (Verde River, Salt River, and Fossil Creek); and in local areas under intensive management such as Cibola High Levee Pond, Achii Hanyo Native Fish Facility, and Parker Strip (USFWS 2002c). The lower Paria River may provide suitable habitat for razorback sucker near the confluence with the Colorado River in Grand Canyon.

3.2.7.3 Life History and Ecology

Habitats required by adults in rivers include deep runs, eddies, backwaters, and flooded off-channel environments in spring; runs and pools often in shallow water associated with submerged sandbars in summer; and low-velocity runs, pools, and eddies in winter (USFWS 2002c). Spring migrations of adult razorback sucker were associated with spawning in historic accounts, and a variety of local and long-distance movements and habitat-use patterns have been documented (USFWS 2002c). Young require nursery environments with quiet, warm, shallow water

such as tributary mouths, backwaters or inundated floodplain habitats in rivers, and coves or shorelines in reservoirs (USFWS 2002d).

3.2.7.4 Designated Critical Habitat

Critical habitat was designated in 15 river reaches in the historical range of the razorback sucker on March 21, 1994, with an effective date of April 20, 1994. Critical habitat included portions of the Colorado, Duchesne, Green, Gunnison, San Juan, White, and Yampa rivers in the Upper Colorado River Basin, and the Colorado, Gila, Salt, and Verde rivers in the Lower Colorado River Basin.

3.2.8 Siler Pincushion Cactus

3.2.8.1 Listing History and Status

The Siler pincushion cactus (*Pediocactus sileri*) was listed as endangered under the ESA in 1979 (44 FR 61786, October 26, 1979) and down-listed to threatened in 1993 (58 FR 68476, December 27, 1993). No critical habitat has been proposed or designated for this species. A recovery plan was published by the USFWS in 1986 (USFWS 1986). A 5-year review of the Siler pincushion cactus' status was announced in 2006 (71 FR 20714, April 21, 2006).

3.2.8.2 Distribution

The Siler pincushion cactus is restricted to gypsum and salt-rich soils found in southwestern Utah and northwestern Arizona. It is known primarily from the Fredonia area in northwestern Coconino County, Arizona, west into north-central Mohave County, Arizona (USFWS 1986). Its range also extends into Washington and Kane counties in Utah (Welsh et al. 2008). In and near the action area, the Siler pincushion cactus is encountered predominantly within the Kaibab-Paiute Indian Reservation, and can be found from White Sage Wash to Seaman Wash and at Canaan Gap.

3.2.8.3 Life History and Ecology

The Siler pincushion cactus is a perennial succulent in the Cactaceae (Cactus Family). It is globose in shape and occasionally with clustered heads, reaching 4 inches (10 centimeters) tall and 3 inches (7.6 centimeters) to 4 inches (10 centimeters) in diameter. As the cactus matures, it tends to elongate. Tubercles are 0.35 inches (9 millimeters) to 0.59 inches (15 millimeters) long and 0.24 inches (6 millimeters) to 0.43 inches (11 millimeters) wide. Circular areoles contain three to seven brownish-black central spines reaching 1 inch (2.5 centimeters) in length. Central spines are straight and turn pale gray or white with age. Areoles also contain 11 to 16 whitish radial spines, slightly smaller than the central spines. Flowers are yellowish in color with purple veins, 0.7 inches (18 millimeters) to 0.9 inches (22 millimeters) long, and 0.8 inches (20 millimeters) to 1.2 inches (30 millimeters) wide. Fruit is dry, greenish-yellow in color, 0.5 inches (1.2 centimeters) to 0.6 inches (1.5 centimeters) long, and contain gray to black seeds. The flowers of the Siler pincushion cactus open from April to mid-May in Arizona and from March through April in Utah.

The Siler pincushion cactus is habitat specific and found only on low red or gray gypsiferous soils derived from the Moenkopi Formation, and sometimes similar Chinle and Kaibab Formations. It is known mostly from the Great Basin Desertscrub biotic community, but also from the Great Basin Conifer Woodland and Plains, Great Basin Grassland, and Mojave Desert scrub biotic communities (USFWS 1986). The USFWS reports the elevation across this species range from 2,800 feet (853 meters) to 5,400 feet (1,646 meters) (1986). In Utah, the range is reported from 2,950 feet (899 meters) to 5,220 feet (1,591 meters) in elevation (Welsh et al. 2008). The cactus is often found in rolling hills that have a "badlands" appearance with sparse vegetation. It is found in association with *Atriplex canescens*, *Artemisia tridentata*, *Artemisia bigelovii*, *Chrysothamnus* spp., *Salvia dorrii*, *Eriogonum*

corymbosum, *Eriogonum mortonianum*, *Eriogonum thompsoniae* var. *atwoodii*, and *Gutierrezia sarothrae* (USFWS 1986).

3.2.8.4 Designated Critical Habitat

No critical habitat has been designated or proposed for the Siler pincushion cactus.

3.3 Nonessential Experimental Populations

3.3.1 California Condor

3.3.1.1 Listing History and Status

The California condor (*Gymnogyps californianus*) is listed as endangered (32 FR 4001, March 11, 1967) with critical habitat (41 FR 41914, September 24, 1976). The population of California condor in northern Arizona and southern Utah that could be affected by the LPP, however, is designated as a nonessential experimental population pursuant to Section 10(j) of the ESA (61 FR 54044, October 16, 1996). By definition, a "nonessential experimental population" is not essential to the continued existence of the species. Therefore, no proposed action impacting this population could lead to a jeopardy determination for the entire species. This nonessential experimental population is managed in accordance with the provisions of a Memorandum of Understanding (MOU) among the cooperators (noted in the regulation), an Agreement between the Service and a coalition of county and local governments in the California condor experimental population area (Condor Agreement), and the final rule. If legal actions or other circumstances compel a change in this nonessential experimental population's legal status to essential, threatened, or endangered, or compel the Service to designate critical habitat for the California condor within the experimental population area defined in the rule, all California condors will be removed from such area and this experimental population rule will be revoked unless the parties to the MOU and Condor Agreement existing at that time agree that the birds should remain in the wild. 61 FR 54044, 54051. Under the Condor Agreement, current and future water development projects should not be restricted due to the designation of the nonessential experimental population, the presence or potential presence of California condors. According to the USFWS Handbook, a conference is required only when a proposed action is likely to jeopardize the existence of a species. Nevertheless, this report discusses potential consequences to the California condor.

3.3.1.2 Distribution

Severe condor population declines prompted captive breeding programs in the late 1970s. The species' range was restricted to chaparral, coniferous forests, and oak savannah habitats in southern and central California. By 1982, only 22 birds survived (Peregrine Fund 2010) and all remaining wild birds were brought into captivity in 1987. As captive breeding programs developed adequate numbers of young condors, reintroduction programs were initiated with one site located on the Vermilion Cliffs in northern Arizona approximately 20 miles southeast of the LPP. Early in the reintroduction program, young condors were released on the Hurricane Cliffs, but that site was terminated (USFWS 2007). About 300 condors now exist in the world, with half of them flying free. By the end of 2010, the total California condor population in Arizona and southern Utah numbered 76, including eight birds fledged in the wild (USFWS 2010a; Peregrine Fund 2010). Condors released in Arizona are radio and global positioning system (GPS) monitored. In the past several years, condors have regularly traveled to the Kolob Plateau region of Utah in Zion National Park, crossing the action area near the western portion of the proposed LPP route. (Peregrine Fund 2010). The current population estimate for condors in Arizona and Utah is 80 individuals (http://www.fws.gov/cno/es/pdf%20files/Ca-Condor-Recovery-Prog2015PopulationStatus.pdf).

3.3.1.3 Life History and Ecology

Condors are a cavity-nesting species with sites ranging from overhung ledges on cliffs to crevices in boulder piles, potholes, caves and (rarely) tree cavities in giant sequoias. Condors prefer sites that are at least partly sheltered from weather and on a cliff or steep slope or a tall tree to allow for easy approach from the air (BNA 2010). Nests are simple scrapes, and condors do not bring nesting materials to the nest site. High perches are necessary for roosting as well, to create the strong updrafts required for lift into flight. California condors reach sexual maturity between 5 and 7 years of age. Survival has been estimated to be up to 40 years in the wild (USFWS 2010a). Pairing begins in late fall and may last for several years; lifetime mating is uncertain (BNA 2010). Females lay a single egg, usually in January or February (BNA 2010) and may produce a replacement egg in 4 to 5 weeks if the first one is lost. Chicks hatch after 54 to 58 days of incubation (USFWS 2010a); chicks have white down at hatching and their eyes are open (BNA 2010). Fledging occurs at about 6 months. Chicks remain dependent on their parents for up to 2 years as they learn to forage in the wild. Because of this, pairs do not breed every year (BNA 2010). All California condors are now descended from only 14 founders. There are 3 distinct clans, but within each clan there is extreme inbreeding (San Diego Zoo 2010).

Open grasslands or savannahs are important to condors while searching for food (AGFD 2010). Condors are strictly carrion eaters and tend to prefer larger mammals (USFWS 2010a), but they will also seek food near human habitation (Sibley 2001). Condors may travel up to 150 miles per day while foraging (USFWS 2010a). Foraging occurs mostly in grasslands, including *potreros* (a paddock or pasture for horses or cattle) within chaparral areas, or in oak savannahs (USFWS 2010a).

Potential threats to condors in the wild include illegal poaching, lead poisoning from eating contaminated hunting carcasses, collisions with electrical transmission lines and habituation to humans and dependence on human sources of food (USFWS 2010a). The lead poisoning has partly been managed by regular blood testing and chelation treatment of poisoned birds, but mortality continues (BNA 2010). Since 2005, the AGFD has provided free non-lead ammunition to big game hunters in the areas condors frequent most during the hunting season; this effort has helped to reduce lead exposure for condors in Arizona. (http://www.azgfd.gov/w_c/california_condor_lead.shtml).

3.3.1.4 Designated Critical Habitat

Critical habitat has been designated for the California condor in California, but there is no critical habitat designated in Arizona and Utah (USFWS 2010a).

Chapter 4
Effects of the Action

4.1 Effects Determinations

The following are accepted determinations of effects on listed species:

- No Effect: no effect on the listed species or designated critical habitat
- Is Not Likely to Adversely Affect: effects on the listed species or designated critical habitat are insignificant, discountable, or completely beneficial.
- Is Likely to Adversely Affect: effects to species are not discountable, insignificant, or beneficial, and/or that would result in incidental take of the listed species or designated critical habitat that is not discountable, insignificant, or beneficial
- Beneficial effects are positive responses without any negative response at the individual level. If an action will have beneficial effects for the species overall, but adversely impacts one or more individuals in the process, "likely to adversely affect" is the appropriate conclusion.

Adverse effects on listed species include the following:

- Taking of threatened or endangered species
- Loss or degradation of utilized or potentially utilized habitat that would exceed the estimated level necessary to maintain viable populations or sub-populations of each species
- Actions that lead to long-term disturbance in species migration and dispersal, breeding behavior or pollination that would threaten the viability of the population or sub-population

4.2 Potential Effects of the Proposed Project

4.2.1 Pipeline and Ancillary Facilities

The Proposed Action will involve constructing, operating and maintaining the features and facilities described in Chapter 1 and shown in Figures 1-1, 1-2 and 1-4. Pipelines (water delivery system and penstocks) will have a 100-foot wide permanent disturbance corridor over the length of the features, including a single lane inspection and service road, and 50-foot wide temporary construction disturbance corridor on one side of the permanent disturbance area. Footprints of booster pump stations, hydro generation stations, regulating tanks, forebays and afterbays, and access roads associated with those features are included in the permanent disturbance area. The temporary access and construction corridors will be restored and revegetated with native species; shrubs and trees will be allowed to revegetate naturally in these corridors except directly over the pipeline. Construction staging areas will be revegetated with native species after construction is completed.

4.2.2 Transmission Lines

Transmission lines will be constructed, operated, and the features and facilities maintained as described in Chapter 1 and shown in Figures 1-5 and 1-6.

All of the aerial transmission lines to be constructed are high-voltage lines with voltages ranging from 12 kV (one line) to 345 kV (one line). Approximately 91.4 miles of new transmission lines will be constructed. Most of the

aerial lines will be 138 kV (two lines) or 69 kV (seven lines). One new 12 kV transmission line of 0.6 mile will be constructed. Aerial transmission line supports will be 75- to 100-foot-tall steel single-poles. Foundations for the poles will be constructed by ground crews, and the towers will be delivered to each foundation by helicopter for installation. Pole foundations will be approximately 8 by 8 feet square and spaced approximately 450 feet apart (12 per mile). Total permanent tower-base disturbance will be approximately 0.02 acre per line mile. Each new transmission line will have a double track 10-foot-wide access road constructed parallel to the line, except where use of existing access road alignments is possible. Total permanent disturbance for new or upgraded access roads will be approximately 1.2 acres per line mile; total permanent disturbance for transmission lines will be approximately 1.22 acres per line mile. Conductors will be pulled by helicopter with ground crew support and will not require additional disturbance area for installation.

A transmission line ROW requires an area cleared of trees sufficient to protect the conductor wires from hazards from falling trees and arcing. The required distance of clearing from the centerline of the ROW is variable because of the variable sag of conductors between support poles, the greatest sag occurring at the midpoint between support poles. Conductor sag is greater with higher loads and during hot weather. Conductors sway laterally because of wind pressure. Any trees within the conductor cross-section of the line that will potentially contact or arc to the conductors at maximum sag, load and sway will be removed from the ROW; certain tall "danger trees" outside of the ROW will be removed if there were risk to the conductors if the trees fell. In general, for a 75-foot support tower pole line, vegetation over 25 feet in height will be required to be cleared to a distance of 50 feet from the center line only in the region surrounding maximum sag. It is not possible to estimate the necessary area of ROW clearing because of the patchy distribution of trees along most of the new transmission lines and varying topography.

New switch stations and substations will be constructed and existing substations will be upgraded to handle the increased line voltages. Upgraded substations will require about 5 acres of additional permanent land disturbance outside of the existing substation footprint. New switch stations and substations will require a footprint of approximately 5 acres of permanent land disturbance.

4.2.3 Summary of Effects Determinations

The effects determinations for the species evaluated in the following sections are summarized in Table 4-1.

Table 4-1
Summary of Effects Determinations

Species	Effects Determinations
Mexican Spotted Owl	Not Likely to Adversely Affect
Southwestern Willow Flycatcher	Not Likely to Adversely Affect
Yellow-billed Cuckoo	No Effect
Mojave Desert Tortoise	Likely to Adversely Affect
Bonytail Chub	No Effect
Humpback Chub	No Effect
Razorback Sucker	No Effect
Siler Pincushion Cactus	Not Likely to Adversely Affect

4.3 Species Effects Analyses

4.3.1 Mexican Spotted Owl

4.3.1.1 Construction Effects

4.3.1.1.1 Pipeline and Ancillary Facilities. LPP features will not be constructed, operated or maintained in Mexican spotted owl nesting habitat. The proposed action will not result in any permanent disturbance of critical habitat and will only temporarily impact a small portion of available foraging habitat for the spotted owl when compared to available habitat in the vicinity of the action area. Construction of the pipelines and ancillary facilities will not change the prey population for the spotted owl. No individuals or populations will be at risk. Preconstruction consultation with wildlife agencies will determine if recent occurrences of Mexican spotted owl have been reported within or near the LPP action area.

Estimated maximum construction noise is estimated to be 100 A-weighted decibels (dBA) (UBWR 2016c) and will be considered a "point" source which will decay at 3 dBA with doubling of distance from the source (FHA 1995). Traffic noise is considered a "linear' sound source and decays at approximately 4.5 dBA per doubling of distance from the source over landscape (as opposed to paved or "hard" surfaces) (FHA 1995). Noise has the potential to temporarily disrupt owls in the vicinity by masking calls or interfering with foraging behavior in the limited foraging habitat where the alignment intersects with pinyon-juniper woodlands.

4.3.1.1.2 Transmission Lines. No Transmission Line features will be constructed in Mexican spotted owl primary nesting, foraging and designated critical habitat.

4.3.1.2 Operation and Maintenance Effects

4.3.1.2.1 Pipeline and Ancillary Facilities. Inspection and maintenance activities will not occur in designated Mexican spotted owl critical habitat. Therefore, no effects will occur on designated critical habitat from operation and maintenance activities.

Indirect effects from exterior lighting at pump stations and hydro stations will be insignificant because they will not be located in prime spotted owl nesting, roosting or foraging habitat, and pump station lighting will be controlled using motion detectors.

4.3.1.2.2 Transmission Lines. Injury or electrocution of spotted owls by transmission lines is a potential hazard. The joint Edison Electrical Institute (EEI) and USFWS *Avian Protection Plan Guidelines* (2005), *Suggested Practices for Avian Protection on Power Lines: The State of the Art in 2006* (APLIC 2006), and *Reducing Avian Collisions with Power Lines: The State of the Art in 2012* (APLIC 2012) guidelines s will be employed on all LPP transmission lines. The potential for spotted owl electrocution or injury from transmission conductors or supports is probably lower than that for open-country raptors because their preferred roosting and foraging habitat is in closed-cover forests, where power lines are less frequent. Effects from operation and maintenance of the Transmission Line Alignments on the Mexican spotted owl are unlikely.

4.3.1.3 Effects Determination. The Proposed Action pipelines, penstocks and associated facilities will not affect the Mexican spotted owl and will have no effect on designated critical habitat. The Transmission Line

Alignments portion of the Proposed Action may affect, but are unlikely to adversely affect, the Mexican spotted owl.

4.3.2 Southwestern Willow Flycatcher

4.3.2.1 Construction Effects.

4.3.2.1.1 Pipeline and Ancillary Facilities. Potential southwestern willow flycatcher nesting habitat within the action area was surveyed following USFWS defined field survey protocols during May 2010 (LSD 2010a and 2010b; see Appendices B and C). Seven potential willow flycatcher sites were evaluated. The only site meeting protocol criteria was the Paria River crossing within the action area. No breeding southwestern willow flycatchers were detected; one transient willow flycatcher was detected, but it did not vocalize so confirmation of the southwestern subspecies was not possible. If re-survey of the Paria River crossing site is not performed prior to construction to verify absence, the construction will be conducted outside of Southwestern willow flycatcher breeding and fledging period.

The action area is proximate to the stream segments designated as critical habitat within the Virgin Management Unit of the Lower Colorado Recovery Unit and the Paria River north of U.S. Highway 89 of the Powell Management Unit (78 FR No. 278, January 3, 2013). Within the action area, potential southwestern willow flycatcher nesting habitat was determined suitable for the species if the site provided a combination of characteristics that included standing water or moist soils with dense stands of native (e.g., cottonwood) and/or nonnative (e.g., tamarisk) riparian trees that form a closed canopy. Additionally, the level of disturbance from livestock grazing, development, and recreation were considered in evaluating potentially suitable habitat (See Chapter 3).

The pipeline corridor will cause permanent disturbance to a small area of potential southwestern willow flycatcher nesting habitat; however, that habitat will be immediately adjacent to U.S. Highway 89 and likely will not be utilized for nesting in the absence of the LPP.

Project construction will not materially change the foraging habitat or potential prey population of the southwestern willow flycatcher. The LPP features at the Paria River crossing will not change human activity in the area. Indirect effects from the LPP will be insignificant.

Project construction will occur proximate to designated southwestern willow flycatcher critical habitat at the Paria River. The Proposed Action will result in effects to southwestern willow flycatcher critical habitat.

4.3.2.1.2 Transmission Lines. One transmission line will be constructed crossing the Paria River approximately 3.9 miles downstream (south) of the U.S. Highway 89 crossing. This crossing site does not have suitable breeding habitat for the willow flycatcher and is outside of the species' critical habitat.

4.3.2.2 Operation and Maintenance Effects.

4.3.2.2.1 Pipeline and Ancillary Facilities. Occasional routine maintenance at the Paria River crossing will be scheduled outside of the southwestern willow flycatcher breeding season. With this mitigation measure, operation and maintenance will not affect the southwestern willow flycatcher. Protocol surveys for the southwestern willow flycatcher will be repeated at the Paria River crossing to determine if suitable habitat develops, sustains, and becomes occupied by southwestern willow flycatchers.

Project water delivery to end users will not materially affect existing or potential riparian habitat for the southwestern willow flycatcher in the action area (UBWR 2016d). LPP return flows to the Virgin River via treated wastewater effluent pathways will not measurably change the Virgin River flows.

Nighttime lighting at pump stations or hydro stations will have no effect on the southwestern willow flycatcher because these facilities will not be located in or near suitable or critical habitat and the exterior lighting will be controlled by motion detectors.

4.3.2.2.2 Transmission Lines. Electrocution or injury of willow flycatchers by transmission lines will be unlikely. Avian protection measures (EEI and USFWS 2005; APLIC 2006, 2012) will be employed on all LPP transmission lines.

4.3.2.3 Effects Determination.

The Proposed Action may affect, but is not likely to adversely affect southwestern willow flycatcher, its habitat, or designated critical habitat.

4.3.3 Yellow-billed Cuckoo

4.3.3.1 Construction Effects.

4.3.3.1.1 Pipeline and Ancillary Facilities. Potential yellow-billed cuckoo nesting habitat within the action area was surveyed coincident with southwestern willow flycatcher surveys (LSD 2010a; see Appendix B). The Paria River crossing site was the only location that met criteria for potential cuckoo nesting habitat. Field surveys using the USFWS survey protocols were performed during May 2010. No cuckoos were detected. The habitat was considered to be inadequate for the specific habitat elements required for cuckoo nesting (LSD 2010a).

The USFWS proposed to designate critical habitat for the western distinct population segment of the yellow-billed cuckoo in August 2014 (79 FR 79 No.158, August 15, 2014). Proposed critical habitat in Utah includes Critical Habitat Unit 68 composed of a portion of the Virgin River in Washington County. Critical Habitat Unit 68 within Washington County occurs within the Virgin River corridor from the Atkinville Wash confluence, extending continuously north along the river corridor, to the confluence with Mill Creek. Critical habitat is currently proposed for the western distinct population segment of the yellow-billed cuckoo. The northern portion of the Proposed Action alignment at Sand Hollow Reservoir is approximately 7.5 miles east of the proposed yellow-billed cuckoo critical habitat.

Construction of the Proposed Action will not materially change the potential foraging habitat or prey base for the yellow-billed cuckoo. There will be no indirect impacts from the Proposed Action on the yellow-billed cuckoo. Proposed Action construction will not approach or cross proposed yellow-billed cuckoo critical habitat; there will be no effect on proposed yellow-billed cuckoo critical habitat.

4.3.3.1.2 Transmission Lines. No transmission lines will be constructed over potential yellow-billed cuckoo habitat at the U.S. Highway 89 crossing of the Paria River. No cuckoos were identified during field survey of this site (LSD 2010a; see Appendix B), and the habitat was considered to not meet cuckoo nesting requirements. No other yellow-billed cuckoo potential habitat is present in any transmission line alignments.

4.3.3.2 Operation and Maintenance Effects.

4.3.3.2.1 Pipeline and Ancillary Facilities. Occasional maintenance at the Paria River crossing site will not affect yellow-billed cuckoos.

Project water delivery to end users will not materially affect existing or potential riparian habitat for the yellow-billed cuckoo in the LPP action area (UBWR 2016d). LPP return flows to the Virgin River via treated wastewater effluent pathways will not measurably change the Virgin River flows.

4.3.3.2.2 Transmission Lines. Electrocution or injury of yellow-billed cuckoos by transmission line conductors or supports is highly unlikely to occur. No transmission lines will cross yellow-billed cuckoo potential habitat at the Paria River crossing of the LPP.

4.3.3.3 Effects Determination.

The Proposed Action will have no effect on the yellow-billed cuckoo, its habitat or proposed critical habitat.

4.3.4 Mojave Desert Tortoise

4.3.4.1 Construction Effects.

4.3.4.1.1 Pipeline and Ancillary Facilities. Mojave desert tortoise surveys were conducted in Washington County, Utah in 2010. Surveys were performed according to the USFWS survey protocol as provided in *2010 Preparing for Any Action That May Occur Within the Range of the Mojave Desert Tortoise (Gopherus agassizii)* (LSD 2010c; see Appendix D). The LPP construction corridor (generally 150 feet), as well as all equipment and facilities sites, and forebay and afterbay reservoirs, require 100 percent survey coverage (see Figure 4-1) where these areas are within potentially suitable habitat for the Mojave desert tortoise. All transect routes were surveyed to the extent possible unless precluded by private property or where impassable terrain limited access. Lands that were not surveyed because suitable tortoise habitat is not present included the following:

- steep slopes adjacent to the Hurricane Cliffs
- private residential and commercial developments adjacent to Highway 17 in Toquerville, south of Highway 9 at Sheep Bridge Road, within the City of Hurricane, and adjacent to Sky Ranch Airport Community
- private agricultural and ranch developments south of Highway 9 to Sand Hollow State Park, along 1500 West, and south of Highway 9 along the Honeymoon Trail (LSD 2010c).

Table 4-2 shows the estimated amount of acres of occupied and unoccupied habitat in the vicinity of the action area on federal and non-federal lands based on the results of surveys (2 live tortoises and 69 sites with tortoise sign [burrows, scats and 1 skeletal remain]). Results are also shown on Figure 4-1. Table 4-3 is a subset of the habitat acreage shown in Table 4-2 and shows the amount of permanent (construction of above ground facilities and reservoirs and permanent pipeline ROW) and temporary construction disturbance anticipated under the Proposed Action to desert tortoise habitat in the action area.

Table 4-2
Desert Tortoise Habitat in the Action Area (acres)

Occupied		Unoccupied		Unsurveyed
Federal Land	Total (includes HCP Lands)	Federal Land	Total (includes HCP lands)	
2,785	4,998	4,779	7,135	4,080

Table 4-3 Desert Tortoise Habitat Disturbance (acres)		
	Permanent	**Temporary**
Federal, Occupied Land	399.1	8.2
Federal, Unoccupied Land	524.5	3.2
Total Federal Land	**923.6**	**11.4**
HCP Land	310.5	1,240.9
Total Federal and HCP Land	**1,234.1**	**1,252.3**

Occupied habitat is identified as lands where tortoises or tortoise sign was observed and the lands contiguous with this area that share similar habitat features important to tortoise (e.g. topography and vegetation). Tortoise sign was not located in areas mapped as unoccupied, and these areas lacked topographic, soil characteristics, and/or vegetative features necessary to support Mojave desert tortoise. Locations of observed tortoise sign are shown on Figure 4-2.

The Red Cliffs Desert Reserve has defined "incidental take areas" that are designated Mojave desert tortoise habitat outside of the Reserve boundaries; any development or habitat disturbance within an incidental take area must be coordinated with the Desert Reserve administration (Red Cliffs Desert Reserve 2011a). Take Area 10, South Hurricane, consists of 87 acres on SITLA-administered land and covers part of the proposed Hurricane Cliffs afterbay (Red Cliffs Desert Reserve 2011b). It is designated for incidental take because of its isolation. The incidental take permit is a county-wide take permit for desert tortoises, so take may occur anywhere in Washington County outside the Reserve (excluding the Beaver Dam Slope) in the unincorporated county and where a city has passed the Habitat Conservation Plan Impact Fees Ordinance. Hurricane City has passed the HCP Impact Fees Ordinance. The HCP process has identified areas where incidental take is most likely to occur, totaling 12,264 acres. HCP take areas do not apply to BLM-administered lands. Take areas are primarily low-density habitat adjacent to existing development. Most of these areas are within the boundaries of the incorporated cities of Washington County and have already been adversely impacted by urban development and human activities. The USFWS could coordinate with the HCP administration to provide the same protections provided by the HCP, rather than bifurcating tortoise treatment related to the project.

Because Mojave desert tortoises are mobile, re-survey of the action area will be performed prior to construction and the Desert Tortoise Council *Guidelines for Handling Desert Tortoises During Construction Projects* (Desert Tortoise Council 1999) and USFWS *Guidelines For Handling Desert Tortoises- Mojave Population And Their Eggs* (USFWS 2009c) will be rigorously adhered to. A tortoise biologist will be present or immediately available during construction to manage any tortoises encountered during construction. Other mitigation and monitoring measures that will reduce impacts to desert tortoise are discussed in Chapter 5.

Filling of the afterbay reservoir could drown Mojave desert tortoise in their dens or if they were unable to disperse rapidly enough. If there is a desert tortoise observed, it will be left to move on its own – the tortoise will not be approached or handled. If this does not occur prior to reservoir filling, an approved desert tortoise biologist will be contacted to remove and relocate the tortoise. Burrows, tortoise scat and one live tortoise were observed in or near Take Area 10 during field surveys. All construction activity in or near Take Area 10 will require coordination with the HCP administration and compliance with HCP requirements.

Mojave desert tortoise will not be adversely affected by actions within take areas of the HCP in compliance with the HCP because they are covered under the HCP provisions. On federal lands, to the extent that habitat will be

permanently disturbed, construction of LPP facilities will likely adversely affect the Mojave desert tortoise. Impacts to the desert tortoise will occur from loss of habitat, both in the short-term and long-term. Increased noise and human presence during construction in suitable tortoise habitat will also have the potential to affect desert tortoise behavior.

No designated Mojave desert tortoise critical habitat will be disturbed by pipeline or transmission line construction. Forebay and afterbay reservoirs will not be located in designated critical habitat. There are no new access roads planned for construction in existing Mojave desert tortoise habitat.

4.3.4.1.2 Transmission Lines. Three transmission lines will be constructed in Mojave desert tortoise habitat that was classified as "occupied" in the tortoise field survey (LSD 2010c; see Appendix D). Surveyed occupied habitat totaling 19.7 acres will be permanently disturbed on private land, and surveyed occupied habitat totaling 3.7 acres will be permanently disturbed on BLM-administered land. Construction could cause adverse effects on desert tortoises. Precautionary measures outlined in Chapter 5 will be implemented to minimize potential mortality or disturbance of tortoises.

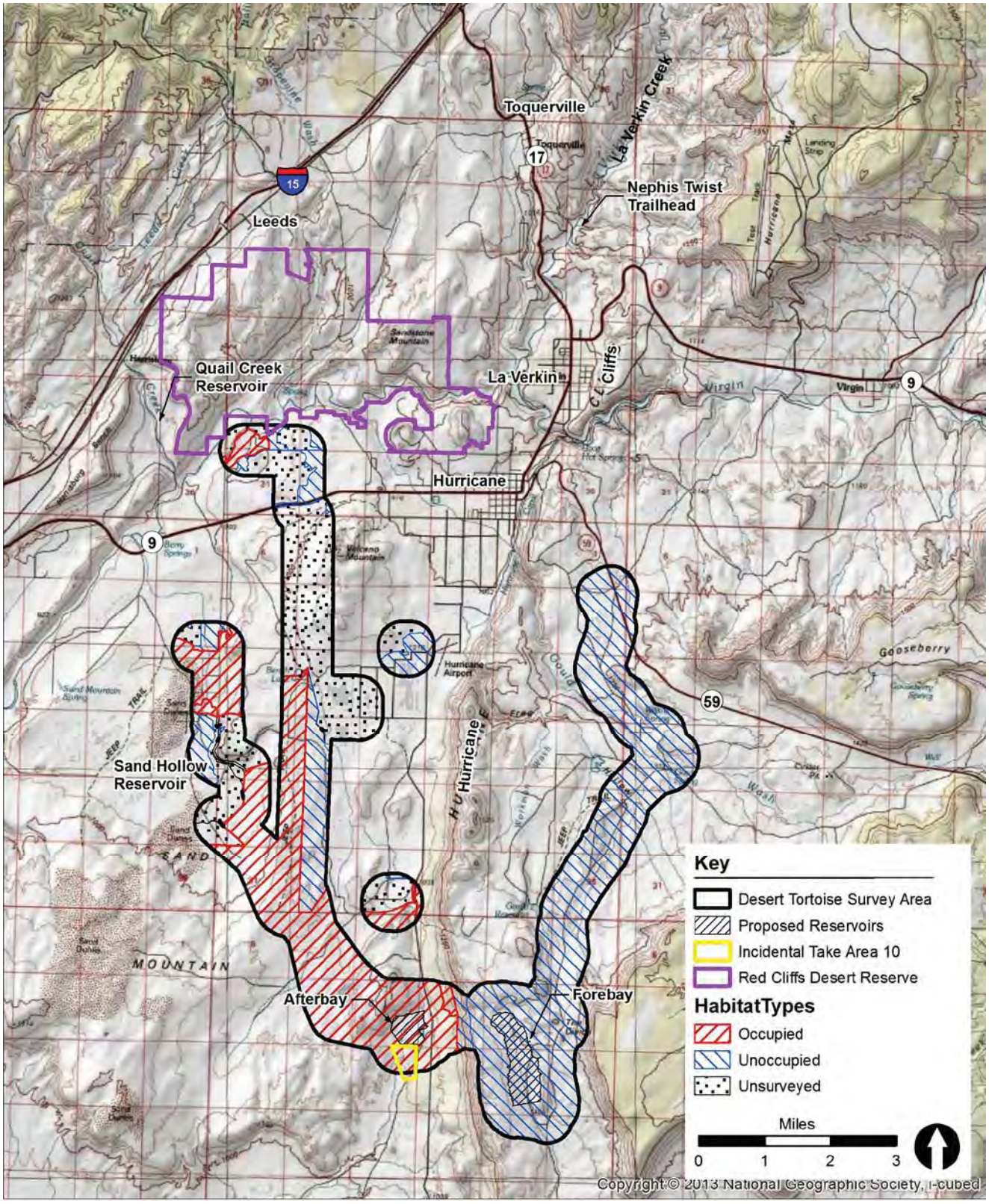
4.3.4.2 Operation and Maintenance Effects.

4.3.4.2.1 Pipeline and Ancillary Facilities. LPP facilities will be staffed, operated and maintained in Mojave desert tortoise habitat and will increase vehicular traffic, placing tortoises at risk of vehicular mortality. Operations and maintenance activity in or near Take Area 10 will be coordinated with HCP administration. Precautions outlined in Chapter 5 will be included in all operation and maintenance plans and will minimize potential tortoise mortality.

4.3.4.2.2 Transmission Lines. Three transmission lines will be subject to periodic inspection and maintenance in occupied Mojave desert tortoise habitat; this activity could cause adverse effects on desert tortoises due to potential increase in vehicle traffic on transmission line access roads. Additionally, ravens and other known avian predators of desert tortoise may use the transmission lines as perches, increasing mortality of tortoises near those areas. Perch discouragers will be designed and constructed on LPP transmission lines in accordance with the recommendations of the Avian Power Line Interaction Committee (APLIC, 2006) to limit avian predation of desert tortoise.

4.3.4.3 Effects Determination.

The Proposed Action may affect, and is likely to adversely affect the Mojave desert tortoise or its habitat, and will have no effect to designated critical habitat as none is present in the vicinity.



Source:
This map is from the
"Draft Lake Powell Pipeline Project
Mojave Desert Tortoise Survey Report"
Prepared by Logan Simpson Design.

FERC Project Number:
12966-001
BLM Serial Numbers:
AZA-34941
UTU-85472

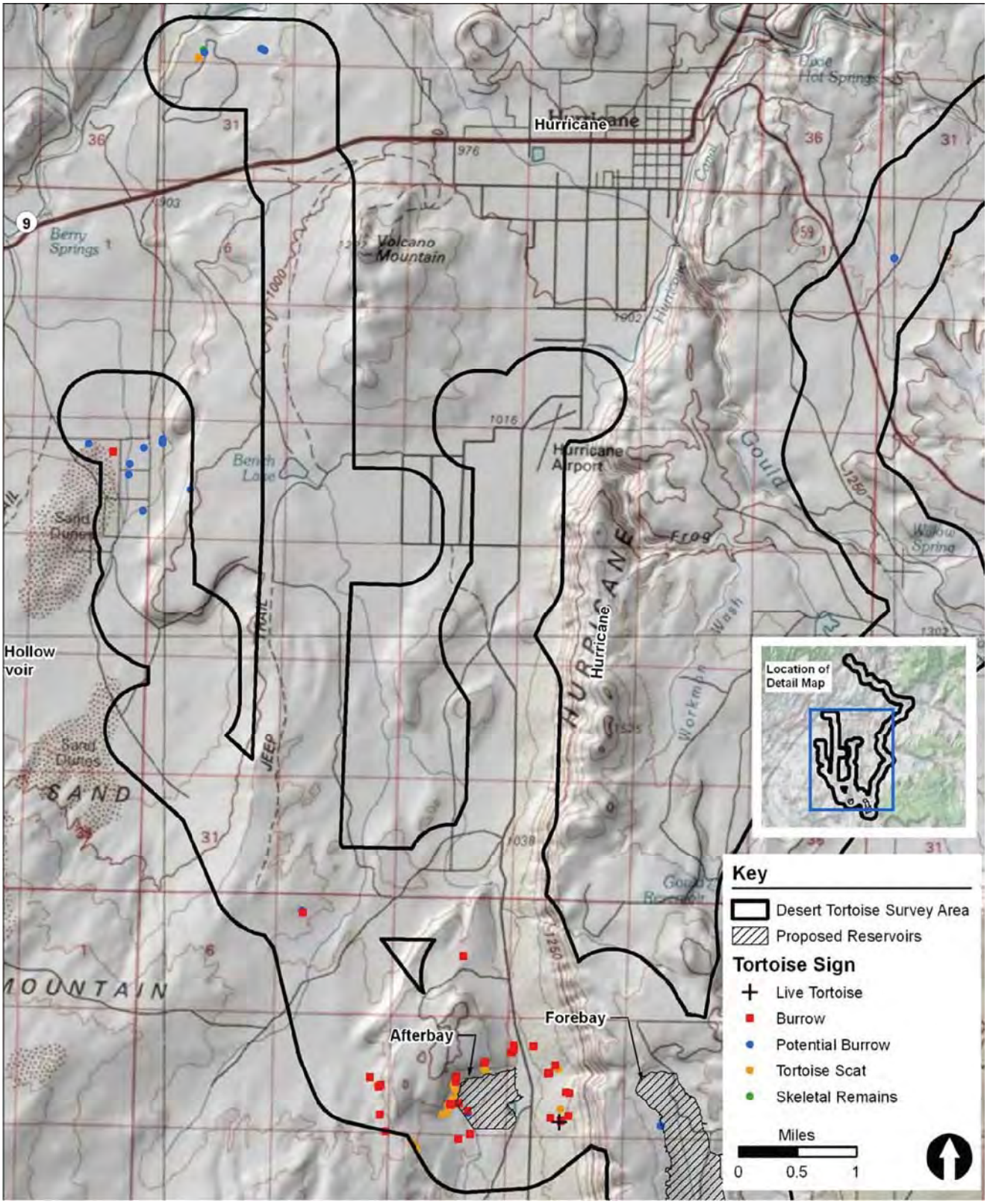
N

Lake Powell Pipeline Project

Spatial Reference: UTM Zone 12N, NAD-83

UDWRe **Figure 4-1** Stantec

Mojave Desert Tortoise Habitat Map



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Lake Powell Pipeline Project

Spatial Reference: UTM Zone 12N, NAD-83

UDWRe **Figure 4-2** Stantec

Mohave Desert Tortoise Sign Location Map

4.3.5 Bonytail Chub

4.3.5.1 Construction Effects.

4.3.5.1.1 Pipeline and Ancillary Facilities. No pipelines or ancillary facilities will be constructed in bonytail chub habitat.

4.3.5.1.2 Transmission Lines. No transmission line facilities will be constructed in bonytail chub habitat.

4.3.5.2 Operation and Maintenance Effects.

4.3.5.2.1 Pipeline and Ancillary Facilities. The Reclamation hydrologic modeling of Lake Powell levels and Glen Canyon Dam releases demonstrate that the hydrologic impacts of the LPP will not be measurable, particularly within the variation of river flows resulting from Glen Canyon Dam water releases. The Reclamation model results indicate that the LPP will not measurably or adversely affect river flows or hydrology in the Colorado River downstream from Glen Canyon Dam. The LPP will have no hydrologic effect on bonytail chub.

The Reclamation water quality modeling of Lake Powell and Glen Canyon Dam releases demonstrate that the water quality impacts of the LPP will not be measurable, especially within the variation of conditions resulting from Glen Canyon Dam water releases. The Reclamation water quality modeling results indicate that the LPP will not measurably or adversely affect water quality in the Colorado River downstream from Glen Canyon Dam. The LPP will have no effect on water quality for bonytail chub.

There will be no operation and maintenance effects on the bonytail chub.

4.3.5.2.2 Transmission Lines. No transmission line facilities will be operated or maintained in bonytail chub habitat.

4.3.5.3 Effects Determination.

The Proposed Action will have no effect on the bonytail chub or its habitat.

4.3.6 Humpback Chub

4.3.6.1 Construction Effects.

4.3.6.1.1 Pipeline and Ancillary Facilities. No pipelines or ancillary facilities will be constructed in humpback chub habitat.

4.3.6.1.2 Transmission Lines. No transmission line facilities will be constructed in humpback chub habitat.

4.3.6.2 Operation and Maintenance Effects.

4.3.6.2.1 Pipeline and Ancillary Facilities. The Reclamation hydrologic modeling of Lake Powell levels and Glen Canyon Dam releases demonstrate that the hydrologic impacts of the LPP will not be measurable, particularly within the variation of river flows resulting from Glen Canyon Dam water releases. The Reclamation model results indicate that the LPP will not measurably or adversely affect river flows or hydrology in the Colorado River downstream from Glen Canyon Dam. The LPP will have no hydrologic effect on humpback chub.

The Reclamation water quality modeling of Lake Powell and Glen Canyon Dam releases demonstrate that the water quality impacts of the LPP will not be measurable, especially within the variation of conditions resulting from Glen Canyon Dam water releases. The Reclamation water quality modeling results indicate that the LPP will not measurably or adversely affect water quality in the Colorado River downstream from Glen Canyon Dam. The LPP will have no effect on water quality for humpback chub.

There will be no operation and maintenance effects on the humpback chub.

4.3.6.2.2 Transmission Lines. No transmission line facilities will be operated or maintained in humpback chub habitat.

4.3.6.3 Effects Determination.

The Proposed Action will have no effect on the humpback chub or its habitat.

4.3.7 Razorback Sucker

4.3.7.1 Construction Effects.

4.3.7.1.1 Pipeline and Ancillary Facilities. No pipelines or ancillary facilities will be constructed in razorback sucker habitat.

4.3.7.1.2 Transmission Lines. No transmission line facilities would be constructed in razorback sucker habitat.

4.3.7.2 Operation and Maintenance Effects.

4.3.7.2.1 Pipeline and Ancillary Facilities. The Reclamation hydrologic modeling of Lake Powell levels and Glen Canyon Dam releases demonstrate that the hydrologic impacts of the LPP will not be measurable, particularly within the variation of reservoir levels and river flows resulting from Glen Canyon Dam operations and water releases. The Reclamation model results indicate that the LPP will not measurably or adversely affect river flows or hydrology in the Colorado River downstream from Glen Canyon Dam. The LPP will have no hydrologic effect on razorback sucker.

The Reclamation water quality modeling of Lake Powell and Glen Canyon Dam releases demonstrate that the water quality impacts of the LPP will not be measurable, especially within the variation of conditions resulting from Glen Canyon Dam operations and water releases. The Reclamation water quality modeling results indicate that the LPP will not measurably or adversely affect water quality in Lake Powell and the Colorado River downstream from Glen Canyon Dam. The LPP will have no effect on water quality for razorback sucker.

There will be no operation and maintenance effects on the razorback sucker.

4.3.7.2.2 Transmission Lines. No transmission line facilities would be operated or maintained in razorback sucker habitat.

4.3.7.3 Effects Determination.

The Proposed Action would have no effect on the razorback sucker or its habitat.

4.3.8 Siler Pincushion Cactus

4.3.8.1 Construction Effects

4.3.8.1.1 Pipeline and Ancillary Facilities. Rare plant surveys were conducted from April through mid-September 2009 and from mid-April through July 2010. Siler pincushion cacti were predominantly found within gypsum badlands of the Colorado Plateau supporting diverse plant communities that included other rare, endemic plants, including *Cryptantha semiglabra*, *Eriogonum mortonianum*, and *Eriogonum thompsoniae* var. *atwoodii*. A total of eight Siler pincushion cacti were detected along the 600-foot-wide survey corridor along the Proposed Action alignment in Coconino County, Arizona, and Washington County, Utah; however, the recorded locations for these cacti are outside of the construction easement where ground-disturbing activities will occur (Figure 4-3 through Figure 4-5). No documented Siler pincushion cacti were found within the proposed construction easement; however, it is possible for cacti that weren't previously documented to be found during future preconstruction surveys given that suitable habitat is present.

4.3.8.1.2 Transmission Lines. Project transmission lines and associated substations, switch stations and access roads will not be constructed in or near suitable habitat for the Siler pincushion cactus.

4.3.8.2 Operation and Maintenance Effects

4.3.8.2.1 Pipeline and Ancillary Facilities. Routing the pipeline through habitat supporting special status plant species could adversely affect the viability of individuals located within or adjacent to the action area. The establishment and maintenance of roads in association with the Proposed Action may provide a route for noxious and invasive weeds to colonize adjacent natural lands. Disturbance associated with the Proposed Action, including the creation and filling of penstock trenches, may lead to erosion. Creating access roads can open up remote areas to off highway vehicle use. Mitigation and monitoring of these potential effects are discussed in Chapter 5.

4.3.8.2.2 Transmission Lines. Project transmission lines and associated substations, switch stations and access roads will not be constructed in or near suitable habitat for the Siler pincushion cactus.

4.3.8.3 Effects Determination

The Proposed Action may affect, but is not likely to adversely affect the Siler pincushion cactus or its habitat.

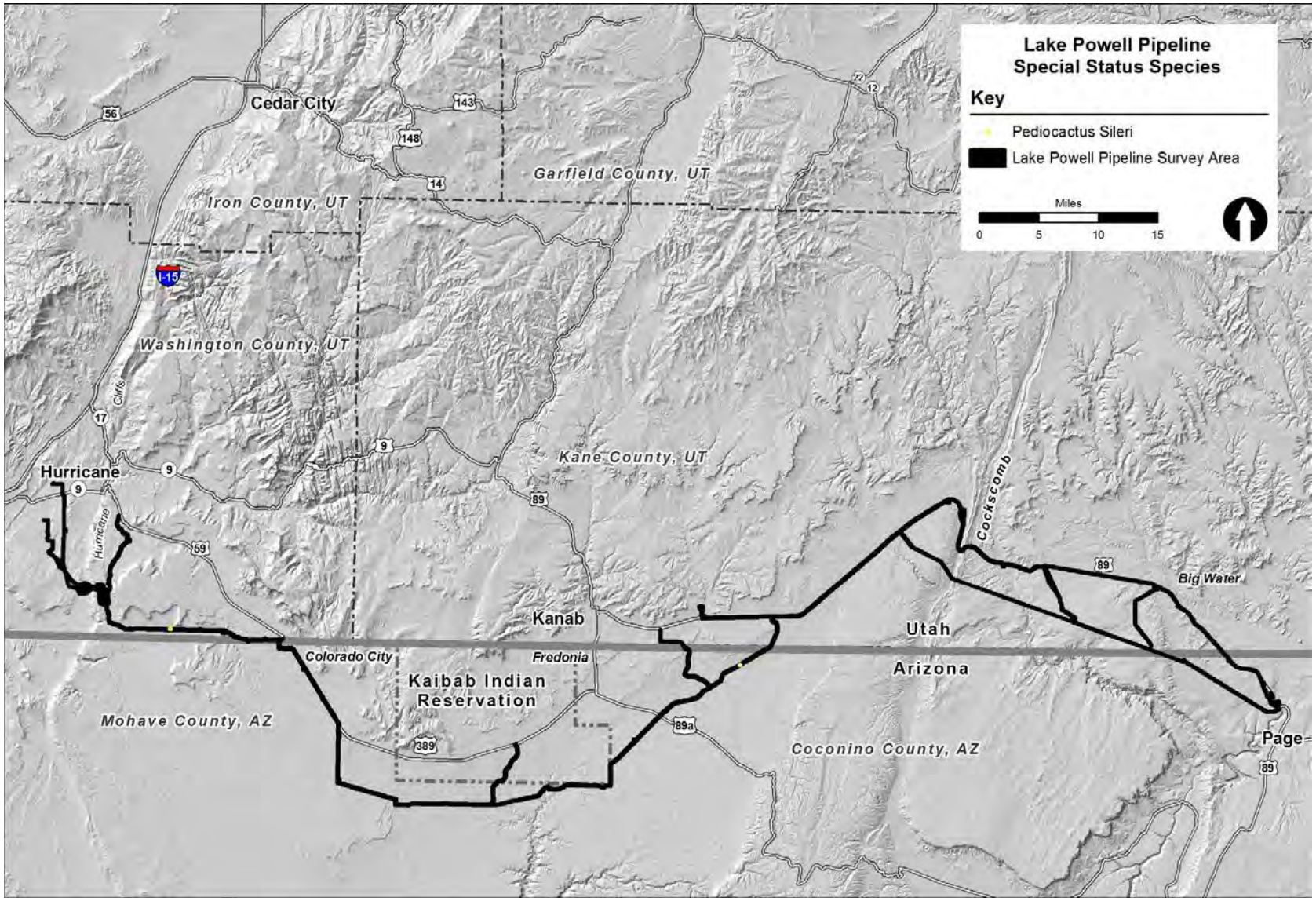

Figure 4-3
Siler Pincushion Cactus Overview Map

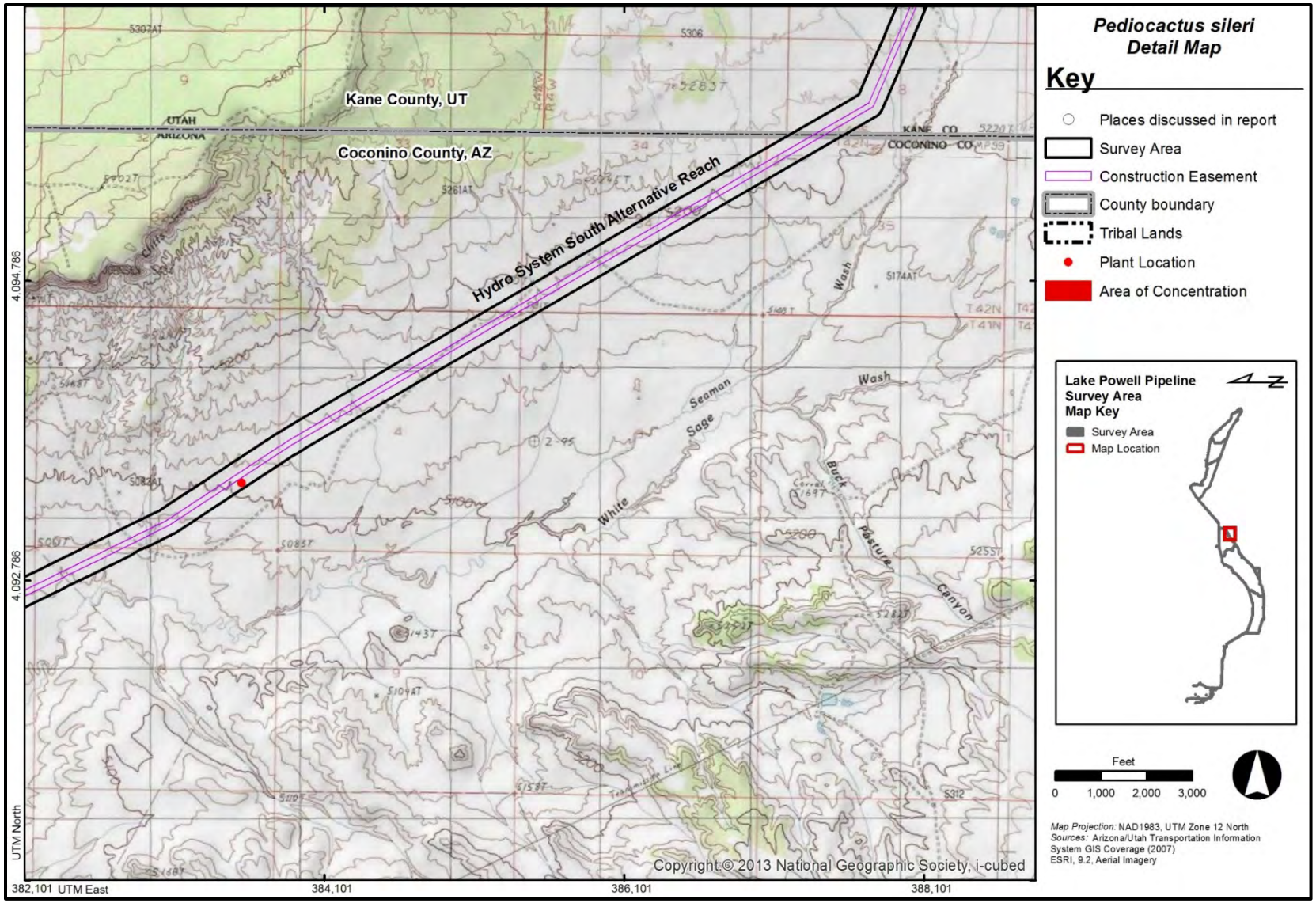

Figure 4-4
Siler Pincushion Cactus Detail Map 1

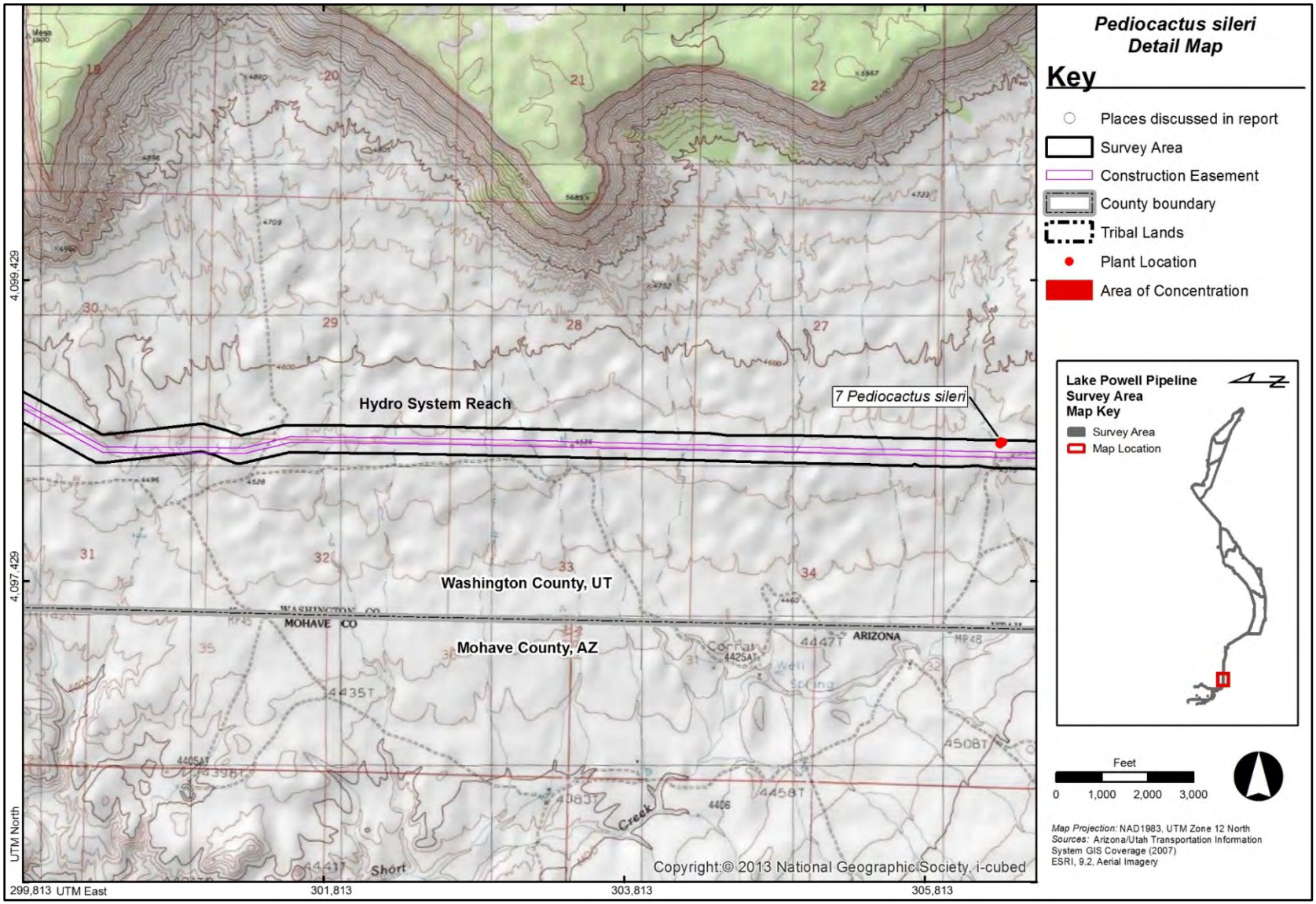

Figure 4-5
Siler Pincushion Cactus Detail Map 2

4.4 Nonessential Experimental Population Analyses

4.4.1 California Condor

4.4.1.1 Construction Effects

4.4.1.1.1 Pipeline and Ancillary Facilities. California condors do not nest in and are not reintroduced in the LPP action area, although they range widely. Construction will disturb 1,619 acres of potential foraging habitat within the action area; however, condors were not recorded during vegetation mapping and wildlife field surveys. Foraging condors will not normally be at risk of direct LPP construction mortality as the increased presence of humans and machinery will prevent condors from approaching active construction areas. Project workers and supervisors will be instructed to avoid interaction with condors. If a condor visits a worksite while activities are underway, operations will cease until the bird leaves on its own or until techniques are employed by permitted personnel that result in the individual condor leaving the area. Construction of the forebay and HS-4 facility at the top of the Hurricane Cliffs could affect potential condor roosting in that area, although use of this area by condors is not known and has not been recorded.

Condors that are attracted to non-active (e.g., at night) construction sites during foraging could become habituated to human garbage and then could alight in construction zones where they could be injured. Although this occurrence will be unlikely, construction managers and environmental supervisors will be alert to this possibility and will coordinate with the condor reintroduction team to monitor condor locations and to follow established procedures if condors begin to utilize LPP sites. Project sites will be cleaned up at the end of each day the work is being conducted (e.g., trash removed, scrap materials picked up) to minimize the likelihood of condors visiting the site. Strict hazardous or toxic substance spill prevention and remediation will be implemented in all construction areas.

No designated critical habitat for the California condor is present in the action area; therefore, the Proposed Action will have no effect on designated critical habitat for the California condor.

4.4.1.1.2 Transmission Lines. Project transmission lines and associated substations, switch stations and access roads will not be constructed in or near condor designated critical habitat, reintroduction sites, or primary breeding or roosting habitat. Effects during foraging at construction sites will be similar to those described in the previous section, and the same precautions will be employed to prevent condors from being attracted to construction sites.

4.4.1.2 Operation and Maintenance Effects

4.4.1.2.1 Pipeline and Ancillary Facilities. There will be no direct effects on California condors from operations and maintenance of LPP facilities. Environmental hygiene will be maintained to prevent condors from seeking garbage as a food source near LPP facilities. Discussions with the condor reintroduction team will occur if condors begin to frequent any LPP facility site.

4.4.1.2.2 Transmission Lines. Injury or electrocution of condors by power lines (including transmission lines) is a recognized hazard (USFWS 2001), and as of 2001, seven condors have died from transmission line accidents (USFWS 2001). Bird collisions with power lines generally occur when a power line or other aerial structure transects a daily flight path used by a concentration of birds and when migrants travel at lower altitudes and encounter tall structures in their path (Brown 1993). Condors have excellent eyesight and do not fly during inclement weather; a factor which may explain why they readily avoid transmission lines, which are typically larger and easier to spot than power distribution lines. However, the possibility remains that a condor could collide with a transmission line, tower, conductor, or guard wire. The joint EEI and USFWS *Avian Protection Plan Guidelines* (2005), *Suggested Practices for Avian Protection on Power Lines: The State of the Art in 2006*

(APLIC 2006), and *Reducing Avian Collisions with Power Lines: The State of the Art in 2012* (APLIC 2012) guidelines will be employed on all Project transmission lines Power line collisions.

4.4.1.3 Effects Determination

The Proposed Action is not likely to jeopardize the California condor nonessential experimental population.

Chapter 5
Mitigation and Monitoring

Many of these mitigation and monitoring measures will be incorporated into project "Standard Construction Procedures" and "Standard Operating Procedures" to be used in the field as LPP features and facilities are being constructed, operated and maintained.

5.1 General Mitigation Measures

The following measures will be applicable to all LPP features and facilities during construction, operation and maintenance. Species-specific measures in this chapter are in addition to but may supersede general mitigation measures, as applicable.

- Qualified biologists will act as biological monitors and be present on-site during project-related actions that may impact special status biological resources. The USFWS will approve the selected consulting firm/biologists to be used to implement the terms and conditions of the Biological Opinion or other agreements between UDWRe and other federal or state agencies. Any biologist and/or firm not previously approved will submit a curriculum vitae and be approved by the USFWS. Other personnel may assist with implementing terms and conditions that do not involve tortoise handling, monitoring, or surveys, but only under direct field supervision of the USFWS-approved biologists. Specific biologist requirements for Mojave Desert tortoise are described further in the tortoise measures below.

- The biological monitors will be responsible for determining compliance with measures as defined by the Biological Opinion or other agreements between UDWRe and other federal or state agencies. Biological monitors will have the authority to halt non-emergency construction activities that are not in compliance with these measures. Stop work directives will be effective long enough to remedy the immediate situation, and will be limited to the equipment and parties involved in the situation. All action of noncompliance or conditions of threat to listed species will be recorded immediately by the biological monitor and reported to UDWRe. UDWRe will immediately report all such action and conditions to the appropriate federal or state agencies for reporting to the USFWS.

- No harassment or harming of animals will be allowed. Animals found entrapped in open holes, open pipes/culverts, or excavations will be reported to the biological monitor. Before any pipe with a diameter of three inches or greater is buried, capped, or moved it will first be inspected for animals. If the wildlife is unable to escape on its own, it will be moved from the construction area by the biologists, in accordance with applicable federal and state guidelines.

- Prior to discharge of water used for hydrostatic testing of the pipeline and other facilities, all appropriate discharge and biological permits will be obtained and the drainage locations will be surveyed for listed species.

- The rights-of-ways will be kept free from any accumulation of construction waste, trash, and debris to reduce the attractiveness of the area to opportunistic predators such as desert kit fox, coyotes, and common ravens. Food-related trash, also including cigarettes, cigars, gum wrappers, tissue, cans, paper, and bags, will be disposed of promptly in predator-proof containers with re-sealable lids. Trash, debris, recyclables and/or waste will not be buried or burned. Disposal or recycling of trash and debris will be off-site, at a State of Utah or State of Arizona approved sanitary landfill or recycling site.

- Escape ramps will be placed at each end and every ¼- mile of any trench or other excavation deeper than 4 feet to allow escape of wildlife or livestock that may become entrapped. The spacing of escape ramps may be adjusted to ensure ramps are placed in areas near sources and visible livestock/wildlife trails. The

escape ramps will consist of loose dirt at a 2:1 or shallower slope. Excavation areas that are left open overnight will be checked by construction personnel every morning and evening and directly prior to backfilling.

- Hazardous and toxic materials such as fuels, solvents, lubricants, and acids used during construction will be controlled to prevent accidental spills. Toxic and hazardous materials will be stored in accordance to the project Spill Prevention, Control and Countermeasure plan. Vehicle and equipment refueling and hazardous materials storage will not be allowed within 100 feet of any wash, stream, or spring.

- A site-specific stormwater pollution prevention plan (SWPPP) will be prepared and implemented for each construction contract. The plan will be submitted to applicable agencies. The SWPPP will identify all potential sources of pollution which could affect the quality of stormwater discharges from the construction site, describe the construction activities that disturb soils at the site, provide an estimate of the total disturbance area, and identify waters of the United States within one mile of the site. The SWPPP will identify erosion and sediment control measures, compliance inspection metrics, maintenance, and reporting. A copy of the SWPPP will be kept on site and updated as needed to manage pollutants or reflect changes in site conditions.

- An Integrated Weed Management Plan will be prepared and submitted to the appropriate agencies for approval prior to the start of construction. The agencies will coordinate with USFWS as needed. Noxious weed control will be implemented to minimize the spread of noxious weeds during and following construction activities. Weed control efforts will be in compliance with the BLM Handbook H-9011, H-9011-1 Chemical Pest Control, H-9014 Use of Biological Control Agents of Pests on Public Lands, and H-9015 Integrated Pest Management.

- A detailed Restoration Plan will be prepared prior to the start of construction. The portion of the plan pertaining to restoration in listed species habitat will be in accordance with approved study reports and permits and submitted to the USFWS by applicable federal and state agencies. The Restoration Plan will describe reclamation and rehabilitation objectives and methods to be used, species of plants and/or seed mixture to be used, time of planting, blending with existing vegetation at ROW edges, fertilizer mix reviews and approvals, success standards, and follow-up monitoring.

- Power poles, perch discouragers, and line spacing will be designed and constructed in accordance with the recommendations of the Avian Power Line Interaction Committee (APLIC, 2006), in order to reduce the potential to electrocute or otherwise harm raptors.

5.2 Mexican Spotted Owl

In addition to the general mitigation procedures described in Section 5.1, the following measures will be employed to protect Mexican spotted owls:

5.2.1 Construction

- "Perch discouragers" will be incorporated into new electrical transmission lines in Mexican spotted owl habitat to restrict perching or nesting by competitive or predator raptors species, such as great horned owls.

5.2.2 Operation and Maintenance

- The joint EEI and USFWS *Avian Protection Plan Guidelines* (2005), *Suggested Practices for Avian Protection on Power Lines: The State of the Art in 2006* (APLIC 2006), and *Reducing Avian Collisions with Power Lines: The State of the Art in 2012* (APLIC 2012) guidelines will be employed on all LPP transmission lines.

5.3 Southwestern Willow Flycatcher

In addition to the general mitigation procedures described in Section 5.1, the following measures will be employed to protect southwestern willow flycatchers:

5.3.1 Construction

- Clearing of the pipeline construction corridor through riparian areas near the Paria River will be scheduled outside of the willow flycatcher breeding and nesting season, which is generally May through July.

- Protocol surveys will be conducted within all suitable habitat prior to construction to document presence/absence of southern willow flycatcher.

5.3.2 Operation and Maintenance

- Routine maintenance of the pipeline at the Paria River and riparian areas determined to be suitable will be scheduled outside of the willow flycatcher breeding and nesting season, which is generally May through July.

5.4 Yellow-billed Cuckoo

No other measures would be required because yellow-billed cuckoos were not identified during field surveys and the only potential habitat surveyed did not meet the primary nesting criteria for cuckoos.

5.5 Mojave Desert Tortoise

In addition to the general mitigation procedures described in Section 5.1, the following mitigation measures based on the USFWS 2018 Desert Tortoise Section 7 Conservation Guidelines will be used to avoid and minimize impacts, including mortality, stress, and disturbances, to desert tortoises and their habitat. The selection of appropriate conservation measures will depend on whether the disturbance is temporary or permanent:

- Temporary action—leaves no permanent structures and results in no permanent habitat loss.

- Permanent action—continues for more than one breeding season and causes a loss of tortoise habitat or permanently displaces tortoises through the creation of permanent structures.

Desert tortoises can be active in every month of the year. The selection of specific conservation measures will also be determined by the seasonal timing of construction activities:

- More active season: February 15-November 30;

- Most active season: March 15 – May 15 and August 20 – October 20;

- Less active season: December 1 – February 14.

The following measures will be applied to Desert tortoises and associated habitat on federal lands affected by the LPP. Desert tortoise mitigation on non-federal lands will be governed by the HCP.

5.5.1 Construction

5.5.1.1 Surveyor and Monitor Requirements

Desert tortoise surveys and monitoring per current USFWS protocols will be completed prior to any project activities and desert tortoise monitors or field contact representatives will be used on any project activities occurring in suitable desert tortoise habitat. UDWRe will submit to USFWS, Utah Ecological Services Field Office, the qualifications and references for individuals conducting surveys and monitoring at least 30 days prior to initiation of LPP activities. The following definitions describe the individual qualifications for survey and monitoring personnel and typical actions they would typically be approved to conduct.

AUTHORIZED DESERT TORTOISE BIOLOGISTS - Authorized desert tortoise biologists are approved to conduct and oversee presence/absence and clearance surveys, handle desert tortoises, translocate tortoises, construct burrows, excavate burrows, conduct health assessments (including any necessary bloodwork), and oversee project monitoring and compliance. Authorized biologists should have sufficient desert tortoise field experience in each category (a minimum of 480 hours searching for tortoises and tortoise sign) to detect the presence of desert tortoises through observations of animals and sign including scat and burrows. Authorized biologists must maintain up-to-date federal and state tortoise handling permits when they are conducting any handling activities. In some circumstances, Washington County Habitat Conservation Plan (WCHCP) Administration staff or local state or federal biologists may be available to serve this function. Contract desert tortoise biologists must report to and coordinate with the WCHCP Biologist.

DESERT TORTOISE MONITOR–Desert tortoise monitors are individuals who are approved by the USFWS to:

- assess habitat suitability;
- independently conduct presence/absence and abundance surveys for desert tortoises;
- monitor project activities within desert tortoise habitat;
- ensure proper implementation of conservation measures; and
- report incidents of non-compliance in accordance with biological opinions and permits.

Desert tortoise monitors should have sufficient desert tortoise field experience (a minimum of 480 hours searching for tortoises and tortoise sign) to detect the presence of desert tortoises through observations of animals and sign including scat and burrows. A desert tortoise monitor is not authorized to handle desert tortoises. The monitor will keep detailed field notes that will be turned into the USFWS Utah Ecological Services Field Office every three months.

FIELD CONTACT REPRESENTATIVE – Field contact representatives (FCR) are individuals who are approved by the USFWS to:

- monitor project activities within desert tortoise habitat;
- conduct daily clearance sweeps as detailed in the text below;
- ensure proper implementation of protective measures; and

- call the desert tortoise monitor or USFWS with any questions or concerns.

The FCRs are not permitted to assess habitat suitability or conduct USFWS protocol level surveys for desert tortoises because they do not have sufficient training or field experience.

Desert tortoise monitors or authorized desert tortoise biologists will ensure the FCRs meet the following qualifications:

- can recognize signs of desert tortoises;
- understand current monitoring protocols; and
- have a minimum of one field day under the supervision of a desert tortoise monitor in each activity season and habitat type.

While FCRs are not authorized to handle desert tortoise or conduct USFWS protocol level surveys, FCRs may be approved, depending on activity season and habitat quality, to conduct daily clearance sweeps for desert tortoises immediately prior to or during project activities. The FCR will keep detailed field notes that will be turned into the USFWS Utah Ecological Services Field Office every three months.

5.5.1.2 Construction Measures

5.5.1.2.1 General Measures

1) All individuals working on the project in threatened or endangered species habitat will be required to take a worker education training class, conducted by Washington County (see Development Protocols-Red Cliffs Desert Reserve 2006). The class will describe the threatened or endangered species that may be found in the area, and the appropriate measures to take upon discovery of a threatened or endangered species. The class will also include a discussion of construction techniques and conservation measures to minimize potential adverse impacts. All project personnel shall sign an affidavit certifying that they have read and understand the material presented in the brochure and class. Washington County will maintain all records of affidavits.

2) Before project activities begin, a pre-project meeting will be held between the applicant, all onsite workers, WCWCD, and the desert tortoise monitor to review all conservation measures. A handout of the conservation measures will be provided to all onsite workers.

3) Anytime a vehicle or construction equipment is parked for more than 30 minutes in desert tortoise habitat, the area around and directly under the vehicle must be inspected for tortoises before the vehicle or equipment is moved. The inspection does not need to be performed by a tortoise monitor or FCR. If there is a desert tortoise observed, it will be left to move on its own – the tortoise will not be approached or handled. If this does not occur within 15 minutes, an approved desert tortoise biologist may be contacted to remove and relocate the tortoise, or the equipment may be left in place until the tortoise moves on its own.

4) If a desert tortoise is found in the project area during project activities, the tortoise will not be approached or handled and all Project activities within 300 feet of the tortoise will be halted immediately, until such time as the tortoise leaves the area or is moved from the site. This distance can be adjusted depending on specific circumstances as coordinated with the Utah Division of Wildlife Resources. The Utah Division of Wildlife Resources will be contacted to approach and handle the tortoise. The USFWS (and the Washington County HCP administrator, if so directed by Utah Division of Wildlife Resources or USFWS) will be notified within 24 hours if a tortoise is found in the project area.

Site Access

1) All equipment taken into desert tortoise suitable habitat will be power-washed to remove noxious weeds and seeds and petroleum products prior to entering or re-entering the site. Fueling machinery will occur on already disturbed areas within the ROW. Laws and regulations pertaining to fueling of vehicles and equipment will be observed.

2) Project activities and equipment will be confined to the designated ROW which will be identified by stakes, lathes, flagging and/or fencing. To the extent feasible, previously disturbed areas within the ROW will be used for temporary storage areas.

3) Already designated routes of travel will be used whenever possible. Additional access routes outside designated routes of travel or the ROW will be limited to areas pre-cleared by the desert tortoise monitor that do not contain sign of desert tortoise within 100 meters. Use of access routes will be kept to a minimum.

    a) If construction or modification of access routes is needed, desert tortoise monitor(s) approved to conduct protocol level surveys will survey the new action area. If a desert tortoise or fresh tortoise sign is found, the monitor will contact Utah Division of Wildlife Resource and USFWS to discuss appropriate avoidance and minimization measures based on the case-specific circumstances.

4) Cross-country vehicular travel outside of the ROW by contractor personnel will be prohibited.

5) Unforeseen surface occupancy or other surface disturbing activities will be avoided as much as feasible within 0.5 mile of known occupied desert tortoise habitat to protect the possible home range of the individual.

Site By-products

1) Trash and food items will be contained in closed (predator-proof) containers and removed regularly as needed to reduce attractiveness to opportunistic predators such as ravens, coyotes, and feral dogs.

2) Use of firearms by contractor personnel for target practice will be prohibited from the site and access routes. Contractor personnel will be prohibited from bringing domestic dogs to the project site.

3) A hazardous materials spill kit will be kept on site during construction that is appropriate for the materials involved in operation and maintenance of vehicles and machinery used during the project. Laws and regulations pertaining to hazardous materials will be observed.

4) Bulk concrete, grout, cement mortar, and solid and source site materials will be stored at a staging area.

5.5.1.2.2 Occupied or High Quality (including Critical Habitat) Desert Tortoise Habitat

Habitat quality is based on the physical and biological features necessary for the species (USFWS 2018). High Quality Habitat areas may or may not include the presence of live tortoises and/or active burrows. The presence of live tortoise is assumed to also be High Quality Habitat (Occupied/High Quality). Where no tortoise are found in presence/absence survey, high quality habitat will include:

- at least 35 acres of continuous habitat (may include patchy habitats connected by artificial or natural corridors);
- sufficient quality and quantity of forage;
- suitable substrates for burrowing, nesting, and overwintering;
- slopes and topography hospitable to desert tortoises;
- suitable shelter vegetation; and
- habitat protected or removed from human disturbance.

Active Season Conservation Measures (February 15 – November 30)

In addition to the general conservation measures described above, UDWRe will include the following protocols for any project activities that occur within occupied or high quality desert tortoise habitat during the active season.

1) Desert tortoise monitors:

    a) Desert tortoise monitors will be on site during all project activities within occupied or high quality desert tortoise habitat for the protection of desert tortoises. These monitors will be responsible for determining compliance with measures as defined in the biological opinion.

    b) No more than one hour prior to daily construction activities commencing or by 7 am each work day (whichever is later), a desert tortoise monitor will conduct a clearance sweep of that day's project activity area (including a 200-foot buffer beyond the footprint on all sides, which may be expanded as appropriate depending on the anticipated action, i.e, blasting, geologic constraints, potential for boulder movement beyond 200 feet) and carefully inspect any hazards (e.g. trenches, open pipes).

    c) A desert tortoise monitor will be assigned to each grouping of equipment operating in spatially disjunct areas within the project site. A grouping of equipment is defined as all construction equipment working within a 1,000-foot linear distance from the first piece of equipment to the last piece of equipment. Equipment performing backfilling, re-contouring, and reclamation activities are included in this measure.

    d) If UDWRe chooses not to have a desert tortoise monitor on every grouping of equipment, it can use temporary fencing, as detailed below.

    e) Project vehicle speeds in the project area will be limited to 15 mph. Speed limit signs can be posted when entering and exiting occupied habitat.

2) Blasting is not permissible within 300 feet of an occupied tortoise burrow without notification to USFWS, due to possible direct effects of this action on burrow stability. Areas within 300 feet of proposed blasting would be surveyed for potential burrows and potential burrows would be checked for occupancy directly prior to blasting.

3) If project activities occur within occupied habitat during the most active seasons (March 15 – May 15 and August 20 – October 20), UDWRe will hold a short refresher meeting with all personnel working within potential desert tortoise habitat that will be led by the desert tortoise monitor or FCR (whichever is on-site when the meeting is conducted) on March 15 and August 20 (or the first working day just prior to those dates). This meeting will include instruction and handouts to remind workers of the conservation measures. A refresher meeting may need to be given on both dates for this project. Refresher meetings will be held in addition to the pre-project meeting described in *General Measures*. However, if the initial pre-project meeting occurred recently (within one month prior to the most active season start date, March 15 or October 20), the refresher meeting that would have normally been held on that date is not required.

4) UDWRe may choose to use temporary tortoise-proof fencing infrastructure in lieu of full-time monitoring to keep desert tortoises out of project activities. When temporary fencing is used and if the temperature is 95 degrees F or higher, the entire fence line will be checked at least three times a day—once by a tortoise monitor no more than one hour prior to each day's construction activities beginning or by 7 am (whichever is later), and twice more by the FCR throughout the day. Tortoise shade structures (see item b, below) can be installed to lessen the need for three daily checks of the fence to one daily check. In the event shade structures are installed, daily fence line checks must continue no more than one hour prior to each day's project activities beginning or 7 am (whichever is later). If temperatures do not reach 95 degrees F, the fence line can be checked once a day. Any fencing plans must be approved by USFWS.

a) Temporary tortoise-proof fencing often consists of barrier fence buried at least 15 centimeters (leaving 1 meter aboveground) and supported by stakes. For activities lasting for one day or less, a solid barrier fencing installed above grade without trenching could be used along with continuous fence line checks.

b) Shade structures will be constructed on a flattened mound of dirt 20 centimeters high (to protect the shelter from runoff). Shelter material will be arranged in a half moon shape, and must be a minimum of 20 centimeters tall, 40 centimeters long, and 40 centimeters wide. Shelters must be covered with 20 centimeters of soil on the top and sides to stabilize and insulate the structure.

5) If UDWRe does not install temporary fencing (described above), then each day open trenches and other open excavations will be covered at the end of work activities or provided with tortoise escape ramps. Covered excavations or having tortoise escape ramps will at a minimum be checked no later than 7:00 a.m and prior to commencement of daily work each morning for presence of tortoise.

a) Escape ramps will have a slope no steeper than 3:1 and be a minimum of 91.5 centimeters (3 feet) in length. Escape ramps will be placed at 100-meter intervals. These distances will be reduced if the FCR, desert tortoise monitor, and approved desert tortoise biologist determine that the plug/escape ramp spacing is insufficient to facilitate animal escape from the trench.

6) Standing water as a result of project operations will be avoided as feasible in desert tortoise habitat because this can attract desert tortoises and predators. Similarly, leaks on water trucks and water tanks will be repaired to prevent pooling water. If watering conditions could temporarily attract tortoises, the FCR or a desert tortoise monitor assigned to a group of equipment constructing the pipeline may periodically leave the group of equipment to patrol each area being watered.

7) The storing and handling of bulk hazardous materials will be excluded from the project areas within 0.5 mile of active tortoise burrows.

Less Active Season Conservation Measures (December 1 – February 14)

The same measures as above (active season) would apply with the following exceptions:

1) A desert tortoise monitor is not required. A FCR will remain on-site during all project activities, conduct daily clearance sweeps out to 200-300 feet, check any hazards, and check all backfilling, re-contouring, and reclamation activities prior to initiation. A desert tortoise monitor will come out to the site twice a week to check in with the FCR, review and collect field notes, and check any hazards.

2) In lieu of a FCR that remains on site throughout the day, UDWRe may use temporary fencing infrastructure in combination with the following to keep desert tortoises out of project activity sites.

a) A FCR will come out to the site daily to check the fence line and any hazards. A desert tortoise monitor will come out to the site twice a week to check in with the FCR, review and collect field notes, and check the fence line and any hazards (regardless of temperatures).

3) Project vehicle speeds in the project area will be limited to 20 mph. Speed limit signs can be posted when entering and exiting occupied habitat (e.g. long linear projects).

5.5.1.2.3 Unoccupied Desert Tortoise Habitat in Low or Medium Quality Habitat

Habitat quality is based on the physical and biological features necessary for the species (USFWS 2018). Medium Quality Habitat is defined as:

- at least 35 acres of continuous habitat (may include patchy habitats connected by artificial or natural corridors);

- suitable substrates for burrowing, nesting, and overwintering;
- decreasing quantity of high quality forage, increasing presence of cool-season annual grasses;
- may include some steeper slopes less hospitable to tortoises;
- more blackbrush and less creosote than high quality habitat. Creosote, when found, is located in more isolated pockets;
- increased disturbance and probability of human-caused mortalities.

Low Quality Habitat is defined as:

- less than 35 acres of continuous habitat (may include patchy habitats connected by artificial or natural corridors);
- suitable substrates for burrowing, nesting, and overwintering;
- forage is predominantly cool-season annual grasses with very low presence of suitable forage;
- more blackbrush and less creosote than high quality habitat. Creosote, when found, is located in more isolated pockets;
- may include some steeper slopes less hospitable to tortoises;
- highly developed, cultivated, or otherwise disturbed areas.

Active Season Conservation Measures (February 15 – November 30)

Conservation measures applied in unoccupied desert tortoise habitat during the active season will vary depending on the quality of the habitat. The following measures apply to low or medium quality unoccupied habitat.

1) Desert tortoise monitors are not required to be on site during all project activities and temporary fencing is not required.

2) A desert tortoise monitor will come out to the site twice a week to check in with the FCR, review and collect field notes, and check any hazards.

3) A FCR will remain on-site during all project activities, conduct one daily clearance sweep of that day's project activity area (including a 200-foot buffer beyond the footprint on all sides, which may be expanded as appropriate depending on the anticipated action, i.e, blasting, geologic constraints, potential for boulder movement beyond 200 feet) and carefully inspect any hazards (e.g. trenches, open pipes). If a desert tortoise or fresh tortoise sign is found the FCR will contact the monitor, Utah Division of Wildlife Resource, and the USFWS to discuss appropriate avoidance and minimization measures based on the case-specific circumstances. Measures could include translocation, site-specific fencing or additional clearance sweeps and monitoring.

4) Standing water as a result of project operations (proposed forebay and afterbay excluded) will be avoided as feasible in desert tortoise habitat as this can attract desert tortoises and predators. Similarly, leaks on water trucks and water tanks will be repaired to prevent pooling water. If conditions favor tortoise activity, the FCR or a desert tortoise monitor assigned to a group of equipment constructing the pipeline may periodically leave the group of equipment to patrol each area being watered. Note that the proposed forebay and afterbay will be fenced with approved tortoise fencing after construction for the duration of operations.

5) If project activities occur within unoccupied habitat during the most active seasons (March 15 – May 15 and August 20 – October 20), UDWRe will hold a short refresher meeting with all personnel that will be led by the desert tortoise monitor or FCR (whichever is on-site when the meeting is conducted) on March 15 and August 20 (or the first working day just prior to those dates). This meeting will include handouts to remind workers of the conservation measures. A refresher meeting may need to be given on both dates. However, if the initial pre-project meeting occurred recently (within one month prior to March 15 or August 20), the refresher meeting that would have normally been held on that date is not required.

Less Active Season Conservation Measures (December 1 – February 14)

The following measures apply:

1) Desert tortoise monitors or a FCR are not required to remain on-site during all project activities and temporary fencing is not required.

2) A FCR will perform a sweep of any open trench and any other open excavations once daily.

3) A FCR will contact a desert tortoise monitor twice a week to review and submit field notes (electronic submission is permissible), and report any hazards. A desert tortoise monitor will come out to the site every two weeks to check with the FCR and check any hazards.

4) If a desert tortoise or fresh tortoise sign is found the FCR will contact the monitor, Utah Division of Wildlife Resource, and USFWS to discuss appropriate avoidance and minimization measures based on the case-specific circumstances. Measures could include translocation, site-specific fencing or additional clearance sweeps and monitoring.

5.5.1.3 Post-Project Conservation Measures:

1) A formal Reclamation Plan for all occupied or high quality desert tortoise habitat will be developed and submitted to USFWS and action agency. Formal reclamation plans are typically needed on projects with permanent or new surface disturbance in occupied or high quality desert tortoise habitat. Only native plant species will be used in reclamation activities. Locally derived seed is preferred. Restoration of biocrusts and associated mycorrhizal fungi should be considered in the Reclamation Plan. Fill materials will be free of fines, waste, pollutants, and must be certified weed-free. The approved survey biologist will inspect reclamation activities at the end of construction to ensure disturbed areas are revegetated/restored according to reclamation criteria approved by the action agency and USFWS.

2) Broadcast applications of herbicides will be prohibited in desert tortoise habitat within the project area; if necessary, spot treatments will be applied by hand using herbicides approved by the U.S. Environmental Protection Agency in order to treat noxious weeds. The project's permanent ROW affecting desert tortoise will be monitored and controlled, as necessary, for weeds in coordination with BLM per the Plan of Development and the Integrated Weed Management Plan.

3) Desert tortoise monitor(s) will prepare all survey reports and field notes and submit them to USFWS every 3 months and at Project completion. The reports will identify the extent of impacts to desert tortoises. They will include:

    a) Desert tortoise survey and monitoring reports.

    b) Desert tortoise encounters within Project boundaries and how they were reported and addressed.

4) Restoration of unoccupied low or medium quality habitat areas will be governed by the Restoration Plan, as outlined in the BLM Plan of Development

5.5.2 Operation and Maintenance

1) During routine inspections and conditions assessments, annual exercising of appurtenance valves, emergency maintenance, or any other infrequent maintenance, if desert tortoises are encountered they will be avoided and the applicable federal and state agencies will be contacted if there appear to be hazards to the tortoise. The agencies will coordinate with the USFWS as appropriate.

2) Maintenance activities in high quality habitat that are not performed during the less-active season, or that create new surface disturbance in suitable habitat will be coordinated with the USFWS and the action agency.

3) If emergency maintenance activities create new surface disturbance in high-quality habitat or is required during the active season in high-quality habitat, the action agency will be contacted within 24 hours to minimize any impacts and coordinate post-emergency response. The action agency will coordinate with the USFWS as appropriate.

5.6 Bonytail Chub

No other measures would be required because no LPP features or facilities would be constructed, operated or maintained in bonytail chub habitat.

5.7 Humpback Chub

No other measures would be required because no LPP features or facilities would be constructed, operated or maintained in humpback chub habitat.

5.8 Razorback Sucker

No other measures would be required because no LPP features or facilities would be constructed, operated or maintained in razorback sucker habitat.

5.9 Siler Pincushion Cactus

In addition to the general mitigation procedures described in Section 5.1, best management practices (BMP) discussed in the LPP BLM Plan of Development will be employed regarding erosion, revegetation, topsoil salvage, livestock management, and invasive species during construction and operation and maintenance.

The known occurrences of Siler pincushion cactus outside the construction easement along the Proposed Action will be avoided. If additional Siler pincushion cacti are discovered within the Proposed Action ROW, non-emergency construction activities will be stopped in order to: 1) mark the area with T-posts and rope, including a reasonable buffer, to alert construction personnel to avoid the area, and 2) allow time to reinitiate consultation with USFWS, if appropriate.

5.10 California Condor

In addition to the general mitigation procedures described in Section 5.1, the following measures contained in the applicable BLM Resource Management Plans may be followed to the extent that the measures do not conflict with the MOU, the Condor Agreement, and the final rule:

5.10.1 Construction

- Immediately prior to the start of an authorized or permitted project, applicable Federal and state agencies will contact personnel monitoring California condor locations and movements to determine the locations and status of condors in or near the project area.

- UDWRe will notify the applicable federal and state agencies if California condors visit the worksite while permitted activities are underway.

- Where condor nesting activity is known within 0.5 miles of permitted or authorized activities that include operation of heavy machinery, the operator may avoid use of the equipment during the active nesting

season (February 1- November 30), or as long as the nest is viable, to the extent consistent with the Condor Agreement.

- Where condors occur within 1.0 mile of permitted or authorized activities that include blasting, blasting may be postponed until the condors leave the area or are hazed away by personnel permitted to haze condors to the extent consistent with the Condor Agreement.

- Where condor nesting activity is known within 1.0 mile of the project area, blasting activity may be delayed until after the active nesting season (February 1- November 30), or as long as the nest is viable to the extent consistent with the Condor Agreement. These dates may be modified based on the most current information regarding condor nesting and in coordination with applicable federal and state agencies.

- Where California condors visit a worksite while activities are underway, the onsite supervisor will notify the biological monitor. Project workers and supervisors will be instructed to avoid interaction with condors. Operations may cease until the bird leaves on its own or until techniques are employed by permitted personnel that result in the individual condor leaving the area to the extent consistent with the Condor Agreement.

- The project site will be cleaned up at the end of each day the work is being conducted (e.g., trash removed, scrap materials picked up) to minimize the likelihood of condors visiting the site. Applicable federal and state agency staff may conduct site visits to the area to ensure adequate clean-up measures are taken.

- For projects where potential exists for leakage or spill of hazardous materials, a spill plan will be developed and implemented to prevent water contamination and potential poisoning of condors. The plan will include provisions for immediate cleanup of any hazardous substance, and will define how each hazardous substance will be treated in case of leakage or spill. The plan will be reviewed by applicable federal and state agencies to ensure condors are adequately addressed.

5.10.2 Operation and Maintenance

Mitigation measures will be the same as described in Sections 5.1 and 5.9.1.

Chapter 6
Cumulative Effects

This chapter analyzes cumulative effects that may occur from construction and operation of the proposed LPP. Cumulative effects include the effect of future State, tribal, local or private actions that are reasonably certain to occur in the action area considered in this BA. Future federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to Section 7 of the ESA. Only those resources with the potential to cause cumulative effects are analyzed in this chapter.

The Proposed Action will have direct cumulative effects on federally listed species when combined with the effects of the Southern Corridor Highway (UDOT 2008), which will cross the LPP penstock alignment near Sand Hollow Reservoir. The habitat disruption for Southern Corridor Highway construction will permanently remove potential federally listed wildlife habitat extending for miles north and south of the penstock crossing, with the intensity of the cumulative effects decreasing with distance from the intersection of the two projects. The direct cumulative effects on federally listed species habitat will be minor. If the LPP construction effects and Southern Corridor Highway construction effects occur on the Mojave desert tortoise and/or its suitable habitat, then the cumulative effects will be likely to adversely affect the Mojave desert tortoise.

The LPP will have direct cumulative effects on federally listed species when combined with the effects of the proposed Kern River-Hurricane Natural Gas Pipeline, which will parallel the Southern Corridor Highway and cross the LPP penstock alignment near Sand Hollow Reservoir. Similar to the Southern Corridor Highway, the habitat disruption for Kern River-Hurricane Natural Gas Pipeline construction will permanently remove Mojave Desert Region wildlife habitat extending for miles north and south of the LPP penstock crossing, with the intensity of the cumulative effects decreasing with distance from the intersection of the two projects. If the LPP construction effects and Kern River-Hurricane Natural Gas Pipeline construction effects occur on the Mojave desert tortoise and/or its suitable habitat, then the cumulative effects will be likely to adversely affect the Mojave desert tortoise. Effects on Mojave desert tortoise will be minimized by implementing the BMPs, general construction practices, and the protection and mitigation measures in Chapter 5.

The direct cumulative effects of the LPP, Southern Corridor Highway and Kern River-Hurricane Natural Gas Pipeline construction on federally listed species could be short-term during construction and long-term with increases in vehicular traffic for operations and maintenance. Effects on Mojave desert tortoise will be minimized by implementing BMPs, general construction practices, and the protection and mitigation measures in Chapter 5.

References Cited

A note on Internet portal reference sites: several cited references are Internet portals at which species information is available by search from the portal web cover page. These sites include the USFWS Critical Habitat Portal (accessed 2016), USFWS Information for Planning and Conservation web site, Southwest Regional Gap Analysis Project (GAP) Animal Habitat Models Data, NatureServe (2010), Birds of North America Online, the UCDC, the AGFD HDMS, Partners in Flight (2010) and Birds of Utah (2010). In an effort to shorten the References Cited list, these portals are cited as the web cover page rather than the individual species page within the portal. The cited information for each species is easily retrieved by the search function at the portal web cover page.

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Glossary

Adverse. Negative.

Affect, affected. To change or be changed by an action arising from the proposed project.

Afterbay. A body of water or reservoir of a hydroelectric power plant at the outlet of the turbines.

Avian. Pertaining to birds.

Baseline. Existing conditions before any action by the proposed project.

Booster Pump Station. A pump facility to move water in a pipeline to a higher elevation.

Candidate. A species deemed eligible for listing under the Endangered Species Act, but precluded from action by higher priority species and/or insufficient resources.

Carrion. Dead animal bodies or carcasses.

Chaparral. An area of dense growth of shrubs or small trees.

Chelation. A method of removing heavy metals from the body.

Clutch. The group of eggs laid at one time or in a short period of time, usually a few days.

Contiguous. Areas immediately adjoining each other, having a common boundary.

Corridor. A linear area containing the construction of a pipeline or transmission line, including temporary and permanent roads and staging areas for materials or equipment.

Critical habitat. Critical habitat consists of the specific areas within the geographical area occupied by a species at the time it is listed on which are found those physical or biological features essential to the conservation of the species and which may require special management considerations or protection.

Decibel (dBA). A-weighted decibel, a standard measure of the loudness of sound.

Dispersal. Movement of wildlife species out of one habitat area into another habitat area.

Disjunct population(s). Populations that are not connected spatially and do not interbreed.

Ecotone. The boundary between two vegetation communities where the differing vegetation composition and structure create a new zone of habitat that may be utilized by wildlife.

Effect. Result or consequence of a proposed action.

Endangered species. Any species which is in danger of extinction throughout all or a significant portion of its range.

Ephemerals. Plants with a short life cycle of leaf production and flowering, usually six to eight weeks.

Fledge, fledgling. The process by which a young bird acquires flight feathers, a young bird that has acquired flight feathers and is ready to leave the nest.

Footprint. The area occupied by a constructed project feature or facility (building, substation, transmission tower base).

Foraging. The act of seeking food.

Forebay. A body of water or reservoir of a hydroelectric power plant at the inlet of the turbines.

Friable. Soil that is soft and crumbly, not dense and compacted.

Geographic Information Systems (GIS). A computer mapping system used to depict and analyze spatial data.

Global Positioning System (GPS). A system of recording spatial data using multiple satellites; the data is often depicted in a GIS

Growing Season. A defined annual period of plant growth at any location, based on days without frost.

Habitat. The environment normally utilized by an animal or group of animals.

Herbaceous. Low-growing vegetation with no permanent leaves or stems, leaves and stems die at the end of the growing season each year.

Hydro Station. A facility to generate electrical power from turbines powered by water.

Hygiene. A practice of cleanliness.

Impact. A change in environmental conditions caused by construction or operation of project features and facilities. An impact may be either positive or negative.

Interspecific. Between different species.

Intraspecific. Within a species.

Kilovolt (kV). A unit of electromotive force equal to 1,000 volts.

Listing, listed. Referring to species declared as threatened, endangered or candidate under the Endangered Species Act of 1973, as amended.

Migration, migratory. Movement of a group of animals from one habitat to another, usually seasonally; a species that migrates.

Mitigate, Mitigation. To cause to become less severe or harmful; to reduce, avoid, minimize or rectify impacts on resources.

Monitor. To systematically and repeatedly measure conditions in order to track changes.

Mortality. The sum or number of deaths in a given time in a given population.

Mosaic (of vegetation). A varying pattern of plant communities along a construction corridor, both laterally and longitudinally.

Municipal & Industrial. Water supplies used for domestic and commercial use, as opposed to agricultural irrigation.

Nocturnal. Referring to wildlife species that are active during nighttime hours.

Penstock. A pipeline that conveys water to an electrical generating station (hydro station).

Permanent (Impacts). A change in environmental conditions that would never revert to baseline conditions.

Perennial. Referring to plants that live for more than two years, as opposed to annuals (one year) or biennials (two year) plants.

Potrero. A pasture of grassy area.

Raptor. Bird species that consume animal flesh as the major part of their diet.

Regulating Tank. A tank constructed for the purpose of regulating water pressures and volumes within an acceptable range over a particular segment of a pipeline or penstock.

Revegetation. Replanting or reseeding of disturbed land.

Right-of-way. A linear area containing a road or power line, including shoulders and open land on each side of the road or power line that is legally restricted in use for the road or utilities.

Riparian. Vegetation adjacent to a permanent or intermittent waterway.

Savannah. A grass land with limited tree growth.

Staging Area. An area used to store construction materials or equipment.

Standard Construction Procedures. Measures followed during construction of a project to avoid, minimize or rectify adverse impacts on natural resources.

Substation. An electrical facility where voltage is stepped up or down.

Substrate. The natural habitat or ground surface an organism grows on or utilizes.

Take. A definition under the Endangered Species Act of actions that would harass, harm, pursue, hunt, wound, shoot, trap, capture, or collect any species listed under the Act.

Temporary (Impact). A change in environmental conditions that will revert to baseline conditions.

Threatened species. Any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

Topography. The contour of land, changes in elevation of the ground surface.

Transmission Line. Large electrical lines that conduct high voltage current over long distances.

Tribal. Referring to any Native American nation or tribe.

Water Conveyance. A pipeline for moving water from one location to another.

Wildlife. Animal species normally existing in the wild that are not domesticated

List of Preparers

Name	Degree(s)	Role
Logan Simpson		
Kay Nicholson	M.S. – Environmental Resources B.S. – Animal Science	Compilation of information on listed species from Lake Powell Survey Reports (FSR 11, FSR 12, and FSR 13)
Richard Remington	B.S. – Wildlife Biology	Report QA/QC review
Stantec		
Neil Lynn	B.S. – Wildlife Biology	Report updates/revisions
Josh Cowden	Ph.D. – Environmental Engineering M.S. – Environmental Engineering B.S. – Zoology/Environmental Studies	Report QA/QC review
Perkins Coie LLP		
Laura Zagar	J.D.	Report QA/QC review

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Appendix A
Noise Buffer Zone Maps

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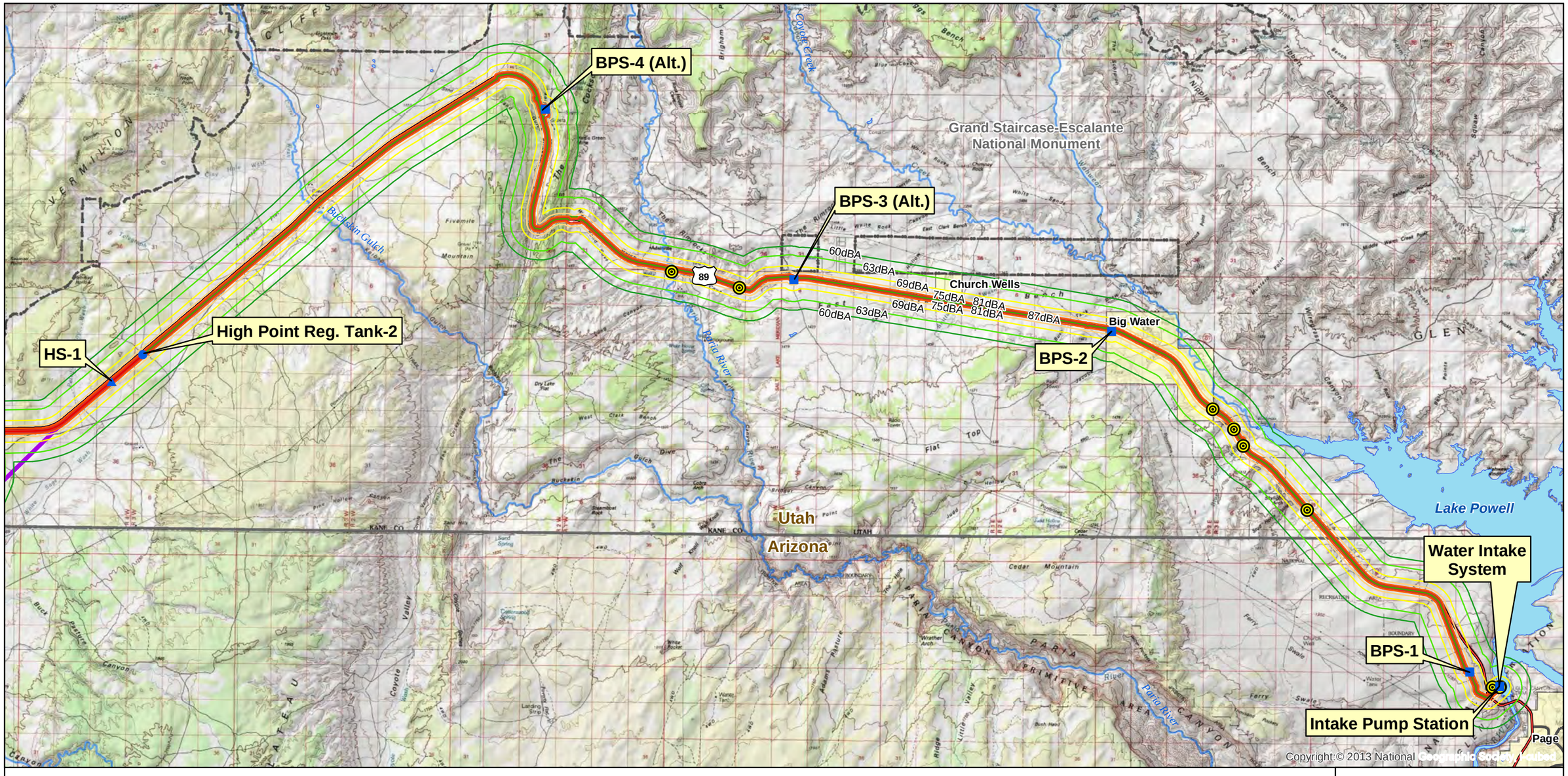


Noise Contour dBA Levels from Construction

- 87dBA
- 81dBA
- 75dBA
- 69dBA
- 63dBA
- 60dBA

- Noise Sample Location
- Project Pump Station
- Project Regulating Tank
- Project Hydro Station
- Water Conveyance System
- Hydro System - Proposed Action
- Hydro System - South Variant Alternative

- Interstate
- US Highway
- ST Highway
- Hwy
- Major Road

- Lakes & Reservoirs
- Major Rivers & Streams
- National Park/Monument
- State Boundaries
- Cities

FERC Project Number: 12966-001
BLM Serial Numbers: AZA-34941 UTU-85472

N

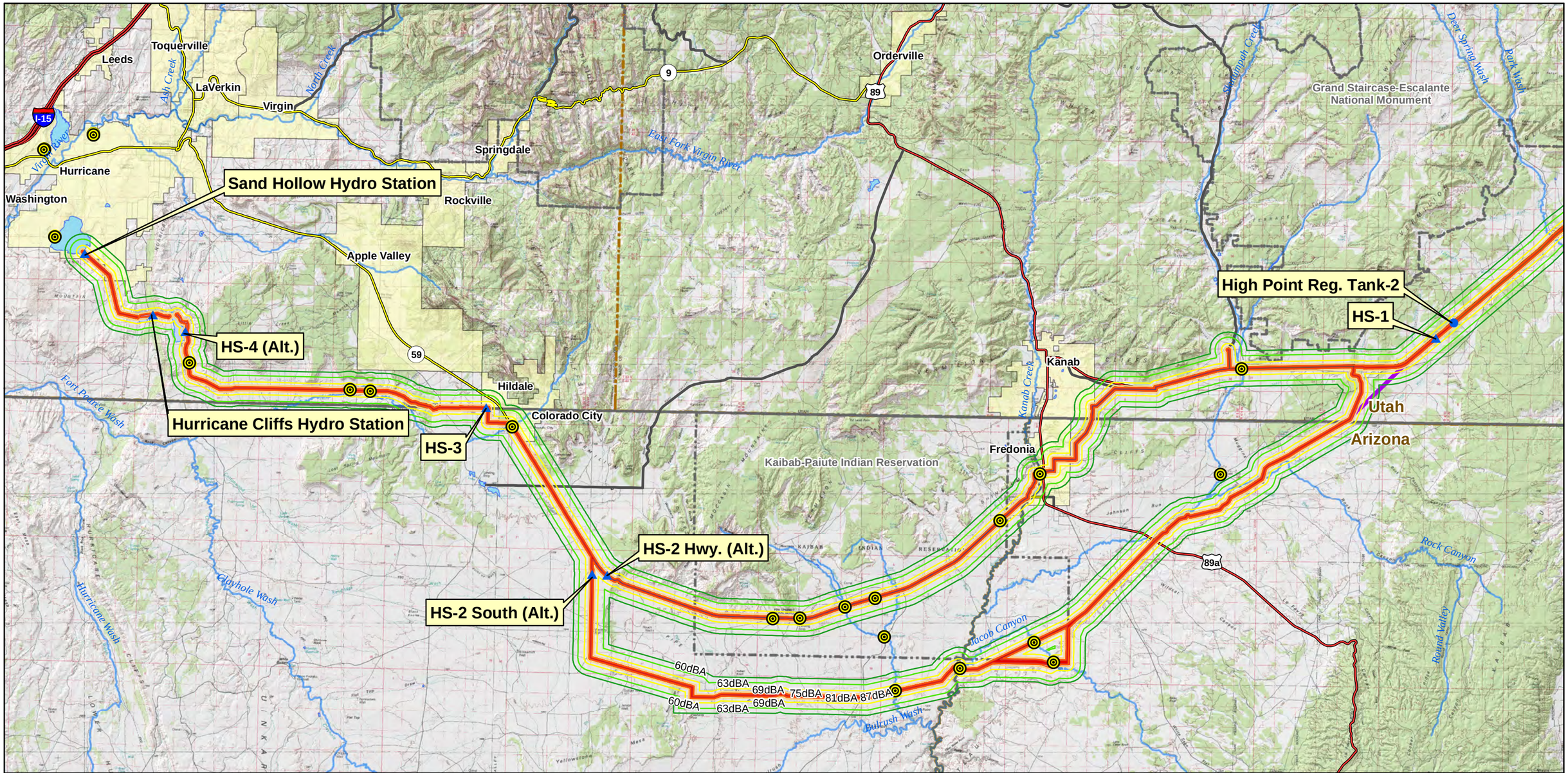
0 0.5 1 2 3 4 Miles

Lake Powell Pipeline Project

Spatial Reference: UTM Zone 12N, NAD-83

UDWRe **Figure A-1** Stantec

Lake Powell Pipeline Water Conveyance System Decibel Contours - Construction Impacts



Noise Contour dBA Levels from Construction

- 87dBA
- 81dBA
- 75dBA
- 69dBA
- 63dBA
- 60dBA

- Noise Sample Location
- Project Pump Station
- Project Regulating Tank
- Project Hydro Station

- Water Conveyance System
- Hydro System - Proposed Action
- Hydro System - South Variant Alternative
- KCWCD System
- Hydro System - Existing Highway Alternative
- Hydro System - Southeast Corner Alternative

- Interstate
- US Highway
- ST Highway
- Hwy
- Major Road
- Hurricane Cliffs Forebay/Afterbay
- Major Rivers & Streams

- National Park/Monument
- Tribal Lands
- State Boundaries
- Cities
- County Boundaries
- Lakes & Reservoirs

FERC Project Number: 12966-001
BLM Serial Numbers: AZA-34941 UTU-85472

N

0 1.25 2.5 5 7.5 10 Miles

Lake Powell Pipeline Project

Spatial Reference: UTM Zone 12N, NAD-83

UDWRe **Figure A-2** Stantec

Lake Powell Pipeline Hydro System Decibel Contours - Construction Impacts

Appendix B
Avian Survey Report, Lake Powell Pipeline Project
January 2010

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LAKE POWELL PIPELINE PROJECT
2009 AVIAN SURVEY REPORT

PREPARED FOR

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JANUARY 2010

CONTENTS

List of Tables

List of Figures

List of Maps

List of Appendices

1. INTRODUCTION

The proposed Lake Powell Pipeline (LPP) project stretches across Iron, Washington, and Kane counties, Utah and Mohave and Coconino counties, Arizona. MWH Global Inc. identified 15 riparian habitat sites along washes and rivers intersecting the LPP survey area during a 2008 helicopter survey (see Figure 1). The intersection of these riparian areas with the LPP survey area and a 0.25 mile buffer around the intersections were evaluated by Logan Simpson Design (LSD) biologists for the presence of potentially suitable habitat for the Endangered Species Act (ESA) listed endangered southwestern willow flycatcher (*Empidonmax traillii extimus*; SWFL) and the ESA candidate yellow-billed cuckoo (*Coccyzus americanus*; YBCU). Potentially suitable habitat for the SWFL was identified at 7 sites, and potentially suitable habitat for the YBCU was identified at 2 sites.

2. SPECIES BACKGROUND

Southwestern Willow Flycatcher

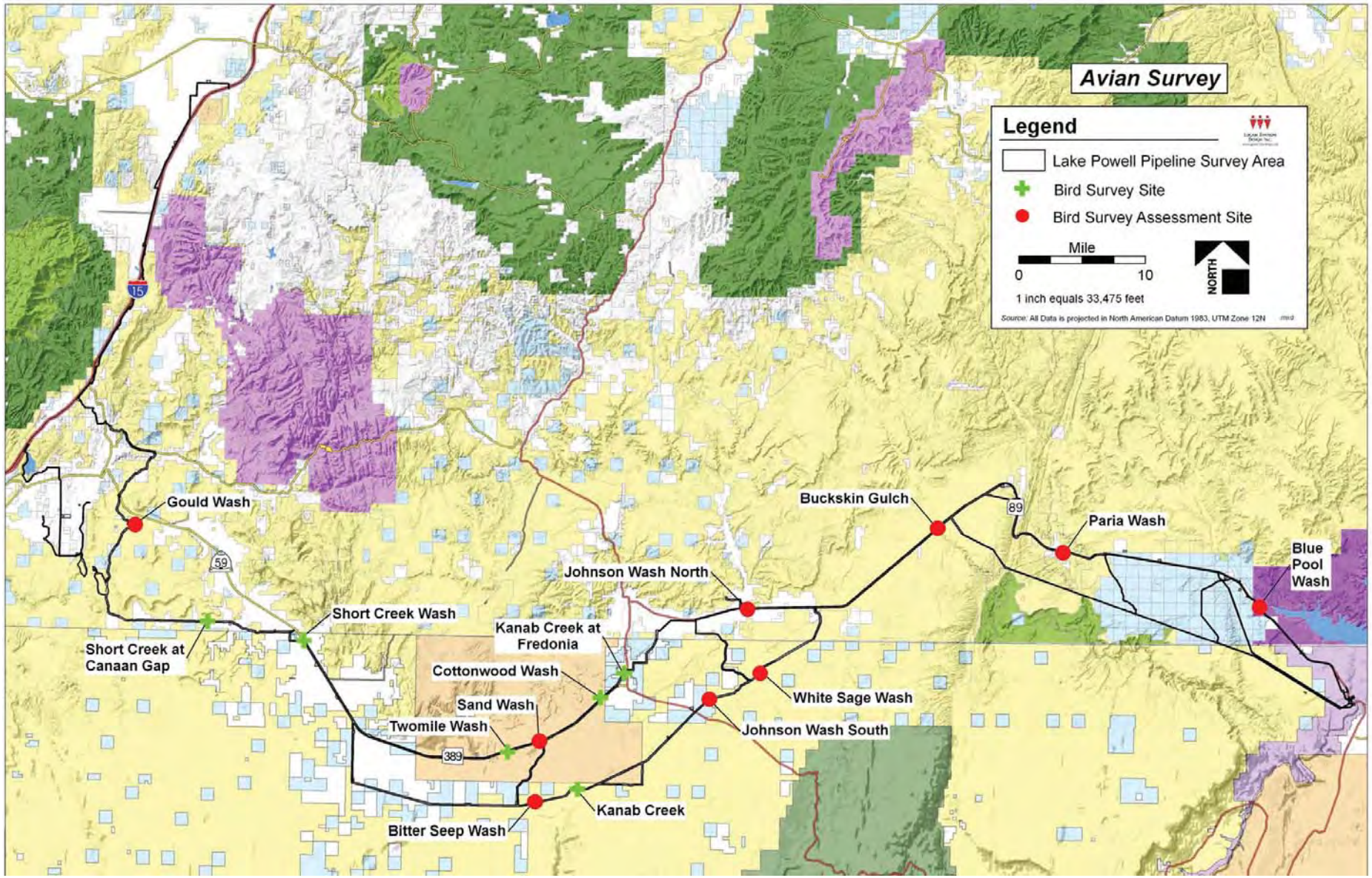
The SWFL is a small, insectivorous songbird that winters in Central America and migrates north to breed in the United States during the summer. Four subspecies of willow flycatcher are generally recognized in North America, with each subspecies occupying distinctly different breeding ranges, and varying slightly in color and morphology. The breeding range of the SWFL includes southern California, Arizona, New Mexico, southwestern Colorado, and extreme southern portions of Nevada and Utah, from at or near sea level to 8,530 feet elevation. The SWFL is a riparian obligate, breeding only in dense riparian vegetation near a permanent or semi-permanent source of water or saturated soil (Sogge et al. 2010).

Historical breeding habitat was typically mature cottonwood-willow (*Populus freemontii-Salix* spp) riparian forest at lower elevations, or willow thickets (often coyote willow [*Salix exigua*] or Geyer willow [*Salix geyeriana*]) at higher elevations (Sogge et al. 2010). Both types of riparian habitat are now mostly degraded or destroyed throughout the Southwest because of the damming and diverting of rivers and streams; groundwater pumping; overgrazing by cattle; recreational vehicle use; and invasion by salt cedar (*Tamarix* spp.), an exotic tree species that has replaced most historical cottonwood-willow riparian forests throughout the Southwest. However, SWFL populations at lower elevations now also breed in dense stands of salt cedar, as it approximates the structure of their preferred habitat (USFWS 2002).

The SWFL typically arrives at breeding sites from late April to mid-June. Males generally arrive before females and claim territories by constantly singing at favored perches within the territory. When females arrive, pairs are established and mating begins. Females build a tightly woven, open-cup nest, typically in forked branches of the substrate tree. Average clutch size is three eggs, which generally hatch in 12 days. Fledging usually occurs within 12 days of hatching, and fledglings are dependent on parents for food for approximately 2 weeks. Only the female incubates the eggs, although both parents feed nestlings and fledglings. Renesting may occur if the first nesting attempt is unsuccessful, although second clutches are uncommon when the first nesting attempt is successful. After fledging, SWFLs typically begin their southward migration in early August (USFWS 2002).

The SWFL was listed by U.S. Fish and Wildlife Service (USFWS) under the Endangered Species Act as endangered in 1995, and critical habitat was designated in October 2005. In Utah, critical habitat was designated along sections of the Colorado, Green, and San Juan Rivers; and in Arizona, along sections of the Big Sandy, Bill Williams, Colorado, Gila, Little Colorado, Salt, San Pedro, Santa Maria, Verde, and Virgin Rivers and their tributaries (USFWS 2005). No critical habitat is designated within the LPP survey area. A recovery plan has been prepared that identifies six recovery units, each with four to seven management units (USFWS 2002). The survey area is located within the Upper Colorado Recovery Unit. In 2006, this unit contained the fewest territories out of the six recovery units with 4 known territories (Durst et al. 2007). The survey area falls within the Powell Management Unit; a total of 0 sites and 0 territories were documented in the Powell Management Unit in 2006 (Durst et al. 2007). Survey data are no longer published on an annual basis, so more recent data are not available.

Threats to this species include riparian habitat loss and degradation attributable to invasion by nonnative species; livestock grazing; and water management practices such as damming or diverting water, flood control, channelization, and bank protection. Another threat to the SWFL is brood parasitism by the brown-headed cowbird (*Molothrus ater*).



Map 1
Lake Powell Pipeline riparian habitat assessment sites and avian survey

Rather than raise their own young, female cowbirds lay eggs in the nests of other species, which incubate the cowbird eggs and raise the young. Cowbird eggs hatch after a relatively short incubation period; thus, cowbird nestlings often out-compete the host's own young for parental care by developing more quickly. In addition, cowbirds may also act as predators by physically removing eggs from the host species'

3. SITE DESCRIPTIONS AND EVALUATIONS

Each riparian habitat site was visited and evaluated by LSD biologists on May 28 and May 29, 2009. Riparian habitat sites were determined to be potentially suitable for the SWFL and/or the YBCU if they had a combination of the following characteristics: standing water or moist soils on site; dense stands of either native riparian trees, including willow (*Salix* spp.) and cottonwood (*Populus fremontii*), nonnative trees, including salt cedar(*Tamarix* spp.) and Russian olive (*Elaeagnus angustifolia*); or a mix of native and nonnative riparian trees forming a closed canopy (Sogge et al. 1997, Johnson et al. 2006). Additionally, the level of disturbance from livestock overgrazing, development, and recreation at each site was considered. For sites on private property, access to conduct surveys had to be granted prior to entry. Table 1 provides a summary of the riparian habitat sites assessed along the LPP survey area during the 2009 survey season.

Table 1. Summary of riparian habitat assessment and avian survey sites along the LPP survey area from west to east.

Site Name	UTM location (NAD 83, Zone 12)	Suitable habitat present?	Private property access granted?	Survey conducted?	Future surveys needed?
Gould Wash	N 0301332 E 4110623	No	N/A	No	No
Short Creek at Canaan Gap	N 0312293 E 4097855	Yes	N/A	Yes	No
Short Creek at Colorado City	N 0323392 E 4095565	Yes	N/A	Yes	No
Two-mile Wash	N 0348678 E 4081591	Yes	N/A	Yes	No
Sand Wash	N 0352884 E 4082880	No	N/A	No	No
Bitter Seep Wash	N 0352206 E 4174808	No	N/A	No	No
Kanab Creek	N 0357350 E 4077648	Yes	N/A	Yes	No
Cottonwood Wash	N 0360549 E 4088374	Yes	N/A	Yes	No
Kanab Creek at Fredonia	N 0366767 E 4091797	Yes	Yes	Yes	No
Johnson Wash South	N 037452 E 4087967	No	N/A	No	No
Johnson Wash North	N 0379610 E 4099838	No	N	No	No
White Sage Wash	N 0380898 E 4091494	No	N/A	No	No
Buckskin Gulch	N 0403419 E 4110216	No	N/A	No	No
Paria Wash	N 0419427 E 4107231	Yes	N	No	Yes
Blue Pool Wash	N 0444592 E 4100109	No	N/A	No	No

Surveyed sites

<u>Short Creek at Canaan Gap</u>

Short Creek flows from just east of Colorado City in the Vermillion Cliffs (Moccasin Mountains) and west through Canaan Gap in Mohave County, Arizona and Washington County, Utah. Short Creek crosses the LPP survey area

once at Canaan Gap, between the Hurricane and Vermilion Cliffs in Washington County (see Figure 1). The second crossing is further west at Colorado City, Arizona. At Canaan Gap, Short Creek crosses the LPP survey area once and runs northeast before gently curving southeast to cross the survey area again a mile and a half to the east.

Short Creek at Canaan Gap is a dry, sandy wash with deeply cut banks. The wash reaches up to 600 feet wide, and the cut banks are up to 30 feet tall. As Short Creek crosses the survey area on the east end of Canaan Gap, the wash is a narrow incised ravine with scattered salt cedar trees in the wash and along the banks. Following the wash upstream to the north, native and nonnative vegetation form a thick patch from cut bank to cut bank (Figure 1). The dominate species within Short Creek at Canaan Gap is nonnative salt cedar, ranging from 5 to 10 feet tall. Russian olive from 5 to 10 feet tall is mixed with the salt cedar, as are patches of willow from 5 to 10 feet tall and scattered, individual cottonwood trees up to 45 feet. Vegetation becomes more scattered and the wash widens as Short Creek crosses the west end of Canaan Gap (Figure 2). Evidence of livestock and recreational activities were present throughout the site at the time of the surveys. Adjacent lands are used for grazing and agriculture.

The presence of dense stands of mixed native and nonnative riparian trees and a closed canopy represent potentially suitable for the SWFL and the YBCU. There were no private property access issues on the site. Surveys were conducted on May 31, June 17 and 30, and July 7 and 14 in 2009.

Short Creek Wash

Short Creek flows from just east of Colorado City in the Vermillion Cliffs (Moccasin Mountains) and west through Canaan Gap in Mohave County, Arizona and Washington County, Utah. It crosses the LPP twice, once at Canaan Gap as mentioned above, and once at U.S. Highway 389 (Hwy 389) in Colorado City, Arizona (see Figure 1).

Short Creek at Colorado City is a dry, sandy wash. Moist soils or running water were not present during the surveys conducted in 2009. Riparian vegetation is present on the north and south side of the Hwy 389 bridge. On the north and south side of the bridge, dense stands of native and nonnative trees are present, however, the north side is dominated by willow from 7 to 15 feet tall, while the south side is dominated by a mix of salt cedar and Russian olive from 7 to 15 feet tall (Photos 3 and 4). Cottonwood trees are scattered throughout the site, and reach approximately 35 feet tall. Other species present include tumbleweed (*Salsoa kali*), bermuda grass (*Cynodon dactylon*), and prickly pear (*Opuntia* sp.).

Lands within Short Creek are used as two-track roads, all terrain vehicle and horse trails, and livestock enclosures. Multiple dump sites were observed on site during surveys. Adjacent lands are used for residential, agriculture, and industry, including borrow pits.

Heavy disturbance due to recreation and development is present throughout Short Creek at Colorado City. However, the large patches of dense riparian vegetation may potentially support SWFL and YBCU. A dense mix of native and nonnative riparian trees creating a uniformly closed canopy represents potentially suitable habitat for the SWFL and the YBCU. There were no private property issues on the site. Surveys were conducted on this site on May 30, June 18, July 1, 8, and 16 in 2009.

Twomile Wash

Twomile Wash is located east of Pipe Springs National Monument on the Kaibab-Paiute Indian Reservation in Mohave County, Arizona. It crosses the LPP survey area and Hwy 389 east of the Kaibab-Paiute Headquarters (see Figure 1).

Twomile Wash runs northwest to southeast across Hwy 389. The sandy bottomed wash is deeply incised with cut banks reaching six feet tall and reaches 12 feet wide. Water flows from the north end of the site, and diminishes south of the Hwy 389 bridge (Figure 5). Vegetation in the wash consists of two linear stringers of salt cedar, reaching 15 feet tall. Cottonwood trees to 15 feet tall are scattered along the wash, mixed in with the salt cedar (Figure 6). Lands adjacent to Twomile Wash include a disturbed right-of-way to Hwy 389 and undeveloped lands.

Flowing water and dense salt cedar trees forming a closed canopy represent potentially suitable habitat components for SWFLs at Twomile Wash. Permission to access the site was granted by the Kaibab-Paiute Indian Tribe on June 30, 2009, during the 3rd SWFL survey period. Surveys were conducted on July 1, 8, and 15 in 2009. The vegetation structure did not support YBCU, and no YBCU surveys were conducted.

Figure 1.
Mixed native and nonnative trees in Short Creek.

Figure 2.
Incised ravine in Short Creek at Canaan Gap.

Figure 3.
View of north side of bridge

Figure 4.
View of south side of bridge.

Figure 5.
Water flowing from north end of Twomile Wash.

Figure 6.
Cottonwood and salt cedar trees in Twomile Wash.

Cottonwood Wash

Cottonwood Wash is located on the Kaibab-Paiute Indian Reservation in Mohave County, Arizona. The wash intersects the LPP survey area as the survey area runs parallel to Hwy 389, south of Sixmile Village (see Figure 1).

Cottonwood Wash runs north to south until it crosses Hwy 389, where it curves east, paralleling Hwy 389 and the LPP survey area (Figure 7). Soils in the wash are sandy and dry. Vegetation at the north end of the site consists of scattered salt cedar trees. Further downstream, the salt cedar becomes dense, creating a thick patch of trees with a closed canopy up to 20 feet in height (Figure 8). Lands adjacent to Cottonwood Wash include a disturbed right-of-way to Hwy 389 and undeveloped lands.

Dense salt cedar trees forming a closed canopy represent potentially suitable habitat components for SWFLs at Cottonwood Wash. Permission to access the site was granted by the Kaibab-Paiute Indian Tribe on June 30, 2009, during the 3rd SWFL survey period. Surveys were conducted on July 1, 8, and 15 in 2009. The vegetation structure did not support YBCU, and no YBCU surveys were conducted.

Kanab Creek

Kanab Creek begins northeast of Alton, Utah in Kane County and flows south through Fredonia, Arizona in Mohave County, and continues south through the Kaibab-Paiute Indian Reservation to the confluence with the Colorado River, north of the Grand Canyon. Kanab Creek crosses the LPP survey area once in Fredonia, Arizona, and once south of the Kaibab-Paiute Indian Reservation on the Kanab Plateau (see Figure 1).

South of the Kaibab-Paiute Indian Reservation, Kanab Creek is a dry, sandy, narrow creek bed, approximately 5 to 10 feet wide. It is bordered to the east and west by steep, bedrock canyon walls reaching over 50 feet tall (Figure 9). Vegetation in and along the creek is a dense, linear stringer, reaching approximately 10 feet wide. Willow is the dominant species north and south of the LPP survey area, however, salt cedar trees reaching 12 feet tall are scattered along Kanab Creek (Figure 10). At the far north end of the survey area, salt cedar replaces the willow. Lands adjacent to Kanab Creek south of the Kaibab-Paiute Indian Reservation are undeveloped or used for livestock grazing.

Little to no disturbances are present at Kanab Creek. The vegetation is a mix of predominately willow and scattered salt cedar trees that created a closed canopy and potentially suitable habitat for SWFLs. No access issues were encountered at this site. SWFL surveys were conducted on May 30, June 16, July 1, 8, and 16 in 2009. The vegetation structure did not support YBCU, and no YBCU surveys were conducted.

Kanab Creek at Fredonia

Kanab Creek begins northeast of Alton, Utah in Kane County and flows south through Fredonia, Arizona in Mohave County, and continues south through the Kaibab-Paiute Indian Reservation to the confluence with the Colorado River, north of the Grand Canyon. Kanab Creek crosses the LPP survey area once in Fredonia, Arizona, and once south of the Kaibab-Paiute Indian Reservation on the Kanab Plateau (see Figure 1).

In Fredonia, Kanab Creek is a dry channel reaching 15 feet wide. Soils are mostly cracked and dry with scattered patches of moist soil in the south end of the survey area, just north of private property. Vegetation is patchy, thin, and limited to the banks and adjacent uplands in the north reach of Kanab Creek (Figure 11). Moving south along the creek, the vegetation fills in along the banks, creating a linear stringer of salt cedar, willow, Russian olive and scattered, mature cottonwoods (Figure 12). Vegetation is dense in the south reach of the survey area, but does not extend more than 15 feet from Kanab Creek. Livestock disturbances are present in the form of cattle trails running across the creek. Lands adjacent to Kanab Creek in Fredonia are used for light agriculture, livestock grazing, and residential areas.

The vegetation in the south reach of Kanab Creek in Fredonia consists of a mix of willow, salt cedar, Russian olive, and scattered cottonwoods. Riparian vegetation formed a dense, linear stringer that created a closed canopy and potentially suitable SWFL habitat in the south reach. Access to private property was not granted until June 30, 2009, during the third SWFL survey period. Surveys were conducted on July 2, 8, and 15 in 2009. The vegetation structure did not support YBCU, and no YBCU surveys were conducted.

Figure 7.
Cottonwood Wash paralleling Hwy 389.

Figure 8.
Dense patch of salt cedar in southern end of wash.

Figure 9.
Dense willow stand in Kanab Creek.

Figure 10.
Overview of Kanab Creek on the Kanab Plateau.

Figure 11.
Patchy vegetation in north reach of Kanab Creek

Figure 12.
Dense stringers in south reach of Kanab Creek.

Blue Pool Wash

Blue Pool Wash intersects with the LPP survey area and U.S. Highway 89 (Hwy 89) east of Big Water, Utah and west of Glen Canyon National Recreation Area in Kane County (see Figure 1).

Blue Pool Wash is a bedrock bench with trapped, pooled water at its center. The pooled water is stagnant and yellow in color, and supports a small, dense patch of salt cedar (Figure 13). The salt cedar patch is approximately 200 feet long by 50 feet wide with trees ranging from 4 to 15 feet in height (Figure 14). No habitat exists upstream or downstream of the salt cedar patch. Adjacent lands are undeveloped.

The vegetation at Blue Pool Wash is a dense patch of salt cedar that creates a closed canopy. Pooled water exists on site, and there are no access issues. Based on these characteristics, a SWFL survey was conducted on May 30, 2009. During the survey, the only species observed were common ravens (*Corvus corax*) and one Say's Phoebe (*Sayornis saya*). Due to the isolated nature and the limited avian life observed on site, no additional SWFL surveys were conducted after May 30, 2009.

Unsurveyed sites

Gould Wash

Gould Wash runs from south of Hurricane, Utah, paralleling U.S. Highway 59 (Hwy 59) until it curves east to intersect Hwy 59 west of Little Creek Station, Utah in Washington County. Gould Wash intersects the LPP survey area and a two track Bureau of Land Management (BLM) road east of the Hurricane Cliffs (see Figure 1).

Gould Wash is a dry, silty wash reaching approximately 60 feet wide. After rains, the wash bottoms are moist, slick, and muddy. The vegetation along the banks of Gould Wash consists of scattered salt cedar reaching 8 feet tall, and 3 individual cottonwood trees, reaching 12 feet tall (Figure 15) Vegetation was a linear stringer, with trees and shrubs scattered too far apart to create a closed canopy (Figure 16). Lands adjacent to Gould Wash are moderately disturbed and used for livestock grazing.

There were no access issues to Gould Wash, however, the vegetation was too sparse and the trees were too young be considered SWFL or YBCU habitat. No surveys were conducted at Gould Wash in 2009.

Bitter Seep Wash

Bitter Seep Wash crosses the LPP survey area south of the Kaibab-Paiute Indian Reservation on the Kanab Plateau. It is east of Kanab Creek (see Figure 1).

Bitter Seep Wash is a sandy, dry wash approximately 15 feet wide. Vegetation is not present within the wash, but is present along the banks as scattered patches of salt cedar reaching 15 feet tall and no greater than 15 feet wide (Photos 17 and 18). Salt cedar trees were too young and too sparse to support a closed canopy. Adjacent upland vegetation includes sagebrush (*Artemisia* spp.) and rabbitbush (*Chrysnothamnus nauseosus*). Adjacent lands are undeveloped.

Vegetation along Bitter Seep Wash was too sparse and scattered to be considered SWFL or YBCU habitat. No moist soils or standing water were present within the wash. No SWFL or YBCU surveys were conducted in 2009.

Figure 13.
Pooled, stagnant water in center of salt cedar patch.

Figure 14.
Isolated salt cedar patch at Blue Pool Wash.

Figure 15.
BLM two-track leading to Gould Wash.

Figure 16.
Patchy salt cedar and cottonwood trees.

Figure 17.
View of Bitter Seep Wash.

Figure 18.
Salt cedar along Bitter Seep Wash banks.

Johnson Wash North and South

Johnson Wash begins in Johnson Canyon on Skutumpah Terrace in southern Kane County, Utah. It flows south into Coconino County, Arizona and then east to Kanab Creek, south of Sixmile Village on the Kaibab-Paiute Indian Reservation. Johnson Wash crosses the LPP survey area twice; once as the survey area parallels Hwy 89, east of Kanab, and a second time south of Fredonia and east of Forest Road 22 (see Figure 1).

North Johnson Wash is a dry, sandy, shallow wash that crosses Hwy 89 at milepost 54. North and south of Hwy 89, soils are compacted with little to no understory present due to overgrazing by livestock and their associated trails (Figure 19). Linear stringers of salt cedar and scattered Russian olive trees and sagebrush are present along the wash banks (Figure 20).

South Johnson Wash is a deeply incised wash with cut banks up to 12 feet tall. Soils are dry, baked, and cracked. Vegetation in the wash and throughout the adjacent uplands is dominated by sagebrush (Figure 21). Salt cedar up to 8 feet tall is also present, but in scattered patches lacking a closed canopy (Figure 22).

Vegetation present along and within north and south Johnson Wash does not represent the appropriate structure or density for SWFL or YBCU habitat. No moist soils or water are present at either survey area crossing. No surveys were conducted at Johnson Wash in 2009.

White Sage Wash

White Sage Wash runs northeast to southwest between the Vermillion Cliffs and the Kanab Plateau in Coconino County, Arizona and Kane County, Utah. It intersects with Hwy 89 east of Kanab and flows into Johnson Wash. White Sage Wash crosses the LPP survey area south of Hwy 89 and Canyon Depot, Utah (see Figure 1).

White Sage Wash is a deeply incised wash with patches of moist, sandy soils. Vegetation in the wash is dominated by sagebrush up to five feet tall. No riparian trees are present within the wash at the survey area crossing, upstream of the survey area crossing, or downstream of the survey area crossing. Adjacent lands are used for livestock grazing.

Patches of moist soils are present in White Sage Wash, however, vegetation is dominated by sagebrush. The wash lacks riparian vegetation. No SWFL or YBCU surveys were conducted in 2009.

Buckskin Gulch

Buckskin Gulch runs west to east between the Vermillion Cliffs and the Cockscombs in Kane County, Utah. It intersects with Hwy 89 and the LPP survey area east of Kanab at milepost 37 (see Figure 1).

Buckskin Gulch is a dry, sandy, incised wash (Figure 23). Within the wash, vegetation is sparsely scattered grasses. Along the wash banks, the vegetation is dominated by sagebrush, but also consists of Russian thistle (*Salsola kali*) and rabbitbush (Figure 24). One salt cedar tree is present within the wash at the survey area crossing, south of Hwy 89, and a patch of salt cedar is present one half mile north of Hwy 89.

No moist soils or suitable patches of riparian vegetation were present at Buckskin Gulch. No SWFL or YBCU surveys were conducted in 2009.

Figure 19.
Overgrazed areas of north Johnson Wash.

Figure 20.
Scattered vegetation in north Johnson Wash.

Figure 21.
Sagebrush dominates south Johnson Wash.

Figure 22.
Scattered salt cedar in south Johnson Wash.

Figure 23.
View to the south from Hwy 89 Buckskin Gulch.

Figure 24.
View to the north from Hwy 89 of Buckskin Gulch.

Figure 25.
Saturated soils and flowing water at the Paria River.

Figure 26.
Dense patch of salt cedar at the Paria River.

Surveys Needed

Paria River

The Paria River is a major tributary of the Colorado River between Lake Powell and the Grand Canyon. It flows north to west at its intersection with Hwy 89, east of the Cockscombs and west of Glen Canyon City in Kane County, Utah (see Figure 1).

The Paria River is a shallow, sandy river with a wide, flat floodplain. Saturated soils and flowing water were present within the Paria River on both the north and south sides of Hwy 89 at the time of the site visit (Figure 25). Vegetation throughout the Paria River floodplain is dominated by salt cedar greater than 5 feet tall, with mature cottonwood trees scattered along the river banks and in the floodplain. Salt cedar is present in dense patches along Hwy 89 and in dense stringers running on either side of the Paria River, creating a continuous and closed canopy (Figure 26).

The vegetation components north and south of Hwy 89 along the Paria River are of the appropriate density and structure to be considered potentially suitable SWFL and YBCU habitats. However, the entire river bottom at the intersection of the Paria River and the LPP survey area is private property. Access to the Paria River via private property was not granted during the 2009 field season. Despite the presence of potentially suitable SWFL and YBCU habitat, private property restricted access to the Paria River and no SWFL or YBCU surveys were conducted in 2009.

4. SURVEY METHODS

Southwestern willow flycatcher

Presence/absence surveys for SWFLs were conducted using the protocol identified in *A Southwestern Willow Flycatcher Natural History Summary and Survey Protocol* (Sogge et al. 1997) and revised by the U.S. Fish and Wildlife Service (USFWS) in 2000 (Appendix A). All surveys conformed to the survey protocol and its revision and were conducted by qualified biologists with current USFWS and Arizona Game and Fish Department (AGFD) permits.

Surveys were conducted by LSD biologists walking through potentially suitable habitat, pausing every 45 to 90 feet in suitable habitat to listen for calling flycatchers, broadcasting a recording of the SWFL's call, and then listening for a response. Each calling/listening period started with a one minute listening period, followed by a 15 to 30 second calling period and then finished with another one to two minute listening period. Surveys were preformed from approximately one hour prior to sunrise to between 0900 and 1000.

Data collected during surveys at each site (survey date, start/stop time, flycatcher responses, and habitat type) was recorded on a Willow Flycatcher Survey and Detection Form (revised by AGFD/USFWS April 2004; Appendix B).

Yellow-billed cuckoo

Presence/absence surveys for YBCU were conducted concurrently with SWFL surveys at Short Creek at Canaan Gap and Short Creek Wash in Colorado City using the draft protocol identified in *Standard Operating Procedure (SOP) #3: Conducting Yellow-billed Cuckoo Surveys* (Johnson 2009). All surveys conformed to the survey protocol and were conducted by qualified biologists with current AGFD permits.

Surveys were conducted by LSD biologists at each site, pausing every 100 feet in potentially suitable habitat to listen for calling YBCUs for 1 minute. After the listening period, a "klowp" call was broadcasted, followed by 1 minute of silence, when the surveyor listened for a response. The call/listening cycle was repeated 4 times. Surveys were preformed from approximately one hour prior to sunrise to between 0900 and 1000.

5. SURVEY RESULTS

Permitted LSD biologists conducted presence/absence surveys for SWFLs consisting of 5 separate visits to Short Creek at Canaan Gap, Short Creek Wash, and Kanab Creek; 3 separate visits to Twomile Wash, Cottonwood Wash, and Kanab Creek; and 1 visit to Blue Pool Wash during the 2009 breeding season. Permitted LSD biologists conducted presence/absence surveys for YBCUs concurrently with SWFL surveys during the 5 separate visits to Short

Creek at Canaan Gap and Short Creek Wash. The area surveyed for SWFLs and YBCUs included all potentially suitable habitats for each species within a 0.25 mile buffer from the center of the LPP survey area.

No SWFLs or YBCUs were detected during the survey season in 2009. No resident territories, breeding pairs, or nests for either species were identified in the survey area.

6. FIELD PERSONNEL

Logan Simpson Design Inc.

Ada Davis, permitting specialist
Bruce Palmer, biologist
Heather English, biologist
Jennifer Cleland, biologist
Richard Remington, biologist
Shaylon Stump, biologist

7. LITERATURE CITED

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8. SIGNATURES

Prepared By: Jennifer Cleland Date: January 20, 2010

Jennifer Cleland, Biologist
Logan Simpson Design Inc.

Reviewed/Approved By: Bruce K. Palmer Date: January 20, 2010

Bruce Palmer, Senior Biologist
Logan Simpson Design Inc.

Appendix A

Southwestern Willow Flycatcher Protocol Revision 2000

United States Department of the Interior

FISH AND WILDLIFE SERVICE
P.O. Box 1306
Albuquerque, New Mexico 87103

In Reply Refer To:
R2/ES-TE

MAY 31 2000

Dear Southwestern willow flycatcher surveyors:

The Fish and Wildlife Service has revised the survey protocol for the southwestern willow flycatcher throughout the bird's range in all western states (Arizona, California, Colorado, Nevada, New Mexico, and Texas).

The enclosed revision separates the methodology for general surveys from those which are done to evaluate the effects of a project on flycatchers. As a result, general surveys will still follow the minimum three survey effort (Sogge et al. 1997). For project-related surveys, plan to do a minimum of five visits in order to have greater confidence in determining the presence/absence of resident southwestern willow flycatchers. If there is uncertainty over which type of survey is appropriate or if surveys are needed, please contact your local Fish and Wildlife Service office.

This revision does not replace Sogge et al. 1997. It is still essential for surveyors to be familiar with this document (especially survey methodology) since it covers a wide range of flycatcher topics (natural history, habitat, permitting, etc.). The revision simply adds a new layer to the already existing protocol. As in the past, all new surveyors will still need to attend flycatcher training before they can receive a Federal permit to survey for flycatchers.

We recognize that some environmental consultants may have already established contracts for flycatcher surveys this upcoming field season. Therefore, those completed contracts will not need to be altered for this revision. However, any new contracts developed following distribution of this correspondence will be expected to use the protocol revision.

If there are any questions about the revision, please contact Greg Beatty in our Arizona Ecological Services office in Phoenix, Arizona, at 602-640-2722 extension 247, or your local Fish and Wildlife Service office.

Sincerely,

[signed Bryan Arroyo]

Assistant Regional Director - Ecological Services

Enclosure

SOUTHWESTERN WILLOW FLYCATCHER PROTOCOL REVISION 2000

The U.S. Fish and Wildlife Service (USFWS) is revising the survey protocol for the southwestern willow flycatcher due to issues raised (Braden and McKernan 1998, 1999, Sogge et al. 1997, 1999), discussion with experts in the field, and subsequent review of pertinent documents by the Ornithological Council. The number and timing of surveys recommended in Sogge et al. (1997) (e.g., a minimum three surveys), are appropriate for general surveys and situations where the survey results will NOT be used to evaluate the effects of a project. However, surveyors will now need to be prepared to make at least five visits to evaluate project effects on flycatchers (e.g., typically those that would involve consultation with the USFWS). The purpose of these additional surveys is to provide greater confidence in determining resident southwestern flycatcher presence/absence and direct limited resources to where they can be most beneficial. Thus, what was once a single approach for all survey purposes has been changed to a two-strategy system; for general purposes, surveyors will need to conduct a minimum of three surveys, and in order to assess project-related impacts, surveyors will need to be prepared to conduct a minimum of five surveys.

ALL SURVEYS

Although the USFWS is modifying the recommended minimum number of survey visits to evaluate project effects to flycatchers, all surveys conducted should follow the general guidelines described in Sogge et al. (1997). This includes the use of tape-playback, thorough coverage of survey sites on ALL visits, ways to minimize impacts to the habitat, importance of recognizing all flycatcher vocalizations, importance of beginning surveys at dawn, etc.

Early-season visits in May and June (needed for both survey strategies) allow surveyors to look for flycatchers when they are most vocal. During these visits, surveyors using taped calls can elicit vocal responses from flycatchers, and subsequently observe behaviors that indicate nesting (e.g., establishing and defending territories, soliciting mates, acquiring/carrying nest material, etc.). These early visits also increase the surveyor's familiarity with the site (e.g., learning vegetation types, topography, etc.), and if birds are located, help the surveyor focus on specific areas within a site where the resident southwestern willow flycatchers might be found during the third survey period (and therefore where to devote extra survey attention).

During ALL visits, surveyors should observe and record flycatcher behavior such as territorial defense, pair status, carrying nest material, feeding fledged young, etc. Surveyors should spend additional time either during or after the survey to observe and document pair behavior and status (while being careful to not disturb the birds). Neither survey method is limited to three or five visits. Searches of large or particularly dense areas may take more than one day to complete a "single" survey of the area (depending on start time, number of surveyors, etc.). Or possibly, some surveyors may want to make extra visits to confirm an observation. It is important that all survey information be recorded on your survey forms (in Sogge et al. 1997) and submitted to your local USFWS or State wildlife agency as specified in your permit.

The survey efforts described in Sogge et al. (1997) and modified herein relate only to presence/absence type surveys. Efforts such as nest monitoring require different techniques, and more extensive effort, experience, and permitting. The permit to survey for willow flycatchers does not authorize surveyors to directly monitor or search for nests. Both State and Federal permits are required for these activities because they are more invasive and require more experience. We recognize that surveyors may discover nests while trying to detect birds. In these instances, surveyors should place themselves at a distance where birds are not disturbed, quickly determine the status of the nest with binoculars, map the location, leave the immediate area, and contact you local State or Federal wildlife agency with this information as soon as possible.

GENERAL SURVEYS

The minimum three survey effort described in Sogge et al. (1997) is appropriate for conducting general willow flycatcher surveys, but should NOT be used to help assess impacts of a specific project. When using the minimum three survey methodology, the flexibility exists to conduct more than three surveys in order to be more certain about the presence/absence, breeding status, home range, absence, etc. of resident southwestern willow flycatchers. This might especially be worthwhile if flycatchers are detected during periods one and two, and/or based on the confidence/experience of the surveyor. If a surveyor has more time, it may best be applied by conducting more surveys during period three

PROJECT-RELATED SURVEYS

Surveyors need to plan to make at least three visits during the third (or last) survey period (June 22 to July 17), because: (a) nesting southwestern willow flycatchers can be more difficult to detect once breeding efforts are well underway (e.g., the third survey period), compared to earlier in the breeding season; (b) detections during the third period are the "verification" that flycatchers are resident, lacking other evidence of local breeding; and (c), the potentially high conservation ramifications of incorrectly determining that flycatchers are not resident at a project-related site. Detecting southwestern willow flycatchers during the last survey period can be difficult because birds are less vocal and less likely to respond (especially with singing) to playback calls. Conducting more visits during this survey period provides greater confidence in determining the presence/absence of resident southwestern willow flycatchers, and can generate more information about nesting behaviors, number of pairs, and other related information.

MODIFIED SURVEY GUIDELINES: TIMING AND NUMBER OF VISITS

Survey schedule

1st survey period.

May 15 to May 31. *Minimum* one survey.

2nd survey period.

June I to June 21. *Minimum* one survey.

3rd survey period.

June 22 to July 17 (this period is extended one week longer than per Sogge et al. 1997).

For general surveys -Minimum one survey.

For project-related surveys - Plan to conduct a *minimum* of three surveys, each at least five days apart.

GUIDELINES FOR THE REVISED PROTOCOL FOR PROJECT-RELATED SURVEYS

1) Surveyors must be familiar with and adhere to the general survey techniques and guidelines in Sogge et al. (1997). Flycatcher survey training must be completed prior to being permitted to conduct surveys. Please follow all reporting requirements described in your permits such as contacting agencies when nests are discovered or submitting survey forms at the end of the season.

2) For project-related surveys, visits in the third period are recommended until flycatchers are found, or until three visits are completed with no flycatcher detections. If birds are found on either the first or second survey within the last survey period (visit 3 or 4), we recommend that surveyors continue to complete all five surveys, especially if pair status could not be determined in earlier visits.

3) Surveys conducted in different survey periods, and multiple surveys within the third survey period, must be at least FIVE days apart from each other.

4) Conduct the initial survey in period three between June 22 and June 30. Because surveys must be at least five days apart and there are just 27 days in the last survey period, it is important that surveys begin as soon as possible.

5) Detecting flycatchers in the third survey period can confirm resident status. Additionally, behaviors observed and recorded on survey forms throughout the survey period can help determine number of pairs, nesting status, etc. Surveyors should spend time either during or after surveys to observe and document flycatcher behavior (without directly monitoring nests or disturbing bird behavior).

6) Flycatchers could be considered as migrants or absent if birds are not detected during the last survey period. Yet, it may. be possible for early-season nests to fail by late June, and the flycatchers not be detected in the last survey period. As a result, observing and reporting behavior of flycatchers in the first two survey periods is important in determining resident southwestern willow flycatcher status.

7) State and Federal permits are required to search for and monitor nesting flycatchers. Contact your State or Federal wildlife agency for more information on methodology. For example, the Arizona Game and Fish Department has produced a report (Rourke et al. 1999) that specifically describes how to monitor southwestern willow flycatcher nests. The applicant is responsible for having all applicable State and Federal permits prior to conducting flycatcher survey, monitoring, and management activities.

LITERATURE CITED

Braden, G.T. and R.L. McKernan. 1998. Nest cycles, vocalizations, and survey protocols of the endangered southwestern willow flycatcher. Report to the U.S. Bureau of Reclamation, Boulder City, Nevada. San Bernardino County Museum, Redlands, CA.

Braden, G.T. and R.L. McKernan. 1999. Rebuttal to the criticism of Sogge et al. (1999) concerning the proposed survey protocol for the endangered southwestern willow flycatcher. Report to the U.S. Fish and Wildlife Service, Albuquerque, New Mexico. San Bernardino County Museum, Redlands, CA.

Rourke, J.W., T.D. McCarthey, R.F. Davidson, and A.M. Santaniello. 1999. Southwestern willow flycatcher nest monitoring protocol. Nongame and Endangered Wildlife Program Technical Report 144. Arizona Game and Fish Department, Phoenix, Arizona.

Sogge, M.K., R.M. Marshall, S.J. Sferra, and T.J. Tibbitts. 1997. A Southwestern Willow Flycatcher Natural History Summary and Survey Protocol. Technical Report NPS/NAUCPRS/NRTR-97/12. USGS Colorado Plateau Research Station, Northern Arizona University, Flagstaff, Arizona.

Sogge, M.K., R.M. Marshall, S.J. Sferra, and T.J. Tibbitts. 1999. Preliminary evaluation of the effectiveness of the southwestern willow flycatcher survey protocol (Sogge et al. 1997). A briefing statement to the U.S. Fish and Wildlife Service, Arizona Ecological Services Office, Phoenix, AZ.

Appendix B

Completed Willow Flycatcher Survey and Detection Forms

Willow Flycatcher Survey and Detection Form (revised April, 2004)

Site Name Short Creek at Canaan Gap State UT County Washington
USGS Quad Name Little Creek Mt + Smithsonian Butte Elevation 4500 (feet) / meters (circle one)

Is copy of USGS map marked with survey area and WIFL sightings attached (as required)? ☑ *Yes* ☐ *No*

Site Coordinates: Start: N 3712293 E 4097855 UTM Datum 83 (NAD27 preferred)
Stop: N 3709101 E 4097813 UTM Zone 12

*** Fill in additional site information on back of this page ***

Survey # / Observer(s) (Full Name)	Date (m/d/y) Survey time	Number of Adult WIFLs	Estimated Number of Pairs	Estimated Number of Territories	Nest(s) Found ? Y or N	Cowbirds Detected? Y or N	Presence of Livestock, Recent sign, If Yes, Describe Y or N	Comments about this survey (e.g., bird behavior, evidence of pairs or breeding, number of nests, nest contents or number of fledges seen; potential threats)
1 J. Cleland H. English K. Remington S. Stump	Date 5.31.09 Start 0522 Stop 0828 Total hrs 2.65	0	0	0	N	Y	Y	Cottonwood overstory w/ willow & TAMA understory
2 J. Cleland H. English K. Remington P. Palmer	Date 6.17.09 Start 0525 Stop 0956 Total hrs 8.3	0	0	0	N	Y	Y	
3 J. Cleland A. Davis S. Stump H. English	Date 6.30.09 Start 0604 Stop 0834 Total hrs 11.02	0	0	0	N	Y	Y	
4 J. Cleland H. English A. Davis S. Stump	Date 7.7.09 Start 0622 Stop 0924 Total hrs 10.05	0	0	0	N	Y	Y	
5 A. Davis S. Stump	Date 7.14.09 Start 0605 Stop 1030 Total hrs 8.82	0	0	0	N	Y	Y Cows present at time of survey	

Overall Site Summary (Total **resident** WIFLs only)	Adults	Pairs	Territories	Nests	Were any WIFLs color-banded? Yes No
Total survey hrs 38.22	0	0	0	0	If yes, report color combination(s) in the comments section on back of form

Reporting Individual Jennifer Cleland Date Report Completed 7.30.09
US Fish and Wildlife Service Permit # TE006655Z AZ Game and Fish Department (or other state) Permit # SP733970

Submit original form by August 1st. Retain a copy for your records.

Fill in the following information completely. Submit original form by August 1st. Retain a copy for your records.

Reporting Individual Jennifer Cleland Phone # 480-6967-1343
Affiliation Logan Simpson Design Inc. E-mail jcleland@lsdaz.com
Site Name Short Creek at Canaan Gap Date Report Completed 7.30.09

Did you verify that this site name is consistent with that used in previous years? Yes / (No) (circle one)
If name is different, what name(s) was used in the past? _____
If site was surveyed last year, did you survey the same general area this year? Yes / No If no, summarize in comments below.
Did you survey the same general area during each visit to this site this year? (Yes) No If no, summarize in comments below.

Management Authority for Survey Area (circle one): (Federal) Municipal/County State Tribal Private
Name of Management Entity or Owner (e.g., Tonto National Forest) BLM

Length of area surveyed: 2.82mi (specify units, e.g., miles = mi, kilometers = km, meters = m)

Vegetation Characteristics: Overall, are the species in tree/shrub layer at this site comprised predominantly of (check one):

☐ Native broadleaf plants (entirely or almost entirely, includes high-elevation willow)

☐ Mixed native and exotic plants (mostly native)

☑ Mixed native and exotic plants (mostly exotic)

☐ Exotic/introduced plants (entirely or almost entirely)

Identify the 2-3 predominant tree/shrub species: Tamarisk sp, Russian olive, Salix sp.

Average height of canopy (Do not put a range): 15 ft. (specify units)

Was surface water or saturated soil present at or adjacent to site? Yes / (No) (circle one)
Distance from the site to surface water or saturated soil: _____ (specify units)

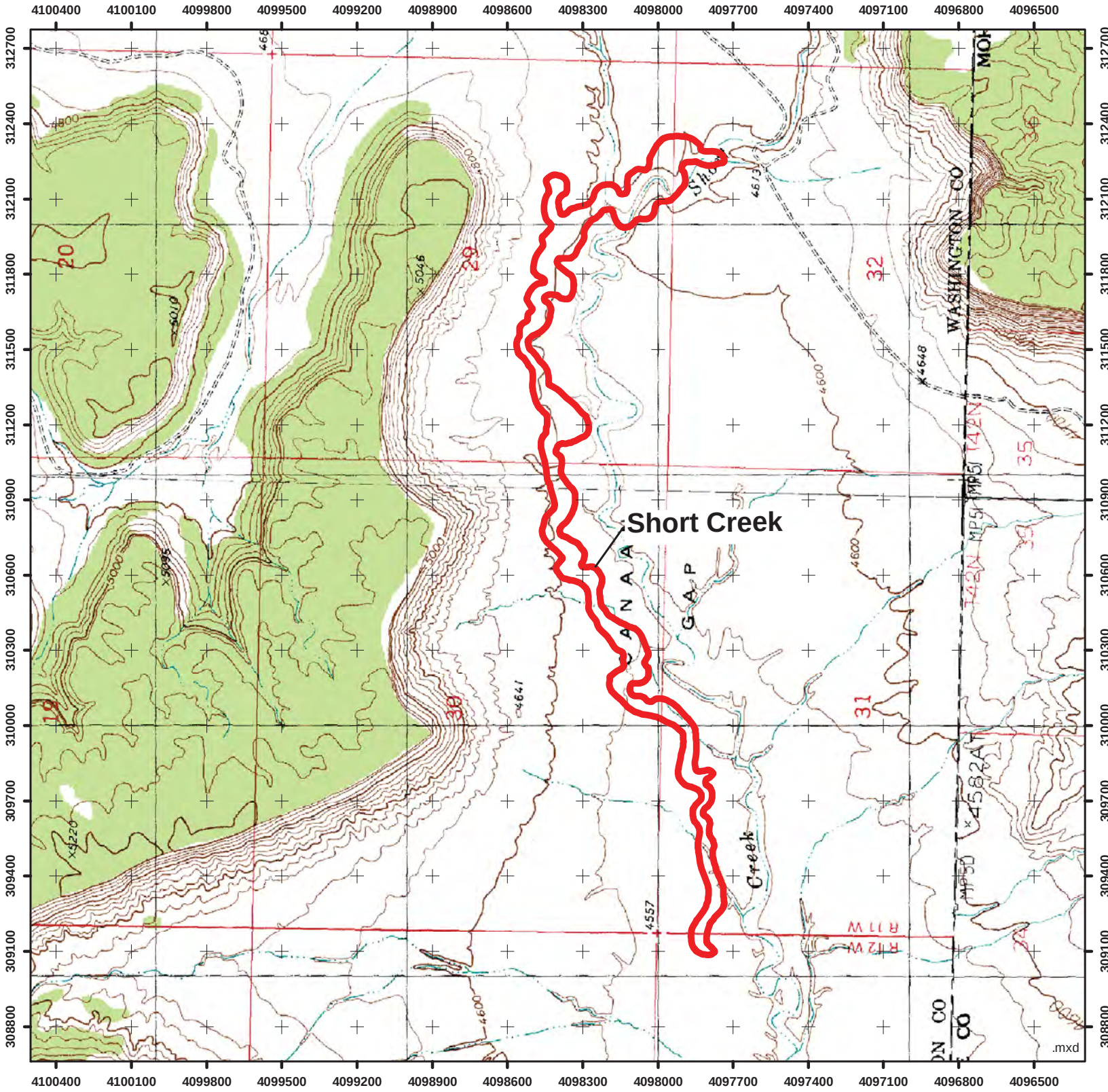
Did hydrological conditions change significantly among visits (did the site flood or dry out)? Yes / (No) (circle one)
If yes, describe in comments section below.

Remember to attach a copy of a USGS quad/topographical map (REQUIRED) of the survey area, outlining the survey site and location of WIFL detections. Also include a sketch or aerial photograph showing details of site location, patch shape, survey route in relation to patch, and location of any willow flycatchers or willow flycatcher nests detected. Such sketches or photographs are welcomed, but DO NOT substitute for the required USGS quad map. Please include photos of the interior of the patch, exterior of the patch, and overall site and describe any unique habitat features.

Comments (attach additional sheets if necessary)

WIFL Detection Locations: None

Date Detected	N UTM	E UTM	Date Detected	N UTM	E UTM



Key

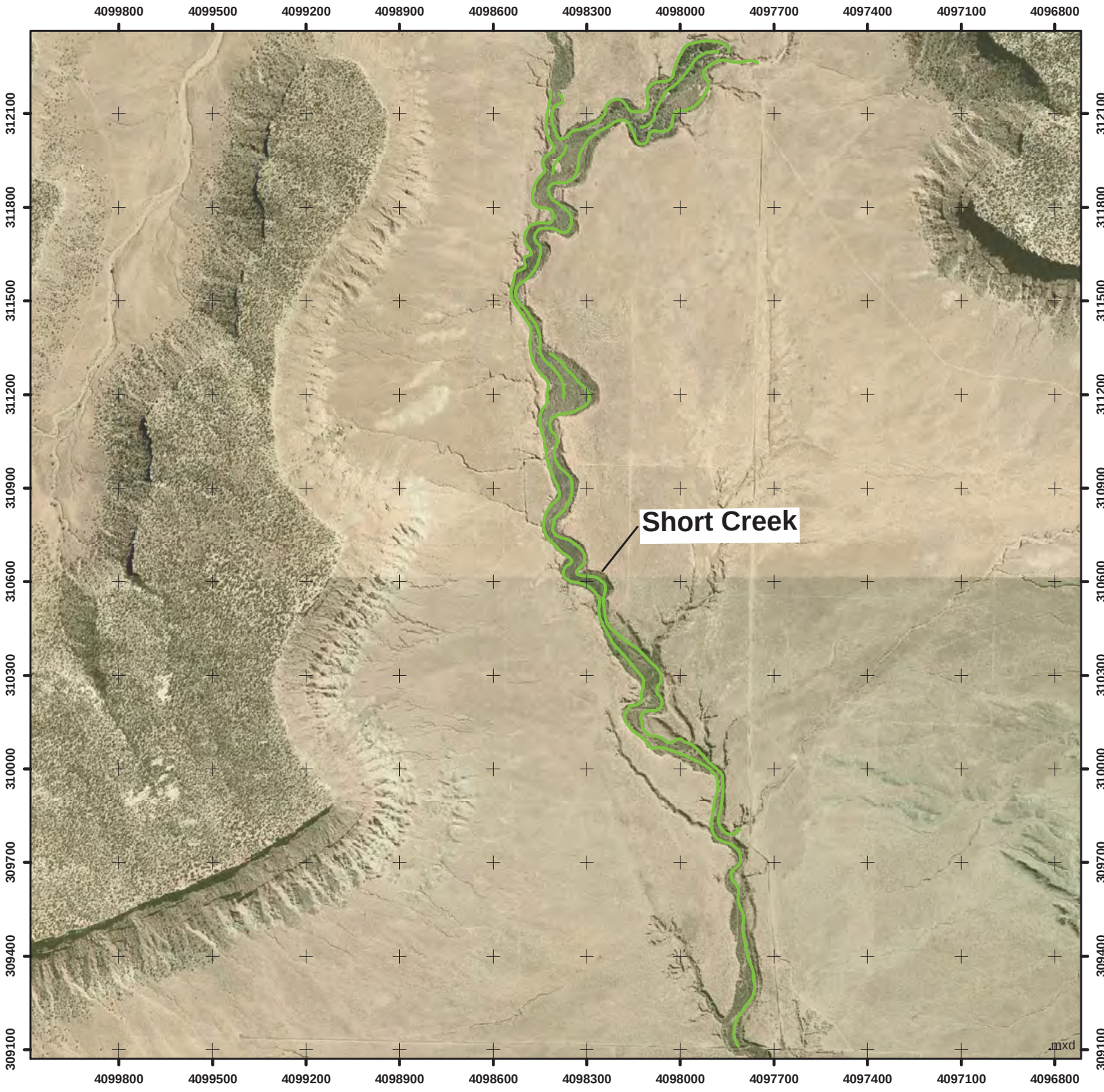
WIFL Survey Area

Mile

0 0.5

Projection: NAD83, UTM Zone 12

NORTH



Key

WIFL Survey Route

Mile

0 0.5

Projection: NAD83, UTM Zone 12

NORTH

Willow Flycatcher Survey and Detection Form (revised April, 2004)

Site Name Short Creek at Colorado City State AZ County Mohave
USGS Quad Name Colorado City Elevation 4900 (feet) meters (circle one)

Is copy of USGS map marked with survey area and WIFL sightings attached (as required)? ☑ *Yes* ☐ *No*

Site Coordinates: Start: N 323392 E 4095565 UTM Datum 83 (NAD27 preferred)
Stop: N 322655 E 4095366 UTM Zone 12

*** Fill in additional site information on back of this page ***

Survey # / Observer(s) (Full Name)	Date (m/d/y) Survey time	Number of Adult WIFLs	Estimated Number of Pairs	Estimated Number of Territories	Nest(s) Found ? Y or N	Cowbirds Detected? Y or N	Presence of Livestock, Recent sign, If Yes, Describe Y or N	Comments about this survey (e.g., bird behavior, evidence of pairs or breeding, number of nests, nest contents or number of fledges seen; potential threats)
1 J.Cleland	Date 5.30.09 Start 0616 Stop 0854 Total hrs 2.63	0	0	0	N	N	N	
2 J.Cleland H.English	Date 6.18.09 Start 0527 Stop 0648 Total hrs 1.4	0	0	0	N	N	N	ATV/horse trails throughout site
3 A.Davis J.Cleland	Date 7.01.09 Start 0516 Stop 0635 Total hrs 2.4	0	0	0	N	Y	N	
4 A.Davis J.Cleland	Date 7.08.09 Start 0500 Stop 0617 Total hrs 1.25	0	0	0	N	N	N	
5 A Davis S. Shump	Date 7.16.09 Start 510 Stop 0608 Total hrs 1.8	0	0	0	N	Y	Y	46 waypts Horses on site

Overall Site Summary (Total **resident** WIFLs only)	Adults	Pairs	Territories	Nests	Were any WIFLs color-banded? Yes No
Total survey hrs 9.48	0	0	0	0	If yes, report color combination(s) in the comments section on back of form

Reporting Individual Jennifur Cleland Date Report Completed 7.30.09
US Fish and Wildlife Service Permit # TE006655 2 AZ Game and Fish Department (or other state) Permit # SP833970

***Submit original** form by August 1st. Retain a copy for your records.*

Fill in the following information completely. Submit original form by August 1st. Retain a copy for your records.

Reporting Individual Jennifer Cleland Phone # 480-967-1343
Affiliation Logan Simpson Design Inc. E-mail jcleland@lsd92.com
Site Name Short Creek at Colorado City Date Report Completed 7.30.09

Did you verify that this site name is consistent with that used in previous years? Yes / (No) (circle one)
If name is different, what name(s) was used in the past? _____
If site was surveyed last year, did you survey the same general area this year? Yes / No If no, summarize in comments below.
Did you survey the same general area during each visit to this site this year? (Yes) No If no, summarize in comments below.

Management Authority for Survey Area (circle one): Federal Municipal/County State Tribal (Private)
Name of Management Entity or Owner (e.g., Tonto National Forest) _____

Length of area surveyed: 0.5 mi (specify units, e.g., miles = mi, kilometers = km, meters = m)

Vegetation Characteristics: Overall, are the species in tree/shrub layer at this site comprised predominantly of (check one):

☐ Native broadleaf plants (entirely or almost entirely, includes high-elevation willow)

☐ Mixed native and exotic plants (mostly native)

☑ Mixed native and exotic plants (mostly exotic)

☐ Exotic/introduced plants (entirely or almost entirely)

Identify the 2-3 predominant tree/shrub species: Tamarisk sp, Russian olive, Salix sp.

Average height of canopy (Do not put a range): 20ft. (specify units)

Was surface water or saturated soil present at or adjacent to site? Yes (No) (circle one)
Distance from the site to surface water or saturated soil: _____ (specify units)

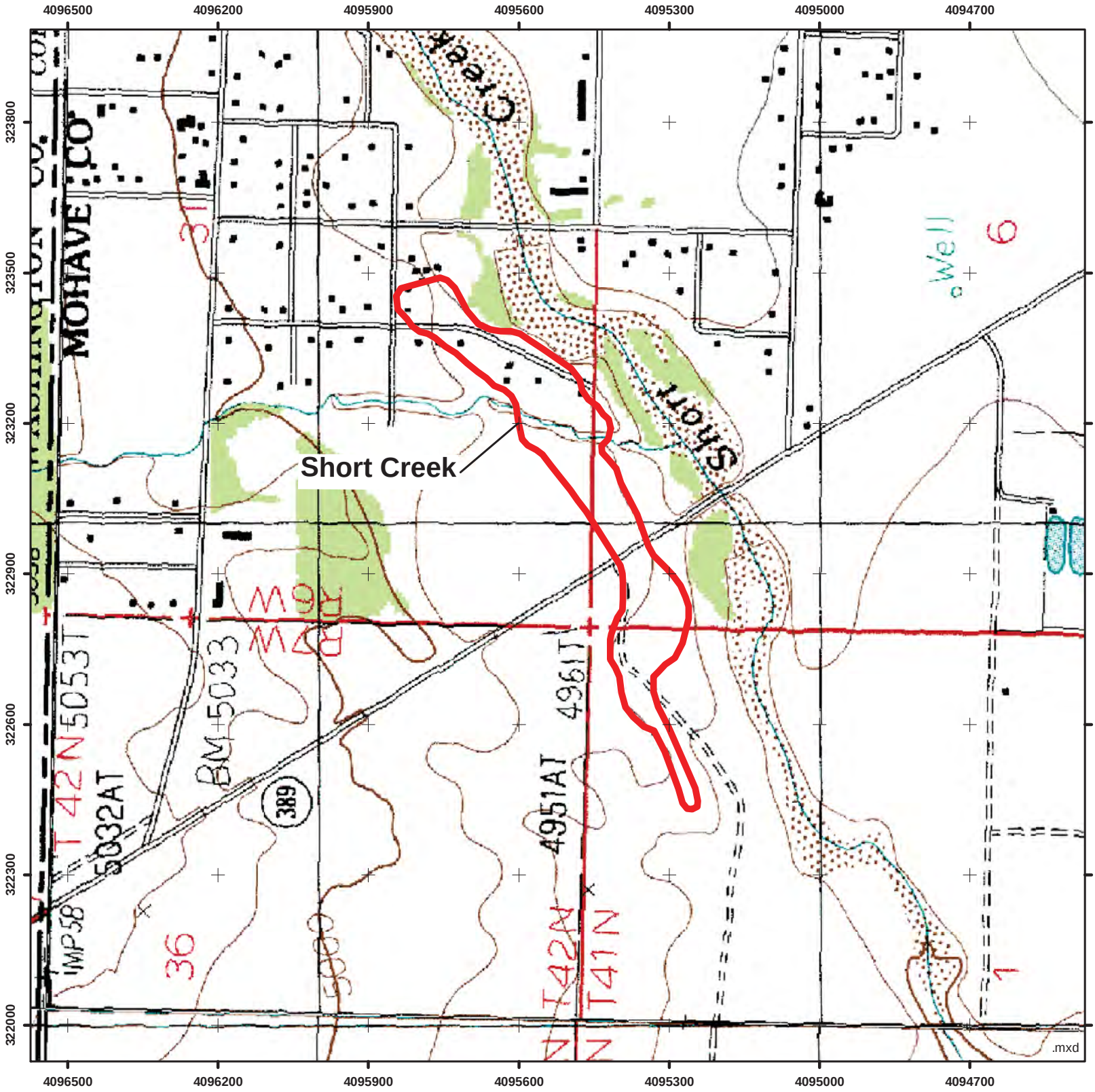
Did hydrological conditions change significantly among visits (did the site flood or dry out)? Yes (No) (circle one)
If yes, describe in comments section below.

Remember to attach a copy of a USGS quad/topographical map (REQUIRED) of the survey area, outlining the survey site and location of WIFL detections. Also include a sketch or aerial photograph showing details of site location, patch shape, survey route in relation to patch, and location of any willow flycatchers or willow flycatcher nests detected. Such sketches or photographs are welcomed, but DO NOT substitute for the required USGS quad map. Please include photos of the interior of the patch, exterior of the patch, and overall site and describe any unique habitat features.

Comments (attach additional sheets if necessary)

WIFL Detection Locations: None

Date Detected	N UTM	E UTM	Date Detected	N UTM	E UTM



Key

WIFL Survey Area

Mile

0 0.2

Projection: NAD83, UTM Zone 12

NORTH

Key

WIFL Survey Route

Mile

0 0.1

Projection: NAD83, UTM Zone 12

NORTH

Willow Flycatcher Survey and Detection Form (revised April, 2004)

Site Name Kanab Creek at Fredonia State AZ County Mohave
USGS Quad Name Fredonia Elevation 4700 (feet) / meters (circle one)

Is copy of USGS map marked with survey area and WIFL sightings attached (as required)? ☑ *Yes* ☐ *No*

Site Coordinates: Start: N 363767 E 4091797 UTM Datum 83 (NAD27 preferred)
Stop: N 363645 E 409143 UTM Zone 12

*** Fill in additional site information on back of this page ****

Survey # / Observer(s) (Full Name)	Date (m/d/y) Survey time	Number of Adult WIFLs	Estimated Number of Pairs	Estimated Number of Territories	Nest(s) Found ? Y or N	Cowbirds Detected? Y or N	Presence of Livestock, Recent sign, If Yes, Describe Y or N	Comments about this survey (e.g., bird behavior, evidence of pairs or breeding, number of nests, nest contents or number of fledges seen; potential threats)
1 J Cleland S. Stump	Date 7.02.09 Start 0603 Stop 0655 Total hrs 1.5	0	0	0	N	Y	Y cow trails	18 waypts
2 S. Stump H. English	Date 7.08.09 Start 0856 Stop 0923 Total hrs 0.45	0	0	0	N	Y	Y	8 waypts
3 S. Stump A. Davis	Date 7.15.09 Start 0901 Stop 0926 Total hrs 0.42	0	0	0	N	Y	Y	8 waypts
4	Date Start Stop Total hrs							
5	Date Start Stop Total hrs							

Overall Site Summary (Total **resident** WIFLs only)	Adults	Pairs	Territories	Nests	Were any WIFLs color-banded? Yes No
Total survey hrs 2.36	0	0	0	0	If yes, report color combination(s) in the comments section on back of form

Reporting Individual Jennifer Cleland Date Report Completed 7.30.09
US Fish and Wildlife Service Permit # TE006552 AZ Game and Fish Department (or other state) Permit # SP733970

Submit original form by August 1st. Retain a copy for your records.

Fill in the following information completely. Submit original form by August 1st. Retain a copy for your records.

Reporting Individual Jennifer Cleland Phone # 480-967-1343
Affiliation Logan Simpson Design Inc. E-mail jcleland@lsda2.com
Site Name Kanab Creek at Fredonia Date Report Completed 7.30.09

Did you verify that this site name is consistent with that used in previous years? Yes / (No) (circle one)
If name is different, what name(s) was used in the past? _____
If site was surveyed last year, did you survey the same general area this year? Yes / No If no, summarize in comments below.
Did you survey the same general area during each visit to this site this year? (Yes) No If no, summarize in comments below.

Management Authority for Survey Area (circle one): Federal Municipal/County State Tribal (Private)
Name of Management Entity or Owner (e.g., Tonto National Forest) _____

Length of area surveyed: 0.23 mi (specify units, e.g., miles = mi, kilometers = km, meters = m)

Vegetation Characteristics: Overall, are the species in tree/shrub layer at this site comprised predominantly of (check one):

☐ Native broadleaf plants (entirely or almost entirely, includes high-elevation willow)

☑ Mixed native and exotic plants (mostly native)

☐ Mixed native and exotic plants (mostly exotic)

☐ Exotic/introduced plants (entirely or almost entirely)

Identify the 2-3 predominant tree/shrub species: Salix sp, Elageanus angustifolia, Tamarisk sp.

Average height of canopy (Do not put a range): 15 ft. (specify units)

Was surface water or saturated soil present at or adjacent to site? (Yes) / No (circle one)
Distance from the site to surface water or saturated soil: _____ (specify units)

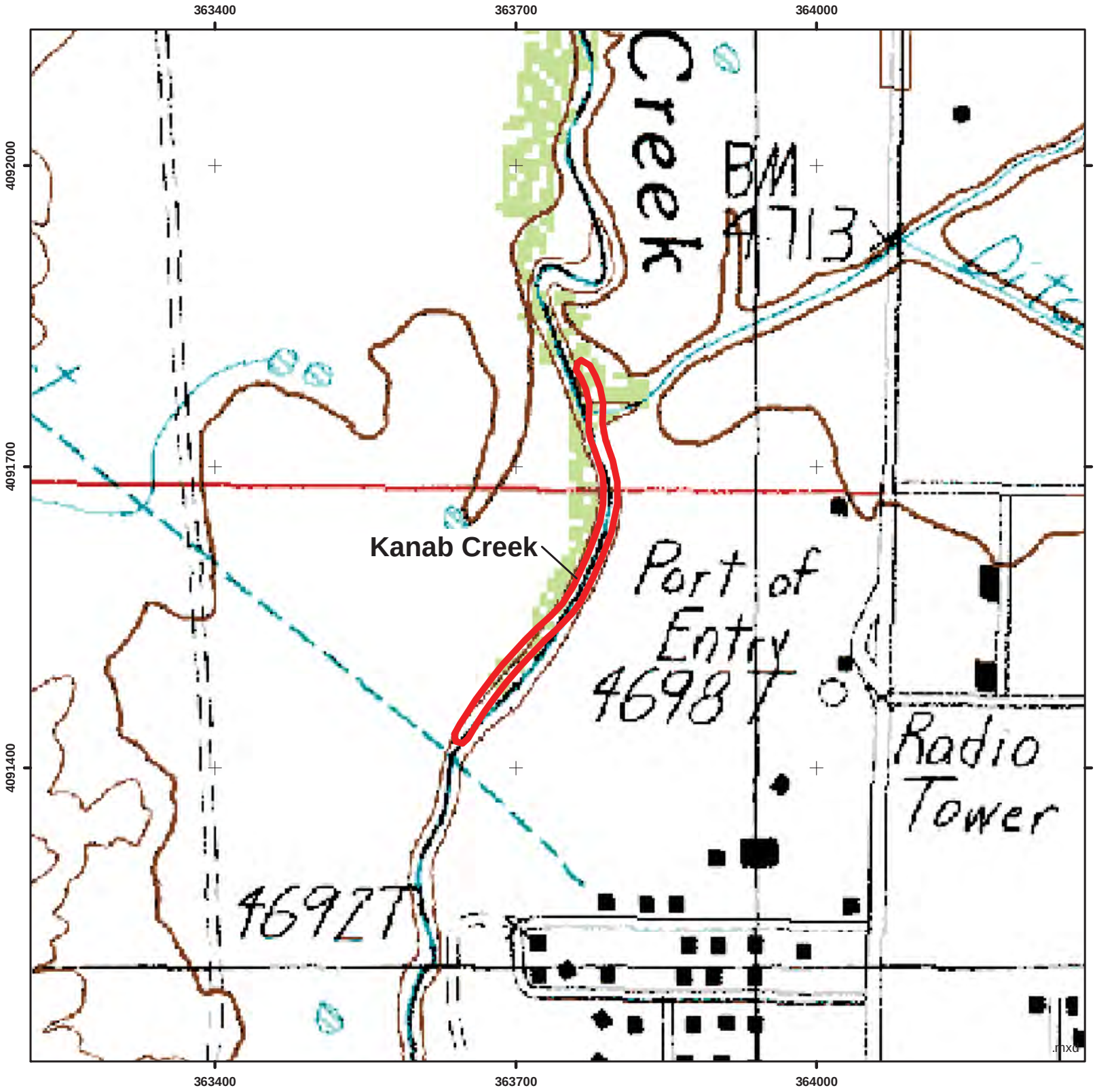
Did hydrological conditions change significantly among visits (did the site flood or dry out)? Yes (No) (circle one)
If yes, describe in comments section below.

Remember to attach a copy of a USGS quad/topographical map (REQUIRED) of the survey area, outlining the survey site and location of WIFL detections. Also include a sketch or aerial photograph showing details of site location, patch shape, survey route in relation to patch, and location of any willow flycatchers or willow flycatcher nests detected. Such sketches or photographs are welcomed, but DO NOT substitute for the required USGS quad map. Please include photos of the interior of the patch, exterior of the patch, and overall site and describe any unique habitat features.

Comments (attach additional sheets if necessary)

WIFL Detection Locations: None

Date Detected	N UTM	E UTM	Date Detected	N UTM	E UTM



Key

WIFL Survey Area

Mile

0 0.2

Projection: NAD83, UTM Zone 12

NORTH

Key

WIFL Survey Route

Mile

0 0.1

Projection: NAD83, UTM Zone 12

NORTH

Willow Flycatcher Survey and Detection Form (revised April, 2004)

Site Name Kanab Creek State AZ County Mohave | Coconino
USGS Quad Name Clear Water Spring Elevation 4400 (feet) meters (circle one)

Is copy of USGS map marked with survey area and WIFL sightings attached (as required)? ☑ *Yes* ☐ *No*

Site Coordinates: Start: N 357350 E 4077348 UTM Datum 83 (NAD27 preferred)
Stop: N 357241 E 4076507 UTM Zone 12

*** Fill in additional site information on back of this page ****

Survey # / Observer(s) (Full Name)	Date (m/d/y) Survey time	Number of Adult WIFLs	Estimated Number of Pairs	Estimated Number of Territories	Nest(s) Found ? Y or N	Cowbirds Detected? Y or N	Presence of Livestock, Recent sign, If Yes, Describe Y or N	Comments about this survey (e.g., bird behavior, evidence of pairs or breeding, number of nests, nest contents or number of fledges seen; potential threats)
1 S. Stump R. Remington	Date 5·30·09 Start 0610 Stop 0724 Total hrs 1.2	0	0	0	N	N	N	
2 J. Cleland R. Remington	Date 6·16·09 Start 0615 Stop 0714 Total hrs 1	0	0	0	N	N	N	
3 J. Cleland A. Davis	Date 7·01·09 Start 0833 Stop 0923 Total hrs 1.5	0	0	0	N	Y	N	
4 A. Davis J. Cleland	Date 7·08·09 Start 0720 Stop 0841 Total hrs 1.5	0	0	0	N	N	N	
5 A. Davis S. Stump	Date 7·16·09 Start 0741 Stop 0833 Total hrs 1.4	0	0	0	N	N	N	

Overall Site Summary (Total **resident** WIFLs only)	Adults	Pairs	Territories	Nests	Were any WIFLs color-banded? Yes No
Total survey hrs 6.6	0	0	0	0	If yes, report color combination(s) in the comments section on back of form

Reporting Individual Jennifer Cleland Date Report Completed 7·30·09
US Fish and Wildlife Service Permit # TE006552 AZ Game and Fish Department (or other state) Permit # SP733970

***Submit original** form by August 1st. Retain a copy for your records.*

Fill in the following information completely. Submit original form by August 1st. Retain a copy for your records.

Reporting Individual Jennifer Cleland Phone # 480-967-1343
Affiliation Logan Simpson Design Inc. E-mail jcleland@lsdaz.com
Site Name _____ Date Report Completed 7.30.09

Did you verify that this site name is consistent with that used in previous years? Yes / (No) (circle one)
If name is different, what name(s) was used in the past? _____
If site was surveyed last year, did you survey the same general area this year? Yes / No If no, summarize in comments below.
Did you survey the same general area during each visit to this site this year? (Yes) / No If no, summarize in comments below.

Management Authority for Survey Area (circle one): (Federal) Municipal/County State Tribal Private
Name of Management Entity or Owner (e.g., Tonto National Forest) BLM

Length of area surveyed: 1.23 mi (specify units, e.g., miles = mi, kilometers = km, meters = m)

Vegetation Characteristics: Overall, are the species in tree/shrub layer at this site comprised predominantly of (check one):

- ☐ Native broadleaf plants (entirely or almost entirely, includes high-elevation willow)
- ☑ Mixed native and exotic plants (mostly native)
- ☐ Mixed native and exotic plants (mostly exotic)
- ☐ Exotic/introduced plants (entirely or almost entirely)

Identify the 2-3 predominant tree/shrub species: Salix sp., Tamarisk sp.

Average height of canopy (Do not put a range): 10 ft. (specify units)

Was surface water or saturated soil present at or adjacent to site? Yes / (No) (circle one)
Distance from the site to surface water or saturated soil: _____ (specify units)

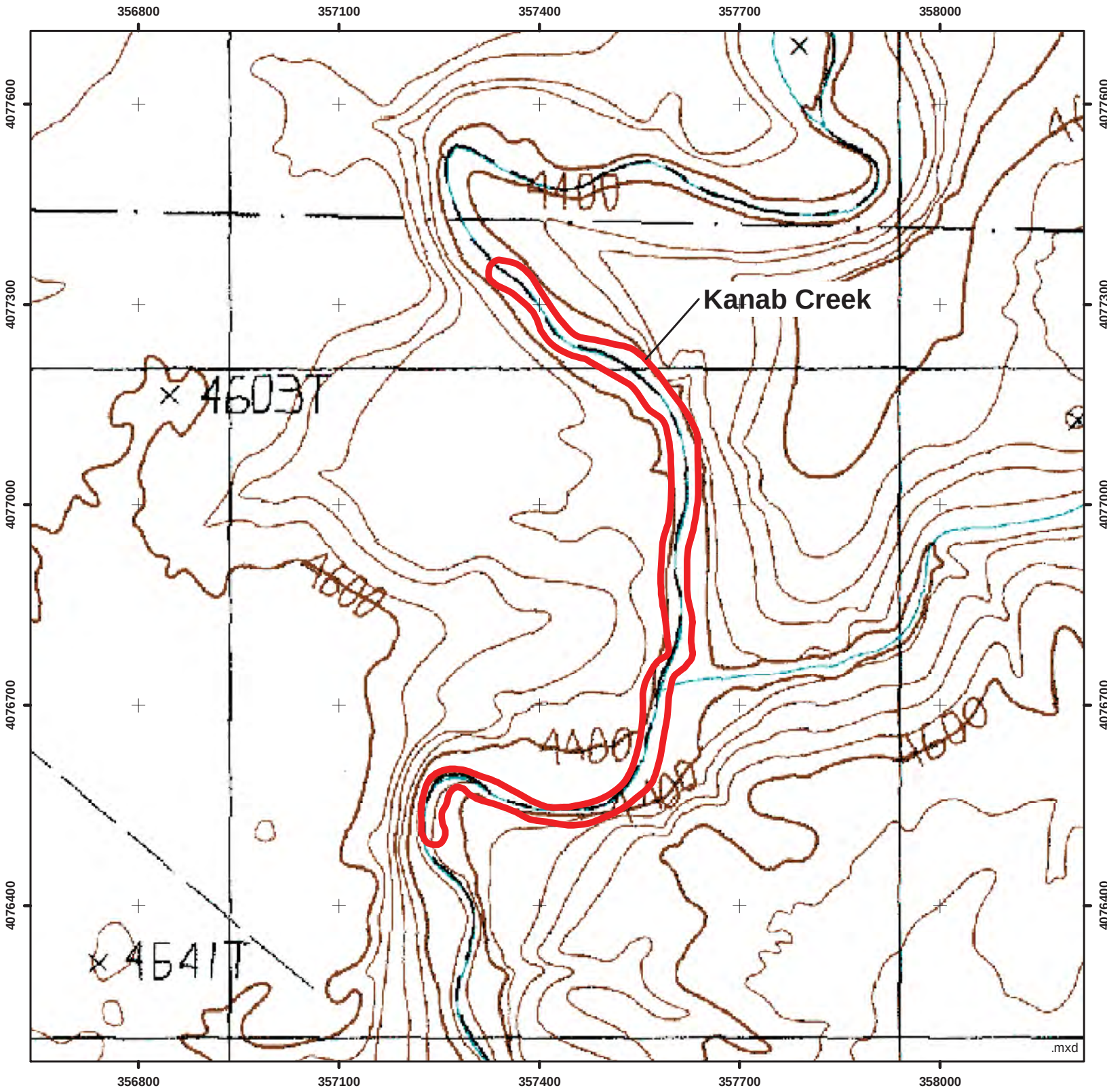
Did hydrological conditions change significantly among visits (did the site flood or dry out)? Yes / (No) (circle one)
If yes, describe in comments section below.

Remember to attach a copy of a USGS quad/topographical map (REQUIRED) of the survey area, outlining the survey site and location of WIFL detections. Also include a sketch or aerial photograph showing details of site location, patch shape, survey route in relation to patch, and location of any willow flycatchers or willow flycatcher nests detected. Such sketches or photographs are welcomed, but DO NOT substitute for the required USGS quad map. Please include photos of the interior of the patch, exterior of the patch, and overall site and describe any unique habitat features.

Comments (attach additional sheets if necessary)

WIFL Detection Locations: None

Date Detected	N UTM	E UTM	Date Detected	N UTM	E UTM



Key

WIFL Survey Area

Mile

0 0.4

Projection: NAD83, UTM Zone 12

NORTH

Key

WIFL Survey Route

Mile

0 0.2

Projection: NAD83, UTM Zone 12

NORTH

Appendix C
Draft Lake Powell Pipeline Project, Avian Survey Report
September 2010

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DRAFT
LAKE POWELL PIPELINE PROJECT
Avian Survey Report

PREPARED FOR

MWH GLOBAL, INC.
671 EAST RIVERPARK LANE
SUITE 200
BOISE, IDAHO 83706

PREPARED BY

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Contents

List of Figures

List of Maps

List of Appendices

1. INTRODUCTION

The proposed Lake Powell Pipeline (LPP) project stretches across Iron, Washington, and Kane counties, Utah and Mohave and Coconino counties, Arizona (Map 1). The proposed pipeline and associated transmission lines and equipment sites overlap potentially suitable habitat for the southwestern willow flycatcher (*Empidonax traillii extimus;* SWFL) and yellow-billed cuckoo (*Coccyzus americanus;* YBCU) in the vicinity of drainages that include stands of riparian vegetation. MWH America, Inc. identified 15 riparian habitat sites along washes and rivers intersecting the Lake Powell Pipeline alignment during a 2008 helicopter survey (Map 2). The intersection of these riparian areas with the Lake Powell Pipeline alignment and a 0.25 mile buffer around the intersections were evaluated by Logan Simpson Design biologists in 2009 for the presence of potentially suitable habitat for both SWFL and YBCU. Surveys for these two species were conducted in 2009 and 2010 for the LPP project. Seven of eight potentially suitable sites were surveyed for both species in 2009 (Map 2). This report presents survey results for 2010 surveys conducted at the Paria River site. Results of 2009 surveys were presented in the 2009 Lake Powell Pipeline Avian Survey Report.

2. SPECIES BACKGROUND

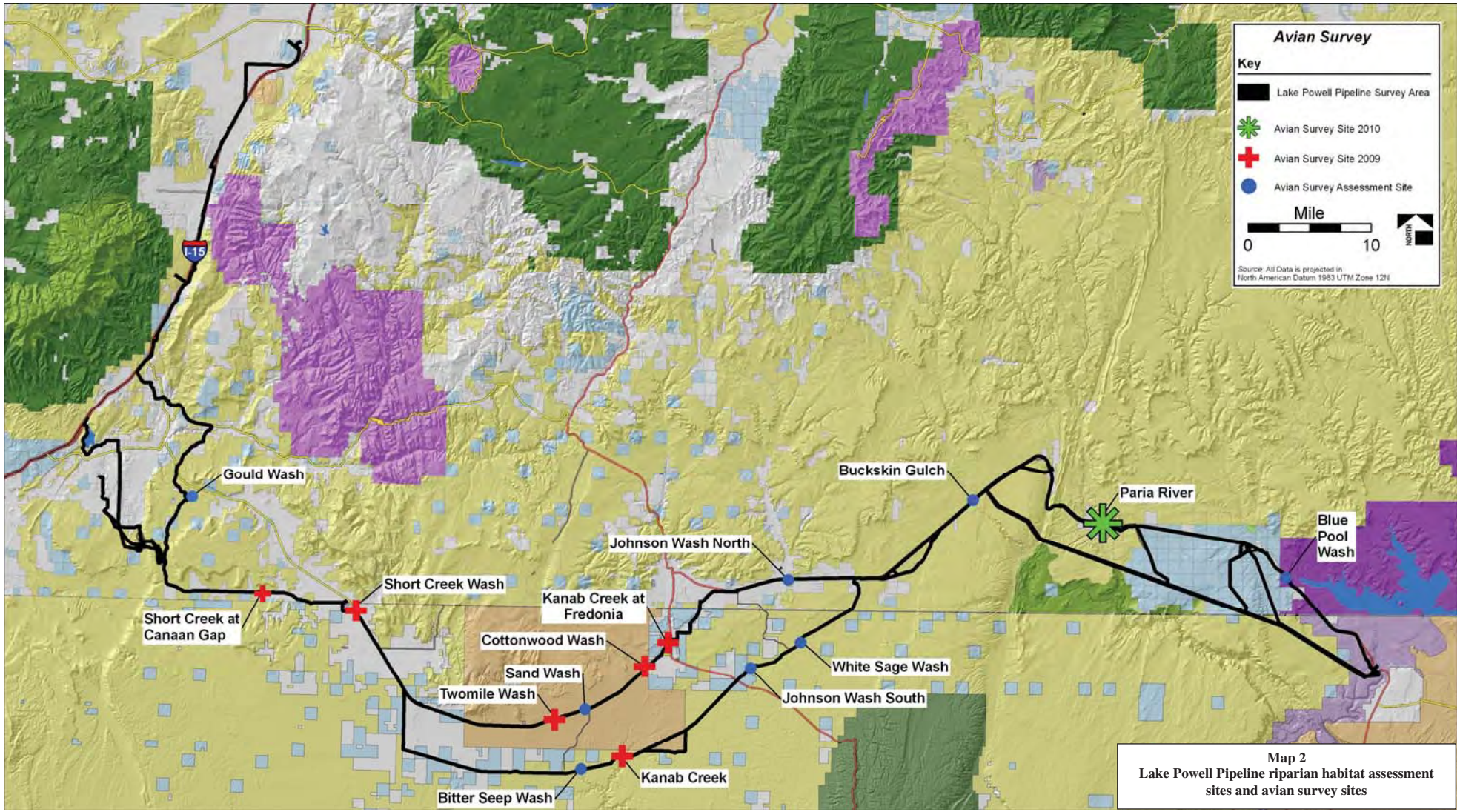
Southwestern Willow Flycatcher

The SWFL is a small, insectivorous songbird that winters in Central America and migrates north to breed in the United States during the summer. Four subspecies of willow flycatcher are generally recognized in North America, with each subspecies occupying distinctly different breeding ranges, and varying slightly in color and morphology. The breeding range of the SWFL includes southern California, Arizona, New Mexico, southwestern Colorado, and extreme southern portions of Nevada and Utah, from at or near sea level to 8,530 feet elevation. The SWFL is a riparian obligate, breeding only in dense riparian vegetation near a permanent or semi-permanent source of water or saturated soil (Sogge et al. 2010).

Historical breeding habitat was typically mature cottonwood-willow (*Populus freemontii-Salix* spp) riparian forest at lower elevations, or willow thickets (often coyote willow [*Salix exigua*] or Geyer willow [*Salix geyeriana*]) at higher elevations (Sogge et al. 2010). Both types of riparian habitat are now mostly degraded or destroyed throughout the Southwest because of the damming and diverting of rivers and streams; groundwater pumping; overgrazing by cattle; recreational vehicle use; and invasion by salt cedar (*Tamarix* spp.), an exotic tree species that has replaced most historical cottonwood-willow riparian forests throughout the Southwest. However, SWFL populations at lower elevations now also breed in dense stands of salt cedar, as it approximates the structure of their preferred habitat (USFWS 2002).

The SWFL typically arrives at breeding sites from late April to mid-June. Males generally arrive before females and claim territories by constantly singing at favored perches within the territory. When females arrive, pairs are established and mating begins. Females build a tightly woven, open-cup nest, typically in forked branches of the substrate tree. Average clutch size is three eggs, which generally hatch in 12 days. Fledging usually occurs within 12 days of hatching, and fledglings are dependent on parents for food for approximately 2 weeks. Only the female incubates the eggs, although both parents feed nestlings and fledglings. Renesting may occur if the first nesting attempt is unsuccessful, although second clutches are uncommon when the first nesting attempt is successful. After fledging, SWFLs typically begin their southward migration in early August (USFWS 2002).

Map 1
Lake Powell Pipeline avian survey location within the state of Utah



Map 2
Lake Powell Pipeline riparian habitat assessment sites and avian survey sites

The SWFL was listed by U.S. Fish and Wildlife Service (USFWS) under the Endangered Species Act as endangered in 1995, and critical habitat was designated in October 2005. In Utah, critical habitat was designated along sections of the Colorado, Green, and San Juan Rivers; and in Arizona, along sections of the Big Sandy, Bill Williams, Colorado, Gila, Little Colorado, Salt, San Pedro, Santa Maria, Verde, and Virgin Rivers and their tributaries (USFWS 2005). No critical habitat is designated within the LPP alignment. A recovery plan has been prepared that identifies six recovery units, each with four to seven management units (USFWS 2002). The survey area is located within the Upper Colorado Recovery Unit. In 2006, this unit contained the fewest territories out of the six recovery units with 4 known territories (Durst et al. 2007). The survey area falls within the Powell Management Unit; a total of 0 sites and 0 territories were documented in the Powell Management Unit in 2006 (Durst et al. 2007). Survey data are no longer published on an annual basis, so more recent data are not available.

Threats to this species include riparian habitat loss and degradation attributable to invasion by nonnative species; livestock grazing; and water management practices such as damming or diverting water, flood control, channelization, and bank protection. Another threat to the SWFL is brood parasitism by the brown-headed cowbird (*Molothrus ater*). Rather than raise their own young, female cowbirds lay eggs in the nests of other species, which incubate the cowbird eggs and raise the young. Cowbird eggs hatch after a relatively short incubation period; thus, cowbird nestlings often out-compete the host's own young for parental care by developing more quickly. In addition, cowbirds may also act as predators by physically removing eggs from the host species' nest (USFWS 2002).

Yellow-billed Cuckoo

The YBCU is a medium-sized bird that winters in Central and South America, but migrates north to breed from northern Mexico to southern Canada. The YBCU is in the avian family *Cuculidae*, whose members share the feature of a zygodactyl foot (i.e., two toes pointing forward and two toes pointing backward). The YBCU has a slender, long-tailed profile, with a stout, slightly down-curved bill that is blue-black above and yellow on the base of the lower mandible. The legs are short and bluish gray, and adults have a narrow, yellow eye ring. Plumage is grayish brown above and white below, with red primary flight feathers and tail feathers that are boldly patterned with black and white below (USFWS 2001).

Until the 1960s, the American Ornithologists' Union (AOU) *Check-list of North American Birds* separated the YBCU into eastern and western subspecies because of slight variations in morphology between birds breeding east and west of the continental divide. Many ornithologists have questioned this separation, and the most recent AOU check-list does not recognize the two subspecies; the taxonomic status of subspecies is under review by the AOU Check-list Committee.

In Utah, YBCUs nest in large blocks of lowland riparian habitat, particularly in cottonwood-willow, velvet mesquite (*Prosopis velutina*), velvet ash (*Fraxinus velutina*), Arizona sycamore (*Platanus wrightii*), and salt cedar (*Tamarix* spp.) forests with dense understory foliage (USFWS 2001). The species is inconspicuous in its habitat, except when calling to attract or to contact mates. Nesting season peaks in mid-July through August, which is later than in most co-occurring riparian bird species, and generally coincides with increased numbers of cicadas, katydids, caterpillars, and other large invertebrate prey that constitute the bulk of the cuckoo's diet. Although YBCUs usually raise their own young, they are facultative brood parasites and will occasionally lay eggs in the nests of other yellow-billed cuckoos or other bird species (USFWS 2001). Threats to the YBCU include riparian habitat loss and degradation attributable to invasion by nonnative species; livestock grazing; and water management practices such as damming or diverting water, flood control, channelization, and bank protection (USFWS 2001).

Regardless of the dispute over the validity of a western subspecies of the YBCU, USFWS concluded that the western population is a "discrete vertebrate population segment" that may warrant listing as threatened or endangered under the Endangered Species Act. However, USFWS has determined that the listing of the YBCU is currently precluded by higher-priority listing actions. Thus, the YBCU is currently a candidate for listing under

the Endangered Species Act, and as a candidate, the YBCU does not receive special protection. The YBCU is included as a sensitive species by the Utah Division of Wildlife Resources (UDWR 2010).

3. SITE DESCRIPTIONS AND EVALUATIONS

Riparian habitat was determined to be potentially suitable for the SWFL and/or the YBCU if the site provided a combination of characteristics that included standing water or moist soils with dense stands of native (e.g., cottonwood) and/or nonnative (e.g., tamarisk) riparian trees that form a closed canopy (Sogge et al. 1997, Johnson et al. 2006). Additionally, the level of disturbance from livestock grazing, development, and recreation were considered in evaluating potentially suitable habitat.

Habitat at the Paria River site is characterized by the presence of water and native and nonnative riparian trees, and therefore potentially suitable for SWFL and/or YBCU.

Paria River Survey Site

The Paria River is a tributary of the Colorado River, flowing for 75 miles through southern Utah and northern Arizona. The river flows from north to south where the LPP alignment crosses the river at the intersection with US Highway 89 (US 89), east of the Cockscomb and west of Glen Canyon City in Kane County, Utah (Map 1).

The Paria River is a shallow, sandy river with a wide, flat floodplain. Saturated soils and flowing water were present within the river on both the north and south sides of US 89 until mid-June (Figure 1). Vegetation throughout the Paria River floodplain is dominated by tamarisk that is generally 5 to 8 feet tall, with mature cottonwood trees scattered along the river banks and in the floodplain (Figure 2).

4. SURVEY METHODS

Southwestern Willow Flycatcher

Presence/absence surveys for SWFLs were conducted using the protocol identified in *A Southwestern Willow Flycatcher Natural History Summary and Survey Protocol* (Sogge et al. 1997) and revised in 2010 (Sogge 2010; Appendix A). All surveys conformed to the revised survey protocol and were conducted by biologists that have received specific training in the survey methodology, and who are named on current USFWS permits.

Surveys were conducted in potentially suitable habitat along the Paria River, 0.25 miles north and south of US 89 (the Lake Powell Pipeline alignment). Biologists walked survey transects (Map 3), pausing every 100 feet in suitable habitat to listen for singing flycatchers, then broadcast a recording of the SWFL's song and listened for a response. Each listening/calling period started with a one minute listening period, followed by a 15 to 30 second calling period and then finished with another one to two minute listening period. Surveys were performed from approximately one hour prior to sunrise to between 0900 and 1000 hours.

Five separate surveys were conducted at the Paria River site during the 2010 breeding season. Surveys occurred on May 18, June 8 and 18, and July 1 and 16, 2010. Data collected during surveys (survey date, start/stop time, flycatcher responses, and habitat type) was recorded on the revised Willow Flycatcher Survey and Detection Form (Sogge 2010). Completed data forms were submitted to the USFWS as required by permit and are provided in Appendix B.

Yellow-billed Cuckoo

Presence/absence surveys for YBCU were conducted concurrently with SWFL surveys using the draft protocol identified in *Standard Operating Procedure (SOP) #3: Conducting Yellow-billed Cuckoo Surveys* (Johnson 2010) (Appendix C). All surveys conformed to the survey protocol and were conducted by biologists that have received specific training in the survey methodology.

Figure 1
Saturated soils and flowing water at the Paria River north of US 89 in mid-June

Figure 2
Distribution of vegetation with tamarisk in foreground and cottonwood in background

Map 3
Location of survey transects and migrant willow flycatcher at Paria River site

Surveys were conducted in potentially suitable habitat along the Paria River, 0.25 miles north and south of US 89. Biologists walked survey transects, pausing every 300 feet to listen for calling YBCUs for 1 minute. After the listening period, a "kowlp" call was broadcast, followed by 1 minute of silence, when the surveyor listened for a response. The call/listening cycle was repeated 4 times. Universal Transverse Mercator points were recorded at 7 call points within the survey area, and the same points were surveyed on all subsequent visits. Surveys were performed from approximately one hour prior to sunrise to between 0900 and 1000 hours. Completed data forms are provided in Appendix D.

5. SURVEY RESULTS

Southwestern Willow Flycatcher

No resident SWFL territories, breeding pairs, or nests were identified at the Paria River site. A migrant willow flycatcher was detected on May 18 in a dense patch of tamarisk north of the US 89 bridge (see Map 3). The flycatcher responded to the broadcast recording and continued to respond to subsequent broadcasts within 300 feet of the original broadcast. The flycatcher was not detected on any of the following survey visits despite a determined effort to locate the bird. Though the flycatcher was located on a survey within the southwestern subspecies' range, this particular flycatcher cannot be definitively labeled as *extimus* due to the fact that willow flycatchers of all subspecies sing during spring migration. The structure and density of riparian vegetation at this site does not currently provide ideal nesting habitat for SWFL; however, as habitat continues to mature and water is present, this habitat may develop increasingly favorable conditions.

Yellow-billed Cuckoo

No YBCUs were detected during surveys. No resident territories, breeding pairs, or nests were identified in the survey area. The extent of riparian habitat, especially the density and stature of cottonwoods and willows, does not appear to be sufficient to support a population of breeding YBCU along the Paria River within 0.25 miles of the project corridor.

6. CONCLUSION

LSD biologists conducted protocol surveys for the SWFL and YBCU along the Paria River at the proposed Lake Powell Pipeline project alignment (US 89 bridge) during 2010. The area surveyed included all potentially suitable habitats within 0.25 mile north and south of the alignment. Though a migrant willow flycatcher was detected, no resident SWFL or YBCU were recorded.

7. FIELD PERSONNEL

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8. LITERATURE CITED

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9. SIGNATURES

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Appendix A

Southwestern Willow Flycatcher Protocol Revision 2010

USGS
science for a changing world

Prepared in cooperation with the Bureau of Reclamation and the U.S. Fish and Wildlife Service

A Natural History Summary and Survey Protocol for the Southwestern Willow Flycatcher

Chapter 10 of
Section A, Biological Science
Book 2, Collection of Environmental Data

Techniques and Methods 2A-10

U.S. Department of the Interior
U.S. Geological Survey

Cover: Southwestern Willow Flycatcher. Photograph taken by Susan Sferra, U.S. Fish and Wildlife Service.

A Natural History Summary and Survey Protocol for the Southwestern Willow Flycatcher

By Mark K. Sogge, U.S. Geological Survey; Darrell Ahlers, Bureau of Reclamation; and Susan J. Sferra, U.S. Fish and Wildlife Service

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Techniques and Methods 2A-10

U.S. Department of the Interior
U.S. Geological Survey

U.S. Department of the Interior
KEN SALAZAR, Secretary

U.S. Geological Survey
Marcia K. McNutt, Director

U.S. Geological Survey, Reston, Virginia: 2010

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Contents

Figures

Conversion Factors

Multiply	By	To obtain
centimeter (cm)	0.3937	inch (in.)
gram (g)	0.03527	ounce, avoirdupois (oz)
hectare (ha)	2.471	acre
kilometer (km)	0.6214	mile (mi)
meter (m)	3.281	foot (ft)
millimeter (mm)	0.03937	inch (in.)

Abbreviations and Acronyms

GPS	Global Positioning System
NDVI	Normalized Difference Vegetation Index
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey

A Natural History Summary and Survey Protocol for the Southwestern Willow Flycatcher

By Mark K. Sogge, U.S. Geological Survey; Darrell Ahlers, Bureau of Reclamation; and Susan J. Sferra, U.S. Fish and Wildlife Service

Background

The Southwestern Willow Flycatcher (*Empidonax traillii extimus*) has been the subject of substantial research, monitoring, and management activity since it was listed as an endangered species in 1995. When proposed for listing in 1993, relatively little was known about the flycatcher's natural history, and there were only 30 known breeding sites supporting an estimated 111 territories rangewide (Sogge and others, 2003a). Since that time, thousands of presence/absences surveys have been conducted throughout the historical range of the flycatcher, and many studies of its natural history and ecology have been completed. As a result, the ecology of the flycatcher is much better understood than it was just over a decade ago. In addition, we have learned that the current status of the flycatcher is better than originally thought: as of 2007, the population was estimated at approximately 1,300 territories distributed among approximately 280 breeding sites (Durst and others, 2008a).

Concern about the Southwestern Willow Flycatcher on a rangewide scale was brought to focus by Unitt (1987), who described declines in flycatcher abundance and distribution throughout the Southwest. *E. t. extimus* populations declined during the 20th century, primarily because of habitat loss and modification from activities, such as dam construction and operation, groundwater pumping, water diversions, and flood control. In 1991, the U.S. Fish and Wildlife Service (USFWS) designated the Southwestern Willow Flycatcher as a candidate category 1 species (U.S. Fish and Wildlife Service, 1991). In July 1993, the USFWS proposed to list *E. t. extimus* as an endangered species and to designate critical habitat under the Act (U.S. Fish and Wildlife Service, 1993). A final rule listing *E. t. extimus* as endangered was published in February 1995 (U.S. Fish and Wildlife Service, 1995); critical habitat was designated in 1997 (U.S. Fish and Wildlife Service, 1997). The USFWS Service released a Recovery Plan for the Southwestern Willow Flycatcher in 2002 (U.S. Fish and Wildlife Service, 2002), and re-designated critical habitat in 2005 (U.S. Fish and Wildlife Service, 2005).

In addition to its federal status, the Southwestern Willow Flycatcher is listed as an endangered species or species of concern in Arizona (Arizona Game and Fish Department, 2006), New Mexico (New Mexico Department of Game and Fish, 1996), California (California Department of Fish and Game, 1991), and Utah (Utah Division of Wildlife Resources, 1997).

Sound management and conservation of an endangered species like the Southwestern Willow Flycatcher requires current, detailed information on its abundance and distribution. This requires, among other things, identifying where flycatchers are and are not breeding, and annual monitoring of as many breeding areas as possible. Such efforts require effective, standardized survey protocols and consistent reporting, at both local and regional levels. However, the Willow Flycatcher is a difficult species to identify and survey for. Moreover, inconsistent or ineffective surveys are of limited value, can produce misleading information (including "false positives" and "false negatives"), hinder regional and rangewide analyses, and waste limited resources.

We developed this document to provide a standardized survey protocol and a source of basic ecological and status information on the flycatcher. The first section summarizes the current state of knowledge regarding Southwestern Willow Flycatcher natural history, based on a wide array of published and unpublished literature. Emphasis is given to information relevant to flycatcher conservation and management, and to conducting and interpreting surveys. The second section details a standard survey protocol that provides for consistent data collection, reporting, and interpretation. This protocol document builds on and supersedes previous versions, the most recent of which was Sogge and others (1997a). In this update, we incorporate over a decade of new science and survey results, and refine the survey methodology to clarify key points. Further, we update the standard survey data sheets and provide guidelines on how to fill in the requested information. Amidst these revisions, the basic approach of the survey protocol has remained unchanged—multiple surveys at each survey area within the same breeding season, the use of the call-playback technique using flycatcher vocalizations to increase the probability of detection, and verification of species identity through its diagnostic song.

Section 1. Natural History

Breeding Range and Taxonomy

The Willow Flycatcher is a widespread species that breeds across much of the conterminous United States (Sedgwick, 2000). Four subspecies commonly are recognized in North America, with each occupying a distinct breeding range (fig. 1): *E. t. adastus*, ranging across the northern Rocky Mountains and Great Basin; *E. t. brewsteri*, found west of the Sierra Nevada and Cascade Mountains along the Pacific Slope; *E. t. extimus*, the Southwestern Willow Flycatcher, which breeds across the Southwest; and *E. t. traillii*, ranging east of the northern Rocky Mountains. Although the overall subspecies' ranges are distinct, Sedgwick (2001) and Paxton (2008) noted interbreeding/gradation zones in the boundary area between *E. t. extimus* and *E. t. adastus*.

The breeding range of the Southwestern Willow Flycatcher includes southern California, Arizona, New Mexico, southwestern Colorado, and extreme southern portions of Nevada and Utah: specific range boundaries are delineated in the subspecies' recovery plan (U.S. Fish and Wildlife Service, 2002). Unitt (1987) included western Texas in the subspecies' range, but recent breeding records from western Texas are lacking. Records of probable breeding Southwestern Willow Flycatchers in Mexico are few and restricted to extreme northern Baja California and Sonora (Unitt, 1987; Wilbur, 1987). Although recent data are lacking, the USFWS does include parts of northern Mexico in its description of *E. t. extimus* breeding range (U.S. Fish and Wildlife Service, 2002).

Although they appear very similar to most observers, experienced taxonomist or those using specialized equipment (for example, an electronic colorimeter) can differentiate among the subspecies by subtle differences in color and morphology (for example, Unitt, 1987; Paxton, 2008). Despite the subtle level of differences, the taxonomic status of *E. t. extimus* has been critically reviewed and confirmed multiple times based on morphological, genetic, and song data (Hubbard, 1987; Unitt, 1987; Browning, 1993; Paxton, 2000; Sedgwick, 2001).

The Southwestern Willow Flycatcher was described by Phillips (1948) from a specimen collected along the San Pedro River in southeastern Arizona. The Southwestern Willow Flycatcher generally is paler than other Willow Flycatcher subspecies, although this difference is indistinguishable without considerable experience and training, and study skins as comparative reference material. The southwestern subspecies differs in morphology (primarily wing formula) but not overall size. The plumage and color differences between the Willow Flycatcher subspecies are so subtle that they should not be used to characterize birds observed in the field (Unitt, 1987; Hubbard, 1999; U.S. Fish and Wildlife Service, 2002).

Migration and Winter Range, Habitat, and Ecology

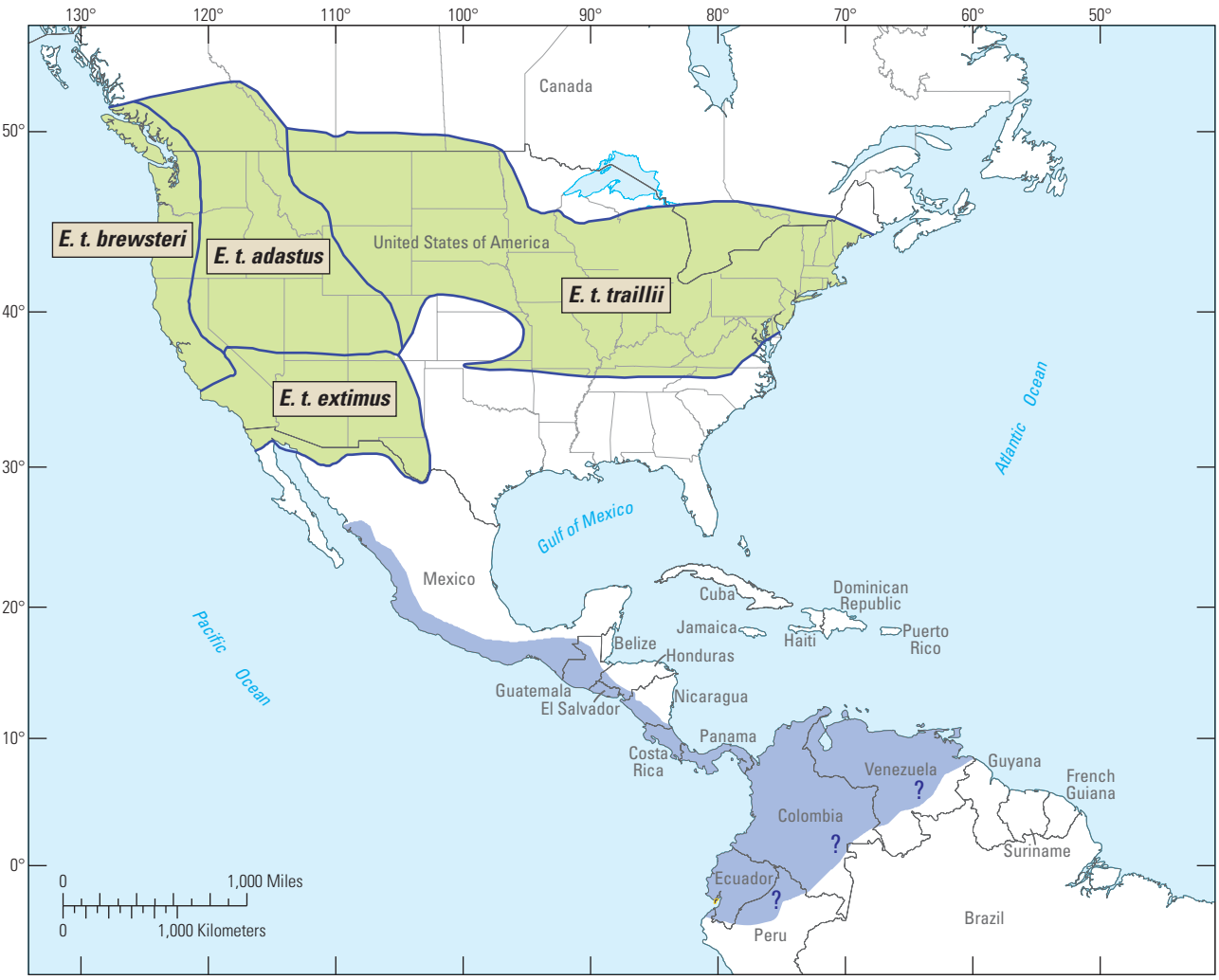
All Willow Flycatcher subspecies breed in North America but winter in the subtropical and tropical regions of southern Mexico, Central America, and northern South America (Sedgwick, 2000; Koronkiewicz, 2002; fig. 1). Most wintering birds are found in the Pacific slope lowlands in Mexico and Central America, and Caribbean slope lowlands in Mexico and Guatemala.

Because all Willow Flycatcher subspecies look very similar, determining specific wintering sites for the southwestern race has been challenging. However, recent genetic analysis of wintering birds (Paxton, 2008) suggests that the four subspecies occupy finite areas of the wintering grounds, but with overlapping ranges. The Southwestern Willow Flycatcher appears to be largely restricted to the center of the winter range (in the vicinity of Costa Rica), although Paxton (2008) suggests more research is needed to address this question.

On the wintering grounds, flycatchers primarily are found in habitats that have four main components: (1) standing or slow moving water and/or saturated soils, (2) patches or stringers of trees, (3) woody shrubs, and (4) open areas (Koronkiewicz and Whitfield, 1999; Koronkiewicz and Sogge, 2000; Lynn and others, 2003; Nishida and Whitfield, 2007; Schuetz and others, 2007). Based on surveys to date, the presence of water or saturated soils is almost universal, although tree heights and configurations, the presence of woody shrubs, and the amount of open space surrounding winter territories can vary considerably (Schuetz and others, 2007).

Male and female flycatchers hold separate, individual non-breeding territories, and defend those territories throughout the winter by using song, calls, and aggression displays. Fidelity to wintering territories and sites is high, as is survivorship over the wintering period (Koronkiewicz and others, 2006b; Sogge and others, 2007).

Willow Flycatchers travel approximately 1,500–8,000 km each way between wintering and breeding areas. During migration, flycatchers use a wider array of forest and shrub habitats than they do for breeding, although riparian vegetation may still be a preferred migration habitat type (Finch and others, 2000). Migration requires high energy expenditures, exposure to predators, and successful foraging in unfamiliar areas. Therefore, migration is the period of highest mortality within the annual cycle of the flycatcher (Paxton and others, 2007). Willow Flycatchers of all subspecies sing during northward migration, perhaps to establish temporary territories for short-term defense of food resources.



Basemap modified from U.S. Geological Survey and other agency digital data, various scales. Projection Mercator, World Geodetic System1984 datum.

EXPLANATION

Approximate range distribution of the Willow Flycatcher (*Empidonax traillii*)—Adapted from Unitt (1987), Browning (1993), and Paxton (2008)

Breeding range, including boundaries of the Willow Flycatcher subspecies

? Wintering range—Question marks reflect uncertainty of the location of the eastern boundary of the winter range

Figure 1. Approximate ranges of the Willow Flycatcher (*Empidonax traillii*) during breeding and non-breeding seasons.

Southwestern Willow Flycatchers typically arrive on breeding grounds between early May and early June (Ellis and others, 2008; Moore and Ahlers, 2009). Because arrival dates vary annually and geographically, northbound migrant Willow Flycatchers of multiple subspecies pass through areas where Southwestern Willow Flycatchers have already begun nesting. Similarly, southbound migrants in late July and August may occur where Southwestern Willow Flycatchers are still breeding (Unitt, 1987). This can make it challenging for an observer to differentiate local breeders from migrants. Other than timing, we still know relatively little about Southwestern Willow Flycatcher migratory behavior, pathways, or habitat use.

Breeding Habitat

Breeding Southwestern Willow Flycatchers are riparian obligates, typically nesting in relatively dense riparian vegetation where surface water is present or soil moisture is high enough to maintain the appropriate vegetation characteristics (Sogge and Marshall, 2000; U.S. Fish and Wildlife Service, 2002; Ahlers and Moore, 2009). However, hydrological conditions in the Southwest can be highly variable within a season and between years, so water availability at a site may range from flooded to dry over the course of a breeding season or from year to year.

The Southwestern Willow Flycatcher breeds in dense riparian habitats across a wide elevational range, from near sea level in California to more than 2,600 m in Arizona and southwestern Colorado (Durst and others, 2008a). Vegetation characteristics of Southwestern Willow Flycatcher breeding habitat generally include dense tree or shrub cover that is ≥ 3 m tall (with or without a higher overstory layer), dense twig structure, and high levels of live green foliage (Allison and others, 2003); many patches with tall canopy vegetation also include dense midstory vegetation in the 2–5 m range. Beyond these generalities, the flycatcher shows adaptability in habitat selection, as demonstrated by variability in dominant plant species (both native and exotic), size and shape of breeding patch, and canopy height and structure (U.S. Fish and Wildlife Service, 2002).

Southwestern Willow Flycatcher breeding habitat can be quantified and characterized in a number of ways, depending on the level of detail needed and habitat traits of interest. For many sites, detailed floristic composition, plant structure, patch size, and even characteristics such as Normalized Difference Vegetation Index (NDVI) have been described in agency reports and scientific journal articles (Allison and others, 2003; Hatten and Paradzick, 2003; Koronkiewicz and others, 2006a; Hatten and Sogge, 2007; Moore, 2007; Schuetz and Whitfield, 2007; Ellis and others, 2008). For purposes of this survey protocol, we take a relatively simple approach and broadly describe and classify breeding sites based on plant species composition and habitat structure. Clearly, these are not the only important components, but they are conspicuous to human perception and easily observed and recorded. Thus, they have proven useful in conceptualizing, selecting and evaluating suitable survey habitat, and in predicting where breeding flycatchers are likely to be found.

Breeding habitat types commonly used by Southwestern Willow Flycatchers are described below. The general categories are based on the composition of the tree/shrub vegetation at the site—native broadleaf, exotic, and mixed native/exotic. In the field, breeding habitats occur along a continuum of plant species composition (from nearly monotypic to mixed species) and vegetation structure (from simple, single stratum patches to complex, multiple strata patches). The images in figures 2–7 illustrate some of the variation in flycatcher breeding habitat, and other examples can be found in numerous publications and agency reports, and on the USGS photo gallery web site (http://sbsc.wr.usgs.gov/SBSCgallery/). The intent of the descriptions and photographs is to provide a general guide for identifying suitable habitat in which to conduct surveys.

Native broadleaf.—Southwestern Willow Flycatchers breed across a great elevational range, and the characteristics of their native broadleaf breeding sites varies between high elevation sites and those at low and mid-elevation sites.

High elevation sites (fig. 2) range from nearly monotypic dense stands of willow to mixed stands of native broadleaf trees and shrubs, 2–7 m in height with no distinct overstory layer; often associated with sedges, rushes, nettles, and other herbaceous wetland plants; usually very dense structure in lower 2 m; live foliage density is high from the ground to the canopy. Vegetation surrounding the patch can range from open meadow, to agricultural lands, to pines or upland shrub.

At low and mid-elevations (fig. 3), flycatcher breeding sites can be composed of single species (often Goodding's willow (*Salix gooddingii*), *S. exigua*, or other willow species) or mixtures of native broadleaf trees and shrubs including (but not limited to) cottonwood, willows, boxelder (*Acer negundo*), ash (*Fraxinus* spp.), alder (*Alnus* spp.), and buttonbush (*Cephalanthus* spp.), height from 3 to 15 m; characterized by trees of different size classes; often a distinct overstory of cottonwood, willow or other broadleaf tree, with recognizable subcanopy layers and a dense understory of mixed species; exotic/introduced species may be a rare component, particularly in the understory.

Monotypic exotic.—(fig. 4) Breeding sites also can include nearly monotypic, dense stands of exotics such as saltcedar (*Tamarix* spp.) or Russian olive (*Elaeagnus angustifolia*), 4–10 m in height forming a nearly continuous, closed canopy (with no distinct overstory layer); lower 2 m commonly very difficult to penetrate due to dense branches, however, live foliage density may be relatively low 1–2 m above ground, but increases higher in the canopy; canopy density uniformly high.

Aerial view of Little Colorado River near Greer, Arizona. Photograph by USGS, 1995.

Little Colorado River near Greer, Arizona. Photograph courtesy of Arizona Game and Fish Department, 1996.

Parkview Fish Hatchery, New Mexico. Photograph by USGS, 2000.

Rio Grande State Wildlife Area, Colorado. Photograph by USGS, 2002.

Tierra Azul, New Mexico. Photograph by USGS, 2005.

McIntyre Springs, Colorado. Photograph by USGS, 2002.

Figure 2. Examples of Southwestern Willow Flycatcher breeding habitat in native broadleaf vegetation at high-elevation sites.

Hassayampa River, Arizona. Photograph by USGS, 2003.

Santa Ynez River, California, Photograph by USGS, 1996.

San Luis Rey River, California. Photograph by USGS, 2005.

Kern River, California. Photograph by USGS, 1995.

Bosque del Apache, Rio Grande, New Mexico. Photograph courtesy of Bureau of Reclamation, 2008.

Kern River, California. Photograph by USGS, 1995.

Figure 3. Examples of Southwestern Willow Flycatcher breeding habitat in native broadleaf vegetation at low and mid-elevation sites.

Aerial view of Topock Marsh, Colorado River, Arizona. Photograph by USGS, 1996.

Topock Marsh, Colorado River, Arizona. Photograph by USGS, 1996.

Rio Grande, New Mexico. Photograph by USGS, 2005.

Salt River, Arizona. Photograph courtesy of Bureau of Reclamation, 1996.

Orrilla Verde, Rio Grande, New Mexico. Photograph by USGS, 2006.

Aerial view of Salt River, Arizona. Photograph by USGS, 1996.

Figure 4. Examples of Southwestern Willow Flycatcher breeding habitat in exotic vegetation.

Mixed native/exotic—(fig. 5) These sites include dense mixtures of native broadleaf trees and shrubs (such as those listed above) mixed with exotic/introduced species, such as saltcedar or Russian olive; exotics are often primarily in the understory, but may be a component of overstory; the native and exotic components may be dispersed throughout the habitat or concentrated as a distinct patch within a larger matrix of habitat; overall, a particular site may be dominated primarily by natives or exotics, or be a more-or-less equal mixture.

Regardless of the plant species composition or height, occupied sites almost always have dense vegetation in the patch interior (fig. 6). These dense patches are often interspersed with small openings, open water, or shorter/sparser vegetation, creating a mosaic that is not uniformly dense.

Gila River, Arizona. Photograph by USGS, 2002.

Roosevelt Lake, Arizona. Photograph by USGS, 1999.

Verde River River, Arizona. Photograph by USGS, 2002.

Virgin River, Utah. Photograph by USGS, 1997.

Figure 5. Examples of Southwestern Willow Flycatcher breeding habitat in mixed native/exotic vegetation.

Gila River, Arizona. Photograph by USGS, 2002.

Kern River, California. Photograph by USGS, 1999.

Rio Grande, New Mexico. Photograph by USGS, 2007.

Salt River, Arizona. Photograph by USGS, 1999.

Rio Grande, New Mexico. Photograph by USGS, 2007.

Rio Grande, New Mexico. Photograph by USGS, 2005.

Figure 6. Examples of dense vegetation structure within breeding habitats of Southwestern Willow Flycatcher.

Riparian patches used by breeding flycatchers vary in size and shape, ranging from a relatively contiguous stand of uniform vegetation to an irregularly shaped mosaic of dense vegetation with open areas. Southwestern Willow Flycatchers have nested in patches as small as 0.8 ha (for example, in the Grand Canyon) and as large as several hundred hectares (for example, at Roosevelt Lake, Ariz., or Elephant Butte Reservoir, New Mex.). They have only rarely been found nesting in isolated, narrow, linear riparian habitats that are less than 10 m wide, although they will use such linear habitats during migration.

Flycatcher territories and nests typically are adjacent to open water, cienegas, marshy seeps, or saturated soil, and within riparian areas rooted in standing water. However, in the Southwest, hydrological conditions at a site can vary remarkably within a season, between years, and among nearby sites (fig. 7). Surface water or saturated soil may only be present early in the breeding season (that is, May and part of June), especially in dry years. Similarly, vegetation at a patch may be immersed in standing water during a wet year, but be hundreds of meters from surface water in dry years (Ahlers and Moore, 2009). This is particularly true of reservoir sites, such as the Kern River at Lake Isabella, Calif., Tonto Creek and Salt River at Roosevelt Lake, and the Rio Grande near Elephant Butte Reservoir. Natural or human-caused river channel modifications and altered subsurface flows (for example, from agricultural runoff), can lead to a total absence of water or visibly saturated soil at a site for several years.

Other potentially important aspects of Southwestern Willow Flycatcher habitat include distribution and isolation of vegetation patches, hydrology, food base (arthropods), parasites, predators, environmental factors (for example temperature, humidity), and interspecific competition (U.S. Fish and Wildlife Service, 2002). Population dynamics

Rio Grande at San Marcial, New Mexico, with dry substrate. Photograph by USGS, 2007.

Rio Grande at San Marcial, New Mexico, with flowing water beneath the territories. Photograph by USGS, 2007.

Tonto Creek inflow to Roosevelt Lake, Arizona, during a dry year. Photograph by USGS, 2004.

Tonto Creek inflow to Roosevelt Lake, Arizona, during high-water year. Photograph by USGS, 2005.

Figure 7. Examples of the variable hydrologic conditions at breeding habitats of Southwestern Willow Flycatcher.

factors, such as demography (for example, survivorship rates, fecundity), distribution of breeding groups across the landscape, flycatcher dispersal patterns, migration routes, the tendency for adults and surviving young to return to their previous year breeding site, and conspecific sociality also influence where flycatchers are found and what habitats they use (U.S. Fish and Wildlife Service, 2002).

It is critically important to recognize that the ultimate measure of habitat suitability is not simply whether or not a site is occupied. Habitat suitability occurs along a gradient from high to poor to unsuitable; the best habitats are those in which flycatcher reproductive success and survivorship result in a stable or growing population. Some occupied habitats may be acting as population sources, while others may be functioning as population sinks (Pulliam, 1988). Therefore, it can take extensive research to determine the quality of any given habitat patch. Furthermore, productivity and survival rates can vary widely among years (Paxton and others, 2007; Ellis and others, 2008; Ahlers and Moore, 2009), so conclusions based on short-term datasets or data extrapolated from one area to another may be erroneous. It also is important to note that not all unoccupied habitat is unsuitable; some sites with suitable habitat may be geographically isolated or newly established, such that they are not yet colonized by breeding flycatchers. There also may simply not be enough flycatchers in a given area to fill all available habitat in particular locations (U.S. Fish and Wildlife Service, 2002). A better understanding of which habitats or sites are sinks or sources can be especially helpful in site conservation and restoration planning.

As described earlier, migrant Willow Flycatchers may occur in riparian habitats that are structurally unsuitable for breeding (for example, too sparse, smaller patch size, etc.), and in non-riparian habitats. Such migration stopover areas, even though not used for breeding, may be critically important resources affecting local and regional flycatcher productivity and survival (U.S. Fish and Wildlife Service, 2002, 2005).

Breeding Chronology and Biology

Unless otherwise noted, the information that follows and upon which the generalized breeding season chronology (fig. 8) is based comes from Unitt (1987), Whitfield (1990), Maynard (1995), Sogge and others (2003b), Paxton and others (2007), Schuetz and Whitfield (2007), and Ellis and others (2008). Extreme or record dates for any stage of the breeding cycle may vary by 1–2 weeks from the dates presented, depending on the geographic area, extreme weather events, yearly variation and other factors. Higher elevation areas, in particular, have delayed chronology (Ahlers and White, 2000).

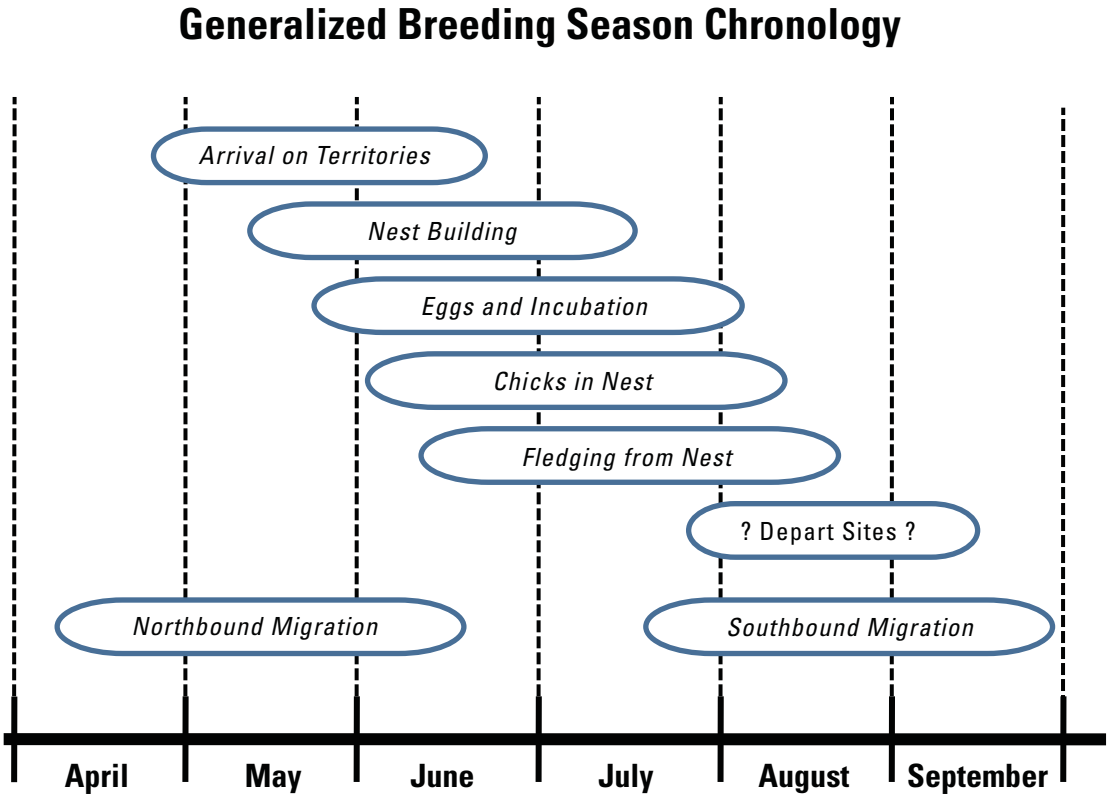


Figure 8. Generalized migration and breeding chronology for the Willow Flycatcher in the Southwest. Extreme or record dates may occur slightly earlier or later than indicated.

Both sexes can breed beginning in their second year. Male Southwestern Willow Flycatchers generally arrive at breeding areas first; older males typically arrive before younger ones. Although females usually arrive a few weeks after males, some older females are present at sites before late-arriving males. Adult flycatchers will sometimes wander extensively through large riparian sites before and after breeding, possibly as a way to evaluate potential breeding habitat (Cardinal and others, 2006).

Males establish and defend their territories through singing and aggressive interactions. Females settle on established territories, and may choose a territory more for its habitat characteristics than for the traits of its territorial male. Territory size tends to be larger when a male first arrives, then gets smaller after a female pairs with the male (Cardinal and others, 2006). Similarly, male song rate is very high early in the season, then declines after pairing (Yard and Brown, 2003). Not all males are successful in attracting mates in a given year, and as a result unpaired territorial males occur at many breeding sites. Unpaired males are usually a small percentage of any local population, but can comprise as much as 15–25 percent of the territories in some populations (Munzer and others, 2005; Ahlers and Moore, 2009).

Although the Willow Flycatcher as a species is considered predominantly monogamous during the breeding season (Sedgwick, 2000), some Southwestern Willow Flycatcher populations have a relatively high degree of polygyny whereby one male can have more than one breeding female in its territory. Polygynous males generally have two females in their territory, but up to four have been recorded (Davidson and Allison, 2003; Pearson and others, 2006). Polygyny rates can vary between sites, and among years at a given site. At some sites, polygynous males have much higher productivity than monogamous males (Paxton and others, 2007).

Nest building within the territory usually begins within a week or two after pair formation. Egg laying begins as early as mid-May, but more often starts in late May to mid-June. Chicks can be present in nests from late May through early August. Young typically fledge from nests from mid-June through mid-August; later fledglings are often products of re-nesting attempts. Breeding adults generally depart from their territories in early to mid-August, but may stay later if they fledged young late in the season. Males that fail to attract or retain mates, and males or pairs that are subject to significant disturbance, such as repeated nest parasitism or predation may leave territories by early July. Fledglings probably leave the breeding areas a week or two after adults, but few details are known.

Southwestern Willow Flycatcher territory size varies widely, probably due to differences in population density, habitat quality (including vegetation density and food availability), and nesting stage. Studies have reported estimated territory sizes ranging from 0.06 to 2.3 ha (Sogge and others, 1995; Whitfield and Enos, 1996; Bureau of Reclamation, 2009). At Roosevelt Lake, Ariz., measurements of home ranges, which include the defended territory and sometimes adjacent use areas, averaged 0.4 ha for actively breeding males; home range can be much larger for pre- and post-breeding males (Paxton and others, 2007). During incubation and nestling phases territory size, or at least the activity centers of pairs, can be very small. Flycatchers may increase their activity area after young are fledged, and use non-riparian habitats adjacent to the breeding area (Cardinal and others, 2006). This variability among sites, individual territories, and over time illustrates the challenge of defining a minimum habitat patch size for breeding flycatchers, or estimating the number of territories based simply on the size of a given breeding site.

At some breeding sites, non-territorial adult "floaters" will be present among the territorial population. Floaters are quieter and less aggressive than territorial adults, and therefore are harder to detect and frequently overlooked. Most floaters are young males, and float for only a single year. At Roosevelt Lake, floaters typically accounted for 3–8 percent of the known adult population, although the rate was much higher in drought years when habitat quality was lower (Paxton and others, 2007). The presence of floaters in a population may indicate that there is not enough high quality habitat to support all potentially territorial individuals present in a given breeding season.

Nests and Eggs

Historically, 75–80 percent of reported Southwestern Willow Flycatcher nests were placed in willows (Phillips, 1948; Phillips and others, 1964; Hubbard, 1987; Unitt, 1987). Southwestern Willow Flycatchers still commonly place their nests in native plants, but will often build nests in exotics, such as saltcedar and Russian olive (Sogge and Marshall, 2000; Stoleson and Finch, 2003; Durst and others, 2008a). In Arizona, most nests are in saltcedar or willows (Paradzick and Woodward, 2003; McLeod and others, 2007). In a unique situation in San Diego County, Calif., the flycatcher nests in coast live oak (*Quercus agrifolia*) along the San Luis Rey River (Haas, 2003), where oak became the dominant plant species adjacent to the river following willow removal in the 1950s. In another unusual situation, flycatchers in the Cliff-Gila Valley in New Mex. nest in tall boxelder (Stoleson and Finch, 2003). Southwestern Willow Flycatcher nests also have been found in buttonbush, black twinberry (*Lonicera involucrata*), Fremont cottonwood (*Populus fremontii*), alder (*Alnus* spp.), blackberry (*Rubus ursinus*), baccharis (*Baccharis* spp.), and stinging nettle (*Urtica* spp.). Overall, flycatcher nest site selection appears to be driven more by plant structure than by species composition.

Southwestern Willow Flycatchers build open cup nests approximately 8 cm high and 8 cm wide (outside dimensions), exclusive of any dangling material at the bottom. Females build the nest with little or no assistance from the males. Nests typically are placed in the fork of a branch with the nest cup supported by several small-diameter vertical stems. Nest height is highly variable and depends on the available plant structure within the territory; nests have been found from 0.6 m to approximately 20 m above ground. In any given habitat type or nest substrate, nests can be placed wherever suitable twig structure and vegetative cover are present.

Egg laying generally begins from mid-May through mid-June, depending on the geographic area and elevation. Willow Flycatcher eggs are buffy or light tan, approximately 18 mm long and 14 mm wide, with brown markings in a wreath at the blunt end. Clutch size is usually three or four eggs for first nests. Only the female develops a brood patch and incubates the eggs. Incubation lasts 12–13 days from the date the last egg is laid, and all eggs typically hatch within 24–48 hours of each other.

Flycatcher chicks are altricial and weigh only about 1–2 g at hatching, but grow rapidly and are ready to leave the nest at 12–15 days of age (Sedgwick, 2000; Paxton and Owen, 2002). The female provides most or all initial care of the young, although the role of the male increases with the age and size of nestlings. After Willow Flycatchers fledge at 12–15 days of age, they stay close to the nest and each other for 3–5 days, and adults continue feeding the fledged young for approximately 2 weeks. Recently fledged birds may repeatedly return to and leave the nest during this period (Spencer and others, 1996). Both male and female adults feed the fledged young, which give frequent, loud "*peep*" calls.

Southwestern Willow Flycatchers readily re-nest following an unsuccessful nesting attempt, although rarely more than once (Ellis and others, 2008). They also will sometimes nest again (double brood) following a successful nesting attempt, although this is more uncommon than re-nesting and varies between sites and years. From 2002 to 2008 at Elephant Butte Reservoir, approximately 13 percent of the pairs produced two successful nests per year (Ahlers and Moore, 2009). The productivity gains from pairs having successful second nests are important drivers of positive population growth (Paxton and others, 2007; Moore and Ahlers, 2009).

Replacement nests are built in the same territory, either in the same plant or at a distance of as much as 20 m from the previous nest. Reuse of old nests is uncommon, but does occur (Yard and Brown, 1999; Darrell Ahlers, Bureau of Reclamation, unpub. data, 2009). Replacement nest building and egg laying can occur (uncommonly) as late as the end of July or early August. Pairs may attempt a third nest if the second fails. However, clutch size, and therefore potential productivity, decreases with each nest attempt (Whitfield and Strong, 1995; Ellis and others, 2008).

Food and Foraging

The breeding season diet of Southwestern Willow Flycatchers is relatively well documented (DeLay and others, 2002; Drost and others, 2003; Durst, 2004; Wiesenborn and Heydon, 2007; Durst and others, 2008b). Breeding flycatchers are exclusively insectivorous, and consume a wide range of prey taxa ranging in size from small leafhoppers (Homoptera) to large dragonflies (Odonata). Major prey taxa include bugs (Hemiptera), bees and wasps (Hymenoptera), flies (Diptera), and leafhoppers; however, diet can vary widely between years and among different habitat types. There is no known differences in diet by sex, but there are differences between adult and nestling diet in the proportions of some arthropod groups. Differences in the composition of arthropods in flycatcher diet have been documented between native and exotic habitats, and between years within particular breeding sites; however, flycatchers appear able to tolerate substantial variation in relative prey abundance, except in extreme situations such as severe droughts (Durst and others, 2008b).

Willow Flycatchers of all subspecies forage primarily by sallying from a perch to perform aerial hawking and gleaning (Sedgwick, 2000; Durst, 2004). Males and females forage with similar maneuvers, although males may forage higher in the tree canopy than females. Foraging frequently takes place at external edges or internal openings within a habitat patch, or at the top of the upper canopy.

Site Fidelity and Survivorship

Based on studies of banded birds, most adult Southwestern Willow Flycatchers that survive from one year to the next will return to the same river drainage, often in proximity to the same breeding site (U.S. Fish and Wildlife Service, 2002; McLeod and others, 2007; Paxton and others, 2007). However, it is common for individual flycatchers to return to different sites within a breeding area, and even to move between breeding areas, from one year to the next. Some of this movement may be related to breeding success and habitat quality. At Roosevelt Lake, those birds that moved to different sites within a breeding area had on average higher productivity in the year following the move than in the year before the move (Paxton and others, 2007). At Roosevelt Lake and on the San Pedro and Gila Rivers, movement out of breeding patches also increased with the relative age of a patch, which may indicate a preference for younger riparian vegetation structure.

In addition to movements within a breeding site, long-distance movements within and between drainages have been observed (Paxton and others, 2007), at distances up to approximately 450 km. Dispersal of first-year flycatchers is more extensive than adult birds, as typical for most bird species.

Survivorship within the breeding season can be very high, averaging 97 percent at Roosevelt Lake (Paxton and others, 2007). Between-year survivorship of adults can be highly variable, but appears to be similar to that of most small passerine birds studied, with estimates generally ranging from approximately 55 to 65 percent (Stoleson and others, 2000; McLeod and others, 2007; Paxton and others, 2007; Schuetz and Whitfield, 2007). Males and females have similar survivorship rates.

Estimated survivorship of young birds (from hatching to the next breeding season) is highly variable, depending in part on how the estimates are generated (Stoleson and others, 2000). Generally reported as between 15 and 40 percent, juvenile survivorship typically is lower than adult survivorship (Whitfield and Strong, 1995; Stoleson and others, 2000; McLeod and others, 2007). Early fledging young have higher survivorship than those that leave the nest later in the season (Whitfield and Strong, 1995; Paxton and others, 2007). Most flycatchers survive for only 1–2 adult years, and mean life expectancy in Arizona was estimated to be 1.9 years following fledging. However, some individuals live much longer. The maximum reported ages of banded Southwestern Willow Flycatchers are 9–11 years (Sedgwick, 2000; Paxton and others, 2007).

Overall, the Southwestern Willow Flycatcher population appears to persist as one or more widely dispersed metapopulations (Busch and others, 2000; U.S. Fish and Wildlife Service, 2002), with movement of individuals, and thus genetic exchange, occurring across the landscape. However, the amount of movement and interchange is lower among sites that are farther apart or more isolated. Some sites serve as population sources while others may be sinks; some sites will be ephemeral over periods of years or decades. Flycatcher movement and dispersal among sites is important for initial site colonization and subsequent recolonization.

There are few general predictors for the persistence of breeding sites. Relatively large populations, such as the Kern River Preserve, San Pedro River, Elephant Butte Reservoir, and the Gila River have persisted for 10 or more years. However, such large sites can be subject to major changes in population numbers, and even potential extirpation, due to changes in local hydrology, site inundation, drought, etc. (Moore, 2005; Paxton and others, 2007). Although some small populations may be ephemeral and last only a few years (Durst and others, 2008a), others have remained occupied for much longer periods (Kus and others, 2003). Breeding populations also may reappear at unoccupied sites following 1–5 year absences. Suitable flycatcher habitat also can develop—and poor quality habitat can improve—relatively quickly in some sites, under favorable hydrological conditions. For example, at Roosevelt Lake and the San Pedro River (AZ), the age of riparian vegetation when first colonized was as young as 3 years (Paxton and others, 2007). In the same study, flycatchers moved back into older habitat patches when nearby younger, occupied habitat was inundated or scoured away.

Overall, the vegetation and flycatcher occupancy of a habitat patch or river drainage are often dynamic; few if any sites remain static over time. The amount of suitable flycatcher habitat can substantially increase or decrease in just a few years, at local and regional scales. Flycatchers can respond quickly to habitat changes, colonizing new sites if available and abandoning others. Therefore, one cannot assume that local, regional, or rangewide flycatcher population numbers will remain stable over time.

Threats to the Flycatcher and Habitat

The greatest historical factor in the decline of the Southwestern Willow Flycatcher is the extensive loss, fragmentation, and modification of riparian breeding habitat (U.S. Fish and Wildlife Service, 2002). Large-scale losses of southwestern wetlands have occurred, particularly the cottonwood-willow riparian habitats historically used by the Southwestern Willow Flycatcher (Unitt, 1987; General Accounting Office, 1988; Dahl, 1990; State of Arizona, 1990). Changes in the riparian plant community have frequently reduced, degraded, and eliminated nesting habitat for the flycatcher, curtailing its distribution and abundance.

Habitat losses and changes have occurred and continue to occur because of urban, recreational, and agricultural development, water diversion and impoundment, channelization, livestock grazing, and replacement of native habitats by introduced plant species (Marshall and Stoleson, 2000; U.S. Fish and Wildlife Service, 2002). Hydrological changes, natural or man-made, can greatly reduce the quality and extent of flycatcher habitat. Although riparian areas are often not considered as fire-prone, several Southwestern Willow Flycatcher breeding sites were destroyed by fire over the past decade (U.S. Fish and Wildlife Service, 2002), and others are at risk to similar catastrophic loss. Fire danger in these riparian systems may be exacerbated by increases in exotic vegetation, such as saltcedar, diversions or reductions of surface water, increased recreational activity, and drawdown of local water tables.

Although the degradation of many river systems and associated riparian habitat is a key cause of their absence, Southwestern Willow Flycatchers do not require free-running rivers or “pristine” riparian habitats. Most of the largest

Southwestern Willow Flycatcher populations in the last decade were found in reservoir drawdown zones, such as at Roosevelt Lake and Elephant Butte Reservoir. Many breeding populations are found on regulated rivers (Graf and others, 2002). In addition, the vegetation at many smaller flycatcher breeding sites is supported by artificial water sources such as irrigation canals, sewage outflow, or agricultural drainages (U.S. Fish and Wildlife Service, 2002). Although rising water levels could be detrimental to breeding flycatchers within a reservoir drawdown zone, reservoir fluctuations can simulate river dynamics with cycles of destruction and establishment of riparian vegetation, depositing rich sediments and flushing salt accumulations in the soil (Paxton and others, 2007). Therefore, managed and manipulated rivers and reservoirs have the potential to play a positive role by providing flycatcher breeding habitat. However, because rivers and reservoirs are not managed solely to create and maintain flycatcher habitat, the persistence of riparian vegetation in these systems—and any flycatchers breeding therein—is not assured.

Although the historic degradation and loss of native riparian negatively affected the Southwestern Willow Flycatcher, this species does not show an inherent preference for native vegetation. Instead, breeding habitat selection is based primarily on vegetation structure, density, size, and other stand characteristics, and presence of water or saturated soils (U.S. Fish and Wildlife Service, 2002). In fact, approximately 25 percent of known territories are found in habitat composed of 50 percent or greater exotic vegetative component—primarily saltcedar (Durst and others, 2008a). Saltcedar also can be an important habitat component in sites dominated by native vegetation (U.S. Fish and Wildlife Service, 2002, 2005). Despite suggestions that flycatchers breeding in saltcedar are suffering negative consequences and that removal of saltcedar is therefore a benefit (DeLoach and others, 2000; Dudley and DeLoach, 2004), there is increasing and substantial evidence that this is not the case. For example, Paxton and others (2007) found that flycatchers did not suffer any detectable negative consequences from breeding in saltcedar. This is consistent with the findings of Owen and others (2005) and Sogge and others (2006). Therefore, the rapid or large-scale loss of saltcedar in occupied flycatcher habitats, without rapid replacement of suitable native vegetation, could result in reduction or degradation of flycatcher habitat (U.S. Fish and Wildlife Service, 2002; Sogge and others, 2008).

In evaluating Southwestern Willow Flycatcher use of either native or exotic habitat, it is important to recognize that throughout the Southwest, there are many saltcedar-dominated and native-dominated habitats in which flycatchers do not breed (U.S. Fish and Wildlife Service, 2002; Sogge and others, 2006). Therefore, the use of any riparian patch—native or exotic—as breeding habitat will be site specific and will depend on the spatial, structural, and ecological characteristics of that particular patch and the potential for flycatchers to colonize and maintain populations within it.

Drought can have substantial negative effects on breeding flycatchers and their breeding habitat by reducing riparian vegetation vigor and density, and reducing prey availability (Durst, 2004; Paxton and others, 2007; Bureau of Reclamation, 2009). For example, the extreme drought of 2002 caused near complete reproductive failure of the large flycatcher population at Roosevelt Lake; among approximately 150 breeding territories, only two nests successfully fledged young in that year (Ellis and others, 2008). If future climate change produces more frequent or more sustained droughts, as predicted by many climate change models (for example, Seager and others, 2007), southwestern riparian habitats could be reduced in extent or quality. This scenario would present a challenge to the long-term sustainability of Southwestern Willow Flycatcher populations.

Brood parasitism by the Brown-headed Cowbird (*Molothrus ater*) was initially considered another significant threat to the Southwestern Willow Flycatcher (Whitfield, 1990; Harris, 1991; U.S. Fish and Wildlife Service, 1993, 1995; Whitfield and Strong, 1995; Sferra and others, 1997). Cowbirds lay their eggs in the nest of other species (the "hosts"), which raise the young cowbirds—often at the expense of reduced survivorship of their own young. Southwestern Willow Flycatchers seldom fledge any flycatcher young from nests that are parasitized by cowbirds (Whitfield and Sogge, 1999). Although parasitism negatively impacts some Southwestern Willow Flycatcher populations, especially at small and isolated breeding sites, it is highly variable and no longer considered among the primary rangewide threats to flycatcher conservation (U.S. Fish and Wildlife Service, 2002). Cowbird abundance, and therefore parasitism, tends to be a function of habitat type and quality, and the availability of suitable hosts, not specific to the flycatcher. Therefore, large-scale cowbirds control may not always be warranted unless certain impact thresholds are met (U.S. Fish and Wildlife Service, 2002; Rothstein and others, 2003; Siegle and Ahlers, 2004).

Section 2. Survey Protocol

The fundamental principles of the methodology described in this version have remained the same since the original Tibbitts and others (1994) and subsequent Sogge and others (1997a) protocols: the use of vocalization play-back, repeated site visits, and confirmation of flycatcher identity via the species-characteristic song. This newest protocol incorporates guidelines of the 2000 USFWS addendum, and includes changes based on our improved understanding of Willow Flycatcher biology and the significance of potential threats, and the availability of new survey technologies.

Several factors work together to make Southwestern Willow Flycatcher surveys challenging. Difficulties include the flycatcher's physical similarities with other species and subspecies; accessing the dense habitat they occupy; time constraints based on their breeding period; and vocalization patterns. Given these challenges, no methodology can assure 100-percent detection rates. However, the survey protocol described herein has proven to be an effective tool for locating flycatchers, and flycatchers generally are detectable when the protocol is carefully followed. Since 1995, hundreds of sites have been surveyed and thousands of flycatchers detected using the two previous versions of the survey protocol.

The Willow Flycatcher is 1 of 10 regularly occurring *Empidonax* flycatchers found in North America, all of which look very much alike. Like all *Empidonax*, Willow Flycatchers are nondescript in appearance, making them difficult to see in dense breeding habitat. Although the Willow Flycatcher has a characteristic *fitz-bew* song that distinguishes it from other birds (including other *Empidonax*), Willow Flycatchers are not equally vocal at all times of the day or during all parts of the breeding season. Because Southwestern Willow Flycatchers are rare and require relatively dense riparian habitat, they may occur only in a small area within a larger riparian system, thus decreasing detectability during general bird surveys. Migrating Willow Flycatchers (of all subspecies) often sing during their migration through the Southwest, and could therefore be confused with local breeders. In addition, Southwestern Willow Flycatchers are in breeding areas for only 3–4 months of the year. Surveys conducted too early or late in the year would fail to find flycatchers even at sites where they breed.

These life history characteristics and demographic factors influence how Southwestern Willow Flycatcher surveys should be conducted and form the basis upon which this protocol was developed. This protocol is based on the use of repeated call-playback surveys during pre-determined periods of the breeding season, to confirm presence or to derive a high degree of confidence regarding their absence at a site. Such species-specific survey techniques are necessary to collect reliable presence/absence information for rare species (Bibby and others, 1992).

The primary objective of this protocol is to provide a standardized survey technique to detect Southwestern Willow Flycatchers, determine breeding status, and facilitate consistent and standardized data reporting. The survey technique will, at a minimum, help determine presence or absence of the species in the surveyed habitat for that breeding season. Ultimately, the quality of the survey that is conducted will depend on the preparation, training, and in-the-field diligence of the individual surveyor.

This protocol is designed for use by persons who are non-specialists with *Empidonax* flycatchers or who are not expert birders. However, surveyors must have sufficient knowledge, training, and experience with bird identification and surveys to distinguish the Willow Flycatcher from other non-*Empidonax* species, and be able to recognize the Willow Flycatcher's primary song. A surveyor's dedication and attitude, willingness to work early hours in dense, rugged and wet habitats, and their ability to remain alert and aware of important cues also are important. Surveys conducted improperly or by unqualified, inexperienced, or complacent personnel may lead to inaccurate results and unwarranted conclusions.

Surveys conducted by qualified personnel in a consistent and standardized manner will enable continued monitoring of general population trends at and between sites, and between years. Annual or periodic surveys in cooperation with State and Federal agencies should aid resource managers in gathering basic information on flycatcher status and distribution at various spatial scales. Identifying occupied and unoccupied sites will assist resource managers in assessing potential impacts of proposed projects, avoiding impacts to occupied habitat, identifying suitable habitat characteristics, developing effective restoration management plans, and assessing species recovery.

The earlier versions of this protocol (Tibbitts and others, 1994; Sogge and others, 1997a) were used extensively and successfully for many years. Hundreds of flycatcher surveys conducted throughout the Southwest since 1994 revealed much about the usefulness and application of this survey technique. Three important lessons were: (1) the call-playback technique works and detects flycatchers that would have otherwise been overlooked; (2) multiple surveys at each site are important; and (3) with appropriate effort, general biologists without extensive experience with *Empidonax* can find and verify Willow Flycatcher breeding sites.

This revised protocol is still based on call-playback techniques and detection of singing individuals. However, it includes changes in the timing and number of surveys to increase the probability of detecting flycatchers and to help determine if they are breeders or migrants. It also incorporates the basic premise of the USFWS 2000 addendum to the 1997 protocol by requiring a minimum of five surveys in all "project-related" sites. A detailed description of surveys and

timing is discussed in section, "Timing and Number of Visits." Changes in the survey data sheets make them easier to use and submit, and allow reporting all site visits within a single year on one form. The new survey forms also are formatted such that the data on the respective forms can be easily incorporated into the flycatcher range-wide database.

This protocol is intended to determine if a habitat patch contains territorial Southwestern Willow Flycatchers, and is not designed establish the exact distribution and abundance of flycatchers at a site. Determining precise flycatcher numbers and locations requires many more visits and additional time observing the behavior of individual birds. This survey protocol also does not address issues and techniques associated with nest monitoring or other flycatcher research activities. Those efforts are beyond the scope usually needed for most survey purposes, and require advanced levels of experience and skills to gather useful data and avoid potential negative effects to the flycatcher. If nest monitoring is a required component of your study, refer to Rourke and others (1999) for appropriate nest monitoring techniques (available for download at http://sbsc.wr.usgs.gov/cprs/research/projects/swwf/reports.asp).

Biologists who are not expert birders or specialists with regard to *Empidonax* flycatchers can effectively use this protocol. However, users should attend a U.S. Fish and Wildlife Service-approved Southwestern Willow Flycatcher survey training workshop, and have knowledge and experience with bird identification, surveys, and ecology sufficient to effectively apply this protocol.

Permits

Federal endangered species recovery permits are required for surveys in all USFWS regions where the Southwestern Willow Flycatcher breeds (application forms can be downloaded at http://www.fws.gov/forms/3-200-55.pdf). State permits also may be required before you can survey within any of the States throughout the Southwestern Willow Flycatcher's range: be certain to check with the appropriate State wildlife agency in your area. It usually takes several months to receive permits, so apply early to avoid delays in starting your surveys. You also must obtain permission from government agencies and private landowners prior to conducting any surveys on their lands.

Pre-Survey Preparation

The degree of effort invested in pre-survey preparation will have a direct effect on the quality and efficiency of the surveys conducted. Pre-survey preparation is often overlooked, but can prove to be one of the more important aspects in achieving high-quality survey results.

Surveyors should study calls, songs, drawings, photographs, and videos of Willow Flycatchers. Several web sites describe life history requirements, and provide photographs and vocalizations. It is especially critical for surveyors to be familiar with Willow Flycatcher vocalizations before going in the field. Although the *fitz-bew* song is the basis of verifying detections using this protocol, Willow Flycatchers use many other vocalizations that are valuable in locating birds and breeding sites. We strongly encourage that all surveyors learn as many vocalizations as possible and refer to the on-line "Willow Flycatcher Vocalizations; a Guide for Surveyors" (available at http://sbsc.wr.usgs.gov/cprs/research/projects/swwf/wiflvocl.asp). Several commercial bird song recordings include Willow Flycatcher vocalizations, but these recordings typically have only a few vocalizations and the dialects may differ from those heard in the Southwest.

If possible, visit known Willow Flycatcher breeding sites to become familiar with flycatcher appearance, behavior, vocalizations, and habitat. Such visits are usually part of the standardized flycatcher survey workshops. All visits should be coordinated with USFWS, State wildlife agencies, and the property manager/owner, and must avoid disturbance to territorial flycatchers. While visiting these sites, carefully observe the habitat characteristics to develop a mental image of the key features of suitable habitat.

Surveyors must be able to identify, by sight and vocalizations, other species likely to be found in survey areas that may be confused with Southwestern Willow Flycatchers. These include Bell's Vireo (*Vireo bellii*), Western Wood-pewee (*Contopus sordidulus*), young or female Vermillion Flycatchers (*Pyrocephalus rubinus*), and other *Empidonax* flycatchers. At a distance, partial song or call notes of Bell's Vireo, Ash-throated Flycatchers (*Myiarchus cinerascens*) and some swallows can sound considerably like a *fitz-bew*. Surveyors also should be able to identify Brown-headed Cowbirds by sight and vocalizations. It is worthwhile to make one or more pre-survey trips to the survey sites or other similar areas to become familiar with the local bird fauna. You might consider obtaining a species list relative to your area and become familiar with those species by site and sound.

Prior to conducting any presence/absence surveys in your respective State or USFWS Region, contact the respective flycatcher coordinators to discuss the proposed survey sites and determine if the sites have been surveyed in prior years. If possible, obtain copies of previous survey forms and maintain consistency with naming conventions and site boundaries. Study the forms to determine if flycatchers have been previously detected in the site, record locations of any previous detections, and read the comments provided by prior surveyors. While surveying, be sure to pay special attention to any patches where flycatchers have previously been detected.

Familiarity with the survey site prior to the first surveys is the best way to be prepared for the conditions you will experience. Determine the best access routes to your sites and always have a back-up plan available in the event of unforeseen conditions (for example, locked gates, weather, etc.). Know the local property boundaries and where the potential hazards may be, including deep water, barbed wire fencing, and difficult terrain. Be prepared to work hard and remain focused and diligent in a wide range of physically demanding conditions. At many sites, these include heat, cold, wading through flowing or stagnant water, muddy or swampy conditions, crawling through dense thickets (often on hands and knees), and exposure to snakes, skunks, and biting insects.

It is imperative that all surveyors exercise the adage "safety first." Be aware of safety hazards and how to avoid them, and do not allow the need to conduct surveys to supersede common sense and safety. Inform your coworkers where you will be surveying and when you anticipate returning. Always take plenty of water and know how to effectively use your equipment, especially compass, Global Positioning System (GPS), and maps.

Equipment

The following equipment is necessary to conduct the surveys:

1. **USGS topographic maps of the area**: A marked copy is required to be attached to survey data sheets submitted at the end of the season. Be sure to always delineate the survey area and clearly mark any flycatcher detections. If the survey area differed between visits; delineate each survey individually.
2. **Standardized survey form**: Always bring more copies than you think you need.
3. **Lightweight audio player**: Be sure the player has adequate volume to carry well; use portable speakers if necessary. Several digital devices, such as CD players and MP3 players, are currently available and can be connected to external amplified speakers for broadcasting the flycatcher vocalizations. However, not all are equally functional or effective in field conditions; durability, reliability, and ease of use are particularly important. Talk to experienced surveyors for recommendations on particular models and useful features.
4. **Extra player and batteries**: In the field, dirt, water, dust, and heat often cause equipment failure, and having backup equipment helps avoid aborting a survey due to equipment loss or failure.
5. **Clipboard and permanent (waterproof) ink pen**: We recommend recording survey results directly on the survey data form, to assure that you collect and record all required data and any field notes of interest.
6. **Aerial photographs**: Aerial photographs can significantly improve your surveys by allowing you to accurately target your efforts, thus saving time and energy in the field. Previously, aerial images were often expensive and difficult to obtain. However, it is now easy to get free or low-cost images from sources, such as Google© Earth. Even moderate resolution images generally are better than none. For higher resolution aerial photographs, check with local planning offices and/or State/Federal land-management agencies for availability. Take color photocopies, not the original aerial photographs, with you in the field. Aerial photographs also are very useful when submitting your survey results but cannot be substituted in lieu of the required topographic map.
7. **Binoculars and bird field guide**: Although this protocol relies primarily on song detections to verify flycatcher presence, good quality binoculars are still a crucial field tool to help distinguish between possible Southwestern Willow Flycatchers and other species. Use a pair with 7–10 power magnification that can provide crisp images in poor lighting conditions. A good field guide also is essential for the same reason.
8. **GPS unit**: A GPS unit is needed for determining survey coordinates and verifying the location of survey plots on topographic maps. All flycatcher detections should be stored as waypoints and coordinates recorded on the survey form. A wide variety of fairly inexpensive GPS units are currently available. Most commercially available units will provide accuracy within 10 m, which is sufficient for navigating and marking locations.
9. **Compass**: Surveyors should carry a compass to help them while navigating larger habitat patches. This is an important safety back-up device, because GPS units can fail or lose power. Most GPS units have a feature to provide an accurate bearing to stored waypoints (for example, previous flycatcher detections, your parked vehicle, etc.); however, many units do not accurately display the direction in which the surveyor is traveling slowly through dense vegetation. A compass set to the proper bearing provides a more reliable method to navigate the survey site and relocate previously marked locations.

The following equipment also is recommended:

10. **Camera:** These are very helpful for habitat photographs, especially at sites where flycatchers are found. Small digital cameras are easily portable and relatively inexpensive.
11. **Survey flagging:** Used for marking survey sites or areas where flycatcher are detected. Check with the local land owner or management agency before flagging sites. Use flagging conservatively so as to not attract people or predators.
12. **Field vest:** A multi-pocket field vest can be very useful for carrying field equipment and personal items. We recommend muted earth-tone colors.

13. **Cell phone and/or portable radio**: In addition to providing an increased level of safety, cell phones or portable radios may be used by surveyors to assist each other in identifying territories and pairs in dense habitats, or where birds are difficult to hear.

In addition to the necessary equipment mentioned above, personal items, such as food, extra water or electrolyte drink, sunscreen, insect repellent, mosquito net, first-aid kit, whistle, and a light jacket, also should be considered. Being prepared for unforeseen difficulties, and remaining as comfortable as conditions allow while surveying are important factors to conducting thorough and effective surveys.

All survey results (both negative and positive) should be recorded directly on data forms when possible. These data forms have been designed to prompt surveyors to record key information that is crucial to interpretation of survey results and characterization of study sites. Even if no flycatchers are detected or habitat appears unsuitable, this is valuable information and should be recorded. Knowing where flycatchers are not breeding can be as important as knowing where they are; therefore, negative data are important. Standardized data forms are provided in appendix 1, or can be downloaded online. Always check for updated forms prior to each year's surveys.

Willow Flycatcher surveys are targeted at this species and require a great deal of focused effort. Surveyors must be constantly alert and concentrate on detecting a variety of flycatcher cues and responses. Therefore, field work, such as generalized bird surveys (for example, point counts or walking transects) or other distracting tasks, should not be conducted in conjunction with Willow Flycatcher surveys. Avoid bringing pets or additional people who are not needed for the survey. Dress in muted earth-tone colors, and avoid wearing bright clothing.

Willow Flycatcher Identification

The Southwestern Willow Flycatcher is a small bird, approximately 15 cm long and weighing about 11–12 g. Sexes look alike and cannot be distinguished by plumage. The upper parts are brownish-olive; a white throat contrasts with the pale olive breast, and the belly is pale yellow. Two white wing bars are visible (juveniles have buffy wing bars) and the eye ring is faint or absent. The upper mandible is dark and the lower mandible light. The tail is not strongly forked. When perched, the Willow Flycatcher often flicks its tail upward. As a group, the *Empidonax* flycatchers are very difficult to distinguish from one another by appearance. The Willow Flycatcher also looks very similar to several other passerine species you may encounter in the field.

Given that Willow Flycatchers look similar to other *Empidonax* flycatchers that may be present at survey sites, the most certain way to verify Willow Flycatchers in the field is by their vocalization. For the purpose of this protocol, identification of Willow Flycatchers cannot be made by sight alone; vocalizations are a critical identification criterion, and specifically the primary song *fitz-bew*. Willow Flycatchers have a variety of vocalizations (see Stein, 1963; Sedgwick, 2000), but two are most commonly heard during surveys or in response to call-playback:

1. ***Fitz-bew***. This is the Willow Flycatcher's characteristic primary song. Note that *fitz-bews* are not unique to the southwestern subspecies; all Willow Flycatchers sing this characteristics song. Male Willow Flycatchers may sing almost continuously for hours, with song rates as high as one song every few seconds. Song volume, pitch, and frequency may change as the season progresses. During prolonged singing bouts, *fitz-bews* are often separated by short *britt* notes. *Fitz-bews* are most often given by a male, but studies have shown female Willow Flycatchers also sing, sometimes quite loudly and persistently (although generally less than males). Flycatchers often sing from the top of vegetation, but also will vocalize while perched or moving about in dense vegetation.
2. ***Whitt***. This is a call often used by nesting pairs on their territory, and commonly is heard even during periods when the flycatchers are not singing (*fitz-bewing*). The *whitt* call appears to be a contact call between sexes, as well as an alarm call, particularly when responding to disturbance near the nest. *Whitt* calls can be extremely useful for locating Willow Flycatchers later in the season when *fitz-bewing* may be infrequent, but are easily overlooked by inexperienced surveyors. When flycatcher pairs have active nests and particularly once young have hatched, *whitts* may be the most noticeable vocalization. However, many species of birds *whitt*, and a *whitt* is not a diagnostic characteristic for Willow Flycatchers. For example, the "*whitt*" of the Black-headed Grosbeak (*Pheucticus melanocephalus*) and Yellow-breasted Chat (*Icteria virens*) are often confused with that of the flycatcher.

The *fitz-bew* and *whitt* calls are the primary vocalizations used to locate Willow Flycatchers. However, other less common Willow Flycatcher vocalizations can be very useful in alerting surveyors to the presence of flycatchers. These include twittering vocalizations typically given during interactions between flycatchers and sometimes between flycatchers and other birds, bill snapping, *britt*'s, and *wheeo*'s. Because these sounds can be valuable in locating territories (Shook and others, 2003), they should be studied prior to going in the field. Willow Flycatcher vocalization recordings are available from Federal and State agency contacts and online at http://sbsc.wr.usgs.gov/cprs/research/projects/swwf/. Standardized recordings of Southwestern Willow Flycatchers also are available online at http://www.naturesongs.com/tyrrcert.html#tyrr. Specifically, only *fitz-bews* and *britts* should be used for conducting surveys, to provide more robust comparative results among sites and years.

Willow Flycatcher song rates are highest early in the breeding season (late May–early June), and typically decline after eggs hatch. However, in areas with many territorial flycatchers or where an unpaired flycatcher is still trying to attract a mate, or where re-nesting occurs, singing rates may remain high well into July. Isolated pairs can be much quieter and harder to detect than pairs with adjacent territorial flycatchers. At some sites, pre-dawn singing (0330–0500 hours) appears to continue strongly at least through mid-July (Sogge and others, 1995). Singing rates may increase again later in the season, possibly coinciding with re-nesting attempts (Yard and Brown, 2003). The social dynamics of adjacent territories can strongly influence vocalization rates. A single "*fitz-bew*" from one flycatcher may elicit multiple responses from adjacent territories. When these interactions occur, it is a good opportunity to distinguish among territories and provides the surveyor with an estimate of territory numbers in the immediate area.

There are some periods during which Willow Flycatchers do not sing and even the use of call-playback sometimes fails to elicit any response. This can be particularly true late in the breeding season. Early and repeated surveys are the best way to maximize the odds of detecting a singing flycatcher and determining its breeding status.

Timing and Number of Visits

No survey protocol can guarantee that a Southwestern Willow Flycatcher, if present, will be detected on any single visit. However, performing repeated surveys during the early to mid-nesting season increases the likelihood of detecting flycatchers and aids in determining their breeding status. A single survey, or surveys conducted too early or late in the breeding cycle, do not provide definitive data and are of limited value.

For purposes of this survey protocol, we have divided the Southwestern Willow Flycatcher breeding season into three basic survey periods, and specified a minimum number of survey visits for each period (fig. 9). Although the Sogge and others (1997a) protocol recommended a minimum of one survey in each period, we now recommend a differing number of visits for general surveys versus project-related studies.

General surveys are conducted for the sole purpose of determining whether Willow Flycatchers are present or absent from a respective site, when there is no foreseeable direct or indirect impact to their habitat from a known potential project or change in site management. In such cases, a minimum of one survey visit is required in each of the three survey periods.

Project-related surveys are conducted to determine the presence or absence of Willow Flycatchers within a site when there is a potential or foreseeable impact to their habitat due to a potential project or change in site management. Additional surveys are required for project-related studies in order to derive a greater degree of confidence regarding the presence or absence of Willow Flycatchers.

All successive surveys must be at least 5 days apart; surveys conducted more closely are not considered to be separate surveys. Although a minimum of three or five surveys are required for general and project-related purposes, respectively, if the habitat patches are large, contiguous and extremely dense, additional surveys are strongly encouraged to ensure full coverage of the site.

If you are uncertain whether three general surveys or five project-related surveys are required for your respective study, contact your USFWS flycatcher coordinator. As noted earlier, this survey protocol will help determine if territorial flycatchers are present and their approximate locations; if your project requires fine-scale estimates of flycatcher numbers or distribution at a site, you may need to conduct more intensive efforts that include additional surveys, nest searches, and nest monitoring.

Survey Period 1: May 15–31.—For both general and project-related surveys: a minimum of one survey is required. The timing of this survey is intended to coincide with the period of high singing rates in newly arrived males, which tends to begin in early to mid-May. This is one of the most reliable times to detect flycatchers that have established their territories, so there is substantial value to conducting period 1 surveys even though not all territorial males may yet have arrived. Migrant Willow Flycatchers of multiple subspecies will likely be present and singing during this period. Because both migrant and resident Willow Flycatchers are present during this period, and relatively more abundant then in subsequent surveys, it is an excellent opportunity to hone your survey and detection skills and gain confidence in your abilities. Detections of flycatchers during period 1 also provide insight on areas to pay particular attention to during the next survey period.

Survey Period 2: June 1–24.—For general surveys: a minimum of one survey is required. For project-related surveys, a minimum of two surveys are required. Note that this differs from the minimum of one survey that was recommended in this period under the previous protocol (Sogge and others, 1997a). During this period, the earliest arriving males may already be paired and singing less, but later arriving males should still be singing strongly. Period 2 surveys can provide insight about the status of any flycatchers detected during survey period 1. For example, if a flycatcher is detected during survey period 1 but not survey period 2, the first detection may have been a migrant. Conversely, detecting a flycatcher at the same site during periods 1 and 2 increases the likelihood that the bird is not a migrant, although it does not necessarily confirm it. Survey period 2 also is the earliest time during which you are likely to find nesting activity by resident birds at most sites. Special care should be taken during this period to watch for activity that will verify whether the flycatchers that are present are attempting to breed. A little extra time and diligence should be spent at all locations where flycatchers were detected during survey period 1.

Survey Visit Timing, Numbers, and Detection Interpretation

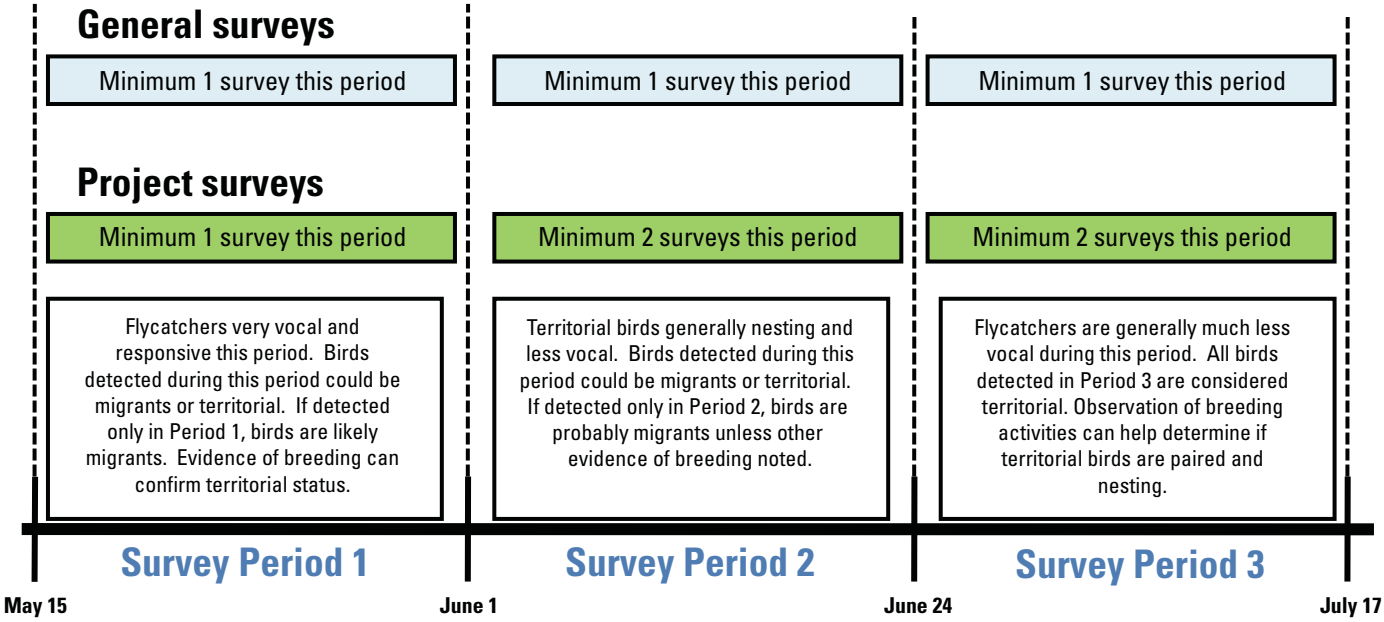


Figure 9. Recommended numbers and timing of visits during each survey period for general surveys and project surveys. General surveys are those conducted when there is no foreseeable direct or indirect impact to their habitat from a known potential project or change in site management. Project-related surveys are conducted when there is a potential or foreseeable impact to their habitat due to a potential project or change in site management.

Survey Period 3: June 25–July 17.—For general surveys, a minimum of one survey is required. For project-related surveys, a minimum of two surveys are required. Virtually all Southwestern Willow Flycatchers should have arrived on their territories by this time. Flycatcher singing rates probably have lessened, and most paired flycatchers will have initiated or even completed their first round of nesting activity. Migrant Willow Flycatchers should no longer be passing through the Southwest; therefore, any flycatchers that you detect are likely to be either territorial or nonbreeding floaters. Surveyors should determine if flycatchers detected during surveys in periods 1 or 2 are still present, and watch closely for nesting activity. Flycatchers that have completed a first nesting attempt may resume vigorous singing during this period. Extra time and diligence should be spent at all locations where flycatchers were detected during survey periods 1 or 2.

At high elevation sites (above 2,000 m), Southwestern Willow Flycatcher arrival and initiation of breeding activities may occur in early June, and possibly later in some years due to weather or migration patterns. Therefore, flycatcher breeding chronology may be delayed by 1 or 2 weeks at such sites, and surveys should be conducted in the latter part of each period.

It may not require multiple surveys to verify Southwestern Willow Flycatcher presence or breeding status. If, for example, Willow Flycatchers are observed carrying nest material during survey periods 1 or 2, this is conclusive verification they are breeders as opposed to migrants, regardless of what is found during period 3. However, it requires a minimum of three surveys for general studies and five surveys for project-related studies to determine with relative confidence that Southwestern Willow Flycatchers probably are not breeding at a site in that year, based on lack of detections.

We strongly encourage additional follow-up surveys to sites where territorial Southwestern Willow Flycatchers are verified or suspected. Extra surveys provide greater confidence about presence or absence of flycatchers at a site, as well as help in estimating the number of breeding territories or pairs, and determining breeding status and the outcome of breeding efforts. Pre-survey visits the evening before the survey or post-survey follow-up later in the morning can help confirm breeding status when surveyors are not under time constraints. However, avoid returning to a site so often as to damage the habitat, establish or enlarge trails, or cause undue disturbance to the flycatchers.

Survey Methods

The survey methods described below fulfill the primary objectives of documenting the presence or absence of Willow Flycatchers, and determining their status as territorial versus migrant. This protocol primarily is a call-playback technique, a proven method for eliciting response from nearby Willow Flycatchers (Seutin, 1987; Craig and others, 1992), both territorial and migrants. The premise of the call-playback technique is to simulate a territorial intrusion by another Willow Flycatcher, which generally will elicit a defensive response by the territorial bird, increasing its detectability. At each site, surveyors should broadcast a series of recorded Willow Flycatcher *fitz-bews* and *britts*, and look and listen for responses. In addition to maximizing the likelihood of detecting nearby flycatchers, this method also allows for positive identification by comparing the responding bird's vocalizations to the known Willow Flycatcher recording.

Documenting Presence/Absence—Begin surveys as soon as there is enough light to safely walk (about 1 hour before sunrise) and end by about 0900–1030 hours, depending on the temperature, wind, rain, background noise, and other environmental factors. Use your best professional judgment whether to conduct surveys that day based on local field conditions. If the detectability of flycatchers is being reduced by environmental factors, surveys planned for that day should be postponed until conditions improve. If observers are camped in or near potential Willow Flycatcher habitat, afternoons and evenings can be spent doing site reconnaissance and planning a survey strategy for the following morning. If camped immediately adjacent to survey sites, surveyors can awaken early and listen for flycatchers singing during the predawn period (0330–0500 hours), when territorial males often sing loudly.

Conduct surveys from within rather than from the perimeter of the sites, while limiting the breaking of vegetation or damaging the habitat. If surveys cannot be conducted from within the habitat, walk along the perimeter and enter the patch at intervals to broadcast the vocalizations and listen for responses. Flycatchers often respond most strongly if the recording is played from within the habitat and territory, rather than from the periphery. In addition, it can be surprisingly difficult to hear singing Willow Flycatchers that are even a short distance away amidst the noise generated by other singing and calling birds, roads, noisy streams, and other extraneous sounds. Therefore, it is preferable to survey from within the habitat, but always move carefully to avoid disturbing habitat or nests. Surveying from the periphery should not be conducted only for the sake of convenience, but is allowable for narrow linear reaches or when absolutely necessary due to safety considerations.

Because flycatchers may be clustered within only a portion of a habitat patch, it is critical to survey all suitable habitat within the patch. Small linear sites may be thoroughly covered by a single transect through the patch. For larger sites, choose a systematic survey path that assures complete patch coverage throughout the length and breadth of the site. This may require multiple straight transects, serpentine, zig-zag, or criss-cross routes. Aerial photographs and previous survey forms are valuable tools to help plan and conduct surveys, and to assure complete coverage. Always move carefully through the habitat to avoid disturbing vegetation or nests.

Initially approach each site and stand quietly for 1–2 minutes or longer, listening for spontaneously singing flycatchers. A period of quiet listening is important because it helps acclimate surveyors to background noises that can be quite loud due to roads, aircraft, machinery, waterways, and other sounds. It also allows surveyors to recognize and shift attention away from the songs and calls of other bird species, letting them focus on listening for flycatchers. Although it happens rarely, some singing Willow Flycatchers will actually stop vocalizing and approach quietly in response to a broadcast song, perhaps in an effort to locate what they perceive as an intruding male. Therefore, playing a recording before listening for singing individuals has at least some potential of reducing detectability.

If you do not hear singing flycatchers during the initial listening period, broadcast the Willow Flycatcher song recording for 10–15 seconds; then listen for approximately 1 minute for a response. Repeat this procedure (including a 10-second quiet pre-broadcast listening period) every 20–30 m throughout each survey site, more often if background noise is loud. The recording should be played at about the volume of natural bird calls, and not so loud as to cause distortion of the broadcast. We recommend that the playback recording include a series of *fitz-bews* interspersed with several *britts*.

Response to the broadcast call could take several forms. Early in the breeding season (approximately May–mid-June), a responding Willow Flycatcher will usually move toward the observer and *fitz-bew* or *whitt* from within or at the top of vegetation. Territorial Willow Flycatchers almost always vocalize strongly when a recording is played in their territory early in the season. If there are several flycatchers present in an area, some or all may start singing after hearing the recording or the first responding individual. Flycatchers can often hear the recording from far away but will not usually move outside of their territory, so listen for distant responses. Also, stay alert and listen for flycatchers vocalizing behind you that may not have responded when you were first in their territory. Another common flycatcher response is alarm calls (*whitts*) or interaction twitters from within nearby vegetation, particularly once nesting has begun. Willow Flycatchers will often sing after a period of *whitting* in response to a recording, so surveyors hearing *whitts* should remain in the area and quietly listen for *fitz-bews* for several minutes. Because some flycatchers may initially respond by approaching quietly, particularly during periods 2 and 3, it is critical to watch carefully for responding birds.

If you detect flycatchers that appear particularly agitated, it is possible that you are in close proximity to their nest. Agitated flycatchers may swoop down at the surveyor, snap their beaks, and otherwise appear distressed. Exercise extreme caution so as to not accidently disturb the nest, and move slowly away from the immediate area.

For the purpose of this protocol, detection of a *fitz-bew* song is essential to identify a bird as a Willow Flycatcher. Similar appearing species (including other *Empidonax* flycatchers) occur as migrants, and even breeders, at potential Willow Flycatcher sites. A few of these other species may even approach a broadcast Willow Flycatcher song and respond with vocalizations. In order to standardize interpretation of survey results and assure a high degree of confidence in surveys conducted by biologists of varying experience and skill, positive identification must be based on detection of the Willow Flycatcher's most unique characteristic—its song. It is important to remember that the *whitt* call is not unique to Willow Flycatchers, and therefore cannot serve as the basis of a positive identification. However, *whitts* are extremely useful for locating flycatchers and identifying areas needing follow-up visits. Loud, strong *whitting* may indicate a nearby nest, dictating that surveyors exercise extra caution moving through the area.

Whenever a verified or suspected Willow Flycatcher is detected, be careful not to overplay the song recording. Excessive playing could divert the bird from normal breeding activities or attract the attention of predators and brood parasites. Wildlife management agencies may consider overplaying the recording as "harassment" of the flycatcher, and this is not needed to verify species identification. Although flycatchers usually sing repeatedly once prompted, even a single *fitz-bew* is sufficient for verification. If you have played a recording several times and a bird has approached but has not *fitz-bewed*, do not continue playing the recording. If a potential Willow Flycatcher responds, approaches or *whitts* but does not sing, it is best to carefully back away and wait quietly. If it is a Willow Flycatcher, it probably will sing within a short time (5–10 minutes). Another option is to return to the same site early the following morning to listen for or attempt to elicit singing again. If you are still uncertain, record the location with your GPS, record comments on the survey form, and follow-up on the detection during subsequent surveys. If possible, request the assistance of an experienced surveyor to determine positive identification.

If more habitat remains to be surveyed, continue onward once a flycatcher is detected and verified. In doing so, move 30–40 m past the current detection before again playing the recording, and try to avoid double-counting flycatchers that have already responded. Willow Flycatchers, particularly unpaired males, may follow the broadcast song for 50 m or more.

Looking For and Recording Color Bands.—Several research projects have involved the capture and banding of Willow Flycatchers at breeding sites across the Southwest. In such projects, flycatchers are banded with one or more small colored leg bands, including a federal numbered band. As a result, surveyors may find color-banded individuals at their survey sites, and identification and reporting of the band combination can provide important data on flycatcher movements, survivorship, and site fidelity.

To look for bands, move to get a good view of the flycatcher's legs. This may be difficult in dense vegetation, but flycatchers commonly perch on more exposed branches at the edges of their territory or habitat patch. If bands are seen, carefully note the band colors. If there is more than one band on a leg, differentiate the top (farthest up the leg) from the bottom (closest to the foot), and those on the bird's left leg versus the right leg. If you are unsure of the color, do not guess. Instead, record the color as unknown. Incorrect color-band data are worse than incomplete data, so only record colors of which you are certain. The fact that a banded bird was seen, even without being certain of its color combination, is very important information. Record the color-band information on the survey form, and report the sighting to the appropriate State or Federal contact as soon as you return from the survey that day.

Determining the Number of Territories and Pairs.—Accurately determining the number of breeding territories and pairs can be more difficult than determining simple presence or absence. Flycatcher habitat is usually so dense that visual detections are difficult, and seeing more than one bird at a time is often impossible. Flycatchers sing from multiple song perches within their territories, and may be mistaken for more than one flycatcher. A flycatcher responding to or following a surveyor playing a recording may move considerable distances in a patch and thus be counted more than once. Territorial male flycatchers often sing strongly, but so do many migrants and some females, particularly in response to call-playback (Seutin, 1987; Unitt, 1987; Sogge and others, 1997b). Rangewide, many territorial male flycatchers are unmated, particularly those in small breeding groups. For these reasons, each singing flycatcher may not represent a territory or a mated pair. Following the established survey protocol and carefully observing flycatcher behavior can help determine if you have detected migrants, territorial birds, breeders, unmated birds, or pairs.

Given sufficient time, effort and observation, it is usually possible to approximate the number of territories and pairs. First, listen carefully for simultaneously singing flycatchers. Note the general location of each bird—especially concurrently singing individuals—on aerial photographs, map, or a site sketch. Spend some time watching each flycatcher to determine approximate boundaries of its territory, and how it interacts with other flycatchers. If one or more singing

birds stay primarily in mutually exclusive areas, they can be considered as separate territories. To determine if a flycatcher is paired, watch for interactions within a territory. Refer to the section, "Determining Breeding Status" for signs of pairing and breeding activity. Do not report a territorial male as a pair unless you observe one or more of the signs listed below. In some cases, it may be possible only to estimate the number of singing individuals. In other cases, it may take multiple site visits to differentiate territories or pairs.

Determining Breeding Status.—One way to determine if the flycatchers found at a particular site are migrants or territorial is to find out if they are still present during the "non-migrant" period, which generally is from about June 15 to July 20 (Unitt, 1987). A Willow Flycatcher found during this time probably is a territorial bird, although there is a small chance it could be a non-territorial floater (Paxton and others, 2007). If the management question is simply whether the site is a potential breeding area, documenting the presence of a territorial flycatcher during the non-migrant period may meet all survey objectives, and the site may not need to be resurveyed during the remainder of that breeding season.

However, in some cases, surveyors will be interested in knowing not only if territorial Southwestern Willow Flycatchers are present at a site, but also whether breeding or nesting efforts are taking place. Some males maintain territories well into July yet never succeed in attracting a mate, so unpaired males are not uncommon (McLeod and others, 2007; Ellis and others, 2008; Ahlers and Moore, 2009). Thus, an assumption that each singing male represents a breeding pair may not be well founded, especially in small populations. If it is important to determine whether a pair is present and breeding in that territory, move a short distance away from where the bird was sighted, find a good vantage point, and sit or lie quietly to watch for evidence of breeding. Signs of breeding activity include:

a. observation of another unchallenged Willow Flycatcher in the immediate vicinity (indicates possible pair);
b. *whitt* calls between nearby flycatchers (indicates possible pair);
c. interaction twitter calls between nearby flycatchers (indicates possible pair);
d. countersinging or physical aggression against another flycatcher or bird species (suggests territorial defense);
e. physical aggression against cowbirds (suggests nest defense);
f. observation of Willow Flycatchers copulating (verifies attempted breeding);
g. flycatcher carrying nest material (verifies nesting attempt, but not nest outcome);
h. flycatcher carrying food or fecal sac (verifies nest with young, but not nest outcome);
i. locating an active nest (verifies nesting). Recall that general survey permits do not authorize nest searching or monitoring, and see section, "Special Considerations";
j. observation of adult flycatchers feeding fledged young (verifies successful nesting).

You may be able to detect flycatcher nesting activity, especially once the chicks are being fed. Adults feed chicks at rates of as many as 30 times per hour, and the repeated trips to the nest tree or bush are often quite evident. Be sure to note on the flycatcher survey form any breeding activity that is observed, including detailed descriptions of the number of birds, and specific activities observed. Also note the location of breeding activities on an aerial photograph, map, or sketch of the area.

The number of flycatchers found at a site also can provide a clue as to whether they are migrants or territorial birds. Early season detections of single, isolated Willow Flycatchers often turn out to be migrants. However, discovery of a number of Willow Flycatchers at one site usually leads to verification that at least some of them remain as local breeders. This underscores the importance of completing a thorough survey of each site to be confident of the approximate number of flycatchers present.

In some cases, regardless of the time and diligence of your efforts, it will be difficult to determine the actual breeding status of a territorial male. In these instances, use your best professional judgment, or request the assistance of an experienced surveyor or an agency flycatcher coordinator to interpret your observations regarding breeding status.

Reporting Results.—There is little value in conducting formal surveys if the data are not recorded and submitted. Fill in all appropriate information on the Willow Flycatcher survey form while still in the field, and mark the location of detections on a copy of the USGS topographic map. Make a habit of reviewing the form before you leave any site—trying to remember specific information and recording it later can lead to missing and inaccurate data. Note the location of the sighting on an aerial photograph or sketch of the site. Attaching photographs of the habitat also is useful. Whenever a Willow Flycatcher territory or nest site is confirmed, notify the USFWS or appropriate State wildlife agency as soon as you return from the field. The immediate reporting of flycatcher detections or nests may differ among USFWS regions and States—discuss these reporting procedures with your respective State and USFWS flycatcher coordinators.

Complete a survey form (appendix 1) for each site surveyed, whether or not flycatchers are detected. "Negative data" (that is, a lack of detections) are important to document the absence of Willow Flycatchers and help determine what areas have already been surveyed. Make and retain a copy of each survey form, and submit the original or a legible copy. Electronic copies of the survey forms also are acceptable and are available online (http://sbsc.wr.usgs.gov/cprs/research/projects/swwf/). All survey forms must be submitted to the USFWS and the appropriate State wildlife agency by the specified deadline identified in your permits. Timely submission of survey data is a permit requirement, and will ensure the information is included in annual statewide and regional reports.

Special Considerations

To avoid adverse impacts to Willow Flycatchers, follow these guidelines when performing all surveys:

1. Obtain all necessary Federal, State, and agency permits and permissions prior to conducting any surveys. Failure to do so leaves you liable for violation of the Endangered Species Act, various State laws, and prosecution for trespass.
2. Do not play the recording more than necessary or needlessly elicit vocal responses once Willow Flycatchers have been located and verified. This may distract territorial birds from caring for eggs or young, or defending their territory. If flycatchers are vocalizing upon arrival at the site, and your objective is to determine their presence or absence at a particular site—there is no need to play the recording. Excessive playing of the recording also may attract the attention of predators or brood parasites. Stop playing the survey recording as soon as you have confirmed the presence of a Willow Flycatcher, and do not play the recording again until you have moved 30–40 m to the next survey location.
3. Proceed cautiously while moving through Willow Flycatcher habitat. Continuously check the area around you to avoid disturbance to nests of Willow Flycatchers and other species. Do not break understory vegetation, even dead branches, to create a path through the surveyed habitat.
4. Do not approach known or suspected nests. Nest searches and monitoring require specific State and Federal permits, have their own specialized methodologies (Rourke and others, 1999), and are not intended to be a part of this survey protocol.
5. If you find yourself close to a known or suspected nest, move away slowly to avoid startling the birds or force-fledging the young. Avoid physical contact with the nest or nest tree, to prevent physical disturbance and leaving a scent. Do not leave the nest area by the same route that you approached. This leaves a "dead end" trail that could guide a potential predator to the nest/nest tree. If nest monitoring is a component of the study, but you are not specifically permitted to monitor the nest, store a waypoint with your GPS, affix flagging to a nearby tree at least 10 m away, and record the compass bearing to the nest on the flagging. Report your findings to an agency flycatcher coordinator or a biologist who is permitted to monitor nests.
6. If you use flagging to mark an area where flycatchers are found, use it conservatively and make certain the flagging is not near an active nest. Check with the property owner or land-management agency before flagging to be sure that similar flagging is not being used for other purposes in the area. Unless conducting specific and authorized/permitted nest monitoring, flagging should be placed no closer than 10 m to any nest. Keep flagging inconspicuous from general public view to avoid attracting people or animals to an occupied site, and remove it at the end of the breeding season.
7. Watch for and note the presence of potential nest predators, particularly birds, such as Common Ravens (*Corvus corax*), American Crows (*Corvus brachyrhynchos*), jays, and magpies. If such predators are in the immediate vicinity, wait for them to leave before playing the recording.
8. Although cowbird parasitism is no longer considered among the primary threats to flycatcher conservation it remains useful to note high concentrations of cowbirds in the comment section of the survey form. While conducting surveys, avoid broadcasting the flycatcher vocalizations if cowbirds are nearby, especially if you believe you may be close to an active flycatcher territory. The intent of not broadcasting flycatcher vocalizations is to reduce the potential for attracting cowbirds to a flycatcher territory or making flycatcher nests more detectable to cowbirds.
9. Non-indigenous plants and animals can pose a significant threat to flycatcher habitat and may be unintentionally spread by field personnel, including those conducting flycatcher surveys. Simple avoidance and sanitation measures can help prevent the spread of these organisms to other environments. To avoid being a carrier of non-indigenous plants or animals from one field site to another visually inspect and clean your clothing, gear, and vehicles before moving to a different field site. A detailed description on how to prevent and control the spread of these species is available by visiting the Hazard Analysis and Critical Control Point Planning for Natural Resource Management web site (http://www.haccp-nrm.org). One species of particular interest is the tamarisk leaf-beetle (*Diorhabda* spp.). If you observe defoliation of saltcedar while conducting flycatcher surveys and believe that *Diorhabda* beetles may be responsible, notify your USFWS coordinator immediately. Other non-native species of concern in survey locations are the quagga mussel (*Dreissena rostriformis bugensis*), cheatgrass (*Bromus tectorum*), red brome (*Bromus rubens*), giant salvinia (*Salvinia molesta*), water milfoil (*Myriophyllum spicatum*), parrot's feather (*M. aquaticum*), and amphibian chytrid fungus (*Batrachochytrium dendrobatidis*).

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Appendix 1. Willow Flycatcher Survey and Detection Form

Always check the U.S. Fish and Wildlife Service Arizona Ecological Services Field Office web site (http://www.fws.gov/southwest/es/arizona/) for the most up-to-date version.

Willow Flycatcher (WIFL) Survey and Detection Form (revised April 2010)

Site Name_____ State_____ County _____
USGS Quad Name _____ Elevation _____ (meters)
Creek, River, Wetland, or Lake Name_____
Is copy of USGS map marked with survey area and WIFL sightings attached (as required)? Yes___ No____

Survey Coordinates: Start: E_____ N_____ UTM Datum_____(See instructions)
Stop: E_____ N_____ UTM Zone _____
If survey coordinates changed between visits, enter coordinates for each survey in comments section on back of this page.

***** Fill in additional site information on back of this page *****

Survey # / Observer(s) (Full Name)	Date (m/d/y) Survey time	Number of Adult WIFLs	Estimated Number of Pairs	Estimated Number of Territories	Nest(s) Found? Y or N / If Yes, number of nests	Comments (e.g., bird behavior; evidence of pairs or breeding; potential threats [livestock, cowbirds, *Diorhabda* spp.]). If *Diorhabda* found, contact USFWS and State WIFL coordinator	GPS Coordinates for WIFL Detections (this is an optional column for documenting individuals, pairs, or groups of birds found on each survey). Include additional sheets if necessary.			
Survey # 1 Observer(s)	Date Start Stop Total hrs ___						# Birds	Sex	UTM E	UTM N
Survey # 2 Observer(s)	Date Start Stop Total hrs ___						# Birds	Sex	UTM E	UTM N
Survey # 3 Observer(s)	Date Start Stop Total hrs ___						# Birds	Sex	UTM E	UTM N
Survey # 4 Observer(s)	Date Start Stop Total hrs ___						# Birds	Sex	UTM E	UTM N
Survey # 5 Observer(s)	Date Start Stop Total hrs ___						# Birds	Sex	UTM E	UTM N
Overall Site Summary Totals do not equal the sum of each column. Include only resident adults. Do not include migrants, nestlings, and fledglings. Be careful not to double count individuals. Total Survey Hrs_____	Total Adult Residents	Total Pairs	Total Territories	Total Nests	Were any Willow Flycatchers color-banded? Yes___ No ___ If yes, report color combination(s) in the comments section on back of form and report to USFWS.					

Reporting Individual _____ Date Report Completed_____ _____
US Fish and Wildlife Service Permit #_____State Wildlife Agency Permit #_____

Submit form to USFWS and State Wildlife Agency by September 1st. Retain a copy for your records.

Fill in the following information completely. Submit form by September 1st. Retain a copy for your records.

Reporting Individual _____Phone # _____
Affiliation _____ E-mail _____
Site Name_____Date Report Completed _____

Did you verify that this site name is consistent with that used in previous years? Yes ____ No _____ Not Applicable ___
If site name is different, what name(s) was used in the past?_____
If site was surveyed last year, did you survey the same general area this year? Yes ____ No ____ If no, summarize below.
Did you survey the same general area during each visit to this site this year? Yes ____ No ____ If no, summarize below.

Management Authority for Survey Area : Federal____ Municipal/County ____ State ____ Tribal ____ Private ____
Name of Management Entity or Owner (e.g., Tonto National Forest) _____

Length of area surveyed: _____ (meters)

Vegetation Characteristics: Mark the category that best describes the predominant tree/shrub foliar layer at this site (check one):

_____ Native broadleaf plants (entirely or almost entirely, > 90% native, includes high-elevation willow)

_____ Mixed native and exotic plants (mostly native, 50 - 90% native)

_____ Mixed native and exotic plants (mostly exotic, 50 - 90% exotic)

_____ Exotic/introduced plants (entirely or almost entirely, > 90% exotic)

Identify the 2-3 predominant tree/shrub species in order of dominance. Use scientific name.
_____

Average height of canopy (Do not include a range): _____ (meters)

Attach copy of USGS quad/topographical map (REQUIRED) of survey area, outlining survey site and location of WIFL detections.
Attach sketch or aerial photo showing site location, patch shape, survey route, location of any WIFLs or WIFL nests detected.
Attach photos of the interior of the patch, exterior of the patch, and overall site; describe any unique habitat features.

Comments (attach additional sheets if necessary)
_____
_____
_____
_____
_____
_____

Territory Summary Table. Provide the following information for each verified territory at your site.

Territory Number	All Dates Detected	UTM N	UTM E	Pair Confirmed? Y or N	Nest Found? Y or N	Description of How You Confirmed Territory and Breeding Status (e.g., vocalization type, pair interactions, nesting attempts, behavior)

Attach additional sheets if necessary

Appendix 2. Willow Flycatcher Survey Continuation Sheet / Territory Summary Table

Always check the U.S. Fish and Wildlife Service Arizona Ecological Services Field Office web site (http://www.fws.gov/southwest/es/arizona/) for the most up-to-date version.

Willow Flycatcher Survey Continuation Sheet

(For reporting additional detections and territories; append to Survey and Detection form)

Reporting Individual _____ Phone # _____
Affiliation _____ E-mail _____
Site Name_____ Date Report Completed _____

Territory Number	All Dates Detected	UTM E	UTM N	Pair Confirmed? Y or N	Nest Found? Y or N	Description of How You Confirmed Territory and Breeding Status (e.g., vocalization type, pair interactions, nesting attempts, behavior)

Comments_____

Appendix 3. Instructions for Completing the Willow Flycatcher Survey and Detection Form and the Survey Continuation Sheet

These instructions are provided as guidance for completing the standard survey form. It is particularly important to provide the correct type and format of information for each field. Complete and submit your survey forms to both the appropriate State Willow Flycatcher coordinator and the U.S. Fish and Wildlife Service (USFWS) by September 1 of the survey year. You also may complete forms digitally (Microsoft© Word or Excel) and submit them via email with attached or embedded topographic maps and photographs.

Page 1 of Survey Form

Site Name. Standardized site names are provided by the flycatcher survey coordinators for each State and should be consistent with the naming of other sites that might be in the area. If the site is new, work with your State or USFWS flycatcher coordinator to determine suitable site names before the beginning of the survey season. If the site was previously surveyed, use the site name from previous years (which can be obtained from the State or USFWS flycatcher coordinator). If you are uncertain if the site was previously surveyed, contact your State or USFWS flycatcher coordinator.

USGS Quad Name. Provide the full quad name, as shown on the appropriate standard 7.5-minute topographic maps.

Creek, River, Wetland, or Lake Name. Give the name of the riparian feature, such as the lake or watercourse, where the survey is being conducted.

Survey Coordinates. Provide the start and end points of the survey, which will indicate the linear, straight-line extent of survey area, based on Universal Transverse Mercator coordinates (UTMs). California surveyors only: provide latitude/longitude geographic coordinates instead of UTMs in the UTM fields and identify them as such. If the start and end points of the survey changed significantly among visits, enter separate coordinates for each survey in the comments section on the back of the survey sheet. Note that we do not need the coordinates for the detailed path taken by the surveyor(s).

Datum. Indicate the datum in which the coordinates are expressed: NAD27, WGS84, or NAD83. The datum can be found in the settings of most GPS units. Note that Arizona prefers NAD27 and New Mexico prefers NAD83.

Zone. Provide the appropriate UTM zone for the site, which is displayed along with the coordinates by most GPS units. Zones for California are 10, 11, or 12. The zone for Arizona is 12. Zones for New Mexico are 12 or 13.

Survey #. Survey 1 – 5. See the protocol for an explanation of the number of required visits for each survey period. **Note:** A survey is defined as a complete protocol-based survey that occurs over no more than 1 day. If a site is so large as to require more than a single day to survey, consider splitting the site into multiple subsites and use separate survey forms for each. Casual site visits, pre-season or supplemental visits, or follow-up visits to check on the status of a territory should not be listed in this column, but should be documented in the Comments section on page 2 or in the survey continuation sheet.

Date. Indicate the date that the survey was conducted, using the format mm/dd/yyyy.

Start and **Stop.** Start and stop time of the survey, given in 24-hour format (e.g., 1600 hours rather than 4:00 p.m.).

Total hours. The duration of time (in hours) spent surveying the site, rounded to the nearest tenth (0.1) hour. For single-observer surveys, or when multiple observers stay together throughout the survey, total the number of hours from survey start to end. If two or more observers surveyed sections of the site concurrently and independently, sum the number of hours each observer spent surveying the site.

Number of Adult WIFLs. The total number of individual adult Willow Flycatchers detected during this particular survey. Do not count nestlings or recently fledged birds.

Number of Pairs. The number of breeding pairs. Do not assume that any bird is paired; designation of birds as paired should be based only on direct evidence of breeding behaviors described in the protocol. If there is strong evidence that the detected bird is unpaired, enter "0". If it is unknown whether a territorial bird is paired, enter "–". Note that the estimated number of pairs can change over the course of a season.

Number of Territories. Provide your best estimate of the number of territories, defined as a discrete area defended by a resident single bird or pair. This is usually evidenced by the presence of a singing male, and possibly one or more mates. Note that the estimated number of territories may change over the course of a season.

Nest(s) Found? Yes or No. If yes, indicate the number of nests. Renests are included in this total.

Comments about this survey. Describe bird behavior, evidence of pairs or breeding, evidence of nest building, evidence of nestlings/fledglings, nesting, vocalizations (e.g., interaction twitter calls, *whitts*, *britts*, *wheeos*, *fitz-bews*/countersinging), potential threats (e.g., livestock, cowbirds, saltcedar leaf beetles [*Diorhabda* spp.] etc.). If *Diorhabda* beetles are observed, contact your USFWS and State flycatcher coordinator immediately. Please be aware that permits are needed for nest monitoring.

GPS Coordinates for WIFL Detections. Provide the number of birds (e.g., unpaired, paired, or groups of birds) and corresponding UTMs. If known, provide the sex of individuals.

Overall Site Summary. For each of these columns, provide your best estimate of the overall total for the season. Do not simply total the numbers in each column. In some cases where consistent numbers were detected on each survey, the overall summary is easy to determine. In cases where numbers varied substantially among the different surveys, use professional judgment and logic to estimate the most likely number of adults, pairs, and territories that were consistently present. Be careful not to double count individuals. Record only territorial adult Southwestern Willow Flycatchers, do not include migrants, nestlings, or fledglings in the overall summary. In complex cases, consult with your State or USFWS flycatcher coordinator.

Total Survey Hours. The sum of all hours spent surveying the site.

Were any WIFLs color-banded? Circle or highlight "Yes" or "No". If yes, report the sighting and color combination (if known) in the comments section on back of form, and contact your USFWS coordinator within 48 hours after returning from the survey. Note that identifying colors of bands is difficult and might require follow-up visits by experienced surveyors.

Reporting Individual. Indicate the full first and last name of the reporting individual.

Date Report Completed. Provide the date the form was completed in mm/dd/yyyy format.

U.S. Fish and Wildlife Service Permit #. List the full number of the required federal permit under which the survey was completed.

State Wildlife Agency Permit #. If a State permit is required by the State in which the survey was completed, provide the full number of the State permit. State permits are required for Arizona and California. State permits are recommended for New Mexico.

Page 2 of Survey Form

Affiliation. Provide the full name of the agency or other affiliation (which is usually the employer) of the reporting individual.

Phone Number. Self-explanatory; include the area code.

E-mail. Self-explanatory.

Was this site surveyed in a previous year? Indicate "Yes", "No", or "Unknown."

Did you verify that this site name is consistent with that used in previous years? Indicate "Yes" or "No". This can be determined by checking survey forms from previous years or consulting with agency flycatcher coordinators.

If site name is different, what name(s) was used in the past? Enter the full site name that was used in previous years.

If site was surveyed last year, did you survey the same general area this year? Indicate "Yes" or "No". If no, indicate the reason and how the survey varied in the Comments section.

Did you survey the same general area during each visit to this site this year? If no, indicate the reason in the Comments section and delineate the differing route of each survey on the topographical map.

Management Authority for Survey Area. Mark the appropriate management authority.

Name of Management Entity or Owner (e.g., Tonto National Forest). Provide the name of the organization or person(s) responsible for management of the survey site.

Length of area surveyed. Estimate the linear straight-line distance of the length of the area surveyed, in kilometers. This is not an estimate of the total distance walked throughout the survey site. Do not provide a range of distances.

Vegetation Characteristics: Mark only one of the categories that best describes the predominant tree/shrub foliar layer at the site.

Native broadleaf habitat is composed of entirely or almost entirely (i.e., > 90%) native broadleaf plants.

Mostly native habitat is composed of 50–90% native plants with some (i.e., 10–50%) non-native plants.

Mostly exotic habitat is composed of 50–90% non-native plants with some (i.e., 10–50%) native plants.

Exotic/introduced habitat is composed entirely or almost entirely (i.e., > 90%) of non-native plants.

Identify the 2–3 predominant tree/shrub species in order of dominance. Identify by scientific name.

Average height of canopy. Provide the best estimate of the average height of the top of the canopy throughout the patch. Although canopy height can vary, give only a single (not a range) overall height estimate.

Attach the following: (1) copy of USGS quad/topographical map (REQUIRED) of survey area, outlining survey site and location of WIFL detections; (2) sketch or aerial photo showing site location, patch shape, survey route, location of any detected WIFLs or their nests; (3) photos of the interior of the patch, exterior of the patch, and overall site. Describe any unique habitat features in Comments. Include the flycatcher territory number and GPS location. You also may include a compact disc of photographs.

Comments. Include any information that supports estimates of total territory numbers and breeding status. You may provide additional information on bird behavior, banded birds, evidence of pairs or breeding, nesting, potential threats (e.g., livestock, cowbirds, saltcedar leaf beetles [*Diorhabda* spp.] etc.), and changes in survey length and route throughout the season. Attach additional pages or use the continuation sheet if needed.

Table. If Willow Flycatchers are detected, complete the table at the bottom of the form. Identify flycatchers by territory number and include the dates detected, UTMs, whether or not pairs were detected, and whether or not nests were located. Also describe the observation. For example, the surveyor might have observed and heard a bird *fitz-bew* from an exposed perch, heard and observed two birds interacting and eliciting a twitter call, heard a bird *fitz-bew* while observing another carrying nesting material, heard birds from territory 1 and 2 countersinging, etc. This information provides supporting information for territory and breeding status. Use the continuation sheet if needed.

Appendix 4. Example of a Completed Willow Flycatcher Survey and Detection Form (with map)

Willow Flycatcher (WIFL) Survey and Detection Form (revised April, 2010)

Site Name: **DL-08** State: **New Mexico** County: **Socorro**

USGS Quad Name: **Paraje Well** Elevation: **1,356** (meters)

Creek, River, or Lake Name: **Rio Grande**

Is copy of USGS map marked with survey area and WIFL sightings attached (as required)? ***Yes*** **X** ***No*** ____

Survey Coordinates: Start: E **306,009** N **3,715,506** UTM Datum: **NAD 83** (See instructions)

Stop: E **304,339** N **3,711,922** UTM Zone: **13**

If survey coordinates changed between visits, enter coordinates for each survey in comments section on back of this page.

*****Fill in additional site information on back of this page*****

Survey # Observer(s) (Full Name)	Date (m/d/y) Survey Time	Number of Adult WIFLs	Estimated Number of Pairs	Estimated Number of Territories	Nest(s) Found? Y or N If Yes, number of nests	Comments (e.g., bird behavior; evidence of pairs or breeding;-potential threats [livestock, cowbirds, *Diorhabda* spp.]). If *Diorhabda* found, contact USFWS and State WIFL coordinator.	GPS Coordinates for WIFL Detections (this is an optional column for documenting individuals, pairs, or groups of birds found on each survey). Include additional sheets if necessary.			
Survey # 1	Date:						# Birds	Sex	UTM E	UTM N
Observer(s):	5/24/2009						1	M	305,276	3,714,926
D. Savage	Start:						1	M	305,131	3,714,628
	5:45	5	0	5	N	Suitable breeding habitat dispersed throughout site. WIFLs were very vocal, and covering large areas. No obvious signs of pairing were observed. Approximately 10 head of cattle were found within this site.	1	M	305,191	3,714,778
	Stop:						1	M	305,394	3,715,009
	10:15						1	M	305,084	3,714,732
	Total hrs:									
	4.5									
Survey # 2	Date:						# Birds	Sex	UTM E	UTM N
Observer(s):	6/10/2009						1	M	305,276	3,714,926
S. Kennedy	Start:						1	M	305,131	3,714,628
	6:00	11	4	7	Y (3)	Portions of site are flooded, 1-2 ft deep. Two males found during 1st survey appear unpaired. Three pairs confirmed based on nesting, and another pair suspected based on vocal interactions and nonaggressive behavior with another flycatcher. Two additional territories (1 pair and 1 unpaired male) found during this survey.	2	M/F	305,191	714,778
	Stop:						2	M/F	305,394	3,715,009
	10:15						2	M/F	305,084	3,714,732
	Total hrs:						2	M/F	305,001	3,714,640
	4.3						1	M	305,010	3,714,524
Survey # 3	Date:						# Birds	Sex	UTM E	UTM N
Observer(s):	6/21/2009						1	M	305,276	3,714,926
S. Kennedy	Start:						1	M	305,131	3,714,628
	5:30	12	5	7	Y (4)	Portions of site still flooded. All territories found in Survey 2 are still active. The two males found during Surveys #1 and #2, still believed to be unpaired. All other territories are believed to be paired. Several cows observed in vicinity of active territories.	2	M/F	305,191	3,714,778
	Stop:						2	M/F	305,394	3,715,009
	10:00						2	M/F	305,084	3,714,732
	Total hrs:						2	M/F	305,001	3,714,640
	4.5						2	M/F	305,010	3,714,524
Survey # 4	Date:						# Birds	Sex	UTM E	UTM N
Observer(s):	7/1/2009						1	M	305,276	3,714,926
D. Moore	Start:						1	M	305,131	3,714,628
	6:00	12	5	7	Y (4)	Site is no longer flooded, but saturated soils persist throughout most of site. No change in territory numbers or status. All SWFL pairs very quiet - only a few whits and fitz-bews. Light rain over night, vegetation was saturated early in the morning. Lots of mosquitos!	2	M/F	305,191	3,714,778
	Stop:						2	M/F	305,394	3,715,009
	10:00						2	M/F	305,084	3,714,732
	Total hrs:						2	M/F	305,001	3,714,640
	4.0						2	M/F	305,010	3,714,524
Survey # 5	Date:						# Birds	Sex	UTM E	UTM N
Observer(s):	7/10/2009						1	M	305,131	3,714,628
D. Moore	Start:						2	M/F	305,191	3,714,778
	5:30	11	5	6	Y (4)	Site beginning to dry out, some portions still muddy. One of the unpaired males could not be detected. It was hard to hear SWFLs due to breezy conditions early in the morning.	2	M/F	305,394	3,715,009
	Stop:						2	M/F	305,084	3,714,732
	10:00						2	M/F	305,001	3,714,640
	Total hrs:						2	M/F	305,010	3,714,524
	4.5									
Overall Site Summary		Total Adult Residents	Total Pairs	Total Territories	Total Nests	Were any WIFLs color-banded? Yes ____ No **X**				
Totals do not equal the sum of each column. Include only resident adults. Do not include migrants, nestlings, and fledglings. Be careful not to double count individuals.		12	5	7	4	If yes, report color combination(s) in the comments section on back of form and report to USFWS.				
Total survey hrs:	21.8									

Reporting Individual: **Darrell Ahlers** Date Report Completed: **8/20/2009**

US Fish & Wildlife Service Permit #: **TE819475-2** State Wildlife Agency Permit #: **N/A**

Submit ***form to USFWS and State Wildlife Agency by September 1st. Retain a copy for your records.***

Fill in the following information completely. Submit form by September 1st. Retain a copy for your records.

Reporting Individual **Darrell Ahlers** Phone # **(303) 445-2233**

Affiliation **Bureau of Reclamation** E-mail dahlers@usbr.gov

Site Name **DL-08** Date report Completed **8/20/2009**

Was this site surveyed in a previous year? Yes__**x**__ No____ Unknown____

Did you verify that this site name is consistent with that used in previous yrs? Yes **x** No _____ Not Applicable _____

If name is different, what name(s) was used in the past? **Not applicable**

If site was surveyed last year, did you survey the same general area this year? Yes **x** No _____ If no, summarize below.

Did you survey the same general area during each visit to this site this year? Yes **x** No _____ If no, summarize below.

Management Authority for Survey Area: Federal **X** Municipal/County _____ State _____ Tribal _____ Private _____

Name of Management Entity or Owner (e.g., Tonto National Forest) **Bureau of Reclamation**

Length of area surveyed: **2.5** (km)

Vegetation Characteristics: Check (only one) category that best describes the predominant tree/shrub foliar layer at this site:

_____ Native broadleaf plants (entirely or almost entirely, > 90% native)

X Mixed native and exotic plants (mostly native, 50 - 90% native)

_____ Mixed native and exotic plants (mostly exotic, 50 - 90% exotic)

_____ Exotic/introduced plants (entirely or almost entirely, > 90% exotic)

Identify the 2-3 predominant tree/shrub species in order of dominance. Use scientific name.

Salix Gooddingii, Populus spp., Tamarix spp.

Average height of canopy (Do not include a range): **6** (meters)

Attach the following: 1) copy of USGS quad/topographical map (REQUIRED) of survey area, outlining survey site and location of WIFL detections;
2) sketch or aerial photo showing site location, patch shape, survey route, location of any detected WIFLs or their nests;
3) photos of the interior of the patch, exterior of the patch, and overall site. Describe any unique habitat features in Comments.

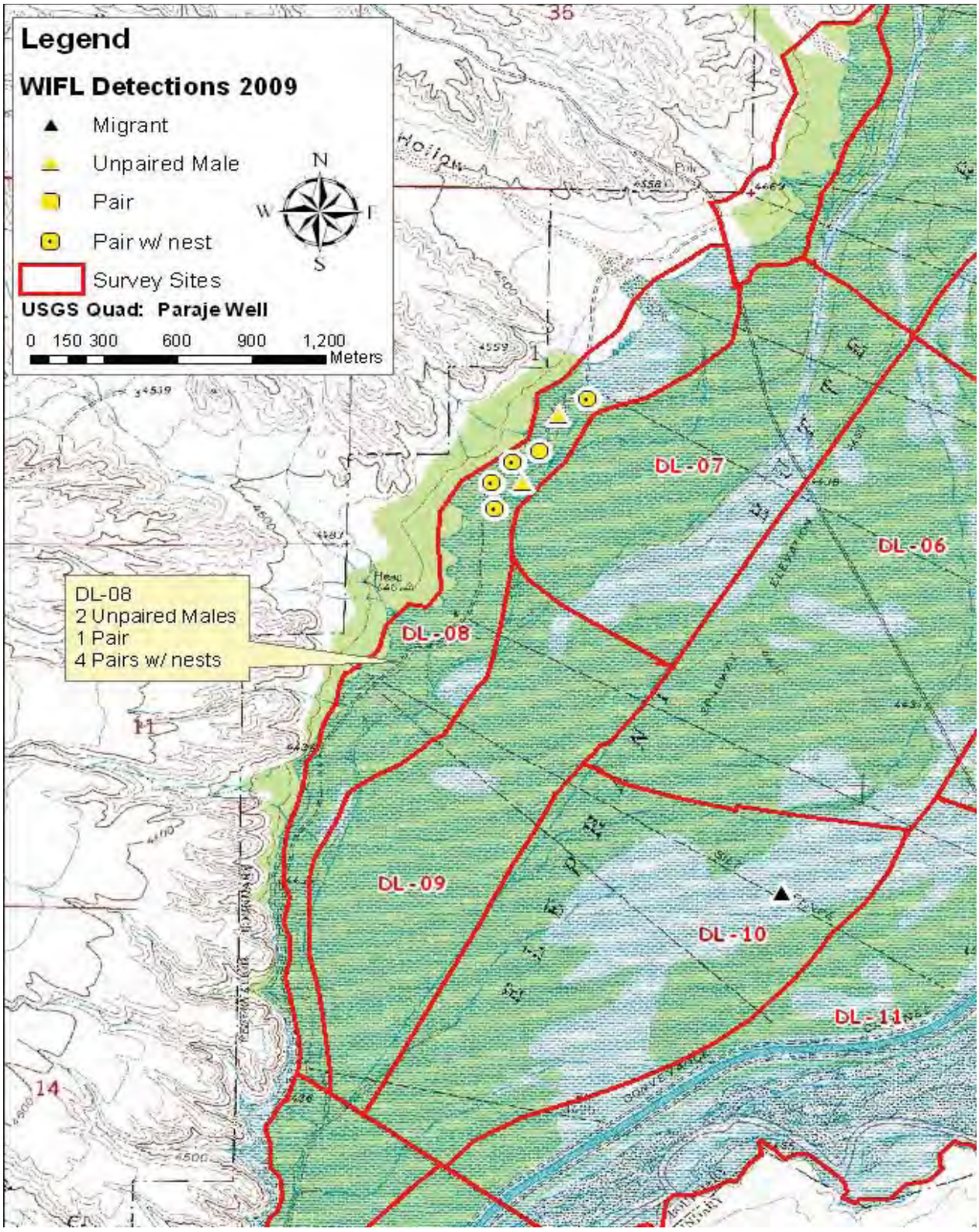
Comments (such as start and end coordinates of survey area if changed among surveys, supplemental visits to sites, unique habitat features. Attach additional sheets if necessary.

Great habitat with saturated or flooded soils throughout most of the site on 1st survey. Site began to dry by the end of the breeding season. SWFL territories are dominated by Gooddings willow, however Tamarix spp. tends to be increasing in density compared to previous years. Site is supported by flows from the Low Flow Conveyance Channel.

Territory Summary Table. Provide the following information for each verified territory at your site.

Territory Number	All Dates Detected	UTM E	UTM N	Pair Confirmed? Y or N	Nest Found? Y or N	Description of How You Confirmed Territory and Breeding Status (e.g., vocalization type, pair interactions, nesting attempts, behavior)
1 (Unpaired male)	5/24, 6/10,6/21,7/1	305,276	3,714,926	N	N	extended presence at site from 5/24 through 7/1, no evidence of pairing
2 (Unpaired male)	5/24, 6/10,6/21,7/1, 7/10	305,131	3,714,628	N	N	extended presence at site from 5/24 through 7/10, no evidence of pairing
3 (Pair)	5/24, 6/10,6/21,7/1, 7/10	305,191	3,714,778	Y	Y	Pair confirmed based on vocalizations and observation of unchallenged WIFL
4 (Pair w/nest)	5/24, 6/10,6/21,7/1, 7/10	305,394	3,715,009	Y	Y	Confirmed breeding status with nest
5 (Pair w/nest)	5/24, 6/10,6/21,7/1, 7/10	305,084	3,714,732	Y	Y	Confirmed breeding status with nest
6 (Pair w/nest)	6/10,6/21,7/1, 7/10	305,001	3,714,640	Y	Y	Confirmed breeding status with nest
7 (Pair w/nest)	6/10,6/21,7/1, 7/10	305,010	3,714,524	Y	N	Confirmed breeding status with nest

Attach additional sheets if necessary


Legend
WIFL Detections 2009
Migrant
Unpaired Male
Pair
Pair w/ nest
Survey Sites
USGS Quad: Paraje Well
0 150 300 600 900 1,200
Meters
N
W
E
S
DL-08
2 Unpaired Males
1 Pair
4 Pairs w/ nests
DL-07
DL-06
DL-08
DL-09
DL-10
DL-11
35
14

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Appendix B

Completed Southwestern Willow Flycatcher Survey and Detection Forms

Willow Flycatcher (WIFL) Survey and Detection Form (revised April 2010)

Site Name_____**Paria River**_____ State_**UT**___ County _____**Kane**_____
USGS Quad Name ____Smokey Mountain_____ Elevation ___1341_____ (meters)
Creek, River, Wetland, or Lake Name_____Paria River_____
Is copy of USGS map marked with survey area and WIFL sightings attached (as required)? Yes_X__ No____

Survey Coordinates: Start: E__419191_____ N___4107664_____ UTM Datum__NAD 83___(See instructions)
Stop: E__419552_____ N___4106756_____ UTM Zone ___12___
If survey coordinates changed between visits, enter coordinates for each survey in comments section on back of this page.

***** Fill in additional site information on back of this page *****

Survey # / Observer(s) (Full Name)	Date (m/d/y) Survey time	Number of Adult WIFLs	Estimated Number of Pairs	Estimated Number of Territories	Nest(s) Found? Y or N / If Yes, number of nests	Comments (e.g., bird behavior; evidence of pairs or breeding; potential threats [livestock, cowbirds, *Diorhabda* spp.]). If *Diorhabda* found, contact USFWS and State WIFL coordinator	GPS Coordinates for WIFL Detections (this is an optional column for documenting individuals, pairs, or groups of birds found on each survey). Include additional sheets if necessary.			
Survey # 1 Observer(s) **J. Cleland** **A. Davis**	Date 5.18.10 Start 0517 Stop 0811 Total hrs 4.5	**1**	**0**	**1**	**N**	WIFL followed observer through habitat. BHCO present	# Birds	Sex	UTM E	UTM N
							1	M	419073	4107541
Survey # 2 Observer(s) **S. Stump** **A. Davis**	Date 6.8.10 Start 0600 Stop 0802 Total hrs 3.3	**0**	**0**	**0**	**N**	BHCO present	# Birds	Sex	UTM E	UTM N
Survey # 3 Observer(s) **S. Stump** **A. Davis**	Date 6.18.10 Start 0717 Stop 0901 Total hrs 2.6	**0**	**0**	**0**	**N**	BHCO present	# Birds	Sex	UTM E	UTM N
Survey # 4 Observer(s) **S. Stump** **J. Cleland**	Date 7.1.10 Start 0559 Stop 0720 Total hrs 2.2	**0**	**0**	**0**	**N**	BHCO present	# Birds	Sex	UTM E	UTM N
Survey # 5 Observer(s) **S. Stump** **J. Cleland**	Date 7.16.10 Start 0711 Stop 0830 Total hrs 2.4	**0**	**0**	**0**	**N**	BHCO present	# Birds	Sex	UTM E	UTM N

Overall Site Summary Totals do not equal the sum of each column. Include only resident adults. Do not include migrants, nestlings, and fledglings. Be careful not to double count individuals. Total Survey Hrs___15___	Total Adult Residents	Total Pairs	Total Territories	Total Nests	Were any Willow Flycatchers color-banded? Yes___ No _X_ If yes, report color combination(s) in the comments section on back of form and report to USFWS.
	0	**0**	**0**	**0**	

Reporting Individual _Shaylon Stump_____ Date Report Completed____8/5/10_____
US Fish and Wildlife Service Permit #__TE0066552_____State Wildlife Agency Permit #__SP733970_____
Submit form to USFWS and State Wildlife Agency by September 1st. Retain a copy for your records.

Fill in the following information completely. Submit form by September 1st. Retain a copy for your records.

Reporting Individual __Shaylon Stump_____Phone # __480-967-1343_____
Affiliation __Logan Simpson Design _____ E-mail _sstump@logansimpson.com___
Site Name__Paria River_____Date Report Completed __8/5/10_____
Was this site surveyed in a previous year? Yes___ No ___ Unknown _X__
Did you verify that this site name is consistent with that used in previous years? Yes ____ No _X__ Not Applicable ___
If site name is different, what name(s) was used in the past?_____
If site was surveyed last year, did you survey the same general area this year? Yes ____ No ____ If no, summarize below.
Did you survey the same general area during each visit to this site this year? Yes _X__ No ____ If no, summarize below.

Management Authority for Survey Area: Federal____ Municipal/County ____ State ____ Tribal ____ Private _X__
Name of Management Entity or Owner (e.g., Tonto National Forest) _____

Length of area surveyed: ___0.08_____ (km)

Vegetation Characteristics: Check (only one) category that best describes the predominant tree/shrub foliar layer at this site:

_____ Native broadleaf plants (entirely or almost entirely, > 90% native)

_____ Mixed native and exotic plants (mostly native, 50 - 90% native)

_X__ Mixed native and exotic plants (mostly exotic, 50 - 90% exotic)

_____ Exotic/introduced plants (entirely or almost entirely, > 90% exotic)

Identify the 2-3 predominant tree/shrub species in order of dominance. Use scientific names. *Tamarisk* sp., *Populus fremontii, Salix goodingii*_____

Average height of canopy (Do not include a range): ____4_____ (meters)

Attach the following: 1) copy of USGS quad/topographical map (REQUIRED) of survey area, outlining survey site and location of WIFL detections; 2) sketch or aerial photo showing site location, patch shape, survey route, location of any detected WIFLs or their nests; 3) photos of the interior of the patch, exterior of the patch, and overall site. Describe any unique habitat features in Comments.

Comments (such as start and end coordinates of survey area if changed among surveys, supplemental visits to sites, unique habitat features. Attach additional sheets if necessary.
_____
_____
_____
_____
_____
_____

Territory Summary Table. Provide the following information for each verified territory at your site.

Territory Number	All Dates Detected	UTM E	UTM N	Pair Confirmed? Y or N	Nest Found? Y or N	Description of How You Confirmed Territory and Breeding Status (e.g., vocalization type, pair interactions, nesting attempts, behavior)

Attach additional sheets if necessary

Appendix C

Yellow-billed Cuckoo Draft Survey Protocol 2010

Standard Operating Procedure (SOP) #3: Conducting Yellow-billed Cuckoo Surveys

DRAFT May 24, 2010

This Standard Operating Procedure (SOP) #3 describes materials and procedures for conducting surveys to detect yellow-billed cuckoos in targeted sites in the Western United States using a version of the call-playback technique (Johnson et al. 1981). Data collected are structured to facilitate incorporation into a range-wide database. Topics covered in this SOP include: 1) a brief overview of the survey design; 2) procedures to conduct prior to conducting surveys; 3) procedures for conducting the surveys; and, 4) procedures to conduct after the surveys. Descriptions include how to collect data and fill in the "Yellow-billed Cuckoo Survey Data Form" (Appendix A). Appendix B lists all the codes for use in completing the data forms. If you are unable to adhere to the methods detailed in this SOP, contact your local ecological services office for guidance.

3.1 Definitions

The following definitions refer to the terms used in this SOP:

- **Survey:** **1.** A year's effort (during one breeding season) conducting broadcast-point counts along transects to determine presence, absence, or estimate number of cuckoos, within a given area. **2.** The act of conducting broadcast-point counts for yellow-billed cuckoo detections.

- **Survey Period:** A period of time during which areas included in the survey should be surveyed.

- **Survey Visit #:** A set of consecutive integers that denotes the number of times a particular site and transect has been **surveyed** for yellow-billed cuckoos within a year (i.e., directly prior to, and/or during one breeding season). Only one survey visit is required per survey period but multiple survey visits can be made (as long as they are not conducted within the minimum days required between surveys), depending on survey objectives.

- **Visit #:** A set of consecutive integers that denotes the number of times a particular site and transect has been visited within a year (i.e., directly prior to, and/or during one breeding season), **including both survey visits and non-survey follow-up visits.** Only one survey visit is required per survey period but depending on survey objectives, multiple survey visits can be made (as long as they are not conducted within the required minimum number of days between surveys), depending on survey objectives.

- **Follow-up Visit:** A visit to a site that does not involve conducting a survey. Follow-up visits can include visits to the site to conduct nest searching and monitoring, behavioral observations, habitat sampling, and other non-survey activities.

- **Site:** An area where cuckoos are surveyed. A site may include more than one transect (for example, an area of riparian vegetation that is very wide and requires multiple transects for adequate coverage).

- **Transect:** One or more points where broadcast-point counts are conducted in a survey visit; transects need not be linear.

- **Broadcast-point count:** The act of broadcasting the recorded *kowlp* call five times, after a minute waiting-period and with a minute in-between each broadcast, and recording the number and type(s) of yellow-billed cuckoo detections made. A transect consists of one or more broadcast-points where counts of detections are made.

- **Detection:** An observation of a yellow-billed cuckoo, made visually or aurally.

3.2 Equipment

Table SOP 3.1. List of necessary items for conducting yellow-billed cuckoo surveys.

Number Required per Surveyor	Item Description
1	Binoculars
1	GPS unit with extra batteries; with start and stop points entered
1	Broadcast equipment (e.g., MP3 player, CD player, and speakers) capable of broadcasting recorded calls at least 100 m without distortion, extra batteries.
1	Recorded "kowlp" calls (available from M. Halterman)
1	Map and/or aerial photo of survey area
1	Device to record time (GPS unit or watch)
1	Laser Rangefinder (optional)
1	Hard copy of start and stop point UTMs
1	Compass
1	Clipboard with data forms
3-6	Pens, Pencils, and Sharpies
1	Radio
1	Copies of required permit(s)

3.4 Within-Site Survey Spatial Design

Methods for selecting sites to be surveyed for yellow-billed cuckoos are detailed in SOP #2. Here we discuss within-site establishment of transects. Sampling is similar to a census sampling design, in that the entire area that constitutes a site is sampled/surveyed. Therefore, within a site, all potentially suitable habitat should be surveyed, with transects placed in the habitat when it exceeds 200 m in width. Within-site areas of unsuitable habitat (e.g., an extensive gravel bar, a patch of low, non-woody vegetation, an extensive tamarisk monoculture below head-height) that are 300 m long (measured running the direction of the transect, generally parallel to the drainage), can be excluded from the transect. That is, the surveyor can skip over areas of unsuitable habitat between patches of suitable habitat while surveying along a transect.

Broadcast-points along a transect do not need to be established directly within the habitat, but should be no more than 10 m from the edge of the habitat to be surveyed. Areas that are not

accessible by foot can be surveyed by boat, as long as the route taken by the boat enables surveying all suitable habitat at the site. For example, small, narrow stringers (less than or equal to 200 m wide) of habitat, and backwater sloughs can be surveyed from a boat. When surveying by boat, the surveyor should employ, as closely as possible, the same methods for surveying as described below.

A transect consists of a starting point (in Universal Transverse Mercator, UTM) an ending point, and points in-between. The start and end points of a transect are established prior to, or during, the initial survey visit to a site, and these same start and end points are used in subsequent survey visits. Points in-between can consist of established locations that are surveyed repeatedly, or "new" points within the site, where the surveyor covers the site, but does not conduct broadcast-point counts at the exact same location on each visit. In practice, we have found that the latter methods works best, primarily because the distance between points on a particular visit depends on whether a cuckoo is detected at a point, and whether an unsolicited detection is made, necessitating the surveyor travel 300 m before conducting a subsequent broadcast-point count. In general, the direction of the transect is determined based on logistical considerations (e.g., travel time required to reach the first point). But, for surveys that cover an extensive area and take several hours, the surveyor should consider reversing the direction of the route so that areas surveyed after 0900 in one visit are covered earlier than 0900 during the subsequent visit.

3.5 Design of Survey Methods

Survey methods consist of broadcast-point counts, a version of the call-playback technique described by Johnson et al. (1981), recommended for the detection of secretive species. This technique increases the detectability of species that occur in low densities or in dense vegetation (Johnson et al. 1981, Sogge et al. 1997). Surveys should be conducted using a recording of a cuckoo's *Kowlp* call, (sometimes referred to as the "contact" or "series" call; available from M. Halterman), using a device powerful enough to broadcast the call approximately 100 m through vegetation. In practice, this requires using the highest volume possible without distortion.

To conduct a survey, stops are made at broadcast-points spaced every 100 m within, or along the edge of, suitable habitat (see section 3.4, above). A handheld GPS unit should be used to record the UTM coordinates of the starting point and ending point of each transect through a patch. These same starting point and stopping points should be used every time a transect is surveyed. In addition, the UTM coordinates of each broadcast-point should be recorded, each time a transect is surveyed. The surveyor arrives at the broadcast-point and waits one minute to listen for unsolicited cuckoo calls (i.e., cuckoos that may be calling before broadcast of the recorded calls). After the brief listening period, five *Kowlp* calls, each spaced one minute apart, are played to elicit responses. After each broadcasted call, in the intervening minute, the surveyor listens and watches carefully for cuckoos responding to the broadcast (making sure to look out for birds silently flying in towards the broadcast-point; these can be missed while filling in a data sheet, or otherwise distracted).

When a cuckoo is detected at a broadcast-point, the broadcast is terminated as playing the recording once a bird is detected may be harassment and may negatively affect breeding behavior or nest success. The UTM coordinates, time of detection, estimated distance, and compass direction to the cuckoo, type of vocalization, estimated breeding status, and behavior are recorded. The surveyor does not broadcast calls when a cuckoo is encountered between survey points. Once all of the information is recorded, the surveyor then moves 300 m further along the transect before conducting the next broadcast-point count, to avoid detecting the same cuckoo.

While it is unusual for cuckoos to move 300 m after being detected by a surveyor (Halterman 2009), the surveyor should be aware of the possibility, attempt to track an individual's movements, and use their judgment to estimate if they have detected separate individuals or whether the detections are likely the same individual. All observations regarding individual movements, and reasoning used in determining number of individuals should be recorded under the comment section of the datasheet.

If a cuckoo is encountered between broadcast-points (i.e., an unsolicited detection is made while traveling to, from, or between broadcast-points), the surveyor stops and records all information in the same manner as if the detection was made at a survey point (the surveyor records the UTM coordinates of their location, the distance and direction to the detected individual, and any behavior). The surveyor then travels 300 m before conducting the next broadcast-point. The surveyor listens for one minute for the previous, unsolicited cuckoo to call, then continues the survey as described above.

Breeding status of cuckoos can sometimes be determined using a combination of behavior and vocalizations. While it is not possible to determine the breeding status of most cuckoos detected, detailed field notes on calls and behavior can provide important clues for future determinations. Therefore, when a cuckoo is detected, the surveyor records the type of call, or series of calls given (as described in Table SOP 3.8, below), and any breeding behavior. In addition, all observations are recorded in detail (e.g., whether foraging, prey items, interactions among individuals, tree species, vegetation type, etc.), in the comments/observation section of the data sheet.

Surveys should be conducted from sunrise until temperatures reach 40 degrees C (104 F), or until 1200, whichever comes first. Surveys should not be conducted if sustained winds exceed 10 mph (Beaufort = 3) with stronger gusts, or if it is raining hard enough to make hearing difficult. Depending on project objectives, additional evening surveys can be conducted from 1700 to 1930. Surveys should not be conducted if excessive noise (i.e. construction, powerboats, jet skis, etc.) might prevent detection of cuckoos.

Standardized forms should be used during surveys (Appendix A). The forms are designed to be used to record data for a transect. New datasheets should be used for each transect of broadcast-points surveyed. There is one page for completing general information and for data gathered at the initial broadcast-point. The back of this form is used for writing observations and comments. Use an additional data sheet for transects that include more broadcast-points than can be accommodated on the initial "Yellow-billed Cuckoo Survey Data Form (2009)". Be sure to mark the continuation box, and fill out the top line of the form (i.e., Site Code, Site Name, etc.). Crews should be instructed on how to properly record information on the forms and how to correctly describe cuckoo behavior and vocalizations, as described below.

3.6 Survey Schedule

Prior to the field season, we suggest developing a sampling schedule for the field season, based on the survey periods (Table SOP 3.2) and the number and extent of sites to be surveyed. Yellow-billed cuckoo surveys should be scheduled to begin after a thorough training session. Initiation of sampling is tailored to the phenology of the yellow-billed cuckoo in the study region, and is generally timed to begin after migrant individuals have arrived, presumably to breed, within the region. Each survey site is visited a minimum of four times within the breeding

season, with a minimum of 12 days between surveying at a particular site, and a maximum of 20 days between surveys.

Table SOP 3.2. List of yellow-billed cuckoo survey periods.

Survey Period	Time Period	Survey Requirements
Pre-Survey	late May to mid-June	Optional
Survey 1	mid-June to late June	Required
Survey 2	early July to mid-July	Required
Survey 3	mid-July to late July	Required
Survey 4	early August to mid-August	Required
Survey 5	mid-August to mid-September	Optional

3.7 Procedures for the Evening Prior to Going into the Field for Surveying

- **Determine which site(s) will be surveyed in which order:** We suggest that surveyors maintain a schedule of survey sites to be sampled, and consult the schedule to determine the site(s) to be sampled on a particular day.
- **Confirm Transect Starting and Stopping Points UTM coordinates:** Make certain that your UTM coordinates for the transect's starting point and stopping point for each transect to be surveyed are in the GPS unit. As a backup, bring a written list of UTM X and UTM Y coordinates for each point, as this information can be entered manually into the GPS unit.
- **Set a time for departure:** Sampling occurs in the morning, beginning from sunrise until temperatures reach 40 degrees C (104 F), or until 1200, whichever comes first. Estimate how long it will take (for each crew member) to arrive at their transect's starting point in order for the broadcast-point to be sampled near sunrise. Know the direction and estimate the time it will take to get to the first point by driving and walking, possibly in the dark. Then establish a departure time for the following morning that will ensure arrival at the starting point at sunrise.
- **Consult weather reports:** Canceling surveys during the breeding season is rare, but strong storms can occur. Unless there are extreme conditions predicted for the morning surveys (i.e., strong winds and/or heavy rain), we recommend that surveyors attempt to conduct a survey. **Counts should not be conducted if wind strength on the Beaufort scale is a sustained 3 or greater** (see Table SOP3.4), **or if it is raining hard** (precipitation code ≥2 in Table SOP3.5). If strong winds and/or heavy rain are extremely likely, cancel the sampling for the day and try again on the next day.

3.8 Procedures Immediately Prior to Conducting a Survey Transect

As you arrive at the starting point, do the following things as you approach the point:

- **Assess the weather:** Surveys should not be conducted if wind strength on the Beaufort scale is a sustained 3 or greater (see Table SOP 3.4), or if it is raining hard (precipitation code ≥2 in Table SOP 3.5). If you encounter these conditions, wait until the weather

improves or, if adverse conditions are likely to continue for over 2 hours, cancel the survey for the day, and try again on another day.

3.9 Procedures for Starting the Yellow-billed Cuckoo Survey

Arrive at the broadcast-point and wait one minute to listen for unsolicited cuckoo calls (i.e., cuckoos that may be calling before broadcast of the calls). During this time, fill in the general information and survey conditions at the top of the "Yellow-billed Cuckoo Survey Data Form (2009).

1. General Information. Fill out relevant information at the top of the "Yellow-billed Cuckoo Survey Data Form (2009)". Information includes:

- **Non-survey Detection:** Check this box if the data form is used to describe a detection made outside of a survey (e.g., when doing habitat sampling, or hiking to the survey area).
- **Site Code:** Letter code that denotes a particular site.
- **Site Name:** Write the full name of the site to be surveyed.
- **Transect #:** Enter if applicable (if there is more than one transect at the site).
- **Survey Period:** The survey period in which the survey is being conducted, as defined in the protocol.
- **Visit #:** In many cases, this will be the same as the survey period, as most sites will be surveyed only once during a survey period. If more than one survey is conducted within one or more survey periods, number the visits sequentially, from the start of the survey season to the end.
- **Date:** The month (mm) / day (dd) / year (yyyy) the survey is conducted.
- **Drainage:** The name of the river, stream, or drainage where the site is located.
- **Habitat:** The habitat classification that applies to the site as a whole, as defined in Table SOP 3.3.
- **GPS #:** Individual identification number of the GPS unit being used.
- **Transect Start Time (hhmm):** Write in the time of the start of the initial broadcast-point count (at the transect starting point) using the hour and minute format using military time. Fill in all four digits. Examples are 0630 (6:30 am), 0802 (8:02 am).
- **UTM Start:** Enter the UTM Easting (E) and Northing (N) for the transect starting point.
- **Data Collected in Zone:** Record the zone that the GPS data is collected in.
- **Data Collected in NAD:** Record the NAD that the GPS data is collected in (e.g., 83).
- **GPS Accuracy of Start and Stop:** The accuracy of the GPS reading for the UTMs, recorded in meters.
- **Observer:** Record your first initial and last name.

Table SOP 3.3. List of yellow-billed cuckoo habitat classifications

Habitat Class	Definition
Native Habitat	Sites containing > 75% canopy cover comprised of native tree species
Mixed Native Habitat	Sites containing 51-75% canopy cover comprised of native tree species
Mixed Exotic Habitat	Sites containing 51-75% canopy cover comprised of exotic tree species
Exotic Habitat	Sites containing > 75% canopy cover comprised of exotic tree species

2. Survey Conditions. The following information must be filled in for each transect, using the codes provided in tables 3.3, 3.4, and 3.5. In order to record the average conditions during a survey transect, record this information at the start of the transect, and assess and make any changes when you finish the last broadcast-point count of the transect.

- **Wind (0-6):** Record the wind code (0 through 6; Table SOP 3.4) as it applies to the strength of the wind during the transect. Record the average wind condition, not the maximum condition (e.g., periods of gusty winds).
- **Cloud Cover (0-100):** Ocular estimate of the percent cloud cover, rounded off to the nearest 10 percent. This should be a number between 0 (no clouds) and 100 (complete overcast). If there are patches of clouds in different areas of the sky, try to image gathering all of them together into one part of the sky and recording what percent of cloud cover that would represent.
- **Precip(itation) (0-5):** Record the appropriate code (0 through 5; Table SOP 3.5).
- **Noise (0-3):** Record the noise code (0-3; Table SOP 3.6) that applies to background noise conditions during the transect, as it relates to your ability to hear cuckoos. Record the average noise conditions, not the maximum condition.
- **Temp(erature):** Record the ambient temperature, in Fahrenheit.

Table SOP 3.4. Wind Codes. Beaufort scale used to record wind strength during surveys.

Wind Code	Explanation
0	calm, smoke rises vertically (< 2 km/h)
1	smoke drifts (2-5 km/h)
2	light breeze felt on face, leaves rustle (6-12 km/h)
3	leaves and twigs in constant motion (13-19 km/h)
4	small branches move, raises loose paper, dust rises (20-29 km/h)
5	fresh breeze, small trees sway (30-39 km/h)
6	strong breeze, large branches moving, wind whistling (40-50 km/h)

Table SOP 3.5. Precipitation Codes. Used to record precipitation codes during surveys.

Precipitation Code	Explanation
0	no precipitation
1	mist or fog
2	light drizzle
3	light rain
4	heavy rain; difficult to hear birds; discontinue count
5	snow

Table SOP 3.6. Noise Codes. Used to record level of background noise as it affects observer's ability to hear cuckoos.

Noise Code	Explanation
0	quiet; no interference
1	low noise; might be missing some calls of distant birds
2	medium noise; detection radius is probably substantially reduced
3	high noise; probably detecting only the loudest/closest birds

3.10 Procedures for Conducting the Broadcast-Point Counts

1. General survey procedures. Survey data are collected as described in the following procedures.

- Arrive at the broadcast-point and wait one minute, and fill in the broadcast-point start time, GPS accuracy, and the point's UTM coordinates.
- **Broadcast-Point Start Time (hhmm):** Write in the time of the start of the individual broadcast-point count (when the first of five broadcasts is started), using the hour and minute format using military time. Fill in all four digits. Examples are 0630 (6:30 am), 0802 (8:02 am).
- **GPS Accuracy:** The accuracy of the GPS readings when recording the UTM coordinates, in meters.
- **UTM Coordinates:** Enter the UTM Easting (E) and Northing (N) for the survey starting point.
- Broadcast five *Kowlp* calls, each spaced one minute apart. After each broadcasted call, in the intervening minute, listen and watch carefully for cuckoos responding to the broadcast.
- If no cuckoo is detected at the broadcast-point, continue 100 m along the transect and start a new broadcast-point count as described in the steps immediately above.
- Use additional datasheets, "Continued Survey Data Form", for additional broadcast-point counts within a transect. Use the backside of each datasheet to record observations and comments, linking the data by recording the "note #" in the right column of the survey data table on the front of the datasheet, and on the backside of the datasheet along with the corresponding observations and comments.

2. Procedures when a cuckoo is detected during a broadcast-point count

- When a cuckoo is detected at a point, terminate the broadcast. **Do not continue to play the recording once a cuckoo is detected.** Record the following information:
- **YBCU Detection #:** When a cuckoo is detected, record a unique number for the detection. If it is the first detection of the survey visit, the detection number is "1". If more than one cuckoo is detected at the point, record the second detection in the next row on the data sheet, and record the detection number as "2". In the columns to the left (Broadcast-Point Start Time, GPS accuracy, UTM coordinates) record "" to denote that these values are the same as those in the row directly above. Also, if more than one cuckoo is detected at a point, be sure to thoroughly describe your observations on the backside of the datasheet as described under "Note #", below.
- **Total # Detected:** Record the total number of cuckoos detected from the point.
- **Time of Detection:** Record the time that the cuckoo was detected, using the hour and minute format using military time. Fill in all four digits.
- **Detection Type (Det type):** Record how the cuckoo was detected; A = Audio, V = Visual, or B = Both. If the cuckoo was detected both by sight and sound (i.e., "B"), write in parenthesis the order in which the type of detections occurred. For example, "B (A/V), and describe the detection(s) under "Note #" as detailed below.
- **Compass Bearing (°):** Record the estimated compass bearing, in degrees, to the detected cuckoo. The compass declination should be set to zero.
- **Estimated Distance (Est. Dist (m)):** Record the horizontal distance in meters between the broadcast point (where you are standing), and the location or presumed location of the cuckoo where you first detect it.
- **Accuracy of Estimate (Est. Accuracy):** Indicate some kind of relative accuracy of your estimate using the codes shown in Table SOP 3.7.

- **Vocalizations (codes):** Record the appropriate code (see Table SOP 3.8), or series of codes for the calls heard when you made the detection.
- **Breeding code:** Record the appropriate breeding behavior code(s), for the behavior observed using the codes in Table SOP 3.8.
- **Note #:** To record observations of cuckoo detections, or other note-worthy information, first record a sequential number, starting with the number 1 for the first observation of the survey, in the row pertaining to the broadcast - point in which the observation was made. Flip the data form to the back, write the note number, and record detailed notes regarding your observations.
- After making observations and recording information regarding the detection(s), move 300 m further along the transect before conducting the next survey broadcast, to avoid detecting the same cuckoo. While it is unusual for cuckoos to move 300 m after being detected by a surveyor, the surveyor should be aware of the possibility, attempt to track an individual's movements, and use their judgment to estimate if they have detected separate individuals or whether the detections are likely of the same individual. All observations regarding individual movements, and reasoning used in determining number of individuals should be recorded under the note section of the datasheet (on the back of the data sheet).

Table SOP 3.7. Codes for quantifying the degree of accuracy in estimating the distance to a detected cuckoo.

Accuracy Code	Explanation
1	Measured distance, using laser rangefinder or pacing, to a known location.
2	Measured distance, using laser rangefinder or pacing, to an estimated location.
3	Estimated location of detection and distance, feel confident it was within **25 m** of true location.
4	Estimated location of detection and distance, feel confident it was within **50 m** of true location.
5	Estimated location of detection and distance, feel confident it was within **100 m** of true location.
6	Little confidence in your estimate, a complete "guesstimate".

Table SOP 3.8. Codes for describing cuckoo call(s) made during the detection.
Descriptions of calls taken from Hughes (1999).

Call Code	Explanation
COO	*coo* call, generally comprised of 5-11 soft, repeated cooing notes: *coo-coo-coo-coo-coo-coo-coo-coo*
CON	Contact call, includes both *Kowlp* and *Kuk* calls. *Kowlp* call is the call we play during the point-broadcast. Generally consists of 8-12 gutteral, wooden-sounding syllables: *ka-ka-ka-ka-ka-kow-kow-kowlp-kowlp-kowlp-kowlp*. *Ka* syllables given more rapidly; *kowlp* syllables more deliberately, and with longer intervals. *Kuk* call is distinct from alarm call
ALA	Alarm call, a sharp "knock"

Table SOP 3.9. Breeding behavior codes.

Code	Explanation
CN	Carrying nesting material (e.g., stick, twig).
NB	Nest building seen at actual nest site.
DD	Distraction displays. Defense of unknown nest or young or injury feigning. Used if adult bird is seen trying to lead people away from nest or young. Does not include agitated behavior.
US	Used nest with (blue/green) eggshells found. Use only when identification is unmistakable.
FL	Recently fledged young of species incapable of sustained flight.
ON	Occupied nest indicated by adult entering or leaving nest in circumstances indicating an occupied nest, including those in high trees, where the contents of the nest and incubating brood cannot be seen.
CF	Adults seen carrying food.
FY	Adults feeding recently fledged young.
FS	Adult carrying fecal sac.
NE	Nest with eggs found. Be careful with identification unless you see adult.
NY	Nest with young seen or heard. Use when you see or hear the young.

3. Procedures when a cuckoo is detected between broadcast points

- When a cuckoo is encountered between broadcast-points (i.e., an unsolicited detection is made while traveling to, from, or between broadcast-points), stop and record all information in the same manner as if the detection was made during a broadcast-point count. **Do not broadcast calls.** Then,
- After making observations and recording information regarding the detection(s), continue 300 m, from the point where the detection was made, along the transect. Then continue with the procedures for conducting a broadcast-point count.

4. Procedures for recording other bird species

- **Other Species:** During the survey, record additional bird species encountered. For species of concern (e.g., common black-hawk, Swainson's hawk, Yuma clapper rail, southwestern willow flycatcher, bank swallow), record the UTM coordinates of the detection.

3.11 Procedures at the End of the Survey Transect

1. Immediately after finishing the final broadcast-point count of a transect.

- **Transect Stop Time:** Write in the time of the end of the final broadcast-point count (at the transect stopping point) using the hour and minute format using military time.
- **UTM Stop:** Enter the UTM Easting (E) and Northing (N) for the transect stopping point.

2. Data to complete the data sheet. Enter the following information after the transect is completed, preferably on the same day.

- **Site Owner:** The name of the land owner or land management agency responsible for the area to be surveyed. This does not need to be entered in the field, but should be recorded before data sheet is filed and data is entered into a database.

- **State:** The state where the site is located.
- **County:** The County where the site is located. This does not need to be entered in the field, but should be recorded before data sheet is filed and data is entered into a database.
- **Data Entry (mm/dd/yyyy):** This information is recorded on the day of data entry.
- **Data Verification (mm/dd/yyyy):** This information is recorded on the day the data is verified.

Literature Cited

Appendix A. Data Sheets [to be completed]

Appendix D

Completed Yellow-billed Cuckoo Survey and Detection Forms

Yellow-billed Cuckoo Survey Data Form (2009)

Non-Survey Detection (check box) ☐

Pre-Survey

Site Code:	Site Name: Paria River	Transect #:	Survey Period:	Visit #: 3	Date: 06082010
Drainage: Paria River	Habitat: non-native w/ a few old growth cottonwoods	GPS #:	Transect **Start** Time: 0631		
UTM Start E: 419315	Start GPS acc. (m):	Transect **Stop** Time: 0742			
UTM Start N: 4107419	Zone: 12				
UTM Stop E: 419529	Stop GPS acc. (m):	NAD: 83			
UTM Stop N 4107281	**Observer:** Shay Stump				

Site Owner: Private	State: Utah	County: Kane	Data Entry:	
			Data verification:	

Wind: 0	Cloud Cover: 5%	Precip: ø	Noise: ø	Temp (F^0) start/stop:

Broadcast -Point Start Time	GPS acc.	UTM	YBCU Detect. #	Time of Detect.	Det. Type A,V,B	Compass Bearing (°)	Est. Dist (m)	Est. Acc.	Vocal. Code	Breed. Code	Note #
0631		E 419315 N 4107419	—								
0711		E 419300 N 4107664	—								
0726		E 419421 N 4107593	—								
0742		E 419529 N 4107281									
		E N									
		E N									
		E N									
		E N									
		E N									
		E N									
		E N									
		E N									
		E N									
		E N									
		E									
		E									

Other Species: Western kingbird, yellow warbler, Say's phoebe, blue grosbeak, brown-headed cowbird, common raven, yellow-breasted chat, house sparrow, cliff swallows, ash-throated flycatcher, mourning dove, turkey vulture, black-throated sparrow

Yellow-billed Cuckoo Survey Data Form (2009) - Back Page

Site Code:	Site Name:	Transect #:	Survey Period:	Visit #:	Date:
Observer:					

Note #: Comments/Observations

Same points for these surveys:

Shay Stump

Survey 1 — Start 0725 — Stop 0845

# detections		
	6/18	0723 ~~0845~~
	6/18	0740
	6/18	0810
	6/18	0840

Jen Cleland

Survey 2 — Start 0559 — Stop 0710

# detections		
	7/1	0607
	7/1	0620
	7/1	0637
	7/1	0649

Shay Stump

Survey 3 — Start 0711 — Stop 0850

# detections		
	7/16	0711
	7/16	0737
	7/16	0809
	7/16	0839

Yellow-billed Cuckoo Survey Data Form (2009)

Non-Survey Detection (check box) ☐

Pre-Survey

Site Code:	Site Name: Paria River	Transect #:	Survey Period:	Visit #: 1	Date:
Drainage: Paria River	Habitat: non-native w/ a few old growth cottonwood	GPS #:	Transect Start Time:		
UTM Start E: 4 1 9 5 1 9		Start GPS acc. (m):	Transect Stop Time:		
UTM Start N: 4 1 0 7 1 5 2			Zone: 12		
UTM Stop E: 4 1 9 3 5 0		Stop GPS acc. (m):	NAD: 83		
UTM Stop N 4 1 0 7 0 5 5			Observer: Ada Davis		

Site Owner: Private	State: Utah	County: Kane	Data Entry:
			Data verification:

Wind: ∅	Cloud Cover: 5%	Precip: ∅	Noise: ∅	Temp (F°) start/stop:

Broadcast-Point Start Time	GPS acc.	UTM E	UTM N	YBCU Detect. #	Time of Detect.	Det. Type A,V,B	Compass Bearing (°)	Est. Dist (m)	Est. Acc.	Vocal. Code	Breed. Code	Note #
0607		E 419519	N 4107152	—								
0701		E 419460	N 4107008	—								
0736		E 419350	N 4107055	—								
		E	N									
		E	N									
		E	N									
		E	N									
		E	N									
		E	N									
		E	N									
		E	N									
		E	N									
		E	N									
		E	N									
		E	N									
		E										
		E										

Other Species:

Yellow-billed Cuckoo Survey Data Form (2009) - Back Page

Site Code:	Site Name:	Transect #:	Survey Period:	Visit #:	Date:								
Observer:													

Note #: Comments/Observations

Same points for these surveys:

Survey 1 — Ø detections

		Start	Stop	
6/18	0715	0715	0901	Ada Davis
6/18	0736			
6/18	0801			

Survey 2 — Ø detections

		Start	Stop	
7/1	0601	0601	0710	Shay Stump
7/1	0629			
7/1	0655			

Survey 3 — Ø detections

		Start	Stop	
7/16	0714	0712	0822	Jen Cleland
7/16	0736			
7/16	0759			

Appendix D
Draft Lake Powell Pipeline Project, Mohave Desert Tortoise Survey Report
September 2010

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DRAFT
LAKE POWELL PIPELINE PROJECT
2010 MOJAVE DESERT TORTOISE SURVEY REPORT

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SEPTEMBER 2010

Contents

List of Tables

List of Figures

List of Maps

List of Appendices

1. INTRODUCTION

The Lake Powell Pipeline (LPP) project stretches across Iron, Washington, and Kane counties, Utah and Mohave and Coconino counties, Arizona. The pipeline, and associated transmission lines, equipment sites, and reservoirs overlap potentially suitable Mojave desert tortoise (*Gopherus agassizii*) habitat from the Hurricane Cliffs west, and include lands surrounding the cities of Hurricane (Hurricane) and LaVerkin (LaVerkin), and the towns of Toquerville (Toquerville) and Leeds (Leeds) in Washington County (Maps 1 and 2). Logan Simpson Design (LSD) biologists conducted presence/absence surveys for Mojave desert tortoise within potentially suitable habitat during the 2010 survey season.

2. SPECIES BACKGROUND

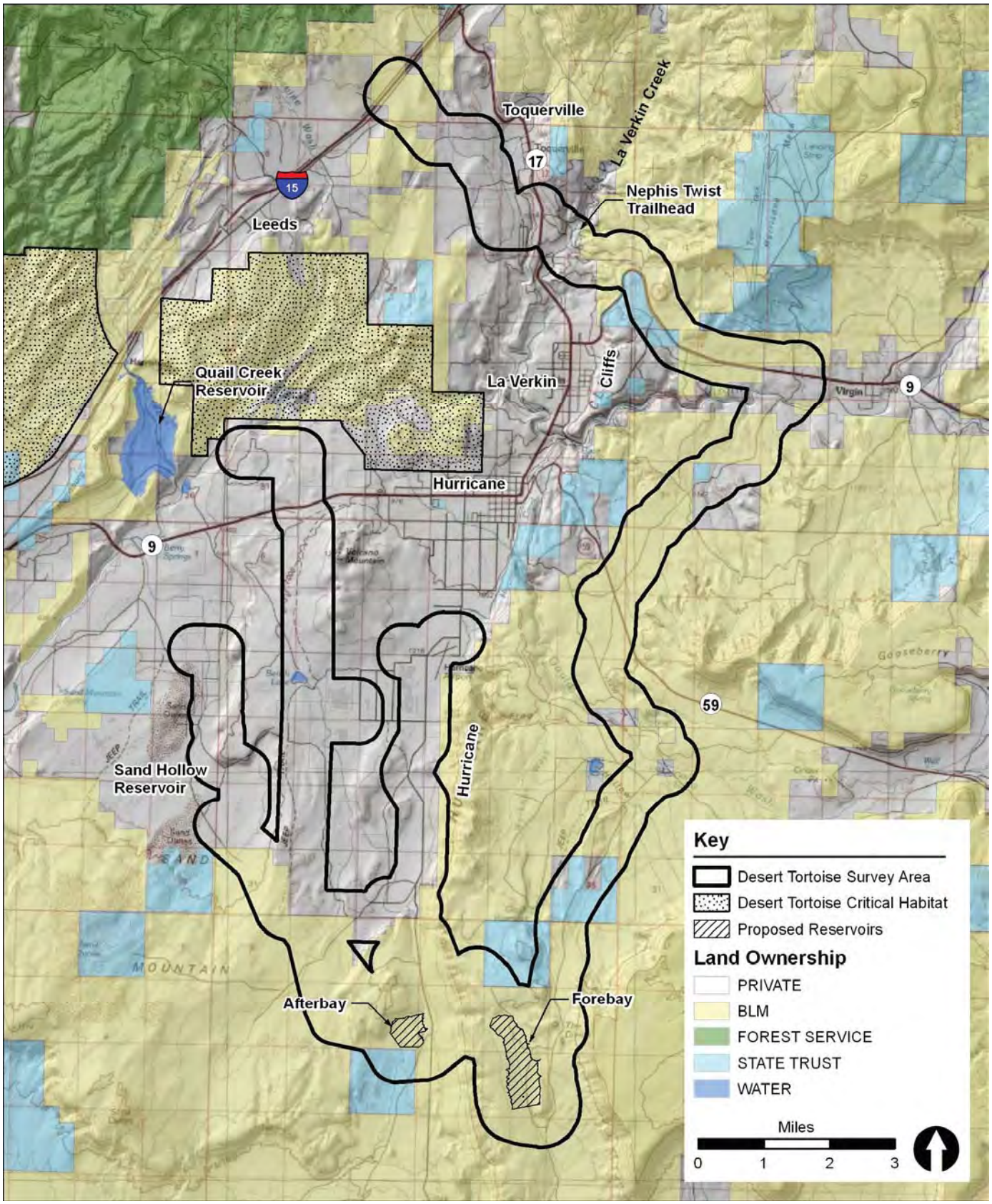
The Mojave desert tortoise occurs throughout the Mohave Desert north and west of the Colorado River in Arizona, Utah, Nevada, and California. The tortoise occupies a variety of habitats that include flats and rocky slopes, from creosote (*Larrea tridentata*) scrub at lower elevations to habitats that include blackbrush (*Coleogyne ramosissima*), sagebrush (*Artemisia* spp.), and juniper (*Juniperus* spp.) woodlands at higher elevations (USFWS 2008). Mojave tortoise populations reach greatest densities in habitats between 1,000 feet and 3,000 feet elevation, but tortoise may occur at elevations as high as 4,100 to 5,250 feet in the eastern Mohave Desert (Bury et al. 1994). The Mojave desert tortoise is commonly found on sloping terrain with friable soils (i.e., crumbles easily in the hand) that are loose enough for digging but stable enough to support burrows (USFWS 2008).

Mojave desert tortoises spend much of their lives in burrows, deep caves, rock and caliche crevices, or under rock overhangs. Tortoises emerge from their burrows to mate in the spring and fall, to drink surface water during summer rain storms, and to forage on a wide variety of grasses and annual plants, as well as cacti and non-native vegetation (USFWS 2008).

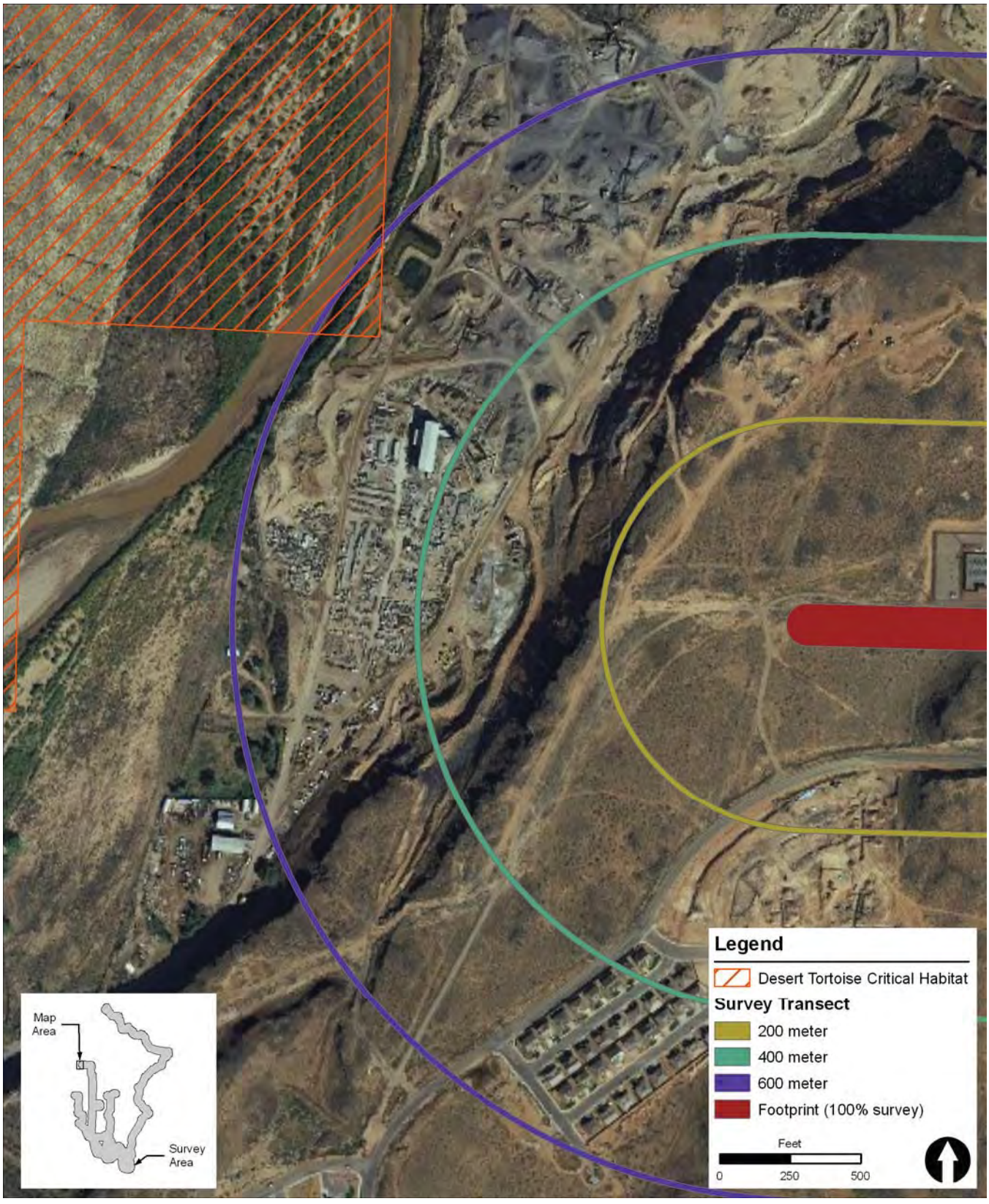
In 1980, the desert tortoise from the Beaver Dam Slope in Utah was listed by the U.S. Fish and Wildlife Service (USFWS) as threatened under the Endangered Species Act (USFWS 1980). The entire Mojave desert tortoise population was listed as threatened in 1990 (USFWS 1990). The primary causes for population decline of the Mojave desert tortoise are cited as habitat loss, deterioration, and fragmentation attributable to urban development, military operations, and multiple-uses of public land, such as OHV activities and livestock grazing. Also cited as threatening the desert tortoise's continuing existence are predation by avian predators including the common ravens (*Corvus corax*) and mammals including coyotes (*Canis latrans*), kit foxes (*Vulpes macrotis*), and free roaming dogs; and direct taking by humans, either accidental or intentional. People illegally collect desert tortoises for pets, food, and commercial trade (USFWS 1993). In addition, fire is becoming an increasingly important threat to desert tortoise habitats. Fires degrade or eliminate habitat for desert tortoises (USFWS 2008).

Critical habitat was designated for the Mojave desert tortoise in 1994 on primarily federal lands in southwestern Utah, northwestern Arizona, southern Nevada, and southern California (USFWS 1994a, revised USWS 1994b). The Mojave desert tortoise recovery plan (USFWS 2008) established the Upper Virgin River Recovery Unit (RU) that includes tortoise habitat in Utah from east of the Beaver Dam Mountains to the Hurricane Cliffs. This area encompasses the Upper Virgin River critical habitat unit, the Washington County Red Cliffs Desert Reserve, and the entire LPP Mojave desert tortoise survey area. Tortoise habitat within this RU is described by the USFWS (2008) as having complex topography that includes sand dunes, mesas, and sandstone outcrops with creosote scrub, sagebrush scrub, blackbrush scrub, and sandy-soil plant communities. Less than 1 acre of designated critical habitat overlaps with the LPP Mojave desert tortoise survey area buffer. At this location a small corner of the section lines designating the critical habitat boundary crosses to the south side of the Virgin River floodplain. The river and its associated steep-sided canyon separate this small parcel of critical habitat and the LPP project from the rest of the Upper Virgin River critical habitat (Map 3).

Map 1
Lake Powell Pipeline Mojave desert tortoise survey location map within the state of Utah



Map 2
Lake Powell Pipeline Mojave desert tortoise survey area vicinity map



Map 3
Lake Powell Pipeline Mojave desert tortoise detailed map of buffer transects and critical habitat

3. METHODS

Prior to conducting desert tortoise surveys, an assessment of tortoise habitat suitability for the LPP survey area was completed. This included a review of published and agency reports, and discussions with agency biologists and others knowledgeable on the desert tortoise to characterize tortoise habitat parameters and to identify the known distribution of the tortoise. Information on vegetation, soils, and land use along the LPP survey area was available from vegetation surveys conducted during 2009 for the LPP project, and as observed during tortoise habitat reconnaissance surveys during spring 2010. All lands within the LPP survey area that included characteristics of suitable desert tortoise habitat and that were within or adjacent to the Mohave Desert Ecological Region (LSD 2010) were identified for tortoise surveys. Survey areas included some lands that did not appear to be suitable (e.g., soils too sandy), but these areas were surveyed anyway to assure there were not smaller inclusions of suitable tortoise habitat that may be occupied. The LPP tortoise survey area (see Map 2) included lands within the LPP survey area from the top of the Hurricane Cliffs west, but did exclude areas of high-density residential or commercial developments. The LPP tortoise survey area included an elevation range from approximately 2,800 feet to approximately 4,600 feet on top of the Hurricane Cliffs.

Surveys were performed according to the USFWS protocol as provided in *2010 Preparing for Any Action That May Occur Within the Range of the Mojave Desert Tortoise* (*Gopherus agassizii*) (USFWS 2010; Appendix A). The protocol states surveys must be performed during the desert tortoise's most active period–from April through May and September through October when air temperatures are below 104 °F. LPP surveys began on April 15, 2010 and concluded May 20, 2010. No surveys were conducted when air temperatures were over 104 °F.

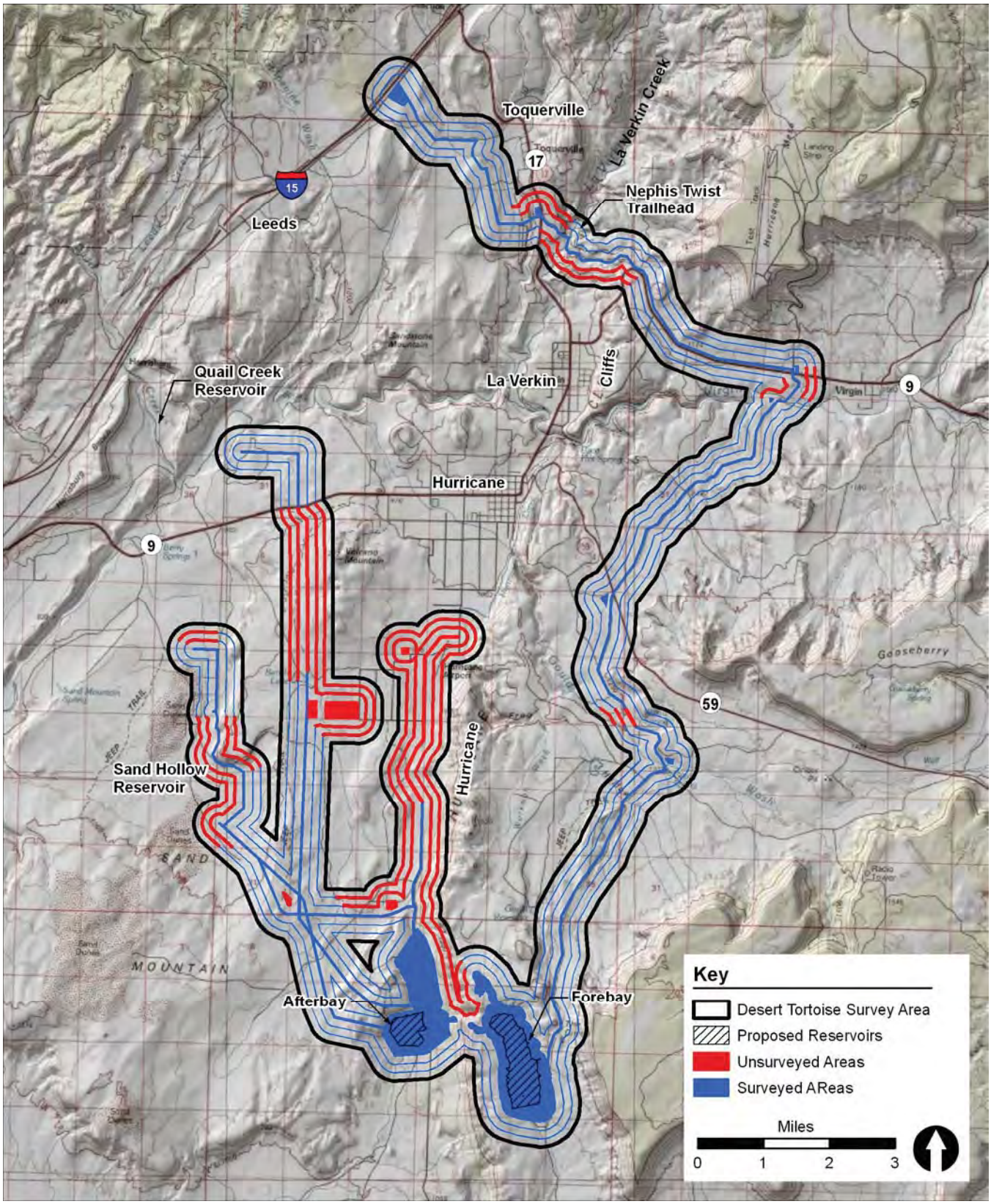
The LPP survey area, whether for pipeline or transmission line construction, has a defined width of 150 feet. This construction footprint, as well as all equipment and facilities sites, and Forebay and Afterbay reservoirs, required 100 percent survey coverage. This coverage is achieved by one person surveying no more than a 30-foot wide belt transect. Additional transects outside of the construction footprint, referred to as buffer transects, were surveyed at 200-, 400-, and 600-meter intervals parallel to or encircling the LPP survey area and equipment sites. Tortoise surveys of the LPP survey area were typically conducted by five surveyors spaced no more than 30 feet (10-meter) apart walking transects parallel to the survey area (Figures 1 and 2). Surveyors would zigzag back and forth across their 30-foot wide belt transect to seek out likely tortoise use areas and to achieve 100 percent visual coverage. Large, non-linear areas(i.e., the Forebay and Afterbay) required multiple passes to provide complete coverage. The LPP survey area was typically surveyed in 2- to 4-mile long segments. A global positioning system (GPS) unit was used to log segment start and stop positions, and to track the outer perimeter of the survey area and buffer transects routes to define the survey area.

A total of 15 biologists participated in tortoise surveys of the LPP survey area. Each person was previously experienced in conducting biological surveys (plants and animals), and most had previous desert tortoise survey experience. Each field crew leader had attended the desert tortoise handling and survey workshop coordinated by the Desert Tortoise Council. Senior biologists provided training in survey techniques and recognition of tortoise sign prior to initiation of surveys. Less experienced surveyors were always paired with a biologist that had more extensive tortoise survey experience and training.

All transect routes were surveyed to the extent possible unless precluded by private property or where impassable terrain limited access (Map 4). Overall, unsurveyed lands would not be expected to provide suitable tortoise habitat, and included steep slopes adjacent to the Hurricane Cliffs; and private residential and commercial developments adjacent to Highway 17 in Toquerville, south of Highway 9 at Sheep Bridge Road, within the city of Hurricane, and adjacent to Sky Ranch Airport Community; private agricultural and ranch developments south of Highway 9 to Sand Hollow State Park, along 1500 West, and south of Highway 9 along the Honeymoon Trail.

Figure 1
Surveyors walking parallel transects no more than 30 feet apart in the Forebay

Figure 2
Surveyors walking parallel transects no more than 30 feet apart in the Afterbay



Map 4
Lake Powell Pipeline Mojave desert tortoise survey completion map

The first two weeks of surveys targeted the highest quality potential tortoise habitat–lands west of the Hurricane Cliffs in creosote valleys and bottoms, on rocky slopes, and in the vicinity of sandstone outcrops. Surveyors paid special attention to important landscape features used by tortoises (e.g., sandstone crevices, rocky slopes, and caliche wash banks), and searched for tortoise sign including live animals, shells, bones, scutes, burrows, resting pallets under shrubs, scats, and tracks. All signs encountered during surveys were photographed and the locations were collected using GPS units.

Project data sheets included information based on all transects within a survey area segment. For each segment, general information was recorded including the date, time, and temperature of the survey; the Universal Transverse Mercator (UTM) coordinates for the start and end of the survey segment; the names of all surveyors; a photograph log documenting landscape characteristics of that survey area segment; photographs of tortoise sign, if located; and the presence of potential predators. Details qualifying habitat suitability for the tortoise were also noted on the datasheet and included descriptions of the soils and vegetation type, topography, forage plants, and land use.

When a surveyor encountered sign, they would circle out from the location intensely scanning the surrounding area for additional sign (Figure 3). The depth, shape, and occupancy of all potentially suitable tortoise burrows were visually investigated using a handheld mirror (Figure 4). Burrows were documented as a tortoise burrow if the burrow exhibited the typical tortoise burrow shape (i.e., flat along the floor with a dome shaped top) and/or by the presence of additional sign (e.g., tortoise scat or bones). The burrow would be designated as a potential tortoise burrow if the burrow deviated from the expected tortoise shape, or occurred in low quality desert tortoise habitat with no tortoise sign present; however, tortoise use of these burrows could not be definitively ruled out. Burrows that were not considered were obviously constructed and used by another animal and were not suitable for a tortoise (e.g., too small or too steep a descending slope). When a surveyor encountered a tortoise or sign, information recorded on a datasheet included the estimated size (midline carapace length) and sex of a live tortoise, the freshness and size of scat, deterioration of bones or carcasses, and dimensions of burrows. All tortoise data was collected without physically contacting, harassing, or harming any tortoise. Completed datasheets and photographs are on file at LSD; completed USFWS datasheets are attached in Appendix B.

4. RESULTS

Habitat Description

Based on the presence of tortoises, tortoise sign, and habitat evaluations in the survey area and buffer transects, the survey identified 5,894 acres of occupied Mojave desert tortoise habitat and 17,164 acres of unoccupied desert scrub habitat (Map 5) within the LPP tortoise survey area. Occupied habitat is identified as lands where tortoises or tortoise sign was observed and the lands contiguous with this area that share similar habitat features important to tortoise (e.g. topography and vegetation). Tortoise sign was not located in areas mapped as unoccupied, and these areas lacked topographic, edaphic, and/or vegetative features necessary to support Mojave desert tortoise.

Occupied habitat was generally observed in the Mohave Desert Ecological Region (LSD 2010) from Sand Hollow Reservoir southeast to the Hurricane Cliffs on lands with generally low to moderate levels of human-related impacts. Within this area, potential tortoise food plants are dominated by nonnatives including red brome (*Bromus rubens*), cheatgrass (*Bromus tectorum*), and redstem fillaree (*Erodium cicutarium*), but also include native plants such as globe mallow (*Sphaeralcea ambigua*), desert poppy (*Eschscholzia glyptosperma*), desert marigold (*Baileya multiradiata*), and other native annuals. Topographic features in occupied habitat include sandstone rock outcrops, rocky slopes, colluvial slopes, and caliche washes. Semi-natural vegetation communities of creosote, sagebrush, and mixed desert scrub include understories of predominately nonnative plants (e.g., Russian thistle [*Salsola tragus*], annual grasses) in over 25 percent of the mapped vegetation community acres represented in the occupied habitat. A complete list of vegetation communities within occupied tortoise habitat is provided in Appendix C.

The majority of occupied habitat occurred in the area of the Afterbay, a proposed reservoir located below the Hurricane Cliffs. Topography in the Afterbay includes colluvial slopes and rolling hills bisected by rocky washes, grading to gently sloping bottoms with volcanic exposures and isolated sandstone outcrops. Creosote, blackbrush, and mixed desert scrub communities dominate; however, bottoms and slopes in the eastern portion of the Afterbay show evidence of a recent fire over a large portion of the area. Vegetation there is dominated by nonnative annual vegetation; native shrubs are few, and charred stumps are evident. Based on survey results, areas unoccupied by tortoises generally lacked connection to areas of known or expected tortoise occurrence, and tortoise sign was not observed. Unoccupied areas occurred within the survey area from I-15 to the residential areas in the vicinity of LaVerkin, and on top of the Hurricane Cliffs.

The lands between I-15 and the residential areas in the vicinity of LaVerkin Creek are grazed by livestock, and the dominant vegetation consists of sagebrush and mixed desert scrub on sandy soils. At LaVerkin Creek, the Nephi Twist Trailhead ascends the Hurricane Cliffs, bedrock cliffs too steep for tortoise. At the top of the Hurricane Cliffs and running along State Route (SR) 9, soil substrates are generally too crumbly to support tortoise burrows. Vegetation is sparse, and offers little cover for tortoise.

On top of the Hurricane Cliffs from SR 9 south to Highway 59 and into the Forebay (the other proposed reservoir) the landscape is characterized by a patchwork of spare gypsum-loving vegetation, mixed shrub communities, and juniper woodland communities. Sagebrush and blackbrush communities occur locally with rocky slopes, volcanic rock hillsides, and flats. In the Forebay, soils are generally crumbly and cannot support tortoise burrows. Mojave desert tortoise may be able to persist in patches of potentially suitable habitat, but the habitat is fragmented. Two potential tortoise burrows were documented; one north of Highway 59 and one in the Forebay. These burrows were the appropriate size and shape to support a tortoise (Figure 5), but were isolated from additional tortoise sign. It is unlikely that Mojave desert tortoise use these burrows.

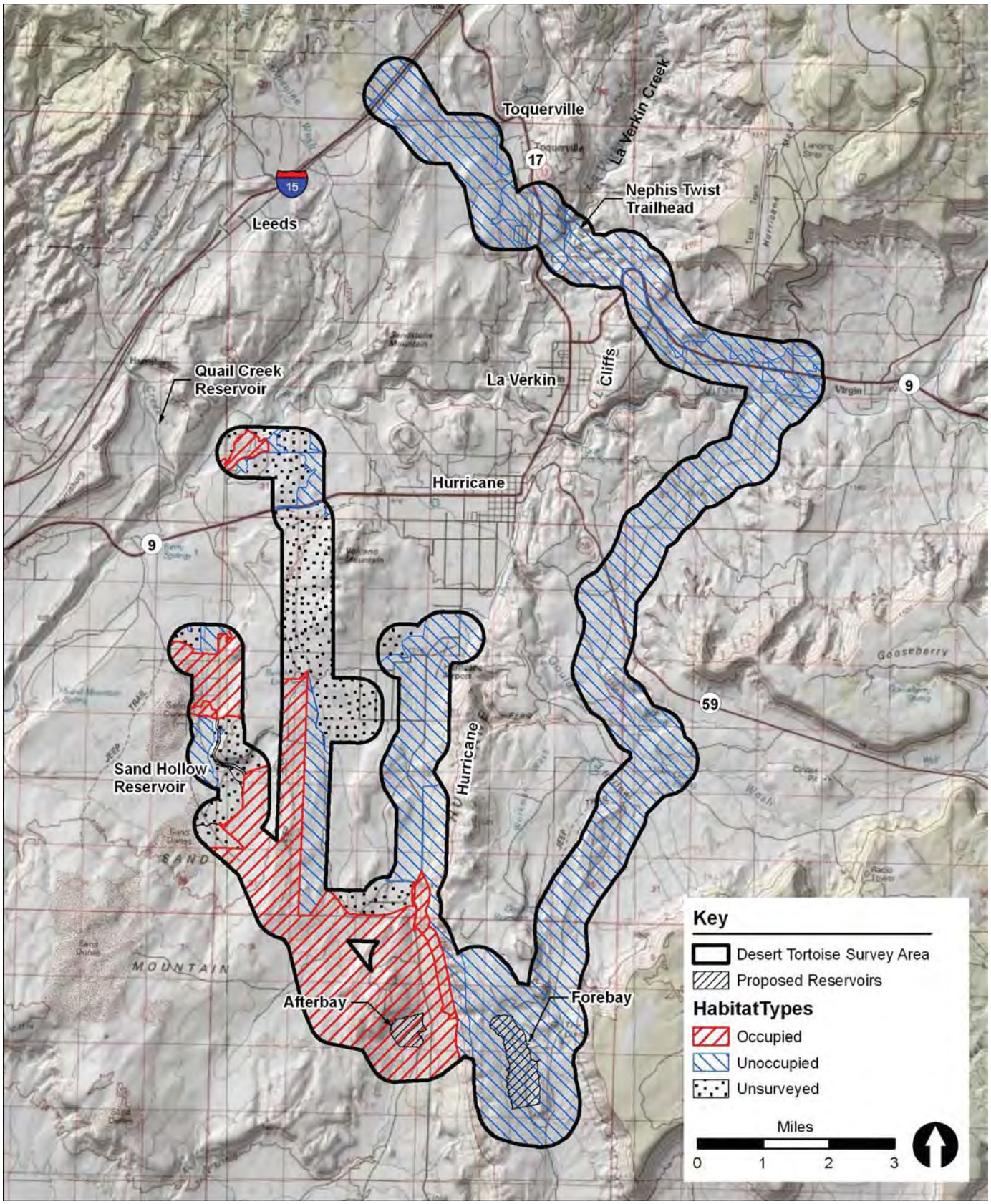
High levels of human activity, vehicle traffic, and developments within the vicinity of Leeds, Toquerville, LaVerkin, and Hurricane have contributed to landscape modifications that no longer support habitats suitable for the desert tortoise. Recreational activities, including hiking, camping, and off-highway vehicle use occur within and adjacent to the Afterbay. These activities were observed and appear to occur regularly on the sandstone outcrops on the eastern slopes of the Afterbay.

Surveys

Desert tortoise surveys were conducted on 4,449 acres within the LPP survey area, and along 115 miles of buffer transects. A total of 445 acres were not surveyed due to private property constraints or impassable terrain (see Map 4).

Figure 3
Surveyors circling out from first scat observation in search of additional sign in the Afterbay

Figure 4
Using a handheld mirror to check the occupancy of a potential burrow in the Afterbay



Map 5
Lake Powell Pipeline Mojave desert tortoise habitat map

Tortoise Sign

Two live male tortoises were located on the recently burned colluvial slopes west of the Hurricane Cliffs in the area of the Afterbay (Figures 6 and 7). Additional tortoise sign included the skeletal remains from one male tortoise (Figure 8), 30 tortoise burrows (burrows found in the vicinity of additional sign) (Figures 9 and 10 provide examples of these burrows), 17 potential tortoise burrows (burrows found in low quality habitat or without additional sign but were the approximate size and shape for tortoise) (see Figure 5), and numerous scat (Figures 11 and 12 provide examples of tortoise scat) found at over 38 locations (Map 6). UTM coordinates for all tortoise sign are provided in Appendix D.

Tortoise sign overlapped 13 mapped vegetation communities identified in the *2010 LPP Vegetation Community Report* (LSD 2010) as listed in Table 1. Both of the live tortoises observed during surveys were found in the Mojave Desert Creosote-White Bursage Desert Scrub Ecological System in areas recently disturbed by fire and classified as the Larrea tirdentata / Erodium cicutarium Semi-natural Herbaceous Vegetation Association. The majority of tortoise sign occurred in areas where non-native vegetation was dominant (i.e., semi-natural herbaceous plant associations) with species such as red brome, redstem fillaree, and Russian thistle reflecting recent disturbances, primarily by fire. Tortoise sign was also concentrated in areas of exposed sandstone bedrock and other locations where suitable burrows (e.g. rock outcrops, rocky washes, and soils at the base of vegetation) were available, suggesting that the presence of potential cover site locations is more important to the tortoise than the vegetation and selection of potential food plants.

Recreational activities (e.g. hiking, ATV use, camping, and hunting/shooting) were observed within the Afterbay. High intensity use appeared to be concentrated on sandstone rock outcrops located at the western limits of the Afterbay. Desert tortoise sign was missing on what would have been considered highly suitable habitat associated with these sandstone outcrops. Just upslope from this area basalt rock and sandstone outcrops were found to support desert tortoise habitat and recent tortoise sign.

5. CONCLUSIONS

Occupied Mojave desert tortoise habitat is found on 5,894 acres of land within the LPP tortoise survey area. Two live tortoises and 69 sites were recorded where confirmed tortoise sign (skeletal remains, tortoise burrows, and scats) was found, with occupied habitat extending west from the Hurricane Cliffs to Sand Hollow Reservoir, and north to the Virgin River.. The majority of tortoise use appeared to be concentrated in the area of the Afterbay at the base of the Hurricane Cliffs.

Figure 5
Potential burrow in the Forebay with no indication of tortoise use and isolated from known occupied tortoise habitat.

Figure 6
Live, male tortoise observed foraging, documented in the Afterbay

Figure 7
Live, male tortoise documented in the Afterbay

Figure 8
Adult skeletal remains of a male tortoise documented south of the Virgin River

Figure 9
A tortoise burrow in a caliche wash documented in the Afterbay. Scat and additional burrows were observed in the same wash

Figure 10
A tortoise burrow in a sandstone outcrop with scat at the entrance documented in the Afterbay

Figure 11
Close up view of tortoise scat found on rocky blackbrush scrub slopes documented west of the Afterbay within the construction footprint

Figure 12
Close up view of tortoise scat found on sandstone outcrop documented in the Afterbay

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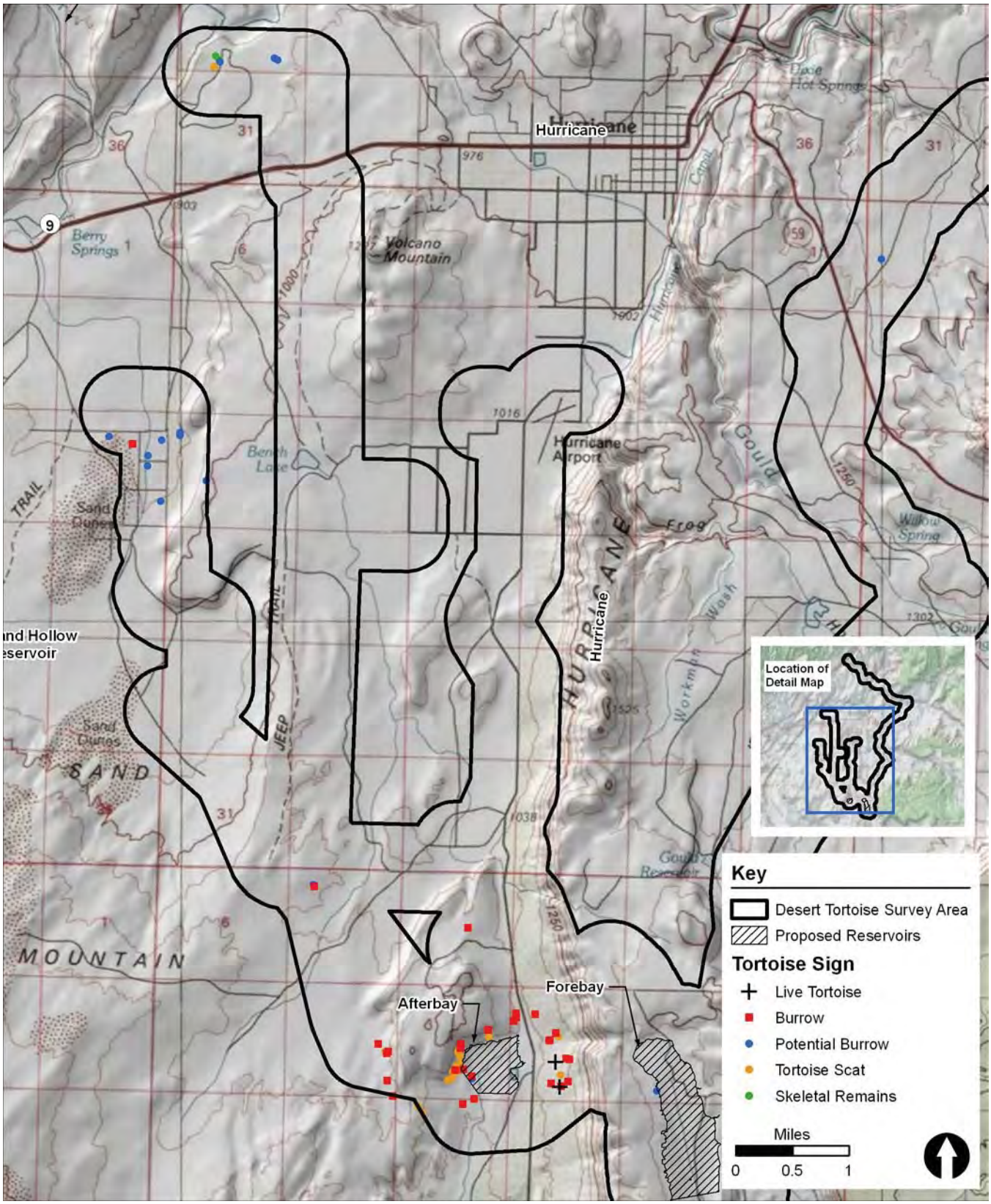

Map 6
Lake Powell Pipeline Mojave desert tortoise sign location map

Table 1
Tortoise sign occurrences overlapping mapped vegetation communities in the LPP survey area*

Ecological System	Alliance	Association	Sign
Colorado Plateau Mixed Desert Scrub	Mixed Desert Shrub Shrubland Alliance	Mixed Desert Scrub Shrubland	1 Potential Burrow
Invasive Upland Vegetation	*Erodium cicutarium* Semi-natural Herbaceous Alliance	*Erodium cicutarium* Semi-natural Herbaceous Vegetation	1 Potential Burrow
Mojave Desert Bedrock Cliff and Outcrop	*Coleogyne ramosissima* Shrubland Alliance	*Coleogyne ramosissima* / Sandstone Outcrop Sparse Shrubland	1 Burrow, 3 Scats
	Purshia (*stansburiana*, *glandulosa*, *mexicana*) Sparsely Vegetated Alliance	*Purshia* (*stansburiana*, *mexicana*) / Sandstone Outcrop Sparse Vegetation	1 Burrow, 1 Scat
Mojave Desert Blackbrush-Mormon-tea Shrubland	*Coleogyne ramosissima - Ephedra nevadensis* Shrubland Alliance	*Coleogyne ramosissima - Ephedra nevadensis* / *Bromus rubens* Semi-natural Dwarf-shrubland	1 Scat
	Coleogyne ramosissima Shrubland Alliance	*Coleogyne ramosissima* / (*Erodium cicutarium*, *Bromus* (*rubens*, *tectorum*), *Salsola tragus*) Semi-natural Shrubland	3 Burrows, 10 Scats
Mojave Desert Creosotebush-White Bursage Desert Scrub	*Erodium cicutarium* Semi-natural Herbaceous Alliance	*Larrea tridentata* / *Erodium cicutarium* Semi-natural Shrub Herbaceous Vegetation	2 Tortoise, 9 Burrows, 8 Scats, 1 Potential Burrow
	Larrea tridentata Shrubland Alliance	*Larrea tridentata - Coleogyne ramosissima* / *Bromus rubens* Semi-natural Shrubland	3 Burrows
		Larrea tridentata / (*Erodium cicutarium*, *Bromus rubens*, *Salsola tragus*) Semi-natural Sparse Shrubland	3 Burrows, 1 Scat, 2 Potential Burrows
		Larrea tridentata Shrubland	1 Burrow, 1 Potential Burrow
Mojave Desert Volcanic Rock and Cinder Land	Mixed Desert Shrub Shrubland Alliance	Mixed Desert Shrub / (*Bromus rubens*, *Salsola tragus*, *Erodium cicutarium*) Semi-natural Dwarf-shrubland	2 Burrows, 3 Scat
Mojave Desert Wash	*Hymenoclea salsola* Shrubland Alliance	*Hymenoclea salsola* Shrubland	1 Potential Burrow
	Non-vegetated sandstone	Non-vegetated Sandstone Outcrop	1 Burrow, 2 Scats
Unmapped areas in survey buffers	Unmapped areas in survey buffers	Unmapped areas in survey buffers	1 Skeletal Remain, 10 Burrows, 7 Scats, 10 Potential Burrows

* Definitions of Ecological Systems, Alliances, and Associations are available in the *2010 Lake Powell Pipeline Vegetation Community Report* (LSD 2010)

6. FIELD PERSONNEL

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Kay Nicholson, crew leader
Gerry Perry
Arthur Pizzo
Bruce Palmer, senior biologist
Gary Reese
Richard Remington, senior biologist
Joan Scott
Shaylon Stump

7. LITERATURE CITED

Bury, R. Bruce, Esque, Todd C.; DeFalco, Lesley A., Medica, Philip A. 1994. Distribution, habitat use, and protection of the desert tortoise in the eastern Mojave Desert. [Washington , DC]: U.S. Department of the Interior, Fish and Wildlife Service: 57-72.

Logan Simpson Design Inc (LSD). 2010. Lake Powell Pipeline Vegetation Community Report. Tempe, AZ.

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_____.1990. Endangered and Threatened Wildlife and Plants; Determination of Threatened Status for the Mojave Population of the Desert Tortoise. Federal Register 55: 63 (April 2, 1990) 12178-12191.

_____.1993. Endangered and Threatened Wildlife and Plants; Proposed determination of Critical Habitat for the Mojave Population of the Desert Tortoise. Federal Register 58:166 (August 30, 1993) 45748-45768.

_____.1994a. Endangered and Threatened Wildlife and Plants; Animal Candidate Review for Listing as Endangered or Threatened Species. Federal Register 59:26 (February 8, 1994) 58982-59028.

_____.1994b. Endangered and Threatened Wildlife and Plants; Proposed determination of Critical Habitat for the Mojave Population of the Desert Tortoise. Federal Register 59:219 (November 15, 1994) 45748-45768.

_____.2008. Draft Revised Recovery Plan for the Mojave Population of the Desert Tortoise (*Gopherus agassizii*). Sacramento, California.

_____.2010. Preparing for Act That May Occur Within the Range of the Mojave Desert Tortoise (*Gopherus agassizii*). Ventura, CA.

8. SIGNATURES

Prepared By: _____ Date: September 23, 2010

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Reviewed/Approved By: _____ Date: September 23, 2010

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Appendix A

USFWS 2010 Preparing for Any Action That May Occur Within the Range of the Mojave Desert Tortoise Occupied Habitat

PREPARING FOR ANY ACTION THAT MAY OCCUR WITHIN THE RANGE OF THE MOJAVE DESERT TORTOISE (*Gopherus agassizii*)

The Mojave population of the desert tortoise (*Gopherus agassizii*) was listed by the U.S. Fish and Wildlife Service (USFWS) as threatened on April 2, 1990 (USFWS 1990). Subsequently, proposed actions within the range of the desert tortoise fall under purview of the Endangered Species Act 1973, as amended (ESA), in addition to State regulations. For detailed information on the ecology of the Mojave desert tortoise, please see USFWS (2010).

This protocol provides recommendations for survey methodology to determine presence/absence and abundance of desert tortoises for projects within the range of the species and a standard method for reporting survey results. Information gathered from these procedures will: 1) help determine the appropriate level of consultation with USFWS and the appropriate state agency; 2) help determine the amount of incidental take of desert tortoises resulting from proposed projects as defined by the ESA and appropriate state laws; and 3) help minimize and avoid take.

This guidance includes:

- Site Assessment
- Pre-project Field Survey Protocol for Potential Desert Tortoise Habitats
- USFWS 2010 Desert Tortoise Pre-project Survey Data Sheet

This guidance is subject to revision as new information becomes available. Before initiating the protocols described below, please check with your local USFWS and appropriate state agency office to verify that you are implementing the most up-to-date methods. To ensure quality and reduce the likelihood of nonconcurrence with survey results, we recommend that the names and qualifications of the surveyors be provided to USFWS and appropriate state agency for review prior to initiating surveys.

In Arizona:

U.S. Fish and Wildlife Service
Arizona Ecological Services
323 N. Leroux St., Suite 201
Flagstaff, AZ 86001
(928) 226-0614

In California, for Inyo, Kern, Los Angeles, and San Bernardino Counties:

U.S. Fish and Wildlife Service
Ventura Fish and Wildlife Office
2493 Portola Road, Suite B
Ventura, California 93003
(805) 644-1766

In California, for Imperial and Riverside Counties, and Joshua Tree National Park and the San Bernardino National Forest in San Bernardino Co:

U.S. Fish and Wildlife Service
Carlsbad Fish and Wildlife Office
6010 Hidden Valley Road
Carlsbad, California 92009
(760) 431-9440

In Nevada:

U.S. Fish and Wildlife Service
Nevada Fish and Wildlife Office
4701 North Torrey Pines Drive
Las Vegas, Nevada 89130
(702) 515-5230

In Utah:

U.S. Fish and Wildlife Service
Utah Ecological Services Field Office
2369 West Orton Circle
West Valley City, Utah 84119
(801) 975-3330

State Agencies

Arizona Game & Fish Department
State Headquarters--Nongame Branch
5000 W. Carefree Highway
Phoenix, AZ 85086
623-236-7767

California Department of Fish and Game (CDFG)
For Kern County:
Central Region Headquarters Office
1234 E. Shaw Avenue
Fresno, CA 93710
(559) 243-4005 ext. 151

For Imperial, Inyo, Riverside and San Bernardino Counties:
Inland Deserts Regional Office
3602 Inland Empire Boulevard, Suite C-220
Ontario, CA 91764
(909) 484-0167

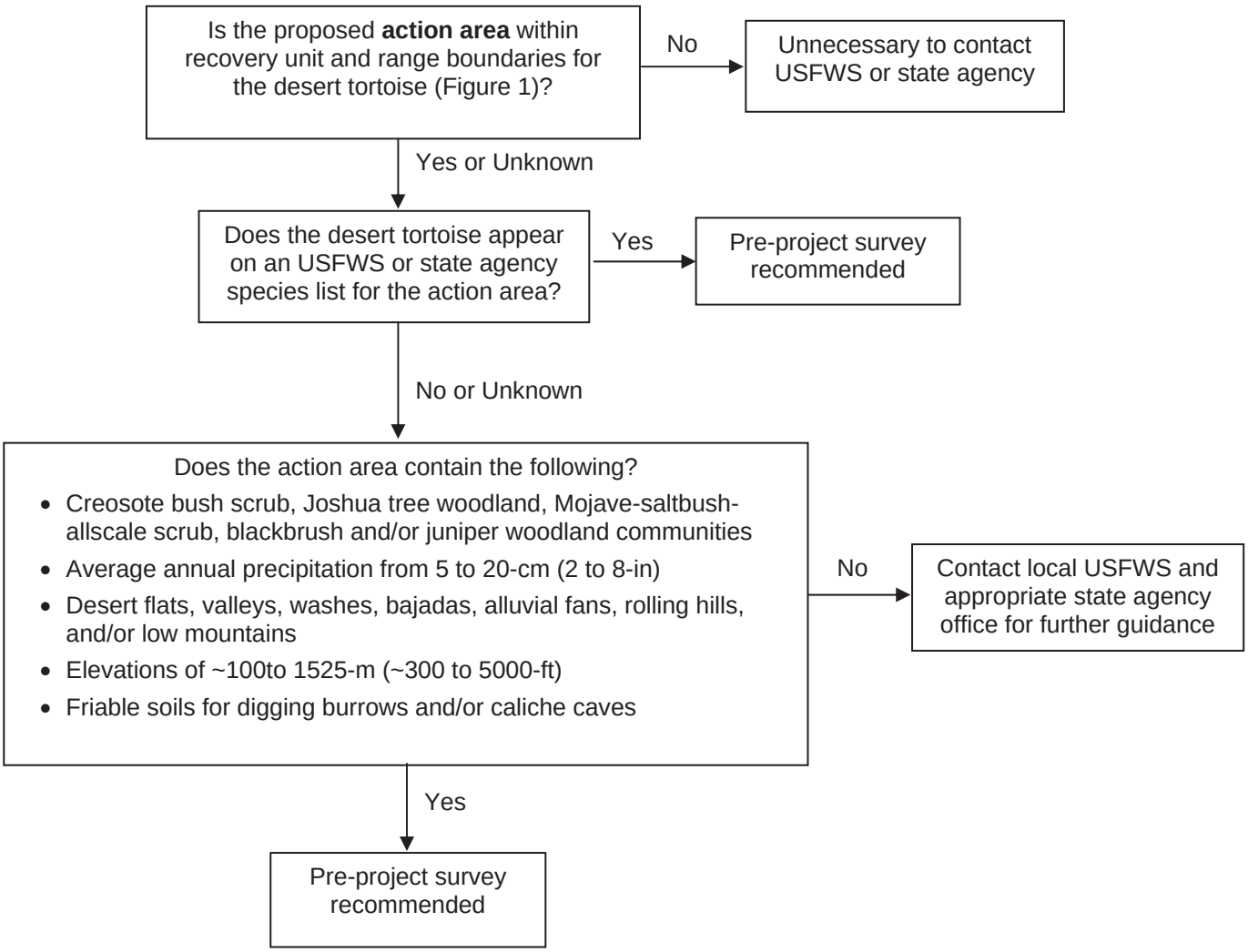
For Los Angeles County:
South Coast Regional Office
4949 Viewridge Avenue
San Diego, CA 92123
(858) 467-4201

Nevada: Department of Wildlife:
Southern Region
4747 Vegas Dr.
Las Vegas, NV 89108
(702) 486-5127

Utah Division of Wildlife Resources:
Southern Region
1470 N Airport Rd
Cedar City, UT 84720
(435) 865-6100

Site Assessment

Use the key below to assess if desert tortoises may be present within or near the action area and determine survey and consultation requirements. The **action area** is defined by regulation as all areas to be affected directly or indirectly and not merely the immediate area involved in the action (50 CFR §402.02). The extent of the action area is not limited to the "footprint" of the action nor is it limited by the authority of the Federal, state, or local agency or any other entity proposing the project; it can and will vary accordingly with each proposed action. The environmental baseline, the analysis of the effects of the action, and the amount or extent of incidental take are based upon the action area. If you cannot access the entire action area during your surveys for some reason (e.g. access to private property is unavailable), please note that in your survey report.



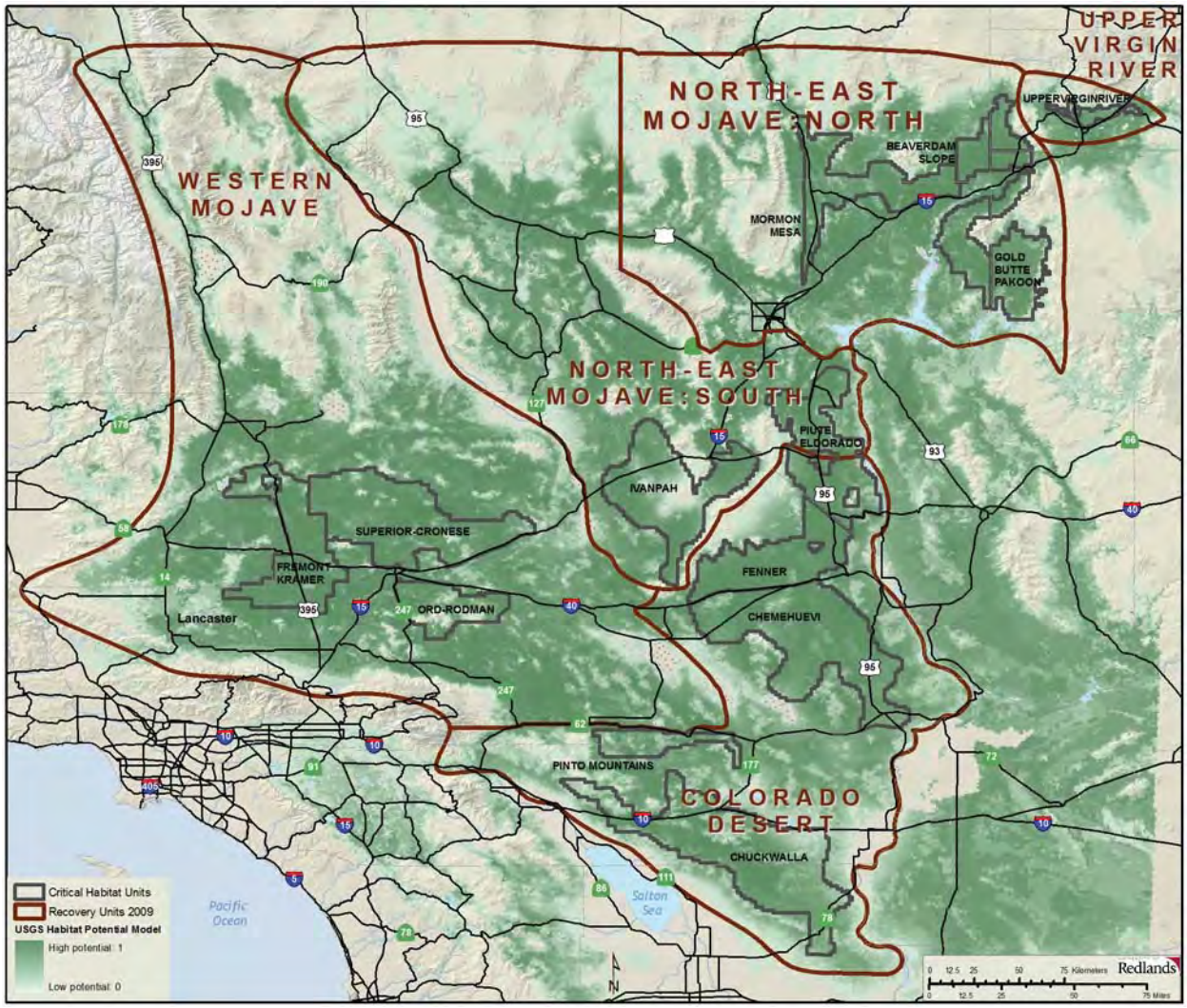


Figure 1. Known range of the desert tortoise (Mojave Population) shown as USGS desert tortoise habitat potential model (Nussear et al. 2009). Boundaries of 2010 revised recovery units are shown, with the North-East Mojave Recovery Unit, split into north and south (as in Table 2).

Pre-project Field Survey Protocol for Potential Desert Tortoise Habitats

Objectives of survey

- Determine presence or absence of desert tortoises within the action area
- Estimate the number of tortoises (abundance) within the action area
- Assess the distribution of tortoises within the action area to inform take avoidance and minimization

See *Frequently Asked Questions* for further definition and discussion of the action area.

Field Methods

This protocol takes into account the fact that not all tortoises within the action area are seen by the surveyor. The following equation accounts for tortoises that are below ground at the time of surveys and for above-ground tortoises that are cryptic and may be missed and should be used to estimate the number of tortoises within the actions area for both 100% coverage and probabilistic sampling.

$$\begin{pmatrix}\text{Estimated number of tortoises}\\ \text{within action area}\end{pmatrix} = \frac{\begin{pmatrix}\text{Number of tortoises}\\ \text{observed above ground}\end{pmatrix}}{\begin{pmatrix}\text{Probability that}\\ \text{a tortoise is}\\ \text{above ground } (P_a)\end{pmatrix}\begin{pmatrix}\text{Probability of}\\ \text{detecting a tortoise,}\\ \text{if above ground } (P_d)\end{pmatrix}}\begin{pmatrix}\frac{\text{Size of action area}}{\text{Size of area surveyed}}\end{pmatrix}$$

- Information to determine presence/absence *and* estimate number of tortoises within the action area is collected during the same survey effort. Surveyed objects include all tortoises that are above ground (both out of burrows and within burrows but still visible), as well as all tortoise sign (burrows, scats, carcasses, etc). Record all locations of tortoises and sign using the USFWS 2010 Desert Tortoise Pre-Project Survey Data Sheet (attached). Please submit a copy of the original datasheets with results of the survey to the local USFWS office within 30 days of survey completion.
- If the action area is large (e.g., 16 hectares [40 acres]) or the project could affect more than 2 or 3 tortoises, surveys should be conducted during the tortoise's most active periods [April through May or September through October when air temperatures are below 40°C (104°F)] (Zimmerman et al. 1994; Frielich et al. 2000; Walde et al. 2003; Nussear and Tracy 2007; Inman 2008). Air temperature is measured ~5-cm from the soil surface in an area of full sun, but in the shade of the observer. Surveys outside these periods may be approved by the local USFWS office when only presence/absence needs to be determined.
- Ten-meter (~30-ft) wide belt transects should be used during surveys. For all projects, surveys which cover the entire project area with the 10-m belt transects (100% coverage) are always an acceptable option. For very large action areas, probabilistic sampling may also be an option, such that the appropriate proportion of the action area is surveyed (Table 2). If probabilistic sampling is an option for the project site, each transect should be chosen either systematically or randomly ensuring that the entire action area has an equal probability of being included in the sample. Transects should be completed in a random order, oriented in a logistically convenient pattern (e.g., lines, squares, or triangles). Any sampling design other than simple systematic or random sampling (e.g. stratification) must be approved by USFWS and appropriate state agency. See *Frequently Asked Questions* for further discussion of 100% coverage and probabilistic sampling.
- USFWS considers the results of a pre-project survey to be valid for no more than one year. If survey results are older than one year, please contact the local USFWS office.

Presence or absence of desert tortoises within the project vicinity

- Occurrence of *either* live tortoises or tortoise sign (burrows, scats, and carcasses) in the action area indicates desert tortoise presence. If either live tortoises or tortoise sign are observed in the action area, contact the USFWS to determine the best manner in which to comply with the Federal Endangered Species Act.
- If neither tortoises nor sign are encountered during the action area surveys and the project, or any portion of project, is ≤ 0.8 k^{m2} (200 acres) or linear, three additional 10-m (~30-ft) belt transects at 200-m (~655-ft) intervals parallel to and/or encircling the project area perimeter (200-m, 400-m, and 600-m from the perimeter of the project site) should be surveyed. These transects are only for the presence/absence determination; they are not included in the estimation of tortoise abundance. See *Frequently Asked Questions* for an explanation of why additional surveys are needed.
- If neither tortoises nor sign are encountered during the action area surveys, as well as project perimeter surveys where appropriate, please contact your local USFWS office. This will allow the USFWS to advise you on how best to demonstrate compliance with the Endangered Species Act. Also contact the responsible state agency to determine compliance with State laws.

Number of tortoises within the action area

The attached Table 3 spreadsheet will estimate the number of adult tortoises (>160 mm MCL) within the action area using the "Number of tortoises within the action area" equation from above.

Enter the requested information into the Table 3 spreadsheet, as follows:

1. Enter the area of the total project.
2. Enter the appropriate value from Table 1 for the term "probability that a tortoise is above ground" (P_a).
3. Enter the number of adult tortoises (>160-mm midline carapace length) found during the survey of the action area for the term "number of tortoises observed above ground" (n).

Table 1. Probability that a desert tortoise is above ground (P_a) relative to the previous winter's rainfall (October through March)

Use amount of rainfall from the winter preceding the pre-project survey to determine which value of P_a *is appropriate for the project*

To find this amount of rainfall, go to the Western Regional Climate Center site: http://www.wrcc.dri.edu/summary/Climsmsca.html; click on your location and scroll down to "monthly totals"

Previous Winter Rain	Probability (P_a)	Variance(P_a)
<40 mm (~1.5 inches)	0.64	0.08
≥40 mm (~1.5 inches)	0.80	0.05

The estimate for the term "probability of detecting a tortoise if above ground (P_d)" is already included in spreadsheet Table 3 (P_d = 0.63; variance = 0.011). See *Frequently Asked Questions* section below for how P_a and P_d and their associated variances were estimated.

See *Appendix 1* for a detailed description of the method used to estimate desert tortoise abundance.

100% Coverage or Probabilistic Sampling?

100% coverage surveys are always an acceptable option, regardless of the size of the action area. For very large action areas, probabilistic sampling may be an additional option, such that the appropriate proportion of the action area is surveyed as detailed below. Use the boundaries in Figure 1 and numbers provided in Table 2 to determine if probabilistic sampling could be an appropriate option for the proposed action area.

For the 2010 field season, probabilistic sampling may not be an option for desert tortoise pre-project surveys in California due to the requirement of CESA to avoid, minimize, and fully mitigate (CDFG code section 2081). Please contact your local CDFG office (see contact info on page 2).

Table 2. Is probabilistic sampling an appropriate option for the proposed action area?

Is your action area smaller than the area given below for the recovery unit in which the project occurs?

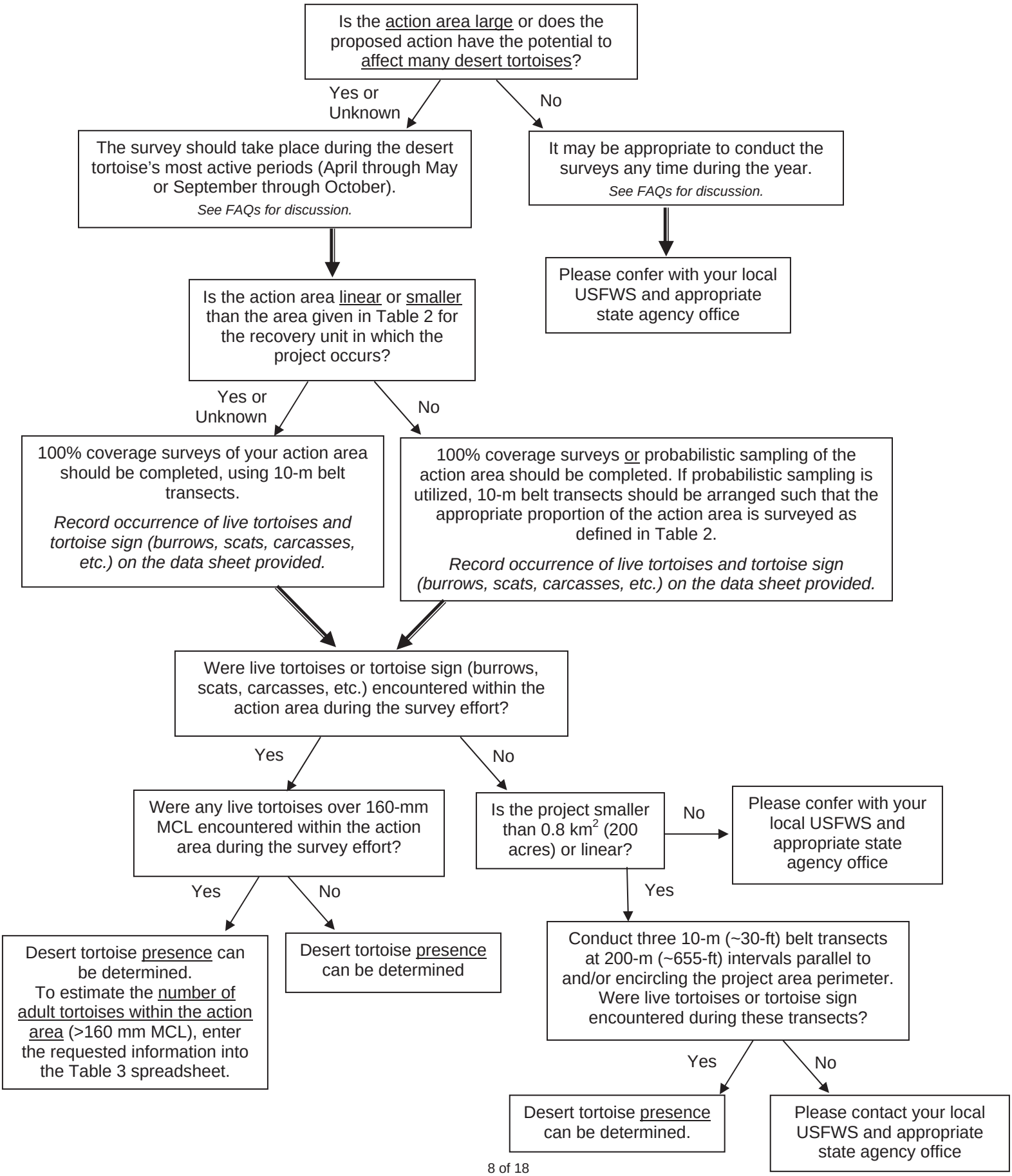
Recovery Unit	Threshold Action Area to Allow Sampling
Western Mojave	4.3 km^2 (1,066 acres)
Colorado Desert	3.3 km^2 (811 acres)
North-East Mojave: North	11.3 km^2 (2,789 acres)
North-East Mojave: South	4.5 km^2 (1,103 acres)
Upper Virgin River	1.1 km^2 (270 acres)

If yes: 100% coverage surveys of your action area must be completed.

If no, total transect lengths that must be surveyed are given below. 100% coverage surveys are also an option, regardless of the size of the project.

Recovery Unit	Total Transect Length (km) to Sample
Western Mojave	431
Colorado Desert	328
North-East Mojave: North	1,129
North-East Mojave: South	446
Upper Virgin River	109

DECISION TREE FOR PRE-PROJECT FIELD SURVEY PROTOCOL FOR POTENTIAL DESERT TORTOISE HABITATS



FREQUENTLY ASKED QUESTIONS: DESERT TORTOISE PRE-PROJECT FIELD SURVEY PROTOCOL

Why did USFWS revise the 1992 USFWS Desert Tortoise Pre-project Survey Protocol?

The 2010 protocol uses the best available science on the desert tortoise to determine presence and abundance. Desert tortoises occur at low densities across most of the Mojave Desert (USFWS 2006). They are cryptic and spend much of their time underground in burrows (Burge 1977; Nagy and Medica 1986; Bulova 1994) and therefore not all animals within an area will be seen by even the best trained surveyors. Tortoises underground in burrows, as well as individuals hidden above ground, need to be included in estimates of abundance.

The 1992 USFWS Desert Tortoise Pre-project Survey protocol was based on a Bureau of Land Management protocol from the mid-1970s, which utilized the best available information at the time, but did not take into account that some tortoises will be underground and missed during the survey effort. The data collected during the USFWS range-wide monitoring program (currently >7,000-km of transects each year; USFWS 2006) have allowed us to improve pre-project survey methods for estimating abundance. Data about the proportion of tortoises underground in burrows, as well as the probability that an above-ground tortoise greater than 160 mm MCL will be observed by the surveyor are included in the estimate of the number of tortoises within the action area (P_a and P_d).

This revised protocol also addresses the potential for using probabilistic sampling when the action area is larger than size limits given in Table 2. 100% coverage surveys are *always* an acceptable option, regardless of size of the action area. For very large action areas, sampling may be an additional option, such that the abundance estimate can be calculated when an appropriate proportion of the action area is surveyed. Estimates of tortoise densities within recovery units have been used to calculate how many km^2 of a project site must be surveyed to produce a statistically robust abundance estimate (Table 2).

Why did you make the change to recommend that the "action area" should be surveyed, as opposed to the "project area? How do I determine the action area?

We recommend that the action area be surveyed to better reflect the scope of an action that USFWS is required to review under the authorities of the Endangered Species Act. When USFWS is considering whether desert tortoises may be affected by a proposed action, we cannot limit our evaluation to the actual footprint of the proposed action; we have to consider all areas that may be affected directly or indirectly by the action. We call this the "action area," which is defined by the implementing regulations for section 7(a)(2) of the Endangered Species Act (50 *Code of Federal Regulations* 402.02), as "areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action." (Non-federal actions for which a project proponent has requested an incidental take permit under the authority of section 10(a)(1)(B) of the Endangered Species Act also require consideration of the effects within the action area.)

You can determine the action area by thinking about all components of the proposed action plus desert tortoise ecology, and then calculating the area that may be affected. For example, the proposed action is a 10-acre mine site located adjacent to I-15. From the Harvard Road exit, haul trucks would pull immediately into the mine site. The action area in this case would be the 10-acre mine site. We would not include I-15 in the action area because traffic associated with the mine would not measurably change traffic volume on the freeway.

If the mine operator proposes to conduct blasting activities at the site, the action area includes areas to be affected directly or indirectly by the blasting. If debris moved by the blast, noise, or vibrations would extend beyond the boundaries of the mine site, the area affected by the blasting would become part of the action area. In this case, the delineation of the action area is less than precise; we suggest that you discuss the issue with the project proponent to assess the area that may be affected by the blasting.

As a third example, if the mine site is located 5 miles from Interstate 15 and is accessed by a lightly travelled unpaved road, this unpaved road between the freeway and the mine is part of the action area. We suggest that the access road be treated as a linear project. The road bed itself would not need to be surveyed unless it is so degraded that tortoises would possibly use it for burrowing or shelter; otherwise, place the first transect so that it extends from the edge of the road into the desert, with the second and third transects placed as described in the decision tree. If a new road needs to be built, we recommend that the guidance for a linear project be followed.

If the action area encompasses restricted access private lands, survey the areas for which access is available and note the inaccessible areas in the report. If anything about habitat conditions on the inaccessible areas can be determined (e.g., they support the same type of habitat, are more or less disturbed, etc.), also note that in the report.

What happened to the zone of influence transects recommended in the 1992 protocol?

This revised protocol requires that the entire action area, rather than just the project footprint, be included in the survey effort. The action area provides a more realistic view of where desert tortoises may be affected by the proposed action.

Why is it important to survey during the active period when the action area is large or the proposed action has the potential to affect more than 2 or 3 desert tortoises?

In these cases, USFWS needs more information than just presence/absence to conduct our analyses and determine the extent of the effects on the desert tortoise; we also need a robust estimate of the number of tortoises within the project area, particularly for large projects that involve translocating tortoises >5 km or <5 km. The most expedient way to estimate abundance for tortoises is to conduct surveys when tortoises are most active, when the estimates of the number of tortoises below ground and of the number of tortoises missed during the survey are applicable. As mentioned above, these calculations have been developed from analyses of years of survey data. Abundance estimates will also be useful to the project proponent and lead agencies because it would allow them to conduct their own analyses and assess potential costs of proceeding with the proposed action in this location. The ESA's implementing regulations 50CFR 402 require federal agencies to use the best scientific information which can be obtained during the consultation process, and USFWS to specify the amount or extent of incidental take. Therefore, we have developed this estimate of abundance to comply with these regulations.

What factors does the Service take into consideration when reviewing the results of surveys that are conducted outside the active period?

Surveys outside the active period may be appropriate when only presence/absence is necessary or when the project area is small and only very few tortoises are likely present. We base our determination of whether the results are valid on a whole suite of factors, including but not limited to the type and condition of habitat, the general location of the survey area, the experience of the surveyors, the time and weather when the survey was conducted, the nature of the year in which the survey occurred (i.e., if it rained a lot, desert tortoises are likely to have been active and are more likely to have left evidence of their presence), how much time surveyors spent at the site, and whether they were conducting a focused survey for tortoises or looking for a suite of biological and/or cultural resources. We consider these factors in combination to determine whether the surveyors were likely to have found whatever evidence that desert tortoises were present. Depending on the factors that are present during a survey, the results are more or less likely to represent the true status of the tortoise in that specific area.

What if the pre-project survey was negative (i.e., no desert tortoises or sign) and then a desert tortoise or sign is detected during implementation of the proposed project?

If a tortoise or tortoise sign (shells, bones, scutes, limbs, burrows, pallets, scats, egg shell fragments, tracks, courtship rings, drinking sites, mineral licks, etc.) is found in the action area during implementation of the proposed project, we recommend that all activities that could result in the take of a desert tortoise cease *immediately* and that the USFWS and responsible State agency be contacted. USFWS would need to determine the necessary actions to comply with the ESA; the responsible State agencies would also need to review the situation to ensure their laws are not violated. Please notify the USFWS and appropriate state agency as soon as possible as well as in writing within three days of the discovery. If we determine that desert tortoises are indeed present on site, we would have very limited options for allowing the proposed action to proceed in short order. Consequently, we stress the importance of following USFWS guidance and ensuring that qualified workers conduct the surveys.

How did USFWS determine the values for the "probability that a tortoise is above ground"?

The USFWS range-wide monitoring program estimated the proportion of the desert tortoise population that is visible using telemetered animals from focal areas in spring 2001-2005 (USFWS 2006). This probability is related to the previous winter's rainfall, as illustrated in Table 1. The range of fall above-ground activity is similar to spring numbers, but the variability is much higher (Nussear and Tracy 2007; Inman 2008). Until more robust estimates of fall above-ground activity are available, spring estimates based on the previous winter's rainfall (October through March) are used for surveys conducted in either active period.

How did USFWS establish the value for the "probability of detecting a tortoise, if above ground"?

For the past 5 years, surveyors in the USFWS range-wide monitoring program have undergone training on established transects with artificial tortoises. Trained surveyors detected an average of ~63% of model tortoises that were within 5 m of either side of the transect center-line (USFWS unpublished).

Why are only tortoises over 160-mm MCL used to estimate the number of tortoises within the action area?

The values of P_a and P_d used in the equation to estimate the number of tortoises within the action area are based on USFWS range-wide monitoring data collected for adult tortoises ≥160-mm MCL. Live tortoises of all sizes and tortoise sign are used to determine if tortoises are present within the action are.

What is the purpose of 100% coverage surveys versus probabilistic sampling?

The purpose of surveying is to determine presence/absence and estimate the abundance of desert tortoises within the action area. For 100% coverage surveys, transects are placed across the entire action area; thus, the entire area for which abundance is estimated is surveyed. A probabilistic sampling approach, on the other hand, uses data from randomly or systematically placed transects to draw inferences about locations where surveys are not conducted. All locations for which abundance will be estimated *must* have an equal probability of being included in the sample.

How were the threshold project sizes calculated for determining whether 100% coverage or probabilistic sampling is appropriate?

The validity of probabilistic sampling requires that all locations for which abundance will be estimated have an equal probability of being included in the sample, as well as a minimum expected sample size. Estimating the number of tortoises within the project area using probabilistic sampling is limited by number of tortoises encountered during the survey effort. Therefore, whether or not the project area must be surveyed using 100% coverage or can be probabilistically sampled is based on the area expected to yield a survey count of 20 tortoises (Krzysik 2002). Table 2 uses tortoise densities and detection probabilities estimated from 2004-2009 range-wide line-distance sampling efforts for each tortoise recovery unit (USFWS unpublished) to calculate that area of a project site that must be surveyed to produce a statistically robust estimate. If the project area is large enough to potentially allow probabilistic sampling, Table 2 provides the minimum transect kilometers (10-m wide) that must be surveyed.

What if the minimum length of 10-m wide transect kilometers are completed but 20 tortoises were not found in the action area?

If probabilistic sampling is used and <20 tortoises are found after surveying the total area prescribed by Table 2, the number of tortoises within the action area may be estimated using the number found.

Do I keep surveying if 20 tortoises are found before the minimum transect kilometers that must be surveyed are completed?

If probabilistic sampling was used and the transects have been completed in a random order, project-area surveys may be considered complete when 20 tortoises have been found or the specified number of kilometers have been sampled, whichever happens first. It is okay (even desirable) if more that 20 tortoises are found; this will decrease the width of the confidence interval for the abundance estimate.

Why do small and linear projects where no tortoises were found have to do additional surveys at 200-m (~655-ft) intervals parallel to the project area perimeter?

Even though neither tortoises nor tortoise sign were found within the action area at the time of the survey, the area may be part of an animal's home range. The annual home range of a female desert tortoise averages around 0.15 to 0.16 km^2 (35 to 40 acres), about one third the size of male home ranges, which are variable and can be >2 km^2 (500 acres; O'Conner et al. 1994; Duda et al. 1999; Harless et al. 2009). Therefore, projects that are ≤0.8 km^2 (200 acres) or linear may overlap only part of a tortoise's annual home range and the possibility that a resident tortoise was outside the project area at the time surveys were conducted must be addressed. In these cases, three additional 10-m (~30-ft) belt transects at 200-m (~655-ft) intervals parallel to and/or encircling the project area perimeter (200-m, 400-m, and 600-m from the perimeter of the project site) should be completed. Record any tortoises or sign encountered during these surveys. These transects are only used for the presence/absence determination; they are not included in the estimation of tortoise abundance within the project area.

What does the 95% confidence interval for the number of tortoises within the action area mean?

Confidence intervals are used to indicate the reliability of an estimate. The interval gives an estimated range of values, calculated from a set of sample data, which will include an unknown population parameter (in this case, the true number of tortoises within the action area) at the specified rate (e.g., 95%). A wider confidence interval indicates that less certainty is associated with the estimate (see Appendix 2). The Table 3 spreadsheet calculates the abundance and associated 95% confidence interval for the estimated number of tortoises within the project area (Buckland et al. 2001).

Acknowledgments

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Appendix 1. Detailed description of desert tortoise abundance and CI estimation

The estimated abundance of adult desert tortoises within the action area is given by:

$$\begin{pmatrix}\text{Estimated number of tortoises}\\ \text{within action area}\end{pmatrix} = \frac{\begin{pmatrix}\text{Number of tortoises}\\ \text{observed above ground}\end{pmatrix}}{\begin{pmatrix}\text{Probability that}\\ \text{a tortoise is}\\ \text{above ground}\end{pmatrix}\begin{pmatrix}\text{Probability of}\\ \text{detecting a tortoise,}\\ \text{if above ground}\end{pmatrix}}\begin{pmatrix}\text{Size of action area}\\ \text{Size of area surveyed}\end{pmatrix}$$

,

which is equivalent to:

$$\hat{N} = \left[\frac{(n)}{(Table2)(0.63)}\right]\left[\frac{(A)}{(a)}\right],$$

where $\hat{N}$ = estimated abundance within entire action area, *n* = number of tortoises observed above ground, *A* = total action area, and *a* = size of actual area surveyed (= total # km surveyed * 0.01). For 100% coverage surveys, *A/a* = 1.

Table 3 uses the following equations to calculate the 95% confidence interval for the estimate of tortoise abundance within the action area (Buckland et al. 2001), assuming all replicate transect lines are the same length, 10-km.

$$\hat{\text{var}}(n) = L\sum_{i=1}^{k} l_i\left(\frac{n_i}{l_i} - \frac{n}{L}\right)^2 /(k-1)$$

where $\hat{\text{var}}(n)$ = the spatial variation in the number of tortoises detected through the total transect length L, n_i = the number of tortoises seen on transect *i*, l_i = the length of individual transect *i*, and *k* = total number of transects walked.

Putting the sources of variability together, the variance of density is:

$$\text{var}\,\hat{D} = \hat{D}^2\left[\frac{\text{var}(n)}{n^2} + \frac{\text{var}(\hat{P}_a)}{(\hat{P}_a)^2} + \frac{\text{var}(\hat{P}_d)}{(\hat{P}_d)^2}\right]$$

Because the tortoise density sampling distribution is positively skewed, the confidence interval is calculated using a log-distribution for density and built with division and multiplication, rather than addition and subtraction from the mean as with a symmetrical interval (Buckland et al. 2001).

Thus, the 95% confidence interval for $\hat{N}$ is:

$$\left(\hat{N}/C_N, \hat{N}\cdot C_N\right),$$

where $C_N = \exp\left\lfloor z_\alpha\sqrt{\text{var}(\log_e \hat{D})}\right\rfloor$ and $\text{var}(\log_e \hat{D}) = \log_e\left[1 + \frac{\text{var}(\hat{D})}{\hat{D}^2}\right]$.

Given the simplifying assumptions in this protocol, the 95% confidence interval around the estimated number of tortoises within the action area will be wide (e.g., the estimate of the number of tortoises will be imprecise). While this level of imprecision would not be appropriate for recovery planning and decision making at large scales, this protocol provides estimates at local scales that most efficiently utilize the best information that is available to provide statistically defensible results.

Appendix 2. Example

Project location = near Beatty, NV (within the Eastern Mojave RU)

Action area = 12 km^2 (3,000 acres)

According to this protocol's Site Assessment key, the proposed action is within the known range of the desert tortoise. The local USFWS and appropriate state agency offices were contacted and a species list, which includes the desert tortoise, was obtained for the action area. Therefore, pre-project survey and consultation are necessary.

The project footprint is only 10 km^2, but since the project will include blasting, the reach of the proposed action on listed species extends to 12 km^2. Thus, the action area (and therefore the area which needs to be surveyed for desert tortoises) is 12 km^2 (which is more inclusive than the 10 km^2 project footprint).

According to Table 2 of the pre-project survey protocol, the project size of 12 km^2 is above the threshold project area to allow probabilistic sampling in the Western Mojave RU (10.8 km^2 threshold). Therefore, at a minimum, 1,083 km of transects must be walked. For this example, 108 10-km transects (10-m wide) were placed systematically across the project site and were completed in a random order. Surveys of 100% coverage in which 10-m wide transects were placed across the entire 12 km^2 action area would also have been acceptable.

Transects totaling 1,083 km were conducted and 19 adult tortoises (> 160 mm carapace length) were found (as well as tortoise sign, both of which were catalogued using the USFWS 2010 DT pre-project survey protocol data sheet). If 20 adult tortoises had been encountered before the 1,083 km of transects were completed, and transects were conducted in a random order, then surveys could have been considered complete after the 20th tortoise was catalogued.

Data collected from the108 transects (live animals encountered <160-mm MCL)

Number of tortoises (n_i)	Number of transects on which n_i tortoises were seen
0	93
1	11
2	4

Using the Western Regional Climate Center website, it was determined that the Beatty area had received 97-mm (3.8 inches) of rain in the October through March preceding the survey effort, which is above the 40-mm (1.5 inches) in Table 1. Therefore, P_a of 0.80 will be used in this estimation.

Thus, from

$$\hat{N} = \left[\frac{(n)}{(Table2)(0.63)}\right]\left[\frac{(A)}{(a)}\right]$$, we get $$\hat{N} = \left[\frac{(19)}{(0.80)(0.63)}\right]\left[\frac{(12\,km^2)}{(10.8\,km^2)}\right]$$, or $\hat{N} =\sim 42$ tortoises

$$\text{Density} = \frac{(\hat{N})}{(A)}$$, we get $$\hat{D} = \frac{(42)}{(12\,km^2)}$$, or $\hat{D} =\sim 3.5$ tortoises/km^2

To calculate the 95% confidence interval for our abundance estimate, we use:

$$\hat{\text{var}}(n) = L\sum_{i=1}^{k} l_i\left(\frac{n_i}{l_i} - \frac{n}{L}\right)^2 /(k-1),$$

$$\text{we get } \hat{\text{var}}(19) = 1080\left[(93)(10)\left(\frac{0}{10} - \frac{19}{1080}\right)^2 + (11)(10)\left(\frac{1}{10} - \frac{19}{1080}\right)^2 + (4)(10)\left(\frac{2}{10} - \frac{19}{1080}\right)^2\right] /(108-1), \text{ or}$$

$$\hat{\text{var}}(19) = 23.88$$

And for,

$$\text{var}\,\hat{D} = \hat{D}^2\left[\frac{\text{var}(n)}{n^2} + \frac{\text{var}(\hat{P}_a)}{(\hat{P}_a)^2} + \frac{\text{var}(\hat{P}_d)}{(\hat{P}_d)^2}\right], \text{ we get } \text{var}\,\hat{D} = 3.5^2\left[\frac{23.88}{19^2} + \frac{0.05}{0.80^2} + \frac{0.011}{0.63^2}\right], \text{ or } \text{var}\,\hat{D} = 2.107$$

Using our log-transformation because the tortoise density sampling distribution is positively skewed,

$$\text{var}(\log_e \hat{D}) = \log_e\left[1 + \frac{\text{var}(\hat{D})}{\hat{D}^2}\right], \text{ we get } \text{var}(\log_e \hat{D}) = \log_e\left[1 + \frac{2.107}{3.5^2}\right], \text{ or } \text{var}(\log_e \hat{D}) = 0.15$$

Then,

$$C_N = \exp\left[z_\alpha\sqrt{\text{var}(\log_e \hat{D})}\right], \text{ we get } C_N = \exp\left[(1.96)\sqrt{0.15}\right], \text{ or } C_N = 2.18$$

And,

$$\left(\hat{N}/C_N, \hat{N}\cdot C_N\right), \text{ we get } \left((42/2.18), (42\cdot 2.18)\right), \text{ or } \sim(19, 92).$$

Summary

Using the Site Assessment key, it was determined that survey and consultation were necessary for the proposed action. Thus, the pre-project field survey protocol was implemented. In this case, probabilistic sampling with equal length transects (10-km long) was used and 19 adult tortoises and tortoise sign were found during the sampling of the action area, indicating presence. Using the equations and data presented in Appendix 1 of this protocol, Table 3 estimated the actual number of tortoises within the project was estimated to be ~42, with a 95% confidence interval of ~(19, 92).

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: _____ Survey biologist(s): _____
(day, month, year) (name, email, and phone number)

Site description: _____
(project name and size; general location)

County:_____ Quad:_____ Location:_____
(UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: _____ Transect #: ____ Transect length: _____

GPS Start-point: _____ _____ Start time: _____am/pm
(easting, northing, elevation in meters)

GPS End-point: _____ End time: _____am/pm
(easting, northing, elevation in meters)

Start Temp: _____ºC End Temp: _____ºC

Live Tortoises

Detection number	GPS location Easting	GPS location Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (*Yes, No or Unknown*)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	GPS location Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1				
2				
3				
4				
5				
6				
7				
8				

Appendix B

Completed USFWS Mojave Desert Tortoise Survey Forms

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 5, 04, 2010 (day, month, year) Survey biologist(s): Jen Cleland, jcleland@lsda2.com, 480-967-1347 (name, email, and phone number)

Site description: Lake Powell Pipeline – South of Virgin R. (project name and size; general location)

County: Washington Quad: Hurricane Location: S29-32, T41, R13 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: _____ Transect #: ____ Transect length: _____

GPS Start-point: 0290199, 4118022 (easting, northing, elevation in meters) Start time: 10:28 am/pm

GPS End-point: 0290531, 4118178 (easting, northing, elevation in meters) End time: 12:55 am/pm

Start Temp: 22.7 °C End Temp: 26.4 °C

Live Tortoises

Detection number	GPS location Easting	GPS location Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (Yes, No or Unknown)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	GPS location Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1	0290531	4118180	Skeletal remains Carcass	scutes & bones male-gular horn, bleached white
2	0291364	4118173	Potential burrow	under creosote, odd shape
3	0290542	4118145	Potential burrow	HWD: 10cm x 24cm x 80cm
4				
5				
6				
7				
8				

Page: 1 of 1

Transect number: 1

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 19,8,10 (day, month, year) Survey biologist(s): J Cleland (name, email, and phone number)

Site description: White Powell Pipeline (WPP) - South of Virgin River (project name and size; general location)

County: WASH Quad: Hurricane Location: S 30 T41, R13 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: _____ Transect #: ____ Transect length: _____

GPS Start-point: _____ (easting, northing, elevation in meters) Start time: 3:00 am/pm

GPS End-point: _____ (easting, northing, elevation in meters) End time: _____ am/pm

Start Temp: _____ °C End Temp: _____ °C

Live Tortoises

Detection number	GPS location Easting	GPS location Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (Yes, No or Unknown)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	GPS location Northing	Type of sign (*burrows, scats, carcass; etc*)	Description and comments
1	0290455	4118073	Scat.	1½ inch long, dry & gray
2				
3				
4				
5				
6				
7				
8				

Page: 1 of 1

Transect number: 2

USFWS 2010 Desert Tortoise Pre-Project Survey Data Sheet

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 20, 4, 2010 (day, month, year) Survey biologist(s): Jennifer Cleland, jcleland@lsdaz.com 480.619.1283 (name, email, and phone number)

Site description: Lake Powell Pipeline (project name and size; general location) ; South of Hurricane, UT & west of Hurricane Cliffs

County: Washington Quad: The Divide Location: S4,5,89 T43, R13 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: _____ Transect #: ____ Transect length: _____

GPS Start-point: 0294554, 4104430 (easting, northing, elevation in meters) Start time: _____ am/pm

GPS End-point: 0291980, 4106613 (easting, northing, elevation in meters) End time: 3:19 am/pm

Start Temp: 25.2 °C End Temp: 28.0 °C

Live Tortoises

Detection number	GPS location Easting	Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >180-mm? (Yes, No or *Unknown*)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1	0291884	4106398	inactive burrow	under ~~Un-Calliche~~ Artemesia filifolia along wash. 6 inches deep; opening 6 inches wide & 2 inches tall
2	0292940	4104041	burrow	sandstone crevice, 3 feet deep and curves left + Opening 6 inches wide & 3 inches tall
3	0292940	4104041	Scats	3 brown & dried inside burrow
4	0292917	4104016	burrow	Sandstone crevice, 2 feet deep. Opening 10 inches wide, 3 1/2 inches tall
5	0292897	4104041	scat	1 scat, not with a burrow. Greenish brown & dry.
6	0291872	4106420	inactive burrow in sand along wash.	no additional sign. 2 1/2 feet deep. Opening 9 inches wide & 2 inches tall
7	0292972	4104047	burrow	Sandstone burrow. 3 feet deep. Opening 1 1/2 ft wide & 1 foot tall.
8	0292972	4104047	Scats	2 Scats - brown + dry

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 20, 4, 2010 (day, month, year) Survey biologist(s): Cleland (name, email, and phone number)

Site description: Lake Powell Pipeline - East of Sand Hollow (project name and size; general location)

County: Washington Quad: The Divide Location: S 4, 5, 8, 9 T 43, R 13 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: _____ Transect #: ____ Transect length: _____

GPS Start-point: 0294554, 4104430 (easting, northing, elevation in meters) Start time: _____ am/pm

GPS End-point: 0291980, 4104466613 (easting, northing, elevation in meters) End time: 3:19 am/pm

Start Temp: 25.2 °C End Temp: 28.0 °C

Live Tortoises

Detection number	GPS location Easting	GPS location Northing	Time	Tortoise location (*in burrow*; all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (Yes, No or Unknown)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	GPS location Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1	292795	4104148	burrow	in sand at base of basalt hill. 15 inches deep; Opening 12 inches wide & 5 inches tall
2				
3				
4				
5				
6				
7				
8				

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 26,4,10 (day, month, year) Survey biologist(s): J Cleland (name, email, and phone number)

Site description: Lake Powell, afterbay (project name and size; general location)

County: WASH Quad: The Divide Location: S9,10,15,16, T43, R13 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage/or Sampling Area size to be surveyed: _____ Transect #: ____ Transect length: _____

GPS Start-point: 0294863, 4104046 (easting, northing, elevation in meters) Start time: 1:35 am/pm

GPS End-point: 0294586, 4104318 (easting, northing, elevation in meters) End time: 4:25 am/pm

Start Temp: 31.8 °C End Temp: 27.7 °C

Live Tortoises

Detection number	GPS location Easting	GPS location Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (*Yes, No or Unknown*)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	GPS location Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1				
2				
3				
4				
5				
6				
7				
8				

Page: 1 of 1

Transect number: 4

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 4,27,10 (day, month, year) Survey biologist(s): Cleland 480-967-1343 (name, email, and phone number)

Site description: Lake Powell afterbay (project name and size/ general location)

County: WASH Quad: The Divide Location: S9,10,16 T43,R13 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: _____ Transect #: ____ Transect length: _____

GPS Start-point: 0294576, 4104320 (easting, northing, elevation in meters) Start time: 8:15 am/pm

GPS End-point: 0294262, 4103096 (easting, northing, elevation in meters) End time: 4:53 am/pm

Start Temp: 22.8 °C End Temp: _____ °C

Live Tortoises

Detection number	GPS location Easting	GPS location Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (Yes, No or Unknown)	Existing tag # and color, if present
1						
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Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	GPS location Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
~~1~~	~~0294196~~	~~4103241~~	~~scat~~	~~long, white + dry~~ RODENT
2	029387~~3~~5	4103~~36~~54	scats	4, dry, on basalt hillside
3	0293895	413794	burrow	sandstone crevice - various sized fresh + dry scats ↳ 3-4 ft deep; opening is 2 ft wide, 8 inches tall
4				
5	0294363	4104352	burrow	basalt rock outcrop
6	0294363	4104352	scats	3, dry and old @ burrow entrance
7	0293877	4103378	scats	2, old and dry
8	0293930	4103784	scat	dark brown on sandstone ledge

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 27,4,10 (day, month, year) Survey biologist(s): Cleland (name, email, and phone number)

Site description: PP afterbay (project name and size; general location)

County: WASH Quad: The Divide Location: S 9,10,16 T43, R13 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: _____ Transect #: ____ Transect length: _____

GPS Start-point: _____ (easting, northing, elevation in meters) Start time: _____am/pm

GPS End-point: _____ (easting, northing, elevation in meters) End time: _____am/pm

Start Temp: _____°C End Temp: _____°C

Live Tortoises

Detection number	GPS location Easting	Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (Yes, No or Unknown)	Existing tag # and color, if present
1						
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Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1	0293948	4104061	scat	white, on basalt stones
2	293862	4103758	scat	1.25" long, old, dry
3	293872	4103755	scat	1.25" long, dark, dry
4	293926	4103848	scats	dry, white
5	293936	4104045	scats	
6	293943	4104026	scats	dry, white, under ephedra
7	293972	4104088	burrow, scat	HWD: 10" x 12" x 72" w/ fresh scat
8	293975	4104152	burrow, track	HWD: 6" x 7" x 18in in rock outcrop w/ plastron imprint

USFWS 2010 Desert Tortoise Pre-Project Survey Data Sheet

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

480-967-1343

Date of survey: 4,28,4,10 (day, month, year) Survey biologist(s): Jen Cleland, jcleland@lsdaz.com (name, email, and phone number)

Site description: Lake Powell afterbay (project name and size; general location)

County: Wash Quad: The Divide Location: S 9,16 T43, R13 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: _____ Transect #: ____ Transect length: _____

GPS Start-point: 0294542, 4104282 (easting, northing, elevation in meters) Start time: 8:05 am/pm

GPS End-point: 0294121, 4104151 (easting, northing, elevation in meters) End time: 3:18 am/pm

Start Temp: 20.1 °C End Temp: 28.1 °C

Live Tortoises

Detection number	GPS location Easting	Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or not *in burrow*)	Approx MCL >160-mm? (Yes, No or Unknown)	Existing tag # and color, if present
1						
2						
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Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1	0293921	4103951	Scats	3; old, dry & white on gravel
2	0293930	4103759	Scats	12 old & dry, 1 fresh & juvenile?; 6 old & juvenile
3	0294162	4103367	burrow	2.5 ft deep. Opening 10 inch tall, 2.5 ft wide sandstone
4	"	"	Scat	in burrow, juvenile(?), old
5	"	"	Scats	6 fresh, juvenile(?)
6	0294162	4103367	burrow	2 ft deep, 3 inch tall, 24 inch wide sandstone
7	0294139	4103652	potential burrow	Inactive - 2+ ft deep. 10 inch wide 4 inch tall
8	0294008	~~4103985~~ 4103787	burrow	6 ft deep. 15 inches wide, 8 inch tall. Sandstone

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 28.4.10 (day, month, year) Survey biologist(s): Cleland (name, email, and phone number)

Site description: VPP Afterbay (project name and size; general location)

County: WASH Quad: The Divide Location: S 9,16 T43, R13 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: _____ Transect #: ____ Transect length: _____

GPS Start-point: _____ (easting, northing, elevation in meters) Start time: 8:05 am/pm

GPS End-point: _____ (easting, northing, elevation in meters) End time: 3:18 am/pm

Start Temp: 20.1°C End Temp: 28.1°C

Live Tortoises

Detection number	GPS location Easting	Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (Yes, No or Unknown)	Existing tag # and color, if present
1						
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Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1	0294370	4104251	scats	2 fresh, juvenile?
2	0293971	4103956 ~~4103956~~	scats	3, dry + old
3	0294132	4103687	burrow	wash bank. 1½ ft deep, 10.5cm tall 22cm wide. Fresh diggings
4	0293999	4103298	burrow	8 cm tall, 18cm wide
5	0293786	4103634	scat	1-old & dry, white
6	0294060	4103885	scat	1-old & white; 1-fresh
7				
8				

USFWS 2010 Desert Tortoise Pre-Project Survey Data Sheet

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 29,4,10 (day, month, year) Survey biologist(s): Cleland, jcleland@lsdaz.com, 480-967-1343 (name, email, and phone number)

Site description: Lake Powell afterbay (project name and size; general location)

County: Wash Quad: The Divide Location: S 10, T43, R13 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: _____ Transect #: ____ Transect length: _____

GPS Start-point: 0294955, 4103910 (easting, northing, elevation in meters) Start time: 7:55 am/pm

GPS End-point: 0295433, 4103544 (easting, northing, elevation in meters) End time: 11:39 am/pm

Start Temp: 12.0 °C End Temp: 12.3 °C

Live Tortoises

Detection number	GPS location Easting	GPS location Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (Yes, No, or Unknown)	Existing tag # and color, if present
1						
2						
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Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	GPS location Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1	0295228	4104200	potential burrow	along wash / cut bank. 1 foot deep, 8 inch wide, 5 inch tall
2	0295232	4104200	~~potential~~ burrow	along wash. 8 inch deep, 6 inches wide, 8 inch tall
3	0295240	4104206	burrow	along wash. 1 ft + deep, 9 inch wide, 5 inch tall
4	0295368	4104254	scat	white, dry - old, in wash
5	0295394	4103712	scat	white, dry - old, on gravel
6	0295474	4103941	burrow	limestone rock pocket on N face slope 15 inch deep; 12 inch tall, 20 inch
7	0295504	4103617	burrow	2 openings. 20 inch wide, 10 inch tall wide and 6 feet deep. Right hole 12 inch de
8	"	"	scat	old, white & dry in burrow

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 29,4,10 (day, month, year) Survey biologist(s): Cleland (name, email, and phone number)

Site description: Lake Powell afterbay (project name and size; general location)

County: _____ Quad: _____ Location: _____ (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: _____ Transect #: ____ Transect length: _____

GPS Start-point: _____ (easting, northing, elevation in meters) Start time: 7:55 (am)/pm

GPS End-point: _____ (easting, northing, elevation in meters) End time: 11:39 am/(pm)

Start Temp: 12.0 °C End Temp: 12.3 °C

Live Tortoises

Detection number	GPS location Easting	GPS location Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (Yes, No, or Unknown)	Existing tag # and color, if present
1	0295384	4103533	10:43 AM	in wash. retreated to small rock crevice	12 cm	no tag
2						
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Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	GPS location Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1	0295261	4103589	burrow	caliche/limestone wash. 160cm deep; 16cm tall, 40cm wide
2	"	"	scats	2 old, dry pieces inside burrow
3	0295241	4104206	burrow	on broken limestone along wash 72cm deep; 13cm tall x 24cm wide
4	"	"	scats	2 pieces old, dry inside burrow
5	0295327	4104307	burrow	75cm deep; 11cm tall x 35cm wide
6	"	"	scat	dry, old and in burrow
7	0295400	4103550	burrow	60 deep. 9 tall x 16 wide
8	"	"	burrow	along dry wash. 40 deep. 6 tall x 11 wide

Page: 2 of 3

Transect number: 7

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 29.4.10 (day, month, year) Survey biologist(s): Cleland (name, email, and phone number)

Site description: Lake Powell afterbay (project name and size; general location)

County: _____ Quad: _____ Location: _____ (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: _____ Transect #: ____ Transect length: _____

GPS Start-point: _____ (easting, northing, elevation in meters) Start time: 7:55 (am)/pm

GPS End-point: _____ (easting, northing, elevation in meters) End time: 11:39 (am)/pm

Start Temp: _____ °C End Temp: _____ °C

Live Tortoises

Detection number	GPS location Easting	GPS location Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (Yes, No or Unknown)	Existing tag # and color, if present
1						
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Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	GPS location Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1	295400	4103550	scat	small juvenile(?) outside burrow
2	295521	4103927	burrow	HWD: 9in x 8in x 20in
3				
4				
5				
6				
7				
8				

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 3,5,10 (day, month, year) Survey biologist(s): Shaylon Stump (name, email, and phone number)

Site description: LPP - north of Sand Hollow Reservoir (project name and size; general location)

County: Washington Quad: Hurricane Location: S13, T42 R~~14~~13 and S18, T42, R13 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: _____ Transect #: ____ Transect length: _____

GPS Start-point: 0288763, 4113174 (easting, northing, elevation in meters) Start time: 1:59 am/pm

GPS End-point: 0289908, 4113199 (easting, northing, elevation in meters) End time: 5:10 am/pm

Start Temp: 26 °C End Temp: 24 °C

Live Tortoises

Detection number	GPS location Easting	GPS location Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (Yes, No or Unknown)	Existing tag # and color, if present
1						
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Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	GPS location Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1	0289971	4112818	Potential burrow	12" wide x 8" ~~deep~~ tall; 2 feet of ~~deep~~ fresh diggings
2	0289971	4112842	potential burrow	14" W x 12" H x 2' D. fresh dirt
3	0289969	4112862	potential burrow	8" W x 7" H x 2' D.
4	0289518	4112534	potential burrow	no scat. South side of Creosote
5	0289508	4112387	Potential burrow	fresh dirt
~~6~~	~~0289716~~	~~4112795~~	~~burrow~~	
7	0289710	4112754	Potential burrow	7" W x 15 in H
8	0288960	4112804	Potential burrow	9" W x 5" H. no

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 3,5,10 (day, month, year) Survey biologist(s): Stump (name, email, and phone number)

Site description: LPP - NOJ Sand Hollow (project name and size; general location)

County: Wash Quad: Hurricane Location: S13, T42 R14 AND S18 T42 R13 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: _____ Transect #: ____ Transect length: _____

GPS Start-point: 0288763, 4113174 (easting, northing, elevation in meters) Start time: _____am/pm

GPS End-point: 0289908 4113199 (easting, northing, elevation in meters) End time: _____am/pm

Start Temp: 26 °C End Temp: 24 °C

Live Tortoises

Detection number	GPS location Easting	GPS location Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (Yes, No or Unknown)	Existing tag # and color, if present
1						
2						
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Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	GPS location Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1	0289296	4112704	burrows	3 burrows within 5 feet of each other
2	0290349	4112179	potential burrow	D-shape @ base of creosote
3	0289699	4111885	potential burrow	15" tall x 7" wide
4				
5				
6				
7				
8				

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 4,5,10 (day, month, year) Survey biologist(s): ~~Shaylon~~ Shaylon Stump (name, email, and phone number)

Site description: _____ (project name and size; general location)

County: Mohave Quad: The Divide Location: S19T42R13 and S30 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: _____ Transect #: ____ Transect length: _____

GPS Start-point: 0289762, 4111439 (easting, northing, elevation in meters) Start time: 8:01 (am)/pm

GPS End-point: 0290294, 4108474 (easting, northing, elevation in meters) End time: 10:28 (am)/pm

Start Temp: 19 °C End Temp: 27 °C

Live Tortoises

Detection number	GPS location Easting	GPS location Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (*Yes, No, or Unknown*)	Existing tag # and color, if present
1						
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Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	GPS location Northing	Type of sign (*burrows, scats, carcass, etc*),	Description and comments
1				
2				
3				
4				
5				
6				
7				
8				

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 4,5,10 (day, month, year) Survey biologist(s): Shaylon Stump (name, email, and phone number)

Site description: UPP afterbay (project name and size; general location)

County: Wash Quad: The Divide Location: S10 T43 R13 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage of Sampling Area size to be surveyed: _____ Transect #: ____ Transect length: _____

GPS Start-point: 0294860, 4104373 (easting, northing, elevation in meters) Start time: 11:56 (am)/pm

GPS End-point: 0294766, 4109496 (easting, northing, elevation in meters) End time: 3:45 am/(pm)

Start Temp: 30 °C End Temp: 36 °C

Live Tortoises

Detection number	GPS location Easting	GPS location Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or not *in burrow*)	Approx MCL >160-mm? (Yes, No or Unknown)	Existing tag # and color, if present
1						
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6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	GPS location Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1	295031	4104373	burrow	WD: 16in x 36in on flats
2				
3				
4				
5				
6				
7				
8				

Page: 1 of 1

Transect number: 10

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 6/5/10 (day, month, year) Survey biologist(s): Bruce Palmer (name, email, and phone number)

Site description: LPP - E of Sand Hollow (project name and size; general location)

County: WASH Quad: The Bridge Location: T S 20, 29, 32 T 42 R 13 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: _____ Transect #: ____ Transect length: _____

GPS Start-point: 0291788, 4107156 (easting, northing, elevation in meters) Start time: 1:51 am/pm

GPS End-point: 0291925, 4111434 (easting, northing, elevation in meters) End time: 3:50 am/pm

Start Temp: 30 °C End Temp: 30 °C

Live Tortoises

Detection number	GPS location Easting	GPS location Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (Yes, No or Unknown)	Existing tag # and color, if present
1						
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8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	GPS location Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1				
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3				
4				
5				
6				
7				
8				

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 7.5.10 (day, month, year) Survey biologist(s): Jennifer Cleland (name, email, and phone number)

Site description: UPP-afterbay (project name and size; general location)

County: WASH Quad: The Divide Location: S8-10,16 T43 R13 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: ~~100% coverage or Sampling~~ Area size to be surveyed: _____ Transect #: ____ Transect length: _____

GPS Start-point: 0294895, 4102629 (easting, northing, elevation in meters) Start time: 8:50 (am)/pm

GPS End-point: 0289645, 4108194 (easting, northing, elevation in meters) End time: 10:59 (am)/pm

Start Temp: 18.2 °C End Temp: 24.3 °C

Live Tortoises

Detection number	GPS location Easting	Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (Yes, No or Unknown)	Existing tag # and color, if present
1						
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8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1	0293428	4103171	scats	fresh, no burrows
2	0293365	4103261	~~burrow~~ scats	~~14"W x 9"H x 2 ft deep~~ DRY, WHITE, ON SANDSTONE
3	0292928	4103630	scat burrow	55cm W x 20cm H x 1.5m deep sandstone
4	0294767	4104526	burrow	3.5" H x 9" W x dia sandy wash no fresh sign
5	0294762	4104585	burrow	~~Potential~~ burrow, no sign 12" H x 6" W x 1 foot D
6	0294077	4105803	burrow	20" W x 10" H x 2ft+ D unoccupied, basalt rocks
7	0293008	4103408	burrow, scats	HWD: 9" x 14" x 24" w/scat
8	294772	4104482	burrow	HWD: 8" x 14" x 24" in flats

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 8,5,10 (day, month, year) Survey biologist(s): Jennifer Cleland (name, email, and phone number)

Site description: UPP - 115 to Toquerville (project name and size; general location)

County: Washington Quad: Pintura & Hurricane Location: S 32,33 T40 R13 AND S4,5,10-14 T41 R13 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: _____ Transect #: ____ Transect length: _____

GPS Start-point: 0293789, 4126579 (easting, northing, elevation in meters) Start time: 8:42 (am)/pm

GPS End-point: 0297010, 4123396 (easting, northing, elevation in meters) End time: 5:14 am/(pm)

Start Temp: 23.2 °C End Temp: 27.4 °C

Live Tortoises

Detection number	GPS location Easting	GPS location Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (Yes, No, or Unknown)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	GPS location Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1	0291316	4118198	Potential burrow	7"W x 4"H x 1ft D sandy, no other signs
2				
3				
4				
5				
6				
7				
8				

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 9,5,10 (day, month, year) Survey biologist(s): Jennifer Cleland (name, email, and phone number)

Site description: UPP - 115 to private prop (project name and size; general location)

County: WASH Quad: Pintura Location: S3,4 T41R13 AND S32,33 T41R13 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: _____ Transect #: ____ Transect length: _____

GPS Start-point: 0294166, 4127050 (easting, northing, elevation in meters) Start time: 8:14 (am)/pm

GPS End-point: 0295409, 4125660 (easting, northing, elevation in meters) End time: 4:00 am/(pm)

Start Temp: 27.8 °C End Temp: 29 °C

Live Tortoises

Detection number	GPS location Easting	GPS location Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (Yes, No, or Unknown)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	GPS location Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1				
2				
3				
4				
5				
6				
7				
8				

USFWS 2010 Desert Tortoise Pre-Project Survey Data Sheet

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 10,5,10 (day, month, year) Survey biologist(s): Jennifer Cleland (name, email, and phone number)

Site description: UPP- E of LaVerkin Creek (project name and size; general location)

County: WASH Quad: Hurricane & Virgin Location: S13 T41, R13 ; S12, 19, 20 T41 R12 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: _____ Transect #: ____ Transect length: _____

GPS Start-point: 0299799, 4121797 (easting, northing, elevation in meters) Start time: 7:20 am/pm

GPS End-point: 0302715, 4119571 (easting, northing, elevation in meters) End time: 9:05 am/pm

Start Temp: _____°C End Temp: _____°C

Live Tortoises

Detection number	GPS location Easting	GPS location Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (*Yes, No or Unknown*)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	GPS location Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1				
2				
3				
4				
5				
6				
7				
8				

Page: 1 of 1

Transcript number: 15

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 17,5,10 (day, month, year) Survey biologist(s): J. Meland (name, email, and phone number)

Site description: S of Virgin River (project name and size; general location)

County: WASH Quad: Virgin Location: S28,29T41R12 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: _____ Transect #: ____ Transect length: _____

GPS Start-point: 0303474, 4119284 (easting, northing, elevation in meters) Start time: 2:12 am/pm

GPS End-point: 0302438, 4117969 (easting, northing, elevation in meters) End time: 4:00 am/pm

Start Temp: 28.6 °C End Temp: 27.1 °C

Live Tortoises

Detection number	GPS location Easting	GPS location Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (*Yes, No, or Unknown*)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	GPS location Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1				
2				
3				
4				
5				
6				
7				
8				

Page: 1 of 1

Transect number: 16

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 10,5,10 (day, month, year) Survey biologist(s): K. Nicholson (name, email, and phone number)

Site description: Lake Powell - S of Highway 9 (project name and size; general location)

County: Wash Quad: Virgin Location: S29-32T41R12; S6T42R12 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: _____ Transect #: ____ Transect length: _____

GPS Start-point: 0301087, 4116904 (easting, northing, elevation in meters) Start time: 8:11 am/pm

GPS End-point: 0299082, 4103822 (easting, northing, elevation in meters) End time: 4:25 am/pm

Start Temp: 18.2 °C End Temp: 21.2 °C

Live Tortoises

Detection number	GPS location Easting	GPS location Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (*Yes, No, or Unknown*)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	GPS location Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1	0299969	4115330	potential burrow	no tortoise sign 12"W x 5"H x 12"D
2				
3				
4				
5				
6				
7				
8				

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 19,5,10 (day, month, year) Survey biologist(s): K Nicholson (name, email, and phone number)

Site description: Lake Powell - Forebay (project name and size; general location)

County: Wash Quad: The Divide Location: S11-13 T43R13 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: _____ Transect #: ____ Transect length: _____

GPS Start-point: 0297153, 4103458 (easting, northing, elevation in meters) Start time: 8:26 (am)/pm

GPS End-point: 0297129, 4104402 (easting, northing, elevation in meters) End time: 3:49 am/(pm)

Start Temp: _____ °C End Temp: 28.5 °C

Live Tortoises

Detection number	GPS location Easting	GPS location Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (Yes, No or Unknown)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	GPS location Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1	296767	4103480	potential burrow	HWD: 9cmx16cmx36cm
2				
3				
4				
5				
6				
7				
8				

Page: 1 of 1

Transect number: 18

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 20,5,10 (day, month, year) Survey biologist(s): JCleland 480967-1343 (name, email, and phone number)

Site description: Forebay (project name and size; general location)

County: Kern Quad: The Divide Location: S11-13 T43 R13 (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage of Sampling Area size to be surveyed: _____ Transect #: _____ Transect length: _____

GPS Start-point: 0296296, 4104881 (easting, northing, elevation in meters) Start time: ~~8:30~~ 8:38 am/pm

GPS End-point: 0296487, 4104406 (easting, northing, elevation in meters) End time: 4:45 am/pm

Start Temp: 23.3°C End Temp: _____°C

Live Tortoises

Detection number	GPS location Easting	GPS location Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (Yes, No or Unknown)	Existing tag # and color, if present
1						
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	GPS location Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1				
2				
3				
4				
5				
6				
7				
8				

USFWS 2010 DESERT TORTOISE PRE-PROJECT SURVEY DATA SHEET

Please submit a completed copy to the action agency and local USFWS office within 30-days of survey completion

Date of survey: 2,5,10 (day, month, year) Survey biologist(s): J. Cleland (name, email, and phone number)

Site description: Afterbay - plant survey - incidental observation (project name and size; general location)

County: WASH Quad: The Divide Location: (UTM coordinates, lat-long, and/or TRS; map datum)

Circle one: 100% coverage or Sampling Area size to be surveyed: _____ Transect #: ____ Transect length: _____

GPS Start-point: 0295323 4103890 (easting, northing, elevation in meters) Start time: ~~9:00 am/pm~~ 9:06 AM

GPS End-point: 0295323 4103890 (easting, northing, elevation in meters) End time: _____ am/pm

Start Temp: _____ °C End Temp: _____ °C

Live Tortoises

Detection number	GPS location Easting	GPS location Northing	Time	Tortoise location (*in burrow*: all of tortoise beneath plane of burrow opening, or *not in burrow*)	Approx MCL >160-mm? (Yes, No or Unknown)	Existing tag # and color, if present
1	0295323	4103890	9:06 AM	not in or near burrows appeared healthy was eating Erodium cicutarium	11 inches	None
2						
3						
4						
5						
6						
7						
8						

Tortoise Sign (burrows, scats, carcasses, etc)

Detection number	GPS location Easting	GPS location Northing	Type of sign (*burrows, scats, carcass, etc*)	Description and comments
1	0295323	4103890	Scat	fresh and moist
2				
3				
4				
5				
6				
7				
8				

Page: 1 of 1

Transcript number: 10

Appendix C

Acreages of Vegetation Communities within 2010 LPP Mojave Desert Tortoise Occupied Habitat

Table C-1
Acreages of vegetation communities within 2010 LPP Mojave desert tortoise occupied habitat

Ecological System	Alliance	Association	Acres
Agricultural land	Agricultural land	Agricultural land	0.46
	Stock pond	Stock pond	2.43
Developed - Road	Developed - Road Graded	Developed - Road Graded	20.14
	Developed - Road Paved	Developed - Road Paved	9.61
	Developed - Road unimproved	Developed - Road unimproved	3.51
Developed land	Developed land	Developed land	8.06
Invasive Upland Vegetation	*Bromus* (*rubens*, *tectorum*) Semi-natural Herbaceous Alliance	*Bromus rubens* Semi-natural Herbaceous Vegetation	3.09
	Erodium cicutarium Semi-natural Herbaceous Alliance	*Erodium cicutarium* Semi-natural Herbaceous Vegetation	5.30
Mojave Desert Active and Stabilized Dune	*Artemisia filifolia* Shrubland Alliance	*Artemisia filifolia - Ephedra* (*nevadensis*, *torreyana*, *viridis*) Shrubland	11.98
		Artemisia filifolia - Gutierrezia sarothrae Shrubland	21.07
		Artemisia filifolia Shrubland	53.35
	Coleogyne ramosissima - Ephedra nevadensis Shrubland Alliance	*Coleogyne ramosissima - Ephedra nevadensis* Dwarf-shrubland	5.73
	Coleogyne ramosissima Shrubland Alliance	*Coleogyne ramosissima - Ephedra nevadensis* Dwarf-shrubland	4.00
Mojave Desert Bedrock Cliff and Outcrop	*Coleogyne ramosissima* Shrubland Alliance	*Coleogyne ramosissima* / Sandstone Outcrop Sparse Shrubland	7.85
	Lepidium fremontii Sparsely Vegetated Alliance	*Lepidium fremontii - Coleogyne ramosissima* / *Pleuraphis rigida - Bromus rubens* Semi-natural Sparse Vegetation	6.52
	Non-vegetated sandstone	Non-vegetated Sandstone Outcrop	0.96
	Purshia (*stansburiana*, *glandulosa*, *mexicana*) Sparsely Vegetated Alliance	*Purshia* (*stansburiana*, *mexicana*) / Sandstone Outcrop Sparse Vegetation	5.01
Mojave Desert Blackbrush-Mormon-tea Shrubland	*Coleogyne ramosissima - Ephedra nevadensis* Shrubland Alliance	*Coleogyne ramosissima - Ephedra nevadensis* / *Bromus rubens* Semi-natural Dwarf-shrubland	16.99
	Coleogyne ramosissima Shrubland Alliance	*Coleogyne ramosissima - Ephedra nevadensis* / (*Erodium cicutarium*, *Bromus* (*rubens*, *tectorum*), *Salsola tragus*) Semi-natural Shrubland	0.79
		Coleogyne ramosissima / (*Erodium cicutarium*, *Bromus* (*rubens*, *tectorum*), *Salsola tragus*) Semi-natural Shrubland	52.93
	Ephedra nevadensis Shrubland Alliance	*Ephedra nevadensis - Lycium andersonii* Shrubland	0.83
		Ephedra nevadensis Shrubland	6.15

Table C-1
Acreages of vegetation communities within 2010 LPP Mojave desert tortoise occupied habitat

Ecological System	Alliance	Association	Acres
Mojave Desert Creosotebush-White Bursage Desert Scrub	*Ambrosia dumosa* Shrubland Alliance	*Ambrosia dumosa* / (*Erodium cicutarium*, *Bromus rubens*) Dwarf-shrubland	2.01
		Ambrosia dumosa Dwarf-shrubland	2.17
	Erodium cicutarium Semi-natural Herbaceous Alliance	*Larrea tridentata* / *Erodium cicutarium* Semi-natural Shrub Herbaceous Vegetation	86.35
	Larrea tridentata Shrubland Alliance	*Larrea tridentata - Ambrosia dumosa* Shrubland	2.05
		Larrea tridentata - Ambrosia dumosa Sparse Shrubland	0.51
		Larrea tridentata - Coleogyne ramosissima / *Bromus rubens* Semi-natural Shrubland	42.20
		Larrea tridentata - Gutierrezia sarothrae Sparse Shrubland	2.29
		Larrea tridentata / (*Erodium cicutarium*, *Bromus rubens*, *Salsola tragus*) Semi-natural Shrubland	31.33
		Larrea tridentata / (*Erodium cicutarium*, *Bromus rubens*, *Salsola tragus*) Semi-natural Sparse Shrubland	373.34
		Larrea tridentata Shrubland	20.45
	Larrea tridentata Sparsely Vegetated Alliance	*Larrea tridentata* / (*Erodium cicutarium*, *Bromus rubens*, *Salsola tragus*) Semi-natural Sparse Vegetation	48.49
Mojave Desert Grassland	*Pleuraphis rigida* Herbaceous Alliance	*Pleuraphis rigida* Herbaceous Vegetation	30.60
Mojave Desert Lower Montane Riparian Woodland and Shrubland	*Typha latifolia* Herbaceous Alliance	*Tamarix chinensis* / *Typha latifolia* Semi-natural Shrub Herbaceous Vegetation	1.34
Mojave Desert Mixed Desert Scrub	*Chrysothamnus viscidiflorus* Shrubland Alliance	*Chrysothamnus viscidiflorus* / (*Erodium cicutarium*, *Bromus* (*rubens*, *tectorum*), *Salsola tragus*) Semi-natural Dwarf-shrubland	16.70
		Chrysothamnus viscidiflorus Sparse Shrubland	18.33
	Grayia spinosa Shrubland Alliance	*Grayia spinosa - Lycium andersonii* / (*Erodium cicutarium*, *Bromus rubens*) Semi-natural Dwarf-shrubland	23.80
	Gutierrezia sarothrae Shrubland Alliance	*Gutierrezia sarothrae* / (*Erodium cicutarium*, *Bromus* (*tectorum*, *rubens*), *Salsola tragus*) Semi-natural Dwarf-shrubland	26.30
		Gutierrezia sarothrae / (*Erodium cicutarium*, *Bromus* (*tectorum*, *rubens*), *Salsola tragus*) Semi-natural Sparse Dwarf-shrubland	0.94
		Gutierrezia sarothrae Dwarf-shrubland	10.16
		Gutierrezia sarothrae Sparse Dwarf-shrubland	2.79
	Krascheninnikovia lanata Shrubland Alliance	*Krascheninnikovia lanata* Dwarf-shrubland	9.51

Table C-1
Acreages of vegetation communities within 2010 LPP Mojave desert tortoise occupied habitat

Ecological System	Alliance	Association	Acres
Mojave Desert Mixed Desert Scrub (*cont.*)	Mixed Desert Shrub Shrubland Alliance	Mixed Desert Shrub / (*Bromus rubens*, *Salsola tragus*, *Erodium cicutarium*) Semi-natural Shrubland	53.45
	Salsola tragus Semi-natural Herbaceous Alliance	*Lycium pallidum* / *Salsola tragus* Semi-natural Shrub Herbaceous Vegetation	12.67
	Unclassified	Unclassified	5.61
	Yucca baccata Shrubland Alliance	*Yucca baccata* / *Bromus rubens* Semi-natural Shrubland	33.18
		Yucca baccata / *Salsola tragus* Semi-natural Sparse Shrubland	26.57
Mojave Desert Shrub-Steppe	*Ericameria linearifolia* Shrubland Alliance	*Ericameria linearifolia* / *Pleuraphis rigida* Dwarf-shrubland	3.05
	Gutierrezia sarothrae Shrubland Alliance	*Gutierrezia sarothrae* / *Pleuraphis rigida* Dwarf-shrubland	7.96
	Larrea tridentata Shrubland Alliance	*Larrea tridentata* / *Pleuraphis rigida* - (*Erodium cicutarium*, *Bromus rubens*, *Salsola tragus*) Semi-natural Sparse Shrubland	7.92
		Larrea tridentata / *Pleuraphis rigida* Shrubland	1.47
		Larrea tridentata / *Pleuraphis rigida* Sparse Shrubland	14.42
	Lycium andersonii Shrubland Alliance	*Lycium andersonii* / *Pleuraphis rigida* - (*Erodium cicutarium*, *Bromus rubens*, *Salsola tragus*) Semi-natural Sparse Shrubland	5.09
	Lycium andersonii Shrubland Alliance	*Lycium andersonii* / *Pleuraphis rigida* Shrubland	25.69
	Pleuraphis rigida Herbaceous Alliance	*Ephedra nevadensis* / *Pleuraphis rigida* - *Bromus rubens* Semi-natural Shrub Herbaceous Vegetation	15.37
		Gutierrezia sarothrae / *Pleuraphis rigida* - *Erodium cicutarium* Semi-natural Shrub Herbaceous Vegetation	5.71
		Gutierrezia sarothrae / *Pleuraphis rigida* - *Erodium cicutarium* Shrub Herbaceous Vegetation	0.19
		Gutierrezia sarothrae / *Pleuraphis rigida* Shrub Herbaceous Vegetation	47.42
Mojave Desert Volcanic Rock and Cinder Land	*Artemisia ludoviciana* Herbaceous Alliance	*Artemisia ludoviciana* Herbaceous Vegetation	0.36
	Coleogyne ramosissima Shrubland Alliance	*Coleogyne ramosissima* - *Ephedra nevadensis* Shrubland	17.52
		Coleogyne ramosissima Shrubland	7.06
	Ephedra nevadensis Shrubland Alliance	*Ephedra nevadensis* - *Lycium andersonii* Shrubland	0.89
	Gutierrezia sarothrae Shrubland Alliance	*Gutierrezia sarothrae* / *Artemisia ludoviciana* Dwarf-shrubland	4.43

Table C-1
Acreages of vegetation communities within 2010 LPP Mojave desert tortoise occupied habitat

Ecological System	Alliance	Association	Acres
Mojave Desert Volcanic Rock and Cinder Land (*cont.*)	*Larrea tridentata* Shrubland Alliance	*Larrea tridentata - Ambrosia dumosa* Shrubland	1.54
		Larrea tridentata - Coleogyne ramosissima Shrubland	27.24
		Larrea tridentata Sparse Shrubland	1.84
	Mixed Desert Shrub Shrubland Alliance	Mixed Desert Shrub / (*Bromus rubens*, *Salsola tragus*, *Erodium cicutarium*) Semi-natural Dwarf-shrubland	12.53
		Mixed Desert Shrub / (*Bromus rubens*, *Salsola tragus*, *Erodium cicutarium*) Semi-natural Shrubland	23.66
Mojave Desert Wash	*Fallugia paradoxa* Shrubland Alliance	*Fallugia paradoxa* Desert Wash Shrubland	5.42
	Hymenoclea salsola Shrubland Alliance	*Hymenoclea salsola* / (*Erodium cicutarium*, *Bromus rubens*, *Salsola tragus*) Semi-natural Shrubland	1.54
		Hymenoclea salsola / (*Erodium cicutarium*, *Bromus rubens*, *Salsola tragus*) Semi-natural Sparse Shrubland	0.82
		Hymenoclea salsola Shrubland	3.66
	Non-vegetated sandstone	Non-vegetated Sandstone Outcrop	0.73
Reservoir	Reservoir	Reservoir	0.69
Ruderal Vegetation	*Bromus* (*rubens*, *tectorum*) Semi-natural Herbaceous Alliance	*Bromus rubens* Semi-natural Herbaceous Vegetation	1.67
	Ruderal Vegetation	Ruderal Vegetation	9.04
		Total	**1384.81**

Note: For Ecological System, Alliance, and Association definitions, see the *2010 Lake Powell Vegetation Communities Report*

Appendix D

Locations of All Tortoise Sign Found Within the 2010 LPP Survey area

Table D-1
Locations of all tortoise sign found within the 2010 LPP survey area

UTM Coordinate (Zone 12 NAD 83)		Tortoise Sign
Northing (m)	Easting (m)	
288961	4112809	Potential Burrow
289297	4112703	Burrow
289509	4112387	Potential Burrow
289518	4112534	Potential Burrow
289699	4111885	Potential Burrow
289710	4112753	Potential Burrow
289970	4112842	Potential Burrow
289970	4112861	Potential Burrow
289972	4112818	Potential Burrow
290350	4112179	Potential Burrow
290461	4118079	Scats
290532	4118179	Carcass
290542	4118145	Potential Burrow
291317	4118198	Potential Burrow
291365	4118172	Potential Burrow
291873	4106420	Potential Burrow
291885	4106397	Burrow
292796	4104148	Burrow
292898	4104041	Scats
292918	4104015	Burrow, Scats
292929	4103630	Burrow, Scats
292942	4104041	Burrow, Scats
293008	4103408	Burrow, Scats
293365	4103260	Scats
293429	4103171	Scats
293787	4103634	Scats
293846	4103654	Scats
293862	4103758	Scats
293872	4103755	Scats
293878	4103737	Scats
293878	4103764	Scats
293896	4103773	Burrow, Scats
293926	4103848	Scats
293930	4103784	Scats
293931	4103759	Scats
293936	4104045	Scats

Table D-1
Locations of all tortoise sign found within the 2010 LPP survey area

UTM Coordinate (Zone 12 NAD 83)		Tortoise Sign
Northing (m)	Easting (m)	
293943	4104027	Scats
293949	4104061	Scats
293971	4103856	Scats
293972	4103956	Scats
293972	4104089	Burrow, Scats
293975	4104153	Burrow
294000	4103297	Burrow
294008	4103788	Burrow
294077	4105803	Burrow
294133	4103686	Burrow
294141	4103654	Potential Burrow
294164	4103367	Burrow, Scats
294365	4104351	Burrow, Scats
294371	4104250	Scats
294763	4104585	Burrow
294768	4104525	Burrow
294772	4104482	Burrow
295031	4104573	Burrow
295229	4104199	Potential Burrow
295232	4104200	Burrow
295241	4104205	Burrow
295245	4104206	Burrow, Scats
295263	4103587	Burrow, Scats
295323	4103890	Tortoise, Scats
295327	4104306	Burrow, Scats
295369	4104254	Scats
295386	4103532	Tortoise
295396	4103711	Scats
295401	4103549	Burrow, Scats
295474	4103941	Burrow
295474	4103941	Burrow
295505	4103616	Burrow, Scats
295521	4103927	Burrow
296767	4103480	Potential Burrow
299970	4115329	Potential Burrow

Appendix E
Nesting Raptor Survey Report

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LAKE POWELL PIPELINE PROJECT
NESTING RAPTOR SURVEY REPORT

PREPARED FOR

MWH GLOBAL, INC.
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FEBRUARY 2012

CONTENTS

List of Figures

List of Maps

List of Tables

List of Appendices

1. INTRODUCTION

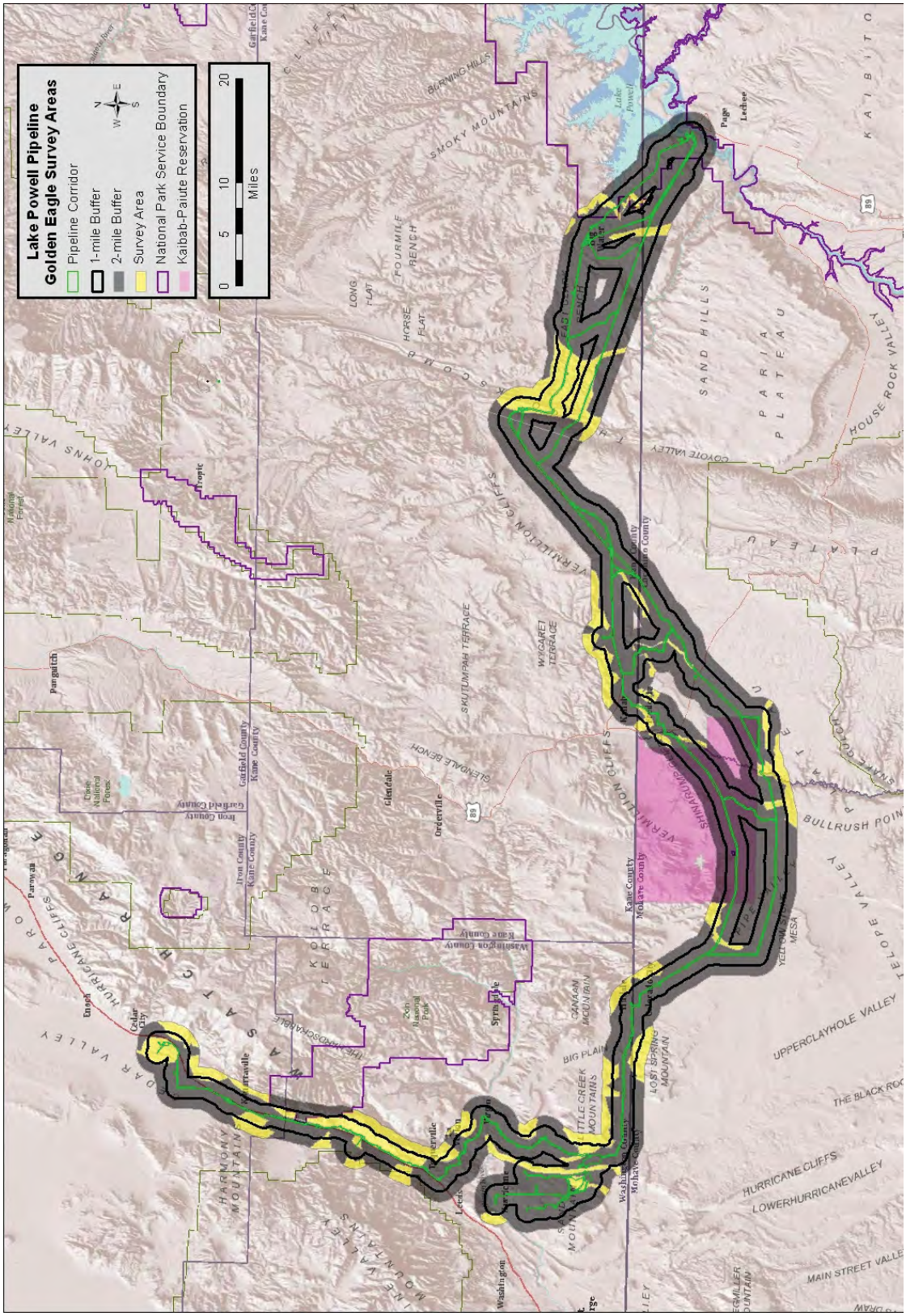
The Utah Board of Water Resources has proposed a project, the Lake Powell Pipeline (LPP), which when constructed, would deliver water from Lake Powell at Page, Arizona west to St. George, Utah and north to Cedar City, Utah (Map 1). The pipeline project consists of approximately 186 miles of buried pipeline, water intake facilities at Lake Powell, buried and surface water storage reservoirs, irrigation system turnouts, in-line hydro-stations, hydro-electric generation facilities, and transmission lines on federal, state, private, and possibly tribal lands in Kane, Washington, and Iron counties in Utah; and Coconino and Mohave counties in Arizona. Potential alignments include the existing Arizona Highway 389 alignment which crosses the Kaibab Indian Reservation and the southern alignment bypassing the Reservation to the south.

Logan Simpson Design Inc. (LSD) conducted preliminary surveys in October 2011 for nests of diurnal birds of prey (e.g., hawks, eagles, and falcons), specifically emphasizing golden eagles *(Aquila chrysaetos)* in October 2011. This report documents the survey routes, and the potential birds of prey nests observed during the survey. Surveys were conducted within the pipeline corridor, which has a defined width of 150 feet, and within a 1- and 2-mile buffer extending perpendicular from the center of the corridor, producing up to a 4-mile wide evaluation area paralleling the centerline of the corridor (Map 2).

2. SPECIES BACKGROUND

Birds of prey (raptors) are protected wildlife and are widely accepted indicator species of environmental quality, due in part to being at the top of the biological food chain and therefore sensitive to environmental changes within their habitats (Romin and Muck 2002). A variety of birds, small mammals, reptiles, amphibians, fish, and insects comprise the bulk of prey for raptor species. Some raptors will feed on carrion as well as live prey, some feed specifically on few prey types (e.g., fish), while other raptors feed on a wide variety of prey. Raptors are inherently mobile and forage over wide areas; however, wintering habitats requirements may differ significantly from nesting habitat requirements. Raptors will use a greater array of habitat types than many avian species, on both a daily and seasonal basis. The types and variety of biotic communities and topographic diversity present in any given area will largely determine the species, density, and distribution of raptors that may be present (Gliniski 1998). In Utah, 16 species of diurnal raptors are known to occur, these include: 12 species in the order Accipitriformes (eagle, hawks, kites, vultures, and ospreys) and four in the order Falconiformes. Table 1 includes a listing of these 16 species and information regarding nest placement by each.

Map 1 State location map



Map 2
Nesting raptor survey areas within the Lake Powell Pipeline corridor

Table 1. Typical nesting substrate of raptors in Utah (from UDNR 2011).

Species	Conifer Tree	Broadleaf Tree	Pinyon/ Juniper	Cavity Nest	Cliff Nest	Utility Structure	Building	Ground
Bald eagle	X	X						
Northern goshawk	X	X						
Ferruginous hawk			X		X			
Golden eagle		X			X			
Peregrine falcon					X		X	
Red-tailed hawk	X	X	X		X			
Prairie falcon					X			
Swainson's hawk		X	X			X		
Osprey	X	X				X		
Northern harrier								X
Sharp-shinned hawk	X		X					
Cooper's hawk	X	X	X					
Turkey vulture					X			
California condor								
Merlin	X							
American kestrel				X				

Threats and Protections

The general life history of raptors include long life spans, low reproductive rates, and specific habitat requirements for nesting and foraging that make raptor populations particularly vulnerable to disturbances. Increasing disturbance and alteration of habitat from industrial, municipal, transportation, and recreational activities have potential to negatively affect raptor populations (Romin and Muck 2002). Threats to golden eagles include direct and indirect human-caused mortality, disturbance, and the elimination of prey by habitat alteration (Tesky 1994). Urbanization, illegal shooting, trapping, lead poisoning, and collisions with powerlines have caused declines in populations. Climate change, prolonged drought, and invasive species altering prey densities adversely affect golden eagle prey populations. The status of raptors in Utah was and is considered uncertain (Romin and Mack 2002); stable for some species and declining for others (Whittington and Allen 2008; Smith et al 2008; Hawk Migration Association of North America [HMANA] 2011). Proponents of land-use activities are responsible for determining potential impacts to raptors from those activities, as well as for the development of strategies for conserving raptor populations and their habitats associated with the proposed land-use actions (Romin and Mack 2002; Whittington and Allen 2008).

Raptors are considered migratory birds, and as such come under the authority of the Migratory Bird Treaty Act (MBTA) of 1918 (16 United States Code 703–712) administered by the U.S. Fish and Wildlife Service (USFWS). The MBTA prohibits the unlawful taking of any migratory bird or any part, nest, or egg, except permitted by regulation. "Take" includes any attempt to hunt, pursue, wound, shoot, kill, trap, capture, possess, or collect any migratory bird, nest, egg, or part thereof. The prohibition against killing birds contained within the MBTA applies to both intentional and unintentional harmful conduct (Romin and Muck 2002). Eight of Utah's raptors are also included as special status species by the Bureau of Land Management (BLM) and currently receive additional consideration from the BLM in assessing project related impacts (BLM 2008).

Golden eagles receive federal protection under the MBTA and the1962 amendments to the Bald and Golden Eagle Protection Act (Eagle Act; 16 United States Code 668-668d). The Eagle Act prohibits the "taking" of bald and golden eagles. This Act defines "take" as "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest, or disturb." "Disturb" means to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available: 1) injury to an eagle; 2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior; or 3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior" (16 United States Code 668c; 50 CFR 22.3). In addition to immediate impacts, this definition also covers impacts that result from human-induced alterations initiated around a previously used nest site during a time when eagles are not present, if, upon the eagle's return, such alterations agitate or bother an eagle to a degree that injures an eagle or substantially interferes with normal breeding, feeding, or sheltering habits and causes, or is likely to cause, a loss of productivity or nest abandonment.

Golden Eagle Life History Information

Golden eagles are an upper trophic-level aerial predator that forages on reptiles, birds, and mammals up to the size of mule deer fawns and coyote pups, and also scavenge and utilize carrion (USFWS 2010). Studies of golden eagle nests in central Arizona revealed that jackrabbits were the most frequently captured prey (Glinski 1998), with medium sized mammals such as ground squirrels and prairie dogs being secondary prey (Glinski 1998; Corman and Wise-Gervais 2005). The nesting season of golden eagles is prolonged, extending more than six months from the time eggs are laid to until young are independent (Kochert et al 2002 in Corman and Wise-Gervais 2005). In North America, the golden eagle breeds from northern and western Alaska east through the Northwest Territories to Labrador, south to Baja California and northern Mexico, into central Texas, western Oklahoma, and western Kansas. Golden eagles nest on cliffs, in the upper one third of large deciduous and coniferous trees, or on artificial structures such as windmills or electrical transmission towers. Nests are built in locations that afford an unobstructed view of the surrounding habitat (Glinski 1998; Corman and Wise-Gervais 2005; USFWS 2010). Golden eagles construct large, flat or bowl-shaped nests. Existing nests may also be used and altered with additional sticks and soft material (USFWS 2010). Nest size varies, from large and multi-layered to a small augmentation of sticks in caves with little material other than extant detritus (USFWS 2010). Pairs may have several alternate nests within a territory, but only one nest is chosen for egg-laying. Golden eagle mating occurs between late February and early March in Utah. Golden eagles normally lay two eggs (Glinski 1998) that are incubated by the female for 45 days, with juveniles remaining in the nest for 60-75 days. Adults care for post-fledgling birds for an additional 30 days. Family units may stay together for several months after fledging. Eaglets do not reach adulthood until the fourth or fifth year. Golden eagle pairs commonly refrain from laying eggs in some years, particularly when prey, especially rabbits, are scarce. Therefore the number of young that golden eagles produce each year largely depends on a combination of weather and prey population cycles (Kochert et al 2002 in Corman and Wise-Gervais 2005).

Eagles make use of distinct geographic areas and landscape features throughout their home range. The USFWS defines these locations for golden eagles as "important eagle-use areas" that include "an eagle nest, foraging area, or communal roost site that eagles rely on for breeding, sheltering, or feeding, and the landscape features surrounding such nest, foraging area, or roost site that is essential for the continued viability of the site for breeding feeding or sheltering eagles" (USFWS 2009).

Golden Eagle populations are believed to be declining throughout their range (Pagel et al 2010), as well as locally in northern Arizona (unpublished Arizona Game and Fish Department data). A declining trend has also been noted in migrating golden eagle observations documented locally at the Grand Canyon during the last decade

(Figure 1; HMANA 2011; USFWS 2010; Smith 2010; Smith et al 2008; Kochert and Steenhof 2002). Due in part to recent declines in golden eagle populations, the USFWS has provided guidance that can be used by agencies for avoiding and minimizing disturbance and other kinds of take, including short and long-term site-specific monitoring of local golden eagle populations (USFWS 2010). Additionally the BLM has established seasonal restrictions in proximity to some nesting raptors (BLM 2008; BLM 2010).

Figure 1
Yaki Point (Grand Canyon) Raptor Migration Project Site Profile (HMANA 2011)

3. METHODS

There is minimal information available on diurnal raptors within the LPP project area that allows for the site-specific determination of raptor species occurrence, nesting, winter roosting, foraging, and other important raptor habitats. As such, information from a broad range of sources was used, including data provided in the Utah Department of Natural Resources (UDWR) Raptor Survey Guidelines (UDWR 2002). Searches for raptor nests and raptor breeding territories focused on species-specific suitable nesting habitat. This initial survey for unoccupied nest structures was conducted in suitable nesting terrain and habitat types (e.g., cliffs, ridges, and in areas with mature trees) utilizing appropriate methods for conducting raptor surveys (e.g., aerial surveys and ground surveys). Prior to conducting raptor nest surveys and applying the USFWS definition of "important eagle-use areas", potential important raptor-use areas were identified within the project corridor and within a 1- and 2-mile corridor buffer, providing a 4-mile wide evaluation area paralleling the centerline of the LPP corridor. The 4-mile wide evaluation area was designed to be essentially consistent with Pagel et al (2010) and spatial buffers recommendations (Appendix A). Potentially important raptor-use areas were delineated using topographical and aerial maps as a background in ArcMap, and included areas suitable for raptor nesting, such as canyons, cliffs, and areas with trees of variable height. In addition, the locations of suitable artificial structures such as power

transmission line towers were identified. These potential raptor-use areas became the focus of both the aerial surveys and ground based follow-up surveys. Raptor nest searches were conducted October 4-6, 2011, outside the period of active nest use by these raptor species. As such, observation data was limited to unoccupied raptor nests structures and incidental observations of raptors present within 2 miles of the proposed LPP development corridor.

Aerial surveys were conducted in a Robinson R44 Series helicopter (Figure 2) with two or three biologists as observers and data recorders. Aerial surveys were conducted following techniques described in Pagel et al 2010 and UDWR 2011. The helicopter was flown with doors off on two of three survey days to make observations easier and to increase the field of vision for biologists (Figure 3). Surveys were flown with the doors-on on the third day due to cooler temperatures and threat of heavy rains. Biologists scanned cliff faces for signs of nesting, nests, and whitewash (white streaks of avian excrement). Large trees and power lines were also scanned for nests from the air. Aerial surveys in areas with dense canopy cover should not be considered 100 percent coverage surveys. It is difficult and time consuming to conduct 100 percent coverage surveys in dense vegetation. Aerial surveys in the areas with dense canopy structure included passing over the areas more than once and from different angles. Ground surveys of potentially suitable cliff habitat were conducted where areas were inaccessible to the helicopter. Spotting scopes and binoculars were utilized during ground surveys where biologists maneuvered as close to a cliff as possible in a vehicle and then used optical equipment to identify perching and nesting areas.

Data collected during surveys conducted on October 4-6 was recorded on the LPP Raptor Survey Datasheet (Appendix B). Information collected included date and time of the survey; the type, size, and condition of the nest; the Universal Transverse Mercator (UTM) coordinates for nests and observed golden eagles; and a photograph log documenting nests and golden eagles. Daily track logs of flight and survey routes were also recorded on hand held Garmin CSx60 Global Positioning System (GPS) units.

Figure 2
Helicopter used for aerial surveys

Figure 3
Helicopter with doors off

4. RESULTS

Habitat Description

The proposed project area lies in southwestern and south central Utah and north central Arizona. Three main ecological regions, the Colorado Plateau, Great Basin, and Mohave Desert, are represented within the project area. The vast majority of the project area occurs within the Colorado Plateau Ecological Region, from Page, Arizona to the community of Hurricane, Utah. The project area north of Hurricane to Cedar City occurs within the Great Basin Ecological Region. The Mohave Desert Ecological Region is represented by the area southwest of Hurricane. Diverse landforms, geologic exposures, and elevation gradients present across the project area contribute to the biodiversity and unique character of the vegetation of the ecological regions.

Habitat suitable for nesting by several species of raptors within the project area includes cliffs, large broadleaf and conifer trees in undisturbed native habitats, large trees within agricultural areas, and also artificial nesting structures such as electrical transmission towers and power poles. Many cliff systems exist within the 1- and 2-mile buffer survey area (Figures 4 and 5). Cliff systems include the Hurricane Cliffs from south of Hurricane north to Cedar City, the Vermilion Cliffs of the Moccasin Mountains from east of Hurricane to east of Kanab, Utah, and the Shinarump Cliffs near Fredonia, Arizona. Riparian areas consisting of large broadleaf trees available for potential nesting include Ash Creek Reservoir (Figure 6), and sections of the Virgin River and Kanab Creek. Large, isolated trees and electrical transmission towers are also available near rural residential areas including Cedar City and Colorado City, Arizona.

Land ownership in the pipeline corridor and 1- and 2-mile buffers includes federal, state, tribal, and private. The largest percentage of land ownership in the pipeline corridor includes large tracts of public lands administered by the BLM. Most of the available cliff habitat is unaltered and suitable for nesting (as evidenced by the number of nests found), even when occurring near residential developments in the vicinity of Hurricane and Fredonia.

Surveys

Both aerial and ground based surveys were conducted during the same three-day period of October 4-6, 2011. During the aerial survey, 21.3 helicopter flight hours (includes ferry time) were expended over three consecutive days to survey 667 flight miles within the pipeline corridor and the 1- and 2-mile buffers (Map 3). Ground survey crews were comprised of three to four biologists working in pairs or singularly. Ground survey effort totaled 72 team hours over the three days. Total survey effort consisted of the 21.3 aerial survey hours and 72 ground-based survey hours. A total of 142 individual nests (Table 2; Map 4; Figures 7-9) were documented; 91nests were located within the 1-mile buffer and 51 nests were found within the 1- to 2-mile buffer. The vast majority of nests were located on cliff habitats (129 nests, 91 percent of all nests; Table 2), with nine tree nests (six percent of all nests; Table 2), and four transmission tower nests (three percent of all nests; Table 2) documented. Surveys of cliff nesting raptors ordinarily are initiated in early May when most raptor chicks have generally hatched and parent birds would be less likely to abandon a nest from survey disturbance. Raptor surveys are generally completed by June 1 to ensure that the chicks are young enough that they will not be prematurely flushed from the nest by survey disturbance (UDWR 2011). This initial survey was conducted in October 2011, and therefore the species that constructed the nest or last year's occupancy and nesting success could not be determined in most cases. However, nine adult golden eagles were observed, four of which (Figures 10 and 11) were near recorded nest sites. Additionally two ferruginous hawk nests and four raven nests (based on nest size, structure, and substrate) were identified during the survey.

Table 2 also includes the approximate UTM coordinates for a Cooper's hawk nest confirmed during willow flycatcher surveys conducted by LSD biologists along Short Creek at Canaan Gap, and burrowing owls observed

during vegetation surveys along the East Clark Bench, west of Page. It should be noted that LSD biologists have observed numerous raptors along the LPP corridor while conducting vegetation surveys between 2009 and 2011. It was not uncommon to observe both golden eagles and red-tailed hawks perched on power poles adjacent to Highway 389 between Colorado City and east of Fredonia.

Table 2. Raptor nest survey results includes all raptor nest structures documented within the 1- and 2-mile buffers, as well as golden eagles observed during surveys with no nest observed nearby.

Unique Identification Number	Easting UTM Zone 12, NAD83	Northing UTM Zone 12, NAD83	Survey Date	Nest Structure			Nest Substrate		
				Stick Nest	Ledge Nest	Pothole Nest	Cliff	Tree	Power pole
147	294611	4106550	10/03/11	1			1		
148	294611	4106550	10/03/11	1			1		
150	294611	4106550	10/03/11	1			1		
152	299930	4119392	10/04/11	2			2		
24	307453	4163199	10/04/11	1				1	
Above nest located in an isolated tree									
25	306982	4162637	10/04/11	1				1	
Above nest located in a juniper tree; Ferruginous hawk nest									
119	314891	4167752	10/04/11	1					1
103	296330	4130335	10/04/11	1			1		
Above entry includes an adult golden eagle near observed nest									
127	303335	4147706	10/04/11			1	1		
Above nest is a potential raven nest									
129	303125	4147497	10/04/11			1	1		
Above nest is a potential raven nest									
11	303175	4145910	10/04/11	1			1		
12	303146	4145449	10/04/11	1			1		
13	302846	4143996	10/04/11	1			1		
14	305481	4152313	10/04/11	1			1		
16	306780	4154554	10/04/11	1			1		
17	306665	4154290	10/04/11	1			1		
18	306565	4154184	10/04/11	2			2		
19	306414	4153993	10/04/11	1			1		
20	307121	4154783	10/04/11	2			2		
120	307526	4163885	10/04/11	1				1	
Above nest is a grass nest located at the top of the tree									
26	310745	4168195	10/04/11	1				1	
Above nest located in a juniper tree									
27	310761	4168265	10/04/11	1				1	
Above nest located in a juniper tree									
28	310363	4168499	10/04/11	2				2	
Above nest located in a juniper tree									
121	306948	4159015	10/04/11	1				1	

Unique Identification Number	Easting UTM Zone 12, NAD83	Northing UTM Zone 12, NAD83	Survey Date	Nest Structure			Nest Substrate		
				Stick Nest	Ledge Nest	Pothole Nest	Cliff	Tree	Power pole
Ferruginous hawk nest									
104	298221	4134344	10/04/11			1	1		
101	303146	4119430	10/04/11	1			1		
2	298623	4125784	10/04/11						
Above entry is a Golden eagle observed with no nest observed nearby									
4	298208	4127860	10/04/11	1			1		
5	298108	4128407	10/04/11	1			1		
6	298321	4128975	10/04/11						
Above entry is a Golden eagle observed with no nest observed nearby									
7	298194	4130040	10/04/11	1			1		
8	300847	4135968	10/04/11	1			1		
9	302772	4142897	10/04/11	2			2		
15	304263	4151307	10/04/11						
Above entry is a Golden eagle observed with no nest observed nearby									
102	301918	4119468	10/04/11		1		1		
95	418338	4107282	10/05/11	1			1		
133	415427	4111089	10/05/11		1		1		
134	455774	4088741	10/05/11	2			2		
135	442034	4091816	10/05/11	1			1		
136	388108	4098166	10/05/11		1		1		
137	383662	4102469	10/05/11	1			1		
138	382250	4101289	10/05/11	1			1		
139	380305	4101814	10/05/11	1			1		
140	376233	4101508	10/05/11	1			1		
141	374748	4100157	10/05/11	1			1		
96	387995	4101525	10/05/11	1			1		
142	367598	4095835	10/05/11	1			1		
143	367320	4095164	10/05/11	1			1		
144	366530	4094531	10/05/11	1			1		
145	365834	4094141	10/05/11	1			1		
146	364227	4094342	10/05/11	1			1		
29	323099	4094760	10/05/11	1				1	
Above nest located in a cottonwood tree									
64	360761	4090573	10/06/11	1			1		
107	294819	4100563	10/06/11	1			1		
108	294838	4101187	10/06/11	1			1		
45	287053	4118204	10/06/11	1			1		
46	303918	4122437	10/06/11	1			1		
123	333604	4082481	10/06/11	3			3		

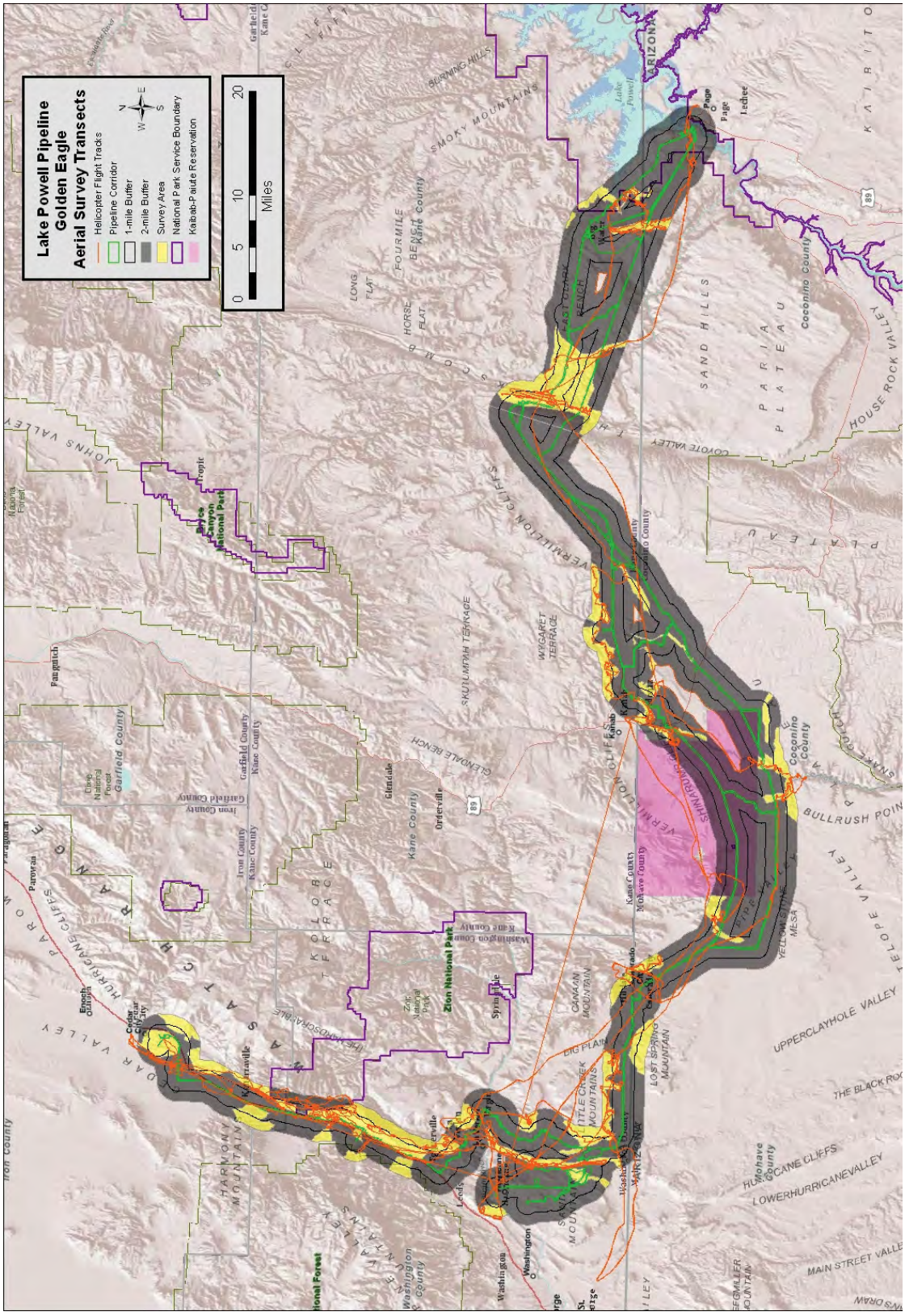
Unique Identification Number	Easting UTM Zone 12, NAD83	Northing UTM Zone 12, NAD83	Survey Date	Nest Structure			Nest Substrate		
				Stick Nest	Ledge Nest	Pothole Nest	Cliff	Tree	Power pole
124	337097	4081268	10/06/11	1			1		
105	287196	4117813	10/06/11	1			1		
47	336663	4075215	10/06/11	2			1[4]		1
Above nest is a potential raven nest									
48	338848	4074482	10/06/11	1					1
Above nest is a potential raven nest									
49	350616	4074252	10/06/11	1					1
50	352462	4074403	10/06/11	1			1		
51	351937	4073617	10/06/11	1			1		
52	354854	4072129	10/06/11	1			1		
53	354630	4072508	10/06/11	1			1		
54	354034	4072577	10/06/11		1		1		
55	356531	4073708	10/06/11	2			2		
56	357254	4074554	10/06/11	1			1		
57	363470	4093937	10/06/11	3			3		
58	363141	4092269	10/06/11	2			2		
59	362672	4091828	10/06/11	1			1		
60	362429	4091303	10/06/11		1		1		
106	294836	4099797	10/06/11	2			2		
61	361712	4090976	10/06/11		1		1		
62	360584	4089997	10/06/11	1			1		
63	360627	4089921	10/06/11	1			1		
109	294922	4104158	10/06/11	1			1		
65	333953	4083219	10/06/11	1			1		
66	333620	4083302	10/06/11	1			1		
67	333604	4083303	10/06/11	1			1		
68	332690	4083967	10/06/11	1			1		
110	294555	4106282	10/06/11	1	1		2		
69	310974	4099728	10/06/11	1			1		
111	294594	4106823	10/06/11	1			1		
70	303742	4100628	10/06/11	2			2		
112	294553	4107387	10/06/11	1			1		
71	300272	4100785	10/06/11	2			2		
72	300135	4100413	10/06/11	1			1		
73	300285	4100760	10/06/11	1			1		
113	294751	4108781	10/06/11	1			1		
74	299662	4101499	10/06/11	1			1		
75	299321	4101953	10/06/11	1			1		
76	299187	4102500	10/06/11	1			1		

Unique Identification Number	Easting UTM Zone 12, NAD83	Northing UTM Zone 12, NAD83	Survey Date	Nest Structure			Nest Substrate		
				Stick Nest	Ledge Nest	Pothole Nest	Cliff	Tree	Power pole
77	299149	4102607	10/06/11						
Above entry is a Golden eagle observed with no nest observed nearby									
80	299455	4104385	10/06/11	1			1		
114	294762	4109425	10/06/11	1			1		
81	301338	4106604	10/06/11	1			1		
82	302050	4112770	10/06/11	1			1		
83	301940	4112739	10/06/11	1			1		
84	301736	4112791	10/06/11	1			1		
85	302071	4112554	10/06/11	1			1		
86	301578	4112875	10/06/11	1			1		
87	302996	4113254	10/06/11	1			1		
115	295052	4110246	10/06/11	2			2		
88	302710	4121990	10/06/11	1			1		
89	301998	4123494	10/06/11	1			1		
90	298745	4118673	10/06/11	1			1		
116	294797	4111027	10/06/11		1		1		
Above entry is a falcon scrape									
91	312000	4100103	10/06/11	1			1		
92	311685	4100034	10/06/11	1			1		
93	312920	4100582	10/06/11	1			1		
30	296855	4114272	10/06/11	1			1		
31	296381	4113625	10/06/11	1			1		
32	296374	4113787	10/06/11	1			1		
33	296298	4112009	10/06/11	1			1		
34	296495	4111637	10/06/11	1			1		
35	296571	4111466	10/06/11	1			1		
36	296556	4111392	10/06/11	1			1		
37	296532	4111389	10/06/11	1			1		
38	296305	4111687	10/06/11	1			1		
39	295476	4110413	10/06/11	1			1		
40	295515	4109291	10/06/11	1			1		
41	295965	4104133	10/06/11	1			1		
42	295886	4103645	10/06/11		1		1		
43	295127	4106340	10/06/11	1			1		
44	295175	4106299	10/06/11	1			1		
153	312078	4098191		1				1	
Above entry is a Coopers hawk nest									
154	425852	4104870							
Above entry is the location where Burrowing owls were observed									

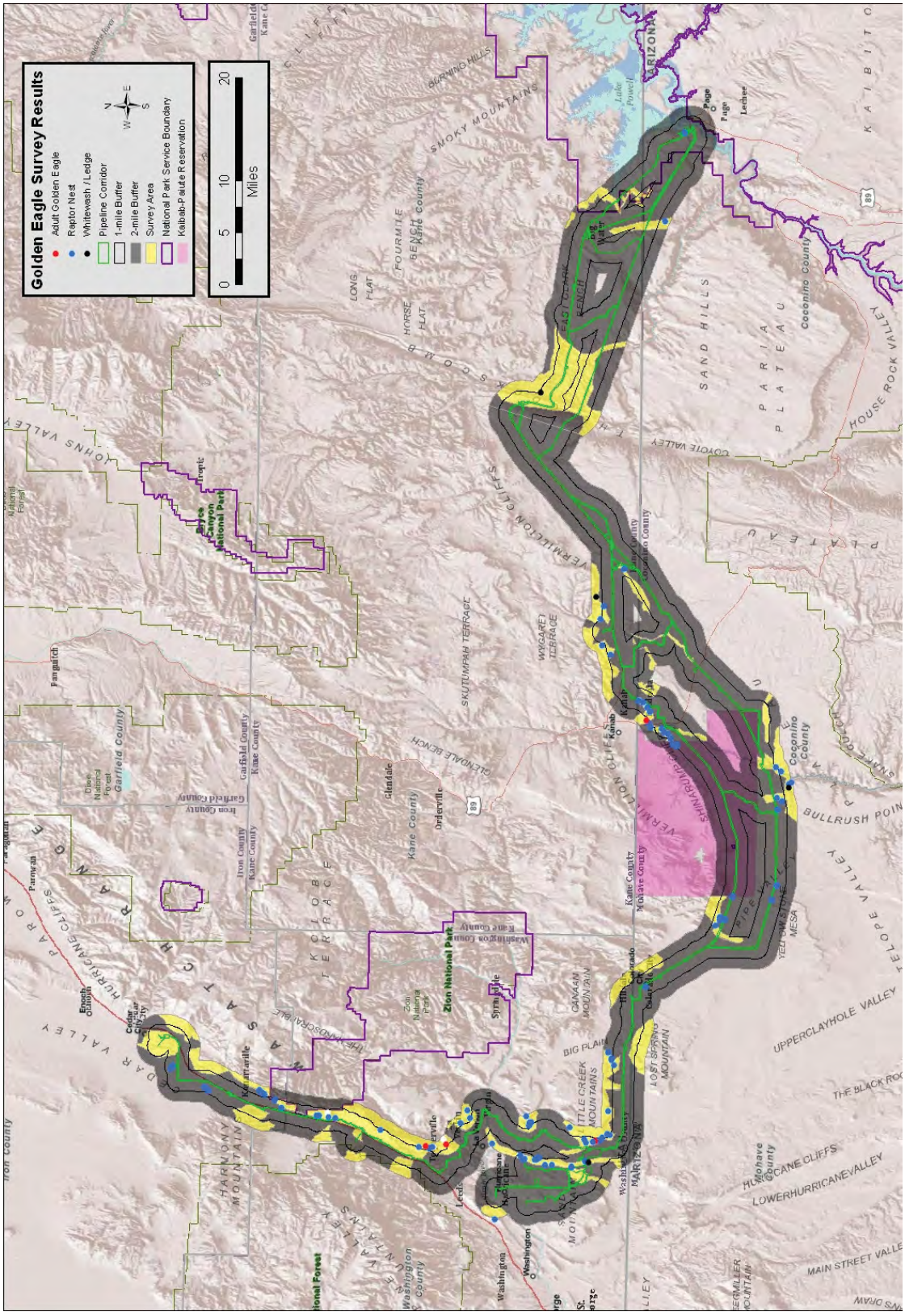
Figure 4
Cliff habitat northeast of Ash Creek Reservoir, near Zion National Park

Figure 5
Cliff habitat along The Divide, 10 miles southeast of Hurricane

Figure 6
Broadleaf tree habitat at Ash Creek Reservoir, near Zion National Park



Map 3
Aerial survey routes



Map 4
Nest Locations

Figure 7
Nest structure on power pole 3 miles south of Cedar City

Figure 8
Nest structure near Crescent Butte, 11 miles east of Kanab

Figure 9
Nest structure on the Hurricane cliffs near Hurricane

Figure 10
Adult Golden Eagle near Fredonia

Figure 11
Close-up of adult Golden Eagle near Fredonia

5. RECOMMENDATIONS

Surveys for the LPP project were conducted by helicopter and ground based observations in suitable raptor nesting habitat to provide information on potential raptor activity and occupancy, with an emphasize on golden eagles. The metrics of interest to the USFWS include: 1) number and location of nests within territories with an occupied nest; 2) number and location of likely eagle nests within apparently unoccupied territories (suspected occupied eagle territory within an occupied nest on the current year); and 3) productivity (number of young surviving greater than 51 days of age) in each occupied nest (USFWS 2010).

It has been reported that some segments of golden eagle populations can be found near their nest sites throughout the year (Pagel et al 2010). The presence of adult golden eagles and large raptor nests observed during the survey indicates potential golden eagle nesting in proximity to the corridor. The 2011 surveys were conducted outside of the breeding season (January – July), so each of the standard metrics required to document raptor nesting could not be accurately determined. In order to provide raptor nesting data, within the corridor and buffer area, with an emphasize on golden eagles, additional raptor surveys for this project are recommended to be conducted by helicopter with supporting ground based surveys to confirm raptor activity, occupancy, breeding status, and fledging success.

Consistent with USFWS (2010) raptor nest survey guidance a two-phase survey effort is recommended with the Phase-one inventory survey to be conducted during late courtship (when the adults are mobile and conspicuous) into early incubation (when the females will be on the nest). Phase-one surveys include two separate surveys conducted 30 days apart. It is recommended that the first Phase-one survey be conducted between March 1 and March 30 when biologists would revisit nests located during the 2011 survey effort to determine current occupancy. The second Phase-one survey would be conducted approximately 30 days after the first survey effort and would also revisit the nests located during the 2011 survey effort. This second survey would document those

nests that were not active during the first survey as well as identify nesting attempts that may have already failed. These Phase-one surveys would determine occupancy, activity, and nesting territories within the corridor and buffer area. If an active nest or pair of birds is located, the search can then be expanded to survey adjacent suitable habitat to determine if additional territories exist. The two separate Phase-one surveys are necessary for the purpose of documenting potential raptor nesting and should be spaced no closer than 30 days apart (USFWS 2010). Ground based surveys would also be conducted at the same time in areas inaccessible to the helicopter or to nest locations easily observed remotely from the ground.

Phase-two monitoring surveys are recommended to be conducted via helicopter in remote access areas and via ground in areas where nests are easily observed, approximately 60 days subsequent to the second Phase-one survey. Phase-two surveys are recommended to revisit nesting territories documented during Phase-one surveys (not the entire 2011 survey area). The presence of golden eagle (as well as other raptors) nestlings, fledglings, or new nest activity would be recorded to indicate nesting success. The two phase survey effort would provide raptor inventory data and initial information of raptor productivity within the corridor in support of the USFWS, BLM, and other land and wildlife managers.

Timeframe for recommended surveys

Phase-one inventory surveys (2 surveys 30 days apart)

Survey 1	March 1 – March 30
Survey 2	April 1 – April 30

Phase-two monitoring surveys (1 survey 60 days subsequent to Survey 2)

Survey 3	June 1 – June 30

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7. FIELD PERSONNEL AND SIGNATURES

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Appendix A

Nesting Periods and Spatial Buffers for Raptors in Utah

Nesting periods and recommended buffers for raptors in Utah[1]

Species	Spatial Buffer in Non-Urban Areas	Incubation[2]	Brooding Post-hatch	Fledging Post-hatch	Post-fledge Dependency to nest
Bald eagle	0.5 to 1.0 mile	34-36	21-28	70-80	14-20
Northern goshawk	0.5 mile	36-38	20-22	34-41	20-22
Ferruginous hawk	0.5 to 1.0 mile	32-33	21	38-48	7-10
Golden eagle	0.5 mile	43-45	30-40	66-75	14-20
Peregrine falcon	1.0 mile	33-35	14-21	35-49	21
Red-tailed hawk	0.33 to 0.5 mile	30-35	35	45-46	14-18
Prairie falcon	0.25 to 0.5 mile	29-33	28	35-42	7-14
Swainson's hawk	0.25 to 0.5 mile	33-36	20	36-40	14
Osprey	0.5 mile	37-38	30-35	48-59	45-50
Northern harrier	0.5 mile	32-38	21-28	42	7
Sharp-shinned hawk	0.5 mile	32-35	15	24-27	12-16
Cooper's hawk	0.5 mile	32-36	14	27-34	10
Turkey vulture	0.5 mile	38-41	14	63-88	10-12
California condor	1.0 mile	56-58	5-8 weeks	5-6 month	2 months
Merlin	0.5 mile	28-32	7	30-35	7-19
American kestrel	NN[2]	26-32	8-10	27-30	12
Boreal owl	0.25 mile	25-32	20-24	28-36	12-14
Burrowing owl	0.25 mile	27-30	20-22	40-45	21-28
Flammulated owl	0.25 mile	21-22	12	22-25	7-14
Great horned owl	0.25 mile	30-35	21-28	40-50	7-14
Long-eared owl	0.25 mile	26-28	20-26	30-40	7-14
N. saw-whet owl	0.25 mile	26-28	20-22	27-34	7-14
Short-eared owl	0.25 mile	24-29	12-18	24-27	7-14
Mex. Spotted owl	0.25 mile	28-32	14-21	34-36	10-12
N. Pygmy owl	0.25 mile	27-31	10-14	28-30	7-14
W. Screech owl	0.25 mile	21-30	10-14	30-32	7-14
Common Barn-owl	NN[2]	30-34	20-22	56-62	7-14

Romin and Muck 2002, Whittington and Allen 2008, BLM 2010

[1]Number of days

[2]Not necessary

Appendix B

Lake Powell Pipeline Raptor Survey Datasheet

LPP Raptor Survey Form

Survey Location: _____ Page ___ of ___

Date: _____ Personnel: _____

Survey Start Time: _____ Survey End Time: _____ Weather: _____

WAYPOINT	SPECIES	AGE	TYPE	LOC	HGT	SIZE	COND	ASP	UTM E (NAD 83 Zone 12)	UTM N (NAD 83 Zone 12)	PHOTOS	NOTES

Aspect: Direction nest faces

Condition:
1 New Material
2 Weathered Material
3 Dilapidated
4 Whitewash Present

Age: A - Adult
S - Sub-adult
J - Juvenile

Location: 1 Cliff
2 Transmission Tower
3 Tree

Type: 1 Stick
2 Open ledge
3 Pothole

Height: 1 Upper third of cliff
2 Middle third
3 Lower third

Size: 1 Large (5' to 8' diam)
2 Medium (3' to 5' diam)
3 Small (1' to 3' diam)

Species:
GOEA: golden eagle, RTHA: red-tailed hawk, CORA: common raven, BAEA: bald eagle, PEFA: Peregrine falcon, FEHA: ferriginous hawk, OSPR: osprey, GOSH: goshawk, PRFA: prairie falcon, SWHA: swainson's hawk, KEST: kestrel; UNK - Unknown