



United States Department of the Interior

BUREAU OF LAND MANAGEMENT

Arizona Strip District Office
345 East Riverside Drive
St. George, UT 84790
www.blm.gov/az/



April 2, 2010

**In Reply Refer To:
(A010) 6716**

NOTICE OF AVAILABILITY

Environmental Assessment for the Proposed Redevelopment of Six Water Catchments on the Arizona Strip, Mohave County, Arizona (DOI-BLM-AZ-A010-2009-0012-EA)

Dear Interested Party:

Please be advised that an Environmental Assessment (EA) has been prepared (DOI-BLM-AZ-A010-2009-0012-EA) for the proposed redevelopment of six water catchments on the Arizona Strip, Mohave County, Arizona. This EA is a public document, and is available for your review and comment.

The proposed action analyzed in the EA is to redevelop and improve six existing water catchments on the Arizona Strip in northwestern Arizona within Arizona Game and Fish Department Game Management Unit 13A.

Catchment Nos. 758, 828, 829, 837, 838, and 4486 are located on BLM-administered lands within the Arizona Strip Field Office (ASFO). All six catchments are located in Mohave County, Arizona (Table 1.1).

Table 1.1. Location of the Six Catchments

Catchment No./Name	Section, Township, Range (Quadrangle, Gila and Salt River Baseline and Meridian)
758/Uinkaret Plateau No. 3	NW ¼ S31, T36N, R9W (USGS Jones Hill)
828/Lang's Run	NW ¼ S34, T36N, R9W (USGS Jones Hill)
829/Finale	NW ¼ of S11, T36N, R9W (USFS Moriah Knoll)
837/Deadman Knoll	NE ¼ S9, T37N, R8W (USFS Moriah Knoll)
838/Jody Lake	NW ¼ of S26, T37N, R8W (USFS Hat Knoll)
4486/Rim No. 2	NW ¼ S17, T35N, R9W (USGS Jones Hill)

After years of use, the six catchments no longer function adequately for mule deer and other wildlife water needs. Routine inspections have revealed that these water catchments function poorly due to age-related deterioration, resulting in loss of water through leakage. The purpose of this project is to redevelop the existing water sources, increase the storage capacity of the

catchments, and reduce the visual profile of each catchment. Redeveloped and improved catchments would reduce the need to haul water to the catchments and would require less maintenance, while continuing to provide permanent water sources for wildlife.

Under the no action alternative, none of the water catchments would be replaced, and no new construction, renovation, or upgrading would occur. Water would continue to be hauled to the sites at a rate that would be expected to increase as the condition of the existing catchments deteriorates. The expected frequency of future water hauling trips could increase up to double the current rate (i.e., from one to two trips per year to two to four trips per year). Wildlife in the area would continue to use the existing catchments' water and any naturally occurring seasonal water sources in the area.

This proposed action is in conformance with the Arizona Strip Field Office Resource Management Plan approved on January 29, 2008.

Copies of the EA are available upon request from, and written comments may be submitted to:

Tom Denniston
BLM Grand Canyon-Parashant National Monument
345 East Riverside Dr.
St. George, UT 84790
Telephone: 435-688-3385 Fax: 435-688-3388
Email: larry_denniston@blm.gov

This EA is also posted on the Arizona Strip Field Office's web home page at:
http://www.blm.gov/az/st/en/fo/arizona_strip_field.html.

The public review and comment period for this EA will extend for 30 days, from April 2, 2010 to May 1, 2010. All written comments must be received by close of business on May 1, 2010. The BLM encourages and welcomes all public comments. This will also ensure that you are on our mailing list for notification of actions connected with this proposed project.

By law, the names and addresses of those commenting are available for public review during regular business hours. Before including your address, phone number, e-mail address, or other personal identifying information in your comment, you should be aware that your entire comment – including your personal identifying information – may be made publicly available at any time. While you can ask us in your comment to withhold your personal identifying information from public review, we cannot guarantee that we will be able to do so. All comments from organizations or businesses will be available for public inspection in their entirety.

Sincerely,

/s/ Lorraine M. Christian
Lorraine M. Christian
Field Office Manager

**ENVIRONMENTAL ASSESSMENT FOR THE PROPOSED
REDEVELOPMENT OF SIX WATER CATCHMENTS ON THE ARIZONA
STRIP, MOHAVE COUNTY, ARIZONA
(DOI-BLM-AZ-A010-2009-0012-EA)**

Prepared for

**U.S. Department of the Interior
Bureau of Land Management**
Arizona Strip Field Office
345 East Riverside Drive
St. George, Utah 84790-6714

April 2010

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Acronyms and Abbreviations

ASFO	Arizona Strip Field Office
AGFD	Arizona Game and Fish Department
AZHGIS	Arizona Heritage Geographic Information System
BLM	Bureau of Land Management
BMP	Best Management Practice
CFR	Code of Federal Regulations
DFC	Desired Future Conditions
DPC	Desired Plant Community
EA	Environmental Assessment
ERMA	Extensive Recreation Management Area
ESA	Endangered Species Act
GCPNM	Grand Canyon – Parashant National Monument
GMU	Game Management Unit
HDMS	Heritage Data Management System
NEPA	National Environmental Policy Act
RMP	Resource Management Plan
ROS	Recreation Opportunity Spectrum
USC	United States Code
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VRM	Visual Resource Management

Chapter 1

INTRODUCTION

1.1 BACKGROUND

The Bureau of Land Management (BLM), in cooperation with the Arizona Game and Fish Department (AGFD), proposes to make improvements to, and redevelop, six existing water catchments (Nos. 758, 828, 829, 837, 838, and 4486) in northwestern Arizona on the Arizona Strip within AGFD Game Management Unit (GMU) 13A. The Arizona Strip is isolated from the rest of Arizona by the Grand Canyon, making it some of the most remote, rugged land in the lower 48 states. The catchments are managed by the AGFD, are intended as supplemental water sources for wildlife, and have been in use for more than 35 years. Wildlife species such as mule deer (*Odocoileus hemionus*), pronghorn antelope (*Antilocapra americana*), and Merriam's turkey (*Meleagris gallopavo merriami*), as well as other species, benefit from the water supplied by these water catchments. Redevelopment and renovation of these catchments are intended to improve the reliability of water sources for wildlife use in the area.

Catchment Nos. 758, 828, 829, 837, 838, and 4486 are located on BLM-administered lands within the Arizona Strip Field Office (ASFO) (Figures 1.1–1.7). All six catchments are located in Mohave County, Arizona (Table 1.1). Photographs of the existing catchments are provided in Appendix A.

Table 1.1. Location of the Six Catchments

Catchment No./Name	Section, Township, Range (Quadrangle, Gila and Salt River Baseline and Meridian)
758/Uinkaret Plateau No. 3	NW ¼ S31, T36N, R9W (USGS Jones Hill)
828/Lang's Run	NW ¼ S34, T36N, R9W (USGS Jones Hill)
829/Finale	NW ¼ of S11, T36N, R9W (USFS Moriah Knoll)
837/Deadman Knoll	NE ¼ S9, T37N, R8W (USFS Moriah Knoll)
838/Jody Lake	NW ¼ of S26, T37N, R8W (USFS Hat Knoll)
4486/Rim No. 2	NW ¼ S17, T35N, R9W (USGS Jones Hill)

1.2 PURPOSE AND NEED

These six catchments were constructed in the 1960s and 1970s; original construction of the catchments specifically targeted mule deer and pronghorn antelope in order to provide local herds with a reliable, year-round water source. A reliable year round water source is important because the Arizona Strip has limited rainfall and few permanent water sources for mule deer, pronghorn, and other area wildlife. Permanent water sources are thought to expand wildlife distribution across the landscape, reduce mortality, and increase productivity (Roberts 1977; Thompson, personal communication, 2010). Mule deer are dependent on free-standing water during very dry periods; according to Remington et al. (1984) and Hervert and Krausman (1986), water developments in Arizona experience the most use by mule deer during hot summer months. According to habitat guidelines for mule deer, “water sources should not be more than 3 miles apart so all mule deer habitat is within 1.5 miles of a permanent water source” (Heffelfinger et al. 2006). Mule deer do not typically use only one water source within their home ranges. Mule deer in semi-arid desert environments will freely move 1.5 miles to find water, but as you

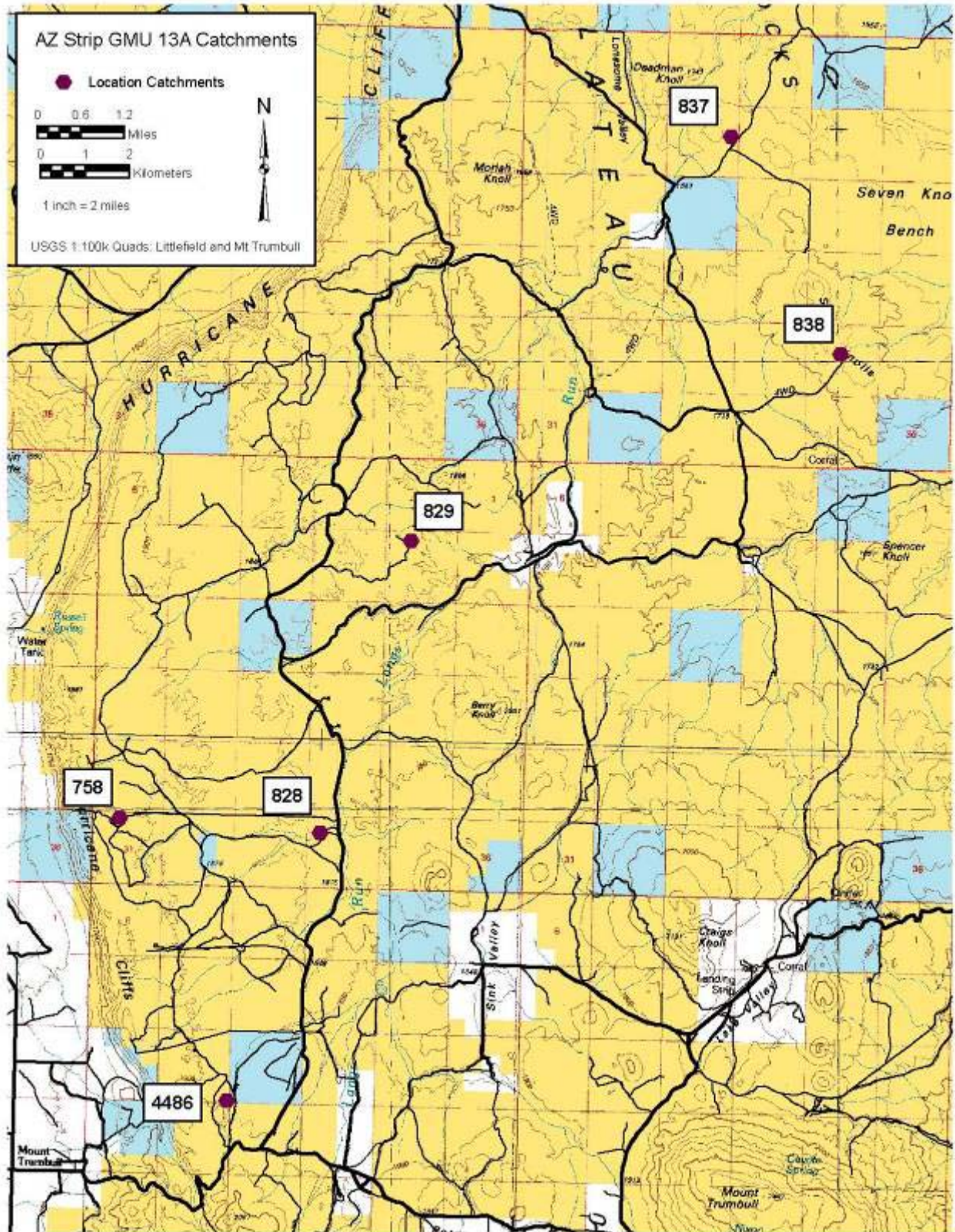


Figure 1.1. General location of the existing catchments.

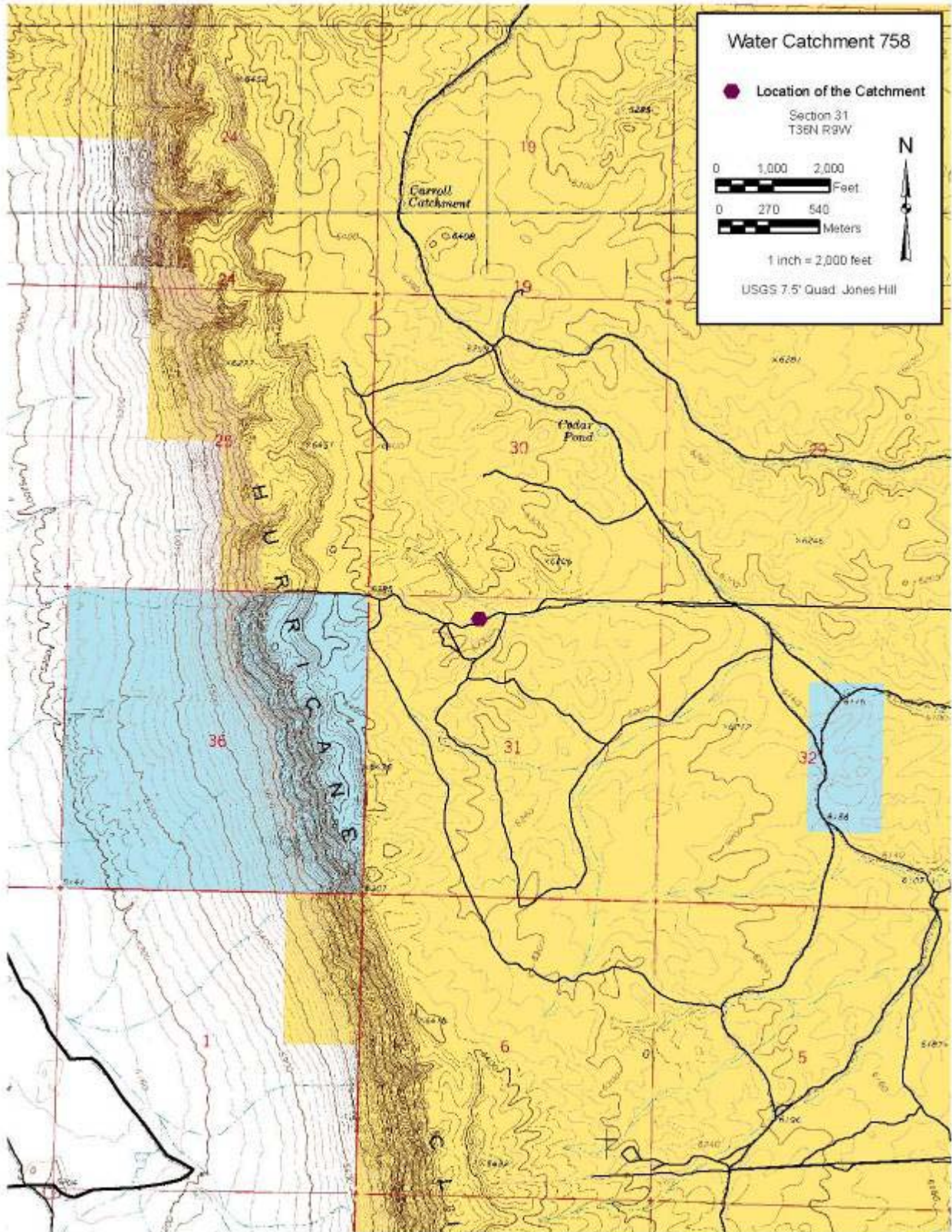


Figure 1.2. Water Catchment No. 758 location.

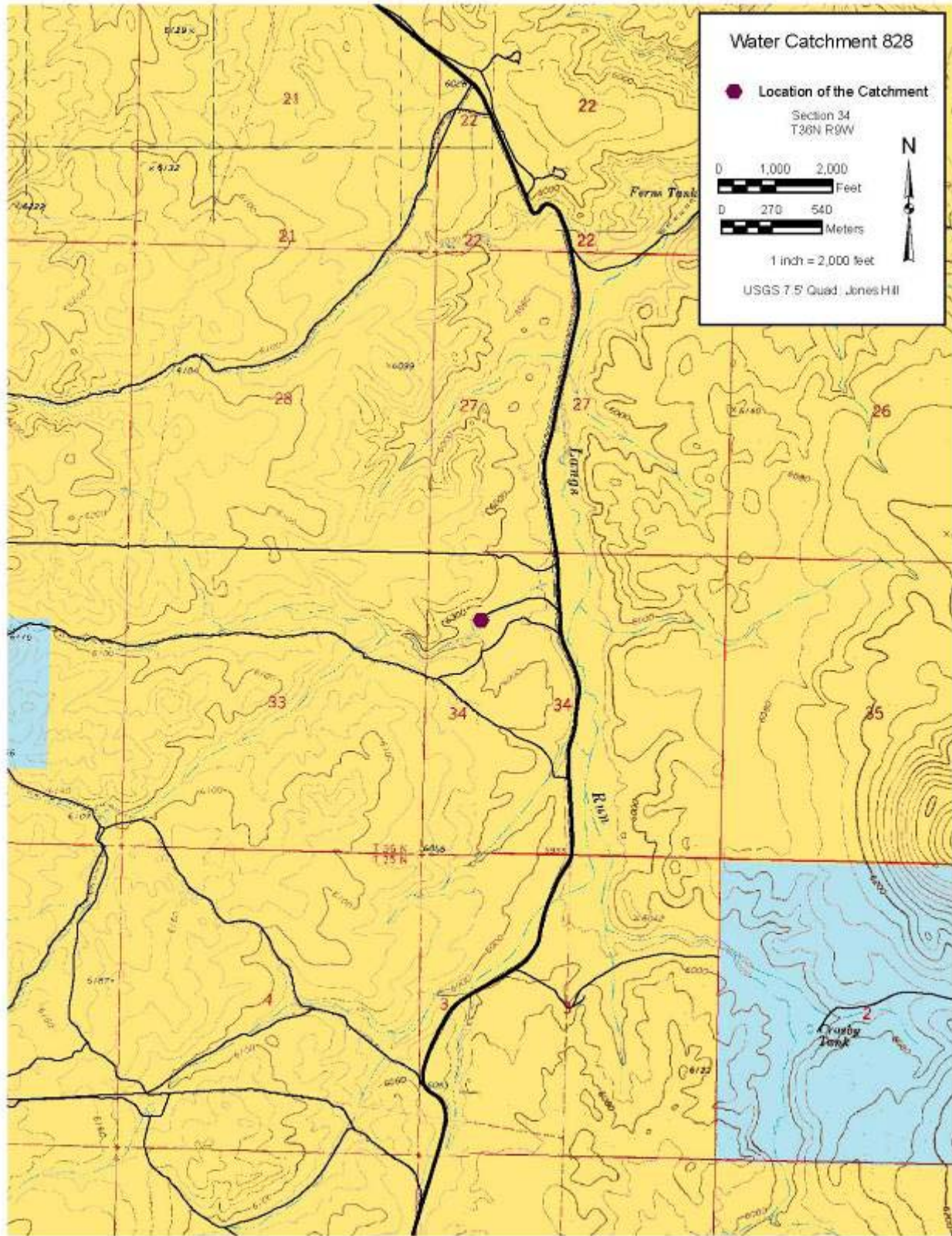


Figure 1.3. Water Catchment No. 828 location.

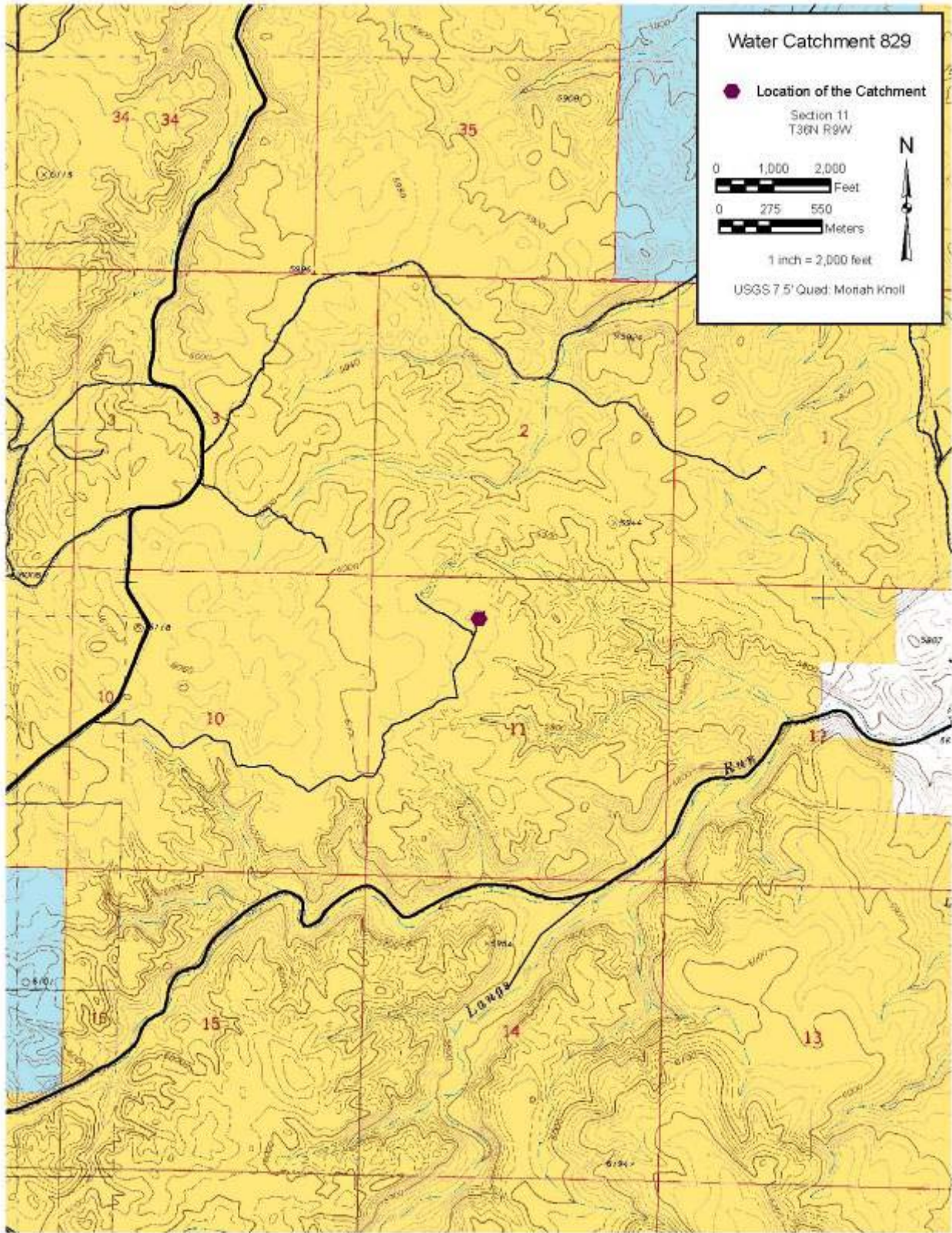


Figure 1.4. Water Catchment No. 829 location.

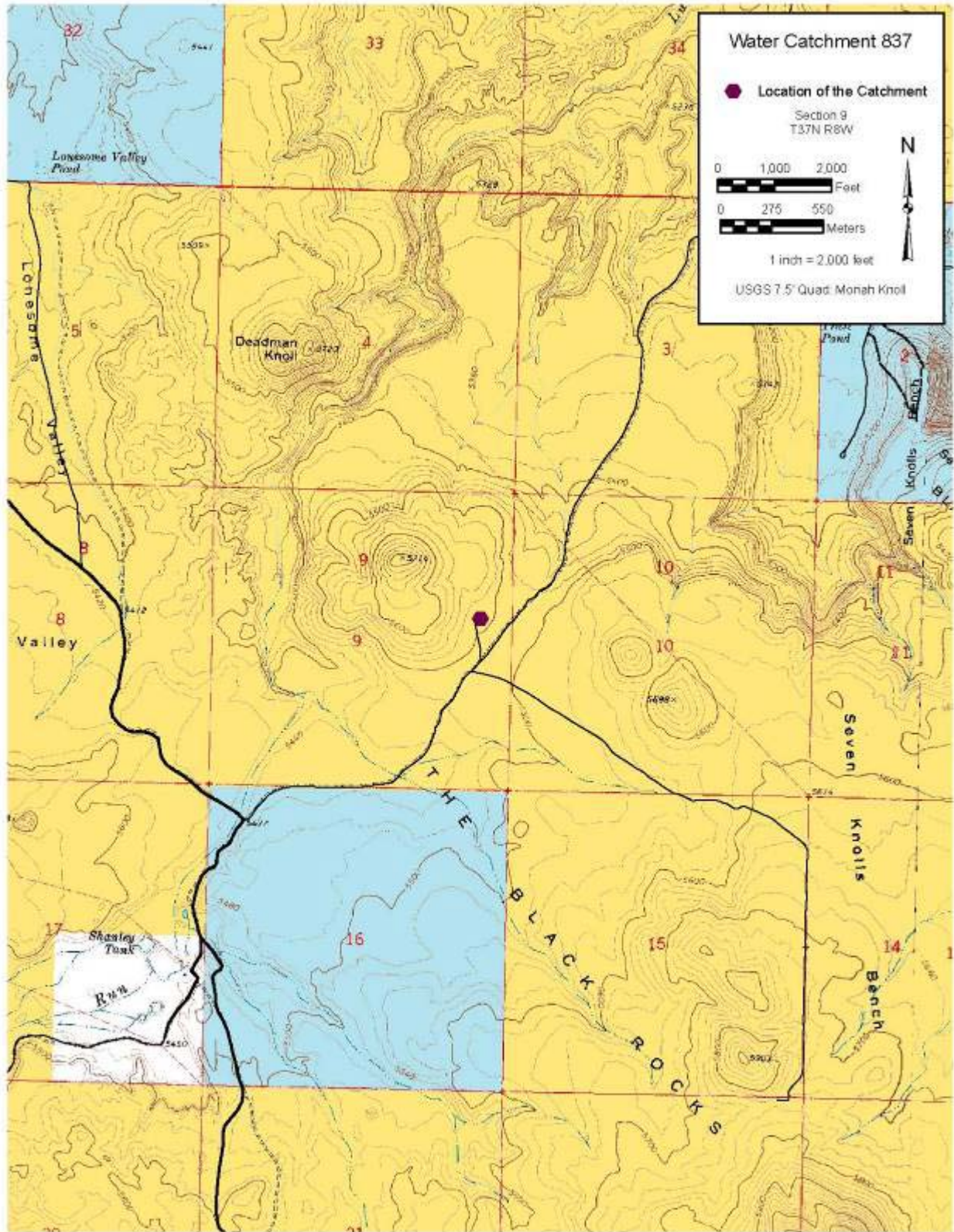


Figure 1.5. Water Catchment No. 837 location.

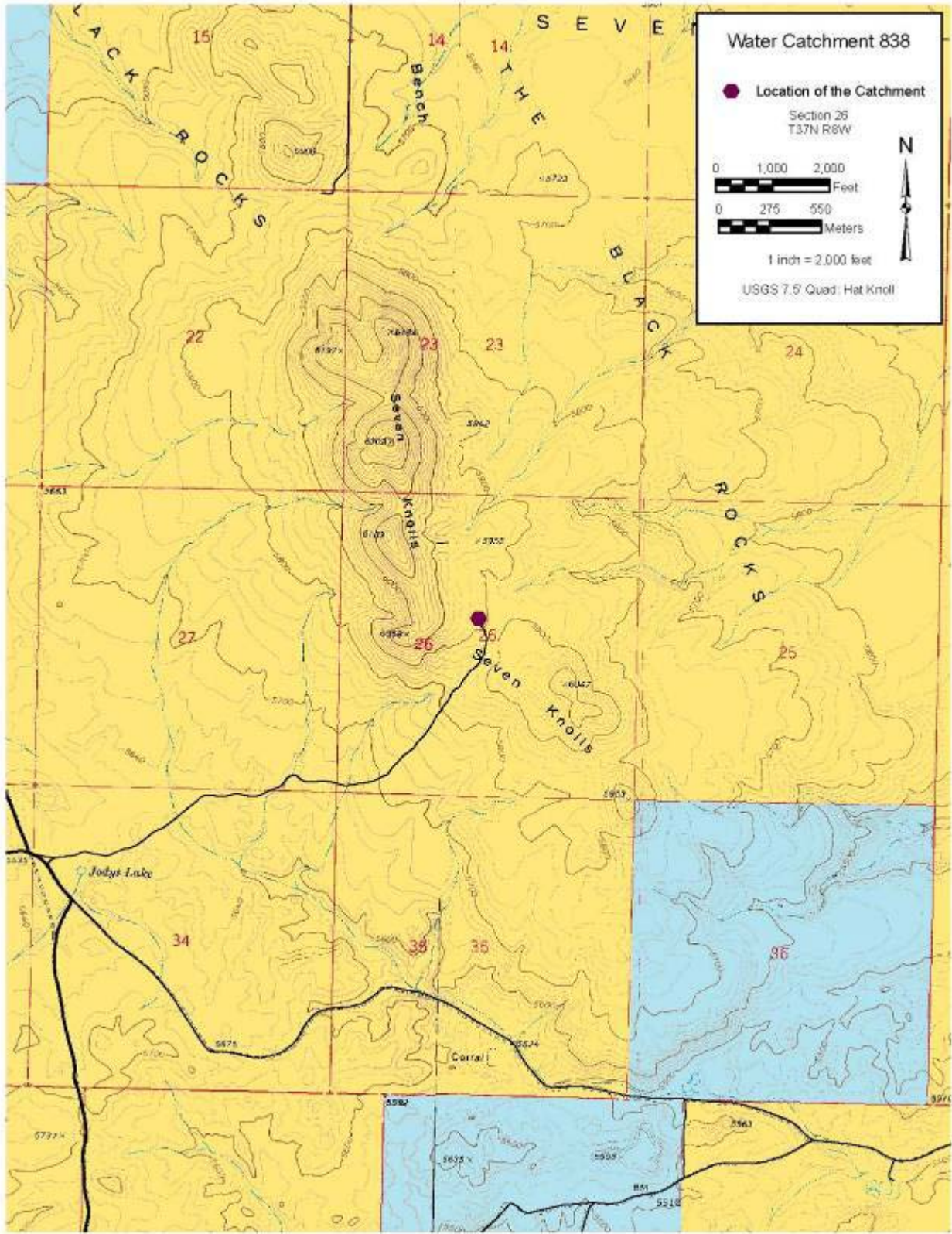


Figure 1.6. Water Catchment No. 838 location.

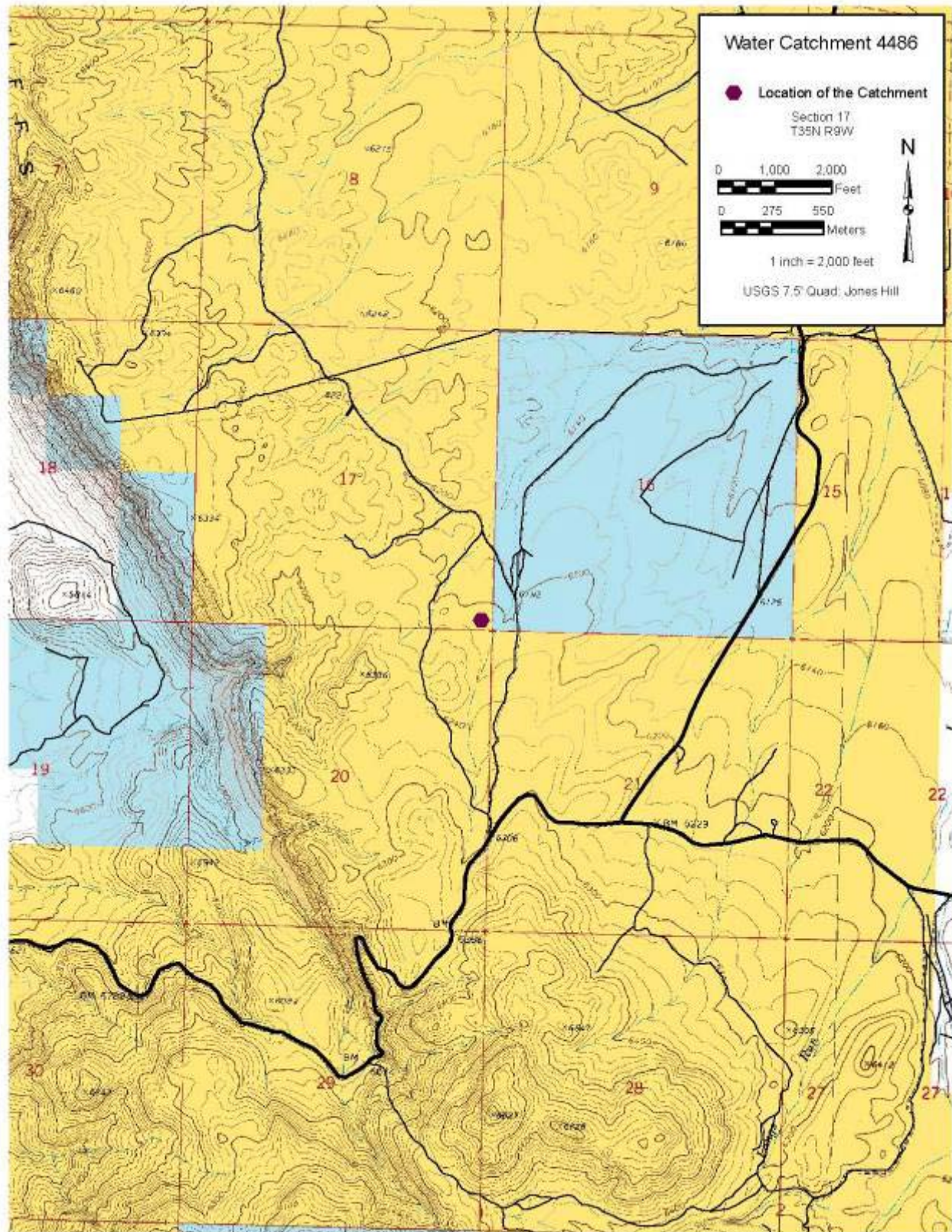


Figure 1.7. Water Catchment No. 4486 location.

move away from the water source, the deer are found at decreasing densities (Heffelfinger et al. 2006, Wood et al. 1970). Thus, it is a benefit to have more than 1 water dedicated to wildlife within a 3 mile radius so that they can utilize different portions of the habitat throughout the year. This can be important if one area has experienced a drought or palatable species are not at optimum levels. It also reduces the pressure on each individual catchment, reducing needs for water hauling, ensuring adequate water is available per individual, and reducing the risk of a water going completely dry. Mule deer are particularly dependant on reliable water during fawning and lactation periods. This period is typically in May through July and into August, which is also typically the warmest time of year. Having reliable water source(s) spaced no more than 3 miles apart reduces individual stress to these animals, helping to ensure success of the fawn.

Pronghorn, like mule deer, are dependent on free-standing water during very dry periods. When water catchments are the only water source available, pronghorn and mule deer use of catchments is similar (Thompson, personal communication, 2010). Pronghorn in semi-arid environments are usually found within 2 miles of a water source (Ockenfels et al. 1994, Clemente et al. 1995, Autenrieth et al. 2006).

After years of use, the six catchments addressed in this Environmental Assessment (EA) no longer function adequately for mule deer or other wildlife water needs. Routine inspections have revealed that the existing water catchments function poorly due to age-related deterioration, resulting in loss of water through leakage. Additionally, water in the catchments evaporates at a rate faster than can be replenished by rainfall, so water must be hauled to the catchments to maintain a water supply. Therefore, the AGFD needs to replace the existing catchments.

The purpose of this project is to redevelop the existing water sources (catchments), increase the storage capacity of these catchments, and reduce the visual profile of each catchment. Dependable, operating catchments would reduce the need to haul water to the catchments and would require less maintenance. This would allow continued provision of permanent water sources available for wildlife dependent on them, and substantially reduce the number of water hauling trips and required maintenance activities, reducing the cost to AGFD.

The AGFD needs to improve the existing wildlife water sources to maintain the availability of water for wildlife at these locations. As elaborated further in Section 1.3.1, the BLM needs to manage wildlife forage, water, cover, and space in order to support productive and diverse wildlife populations. Also elaborated in Section 1.4, AGFD's strategic plan and development standards support the management and enhancement of wildlife habitats, including maintenance and/or redevelopment of existing water catchments, through partnerships with public agencies, property owners and lessees, and wildlife conservation organizations. Thus, improving the availability of dependable water sources helps to assure that wildlife in the area thrive and remain self-sustaining by providing the necessary habitat components.

1.3 CONFORMANCE WITH LAND USE PLAN

The proposed action described in Chapter 2 is in conformance with the *Arizona Strip Field Office Resource Management Plan* (RMP), approved on January 29, 2008 (BLM 2008a). The proposed action is consistent with the following decisions contained within this plan.

The following decisions are from Table 2.3 of the RMP (BLM 2008a) regarding Vegetation and Fuels Management:

- **DFC-VM-02:** Native vegetative communities will be protected. A mosaic of native perennial and non-invasive annual vegetative communities would be present across the landscape with diversity

of species, canopy, density, and age class reflecting its local ecological site potential and naturally occurring habitat conditions.

- **DFC-VM-04:** Ecological processes and functions will be protected, enhanced, and/or restored by allowing tools that are necessary and appropriate to mitigate adverse impacts of allowable uses and undesirable disturbances, and contribute to meeting the Standards for Rangeland Health.
- **DFC-VM-05:** Invasive plant species will be contained, controlled, or eliminated and native species restored to meet Desired Plant Community (DPC) objectives.
- **DFC-VM-06:** Each vegetation community is maintained within its natural range of variation in plant composition, structure, and function.
- **MA-VM-12:** Implementation of ongoing noxious weed and invasive species control actions will be continued as per national guidance and the Weed Management Area Plan. Integrated weed management will continue using available tools to control noxious weeds consistent with vegetation management decisions for each Ecological Zone and as appropriate to the land use allocation and in order to protect resources.
- **DFC-VM-12:** There will be no net loss of total acres within sagebrush communities (i.e., long-term or permanent removal from the landscape). A no net loss objective will not preclude restoration, rehabilitation, or related management actions.
- **DFC-VM-24:** Stands of pinyon-juniper will include a balance between tree, shrub, and perennial grass cover to support pinyon jay and mule deer. This mosaic will include stands of old growth pinyon-juniper to support juniper titmouse; large openings of grasses, forbs and shrubs to support mule deer and provide foraging habitat for raptors such as sharp-shinned hawk, northern goshawk, Coopers hawk, American kestrel, and red-tailed hawk; and areas of sparse to dense tree canopy cover to support pinyon jay. (See Wildlife and Fish decisions.)

The following decisions are from Table 2.4 of the RMP (BLM 2008a) regarding Wildlife and Fish Management:

- **DFC-WF-01:** Ecological conditions will be within the range of natural variability and will be functional for dependent animal species.
- **DFC-WF-02:** Native wildlife communities will be protected. A complete range of diverse, healthy, and self-sustaining populations of native animal species will occupy all available suitable habitats.
- **DFC-WF-03:** Forage, water, cover, and space will be available to wildlife of sufficient quantity and quality to support productive and diverse wildlife populations.
- **DFC-WF-04:** All waters will be safely accessible to wildlife.
- **DFC-WF-05:** Fences will be the minimum necessary for effective livestock control or other administrative purposes. Fences will be wildlife passable, consistent with the species found in the area.
- **DFC-WF-10:** Management of game and nongame species by AGFD will be consistent with AGFD Strategic Plans and other appropriate guidelines.
- **DFC-WF-11:** The natural biological diversity of fish, wildlife, and plant species will be maintained or, where necessary and feasible, restored throughout the ASFO. Habitats will be

managed on an ecosystem basis, ensuring that all parts of the ecosystem and natural processes are functional.

- **DFC-WF-12:** Mule deer habitat will provide the necessary forage, water, and shelter components for healthy, self-sustaining populations within the range of natural variability.
- **DFC-WF-17:** Water sources within mule deer habitat will be safely accessible to deer and other wildlife.
- **DFC-WF-18:** Water sources within mule deer habitat will be spaced no more than 3 miles apart.
- **DFC-WF-20:** Pronghorn habitat will provide the necessary forage, water, and shelter components for healthy, self-sustaining populations within the range of natural variability.
- **DFC-WF-24:** Water sources within pronghorn antelope habitat will be safely accessible to deer and other wildlife.
- **DFC-WF-25:** Water sources within pronghorn antelope habitat will be spaced no more than 3 miles apart.
- **MA-WF-01:** Management emphasis and priority will be given to priority species and habitats in conflict resolution. Priority species include the following:
 - All special status wildlife species known or suspected to occur in the area. Special status species include those that are Federally listed, proposed, or candidate species; species for which there is a signed conservation agreement or strategy; all species referenced in AGFD's Wildlife Species of Concern in Arizona document; and species included on the Arizona BLM sensitive list.
 - All species of migratory birds known or suspected to occur within the ASFO.
 - All game mammals, including: mule deer, pronghorn antelope, desert bighorn sheep, mountain lion, Kaibab squirrel, and desert cottontail rabbit.
 - Game birds, including Merriam's turkey, Gambel's quail, white-winged dove, mourning dove, band-tailed pigeon, chukar partridge, and waterfowl.
 - The following carnivores: kit fox, gray fox, and long-tailed weasels.
 - Priority habitats include the following:
 - All aquatic and/or riparian areas, including springs, seeps, and man-made waters. These areas are important for all wildlife species, particularly native fish, and migratory birds.
 - All portions of the ponderosa pine ecological zone. This habitat is important for Merriam's turkey and a variety of bats and migratory birds. It is also crucial summer range for mule deer.
 - All areas considered crucial mule deer winter range, including the Buckskin Mountains, Whitmore Canyon, Grey Points/Low Mountain, north, and eastern slopes of Seegmiller Mountain, Bull Rush Point, Andrus Point, and the western slope of the Kaibab Plateau.
 - All bighorn sheep habitat areas, including the Virgin Mountains, Hurricane Cliffs, and Kanab Creek Wildlife Habitat Management Area.
 - House Rock Valley. The only known habitat for an endemic kangaroo rat and includes several special status plant species.

- **MA-WF-07:** Construction of wildlife habitat improvement projects, including water developments and vegetation treatments, can be authorized to meet Desired Future Conditions (DFCs), assuming compliance with the National Environmental Policy Act (NEPA), the Endangered Species Act (ESA), and other applicable laws, regulations, and policies. DPC objectives for wildlife will be incorporated into all habitat improvement projects, including restoration and vegetation treatment projects. Specific projects will be listed in HMPs.¹
- **MA-WF-09:** Existing water developments will be modified to ensure wildlife have safe access to water. Existing water developments will be maintained to ensure reliability of the water. Maintenance of existing waters will generally take priority over new construction. Development of cooperative waters for livestock and wildlife will be encouraged where doing so will benefit wildlife, will be consistent with achieving DFCs, and will be economically efficient.
- **MA-WF-16:** Mule deer will be managed for healthy, self-sustaining populations in accordance with population goals and objectives established in the AGFD Strategic Plan for the species.

The following decisions are from Table 2.7 in the RMP (2008a) regarding Visual Resources:

- **DFC-VR-01:** Public lands will be managed in a manner which will protect the quality of the scenic (visual) values of these lands (43 U.S. Code [USC] 1701, Section 102 (a) (8)).
- **DFC-VR-03:** The region's scenic beauty, open space landscapes, and other high-quality visual resources will be maintained within the Arizona Strip FO.
- **DFC-VR-06:** There are four visual resource management (VRM) classes. The objectives for each class, which provide visual management standards for the design and development of future projects and for rehabilitation of existing projects in the Arizona Strip FO are as follows.
 - Class 1* - The objective of this class is to preserve the existing character of the landscape. This class provides for natural ecological changes; however, it does not preclude very limited management activity. The level of change of the characteristic landscape should be very low and must not attract attention.
 - Class 2* - The objective of this class is to retain the existing character of the landscape. The level of change to the characteristic landscape should be low. Management activities may be seen, but should not attract the attention of the casual observer. Any changes must repeat the basic elements of form, line, color, and texture found in the predominant natural features of the characteristic landscape.
 - Class 3* - The objective of this class is to partially retain the existing character of the landscape. The level of change to the characteristic landscape should be moderate. Management activities may attract attention but should not dominate the view of the casual observer. Changes should repeat the basic elements found in the predominant natural features of the characteristic landscape.
 - Class 4* - The objective of this class is to provide for management activities that require major modification of the existing character of the landscape. The level of change to the characteristic landscape can be high. These management activities may dominate the view and be the major focus of viewer attention. However, every attempt should be made to minimize the impact of these activities through careful location, minimal disturbance, and repeating the basic elements.

¹These six catchments are specifically listed in the Clayhole Habitat Management Plan (HMP) and Mt. Trumbull HMP.

- **MA-VR-03:** All new surface disturbing projects or activities, regardless of size or potential impact, will incorporate visual design considerations during project design as a reasonable attempt to meet the VRM class objectives for the area and minimize the visual impacts of the proposal. Visual design considerations will be incorporated by:
 - Using the VRM contrast rating process (required for proposed projects in highly sensitive areas, high impact projects, or for other projects where it appears to be the most effective design or assessment tool), or by
 - Providing a brief narrative visual assessment for all other projects that require an environmental assessment (EA) or environmental impact statement.
 - Measures to mitigate potential visual impacts include the use of natural materials, screening, painting, project design, location, or restoration (See Appendix I; BLM Handbook H-8431-1, Visual Resource Contrast Rating; or online at <http://www.blm.gov/nstc/VRM/8431.html>, for information about the contrast rating process).

It has also been determined that the proposed action would not conflict with other decisions throughout this plan.

1.4 RELATIONSHIP TO STATUTES, REGULATIONS, OR OTHER PLANS

This EA has been prepared in accordance with the requirements of NEPA and any additional Federal, State, and local statutes that may be relevant to the proposed action, such as those cited below.

The proposed action is consistent with the Fundamentals of Rangeland Health (43 Code of Federal Regulations [CFR] 4180.1) and Arizona's Standards and Guidelines, which were developed through a collaborative process involving the Arizona Resource Advisory Council and the BLM State Standards and Guidelines Team. The Secretary of the Interior approved the Standards and Guidelines in April 1997. These standards and guidelines address watersheds, ecological condition, water quality, and habitat for sensitive species. These resources are addressed later in this document.

The proposed action conforms to the President's National Energy Policy and would not have adverse energy impacts. The proposed action would not deny energy projects, withdraw lands, close roads, or in any other way deny or limit access to mineral materials to support energy actions.

Executive Order 13186 requires the BLM and other Federal agencies to work with the U.S. Fish and Wildlife Service to provide protection for migratory birds. Implementation of the proposed action is not likely to adversely affect any species of migratory bird known or suspected to occur in the project areas. No take of any such species is anticipated.

The project areas are located in Mohave County, Arizona. The proposed action is consistent with the *Mohave County General Plan* (adopted September 1994). While water catchments are not specifically addressed in the *Mohave County General Plan*, this action does not conflict with decisions contained within the plan.

The proposed action complies with the *Arizona Game and Fish Department's Wildlife Program Management Strategic Plan for the Years 2007–2012* (AGFD 2007) and the *Arizona Game and Fish Department Water Development Standards* (AGFD 2005a). AGFD's strategic plan and development standards support the management and enhancement of wildlife habitats, including maintenance and/or redevelopment of existing water catchments, through partnerships with public agencies, property owners and lessees, and wildlife conservation organizations.

In addition, the proposed action would comply with the following laws and/or agency regulations and other plans and are consistent with applicable Federal, State, and local laws, regulations, and plans to the maximum extent possible.

- Federal Land Policy and Management Act of 1976 (43 USC 1707 *et seq.*)
- Endangered Species Act of 1973, as amended
- Section 106 of the National Historic Preservation Act of 1966, as amended
- Native American Graves Protection and Repatriation Act of 1990 (25 USC 3001–3013; 104 Stat. 3048-3058)
- National Environmental Policy Act of 1969
- Executive Order 13186, Responsibilities of Federal Agencies to Protect Migratory Birds

1.5 IDENTIFICATION OF ISSUES

Identification of issues for this assessment was accomplished by considering the resources that could be affected by implementation of one of the alternatives. A summary of the issues and the rationale for analysis are given below.

- **Vegetation:** Disturbance to vegetation could occur during construction, including the potential loss of shrubs, grasses, and forbs in and around the footprint of the catchments. Maintenance and water hauling could also result in minor trampling of vegetation within and adjacent to the catchment sites.
- **Wildlife:** Disturbance to wildlife, including migratory birds and sensitive species, could occur during construction, water-hauling, and maintenance activities, including the potential loss of vegetation and, consequently, the potential short-term loss of wildlife habitat, as well as increased short-term noise. Wildlife could be affected in the long-term by providing a more reliable water source.
- **Recreation:** Disturbance to the recreating public could occur during construction activities. Disturbances could include increased noise as well as reduced opportunities for solitude in the short term. In the long-term, improvements to the catchment design should reduce the number of water hauling and maintenance trips, and attract wildlife to the catchments, resulting in increased opportunities for solitude in the area and for wildlife viewing.
- **Visual Resources:** The proposed action has the potential to alter the appearance of the project area (i.e., the visual setting).

Chapter 2

PROPOSED ACTION AND ALTERNATIVES

This EA focuses on the proposed action and no action alternatives. The no action alternative is considered and analyzed to provide a baseline for comparing the impacts of the proposed action. The BLM interdisciplinary team explored and evaluated several different alternatives to determine whether the underlying need for the proposed action, to provide a reliable, year-round water source for wildlife, would be met. Those alternatives considered but eliminated from further analysis are described in Section 2.3, along with the rationale for not further considering these alternatives.

2.1 PROPOSED ACTION

The existing water catchments would be replaced to ensure adequate future water supply in each area. The proposed improvements include complete removal of the existing catchments. Construction of each replacement catchment includes installing a new apron, trough, pipeline, fence, and an underground (fiberglass) storage tank in a manner consistent with the *AGFD Wildlife Water Development Standards* (AGFD 2005a). All ground disturbances would remain within the existing fenced areas.

Access to the catchments would occur on existing routes. Catchment Nos. 828 and 758, are on Route 317; Catchment No. 4486 is on a two track off Route 317 (see Appendix C for photo of road at water catchment 4486); Catchment No. 829 is on Route No. 450; and Catchment No. 837 is on Route No. 446. No road improvements are proposed or expected to be necessary at any of the six catchments; however, if erosion or road deterioration occurs over time, BLM standard best management practices (BMPs), as described in Section 2.1.1, would be implemented.

Redevelopment of each water catchment would involve the installation of three separate components, all of which have a lower visual profile than the existing catchments. These components are 1) a 3-foot-deep fiberglass walk-in trough for each catchment; 2) a 3-foot-deep × 18-foot-diameter fiberglass storage tank; and 3) a 24-foot-wide × 72-foot-long steel frame apron with R-panel sheeting. An “R-panel” is heavy-gauge corrugated tin with a baked-on color finish. The existing barbed-wire fence would be removed and replaced to AGFD standards. These standards include constructing a welded, wildlife-friendly pipe-rail enclosure fence on the existing fence line. Appendix B provides schematic drawings of the proposed catchments.

The proposed improvements would result in the short-term surface disturbance of up to 1.0 acre at each catchment location resulting from construction and installation of the catchment, as well as equipment and materials being spread out/stored on-site during the construction – the exact area of disturbance would vary at each catchment based upon vegetation and topography. Ground disturbance and redevelopment activities at each catchment would include the backhoe excavation of a 5-foot-deep × 20-foot-wide × 45-foot-long trench to install the storage tanks. If large boulders, bedrock, or other conditions prevent digging the hole to the desired depth, the tank would either be partially buried or placed above ground. A new 24-foot-wide × 72-foot-long metal precipitation collection apron would be installed over the tank hole; the apron would have a fiberglass gutter that would feed directly into the tank. A 3-foot-deep × 4-foot-wide hole would be excavated to install the fiberglass walk-in trough; again, if large boulders, bedrock, or other conditions occur, the trough would either be partially buried or placed above ground. A trench measuring approximately 3–5 feet deep × 20–40 feet long would be excavated prior to the installation of a pipeline leading from the tank to the trough. Any soil and rock removed from excavation of the tank would be spread within the fenced area, and all disturbed areas would be leveled

and smoothed to match the surrounding topography. After construction is completed, the area of long-term disturbance at each catchment site (the apron area, trough area, and access area that allows for routine maintenance) would be approximately 0.1 acre.

Installed catchment components would be kept as inconspicuous as possible using various camouflage techniques, to the greatest extent possible, to minimize any potential impacts. Techniques could include painting components with earth tones, using no reflective materials, breaking up linear shapes with sculpted concrete, covering components with soil rock or dead limbs, and/or burying components underground. The walk-in water trough, tanks, and connecting pipelines would be partially or wholly buried underground. However, if soil conditions impede excavation to the desired depth (up to approximately 5 feet), camouflage techniques would be limited to the use of rocks and dead vegetation native to the catchment location to blend the structure into the surrounding landscape.

Crew work time at each catchment is estimated to be up to two weeks. Once construction at each catchment is complete, all extraneous construction materials would be removed from the area and properly disposed of. Disturbed surfaces would be leveled and smoothed to match the surrounding topography. Disturbance to live vegetation would be kept to a minimum by restricting construction activities to the existing catchment footprints and immediate areas. Vegetation thinning is not anticipated.

During construction, a campsite may be needed for work crews at each catchment site. The locations of any campsite for construction crews would be coordinated with the BLM and located in previously disturbed areas. Workers would camp and park, during nonworking hours, at least ¼ mile away from each construction area, for the entire work period.

The minimum number of tools necessary to complete the project would be transported to the site via trucks and trailers. Using only existing roads, trucks would transport materials and a backhoe tractor to each project site. The trucks would transport small hand tools and miscellaneous hardware. The backhoe would excavate a hole for the tanks, trough, and pipeline at the site and would help position these components in place. The backhoe would only be used in disturbed areas inside the enclosure fence and in an area within 20 feet of the fence line.

After construction is complete, two activities would occur at each catchment location: site restoration and maintenance, including limited water hauling. First, excavated dirt would be recontoured throughout the project areas by the construction crew. Dead and downed plant material, in addition to existing rock debris, would be placed on top of the disturbed area to camouflage the catchment area and facilitate revegetation. The construction crew would lightly rake out human footprints and tire tracks from the backhoe and trucks. Any topsoil would be replaced, and a BLM-approved seed mix would be applied to the area to aid in revegetation.

Second, water would be hauled to each catchment to sufficiently fill the tanks until naturally occurring rainfall replaces the initial delivery. Additional water would be hauled to each catchment as needed; the amount would depend on local precipitation levels. The proposed catchment design is expected to require fewer water-hauling trips than the existing catchments because the redeveloped catchments could hold up to 10,000 gallons of water, while the existing catchment can only store up to 5,000 gallons of water.

Long-term maintenance activities at the catchments would include conducting inspections seven to eight times per year to ensure adequate water levels, removing debris from intake areas, assessing and repairing damage to each catchment, and performing other minor maintenance activities. The frequency of maintenance activities would depend on weather conditions, volume of animal use, and unexpected damage to the catchments. The redeveloped catchments are expected to require less maintenance than the existing catchments. For example, most components of the proposed redeveloped catchments are expected to be located beneath the surface, which reduces impacts from weather deterioration.

The proposed action does not currently include plans for installation of a precipitation/water-level gauge; however, long-term maintenance at the catchments could include installation of such a device.

Components associated with the gauge include a 10-foot-tall × 12-inch-wide tube anchored in concrete, which houses the battery; associated electronics; and a solar panel. Depending on the location and reception in the area, a 6-to 10-foot-long antenna would be mounted atop the tube to send and receive data. A ¾-inch conduit would be run from the housing tube to the gauge in the catchment, which is housed in a 2-inch galvanized pipe. These gauges could be installed at the catchments to collect raw data on precipitation levels and monitor the level of the water in the catchment. An email alert is transmitted to AGFD when water in the catchment reaches below 0.5 foot. This alert system could enable AGFD to haul supplemental water to catchments as needed, much more efficiently than the current manual inspection system. Installation of a precipitation/water-level gauge would reduce vehicular traffic and impacts from human presence, both at the catchments and along the access routes. Installed catchment gauge components would be kept as inconspicuous as possible, using various camouflage techniques, to minimize any potential visual impacts. Gauge components would be painted with earth tones, and no reflective materials would be used.

2.1.1 Best Management Practices

The following BMPs are included in the proposed action in an effort to minimize the impacts of the proposed action to social and natural environmental resources. The following are practices to be implemented at all catchments:

- Construction activities would be limited to daylight hours to minimize impacts to wildlife.
- Construction activities would be limited to periods when the soil and ground surface are not wet in order to avoid soil compaction issues.
- Construction activities would be conducted in a manner that would minimize disturbance to existing vegetation by limiting vegetation thinning and restricting construction activities to the existing catchment footprints, within the existing fenced areas.
- If an active bird nest is observed before or during construction, measures would be taken to protect the nest.
- The locations of any campsites for construction crews—if needed—would be coordinated with the BLM and located in previously disturbed areas.
- Vehicles and equipment would be power washed off-site before construction activities at each catchment site to minimize the risk of spreading weeds; this would include cleaning all equipment before entering the Arizona Strip, as well as cleaning it between work sites. The project areas would be monitored for weeds after construction until they are recovered/revegetated, or for 2 years, whichever comes sooner.
- Soil disturbance associated with construction activities would be limited by restricting disturbance to the existing catchment footprints and immediate vicinity.
- Excavated soil would be recontoured throughout the project area (includes scraping and piling).
- Any topsoil would be replaced and a BLM-approved seed mix would be applied to aid in revegetation.
- The following actions would be implemented to minimize visual impacts associated with the redevelopment activities: 1) natural material, such as dead vegetation and rock debris, would be returned to the disturbed area; 2) above ground components would be painted colors that blend in with the surrounding landscape (i.e., medium grays or earthen colors); 3) pigment would be added to cement used in the trough so that they blend in with the surroundings; 4) rocks from the

area would be used to avoid or mask straight lines; and 5) if installed, precipitation/water-level gauge components would be kept as inconspicuous as possible employing various camouflage techniques, such as using native materials and/or paint colors that blend in with the surrounding landscape and no reflective materials.

- If amphibians (any life stage) are present at the time of reconstruction, they would be transferred to buckets using the water from the wildlife catchment and returned when construction is complete.
- During construction, vehicular traffic would be restricted to existing routes.
- Construction trenches would be designed with 45° to 60° slopes to meet Occupational Health and Safety Administration standards for trenching and to prevent wildlife from becoming entrapped. Trenches would be checked each day for entrapped animals before commencing work activities.
- Construction debris would be removed to an appropriate landfill location.
- Any cultural (historic/prehistoric site or object) or paleontological resource (fossil remains of plants or animals) discovered at the catchment sites would immediately be reported to the authorized officer or his/her designee. All operations in the immediate area of the discovery shall be suspended until written authorization to proceed is issued. An evaluation of the discovery shall be made by a qualified archaeologist or paleontologist to determine appropriate actions to prevent the loss of significant cultural or scientifically important paleontological values.
- If in connection with this work any human remains, funerary objects, sacred objects or objects of cultural patrimony as defined in the Native American Graves Protection and Repatriation Act (P.L. 101-601; 104 Stat. 3048; 25 U.S.C. 3001) are discovered, operations in the immediate area of the discovery would stop, the remains and objects would be protected, and the authorized officer would be immediately notified. The immediate area of the discovery would be protected until notified by the Arizona Strip Field Office Manager that operations may resume.
- Construction of the improvements is not anticipated to affect waters of the United States; however, the AGFD would obtain appropriate permits when necessary before project implementation.
- At no time shall vehicle or equipment fluids (including motor oil and lubricants) be dumped on public lands. All accidental spills must be reported to the authorized officer and be cleaned up immediately, using best available practices and requirements of the law, and disposed of in an authorized disposal site. All spills of federally or state listed hazardous materials which exceed the reportable quantities shall be promptly reported to the appropriate state agency and the authorized officer.
- Those involved with catchment redevelopment and/or maintenance activities must notify the BLM wildlife team lead if California condors visit the worksite while permitted activities are underway. Project activities would be modified or delayed where adverse effects to condors may result.
- The project site would 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. BLM staff may conduct site visits to the area to ensure adequate clean-up measures are taken.

2.1.2 Monitoring

Monitoring under the proposed action would consist of inspections of the water catchments by the AGFD and BLM during redevelopment to ensure compliance with the best management practices listed in Section 2.1.1. Periodic inspections would subsequently be conducted by BLM specialists as determined

necessary. Monitoring may also be conducted by the grazing permittee in cooperation with BLM specialists. The project areas would be monitored for weeds after construction until they are recovered/revegetated, or for 2 years, whichever comes sooner.

2.2 NO ACTION ALTERNATIVE

Under the no action alternative, none of the water catchments would be replaced, and no new construction, renovation, or upgrading would occur. Water would continue to be hauled to the sites at a rate that would be expected to increase as the condition of the existing catchments deteriorates. The expected frequency of future water-hauling trips could increase up to double the water delivery of current conditions; water delivery could increase from one to two trips per year to two to four trips per year. Wildlife in the area would continue to use the existing catchments' water and any naturally occurring seasonal water sources in the area.

2.3 ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED ANALYSIS

2.3.1 Refrain from Replacing the Water Catchments and Discontinue Water Hauling

Under this alternative, AGFD would not build the new water catchments and would discontinue hauling water to the existing catchments. These water sources would no longer provide a reliable, year-round water supply, and wildlife in the area would rely solely on naturally occurring seasonal water sources.

Wildlife populations have come to depend on water sources such as the six catchments analyzed in this EA. Not replacing these catchments and not continuing to haul water to fill them would likely result in a reduced wildlife population size in this GMU area. This alternative does not meet the purpose and need of the project as described in Section 1.2. In addition, this alternative would not be in conformance with ASFO RMP decision DFC-WF-03 listed in Section 1.3.1 of this document. Therefore, it was not carried forward for further analysis.

Chapter 3

AFFECTED ENVIRONMENT

The purpose of this chapter is to describe the existing environment potentially affected by the alternatives. AGFD staff expect up to 1 acre of disturbance associated with the construction of each water catchment system. Following completion of the project (including restoration activities), approximately 0.1 acre would remain disturbed in the long term.

The six catchment sites are located on BLM-administered lands along the Uinkaret Plateau. Elevation of the project areas ranges from 5,531 to 6,316 feet above mean sea level. The terrain is mostly flat or has minimal relief in the project areas; however, small, mountainous peaks, ephemeral drainages, subtle rolling hills, and steep cliffs are located in the vicinity of the project areas. These six catchments were originally constructed in the 1960s and 1970s as water sources that targeted mule deer, pronghorn antelope, Merriam's turkey, and other small or non-game wildlife species. The original construction at each catchment consisted of a 200 × 225-foot barbed-wire fence, a 20 × 60-foot corrugated sheet-metal apron, a concrete vault at the end of the apron, and a concrete drinker. The metal aprons are secured to the ground at intervals, using concrete anchors rather than wood studs, and are encompassed by a 40 × 80-foot barbed-wire enclosure fence.

Water Storage and Hauling

Catchment No. 758 (also named Uinkaret Plateau No. 3): The existing catchment has the capacity to store up to 5,000 gallons of water. Between 2000 and 2007, the AGFD annually hauled 1,500 gallons of water to the site, averaging one trip per year at a cost of \$800 per load.

Catchment No. 828 (also named Lang's Run): The existing catchment has the capacity to store up to 5,000 gallons of water. Between 2000 and 2007, the AGFD annually hauled 1,500 gallons of water to the site, averaging one trip per year at a cost of \$800 per load.

Catchment No. 829 (also named Finale): The existing catchment has the capacity to store up to 5,000 gallons of water. Between 2000 and 2007, the AGFD annually hauled 1,500 gallons of water to the site, averaging one trip per year at a cost of \$800 per load.

Catchment No. 837 (also named Deadman Knoll): The existing catchment has the capacity to store up to 5,000 gallons of water. Between 2000 and 2007, the AGFD annually hauled 1,500 gallons of water to the site, averaging one trip per year at a cost of \$800 per load.

Catchment No. 838 (also named Jody Lake): The existing catchment has the capacity to store up to 5,000 gallons of water. Between 2000 and 2007, the AGFD annually hauled 1,500 gallons of water to the site, averaging one trip per year at a cost of \$800 per load.

Catchment No. 4486 (also named Rim No. 2): The existing catchment has the capacity to store up to 5,000 gallons of water. Between 2000 and 2007, the AGFD annually hauled 1,500 gallons of water to the site, averaging one trip per year at a cost of \$800 per load.

3.1 ELEMENTS/RESOURCES OF THE HUMAN ENVIRONMENT

The BLM is required to consider many authorities when evaluating a Federal action. Those elements of the human environment that are subject to the requirements specified in statute, regulation, or executive order, and must be considered in all EAs (BLM 2008b), have been considered by BLM resource

specialists to determine whether they would be potentially affected by the proposed action. These elements are identified in Table 3.1, along with the rationale for determination on potential effects. If any element was determined to be potentially impacted, it was carried forward for detailed analysis in this EA; if an element is not present or would not be affected, it was not carried forward for analysis. Table 3.1 also contains other resources/concerns that have been considered in this EA. As with the elements of the human environment, if these resources were determined to be potentially affected, they were carried forward for detailed analysis in this document.

Table 3.1. Summary Evaluation of Elements/Resources of the Human Environment

Resource	Determination*	Rationale for Determination
<p>*NP = Not present in the area that would be impacted by the proposed action. NI = Present, but not affected to a degree that would mean detailed analysis is required. PI = Present with potential for impact; analyzed in detail in the EA.</p>		
Air Quality	NI	Air quality within the general area is good, although wind-blown dust can be a minor source of pollution. The six catchments are within an attainment area for all National Ambient Air Quality Standards. The proposed action would result in temporary, localized deterioration of air quality because of the operation of equipment and the dust generated from renovation and construction activities at each catchment, but these emissions would be temporary and would cease once renovation at each catchment site is complete.
Areas of Critical Environmental Concern	NP	None of the catchments addressed in this EA are within an Area of Critical Environmental Concern.
Cultural Resources	NI	Two separate cultural resource inventories have been conducted for the six catchment locations (Logan Simpson Design 2005; SWCA Environmental Consultants 2008b). The footprint of each existing catchment is less than 1 acre; however, 4 acres at each catchment was surveyed. No cultural resources were documented at Catchment Nos. 758, 828, 829, 837, and 838. One archaeological site is documented at Catchment No. 4486; however, the archaeological site is not considered significant. Because no significant cultural resources exist at any of the catchment locations, the proposed action would have no impact to cultural resources.
Environmental Justice	NI	The proposed action would have no disproportionately high or adverse human health or other environmental effects on minority or low-income segments of the population. The proposed action would also have no effect on low-income or minority populations.
Farmlands (Prime or Unique)	NP	There are no prime or unique farmlands within the project areas.
Floodplains	NP	No actions are proposed that would result in permanent fills or diversions, or placement of permanent facilities, in floodplains or special flood or hazard areas. In addition, according to the Federal Emergency Management Agency Flood Insurance Rate Maps, none of the catchments are located within a 100-year floodplain. The catchments are located in a zone of minimal or unknown flooding hazard.
Invasive, Non-native Species	NI	There are currently no known noxious weeds at Catchment Nos. 758, 828, 829, 837, 838, and 4486. Cheatgrass is the only invasive species found at the catchment sites. A variety of measures (including power washing vehicles and minimizing areas of disturbance) would be implemented which would ensure that the proposed redevelopment activities would not contribute to the further spread of cheatgrass or other invasive species.
Native American Religious Concerns	NP	During consultations with American Indian Tribes who claim cultural affiliation to northern Arizona, no Native American religious concerns have been identified in relation to redeveloping wildlife water catchments.
Threatened, Endangered, or Candidate Plant Species	NP	No Threatened, Endangered, or Candidate plant species occur in the project areas.

Resource	Determination*	Rationale for Determination
Threatened, Endangered, or Candidate Animal Species	NP	None of the catchment sites are within any critical habitat that has been designated or proposed under the ESA, and no Federally listed species are known or suspected to occur at any of these locations.
Wastes (hazardous or solid)	NP	No known hazardous or solid waste issues occur in the project areas.
Water Quality (drinking/ground)	NI	No permanent springs or continuously flowing streams are located at any of the six catchments. Additionally, there is no connection to any drinking or groundwater sources. Therefore, redevelopment of the water catchments would not affect water quality.
Wetlands/Riparian Zones	NP	There are no wetlands/riparian zones at any of the six catchment sites.
Wild and Scenic Rivers	NP	There are no designated, eligible, or suitable Wild and Scenic River segments within the project areas.
Wilderness	NP	None of the six catchment sites are located within designated wilderness.
Livestock Grazing	NI	Each of the water catchments is located within an active grazing allotment. However, the catchments are currently fenced to exclude livestock, and would remain fenced. Thus, redevelopment of the water catchments would not affect livestock grazing.
Woodland/Forestry	NI	Redevelopment of the water catchments would not affect the availability of, or access to, these resources because the proposed action would not close any areas to collection of woodland products.
Vegetation	PI	Disturbance to vegetation could occur during construction, maintenance and water hauling.
BLM or State Sensitive Plants	PI	Whipple cholla (<i>Cylindropuntia whipplei</i>) is known to occur in the project area of water catchment Nos. 837, 838, and 4486.
Wildlife (including mule deer, pronghorn, sensitive species and migratory birds)	PI	Disturbance to wildlife could occur during construction, water hauling, and maintenance activities, including the potential loss of vegetation and, consequently, the potential short-term loss of wildlife habitat, as well as increased noise and soil compaction.
Soils	NI	The terrain at the project areas is mostly flat or has minimal relief; however, small, mountainous peaks, ephemeral drainages, subtle rolling hills, and steep cliffs are located in the vicinity of the project areas. The catchments are within mesic semiarid soils. Catchment Nos. 758, 828, 829, and 4486 are within the Winona-Boysag-Rock Outcrop Association; soils within this association tend to be shallow, medium- and fine-textured along rolling soils and rock outcrops on plateaus and plains. Catchment Nos. 837 and 838 are within the Rudd-Bandera-Cabezon association, where soils are shallow, gravelly, cobbly and stony, medium- and fine-textured, undulating soils typically found on plains and mesa tops (Hendricks 1985). Since these areas are already disturbed and no construction activities would occur when soils are wet (in order to avoid compaction), impacts to soils would be negligible.
Recreation	PI	Disturbance to the recreating public could occur during construction activities, including increased noise as well as reduced short-term opportunities for solitude. Not implementing the proposed action could result in increased disturbance to recreation users from additional water hauling activities as the existing water catchments fail.
Visual Resources	PI	Short-term alteration to the visual setting of the project areas could occur during and immediately after construction activities.
Geology/Mineral Resources/Energy Production	NI	None of the catchments are expected to affect geology, mineral resources, or energy production because the proposed action would not close any areas to mineral development and would not alter any known geologic features.
Paleontology	NP	No paleontological resources are known to occur in the project areas.
Lands/Access	NI	Access to public lands would not be altered or impaired by implementation of the proposed action. No other land issues have been identified in connection with the proposed action.

Resource	Determination*	Rationale for Determination
Fuels/Fire Management	NI	No hazardous fuels reduction or fuels management projects are proposed for these areas. Redevelopment of the six water catchments would not affect fire management.
Socioeconomic Values	NI	The economic base of the Arizona Strip is mainly ranching with a few gypsum/selenite mines and uranium operations. Nearby communities are supported by tourism (including outdoor recreation), construction, and light industry. The social aspect involves remote, unpopulated settings with moderate to high opportunities for solitude. Proposed redevelopment of the water catchments would have no effect on the economy or social aspect of the region since there would be no displacements or disruption to established businesses or uses of the area.
Wild Horses and Burros	NP	Disturbances to wild horses and burros would not occur because none of the six water catchments are located within a wild horse or burro herd management area.
Wilderness Characteristics	NP	None of the catchments are located within areas managed to maintain wilderness characteristics.

3.2 RESOURCES BROUGHT FORWARD FOR ANALYSIS

3.2.1 Vegetation, Including Sensitive Species

The terrain is mostly flat or has minimal relief in the project areas; however, small, mountainous peaks, ephemeral drainages, subtle rolling hills, and steep cliffs are located in the vicinity of the project areas. The elevation within the project areas ranges from 5,531 feet to 6,316 feet above mean sea level.

Vegetation was classified to the Ecological Zone level according to the Ecological Zones on the ASFO RMP map (BLM 2008a). All six catchments are located in the Uinkaret Plateau Ecological Zone. Four of the six catchments (Catchment Nos. 758, 828, 829, and 4486) are surrounded by subtle hills, pinyon-juniper forest, or both. These four catchments are each located within an opening of pinyon-juniper woodland where smaller shrubs and a few scattered trees are present. The dominant vegetative species (U.S. Department of Agriculture [USDA] 2008) observed in these project areas included two-needle pinyon (*Pinus edulis*), and juniper (*Juniperus* sp.). Catchment Nos. 837 and 838 are situated on subtle slopes in a grassland vegetation community where pinyon-juniper woodland is absent. These areas also contain a sagebrush understory vegetative community. The dominant vegetative species (U.S. Department of Agriculture [USDA] 2008) observed in these project areas included big sagebrush (*Artemisia tridentata*), and longflower rabbitbrush (*Chrysothamnus depressus*).

Two of the six catchments (Catchment Nos. 837 and 838) contain a different vegetation composition; however, they also occur in the Uinkaret Plateau Ecological Zone, as characterized by the BLM RMP. Although not necessarily found at every catchment site, vegetative species (USDA 2008) observed in the project areas included grama grass (*Bouteloua* sp.), big sagebrush, three-awn (*Aristida* sp.), globemallow (*Sphaeralcea* sp.), Mormon tea (*Ephedra viridis*), saltbush (*Atriplex* sp.), banana yucca (*Yucca baccata*), desert-thorn (*Lycium* sp.), fleabane (*Erigeron* sp.), pale desert-thorn (*Lycium pallidum*), thistle (*Cirsium* sp.), phacelia (*Phacelia* sp.), cheatgrass (*Bromus tectorum*), dwarf mentzelia (*Mentzelia pumila*), squirreltail (*Elymus elymoides*), galleta grass (*Pleuraphis* sp.), and winding mariposa lily (*Calochortus flexuosus*). Cacti observed included Engelmann's hedgehog cactus (*Echinocereus engelmannii variegatus*), prickly pear (*Opuntia* sp.), and Whipple cholla (*Cylindropuntia whipplei*). Other species (USDA 2008, AGFD 2005b) observed included sandmat (*Chamaesyce* sp.), Stansbury cliffrose (*Purshia stansburiana*), juniper mistletoe (*Phoradendron juniperinum*), mountain phlox (*Phlox austromontana*), spreading phlox (*Phlox diffusa*), southwestern beardtongue (*Penstemon laevis*), Arizona bladderpod (*Lesquerella arizonica*), cryptantha (*Cryptantha* sp.), Fremont's mahonia (*Mahonia fremontii*), grama

grass, horehound (*Marrubium vulgare*), broom snakeweed (*Gutierrezia sarothrae*), and gooseberry (*Ribes* sp.). Cacti observed included Arizona spiny star (*Escobaria vivipara arizonica*), hedgehog cactus (*Echinocereus* sp.).

3.2.1.1 Sensitive Species

Habitat requirements and potential for occurrence of BLM sensitive and State-listed species are available in the project record. Based on the presence of suitable habitat and/or historical records of occurrence, the following Arizona State sensitive salvage restricted species may occur: Whipple cholla (*Cylindropuntia whipplei*).

Whipple cholla (*Cylindropuntia whipplei*)

Habitat and range requirements. Whipple cholla is an upright shrub and has been known to occur in plains and grasslands at 4,500 to 7,000 feet (Epple 1995). This plant flowers in late spring-early summer (May-July) depending on local conditions. Whipple cholla is uncommon in Utah, and common in much of Arizona and New Mexico (Pinkava 2003). Little is known about whipple cholla specifically, but cacti belonging to the genus *Cylindropuntia* are known to depend on birds and other animals for seed dispersal, and their spines provide escape cover for small animals. Woodrats (*Neotoma spp.*) are known to build nests consisting in part of stems from cholla.

Habitat evaluation and suitability. The AGFD online review tool (Arizona Heritage Geographic Information System [AZHGIS] 2008) showed a record of occurrence within 3 miles of Catchment No. 838. In addition, Whipple cholla was observed at Catchment Nos. 837, 838, and 4486.

3.2.2 Wildlife, Including Mule Deer, Pronghorn, Migratory Birds and Sensitive Species

Wildlife populations at the project areas are typical of the Great Basin Conifer Woodland and Rocky Mountain Petran Conifer Forest biotic communities. Mammals that use the area include jackrabbits (*Lepus* sp.), coyote (*Canus latrans*), mule deer, pronghorn, and various bat species. Birds include Merriam's turkey, northern flicker (*Colaptes auratus*), Clark's nutcracker (*Nucifraga columbiana*), red-breasted nuthatch (*Sitta canadensis*), dark-eyed junco (*Junco hyemalis*), western bluebird (*Sialia mexicana*), red crossbill (*Loxia curvirostra*), and red-tailed hawk (*Buteo jamaicensis*). Amphibians that may be found in this habitat include Woodhouse's toad (*Bufo woodhousii woodhousii*), and Great Basin spadefoot (*Spea intermontana*). Reptiles that may be found in this habitat include western fence lizard (*Sceloporus occidentalis*), and gopher snake (*Pituophis catenifer*). Wildlife species observed in the vicinity of the project areas included pronghorn, golden eagle (*Aquila chrysaetos*), mule deer, and coyote. One mourning dove (*Zenaida macroura*) was observed drinking from Catchment No. 4486. Moths (Order Lepidoptera), bees (Family Apidae), and other insects were observed near the water trough or in the trough of each catchment.

3.2.2.1 Mule Deer

Mule deer can be found throughout the Arizona Strip. Concentrations occur on Black Rock and Poverty Mountains, on Mt. Trumbull, in the Buckskin Mountains and in the Kanab Creek area. Mule deer are generally found in association with more open habitats. Classic mule deer habitat is rough, steep canyons sparsely vegetated with brushy pockets that carve their way down through open grasslands. Mule deer often bed in juniper thickets or other shrubby areas.

Water sources can have a major influence on the distribution and movements of deer in semi-arid environments (Watkins, et al. 2007), particularly in summer. During summer, does are often distributed closer to water than bucks, presumably because of their increased need for water during lactation. Water developments appear to increase mule deer populations. Thus, numerous waters have been developed to improve mule deer distribution across the landscape and to sustain healthy populations.

3.2.2.2 Pronghorn

Pronghorn are found in the Clayhole, Mainstreet, Hurricane, and House Rock areas. Catchment Nos. 837 and 838 are both located in pronghorn habitat classified as moderate quality. Pronghorn typically prefer open landscapes consisting of level to rolling topography, with less than five to ten percent slope. Pronghorn diet generally varies with seasonality and consists of young green grasses during the spring then shifts to forbs and cactus during the summer. During the fall, a shift toward browse species occurs. During winter, browse is likely the dominant part of a pronghorn's diet.

Water use is highest in conditions exhibiting high temperatures, dry forage, dry atmospheric conditions, and lack of snow in winter months. During dry periods, when water catchments are the only water source available, pronghorn tend to remain close to available water (Thompson, personal communication, 2010). During summer, does are often distributed closer to water than bucks, presumably because of their increased need for water during lactation. Most observations of pronghorns in Arizona and New Mexico are usually within 2 miles of water (Ockenfels et al. 1994, Clemente et al. 1995, Autenrieth et al. 2006). Pronghorn were observed at Catchment Nos. 837 and 838.

3.2.2.3 Migratory Birds

The Migratory Bird Treaty Act protects against the take of migratory birds, their nests, and eggs except as permitted by regulations. Various migratory birds use the project areas for foraging. Eight bird species were observed during the field reconnaissance conducted for this evaluation (SWCA Environmental Consultants 2008a): ash-throated flycatcher (*Myiarchus cinerascens*), common raven (*Corvus corax*), golden eagle, house finch (*Carpodacus mexicanus*), mourning dove, northern mockingbird (*Mimus polyglottos*), pinyon jay (*Gymnorhinus cyanocephalus*), and turkey vulture (*Cathartes aura*); however, no active nests were observed at any of the project areas.

3.2.2.4 Sensitive Species

Habitat requirements and potential for occurrence, of BLM sensitive and State-listed species are available in the project record.

Based on the presence of suitable habitat and/or historical records of occurrence, the following BLM sensitive, and State-listed species may occur in the project areas: northern sagebrush lizard (*Sceloporus graciosus graciosus*), western burrowing owl (*Athene cunicularia hypugea*), Allen's (Mexican) big-eared bat (*Idionycteris phyllotis*), western small-footed myotis (*Myotis ciliolabrum*), fringed myotis (*Myotis thysanodes*), long-legged myotis (*Myotis volans*), big free-tailed bat (*Nyctinomops macrotis*), and golden eagle.

Northern sagebrush lizard (*Sceloporus graciosus graciosus*)

Habitat and range requirements. This species is chiefly a ground-dweller, usually found near bushes, brush heaps, logs, or rocks, and occasionally in trees. Throughout much of its range, it occurs in sagebrush communities; it may also be found in manzanita and ceanothus brushland, pinyon-juniper woodlands, pine and fir forests of canyon bottoms, and boulder fields within oak thickets. In Arizona, its

range extends throughout most of the northern part of the state, at elevations from 500 to 10,500 feet. The northern sagebrush lizard feeds on a wide variety of insects and other arthropods (AGFD 2000).

Habitat evaluation and suitability. The project areas are within the geographic and elevational range for the northern sagebrush lizard. In addition, portions of the project areas contain pinyon-juniper woodlands and sagebrush as dominant vegetation. Metal aprons may also provide suitable shade structures, allowing this species to thermoregulate more efficiently during periods of rising temperatures. Suitable habitat for this species occurs in the project areas.

Western burrowing owl (*Athene cunicularia hypugea*)

Habitat and range requirements. Burrowing owls inhabit open areas, such as grasslands, pastures, coastal dunes, desertscrub, and the edges of agricultural fields, and wherever there is sufficient friable soil for a nesting burrow (Haug et al. 1993) at elevations between 650 and 6,140 feet in Arizona. The presence of other nesting burrows (such as that of a badger, prairie dog, tortoise or other animal) seems to be a requirement for the species; a decline in the population of burrowing mammals may adversely affect owls through a lack of available burrows (Haug et al. 1993). Burrowing owls forage primarily at twilight but have been observed to hunt any time of the day or night. Insects are often taken during daylight and small mammals after dark. Observed causes of mortality include human disturbance through agricultural and construction activities and collisions with vehicles (owls habitually sit and hunt on roads at night). Scientific research involving burrow and nest excavation causes destruction and abandonment of these sites. Human activities that reduce quality of prey habitat and thus lower food supplies result in poorer reproductive success in females (Haug et al. 1993).

Habitat evaluation and suitability. Western burrowing owl habitat is found within those project areas that include a grassland vegetation component (Catchment Nos. 837 and 838). In addition, these two catchments are within the geographic and elevational range of the species.

Allen's (Mexican) big-eared bat (*Idionycteris phyllotis*)

Habitat and range requirements. Allen's big-eared bat usually inhabits forested areas of the mountainous southwest and is relatively common in pine-oak forested canyons and coniferous forests; however, it also may occur in non-forested, arid habitats. At most sites where this species occurs, cliffs, outcroppings, boulder piles, or lava flows are found nearby. Day roosts may include rock shelters, caves, trees and mines. Seasonal movements and winter whereabouts and activities are unknown (Best et al. 2007). Their elevational distribution ranges from 1,320 to 9,800 feet, and their main food source is small moths gleaned from surfaces or in flight (AGFD 2001). The bats are known to use stock ponds as water and food sources, but are theorized as too large bodied to drink from water catchments (Herder 1996).

Habitat evaluation and suitability. Heritage Data Management System (HDMS 2008) shows that the species is known to occur approximately 20 miles northwest of Catchment Nos. 829 and 837. All catchments occur within the geographical range of the species and are located in or near vegetation communities suitable for this species. Thus all catchments contain suitable foraging habitat; however, only Catchments Nos. 758, 828, 829, and 4486 contain trees that could be suitable day roosting habitat for this species.

Western small-footed myotis (*Myotis ciliolabrum*)

Habitat and range requirements. In Arizona, the western small-footed myotis is found in oak-juniper woodlands, desertscrub, chaparral, and riparian areas at elevations from 2,120 to 8,670 feet. In the summertime, they roost in crevices, cracks, snags, holes, hollow trees, buildings, and under rocks, and in the winter, they rely heavily on mines for hibernation. At night they forage on flying insects, with a

preference to hunt over rocks instead of water (AGFD 2003a). Western small-footed myotis is known to use water catchments as water and food sources (Herder 1996).

Habitat evaluation and suitability. HDMS (2008) shows that the species is known to occur 5 to 10 miles southeast of Catchment Nos. 828 and 4486. All catchments occur within the geographical range of the species and are located in or near vegetation communities suitable for this species. Thus all catchments contain suitable foraging habitat; however, only Catchments Nos. 758, 828, 829, and 4486 contain trees that could be suitable summertime roosting habitat for this species.

Fringed myotis (*Myotis thysanodes*)

Habitat and range requirements. This species occurs most often in mid-elevation habitats ranging from deserts, grasslands, and woodlands and oak-pinyon and other coniferous forests. Fringed myotis is found in elevations ranging from 4,000 to 8,400 feet. Roost sites have been recorded in caves, mine tunnels, large snags, and buildings and under exfoliating bark. They are thought to hibernate in caves and mines. Fringed myotis forages in flight, mainly on small beetles and moths in and around vegetation, and may pick up prey from the ground (AGFD 2003b). Fringed myotis is known to use water catchments as water and food sources (Herder 1996).

Habitat evaluation and suitability. HDMS (2008) shows that the species is known to occur approximately 30 miles southeast of Catchment Nos. 828 and 4486. All catchments occur within the geographical range of the species and are located in or near vegetation communities suitable for this species. Thus all catchments contain suitable foraging habitat; however, only Catchments Nos. 758, 828, 829, and 4486 contain trees that could be suitable roosting habitat for this species.

Long-legged myotis (*Myotis volans*)

Habitat and range requirements. Long-legged myotis is primarily a coniferous forest bat that may also be found in riparian and desert habitats at elevations between 6,600 and 10,000 feet in the forested mountains of Mohave County. Long-legged myotis day-roost in abandoned buildings, cracks in the ground, cliff crevices, and tree bark and hibernate in caves and mine tunnels. They forage mainly on moths and other flying insects high over water and openings in woods (AGFD 2003c). Long-legged myotis have been documented day-roosting in ponderosa pine snags and live trees in the Mt. Trumbull area. They are also known to use water catchments as water and food sources (Herder 1996).

Habitat evaluation and suitability. HDMS (2008) shows that the species is known to occur approximately 30 miles southeast of Catchment Nos. 828 and 4486. All catchments occur within the geographical range of the species and are located in or near vegetation communities suitable for this species. Thus all catchments contain suitable foraging habitat; however, only Catchments Nos. 758, 828, 829, and 4486 contain trees that could be suitable day roosting habitat for this species

Big free-tailed bat (*Nyctinomops macrotis*)

Habitat and range requirements. Big free-tailed bat has been found near high cliffs and rugged, rocky outcrops in a variety of habitats, including desertscrub and pine-oak forests in the southwest. However, they are primarily inhabitants of rugged, rocky country and riparian areas. They have been documented at elevations between 190 and 7,520 feet. They forage mainly on large moths and some other flying insects. Big free-tailed bats are known to use stock ponds as water and food sources, but are theorized as too large bodied to drink from water catchments (Herder 1996). Roost sites include rock crevices, human-built structures, and occasionally holes in trees. They do not hibernate; therefore, Arizona populations are expected to spend their winters in the southern part of the state (AGFD 2003d).

Habitat evaluation and suitability. HDMS (2008) indicates that the species is known to occur less than 15 miles west of Catchment Nos. 758 and 4486. Bat roost occurrence records (BLM GIS 2010) indicate the presence of this species within 5 miles of Catchment No. 4486. All project locations are north of areas such as Mt. Trumbull and the Mount Logan Wilderness (which contain pine-oak forests) and are east of the Hurricane Cliffs (which have numerous high cliffs and rocky outcrops). All catchments occur within the geographical range of the species and are located in or near vegetation communities suitable for this species. Thus all catchments contain suitable foraging habitat; however, only Catchments Nos. 758, 828, 829, and 4486 contain trees that could be suitable roosting habitat for this species.

Golden eagle (*Aquila chrysaetos*)

Habitat and range requirements. In Arizona, golden eagles, nest in large trees, rock ledges, or cliffs at elevations ranging from 4,000 to 10,000 feet amsl and are typically found in mountainous regions of open country, prairies, arctic and alpine tundra, open wooded areas, and barren areas. Golden eagles are carnivores that forage in flight or on perch, feeding mainly on small mammals as well as invertebrates, carrion, and other wildlife (AGFD 2002).

Habitat evaluation and suitability. The AGFD online review tool (AZHGIS 2008) showed a record of occurrence within 3 miles of Catchment No. 4486. This record is most likely a breeding record located near the Hurricane Cliffs, west of this catchment. However, one juvenile golden eagle was also observed immediately adjacent to Catchment No. 838. In addition, Catchment No. 837 contains open habitat (e.g. sagebrush, grassland, and steppe-like vegetation) suitable for eagle foraging.

3.2.3 Recreation

All six catchments are located in rugged, isolated areas, accessible by unimproved roads that are exposed to a low concentration of recreational users. According to the ASFO RMP, all six catchments are within the Arizona Strip Extensive Recreation Management Area (ERMA). ERMAs receive only custodial management regarding visitor health and safety, user conflict and resource protection issues, with no activity level planning. In the ERMA, regulation of visitor use will occur only when monitoring indicates a trend towards unacceptable change to desired recreational settings brought about by such use.

The Recreation Opportunity Spectrum (ROS) system used by the BLM is a framework for outdoor recreation managers and policymakers who make decisions regarding both the allocation and management of opportunities for recreation. ROS conditions, under this framework, range from modern and developed to primitive and undeveloped. Under the ROS system, Catchment Nos. 758, 828, 837, and 4486 are in areas classified as “semi-primitive, motorized;” Catchment No. 838 is in an area classified as “semi-primitive, non-motorized;” and Catchment No. 829 is in an area classified as “roaded-natural” (see descriptions of these classifications below). The area in which Catchment No. 838 is located was classified prior to completion of the master route inventory that verified the existence of the road and was therefore classified as non-motorized. The road is used for administrative purposes (e.g., maintenance of the catchment).

Semi-primitive, non-motorized

The physical setting of these areas is characterized by predominantly natural or natural-appearing environment of moderate to large size. Interaction between users is low, but there is often evidence of other users. Minimum on-site controls and restrictions may be present, but are subtle and motorized use is not permitted.

Semi-primitive, motorized

The physical setting of these areas is characterized by predominantly natural or natural-appearing environment of moderate to large size. Concentration of users is low, but there is often evidence of other users. The area is managed in such a way that minimum on-site controls and restrictions may be present, but are subtle. Motorized use is permitted.

Roaded natural

The physical setting of these areas is characterized by predominantly natural-appearing environment with moderate evidences of the sights and sounds of man. Such evidences usually harmonize with the natural environment. Resource modification and utilization practices are evident, but harmonize with the natural environment. Interaction between users may be low to moderate, but with evidence of other users prevalent. Conventional motorized use is provided for in construction standards and design of facilities.

Primary recreational activities that occur in the vicinity of each catchment are wildlife viewing and hunting, camping, hiking, mountain biking, horseback riding, and backpacking. Off-highway vehicle travel in the area is limited to existing roads and trails.

The catchments are located within the AGFD GMU 13A. Several hunting seasons are authorized by AGFD in this management unit including general deer season; archery-only non-permit deer season; pronghorn tag obtained only through application and draw process only; and general turkey open season.

3.2.4 Visual Resources

BLM inventories and classifies public lands in order to identify and maintain areas that contain important scenic qualities; the Visual Resource Inventory classification system is based on a combination of three elements—scenic quality, visual sensitivity, and distance zones—with the most important to visitors probably being scenic quality (BLM 1986). Scenic quality is described as the visual appeal of an area. The rating is based on seven key factors: landform, vegetation, water, color, adjacent scenery, scarcity, and cultural modifications. BLM lands fall into one of four Visual Resource Management (VRM) classes.

Catchment Nos. 758, 828, 829, 837, 838, and 4486 are within an area designated as VRM Class III. The management objective for VRM Class III is to partially retain the existing character of the landscape, with no more than moderate changes to the landscape. Management activities may attract attention but should not dominate the view of the casual observer. Changes should repeat the basic elements found in the predominant natural features of the characteristic landscape (BLM 1986).

Chapter 4

ENVIRONMENTAL CONSEQUENCES

This section includes a discussion of the environmental consequences (including a description of direct and indirect impacts and cumulative effects, if any). Impacts are defined as modifications to the existing condition of the environment and/or probable future condition that would be brought about by implementation of one of the alternatives.

Impacts can be direct or indirect; direct impacts are those effects that are caused by the action or alternative and occur at the same time and place, while indirect effects are those effects that are caused by or would result from an alternative and are later in time but that are still reasonably certain to occur. Cumulative impacts are generally assessed with the environmental impacts of past, present, or reasonably foreseeable future actions within the project areas.

The impact analyses in the following sections were based on knowledge of the resources and the site, review of existing literature information provided by experts and other agencies, and professional judgment.

4.1 ENVIRONMENTAL CONSEQUENCES OF THE PROPOSED ACTION

4.1.1 Vegetation, Including Sensitive Species

Construction activities would result in approximately 1.0 acre of short-term disturbance. After construction is completed, the area of long-term disturbance at each catchment site (the apron area, trough area, and access area that allows for routine maintenance) would be approximately 0.1 acre. The renovations have been designed to minimize impacts on vegetation by restricting construction activities to the existing catchment footprint and immediate vicinity. In most cases, disturbance to vegetation during construction would consist of the short-term loss of shrubs, grasses, and forbs. Uprooting of any trees and cacti would be avoided. Maintenance and water-hauling activities would intermittently result in minor trampling of vegetation within and adjacent to the catchment sites, but the increase in water-storage capacity under the proposed action would reduce the frequency of water-hauling trips.

These impacts would be offset by revegetation efforts. After construction is complete, excavated dirt would be recontoured throughout the disturbed areas. Dead and downed plant material, as well as existing rock debris, would be placed on top of the disturbed area to aid in revegetation efforts and camouflage the catchment areas. Any removed topsoil would be replaced, and a BLM-approved seed mix would be applied to the area to aid in revegetation. Therefore, any impacts to vegetation would be short term until construction activities are complete and the area is revegetated.

4.1.1.1 Sensitive Species

Renovation activities would result in a temporary loss of approximately 1.0 acre of habitat at each site during catchment improvements. The proposed improvements have been designed to minimize impacts to habitat (vegetation) by restricting construction to the existing catchment footprint and immediate vicinity. Construction activities would disturb approximately 0.1 acre in the long-term at each catchment site; this is a negligible loss of habitat, compared with the relative amount of habitat available in the surrounding landscape.

Whipple cholla (*Cylindropuntia whipplei*)

Whipple cholla is known to occur within 3 miles of Catchment No. 838; cholla was observed at Catchment Nos. 837, 838, and 4486. Although construction activities associated with the proposed action could have minor impacts to individual Whipple cholla, no impacts to the species (i.e., a trend toward Federal listing or loss of viability) are expected because Whipple cholla are fairly common in the area and if individual joints of the cactus are broken off, they are capable of rooting and forming new plants. Because of these factors, the disturbance associated with the proposed action would result in minimal impacts to this species.

4.1.2 Wildlife, Including Mule Deer, Pronghorn, Migratory Birds and Sensitive Species

Water is essential for all animals. Wildlife populations in general and mule deer, pronghorn, Merriam's turkey, and migratory birds in particular depend on reliable water sources. When ambient temperatures are high, it is reasonable to assume that survival and productivity of wildlife would be adversely affected by a lack of water. In semi-arid regions, such as the areas where the catchments addressed in this EA are located, water catchments can be beneficial in combination with adequate foraging areas (Rosenstock et al. 1999). Wildlife will traditionally use water catchments during the hottest, driest months of the year when natural water sources dry up.

Wildlife would likely avoid the project areas during renovation construction activities. After construction activities are complete, the catchments would have an increased ability to retain water in times of drought and would directly impact wildlife populations that rely on the catchments by increasing survivability in times of environmental stress.

4.1.2.1 Mule Deer

As described in Section 4.1.1 above, construction activities would result in approximately 1.0 acre of short-term disturbance. After construction is completed, the area of long-term disturbance at each catchment site would be approximately 0.1 acre. This is a negligible loss of habitat, compared with the relative amount of habitat available in the surrounding landscape. The proposed improvements have been designed to minimize impacts to vegetation by restricting construction to the existing catchment footprint and immediate vicinity; impacts would be mostly to shrubs, forbs, and grasses. The amount of disturbance to shrubs, forbs, and grasses would not hinder mule deer ability to forage. The cleared land would temporarily reduce habitat in the area surrounding the catchment; however, the area would be so small, relative to the overall foraging habitat and range in the ASFO management area, that impacts would be negligible. In addition, disturbed areas would be reseeded to aid in revegetation of the area, which would minimize loss of habitat.

Mule deer would likely avoid the catchment areas and be temporarily displaced during renovation activities. Construction activities and human presence would result in a localized and temporary increase in noise that would likely cause mule deer to temporarily avoid the catchment vicinity and find an alternate source of water for the duration of renovations. Although deer would be temporarily displaced, once redevelopment of the catchments is completed, the availability of water would be improved by decreasing the amount of water lost through leaking and evaporation at the catchment. Thus, the long-term benefits of a consistent water source for mule deer would outweigh any short-term adverse impacts that could result from catchment construction.

4.1.2.2 Pronghorn

As described in Section 4.1.1, construction activities would result in approximately 1.0 acre of short-term disturbance. After construction is completed, the area of long-term disturbance at each catchment site would be approximately 0.1 acre. This is a negligible loss of habitat, compared with the relative amount of habitat available in the surrounding landscape. The proposed improvements have been designed to minimize impacts to vegetation by restricting construction to the existing catchment footprint and immediate vicinity; impacts would be mostly to shrubs, forbs, and grasses. The amount of disturbance to shrubs, forbs, and grasses would not hinder pronghorn ability to forage. The cleared land would temporarily reduce habitat in the area surrounding the catchment; however, the area would be so small, relative to the overall foraging habitat and range in the ASFO management area, that impacts would be negligible. In addition, disturbed areas would be reseeded to aid in revegetation of the area, which would minimize loss of habitat.

Pronghorn would likely avoid the catchment areas and be temporarily displaced during renovation activities. Construction activities and human presence would result in a localized and temporary increase in noise that would likely cause pronghorn to temporarily avoid the catchment vicinity and find an alternate source of water for the duration of renovations. Although pronghorn would be temporarily displaced, once redevelopment of the catchments is completed, the availability of water would be improved by decreasing the amount of water lost through leaking and evaporation at the catchment. Thus, the long-term benefits of a consistent water source for pronghorn would outweigh any short-term adverse impacts that could result from catchment construction.

4.1.2.3 Migratory Birds

Renovation activities would result in a temporary loss of habitat, soil compaction, and construction noise, at each site. Construction activities would result in approximately 1.0 acre of short-term disturbance while long-term disturbance would be approximately 0.1 acre at each catchment site. This is a negligible loss of habitat, compared with the relative amount of habitat available in the surrounding landscape. The proposed improvements have been designed to minimize impacts to vegetation by restricting construction to the existing catchment footprint and immediate vicinity, which would be mostly to shrubs, forbs, and grasses. The amount of disturbance to shrubs, forbs, and grasses would be negligible and would not hinder migratory birds' ability to forage. The short-term loss of vegetation at each catchment could result in a short-term reduction of migratory bird habitat. The cleared land could impact migratory birds that use the project sites for foraging, migration, and breeding by temporarily reducing habitat in the area surrounding each catchment. However, the area would be so small, relative to the overall foraging, migration, and breeding habitat and range in the ASFO management area that impacts from cleared land would be minor. In addition, disturbed areas would be reseeded to aid in revegetation, which would minimize loss of habitat. Lastly, upon completion of the renovation, the birds would benefit long-term by having a reliable water source for drinking and bathing.

If construction occurs in early spring, short-term impacts to migratory birds as a result of human presence and noise could impact individual birds that arrive early to breeding sites and could lead to abandonment of early breeding and/or nesting attempts. However, the increased noise and construction activity would occur only in the short term. In the long term, occasional water catchment maintenance would have a negligible impact to migratory birds.

Impacts to migratory birds would be minimized by implementing the best management practices listed in Section 2.1.1. (i.e., measures would be taken to protect active bird nests). Additionally, by minimizing disturbance to existing vegetation, migratory birds would have access to the vegetation for cover and as an area to forage once construction is complete.

4.1.2.4 Sensitive Species

In general, as with migratory birds, renovation activities would result in a temporary loss of habitat and some construction noise at each site during catchment redevelopment. The proposed improvements have been designed to minimize impacts to habitat (vegetation) by restricting construction to the existing catchment footprint and immediate vicinity. The cleared land could impact sensitive species that use the project areas for foraging, migration, and breeding by temporarily reducing habitat in the area surrounding each catchment. However, the area would be so small, relative to the overall foraging, migration, and breeding habitat and range in the ASFO management area that impacts from cleared land would be minor. In addition, disturbed areas would be reseeded to aid in revegetation of the area, which would minimize long-term loss of habitat.

Equipment associated with construction could also generally affect sensitive species as a result of noise. The increased noise and construction activity would occur only in the short term. In the long term, occasional water catchment maintenance would have a negligible impact to sensitive species. Specific impacts to sensitive species are detailed below.

Northern sagebrush lizard (*Sceloporus graciosus graciosus*)

Catchment redevelopment activities may deter northern sagebrush lizards from dispersing and foraging in the project areas. Upon completion of project activities, the amount of habitat in the project areas may be reduced in the short-term. However, the disturbance areas are negligible, compared with the amount of potential habitat in the surrounding areas. In addition, disturbed areas would be reseeded once renovation activities are completed, which would minimize long-term loss of habitat. Thus, although the proposed action could have minor short-term impacts to individual northern sagebrush lizards, no long-term impacts to the species (i.e., a trend toward Federal listing or loss of viability) are expected.

Western burrowing owl (*Athene cunicularia hypugea*)

Because western burrowing owls forage during the day, when construction is most likely to occur, the foraging behavior of the owls could be impacted in the short term by the vibration of construction equipment or by destruction of burrows during construction activity; however, the area disturbed around the catchments would be minimal, compared with the overall range of the owl. Construction activity could also reduce the availability of prey in the area of the water catchments, which would further impact the owls. However, the owls would benefit from a consistent water source. Thus, although the proposed action could have minor impacts to individual western burrowing owls, no impacts to the species (i.e., a trend toward Federal listing or loss of viability) are expected.

Allen's (Mexican) big-eared bat (*Idionycteris phyllotis*)

There are no rock shelters, caves, or mines that would be impacted within the project areas. The presence of a water catchment in the foraging habitat of Allen's big-eared bat would enhance the foraging efforts of the species (McIntire, personal communication, 2008) by increasing the amount of moths in the area. Therefore, the proposed action should have a beneficial impact to Allen's big-eared bat.

Western small-footed myotis (*Myotis ciliolabrum*)

Potential roosting and/or foraging habitat for this species is present in the project areas, but the project areas do not contain potential hibernation sites. Construction activity may impact the summer roosting sites of the species if there is tree removal near the catchment sites; however, tree removal is not expected for this project, and construction activities would only occur during the day. The long-term benefits of a

consistent water and food source for western small-footed myotis outweigh any short-term adverse impacts that could result from catchment redevelopment activities.

Fringed myotis (*Myotis thysanodes*)

Potential roosting and/or foraging habitat for this species is present in the project areas, but the project areas do not contain potential hibernation sites. Construction activity may impact the summer roosting sites of the species if there is tree removal near the catchment sites; however, tree removal is not expected for this project, and construction activities would only occur during the day. The long-term benefits of a consistent water and food source for fringed myotis outweigh any short-term adverse impacts that could result from catchment redevelopment activities.

Long-legged myotis (*Myotis volans*)

The project areas do not contain hibernation sites, but do contain potential daily roosting and/or foraging sites. Construction activity may impact the roosting sites of the species if there is tree removal near the catchment sites; however, tree removal is not expected for this project, and construction activities would only occur during the day. The long-term benefits of a consistent water and food source for long-legged myotis outweigh any short-term adverse impacts that could result from catchment redevelopment.

Big free-tailed bat (*Nyctinomops macrotis*)

This species may use the project areas during foraging activities. Trees are present in four of the six project areas, which could serve as roost sites for this species. Construction activity may impact roosting sites of the species if there is tree removal at these four catchment sites; however, tree removal is not expected for this project and construction activities would only occur during the day. In addition, the increase in water availability at the catchments may result in an increase in the population numbers for prey species of the big free-tailed bat. Thus, the long-term benefits of a consistent water and food source for long-legged myotis outweigh any short-term adverse impacts that could result from catchment redevelopment.

Golden eagle (*Aquila chrysaetos*)

Golden eagles are known to forage in the vicinity of the catchments. Because golden eagles forage during the early morning and early evening, when construction could occur, the foraging behavior of the eagles could be temporarily disturbed by the vibration of construction equipment. However, the area of human activity around the catchments would be minimal, compared with the overall range of the eagle, and potential disruption would cease as soon as redevelopment activities are completed.

Construction activity could also reduce the availability of prey in the area of the water catchments, which could further impact the eagles. Displacement of the golden eagle would be short-term and localized, and individuals could return to the area upon completion of construction. Additionally, the increase in water availability at the catchments may result in an increase in population numbers for prey species of golden eagles. The long-term benefits of a consistent water and food source for the prey of golden eagles outweigh any short-term adverse impacts that could result from catchment construction. Thus, although the proposed action could have minor short-term impacts to individual golden eagles, no impacts to the species (i.e., a trend toward Federal listing or loss of viability) are expected.

4.1.3 Recreation

Inconvenience to the recreating public would occur during catchment renovation activities and would include an increase in noise and dust at each catchment site, as well as the reduced ability for users to avoid the sights, sounds, and evidence of other people. The presence of construction equipment and workers would result in a reduced opportunity for solitude in the vicinity of the catchments.

Water catchments provide opportunities for hunters to locate wildlife; construction activities at each catchment may cause wildlife seeking hydration to seek alternate sources of water. However, these disturbances would only last approximately two weeks and would be localized to each catchment location.

Once construction is complete, wildlife would be attracted to the catchments, which would increase opportunities for the recreation to view and/or hunt wildlife. Renovation activities would not result in a permanent reduction in recreation choices. Impacts to the natural appearance of the area would be minimized by treating aboveground structures with materials and colors that match or blend in with the surrounding areas. The reduced need for routine maintenance inspections and water hauling trips would reduce the already minimal recreational distractions caused by maintenance inspection trips and AGFD personnel. The proposed action would therefore have minor direct and indirect impacts to recreation.

4.1.4 Visual Resources

Short-term impacts to visual resources associated with the proposed action would occur from the soil and vegetation disturbance during and immediately following renovation activities at each catchment site. Vegetation would reclaim each site, and in turn, visual quality would return to its existing conditions. Airborne dust would be visible during renovation activities at each catchment site because of the increased use of motorized vehicles and equipment, but it would be temporary and would cease once renovation activities have been completed. Four of the catchments proposed for redevelopment in this EA are located within areas dominated by pinyon/juniper woodlands. Because these catchments are located in areas surrounded by pinyon and juniper trees, and due to their small size and low profile, none of the catchments is in a location that is likely to be seen by most observers.

All locations have water catchments currently in place. The only change would be the increased size of the catchments. However, redevelopment of all catchments would implement the following actions to minimize visual impacts: 1) natural material, such as dead vegetation and rock debris, would be returned to the disturbed area; 2) above ground components would be painted colors that blend in with the surrounding landscape (i.e., medium grays or earthen colors); 3) pigment would be added to cement used in the trough so that they blend in with the surroundings; 4) rocks from the area would be used to avoid or mask straight lines; and 5) if installed, precipitation/water-level gauge components would be kept as inconspicuous as possible employing various camouflage techniques, such as using native materials and/or paint colors that blend in with the surrounding landscape and no reflective materials. These actions would reduce the present visual imprint of all six catchments.

The characteristic landscape of each catchment area already includes disturbance from the existing catchments; therefore, the level of change would be low. The proposed catchment redevelopments may be seen but they are not expected to attract the attention of a casual observer. To the extent possible, the basic elements of form, line, color, and texture found in the predominant natural features of the characteristic landscape would be repeated. Implementing the proposed action is expected to meet VRM Class III management objectives at each catchment location.

4.1.5 Cumulative Impacts of Proposed Action

The proposed action would result in up to 1.0 acre of disturbance at each catchment location in the short term, with long term disturbance approximately 0.1 acre at each catchment location. Known future actions in the general vicinity of the proposed catchment redevelopment projects include additional water catchment renovation projects (Catchment Nos. 613-620, 645-648, 816, and 818) which have similar disturbance areas. There would be a minor impact to wildlife, resulting from the loss of habitat and noise from construction, as detailed in Section 4.1.2. However, these impacts would be short-term and negligible (even cumulatively) when considering the relative amount of habitat available in the surrounding landscape. Alternatively, the overall sustainability and viability of wildlife populations in this portion of the ASFO would be enhanced over time. The redevelopment of the six catchments addressed in this EA would provide more reliable, durable, and efficient catchments that would cumulatively contribute to the benefits of permanent water sources for vulnerable wildlife species, especially during times of prolonged drought or particularly dry (limited precipitation) years.

Other habitat enhancement projects planned in the general area include prescribed burns, seeding, and chemical or mechanical treatments. Specific projects that are likely to occur in the reasonably foreseeable future are:

- The Mt. Trumbull land treatment project (within Grand Canyon – Parashant National Monument (GCPNM)) would burn approximately 3,000 acres of ponderosa pine units. These areas have been previously thinned (a combination of mechanical techniques and burning), and are proposed to be reburned. The objectives of the treatments are to reduce tree density to emulate the more open historic ponderosa pine conditions. Burning also reduces the potential for hazardous fuel accumulation.
- The Upper Langs Run watershed project (9,409 acres located partially within GCPNM and partially within ASFO) would utilize a variety of land treatment prescriptions (manual, mechanical, chemical treatments, prescribed fire, and seeding) to restore ecosystem health, decrease the effects of catastrophic wildfire, reduce soil erosion, and promote biodiversity. Long-term plant productivity is being reduced in the watershed by persistent sheet, rill, and gully erosion which effectively removes the litter and organic matter soil horizons. Erosion of the litter and organic horizons has also removed the buffer to raindrop impact, which in turn has reduced soil permeability, increased surface runoff and erosion, and lowered the water quality of downstream flows. This erosion has resulted in severe headcutting in the major drainages. Tree density of pinyon-juniper and ponderosa pine stands has increased canopy closure to the level that understory plant species that require sunlight to germinate and reproduce has dramatically decreased. Much of the ground below the closed tree canopy has little to no shrubs, forbs, or grasses, all of which are important to wildlife, livestock, and ecosystem stability. The Upper Langs Run watershed project would therefore improve the diversity of plant communities by decreasing the tree density, which in turn would increase soil moisture, reduce competition for water, space and light for understory plant species, and reduce soil loss.
- The Shivwits Plateau Vegetation Project area encompasses 356,820 acres within GCPNM. The goals of this project are to achieve desired plant community objectives identified in the GCPNM Management Plan, including restoring native woodland, shrubland, and grassland communities on the Shivwits Plateau. Management prescriptions would generally use landscape level techniques such as prescribed fire, mechanical treatment, and chemical treatment. Treatments in the ponderosa pine communities would focus on restoring open stand characteristics of pre-settlement forests. Treatments in the pinyon-juniper communities would reduce stand density

and allow increases in shrub density, forb cover, and plant species richness, which in turn would reduce erosion and provide enhanced habitat conditions for wildlife.

4.2 ENVIRONMENTAL CONSEQUENCES OF THE NO ACTION ALTERNATIVE

4.2.1 Vegetation, Including Sensitive Species

Under the no action alternative, no additional disturbance would occur at the existing catchments. Periodic water hauling to and maintenance of the existing facilities would intermittently result in minor trampling of vegetation adjacent to the existing catchment sites and could provide additional opportunities for the spread of invasive species seed. However, since these areas are already disturbed, new impacts would be negligible.

4.2.1.1 Sensitive Species

There would be no construction activities resulting in additional ground disturbance under the no action alternative; therefore, no sensitive species habitat would be affected, as discussed below.

*Whipple cholla (*Cylindropuntia whipplei*)*

Under the no action alternative, no construction activities, and therefore no additional ground disturbance, would occur. Periodic water hauling to and maintenance of the existing facilities could result in intermittent and short-term disturbance to this species. The frequency of water hauling trips and maintenance activities would likely increase over time due to the inefficiency of the collection systems. However, no impacts to the species (i.e., a trend toward Federal listing or loss of viability) are expected.

4.2.2 Wildlife, Including Mule Deer, Pronghorn, Migratory Birds and Sensitive Species

Under the no action alternative, no construction activities and, therefore, no additional ground disturbance would occur with the exception of the current measures implemented by AGFD. Periodic water hauling to and routine maintenance activities of the existing facilities would intermittently result in minor, temporary disturbances to wildlife. The no action alternative would, therefore, have minor, site-specific impacts to wildlife resulting from ongoing maintenance activities. However, under the no action alternative, more disturbance could occur as the frequency of water hauling trips and maintenance activities increase because of the current inefficiency of the collection systems. Lack of available water due to catchment inefficiency could also adversely impact wildlife dependent on these water sources as they search for water during periods of drought.

4.2.2.1 Mule Deer

Under the no action alternative, no construction activities and, therefore, no additional ground disturbance would occur. Periodic water hauling to and maintenance of, the existing facilities would intermittently result in minor, temporary disturbances (i.e., noise) to mule deer from human presence on access roads and at each catchment. This would result in temporary displacement of deer while activities are occurring. However, these disturbances would be intermittent and localized, and do not exceed current conditions. As the catchments continue to deteriorate, an increase in water hauling and maintenance trips to catchments and an associated increase in temporary disturbances to wildlife may occur.

Mule deer in the region rely on these catchments as a supplemental water source. Lack of available water due to catchment inefficiency could also adversely impact mule deer dependent on these water sources as they search for water during periods of drought. Therefore, this alternative would have minor impacts to mule deer resulting from unreliable water and from ongoing water hauling and maintenance activities.

4.2.2.2 Pronghorn

Under the no action alternative, no construction activities and, therefore, no additional ground disturbance would occur. Periodic water hauling to and maintenance of, the existing facilities would intermittently result in minor, temporary disturbances (i.e., noise) to pronghorn from human presence on access roads and at each catchment. This would result in temporary displacement of pronghorn while activities are occurring. However, these disturbances would be intermittent and localized, and do not exceed current conditions. As the catchments continue to deteriorate, an increase in water hauling and maintenance trips to catchments and an associated increase in temporary disturbances to wildlife may occur.

Pronghorn in the region rely on these catchments as a supplemental water source. Lack of available water due to catchment inefficiency could also adversely impact pronghorn dependent on these water sources as they search for water while lactating. Therefore, this alternative would have minor impacts to pronghorn resulting from unreliable water and from ongoing water hauling and maintenance activities.

4.2.2.3 Migratory Birds

Under the no action alternative, no construction activities and, therefore, no additional ground disturbance would occur. As a result, there would be no additional loss of habitat (beyond the loss that resulted from the original construction of the existing catchments). Opportunities for migratory birds to forage, migrate, or breed are not likely to be adversely impacted because no construction activity or ground disturbance would occur.

Periodic water hauling to, and maintenance of, the existing facilities would intermittently result in minor, temporary disturbances to wildlife from human presence (i.e., noise and vibration) at access roads and at each catchment. However, these disturbances would not exceed current conditions. The no action alternative would, therefore, have minor, site-specific impacts to migratory birds resulting from ongoing water hauling and maintenance activities.

4.2.2.4 Sensitive Species

There would be no construction activities resulting in additional ground disturbance under the no action alternative; therefore, no sensitive species habitat would be affected. Wildlife in the region rely on these catchments as a supplemental water source, particularly during times of drought. As the catchments continue to deteriorate, an increase in water hauling and maintenance trips to the catchments and an associated increase in temporary disturbances to wildlife may occur.

Periodic water hauling and maintenance of the existing facilities could result in short-term disturbance to some sensitive species; potential impacts to these species are discussed below. Disturbance to animals that inhabit the nearby area or that are foraging or drinking near or at each catchment location could result from increased human presence and motorized travel. Effects such as noise, ground vibration, and minor trampling of vegetation from motorized travel are likely to occur. However, these disturbances would only be temporary, and individual animals would resume their activities as soon as water-hauling and maintenance actions are completed.

Northern sagebrush lizard (*Sceloporus graciosus graciosus*)

Routine maintenance and water hauling may periodically deter northern sagebrush lizards from dispersing and foraging in the project areas; however, the no action alternative is not expected to reduce the amount of habitat in the project areas. While the no action alternative may temporarily impact individual northern sagebrush lizards, it is not likely to result in a trend toward Federal listing or loss of viability.

Western burrowing owl (*Athene cunicularia hypugea*)

Because western burrowing owl forage during the day when water hauling and maintenance trips occur, the foraging behavior of the owls could be impacted in the short term by noise and the vibration of vehicular traffic; however, the area disturbed around the catchments would be minimal, compared with the overall range of the owl and the suitable habitat that is available immediately adjacent to the catchments and beyond. Maintenance activity could also reduce the availability of prey in the area of the water catchments, which could further impact the owls. Although the no action alternative could have minor impacts to individual western burrowing owls from routine maintenance and water hauling activities, no impacts to the species (i.e., a trend toward Federal listing or loss of viability) are expected.

Allen's (Mexican) big-eared bat (*Idionycteris phyllotis*)

There are no rock shelters, caves, or mines that would be impacted within the project areas. The presence of the existing water catchments has enhanced the foraging habitat of this species. Routine maintenance and water hauling are needed for continued use of these catchments by this species. Moths and other insects that are primary food resources for Allen's big-eared bats are also attracted to catchments. Therefore, the no action alternative would benefit Allen's big-eared bats as long as routine maintenance and water hauling efforts continue.

Western small-footed myotis (*Myotis ciliolabrum*)

Potential roosting and/or foraging habitat for this species is present in the project areas, but the project areas do not contain potential hibernation sites. If water hauling and maintenance trips occur during the summer, summer roosting sites of the species could be impacted if there is tree removal near the catchment sites; however, no tree removal is expected for these routine water hauling and maintenance trips, and the trips would only occur during the day. The long-term benefits of a consistent water and food source for western small-footed myotis outweigh any short-term adverse impacts that could result from routine maintenance.

Fringed myotis (*Myotis thysanodes*)

Potential roosting and/or foraging habitat for this species is present in the project areas, but the project areas do not contain potential hibernation sites. If water hauling and maintenance trips occur during the summer, summer roosting sites of the species could be impacted if there is tree removal near the catchment sites; however, no tree removal is expected for these routine water hauling and maintenance trips, and the trips would only occur during the day. The long-term benefits of a consistent water and food source for fringed myotis outweigh any short-term adverse impacts that could result from routine maintenance.

Long-legged myotis (*Myotis volans*)

The project areas do not contain hibernation sites, but they do contain potential daily roosting and/or foraging sites. If water hauling and maintenance trips occur during the summer, summer roosting sites of the species could be impacted if there is tree removal near the catchment sites; however, no tree removal

is expected for these routine water-hauling and maintenance trips, and the trips would only occur during the day. The long-term benefits of a consistent water and food source for long-legged myotis outweigh any short-term adverse impacts that could result from routine maintenance.

Big free-tailed bat (*Nyctinomops macrotis*)

This species may use the project areas during foraging activities. Trees are present at four of the six catchment sites, which could serve as roost sites for this species. Construction activity may impact roosting sites of the species if there is tree removal at these four catchment sites; however, tree removal is not expected for this project and construction activities would only occur during the day. In addition, the catchments provide a supplemental water source that is available to wildlife inhabiting the area around the catchments including big free-tailed bats, as well as their prey species. However, the water supply can be unreliable due to deterioration of the catchments and a decrease in water storage efficiency. Therefore, the no action alternative would only benefit big free-tailed bats as long as routine maintenance and water hauling continue.

Golden eagle (*Aquila chrysaetos*)

Because golden eagles forage during the early morning and early evening, when routine maintenance and water hauling could occur, the foraging behavior of the eagles could be disturbed by the vibration of AGFD vehicles and water trucks. However, this disturbance would be temporary and the area of human activity around the catchments would be negligible compared with the overall range of the eagle.

Maintenance activity could also temporarily reduce the availability of prey in the area of the water catchments, although prey animals would return to the sites once these activities were completed. While the no action alternative could have minor impacts to individual golden eagles from minor maintenance and water hauling activities, no impacts to the species (i.e., a trend toward Federal listing or loss of viability) are expected.

4.2.3 Recreation

Under the no action alternative, no construction would occur. Minimal disturbance to recreational users would continue due to periodic water hauling and maintenance activities. However, this disturbance would be intermittent and localized and would not reduce the recreational opportunities available in the area.

4.2.4 Visual Resources

Because no renovations would occur, this alternative would not affect the existing visual character. The no action alternative would not change the characteristic landscape of the project areas, so this alternative would continue to meet the VRM class objectives at each of the catchment sites.

4.2.5 Cumulative Impacts of the No Action Alternative

Additional water catchment renovation projects are known to be planned for the ASFO (Catchment Nos. 613–620, 645–648, 816, 818, and 9637). As described in Section 4.1.5, other habitat enhancement projects planned for the vicinity include prescribed burns, seeding, and vegetation treatments. (See Section 4.1.5 for a discussion of cumulative impacts from these reasonably foreseeable actions.)

Short-term impacts could result from reconstruction activities at other catchments in the region; these impacts would be similar to the direct and indirect impacts from the proposed action. Alternatively, there

could be long-term, cumulatively adverse impacts as these catchments begin to fail. If the existing catchments fail, and are not replaced, there is the potential for reduced animal distribution across the landscape, as well as reduced population numbers, as water sources become less reliable. The management objective of providing the necessary habitat components (including reliable waters) may therefore not be as successfully met under this alternative as compared to the proposed action.

Chapter 5

CONSULTATION AND COORDINATION

5.1 LIST OF PREPARERS AND CONTRIBUTORS

Table 5.1. List of BLM Preparers/Reviewers

Name	Title	Responsible for the Following Program
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Lorraine Christian	Field Office Manager	Project Oversight
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Laurie Ford	Team Lead, Lands and Geological Sciences	Lands and Realty
Diana Hawks	Team Lead, Recreation/Wilderness/Cultural Resources	Recreation, Wilderness, Visual Resources
John Herron	Archaeologist	Cultural Resources
Lee Hughes	Ecologist	Special Status Plants, Vegetation, Range
Jon Jasper	Outdoor Recreation Planner	Visual Resources
Linda Price	Vermilion Cliffs National Monument Manager/Team Lead, Standards and Guidelines	Standards and Guidelines
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Richard Spotts	Environmental Coordinator	NEPA Compliance
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L.D. Walker	Weed Coordinator	Invasive, Non-native Species

Table 5.2. Non-Federal Agency EA Preparers/Reviewers

Name	Agency/Organization	Title
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Chapter 6

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Appendix A

SITE PHOTOGRAPHS OF EXISTING CATCHMENTS



Catchment No. 758, Uinkaret Plateau No. 3



Catchment No. 828, Lang's Run



Catchment No. 829, Finale



Catchment No. 837, Deadman Knoll



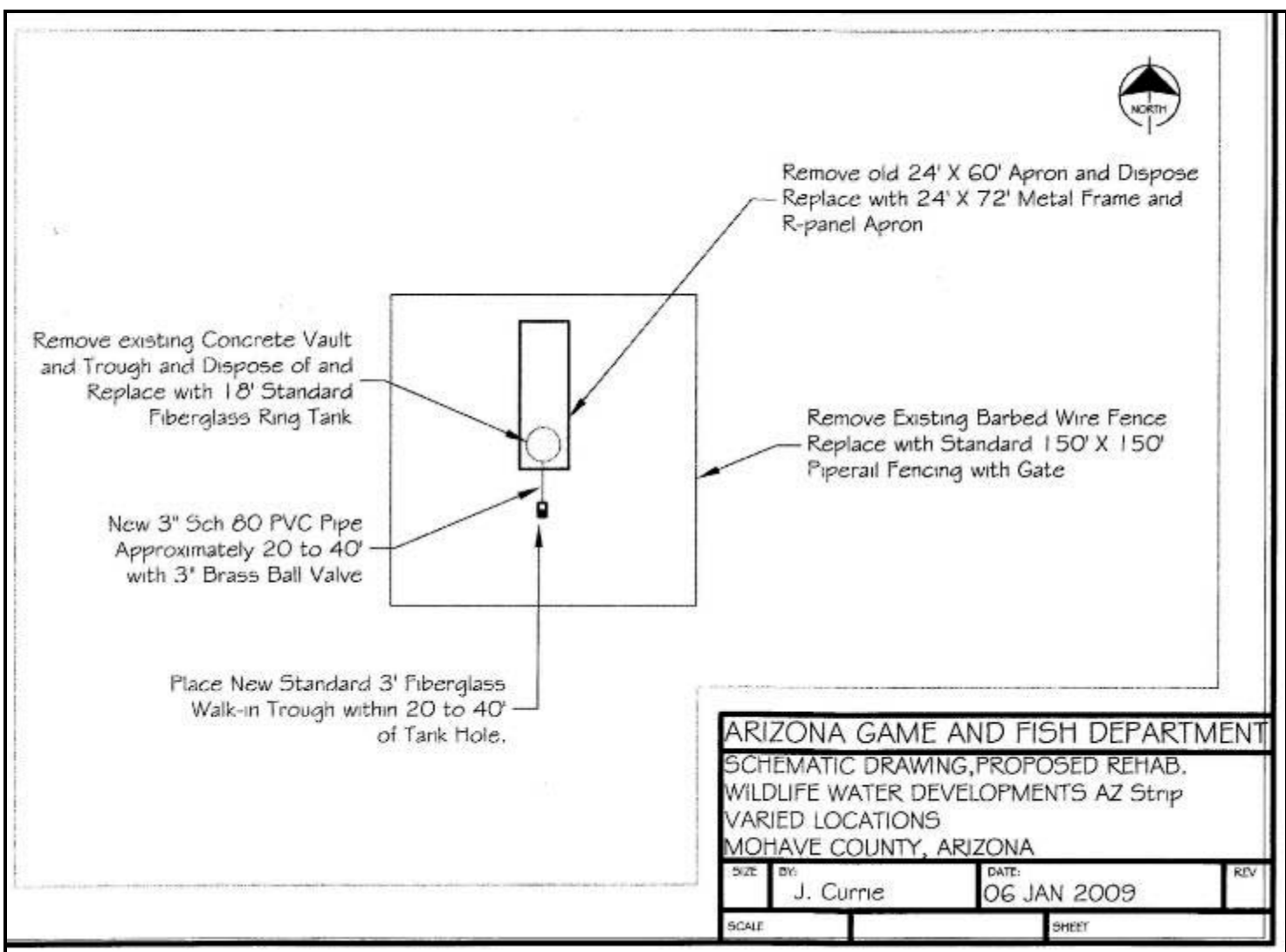
Catchment No. 838, Jody Lake



Catchment No. 4486, Rim No. 2

Appendix B

SCHEMATIC DRAWINGS OF THE PROPOSED CATCHMENTS



Appendix C

PHOTO OF ROAD TO WATER CATCHMENT 4486

