

Management Plan for the 7B Ranch



Prepared for Resolution Copper Mining
By The Nature Conservancy in Arizona

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Cover photo by Celeste Andresen.

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I. Introduction and Background

The 7B Ranch is a 3,073-acre parcel, primarily on the eastern side of the lower San Pedro River, directly east of the town of Mammoth, Arizona (Figures 1, 2). It contains approximately 6.8 miles of the San Pedro River corridor and supports one of the largest, uncut, intact mesquite bosques in the American Southwest. The 7B's mesquite bosque has been proposed as a state Natural Area and as a National Natural Landmark. Both nominations emphasized the quality and the size of its mesquite bosque, among other worthy conservation characteristics, as the primary consideration for the nominations.

The 7B Ranch is currently owned by Resolution Copper Mining (RCM). It was purchased by Resolution in March of 2004 from BHP-Billiton with the intent of conveying it to the U.S. Department of the Interior as part of a contemplated Federal land exchange. When the land exchange is finalized the property will join a suite of conservation lands strung out along the lower San Pedro River and will be managed primarily to enhance its conservation values.

The northern boundary of the 7B Ranch is approximately 20 miles upstream from the San Pedro River's confluence with the Gila River. Of this 20 miles, approximately 11 miles of river and 3,570 acres have been set aside in some form of conservation by the Salt River Project, the Bureau of Reclamation, The Nature Conservancy, the Arizona Game and Fish Department, and the Bureau of Land Management (Figure 1). With the transfer of the 7B to federal conservation-status ownership, 42% of the river from the Pinal County line north to the Gila will have been protected.

This management plan describes a number of management steps that will prepare the property for transfer to the Department of the Interior, and establish a long-term conservation management approach for the 7B Ranch that

will integrate general management objectives with other conservation properties along this stretch of the river.

The Past: Ownership and Agriculture

Portions of the 7B Ranch have been farmed since at least the early 1900's. The Clark family, whose descendents still own and work land adjacent to the 7B, farmed the property from about 1910 until about 1930, leasing it from an eastern family by the name of Smith, of Smith Brothers Cough Drops. Sometime around 1930 the Smith family sold the 7B to another family from the east, who subsequently sold the property to Newmont Copper Company in the early 1950's. The property continued to be farmed, primarily alfalfa and various grains, throughout most of the 20th century, as the property passed from Newmont to Magma Copper and eventually to BHP in 1997.

Fred Martin was the last farmer to work the 7B, farming it up until the early 1990's. Mr. Martin reportedly phased out of farming gradually, stopping farming first on the southernmost fields, then phasing out toward the north. This phased cessation is evident in an aerial view of the 7B as the regrowth of mesquite in the old agricultural fields is further along in the southernmost fields. Farming has been absent from the property for approximately twenty years.

An interconnected series of irrigation ditches is still evident on the property, suggesting they were once fed by a surface diversion from the San Pedro (Figure 3). Interviews with Robert Clark, the grandson of the Clarks who farmed the property back in the early part of the century, indicate that the primary diversion point was near the artesian hot well located in the NE1/4 of Section 32.

It seems that no other major land use activities have taken place, to any significant degree, on the 7B's bosque and river bottom

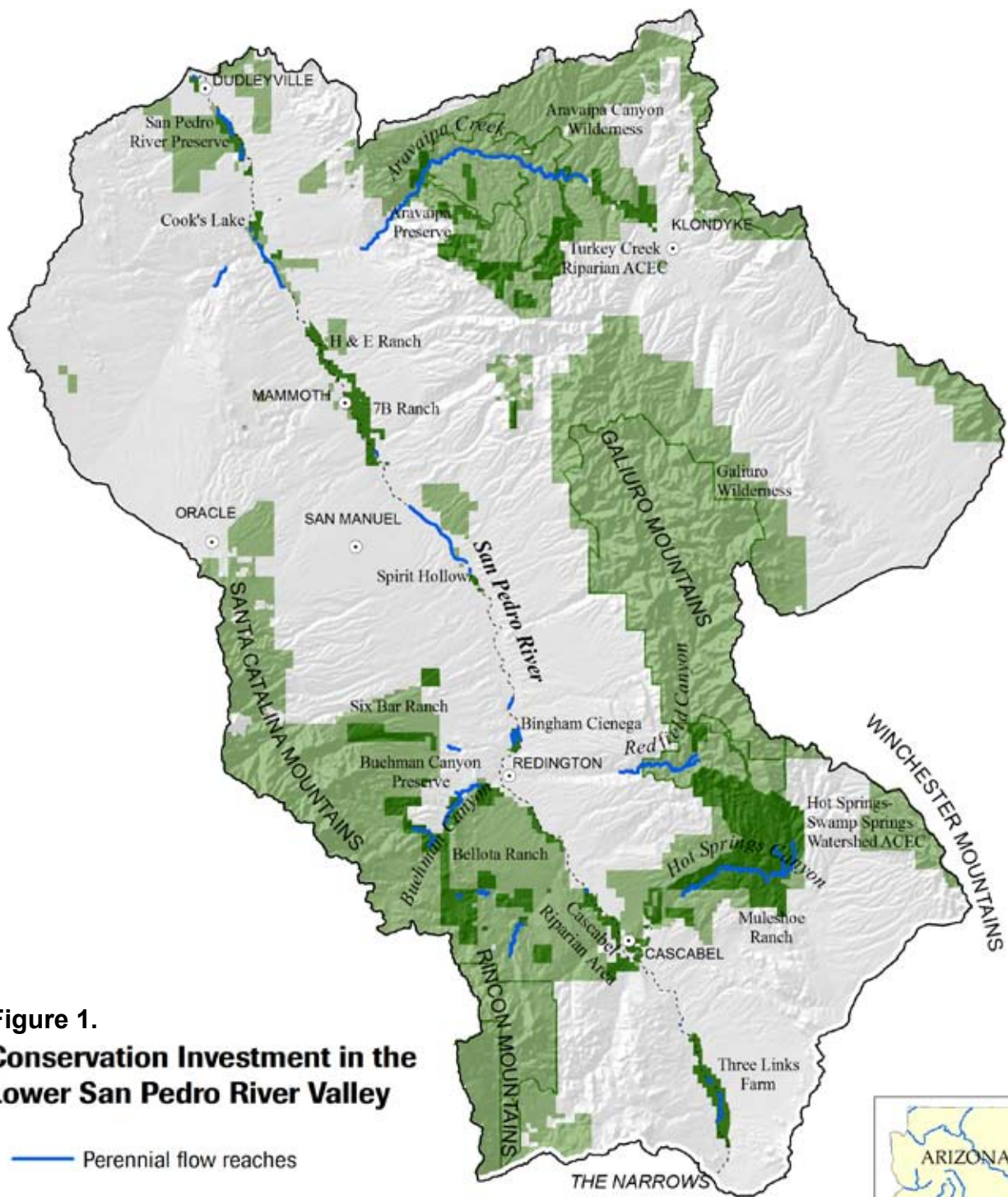


Figure 1.
Conservation Investment in the
Lower San Pedro River Valley

- Perennial flow reaches
- Land acquired and designated for conservation
- Public land and leases managed for conservation

Map by The Nature Conservancy
 July 2010

0 5 10 Miles



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 Protecting nature. Promoting life.

lands aside from farming and the grazing of cattle.

The Present: Land Use Issues, Threats and Trespass

Between about the mid-1990's, soon after lessee farmers were no longer on the property, and the property's acquisition in 2004 by Resolution, the 7B had little direct management attention. As a result, unauthorized use of the property became relatively widespread.

Resolution quickly took control of the situation and immediately began to fund the clean-up and removal of all wildcat dumps, addressed the general trespass issue by repairing fences, installing vehicle barriers and locking gates, and contracted with The Nature Conservancy's Lower San Pedro River Program to provide daily patrols and other management actions designed to "take back the property" and provide an obvious and ongoing management presence. This effort has resulted in a significant decrease in the amount of wildcat dumping and unauthorized woodcutting that are taking place on the property. While much less of a problem now, these activities still occur and need to be addressed more assertively.

Livestock grazing has been another common occurrence, either as a trespass activity or through informal agreement with neighboring ranchers. This has suppressed the native plant diversity in the understory, which reduces habitat diversity for birds and other wildlife. Grazing is now being phased out, by the mutual desires of both the most recent grazer and the landowners.

Another serious concern, exacerbated by trespass use of the property, is the potential for wildfire. In recent decades, at least, grazing of the 7B has decreased fuel loading in the bosque's understory and has, most likely, decreased the potential for a serious wildfire. With grazing activity reduced, understory fuel loading in the bosque has increased. This, along with trespass woodcutting, ATV trespass,

and other unauthorized uses of the property, increases the potential for wildfire.

An additional concern, about which much needs to be learned, are the extremely dense, nearly impenetrable thickets of mesquite that have colonized agricultural fields abandoned since the early 1990's. Questions remain regarding the transitional nature of these mesquite thickets and whether management intervention would be beneficial.

The Future: Desired Future Conditions

The 7B's primary ecological value, aside from the river itself, is its 700-acre mesquite bosque, a climax community that is fairly stable. Hence, one primary management objective for the 7B is relatively simple: *Protect the 7B's mesquite forest from degradation or habitat alteration.*

Management recommendations below regarding better fencing, fire control and public outreach are designed to both control access into the bosque and to raise the level of local appreciation for and understanding of the genuinely unique nature of this particular forest.

Recommendations for monitoring, maintaining and enhancing groundwater levels on the 7B will be critical to long-term maintenance of the bosque, and to avoiding negative impacts on downstream properties.

Many of the other management recommendations in this plan are aimed at enhancing conditions for increased biodiversity on the property, including outreach to local communities, some public education, species reintroductions, and biological surveys.

This plan has been written with the idea of creating a regional natural area that Resolution Copper, The Nature Conservancy, and local communities can be proud of, that will become a keystone part of a larger recognized national conservation area on the lower San Pedro and, when the land exchange occurs, transferring a "turn-key operation" to the Department of the Interior that they will be proud to accept.

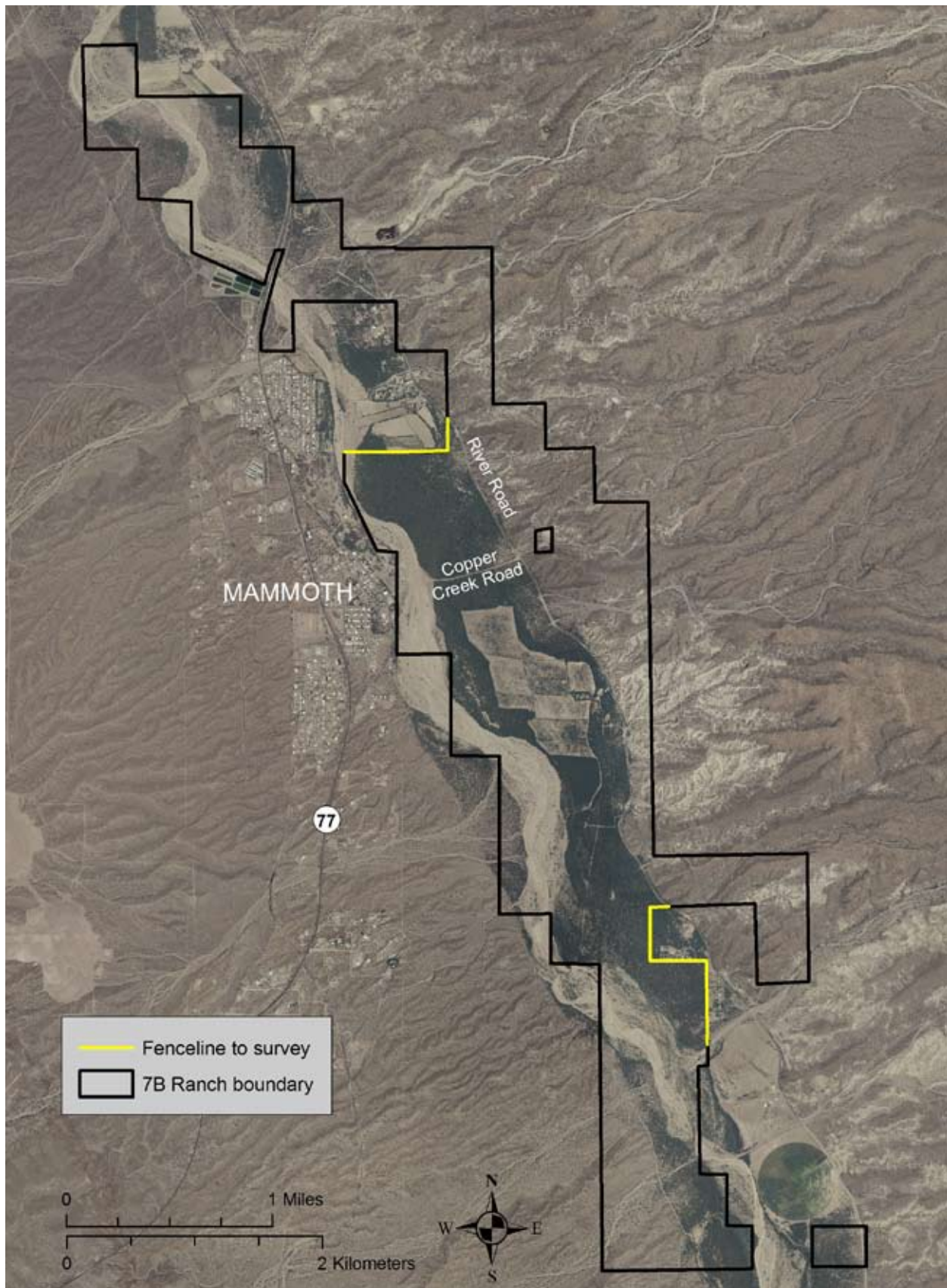


Figure 2. The 7B Ranch. Aerial photo taken in 2007.

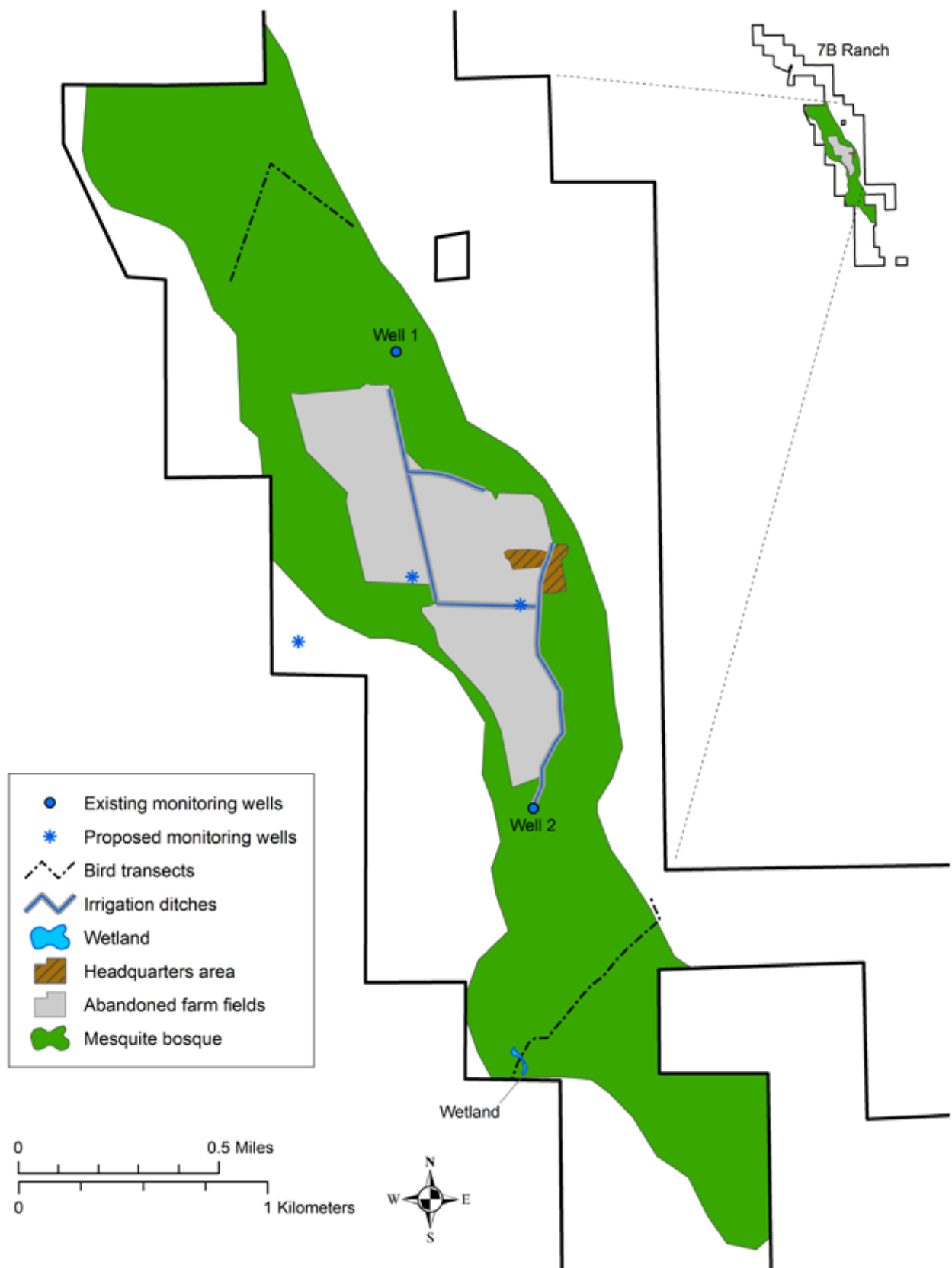


Figure 3. Important features of the 7B Ranch.

Key objectives of this plan are to:

1. Protect the 7B's mesquite forest from degradation or habitat alteration;
2. Maintain and restore, where necessary and appropriate, the native biological diversity of the 7B Ranch;
3. Improve local understanding of, appreciation for and attitudes about the 7B Ranch; and
4. Implement a "turn-key" management operation to hand over to the recipient agency within the Department of the Interior when the land exchange is finalized.

II. Natural values of the 7B Ranch

Ecological conditions on the 7B Ranch, combined with its landscape context, make it a conservation site of global significance.

Landscape context

The San Pedro River basin sits in the heart of the Sky Island region (also known as the Apache Highlands Ecoregion, or Madrean Archipelago). Ranging from sub-tropical forests and semi-desert grasslands to pine-oak woodlands and mixed conifer forests, this is among the most biologically diverse regions in North America. It is a zone of overlap for plants and animals from the Sierra Madre to the south and the Rocky Mountains to the north, the Sonoran Desert to the west and the Chihuahuan Desert to the east.

Cutting through the region for 140 miles, the San Pedro River serves as a north/south corridor between the mountains of Sonora and the highlands of central Arizona. One of the last major undammed rivers in the Southwest, the San Pedro forms a ribbon of water and riparian vegetation in an otherwise arid environment. As such, it provides habitat for a huge diversity of life, with desert riparian forests supporting some of the highest species richness and abundance totals of terrestrial vertebrates in North America. More than 750 vascular plant species have been identified within the San Pedro riparian corridor and bordering uplands (Stromberg et al. 2009).

Bird diversity is particularly high, due to high vegetative diversity and complex habitat structure, along with the regional setting. Breeding birds include more than 100 species,

with species richness about double the reported estimates from other southwestern rivers (Brand et al. 2009). More than 200 species of migratory birds also use the San Pedro riparian corridor to move between their breeding and wintering grounds, with estimated totals of one million to four million individual birds passing through each year (Commission for Environmental Cooperation 1999). The San Pedro constitutes one of the most important corridors for migrating birds in North America, and the lower San Pedro (including the 7B) has been identified as a Globally Important Bird Area by the National Audubon Society and Birdlife International.

The Nature Conservancy has also identified the lower San Pedro as a priority conservation area. In a comparison of priorities for the five ecoregions that include Arizona, covering 196 million acres, the lower San Pedro ranked 16th out of 391 sites.

In 1988, Congress designated 40 miles and 58,000 acres of the upper basin as the San Pedro Riparian National Conservation Area. Additional lands along the river and adjacent mountains have been conserved by private, state, and federal efforts. Overall, more than 700,000 acres (26%) of the San Pedro watershed are protected from development.

Significance of the 7B within the San Pedro

The 7B Ranch contains an intact mature forest of mesquite trees, regionally known as a mesquite bosque, of approximately 700 contiguous acres. It is one of the largest remaining examples of that community

type. Mesquite bosques have been lost to groundwater decline or deliberate clearing throughout the region, including elsewhere along the San Pedro.

Breeding bird species richness in mesquite is equal to that found in cottonwood forests, and supports a different suite of species (Brand et al. 2008). Surveys conducted on the 7B have found 81 bird species (Appendix 1), including grey hawk, Swainson's hawk, yellow-billed cuckoo, northern beardless-tyrannulet, Lucy's warbler, and Bell's vireo.

Surveys for other wildlife groups on the 7B have been less thorough, but have identified 5 bat, 4 amphibian, and 29 reptile species (Appendix 2, 3). We are not aware of any plant inventory efforts there.

Due to their ecological importance and increasing scarcity, mesquite bosques have been recognized as conservation targets for many years. The 7B Ranch bosque was proposed in 1974 for designation as a state Natural Area (Appendix 4), and was identified in 1979 as a potential National Natural Landmark, a designation of the National Park Service (Appendix 5).

Deep in the bosque hides a 1,500-foot-deep man-made well. The free-flowing artesian well puts out water at 106 degrees F, at twenty gallons per minute year-round, forming a 1/3-acre wetland stretching about 140 yards (Figure 3). Due to management actions in 2007 to remove nonnative frog and fish species, that wetland provides aquatic habitat for lowland leopard frog and longfin dace, while also supporting a higher diversity and density of birds and other wildlife (Appendix 6).

Other vegetation communities on the 7B include saguaro-dominated Sonoran Desertscrub (1,100 acres), and approximately six and a half miles of river channel with adjacent xeroriparian vegetation dominated by low-density, low-statured mesquite trees. It also includes 175 acres of recovering agricultural fields which have extremely dense stands of young mesquite trees.



Figure 4. Gray hawk.

Wildlife using the 7B Ranch includes, but not limited to, desert tortoise, ornate box turtle, bobcat, mountain lion, black bear, ring-tailed cat, and coatimundi.

Water resources

Groundwater and surface water resources are critical to maintaining the natural values of the 7B Ranch. There is historical evidence showing regular surface flows in the San Pedro River through at least part of the 7B, a reach that is now ephemeral. (Carmony et al. 1981). Surface flows were captured by a diversion ditch that supplied a series of farm fields. Shallow groundwater under the ranch supports the large trees which form the mesquite bosque. Depth-to-groundwater measurements indicate Well 1 averages 23 feet deep, and Well 2 averages 32 feet deep. (Figure 5). Monitoring data show very little change in that depth since regular monitoring was initiated by TNC. Deep groundwater (1,500 feet) supplies the artesian well and its associated wetland. We are not aware of any data on status or trend of that deep aquifer.

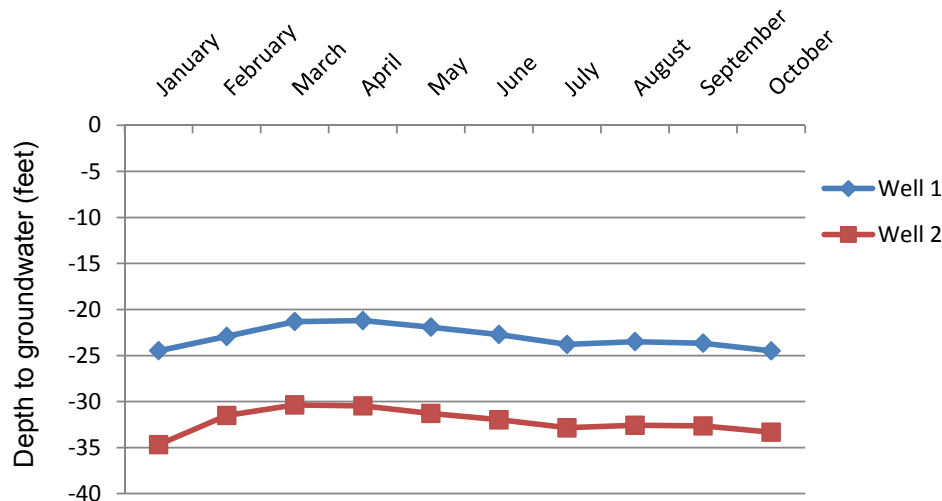


Figure 5. Depth to groundwater on the 7B Ranch. Monitoring conducted in January-October 2010 at two wells, shown on Figure 3.

The 7B Ranch has a senior surface water claim for 177 irrigated acres with a priority of 1898. By the time the claims were filed for the Hydrographic Survey Report (ADWR 1991), the diversion had been changed to a well, and the quantity claimed was 1,700 acre-feet per annum. The pre-code surface diversion was much larger – 18,000 afa according to the watershed file report. According to the Arizona Department of Water Resources Imaged Records Database, as of August 2009, these water right claims, under Claim #36-102337, are still listed as being held by Magma Copper Company. It is recommended that the paperwork be filed to transfer this claim to Swift Land and Cattle Company.

In addition to the abandoned fields now visible, the State Water Commissioner map of 1921 shows two other areas under cultivation: about 15 acres in Section 4 at the south end of the property on the west side of the river, and about 80 acres in Section 20 to the north of the large field. Both of these areas are now dense mesquite bosque and obviously have not been cultivated for a long time. All of these fields were served by ditches (Smith Ditch 1 and 2, Smith Ditch Lateral).

The continued supply of surface and groundwater at the 7B is affected by activities outside its boundaries, both upstream and up-gradient. In turn, water use or conservation on the 7B affects other lands downstream

and down-gradient. There are no current or planned water developments on the 7B, but its location and ecological condition suggests that continued monitoring of groundwater levels may be critical to future management decisions.

III. Cultural values of the 7B Ranch

The lower San Pedro River Valley contains one of the most intact prehistoric cultural landscapes in the Southwest, preserving a record of continuous human occupation over several thousand years. It includes extensive Hohokam habitation sites with prominent public architecture and cultural interface areas, dating from the late Classic period between the Hohokam culture and immigrants from Ancestral Puebloan areas north of the Mogollon Rim.

The 7B Ranch includes 21 known archeological sites, found during surveys by the Center for Desert Archaeology. These include four platform mound village compounds, artifact scatters, and dry land farming features (Appendix 7).

While these sites have all been subject to some degree of vandalism and pothunting, they retain a great deal of preserved archaeological deposits both on the surface and especially below ground.

IV. Threats to resource values

A. Local threats

Threats to the resource values of the 7B Ranch fall into two primary categories; 1) threats to groundwater levels and 2) degradation resulting from a variety of unauthorized uses.

Threats from unauthorized uses will generally have a lower impact on the overall resource health of the property and have a higher potential for being effectively managed. These threats are generally localized and are specific to trespass use of the property for wood, grazing and recreational uses. These threats can be reasonably managed by construction of a fence, increasing security, and improving public outreach and education within the community.

The threats that have the highest potential impact to the long-term viability of the habitat and wildlife at the 7B involve more complicated issues around conserving water in the river and its shallow aquifer. These threats will require management through effective monitoring of resource conditions, education and outreach to inform the public about the sensitivity of the habitat to changes in water availability, and thoughtfully engaging in community development. This threat will be harder to manage because it requires cooperation from adjacent landowners and communities to recognize the importance of protecting these resource values from impacts of pumping upstream and downstream of the property.

Communities

Issues of concern for communities in the San Pedro River Valley include balancing economic development, water availability and infrastructure upgrades to accommodate development including transportation and utility corridors, with the protection of open space, increased need for recreational access, protection of wildlife and habitat, aesthetics, cultural resources, and maintaining a rural way of life. As communities grow, increased

pressure will be placed on the limited water resources in the valley. Growth in the floodplain may necessitate groundwater pumping from the subflow zone, which could directly reduce water availability for riparian habitats and wildlife.

Fire in the wildland-urban interface

The mesquite forest of the 7B property is adjacent to the Town of Mammoth and borders several private properties. It thus meets the criteria of a wildland-urban interface scenario. A wildland-urban interface (WUI) refers to the zone of transition between unoccupied land and human development. These lands, and communities adjacent to or surrounded by wildlands, have a greater risk of damage by wildfires.

There have been several WUI assessments at the state and county levels to help emergency managers define high risk areas. The 2004 Arizona Wildland Urban Interface assessment was a statewide strategic report. The findings from the WUI assessment indicate areas that are at a low, moderate or high potential, based on topography, hazard indicators related to fuel type, fire regimes, and condition class, and risk in terms of historical fire density and built infrastructure. Results of this assessment describe the Mammoth area as at *moderate* risk. In the Arizona - Identified Communities At Risk report (AZDF 2009), the analysis did not identify Mammoth in the list of communities at risk, and the Pinal County Community Wildfire Protection Plan, February 2009 rated the town of Mammoth as having a low WUI risk due to the low incidence of fires and the low population of the area in the WUI.

The 7B Ranch contains a mature forest of mesquite trees of approximately 700 contiguous acres. The characteristics of the mesquite bosque can be described as a dense and continuous fuel type with low age class diversity, thick ladder fuels and closed canopy conditions. This forest had been routinely

thinned of ladder fuels, to some degree, by firewood cutters and the ground level fine fuels have been grazed by trespass cattle. Therefore it is important to point out that management changes which reduce these impacts may effectively increase the fuel loading of the understory and ladder fuels, and treatment alternatives may need to address this increased risk.

The WUI risk of the mesquite bosque to neighboring properties is localized to several pockets of houses along the southern and eastern edge of the bosque (Figure 2). These areas would benefit from construction of a fuel break when the fence construction is completed. This would break up the continuous fuels and thus reduce the threat of wildfire spreading from the bosque to the adjacent residences. It would also add protection for the bosque against fire spreading from adjacent lands into the bosque.

Contacts have been made with local fire departments to establish a fire response plan and to provide framework for development of a fire plan for the 7B property. Coordination with the responding units will be crucial in developing a sound fire plan and also help to establish local knowledge of the property access points, defensible spaces, and identification of water sources. In the event of a fire, the Fire Department recommended that the State Fire Dispatch (800.309.7081) be contacted and to expect San Manuel and/or Oracle to be the responding wildland fire crews.

Groundwater pumping

Groundwater pumping is a threat to existing groundwater conditions in the lower San Pedro River watershed. Pumping leads to groundwater level decline and decreased perennial flow, which cause degradation of riparian and aquatic ecosystems (Haney 2005).

The threat of groundwater pumping is magnified at the 7B, since the San Pedro River through the property is consistently dry except for short periods following localized rains that produce enough runoff to maintain flow.

Immediately upstream is land owned by BHP and immediately west, and contiguous with the 7B is the Town of Mammoth; both may initiate large-scale development projects and significantly increase groundwater pumping.

Mammoth has a wastewater treatment facility that currently utilizes evaporation ponds to treat effluent. The treatment plant is adjacent to the San Pedro River and pumps groundwater for operation. This treatment plant may be upgraded, which would affect flows on the 7B if water conservation strategies are not utilized. There is an opportunity to conserve large quantities of groundwater by increasing the efficiency of water use at this treatment plant and by incorporating effluent recharge to the aquifer.

Due to local geological conditions, the groundwater levels are lower in this reach of the San Pedro, yet still provide for enough water to maintain the bosque. Currently, groundwater appears in two wells on the 7B at 20-30 ft deep (Figure 5). Research conducted in the lower San Pedro River Valley suggests that a mature mesquite bosque will begin to suffer from water stress if groundwater drops below about 16 ft. The trees will show steadily greater stress as the water table drops to about 50 ft and approaches lethal levels at about 80 ft. The effects include smaller and fewer leaves, fewer flowers and fewer fruits, which result in fewer insects, fewer birds, and lower bird diversity (Stromberg et al. 1993).

Cattle grazing in the mesquite bosque

In recent decades, cattle use of the 7B mesquite bosque has been essentially unmanaged and year-round, leading to high grazing pressure on understory plants. Research in the region has shown that heavy grazing changes the understory of a bosque from a diverse plant community with dense stands of native grasses to one with a small number of disturbance-adapted nonnative species (Stromberg 1993). By simplifying the food sources and vegetation structure, that limits the abundance and diversity of insects and birds.



Figure 6. Lowland leopard frog.

B. Regional threats

Climate change

The climate in Arizona has long experienced swings in temperature and precipitation. Historical climate variability has changed fire frequency and intensity, induced variations in flood and drought severity, and caused indigenous population shifts throughout the region. Recent changes in temperature and precipitation have increased the severity of forest insect outbreaks in the western states and have contributed to some of the largest wildfires in Arizona's history. While climate has always been variable, abrupt changes in precipitation and temperature create cascading effects of reduced surface flow, lowered groundwater levels, increased tree mortality, and increased likelihood of landscape-scale disturbance from fire. These climate dynamics could alter the 7B landscape dramatically, increasing the importance of understanding the groundwater system and securing available water to sustain the habitat.

Utility Corridors

The Bureau of Land Management (BLM) is developing an Environmental Impact

Statement for the proposed SunZia Southwest Transmission Project, to be released in spring 2011. The proponents plan to construct and operate up to two 500 kilovolt (kV) transmission lines originating in New Mexico and terminating at the Pinal Central Substation near Coolidge, Arizona. The project purpose is to transport electricity from power generation sources, primarily renewable resources, to western power markets and load centers.

The proposed transmission line would be approximately 460 miles long. The proposed route has defined a mile-wide corridor for the analysis area and would then permit two 400-foot-wide corridors for transmission line construction, access and maintenance within that mile wide corridor.

One of the proposed routes is located on the north end of the 7B property. If constructed there, it would likely involve removal of all trees under the power lines to prevent arcing, and regular maintenance of that clearing.

If the SunZia corridor is approved, there is a significant potential that it will be subsequently used for gas or other utility lines, which would bring additional impacts.

V. Security and basic property management

1. Fencing

Past unregulated use of the 7B has created a legacy of boundary enforcement issues, including wood cutting, OHV use, trespass grazing, vandalism, and garbage dumping. These pressures necessitate the construction of a signed fence surrounding the mesquite bosque. Without a fence, boundary enforcement is not realistically possible.

Historically, locals have gathered and cut firewood on the 7B Ranch property. As a result, large areas that are easily accessible from the road or river have been affected. A perimeter fence surrounding the mesquite bosque would greatly discourage illegal woodcutting. In addition, patrolling for breaches in a fence line would be much easier than looking for footprints along nine miles of unfenced property.

Currently, several neighboring ranchers release their cattle into the bosque where they graze unrestrained and uncontrolled. With fencing, cattle could be taken out of the bosque and excluded from returning unless the need for selective grazing is determined as a desirable treatment. In that case, a small herd of cattle could be released onto a portion of the bosque, then removed when the desired level of vegetation management is achieved.

The perimeter of the 7B mesquite bosque, between the river and River Road and from the northern end at the Clark's property to Copper Creek Wash, measures approximately nine miles and will require the building of approximately 47,250 feet of new security fencing. Small sections of fence already exist in the area, but they are not wildlife friendly and are in various stages of disrepair. Therefore, little of the existing fencing will be incorporated into the new fence alignment and construction.

Copper Creek Road roughly bisects the 7B mesquite bosque; therefore, the bosque will be fenced into two distinct portions. The portion north of Copper Creek Road runs to the

southern boundary of the Clark's property. The portion south of Copper Creek Road runs to Copper Creek Wash. Both the north and south areas along Copper Creek Road will be fenced.

In both the north and south portions, on the west side of the bosque, the fence will be built between the bottom lands and the river channel. To the east, the fence will be placed between the bosque and the road. A property survey will be necessary to ensure that placement of the fence, along shared boundaries (Figure 2), is on the proper alignment. The survey will be a crucial component of improving neighbor relations. It will also provide an opportunity to educate and work with neighbors during the fence clearing and associated fuel break construction project.

Appendix 7 summarizes the known archeological sites found within and adjacent to the 7B boundaries. Fencing recommendations for three important and vulnerable sites are incorporated into this management plan and reflected in the budget. Approximately 6,300 feet of new fencing is recommended to protect these three sites, along with a small amount of survey work where these sites cross property boundaries. The location of these sites is not mapped in this document to avoid accidental distribution of that sensitive information.

Fire management

Removing the cattle to reduce unauthorized trespass grazing may increase fine and ladder fuels in the bosque. The perimeter fence will decrease illegal woodcutting which may also slightly increase fuel loading since dead and down wood will not be removed on a constant basis. An increase in fuel loading increases the potential of a higher-severity fire that may damage habitat resources, ecosystem function, health and diversity associated with the property. These factors make it necessary to incorporate the following steps as the fire management plan:

- Maintain a mowed 10-15 foot fire line

around the bosque-public road interface.

- Purchase an ATV with pull-behind mower to mow the fire lanes.
- The mowing will be done at least twice per year, or as deemed necessary.
- Collaborate with the local fire departments on a fire suppression plan in event of a wildland fire in the bosque.

2. Water

Monitoring threats to groundwater levels

1. Install shallow piezometers, a deep monitoring well, and a flow meter at the hot well outflow to supplement existing groundwater monitoring on the 7B (Figure 3).

Rationale: Groundwater monitoring piezometers and deep observation wells have been proposed for the 7B and other properties along the lower San Pedro by the Salt River Project (SRP). These piezometers and wells will enable monitoring of fluctuations in depth to groundwater over time. This monitoring array will help define locations where pumping may cause reductions to either surface flow, sub-flow, or groundwater on conservation properties and, as a result, cause degradation of the mesquite bosque and/or riparian habitat downstream

This project was proposed to Resolution Copper in July, 2010, and TNC has met with SRP to discuss site locations on the 7B and other properties upstream and downstream.

These monitoring wells will be spread out on seven conservation properties from the 7B downstream to the confluence with the Gila. There will be up to 11 piezometers and 7 deep wells included in this project. The data will supplement existing well data collected in the valley to better understand depth to groundwater levels and stratigraphy of alluvial deposits in the reach between the 7B and the San Pedro's confluence with the Gila River.

Coordination and sharing of

groundwater data across partnerships and properties along the lower San Pedro River has created a collective

understanding of groundwater levels at a watershed scale. The addition of these new groundwater monitoring wells is expected to fill a major gap in the existing data set and creates a management tool for better understanding the threats to groundwater levels at the 7B. The wells will be placed in locations that will help define the threat of groundwater pumping upstream and downstream of the 7B and give conservation property managers the ability to monitor the threats and have data to support claims if there is a negative impact to groundwater levels and related impacts to the mesquite bosque and habitat.

Improve overland flow conditions on 7B

1. Breach historic irrigation ditches at strategic locations to restore the natural movement of runoff through the site.

Rationale: There are several segments of old concrete or earthen irrigation ditch near the headquarters area (Figures 3, 7) that capture surface runoff upslope of the ditch and act as a barrier to natural overland flow below the ditch. Breaching these ditches at strategic locations would restore the natural runoff hydrology of the site. This would immediately improve local water availability to the abandoned agricultural fields down-gradient from the ditches, improving the speed of their recovery toward natural conditions.



Figure 7. Old irrigation ditch at margin of agricultural field.

VI. Wildlife and habitat management

While biodiversity values on the 7B are high, there are a number of potential management actions that will be important to maintain or improve those values.

A. Wetland

1. Install meter on outflow from artesian well to measure monthly and annual flow rates, and to detect changes in flow over time.

Rationale: Flow from the well is critical to maintaining the wetland. It seems to have flowed continuously for decades, but there is no information available about whether flow rates have changed.

2. Reconstruct flow outlet from artesian well to improve both function and appearance.

Rationale: Currently, a pipe from the flow outlet diverts some of the water to an outside corral which was used by a local rancher as a water point for his cattle. Those cows will be removed and it will no longer be necessary to divert that water. In addition, because the top of the well casing allows for the pooling of water, bees tend to swarm in that area. Reconstructing the flow outlet will aid in eliminating this swarming, as well as visually improve the area.

3. Introduce Gila topminnow to the wetland.

Rationale: The Endangered Gila topminnow is native to the greater Gila River basin, but has been lost from most of its former locations. One of two historic records of Gila topminnow in the San Pedro River basin was found in 1978 in a wetland formed by an artesian well about 6 miles south of the 7B wetland. The well was capped later that year, and the topminnow population lost (McNatt 1979).

B. Mesquite bosque

1. Eliminate livestock grazing from the bosque or limit it by season and area.

Rationale: The plant diversity and density in the understory appears to be very low, relative to some other bosques in southern Arizona. That likely constrains the abundance and diversity of insects and birds. Current use of the bosque by cattle is essentially unmanaged

and year-round, leading to high grazing pressure on understory plants. Excluding livestock, whether totally, seasonally, or in rotation through segments, would allow recovery of the understory.

C. Abandoned farm fields

1. Restore hydrologic conditions by breaching irrigation ditches and berms.

Rationale: Rainfall runoff from the surrounding landscape is diverted around the abandoned farm fields by a system of ditches and berms. Breaching the berms and filling ditches at strategic locations will allow the delivery of water from the uplands to the fields. It will also allow flood waters to restore fine-scale topography to the fields, which are currently level and flat, thus creating microhabitat features for plants and animals.

2. Research ecological values and potential restoration needs for mesquite in abandoned farm fields.

Rationale: Old farm fields on the 7B contain unusually dense stands of young mesquite trees, unlike any that develop under natural conditions. It is not clear whether or how they will move from their current state to something resembling the mature bosque that surrounds them. Nor is it clear whether these dense stands fulfill the same ecological functions as the bosque. Getting more clarity on these questions is critical to determining if restoration actions are needed.

D. Herpetological surveys

1. Conduct herpetological surveys using drift fences and traps as well as transect surveys to document species and populations. This will require construction of suitable traps.

Rationale: There was little known about the populations of amphibians and reptiles on the 7B prior to a brief effort in August-September, 2010. A more complete inventory will determine whether the site has other species of conservation concern, while tracking their numbers will give an indication of the health of the bosque and herpetological habitat.

VII. Monitoring

A. Groundwater monitoring

1. Continue monitoring shallow groundwater conditions, using the two existing wells where depth-to-groundwater measurements are taken on a monthly schedule (Figure 3). These may be augmented by additional wells and piezometers near the wetland and in the retired agricultural fields near the 7B headquarters. Data from groundwater monitoring will be included in regular reports to Resolution Copper Mining. *Rationale: In August 2010, staff from The Nature Conservancy, Resolution Copper Mining, and Salt River Project discussed plans for these installations.*

B. Wetland monitoring

1. To track the changes and monitor the effects of cattle removal, and as part of the Partners for Fish and Wildlife grant that funded the rehabilitation of the wetland, photo points were installed around the wetland: at the outflow, at the north end looking south, at the footbridge looking north and south, at the gate looking south into the wetland area. Photos will be taken at these points no less than 4 times a year, during each quarter.

Rationale: In 2007, the artesian well outflow was diverted to the river, the surrounding wetland dried, and invasive bullfrogs were removed (Appendix 6). A perimeter fence was installed around the land surrounding wetland, and the cows were removed from approximately 8.5 acres. Native species have since returned and are contained within the enclosure which prohibits bullfrogs from inhabiting the wetland immediately adjacent to the outflow as well as a smaller exclosed area north of the outflow.

C. Bird monitoring

1. Working with Audubon's Important Bird Areas Program, continue annual bird surveys established and initiated in 2006. One-kilometer transects have been established in the "Hot Spring" bosque (west of River Road) and the River bosque (north of Copper Creek Road). Transects surveys use a 50 meter truncation (perpendicular) distance on either

side of the transect path, within which all birds were recorded with numbers, sex, and behavior. Point counts (3 per transect) also occurred in 2006 and 2007, with a 100 meter truncation distance. Birds observed on the 7B Ranch property before or after the surveys, or beyond truncation distances were recorded as "supplemental." Two experienced bird surveyors conducted all surveys.

In a separate effort, a 16-hectare plot survey, randomly chosen under the Arizona Game and Fish Department's riparian bird monitoring program was conducted in May 2010. This was conducted by one surveyor. Resurvey of this plot will probably depend on AGFD resource availability.

D. Exotic species monitoring

1. Perform weekly inspections of the wetland outer perimeter fence to ensure the fence is intact and cattle are not entering the area. Any repairs will be made immediately.

2. Perform weekly inspections of the bullfrog enclosure fencing for breaches. Any repairs will be made immediately. The wetland will be monitored for bullfrog activity. Monitoring may include active surveying, or point observations and active listening for calls. If bullfrogs are located, action will be taken to remove the bullfrogs.

3. Perform weekly monitoring in and around the wetland for tamarisk and other invasive plants. Any invasive species will be removed immediately.

E. Vegetation and photo point monitoring

Once fencing of the bosque is completed, and all grazing is removed, a vegetation monitoring plan will be developed to track changes in understory vegetation response and the development of fine fuels. In addition to the photo points previously established around the rehabilitated wetland, permanent photo points will be established at appropriate locations throughout the bosque for long-term monitoring of changes in the vegetative structure, of the impacts of breaching the irrigation ditches and their related berms, and other areas to be determined.

VIII. Public contact and community relations

Global IBA designation and birding trail

There is a great opportunity for Resolution Copper to showcase the valuable bird habitat on the 7B as an outreach tool.

Arizona Audubon has identified the Lower San Pedro River corridor as an Important Bird Area (IBA) that also has Global significance. Habitat on the 7B has been surveyed and verified to meet the requirements for this designation. Establishment of a birding trail at the 7B in recognition of the IBA is an excellent opportunity to involve the local communities, county and state entities to celebrate this designation.

As a partnership project, Resolution, TNC, and the Audubon IBA program will work together to establish a birding and interpretive trail in conjunction with the hiking trail. The parking lot for both the hiking trail and the birding and interpretive trail will be located on the east side of the San Pedro River where Copper Creek Road crosses the river. This area is already disturbed, used as an unauthorized parking lot, is free of vegetation, and can easily be converted into an official trail-use only parking area. It is recommended that the cost for completing the trails include funds to build an outhouse near the parking area. The trail will be built by volunteers according to specifications by The Nature Conservancy and Resolution Copper Mining. The signs would be made by a professional sign company.

Partnerships between Resolution Copper, TNC and the Arizona and Tucson Chapters of Audubon have created a unique opportunity to focus outreach on the outstanding birding opportunities at the site, with an associated array of educational opportunities for local schools, ecotourists, and community groups.

Media outreach

To improve community awareness and outreach, a series of articles in local papers will be solicited, describing why this parcel is part of the land exchange, its importance as a unique biotic community, the importance of the

San Pedro River, and the value of the bosque to bird life and migration. The articles will feature the history of property, and describe Resolution Copper Mining, who they are, and their role on the San Pedro River and 7B Ranch. The first story appeared in the San Manuel Miner, Wednesday, July 28, 2010. The article was a cursory glance at the land exchange and property features, and highlighted comments by TNC and RCM employees.

Public access

Providing a controlled access point to the 7B would increase public understanding of the place and its values. This will involve developing the small parking area along Copper Creek Road with a visually pleasing fence and access to a loop hiking/birding trail. The trail will be relatively short, with some high-quality information and education signs. The use of the trail will be promoted locally with schools and local citizens' groups. Upon completion of the trail, RCM could host a local event on-site to open it for use, with some publicity and with Resolution staff in attendance.

Students from the Ecological Design Studio of the Landscape Architecture School at Arizona State University have approached TNC about developing an interpretive birding trail design for the implementation of this outreach project. Preliminary planning for this project is set to be completed by December 2010. Messaging for the interpretative signage will incorporate core components of Resolution Copper Mine's commitment to biodiversity and partnership building to leverage large scale conservation, including the Audubon's Global IBA program and The Nature Conservancy's Lower San Pedro River Program.



Figure 8. Dragonfly at the 7B wetlands.

IX. Annual Reporting

As part of implementing this management plan, The Nature Conservancy will provide annual reports to Resolution Copper Mining. Reports will include progress on management actions, summaries of monitoring data, challenges encountered, and any recommended changes in the plan.

X. 7B Ranch Management Plan Budget

The following budget includes recommendations for initial investment costs and anticipated annual maintenance

costs related to implementing the proposed management activities in the plan.

Start-up Equipment and Capital Costs

Personnel	Artesian Well & plumbing	750	
	Remove/regrade sections of historical irrigation ditch to restore flow	2,000	
	Gate install	350	
	Subtotal	3,100	
Supplies	10' x 17' Storage Building	1,500	
	4 new steel gates for access roads	1,200	
	Reconstruct artesian well	2,500	
	Totalizing flowmeter/artesian well	1,600	
	Miscellaneous tools	800	
	Subtotal	7,600	
Equipment	ATV: Polaris Sportsman	12,000	
	ATV tow-behind brush mower	2,500	
	ATV tow-behind utility trailer	400	
	Trailer for hauling ATV	1,700	
	Subtotal	16,600	
Contracts	Bosque Perimeter Fencing (47,500 ft @ \$1.50/ft.)	71,250	
	Fencing; selected archeological sites (6,300 ft @ \$1.50/ft)	9,450	
	Survey of Property Boundary (partial/estimate)	10,000	
	Interpretive/Educational Trail Signs	1,500	
	Subtotal	92,200	
		Subtotal:	119,500
	Indirect Cost (23.13%)		27,640
		TOTAL:	\$147,140

Annual Operations Costs*

Personnel	Personnel (Salaries and Benefits)	43,000
Supplies	ATV annual maintenance	600
	ATV tires (4 tubeless @ \$65/each)	260
	Maintenance/repairs 7B Truck/Trailer	1,200
	Fuel (ATV and work truck)	1,200
	Fence maintenance (materials)	700
	Interpretive Trail maintenance	600
	Replacement tools/miscellaneous	1,200
	Office supplies	200
	Subtotal	5,960
Fees & Licenses	Truck license and registration	250
	ATV license and registration	100
	Truck insurance	1,400
	Subtotal	1,750
Other	Phone/Printing/Postage, etc	1,000
	Subtotal:	51,710
	Indirect Cost (23.13%)	11,961
	TOTAL:	\$63,671

*Includes costs included within current management agreement between TNC and Resolution

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Appendix 1. Birds of the 7B Ranch.

Avian species detected during surveys of the 7B Ranch, 2006-2010. Surveys were conducted by Audubon's Important Bird Areas Program, Avian Science Initiative, Tucson Audubon Society and by Arizona Game and Fish Department. Recorded on transect = "T". Recorded only as "supplemental" to transect (but within 7B ranch) = "S". Recorded only on Arizona Game and Fish Department's Cooperative Bird Monitoring, Riparian Plot at 7B ranch (River Bosque, sub-area) in 2010 = P.

Common Name	Species	Hot Springs Bosque Transect (n=7 surveys) (925 m)	River Bosque Transect (n=5 surveys) (924 m)
Gambel's Quail	<i>Callipepla gambelii</i>	T	
Great Blue Heron	<i>Ardea herodias</i>	T	
Turkey Vulture	<i>Cathartes aura</i>	T	T
Northern Harrier	<i>Circus cyaneus</i>	S	
Cooper's Hawk	<i>Accipiter cooperii</i>	T	T
Gray Hawk	<i>Asturina nitida</i>	T	T
Swainson's Hawk	<i>Buteo swainsoni</i>	T	T
Red-tailed Hawk	<i>Buteo jamaicensis</i>		T
American Kestrel	<i>Falco sparverius</i>	S	
Prairie Falcon	<i>Falco mexicanus</i>		S
Unidentified Raptor (Diurnal)	<i>Accipitriformes</i>	T	
White-winged Dove	<i>Zenaida asiatica</i>	T	T
Mourning Dove	<i>Zenaidura macroura</i>	T	T
Inca Dove	<i>Columbina inca</i>	T	T
Common Ground-Dove	<i>Columbina passerina</i>	T	T
Yellow-billed Cuckoo	<i>Coccyzus americanus</i>	T	
Greater Roadrunner	<i>Geococcyx californianus</i>	T	
Lesser Nighthawk	<i>Chordeiles acutipennis</i>	T	
Black-chinned Hummingbird	<i>Archilochus alexandri</i>	T	T
Anna's Hummingbird	<i>Calypte anna</i>	T	T
Costa's Hummingbird	<i>Calypte costae</i>		S
Unidentified Hummingbird	<i>Trochilinae</i>	T	
Gila Woodpecker	<i>Melanerpes uropygialis</i>	T	T
Ladder-backed Woodpecker	<i>Picoides scalaris</i>	T	T
Northern Flicker	<i>Colaptes auratus</i>		T
Gilded Flicker	<i>Colaptes chrysoides</i>	S	
Unidentified Flicker sp.	<i>Colaptes sp.</i>	T	
Unidentified Woodpecker	<i>Picinae</i>	T	
Northern Beardless-Tyrannulet	<i>Camptostoma imberbe</i>		T
Western Wood-Pewee	<i>Contopus sordidulus</i>	T	
Unidentified Empidonax	<i>Empidonax sp.</i>	T	
Black Phoebe	<i>Sayornis nigricans</i>	T	
Say's Phoebe	<i>Sayornis saya</i>	T	T
Vermilion Flycatcher	<i>Pyrocephalus rubinus</i>	T	T
Ash-throated Flycatcher	<i>Myiarchus cinerascens</i>	T	T
Brown-crested Flycatcher	<i>Myiarchus tyrannulus</i>	T	T
Unidentified Myiarchus sp.	<i>Myiarchus sp.</i>	T	
Cassin's Kingbird	<i>Tyrannus vociferans</i>		P
Western Kingbird	<i>Tyrannus verticalis</i>	T	T
Bell's Vireo	<i>Vireo bellii</i>	T	T

Common Name	Species	Hot Springs Bosque Transect (n=7 surveys) (925 m)	River Bosque Transect (n=5 surveys) (924 m)
Plumbeous Vireo	<i>Vireo plumbeus</i>		T
Cassin's Vireo	<i>Vireo cassinii</i>	T	
Unidentified "Solitary" Vireo	<i>Vireonidae</i>	T	
Warbling Vireo	<i>Vireo gilvus</i>		T
Unidentified Vireo	<i>Vireo sp.</i>	S	
Common Raven	<i>Corvus corax</i>	T	T
Unidentified Raven	<i>Corvus sp.</i>	T	
Purple Martin	<i>Progne subis</i>	S	
Northern Rough-winged Swallow	<i>Stelgidopteryx serripennis</i>	T	P
Barn Swallow	<i>Hirundo rustica</i>	S	
Verdin	<i>Auriparus flaviceps</i>	T	T
Bushtit	<i>Psaltiparus minimus</i>	T	
Cactus Wren	<i>Campylorhynchus brunneicapillus</i>	T	T
Bewick's Wren	<i>Thryomanes bewickii</i>	T	T
Ruby-crowned Kinglet	<i>Regulus calendula</i>	T	T
Blue-gray Gnatcatcher	<i>Poliophtila caerulea</i>	T	
Black-tailed Gnatcatcher	<i>Poliophtila melanura</i>	T	
Northern Mockingbird	<i>Mimus polyglottos</i>	T	
Curve-billed Thrasher	<i>Toxostoma curvirostre</i>	T	
Phainopepla	<i>Phainopepla nitens</i>	T	T
Orange-crowned Warbler	<i>Vermivora celata</i>	T	
Virginia's Warbler	<i>Oreothlypis virginiae</i>	S	
Lucy's Warbler	<i>Vermivora luciae</i>	T	T
Yellow Warbler	<i>Dendroica petechia</i>	T	T
Yellow-rumped Warbler	<i>Dendroica coronata</i>	T	T
Townsend's Warbler	<i>Dendroica townsendi</i>	T	
Louisiana Waterthrush	<i>Parkesia motacilla</i>		P
Common Yellowthroat	<i>Geothlypis trichas</i>	T	
Wilson's Warbler	<i>Wilsonia pusilla</i>	T	P
Yellow-breasted Chat	<i>Icteria virens</i>	T	T
Summer Tanager	<i>Piranga rubra</i>	T	T
Western Tanager	<i>Piranga ludoviciana</i>	T	
Green-tailed Towhee	<i>Pipilo chlorurus</i>	T	
Canyon Towhee	<i>Melospiza fusca</i>	T	T
Abert's Towhee	<i>Melospiza aberti</i>	T	T
Chipping Sparrow	<i>Spizella passerina</i>	T	T
Lark Sparrow	<i>Chondestes grammacus</i>	T	
Black-throated Sparrow	<i>Amphispiza bilineata</i>	T	T
Song Sparrow	<i>Melospiza melodia</i>	T	T
White-crowned Sparrow	<i>Zonotrichia leucophrys</i>	T	
Unidentified Sparrow	<i>Emberizidae</i>	T	
Dark-eyed Junco	<i>Junco hyemalis</i>	S	
Northern Cardinal	<i>Cardinalis cardinalis</i>	T	T
Pyrrhuloxia	<i>Cardinalis sinuatus</i>	S	
Blue Grosbeak	<i>Passerina caerulea</i>	T	
Great-tailed Grackle	<i>Quiscalus mexicanus</i>	T	
Brown-headed Cowbird	<i>Molothrus ater</i>	T	T

Common Name	Species	Hot Springs Bosque Transect (n=7 surveys) (925 m)	River Bosque Transect (n=5 surveys) (924 m)
Hooded Oriole	<i>Icterus cucullatus</i>	T	T
Bullock's Oriole	<i>Icterus bullockii</i>	T	T
Unidentified Oriole	<i>Icterus sp.</i>	S	
House Finch	<i>Carpodacus mexicanus</i>	T	T
Lesser Goldfinch	<i>Carduelis psaltria</i>	T	T
TOTALS (not including "Unidentified")	81	64	49

Appendix 2. Bats of the 7B Ranch.

Bats were surveyed in April-June, 2010, by Deborah Buecher and Ronnie Sidner.

Common Name	Species
pallid bats	<i>Antrozous pallidus</i>
Townsend's big-eared bats	<i>Corynorhinus townsendii</i>
big brown bats	<i>Eptesicus fuscus</i>
California myotis	<i>Myotis californicus</i>
cave myotis	<i>Myotis velifer</i>

Appendix 3. Amphibians and reptiles of the 7B Ranch.

Amphibians and reptiles were surveyed by TNC staff during summer 2010, using funnel traps and drift fences set near the hot well. Additional species were recorded during general management activities throughout the year.

Common Name	Species	Wetland & Drift Fence Surveys	7B Bosque	River Road & Upland
Sonoran Desert Toad	<i>Bufo alvarius</i>	X		X
Couch's spadefoot	<i>Scaphiopus couchii</i>		X	X
American bullfrog	<i>Rana catesbeiana</i>	X		
Lowland leopard frog	<i>Rana yavapaiensis</i>	X		
Desert Tortoise	<i>Gopherus agassizii</i>		X	X
Sonoran mud turtle	<i>Kinosternon sonoriense</i>	X	X	X
Ornate box turtle	<i>Terrapene ornata</i>	X	X	X
Whiptails	<i>Aspidoscelis sp.</i>	X	X	X
Zebra-tailed lizard	<i>Callisaurus draconoides</i>			X
Western banded gecko	<i>Coleonyx variegatus</i>		X	X
Greater earless lizard	<i>Cophosaurus texanus</i>			X
Eastern collared lizard	<i>Crotaphytus collaris</i>			X
Gila monster	<i>Heloderma suspectum</i>		X	X
Common lesser earless lizard	<i>Holbrookia maculata</i>			X
Regal horned lizard	<i>Phrynosoma solare</i>		X	X
Clark's spiny lizard	<i>Sceloporus clarkii</i>	X	X	X
Desert spiny lizard	<i>Sceloporus magister</i>	X		X
Ornate tree lizard	<i>Urosaurus ornatus</i>	X	X	X
Common side-blotched lizard	<i>Uta stansburiana</i>			X
Western diamond-backed rattlesnake	<i>Crotalus atrox</i>	X	X	X
Mohave rattlesnake	<i>Crotalus scutulatus</i>		X	X
Tiger rattlesnake	<i>Crotalus tigris</i>			X
Ring-necked snake	<i>Diadophis punctatus</i>			
Common king snake	<i>Lampropeltis getula</i>	X	X	X
Coachwhip	<i>Masticophis flagellum</i>	X	X	X
Sonoran whipsnake	<i>Masticophis bilineatus</i>			X
Gophersnake	<i>Pituophis catenifer</i>	X	X	X
Long-nosed snake	<i>Rhinocheilus lecontei</i>			X
Western patch-nosed snake	<i>Salvadora hexalepis</i>	X	X	X
Ground snake	<i>Sonora semiannulata</i>			X
Smith's black-headed snake	<i>Tantilla hobartsmithi</i>		X	
Black-necked gartersnake	<i>Thamnophis cyrtopsis</i>	X		
Checkered gartersnake	<i>Thamnophis marcianus</i>	X		

Appendix 4. Proposal to designate 7B Ranch Bosque as a state Natural Area.

PROPOSED NATURAL AREAS

MAMMOTH MESQUITE BOSQUE

REPORT NO. 61

Prepared by

Arizona Academy of Science

for

Planning Division
Office of Economic Planning and Development
Office of the Governor
State of Arizona

September 1974

Principal Authors

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MAMMOTH MESQUITE BOSQUE NATURAL AREA

Establishment Proposal

Location and Ownership

The proposed Mammoth Mesquite Bosque Natural Area (MMBNA) is located on the San Pedro River 2 miles (3.2 km) south and 1.2 miles (1.9 km) east of Mammoth in Pinal County, Arizona. The site includes parts of Sections 28, 29, 32 and 33 of R. 17E., T. 8S. at 32° 42' N. Lat., 110° 37' W. Long. and is privately owned by the Magma Copper Company of San Manuel, Arizona.

Description

The site is located on the floodplain of the San Pedro River at the base of a long bajada which originates several miles away in the Galiuro Mountains. The site slopes gently westward from the bajada's rocky hillsides to the edge of the San Pedro River. The average elevation of the site is 2,400 feet above sea level and no rocky outcrops of any kind occur on the site.

The climate of MMBNA is characteristic of southern Arizona with very warm summers and mild winters. Rainfall, which averages about 14 inches per year (See Green and Sellers, 1964, pg. 157) is bimodally distributed with distinct rainy periods in July through September and December through February. The intervening spring and autumn months are typically quite dry and severe drought conditions often occur during spring.

The MMBNA is florally dominated by mesquite (Prosopis velutina) which forms a nearly closed canopy over 90% of the area. Many of the mesquite trees are well over 100 years of age and replacement of mesquite is occurring to the exclusion of other tree species (Tom Gavin, Univ. of Ariz. - Personal Communication). Other perennial species that occur on the site are; willow (Salix gooddingii), cottonwood (Populus fremonti), ash (Fraxinus velutina), condalia (Condalia lycioides) and lycium (Lycium sp.). A few cacti (Opuntia sp.), salt cedars (Tamarix petandra) and burrow bushes (Aplopappus tenuisectus) also occur on the site. The large tree species are supported, to some extent, by permanently flowing artesian wells that occur on the site (See Figure 1). These wells also provide a source of water for the vertebrate inhabitants.

The vertebrate faunas of MMBNA have been studied by Mr. Thomas Gavin who conducted a research project on the site while working for a Master's Degree at the University of Arizona. Gavin reports (Personal Communication) finding over 85 species of birds on the site including many migratory species which utilize the area for food, water and cover during their travels. Some of the breeding birds are Ladder-backed Woodpecker (Dendrocopos scalaris), Mourning Dove (Zenaida macroura), White-winged Dove (Zenaida asiatica), Gambel's Quail (Lophortyx gambelii), Vermilion Flycatcher (Pyrocephalus rubinus), Bell's Vireo (Vireo belli), Lucy's Warbler (Vermivora luciae) and Abert's Towhee (Pipilo aberti). Many mammals including Javelina (Tayasu tajacu), Mule Deer (Odocoileus hemionus), Coyote (Canis latrans), Bobcat (Lynx rufus) and Raccoon (Procyon lotor) are also known to occur on the site. The herpetofauna includes a number of

toads, lizards and snakes some of which reach their greatest population levels in dense mesquite forest habitats such as occur at MMBNA.

History of Disturbance

A number of disturbance factors have and do occur on this site. However, few disturbances have altered the generally outstanding quality of the mesquite forest itself. Livestock grazing on the site has adversely affected the quality of ground cover but had no apparent impact on the mesquite. One area of about 5 acres was burned in the early 1960's and another 5 acres has been partially cleared to permit placement of beehives. The presence of stumps indicates that some trees were cut down many years ago but no wood cutting activities have occurred in recent years. The areas that have been cleared are being reinvaded by mesquite indicating that the damage is transitory and will, in time, be obscured by regrowth. A small (seven feet wide) dirt road runs through the bosque (mesquite forest) but does not constitute a highly significant impact.

Natural Area Qualities

Mesquite forest habitats that formerly occurred commonly along major drainages in Arizona have practically disappeared in the past half-century. Most of the areas that supported such forests have been cleared for agricultural purposes or disappeared as a result of other human endeavors that preclude the existence of mesquite bosques. Consequently one of the prime motivations for Natural Area establishment at MMBNA is that of preservation of an endangered habitat type.

Additionally, MMBNA is a very good example of a mesquite forest despite its history of disturbance. The site could be used by educators and scientists for interpretive purposes as well as for conducting research projects dealing with mesquite forest ecology.

Recommendations and Boundaries

We recommend that a Scientific and/or Educational Natural Area be established at this site to preserve, in good condition, a portion of San Pedro River mesquite forests and to provide an area of mesquite dominated habitat for educational and scientific purposes.

Suggested boundaries are shown in Figure 1 and include the San Pedro River on the west, the Mammoth-Redington Road on the east, Copper Creek on the south and mid-section line of Section 28 on the north.

LITERATURE CITED

- Green, C. R. and W. D. Sellers
1964. Arizona Climate. Univ. of Ariz. Press, Tucson, 503 pp.

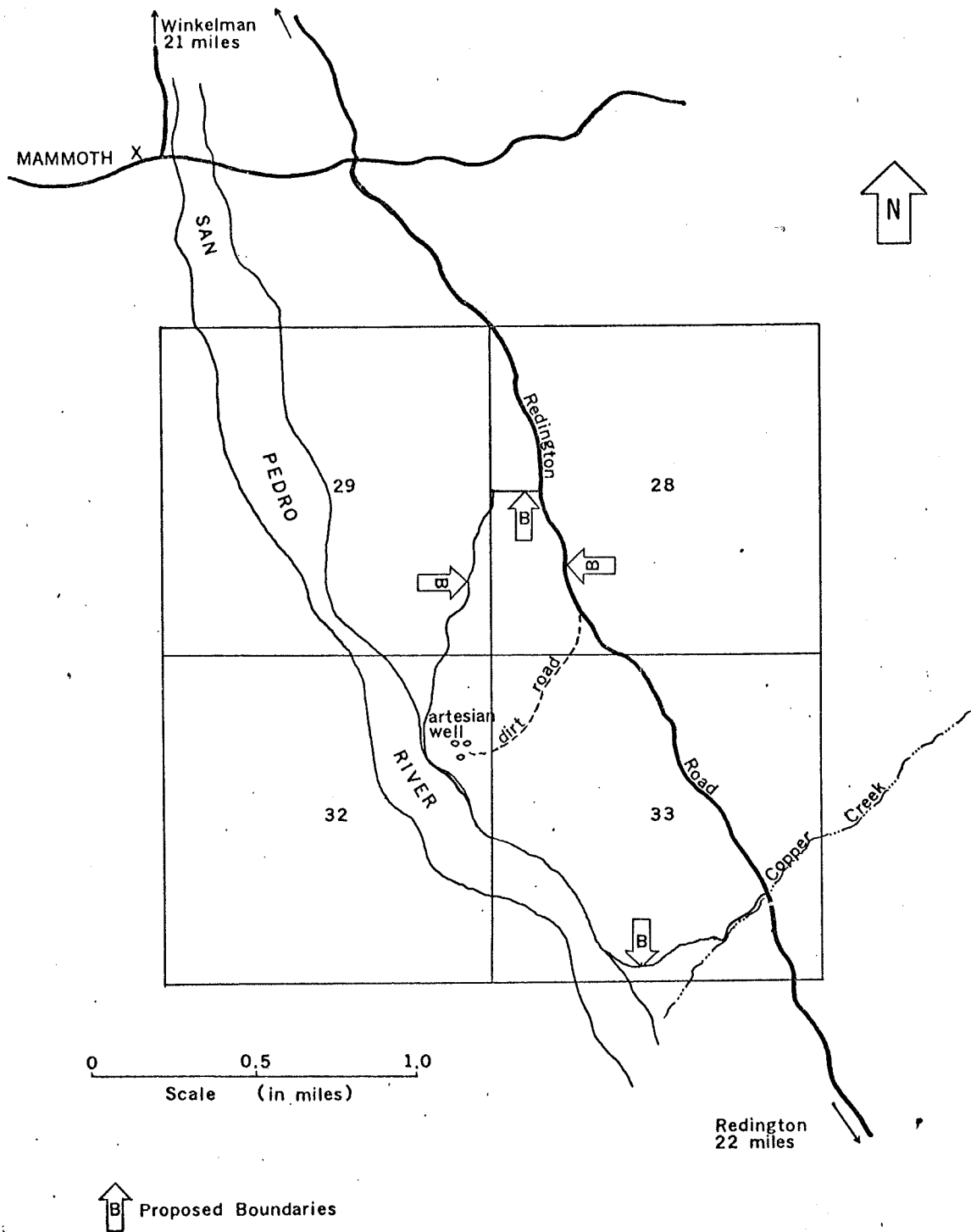


FIGURE 1. Sketch map of the proposed Mammoth Mesquite Bosque Natural Area.

Appendix 5. Description of 7B Ranch Bosque as a potential National Natural Landmark.

A SURVEY OF POTENTIAL NATURAL LANDMARKS, BIOTIC THEMES,
OF THE MOJAVE-SONORAN DESERT REGION

BIOTIC THEMES

Paul S. Martin
Department of Geosciences
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Tucson, Arizona 85721

Prepared for the Heritage Conservation and Recreation Service
United States Department of the Interior

November 1979

MAMMOTH MESQUITE BOSQUE

Major theme: Desert riparian forest.

Minor theme: Hot water biota.

Location and map: Pinal Co., Arizona, T8S, R17E, parts of Sections 28, 29 32 and 33, 2400 feet elevation, 1.2 miles east of Mammoth. Clark Ranch, 7.5 minute series.

Ownership and size: Magma Copper Company, approximately 500 acres.

Natural values: Over ninety percent of coverage is a closed gallery forest of mesquite (Prosopis juliflora). Other woody species include walnut (Juglans major), ash (Fraxinus velutina), cottonwood (Populus fremontii), willow (Salix gooddingii), gray-thorn (Condalia lycioides) and wolf berry (Lycium sp.). Smith and Bender (1973) also report a few cacti (Opuntia sp.), salt cedar (Tamarix pentandra) and burro-weed (Haplopappus tenuisectus). A heavy ground cover of London rocket (Sisymbrium irio) and annual grasses can be expected under the leafless mesquite after a wet winter.

The location was used as a study site by Thomas Gavin for his masters thesis and Paul Winkler for his Ph.D from the University of Arizona. Gavin found 85 species of birds. Breeding species include ladder-backed woodpecker (Dendrocopos scalaris), mourning dove (Zenaida macroura), white-winged dove (Zenaida asiatica), Gambel's quail (Lophortyx gambelii), vermilion flycatcher (Pyrocephalus rubinus), Bell's vireo (Vireo belli), Lucy's warbler (Vermivora luciae) and Abert's towhee (Pipilo aberti).

An ecologically significant feature of the site is the artesian discharge of hot water (41.2°C) flowing from the stand pipe of a well drilled in 1900 by the Magma Copper Company. The "hot spring" fauna, including introduced mosquito fish (Gambusia affinis), have been studied by Winkler. He found that tendipedid larvae, odonate nymphs and naiplid, dytiscid and hydrophilid adults showed a thermally controlled distribution in the stream flowing from the spring. Ten of twenty-seven species of aquatic insects were restricted to the warmest area of the stream. There were behavioral differences in the mosquito fish related to stream temperature with more males present at cooler stations.

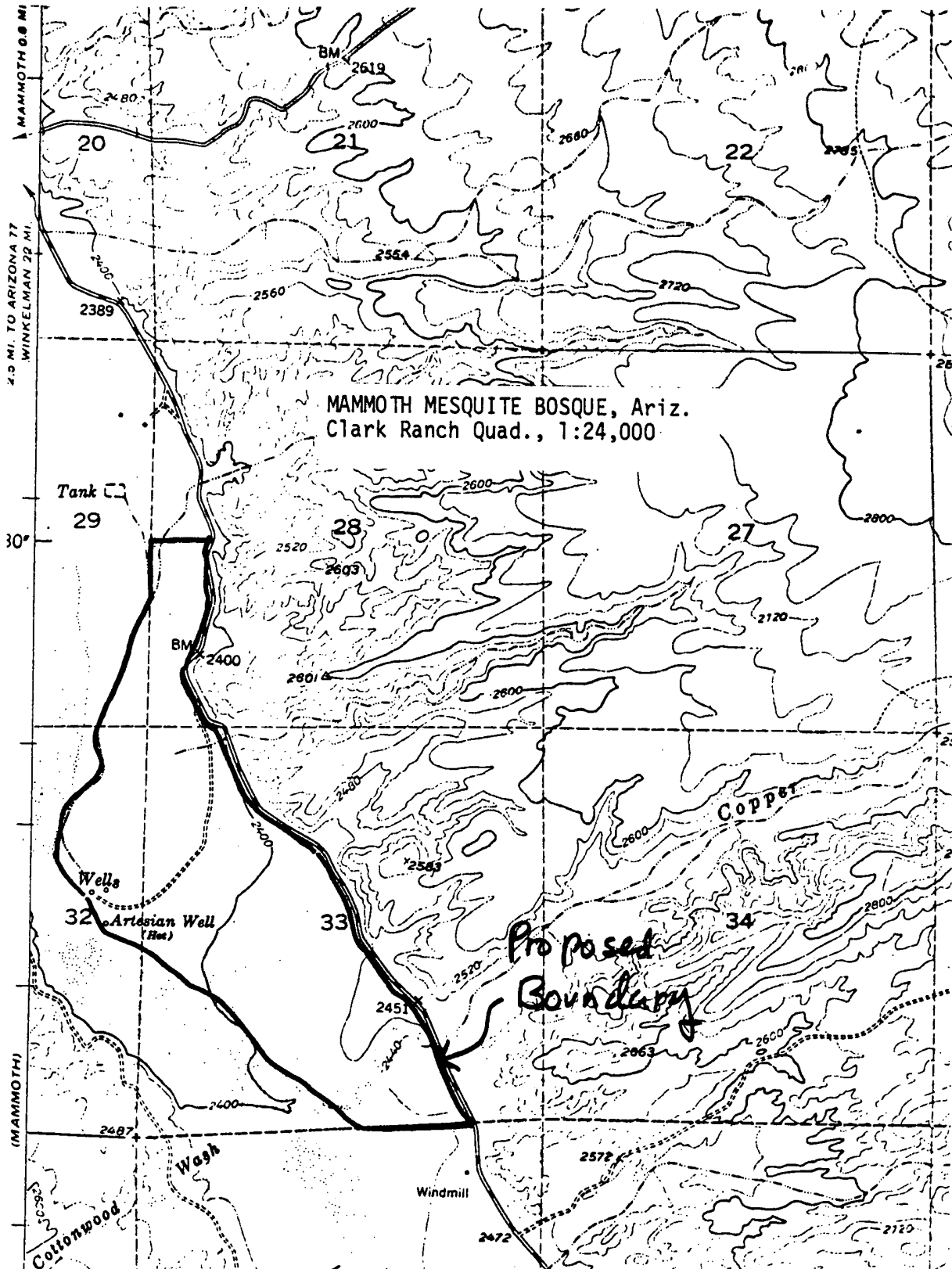
Land use and threats: Mesquite forest (bosque) is being cleared and cultivated along many parts of the San Pedro River. Uncleared mesquite outside fence is often damaged severely by wood cutters. This area is heavily grazed. The road to the hot spring mentioned by Smith has overgrown and is apparently used mainly by cattle and hunters.

Data source and knowledgeable persons: Lyle Sowles and Thomas Gavin, University of Arizona; Patricia Bergthold; E. Linwood Smith; Paul Winkler; Donna J. Howell, Purdue University; visits by P.S. Martin

References: Gavin and Sowles 1975; Smith and Bender 1973; Winkler 1975, 1976.

Recommendation: This area combines both an excellent and easily visited example of southwest mesquite forest with an interesting, recently established, hot spring biota. It might be included in a much larger segment of San Pedro bosque, if a more suitable site can be found.

Priority: 2-A,B; not listed by Wachter et al.



Appendix 6. Wetland Restoration at 7B Ranch Hot Spring

Dan Wolgast, dwolgast@tnc.org, and Robert Burton, rburton@tnc.org
The Nature Conservancy in Arizona

(left) Wetland, post-dry-up.
(right) Same view,
post-re-establishment
Photos by Dan Wolgast.



removal of these sections will provide access for wildlife to the wetland at times of the year when bullfrogs are not active. The rest of the year, wildlife will have access to the unfenced portion of the wetland.

Results

Mosquitofish eradication was 100% successful, and the bullfrog population

has yet to rebound. No bullfrogs, tadpole nor adult, have been seen in the wetland area since mid-May 2007. Lush growth of emergent vegetation has filled the wetland, and water-reliant insects like damselflies have returned in force. One notably absent insect is the mosquito. Larvae were found in a puddle around the well head while the outflow was diverted, but since re-establishment, none have been seen in the entire wetland. In January 2008, egg clutches, tadpoles, metamorphs, and adults of Lowland Leopard frogs (*Rana yavapaiensis*) were observed in the wetland. Their numbers have subsequently increased, and adults can now be seen from the well head all the way to the downstream terminus of the wetland.

Acknowledgements

This project was made possible by a grant from the U.S. Fish and Wildlife Service through the Arizona Partners program (Grant No. 1448-20181-06-G; 2006). Many thanks go to Kris Randall and Jennifer Graves, USFWS, for their input and hard work in securing funding. Resolution Copper Co. and Swift Land & Cattle were very supportive and offered much encouragement. Charlie Allen deserves much gratitude for his hard work clearing the hot spring of trash and debris and for securing the wetland area from cattle, without which this restoration would have not been possible.



Lowland Leopard Frog (*Rana yavapaiensis*).

The 7B Ranch, near the town of Mammoth, Arizona, is 13.4 sq. km (3,300 ac) of the most contiguous mesquite bosque in the Southwest. Stretching along 10.5 km (6.5 mi) of the San Pedro River, the 7B was purchased by Resolution Copper Co. and is currently managed by The Nature Conservancy for its conservation values. Among the many features that make the 7B unique is the existence of a 457-m (1,500-ft) deep man-made artesian well. Re-termed the “hot spring”, the well puts out water at 41.1° C (106° F), at 75.7 l/min (20 gal/min) year-round. This output forms a wetland roughly 274 m (300 yd) long, vegetated primarily by mesquite (*Prosopis velutina*), willow (*Salix gooddingii*), ash (*Fraxinus velutina*), watercress (*Rorippa* sp.), and spike-rush (*Eleocharis* sp.).

Restoration Procedure

In January 2007, outflow from the hot spring was diverted to the nearby San Pedro River, using 45.7 m (150 ft) of 5.1-cm (2-in) PVC pipe. All fish in the wetland were identified as Mosquitofish (*Gambusia affinis*), and most of the frogs were American Bullfrogs (*Rana catesbiana*). The purpose of drying the wetland was to eliminate these exotic vertebrates so that native fish and frogs could be introduced there.

Total dry-up took about 3 weeks. The wetland was then left dry until April 9, at which time the outflow diversion was disconnected and water returned to the wetland. Re-hydration has taken over a year, and the area covered by standing water continues to expand.

An enclosure fence has been erected around the upper part of the wetland to prevent re-infestation by bullfrogs. The fence consists of 1.5-m (5-ft) steel t-posts driven about 0.6 m (2 ft) into the ground, spaced roughly 2.1 m (7 ft) apart, and 0.9x4.6-m (3x5-ft) panels of 6.4-mm (0.25-in) black PVC hardware cloth. The panels are tied to the t-posts using plastic zip-ties and are buried roughly 15 cm (6 in) in the ground. The

No bullfrogs,
tadpole nor adult,
have been seen
in the wetland
area since
mid-May 2007.

Appendix 7. Letter from Center for Desert Archaeology.

June 24, 2010

Ms. Lydelle Davies
Resolution Copper Company
402 W. Main
PO Box 27
Superior, AZ 85173

Dear Lydelle:

Per your request, I have provided a summary of our observations and recommendations from our recent field trip of cultural sites on the 7B Ranch. Previously, we have provided you with a map of the areas surveyed by the Center for Desert Archaeology in the 1990s as well as the sites that were encountered during these survey efforts. With minor exception, our survey efforts were restricted to the upland terraces bordering the modern floodplain of the river. These surveys were not intended to constitute a clearance of any kind as it may relate to the National Historic Preservation Act. This work was done with the permission of BHP, the owner at that time.

There are 21 known sites and a brief descriptor for each of these sites is attached. There are three major habitation sites that we would encourage more active management to safeguard and ensure that when the land is transferred to BLM their management will be "turnkey". While these sites have all been subject to some degree of vandalism and pothunting, they all retain a great deal of preserved archaeological deposits both on the surface and especially below ground. A strong management program to protect and enhance the condition of these sites could include the following general approaches:

1. Reduce or control access to the sites.
2. Control active erosion where it is causing or has a likelihood of causing significant damage.
3. Document past vandalism through surface mapping in order to plan site restoration measures and provide a baseline for future monitoring.
4. Implement site restoration measures by filling in damaged areas with fresh soil obtained from off the site.
5. Monitor sites regularly to ensure that vandalism does not resume.

I have elaborated further on a site by site basis below:

1. [REDACTED] - Located on [REDACTED], this site has numerous looter's pits. The northern most [REDACTED] is eroding into

[REDACTED]. The area that we believe should receive management attention also includes [REDACTED] [REDACTED] e that is located [REDACTED]. There is vehicular traffic up and down the wash as well as on a road located on state trust land immediately west of the 7B property line that enables access to the site. Fences are down throughout the area.

Recommendations:

- i. Wildlife friendly fencing along the western boundary of the 7B and at the [REDACTED]. The fence should extend across [REDACTED]. This will hopefully keep vehicular traffic in the main San Pedro River channel and away from the archaeological sites. Ideally the entire property would be fenced restricting vehicular traffic from the entire San Pedro floodplain area and adjoining washes.
- ii. A professional archaeologist should inventory the site to determine specific treatment measures that may include more detailed mapping of above ground features that would supplement the mapping that we have already done, mapping and backfilling looter pits and possibly capping portions of the site with off-site soils.
- iii. Monthly site monitoring by ranch managers.

1. [REDACTED] Located on [REDACTED]. The south entrance is restricted by a locked gate. The north entrance is open to vehicular traffic. The site has been looted and [REDACTED] has been mechanically disturbed. Some soil erosion is also occurring [REDACTED].

Recommendations:

- i. A strong traffic barrier and locked gate is required at the north entrance.
- ii. A professional archaeologist should inventory the site to determine specific treatment measures that may include more detailed mapping of above ground features that would supplement the mapping that we have already done, mapping and backfilling looter pits and possibly capping portions of the site with off-site soils.
- iii. Monthly site monitoring by ranch managers.

2. [REDACTED] Located [REDACTED]. This portion of the road is on the 7B property. The site is not fenced. There are several large potholes and [REDACTED]. A backhoe may have been used [REDACTED]. Based on the surface disturbance notes, some looting may have occurred in the last five years.

Recommendations:

- i. Close that portion of the road that passes through southern end of the 7B on this side of the San Pedro River. Ideally the road can be re-located west on state trust land allowing the 7B to restrict vehicular traffic through the ranch property without disrupting this recreational activity which could cause folks to violate any road closure efforts. If a suitable route re-location cannot be found, we recommend a four strand, wildlife friendly fence at the eastern edge of the road be installed. Because the site extends so close to the road, the fence should be located with the assistance of an archaeologist.
 - ii. A geo-referenced, site map should be prepared of [REDACTED]
[REDACTED]
 - iii. A site visit by a professional archaeologist to recommend treatment options that would at a minimum include mapping and backfilling of looter pits with off-site soils.
 - iv. Monthly site monitoring by ranch managers.
3. Two sites, [REDACTED], do not have the benefit of a recent site visit that would allow us to ascertain management needs. It is recommended that site visits occur on these two remaining sites, possibly in conjunction with the professional archaeologist site visits recommended above.
 4. The remaining sites do not appear to be impacted at this time and several are not easily accessible. For all these sites continued avoidance of any ground disturbing activities is the only recommendation at this time.

We appreciate the opportunity to better inform you of the significant cultural resources on the 7B and commend your interest in managing these resources appropriately prior to their conveyance to BLM. We look forward to continuing to assist you with this project. Please call if you need additional information or clarification.

Sincerely,

Andy Laurenzi

Cc: William H. Doelle, CEO & President Center for Desert Archaeology
Mike Weitlinger, Resolution Copper Company

7b Ranch Lands

The following are our known site records for archaeological sites documented on the 7b RANCH owned by the Swift Land & Cattle Company. This information is of record with AZSITE maintained by Arizona State Museum. Most of the documented occurrences are a result of exhaustive survey work conducted by the Center for Desert Archaeology. [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

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