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7B RANCH MANAGEMENT PLAN

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.

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.

<u>The Past: Ownership and Agriculture</u>

Portions of the 7B Ranch have been farmed since at least the early 1900's. The Clark family, whose descendants 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.

Photo 1: 7B Ranch Mesquite Bosque. Photo: C. Andresen

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 bottomlands aside from farming and the grazing of cattle.

The Present: Land Use Issues, Threats and Trespass

Between 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 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 had been another common occurrence, either as a trespass activity or through informal agreement with neighboring ranchers. This suppressed the native plant diversity in the understory, which reduces habitat diversity for birds and other wildlife. Grazing has now been 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 the past, grazing of the 7B decreased fuel loading in the bosque 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. In 2013, Resolution began hosting wood collection events for employees. These events clear downed trees that help with fire prevention and at the same time offers free mesquite firewood.

An additional concern is the extremely dense, nearly impenetrable thickets of mesquite that 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.

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.

Photo 2: 7B Ranch Sonoran Desert uplands. Photo: C. Andresen

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.

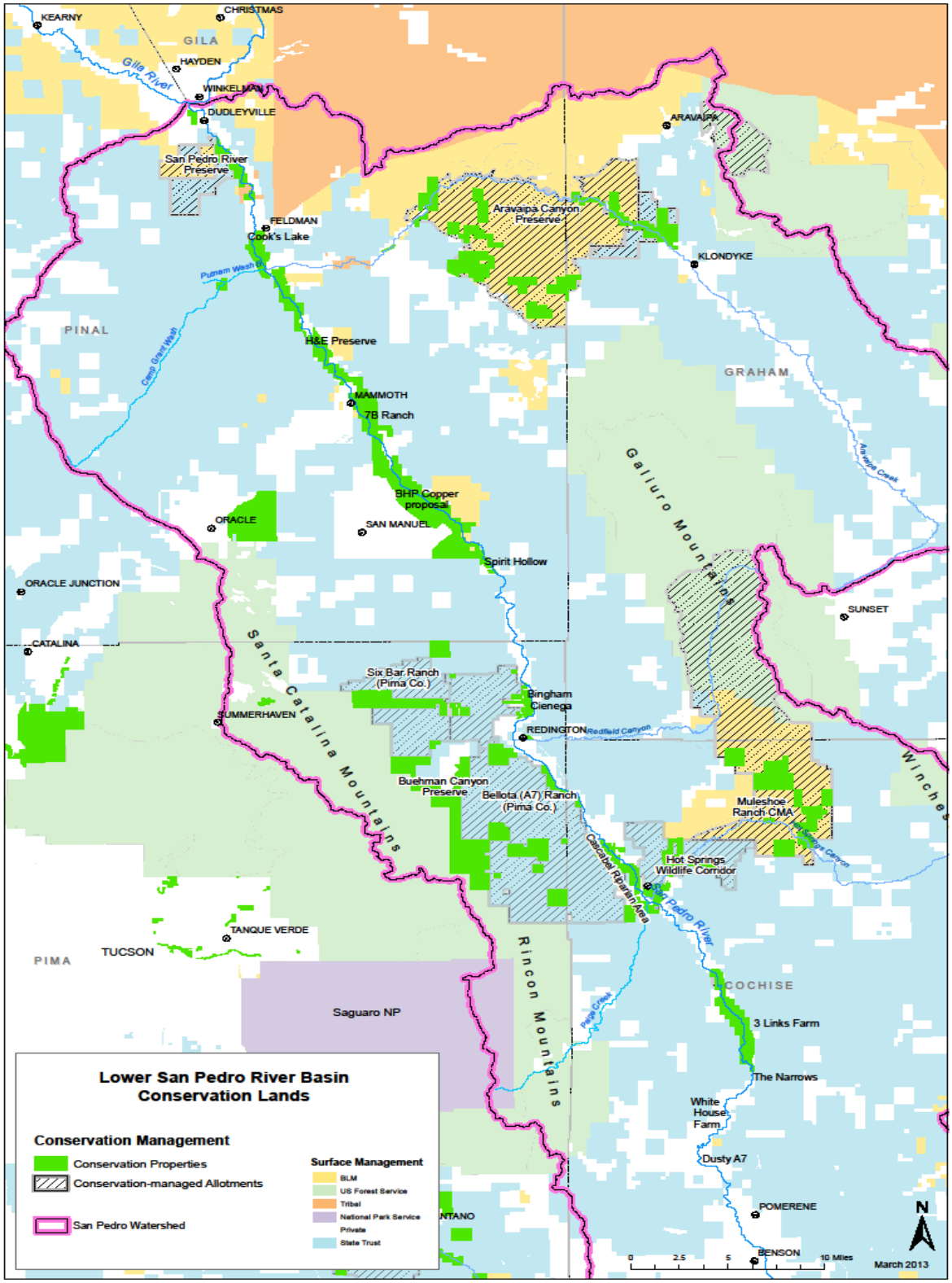


Figure 1: Lower San Pedro River Basin Conservation Lands.

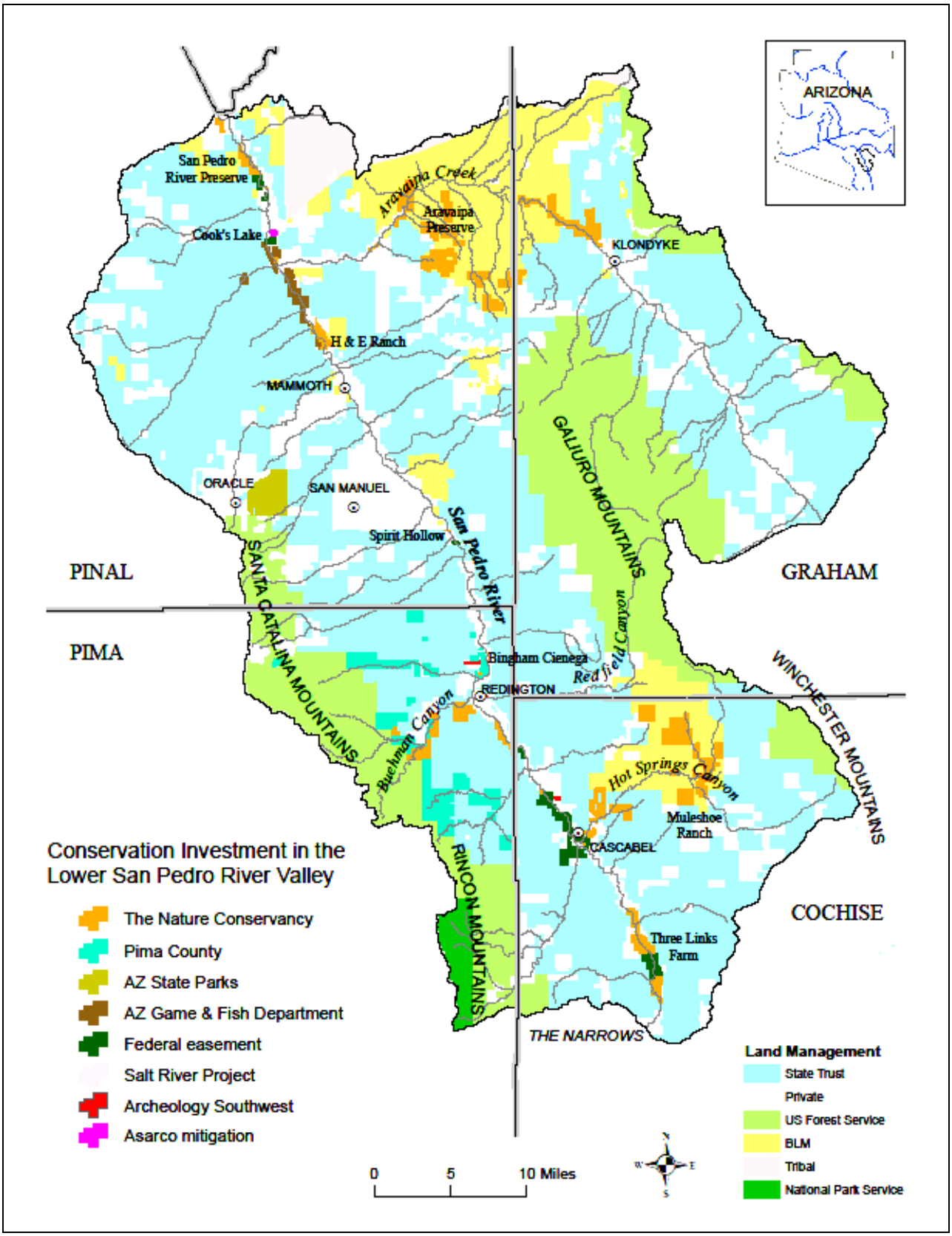


Figure 2: Conservation Investment in the Lower San Pedro River Valley.

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 included bat and herpetological surveys (Appendices 2 & 3).

Photo 3: Long-eared owl in the mesquite bosque. Photo: C. Andresen

Vegetation surveys and photo point monitoring on the 7B was initiated in 2013 and will continue periodically. These surveys are being performed by a contract organization.

Beginning in June 2015, Yellow-billed cuckoo surveys are being performed each year during the migration and breeding season of that species. The Yellow-billed cuckoo was listed by U.S. Fish and Wildlife Service as a Threatened species in 2014.

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).

Photo 4: Lowland Leopard frog at the 7B wetland. C.Andresen.

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. Due to management actions in 2007 to remove nonnative frog and fish species, that wetland provides aquatic habitat for lowland leopard frog, while also supporting a higher diversity and density of birds and other wildlife than elsewhere on the property.

Other vegetation communities on the 7B include saguaro-dominated Sonoran Desert scrub (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. 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 from 5 observation wells currently indicate averages between 29 and 50 feet deep. (Figure 1). Monitoring data shows seasonal change in groundwater depth since regular monitoring was initiated by TNC. The depth-to-groundwater also indicates a general trend of a dropping water table. Rain during the winter months is not sufficient to recharge the water table. The continued drought is also a likely contributor. However, determining the causes for the dropping water table is beyond the scope of this plan.

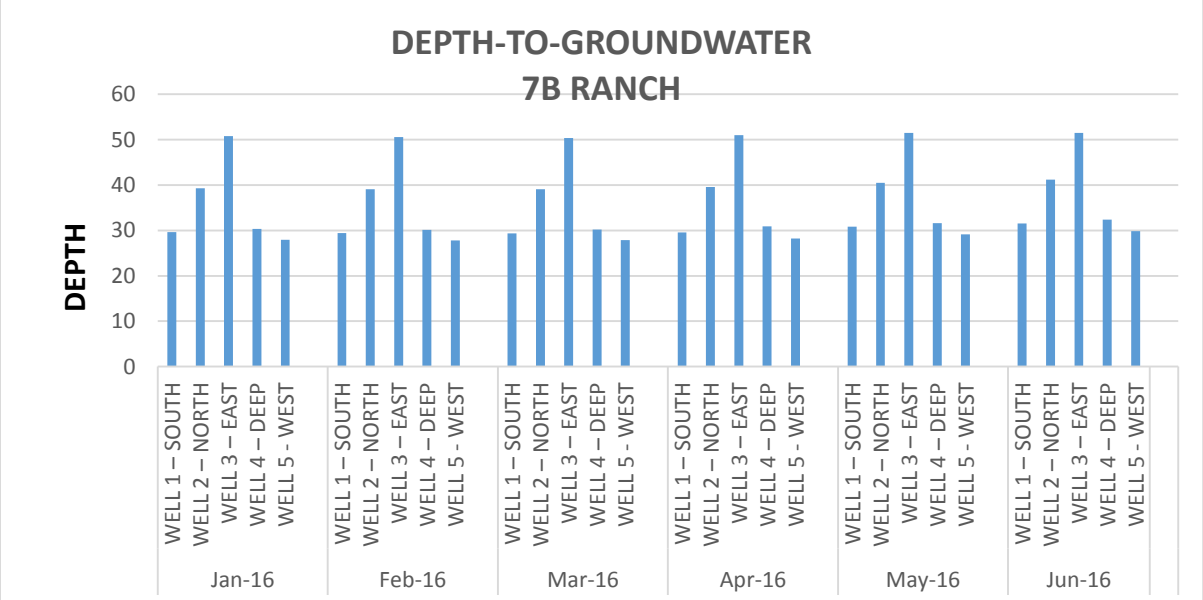


Figure 3: Depth-to-Groundwater measurements of the 5 wells on the 7B Ranch.

A senior surface water claim for 177 irrigated acres with a priority date of 1898 is associated with the property. 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 acre feet annually 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.

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.

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 Archaeology Southwest. 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 pot hunting, 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. The threats are generally localized, and specific to trespass use of the property for wood, grazing, and recreational uses.

These threats are reasonably managed by the perimeter fence (completed in 2011), 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 sub flow 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.

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.

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 *moderate* risk.

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.

Photo 5: Vermilion Flycatcher in the mesquite bosque. C. Andresen

Contacts have been made with local fire departments, and a draft fire response plan has been developed for the 7B property.

Coordination with the responding units will be crucial in implementing the 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 State Fire Dispatch (800.309.7081) will be contacted. It is expected that San Manuel and/ or Oracle to be the responding wildland fire crews due to their location and expected response time.

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.

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 30-50 ft. deep (Figure 1). 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

Until the construction of a perimeter fence in 2011, cattle use on the 7B mesquite bosque had 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.

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.

V. Security and basic property management

1. Fencing

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

Historically, locals had 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 has greatly discouraged illegal woodcutting. In addition, patrolling for breaches in a fence line has been much easier than looking for footprints along nine miles of unfenced property.

Fencing around the bosque was installed in 2011. As a result, the incidence of trespassing for illegal woodcutting, hunting, vandalisim and dumping has been nearly eliminated. It also effectively excludes cattle from returning to the bosque.

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 required the building of approximately 47,250 feet of new security fencing. Copper Creek Road roughly bisects the 7B mesquite bosque; therefore, the bosque was 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 were fenced.

In both the north and south portions, on the west side of the bosque, the fence was built between

the bottom lands and the river channel. To the east, the fence was placed between the bosque and the road. A property survey was performed to ensure that placement of the fence was properly aligned along shared boundaries. The survey was a crucial component of improving neighbor relations. It also provided an opportunity to educate and work with neighbors during the fence clearing.

Appendix 7 summarizes the known archeological sites found within and adjacent to the 7B boundaries. Fencing for three important and vulnerable sites was incorporated into the management plan. Approximately 6,300 feet of new fencing was installed to protect these three sites. The location of these sites is not mapped in this document to avoid accidental distribution of that sensitive information.

2. Fire Management

The removal of the cattle to reduce unauthorized trespass grazing has increased fine and ladder fuels in the bosque. The perimeter fence has decreased 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 fire line around the bosque-public road interface.
  1. An ATV with pull-behind mower to mow the fire lanes and open areas was purchased in 2011.
  2. Mowing will be done at least twice per year, or as deemed necessary.
- The 7B Ranch fire suppression plan will be implemented in the event of a wildland fire.
- Contacts with state, federal, and local fire departments will be updated as necessary.

3. Water

<u>Monitoring threats to groundwater levels</u>
Ground water data across partnerships and properties along the lower San Pedro River has created a collective understanding of groundwater levels at a watershed scale. Three monitoring wells were installed in November 2015. Two are shallow piezometers, and one is a deep well (50 feet). 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 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.

The wells were 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. Coordination and sharing of data is currently being discussed by TNC, RCM, and other property managers and partners in the Lower San Pedro River valley.

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.

1. Mesquite Bosque

As of January 2011, the livestock have been removed from the property. In the event that management of the understory and fine fuels requires clearing, removal of vegetation by mowing or harrow-dragging may be used on a case by case basis. TNC has advised that grazing be completely discontinued on the property.
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.

2. Surveys

A. Yellow Billed Cuckoo Surveys
Conduct Yellow-billed cuckoo surveys according to the survey protocol (Johnson, et al, 2015) to document the presence / absence of this bird in the mesquite bosque. These surveys began officially in 2015.
Rationale: The birds had been observed and documented as casual observations in previous years. With the U.S. Fish and Wildlife listing of the bird as Threatened in 2014, it is important to maintain accurate records of their location on the 7B Ranch.

Photo 6: Yellow-billed cuckoo that was observed in the 7B mesquite bosque. Photo: C. Andresen

B. Herpetological Surveys
Conduct herpetological surveys using drift fences and traps as well as transect surveys to document species and populations. These surveys were done seasonally in 2012, 2013, and 2014. They will be repeated again every 3-5 years. The most recent herpetological list is included as Appendix 3.
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 is performed every few years to 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

Continue monitoring shallow groundwater conditions, using the five observation wells where depth-to-groundwater measurements are taken on a monthly schedule (Figure 3). Data from groundwater monitoring will be included in regular reports to Resolution Copper Mining.
Rationale: These piezometers and wells 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.

B. Wetland monitoring

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 annually.
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 exclosure 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

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.

D. Exotic species monitoring

1. Perform weekly inspections of the perimeter fences 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 exclosure 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

Following the removal of grazing from the property, a vegetation monitoring plan was developed by RCM and the consulting firm, SWCA, to track changes in understory vegetation and the development of fine fuels. In addition to the photo points previously established around the rehabilitated wetland, permanent photo points were established at appropriate locations throughout the property for long-term monitoring of changes in the vegetative structure. The consulting firm SWCA began a program of periodic monitoring in 2013. Monitoring is expected to continue approximately every 5 years.

With the removal of cattle from the bosque, in the long-term it will be useful to have a sense of the plant and animal communities that will develop. This information can aid in building management actions at other properties TNC manages in the region. The information can serve to be a successful model for other land management strategies for federal land transfers. It will be important to be able to share the success of this grazing exclusion and transition of ownership with government agencies and conservation groups.

VIII. Public contact and community relations

Global IBA designation and birding trail

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. As a partnership project, Resolution, TNC, and the Audubon IBA program worked together to establish a birding and interpretive trail. Establishment of a birding trail at the 7B in recognition of the IBA has been an excellent opportunity to involve the local communities, county and state entities to celebrate this designation.

The trail was built by staff and volunteers of The Nature Conservancy and Resolution Copper Mining, and open to the public in April 2013. The signs were made by a professional sign company. A sign-in book is kept at the trailhead, and indicates that the trail is visited by approximately 200 people per year since 2014, with the majority of visitors using the trail in the spring. The trail is patrolled by TNC staff at least weekly, with trail maintenance taking place as required. Maintenance includes but is not limited to clearing fallen limbs and grooming the trail using a mower or drag-harrow.

Public access

Public access to the 7B Ranch is limited to the 1.2-mile loop trail through the mesquite bosque. Cowboy Miller Road and Copper Creek Road through the property are used to access the State Land Trust and public lands adjacent to the 7B Ranch uplands.

Photo 7: RCM and TNC are instrumental in planning several community events. Photo: C. Andresen

Media outreach

To improve community awareness and outreach, TNC staff continue to work with the communities to describe the land exchange, the 7B Ranch's unique biotic community, the importance of the San Pedro River, and the value of the bosque to bird life and migration. Articles in local papers have featured the history of property, and describe Resolution Copper Mining, who they are, and their role on the San Pedro River and 7B Ranch. TNC staff have presented to school groups and community groups to raise awareness for the trail as well as the San Pedro River.

IX. Annual Reporting

As part of implementing this management plan and per the Management Agreement (contract), The Nature Conservancy will provide an annual report to Resolution Copper Mining in June of each year. Reports will include progress on management actions, summaries of monitoring data, challenges encountered, and any recommended changes in the plan.

Refer to the current Management Agreement for current budget information.

Photo 8: Dragonfly perched at the wetland. Photo: C. Andresen

References

Arizona Department of Water Resources. 1991. Hydrographic survey report for the San Pedro River watershed, in re the general adjudication of the Gila River system and source. Filed with the court November 20, 1991.

Arizona State Forestry Division. 2010. Arizona forest resource assessment. Prepared for the Arizona State Forestry Division and U.S. Forest Service by The Arizona Forest Resources Task Group. 130 pp.

Brand, L.A., D.J. Cerasale, T.D. Rich, and D.J. Krueper. 2009. Breeding and migratory birds. Pp. 153-174 in J.C. Stromberg and B. Tellman, eds. Ecology and Conservation of the San Pedro River. University of Arizona Press, Tucson.

Brand, L.A., G.C. White and B.R. Noon. 2008. Factors influencing species richness and community composition of breeding birds in a desert riparian corridor. The Condor 110 (2): 199–210

Commission for Environmental Cooperation. 1999. Sustaining and enhancing riparian migratory bird habitat on the Upper San Pedro River. Final draft from the San Pedro Expert Study Team.

Fish and Wildlife Service, 50 CFR Part 17, RIN 1018–AF37, Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the Huachuca Water Umbel, a Plant. Federal Register/Vol. 64, No. 132 /Monday, July 12, 1999 /Rules and Regulations. Pp. 37441-37443.

Haney, J. 2005. The Lower San Pedro River— Hydrology and Flow Restoration for Biodiversity Conservation. Pp. 311-315 in G.J.Gottfried, B.S. Gebow, L.G. Eskew, and C.B. Edminster, compilers. Connecting mountain islands and desert seas: biodiversity and management of the Madrean Archipelago II. 2004 May 11-15; Tucson, AZ. Proceedings RMRS-P-36. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

Leenhouts, J.M., J.C. Stromberg, and R.L. Scott. 2006. Hydrologic requirements of and consumptive ground-water use by riparian vegetation along the San Pedro River, Arizona: U. S. Geological Survey, Scientific Investigations Report 2005-5163.

Logan Simpson Design Inc. 2009. Pinal County Community Wildfire Protection Plan. 148 pp.

McNatt, R. 1979 Discovery and Loss of a New Locality for the Gila topminnow, *Poeciliopsis Occidentalis occidentalis* (Poeciliidae). The Southwestern Naturalist 24 (3): 555-556.

Stromberg, J.C., K.J. Bagstad, and E. Makings. 2009. Floristic diversity. Pp. 89-104 in J.C. Stromberg and B. Tellman, eds. Ecology and Conservation of the San Pedro River. Univ. of Arizona Press, Tucson.

Stromberg, J.C., S.D. Wilkins, and J.A. Tress. 1993. Vegetation-hydrology models: implications for management of *Prosopis velutina* (velvet mesquite) riparian ecosystems. Ecological Applications 3: 307-314.

Stromberg, J.C. 1993. Riparian mesquite forests: a review of their ecology, threats and recovery potential. Journal of the Arizona-Nevada Academy of Science 27:111-124.

Appendix 1. Birds of the 7B Ranch.

Avian species detected during surveys of the 7B Ranch from 2006 through 2015, updated in 2015. Surveys were conducted by Audubon's Important Bird Areas Program, and staff from TNC and RCM.

Species_Code	Name	Total
GAQU	Gambel's Quail	3
GBHE	Great Blue Heron	3
GREG	Great Egret	4
TUVU	Turkey Vulture	16
NOHA	Northern Harrier	2
COHA	Cooper's Hawk	14
GRHA	Gray Hawk	18
SWHA	Swainson's Hawk	5
RTHA	Red-tailed Hawk	5
AMKE	American Kestrel	1
PRFA	Prairie Falcon	1
WWDO	White-winged Dove	83
MODO	Mourning Dove	119
INDO	Inca Dove	2
COGD	Common Ground-Dove	22
YBCU	Yellow-billed Cuckoo	2
GRRO	Greater Roadrunner	8
GHOW	Great Horned Owl	2
LENI	Lesser Nighthawk	5
BBLH	Broad-billed Hummingbird	1
BCHU	Black-chinned Hummingbird	9
ANHU	Anna's Hummingbird	4
COHU	Costa's Hummingbird	2
GIWO	Gila Woodpecker	116
RNSA	Red-naped Sapsucker	1
LBWO	Ladder-backed Woodpecker	44
NOFL	Northern Flicker	21
GIFL	Gilded Flicker	2
NBTY	Northern Beardless-Tyrannulet	6
WEWP	Western Wood-Pewee	5
GRFL	Gray Flycatcher	6
BLPH	Black Phoebe	3
SAPH	Say's Phoebe	5
VEFL	Vermilion Flycatcher	279
ATFL	Ash-throated Flycatcher	129
BCFL	Brown-crested Flycatcher	54
CAKI	Cassin's Kingbird	2
WEKI	Western Kingbird	30

	BEVI	Bell's Vireo	388	
	PLVI	Plumbeous Vireo	7	
	CAVI	Cassin's Vireo	2	
	HUVI	Hutton's Vireo	1	
	WAVI	Warbling Vireo	6	
	AMCR	American Crow	1	
	CORA	Common Raven	21	
	PUMA	Purple Martin	1	
	NRWS	Northern Rough-winged Swallow	14	
	BARS	Barn Swallow	2	
	VERD	Verdin	53	
	BUSH	Bushtit	4	
	CACW	Cactus Wren	2	
	BEWR	Bewick's Wren	184	
	HOWR	House Wren	3	
	RCKI	Ruby-crowned Kinglet	6	
	BGGN	Blue-gray Gnatcatcher	10	
	BTGN	Black-tailed Gnatcatcher	10	
	NOMO	Northern Mockingbird	2	
	CBTH	Curve-billed Thrasher	1	
	PHAI	Phainopepla	50	
	OCWA	Orange-crowned Warbler	4	
	VIWA	Virginia's Warbler	1	
	LUWA	Lucy's Warbler	798	
	YWAR	Yellow Warbler	60	
	YRWA	Yellow-rumped Warbler	19	
	BTYW	Black-throated Gray Warbler	2	
	TOWA	Townsend's Warbler	3	
	LOWA	Louisiana Waterthrush	3	
	MGWA	MacGillivray's Warbler	2	
	COYE	Common Yellowthroat	5	
	WIWA	Wilson's Warbler	28	
	YBCH	Yellow-breasted Chat	116	
	SUTA	Summer Tanager	80	
	WETA	Western Tanager	15	
	GTTO	Green-tailed Towhee	9	
	CANT	Canyon Towhee	13	
	ABTO	Abert's Towhee	58	
	CHSP	Chipping Sparrow	26	
	LASP	Lark Sparrow	16	
	BTSP	Black-throated Sparrow	29	
	SOSP	Song Sparrow	36	
	LISP	Lincoln's Sparrow	37	
	WCSP	White-crowned Sparrow	16	

	DEJU	Dark-eyed Junco	5	
	NOCA	Northern Cardinal	65	
	PYRR	Pyrrhuloxia	2	
	BHGR	Black-headed Grosbeak	2	
	BLGR	Blue Grosbeak	2	
	LAZB	Lazuli Bunting	1	
	COGR	Common Grackle	1	
	GTGR	Great-tailed Grackle	2	
	BHCO	Brown-headed Cowbird	15	
	HOOR	Hooded Oriole	11	
	BUOR	Bullock's Oriole	7	
	HOFI	House Finch	55	
	LEGO	Lesser Goldfinch	77	

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	*Antrozous pallidus*
Townsend's big-eared bats	*Corynorhinus townsendii*
big brown bats	*Eptesicus fuscus*
California myotis	*Myotis californicus*
cave myotis	*Myotis velifer*

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

Amphibians and reptiles were surveyed by TNC staff during summers of 2010-2014 using funnel traps and drift fences set near the hot well, in washes, and adjacent to the river bottom. Additional species were recorded during general management activities throughout the year. This list was updated in 2014.

Common Name	Species	Wetland & Drift Fence	Bosque	River Road, & Upland Drift Fence
Common king snake (california)	*Lampropeltis getula*	X	X	X
Long-nosed snake	*Rhinocheilus lecontei*			X
Striped whip snake	*Masticophis taeniatus*			X
Western patch-nosed snake	*Salvadora hexalepis*	X	X	X
Ring-necked snake	*Diadophis punctatus*			
Gopher snake	*Pituophis catenifer*	X	X	X
Ground snake (banded)	*Sonora semiannulata*			X
Coachwhip (red and black phase)	*Masticophis flagellum*	X	X	X
Western diamondback	*Crotalus atrox*	X	X	X
Mohave rattlesnake	*Crotalus scutulatus*		X	X
Tiger rattlesnake	*Crotalus tigris*			X
Checkered garter snake	*Thamnophis marcianus*	X		
Black-neck garter snake	*Thamnophis cyrtopsis*	X		
Western banded gecko	*Coleonyx variegatus*		X	X
Gila monster	*Heloderma suspectum*		X	X
Desert Tortoise	*Gopherus agassizii*		X	X
Sonoran mud turtle	*Kinosternon sonoriense*	X	X	X
Ornate box turtle	*Terrapene ornata*	X	X	X
Sonoran Desert Toad	*Bufo alvarius*	X		X
Bull Frog	*Rana catesbeiana*	X		
Lowland leopard frog	*Rana yavapaiensis*	X		
Regal horned lizard	*Phrynosoma solare*		X	X
Whiptail lizard	*Aspidoscelis sp.*	X	X	X
Clark's spiny lizard	*Sceloporus clarkii*	X	X	X

Common Name	Species	Wetland & Drift Fence	Bosque	River Road, & Upland Drift Fence
Desert spiny lizard	*Sceloporus magister*	X		X
Eastern collared lizard	*Crotaphytus nebrius*			X
Zebra-tailed lizard	*Callisaurus draconoides*			X
Greater earless lizard	*Cophosaurus texanus*			X
Common lesser earless lizard	*Holbrookia maculata*			X
Ornate tree lizard	*Urosaurus ornatus*	X	X	X
Common side-blotched lizard	*Uta stansburiana*			X
Western Lyresnake	*Trimorphodon biscutatus*			X
Sonoran Coralsnake	*Micruroides euryxanthus*			X
Red-spotted toad	*Bufo punctatus*		X	X
Nightsnake	*Hypsiglena torquata*			X
Black-headed snake	*Tantilla hobartsmithi*		X	
Couch's spadefoot	*Scaphiopus couchii*		X	X
Long-nosed Leopard lizard	*Gambelia wislizenii*		X	X

Appendix 4. Letter from the Center for Desert Archaeology & 7B Site Cards.

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. BB:6:5 (Camp Village) - Located on the south side of Mammoth Wash, this site has numerous looter's pits. The northern most platform mound is eroding into Mammoth Wash. The area that we believe should receive management attention also includes BB:6:150 a small, multi-room structure believed to be a farmstead associated with Camp Village that is located immediately north of Mammoth Wash.

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:

1. Wildlife friendly fencing along the western boundary of the 7B and at the eastern base of the terraces immediately north and south of Mammoth Wash. The fence should extend across Mammoth Wash at the east and west ends. 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.
2. 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.
3. Monthly site monitoring by ranch managers.

2. ***BB:6:11 (Leverton):*** Located on a mesa immediately south of Copper Creek Road the site is accessible by a powerline access road that includes a north and south entrance off of the River Road. The south entrance is restricted by a locked gate. The north entrance is open to vehicular traffic. The site has been looted and a large portion of the platform mound has been mechanically disturbed. Some soil erosion is also occurring on the mound.

Recommendations:

1. A strong traffic barrier and locked gate is required at the north entrance.
2. 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. Monthly site monitoring by ranch managers.

3. ***BB:6:126 (multi-room pueblo).*** Located immediately adjacent to a road that is heavily traveled by ATVs that passes in close proximity to this site. This portion of the road is on the 7B property. The site is not fenced. There are several large potholes and many of the rooms have been dug. A backhoe may have been used in one of the rooms. Based on the surface disturbance notes, some looting may have occurred in the last five years.

Recommendations:

1. 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.

2. A geo-referenced, site map should be prepared of wall alignments and other archaeological features.
3. 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. Monthly site monitoring by ranch managers.

Two sites, BB:6:140 and BB:6:141, 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.

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 Site Cards

The following 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. This survey work excluded the recent Holocene floodplain area but instead focused on the Late Pleistocene terraces bordering the modern floodplain.

BB:2:028 - dry land farming features

BB:6:005 – "Camp Village" Two platform mounds, compound wall and room block

BB:6:011 - "Leverton" Two platform mounds, compound wall and room block

BB:6:058 - dry land farming feature

BB:6:121 – light artifact scatter

BB:6:122 – dry land farming feature

BB:6:124 – light to moderate artifact scatter

BB:6:125 – unknown rock alignment (not located on May 2010 site visit)

BB:6:126 – Room block (8-20 rooms)

BB:6:137 - dry land farming feature

BB:6:138 – light scatter possible compound wall (not located on May 2010 visit)

BB:6:139 - dry land farming feature

BB:6:140 – Compound and possible trash mounds (no recent site visit)

BB:6:141 – 3-4 room masonry structures (no recent site visit)

BB:6:145 - dry land farming features

BB:6:147 – dry land farming features

BB:6:149 - dry land farming feature

BB:6:150 – 3-4 room masonry structures, immediately north across the wash from Camp Village

BB:6:156 – dry land farming features

BB:6:157 – dry land farming features

BB:6:158 – dry land farming features

Appendix 5

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

E. Linwood Smith Gordon L. Bender

The preparation of this document was financed in part through a comprehensive planning grant from the U.S. Department of Housing and Urban Development

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.

WILLIAM G. ROE
2318 EAST ELM STREET
TUCSON
ARIZONA 85719

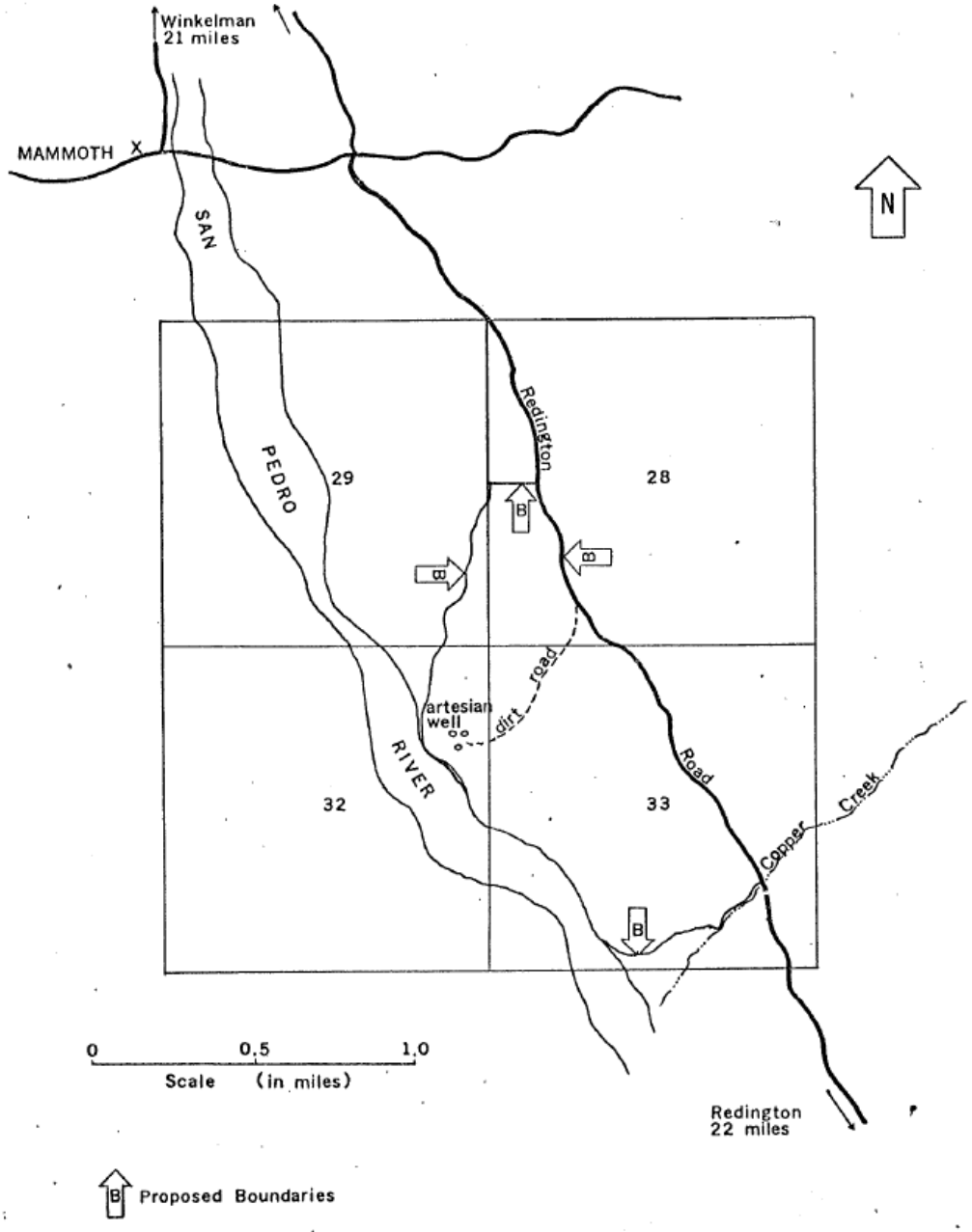


FIGURE 1. Sketch map of the proposed Mammoth Mesquite Bosque Natural Area.

Appendix 6

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

BIOTIC THEMES

Paul S. Martin
Department of Geosciences
University of Arizona
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 nalipid, 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.

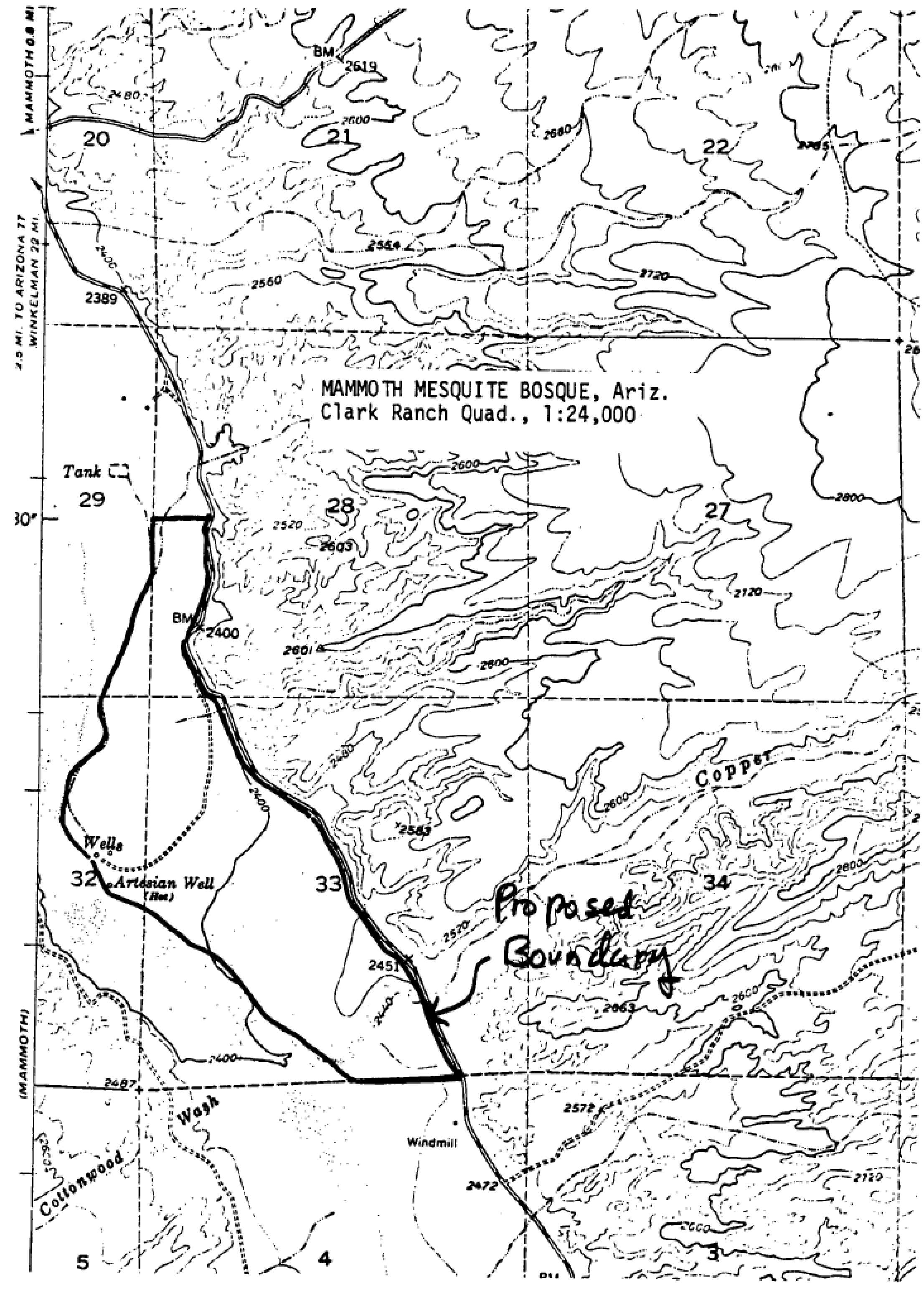
Land use and threats: Mesquite forest (bosque) is being cleared and cultivated along many parts of the San Pedro River. Uncleared mesquite outside fence is often damaged severely by wood cutters. This area is heavily grazed. The road to the hot spring mentioned by Smith has overgrown and is apparently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


MAMMOTH MESQUITE BOSQUE, Ariz.
Clark Ranch Quad., 1:24,000
Proposed Boundary
Tank
Wells
Artesian Well
Windmill
Copper
Cottonwood
Wash
20
21
22
27
28
29
32
33
34
3
4
5
2619
2389
2400
2451
2487
2472
2572