

ECOLOGICAL OVERVIEW

**LX BAR RANCH PARCEL
YAVAPAI COUNTY, ARIZONA**

Prepared for:



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EXECUTIVE SUMMARY

WestLand Resources, Inc. (WestLand) was retained by Resolution Copper Company to prepare an Ecological Overview for approximately 59.9 hectares (148 acres) of land along Tangle Creek within the Tonto National Forest in Yavapai County, Arizona (referred to as the Property or LX Bar Ranch in this report). The Property is located in the central portion of a broad valley known as Bloody Basin, and includes a reach of Tangle Creek as well as adjacent floodplains and upland areas. Tangle Creek is an ephemeral tributary to the Verde River, a perennial watercourse about 9.6 km (6 miles) due east of the Property. The nearest large metropolitan community is Phoenix, Arizona, located approximately 64 kilometers (40 miles) south of the Property.

This ecological evaluation was conducted to identify the type and relative condition of the biological resources found on and evaluate ecological characteristics of the Property to identify remarkable resource attributes, and to briefly assess their conservation values in reference to local and regional contexts.

The Property is a private in-holding within the Tonto National Forest, and was reportedly homesteaded by the Babbitt family in the early 1890s for use as winter cattle grazing land. On-site development is limited to a house foundation and several wood and tin outbuildings, water management features, and small areas (less than 10 percent of the Property) cleared for agriculture. The majority of the Property is undeveloped land likely used for cattle grazing. However, the Property has not been actively used for cattle grazing since the mid 1990s.

From a biological perspective, the most productive vegetation within the Property is the mesoriparian trees and shrubs that line a portion of Tangle Creek channel and occur on the tributary alluvial fans, particularly near the house site. The mesoriparian tree species include net-leaf hackberry, mesquite, ash, and sycamore. It is the groves of net-leaf hackberry that provide exceptional habitat value for wildlife, especially migratory and nesting songbirds. Judging by the trunk diameters of the trees, many of the net-leaf hackberry and perhaps each of the sycamores are likely to be at least 100 years old. The two abandoned farm fields on the property appear to be reverting to open woodlands or thickets of hackberry, mesquite, and cat-claw acacia. Reestablishment of these woodlands and thickets will likely increase connectivity for wildlife of the landscape within Bloody Basin in two ways, (1) as a migratory corridor, and (2) in providing shelter, forage, and breeding sites for a number of bird and mammal species. As such, conservation values and opportunities for the Property are dependent on long-term approaches to land management, because long-term approaches are required for the vegetation to recover. Returning the Property to public domain would prevent private development and ease regional management concerns.

1. INTRODUCTION AND METHODS

1.1. PURPOSE AND ORGANIZATION OF REPORT

WestLand Resources, Inc. (WestLand) was retained by Resolution Copper Company (Resolution) to prepare an Ecological Overview for approximately 59.9 hectares (148 acres) of land along Tangle Creek in the Tonto National Forest, in Yavapai County, Arizona. In this report, the site is referred to as the Property or LX Bar Ranch.

The Property is located within the floodplain and adjacent upland areas of Tangle Creek near the center of a broad valley known as Bloody Basin (Figures 1 and 2), approximately 48 kilometers (km; 30 miles) north of Cave Creek, Arizona and 9.6 km (6 miles) due west of the Verde River. Access to the Property is via Forest Road (FR) 24 from the south or FR 269 (Bloody Basin Road) from the west.

This ecological overview was conducted to identify the types and condition of the biological resources on and evaluate ecological characteristics of the Property to identify remarkable resource attributes, and to briefly assess their current and potential conservation values in reference to local and regional (Verde River watershed) contexts.

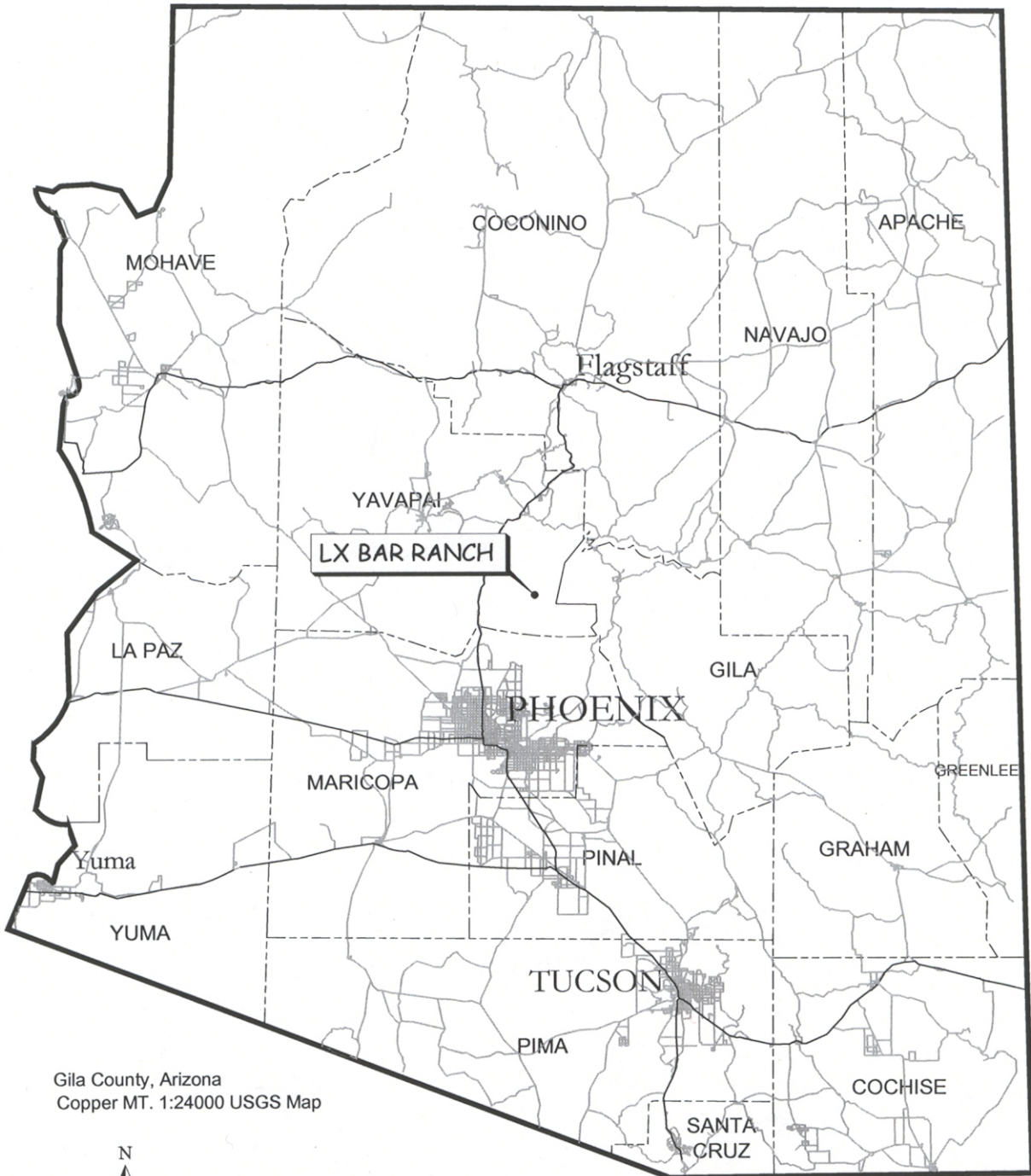
This report is presented in seven sections:

- Section 1 – Introduction and Methods (this section)
- Section 2 – Regional Setting
- Section 3 – Existing and Adjacent Land Uses
- Section 4 – Physical Resources
- Section 5 – Biological Resources
- Section 6 – Conservation Value and Opportunities
- Section 7 – References

1.2. METHODS AND APPROACH

WestLand completed this evaluation by conducting background research of available natural history information and aerial photography of the Property and surrounding region, and through field reconnaissance to identify, map, and photograph vegetation and habitat. WestLand also interviewed the current Property owner to determine the human development history of the LX Bar Ranch.

ARIZONA



Gila County, Arizona
Copper MT. 1:24000 USGS Map



LX BAR RANCH

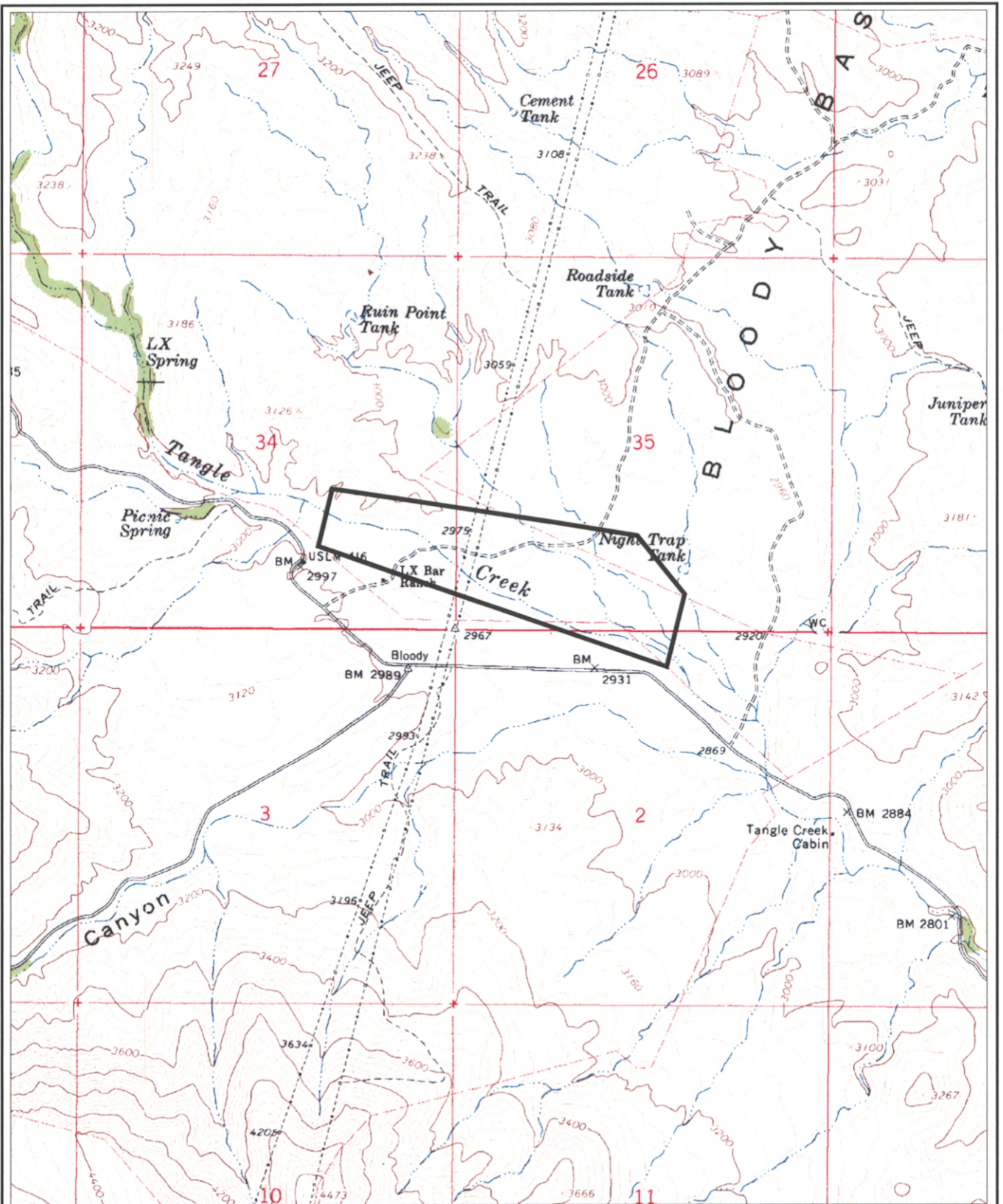
VICINITY MAP

Figure 1

WestLand Resources Inc.

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Yavapai County, Arizona
 Bloody Basin 1:24000 USGS Map

— SITE BOUNDARY



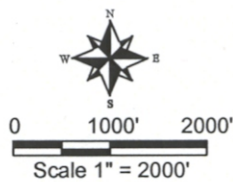
**Resolution
 Copper Company**

LX BAR RANCH

LX BAR RANCH STUDY AREA

Figure 2

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WestLand obtained and reviewed available literature pertaining to biotic communities of the southwest, riparian ecosystems, and the Verde River valley. Primary sources of information that were reviewed include *Biotic Communities of the Southwestern United States and Northwestern Mexico* (Brown, 1994; a comprehensive reference of the desert southwest), wildlife abstracts from the U.S. Fish & Wildlife Service (USFWS), and various websites maintained by the US Forest Service (USFS) Tonto National Forest, Arizona Department of Water Resources (ADWR), and other agencies and conservation organizations. These references and aerial photographs were reviewed to identify potential and confirm observed vegetation communities on the Property.

In order to identify special status species that might occur on the Property, we obtained the current list of federally listed species for Yavapai County from the USFWS database (USFWS, 2003). The life history of each of these species was then studied to determine habitat requirements such as vegetation communities, elevation ranges, presence of surface water, and other landscape features. This information was utilized in a screening analysis to identify species potentially occurring on or near the Property for further evaluation, as well as eliminate those that were unlikely to occur. Additional literature research was conducted and summarized for those species that have known ranges and habitat requirements close to or which have a high likelihood of occurring on the Property.

WestLand biologists conducted field reconnaissance of the Property on February 9, 2004 to observe current site conditions, biological resources, and abiotic factors affecting biota distribution and relative habitat value within the Property. The reconnaissance consisted of a vehicular tour of perimeter roads and a pedestrian reconnaissance that focused on areas of interest identified during the background research phase of the evaluation. Inaccessible areas were scanned using binoculars to observe distant vegetation communities. Field observations were recorded and photographs taken during the reconnaissance to document the various physical and biological resources present on the Property. In particular, vegetation patterns were noted and observed species recorded. The general vegetation patterns were delineated on an aerial photograph and transcribed onto a vegetation map of the Property. Direct and indirect (tracks, scat, burrows, etc.) observation of wildlife was noted.

Special attention was paid to the Property's potential to provide habitat for special status species as mentioned above. Using the list of special status species and data collected during field reconnaissance, we conducted a screening analysis to identify those special status species that had the potential to occur on or near the Property. Information such as the Property's elevation range, habitat type, availability of water resources, climate data, and other related information was compiled and compared to the background research information to predict the potential for occurrence of listed species in the Property area. The screening analysis resulted in a list of target species that have potential to occur on the Property.

2. REGIONAL SETTING

The Property is located near the center of a broad valley known as Bloody Basin. Four streams drain the basin; the broadness of the valley is the geomorphological result of erosion of the surrounding mountains and accretion in ancient lakebeds and recent streambeds. Tangle Creek, as previously mentioned, bisects the LX Bar Ranch from west-northwest to east-southeast and flows to the Verde River; Roundtree



Photograph 1. Overview of Bloody Basin.

Canyon enters Bloody Basin from the southwest (and reaches a confluence with Tangle Creek just east of the Property); and Soda Springs and Red Creeks enter Bloody Basin from the north and then flow east to the Verde River. Streambeds within the broad portion of the valley slope gently to the east. Nearly flat floodplains adjacent to the streams are up to approximately 2 meters (m; 19.5 feet [ft]) above the active channels. Upland areas display moderately sloping to rolling hills, with some steep to vertical sections where erosion has removed sedimentary (alluvial [stream bed] or lacustrine [lake bed]) deposits. Surrounding mountains are rugged and rise steeply to elevations near 1,800 m (6,000 ft) above mean sea level (amsl).

In a larger context, the Bloody Basin lies in the Verde River Watershed; the Verde River itself is some 19 km (12 miles) downstream (and 9.6 km [6 miles] in a straight line) from the Property.

The closest large metropolitan community is Phoenix, Arizona, located approximately 64 km (40 miles) to the south. Maricopa County, in which the Phoenix metropolitan area lies, has some 3.2 million residents. Cave Creek (2000 census population = 3,720; US Census Bureau, 2004), a rural suburb of Phoenix, is located about 48 km (30 miles) south. Regardless of the presence of the Phoenix metropolitan area, no significantly populous communities are within 32 km (20 miles) of the Property.

3. PROPERTY AND ADJACENT LAND USES

The LX Bar Ranch was reportedly homesteaded by the Babbitt family in the early 1890s. The 59.9-hectare (148-acre) Property was used for winter cattle grazing, with a full-time resident relying principally on local resources for sustenance until the early 1980s. A diversion of Tangle Creek, 2.4 km (1.5 miles) upstream from the Property, was constructed to provide water to the ranch via pipeline and canal. Several reservoirs, an aboveground water tank, and an in-ground cistern are apparently fed by this diversion, surface water runoff, and groundwater. Water was used for human drinking supply, crops (for human and cattle consumption), and stock watering. Farming was apparently conducted in two parts of the western portion of the Property; agricultural activities reportedly ceased in the early 1970s.



Photograph 2. Horse-drawn seeder at LX Bar Ranch.

The majority of the Property remains undeveloped. The developed portion of the Property, including the aforementioned agricultural areas, constitutes less than 10 percent of the total acreage. A ranch house was located near the cleared areas; according to the current Property owner, the house burned in the early 1980s. The remaining foundation is a fairly substantial concrete structure that suggests construction in the 1930 to 1950 period. [Prior to about 1930, homesteaders typically built foundations with a minimum amount of cement in the concrete.] A small number of other wood and metal sheds are present in the home site vicinity; these were apparently used for a variety of storage and functional purposes. Recent use of the Property consisted of seasonal cowboy occupancy, which ceased approximately six years ago. The Property has been largely inactive since. Evidence was observed of unauthorized dispersed recreational activities (hunting) encroaching on the Property from adjacent public lands. Cattle from adjacent grazing operations also occasionally stray on to the LX Bar Ranch: one cow was observed onsite during the WestLand site reconnaissance, and tracks were present throughout the Property.

The Property is currently owned by the Schuster family, which acquired the LX Bar Ranch from the Babbitt family in 1983.

Land uses evident on adjoining properties include the aforementioned dispersed recreational activities (hunting) and cattle grazing. Designated pack and jeep trails are located on nearby public lands. Roads

accessing the site and surrounding properties are dirt, and are frequently enjoyed by off-road vehicle enthusiasts. The Great Western Trail, a designated off-road vehicle route from the Mexican to Canadian borders, utilizes the adjacent Forest Roads. A Salt River Project high voltage transmission line bisects the Property from north to south, extending to the Phoenix metropolitan area.

4. PHYSICAL RESOURCES

This section describes the regional and local features of the ground surface (shape, type, and age), climate (temperature and precipitation ranges), and water (surface and subsurface occurrence).

4.1. LANDFORM AND TOPOGRAPHY

The LX Bar Ranch is situated near the center of the Bloody Basin (Figure 2). Bloody Basin is defined by a series of mesas and mountains around its perimeter. East Cedar Mountain lies about 6.5 km (4 miles) to the south-southeast and West Cedar Mountain is about 5 km (3 miles) due south of the LX Bar Ranch. Cooks Mesa, Hutch Mesa, Mesa Butte, Turret Peak, Pine Mountain, Yellow Jacket Mesa, and Rugged Mesa extend clockwise in a general arc around Bloody Basin from the southwest to the northeast; these peaks and mesas are generally 6 to 10 km (4 to 6 miles) from the center of Bloody Basin and range from just under 1,220 to nearly 1,830 m (4,000 to nearly 6,000 ft) amsl.

The Bloody Basin watershed includes a portion of each of these mesas and peaks. The slopes ascending from Bloody Basin to the ridge and mesa tops are generally not cliff-forming until near the tops of the mesas. Perhaps the most notable topographic feature within Bloody Basin are the steep, easily eroded cliffs of Tertiary lacustrine sediments that at one time filled much of Bloody Basin but have been largely lost due to erosion. The eroded cliffs are highly reflective and are easily seen from a distance.

The southern portion of Bloody Basin is drained by Tangle Creek (which bisects the Property) and the northern portion by Red Creek. Tangle Creek flows to the southeast, dropping about 200 m (600 ft) from the Property elevation before reaching the Verde River about 13.9 km (8.6 miles) from the Property. Red Creek flows south and then east, reaching the Verde River about 9.7 km (6 miles) from the Bloody Basin; Red Creek approaches within about 4 km (2.5 miles) of the Property. An approximately 1,500-m (5,000-ft) long stretch of Tangle Creek's channel is found within the LX Bar Ranch. On the Property, this channel descends from about 900 to 880 m (2,960 to 2,880 ft) amsl. The stream terrace on the south side and the slopes of the ridge to the northwest of the Property are only about 6 to 12 m (20 to 40 ft) above the stream channel. The LX Bar Ranch homestead site is within about 600 ft (200 m) of the channel of Tangle Creek.

4.2. GEOLOGY AND GEOMORPHOLOGY

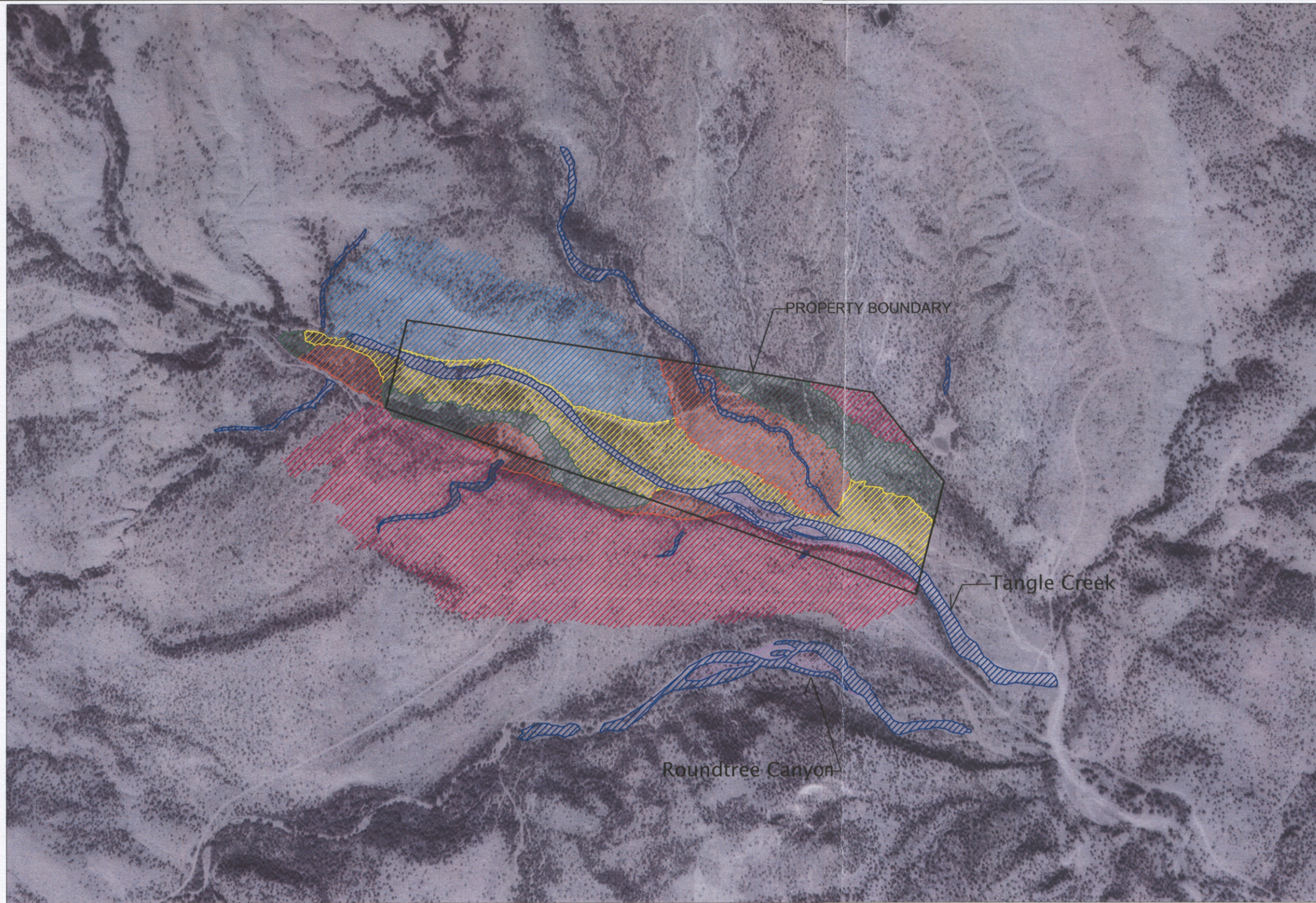
A detailed geologic map (1:24,000 scale) has not been developed for the Bloody Basin area; the following description is based upon regional geologic mapping and observations made during WestLand's field reconnaissance of the Property and vicinity. WestLand prepared a provisional geologic map (Figure 3) of the Property and immediate vicinity based on this information and aerial photography.

The LX Bar Ranch does not display bedrock outcrops. The exposed surfaces are either Tertiary lacustrine sediments or younger (Quaternary) alluvial sediments. However, Miocene basalts deposited as lava flows 8 to 16 million years ago (Ma) almost completely surround Bloody Basin. The lava flows are evident as the mesas named and located in Section 4.1. In addition to the basalts, early Proterozoic granitic rocks are exposed along the southeast-facing slopes of Pine Mountain on the northwest side of Bloody Basin. There are several relatively small outcrops of older Tertiary sediments (Oligocene to perhaps as early as Paleocene) several miles to the west of the Property (Figure 1 in Elston and Young, 1991). The older Tertiary sediments both here and elsewhere in Arizona are significant in terms of our understanding of regional and local erosion and landscape development during late Cretaceous and earliest Tertiary.








4.2.1. Active Channels and Holocene Floodplains

Holocene (recent) floodplains occupy about 50 percent of the eastern half of the Property, and possibly a similar proportion of land on the west half. The original surface of the west floodplain has been significantly altered by farming and other anthropogenic activities. The eastern floodplain has not been as extensively altered and it is still possible to identify the braided network of older abandoned channels (Figure 3). The more recent (mid- to late-Holocene?) floodplains in this area are no more than 1 m (3 ft) above (higher than) the active channel bottom.

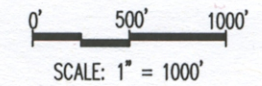
There are areas on the northeast side of Tangle Creek and in the abandoned fields south of Tangle Creek in the southwestern portion of the Property that may be early Holocene floodplains. Some portions of these floodplains are farther from Tangle Creek than the floodplains in the eastern half and appear to be at least 2 m (6 ft) above the active channel. At least two factors could contribute to the greater height above the channel in these sections: 1) they are older, higher floodplains; and 2) they have a contribution of alluvium deposited across the floodplain as outwash from tributary channels.



Surficial Geology of LX Bar Ranch on Tangle Creek.


-  Active Channels
-  Point Bars in Active Channels
-  Late Holocene and Recent Floodplain
-  Early Holocene Floodplain
-  Alluvial Fans deposited by Tributary Channels
-  Pleistocene Stream Terraces
-  Tertiary Lacustrine Sediment

Disclaimer: This map is incomplete and provisional. The major surficial units have been identified for the property but their boundaries have not been methodically delineated and require further field verification.



Yavapai County, Arizona
Bloody Basin 1:24000 USGS Map

Photo Source: USGS Digital Ortho Quarter Quadrangles.
Bloody Basin SE & SW. 1992


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— PROPERTY BOUNDARY



LX BAR RANCH

Surficial Geology Map

Figure 3



Photograph 3

Alluvial fans (or “alluvial cones”) deposited by tributary streams are evident on the northeast side of the Property. A similar alluvial fan appears to be present for the tributary on the south side of Tangle Creek; this channel no longer spreads out onto the alluvial fan but delivers water and sediment into the tinaja (with a rock and mortar dam) immediately east of the homestead site (Photograph 3). This alluvial fan’s original configuration has been considerably altered by ranching or farming and by the construction of the water collection and management features outlined in Section 3.

4.2.2. Pleistocene Stream Terraces

Along the southern edge of the Property is a relatively flat surface that is likely a Pleistocene stream terrace. The surface soil is dark red (suggesting the accumulation of aeolian clay), stratification has a plant aspect, and on the surface are numerous cobbles (“lag”) (Photograph 4). The Tangle Creek channel



Photograph 4

cuts into this terrace for about a third of a mile along the south side of the channel at the southeastern extreme of the Property (Figure 3).



Photograph 5

Just north of the southeast corner of the property, this bank cut is a 7- to 8-m (20- to 25-ft) tall



Photograph 6

vertical section of the stream terrace (Photographs 5 and 6). The large boulder evident on the side of the exposure in Photograph 6 is approximately 150 by 80

centimeters (cm; 60 by 30 inches [in]). An orange color, further suggesting aeolian clay, is evident in the soil of this exposed cross-section of the terrace. The rounded boulders and cobblestones within the terrace clearly indicate fluvial transport, and those which have loosened and accumulated at the toe of the slope likely minimize further erosion of the terrace.

4.2.3. Tertiary Lacustrine Sediments

Elston and Young (1991) and Richard et al. (2000) recognize Bloody Basin (including the LX Bar Ranch) to have sedimentary deposits with an age range of Pliocene to middle Miocene (2 to 16 Ma). Sedimentary deposits of this age occur widely in central and southeastern Arizona in basins that have generally become dissected since deposition. Impoundment of the valleys of the Verde, Gila, San Pedro



rivers and elsewhere was one of the consequences of extensional faulting in the mid-Tertiary in Arizona. Sedimentary deposits of this age include conglomerate, sandstone, mudstone, siltstone, limestone, and gypsum. Lacustrine deposits are evident around the perimeter of Bloody Basin, suggesting that this area was similarly impounded in the Tertiary period. On this Property, the lacustrine sediments have many fine-grained, often finely laminar horizons; some of the horizons are limestone or marls several

inches to several feet thick and low ridge of the northwestern corner of the Property (Photograph 7). The beds do not dip, which suggests that these particular lacustrine deposits occurred after late Tertiary regional faulting.

4.3. CLIMATE

There are no long-term weather stations within Bloody Basin. One of the nearest weather stations is the Ashdale Ranger Station, about 19 km (12 miles) south-southwest of Bloody Basin (Sellers and Hill, 1974). The Ashdale Ranger Station is at 1,006 m (3,300 ft) amsl in the Cave Creek area north of Phoenix. Its climate probably resembles that of Bloody Basin more closely than any of the long-term weather stations to the north and east (e.g., Irving, Dugas, or Payson), which are more than 300 m (1,000 feet) higher in elevation than the Property. However, Bloody Basin, because it is a basin almost completely surrounded by higher mesas and ridges, may depart significantly both in temperatures and precipitation from what is recorded at Ashdale. For example, cold air drainage from the surrounding

higher slopes in the winter may result in relatively colder nights in Bloody Basin. Summer temperatures could be higher than Ashdale's if Bloody Basin behaves as a heat trap.

Regardless, mean daily maximum temperatures for Ashdale Ranger Station range from a high of 36° Centigrade (C; 97° Fahrenheit [F]) in July to a low of 15.5° C (59° F) in January. Mean daily minimum temperatures at this station range from a high of 18° C (64° F) in August to a low of -1.7° C (29° F) in December (Sellers and Hill, 1974). Mean annual precipitation for Ashdale (from a very limited period of record of 1941 to 1948) is 39 cm (15.3 in). As is true for much of central and southern Arizona, precipitation is almost evenly divided between the monsoon season (July-October) and winter (December-March).

Reconstructed stream flows for the Verde River watershed for the period of 1580 to 1980 (Smith and Stockton, 1981) based on tree-ring data and stream gage, suggest that a period of high flow occurred in the Verde River in the early 1900s (1900-1920). Presumably, similar high flows (above average) occurred in Tangle Creek at this time, which would correspond with the early agricultural activities of LX Bar Ranch. Accordingly, it is possible that the construction of the surface water management features described above took advantage of these higher flows, and subsequent decades of low-flow adversely impacted agriculture.

4.4 WATER RESOURCES

4.4.1. Surface Water Resources

Similarly, there are no stream gauges along Tangle Creek. As observed during WestLand's field reconnaissance, Tangle Creek was dry in the reach where it passes through the LX Bar Ranch. The channel bottom is generally sandy. The boulders in and along the south edge of the channel do not have black watermarks, suggesting that surface flow in Tangle Creek on the LX Bar Ranch is rare and very brief. Based on these observations, flow in this reach is likely ephemeral, occurring only during periods of unusually heavy rains or rapid snow melts.

Tangle Creek's channel bottom is bedrock about one mile east (downstream) of the Property, below the confluence with Roundtree Canyon (about ¼ mile east of the Property boundary). During WestLand's field reconnaissance of this portion of Tangle Creek, surface flow provided a stream width of about 1.5 to 3 m (5 to 10 ft) and a depth of about 15 cm (6 in) along much of the channel.

It should be noted that Brown, et al. (1978) identifies portions of Tangle Creek as perennial in a state-wide map of perennial streams. However, at the scale provided, it is not possible to determine if the Property lies within an ephemeral or perennial reach. It is likely that perennial reaches are or were

present both upstream and downstream of the Property, where near-surface bedrock faces groundwater to the surface.

4.4.2. Ground Water Resources

Available information from the US Geological Survey (USGS) and ADWR indicates that three registered wells are present on or near the Property. Unfortunately, detailed information regarding precise location, depth of well or water, or ownership of these wells, was not available from these sources.



Photograph 8

There is one open, hand-dug well to the north of the ranch house (Photograph 8). This well has an inner diameter of about 4.5 by 4.5 m (15 by 15 ft) and is approximately 3.5 m (12 ft) deep, within a larger, shallow bermed impoundment. There is a rock-and-mortar casement for at least the upper 2.5 m (8 ft) of the well. Water apparently infiltrates the bottom and lower sides of this well. When we visited the site on February 9, 2004, we found that the water level was about 1.5 m (5 ft) below the

surrounding ground surface within the larger impoundment. This particular hand-dug well is likely to have been sited intentionally in an area where groundwater was or is unusually close to the surface. Elsewhere on LX Bar Ranch's floodplain beside Tangle Creek (judging by the small, widely spaced, slow growing mesquite), we suspect that groundwater occurs at a greater depth (perhaps 7 m [20 ft]).

Within 5 km [3 miles] to the west (upstream) of LX Bar Ranch, there are at least twelve named springs and seeps in the upper drainages of Tangle Creek and Roundtree Canyon (USGS, 1981). As described in Section 6, additional research into the hydrogeologic characteristics of these features may yield important information about groundwater occurrence within the vicinity of the Property.

5. BIOLOGICAL RESOURCES

5.1. VEGETATION AND HABITAT DESCRIPTION

The Property's vegetation can be described in terms of several of Brown's (1994) biotic communities of the southwestern United States and northwestern Mexico. Generally, the area is an interdigitating assemblage of three biotas: Great Basin Conifer Woodland, the Arizona Upland Subdivision of the Sonoran Desertscrub, and Semidesert Grassland, with one final biotic community, the Sonoran Riparian Deciduous Forest, in a defined corridor. The Arizona Upland Subdivision appears to intrude into Bloody Basin along the lacustrine sediments and on bedrock outcrops (with fairly dense stands of saguaros [*Carnegiea gigantea*] only a mile or two farther east along Tangle Creek). Both the Great Basin Conifer Woodland (represented by one-seed juniper *Juniperus monosperma*) and Semidesert Grassland (represented by a number of grass species, including the locally dominant side-oats grama, *Bouteloua curtipendula*) are also clearly present on or adjacent to LX Bar Ranch. Two of these biotas, the conifer woodland and grassland, are evident in Photograph 9 of the Property; the third biota occurs on the exposed lacustrine cliffs seen in the distance. The riparian deciduous forest occurs in and along the floodplains of Tangle Creek.



For the broad regional scale that Brown (1994) was addressing, climate plays an over-arching role in determining the distribution and composition of the biotic communities. In an area the size of the Property, the climate (on the scale considered by Brown) is essentially constant. Instead, surficial geology, presence or absence of surface water, depth to groundwater, and topography (slope and aspect) play more significant roles in determining plant species occurrences. Based on these factors, we recognize three groupings of vegetation on the Property:

- (1) active channels, floodplains, and alluvium,
- (2) stream terrace, and
- (3) lacustrine sediments.

The following sections discuss on-site vegetation and habitats in respect to these groupings.

5.1.1 Active channels, floodplains, and alluvium.

Plants were generally absent from the center or bottom of the active Tangle Creek channel (Photograph 10). At least three factors can be considered in accounting for the absence of plants in the channel:

- (1) the coarse channel sand is difficult as a site for seed germination,
- (2) the groundwater level apparently drops quickly after surface flow, dropping faster than establishing seedlings can match with taproot growth, and
- (3) flood flows in the channel are apparently forceful enough to scour the occasional plant that succeeds in establishing.



Photograph 10

Point bars within the channel (Photograph 11) and the youngest, lowest floodplains (Photograph 12) have dense stands of burro-brush (*Hymenoclea* sp.).



Photograph 11



Photograph 12

Along the western portion of the active channel's edge, we found several mature sycamores (*Platanus wrightii*) (Photographs 13 and 14), as well as mature ash (*Fraxinus velutina*) (Photograph 15) and net-leaf hackberry (*Celtis reticulata*). As discussed in Section 4.3, it is likely that a period of high flow occurred in Tangle Creek in the early decades of the 1900s. Based on the assumed age of these trees, it is likely that they became established during a wetter period than is exhibited today. We did not see juvenile sycamores and ash along the channel's edge; the general impression was that no recruitment of saplings of these two species has occurred in a long time. Along the eastern portion of the active channel's edge, at the point where the channel cuts into the Pleistocene stream terrace described above, there is a dense stand of net-leaf hackberry, one-seed juniper (*Juniperus monosperma*), and barberry (*Berberis haematocarpa*) growing on the shaded slopes down to the channel (Photographs 16, 17, and 18); this vegetation is delineated in Figure 4.



Photograph 13.



Photograph 14.



Photograph 15.



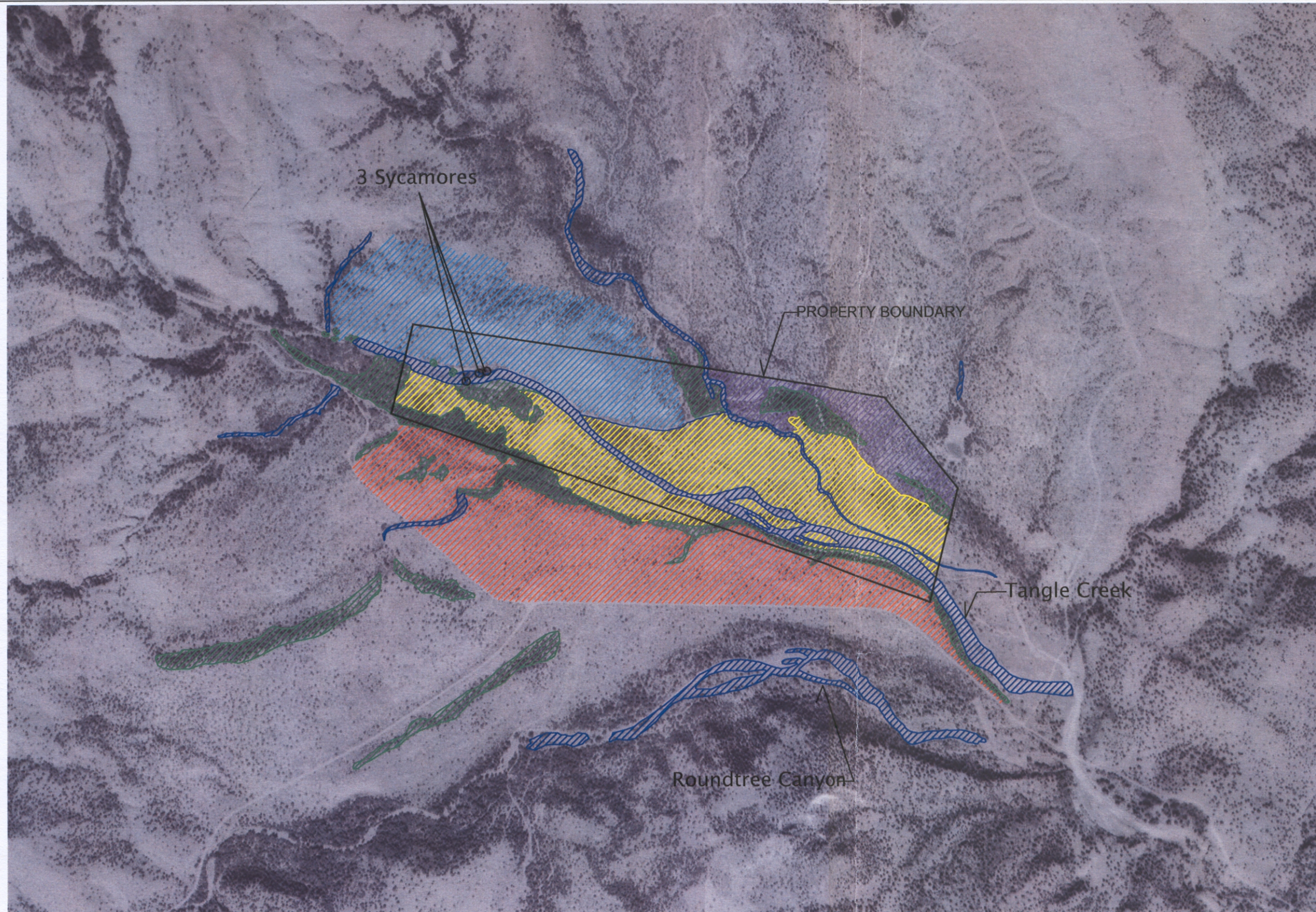
Photograph 16.









Photograph 17.



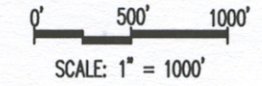
Photograph 18.



Vegetation of LX Bar Ranch on Tangle Creek


-  Active Channel: Generally with no vegetation. Along Tangle Creek on the west side of the Property are three large sycamores (*Platanus wrightii*), ash (*Fraxinus velutina*), and net-leaf hackberry trees (*Celtis reticulata*) in or on the edge of the active channel.
-  Point Bars and Holocene Floodplains: Burrobrush (*Hymenoclea* sp.) forms dense stands on the youngest surfaces; small mesquite (*Prosopis velutina*), catclaw (*Acacia greggii*) and burrobrush occur on the younger abandoned fields; large mesquite and juniper, on the oldest Holocene surfaces. Net-leaf hackberry and ash are on portions of the Holocene floodplain on the west side of the Property. Note: Large mesquite and juniper occur on both the tributary alluvial fans and the oldest Holocene floodplains on the northeast side of the Property; delineation of these two surfaces was not made during the site visit.
-  Upper alluvial fans of tributaries: Along the south edge of the floodplain particularly near the LX Ranch house site are dense stands of net-leaf hackberry trees. Juniper (*Juniperus monosperma*), mesquite, and barberry (*Berberis haematocarpa*) are on the upper alluvial fan on the northeast side of property.
-  Pleistocene Stream Terrace: Widely scattered small mesquite and catclaw along with pencil cholla (*Opuntia leptocaulis*) on this surface. Along the north edge of the south terrace on the Property is a steep bank cut, this north-facing channel bank supports a dense stand of small net-leaf hackberry, juniper, and barberry.
-  Tertiary Lacustrine sediments: Sediments are actively eroding, much of the surface within the Property is unstable and bare. Trees and shrubs are widely spaced and include crucifixion thorn (*Canotia holacantha*), foothill palo verde (*Cercidium microphyllum*), and ephedra (*Ephedra aspera*).
-  Uplands of low density mesquite and juniper.

Disclaimer: This map is incomplete and provisional.



Yavapai County, Arizona
Bloody Basin 1:24000 USGS Map

Photo Source: USGS Digital Ortho Quarter Quadrangles,
Bloody Basin SE & SW. 1992



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— PROPERTY BOUNDARY



LX BAR RANCH

Vegetation Map

Figure 4



On the floodplain along the eastern portion of Tangle Creek (Photograph 19) are large desert willows (*Chilopsis linearis*), which in central and southern Arizona, are common where the alluvial material beneath the channel is deep.

Alluvial fans at the mouth of the tributary at the homestead site support a fairly dense stand of large net-leaf hackberry; some of these trees are at least 7 to 9 m (20 to 30 ft) tall. These trees are probably in excess of 100

years old. They can be seen as the bluish gray grove of trees along the higher edge of the floodplain in the panoramic photopage (Photograph 20). Some of the hackberry trees have the liana, canyon grape (*Vitis arizonica*), growing in their crowns; the hackberry tree in Photograph 21 has succumbed to the weight of the liana. Older, higher alluvial fans or floodplains have open stands of mesquite, juniper, and barberry (Photograph 22). In general, this was the only area we saw dense stands of winter ephemerals (native red fescue [*Bromus rubra*] and red-stemmed filaree [*Erodium cicutarium*]). Our impression was that the stands of mesquite, juniper, barberry, and large hackberry trees on these higher alluvial fans/floodplains are likely to be the most productive vegetation on the property in terms of biomass (especially the contribution by winter ephemerals) and fruit (hackberry, barberry, and juniper berries and mesquite pods).

5.1.2 Stream Terraces

There are several notable features of the vegetation on the stream terrace near the old corral and loading chute on the southeast portion of the property (Photograph 23). These features are:

- (1) General lack of herbaceous plants, especially grasses, on the stream terrace;
- (2) Short stature of mesquite (2 to 4 m [6.5 to 13 ft]);
- (3) Greater density of pencil cholla (*Opuntia leptocaulis*) on this surface, with many of the pencil chollas growing beneath mesquite; and
- (4) Junipers less abundant on this surface than on the higher rocky hillsides, the alluvial fans of the minor tributaries, or on the north-facing bank cuts of this same stream terrace.



Photograph 20.



Photograph 21.



Photograph 22.



Photograph 23.

A primary feature of undegraded middle to late Pleistocene surfaces is the accumulation of aeolian clay in the uppermost, argillic horizon (Bull, 1991; McAuliffe, 1995; Youberg and Helmick, 2001). This clay-rich soil is relatively more difficult for seedlings to establish (and older woody plants to grow) in than soils of the younger alluvium. Comparatively, precipitation is able to infiltrate to greater depths on younger soils that lack the well-developed argillic horizons present on the Pleistocene surface. We would suggest that the Property may have supported perennial grasses prior to ranching; but with year-round intense grazing in the late 1800s and early 1900s, the grasses were killed. Grasses and other perennials on this argillic surface may require many more decades of careful land management before a trend in reestablishment is exhibited.

5.1.3 Tertiary Lacustrine Sediments

The lacustrine sediments are soft, easily eroded and, therefore, unstable. Reflecting this instability, a large portion of the lacustrine slopes present on the northwestern extreme of the Property was devoid of significant vegetation. Junipers and small mesquite were scattered on both the upper and lower slopes. Crucifixion thorn (*Canotia holacantha*), a tree common on many of the lacustrine sediments in central and southeastern Arizona, is also present on this surface (dark green shrubs in distance, Photograph 24).



Photograph 24

This plant is not necessarily restricted to lacustrine sediments; it also occurs on limestone outcrops. Boundary ephedra (*Ephedra aspera*) occurs on the slopes of the lacustrine sediment on the LX Bar Ranch. This particular species of *Ephedra* generally is restricted to limestone outcrops or limy soils (such as exposed petrocalcic horizons). We found flat-top buckwheat (*Eriogonum fasciculatum*), a fairly common wild buckwheat in this area of Arizona, only on the lacustrine sediments on

the Property. It did occur on the thin soils of bedrock to the south of the Property (off site). The subtropical foothill paloverde (*Cercidium microphyllum*) also occurred on the lacustrine sediment; this occurrence on the Property is near its most northern occurrence in central Arizona.

5.1.4. Human Altered Aspects of LX Ranch

There are two abandoned fields on the LX Bar Ranch; both are in the floodplain on the south side of Tangle Creek. One is west of the homestead site and is evident both in the 1965 aerial photograph (Appendix A, Figure 1) and in the site panoramic photograph previously mentioned (Photograph 20).

The other abandoned field is to the east of the homestead site (Photograph 25). The east field was abandoned in the early 1970s, and already has a large number of mesquite and catclaw acacia (*Acacia greggii*), about 2 m (6 ft) in height, naturally recruited in the field. An abandoned horse-drawn seed planter in the east field (Photograph 26) suggests that corn and other food crops (not just forage crops) had been grown in these fields.



Photograph 25



Photograph 26

There is a series of earthen canals and berms on the Property, concentrated around the homestead site. These features have affected natural surface water flow. The canals divert and maintain surface water close to the south, upper edge of the Tangle Creek floodplain, while the berms near the edge of the active channel likely keep floodwaters diverted away from the now-abandoned farm fields. The canals are likely to enhance the growth and survivorship of the stands of net-leaf hackberry trees. The effect of diverting floodwater from covering the farm fields is not known but may delay or reduce the rate of natural revegetation.

The Property has been grazed, probably intensely, in the past. The bare, grassless stream terrace surface and the lack of sapling sycamores and ash trees may be directly or indirectly related to at least a century of cattle grazing.

5.2. WILDLIFE

As described above, the biotic communities (as identified by Brown, 1994) on the Property are Great Basin Conifer Woodland, the Arizona Upland Subdivision of the Sonoran Desertscrub, Semidesert Grassland, and the Sonoran Riparian Deciduous Forest. Wildlife species found on the Property are expected to include representatives of these biotic communities. As with other lowland vegetation communities in the southwestern United States, habitat values for both migrating and breeding territorial bird species on the Property are expected to be positively correlated with the amount of vegetation (vegetation volume) present (Mills et al., unpublished). For example, we would expect the dense stands

of mature net-leaf hackberry along Tangle Creek to be utilized seasonally by a number of migratory birds as well as providing habitat for breeding birds.

Common reptile and amphibian species that can be expected to occur on the Property include diamondback rattlesnake (*Crotalus atrox*), gopher snake (*Pituophis catenifer*), common kingsnake (*Lampropeltis getula*), tree lizard (*Urosaurus ornatus*), Gila monster (*Heloderma suspectum*), Couch's spadefoot toad (*Scaphiopus couchii*), and Mexican spadefoot toad (*Spea multiplicata*) (Brown, 1994; Stebbins, 2003). Common bird species expected to occur on the Property include northern mockingbird (*Mimus polyglottos*), Gambel's quail (*Callipepla gambelii*), ash-throated flycatcher (*Myiarchus cinerascens*), black-throated gray warbler (*Dendroica negrescens*), black-throated sparrow (*Amphispiza bilineata*), common raven (*Corvus corax*), and greater roadrunner (*Geococcyx californianus*) (National Geographic, 2002). Common mammals expected to occur on the Property include white-footed and deer mice (*Peromyscus spp.*), pack rat (*Neotoma spp.*), cottontail rabbit (*Sylvilagus audubonii* and/or *S. floridanus*), desert mule deer (*Odocoileus hemionus crooki*), javelina (*Tayassu tajacu*), bobcat (*Felis rufus*), mountain lion (*Felis concolor*), raccoon (*Procyon lotor*), and coyote (*Canis latrans*) (Hoffmeister 1986).

Wildlife species observed¹ on the Property by WestLand personnel include black Phoebe (*Sayornis nigricans*), rufous crowned sparrow (*Aimophila ruficeps*), mule deer, deer mouse, and pack rat. It should be noted that the field reconnaissance on this site was conducted in February, when wildlife activity is relatively low and migratory birds are not present. Wintering birds were noted. A more extensive wildlife inventory would be expected in spring and fall.

Wildlife values are expected to be highest in the most vegetatively productive areas of the Property, the higher floodplains and alluvial fans of tributaries of Tangle Creek. Tangle Creek is tributary to the Verde River and provides a riparian habitat linkage for wildlife between lower elevation Sonoran desert habitats and higher elevation plateau habitats.

5.3. SPECIAL STATUS SPECIES

The following special status species list (Table 1) was provided by the USFWS and contains all federally listed threatened, endangered, proposed, and candidate species for Yavapai County, Arizona. The table includes the species' common and scientific name, federal listing status, and the likelihood of occurrence on or near the Property.

¹ Wildlife observations included direct visual observation and the observation of tracks and scat.

Table 1 Special-Status Species: Known or Suspected to Occur in Yavapai County, Arizona.

Species	Status	Potential Occurrence at Project Site and Basis for Potential Occurrence Determination
Arizona agave (<i>Agave arizonica</i>)	Endangered	Unlikely; there are known locations of this plant in the vicinity, however, the site is at the lower extreme of this plants elevation range (3000-6000') and lacks steep, rocky slopes that are preferred by this species. No specimens were observed on the site during field reconnaissance.
Arizona cliffrose (<i>Purshia subintegra</i>)	Endangered	Possible; site contains white soils of tertiary limestone lakebed deposits inhabited by this species. No specimens were observed on the site during field reconnaissance.
Page springsnail (<i>Pyrgulopsis morrisoni</i>)	Candidate	None: This species is locally endemic and only known to occur within a complex of springs within an approximately one mile area along the west side of oak creek around the community of Page Springs, Arizona.
Colorado white salmon (<i>Ptychocheilus lucius</i>)	Endangered	None; aquatic habitat on the site is limited to a cistern and a stock tank that only contains water intermittently. Tangle Creek flows are limited to storm events.
Desert Pupfish (<i>Cyprinodon macularius</i>)	Endangered	None: aquatic habitat on the site is limited to a cistern and a stock tank that only contains water intermittently. Tangle Creek flows are limited to storm events.
Gila Topminnow (<i>Poeciliopsis occidentalis occidentalis</i>)	Endangered	None: aquatic habitat on the site is limited to a cistern and a stock tank that only contains water intermittently. Tangle Creek flows are limited to storm events.
Loach Minnow (<i>Tiaroga cobitis</i>)	Threatened	None: aquatic habitat on the site is limited to a cistern and a stock tank that only contains water intermittently. Tangle Creek flows are limited to storm events.
Razorback Sucker (<i>Xyrauchen texanus</i>)	Endangered	None: aquatic habitat on the site is limited to a cistern and a stock tank that only contains water intermittently. Tangle Creek flows are limited to storm events.
Spikedace (<i>Gila intermedia</i>)	Threatened	None: aquatic habitat on the site is limited to a cistern and a stock tank that only contains water intermittently. Tangle Creek flows are limited to storm events.
Bald Eagle (<i>Haliaeetus leucocephalus</i>)	Threatened	Possible; No potential for breeding because site lacks large cliffs or trees near permanent water. There are documented bald eagle breeding territories along the Verde river approximately 12 miles east of the site. There is some potential for the site to be utilized for foraging by resident or wintering bald eagles.
Chiricahua Leopard Frog (<i>Rana chiricahuensis</i>)	Threatened	None; the elevation of the property (3000 feet) is below that which is known to support this species in central Arizona.
California Brown Pelican (<i>Pelecanus occidentalis californicus</i>)	Endangered	None; occurrence of this species in Arizona is limited to larger lakes and rivers.
Mexican Spotted Owl (<i>Strix occidentalis lucida</i>)	Threatened	None; site lacks canyons and dense forest habitat preferred by this species. Additionally, this species occurs at an elevation range from 4100-900 feet. The elevation of the subject property is 2900-3000 feet.
Southwestern Willow Flycatcher (<i>Empidonax traillii extimus</i>)	Endangered	None; the site lacks riparian habitat containing cottonwood/ willow and tamarisk vegetation communities along rivers and streams that are required by this species.

Table 1 Special-Status Species: Known or Suspected to Occur in Yavapai County, Arizona.

Species	Status	Potential Occurrence at Project Site and Basis for Potential Occurrence Determination
Yellow-billed cuckoo (<i>Coccyzus americanus</i>)	Candidate	None; site lacks large blocks riparian woodlands (Cottonwood, willow, and tamarisk galleries) required by this species.
Primary Sources: USFWS Yavapai County Special-Status Species List (USFWS, 2003)		

The screening analysis conducted by WestLand indicates that three federally listed threatened, endangered, proposed, or candidate species for Yavapai County, Arizona have the potential to occur on the Property. These species are the Arizona agave (*Agave arizonica*), Arizona cliffrose (*Purshia subintegra*), and bald eagle (*Haliaeetus leucocephalus*). These species are discussed in the following sections.

5.3.1. Arizona Agave

Life History

The Arizona agave was listed as endangered in 1984. Arizona agave has attractive rosettes of bright green leaves with dark mahogany margins; mature leaves are 17 to 24 cm (7 to 10 in) long and 2 to 4 cm (0.8 to 1.5 in) wide. The yellow flowers are born on sub-umbellate inflorescence. This species occurs in the transition zone between oak-juniper woodland and mountain mahogany-oak scrub at 900 to 1,850 m (3,000 to 6,000 ft) in elevation. Arizona agave primarily inhabits steep rocky slopes but is also known to occur on drainage bottoms or gentle slopes or saddles. Its current documented range in Arizona includes the New River Mountains (Maricopa and Yavapai Counties) and the Sierra Ancha Mountains (Gila County). Other areas of potential occurrence, such as the Mazatzal Mountains east of the Property, have not been surveyed for Arizona agave. This species was listed as endangered because it was deemed vulnerable due to low numbers and limited distribution. Other perceived threats include habitat degradation due to overgrazing by livestock, feral burros, and wildlife.

There is a growing body of evidence that this plant may be a hybrid. In the final listing for the species, the USFS “expressed doubt” that Arizona agave is a good species indicating that it appears in some respects to be intermediate between two other species in the genus, apparently sets seeds infrequently, and may be of recent hybrid origin. In the *Arizona Rare Plant Field Guide* (Arizona Rare Plant Society, unpublished), the plant is referred to as *agave x. arizonica*, emphasizing its hybrid status. Recent research indicates that the plant is likely a hybrid between *A. chrysantha* and *A. toumeyara*. It is possible that, because of its hybrid status, the USFWS may petition to delist this species (M. Faulk, USFWS, pers. comm. to R. Schmalzel, WestLand).

Potential for Occurrence on the Property

It is unlikely that Arizona agave occurs on the Property. Although there are known locations of this plant in the vicinity (New River Mountains, 8 to 16 km [5 to 10 miles] west of the Property), the Property is at the lower extreme of this plant's elevation range (900 to 1,850 m [3,000 to 6,000 ft]) and lacks the steep, rocky slopes that are preferred by this species. No specimens of any agave species were observed on the Property during field reconnaissance.

5.3.2. Arizona Cliffrose

Life History

The Arizona cliffrose was also listed as an endangered species in 1984. This member of the rose family is an evergreen shrub that can attain heights of 1.5 to 1.8 m (5 to 6 ft). The bark is pale gray and shreddy. Young twigs are covered with dense, soft, white hairs and are glandless. Leaves are also glandless and are usually simple, but can have one to five lobes. Leaf margins are smooth and curled under. Flowers have five white or yellow petals about 1 cm (0.4 in) long. This species only grows on Tertiary limy lacustrine deposits. This species is vulnerable due to localized habitat and a limited number of populations. Threats include urbanization, mining, and overgrazing.

Potential for Occurrence on the Property

It is possible that Arizona cliffrose occurs on the Property. The Property contains the white calcareous soils of Tertiary limy lacustrine deposits (in the northwestern corner) required by this species and is proximate to two of the four known locations of this plant in Arizona (Horseshoe Lake and the Verde Valley, 16 to 32 km [10 to 20 miles] northeast to southeast). However, no specimens were observed on the Property during the field reconnaissance.

5.3.3. Bald Eagle

The bald eagle was downlisted from endangered to threatened status in 1995. This large bird of prey is 1 m (3 ft) long and has a wingspan of 1.8 to 2.1 m (6 to 7 ft). Adults have a characteristic white head and tail with a brown body. Immature bald eagles are mostly dark and lack the white head and tail found in adult birds. Nesting populations are increasing throughout the United States. Arizona supports a small, widely dispersed resident population of approximately 40 pairs that breeds along the Salt, Verde, Gila, Bill Williams, Agua Fria, and San Francisco Rivers and associated reservoirs, and also Tonto and Canyon Creeks. Arizona also hosts a number of wintering eagles, with at least 200 to 300 wintering birds documented each year. Bald eagles in Arizona prey upon fish, waterfowl, small mammals, and carrion.

Potential for Occurrence on the Property

There is no potential for breeding bald eagles to utilize the Property for nesting because the site lacks large cliffs or trees near permanent water. However, there are documented bald eagle breeding territories along the Verde River approximately 19 km (12 miles) east of the site. Bald eagles in Arizona are known to forage 19 km (12 miles) or more from their nest locations (Hunt et. al. 1992). Wintering bald eagles are also known to range widely throughout central Arizona, including areas within the Property's vicinity. Although bald eagles forage primarily along waterways, terrestrial habitats are utilized during certain periods of the year, especially by non-breeding and wintering birds. Cattle (as carrion) may become important as a food item both episodically (during prolonged droughts) and periodically during the calving season (such as early spring) when placentas, stillborn calves, and cows that die while calving become available to scavengers. Terrestrial habitats may also supply deer carrion, rabbits, and other mammals of appropriate size, upland birds, and reptiles (Hunt et al, 1992). Therefore, there is some potential for the Property to be utilized for foraging by resident or wintering bald eagles.

6. CONSERVATION VALUES AND OPPORTUNITIES

LX Bar Ranch is a private in-holding property within an important greenbelt north of metropolitan Phoenix, Arizona. Acquisition of the Property would ensure seamless management of surrounding public lands and offer additional management options with regard to recreation, grazing, and land rehabilitation. The following paragraphs summarize the unique conservation values and opportunities presented by the Property.

6.1. VALUES

From a biological perspective, the most productive vegetation within the Property is the mesoriparian trees and shrubs that line a portion of Tangle Creek channel and occur on the tributary alluvial fans, particularly near the house site. The mesoriparian tree species include net-leaf hackberry, mesquite, ash, and sycamore.

It is the groves of net-leaf hackberry that provide exceptional habitat value for wildlife, especially migratory and nesting songbirds and mammals. As leaves emerge in spring on net-leaf hackberry, a number of warbler species, vireos, and finches such as lazuli bunting (*Passerina amoena*) can be found gleaning insects from the young leaves. Flowering is in spring; fruiting, in fall. Studies are lacking, but casual observation in Arizona suggests that net-leaf hackberry, flowering later in the spring than most other mid-elevation trees and shrubs, avoids frost damage that may more frequently depress fruit production in these other species. As another aspect of its fruit production, net-leaf hackberry may have less variance (be more constant) in year-to-year fruit production than other woody species.

The fruit (a drupe) has a thin, sweet mesocarp surrounding a seed with a hard seed coat (endocarp). The mesocarp is an obvious carbohydrate source. Perhaps less appreciated is the relatively high protein value of the hackberry seed; the ratio of essential amino acid concentrations in net-leaf hackberry seeds to whole egg protein (a standard) has been determined to be relatively high, at 69 percent (Peoples et al., 1994).

Both migratory and resident bird species consume the mature fruit. Although not yet studied in detail, compared to mammals, birds are more likely to regurgitate the seeds intact and in a widely scattered pattern, and are likely to be the primary dispersal agent of that set of hackberry seeds that germinate. A large number of mammal species also utilize the mature fruits of hackberry, including gray fox, coati, raccoon, black bear, and coyote. In canyons with net-leaf hackberry, scat in autumn and winter from these animals are frequently found that are composed almost exclusively of hackberry seeds. The scat of these mammals includes both intact seeds and crushed seed coats. In western Oklahoma, where net-leaf hackberry also occurs, it was the most frequently eaten food item by raccoons during the winter (Tyler et al., 2000).

Powell and Steidl (2000, 2002) found that, within a comparable riparian area (in Brown Canyon, Buenos Aires National Wildlife Refuge, southeastern Arizona), seven riparian songbird species (Bell's Vireo, *Vireo bellii*; verdin, *Auriparus flaviceps*; phainopepla, *Phainopepla nitens*; summer tanager, *Piranga rubra*; northern cardinal, *Cardinalis cardinalis*; blue grosbeak, *Guiraca caerulea*; and hooded oriole, *Icterus cucullatus*) strongly selected Arizona sycamore and net-leaf hackberry for nesting. Blue grosbeak showed an interesting pattern in nest-site choice; although it typically nests low to the ground in riparian areas with dense understory vegetation and little canopy cover, in their study area, it nested high in large sycamores in areas with little understory vegetation. Powell and Steidl (2002) determined that, within Brown Canyon, most of these bird species nested in areas with higher vegetation density and volume than available at random. In addition, they concluded that "managing riparian areas to foster high vegetation density and key structural components, such as sycamore and hackberry trees, is essential for meeting the habitat requirements necessary to maintain abundant and diverse songbird communities in the arid southwestern United States and adjacent Mexico" (Powell and Steidl, 2002; p. 1096).

Judging by the trunk diameters of the trees on the Property, many of the net-leaf hackberry and perhaps all three of the sycamores are likely to be at least 100 years old. To our knowledge, net-leaf hackberry trees have not been systematically sampled in Arizona to determine growth rates, mean age, maximum ages, and age structure of populations. However, a recent comprehensive study (DeBolt and McCune, 1995) of growth and demography of net-leaf hackberry populations in Idaho suggests that this species is slow-growing, averaging 4 m height at 50 years, and long-lived (to 300 to 400 years). The mean age of hackberry trees in their study was about 75 to 100 years (our estimate from their Figure 5). They found that newly established net-leaf hackberry stands were rare, with only six young (< 33 years) stands out of 250 total studied stands; most stands were even-aged. DeBolt and McCune suggest that this species deserves to be included in restoration efforts because of the plant's (1) tolerance to a variety of microsites, (2) importance to wildlife as food and cover, and (3) persistence in landscapes highly degraded by cattle grazing.

We obtained from the U. S. Geological Survey's EROS Data Center (Sioux Falls, SD) a black and white aerial photograph (GS-VBFL 1-153) taken on May 16, 1965 of Bloody Basin with the Property in the center of the photograph. This photograph (Figure A-1) is of sufficient resolution (ca 2-5 m) that we were able to see individual seed-harvester ant colonies (*Pogonomyrmex* and/or *Aphaenogaster*) in the fields on the Property, the concrete footings of the power line towers, and individual trees that are still present on the Property today. The features in this photograph show clearly that the installation of the power line was on-going (surface disturbance at the tower pads was fresh, most concrete footings were in place, but the towers had not yet been installed). Comparison of this 1965 photograph with a 1997 aerial photograph (Figure A-2) provided by Environmental Data Resources reveals several easily identified changes to the LX Ranch landscape. The notable features and their changes include:

- Agricultural fields are present on both the south side of Tangle Creek (to either side of the homesite) and on the north side of Tangle Creek in 1965. These fields have shrubs evident in the 1997

photograph that were absent in 1965. In the northeast field, at least one channel (with adjacent shrubs) crosses the field; this channel is not distinct in the 1965 photograph.

- The power line development roads as well as several dirt roads on the Property are active in 1965, but at least partly vegetated in 1997.
- Night Trap Tank and the reposito immediately east of the LX homesite had fewer trees lining the tanks in 1965 than in 1997.
- Many of the Property's trees evident in the 1965 photograph are still present in the 1997 photograph.
- The amount of woody vegetation has increased on the abandoned farm fields since 1965. Based on our site visit on February 9, 2004, the abandoned farm fields on the Property are reverting to open woodlands or thickets of hackberry, mesquite, and cat-claw acacia.
- About one-fourth of Tangle Creek's channel length has changed significantly during the past 40 years. These changes include channel abandonment, fresh cuts, and channel widening. In some cases the vegetation along the channel appears to have been lost due to the changes.

In the 40 to 50 years since farming ceased, there is clear evidence for an expansion of mesoriparian vegetation. The reestablishment of woodlands and thickets of mesoriparian trees will likely increase connectivity for wildlife of the landscape within Bloody Basin in two ways, (1) as a migratory corridor, and (2) in providing local shelter, forage, and breeding sites for a number of bird and mammal species.

The relatively slow encroachment of native vegetation back onto the farm fields underscores the importance of long-term, consistent approaches to land management that favor the restoration of this mesoriparian vegetation. Returning the Property to public domain (the National Forest) would prevent private development. Management by the Forest Service could be done in a way that increases the likelihood of eventual mesoriparian restoration over the next 100 to 150 years.

6.2. OPPORTUNITIES

Opportunity #1. Our visit and the comparison of photographs that document vegetation conditions between 1965 and 1997 make clear that the native vegetation is recolonizing the abandoned fields and roads. It would be useful to provide a more precise account of what changes have occurred in the last 45 years. There are two approaches that could be used to document the changes: (1) mapping the shrubs and trees in several north-south belt transects across the flood plain and determining their heights and diameters, and (2) determining the age of net-leaf hackberry trees (in particular) and saplings both on the belt transects and in selected groves by taking tree core samples. Annual rings are evident in trunk cores of net-leaf hackberry and provide an accurate, rapid, non-destructive means of determining the age of specific trees, and age-structure of the populations.

Opportunity #2. A longitudinal transect along Tangle Creek for several miles upstream and downstream from the Property is needed in order to document the distribution of mature, sapling, and recently dead sycamores, cottonwoods, net-leaf hackberry trees and other significant riparian species. This kind of survey would identify if and where significant mortality and recruitment of these species is occurring, and allow for comparison of vegetation within the broad Bloody Basin valley to the narrower canyons both up- and downstream from the Property. Identification of sites with high mortality or high recruitment is likely to provide comparative information on what conditions are required for successful recruitment and survivorship.

Opportunity #3. Information on the seasonal flow from upstream springs and their associated groundwater or aquifers would be helpful in determining available groundwater discharge in the west half of Bloody Basin. It appears that stream flow in Tangle Creek upstream and downstream of the Property is controlled by shallow bedrock, whereas on the Property deeper alluvium is present and surface water apparently infiltrates for subsurface flow for most if not all of the year. Of particular interest would be data from long-term monitoring of groundwater levels on the LX Bar Ranch itself, in terms of depth to and seasonal fluctuations of groundwater. This information would be useful in determining groundwater resources available for re-establishment of the woodlands and thickets noted above.

7. REFERENCES

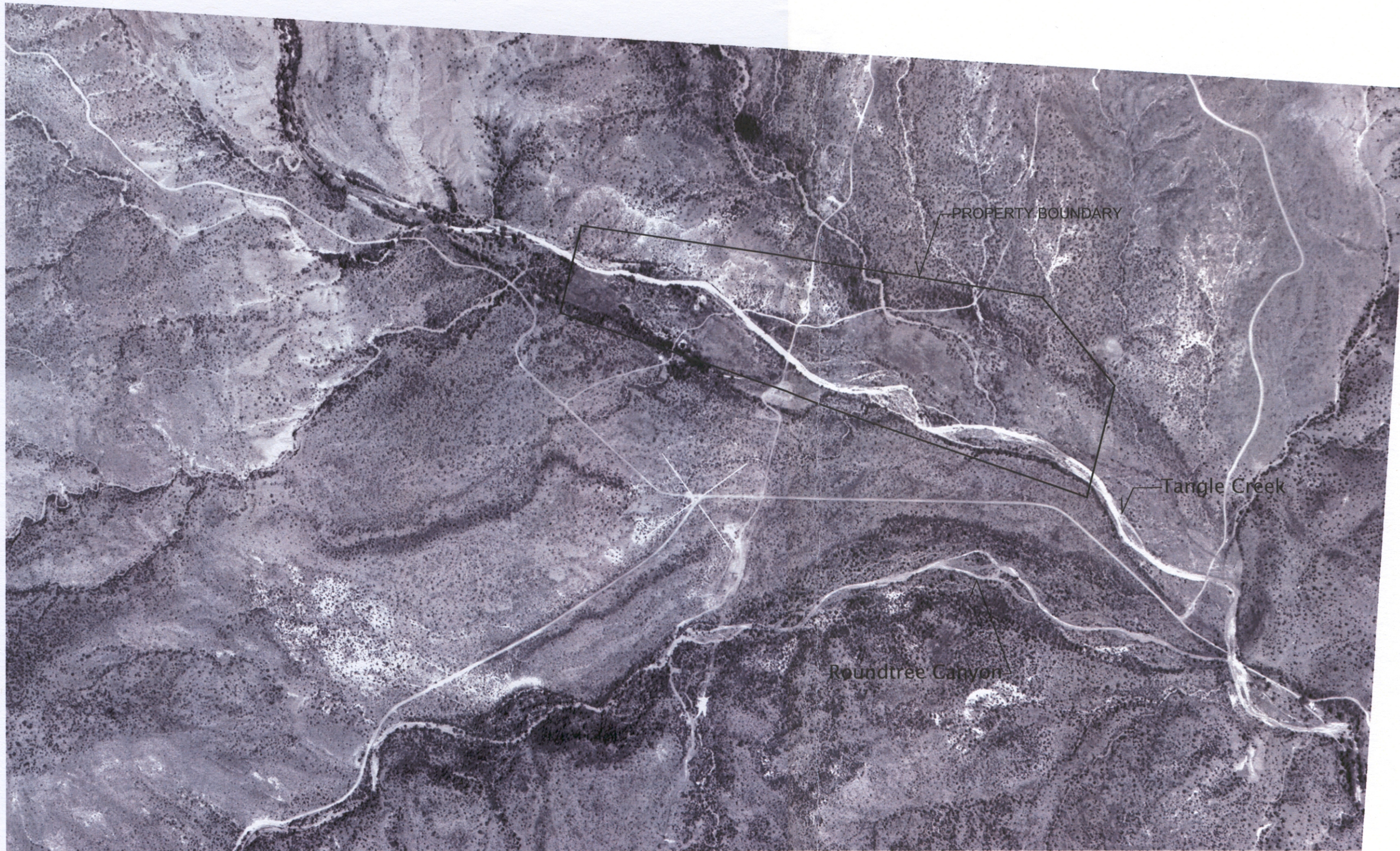
- Arizona Ecological Services Field Office, US Fish and Wildlife Service. 2004. Bald Eagle. <http://arizonaes.fws.gov/bald.htm>. Accessed on March 8, 2004.
- _____. 2003a. Arizona Agave. <http://arizonaes.fws.gov/arizona.htm>. Accessed on March 8, 2004.
- _____. 2003b. Arizona Cliffrose. <http://arizones.fws.gov/arizona2.htm>. Accessed on March 8, 2004.
- Brown, D.E., ed. 1994. Biotic Communities, Southwestern United States and Northwestern Mexico. University of Utah Press: Salt Lake City.
- Brown, D.E., N.B. Carmony and R.M. Turner. 1978. Drainage Map of Arizona Showing Perennial Streams and Some Impartial Wetlands. Arizona Game and Fish Department: Phoenix.
- Bull, W. B. 1991. Geomorphic Response to Climatic Change. Oxford Univ. Press, New York.
- DeBolt, A. M. and B. McCune. 1995. Ecology of *Celtis* in Idaho. Pp 237-248 in Great Basin Naturalist 55.
- Elston, D. P. and R. A. Young. 1991. Cretaceous-Eocene (Laramide) Landscape Development and Oligocene-Pliocene Drainage Reorganization of Transition Zone and Colorado Plateau, Arizona. Pp 12389-12406 in Journal of Geophysical Research 96 (B7).
- Hoffmeister, D. F. 1986. Mammals of Arizona. University of Arizona Press: Tucson.
- Hunt, W.G., D.E. Driscoll, E.W. Bianchi, and R.E. Jackman. 1992. Ecology of Bald Eagles in Arizona. Volumes I-IV. Unpublished Report to U.S. Bureau of Reclamation, Contract 6-CS-30-04470. BioSystems Analysis, Inc.: Santa Cruz, California.
- Sredl, M. 2004. Arizona Game and Fish Department. Personal communication with Michael Cross, WestLand Resources, February 24, 2004.
- McAuliffe, J. R. 1995. Landscape evolution, soil formation, and Arizona's desert grasslands. Chapt. 4, Pp. 100-129, IN: McClaran, M. P. and T. R. Van Devender. The Desert Grassland. Univ. of Arizona Press, Tucson.
- Mills, S. G., J. B. Dunning, Jr. and J. M. Bates. 1991. The Relationship Between Breeding Bird Density and Vegetation Volume. Pp 468-479 in Wilson Bull, 103(3).

- Peoples, A. D., R. L. Lochmiller, D. M. Leslie, Jr., J. C. Boren, and D. M. Engle. 1994. Essential Amino Acids in Northern Bobwhite Foods. Pp 167-175 in *Journal of Wildlife Management* 58.
- Powell, B. F. and R. J. Steidl. 2002. Habitat Selection By Riparian Songbirds Breeding In Southern Arizona. Pp 1096-1103 in *Journal of Wildlife Management* 66.
- _____. 2000. Nesting Habitat and Reproductive Success of Southwestern Riparian Birds. Pp 823-831 in *The Condor* 102.
- Richard, S.M., S. J. Reynolds, J. E. Spencer, and P. A. Pearthree. 2000. Geologic Map of Arizona. Map 35. Arizona Geological Survey: Tucson.
- Sellers, W. D., and R. H. Hill. 1974. *Arizona Climate, 1931-1972*. University of Arizona Press: Tucson.
- Smith, L.P. and C.W. Stockton. 1981. Reconstructed Stream Flows for the Salt and Verde Rivers from Tree-Ring Data. Pp 939-947 in *Water Resources Bulletin*, Vol. 17, No. 6.
- Stebbins, R. C. 2003. *A Field Guide to Western Reptiles and Amphibians*, 3rd Ed. Houghton Mifflin Company: New York.
- The National Geographic Society. 1987. *Field Guide to Birds in North America*. National Geographic Society, Washington D.C.
- Tyler, J. D., M. Haynie, C. Bordner, and M. Bay. 2000. Notes on Winter Food Habits of Racoons From Western Oklahoma. Pp 115-117 in *Proceedings of the Oklahoma Academy of Science* 80.
- US Census Bureau. 2001. Table DP-2. Profile of Selected Social Characteristics: 2000. Geographic Area: Cave Creek town, Arizona in Census 2000. US Census Bureau: Washington, D.C.
- US Geological Survey. 1981. USGS: Reston, VA. 1:100,000-scale metric Topographic Map of Payson, Arizona.
- US Fish and Wildlife Service. 1999. Endangered and Threatened Wildlife and Plants; Proposed Rule to Remove the Bald Eagle in the Lower 48 States from the List of Endangered and Threatened Wildlife; Proposed Rule. Pp 36453-36464 in *Federal Register* Vol. 64, No. 128. Department of the Interior: Washington, D.C.
- _____. 1995. Endangered and Threatened Species; Bald Eagle Relclassification; Final Rule. Pp 35999-36010 in *Federal Register* Vol. 60, No. 133. Department of the Interior; Washington, D.C.

- _____. 1984. Endangered and Threatened Wildlife and Plants; Final Rule to Determine *Cowania subintegra* (Arizona Cliffrose) to be an Endangered Species. Pp 22326-22329 in Federal Register Vol. 49, No. 104. Department of the Interior: Washing, D.C.
- _____. 1984. Endangered and Threatened Wildlife and Plants; Final Rule to Determine *Agave Arizonaica* (Arizona Agave) to be an Endangered Species. Pp 21055-21508 in Federal Register Vol. 49, No. 98. Department of the Interior: Washington, D.C.
- Youberg, A. and W. R. Helmick. 2001. Surficial geology and geologic hazards of the Amado-Tubac area, Santa Cruz and Pima Counties, Arizona. Amado and Tubac 7.5' Quadrangles. Arizona Geological Survey Digital Geologic Map 13.

APPENDIX A

**1965 AND
1997
AERIAL
PHOTOGRAPHS**



Yavapai County, Arizona
Bloody Basin 1:24000 USGS Map

Photo Provided By: EROS Data Center, 1965.


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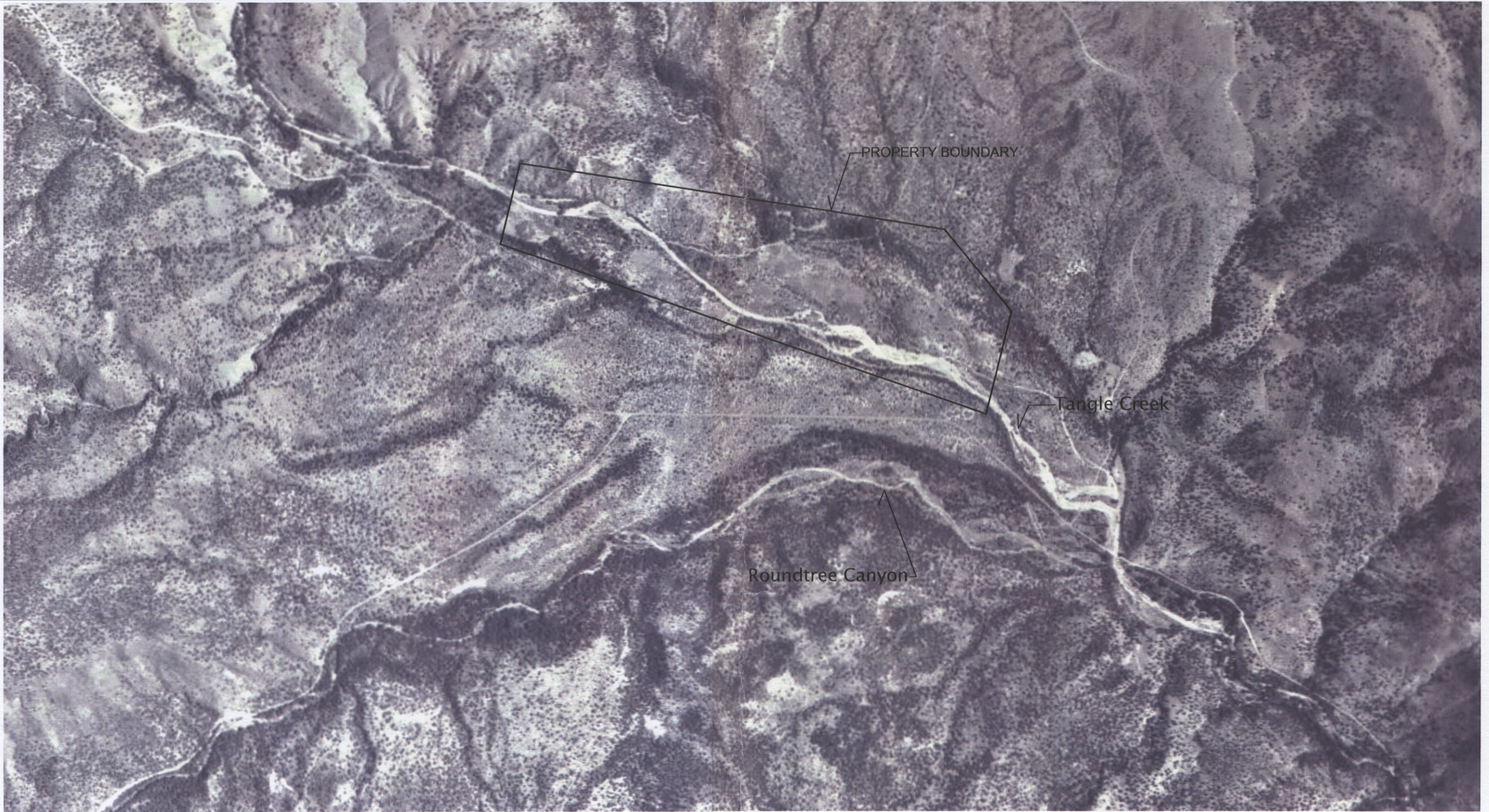


0' 500' 1000'
SCALE: 1" = 1000'



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1965 Aerial
Figure A1



Yavapai County, Arizona
 Bloody Basin 1:24000 USGS Map

Photo Provided By: Environmental Data Resources, 1997.

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0' 500' 1000'
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1997 Aerial
 Figure A2