Mission:
“Our Mission is to protect and improve the watershed health for users/uses of the Tularosa Creek and Three Rivers Creek watersheds, through identification of watershed health concerns and the development of strategies to address those concerns, by seeking resources to implement practices that help resolve the concerns of the watersheds”.

Compiled by: Three Rivers Creek and Tularosa Creek Watershed Committee: 
Otero Soil and Water Conservation District
Department of Interior Bureau of Land Management
Mescalero Apache Tribe
USDA Lincoln National Forest Service
USDA Natural Resources Conservation Service
New Mexico Environment Department, Surface Water Quality Bureau
Village of Tularosa
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1. Introduction

Clean Water Act Section 319(h) Program and the Watershed Approach to Non Point Source Pollution Control

Watersheds are areas of land that drain to a stream or other water body.

Non Point Source (NPS) Pollution occurs when rainfall, snowmelt or irrigation runs over the surface of the land and picks up pollutants and deposits them into rivers, streams, lakes, and ponds. NPS pollution control projects can be most effective when activities are focused with a watershed plan, because the watershed approach integrates the effects that land use, climate, hydrology, drainage, and vegetation have on water quality.

The New Mexico Environment Department Surface Water Quality Bureau (NMEDSWQB) administers Clean Water Act Section (CWA) 319(h) funding from the US Environmental Protection Agency (EPA) to abate NPS pollution. Requests for Proposals (RFP’s) are released each year to apply for funding to targeted watersheds throughout New Mexico. Typically, two types of proposals are requested: “Watershed Group Formation” and “On-the-Ground Surface Water Quality Improvements” to abate NPS pollution. Both grants focus on addressing a Total Maximum Daily Load (TMDL) through the development/implementation of a Watershed Restoration Action Strategy (WRAS). A request for Watershed Group Formation was submitted by the Bureau of Land Management (BLM) in September of 2005, and accepted on December 28, 2005 by NMEDSWQB. Priorities for grant funding are streams that have been listed as impaired on the State of New Mexico CWA Sections 303(d)/305(b) Integrated List (Integrated List).

(http://www.nmenv.state.nm.us/wqcc/303d-305b/2004/AppendixB/index.html)

A TMDL is a non-regulatory document describing a budget for pollutant influx to a specific water body. They are established for individual stream segments, by pollutant. TMDLs are planning documents that provide pollution reduction targets and guidance on how to reduce pollutant loads. A WRAS document is developed by a watershed group in an effort to restore the health of water bodies that are not meeting water quality standards and other natural resource goals.

Desired outcomes of on-the ground implementation projects: Watershed groups must address impairment issues on stream segments currently listed on the Integrated List. Eligible stream segments will have one of the following characteristics:

- WRAS developed and approved by SWQB;
- Targeted stream reach(s) have (or will have within the coming year) a TMDL in place (http://www.nmenv.state.nm.us/swqb/TMDL/list.html).

For proposals components see the RFP’s at: http://www.nmenv.state.nm.us/swqb/
The Tularosa watershed encompasses a closed basin consisting of 3.2 million acres and includes parts of Santa Fe, Torrance, Socorro, Lincoln, Otero, and Dona Ana counties in southern New Mexico. The project area is located on the eastern edge of the Tularosa valley in Otero County, and forms the geographic divide between Sierra Blanca and the Sacramento mountains. Both Tularosa creek and Three Rivers creek originate on the Mescalero Apache Indian reservation and U.S. Forest Service land from perennial springs at 7,000 to 8,000 feet elevation.

Tularosa creek originates from two major drainages on the Mescalero Apache reservation and flows westward joining near the community of Mescalero, continuing westward for approximately 16 miles. Tularosa creek passes through the community of Bent and the Village of Tularosa before infiltrating into playas in the Tularosa basin. Major uses in the Tularosa creek watershed include irrigated agriculture, the primary and only municipal water supply for the Village of Tularosa, livestock grazing, timber production and harvesting, recreation and urban development.

Three Rivers creek originates from three tributaries (Indian creek, Three Rivers creek, and Lincoln Canyon creek), beginning on the Mescalero Apache Indian reservation and U.S. Forest Service land which join on private land owned by Three Rivers ranch. Three Rivers creek flows for 11 miles and is the longest within the watershed which also terminates in the playas of the Tularosa basin. Major uses in the Three Rivers watershed and adjacent basins include irrigated agriculture, livestock grazing, timber production and harvesting, and recreation.

The area is the ancestral homeland of the Mescalero Apaches with European settlers arriving in the 1860’s. Spanish settlers established the Village of Tularosa and thrived as a farming community relying solely on the water from Tularosa creek for domestic consumption and to irrigate crops. The village maintains this irrigation system for use on lawns, gardens and orchards with the majority of water rights administered by both the Tularosa Ditch Corp, and the Rosalio Ditch Corp. The remaining water rights are owned by farmers, the original forty nine city blocks, and the Village of Tularosa for use as a municipal water source.

2. Project Area Information

The Tularosa/Three Rivers Watershed Restoration project area will begin at the eastern watershed boundary within the Mescalero Apache Indian Reservation and/or U.S. Forest Service boundaries and end adjacent to White Sands Missile Range and Holloman Air Force Base located west of Highway 54. The cumulative area includes approximately 30 miles of perennial water, including Tularosa creek, Three Rivers creek, Tecolote canyon, Coyote canyon, Rancheria canyon, and Domingo canyon (see map 1).
Map 1. Three Rivers and Tularosa Watersheds Project Map
The project area consists of perennial reaches of Tularosa Creek, Three Rivers Creek and adjacent drainages encompassing 423,417 acres consisting of state, federal private and Indian lands.

The following table is a break down of land ownership within the project area.

<table>
<thead>
<tr>
<th>Ownership</th>
<th>Acres</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mescalero Apache Tribe</td>
<td>138,215</td>
<td>33%</td>
</tr>
<tr>
<td>Bureau of Land Management</td>
<td>94,210</td>
<td>22%</td>
</tr>
<tr>
<td>U.S. Forest Service</td>
<td>23,199</td>
<td>6%</td>
</tr>
<tr>
<td>State Land</td>
<td>69,229</td>
<td>16%</td>
</tr>
<tr>
<td>Private Land</td>
<td>98,564</td>
<td>23%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>423,417</td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

2.1 Tularosa Watershed

2.1.1 Soils

The Tularosa watershed consists of three Major Land Resource Areas (MLRAs), each in different soil temperature and moisture regimes, and a variety of topographic features. These include the Arizona and New Mexico Mountain (AN-3) at higher elevations with pines, spruce, and fir trees; Pecos-Canadian Plains (CP-4) at intermediate elevations in the pinon-juniper zone; and Southern Desert (SD-2) at lower elevations with desert shrubs on the basin floor. The soils vary in specific characteristics depending on their formation, which is influenced by climate, topography, parent materials, living matter, and time. Soils within the Tularosa Watershed consist of the following:

**Badland** is gently rolling to very steep, highly dissected, nearly barren land consisting of areas of rock outcrop and thin soils. These soils formed primarily in material weathered from inter-bedded shale, siltstone, arkosic sandstone, and cobble conglomerate of the Abo Formation and calcareous shale, thin argillacious limestone, quartz sandstone and limestone conglomerate of the Bursum Formation. Runoff is rapid on most areas of Badland. Severe sheet and gully erosion takes place even during small rain showers. Wind and water erosion are rated medium to high.

The **Alamogordo-Gypsum land complex, 0 to 5% Slopes** consists of relatively small areas of deep, well drained Alamagordo soil and areas of exposed gypsum. The landscape is mainly broad, dissected pediment toe slopes and filled valleys. The soils formed in highly gypsiferous alluvium and aeolian deposits. Permeability is moderately rapid and available water holding capacity is low. Water and wind erodibility is rated at moderate.

The **Alamogordo-Gypsum land Aztec complex, 15 to 50% slopes**, consists of areas of deep well drained soils and areas of exposed gypsum. The landscape is mainly severely dissected, partially truncated side slopes of pediments. These soils are calcareous throughout, but in places it is non-calcareous in the lower part of the substratum. It is
moderately alkaline and slightly saline. Permeability is moderately rapid, and available water capacity is low.

Pena-Aztec Variant association, strongly sloping, consists of areas of deep, well drained soils, which occur in a regular and repeating pattern mainly on side slopes of pediments that have been dissected by many deep, narrow drainage-ways. The Pena soils are on the upper, more gently sloping parts of the pediment slopes. The Aztec Variant soils are on the lower, more sloping parts of the pediment slopes and along the dissected drainage-ways. These soils are moderately calcareous in the surface layer and strongly calcareous in the substratum. They are moderately alkaline. Permeability is moderate, and available water capacity is low.

2.1.2 Vegetation
Vegetation growing within the Tularosa Watershed include the following grasses: black grama, blue grama, side oats grama, sixweeks grama, bush muhly, ear muhly, silver bluestem, alkali sacaton, gyp grama, gyp dropseed, Neally dropseed, galleta grass, sand dropseed, mesa dropseed, threeawns, plains bristle grass, lovegrass, tobosa grass, fluffgrass, burrograss, and vine mesquite.

Shrubs, half shrubs, trees and forbs include: fourwing saltbush, creosote, broom snakeweed, littleleaf sumac, coldenia, nama, flax, mormon tea, croton, mesquite, graythorn, ocotillo, one seeded juniper, pinyon, winterfat, oak, javalina bush, yerba de pasmo, pepperweed, stickleaf, buffalo gourd, wild buckwheat, globemallow, tarbush, desert bailey, Yucca, mustard, prickly pear and cholla cactus, Russian thistle, nightshade, feather peabush, desert willow, globe mallow, and purslane.

Riparian vegetation includes: Coyote willow, cottonwood, seepweed, baccharis, rabbitbush, mariola, desert willow, fourwing saltbush, mesquite, salt cedar, desert salt grass, Muhlenbergia spp., spike dropseed, sixweeks grama, windmill grass, alkali sacaton, cane bluestem, side oats grama, water bent grass, slim tridens, bermuda grass, Wrights sacaton, rabbit brush, bristlebush, sumac, white milkwort, false pennyroyal, horseweed, horse nettle, sunflower, spurge, apache plume, reeds, cat tails, buckwheat, and catchfly gentian.

2.2 Three Rivers Watershed

2.2.1 Soils
The Three Rivers watershed consists of three Major Land Resource Areas (MLRAs), each in different soil temperature and moisture regimes, and a variety of topographic features. These include the Arizona and New Mexico Mountain (AN-3) at higher elevations with pines, spruce, and fir trees; Pecos-Canadian Plains (CP-4) at intermediate elevations in the pinon-juniper zone; and Southern Desert (SD-2) at lower elevations with desert shrubs on the basin floor. The soils vary in specific characteristics depending on their formation, which is influenced by climate, topography, parent materials, living matter, and time. Soils within the Three Rivers watershed consist of the following:
Alamogordo-Gypsum land complex, 0 to 5% slopes, consists of relatively small areas of deep, well drained Alamogordo soil and areas of exposed gypsum. The landscape is mainly broad, dissected pediment toe slopes and filled valleys. The soils formed in highly gypsiferous alluvium and eolian deposits. Permeability is moderately rapid and available water holding capacity is low. Water and wind erodibility is rated at moderate.

Alamogordo-Gypsum land Aztec Complex, 15 to 50% slopes, consists of areas of deep well drained soils and areas of exposed gypsum. The landscape is mainly severely dissected, partially truncated side slopes of pediments. These soils are calcareous throughout, but in places it is noncalcareous in the lower part of substratum. It is moderately alkaline and slightly saline. Permeability is moderately rapid and available water capacity is low.

Aztec-Rock Outcrop-Lozier Complex, 20 to 65% slopes, consists of areas of Rock outcrop and shallow, well drained Lozier soil, which is on steep side slopes of limestone controlled hills. Rock outcrop makes up about 50 percent of each mapped area. The outcrop is limestone bedrock in the form of cat-step escarpments of shelves. Runoff is rapid on rock outcrop. Water flows onto the surrounding soils and accelerates erosion there. The Lozier very gravelly loam makes up about 35 percent of each mapped area. This soil is severely eroded in some areas and is only a thin mantle over limestone bedrock. Permeability is moderate and available water capacity is very low. The petroglyph ridge and small hills scattered throughout the Northwestern part of the allotment make up this small inclusion.

Tome Silt Loam 0 to 5% slopes, is a deep, well drained, nearly level to gently sloping soil of flood plains and lower parts of pediment side slopes of major streams and basins. Parts of this unit are flooded each year. All areas receive run-on water from surrounding areas. The soil formed in calcareous alluvium derived from limestone. This soil is strongly calcareous throughout and moderately alkaline. Permeability is moderately slow, and available water capacity is high.

Onite-Pintura Association, gently sloping, consists of areas of deep, well drained and somewhat excessively drained soils. They occur in a regular and repeating pattern on broad eolian and alluvial uplands dissected by a few entrenched intermittent stream channels. The Onite soil is on nonduned uplands, and the Pintura soil is on dunes and parts of the areas between dunes. These soils formed in coarse textured to medium textured alluvium and reworked eolian sediment. The well drained Onite soils make up about 55 percent of this association, while the somewhat excessively drained Pintura soils make up about 25 percent of the association. These soils are slightly calcareous throughout and are mildly alkaline to moderately alkaline. Permeability is moderately rapid to rapid and available water capacity is low.

Pena Variant-Rock outcrop association, steep, consists of areas of deep, well drained soils and igneous outcrop. These areas occur in a regular and repeating pattern on steep
and very steep mountain crests and sides, on narrow winding tops, on nearly vertical escarpment fronts, and in narrow drainageways. The Pena Variant soils are generally on the west facing slopes and some crests. Rock outcrop occurs as escarpments, ledges, and talus slopes throughout the unit and as a major escarpment on the south and west sides of the area. The soils formed in material weathered from volcanic rocks, primarily andesite, latite, rhyolite, and associated tuff and ash of the Sierra Blanca Series. The Pena Variant soils, which make up about 60% of the association, are strongly calcareous and moderately alkaline throughout. Permeability is moderate, and available water capacity is moderate. Rock outcrop makes up about 25% of the association. It occurs on escarpments, rock bluffs, talus slopes, ledges, and boulders throughout the area. The rock is volcanic, primarily andesite, latite, and rhyolite. It weathers quite readily on the north and east facing side slopes and forms the major escarpments and bluffs on the west and south facing side slopes. Since runoff from Rock outcrop is rapid, excess water pours onto the surrounding soils. This causes erosion during the intense storms of summer. The Godfrey Hills are included with this soil association.

La Fonda association, gently sloping, consists of areas of deep, well drained soils, which occur in a regular and repeating pattern on alluvial fans and terraces on side slopes of pediments of the Godfrey Hills and the upper valley plain along Three Rivers Creek. The La Fonda soils, which make up about 40% of the association, are strongly calcareous to moderately alkaline below the surface layer. Permeability is moderate, and available water capacity is high. The deep, well drained dark colored soils, which make up about 25% of the association, are strongly calcareous and moderately alkaline throughout. Permeability is moderate, and available water capacity is high. Included in mapping are areas of Bluepoint soils on dunes and Onite soils between the dunes. Also included are small areas of deep Gabaldon and Shanta soils adjacent to the flood plains. These soils formed in mixed alluvium that weathered mostly from limestone. These soils make up about 35% of the association.

Shanta-Gabaldon association, nearly level, consists of deep, well drained soils, which occur in a regular and repeating pattern on narrow flood plains and adjacent terraces dissected by one major stream and many smaller side tributaries. Both soils are adjacent to the stream beds, but the Shanta soils occur more commonly on the first and second terraces. These soils formed in moderately fine textured alluvial sediment derived from basic igneous rocks in the mountains to the east. They have received deposits of calcareous eolian material in recent times. The Shanta soils, which make up about 55% of the association, are calcareous and mildly alkaline to moderately alkaline. Permeability is moderate, and available water capacity is high. The Gabaldon soils, which make up about 25% of the association, are calcareous throughout and are mildly alkaline. Permeability is moderate, and available water capacity is high. Included in mapping are a few areas of Reeves Variant and La Fonda soils and riverwash. These soils make up about 20% of the association.

Reeves Variant-Shanta association, gently sloping, consists of deep, well drained soils, which occur in a regular and repeating pattern on relic gently sloping alluvial pediments above the present valley floor. This area contains depressions, uplands, and narrow
dissected drainageways. The Reeves Variant soils are primarily on the uplands, and the
Shanta soils are in the depressions and lower terraces. These soils formed in both
gypsiferous sediment and finer textured alluvium. The Shanta soils receive additional
run-on water from surrounding soils of the association. The Reeves Variant soils, which
make up about 55% of the association, are strongly calcareous and moderately alkaline.
Permeability is moderate, and available water capacity is moderate to low. The Shanta
soils, which make up about 25% of the association, are noncalcareous in some part of the
surface layer and calcareous throughout the lower layers. They are mildly alkaline to
moderately alkaline. Permeability is moderate, and available water capacity is moderate.
Included in mapping are a few areas of soils that have a strongly cemented gypsum layer.
These soils make up about 18 percent of each mapped area. Very gravelly soils and
bottom land in arroyos make up about 2 percent of the association.

2.2.2 Vegetation
Vegetation growing within the Three Rivers Watershed include the following grasses:
black grama, blue grama, sideoats grama, sixweeks grama, hairy grama, fluffgrass, bush
muhly, alkali sacaton, sand dropseed, mesa dropseed, threeawns, plains bristle grass,
tabosa grass, burrograss, Arizona cottontop, wolf tail, lovegrass, vine mesquite,
needlegrass, rabbit foot grass, water bent grass and red top.

Shrubs, half shrubs, trees and forbs include: fourwing saltbush, creosote, broom
sneakweed, croton, mesquite, rocky mountain zinnia, field bahia, desert marigold,
dogretch, pale wolfberry, yucca, pepperweed, mustard, puncturevine, four o’clock,
stickleaf, dwarf desert holley, wild buckwheat, rubberbrush, prickly pear and cholla
cactus, Russian thistle, nightshade, thorn apple, spicebush, apache plume, groundsel,
ocotillo, bear grass, bridle bush, littleleaf sumac, cliffrose, one-seed juniper, skunkbush,
feather peabush, salt cedar, globe mallow, annual sunflower, wild onion, plantain,
pigweed, sweet clover, mariola, verbena, dock and purslane.

Riparian vegetation includes: Seepwillow, rio grande cottonwood, Arizona ash, box
elder, iodineweed, little walnut, netleaf hackberry, New Mexico olive, New Mexico
alder, seepweed, desert willow, fourwing saltbush, mesquite, salt cedar, inland salt grass,
Muhlenbergia spp., spike dropseed, sixweeks grama, windmill grass, alkali sacaton,
sideoats grama, water bent grass, rabbit foot grass, slim tridens, bermuda grass, wrights
sacaton, rabbit brush, bridle bush, sumac, horse nettle, sunflower, spurge, apache plume,
reeds, cat tails, buckwheat, and catchfly gentian.

3. Identification of Causes and Sources of Impairments

3.1 Tularosa Watershed
In a 1994 report by the NM Water Quality Control Commission (NMWQCC) to
Congress, as required by Section 305(b) of the CWA, 10.2 miles of the Tularosa Creek
from the town of Tularosa to the headwaters was identified as an “Assessed Stream
Reach Partially Supporting or Not Supporting Designated or Attainable Uses”. The use
not fully supported was limited warm water fishery. Probable causes of nonsupport
included metals, reduction of riparian vegetation, and stream bank destabilization.
Aluminum and mercury were listed as toxics at chronic levels. Agriculture (rangeland)
and unknown sources were listed as probable sources of nonsupport on the 10.2 mile stream stretch.

After further studies were conducted, the 1998-2000 303(d) Record of Decision (ROD) for assessed river/stream reaches requiring TMDL determination lists the Tularosa Creek from the town of Tularosa to the headwaters as “partially” supported for use as a coldwater fishery. The specific pollutant(s) or threat is unknown toxicity. Removal of Riparian Vegetation, Stream bank Modification and Destabilization, and unknown sources are the probable sources of pollutant/threat. The specific pollutant is also unknown. No aquatic or T&E species are listed on the reach nor is there an acute public health concern.

Rangeland agriculture (grazing) was removed as a probable source of pollutant/threat in the latest ROD 303(d) list on this stream stretch of the Tularosa Creek. Some of the Best Management Practices (BMP’s) in place on the BLM portion include non-grazing during the growing season (June-December), on certain allotments, and erosion control projects undertaken in 1997, 1998, and 1999. Numerous gully plugs were constructed, and continue to be constructed to control runoff and reduce sedimentation on the southern portion of the stream stretch.

Three segments of riparian habitat along the Tularosa Creek were inventoried by BLM in 1995. Segment 1 is located approximately 10 miles east of Tularosa. Segments 2 and 3 are located approximately 3 miles east of Tularosa. Stream segment 1 (.2 mi.) rated properly functioning with an upward trend. Segment 2 rated properly functioning with a not apparent trend, while segment 3 rated functional at risk with a not apparent trend. Segment 1 was traded out of BLM ownership during a 1998 land exchange. In return BLM acquired approximately 1.8 miles of riparian habitat along Tularosa creek, which has been excluded from livestock grazing. Segment 2 (.2 mi.) is affected by a water diversion approximately .2 miles upstream which feeds water to the village of Tularosa as a source of municipal drinking water. It is also affected by a cemented road which crosses the creek laterally. There is an old diversion 2/3 of the way down this segment which probably fed an acequia at one time. Segment 3 (.3 mi.) is delineated by a large diversion (between segments 2 and 3) which diverts most of the remaining water for irrigation in the village of Tularosa.

Mainstream Contracting was hired to conduct a Proper Functioning Condition Assessment Report for Tularosa creek in January, 2000. Initial reach breaks were chosen using topographic maps and aerial photographs. Reach breaks were adjusted in the field as needed. Nineteen reaches were identified during the assessment based on channel/valley form, confluence with tributaries, and land use changes. All reaches are considered perennial streams with flowing water year around, and all were spring fed. Of the 19 reaches assessed three reaches were determined to be in proper functioning condition (PFC). Eight reaches were functioning at risk (FAR), and likely to lose functionality during relatively high flood events. Eight reaches were rated as non-functional (NF), and two were unknown at the time.
According to the 2004 303 (d) ROD, there is water quality impairment on Tularosa Creek of undetermined origin. Historically, Tularosa Creek has been impaired by both excess aluminum and mercury, although exceedance has been only identified in 10% of all samples taken. Possible impairment previously existed from release of treated waters into Tularosa Creek on the Mescalero Apache Indian Reservation resulting in Nutrient/Eutrophication Biological Indicators. Since the printing of the 2004 ROD the Mescalero Tribe has constructed a new wastewater treatment plant to address this situation. The 2004 ROD states that Tularosa Creek is not supporting its designation as a cold water fishery, which results from biological impairment due to benthic macroinvertebrates not being indicative of a cold water fishery. Tularosa Creek was scheduled to be monitored for TMDL in 2006. The final report for TMDL has not been published yet.

3.2 Three Rivers Watershed

The Three Rivers watershed is dissected by east to west running arroyos and drainages that drain the Godfrey Hills and Sierra Blanca to the Tularosa Basin. The major drainage is the Three Rivers creek, a perennial stream at its upper reaches, but ephemeral and/or intermittent during most years below the campground due to diversions for irrigation.

In a 1994 report by the NMWQCC to congress, as required by Section 305 (B) of the CWA, Three Rivers perennial portions from U.S. Highway 54 to the White Mountain Wilderness boundary was identified as an “Assessed Stream Reach Partially Supporting or Not Supporting Designated or Attainable Uses”. The use not fully supported was as a high quality coldwater fishery. Probable causes of nonsupport included temperature, conductivity, salinity, and total phosphorous. Agriculture (rangeland) was the probable cause of nonsupport on the 7.5 mile stream stretch.

The 1998-2000 303(d) ROD for assessed river/stream reaches, requiring TMDL determination final ROD lists the Three Rivers perennial portions, from U.S. Highway 54 to White Mountain Wilderness boundary, as not supported for the use of a high quality coldwater fishery. The specific pollutant(s) or threat is temperature and conductivity. Agriculture (rangeland) is listed as the probable source of pollutant/threat. As of the fall of 2007, the TMDL schedule hasn’t been published.

The ROD for BLM’s White Sands Resource Area/Resource Management Plan (WSRA/RMP) calls for a watershed activity plan to be developed on 21,446 acres in the Three Rivers watershed. The primary objectives of the watershed treatments will be to improve watershed values by reducing peak runoff rates, reducing sediment yields, improving water quality, and receiving better on-site utilization of runoff in the long term. Off Road Vehicle (ORV) use is limited to existing roads and trails on the 21,446 acres for protection of watershed values.

Average stream width of the .5 mile long riparian area, on BLM lands, is about 8 feet, and depth is 12 to 18 inches. Total Riparian acreage is about 20 acres. The broad vegetation type for the area is mixed desert shrub with the riparian zone predominately consisting of coyote willow, salt cedar, cottonwood, salt grass and sacaton. The elevation
is approximately 4900 feet and annual precipitation is 11 inches. Riparian evaluations conducted in 1993 and 1995 determined that the condition rating of this segment was Functional at Risk with an Upward Trend.

According to the 2004 303(d) ROD, there are water quality impairments on Three Rivers of Temperature and Conductivity. Historically, Three Rivers has been impaired by temperature, salinity, total phosphorous and conductivity, but salinity and total phosphorous were removed in 1998 as a cause of non-support for this watershed. Data collected in 1987 displayed exceedance of conductivity for 90% of the samples taken, while temperature exceeded standards 100% of every sample taken. The 2004 ROD states that Three Rivers is not supporting its designation as a High Quality Cold Water Fishery resulting from increased water temperatures. Three Rivers is scheduled to be monitored for TMDL in 2006. The final report for TMDL has not been published yet.

3.3 Stake-holder Concerns, Causes and Indicators
Natural processes within the project area do affect water quality and watershed health. The Tularosa and Three Rivers watersheds are capable of generating large amounts of sediment due to high gradients, the steepness of the canyon walls, and erodibility of some of the soils and rock. Erosion of the parent materials and soils leads to the mobilization of aluminum and mercury found dissolved in the waters of Tularosa Creek. Healthy uplands can provide vegetative protection from erosion to minimize sediment moving towards the stream channels. Healthy riparian areas and stable vegetated stream banks can also reduce erosion, act as a pollutant filter, and minimize sediment delivery to Tularosa and Three Rivers Creeks.

The Tularosa and Three Rivers watershed stakeholders group utilized the following worksheet to assist in linking their concerns with watershed goals. It was also used to develop indicators to measure the current watershed conditions, as well as to identify possible indicators to measure progress once the watershed plan is implemented.

### STAKEHOLDER WATERSHED WORK GROUP WORKSHEET

<table>
<thead>
<tr>
<th>What are the problems/concerns in the watershed?</th>
<th>What do you think caused the problems?</th>
<th>How can we assess current conditions? (Indicators)</th>
<th>What would you like to see for your watershed? (Goals)</th>
<th>How will we measure progress toward meeting those goals? (Indicators)</th>
</tr>
</thead>
</table>
| Increase in bare ground                         | 1. Increase of pinon juniper woodland cover.  
  2. Historic overgrazing.                      | 1. % cover ratio.  
  2. BMPs and Grazing management plan development. | 1. % cover ratio.  
  2. BMPs and Grazing management plan implemented. Range monitoring. |
<table>
<thead>
<tr>
<th>What are the problems/concerns in the watershed?</th>
<th>What do you think caused the problems?</th>
<th>How can we assess current conditions? (Indicators)</th>
<th>What would you like to see for your watershed? (Goals)</th>
<th>How will we measure progress toward meeting those goals? (Indicators)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Noxious weeds: Elm Removal, targeting Tularosa riparian corridor and fish hatchery grounds targeted site.</td>
<td>Disturbance coupled with ready supply of weed seed.</td>
<td>% cover – aerial photo.</td>
<td>Yearly treatment of weed populations.</td>
<td>% cover – aerial photo.</td>
</tr>
<tr>
<td>Soil erosion</td>
<td>All of above.</td>
<td>All of above.</td>
<td>All of above.</td>
<td>All of above.</td>
</tr>
<tr>
<td>Flooding</td>
<td>Flooding may be a regular occurrence in places and in certain land formations. Zoning recommendations for home sites. Assess situation for those people living in floodplains, and at mouths of canyons.</td>
<td>Identify structures located in at-risk locations.</td>
<td>Zoning recommendations drafted, and implemented.</td>
<td>Draft a set of meaningful Zoning recommendations that would be acceptable to Tribal Council. Implementation of a set of Zoning Recommendations that would be acceptable to Tribal Council.</td>
</tr>
<tr>
<td>What are the problems/concerns in the watershed?</td>
<td>What do you think caused the problems?</td>
<td>How can we assess current conditions? (Indicators)</td>
<td>What would you like to see for your watershed? (Goals)</td>
<td>How will we measure progress toward meeting those goals? (Indicators)</td>
</tr>
<tr>
<td>------------------------------------------------</td>
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<td>---------------------------------------------------------------</td>
</tr>
<tr>
<td>Outreach</td>
<td>Not applicable</td>
<td>Not applicable</td>
<td>Interpretive Walk along the Tularosa River walking path.</td>
<td>Organize an annual river clean up. Guided walks, signage, brochures, and school involvement.</td>
</tr>
<tr>
<td>Forest Management</td>
<td>Removal of fire from the landscape. Tree and shrub densities exceed historic levels.</td>
<td>Evaluate plant community composition.</td>
<td>Assessment for timber management. Thinning and prescribed fire.</td>
<td>Timber sales, thinning contracts.</td>
</tr>
<tr>
<td>Surface Water Management</td>
<td>Conversion from grasslands to shrub dominated state.</td>
<td>Inventory and aerial photographs.</td>
<td>Reduction of shrubs w/in upland grassland sites.</td>
<td>Establishment of riparian reserves.</td>
</tr>
<tr>
<td>Loss of Wetlands in Tularosa Riparian Corridor</td>
<td>Down cutting of the creek.</td>
<td>Aerial photos and GPS before treatments.</td>
<td>Rewet or restore wetlands in the Tularosa riparian corridor.</td>
<td>Aerial photos and GPS after treatments.</td>
</tr>
<tr>
<td>Soil Erosion</td>
<td>Human Development.</td>
<td>Inventory</td>
<td>Improved Water Quality.</td>
<td>Monitoring</td>
</tr>
</tbody>
</table>
4. Description of Best Management Practices

4.1 Forest Canopy Management

*Purpose:* Reducing the forest canopy would increase herbaceous cover and reduce erosion, which in turn would result in improved water quality. Pinon-Juniper stands within the Mescalero Apache Reservation, Lincoln National Forest, and BLM lands are currently outside of the “historic range of variability” with respect to stand density and vegetative composition. Stand densities, measured in terms of basal area/acre are in excess of 100 square feet/acre. Under story composition of grasses and forbs are typically sparse. Precipitation infiltration rates are poor due to continuous needle and duff litter interspersed with bare ground (unprotected loose soil and rock). The absence of desirable, soil binding under story vegetation has contributed to increased rates of soil loss and downstream sedimentation. Geologic parent material in areas targeted for this management practice is composed primarily of Limestone.
Description: Treatment of these stands involves a three step process whereby initial density reduction operations would be performed mechanically using chain saws. Pinon-Juniper density within the treatment area would be reduced to 30 square feet of basal area/acre or less. Fuel breaks are being incorporated to prevent stand replacement fires, and subsequent adverse impacts to the watershed. Clumps of large diameter, seed producing pinon would be retained in widely spaced clumps with relatively large openings in between. To designate the clumps a “leave tree” mark would be employed. All trees not designated for retention would be cut, and slash lopped to a height that would improve consumption and rate of spread during post thinning burning operations. Some of this thinning would be facilitated by commercial fuel wood sales, where possible, in stands composed of larger fuel wood size trees.
Following treatments disturbed areas would be reseeded, where necessary, in order to minimize soil erosion, and to prevent invasion of noxious weed species. Treatment units would be planted with a grass mixture emphasizing native perennial species. This mixture would also include quick growing annuals for immediate soil stabilization and leguminous species for their nitrogen fixing capabilities.

4.2 Prescribed Fire and Natural Ignitions

*Purpose:* Prescribed fire would be used to reduce hazardous fuels and restore ecosystem health. Prescribed fire may also be used to meet resource objectives, such as restoring fire-adapted grass and shrub-lands, or increasing variation of age classes in shrub-lands. Treatments would be designed to achieve mosaic patterns, which would also reduce the potential of entire stands being destroyed by wild-land fire. Fire suppression, grazing, and forest product harvesting, have helped create density levels of small diameter trees beyond what would naturally occur. These small diameter trees create “ladder fuels” that carry fire from the ground into the canopy of adjoining crowns or over story trees, where the fire becomes difficult and dangerous to suppress. Where prescribed fire would be difficult or
impossible to control because of existing fuels buildup, mechanical or manual preparation may be required to reduce densities and allow a controllable prescribed burn.

Prescribed burning following manual preparation in the Bent Area on November 2006

Wild-land fire use for resource benefits would be allowed in areas such as the Sierra Blanca Wilderness Area. However, prior to implementation of wild-land fire use the appropriate agency must have an approved Fire Management Plan in place. The Fire Management Plan would identify areas where wild-land fire use is acceptable, and must identify the conditions under which a fire would be managed for resource benefit.

**Description:** Under the Three Rivers and Tularosa Watersheds WRAS, the use of prescribed fire would require the development of a fire prescription. Prescribed burns would generally be conducted in late spring, summer or fall in New Mexico when temperatures and fuel moistures are within prescription. The prescribed burn prescription analysis would consider factors such as plant mortality, post-fire sprouting, reproduction from seed, effect of season of burning, effects of weather, post-fire plant productivity, relationship of fire to animal use, and post plant fire competition.

4.3 Integrated Weed Management

**Purpose:** When a vegetative community is functioning well, the soil, air, water, and animal components of the ecosystem usually function well also. Healthy vegetative communities ensure that watershed components contribute to good water quality. Noxious plants are an
increasing problem within the project area. Two particular plant species that are causing concern are Siberian Elm and Salt Cedar, which are well established in riparian areas and historic flood plains. They are extremely aggressive and rapidly gain dominance over native species, competing for growth, space, and water. Native cottonwood, willow, and walnut are out-competed in many areas by these aggressive plants. Besides Salt Cedar and Siberian Elm, the New Mexico Department of Agriculture lists an additional thirty species of noxious weeds. The New Mexico noxious weed list is classified into three divisions: Class A, Class B, Class C weeds, all of which are not native to New Mexico. Class A weeds are species that currently are not present in New Mexico or have limited distribution. Preventing new infestations of these species and eradication of existing infestations is the highest priority. Class B weeds are species that are limited to portions of the state. In areas that are not infested, these species should be treated as class A weeds. In areas with severe infestations, management plans should be designed to contain the infestation and stop any further spread. Class C weeds are species that are wide spread in the state. Management decisions for these species should be determined at the local level based on feasibility of control and level of infestation.
Description: The treatment would involve an integrated program using several different methods for treating trees and weeds depending on the situation. Mechanical practices such as shearing, bull dozing, sawing, or shredding would be used where herbicide spraying is not possible. Hand spraying or ground spraying from a vehicle would be used where necessary, and aerial spraying would be used where feasible.

For all project activities on federal lands, or funded by federal dollars, appropriate National Environmental Policy Act (NEPA) documentation and environmental clearances would be obtained by the respective land management agencies prior to implementation of on the ground project activities. For all earth disturbing activities, archeological clearances would be obtained by landowners or land management agencies in accordance with New Mexico State Historical Preservation Act.

4.4 Shrub Control of Creosote and Mesquite Communities

Purpose: Mesquite and creosote bush are native plants to southern New Mexico, but considered to be invasive. Once these species of shrubs become established in areas, they tend to increase in density and out-compete other native vegetation for soil moisture, nutrients, and sunlight. Lands with high densities of mesquite and creosote bush typically exhibit accelerated soil erosion rates, decreased water infiltration into soil, and lower amounts of forage available for wildlife and permitted livestock.

The creosote above the road has been treated, while the creosote below continues to grow unabated. Note the increase in herbaceous cover in treated vs. untreated.

Under this WRAS, stakeholders propose to restore rangelands to reasonable densities of mesquite and creosote bush, which would allow other native vegetation such as warm season perennial grasses, forbs, and favorable shrub species to exist and/or recover. Reducing the density of mesquite and creosote bush along with increased desirable
grasses and forbs and favorable shrubs would improve watershed conditions and habitat conditions for numerous wildlife species.

*Description:* Mesquite and creosote treatments, designed to reduce percent species composition, would be accomplished by the most appropriate technique depending on the site (i.e. chemical, mechanical, prescribed fire, biological, etc.), as determined by a site specific National Environmental Policy Act (NEPA) analysis. Where appropriate, chemicals used for these projects are registered for use within the stated application rates on rangelands for creosote and mesquite control, and are addressed in the 2007 Final EIS Vegetation Treatment Using Herbicides on BLM lands. Treatment areas would be deferred from livestock grazing for a minimum of two growing seasons, in years 2 and 3 following treatment.

Before and after photos of a mesquite treatment using chemicals applied with a fixed wing aircraft.

For all project activities on federal lands or funded by federal dollars, appropriate NEPA documentation and environmental clearances would be obtained by the respective land management agencies prior to implementation of on the ground project activities. For all earth disturbing activities, archeological clearances will be obtained by landowners or land management agencies in accordance with New Mexico State Historical Preservation Act.

### 4.5 Installation of Grade Stabilization Structures

*Purpose:* To reduce the amount of non-point source pollution entering Tularosa and Three Rivers Creeks, while reducing sediment loads and increasing infiltration of surface flows.

*Description:* Construct erosion control structures on sub watersheds within the project area. Heavy equipment would be utilized to construct these structures on manageable arroyos less than 10 feet deep and 20 feet wide. On all lands covered by this WRAS, engineering and feasibility studies would be required for structures larger than those previously discussed.

### 4.6 Grazing Management

*Purpose:* Proper rangeland management and use of resources is essential to healthy watersheds and maintaining water quality. Of fundamental importance are; grazing the range with proper kind of animals; balancing numbers with forage resources; grazing at the correct
season of the year; and obtaining proper distribution of livestock over the range. Participating agencies that administer livestock grazing programs on their respective lands, have already implemented strategies for grazing management to improve grass cover and ensure proper utilization levels are achieved.

Description: Cross fencing, and water source developments are proposed to be installed, if it is determined that improved livestock grazing management and distribution would result. Pipelines, fences or additional range improvements would be installed as needed to remove livestock grazing from the creek wherever needed to enhance water quality and/or watershed values. Appropriate post treatment livestock grazing deferment would be implemented based on agency standards. Livestock grazing would also be deferred for one full year following establishment of seeded native species where reclamation of disturbed areas has occurred.

4.7 Bank Stabilization and Protection/Flow Deflection and Concentration/Bio-Engineering

Purpose: Erosion of stream banks is a natural process. However, excessive erosion can have unwanted consequences such as increased sedimentation, loss of fish habitat, stream temperature changes, spawning area degradation and increased nutrient loading. Additionally, erosion can lead to channelization and down cutting, resulting in increased stream channel width and decreased depth, degradation and loss of riparian habitat ultimately affecting water quality. Stream bank stabilization and flow deflection are important to enhance fish habitat and protect from severe erosion, increased sedimentation, channel slope, and stream velocity.

Description: Stream quality would be enhanced by several techniques. Tree and root-wad revetments, several types of deflectors, bank armoring and rock structures would be employed to help protect stream banks, reduce sedimentation rates, counteract severe erosion, increase sinuosity, and decrease velocity. Additionally, grade control structures would alleviate further down-cutting of the stream bed. This in turn would create slack waters, pools and a diversity of habitats for aquatic species including invertebrates and fish. Native cuttings and seeds along with bioengineering techniques would be used to re-vegetate areas disturbed by stabilization techniques and to increase the amount of vegetation in the riparian zones. This would further protect against sever bank erosion.

5. Estimate of Needed Resources

<table>
<thead>
<tr>
<th>Proposed Management Practice</th>
<th>Estimated Amount Required</th>
<th>Average Estimated Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upland Thinning</td>
<td>2,500 acres</td>
<td>$1,000.00 per acre</td>
</tr>
<tr>
<td>Prescribed fire</td>
<td>30,000 acres</td>
<td>$15.00 per acre</td>
</tr>
<tr>
<td>Bank Stabilization and Protection</td>
<td>2,000 feet</td>
<td>$50.00 per foot</td>
</tr>
<tr>
<td>Seeding and Pole Plantings</td>
<td>1,000 acres</td>
<td>$250.00 per acre</td>
</tr>
<tr>
<td>Riparian Thinning</td>
<td>250 acres</td>
<td>$1,000.00 per acre</td>
</tr>
<tr>
<td>Mesquite Control</td>
<td># to be determined based on assessment of need</td>
<td>$60.00 per acre</td>
</tr>
<tr>
<td>Creosote Control</td>
<td># to be determined based on assessment of need</td>
<td>$35.00 per acre</td>
</tr>
<tr>
<td>Invasive tree control (Salt)</td>
<td># to be determined based</td>
<td>$1,500.00 per acre</td>
</tr>
<tr>
<td>Proposed Management Practice</td>
<td>Estimated Amount Required</td>
<td>Average Estimated Cost</td>
</tr>
<tr>
<td>------------------------------</td>
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<td>------------------------</td>
</tr>
<tr>
<td>Cedar and Siberian Elm) on assessment of need</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Erosion Control Structures &lt;100 yd³</td>
<td># to be determined based on assessment of need</td>
<td>$500.00 each</td>
</tr>
<tr>
<td>Fencing</td>
<td>10 to 20 miles</td>
<td>$2.00 per linear ft.</td>
</tr>
<tr>
<td>Watering facilities</td>
<td>5 to 10</td>
<td>$1,000.00 each</td>
</tr>
<tr>
<td>Water storage (5,000 gal)</td>
<td>10</td>
<td>$3,500.00 each</td>
</tr>
<tr>
<td>Digital Imagery and/or data, (i.e. digital terrain models, aerial photography, satellite imagery, etc.)</td>
<td>50 to 100 mi.²</td>
<td>$60 to 120K</td>
</tr>
<tr>
<td>Recreation and Public Outreach (Public meetings, news releases, pamphlets, signage)</td>
<td>Variable</td>
<td>$10.00 to $20.00</td>
</tr>
<tr>
<td>Water Quality Monitoring Stations</td>
<td>1 to 3 Stations</td>
<td>$10 to 30 K</td>
</tr>
<tr>
<td>Refinement of Range Site Descriptions and Development of State and Transition Models</td>
<td>Variable based on area</td>
<td>$50 to 100 K</td>
</tr>
</tbody>
</table>

6. Education and Outreach

Hold periodic watershed group meetings, to include private land owners. Also develop an outreach program directed at landowners, along the creeks to address storm water runoff and water quality issues.

Conduct school field days which include data collection and water fairs, in accordance with school policy. These would be covered under a separate grant.

Develop National Resources Conservation Service correspondence to reach landowners and local citizen groups.

Conduct volunteer river cleanup projects.

The Tularosa watershed group would provide local newspapers with articles about different aspects of the watershed.

Conduct tours to evaluate the effectiveness of BMP implementation. The tours would be open to the public.
7. Schedule for Implementation

It is anticipated that all management practices identified in the above table would continue over the next three to five years. Implementation would be dependent upon when the watershed group members and agencies have completed planning and NEPA documentation for their portions of the WRAS. For all project activities on Federal Lands, or funded by federal dollars, appropriate National Environmental Policy Act (NEPA) documentation and environmental clearances would be obtained by the respective land management agencies prior to implementation of on the ground project activities. For all earth disturbing activities, archeological clearances would be obtained by landowners or land management agencies in accordance with New Mexico State Historical Preservation Act.

Previous best management practices which have already been implemented within the watershed include:

a) 1,058 acres of salt cedar control between 2003 and 2007.
b) 13,596 acres of creosote control between 1995 and 2007.
c) 1,832 acres of mesquite control in 2007.
d) 300 erosion control structures from 1997 to 1999.
e) 256 acres of Siberian elm control on the Mescalero Apache Reservation.
f) 2,780 acres of upland thinning on the Mescalero Apache Reservation and BLM.
g) 947 acres of prescribed fire on the Mescalero Apache Reservation and BLM.
h) 8 stream channel structures were installed in Tularosa creek in 2006 and 2007.

Several different funding sources have been used to achieve these management practices over the years, including previous 319(h) EPA Grants; BLMs range improvement program, fire, soil/air/water, wildlife and riparian funding; NRCSs EQIP program funding; Mescalero Apache Tribes various funding sources; and contributions from stakeholders through the use of cooperative agreements.

8. Description of Measurable Milestones

a) On going inventories to document reduction of noxious/invasive plants in riparian areas and replacement by natural processes and/or planting of native riparian vegetation where appropriate. Actual amounts would be determined based on assessment of need.
b) Canopy cover readings, along with plant surveys, to determine type and composition of vegetation, would be taken at monitoring stations.
c) Density reduction of pinon-juniper stands and increases in native herbaceous ground cover. Stand densities, measured in terms of basal area/acre would be reduced from 100 square feet per acre to 30 square feet per acre.
d) Decrease in creosote crown cover from 70% to 10% composition, and increase in native herbaceous ground cover from 5% to 15%, based on site potential.
e) Decrease in mesquite crown cover from 50% to 20% composition, and increase in native herbaceous ground cover from 5% to 15% based on site potential.
e) Measurable improvement in ground cover, based on site potential that would result in reduction in sediment entering streams where BMP’s have been implemented.
f) Photographic documentation of vegetative improvement that would result in water quality improvements (particularly in riparian areas).
g) Monitoring stations would be located and readings on amount of flow (discharge) and water quality would be collected. Information would be compared to baseline data.

9. Criteria to Determine If Loadings Are Being Achieved

a) Sediment traps in arroyos would be surveyed to determine amount of sediment deposition
b) Channel cross sections would be used to note changes in channel morphology.
c) Photo documentation and transect information would be compared to baseline data to determine vegetative trends in upland and riparian areas.

10. Watershed Assessment and Monitoring

Monitoring stations would be established to determine effects of watershed restoration activities within the project area. This information would be used to guide our monitoring program and draw conclusions regarding changes in channel conditions.

Greenline Monitoring Method and/or proper functioning condition assessments would be conducted, on major perennial streams, where BMP’s would be implemented. In addition, at the beginning and the end of the project, Rosgen surveys would be conducted where appropriate and additional in-stream information would be collected including: Temperature, Suspended Sediment, Turbidity, Dissolved Oxygen, pH, Stream Discharge, Photo Points, and Canopy Closure.

Water Quality data would be collected in the first year of a project where riparian treatments would be implemented, to establish baseline conditions.

Transects and Photo Stations would also be established and sampled prior to land treatments, where upland brush treatments would be implemented. Data would also be collected at the end of the growing season each year of the project, to determine if there has been a decrease in composition of the target species, and a corresponding increase in herbaceous cover.

The Village of Tularosa proposes to monitor water quality at their collection point, as well as three new locations, using new equipment to be installed in the near future. The development of a water quality monitoring program would serve as the measures of success for other watershed projects, and the purposes of the Tularosa village for improving water quality. This would allow us to monitor change in conditions, and allow for adaptive management.

Digital terrain model data was acquired in 2007 for two 25 square mile areas on the Three Rivers and Tularosa creeks. This data will be used, in addition to other available digital imagery or data, to assist in watershed assessment and project planning.