Programmatic Environmental Assessment/ Biological Assessment of the Carlsbad Project Vegetation Management Program

U.S. Department of the Interior
Bureau of Reclamation
Albuquerque Area Office
Albuquerque, New Mexico

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COVER SHEET

Draft Programmatic Environmental Assessment/Biological Assessment of the Carlsbad Project Vegetation Management Program

Lead Agency
U.S. Department of the Interior, Bureau of Reclamation

Counties that could be Affected
Carlsbad Project Lands, Eddy County, NM

Abstract

The United States Department of the Interior, Bureau of Reclamation Albuquerque Area Office has prepared a draft programmatic environmental assessment/biological assessment (draft EA/BA) to assess potential environmental effects of the Carlsbad Project Vegetation Management Program (Vegetation Management Program or Program). The Vegetation Management Program consists of a research component and a treatment component. The research component includes studies of a biological agents, herbicides, and mechanical methods; revegetation; and herbicide residue. The treatment component includes potential aerial application of an herbicide for treating saltcedar and some treatments of other invasives that would be implemented in cooperation with the Carlsbad Irrigation District and the Carlsbad Soil and Water Conservation District. The Vegetation Management Program, if implemented, is envisioned to further our knowledge of the most appropriate and most effective treatment and revegetation methodologies while simultaneously reducing the acreage currently impacted by saltcedar and other invasive plants. The Program is anticipated to be dynamic and ongoing over the next approximately 10 years, adapting to new information, and likely initiating new studies. The long-range vision of the Program is a reduction of invasive plants and reestablishment of native vegetation (grasses/shrubs). Though many details and specific activities of the Program are unknown at this time, all future work proposals will be consistent with the long-range vision. The purpose of the Program is to learn about the range of treatment methods, their effectiveness on Carlsbad Project lands, how to optimize invasive species control through integration of the methods, and how to reestablish native vegetation on treated lands as well as to actually reduce the acreage currently infested with saltcedar and other invasive plants. The need for the Program is based on Reclamation's desire to control saltcedar and other invasive plants on its Carlsbad Project lands and reestablish native vegetation appropriate to the impacted areas. Acre for acre, native vegetation consumes less water than saltcedar and is overall more ecologically compatible.

The environmental analysis addresses the following topics: soils, range conditions, noxious weed infestations, grazing, water quality, water, fisheries, wildlife, threatened and endangered species, cultural resources, recreation and accessibility, socioeconomic considerations, environmental justice, Indian trust assets, and cumulative impacts.

Interagency Coordination
The proposed Vegetation Management Program was coordinated with the Carlsbad Irrigation District (CID), the New Mexico Department of Game and Fish (NMDGF), and the Carlsbad Soil and Water Conservation District (SWCD). The CID is the beneficiary of the Carlsbad Project and is contracted by Reclamation for operations and maintenance activities. NMDGF is contracted by Reclamation to manage Brantley Wildlife Management Area. SWCD is the source of support for a component of the proposed Vegetation Management Program through its helicopter spraying program.

Public Notification

- A public meeting was held in Carlsbad, New Mexico at the Stevens Inn on Wednesday, March 12, 2004 from 6-8 pm to present information about biological treatment of saltcedar. The field release and study of an approved saltcedar biocontrol beetle was discussed.
- The public will be notified prior to aerial herbicide spraying
- Reclamation issuance of a draft EA/BA for 15-day public review.

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ACRONYMS AND ABBREVIATIONS

AF	Acre-ft
CEQ	Council on Environmental Quality
DOI	Department of the Interior
EA	Environmental Assessment
EPA	Environmental Protection Agency
FONSI	Finding of No Significant Impact
ITA	Indian Trust Assets
NEPA	National Environmental Policy Act
NMDGF	New Mexico Department of Game and Fish
Carlsbad Project Vegetation Management Program	Vegetation Management Program or Program
RMP	Resource Management Plan
Reclamation	Bureau of Reclamation
SHPO	State Historic Preservation Office
TCP	Traditional Cultural Property

Draft Programmatic Environmental Assessment/Biological Assessment for the Carlsbad Project Vegetation Management Program

Summary

This programmatic environmental assessment was prepared by Reclamation to evaluate potential environmental impacts of the Carlsbad Project Vegetation Management Program. Two alternatives, the Vegetation Management Program and the No Action alternative, were assessed. Potential impacts of each alternative are briefly listed in Table 1 for comparison and are further described within this document.

Table 1
Environmental Consequences
Summary of Impacts

INDICATOR (By order of table of contents in document)	No Action Alternative	Vegetation Management Program
Soils (erodibility, productivity)	No change from existing conditions. Moderate localized disturbances from wheeled equipment.	Potentially better soil nutrient availability.
Range Condition	Existing conditions	Excellent potential for improvement.
Noxious Weed Infestations	Moderate potential for noxious weed infestations by scattering reproductive parts and seeds due to mechanical treatments.	Low potential for noxious weed establishment with chemical and biological treatments. Moderate potential with mechanical treatments.
Grazing	Existing conditions – Grazing leases below Brantley and around Avalon	Grazing leases continue with some possibility of improvement.
Water Quality	Existing conditions	Potential for some increased sediment load; chemical use will be protective of water quality; no adverse impacts anticipated.
Water	Existing conditions	Some potential to salvage water though immeasurable.
Fisheries	Existing conditions	No effect
Wildlife (habitat diversity)	Existing conditions	Some potential loss with saltcedar treatments; displacement of some wildlife to adjacent stands; some potential improvement if vegetation is successful.
Threatened and Endangered Species	Existing conditions	No effect
Cultural Resources	Existing conditions	No change
Recreation and Accessibility	Existing conditions	Potentially improved human access to recreation sites.
Socioeconomic	Existing conditions	No effect
Environmental Justice	Existing conditions	No effects.
Indian Trust Assets	No ITAs identified.	No ITAs identified.
Cumulative Impacts	Existing conditions continue	If Vegetation Management Program is successful there may be some water salvaged over the years, there may be a progressive loss of habitat provided by saltcedar; and a progressive increase in native vegetation and the wildlife communities it would support.

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Chapter 1. Purpose and Need

Federal Action

The federal action addressed in this draft programmatic Environmental Assessment/Biological Assessment is implementation of the Carlsbad Project Vegetation Management Program. The Vegetation Management Program consists of a research component and a treatment component, both targeting the pest saltcedar (*Tamarix* sp.) and potentially other invasive plants such as kochia. The research component includes studies of a biological agents, herbicides, and mechanical methods; revegetation; and herbicide residue. The treatment component includes potential aerial application of an herbicide that would be implemented in cooperation with the Carlsbad Irrigation District and the Carlsbad Soil and Water Conservation District. The Vegetation Management Program, if implemented, is envisioned to further our knowledge of the most appropriate and most effective treatment and revegetation methodologies while simultaneously reducing the amount of acreage currently impacted by non-native invasive species (including trees that consume lots of water) infestations. The Program is anticipated to be dynamic and ongoing over the next approximately 10 years, adapting to new information, and likely initiating new studies. The long-range view of the Program is a reduction of non-native invasive species, such as saltcedar and kochia, and reestablishment of native vegetation like grasses and shrubs. Though many details and specific activities of the Program are unknown at this time, all future work proposals will be consistent with this long-range view. The Program is proposed to be conducted on lands of the Carlsbad Project administered by the Bureau of Reclamation and potentially on lands within the Carlsbad Project which are owned by the Carlsbad Irrigation District (CID). Reclamation will fully coordinate the Vegetation Management Program with CID. No lands owned by CID would be included without concurrence by CID.

Purpose of and Need for Action

The purpose of the Vegetation Management Program is to learn about the range of treatment methods, their effectiveness on Carlsbad Project lands, how to optimize invasive plants control through integration of the methods, and how to reestablish native vegetation on treated lands as well as to actually reduce the amount of acreage currently infested with saltcedar and other invasive plants. The need for the Program is based on Reclamation's desire to control saltcedar and other invasive plants on its Carlsbad Project lands and reestablish native vegetation appropriate to the impacted areas. The Department of Interior Strategic Plan 2003-2008 includes one goal, "Sustain biological communities on DOI managed and influenced lands and waters in a manner consistent with obligations regarding the allocation and use of water" and a performance measure associated with that goal of "Percent change from baseline in the number of acres infested with invasive plant species". Reclamation's performance goal essentially mimics and supports the Department's goal and will be measured by the percent change in infested priority acres. The consumption of water by invasive species, particularly the nonnative species such as saltcedar, is a continuing problem in the arid and semiarid regions of the western United States. Recent prolonged and severe drought in the Pecos River Basin increases the need for water conservation and water salvage. A multi-agency cooperative study was completed in New Mexico on the Rio Grande to measure evapotranspiration associated with saltcedar and native vegetation. Preliminary results indicate the average annual water use by saltcedar in the floodplain is equivalent to the requirements for alfalfa, roughly four acre feet (AF) of water per

year (Draft Technical Report Project # 1-4-23955).

Location, Setting, and Background

The Carlsbad Project stores water in Santa Rosa (a Corps of Engineers Dam), Sumner, Brantley, and Avalon Dams to provide water for about 25,000 acres within the Carlsbad Irrigation District. Project features include Sumner Dam and Lake Sumner (formerly Alamogordo Dam and Reservoir), McMillan Dam (breached in 1991 and replaced with Brantley Dam), Avalon Dam, and a drainage and distribution system to irrigate 25,055 acres of land in the Carlsbad area.

The Vegetation Management Program is proposed to be implemented on lands of the Carlsbad Project administered by the Bureau of Reclamation or owned by CID. Approximately 33,400 acres of saltcedar were cleared during the 1960s – 1970s on the Pecos River in New Mexico. These areas have had limited success in passive revegetation because of limited available moisture and most areas are still occupied by rudimentary annual species such as Kochia, sunflower and cocklebur. Some areas have had active revegetation attempts as late as the 1990's with limited success. Approximately 2,700 acres were seeded with several grass species including the Aggressive Lehman's Lovegrass via broadcast seeding under contract with Granite Seed.

Though the Carlsbad Project includes a broad geographic area in southeastern New Mexico, the location currently considered for the Vegetation Management Program is limited to Carlsbad Project lands around Brantley and Avalon Reservoirs north of the city of Carlsbad. These Carlsbad Project lands total 7,829 acres, of which 5,026 acres are administered by Reclamation and 2,803 acres are owned by CID (Appendix D). The project area also supports extensive mineral leasing activities (oil and gas wells) administered largely by the Bureau of Land Management (BLM). Livestock grazing occurs within the project area as well, primarily on lands surrounding the Pecos River downstream from Brantley Reservoir and on lands surrounding Avalon Reservoir.

Target Species

Saltcedar is an exotic deciduous tree growing on an estimated 6,172 acres within the Carlsbad Project area (Resource Management Plan (RMP), December, 2003). Saltcedar is considered a noxious species whose impacts to water resources in New Mexico are detrimental. It transpires large amounts of water in comparison to native vegetation. It consumes water 35 percent more rapidly than native vegetation (Johns, E. L. 1990). It has been classified as a salt secreting halophyte. A halophyte is defined as a plant that tolerates large amounts of salt or alkali in the soil or water. Saltcedar can successfully out-compete native vegetation to form monotypic stands. Along channels it increases sedimentation and reduces channel capacity (Blackburn et al 1982). Saltcedar is also classified as a phreatophyte which is defined as "a plant that habitually obtains its water supply from the zone of saturation, either directly or through the capillary fringe" (def. Meinzer, O. E. 1927). With the increasing scarcity and demand for water, limiting non-beneficial consumptive uses of water becomes paramount. Saltcedar can be treated with various methodologies. Within the Carlsbad Project, Reclamation has relied on mechanical treatments. Root Plowing is currently used where the machine shears vegetation below the soil surface. To ensure cutting below the root crown of saltcedar, the root plow must be between 12 to 18 inches below the ground. The above ground vegetation is removed before or during root plowing, and is piled and burned to prevent resprouting of shoots and stems. This action occurs around the shoreline at Brantley where the saltcedar is too large to use the tractor.

Saltcedar can have regrowth rates which exceed six feet per growing season. Regrowth typically occurs as multiple stems from the cut trees base and the number of stems increases after each cutting. Stem diameters often increase to greater than two inches within a short period of time. Stem diameters exceeding two and one half inches cannot be cut with mowing equipment currently on hand. In the absence of any control methods, saltcedar will effectively eliminate or "crowd out" desirable vegetation.

Other target species occurring in the project area include not only kochia (*Kochia scoparia*) but *Centaurea melitensis* (Malta starthistle) and *Peganum harmala* (African rue) which are identified as noxious weeds.

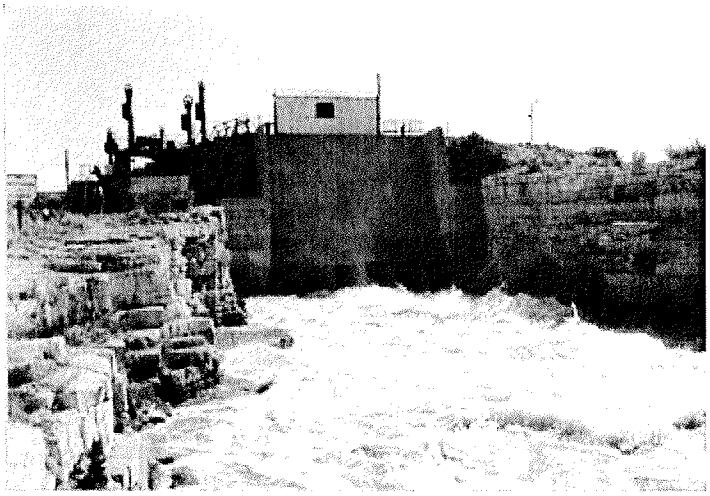
Brantley Reservoir

Brantley Dam and Reservoir of the Brantley Project were authorized on October 20, 1972, by Public Law 92-514, for irrigation, flood control, fish and wildlife, recreation benefits, and to replace McMillan Dam, which was determined to be unsafe. Construction of Brantley Dam was completed in August 1988. The dam is on the Pecos River at mile 478.5, situated in Eddy County about 13 miles upstream from the city of Carlsbad, New Mexico. It is about 10 miles upstream from the Avalon Dam in the Carlsbad Project and 25 miles downstream from Artesia. The Brantley Project area extends about 16.5 miles above the damsite. The dam was designed high enough to allow for future siltation and the gradual raising of the reservoir pool elevation as it occurs over the next 100 years. The conservation pool encompasses approximately 3,800 surface acres Carlsbad Irrigation District operates and maintains Brantley Dam for irrigation releases.

Brantley Dam and Reservoir

Avalon Reservoir

Avalon Dam was originally built in the early 1890s and then reconstructed by Reclamation in 1907 after being destroyed twice by floodwaters. The dam's height was increased in 1912 and again in 1936 Avalon Reservoir is located in Eddy County and has a structural height of 58 feet and a volume of 202,000 cubic yards with a water surface area of 930 acres when full. In addition to being both a storage and regulating reservoir, Avalon Dam serves as the diversion dam for the project by diverting water in to the Main Canal to irrigate project lands on both sides of the Pecos River near Carlsbad. Total reservoir capacity today is 4,980 AF at maximum water surface elevation at 3177 feet (Reclamation datum). The dam is located on the Pecos River five miles north of Carlsbad, NM. Carlsbad Irrigation District operates and maintains Avalon Dam for irrigation releases.



Avalon Canal Outlet Works

Chapter 2. Proposed Action and Alternative

Alternatives considered in this draft EA/BA are the Proposed Action and the No Action alternative (Table 1). The Proposed Action consists of implementing the Vegetation Management Program in addition to ongoing operation and maintenance activities (O&M). The No Action consists of continuing ongoing O&M.

Table 1. Summary Comparison of the Alternatives

NO ACTION	PROPOSED ACTION
Vegetation Treatments: Ongoing periodic mowing of kochia in the floodway/ root plowing, grubbing and a rubber tire tractor use are used on saltcedar on the shoreline areas of Brantley and Avalon Reservoirs	**Vegetation Treatments:** Possible aerial herbicide treatments of monotypic saltcedar stands; Ongoing periodic mowing of noxious and invasive weeds in the floodway/root plowing, grubbing and use of a tractor on saltcedar on the shoreline areas of Brantley and Avalon Reservoirs; treatments of noxious weeds and kochia possible.
Investigations: None	**Investigations:** Biological, mechanical, and herbicide treatment studies; herbicide residue study; revegetation studies.

Partnering agencies: Carlsbad Irrigation District	**Partnering agencies:** Carlsbad Irrigation District; Carlsbad Soil and Water Conservation District; and New Mexico Department of Game & Fish

No Action

Under this alternative, Carlsbad Irrigation District on behalf of Reclamation would continue to perform O&M activities within the Carlsbad Project. CID manages vegetation in the "floodway", an approximately 6-mile long by 200-300 feet wide strip which is mechanically mowed 1-2 times per year to assure passage of flood flows if and when that type of flood event occurs. The frequency of mowing depends on the rate of vegetation growth and the availability of resources to conduct the work. CID also manages vegetation invading the areas around Brantley and Avalon Reservoirs. Using tractors pulling root plows or rake attachments, stands of saltcedar are cleared and placed in piles. The piles of dead and dried saltcedar are burned once all required burn permits are in place. In addition, CID is considering implementing some chemical treatments of plants invading sites which do not lend themselves to mechanical treatments. The length of Brantley Dam, for example, may be a candidate for chemical application. Current budget limitations have made it increasingly difficult to treat the areas in a timely manner. For those areas not currently being treated, saltcedar would be allowed to grow unimpeded. As evidenced on non-managed areas, the desirable vegetation would decrease as a result of shading, accumulation of litter or "duff", increasing soil salinity, and potentially decreasing water availability through the lowering of water tables. Under this alternative, a Vegetation Management Program proposed by Reclamation would not be implemented. There would be no biological treatments and no aerial application of herbicides and no attempts at revegetation. No research or studies of vegetation management would be proposed.

Under this alternative, there would continue to be independent ongoing efforts in the surrounding landscape targeting control of saltcedar. These are briefly described below.

Pecos River Basin Water Salvage Project

The Pecos River Basin Water Salvage Project is the largest effort to date for removing saltcedar in the Pecos River Basin. It is a federally approved agreement between the states of New Mexico and Texas, Congress authorized the Secretary of the Interior to carry out a continuing program to reduce the nonbeneficial consumptive use of water in the Pecos River Basin, including removal of *Tamarix* (saltcedar) and other undesirable invasive species between the headwaters of the Pecos River and Girvin, Texas. This Project is outside the bounds of and distinct from the Carlsbad Project. The Pecos River Basin Water Salvage Project involves mechanical control only. The project originally encompassed 590 miles and over 200,000 acres within the Pecos River Basin. Of the Pecos River Basin area, approximately 33,230 acres in New Mexico, and 14,000 acres between the State Line of New Mexico, and Girvin, Texas, received saltcedar removal treatment. The process was stopped in 1973 as a result of a lawsuit filed by Central New Mexico Audubon Society, New Mexico Wildlife Federation and others seeking an injunction on further work stating that Reclamation failed to comply with and satisfy the requirements of the National Environmental Policy Act (Civil Action No. 10118, United States District Court). The lawsuit was eventually dismissed in June 1979 after Reclamation had

completed and filed a Final Environmental Impact Statement (FEIS). While no additional lands have been cleared under the program since then, maintenance on those cleared areas continues today. (Brantley and Avalon Reservoirs RMP Project Final EA, Oct 2003).

Currently, Reclamation is maintaining the 33,000+ acres originally cleared in New Mexico, and the State of Texas has withdrawn from the program. Under contract RO910, with Carlsbad Irrigation District, these areas are still being mechanically cleared of any new salt cedar growth, utilizing Reclamation equipment, and labor being furnished by CID. These acreages are scattered on both sides of the river, from Santa Rosa, New Mexico, to the State line of Texas, with about 40% being south of Carlsbad, 40% being north of Artesia, to just north of Roswell at the N.M. State Game Refuge, and about 20% between Santa Rosa and Ft. Sumner Irrigation District.

Pecos River Saltcedar Control Project
The Pecos River Saltcedar Control Project is part of a special appropriation by the New Mexico State Legislature to fund invasive species vegetation control along the Pecos River by soil and water conservation districts. The Carlsbad Soil and Water Conservation District has overseen aerial herbicide applications by helicopter and ground applications. The aerial treatments were applied by North Star Helicopter in September 2002 and again in September 2003, with the following acres being treated:

County	Acres 2002	Acres 2003	Total Acres
Eddy	2,520	2,551	5,071
Chaves	2,853	883	3,736
DeBaca	2,599	1,548	4,147
Guadalupe	1,146	91	1,237

In addition, ground applications included the following acreages treated in the cut-stump contracts:

- Carlsbad SWCD - 29.8 acres
- Upper Hondo SWCD - 37.1 acres
- Guadalupe SWCD - 29.8 acres

(Carlsbad Soil and Water Conservation District Email, July 29, 2004).

Bitter Lake National Wildlife Refuge Integrated Weed Management Plan
The U.S. Fish and Wildlife Service Bitter Lake National Wildlife Refuge, located about nine miles northeast of Roswell, New Mexico along the Pecos River has an Integrated Weed Management Plan to address saltcedar infestations.

Proposed Action

Under this alternative, Reclamation in consultation with the Carlsbad Irrigation District would implement a Vegetation Management Program consisting of a research component and a treatment component, both targeting the pest saltcedar (*Tamarix* sp.) and other invasive or non-desired plants. The research component includes studies of a biological agents, herbicides, and mechanical methods; revegetation; and herbicide residue. The treatment component includes potential aerial application of an herbicide that would be implemented in cooperation with the

Carlsbad Irrigation District and the Carlsbad Soil and Water Conservation District. Treatments of noxious weeds and other invasives are also considered. More details of each aspect of the Program are provided below. The Vegetation Management Program would further our knowledge of the most appropriate and most effective treatment and revegetation methodologies while simultaneously reducing the amount of acreage currently impacted by invasive plants. The Program is anticipated to be dynamic and ongoing over the next approximately 10 years, adapting to new information, and likely initiating new studies. The long-range view of the Program is a reduction of invasive plants, such as saltcedar, noxious weeds, including kochia, and re-establishment of native vegetation like grasses and shrubs. Though many details and specific activities of the Program are unknown at this time, all future work proposals will be consistent with this long-range view. The Program is proposed to be limited to lands of the Carlsbad Project administered by the Bureau of Reclamation or owned by CID. Reclamation will work closely with CID on the Program. No CID land would be included without concurrence of CID.

Reclamation also proposes to treat undesired vegetation on the upstream and downstream slopes of Brantley and Avalon Dams (see Appendix J) for the following reasons:

1) To allow proper surveillance and inspection of the structures and adjacent areas for seepage, cracking, sinkholes, settlement, deflection, and other signs of distress.
2) To allow adequate access for normal and emergency Operation and Maintenance (O&M) activities.
3) To prevent damage to the structures due to root growth, such as shortened seepage paths through embankments; voids in embankments from decayed roots or toppled trees; expansion of cracks or joints of concrete walls, canal lining, or pipes; and plugging of perforated or open-jointed drainage pipes.
4) To discourage animal/rodent activity (by eliminating their food source and habitat), thereby preventing voids within embankments and possible shortened seepage paths.
5) To allow adequate flow-carrying capability of water conveyance channels (e.g., spillway inlet an outlet channels; open canals, laterals, and drains).

The methods selected to control the unwanted vegetation on the dam's slopes will provide excellent control at a minimal cost. The herbicide applications, suggested within Appendix J, can be done in the fall or early winter when temperatures are more favorable for such work. As much as possible, selective herbicides and selective application methods were the preferred choice to limit affects to desirable plants. "Restricted Use" herbicides, which would require certification, and mobile herbicides (those that could potentially cause water contamination) were not selected for use.

Treatment Component

This component would include aerial application of an herbicide that would be implemented in cooperation with the Carlsbad Irrigation District and the Carlsbad Soil and Water Conservation District (SWCD). Reclamation currently has no funding for this type of work but has entered into a Memorandum of Agreement with the SWCD. Reclamation and CID would identify potential areas to be treated and SWCD would determine whether the treatments would be implemented. A separate agreement would be needed between CID and SWCD for treatment of

any lands owned by CID. Reclamation would use the following criteria for selecting potential treatment locations:

1) Limited to stands of monotypic saltcedar on Carlsbad Project lands
2) Coordinate with Carlsbad Irrigation District on treatment site selection
3) At the reservoir, treatment may occur anywhere except within 50 feet of the wetted perimeter.
4) Avoid or minimize environmental impacts and avoid all impacts to any federally listed species.
5) Limited to flat or gently sloped topography, with the exception of channel banks selected by CID.
6) Limited to locations that can be defined with GPS technology.

McMillan – off-road way just North of Dam tenders house, approximately 65 acres (Proposed treatment site #1)

Total acreage of monotypic saltcedar on Carlsbad Project land around Brantley and Avalon Reservoirs is estimated to be approximately 6,172 acres. Some of this saltcedar appears to be thriving while other stands appear less healthy. These differences may be due to the variation in depth to shallow groundwater throughout the Project area. Thriving saltcedar in areas with less depth to groundwater would likely consume more water than saltcedar in poor condition with greater depths to groundwater. This factor is considered when selecting potential treatment sites. Initially, it is likely that no more than a few hundred acres would be proposed for treatment, although in the long term Reclamation would seek to maximize the acreage treated as long as the treatments are successful and there are no highly controversial or detrimental effects. Aerial treatments would facilitate vegetation management in limited access areas while reducing site disturbances. Treatments would normally be applied in late summer or early fall to maximize effectiveness. All applicable laws and regulations will be adhered to and primary considerations will be given to minimizing impacts to non-target vegetation and/or water quality. Treated sites would be allowed a minimum of two years without additional disturbances to allow for maximum herbicide effectiveness. At least initially, revegetation of treated sites would be limited to passive revegetation. Ultimately the desired objective is to reestablish desirable perennial species to aid in site stability and provide some level of control against invasion by noxious weeds or reinvasion by saltcedar.

Area proposed by CID for spraying, an estimated 160 acres of Reclamation Lands (proposed treatment site 2)

Research Component

This component includes studies of a biological agent, herbicides, and mechanical methods; revegetation; and herbicide residue. The treatment methodologies would be tested individually and in combination to evaluate their effectiveness. Revegetation studies would be conducted to determine effective strategies for rehabilitating and stabilizing treated areas. In addition, any channel banks treated per CID request may be studied for stabilization via revegetation. An herbicide residue study would be a specific investigation of the rate of dissipation and persistence of the herbicide Imazapyr applied aerially.

1) Biological Control Study Using Saltcedar Leaf Beetle

Biological control is intended to target and control exotic, invasive plants in relatively stable ecosystems such as natural areas and rangelands, by the introduction of the natural enemies (insects) that regulate the weed's abundance in its native region. The objective is to permanently reduce the weed's abundance below the damaging level, but not to eradicate the weed. Saltcedar is an "ideal" weed for biological control. It has low beneficial values, lacks closely related plants in the Western Hemisphere, and has a large number of host-specific and damaging insects that attack it within its native distribution (Briefing Paper: Biological control of Saltcedars, DeLoach and Carrauthers, Jan 2004).

Both adults and larvae of the saltcedar leaf beetle feed on the foliage of saltcedar. The large larvae also remove the outer layer of stem tissue causing the distal foliage to die. The adults overwinter and the larvae pupate under litter beneath the trees. Field cage studies showed a range of population increases with a 30-fold increase per generation not uncommon. In Colorado and Wyoming, overwintered adults become active in late April and produced two generations before they began overwintering in September. In the more southern areas, the saltcedar growing season appears to be long enough to allow completion of three or possibly even five generations. (Briefing Paper: Biological control of Saltcedars, DeLoach and Carrauthers, Jan 2004).

Preliminary results indicate the biological program has a high probability of providing good control of saltcedar over much of the infested areas of the United States. The US Department of Agriculture (APHIS) has permitted the controlled release of two species of insects for saltcedar biocontrol. Clearances have been obtained from US Fish and Wildlife Service (Service) for release on the Pecos River.

This study includes the release of the saltcedar leaf beetle for research purposes only. The release site would not exceed ten acres. The environmental clearance for this study has already been obtained and the study was initiated in May. However, it is included in this document to present a more comprehensive assessment.

Beetle population increase outside the cages and damage to saltcedar

Eggs will be used as an indicator life stage because they are immobile, they are easy to see, and they persist for a long time. To estimate the increase in beetle populations from one generation to the next, we will count the number of eggs laid during each generation on sentinel branches that are sampled repeatedly. Sampling will therefore be done once per generation or two to three times per year depending on the length of the growing season. Sampling should be done around the time of peak egg deposition, or about 2 weeks after peak adult emergence. Eggs will be counted on 25 trees that are randomly selected from all saltcedar trees within a 56.4 m radius circle (ca. 1 ha) around the release point. If aerial photographs of the site are available, and the exact beetle release site is known, the sample trees can be pre-selected using the aerial photos. Coordinate tree selection with personnel monitoring vegetation at the site because the vegetation and insect groups will be monitoring some of the same trees. Number each tree and make a photograph of each tree. Repeat photographs should be taken at least each year.

On each of the 25 trees, select four branches (one in each of the N, S, E, and W cardinal directions). Do not select branches on which beetles have been released. If there are fewer than 25 trees within the 56.4 m radius circle, more branches per tree can be selected so that a total of 100 branches are monitored. Trees of different sizes can also be selected. Flag, tag, and/or spray-paint the branch so the branch can be located again (for at least two years). Place a permanent mark on the branch 40 cm from the tip.
At the time of peak egg laying for each generation, collect the following data for each of the 100 branches: 1) length of the branch from the mark to the tip, 2) the number of *Diorhabda* eggs on the branch, 3) the percentage damage of the branch due to *Diorhabda* (0 - none; 1-10% - light; 10-50% - moderate; 51-95% - heavy; and 96-100% - complete), 4) the relative abundance of leafhoppers, 5) the relative abundance of scale insects, and 6) the damage from leafhoppers. As the population of beetle moves outside the 56.4 m radius circle, it may be worthwhile to start sampling the other saltcedar plants already being monitored by the vegetation group.

Dispersal

Both short- and long-range dispersal of the beetles will be monitored. Insects often exhibit two types of movement: trivial and migratory. If these beetles act like other weed biocontrol agents, their populations will build up locally and spread out like ripples on a

pond (trivial dispersal). A small number of females may also migrate some distance away from this general area of infestation and start new populations (migratory dispersal). With many insect species, migratory dispersal does not begin until after a few years when populations have increased to large numbers in the release area. It is desirable to determine the presence, extent, and timing of these types of dispersal behavior for *D. elongata*. The general change in beetle density and distribution near the release site will be determined, and samples will be collected up to 8 km in each cardinal direction away from the release site to look for longer-range dispersal and the initiation of new populations.

Opportunities to integrate the other treatment methodologies and revegetation studies will be implemented as appropriate. Those opportunities will depend on the results and success of the beetles and identifiable research needs.

2) Herbicide Treatment Studies

Reclamation would treat saltcedar with herbicide products currently labeled for use on range and pasture, noncropland or aquatic sites in New Mexico. Developments of successful herbicide treatments and products within the last ten years make possible a reduction in saltcedar densities through plant mortality. The work would be inclusive of foliar broadcast applications, foliar individual plant treatments, carpeted roller treatments, basal bark and cut-stump applications dependant upon plant densities, location to water, presence or absence of other vegetation, and cost effectiveness. The candidate sites for aerial application would be limited to monotypic saltcedar. Aerial treatments would facilitate vegetation management in limited access areas while reducing site disturbances. The proposed work would be conducted to avoid impacts to any federally listed species. All applicable laws and regulations will be adhered to and primary considerations will be given to minimizing impacts to non-target vegetation and/or water quality. Herbicide treatment selection would be based upon location, size, density and physiological condition of saltcedar. Foliar treatments either ground based or aerially applied requires saltcedar to have adequate green foliage to uptake the herbicide and locations where plants are under drought stress will be avoided.

Treated sites would be allowed a minimum of two years without additional disturbances to allow for maximum herbicide effectiveness. Passive revegetation utilizing natural responses would be managed for in most cases. Active revegetation through site preparation, reseeding and additional weed management may be necessary in some areas, e.g., where weedy species, such as kochia, begin to dominate the sites, or in areas devoid of all cover due to saltcedar duff and high salinity. Ultimately the desired objective is to reestablish desirable perennial species to aid in site stability and provide some level of control against invasion by noxious weeds or reinvasion by saltcedar.

3) Mechanical Treatment Studies

Mechanical treatments (mowing on weeds/shredding) that may be employed would involve the use of tractor mounted rotary mowers to cut smaller trees and the use of larger flail head /mulcher type cutters mounted on wheeled and track vehicles for larger

diameter trees. A root plow and grubber are also used in the mechanical treatment for saltcedar (see photos below). Mechanical treatments would occur in combination with 1) biological controls and 2) revegetation site preparation. Work may be located at the McMillan Breach area and would not be expected to exceed 600 acres.

Root Plow used in saltcedar removal.

Grubber used in saltcedar removal.

4) Revegetation Studies

Initially, two 6.2 acre study sites in the existing "floodway" on Reclamation administered Project lands are being considered for establishment. These sites were selected based upon their soil morphology and history. Both sites were previously occupied by dense infestations of saltcedar which were cleared by root plowing over a decade ago. Site selections were made to include one site having a predominant lacustrine (lakebed) soil and the other an alluvial (river deposited) soil more typical of the area. The lakebed site is currently occupied by *Kochia sp.* while the alluvial site is mostly bare ground with some patches of grass. Both sites would be treated with a non-selective herbicide containing the active ingredient glyphosate prior to seedbed preparation and seeding in order to obtain unbiased results.

Revegetation Plot South Site just north of major power line.
CID mows this floodplain 1-2 times annually for Reclamation.

Results obtained from these studies would be used to determine best practices for

revegetation and rehabilitation of treated sites. Additional study sites may be established subject to funds availability and need for further investigations. CID will be consulted for recommendations on additional or preferable study locations. Channel bank locations could possibly be identified for bank stabilization revegetation studies.

Appropriate methods for revegetation will be based upon results from field investigations. Work is expected to be located within the old McMillan lakebed (lacustrine soils) and the other to the north with soils deposited primarily through historic flooding events. A component of each will receive limited irrigation to simulate annual rainfall. The irrigated component will provide moisture to simulate typical monsoon rainfall events and may incorporate rainfall simulation to insure timing and total expected rainfall. Ideally monsoon rains typical for the area will be the norm; however it will be expedient to have irrigated sites to show what is possible in the event that rainfall is below normal.

5) **Herbicide Residue Study** Residual Imazapyr Levels in Soils of Areas Treated in the Pecos River Salt Cedar Control Project

The Pecos River Salt Cedar Control Project was initiated in September of 2002 with the aerial spraying of approximately 9,000 acres of private land situated along the banks of the Pecos River, with the herbicide Imazapyr. Approximately 5,000 acres of private and Bureau of Land Management lands were sprayed in September 2003. Aerial applications for September 2004 are anticipated to include approximately 500 acres (to be updated) of Reclamation land in the proximity of McMillan Delta, approximately 20 miles north of Carlsbad, New Mexico.

Reclamation is attempting to document any residual concentrations of Imazapyr in the areas treated in 2002 to aid in future revegetation efforts. Results from the initial analysis of samples selected for method development yielded only a trace of the herbicide in one of the samples. Four of the samples analyzed were collected from areas sprayed with the herbicide in 2002. One of the samples was from an unsprayed area. The four treated samples were selected for their range in salinity.

Because of the absence of Imazapyr in the initial analysis, samples are currently being examined from two isolated areas suspected of being sprayed with possibly excessive concentrations of the herbicide due to excessive kills of "non-susceptible" plant species. Soil samples from the two suspect areas, recently collected in June 2004, are currently being analyzed (16 samples). Additional samples covering a balanced representation of the total treated area along the Pecos River will be submitted for additional analysis.

Based on preliminary results, there was essentially no residual Imazapyr in the archived soils samples collected 3, 6, 9 and 14 months after application. Imazapyr in archived samples (air-dried samples sealed in plastic bags, and stored in the dark) is believed to be stable, but not definitely known. Two strategies are currently underway or planned to address this stability issue.

First, soil samples collected July 1-2, 2004 from Reclamation land aerially treated with Imazapyr in September 2003, in the vicinity of Elephant Butte Reservoir situated on the Rio Grande will be analyzed. These samples are currently being air-dried and will soon be shipped for laboratory analysis without archiving. This will be one approach to address the effects on the stability of Imazapyr from archiving soil samples. Eight sites were sampled from treated areas and two sites were sampled from non-treated areas. Four depth intervals were collected at each site. Forty samples will be available for analysis; however, the cost of analysis may require that only a subset of these samples be analyzed.

Second, a sampling program will follow the 2004 aerial spraying of Carlsbad Project land described above. Samples will be collected from established sites in treated areas over a period of time, until no residual herbicide can be detected. The sampling of Carlsbad Project land will be initiated at two week intervals, two weeks after herbicide application is completed for three sampling intervals. If significant concentrations of residual Imazapyr are detected after the initial sampling period, sampling will continue at monthly intervals for a period of three months. Should the herbicide persist through this observation period, the sampling period will be adjusted to two-month intervals until no residual herbicide can be detected, or it is concluded that no additional analyses are needed for assessing the persistence of Imazapyr.

Three sites will be established on herbicide-treated Carlsbad Project land (approximately 500 acres (to be updated)) for the duration of the time-interval sampling study. Samples will be collected at depth intervals of 0-3, 3-6, 6-12, and 12-18 inches. This will yield 12 samples from three sites per time interval. The deeper sampling intervals are included to address the possible mobility of the herbicide. (M. Walthall, Ph.D., July 28, 2004 email).

Alternatives Considered but Eliminated From Further Study

Prescribed Burning (Sole treatment)

Burning may effectively suppress saltcedar however it seldom causes mortality. It can be used as a tool for height management in conjunction with herbicide treatments, or to remove standing deadwood and duff. Since burning is nonselective, oftentimes less fire tolerant species such as cottonwoods and willows can be lost or damaged. Fire by itself is not an effective treatment option for established saltcedar.

Livestock Browsing

Livestock, native ungulates and other animals readily browse or eat the bark of native cottonwoods and willows, frequently killing the young plants and bringing reproduction to a halt. However, these animals feed much less on saltcedar, which soon grows taller than the livestock can reach. (USDA, Biological Assessment, September 1997).

Chapter 3. Affected Environment

The Carlsbad Project area is characterized by Desert Scrub and Desert Grassland vegetation suited for the annual rainfall of approximately 8.15 inches. Brantley and Avalon Reservoir were primarily constructed for irrigation and flood-control purposes; however, fishing, and other recreational activities have become important secondary functions. Storage elevations are influenced by annual inflows and releases for irrigation demands causing significant fluctuations to the reservoir pool and exposed reservoir lands.

Soils

The soils in the Research Project area (see Appendix C) vary from flat, alluvial loams to steep, rocky outcrops, to exposed caliche surfaces. Seven soil associations are found throughout Eddy County, but five of these are found specifically within the Research Project area. These include the following: 1) Arno-Harkey-Anthony Association: loamy, deep soils from recently mixed alluvium; 2) Limestone Rock Land-Ector Association: rockland and very shallow, stony, rocky, loamy soils over limestone; on hills and mountains; 3) Reagan-Upton Association: loamy, deep soils that are shallow to caliche; from old alluvium; 4) Reaves Gypsum Land-Cottonwood Association: loamy soils that are very shallow to moderately deep over gypsum beds and gypsum lands; and 5) Simona-Pajarito Association: sandy, deep soils from wind-worked mixed sand deposits.

Range Conditions

Reclamation land in the Carlsbad Project area consists primarily of upland range sites, with small draws occurring occasionally. Reclamation currently manages Carlsbad project area grazing permits and allotments. These grazing areas are limited to lands surrounding the Pecos River downstream of Brantley Reservoir. The primary influences on the conditions of riparian-wetlands at Avalon Reservoir appear to be water level fluctuations and grazing.
The treatments would be made to saltcedar occupying alluvial soils in the floodplain between Avalon and Brantley Dams (within the dam's floodplain). The plant communities within the defined limits for this action can be described as mixed desert shrubland, juniper shrubland, mesquite shrubland, saltbush shrub land, limestone/gypsum hills shrubland, desert plains grassland, kochia-dominated area, and arroyo shrubland (Brantley and Avalon Reservoirs Resource Management Plan, Environmental Assessment, October 2003).

- Mixed Desert shrubland is dominated by a mixture of desert shrubs, mainly creosotebush and whitethorn acacia *(Acacia constricta)*.
- Juniper Shrubland is dominated by primarily juniper or *Juniperus osteosperma* (utah juniper). Indian ricegrass and sand huhly are grasses commonly founding this plant community.
- Mesquite Shrubland is characterized by areas where mesquite occurs as the dominate shrub. This is found in two habitat types within the Research Project area, drainages (arroyos) and areas with deep sandy soils.
- Saltbush Shrubland occurs in scattered pockets over the entire Research Project area. This plant community is dominated by four-wing saltbush and found on deep loamy soils often adjacent to drainages or bodies of water.

- Limestone/Gypsum Hills Shrubland is a sparsely vegetated plant community found on the limestone and gypsum hills along the Pecos River Valley region's northeastern boundary. This plant community is also potential habitat of *Eriogonum gypsophilum* (gypsum wild buckwheat), a federally threatened species. Dominance of any particular shrub is rate; rather, an assemblage of many low-growing, sparsely spaced shrubs is typical. Theses include feather indigobush, mariola, turpentine bush, horse brush, Gregg's coldenia, wooly coldenia, broom snakeweed-, various prickley pear species, soaptree yucca, and banana yucca.
- Desert Plains Grassland is a plant community dominated by either tobosa or alkali sacaton. Burrograss, blue grama, and bush muhly are codominated in some areas.
- Kochia-Dominated Area is a plant community dominated by a single species, summer cypress. Russian thistle and peppergrass are also found within this vegetation type in some areas.
- Arroyo Shrubland plant community is dominated by a mixture of shrubs, which include wait-a-minute bush, catclaw acacia, mesquite, Apache plume, burro-brush, little leaf sumac, western whitethorn, California bricklebush, and smooth sumac. This plant community is made up of many species that are not found in other plant communities or are not found as abundantly. This complex structure is especially important as wildlife, especially for birds. Several of the shrub species are also prime forage for deer. For these reasons, this plant community is considered sensitive since it provides biodiversity and wildlife habitat.

The treatments would be made to emergent saltcedar and possibly other invasive plants occupying lands within the Carlsbad Project Area.

For the purposes of this action, efforts would be made to avoid impacts upon desirable native vegetation. Only saltcedar dominant sites would be treated with the appropriate methodology to ensure this goal. Proper site management includes the avoidance of creating bare ground, protecting wetlands, and avoiding adverse impacts to water quality and wildlife; protecting federally listed species is paramount. This action is an essential stopgap measure to control the spread and influence of the exotic saltcedar on our native plant communities and riparian system.

Noxious Weed Infestations

Under Federal law, noxious weeds are defined as those plants that are "of foreign origin, are new to or not widely prevalent in the United States, and can directly or indirectly injure crops, other useful plants, livestock, or poultry or other interests of agriculture, including irrigation or navigation, or the fish or wildlife resources of the United States or the public health." In addition to saltcedar, there are currently known populations of the following plants classified as noxious by State and Federal laws near or occupying sites within the Carlsbad Project areas: African rue (*Peganum harmala*) and Malta starthistle (*Centarea melitensis*).

Reclamation is particularly concerned about noxious weed infestations existing on lands owned by the federal government. Near or within the Carlsbad Project area are known populations of kochia (*Kochia scoparia*), African rue (*Peganum harmala*), Malta starthistle (*Centarea melitensis*) and many other undesirable weed populations. To deal more effectively with these weed issues, a draft Integrated Pest Management (IPM) Plan is currently being written by Reclamation. The IPM plan will include all the proposed work discussed within this EA/BA.

The IPM plan is considered a "living document" and will be revised as needed to ensure that weed infestations are being addressed to the extent possible.

Grazing

Carlsbad Project area grazing management consists primarily of continuous, year-round stocking of cows and calves. Along stream channels and other water bodies within the Carlsbad Project area, no physical separations (fences) exist, and if alternative livestock water sources are not readily available, cattle will congregate on the banks of Avalon Reservoir, in draws, or along the Pecos River. The Pecos River dissects the Carlsbad Project area and is the primary source of water in most allotments. Grazing is permitted on lands along the Pecos River below Brantley Dam and on lands surrounding Avalon Reservoir. These areas are managed cooperatively under BLM permitting and oversight. Reclamation lands constitute 52 percent of the allotments and are supplemental to adjacent BLM grazing lands (Brantley and Avalon Reservoirs RMP Project Final EA, Oct 2003). Reclamation land within these allotments is primarily sub-irrigated bermuda and saltgrass sods and is extremely valuable to livestock producers.

Water Quality

Nutrient levels in Brantley and Avalon Reservoirs are fairly high, in part because of stormwater runoff returns. Brantley Reservoir was classified as meso-eutrophic, also with good phytoplankton diversity and Avalon Reservoir is eutrophic, with good phytoplankton diversity (NMED/SWQB 1991b). In late February of 2004, about a dozen fish were over come by anxoic conditions from tainted well water when Reclamation restarted an existing well at Seven Rivers, New Mexico. The fish kill was limited to the immediate area at the outflow of the pipe.

Water

The study areas will be located over the Roswell basin: a shallow alluvial aquifer and a deep artesian aquifer. The Major Johnson Springs aquifer, in the southern part of the ground water basin, is part of the shallow aquifer (Daniel B. Stephens &Associates [DBS&A], 1995). As shown in Figure 1, the shallow and carbonate aquifers are separated by a semiconfining layer throughout most of the Roswell Basin. Both aquifers, however, are connected in the northwestern part of the ground water basin where the carbonate aquifer rises structurally to meet the shallow aquifer. The deep artesian aquifer is associated with the San Andres Formation and is confined on the east side and unconfined on the west. The shallow alluvial aquifer is unconfined throughout the basin. Both of the aquifers were developed significantly for irrigation water supplies in the 20th century.

A veneer of alluvial sediments deposited by the Pecos River covers the floodplain and comprises the shallow alluvial aquifer. As described by DBS&A (1995), the alluvial fill in the Roswell to Artesia area was deposited by streams ancestral to the current Pecos River in prehistoric times on an eroded surface of eastward dipping bedrock (Kelley, 1971; Lyford, 1973). The alluvial fill material includes the Plio-Pleistocene Gatuna Formation. The shallow aquifer saturated thickness ranges from 0 at its edge to approximately 300 feet in the north-central portion of the aquifer, and it is generally saturated with water within 50 feet (and frequently less) of the ground surface.

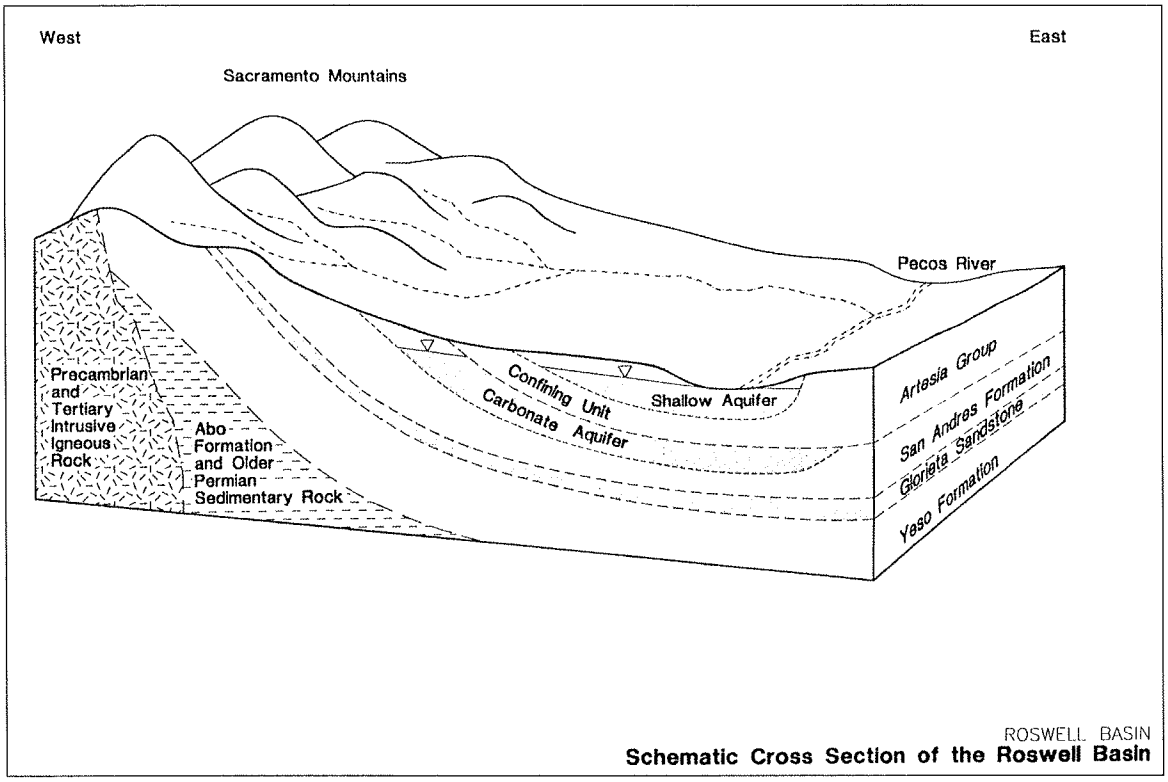


Figure **1**. Schematic West-East cross-section illustrating the geologic profile in the Roswell Basin (from DBS&A, 1995).

The reach from Artesia to Brantley Reservoir is generally a losing reach. More specifically, the sub-reach contained within the upstream and downstream limits of the Kaiser Channel is a losing reach. The Kaiser Channel was built from October 1948 to April 1949 and was originally a 4-mile channel that served to bypass flows through the immense delta that had formed on Lake McMillan. The channel was built to reduce transpiration losses from tamarisk (saltcedar) that grew on the delta and presently still proliferates. Due to the construction of Brantley Reservoir and the breach of the old McMillan Dam, the Kaiser channel is now closer to 13 miles long and runs from the start of the old Lake McMillan Delta to the mouth at Brantley Reservoir. Although the channel keeps water confined from most of the delta area, it still has significant losses through this stretch.

The USGS Ground Water Atlas (Atlas) indicates that in 1975, the artesian aquifer in the Roswell Basin had a potentiometric surface that slopes gently to the southeast and ranges in elevation from 3,250 to 3,550 feet above sea level (1995). The *Atlas* also indicates that in 1926, when the first ground water studies of the Roswell Basin were conducted, the potentiometric surface of the carbonate rock aquifer near the river was as much as 100 ft above the land surface (USGS, 1995). By 1950, the water levels had declined 10 ft to 30 ft below ground surface (bgs) in the eastern part of the aquifer, and by 1975, the levels had declined to more than 40 ft bgs over the entire extent of the aquifer and as much as 100 ft bgs near Lake McMillan (USGS, 1995).

The shallow aquifer in the Roswell basin had experienced similar declines in water levels from 1950 to 1975. Some area declines were close to 40 ft for that period, while in the center of the

basin, a cone of depression as large as 80 ft bgs was noted (USGS, 1995). Areas with large declines in the carbonate aquifer do not coincide with areas of decline in the alluvial aquifer (USGS, 1995). By 1975, in some places, the carbonate aquifer's decline was so great that in effect, the gradient, which typically flowed up from the carbonate aquifer, was reversed in some areas (USGS, 1995). The intensive development of the groundwater resources for irrigation supplies has significantly reduced water levels in both the shallow and deep aquifers compared to pre-development levels.

Recent well data shows that water level declines are recovering somewhat. These recoveries are attributed to the New Mexico Interstate Stream Commission's and Pecos Valley Association Carlsbad District's (PVACD) buy-up and retirement of many of the wells in the Roswell Basin.

Numerous studies demonstrate that Salt cedar evapotransporates from 30 inches to 90 in inches of water per year (Hays 2003). The average size saltcedar consumes 300 gallons of water per day (Reclamation, 2003). The actual water use is site specific.

Fisheries

Brantley and Avalon Reservoirs are important warmwater fisheries in southeastern New Mexico. Since Brantley and Avalon Reservoirs, as well as parts of the Pecos River, support essentially the same fish species, this discussion combines all three water resources into "Research Project area fisheries." Conditions unique to a particular water body are noted where they occur.

The primary sport fishes are largemouth bass and walleye. The NMDGF stocks largemouth bass (northern and Florida strains) and walleye periodically. Other important game species include channel catfish, *Micropterus punctulatus* (spotted bass), white bass, and *Pomoxis annularis* (white crappie). The primary forage fish in the reservoirs are *Dorosoma cepedianum* (gizzard shad), with various other fishes from "bait-bucket" introductions making up a small part of the forage base.

Habitat for primary sport fish species appears to be good, at least for adult fishes. Shallow littoral areas with inundated vegetation are seasonally available, as are gravel, rip-rap, and rocky shorelines. Gravel and rocky areas are preferred by littoral species (*centrarchid* spp. [sunfishes], including black bass) for spawning and nursery areas. Walleye are believed to spawn over the rip-rap along the dam; however, reproduction and recruitment is not successful because of water level fluctuations during the period of spawning and egg incubation.

The reservoirs and river within the Research Project area support 26 species of fish representing 11 families (See Appendix H). All of the species listed are found in both reservoirs and the river within the Research Project area, except for the *Moxostoma congestum* (gray redhorse), which is thought to occur only in Avalon Reservoir.

Live vegetation in and along the riparian zone, next to the stream bank, serves as vital cover and nutrient input for fish and wildlife. Moreover, it serves as a barrier to prevent sediments, debris, and pollution from entering the river. Dead and dying vegetation contributes to long-term point source pollution (nutrient and organic debris loading) at these sites.

At the reservoir, treatment may occur anywhere except within 50 feet of the wetted perimeter.

Wildlife

Other information used in the assessment included the *Final Environmental Statement for the Brantley Project* and *Final Supplement* (Bureau of Reclamation 1972, 1982) and the results of a 1998 study of the effects on wildlife from efforts to control saltcedar along the Pecos River (Andersen et al. 2000).

Approximately 80 percent of the wildlife habitat in the Research Project area is composed of upland vegetation types (i.e., Mixed Desert Shrubland Arroyo Shrubland, Desert Plains Grassland, Juniper Shrubland, Kochia-Dominated Area, Limestone/Gypsum Hills Shrubland, Mesquite Shrubland, and Saltbush Shrubland). The majority of the upland vegetation types are located away from the waterways and contain relatively little understory because of natural conditions and grazing. Nevertheless, upland vegetation is important to a wide range of wildlife including rodents, big game, lizards, snakes, turtles, upland game birds, raptors, and songbirds.

Riparian-wetland vegetation types (i.e., Marsh, Tamarisk Shrubland, and Riparian Grassland) comprise about 20 percent of the wildlife habitat in the Research Project area. Of this 20 percent, 98 percent of the habitat is Tamarisk Shrubland. Riparian-wetland vegetation types are primarily located along the Pecos River and shorelines of Brantley and Avalon Reservoirs. Despite the limited amount of riparian-wetland vegetation types, these habitats substantially add to the biological diversity of the Research Project area by attracting a diverse assemblage of wildlife species that otherwise would not occur in the general area. Riparian-wetland habitats are considered a limited resource in the surrounding arid environment, yet are used by a number of waterfowl, shorebirds, passerines, and amphibians.

The Brantley Wildlife Management Area, designated as part of the mitigation for the development of Brantley Dam and Reservoir, lies within the Research Project area boundary. It is managed by the NMDGF and consists primarily of Tamarisk Shrublands of varying densities and open field areas. The NMDGF manages this area for upland species with techniques such as mowing strips, planting small grains, and controlled burning. Within the Brantley Wildlife Management Area, the Seven Rivers Waterfowl Management Area is used to grow corn and alfalfa primarily for waterfowl. Milo, wheat, and millet are also grown to a lesser extent.

The fluctuating water levels in Brantley and Avalon Reservoirs and the Pecos River affect wildlife in a number of ways. For instance, when water levels are low, species that prefer mudflats and shallow water, such as shorebirds, benefit by having an increase in available habitat and prey. However, lowered water levels increase the distance from riparian-wetland habitats to the water, and thereby result in reduced-value habitats. When water levels are raised during the breeding season, nesting and roosting sites may become flooded. Fish spawning areas also vary with the changing water levels. The greatest adverse effect to wildlife from fluctuating water levels is related to the scouring of the shores which prevents vegetation from establishing, thereby limiting bank-side vegetation in some areas.

Birds

A total of 179 bird species were documented in the general area during past studies, including 32 known and 25 suspected breeding species (Bureau of Reclamation 1972). More recently, species

observed as part of the development of the 2003 Brantley and Avalon Reservoirs RMP EA is presented in Appendix G.

The Pecos River Valley is noted for its migratory waterfowl and shorebirds and, to a lesser extent, nesting and wintering species. The Research Project area attracts a large number of waterfowl and shorebirds because of its complex of open water, riparian-wetland, and upland habitats. This complex provides resources required by water-dependent birds such as food items (e.g., fish, macroinvertebrates, and emergent vegetation), sites to loaf and rest, protective cover, nest material, and secluded nesting areas. Such resources are directly associated with riparian-wetland vegetation types (Marsh, Riparian Grassland, and Tamarisk Shrubland) that are larger than 0.4 hectare (1.0 acre) in size and are within 30 meters (100 feet) of the Pecos River and reservoir shores. The habitat quality for waterfowl and shorebirds is limited in some parts of the Research Project area by the high degree of disturbance resulting from recreational use, cattle grazing, fluctuating water levels, and the invasion of large, mono-typic stands of Tamarisk Shrublands. Regardless, the Research Project area does contain areas that are particularly suitable for waterfowl and shorebirds. Common waterfowl and shorebird species include mallards, *Anas strepera* (gadwalls), *Anas acuta* (northern pintails), *Anas* spp. (teals), *Aythya americana* (redheads), *Aythya affinis* (lesser scaups), *Branta canadensis* (Canada geese), *Grus canadensis* (sandhill cranes), *Charadrius vociferus* (killdeers), *Recurvirostra americana* (American avocets), and *Himantopus mexicanus* (black-necked stilts) (Bureau of Reclamation 1972).

One notable habitat area, a small Marsh below the Avalon Reservoir dam, supports high densities of waterfowl and shorebirds. This area is comprised of open water with emergent vegetation, several scattered cottonwoods, and stands of *Baccharis* sp. (seepwillow). The Marsh is bordered by Riparian Grassland and Tamarisk Shrubland communities and is likely used by breeding birds (e.g., teals, northern shovelers, and grebes) for nesting, foraging, and brood-rearing. Migrating and wintering birds also likely use this area because of its abundance of food items and isolation. Arroyo outflow areas in the Research Project area may also provide secluded sites for nesting and brood-rearing.

Mudflats along the shores of the reservoirs and the Pecos River provide loafing and foraging areas for many species of waterfowl and shorebirds such as American avocets, black-necked stilts, killdeers, sandpipers, terns, and ducks. Research Project area mudflats are typically inundated during high water periods but remain exposed when water levels drop. Mudflats primarily occur within the footprint of Avalon Reservoir and immediately downstream along the Pecos River in areas where topographic relief is minor. Riparian Grasslands often border the mudflats.

Other areas of importance to waterfowl and shorebirds for feeding are located near fish spawning areas, such as within the shallow littoral zones containing inundated vegetation and shorelines composed of gravel and rock. Some waterfowl, including American coots, *Mergus merganser* (common mergansers), and *Larus argentatus* (herring gulls), forage within the deeper portions of Avalon Reservoir.

Raptors, such as *Buteo jamaicensis* (red-tailed hawks), *Buteo swainsoni* (Swainson's hawks), and *Falco sparverius* (American kestrels), are known to occur throughout the Research Project area.

The upland areas provide an abundance of small mammal prey including *Dipodomys* spp. (kangaroo rats), *Mus musculus* (house mouse), *Peromyscus maniculatus* (deer mouse), and *Thomomys* spp. (gophers). However, few roosting and nesting sites are available for raptors with the exception of 4.3 hectares (10.7 acres) of Juniper Woodland located within the upper draws of the Research Project area. Raptors may also use mature stands of Tamarisk Shrubland for roosting and nesting.

Habitat for most songbirds is associated with the riparian-wetland areas. In particular, Marsh and Tamarisk Shrublands with dense growth and complex vertical structure support nesting, migrating, and wintering populations of songbirds. These habitats provide nesting sites, protective cover from weather and predators, and prey items (e.g., seed, plant material, and insects). The Research Project area contains 1.9 hectares (4.7 acres) of Marsh and 2,497.6 hectares (6,171.7 acres) of Tamarisk Shrubland.

Several Pecos River studies confirmed the high use of dense stands of Tamarisk Shrublands by birds, especially songbirds (Hildebrandt and Ohmart 1982, Hunter et al. 1985, Hunter et al. 1988, Andersen et al. 2000). This is in contrast to the findings of studies on other perennial western river systems (e.g., Colorado River, Rio Grande) that found a lower density and diversity of birds in Tamarisk Shrublands than in native vegetation (Anderson et al. 1977, Cohan et al. 1978, Anderson and Omhart 1984). The difference may be related to past vegetative conditions in the riparian corridors. For instance, the Pecos River historically contained few stands of tall, mature vegetation, whereas the Colorado River and Rio Grande supported extensive willow and cottonwood forests prior to human manipulation. Thus, saltcedar may be providing habitat on the Pecos River where none previously existed.

Mammals

Twenty-six mammal species were documented in the general Research Project area (Bureau of Bureau of Reclamation 1972). More recently, species observed as part of the development of the 2003 Brantley and Avalon Reservoirs RMP EA is presented in Appendix G. An additional 40 species occur in the Pecos River Valley and may be present within the Research Project area. Common mammals include *Lepus californicus* (blacktail jackrabbits), *Sylvilagus auduboni* (desert cottontails), *Peromyscus leucopus* (white-footed mouse), deer mouse, *Canis latrans* (coyotes), *Mephitis mephitis* (striped skunks), and *Procyon lotor* (raccoons). Mammals inhabit all vegetation types in the Research Project area.

Furbearers known to occur in the Research Project area include coyotes, *Bassariscus astutus* (ringtails), *Vulpes* (foxes), *Ondatra zibethica* (muskrats), *Taxidea taxus* (badgers), *Lynx rufus* (bobcats), striped skunks, and raccoons. Raccoons and skunks are becoming more of a presence in developed areas of Brantley Lake State Park (Fiala 1998, pers. comm.), although they likely occur throughout the Research Project area. Other furbearers are found in all upland and riparian-wetland habitats, with the exception of muskrats and ringtails which are more specialized in their habitat needs. Muskrats are more commonly associated with wet areas, such as the reservoirs, Pecos River, canals, small ponds, and adjacent vegetation. Ringtails inhabit the rockier sites, such as those along Brantley Dam.

Big game species within the Research Project area include *Odocoileus hemionus* (mule deer) and *Antilocapra americana* (pronghorn antelope). The Research Project area is on the eastern edge

of the mule deer range in New Mexico (Bureau of Reclamation 1972). These species use all upland habitats and Riparian Grasslands for foraging. Areas of particular importance include 284.1 hectares (702.1 acres) of desert plains grasslands and 582.4 hectares (1,439.2 acres) of Arroyo Shrublands that provide protective cover and forage. The arroyos leading to the reservoirs are also used as movement corridors. However, species movement may be limited by the presence of five-strand barbed wire fencing in some Research Project area locations. The reservoirs, Pecos River, canals, and small ponds provide important water sources.

The Research Project area likely supports a high number of bat species because of the availability of roosting and nursery sites associated with several caves (Coffee Cave, Clark's Caverns, and Homogenized White Cave) and abandoned buildings in the Research Project area. The aquatic resources (reservoirs, Pecos River, canals, and small ponds) and Marsh and Riparian Grassland habitats within the Research Project area provide a source of insect prey for bats.

Herpetofauna

Fourteen species of amphibians and 57 species of reptiles are known to exist in the Pecos River Valley (Bureau of Reclamation 1972), with the *Cnemidophorus inornatus* (little striped whiptail) being the most-common reptile. More recently, species observed as part of the development of the 2003 Brantley and Avalon Reservoirs RMP EA is presented in Appendix G. Other common herpetofauna are ornate *Terrapene ornata* (box turtles), *Phrynosoma cornutum* (Texas horned lizards), *Heterodon nasicus* (western hognose snakes), *Pituophis melanoleucus* (gopher snakes), *Crotalus viridis* (prairie rattlesnakes), *Cnemidophorus tesselatus* (checkered whiptails), *Bufo woodhousei* (Woodhouse toads), and *Acris crepitans* (cricket frogs). Reptiles can be found throughout the Research Project area in all upland habitats. *Thamnophis* spp. (garter snakes), several turtle species (*Kinosternon flavescens* [yellow mud turtle] and *Trionyx spiniferus* [Texas spiny softshell turtle]), and amphibians are more typically associated with aquatic sites such as the 1.9 hectares (4.7 acres) of Marsh and 58.2 hectares (143.7 acres) of Riparian Grassland habitats, Pecos River, canals, and scattered small ponds. Toads may also occur in the sandy areas of upland habitats.

Threatened and Endangered Species

Federally listed threatened and endangered species that are known from or are suspected to occur within the Research Project Area include: Bald Eagle (*Haliaeetus leucocephalus*), Interior Least Tern (*Sterna antillarum athalassos*), Pecos Bluntnose Shiner (*Notropis simus pecoensis*), Pecos Gambusia (*Gambusia nobilis*), and Gypsum Wild Buckwheat (*Eriogonum gypsophilum*). Other Federally listed species found in Eddy County, New Mexico, but not associated with the Research Project Area are listed in Appendix I.

Bald Eagle

Bald Eagles select large trees near an abundant prey source for nesting, roosting, and perching. Fish and waterfowl are their primary prey, with rabbits and carrion consumed to a lesser extent. Foraging habitat consists of large, unobstructed open areas, such as openings in river corridors or lakes. Open water is a critical habitat component because it allows access to fish and attracts waterfowl, especially during the winter months (Reel et al. 1989, Paige et al. 1990).

Bald Eagles are known to frequent the Pecos River Valley during the winter. The species potentially forages on the reservoirs and Pecos River during this time, although roosting and

perching sites are limited along the waterways. Based on the few available roosting and perching sites, the wintering population in the area is expected to be low. Foraging habitat is associated with the reservoirs, Pecos River, small ponds, and 1.9 hectares (4.7 acres) of Marsh. Few nesting pairs of Bald Eagles have been documented in New Mexico, none of which occur near the Research Project Area.

Interior Least Tern

Interior least terns favor bare or sparsely vegetated sand beaches or sand bars for nesting, such as those found along scoured river shorelines. However, the species will also use rockier substrate and even areas such as parking lots. Interior Least Terns are colonial nesters. Common prey includes small fish, crustaceans, and insects. Thus, shallow water areas in lakes, ponds, and river backwater areas with abundant prey near nesting areas are required. During migration, Interior Least Terns move in small groups, feed in shallow water near land, and loaf along the exposed shorelines (Spendelow and Patton 1988, Whitman 1988, Thompson et al. 1997).

Suitable habitat for the species occurs primarily along the shorelines of the reservoirs and Pecos River and exposed mudflats. The fish community of the reservoirs and the Pecos River contains many species that Interior Least Terns feed upon (NMDGF 1998, Thompson et al. 1997).

Prior to 2004 the only known breeding colony of Interior Least Terns in New Mexico occurred at Bitter Lake National Wildlife Refuge near Roswell, approximately 60 miles north of the Research Project Area. In June 2004 a small breeding colony of Interior Least Terns was discovered at Brantley Reservoir in an area of the reservoir shoreline that was cleared of saltcedar in 2003. This colony contained at least 14 adults and a minimum of 7 nests were located. The tern's nests were situated at varying distances to the edge of the lake, mostly between 150 – 250 yards, and 2 – 3 feet in elevation above the water's surface. Water levels in Brantley Reservoir were monitored during summer 2004 to ensure that the tern colony was not inundated. Observations of the Interior Least Tern colony during the ensuing summer revealed that at least a portion of the nests were successful as evidenced by the presence of juvenile terns. The extent of success for all nests was not determined due to the inability to access the entire colony with a minimum of disturbance.

Gypsum Wild Buckwheat

Currently, only one designated plant, the threatened Gypsum Wild Buckwheat, is known to occur in the Research Project Area. Only three populations are known to exist in the world, all occurring in Eddy County, New Mexico. One of these populations is found on both Reclamation and BLM lands in the lower Seven Rivers Hills area, immediately west of US 285 on the west side of the Research Project Area. On Reclamation lands, the species occurs within the Mixed Desert Shrub habitat on the Seven Rivers Hills escarpment where approximately 50 individuals were observed. An adjacent 219-hectare (540-acre) parcel of BLM land is designated as a Special Management Area (SMA) to protect the species and its habitat. The plant is found on gypsum soils, most frequently on material that has eroded from nearby gypsum outcrops. In the Seven Rivers Hills SMA, the terrain is mostly a complex of bare, steep slopes and deep, eroded arroyos (BLM 1986). In 1998, a through search was also conducted on Reclamation land in similar habitat and east of US Highway 285, and no plants were found (Bureau of Reclamation, 2003).

Pecos Bluntnose Shiner
The Pecos Bluntnose Shiner is federally listed as threatened (USFWS 1987) and listed as endangered (Group 2) by the State of New Mexico. It historically inhabited the Pecos River from Santa Rosa downstream to Carlsbad, New Mexico. Critical habitat for the Pecos Bluntnose Shiner has been designated, but it does not extend into the Research Project Area. However, Pecos Bluntnose Shiner reportedly occurs seasonally in the headwaters of Brantley Reservoir (USFWS 1992), when young fish are displaced from upstream habitats by flood events.

Pecos Gambusia
The Federally endangered Pecos Gambusia is endemic to the Pecos River Basin in southeastern New Mexico and western Texas. It inhabits the ponded habitats, springs, tributaries, connected or formerly connected backwaters (i.e. sinkholes, isolated permanent pools, and oxbows) usually in association with aquatic vegetation throughout Bitterlake National Wildlife Refuge and the Salt Creek Wilderness Areas (per comm. w/Fish and Wildlife Service, 2004).

Cultural Resources
The human history of the Carlsbad Project area stretches from Paleo-Indian to the Historic period. Within the Carlsbad there are 252 archaeological sites. Only 57 prehistoric sites and one historic site are considered to be in an area of impact. Section 106 will apply to these sites. The rest of the sites identified within the Carlsbad Project area are considered to have their data potential exhausted under a Memorandum of Agreement with the Bureau of Reclamation, New Mexico State Historic Preservation Office and the Advisory Council. If any new sites are located during the integrated controls methods action, Reclamation will follow procedures of Section 106 of the National Historic Preservation Act of 1966. Special Environmental Commitments have been established and will be followed.

Recreation and Accessibility
The dominant opportunities and attractions at Brantley and Avalon Reservoirs are water based activities: fishing, boating and swimming. Camping, picnicking, hiking are also enjoyed in conjunction with water-based activities along the Pecos River.

Socioeconomic
The local economy is linked to the extraction of mineral resources (oil, natural gas, and potash). Ranching and agriculture have also generated much of the local economic activity, however tourism with the Carlsbad Caverns and the Guadalupe Mountains National Parts are major areas of attraction.

Environmental Justice
Environmental justice refers to the protection of human rights, particularly to minority and low income populations, for any government action affecting both the human and natural environment. Environmental justice is included in this EA in compliance with the Executive Order 12898, signed in 1994:

Executive Order 12898, "Federal Actions to address environmental justice in Minority Populations and Low-Income Populations," requires that "each Federal Agency make achieving environmental justice part of it mission by identifying and addressing, as appropriate, disproportionately high and adverse human health and environmental effect of its programs,

policies and activities on minority populations and low-income populations."

Eddy County had a population of approximately 51,658 in 2000. This represents 2.8 percent of the total New Mexico population. The 2000 census found that 70.1 percent of the population is considered "urban" or living within an urbanized area. In the case of Eddy County, this reflects the fact that 49.6 of the total county population resided in the City of Carlsbad. There is a large Hispanic population in the county (38.8 percent of the total in 2000) (Bureau of Reclamation 2003).

Chavez County had a population of approximately 61,382 in 2000. This represents 3.4 percent of the total New Mexico population. The 2000 census found that 73.6 percent of the population is considered "urban" or living within an urbanized area, residing primarily in the City of Roswell. There is a Hispanic population in the county (43.8 percent of the total in 2000) (Bureau of Reclamation 2003).

Indian Trusts Assets

Indian Trusts Assets (ITAs) are "legal interests" in assets held in trust by the U.S. Government for individual Indians or tribes. Lands, minerals, water rights, hunting and fishing rights, claims, titles or money are some of the assets held in ITAs. As assets held in trust, ITAs cannot be sold, leased, or alienated without the express approval of the U.S. Government. Secretarial Order 3175 and Reclamation policy require that Reclamation evaluate and assess impacts of a proposed project on ITAs. This requires inventorying all ITAs within the Research Project area. Should any ITAs be impacted, mitigation of impact must be undertaken.

To date, Reclamation has received no tribal claims regarding the sacred nature of any location within the Research Project Area. Correspondence with the Mescalero Apache, the Commanche, and the Kiowa was conducted in conjunction with the initial Traditional Cultural Properties (TCPs). Although all of the groups contacted made statement to the effect that they recognize the importance of the Pecos River to their general cultural heritage, no concern was voiced about the sanctity of any particular property. (Bureau of Reclamation 2003).

Chapter 4. Environmental Consequences

Soils

Soil erosion is not a major concern in the Research Project area, except along certain riverine reaches of the Pecos River. Upstream of the old Lake McMillan Delta and north of the Brantley Reservoir, levees, steep banks and river channelization into a straight narrow space has increased the potential for erosion in these areas. (Brantley and Avalon Reservoirs RMP Project Final EA, Oct 2003).

No Action Alternative is expected to maintain current productivity.

Proposed Action - Vegetation Management Program is expected to increase productivity of soils through improved soil moisture availability and reduced soil disturbance from maintenance equipment. Within this alternative, **Herbicide Treatments, Biological Control, and limited Mechanical Treatments,** would maintain a lower level of productivity of saltcedar growth which would increase productivity of soils through improved soil moisture availability.

This extend of treatments is initially only a fraction of Carlsbad Project Land. With time and positive results, the acreage treated would likely increase through the magnitude of total acreage cannot currently be speculated. Thus, improvements in soil conditions may be minimal from a Carlsbad Project or regional perspective. The Reclamation Denver Office is planning to study and perform monitoring of bank stabilization in these areas pending fiscal year funding.

Range Condition

Reclamation land in the Research Project area consists primarily of upland range, with small draws occurring occasionally. The only true riparian areas in the grazed portion of the Research Project area are on those lands surrounding Avalon Reservoir. Riparian areas around Avalon Reservoir have been invaded by saltcedar, which provides some shade for the livestock but has no grazing value. Saltcedar dominates the riparian-wetland communities bordering the Pecos River in the northern portion of the Research Project area upstream of Brantley Reservoir. Decadent stands of saltcedar with little or no understory vegetation border the river banks. Understory vegetation that remains includes Bermuda grass, cattail, and rushes. Although saltcedar stands are present on the historic floodplain, they are not considered to be riparian-wetland plant communities because of the absence of riparian-wetland plant species in their understories. The expected effects from this action are as follows:

No Action Alternative would have no change.

Proposed Action - Vegetation Management Program:

Under this alternative **Herbicide Treatments** would create conditions favorable to range improvement through improved soil moisture relationships and reduced competition. **Biological Control** would have slight improvement over time due to the beetle feeding on the saltcedar, reducing their abundance. **Mechanical Treatments** would be expected to create conditions favorable to improvement when followed by reseeding. and adequate rainfall.

Noxious Weed Infestations

Minimizing soil disturbances and bare ground situations would reduce the likelihood of noxious weed infestations and spread (***see Table 1 for the "Environmental Consequences Summary of Impacts***").
The **No Action** would moderately raise the risk of noxious weed infestations. The **Proposed Action - Vegetation Management Program** would lower the risk of noxious weed infestation under successful revegetation with desirable species.
Reclamation maintains an ongoing cooperative and joint effort with local, state, and other federal agencies in the identification, mapping, treatment and monitoring of noxious weeds.

Reclamation is currently working on an Integrated Pest Management Plan which includes treatment of vegetation on dams (see Appendix J). This plan will provide guidance on following low-impact methods recommended for controlling unwanted vegetation on three dams (Sumner, Brantley and Avalon) along the Pecos River in New Mexico. No herbicides that are mobile and could have the potential for water contamination will be recommended for use.

Grazing

All alternatives provide for continued grazing within the areas however, the effects of each

alternative may differ.
The **No Action Alternative** would have no change in existing resources.

Under the **Proposed Action - Vegetation Management Program:**
Herbicide Treatments would provide for potential gains in forage under current grazing management. **Biological Control** would provide for potential gains in forage under current grazing management. **Mechanical Treatments** would provide better accessibility for grazing animals and their management.

Water Quality

The **No Action Alternative** would have no change in water quality.

Under the **Proposed Action - Vegetation Management Program**:
Herbicide Treatments are not expected to negatively impact water quality. A 2,4-C label has been issued by the Environmental Protection Agency for the use of imazapyr herbicide in New Mexico that allows for inadvertent overspray onto water when treating adjacent saltcedar. Imazapy herbicide readily breaks down in water in the presence of sunlight and has extremely low mammalian and aquatic effects. Recently imazapyr has received an aquatic label under product name habitat herbicide. Precautions according to product labels will be adhered to protect water quality. **Biological Controls** may decrease some soil movement into the waters from reduction of bare ground sites. Historically, the Pecos River has carried very high sediment loads, especially during high stormwater runoff periods. The river drains vast areas of arid grasslands and shrublands with highly erodible soil surfaces (Reclamation, 2003). **Mechanical treatments** such as root plowing, grubbing, mowing or shredding are not anticipated to impact water quality.
Removal of saltcedar from the banks and shoreline of the reservoirs have the possibility of adding to sedimentation in the river but effects are unknown at this time.

Water

The net water savings from removal of salt cedar is dependent on the replacement vegetation. Although saltcedar has been shown to consume significant amounts of water if a high water use plant begins growing, the net water use will be minimal. If a low water use plant replaces the salt cedar water savings will be greater. The interaction between the Pecos River and the Roswell basin aquifers is not adequately identified to determine whether any of the saved water will reach the Pecos River.

Fisheries

The **No Action** and **Proposed Action - Vegetation Management Program** are not anticipated to adversely impact fisheries within the Research Project area. For alternatives using approved herbicides, application of those herbicides will be done according to product label, state law, and EPA guidelines. Imazapyr (herbicide proposed for the control of saltcedar) is of low toxicity to fish and invertebrates (appendix E).

Wildlife

The **No Action** alternative would not adversely impact wildlife. The **Proposed Action - Vegetation Management Program** may potentially increase wildlife diversity as a result of the

reduction of monotypic saltcedar stands and eventual replacement by more diverse, native plant communities. The effects of this alternative to wildlife would, however, not be observed for several years since establishment of native vegetation would not be instantaneous after the management of saltcedar. The Reclamation Denver Office is planning to study and perform monitoring of wildlife in these areas pending fiscal year funding.

Herbicide Treatments and Mechanical Treatments may have some short term impacts to birds, small mammals, and herpetofauna who use saltcedar for cover, however overall species diversity would potentially increase over time.

Biological Controls may potentially increase wildlife diversity under improving range conditions.

Threatened and Endangered Species

Bald Eagle and Interior Least Tern

The **No Action** alternative would have no adverse impacts to the Bald Eagle or Interior Least Tern within the Research Project area. Because this alternative does not involve habitat alteration, no adverse would be anticipated.

The **Proposed Action – Vegetation Management Program** alternative would not have an adverse affect on the Bald Eagle because the target habitat, monotypic saltcedar, in not utilized by this species. Aerial application of herbicide would not affect the Bald Eagle because the application of herbicide, consistent with the product's label restrictions, would not be applied within 50 feet of the wetted perimeter, eliminating the potential for affects to fishes—the food source of wintering Bald Eagles.

The **Proposed Action – Vegetation Management Program** alternative would have no adverse affect on the Interior Least Tern because of the proximity of the 2004 tern colony to the proposed vegetation management area—over ½ mile. Further, the application of the herbicide will be such that it will not be administered within 50 feet of the wetted perimeter, eliminating potential affects to the fishery for which the terns are dependant.

Gypsum Wild Buckwheat

Because the Gypsum Wild Buckwheat only occurs on gypsum outcrops on the extreme western edge of the Research Project area which has no saltcedar to treat. None of the proposed alternatives within the Research Project area will have any effect on this federally threatened plant.

Pecos Bluntnose Shiner

The Pecos bluntnose shiner (shiner) exists within the project area. The shiner is restricted to the mainstream and flowing tributaries of the Pecos River, ...downstream to the inflow area of Brantley Reservoir (Klingel, 2000a), but in periods of low water, shiners may find their way into the reservoir and through the dam outlet works to the river channel below Brantley. The shiner had not been seen below Brantley Dam since the completion of the dam in 1987, however in 2003, several shiners along with other pelagic spawning fishes were collected by the New Mexico Department of Game and Fish (Game and Fish) between Brantley Dam and Avalon

Reservoir. The Game and Fish reported to Reclamation, in an e-mail (Larson, 2003), on November 6, 2003:

"An unusual development occurred during our (NMDGF and USFWS) "Tour of the Pecos" sampling. Two samples from sites below Brantley Dam, Rocky Arroyo and Hwy 30 Crossing, produced specimens of pelagic spawning fishes, including Pecos bluntnose, Speckled chub, Plains minnow, Rio Grande shiner, and Plains minnow... These species...have not been collected in this section for many years. ...they probably drifted as eggs and larvae through Brantley Dam."

Concern for this species establishing itself below Brantley Dam is low because of the limited amount of optimal shiner habitat below the dam, including higher concentrations of salinity than the shiner prefers. However, this reach is being monitored closely for reoccurrences of this species. Shiners above Brantley Reservoir within the project area are mostly young-of-year or first year fish and have been displaced from more suitable habitats above in the Pecos River by primarily operational block releases. Shiners remain federally threatened and protected wherever they are found, however, the U.S. Fish and Wildlife Service (Service), has recognized the loss of shiner eggs and larvae as a result of block releases which have transported them into the Brantley area, cited in the 2003 Biological Opinion, (Service, 2003):

"These block releases are anticipated to transport the eggs and larvae downstream into Brantley Reservoir. This will harm many eggs and larvae by modifying their habitat and subjecting them to abnormally large and lengthy discharges that will transport them into Brantley Reservoir where death will occur, or where they will be unable to successfully develop and breed and thereby contribute offspring to the next generation. It will also harass larvae through the disruption of the normal behavior pattern of seeking sheltered mesohabitats as they would under more natural, lower discharges. It is anticipated that killing of larvae and eggs will occur when they reach Brantley Lake through consumption by predatory fish, by exposure to higher salinity, or by other unsuitable habitat conditions in the reservoir."

Further, the Service stated in the 2003 Biological Opinion under "Effect of the Take" that:

"In the accompanying biological opinion, the Service determined that the level of anticipated take is not likely to result in jeopardy to the shiner or destruction or adverse modification of critical habitat."

The population of shiners in this area represents an insignificant portion of the population and do not contribute to sustaining main population of shiners above. The Vegetation Management Program will not impact any Pecos bluntnose shiner. Research studies on invasive plant treatments will be conducted to avoid any potential effects to listed species. Use of the herbicide Imazapyr will not be toxic to the Pecos bluntnose shiner.

Pecos Gambusia

The Pecos Gambusia is found primarily in the Bitter Lake NWR and the Salt Creek Wilderness areas of the Pecos River away from the immediate project area. No populations of these fish have been collected since monitoring began in 1986 or are known to exist permanently within

the Research Project Area. For alternatives using approved herbicides, application of those herbicides will be done according to product label, state law and EPA guidelines. Integrity of the channel will be preserved whenever possible. The proposed action would have "no effect" to the Pecos Gambusia.

No other threatened or endangered species found in Eddy County (Appendix G) would potentially be affected by any of the proposed alternatives. This determination is made based on the lack of appropriate habitat in the vicinity of the Project Area and distant proximity to known populations of the more sessile species.

In summary, Reclamation has determined that the proposed action would have a "no effect" to any Federally Listed Species.

Cultural Resources

At Brantley Reservoir the majority of the recorded cultural resource sites occur at elevations above and outside of the proposed action. All alternatives considered would have no impact to cultural resources.

Recreation and Accessibility

Impacts due to limited access during spraying and treatment is associated increased use are considered minor in relationship to the availability of public land present in the area at both Brantley and Avalon Reservoirs. Increased "use" would be dispersed at both reservoirs.
No Action Alternative would support the current levels of use.
Proposed Action - Vegetation Management Program would improve accessibility to recreation by removing physical barriers to the river channel.

Socioeconomic Considerations

The **No Action Alternative** maintains existing economies derived from river fishermen and tourist dollars spent as well as beef produced upon grazing allotments. The **Proposed Action - Vegetation Management Program** would be expected to have potentially short term negative impacts due to limited access during treatments, with net positive impacts over time with increased accessibility on the Pecos River.

Environmental Justice

The **No Action Alternative** and the **Proposed Action - Vegetation Management Program** maintains the existing conditions and would remain neutral. Disproportionately high impacts to minority groups or low-income populations were not identified under either alternative. Impacts with net positive impacts over time and low income or minority populations would not be affected by the proposed action.

Indian Trust Assets

No Action Alternative would have no effect on Indian Trust Assets. At the Research Project area, the no recorded Indian Trust Assets occur at elevations above and outside of the proposed action. **Proposed Action - Vegetation Management Program** would be anticipated to adversely impact previously unrecorded sites due to the depth of soil disturbances. All alternatives considered would have no impact to Indian trust assets. Both Brantley and Avalon

Reservoirs occupy withdrawn and acquired lands for the purposes of reservoir operations. Reclamation has received no tribal claims regarding the sacred nature of any location within the Research Project Area. Correspondence with the Mescalero Apache, the Commanche, and the Kiowa was conducted in conjunction with the initial Traditional Cultural Properties (TCPs). Although all of the groups contacted made statement to the effect that they recognize the importance of the Pecos River to their general cultural heritage, no concern was voiced about the sanctity of any particular property. (Bureau of Reclamation, 2003).

Cumulative Impacts

Cumulative Impacts are defined as: "The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions."

No Action- Saltcedar will continue to dominate large areas by the banks and edges of the reservoirs. Mowing large areas in the flood plain will continue and possible continuation of creation of new habitat for the Interior Least Tern.

Proposed Action - Vegetation Management Program would not cause irreversible loss of the potential to support native vegetation.

Change in quality and amount of habitat. Possible displacement of wildlife associated with the proposed treated saltcedar acreage due to loss of this vegetation, if native species does not revegetate. This could either reduce or increase the amount of sedimentation of surface waters within the project area, depending upon test and demonstration results with the revegetation sites and the effectiveness of spraying saltcedar.

If the Vegetation Management Program is successful, native plant communities may replace invasive species and may over the years, establish a more ecologically balanced vegetation community.

Irreversible and Irretrievable Commitments of Resources

This section describes unavoidable adverse impacts to the resources discussed in this EA/BA that would occur with the implementation of the proposed action. Unavoidable adverse impacts are impacts that are unavoidable and not able to be mitigated.

During project implementation, materials such as fossil fuels, labor, and materials would be needed to accomplish the proposed work. Generally speaking, these materials are not retrievable, but are not considered in short supply. Their use would not have an effect on continued resource availability. State and Federal public funds, which are not retrievable, would be utilized for the proposed work.

Environmental Commitments

1) The rate of dissipation testing and analysis would be performed in conjunction with aerial treatments of saltcedar with imazapyr.

2) All use of herbicides will be done in accordance with all federal mandates and as stated by Environmental Protection Agency (EPA) guides (specifically EPA Reg. No. 241-346). Environmental justice refers to the protection of human rights; particularly minority and low income populations, for any government action affecting both the human and natural environment. Environmental justice is included in this EA/BA in compliance with the Executive Order 12898, signed in 1994: Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," requires that "each Federal Agency make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health and environmental effects of its programs, policies and activities on minority populations and low-income populations."

3) Efforts would be made to minimize and avoid impacts upon desirable native vegetation and fauna. Only saltcedar dominated sites would be treated. Site stability through proper management would include the avoidance of creating bare ground situations and avoiding adverse impacts to water quality and wildlife. This action is an essential stop gap measure to control the spread and influence of the exotic saltcedar on our native plant communities and riparian system. Significant portions of the treatments would be made via helicopter to avoid ground disturbances and to limit the disturbance to wildlife.

4) Public notification of aerial pesticide applications would be given, and the activity would be conducted in such a manner to protect the environment and the public's health and safety. At the reservoir, treatment may occur anywhere except within 50 feet of the wetted perimeter.

5) The Carlsbad Soil and Water Conservation District in conjunction with the Carlsbad Irrigation District would assist in treating noxious and invasive weed infestations and monitoring as necessary.

6) The selection of application techniques would be used to minimize effects to non-target vegetation and avoid water quality impacts. At the reservoir, treatment may occur anywhere except within 50 feet of the wetted perimeter

7) Existing dead snags would be left in place and spraying activities would occur at times other than late fall and winter. The herbicides proposed for use do not bio-concentrate in the food chain, and all label precautions would be followed to insure no effect on water quality and fisheries.

8) Reclamation proposes intense monitoring of the leaf beetle research. The number of eggs and the population increase would be monitored for at least one field season. After one generation in the cages, part of the adults or larvae of the next generation may be released on plants outside of but near the cages. Part of the adults and larvae will be retained in the cages during the remainder of the first year and through the winter to determine over wintering survival and mortality, and date of spring emergence.

9) Should evidence of possible scientific, prehistorical, historical, or archeological data be discovered during the course of this action, work shall cease at that location and Reclamation Albuquerque Area office's archaeologist shall be notified by phone immediately, with the location and nature of the findings. Care shall be exercised so as not to disturb or damage

artifacts or fossils uncovered during operations, and the proponents shall provide such cooperation and assistance as may be necessary to preserve the findings for removal or other disposition by the Government.

10) Discovery of Human Remains. Any person who knows or has reason to know that he or she has inadvertently discovered human remains on Federal or tribal lands, must provide immediate telephone notification of the inadvertent discovery, with written confirmation, to the responsible Federal agency official with respect to Federal lands, and, with respect to tribal lands, to the responsible Indian tribe official. The requirement is prescribed under the Native American Graves Protection and Repatriation Act (P.L. 101-601; 104 Stat. 3042) of November 1990 and National Historic Preservation Act, Section 110(a)(2)(E)(iii) (P.L. 102-575, 106 Stat. 4753) of October 1992.

11) Interior Least Terns - Reclamation proposes to take the follow actions a) Monitor the birds to determine population size, nesting activity, and identify immediate threats; b) Coordinate with NM Department of Game & Fish (NMDG&F), NM State Parks, and Eddy County to help prevent public access to the colony; c) Erect signage within one week to discourage public access to the area; d) Discuss water management options with the CID to avoid flooding the nests; e) Consult with the Service under Section 7 of the Endangered Species Act, if necessary, for this and other actions, that "may affect" the species; f) Determine potential long-term management options for this species at Brantley Reservoir in coordination with the Service, NMDG&F and CID; and g) Incorporate considerations for the species into ongoing EIS analysis.

Risks

As a research and treatment project, these areas are to be monitored so that all effects, positive and detrimental, can be disclosed. Once data is collected and areas observed determinations as to the best treatment methods can be better identified. We discuss the environmental impacts for each resource in Chapter 4 for the no action and the preferred alternative, integrated methods.

Table 1, Environmental Consequences (page iv) also shows effects.

Areas requiring further studies and monitoring include:

1. Concern over kochia taking over in areas where saltcedar is removed.
Test areas of different seeds mixtures and plant species are to be developed during this test and evaluation on Reclamation lands. Success of the study areas to reseed will result largely from soil and weather conditions and the selection of proper plant species adapted to the site.

2. Sediment entering the Pecos River from the lack of saltcedar to which was used to stabilize the banks. As stated in the proposed action Reclamation will perform treatment outside a 50-foot buffer along the Pecos River and the Kaiser Channel unless previously coordinated with CID for exception (river banks, not reservoirs). At the reservoir, treatment may occur anywhere except within 50 feet of the wetted perimeter

3. Herbicide entering the Pecos River during application.
Treatments will be conducted in accordance with the EPA approved label recommendations. All

treatments will meet or exceed state label standards (ensuring buffer zones are enforced and followed.) Treatments will be scheduled and designed to minimize potential impact on non-target plants and animals, checking wind speeds and directions prior to any applications.

4. Debris entering the channel. Test areas successful in control of the saltcedar have the possibility of entering into channels and causing blockage. Reclamation will need to monitor these areas and to keep as much debris as possible out of these areas.

Chapter 5. Consultation and Coordination

In developing the Vegetation Management Program and this environmental documentation, Reclamation consulted and coordinated with:

Tom Davis
Carlsbad Irrigation District
Carlsbad NM

Debbie Hughes
Executive Director
New Mexico Association of Conservation Districts

William H. See
Project Manager
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NMSU
Agricultural Science Center
Artesia NM

Aaron Curbello
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Carlsbad, New Mexico

Selected sites, funded by the State of New Mexico, would be included for herbicide treatment applied via helicopter. Monitoring and investigations would be performed jointly by Reclamation and CSWCD under a Cooperative Assistance Agreement. A Memorandum of Understanding has been completed and signed by Reclamation and CSWCD (Appendix D).

Reclamation plans to seek additional participation from local, state and federal agencies to coordinate and assist in saltcedar management within the project area and on adjacent lands.

- On May 6 and 7th of 2003 Reclamation, Albuquerque Area Office and Denver Technical

Center, met with Tom Davis of CID and discussed biocontrol, aerial herbicide applications and Revegetation. The Seven Rivers area was visited in search of a location for biocontrol releases and a revegetation project site near Artesia. Tours by CID were given to show areas of saltcedars for possible treatments.

- During the development and finalization of the Brantley and Avalon Reservoirs Resource Management Plan (October 2003) the Comanche, Kiowa, Mescalero Apache and the Bureau of Indian Affairs were contacted concerning the possible presence of ITAs within the Project Area. To date, none have been identified (Reclamation, 2003). This document tiers off the Brantley and Avalon Reservoirs Resource Management Plan (RMP) Final Environmental Assessment, October 2003 in accordance with the Council of Environmental Quality (40CFR 1500.4). All alternatives considered in this EA are planned in the same Carlsbad Project Area. Consultation was initially performed for the RMP EA document and used in the development of this EA. This is also true for the New Mexico State Historic Preservation Office consultation.
- On March 12, 2004 Reclamation held a meeting in Carlsbad NM on the Biological Control method. Information was provided to the public on proposed Reclamation work to make field releases and conduct monitoring of an approved saltcedar biocontrol beetle. New Mexico State University, New Mexico Department Game and Fish, Carlsbad Irrigation District, Fish and Wildlife Service, and the Carlsbad Soil and Water Conservation District were in attendance as well as the public.
- A field site visit between Reclamation staff and the Carlsbad Irrigation District on July 21 and 22, 2004 was conducted to choose areas for treatment to be included in the Draft EA/BA.
- Reclamation plans to seek opportunities to cooperate with local groups and community projects to promote native vegetation on the riparian corridor, including providing plant materials for plantings on project and adjoining public lands when applicable.
- Public notification of spraying by CSWCD will be done prior to aerial pesticide applications as stated in the Memorandum of Understanding (Appendix C).

The following individuals and their respective agencies were contacted during the preparation of this document. They assisted in developing alternatives and/or identifying potential environmental impacts:

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APPENDICES
Appendix A

Herbicide Application Treatment Techniques

Broadcast Foliar Applications: Moderate to High Density Stands.

Spray using equipment calibrated to deliver a minimum of 25 gallons per acre. Select coarse nozzle tips that will provide adequate coverage at lower spraying pressures (less than 40 psi) to avoid drift. Use boom-less tips when spraying swaths to the sides to avoid damage to equipment. Adjust nozzle height as recommended by manufacturer. Use blue dye indicator to avoid over-applications and missed plants. Provide for overlap of spray swaths to avoid "banding" or skips. General appearance of foliage should glisten.

Applications using helicopter: Apply 4 pts/acre Imazapy for habitat Herbicide (2-lb a.e. per gal) plus nonionic surfactant in a total spray mix using at a minimum of 15gallons per acre. Follow label precautions.
Applications made adjacent to open water using arsena under 2,4-C label for imazapyr use in New Mexico.

May use imazapyr under aquatic label Habitat™ when approved by New Mexico Department of Agriculture.

*** Public notification prior to aerial pesticide applications required.***

(See-Reclamation Manual/Directives and Standards ENV 01-02)

Individual Foliar Application: Moderate to Low Density Stands

Spraying would occur utilizing backpack sprayers or from hose reel equipped equipment; spray individual plants to glisten or to wet but not to the point of runoff. Insure that all foliage has been sprayed especially terminal tips of branches. Use blue die indicator.

Carpeted Roller Application: Moderate to Low Density Stands

Follow instructions from "Construction and Use of a Carpeted Roller for Weed and Brush Control." Avoid breaking stems and limbs. Do not exceed label rate for active ingredient per acre.

Low Volume Basal Application: Low Density Stands up to waters edge

Use a backpack sprayer or ATV mounted sprayer to treat individual plants. Clear or stomp down any grass or non-target vegetation around plants to avoid interference. Use small orifice nozzle tip (Conejet 5500 X-1 or similar) and direct a low pressure spray to the lower 15-20 inches of plant stems. Ensure that stem surfaces are treated completely around. Spray to wet but not to the point of runoff. Use blue dye indicator.

Cut Stump Treatment: Low Density Stands up to waters edge
These treatments are made immediately after cutting tree. Spray entire exposed stump, particularly the cambium layer next to the bark of the cut surface. Undiluted herbicide may be used if label permits to paint the surface with a brush or wick.

Appendix B

Herbicide Selection for Saltcedar Treatments

Brush or weed controlled	Trade name and product rate/acre	Herbicide common name and active ingredient	Treatment type	Time of application	Remarks
Saltcedar	Arsenal™ or Habitat ½ gal or Tank mix 1 to 1/1/2 qt Arsenal™ with 1 ½ to 2 ½ pt Roundup	imazapyr 1 lb/acre (4 pts/acre) or imazapyr ½ to ¾ lb per/acre + Glyphosate ½ to 1 lb per/acre	Broadcast foliar and individual foliar treatments	July to early September	Use ¼% by volume non-ionic surfactant May use 2pts/acre 90% non-ionic aquatic labeled surfactant
Saltcedar	Garlon 4	trichlopyr 20 to 25 % solution mixed with vegetable oil	low volume basal and cut stump	anytime	wet cambium layer use die indicator
Saltcedar	Arsenal™	imazapyr 12 oz. Mixed with 1 gallon water	cut stump	within 2 weeks of cutting	Use die indicator. Addition of penetrating oil will enhance treatment
Saltcedar	Arsenal™	imazapyr	carpeted roller	growing season	use die indicator. avoid breaking plants

Appendix C

MEMORANDUM OF UNDERSTANDING

Between the

CONSERVATION SOIL AND WATER CONSERVATION DISTRICT

And the

US DEPARTMENT OF THE INTERIOR, BUREAU OF RECLAMATION ALBUQUERQUE AREA OFFICE

On August 1, 2003, the Carlsbad Soil and Water conservation District (hereinafter referred to as CSWCD) and the United States Department of the Interior (USDI), Bureau of Reclamation, Albuquerque Area Office, (hereinafter referred to as Reclamation) entered into a Memorandum of Understanding (MOU) for the purpose of defining the basis of cooperation to perform activities consistent with the Pecos River Saltcedar Control Project. The Pecos River Saltcedar Control Project is part of a special appropriation by the New Mexico State Legislature to fund phreatophyte vegetation control along the Pecos River by soil and water conservation districts.

Federal involvement in the Pecos River Basin began in 1905 with authorization of the Carlsbad Project. Reclamation stores and delivers Carlsbad Project water for the benefit of the Carlsbad Irrigation District (CID). Reclamation's Carlsbad Project facilities on the Pecos River now include Sumner Dam, Brantley Dam, and Avalon Dam. The State of New Mexico has an on going obligation to meet the terms and conditions of the federally approved Pecos River Compact (Public Law 91, Ch. 184) and U.S. Supreme Court Amended Decree with water derived in the Pecos River Basin, New Mexico. New Mexico can meet those obligations only if water is delivered to the New Mexico-Texas state line in appropriate quantities.

The CSWCD, through their efforts to control phreatophytes could improve Carlsbad Project water supply and water deliveries to the Texas state line if net water savings are realized. In addition, authority is given under the Federal Noxious Weed Act- Section 2814 (Management of undesirable plants on Federal lands) for agencies, as appropriate, to enter into cooperative agreements with State agencies to coordinate the management of undesirable plant species on Federal lands.

Therefore, the CSWCD and Reclamation hereby enter into this MOU.

A. The CSWCD will:

1. Provide Reclamation with a written project plan and aerial applications specifications containing the specific details of the aerial application, application

rates, chemical information, and other related pertinent information. Reclamation will utilize this information for obtaining the necessary environmental clearances and a right-of-use permit (Reference Federal Noxious Weed Act, Section 2814, Attachment 1).

2. CSWCD will comply with all Federal laws and regulations related to pesticide use on Federal lands including, but not limited to, the Department of the Interior Pesticide Use Policy (Part 517 Departmental Manual 1.1); Carlson-Foley Act of 1968 (Public Law 90-583), see Attachment 2; and Public Lands Weed Control Program (Part 609 Departmental Manual 1.1), see Attachment 3.

3. Implement aerial herbicide treatments on Reclamation administered lands only after all necessary environmental clearances have been obtained and a right-of-use permit has been executed by Reclamation for the activity.

4. Properly notify the public as per Department of the Interior requirements associated with aerial pesticide applications (see Attachment 4).

5. Provide technical oversight and inspection of work activities.

6. Provide contract administration and supervision.

B. Reclamation will:

1. Designate aerial herbicide treatment sites on Reclamation administered land.

2. Provide the CSWCD the GPS coordinate locations for the designated aerial herbicide treatment sites, and copy of maps depicting such activities.

3. Complete all necessary environmental clearances prior to the aerial herbicide applications on selected lands administered by Reclamation.

4. Provide a right-of-use permit that will authorize the CSWCD to conduct activities on Reclamation administered land for the purpose of implementing the aerial herbicide application.

5. Perform post-treatment herbicide monitoring on sites located on Reclamation administered land.

6. Provide CSWCD all monitoring and evaluation information gathered on the treated Reclamation sites.

7. Provide technical oversight and review as needed.

C. It is further understood:

1. This MOU may be modified at any time by the joint agreement of the parties or terminated by either party by giving sixty (60) days notice in writing to the other party.

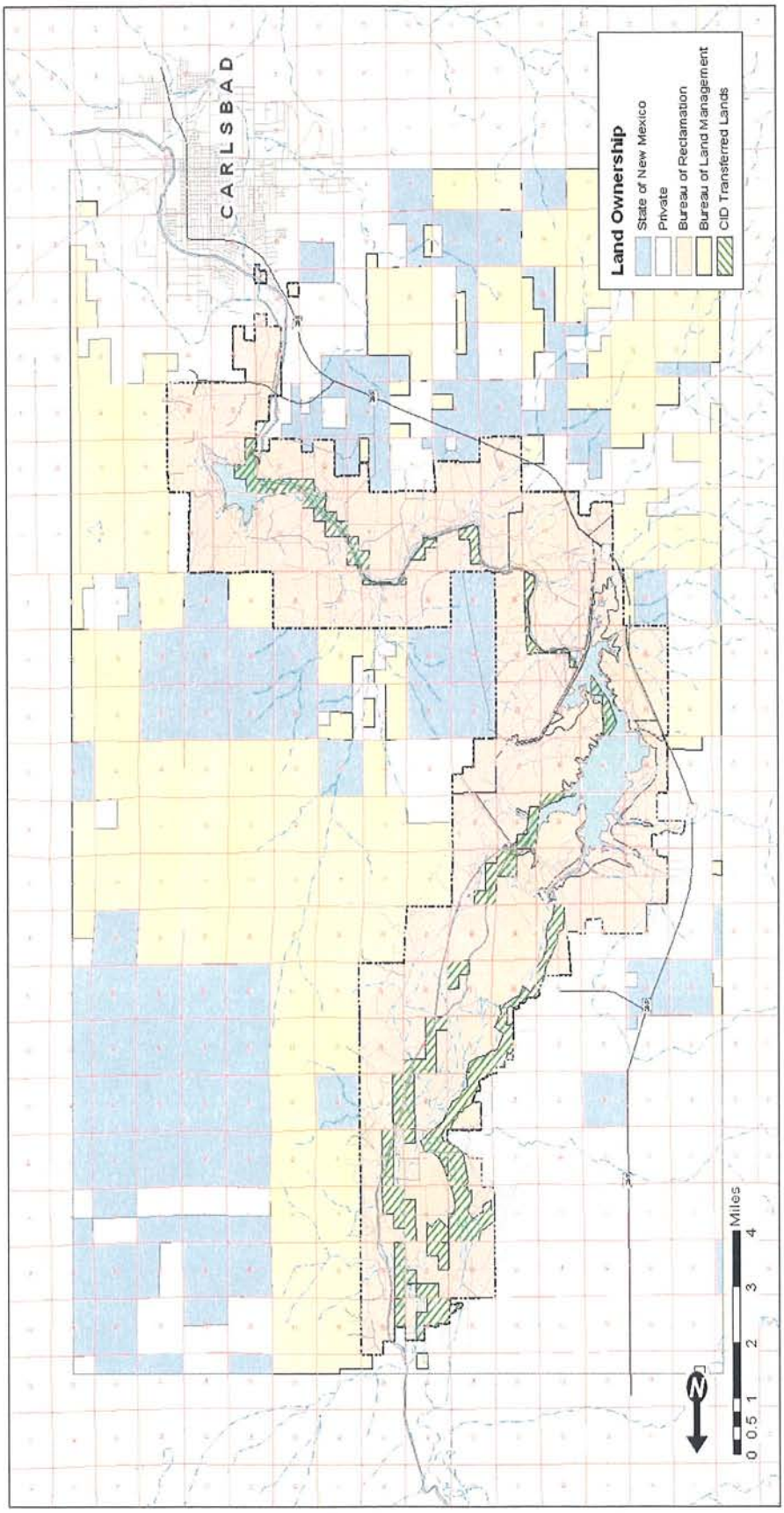
CARLSBAD SOIL AND WATER CONSERVATION DISTRICT

By: _____ Date: 8/1/03
Garth Goody, Chairman

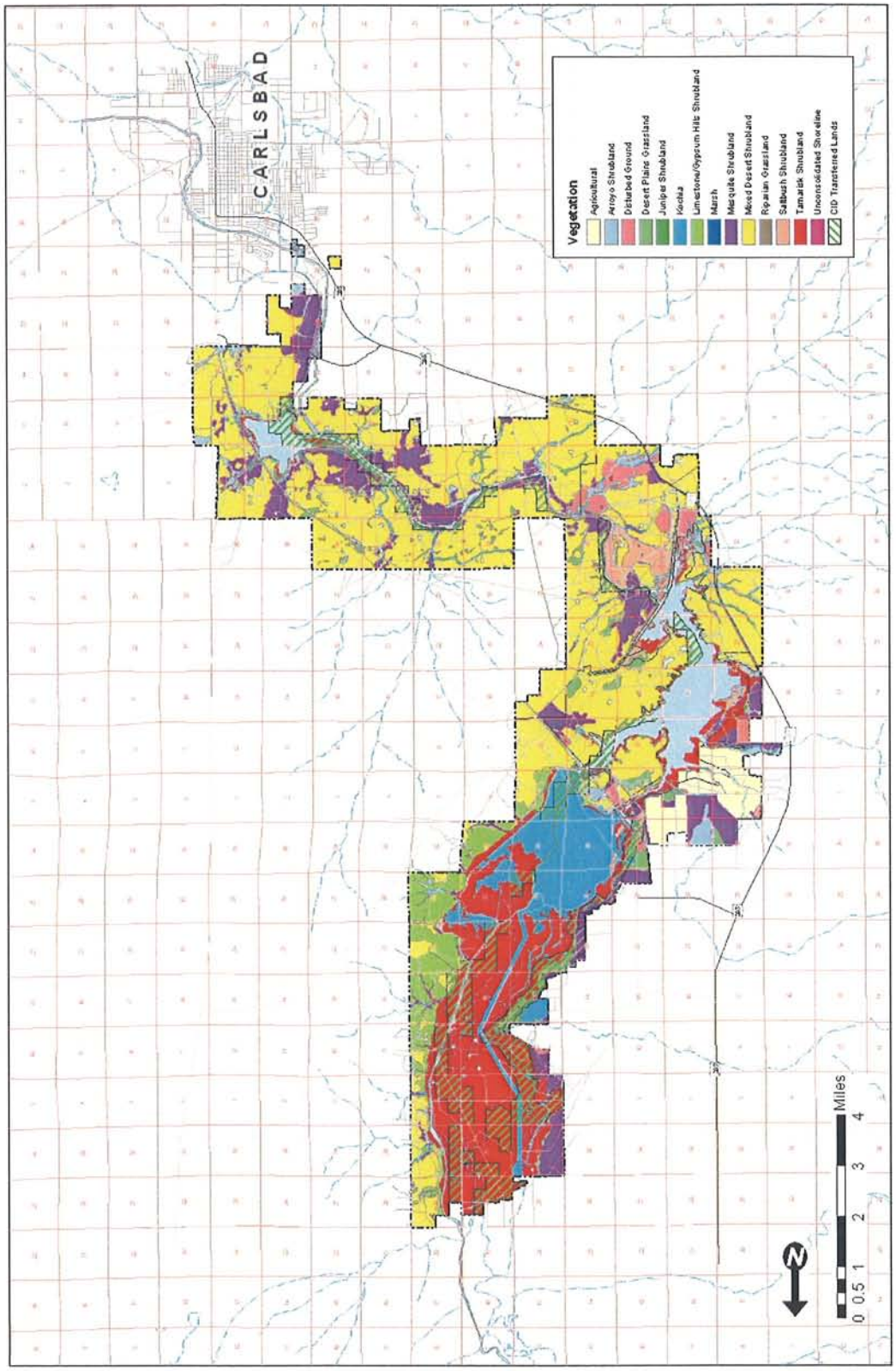
USDI-BUREAU OF RECLAMATION

By: _____ Date: 8/1/03
Ken Maxey, Area Manager

Appendix D
Figure 1



Appendix D
Figure 2



Appendix E –Imazapyr

[redacted]

Herbicide Basics

Chemical formula: (±)-2-[4,5-dihydro-4-methyl-4-(1-methylethyl)-5-oxo-1H-imidazol-2-yl]-3-pyridinecarboxylic acid

Herbicide Family: Imidazolinone

Target Species: grasses, broadleaves, vines, brambles, shrubs and trees, riparian and emerged aquatics

Forms: acid & salt

Formulations: SL, GR

Mode of Action: Amino acid synthesis inhibitor

Water Solubility: 11,272 ppm

Sorption potential: low

Primary degradation mech: Slow microbial metabolism and photolysis

Average Soil Half-life: 25-141 days

Mobility Potential: high

Dermal LD50 for rabbits: >2,000 mg/kg

Oral LD50 for rats: >5,000 mg/kg

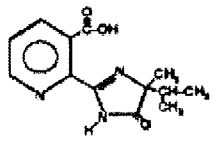
LC50 for bluegill sunfish: >100 mg/L

Trade Names: Arsenal®, Habitat®, Chopper®, and Stalker®

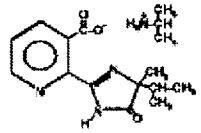
Manufacturer: BASF (previously American Cyanamid Company)

Synopsis

Imazapyr is a non-selective herbicide used for the control of a broad range of weeds including terrestrial annual and perennial grasses and broadleaved herbs, woody species, and riparian and emergent aquatic species. It controls plant growth by preventing the synthesis of branched-chain amino acids. Because imazapyr is a weak acid herbicide, environmental pH will determine its chemical structure, which in turn determines its environmental persistence and mobility. Below pH 5 the adsorption capacity of imazapyr increases and limits its movement in soil. Above pH 5, greater concentrations of imazapyr become negatively charged, fail to bind tightly with soils, and remain available (for plant uptake and/or microbial breakdown). In soils imazapyr is degraded primarily by microbial metabolism. It is not, however, degraded significantly by photolysis or other chemical reactions. The half-life of imazapyr in soil ranges from one to five months. In aqueous solutions, imazapyr may undergo photodegradation with a half-life of two days. Imazapyr is not highly toxic to birds and mammals, but some formulations (for instance, the inert ingredients in Chopper® and Stalker®) can cause severe, irreversible eye damage. Studies indicate imazapyr is excreted by mammalian systems rapidly with no bioaccumulation. It has a low toxicity to fish, and algae and submersed vegetation are not affected. Because imazapyr can affect a wide range of plants and can remain available, care must be taken during application to prevent accidental contact with non-target species. Further, a few studies have reported that imazapyr may be actively exuded from the roots of legumes (such as mesquite), likely as a defense mechanism by those plants. This exudate and the ability of imazapyr to move via intertwined root grafts may therefore adversely affect the surrounding desirable vegetation with little to no control of the target species.



imazapyr acid



imazapyr isopropylamine salt

Weed Control Methods Handbook, The Nature Conservancy. Tu *et al.*
http://tncweeds.ucdavis.edu

Herbicide Details

Chemical Formula: (±)-2-[4,5-dihdro-4-methyl-4-(1-methylethyl)-5-oxo-1*H*-imidazol-2-yl]-3-pyridinecarboxylic acid

Trade Names: Arsenal®, Chopper®, and Stalker®. As of September 2003, imazapyr has received an EPA aquatic registration for Habitat®.

Manufacturer: BASF (previously by American Cyanamid Company, which was purchased by BASF in 2000)

Use Against Natural Area Weeds: Imazapyr is a broad-spectrum herbicide that controls terrestrial annual and perennial grasses and broadleaved herbs, woody species, and riparian and emergent aquatic species. It can be used where total vegetation control is desired or in spot applications. Imazapyr is relatively slow acting, does not readily break down in the plant, and is therefore particularly good at killing large woody species. Imazapyr can control saltcedar (*Tamarix ramosissima*), privet (*Ligustrum vulgare*), blackberries (*Rubus* spp.), field bindweed (*Convolvulus arvensis*), bahiagrass (*Paspalum notatum*), and downy brome (*Bromus tectorum*) (American Cyanamid 1986). Caution should be used when applying imazapyr, as a few reports to TNC from the field indicate that imazapyr might be exuded from the roots of target species. Some legume species, such as mesquite, may actively exude imazapyr (J. Vollmer pers. comm.). Imazapyr herbicide can be mobile within roots and transferred between intertwined root systems (root grafts) of many different plants and/or to several species. Movement of imazapyr via root grafts or by exudates (which is a defense mechanism of those plants) may therefore adversely affect the surrounding vegetation. This movement of herbicide may also be compounded when imazapyr is incorrectly overapplied. Movement of soil particles that contains imazapyr can also potentially cause unintended damage to desirable species.

Imazapyr is effective for creating openings for wildlife use. It can be applied pre-emergent, but is most effective when applied as a post-emergent herbicide. Care should be taken in applying it around non-target species, as it is readily adsorbed through foliage and roots, and therefore, could be injurious by drift, runoff, or leaching from the roots of treated plants. To avoid injury to desirable trees, do not apply imazapyr within twice the drip line (tree canopy).

On TNC preserves in Texas, imazapyr provided good control of saltcedar (*Tamarix* spp.) and Chinese tallow tree (*Sapium sebiferum*). In North Carolina preserves, it was effective against oriental bittersweet (*Celastrus orbiculata*), cut-stumps of Chinese privet (*Ligustrum sinese*), and tree-of-heaven (*Ailanthus altissima*). Recent work in California demonstrated that foliar applications of imazapyr effectively controlled jubatagrass and pampasgrass (*Cortaderia jubata* and *C. selloana*) (DiTomaso et al. 1999; Drewitz 2000), and experimental studies in Washington showed that imazapyr provided excellent control of smooth cordgrass (*Spartina alterniflora*) in tidal estuarine habitats (Patten 2002).

Mode of Action: Imazapyr is absorbed quickly through plant tissue and can be taken up by roots. It is translocated in the xylem and phloem to the meristematic tissues, where it inhibits the enzyme

acetohydroxy acid synthase (AHAS), also known as acetolactate synthase (ALS). ALS catalyzes the production of three branched-chain aliphatic amino acids, valine, leucine, and isoleucine, required for protein synthesis and cell growth. The rate of plant death usually is slow (several weeks) and is likely related to the amount of stored amino acids available to the plant. Only plants have ALS and produce these three amino acids, and therefore, imazapyr is of low toxicity to animals (including fish and insects). Animals need these three branched chain aliphatic amino acids, but obtain them by eating plants or other animals.

Dissipation Mechanisms:
Summary: Imazapyr is degraded in soils primarily by microbial metabolism. It will quickly undergo photodegradation in aqueous solutions (photohydrolysis), but there is little to no photodegradation of imazapyr in soil, and it is not readily degraded by other chemical processes. Imazapyr does not bind strongly with soil particles, and depending on soil pH, can be neutral or negatively charged. When negatively charged, imazapyr remains available in the environment.

Volatilization
Imazapyr does not volatilize readily when applied in the field (T. Lanini, pers. obs.). The potential to volatilize, however, increases with increasing temperature, increasing soil moisture, and decreasing clay and organic matter content (Helling et al. 1971).

Photodegradation
Imazapyr is rapidly degraded by sunlight in aquatic solutions. In soils, however, there is little or no photodegradation of imazapyr (WSSA 1994). The half-life of imazapyr due to photodegradation in aqueous solution is approximately two days, and decreases with increasing pH (Mallipudi et al. 1991, Mangels 1991a).

Microbial Degradation
Microbial degradation is the primary mechanism of imazapyr degradation in soils (WSSA 1994). American Cyanamid (1986) reported that the half-life of imazapyr in soils typically ranged from one to seven months, depending on soil type, temperature, and soil moisture (Mangels 1991b). The half-life of imazapyr is shorter at cooler soil temperatures (25° C versus 35° C) and in sandier soils (sandy loam versus clay loam) (American Cyanamid 1986). Degradation rates are decreased in anaerobic soil conditions (WSSA 1994).

In studies of the related compound imazaquin, microbial degradation rates increased with increasing soil moisture content (between 5-75% of field capacity) and increasing soil temperatures (from 15° C to 30° C) (Mangels 1991b). Microbial degradation additionally, was more rapid in soils that did not bind the herbicide strongly. Imazapyr that is bound strongly to soil particles may be unavailable for microbial degradation.

Adsorption
The adsorption of imazapyr to soil particles is generally weak, but can vary depending on soil properties (Mangels 1991b). Adsorption is reversible, and desorption occurs readily (WSSA 1994). Because the exact chemical form of the herbicide is determined by environmental pH, the adsorption capacity of imazapyr changes with soil pH. A decline in pH below 5 increases

adsorption of imazapyr to soil particles. Above pH 5, imazapyr becomes ionized, increasing its negative charge, and limiting its ability to bind with soils (Mangels 1991b). Vizantinopoulos and Lolos (1994) found that adsorption decreased with increasing soil temperature, and Dickens and Wehtje (1986) found that adsorption increased with time and decreased soil moisture. In general, imidazolinone herbicides show an increase in soil adsorption capacity with an increase in soil clay content and organic matter, but studies of imazapyr have been conflicting (Dickens and Wehtje 1986, Wehtje et al. 1987, Mangels 1991b, McDowell et al. 1997, Pusino et al. 1997, El Azzouzi et al. 1998).

Chemical Decomposition

Imazapyr changes form readily with changes in pH, but is not necessarily degraded in this process. It does not readily undergo hydrolysis (Mangels 1991a), and no other chemical degradation mechanisms have been reported.

Behavior in the Environment

Summary: Imazapyr is slowly degraded by microbial metabolism and can be relatively persistent in soils. It has an average half-life in soils that range from one to five months. At pH above 5, it does not bind strongly with soil particles and can remain available (for plant uptake) in the environment. In water, imazapyr can be rapidly degraded by photolysis with a half-life averaging two days. There have been a few reports from the field of unintended damage to desirable, native plants when imazapyr has either exuded out of the roots of treated plants into the surrounding soil, or when intertwined roots transfer the herbicide to non-target plants. Make sure to not overapply imazapyr, and also confirm that soil particles with imazapyr are not moved in-contact with desirable species.

Soils

Depending on environmental conditions, imazapyr has an average half-life in soils of several months (Vizantinopoulos and Lolos 1994, El Azzouzi et al. 1998). El Azzouzi et al. (1998) reported half-lives between > 58 to 25 days in two Moroccan soils. In a laboratory study, the half-life of imazapyr ranged from 69-155 days, but factors affecting degradation rates were difficult to identify because the pH varied with temperature and organic content (McDowell et al. 1997). In a more extreme example, Vizantinopoulos and Lolos (1994) found that in loam and clay loam soils with pH 7-8, half-lives ranged up to 50 months. The manufacturer reports that persistence in soils is influenced by soil moisture, and that in drought conditions, imazapyr could persist for more than one year (Peoples 1984).

Lee et al. (1991) reported that imazapyr residues in soil following postemergent application increased eight days after initial application and continued to increase until a peak of 0.23 ppm at day 231 post-treatment. The authors attributed these increases to runoff of residues from plant surfaces following rainfall and to the release of residues from decaying plant matter.

Under most field conditions imazapyr does not bind strongly to soils and can be highly available in the environment. Above pH 5, the herbicide will take on an ionized form, increasing the risk of herbicide runoff. McDowell et al. (1997) found that heavy rainfall caused significant movement

of the herbicide (or more likely, moved the soil particles that the imazapyr was adsorbed to), and leaching up to 50 cm deep in soils have been reported (WSSA 1994).

Water
Despite its potential mobility, imazapyr has not been reported in water runoff, and we found no reports of imazapyr contamination in water. If it enters the water column, imazapyr can be photodegraded by sunlight with an average half-life of two days (Mallipudi et al. 1991).

Vegetation
Because imazapyr kills a wide variety of plants and can be relatively persistent and remain available in soils, damage to desirable non-target plants is possible. When imazapyr is applied in high rates, directly to soil, it can result in season-long soil activity. Plant species that are resistant to imazapyr apparently metabolize it to an immobile form that cannot be translocated to the meristematic tissues (Shaner & Mallipudi 1991).

Environmental Toxicity
Birds and Mammals
Imazapyr is of relatively low toxicity to birds and mammals. The LD50 for rats is > 5,000 mg/kg, and for bobwhite quail and mallard ducks is >2,150 mg/kg (WSSA 1994). American Cyanamid reports that studies with rats indicate that imazapyr was excreted rapidly in the urine and feces with no residues accumulating in the liver, kidney, muscle, fat, or blood (Miller et al. 1991). Imazapyr has not been found to cause mutations or birth defects in animals, and is classified by the U.S. EPA as a Group E compound, indicating that imazapyr shows no evidence of carcinogenicity.

Aquatic Species
Imazapyr is of low toxicity to fish and invertebrates. The LC50s for rainbow trout, bluegill sunfish, channel catfish, and the water flea (*Daphnia magna)* are all >100 mg/L (WSSA 1994). As of September 2003, imazapyr (tradename Habitat®) is registered for use in aquatic areas, including brackish and coastal waters, to control emerged, floating, and riparian/wetland species. A recent study from a tidal estuary in Washington showed that imazapyr, even when supplied at concentrations up to 1600 mg/L, did not affect the osmoregulatory capacity of Chinook salmon smolts (Patten 2003). Similarly, the Washington State Department of Agriculture reported that the 96-hour LC50 for rainbow trout fry to be 77,716 mg/L (ppm) -22,305 ppm of the active ingredient- which represents a greater concentration of imazapyr than found in commercially-sold containers (J. Vollmer, pers. comm.).

Other Non-Target Organisms
Limited information was found on the effects of imazapyr on other non-target organisms such as soil bacteria and fungi. The manufacturers report that Arsenal® is non-mutagenic to bacteria (Peoples 1984).

Application Considerations:
Imazapyr is a slow acting herbicide that is not readily metabolized in plants. It can be very effective against woody species. Due to its persistence in the environment, it may be preferable to

apply imazapyr directly to vegetation (using a low-volume backpack, cut-stump, or basal bark application) instead of using a broadcast spray method. When using a cut-stump application, be careful to avoid overapplication of imazapyr on the stump, as this may lead to excess imazapyr to be transferred between root grafts or movement by soil particles. When completing a cut-stump treatment, apply imazapyr only to the outer cambium layer of the stump (versus applying herbicide to the entire cut-stump), and this should sufficiently kill the tree (J. Vollmer, pers. comm.).

A study of wipe-on applications to the reed *Phragmites australis*, however, found that this method provided some suppression of reeds in the short-term, but failed to control them in the long term (Kay 1995). Malefyt and Quakenbush (1991) reported better results when imazapyr was applied at 21° C rather than 32° C. Rainfall is considered important for good activity following soil application (Malefyt and Quakenbush 1991) but can increase movement of imazapyr in the soil column. A non-ionic surfactant can improve the efficacy of imazapyr.

Safety Measures:
Some formulations of imazapyr can cause severe irreversible eye damage. Care should be taken to prevent accidental splashing or other exposure of eyes to the herbicide.

Human Toxicology
Imazapyr is of relatively low toxicity to mammals, and shows no mutagenic or teratogenic potential. It can be an eye and skin irritant, but is not a dermal sensitizer (American Cyanamid 1986; Cyanamid Ltd. 1997).

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Appendix F – Revegetation Studies

Treatments for Pecos Revegetation Studies

Revised 05/25/2004

(From Sarah Wynn)

Non-Irrigated	**1**	**5**	**2**	**7**	**6**	**4**	**3**
4 Replications	**4**	**6**	**7**	**3**	**5**	**2**	**1**
	6	**1**	**2**	**7**	**3**	**5**	**4**
	5	**7**	**1**	**4**	**2**	**6**	**3**
Irrigated							
Demonstration	**4**	**1**	**3**	**7**	**5**	**6**	**2**

Dryland studies: North and South Sites on the Seven Rivers Farm
These treatments will be replicated 4 times using one seed mix on the clay south site and one seed mix on the more gravelly north site.

1. **Broadcast seed before subsoiler treatment**
2. **Broadcast seed before imprinter treatment**
3. **Broadcast seed before roller/chopper treatment**
4. **Seed with deep-furrow drill**
5. **Seed with Pitter-seeder**
6. **Seed with no-till seeder**
7. **Control: No Seeding**

Factor 1 = Seeding Method
Factor 2 = Mycorrhizal Inoculation (Each ½ plot will be treated with broadcast mychorrizae)

Irrigated Demonstration
Each of the treatments will be laid out one time and irrigated to match average monthly rainfall.

Individual plots are 50' x 100'.

Each dry land study with irrigated demonstration will be 800 feet wide by 340 deep or 272,000 square feet = 6.244 acres. This includes 10 foot lanes between plots, a 20 foot east-west land between the non-irrigated study and irrigated demonstration area, and a 20 foot lane around each study area. Each study area will be fenced.

Preliminary species list for use at Restoration Project on the Pecos River 04/13/2004
***Seed known to be available for 2004 from Curtis & Curtis Seed**

Shrubs: To be seeded in FY 2005 or 2006 using pitter-seeder or plot drill

**Four-Wing Salt Bush*	*Atriplex canescens*
**Quail Bush*	*Atriplex lentiformis*
***Desert willow*	*Chilopsis linearis*

***questionable on clay site*

Grasses for Clay Site: To be seeded in FY 2004*

05	**Desert Saltgrass*	*Distichlis spicata*
25	**Alkali sacaton*	*Sporobolus airoides*
	**Giant sacaton*	*Sporobolus gigantea*
05	*Bush muhly*	*Muhlenbergia porteri*
10	**Vine mesquite*	*Panicum obtusum*
25	**Switch gras*	*Panicum virgatum*
05	**Blue grama*	*Bouteloua gracilis*
10	**Sideoats Grama*	*B. curtipendula*
15	**Galleta Grass*	*Pleuraphis jamesii*
	Tobosa Grass	*Pleuraphis (Hilaria) mutica*

Grasses for Non-Clay Site: To be seeded in FY 2004*

	**Desert Saltgrass*	*Distichlis spicata*
20	**Alkali sacaton*	*Sporobolus airoides*
05	**Giant sacaton*	*Sporobolus gigantea*
	Bush muhly	*Muhlenbergia porteri*
	**Vine mesquite*	*Panicum obtusum*
25	**Switch gras*	*Panicum virgatum*
10	**Blue grama*	*Bouteloua gracilis*
25	**Sideoats Grama*	*B. curtipendula*
10	**Galleta Grass*	*Pleuraphis jamesii*
05	*Tobosa Grass*	*Pleuraphis (Hilaria) mutica*

Revegetation Plots
Site Locations

Homogeneity

The southern site we originally stood on was south of the major power line running east/west. This area is dissected by a number of small drainage channels. I located the southern site just north of the major power line on a relatively flat surface. However, there is a drainage channel cutting through the northern half of the plot. If we shifted the northern half 300 ft. to the north, both would be on a relatively flat surface. We could shift the whole plot to the north keeping them together. Kochia dominates the low areas in this site. As of 3/29/04, the Kochia was 1 to 2 inches tall for the most part with maybe 10% being 3 inches tall.

The northern site has a drainage channel at the very end of the southern boundary. I don't see where it will interfere with the plot. The northern site has a hummocky microrelief. The alkali sacaton occurs in the low areas, apparently where water collects. Kochia has not started growing at this site to any great extent.

It follows that any control efforts especially those requiring soil disturbance will most likely result in the same early seral species occupying the sites. It is important for these sites to progress toward more stable perennial species for long-term stability. It is proposed that strategies be developed to accomplish this task without the necessity of incorporating control efforts on sites still occupied by salt cedar. These strategies should include the testing of soils to insure relative similarities in physical and chemical properties for a given site and to predict which methods will be most effective given soil type and texture, organic matter content and moisture availability. The major differences between cleared sites and those still occupied by salt cedar should be described as well, e.g., presence/absence of surface salinity, mulch type and depth to water table.

One possible strategy may be to roughen the soil surface via disking, pitting, imprinting, etc., to create micro-catchments. This may also be desirable in mulch management. Mulch presence, type and depth may be critical to the success of perennial species establishment either positive by increasing moisture availability or negative by raindrop interception or shading. In some areas it may be necessary to provide control efforts, to limit weedy competition. This may be accomplished through nitrogen sequestration, herbicides or other means.

It is proposed that two revegetation sites differing in soil type be developed: one within the old McMillan lakebed (lacustrine soils) and the other to the north with soils deposited primarily through historic flooding events. A component of each site will receive limited irrigation to simulate annual rainfall.

The irrigated component will provide moisture to simulate typical monsoon rainfall events and may incorporate rainfall simulation to insure timing and total expected rainfall. Ideally monsoon rains typical for the area will be the norm; however it will be expedient to have irrigated sites to show what is possible in the event that rainfall is below normal.

Appendix G. Selected Wildlife Species reported from Brantley and Avalon Reservoirs, New Mexico[a].

COMMON NAME	SCIENTIFIC NAME
BIRDS	
American Coot	*Fulica americana*
American Avocet	*Recurvirostra americana*
American White Pelican	*Pelecanus erythrorhynchos*
Bank Swallow	*Riparia riparia*
Barn Swallow	*Hirundo rustica*
Belted Kingfisher	*Ceryle alcyon*
Black-Necked Stilt	*Himantopus mexicanus*
Brown Pelican	*Pelecanus occidentalis carolinensus*[b]
Burrowing Owl	*Athene cunicularia*
Canyon Wren	*Catherpes mexicanus*
Cliff Swallow	*Hirundo pyrrhonota*
Common Loon	*Gavia immer*
Common Nighthawk	*Chordeiles minor*
Double-Crested Cormorant	*Phalacrocorax auritus*
Eared Grebe	*Podiceps nigricollis*
Gambel's Quail	*Callipepla gambelii*
Greater Roadrunner	*Geococcyx californianus*
Great Blue Heron	*Ardea herodias*
Great-Horned Owl	*Bubo virginianus*
Green Heron	*Butorides virescens*
Herring Gull	*Larus argentatus*
House Sparrow	*Passer domesticus*
Interior Least Tern	*Sterna antillarum*[b]
Kill Deer	*Charadrius vociferus*
Mallard	*Anas platyrhynchos*
Mourning Dove	*Zenaida macroura*
Northern Harrier	*Circus cyaneus*
Northern Shoveler	*Anas clypeata*
Red-Winged Blackbird	*Agelaius phoeniceus*
Ring-Necked Pheasant	*Phasianus colchicus*
Snowy Egret	*Egretta thula*
Turkey Vulture	*Cathartes aura*
Western Kingbird	*Tyrannus verticalis*

Western Meadowlark	*Sturnella neglecta*
White-Winged Dove	*Zenaida asiatica*
Wilson's Phalarope	*Phalaropus tricolor*
Yellow-billed Cuckoo	*Coccyzus americanus*[c]
MAMMALS	
Blacktail Jackrabbit	*Lepus californicus*
Coyote	*Canis latrans*
Raccoon	*Procyon lotor* (sign observed)
Mule Deer	*Odocoileus hemionus*
HERPETOFAUNA	
Little Striped Whiptail	*Cnemidophorus inornatus*
Turtle	Unidentified
Western Whiptail	*Cnemidophorus inornatus*

[a] Brantley and Avalon Reservoirs RMP Environmental Assessment, December 2003
[b] Federally listed species
[c] Also known to occur on the Pecos River (USBR 1996)

Appendix H. Fish species reported from Brantley Reservoir (BR), Avalon Reservoir (AR), and the Pecos River (PR) within the Project Area.

COMMON NAME (*SCIENTIFIC NAME*)	BR	AR	PR
Family Atherinidae – silversides			
Inland Silverside (*Menidia beryllina*)	X	X	X
Family Catostomidae - suckers			
Blue Sucker (*Cycleptus elongates)*			X
Gray Redhorse (*Moxostoma congestum*)		X	
River Carpsucker (*Carpiodes carpio)*	X	X	X
Smallmouth Buffalo (*Ictiobus bubalus)*	X	X	X
Family Centrarchidae - sunfishes			
Black Crappie (*Pomoxis nigromaculatus*)	X	X	X
Bluegill (*Lepomis macrochirus)*	X	X	X
Green Sunfish (*Lepomis cyanellus*)	X	X	X
Largemouth Bass (*Micropterus salmoides)*	X	X	X
Longear Sunfish (*Lepomis megalotis*)	X	X	X
Spotted Bass (*Micropterus punctulatus*)	X	X	X
Warmouth (*Lepomis gulosus)*	X	X	X
White crappie (*Pomoxis annularis)*	X	X	X
Family Clupeidae - herrings			
Gizzard Shad (*Dorosoma cepedianum*)	X	X	X
Threadfin Shad (*Dorosoma petenense)*	X	X	
Family Cyprinidae - carp and minnow			
Common Carp (*Cyprinus carpio*)	X	X	X
Fathead Minnow (*Pimephales promelas)*	X	X	X
Red Shiner (*Cyprinella lutrensis)*	X	X	X
Family Fundulidae - killifishes			
Plains Killifish (*Fundulus zebrinus*)	X	X	X
Family Ictaluridae - catfishes			
Black Bullhead (*Ameiurus melas)*	X	X	X
Channel Catfish (*Ictalurus punctatus*)	X	X	X
Flathead Ccatfish (*Pylodictis olivaris)*	X	X	X
Family Lepisosteidae - gars			
Longnose Aar (*Lepisosteus osseus)*	X	X	X
Family Percichthyidae - temperate basses			
White Bass (*Morone chrysops)*	X	X	
Family Percidae – perches			
Bigscale Logperch (*Percina macrolepida*)	X	X	X
Walleye (*Stizostedion vitreum)*	X	X	

Family Poeciliidae – livebearers			
Western Mosquitofish (*Gambusia affinis*)	X	X	X

Appendix I. Other federally listed threatened and endangered species found in Eddy County, New Mexico.

Common Name (Scientific Name)	Federal Status	Typical Habitat
Mexican Spotted Owl (*Strix occidentalis lucida*)	Threatened	Old-growth conifer forest in mountainous terrain.
Northern Aplomado Falcon (*Falco femoralis septentrionalis*)	Endangered	Yucca or mesquite desert grasslands with scattered prominent woody vegetation.
Black-footed Ferret (*Mustela frenata neomexicana*)	Endangered (Experimental Pop.)	Prairie dog towns in prairie grasslands up to 10,500 feet elevation.
Pecos Gambusia (*Gambusia nobilis*)	Endangered	Restricted to a few springs and gypsum sinkholes.
Kuenzler Hedgehog Cactus (*Echinocereus fendleri* var. *kuenzleri*)	Endangered	Occurs in woodland between 5800 and 7000 feet on gentle south-facing slopes having limestone influenced soil.
Lee's Pincushion Cactus (*Coryphantha sneedii* var. *leei*)	Threatened	Restricted to cracks and ledges of steep limestone outcrops above 4000 feet.

Appendix J. Additional Invasives Treatments

Dominant Vegetative Species Present and Recommended Treatments

A Field Review Conducted 08/03-05/04) by Nancy Umbreit (Bureau of Reclamation) And Doug Parker (U.S. Forest Service)

The following low-impact methods are recommended for controlling unwanted vegetation on three dams (Sumner, Brantley, and Avalon Dams) located along the Pecos River, New Mexico. These methods will provide excellent control results at a minimal cost. Many of the herbicide applications can be done in the fall or early winter, which is a distinct advantage when temperatures are more favorable for such work. "Restricted Use" herbicides were not selected for recommendation (since they require applicator certification which is not necessary for the proposed control) nor herbicides that are mobile and could have the potential for water contamination. As much as possible, we have recommended the use of selective herbicides and selective application methods to limit affects to desirable plants. The recommended treatments at all three dams are similar which is beneficial to contracting the work under one contract.

Introduction

The vegetative control work is necessary for the following reasons (Ref: Guidelines for Removal of Trees and other vegetative growth from Earth Dams, Dikes, and Conveyance Features, Bureau of Reclamation, April 26, 1989):

1) To allow proper surveillance and inspection of the structures and adjacent areas for seepage, cracking, sinkholes, settlement, deflection, and other signs of distress.
2) To allow adequate access for normal and emergency Operation and Maintenance (O&M) activities.
3) To prevent damage to the structures due to root growth, such as shortened seepage paths through embankments; voids in embankments from decayed roots or toppled trees; expansion of cracks or joints of concrete walls, canal lining, or pipes; and plugging of perforated or open-jointed drainage pipes.
4) To discourage animal/rodent activity (by eliminating their food source and habitat), thereby preventing avoids within embankments and possible shortened seepage paths.
5) To allow adequate flow-carrying capability of water conveyance channels (e.g., spillway inlet an outlet channels; open canals, laterals, and drains).

The vegetative growth of trees and potentially detrimental vegetation should be prevented during its early states as part of the normal O&M program. Early control is generally the most cost effective means of avoiding potential adverse effects on these structures.

Brantley Dam

1) **Vegetation Location: On upstream and downstream faces of Brantley Dam (major two species present are honey mesquite and yerba-de-pasmo).**

a) Treat the following seven species using triclopyr (product name = Garlon 4 or Tahoe 4) and Oil: Treatments will involve the oil basal approach as previously described. The 25% herbicide mixture (one part herbicide to three parts

vegetable oil) needs to be applied to the stems from the ground up for about a foot. All sides of the stems need to be covered with the spray. Application is best done in the fall or early winter. Follow instructions in the earlier mentioned guides.

Whitethorn (*Acacia constricta*)
Catclaw acacia (*Acacia greggii*)
Feather dalea (*Dalea formosa*)
Cooper golden bush (*Ericameria cooperi*)
Baccharis (*Baccharis sp.*)
Honey mesquite (*Prosopsis glandulosa*)
Yerba-de-pasmo (*Baccharis pteronioides*)

b) Grub the individual narrowleaf yucca plants

Narrowleaf yucca (*Yucca glauca*)

Avalon Dam

1) **Vegetation Location: On upstream and downstream faces of Avalon Dam (mix of species, no particular species dominating).**

a) Treat the following seven species using triclopyr (product name = Garlon 4 or Tahoe 4) and Oil (oil basal technique). Treat the following seven species using triclopyr and Oil: Treatments will involve the oil basal approach as previously described. The 25% herbicide mixture (one part herbicide to three parts vegetable oil) needs to be applied to the stems from the ground up for about a foot. All sides of the stems need to be covered with the spray. Application is best done in the fall or early winter. Follow instructions in the earlier mentioned guides.

Catclaw acacia (*Acacia greggii*)
Honey mesquite (*Prosopsis glandulosa*)
Saltcedar (*Tamarisk sp.*)
Creosotebush (*Larrea tridentata*)
Ash (*Fraxinus sp.*)
Mulberry (*Morus sp.*)
Net-leaf Hackberry (*Celtis reticulata*)

b) Cut tree as low to the ground as possible. This species will not sprout.

Juniper (*Juniperus monosperma*)

a) Spot treatment using imazapyr (product name = Arsenal). Mix two ounces of the concentrate in a gallon of water and apply the solution to the foliage of actively growing plants. Since imazapyr is a broad spectrum herbicide that is soil active, some nearby plants will be killed.

Silverleaf nightshade (*Solanum elaeagnifolium*)

b) Grub the individual following plants.

Prickly Pear (*Opuntia sp.*)
Yucca (*Yucca spp.*)

c) Pull individual plants before seed production (annual plant). Also, glyphosate (2% solution in water) or imazapyr (1% solution in water) can to applied to foliage prior to seed set.

Buffalo bur (*Solanum rostratum*)

d) Pull prior to plants seeding or control plants with an herbicide. Glyphosate (2% solution in water) or imazapyr (1% solution in water) can to applied to foliage prior to seed set.

Sandburs (*Cenchrus longispinus*)

Appendix K – Map of Treatment and Research Areas