Appendix A

Sample Field Data Collection Sheet

Site Evaluation Sheet Middle Carson Habitat Conservation Plan

Date Field Personnel Location

Vegetation
Mapped/Actual

Herbaceous
Dominant Species:
Notable/Desirable Natives Present (e.g. perennial grasses)
Indicator of Alkali Conditions?
Weeds types and prevelance/risk

Shrubs (non Willow)
Dominant Species:
Notable/Desirable Native Shrubs present (e.g. shrubs with berries or thorns)
Recruitment evident? Y N
Age Mature Young

Willow Shrubs/Trees
Dominant species:
Number of different willow types present
Recruitment evident? Y N
Age classes present: Mature Young

Cottonwood Trees
Recruitment evident? Y N
Age classes present: Mature Young Sapling Seedling

<u>Degree of hinderance to natural recruitment</u>
Lack of hydrology
Lack of propagule source
Herbivory/grazing
Weed infestation
ORV
Land use practice
Erosion
Other

Special weed considerations

<u>Opportunities for planting/natural recruitment</u>
Reconnect to the river
Oxbows and relict channels
Downslope of irrigation canal
Hydrologic curtain site
Buffaloberry site
Other

<u>Opportunities for habitat biodiversity</u>
Increase density
Increase species diversity
Replace species
Patch connection
Open Water Pond
Change seral stage

Appendix B

Carson River-Dayton Valley Santa Maria Vegetation Enhancement and Restoration Plan

Carson River-Dayton Valley
Santa Maria Park
Vegetation Enhancement & Restoration Plan

Project Name: Santa Maria Ranch Park Vegetation Enhancement and Restoration Project

Project Goals:

Goal #1: Increase habitat for native plants and wildlife
Goal #2: Protect stream banks from erosion
Goal #3: Establishment of a multi-level vegetation structure, including stream-shading vegetation
Goal #4: Increase recruitment of native trees such as Fremont cottonwood
Goal #5: Prevent the establishment of invasive plants

Revegetation Methods: ☐ Passive ☐ Active ■ Passive *and* Active

Target Date	Task
Ongoing	Monitoring to prioritize sites for revegetation
Ongoing	Site Preparation (debris removal, grading/drainage, erosion and pest control, fencing/signage)
May 1, 2009	Planting Design (drawing, plant list, spacing, mulching, plant sources, planting time)
May 15, 2009	Plant Acquisition-native trees, shrubs, and grasses for planting in the spring (Phase 1)
May 15, 2009	Collect willow cuttings and plant sprigs.
Sept. 15, 2009	Seed Collection- native trees, shrubs, and grasses for planting in the fall (Phase 2)
Nov. 1, 2009	Planting of collected seeds, cuttings, and saplings
Ongoing	Monitoring of sites for supplemental plantings and/or maintenance

Background & Existing Conditions:

Background: Historically, the Santa Maria Ranch Park (34 acres) was an agricultural-based ranch with alfalfa hay being the primary commodity. The property was also utilized for winter-grazing for numerous cattle which has significantly impacted the overall ecological health of the riparian zone. Over the year, wild horses have also significantly impacted the area, especially during the summer and winter months when horse visitation is the highest. Currently, the property is showing the long term effects of overgrazing, excessive wood cultivation, and encroachment of invasive plant species (e.g. noxious weeds).

Site #1: Upland zone

- Presence of noxious weeds (musk thistle, perennial pepperweed) and low plant diversity
- Potential restoration site = ~16,875 ft^2

Site #2: Upland zone

- Same condition as Site #1 with the exception of higher plant diversity and presence of wetland plant species due to hydric soils
- Potential restoration site = ~60,075 ft^2

Sites #3 & 4: Cottonwood woodland zone

- High plant diversity and lower presence of invasive plant species
- Significant diversity in grasses (i.e, intermediate wheatgrass, Indian ricegrass, Great Basin wildrye, and saltgrass) and in wetland plants (i.e., horsetail and rushes)
- Minimal forb understory; needs increased shrubs and forbs
- No diversity of age-classes in the cottonwood trees
- Potential restoration site = ~117,248 ft^2

Sites #5, 6, 7, 8, and 9:
Riparian zone

- Increased presence of invasive plant species (Russian olive, perennial pepperweed, hoary cress, and thistles)
- Coyote willow dominated sites
- Some streambank erosion due to high flows and low density of willow/forb vegetation complex
- Potential restoration site = ~ 12,000 ft^2

Site #10: Aquatic Recreational Zone

- Open shoreline area for human traffic; minimal vegetation
- Sandbar area trapping sediment and not showing signs of erosion or scouring (low erosion potential)

Site #11: Aquatic Recreational Zone

- Some signs of streambank erosion and undercutting
- Minimal presence of

Site Preparation:

Intensive site preparation will not be necessary. Revegetation will be focused on areas of bare soil, stream bank, and around noxious weed patches.

Planting Plan:

Plant densities

Individual plant species should be planted in small groups. Generally, tree species are planted in groups of two to three, and shrubs should be planted in groups of three to five. Planting should alternate trees and shrubs with the ultimate goal of establishing a habitat that includes both tree and shrub layers. Dense stands of mature willows and other riparian

species with spacings of 12 to 15 feet, relating to a minimum density of 120 to 300 trees per acre.

Listed below are the revegetation activities that will be used. Revegetation methods are determined by the size of patch, position on bank, the presence or absence of erosion, and the presence of invasive weeds.

Patch #	Passive (P) Active (A) Revegetation		
	Upland Shrubs and Trees	Grasses, Rushes and Sedges	Willow Planting
1	A	P,A	N/A
2	A	P,A	N/A
3	P,A	P,A	N/A
4	P,A	P,A	N/A
5	A	A	A
6	A	A	A
7	A	A	A
8	A	A	A
9	A	A	A
10	P,A	P	P,A
11	P,A	P	P,A

Plant Selection:

Selecting plant species appropriate for the Santa Maria Park is a key step in designing its revegetation plan. The plant selection process for Santa Maria Revegetation Plan involved the following steps:

1. Establishing plant selection criteria
2. Examining characteristics of a variety of plant species
3. Examining plants used at previous replantings on the site

Selection criteria

Depending of the goal of a revegetation project, plant selection criteria may differ. The main goals of the Santa Maria Park restoration project is to provide an understory to the existing Fremont cottonwood grove, increase Fremont cottonwood recruitment within the park, improve wildlife habitat, prevent further stream bank degradation, and prevent the establishment of invasive plants. In order to fulfill the project goal and objectives, the following plant selection criteria was developed:

Criteria #1: Plants should preferably be native to riparian systems found within the Great Basin ecosystem and, if possible, found in the Carson River watershed.

Criteria #2: Plants should re-establish native biodiversity, and provide increased value, to the aquatic and riparian habitat.

Criteria #3: Plants must establish relatively quickly to compete with non-native, invasive vegetation and so that maintenance (irrigation) activities are limited to the first two or three growing seasons.

Criteria #4: Plants must be available from native plant sources in the area.

Plant Characteristics

In order to satisfy the plant selection criteria, the characteristics of potential plants were examined for a variety of factors such as native habitat, growing rates/invasiveness, establishment potential, bank location requirements, wildlife value, and availability. The following table summarizes the factors examined and the criteria they would satisfy:

Factor	**Purpose**	**Selection Criteria**
Native habitat	Plants should be native (when applicable)	Criteria #1
Growing rate/competitiveness	Plants must be able to establish quickly and adequately compete with non-native invasive vegetation. Therefore, moderate to rapid growth rate and high competitiveness are desired	Criteria #3
Establishment potential	Plants must be able to establish within two or three growing seasons to lessen required maintenance. Therefore, easy to establish plants are preferred	Criteria #3
Bank location requirements	Plants must cover a variety of bank locations for aesthetic, habitat, and canopy establishment purposes	Criteria #2, #3
Wildlife Value	Plants should improve the aquatic and riparian habitat value of the site. Therefore, plants with high habitat value are desired	Criteria #4
Availability	Selected plants must be available from a local source	Criteria #4

Below is a list of plants that will be used in revegetation; however additional plants might be added throughout the planning process. The recommended plants were examined to be sure that site conditions such as soils, moisture requirements and exposure requirements were suitable for the Santa Maria Park site.

Common Name	Scientific Name	Source	Timing
Fremont Cottonwood	*Populus fremontii*	Sapling/Seed	Oct-Apr
Coyote Willow	*Salix exigua*	Sprigs/container	Oct-May
Great Basin Wildrye	*Leymus cinereus*	Seed	Sept-Nov
Tall Wheatgrass	*Elytrigia elongata*	Seed	Sept-Nov
Baltic Rush	*Juncus balticus*	Seed	Oct-Jan
Creeping Wildrye	*Leymus arenarius*	Seed	Sept-Nov
Intermediate Wheatgrass	*Elytrigia intermedia*	Seed	Sept-Nov
Inland Saltgrass	*Distichlis spicata*	Seed	Sept-Nov
Desert Globemallow	*Sphaeralcea ambigua*	Seed	Aug-Nov
Wood's Rose	*Rosa woodsii*	Container	Aug-Apr
Sulfur-flower Buckwheat	*Eriogonum umbellatum*	Seed	Sept-Nov
Four-wing Saltbush	*Atriplex canescens*	Seed	Sept-Nov
Black Greasewood	*Sarcobatus vermiculatus*	Seed	Sept-Nov
Indian Ricegrass	*Achnatherum hymenoides*	Seed	Sept-Jan
Scouringrush horsetail	*Equisetum spp.*	Sprigs	Oct-Apr

Passive Regeneration

Generally smaller patches (<1,000 ft^2) will be left to revegetate on their own. In addition, the seeds from mature grasses will be cultivated and spread throughout the site. These patches will be monitored for the establishment of invasive plants and eradication methods will be used to control invasive plants in and around the patches.

Upland Shrubs and Trees

Shrubs and trees will be planted from seed, plugs, cuttings, or saplings from a source as close as possible to the site being revegetated. The shrubs and trees will be planted in the fall. If irrigation is possible, then spring planting may occur, based on availability of the plants. The seeds will be spaced two feet apart and covered with 1-3 inches of soil. Shrubs and trees will be planted on the upland terrace and upper bank on the north side of the Carson River. Cottonwoods may be planted from the toe to mid-bank.

Grasses, Rushes, and Sedges

Grasses will be planted in the fall from upland to mid-bank. Sedges and/or rushes will be planted in fall from toe to mid-bank.

Willow Sprig Planting

Willow sprigs will be planted in fall from the toe to midbank with two-foot spacing between sprigs. The sprigs should be 2 to 4 feet long and 1 to 3 inches in diameter. Harvesting of sprigs should occur no sooner than three days before planting. If not collected on the same day as planting sprigs will be stored in a holding pond.

Planting Activity:

Replanting events
For the Santa Maria Park, plant installation will be conducted through community volunteer activities. In the days prior to the plant installation, Lyon County Parks will dig holes for the plants. Plant installation will be lead by Audubon staff. Plant installation is scheduled for the morning (between 10:00 am and 1:00 pm) of each planting day. School children (one high school class and one grade school class) will participate in planting activities. Local residents and community groups will also assist with planting. During the afternoon of the replanting, Lyon County will irrigate the newly revegetated areas.

In addition to the plants, the following materials will be made available on planting days:

- Hand trowels and shovels
- Gloves
- Mulch
- Soil
- Pin flags
- Plant protection (e.g. staking or beaver/vole damage abatement)
- Mallets, ties, clips
- Trash bags

Container plant installation
Planting holes should generally be one to two feet wide and two feet deep. Plants should be installed so that their root crowns are at or slightly above the soil surface.

Plant Protection
Beaver, vole, livestock, and human impacts will be prevented or mitigated through exclusion methods (e.g. wire cages, fencing, etc.).

Maintenance:

Invasive weeds will be controlled by mechanical and chemical control methods and plants will be planted in high densities to compensate for the lack of water. Planting in the fall or late winter/early spring will also help native plant establishment.

Monitoring and Success Criteria:

Sites will be monitored monthly during the rainy season to detect any erosion problems and to identify needed maintenance. Monitoring of native plant establishment and vigor will be in May through July. Information collected will be used to access the success and failures of the revegetation plan so that improvements can e made prior to the next planting season. The following criteria will be used to evaluate the success of this plan:

1. > 50% survival of upland shrubs and trees
2. > 25% survival of grasses, rushes, and sedges
3. > 40% establishment from willow sprigs
4. < 40% bare soil

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Santa Maria Park Restoration Plan Map

Developed by: Robin Powell, NV Director of Bird Conservation Audubon
March 22, 2009

Appendix C

Site Photographs

Photo B-1. Backwater at Dayton State Park.

Photo B-2. Backwater extending from Dayton State Park onto Walker Property.

Photo B-3. Young cottonwoods on bench above railroad bridge, Fort Churchill State Historic Park.

Photo B-4. Young cottonwoods on south side of river south of Fort Churchill State Historic Park picnic area.

Photo B-5. Decadent sage under cottonwoods, Main Camp, Fort Churchill State Historic Park.

Photo B-6. Cottonwood and willow recruitment on and above bar, Main Camp, Fort Churchill State Historic Park.

Photo B-7. Beaver damage in young cottonwood stand above Overlook site.

Photo B-8. Cottonwood recruitment and healthy creeping wildrye understory, Lahontan State Recreation Area.

Appendix D

Carson River-Dayton Valley Upper Rolling A Ranch (formerly known as Walker Property)
Vegetation Enhancement and Restoration Plan

Carson River-Dayton Valley
Upper Rolling A Ranch (formerly known as Walker Property)
Vegetation Enhancement & Restoration Plan

Project Name: Upper Rolling A Ranch Habitat Enhancement and Restoration Project

Project Goals:

Goal #1: Increase habitat for native plants and wildlife
Goal #2: Protect stream banks from erosion
Goal #3: Establishment of a multi-level vegetation structure, including stream-shading vegetation
Goal #4: Increase recruitment of native trees such as Fremont cottonwood
Goal #5: Prevent the establishment of invasive plants

Revegetation Methods: ☐ Passive ■ Active ☐ Passive *and* Active

Target Date	Task
April-May 2010	Identify and assess densest perennial pepperweed patches for treatment.
May 2010	Remove dead vegetative material (or thatch) from previous year's growth within target areas
June-August 2010	Treat and re-treat targeted patches with Telar XP in upland sites and WeedAR 64 (2,4-d amine) in wet sites.
Ongoing	Site Preparation (debris removal and fencing/signage)
Oct 30, 2010	Drill seed proper seed mix for the upland areas within treated areas.
Ongoing	Monitoring of sites for supplemental plantings and/or maintenance

Background & Existing Conditions:

Background: This property was privately owned and was transferred to Lyon County ownership in 2009 through the Question 1 Bond. The property possesses excellent floodplain and drainage areas. The Upper Cardelli ditch runs along the north edge of the property and could act as a conveyance for weed species. Currently, the property has localized patches of perennial pepperweed and dispersed patches of cocklebur.

Sites #1: Cottonwood woodland zone

- High plant diversity and lower presence of invasive plant species
- Significant diversity in grasses (i.e, intermediate wheatgrass, Indian ricegrass, Great Basin wildrye, and saltgrass) and in wetland plants (i.e., horsetail and rushes)
- Minimal forb understory; needs increased shrubs and forbs
- No diversity of age-classes in the cottonwood trees
- Increased presence of invasive plant species (Russian olive, perennial pepperweed, hoary cress, and thistles)

Site Preparation:

In preparation for the treatment of perennial pepperweed patches within the property boundary, all prior year growth and skeletons will be removed through minimally-invasive mowing techniques. Once the mowing has been completed, chemical applications will be conducted on the weed patches. With regards to revegetation, intensive site preparation will not be necessary. Revegetation will be focused on areas that were treated or bare soils adjacent to treated areas.

Planting Plan:

Plant densities
The developed seed mixes will be drill seeded based on species recommendations and soil types.

Selecting plant species appropriate for Upper Rolling A Ranch is a key step in designing its revegetation plan. The plant selection process for Upper Rolling A Ranch Revegetation Plan involved the following steps:

1. Identifying existing vegetation community where noxious weed patches are treated.
2. Establishing plant selection criteria.
3. Examining characteristics of a variety of plant species.

Selection criteria
Depending of the goal of a revegetation project, plant selection criteria may differ. The main goals of the Upper Rolling A Ranch restoration project is to eliminate the noxious weed monocultures in an effort to promote an understory to the existing Fremont cottonwood grove, increase Fremont cottonwood and native shrub recruitment within the property, improve wildlife habitat, and prevent the spread of invasive plants. In order to fulfill the project goal and objectives, the following plant selection criteria was developed:

Criteria #1: Plants should preferably be native to riparian systems found within the Great Basin ecosystem and, if possible, found in the Carson River watershed.

Criteria #2: Plants should re-establish native biodiversity, and provide increased value, to the aquatic and riparian habitat.

Criteria #3: Plants must establish relatively quickly to compete with non-native, invasive vegetation and so that maintenance (irrigation) activities are limited to the first two or three growing seasons.

Criteria #4: Plants must be available from native plant sources in the area.

Plant Characteristics
In order to satisfy the plant selection criteria, the characteristics of potential plants were examined for a variety of factors such as native habitat, growing rates/invasiveness, establishment potential, bank location requirements, wildlife value, and availability. The following table summarizes the factors examined and the criteria they would satisfy:

Factor	Purpose	Selection Criteria
Native habitat	Plants should be native (when applicable)	Criteria #1
Growing rate/competitiveness	Plants must be able to establish quickly and adequately compete with non-native invasive vegetation. Therefore, moderate to rapid growth rate and high competitiveness are desired	Criteria #3
Establishment potential	Plants must be able to establish within two or three growing seasons to lessen required maintenance. Therefore, easy to establish plants are preferred	Criteria #3
Bank location requirements	Plants must cover a variety of bank locations for aesthetic, habitat, and canopy establishment purposes	Criteria #2, #3
Wildlife Value	Plants should improve the aquatic and riparian habitat value of the site. Therefore, plants with high habitat value are desired	Criteria #4
Availability	Selected plants must be available from a local source	Criteria #4

Below is a list of plants that may be used in revegetation; however additional plants might be added throughout the planning process. The recommended plants were examined to be sure that site conditions such as soils, moisture requirements and exposure requirements were suitable for the Rolling A Ranch Park site.

Common Name	Scientific Name	Source	Timing
Fremont Cottonwood	*Populus fremontii*	Sapling/Seed	Oct-Apr
Coyote Willow	*Salix exigua*	Sprigs/container	Oct-May
Great Basin Wildrye	*Leymus cinereus*	Seed	Sept-Nov
Tall Wheatgrass	*Elytrigia elongata*	Seed	Sept-Nov
Baltic Rush	*Juncus balticus*	Seed	Oct-Jan
Creeping Wildrye	*Leymus arenarius*	Seed	Sept-Nov
Intermediate Wheatgrass	*Elytrigia intermedia*	Seed	Sept-Nov
Inland Saltgrass	*Distichlis spicata*	Seed	Sept-Nov
Desert Globemallow	*Sphaeralcea ambigua*	Seed	Aug-Nov
Wood's Rose	*Rosa woodsii*	Container	Aug-Apr
Sulfur-flower Buckwheat	*Eriogonum umbellatum*	Seed	Sept-Nov
Four-wing Saltbush	*Atriplex canescens*	Seed	Sept-Nov
Black Greasewood	*Sarcobatus vermiculatus*	Seed	Sept-Nov
Indian Ricegrass	*Achnatherum hymenoides*	Seed	Sept-Jan
Scouringrush horsetail	*Equisetum spp.*	Sprigs	Oct-Apr

Passive Regeneration
Generally smaller patches (<1,000 ft^2) will be left to revegetate on their own. In addition, the seeds from mature grasses will be cultivated and spread throughout the site. These patches will be monitored for the establishment of invasive plants and eradication methods will be used to control invasive plants in and around the patches.

Grass and shrub mixes
Grass and shrub seed mixes will be planted in the fall from upland to mid-bank.

Planting Activity:

All drill seeding will be conducted by a contractor with the adequate equipment and knowledge.

Maintenance:

Invasive weeds will be controlled by mechanical and chemical control methods and plants will be planted in high densities to compensate for the lack of water. Planting in the fall or late winter/early spring will also help native plant establishment.

Monitoring and Success Criteria:

Sites will be monitored monthly during the rainy season to detect any erosion problems and to identify needed maintenance. Monitoring of native plant establishment and vigor will be in May through July. Information collected will be used to access the success and failures of the revegetation plan so that improvements can e made prior to the next planting season. The following criteria will be used to evaluate the success of this plan:

1. > 50% decrease in return growth of perennial pepperweed
2. > 50% establishment of seedlings in drill seeded areas
3. < 40% bare soil

Contact Information:

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Carson River
Gee Ditch
Carson River
Upper Dardell Ditch
US ROUTE 50
ROSE PEAK RD
CAMAS ST
FLOWERY AVE
STOPE RD

Appendix E

Carson River-Dayton Valley Rolling A Ranch Vegetation Enhancement and Restoration Plan

Carson River-Dayton Valley
Rolling A Ranch
Vegetation Enhancement & Restoration Plan

Project Name: Rolling A Ranch Park Habitat Enhancement and Restoration Project

Project Goals:

Goal #1: Increase habitat for native plants and wildlife
Goal #2: Protect stream banks from erosion
Goal #3: Establishment of a multi-level vegetation structure, including stream-shading vegetation
Goal #4: Increase recruitment of native trees such as Fremont cottonwood
Goal #5: Prevent the establishment of invasive plants

Revegetation Methods: ☐ Passive ☐ Active ■ Passive *and* Active

Target Date	Task
Ongoing	Monitoring to prioritize sites for revegetation
Ongoing	Site Preparation (debris removal, grading/drainage, erosion and pest control, fencing/signage)
Oct 15, 2011	Planting Design (drawing, plant list, spacing, mulching, plant sources, planting time)
Oct 30, 2011	Plant Acquisition-native trees, shrubs, and grasses for planting in the spring (Phase 1)
Oct 30, 2011	Collect willow cuttings and plant sprigs.
Nov 15, 2011	Seed Collection- native trees, shrubs, and grasses for planting in the fall (Phase 2)
Nov 15, 2011	Planting of collected seeds, cuttings, and saplings
Ongoing	Monitoring of sites for supplemental plantings and/or maintenance

Background & Existing Conditions:

Background: Historically, the Rolling A Ranch was an agricultural-based ranch with alfalfa hay being the primary commodity. The property was also utilized for winter-grazing for numerous cattle which has significantly impacted the overall ecological health of the riparian zone. Over the year, wild horses have also significantly impacted the area, especially during the summer and winter months when horse visitation is the highest. Currently, the property is showing the long term effects of overgrazing, excessive wood cultivation, and encroachment of invasive plant species (e.g. noxious weeds).

Site #1: Upland zone

- Presence of noxious weeds (musk thistle, perennial pepperweed) and low plant diversity
- Potential restoration site = ~86,875 ft^2

Sites #2 & 3: Cottonwood woodland zone

- High plant diversity and lower presence of invasive plant species
- Significant diversity in grasses (i.e, intermediate wheatgrass, Indian ricegrass, Great Basin wildrye, and saltgrass) and in wetland plants (i.e., horsetail and rushes)
- Minimal forb understory; needs increased shrubs and forbs
- No diversity of age-classes in the cottonwood trees
- Potential restoration site = ~117,248 ft^2

Sites #3, 4 & 5: Riparian zone

- Increased presence of invasive plant species (Russian olive, perennial pepperweed, hoary cress, and thistles)
- Coyote willow dominated sites
- Some streambank erosion due to high flows and low density of willow/forb vegetation complex
- Potential restoration site = ~ 12,000 ft^2

Site Preparation:

Intensive site preparation will not be necessary. Revegetation will be focused on areas of bare soil, stream bank, and around noxious weed patches.

Planting Plan:

Plant densities

Individual plant species should be planted in small groups. Generally, tree species are planted in groups of two to three, and shrubs should be planted in groups of three to five. Planting should alternate trees and shrubs with the ultimate goal of establishing a habitat that includes both tree and shrub layers. Dense stands of mature willows and other riparian species with spacings of 12 to 15 feet, relating to a minimum density of 120 to 300 trees per acre.

Listed below are the revegetation activities that will be used. Revegetation methods are determined by the size of patch, position on bank, the presence or absence of erosion, and the presence of invasive weeds.

Patch #	Passive (P) Active (A) Revegetation		
	Upland Shrubs and Trees	Grasses, Rushes and Sedges	Willow Planting
1	A	P,A	N/A
2	A	P,A	P,A
3	P,A	P,A	P,A
4	P,A	P,A	P,A

5	A	A	A

Plant Selection:

Selecting plant species appropriate for the Rolling A Ranch Park is a key step in designing its revegetation plan. The plant selection process for Rolling A Ranch Revegetation Plan involved the following steps:

1. Establishing plant selection criteria
2. Examining characteristics of a variety of plant species
3. Examining plants used at previous replantings on the site

Selection criteria

Depending of the goal of a revegetation project, plant selection criteria may differ. The main goals of the Rolling A Ranch Park restoration project is to provide an understory to the existing Fremont cottonwood grove, increase Fremont cottonwood recruitment within the park, improve wildlife habitat, prevent further stream bank degradation, and prevent the establishment of invasive plants. In order to fulfill the project goal and objectives, the following plant selection criteria was developed:

Criteria #1: Plants should preferably be native to riparian systems found within the Great Basin ecosystem and, if possible, found in the Carson River watershed.

Criteria #2: Plants should re-establish native biodiversity, and provide increased value, to the aquatic and riparian habitat.

Criteria #3: Plants must establish relatively quickly to compete with non-native, invasive vegetation and so that maintenance (irrigation) activities are limited to the first two or three growing seasons.

Criteria #4: Plants must be available from native plant sources in the area.

Plant Characteristics

In order to satisfy the plant selection criteria, the characteristics of potential plants were examined for a variety of factors such as native habitat, growing rates/invasiveness, establishment potential, bank location requirements, wildlife value, and availability. The following table summarizes the factors examined and the criteria they would satisfy:

Factor	**Purpose**	**Selection Criteria**
Native habitat	Plants should be native (when applicable)	Criteria #1
Growing rate/competitiveness	Plants must be able to establish quickly and adequately compete with non-native invasive vegetation. Therefore, moderate to rapid growth rate and high	Criteria #3

	competitiveness are desired	
Establishment potential	Plants must be able to establish within two or three growing seasons to lessen required maintenance. Therefore, easy to establish plants are preferred	Criteria #3
Bank location requirements	Plants must cover a variety of bank locations for aesthetic, habitat, and canopy establishment purposes	Criteria #2, #3
Wildlife Value	Plants should improve the aquatic and riparian habitat value of the site. Therefore, plants with high habitat value are desired	Criteria #4
Availability	Selected plants must be available from a local source	Criteria #4

Below is a list of plants that will be used in revegetation; however additional plants might be added throughout the planning process. The recommended plants were examined to be sure that site conditions such as soils, moisture requirements and exposure requirements were suitable for the Rolling A Ranch Park site.

Common Name	Scientific Name	Source	Timing
Fremont Cottonwood	*Populus fremontii*	Sapling/Seed	Oct-Apr
Coyote Willow	*Salix exigua*	Sprigs/container	Oct-May
Great Basin Wildrye	*Leymus cinereus*	Seed	Sept-Nov
Tall Wheatgrass	*Elytrigia elongata*	Seed	Sept-Nov
Baltic Rush	*Juncus balticus*	Seed	Oct-Jan
Creeping Wildrye	*Leymus arenarius*	Seed	Sept-Nov
Intermediate Wheatgrass	*Elytrigia intermedia*	Seed	Sept-Nov
Inland Saltgrass	*Distichlis spicata*	Seed	Sept-Nov
Desert Globemallow	*Sphaeralcea ambigua*	Seed	Aug-Nov
Wood's Rose	*Rosa woodsii*	Container	Aug-Apr
Sulfur-flower Buckwheat	*Eriogonum umbellatum*	Seed	Sept-Nov
Four-wing Saltbush	*Atriplex canescens*	Seed	Sept-Nov
Black Greasewood	*Sarcobatus vermiculatus*	Seed	Sept-Nov
Indian Ricegrass	*Achnatherum hymenoides*	Seed	Sept-Jan
Scouringrush horsetail	*Equisetum spp.*	Sprigs	Oct-Apr

Passive Regeneration

Generally smaller patches (<1,000 ft^2) will be left to revegetate on their own. In addition, the seeds from mature grasses will be cultivated and spread throughout the site. These patches will be monitored for the establishment of invasive plants and eradication methods will be used to control invasive plants in and around the patches.

Upland Shrubs and Trees

Shrubs and trees will be planted from seed, plugs, cuttings, or saplings from a source as close as possible to the site being revegetated. The shrubs and trees will be planted in the fall. If irrigation is possible, then spring planting may occur, based on availability of the plants. The seeds will be spaced two feet apart and covered with 1-3 inches of soil. Shrubs and trees will be planted on the upland terrace and upper bank on the north side of the Carson River. Cottonwoods may be planted from the toe to mid-bank.

Grasses, Rushes, and Sedges

Grasses will be planted in the fall from upland to mid-bank. Sedges and/or rushes will be planted in fall from toe to mid-bank.

Willow Sprig Planting

Willow sprigs will be planted in fall from the toe to midbank with two-foot spacing between sprigs. The sprigs should be 2 to 4 feet long and 1 to 3 inches in diameter. Harvesting of sprigs should occur no sooner than three days before planting. If not collected on the same day as planting sprigs will be stored in a holding pond.

Planting Activity:

Replanting events

For the Rolling A Ranch, plant installation will be conducted through community volunteer activities. In the days prior to the plant installation, Lyon County Parks will dig holes for the plants. Plant installation will be lead by Audubon staff. Plant installation is scheduled for the morning (between 10:00 am and 1:00 pm) of each planting day. School children (one high school class and one grade school class) will participate in planting activities. Local residents and community groups will also assist with planting. During the afternoon of the replanting, newly planted materials will be irrigated.

In addition to the plants, the following materials will be made available on planting days:

- Hand trowels and shovels
- Gloves
- Mulch
- Soil
- Pin flags
- Plant protection (e.g. staking or beaver/vole damage abatement)
- Mallets, ties, clips
- Trash bags

Container plant installation

Planting holes should generally be one to two feet wide and two feet deep. Plants should be installed so that their root crowns are at or slightly above the soil surface.

Plant Protection

Beaver, vole, livestock, and human impacts will be prevented or mitigated through exclusion methods (e.g. wire cages, fencing, etc.).

Maintenance:

Invasive weeds will be controlled by mechanical and chemical control methods and plants will be planted in high densities to compensate for the lack of water. Planting in the fall or late winter/early spring will also help native plant establishment.

Monitoring and Success Criteria:

Sites will be monitored monthly during the rainy season to detect any erosion problems and to identify needed maintenance. Monitoring of native plant establishment and vigor will be in May through July. Information collected will be used to access the success and failures of the revegetation plan so that improvements can e made prior to the next planting season. The following criteria will be used to evaluate the success of this plan:

1. > 50% survival of upland shrubs and trees
2. > 25% survival of grasses, rushes, and sedges
3. > 40% establishment from willow sprigs
4. < 40% bare soil

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Appendix F

Weed Management Matrix

Middle Carson River Noxious Weed Treatment Matrix

Common Name	Biological Name	Description	Current Distribution	Classification	Reproduction	# Seeds/Plant	Treatment Types				Additional Information
							Mechanical	Cultural	Biological	Chemical	
***Spotted Knapweed**	***Centaurea maculosa***	Growing up to 3-4 feet in height, the basal leaves are deeply lobed and arranged in a rosette. The slender, hairy stems grow in an erect and branched arrangement. Single thistle-like, pinkish-purple flower heads reach 3/4 inches in diameter and occur at the tips of terminal or axillary stems from late June through August.	Found in dry prairie sites, oak and pine barrens, and on lake dunes and sandy ridges. It seems to be especially problematic in the central sands, northern Wisconsin, and near the Great Lakes.	Biennial, but acts as Perennial in Nevada	Seed, Roots	1,000	Small populations can be removed by digging or pulling. This is best done when the soil is moist. The entire root should be removed. Mowing has not been successful--plants merely reflower at a lower height.	Eliminate small satellite populations immediately. Use herbicide followed by seeding with a mixture of competitive grasses.	A few agents exist including the weevil *Larinus minutus* , the fruit fly *Urophora affinis* , and the seedhead gall fly *Urophora quadrifasciata* . Also, the larvae of the knapweed peacock weevil and the broad-nosed seedhead weevil may consume up to 95% of seeds being produced by the knapweed.	There are many effective herbicides including 2, 4-D Amine and glyphosate (Roundup®). Use with caution near water. 2,4-D LV Ester or Amine applied during early growth to "broccili head" stage gives fair control. Apply chlorsulfuron (Telar®) or metsulfuron (Accurate®). Once competitive grasses have been established and if repeated treatment is necessary, apply either 2,4-D Amine, cholorsulfuron, metsulfuron.	
***Musk Thisltle**	***Cardus nutans***	Up to seven feet tall with freely branched stems and purplish nodding flowers. Leaves are dark green with large midrib veins and spines. Similar to Scotch thistle, but musk thistle has dropping flower heads. Look for a single large flower head at the end of a stem.	Found in rangelands, pastures, non-crop lands and irrigated areas throughout the U.S. and Canada.	Biennial	Seed	20,000	Control rosettes in the first season. Dig out at least 2 inches of root. Cut or chopped plants may still flower or set seed. Mowing does not kill the plant, but does help limit seed production.	Encourage perennial vegetation, and control while in rosette stage.	Several agents exist including thistle crown fly, thistle head weevil, thistle crown weevil, and rust, but they have not been effective in Nevada.	Apply 2,4-D Amine at 1.5 to 2.0 lb/A during rosette stage of growth. 2,4-D Amine can be used in the fall if the soil moisture is sufficient and air temperatures exceed 50 degree F. Apply chlorsulfuron 0.75 oz ai/A (Telar®) in the spring from rosette to pre-bloom stage of growth. Follow label directions and precautions. Clopyralid at 0.09 to 0.375 lb ai/A (check lable for rate based on acerage)(Stinger®, Transline®, Curtail® (includes 2,4-D), is also effective; glyphosate may provide control. If repeated treatment is necessary, use any herbicide recommended here, except glyphosate, as it will kill desirable grasses.	It is easiest to control this weed when in rosette stage.
***Perennial Pepperweed, tall whitetop**	***Lepidium latifolium***	Two to six feet tall with lanceolate, bright green to grayish leaves with entire to toothed margins. Basil leaves are larger than the upper leaves, which occur on flower stalks. Individual white flowers are small and clustered at the ends of the branched flower stalks.	Has naturalized to many areas of the U.S. Commonly inhibits water ways, ditch banks and wet meadows. Adapted to saline soils.	Perennial	Rhizomes and seeds	10,000/stem	Mowing prevents seed production and depletes food production in plant, but does not kill it. Avoid Cultivation! Tilling encourages resprouting from rhizomes.	Eliminate small satellite populations immediately. Use herbicide followed by seeding with a competative crop or rhizomatious grass.	No insect or diseases have been found so far, but many agents are being examined. There are concerns on biocontrol on mustard due to potential for crop damage grazing may be useful to decrease stem densities and biomass, especially prior to herbicide application. Grazing will not kill the plant.	Many being tried. 2,4-D amine formulations such as Weedar 64® on wet sites, and ester formulations on dry sites at 4lb/A (repeat applications essential). Metsulfron at 0.6 to 1.2 oz ai/A (Escort ®) is used for control in pasture, rangeland, and non-crop areas, since it does not injure grasses. Chlorsulfron at 0.75 to 1.125 oz ai/A(Telar ®) is used on non-crop sites only, but is not as safe on grasses. Imazapyr (Arsenal®, Renovate®) (water labeled)) gives bare-ground control. Read label for grazing restrictions.Once competitive grasses have been established and if repeated treatment is necessary, apply metsulfuron.	
Bull thistle	***Cirsium vulgare***	Grows 2 to 5 feet tall with numerous spreading branches. Stems of the plant are sparsely hairy, irregularly and spiny winged, green or brownish in color with purple veins. Flower heads are usually solitary on the end of each stem, gumdrop-shaped, one to two inches tall with long, stiff, yellow tipped spines. Flowers are generally bright purple but sometimes white in color.	The plant thrives in moist soils and is less common on sand and pure clay soils. Typical habitats include disturbed or degraded land, such as roadsides, fence rows, overgrazed pastures and rangelands, eroded gullies, ditch banks and vacant lots.	Biennial	Seed	5,000 - 50,000	Severing the root below the soil surface will kill bull thistles. Repeated hand pulling, hoeing, tillage, and mowing can be utilized. This should be done before the reproductive growth stage to prevent seed production and distribution.	Plant competitive grasses, especially tall grasses as bull thistle seedlings cannot tolerate shade.	The seedead fly, *Urophora stylata* , has reportedly provided good control in Oregon by reducing seed production by up to 65%.	Dicamba, triclopyr, aminopyralid or 2,4-D work best when applied in the spring before stem elongationand again in the fall to control rosettes. Metsulfuron can be applied anytime plants are actively growing and clopyralid can be applied up to the bud stage. Once competitive grasses are established, if treatment is still neceassry apply metsulfuron.	
***Hoary Cress**	***Cardaria draba***	Grows 1 to 2 feet tall. Leaves are 1 to 1-1/2 inches long, blue-green, waxy, and lanceolate. Lower leaves are stalked, while upper leaves are stalkless and have two lobes that clasp the stem. Flowers are produced in clusters with four white petals that give the plant a white flat top.	Grows on abandoned fields, roadways, ditchbanks, and disturbed sites with alkaline soils. Prefers 12 to 16 inches annual precipitation.	Spring-flowering perennial.	Rhizomes and seeds	4,800	Prevent seed production. Cultivate every 21 days beginning in the spring until no additional shoots or seedlings appear. Try repeat disking.	Plant competative vegetation.	At this time, there are no known successful biological control agents in the United States for hoary cress.	There are many effective herbicides including 2, 4-D amine and glyphosate (Roundup®). Use with caution near water. 2,4-D LV ester or amine applied during early growth to "broccili head" stage gives fair control. Apply chlorsulfrom (Telar®) or metsulfron (Escort®) prebloom to bloom stage, or onto rosettes in the fall. Use of surfactant will increase the effectiveness. Good results have been achieved with application of glyphosate followed by grass seeding into the treated area. Once competitive grasses are established, use metsulfuron if repeated treatment is necessary.	There are three types of *Cardaria* (heart, globe, and lens poded). The seed life in the soil is 3 to 6 years. This plant is often confused with perennial pepperweed (*Lepidium latifolium).*

Source: Weed Warriors, Sue Donaldson, University of Nevada Cooperative Extension
*Priority Species
ai = active ingredient
lb = Pounds
oz = ounces
A = Acres

Middle Carson River Noxious Weed Treatment Matrix

Common Name	Biological Name	Description	Current Distribution	Classification	Reproduction	# Seeds/Plant	Treatment Types				Additional Information
							Mechanical	Cultural	Biological	Chemical	
***Canada Thistle**	***Circium arvense***	Deeply lobed leaves are spiny, with small bristly clusters of purple to whitish flowers produced mid-June through September.	Deep, loose, cool soils. Found throughout U.S. except Alaska. Also through S. Canada.	Creeping perennial emerging mid to late spring.	Vegetative buds on the root system, creeping roots, and seeds.	680 to 1500 /stem; surviving 21 years in the soil.	Continually stress the plant by mowing several times/ year over many growing seasons. Mow every 3 to 4 weeks from June through September. Disking and plowing spread this weed**.**	Rotate crops, for example, to annual cereals planted early, with tillage in the fall.	Stem weevil, Canada thistle bud weevil, stem gall fly.	Clopyralid (Stinger®; Transline®; Curtail® (includes 2,4-D) works well at any time of the year. Aminopyralid (Milestone®), picloram (Tordon®, restricted use), imazapic (Plateau); clopyralid +triclopyr (Redeem®); clopyralid + 2,4-D (Curtail®), imazapry (Arsenal®) and glyphosate (Roundup®)may also be used. Once competitive grasses are established, apply aminopyralid if repeated treatment is neceassry.	
Russian Olive	***Elaeagnus angustifolia***	Russian olive is a fast-growing tree of moderate size that can reach heights from 10 to 25 feet. The trunks and branches of the tree are armed with 1 to 2 inch woody thorns. Leaves are simple, alternate, lanceolate to oblong, entire, and 1 1/2 to 3 inches in length. The upper surfaces of the leaves are light green and covered with silvery star-shaped hairs.	Central and western United States	Woody shrub to small tree. Perennial.	Primarily by seed production, but may establish from underground rootstalks as well.	Seed/fruit production is proportional to the size of the tree, ranging from several hundred to several thousand per tree.	Saplings can be controlled through repeated cutting, and large trees can be cut but will resrpout from the stump. Herbicide must be applied to the cut stump to be effective. Other Methods: 1. Frill cut (or hack and squirt) method: hack diagonal slashes into the main trunk and squirt hacks with herbicide (good for older, large trees) 2. Basal bark treatment: spray herbicide on basal bark on the trunk (great for young trees but not for woody, older trees). 3. foliar spray: spray the leaves, stems, and branches of young trees (not super effective unless on 1-2 year old plants)	Establish native vegetation such as willows and cottonwoods to displace Russian olive.	Research is still being performed to determine the effectiveness of several biological control agents in controlling Russian olive.	Immediate herbicide application to cut stumps is the most common method. Triclorpyr (Garlon®, Renovate®) is used for cut stumps at basal growth. Use glyphosate (Roundup®) undiluted as a cut stump treatment, as it is not take up by the leaves. Apply imazapyr (Arsenal®) late in the season at a 1 to 2 % solution. A 1:1 mixture of imazapyr and glyphosate can be used for similar effectiveness at a lower cost.	
Cocklebur	***Xanthium strumarium***	Cocklebur seedlings have long, narrow, fleshy cotyledons (first leaves) which taper to a point at the tip. Stems are hairy, rough, frequently spotted with red, and reach 2-4 feet in height. Leaves are triangular shaped, hairy, and rough to the touch. Flowres are green and mature into burs that are hard and covered with hooked spines.	North America	~~Perennial~~ Annual	Seed	Seed production is proportional to plant size, ranging from several hundred to several thousand seeds per plant.	Do not attempt to cultivate, as tilling will increase the liklehood of seed germination. Mowing is often ineffective because cocklebur is low growing and flower buds can regrow lower on the stem after it has been cut.	Establish a mixture of competitive grasses.	None known at this time.	Effectively controlled with post-emergent, broad-spectrum herbicides like imazethapyr (Pursuit®) or glyphosate (Roundup®), and broadleaf herbicides like bentazon (Basagran Forte®). Also, pre-emergent herbicides like imazethapyr plus metribuzin (Conquest®), flumetsulam (Broadstrike®), or metribuzin (Sencor®/Lexone®) work as well. Once competitive grasses are established, apply bentazon if repeated treatment is neceassry.	Attempting to cultivate often results in seed germination by increasing the level of contact between the bur and the soil. Tilling should not be utilized as a control method. Cocklebur is toxic to cattle, horses, and sheep. Toxicity in goats is not well documented.
Russian thistle	***Tribulus terrestris***	Prostrate plant with a simple taperoot, and pinnately compound leaves. Small yellow flowers produce spiked seeds or bus.	Throughout the U.S. except the northern tier from Montana to Maine.	Warm season annual	Seed	up to 250,000	Use cultivation when small. If plants have produced seed, harvest seed into bags or hole-free containers and burn or send to local land fill. Establish a management plan for the following year.	Mulch area 4 inches deep	Poncturvine seed and stem weevile. Only successful in areas with mild winters.	Herbicides are used before seed production and subsequently for 2 to 3 years to eliminate the seed source. Apply 2, 4-D amine or LV ester every three weeks during germination or when new seedlings appear, and repeat if neceassry. Glyphosate and preemergents may be helpful.	Probably came over from the Mediterranean on contaminated wool, spreading to the midwest. First reported in California in 1903. Seeds will remain dormant in the soil for 4-5 years, making eradication difficult.

Source: Weed Warriors, Sue Donaldson, University of Nevada Cooperative Extension
*Priority Species
ai = active ingredient
lb = Pounds
oz = ounces
A = Acres

Middle Carson River Noxious Weed Treatment Matrix

Common Name	Biological Name	Description	Current Distribution	Classification	Reproduction	# Seeds/Plant	Treatment Types				Additional Information
							Mechanical	Cultural	Biological	Chemical	
***Tamarsk, salt cedar**	***Tamarix ramosissima***	Five to 20-foot-tall tree or shrub with reddish-brown bark, turning fissured gray with age. Pale, bluish-green leaves are small and scale-like, with smooth entire margins. Flowers are small, pink to white, five leaved, delicate and showy. Has a deep primary root. Deep adventitious roots are produced at nodes from buried stems.	Naturalized throughout the southwestern desert.	Woody shrub to small tree. Flowers from early spring to late summer.	Seed. Roots spread if disturbed or fragmented.	500,000/plant/year	~~Burning followed by herbicide; bulldozing; pulling of roots. Will resprout after cutting or burning. Grazing by sheep or goats can be used to remove understory prior to herbicide application.~~ Can be burned with herbicide treatment on the regrowth only. Once the plant has been burned, applying herbicide directly to the burned wood is pointless. Important to have the resprouts treated.	Extended flooding and hand removal of small seedlings.	A leaf-eating beetle, *Diorrhabda elongata*, was released in NV in 2001, and sufficiently defoliated trees in the Lovelock area. There are concerns with the use of biological agents due to potential impacts on the habitat of the endangered southwestern willow fly catcher.	Immediate herbicide application to cut stumps is the most common method. Triclorpyr (Garlon®, Renovate®) is used for cut stumps at basal growth. Use glyphosate (Roundup®) undiluted as a cut stump treatment, as it is not take up by the leaves. Apply imazapyr (Arsenal®) late in the season at a 1 to 2 % solution. A 1:1 mixture of imazapyr and glyphosate can be used for similar effectiveness at a lower cost.	Originally introduced to the U.S. as a streambank stabilizer. Well adapted to heat, cold, alkaline and salty soils, wind and flooding. Can grow several feet per season. It is no longer legally sold in NV. Can use 200-300 gallons of water per mature plant per day.

Source: Weed Warriors, Sue Donaldson, University of Nevada Cooperative Extension
*****Priority Species
ai = active ingredient
lb = Pounds
oz = ounces
A = Acres

Appendix G

Project Descriptions

Vegetation Enhancement Project
Rolling A Park Site 1
Community: AG and OR2

Site Analysis

This site was a part of a former ranch operation that included alfalfa production and winter cattle grazing. The site is now designated Lyon County Open Space and is being developed as the Rolling A Park (Figure 11). The abandoned fields had become severely infested with noxious and invasive weeds. An estimated 180 acres of this 276 acre site consisted of a monoculture of perennial pepperweed (Lepidium latifolium), often called tall whitetop. For several years the Dayton Valley Conservation District (DVCD) has been treating the site to control this weed, along with other invasives such as Russian thistle (*Salsola tragus*; *S. kali*). Control efforts for perennial pepperweed involve a combination of burning to remove decadent plants, chemical treatments, and mechanical methods such as mowing and hand pulling. DVCD also implemented an aggressive seeding program with competitive grasses to suppress the re-establishment of the weeds. These efforts have significantly reduced the presence of perennial pepperweed from the original approximately 180 acres to under 0.5 acre. Russian thistle remains a problem, and the DVCD is continuing to implement control measures for this species. Control of Russian thistle involves burning, spraying and replanting with a competitive grass seed mix. Budget constraints currently limit the size of the area that can be seeded. Providing water to establish and support the seeding also remains a problem.

Old growth cottonwoods are located at the western end of the Rolling A Ranch site and in a narrow stringer of mature cottonwoods that fringe the river. The Koch Ditch diversion is located near the middle of the site. Mature cottonwoods with a mature/decadent big sagebrush understory occur between the river and the Koch Ditch, on north side of river. The Rolling A Master Plan (Master Plan) has been developed for the park (Figure RA-1). This plan includes a river trail for pedestrian and equestrian use, benches, picnic facilities, and river access for swimmers. A Frisbee golf course established in the cottonwood stand at the western end of the site has become quite popular. Also at the western end of the site, the banks of the Cardelli Ditch have been stabilized at the ditch's confluence with the Carson River and planted with willow shrubs. Numerous bio-engineering streambank stabilization projects have been implemented on the site to include bendway weirs constructed along a short stretch of the river with additional tree and shrub plantings.

The NRCS Soil Survey of Lyon County, Nevada, indicates the site includes a number of mapped soil types (Map Units 251, Dia loam; 261, Dithod loam; 263, Dithod clay loam, wet; 264, Dithod loam, saline-alkali; 291, Fallon sand; 293, Fallon fine sandy loam, frequently flooded; 294, Fallon, fine sandy loam, saline-alkali; and 591, Rose Creek loam). According to the NRCS, the potential plant community (the community that would be present in the absence of disturbance, including weeds) in the majority of the area is creeping wildrye, Basin wildrye, Basin big sagebrush, rubber rabbitbrush and western wheatgrass. Wetter sites in the area (Map Units 263, Dithod clay loam, wet and 591, Rose Creek loam) support a potential plant community that includes rushes, sedges, tufted hairgrass and Nevada bluegrass. These soil units are located in the central and western

parts of the area. Mapped saline-alkali soils are limited in the area, occurring in the central and western portions of site. According to the NRCS, the potential vegetation community of these soils is alkali sacaton, inland saltgrass, creeping wildrye and black greasewood.

Problem Conditions

Weed encroachment, perennial pepperweed and Russian thistle
No/little understory layers of native trees and shrubs - limited diversity or physical structure
Mature cottonwoods along the river are limited to a narrow strip
Unstable river banks
Extremely variable hydrology conditions
Water supply to support competitive seeding efforts

Opportunities

1. An old oxbow in center of the park would be suitable site for riparian plantings. The Master Plan drawing shows the oxbow area as an area of existing grasses with a seating area below existing cottonwoods.
2. The oxbow area may receive some urban runoff from the housing development to the north, but the area potentially benefitting from this additional runoff is limited. The Master Plan drawing shows two "drainage" features entering the area from the housing development. Drainage may introduce pollutants, but may also provide moist soil conditions suitable for establishing and maintaining grasses or riparian vegetation.
3. Site easily accessed. Public access is good and a trail is system planned.
4. Treated wastewater may become available to support seeding and replanting efforts, though constraints on the use of treated waste water exist.

Challenges

1. Perennial pepperweed and Russian thistle infestation.
2. Some areas of saline-alkali soils.
3. River trail is planned. Plantings need to accommodate the trail alignment and be consistent with and complimentary to the long terms goals of the park.

Habitat Goal- Increase riparian density and diversity adjacent to river. (An open understory should be maintained in the cottonwood grove at west end of site containing the Frisbee golf course.) Create central grove of riparian woodland in the old oxbow in center of site.

Overall approach

1. Continue weed control to eradicate perennial pepperweed, Russian thistle, including planting competitive weed suppression mix.
2. Continue to establish cottonwood pole plantings adjacent to river to increase riparian width.
3. The old oxbow in the central part of the site provides a suitable planting site for willow and cottonwood pole plantings. May supplement with or substitute buffaloberry and rose. Soil testing for saline-alkali conditions would determine suitability of site for plantings. Cottonwood and willow poles should be planted if depth to the summer water table can be reached.
4. Increase focus on Cardelli Ditch. Conduct weed control and implement revegetation program along the ditch. Investigate potential for establishment of small sediment basin on the ditch approximately 50 feet from confluence with the river. In addition to improving

river water quality by providing an area for sediment deposition and pollutant filtering, this feature could be used by members of community for recreation.

5. As funding becomes available, consider the installation of education signage explaining the methods used to establish and maintain plantings in the park, and their value to wildlife and river restoration goals.

Enhancement Steps

Pre-project Planning

1. Study summer groundwater level through as many summers as possible, with a minimum of three years recommended. Utilize existing groundwater monitoring wells, install new monitoring wells or use hand augered holes (which must be backfilled every time).
2. Conduct annual site assessment tours to estimate and map weed cover.
3. Establish photopoints or enhance existing photopoints. This will be the baseline to track treatment success. If photopoints are used, permanent photopoint locations and specific photo methodology should be used (record photopoint location with gps receiver or permanently mark these sites; take photos in specific directions, using previous years' photographs as a guide to ensure accurate repetition; take photos that include a marked frame of a specific size [one square meter or similar] from directly overhead; zoom close enough to distinguish plant species). USDA publications "Ground-Based Photographic Monitoring" general technical report #PNW-GTR-503 and USDA publication "Photopoint Monitoring Handbook," technical report #PNW-GTR-526, are good references for photo-monitoring and include forms for photopoint documentation.
4. Soil testing. Alkalinity and salts may limit site suitability for some species.
5. Identify sources for cottonwood and willow poles, and containerized plant material. Planting may be several years away, which would give nurseries sufficient lead-time to grow containerized stock. Stormwater retention basins at Santa Maria Ranch and a backwater channel at Dayton State Park are potential sites for harvesting cottonwood poles.
6. Plan for supplemental irrigation of containerized plant material, if used, for the first two years to establish plants.

   Potential Irrigation Options:

   a. Water truck and/or water storage drums
   b. Pumping water from the river or Koch Ditch (This would require a temporary transfer of water rights from either Lyon County or the CWSD).
   c. Using Dri-water® water from time-release gel packs would minimize need for supplemental irrigation. Gel packs become depleted and should be replaced every 30-90 days. This option can be costly and should be used in smaller, specific areas.
   d. Treated wastewater may be available to irrigation on the site and can be coordinated with the Lyon County Public Utilities Department.
   e. Combination of above

   Supplemental irrigation of cottonwood and willow pole plantings should not be necessary if poles are planted at sufficient depth to intercept the summer water table.
7. Visualize riparian plantings at maturity, and consider whether they are consistent and complimentary with planned and future park amenities.

Years 1 and 2 – Continue Weed Control

Objective- Reduce weed cover to less than 5 percent noxious species and less than 10 percent invasive weeds before planting

1. Continue weed control efforts. Spray and/or mow to weaken and prevent seed set of perennial pepperweed. Burn, spray and mow/hand pull to control Russian thistle. Monitor perennial pepperweed through the growing season to determine if repeat treatment is necessary due to regrowth.
2. Continue to seed with competitive grass mixture to suppress germination of invasive weed seeds.

Year 2 to 3 - Planting

1. After plantings, inventory and map plantings in order to track survival and performance over time.
2. Establish permanent photopoints in all planting areas for year to year comparison. Permanent photopoints used for weed monitoring may be used if appropriate.

Along River

Planting Area	5.2 acres, along 4,500 feet river below the western OR-community type stand and above the central grove planting site
Planting Density	Two rows of cottonwoods planted at 30-foot centers 30 and 60 feet back from river; two rows of sandbar and red willow poles planted at 10 foot intervals on river bank and 15 feet north of bank
Planting Ratio	8 sandbar: 1 red willow
Planting Pattern	Minimum of 2 rows of cottonwoods and willows

Old Oxbow

Planting Area	Up to 14 acres
Planting Density	50-100 trees and shrubs/acre. May be reduced consistent with the Master Plan. Planting density (and ratio) is based on a visualization of mature plantings, desired habitat conditions (diversity and physical structure), and expected survival. Density used at Lyon County's Santa Maria Ranch Park is 120-300 trees and shrubs/acre (15-20 foot centers). The success rate was high during the first year, using a water truck to irrigate container plantings.
Planting Ratio	8 cottonwood: 3 buffaloberry: 3 Woods rose: 1 golden currant (Woods rose and golden currant may not be suitable due to saline-alkali conditions)
Planting Pattern	Alternate trees with clusters of shrubs
Planting Tips	Irrigate buffaloberry, Woods rose, and golden current planting holes one day before installation to maximize survival. Use weed mats or mulching around planting sites if weeds are a problem

Monitoring Tasks

Prior to Planting

- Develop a monitoring checklist, which would include items to be monitored, including presence and approximate percent of weed cover, identification and location of problem conditions, photopoint monitoring guidelines, condition planted or desirable colonizing species..
- Weekly groundwater monitoring in summer and late summer. Every week between July 1-October 1.
- Frequent (twice-monthly if possible) monitoring of weed growth stage through the growing season to time the next treatment.
- Annual site tour to estimate and map weed cover and/or photomonitoring at permanent photopoints for year to year comparison.

After Planting

- Frequent and routine monitoring of plantings through the growing season to determine the next irrigation event.
- Frequent and routine monitoring for weeds during the growing season.
- Eradicate small infestations (1 – 10 plants) of invasive weeds as soon as possible by mechanical or chemical methods to prevent expanded infestations.
- Annual count of survival and overall condition of plantings at site.
- Annual photo documentation at established photopoints.

Vegetation Enhancement Project
Buckland Station Field Site 2
Immediately north of Buckland Station
Community: Dev (old Ag)
8 acres

Site Analysis

This site is a former agricultural field now reverted to a vegetation community consisting of big sagebrush, rubber rabbitbrush, five-horn smother-weed and weedy species (Figure 12). The site is fenced on the north, south and east and has not been recently grazed. The site is somewhat unique in that sources of water are available for irrigation or establishment of a cottonwood nursery. Tailwater from fields to the west enters ditches on the south side of the parcel and an irrigation well is available north of the site. The site's proximity to Buckland Station, an area of historic interest, make the site well suited for development as an interpretive site.

The NRCS Soil Survey of Lyon County, Nevada, indicates soils on the site are Soil Unit 262, Dithod loam, clay substratum. According to the NRCS, the potential plant community (the community that would be present in the absence of disturbance, including weeds) is creeping wildrye, Basin wildrye, Basin big sagebrush, rubber rabbitbrush and western wheatgrass.

Problem Conditions

Weed encroachment, perennial pepperweed and spotted knapweed
Mosquito infestation
Potential for wildlife-vehicle collisions due to the proximity to Highway 95

Challenges

1. Mosquito infestation. Creation of additional breeding habitat is undesirable.
2. Depth to summer water table may be excessive.
3. Slope of the field is irregular (Figure 12). To take advantage of the tailwater ditch on the south side of the field as a source of irrigation water, the field would need to be resloped to drain toward the north prior to planting.
4. Attracting deer to the site represents a potential wildlife hazard on the adjacent section of Highway 95

Opportunities

1. Site has a source of water (9.9 acre/ft) for irrigation from a well plus tailwater from fields to west.
2. The site is in a good location for the development of an interpretive site, and was historically farmed. The site is immediately adjacent to an already developed and popular attraction (Buckland Station), and has easy access with parking.
3. The site is already fenced on three sides.

4. Labor and funding for the project may also be available as a part of the in-lieu grazing agreement between the park and the ranchers who graze cattle on park lands.

Project Goal-

The goal of this project differs from the habitat enhancement goals of other Carson River projects. The goal at this site is to create an interpretive site demonstrating a working farm and agricultural practices. Tailwater from fields to the west and the existing water right would allow irrigation of the field north of Buckland Station. Irrigation could be used to support pasture or crop production, and the development of a cottonwood nursery. A short trail system could be established with interpretive signage. Old farm equipment could be placed along this trail or housed nearby. Plantings adjacent to Highway 95 could include a crop such as grapes, as grape arbors may create a barrier that would inhibit wildlife movement (particularly deer movement) out of the field and into the area of the highway.

As another element, and to attract a wider "audience," native species that are attractive to wildlife could be planted on the site, particularly along the site's eastern boundary (the most distant part of the area from Highway 95). The interpretive trail would pass by this area and signage explaining the value of the native habitat to wildlife could be placed adjacent to the native plantings. A border of buffaloberry and other riparian species planted on the east side of the parcel, adjacent to the stand of mature cottonwoods on the USFWS parcels, would be expected to attract a variety of wildlife. Piped flow from an irrigation well north of the parcel could be used to support the riparian planting and to establish a cottonwood nursery.

Enhancement Steps

1. Eradicate perennial pepperweed and spotted knapweed on the parcel through appropriate weed control, with continuing monitoring and control as necessary.
2. Identify a crop or crops that would provide examples of farming practices in a relatively small area, and through which an interpretive loop trail could be constructed. The crop(s) could be selected to demonstrate old farming practices, or new, innovative practices. The crop(s) selected can require irrigation, since a water right for irrigation is available. Irrigation should, however, be conducted so as to minimize ponding, as ponding may exacerbate the mosquito problem in the area. Irrigation controls (check dams) should be small to minimize ponding. Possible crops include teff, triticale or grapes. Row crops have also been suggested to demonstrate the workings of a historic farm. Inmate labor is available to tend such a crop, and a dedicated staff position at Buckland Station has recently been funded. A cooperative agreement with a group such as the Food Bank could also be pursued. Such an agreement would entail logistic coordination, but would have public relations value for State Parks.
3. Determine the need to reslope the field prior to planting. Resloping would require clearing the field, an activity that should be conducted in the fall, followed immediately by heavy seeding to minimize colonization by weedy species (see Enhancement Step 6).
4. Identify irrigation methods. Modern methods such drip irrigation would be less likely to exacerbate the mosquito problem, but would not reflect historic farming methods. Flood irrigation of row crops could be used as long as ponding can be minimized.
5. Plan a short loop trail system through the area with interpretive signage, including a descriptive kiosk at the trailhead. The kiosk and signage for the trailhead and trail would

describe the agricultural practices demonstrated; equipment displayed, and could discuss the value of the native habitat and habitat diversity if a native shrub border planting option is selected. The kiosk and signage might also include a discussion and photos of noxious and invasive weeds. Consider planting buffaloberry and other riparian shrubs along the eastern boundary of the site to increase vegetative structural diversity and attract a greater variety of wildlife. Such an addition may broaden the public interest by appealing to wildlife enthusiasts as well as history buffs or members of the public interested in agriculture. The water right held by the park would allow for the inclusion of an irrigation system for shrub (buffaloberry, Woods rose, and/or currant) plantings.

6. The park's water right could also be used to establish and support a cottonwood nursery along the parcel's northern edge. To most efficiently utilize this water, a pipeline would be installed from the well to the site.
7. In order to minimize the establishment of weeds on cleared ground, clear existing sagebrush and rabbitbrush in the fall, and heavily seed with the selected crop(s) if a grain or pasture (hay) crop is selected. If a non-grain/pasture crop is selected, establish the crop in a manner that minimizes the amount of bare ground available for colonization by weed species.

Planting Areas, Working Farm Site:

1. The Project area is 8 acres in total. The crop planting area would include the majority of the parcel, with the exception of a strip along the eastern margin that would be used for buffaloberry and other shrub planting, and a strip along the northern edge of the parcel that may be used as a cottonwood nursery. Maintain a clear strip adjacent to Highway 95 to allow motorists to see wildlife that may move onto the highway.
2. Planting Density – The crop area, if planted with a pasture grass or a grain crop, should be planted at sufficient density to exclude weeds.
3. Consider installing grape arbors along the western edge of the field. Arbors should be of substantial construction to inhibit deer movement out of the field and into the Highway 95 right-of-way. Maintain a cleared strip between the planting area and the highway, as described above.

1. Planting area, Wildland Planting Area: The wildland planting site would be located along the field's eastern margin. Identify species to be planted. Buffaloberry is suggested, Woods rose and current may be included depending on soil conditions (if not too alkaline).
2. Planting density (and ratio) of shrubs would be based on a visualization of mature plantings, desired habitat conditions (diversity and physical structure), and expected survival. Density used at Lyon County's Santa Maria Ranch Park is 120-300 trees and shrubs/acre (15-20 foot centers). The success rate was high during the first year, using a water truck to irrigate container plantings.
3. Planting Ratio, if buffaloberry planting is supplemented with rose and currant: 3 buffaloberry: 3 Woods rose: 1 golden currant.
4. Planting Pattern - Minimum of 2 rows of buffaloberry, supplemented with rose and currant in the above ratio.

5. Planting Tips - Irrigate buffaloberry, woods rose, and golden current planting holes one day before installation to maximize survival. Installation of a drip system or flood irrigation via a constructed swale through the planting area may increase survival. If using flood irrigation, manage irrigation to minimize ponding.
6. If a cottonwood nursery is established along the parcel's northern edge, follow the recommendations in Hoag 2007: *How to Plant Willows and Cottonwoods for Riparian Restoration*, NRCS Technical Note TN Plant Materials No. 32, January 2007 revision (see the West of Overlook Planting Tips section), modified to include the availability of irrigation to support the plantings. This document emphasizes need to establish good soil to stem contact with the below-ground portion of the pole. Steps should be taken to ensure no air pockets are in contact with the planted section of the cutting. Filling the hole with native soil is recommended to encourage good soil to stem contact. "Mudding" the cuttings ensures soil to stem contact while minimizing air pockets. Native soil and water are mixed to a "consistence of cheap syrup" (Hoag 2007). This mixture is poured into the hole around the cutting until the mixture reaches the surface. Water will leach into the surrounding soil, while the soil in the mixture will settle around the cutting. Repeat this process until the hole in entirely filled with soil. If a ditch is constructed on the north site of the parcel to support this nursery, plant poles in close proximity to either side of the ditch. Otherwise provide irrigation to poles with a high capacity drip system. The objective is to provide sufficient water to ensure the growing cottonwood roots maintain contact with water through the driest times of the year.

Monitoring Tasks

- Managing and maintaining the demonstration farm area would involve weed control typical of a farming operation. This may include chemical or physical weed management.
- Annual monitoring of the site would identify weed issues and may be used to provide measures of production.
- Establish permanent photopoints for year to year comparison of production and activities on the site. Photographs may be used in kiosks that describe practices on the site.

Alternative 1

Additional riparian habitat could be established in the proposed shrub planting area at the eastern end of the field. Under this alternative, willow and cottonwood poles could be planted along the parcel borders, particularly the east border. The poles would be deep-planted and supported by supplemental irrigation using the existing water right to encourage cottonwood and willow establishment. If cottonwoods are established, nest boxes and bat houses could later be installed in the cottonwoods as they reach a suitable size. If additional riparian habitat becomes established on the parcel, additional emphasis could be placed on describing the value of riparian habitats and cover for wildlife. Shrub plantings conducted under this alternative would tend to attract deer. Accordingly, most plantings should be sited in the eastern part of the area, away from the highway.

Vegetation Enhancement Project
Fort Churchill River Ranches
West of Overlook Site 3
Community: OR3 Low Density Cottonwood Stand
15 acres

Site Analysis

This site is a sparse cottonwood community with two swales (relict channels) running across it (Figure 14). Individual cottonwoods are widely spaced along the swales. It is unknown whether the swales are inundated when flows are high in the river, but there is a potential connection approximately 0.5 mile upstream. The swales vary in dimension, but are up to 20 feet wide and up to 3-4 feet deep. The northern swale is the deeper of the two. In 2010 (a wet year) the shallowest areas were seasonally moist and the deeper areas were seasonally saturated. The deepest portions of the swales contain a mix of strong and weak wetland indicator plants including Baltic rush (*Juncus balticus*), spike rush (*Eleocharis macrostachya*), strawberry clover (*Trifolium fragiferum*), bigbract verbena (*Verbena bracteata*), cocklebur (*Xanthium strumarium*), curly dock (*Rumex crispus*), rabbit'sfoot grass (*Polypogon monspeliensis*), other grasses and an occasional stem or cluster of sandbar willow. The mix of strong and weak wetland indicators suggest that the deep areas are seasonally saturated as opposed to inundated for long periods. Sandbar willow (*Salix exigua*) occurred as browsed single stems no more than 2 feet tall. Other grasses were grazed and not identifiable. Sedges (*Carex* spp.) were absent perhaps due to grazing and/or saline-alkali conditions. Large Russian olive (*Elaeagnus angustifolia*) shrubs were also found within the swales.

Outside of the swales, the dominant understory species are threadleaf rubber rabbitbrush (*Ericameria nauseosa ssp. consimilis*) and creeping wildrye (*Leymus triticoides*). Some perennial pepperweed is present but not in great amount. Sagebrush is uncommon to absent.

The NRCS Soil Survey for Lyon County depicts both swales in the area cross two soil map units. One soil is Soil Map Unit 263 Dithod clay loam, wet. According to the NRCS, characteristic vegetation for this soil unit consists of creeping wildrye, sedges, and rubber rabbitbrush (*Ericameria nauseosa ssp. nauseosa*). In contrast, native vegetation that would be present in the absence of disturbance and weeds (termed "potential native vegetation") would be sedges, rushes, tufted hairgrass (*Deschampsia caespitosa*) and Nevada bluegrass (*Poa nevadensis*). The other soil unit present is Map Unit 724 Wabuska loam, strongly saline-alkali. According to the soil survey, this soil type is moderately to strongly salt and alkali affected in the upper profile. Salinity effects decrease with depth. Characteristic vegetation for this soil type is inland saltgrass (*Distichlis spicata*), black greasewood (*Sarcobatus vermiculatus*), rubber rabbitbrush, and alkali sacaton (*Sporobolus airoides*). The potential native vegetation would be alkali sacaton, inland saltgrass and Baltic rush. The presence of threadleaf rubber rabbitbrush and a whitish cast on the soil surface indicate that this site is salt/alkali affected, but the dominance of creeping wildrye rather than inland saltgrass suggests that this site is less salt/alkali-affected than the typical Wabuska loam, strongly saline-alkali soil.

Problem Conditions

Low density of cottonwoods

Minimal understory layers of native trees and shrubs

Observation of the site relative to less heavily grazed locations (e.g., willow stands on Lahontan State Recreation Area lands northeast of Hercules Well) indicates that grazing is hindering sandbar willow recruitment

Challenges

1. Saline-alkali affected soil. Selection of plant material should be based on salt and alkali tolerance. According to Nevada Division of Forestry, the salt/alkali tolerance is high for buffaloberry, moderate/high for sandbar willow, moderate for golden currant, and low/moderate for Woods rose.
2. Nevada State Parks personnel have noted that swales are only inundated when flows are high in the river. This limits the hydrology necessary to support cottonwoods and willows. When high flows do reach these swales, cocklebur seeds would be brought in from upstream sources.
3. Livestock grazing would not likely be an effective tool to eliminate perennial pepperweed, Canada thistle, and cocklebur. Cocklebur is toxic to cattle and sheep.
4. Swales only receive surface flow from the river during high runoff periods. Swales may be deepened to intercept the water table to create wetland habitat. Further study is needed to determine saline-alkalinity conditions.
5. Beaver in the river represent a challenge to cottonwood and willow plantings. Fencing, possibly including solar or battery-charged electric fencing, may be required.

Opportunities

1. Swale segments that are seasonally moist provide planting sites for riparian shrubs and trees. The presence of Russian olive shrubs within the swales suggests that the site would be suitable for buffaloberry. Seasonally moist conditions in the swale should increase the survival of deep pole plantings with minimal irrigation. Depth to the summer water table will determine whether cottonwood and willow pole plantings are possible.
2. Swale segments that are seasonally saturated support wetlands that contain sandbar willow. Rest from grazing can promote natural recruitment of this species.
3. A primitive trail runs parallel to the river, adjacent to the site, enhancing access.

Habitat Goal- Patches of dense shrubs interspersed with trees to provide a semi-open canopy

Overall Approach

1. Several years of weed control required to eradicate perennial pepperweed and cocklebur. Control cocklebur in a manner that spares sandbar willows in swales.
2. To better ensure success, the decision to fully implement this enhancement project should be contingent on achieving favorable results of several years of weed control and water table monitoring. Install water monitoring wells early in the process and monitor for several years. Test plantings (in cages or exclusions) are recommended prior to full project implementation.
3. If test plantings are successful, fence individual planting areas in swales to provide several years of rest from grazing to allow pole plantings to become established and encourage natural recruitment of sandbar willow and other native species in swales.
4. If needed, supplement natural recruitment with plantings in swales. Buffaloberry is the best choice because of its saline-alkali tolerance. Plant cottonwood and willow poles if depth to the summer water table can be reached (see *Planting Tips*, below).

5. Plant the deeper northern swale first, as deep pole plantings would be more likely to remain in contact with the water table at this site than in the shallower southern swale.

Enhancement Steps

A 15-acre site is initially proposed containing two swale segments totaling 3,100 feet.

Pre-project Planning

1. Study summer groundwater level through as many summers as possible. Install groundwater monitoring wells (preferred) or use hand augered holes (which must backfill every time).
1. Measure and map weed cover. Establish permanent transects and/or photopoints. This will be the baseline to track treatment success. If using photopoints, follow a set photographic protocol. USDA publications "Ground-Based Photographic Monitoring" general technical report #PNW-GTR-503 and USDA publication "Photopoint Monitoring Handbook," technical report #PNW-GTR-526, are good references for photo-monitoring and include forms for photopoint documentation. Include some photos with a marked, graduated frame of a specific size [one square meter or similar] from directly overhead. Compile a photo binder of photographs taken each year. Take copies of previous years' photos (keep originals in the office) into the field and match frames as closely as possible.
2. Soil testing. Alkalinity and salts may limit container plantings to buffaloberry.
3. Find sources for cottonwood and willow poles and containerized plant material. Planting may be years away, which will give nurseries sufficient lead time. Stormwater retention basins at Santa Maria Ranch and a backwater channel at Dayton State Park are potential sites to gather poles. Buckland Ditch (Fort Churchill) is a reliable source for sandbar willow poles, Lahontan shoreline is a reliable source for cottonwood poles.
4. Plan for supplemental irrigation of containerized plant material for the first two years to establish plants.

   Options:

   a. Water truck to fill drums or totes for slow release of water.
   b. Using Dri-water® water from time-release gel packs would minimize need for supplemental irrigation. Depleted gel packs are replaced every 30-90 days. This option can be costly and should be used in smaller, specific areas.

   Supplemental irrigation of cottonwood and willows pole plantings should not be necessary if a high middle and late-season groundwater table is present.

Years 1, 2, and 3- Weed Control

Objective- Reduce weed cover to less than 5 percent before planting

1. Spray and/or mow to weaken and prevent flower production and seed set of perennial pepperweed. Spray to control cocklebur. Repeat treatment during the growing season because perennial pepperweed and Canada thistle, which is also present in the area, regrow. This requires frequent and regular monitoring of weed flower production throughout the growing season to determine the timing of the next round of treatment.
2. Seed with competitive grass mixture to suppress germination of weed seeds. Where topography allows, drill seeding typically requires less seed, results in better soil to seed contact, and reduces seed predation. Swales, however, may require broadcast seeding. Fence planting sites to ensure seeded grass is not over-utilized by cattle. Managing grazing without fencing is an option but not recommended unless utilization of seeded grass can be frequently monitored.

3. Reduce weed cover to 5 percent or less before planting.

Year 4- Planting

1. Fence planting site, or the entire project site. A 15-acre site is initially proposed containing two swale segments totaling 3,100 feet. Fenced site(s) can be made smaller or larger depending on ability to monitor and maintain the project area.
2. Use initial test plantings of cottonwood and willow poles to determine probability of success prior to attempting larger-scale pole plantings.
3. After planting, inventory, tag and map plantings to track survival and performance over time using established transects or photopoints.
4. Plant and monitor willow and cottonwood poles in the deeper northern swale first, as plantings at this site are more likely to remain in contact with groundwater. If these plantings are successful, consider installing pole plantings in the shallower southern swale.

Planting Area	Planting area is 4.3 acres, along 3,100 feet of swale (20 to 30 foot corridor on each side of each swale, with this width potentially modified based on groundwater monitoring). Initial pole planting area will be smaller and restricted to the deeper northern swale until survival of pole plantings can be demonstrated.
Planting Density	120-300 trees and shrubs/acre Planting density (and ratio) is based on a visualization of mature plantings, desired habitat conditions (diversity and physical structure), and expected survival. Density used at Lyon County's Santa Maria Ranch Park is 120-300 trees and shrubs/acre (15-20 foot centers). The success rate was high during the first year, using a water truck to irrigate container plantings
Planting Ratio	8 sandbar willow: 4 cottonwoods: 1 red willow 3 buffaloberry: 3 Woods rose: 1 golden currant (Woods rose and golden currant may not be suitable due to saline-alkali conditions)
Planting Pattern	Minimum of 2 rows of cottonwoods in or immediately adjacent to the swales. Alternate trees with clusters of shrubs
Planting Tips	Irrigate buffaloberry, woods rose, and golden current planting holes one day before installation to maximize survival. Flood irrigation of the swale may be a suitable alternative if a source of water is available (potential during high flow years). For cottonwood and willow plantings, follow the recommendations in Hoag 2007: *How to Plant Willows and Cottonwoods for Riparian Restoration*, NRCS Technical Note TN Plant Materials No. 32, January 2007 revision. Poles should be of relatively large diameter. Cuttings over ¾ inch in diameter are preferred, though sandbar willow stems of this size may be uncommon. Hoag recommends cuttings that are between 2 and 7 years old with smooth bark that is not split or deeply furrowed. Remove the apical (tip) bud and the top several inches below the bud. The upper part of the stem includes the flowering parts.

Removing this part of the stem ensures energy is directed into the root and branch primordia in the older parts of the stem. Trim off side branches so the cutting is a single stem. Cut off the top of the stem with a horizontal cut and make the bottom cut with a 45 degree cut, allowing easy identification of the top of the cutting, so that the cutting will not be planted upside down. The top one or two inches of the cutting can also be dipped in a thin latex paint for easy identification of the stem's top and bottom during planting.

Planting should occur in early spring after spring runoff. Planting can be aided through the use of augers, excavators, soil probes or The Stinger, or in soft soil and with stout poles, pushing the pole cutting directing into the ground. Particularly if the mid-summer water table is at significant depth, reaching the recommended planting depth may require the use of mechanical equipment. Poles should be planted to ensure 6 to 8 inches of the cutting are in the mid-summer water table. No less than ½ the total length of the cutting should be planted below the ground surface, with 3-4 buds remaining above the ground.

Soil to stem contact with the below-ground portion of the pole is critical. Steps should be taken to ensure no air pockets are in contact with the planted section of the cutting. Filling the hole with native soil is recommended to encourage good soil to stem contact. "Mudding" the cuttings ensures soil to stem contact while minimizing air pockets. Native soil and water are mixed to a "consistence of cheap syrup" (Hoag 2007). This mixture is poured into the hole around the cutting until the mixture reaches the surface. Water will leach into the surrounding soil, while the soil in the mixture will settle around the cutting. Repeat this process until the hole in entirely filled with soil.

Summary of Monitoring Tasks

Prior to Planting

- Study surface hydrology of the swales.
- Weekly groundwater monitoring between July 1-October 1.
- Frequent and routine monitoring of weed growth stages through the growing season to time the next treatment.
- Annual measurement of vegetation cover, including percent cover of weeds using permanent transects and/or permanent photopoints for year to year comparison.

After Planting

- Frequent monitoring of plantings through the growing season to determine the next irrigation event.
- Frequent and routine weed monitoring during the growing season. Treat weeds when weed cover exceeds 10 percent.
- Annual monitoring to assess survival, overall condition of site, including fences and transect markers. Individual plants should be tagged for easy identification.
- Continue annual measurement of vegetation cover at permanent transects and/or permanent photopoints for year to year comparison of desirable species.

Alternatives

1. Old ditches or the upstream segment of the relict channel can be used to deliver water from the river to flood irrigate swales to establish plants (may require a water right change in Beneficial Use from Irrigation to Environmental). However, Nevada State Park personnel have noted that river water only enters the relict channel segments during very high flows. No method to divert flows into the old channels is available under current budget conditions.

2. Swale bottom can be recontoured or deepened in selected areas to create varied wetland habitat, with pockets of open water and emergent marsh. Grading and recontouring is considered a fill activity, and such actions within the wetland swale would require a wetland delineation and a Section 404 Clean Water Act permit from the U.S. Army Corps of Engineers. The project would likely qualify for a Nationwide Permit 27 which is used to authorize restoration activities. The permit may require the applicant to develop a monitoring plan with criteria for success.

Vegetation Enhancement Project
Fort Churchill River Ranches
Horse Camp East Site 6 – Hercules Well Alternative 3
Community: MF2 Sparse Mature Cottonwood Willow Forest, AG, W, OW and Ch
40 acres

Site Analysis

The main part of this site is located down-gradient of Hercules Well and includes generally sparse cottonwood forest and wetland and channel habitat, as well as two agricultural fields (Figure 16). Ditching conveys flow from Hercules Well to the pair of agricultural fields/pastures east and northeast of the well. A wetland swale runs from Horse Camp, to the west, and ends at a small pond (here referred to as "Hercules Pond"), which is impounded by a dike downstream of the well. The wetland swale is charged by high flows in the Carson River, and in extremely wet years, flows in the wetland swale will overtop the Hercules Pond and flow into the agricultural fields. On the down-gradient side of the dike, a side channel (channel braid) of the Carson River parallels the toe of the dike, flowing south and turning east just before reaching the agricultural fields. Beyond this site, to the north and east, the channel braid continues and branches into a number of smaller channels with adjacent wetlands. Key features of this site are Hercules well itself, the ditches used to irrigate the agricultural fields, the wetland swale coming from the Horse Camp area and the associated Hercules Pond, and the channel braid. All these features are potential enhancement sites. Cottonwoods in the area may provide a source for natural cottonwood colonization along the channel braid, though the braid area is heavily infested with perennial pepperweed.

In addition to irrigating the agricultural fields, ditching below Hercules Well can direct pumped flow into Hercules Pond and/or into the channel braid at the southeastern end of the dike. Flow from the well as well as from the Carson River and associated diversions tend to maintain the pond even during the dry season. Nevada State Parks personnel have identified Hercules Pond as an import water source for wildlife during drier times of the year. Rains that occurred during the fall of 2010 provided natural flow into the braid and wetted the fenced pastures and many of the branching channels north and east of the pastures. Grazing appeared light, and regeneration of sandbar willow was noted east of the fenced pastures.

Hercules Pond is seasonally inundated, and the channel braid is inundated in wet years. Natural flows could be supplemented with flow pumped from Hercules Well to ensure inundation is maintained during summer and during drought periods. Sandbar willow stands border portions of the channel braid east of the fenced pastures. A young cottonwood stand bordered by bulrush (*Scirpus* sp.) was also found east of the fenced pastures, suggesting further cottonwood colonization or enhancement in this area is possible. The source of seasonal flows in the channel braid appears to be the river when flows are high.

The NRCS Soil Survey for Lyon County maps soils in the area of the channel braid as soil unit 724 Wabuska loam, strongly saline-alkali. According to the NRCS, typical vegetation for this soil type includes

black greasewood, inland saltgrass and rubber rabbitbrush. Native vegetation that would occur in the absence of disturbance and weeds (potential native vegetation) would be dominated by alkali sacaton, inland saltgrass, Great Basin wildrye, and black greasewood. About 80 percent of the community would be grasses and grass-like plants, 10 percent forbs, and 10 percent shrubs and trees. The NRCS maps soils in the area of the wetland swale as map unit 264, the Dithod clay loam, saline-alkali. Observations of actual vegetation at the site suggests that ungrazed or lightly grazed areas currently support a community similar to that expected under relatively undisturbed conditions (a high percentage of inland saltgrass and alkali sacaton, with willows and young cottonwoods present adjacent to channels of the branching drainages north and east of the pastures).

Problem Conditions

1. The area of the channel braid is heavily infested with perennial pepperweed, to the point control may not be economically feasible.
2. Some cocklebur infestation continues in the wetland swale north and northwest of Hercules Well and perennial pepperweed is present in the area.
3. The occurrence of native trees and shrubs immediately adjacent to ditches and the channel braid is limited, suggesting some conditions on the site may not be suitable to support these species.

Challenges

1. Weed management.
2. Cocklebur seeds are brought in from upstream sources, livestock and wildlife.
3. Potential for mercury in floodplain sediment. Soil testing for mercury should be conducted prior to any ground disturbing activities or wetland creation.
4. Natural inundation of the channel braid is dependent on high flows in the Carson River.
5. In high runoff years when the channel braid is inundated, access to the area of the braid may limited.
6. Saline-alkali affected soil. According to the Nevada Division of Forestry, buffaloberry has a high tolerance for salt/alkali conditions; sandbar willow and golden currant have a moderate tolerance for these conditions, while Woods rose has a moderate to low tolerance for saline/alkali conditions.
7. Suitability for riparian plantings is unknown. Further evaluation of surface hydrology and soil characteristics is needed.

Opportunities

1. Site has both natural and supplemental hydrology sources available.
2. Good access to much of the area exists.
3. The site is currently grazed, but existing fencing could be supplemented to exclude planting sites.
4. Borders of the irrigation ditches and Hercules Pond on upstream side of dike appear to be good candidates as planting sites. The pond already attracts wildlife, and represents an important dry-season water source that can be supplemented with flow from Hercules Well.
5. Banks of ditches between and bordering fields are candidates for planting shrubs and possibly cottonwoods to create a hedgerow type of habitat.
6. Some fencing is already in place along the ditches. Hydrologic conditions and soil characteristics, including texture and salinity/alkalinity would determine suitability.
7. Fields below Hercules Well have been used for forage crop production, and could be placed into forage production again. Planting forage beneficial to wildlife (alfalfa or similar browse-type

crops) would be emphasized over livestock forage.

8. Banks of the channel braid below the dike may be suitable for natural cottonwood recruitment and plantings may be unnecessary if sufficient hydrology is present and perennial pepperweed can be addressed. Natural recruitment appears possible, but is dependent on suitable hydrology (mid and late season high water table).
9. This site is not as accessible as Buckland Station for the development of an interpretive site, but wetland enhancement would not generate concerns regarding mosquito infestation or deer-highway problems at this site. Cattails or bulrush enhancement at the pond on the site would not adversely affect ditches (also a potential issue at the Buckland Station site).

Habitat Goal – establish hedgerow-type vegetation bordering the irrigation ditches; riparian vegetation enhancement at the pond above the dike; forage production in one or both of the agricultural fields at the site. Enhancement of wetland vegetation in the swale above (north and northwest of) Hercules Well and potential natural cottonwood recruitment, possibly supplemented with riparian shrubs (established either by natural recruitment or pole plantings) to provide a mixed tree and shrub community with a semi-open canopy are optional goals.

Overall Approach

1. Weed control may be required to eradicate cocklebur and perennial pepperweed. Seed with weed suppression mix as needed. Use a wetland seed mix in the wetland swale (and possibly on the banks of the channel braid) to compete with the continual influx of cocklebur seeds.
2. Seeding of the pastures with wildlife/livestock forage may be initiated early if inspection indicates the pastures are not subject to weed infestation.
3. Install a culvert and irrigation controls at the pond above the dike, permitting diversion of water either into the pond or into the ditches and/or the channel braid.
4. Install water table observation wells to track groundwater elevation over the course of the year and identify areas of seasonally high groundwater. Install water table wells/observation wells adjacent to the pond above the dike; adjacent to the ditches bordering and between the fields; and in and adjacent to the wetland swale north and northwest of Hercules Well.
5. Manage grazing to encourage native grasses, recruitment of cottonwoods and willows, and establishment of plantings. Practices that would encourage cottonwood and willow recruitment include localized exclusion (fencing) of planting sites until cottonwoods and willows have attained sufficient vigor to tolerate grazing.
6. Use the margins of ditches, the dike immediately adjacent to the pond, and potentially the channel braid (depending on soil and hydrology conditions and weed management considerations) as planting sites for riparian shrubs and trees. The dike supports some sandbar willow. Fence this section of the dike (which would require installing some fence posts within the pond adjacent to the dike) to encourage further colonization by willows. Use supplemental willow and possibly cottonwood pole planting if natural colonization does not occur.
7. To better ensure success, the decision to fully implement this enhancement project should be contingent on achieving favorable results of several years of weed control and water table monitoring. Test plantings (in cages or exclusions) are recommended prior to full project implementation.

Enhancement Steps

Conversation with Nevada State Parks personnel indicates pumping costs may limit the forage production area to a part of one of the two agricultural fields at the site. The western field is approximately 37 acres in size; the eastern field is approximately 36 acres in size. The western field is

closer to Hercules Well, and selection of this field would reduce pumping costs from the well. Initially, approximately half this acreage would be planted to ensure sufficient irrigation water is available. Additional acreage can be planted if sufficient funds are available for additional irrigation. Tailwater or water pumped directly to the ditches would be used to support hedgerow vegetation planted along these ditches. Approximately 1,600 feet of ditch exists between the two fields. 1,800 feet of ditch could be created at minimal cost along the northern side of the two fields. Install fencing 20 feet beyond the unfenced side of the ditch, to create an approximately 30 foot wide planting area along the ditches. This would create approximately 2.3 acres of hedgerow planting area. Containerized buffaloberry would be planted within this fenced strip, supplemented with other species selected based on the results of groundwater monitoring and soil testing. Willow and cottonwood pole plantings could be installed within this strip if groundwater monitoring indicates a shallow water table can be maintained along the ditches. Otherwise, Wood's rose and golden current can be planted if soil conditions are suitable.

A second approximately 0.45 acre area (400 feet by 50 feet) on the upstream (west) side of the dike and adjacent to the pond below Hercules Well would also require fencing. This would be the willow enhancement site. Additional natural willow colonization would be encouraged in this area, potentially supplemental with willow pole plantings.

The wetland swale north and northwest of Hercules Well represents an additional potential planting/enhancement site. This area is partially fenced. The installation of additional fencing could exclude an approximately 8 acre area that includes this wetland swale. Cocklebur in the swale could then be treated, and herbaceous wetland species such as bulrush, sedges or cattail could then be planted. Test plantings of willow and cottonwood poles could also be planted within the excluded portion of the swale. Soils should be tested for mercury concentrations prior to planting herbaceous wetland species, as methylation can occur under the low-oxygen conditions present in wetlands.

Pre-project Planning

1. Survey the pastures for weeds to determine if control is necessary prior to planting forage crops.
2. Install water table monitoring wells to study summer groundwater level through as many summers as possible. Monitoring wells should be installed adjacent to ditches, including near control structures; on the dike in the proposed willow enhancement area; across the swale north and northwest of Hercules Well; and near the channel braid on the eastern side of the dike and north of the two agricultural fields.
3. Quantify the extent of cocklebur establishment in the wetland swale north of Hercules Well, in the channel braid and on the banks of the braid through photopoints and/or mapping and density transects. If photopoints are used, permanent photopoint locations and specific photo methodology should be used (take photos in specific directions, using previous years' photographs as a guide to ensure accurate repetition; take photos that include a marked frame of a specific size [one square meter or similar] from directly overhead). USDA publications "Ground-Based Photographic Monitoring" general technical report #PNW-GTR-503 and USDA publication "Photopoint Monitoring Handbook," technical report #PNW-GTR-526, are good references for photo-monitoring and include forms for photopoint documentation. Take copies of previous years' photos (keep originals in the office) into the field and match frames as closely as possible.
4. To more accurately monitor weeds in the area and if staff is available, measure and map weed cover using GPS receivers. This mapping as well as photopoints would be the baseline to monitor weed treatment success. Permanent transects/photopoints should be established and

located with GPS receivers.

5. Soil testing. Mercury in wetland swale and channel braid bank sediments may make the site unsuitable for some enhancement measures, since ground disturbing activities may mobilize mercury, potentially posing a risk to wildlife. Wetland creation may result in unacceptable methylation levels if high mercury concentrations are present in the wetland swale. Salt/alkalinity may limit container plantings to buffaloberry.
6. Conduct a detailed inventory of native species in the wetland swale north and northwest of Hercules Well to verify the potential for natural recruitment and predict the type of wetland community that could occur in absence of cocklebur and with limited grazing.
7. Study site surface hydrology and soil characteristics near the pond, along the ditches and along the channel braid to determine suitability for native riparian establishment or planting (e.g. is natural hydrology present? Would supplemental irrigation, possibly using 55-gallon drums or plastic tote-type tanks benefit cottonwood and riparian shrub establishment)?
8. Planting could occur sooner in the agricultural field at this project location than at some weedier project sites. Find sources for cottonwood and willow poles and containerized plant material. Nevada State Parks personnel indicated shore areas at Lahontan State Park represent a nearby source for cottonwood poles. Poles should be of large caliper and should be deeply planted (12 to 15 feet tall poles planted at more than half their height). Plan for supplemental irrigation of containerized plant material (buffaloberry along ditches) for the first two years to establish plants.

   Options:

   a. Pumping from Hercules Well into the ditches. Diversion structures in the ditches may be used to pond water and increase percolation.
   b. Water truck to fill drums or totes for slow release of water.
   c. Using Dri-water® water from time-release gel packs would minimize need for supplemental irrigation. Depleted gel packs are replaced every 30-90 days. This option can be costly and should be used in smaller, specific areas.
9. Fix fence and ensure gates can be closed by trail users.

<u>Years 1 and 2 - Weed Control; Restore Irrigation Controls</u>

Objective- Reduce weed cover to less than 5 percent before planting

1. Install additional fencing to exclude an approximately 30-foot wide strip adjacent to the ditches, and in the approximately 400 X 50 foot willow enhancement area on the upstream side of the dike adjacent to the pond. Additional fencing would be required in the area of the swale north and northwest of Hercules Well prior to attempting to enhance wetlands in the swale.
2. Limit grazing to maintain the existing grass community and minimize weed colonization, particularly in the forage pastures, as these sites currently do not appear to be infested with weeds.
3. Spray to control cocklebur as needed. Spray and/or mow to weaken and prevent seed set of perennial pepperweed. Use water-safe formula when there is a possibility of drift into open water. Repeat treatment during the growing season because perennial pepperweed will regrow. This requires frequent and routine monitoring throughout the growing season to determine timing the next round of treatment.
4. Restore/replace irrigation controls on the ditch system used to irrigate the fields. Install a control that allows flows to be directed into the ditches or into the pond above the dike, as desired.

Year 3 and 4 Observation Period; Forage Seeding; Flow Management to Encourage Natural Cottonwood Colonization

Objective- Determine whether there is natural recruitment in wetlands

1. If weed density is less than 5 percent, seed forage species in approximately half of the eastern pasture and begin irrigation. Monitor groundwater levels near the irrigation ditches through the summer, as well as at other selected project/planting sites.
2. Monitor the wetland swale north and northwest of Hercules Well to detect new wetland plants. Recognize that some species were seeded for weed suppression. Additional permanent transects or photopoints can be established in addition to transects/photopoints established earlier to make year to year comparisons.
3. Monitor the channel braid for evidence of natural cottonwood or willow colonization. Natural colonization may only occur in years of high runoff.

Year 5 – Planting and Supplemental Planting

1. Plant containerized buffaloberry plants within fenced strips bordering the irrigation ditches. Pole plant willows and possibly cottonwoods adjacent to ditches if monitoring indicates groundwater conditions are sufficient to maintain these species; alternately, supplement buffaloberry plantings with Woods rose and golden current if soils are suitable. Manage flows from Hercules Well to wet ditches sufficiently to support planted riparian shrubs (buffaloberry or willow) or cottonwoods planted on ditch banks. Maintain flows late into the season if possible and reduce flows slowly to allow the roots of cottonwood seedlings to maintain contact with groundwater.
2. Determine planting areas.
3. Supplement willows on the upstream side of the dike with willow pole plantings
4. After planting, inventory and map plantings (tag individual plants) to track survival and performance over time using established transects or photopoints.

Planting Area

Plant containerized buffaloberry and either willow poles or Woods rose and golden current along ditches, with groundwater hydrology determining the species to be planted. If monitoring suggests groundwater in the ditches can be maintained in the early season, then drawn down slowly, plant cottonwood poles adjacent to the ditches. A 2.3 acre hedgerow planting area along approximately 3,400 feet of ditch is available for hedgerow planting. Use test plantings to establish shrub and/or willow and cottonwood survival prior to a large-scale planting effort.

A 400 X 50 foot sandbar willow enhancement area is proposed on the upstream side of the dike adjacent to the pond.

If a wetland enhancement of the swale north and northwest of Hercules Well is selected, drill seed or plant the excluded part of the swale with wetland species (bulrush, cattail, sedge). Determine mercury concentration in soils prior to wetland creation/enhancement. If planting rather than seeding, use plugs of these species collected at nearby sources (weed-free if at all possible). Investigate natural cottonwood colonization of the channel braid banks east of the dike and north of the fields. Fencing may be necessary until new plants become established. Supplemental planting with willow poles is recommended

if natural colonization does not occur. Weed infestation in the area of this braid may make this alternative unfeasible.

Use planting ratio and planting pattern as described in Overlook Site 4 and West of Overlook Site 3.

Summary of Monitoring Tasks

Prior to Planting

- Weekly groundwater monitoring between July 1-October 1.
- Frequent and routine monitoring of weed growth stages through the growing season to time the next treatment.
- Annual measurement of vegetation cover, including presence/absence and extent of natural colonization by cottonwoods and willows, as well as percent cover of weeds using permanent transects and/or permanent photopoints for year to year comparison. If using photopoints, take copies of previous years' photos into the field and match frames as closely as possible. Include photos with a marked frame of a specific size [one square meter or similar] from directly overhead. A toe-point transect could be used as a simple quantitative methodology to monitor vegetation in the area.

After Planting

- Frequent monitoring of plantings through the growing season to determine the rate of flow reduction from Hercules Well to allow cottonwood roots to maintain contact with groundwater if cottonwood poles are planted along ditches.
- Frequent and routine monitoring for weeds during the growing season. Treat weeds when cover exceeds 10 percent.
- Annual monitoring to assess survival and overall condition of site, including maintaining fences and transect/photopoint markers.
- Continue annual measurement of vegetation cover at permanent transects and/or permanent photopoints for year to year comparison of desirable species.

Alternative Project 1

Greater emphasis could be placed on enhancing riparian vegetation along the channel braid below the dike and north of the pastures. Natural colonization of the channel braid may occur, but could be supplemented with pole plantings of willow and cottonwood. If groundwater monitoring indicates a high water table is present in this area during drier times of the year, and funds become available for perennial pepperweed control, planting areas along the banks of this braid could be fenced and pole plantings installed. Test plantings of small groups of willow and cottonwood poles should be planted to determine the suitability of this site prior to a more substantial planting effort.

Selection of this alternative would require intensive and costly perennial pepperweed control measures. The channel braid banks could be recontoured to create additional areas of bare bank, which, if sufficient hydrology can be maintained, may be suitable for natural cottonwood colonization. Due to the presence of nearby weed infestations, however, ground disturbance should occur only sparingly. Grading and recontouring is considered a fill activity, and such actions within the channel braid would require a wetland delineation and a Section 404 Clean Water Act permit from the U.S. Army Corps of Engineers. The project would likely qualify for a Nationwide Permit 27, which is used to authorize restoration activities. The permit may require the applicant to develop a monitoring plan with criteria for success. Soils should also be tested to determine mercury concentrations prior to ground disturbance activities.

Alternative Project 2

Investigate drier-season hydrology along the northeastern side of the fields. This area supports willow, and State Parks personnel indicate the area is inundated for much of the year. A stand of young cottonwoods was found in this area during a visit in the fall of 2010. If investigation indicates suitable hydrology exists in this area, install cottonwood pole plantings. Plantings sites may require fencing to exclude beaver as well as livestock and other wildlife. Though it is farther from Hercules Well, this site has the advantage of being much less weedy than the channel braid east of the dike. At least during the fall of 2010 (a wet period), this site appeared to have sufficient hydrology to potentially support the establishment of additional cottonwoods.