Adaptive Weed Management Plan

Address: 2902 S 900 W, South Salt Lake, UT 84119
Updated: 7/9/2020 by Brian Tonetti

- Executive Summary -

The Mill Creek Confluence Restoration and Enhancement Project is an eight-acre natural lands, owned by Salt Lake County, situated at the convergence of Mill Creek and the Jordan River. The north-side of Mill Creek, designated as a flood control levee by the United States Army Corps of Engineers, is highly-managed by the Salt Lake County Division of Flood Control. Management needs, such as piling dredge spoils, mowing for levee inspections, and removal of all woody species, make restoration on the north-side challenging. The south-side is not designated as a levee. Noxious weeds and social issues undermine habitat value and usership of the area.

The Seven Canyons Trust, in partnership with Jordan River Commission, Salt Lake County, and South Salt Lake, began restoration and enhancement of the Mill Creek Confluence in 2017. Project goals: (1) Restore habitat value and biodiversity; (2) Improve user safety and recreation; and (3) Increase site stewardship. The *Adaptive Weed Management Plan* provides a framework for the adaptive control of noxious weeds at the Mill Creek Confluence in South Salt Lake, Utah, located at approximately 2902 South 900 West.

Lessons Learned

Work on the Mill Creek Confluence Restoration and Enhancement Project has largely been successful. Chemical treatments on common reed (*Phragmites australis*) have diminished coverage within the wetland area to less than ten percent. Initial visual inspections have shown a decrease in distribution of hoary cress (*Cardaria draba*), Scotch thistle (*Onopordum acanthium*), Canada thistle (*Cirsium arvense*), and puncturevine (*Tribulus terrestris*) across the site. Mechanical treatments using volunteers to sever the plant's taproot and bag if seeding have been successful for Scotch thistle, Canada thistle, and puncturevine. Chemical treatments of hoary cress and large areas of Scotch and Canada thistle have been successful. Refer to Appendix B for completed noxious weed treatments. Further monitoring and data collection is required to confirm.

Project challenges can be broken-down into three categories: (1) Disturbance Events; (2) Irrigation Requirements; and (3) Coordination.

<u>Disturbance Events</u>

Prior to work on-site, fire damage was present on vegetation. A fire event in June 2017 burned approximately two acres of vegetation in roughly the same area. Damage encompassed approximately one acre of desirable vegetation, including Woods' rose (*Rosa woodsii*) and coyote willow (*Salix exigua*). Efforts took advantage of this opportunity to seed the bare soil in July 2017. Visual inspections show an increase of priority weeds: hoary cress (*Cardaria draba*) and Scotch thistle (*Onopordum acanthium*), non-prority weeds: cheatgrass (*Bromus tectorum*), and desirable vegetation: inland saltgrass (*Distichlis spicata*) and intermediate wheatgrass (*Thinopyrum intermedium*). Fire events, and other large disturbances, should be viewed as opportunities, and seized upon, to establish desirable vegetation. Without revegetation treatments, noxious weeds will colonize the area.

In addition, a surrounding business owner continuously mows a large portion of the south-side of the site due to security concerns. This result in the mowing, and mortality, of approximately 500 potted plants installed in April 2017. This resulted in unexpectedly high mortality rates of potted plants installed in 2017. Continuous mowing diminishes the stability of the intermediate wheatgrass-dominated ecosystem that prevents the establishment of noxious weeds. This illustrates the need for better coordination with surrounding landowners.

<u>Irrigation Requirements</u>

Project Oxygen, an April 2017 planting event in partnership with TreeUtah, Mark Miller Subaru, and HawkWatch International, utilized 75 volunteers to plant 1,500 trees and shrubs at the site. Plants were purchased in smaller-sized pots (10ci) and cuttings to decrease price. Although, plants were planned for certain areas to take advantage of existing pockets of desirable vegetation, access to surface and groundwater was not considered. Partners agreed to provide the plants with supplemental irrigation throughout the summer and fall. However, limited staff time and resources meant the plants were irrigated once or twice a month in 2017

and not at all in 2018. This, and disturbance events highlighted above, led to high mortality rates for this planting event, estimated at 90 to 95 percent mortality. Refer to Appendix G for plant survival rates.

A different solution was required to maximize limited resources available in 2018. Thus, the focus of revegetation efforts is on the one-acre wetland area on-site. This area has access to perennial or nearly-perennial surface water, according to visual inspections throughout the year, and a high groundwater table. It is also fairly accessible from the parking lot adjacent to the south-side of the site. Revegetation treatments will be focused on this area and then work outward to other pockets of desirable vegetation. Approximately 150 volunteers in July 2018 planted 250 wetland plugs, including arctic rush (*Juncus arcticus*), Nebraska sedge (*Carex nebrascensis*), Torrey's rush (*Juncus torreyi*), woolly sedge (*Carex pellita*), and hardstem bulrush (*Schoenoplectus acutus*), within the wetland area. In addition, two volunteer groups in November 2018, an estimated 120 participants, spread 100 pounds of the south-side seed mix to the wetland area, and planted 27 coyote willow (*Salix exigua*) cuttings and 28 Fremont cottonwood (*Populus fremontii*) trees in D60 sized-pots. A Utah Conservation Corps crew, in November 2018, spread 150 pounds of the south-side seed mix to the area, and planted 27 Fremont cottonwoods and 23 peachleaf willows (*Salix amigdaloides*), in 30-inch tall-pots, on the bench around the wetland area. These tall-pot plants were grown to focus on robust development of the root structure. A motorized-auger was used to drill holes approximately 35 inches deep with the goal of reaching the groundwater table. A pilot remote irrigation system was installed to insure the tall-pots get enough water.

<u>Coordination</u>

As mentioned, coordination with surrounding landowners has been a challenge throughout the process. For instance, mowing events have actively competed against noxious weed management efforts. It is crucial surrounding landowners are engaged in the process to prevent miscommunication and misaligned efforts, as well as inviting them to participate to create site stewards. Refer to Goal 3 for strategies on how to engage surrounding landowners.

In addition, coordination with project partners is critical to project success and the dissemination of best management practices. A lack of coordination caused chemical treatments, by land managers, to diminish revegetation efforts on the north-side of the project, which is designated as a flood control levee. This was predominately caused by a lack of coordination. However, miscommunication among county departments make communication and coordination challenging. Therefore, efforts to revegetation this area proved to be too difficult. Realigned focus on wetland area of the south-side will generate interest and develop stewards for the project area as a whole. With an increase in interest in site, efforts on the north-side can resume.

The *Five-Year Adaptive Weed Management Plan | 2017-2021* will spread best management practices and lessons learned for the project site. In future efforts, communication with land managers, on noxious weed management treatments, volunteer events, and accomplishments, should increase.

- Approach -

Management

1. Be familiar with the target species, proper control methods, and appropriate follow-up to ensure success;
2. Collect information on treatments including: location, timing, and follow-up to ensure success;
3. Target existing infestations to limit spread;
4. Use an integrated management approach with a variety of treatment methods to improve efficacy;
5. When applying herbicide*, always read and follow requirements on the label, ensure weather conditions are appropriate, and take precautions to protect personal health and safety then health of the environment; and
6. Monitor treatments to ensure progress on reducing noxious weed coverage and preventing new infestations, and adapt strategies as needed.

Prevention

1. Prioritize control in recent or future disturbance areas;
2. Identify vectors of noxious weed introduction and spread and understand their impact on the site; and
3. Work with landowners to reduce spread from surrounding properties.

Early Detection & Rapid Response

1. Use this guidance document to improve detection and identification of noxious weeds;
2. Collect baseline vegetation data and survey each year for new species; and
3. Coordinate response efforts to eradicate species before establishment with stakeholders working within and adjacent to the site.

Revegetation

1. Select site-adapted vegetation that can outcompete noxious weeds when established;
2. Place plants based on local soils and access to surface and groundwater;
3. Prepare soil and seed disturbed areas immediately after a disturbance; and
4. Maintain plantings for five years to ensure establishment.

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* *Disclaimer:* Herbicide should be applied by certified sprayers, and all instructions on the label should be adhered to. Project partners do not take any liability of herbicide application, and shall hereby be indemnified, within this project area or elsewhere. This report contains only suggested treatment methodology.

- Project Goals -

Goal 1 – Restore habitat value and biodiversity

Work accomplished at the Mill Creek Confluence will, first and foremost, improve the habitat value of the site and increase biodiversity. This is accomplished through a variety of adaptive weed management techniques, including the removal of priority noxious weeds and the protection and establishment of desirable vegetation. Priority noxious weeds have been chosen based on their ability to outcompete desirable vegetation and their distribution across the site. Priority Noxious Weeds: (1) hoary cress (*Cardaria draba*); (2) Canada thistle (*Cirsium arvense*); (3) Russian olive (*Elaeagnus angustifolia*); (4) Scotch thistle (*Onopordum acanthium*); (5) common reed (*Phragmites australis*); (6) salt cedar (*Tamarix ramosissima*); and (7) puncturevine (*Tribulus terrestris*). Other non-priority noxious weeds have been identified on-site, including: Russian knapweed (*Acroptilon repens*), cheatgrass (*Bromus tectorum*), yellow starthistle (Centaurea diffusa), poison hemlock (*Conium maculatum*), field bindweed (*Convoluvulus arvensis*), tree-of-heaven (*Ailanthus altissima*), and Siberian elm (*Ulmus pumila*). The removal of noxious tree species should be coordinated with partners to minimize effects on migratory birds and other wildlife. Phased removal of noxious trees, and establishment of desirable vegetation, will retain the beneficial aspects of riparian cover and a multi-story canopy. Collaboration between partners will determine the most effective methods of treatment.

Revegetation, after noxious weed removal, large disturbance events, and in suitable locations across the site, is critical to the ensuring adaptive weed management efforts are successful into the future. Desirable vegetation that has been identified on-site include: inland saltgrass (*Distichlis spicata*), American licorice (*Glycyrrhiza lepidota*), Fremont cottonwood (*Populus fremontii*), golden currant (*Ribes aureum*), Woods' rose (*Rosa woodsii*), coyote willow (*Salix exigua*), Canada goldenrod (*Solidago canadensis*), and intermediate wheatgrass (*Thinopyrum intermedium*). Efforts should ensure the protection of this existing desirable vegetation. In addition, work should be center around these “islands” of desirable vegetation. As, it is likely these areas have proper soil conditions and access to surface and groundwater. A diverse variety of potted plants, including wetland, riparian, and upland species, should be established in 20-foot by 5-foot-fenced habitat patches. Seed, containing desirable vegetation, should be spread in untreated bare areas and after disturbance events. Refer to Appendix D for suggested potted plants and seed mixes.

<u>Habitat Patch Installation</u>
Suggested installation of habitat patches consists of six t-posts (four at each end and two in the middle) and five to six-foot welded wire fencing. Plots should be exactly 20 feet by five feet to prevent wildlife from jumping over the fence, and fencing should touch the ground to prevent climbing under. A door can be created using the ends of the fencing material and should be located towards the location in which the site is accessed from, if possible. Disturbed

areas within the plots should be seeded post-installation. Plots should be weeded on a monthly basis and as needed. Mulch, around plants, can be used to increase moisture retention and suppress weeds within the plots.

Seeding Technique

Seeding is suggested to be done via broadcast to utilize volunteer labor. Prior to seeding, the seedbed should be prepared by scoring the soil to an average topography of approximately one to two inches. Five-gallon buckets and plastic cups are used spread seed at a rate of 40-60 pounds per acre of pure live seed. Visually, this does not look like a lot of seed. Volunteer leaders must be diligent about teaching volunteers the proper technique. Hand-held seeders can be used to broadcast seed, but have been found to be more trouble than they are worth. Seed should be covered with an inch of soil and tamped down to remove air pockets. To increase effectiveness, a drill-seeder can be used to prepare the seedbed and hydroseeding to spread the seed. However, this process can be expensive and does not meet Goal Three to increase site stewardship through the use of volunteer groups.

Remote Irrigation System

Around the wetland area, a pilot remote irrigation system to the habitat patches on higher-ground was installed. This system will connect to a hitched water trailer with a pump attachment that can pressurize the system. The water trailer will be parked in an easily accessible area (in the parking lot adjacent to the south-side of the site). Three-fourth-inch garden hosing runs from the parking lot to the habitat patches around the wetland. From there, ½-inch irrigation tubing is used to convey water to each plot, and ¼-inch irrigation tubing runs to individual plants. Materials are kept at a low-cost and the system was installed modularly so as to be replace in the event of vandalism.

Measurable Objectives

Objective 1.1 – Preserve existing desirable species on-site (retain greater than 90% of existing cover).

- Task 1.1.1 – Ensure herbicide sprayers and field crews can identify and prevent mortality of desirable vegetation from trampling, herbicide drift and overspray, and other common mishaps.
- Task 1.1.2 – Install herbivory controls around applicable desirable vegetation to protect from beaver, deer, and other herbivorous species.
- Task 1.1.3 – Focus spot-spray treatments in areas with existing desirable vegetation to prevent competition from noxious weeds and allow for regeneration.
- Task 1.1.4 – Avoid the use of insecticides that can impact pollinator species and utilize strategies to provide pollinator habitat on-site, such as maintaining dead wood for bee nests and planting beneficial pollinator species.

Objective 1.2 – Reduce coverage of priority noxious weeds (decrease from 40% to less than 10% absolute cover).

- Task 1.2.1 – Utilize mechanical treatments on priority noxious weeds where effective, whenever possible. Refer to Appendix B for more information on mechanical treatments.
- Task 1.2.2 – Apply chemical treatments on priority noxious weeds where necessary, adhering to proper herbicide application protocol and protecting existing desirable vegetation. Refer to Appendix B for more information on chemical treatments.

Objective 1.3 – Increase coverage of desirable vegetation (increase from 30% to greater than 50% absolute cover).

- Task 1.3.1 – Plant a diverse variety of vegetation, including wetland, riparian, and upland vegetation, based on local soils and access to surface and groundwater.
- Task 1.3.2 – Broadcast seed, utilizing proper seeding technique, untreated bare areas, after large disturbance events, and treated bare areas once the persistence of chemical treatments are at a safe level.
- Task 1.3.3 – Install fencing, in 20-foot by five-foot habitat patches, around plantings and connect to remote irrigation system where supplemental irrigation is necessary.

Goal 2 – Improve user safety and recreation

The Mill Creek Confluence is impacted by socio-economic factors, stemming from the geographic stratification of income in the Salt Lake County to upper east-side neighborhoods. This has concentrated crime, homelessness, and drug-use in neighborhoods on the west-side. Homeless encampments and drug paraphilia are common at the project site. Sharps present a direct safety hazard to users and volunteer groups assisting in project goals. Homeless encampments, while not inherently a safety hazard, can detract aesthetically, create a negative perception, and cause less usership of the site. Noxious weeds, such as Russian olive (*Elaeagnus angustifolia*), common reed (*Phragmites australis*), and salt cedar (*Tamarix ramosissima*), that create hiding places should be prioritize for removal. Desirable vegetation may need to be thinned, or removed in extreme cases, based on crime prevention through environmental design principles. Species contained in revegetation treatments should be chosen and located in areas that will prevent future hiding places.

Puncturevine (*Tribulus terrestris*) can inhibit recreational use of the project site due to its sharp, thorny seed. Cyclists often get flat tires and unsuspecting dogs and children can get painfully poke by seeds on unprotected hands and feet. This can detract users from enjoying the project site. A decrease in puncturevine infestations will bring cyclists, dog-walkers, and other users back to the trail with unenjoyable experiences that are free of puncturevine. Mechanical treatments, utilizing volunteer labor, to sever the plant's taproot and bag the seeds should be prioritized as plants begin to sprout in June and July. Increased usership will provide community surveillance of the site to diminish unwanted activity.

Efforts will provide economic benefit to the area. A University of North Carolina study found that properties adjacent to habitat restoration sites increased, on average, by $3,100 (*The land*

value impacts of wetland restoration). In addition, beautification of the site will incentivize businesses to locate in the area, improving economic conditions of the neighborhood and bringing in even more users.

Measurable Objectives

Objective 2.1 – Eliminate hiding spots using crime prevention through environmental design principles.

- Task 2.1.1 – Prioritize removal of noxious weeds where homeless encampments have been built, that create potential hiding spots, and that generate an unsafe perception.
- Task 2.1.2 – Thin, or (in extreme cases) remove, neutral and desirable vegetation that create hiding spots.
- Task 2.1.3 – Chose desirable vegetation that will mitigate future hiding spots, and plant in suitable locations to prevent user conflict.

Objective 2.2 – Eradicate puncturevine (*Tribulus terrestris*) from the project site.

- Task 2.2.1 – Utilize volunteer events to remove puncturevine by severing the plant's taproot an inch below the surface of the soil and putting the plant and seeds in a sealable trash bag.
- Task 2.2.2 – Reduce puncturevine's seedbank by decreasing seed vectors, including transport via users and volunteers on the underside of shoes.
- Task 2.2.3 – Employ pilot technologies to gather excess seed not bagged, such as leaf vacuums or rollers that can pick up seed.

Objective 2.3 – Clear common reed (*Phragmites australis*) from access points to Mill Creek and the Jordan River for recreationalists.

- Task 2.2.1 – Identify, or establish, access points to water resources on-site for boaters and anglers.
- Task 2.2.2 – Utilize proper treatment techniques for common reed in access points.
- Task 2.2.3 – Revegetate access points with grasses and other low-growing desirable vegetation to prevent future infestations of common reed and erosion of bare soil.

Goal 3 – Increase site stewardship

A key component of the Mill Creek Confluence Restoration and Enhancement Project is to increase stewardship of the site with project partners, surrounding landowners, and community members. Since April 2017, 600 community members and students have contributed 1,453 hours to the project to remove 600 pounds of debris and 1,000 pounds of noxious weeds. Volunteer events have directly involved the community in efforts. According to a Griffith University study on post-event attitudes, volunteers "strongly identified with the physical location where the [volunteering] took place, and that this 'sense of place' can be cultivated to foster active volunteer groups" (*A sense of place: Ecological identity as a driver for catchment volunteering*). Events should combine educational and informational experiences with hands-on restoration work. To increase productivity and interest, volunteers

should be given a diverse set of tasks, ideally combining noxious weed removal with revegetation treatments. To increase stewardship knowledge, volunteers should be educated about why their work is important prior to the event. Post-event, share accomplishments, completed during the event, to leave volunteers with a positive sense of their achievements. Retaining volunteers is critical in developing site stewards. As topophilia – love of place – is created around the Mill Creek Confluence, community members are more likely to view the site as a community and educational amenity, and support future enhancements.

Site visits with project partners disseminate best management practices piloted at the site, and build excitement for future enhancements. Increased coordination with partners will improve efficacy in noxious weed management and restoration work. Refer to the Executive Summary for lessons learned on coordination.

Engagement of adjacent landowners in project goals is critical to success. A lack of understanding or knowledge contributes to negative outcomes. Surrounding properties can harbor noxious weed seeds that easily spread to the site through vectors established in Appendix B. Green waste and debris may be dumped on-site. Communication, through direct mail or door-to-door contact, prevent misaligned efforts and illegal activity, as well as encourage active participation in project goals.

Landowners should be encouraged to treat noxious weeds on their property. Signage and fencing, if dumping continues, can be used to restrict illegal dumping on the site. Refer to the Executive Summary for lessons learned on engagement with surrounding landowners.

<u>Future Improvements</u>

A future large-scale restoration project will turn the Mill Creek Confluence into a community amenity. A constructed wetland will improve wildlife habitat and treat water quality impairments through natural processes. The Central Valley Water Reclamation Facility treats and discharges 50 to 60 million gallons of wastewater daily into Mill Creek, just above the site. This wastewater is high in nutrients, notably phosphorus. Pathways and boardwalks provide a place to walk, run, and bike, and to enjoy and learn about the ecosystem. The Mill Creek Confluence can serve as a gateway to the regional Mill Creek Trail.

<u>Measurable Objectives</u>

Objective 3.1 – Increase interest in the site among project partners, surrounding landowners, and community members.

- Task 3.1.1 – Maintain a list of surrounding business, organizations, and landowners for outreach and engagement.
- Task 3.1.2 – Develop and disperse outreach pamphlet and project information to surrounding business, organizations, and landowners.
- Task 3.1.3 – Host volunteer service projects, community science events, and site tours to build awareness and excitement, as well as continue monitoring and maintenance of site.

Objective 3.2 – Monitor and disseminate best management practices and lessons learned.

- Task 3.2.1 – Publish this adaptive weed management plan on website and disseminate to project partners.
- Task 3.2.2 – Partner with universities and organizations to continue monitoring and data collection.
- Task 3.2.3 – Write-up successes and findings to guide future restoration work.

- Contributors –

1. Brian Tonetti, Executive Director – Seven Canyons Trust (brian@sevencanyonstrust.org);
2. Eric McCulley, Restoration Expert – River Restoration (eric.mcculley@riverrestoration.org); and
3. Adam Wolford, Undergraduate Student – Westminster College.

- Appendix A – Project Map -

A map of the Mill Creek Confluence shows project site boundaries, photo points, and bird monitoring points. Additional mapping and geographic data on noxious weed management is available upon request.

- Appendix B – Suggested Priority Noxious Weed Treatments -

Priority noxious weeds targeted by efforts at the Mill Creek Confluence include: (1) hoary cress (*Cardaria draba*); (2) Canada thistle (*Cirsium arvense*); (3) Russian olive (*Elaeagnus angustifolia*); (4) Scotch thistle (*Onopordum acanthium*); (5) common reed (*Phragmites australis*); (6) salt cedar (*Tamarix ramosissima*); and (7) puncturevine (*Tribulus terrestris*). Priority noxious weeds have been chosen based on their ability to outcompete desirable vegetation and their distribution across the site. Other non-priority noxious weeds have been identified on-site, including: Russian knapweed (*Acroptilon repens*), cheatgrass (*Bromus tectorum*), yellow starthistle (Centaurea diffusa), poison hemlock (*Conium maculatum*), field bindweed (*Convoluvulus arvensis*), tree-of-heaven (*Ailanthus altissima*), and Siberian elm (*Ulmus pumila*). These species, and other know noxious weeds identified on-site from the Salt Lake County and State of Utah noxious weeds lists, should be monitored for secondary infestations, as priority species are treated. If any non-priority noxious weed begins to diminish any of the project goals established above, they should be added to the priority noxious weeds list and treated according to best known management practices.

<u>Chemical Treatment Guidelines</u>

Any chemical treatments done on-site must abide by the following guidelines:

1. Any use of herbicide must be done by a licensed applicator;
2. Always read herbicide labels and follow specific requirements therein;
3. Choose the appropriate herbicide for chemical treatments to prevent residual effects on soil that diminish revegetation efforts. Refer to the herbicide label for how long chemical effects remain in the soil;
4. Ensure weather conditions, such as wind or precipitation, are appropriate for herbicide use;
5. Post signs to alert public about the use of herbicides;
6. Always wear chemical-resistant gloves, a long-sleeved shirt, long pants, and sturdy chemical-resistant boots;
7. Transport herbicides in a tightly-sealed container in a watertight box, with the application equipment, in the open bed of a vehicle;
8. Wash gloves and footwear before removing them, and store clothing used during application in a sealable bag; and
9. Wash hands, forearms, face, and any other body parts that may have been exposed, and wash hair and body in the shower at the end of the day.

<u>Noxious Weed Vectors</u>

Vectors are the vehicles in which noxious weeds utilize to spread throughout the site. These vectors include: (1) people; (2) animals; (3) waterways; and (4) wind. As people utilize trails systems, often noxious weeds stick to clothing or equipment, and thus spread down the trail. Users should be encouraged to clean shoes, clothing, and equipment before recreating. In addition, surrounding property owners can be a major source of noxious weed seeds. Green waste or debris, containing noxious weed seeds, may be dumped onto the site. Weeds present

on an adjacent property can easily spread to the site through any of the established vectors. Landowners should be encouraged to treat noxious weeds on their property. Signage and, if it continues, fencing can be used to restrict illegal dumping on the site. People will spread all priority noxious weeds.

Wild and domestic animals can carry noxious weed seeds into the property through skin or fur and feces. While no restrictions should be placed on wild animals, domestic animals should be prevented from entering the site. If a domestic animal is seen on-site, contact Salt Lake County Animal Services at 801.743.7045 to report the animal. Animals will spread all priority noxious weeds.

Propagules of noxious weeds can be spread into the site by the adjacent waterways. These waterways pick up seeds from upstream properties and deposit them downstream. Upstream landowners should be encouraged to treat noxious weeds along waterways, much the same as adjacent landowners. Waterways will spread Canada thistle (*Cirsium arvense*), Russian olive (*Elaeagnus angustifolia*), Scotch thistle (*Onopordum acanthium*), common reed (*Phragmites australis*), and salt cedar (*Tamarix ramosissima*).

Wind may spread noxious weeds on-site. Wind breaks, utilize desirable trees and vegetation, can diminish wind corridors and travel of noxious weeds. However, this vector is often difficult to mitigate. Wind will spread Canada thistle (*Cirsium arvense*), Scotch thistle (*Onopordum acanthium*), and common reed (*Phragmites australis*).

Treatment Information

Hoary cress (*Cardaria draba*)

1. Chemical Treatment
   - Herbicide: Metsulfuron (Chlorosulfuron or 2,4-D near water);
   - Timing: Spring & Fall; and
   - Method: Spray at bud or early flower phase in established infestations. It may be necessary to follow-up with spot-treatments in preceding months. Do not dig or pull. This can increase spread through rhizomes.

Canada Thistle (*Cirsium arvense*)

1. Chemical Treatment
   - Herbicide: Aminopyralid ;
   - Timing: Fall; and
   - Method: Spray when in rosette phase, prior to seed set.

Russian olive (*Elaeagnus angustifolia*)

1. Mechanical Treatment
   - Timing: Winter, Spring, & Fall; and
   - Method: For trees less than an inch in diameter, grub with shovel. Make sure to remove all parts of the root system to prevent resprouting.

2. Chemical Treatment
   - Herbicide: Glyphosate;
   - Timing: Winter, Spring, & Fall; and
   - Method: For trees greater than an inch, high-cut the tree at approximately six to 12 inches. Remove the material and pile for chipping. Ready herbicide paintbrush kits. Low-cut the stump to a level surface (horizontal to the ground) as close to the ground as possible. Paint the whole surface of the stump within fifteen minutes of low-cut. Focus on the cambial layer just inside the bark ring. Chip the cut material, and utilize chippings as mulch.

Scotch thistle (*Onopordum acanthium*)

1. Mechanical Treatment
   - Timing: Winter, Spring, Summer, & Fall; and
   - Method: Sever taproot two to four inches below the surface of soil. Put into a sealable trash bag if bulbous seed head is present, it's flowering, or cotton-like seeds are seen. If in its first-year rosette phase, the plant does not need to be bagged.

1. Chemical Treatment – Milestone
   - Herbicide: Aminopyralid;
   - Timing: Spring; and
   - Method: For large infestations that are not feasible to treat mechanically, spray prior to flower phase. It may be necessary to follow-up with spot-treatments in preceding months.

Common reed (*Phragmites australis*)

1. Chemical Treatment – Glyphosate
   - Herbicide: Glyphosate;
   - Timing: Fall; and
   - Method: In early Spring, mow in flat areas, such as wetlands, and brush cut in steep, rocky areas (on banks) or areas with existing desirable vegetation, as close to the ground as possible. Remove the cuttings from the treatment area and pile into wind rows in a dry, upland area to decompose or remove entirely from site. In mid-August to late-October, spray when plants regrow to approximately three feet, after feathery tassels have been sent out at the top of the plant. Mow or brush cut treated vegetation in late Fall, and pile into wind rows or remove entirely.

Salt cedar (*Tamarix ramosissima*)

1. Mechanical Treatment
   - Timing: Winter, Spring, & Fall; and
   - Method: For trees less than a half-inch in diameter, grub with shovel. Make sure to remove all parts of the root system to prevent resprouting.

2. Chemical Treatment
    - Herbicide: Triclopyr;
    - Timing: Winter, Spring, & Fall; and
    - Method: For trees greater than a half-inch, high-cut the tree at approximately six to 12 inches. Remove the material and pile for chipping. Ready herbicide paintbrush kits. Low-cut the stumps to a level surface (horizontal to the ground) as close to the ground as possible. Paint the whole surface of the stumps within fifteen minutes of low-cut. Focus on the cambial layer just inside the bark ring, and be diligent about treating all cut surfaces. Chip the cut material, and utilize chippings as mulch.

<u>Puncturevine (*Tribulus terrestris*)</u>

1. Mechanical Treatment
    - Timing: Summer & Fall; and
    - Method: Sever taproot of Scotch thistle and puncturevine. Put into a sealable trash bag if seed is present. Sever taproot two to four inches below the surface of soil. Put into a sealable trash bag if sharp, thorny seed is present. If no seeds are present, the plant does not need to be bagged. Collect any seeds that may have dropped from the plant, and take time to ensure no plant parts remain.

2. Chemical Treatment
    - Herbicide: Chlorsulfuron;
    - Timing: Summer; and
    - Method: For large infestations that are not feasible to treat mechanically, spray when plants are beginning to sprout in June and July, prior to seeding phase. It may be necessary to follow-up with spot-treatments in preceding months.

3. Biological Treatment
    - Species: Puncturevine weevil (*Microlarinus ssp.*);
    - Timing: Summer; and
    - Method: Place weevils on active infestations when plants are beginning to seed in July and August. Spread units approximately 500 feet from each other. Flag release sites for monitoring of efficacy and overwintering. To monitor, collect five seed pods, and look at outside to count the number of oviposition holes (small holes that have been covered) and exit holes (large, open holes). Dissect each segment and count number of larvae inside. Take this as a percentage of the total seeds (oviposition holes/25, exit holes/25, and larvae/25). In each pod, there are five seed segments with a seed in each). Research suggests weevils are not able to overwinter. Therefore, weevils must be spread each year.

- Appendix C – Draft Schedule -

A draft schedule has been produced based off of previous work at the project site and experience from restoration efforts along the Jordan River and lower Mill Creek. As work commences, fill out the "Responsibility" column with the partner that will be accomplishing each task. Mark the check box to ensure tasks are accomplished. Each task should be accomplished within the suggested month to maximize treatment efficacy. Some tasks may be completed in previous months, and therefore, won't need to be accomplished in later months.

Month: Ongoing	Responsibility	Completed
1. Monitoring - Task 0.1 – Check herbivory controls one week after installation and then on a quarterly basis. - Task 0.2 – Assess and record treatment efficacy one week after treatment, one month after, and then as needed. - Task 0.3 - Take photo points on a quarterly basis for comparison. Refer to Appendix F for the locations of each photo point.		☐ ☐ ☐

Month: January	Responsibility	Completed
1. Chemical Treatments - Task 1.1 – Cut/stump treatment of Russian olive and salt cedar that are greater than one-inch in diameter. Refer to Appendix B for suggested noxious weed treatments.		☐

Month: February	Responsibility	Completed
1. Chemical Treatments - Task 2.1 – Cut/stump treatment of Russian olive and salt cedar.		☐

Month: March	Responsibility	Completed
1. Chemical Treatments - Task 3.1 – Cut/stump treatment of Russian olive and salt cedar.		☐

Month: April	Responsibility	Completed
1. Chemical Treatments		
- Task 4.1 – Spot-spray hoary cress, Scotch thistle, and Canada thistle.		☐
- Task 4.2 – Cut/stump treatment of Russian olive and salt cedar.		☐
2. Mechanical Treatments		
- Task 4.3 – Sever taproot of Scotch thistle, and put into a sealable trash bag if purple flower is present or seeding.		☐
- Task 4.4 – Grub Russian olive and salt cedar that are less than one-inch in diameter.		☐
- Task 4.5 – Mow common reed, and remove biomass from area.		☐
3. Revegetation Treatments		
- Task 4.6 – Seed after any large disturbance event and applicable treatments. Refer to Appendix D for suggested seed mixes.		☐
4. Monitoring		
- Task 4.7 – Measure point-intercept vegetation transects. Refer to Appendix I on protocol.		☐

Month: May	Responsibility	Completed
1. Chemical Treatments		
- Task 5.1 – Follow-up on spot-spray treatment of hoary cress, Scotch thistle, and Canada thistle as needed.		☐
2. Mechanical Treatments		
- Task 5.2 – Sever taproot of Scotch thistle and puncturevine. Put into a sealable trash bag if seed is present.		☐
3. Revegetation Treatments		
- Task 5.3 – Water habitat patches as needed (up to three times a week). Check precipitation and increase watering if dry.		☐

Month: June	Responsibility	Completed
1. Chemical Treatments - Task 6.1 – Spot-spray puncturevine.		☐
2. Mechanical Treatments - Task 6.2 – Sever taproot of Scotch thistle and puncturevine.		☐
3. Revegetation Treatments - Task 6.3 – Water habitat patches as needed.		☐

Month: July	Responsibility	Completed
1. Chemical Treatments - Task 7.1 – Follow-up on spot-spray treatment of puncturevine as needed.		☐
2. Mechanical Treatments - Task 7.2 – Sever taproot of Scotch thistle and puncturevine.		☐
3. Revegetation Treatments - Task 7.3 – Water habitat patches as needed.		☐

Month: August	Responsibility	Completed
1. Chemical Treatments - Task 8.1 – Spot-spray common reed.		☐
2. Mechanical Treatments - Task 8.2 – Sever taproot of Scotch thistle and puncturevine.		☐
3. Revegetation Treatments - Task 8.3 – Water habitat patches as needed.		☐

Month: September	Responsibility	Completed
1. Chemical Treatments		
- Task 9.1 – Cut/stump treatment of Russian olive and salt cedar.		☐
2. Mechanical Treatments		
- Task 9.2 – Sever taproot of Scotch thistle and puncturevine.		☐
3. Revegetation Treatments		
- Task 9.3 – Water habitat patches as needed.		☐

Month: October	Responsibility	Completed
1. Chemical Treatments		
- Task 10.1 – Cut/stump treatment of Russian olive and salt cedar.		☐
2. Mechanical Treatments		
- Task 10.2 – Sever taproot of Scotch thistle, and bag as needed.		☐
- Task 10.3 – Mow common reed, and remove biomass from area.		☐
3. Revegetation Treatments		
- Task 10.4 – Water habitat patches as needed.		☐
- Task 10.5 – Seed untreated bare areas and applicable treated bare areas.		☐

Month: November	Responsibility	Completed
1. Chemical Treatments		
- Task 11.1 – Cut/stump treatment of Russian olive and salt cedar.		☐
2. Mechanical Treatments		
- Task 11.2 – Sever taproot of Scotch thistle, and bag as needed.		☐
3. Revegetation Treatments		
- Task 11.3 – Create fenced habitat patches in locations suitable for planting. Refer to Goal 1 for more information on habitat patches.		☐
- Task 11.4 – Plant potted wetland, riparian, and upland vegetation within habitat patches. Refer to Appendix D for suggested potted-plants.		☐

- Task 11.5 – Install remote irrigation system as needed to supplement access to surface or groundwater. Refer to Goal 1 for more information on remote irrigation systems. - Task 11.6 – Seed untreated bare areas and applicable treated bare areas.		☐ ☐

Month: December	Responsibility	Completed
1. Monitoring - Task 12.1 – Compile work accomplished, lessons learned, monitoring data collected, and any additional information into the *Five-Year Adaptive Weed Management Plan	2017-2021*. Revise and update adaptive weed management goals, objectives, and tasks as needed based on new information.		☐

- Appendix D – Suggested Plant List and Seed Mixes -

The following plant list and seed mixes have been selected based on observations of native riparian habitat in Salt Lake County by Dr. Ty Harrison over the last half-century. Refer to Goal 1 for information on habitat patch installation, seeding technique, and remote irrigation systems.

Riparian Potted Plants

1. Box elder (*Acer negundo*)
2. Black hawthorn (*Crataegus douglasii*)
3. Fremont cottonwood (*Populus fremontii*)
4. Oakleaf sumac (*Rhus aromatica*)
5. Golden currant (*Ribes aureum*)
6. Woods' rose (*Rosa woodsii*)
7. Peachleaf willow (*Salix amigdaloides*)
8. Coyote willow (*Salix exigua*)

Upland Potted Plants

1. Big sagebrush (*Artemisia tridentata*)
2. Fourwing saltbush (*Atriplex canescens*)
3. Gardner's saltbush (*Atriplex gardneri*)
4. Rubber rabbitbrush (*Ericameria nauseosa*)
5. Greasewood (*Sarcobatus vermiculatus*)

Wetland Potted Plants

1. Nebraska sedge (*Carex nebrascensis*)
2. Woolly sedge (*Carex pellita*)
3. Arctic rush (*Juncus arcticus*)
4. Torrey's rush (*Juncus torreyi*)
5. Hardstem bulrush (*Schoenoplectus acutus*)
6. Three-square bulrush (*Schoenoplectus americanus*)

North-side Seed Mix

	Mix Percentage
Tall wheatgrass (Thinopyrum ponticum)	30
Crested wheatgrass (Agropyron cristatum)	20
Sheep fescue (Festuca ovina)	20
Intermediate wheatgrass (Thinopyrum intermedium)	20
Inland saltgrass (Distichlis spicata)	5
Bottlebrush squirreltail (Elymus elymoides)	5

South-side Seed Mix

	Mix Percentage
Tall wheatgrass (Thinopyrum ponticum)	20
Great Basin wildrye (Leymus cinereus)	20
Crested wheatgrass (Agropyron cristatum)	20
Sheep fescue (Festuca ovina)	20
Rubber rabbitbrush (Ericameria nauseosa)	5
Bottlebrush squirreltail (Elymus elymoides)	5
Inland saltgrass (Distichlis spicata)	5
Lewis flax (Linum lewisii)	1
Common sunflower (Helianthus annuus)	1
Common blanketflower (Gaillardia aristata)	1
Rocky Mountain beeweed (Cleome serrulata)	1
Scarlet globemallow (Sphaeralcea coccinea)	1

Future Seed Mix

	Mix Percentage
Great Basin wildrye (Leymus cinereus)	30
Western wheatgrass (Pascopyrum smithii)	30
Rocky Mountain beeweed (Cleome serrulata)	20
Lewis flax (Linum lewisii)	6
Common blanketflower (Gaillardia aristata)	5
Sandberg bluegrass (Poa sandbergii)	5
Inland saltgrass (Distichlis spicata)	1
Scarlet globemallow (Sphaeralcea coccinea)	1
Alkali sacaton (Sporobolus Airoides)	1
Sand dropseed (Sporobolus cryptandrus)	1