## Revision History

<table>
<thead>
<tr>
<th>Revision</th>
<th>Date</th>
<th>Reason for Revision</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>April 2009</td>
<td>Initial issue.</td>
</tr>
<tr>
<td>1</td>
<td>September 2010</td>
<td>Update includes 2010 areas and future planning.</td>
</tr>
<tr>
<td>2</td>
<td>July 2014</td>
<td>Update includes 2014 areas and activities.</td>
</tr>
<tr>
<td>3</td>
<td>June 2017</td>
<td>Revision includes update to performance monitoring and activities and incorporation of the Weed Control Plan (formerly DOE-EM/GJTAC1406).</td>
</tr>
<tr>
<td>4</td>
<td>July 2018</td>
<td>Updated to include watering schedule and various new methodologies.</td>
</tr>
<tr>
<td>5</td>
<td>August 2019</td>
<td>Periodic update to reflect SME recommendations and associated procedures.</td>
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</tbody>
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1.0 Introduction

This Revegetation and Weed Control Plan describes activities for developing, maintaining, and promoting desirable vegetation on approximately 135 acres of the off-pile area at the Moab site, mostly along the eastern portion outside of the Contamination Area (Figure 1).

1.1 Site Description

The Moab Uranium Mill Tailings Remedial Action (UMTRA) Project site consists of 480 acres of U.S. Department of Energy (DOE)-owned land, located approximately 4 miles northwest of Moab, Utah. The average temperature for Moab is 57°F, and average annual precipitation is approximately 10 inches per year (US Climate Data 1981 – 2010).

Soil at the site is highly disturbed due to the removal of topsoil during previous remediation efforts. Soils at the site are variable, but generally alkaline, salty, and fine grained, which further complicates vegetation establishment. The site is home to several wildlife species, including mule deer, sparrow hawks, coyotes, mountain lions, and beaver. The portion of the Colorado River that runs adjacent to the site is home to several species of protected native fish.

DOE remediation operations on the site consist of removing radiologically contaminated soil and relocating it to a secure cell located in Crescent Junction, Utah. Currently there remains an area of approximately 130 acres of contaminated mill tailings being relocated to the secure holding cell. In 2003, the DOE began remediation of radiologically contaminated soil in non-pile (off-pile) areas of the Moab site. As non-pile areas were remediated, efforts were made to stabilize and revegetate the landscape with a variety of native plant species.

1.2 Purpose and Scope

The purpose of this document is to outline a plan that will continue to promote and ultimate realize the DOE’s vision of the site as a self-sustaining native landscape that will require little to no maintenance.

Due in large part to the removal of top soil during previous restoration efforts, much of the off-pile area at the site has been developed with non-desirable weeds such as Kochia (Bassia scoparia). Revegetating disturbed areas with desirable, native plant species minimizes production of fugitive dust and helps control erosion and off-site transport of sediment. Promoting a healthy native ecosystem also promotes native wildlife.

1.3 Planning

Vegetation at the site is in various stages of soil stabilization. Revegetation staff will coordinate with the revegetation subject matter expert (SME) and DOE to plan appropriate revegetation as additional off-pile areas are remediated. Table 1 shows typical seasonal revegetation activities and summarizes typical activities planned for vegetative cover in TAC-responsible areas.
Figure 2 shows planned vegetative cover for the areas covered by this plan. On March 5, 2019, the revegetation staff met with the SME, and received guidance on planning for the 2019 growing season. Items discussed during the meeting are outlined in the following section.
Table 1. Typical Seasonal Revegetation Activities

<table>
<thead>
<tr>
<th>Season</th>
<th>Typical Activities</th>
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</thead>
<tbody>
<tr>
<td>Winter</td>
<td>Thin tree plots as needed, chipper/shredder use, contour around cottonwoods as needed, plan weed management activities for the spring, order supplies, ensure pump/equipment maintenance is complete.</td>
</tr>
<tr>
<td>Spring</td>
<td>Start up irrigation systems, make any necessary plumbing repairs, begin weed control (implement burn plan), supplement with wildflower seeds at tree-line, soil sampling, plant cottonwood and willow “poles.”</td>
</tr>
<tr>
<td>Summer</td>
<td>Mowing, weed control, irrigation.</td>
</tr>
<tr>
<td>Fall</td>
<td>Planting poles/containers, winterize irrigation system, seeding, thin tree plots as needed, contouring around the tree line, conduct irrigation pump maintenance (if needed), soil sampling.</td>
</tr>
<tr>
<td>Ongoing Activities</td>
<td>Compost operations, hauling soil amendments to underperforming areas, necessary plumbing repairs.</td>
</tr>
</tbody>
</table>

1.4 SME Assessment and Recommendations

**Underperforming area F4:** This low-lying area, located just north of the lower Moab Wash crossing has poor quality soils and frequently floods. It is used as sanctuary habitat for aquatic species during periods of high water. We were advised to compare this area with similar areas across the river in the Matheson Wetland Preserve. Dohrenwend advised staff to monitor the established berms in the area and ensure they are designed in a way that compliments the potential aquatic habitat, while also acting as a buffer to reduce any fugitive dust from escaping the site during high winds. Considering that this area frequently floods and will likely be included in a re-routing of the Moab Wash, we determined that this area may not be a high priority use of our resources. It will take some time and effort to revegetate the area. These actions should include: planting cottonwoods along edges of existing berms, planting willows along river banks, qualitatively monitoring the area as flood waters fill the area, possibly collecting elevation data to determine areas that may need fill, and planting salt tolerant shrubs and trees such as New Mexico privet and Woods’ rose.

**General points discussed regarding successful planning for revegetation of the site:**
- Irrigation sprayers should be removed and stored before flooding occurs. Any PVC irrigation lines that may be affected by flood events should be secured or removed.
- Much of the Kochia in the Moab area is resistant to herbicide as a result of heavy herbicide use on this species upriver from the Project.
- Cottonwoods and willows should be planted by grafting new trees from branches of existing trees on site. Specific guidance provided by Dohrenwend has been provided and is available for reference.
- A “zoned” approach to management is best for overall revegetation of the site. This includes mapping specific polygons based on historical use/time of disturbance, visual assessments of obvious delineations in plant growth (including areas void of plant growth), soil analyses, and elevation data.
- The best approach for Kochia eradication is continuing to mow, primarily in late summer just before it goes to seed, and planting some annuals in Kochia patches, such as Buckwheat, that will out-compete the Kochia.
- Pole plantings of cottonwoods and willows should be done in March and April before spring floods, using smooth bark branches to promote root germination. A water jet stinger is recommended as a good tool to use for pole plantings.
- Black willow was recommended as a good species to use regarding climate adaptation, as the site is on the northern end of its habitat range. Conversely, Box Elder would be a poor choice to manage climate adaptation as the site is located at the southern end of this species range.
- Staff should consider visiting similar areas (Matheson Wetland Preserve and Roberts Bottom) and qualitatively compare current vegetation density, composition, and diversity to gain a better understanding of what actions we should take to achieve at our site.
- Southwest Seed and Stevenson Intermountain Seed were both recommended as seed vendors. Southwest Seed grows their stock and may be slightly less costly and better to purchase annual seed. Stevenson collects their seed and is a Utah-specific plant company. They would be best used for purchasing shrubs, forbs, and specific species.
- Spacing/density achieved by the recent thinning of trees in the C-plots was adequate. Planting of diverse species in the understory of one of the plots will be performed.
- Select areas will be evaluated as anticipated flooding occurs and recedes this spring. Observations will be made through the seasons to record changes based on historic disturbance of individual areas, site grade, current vegetation, and soil composition.
- Possible species include: New Mexico privet, Woods’ rose, white sage, three leaf sumac, sand dropseed, alkali sacaton, bee plant, and globe mallow.

2.0 Revegetation Activities

2.1 Planting

Planting includes establishing vegetation in areas that have been newly disturbed and augmenting vegetation in areas previously planted with only limited success. Depending on the location and purpose, planting may consist of seeding or planting poles or cuttings and, in some cases, may involve using containerized stock. When seeding, mixes of native species are used to encourage overall successful vegetation establishment. Seed names and application rates for commonly used seeds (for broadcast seeding) in mixes are shown in Table 2.

Native seed mixes may be used to supplement underperforming areas. Live plants using container stock, transplants, or cuttings may include coyote willow (*Salix exigua*) or Freemont cottonwood trees.

2.2 Watering

Irrigation by means of flooding, drip systems, sprinklers, and hose reels may be used to help establish vegetation growth in newly planted areas and to facilitate additional growth in areas that have been revegetated. The irrigation schedule for each area is designed to apply ample water in the first few years to encourage wide, deep root growth and plant establishment. After the first few years, the amount of irrigation water applied is reduced to encourage the plants to adapt to the local water table/precipitation. The goal is to have resilient vegetation that does not require supplemental watering. Irrigation areas at the Moab site are identified as plots A through F (see Figure 2). Other areas, including the U.S. Highway 191 rights-of-way, have been successfully revegetated with desert grasses and shrubs and need no irrigation.
In coordination with the SME, the appropriate watering schedule for each plot was determined and is provided in Table 3. The schedule is subject to change based on seasonal variability. Table 2 contains the watering schedule as recommended in April 2019.

Watering irrigation plots shown in Figure 2 is performed throughout the growing season. Water application is recorded in an irrigation log and will be updated to accurately track water use.
Table 2. Seed Name and Application Rates

<table>
<thead>
<tr>
<th>Common Name</th>
<th>Scientific Name</th>
<th>Application Rate (lb pure live seed/acre)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Big bluestem</td>
<td><em>Andropogon gerardii</em></td>
<td>1</td>
</tr>
<tr>
<td>Yellow beeplant</td>
<td><em>Cleome lutea</em></td>
<td>0.2</td>
</tr>
<tr>
<td>Rocky Mountain beeplant</td>
<td><em>Cleome serrulata</em></td>
<td>0.2</td>
</tr>
<tr>
<td>Inland salt grass</td>
<td><em>Distichilis spicata</em></td>
<td>4</td>
</tr>
<tr>
<td>Slender wheatgrass</td>
<td><em>Elymus trachycaulus</em></td>
<td>2</td>
</tr>
<tr>
<td>Beardless wildrye</td>
<td><em>Leymus triticioides</em></td>
<td>2</td>
</tr>
<tr>
<td>Alkali sacaton</td>
<td><em>Sporobolus airoides</em></td>
<td>1</td>
</tr>
<tr>
<td>Greasewood</td>
<td><em>Sarcobatus vermiculatus</em></td>
<td>1</td>
</tr>
</tbody>
</table>

lb = pounds

Table 3. Moab Revegetation Area Watering Schedule

<table>
<thead>
<tr>
<th>Area</th>
<th>Description</th>
<th>Frequency and Time Period Recommended by SME</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-Z3</td>
<td>East property boundary</td>
<td>No water.</td>
</tr>
<tr>
<td>A-Z4</td>
<td>Cottonwood hedgerow eastern side shrub/tree nursery with bubblers</td>
<td>Once every 10 days (about 6 hours or 120 gal/tree) March through October. This is a 20% reduction from last year, as accepted by Steering Comity notes 2017.</td>
</tr>
<tr>
<td>A-Z5, A-Z6</td>
<td>Entrance landscaping, cottonwood tree hedgerow north of offices</td>
<td>Once every 10 days (about 6 hours or 120 gal/tree) March through October. This is a 20% reduction from last year, as accepted by Steering Comity notes 2017.</td>
</tr>
<tr>
<td>B-1</td>
<td>Pollinator plot</td>
<td>Rainbird system will be installed here, and irrigation rates will be determined once planning is complete.</td>
</tr>
<tr>
<td>B-2</td>
<td>Grassy plot</td>
<td>No water.</td>
</tr>
<tr>
<td>C-1 through C-9</td>
<td>Well field</td>
<td>No water.</td>
</tr>
<tr>
<td>D-1 through D-5</td>
<td>Off-pile remediated areas (2010/2011)</td>
<td>Water underperforming areas only as needed.</td>
</tr>
<tr>
<td>E-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F-1 through F-5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* These areas are complete and stabilized (Kara Dohrenwend, Wildland Scapes, March 5, 2019, site visit).

2.3 Pruning and Chipping

Periodic thinning of mature cottonwood and willow trees is performed to improve overall growth and avoid creating a safety hazard. Tree trimmings from pruning/thinning may be shredded in a chipper and spread or composted. Composted materials and wood chips are used to create a soil amendment for underperforming areas to improve soil chemistry and fertility.
2.4 Compost Pit and Soil Amendments

We are currently investigating different composting methods to be utilized on site.

Figure 3. Moab Site Irrigation Areas
2.5 Periodic Assessments

Periodic assessments of vegetation coverage are documented in internal reports. These reports include descriptions of the areas, observations compared to previous data, and photographs showing the areas surveyed.

Biannual (every other year) soil sampling will be conducted at designated sites to assess the texture, salinity, pH, organic content, and general soil chemistry. Samples will be sent to a certified analytical soil laboratory for analysis. All assessment reports and sampling data and results will be sent to Records Management.

2.6 Oversight activities

Revegetation staff will develop monthly plans and track monthly activities. These plans will be reviewed, edited, and approved by the Field Manager to help prioritize revegetation activities and track and document progress.

3.0 Weed Control

The Revegetation staff are responsible for controlling weeds on the 2018 State of Utah Noxious Weed List present at the Moab site (see Attachment 1). Priority is given to areas of recent disturbance where vegetation is not well established. Weed-specific preventive and reactive treatments are implemented, and mapping and monitoring are utilized to assess weed control results and new infestations.

3.1 Weed Infestation Timing

Various weed species are more prominent during certain times of the year.
- Spring and early summer emergent weeds include kochia and Russian thistle (*Salsola tragus*), also known as tumbleweeds.
- Mid-summer weeds include Russian knapweed (*Acroptilon repens*); diffuse knapweed (*Centaurea diffusa*); puncturevine (*Tribulus terrestris*), also known as goathead; halogeton (*Halogeton glomeratus*); horseweed (*Erigeron Canadensis*); and common cocklebur (*Xanthium spinosum*).
- Fall weeds include: diffuse knapweed; kochia; tamarisk, also known as saltcedar; puncturevine; Russian thistle; Russian olive (*Elaeagnus angustifolia*); and halogeton.

3.2 Weed-control Methodology Descriptions

Weed-control methodologies include applying herbicides/bio-herbicides, bio-controls, physically removing weeds by cutting, pulling, mowing, or a combination of these methods. Care must be exercised during manual removal of weeds to prevent seed spread and dispersal.
Some areas of the site, such as Configuration 5 of the well field and the southernmost portion, are periodically mowed to cut down weeds. This activity also promotes growth of grasses and shrubs in these areas. Mowing annuals before flower set can inhibit and sometimes prevent flower and seed set.

Although tamarisk leaf beetles (Diorhabda elongata) have reduced tamarisk populations, they do not eliminate the tree. Seedling tamarisk will likely be most affected by the leaf beetle because of its small root mass. Seed production of mature plants is also expected to be reduced by beetle damage.

In some cases, it is helpful to leave the declining trees in place to help keep soils stable while other plants become established. In other cases, removing the aboveground biomass may be necessary. When removing apparently dead tamarisk trees by cutting them, it is important to continue treating the cut stump with Triclopyr to ensure the roots are killed as well.

Weed-control activities performed are dependent on site conditions and extent of infestation.

4.0 Pest Control

Pesticides, bio-pesticides, or mechanical methods are used to control Cottonwood Caterpillars (Leucoma salicis) and cottonwood leaf beetles (Chrysomela scripta Fabricius) as needed and when resources are available.
Attachment 1.
2019 State of Utah Noxious Weed List
2019 State of Utah Noxious Weed List

The following weeds are designated as noxious for the State of Utah, as per the Utah Noxious Weed Act:

- African Rue
- Malta Starthistle
- Plumless Thistle
- Spring Milletgrass
- Camelthorn
- Cutleaf Vipergrass
- Garlic Mustard
- Goats rue
- Oxeye Daisy
- Sahara Mustard
- Viper Bugloss
- Dalmation Toadflax
- Dyers Woad
- Medusahead
- Rush Skeletonweed
- Squarrose Knapweed
- Yellow Toadflax
- Canada Thistle
- Hoary Cress
- Jointed Goutgrass
- Perennial Pepperweed
- Phragmites
- Puncturevine
- Russian Knapweed
- Scotch Thistle
- Damesrocket
- Russian Olive
- Common Crupina
- Mediterranean Sage
- Small Bugloss
- Syrian Beancaper
- Common St. Johnswort
- Elongated Mustard
- Giant Reed
- Japanese Knotweed
- Purple Starthistle
- Venenata
- Black Henbane
- Diffuse Knapweed
- Leafy Spurge
- Purple Loosestrife
- Spotted Knapweed
- Yellow Starthistle
- Bermudagrass
- Field Bindweed
- Houndstongue
- Musk Thistle
- Perennial Sorghum species
- Poison Hemlock
- Quackgrass
- Saltcedar
- Cogongrass
- Myrtle Spurge
- Scotch Broom

Pursuant to Utah Noxious Weed Act (Utah Code § 4-17-101 et seq.) and Utah Administrative Code R-68-9-6, it is the duty of every property owner to control and prevent the spread of noxious weeds on any land in his/her possession or control. Enforced weed control measures may be imposed against you for failure to comply with this notice. For any questions you may have, please contact the Utah County Weed Control at 801-851-8638 or visit the Utah County website at www.utahcounty.gov.