Nevada Irrigation District

Staff Report

for the Maintenance and Resources Committee Meeting of October 23, 2018

TO: Maintenance and Resources Committee

FROM: Brian Powell

DATE: October 23, 2018

SUBJECT: Standing Item – Vegetation Management Update

MAINTENANCE DEPT

RECOMMENDATION:
Informational item to update the committee on the status of the Integrated Vegetation Management Pilot Study.

BACKGROUND:
The IVM team (Brian Powell, Brian Morris, Neysa King, Don Bartel, Daniel Nicholson, Keri Rinne, and Amigo Cantisano) has begun planning and design of Phase II of the pilot study to field test alternatives to glyphosate/Roundup. The attached Draft Phase II Plan outlines the products and approaches to be tested, as well as the locations and strategy for data collection and analysis.

Also attached is a Draft Phase I report, which describes the activities and outcomes of the first phase of the pilot study.

On September 12, 2018, the IVM team presented information regarding Phase I outcomes and preliminary plans for Phase II to the Vegetation Management Working Group. The Working Group was generally supportive of the Phase II plans. They requested that NID share information regarding the pilot study more broadly. NID shared information about the study with the public on October 17 at the NID Watershed Open House event. Additionally, NID plans to post information about the study on its website.

Attachments (2):

- NID Integrated Vegetation Management Project – Draft Phase I Report
- NID Integrated Vegetation Management Project – Draft Phase II Plan

October 2018

NID Integrated Vegetation Management Pilot Project

DRAFT Phase I Report

Background

In the summer of 2017, NID took early steps to begin expanding its integrated vegetation management[1] (IVM) practices. Vegetation management is a critical element of canal and reservoir maintenance—it ensures adequate water flows for human consumption, irrigation, and fire suppression. If left untreated, excessive vegetation can choke canals as encroaching plants restrict flow, reduce storage, and impact water quality and public health. Obstructed canals can also cause flooding and erosion and provide breeding grounds for mosquitoes and other vectors.

Over the last 40 years, NID has used RoundUp (whose key ingredient is glyphosate) as a primary vegetation management tool. It is effective, cost-efficient and until recently was thought to be a safe product. In July 2017, the Office of Environmental Health Hazard Assessment placed glyphosate on California's Proposition 65 list of chemicals known to cause cancer. This has led some cities to ban glyphosate's use in public spaces. Additionally, NID has received complaints regarding the use of glyphosate on lands adjacent to organic farms.

NID embarked on a process to develop and field test alternative strategies to vegetation management, and to refine and expand its IVM program. As part of this process, NID convened the Vegetation Management Working Group, which comprises local farmers, ranchers, representatives of the agricultural industry and others (such as the Placer and Nevada County Ag Commissioners and the Nevada County Resource Conservation District). This group continues to meet periodically. Soon after first convening this group, NID was encouraged to apply for a Department of Pesticide Regulation Research Program Grant to support a field study aimed at identifying effective glyphosate alternatives.

The District hired Amigo Bob Cantisano (of Organic Ag Advisors), Don Bartel (of Sierra Consulting and IPM), and Keri Rinne (a grant writer) to assist NID staff members Brian Powell, Brian Morris, and Neysa King with designing the field study and preparing the grant proposal.

Although the grant was not awarded, the process of developing the application helped the District to establish the IVM team and catalyzed the field study efforts. As part of

[1] Integrated Vegetation Management (IVM) is generally defined as the practice of using appropriate, environmentally sound, and cost-effective control methods, which can include a combination of chemical, biological, cultural, mechanical, and/or manual treatments.

the grant application development, the District designed a pilot study to field test organic chemical, biological and mechanical treatment methods. The study design included application, data collection, and data analysis regarding the efficacy and costs of each method, with a goal of developing a comprehensive IVM program to guide terrestrial vegetation management. NID determined that it would implement a scaled-down version of the field study included in the grant proposal. The IVM team was expanded to include botanist Daniel Nicholson, to assist with monitoring and assessment. The team began implementing the first field study phase in spring 2018.

Phase I Field Study

Phase I of the field study was implemented at two sites, Tarr Canal, downstream of McCourtney Road, and Newtown Canal off Bitney Springs Road. Most treatments were applied at the Tarr Canal site, including two mechanical methods and nine organic herbicides (listed below). Goat grazing was tested along Newtown Canal.

The Tarr Canal site was prepared with 48 plots, each measuring 10 feet by 10 feet, which allowed for four replicates of each treatment and one control plot (also replicated four times).

The organic herbicides tested were:

1. A.D.I.O.S. (WSG Sodium Chloride)
2. Axxe (Ammonium Nonanoate)
3. Avenger Concentrate (d-limonene)
4. Weed-A-Way (Lemon grass and clove oil)
5. Weed Zap (Clove and Cinnamon oil)
6. Finalsan (Ammonium Soap)
7. Suppress EC (Cupressic Acid)
8. Opportune (Plant Extract)
9. Marrone (Microbial Pesticide)

The two mechanical methods tested included mowing and an abrasion tool recommended by Amigo Cantisano, which uses crushed walnut shells to blast plants. The team had planned to test a steamer unit as well, but this did not occur as the equipment was not available during Phase I.

Testing began on April 3, 2018, when the IVM team and Working Group members gathered at the Tarr study site for the first application of the organic herbicides. Don Bartel conducted a second application of one product (Marrone) on April 9. The site was monitored (see details below) for 28 days, after which Don Bartel recommended that no further treatment or monitoring occur as the plants had grown beyond the point

at which herbicides would be effective. NID staff mowed the site and tracked costs to include in treatment comparisons.

The goat grazing was tested in July 2018. Brad Fowler of The Goat Works grazed approximately 100 goats and sheep for 16 days along 1 mile of canal running through Nevada City School of the Arts on Bitney Springs Road. Brad used electric fencing to contain the animals on the first ¾-mile of the canal. He erected fencing on both sides of the canal, and used supplemental feeding on the top of the berm in some areas to concentrate animal impact to the vegetation adjacent to the canal. For three days, along the last quarter-mile of the study site, Brad herded the animals with dogs along the berm without using any fencing (the animals were kept in a pen on-site at night). This was the most effective approach in terms of vegetation control, but it was also the costliest in terms of man power. Brad recommended that if grazing is tested in Phase 2, at least twice as many animals should be used and herded each day (and kept in night pens). He also recommended two sessions to be most effective, one in the spring and the second in the summer.

Phase I Monitoring and Data Analysis

Prior to the April 3 treatment, Daniel Nicholson evaluated the plots to gather data regarding plant species and basal cover. For each plot, Daniel completed a list of species present (including USDA plant codes, nativity, form, and other factors for each species). He also began photo monitoring. Both Daniel and Don gathered data on three site visits—at 7 days, 14 days, and 28 days post-treatment.

Daniel identified annual and perennial grasses and forbs at the Tarr site and during each visit, completed a data sheet for each plot that included: plot number, date, location, weather, and visit number. Data sheets also included the top two dominant species and their percentage of cover in the 10-foot by 10-foot plot and cover of organic (dead material), bare soil, and rocks/gravel. Daniel also took photos of each plot during each visit.

Don recorded the weather conditions for each treatment application and assessed the plots based on plant response to treatment (measured as percent control, defined within percentage categories to measure symptoms such as plant stunting, chlorosis, and necrosis).

<u>Data Analysis</u>

Dave Weixelman, a range ecologist with the US Forest Service who has significant experience with vegetation, restoration, and statistics, assisted with Phase I data analysis and helped to guide development of the Phase II monitoring protocol. The

graphs below show the results of each herbicide tested. Figure 1 shows percent control (i.e., plant response to the herbicides), and Figure 2 shows the changes in percentage of basal cover. In Figure 1, higher numbers on the Y-axis show a higher level of product efficacy, while in Figure 2, lower numbers show a higher level of efficacy (i.e., larger percentage of bare ground).

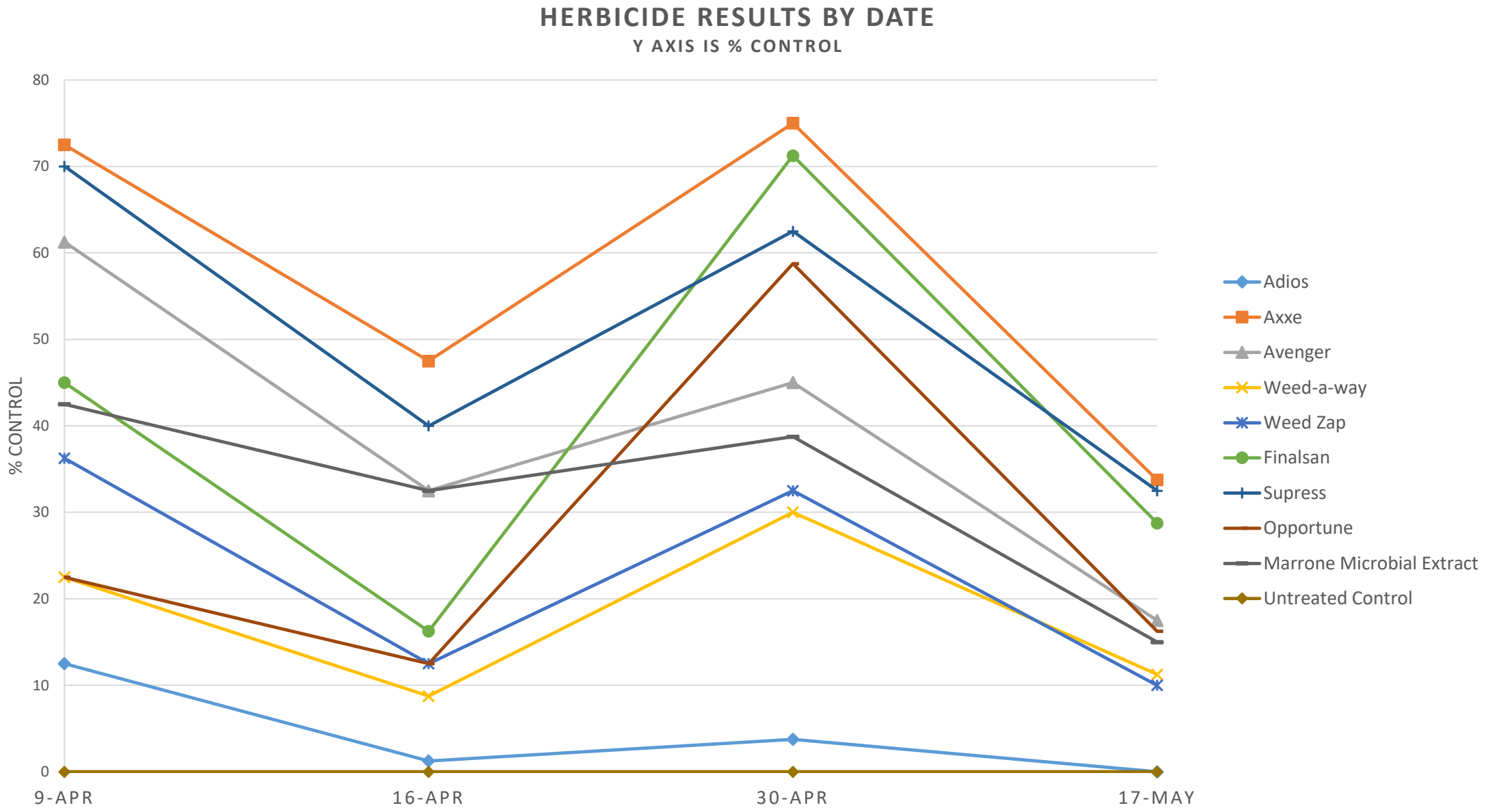
Although some products demonstrate higher potential than others, overall it is clear that in order to be effective the organic herbicides should be applied earlier in the season when the target vegetation is no taller than 4 inches.

The costs associated with the grazing and mowing have not yet been included in the analysis of Phase I outcomes. This calculus will occur once Phase II is complete.

Next Steps

Phase I has directly informed design of Phase II, which the IVM team has initiated (described in the Phase II plan). Phase I data analysis results guided the determination of which products and approaches to test further. Phase I results will also be integrated into an overall analysis once Phase II is completed.

Figure 1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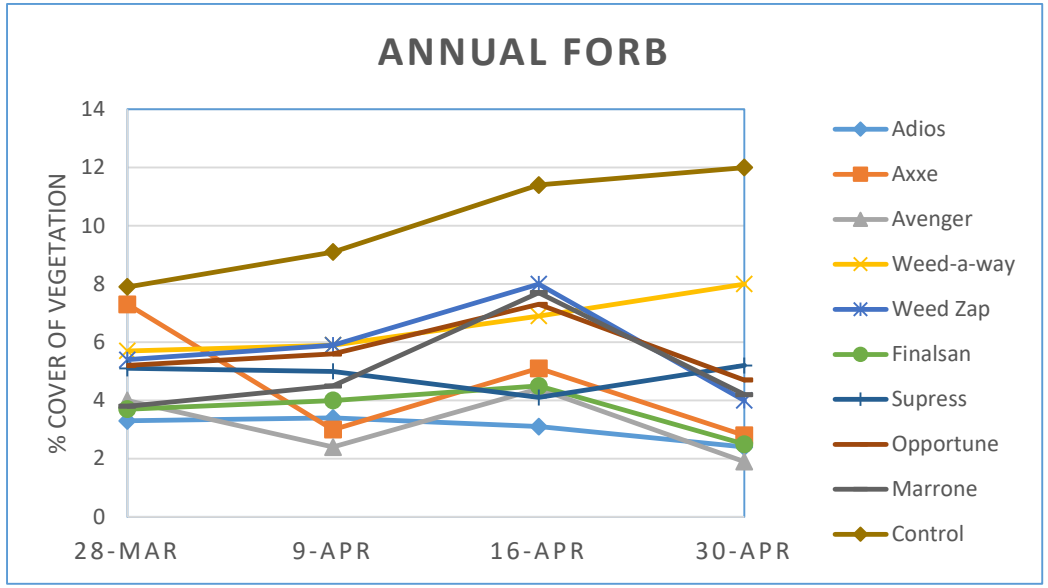
Finalsan
Supress
Opportune
Marrone Microbial Extract
Untreated Control

Figure 2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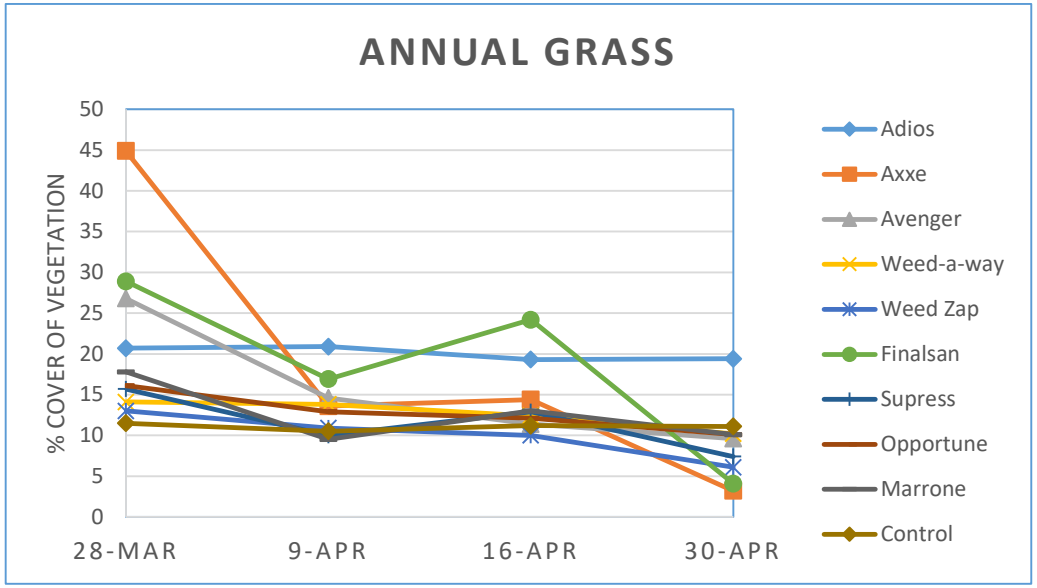
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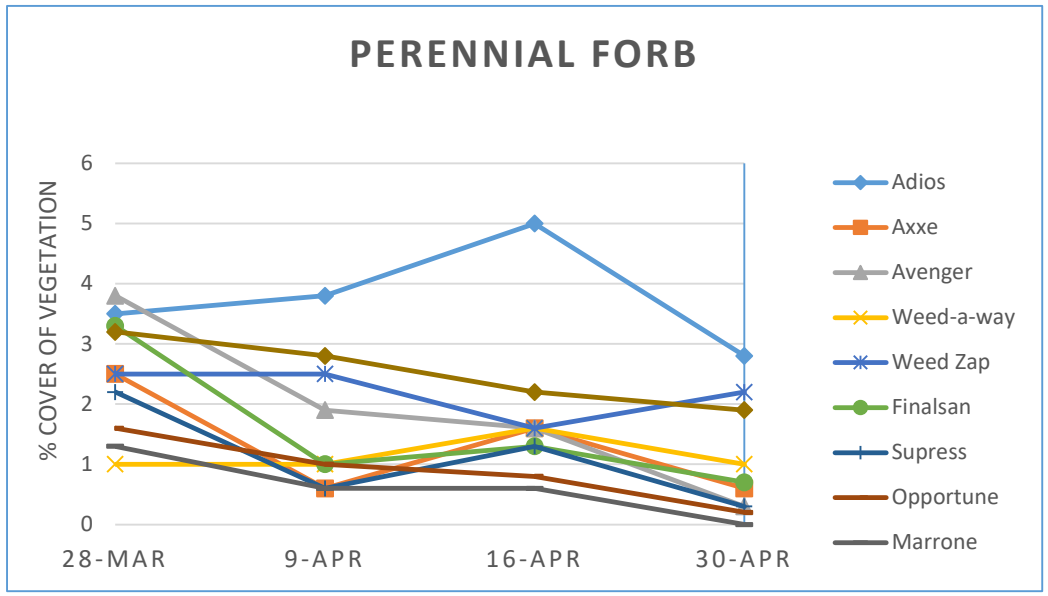
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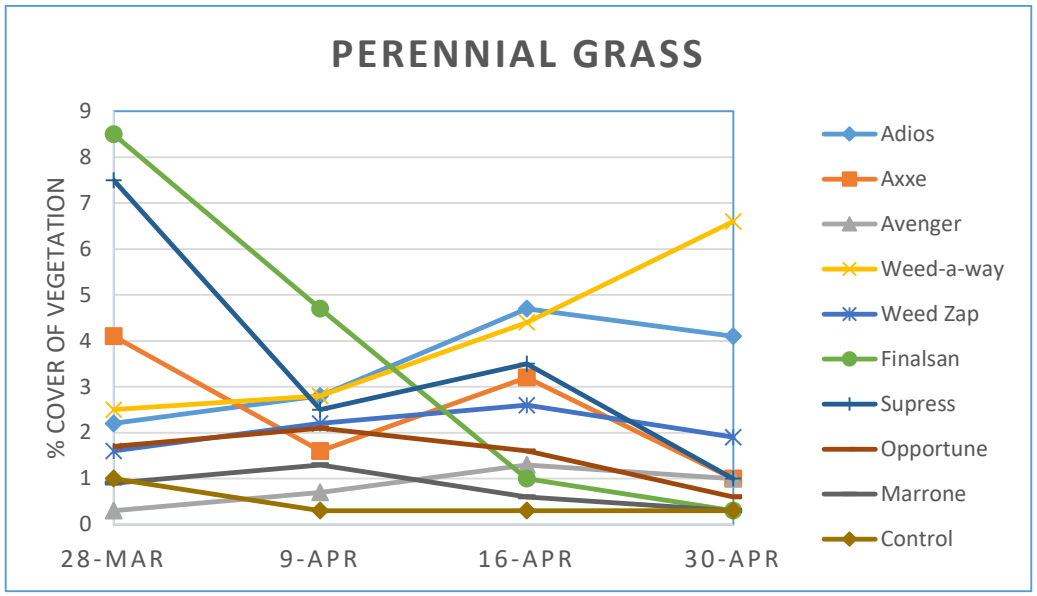
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October 2018

NID Integrated Vegetation Management Pilot Project

DRAFT Phase II Plan

The IVM team has begun planning for Phase II, which will be implemented in fall 2018. Many of the Phase I treatments will be tested again. Conducting Phase II in this way—applying the same treatments on a variety of different sites during an optimal window in the growing season—will allow the team to fine-tune vegetation management practices and obtain a robust dataset to inform future decisions.

The team has identified study locations, and is currently working to obtain land owner permission. The details regarding products and approaches to be tested, as well as monitoring and data collection, are provided below.

Phase II Field Study

Phase II of the study will begin soon after the first significant rains of the fall of 2018. As with Phase I, a range of organic herbicides will be tested (including many that were used in the initial phase), along with several mechanical treatments, including an abrasion tool, mowing, and the high-heat steam unit (from Weedtechnics), which was not available during Phase I. Flaming (with a Sunburst unit) and goat grazing may also be tested as well.

Organic herbicides to be tested include:

1. Axxe (Ammonium Nonanoate)
2. Avenger Concentrate (d-limonene)
3. Finalsan (Ammonium Soap)
4. Suppress EC (Cupressic Acid)
5. Opportune (Pre-emergent application)
6. Axxe + Opportune (Post application)
7. EcoBlend Organic Weed and Grass Killer (soybean oil, soap, coconut oil, acetic acid)
8. Weed Slayer (clove oil, molasses)
9. Phydura (citric acid, clove oil, malic acid)

Phase II testing will involve top-of-the-berm and inner bank treatments down to the waterline on three sites and seed and plug planting on four sites (see site information below).

Phase II will include test plots of low-height native vegetation, which should outcompete less desirable plants and manage erosion issues on canals with decomposed granite. NID has ordered plugs and seeds that are appropriate for our region and needs from Hedgerow Farms. These will be planted at four locations along canal side slopes, from the waterline up to the edge of the berm (see attached document *Recommended Procedures for NID Canal Vegetation Establishment* for more detail).

The layout of the plots and the locations of the replicates will be designed to ensure that the study can provide scientifically and technically defensible information. There will be four replicates of each organic herbicide and mechanical treatment and three replicates of the plots with native plant plugs and seeds.

Testing Locations

Testing will occur on four sites:

1. Newtown (planting and organic herbicide treatments)
2. Gold Hill (two different locations – organic herbicides and planting)
3. Miller (organic herbicides and planting)
4. AR II canal (planting only – Wise Road and Garden Bar)

Monitoring and Data Analysis

Phase 2 data collection will follow the same strategy as Phase 1. The monitoring protocol documents are attached and provide further detail. The data analysis will include a Phase 2 standalone assessment and combined analysis of both phases.

NID Vegetation Monitoring Protocol for Herbicide Alternatives -Phase 2

Updated 9-24-2018

For each overall site a complete species list will be maintained.

During each visit, one data sheet for each plot will be completed that will include: plot number, date, observers' names, location, weather, and visit number. Data sheets will also include the top two dominant species and their percentage of cover in the 10' by 10' plot and cover of organic (dead material), bare soil, and rocks/gravel.

Site visits will occur within 2 days before spray treatment and at approximately day 7, 14, 28, 45, 60.

A photo will be taken of each plot during each visit, from the center of the berm and face the canal water line. The photo will include the plot number and date.

Sample Quadrat Vegetation

Vegetation will be recorded in two 24" square quadrats in the center of plot and at the center at the waterline (Figure 1). Every plant species rooted within each quadrat will be recorded by percentage of species leaf cover. If species name is not known, a reference place holder name will be used or it will be placed in one of the established plant groups used for analysis. Average height estimate for each quadrat surveyed will be noted.

Overall Condition of Test Plot

Current condition or "Percent Control" of each plot will be determined by selecting one option from the chart below during each site visit.

Check One Box	% Impact	Observed Effect
	0%	No effect.
	10%	Minor plant stunting or curling of leaves and stems.
	20%	Stunting or curling is more pronounced and plant is still mostly green.
	30%	Leaf margin or chlorosis increase to approximately 1/3 of plant surface.
	40%	Symptoms have increased with more severe leaf chlorosis but affecting less than 50% of plant surface or population in the treatment area.
	50%	Approximately half of the weeds present in the treatment area display stunting, curling, chlorosis, and/or necrosis on 50% of the plant leaves or stems.
	60%	Slightly more than half of the weed population present in the treatment area display severe chlorosis or necrosis.
	70%	Chlorosis and/or necrosis symptoms now present on most plants but still about 30% of plant tissue is green.
	80%	Symptoms have expanded or increased to a majority of plants present but some still functioning tissue.
	90%	A majority of plants in the treatment zone are displaying complete mortality but a few remaining plants have not been completely killed.
	100%	All plants in treatment area are completely affected by the treatment and are dead.

Recommended Procedures for NID Canal Vegetation Establishment

October 2018

Introduction

Establishment of vegetation in ditch canals is recommended for weed suppression, soil stabilization, and ecological benefits. The following provides a preliminary description of the suggested planning, site preparation, seeding, plug planting, maintenance, and monitoring procedures for vegetation establishment.

Planning

- Estimate area to be vegetated. In 2018, vegetation will only be implemented to the inside of the canal bank and not on the berm or access trail (top of canal).
- Determine species to be used. To maximize weed suppression, soil stabilization, and ecological benefits Plant selection should focus on plants with stabilizing roots, low growth, known regional performance, and perennial species.
- Source and order plant material well in advance. Determine plug spacing and seeding rates. In 2018 we will plant plugs at 8” on center. Seeding rates vary by species and desired effect.

Site preparation

- Mow or weed-eat planting site, if possible, with the goal of clearing and reducing organic matter in seeding/planting zone before vegetation establishment. Pull back organic vegetation (i.e., rake sticks and leaves) to assure seed to soil contact, easier planting medium, and make the job easier.
- Pre-treatment with herbicides can increase success where mid to early fall germination of weedy annual plants occur and there is a longer winter growing period (i.e., the low elevation central valley influenced sites). This pretreatment is dependent on annual precipitation patterns, which vary. Where soils are colder through the winter (i.e., sites above 2,000 feet elevation) seeding should be initiated as early as possible and mowing preparation is recommended.

Seeding

- Wait to seed until the soil is workable by the fall rain cycle. Saturation should penetrate to a depth of 2” or more.
- Prepare seed bed by creating light furrows, scratched with a rake, or using a hoe treatment that can evenly penetrate soil by ¼” to 2”.
- Spread seed evenly and rake over lightly to accomplish seed to soil contact. If soils seem very loose, consider tamping down with the back of a flat shovel, a McLeod, or a tamper tool.

Planting Plugs

- Plant plugs when anticipating a soaking rain event and when moisture in the planting area has reached a depth of 2” to 4” from previous rain events or hand watering.

- Using a long Dibbler stick and/or hand planter tool, plant evenly- spaced plugs with offset pattern from the water line to top of berm.

Maintenance

- Manage weeds as soon as possible. Hand/mechanical weeding can be the most effective method in reducing competition.
- Emergency spring watering can increase success of seedling and plugs when spring precipitation is low or temperatures are consistently high in early spring.
- Grazing animals should be excluded for at least the majority of the first year of establishment.
- After direct seeding, only spot treatment of herbicides is recommended for the first year.
- In future years, research shows that broadcast-spraying over established perennial bunchgrasses and perennial sedges can reduce annual grasses, while not being detrimental to desired species.
- Mowing and or spot-weed treatment with a weed-eater should be implemented before annual grasses and other weedy species go to seed.

Monitoring

- Create a species list for each location.
- Establish photo plot points.
- Complete on-going vegetation sampling that includes analysis of species composition based on percent basil leaf cover, plant height, and overall condition of each plot.