ROCKY MOUNTAIN ECOLOGICAL SERVICES, INC.
NEPA••WILDLIFE••VEGETATION••WILDFIRE MITIGATION••WETLANDS••PLANNING

Vegetation Management Plan

for the

Carbondale Nature Park

Town of Carbondale, Public Works Department

March, 2008

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1 SUMMARY

The Carbondale Nature Park was recently purchased by the Town of Carbondale as open space for community use. The town's elected officials are interested in managing this piece of property as 'passive open space' as desired by the town's residents. Management of the property will strive toward proper vegetation composition, structure and health in order to engender a healthy ecosystem, and provide a natural setting for visitors.

During an initial survey of the property completed in August of 2007 by Rocky Mountain Ecological Services, several priority vegetation elements were noted within the park that are in need of protection and/or management. First, the ubiquitous presence of noxious weeds within the park presents the largest obstacle to a healthy ecosystem function. Several actions should be undertaken to effectively manage noxious weeds. A comprehensive weed survey will need to be completed to fully understand the extent of the problem and to formulate a sensible and effective weed control program. It will also be important to implement education programs and other steps to reduce and/or cease the introduction of noxious weeds to the park. Second, the Ute Ladies' Tresses orchid (*Spiranthes diluvialis*), a federally listed threatened plant is present on the property. As per the US Fish and Wildlife Service (USFWS), it is required by law to protect this plant and not allow destruction or deterioration of its habitat or any unpermitted 'taking' of the plant. For this reason, it will be desirable to fence the small wetland area where this plant is found on the property to deter disturbance to its habitat or any over zealous wildflower collectors.

Recommendations for an effective vegetation management program include the prevention of noxious weed introduction and spread, options for noxious weed control, and revegetation suggestions.

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2 EXISTING CONDITIONS

2.1 Historical Use and Habitat

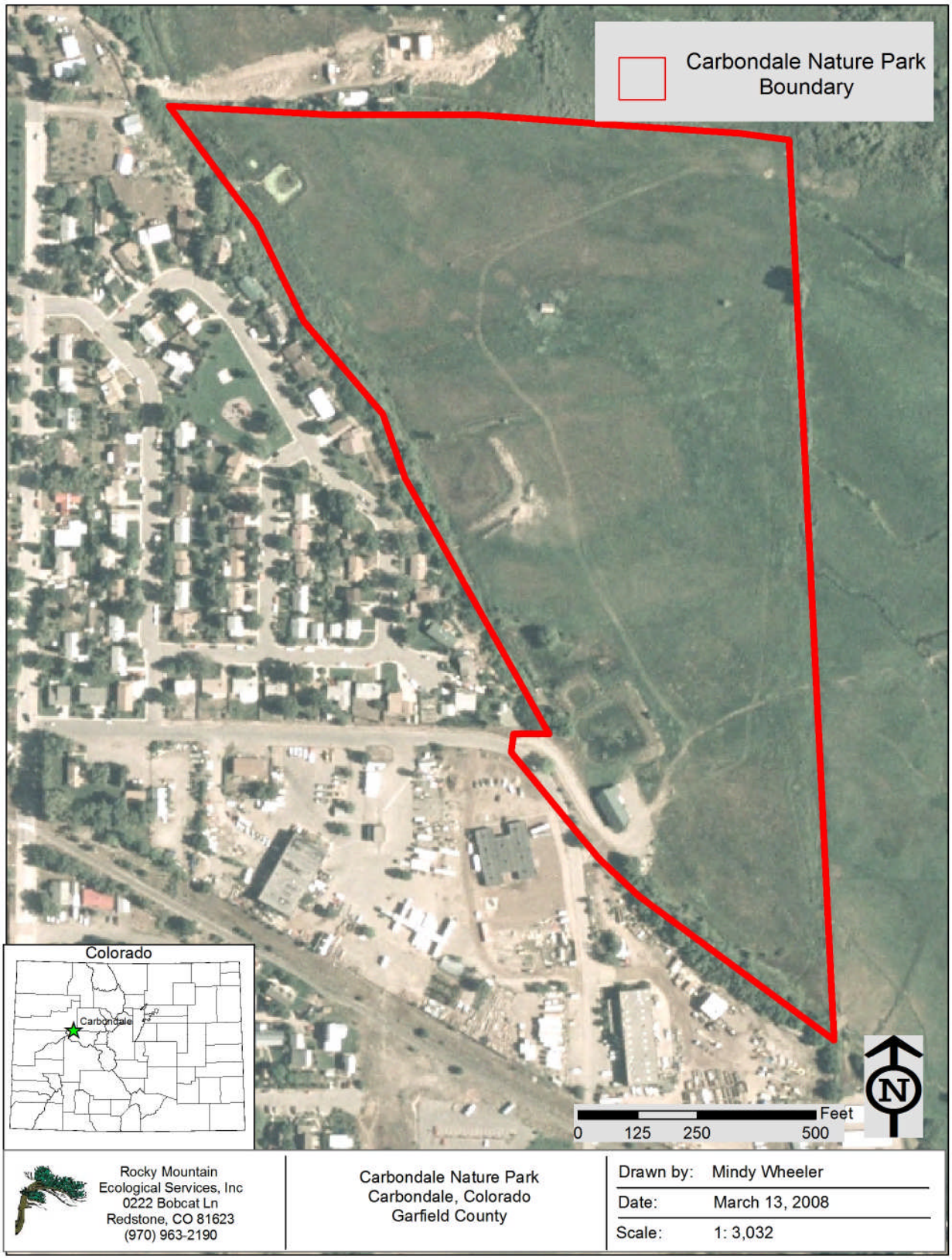
Figure 1 shows the location and the boundary of the Carbondale Nature Park. The entire property was historically used for irrigated hay and alfalfa production as well as livestock grazing. The area has been flood irrigated in the past to support this use via ditches that tie into the Roaring Fork River. The property retains these water rights today. It is unknown if other agricultural crops were produced on the site previous to the current hay/alfalfa production.

Irrigated Meadows of the Carbondale Nature Park

In the fall of 2001, a small area in the southwest corner of the property was used for a wetland mitigation site by the Town for wetlands disturbed as a result of the construction of the water treatment plant. An area about 14,000 square feet (120 ft X 120 ft) was excacated to ground water level (about 3 feet) to create wetland habitat. In the spring of 2002, the area was planted with several wetland plant species such as bulrush (*Schoenoplectus pungens),* beaked sedge (*Carex utriculata*), water sedge (*Carex aquatilus*), several rushes (*Juncus balticus, J. ensifolius, J. torreyi*), and some shrubs such as willow (*Salix monticola* and *S. drummondii*), and red-osier dogwood (*Swida sericea*). The wetland habitat created is considered a success as the area is exhibiting all the characteristics of a properly functioning wetland. However, the excavated soil from the area still sits on the property and is not particularly aesthetically pleasing, and is dominated by noxious weeds and ruderal plant species.

Created wetlands on site

2.2 FIGURE 1: MAP OF CARBONDALE NATURE PARK



3 VEGETATION MANAGEMENT RECOMMENDATIONS

The noxious weeds on the property pose a threat to the integrity of the natural vegetation communities. This section provides background information regarding noxious weeds, will outline specific goals for the property, and give suggestions for effective management.

In order to define the purpose and objectives of weed management, it is essential to define the problem as clearly as possible to set and achieve aggressive yet feasible management goals. It is a well documented fact that noxious and invasive weeds pose a significant threat to native ecosystems. It has been documented that the United States is losing 4,600 acres (10 square miles) per day as noxious weeds make large tracts of land inhospitable for any beneficial use (Westbrooks, 1998). As these non-native populations grow, the amount of effort, time and money also increases exponentially to restore these areas to a functioning native ecosystem. As such, it is imperative to utilize all methods available to control current weed infestations, prevent new infestations and protect non-infested lands.

The prioritization of weed management efforts is based upon many factors which will be discussed. However, the level of weed management is often dictated by available funds, therefore it is necessary to strategize so that weed management efforts are done in the most efficient and cost effective manner possible given monetary constraints.

According to the State Noxious Weed Act, counties may enforce the control of designated species. The species found at Carbondale Nature Park that are on the Garfield County noxious weed list require control as mandated by the weed law. The Colorado State Weed List was recently revised, and the state has made the 'A' list the top priority species. List A species are those that are not yet impacting Colorado greatly, but that have the potential to do so. The Town of Carbondale staff should become well acquainted with all 'A' list species so that any future infestations can be recognized and controlled quickly. See **Appendix I** for the Colorado State Weed List.

3.1 WEED SURVEY

It is difficult to lay out objectives and goals of any weed management plan without first knowing in detail the extent of the problem. Any first step of an effective weed control program should include a comprehensive weed survey on the property in question to fully understand the problem. A weed survey will yield information such as the various weed species present, where they are located, and how large and how dense each infestation is. This type of information is essential to assure the most effective control methods for each weed can be used. The data provided by an initial weed survey can also serve as the baseline for an accurate and valuable weed management monitoring program that will allow a dynamic weed control program that can be modified and monitored with changes in the program as needed.

The North American Weed Management Association (NAWMA) has produced mapping standards for noxious weeds and posts the protocol on their website (http://www.nawma.org/). It is most beneficial to use a GPS and put the mapping data

into a GIS system to be able to more easily share the data with others as well as to be able to see the overall issue at one time.

3.1.2 Prioritization of Weed Control

Once the full extent of the problem is known through the weed survey, the distribution of weeds at a site is an important factor in prioritizing weeds for management activities. Steven Dewey of Utah State University uses a wildfire analogy to describe weed spread. In this model, small, isolated patches of weeds are the 'hot spots' of the wildfire and need to be higher priority than very large, well-established infestations. Smaller, newly discovered patches are easier to eradicate because there are fewer plants, there is a smaller soil seed bank, and the weed has not yet had time to form an extensive root system with a large energy reserve.

For these reasons, high priority should be given to:

- Weeds that are new or relatively uncommon to the region.
- Small infestations of species known to be highly invasive.
- Infestations likely to spread to other areas such as road sides, trail sides, and drainages.
- Edges of large infestations.
- Weeds near high quality natural resource areas.

Lower priority will be given to:

- Large established infestations that would be difficult to eradicate.
- Less invasive species that only infest highly disturbed areas.

Table 1 provides an initial breakdown of how species should be prioritized for weed management. However, this table could be modified if the weed survey reveals additional species or a weed patch that severely threatens natural resources within the park. It should be noted however, that within each species, specific patches exist that may be considered priority patches. For example, although Canada thistle is medium priority as a SPECIES, very small isolated patches should be considered high priority for control. A small patch of Canada thistle can be eradicated before it becomes established and spreads, thus the formation of a large patch can be prevented. The prevention of small patches from becoming large, uncontrollable patches should be a primary goal of any weed management plan.

Table 1: Noxious weeds found at Carbondale Nature Park

Common Name	Latin Name	Priority	State Noxious List
Yellow toadflax	*Linaria vulgaris*	1	B
Absinth wormwood (?)	*Artemisia absinthium*	1	B
Oxeye daisy	*Chrysanthemum leucanthemum*	2	B
Plumeless thistle	*Carduus acanthoides*	2	B
Musk thistle	*Carduus nutans*	2	B
Canada thistle	*Breea arvense*	2	B
Hounds tongue	*Cynoglossum officinale*	2	B
TOTAL			

Additionally, regular communication with the Garfield and Pitkin County weed program can be helpful to become aware of the potential invaders in the area. Their contact number is (970) 625-8601, and (970) 920-5214 respectively.

3.1.3 Prevention

In addition to controlling noxious weeds already present at the park, it will be of utmost importance to try to prevent additional and/or new infestations. For successful long-term weed prevention and control, it is essential to determine the management practices that cause or contribute to the weed infestation and to cease those practices.

Prevention is widely recognized to be the most effective, least costly and most environmentally sensitive weed control method. Prevention aspects include steps that limit weed seed introduction and dispersal, minimizing soil disturbance, and education of land management staff and park visitors. In addition, healthy plant communities are vital to preventing weed infestations. Healthy, established plant communities are more difficult for weeds to invade. As such, intact and healthy plant communities should be identified to help prioritize and plan weed prevention efforts. Effective weed management must also include consideration of the impacts management decisions will have on plant communities (e.g. trail and facility design and construction, etc).

Given that noxious weed infestations begin with seed introduction and subsequent establishment, an effective prevention program must contain the following components:

1) Limit introduction and dispersal of weed seeds.

Vehicles, people, and animals, as well as water and wind, are vectors for seed dispersal. While the park cannot practically control the movements of wildlife, measures can be taken to minimize the spread of noxious weed seed by people, vehicles, and domestic animals. For example, houndstongue seed is dispersed by any animal or person that comes in contact with it when it is in seed. The seeds have barbs on them that readily attach to almost anything. Visitors should be able to recognize the plant and its seeds separately and know they should pick their clothing and pets clean of these seeds before they go for a walk in the park as well as to put the seeds in the garbage if they pick find some on their pets or clothing after the walk. **Figure 2** shows the propensity of these seeds to disperse themselves.

Figure 2. Houndstongue seed on a hiker's clothes

2) Limit disturbance from management activities and revegetate after unavoidable disturbances.

As a rule of thumb, new construction should always be followed by revegetation and preceded by weed control if it is needed. Try not to disturb land that is already infested with weeds, as the disturbance will most likely make the weed situation much worse. Plan ahead to make weed control preceding construction and revegetation post-construction as part of the process and budget to reduce maintenance costs for weed control in the long run. Include weed control, revegetation costs, labor requirements, and follow up maintenance in construction planning and estimates.

3) Maintain and improve existing native plant communities.

Healthy, established plant communities are more difficult for weeds to invade (Belsky and Gelbard, 2000). Consideration must be given to the potential impacts management decisions will have on plant communities. Healthy vegetation communities should be identified and mapped to prioritize and plan vegetation management and weed prevention efforts. In any case, management decisions should consider preventing and limiting soil disturbance, seed vectors, and spread of weed patches to attempt to prevent weed infestations.

4) Educate staff, managers, and home owners about noxious weeds.

Education is an important and cost effective method of preventing the introduction and spread of exotic weeds and should be a vital component of the Nature Park's weed control program.

3.1.4 Control of Existing Infestations

The best technique (or techniques) for managing a given weed infestation is dependent on many factors: access, growth form of the weed species (e.g. annual, biennial or perennial), size of the weed patch, and proximity of the weed patch to sensitive areas (water sources, rare plant or animal habitat, etc), and the weather and temperature at the time of control. In addition, other considerations that will determine how weeds are managed include availability of labor, time, and financial resources. The techniques for managing weeds can be a combination of mechanical (e.g. pulling, mowing and cutting), cultural controls (e.g. maintaining native plant communities, fire, reseeding, livestock grazing), biological control agents, and herbicides.

Biological Controls

Biological controls can play an important role in integrated weed management. However, biological controls are not available for every noxious weed, and can rarely be the only form of control for a weed infestation. A weed plan is most effective then it combines chemical, mechanical and biological controls for higher success. Contact the state insectaria at (866) 324-2963 for further information, or fill out the request form at: http://www.ag.state.co.us/requestabug/ to receive biological controls from the insectary.

It is important to keep track of where the biological controls were released to avoid spraying them with herbicides when they are active. It is recommended to take a GPS point at the location of release and add that to the property's weed database.

Integrated Weed Management

The following pages have detailed information regarding the noxious weeds present at the Carbondale Nature Park and options for control. **BE SURE TO READ, UNDERSTAND AND FOLLOW ALL HERBICIDE LABELS – IT IS THE LAW**

Yellow Toadflax (*Linaria vulgaris*)
Yellow toadflax is a perennial that can reach up to 2 feet in height. The plant reproduces both by seed and vegetative propagation. Once established, high seed production and the ability for vegetative reproduction allow for rapid spread and high persistence

Integrated control: In order to control yellow toadflax, it is essential to eliminate or greatly reduce seed production from established individuals and to destroy toadflax seedlings that

arise from the soil seed bank before these plants become established.

Chemical control: Promising results have been realized by applying herbicide just after a frost in the fall or during flowering when the plant reserves are low. Picloram (Tordon) applied at 2 quarts/acre has been shown to provide the most control in some areas. However, it is important to consider soil type when using this herbicide, since leaching of the herbicide is more likely on sites with sandy soils or on soils low in organic matter. As a result, Tordon should not be used where the groundwater is shallow. Telar® is another option at 1.5 oz/acre applied in the fall. Chemical control is usually the most effective and cost-efficient control for yellow-toadflax.

Cultural Control: Fire is not recommended for control of yellow toadflax. As with all weed management programs, it will likely be necessary to reseed and/or replant with native species after control of yellow toadflax to provide competition for any remaining toadflax plants or viable seeds. See the **Section 3.2** below for recommended seed mixes for this area.

Mechanical control: Cutting or removal of the above ground portion of toadflax plants reduces the current year growth, but it will not kill them. Cutting toadflax stands in spring or early summer is an effective way to eliminate plant reproduction from seed production and dispersal. However, the long dormancy of toadflax seeds requires that the process be repeated annually for up to ten years.

Oxeye Daisy (*Chrysanthemum leucanthemum*)

Oxeye daisy is a deceivingly beautiful flower whose stems grow 1 to 3 feet tall and are smooth and sometimes branch near the top. Leaves progressively decrease in size upward on the stem. The plant is a prolific seed producer; it has been shown that a single plant can produce up to 26,000 seeds. Reproduction occurs primarily through seed, although spreading rootstalks also contribute to its propagation. Flowering occurs from June through August

Integrated control: Some key points to oxeye daisy control include providing competition from a healthy plant community and/or preventing seed production. Integrated treatments have included nitrogen fertilization, sheep or goat grazing; and herbicide application. Nitrogen fertilizer stimulates other vegetation that can out-compete daisy plants for nitrogen which grow taller and shade out the daisy.

Chemical control: Herbicides that has been effective on this weed include Milestone®, Redeem®, and Escort®. Contact the Garfield County weed supervisor or you local extension agent for the most up to date information on chemical control of oxeye daisy.

Mechanical control: Oxeye daisy can be mowed as soon as flowers appear to reduce seed production. However, mowing needs to be repeated during a long growing season because it may stimulate shoot production and subsequent flowering. Root systems are shallow and the plant can be dug up and removed. However, the entire root system needs to be

removed as remaining roots may produce new shoots. Hand removal will have to be continued for several years because seeds may remain viable in the soil for a long time.

Cultural Control: Fire is not recommended for control of oxeye daisy. As with all weed management programs, it will likely be necessary to reseed and/or replant with native species after control of oxeye daisy to provide competition for any remaining oxeye daisy plants or viable seeds. See the **Section 3.2** for recommended seed mixes for this area.

Biological control: No biological controls have been discovered for oxeye daisy.

Musk Thistle (*Carduus nutans*)

Musk thistle is a biennial and therefore puts much of its energy into seed production; therefore, the key to managing musk thistle is to prevent seed production. A single musk thistle plant can produce up to 11,000 seeds per plant per year, and these seeds are viable in the soil for up to 10 years. Due to the long seed viability of musk thistle, control methods may have to be repeated for many years to completely eliminate a stand.

Integrated control: It is possible to repeatedly cut and bag flowering stalks at the base of the plant during the summer and apply Milestone® to rosettes in the fall. It is likely this may have to be repeated several times over the growing season. It is also possible to apply Milestone®, Redeem®, or Transline®, to rosettes in the spring. Fire is not recommended as a method of control for musk thistle

Chemical: Milestone®, Redeem®, or Transline® have shown to be effective on musk thistle. The most effective chemical control occurs when musk thistle is still in the rosette stage, as herbicide tolerance increases once the plant has bolted. Escort® and Telar® are also effective when applied in spring on bolting plants.

Biocontrol: *Rhinocyllus conicus* beetles and *Trichosirocalus horridus* have both been introduced as bio-controls for musk thistle. These bio-controls are relatively widespread throughout Colorado and are likely in the area. Both have documented cases of moving to non-target species and are already found widely throughout Colorado.

Plumeless Thistle (*Carduus acanthoides*)

Plumeless thistle is closely related to musk thistle. Plumeless thistle is also a biennial that produces large amounts of seed. Plumeless thistle rosettes are distinguished from musk thistle rosettes because the leaves are deeply serrated almost to the midrib, whereas musk rosettes are not that deeply serrated.

Control: Control methods for plumeless thistle are identical to those for musk thistle.

Houndstongue (*Cynoglossum officinale*)

Houndstongue is a biennial or short-lived perennial that invades disturbed areas. Houndstongue reproduces solely by seed. Each flower produces 4 seeds that are armed with velcro-like barbs that attach themselves to all potential seed dispersers (wildlife, pets, humans, etc).

Houndstongue rosette

Integrated control: A combination of maintenance of a healthy vegetation communities, measures to prevent seed production and herbicide application is a good integrated program for slowing the spread of houndstongue.

Houndstongue plant

Chemical: Telar® or Escort® are effective herbicides for the control of houndstongue. Apply herbicides early in the spring when the plants are still in the rosette stage to prevent seed production.

Mechanical: Mowing or clipping plants as they are flowering before they go to seed will reduce seed production.

Biocontrol: At present, there is no biocontrol known for houndstongue.

Canada Thistle (*Cirsium (Breea) arvense*)

Canada thistle is a colony forming perennial from deep and extensive horizontal roots. Control efforts should include stressing the plant to deplete root reserves. Priority should be given to Canada thistle plants in high-quality vegetation communities, and then work on controlling lower quality areas. Management strategies should be adjusted to reflect environmental conditions. For example, drought stress reduces the effectiveness of most herbicides, but increases the effectiveness of mechanical controls (e.g., mowing or burning). Mowing also reduces seed spread.

Integrated control: In most situations, effective Canada thistle control involves the use of herbicides (see below). However, in situations of restricted root growth (e.g. highly compacted soils or high water tables); repeated mowing in addition to application of Milestone® may improve control. When damage to natives is a concern, consider spring burning to enhance the production of native species, and then cut or spot treat Canada thistle when it is at or beyond the bloom growth stage, usually late June.

Chemical: Milestone®, Redeem® or Transline®, applications in the summer when Canada thistle plants are in the bud to bloom stages. Telar® or Milestone® can be applied in the fall when Canada thistle is actively storing reserves in its roots.

Biocontrols: *Urophora cardui*, has been released to help combat Canada thistle. This gall forming fly has become established in Colorado and is available on a very limited basis upon request. Check with Colorado Division of Conservation Services, State Insectary for updated information on the efficacy of this biological control agent.

Wetter areas: The tendency of this species to grow in wet areas may restrict the use of certain herbicides. June or July mowing or sheep/goat grazing can be effective combined with herbicide treatment by aquatically approved 2,4D amine, Rodeo®, or a mix of Garlon 3A® and aquatically approved 2,4-D. These aquatically approved herbicides can be used in wetland areas and is effective when applied in mid-summer to fall.

Absinth Wormwood (*Artemisia absinthium*)

Absinth wormwood is a perennial that can be easily recognized by its grayish sage color and its strong odor. Absinth generally becomes established in disturbed areas and produces abundant seed so it can spread easily. Allelopathy has been demonstrated in *A. absinthium*, a phenomena that makes the soil inhospitable for other species.

Integrated Control: Burning is not recommended for control of absinth wormwood. As with control of all weedy species, it is especially important to seed the area after control efforts to provide competition for the weed. Some applicators note a strong flush of seedlings of this weed immediately after control of the larger plants. It will be very important to keep treating this weed and to try to establish some competitive vegetation cover with native grasses.

Chemical Control: Absinth can be controlled with herbicides. Those most commonly used include picloram (Tordon®), and triclopyr (Garlon 3A®). The most effective time to treat this weed is in the spring (May-June).

Biological Control: At present, there is no bio-control available for this plant.

3.1.1 Table 2: Control calendar for weeds.

Weed Species	Spring (April to Mid-June)	Summer (Mid-June to August)	Fall (September and October)
Canada Thistle	Use herbicide on rosettes, (Milestone®). If possible, mow large patches once plants have reached about a foot in height.	If possible, mow or cut patches monthly through the summer.	Apply Milestone® or Telar® to all patches in October or about a month after the last mowing.
Plumeless thistle/ Musk thistle	Small plants and infestations can be hand pulled with some success. Careful foliar application can be done in the spring if rosettes are up and recognizable.	Apply Milestone® or Redeem® to rosettes. Continue to cut seed heads through summer.	Revegetate where large infestations have been treated to increase competition to thistle seedlings.
Hounds Tongue	Use Escort® or other broad-leaf specific herbicides on rosettes.	Mow bolted plants prior to seed production.	Plant controlled areas with native perennials to prevent reestablishment of weeds.
Oxeye daisy	Target rosettes with herbicide (Milestone®).	Continue to treat plants with herbicide.	Revegetate areas that have been treated and/or fertilize the area to increase competition for the daisy seedlings.
Absinth Wormwood	Treat the absinth in its 'elongation' stage (mid to late spring) with Garlon 3A®.		Revegetate areas that have been treated with a temporary mix until the absinth population is sufficiently low to reseed with the permanent mix.
Yellow toadflax	If seedlings are visible and identifiable, small infestations can be pulled.	Small infestations can continue to be pulled before seed production, the populations that are flowering can be treated with herbicide	Flowering populations can continue to be treated with herbicide well into the fall after the first frost.

3.2 REVEGETATION/ CREATION OF NATIVE VEGETATION COMMUNITIES

Successful weed control programs include a sizeable budget for revegetation of the area formerly occupied by noxious weeds. If revegetation is not part of the management plan, noxious weeds will proliferate rampantly. A healthy native vegetation community is better able to resist invasion by noxious weeds. Therefore, revegetation efforts need to use similar native plant species found in the area. Revegetation should also occur as soon as possible following treatment. If an area has been treated with herbicides, refer to the label on the herbicide to determine how soon after treatment reseeding is recommended (herbicides have varying residence time in the soils).

Berms around wetland area

When the wetland was created in the southwest region of the park, the excavated soil was left on site. These berms and piles have created an unnatural aesthetic to the park in the area. These berms can be moved, re-shaped and/or graded in such a way to create a more natural aesthetic in the park. To keep costs low, the excess soil from the berm can be graded in such a way to create interesting and desirable micro topography for seeds and/or plants. Small and large depressions (anywhere from 1 inch across and very shallow to 18 inches across and 6 to 12 inches deep) can help to collect and hold moisture for seed germination, plant establishment and growth. If shrubs or other woody vegetation are desired for the newly shaped berm, these should be planted and irrigated for up to two or three growing seasons (time needed for the roots to reach groundwater) before the remainder of the area is seeded. Some appropriate species for planting could include:

Wood's Rose (*Rosa woodsii*) – Plant at 5-6 feet intervals
Golden currant (*Ribes aureum*) – Plant at 5-6 foot intervals
Silverberry (*Sheperdia argentea*) – Plant at 10-12 foot intervals

Narrowleaf cottonwood (*Populus angustifolia*) – If it is possible to find large enough trees and dig a small hole with a Stinger (http://plant-materials.nrcs.usda.gov/pubs/idpmctn60694.pdf) , it may be feasible to install the cottonwood directly into the groundwater. Spacing for cottonwoods should be at least 15 feet apart.

A suggested seed mix for a newly shaped berm is:

Common name	Scientific name	Variety	lbs	# seeds/ lb	total # seeds	% of mix
Mtn brome	*Bromus marginatus*	Garnet	4	90,000	360,000	21
Big bluegrass	*Poa ampla*		0.25	882,000	220,500	14
Streambank wheatgrass	*Elymus lanceolatus ssp psammophilus*	Sodar	3	156000	468,000	27
Slender wheatgrass	*Elymus trachycaulus*	Pryor	3	159,000	477,000	28
Rocky Mtn penstemon	*Penstemon strictus*		0.3	592,000	177,600	10
	Total PLS lbs/acre	11				
	# seeds/sq ft	39				

Furthermore, if herbicide treatment is expected to continue for a number of years, it is recommended to seed mostly short-lived native perennial grasses mixed with a cover crop. Grasses will not be susceptible to most herbicides and will provide the competition to keep noxious weeds at bay. Additionally, these grasses establish quickly, but will yield to the native longer lived perennial species of the area. An example of such a mix includes:

Common name	Scientific name	Variety	lbs	# seeds/ lb	total # seeds	% of mix
Mountain brome	*Bromus marginatus*	Garnet	5	90,000	450,000	40
Slender wheatgrass	*Elymus trachycaulus*	Pryor	3	159,000	477,000	43
Barley	*Hordeum vulgare*		15	12,500	187,500	16
	Total PLS lbs/acre	23				
	# seeds/sq ft	26				

After seeding in the selected seed mix(es), the site should be mulched with certified weed-free straw, to a depth of approximately 2 inches. To keep straw from blowing away the straw should be sprayed with a tackifyer. A hydromulch may also be applied to the site, but the straw mulch will likely offer more protection for the native seedlings.

It is probable that the Town will opt to no longer irrigate much of the nature park. Thus, the pasture grasses that dominate the area now will likely not be able to survive without supplemental water. As a result, a series of steps will likely be needed to convert the area to species that will withstand the drier environment while maintaining the natural aesthetics of the park.

Before attempting to convert an area to a different vegetation community, it will be important to clear the area of noxious weeds as best as possible so as to not necessitate aggressive weed control in newly planted areas, although some level of weed control will likely always be needed. Additionally, it may in the best interest of park management to attempt to change vegetation types within the park in a stepwise manner, potentially an acre or two at a time. A large area where caring for new seedlings, weed control and management of park visitors to allow for successful revegetation can quickly become overwhelming.

Once the weeds have been sufficiently treated and controlled, it will likely be desirable to remove the pasture grasses in the late spring as best as possible with a couple of treatments with glyphosate (Rodeo®). Wait for about 14 days for the herbicide to take full effect, then mow the remainder of the grasses to within 2 inches of the ground if possible. The removal of the grasses will provide for an improved seed bed for desirable species. **Table 2** shows a potential seed mix for the desired dry meadow.

Table 2: Potential seed mix for non-irrigated meadow

Common name	Scientific name	Variety	lbs	# seeds/ lb	total # seeds	% of mix
GRASSES						
Western wheatgrass	*Pascopyrum smithii*	Critana	4	110000	440,000	23
Prairie junegrass	*Koeleria macrantha*		0.1	2,315,400	231,540	12
Mtn brome	*Bromus marginatus*	Garnet	3	90,000	270,000	14
Big bluegrass	*Poa ampla*		0.25	882,000	220,500	12
Slender wheatgrass	*Elymus trachycaulus*	Pryor	3	159,000	477,000	26
FORBS						
Yarrow	*Achillea millefolium*		0.02	2,770,000	55,400	3
American Vetch	*Vicia americana*		1	32,800	32,800	2
Aspen fleabane	*Erigeron speciosus*		0.1	1,600,000	160,000	8
	Total PLS lbs/acre	11				
	# seeds/sq ft	43				

Another option for the area could involve the addition of some varying vegetation structure within the park in specific areas. It may be possible to excavate areas down closer to the water table to plant some cottonwoods and/or some mesic shrubs. It may also be possible to construct a channel through the property to use the irrigation water and at the same time create a functioning riparian corridor. It will be necessary to first conduct a feasibility study if this option is found desirable by the Town.

4 REFERENCES

Sheley, R.,J. Petroff, M.. Borman, 1999. Introduction to Biology and Management of Noxious Rangeland Weeds, Corvallis, OR.

Weber, W.A and R.C. Whitman, 2001. Colorado Flora: Western Slope. 3rd Ed. University Press of Colorado, Boulder.

Westbrooks, R. 1998. Invasive plants, changing the landscape of America: Fact book. Federal Interagency Committee for the Management of Noxious and Exotic Weeds (FICMNEW). Washington, DC.

5 APPENDIX I – COLORADO STATE WEED LIST

State Noxious List	Latin Name	Common Name	Plant Code
A LIST			
A	*Alhagi pseidalhagi*	CAMELTHORN	ALPS3
A	*Centaurea pratensis*	MEADOW KNAPWEED	CEPR2
A	*Centaurea solstitialis*	YELLOW STARTHISTLE	CESO3
A	*Centaurea virgata*	SQUARROSE KNAPWEED	CEVI
A	*Chondrilla jundea*	RUSH SKELETONWEED	CHJU
A	*Crupina vulgaris*	COMMON CRUPINA	CRVU2
A	*Euphorbia cyparissias*	CYPRESS SPURGE	EUCY2
A	*Euphorbia mysinites*	MYRTLE SPURGE	EUMY2
A	*Hierarcium aurantiacum*	ORANGE HAWKWEED	
A	*Hydrilla verticillata*	HYDRILLA	HYVE3
A	*Isatis tinctoria*	DYER'S WOAD	ISTI
A	*Lespedeza cuneata*	SERICEA LESPEDEZA	LECU
A	*Lythrum salicaria*	PURPLE LOOSESTRIFE	LYSA2
A	*Peganum harmala*	AFRICAN RUE	PEHA
A	*Salvia aethiopis*	MEDITERRANEAN SAGE	SAAE
A	*Salvinia molesta*	GIANT SALVINIA	SAMO5
A	*Senecio jacobaea*	TANSY RAGWORT	SEJA
A	*Taeniatherum caput-medusae*	MEDUSAHEAD	TACA8
B LIST			
B	*Acroptilon repens*	KNAPWEED, RUSSIAN or CREEPING	ACRE3
B	*Anoda cristata*	SPURRED ANODA	ANCR2
B	*Anthemis arvensis*	CORN CHAMOMILLE	ANAR6
B	*Anthemis cotula*	MAYWEED CHAMOMILLE	ANCO2
B	*Artemisia absinthiun*	ABSINTH WORMWORD	ARAB3
B	*Cardaria draba*	WHITETOP, HOARY CRESS	CADR
B	*Carduus acanthoides*	THISTLE, PLUMELESS	CAAC
B	*Carduus nutans*	THISTLE, MUSK	CANU4
B	*Carum carvi*	WILD CAROWAY	CACA19
B	*Centaurea diffusa*	KNAPWEED, DIFFUSE	CEDI3
B	*Centaurea maculosa*	KNAPWEED, SPOTTED	CEMA4
B	*Chrysanthemum leucanthemum*	OXEYE DAISY	LEVU
B	*Cirsium arvense*	THISTLE, CANADA or CREEPING	CIAR4
B	*Cirsium vulgare*	BULL THISTLE	CIVU
B	*Clematis orientalis*	CHINESE CLEMATIS	CLOR
B	*Cynoglossum officinale*	HOUNDSTONGUE	CYOF
B	*Cyperus esculentus*	YELLOW NUTSEDGE	CYES
B	*Dipsacus fullonum*	COMMON TEASEL	DIFU2
B	*Dipsacus laciniatus*	CUTLEAF TEASEL	DILA4
B	*Elaeagnus angustifolia*	RUSSIAN OLIVE	ELAN
B	*Elytrigia repens*	QUACKGRASS	ELRE4
B	*Erodium cicutarium*	REDSTEM FILAREE	ERCI6

B	*Euphorbia esula*	SPURGE, LEAFY	EUES
B	*Hesperis matronalis*	DAME'S ROCKET	HEMA3
B	*Hibiscus trionum*	VENICE MALLOW	HITR
B	*Hieracium aurantiacum*	ORANGE HAWKWEED	HIAU
B	*Hyoscyamus niger*	BLACK HENBANE	HYNI
B	*Lepidium latifolium*	PERENNIAL PEPPERWEED	LELA4
B	*Linaria dalmatica*	BROAD-LEAVED DALMATION TOADFLAX	LIDA
B	*Linaria genistifolia*	NARROW-LEAVED DALMATION TOADFLAX	LIGE
B	*Linaria vulgaris*	TOADFLAX, YELLOW	LIVU2
B	*Matricaria perforata*	SCENTLESS CHAMOMILLE	MAPE2
B	*Myriophyllum spicatum*	EURASIAN WATERMILFOIL	MYSP2
B	*Onopordum acanthium*	SCOTCH THISTLE	ONAC
B	*Onopordum tauricum*	SCOTCH THISTLE	ONTA
B	*Potentilla recta*	SULFUR CINQUEFOIL	PORE5
B	*Saponaria officinalis*	BOUNCINGBET	SAOF4
B	*Tamarix chinensis, T.parviflora, and T. ramosissima*	SALT CEDAR	TACH2, TAPA4
B	*Tanacetum vulgare*	COMMON TANSY	TAVU
B	*Verbascum blattaria*	MOTH MULLEIN	VEBL
C LIST			
C	*Abutilon theophrasti*	VELVETLEAF	ABTH
C	*Aegilops cylindrical*	JOINTED GOATGRASS	AECY
C	*Arctium minus*	COMMON BURDOCK	ARMI2
C	*Bromus tectorum*	CHEATGRASS	BRTE
C	*Cichorium intybus*	CHICORY	CIIN
C	*Conium maculatum*	POISON HEMLOCK	COMA2
C	*Convolvulus arvensis*	BINDWEED, FIELD	COAR4
C	*Halogeton glomeratus*	HALOGETON	HAGL
C	*Hypericum perforatum*	ST. JOHNS WORT, COMMON	HYPE
C	*Panicum miliaceum*	WILD PROSO MILLET	PAMI2
C	*Sonchus arvensis*	PERENNIAL SOWTHISTLE	SOAR2
C	*Sorghum halepense*	JOHNSONGRASS	SOHA
C	*Tribulus terrestris*	PUNCTUREVINE	TRTE
C	*Verbascum thapsus*	COMMON MULLEIN	VETH