

INCOMPLETE DRAFT

RIO BLANCO COUNTY NOXIOUS WEED MANAGEMENT PLAN

Enactment Authority

The Undesirable Plant Management Act (CRS 35-5.5) was signed into state law in 1991 and amended in 1996. Now known as the Colorado Noxious Weed Act CRS Title 35 Article 5.5, it “declares that certain undesirable plants constitute a present threat to the continued economic and environmental value of the lands of the state and if present in any area of the state must be managed.” It also states that it is the duty of all persons to use integrated methods to manage noxious weeds if the same are likely to be materially damaging to the land of neighboring landowners. The act also requires that identified landowners shall submit an individual Integrated Weed Management (IWM) plan to control noxious weeds on their property. It further directs that the Board of County Commissioners of each county in the state shall adopt a Noxious Weed Management Plan for all unincorporated land within the county.

The Act directs the Board of County Commissioners to appoint a local advisory board, whose power and duties are threefold:

1. Develop recommended management criteria and IWM plans for managing designated noxious weeds.
2. Declare noxious weeds and any state noxious weeds designated by rule to be subject to integrated management; and
3. Recommend to the Board of County Commissioners that certain landowners be required to submit IWM plans for managing designated noxious weeds on their properties.

The jurisdictional area of the Rio Blanco County Board of Commissioners is all the unincorporated land in Rio Blanco County. This plan shall be referred to as the Rio Blanco County Noxious Weed Management Plan.

Jurisdiction and Scope of Plan

This plan shall apply to all subject lands within Rio Blanco County. It does not preclude the County from entering into intergovernmental agreements with other governmental entities towards managing noxious weeds under the Colorado Noxious Weed Act CRS 35-5.5. The Rio Blanco County Weed Department (RBCWD) is aware that the Federal Noxious Weed Act (1974), as amended by Section 15 (management of Undesirable plants on Federal Lands 1990), directs federal agencies to have an office or person trained to coordinate a noxious weed management program, to adequately fund the program, to implement cooperative agreements and to conduct IWM. It also directs that such agencies manage on Federal lands those noxious weeds that are designated in the County within which the Federal land lies. The RBCWD is aware that the State of Colorado Executive Order D 006 99 signed into order in 1999 states, “Principle departments and state agencies are required to manage noxious weeds on lands and public rights-of-way

subject to their jurisdiction (C.R.S. 35-5.5-110; C.R.S. 35-5.5-112).”

The Rio Blanco County Weed Department recognizes that a Memorandum of Agreement regarding noxious weeds was signed in Colorado in 1996 among 13 federal and state agencies with land management and natural resource protection responsibilities.

1. Introduction

A. Purpose of this plan

1. To provide guidelines for effectively managing designated noxious weeds by specific areas, which constitute a present threat to the natural resources of lands in unincorporated Rio Blanco County.
2. To comply with the Colorado Weed Management Act, CRS 35-5.5.
3. Noxious weeds negatively impact county residents, recreationist, federal, state and local governmental agencies, business communities, water sheds, adjoining states as well as wildlife and the ecology. It is this plans intent, to establish priorities and procedures for noxious weed control, to provide scientific information on options that constitute the Best Management Practices (BMP) for the named noxious weeds. It is also this plan’s intent to incorporate those options that are the lease environmentally damaging, yet practical, timely, economically feasible and effective to protect all lands in Rio Blanco County from the pernicious effects of noxious weeds.

B. Goal

1. Fulfil duties outlined in CRS 35-5.5.
2. Public education.
3. Systematic and effective noxious weed management.

C. Severity of noxious weed problem(s) in Rio Blanco County.

1. Accurate acreage counts not available at this time. Noxious weeds are a growing threat in Rio Blanco County. Mapping and planning will be on going and updated on a regular basis.
2. Noxious weeds and their encroachment are of importance to county residents, recreationist, federal, state and local governmental agencies and the business community, resulting in negative impacts to the local and state economy, agricultural vitality, and natural resources.

2. Statement of noxious weed problem

- A. The following nine noxious weeds species are identified on the State of Colorado’s “B” list top ten prioritized undesirable noxious weed species. The noxious weed species in this list are acknowledged to be of the most widespread and causing the greatest economic impact in the State of Colorado at this time. This list was amended in to, resolution 92-5 and resolution 95-6 pertaining to the Rio Blanco County Noxious Weed Management Program, by the Rio Blanco County Commissioners on September 8, 1997. The following lists are by alphabetical order not by priority.

Canada thistle (*Cirsium arvense*)
Diffuse knapweed (*Centaurea diffusa*)
Field bindweed (*Convolvulus arvensis*)
Hoary cress (*Cardaria draba*)
Leafy spurge (*Euphorbia esula*)
Musk thistle (*Carduus nutans*, *C. macrocephalus*, and *C. thoermeri* compose the species of musk thistle)
Russian knapweed (*Centaurea repens*)
Spotted knapweed (*Centaurea maculosa*)
Yellow toadflax (*Linaria vulgaris*)

B. The following noxious weeds are judged by the Rio Blanco County Weed Advisory Board to be undesirable and are all included on the State of Colorado's "A" noxious weed list. This list was amended in to, resolution 92-5 and resolution 95-6 pertaining to the Rio Blanco County Noxious Weed Management Program, by the Rio Blanco County Commissioners on September 8, 1997.

Black henbane (*Hyoscyamus niger*)
Black knapweed (*Centaurea nigra*)
Common burdock (*Arctium minus*)
Common mullein (*Verbascum thapsus*)
Dalmatian toadflax (*Linaria dalmatica*)
Halogeton (*Halogeton glomeratus*)
Houndstongue (*Cynoglossum officinale*)
Perennial pepperweed (*Lepidium latifolium*)
Plumeless thistle (*Carduus acanthoides*)
Scotch thistle (*Onopordum acanthium* and *tauricum*)

C. Rio Blanco Counties prioritized noxious weed list according to area.
(TO BE DETERMINED BY THE RIO BLANCO COUNTY WEED ADVISORY BOARD)

This is not an all-inclusive list and therefore it is subject to change as other noxious weeds present a threat to Rio Blanco County.

C. Problem areas include county property, municipalities, roadsides, drainage areas, private property, industrial properties and right of ways, federal and state lands.

D. Management of noxious weed shall be the responsibility of the landowner. Cooperative agreements may be drawn between the parties to assist in noxious weed management.

3. Plan of work: objectives and Implementation

A. Short term goals (1-5 years)

1. Education of Rio Blanco County residents and business regarding the named noxious weeds, including escape ornamentals, the problems caused by those noxious weeds and the benefits of controlling them.
2. Identify non-informed or negligent landowners that are not carrying out noxious weed management programs on their property and provide technical support for establishing IWM plans and assistance in carrying out plans or enforcement on properties if necessary.
3. Continue mapping of noxious weeds on county roads and county property with Geographical Information System (GIS) and provide that information to all agencies and landowners that it will benefit.
4. Continue and expand the leafy spurge management project as well as other listed noxious weeds and set goals to obtain the management and control of those species.
5. Continue research and the establishment of biological agents in appropriate areas.
6. Encourage and assist private landowners in developing IWM plans.
7. Encourage mapping and management of listed noxious weeds with public land managers, surrounding counties and states, while cooperating and assisting those entities as much as possible.
8. Review noxious weed list and management plan every three years, per CRS 35-5.5-107 (4a).
9. Carry out actual management via chemical, cultural, biological and mechanical means.
10. Investigate the establishment of new noxious weed species that may be established in or around Rio Blanco County and educate landowners on the identification and management of those species.
11. Develop and adopt into the Rio Blanco County Development Master Plan, permit requirements pertaining to management of noxious weeds for all approved permits and gravel pits.
12. Educate landowners on how to prevent movement of noxious weeds to their property.
13. Encourage municipalities in Rio Blanco County to adopt management plans for noxious weed control in their incorporated boundaries.
14. Establish educational programs that will effectively communicate noxious weed management information to all landowners, families and organizations in Rio Blanco County.
15. Assist Universities and manufactures in the research of noxious weed management in Rio Blanco County.
16. Establish goals to be met during the course of each year.

B. Long term goals (5-10 years)

1. Continue and intensify the education of Rio Blanco County residents regarding the problems caused by the named noxious weeds and the benefits of controlling them.
2. Continue and improve mapping of noxious weeds on GIS for all entities in Rio Blanco County.
3. Continue intensify and improve leafy spurge management project to include all landowners with infestations as well as other county listed noxious weeds.
4. Continue research and establishment of biological controls.
5. Add additional noxious weeds if needed to the local noxious weed list.

6. Continue to strengthen partnerships with public and private land managers.
7. Enforce the established guide lines and best management practices for all permitted projects in Rio Blanco County to assist in the prevention and control of noxious weeds.
8. Improve on all short-term goals as applicable to improve on the long-term management of noxious weeds.

4. Implementation

A. Public education

1. Provide information concerning the Colorado Noxious Weed Act CRS 35-5.5.
2. Provide information on the BMP for noxious weed control and management.
3. Develop or obtain educational materials, displays, and slides, ETC and work with media.
4. Targeted audience for public education
 - a) Farmers and ranchers
 - b) Governmental agencies
 - c) Schools
 - d) Industries
 - e) Municipalities
 - f) Residential

B. Noxious weed Best Management Practices

1. Set criteria for the BMP for each listed noxious weed species.
 - a) Biology of listed noxious weeds
 - b) Preventative measures
 - c) Chemical
 - d) Cultural
 - e) Biological controls
 - f) Mechanical
 - g) Proven Integrated Management Practices (IMP)

C. Geographical Information System (GIS).

1. Map or assists in mapping noxious weed infestations within Rio Blanco County including, county roads and county properties.
2. Inform land managers, surrounding counties and states of the noxious weeds identified in Rio Blanco County.
3. Encourage other landowners and managers in Rio Blanco County to map listed noxious weeds and share information.
4. Target areas:
 - a) County roads
 - b) County owned property
 - c) Private landowners
 - d) Federal and state lands

- e) Municipalities and districts
- 5. Use the information obtained from the mapping of noxious weeds in Rio Blanco County to stimulate funding for Federal, State, County and Municipalities budgets and obtain grants to assist programs.

D. Cooperative agreements

- 1. Establish cooperative agreements that benefit the management of noxious weeds in Rio Blanco County.
- 2. Target audience
 - a) Private landowners
 - b) Federal and state lands agencies
 - c) Other governmental agencies in Rio Blanco County, surrounding counties and states
 - d) Business entities
 - f) Universities

E. Non compliance

- 1. Private lands: CRS 35-5.5-109
- 2. Public lands: CRS 35-5.5-110
- 3. Public right of way: CRS 35-5.5-112

F. Level of enforcement

It is the desire of the Rio Blanco County Commissioners to utilize all methods feasible to encourage the management of all noxious weeds in Rio Blanco County. Methods to be used for private lands are:

- 1. Educational
- 2. Monetary assistance from County funds and programs.
- 3. Grant funds and other potential programs.
- 4. One on one contact with negligent landowners or managers.
- 5. Any other methods that may be deemed necessary and reasonable.
 - a) First, a management program must be in place on a particular prioritized noxious weed species and operating at an effective level on a county wide basis or management area. Or the noxious weed species is a new invader that the landowner or manager is refusing to control after options 1,2,3,4 and 5 as listed above are exhausted and the new species is adopted into the Rio Blanco County Noxious Weed List.
 - b) There must be proof that the identified landowner(s) are negligent in the management of the said noxious weed (s) on property owned or managed by them.
 - c) Only then, can enforcement proceed under authority of, the Colorado Noxious Weed Act CRS Title 35 Article 5.5 Sections 109 and 110.

State and Federal land managers are expected to work with Rio Blanco County to establish beneficial, cooperative and effective management goals and plans to control noxious weeds. These agencies are also expected to pursue and obtain proper funding,

personnel and equipment to manage noxious weeds on their property.

5. Development of special management areas

- A. Delineate areas requiring intensive management for the control of specific species of noxious weeds.
- B. Delineate areas requiring various levels of management or preventative measures to protect non-infested areas.
- C. Cooperate with adjoining counties, states, special management areas and agencies in controlling other noxious weeds of their concern when possible.
- D. Examples of special management areas include:
 - 1. Areas that contain specific named noxious weeds.
 - 2. Water ways.
 - 3. Public and private Rights of Way
 - 4. Areas containing endangered plants and animals.
 - 5. Areas with high water tables.
 - 6. Areas where individuals have been identified as being sensitive to herbicides as publicized by the Colorado Department of Agriculture.
 - 7. Adjoining areas and noxious weeds of concern.

6. Evaluation after each year

- A. Have we met our goals and timetable of work?
- B. Is the public satisfied with the work performed and accomplishments made?
- C. Is the budget adequate for accomplishing desired goals?
- D. Are their changes in the overall program that need to be addressed?
- E. Is the equipment adequate for the programs needs?
- F. Are all agencies doing the same?

7. Conclusion

This plan is a preliminary plan that is subject to change and will be reviewed within three years. This plan is not all-inclusive as to the operations of the Rio Blanco County Weed Department. This plan is designed to be a guideline for implementing the Colorado Noxious Weed Act CRS Title 35 Article 5.5 and to encourage cooperation to achieve the best possible noxious weed management in Rio Blanco County.

RIO BLANCO COUNTY NOXIOUS WEED MANAGEMENT PLAN ADDENDUM

I. Statement of weed presence

1. Canada thistle (*Cirsium arvense*) is a native of southeastern Eurasia, and easily displaces vegetation in agricultural, residential and environmentally sensitive areas. It quickly invades disturbed and impacted areas and invades healthy lands. Canada thistle is one of the most widely distributed noxious weeds in Colorado. It is difficult to control because of its extensive root system and wide distribution. It occupies to a varying degree a large percent of irrigated hay fields, grain fields and ditch banks as well as river frontage and creeks, rights of way's, trail heads in the National Forest and many lawns in the Meeker area. This thistle will invade disturbed areas, or areas, which receive approximately sixteen inches of rain or irrigation annually. It can be found just about anywhere in RBC except the dryer areas. It is difficult to control because of its extensive root system and wide distribution. In RBC, it appears to grow between elevations of approximately 5,000 to 10,000 feet. This is one of the most widely distributed noxious weeds in RBC. Canada thistle could be drastically reduced but will always be present in RBC.

Canada thistle is an aggressive, creeping perennial that forms colonies and reproduces by seed and vegetative root buds. Stems are usually one to four feet tall, ridged and branching. Leaves are alternate, lacking petioles, oblong or lance-shape, divided into spiny-tipped irregular lobes. Flowers are unisexual, on separate plants; flowers purple (occasionally white) in heads of 1/2 to 3/4 inch in diameter; involucre bracts spineless. Flowering occurs during July and August. Vertical and horizontal roots may exceed nineteen feet.

2. Diffuse knapweed (*Centaurea diffusa*) is a native of the Mediterranean region of Europe, it is highly competitive against native vegetation and makes land very susceptible to soil erosion, which can lead to severe sedimentation along streams and rivers causing declines in fish populations. It is primarily found along rights of way and in rangeland. It is the most established knapweed in RBC. Its only known locations are in Piceance creek on county road 24 and 31. East of county road 127 in a camp ground on Division of Wildlife property, at the east end of county road 40 next to the Big Beaver Ranch and at Lake Avery and county road 8 and occasionally found along road sides in those areas. In RBC, it appears to grow between elevations of approximately 5,000 to 9,000 feet. This plant is highly competitive and threatens to exclude many desirable plant species, without proper detection and management. Early detection and management is imperative. This plant spreads rapidly and therefor it can be very difficult to manage. Diffuse knapweed should all but be eradicated in a few years, with some intense management, unless many other infestations are found.

Diffuse knapweed is usually an annual but can be a short-lived perennial reproducing primarily by seed. Leaves are pinnately divided; the reduced leaves of the inflorescence are mostly entire. Flowering heads are numerous and narrow. Flowers are white to rose or sometimes purplish; margins of involucre bracts are divided like teeth of a comb, and bracts are tipped with a definite slender spine. Achenes are brown or grayish; pappus is lacking. Flowering occurs from July to September.

3. Field bindweed (*Convolvulus arvensis*) is a native of Europe and a serious problem in agriculture and residential situations. Its deep root system and the fact that most of the Field bindweed occurs in Meeker, and to some degree in Rangely, in lawns with trees, shrubs and flowers, making this plant difficult to control. Occasional plants are found throughout roads anywhere in RBC and occasionally found in fields or pastures. It can also be found in very dry regions of the county, and up to elevations of approximately 9,000 feet. The municipalities in RBC will need to address the issue more aggressively with at least education and awareness or many more acres will be infested in the future. Field bindweed will never be eradicated but it can be kept to a minimum outside the city limits with landowner awareness and education.

Field bindweed is a perennial that forms an extensive root system, often climbing or forming dense tangled mats. Stems are prostrate, usually one to four feet long. Leaves alternate, more or less arrowhead-shaped, pointed or blunt lobes at the base. The flowers are bell- or trumpet-shaped, usually white to pinkish, approximately one inch in diameter with two small bracts located one inch below the flower. Fruit is a small, round capsule, usually four seeded. The flowering period is from late June until frost in the fall. Seeds may remain viable for up to fifty years.

4. Hoary cress (*Cardaria draba*) is a native of Europe, and is highly competitive with native plants once established. It contains *glucosinolates*, which can be toxic to cattle. Hoary cress is very efficient in competing for soil moisture. It is commonly known as Whitetop in RBC. Management of hoary cress can be difficult to control, especially if it is not addressed in an aggressive, timely and persistent manner. Much of the hoary cress in RBC occurs in the Rangely area. Landowner education and awareness is very important since the largest amount is found on private land. This noxious weed could be drastically reduced but it would take the efforts and funding of many and several years. It is most commonly found along road rights of way's, pastures and rangeland in the Rangely area. Some infestations are located around Douglas pass, along State Hwy 64 towards Meeker, scattered around Meeker, county road 6 and 7, by the pyramid store on county road 19, with small scattered populations throughout RBC. Hoary cress does not appear to be greatly restricted to elevation, soil type or moisture in RBC, and it appears to grow at elevations from 5,000 to approximately 9,000 feet.

Hoary cress is a deep rooted perennial growing up to two feet tall, reproducing from root segments or seeds. Leaves are blue-green in color, lance-shaped. Lower leaves are stalked; upper leaves have two lobes clasping the stem. Plants have many white flowers with four petals, giving the plant a white, flat-topped appearance. Heart shaped seed capsules contain two reddish-brown seeds separated by a narrow partition. Plants emerge in very early spring and have bloomed and set seed by mid-summer.

5. Leafy spurge (*Euphorbia esula*) is a native to Eurasia. It displaces native vegetation, forming a monoculture and causes severe irritation of the mouth and digestive tract in cattle, which may result in death. Wildlife avoids grazing in infestations of leafy spurge. In RBC it is substantial and primarily infests the eastern end of the county at approximately two to three thousand acres. In RBC, it appears to grow at elevations of approximately 5,000 to 9,000 feet. Due to the fact, this noxious weed is well established and the perennial nature of this plant with its deep vigorous root system that contains large nutrient reserves makes this noxious weed very difficult to manage. Leafy spurge will never be eradicated in

RBC, but continued funding and work from everyone is imperative to keep it from spreading further. It is mostly found in six locations. The Hay gulch area, Nine mile area spreading north to Moffat County, Lake Avery area, Hunter Creek, the extreme east end of RBC in the Routt National Forest and approximately 100 miles along the White River from east of Buford to Kenny reservoir. Small isolated infestations have been found growing throughout RBC, except for the driest areas. It is also suspected of growing in the Flat Tops Wilderness area.

Leafy spurge is a deep-rooted perennial, usually growing three foot tall or more, it reproduces by deep vigorous rootstalks and seed. Leaves are alternate, narrow; one to four inches long. Stems are thickly clustered. Flowers are yellowish-green, small, arranged in numerous small clusters and subtended by paired heart-shaped yellow-green bracts. Roots are brown, containing numerous pink buds, which may produce new shoots or roots. The entire plant contains a caustic, milky juice. Seeds are oblong, grayish to purple, contained in a three celled capsule, each cell containing a single seed. Seed capsules explode when dry; often projecting seeds as far as fifteen feet. Flowering usually occurs from June to July.

6. Musk thistle (*Carduus nutans*) is a native of southern Europe and western Asia it can spread quickly and displace native plants forming a virtual monoculture of musk thistle. Its long pointed needles contribute to this plants undesirable status and can impede access through infestations. Musk thistle has the potential to at least be greatly reduced in acreage and should be considered eradicable except for a few plants found occasionally. This noxious weed is easy to manage with varying approaches as long as it is not too wide spread. Regardless of the management technique timing and persistence is critical. It occurs in Meeker, along Flag Creek road, around the Little Beaver and Thornburg area and up-river around Elk Creek, and Miller Creek as well as Piceance Creek area and county road 89, with scattered plants occasionally found in the Rangely area. It is also present in large amounts in surrounding counties. In RBC, it appears to grow between elevations of approximately 5,000 to 8,000 feet. Musk thistle invades pasture, range and forest lands along with roadsides, waste areas, and grain fields. Its aggressive nature allows it to spread rapidly forming extremely dense stands, which crowd out desirable forages and native plants.

Musk thistle is a biennial or sometimes a winter annual which grows 6 feet or taller. Leaves are dark green with light green midrib, deeply lobed, and spiny margined. Leaves extend onto the stem giving a winged appearance. Flower heads are terminal, solitary, 1 to 3 inches in diameter, and usually bent over. Flowers are deep rose, violet or purple, occasionally white; broad spine-tipped bracts subtend them. Fruits are 3/16 inch long, shiny, and yellowish-brown with a plume of white hair-like fibers. Flowering occurs from July until frost.

7. Russian knapweed (*Centaurea repens*) is a native of Eurasia, is toxic to horses and is capable of developing monocultures where it grows. It decomposing leaves release a chemical that essentially restricts the growth of other plant species, clearing the path from competition of those species. In RBC, it is virtually non-existing any more as compared to other noxious weeds and the goal should be eradication if found. It appears to grow between elevations of 4,500 to 7,500 feet in RBC. If managed properly, it is not extremely difficult to control. It is usually found along rights of way, irrigated fields and even at higher elevations in rangeland. This noxious weed can occasionally still be found along the State highway rights of way, in mostly small scattered infestations, with the exception of State highway

139 South, where a substantial amount of knapweed is advancing from other counties. Currently the larger infestations in RBC are found in the Rangely, area around the County Road and Bridge Shop mostly on Moon Lake Electric Property. The Bureau of Land Management has one known location in the extreme southwest part of RBC. Another infestation was known to be up Miller Creek, behind 494 County Road 57 and neighbor to the south, but appears to at least be reduced in density and size. Small infestations are present along state highway 13 south between Meeker and Rifle. All infestations in RBC are typically very small. Other populations most likely exist but have not been discovered yet.

Russian knapweed is a deep-rooted perennial; Establishing dense colonies by advantageous shoots from widely spreading black roots. It reproduces by seeds and roots. Stems are erect, openly branched, eighteen to thirty six inches tall. Lower leaflets are deeply lobed, two to four inches long; upper leaves entire or serrated, narrow to a sessile base. Cone-shaped flowering heads are 1/4 to 1/2 inch in diameter, solitary at the tip of leafy branchlets. Flowers are pink to lavender. Many pearly involucre bracts form with rounded or acute papery margins. Flowering occurs from June to September.

8. Spotted knapweed (*Centaurea maculosa*) is a native of Eurasia, is highly competitive against native vegetation and makes land very susceptible to soil erosion, which can lead to severe sedimentation along streams and rivers causing declines in fish populations. Early detection and management is imperative to reduce the threat of large-scale infestations. It is only found in small populations scattered around RBC and should be eradicated. It is primarily found along right of ways and rangeland. In RBC, it definitely poses a threat but has only been found in small isolated spots. The largest infestations are up-river on county road 10 by the bridge along the south side of the river at the public fishing access. In the Piceance Creek area, it is found in Sprague Gulch, and very small, scattered infestations along county road 103 (cathedral ridge). Occasionally a few plants can be found along roadsides anywhere, throughout RBC. With continued efforts this weed will not be a major problem in RBC.

Spotted knapweed is an aggressive biennial or short lived perennial with a stout taproot that produces primarily by seed. It has one or more stems, branched one to three feet tall. Basal leaves up to six inches long, blades narrowly elliptic to oblanceolate, entire to pinnately parted; principal stem leaves pinnately divided. Flowering heads are solitary at end of branches; involucre bracts stiff and tipped with a dark comb-like fringe. The ray flowers are pinkish-purple or rarely cream-colored. Fruits are about 1/8 inch long, tipped with a tuft of persistent bristles. The flowering period extends from June to October.

9. Yellow toadflax (*Linaria vulgaris*) is a native of Eurasia and easily displaces native vegetation and has little forage value worth mentioning. In India, it is reported to cause severe bloating and death in cattle (according to the Utah poison control center). In RBC it is very significant, and infests many landowners. In RBC, this noxious weed is considered out of control in some areas. It appears to grow in RBC at elevations between 5,000 to approximately 11,500 feet Management is very difficult and costly. Management of this weed needs to be directed at containment of large infestations and eradication of outlying and smaller small infestations at the least. The largest portion of the infestation is on the White River National Forest and has spread along the White River to the Utah State line. Approximately seventy-five acres exist in the Piceance Creek area in Willow Creek and along the upper end of county road 5. It is also present in the city limits of Meeker and Rangely. Yellow toadflax infests rangeland, pasture land, cropland, roadsides, right of-way's and ditch banks.

Yellow toadflax is a perennial 1-2 feet tall reproducing by seed and underground rootstocks. Leaves are pale green, numerous, narrow, pointed at both ends, 2 or more inches long. Flowers are one inch long with a bearded, orange throat. Fruit is round, 1/4 inch in diameter, brown, 2-celled, with many seeds. Seeds are dark brown to black, 1/12 inch in diameter, flattened with a papery circular wing. Flowering occurs from June to August depending on elevation.

10. Black henbane (*Hyoscyamus niger*) is a native of Europe. It contains hyoscyamine and other alkaloid's which has caused occasional livestock poisoning and is considered poisonous to humans. However, the plant is usually not grazed heavily by animals unless, more palatable forage is not available. It primarily infests disturbed areas and rights of way's. In RBC, it is limited to a few areas and should be eradicated. If managed properly it is easy to control. It occurs up-river along Elk Creek, the potholes, and along county road 115, above Lake Avery. It is also present outside Meeker, south of Nine-Mile pass, at the top of county roads 3, 3A and 76 around Magnolia Camp and at the top of Collins Gulch.

Black henbane can be an annual or biennial, one to six feet tall. Leaves are coarsely-tooth to shallowly lobed and pubescent. Foliage has a foul order. Flowers, on long racemes in axils of upper leaves, are brownish-yellow with a dark purple center and veins. Fruits are approximately one inch long, 5-lobed. Flowering occurs from June through July.

11. Black knapweed (*Centaurea nigra*) is most likely a native of Europe and is probably quite capable of displacing native vegetation. In RBC, it has only been found in one location, approximately one mile north of Douglas pass on the West Side of the road. It appears to have been eradicated and has not been noticed since 1996. Meadow knapweed (*Centaurea pratensis*) is considered a hybrid between Black knapweed and Brown knapweed (*Centaurea jacea*). Black knapweed is a perennial, with erect stem, six inches to three feet high, usually freely branched in the upper part of the plant. The leaves are variable, both in width and degree of division, the upper leaves are narrow and generally with entire margins, with the lower leaves lobed and/or with course teeth. The whole plant is a dull green, rather rough with small hairs. The florets being tubular with cone shape flowers, allow the black fringes on the bracts to be most noticeable, hence the name black knapweed. The flower resembles in appearance to spotted knapweed except the flower head of black knapweed is much larger and the florets a brighter purple. Black knapweed typically establishes in rights of way, cliffs and grasslands. Black knapweed can thrive in ordinary soil but prefers a well-drained and fertile soil with a sunny location. Once established, plants can tolerate drought, and alkaline soils, thriving and even self-sowing in dense growth. This species is available in some nurseries and is now an escape ornamental. At this time, no other description of this noxious weed has been located. When more information is discovered it will be included. It is apparently easy to control with herbicides if not well established.

12. Common burdock (*Arctium minus*) is a native of Europe and interferes with various aspects of agriculture, such as reducing the value of wool, entangling its self in the hair of cows, in the mane and tails of horses. In RBC, it is widely distributed. It appears to grow between 4,500 and 8,000 feet in elevation. If management is timed properly, it is easy to control but is not considered eradicable in RBC. It is most prevalent around irrigated fields, on the edge of stock ponds, in wooded and open areas along

irrigation ditches and the White River and can be found along roadsides.

Common burdock is a biennial, producing a rosette of large, cordate, thickly hairy leaves the first year and an erect, much branched, coarse stem three to ten feet tall the second year. The leaves are alternate, large, broadest at the leaf base, somewhat diminished upwards, margins toothed or wavy, woolly beneath at least when young, dark green above. Flowers are purple, heads born in leaf axils or at the end of branches, numerous, clustered, covered with many slender, hooked spines, achenes gray to brown, mottled, oblong, about 1/4 inch long, flattened and slightly curved. Flowering and seed production occur from July to September.

13. Common mullein (*Verbascum thapsus*) is a native of Asia and thrives on shale soils, rocky slopes, rights of way's and particularly in disturbed areas. It is possible to eradicate from areas but not on a countywide basis. Good plant competition and land stewardship is important when combating against common mullein. In RBC, it is widely distributed. It is a major problem along roadsides and works its way into, range-land, national forest lands and adjoining fields, where it's large leaf effectively choke out other vegetation. Its greatest concentrations occur in the Piceance Creek area, but it can be found in all but the highest and driest areas of the county. Its thick pubescent hairs attribute to its difficulty to manage.

Common mullein is a biennial that produces a large thick rosette with fuzzy pubescent hair on the leaves, the first year and a single, stout, erect stem, two to eight feet tall, the second year with equally pubescent leaves as the first year. The leaves are alternate, overlapping one another, light green, densely woolly. Flowers are sessile, borne in long terminal spikes, sulfur yellow, five lobed and more than an inch in diameter. Fruits are two chambered with numerous, small, angular, brownish seeds are 1/32 inch long. Flowering and seed production occur from June to September. In RBC, it appears to grow at elevations between approximately 5,000 to 9,000 feet. If management is timed properly, it is not extremely difficult to control.

14. Dalmatian toadflax (*Linaria dalmatica*) is a native of southeastern Europe and is highly competitive displacing native vegetation. In RBC it may quickly becoming a major problem if neighboring counties, agencies or landowners lose or neglect to control dalmatian toadflax. In RBC it has been noticed growing at elevations from 6,000 to 7,500 feet, and will most likely grow at higher and lower elevations. An extensive and deep root system along with thick waxy leaves and readily dispersible seeds make this an extremely difficult noxious weed to control. In 1997, one plant was found next to the State Highway Department Shop in Meeker. In 1998, several of these noxious weeds were discovered from the Moffat County line to the State Highway Department Shop. It was also found along county road 9 and one small infestation was discovered in the Piceance Creek area on County Road 122 by mile marker 26, over 40 miles away from its closest known infestation. This noxious weed will most likely be a major problem in range-lands in ten years due to the fact it spreads rapidly, can be difficult to control, and is found in large amounts in Moffat County and to some degree in Routt County.

Dalmatian toadflax is a perennial, up to three feet tall, reproducing by seed and underground rootstocks. Leaves are dense, alternate, entire, upper leaves are conspicuously broad-based. Flowers are borne in

axils of upper leaves and are two lipped, approximately 3/4, to 1 1/2 inches long with a long spur and yellow and orange, bearded throat. Fruit a two-celled capsule with many irregularly angled seeds. Flowers bloom from early summer until early fall

15. Halogeton (*Halogeton glomeratus*) is a native of Asia and is poisonous sheep, though cattle may also be affected, and it is responsible for thousands of livestock poisonings. Halogeton is not an extremely competitive plant, but readily invades disturbed or over-grazed lands. It is a prolific seeder and is spreading in spite of control efforts across the west. In RBC it is most prevalent along roadsides in some areas, and seems ideally adapted to the alkaline soils and semi-arid environment of the high-desert winter livestock ranges in the western end of the County. With the large acreage in Utah, it will always be around in RBC.

Halogeton is an annual ranging in height from a few inches to over eighteen inches and reproduces by seed. Main stems branch from the base, spreading at first, and the becoming erect. Plants are blue-green in the spring and early summer, turning red or yellow by late summer. Leaves are small, fleshy, and nearly tubular, ending abruptly, tipped with a delicate needle-like spine. Flowers are green and inconspicuous, borne in leaf axils.

16. Houndstongue (*Cynoglossum officinale*) is a native of Asia, it is toxic to horses, and is very invasive as well as prolific. Its invasive nature and dispersal mechanism combined, (attach to passing animals or humans) make it difficult to control in spite of the fact it is easy to kill a young plant. Elk have been found with houndstongue seed covering large portions of their body. Houndstongue will probably be one of the greatest noxious weed concerns in the future for RBC. It most likely has impacted more acreage than any other noxious weed in RBC at this time, and appears to grow everywhere except the highest elevations and in the driest areas of the county. It is found extensively through out many areas in RBC. It is found throughout the Piceance Creek area, Douglas Pass, along the White River and other waterways, all directions around Meeker and anywhere there is adequate moisture. This plant will never be eradicated from RBC.

Houndstongue is a biennial growing one to four feet tall and reproduces by seed. Leaves are alternate, one to twelve inches long, one to three inches wide, rough, hairy, and lacking teeth or lobes. Flowers are reddish-purple and terminal. The fruit is composed of four prickly nutlets each about 1/3 of an inch long, and attach to passing animals or humans, aiding in its dispersal.

17. Perennial pepperweed (*Lepidium latifolium*) is native to southern Europe and western Asia and is a severe problem in other western states. It can be found in irrigated fields, along rivers, streams, springs, irrigation ditches and any place that is moist for short periods of time as well as roadsides and sometimes slightly drier areas. If something is not done soon to control this noxious weed, it will be too late and costly to control effectively. To eradicate this species would take, proper funding and a consorted effort from many agencies and landowners for many years. Perennial pepperweed in RBC originates in Moffat County by their county road 57 in Deep Channel, from there it dumps into Crooked Wash, and in to the White River and has spread into Kenny Reservoir. It has been found south of Douglas pass and up the south fork of the White River by the White River National Forest boundary. It has been found around RBC, and it has been noticed growing at elevations from 5,000 to 8,800 feet. Any perennial noxious

weed that grows in or near water will always be problematic.

Perennial pepperweed is a deep-rooted perennial, one to over eight feet in height, with a heavy sometimes-woody crown. Leaves lanceolate, bright green to gray-green, entire to toothed, basal leaves larger than upper leaves, inflorescence a raceme. Flowers are white, in dense clusters near ends of branches, very small; fruit a silicle; seeds two per fruit, rounded, flattened, slightly hairy, about 1/16 inch long, and reddish-brown and blooms during the summer.

18. Plumeless thistle (*Carduus acanthoides*) is native to Eurasia. It has impacted thousands of acres in Pitkin County. Its thorn-like spines have impacts similar to musk and scotch thistle. Only a few plants have ever been found in RBC and because of that it is considered eradicable. In RBC it is currently found in the Piceance creek area in Davis Gulch next to county road 5, next to county road 13 along Flag Creek, on Soaring Eagle Ranch property, and up river on county road 52, approximately 1/4 mile up from county road 8. There has been some noticed on State Highway 13 south in Garfield County. With the large infestations of plumeless thistle found in Pitkin and Garfield counties, we most likely have more than we realize. Plumeless thistle is commonly confused with Canada thistle. In RBC it has been noticed growing at elevations of 6,000 to 7,000 feet and most likely will grow at higher and lower elevations. This noxious weed is not too difficult to manage on a small scale. Timing and persistence is the key.

Plumeless thistle is a winter annual or biennial herb that produces only by seed. It forms a stout fleshy taproot, rarely flowering the first year. Stems grow from one to four feet tall or taller; they are freely branched above and covered with spiny wings 1/4 to 3/4 inch wide extending up to the flowering heads. Basal rosette leaves are usually four to eight inches long with spinose lobes. Stem leaves usually alternate, sessile and blending into the stem. Peduncles usually spiny-winged up to the base of the flowering heads. Heads are solitary at the ends of branches or in clusters of two to five. Involucral bracts narrowly lanceolate, sparsely to densely hairy, corolla mostly purple, rarely white or yellowish. Flowering occurs from May to July.

19. Scotch thistle (*Onopordum acanthium* and *tauricum*) is native to Europe and eastern Asia. It is the most robust thistle species in RBC. It is considered eradicable but more needs to be done to achieve that goal. The large nature of this plant including its spines that grow profusely throughout the plant easily restricts access of people and large mammals to foraging and watering or recreation areas. It primarily infests disturbed areas such as plowed and over grazed fields. Scotch thistle is currently found in RBC along county road 7, around the Big Rock Ranch, on county road 4 along the Highland Ditch, and by the White River, with occasional plants found up river by Elk Creek. Scotch thistle will grow along roadsides, irrigation ditches, impacted areas along the edge of fields and waste areas. In RBC, it has been noticed growing at elevations from 6,000 to 7,000 feet. Management is not difficult. Timing, persistence and revegetation is the key.

Scotch thistle is a biennial that grows only from seed, and up to twelve feet tall. Stems have broad, spiny wings. Leaves are large (up to 2 feet long and 1 foot wide), spiny, and covered with fine dense hair, giving a grayish appearance. Upper leaves are alternate, coarsely lobed; basal leaves may be up to two feet long and one foot wide. Flower heads are numerous, one to two inches in diameter, bracts spine-tipped. Flowers are violet to reddish. Fruits are about 3/16 inch, tipped with slender bristles. Scotch

thistle blooms in June and July.

20. Sulfur cinquefoil (*Potentilla recta*) is native to Eurasia, unlike the native *Potentilla* species found throughout the state. The Forest Service weed crew recently discovered it in RBC, and it is most likely eradicated from RBC, but needs to be monitored yearly. It was found about 1/3 the way up the Bailey lake trail along Buckeye creek and along county road 12 just before you enter Forest Service property on the right side of the road on a hillside. Sulfur cinquefoil is adapted to a wide range of environmental conditions. It will grow in open grasslands, shrubby areas, open forest, and logged areas, and is often found in association with spotted knapweed. This noxious weed easily invades sites such as roadsides, waste areas, and abandoned fields. Sulfur cinquefoil can rapidly invade rangeland that is in good condition and healthy non-grazed lands. In RBC, it has been noticed growing at elevations of approximately 8,000 and higher. Management is not difficult if it is not wide spread.

Sulfur cinquefoil is a perennial; one to one and one half feet tall, with well developed rootstocks. Leaves are palmately compound with five or seven toothed leaflets on each leaf. Leaves are sparsely hairy appear green on the underside rather than silvery as in many *Potentilla* species. Flowers are light yellow with five petals, each flower producing numerous single-seeded oval achenes with net like patterns on seed coat. Sulfur cinquefoil begins to bloom in late May and can produce flowers throughout the summer if growing conditions are favorable.

21. Yellow starthistle (*Centaurea solstitialis*) is native to Europe, grows on various soil types and is usually introduced on roadsides and waste areas first. It is considered a serious noxious weed problem in other Western states and millions of acres have been lost to this species. "Chewing disease" results when horses eat Yellow starthistle. A county weed department employee recently discovered it in RBC as well as Bureau of Land Management weed crew. It is most likely eradicated from RBC, but needs to be monitored yearly. It has been found along the Deserado mine road on the south side approximately one half of the way out from the mine, before you connect to RBC road #65 and along the Yellow Creek jeep trail. In RBC, it has been noticed growing at approximately 5,500 to 6,000 feet in elevation. Management is not difficult if it is not wide spread.

Yellow starthistle is an annual, two to three foot tall, has rigid branching, and winged stems covered with a cottony pubescence. Basal leaves are deeply lobed while upper leaves are entire and sharply pointed. Flower heads are yellow, located singly on ends of branches, and armed with sharp straw-colored thorns up to three-quarters inch long. Fruits from ray flowers are dark-colored without bristles, while fruits from disk flowers are lighter and have a tuft of white bristles. Yellow starthistle blooms and sets seed by early to mid summer

Many other species of noxious weeds will most likely be found in RBC in the future. If additional noxious weed species are found the goal should be eradication before the problem escalates and becomes irreversible. Other noxious weeds may be added to the RBC noxious weed list in the future. If so, they will be included in this plan.

II. Management options

"Management", which means any activity that prevents a plant from establishing, reproducing, or
"Mechanical management", which means methodologies or management practices that physically disrupt plant growth, including tilling, mowing, burning, flooding, mulching, hand-pulling, hoeing, and grazing. (Care must be taken to assure cultivation does not interfere with Natural Resource Conservation Service, or result in soil erosion.)

"Integrated Management Plan" (IMP) means the planning and implementation of a coordinated program utilizing a variety of methods for managing noxious weeds, the purpose of which is to achieve desirable plant communities. Such methods may include but are not limited to education, preventive measures, good stewardship, and the following techniques:

"Biological management", which means the use of an organism to suppress and disrupt the growth and spread of noxious weeds.

"Chemical management", which means the use of herbicides or plant growth regulators to disrupt the growth of noxious weeds.

"Cultural management", which means methodologies or management practices that favor the growth of desirable plants over noxious weeds, including maintaining an optimum fertility and plant moisture status in an area, planting at optimum density and spatial arrangement in an area, and planting species most suited to an area.

"Integrated Weed Management" (IWM) means the utilization of many known and approved practices that provide the least favorable environment and conditions for any particular noxious weed species.

By no means are all the management options developed for each noxious weed species. Additional combinations of management techniques and new research revelations in the various controls are possible, and may be submitted by private landowners with disclosure of the source. All IWM plans submitted by individual land owners or land managers will be evaluated by the Rio Blanco County Weed Advisory Board and Rio Blanco County Weed Supervisor on a case by case basis.

All known biological suppression and control agents are listed for the various noxious weed species. Many of the biological agents are listed primarily for informative reasons and the possibility that very large infestations of various noxious weeds may be discovered in Rio Blanco County in the future. Some noxious weed species in Rio Blanco County are considered eradicable by other Integrated Management options. In these situations, biological agents are not a viable option for control. The use of biological controls can not be in place as a substitution for poor land management.

Biological controls can be difficult to establish and are not capable of eradicating any noxious weed species by them selves. Establishment of biological controls can take years to reach populations that can assist you in controlling noxious weeds. Various conditions are required to establish each species, such as temperature, soil type, soil moisture, ETC. Failure to observe the specific requirements for each species will typically result in death of the biological agent. Biological controls by them selves are not suited for small infestations, but they can be utilized in a very large infestation (hundreds of acres) with other methods of management for improved control. When utilizing biological controls with other management methods, you have to avoid disrupting the life cycle of the various biological agents used to maintain a beneficial population.

The integrated management options listed below are meant to provide various management techniques

for controlling the noxious weeds in many of the different environmental sites they may be found in Rio Blanco County. Caution should be used when applying herbicides and all label directions must be followed. The label is the LAW.

Herbicide labels can change frequently and various rates may be listed on the label for any one particular species. Lower herbicide rates may give good control of some species, but the higher listed rates may be needed for other species, for longer term or enhanced control. There for only product common names will be used with no rate recommendations. Contacting a knowledgeable representative of local resource office will be needed to obtain current rates. The recommendations in the following pages are to serve as guidelines only and are not a substitute for reading the label. **Always read the entire label before buying, mixing, applying disposing or storing any pesticide to determine if it properly suites your needs.** Not all herbicide products will be listed for the various species to be controlled. Many herbicides are classified as “restricted use products”. They can only be obtained with an Environmental Protection Agency or Colorado Department of Agricultural license. Some of the various herbicides and their effects or label restrictions are listed as follows. Herbicides can increase the palatability of some poisonous plants. Care should be taken to not allow grazing until treated plants are no longer palatable. Tordon, Banvel and many other herbicides can be taken up through the roots of desirable vegetation causing damage or death, but they do not sterilize the soil in the true form they only inhibit certain broadleaf species from growing for a given duration of time depending on many varying factors. Tordon 22K is not labeled for use in residential areas, sandy soils, flood plains, irrigated fields, or in areas, that have a high water table. 2,4-D formulations vary in their labeled uses, some are labeled for aquatic use, and others can volatize into a vaporous gas and cause damage to surrounding vegetation. Round up products also vary in their label uses. Round up Ultra Max is labeled for use in certain crops. Round up Pro is labeled for residential use. Rodeo is labeled for aquatic use. All three can kill or damage any type of vegetation but they do not sterilize the soil or seeds. If Round up type products are used, repeated applications most likely will be needed for perennial noxious weeds and revegetation is very important after noxious weeds are adequately controlled. Round up products will kill or damage any plants that are green and actively growing. Most herbicide applications targeted for annuals, winter annuals and biennials during flowering will not kill the seeds, and typically, the plants are about to die anyway. Also physically removing many annuals, winter annuals or biennials during the bloom stage will not kill the seeds. Many herbicide products performance will be increased with the addition of a surfactant, spreader, adjuvant, ETC, and some will not perform without them such as Escort and Telar. Some aspects of weed management with herbicides are not on the label. If you have any concerns or special conditions, you should always inquire with a knowledgeable resource and relate those issues prior to buying, mixing, applying, disposing or storing of any herbicide. Current herbicide information and recommendations can be obtained through the County weed department or local resource management offices. A web site with new and revised labels and material safety data sheets can be accessed through www.greenbook.net to serve as a handy reference for many pesticide and crop needs.

Management of the various noxious weed species will vary depending upon the extent and location of infestations and conditions where the species are located. Management options for each noxious weed species will be developed for various sites. When any new noxious weed species are discovered in Rio Blanco County, the goal will be eradication if possible.

The most important component of weed control is prevention by good land stewardship practices. The cheapest noxious weed that you will ever control is the noxious weed that you don't have. Once a noxious weed infestation is identified you must communicate with others so that they can be aware them. At that point containment is imperative as well as determining if any land management practices can be changed to reverse any conditions that may have been favorable for the noxious weed to invade. IWM practices must be implemented to focus on the conditions and practices that cause the least favorable environment for any noxious weed species. The next effort will be evaluating the IWM plan to determine if adjustments in the techniques being applied need to be changed and if new technology can be applied to improve the IWM goals.

The newest threat in the future is the plants that are classified as escape ornamentals. These exotic plants were selected for their aggressive habits, reseeding capabilities and drought resistance for landscape and garden plantings. Unfortunately, the very traits that make the plants desirable for ornamental reasons are the same traits that have allow them to escape and thrive in the wild. Once in the wild they can out compete the native plants for food and nutrients and destroy the delicate native ecosystem. It is also unfortunate that even when these species are known to be destructive (such as is the case for yellow and dalmatian toadflax) they may still allowed to be sold throughout the country. It is imperative that we educate nursery's, architects and homeowners on the destructive nature of identified escape ornamentals before our natural landscape is permanently altered and destroyed. What your neighbor grows may soon be yours.

It is important to read all the IWM control options for any particular noxious weed species to obtain a full understanding of the components that are effective in controlling that species. Some wordings or practices are only listed once and they are not repeated repetitiously throughout the various control options to which they may also apply.

Irrigation and drainage ditches, flood plains and similar situations are considered riparian areas.

2. Implementation of Integrated Weed Management

CANADA THISTLE:

1. Control Measures

a. Cultural Control: Plant competition from various grasses and from alfalfa can be an effective management tool in some instances. Early emerging grass species such as smooth brome and crested wheatgrass can be used to compete with canada thistle and slow the spread and establishment of new infestations. Promoting healthy grass growth by proper grazing and irrigation is critical when competing against any noxious weed species. Competition alone, however, is seldom effective in the management of canada thistle once it is established. Canada thistle is capable of utilizing fertilizer more efficiently than grasses in dry land situations but fertilization is capable of reducing canada thistle density when irrigated.

b. Mechanical Control: Mechanical control of canada thistle could be carried out throughout the

summer and fall. Repeated mowing or similar efforts, 2 to 3 times a year for 4 years in alfalfa can reduce canada thistle in some cases. Such methods keep canada thistle from going to seed; however, mowing has shown to stimulate new shoot growth from roots in other cases. Consequently, mowing alone may increase shoot density in an established stand if not carried out frequently enough to exhaust the root system of food reserves. Whether consistent mowing for several consecutive years will reduce the root mass and subsequently reduce an existing stand in all situations is still unknown. Goats if managed properly may be used to graze canada thistle instead of mowing. Cultivation of canada thistle every 21 days during the entire growing season for a few years can cause a drastic reduction in canada thistle infestations in many cases. Regardless of the method of mechanical management, revegetation with a proper perennial species is imperative after depletion of canada thistle and care should be taken to avoid soil erosion. Excluding sunlight by covering with black plastic for three years will at least reduce an infestation. This may be suitable for very small infestations, but the roots can spread 19 feet or more horizontally in one season.

c. Biological Suppression and Control: There are several species to assist in the management of canada thistle.

1. Canada thistle stem weevil *Ceutorhynchus litura* is currently available as a biological suppression agent on canada thistle in Colorado. The female lay eggs on the underside of the leaves in early spring and then the larvae bore into the main leaf vein and migrate down to the crown of the plant. Older larva, mine the stem, crown and root. The holes created by the larva open up canada thistle to possible secondary infection. Where a large population of the larva occur, death of canada thistle may be noticed.

2. Tortoise beetle *Cassida rubiginosa* larva and adults feed on the stems and foliage of canada and musk thistle. Over-wintering adults begin feeding and laying eggs in early spring. Feeding continues until after a hard frost. Plants can be heavily defoliated.

3. Thistle stem gall fly *Urophora cardui* attacks the primary and lateral stems of canada thistle. Adults lay their eggs on the thistle plant in the early summer when bolting plants are 12 inches tall or more. The developing larvae stimulate the plant to form a hard, woody stem gall. Gall formation directs nutrients away from the normal metabolic and reproductive functions of this noxious weed. Abnormally developed flower heads frequently occur above the gall, often reducing seed production. Multiple galls are possible on a single plant.

4. Canada thistle bud weevil *Larinus planus* lays eggs in the mature flower bud. Larva, destroy the flower's receptacle tissue and seeds. Adults also feed on the plant tissue but do not cause significant damage. The obligate rust fungus *Puccinia punctiformis* can be effective in reducing flowering and vegetative reproduction.

d. Herbicide Control: There are a number of herbicides labeled for use on canada thistle, depending upon where the thistle is found. Some of the most common herbicides that can be used independently or in combination with other compounds are: Tordon 22K, Banvel, 2,4-D formulations, Telar, Amber, Curtail, Stinger, Transline, Roundup ultra, Roundup pro, and Rodeo and any other EPA approved chemicals labeled for use on Canada thistle depending on area being treated. Round up products, are usually only suited for infestations that are monocultures unless proper revegetation will be initiated. Round up products will damage or kill all vegetation. All broadleaf herbicides can damage alfalfa and

similar plants and sometimes grasses at higher rates. Curtail and Stinger is most effective up to bud stage. Higher rates of Banvel will cause grass damage and inhibit grass seed germination. Escort and Telar must have specific surfactants added to them to be effective and at higher rates can cause damage to some types of grasses and are usually mixed with other compatible herbicides. Tordon 22K will usually give very good control, but it is not labeled for use in riparian or irrigated sites. With many herbicides, the addition of 2,4-D products is favorable at moderate amounts. 2,4-D by its self will only control the above ground portion of canada thistle unless repeated applications before bud stage are applied for several years. Herbicide applications can be made to canada thistle from rosette to the bud stage, and/or in the fall, depending upon the herbicide being used, the label typically states the proper timing. With many herbicides fall is usually a very good time to control canada thistle while carbohydrates are increasing in the root system. In industrial sites where no vegetation is desirable a ground sterilant, preemergent or Round up product may be used. For more current and specific herbicide information and recommendations, contact the county weed department. Always read the entire label and follow the directions for each herbicide being used. The entire label is the law.

2. Integrated Management Options by Site

A. Range, Pasture and Riparian Sites

Option #1 Biological and Herbicide Control: Currently biological controls for canada thistle have not shown exceptionally favorable results. This combination could fit in to a very large-scale infestation as only part of an overall program incorporated with control options. Release of the insect *Ceutorhynchus litura* can be made during the early summer. A herbicide application can then be made at the bud stage (where insects were not released) and in the fall where insects were released. Herbicide applications should only be carried out in the fall, where insects were directly released. Use of herbicides at different times of the growing season may be instituted as additional Integrated Pest Management (IPM) research is coordinated and recommendations are developed.

Option #2 Mechanical and Herbicide Control: Mowing or grazing of canada thistle can be carried out throughout the season with the first cycle at the bud stage before flowering. The cycle should stop during July depending on elevation, followed by a herbicide treatment during September depending on elevation, well before a hard killing freeze and repeated at least one more year if needed, with follow up herbicide treatments as needed. Canada thistle has the potential to set seed lower than a mower height.

Option #3 Cultural and Herbicide Control: Herbicide applications can be made followed up by reseeding with a competitive grass species such as smooth brome or other sod forming species. In addition, in some areas fertilization and irrigation could be instituted to stimulate and increase grass growth. Some herbicide products can interfere with seed germination.

Option #4 Mechanical and Cultural Control: Mechanical control as listed above in options, combined with cultural controls as listed above in options could be carried out. This may not eliminate canada thistle in many circumstances, even if the mechanical control is thorough and effective.

Option #5 Mechanical, Herbicide and Cultural Control: These methods combined would be most

desirable if the infestation is very large and the intent is to eradicate Canada thistle. Mechanical control as listed above would be used to weaken the root system and reduce seed production. Depending on the severity of the infestation this may need to be carried out for a few years with herbicide applications in the fall at a minimum. Once desirable control is achieved, proper revegetation helps to compete with any Canada thistle that may grow from seed or roots. Selection of the best herbicide for the species selected for revegetation is very important. Grasses would be favorable over broadleaf species for revegetation for a few years until all Canada thistle is eradicated.

Option #6 Multiple Integrated Control: Biological, mechanical, cultural and herbicide controls could and should be utilized on a very large-scale infestation. Development of an IMP requires information on the crop or plant community affected; lifecycles of weed that is targeted and biological agents to be used, and the control techniques to be incorporated in the IMP. Considerable planning, and time would be essential to properly utilize all controls to be effective and not allow the infestation to spread to other areas. Constant evaluation incorporating improved strategies and substantial efforts are critical in any integrated management program. Each situation will require specific needs for a multiple integrated control plan to be effective. Smaller infestations can utilize mechanical, cultural and herbicide controls depending on specific needs. Recommendations can be made once all the factors are discovered.

B. Right of Ways and Other Non-Crop Sites: Right of ways will usually cross many different types of land use. During construction or maintenance, preventive measures should be utilized to minimize the establishment and spread of noxious weeds. Consideration of all land use must be observed to properly implement any control plans. Non-crop sites will have to have specific consideration. Biological controls are not recommended for roadsides. Right of ways are typically not suited for biological controls unless the right of way passes through a very large infestation that is out of control and not being managed by other land owners or managers.

Option #1 Biological and Herbicide Control: Biological controls are not recommended for roadsides due to the fact that roadsides are a major mechanism for noxious weed dispersal and they must be controlled to protect other areas. Potential damage to biological agents is greater along roadsides. The same is true for right of ways, they adjoin other land use types and those lands must be protected. Industrial right of ways and other non-crop sites can be managed the same as option # 1 as listed above in range, pasture and riparian with consideration of the different land use types.

Option #2 Mechanical and Herbicide Control: Same as option #2 as listed above in range, pasture and riparian.

Option #3 Cultural and Herbicide Control: Same as option #3 as listed above in range, pasture and riparian.

Option #4 Mechanical and Cultural: Same as option # 4 as listed above in range, pasture and riparian.

Option #5 Mechanical, Herbicide and Cultural Control: Same as option #5 as listed above in range,

pasture and riparian.

Option #6 Multiple Integrated Control: Same as option #6 as listed in range, pasture and riparian. However, the same considerations as in option #1 above need to be observed.

C. Cropland Sites: Canada thistle is found in wheat crops and could be found in other potential crops in RBC. Prescription weed management measures developed by Colorado State University will be used when applicable. The county weed department and extension office can provide copies of research for species listed.

D. Residential Sites: Biological controls typically do not work well in residential sites and will not be allowed. Roundup products or other EPA listed herbicides such as preemergents could be used in gardens and/or flower beds but, damage to flowers and gardens can occur if some herbicide are allowed to come in to contact with desirable plants, even in very small amounts. The same is true for products that can be picked up through the root system of desirable vegetation. Roundup will kill grasses in turf areas or any other plant that it contacts. Products such as 2,4-D or similar selective herbicides should be used in turf. Proper turf management and/or establishment to improve the health of turf are imperative to combat against all weeds especially perennials. Colorado State University, Service in Action (SIA) sheet recommendations will be used for residential properties in most cases. Other management practices may be feasible in some cases. The county extension office can provide copies of SIA sheets.

DIFFUSE KNAPWEED:

1. Control Measures

a. Cultural Control: Cultural control of diffuse knapweed with perennial grasses such as smooth brome and crested wheatgrass may help to compete with diffuse knapweed and slow its spread to a degree. Diffuse knapweed will establish in healthy environments but is more likely to be problematic in areas that are impacted or lacking desirable species that occupy all niches of the environment. Seeding alone in infested diffuse knapweed sites will not, however, control the existing stand. Its produces early spring growth that is difficult to compete against. Good land stewardship practices are always essential in managing diffuse knapweed or any other weed species.

b. Mechanical Control: Hand pulling or grubbing of diffuse knapweed when it is in the bud stage and again when it is in the very early flowering stage can significantly reduce seed production and is well suited for smaller infestations. Pulling is best when the soil is moist since more of the root system can be removed. Similar results may be obtained with sheep or goats in some cases. Mowing may be able to be used with repeated mowing, whenever diffuse knapweed reaches the early bud stage. Mowing can stimulate and increase seed production below mower height in some cases. Mowing does not appear to control diffuse knapweed. It is very important to not let diffuse knapweed seed out, as this will extend control practices for several years. Keeping all diffuse knapweed from going to seed over a number of years can eventually eliminate an infestation, once the seed source in the soil is depleted. Uncontrolled knapweed on adjoining properties may reintroduce seeds. Burning of knapweed has shown limited results and may increase the cover and density of this noxious weed without other controls in place.

Burning may be used to clean up old dead growth that could obstruct herbicide applications. It is also important to minimize ground disturbance so that competition from desirable vegetation is not disrupted.

d. Biological Suppression and Control: There are many biological agents for diffuse knapweed. Some are currently not available but will be listed. Biological control agents alone have not been successful in controlling diffuse knapweed. However, they reduce seed production and may reduce the competitiveness of diffuse knapweed to a limited degree.

1. There are two kinds of knapweed seed head flies also known as picture-winged flies, *Urophora affinis* and *Urophora quadrifasciata* available for diffuse and spotted knapweed. These have shown to have effect in dense stands mainly on spotted knapweed. These knapweed seed head flies attack the flowers of diffuse and spotted knapweed to produce galls and reduce the seed production in infested plants. Neither of these species is established in RBC at present.

2. The knapweed flower weevil *Larinus minutus* attacks diffuse and spotted knapweed. Larva consumes developing seeds. Adults feed on rosettes and flowers.

3. Spotted knapweed seed head moth *Metzneria paucipunctella* is a flower-feeding moth. Spotted knapweed is preferred, but it also attacks diffuse knapweed. Adult moths lay eggs on bracts at the base of flowers. Larva's enter the flower, consuming florets and, later, seed. Mature larvae mine the receptacle tissue. Studies have shown that this moth, together with seed-head flies, reduces seed production more than either species alone. *Metzneria* does not do well in areas that are very cold with little snow cover.

4. Sulphur knapweed moth, *Agapeta zoegana* attacks spotted and diffuse knapweed. Larva mines the root and crown. Larva feeding in the first season can kill small plants. Older plants often do not flower.

5. Buprestidae beetle, *Sphenoptera jugoslavica* attacks diffuse knapweed. The larva bore into the root crown and upper roots retarding the development of rosettes and stunting plant growth.

6. *Bangasternus fausti* a small seedhead weevil lay eggs on the flowers of diffuse and spotted knapweed. The larva feed within the flower receptacle, destroying the seed.

7. *Cyphocleonus achates* prefers spotted knapweed, but also attacks diffuse knapweed. Larvae mine and gall the central vascular tissue of the roots. Feeding by older larva causes considerable damage to the root, especially too small plants or plants containing multiple larvae.

8. Knapweed peacock fly, *Chaetorellia acrolophi* larva burrows through the bracts into the center of the bud and feed on developing seed. *C. acrolophi* attacks spotted and diffuse knapweed but it is currently not available in Colorado.

9. Lesser knapweed flower weevil, *Larinus minutus* larva feed on the pappus hairs and then move downward to the achenes where they consume the contents of individual seeds as well as some near by seeds and the receptacle. *L. minutu* prefers diffuse knapweed but also attacks spotted knapweed but it is currently not available in Colorado to my knowledge.

10. Blunt knapweed flower weevil, *Larinus obtusus* larva feed within the seed head on the pappus hairs and developing seeds. This beetle species prefers spotted knapweed and to a lesser extent, diffuse knapweed. *L. obtusus* is currently not available in Colorado to my knowledge.

11. Brown-winged root moth, *Pelochrista medullana* larva move to the center of the rosette and mine its root. Larva feeding reduces nutrient uptake by the plant. *P. medullana* attack both diffuse and spotted knapweed. First released in Montana in 1984, but none have ever been recovered.

12. Grey-winged root moth, *Pterolonche inspersa* larva feed down into the root of the plant, some mine

the woody portion while others feed on the epidermis. *P. inspersa* attacks diffuse, spotted and squarrose knapweed. It was first released in 1986 in Idaho, Oregon and Utah.

13. Green clearwing fly also called the verdant seed fly, *Terellia virens* first and second instars feed inside developing seeds, but later consume other seeds in the flower head, or receptacle tissue. *T. virens* seems to prefer spotted knapweed but diffuse knapweed is also attacked to a lesser extent. It is now established in Montana and Oregon.

14. Russian knapweed gall *Subanguina picridis* females give birth to larval nematodes. Larva development stimulates galls at the infected site. Both adult and larva are destructive, attack russian and diffuse knapweed, and is available in Colorado in limited supplies.

Biological controls of diffuse knapweed have shown limited results in most cases. Utilizing biological controls that will attack many different parts of diffuse knapweed should improve control. Currently all knapweed species in RBC are small and eradication of all species is possible in this county. Unless a very large infestation is discovered in this county biological control agents will not be considered a viable option for control.

d. Herbicide Control: There are a few herbicides labeled for use on diffuse knapweed. Many can be used independently or in combination with each other. Some of the herbicides commonly used are Tordon 22K, Banvel, 2,4-D, Escort, and Clopyralid products such as Transline, Stinger and Curtail. Some formulations of 2,4-D may be used in aquatic situations. Any other EPA approved herbicide labeled for use on diffuse knapweed may be used depending on the situation. Herbicide applications can be made during the rosette to very early bolting stages early in the year. Applications can also be made during the fall as long as the rosettes are green and healthy and the ground is not frozen or covered with snow. Early spring and late fall applications are the most effective and cost efficient times for herbicide applications. Herbicides that reside in the soil for a short period will usually improve control if done properly. If herbicides are applied when diffuse knapweed is in the flower stage, results will typically be reduced and with most products, seeds will remain viable. Herbicides are only one of the components needed to successfully control knapweed in large infestations.

2. Integrated Management Options by Site

A. Range Pasture and Riparian Sites

Option #1 Biological and Herbicide Control: The release of biological control agents such as *Urophora affinis* and *U. quadrifasciata* can be made. A herbicide application can then be made from the rosette through the bolting stage (where insects were not released) and in the fall where insects were released. The use of herbicides at different times of the year for different biological agents may be instituted in the future when research is conducted and scientific recommendations are developed. With the small populations of knapweed in RBC, biological controls are not recommended.

Option #2 Mechanical and Herbicide Control: Mowing pulling or grubbing can be carried out when diffuse knapweed is in the bud and again before any flowering. A herbicide application can then be made

to any plants that have been missed, re-bolted or that develop rosettes, if necessary. Burning can sometimes be effective in delaying the plant's ability to produce seed and in some instances allow for improved herbicide performance in dense infestations.

Option #3 Cultural and Herbicide Control: A herbicide application can be made in the early summer when diffuse knapweed is in the early summer rosette through early bolting stage. Reseeding with competitive perennial grasses can be followed later in the summer depending upon the herbicide used and the rate of application. In some cases, grasses will rebound by themselves after a herbicide application, depending on the herbicide being used. Any knapweed re-growth can be treated with a properly selected herbicide for the site.

Option#4 Mechanical and Cultural Control: This option could be desirable in situations where desirable vegetation is in poor condition. The mechanical control should be carried out and followed by reseeding of competitive perennial grasses desirable for the intended land use. Follow up mechanical control will still be needed for the next several years without letting any plants seed out.

Option #5 Mechanical, Herbicide and Cultural Control: Utilization of these control measures could work well with a large or small infestation. The procedure would depend on whether or not the desirable vegetation is sufficient to help compete against diffuse knapweed, with some improved cultural controls.

Option #6 Multiple Integrated Control: Biological, mechanical, cultural and herbicide controls could and should be utilized on a very large-scale infestation. Development of an IMP requires information on the crop or plant community affected; lifecycles of weed that is targeted and biological agents to be used, and the control techniques to be incorporated in the IMP. Considerable planning, and time would be essential to properly utilize all controls to be effective and not allow the infestation to spread to other areas. Constant evaluation incorporating improved strategies and substantial efforts are critical in any integrated management program. Each situation will require specific needs for a multiple integrated control plan to be effective. Smaller infestations can utilize mechanical, cultural and herbicide controls depending on specific needs. Recommendations can be made once all the factors are discovered.

B. Rights of Way and other Non Crop Sites: Right of ways will usually cross many different types of land use. During construction or maintenance, preventive measures should be utilized to minimize the establishment and spread of noxious weeds. Consideration of all land use must be observed to properly implement any control plans. Non-crop sites will have to have specific consideration. Biological controls are not recommended for roadsides. Right of ways are typically not suited for biological controls unless the right of way passes through a very large infestation that is out of control and not being managed by other land owners or managers.

Option #1 Biological and Herbicide Control: With the small populations of knapweed in RBC, biological controls are not recommended.

Option #2 Mechanical and Herbicide Control: Same as option #2 as listed above in range, pasture and riparian.

Option #3 Cultural and Herbicide Control: Same as option #3 as listed above in range, pasture and riparian.

Option#4 Mechanical and Cultural Control: Same as option #4 as listed above in range, pasture and riparian.

Option#5 Mechanical, Herbicide and Cultural Control: Same as option #5 as listed above in range, pasture and riparian.

Option #6 Multiple Integrated Control: Same as option #6 as listed in range, pasture and riparian. However, the same considerations as in option #1 above need to be observed.

C. Cropland Sites: Diffuse knapweed could potentially be found in any crop land situation in RBC. Prescription weed management measures developed by Colorado State University will be used when applicable. The county weed department and extension office can provide copies of research for species listed.

D. Residential Sites: Biological controls typically do not work well in residential sites and will not be allowed. Roundup products or other EPA listed Herbicides such as preemergents could be used in gardens and/or flower beds but, damage to flowers and gardens can occur if some herbicide are allowed to come in to contact with desirable plants, even in very small amounts. The same is true for products that can be picked up through the root system of desirable vegetation. Roundup will kill grasses in turf areas or any other plant that it contacts. Products such as 2,4-D or similar selective herbicides should be used in turf. Proper turf management and/or establishment to improve the health of turf are imperative to combat against all weeds. Colorado State University, Service in Action (SIA) sheet recommendations will be used for residential properties. The county extension office can provide copies of SIA sheets.

Field bindweed :

1.Control Measures

Control by means other than herbicides is difficult. The biggest threat posed by field bindweed in the future is to hay producers.

a. Cultural Control: Cultural control methods tend to work poorly towards controlling field bindweed. Seeding with perennial grasses may help slow the spread and to deter establishment of new infestations. However, field bindweed will survive and spread even in optimum conditions for grass.

b. Mechanical Control: Mechanical control of field bindweed is difficult due to its tremendous root

system and capability of low growth. Mowing generally has little or no effect while continuous hoeing or grubbing can be slightly more effective. Cultivation at intervals of ten to fourteen days can be effective, but two or more growing seasons of diligent efforts are needed to achieve stand reduction. This would keep Field bindweed from producing seed and would start to reduce root reserves. Cultivation intervals must be maintained or you will spread field bindweed throughout the field. Cultivation for such a long time would not be environmentally sound in many situations.

Plastic or fabric can be placed over a smaller infestation and sealed around the edges for three years or more to reduce the infestation. Care must be taken to place the plastic over a large enough area to avoid having the plant spread underground and enlarge the infestation.

c. Biological Suppression and Control: Two biological agents are available for field bindweed.

1. Bindweed gall mite *Aceria malherbae* will cause galls on leaves, petioles, and stem tips, stunting the plant and reduce flowering.
2. Bindweed moth *Tyta luctuosa* larva feed on flowers and leaves. Neither species have been proven effective in controlling field bindweed to date. These biological agents should probably be introduced in safe areas within the city limits of Meeker and Rangely in large infestations.

d. Herbicide Control: There are a many herbicides labeled for use on field bindweed. Many can be used independently or in combination with each other. Some of the herbicides commonly used are Tordon 22K, Banvel, 2,4-D, Krenite, Roundup, Rodeo or Escort and any other EPA approved herbicide labeled for use on Field bindweed may be used depending on the situation. Herbicide applications can be made at various stages of growth depending on the herbicide being used. Applications can also be made during the fall as long as the plant is green and healthy and there is ample time for the herbicide to be effective before frost damage. Fall applications are usually the most effective time for herbicide applications. Herbicides that reside in the soil will usually improve control if done properly. Effective control may take many years of management.

2. Integrated Management Options by Site

B. Range Pasture and Riparian Sites

Option #1 Biological and Herbicide Control: No studies have been released on utilizing the biological agent's *A. malherbae* and *T. luctuosa* with herbicides or livestock. Livestock may be used to graze from May through July or August (depending on elevation) followed by a herbicide application in September or October. A minimum of 12 inches of re-growth should be obtained before herbicide applications. For riparian areas Rodeo, Krenite and aquatic 2,4-D may be used according to label directions.

Option #2 Mechanical and Herbicide Control: Cultivate or use manual efforts and follow herbicide guidelines in option #1 listed directly above.

Option #3 Cultural and Herbicide Control: A herbicide application using short residual herbicides can be made throughout the year followed by reseeding of a competitive sod forming grass mix if competition is lacking. Care must be taken to use a herbicide and rate that will not cause damage to

grass seedlings. Fertilization according to soil test and/or irrigation could be instituted to stimulate increased grass growth. Once grass has matured so that it is not susceptible to herbicide damage, herbicide applications can then be made to obtain better control of Field bindweed.

Option#4 Mechanical and Cultural Control: Mechanical and cultural controls combined will not control Field bindweed.

Option #5 Mechanical, Herbicide and Cultural Control: Combining these controls would be similar to either option # 2, 3 and 4 above as listed in range pasture and riparian.

Option #6 Multiple Integrated Control: Biological, mechanical, cultural and herbicide controls could and should be utilized on a very large-scale infestation. Development of an IMP requires information on the crop or plant community effected; lifecycles of weed that is targeted and biological agents to be used, and the control techniques to be incorporated in the IMP. Considerable planning, and time would be essential to properly utilize all controls to be effective and not allow the infestation to spread to other areas. Constant evaluation incorporating improved strategies and substantial efforts are critical in any integrated management program. Each situation will require specific needs for a multiple integrated control plan to be effective. Smaller infestations can utilize mechanical, cultural and herbicide controls depending on specific needs. Recommendations can be made once all the factors are discovered.

B. Rights of Way and other Non Crop Sites: Right of ways will usually cross many different types of land use. During construction or maintenance, preventive measures should be utilized to minimize the establishment of spread of noxious weeds. Consideration of all land use must be observed too properly implement any control plans. Non-crop sites will have to have specific consideration Biological controls are not recommended for roadsides. Right of ways are typically not suited for biological controls unless the right of way passes through a very large infestation that is out of control and not being managed by other land owners or managers.

Option #1 Biological and Herbicide Control: With the small populations of field bindweed in Rio Blanco County except within the city limits of the municipalities, biological controls are not recommended at this time except for use in the municipalities.

Option #2 Mechanical and Herbicide Control: Same as option #2 as listed above in range, pasture and riparian.

Option #3 Cultural and Herbicide Control: Same as option #3 as listed above in range, pasture and riparian.

Option#4 Mechanical and Cultural Control: Same as option #4 as listed above in range, pasture and riparian.

Option#5 Mechanical, Herbicide and Cultural Control: Same as option #5 as listed above in range, pasture and riparian.

Option #6 Multiple Integrated Control: Same as option #6 as listed in range, pasture and riparian. However, the same considerations as in option #1 above need to be observed.

C. Cropland Sites: Field bindweed could potentially be found in any crop land situation in Rio Blanco County. Prescription weed management measures developed by Colorado State University will be used when applicable. The county weed department and extension office can provide copies of research for species listed.

D. Residential Sites: Biological controls will be allowed in residential sites due to the severity of the problem in the municipalities. Roundup products or other EPA listed Herbicides such as preemergents could be used in gardens and/or flower beds but, damage to flowers and gardens can occur if some herbicide are allowed to come in to contact with desirable plants, even in very small amounts. The same is true for products that can be picked up through the root system of desirable vegetation. Roundup will kill grasses in turf areas or any other plant that it contacts. Products such as 2,4-D or similar selective herbicides should be used in turf. Proper turf management and/or establishment to improve the health of turf are imperative to combat against all weeds especially perennials. Colorado State University, Service in Action (SIA) sheet recommendations will be used for residential properties. The county extension office can provide copies of SIA sheets.

Hoary cress:

1.Control Measures

Control of hoary cress is difficult at best. No single method provides long-term control on large established sites. Integrated management will usually, only be as successful as the effort put in to controlling hoary cress.

a. Cultural Control: Planting alfalfa can reduce hoary cress for a few years until the alfalfa matures out. Plantings of various competitive grasses will allow herbicide applications to help control hoary cress, unlike alfalfa or other legumes. Flooding from May through September will help control hoary cress. Moderate grazing with sheep can be utilized as long as the competition from other plants is not reduced.

b. Mechanical Control: Persistent digging or pulling when the soil is moist for 3 to 4 years or more, removing as much of the root system as possible within 10 days of emergence can be successful. Cultivation at least 6 inches deep within 10 days of hoary cress emergence for 3 to 4 years or more can be successful when practicable. Mowing by its self will not provide control but can be effective when combined with herbicide applications. Plastic or fabric can be placed over a smaller infestation and sealed around the edges for 3 to 4 years or more to reduce the infestation. Care must be taken to place the plastic over a large enough area to avoid having the plant spread underground and enlarge the infestation.

c. Biological Suppression and Control: There have been reports of 2 biological agents that have been released in Wyoming but no other information is currently available. When information is obtained it will be listed.

d. Herbicide Control: Few herbicides are labeled for use on hoary Cress. Escort or Telar are the most effective but can cause severe damage to certain grasses at various rates. Calibration of spray equipment is of most importance when using these products. Herbicide applications should be made to rosettes in the early spring, to re-growth before the bud stage and fall re-growth several weeks before a killing frost. Only certain amounts of Escort or Telar can be applied in one growing season so alternatives such as 2,4-D may need to be applied during the summer or fall so that rates are not exceeded. Spring and fall applications are usually very effective times for Escort or Telar applications. Herbicide applications during the bloom stage are usually less effective. Effective control may take many years of management.

2. Integrated Management Options by Site

A. Range Pasture and Riparian Sites

Option #1 Biological and Herbicide Control: None available at this time.

Option #2 Mechanical and Herbicide Control: Mowing to ground level can be useful in keeping hoary cress from setting seed and allowing for a fall herbicide application. This would allow for a higher labeled rate of Escort or Telar while keeping within the yearly rate limits on those labels. Cultivating or grazing with sheep could be utilized instead of mowing.

Option #3 Cultural and Herbicide Control: A herbicide application using short residual herbicides such as Escort or Telar can be made early in the year followed by reseeding of a competitive sod forming grass in the fall if competition is lacking. Care must be taken to time the herbicide and use a rate that will not cause damage to grass seedlings. Fertilization according to soil test and/or irrigation could be instituted to stimulate increased grass growth. Once grass has matured so that it is not as susceptible to herbicide damage, herbicide applications can then be made to obtain better control of hoary cress.

Option#4 Mechanical and Cultural Control: Mechanical controls performed as listed above in control measures can be combined with plantings of competitive legumes or grasses. There are no herbicides labeled for use in alfalfa that control hoary cress and the products Escort and Telar can damage grass species at various rates.

Option #5 Mechanical, Herbicide and Cultural Control: Combining these controls would be similar to either option # 2, 3 and 4 above as listed in range pasture and riparian.

Option #6 Multiple Integrated Control: Biological, mechanical, cultural and herbicide controls could and should be utilized on a very large-scale infestation. Development of an IMP requires information on the crop or plant community effected; lifecycles of weed that is targeted and biological agents to be used, and the control techniques to be incorporated in the IMP. Considerable planning, and time would be

essential to properly utilize all controls to be effective and not allow the infestation to spread to other areas. Constant evaluation incorporating improved strategies and substantial efforts are critical in any integrated management program. Each situation will require specific needs for a multiple integrated control plan to be effective. Smaller infestations can utilize mechanical, cultural and herbicide controls depending on specific needs. Recommendations can be made once all the factors are discovered.

B. Rights of Way and other Non Crop Sites: Right of ways will usually cross many different types of land use. During construction or maintenance, preventive measures should be utilized to minimize the establishment and spread of noxious weeds. Consideration of all land use must be observed too properly implement any control plans. Non-crop sites will have to have specific consideration Biological controls are not recommended for roadsides. Right of ways are typically not suited for biological controls unless the right of way passes through a very large infestation that is out of control and not being managed by other land owners or managers. Recommendations can be made once all the factors are discovered.

Option #1 Biological and Herbicide Control: Biological controls for hoary cress are currently not available.

Option #2 Mechanical and Herbicide Control: Same as option #2 as listed above in range, pasture and riparian.

Option #3 Cultural and Herbicide Control: Same as option #3 as listed above in range, pasture and riparian.

Option#4 Mechanical and Cultural Control: Same as option #4 as listed above in range, pasture and riparian.

Option#5 Mechanical, Herbicide and Cultural Control: Same as option #5 as listed above in range, pasture and riparian.

Option #6 Multiple Integrated Control: Same as option #6 as listed in range, pasture and riparian. However, the same considerations as in option #1 above need to be observed.

C. Cropland Sites: Hoary cress could potentially be found in any crop land situation in Rio Blanco County. Prescription weed management measures developed by Colorado State University will be used when applicable. The county weed department and extension office can provide copies of research for species listed.

D. Residential Sites: Biological controls are currently not available for hoary cress. Roundup products or other EPA listed Herbicides for residential sites such as preemergents could be used in gardens and/or flower beds but, damage to flowers and gardens can occur if some herbicides are allowed to come in to contact with desirable plants, even in very small amounts. The same is true for products that can be

picked up through the root system of desirable vegetation. Roundup will kill grasses in turf areas or any other plant that it contacts. Products such as 2,4-D or similar selective herbicides should be used in turf but will have to be timed properly to have any effect. Proper turf management and/or establishment to improve the health of turf are imperative to combat against all weeds especially perennials. Colorado State University, Service in Action (SIA) sheet recommendations will be used for residential properties. The county extension office can provide copies of SIA sheets.

Leafy spurge:

1. Control Measures

Control of leafy spurge is very difficult. Genetic variability in localized areas can cause controls to be inconsistent. No single method provides long-term control on large established sites and many times smaller sites. Integrated management can only be as successful as the effort put in to controlling leafy spurge. Long term integrated management programs must be implemented and adjusted as needed to manage leafy spurge. Success is possible, but only with persistence. Prevention is of great importance when dealing with leafy spurge.

a. Cultural Control: Seeding and maintaining select perennial grasses can be an effective tool in suppressing leafy spurge. Bozoisky Russian wild rye, pubescent wheatgrass, smooth brome, western wheatgrass, Dahurian wildrye and little bluestem have been shown as good grasses to compete against leafy spurge. In addition to the establishment of grasses, when reseeding select a mixture of competitive species with deep, shallow, and intermediate root systems that are well adapted to the particular site. Selecting a combination of competitive species that actively grow in early spring, midseason and fall will improve the concepts of cultural control. Leafy spurge is quite capable of competing for moisture and nutrients. Any activity that encourages vigorous growth of grasses is very important.

b. Mechanical Control: Mechanical control of leafy spurge is difficult at best. Cultivation in cropland has been used to control leafy spurge. Cultivation must begin 2 to 4 weeks after leafy spurge emergence, tilling 4 inches deep every 3 weeks until the soil freezes. This schedule can not be interrupted and must be continued for at least two seasons to be effective. Seedlings will then need to be controlled so it is important to select a crop that will not be damaged by herbicides that will control leafy spurge. Mowing and burning are ineffective for controlling leafy spurge but burning prior to herbicide applications can improve spray coverage and visibility in dense stands. Mowing alone can prevent seed production if carried out throughout the growing season. Hand pulling is not effective except for very young seedlings (usually less than 2 weeks old) but this will not address where the seeds came from.

c. Biological Suppression and Control: There are 13 species of biological controls currently available. The most effective to date are in the genus *Aphthona* and a root boring beetle, *Oberea erythrocephala*. All flea beetle adults' feed on above ground parts of leafy spurge reducing photosynthesis while larva feed on root hairs, shoots and shoot buds. Large populations can cause death to plants reduce flowering or stun plants reducing competition. Some have more than one generation per year. Following is the common and scientific names of the genus *Aphthona*.

1. Minute spurge flea beetle, *A abdominalis*.

2. Brown dot leafy spurge flea beetle, *A cyparissiae*.
3. Black leafy spurge flea beetle, *A czwalinae*.
4. Cooper leafy spurge flea beetle, *A flava*.
5. Brown-legged leafy spurge flea beetle, *A lacertosa*.
6. Black dot leafy spurge flea beetle, *A nigriscutis*.
7. A clear wing moth with no common name, *Chamaesphecia empiformis* and the Hungarian clearwing moth *Chamaesphecia hungarica* and *Chamaesphecia tenthrediniformis* also with no common name, larva deplete root reserves and the plants ability to replace those reserves, causing loss of plant vigor and sometimes death. They may also allow soil-borne pathogens to invade damaged root tissue.
8. A fly, gall midge *Dasineura capsulae* attack the inner part of the bract producing galls reducing seed potential.
9. The Leafy spurge hawkmoth *Hyles euphorbiae* larva feed on leaves and bracts but is mostly ineffective as a biological control agent.
10. The Red-headed leafy spurge stem borer *Oberea erythrocephala* adult feed on the leaves and stem. It is the girdling by the adult with subsequent egg laying that generally results in shoot death. The larva in the stem, also cause the stem to die, and the feeding in the crown and root greatly reduces the plants root reserves.
11. The Leafy spurge tip gall midge *Spurgia esula* multiple larval generations attacks the tips of leafy spurge plants destroying the shoots ability to flower and produce seed, thus causing another flush of growth repeating the cycle. Several other species are currently being studied for potential release in the future, when they are released they will be listed. Grazing with sheep or goats in the spring and again in the fall combined with other biological control agents in the genus *Aphthona* have shown positive results. Neither grazing controls and biological controls or the combination of either control should be used on small infestations since they will not eradicate it. Stocking rates for sheep and goats will vary with leafy spurge density, terrain and rainfall. Anytime grazing is done when leafy spurge has set seed the animals must be corralled or held in a specific area for at least 5 to 7 days to pass seeds from their digestive tracts. Corrals or holding areas must be monitored for any spurge regularly and if found treated with herbicides immediately. Goats require more management than sheep and can cause damage to woody species. Sheep may need a 5 to 10 day adjustment period before they readily accept leafy spurge. Grazing rotations must be timed to minimize stress to grasses when they are growing stems and flowering. Grazing can be utilized to prevent seed production. It is not known if this method will keep an existing infestation from spreading by underground root growth. Continual grazing of leafy spurge with sheep without other vegetation in their diet throughout the year may cause scours.

d. Herbicide Control: Annual applications of herbicide are one component of an effective management plan. The small and isolated leafy spurge sites are usually eradicable with herbicides and should be attempted. Herbicides should be applied at least 15 feet beyond any leafy spurge infestation. Most herbicides are recommended for application at the true flower stage (which is about 2 weeks after the yellow-green bracts appear). Krenite, Rodeo and aquatic formulations of 2,4-D can be used in riparian areas. Rodeo and Roundup products can be applied but can cause varying degrees of grass injury and usually should not be applied 2 years in a row without revegetation. Tordon is the most proven and used herbicide to date although others are showing promise. Plateau, Krenite, Oust, Banvel, 2,4-D formulations, Roundup products and Rodeo or any other EPA approved herbicide for use on leafy spurge may be used. Herbicide management of leafy spurge can be costly with some products. All

herbicide products must be kept out of water and most can not be applied in flood planes.

2. Integrated Management Options by Site

B. Range Pasture and Riparian Sites

Option #1 Biological and Herbicide Control: Grazing with sheep or goats at least 3 times a year will help keep leafy spurge from going to seed and make it more susceptible to herbicides that fall. Multiple years of repeated grazing will stress the plant making it less vigorous and more susceptible to competition from other desirable species. Grazing should start when leafy spurge is approximately 4 to 6 inches tall. Do not leave the sheep or goats in the infested area once the leafy spurge is graze off. Repeat the grazing cycle when the leafy spurge is approximately 10 inches tall or less and repeat the cycle until approximately late August or early September depending on elevation and soil moisture making sure it does not produce seeds. If combining the management with herbicides, allow enough time for the leafy spurge to grow tall enough for a fall herbicide treatment to be effective but treat before seed set and at least 2 weeks before a hard freeze. The release of *Aphthona* species with herbicide applications around the perimeter, to keep leafy spurge from spreading is acceptable for large areas. Herbicides can then be carried out in the fall where biological insects were used. Herbicides should not be used during the spring or summer where biological insects were used. Once *Spurgia esula* is well established and the insect has completed its second generation for that year, limited herbicide use can be used. The use of 2,4-D at 10 ounces per acre can be used around trees, and Tordon 22K can be added at 4 ounces per acre for use in other labeled areas. You must leave approximately 15% to 25% of the area in the center of the infestation untreated when using this method. After *Hyles euphorbiae* reaches the fifth instar stage, 2,4-D at slightly less than 1 Lb per acre and Tordon 22K at slightly less than 1 Lb per acre can be applied with minimal injury to larva. Biological controls by them self will produce a revolving cycle of control but will never eradicate leafy spurge. Other uses of herbicides with biological controls may be instituted as additional IPM research is conducted and recommendations are developed.

Option #2 Mechanical and Herbicide Control: Burning can clean up dense growth allowing better performance of herbicides, but one must allow usually 5 weeks of re-growth before any herbicide applications. Various mechanical controls can be used to keep leafy spurge from setting seed and make it more susceptible to herbicide damage as long as sufficient growth is allowed for maximum herbicide uptake at least 2 weeks before a hard freeze. This procedure is very similar to the grazing and herbicide treatment in option #1 above. Burning or other mechanical controls should only be performed in the early spring or late fall if biological controls are being used in the immediate treatment spot.

Option #3 Cultural and Herbicide Control: A herbicide application using short residual herbicides can be made early in the year followed by reseeding of a competitive sod forming grass in the fall if competition is lacking. Care must be taken to time the herbicide and use a rate and product that will not cause damage to grass seedlings. Fertilization according to soil test and/or irrigation could be instituted to stimulate increased grass growth. Once grass has matured so that it is not as susceptible to herbicide damage, herbicide applications can then be made to obtain better control of leafy spurge.

Option#4 Mechanical and Cultural Control: This combination has not proven effective in controlling

leafy spurge but could be manipulated to prevent seed set and slow the spread of leafy spurge. Without proper competition, leafy spurge will reestablish.

Option #5 Mechanical, Herbicide and Cultural Control: This may be a favorable combination for many landowners especially if there is a lack of proper competition. The combinations are plentiful and various combinations can be utilized in different ways. The mechanical, cultural and herbicide recommendations listed above can be combined to suite almost any need but persistence and eliminating seed production are the keys when dealing with leafy spurge. Recommendations can be made once all the factors are discovered. Typical applications consist of mowing or grazing to prevent seed production and stress the leafy spurge. Apply a proper herbicide in late summer or early fall. Then incorporate a competitive grass species for that site to help compete against leafy spurge. Proper fertilization, water management and grazing practices with follow up herbicide applications will help gain control of leafy spurge. Yearly monitoring and adjustments in management practices will be needed to eradicate leafy spurge.

Option #6 Multiple Integrated Control: Biological, mechanical, cultural and herbicide controls could and should be utilized on a very large-scale infestation. Development of an IMP requires information on the crop or plant community effected; lifecycles of weed that are targeted and biological agents to be used according to the site, and the control techniques to be incorporated in the IMP. Considerable planning, and time would be essential to properly utilize all controls to be effective and not allow the infestation to spread to other areas. Constant evaluation incorporating improved strategies and substantial efforts are critical in any integrated management program. Each situation will require specific needs for a multiple integrated control plan to be effective. Smaller infestations can utilize mechanical, cultural and herbicide controls depending on specific needs. Pastures, range lands and riparian areas will all be managed differently. Recommendations can be made once all the factors are discovered.

Typically, a program of this type will first establish appropriate funding and time to be utilized on a yearly basis. Determine if changes in land management can be a benefit in controlling the noxious weed. Appropriate biological controls are released in the crux of the infestation. Management of satellite or outlying infestations must be controlled with herbicides, proper grazing and inter-seeded with appropriate competitive grass species as needed as well as proper fertilization and water management if applicable. As satellite infestations are controlled similar management practices are moved inward in an effort to reduce the size of the infestation while follow up treatments are utilized on the original satellite infested areas as needed. Monitoring the biological release areas after a few years will indicate if the releases were successful. If not establish new releases, if successful in a few more years collect and spread some of the biological controls around the crux of the infestation. Continue to work the management program inward as outlying areas are reduced in size and density. Surveys should be performed yearly to determine where the biological controls are spreading to and only approved herbicide management practices should be utilized in those areas that avoid damage to the biological controls. Yearly surveys should also be done to determine if new satellite infestations occur elsewhere in the management area. If adjoining neighbors do not have infestations on their property, many times they are willing to assist you in managing the problem on your property. If adjoining neighbors do have infestations on their property, both landowners should evaluate and adjust management plans to be of the most benefit to each other.

B. Rights of Way and other Non Crop Sites: Right of ways will usually cross many different types of land use. During construction or maintenance, preventive measures should be utilized to minimize the establishment and spread of noxious weeds. Consideration of all land use must be observed too properly implement any control plans. Non-crop sites will have to have specific consideration Biological controls are not recommended for roadsides. Right of ways are typically not suited for biological controls unless the right of way passes through a very large infestation that is out of control and not being managed by other land owners or managers. Recommendations can be made once all the factors are discovered. Typically, herbicides labeled for the weed species and land use are the best choice for initial controls along rights of way, followed by proper revegetation and monitoring.

Option #1 Biological and Herbicide Control: Same as option #1 as listed above in range, pasture and riparian.

Option #2 Mechanical and Herbicide Control: Same as option #2 as listed above in range, pasture and riparian.

Option #3 Cultural and Herbicide Control: Same as option #3 as listed above in range, pasture and riparian.

Option#4 Mechanical and Cultural Control: Same as option #4 as listed above in range, pasture and riparian.

Option#5 Mechanical, Herbicide and Cultural Control: Same as option #5 as listed above in range, pasture and riparian.

Option #6 Multiple Integrated Control: Same as option #6 as listed in range, pasture and riparian. However, the same considerations as in option #1 above need to be observed.

C. Cropland Sites: Leafy spurge could potentially be found in any crop land situation in Rio Blanco County. Prescription weed management measures developed by Colorado State University will be used when applicable. The county weed department and extension office can provide copies of research for species listed.

D. Residential Sites: Biological controls typically do not work well in residential sites and will not be allowed. Roundup products or other EPA listed Herbicides for residential sites such as preemergents could be used in gardens and/or flower beds but, damage to flowers and gardens can occur if some herbicides are allowed to come in to contact with desirable plants, even in very small amounts. The same is true for products that can be picked up through the root system of desirable vegetation. Roundup will kill grasses in turf areas or any other plant that it contacts. Products such as 2,4-D or similar selective herbicides should be used in turf but will have to be timed properly to have any effect. Proper turf management and/or establishment to improve the health of turf are imperative to combat against all

weeds especially perennials. Colorado State University, Service in Action (SIA) sheet recommendations will be used for residential properties. The county extension office can provide copies of SIA sheets.

Musk thistle:

1. Control Measures

Musk thistle control is best achieved by preventing seed development and dispersal along with proper competitive vegetation for several years. The selection of competitive species will depend on the zone in which it grows. If adjoining properties have infestations joint efforts are needed to properly control musk thistle since the seeds can be carried by the wind. Sites that are stressed or have disturbed soils with a lack of competitive species are the primary sites of infestation.

a. Cultural Control: Seeding and maintaining perennial grasses can be an effective tool in suppressing and controlling musk thistle. In addition to the establishment of grasses, avoid nitrogen fertilizers since they appear to favor the establishment of musk thistle. Selecting a combination of competitive species that actively grow in early spring, midseason and fall will improve the concepts of cultural control. Proper grazing will assist in suppressing the growth and spread of musk thistle.

b. Mechanical Control: Although mechanical control of musk thistle is effective, without proper competitive grass species failure of control in the long run will likely occur. For mature plants, severing the plant below the crown at least one inch and burning if viable seeds are present is prudent. Follow up with monitoring to ensure no plants have been missed and be sure to scout for individual plants in remote and outlying areas. When grubbing musk thistle, be careful to limit ground disturbance. Repeatedly mowing throughout the year to inhibit flower development will at least reduce viable seeds. Repeated scouting for escape plants will be needed for control and outlying areas to eliminate seed production in a given area. Mowing at the wrong time can disrupt the lifecycle of certain biological controls and repeatedly mowing the same area can stress certain grasses.

c. Biological Suppression and Control: Fortunately musk thistle is not known to exhaust in populations in RBC that are absolutely crucial to allow for all biological controls to be used in an IWM program for any particular infestation. They are crucial in the overall control of musk thistle on a county or state level but musk thistle can easily be controlled with the other IWM options for the known infestations in this county.

There are three species of biological controls available for the control of musk thistle. Utilizing all three species will improve control.

1. The Musk thistle seedhead weevil *Rhinocyllus conicus* is widely dispersed in Colorado. Adults lay eggs on the flower heads and stems. The larva feed on the receptacle tissue in side the flower reducing seed production. The weevil limits seed production anywhere from 10% to 75%. Higher elevations will usually allow the weevil to be more effective. Since the plant has a shorter growing season at higher altitudes and the weevil lays eggs early on in the season, less flower seeds are able to escape consumption by the weevil. This species is no longer available for distribution by biological control

suppliers but may be collected and dispersed locally.

2. The Musk thistle weevil *Trichosirocalus horridus* attacks the crown of the plant and rosette leaves and disrupts the apical dominance of the plant inhibiting growth. This species is more effective when used with *R. conicus*. Adults are most active in late September until cold weather sets in and again in early spring. Eggs are laid on the underside of leaves, hatch in about 14 days then the larva move down to the leaf stem then to the root-stem junction then enter the soil where pupation occurs.

3. The Thistle defoliating beetle *Cassida rubiginosa* feeds on the stems and foliage of musk thistle. Damage can be observed throughout the spring, summer and fall. Because it does not compete with the other species it should complement control.

4. A species that is approved but not currently available for control is the Thistle crown fly *Cheilisia corydon*. The larva interrupts the plant's moisture and nutrient transport system and retards flower development, lowering seed production.

Weather sheep or goats will effectively graze musk thistle throughout the growing season without being induced by containment is not known at this time. Certainly, proper grazing management for desirable species health is critical to compete against musk thistle.

d. Herbicide Control: Several herbicides are labeled for control of musk thistle. The best time to control musk thistle is in the spring or fall when the plant is in the rosette stage. In the fall, treatment should begin before cold weather damages the rosettes, the ground freezes or snow covers the ground. The fall is the cheapest time to obtain control with residual active herbicides such as Tordon 22K or Banvel. Tordon 22K and Banvel are best suited for fall or spring applications. Early spring applications before the plant starts to bolt are the next best time. 2,4-D will usually need to be added to obtain control after bolting but before flowering. These products persist in the soil and will allow an extended control of musk thistle. Tordon 22K will give better and longer control of musk thistle than Banvel. Caution should be used when using these products around desirable trees, woody plants or broadleaf species or damage could result. The problem with fall and spring applications is that musk thistle is harder to locate. After bolting starts, only a few products are effective, but they are much easier to locate in this stage. Escort and Telar can be used around water and are effective during bolting. The products can not be applied directly to water or allowed to drift into water. They can not be applied to intertidal areas below the mean high water mark or to standing water. They are probably the best choice when musk thistle has bolted and can help reduce viable seed during the flowering stage and inhibit re-growth for a short period, but an approved non-ionic surfactant must be used. Aquatic formulations of 2,4-D and Rodeo can be used in riparian sites. Rodeo can kill or damage all species that it contacts if they are in any active growth stage and 2,4-D can damage all broad leaf species. Transline, Stinger or Curtail can be safer to use around trees but do not persist as long as Tordon 22K. Tordon 22K is the most common product choice used, depending on where the thistle is located and the time of application. Complete control of musk thistle can only be obtained once the seed reserves in the soil are depleted.

2. Integrated Management Options by Site

C. Range Pasture and Riparian Sites

Option #1 Biological and Herbicide Control: The only research released to date incorporating

biological and herbicide for the control of musk thistle is associated with the Musk thistle seedhead weevil, *Rhinocyllus conicus*. *R. conicus* is well established in Colorado. The key to an integrated management program is considering the weevil's life cycle. The life of a musk thistle weevil revolves around the flowering of the plant. *R. conicus* will be more effective at higher elevations in reducing seeds than lower elevations. The insect has usually laid its eggs on the flower and emerged and overwinter in the ground by the end of July. After adults have emerged, (around the end of July) herbicides such as Telar or Escort can be used to stop the continued flowering that will occur at the lower elevations and reduce some seed viability. Certain fall applications of residual active herbicides work especially well. Spring applications of herbicides can be made until approximately the middle to the end of April but typically, results are reduced once the plant has bolted. Mowing or grazing and even drought during the months between April and August can cause death of the weevil or abandonment of the site by the weevil. When the Musk thistle weevil *Trichosiocalus horridus* is present, spring and fall herbicide applications will cause mortality of the biological agent. Herbicide and biological uses for the control of musk thistle are limited. Other uses of herbicides with biological controls may be instituted as additional IPM research is conducted and recommendations are developed. It is not known whether sheep or goats will effectively graze musk thistle throughout the entire growing season to inhibit seed production, even though they may graze it at certain growth stages. Certainly, proper grazing management for desirable species health is critical to compete against musk thistle.

Option #2 Mechanical and Herbicide Control: Burning can clean up dense growth allowing better performance of herbicides, but one must usually allow 4 to 5 weeks of re-growth before any herbicide applications. Burning could only be performed in early spring or late fall if weather permits. Various mechanical controls can be used to keep musk thistle from setting seed throughout the year but this could cover the ground with litter (depending on the density of the infestation and type of mechanical control), reducing any fall herbicide weed control. Herbicide applications with residual activity can be made in the fall before the cold weather damages the rosettes or the ground freezes. Fall is typically the best and cheapest time to control musk thistle with residual herbicides. Tordon 22K and Banvel are the most common product choices depending on where the thistle is located. A spring application can be made with the addition of 2,4-D with the same products for a fall application. A spring or fall herbicide application could also be made with any escapes discovered during the summer manually removed and properly disposed of. Complete control of musk thistle can only be obtained once the seed reserves in the soil are depleted.

Option #3 Cultural and Herbicide Control: A herbicide application using short residual herbicides can be made early in the year followed by reseeding of a competitive sod forming grass in the fall if competition is lacking. Alternatively, you may apply the herbicide in the fall and seed in the spring. Care must be taken to time the herbicide and use a rate and product that will not cause damage to grass seedlings. Once grass has matured so that it is not susceptible to herbicide damage, herbicide applications can then be made to obtain control of any new musk thistle plants. Improving competition will not eradicate musk thistle in many cases, depending on the species planted and other factors. Complete control of musk thistle can only be obtained once the seed reserves in the soil are depleted.

Option #4 Mechanical and Cultural Control: This combination has not been proven effective in

controlling musk thistle. If competition is lacking and it is properly implemented it should at least greatly reduce many infestations. Persistence in prohibiting all seed production in a given area would be critical as well as establishing a proper competitive grass species for the site. If competition is lacking, plowing and drilling the site with desirable grasses in the very late fall or early spring will disrupt the biennial nature of musk thistle allowing one year without flowering plants in that area. Grubbing any thistles around the seeded area will be necessary to prohibit seed dispersal back into the seeded area. Without proper competition and persistence in elimination all seeds, musk thistle will reestablish.

Option #5 Mechanical, Herbicide and Cultural Control: This may be a favorable combination for many landowners especially if there is a lack of proper competition. The combinations are plentiful and various combinations can be utilized in different ways. The mechanical, cultural and herbicide recommendations listed above can be combined to suite almost any need but persistence and eliminating seed production are the keys when dealing with musk thistle. Recommendations can be made once all the factors are discovered. A typical application may consist of a spring herbicide application, mowing or grubbing any plants in the treatment and outlying area to prevent seed production, then drilling or broadcasting a competitive grass species for that site to help compete against musk thistle. Plowing and seeding as listed in option #4 directly above with fall application of herbicide after grasses have matured would obtain favorable control of black henbane if all escape plants are properly removed. Proper fertilization, water management and grazing practices with follow up herbicide applications or grubbing will help gain control of musk thistle. Yearly monitoring and adjustments in management practices will be needed to eradicate musk thistle.

Option #6 Multiple Integrated Control: Typically musk thistle is a problem because the area is disturbed or degraded. Musk thistle can be treated with herbicides at very low rates reducing large herbicide bills. The most critical and expensive component of this type of program for musk thistle is the reseeded. I have seen no infestations large enough in RBC that have to be dependent on biological controls although biological controls definitely have a place in the overall program throughout the county. Wherever biological controls are established care should be taking to try and avoid disrupt their life cycle. Biological controls are well established in RBC in many areas. Biological, mechanical, cultural and herbicides could be utilized on a very large-scale infestation of hundreds of acres depending on the situation. Development of IWM for musk thistle requires information on the crop or plant community effected, lifecycles of weed targeted and biological agents to be used according to the site, and the control techniques to be incorporated in the IMP. Considerable planning, and time would be essential to properly utilize all controls to be effective and not allow the infestation to spread to other areas. Constant evaluation incorporating improved strategies and substantial efforts are critical in any integrated management program. Each situation will require specific needs for a multiple integrated control plan to be effective. Smaller infestations can utilize mechanical, cultural and herbicide controls very effectively depending on specific needs. Pastures, range lands and riparian areas will all be managed differently. Recommendations can be made once all the factors are discovered.

Typically, a program of this type will first establish appropriate funding and time to be utilized on a yearly basis that will obtain control in the long term without allowing that species to spread. Determine if changes in land management can be a benefit in controlling the noxious weed. Appropriate biological controls are released in the crux of the infestation. Management of satellite or outlying infestations must

be controlled with herbicides, proper grazing and inter-seeded with appropriate competitive grass species as needed as well as proper fertilization and water management if applicable. As satellite infestations are controlled, similar management practices are moved inward in an effort to reduce the size of the infestation while follow up treatments are utilized on the original satellite infested areas as needed. Monitoring the biological release areas after a few years will indicate if the releases were successful. If not establish new releases, if successful in a few more years collect and spread some of the biological controls around the crux of the infestation. Continue to work the management program inward as outlying areas are reduced in size and density. Surveys should be performed yearly to determine where the biological controls are spreading to and only approved herbicide management practices should be utilized in those areas that avoid damage to the biological controls. Yearly surveys should also be done to determine if new satellite infestations occur elsewhere in the management area. If adjoining neighbors do not have infestations on their property, many times they are willing to assist you in managing the problem on your property. If adjoining neighbors do have infestations on their property, both landowners should evaluate and adjust management plans to be of the most benefit to each other.

B. Rights of Way and other Non Crop Sites: Right of ways will usually cross many different types of land use. During construction or maintenance, preventive measures should be utilized to minimize the establishment and spread of noxious weeds. Consideration of all land use must be observed too properly implement any control plans. Non-crop sites will have to have specific consideration Biological controls are not recommended for roadsides. Rights of Way are typically not suited for biological controls unless the right of way passes through a very large infestation that is out of control or not being properly managed by other land owners or managers. Recommendations can be made once all the factors are discovered. Typically, herbicides labeled for the weed species and land use are the best choice for initial controls along rights of way, followed by proper revegetation and monitoring.

Option #1 Biological and Herbicide Control: Same as option #1 as listed above in range, pasture and riparian.

Option #2 Mechanical and Herbicide Control: Same as option #2 as listed above in range, pasture and riparian.

Option #3 Cultural and Herbicide Control: Same as option #3 as listed above in range, pasture and riparian.

Option#4 Mechanical and Cultural Control: Same as option #4 as listed above in range, pasture and riparian.

Option#5 Mechanical, Herbicide and Cultural Control: Same as option #5 as listed above in range, pasture and riparian.

Option #6 Multiple Integrated Control: Same as option #6 as listed in range, pasture and riparian. However, the same considerations as in option #1 above need to be observed.

C. Cropland Sites: Musk thistle could potentially be found in any crop land situation in Rio Blanco County. Prescription weed management measures developed by Colorado State University will be used when applicable. The county weed department and extension office can provide copies of research for species listed.

D. Residential Sites: Biological controls typically do not work well in residential sites and will not be allowed. Roundup products or other EPA listed Herbicides for residential sites such as preemergents could be used in gardens and/or flower beds but, damage to flowers and gardens can occur if some herbicides are allowed to come in to contact with desirable plants, even in very small amounts. The same is true for products that can be picked up through the root system of desirable vegetation. Roundup will kill grasses in turf areas or any other plant that it contacts. Products such as 2,4-D or similar selective herbicides should be used in turf but will have to be timed properly to have any effect. Proper turf management and/or establishment to improve the health of turf are imperative to combat against all weeds especially perennials. Existing musk thistle is probably best controlled in residential sites by grubbing and proper plant competition. Colorado State University, Service in Action (SIA) sheet recommendations will be used for residential properties. The county extension office can provide copies of SIA sheets.

Russian knapweed:

Russian knapweed is a deep-rooted creeping perennial introduced from Europe. It will establish dense colonies by advantageous shoots from widely spreading black roots. Stems are covered with fine, white hairs giving the stem a blue-green color. It reproduces by seeds and roots. Seeds can germinate for around five years. Stems are erect, openly branched, eighteen to thirty six inches tall. Lower leaves are deeply lobed, two to four inches long; upper leaves entire or serrated, narrow to a sessile base. Cone-shaped flowering heads are 1/4 to 1/2 inch in diameter, solitary at the tip of leafy branchlets. Flowers are pink to lavender. Many pearly involucral bracts form with rounded or acute papery margins. Flowering occurs from June to September. Russian knapweed is more efficient in competing for water and nutrients than many other species. Russian knapweed is allelopathic, suppressing the growth of surrounding plants, clearing the path for only its own species to grow in the immediate area. Russian knapweed frequently grows in areas that have a shallow water table or have excessive irrigation. In RBC, it mainly grows along roadsides, disturbed areas, pastures and along waterways.

1. Control Measures

Control of russian knapweed can be costly but it is not usually very difficult. No single method provides long-term control on large established sites and many times smaller sites. Integrated management is usually the only means of controlling russian knapweed. Long term integrated management programs must be implemented and adjusted as needed to manage russian knapweed. Success is possible, but only with persistence. Prevention is of great importance when dealing with russian knapweed. Over graze, disturbed or stressed sites are the most vulnerable to russian knapweed invasion.

a. Cultural Control: Seeding and maintaining select cool season perennial grasses can be an effective tool in suppressing russian knapweed. Before reseeding in established stands of russian knapweed,

complete removal of all plant residues must be removed from the ground or failure of reseeded will result. Wheat grass species have been shown as good grasses to compete against russian knapweed. When reseeding select a mixture of competitive species that are well adapted to the particular site. Selecting a combination of competitive species that actively grow in early spring, midseason and fall will improve the concepts of cultural control. Russian knapweed is quite capable of competing for moisture and nutrients. Any activity that encourages vigorous growth of grasses is very important but do not irrigate excessively.

b. Mechanical Control: Mechanical control of russian knapweed is difficult at best. Cultivation in cropland could be used to control russian knapweed in some cases particularly grains. Mowing every 14 to 21 days may stress the plant if carried out throughout the growing season for several years. This method will keep the plant from going to seed and it is possible to reduce plant density under the best possible scenario. Burning has proven ineffective for controlling russian knapweed but burning may be an effective way to remove some plant residue before seeding but is not considered proper seedbed preparation. Hand pulling has not been proven effective in controlling russian knapweed and there is a concern of health problems associated with pulling russian knapweed.

c. Biological Suppression and Control: There is only one species of biological control available for the control of russian knapweed at this time. The Russian knapweed gall nematode *Subanguina picridis* is a gall-forming nematode. This species causes gall's to form on the leaves, stems and crown of russian and diffuse knapweed. This nematode has been effective in favorable climatic areas of the former USSR. Other species of biological controls are currently being studied for the control of russian knapweed and when released they will be listed. Goats and sheep will eat russian knapweed but will not effectively remove plant residue from the ground allowing for good reseeded establishment. Stocking rates for sheep and goats will vary with russian knapweed density, terrain and rainfall. Anytime grazing is done when russian knapweed has set seed the animals should be corralled or held in a specific area for at least 11 days to pass seeds from their digestive tracts. Corrals or holding areas must be monitored for any knapweed regularly and if found treated with herbicides immediately. Goats require more management than sheep and can cause damage to woody species. Sheep may need a 5 to 10 day adjustment period before they readily accept russian knapweed. Grazing rotations must be timed to minimize stress to grasses when they are growing stems and flowering especially in areas where russian knapweed is not well established. Grazing can be utilized to prevent seed production. It is not known if this method will keep an existing infestation from spreading by under ground root growth but it can inhibit seed production.

d. Herbicide Control: Annual applications of herbicide are one component of an effective management plan. The small and isolated sites of russian knapweed are usually eradicable with herbicides and should be attempted but several years of monitoring will be needed. Herbicides should be applied approximately 15 feet beyond any russian knapweed infestation. Most herbicides are recommended for application at the bud stage through early fall. Rodeo, Curtail and aquatic formulations of 2,4-D can be used in riparian areas as long as all label directions are followed. Telar can also be used as long as it is not be applied directly to water or allowed to drift into water. It can not be applied to intertidal areas below the mean high water mark or to standing water. Rodeo and Roundup products can cause varying degrees of grass injury and usually should not be applied 2 years in a row without revegetation. Tordon is the most

proven and used herbicide to date although others are showing promise. Banvel products, 2,4-D formulations, Telar, Curtail, Roundup products and Rodeo or any other EPA approved herbicide for use on russian knapweed may be used depending on the site. Herbicide management of russian knapweed can be costly with some products. Herbicides are only one of the components needed to successfully control knapweed.

2. Integrated Management Options by Site

D. Range Pasture and Riparian Sites

Option #1 Biological and Herbicide Control: The effects of herbicides or livestock on *Subanguina picridis* is not known at this time, most likely they would be detrimental to *S picridis*. Grazing with sheep or goats at least 2 to 4 times a year will help keep russian knapweed from going to seed and make it more susceptible to herbicides that fall. Grazing should start when russian knapweed is approximately 4 to 6 inches tall. Do not leave the sheep or goats in the infested area once the knapweed is graze off. Repeat the grazing cycle when the knapweed is approximately 6 to 8 inches tall and repeat the cycle again if needed until approximately late July depending on elevation and soil moisture allowing enough time for re-growth to produce flower bracts. Grazing may stimulate more plants to emerge from the root system but this will allow a good effect for a fall herbicide treatment. This would not be a favorable control practice in established stands of russian knapweed unless the goal is to set the stage for a better fall herbicide treatment with proper reseeding to be followed in the spring. Other uses of herbicides with biological controls may be instituted as additional IPM research is conducted and recommendations are developed.

Option #2 Mechanical and Herbicide Control: Mowing can be used to keep russian knapweed from setting seed and make it more susceptible to herbicide damage as long as sufficient growth is allowed for maximum herbicide uptake in the fall. This procedure is very similar to the grazing and herbicide treatment in option #1 above. Hand pulling has not been proven effective in controlling russian knapweed and there is a concern of health problems associated with pulling this species but this method could also be used similarly to grazing or mowing. These practices alone are typically not suited for controlling monocultures of russian knapweed. Disking after the mowing and fall herbicide treatment would prepare a good seed bed for a late fall seeding.

Option #3 Cultural and Herbicide Control: A herbicide application using a residual herbicide can be made during bloom followed by reseeding of a competitive sod forming grass in the fall. Care must be taken to time the herbicide and use a rate and product that will not cause damage to grass seedlings, and proper seedbed preparation must be performed in dense established stands. Proper fertilization according to soil test and/or irrigation could be instituted to stimulate increased grass growth. Once grass has matured so that it is not as susceptible to herbicide damage, herbicide applications can then be made to obtain better control of russian knapweed.

Option#4 Mechanical and Cultural Control: This combination has not proven effective in controlling

russian knapweed.

Option #5 Mechanical, Herbicide and Cultural Control: This is the most favorable combination for control of russian knapweed especially if there is a lack of proper competition. The combinations are plentiful and various combinations can be utilized in different ways. The mechanical, cultural and herbicide recommendations listed above can be combined to suite almost any need but persistence is the key when dealing with russian knapweed. Recommendations can be made once all the factors are discovered. Typical applications consist of mowing or grazing to prevent seed production and stress the knapweed. Apply a proper herbicide in late summer or early fall. Removal of soil residue left behind by the russian knapweed is critical to properly prepare the seed bed. Then incorporate a competitive grass species for that site to help compete against the knapweed. Proper fertilization, water management and grazing practices with follow up herbicide applications will help gain control of Russian knapweed. Yearly monitoring and adjustments in management practices will be needed to eradicate russian knapweed.

Option #6 Multiple Integrated Control: Biological, mechanical, cultural and herbicide controls could and should be utilized on a very large-scale infestation of russian knapweed. Fortunately, no infestations of this size are known to exist in RBC. Development of an IMP requires information on the crop or plant community effected; lifecycles of weed that are targeted and biological agents to be used according to the site, and the control techniques to be incorporated in the IMP. Considerable planning, and time would be essential to properly utilize all controls to be effective and not allow the infestation to spread to other areas. Constant evaluation incorporating improved strategies and substantial efforts are critical in any integrated management program. Each situation will require specific needs for a multiple integrated control plan to be effective. Smaller infestations can utilize mechanical, cultural and herbicide controls depending on specific needs. Pastures, range lands and riparian areas will all be managed differently. Recommendations can be made once all the factors are discovered.

Typically, a program of this type will first establish appropriate funding and time to be utilized on a yearly basis. Determine if changes in land management can be a benefit in controlling the noxious weed. Appropriate biological controls are released in the crux of the infestation. Management of satellite or outlying infestations must be controlled with herbicides, proper grazing and inter-seeded with appropriate competitive grass species as needed as well as proper fertilization and water management if applicable. As satellite infestations are controlled similar management practices are moved inward in an effort to reduce the size of the infestation while follow up treatments are utilized on the original satellite infested areas as needed. Monitoring the biological release areas after a few years will indicate if the releases were successful. If not establish new releases, if successful in a few more years collect and spread some of the biological controls around the crux of the infestation. Continue to work the management program inward as outlying areas are reduced in size and density. Surveys should be performed yearly to determine where the biological controls are spreading to and only approved herbicide management practices should be utilized in those areas that avoid damage to the biological controls. Yearly surveys should also be done to determine if new satellite infestations occur elsewhere in the management area. If adjoining neighbors do not have infestations on their property, many times they are willing to assist you in managing the problem on your property. If adjoining neighbors do have infestations on their property, both landowners should evaluate and adjust management plans to be of the

most benefit to each other.

B. Rights of Way and other Non Crop Sites: Right of ways will usually cross many different types of land use. During construction or maintenance, preventive measures should be utilized to minimize the establishment and spread of noxious weeds. Consideration of all land use must be observed too properly implement any control plans. Non-crop sites will have to have specific consideration Biological controls are not recommended for roadsides. Right of ways are typically not suited for biological controls unless the right of way passes through a very large infestation that is out of control and not being managed by other land owners or managers. Recommendations can be made once all the factors are discovered. Typically, herbicides labeled for the weed species and land use are the best choice for initial controls along rights of way, followed by proper revegetation and monitoring.

Option #1 Biological and Herbicide Control: Same as option #1 as listed above in range, pasture and riparian.

Option #2 Mechanical and Herbicide Control: Same as option #2 as listed above in range, pasture and riparian.

Option #3 Cultural and Herbicide Control: Same as option #3 as listed above in range, pasture and riparian.

Option#4 Mechanical and Cultural Control: Same as option #4 as listed above in range, pasture and riparian.

Option#5 Mechanical, Herbicide and Cultural Control: Same as option #5 as listed above in range, pasture and riparian.

Option #6 Multiple Integrated Control: Same as option #6 as listed in range, pasture and riparian. However, the same considerations as in option #1 above need to be observed.

C. Cropland Sites: Mechanical control of russian knapweed is difficult at best. Cultivation in cropland could be used to control russian knapweed in some cases particularly grains. Russian knapweed could potentially be found in any crop land situation in Rio Blanco County. Prescription weed management measures developed by Colorado State University will be used when applicable. The county weed department and extension office can provide copies of research for species listed.

D. Residential Sites: Biological controls typically do not work well in residential sites and will not be allowed. Roundup products or other EPA listed Herbicides for residential sites such as preemergents could be used in gardens and/or flower beds but, damage to flowers and gardens can occur if some herbicides are allowed to come in to contact with desirable plants, even in very small amounts. The same is true for products that can be picked up through the root system of desirable vegetation. Roundup will kill grasses in turf areas or any other plant that it contacts. Products such as 2,4-D or similar selective

herbicides should be used in turf but will have to be timed properly to have any effect. Proper turf management and/or establishment to improve the health of turf are imperative to combat against all weeds especially perennials. Colorado State University, Service in Action (SIA) sheet recommendations will be used for residential properties. The county extension office can provide copies of SIA sheets.

Spotted knapweed (*Centaurea maculosa*): Spotted knapweed is an aggressive biennial or short lived perennial with a stout taproot that produces primarily by seed. It has one or more stems, branched one to three feet tall. Basal leaves up to six inches long, blades narrowly elliptic to oblanceolate, entire to pinnately parted; principal stem leaves pinnately divided. Flowering heads are solitary at end of branches; involucre bracts stiff and tipped with a dark comb-like fringe. The ray flowers are pinkish-purple or rarely cream-colored. Fruits are about 1/8 inch long, tipped with a tuft of persistent bristles. The flowering period extends from June to October. Spotted knapweed produces an allelopathic compound that could reduce germination in wheatgrass and fescue communities. Control practices of spotted knapweed is similar to the controls of diffuse knapweed.

1. Control Measures

a. Cultural Control: Cultural control of spotted knapweed with perennial grasses such as smooth brome and crested wheatgrass may help to compete with spotted knapweed and slow its spread to a degree. Spotted knapweed will establish in healthy environments but is more likely to be problematic in areas that are impacted or lacking desirable species that occupy all niches of the environment. Seeding alone in infested spotted knapweed sites will not control an existing stand. It produces early spring growth that is difficult to compete against and its allelopathic properties add to its aggressive nature. Good land stewardship practices are always essential in managing spotted knapweed or any other weed species.

b. Mechanical Control: Hand pulling or grubbing of spotted knapweed when it is in the bud stage and again when it is in the very early flowering stage can significantly reduce seed production and is well suited for smaller infestations. Pulling is best when the soil is moist since more of the root system can be removed. Similar results may be obtained with sheep or goats in some cases. Mowing may be able to be used with repeated mowing, whenever spotted knapweed reaches the early bud stage. Mowing can stimulate and increase seed production below mower height in some cases. Mowing does not appear to control spotted knapweed. It is very important to not let spotted knapweed seed out, as this will extend control practices for several years. Keeping all spotted knapweed from going to seed over a number of years can eventually eliminate an infestation, once the seed source in the soil is depleted. Uncontrolled knapweed on adjoining properties may reintroduce seeds. Burning of knapweed has shown limited results and may increase the cover and density of this noxious weed without other controls in place. Burning may be used to clean up old dead growth that could obstruct herbicide applications. It is also important to minimize ground disturbance so that competition from desirable vegetation is not disrupted.

e. Biological Suppression and Control: There are many biological agents for spotted knapweed. Some are currently not available but will be listed. Biological control agents alone have not been successful in

controlling spotted knapweed. However, they reduce seed production and may reduce the competitiveness of spotted knapweed to a limited degree.

1. There are two kinds of knapweed seed head flies also known as picture-winged flies, *Urophora affinis* and *Urophora quadrifasciata* available for diffuse and spotted knapweed. These have shown to have effect in dense stands mainly on spotted knapweed. These knapweed seed head flies attack the flowers of diffuse and spotted knapweed to produce galls and reduce the seed production in infested plants. Neither of these species is established in RBC at present.

2. The knapweed flower weevil *Larinus minutus* attacks diffuse and spotted knapweed. Larva consumes developing seeds. Adults feed on rosettes and flowers.

3. Spotted knapweed seed head moth *Metzneria paucipunctella* is a flower-feeding moth. Spotted knapweed is preferred, but it also attacks diffuse knapweed. Adult moths lay eggs on bracts at the base of flowers. Larva's enter the flower, consuming florets and, later, seed. Mature larvae mine the receptacle tissue. Studies have shown that this moth, together with seed-head flies, reduces seed production more than either species alone. *Metzneria* does not do well in areas that are very cold with little snow cover.

4. Sulphur knapweed moth, *Agapeta zoegana* attacks spotted and diffuse knapweed. Larva mines the root and crown. Larva feeding in the first season can kill small plants. Older plants often do not flower.

5. Buprestidae beetle, *Sphenoptera jugoslavica* attacks diffuse knapweed and to a lesser extent, spotted knapweed. The larva bore into the root crown and upper roots retarding the development of rosettes and stunting plant growth.

6. *Bangasternus fausti* a small seedhead weevil lay eggs on the flowers of diffuse and spotted knapweed. The larva feed within the flower receptacle, destroying the seed.

7. *Cyphocleonus achatodes* prefers spotted knapweed, but also attacks diffuse knapweed. Larvae mine and gall the central vascular tissue of the roots. Feeding by older larva causes considerable damage to the root, especially too small plants or plants containing multiple larvae.

8. Knapweed peacock fly, *Chaetorellia acrolophi* larva burrows through the bracts into the center of the bud and feed on developing seed. *C. acrolophi* attacks spotted and diffuse knapweed but is currently not available in Colorado.

9. Lesser knapweed flower weevil, *Larinus minutus* larva feed on the pappus hairs and then move downward to the achenes where they consume the contents of individual seeds as well as some near by seeds and the receptacle. *L. minutus* prefers diffuse knapweed but also attacks spotted knapweed but it is currently not available in Colorado to my knowledge.

10. Blunt knapweed flower weevil, *Larinus obtusus* larva feed within the seed head on the pappus hairs and developing seeds. This beetle species prefers spotted knapweed and to a lesser extent, diffuse knapweed. *L. obtusus* is currently not available in Colorado to my knowledge.

11. Brown-winged root moth, *Pelochrista medullana* larva move to the center of the rosette and mine its root. Larva feeding reduces nutrient uptake by the plant. *P. medullana* attack both diffuse and spotted knapweed. First released in Montana in 1984, but none have ever been recovered.

12. Grey-winged root moth, *Pterolonche inspersa* larva feed down into the root of the plant, some mine the woody portion while others feed on the epidermis. *P. inspersa* attacks diffuse, spotted and squarrose knapweed. It was first released in 1986 in Idaho, Oregon and Utah.

13. Green clearwing fly also called the verdant seed fly, *Terellia virens* first and second instars feed inside developing seeds, but later consume other seeds in the flower head, or receptacle tissue. *T. virens* seems to prefer spotted knapweed but diffuse knapweed is also attacked to a lesser extent. It is now

established in Montana and Oregon.

Native fungal and bacterial pathogens may infect spotted knapweed and cause wilt and death under the best conditions.

Biological controls of diffuse knapweed have shown limited results in most cases. Utilizing biological controls that will attack many different parts of diffuse knapweed should improve control. Currently all knapweed species in RBC are small and eradication of all species is possible in this county. Unless a very large infestation is discovered in this county biological control agents will not be considered a viable option for control.

d. Herbicide Control: There are a few herbicides labeled for use on spotted knapweed. Many can be used independently or in combination with each other. Some of the herbicides commonly used are Tordon 22K, Banvel, 2,4-D, Escort, and Clopyralid products such as Transline, Stinger and Curtail. Some formulations of 2,4-D may be used in aquatic situations. Any other EPA approved herbicide labeled for use on diffuse knapweed may be used depending on the situation. Herbicide applications can be made during the rosette to very early bolting stages early in the year. Applications can also be made during the fall as long as the rosettes are green and healthy and the ground is not frozen or covered with snow. Early spring and late fall applications are the most effective and cost efficient times for herbicide applications. Herbicides that reside in the soil for a short period will usually improve control if done properly. If herbicides are applied when spotted knapweed is in the flower stage, results will typically be reduced and with most products, seeds will remain viable. Herbicides are only one of the components needed to successfully control knapweed in large infestations.

2. Integrated Management Options by Site

C. Range Pasture and Riparian Sites

Option #1 Biological and Herbicide Control: The release of biological control agents such as *Urophora affinis* and *U. quadrifasciata* can be made. A herbicide application can then be made from the rosette through the bolting stage (where insects were not released) and in the fall where insects were released. The use of herbicides at different times of the year for different biological agents may be instituted in the future when research is conducted and scientific recommendations are developed. With the small populations of knapweed in RBC, biological controls are not recommended.

Option #2 Mechanical and Herbicide Control: Mowing pulling or grubbing can be carried out when spotted knapweed is in the bud and again before any flowering. A herbicide application can then be made to any plants that have been missed, re-bolted or that develop rosettes, if necessary. Burning can sometimes be effective in delaying the plant's ability to produce seed and in some instances allow for improved herbicide performance in dense infestations.

Option #3 Cultural and Herbicide Control: A herbicide application can be made in the early summer when spotted knapweed in the early summer rosette through early bolting stage. Reseeding with competitive perennial grasses can be followed later in the summer depending upon the herbicide used and the rate of application. In some cases, grasses will rebound by themselves after a herbicide application, depending on the herbicide being used. Any knapweed re-growth can be treated with a properly selected herbicide for the site.

Option#4 Mechanical and Cultural Control: This option could be desirable in situations where desirable vegetation is in poor condition. The mechanical control should be carried out and followed by reseeding of competitive perennial grasses desirable for the intended land use. Follow up mechanical control will still be needed for the next several years without letting any plants seed out.

Option #5 Mechanical, Herbicide and Cultural Control: The combinations are plentiful and various combinations can be utilized in different ways. The mechanical, cultural and herbicide recommendations listed above can be combined to suite almost any need but persistence is the key when dealing with spotted knapweed. Recommendations can be made once all the factors are discovered. Utilization of these control measures could work well with a large or small infestation. The procedure would depend on whether or not the desirable vegetation is sufficient to help compete against spotted knapweed, with some improved cultural controls.

Option #6 Multiple Integrated Control: Biological, mechanical, cultural and herbicide controls could and should be utilized on a very large-scale infestation. Development of an IMP requires information on the crop or plant community effected; lifecycles of weed that is targeted and biological agents to be used, and the control techniques to be incorporated in the IMP. Considerable planning, and time would be essential to properly utilize all controls to be effective and not allow the infestation to spread to other areas. Constant evaluation incorporating improved strategies and substantial efforts are critical in any integrated management program. Each situation will require specific needs for a multiple integrated control plan to be effective. Smaller infestations can utilize mechanical, cultural and herbicide controls depending on specific needs. Recommendations can be made once all the factors are discovered.

B. Rights of Way and other Non Crop Sites: Right of ways will usually cross many different types of land use. During construction or maintenance, preventive measures should be utilized to minimize the establishment and spread of noxious weeds. Consideration of all land use must be observed too properly implement any control plans. Non-crop sites will have to have specific consideration Biological controls are not recommended for roadsides. Right of ways are typically not suited for biological controls unless the right of way passes through a very large infestation that is out of control and not being managed by other land owners or managers.

Option #1 Biological and Herbicide Control: With the small populations of knapweed in RBC,

biological controls are not recommended.

Option #2 Mechanical and Herbicide Control: Same as option #2 as listed above in range, pasture and riparian.

Option #3 Cultural and Herbicide Control: Same as option #3 as listed above in range, pasture and riparian.

Option#4 Mechanical and Cultural Control: Same as option #4 as listed above in range, pasture and riparian.

Option#5 Mechanical, Herbicide and Cultural Control: Same as option #5 as listed above in range, pasture and riparian.

Option #6 Multiple Integrated Control: Same as option #6 as listed in range, pasture and riparian. However, the same considerations as in option #1 above need to be observed.

C. Cropland Sites: Spotted knapweed could potentially be found in any crop land situation in RBC. Prescription weed management measures developed by Colorado State University will be used when applicable. The county weed department and extension office can provide copies of research for species listed.

D. Residential Sites: Biological controls typically do not work well in residential sites and will not be allowed. Roundup products or other EPA listed Herbicides such as preemergents could be used in gardens and/or flower beds but, damage to flowers and gardens can occur if some herbicide are allowed to come in to contact with desirable plants, even in very small amounts. The same is true for products that can be picked up through the root system of desirable vegetation. Roundup will kill grasses in turf areas or any other plant that it contacts. Products such as 2,4-D or similar selective herbicides should be used in turf. Proper turf management and/or establishment to improve the health of turf are imperative to combat against all weeds. Colorado State University, Service in Action (SIA) sheet recommendations will be used for residential properties. The county extension office can provide copies of SIA sheets.

**This section will apply to both
YELLOW and DALMATIAN TOADFLAX**

Yellow toadflax (*Linaria vulgaris*): Management is very difficult and costly. Yellow toadflax is a perennial 1-2 feet tall reproducing by seed and underground rootstocks. Leaves are pale green, numerous, narrow, pointed at both ends, 2 or more inches long. Flowers are one inch long with a bearded, orange throat, with a spur that is usually as long as the rest of the flower combined. Fruit is round, 1/4 inch in diameter, brown, 2-celled, with many seeds. Seeds are dark brown to black, 1/12 inch in diameter, flattened with a papery circular wing. Flowering occurs from June to August depending on elevation. In the vegetative state, it is sometimes confused for leafy spurge.

Dalmatian toadflax (*Linaria dalmatica*) Dalmatian toadflax is a perennial, up to three feet tall or more, reproducing by seed and underground rootstocks. Leaves are dense, alternate, entire, upper leaves are conspicuously broad-based and tend to clasp around the stem. Flowers are borne in axils of upper leaves and are two lipped, approximately 3/4, to 1 1/2 inches long with a long spur and yellow and orange, bearded throat. Fruit a two-celled capsule with many irregularly angled seeds. Flowers bloom from early summer until early fall. Both leaves and stems are waxy giving the plant a bluish and sometimes whitish appearance.

Hybrids between yellow and dalmatian toadflax can occur, potentially adding to its ability to occupy a broader range of habitat and increasing difficulty of management. Both species are escape ornamentals and therefore they should be avoided for any use.

1. Control Measures

a. Cultural Control: Plant competition from various grasses are not an effective management tool by them self's but are an important part of IWM. Early emerging competitive well adaptive species as well as species that have root systems that grow at deep, intermediate and shallow depths should be used to compete with yellow or dalmatian toadflax and slow the spread and establishment of new infestations. Toadflax is most vulnerable at the seedling stage so desirable species that occupy the space most efficiently at that time are most desirable as a preventive and revegetation component of an IWM plan. Promoting healthy grass growth by proper grazing and irrigation is critical when competing against any noxious weed species especially toadflax.

b. Mechanical Control: For small areas pulling by hand before toadflax seeds out for 5 to 6 years can be effective in depleting root reserves. The site must be controlled however for 10 to 15 years to remove seedlings before they establish, to be effective. Cultivation of toadflax starting in May or June every 7 to 10 days the first year and 5 or more cultivation's the second and possibly the third year if needed, could be carried out to control toadflax. Once started irregular tillage could spread the infestation. Repeated mowing or similar efforts do not control toadflax and may cause it to spread although it may reduce seed production. Regardless of the method of mechanical management, revegetation with the proper perennial species is imperative after depletion of toadflax and care should be taken to avoid soil erosion. In order for any of these controls to work in the long-run adjoining areas should also be controlled.

Biological Suppression and Control: Only a few biological controls are currently available for dalmatian and yellow toadflax.

1. Toadflax flower feeding beetle (*Brachypterolus pulicarius*) adults feed on the young toadflax shoots causing increased branching of the plants. Larva feed on the reproductive parts of the plant reducing seed production.

2. Toadflax moth (*Calophasia lunula*) larva feed on vegetative shoots, terminal portions of the stem, flowers and older foliage when other parts of the plant have been defoliated. This species can reduce the vigor of the plant and reduce seeds.

3. Toadflax capsule weevil (*Gymnetron antirrhini* and *G. netum*) larva can damage shoots and consume immature seeds inside the seed capsule, reducing seed production.

4. A toadflax stem-boring weevil (*Mecinus janthinus*) has been released in Canada as well as the United States. No other information is available at this time.

5. A toadflax root-boring moth (*Eteobalea intermediella*) has also been released in Canada as well as the United States. No other information is available at this time.

All insect species will damage both dalmatian and yellow toadflax. The cumulative effect that these biological controls will have in an IWM plan for either toadflax species is unknown but they may have attributed to a decline in Yellow toadflax densities in western Canada.

Four other species of biological controls are being researched for potential release and if approved they will be listed.

d. Herbicide Control: The effectiveness of herbicides to control toadflax has been highly variable, partly because of the plants genetic variability. Various other conditions are likely contributing to the inconsistencies in herbicide controls such as soil type and moisture, time and volume of application ETC. Few herbicides are labeled for the control of toadflax. Tordon 22K has given the best results with fall applications. The addition of 2,4-D at moderate rates with Tordon may be favorable in some cases. Banvel products will give short-term control. Round up and Rodeo may be used in sensitive or riparian areas but must be applied when toadflax is 6 to 8 inches tall and repeated if needed. If either of these products are used revegetation is imperative once toadflax is controlled. Careful monitoring in areas where Round up or Rodeo is used will be needed to assure that other unwanted species do not infest these sites until revegetated.

2. Integrated Management Options by Site

A. Range, Pasture and Riparian Sites

Option #1 Biological and Herbicide Control: The effects of herbicides on toadflax biological control agents are not known at this time. If biological control agents are used on a large-scale infestation, place them where they will be protected from all control activities, including grazing management.

Option #2 Mechanical and Herbicide Control: Hand pulling may be used to weaken the root system followed up by a herbicide treatment to any re-growth. Repeated treatments of either pulling or herbicides will be needed until eradicated. Cultivation and herbicide management with out revegetation would fail in the long run.

Option #3 Cultural and Herbicide Control: Herbicide applications can be made followed up by reseeding with competitive desirable species that will fill all the growth niches needed by toadflax. Follow up herbicide applications will be needed. Some herbicide products can interfere with seed germination.

Option #4 Mechanical and Cultural Control: Mechanical control as listed above in options, combined with cultural controls as listed above in options could be carried out. This may not eliminate the toadflax species in many circumstances without proper follow up management, even if the mechanical control is

thorough and effective.

Option #5 Mechanical, Herbicide and Cultural Control: The combinations are plentiful and various combinations can be utilized in different ways. The mechanical, cultural and herbicide recommendations listed above can be combined to suite almost any need but persistence is the key when dealing with the toadflax species. These methods combined would be most desirable if the infestation is very large and the intent is to eradicate the toadflax species as quickly as possible. Mechanical control as listed above could at least be used to weaken the root system and reduce seed production. Depending on the severity of the infestation this may need to be carried out for a few years with herbicide applications in the fall at a minimum. Once desirable control is achieved, proper revegetation helps to compete with any toadflax that may grow from seed or roots. Selection of the best herbicide for the species selected for revegetation is very important. Grasses would be favorable over broadleaf species for revegetation for several years until all toadflax is eradicated. Many other scenarios are possible and recommendations can be made once all the factors are discovered.

Option #6 Multiple Integrated Control: Biological, mechanical, cultural and herbicide controls could and should be utilized on a very large-scale infestation. Development of an IMP requires information on the crop or plant community effected; lifecycles of weed that is targeted and biological agents to be used, and the control techniques to be incorporated in the IMP. Considerable planning, and time would be essential to properly utilize all controls to be effective and not allow the infestation to spread to other areas. Constant evaluation incorporating improved strategies and substantial efforts are critical in any integrated management program. Each situation will require specific needs for a multiple integrated control plan to be effective. Smaller infestations can utilize mechanical, cultural and herbicide controls depending on specific needs. Recommendations can be made once all the factors are discovered.

B. Right of Ways and Other Non-Crop Sites: Right of ways will usually cross many different types of land use. During construction or maintenance, preventive measures should be utilized to minimize the establishment and spread of noxious weeds. Consideration of all land use must be observed too properly implement any control plans. Non-crop sites will have to have specific consideration Biological controls are not recommended for roadsides. Right of ways are typically not suited for biological controls unless the right of way passes through a very large infestation that is out of control and not being managed by other land owners or managers.

Option #1 Biological and Herbicide Control: Biological controls are not recommended for roadsides due to the fact that roadsides are a major mechanism for noxious weed dispersal and they must be controlled to protect other areas. Potential damage to biological agents is greater along roadsides. The same is true for right of ways, they adjoin other land use types and those lands must be protected. Industrial right of ways and other non-crop sites can be managed the same as option # 1 as listed above in range, pasture and riparian with consideration of the different land use types.

Option #2 Mechanical and Herbicide Control: Same as option #2 as listed above in range, pasture and riparian.

Option #3 Cultural and Herbicide Control: Same as option #3 as listed above in range, pasture and riparian.

Option #4 Mechanical and Cultural: Same as option # 4 as listed above in range, pasture and riparian.

Option #5 Mechanical, Herbicide and Cultural Control: Same as option #5 as listed above in range, pasture and riparian.

Option #6 Multiple Integrated Control: Same as option #6 as listed in range, pasture and riparian. However, the same considerations as in option #1 above need to be observed.

C. Cropland Sites: Yellow and Dalmatian toadflax can be a serious problem in cultivated crops. Dalmatian toadflax could easily be found in wheat crops in RBC in the future. Prescription weed management measures developed by Colorado State University will be used when applicable. The county weed department and extension office can provide copies of research for species listed.

D. Residential Sites: Biological controls typically do not work well in residential sites and will not be allowed. Roundup products or other EPA listed herbicides such as preemergents could be used in gardens and/or flower beds but, damage to flowers and gardens can occur if some types of herbicide are allowed to come in to contact with desirable plants, even in very small amounts. The same is true for products that can be picked up through the root system of desirable vegetation. Roundup will kill grasses in turf areas or any other plant that it contacts. Products such as 2,4-D or similar selective herbicides should be used in turf. Proper turf management and/or establishment to improve the health of turf are imperative to combat against all weeds especially perennials. Colorado State University, Service in Action (SIA) sheet recommendations will be used for residential properties in most cases. Other management practices may be feasible in some cases. The county extension office can provide copies of SIA sheets.

10. Black henbane (*Hyoscyamus niger*) Black henbane can be an annual or biennial, one to six feet tall. Leaves are coarsely-tooth to shallowly lobed and pubescent. Foliage has a foul odor. Flowers, on long racemes in axils of upper leaves, are brownish-yellow with a dark purple center and veins. Fruits are approximately one inch long, 5-lobed. Flowering occurs from June through July.

1. Control Measures

Black henbane control is best achieved by preventing seed development and dispersal along with proper competitive vegetation for several years. The selection of competitive species will depend on the zone in which it grows. If adjoining properties have infestations joint efforts are needed to properly control black henbane since the seeds can be carried by the wind. Sites that are stressed or have disturbed soils with a lack of competitive species are the primary sites of infestation.

a. Cultural Control: Seeding and maintaining perennial grasses can be an effective tool in suppressing and controlling black henbane. Selecting a combination of competitive species that actively grow in early spring, midseason and fall will improve the concepts of cultural control. Proper grazing and fertilization of desirable species will assist in suppressing the growth and spread of black henbane.

b. Mechanical Control: Although mechanical control of black henbane is effective, without proper competitive grass species failure of control in the long run will likely occur. For mature plants, severing the plant below the crown at least one inch and burning if viable seeds are present is prudent. Once the seedpods are mature, seeds are easily dispersed. Follow up with monitoring to ensure no plants have been missed and be sure to scout for individual plants in remote and outlying areas. When grubbing black henbane, be careful to limit ground disturbance. Repeatedly mowing throughout the year to inhibit flower development will at least reduce viable seeds. Repeated scouting for escape plants will be needed for control and outlying areas to eliminate seed production in a given area.

c. Biological Suppression and Control: There are no known biological controls available for control of black henbane. Weather sheep or goats can effectively graze black henbane throughout the growing season without being poisoned or induced to consume it by containment is not known for sure at this time. Certainly, proper grazing management for desirable species health is critical to compete against black henbane.

d. Herbicide Control: The best time to control black henbane is in the spring or fall when the plant is in the rosette stage. In the fall, treatment should begin before cold weather damages the rosettes, the ground freezes or snow covers the ground. The fall is the cheapest time to obtain control with residual active herbicides such as Tordon 22K or Banvel. Tordon 22K and Banvel are best suited for fall or spring applications. Early spring applications before the plant starts to bolt are the next best time. 2,4-D will usually need to be added to obtain control after bolting but before flowering. These products persist in the soil and will allow an extended control of black henbane. Tordon 22K will give better and longer control of black henbane than Banvel. Caution should be used when using these products around desirable trees, woody plants or broadleaf species or damage could result. The problem with fall and spring applications is that black henbane is harder to locate. After bolting starts, only a few products are effective, but they are much easier to locate in this stage. Escort and Telar can be used around water and are effective during bolting. The products can not be applied directly to water or allowed to drift into water. They can not be applied to intertidal areas below the mean high water mark or to standing water. They are probably the best choice when black henbane has bolted and can help reduce viable seed during the flowering stage and inhibit re-growth for a short period, but an approved non-ionic surfactant must be used. Aquatic formulations of 2,4-D and Rodeo can be used in riparian sites. Rodeo can kill or damage all species that it contacts if they are in any active growth stage and 2,4-D can damage all broad leaf species. Transline, Stinger or Curtail can be safer to use around trees but do not persist as long as Tordon 22K. Tordon 22K is the most common product choice used, depending on where black henbane is located and the time of application. Complete control of black henbane can only be obtained once the seed reserves in the soil are depleted.

2. Integrated Management Options by Site

E. Range Pasture and Riparian Sites

Option #1 Biological and Herbicide Control: There are no known biological controls available for control of black henbane. Weather sheep or goats can effectively graze black henbane throughout the growing season without being poisoned or induced to consume it by containment is not known for sure at this time. Uses of herbicides with biological controls may be instituted as additional IPM research is conducted and recommendations are developed, if developed they will be listed.

Option #2 Mechanical and Herbicide Control: Burning can clean up dense growth allowing better performance of herbicides, but one must usually allow 4 to 5 weeks of re-growth before any herbicide applications. Burning could only be performed in early spring or late fall if weather permits. Various mechanical controls can be used to keep black henbane from setting seed throughout the year but this could cover the ground with litter (depending on the density of the infestation and type of mechanical control), reducing any fall herbicide weed control. Herbicide applications with residual activity can be made in the fall before the cold weather damages the rosettes or the ground freezes. Fall is typically the best and cheapest time to control black henbane with residual herbicides. Tordon 22K and Banvel are the most common product choices depending on where black henbane is located. A spring application can be made with the addition of 2,4-D with the same products for a fall application. A spring or fall herbicide application could also be made with any escapes discovered during the summer manually removed and properly disposed of. Complete control of black henbane can only be obtained once the seed reserves in the soil are depleted.

Option #3 Cultural and Herbicide Control: A herbicide application using short residual herbicides can be made early in the year followed by reseeding of a competitive sod forming grass in the fall if competition is lacking. Alternatively, you may apply the herbicide in the fall and seed in the spring. Care must be taken to time the herbicide and use a rate and product that will not cause damage to grass seedlings. Once grass has matured so that it is not susceptible to herbicide damage, herbicide applications can then be made to obtain control of any new black henbane plants. Improving competition may not eradicate black henbane in many cases, depending on the species planted and other factors. Complete control of black henbane can only be obtained once the seed reserves in the soil are depleted.

Option#4 Mechanical and Cultural Control: This combination has not been proven effective in controlling black henbane. If competition is lacking and it is properly implemented it should at least greatly reduce many infestations. Persistence in prohibiting all seed production in a given area would be critical as well as establishing a proper competitive grass species for the site. If competition is lacking, plowing and drilling the site with desirable grasses in the very late fall or early spring will help to disrupt the biennial and sometimes annual nature of black henbane allowing one year without flowering plants in that area to a large degree in many cases. Grubbing any black henbane plants around the seeded area will be necessary to prohibit seed dispersal back into the seeded area. Without proper competition and persistence in elimination all seeds, black henbane will reestablish.

Option #5 Mechanical, Herbicide and Cultural Control: This may be a favorable combination for

many landowners especially if there is a lack of proper competition. The combinations are plentiful and various combinations can be utilized in different ways. The mechanical, cultural and herbicide recommendations listed above can be combined to suite almost any need but persistence and eliminating seed production are the keys when dealing with black henbane. Recommendations can be made once all the factors are discovered. A typical application may consist of a spring herbicide application, mowing or grubbing any plants in the treatment and outlying area to prevent seed production, then drilling or broadcasting a competitive grass species for that site to help compete against black henbane. Plowing and seeding as listed in option #4 directly above with fall application of herbicide after grasses have matured would obtain favorable control of black henbane if all escape plants are properly removed. Proper fertilization, water management and grazing practices with follow up herbicide applications or grubbing will help gain control of black henbane. Yearly monitoring and adjustments in management practices will be needed to eradicate black henbane. Development of IWM for black henbane requires information on the crop or plant community effected. Considerable planning, and time would be essential to properly utilize all the controls to be effective and not allow the infestation to spread to other areas. Constant evaluation incorporating improved strategies and substantial efforts are critical in any integrated management program. Each situation will require specific needs for a multiple integrated control plan to be effective. Smaller infestations can utilize mechanical, cultural and herbicide controls very effectively depending on specific needs. Pastures, range lands and riparian areas will all be managed differently. Recommendations can be made once all the factors are discovered.

Option #6 Multiple Integrated Control: Since no biological controls are in place option #5 directly above will coincide with this section.

Typically, a program of this type will first establish appropriate funding and time to be utilized on a yearly basis that will obtain control in the long term without allowing that species to spread. Determine if changes in land management can be a benefit in controlling the noxious weed. Management of satellite or outlying infestations must be controlled with herbicides, proper grazing and inter-seeded with appropriate competitive grass species as needed as well as proper fertilization and water management if applicable. As satellite infestations are controlled, similar management practices are moved inward in an effort to reduce the size of the infestation while follow up treatments are utilized on the original satellite infested areas as needed. Continue to work the management program inward as outlying areas are reduced in size and density. Yearly surveys should also be done to determine if new satellite infestations occur elsewhere in the management area. If adjoining neighbors do not have infestations on their property, many times they are willing to assist you in managing the problem on your property. If adjoining neighbors do have infestations on their property, both landowners should evaluate and adjust management plans to be of the most benefit to each other.

B. Rights of Way and other Non Crop Sites: Right of ways will usually cross many different types of land use. During construction or maintenance, preventive measures should be utilized to minimize the establishment and spread of noxious weeds. Consideration of all land use must be observed too properly implement any control plans. Non-crop sites will have to have specific consideration Recommendations can be made once all the factors are discovered. Typically, herbicides labeled for the weed species and land use are the best choice for initial controls along rights of way, followed by proper revegetation and

monitoring.

Option #1 Biological and Herbicide Control: Same as option #1 as listed above in range, pasture and riparian.

Option #2 Mechanical and Herbicide Control: Same as option #2 as listed above in range, pasture and riparian.

Option #3 Cultural and Herbicide Control: Same as option #3 as listed above in range, pasture and riparian.

Option#4 Mechanical and Cultural Control: Same as option #4 as listed above in range, pasture and riparian.

Option#5 Mechanical, Herbicide and Cultural Control: Same as option #5 as listed above in range, pasture and riparian.

Option #6 Multiple Integrated Control: Same as option #6 as listed in range, pasture and riparian. However, the same considerations as in option #1 above need to be observed.

C. Cropland Sites: Black henbane could potentially be found in any crop land situation in Rio Blanco County. Prescription weed management measures developed by Colorado State University will be used when applicable. The county weed department and extension office can provide copies of research for species listed.

D. Residential Sites Roundup products or other EPA listed Herbicides for residential sites such as preemergents could be used in gardens and/or flower beds but, damage to flowers and gardens can occur if some herbicides are allowed to come in to contact with desirable plants, even in very small amounts. The same is true for products that can be picked up through the root system of desirable vegetation. Roundup will kill grasses in turf areas or any other plant that it contacts. Products such as 2,4-D or similar selective herbicides should be used in turf but will have to be timed properly to have any effect. Proper turf management and/or establishment to improve the health of turf are imperative to combat against all weeds especially perennials. Existing black henbane is probably best controlled in residential sites by grubbing and proper plant competition. Colorado State University, Service in Action (SIA) sheet recommendations will be used for residential properties. The county extension office can provide copies of SIA sheets.

11. Black knapweed (*Centaurea nigra*) Black knapweed, a perennial, with erect stem, six inches to three feet high, usually freely branched in the upper part of the plant. The leaves are variable, both in width and degree of division, the upper leaves are narrow and generally with entire margins, with the lower leaves lobed and/or with course teeth. The whole plant is a dull green, rather rough with small

hairs. The florets being tubular with cone shape flowers, allow the black fringes on the bracts to be most noticeable, hence the name black knapweed. The flower resembles in appearance to spotted knapweed except the flower head of black knapweed is much larger and the florets a brighter purple. Black knapweed typically establishes in rights of way, cliffs and grasslands. Black knapweed can thrive in ordinary soil but prefers a well-drained and fertile soil with a sunny location. Once established, plants can tolerate drought, and alkaline soils, thriving and even self-sowing in dense growth. This species is available in some nurseries and is now an escape ornamental. At this time, no other description of this noxious weed has been located. When more information is discovered it will be included. It is apparently easy to control with herbicides if not well established.

1. Control Measures

a. Cultural Control: Cultural control of black knapweed with perennial grasses such as smooth brome and crested wheatgrass may help to compete with black knapweed and slow its spread to a degree. Black knapweed may establish in healthy environments but is more likely to be problematic in areas that are impacted or lacking desirable species that occupy all niches of the environment. Seeding alone in infested black knapweed sites may not, however, control the existing stand. Its produces early spring growth that is difficult to compete against. Good land stewardship practices are always essential in managing black knapweed or any other weed species.

b. Mechanical Control: Hand pulling or grubbing of black knapweed when it is in the bud stage and again when it is in the very early flowering stage can significantly reduce seed production and may be suited for smaller infestations if carefully monitored. Pulling is best when the soil is moist since more of the root system can be removed. Grazing or mowing are not proven control practices and may allow the species to spread. Mowing may also stimulate and increase seed production below mower height in some cases. It is very important to not let black knapweed seed out, as this will extend control practices for several years. Keeping all black knapweed from going to seed over a number of years may eventually eliminate an infestation, once the root reserves and the seed source in the soil is depleted. Uncontrolled knapweed on adjoining properties may reintroduce seeds. Burning of any knapweed has shown limited results and may increase the cover and density of this noxious weed species without other controls in place. Burning may be used to clean up old dead growth that could obstruct herbicide applications. It is also important to minimize ground disturbance so that competition from desirable vegetation is not disrupted.

f. Biological Suppression and Control: One biological agent is available for black knapweed and a few others may attack it. There has been no known research, showing that the biological control agents alone are successful in controlling black knapweed. However, they can reduce seed production and may help to reduce the competitiveness of black knapweed to a limited degree.

1. The knapweed seed head fly also known as picture-winged fly, *Urophora quadrifasciata* is available for black knapweed. This species may have an effect in dense stands black knapweed.

2. *Urophora affinis* also a knapweed seed head fly may also attack black knapweed.

These knapweed seed head flies would attack the flowers of black knapweed to produce galls and reduce the seed production in infested plants. Neither of these species is established in RBC at present.

3. The knapweed flower weevil *Larinus minutus* may also attack black knapweed. Larva consumes

developing seeds. Adults feed on rosettes and flowers.

Currently all knapweed species in RBC are small and eradication of all species is possible in this county. Unless a very large infestation is discovered in this county biological control agents will not be considered a viable option for control.

d. Herbicide Control: There are a few herbicides labeled for use on any knapweed species. Many can be used independently or in combination with each other. Some of the herbicides commonly used are Tordon 22K, Banvel, 2,4-D, Escort, and Clopyralid products such as Transline, Stinger and Curtail. Some formulations of 2,4-D may be used in aquatic situations. Any other EPA approved herbicide labeled for use on diffuse knapweed may be used depending on the situation. Herbicide applications can be made during the rosette to very early bolting stages early in the year. Applications can also be made during the fall as long as the rosettes are green and healthy and the ground is not frozen or covered with snow. Early spring and late fall applications are the most effective and cost efficient times for herbicide applications. Herbicides that reside in the soil for a short period will usually improve control if done properly. If herbicides are applied when black knapweed is in the flower stage, seeds will remain viable with most products. Herbicides are only one of the components needed to successfully control knapweed in large infestations

2. Integrated Management Options by Site

D. Range Pasture and Riparian Sites

Option #1 Biological and Herbicide Control: The release of the biological control agent *U. quadrifasciata* could be made in large infestations. A herbicide application can then be made from the rosette through the bolting stage (where insects were not released) and in the fall where insects were released. The use of herbicides at different times of the year for different biological agents may be instituted in the future when research is conducted and scientific recommendations are developed. With the small populations of knapweed in RBC, biological controls are not recommended.

Option #2 Mechanical and Herbicide Control: Mowing pulling or grubbing can be carried out when black knapweed is in the bud and again before any flowering. A herbicide application can then be made to any plants that have been missed, re-bolted or that develop rosettes, if necessary. Burning can sometimes be effective in delaying the plant's ability to produce seed and in some instances allow for improved herbicide performance in dense infestations.

Option #3 Cultural and Herbicide Control: A herbicide application can be made in the early summer when black knapweed is in the early summer rosette through early bolting stage. Reseeding with competitive perennial grasses can be followed later in the summer depending upon the herbicide used and the rate of application. In some cases, grasses will rebound by themselves after a herbicide application, depending on the herbicide being used. Any knapweed re-growth can be treated with a properly selected herbicide for the site.

Option#4 Mechanical and Cultural Control: This option could be desirable in situations where desirable vegetation is in poor condition. The mechanical control should be carried out and followed by reseeding of competitive perennial grasses desirable for the intended land use. Follow up mechanical control will still be needed for the next several years without letting any plants seed out.

Option #5 Mechanical, Herbicide and Cultural Control: Utilization of these control measures could work well with a large or small infestation. The procedure would depend on whether or not the desirable vegetation is sufficient to help compete against black knapweed, with some improved cultural controls.

Option #6 Multiple Integrated Control: Biological, mechanical, cultural and herbicide controls could and should be utilized on a very large-scale infestation. Development of an IMP requires information on the crop or plant community effected; lifecycles of weed that is targeted and biological agents to be used, and the control techniques to be incorporated in the IMP. Considerable planning, and time would be essential to properly utilize all controls to be effective and not allow the infestation to spread to other areas. Constant evaluation incorporating improved strategies and substantial efforts are critical in any integrated management program. Each situation will require specific needs for a multiple integrated control plan to be effective. Smaller infestations can utilize mechanical, cultural and herbicide controls depending on specific needs. Recommendations can be made once all the factors are discovered.

B. Rights of Way and other Non Crop Sites: Right of ways will usually cross many different types of land use. During construction or maintenance, preventive measures should be utilized to minimize the establishment and spread of noxious weeds. Consideration of all land use must be observed too properly implement any control plans. Non-crop sites will have to have specific consideration Biological controls are not recommended for roadsides. Right of ways are typically not suited for biological controls unless the right of way passes through a very large infestation that is out of control and not being managed by other land owners or managers.

Option #1 Biological and Herbicide Control: With the small populations of knapweed in RBC, biological controls are not recommended.

Option #2 Mechanical and Herbicide Control: Same as option #2 as listed above in range, pasture and riparian.

Option #3 Cultural and Herbicide Control: Same as option #3 as listed above in range, pasture and riparian.

Option#4 Mechanical and Cultural Control: Same as option #4 as listed above in range, pasture and riparian.

Option#5 Mechanical, Herbicide and Cultural Control: Same as option #5 as listed above in range, pasture and riparian.

Option #6 Multiple Integrated Control: Same as option #6 as listed in range, pasture and riparian. However, the same considerations as in option #1 above need to be observed.

C. Cropland Sites: Black knapweed is not very likely to be found in any crop land situation in RBC. If found prescription weed management measures developed by Colorado State University will be used when applicable. The county weed department and extension office can provide copies of research for species listed.

D. Residential Sites: Biological controls typically do not work well in residential sites and will not be allowed. Roundup products or other EPA listed Herbicides such as preemergents could be used in gardens and/or flower beds but, damage to flowers and gardens can occur if some herbicide are allowed to come in to contact with desirable plants, even in very small amounts. The same is true for products that can be picked up through the root system of desirable vegetation. Roundup will kill grasses in turf areas or any other plant that it contacts. Products such as 2,4-D or similar selective herbicides should be used in turf. Proper turf management and/or establishment to improve the health of turf are imperative to combat against all weeds. Colorado State University, Service in Action (SIA) sheet recommendations will be used for residential properties. The county extension office can provide copies of SIA sheets.

12. Common burdock (*Arctium minus*) Common burdock is a biennial, producing a rosette of large, cordate, thickly hairy leaves the first year and an erect, much branched, coarse stem three to ten feet tall the second year. The leaves are alternate, large, broadest at the leaf base, somewhat diminished upwards, margins toothed or wavy, woolly beneath at least when young, dark green above. Flowers are purple, heads born in leaf axils or at the end of branches, numerous, clustered, covered with many slender, hooked spines, achenes gray to brown, mottled, oblong, about 1/4 inch long, flattened and slightly curved. Flowering and seed production occur from July to September.

1. Control Measures

Common burdock control is best achieved by preventing seed development and dispersal along with proper competitive vegetation for several years. The selection of competitive species will depend on the zone in which it grows. If adjoining properties have infestations joint efforts are needed to properly control common burdock since the seeds can be carried by animals and people. Sites that are stressed or have disturbed soils with a lack of competitive species are primary sites of infestation. Complete control of common burdock is difficult at best since the seeds are easily dispersed.

a. Cultural Control: Seeding and maintaining perennial grasses can be an effective tool in suppressing and controlling common burdock. Selecting a combination of competitive species that actively grow in early spring, midseason and fall will improve the concepts of cultural control. Proper grazing and fertilization of desirable species will assist in suppressing the growth and spread of common burdock.

b. Mechanical Control: Although mechanical control of common burdock is effective, without proper competitive grass species failure of control in the long run will likely occur. For mature plants, severing

the plant below the crown at least one inch and burning if viable seeds are present is prudent. When the flowers produce color, seeds will still be viable even if the plant is pulled. Once the seed-heads are mature, seeds can easily dispersed by any passing animal or person. Follow up with monitoring to ensure no plants have been missed and be sure to scout for individual plants in remote and outlying areas. When grubbing common burdock, be careful to limit ground disturbance. Repeatedly mowing throughout the year to inhibit flower development will at least reduce viable seeds. Repeated scouting in wooded areas, along irrigation ditches and the edge of fields for escape plants will be needed for control along with outlying areas to eliminate seed production in a given area. Removing seeds from animals may be possible in some cases to help limit seed dispersal.

c. Biological Suppression and Control: There are no known biological controls available for control of common burdock. Sheep or goats can effectively graze common burdock at least before the plant becomes too mature. Certainly, proper grazing management for desirable species health is critical to compete against common burdock. Common burdock when mature will severely degrade the value of wool in the market place.

d. Herbicide Control: The best time to control common burdock is in the early spring or fall when the plant is in the rosette stage. Adequate herbicide carrier volume is critical to effectively cover the plant and penetrate the leaf tissue. In the fall, treatment should begin before cold weather damages the rosettes, the ground freezes or snow covers the ground. The fall is the cheapest time to obtain control with residual active herbicides such as Tordon 22K or Banvel. Tordon 22K and Banvel are best suited for fall or spring applications. Early spring applications before the plant starts to bolt are the next best time. 2,4-D will usually need to be added to obtain control after bolting but before flowering. These products persist in the soil and will allow an extended control of burdock. Tordon 22K will give better and longer control of common burdock than Banvel. Caution should be used when using these products around desirable trees, woody plants or broadleaf species or damage could result. The problem with fall and spring applications is that burdock is harder to locate. After bolting starts, only a few products are effective, but they are much easier to locate in this stage. Aquatic formulations of 2,4-D and Rodeo can be used in riparian sites. Rodeo can kill or damage all species that it contacts if they are in any active growth stage and 2,4-D can damage all broad leaf species. Transline, Stinger or Curtail can be safer to use around trees but do not persist as long as Tordon 22K

2. Integrated Management Options by Site

F. Range Pasture and Riparian Sites

Option #1 Biological and Herbicide Control: There are no known biological controls available for control of common burdock. Sheep or goats could be used to keep common burdock from seeding out throughout the year, followed up with an early spring herbicide application.

Option #2 Mechanical and Herbicide Control: Burning can clean up dense growth allowing better performance of herbicides for a spring herbicide application, but one must usually allow 4 to 5 weeks of re-growth before any herbicide applications. Burning could only be performed in early spring or late fall

if weather permits. Various mechanical such as grubbing or mowing can be used to keep common burdock from setting seed throughout the year but this could cover the ground with litter (depending on the density of the infestation and type of mechanical control), reducing any fall herbicide weed control. Herbicide applications with residual activity can be made in the fall before the cold weather damages the rosettes or the ground freezes but will likely be needed again in the spring for any newly germinated plants. Tordon 22K and Banvel are common product choices depending on where burdock is located. A spring application can be made with the addition of 2,4-D with the same products for a fall application. A spring or fall herbicide application could also be made with any escapes discovered during the summer manually removed and properly disposed of.

Option #3 Cultural and Herbicide Control: A herbicide application using short residual herbicides can be made early in the year followed by reseeding of a competitive sod forming grass in the fall if competition is lacking. Alternatively, you may apply the herbicide in the fall and seed in the spring. Care must be taken to time the herbicide and use a rate and product that will not cause damage to grass seedlings. Once grass has matured so that it is not susceptible to herbicide damage, herbicide applications can then be made to obtain control of any new burdock plants. Improving competition may not eradicate burdock in many cases, depending on the species planted and other factors.

Option#4 Mechanical and Cultural Control: This combination has not been proven effective in controlling common burdock. If competition is lacking and it is properly implemented it should at least greatly reduce many infestations. Persistence in prohibiting all seed production in a given area would be critical as well as establishing a proper competitive grass species for the site. If competition is lacking, plowing and drilling the site with desirable grasses in the very late fall or early spring will help to disrupt the biennial nature of burdock allowing one year without flowering plants in that area to a large degree in many cases. Grubbing any burdock plants around the seeded area will be necessary to prohibit seed dispersal back into the seeded area. Without proper competition and persistence in elimination all seeds, burdock will likely reestablish.

Option #5 Mechanical, Herbicide and Cultural Control: This is probably the most favorable combination for landowners especially if there is a lack of proper competition and the infestation is large. The combinations are plentiful and various combinations can be utilized in different ways. The mechanical, cultural and herbicide recommendations listed above can be combined to suite almost any need but persistence and eliminating seed production are the keys when dealing with common burdock. Recommendations can be made once all the factors are discovered. A typical application may consist of a spring herbicide application, mowing or grubbing any plants in the treatment and outlying area to prevent seed production, then drilling or broadcasting a competitive grass species for that site to help compete against common burdock. Plowing and seeding as listed in option #4 directly above with fall application of herbicide after grasses have matured would obtain favorable control of burdock if all escape plants are properly removed. Proper fertilization, water management and grazing practices with follow up herbicide applications or grubbing will help gain control of burdock. Yearly monitoring and adjustments in management practices will be needed to prevent burdock from re-infesting the site. Development of IWM for common burdock requires information on the crop or plant community effected. Considerable planning, and time would be essential to properly utilize all the controls to be effective and not allow the infestation to spread to other areas. Constant evaluation incorporating improved strategies and

substantial efforts are critical in any integrated management program on a large scale. Each situation will require specific needs for a multiple integrated control plan to be effective. Smaller infestations can utilize mechanical, cultural and herbicide controls very effectively depending on specific needs. Pastures, range lands and riparian areas will all be managed differently. Recommendations can be made once all the factors are discovered.

Option #6 Multiple Integrated Control: Since no biological controls are in place except sheep and goats, option #5 directly above will coincide with this section possibly using the grazing practices to replace mechanical control or in conjunction with them.

Typically, a program of this type will first establish appropriate funding and time to be utilized on a yearly basis that will obtain control in the long term without allowing that species to spread. Determine if changes in land management can be a benefit in controlling the noxious weed. Management of satellite or outlying infestations must be controlled with herbicides, proper grazing and inter-seeded with appropriate competitive grass species as needed as well as proper fertilization and water management if applicable. As satellite infestations are controlled, similar management practices are moved inward in an effort to reduce the size of the infestation while follow up treatments are utilized on the original satellite infested areas as needed. Continue to work the management program inward as outlying areas are reduced in size and density. Yearly surveys should also be done to determine if new satellite infestations occur elsewhere in the management area. If adjoining neighbors do not have infestations on their property, many times they are willing to assist you in managing the problem on your property. If adjoining neighbors do have infestations on their property, both landowners should evaluate and adjust management plans to be of the most benefit to each other.

B. Rights of Way and other Non Crop Sites: Right of ways will usually cross many different types of land use. During construction or maintenance, preventive measures should be utilized to minimize the establishment and spread of noxious weeds. Consideration of all land use must be observed too properly implement any control plans. Non-crop sites will have to have specific consideration Recommendations can be made once all the factors are discovered. Typically, herbicides labeled for the weed species and land use are the best choice for initial controls along rights of way, followed by proper revegetation and monitoring.

Option #1 Biological and Herbicide Control: Same as option #1 as listed above in range, pasture and riparian.

Option #2 Mechanical and Herbicide Control: Same as option #2 as listed above in range, pasture and riparian.

Option #3 Cultural and Herbicide Control: Same as option #3 as listed above in range, pasture and riparian.

Option#4 Mechanical and Cultural Control: Same as option #4 as listed above in range, pasture and

riparian.

Option#5 Mechanical, Herbicide and Cultural Control: Same as option #5 as listed above in range, pasture and riparian.

Option #6 Multiple Integrated Control: Same as option #6 as listed in range, pasture and riparian. However, the same considerations as in option #1 above need to be observed.

C. Cropland Sites: Common burdock could possibly be found in a crop land situation in Rio Blanco County. Repeat cultivation twice a year for two years should slow the spread and reduce seed production. Cultivation should be performed during the early bud stage. Prescription weed management measures developed by Colorado State University will be used when applicable. The county weed department and extension office can provide copies of research for species listed.

D. Residential Sites Roundup products or other EPA listed Herbicides for residential sites such as preemergents could be used in gardens and/or flower beds but, damage to flowers and gardens can occur if some herbicides are allowed to come in to contact with desirable plants, even in very small amounts. The same is true for products that can be picked up through the root system of desirable vegetation. Roundup will kill grasses in turf areas or any other plant that it contacts. Products such as 2,4-D or similar selective herbicides should be used in turf but will have to be timed properly to have any effect. Proper turf management and/or establishment to improve the health of turf are imperative to combat against all weeds especially perennials. Existing common burdock is probably best controlled in residential sites by grubbing and proper plant competition. Colorado State University, Service in Action (SIA) sheet recommendations will be used for residential properties. The county extension office can provide copies of SIA sheets.

13. Common mullein (*Verbascum thapsus*) Common mullein is a biennial that produces a large thick rosette with fuzzy pubescent hair on the leaves, the first year and a single, stout, erect stem, two to eight feet tall, the second year with equally pubescent leaves as the first year. The leaves are alternate, overlapping one another, light green, densely woolly. Flowers are sessile, borne in long terminal spikes, sulfur yellow, five lobed and more than an inch in diameter. Fruits are two chambered with numerous, small, angular, brownish seeds are 1/32 inch long. Flowering and seed production occur from June to September. In RBC, it appears to grow at elevations between approximately 5,000 to 9,000 feet. If management is timed properly, it is not extremely difficult to control.

1. Control Measures

Common mullein control is best achieved by preventing seed development and dispersal along with proper competitive vegetation for several years. The selection of competitive species will depend on the zone in which it grows. If adjoining properties have infestations joint efforts are needed to properly control common mullein since the seeds are easily dispersed by wind. Sites that are stressed or have disturbed soils with a lack of competitive species are primary sites of infestation.

a. Cultural Control: Seeding and maintaining perennial grasses can be an effective tool in suppressing

and controlling common mullein. Selecting a combination of competitive species that actively grow in early spring, midseason and fall will improve the concepts of cultural control. Proper grazing and fertilization of desirable species will assist in suppressing the growth and spread of common mullein.

b. Mechanical Control: Although mechanical control of common mullein is effective, without proper competitive grass species failure of control in the long run will likely occur. For mature plants, severing the plant below the crown at least one inch and burning if viable seeds are present is prudent. Once the seed-heads are mature, seeds can easily dispersed by wind, water or the transportation of soil by animals or vehicles. Follow up with monitoring to ensure no plants have been missed and be sure to scout for individual plants in remote and outlying areas. When grubbing common mullein, be careful to limit ground disturbance when possible. Repeatedly mowing throughout the year to inhibit flower development will at least reduce viable seeds. Repeated scouting in rocky areas, hillsides, and roads along irrigation ditches and the edge of fields for escape plants will be needed for control along with outlying areas to eliminate seed production in a given area.

c. Biological Suppression and Control: There is one known biological control available for control of common mullein. The seed head weevil *Gymnetron tetrum* consumes seeds and the seed head exudes a black tar like substance further helping to restrict seed dispersal. Sheep or goats can also effectively graze common mullein at least before the plant becomes too mature. Certainly, proper grazing management for desirable species health is critical to compete against common mullein in many cases.

d. Herbicide Control: The best time to control common mullein is in the early spring or fall when the plant is in the rosette stage. Adequate herbicide carrier volume is critical to penetrate the pubescent hair on the leaves. In the fall, broadcast treatments should begin before cold weather damages the rosettes, the ground freezes or snow covers the ground. The fall is an excellent time to obtain control with a residual active herbicide such as Tordon 22K. Tordon 22K is best suited for fall or very early spring applications. Early spring applications before the plant starts to bolt are the next best time. 2,4-D will usually need to be added to obtain control at any time. This product will persist in the soil and will allow an extended control of mullein. Caution should be used when using these products around desirable trees, woody plants or broadleaf species or damage could result. The problem with fall and spring spot applications is that common mullein is harder to locate. After bolting starts, only a few products such as Escort and Telar are usually effective, but they are much easier to locate in this stage. Escort, Telar, aquatic formulations of 2,4-D and Rodeo can be used in riparian sites. Rodeo can kill or damage all species that it contacts if they are in any active growth stage and other products can damage many broad leaf species.

2. Integrated Management Options by Site

G. Range Pasture and Riparian Sites

Option #1 Biological and Herbicide Control: Early spring or fall herbicide applications should not be detrimental to the seed head weevil *G. tetrum*. The same should be true of grazing with sheep or goats.

Option #2 Mechanical and Herbicide Control: Burning can clean up dense growth allowing better

performance of herbicides for a spring herbicide application, but one must usually allow 4 to 5 weeks of re-growth before any herbicide applications and mullein does not burn real well. Burning could only be performed in early spring if weather permits. Various mechanical controls such as grubbing or mowing repeated throughout the year can be used to reduce seed setting from common mullein. Herbicide applications with residual activity can be made in the fall before the cold weather damages the rosettes or the ground freezes but they will likely be needed again in the spring for any newly germinated or missed plants. A spring or fall herbicide application could also be made with any escapes discovered during the summer manually removed and properly disposed of.

Option #3 Cultural and Herbicide Control: A herbicide application using short residual herbicides can be made early in the year followed by reseeding of a competitive sod forming grass in the fall if competition is lacking. Alternatively, you may apply the herbicide in the fall and seed in the spring. Care must be taken to time the herbicide and use a rate and product that will not cause damage to grass seedlings. Once grass has matured so that it is not susceptible to herbicide damage, herbicide applications can then be made to obtain control of any new common mullein plants. Improving competition may not eradicate mullein in many cases, depending on the species planted and other factors.

Option #4 Mechanical and Cultural Control: This combination has not been proven effective in controlling common mullein. If competition is lacking and it is properly implemented it should at least greatly reduce many infestations. Persistence in prohibiting all seed production in a given area would be critical as well as establishing a proper competitive grass species for the site. If competition is lacking, plowing and drilling the site with desirable grasses in the very late fall or early spring will help to disrupt the biennial nature of mullein allowing one year without flowering plants in that area to a large degree in many cases. Grubbing any mullein plants around the seeded area will be necessary to prohibit seed dispersal back into the seeded area. Without proper competition and persistence in elimination all seeds, mullein will likely reestablish.

Option #5 Mechanical, Herbicide and Cultural Control: This is probably the most favorable combination for landowners especially if there is a lack of proper competition and the infestation is large. The combinations are plentiful and various combinations can be utilized in different ways. The mechanical, cultural and herbicide recommendations listed above can be combined to suite almost any need but persistence, competition, and eliminating seed production are the keys when dealing with common mullein. Recommendations can be made once all the factors are discovered. A typical application may consist of a spring herbicide application, mowing or grubbing any plants in the treatment and outlying area to prevent seed production, then drilling or broadcasting a competitive grass species for that site to help compete against common mullein. Plowing and seeding as listed in option #4 directly above with fall application of herbicide after grasses have matured would obtain favorable control of mullein if all escape plants are properly removed. Proper fertilization, water management and grazing practices with follow up herbicide applications or grubbing will help gain control of common mullein. Yearly monitoring and adjustments in management practices will be needed to prevent mullein from re-infesting the site. Development of IWM for common mullein requires information on the crop or plant community effected. Considerable planning, and time would be essential to properly utilize all the controls to be effective and not allow the infestation to spread to other areas. Constant evaluation incorporating improved strategies and substantial efforts are critical in any integrated management

program on a large scale. Each situation will require specific needs for a multiple integrated control plan to be effective. Smaller infestations can utilize mechanical, cultural and herbicide controls very effectively depending on specific needs. Pastures, range lands and riparian areas will all be managed differently. Recommendations can be made once all the factors are discovered.

Option #6 Multiple Integrated Control: Since only one biological insect control, and sheep and goats are available, option #5 directly above will roughly coincide with this section. Using the grazing practices to replace mechanical control or in conjunction with them except that in very large infestations the biological insect *G. tetrum* could be released into the crux of the infestation and controls could proceed around them.

Typically, a program of this type will first establish appropriate funding and time to be utilized on a yearly basis that will obtain control in the long term without allowing that species to spread. Determine if changes in land management can be a benefit in controlling the noxious weed. The release of *G. tetrum* could be preformed in the crux of the infestation with monitoring to be sure they propagate. Management of satellite or outlying infestations must be controlled with herbicides, proper grazing and inter-seeded with appropriate competitive grass species as needed as well as proper fertilization and water management if applicable. As satellite infestations are controlled, similar management practices are moved inward in an effort to reduce the size of the infestation while follow up treatments are utilized on the original satellite infested areas as needed. After *G. tetrum* establishes assisting the insect in spreading further out from the crux would accelerate the control. Continue to work the management program inward as outlying areas are reduced in size and density. Yearly surveys should also be done to determine if new satellite infestations occur elsewhere in the management area. If adjoining neighbors do not have infestations on their property, many times they are willing to assist you in managing the problem on your property. If adjoining neighbors do have infestations on their property, both landowners should evaluate and adjust management plans to be of the most benefit to each other.

B. Rights of Way and other Non Crop Sites: Right of ways will usually cross many different types of land use. During construction or maintenance, preventive measures should be utilized to minimize the establishment and spread of noxious weeds. Consideration of all land use must be observed too properly implement any control plans. Non-crop sites will have to have specific consideration Recommendations can be made once all the factors are discovered. Typically, herbicides labeled for the weed species and land use are the best choice for initial controls along rights of way, followed by proper revegetation and monitoring.

Option #1 Biological and Herbicide Control: Same as option #1 as listed above in range, pasture and riparian.

Option #2 Mechanical and Herbicide Control: Same as option #2 as listed above in range, pasture and riparian.

Option #3 Cultural and Herbicide Control: Same as option #3 as listed above in range, pasture and

riparian.

Option#4 Mechanical and Cultural Control: Same as option #4 as listed above in range, pasture and riparian.

Option#5 Mechanical, Herbicide and Cultural Control: Same as option #5 as listed above in range, pasture and riparian.

Option #6 Multiple Integrated Control: Same as option #6 as listed in range, pasture and riparian. However, the same considerations as in option #1 above need to be observed.

C. Cropland Sites: Common burdock could possibly be found in a crop land situation in Rio Blanco County. Repeat cultivation twice a year for two years should slow the spread and reduce seed production. Cultivation should be performed during the early bud stage. Prescription weed management measures developed by Colorado State University will be used when applicable. The county weed department and extension office can provide copies of research for species listed.

D. Residential Sites Roundup products or other EPA listed Herbicides for residential sites such as preemergents could be used in gardens and/or flower beds but, damage to flowers and gardens can occur if some herbicides are allowed to come in to contact with desirable plants, even in very small amounts. The same is true for products that can be picked up through the root system of desirable vegetation. Roundup will kill grasses in turf areas or any other plant that it contacts. Products such as 2,4-D or similar selective herbicides should be used in turf but will have to be timed properly to have any effect. Proper turf management and/or establishment to improve the health of turf are imperative to combat against all weeds especially perennials. Existing common burdock is probably best controlled in residential sites by grubbing and proper plant competition. Colorado State University, Service in Action (SIA) sheet recommendations will be used for residential properties. The county extension office can provide copies of SIA sheets.