COAL CREEK RIPARIAN RESTORATION PROJECT

1. Project Summary

See attached form

2. Project Purpose

The overall purpose of this project is to improve the ecological health of the Coal Creek riparian corridor for native wildlife, including the Preble's meadow jumping mouse. In the final rule to list the Preble's meadow jumping mouse as a federally threatened species (Federal Register, May 13, 1998, p. 26517- 26530), the U.S. Fish and Wildlife Service stated:

> "Overgrazing by livestock may be an important cause of the decline of the Preble's meadow jumping mouse."

Additionally, the U.S. Fish and Wildlife Service stated that:

> "Alluvial aggregate extraction... can destroy and fragment Preble's meadow jumping mouse habitat."

The key purposes of this project includes (1) improved livestock management to reduce grazing intensity to sustainable levels through the construction of riparian fencing, and (2) restore and reclaim a formerly mined area along Coal Creek to enhance the vegetation upon which the Preble's meadow jumping mouse relies.

Since 1993 the City of Boulder has acquired over 90 percent of the remaining undeveloped riparian land along Coal Creek in Boulder County upstream from the Town of Superior. Additionally the City of Boulder has taken an important step in the preservation of the remaining undeveloped land along Coal Creek in Jefferson County that lies east of the foothills through its 1999 purchase of 1500 acres of land for 8.5 million dollars from its open space fund. Now that all of this land has been protected from development, the long-term management needs must be addressed - needs that are the subject of this grant application.

Project Background. Riparian areas are extremely important parts of the landscape in eastern Colorado because they support unusually high levels of biological diversity. Although they comprise less than two percent of the land cover, riparian areas are habitat for approximately 80 percent of birds, mammals, reptiles and amphibians native to Colorado. Many species, including the federally threatened Preble's meadow jumping mouse depend almost entirely on these creek-side areas for their survival. Because of their relative scarcity, each riparian area is a valuable resource, important for the conservation of Colorado's biological diversity
However, riparian areas are as endangered as they are important. The availability of water, gravel and abundant vegetation has also attracted a host of human uses to riparian area. Since the 1800's gravel mining, channelization, hydrologic modification, urban development and unsustainable agricultural practices in riparian areas have decreased their extent and ecological

integrity. None remain unaffected by human disturbances.

Livestock grazing is the most widespread economic use of public lands in the western United States, including City of Boulder Open Space. While grazing by native species is a natural ecological process that has shaped the natural communities of western North America, domestic livestock grazing differs. Because domestic livestock are not free ranging, their grazing patterns can be more intense. The influence of domestic livestock grazing has been especially damaging in riparian areas where native grazers were probably less common. Unlike bison, domestic livestock and especially cattle, tend to congregate and linger around water and shade. The response by native vertebrates to grazing is usually not caused by the mere presence of livestock, but rather to the changes in vegetation structure and composition, which result from grazing. Vegetation is reduced through soil compaction and direct removal of plants and parts of plants (grazing). Cattle favor some plants while others are avoided. As a result, the species composition of riparian areas shifts with the presence of livestock. Wildlife populations respond to these changes in vegetation composition and structure.

Riparian fencing allows improved grazing management. With appropriate fencing design, management techniques such as grazing exclusions, prescriptive grazing for weed control, and management of intensity, timing, and duration of grazing can be achieved. Implementation of these grazing management practices lead to significant improvements in vegetation of the riparian corridor.

3. Area Map (See attached)

4. Site Map (See attached)

5. Habitat Description

Coal Creek is the most remote riparian system on City of Boulder Open Space and the only riparian area without an associated recreational trail. Through much of its length Coal Creek remains unmined and un-channelized. There are no main-stem impoundments on Coal Creek. Although several ditches at the mouth of Coal Creek Canyon (e.g. McKay Ditch and Upper Church Ditch) divert much of the creek's water, there is a considerable spring flow when snow melts at higher elevations in the watershed. These annual high flows have maintained a complex floodplain. Where it flows through Open Space, Coal Creek's multiple active channels are dynamic. Each year, they cut into their banks and redeposit the eroded material as point bars further downstream. As a result, the Coal Creek floodplain is variable, dynamic and rich in a variety of wetland and upland plant communities.

Vegetation: Native Plants and Weeds. The vegetation of the Coal Creek riparian area is diverse and dominated by native species. Despite the impacts of livestock, portions of the riparian area are well vegetated. Robust stands of hawthorn are common, as are other fruit producing shrubs such as American plum and chokecherry. A list of the plant species recorded during the Open Space Department's wetland inventory is attached as Appendix A. The plains cottonwood riparian woodland is listed by the Colorado Natural Heritage program as a Critically Imperiled

Natural Community in Colorado and one that is imperiled even at a global level. While the project area is not an example of a pristine plains riparian woodland, it certainly has great promise to be restored to an area of high ecological function.

There are extensive infestations of knapweed (*Centaurea spp.*) in the project area. Much of the area's weediness can be traced to a former gravel mine located in the center of the project area. The gravel mine operated for several years prior to purchase of the area as Open Space in 1986. It then operated as a condition of the Open Space purchase, until the City bought the mining rights almost ten years later. The Open Space Department has completed the necessary earthwork for the initial reclamation of this mine site. The funding request for this project would target revegetation of portions of the mine site.

Weed Control: Integrated Pest Management. The Open Space Department allocates several thousand dollars annually for weed control in the vicinity of Coal Creek. The Open Space Department uses an integrated approach to weed control rather than relying only on the use of herbicides. Integrated Weed Management (IWM) is a decision-making process that selects, integrates, and implements weed control techniques to prevent or manage weed populations. IWM focuses on long-term prevention or suppression of weed problems while reducing the impact control techniques may have on the environment, human health and non-target organisms. A whole systems approach is used, looking at the weed species as it relates to the entire ecosystem. Prevention, education, cultural control, mechanical control, biological control and chemical control are the techniques used in integrated weed management. Effective weed management combines several techniques to fix the problem with the least environmental conflict. Weed control using only one technique is usually not effective or economical.

6. Water Rights

The City owns several water rights in Coal Creek that have historically been used for agricultural purposes on the Open Space properties in the area. These water rights are summarized in the table below.

Ditch Name	Adjudication(s)	Volume	Notes
Eggleston #1	June 1, 1860 (most senior right on Coal Creek)	0.5 cfs	Includes rights transferred from Autry-Eggleston and Eggleston #2
	May 1, 1862	1.8 cfs	
Eggleston #3	June 1, 1870	9 cfs	Irrigates 7.5 acres fill Eggleston Reservoir #3
Eggleston #4	October 1, 1879	9 cfs	Irrigates 200 acres & fill Eggleston Reservoir #4

As part of our water resources management program and participation in the recovery and conservation effort for Preble's meadow jumping mouse the City is investigating the relative costs and benefits of working with the Colorado Water Conservation Board to establish an in-stream water right in Coal Creek.

7. Existing Land Use

The entire project area is designated Open Space, which is currently being used for grazing and scientific research.

Grazing. The entire project area upstream of the gravel mine is leased to local ranchers by the City of Boulder for a cow/calf operation. The area is rested during the growing season when the lessee's cattle graze at higher elevation in summer pastures. From time to time the City has allowed the lessee to graze in early spring to assist in control of knapweed. Typically there are about 250 head of cattle on the 2,000 acres around Coal Creek. Although the area downstream of the gravel mine is not currently part of a long-term agricultural lease, limited livestock grazing has been allowed for weed control and to reduce the deep grass thatch which has developed in the absence of grazing or fire. Similar grazing management practices are in place on the Open Space parcels in Jefferson County.

Research. The City has sponsored projects examining the effects of urbanization on avian diversity and predator assemblages, carbon and nitrogen soil amendments on weeds, impacts of habitat fragmentation on insect populations, and the effectiveness of biological controls on diffuse knapweed. Inventory projects have targeted small mammals (1987, 1995, 1999), breeding and migrating songbirds (1999), and wetland/riparian vegetation (1991, 1999). In 1991, the City consulted with Keammerer and Associates to conduct a characterization of the vegetation and wildlife in a portion of the Coal Creek riparian area. The Open Space Department wanted to gain a better understanding of the ecological value of this area anticipating transportation and development projects nearby.

Additional research projects were undertaken in 1999. Coal Creek fish populations were surveyed in 1999 revealing a majority of native species. Currently, monitoring of winter raptor use of the prairie dog towns along Coal Creek uplands and prairie dog populations are being quantified. Large mammal use of Coal Creek is also being studied and has revealed consistent use of Coal Creek as a corridor for black bears and bobcats. These studies are continuing and provide baseline data for future reference.

8. Land Use Conflicts

Existing land use practices are compatible with this proposed project. Fencing of areas along Coal Creek will allow the City of Boulder Open Space Department to better manage grazing in the area. Restoration of strategic areas along the stream and in Coal Creek's wetlands will improve native plant and wildlife habitat, and greatly improve the habitat possibilities for the Preble's meadow jumping mouse.

9. Area Land Use

The proposed project site is a large parcel of contiguous Open Space land. Surrounding land is used for agricultural purposes, therefore there is no threat to the success of this project from incompatible adjacent land use practices.

10. Community and Other Support

The project is partially supported by the project partners: The Terra Foundation, the Boulder County Audubon Society and the Boulder County Nature Association. (See attached Letters of Support).

11. Management and Monitoring Plan

The project is designed to benefit the plant and animal communities of the Coal Creek riparian area. As such, it is important to monitor the project and document any changes to determine if the goals of the project have been met. Documentation is important to explain the value and benefits of this restoration project -- or the costs of not taking any action. Finally, measuring the conditions in riparian areas (or any ecosystem) can provide managers with a better idea of environmental conditions that might characterize a more sustainable or "natural" system. As information from the project is gathered, analyzed and reported, it will be shared with other land management agencies and researchers.

Several local conservation organizations have expressed an interest in participating in the monitoring component of this project including the Colorado Native Plant Society and the Colorado Bird Observatory. In addition, Open Space staff has extensive experience designing, conducting and overseeing vegetation monitoring projects, small mammal trapping surveys and avian studies.

Vegetation Monitoring

A vegetation monitoring project was implemented along lower Coal Creek in 1999. The goal of the project was to set up permanent plots and collect baseline vegetation data in the currently grazed riparian corridor. With the lower section of the creek fenced in 1999, future ungrazed conditions and trends can be compared to 1999's data when grazing occurred. Also pre- and post- riparian restoration data can be compared. The same sampling methodology will be used in the upstream (above Highway 93) project area.

Sixteen permanent transects were set up along Coal Creek from the town of Superior to Highway 93. Transects were randomly placed 400 meters apart and perpendicular to the flow of the creek. Distinct plant assemblages were subjectively demarcated and along each transect permanent one square meter plots were randomly placed within them. (In riparian areas, plant species changes are primarily due to elevation changes in the terrain relative to the level of the creek and consequently the ground water.) A total of 96 permanent plots were placed along sixteen transects. Permanent photo points were set up at the endpoints of each transect. All plots and transects were documented with GPS. Three square meter plots were centered over each of the

96 one meter plots and cover of the overstory component was also measured (shrubs and trees). Vegetation data was entered into an Access97 database. The goal was to keep the database as understandable and simple as possible such that subsequent data collectors and other users will find it easily accessible and more user friendly. Also data analysis in following years should be quick when done with the queries in the Access program.

Bird Monitoring

The City of Boulder Open Space Department has conducted and supported extensive avian research in the Coal Creek riparian area. The department funded a research project between 1995-1997 that examined the effect of human settlement on bird communities in lowland riparian forests (Miller 1999). Sixteen point count locations have been established in coordination with the permanent vegetation transects described above. Data was collected in 1999 at these permanent points and will be collected annually during the breeding season. Additionally, the Boulder County Audubon Society has collected a tremendous amount of data by surveying 30 point count locations monthly since 1998. These data will provide an invaluable baseline upon which comparisons pre and post restoration can be made.

Small Mammal Monitoring

Monitoring specific for Preble's meadow jumping mouse has been conducted during 1995, 1997 and 1999 and has consistently followed the United States Fish and Wildlife Service's Preble's trapping protocol. Additional monitoring to survey upland small mammal species populations were conducted in 1999 using the 16 permanent transects. Fifty-meter trap lines run perpendicular to the creek and have traps spaced every 5 meters (22 traps total). The combination of these methods allows us to get a thorough inventory of small mammal species that we can track with changes in understory vegetation over time.

Ongoing Management

The Open Space Department is committed to maintenance of the project in perpetuity in accordance with the Department's Long Range Management Policies. Management of Open Space includes a wide range of services provided to the project area in the context of the entire Open Space land system. Services include: natural resources management, integrated pest management, patrol by Open Space rangers, maintenance of fences and water resources, and agricultural uses.

12. Other biological/natural resources

Preble's meadow jumping mouse has been captured at various locations along Coal Creek but in low numbers since late 1980's. Trapping surveys located the mouse immediately east of Open Space along the Hake Ditch in 1999, within an unnamed drainage to Coal Creek along the Boulder/Jefferson County line in 1998, and at an unknown date within the last five years on Coal Creek on Jefferson County Open Space.

Although the Preble's meadow jumping mouse is known to occur in seasonally grazed pastures, it appears to prefer a strong over-story of grasses and forbs which may be important components of its ideal habitat. It is very likely that our ability to control livestock grazing will enhance our

efforts to recover the Coal Creek population of this rare animal.

The City of Boulder is actively participation in the state sponsored "Preble's Meadow Jumping Mouse Collaborative Planning Process". Within that process, Coal Creek has been identified as a possible conservation priority for both Boulder and Jefferson Counties. This restoration and fencing project is complementary to and is intended to further support the state's conservation efforts for the Preble's meadow jumping mouse.

Mammals besides the Preble's meadow jumping mouse captured or observed in the project area include, Hispid pocket mice, cottontail rabbits, northern pocket gophers, deer mice, house mice, coyotes, black bear, striped skunks, and mule deer. Preliminary research shows black bear and bobcat use of Coal Creek as a travel corridor. Increased cover established through restoration and livestock fencing would increase vegetation and possibly increase use of the creek by large mammals.

Birds: The Colorado Division of Wildlife concluded that grasslands of southern Boulder County and northern Jefferson County offered some of the highest quality habitat for reintroduction of the plains sharp-tailed grouse. The Coal Creek riparian area could offer important winter cover for grouse, but the lack of winter cover resulting from livestock grazing may limit available habitat.

One hundred ten species of birds were observed along Coal Creek by Boulder County Nature Association during 1998. Nesting northern mockingbirds were confirmed in the area by a researcher from Colorado State University in 1996. Other species of concern observed along Coal Creek include, sage thrasher, cedar waxwing, blue-gray gnatcatcher, loggerhead shrike, lark bunting, willow flycatcher, yellow warbler, American redstart, and blue grosbeak. The research also offered some exciting insights into the promise this creek holds as habitat. Heard singing by the investigators were gray catbirds, brown thrashers, green-tailed towhees, yellow-breasted chats and lazuli buntings. Winter bird monitoring of the Coal Creek area began during 1996-97 by members of Boulder County Audubon Society and the Boulder County Nature Association.

A comprehensive list of species observed along Coal Creek is listed in Appendix B.

13. Other Projects

This restoration and fencing project will serve to complement the state effort to provide habitat protection and restoration for the Preble's Meadow Jumping Mouse. It is hoped that the grant application reviewers view this project within the context of the broader collaborative planning process and the localized county efforts in which Coal Creek has been identified as a conservation priority. Since the Coal Creek area has been identified as an important habitat area for the Preble's meadow jumping mouse, the Open Space Department wishes to work towards the creation of optimal habitat for the mouse by grazing management and restoration.

14. Public Access

The Open Space Department is currently involved in a system-wide planning process to determine public access on Open Space properties that is consistent with the maintenance of natural resource values. During this planning phase, public access is restricted along the Coal Creek property. However, limited access can occur through the Open Space research program on the property (see #7, Existing Land Use) as well as supervised, limited education and outreach programs that will occur along Coal Creek. These programs will serve to educate the public on the significant ecological value of the area, while safeguarding the property from unlimited and unmanaged public access.

15. Publicity

The Education and Outreach Division of the City of Boulder Open Space Department is developing and implementing an initial public outreach plan to inform the public of the ecological significance of the Coal Creek area and the projects occurring in this area of Open Space. As the restoration and fencing project develops, the Education and Outreach Division will continue to take advantage of appropriate media outlets for ongoing education about the Coal Creek environment. The Division will develop educational signs, brochures and other interpretive materials. It will also play a significant role in informing the public on issues of access and behavior once the system-wide natural resource management plan is developed.

16. Budget

17. Schedule

The proposed schedule is as follows:

Date	Task
Summer 2000	Complete fencing and restoration design
Fall 2000	Fence installation
Fall 2000 to Fall 2001	Implement restoration activities

18. Partnerships

This project represents a unique collaboration between the public sector (The City of Boulder Open Space Department), the private sector (The Terra Foundation) and the nonprofit sector (The Boulder County Audubon Society and the Boulder County Nature Association). The role and contribution of each partner is listed below:

City of Boulder Open Space Department

Role: project lead
Financial Contribution: $73,561 cash
In-Kind Services: project management and oversight, scientific research, monitoring, reclamation and restoration design, fencing design, construction supervision and contracting.

The Terra Foundation

Role: financial support
Financial Contribution: $275,000 cash
In-Kind Services: public education

Boulder County Audubon Society

Role: research collaborator
Financial Contribution: $15,000 cash
In-Kind Services: avian monitoring, public education

Boulder County Nature Association

Role: research collaborator
Financial Contribution: none
In-Kind Services: avian monitoring

19. Ability to Complete the Project

The City of Boulder's Open Space program was initiated over thirty years ago with the mandate to establish a public land system for the citizens of Boulder as a way of achieving several community goals. In 1986 the purposes of Open Space were formally incorporated into Boulder's City Charter (see inset below).

Section 176. Open space purposes-Open space land. Open space land shall be acquired, maintained, preserved, retained, and used only for the following purposes:

- Preservation or restoration of natural areas characterized by or including terrain, geologic formations, flora, or fauna that is unusual, spectacular, historically important, scientifically valuable, or unique, or that represent outstanding or rare examples of native species;
- Preservation of water resources in their natural or traditional state, scenic areas or vistas, wildlife habitats, or fragile ecosystems;
- Preservation of land for passive recreation use, such as hiking, photography or nature studies, and if specifically designated, bicycling, horseback riding, or fishing;
- Preservation of agricultural uses and land suitable for agricultural production;
- Utilization of land for shaping the development of the city, limiting urban sprawl and disciplining growth;
- Utilization of non-urban land for spatial definition of urban areas;
- Utilization of land to prevent encroachment on floodplains; and
- Preservation of land for its aesthetic or passive recreational value and its contribution to the quality of life of the community.
- Open space land may not be improved after acquisition unless such improvements are necessary to protect or maintain the land or to provide for passive recreational, open agricultural, or wildlife habitat use of the land.

Since 1967 the Open Space program has spent over $138 million dollars to acquire approximately 30,000 acres of land and associated water rights. The department has a staff of natural resource, engineering, project management, and agricultural resource specialists who manage the program. The combination of staff expertise, public support, and successful history of collaborative land management and protection makes the City of Boulder Open Space Department uniquely qualified to carry out this project for the benefit of the Preble's meadow jumping mouse and other species.

20. Verification of Effectiveness of Techniques

Project success will be evaluated using the methodologies listed under Item #11, Management and Monitoring Plan. An increase in the abundance and diversity of native plant and animal species will be a general measure of success. More detailed success criteria will be developed for vegetation and vertebrate species prior to project implementation.

21. Restoration Plant Species List

Plant species with bold type in Appendix A will be used in the stream channel and riparian wetland restoration project components. Native seed mixes for uplands will be formulated based on site-specific conditions and will follow City of Boulder Open Space native revegetation guidelines. Non-native species will not be used for revegetation.

22. Description of Desired Optimal Habitat Conditions

For the purposes of this project, optimal habitat will be defined as habitat that exhibits the diversity, abundance and heterogeneity of native plant species typically found in Colorado Front Range riparian areas. Colorado Natural Heritage Program community type descriptions and species lists will be used as "reference" conditions for comparison with the Coal Creek project area.

Appendix A: Plant Species Recorded from Coal Creek Riparian Area

Common Name	Scientific Name
TREES	
Peach leaf willow	***Salix amygdaloides***
Plains cottonwoods	***Populus deltoides monolifera***
Narrow leaf cottonwood	***Populus angustifolia***
Cottonwood	*Populus X acuminata*
Russian olive	*Elaeagnus angustifolia*
American elm	*Ulmus americanus*
SHRUBS	
Blue Stem Willow	***Salix irrorata***
Chokecherry	***Padus virginiana***
Hawthorne	***Crataegus erythropoda***
Skunkbrush	***Rhus americana trilobata***
Sandbar willow	***Salix exigua***
FORBS AND GRASSLIKE PLANTS	
Alkali bulrush	*Bolobschoenus maritimus*
Arctic Rush	***Juncus balticus***
Arrowroot	***Sagittaria latifolia***
Barnyard grass	*Echinochloa crus-galli*
Broad leaf cattail	*Typha latifolia*
Broomlike sedge	*Carex scoparia*
Bulrush	***Scirpus pallidus***
Dock	*Rumex crispus*
Foxtail barley	*Critesion brachyantherum*
Horsetail	*Hippochaete laevigata*
Lead Plant	***Amorpha fruticosa***

Common Name	Scientific Name
Manna grass	***Glyceria grandis***
Mint	*Mentha arvense*
Narrow leaf cattail	*Typha angustifolia*
Prairie cordgrass	***Spartina pectinata***
Rabbits foot grass	*Polypogon monospeliensis*
Redtop	*Agrostis gigantea*
Reed canary grass	*Phalaris arundinacea*
Rush	*Juncus nodosus*
Rush	*Juncus articulatus*
Rush	*Juncus interior*
Rush	***Juncus saximontanus***
Rush	***Juncus torreyi***
Sedge	***Carex lanuginosa***
Sedge	***Carex nebrascensis***
Smartweed	*Persicaria coccinea*
Smartweed	*Persicaria lapathifolia*
Softstem bulrush	***Schoenoplectus lacustris acutus***
Speedwell	*Veronica anagallis-aquatica*
Spike rush	*Eleocharis macrostachya*
Three square	***Scirpus pungens***
Water horehound	*Lycopus americanus*
Water plantain	*Alisma triviale*
Water-cress	*Nasturtium officionale*
Wild grape	*Vitis riparia*
Willow-herb	*Epilobium adenocaulon*

Appendix B: Vertebrates Observed in the Project Area

Mammals

Black Bear
Chickaree
Coyote
Eastern Cottontail
Deer Mouse
Hispid Pocket Mouse
House Mouse
Long-tailed Weasel
Mule Deer
Northern Pocket Gophers
Striped Skunks
White-tailed Jackrabbit

Amphibians

Northern Leopard Frog
Tiger Salamander
Western Chorus Frog
Woodhouse's Toad

Reptiles

Bull Snake

Birds

American Goldfinch
American Kestrel
American Robin
Bald Eagle
Baltimore Oriole
Barn Swallow
Belted Kingfisher
Black-billed Magpie
Black-capped Chickadee
Blue Grosbeak
Blue Jay
Brewer's Blackbird
Brewer's Sparrow
Brown Thrasher
Brown-headed Cowbird
Canada Goose
Chipping Sparrow
Clay-colored Sparrow
Cliff Swallow
Common Grackle
Common Nighthawk
Common Raven
Common Snipe
Dark-eyed Junco
Downy Woodpecker
Eastern Kingbird
Eastern Screech-owl
Eastern Towhee
European Starling
Ferruginous Hawk
Franklin's Gull
Golden Eagle
Grasshopper Sparrow
Gray Catbird
Great Blue Heron
Great Horned Owl
Green-tailed Towhee
Green-winged Teal
Horned Lark
House Finch
House Sparrow
House Wren
Indigo Bunting
Killdeer
Lark Bunting
Lark Sparrow
Lazuli Bunting
Lesser Goldfinch
Loggerhead Shrike
Long-eared Owl
Mallard
Mountain Bluebird
Mourning Dove
Northern Flicker

Northern Harrier
Northern Mockingbird
Northern Rough-winged Swallow
Pine Siskin
Prairie Falcon
Red-breasted Nuthatch
Red-tailed Hawk
Red-winged Blackbird
Ring-necked Duck
Rose-breasted Grosbeak
Rough-legged Hawk
Savannah Sparrow
Say's Phoebe
Song Sparrow
Spotted Sandpiper
Tree Swallow
Vesper Sparrow
Warbling Vireo
Western Kingbird
Western Meadowlark
Western Wood-pewee
White-crowned Sparrow
Yellow Warbler
Yellow-breasted Chat
Yellow-rumped Warbler

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Natural Community in Colorado and one that is imperiled even at a global level. While the project area is not an example of a pristine plains riparian woodland, it certainly has great promise to be restored to an area of high ecological function.

There are extensive infestations of knapweed (*Centaurea spp.*) in the project area. Much of the area's weediness can be traced to a former gravel mine located in the center of the project area. The gravel mine operated for several years prior to purchase of the area as Open Space in 1986. It then operated as a condition of the Open Space purchase, until the City bought the mining rights almost ten years later. The Open Space Department has completed the necessary earthwork for the initial reclamation of this mine site. The funding request for this project would target revegetation of portions of the mine site.

Weed Control: Integrated Pest Management. The Open Space Department allocates several thousand dollars annually for weed control in the vicinity of Coal Creek. The Open Space Department uses an integrated approach to weed control rather than relying only on the use of herbicides. Integrated Weed Management (IWM) is a decision-making process that selects, integrates, and implements weed control techniques to prevent or manage weed populations. IWM focuses on long-term prevention or suppression of weed problems while reducing the impact control techniques may have on the environment, human health and non-target organisms. A whole systems approach is used, looking at the weed species as it relates to the entire ecosystem. Prevention, education, cultural control, mechanical control, biological control and chemical control are the techniques used in integrated weed management. Effective weed management combines several techniques to fix the problem with the least environmental conflict. Weed control using only one technique is usually not effective or economical.

6. Water Rights

The City owns several water rights in Coal Creek that have historically been used for agricultural purposes on the Open Space properties in the area. These water rights are summarized in the table below.

Ditch Name	Adjudication(s)	Volume	Notes
Eggleston #1	June 1, 1860 (most senior right on Coal Creek)	0.5 cfs	Includes rights transferred from Autry-Eggleston and Eggleston #2
	May 1, 1862	1.8 cfs	
Eggleston #3	June 1, 1870	9 cfs	Irrigates 7.5 acres fill Eggleston Reservoir #3
Eggleston #4	October 1, 1879	9 cfs	Irrigates 200 acres & fill Eggleston Reservoir #4

As part of our water resources management program and participation in the recovery and conservation effort for Preble's meadow jumping mouse the City is investigating the relative costs and benefits of working with the Colorado Water Conservation Board to establish an in-stream water right in Coal Creek.

7. Existing Land Use

The entire project area is designated Open Space, which is currently being used for grazing and scientific research.

Grazing. The entire project area upstream of the gravel mine is leased to local ranchers by the City of Boulder for a cow/calf operation. The area is rested during the growing season when the lessee's cattle graze at higher elevation in summer pastures. From time to time the City has allowed the lessee to graze in early spring to assist in control of knapweed. Typically there are about 250 head of cattle on the 2,000 acres around Coal Creek. Although the area downstream of the gravel mine is not currently part of a long-term agricultural lease, limited livestock grazing has been allowed for weed control and to reduce the deep grass thatch which has developed in the absence of grazing or fire. Similar grazing management practices are in place on the Open Space parcels in Jefferson County.

Research. The City has sponsored projects examining the effects of urbanization on avian diversity and predator assemblages, carbon and nitrogen soil amendments on weeds, impacts of habitat fragmentation on insect populations, and the effectiveness of biological controls on diffuse knapweed. Inventory projects have targeted small mammals (1987, 1995, 1999), breeding and migrating songbirds (1999), and wetland/riparian vegetation (1991, 1999). In 1991, the City consulted with Keammerer and Associates to conduct a characterization of the vegetation and wildlife in a portion of the Coal Creek riparian area. The Open Space Department wanted to gain a better understanding of the ecological value of this area anticipating transportation and development projects nearby.

Additional research projects were undertaken in 1999. Coal Creek fish populations were surveyed in 1999 revealing a majority of native species. Currently, monitoring of winter raptor use of the prairie dog towns along Coal Creek uplands and prairie dog populations are being quantified. Large mammal use of Coal Creek is also being studied and has revealed consistent use of Coal Creek as a corridor for black bears and bobcats. These studies are continuing and provide baseline data for future reference.

8. Land Use Conflicts

Existing land use practices are compatible with this proposed project. Fencing of areas along Coal Creek will allow the City of Boulder Open Space Department to better manage grazing in the area. Restoration of strategic areas along the stream and in Coal Creek's wetlands will improve native plant and wildlife habitat, and greatly improve the habitat possibilities for the Preble's meadow jumping mouse.

9. Area Land Use

The proposed project site is a large parcel of contiguous Open Space land. Surrounding land is used for agricultural purposes, therefore there is no threat to the success of this project from incompatible adjacent land use practices.

10. Community and Other Support

The project is partially supported by the project partners: The Terra Foundation, the Boulder County Audubon Society and the Boulder County Nature Association. (See attached Letters of Support).

11. Management and Monitoring Plan

The project is designed to benefit the plant and animal communities of the Coal Creek riparian area. As such, it is important to monitor the project and document any changes to determine if the goals of the project have been met. Documentation is important to explain the value and benefits of this restoration project -- or the costs of not taking any action. Finally, measuring the conditions in riparian areas (or any ecosystem) can provide managers with a better idea of environmental conditions that might characterize a more sustainable or "natural" system. As information from the project is gathered, analyzed and reported, it will be shared with other land management agencies and researchers.

Several local conservation organizations have expressed an interest in participating in the monitoring component of this project including the Colorado Native Plant Society and the Colorado Bird Observatory. In addition, Open Space staff has extensive experience designing, conducting and overseeing vegetation monitoring projects, small mammal trapping surveys and avian studies.

Vegetation Monitoring

A vegetation monitoring project was implemented along lower Coal Creek in 1999. The goal of the project was to set up permanent plots and collect baseline vegetation data in the currently grazed riparian corridor. With the lower section of the creek fenced in 1999, future ungrazed conditions and trends can be compared to 1999's data when grazing occurred. Also pre- and post- riparian restoration data can be compared. The same sampling methodology will be used in the upstream (above Highway 93) project area.

Sixteen permanent transects were set up along Coal Creek from the town of Superior to Highway 93. Transects were randomly placed 400 meters apart and perpendicular to the flow of the creek. Distinct plant assemblages were subjectively demarcated and along each transect permanent one square meter plots were randomly placed within them. (In riparian areas, plant species changes are primarily due to elevation changes in the terrain relative to the level of the creek and consequently the ground water.) A total of 96 permanent plots were placed along sixteen transects. Permanent photo points were set up at the endpoints of each transect. All plots and transects were documented with GPS. Three square meter plots were centered over each of the

96 one meter plots and cover of the overstory component was also measured (shrubs and trees). Vegetation data was entered into an Access97 database. The goal was to keep the database as understandable and simple as possible such that subsequent data collectors and other users will find it easily accessible and more user friendly. Also data analysis in following years should be quick when done with the queries in the Access program.

Bird Monitoring

The City of Boulder Open Space Department has conducted and supported extensive avian research in the Coal Creek riparian area. The department funded a research project between 1995-1997 that examined the effect of human settlement on bird communities in lowland riparian forests (Miller 1999). Sixteen point count locations have been established in coordination with the permanent vegetation transects described above. Data was collected in 1999 at these permanent points and will be collected annually during the breeding season. Additionally, the Boulder County Audubon Society has collected a tremendous amount of data by surveying 30 point count locations monthly since 1998. These data will provide an invaluable baseline upon which comparisons pre and post restoration can be made.

Small Mammal Monitoring

Monitoring specific for Preble's meadow jumping mouse has been conducted during 1995, 1997 and 1999 and has consistently followed the United States Fish and Wildlife Service's Preble's trapping protocol. Additional monitoring to survey upland small mammal species populations were conducted in 1999 using the 16 permanent transects. Fifty-meter trap lines run perpendicular to the creek and have traps spaced every 5 meters (22 traps total). The combination of these methods allows us to get a thorough inventory of small mammal species that we can track with changes in understory vegetation over time.

Ongoing Management

The Open Space Department is committed to maintenance of the project in perpetuity in accordance with the Department's Long Range Management Policies. Management of Open Space includes a wide range of services provided to the project area in the context of the entire Open Space land system. Services include: natural resources management, integrated pest management, patrol by Open Space rangers, maintenance of fences and water resources, and agricultural uses.

12. Other biological/natural resources

Preble's meadow jumping mouse has been captured at various locations along Coal Creek but in low numbers since late 1980's. Trapping surveys located the mouse immediately east of Open Space along the Hake Ditch in 1999, within an unnamed drainage to Coal Creek along the Boulder/Jefferson County line in 1998, and at an unknown date within the last five years on Coal Creek on Jefferson County Open Space.

Although the Preble's meadow jumping mouse is known to occur in seasonally grazed pastures, it appears to prefer a strong over-story of grasses and forbs which may be important components of its ideal habitat. It is very likely that our ability to control livestock grazing will enhance our

efforts to recover the Coal Creek population of this rare animal.

The City of Boulder is actively participation in the state sponsored "Preble's Meadow Jumping Mouse Collaborative Planning Process". Within that process, Coal Creek has been identified as a possible conservation priority for both Boulder and Jefferson Counties. This restoration and fencing project is complementary to and is intended to further support the state's conservation efforts for the Preble's meadow jumping mouse.

Mammals besides the Preble's meadow jumping mouse captured or observed in the project area include, Hispid pocket mice, cottontail rabbits, northern pocket gophers, deer mice, house mice, coyotes, black bear, striped skunks, and mule deer. Preliminary research shows black bear and bobcat use of Coal Creek as a travel corridor. Increased cover established through restoration and livestock fencing would increase vegetation and possibly increase use of the creek by large mammals.

Birds: The Colorado Division of Wildlife concluded that grasslands of southern Boulder County and northern Jefferson County offered some of the highest quality habitat for reintroduction of the plains sharp-tailed grouse. The Coal Creek riparian area could offer important winter cover for grouse, but the lack of winter cover resulting from livestock grazing may limit available habitat.

One hundred ten species of birds were observed along Coal Creek by Boulder County Nature Association during 1998. Nesting northern mockingbirds were confirmed in the area by a researcher from Colorado State University in 1996. Other species of concern observed along Coal Creek include, sage thrasher, cedar waxwing, blue-gray gnatcatcher, loggerhead shrike, lark bunting, willow flycatcher, yellow warbler, American redstart, and blue grosbeak. The research also offered some exciting insights into the promise this creek holds as habitat. Heard singing by the investigators were gray catbirds, brown thrashers, green-tailed towhees, yellow-breasted chats and lazuli buntings. Winter bird monitoring of the Coal Creek area began during 1996-97 by members of Boulder County Audubon Society and the Boulder County Nature Association.

A comprehensive list of species observed along Coal Creek is listed in Appendix B.

13. Other Projects

This restoration and fencing project will serve to complement the state effort to provide habitat protection and restoration for the Preble's Meadow Jumping Mouse. It is hoped that the grant application reviewers view this project within the context of the broader collaborative planning process and the localized county efforts in which Coal Creek has been identified as a conservation priority. Since the Coal Creek area has been identified as an important habitat area for the Preble's meadow jumping mouse, the Open Space Department wishes to work towards the creation of optimal habitat for the mouse by grazing management and restoration.

14. Public Access

The Open Space Department is currently involved in a system-wide planning process to determine public access on Open Space properties that is consistent with the maintenance of natural resource values. During this planning phase, public access is restricted along the Coal Creek property. However, limited access can occur through the Open Space research program on the property (see #7, Existing Land Use) as well as supervised, limited education and outreach programs that will occur along Coal Creek. These programs will serve to educate the public on the significant ecological value of the area, while safeguarding the property from unlimited and unmanaged public access.

15. Publicity

The Education and Outreach Division of the City of Boulder Open Space Department is developing and implementing an initial public outreach plan to inform the public of the ecological significance of the Coal Creek area and the projects occurring in this area of Open Space. As the restoration and fencing project develops, the Education and Outreach Division will continue to take advantage of appropriate media outlets for ongoing education about the Coal Creek environment. The Division will develop educational signs, brochures and other interpretive materials. It will also play a significant role in informing the public on issues of access and behavior once the system-wide natural resource management plan is developed.

16. Budget

17. Schedule

The proposed schedule is as follows:

Date	Task
Summer 2000	Complete fencing and restoration design
Fall 2000	Fence installation
Fall 2000 to Fall 2001	Implement restoration activities

18. Partnerships

This project represents a unique collaboration between the public sector (The City of Boulder Open Space Department), the private sector (The Terra Foundation) and the nonprofit sector (The Boulder County Audubon Society and the Boulder County Nature Association). The role and contribution of each partner is listed below:

City of Boulder Open Space Department

Role: project lead
Financial Contribution: $73,561 cash
In-Kind Services: project management and oversight, scientific research, monitoring, reclamation and restoration design, fencing design, construction supervision and contracting.

The Terra Foundation

Role: financial support
Financial Contribution: $275,000 cash
In-Kind Services: public education

Boulder County Audubon Society

Role: research collaborator
Financial Contribution: $15,000 cash
In-Kind Services: avian monitoring, public education

Boulder County Nature Association

Role: research collaborator
Financial Contribution: none
In-Kind Services: avian monitoring

19. Ability to Complete the Project

The City of Boulder's Open Space program was initiated over thirty years ago with the mandate to establish a public land system for the citizens of Boulder as a way of achieving several community goals. In 1986 the purposes of Open Space were formally incorporated into Boulder's City Charter (see inset below).

> Section 176. Open space purposes-Open space land. Open space land shall be acquired, maintained, preserved, retained, and used only for the following purposes:
>
> - Preservation or restoration of natural areas characterized by or including terrain, geologic formations, flora, or fauna that is unusual, spectacular, historically important, scientifically valuable, or unique, or that represent outstanding or rare examples of native species;
> - Preservation of water resources in their natural or traditional state, scenic areas or vistas, wildlife habitats, or fragile ecosystems;
> - Preservation of land for passive recreation use, such as hiking, photography or nature studies, and if specifically designated, bicycling, horseback riding, or fishing;
> - Preservation of agricultural uses and land suitable for agricultural production;
> - Utilization of land for shaping the development of the city, limiting urban sprawl and disciplining growth;
> - Utilization of non-urban land for spatial definition of urban areas;
> - Utilization of land to prevent encroachment on floodplains; and
> - Preservation of land for its aesthetic or passive recreational value and its contribution to the quality of life of the community.
> - Open space land may not be improved after acquisition unless such improvements are necessary to protect or maintain the land or to provide for passive recreational, open agricultural, or wildlife habitat use of the land.

Since 1967 the Open Space program has spent over $138 million dollars to acquire approximately 30,000 acres of land and associated water rights. The department has a staff of natural resource, engineering, project management, and agricultural resource specialists who manage the program. The combination of staff expertise, public support, and successful history of collaborative land management and protection makes the City of Boulder Open Space Department uniquely qualified to carry out this project for the benefit of the Preble's meadow jumping mouse and other species.

20. Verification of Effectiveness of Techniques

Project success will be evaluated using the methodologies listed under Item #11, Management and Monitoring Plan. An increase in the abundance and diversity of native plant and animal species will be a general measure of success. More detailed success criteria will be developed for vegetation and vertebrate species prior to project implementation.

21. Restoration Plant Species List

Plant species with bold type in Appendix A will be used in the stream channel and riparian wetland restoration project components. Native seed mixes for uplands will be formulated based on site-specific conditions and will follow City of Boulder Open Space native revegetation guidelines. Non-native species will not be used for revegetation.

22. Description of Desired Optimal Habitat Conditions

For the purposes of this project, optimal habitat will be defined as habitat that exhibits the diversity, abundance and heterogeneity of native plant species typically found in Colorado Front Range riparian areas. Colorado Natural Heritage Program community type descriptions and species lists will be used as "reference" conditions for comparison with the Coal Creek project area.

Appendix A: Plant Species Recorded from Coal Creek Riparian Area

Common Name	Scientific Name
TREES	
Peach leaf willow	***Salix amygdaloides***
Plains cottonwoods	***Populus deltoides monolifera***
Narrow leaf cottonwood	***Populus angustifolia***
Cottonwood	*Populus X acuminata*
Russian olive	*Elaeagnus angustifolia*
American elm	*Ulmus americanus*
SHRUBS	
Blue Stem Willow	***Salix irrorata***
Chokecherry	***Padus virginiana***
Hawthorne	***Crataegus erythropoda***
Skunkbrush	***Rhus americana trilobata***
Sandbar willow	***Salix exigua***
FORBS AND GRASSLIKE PLANTS	
Alkali bulrush	*Bolobschoenus maritimus*
Arctic Rush	***Juncus balticus***
Arrowroot	***Sagittaria latifolia***
Barnyard grass	*Echinochloa crus-galli*
Broad leaf cattail	*Typha latifolia*
Broomlike sedge	*Carex scoparia*
Bulrush	***Scirpus pallidus***
Dock	*Rumex crispus*
Foxtail barley	*Critesion brachyantherum*
Horsetail	*Hippochaete laevigata*
Lead Plant	***Amorpha fruticosa***

Common Name	Scientific Name
Manna grass	***Glyceria grandis***
Mint	*Mentha arvense*
Narrow leaf cattail	*Typha angustifolia*
Prairie cordgrass	***Spartina pectinata***
Rabbits foot grass	*Polypogon monospeliensis*
Redtop	*Agrostis gigantea*
Reed canary grass	*Phalaris arundinacea*
Rush	*Juncus nodosus*
Rush	*Juncus articulatus*
Rush	*Juncus interior*
Rush	***Juncus saximontanus***
Rush	***Juncus torreyi***
Sedge	***Carex lanuginosa***
Sedge	***Carex nebrascensis***
Smartweed	*Persicaria coccinea*
Smartweed	*Persicaria lapathifolia*
Softstem bulrush	***Schoenoplectus lacustris acutus***
Speedwell	*Veronica anagallis-aquatica*
Spike rush	*Eleocharis macrostachya*
Three square	***Scirpus pungens***
Water horehound	*Lycopus americanus*
Water plantain	*Alisma triviale*
Water-cress	*Nasturtium officionale*
Wild grape	*Vitis riparia*
Willow-herb	*Epilobium adenocaulon*

Appendix B: Vertebrates Observed in the Project Area

Mammals

Black Bear
Chickaree
Coyote
Eastern Cottontail
Deer Mouse
Hispid Pocket Mouse
House Mouse
Long-tailed Weasel
Mule Deer
Northern Pocket Gophers
Striped Skunks
White-tailed Jackrabbit

Amphibians

Northern Leopard Frog
Tiger Salamander
Western Chorus Frog
Woodhouse's Toad

Reptiles

Bull Snake

Birds

American Goldfinch
American Kestrel
American Robin
Bald Eagle
Baltimore Oriole
Barn Swallow
Belted Kingfisher
Black-billed Magpie
Black-capped Chickadee
Blue Grosbeak
Blue Jay
Brewer's Blackbird
Brewer's Sparrow
Brown Thrasher
Brown-headed Cowbird
Canada Goose
Chipping Sparrow
Clay-colored Sparrow
Cliff Swallow
Common Grackle
Common Nighthawk
Common Raven
Common Snipe
Dark-eyed Junco
Downy Woodpecker
Eastern Kingbird
Eastern Screech-owl
Eastern Towhee
European Starling
Ferruginous Hawk
Franklin's Gull
Golden Eagle
Grasshopper Sparrow
Gray Catbird
Great Blue Heron
Great Horned Owl
Green-tailed Towhee
Green-winged Teal
Horned Lark
House Finch
House Sparrow
House Wren
Indigo Bunting
Killdeer
Lark Bunting
Lark Sparrow
Lazuli Bunting
Lesser Goldfinch
Loggerhead Shrike
Long-eared Owl
Mallard
Mountain Bluebird
Mourning Dove
Northern Flicker

Northern Harrier
Northern Mockingbird
Northern Rough-winged Swallow
Pine Siskin
Prairie Falcon
Red-breasted Nuthatch
Red-tailed Hawk
Red-winged Blackbird
Ring-necked Duck
Rose-breasted Grosbeak
Rough-legged Hawk
Savannah Sparrow
Say's Phoebe
Song Sparrow
Spotted Sandpiper
Tree Swallow
Vesper Sparrow
Warbling Vireo
Western Kingbird
Western Meadowlark
Western Wood-pewee
White-crowned Sparrow
Yellow Warbler
Yellow-breasted Chat
Yellow-rumped Warbler

Coal Creek Canyon

The City of Boulder Open Space Department, in partnership with the Terra Foundation, the Boulder County Audubon Society, and the Boulder County Nature Association, is undertaking a collaborative stream channel restoration, wetland restoration, and riparian fencing project in the Coal Creek area of southern Boulder and northern Jefferson Counties, Colorado. The overall goal of this project is to improve the ecological health of the Coal Creek riparian corridor for the benefit of native wildlife along Coal Creek, including the federally threatened Preble's Meadow Jumping Mouse (*Zapus hudsonius preblei*).

Project goals will be achieved by restoring essential wildlife habitat that has been impacted by years of intensive livestock grazing and gravel mining in and along the Coal Creek stream corridor. The project will restore mined areas and will allow improved livestock management within the stream and adjacent wetlands. Specifically, the partners will carry out the following objectives: (1) construct approximately 2.75 miles of fencing along the riparian corridor and (2) restore riparian wetlands and a degraded stream channel at a former gravel mine site along Coal Creek.

Fencing and restoration of the Coal Creek property will particularly benefit the riparian shrublands and forest along the creek. The fencing will allow for recreation management and the exclusion of grazing in the riparian corridor except when needed for weed management. The revegetation and restoration design will enhance the number of acres of riparian shrublands and riparian meadows available to the Preble's meadow jumping mouse within an otherwise degraded portion the riparian corridor.

Milestones for this project include completion of fencing and reclamation design by fall 2000; the installation of riparian fencing, initiation of stream channel restoration, and riparian wetland restoration activities in fall 2000; and completion of all restoration funded through this grant by fall 2001.

The total project cost is estimated at $393,561. Of this amount, the project partners are requesting $50,000 from the Colorado Division of Wildlife to assist with capital costs associated with riparian fencing and stream channel and wetland restoration.