Management Review of Irrigable Agricultural Fields Occupied by Prairie Dogs and Showing Signs of Soil Loss, Ecological Impact, and Loss of Agricultural Viability

OSBT-Recommended Preferred Alternative (as amended)

City of Boulder Open Space and Mountain Parks
07-30-2020

Executive Summary

In May 2019, City Council identified that prairie dog population levels on numerous Open Space and Mountain Parks (OSMP) irrigated agricultural properties have resulted in a conflict between the city prairie dog and agricultural policies and prevent OSMP from fully meeting City Charter purposes of open space and have caused degradation. In response, council directed OSMP to undertake an expedited public process to look at agricultural uses on the northern grasslands including factors affecting the ecological conditions of the land, high soil health, healthy agricultural uses, wildlife health, and other conditions. Council provided additional direction that new land management tools could be considered, including key-lining, soil amendments, lethal control and other measures to achieve the charter's open space goals.

The review has focused on identifying a package of actions that integrates existing policy, community values and on-the ground actions to conserve prairie dogs and associated species, protect irrigable lands as critical elements of sustainable agricultural operations and restore and enhance soil health and the ability of soils to sequester carbon.

Since receiving City Council direction, working with stakeholders from across the community and agency partners, OSMP and Planning Department staff developed a draft approach and evaluated the potential actions to resolve the conflict identified by City Council. Staff presented a range of options to the Open Space Board of Trustees for guidance and to the community for review and has developed a preferred alternative based on what was heard. Next, a staff-prepared preferred alternative was presented to the OSBT for recommendation to City Council. The OSBT amended and unanimously recommended the preferred alternative for City Council approval. This document describes the preferred alternative with emphasis on how it addresses prairie dog conservation, agricultural sustainability and soil health and the potential of soils in irrigable lands to help address the climate crisis.

Findings

Through a process of consultation with community members, partner agencies and the OSBT; review of applicable regulations, plans and policies; and staff's knowledge and experience on the ground; OSMP first developed the following findings regarding the management of irrigated agricultural lands that overlap with prairie dogs colonies in the project area (Figure 1):

Agricultural

1. The city charter describes the purposes of open space to include, among others, the preservation of agricultural uses and land suitable for agricultural production as well as the preservation of water resources in their natural or traditional state. Water resources in their traditional state includes agricultural water rights. Most of OSMP's water rights were purchased for and are dedicated to agricultural uses.
2. The inclusion of *Agriculture Today and Tomorrow* as one of five focus areas in the OSMP Master Plan (2019) is a reflection that agriculture continues to be a relevant and important purpose and community service provided by the city.
3. Since the passage of the open space tax in 1967, the city has invested tens of millions of dollars to purchase and protect approximately 16,400 acres of agricultural lands, including water rights associated with about 6,400 irrigable acres.
4. The role of irrigable lands as the best opportunities for OSMP to deliver sustainable agricultural services was affirmed by the community, board and council in both the Grassland Ecosystem Management Plan (Grassland Plan 2010) and again, in the Agricultural Resource Management Plan (Ag Plan - 2017).
5. The Grassland Plan set a management objective of having 80% or more of irrigable land leased for agriculture; and as of 2020, 78% of irrigable land system-wide is leased for agricultural uses.
6. Irrigable lands are a critical component of agricultural operations in the Boulder Valley and on OSMP lands. Irrigation is required to support the greatest diversity in agricultural production (e.g., hay, regenerative agriculture, vegetables, pasture and forage for a variety of animals including honeybees).
7. Irrigable agricultural fields are also well-suited to manipulations that will enhance their ability to sequester atmospheric carbon in soil. In the presence of water and sunlight, plants are able to take in carbon dioxide during photosynthesis and ultimately store that carbon in plant structures and soil — this is a strategy for carbon sequestration included in the Ag Plan , the OSMP Master Plan and the city's Climate Commitment (2017).
8. The city's strategy when acquiring irrigable fields has been to place them in agricultural management not only to meet the charter purposes, but also to keep costs down. With the basic responsibilities for irrigation maintenance and operations assumed by agricultural tenants, this has proven to be a cost-effective way of preserving lands and waters for a variety of open space purposes that go beyond agriculture, such as supporting wetlands, controlling weeds and preventing sprawl.
9. While leasing agricultural lands provides some cost recovery for maintaining an agricultural landscape and dependent ecological resources; revenue generation has not been the primary driver for the agricultural leasing program.

10. Revenue loss and significant costs have accrued to the city when OSMP staff has had to manage fields (including conducting or contracting out irrigation operations) that have been so degraded they no longer attract agricultural tenants.
11. As of 2019, over 1,200 acres or 19% of OSMP irrigable land (including 967 acres in the project area) are at risk to no longer support an agricultural tenant or are already effectively abandoned in terms of use and maintenance of water rights.

Ecological

12. The city charter also identifies the purposes of open space to include, among others, the preservation and restoration of natural areas, wildlife habitat, and fragile ecosystems.
13. The inclusion of *Ecosystem Health and Resilience* as one of five focus area in the OSMP Master Plan is a reflection that the conservation of plants, animals, and ecological systems, including prairie dogs, continues to be a relevant and important purpose and community service of OSMP.
14. Prairie dogs are an important component of OSMP grasslands worthy of conservation and protection because of their unique and far-reaching ecological effects upon soils, vegetation, and other wildlife. Furthermore, many people enjoy observing them.
15. The importance of prairie dogs in defining a unique ecological system on OSMP is reflected in the Grassland Plan's focus on the protection, preservation and enhancement of habitat suitable for prairie dogs and their associates.
16. OSMP seeks to maintain ecologically viable prairie dog populations in the range of 800 to 3,137 acres and has established management designations on over 5,300 acres of city-managed open space where prairie dogs can live in protected status without removal of prairie dogs except in exceptional circumstances.
17. Anecdotal reports suggest that increasing numbers of raptors and other prairie dog associates reflect an ecological response to the growing abundance and distribution of prairie dogs in the northern portion of the OSMP system.
18. The 2019 occupation of prairie dogs on OSMP lands that are not irrigable agricultural land exceed the Grassland Plan goal of 3,137 acres of occupation, thus satisfying the Grassland Plan conservation goal for prairie dogs and associated species. As a result, removal of prairie dogs from irrigated agricultural properties will not hinder the department's ability to meet its overall prairie dog occupation goals with current occupation levels system wide.
19. The importance of prairie dog colonies is reflected in the city's Wildlife Protection Ordinance (2005) which establishes regulations to minimize the use of lethal control and damage to occupied prairie dog burrows. These regulations apply to city-managed open space.
20. The Urban Wildlife Management Plan Prairie Dog Element (2006) outlines strategies to protect prairie dogs in Boulder's urban areas— none of which are on irrigable open space lands.
21. In the fragmented landscapes of the project area, impacts from reduction or removal of irrigation and current, very high extent of prairie dog occupation, without the ability to move freely across the landscape and under altered predator-prey relationships, have led to locally concentrated soil and vegetation loss.
22. Preliminary analysis of grassland surface soils (top 15 cm) sampled from the Grassland Planning Area demonstrate that soil organic carbon and total nitrogen levels are, on average, lower on OSMP lands occupied by prairie dogs than those never occupied by prairie dogs – further analyses will aim to tease out the relative importance of prairie dogs in altering soil carbon.

Conflict

23. Agricultural activities common in irrigable fields such as irrigation, mowing, seeding, harrowing and hay-baling can potentially harm or kill prairie dogs and damage prairie dog burrows in those fields.
24. Prairie dogs living in irrigable fields can, by virtue of their feeding and digging activities, damage or destroy vegetation and irrigation infrastructure.
25. The presence of prairie dogs in irrigable fields, coupled with prohibitions on damage to occupied burrows has made irrigation and other agricultural management impractical, leading tenants to reduce management and abandon these fields.
26. Because of the land use history of irrigable lands (e.g., disturbed soil horizons, soil erosion), the cessation of irrigation coupled with grazing by prairie dogs can lead to a collapse of existing vegetation communities. The loss of living root systems makes soils more susceptible to erosion, such as during high winds that occur commonly in the Boulder Valley. Depending on the extent of root death, the type of soil exposure and intensity of wind, varying levels of soil degradation and loss occur, some of which can be severe.
27. Because of the effects of irrigated agriculture on prairie dogs and vice versa, areas where prairie dogs and irrigated agriculture overlap present ongoing management conflicts.
28. There are approximately 1,260 acres where irrigable lands overlap with prairie dog colonies on city-managed open space, the majority of which (967 acres) lie within the project area. These areas of overlap were the specific areas of management conflict addressed in this project.
29. Each year, prairie dogs disperse from the location where they were born, expanding existing colonies and establishing new ones. Some colonies expand into irrigable fields; some onto neighboring private property. Consequently, the extent and severity of conflict in the absence of a plague event increases annually.
30. During community engagement, neighboring landowners shared their concerns about the negative impacts of prairie dogs on soils and agricultural operations on adjacent private lands when they emigrate from irrigable OSMP lands. Neighbors are asking that OSMP consider ways to improve the situation for them and help reduce the thousands and thousands of dollars they are spending annually on lethal control.
31. OSMP maps the extent of prairie dog colonies on its lands prior to winter each year, and while colonies occupied only 1,380 acres in 2009, they were found to have expanded to 4,153 acres in 2018 and 4,457-acres system-wide by 2019.
32. The Grassland Plan goal for ecologically viable prairie dog colonies is system-wide occupancy in a sweet spot range between 800 to 3,137 acres; in 2019, prairie dog occupancy was at 142% of the upper end goal, and the majority of prairie dogs system-wide existed in protected colonies so important conservation goals for prairie dogs have been met.
33. The city's Grassland Plan considers the need to conserve *both* prairie dogs and agricultural operations by identifying areas that provide the best opportunity to do each. Irrigable fields are identified as best opportunity areas for agriculture. Native upland prairies are identified as the best opportunity areas for conserving prairie dogs and their associates.
34. The Grassland Plan provides a process to integrate conservation of agricultural operations, prairie dogs and their associates as well as the conservation of six other important elements.
35. Since 2010, all prairie dog colonies on city-managed open space have been assigned to one of five management designation. Most irrigable land on OSMP and the project area is designated as either "Removal Areas" or "Transition Areas" that are intended for the removal of prairie dogs.

36. With a focus on alternatives to lethal control, and limited opportunities and capacities for relocation, the negative impacts to agricultural operations in the project area has greatly increased.
37. In the absence of prairie dog removal and given natural patterns of colony growth on irrigable lands, eleven (11) agricultural tenants are now experiencing conflicts with prairie dogs on >19% of their leased, irrigable agricultural land—most of the conflict is in the project area.
38. Two (2) agricultural tenants are experiencing prairie dog occupation at the levels of 50% and 58% of their entire leasehold, making continued operation extremely difficult or not viable.
39. Changes to the landscape has resulted in decreased revenues and other hardships for these leaseholders; an additional former tenant abandoned a 119-acre leasehold on the Bennett property due to multiple years of unaddressed and growing conflicts with prairie dogs.
40. There is a total of 475 acres of irrigable land system-wide that is no longer leased.
41. Preliminary results from grassland soil inventory work has shown that, on OSMP lands grazed by cattle without prairie dogs present, the soil organic carbon and total nitrogen levels are higher than on either soils where there are prairie dogs present or those where there is no cattle grazing.

Prairie Dog Removals

42. Between 2010 and 2018, only about 750 prairie dogs were removed and relocated from OSMP irrigable agricultural lands because other city and private land prairie dog relocation needs were prioritized over OSMP lands.
43. Receiving site availability for relocations is routinely limited due to prairie dog occupancy, issues of site sustainability and habitat suitability such as the condition of vegetation to support prairie dogs, soils, and topography, as well as concerns from neighboring property owners – these all play a role in decisions by the city and state in determining if a grassland can be used as a receiving site.
44. Until 2019, city policies prioritized receiving sites available on OSMP for private property owners and other city lands (e.g., parks and recreation developments, utility projects). The rationale was that OSMP needs for relocation from irrigable agricultural lands would not result in immediate need for lethal control of prairie dogs, while other imminent developments would. Although a complex process to obtain a lethal control permit exists, OSMP and other city departments acted in a manner consistent with the city's overall policy of avoiding lethal control.
45. While OSMP deferred relocations from its lands, prairie dog populations expanded affecting greater and greater areas outside of conservation areas, including irrigable agricultural lands and neighboring private property.
46. In 2019, OSMP relocated prairie dogs from irrigable lands following a change in the city's policy on prioritizing receiving sites – enabling OSMP lands to be used as receiving sites for relocation from removal and transition Areas.
47. In 2019, with a growing concern over the gap between the on-the-ground situation and the city's objectives for the management of prairie dogs and irrigable agricultural lands, city general fund revenues were allocated to OSMP to support its soil health program (and augment open space funding directed at this management issue) and implementation of the Prairie Dog Working Group recommendations.
48. In 2020, funding and staff capacity (reduced due to COVID-19 budget cuts) is anticipated to support the relocation of approximately 18 acres (ca. 360-540 prairie dogs).

49. Even relocation removals involve lethal control for the small numbers of prairie dogs that cannot be trapped, and there is an inherent mortality rate associated with relocations, although staff attempt to minimize loss of prairie dogs through the use of relocation best management practices.
50. Assuming the on-going availability of funding and receiving sites, and absence of plague, relocation at this 30-40-acre per year level would take decades and decades to fully address grassland management objectives within the project area—longer if all irrigable land and prairie dog conflict areas on city open space are considered.
51. The Prairie Dog Working Group prepared recommendations related to prairie dog conservation and conflict resolution over a 2-year period from 2017-2018. Most of the recommendations from this group were accepted by the city manager and city council and are currently being implemented. Unfortunately, due to the scale of conflict on irrigable agricultural lands, it was determined that these recommendations alone were not enough to address these issues in a timely or feasible manner.
52. In response to the OSBT recommendation and City Council direction, staff has worked with the community to evaluate the benefits, feasibility and estimated costs of various potential management actions in the project area.
53. During community engagement, neighboring landowners have shared their concerns about the negative impacts of prairie dogs on agricultural operations on adjacent private lands when they emigrate from irrigable OSMP lands. Neighbors are asking that OSMP consider ways to improve the situation for them and help reduce the amount of lethal control that they are engaged in.

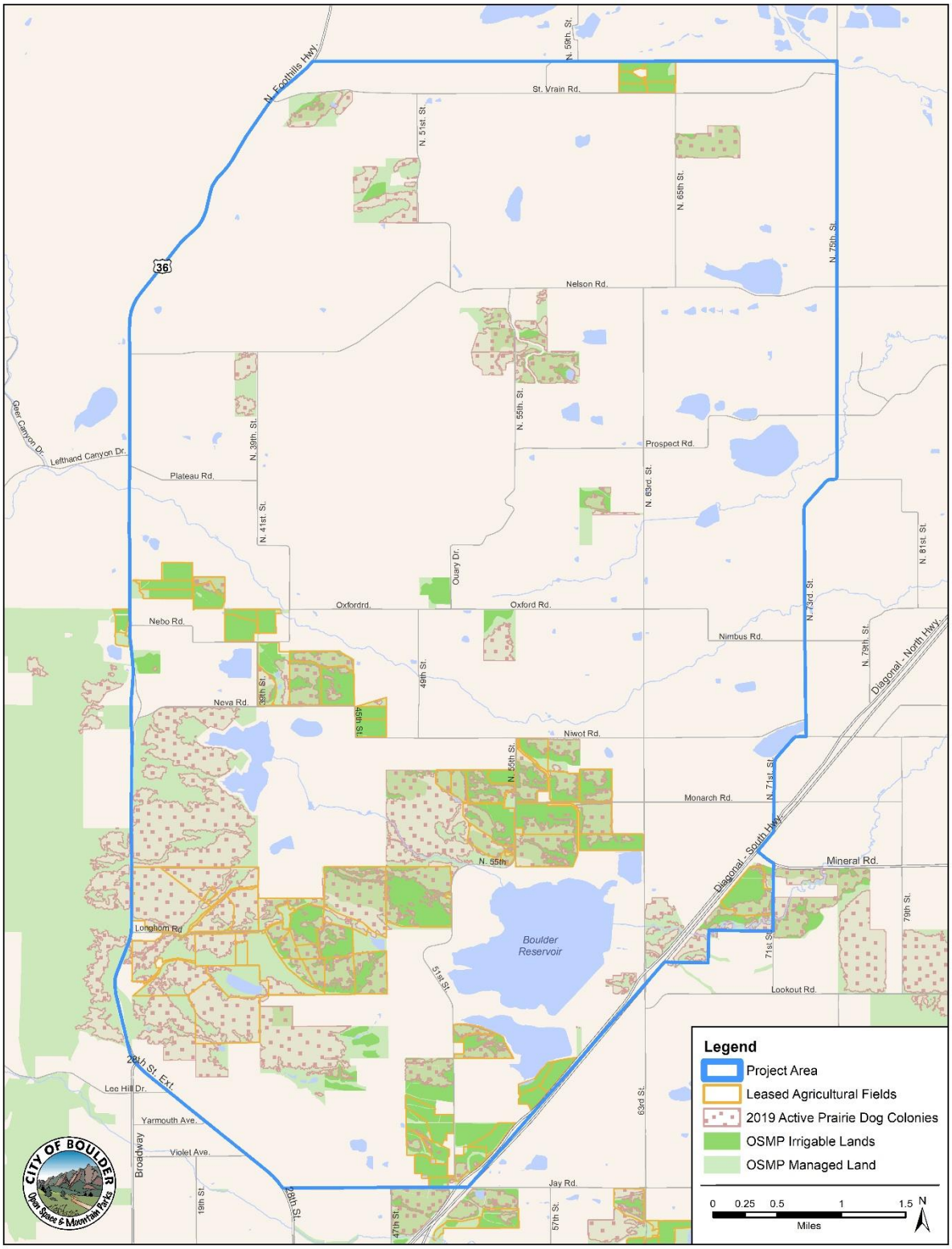

Figure 1: Map of Project Area

Assumptions

Through the process of community engagement—especially hearing from community members about their values, developing and evaluating potential actions, and formulating packages, staff identified a number of key *assumptions* to help draft the preferred alternative and provide transparency about what staff was considering during the drafting process. These assumptions, based on community engagement, direction from plans and policies, feasibility analyses, conversations with the OSBT and between staff have been revised to reflect input from the OSBT at the Feb 12 study session.

Staff assumptions are that it is desirable to:

A. Support farmers and ranchers so they can continue to lease OSMP lands.
B. Support the conservation of black-tailed prairie dogs and associated species, including burrowing owls, horned larks, ferruginous hawks, rough-legged hawks, bald and golden eagles.
C. Be efficient in our actions so that goals are met while removing as few prairie dogs as possible over the long term.
D. Remove prairie dogs using effective, efficient, and humane methods, not just in the project area but across the OSMP system.
E. Be able to maintain and use the city's water rights and irrigation infrastructure to deliver open space services.
F. Exclude prairie dogs after they are removed from an area to avoid additional use of lethal control.
G. Invest in the restoration of land after prairie dogs are removed to the most appropriate vegetative cover type and consider the use of native species.
H. Minimize soil erosion and degradation.
I. Mitigate conflicts with neighbors by reducing emigration of prairie dogs from irrigable lands to neighboring private properties.
J. Avoid prairie dog removal that results in large scale, landscape level impacts to associated species.
K. Implement consistent with budget and staffing constraints recognizing the difficulty and expense of adding additional staff and purchasing and maintaining equipment assets.
L. Consider other OSMP priority projects and the other work that staff are assigned to when evaluating costs and trade-offs of new management actions such as those in this preferred alternative.
M. Recommend adjustments to city plans, policies, rules, and/or code to better integrate the charter purposes of open space.
N. Maintain detailed documentation, produce monitoring and progress reports, hold an annual prairie dog meeting, and keep the public informed so that implementation is a transparent process.
O. Manage prairie dog receiving sites to be ecologically and agriculturally sustainable rather than moving a problem from one part of the system to another.
P. Take actions that affirm, support and implement the recommendations of the Prairie Dog Working Group as approved by OSBT and council.

Q. Integrate prairie dog removal efforts with our conservation program in order to support the overall viability of prairie dogs on OSMP lands over the long term and in what has been a plague-dominated landscape.
R. Work directly with agricultural tenants to identify agricultural practices to mitigate conflicts arising around the overlap of prairie dog colonies and irrigated agriculture.

Preferred Alternative

Working with the community and the OSBT, staff has developed and compared packages that reflect a range of types and levels of nonlethal and lethal removal, barriers and other means of exclusion, restoration and enhancement of soils and vegetation and collaborative efforts with partner agencies and neighboring landowners, as well as changes to plans, policies, rules and/or city code. These packages were summarized in the materials developed for the Feb 12 OSBT study session.

The preferred alternative described below is based on the level of action presented to the board at the Feb 12 study session as "Package C." This modified package includes the following specific components:

1. Meet with stakeholders annually, including agricultural tenants, to evaluate success, to review lessons learned, to review and update annual goals, funding allocated, implementation priorities, properties addressed, and any adjustments to the program, at minimum, at an annual public meeting.
2. Relocate approximately 30-40 acres annually (depending on available funding) from the project area's irrigable lands that are designated as removal or transition areas by: trapping until five clear weather days with no captures, and then, in-burrow humane lethal control using pressurized exhaust (PERC) to complete the removal.
3. Allow for some minor relocations (up to 20 prairie dogs) from urban sites onto open space, if receiving sites are available.
4. In addition to the relocation removals described in #2, conduct approximately 100 to 200 acres (depending on available funding) of removals annually from the project area's irrigable lands (approximately 10% to 20% of the total occupied irrigable land) that are designated as removal or transition areas by in-burrow humane lethal control using carbon monoxide (CO) in the form of Pressurized Exhaust (PERC) or CO cartridges.
5. Have a goal of 100 percent removal from each field where removal is conducted.
6. Conduct removals through private contractors (some of whom may be agricultural tenants) overseen by OSMP staff, as a first preference, or directly by OSMP staff.
7. Use barriers or other exclusion methods to prevent re-colonization by prairie dogs.
8. Work with neighboring landowners and agricultural tenants to take a landscape approach to removal that reduces opportunities for re-colonization.
9. Restore all areas for irrigated agricultural use following removal to re-establish soil profiles with key-line plowing, seeding and adding soil amendments, and repair irrigation infrastructure.
10. Intend to allow usual and ordinary agricultural activities in the project area even if they disturb prairie dog burrows and have incidental impacts to prairie dogs.
11. Implement this preferred alternative legally by special permit and rule change, as described herein and as expeditiously as possible.

In response to the items above, OSMP staff subsequently collaborated with staff from Planning, the City Attorney's Office and the City Manager's Office. The policies and administration of the Wildlife Protection Ordinance reach beyond their application on OSMP lands, and developing a pathway to implement the preferred alternative required careful consideration of policy consistency, realistic standards for administration and legal review. The result are the following specific implementation **recommendations for City Council**:

1. **Staff will implement Action #4 of Attachment C, the OSBT-Recommended Preferred Alternative, (lethal control) through:**
   a. The use of a Special Permit (as described at 6-1-39, B.R.C. 1981) to allow the City of Boulder Open Space and Mountain Parks Department to lethally control prairie dogs on leased and unleased irrigated agricultural lands managed by the Open Space and Mountain Parks Department in the project area as shown in Figure 1 of the "*Management Review of Irrigable Agricultural Fields Occupied by Prairie Dogs and Showing Signs of Soil Loss, Ecological Impact, and Loss of Agricultural Viability OSBT-Recommended Preferred Alternative (as amended) 7-30-2020.*"
   b. City Council's approval and recognition that, consistent with the requirements of 6-1-39 (a)(2):
      i. The management, including soil health restoration, of irrigated agriculture land uses on lands managed by the City of Boulder Open Space and Mountain Parks Department are "maintenance of a public improvement project" [as described at 6-1-39 (a) (2)];
      ii. Non-lethal means of control were evaluated during the development of the Preferred Alternative and found not to be feasible to fully address the management and maintenance of irrigated lands (as described at 6-1-39)
      iii. The staff memo to City Council, and public hearing before City Council associated with these recommendations constitute "notice" per 6-1-39 (a) (2) B.R.C. that prairie dog removal by in burrow humane lethal control will be required.

2. **Staff will implement Action #10 of Attachment C, the OSBT-Recommended Preferred Alternative, (allowing burrow damage) through**:
   a. The rule making authority delegated to the City Manager under 6 -1- 40 B.R.C. The City Manager will issue a rule clarifying that agricultural or soil health restoration activities on irrigated lands managed by OSMP that damage prairie dog burrows but are limited to a depth of no more than three inches below the typical ground surface are allowed on all OSMP irrigated agricultural properties (system wide) as public projects consistent with 6-1-12 (b) (4)(see 6-1-12 B.R.C.). The rule will further describe allowances for the City of Boulder Open Space and Mountain Parks Department agricultural management and soil health restoration activities on irrigated OSMP fields in the project area, to damage prairie dog burrows to a depth of up to six inches; and
   b. The use of a Special Permit (as described at 6-1-39, B.R.C. 1981) to allow the City of Boulder Open Space and Mountain Parks Department agricultural management and soil health restoration activities on irrigated OSMP fields in the project area to disturb prairie dog burrows to a depth of up to twelve inches under special conditions that consider the context of the land and with advance notification. The special conditions for damage to prairie dog burrows at depths greater than six inches and no more than twelve inches would be the following whereby they would be allowed on irrigated OSMP lands in the project area only:

i. In Transition Areas and Removal Areas as defined in the City Council accepted OSMP Grassland Ecosystem Management Plan (2010);
ii. Between June 2 and February 28 to avoid dependent young; and
iii. For the following activities:
    1. Key-line plowing to restore previously irrigated OSMP fields;
    2. Key-line plowing to improve soil health and water infiltration;
    3. Creating and maintaining irrigation laterals with V-plows and ditch plows;
    4. Tillage for seedbed preparation, including plowing, chiseling, disking, roto-tilling, harrowing and minor land leveling;
    5. Mechanical seeding of grain, vegetable, forage and cover crops;
    6. Tillage between crop rows or planting beds intended to control invasive species; and
    7. Mechanical harvesting of deep-rooted vegetable crops.

The preferred alternative targets removal of prairie dogs from approximately 130-240 acres annually. Of this, approximately 30-40 acres would be through relocation to OSMP receiving sites and approximately 100-200 acres would be through in-burrow humane lethal control. In addition to relocation from irrigable agricultural lands, the preferred alternative proposes that up to 20 individual prairie dogs from non-OSMP project areas might also be included as part of annual relocation efforts, if it would not disrupt meeting the 30-40-acre relocation goal from irrigable OSMP lands in the project area. This provision is included in anticipation of periodic needs, often by other city departments to relocate small numbers of prairie dogs from urban development projects.

Lethal control on OSMP lands would be focused on properties that are designated as removal or transition areas in the Grassland Plan. There are also irrigable agricultural lands in the study area that are designated as grassland preserve and multiple objective area, however removal from these areas would be a second-tier priority to be considered at future annual reviews. Pursuing relocation or humane lethal control from these properties might occur once removal and transition areas are addressed across the project area and only if OSMP goals for prairie dog conservation continue to be met system-wide, anticipated impacts to associated species are determined to be limited at the landscape level, and barriers could be effective at excluding prairie dogs from re-entering these areas.

Lethal control efforts in the project area would primarily be using PERC, the most humane method of control found to date. Following 100 percent removal of prairie dogs on properties where prairie dog immigration may lead to recolonization, barriers would be constructed to protect the property from future re-colonization.

After removals, restoration of the property would be accomplished using a suite of tools, depending on the characteristics of each property. For example, staff would work with agricultural tenants to restore the topography and fix damage to field lateral ditches so the property can be properly irrigated. Burrow mounds would be scraped and leveled, and fields may be tilled to ensure that the existing burrows are not visible to dispersing prairie dogs. Similar coordination would occur with neighboring landowners, as possible.

A customized restoration plan would be developed to address soil health, invasive species, revegetation and agricultural production with the goal to restore each field as quickly as possible to irrigated

agriculture. Staff would use regenerative agricultural practices including soil amendments and key-line plowing where appropriate and enhance the potential for soil carbon sequestration as part of restoration.

In some areas, removing and excluding prairie dogs and then returning irrigation to the field may be all that is needed to begin the process of restoration. On the other extreme, in places that are basically devoid of vegetation and have suffered significant soil erosion, it may be necessary to add soil amendments and reseed, perhaps with a cover crop to exclude invasive plant species, until the desired vegetation becomes established. Experiments on the OSMP Bennett property have indicated that compost and deep subsoil plowing using a key-line plow will increase the success of cover crops.

Restoration of healthy soils, and enhancement of carbon sequestration are a focus of OSMP's soil health coordinator. She is working with agricultural tenants to analyze and identify appropriate techniques to limit physical disturbance of the soil, armor soil with vegetation or litter, incorporate a wider diversity of plants species, maintain living roots in the soil throughout the year, and ensure that livestock are at the appropriate stocking rates, and the season and duration of grazing is a match for site conditions and stewardship objectives.

The soil health coordinator has sampled over 100 sites this field season in an effort to establish a baseline soil health assessment on OSMP irrigated agricultural land. These sites have been sampled and analyzed for thirteen (13) indicators of soil health and will allow the city to quantify carbon sequestration into the future. This project will be OSMP's first systematic soil condition baseline and marks the beginning of a long-term and system-wide sampling of OSMP soils that will contribute to long-term monitoring for programs to improve soil health and enhance carbon sequestration. OSMP's soil health and sequestration work will also coordinate with other similar initiatives both in Colorado and elsewhere to accelerate the development of effective soil health and carbon drawdown strategies now critical to stabilizing climate and increasing the ecological resilience of local environments to increasing climate change.

Shifts in OSMP management of irrigable lands are also being developed by OSMP's agricultural land restoration coordinator. He is looking at ways to shift the dominance of OSMP's irrigated hayfields and pastures from a few introduced grass species to a diverse combination of native and introduced grasses and forbs (wildflowers). This will not only provide benefits to native species including pollinators and other beneficial insects but will also provide greater resilience in the face of changing environmental conditions associated with the climate crisis. The agricultural land restoration coordinator has identified approximately 200 acres of the irrigable lands that are no longer able to be leased, due to the conflicts described in this attachment, as good places to try techniques to create more diverse vegetation types in irrigated pastures so that he can experiment without disrupting active agricultural operations. The scaling up and success of the agricultural land restoration coordinator's work is dependent on resolving the conflicts described in this attachment.

Currently OSMP lacks the expertise, infrastructure, equipment or capacity to complete relocation, lethal control and barrier installation with existing staff. Consequently, for the next few years, relocation, lethal control and barrier installation may best be carried out by contractors working with OSMP staff oversight. Restoration projects would be undertaken directly by staff, staff working with contractors and staff collaborating with agricultural tenants. As OSMP gains greater experience with removal techniques,

staff would evaluate the benefits, feasibility and cost effectiveness of transitioning to in-house, staff-led removal and barrier installation.

Staff will also be developing a plan for monitoring and follow up treatment of any prairie dogs that may re-colonize after removal. OSMP is working with Boulder County Parks and Open Space to better understand their program for this ongoing need and evaluate whether parts of their approach could work or be adapted for use by the city.

In order to implement the preferred alternative legally and expeditiously, it will be necessary to develop a special permit and undertake a rule change. OSMP would work with Planning Department staff, the City Attorney's Office and the City Manager's Office to develop the most expedient approach.

Related to implementing the preferred alternative, OSMP and Planning Department staff would continue to work on prairie dog conservation efforts described in the Grassland Plan and as recommended by the Prairie Dog Working Group.

First phase PDWG implementation items that are planned to be undertaken in the next three years include:

- Updating information and websites to provide consistent messaging around prairie dogs and plague
- Supporting barrier installation to mitigate conflict with irrigable agriculture and neighboring land uses
- Create and begin implementing a plague management plan for city owned prairie dog colonies
- Evaluate commitment to black-footed ferret reintroduction on city-owned lands
- Create ferret reintroduction plan with collaborating agencies and landowners if commitment is made for reintroduction on city-owned lands
- Work with outside groups to leverage in-kind donations, volunteer help and funding
- Increase relocations performed across the Boulder area
- Update habitat suitability modeling for prairie dogs on city-owned lands
- Report progress on implementation at least annually to decision-makers and the community
- Other recommendations as funding and staff capacity allow

Integration with Other City Initiatives

The preferred alternative does not stand alone; it has been developed to be integrated with and supported by many other city plans, programs and projects. The removal of prairie dogs from these OSMP irrigated lands north of the city will not conflict with OSMP's long-term program of conservation of the black-tailed prairie dogs. In fact, the current conflict is draining OSMP resources that could otherwise be put more productively to the conservation program. The table below shows the elements of the preferred alternative along with other city initiatives as they related to the three main parts of City Council's direction, "Ecological Condition of Land & Wildlife Health," "Healthy Agricultural Uses," and "High Soil Health."

<table>
<tr><th>Ecological Condition of Land & Wildlife</th><th>Supporting Agricultural Use</th></tr>
<tr><td><u>RECOMMENDATION IN THE PREFERRED ALTERNATIVE</u>
• Relocate 30-40 acres of prairie dogs annually from the project area's irrigable fields
• Restoration of removal areas using regenerative agricultural practices to improve ecological benefits of irrigable OSMP lands.
• Implement appropriate rule changes and special permits.</td><td><u>RECOMMENDATION IN THE PREFERRED ALTERNATIVE</u>
• Remove all prairie dogs from up to 130-240 acres of the project area's irrigable lands annually
• Exclude prairie dogs from areas in the project area where they have been removed
• Work with lessees and neighbors to reduce likelihood of re-colonization.
• Restore all cleared land for irrigated agriculture once removal has been completed.
• Examine appropriate rule changes, and special permits.</td></tr>
<tr><td><u>RELATED PLANS, PROGRAMS & PROJECTS</u>
• On-going funding and implementation of the Prairie Dog Working Group Recommendations.
• On-going management for black-tailed prairie dogs and associates per the specific objectives in the Grassland Plan:
○ 800-3,137 acres of prairie dog colonies on OSMP grasslands
○ 70-85% of all prairie dog occupancy occurring in colonies with protected designations
○ 10-26% of all Grassland Preserves occupied
○ 3-4 successful burrowing owl nesting attempts per year
○ 50-75% of colonies with territorial horned larks
○ Desired abundance and distribution of generalist and sensitive predator species present
• Administration of the Wildlife Protection Ordinance
• Implementation of Urban Wildlife Plan: Prairie Dog Element
• Implementation of other Grassland Plan elements to conserve the ecological values of Boulder's grasslands and ensure on-going agricultural production.
• Continue mapping and monitoring all prairie dog colonies annually.</td><td><u>RELATED PLANS, PROGRAMS & PROJECTS</u>
• Creation and ongoing funding of Soil Health Coordinator and Agricultural Restoration Coordinator positions
• Ongoing management to achieve the specific objectives of the Grassland Plan and Ag Plan
○ 80-90% of irrigable land in agricultural production.
○ Maintain 60% of grazing lands in "Good" condition according to an integrated measure of quality
○ Maintain an agricultural lease program compatible with agricultural and resource stewardship and a working lands program
○ Maintain and support a diversity of agricultural operations and uses on OSMP lands
○ Provide and maintain the infrastructure necessary to support a diversity of agricultural operations
○ Maintain water delivery (irrigation) infrastructure in good condition
• Implementation of other Grassland and Ag Plan elements to maintain and enhance agricultural-related values and long-term sustainability of agricultural operations.</td></tr>
<tr><th colspan="2">Improving Soil Health Carbon Sequestration</th></tr>
<tr><td colspan="2"><u>RECOMMENDATION IN THE PREFERRED ALTERNATIVE</u>
• Restore all areas for irrigated agricultural use following removal to re-establish soil profiles with key-line plowing, seeding and adding soil amendments, and repair irrigation infrastructure.
• Implement appropriate rule changes and special permits.</td></tr>
<tr><td colspan="2"><u>RELATED PLANS, PROGRAMS & PROJECTS</u>
• Creation and ongoing funding of Soil Health Coordinator position.
• Soil monitoring program to establish objectives for soil health.
• On-going experimentation and implementation of techniques to increase or maintain soil organic matter and soil biological diversity on tilled/converted agricultural lands
• Implementation of related Grassland Ag Plan and Climate Commitment elements to achieve soil health and increase the ability of converted OSMP agricultural landscape to sequester carbon.</td></tr>
</table>

Prioritizing Removals from Irrigated Lands in the Project Area

There are currently 967 acres where prairie dog colonies overlap irrigable lands in the project area. The criteria below are ranked in order and intended to guide OSMP's prioritization for the removal of prairie dogs from irrigated lands in the project area.

1. Areas designated as removal and transition areas.
2. Areas where the likelihood of effective removal, exclusion and restoration are most likely to be successful (to avoid recurring needs for lethal control on the same field) based on:
    a. Landscape context.
    b. Smaller parts of a larger area where removal and exclusion can be successfully implemented over time.
    c. Considerations around progressing from areas of low occupancy to areas of higher occupancy.
    d. Recent colonization or expansion.
    e. Opportunities to coordinate with neighboring landowners.
3. Areas leased by tenants that are most affected by prairie dog occupation.
4. Areas that are currently unleased but can be restored to production.
5. Areas where successful management will increase OSMP lease revenue.
6. Areas where removal will have least impact to associated species (e.g., raptors)
7. Areas with the highest degree of neighbor conflict.
8. Areas that provide some degree of relief to the greatest number of tenants.

Implementation of the Preferred Alternative

Adaptive Management

Consistent with best resource conservation practices, and as described in the OSMP Master Plan, staff's commitment is to take an adaptive approach to this project for each aspect of the project, each year of implementation and for 2021 and 2022. Staff will be reviewing and modifying practices in real time to improve efficiency, effectiveness and consistency with the preferred alternative. On an annual basis staff will report out what we have learned in partnership with other agencies, researchers, agricultural tenants, contractors and neighbors, and progress in taking the actions described in the preferred alternative. Changes based upon learning will be shared with the community and presented as appropriate including budget recommendations to the Open Space Board of Trustees and City Council.

Staff have not tried to forecast specific actions beyond 2022. It may be that the practices described in the preferred alternative are found to be appropriate to continue in out years. However, because so much depends upon changes in environmental conditions (e.g., precipitation, plague), our understanding of grassland ecology, economic shifts, and other factors changes in approach will be needed in the future. Revised actions will be developed for 2023 and beyond.

Implementation in 2021 and 2022

Using the prioritization criteria discussed with the board, and included in this memo, staff put together an implementation approach describing work in years 2021 and 2022. This includes planning and cost estimates based on the specifics of colonies that would likely be removed. This is not intended to mean that efforts will stop after two years, but to give an indication about how staff envisions moving forward operationally. It is staff's expectation that it will learn a great deal during the first years of implementation, and that conditions on the ground will change. OSMP's ability to implement the preferred alternative at recommended levels may also be affected by unanticipated events (such as the COVID-19 pandemic).

As proposed, relocations in 2021 and 2022 would result in approximately 60-80 acres of prairie dogs relocated from the project area – with potential inclusion of small numbers of animals from other sites. Additional small relocations may occur outside the project area such as irrigated fields elsewhere on the system where small colonies have recently become established or where agricultural priorities are highest—such as areas suitable for conversion to vegetable production.

Beginning in 2021 and continuing in 2022, in addition to relocation, approximately 100 to 200 acres of prairie dogs would be lethally controlled. The result is expected that through these relocations and lethal control between 260 and 480 acres of irrigable agricultural land within the study site would be prairie dog free and ready for restoration to agricultural production.

Since these numbers are based on specific projects, they are also based on occupancy and on-the ground conditions that, as described above, will change through time. As a result, staff is not presenting additional details at this time because the colonies to be managed may change.

Table A summarizes the estimated costs based on the assumptions listed. An estimated $596,000-$976,000 would be required annually to implement the preferred alternative as presented.

Table A: Estimated Implementation Costs of the OSBT- Recommended Preferred Alternative for 2021-2022 (*All numerical values are estimates*)
Note: This table has been updated since the draft preferred alternative was presented on March 11 based on feedback from the OSBT.

Two Year Focus (2021-2022)	Conservation Efforts	Annual Acres of Removal	Acres of Transition & Removal Areas w/ Prairie Dogs in Project Area	Extent/Number of Prairie Dogs on OSMP System	Prairie Dogs Relocated Annually	Prairie Dogs Lethally Controlled Annually	Annual Non-Staff Cost Estimate	Additional Annual Staff Cost	Total Annual Cost
Removal and Transition Areas in the Project Area	Continue PDWG and other conservation efforts	Relocation: 30-40 Lethal Control: 100-200	Start of 2020: 526 Start of 2023 71 - 333	Start of 2020: 4,457 acres or 133,710 prairie dogs Start of 2023: 4,371-4,690 acres or 131,100- 140,700 prairie dogs	900-1,200	3,000-6,000	Relocation $300,000 - $402,000 Lethal Control $206,000 - $455,000	Lethal Control $90,000	$596,000-$976,000

Calculations are based on the following assumptions:

- All costs are annualized and include planning and permitting, contracting, prairie dog removals, barrier installations, soil restoration work, and mitigation.
- Contractors are assumed to be available for work not done by staff.
- Relocation contractors charge a range of prices based on availability and need to comply with city procurement requirements; estimates are based on past bid amounts of up to $4,400 per acre for relocation done to the city wildlife ordinance standard (i.e., five days of trapping in clear weather without capture before using PERC);
- Cost estimates are based on $221 per acre for humane lethal control by PERC.
- Barriers are a mixture of metal, wire mesh or no barrier specific to each property and estimated costs are $7.70 per foot for wire, $38 per foot for metal, and $1.70 per foot for temporary.
- Restoration costs are estimated to range from $124 to $360 per acre depending on the condition of the site, based on staff experience.
- Current acreage overlap of prairie dogs in 2019 with irrigable ag land was 967 acres and those in areas designated as transition and removal areas was 526 acres (54%). The 526 acres is the basis for determining prairie dog extent results for the start of 2023.
- Density averages are 30 prairie dogs per acre.
- Baseline growth rate for prairie dog colonies in the project area in acres are +3% (based on last several years data).
- FTE = full-time equivalent (2,080 hours), and fully loaded staff costs will range from $23 – $44 per hour depending on the level of work required.
- No plague or other factors to cause unusual population declines (or increases) occur in the area.