

**Evaluation of Land Protection Measures within Agricultural to Municipal
Water Transfers in the Arkansas River Basin**

Valley Resource & Water Management

In conjunction with

The Lower Arkansas Valley Water Conservancy District

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Executive Summary

Colorado has a history of agricultural water being purchased by other users, primarily municipalities and converted to urban uses. Much has been written about the impacts of water transfers on water quantity, diversions, storage, economics, and water quality. There is not much literature on the revegetation of lands with irrigation (agricultural) water removed from the southeast Colorado area. Colorado water law statute (CRS 37-92-305(4.5)(a)), enacted in 1992, requires terms and conditions for permanent water transfers that include “reasonable provisions designed to accomplish the revegetation and noxious weed management of lands from which irrigation water is removed.” Several decrees in the Arkansas Valley were reviewed to see how revegetation and weed management is addressed. Revegetation and weed control are vital for controlling soil erosion, protecting off-farm infrastructure, and increasing land value by planting a permanent vegetative cover. After reviewing several decrees and discussing revegetation with various stakeholders, a set of recommendations were developed to aid in the revegetation of lands where irrigated water has been removed and converted to other beneficial uses.

Project Approach – A Three-Phase Approach

Phase 1 – review a number of water transfer decrees in the Arkansas Valley to determine the range of land protection language in each decree.

- Land protection measures mentioned in decrees varied from none to more specific, including third-party reviews to examine if the decree conditions were met.
- Dryland farming in lieu of revegetation was included in some decrees.
- Most decrees lack specificity on technical revegetation issues.

Phase 2 – interview entities and individuals affected by the revegetation or lack thereof. Ask how land protection actions or inactions affected local citizens and local governments. Request recommendations on how land protection actions could be improved.

- Entities interviewed included municipalities, county commissioners, local landowners, water boards, and irrigation companies.
- Responses were summarized without attributing specific statements to individuals.

Phase 3 – Review on-the-ground revegetation accomplishment of dry-up lands

- Basic field reviews were accomplished and compared back to the decree language.

Recommendations

After reviewing the decree language, interviewing entities, and viewing on-the-ground accomplishments, develop recommendations to improve future decrees. Some of the issue recommendations included:

- The responsibility for completing the revegetation requirement must be clearly delineated.
- The availability of water for new uses should be tied to the successful completion of the revegetation requirement.
- Species seeded must be required to be native to the area. Non-natives species included within a seed mix should be a small percentage to prevent the initial establishment, followed by die-out by species not adapted to the local environment.
- The timeline for when the revegetation must be completed must be determined. Intermediate checkpoints to be met should be included.
- Establish a definition of the revegetation criteria which must be attained in adequately establishing the vegetative cover on the dry-up lands. Details of the monitoring methodology must be included.
- Establish a definition of adequate weed control criteria that must be maintained throughout the revegetation process and in place to successfully establish native vegetative cover on the dry-up lands.
- A decree provision for the control of invasive species, including animal species, should be included.
- Oversight and accountability of the project need to be in place, providing the unbiased evaluation of activities and status of a revegetation project.
- Broad land access must be ensured for all revegetation and monitoring activities throughout the revegetation and maintenance periods.
- Provisions for the continued maintenance of revegetation and weed control following the establishment of adequate vegetative cover on the dried-up lands.

- Protection of the revegetated cover from “sod busting” following successful completion of the revegetation requirement.
- Dryland farming needs to be defined as to what is required, the standard for successful dryland farming, and the responsibility for revegetation should dryland farming cease or failure occurs.
- Provisions should include flexibility for the ultimate use of the land and maintenance, whether through a protective grazing plan or other habitat uses.

Conclusion

- Past water decrees have varied with respect to revegetation issues; there is no current standard of practice.
- Including our recommended items within a transfer will significantly enhance the revegetation program's effectiveness. These recommendations will fill a void that currently exists, aiming to protect the soil and other natural resources when a water transfer occurs.
- There is a need for a revegetation manual emphasizing the unique issues associated with the revegetation of lands where irrigation water has been removed. Such a revegetation manual has been developed in association with this project.

Introduction

The transfer of water rights from agricultural irrigation to other uses, primarily for municipal use, has a long history within Colorado. Land associated with the water right being transferred is required to be dried up to avoid injury to other water rights. Colorado water law statutes (CRS 37-92-305(4.5)(a)), enacted in 1992, require terms and conditions for permanent water transfers that include “reasonable provisions designed to accomplish the revegetation and noxious weed management of lands from which irrigation water is removed.” The statute cited above does not provide further requirements on how revegetation should be implemented or how to assign accountability. Transfers prior to this statute being enacted did not address revegetation.

The value of the land resource is changed with the removal of irrigation water and the drying up of the land, but it does not become valueless. Traditionally, counties will tax irrigated farmlands based on commodity production that is possible due to the water supply available to the lands. After a water sale, the value of the land diminishes, leading many to believe the value of the transaction, including land and water, belonged almost entirely to the water rights. When the lands are properly managed and revegetated with native vegetation, they will provide a greater value for wildlife habitat and grazing lands. The use is far superior to land in annual and noxious weeds. Our review of previous revegetation attempts after water transfers shows protection varies from none to successful native grass establishment. This project reviews the various activities that have taken place to protect the land resource.

This project aims to research and document the many and varied land protection requirements that have been written into agricultural water transfer authorizations and permanent decrees in the Arkansas River Basin and develop a standardized set of requirements and criteria that will better protect the land resource.

The Research Process

A three-phased process was used in researching information for this project. First, we reviewed transfer decrees to evaluate and understand the requirements. Second, interviews were conducted with associated entities and the water rights holders for their views of the revegetation requirements, their adequacy, and on-the-ground implementation results. Thoughts and observations of shortcomings or needed additions to the requirements were discussed and recorded. Third, field assessments of associated dry-up lands and their revegetation progress

were conducted when available to evaluate the effectiveness of the revegetation program. Based on the decree reviews, stakeholder interviews, and field visits, a need was identified for a Revegetation Manual. The Revegetation Manual identifies best management practices to revegetate dry-up acres. The Revegetation Manual is titled “Revegetation Program, Development and Implementation Manual,” attached to this report as Appendix IV.

Phase 1: Decree Requirements Review

The project team researched over twenty water transfer decrees within the Arkansas River basin evaluating the dry-up and land protection/revegetation requirements. While these decrees are not an exhaustive review of all water transfer decrees, they provide a solid representation of the various decree requirements allowing for an evaluation of their effectiveness and appropriateness. The list below is a representative sample of the researched water transfer decrees.

There have been improvements in land resource protection in recent years, but many decrees fall short of accepted standards and practices for soil and natural resource protection. The decrees reviewed for this project have a wide range of requirements. Some early water transfers lack revegetation requirements, while others are more detailed but lack a complete definition of successful revegetation requirements.

Review 1: Booth-Orchard Change Case W-145

Early change decrees prior to the statute requiring revegetation, such as the Pueblo Board of Water Works change of the Booth-Orchard water rights, did not include any provision requiring revegetation or land resource protections. The result of not having revegetation requirements is evident on the land. A lack of permanent vegetation results in inadequate control of weeds and protection of the soil from erosion.

The Both-Orchard change case demonstrates how the early change cases dried up previously irrigated lands with no consideration for protecting the lands or potential continued productive uses of these parcels. There is a markedly different situation when examining the change cases of the mid-80s and beyond, as seen below, particularly with the Rocky Ford Ditch transfer 83-CW-18. This inclusion of revegetation requirements evolved into significant

protections that have been required in the change cases that followed. Revegetation requirements have varied greatly without a uniform standard being developed or applied.

Review 2: Colorado Canal and Rocky Ford Ditch Decree Provision 84-CW-62-63-64; 83-CW-18

The Colorado Canal change of water rights decreed in 84-CW-62-63-64 is an example of one of the first Arkansas River Valley transfer decrees with an associated land protection requirement. The Colorado Canal requirement was developed as a stipulation reached between the transferring entity(s) and a group of non-sellers, the Proxy Group, exerted here:

“...the transferring shareholder shall place into effect a program whose goal will be the establishment of a ground cover of a type which will not require irrigation after its establishment, in order to mitigate the blowing of sand or dust or the proliferation of noxious weeds. A shareholder who intends to transfer water to municipal or other non-irrigation use will not plow up irrigated land covered with a perennial such as alfalfa. The goal shall not so much be the re-establishment of native species but rather of an economically viable dryland forage crop...” (October 21, 1985, Proxy Group Stipulation).

Similarly, a revegetation requirement was developed between the purchasers of the first transfer of the Rocky Ford Ditch 83-CW-18 water rights, Resource Investment Group, and the minority non-sellers, codified in a stipulation associated with the transfer decree (These water rights were ultimately sold to Aurora, CO).

“... shall plant and establish a ground cover, which shall not require irrigation after its establishment, upon such land in order to mitigate the blowing of sand or dust or the establishment of noxious weeds and shall provide water to establish such ground cover through irrigation for no more than one (1) season.” (January 31, 1985, Minority Group Stipulation).

These two initial examples of revegetation requirements demonstrate the concern of neighboring landowners for the need to provide land resource protection on associated dry-up lands. While likely these requirements were developed with good intentions, they also demonstrate some lack of understanding of the difficulty, cost, and other factors involved in successfully revegetating the previously irrigated lands back to conditions similar to the native

plant community. Or, as with the Proxy Group stipulation, a lack of protection with the allowance of some perennial forage crops.

The transferring entity, Resource Investment Group, initially failed to successfully revegetate the land in question. A stipulation (1-31-1985) was reached between the City of Aurora and opposers to develop standards of revegetation to be met and provisions for irrigation, as necessary. The standards were codified in a management table classifying the stage of revegetation development from class I “needing reseeding” to class VI of “15% plant frequency” and “VII of 20% plant frequency”. Lands classified as Class VI and VII were considered established. This classification system has been adopted in other decrees, and we refer to it as “The RFD Revegetation Standard,” attached as Appendix I.

Review 3: Rocky Ford Ditch II Transfer 99-CW-169

The second Rocky Ford Ditch transfer has the establishment completion requirement of any field occurring when perennial grass stands have a plant frequency of 15% or more with no deficient areas larger than one acre in size over 90% of the field.

These fields were reviewed annually by a court-approved expert panel evaluating the status of each. After completion of dry-up and establishing revegetation on 100% of the acreage, the court retained jurisdiction over the revegetation for ten years.

Review 4: Colorado Beef-Five Rivers Ft Lyon Canal Transfer 08-CW-83

The decree includes the CRS37-92-305(4.5)(a) requirement “Reasonable provisions designed to accomplish the revegetation and noxious weed management of lands from which irrigation water is removed.” The revegetation is to be accomplished in substantial compliance with the May 13, 2009, Fort Lyon Board Decision procedures.

The general standard is The RFD Revegetation Standard table rating class I - class VII, with classes VI and VII being established. Specifically, “the completion of revegetation of any given field will occur when perennial grass stands have a plant frequency of 15% or more with no deficient areas larger than one acre of size over 90% of the field.”

Review 5: Hayden Ranch Transfer by Security 16-CW-3055

This decree is similar to some other decrees requiring the district to establish ground cover on the land that can sustain itself under the climatic conditions, soils, precipitation, and terrain prevailing for the revegetation lands with weeds and erosion adequately controlled. However, there are no standards described within the decree. Instead of standards, a methodology that Security must follow is outlined within the decree. This methodology comes from a Vegetation Report prepared by ERO on May 16, 2017, and is attached to the decree.

The decree does require “The District shall establish ground cover on the Revegetation Land that is reasonably capable of sustaining itself under the climatic conditions, soils, precipitation, and terrain prevailing for the Revegetation Land with weeds and erosion adequately controlled.” The district is allowed to use supplemental irrigation to establish the revegetation. A status report on revegetation activities is required annually.

Review 6: Hill Ranch Transfer by Pueblo West 01-CW-152

The Hill Ranch water right transfer is an example from the upper Arkansas River basin where the revegetation requirement did not include any standards to be met. The requirement is that “all dry-up lands shall be revegetated using native seeds to the extent necessary to establish a weed-free, self-sustaining ground cover on the dry-up lands.

Pueblo West was required to provide water for two years following the dry-up of the lands for irrigation of revegetation by the landowners. The requirement came from a settlement agreement between Pueblo West and Chaffee County, which became part of the decree. In the place of standards, the agreement was for “Pueblo West to coordinate with local Chaffee County and NRCS officials in determining whether seeding or irrigation is needed...”

Notably, a recently modified settlement agreement is now in place with Chaffee County changing these requirements, allowing the County and District to develop appropriate establishment standards.

Review 7: Bessemer Irrigation Ditch Transfer by Pueblo Board of Water Works**17-CW-3050**

The recent transfer of Bessemer Irrigation Ditch water rights by the Pueblo Board of Water Works demonstrates the trend and desire to develop sound revegetation and resource protections for dry-up lands using appropriate standards and effective compliance provisions.

The decree requirement is "...lands will be revegetated with a ground cover of plant life demonstrated to be, without irrigation other than that required to initially establish such cover, reasonably capable of sustaining itself under climatic conditions, soils, precipitation, and terrain prevailing for the lands from which irrigation water has been removed. Grasses or other plants used for revegetation must not be phreatophytic or noxious."

The standard is the RFD Revegetation Standard with classes I through VII.

The compliance procedures require that after initial seeding, appropriate action must be taken to encourage and maintain revegetated growth until it is self-sustaining. Subject shares originating from a seller's farm will not be available for the Changed Uses and thus not converted to Designated Changed Shares until such irrigation ceases completely and revegetation is established as successful.

Annual reporting of the status of lands is provided by January 31 of each year.

Developing a Final Report specifies the terms and conditions necessary to maintain ground cover, with weeds adequately controlled under reasonably foreseeable conditions. Such terms and conditions will include provisions for ongoing monitoring of the Revegetation Land, classifications for the conditions, and management, which will be utilized if parcels are unsuccessful at maintaining their revegetation status. This decree is one of the few with a long-term maintenance provision.

Review 8: Revegetation and Dry Land Farming: Tri-State Amity Ditch Transfer**2007-CW-74**

In some decrees, there are provisions for either transition to dryland farming or revegetation on lands from which irrigation water is being removed. The Amity Ditch transfer 2007-CW-74 by Tri-State in Prowers County is one example. The standards of the decree are:

- Revegetation: Revegetation must meet Class VI or VII of the RFD Revegetation Standard table, generally a plant frequency of 15% or more.
- Dryland Farming: The requirement is for the parcel to produce a dry land crop when other dryland farming in the region is producing crops.
- Compliance Period: 5 years from the designation of lands permanently retired to establish and maintain with respect to the lands designated either dryland farming or ground cover, with weeds adequately controlled.

Review 9: LAWMA Highland Canal Transfer 02-CW-181

Another example is the Highland Canal transfer 02-CW-181 by Lower Arkansas Water Management Association (LAWMA). LAWMA was allowed a 10-year compliance period, including the requirement to seed once for revegetation or plant an appropriate dryland crop within the first five years. LAWMA is also required to provide annual reports documenting the progress to the court.

The revegetation standards for this transfer were developed in a stipulation between Bent County, LAWMA, and SECWCD (Southeastern Colorado Water Conservancy District) to require, for revegetation, a minimum standard of 30% basal ground cover on fine or medium-textured soils and 20% basal ground cover on coarse-textured soils. Weeds must be adequately controlled.

On dryland farming fields, a residue requirement minimum average basal ground cover of 30% requirement, with a minimum height for stubble and row spacing maximums, and the requirement weeds must be adequately controlled.

Compliance Periods: Both of these examples include compliance periods of five years from the time of permanent removal of irrigation water to meet the standards. Following these first five years, there is a five-year period where water available for new uses declines 20% per year until the percentage of completion is reached.

The requirements from the nine decree references provided above illustrate the various attempts that have been considered in developing revegetation and land protection measures

when transferring water from irrigation to municipal uses. These descriptions offer a look at requirements without including all of the detailed languages of the decrees.

Phase 2: Interview Comments

The second step in this project evaluation was conducting interviews with affected participants, including landowners, municipalities, and interested entity representatives. In particular, county commissioners dealing with the impacts of water transfers from irrigated agriculture to municipal uses provided comments and additional concerns or deficiencies they would like to see addressed as part of water transfers.

The additional deficiencies or concerns raised and discussed in the interviews have been compiled into these broad categories.

- A. Delineation of Responsibility for Revegetation
- B. Lack of Definition of the Criteria for the Revegetation Establishment,
- C. Weed Control Provisions are not Adequately Defined,
- D. Invasive Species Control
- E. Dry Land Farming Responsibility
- F. Oversight and Accountability During Revegetation Development
- G. Accessibility to Dry-Up Lands
- H. Post Establishment Maintenance of Revegetation
- I. Planning Established Vegetation Uses

These nine categories are further detailed below:

A. Delineation of Responsibility for Revegetation

An overriding concern was how the responsibility for land management protection is set and what/how accountability is attached. The delineation of responsibility to complete a revegetation requirement has been approached from two perspectives: water rights seller (usually a landowner) and water rights purchaser.

1. When a farmer/landowner sells a water right and separates the water from the land, the landowner can sometimes be responsible for conducting the revegetation activity. In the majority of cases, this model has not been successful.

For various reasons, the revegetation has not taken place or has not been successful. The landowner may not want to invest water sale dollars in protecting the land; the landowner may be an absentee owner and cannot find an operator to apply the needed practices or is unwilling to fund the revegetation process; the land may be sold post-water right sale and the new owner is either unaware of the revegetation requirement or does not have the financial resources to complete revegetation. In almost all cases, a landowner will find the costs very high. Indeed, the expected cost of the revegetation exceeds the value of the lands as dry grasslands.

2. A purchaser of water rights has the requirement to complete the revegetation of the land. In most cases, this requirement has been included with little consideration for rectifying deficiencies that may occur not being explicitly defined within the decree. Generally, the municipality has the resources to conduct revegetation activities if the requirement is in place. In some cases, covenants transfer responsibility back to the landowner. This approach leads to the same concerns as Item 1. above.

In either approach, the failure to complete revegetation on the dry-up lands must be addressed to ensure it is completed.

B. Lack of Definition and Uniformity of the Criteria for Revegetation

Establishment

The early decrees attempted to satisfy the need to revegetate the lands without any standards. More recent documents provided more detailed standards; however, some rely only on providing a process to be followed. This approach has led to confusion amongst entities on what is needed to meet the requirements successfully.

C. Weed Control Provisions: “Weeds Adequately Controlled” is not Defined

A common area of concern voiced by county commissioners of some revegetation projects was the issue of adequate weed control. A term that is not defined within the water transfer decree.

Weed control as a revegetation component during the establishment of vegetation in a dry-up parcel is critical to the effort's success. Weed infestations are very aggressive in their development, growing fast and, in the process, competing vigorously with the young grass seedlings planted for revegetation purposes. Indeed, weed infestations not controlled will outcompete grass seedlings for available moisture.

An observed practice is the allowance of weeds to grow to near maturity, then swath and bale the weeds for use as livestock feed. This process mines the soil of the available moisture and nutrients by the weeds to the detriment of the developing revegetation grass plants. This practice is incompatible with a revegetation program designed to conserve and protect the soil resource.

Uncontrolled weed proliferation or inadequate weed control activities potentially lead to nuisance weed issues such as accumulation on fence rows damaging fences or plugging up irrigation and drainage ditches. These types of issues need to be alleviated to the extent possible.

D. Invasive Species Control

Invasive animals, whether native or non-native, in particular Prairie Dogs, are detrimental to the lands being converted from irrigated agriculture and threaten the development of successful revegetation and maintenance. These pests must be controlled in the reclamation setting to allow the vegetation to develop and remain established.

E. Dry Land Farming Responsibility

Lands transitioning from irrigated farming to dryland farming require special consideration. Keeping irrigated land in farming production following the removal of irrigation water is a desirable opportunity when it is a feasible option. Of concern is whether dryland farming is feasible in parts of the southeastern Colorado area. Without deciding on the feasibility of dryland farming, there exists the concern of what happens to the land should dryland farming cease upon a parcel. Will it be revegetated if farming ceases? Who will be responsible?

F. Oversight and Accountability during Revegetation Development

In most instances, lands transitioning from irrigated farming to dryland vegetation should include an independent annual review of the revegetation project activities being conducted. Sometimes no record of the review is provided, or the project proponent provides an annual

report. Without an independent annual review, a couple of concerns arise. First, the lack of activity updates leads to questioning of proponent activities being appropriate, timely, and effective. Second, in some cases, it appears that less-than-expected revegetation and/or weed control was implemented in the revegetation process. This can be expected when there is a lengthy time period to reach establishment with minimal consequences for ineffective action.

G. Accessibility to Dry-Up Lands

Accessibility to lands being revegetated may be hindered by land ownership. Revegetation cannot be implemented if accessibility is limited or denied. The ability to access the dry-up land for revegetation purposes, monitoring, and establishment and maintenance activities must be assured. There needs to be flexibility for all parties needing access to the land, uninhibited.

H. Post Establishment Management of Revegetation

There is a concern for the continued maintenance of the vegetation following the successful establishment on previously irrigated lands. The concern is that while the young plants have reached a level of establishment, they are still more vulnerable than native grasslands. Most decrees that include revegetation requirements do not follow up with maintenance of the revegetation. The vulnerability to degradation can be due to the changed nature of the soils following years of irrigation and the additional development that the plants need. This, combined with an expectation that grazing can occur as it would on native lands, imperils the revegetation. It has been suggested that provisions should be developed which require maintenance for a period of time and demonstration the revegetation will remain and continue to thrive while the resource continues in its new uses.

I. Planning Established Vegetation Uses

The issue of post-establishment land use, while seemingly out of the realm of the water court, is appropriate to include here as it is related to the long-term maintenance of the revegetated lands. The most notable situation is the return of the revegetated land to grazing production, as in native grasslands. It is important to stress that the revegetated lands are NOT equal to native grasslands with stresses such as previously changed soil conditions and

associated impacts on the plant community. Therefore, it is appropriate to include conditions upon the grazing of these dry-up lands to protect the resource, at least during the maintenance period.

Another method of providing this protection suggested is the parcel placement into a type of conservation easement that would have the limitation on grazing methods and resource protection provisions. Such an easement could be administered through a third party, or the local county as deemed appropriate.

Phase 3: On-The Ground Field Reviews

The team field-reviewed several revegetation projects to understand the approach taken by various entities and the associated decree requirement. A wide variety of results were found, and many different approaches were taken to meet the requirements. Generally, the revegetation process uses two significant methods: supplemental irrigation and a dryland approach to revegetation.

Revegetation Field Observations:

Fields that had supplemental irrigation during the revegetation process generally established the native vegetation upon the dry-up fields. The only completely successful (at this time) revegetation projects reviewed employed supplemental irrigation to establish the revegetation on the dry-up fields.

- A. The dryland revegetation (without the use of supplemental irrigation) approach has been shown to re-establish vegetation in some parcels; however, successful revegetation using dryland methods is limited, and those in place are developing slowly.
- B. The selection of species was an issue as some of the species selected were non-native; although these species establish quickly, these species tend to decrease in number with drought conditions over time, leaving a marginal stand of grass.
- C. Weed control, improperly applied, or lacking, was a significant factor in successfully establishing acceptable vegetation.
- D. Not revegetating led to bare ground and weed problems. The establishment of native species in these conditions is unacceptably slow. Entities located close to the revegetation

site appeared to have a greater interest in successful revegetation and being a good neighbor.

E. Dryland farming, in most cases, was not successful.

Discussion of Issues and Recommendations for Alleviating Issues of Concern

Issues of concern were defined during the analysis of decree requirements, interviews with entity representatives, and viewing revegetation efforts in the field. Each of these issues are discussed here with appropriate solutions and suggested remedies. While solutions are listed below in the order, the issues were raised in the previous section, many of the solutions overlap. Specifically detailing the requirements within decrees will help address many of these concerns and issues.

A. Assignment of Responsibility for Revegetation.

The responsibility for successfully completing the revegetation of the dry-up lands should be clearly stated as the obligation of the water right owner. Whether the buyer or the seller conducts the revegetation, the obligation must be associated with the water rights.

As shown through the examples of some previous water transfers where the obligation has been transferred to landowner/water sellers, there is a high likelihood of failure or less than adequate revegetation of the dry-up lands. The potential for failure is intensified without a clear accountability provision with the use of the water right for new uses tied to the successful completion of the revegetation evaluation.

B. Lack of definition of the criteria for the revegetation establishment.

A uniform method of defining the requirements for successful revegetation should be provided, which can be generally applied and include provisions for modification as site-specific conditions may require.

NRCS technical documents and other references provide some reference material on revegetation processes leading to the establishment of permanent vegetation. Some of these references can be found in the Reference Section. Comparisons between existing revegetation sites and local native sites provide additional information which can be used with technical resources to develop appropriate establishment criteria. Several of the decrees reviewed have

included the RFD Revegetation Standard developed in one of the earlier decrees. Although this standard included management suggestions for developing vegetation, it is a useful reference for consideration in developing a reliable standard for inclusion in the water transfer decrees as a dry-up requirement.

This project developed proposed establishment criteria and associated evaluation methods for determining establishment through this review and evaluation. The specifics of the proposal are found in the Establishment Evaluation Criteria, Appendix II, with the particular establishment criteria excerpted here:

“A field shall be considered established when the basal cover of acceptable perennial dryland plants suitable for the climatic and soil conditions for this area, as referenced within the appropriate ecological site, shall be 15% or greater basal cover with no deficient areas larger than 1 acre in size over 90% of the field. Basal cover is the area of the ground surface, measured one inch above ground level, occupied by the basal portion of the plant.”

- The inclusion of the 15% basal cover here should be considered as a minimum, with consideration given to site-specific conditions.

In addition to the determination of grass stand establishment, there is the issue of how to measure establishing stands. Vegetation measurement is accomplished through vegetation monitoring. Monitoring both the developing and established vegetation is critical. Monitoring determines if management objectives are being met and provide a record of how vegetation changes over time. The issues with measuring and determining an adequate stand of grass are addressed in the “Revegetation Manual” along with several references. It should be noted that there are several vegetative monitoring techniques that can be applied. Choosing the specific project implementation and monitoring technique will consider the costs involved, time and labor availability to accommodate monitoring, along with goal consideration and accuracy requirements.

C. Weed control provisions are not adequately defined.

Weed control provisions have generally used the phrase “weeds adequately controlled” without additional definition. Adding a definition to this requirement will alleviate most of the

confusion associated with weed control concerns. Putting the defined requirement in place should also include accountability for compliance with the terms.

The proliferation of noxious and nuisance weeds must be prevented from the standpoint of not only revegetation and dryland farming success but from the perspective of avoiding interference with neighboring lands and improvements, such as fences and the operation of irrigation ditches and laterals.

The Revegetation Manual contains a complete discussion of weed control needs and appropriate practices. A suggested requirement for inclusion within a water transfer decree revegetation requirement would be:

Weed Control Management Goal: The goal of directing weed control management is to protect the soil resource, prevent causing a weed infestation nuisance, protect available soil moisture for crop or revegetation plants, and control and eradicate noxious weed infestations.

Adequate Weed Control: Weed infestations may be controlled using either mowing, herbicide application, biological control, or a combination. When weeds are mowed, they must leave a stubble of at least six-inch height. The mowing operations must be conducted before the weeds develop viable seeds and before weed height produces excessive litter. The residue from mowing must be left on the soil to protect it from solar evaporation. Low-growing weeds shall require herbicide application(s) for adequate control. Herbicide applications will be conducted before the weeds develop viable seeds.

Noxious and Nuisance Weeds:

Noxious Weed Definition: Noxious weeds are plants designated as a noxious weed species by the Colorado Department of Agriculture pursuant to the Colorado Noxious Weed Act, ([CRS 35-5.5-103](#) Definitions, Noxious Weed (16) (a-d))

A noxious weed is an alien plant or parts of an alien plant that have been designated by rule as being noxious or has been declared a noxious weed by a local advisory board and meets one or more of the following criteria:

1. Aggressively invades or is detrimental to economic crops or native plant communities.
2. Is poisonous to livestock.
3. Is a carrier of detrimental insects, diseases, or parasites.

4. The direct or indirect effect of the presence of this plant is detrimental to the environmentally sound management of natural or agricultural ecosystems.

Noxious weeds are aggressive non-native plants that crowd out native vegetation. The specific species of noxious weeds are those identified by the State of Colorado pursuant to the Colorado Noxious Weed Act, on the Noxious Weed List, at the time of field or parcel review. Any species on the "A" list must have an eradication program and be actively applied. Any species on the "B" or "C" list must have a control program in place and be actively applied. These lists can be found in the Colorado Department of Agriculture at <https://ag.colorado.gov/conservation/noxious-weeds/publications>.

Nuisance Weed Definition: Nuisance weeds are “a plant that interferes with management objectives for an area at a given point in time.” Stubbendieck, James L., “Weeds of the Great Plains,” page 1 (2003).

D. Invasive Species Control

Invasive species, particularly prairie dog control identified as a concern, have not generally been addressed within water transfer decree terms and conditions. The impact of developing and establishing revegetation is well understood; however, there exists the potential impacts upon neighboring lands without control requirements. Therefore, a provision requiring control of invasive species should be included within the water right change decree. Such a provision needs to run continuously throughout any retained jurisdiction period.

E. Dry Land Farming Responsibility

Lands transitioning from irrigated farming to dryland farming require special consideration. In some areas, dryland farming of these lands may be viable and economical. However, in many regions in southeast Colorado, dryland farming is marginal. With the changed soil conditions resulting from irrigated agriculture, these lands may not be successful as dryland farms.

All lands being dried up within a water transfer case should be subject to the requirement of land and soil protection provided through adequate revegetation. When a dryland farming option is allowed, additional conditions need to be in place that will provide for the revegetation

of the land should dryland farming of these lands cease or be found infeasible. The water rights holder should bear the continuing revegetation responsibility should dryland farming prove unworkable, as the dryland farmer may not have the resources to complete that revegetation process.

F. Oversight and Accountability During Revegetation Development

Oversight and accountability are linked in this discussion as oversight without consequences is nothing more than monitoring or reporting of activities being conducted. Two examples mentioned below illustrate the difference between not providing an incentive to produce results and consequences for unsatisfactory results, which can have very different results.

The first example is the case of the Highland Canal shares transferred by LAWMA in case 02-CW181. In this case, the decreed revegetation period started in 2007 with an expected 10-year reclamation period. While the decree required revegetation within a defined period with a loss of water use for changed purposes with non-compliance, LAWMA can lease the forfeited water for augmentation purposes instead of losing it completely. In this case, the penalty for non-compliance is substantially negated. Therefore, the incentive to conduct effective, appropriate, and timely revegetation activities is minimized. In this case, annual reviews were conducted; however, appropriate consequences for non-compliance were not in place to provide the accountability to go along with the reviews.

An appropriate example of oversight and accountability is found within the Aurora Rocky Ford Ditch transfer decree(s). The decree requirements include an annual status evaluation and report to the court and objectors by a court-approved panel of revegetation experts. In the Aurora case, successful revegetation was accomplished. Aurora's allowance to use the changed water rights for the new municipal uses was limited to a percentage of the water equal to the percentage of completion of the establishment of the revegetation on the dry-up lands. This approach was positively reviewed and commented on by the county.

The use of associated water rights for new uses must be tied to the successful completion of revegetation. This provides an adequate incentive to conduct efficient and effective revegetation of the dry-up lands. A potential flexibility provision could be an evaluation of whether the revegetation project is meeting interim progress standards. When in use, upon

meeting the interim steps, the entity may be allowed to use the water for other purposes than just for revegetation. A provision must be included that the water will be available for revegetation uses should the need arise.

G. Accessibility to Dry-Up Lands

The ability to access the land to conduct revegetation and oversee the management of the land following the successful establishment of the grasses needs to be explicitly defined within easements burdening the lands for a significant time. Such easements need to include a requirement of specific notification to the buyers of lands that have been dried up to avoid the inevitable confusion; when necessary, revegetation activities need to occur on the new landowner's property.

H. Post Establishment Maintenance of Revegetation

The change decree must implement a maintenance period requirement to protect the soil resource and revegetation. During this period, the water rights owner shall be responsible for maintaining the revegetation in an established state and is required to mitigate any deficiencies that may develop during this maintenance period. Water for new uses should be available during this maintenance period with the potential to use the water, if needed, for supplemental revegetation maintenance.

Indeed, there should be limitations on the use of the lands following revegetation. The revegetation of previously irrigated lands needs an increased level of management over what might be expected on native rangeland. Uses such as grazing, wildlife habitat and open space must be considered and subject to a program designed to enhance the revegetated lands with management objectives and oversight.

I. Planning Established Vegetation Uses

Early in the planning process, decisions about land use after revegetation is complete are needed. The decisions shape the selection of revegetation species. There is a need to consider future uses such as open space, recreation, and small acreage farms and ranches. All of the future land uses present problems and opportunities.

J. Protection of Soil Resources During Temporary Fallowing

Irrigated land which is temporarily fallowed provides an alternative use for the associated water rights instead of permanent dry-up through a decreed water use change. The land temporarily fallowed needs to have erosion protection to minimize damage to soils, neighboring lands, and county infrastructure. With a brief (one to three years) fallowing period, it may not be reasonable to expect the same revegetation requirement as permanent dry-up; however, some negative effects may need to be addressed. Neighboring farms and county infrastructure will still need protection from blowing soil and uncontrolled weed infestations.

The history of temporary water transfers in Southeastern Colorado's Arkansas River basin is limited, occurring primarily in recent years.

The City of Aurora conducted a large lease of water shares from the Rocky Ford High Line Canal for municipal use between 2004 and 2005. The city leased approximately 1/3 of the shares, temporarily fallowing the associated acreage. The terms and conditions of this temporary change of use, issued by the State Engineer Office, show that all requirements were related to water and dry-up issues with no land protection provisions during the plan's temporary fallowing and operation.

Lower Arkansas Valley Super Ditch and Lower Arkansas Valley Water Conservancy District have conducted leases through Pilot Project authorizations demonstrating the operation and viability of leasing using a rotational fallowing concept to provide water for municipal uses. This concept limits the fallowing of individual fields to three years within a ten-year period or 30% of the farm on a rotational basis with no more than three consecutive fallow years.

Beginning in 2007, following the Aurora/RF High Line lease of previous years, the Arkansas Valley Research Station conducted a study on the effect of fallowing land on the productivity of the land when returned to irrigation. This study focused on crop production and did not specifically address land protection measures. However, during the operation of the study, weed control on the fallowed lands was conducted to prevent weed issues from arising. As a result, it is helpful to note that fertilizer that had been applied to the lands at the beginning of the study remained and was available in the soil when the land was returned to irrigation following the various lengths of fallow periods.

Land Protection During Temporary Fallowing

Temporary fallowing of irrigated croplands may be for single years or potentially up to three consecutive years. Maintaining adequate protection of the land during these periods may be a challenging undertaking.

Land protection during temporary fallowing periods is similar to permanently dried-up lands with the additional consideration of preparing the lands to be reirrigated and crop production resuming.

1. **Crop Stubble Retention.** Preparation for temporary fallowing should include the management of the stubble from the previous season's crop. It should be left undisturbed upon the fields where it can provide optimal soil protection. The stubble should not be grazed as grazing removes some of the crop residue opening up areas of bare ground and disturbing the soil, which may lead to increased wind erosion.
2. **Alfalfa Field Management.** The current fallowing regulations require that alfalfa be killed or removed to prevent continued consumptive use of available soil moisture. Ideally, the alfalfa stands will be herbicide controlled from a soil protection standpoint, leaving the plant residue and stubble in place, and providing the necessary protection. When necessary, alfalfa can be killed with a sweep cutting the roots and leaving the stubble with minimal surface disturbance.

Plowing alfalfa fields is not recommended as exposing bare soils exposes the soil to wind erosion and excessive soil moisture loss. When plowing must be used, leaving the soil as cloddy and rough as possible is recommended to reduce the potential for wind erosion. Alternatively, a cover crop may be seeded and grown on these alfalfa fields as land protection measures.

3. **Open Field Management.** Fields with crops grown with little or no crop residue provide little or no soil protection. These fields can potentially become a nuisance with wind erosion for neighboring properties. Planning ahead of time for fallowing operations should include preparation to plant and grow a cover crop on these lands.
4. **Appropriate Cover Crops During Fallowing.**
Protection of the soil during a fallowing period, generally 1-3 years, is primarily through the provision or retention of stubble and plant residue, as discussed previously. In most areas of southeastern Colorado, the selection of crops to be grown without supplemental irrigation is limited. When growing a cover crop with the main objective of soil

protection, a crop with a substantial stalk is preferable. Some small grains can be grown without the aid of irrigation for this purpose.

Weed Control on Fallowed Lands.

Weed control during fallowing periods is vital as untreated weeds utilize the same soil moisture as a growing crop. During some fallowing operations, dryland farming is allowed on the fallowed fields. Thus, the available soil moisture protection is necessary for the potential of growing a crop. The weed control measures necessary would be the same as with revegetation activities with the additional option of cultivation to reduce the weed pressure.

Suggested weed control provisions to be considered are:

Weed Control Management Goal: The goal of weed control management is to protect the soil resource, prevent causing a weed infestation nuisance, protect available soil moisture for crop or revegetation plants, and control and eradicate noxious weed infestations.

Adequate Weed Control: Weed infestations may be controlled using either mowing, herbicide application, biological control, or a combination. When weeds are mowed, they must leave a stubble of at least six-inches in height. The mowing operations must be conducted before the weeds develop viable seeds and before weed height produces excessive litter. The residue from mowing must be left on the soil to protect it from solar evaporation. Low-growing weeds shall require herbicide application(s) for adequate control. Herbicide applications will be conducted before the weeds develop viable seeds.

Noxious and Nuisance Weeds:

Noxious Weed Definition: Noxious weeds are plants designated as a noxious weed species by the Colorado Department of Agriculture pursuant to the Colorado Noxious Weed Act, ([CRS 35-5.5-103](#) Definitions, Noxious Weed (16) (a-d)

A noxious weed is an alien plant or parts of an alien plant that has been designated by rule as being noxious or has been declared a noxious weed by a local advisory board and meets one or more of the following criteria:

Establishment of Annual Cover

The process of establishing annual cover on fallowed lands can be considered the same as dryland cropping on these fields. These recommendations are intended to be applied to both situations as applicable.

Fields to be fallowed in the following season should be pre-irrigated if possible or allowable. Precipitation in southeast Colorado is sporadic and often below historical average, with limited years of above-average precipitation. Soils under irrigation for many decades have unique chemical and physical issues. Soil characteristics combined with marginal precipitation may make establishing temporary cover difficult to impossible. There may be an accumulation of salts that will inhibit annual crop growth. Decades of fine soil deposition may render the soil less able to take in water from rainfall or less available to roots, making the soil more droughty than native soils. Compacted plow pan layers may have developed over time, limiting the degree and depth of root penetration. Examples of successful dryland crop production on formerly irrigated land in Bent / Otero counties are rare.

Recommendations:

The farmer desiring to grow a crop should be prepared to take immediate advantage of limited precipitation and timing of precipitation. Planting into moisture when available likely will provide the best opportunity for success. The specific conditions during the fallowing year suggest that multi-species of annual crops be considered to take advantage of the timing of limited, sporadic precipitation. Single-species plantings can be used as well.

Spring or early summer moisture

Grain crops such as barley, wheat, and triticale, and broadleaf plants such as canola, turnips, cabbage, and peas all designed for forage. Refer to the local Extension Service for other crop possibilities.

Summer moisture

Grain crops such as millet, forage sorghum, teff, corn, broadleaf plants such as sunflower, buckwheat, safflower, squash, and amaranth are possibilities. Refer to the local Extension Service for other crop possibilities.

Weed control, especially prior to planting, is vital as a field of annual weeds consumes the same amount of water as a crop. Including broadleaf plants in the seed mix, will severely limit herbicide choices.

Emergency Soil Erosion Control:

Emergency soil erosion control in the event of soil erosion should be employed. Below is an example of emergency erosion control. This example is from Section IV of the Natural Resources Conservation Service Field Office Technical Guide: *Natural Resources Conservation Service: Conservation Practice Standard – Cross Wind Ridges*

Definition

Soil ridges formed by tillage, planting, or other operations and aligned perpendicular to prevailing wind direction during critical wind erosion periods.

Purpose

This practice is used to accomplish one or more of the following purposes: Reduce wind erosion Improve plant productivity and health. Reduce emissions of soil particulate matter.

Conditions Where Practice Applies

This practice applies to cropland with stable soils to sustain effective ridges and cloddiness, such as loamy and clayey soil materials. It is not well adapted to sandy soils and certain organic soils.

Criteria

General Criteria Applicable to All Purposes

Design the ridge orientation, height, spacing, and time period that ridges are present using the currently approved wind erosion prediction technology and account for other practices in the conservation management system.

Design the orientation of ridges during critical erosion periods not to exceed 45 degrees from perpendicular to erosive wind direction.

Design the spacing between ridges to be no more than four times the designed height of the created ridges.

Considerations

Crosswind ridges should be oriented perpendicular to the direction of erosive winds to be most effective.

Summary: Recommended Decree Terms and Conditions Needed for Land Protection

This project identified several shortcomings in water transfer decrees regarding the protection of lands being dried up. These shortcomings have led to some less-than-desirable outcomes on the lands. As determined through the research and interview process employed in the project, the type of requirements that need to be in place have been identified. The following is a list of topics that should be considered in future decrees.

1. The responsibility for completing the revegetation requirement must be clearly delineated.
2. The availability of water for new uses should be tied to the successful completion of the revegetation requirement.
3. Species seeded must be required to be native to the area. Non-natives species included within a seed mix should be a small percentage to prevent the initial establishment, followed by die-out by species not adapted to the local environment.
4. The timeline for when the revegetation must be completed must be determined. Intermediate checkpoints to be met should be included.
5. Revegetation establishment criteria should be adequately defined. Included should be details of the monitoring methodology to be used in determining adequacy of revegetation.
6. The definition of adequate weed control criteria must be maintained throughout the revegetation process and in place to successfully establish the vegetative cover on the dry-up lands.
7. A provision for control of invasive species, including animal species, should be included.
8. Oversight and accountability of the project need to be in place, providing the unbiased evaluation of activities and status of a revegetation project.
9. Broad, long-term land access needs to be ensured for all revegetation and monitoring activities throughout the revegetation and maintenance periods.
10. Provisions for the continued maintenance of revegetation and weed control following the establishment of adequate vegetative cover on the dried-up lands.

11. Protection of the revegetated cover from “sod busting” or other activities that could result in the destruction of vegetative cover after successfully completing the revegetation requirement should be included within the decree.
12. Dryland farming needs to be defined as to what is required, the standard for successful dryland farming, and the responsibility for revegetation should dryland farming failure occur.
13. Provisions should include flexibility for the ultimate use of the land and maintenance, whether through a protective grazing plan or other habitat uses.

Including these items within a transfer will significantly enhance the effectiveness of the revegetation program. This model will fill a void that currently exists, protecting the soil resource when a water transfer occurs.

Revegetation Program Development and Implementation Manual

The team reviewed the methodology used on various sites and reference material on revegetation and revegetation process in developing the “Revegetation Program Development and Implementation Manual” to provide a roadmap of a proven methodology for the activities needed to complete revegetation of previously irrigated lands in Southeastern Colorado. See Attachment IV.

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APPENDIX I. RFD REVEGETATION STANDARD

Through a stipulation in the Rocky Ford Ditch transfer case 83-CW-18, the city of Aurora and objectors developed the first revegetation classification standard. This classification standard was included and applied within a water transfer decree to evaluate revegetation. This field classification standard has eight classifications for developing and established fields. The first six, classes I through class V, are for developing fields, and classes VI and VII indicate established fields. This classification system, dated October 15, 1992, follows:

REVEGETATION CLASSIFICATION

October 15, 1992

- | | |
|------------|---|
| Class I | Full seeding and irrigation needed, either first seeding or reapplication of seeding. Desired plants scarce or absent. |
| Class II | Seeding and irrigation completed. Stand undetermined. Usually, the beginning of the second growing season following seeding. (All fields seeded and irrigated in 1992 will be called class II.) |
| Class III | Stand is variable. Part of the field has an adequate stand and part does not. Plants may be juvenile plants to well-developed mature plants. More than 10% of the field has an inadequate stand on areas exceeding one acre in size. Plant frequency of desirable plants in deficient areas is less than 10%. (These deficient areas need reseeding.) |
| Class IV-A | Stand is inadequate, frequency is less than 10%, but plants are fairly well distributed over field. May need to be reseeded. |
| Class IV-B | Stand is inadequate, frequency is between 10% - 15%. Plants are uniformly distributed over the field. No further seeding is currently recommended as the stand is expected to develop. |
| Class V | Stand appears to be adequate, but the root system is undeveloped. There are 8 or more desirable plants per ring. Potential is good for stand establishment. (Generally, the first growing season but could be the second growing season.) |

- Class VI Stand adequate. Plants well rooted. Desirable plant frequency in the range of 15% to 20 per cent. (Can be the second growing season but more likely the third growing season and beyond.)
- Class VII Stand adequate. Plants well rooted with vigorous top growth. Desirable plant frequency of 20 to 30 per cent or more over 90% of the field. No deficient areas of more than one acre in size. (Generally, the third growing season and beyond.)

In addition to developing the classification, a listing of revegetation activities associated with the classifications was included within the stipulation excerpted here:

“...Aurora will conduct further revegetation activities in good faith which activities may include, but are not limited to, the following:

For fields in Class I

Seeding, irrigation, herbicide application, and mowing

For fields in Class II

Herbicide application and mowing

For fields in Class III

Spot seeding and irrigation, herbicide application, mowing, and grazing

For fields in Class IV-A

Spot seeding and irrigation, herbicide application, and mowing

For fields in Class IV-B

Herbicide application, mowing, and grazing

For fields in Class V

Spot herbicide application and grazing

Aurora may do any spot seeding and irrigation in any of Class I through Class V in its good faith determination that such activity is necessary for revegetation. As fields matriculate through the classifications, Aurora will continue appropriate revegetation activities....”

The combination of the Rocky Ford Ditch field classification system and the management applications has been adopted within several following water transfer decrees in the Arkansas River basin.

APPENDIX II. RECOMMENDED ESTABLISHMENT EVALUATION CRITERIA

The use of a uniform revegetation evaluation criteria that can be used in future water transfer decrees would be helpful to all involved. The recommended criteria here have been developed and evaluated in varying locations within southern Colorado and have proven effective. The use of these criteria in association with the methodology provided will reduce confusion and provide the uniformity needed.

Establishment Evaluation Criteria:

A demonstrated and effective criterion for determining the establishment of a revegetation field in southeastern Colorado is:

A field shall be considered established when the basal cover of acceptable perennial dryland plants suitable for the climatic and soil conditions for this area, as referenced within the appropriate ecological site, shall be 15% or greater basal cover with no deficient areas larger than 1 acre in size over 90% of the field. Basal cover is the area of ground surface, measured one inch above ground level, occupied by the basal portion of the plant. It is different from foliar cover.

Evaluating fields using this criterion is efficiently accomplished using the suggested methodology below. (While the following methodology is suggested, other monitoring methodologies are available which could be selected.)

Methodology for evaluating basal cover of acceptable perennial dryland plants:

The cover shall be measured using a point intercept method where transects are taken diagonally to the drilled seeding on the field. At each interval, a point shall be evaluated for acceptable plant basal material. The percentage of "hits" to the total points evaluated shall be determined.

In taking the transect, each appropriate perennial, native plant must be healthy and well established, likely three years of age or older, to be counted.

Fields shall be evaluated at or near the end of the growing season on an annual basis.

Evaluation Factors

Prior to evaluation, each field shall have received only natural precipitation with no supplemental irrigation during the season before the establishment evaluation. This condition is important to ensure that supplemental irrigation has no undue influence during establishment evaluation.

Weeds shall have been adequately controlled with no evidence of weed infestations and noxious weed infestations.

APPENDIX III. RECOMMENDED FIELD CLASSIFICATION SYSTEM

We have described a standard of minimum basal cover criteria for evaluating whether or not a field has reached establishment. However, several years may be between planting a new seeding and successful establishment. During this time, it is useful to have a classification system to document the progress made in each field at the end of the growing season.

Classification systems can be developed to meet a particular project's specific needs. An early classification system developed for the Rocky Ford Ditch revegetation program included seven categories, each with a different cover density and management stage. See Appendix I, Appendix I "The Revegetation Standard" attached to the Evaluation of Land Protection Measures report. This standard is generally adequate, although more complex than is necessary for most uses. Here we recommend a simpler revegetation classification system for annual monitoring and classification of revegetation. Apply after the second growing season.

Class 1 0-5% basal density

Field needs close monitoring and potentially reseeding after the second growing season.

Continue with weed control and supplemental irrigation.

Class 2 6%-9% basal density

Seeding may need additional supplemental irrigation and continued weed control for development. Spot reseeding may be needed

Class 3 11-14% basal density

Seeding is developing well, requiring continued weed control and monitoring.

Class 4 15% basal density and above

Seeding has reached establishment.

A classification system such as this is recommended for monitoring revegetation progress over time.

APPENDIX IV. REVEGETATION MANUAL

Revegetation Program: Development & Implementation