2015 Annual Report

H.B. 13-1248 Catlin Canal Company Rotational Land Fallowing-Municipal Leasing Pilot Project

Submitted by

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I. Executive Summary

The Catlin Pilot Project is a ten-year undertaking to make senior water rights available for municipal use through the rotational fallowing of irrigated lands in the Lower Arkansas River Basin. The Catlin Pilot Project provides up to 500 acre-feet of water per year to three municipal water providers – the Town of Fowler, the City of Fountain, and the Security Water District. It uses 1046.83 shares in the Catlin Canal Company shares that historically have irrigated approximately 1,000 acres of lands on six farms. The Colorado Water Conservation Board (CWCB) approved the Catlin Pilot in 2015 and this was the first year of operations. Figure 1 on page 3 shows the general locations of Catlin Pilot Project components.

> ***"I see leasing-fallowing as our alternative to buy and dry and I thought our first year of the pilot project went really well."***
>
> *~Eric Hanagan, participating farmer*

By all accounts, the Catlin Pilot Project operated successfully in 2015. Over 400 acre-feet of water was supplied to the Municipal Participants. The Catlin Pilot Project consistently met all return flow obligations and the recharge ponds used to make those return flows performed well. Exchanges into Pueblo Reservoir were operated at all times requested to deliver water supplies Fountain and Security. The fallowing of fields went smoothly and the participating farms received an average of $1,030.94 per fallowed acre.

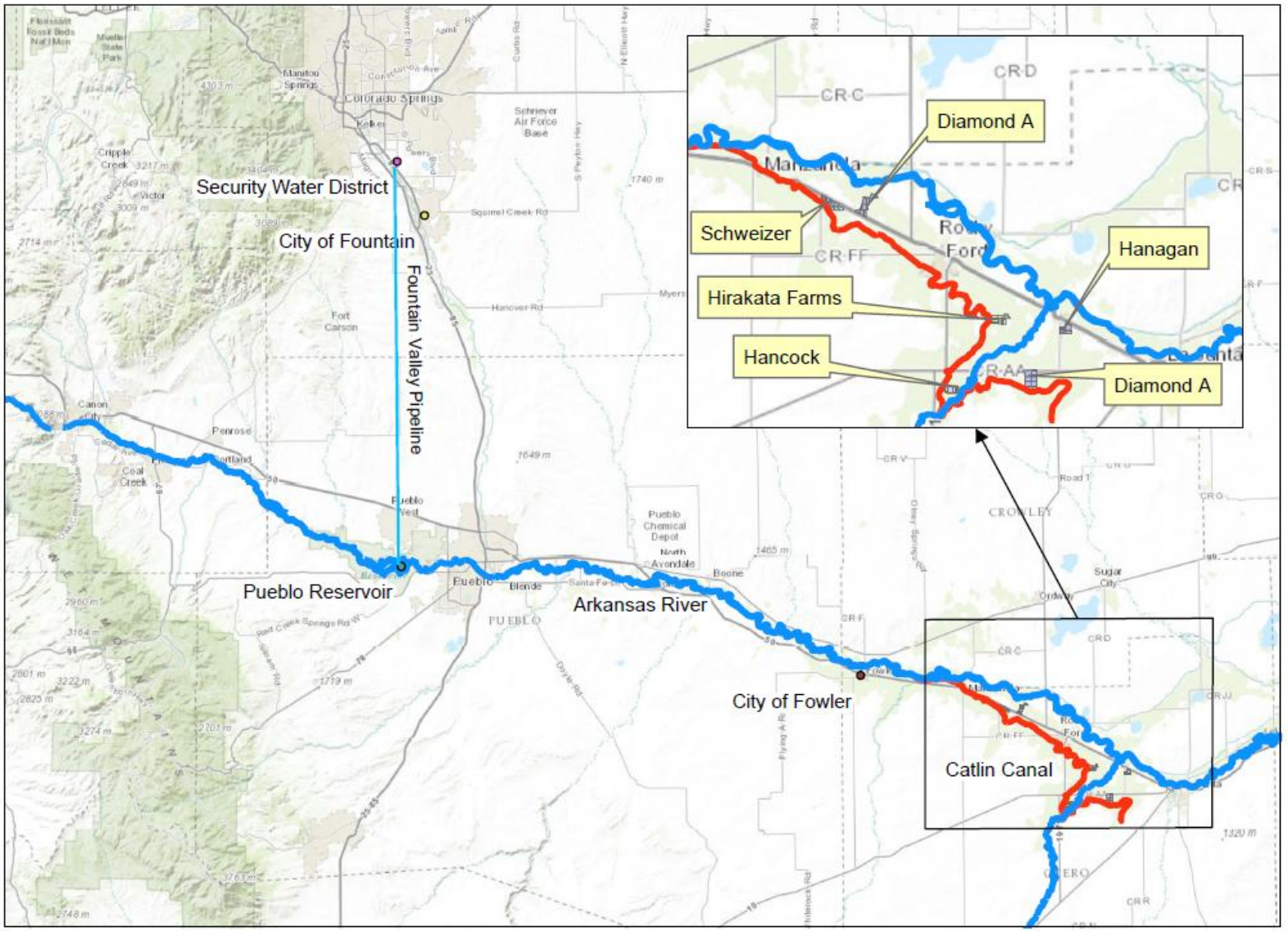
Experience gained during Catlin Pilot Project operations has already begun to identify ways to streamline operations and administration for this and future rotational fallowing-leasing projects. Obstacles to operation of rotational fallowing-leasing were recognized and successfully addressed through cooperation and communication among the State and Division Engineers, water users, Kansas, and the Catlin Pilot Project. Importantly, 2015 operations increased irrigators' interest rotational fallowing-municipal leasing and reduced user's anxiety about temporary transfers for municipal use by demonstrating the successful exchange and delivery of wet water to the Municipal Participants. Success of the Catlin Pilot Project is significant in that it reflects the first "proof of concept" in Colorado for rotational land fallowing-municipal leasing as a viable alternative to the permanent buy-and-dry of agricultural lands.

The Catlin Pilot Project is already successfully meeting the legislative policy goals articulated in H.B. 13-1248. The streamlined approach embodied in the Lease Fallow Tool (LFT) proved to be an efficient means to calculate water available for lease and determine return flows owed to avoid injury to other water rights holders and to ensure compliance with the Arkansas River Compact. Just as significant, the LFT facilitated and expedited the application and approval process. The innovative H.B.13-1248 conference process involving the applicants, commenting parties, the CWCB, and State and Division Engineers capitalized on the common platform of the LFT, and proved to be an especially efficient and useful forum to define issues and develop operating terms and conditions.

> ***"We are very pleased to see the Super Ditch go from concept to reality and we were able to make good use of the water in 2015. This is a great win-win alternative over traditional methods that will enhance future sustainability".***
>
> *~Curtis Mitchell, Utilities Director*

This first year of operations successfully demonstrated that rotational land fallowing - municipal leasing can be a viable alternative to permanent buy-and-dry. This is a critical mission of the Lower Arkansas Valley Water Conservancy District and the Lower Arkansas Valley Super Ditch Company. It is also central to the goals of the Colorado Water Plan, the CWCB, the Interbasin Compact Committee, and basin roundtables. The Lower Arkansas Valley Water Conservancy District and the Lower Arkansas Valley Super Ditch Company are excited about the 2015 results of the Catlin Pilot Project and remain committed to continuing operation of this important and pioneering project.

Figure 1 – Catlin Pilot Project Overview Map



II. Background

On January 27, 2015, the Colorado Water Conservation Board (CWCB) approved the Catlin Pilot Project – the first rotational land fallowing – municipal leasing pilot project under HB 13-1248 (codified at C.R.S. § 37-60-115(8)) and the *Criteria and Guidelines for Fallowing-Leasing Pilot Project*s (November 19, 2013) (Criteria and Guidelines). The Lower Arkansas Valley Water Conservancy District (Lower Ark) and the Lower Arkansas Valley Super Ditch Company, Inc. (Super Ditch) were co-applicants. As required by statute, the State Engineer issued a written determination on January 16, 2015, outlining terms and conditions upon which the Catlin Pilot Project could operate without causing injury and without impairing compliance with any interstate compact. The CWCB's approval is subject to the terms and conditions contained in the State Engineer's Written Determination, and an additional term and condition set forth in a letter dated January 26, 2015, from the Colorado Division of Parks and Wildlife (CWCB Approval). A timeline of the approval process is illustrated at the end of this section.

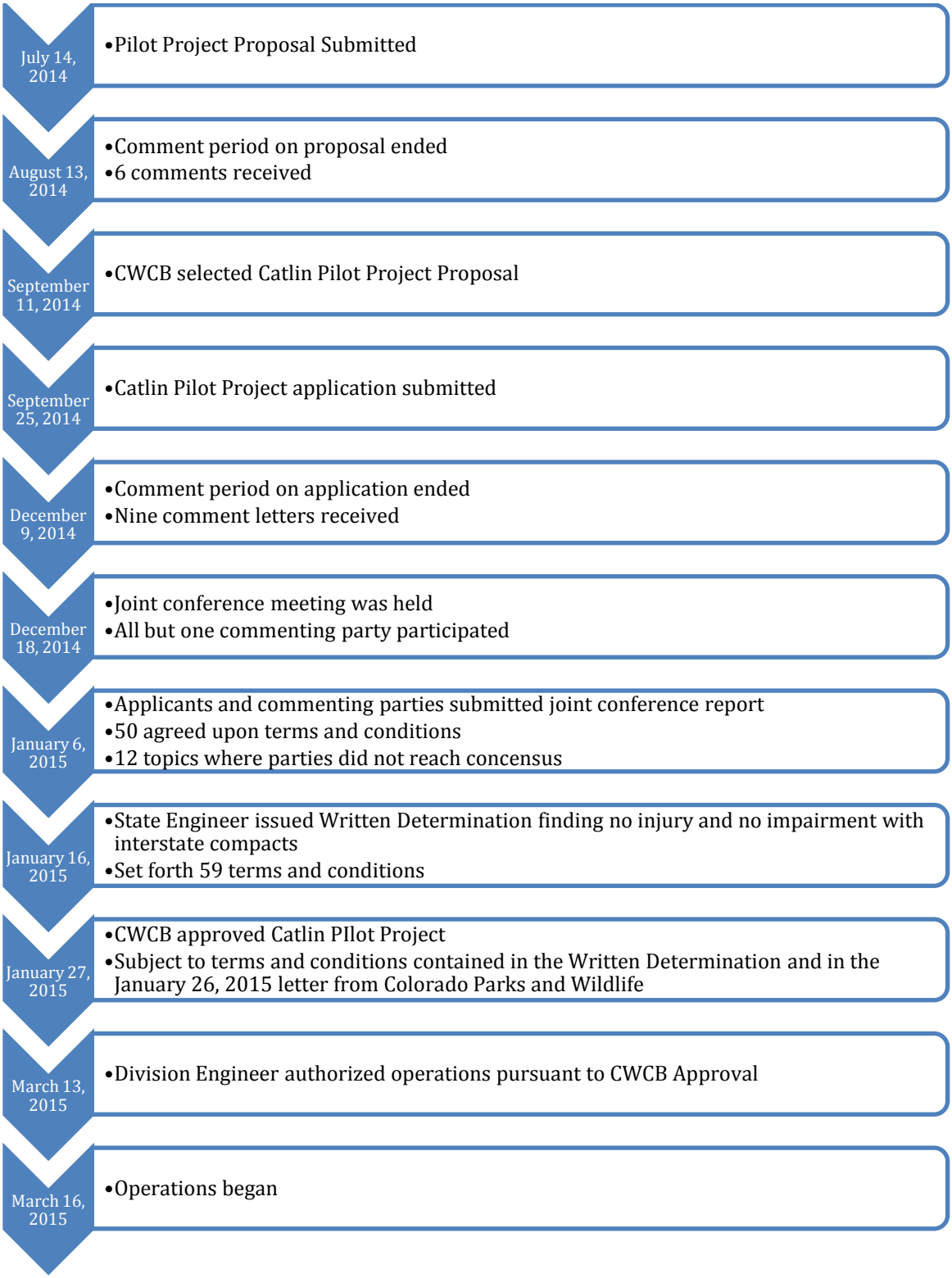
This annual report is being submitted pursuant to the CWCB Approval. Specifically, Condition No. 52 provides:

> *Applicants shall annually prepare a report of Pilot Project operations that will be submitted to the CWCB and the State and Division Engineer on or before January 15 of each year, which shall reflect a reporting year of November 16 of the prior plan year through November 15 of the current plan year for which the report is being prepared. This annual report will present: (a) a summary of plan year accounting, including the total amount of acres and Subject Shares fallowed, plan-year deliveries to the Subject Shares, HCU credits generated, water exchanged for Fowler-CWPDA Municipal Well Replacement, water exchanged to Pueblo Reservoir for Fountain and Security, water exchanged to Pueblo Reservoir for lagged return flow replacement, tail water return flow obligation replaced and un-replaced, lagged return flow obligation replaced and un-replaced, sources of water used to meet lagged return flow obligation, future lagged return flow obligation and firm yield source of water that will be used to meet lagged return flow obligation; (b) any accounting errors or deficiencies discovered during the plan year and any accounting modifications that were made during the plan year or are proposed to be made for the upcoming year; (c) the number of days, if any, when there were un-replaced return flow obligations; (d) efficacy of the LFT, temporary dry-up, prevention of erosion, blowing soils and noxious weeds and re-irrigation of temporarily fallowed lands; (e) information regarding the parcels that have been dried up to date and years of such dry up to demonstrate that the limitations contained in term and condition 2 have not been exceeded; (f) a summary of costs associated with pilot project operations, including lease payments made/received, operational costs, and to the extent available costs of erosion prevention and noxious weed management; (g) identification of any obstacles encountered in pilot project operations; (h) any additional terms and conditions that Applicants believe may be necessary to prevent future material injury to other water rights or contract rights to water; and (i) any proposed minor operational modifications for the upcoming plan year, including and limited to the addition/modification of accounting forms, projection forms, storage locations, recharge facilities, and/or augmentation stations. Any proposed operational modifications shall be accompanied by such information and analysis as is necessary for the State*

and Division Engineer and any interested parties to evaluate the potential for injury resulting from such proposed changes.

As the first-ever pilot project, this report goes beyond the specific requirements of Condition No. 52 and provides additional extensive information on other aspects of the Catlin Pilot Project's 2015 operations and accounting to establish a foundation to facilitate future pilot projects.

A. *Summary of the Approval Process*



III. Project Operations Summary

The Catlin Pilot Project involves the rotational fallowing of lands located on six farms irrigated under the Catlin Canal in the Arkansas River Basin. This project makes available up to 500 acre-feet of water for lease to three municipal water providers – the Town of Fowler, the City of Fountain, and the Security Water District (Municipal Participants). The Catlin Pilot Project uses shares historically used to irrigate lands located on the Schweizer, Diamond A West, Hirakata, Hancock, Diamond A East, and Hanagan Farms (Participating Farms). The Participating Farms currently are entitled use a total of 1046.83 shares of the Catlin Canal Company and the fallowing of up to 902.2 associated acres is authorized by the CWCB Approval.

> ***Why were Colorado Parks and Wildlife Catlin Shares Removed from the Project?***
>
> At the time of the CWCB Approval, Colorado Parks and Wildlife (CPW) raised some concerns that some of the Participating Farms may have, at times, leased Catlin Canal Company shares from CPW. Condition No. 11 in the CWCB Approval provided that Applicants and CWP should work cooperatively to determine whether and the extent to which lands included in the Catlin Pilot Project had been irrigated with Catlin Canal Company shares that were leased from CPW. Applicants conducted interviews with participating farmers and CPW reviewed their available lease documents and corresponding headgate information numbers to try and ascertain locations where CPW shares were used. Based on that information, it was determined that CPW shares had been used on portions of two farms during the study period. For these farms, irrigated acreages proportional to the number of those farms' shares not leased from CPW and used to irrigate Catlin Pilot Project lands were included in a modified LFT run to calculate the consumptive use water available to the project. This information was submitted in accordance with the CWCB Approval by letter dated February 13, 2015.

On March 13, 2015, the State Engineer authorized Catlin Pilot Project operations to begin. Water deliveries under the Catlin Pilot Project began on March 16, 2015, which corresponded with the first water deliveries made to the Catlin Canal. Catlin Pilot Project operations ended on November 14, 2015, which corresponded with the end of the season for deliveries under the Catlin Canal Company direct flow water rights and the beginning of the Winter Water Storage Season for Pueblo Reservoir.

In advance of operations and as required by the CWCB Approval, Applicants submitted for final approval by the Division Engineer for Water Division 2 (Division Engineer) the accounting forms, a revised lease-fallowing tool analysis based on reductions in irrigated acreage and removal of Catlin Canal Company shares leased from Colorado Parks and Wildlife (see sidebar), and a "pay as you go" analysis for meeting return flow requirements (discussed in Section V.B).

A. Hydrologic Conditions in 2015

As the Catlin Pilot Project began operations in mid-March, snowpack in the Arkansas Basin hovered near the historical average. During the first month of pilot project operations, however, snowpack declined considerably and it appeared that a dry year with below-average river conditions may be at hand. By the first week of May, hydrologic conditions shifted dramatically. Heavy rains began to inundate Colorado Springs and surrounding areas, causing Fountain Creek and the Arkansas River to flood. Although high flows allowed the Catlin Canal's most junior water right to be in priority throughout the remainder of May and into most of July, local rains and fears of a canal breach prevented the Catlin Canal Company from diverting its full water rights until late June. In order to prevent more severe flooding on the mainstem of the Arkansas River downstream of Fountain Creek, Bureau of Reclamation temporarily ceased releases from Pueblo Reservoir. When flood levels subsided, this stored water was released back to the river. These releases and above-average runoff maintained above-average river flows throughout the remainder of the 2015 irrigation season.

B. Fallowed Lands and Shares for 2015

For 2015 operations, the Participating Farms fallowed 234.8[1] acres, consisting of 13 distinct parcels, as shown on the aerial photos included in **Appendix A** (2015 Fallowed Acreage). Figure 2 on the following page shows the general location of each Participating Farm. There were 252.14[2] shares associated with the 2015 Fallowed Acreage (2015 Shares). H.B. 13-1248 and the Criteria and Guidelines limit the fallowing of lands in a pilot project to no more than three years in ten, or 30% of each farm. In 2015, fallowed land represented 26% of the total historically irrigated acreage included in the Catlin Pilot Project and no more than 30% of the acreage of any farm was included in 2015 operations. The 2015 Fallowed Acreage and 2015 Shares are summarized by Participating Farm on Table 1 as follows on the next page:

26% of the historically irrigated lands included in the Catlin Pilot Project were fallowed during 2015.

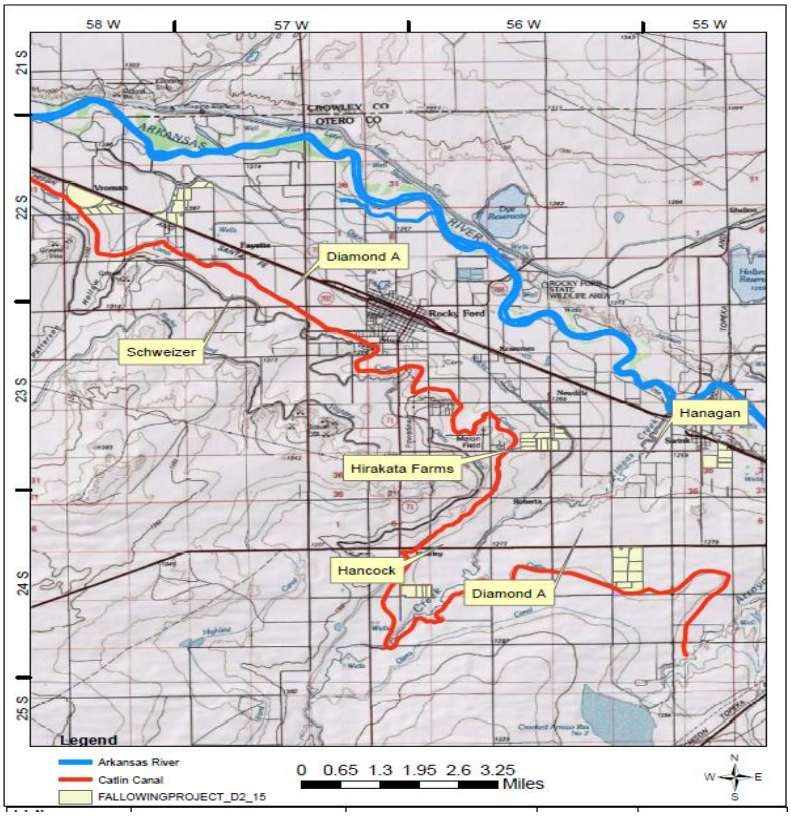
[1] This was reduced beginning in September by 0.5 acre to account for a dividing furrow that overtopped and saturated a small portion of a fallowed parcel, as discussed later in the report.
[2] Along with the 0.5 acre reduction in the 2015 Fallowed Acreage, there was a corresponding reduction in the 2015 Shares in September from 252.14 to 251.63.

Table 1 – Fallowed Shares, Acreage and Parcel ID for 2015

Farm Name	# Shares Fallow	Pilot Project Fallowed Acreage	Measured Fallow Fields	Fallowed Parcels by Parcel ID
Schweizer	31.09	30.6	30.6	22573220 & 22573224
Diamond A West	48.53	36.1	37.2	23570414 & 23570415
Hirakata Farms	38.30	36.4	36.4	23562808, 23562823, 23562834 & a portion of 23562813
Hancock	24.52	22.7	22.7	24560711 & most of 24560722
Diamond A East	76.01	76.3	76.3	24561101 & 24561102
Hanagan	33.69	32.8	32.8	Most of 23563603
Total	252.14	234.8	235.9	

Lower Ark developed a spreadsheet-based tool to track parcels fallowed during the ten-year Catlin Pilot Project to ensure compliance with statutory limits on the frequency and extent of fallowing. Lower Ark will add parcels to this tool as they are included in future years' operations. This tool is included in **Appendix B**.

Figure 2 – Location Map of Participating Farms



C. Water Generated from 2015 Operations

In 2015, the Catlin Pilot Project delivered a total of 1211.75 acre-feet of water. This represented nearly all of the Participating Farms' pro-rata portion of Catlin Canal headgate deliveries associated with their 2015 Shares. As discussed in later sections of this report, the Catlin Pilot Project delivered slightly less than the total pro-rata entitlements of the Participating Farms due to typical difficulties associated with monitoring deliveries to various locations while not exceeding pro-rata deliveries. Deliveries were assigned to one of three categories: (1) consumptive use water available to the Municipal Participants; (2) tailwater return flow obligations; and (3) deep percolation return flow obligations (see sidebar for definitions).

The results of the historical consumptive use analysis conducted for the Catlin Pilot Project application indicated that the 2015 Shares associated with the 2015 Fallowed Acreage would provide 365.5 acre-feet per year on average. In fact, results for 2015 operations were above average because the 2015 water year was wetter than average. The Catlin Pilot Project operations generated 438.45 acre-feet in consumptive use water. The following table[3] provides an overview of water delivered to the Catlin Pilot Project during 2015 operations.

Can you define that?

Consumptive Use Water. The portion of the water delivered to the shares included in the Catlin Pilot Project that is available for municipal use by the Municipal Participants. It is calculated by applying a "consumptive use factor" to the deliveries to arrive at the portion of the delivery that was historically consumed through irrigation of the parcels that were fallowed as part of the Catlin Pilot Project.

Tailwater Return Flow Obligations. The portion of the water delivered to the shares included in the Catlin Pilot Project that was applied to the fallowed parcels, but was not consumed by the crop being irrigated and historically returned to the Arkansas River as surface runoff. The tailwater return flow obligations were required by the Criteria and Guidelines to be calculated as the total pilot project farm headgate deliveries minus the maximum consumptive use portion of the delivery, multiplied by 20%.

Deep Percolation Return Flow Obligations. The portion of the water delivered to the shares included in the Catlin Pilot Project that was applied to the fallowed parcels and infiltrated the soil, but was not consumed by the crop being irrigated and historically returned to the Arkansas River as deep percolation. The deep percolation return flow obligations required by the Criteria and Guidelines to be calculated as the total pilot project farm headgate deliveries minus the maximum consumptive use portion of the delivery, multiplied by 80%.

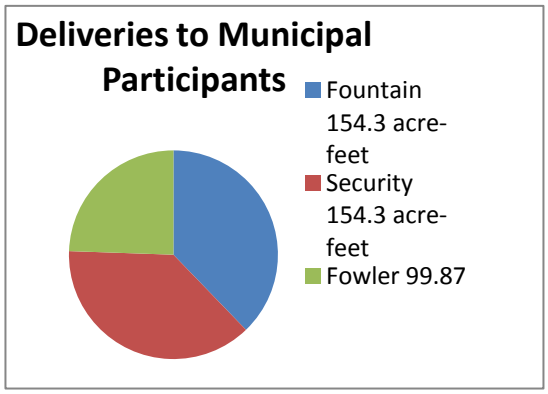
[3] An accounting spreadsheet error resulted in the Total Pilot Project Deliveries reflecting Catlin Pilot Project pro-rata canal headgate deliveries. This resulted in a minor overestimated potential consumptive use deliveries and return flow obligations. This is discussed in Section VIII.C of this report.

Table 2 - Deliveries, Consumptive Use and Return Flow Obligations (AF)

Month	Pro-Rata Total Pilot Project Deliveries	Actual Total Pilot Project Deliveries	Maximum Consumptive Use Portion of Delivery	Delivered CU Water	Tailwater Return Flows Obligation	Deep Percolation Return Flow Obligation
March	105.75	103.22	10.03	10.03	18.64	74.56
April	149.45	145.06	21.80	21.80	24.62	98.49
May	84.68	93.44	30.83	24.04	12.52	50.09
June	155.60	158.82	81.18	78.59	15.53	62.11
July	225.32	205.51	107.20	107.20	19.53	78.11
August	197.74	191.51	98.17	98.07	18.28	73.12
September	129.95	126.94	51.60	51.26	15.00	60.02
October	148.97	138.85	29.11	29.11	21.95	87.79
November	49.26	48.40	8.54	8.54	7.97	31.89
Total	**1246.71**	**1211.75**	**438.45**	**428.63**	**154.04**	**616.18**

The slight variation between the pro-rate deliveries available to the 2015 Shares and the actual deliveries resulted in slightly less water – estimated at 0.52 acre-feet – being available for delivery by the Catlin Pilot Project in 2015.

D. Deliveries to Municipal Participants



The Catlin Pilot Project successfully delivered a total of 408.48 acre-feet of the 428.63 acre-feet of available consumptive use water to the three Municipal Participants. The majority of the 20.26 acre-feet in consumptive use water that was not delivered to the Municipal Participants was either allocated to deep percolation (over-deliveries to recharge), evaporation in the recharge ponds, transit losses from the Timpas Creek augmentation station to the Arkansas River, or as an offset to recharge pond deliveries as a result of weeds in the recharge ponds. Each of these items is discussed later in this report. The Municipal Participants used all consumptive use water delivered in 2015.

Table 3 provides a summary of consumptive use water deliveries to Municipal Participants:

Table 3 – Monthly Deliveries to Municipal Participants

	Fowler	Fountain	Security
March	4.75	2.40	2.40
April	1.27	9.80	9.80
May	3.50	9.70	9.70
June	20.52	27.90	27.90
July	27.08	38.35	38.35
August	1.79	45.46	45.46
September	17.15	15.61	15.61
October	17.13	5.08	5.08
November	6.68	0.00	0.00
TOTAL	**99.87**	**154.30**	**154.30**

1. Deliveries to Fountain and Security

Both Fountain and Security received delivery of their entire 154.3 acre-feet portion of the consumptive use water from Catlin Pilot Project operations at Pueblo Reservoir and moved this water to their municipal systems via the Fountain Valley Conduit. In order to make deliveries to both Fountain and Security, the Catlin Pilot Project exchanged consumptive use water from the confluence of Timpas Creek (where augmentation station deliveries accrue to the Arkansas River) upstream to Pueblo Reservoir.

During March through May, Lower Ark held consumptive use water exchanged to Pueblo Reservoir for delivery to Fountain and Security in its Municipal and Industrial (M&I) Excess Capacity account. In June, both Fountain and Security obtained the necessary amendments to their respective M&I Excess Capacity contracts with the Bureau of Reclamation to store the water in their own accounts. Subsequent transfers were then made from Lower Ark's account into Fountain and/or Security accounts at times requested by Fountain and/or Security. Fountain and Security would then hold the water in their respective storage accounts until needed. The table on the following page shows transfers from the Lower Ark Excess Capacity account to Fountain and Security's Excess Capacity accounts:

Table 4 – Transfers into Fountain/Security Excess Capacity Accounts

Transfer Date	Transfer Amount (AF)	
	Fountain	**Security**
6/30/2015	21.9	0
7/16/2015	27.9	49.8
9/4/2015	38.35	38.35
9/23/2015	45.46	45.46
10/28/2015	15.61	15.61
11/20/2015	5.08	5.08
Total	**154.30**	**154.30**

Fountain delivered its Catlin Pilot Project water from its account via the Fountain Valley Conduit for use in its municipal system during the periods of August 14 - 24 and October 14 -November 23. Security delivered its water from its account via the Fountain Valley Conduit for use in its municipal system generally during the periods of July 16 - October 28 and November 17 - November 23.

2. Deliveries to Fowler

Deliveries to Fowler were used to make replacements owed from the pumping of Fowler's junior wells. Fowler's wells are included in the Rule 14 Plan operated by the Colorado Water Protection and Development Association (CWPDA). If not for the wet conditions during 2015, the consumptive use water available to Fowler through the Catlin Pilot Project would likely have been used to allow Fowler to increase pumping of its wells and allow continued outdoor irrigation at times when Fowler is typically forced to impose watering restrictions on its customers. However, because of the wet conditions, watering restrictions were not required in Fowler during 2015 and therefore the water available from the Catlin Pilot Project allowed Fowler to preserve its Fryingpan-Arkansas Project water in Pueblo Reservoir for later use while still meeting its municipal demands. Fowler's total well depletions owed during operations are summarized on the following Table 5:

What is a Rule 14 Plan?

A Rule 14 Plan is an administrative approval that allows for tributary wells in the Arkansas Basin to continue to pump out-of-priority and replace associated well depletions to prevent injury to senior water rights and to prevent depletions to usable Stateline flow that would otherwise occur as a result to comply with the Arkansas River Compact, as required by the Amended Rules and Regulations Governing the Diversion and Use of Tributary Groundwater in the Arkansas Basin (1995). Currently, there are 11 Rule 14 Plans approved in the Arkansas basin. Three of these in the Lower Arkansas River basin are operated and administered by well augmentation groups that provide well replacements for a large number of member wells, where members are required to dedicate water supplies to provide well replacements to the plans.

Table 5 – City of Fowler Well Depletions

Month	Depletions (acre-feet)
March	35.76
April	42.03
May	45.96
June	46.89
July	40.98
August	35.12
September	44.39
October	42.02
November	36.15
Total	**369.3**

Of Fowler's amount owed, Catlin Pilot Project water replaced 99.87 acre-feet - more than 20% of Fowler's depletions. The following table shows the credits for consumptive use water that were delivered to Fowler and subsequently dedicated to CWPDA's Rule 14 Plan for use.

Table 6 – Consumptive Use Water Available to Fowler and Dedicated to CWPDA

	Consumptive Use Water Delivered to Fowler (AF)	Consumptive Use Water Applied to CWPDA Rule 14 Plan (AF)
March	4.75	-
April	1.27	6.02[4]
May	3.50	3.50
June	20.52	20.52
July	27.08	27.08
August	1.79	1.79
September	17.15	17.15
October	17.13	17.13
November	6.68	6.68
Total	**99.87**	**99.87**

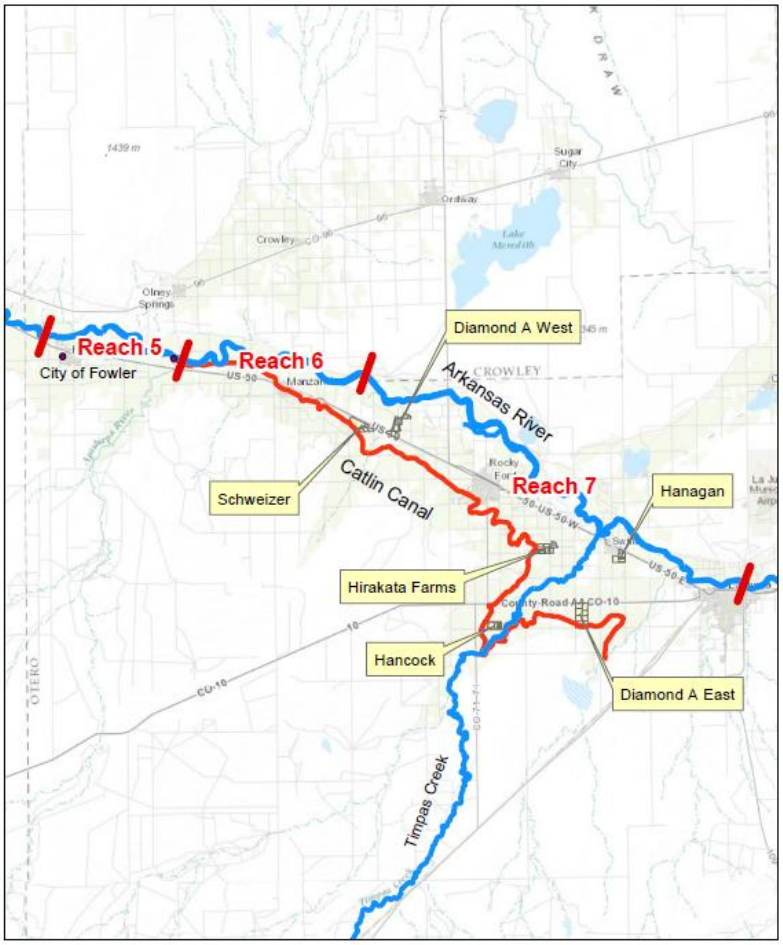
Rather than separately account for or operate an exchange from the confluence of Timpas Creek and the Arkansas River to the point of depletion of the Fowler wells (where Fowler's replacement obligations are due, which is slightly upstream of where consumptive use water is delivered to the Arkansas River), CWPDA instead traded the consumptive use water for other of CWPDA's water supplies available above Fowler's depletions. The Catlin Pilot Project specifically includes the flexibility to apply consumptive use water generated by the Catlin Pilot

[4] March consumptive use water was applied in April (4.75 acre-feet + 1.27 acre-feet = 6.02 acre-feet).

Project within CWPDA's Rule 14 Plan to locations where other members owe well depletions.[5] The use of the credits of consumptive use water made available to Fowler through the Catlin Pilot Project within CWPDA's Rule 14 Plan was regularly discussed as part of the Well Augmentation Coordination monthly meetings with the Division Engineer.

CWPDA's Rule 14 monthly accounting provided to the Division Engineer shows that CWPDA used Fowler's consumptive use water to replace well depletions affecting HI-Model Reach 7 on the Arkansas River. CWPDA then accounted for the replacement of Fowler's depletions owed in Reach 5 with other upstream supplies available to CWPDA. These reaches and their locations relative to Fowler and the Catlin Canal are shown on Figure 3, below.

Figure 3 – Catlin Canal, Fowler, and Rule 14 Well Depletion Reaches



[5] CWPDA's Rule 14 Plan has historically been operated and accounted for in this manner - applying replacements supplies to the reach where they are available irrespective of the location of the well for which those supplies were dedicated by a member.

E. Extreme Precipitation in May

Extreme precipitation during May affected Catlin Pilot Project operations. Runoff coupled with diversions into the Catlin Canal threatened to overtop the canal. It also clogged the Catlin Canal with tumbleweeds. This forced the Catlin Canal Company to cease all deliveries to shareholders on May 9-11, 20, and 24-26. In addition, the Catlin Canal Company reduced deliveries to less than 124 cfs (which is significantly less than the 248 cfs decreed to the Catlin Canal's senior water rights) between and after these dates and continuing through June 8. By the end of June, canal deliveries had been gradually increased up to 298 cfs, which included deliveries of Winter Water requested by the Catlin Canal Company.

Limited Catlin Canal Company diversions affected Catlin Pilot Project operations in several ways. First, deliveries constitutes only half of the May monthly consumptive use credit (24 acre-feet out of the 44 acre-feet monthly limit). Second, the unpredictable variation in flows caused difficulties in delivering the appropriate flows to the recharge ponds and augmentation stations due to the estimated one to two day delivery time between the Schweizer Recharge Pond, which is located in the upper portion of the canal, and the Hanagan Recharge Pond and Timpas Creek Augmentation Station, which are located in the lower portion of the canal (the distance between these structures is more than 12 miles along the canal). The effect of this is discussed in Section V.C. For example, review of the May accounting reveals that when there were deliveries at the Hanagan Recharge Pond after canal headgate diversions ceased, there were no deliveries at the Schweizer Recharge Pond. On such days no credit for consumptive use water was taken because the Catlin Pilot Project accounting only will show consumptive use water available only on days when there are diversions from the river and headgate deliveries should never exceed the pro-rata headgate deliveries. This delivery problem could potentially be mitigated by factoring canal delivery lag time into the accounting.

IV. Operation of Exchanges

B. Generally

In order to make deliveries to both Fountain and Security, the Catlin Pilot Project exchanged consumptive use water from the confluence of Timpas Creek and the Arkansas River upstream to Pueblo Reservoir. The rate of exchange varied because it was limited to the amount of consumptive use water being delivered to the Timpas Creek Augmentation Station on any given day. The lowest operated rate of exchange was 0.07 cfs and the highest was 1.91 cfs. The average rate of exchange for all months was 0.84 cfs. The following Table 7 provides an overview of the exchanges operated:

During 2015, there was no time at which the Catlin Pilot Project could not operate a requested exchange.

Table 7 – Summary of Exchanges to Pueblo Reservoir

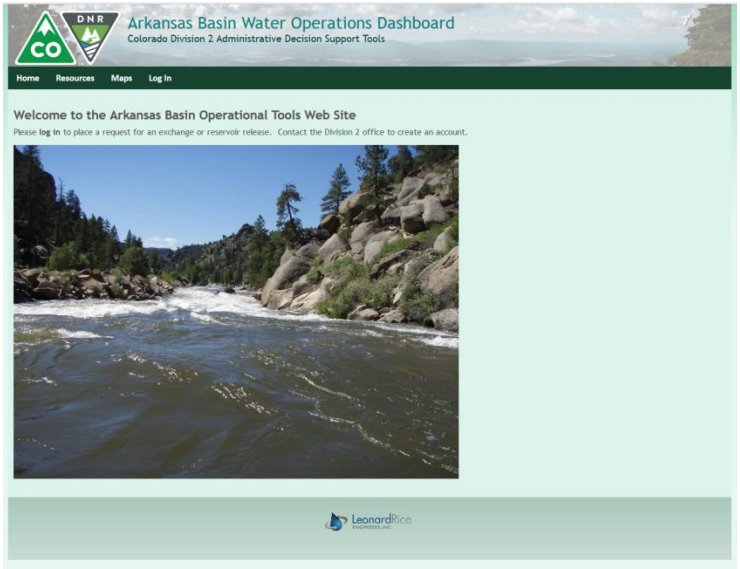
Date	Days with Pueblo Reservoir Exchange	Range of Exchanges Operated (CFS)	Average Exchange Rate (cfs)	Average Exchange Rate (AF/day)	Volume of Pueblo Reservoir Exchange (AF)
March	8	0.29 – 0.33	0.30	0.60	4.77
April	20	0.39 – 0.55	0.50	0.98	19.68
May	12	0.2 – 1.26	0.81	1.61	19.35
June	22	0.73 – 1.89	1.28	2.54	55.83
July	21	1.27 – 1.91	1.84	3.65	76.69
August	29	0.56 – 1.7	1.58	3.13	90.91
September	16	0.11 – 1.2	0.98	1.95	31.22
October	22	0.07 – 0.25	0.23	0.46	10.16
November	0	0	0.00	0.00	0.00
Total	**150**				**308.61**
Average			0.84	1.66	

Significantly, there was sufficient exchange potential to operate the exchange of consumptive use water into Pueblo Reservoir to Fountain and Security at all times requested by Lower Ark throughout the entire 2015 operating season. On a limited number of days, the Catlin Pilot Project did not operate an exchange and the Catlin Pilot Project delivered all consumptive use water to Fowler at point where Timpas Creek Augmentation Station deliveries return to the Arkansas River. In addition, once volumetric limits for a month had been reached (see discussion in Section VI.A), the Catlin Pilot Project suspended exchanges for the remainder of the month.

C. Challenges in Setting the Exchange Rate

Because advance approval of an exchange is required, the Catlin Pilot Project needed to estimate the amount of water that would be available for exchange on any given day and the associated rate of exchange to move that water to Pueblo Reservoir. To make this estimate, the accounting spreadsheet developed for operation of the Catlin Pilot Project includes a "Planning" tab for entry of where anticipated Catlin Canal Company farm headgate deliveries of water supplies available to the Catlin Pilot Project. This includes the Catlin Canal Company's various direct flow priorities and Winter Water deliveries, but does not include any Fryingpan-Arkansas Project water deliveries. Discussions among Lower Ark, Greg Williams (superintendent for the Catlin Canal Company) and Division Engineer staff informed anticipated Catlin Canal Company deliveries.

Once river headgate deliveries were entered into the Planning tab, the weighted consumptive use factors (see Section VIII.A.1) were applied to calculate the consumptive use water available and portions owed for return flow obligations were set for delivery to recharge ponds and to the augmentation station. The accounting spreadsheet then determined the rate of exchange needed to deliver the consumptive use water to Pueblo Reservoir based on an allocation between the Municipal Participants determined by Lower Ark. Lower Ark then utilized the newly operational Arkansas Basin Water Operations Dashboard (http://cdwrdiv2.us/) to request a rate of exchange of consumptive use water into Lower Ark's Municipal and Industrial Excess Capacity account in Pueblo Reservoir for the upcoming month.



Because precisely matching actual deliveries to the theoretical deliveries that are established for planning purposes is not possible even under ideal conditions, predicting the exact amount of consumptive use water available for exchange on any given day poses a challenge in any exchange scenario. Therefore, predicting the amount of river headgate diversions and subsequent deliveries to the farm headgates for the two recharge ponds and Timpas Creek Augmentation Station was impossible, and some adjustments were necessary. To account for this, Lower Ark monitored actual Catlin Canal diversions on a daily basis and tried to ensure that the deliveries to those three Catlin Pilot Project delivery locations met the targeted theoretical deliveries from the Planning tab. When adjustments to the requested exchange rate were

necessary to more closely match actual deliveries, Lower Ark cancelled the pre-set exchange rate and requested a new exchange rate for the rest of the month.

While an "Owe-the-River" reservoir account is sometimes used to balance the accounting in similar situations, the Division Engineer did not allow use of such an account in Catlin Pilot Project operations. After making adjustments on an as-needed basis and to correct for any over- or under-deliveries by exchange for several months, Lower Ark and the Division Engineer agreed in August that more conservatively calculated amounts of consumptive use water available for exchange may improve operations. As a result, the Planning tab on the accounting spreadsheet was modified to apply a 10% reduction to the consumptive use water available to the calculated rate of exchange. The Catlin Pilot Project then delivered any excess consumptive use water not exchanged to Pueblo Reservoir to Fowler at the Timpas Creek Augmentation station. This way, little to no consumptive use water was not delivered to one of the Municipal Participants. This highlights that having multiple Municipal Participants with demands in different locations facilitated operations and the use of all of the historical consumptive use water available, and little went unused.

What is an ""Owe-the-River" Account?

An "owe-the-river " account is an administrative storage account that is be used to balance accounting for water storage one day in arrears using the change in storage information to determine the amount of storage. If the amount of storage exceeds the amount that was stored either directly or by exchange, releases will be made to replace that excess storage. This release could be required on the day following this storage. Alternatively, a Water Division 1 frequently will require reservoir releases when the account balance reaches 1% of the reservoir storage amount. This type of administrative account is really an accounting tool and allows excess storage made by direct diversion or exchange.

This Planning tab adjustment ultimately did not prove particularly useful in more accurately predicting exchange rates. Lower Ark's ability to more accurately estimate exchange amounts, however, improved significantly with more operational experience and with more frequent communication with both the Catlin Canal Company superintendent and the Division Engineer staff. Use of an "Owe-the River" account in future years' operations would address any excess storage by exchange. This would benefit Catlin Pilot Project by alleviating the need for regularly operating overly-conservative exchange rates and would thereby increase the ability of the Municipal Participants to take advantage of a greater portion of the consumptive use water generated through operations.

V. Return Flow Obligations

All return flow obligations for 2015 operations of the Catlin Pilot Project were met using farm headgate deliveries of the water attributable to the 2015 Shares associated with the 2015 Fallowed Acreage. 2015 operations used augmentation station deliveries to the Timpas Creek Augmentation Station and two recharge ponds (the Schweizer Recharge Pond and the Hanagan Recharge Pond) to meet return flow obligations. The Crooked Arroyo Augmentation Station is approved for use in the Catlin Pilot Project, but was not used in 2015. All tailwater return flow obligations were delivered through the Timpas Creek Augmentation Station. Deep percolation return flows were replaced through the use of the recharge ponds and, to a lesser extent, Timpas Creek Augmentation Station deliveries. The Catlin Pilot Project used the Timpas Creek Augmentation Station to replace a portion of deep percolation return flows that historically accrued to the Arkansas River more quickly than recharge accretions from the recharge ponds reach the Arkansas River.

101.84% ***PERCENT OF TAILWATER RETURN FLOW OBLIGATIONS REPLACED***

99.39% ***PERCENT OF DEEP PERCOLATION RETURN FLOW REPLACED***

Based on the revised LFT analysis conducted pursuant to the CWCB Approval, return flow obligations for 2015 pilot operations totaled 770.22 acre-feet. Of this amount, 154.04 acre-feet as due for tailwater return flows and 616.18 acre-feet was due for deep percolation return flows. The following table shows the deliveries made to meet return flow obligations.

Table 8 – Return Flow Deliveries (AF)

Month	Tailwater Return Flow		Deep Percolation Return Flow	
	Delivery	**Excess(+)/ Deficit(-) Delivery from Obligation**	**Delivery**	**Excess(+)/ Deficit(-) Delivery from Obligation**
March	18.64	0.00	74.34	-0.21
April	24.62	0.00	98.41	-0.08
May	11.17	-1.36	58.04	+7.95
June	15.53	0.00	64.57	+2.45
July	19.53	0.00	78.56	+0.45
August	18.28	0.00	74.95	+1.82
September	15.00	0.00	60.53	+0.51
October	21.95	0.00	87.57	-0.22
November	7.97	0.00	31.80	-0.09
Total	**152.69**	**-1.36**	**628.76**	**+12.58**

This table shows that there were five months in which deep percolation deliveries exceeded deep percolation return flow obligations, resulting in 12.58 acre-feet of excess water being delivered to the Arkansas River. In the few instances where the amount delivered for deep percolation obligations did not meet or exceed the amount owed, the largest under-delivery was less than 0.3% of the amount owed for that month. In May, the tailwater return flow delivery was short by 1.36 acre-feet. However, this shortage was a result of the delivery lag time between the river headgate and the augmentation station (after the Catlin Canal Company had resumed diverting at the river headgate after being forced to stop diverting during extreme precipitation as discussed in Section III.E). This lag created an accounting anomaly whereby a tailwater return flow obligation was calculated at the augmentation station based on river headgate deliveries that had not yet reached the augmentation station. As a result, no consumptive use water was available to the Catlin Pilot Project on those days, and thus no associated tailwater replacement obligation should have been due.

A. Deliveries to Recharge

Use of recharge to replace deep percolation return flow obligations proved successful in 2015. To facilitate delivery of water to one of the two recharge ponds, Applicants modified and adjusted divider boxes along a shared lateral ditch to facilitate deliveries to the Hanagan Recharge Pond. The Schweizer Recharge Pond is served by a buried pipeline that diverts directly off the Catlin Canal.

Because there are no decreed diversions from the Arkansas River between the point of return flow from the Schweizer and Hanagan Recharge Ponds and the confluence of Crooked Arroyo and the Arkansas River, return flows from either pond can be used to make return flow obligations from all of the 2015 Fallowed Acreage to prevent injury to other water rights.

Recharge pond deliveries are summarized by month in Table 9 on the next page. Deliveries to the recharge ponds continued after Catlin Canal water associated with the 2015 Shares after

Why is recharge valuable in meeting return flow obligations?

Just as in a permanent change of water right proceeding, ensuring that return flows are properly maintained is a key issue in any rotational fallowing project. In particular, deep percolation return flow obligations can present challenges in replicating the return flow pattern. Use of properly-located recharge can frequently be used to closely replicate the timing of return flows and has the added benefit of managing future return flow replacement obligations at the same time that water is made available under the changed water right. The other primary means of replacing lagged return flows is by having approved sources of replacement water available for delivery either directly or through releases from storage and then to project when those replacements must be made. The challenge in this latter approach is to manage the replacement sources in a manner that closely mimics the return flow pattern.

consumptive use limits were reached in some months. These deliveries exceeded the amounts necessary to meet return flow obligations. During times of excess deliveries to recharge, the consumptive use portion of the delivery that was not available for use by the Municipal Participants was returned to the Arkansas River through the Timpas Creek Augmentation Station, while the portions for return flow obligations continued to be delivered to the recharge ponds for ease of operations. These deliveries account for the net infiltration amounts sometimes being in excess of deliveries.

What recharge facilities were used in the Catlin Pilot Project?

The Schweizer Recharge Pond has a surveyed capacity of 15 acre-feet at a surface area of 5.15 acres. Recharge from the Schweizer Recharge Pond returns to the Arkansas River downstream of the Rocky Ford Ditch and Fort Lyon Storage Canal. The Schweizer Recharge Pond is located on the Schweizer Farm upstream of all other Participating Farms and therefore ideally located to provide replacement of lagged return flows upstream of the historical lagged return flows for all of the Participating Farms.

The Hanagan Recharge Pond has a surveyed capacity of 13.06 acre-feet at a surface area of 3.86 acres. Recharge from the Hanagan Pond returns to the Arkansas River just downstream of the Town of Swink. Because there are no surface diversions located between the points of recharge from the Schweizer Recharge Pond and the Hanagan Recharge Pond, the Hanagan Recharge Pond may also be used to replace lagged return flows from all of the Participating Farms.

Schweizer Recharge Pond

Hanagan Recharge Pond

Table 9 – Deep Percolation Return Flow Deliveries to Recharge (AF)

Month	Schweizer Pond		Hanagan Pond	
	Deep Percolation Delivery	**Recharge (Net Infiltration)**	**Deep Percolation Delivery**	**Recharge (Net Infiltration)**
March	31.26	31.09	26.15	19.36
April	41.07	59.29	39.18	56.54
May	22.91	23.19	28.05	29.84
June	12.49	12.55	41.81	39.61
July	12.49	13.38	48.33	49.30
August	8.17	8.17	50.17	52.63
September	14.88	21.10	33.62	41.31
October	33.28	33.28	36.52	36.84
November	13.30	13.35	11.27	15.30
Total	**189.85**	**215.40**	**315.11**	**340.73**

Overall, both recharge ponds performed very well throughout 2015 operations. Some minor operational issues associated with the recharge ponds are discussed later in this report.

1. Augmentation Station Deliveries

The deliveries to the Timpas Creek Augmentation Station were made for consumptive use water for the Municipal Participants, tailwater return flows, and deep percolation return flows. Deep percolation return flow deliveries were necessary because neither recharge pond was capable of providing recharge to the Arkansas River as quickly as the historical deep percolation from the Diamond A West Farm returned to the river. The augmentation station deliveries were allocated first to return flow obligations and the remainder was allocated to consumptive use water. Nearly all consumptive use water delivered to the augmentation station was subsequently delivered to the Municipal Participants. The deliveries were charged a transit loss from the point of delivery on Timpas Creek to its confluence with the Arkansas River, a distance of approximately 3.6 miles. A small portion of consumptive use water was used for transit loses and to replace weed evapotranspiration and surface evaporation from the recharge ponds. A summary of augmentation station deliveries is provided in Table 10 on the following page:

Table 10 - Deliveries to the Timpas Creek Augmentation Station

Month	Total Augmentation Station to Arkansas River	Consumptive Use to Municipal Participants	Return Flow Delivery	Transit Losses/Weed ET/Evaporation
	(ac-ft)	(ac-ft)	(ac-ft)	(ac-ft)
March	45.61	9.51	35.78	0.31
April	64.21	20.94	43.01	0.26
May	41.57	22.85	18.34	0.39
June	103.24	76.35	25.93	0.96
July	142.57	103.78	37.49	1.31
August	131.45	92.70	35.09	3.65
September	76.92	48.37	27.19	1.37
October	67.66	27.29	39.94	0.42
November	23.35	6.68	15.29	1.37
Total	**696.59**	**408.48**	**278.06**	**10.06**

B. Use of Pay As You Go Approach

Under certain circumstances, use of recharge and "Pay As You Go" to replace deep percolation return flow obligations can effectively mimic historical deep percolation return flow timing. This is done through contemporaneous deliveries of deep percolation return flow obligations to properly-located recharge facilities. Condition No. 31 of the CWCB Approval authorized "Pay As You Go" to meet deep percolation return flow obligations.

In order to utilize Pay As Use Go in Catlin Pilot Project operations, Lower Ark needed to demonstrate that deliveries to the two recharge ponds and augmentation stations would meet return flow obligations within 10 acre-feet per month, assuming 10 years of operations and average-year deliveries. Ten acre-feet per month was assumed to be a reasonable range of variation in deep percolation return flow accretions that may occur when Catlin Canal shares have historically been moved from one farm headgate to another or individual fields were fallowed from year to year.

Why wasn't Pay As You Go originally proposed by Applicants?

Recognizing the benefits of employing a Pay As you Go approach, Tri-State Transmission and Generation proposed use of Pay as You Go for all six pilot project farms, as reflected in Condition No. 31. This was in spite of the fact that the Criteria and Guidelines limit use of Pay As You Go to meet return flow replacement obligations to recharge ponds within ¼ mile of the dried-up land. Because of the location of the recharge ponds available to the Catlin Pilot Project, this restriction would have allowed only one of the pilot project farms (Hanagan) to rely exclusively on a Pay As You Go approach for deep percolation return flow replacement. For the remaining five farms, the distance from the recharge facilities is greater than 14 mile, so Applicants originally proposed to calculate the deep percolation return flow obligation and account for replacement through recharge accretions and use of other water supplies and use a projection to demonstrate the ability for such accretions and supplies to meet the deep percolation return flow obligation. In compliance with Condition No. 31, Applicants demonstrated that use of the two available recharge facilities would closely mimic deep percolation return flows from those farms.

Use of Pay As You Go deep percolation return flow replacement eliminated the need to maintain a projection of the firm and committed sources of water for future return flow replacement as part of pilot project operations. This greatly simplified operations for the Catlin Pilot Project. Operations did not need to involve the exchange and storing of water for winter return flow replacement because all winter deep percolation return flow obligations were delivered to the recharge ponds and replaced as recharge accretions during the irrigation season. And while exchange potential did not affect operations during 2015, Pay As You Go nevertheless proved to be a useful approach in that 2015 operations did not need to rely on limited exchange potential between the Catlin Canal and Pueblo Reservoir to replace winter (deep percolation) return flows.

In 2015, Pay As You Go consisted of deliveries to the recharge ponds and the Timpas Creek Augmentation Station based on the ranges of deliveries illustrated in Figure 4 on the next page. The deliveries are expressed as percentages of deep percolation return flow obligations at the farm, and are designed so that the difference in the timing of deep percolation return flow between historical return flow obligations and deep percolation deliveries to the Arkansas River would not exceed ten acre-feet in any month. The accounting utilizes a target value within the ranges for each structure to which Catlin Pilot Project water is delivered. So long as the actual delivery range is within the stated ranges deep percolation return flows are considered to have been replaced in accordance with Pay As You Go.

Figure 4 - Percent of Deep Percolation Deliveries

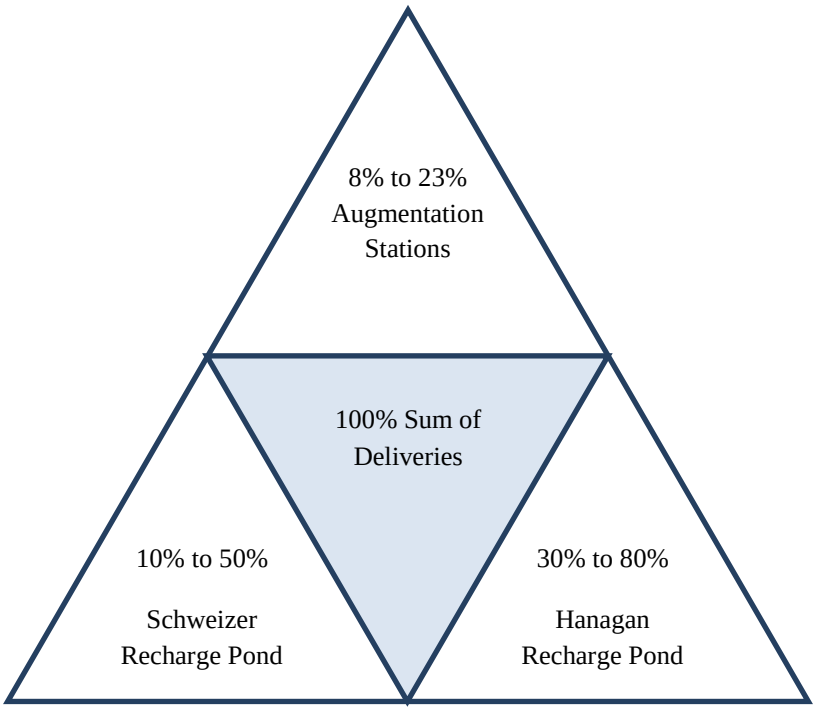


Figure 4 illustrates the variability in deep percolation deliveries that meet the 10 acre-feet per month criterion described above, the sum of which must equal 100%. For example, Timpas Creek Augmentation Station deep percolation deliveries of 15% plus Schweizer Recharge Pond deep percolation deliveries of 30% plus and Hanagan Recharge Pond deep percolation deliveries of 55% total 100% and thus meet the 10 acre-feet per month criteria.

Pay As You Go in 2015 operations proved successful. Table 11 on the next page illustrates the monthly percentage of deep percolation deliveries to each point of delivery during 2015 operations of the Catlin Pilot Project. Sums greater than 100% indicate over-delivery of deep percolation return flows.

Table 11 - % Deep Percolation Deliveries

Month	Schweizer Pond	Hanagan Pond	Timpas Creek Augmentation Station	Sum of All Delivery Points
	10%-50%	**30%-80%**	**8%-23%**	**100%**
	%	**%**	**%**	**%**
March	42%	35%	23%	100%
April	42%	40%	19%	100%
May	46%	56%	15%	116%
June	20%	67%	17%	104%
July	16%	62%	23%	101%
August	11%	69%	23%	103%
September	25%	56%	20%	101%
October	38%	42%	20%	100%
November	42%	35%	23%	100%

This Table shows that 2015 operations of the Catlin Pilot Project provided the required deep percolation deliveries during all months.[6]

Lower Ark conducted a review of how the Pay As You Go target deliveries worked at staying within the 10 acre-feet per month limitation. A summary table of this analysis is provided in **Appendix C**. This analysis demonstrated that the deliveries targets were successful at maintaining deliveries within the 10 acre-feet per month limitation in all months except one month (March) where approximately 11 acre-feet of return flow deliveries in excess of obligations were made. This excess was due to deliveries at the augmentation station being at the high end of the delivery range (23%, the range for the Timpas Creek Augmentation Station is 9% to 23%), which resulted in providing deep percolation return flows that were delivered through that augmentation to the Arkansas River slightly sooner that historical deliveries would have accrued in an average year.

C. Number of Days Return Flow Obligations Unmet

Because Applicants elected to use Pay As You Go for deep percolation return flow replacement, the Catlin Pilot Project was not required to meet daily return flow obligations for deep percolation. With respect to tailwater return flow obligations, Condition No. 19 of the CWCB Approval requires tailwater return flow obligations to be calculated daily and that Applicants demonstrate on a monthly basis that all tailwater return flow obligations were replaced. In

[6] Note that while the calculation of the percentages did not include the mis-application of transit losses resulting in 1.57 acre-feet erroneously charged against deep percolation deliveries to the Timpas Creek Augmentation Station (discussed in Section VIII.B), this reflects only 0.25% of deep percolation deliveries and therefore did not affect compliance with delivering within these target values.

recognition of the operational constraints and variability of deliveries, this condition goes on to provide that the Catlin Pilot Project shall *endeavor* to replace the calculated amount of tailwater return flow on a daily basis.

As discussed at the beginning of this Section V, tailwater return flow obligations were met on a monthly basis with the exception of May when a minor shortfall of 1.36 acre-feet occurred. Deep percolation return flows consistently exceeded monthly obligations. And while there was some variability in the amounts of deep percolation return flows owed vs. delivered by month, these variations all fell within the approved 10 acre-foot per month deviation approved with Pay As You Go. Nevertheless, in compliance with the annual reporting requirements, Lower Ark calculated the days of unmet return flows. The results of this calculation are summarized in the following Table 12.

Table 12 - Un-met Return Flow Obligations

Month	Deep Percolation Deliveries Short	Deep Percolation Deliveries Monthly Excess/Deficit	Tailwater Deliveries Short	Tailwater Deliveries Monthly Excess/Deficit
	# days	**(acre-feet)**	**# days**	**(acre-feet)**
March	0	0.00	0	0.00
April	0	+0.15	0	0.00
May	2	+6.79	4	-0.94
June	0	+2.58	0	0.00
July	0	+0.68	0	0.00
August	0	+2.03	0	0.00
September	0	+0.66	0	0.00
October	0	0.00	0	0.00
November	0	0.00	0	0.00
Total	**2**	**+12.90**	**4**	**-0.94**
Delivery shortages are negative (-) and excess deliveries are (+).				

For this analysis, un-met return flows were defined as the difference between the return flow obligations and return flow deliveries. Return flow obligations were calculated in the monthly accounting for the pilot project. As required by the CWCB Approval, consumptive use water was calculated as a percentage of measured farm headgate deliveries, and tailwater and deep percolation obligations were calculated as 20% and 80%, respectively, of farm headgate deliveries minus consumptive use. Farm headgate deliveries were determined by adding the deliveries to the recharge ponds and augmentation stations. Deep percolation deliveries were based on the actual deliveries to the recharge ponds and the augmentation station. Therefore, return flow obligations were met by application of the accounting, which divides the deliveries such that the amount of water allocated to return flows is in correct proportion to the amount allocated to consumptive use water.

The only daily return flow replacement shortages shown in this analysis were for tailwater return flow obligations in May. During May, the extreme precipitation events forced the Catlin Canal Company to curtail diversions (see Section III.E). These days were removed from consideration because no consumptive use water was available on those days. The daily shortages calculated in May were the result of the lag times from when the Catlin Canal Company had re-initiated diversions and river headgate diversions were occurring but there was no water at the Timpas Creek Augmentation Station. This created a very minor calculated shortage in tailwater deliveries are calculated based on river headgate diversions of less than one acre-foot.[7]

Notably, no days of unmet return flows would have occurred if the Catlin Pilot Project accounting allowed for excess deep percolation deliveries to be allocated as a stream depletion credit on a monthly basis. Currently, Condition No.23 only allows for allocating excess deliveries as a stream depletion credit on a daily basis. For example, this type of monthly balancing would have negated the calculated 0.94 acre-foot shortage in tailwater delivery in May with the excess delivery of deep percolation return flows of 6.79 acre-feet in the same month. It is also worth noting that if the CWCB Approval allowed credit for excess deliveries to deep percolation to be allocated on a monthly basis, 2015 operations would have likely generated additional consumptive use water. This is because if stream depletion credits for excess deliveries of deep percolation water (this excess was 12.9 acre-feet in 2015), then operations would have adjusted over the course of the month to maximize the credits available as consumptive use water by re-allocating deliveries. For example, this monthly balancing could have allowed 2015 operations to generate up to an additional 11.96 acre-feet of consumptive use water (12.9 af surplus - 0.94 af deficit = 11.96 af). Nevertheless, this analysis shows the Catlin Pilot Project achieved daily return flow obligations almost every day.

D. Challenges in Operating Hanagan Recharge Pond

Throughout 2015 operations, deliveries to the Hanagan Recharge Pond required close monitoring. This was due to the fact that the Hanagan Recharge Pond is located at the end of a farm lateral that is utilized by five other farms. Because of this situation, existing divider boxes were modified and adjusted on this lateral prior to commencement of 2015 operations.

Divider box on the lateral serving the Hanagan Recharge Pond

[7] Note that this table does not include the minor shortages due to allocation of transit losses to deep percolation deliveries at the Timpas Creek Augmentation Station (see Section VIII.B) because they were inconsequential in light of the over-replacement of deep percolation return flows.

These modifications were intended to allow for farm headgate deliveries to be allocated proportionally amongst the irrigators on the farm lateral. However, at times, other irrigators on the lateral would make adjustments to these divider boxes to allow that irrigator to apply more water to a field for a short period of time to complete an irrigation set. After the set was complete, deliveries to the field were curtailed and excess water was then made available to other irrigators on the lateral. This practice is not uncommon, but presented a challenge to assure that adequate water was delivered to the Hanagan Recharge Pond. Monitoring of deliveries was aided installing telemetry equipment in June. This allowed Lower Ark to quickly respond to unanticipated changes in deliveries to the recharge ponds and correct those deliveries.

After 2015 operations ceased, there was an allegation that the Hanagan Recharge Pond was causing seepage onto a nearby field. Seepage would be a concern because water rising to the surface could indicate a portion of the recharged water might be consumed by plants and/or evaporation before than returning to the Arkansas River. There was no opportunity to confirm this allegation since the seepage was reported after project operations ended for the year. However, the testing of the Hanagan Recharge Pond was conducted at a much higher rate than deliveries to the pond during 2015 operations, and no significant water was observed to have ponded in low areas during that testing. During 2016 operations, Lower Ark will continue to monitor the areas near and down-gradient of the ponds in the direction of the Arkansas River to assure that the recharged water is not surfacing.

E. Weed Evapotranspiration and Surface Evaporation

The CWCB Approval provides that replacements must be made at times when standing water is present in the recharge ponds. Standing water rarely occurred in the Schweizer Recharge Pond. However, the Hanagan Recharge Pond did regularly have standing water. Consumptive use water generated from the Catlin Pilot Project was used to make replacements for this surface evaporation. In total, the amount of water owed for surface evaporation from the ponds was minimal – 10.2 acre-feet for 2015 operations. Surface evaporation owed by month to the Schweizer and Hanagan Recharge Ponds is shown on the next page in Table 13.

Table 13 – Summary of Recharge Pond Evaporation

Month	Schweizer Recharge Pond Evaporation	Hanagan Recharge Pond Evaporation
	(ac-ft)	(ac-ft)
March	0.12	0.08
April	0.24	0.35
May	0.30	0.61
June	0.38	0.90
July	0.01	2.11
August	0.00	1.72
September	0.00	1.53
October	0.12	1.27
November	0.09	0.39
Total	**1.26**	**8.94**

In May, Lower Ark observed weed growth in both ponds and requested that Mr. Hanagan and Mr. Schweizer spray the weeds. Mr. Schweizer also mechanically removed weeds in both June and August. However, by August, it was determined that weeds had not been totally controlled and replacements for weed evapotranspiration (ET) should be made. As a result and in compliance with Condition No. 42(c) of the CWCB Approval, weed ET was estimated in order to make replacements of the ET to the Arkansas River using credits from consumptive use water. These ET estimates are described and illustrated in **Appendix D**.

Recharge ponds after spraying weeds

After consulting with the Division Engineer, rather than reduce the recharge credit at the Arkansas River, an equivalent amount of consumptive use water was delivered to the river to

offset the minor amount of weed ET. Following calculation of these estimates, Lower Ark monitored the ponds for the presence of weeds and to assure that deliveries were being made at the prescribed rates and that measurement devices were operating correctly. Weed ET estimates in May were not owed because precipitation that month was so high as to provide water in excess of that which was calculated to be used for weed growth. Releases of consumptive use water to replace depletions associated with weed ET were aggregated for June through August, and a single release was made in August to replace 1.98 acre-feet of weed ET. Thereafter, consumptive use water was released on a monthly basis. Table 14 presents a summary of estimated monthly net weed ET and the associated consumptive use water releases made to replace that weed ET.

Table 14 - Estimated Net Weed ET and Consumptive Use Credit Releases (AF)

Month	Estimated Net Weed ET Depletion	CU released for Weed ET	CU Balance
March	-	-	-
April	-	-	-
May	0.00		0.00
June	-0.72		-0.72
July	-0.63		-1.35
August	-0.63	1.98	0.00
September	-0.40	0.40	0.00
October	-0.07	0.07	0.00
November	-0.02	0.02	0.00
Total (af)	**-2.48**	**2.48**	**0.00**

VI. Efficacy of the Lease-Fallow Tool

The Criteria and Guidelines require the use of the Lease-Fallowing Tool (LFT), developed by the State Engineer, to estimate the historical consumptive use of water included in a lease-fallowing pilot project. The Criteria and Guidelines also require the use of specific data, methodologies and factors in LFT for the purposes of providing a streamlined and conservative analysis of consumptive use. 2015 operations demonstrated that the LFT methodology for calculating consumptive use water was, if fact, quite conservative. This section provides a discussion of certain conservative aspects of the LFT and the Criteria and Guidelines.

A. Conservative CU Volumetric Limits

Pursuant to the Criteria & Guidelines, the CWCB Approval incorporates monthly volumetric consumptive use (CU) limits on the amount of consumptive use water that can be delivered to the Catlin Pilot Project. During four months (April, July, August and September) of Catlin Pilot Project operations, deliveries reached these monthly volumetric consumptive use limits. This required cessation of deliveries of consumptive use water to the Catlin Pilot Project. This was in spite of the fact that the Catlin Canal Company water rights remained in priority and continued to be diverted for use by other Catlin Canal Company shareholders.

During 2015 Operations, conservative monthly consumptive use limits resulted in 18.3 acre-feet less of consumptive use water being delivered to the Catlin Pilot Project

The consumptive use limits developed for the Catlin Pilot Project were based on the average monthly consumptive use of each month in the three years with the highest annual consumptive use for the period of record, as required by the Criteria and Guidelines. This method of determining the CU Limit is not what is typically done for a change of use application or substitute water supply plan. Rather, this method is more conservative than the standard method of calculating CU limits, which uses the highest months or the average of three highest months during the period of record. This is because it is unlikely that the three maximum years of record would also contain all of the highest months of record. Table 15 (next page) compares the monthly consumptive use limits for 2015 derived via the Criteria and Guidelines with CU limits developed using the three highest months in the study period.

Table 15 - Consumptive Use Limit Comparison (AF)

Month	CU Limit - 3 Highest Years	CU Limit - 3 Highest Months	ΔCU Limit
March	11.5	33.2	-21.7
April	21.3	45.7	-24.3
May	43.1	72.0	-28.9
June	96.6	115.7	-19.1
July	107.2	118.2	-11.0
August	98.1	119.2	-21.2
September	51.3	71.1	-19.9
October	37.8	52.9	-15.0
November	9.6	36.2	-26.6

The Criteria and Guidelines CU monthly limits range from 11.0 acre-feet to 28.9 acre-feet lower than the limits developed using the three highest years of record during the study period.[8] Use of the three-highest month methodology would have allowed for increased consumptive use water available for the Municipal Participants in the four months that 2015 operations constrained by the current CU limits.

The following table presents a comparison of the Planning CU delivery for 2015 with the Planning Delivery allowable under monthly CU limits based on the three highest months in the study period. Use of the more realistic CU limits would have resulted in an increase in consumptive use credits of 18.3 acre-feet (429.15 - 410.85 = 18.3).

Table 16 - Comparison of 2015 CU Delivery with Deliveries under Revised CU Limits (AF)

Month	Planning CU Delivery for 2015 – 3 Highest Years Limits	Planning CU Delivery – 3 Highest Months Limits
March	8.84	8.84
April	21.80	29.64
May	24.05	24.05
June	68.45	68.45
July	107.20	108.32
August	94.90	94.90
September	51.26	60.60
October	26.88	26.88
November	7.48	7.48
Total	**410.85**	**429.15**

[8] Under either method for calculating the monthly CU limit, the annual limit will be the same because the annual limit is based on an average of the three highest years in the period of record.

Given the already conservative nature of the various inputs that are required to be used in running the LFT under the Criteria and Guidelines (discussed in Section VI.B, below), this nontraditional method for calculating monthly consumptive use limitations contained in the Criteria and Guidelines unnecessarily restricts the ability of a pilot project to take full advantage of consumptive use water generated through land fallowing. As a result, Lower Ark recommends that the Criteria and Guidelines be revised to calculate monthly consumptive use limits using the three highest months in the 30-year study period.

B. Conservativeness of HB 1248 & the Lease-Fallow Tool

In April 2015, Lower Ark and Super Ditch conducted a comparison of the amount of historical consumptive use water determined using two different sets of inputs available for use in the LFT. The first were those inputs that are those required by the Criteria and Guidelines. The second set of inputs was from the Hydrological Institutional Model (HI Model).

The results of the comparison are as follows in Table 17:

What is the HI Model?

The HI Model was a model developed and agreed to by the States of Kansas and Colorado in litigation over the replacement of well depletions affecting the Arkansas River in Kansas. This model was vetted by experts from both States and provides the basis for compliance with the Arkansas River Compact through the operation of Rule 10 and Rule 14 Plans.

Table 17 - Comparison of Historical Consumptive Use Methodologies

LFT Option	HCU (Minimum)	HCU (Average)	HCU (Limit)
	acre-feet/acre	acre-feet/acre	acre-feet/acre
HB1248	0.33	1.71	2.23
HI Model	0.59	1.95	2.48
HB 1248 as %HIM	56%	87%	90%

The comparison illustrates that for the Catlin Canal Pilot Project, the historical consumptive use per acre available when using the Criteria and Guidelines inputs in the LFT ranged from 56% to 90% of the HI Model inputs results in minimum and maximum years, respectively. This comparison was done with both inputs for calculating monthly volumetric consumptive use limits established by the Criteria and Guidelines. Therefore, the LFT and Criteria and Guidelines could constrain the water available to Municipal Participants by as much as 10% in a wet year and 44% in a dry year.

What are the HI Model Inputs and the Criteria and Guidelines Inputs for the LFT?

Diversions: SEO Diversion Records – Direct Flow Rights & Winter Water

Irrigated Acreage: Based on irrigated acreage mapping done under the various Decision Support System projects. However, the CWCB approval limited the maximum allowed acreage to the 1985 acreage developed for Kansas v Colorado.

LFT options specific to Criteria and Guidelines

- Farm Efficiency – 55%
- County Crop Mix
- Modified Blaney-Criddle - TR-21 Crop Coefficients
- Climate Station nearest to headgate
- USBR Method for Effective Precipitation
- Soil Moisture – 6 inches or 0.5 acre-feet per acre
- Deep Percolation - 80% Return Flow Fraction
- Surface Runoff– 20% Return Flow Fraction
- Diversion Limits – Average of 3 greatest years
- Minimum 30-year study period

LFT options specific to HI Model

- Farm Efficiency – 65%
- Crop Mix - Approved HIM Ditchwide
- Ditchwide Crop PET (from ASCE Std PM/ Cal-MBC HI model data) from weighted Coagmet stations (pre/post2007 fwl01-0/0.05 rfd01-1/0.95)
- Climate Station Approved HIM Ditchwide
- Approved ditchwide Precip from 2013 HI model (approved by CO/KS) for Catlin Canal
- Soil Moisture – 7.8336 inches or 0.6285 acre-feet per acre
- Deep Percolation – calculated by model
- Tailwater factor– 10% Return Flow Fraction
- Diversion Limits – Annual: Average of 3 greatest years; Monthly: Average of three greatest months for each month
- Minimum 30-year study period (chosen to be consistent with the pilot project study period

To further evaluate the conservative nature of the Criteria and Guidelines inputs, the HI Model inputs were applied to the 2015 Catlin Pilot Project accounting. In this comparison, the monthly CU Limit used in the LFT run with the HI Model inputs used the average of the three highest months for each month in the study period. A side-by-side comparison with the 2015 Catlin Pilot Project limits, consumptive use deliveries and potential consumptive use deliveries is provided in Table 18 on the next page:

Table 18 - Comparison of H.B. 13-1248 and HI Model Methods (AF)

Month	H.B. 13-1248 Method - Max 3 Highest Years (reflects actual operations in 2015)				HI Model Method - Max 3 Highest Months (simulated 2015 operations)		
	CU Limit	CU Actual	Planning Delivery		CU Limit	CU Delivered	Potential CU Delivery
March	11.5	10.03	8.84		41.1	23.49	20.77
April	21.3	21.80	21.80		64.3	36.82	50.39
May	43.1	24.04	24.05		88.5	28.33	28.24
June	96.6	78.59	68.45		129.5	83.10	72.91
July	107.2	107.20	107.20		133.1	111.21	112.43
August	98.1	98.07	94.90		128.9	99.99	96.92
September	51.3	51.26	51.26		80.2	56.81	67.53
October	37.8	29.11	26.88		51.1	22.73	20.99
November	9.6	8.54	7.48		42.6	8.54	9.07
Total	**476.4**	**428.64**	**410.85**		**537.7**	**471.03**	**479.26**

The potential CU delivery that would have been available to 2015 operations using the HI Model inputs was 68.4 acre-feet greater (479.26-410.85=68.4) than what was actually available 2015 operations, which is a 17% difference. The consumptive use that would have been delivered if the 2015 operations had been based on the LFT utilizing the HI Model inputs would have been 42.4 acre-feet greater (471.03-428.64=42.4) than actual deliveries in 2015, which is a 10% difference. This evidences the conservative nature of the LFT, which is underscored by the widespread belief that the HI Model itself produces a very conservative estimate of historical consumptive use.

This comparison further highlights the effect that the method for calculating the monthly CU limits has on the availability of consumptive use water as previously discussed in Section VI.A, above. By using the average of the maximum diversions in the three highest months as the basis for the monthly volumetric limit, the monthly volumetric limit increase would range from 13.3 acre-feet in October to 45.4 acre-feet in May and the annual volumetric limit would increase by 61.3 acre-feet (537.7 – 476.4 = 61.3).

VII. Compliance with Dry-Up Requirements

The CWCB Approval contains a number of terms and conditions regarding how dry-up is conducted and monitored. Dry-up of 2015 Fallowed Acreage was successful. As required by Condition No. 6, signs were posted on all parcels included in the 2015 Fallowed Acreage. 2105 Fallowed Acreage was fallowed as shown in Table 19 and illustrated in the photos on the next page:

Example of posted dry up sign

Table 19 – Dry-up Method by Parcel

Participating Farm	Parcel ID	Dry-Up Method
Diamond A East	24561101	disked
	24561102	winter wheat
Diamond A West	23570414	winter wheat
	23570415	winter wheat
Hanagan	23563603	corn stalks from 2014
Hancock	24560722	corn stalks from 2014
	24560711	corn stalks from 2014
Hirakata	23562808	corn stalks from 2014
	23562824	corn stalks from 2014
	23562823	corn stalks from 2014
Schweizer	22573220	sprayed and disked alfalfa
	22573224	winter wheat - sprayed and disked after wheat harvest

Disked and Sprayed Fields

Disked field

Sprayed and disked alfalfa

Winter Wheat

Early winter wheat

Winter wheat

Winter wheat after cutting

Corn Stalks

2014 corn stalks

2014 corn stalks before spraying

Separation Techniques

Separation between fallow and irrigation

Example of tilled strip of land used to demonstrate dry-up

Inspections of the 2015 Fallowed Acreage were generally conducted by Lower Ark on a weekly or more frequent basis. The Division Engineer conducted periodic inspections. In addition, the State of Kansas conducted inspections of the 2015 Fallowed Acreage in June and September to confirm compliance with the dry-up conditions of the CWCB Approval. Two minor deviations were discovered as a result on these inspections:

A. Hirakata Farm Acreage Reduction

In June, it was discovered that one of the parcels on the Hirakata Farm that was to be partially fallowed had been mis-measured by 6.4 acres, and as a result the buffer zone was placed incorrectly. Because this 6.4 acre area had been briefly irrigated, it could not be claimed as dried-up for 2015 operations because the Criteria and Guidelines prohibit partial year dry-up. For June's accounting and going forward for the remainder of the Catlin Pilot Project, the 2015 Fallowed Acreage and associated 2015 Shares were reduced from 45.04 shares to 38.30 shares. The change was easily accommodated by reducing the Hirakata fallowed shares listed in the accounting, which automatically reduced the consumptive use volumetric limits and recalculated the composite consumptive use factor.

The reduction in shares retroactively reduced the monthly maximum consumptive use limits. Comparison of the new limits to the consumptive use deliveries from March through May revealed a 0.47 acre-feet exceedance of the April monthly consumptive use limit. A small adjustment was also made to the Pay As You Go percentage targets, which allowed for a greater range of deliveries to the augmentation station (8% to 23% as compared to the original 9% to 23%). After discussions with the State of Kansas and the Division Engineer, all agreed that this had not resulted in any functional over-delivery of historical consumptive use water by the Catlin Pilot Project in either March or May since in those months, the Catlin Pilot Project's conservative volumetric limits were reached (See Section VI.A) and consumptive use water associated with the 2015 Shares was released to the stream for a number of days and not delivered to the Municipal Participants. For April, the Division Engineer determined that because the call during the varied between the Fort Lyon Canal and the Catlin Canal, the over-delivery should be replaced when the Fort Lyon Canal was placing a call. This occurred in August, and 0.60 acre-feet[9] was released to the Arkansas River to make these replacements.

B. Schweizer Farm Acreage Reduction

In connection with a State of Kansas inspection in September, it was discovered that a separation ditch that ran between one of the fallowed parcels and a neighboring irrigated parcel had become partially filled with alfalfa and weeds and caused an overflow of irrigation water on to a small area (approximately 0.1 acres) of the fallowed parcel. Notably, this field had been inspected on several prior occasions and it was determined that this was a one-time occurrence that

[9] The portion of this replacement in excess of 0.47 acre-feet (0.13 acre-feet) was made to replace weed evapotranspiration as explained in Section V.E.

necessitated clearing of the ditch. Nevertheless, to simplify operations and accounting and after discussions with the State of Kansas and the Division Engineer, Lower Ark agreed to create a 25-foot buffer between the ditch and the fallowed parcel and to reduce the fallowed parcel by 0.5 acres for the remainder of Catlin Pilot Project operations. This result was a 0.51 share reduction in fallowed shares from 31.09 shares to 30.58 shares. The change was accommodated in the same manner as the previous reduction by a reduction in the Schweizer fallowed shares listed in the accounting, which automatically reduced the consumptive use volumetric limits and recalculated the composite consumptive use factor for September and subsequent months. Thus, there were no exceedances of monthly maximums due to this change in fallowed acreage and fallowed shares. Though the pro-rata deliveries were reduced proportionally by reducing the shares, this small change did not require an adjustment to the percentage of deliveries to each structure to assure that the Pay As You Go targets would be met for each delivery structure.

C. Efficacy of Prevention of Blowing Soils, Erosion and Noxious Weeds

Participating Farmers in the Catlin Pilot Project were contractually bound to undertake actions necessary to prevent blowing soils and erosion and to prevent noxious weeds. There were no reported problems with blowing soils or erosion on the 2015 Fallowed Acreage. Participating Farms controlled for noxious weeds in compliance with their obligations. The following actions were taken to control for noxious weeds on the 2015 Fallowed Acreage:

> ***"We are very pleased with the results from the first year of operations. Fallowing, combined with pilot project payments, gives us an opportunity to rest and improve our ground with laser leveling and weed control."***
>
> *~ Philip Chavez, general manager for Diamond A West and Diamond A East farms*

Table 20 – Noxious Weed Control by Farm

Farm	2015 Acres	Activity
Diamond A East	76.3	Sprayed weeds in empty field. Winter wheat parcel, sprayed after harvest
Diamond A West	36.1	Winter wheat parcels sprayed after harvest
Hancock	22.7	Sprayed weeds (2014 corn stalks)
Schweizer	30.6	Sprayed and disked alfalfa and weeds
Hanagan	32.8	Sprayed weeds (2014 corn stalks)
Hirakata	36.4	Sprayed weeds (2014 corn stalks)

In sum, the Catlin Pilot Project effectively achieved temporary dry-up, prevented blowing soils and erosion, and controlled noxious weeds on the 2015 Fallowed Acreage. Participating Farmers also commented that it allowed them to be more aggressive with weed control, with beneficial effects in subsequent years.

D. Efficacy of Re-Irrigation

Because 2015 was the first year of Catlin Pilot Project operations, information regarding the efficacy of re-irrigation of the 2015 temporarily fallowed lands is not yet available. However, 2016 operations for the Catlin Pilot Project will track and document the re-irrigation of those parcels temporarily fallowed during 2015, and the efficacy of re-irrigation will be monitored and discussed with the irrigators. In subsequent years, Participating Farms will be asked to track progress and provide information regarding any difficulties encountered during re-irrigation or conversely, and benefits realized during re-irrigation as a result of prior years' fallowing.

VIII. Accounting Modifications & Errors

As required by Condition No. 52 of the CWCB Approval, this section discusses accounting modifications made during 2015 operations, proposed accounting modification, and identified errors in accounting.

Overall, the accounting developed and approved for the Catlin Pilot Project worked well. A set of summary tables for the annual accounting is provided in **Appendix E**. Before operations began, proposed accounting was submitted to the Division Engineer's Office on February 6, 2015 in compliance with Condition No. 46 of the CWCB Approval. This proposed accounting was also provided to all commenting parties for their review. As a result of this review, a number of small changes were made to the accounting forms and the State and Division Engineer approved the accounting on March 13, 2015. The monthly accounting and other Catlin Pilot Project submittals were all posted online, as required by Condition No. 3of the CWCB Approval. These are located on the Colorado Division of Water Resources Laserfiche Weblink (WDID 1707700) at http://dwrweblink.state.co.us/dwrweblink/search.aspx?dbid=0.

A. Accounting Modifications Made

Over the course of 2015 operations, Applicants worked with the Division Engineer to add a number of columns to better facilitate accounting. These modifications to the accounting are summarized in this section.

1. Use of Composite Consumptive Use Factors

As part of the approval process, Lower Ark developed consumptive use factors to be applied on a farm-by-farm basis to determine the amount of consumptive use water available from the 2015 Shares associated with the 2015 Fallowed Acreage. Farm headgate deliveries would be multiplied by these factors to determine the portion of deliveries attributable to consumptive use available to the Municipal Participants. The consumptive use factors were updated in Applicants' March 5, 2015 submittal to the State Engineer and Division Engineer regarding revisions to the LFT and Pay As You Go analyses resulting from changes in the 2015 Fallowed Acreage and 2015 Shares. The consumptive use factors for 2015 operations are set out in Table 21 on the next page.

Table 21 – 2015 Updated Consumptive Use Factors

Farm	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Schweizer	-	0.000	0.063	0.155	0.377	0.531	0.537	0.538	0.445	0.250	0.179	-
Diamond A West	-	0.000	0.081	0.139	0.273	0.450	0.476	0.463	0.299	0.115	0.123	-
Hirakata Farms	-	0.000	0.093	0.150	0.328	0.521	0.533	0.532	0.417	0.222	0.188	-
Hancock	-	0.000	0.094	0.149	0.320	0.518	0.526	0.530	0.392	0.190	0.157	-
Diamond A East	-	0.000	0.122	0.156	0.348	0.528	0.542	0.541	0.454	0.249	0.202	-
Hanagan	-	0.000	0.101	0.158	0.337	0.526	0.536	0.537	0.436	0.221	0.194	-

The determination of the amount of consumptive use water available and the associated accounting was originally proposed to be completed on a farm-by-farm basis. However, it was suggested by a commenting party that the accounting would be simplified and streamlined if done on a combined basis. Applicants and the Division Engineer agreed that approach made sense.

In order to operate and perform accounting on a combined basis, Applicants needed to develop a monthly composite consumptive use factor that could be applied to the Catlin Pilot Project pro-rata farm headgate deliveries associated with all 2015 Shares and 2015 Fallowed Acreage. These factors are based on the updated consumptive use factors shown in the Table 20, above. The composite factor is simply a weighted average consumptive use factor obtained by multiplying the monthly consumptive use factors for each farm by the number of fallowed shares for each farm, then dividing the sum of the results by the total number of fallowed shares. Table 22, below, illustrates calculation of the March composite consumptive use factor. A composite consumptive use factor was determined in this manner for each month.

Table 22 - Sample Composite Consumptive Use Factor Calculation - March

Farm	CU Factor		Fallowed Shares[10]		Product
Schweizer	6.3%	x	31.09	=	1.97
Diamond A West	8.1%	x	48.53	=	3.95
Hirakata Farms	9.3%	x	45.04	=	4.20
Hancock	9.4%	x	24.52	=	2.31
Diamond A East	12.2%	x	76.01	=	9.31
Hanagan	10.1%	x	33.69	=	3.42
Total			258.88		25.15
				÷	258.88
				=	9.72%

[10] The fallowed shares are based on the Applicant's March 11, 2015submittal to the State Engineer and Division 2 Division Engineer regarding revisions to the LFT and "Pay As You Go" analyses. The fallowed shares for the Hirakata and Schweizer Farms were later changed during operation of the pilot project as explained in this report.

2. *Weed Evapotranspiration*

As discussed in Section V.E, Lower Ark calculated weed ET after observing weed growth in the recharge ponds. In order to account for deliveries of water for weed ET, a column labeled "CU Release to River" on the Actual Accting tab was added to show consumptive use water that was used to replace amounts owed to balance plan accounting for weed ET. This refinement also accounts for the inadvertent over-delivery of consumptive use water as a result of the reduction in the Hirakata farm dry-up shares from 45.04 to 38.30, as discussed in Section VII.A.

3. *Recharge Pond Volume Carry-Over*

Lower Ark discovered that the Recharge Pond accounting tab was missing a row to record the pond volume on the last day of one month for carryover to the next month's accounting. This value is needed to calculate the net infiltration from the pond on the last day of the month. Therefore, a "Pond Volume Beginning of Day" column was added for each pond (columns 6 and 15).

4. *Unit of Measure for Precipitation*

The unit of measure for precipitation on the Recharge Pond accounting tab (columns 8 and 17) was changed from feet to inches to allow for ease of data entry.

5. *Calculated Reduction in Exchange Rate*

As discussed in Section IV.B, the Planning-All Farms tab of the accounting was modified to automatically compute a 10% reduction in the amount of water available for exchange in recognition of the fact that it is impossible to precisely match estimated deliveries and actual deliveries in any operating scenario.

B. Proposed Modification to Transit Loss Assessment/Accounting Error

In addition to these modifications that were made over the course of 2015 operations, Lower Ark proposes another modification to the accounting to correct for an accounting error that resulted from the mis-application of transit losses. During 2015 operations, the accounting form applied the ditch-system transit loss that is owed on deliveries between the ditch headgate and the augmentation stations to the deep percolation deliveries themselves. However, the CWCB Approval required that the ditch transit loss be attributed to the consumptive use water. As a result, every day there were deep percolation deliveries made to the Timpas Creek Augmentation Station, the transit loss was incorrectly charged for the portion of the augmentation station delivery intended for deep percolation and a corresponding miniscule amount of water (0.0064 acre-feet per day, or 1.57 acre-feet for all of 2015 operations) was reportedly under-delivered to the recharge ponds. Importantly, the Catlin Pilot Project still achieved the target Pay As You Go target deep percolation deliveries in every month.

Table 23 illustrates the transit losses and the CU deliveries that effectively offset the transit losses.

Table 23 - Deep Percolation Transit Losses & Offsetting CU Credit

Month	CU Credit	Deep Percolation Transit Loss	CU Credit Balance	CU Credit Notes
March	0.19	-0.21	-0.02	March 15 un-used CU[1]
April		-0.23	-0.25	
May		-0.09	-0.34	
June		-0.13	-0.47	
July		-0.22	-0.70	
August		-0.21	-0.91	
September	0.34	-0.15	-0.71	September Excess Weed ET Delivery
October	0.01	-0.22	-0.93	October Excess Weed ET Delivery
November	1.25	-0.09	0.23	November unused CU
Total[2]	1.80	-1.57	0.23	Remaining CU Credit
[1]Not used since consumptive use credits were available but not delivered to Municipal Participants on the first day of operations.				
[2]Used to offset un-replaced lagged deep percolation.				

In some months, these amounts were offset by excess deliveries to recharge (May – August) because under Pay As You Go these deliveries could have been re-apportioned between the delivery locations and remained within the target percentages. These were also offset by a replacement of 1.25 acre-feet of unused consumptive use water in November due to a limitation in the CWCB Approval.[11] Excess deliveries of 0.35 acre-feet to replace weed ET in September and October and 0.19 acre-feet of CU credit available on the first day of operations were also available to offset any un-replaced deep percolation return flow obligations.

Lower Ark proposes to change the application of transit losses, affecting columns (33), (34), (40), (41), and (57) on the Planning-All Farms and Actual Accting tabs of the accounting spreadsheet. The current calculation applies the transit losses for the deep percolation delivered to the augmentation stations to deep percolation deliveries. While this error did not prevent proper deliveries of deep percolation return flows through the 2015 operations, the transit loss should nevertheless be deducted from the consumptive use rather than the deep percolation deliveries as required by the CWCB Approval. The proposed modification will allocate deep percolation transit

[11] This water was unused due to Condition No. 13 of the CWCB Approval regarding use of share water in Rule 14 plans. Under that condition, small number of parcels included in the Catlin Pilot Project had previously claimed credit for dry-up as part of a Rule 14 Plan. As a result of the agreement between Kansas and Colorado contained in Appendix A.4 to the *Kansas v. Colorado* Decree, credit may not be claimed for these parcels for use in a Rule 14 Plan. Because the Catlin Pilot Project provides water for Fowler's use by deliveries consumptive use credits to CWPDA's Rule 14 Plan, credits from those parcels cannot be used for Fowler or for any other Rule 14 plan until a change in use is decreed with the water court for the associated shares.

losses to consumptive use to assure that the full amount of deep percolation deliveries are delivered to the Arkansas River.

C. *Proposed Modification to Computations of Deliveries to Augmentation Stations and Recharge/Accounting Error*

While compiling data required for this report, it was noticed that computations of deliveries to the augmentation stations and the recharge ponds are based on canal headgate diversions rather than farm headgate deliveries. This oversight apparently originated while addressing a request by a commenting party on the Catlin Pilot Project application to change the consumptive use factors from a percentage of canal deliveries to a percentage of farm headgate deliveries. The consumptive use factors were modified as requested, but ditch and lateral losses, which must be applied to the pro-rata canal headgate deliveries to estimate farm headgate deliveries, were inadvertently overlooked. This oversight was contained in the accounting submitted to the State and Division Engineers on February 6, 2015.

Columns will be added to the Planning-All Farms and Actual Accting tabs of the accounting spreadsheet to correct this deficiency. Table 24 on the next page was developed to estimate any over-delivery of consumptive use water that may have occurred as a result of this error. The CU Limit column in the table is the monthly consumptive use limits imposed on the Catlin Pilot Project and the CU Actual column is the consumptive use claimed in 2015 operations of the Catlin Pilot Project by applying the consumptive use factors to pro-rata canal headgate diversions. The Planning CU Delivery is the pro-rata consumptive use that would have been available to the Municipal Participants in 2015 if the consumptive use factors had been appropriately applied to the pro-rata farm headgate delivery. The over-delivery column is the amount of excess consumptive use delivery that occurred in 2015 due to the use of the pro-rata canal headgate diversion.

Table 24 - Over-delivery of Consumptive Use Credits (AF)

Month	CU Limit	CU Actual	Planning CU Delivery	Over-Delivery
March	11.5	10.03	8.84	1.19
April[12]	21.3	21.80	21.80	0.00
May	43.1	24.04	24.05	0.00
June	96.6	78.59	68.45	10.14
July	107.2	107.20	107.20	0.00
August	98.1	98.07	94.90	3.17
September	51.3	46.94	51.26	0.00
October	37.9	29.11	26.88	2.23
November	9.6	8.54	7.48	1.06
Total	**475.7**	**428.64**	**410.85**	**17.79**

The result of this analysis indicates that the over-delivery of consumptive use credit was zero in four months. In the remaining months, the over-delivery ranged between 1.06 and 10.14 acre-feet. The annual over-delivery was only 17.79 acre-feet of consumptive use credit, which represents less than 5% of the estimated and delivered consumptive use credits. This is less than the estimated 10%-17% conservative under-estimate of consumptive use built into the LFT, as discussed in Section VI.A, above. In addition, as previously discussed in Section V.C, if the CWCB Approval allowed for stream depletion credits to be allocated on a monthly (rather than daily) basis, the excess consumptive use that resulted from this error would have been reduced by the excess deep percolation deliveries made in the corresponding month. In sum, the experience illustrates the value of conservative approach embodied in the LFT and CWCB Approval, which ensures a cushion so that operation of the Catlin Pilot Project does not injure other water rights or violate the Arkansas River Compact.

[12] The monthly CU limit for April, which was originally 21.8 acre-feet, was reduced due to the fallowed acreage shortage on the Hirakata Farm detailed in this report. The exceedance of the April CU limit shown in the CU Actual column was replaced in August via delivery of 0.47 acre-feet of CU to the river, as discussed in Section VII.A.

IX. Financial Information

The Catlin Pilot Project was the first application to be submitted and approved through the CWCB's H.B. 13-1248 pilot program. This meant that the Catlin Pilot Project application was the first to go through the process established in the CWCB's Criteria and Guidelines and was also the first to conduct an analysis using the LFT that was developed by the State Engineer. As a result, the process of putting together the Catlin Pilot Project application, working through the comments of nine parties, preparing a joint conference report with proposed terms and conditions, obtaining the CWCB Approval and then complying with the "conditions precedent" to 2015 operations that were set out in that approval, was an arduous one that involved significant commitment of time and financial resources by the Lower Ark District.

As a result of the costs incurred in developing the first pilot project application, the Lower Ark District requested and obtained grant funding from the CWCB's Alternative Transfer Methods Grant Program in May 2015. The grant money covers certain operational expenses incurred as a part of 2015 and 2016 Catlin Pilot Project operations, including accounting and reporting. Lower Ark and Super Ditch are deeply appreciative for this financial support.

A. Operational Expenses

Expenses incurred during 2015 operations primarily consisted of cost associated with Lower Ark personnel time, work conducted by Martin & Wood Water Consultants, Inc., and legal support provided by Berg Hill Greenleaf Ruscitti LLP. These efforts generally included such things as regular monitoring of the recharge facilities and deliveries; compiling and reviewing data on recharge and augmentation station deliveries; preparing both planning and actual accounting (this was done on a weekly basis for the first 10 weeks of the pilot project); installing and maintaining equipment; setting exchanges and associated coordination with the Catlin Canal Company superintendent and the Division Engineer monitoring of 2015 Fallowed Acreage; communicating with pilot project participants; modifying the Security and Fountain lease agreements; and addressing operations issues/concerns as they arose.

Labor costs associated with 2015 operations are summarized on Table 25:

Table 25 – 2015 Operational Expenses

Category	Hours	Amount
Engineering – Lower Ark Staff	664*	$39,340.00
Engineering – M&W Consulting	120	$22,715.00
Legal - BHGR	40	$9,010.00
Administrative – Lower Ark Staff	45**	$810.00
Total		$71,875.00
* June – November tracked at 414 hours. March – May estimated at 250 hours.		
** Administrative time estimated at 45 hours.		

In addition, expenses were incurred for the purchase of equipment intended to facilitate operations and in particular use of the Schweizer and Hanagan Recharge Ponds. In 2014, both of these ponds were equipped with a Parshall flume with stage discharge recorder to measure and record pond infiltration and a staff gauge to measure pond water surface elevation. In June 2015, both ponds were equipped with a radar level recorder to measure pond water surface elevation and with GPRSLink logging transmitters. These use telemetry to transmit pond inflow volumes and to record and transmit pond water surface elevations to SutronLink computer software used by Lower Ark. Lower Ark personnel also purchased one divider box for installation on the farm lateral serving the Hanagan Recharge Pond in 2015. These 2015 equipment costs are summarized in the following table.

Table 26 – 2015 Equipment & Supplies

Equipment & Supplies	No.	Unit Cost	Total Cost
Splitter Boxes and Installation Supplies	1	$500.00	$500.00
Radar Level Recorder	2	$2,850.00	$5,700.00
Miscellaneous Installation Supplies	1	$1,000.00	$1,000.00
Laptop computer	1	$1,500.00	$1,500.00
GPRSLink Station	4	$1,950.00	$7,800.00
TGPRS Activation Fee (one time)	4	$60.00	$240.00
TGPRS 5MB Plan (per 12 months)	4	$120.00	$480.00
SutronWIN User Account Setup	1	$500.00	$500.00
SutronWIN Activation Fee (one time)	4	$250.00	$1,000.00
SutronWIN Annual Subscription	4	$365.00	$1,460.00
TOTAL			$20,180.00

Equipment installed on Schweizer Recharge Pond

Finally, operation of the Catlin Pilot Project in 2015 required Lower Ark to obtain additional space in its M&I Excess Capacity Contract with the Bureau of Reclamation. The estimated cost associated with this additional space is $14,895.00.

In 2015, Fountain and Security paid $500 per acre-foot of water

B. Lease Payments

From the perspective of the Participating Farmers and the Municipal Participants, the Catlin Pilot Project was a success. All farms will participate again in 2016 and a number have offered to include additional irrigated acreage in future operations. Table 27 summarizes the payments made to Participating Farms.

Table 27 - Payments to Participating Farmers

Farm [13]	C.U. Delivered (AF)	Delivery Payment ($500/af)	Option Payment ($150/acre)	Total Payment	Payment per acre
A	130.81	$ 65,403.44	$ 11,445.00	$ 76,848.44	$ 1,007.19
B	52.99	$ 26,494.95	$ 5,415.00	$ 31,909.95	$ 883.93
C	59.54	$ 29,769.63	$ 4,920.00	$ 34,689.63	$ 1,057.61
D	42.22	$ 21,111.47	$ 3,405.00	$ 24,516.47	$ 1,080.02
E	66.07	$ 33,037.03	$ 5,460.00	$ 38,497.03	$ 1,057.61
F	58.09	$ 29,047.04	$ 4,590.00	$ 33,637.04	$ 1,099.25
Totals	**409.73**	**$ 204,863.58**	**$ 35,235.00**	**$ 240,098.58**	**$ 1,030.94**

The average payment per fallowed acre in 2015 was $1,030.94

Both Fountain and Security paid a total of $77,150.00 ($500 per acre-foot). For the first year of Catlin Pilot Project operations, the Lease Agreement entered into between Fowler and Super Ditch did not require a lease payment for water received and payments to Participating Farms associated with those deliveries were made by Lower Ark. All three Municipal Participants currently anticipate continued participation on the Catlin Pilot Project.

C. Costs Associated with Fallowed Fields

Lower Ark requested information from Participating Farms regarding the costs associated with fallowing the 2015 Fallowed Acreage and compliance with requirements concerning erosion,

[13] In the interest of privacy, we have withheld the name of the farm associated with the specific payment amount.

blowing soils, and noxious weeds. All six Participating Farms responded. Table 28 shows the costs associated with fallowing the fields and controlling for weeds were modest.

Table 28 – Estimated Costs Associated with Weed Control

Farm	2015 Acres	Est. Cost per Acre	Total Est. Cost	Activity
Diamond A East	76.3	$40.00	$3,052.00	Sprayed weeds in empty field. Winter wheat parcel, sprayed after harvest
Diamond A West	36.1	$40.00	$1,444.00	Winter wheat parcels sprayed after harvest
Hancock	22.7	$25.00	$567.50	Sprayed weeds (2014 corn stalks)
Schweizer	30.6	$50.00	$1,530.00	Sprayed and disked alfalfa and weeds
Hanagan	32.8	$20.00	$656.00	Sprayed weeds (2014 corn stalks)
Hirakata	36.4	$40.00	$1,456.00	Sprayed weeds (2014 corn stalks)
Total	234.9		**$10,705.50**	

In addition, Mr. Hanagan and Mr. Schweizer expended approximately $1,000.00 to spray the weeds in and around their respective recharge ponds.

D. Summary

The available financial information for 2015 generally demonstrates that rotational leasing-fallowing is a financially attractive means for farmers to provide temporary water supplies for municipal users, while keeping the associated water in agricultural communities. In coming years, operational costs for the Catlin Pilot Project will decline from the 2015 costs with additional experience and the development of new tools to streamline and simplify operations. In addition, significant start-up costs and one-time equipment expenses are not reoccurring. Moreover, much of the operating expense is unrelated to the volume of water delivered, and scale-up of the pilot project concept would not correspondingly increase costs.

X. Conclusions and Recommendations

2015 was the first year for operation of the Catlin Pilot Project. By any measure, it was a successful year. Over 400 acre-feet of water was supplied to the Town of Fowler, the City of Fountain, and the Security Water District. Operations were able to consistently meet all return flow obligations through the use of project facilities, include two recharge ponds that performed well. The Catlin Pilot Project operated exchanges into Pueblo Reservoir at all times desired to make deliveries to Fountain and Security. The fallowing of historically irrigated fields went smoothly without problems with erosion or noxious weeds. An aspect of project design that proved particularly helpful in utilizing all water generated by operations was differing delivery locations for the multiple municipal participants (Fountain and Security by exchange in Pueblo Reservoir and Fowler at the point of delivery to the Arkansas River) such that operation of an exchange was not always necessary. Participating Farms received an average of $1,030.94 per fallowed acre. Fountain and Security obtained water during times of high demand for $500 per acre-foot. Experience gained during Catlin Pilot Project operations has identified ways to streamline operations and administration for this and future rotational fallowing-leasing projects. The cooperation and communication among the State and Division Engineers, water users, Kansas, and the Catlin Pilot Project facilitated identification and resolution of obstacles to operation of rotational fallowing-leasing.

The Catlin Pilot Project is already successfully meeting the legislative policy goals articulated in HB 13-1248. The streamlined approach embodied in the Lease Fallow Tool proved to be an efficient means to calculate water available for lease and to determine return flows to avoid injury to other water rights holders and to ensure compliance with the Arkansas River Compact. The LFT also was effective at facilitating and expediting the Catlin Pilot Project application and approval process. The conference involving the applicants, commenting parties, the CWCB, and State and Division Engineers capitalized on the common platform of the LFT. Taken together, the LFT and the innovative application and approval process efficiently served to define issues and develop operating terms and conditions for the Catlin Pilot Project the first time they were used.

The Catlin Pilot Project is significant to the entire State of Colorado because it is the first “proof of concept” in the State of rotational land fallowing-municipal leasing. This first year of operations successfully demonstrated that rotational land fallowing-municipal leasing can be a viable alternative to permanent buy-and-dry. Specifically, the success of the Catlin Pilot Project in 2015 increased irrigators’ interest rotational fallowing-municipal leasing. It has also reduced other water user’s anxiety about temporary transfers for municipal use and demonstrated the successful exchange and delivery of wet water at a reasonable cost.

Rotational land fallowing-municipal leasing is central to the goals of the Colorado Water Plan, the CWCB, the IBCC, and basin roundtables. The Catlin Pilot Project's success means those goals are not misplaced, and are achievable with leadership, determination, and cooperation.

A. Recommendations

The Catlin Pilot Project operations in 2015 have highlighted two substantive recommendations for consideration by the CWCB. First, as discussed in Section VI, use of an "Owe-the-River" account should be permitted in future years' operations to allow the storage of excess exchange water for subsequent delivery to a municipal participant, or back to the river as return flow. This is because precisely matching actual deliveries to the river for exchange with desired deliveries is not possible under ideal conditions. An "Owe-the-River" reservoir account is often used to balance the accounting in situations such as these, but was not permitted in Catlin Pilot Project operations for 2015. This would alleviated the need for the Catlin Pilot Project to operate overly-conservative exchange rates and would thereby increase the ability to take advantage of a greater portion of the consumptive use water generated through fallowing operations.

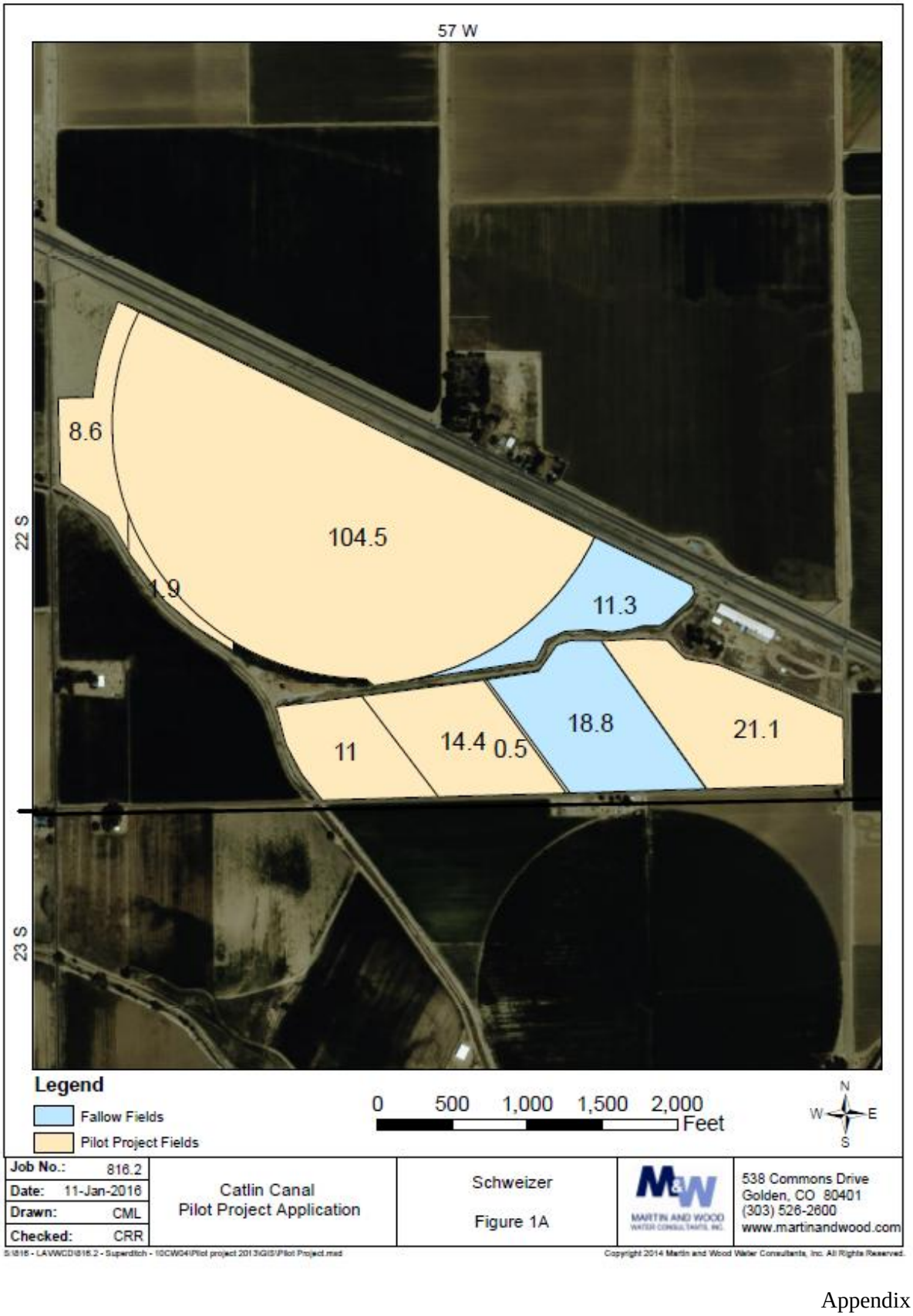
Second, as discussed in Section VI.A, the Criteria and Guidelines currently require average monthly volumetric consumptive use limits based on the three years with the highest annual consumptive use for the period of record. However, the standard method of calculating CU limits uses the highest months or the average of three highest months during the period of record because it is unlikely that the three maximum years of record would also contain all of the highest months of record. For 2015, the Criteria and Guidelines CU monthly limits ranged from 11.0 acre-feet to 28.9 acre-feet lower than the limits developed using the three highest years of record during the study period. Use of the three-highest month methodology would have allowed for increased consumptive use credits for municipal use in the four months (April, July, August, and September) where deliveries were curtailed in 2015 operations as a result of those limits. Given the already conservative nature of the various inputs that are required to be used in running the LFT under the Criteria and Guidelines, this nontraditional method for calculating monthly consumptive use limitations unnecessarily restricts pilot project operations. As a result, we recommend that the CWCB modify the Criteria and Guidelines to calculate monthly consumptive use limits using the three highest months in the 30-year study period.

Appendix A

Aerials Showing 2015 Fallowed Acreage

Appear on the Following Pages

1. **Schweizer Figure 1A**
2. **Diamond A West Figure 2A**
3. **Hirakata Farms Figure 3A**
4. **Hancock Figure 4A**
5. **Diamond A East Figure 5A**
6. **Hanagan Figure 6A**



Job No.: 816.2 Date: 11-Jan-2016 Drawn: CML Checked: CRR	Catlin Canal Pilot Project Application	Schweizer Figure 1A	MARTIN AND WOOD WATER CONSULTANTS, INC.	538 Commons Drive Golden, CO 80401 (303) 526-2600 www.martinandwood.com

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Pilot Project Fields
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Job No.: 816.2
Date: 09-Sep-2015
Drawn: CRR
Checked: EP
Catlin Canal
Pilot Project Annual Report
Diamond A West
Figure 2A
MARTIN AND WOOD
WATER CONSULTANTS, INC.
538 Commons Drive
Golden, CO 80401
(303) 526-2600
www.martinandwood.com
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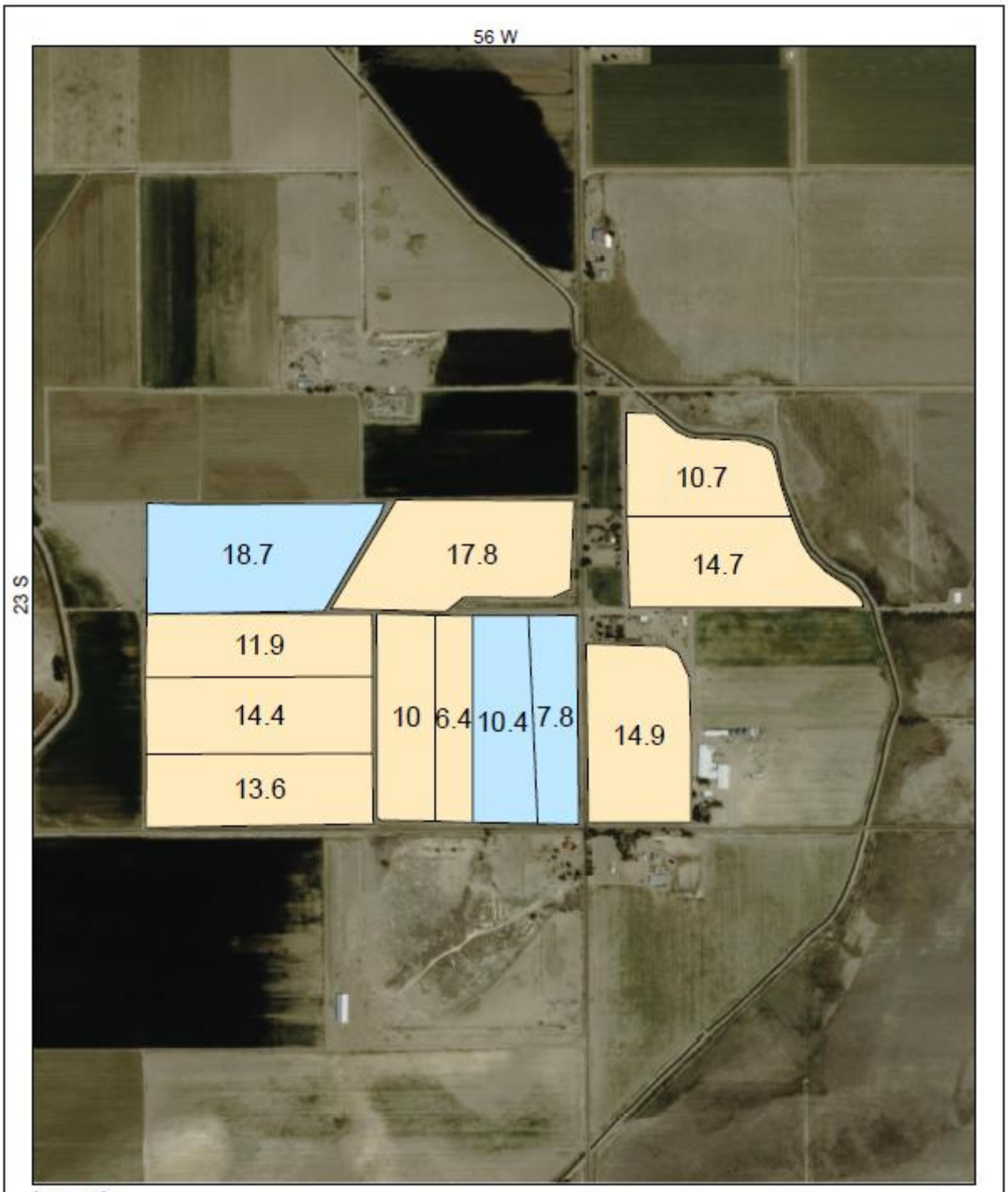

Job No.: 816.2 Date: 09-Sep-2015 Drawn: CML Checked: EP	Catlin Canal Pilot Project Annual Report	Hirakata Farms Figure 3A	MARTIN AND WOOD WATER CONSULTANTS, INC.	538 Commons Drive Golden, CO 80401 (303) 526-2600 www.martinandwood.com

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Job No.: 816.2	Catlin Canal Pilot Project Annual Report	Hancock	MARTIN AND WOOD WATER CONSULTANTS, INC.	538 Commons Drive Golden, CO 80401 (303) 526-2600 www.martinandwood.com
Date: 09-Sep-2015		Figure 4A		
Drawn: CML				
Checked: CRR				

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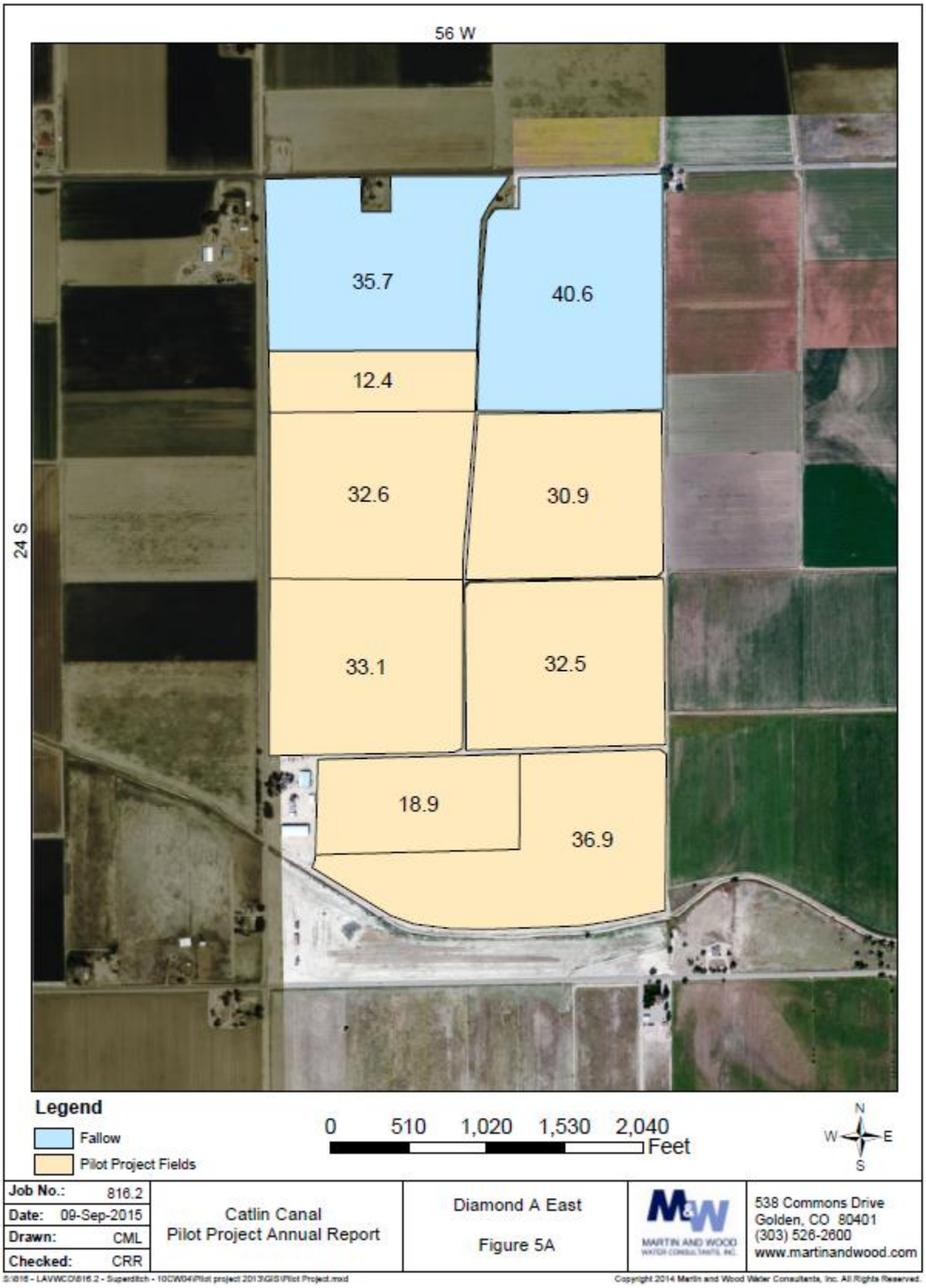

Job No.: 816.2 Date: 09-Sep-2015 Drawn: CML Checked: CRR	Catlin Canal Pilot Project Annual Report	Diamond A East Figure 5A	MARTIN AND WOOD WATER CONSULTANTS, INC.	538 Commons Drive Golden, CO 80401 (303) 526-2600 www.martinandwood.com

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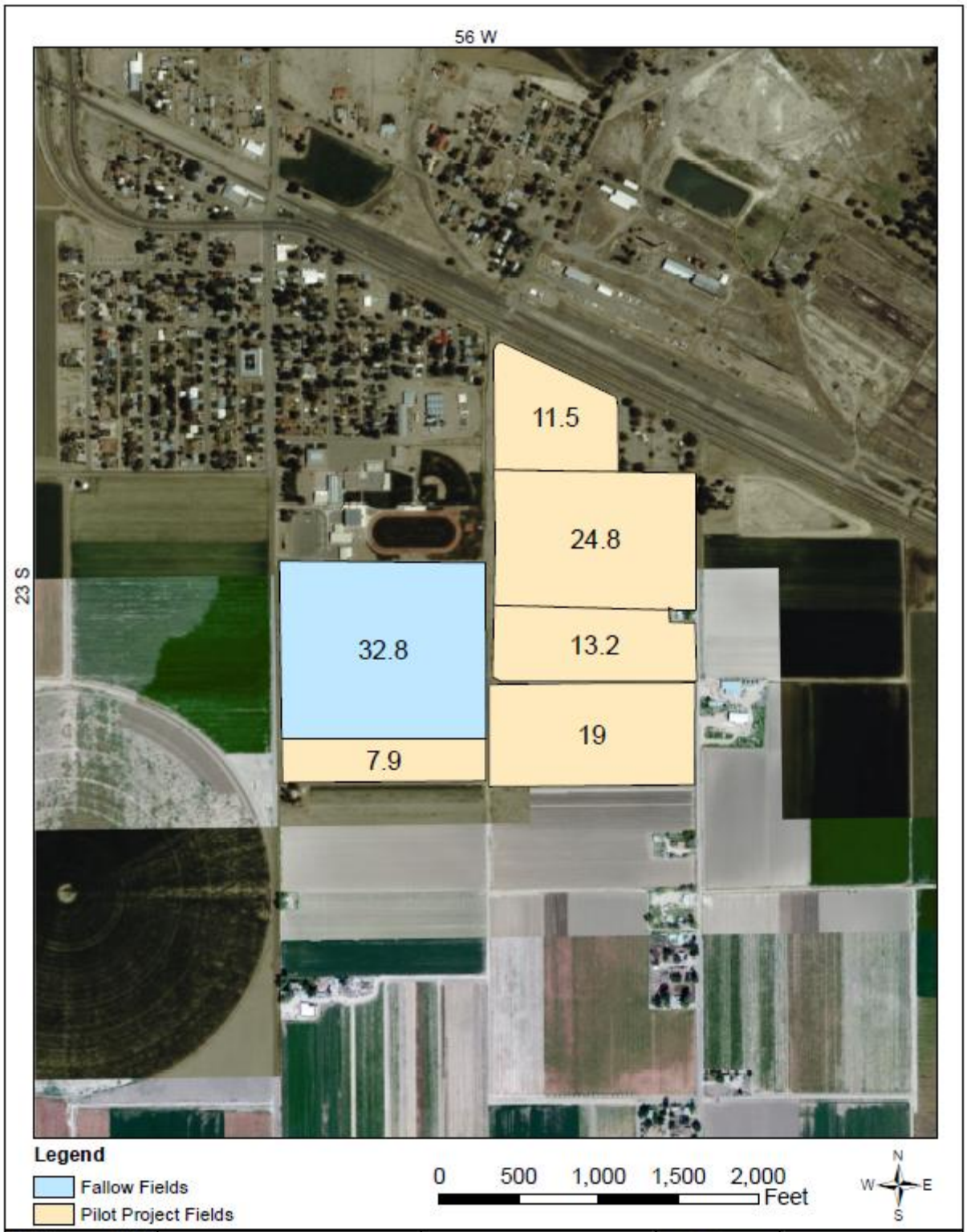

Job No.: 816.2	Catlin Canal Pilot Project Annual Report	Hanagan	MARTIN AND WOOD WATER CONSULTANTS, INC.	538 Commons Drive Golden, CO 80401 (303) 526-2600 www.martinandwood.com
Date: 09-Sep-2015		Figure 6A		
Drawn: CML				
Checked: CRR				

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APPENDIX B

Tracking of Dry-up, Fallowed Acreage & Fallowed Shares

Farm	Parcel ID	Acreage	Shares	Dry-up									
				2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Schweizer	**22573025**	**8.6**	**8.69**										
	22573207	**11**	**11.11**										
	22573215	**1.9**	**1.92**										
	22573217	**104.5**	**105.53**										
	22573220	**11.3**	**11.41**	11.3									
	22573224	**19.3**	**19.49**	18.8									
	22573225	**21.1**	**21.31**										
	22573228	**14.4**	**14.54**										
	*												
	Total	**192.1**	**194.00**	30.1									
		.											
Fallowed Credit				30.1									
Shares	**194**			30.58									
Shares/acre	**1.02**												

Farm	Parcel ID	Acreage	Shares	Dry-up									
				2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Diamond A West	**22573309**	**28.4**	**40.34**										
	22573321	**8.9**	**12.64**										
	22573328	**16.5**	**23.44**										
	22573411	**19.3**	**27.42**										
	22573412	**18.5**	**26.28**										
	22573417	**2.1**	**2.98**										
	22573425	**5**	**7.10**										
	22573426	**6.9**	**9.80**										
	23570402	**14.4**	**20.45**										
	23570414	**19.6**	**27.84**	19.6									
	23570415	**17.6**	**25.00**	17.6									
	*												
	Total	**157.2**	**223.30**	37.2									
Fallowed				36.07									
Shares	**223.3**			48.53									
Shares/acre	**1.35**												

Farm	Parcel ID	Acreage	Shares	Dry-up									
				2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Hirakata Farms	23562715	14.7	14.72										
	23562716	14.9	14.92										
	23562725	10.7	10.71										
	23562808	18.2	18.22	18.2									
	23562812	14.4	14.42										
	23562813	15.4	15.42										
	23562823	7.8	7.81	7.89									
	23562824	11.4	11.42	10.4									
	23562827	11.9	11.92										
	23562828	13.6	13.62										
	23562829	17.8	17.82										
	*												
	Total	150.8	151.00	36.49									
Fallowed				36.40									
Shares	151			38.30									
Shares/acre	1.05												

Farm	Parcel ID	Acreage	Shares	Dry-up									
				2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Hancock	24560711	12.9		12.9									
	24560722	11		9.8									
	24560723	37.4											
	24560724	14.3	15.13										
	*												
	Total	75.6	15.13	22.7									
Fallowed				22.68									
Shares	80			24.52									
Shares/acre	1.08												

Farm	Parcel ID	Acreage	Shares	Dry-up									
				2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Diamond A East	24561101	58.1	57.06	35.7									
	24561102	40.6	39.87	40.6									
	24561103	32.6	32.02										
	24561104	30.9	30.35										
	24561108	18.9	18.56										
	24561116	32.5	31.92										
	24561117	36.9	36.24										
	24561118	33.1	32.51										
	*												
	Total	283.6	278.53	76.3									
Fallowed				76.30									
Shares	278.53			76.01									
Shares/acre	1.00												

Farm	Parcel ID	Acreage	Shares	Dry-up									
				2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Hanagan	**23562509**	**11.5**	**12.64**										
	23563604	**24.8**	**27.25**										
	23566303	**40.7**	**44.73**	32.8									
	23563632	**13.2**	**14.51**										
	23563608	**19**	**20.88**										
	*												
	Total	**109.2**	**120.00**	32.8									
Fallowed				32.76									
Shares	**120**			33.69									
Shares/acre	**1.03**												

Totals for All Farms													
Fallowed				234.30									
Shares	**1046.83**			251.63									
Shares/acre (weighted value)				1.07									
*Reserved for additional parcel ID entry. Additional lines will be added as needed.													

APPENDIX C – PAY AS YOU GO TARGET DELIVERIES

Total Replacement of Deep Percolation at the Stream for 2015 Operations															
Actual Deliveries															
(acre-feet)															
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	Depletion	Accretion
2015	0.00	0.00	10.92	4.35	-7.18	-3.61	1.90	0.02	-3.30	1.17	-6.54	-7.55	-9.82	-9.82	0.00
2016	-4.50	-3.49	-2.90	-2.41	-1.93	-1.56	-1.21	-0.90	-0.57	-0.39	-0.24	-0.22	-20.32	-20.32	0.00
2017	-0.24	-0.25	-0.26	-0.26	-0.25	-0.24	-0.22	-0.21	-0.19	-0.17	-0.07	0.03	-2.33	-2.33	0.00
2018	0.08	0.14	0.21	0.27	0.32	0.39	0.40	0.38	0.36	0.35	0.41	0.49	3.80	0.00	3.80
2019	0.52	0.55	0.60	0.64	0.66	0.70	0.70	0.68	0.65	0.62	0.59	0.56	7.47	0.00	7.47
2020	0.54	0.52	0.50	0.48	0.47	0.45	0.30	0.12	0.02	-0.04	-0.08	-0.10	3.18	0.00	3.18
2021	-0.16	-0.30	-0.33	-0.31	-0.30	-0.28	-0.26	-0.24	-0.23	-0.21	-0.20	-0.18	-3.00	-3.00	0.00
2022	-0.17	-0.15	-0.14	-0.12	-0.04	0.06	0.11	0.17	0.25	0.31	0.37	0.44	1.09	0.00	1.09
2023	0.47	0.47	0.46	0.46	0.45	0.45	0.44	0.44	0.44	0.43	0.43	0.43	5.37	0.00	5.37
2024	0.42	0.42	0.42	0.41	0.41	0.41	0.40	0.40	0.40	0.39	0.39	0.39	4.86	0.00	4.86
2025	0.38	0.38	0.38	0.37	0.37	0.37	0.36	0.36	0.36	0.36	0.35	0.35	4.39	0.00	4.39
2026	0.35	0.35	0.34	0.34	0.34	0.33	0.32	0.32	0.33	0.32	0.32	0.32	3.98	0.00	3.98
2027	0.32	0.31	0.32	0.31	0.31	0.30	0.30	0.30	0.30	0.29	0.29	0.29	3.64	0.00	3.64
2028	0.29	0.29	0.28	0.28	0.28	0.28	0.28	0.27	0.27	0.27	0.27	0.26	3.32	0.00	3.32
2029	0.26	0.26	0.26	0.26	0.25	0.26	0.26	0.25	0.26	0.25	0.25	0.23	3.05	0.00	3.05
2030	0.24	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.22	0.22	0.22	2.74	0.00	2.74
2031	0.22	0.22	0.22	0.21	0.21	0.21	0.21	0.21	0.21	0.19	0.17	0.15	2.43	0.00	2.43
2032	0.12	0.08	0.05	0.03	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.29	0.00	0.29
2033	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2034	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2035	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2036	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2037	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2038	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2039	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2040	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2041	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2042	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2043	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2044	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2045	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total														-35.47	49.61

APPENDIX D

Weed Evapotranspiration Calculations

Based on the observation of vegetation in the Recharge Ponds, ET from weed cover was estimated using State CU as described in the below table and notes. Note that due to the high precipitation, May IWR was calculated as zero feet since the ET was wholly provided for by effective precipitation. Additionally, as noted by Lower Ark personnel, there were several days in May that evaporation was calculated by the accounting when there was no visible water surface in the pond. This amount has also been used as a credit against weed ET, resulting in over-replacement to the stream system for May.

May			
	Hanagan	**Schweizer**	**Total**
Average Vegetative Cover	35%	24%	-
PET feet)	0.323	0.323	-
Effective Precipitation (feet)	0.323	0.323	-
IWR (feet)	0	0	-
Maximum Pond Surface (acres)	3.862	5.150	-
Vegetative Cover (acres)	1.352	1.236	2.588
IWR (acre-feet/acre)	0.000	0.000	-
Pond Evaporation Credit (acre-feet)	-	0.05	0.05
Weed ET (acre-feet/acre)	0.00	-0.05	-0.05

June			
	Hanagan	**Schweizer**	**Total**
Average Vegetative Cover	20%	15%	-
PET feet)	0.556	0.556	-
Effective Precipitation (feet)	0.089	0.089	-
IWR (feet)	0.467	0.467	-
Maximum Pond Surface (acres)	3.862	5.150	-
Vegetative Cover (acres)	0.772	0.773	1.545
Weed ET (acre-feet/acre)	0.361	0.361	0.721

July			
	Hanagan	**Schweizer**	**Total**
Average Vegetative Cover	21%	6%	-
PET feet)	0.591	0.591	-
Effective Precipitation (feet)	0.026	0.026	-
IWR (feet)	0.565	0.565	-
Maximum Pond Surface (acres)	3.862	5.150	-
Vegetative Cover (acres)	0.811	0.309	1.120
Weed ET (acre-feet/acre)	0.458	0.175	0.633

August			
	Hanagan	**Schweizer**	**Total**
Average Vegetative Cover	36%	0%	-
PET feet)	0.535	0.535	-
Effective Precipitation (feet)	0.084	0.084	-
IWR (feet)	0.451	0.451	-
Maximum Pond Surface (acres)	3.862	5.150	-
Vegetative Cover (acres)	1.390	0.000	1.390
Weed ET (acre-feet/acre)	0.627	0.000	0.627
Total Weed ET - June, July & August	1.446	0.535	1.981

September			
	Hanagan	**Schweizer**	**Total**
Average Vegetative Cover	27%	0%	-
PET feet)	0.391	0.391	-
Effective Precipitation (feet)	0.004	0.004	-
IWR (feet)	0.387	0.387	-
Maximum Pond Surface (acres)	3.862	5.150	-
Vegetative Cover (acres)	1.043	0.000	1.043
Weed ET (acre-feet/acre)	0.404	0.000	0.404

October			
	Hanagan	**Schweizer**	**Total**
Average Vegetative Cover	18%	0%	-
PET feet)	0.202	0.202	-
Effective Precipitation (feet)	0.096	0.096	-
IWR (feet)	0.106	0.106	-
Maximum Pond Surface (acres)	3.862	5.150	-
Vegetative Cover (acres)	0.695	0.000	0.695
Weed ET (acre-feet/acre)	0.074	0.000	0.074

November			
	Hanagan	Schweizer	Total
Average Vegetative Cover	18%	0%	-
PET feet)	0.028	0.028	-
Effective Precipitation (feet)	0.003	0.003	-
IWR (feet)	0.025	0.025	-
Maximum Pond Surface (acres)	3.862	5.150	-
Vegetative Cover (acres)	0.695	0.000	0.695
Weed ET (acre-feet/acre)	0.017	0.000	0.017

State CU Notes

Pasture Grass SCS TR21 Crop Coefficients

USBR Effective Precipitation Method

No Altitude Adjustment

Entered Average Precipitation and Temperature for July through December to force computations for 2015

Rocky Ford 2SE Climate Station when available, CSU Expt Stn Rocky Ford used when Rocky Ford 2SE data not available.

Additional Notes

The accounting calculates the full water surface for each pond.

No deductions to the water surface were made for the Vegetative Cover.

Pond Evaporation Credit is credit for evaporation calculated by the accounting for days when there was no water surface per observation by Lower Ark personnel.

Average Vegetative cover provided per observation by Lower Ark personnel.

APPENDIX E

SUMMARY OF 2015 ACCOUNTING TABLES

	Deliveries			
Month	Pro-rata Delivery	Timpas Creek Augmentation Station	Schweizer Pond	Hanagan Pond
	(ac-ft)	(ac-ft)	(ac-ft)	(ac-ft)
March	103.22	45.61	31.38	26.23
April	145.06	64.21	41.32	39.53
May	93.44	41.57	23.21	28.66
June	158.82	103.24	12.87	42.70
July	205.51	142.57	12.50	50.44
August	191.51	131.45	8.17	51.89
September	126.94	76.92	14.88	35.15
October	138.85	67.66	33.40	37.79
November	48.40	23.35	13.39	11.66
Total	1211.75	696.59	191.11	324.05
%Delivery	100.00%	57.49%	15.77%	26.74%

Month	Timpas Creek Augmentation Station													
	Total Augmentation Station to Arkansas River	Total Consumptive Use to Municipal Participants	Town of Fowler CU Credits	City of Fountain CU Credits	Security Water District CU Credits	Return Flow Delivery	Deep Percolation Portion of Delivery	Tailwater Portion of Delivery	Deep Percolation to Transit Losses	Total CU Deilvery to Offset Transit Losses/Weed ET/Evaporation	CU Delivery for Transit Losses	CU Delivery for Deep Perc to offset Pond Evap	CU Delivery for Deep Perc to offset Weed ET	Unsused CU Delivered to River
	(ac-ft)	(ac-ft)	(ac-ft)	(ac-ft)	(ac-ft)	(ac-ft)	(ac-ft)	(ac-ft)	(ac-ft)	(ac-ft)	(ac-ft)	(ac-ft)	(ac-ft)	(ac-ft)
March	45.61	9.52	4.75	2.38	2.38	35.78	16.93	18.64	0.21	0.12	0.12			0.19
April	64.21	20.95	1.27	9.84	9.84	43.01	18.16	24.62	0.23	0.26	0.26			0.00
May	41.57	22.85	3.50	9.67	9.67	18.34	7.08	11.17	0.09	0.39	0.29	0.10		0.00
June	103.24	76.35	20.52	27.92	27.92	25.93	10.27	15.53	0.13	0.96	0.96			0.00
July	142.57	103.77	27.08	38.35	38.35	37.49	17.74	19.53	0.22	1.31	1.31			0.00
August	131.45	92.70	1.79	45.46	45.46	35.09	16.60	18.28	0.21	3.18	1.20		1.98	0.47
September	76.92	48.37	17.15	15.61	15.61	27.19	12.03	15.00	0.15	1.02	0.62		0.40	0.35
October	67.66	27.29	17.13	5.08	5.08	39.94	17.77	21.95	0.22	0.42	0.34		0.07	0.01
November	23.35	6.68	6.68	0.00	0.00	15.29	7.23	7.97	0.09	0.12	0.10		0.02	1.25
Total	696.59	408.48	99.87	154.30	154.30	278.06	123.81	152.69	1.57	7.79	5.21	0.10	2.48	2.26
%Delivery	100.00%	58.64%	14.34%	22.15%	22.15%	39.92%	17.77%	21.92%	0.23%	1.12%	0.75%	0.01%	0.36%	0.32%

Month	Schweizer Recharge Pond				Hanagan Recharge Pond			
	Total Deliveries	Deep Percolation Delivery	Recharge (Net Infiltration)	CU to Evaporative Losses	Total Deliveries	Deep Percolation Delivery	Recharge (Net Infiltration)	CU to Evaporative Losses
	(ac-ft)	(ac-ft)	(ac-ft)	(ac-ft)	(ac-ft)	(ac-ft)	(ac-ft)	(ac-ft)
March	31.38	31.26	31.09	0.12	26.23	26.15	19.36	0.08
April	41.32	41.07	59.29	0.24	39.53	39.18	56.54	0.35
May	23.21	22.91	23.19	0.30	28.66	28.05	29.84	0.61
June	12.87	12.49	12.55	0.38	42.70	41.81	39.61	0.90
July	12.50	12.49	13.38	0.01	50.44	48.33	49.30	2.11
August	8.17	8.17	8.17	0.00	51.89	50.17	52.63	1.72
September	14.88	14.88	21.10	0.00	35.15	33.62	41.31	1.53
October	33.40	33.28	33.28	0.12	37.79	36.52	36.84	1.27
November	13.39	13.30	13.35	0.09	11.66	11.27	15.30	0.39
Total	191.11	189.85	215.40	1.26	324.05	315.11	340.73	8.94
%Delivery	100.00%	99.34%	112.71%	0.66%	100.00%	97.24%	105.15%	2.76%

Month	Total Consumptive Use to Municipal Participants	Town of Fowler CU Credits		City of Fountain CU Credits		Security Water District CU Credits	
		Delivered to Arkansas River HIM Reach 7	Credits Applied to CWPDA R-14 Plan	Exchanged to LAVWCD Account in Pueblo Reservoi	City of Fountain	Water Delivered to Participant's Pueblo	Security Water District
	(ac-ft)	(ac-ft)	(ac-ft)	(ac-ft)	(ac-ft)	(ac-ft)	(ac-ft)
March	9.52	4.75	-	2.40	-	2.40	-
April	20.95	1.27	6.02	9.80	-	9.80	-
May	22.85	3.50	3.50	9.70	-	9.70	-
June	76.35	20.52	20.52	27.90	21.90	27.90	21.90
July	103.77	27.08	27.08	38.35	27.90	38.35	27.90
August	92.70	1.79	1.79	45.46	-	45.46	-
September	48.37	17.15	17.15	15.61	83.81	15.61	83.81
October	27.29	17.13	17.13	5.08	15.61	5.08	15.61
November	6.68	6.68	6.68	0.00	5.08	0.00	5.08
Total	408.48	99.87	99.87	154.30	154.30	154.30	154.30
%Delivery	100.00%	24.45%	24.45%	37.77%	37.77%	37.77%	37.77%