TO: PRRIP WATER ADVISORY COMMITTEE
FROM: PRRIP EXECUTIVE DIRECTOR'S OFFICE
SUBJECT: PRRIP WATER PROJECTS ACCOUNTING UPDATE
DATE: NOVEMBER 30, 2021

I. INTRODUCTION

This memorandum was prepared by the Executive Director's Office (EDO) of the Platte River Recovery Implementation Program (PRRIP or Program) to document the operations of the Program's water projects through the end of calendar year 2020.[1] It is an update to the original accounting analysis that covered the years from the start of the Program in 2007 through 2018.[2] **Table 1** identifies current Program water projects and the initial year of operation. A few projects pre-date the start of the Program's First Increment, in which case 2007 is recognized as the first year of operation. Many of these projects are operated on behalf of the Program by stakeholder organizations, including the Central Nebraska Public Power and Irrigation District (CNPPID), the Nebraska Public Power District (NPPD), and the Central Platte Natural Resources District (CPNRD).

Table 1. Program Water Projects Operational in 2020.

Project	First Year of Operation
State Water Projects	
Tamarack I (Colorado)	2007
Lake McConaughy EA – Storable Natural Inflows (Nebraska)	2007
Pathfinder EA (Wyoming)	2012
Water Action Plan (WAP) Projects	
No-Cost Net Controllable Conserved Water (NCCW)	2007
Phelps County Canal Groundwater Recharge	2011
Pathfinder Municipal Account Lease	2012
CPNRD Recharge (Thirty Mile, Cozad, and Orchard-Alfalfa canals)	2013
Elwood Reservoir Recharge	2015
NPPD Recharge (Gothenburg and Dawson County canals)	2015
Cook Recapture Well (part of the Phelps recharge project)	2016
CNPPID Irrigator Lease	2016
CPNRD Surface Water Lease	2018
NPPD Surface Water Lease	2019
Cottonwood Ranch Broad-Scale Recharge	2020

[1] The need to regularly review Program water projects operations was specified in Milestone Steps 4.6 and 4.7 (Program Document, Attachment 2) and item #7 in Appendix B of the Water Plan Reference Material (Program Document, Attachment 5, Section 11). https://platteriverprogram.org/document/final-platte-river-recovery-implementation-program-full-document-appendices

[2] PRRIP Executive Director's Office. 2018 PRRIP Water Projects Accounting. Final Memorandum, August 27, 2019. https://platteriverprogram.org/internal-document/final-2018-prrip-water-projects-accounting-memo

Program water projects are generally one of two types, and the sections that follow are organized accordingly:

- Projects that divert Platte River streamflows above U.S. Fish and Wildlife Service (USFWS) target flows (i.e., excess flows) for retiming through intentional groundwater recharge, mostly in existing canals and reservoirs.
- Projects in which surface water is leased or otherwise made available in the Lake McConaughy Environmental Account (EA) and later released to meet downstream flow needs.

Water projects accounting seeks to assess the extent to which the Program's water-related efforts are fulfilling the intent of its water objectives by contributing to real-time reductions to target flow deficits. The analyses utilize actual volumes of water leased or recharged; gaged streamflows as recorded at Grand Island (USGS 06770500) since 2007 (or whenever project operations subsequently began); and the real-time hydrologic condition—wet, normal, or dry, as evaluated by the EDO using methods developed by the USFWS—which can vary throughout the calendar year based on near-term flow, climate, and water supply conditions.

The previous accounting documentation included extensive discussion and comparison of operations accounting vs project scoring.[3] Inherent differences in the analyses dictate that results are not likely to match, and two other key factors were identified:

- Time, in the sense that not enough has elapsed to draw meaningful conclusions.
  - Project scores are based on 48-year averages of model results but the earliest Program water projects have only 14 years of real operations data through 2020; most projects have been active for even less time. The initial years following the startup of individual projects may not be indicative of the range of operations and hydrologic conditions that will occur in future years and decades.
  - Return flows to the river from groundwater recharge projects lag behind the time of diversion and recharge by months to years, even decades. After just a few years of operations, large quantities of water recharged for the Program have not yet returned to the river.
- Reduced availability of excess flows since 2007 compared to the 1947-1994 historical period, with differences in the winter months in particular impacting diversions for recharge projects.[4,5]

[3] Operations accounting is an analysis of what actually happened during real-time project operations (inputs, outputs, water reaching Grand Island, etc.). Scoring is an analysis for planning purposes to estimate the potential for a Program water project to reduce deficits to USFWS target flows at Grand Island.

[4] Excess Availability. EDO Draft Memorandum, August 21, 2015. https://platteriverprogram.org/internal-document/winter-excess-availability-memo

[5] Excess Analysis White Paper. EDO Draft White Paper, April 20, 2016. https://platteriverprogram.org/internal-document/excess-analysis-white-paper

Additional years of data are necessary to determine the long-term implications of these factors but with just two more years of project operations (2019-2020) since the previous analysis, the detailed comparisons of accounting and scoring results are not necessary to repeat here.

In addition, the previous accounting memo included extensive appendices consisting of Water Service Agreements (WSAs) or lease agreements between the Program and other entities, permits issued by the Nebraska Department of Natural Resources (NDNR) for diversions from the Platte River, invoices for water paid by the Program, and other relevant supporting documentation. All of those documents for 2019-2020 water projects operations are available in the EDO's files and are not necessary to include here.

II. GROUNDWATER RECHARGE

By 2020, the following groundwater recharge projects were being operated to benefit the Program:

- Tamarack I project in northeast Colorado
- Phelps County Canal groundwater recharge project and Cook recapture well
- Elwood Reservoir groundwater recharge project
- CPNRD recharge project using the Thirty Mile, Cozad, and Orchard-Alfalfa canals
- NPPD recharge project using the Gothenburg and Dawson County canals
- Cottonwood Ranch broad-scale recharge project

Operations accounting for recharge projects is a process that begins with measured diversions of excess flows from the Platte River. Excess flows are generally diverted for recharge during the non-irrigation season months between September and April, when the canal systems are not in use for the delivery of water to irrigators for crop production. However, if excesses are available and there is adequate carrying capacity in the CNPPID canals, water may be delivered to Elwood Reservoir or Cottonwood Ranch for recharge during the irrigation season as these projects only utilize the canals for deliveries.

Recharged water seeps into the underlying alluvial groundwater aquifers and migrates back towards the Platte River over time, eventually emerging as lagged baseflow accretions (return flows). Unit response functions (URFs) derived from numerical groundwater models are used to simulate the migration of water through the alluvial aquifer in order to estimate the timing and amounts of accretions.

Once the lagged accretions from intentional groundwater recharge are calculated, transit losses[6] are applied to route this water from the point or reach of return to Grand Island. Transit loss

[6] The calculations actually use the percent reaching Grand Island for a given month and hydrologic condition, based on output from the WMC Loss Model for a specified return location. The WMC Loss Model was first developed by the Water Management Committee as part of the Water Conservation/Supply Reconnaissance Study (Boyle et al. 1999, Chapter 7 and Appendix E), covering the period 1975-1994. The model period was updated to include 1995-2006 as part of the Water Management Study, Phase I (Boyle 2009, Appendix 2. https://platteriverprogram.org/internal-document/water-management-study-phase-i-evaluation-pulse-flows-platte-

rates are a function of the real-time hydrologic condition, month of the year, and the distance the water travels in the river to reach Grand Island. After the volume reaching Grand Island is calculated, it is checked against flow records to estimate the amount to be credited as shortage reductions at times when streamflows are below target flows.

Except for limited recharge recapture pumping, the Program has no operational control over the timing of baseflow accretions after diversions are made. Still, the total volume of accretions reaching Grand Island is of significance in the accounting analyses because groundwater recharge projects provide ongoing benefits to the river by consistently increasing baseflows as recharged water slowly returns to the river. The following sections summarize the operations and accounting for the Tamarack I project in Colorado and the WAP groundwater recharge projects in central Nebraska.

A. Tamarack I

The Tamarack I groundwater recharge project is Colorado's contribution to the Program's three initial state water projects. Located along the last 35 miles of the South Platte River upstream of the Colorado-Nebraska state line, Tamarack I diverts from the river to recharge ponds when there are flows in excess of USFWS targets at Grand Island and there is simultaneously no call on the South Platte River in Colorado. The sandy soils of northeastern Colorado and large groundwater depth allow the ponded water to seep into the underlying alluvial aquifer and migrate back to the South Platte River at rates that are much higher than other Program recharge projects in central Nebraska. The Tamarack I project is funded by Colorado water users in the South Platte Basin through the South Platte Water-Related Activities Program (SPWRAP), and shortage reductions are credited at no cost to the Program.

Tamarack I includes 16 dedicated riverside wells at the Tamarack State Wildlife Area near Crook, Colorado and the Heyborne project lift station between Ovid and Julesburg. Together, these dedicated projects deliver water to 10 recharge ponds. In addition, Tamarack I leases recharge credits from 10 private wells and from the Peterson and Settlers ditches near Julesburg, which deliver water to about 60 recharge ponds. About 40% of Tamarack I recharge credits are attributable to dedicated projects and 60% to private recharge projects.

Six of the dedicated wells were damaged during flooding in 2015 and remained out of commission for several years. Two wells had damage to stairways used to access the platforms upon which the well pumps and motors are mounted. These were repaired and resumed operation during the 2020-2021 non-irrigation season. The other four wells had severely damaged buried pipelines. These were finally repaired and fully operational as of March 2021. All 16 wells will be operational for 2021-2022 recharge.[7]

Colorado submits a Tamarack I report to the Program each year, including monthly and annual accounting of credits for shortage reduction. Diversions to Tamarack I facilities are typically

river-recovery). Use of the WMC Loss Model for routing in WAP project score analyses was approved by the GC in 2010 (GC Meeting Minutes, June 2010. https://platteriverprogram.org/document/2010-june-gc-minutes).

[7] Jon Altenhofen, personal email communication, August 29, 2021.

greatest in December and January, and most credits for shortage reductions occur between February and May. **Table 2** summarizes Tamarack I operations accounting since the Program began in 2007. Colorado's annual report tabulates credits for shortage reduction at the Colorado-Nebraska state line; the EDO takes the next step of routing those credits to Grand Island by applying factors derived from the WMC Loss Model.

Table 2. Tamarack I Operations Accounting (values in AF, rounded to the nearest 100)

Irrigation Year[1]	Tamarack I Net Diversions in Reach (Gross-Evap)	Tamarack I Total Accretions in Reach	Tamarack I Total Accretions at State Line	Tamarack I Credits for Shortage Reduction at State Line	Tamarack I Shortage Reduction Credits Reaching Grand Island
2007	16,300	12,600	4,100	3,300	2,800
2008	26,000	21,800	10,900	6,800	6,000
2009	2,600	9,900	7,600	6,600	5,600
2010	27,400	20,400	16,200	7,300	6,700
2011	79,300	42,600	26,200	2,700	2,500
2012	26,200	39,500	24,000	9,200	8,000
2013	17,900	23,300	12,300	6,600	5,600
2014	16,800	21,500	17,100	12,900	10,800
2015	35,200	29,400	24,400	11,100	10,200
2016	49,900	38,600	26,000	8,400	7,700
2017	29,200	35,700	24,900	8,600	7,700
2018	27,700	31,500	23,300	11,500	10,400
2019	53,000	38,800	28,000	7,500	6,700
2020	55,700	49,900	26,600	6,500	5,800
Total, 2007-2020	**463,200**	**415,500**	**271,500**	**109,000**	**96,600**
Average, 2008-2020	**34,400**	**31,000**	**20,600**	**8,100**	**7,200**

[1] Calculated average values exclude Irrigation Year 2007 (November 1, 2006-October 31, 2007) because the first two months precede the start of the Program in January 2007.

B. Phelps County Canal Groundwater Recharge Project and Cook Recapture Well

The Phelps County Canal Groundwater Recharge Project began with diversions for a pilot study that started at the end of September 2011. Excess flows are diverted at CNPPID's Tri-County Supply Canal headgate near North Platte and carried through that system to the Phelps County Canal headgate. Diversions into the Phelps County Canal are measured in a flume at Mile Post (MP) 1.6 and the canal is checked at MP 13.3 in order to pool water for recharge operations. After the canal is filled for recharge, diversions of excess flows are adjusted to achieve an equilibrium between the diversion and seepage (recharge) rates. Threshold water table elevations were established for two monitoring wells in areas where high groundwater was

observed in 2011-2012. If those levels are exceeded, diversions into Phelps County Canal cannot be made for recharge.

Once started, Phelps recharge operations generally continue as long as excess flows are available, threshold groundwater elevations are not exceeded, and/or the CNPPID infrastructure utilized for the project is not threatened by icy conditions. In the spring, the volume of any water remaining in the canal when irrigation operations begin in mid-April is subtracted from the measured volume of recharge diversions.

The Cook well is operated by the EDO to recapture water recharged through the Phelps County Canal and accelerate the return of that water to the Platte River during times of target flow shortages. Initial operation of the Cook well occurred in October 2016.

Phelps Recharge Diversions and Accretions

Records of measured daily diversions into the Phelps County Canal for recharge are provided by CNPPID. Originally, 50 percent of total Phelps recharge diversions were allocated to the Program. The December 2015 WSA between the Program and CNPPID revised the allocation to 75 percent for the Program and 25 percent for the State of Nebraska. The current WSA for Phelps County Canal recharge, dated September 25, 2019, retains the same allocations.[8] However, Nebraska's agreement expired at the end of 2017 and has not been renewed, so the allocation of Phelps recharge has been 100 percent to the Program since the start of 2018.

Dates and volumes of diversions into Phelps County Canal for recharge are shown in **Table 3**. With limited exceptions, all water used for recharge was excess flow diverted under a series of temporary annual appropriations.[9] There were no Phelps recharge diversions for nearly 14 months between January 2019 and March 2020 because of persistent high groundwater levels during the non-irrigation season months in which diversions could have occurred. Although recharge operations lasted nearly a month in March-April 2020, subsequent opportunities to divert excess flows have been few and limited in duration.

[8] WSA expires December 31, 2023.

[9] For December 2012 to March 2013 recharge operations, all water used was released from the Lake McConaughy EA under appropriation A-18987, as there were no sustained periods of excess flows during that time. The 21 AF credited to the Program in September 2020 for Phelps recharge was Lake McConaughy EA water released under appropriation A-19719 for test fill operations of the Cottonwood Ranch broad-scale recharge project and diverted into the Phelps County Canal, but not delivered by pipeline to Cottonwood Ranch.

Table 3. Phelps County Canal Recharge Diversions, 2011-2020

Diversion Period	Start Date	End Date	# of Days with Recharge Diversions	Measured Diversion Volume (AF)
1	9/28/2011	1/5/2012	100	2,779
2	12/10/2012	3/11/2013	92	4,088
3	9/19/2013	10/28/2013	40	1,945
4	11/26/2014	2/15/2015	82	2,544
5	11/16/2015	2/14/2016	91	3,711
6	3/16/2016	3/17/2016	2	473
7	9/15/2016	10/4/2016	20	1,374
8	10/10/2016	10/14/2016	4	222
9	11/16/2016	2/14/2017	86	2,661
10	9/15/2017	10/12/2017	28	1,353
11	12/1/2017	2/6/2018	68	2,384
12	11/19/2018	1/24/2019	67	2,904
13	3/19/2020	4/14/2020	27	910
14	9/21/2020	9/22/2020	2	21
15	11/17/2020	11/23/2020	7	809
16	11/30/2020	12/3/2020	4	246
		Total	**720**	**28,422**

After factoring in precipitation and evaporation, additional seepage between the Phelps canal headgate and the flume at MP 1.6 is estimated in the accounting analysis based on the average seepage rate from MP 1.6 to MP 13.3. Daily recharge is then summed to monthly totals. Lagged accretions to the Platte River on a monthly basis are determined using a URF that was developed based on the groundwater model used for the project score analysis.[10] **Figure 1** illustrates the monthly and cumulative unit responses for the first 10 years (120 months); the full URF is calculated out for 50 years (600 months).

[10] Phelps County Canal Groundwater Recharge Recommended Score and Scoring Analysis. PRRIP – ED Office Final, November 27, 2013. https://platteriverprogram.org/internal-document/phelps-recharge-score-analysis-memo-final

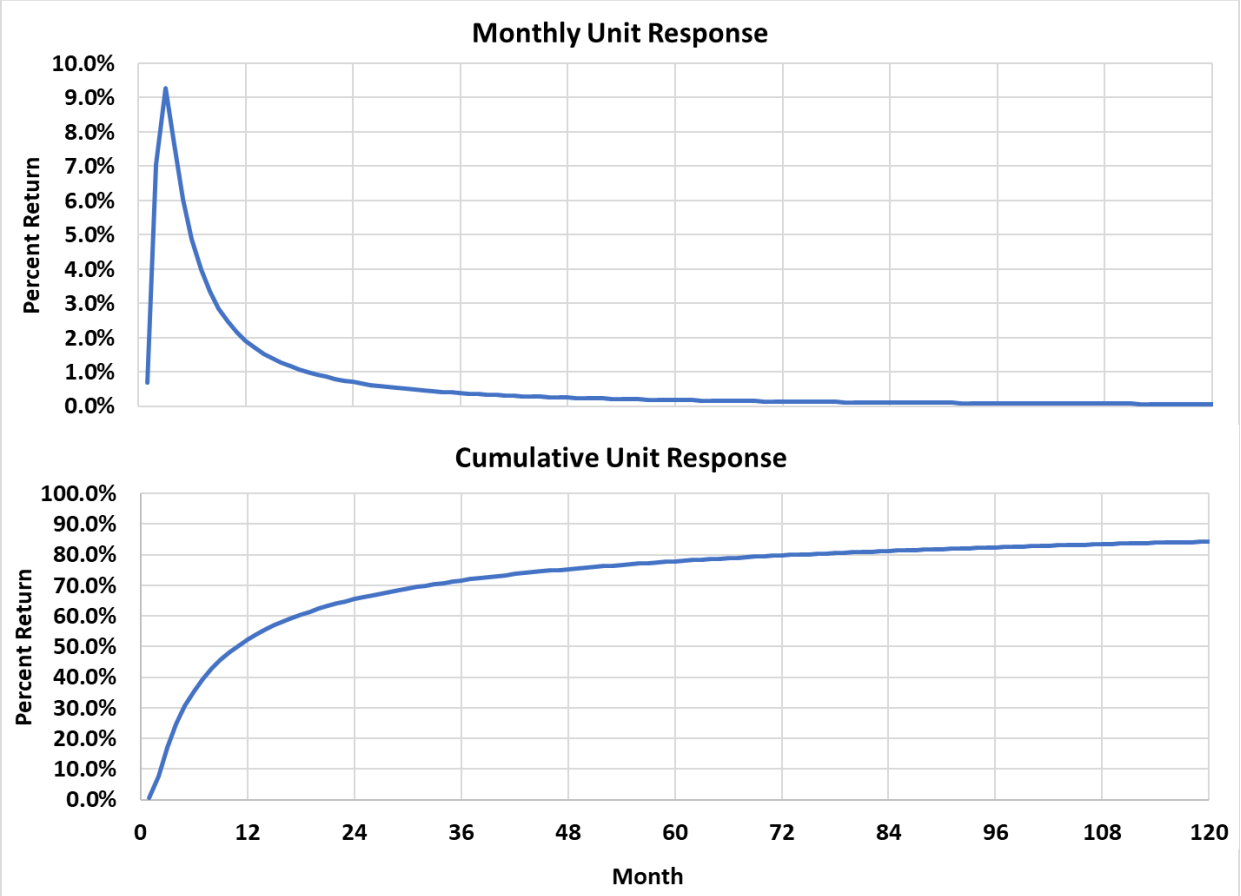

Figure 1. Monthly and Cumulative Unit Response for Phelps County Canal Recharge

Much of the upper extent of the Phelps County Canal used for recharge operations is located within two miles or less of the Platte River channel. Owing to this close proximity as well as the presence of several drains, the monthly unit response shows that accretions from Phelps recharge increase rapidly and peak in the third month, followed by a fairly rapid decline and a long tail that very slowly approaches zero. The magnitude of the actual response curve is scaled according to the volume of water recharged at a given time. Each successive period of recharge initiates a new response curve that is added to those from earlier recharge operations through the principle of superposition. **Figure 2** shows the timing and magnitude of Phelps recharge coupled with the volumetric accretions calculated using the URF through the end of 2020.

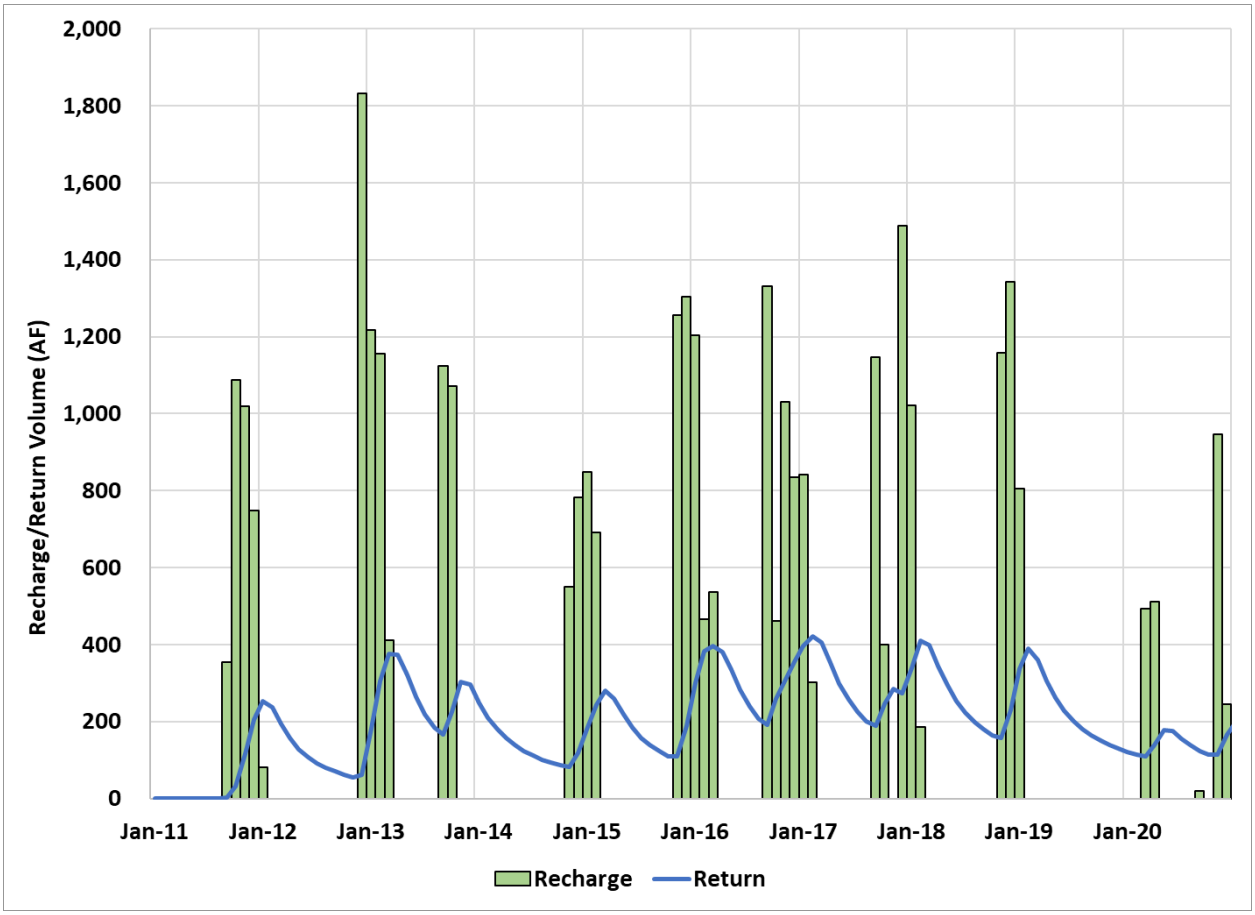

Figure 2. Phelps Canal Recharge (Seepage) and Return Flow (Accretion) Volumes by Month

Table 4 shows the cumulative return percentages at several intervals. After one year, accretions from Phelps recharge exceed 50% of the recharged volume, and after 10 years, 84% of recharged water has returned to the river. In practical terms what this means is that by the end of 2020, more than 80% of the water recharged in the first years of project operations (between September 2011 and March 2013) had returned to the Platte River as lagged accretions.

Table 4. Phelps Recharge Project Cumulative Return Percentage from URF

Month	3	12	36	60	120	600
Cumulative Return	17%	52%	72%	78%	84%	93%

For routing purposes, the score analysis for Phelp recharge split the lagged accretions 60% above Overton and 40% below Overton, and the same approach is applied to operations accounting.[11] Calculated monthly accretion volumes are converted back to a daily average flow rate.

[11] This step of splitting the accretions was neglected in the previous accounting analysis covering Program water project operations through 2018. Changes to the results for 2018 and earlier were minimal because total accretions to the river remain the same, and the only differences are in the amounts of the above/below Overton portions

Cook Well Pumping and Depletions

The EDO records the Cook well meter reading at the start and end of pumping. Dates and volumes of Cook Well pumping are shown in **Table 5**. There was nearly a full year gap between late-February pumping periods in 2019 and 2020 because there were few sustained periods of shortage.

Table 5. Cook Well Pumping, 2016-2020

Pumping Period	Date On	Date Off	# of Days with Pumping	Volume Pumped (AF)
1	10/4/2016	11/15/2016	43	116.67
2	10/4/2017	11/29/2017	57	151.77
3	8/15/2018	8/20/2018	6	16.48
4	8/29/2018	9/5/2018	8	17.96
5	10/2/2018	10/10/2018	9	24.54
6	2/20/2019	2/28/2019	9	25.57
7	2/21/2020	3/4/2020	13	36.67
8	9/2/2020	11/4/2020	64	180.76
		Total	**209**	**570.42**

For the accounting analysis, the total gallons pumped are converted to acre-feet and then to a daily average pumping rate in cfs for the period of operation. By design, this well is intercepting and pumping recharged groundwater that would otherwise eventually discharge to the Platte River. These depletions are estimated on a monthly basis using a URF developed specifically for the Cook well given its physical location and aquifer properties and likewise converted back to a daily average rate. **Figure 3** shows the monthly and cumulative unit responses for Cook well depletions for the first 10 years (120 months).

reaching Grand Island. Because of the relatively short river distance separating the two return locations used for routing purposes, those percentages differ by less than 1 for nearly all months and hydrologic conditions.

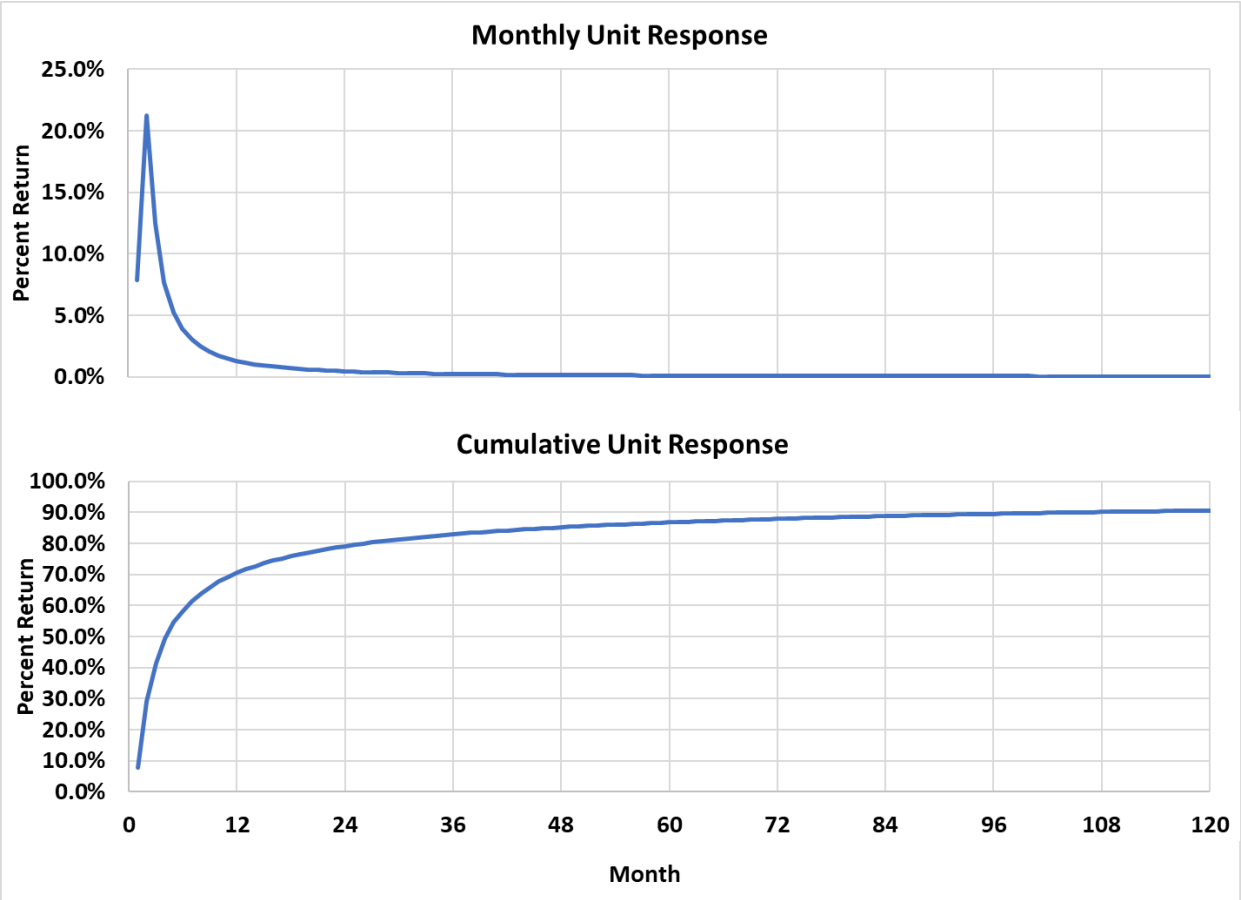

Figure 3. Monthly and Cumulative Unit Responses for Cook Well Depletions

As with the canal recharge, the response timing is quick, with depletions peaking in the second month at 21% and cumulative depletions exceeding 70% after one year.

Phelps and Cook Combined Effects

The net impact of Cook well operations (pumping minus depletions) is applied to the Phelps recharge accretions above Overton. During months in which the Cook well is actively pumping to the river, the net impact is generally positive and added to the daily recharge accretions; in most other months, the calculated depletions have a small net negative impact that is subtracted from the daily Phelps recharge accretions.

Figure 4 shows the periods of Phelps recharge diversions and Cook well pumping, along with the calculated daily average accretion rate.[12] The accretion rate increases with each successive input of recharge water—in a manner consistent with the monthly unit response shown in Figure 1 and the principle of superposition—and peaks in the months thereafter, but since recharge from the canal effectively stops once diversions end, the accretion rate then trails off between recharge

[12] The URFs are used to calculate accretion volumes (AF) on a monthly time step. These values are converted back to a daily average accretion rate (cfs) for each month, which is why the plotted time series appears as steps.

periods. When Cook well pumping is sustained, such as in the fall of 2016, 2017, or 2020, there is a noticeable corresponding jump in the accretion rate. Accretions from Phelps recharge and Cook well pumping peaked at 7.5 cfs in February 2017.

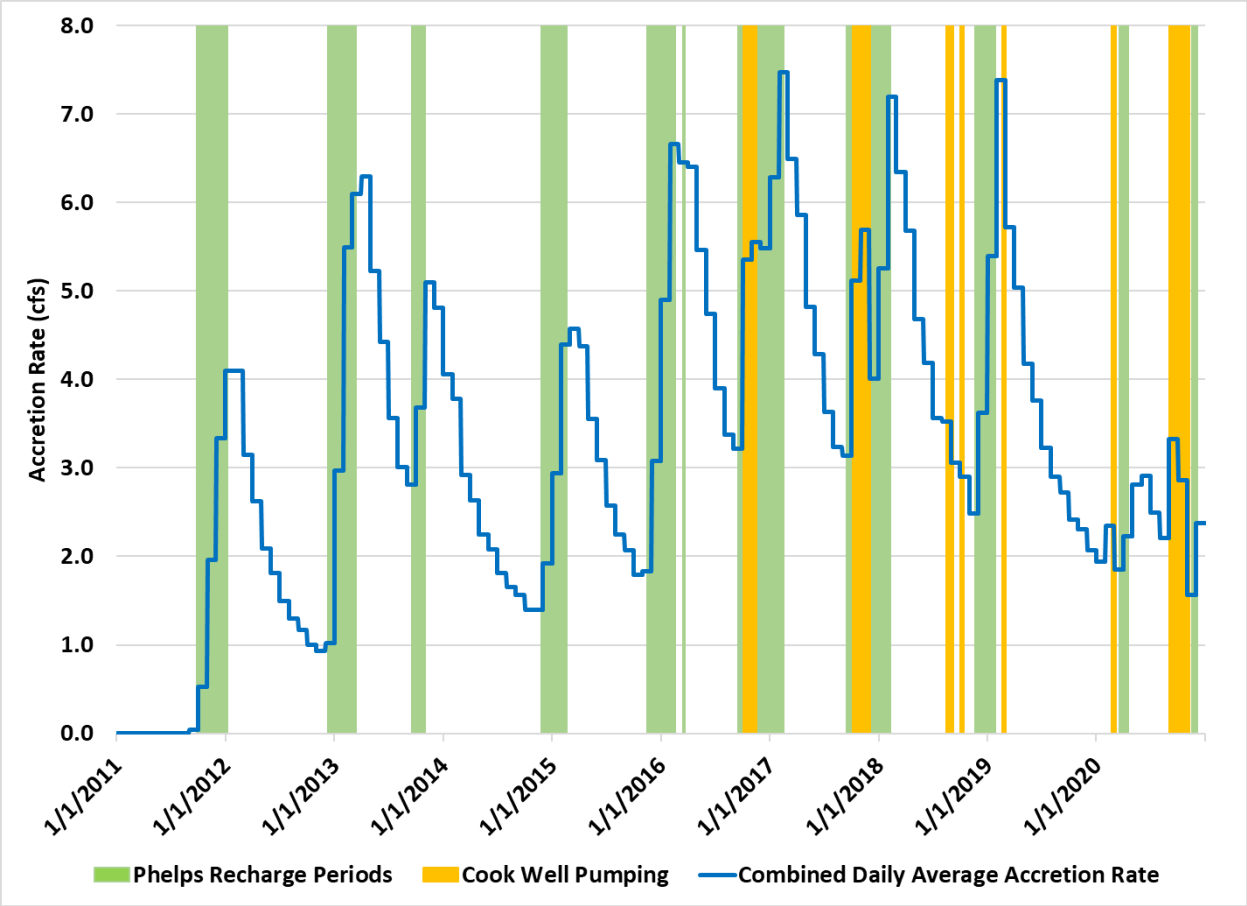

Figure 4. Phelps Recharge and Cook Well Pumping Periods with Accretion Rates

Once the net daily accretions to the Platte River from both Phelps recharge and Cook well pumping are determined, the water is routed downriver to Grand Island by accounting for transit losses. Target flow shortages are assessed on a daily basis, and the contribution of Phelps/Cook water to deficit reduction at Grand Island is determined. Daily results are then summed to get monthly and annual results. **Table 6** presents the annual results of accounting analyses for Phelps County Canal recharge and the Cook well since operations began in 2011.

Table 6. Phelps County Canal Recharge Project and Cook Well Operations Accounting

Year	Invoiced Diversions (AF)	Volume Recharged (AF)	Cook Well Pumping (AF)	Lagged Accretions at the River (AF)	Accretions Reaching Grand Island (AF)	Reductions to Target Flow Deficits (AF)
2011	2,709	3,200	0	360	300	0
2012	1,685	1,900	0	1,500	1,200	800
2013	4,418	5,000	0	3,200	2,500	1,800
2014	1,173	1,300	0	1,600	1,400	1,000
2015	3,613	4,100	0	2,200	2,000	910
2016	5,182	5,900	117	3,700	3,400	1,100
2017	3,687	4,200	152	3,600	3,100	1,600
2018	3,258	3,700	59	3,200	2,800	1,800
2019	712	810	26	2,800	2,600	870
2020	1,986	2,200	217	1,700	1,500	720
Total	**28,421**	**32,300**	**570**	**24,000**	**20,800**	**10,700**
Average	**2,842**	**3,200**	**114**	**2,400**	**2,100**	**1,100**

In the score analysis, Phelps recharge accretions occurring below Overton were discounted 4% based on distance below Overton to account for that portion of the Program's associated habitat reach not benefitting from those contributions to the river. If applied in this accounting analysis, average annual accretions reaching Grand Island drop from 2,078 AF to 2,044 AF, and average annual deficit reductions are reduced from 1,066 AF to 1,049 AF.[13]

Analysis of the Cook well data indicates that 570 AF pumped between October 2016 and December 2020 resulted in cumulative depletions totaling 399.5 AF over the same period, for a net addition to the river of 171 AF or 34 AFY. Overall results of the combined Phelps recharge and Cook well project through the end of 2020 can be summed up as follows (all values estimated through 12/31/2020):

- Total recharge = 32,300 AF
- Total river returns, including Cook well pumping = 24,000 AF
  - Average accretions to the river = 3.5 cfs
- Total return flows at Grand Island = 20,800 AF
  - Average accretions reaching Grand Island = 3.1 cfs
- Total reductions to target flow deficits at Grand Island = 10,700 AF
- Deficit reductions equal
  - 51% of return flows at Grand Island
  - 44% of total river returns
  - 33% of total recharge

[13] Exact calculated values are shown in this comparison because rounded values would imply greater differences.

The volume remaining in the aquifer and potentially available for recapture operations was about 8,300 AF, less future accretions to the river and depletions from pumping, both of which are ongoing continuously.

C. Elwood Reservoir Recharge Project

Elwood Reservoir was constructed in the late-1970s by CNPPID to provide supplemental irrigation water to the E-65 canal system. The reservoir sits on top of porous soils and leaks significantly into the underlying groundwater aquifer. As a WAP project for the Program, Elwood recharge functions as a means to re-time excess flows, which are diverted at the CNPPID's Tri-County Supply Canal headgate and carried through that system to the E-65 Canal, the Carl T. Curtis Pump Station, and into Elwood Reservoir. The pumping rate is a function of water surface elevation in the reservoir, with higher rates when the reservoir is low and lower rates when the reservoir is high, but there must be a minimum of 75 cfs in order to pump into the reservoir.

The Program and the CNPPID first entered into a WSA for intentional groundwater recharge through Elwood Reservoir in 2015. The current WSA dated June 24, 2019, divides water pumped into Elwood Reservoir for recharge into a 50% share for the Program and 50% for Tri-Basin Natural Resources District and the State of Nebraska.[14] However, all water up to the limit of 30,000 AF may be available to the Program during a calendar year if the other parties decline their shares. Invoices show that a total of 18,539.1 AF was pumped into Elwood Reservoir for Program recharge during calendar year 2019. The same year, CNPPID identified an issue with reservoir seepage emerging from the banks near the pump station. A consultant was hired to diagnose and identify solutions to this issue, but that work precluded any diversions into Elwood for recharge after September 2019 and throughout the entirety of 2020.[15]

The accounting process for Elwood recharge is fundamentally the same as that described previously for Phelps recharge. CNPPID maintains an Elwood tracking spreadsheet from which the EDO is able to calculate daily recharge volume. It is assumed for accounting purposes that all water pumped into Elwood Reservoir for the Program eventually seeps out as groundwater recharge, except for net evaporation as calculated from nearby weather station data. However, in contrast to the more or less instantaneous nature of Phelps recharge as water is diverted into the canal, the generally larger volumes of water pumped into Elwood may take months to years to recharge. As a result, recharge from Elwood Reservoir has been occurring continuously at an average rate of about 12 cfs since the project began in May 2015. **Figure 5** shows the timing and volumes of water pumped into the reservoir for the Program and the time series of ongoing recharge (through December 2020).

[14] WSA expires December 31, 2023.

[15] Excess flows were not diverted and pumped into Elwood for recharge for the Program until March 15-24, 2021, nearly 18 months after pumping into Elwood for recharge last ended on September 28, 2019.

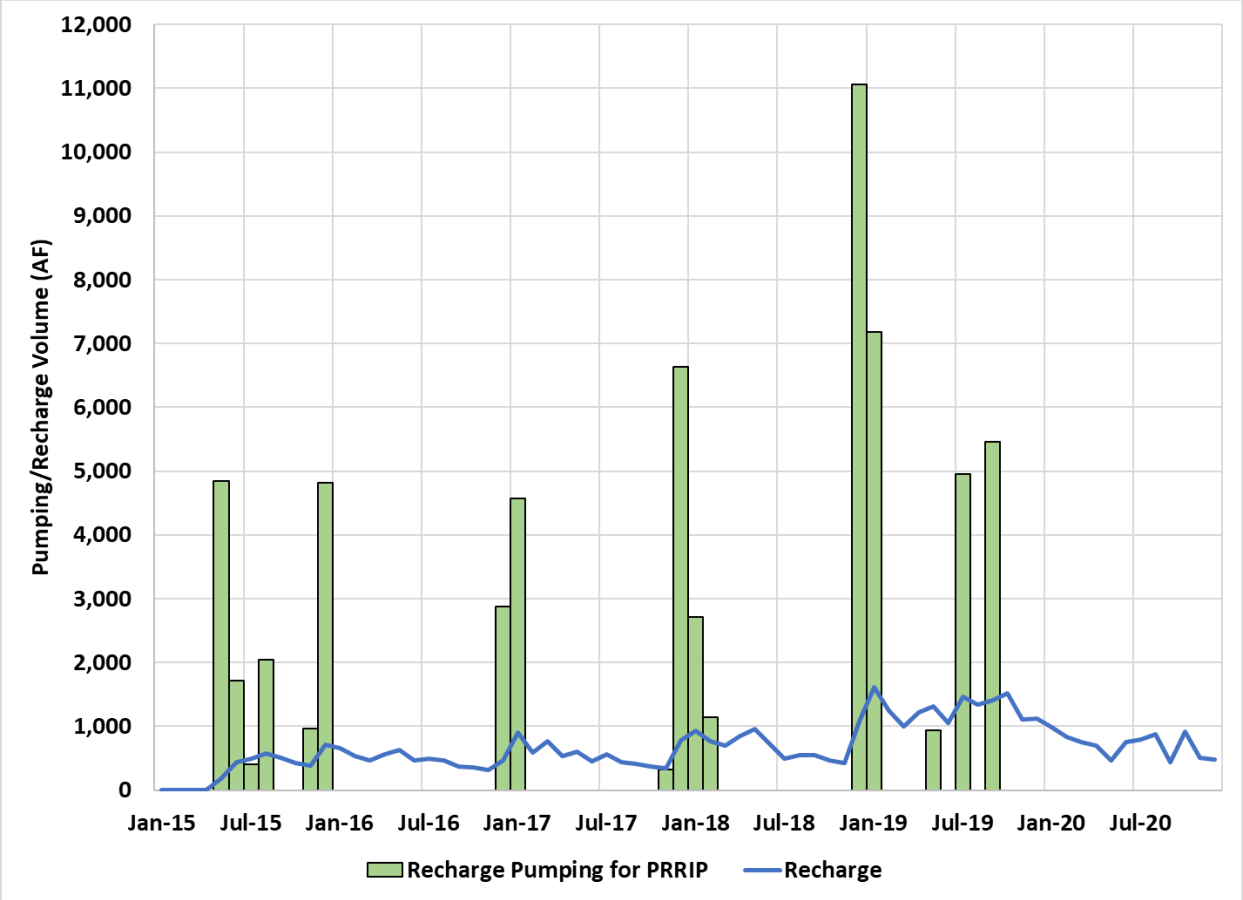

Figure 5. Elwood Reservoir Pumping for PRRIP and Recharge (Seepage) Volumes by Month

Groundwater modeling completed for the project score analysis shows that most of the water from Elwood recharge eventually emerges in the Platte River upstream of Overton, through either groundwater migration or interception by Plum Creek.[16] Monthly accretions from recharge are based on the URFs shown in **Figure 6**, with the actual accounting calculations utilizing the total URF (green lines).

[16] Elwood Reservoir Groundwater Recharge Scoring Analysis. PRRIP Executive Director's Office, September 17, 2019. https://platteriverprogram.org/internal-document/elwood-recharge-score-analysis-gc-september-2019

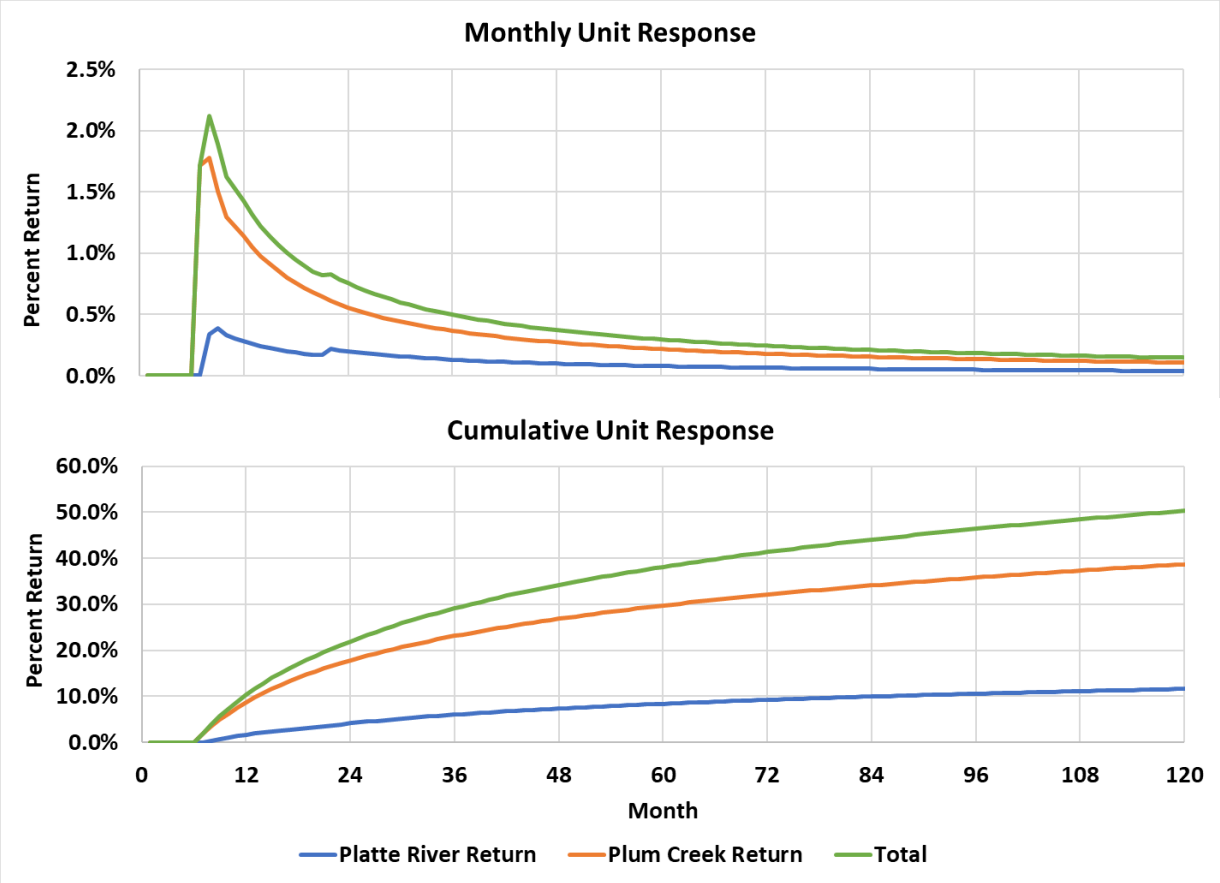

Figure 6. Monthly and Cumulative Unit Responses for Elwood Reservoir Recharge

Assuming Elwood recharge water returns to the Platte River in the reach between Lexington and Overton, the travel distance is roughly 8 to 16 miles, much greater than the distance for Phelps recharge water. As such, there is significant lag time, and the overall return response is much slower for Elwood recharge. The individual URFs show recharged water first reaching Plum Creek in the seventh month, and the first traces of water reach the Platte River through groundwater migration in the eighth month. On the whole, a much greater percentage of Elwood recharge water returns through Plum Creek than through groundwater migration. **Table 7** shows cumulative returns from Elwood recharge at various intervals.

Table 7. Elwood Recharge Project Cumulative Return Percentage from URF

Month	6	12	36	60	120	576
Platte River Cumulative Return	0%	1.6%	6.0%	8.4%	11.6%	18.1%
Plum Creek Cumulative Return	0%	8.7%	23.1%	29.7%	38.7%	57.6%
Total Cumulative Return	0%	10.3%	29.1%	38.1%	50.3%	75.7%

By the end of 2020, just over 5.5 years after the first diversions into Elwood for Program recharge, only about 40% of that initial water would have returned to the Platte River. The full

URFs for Elwood recharge are calculated out for 48 years (576 months). At that point, the total (Platte River return + Plum Creek return) URF indicates that only about 76% of recharged water from Elwood will have returned to the river, compared to more than 90% from Phelps recharge at about the same time. Documentation from the Elwood recharge score analysis indicates that the other 24% of Elwood recharge water would at that point still be in groundwater storage, with some destined for the Republican River basin over the long term.

Figure 7 shows monthly Elwood seepage volume (this was the blue line in Figure 5, shown here as green columns at a different scale) and calculated accretion volumes. The return flows reaching the Platte River are routed to Grand Island then compared against target flow shortages to estimate a volume of deficit reductions resulting from the project in a given calendar year.

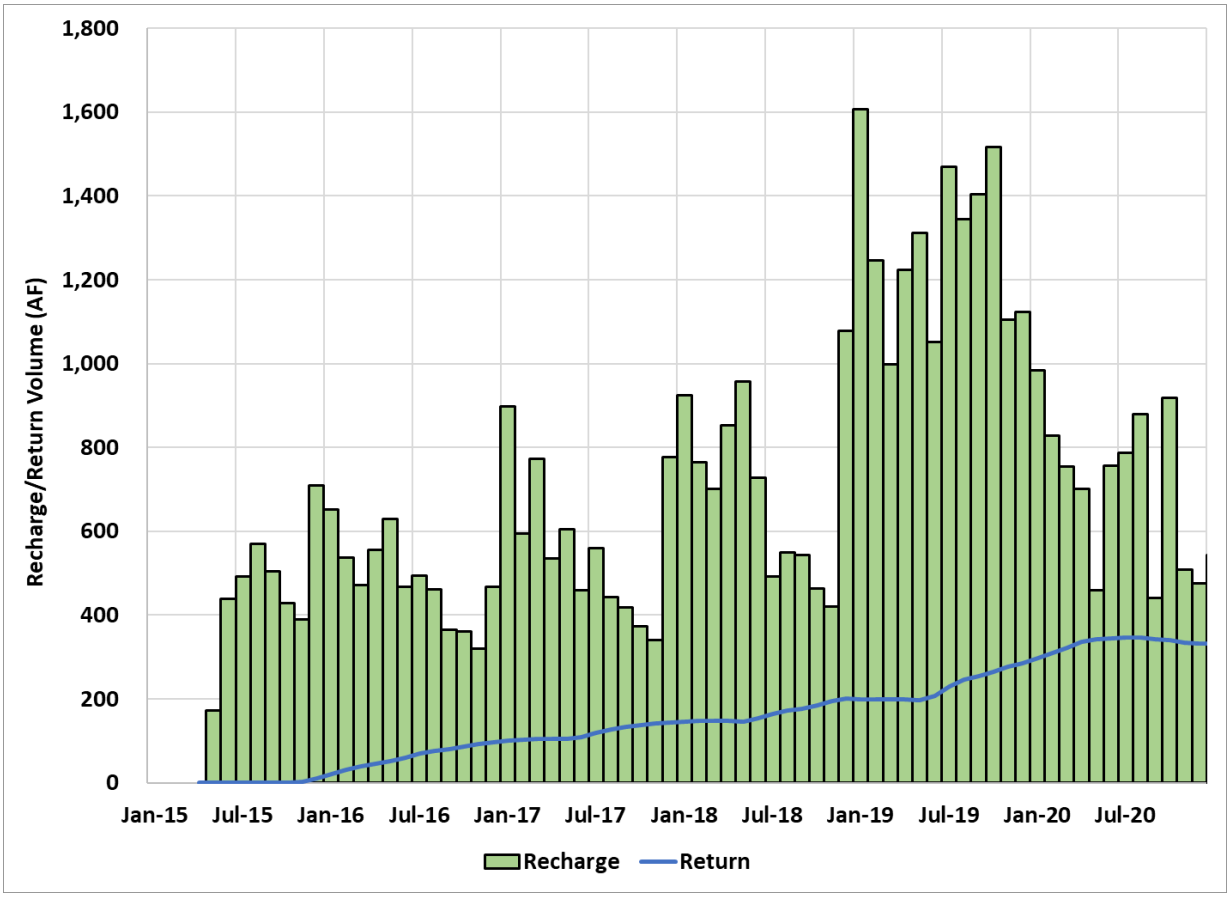

Figure 7. Elwood Reservoir Recharge (Seepage) and Return Flow (Accretion) Volumes by Month

Unlike the oscillations of the accretions between Phelps recharge periods, the accretions resulting from continuous Elwood recharge have generally exhibited a steady upward trend but started to dip slightly in 2020 because there was no new water added to the reservoir for the Program and recharge rates declined. **Figure 8** shows the timing of diversions for Elwood recharge and the calculated daily average accretion rate. Accretions peaked at 5.8 cfs in June 2020.

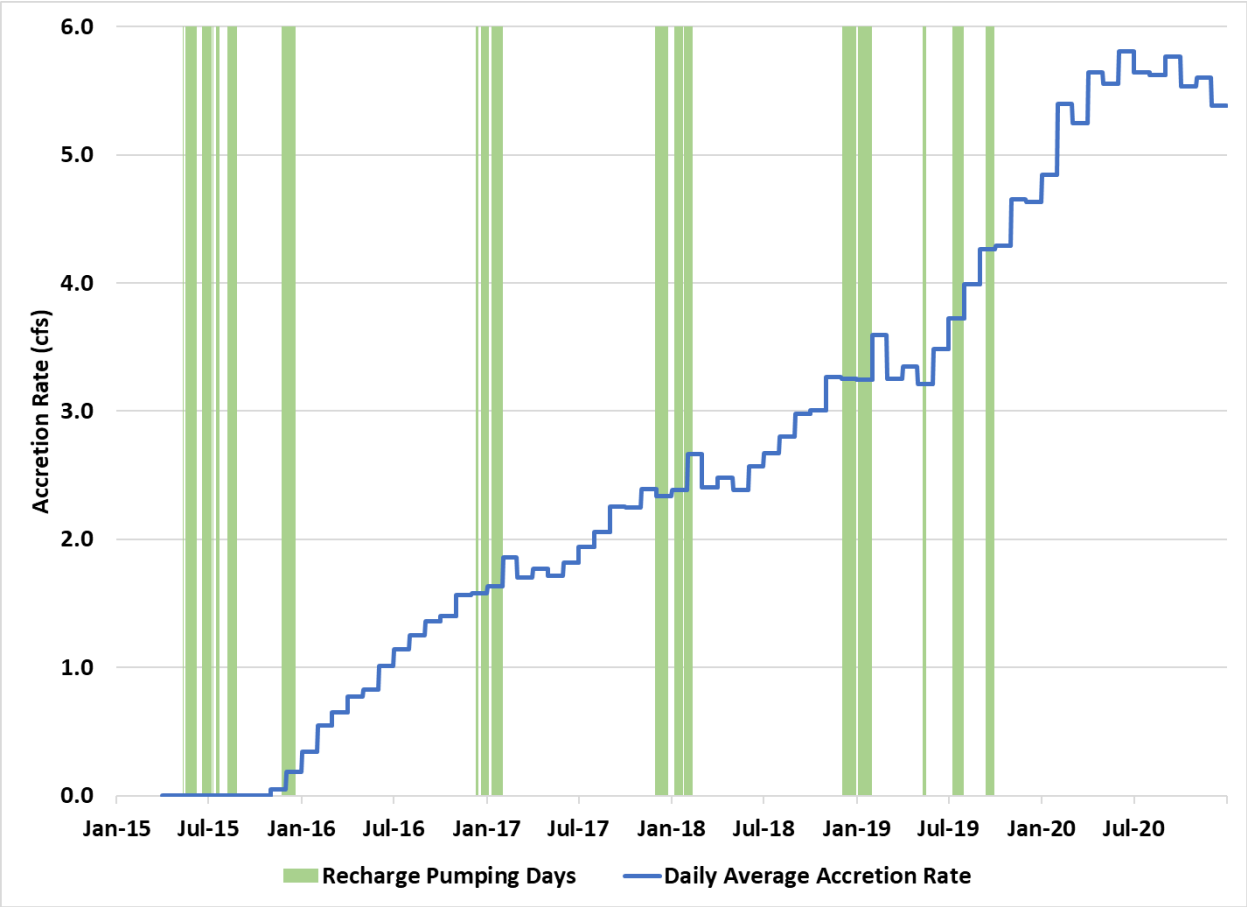

Figure 8. Elwood Recharge Pumping Periods and Accretion Rates.

Table 8 provides the results of Elwood recharge accounting since the project was initiated in 2015.

Table 8. Elwood Reservoir Groundwater Recharge Project Operations Accounting

Year	Invoiced Diversions (AF)	Volume Recharged (AF)	Lagged Accretions at the River (AF)	Accretions Reaching Grand Island (AF)	Reductions to Target Flow Deficits (AF)
2015	14,785	3,700	10	10	0
2016	2,880	5,800	750	660	220
2017	11,524.3	6,800	1,400	1,100	600
2018	14,915.5	8,500	2,000	1,700	1,000
2019	18,539.1	15,400	2,800	2,400	630
2020	0	8,500	4,000	3,500	1,600
Total	**62,643.9**	**48,600**	**10,900**	**9,500**	**4,000**
Average	**10,440.7**	**8,100**	**1,800**	**1,600**	**670**

The overall operation of the Elwood recharge project between May 2015 and the end of 2020 can be summarized as follows (all values as measured or estimated through 12/31/2020):

- Volume pumped into reservoir for Program recharge = 62,644 AF
- Volume lost to evaporation = 5,200 AF
- Volume of reservoir seepage/recharge = 48,600 AF
- Volume remaining in the reservoir = 8,900 AF
- Total river returns above Overton = 10,900 AF
    - Average accretions to the river = 2.9 cfs
- Total return flows at Grand Island = 9,500 AF
    - Average accretions at Grand Island = 2.5 cfs
- Total reductions to target flow deficits at Grand Island = 4,000 AF
- Deficit reductions equal
    - 43% of return flows at Grand Island
    - 37% of total river returns above Overton
    - 8% of total recharge from Elwood
    - 6% of the total volume pumped into Elwood

The volume remaining in groundwater storage and potentially available for recapture operations was about 37,700 AF (the difference between the Elwood volume recharged and the total river returns), minus future accretions to the Platte River/Plum Creek and any volume that may migrate into the Republican River basin.

D. Cottonwood Ranch Broad-Scale Recharge

Construction of the Cottonwood Ranch broad-scale recharge project was completed in 2019. Water for the project is routed through CNPPID's Tri-County Supply Canal system into the Phelps County Canal and then into a pipeline that can deliver water to two locations north and south of the Peterson Drain on the west side of the project.

Test fill operations were conducted in 2020 using water released from the Lake McConaughy EA. A total of 360.6 AF was delivered during three separate fill periods in July (152.3 AF), August (110.2 AF), and September (98.1 AF). Regular project operations involving diversions of excess flows have not been possible since the test fills were completed, and accounting procedures for the broad-scale recharge project are still being developed.

E. CPNRD Canal Recharge

CPNRD first diverted excess flows into the Thirty Mile, Cozad, and Orchard-Alfalfa canals for recharge in April and May 2011.[17] The Program and CPNRD signed a water use lease

[17] In March 2015, NDNR approved permits (priority date June 5, 2012) to divert excess flows for groundwater recharge in each of the three CPNRD canals. Perfection of the appropriations was contingent on beneficially using water for the stated purpose by September 1, 2019, a requirement that was satisfied. Consequently, CPNRD recharge does not have to operate under a succession of temporary annual permits, as is the case with CNPPID and NPPD recharge projects for the Program.

agreement in December 2013, under which CPNRD was to provide up to 20,500 AF per year to the Program through a combination of transferred surface water and accretions from groundwater recharge in the three canals. The surface water and groundwater components were eventually split into separate WAP projects for the Program but the agreement, as amended, remained in effect through the end of 2019. **Table 9** shows the volumes of accretions invoiced under this agreement from 2013-2019.

Table 9. Invoiced Accretions from CPNRD Canal Recharge, 2013-2019

Year		Thirty Mile (AF)	Cozad (AF)	Orchard-Alfalfa (AF)	CPNRD Total (AF)
2013		491	145.9	339	975.9
2014		425	41.5	107.5	574
2015		796	204	221	1,221
2016		892	308	212	1,412
2017	Current Year	1,583	306	488	2,377
	Past Year Adjustments	38	0	826	864
	Total	1,621	306	1,314	3,241
2018		1,282	251	333	1,866
2019		1,019	219	225	1,463
Total		**6,526**	**1,475**	**2,752**	**10,753**
Average		**932**	**211**	**393**	**1,536**

Accretions billed in 2013 included those resulting from recharge operations in 2011 and 2012. No additional water was diverted for recharge in 2018 and 2019. Billings for those years were based on CPNRD's 2017 analysis spreadsheets, which included calculations of accretions in future years from recharge that occurred from 2011-2017.

Table 9 also corrects or clarifies a few issues with the corresponding table in the previous water projects accounting memo:

- Documentation was found showing that the Program received only 50 percent of CPNRD accretions in 2014, not the full calculated volume.
- CPNRD's 2017 analysis for Thirty Mile included both the correction of a calculation error that originated in the 2013 data and the inclusion of additional recharge in late 2016. The net result of these changes was a +38 AF adjustment. However, it should be noted that these adjustments to Thirty Mile accretions at the time of invoicing in 2017 did not account for the fact that the Program was only billed for 50 percent of accretions in 2014.
- CPNRD's 2017 analysis for Orchard-Alfalfa included adjustments to calculated return flows for both 2015 and 2016.

Using the Cozad Canal as an illustrative water accounting example, Attachment A to the water lease agreement between the Program and CPNRD described the procedures for calculating the return flows from groundwater recharge that were billed to the Program:

> There is an excess flow diversion worksheet for each year…In these worksheets daily diversions are converted to monthly volumes of recharge which are distributed for each mile of canal by month and then the monthly recharge from each mile of canal gets distributed as base flow return to the Platte River using a groundwater return flow function.
>
> There is a worksheet…that contains the percentage of canal seepage distributed in each mile of canal. This worksheet also contains the 600 month groundwater return flow functions for the 17 canal reaches. The canal seepage distribution was developed from information collected during the Cozad Canal seepage loss study in August 2008…The groundwater return flow function for each 1 mile canal reach was develop[ed] from the COHYST Eastern Model unit runs made with the cycle well program. A cycle well run was made for model cell[s] within the CPNRD and these runs have been used to establish depletion functions and groundwater return flow functions for the Platte River and [its] tributaries…Five functions were developed for this example analysis and assigned to the 17 miles of [Cozad] canal.

The EDO determined that CPNRD's recharge analysis spreadsheets included sufficient data to assess and report the timing and volumes of both measured recharge diversions and calculated accretions for the three individual canals. With this information, the collective accretions could then be routed to Grand Island to determine the contribution of the CPNRD canal recharge project to target flow deficit reductions. **Table 10** shows the volumes of canal recharge after reconciling CPNRD's invoice documentation and analysis spreadsheets. Recharge in 2011 and 2012 occurred prior to the agreement for the Program to lease the resulting accretions, but lagged accretions from those years contributed to the volumes billed to the Program from 2013-2019.

Table 10. CPNRD Canal Recharge, 2011-2019

Year	Thirty Mile (AF)	Cozad (AF)	Orchard-Alfalfa (AF)	CPNRD Total (AF)
2011	5,716	3,219	2,471	11,406
2012	0	0	851	851
2013	2,140	0	0	2,140
2014	0	303	0	303
2015	4,277	3,213	1,658	9,148
2016	7,484	3,050	1,036	11,570
2017	1,408	427	457	2,293
2018	0	0	0	0
2019	0	0	0	0
Total, 2011-2019	**21,025**	**10,213**	**6,473**	**37,711**
Total, 2013-2019	**15,309**	**6,994**	**3,151**	**25,454**

Table 11 shows the results of routing accretions to Grand Island. Note that the "Total Volume Recharged" column corresponds to the last column in Table 10, and the "Lagged Accretions at the River" column corresponds to the last column in Table 9 above (just the total volume, as there are differences in the annual values due to billing adjustments). These values are not rounded so as to maintain consistency with CPNRD's measured recharge diversions and the accretions billed to the Program. The last two columns were calculated by the EDO and are rounded.

Table 11. CPNRD Canal Recharge Project Operations Accounting, 2013-2019

Year	Total Volume Recharged (AF)	Lagged Accretions at the River (AF)	Accretions Reaching Grand Island (AF)	Reductions to Target Flow Deficits (AF)
2013	2,140	980	740	520
2014	303	331	270	200
2015	9,148	1,590	1,400	470
2016	11,570	2,145	1,900	580
2017	2,293	2,376	1,900	1,000
2018	0	1,865	1,600	990
2019	0	1,463	1,300	360
Total	**25,454**	**10,751**	**9,000**	**4,100**
Average	**3,636**	**1,536**	**1,300**	**590**

From 2013-2019, deficit reductions attributable to the CPNRD canal recharge project represented 46% of return flows reaching Grand Island, 38% of lagged accretions at the river, and 16% of the volume recharged.

A new WSA between the Program and CPNRD dated September 25, 2019, modified the approach to billing for the canal recharge project starting in 2020.[18] For consistency with the Program's other recharge projects, CPNRD now bills for net recharge, the total amount diverted "adjusted by subtracting any deliveries or releases made and recorded by the irrigation district." Net recharge in 2020 included 2,475 AF for Thirty Mile and 475 AF for Orchard-Alfalfa, for a total of 2,950 AF. The return flow functions from CPNRD's old (2017 and earlier) recharge analysis spreadsheets will not be used to calculate lagged accretions occurring after 2019. New URFs for CPNRD canal recharge will be developed based on the current version of COHYST, but the COHYST models are undergoing revisions that have not yet been completed.

F. NPPD Canal Recharge

The Program first signed a WSA with NPPD for groundwater recharge in the Gothenburg and Dawson County canals in 2015, and non-irrigation season diversions of excess flows were first made in September of that year. In order to operate the recharge project each year, NPPD must apply for and secure new temporary diversion permits from NDNR. The Gothenburg Canal

[18] WSA expires December 31, 2024.

typically does not divert in the spring to recharge for the Program because of obligations to deliver water to B-1 Reservoir. Both canals can divert in the fall if excess flows are available. Overall, from 2015-2020, 88 percent of NPPD recharge occurred in the fall and 12 percent in the spring.

Per the terms of the current WSA that went into effect on January 1, 2020, NPPD bills the Program for net recharge, calculated as diversions measured at the canal headgates minus measured returns.[19] **Table 12** shows the diversion and net recharge volumes for the NPPD canals. Both are shown because NPPD billed the Program for total diversions in 2015 and 2016. Starting in 2017, NPPD billed for net recharge even though the WSA in effect from 2017-2019 did not explicitly include such a requirement.[20] Values are based on invoices and supporting data submitted to the Program, as well as recharge reports prepared by NPPD for the NDNR.

Table 12. NPPD Canal Diversions and Net Recharge

	Gothenburg Canal		Dawson County Canal		NPPD Total	
Year	Diversions (AF)	Net Recharge (AF)	Diversions (AF)	Net Recharge (AF)	Diversions (AF)	Net Recharge (AF)
2015	1,609	1,525	3,303	2,845	4,912	4,370
2016	6,019	4,653	7,025	4,780	13,044	9,433
2017	0	0	4,040	3,594	4,040	3,594
2018	680	617	2,666	2,084	3,346	2,701
2019	3,314	2,407	5,722	3,962	9,036	6,369
2020	0	0	3,532	2,817	3,532	2,817
Total	**11,622**	**9,202**	**26,288**	**20,082**	**37,910**	**29,284**
Average	**1,937**	**1,534**	**4,381**	**3,347**	**6,318**	**4,881**

At this time, the EDO does not have the tools necessary to calculate accretions from NPPD canal recharge and complete routing to Grand Island to assess reductions to target flow deficits. It is intended that URFs for NPPD canal recharge will be developed based on the current version of COHYST in order to facilitate project scoring and accounting, but the COHYST models are undergoing revisions that have not yet been completed.

III. LAKE MCCONAUGHY EA

Establishment of the Lake McConaughy EA to provide water for instream use to benefit downstream fish and wildlife was one of the terms of the 1998 FERC license renewals for the operation of the reservoir and hydropower plant. The Lake McConaughy EA and a portion of the water contributed to the account serve as Nebraska's contributions to the Program's initial

[19] WSA expires December 31, 2025.

[20] Per minutes of the November 2, 2016 GC Special Session, discussion at the time the WSA was approved indicated understanding that billing was to be on a net recharge basis: "Kenny said…wasteway returns are subtracted [from diversions] so it is in effect recharge we are paying for. Barels confirmed that explanation." https://platteriverprogram.org/document/2016-november-gc-special-session-minutes

state water projects. Water available in the Lake McConaughy EA from all sources of supply is recorded under permit A-17695, which was approved by NDNR in May 1999. A maximum of 200,000 AF may be available in the account at any given time, but if the water level in Lake McConaughy reaches regulatory capacity, the EA automatically resets to 100,000 AF by addition or subtraction depending on whether the EA volume was already above or below 100,000 AF.

By 2020, there were seven individual sources of water contributing to the Lake McConaughy EA, a combination of initial state water projects for the Program and surface water leases implemented as WAP projects:

- Storable Natural Inflows (SNI)
- Pathfinder EA
- Pathfinder Municipal Account Lease
- No-Cost NCCW
- CNPPID Irrigator Lease
- CPNRD Surface Water Lease
- NPPD Surface Water Lease

Once credited to the Lake McConaughy EA, water from these individual sources becomes one indistinguishable supply that is released at the discretion of the USFWS to meet specific downstream water needs.

The current accounting updates included a comprehensive review of data sources and calculations for the Lake McConaughy EA. Data sources acquired and/or reviewed to verify and correct (as-needed) data used in the accounting analysis included the following:

- NDNR Kingsley Summary spreadsheets. These are maintained by the Bridgeport office and distributed a few times every year. The Kingsley Summary spreadsheets include records of daily EA accruals (in particular SNI and Pathfinder transfers from Wyoming) and releases and are used to calculate monthly losses to seepage and evap. A newly acquired set of these spreadsheets filled in a block of data for several months in 2011 that was previously missing from the EDO files.
- NDNR Glendo tracking spreadsheets. These are developed by the Bridgeport office to track Pathfinder EA and Pathfinder Municipal Account water from Guernsey Reservoir down the North Platte River to the Lewellen gage at the upstream end of Lake McConaughy.
- Platte Water Allocation Model (PWAP) daily reports. These are produced by NDNR for every day; reports since October 1, 2018 are available online[21] and a large portion of earlier daily reports was already in the EDO's files. During EA releases, the PWAP daily reports track the flow from Lake McConaughy to Grand Island. USFWS typically develops a spreadsheet from the PWAP daily reports to track EA releases, and the EDO is now doing the same.

[21] https://nednr.nebraska.gov/pwapweb/

- U.S. Bureau of Reclamation (USBR) North Platte Ownership Accounting sheets. These are produced by USBR for each day and typically distributed a few times every week. These can be used to track the volumes accruing to the Pathfinder EA (aka 34 Account) and Pathfinder Municipal Account (aka 20 Account) as well as the transfer of this water from Pathfinder Reservoir to Glendo Reservoir and eventual release from Guernsey Reservoir.
- Invoices for surface water leases from CNPPID, CPNRD, and NPPD.
- Letters exchanged between CNPPID and NDNR requesting and confirming the surface water lease volumes credited to the Lake McConaughy EA in October each year.

The following sections discuss the individual water supply sources contributing to the Lake McConaughy EA as well as the aggregate releases from the account and estimated reductions to target flow deficits.

A. Storable Natural Inflows

Nebraska's contribution to the Program's initial state water projects includes 10 percent of the Storable Natural Inflows (SNI) entering Lake McConaughy during the October through April non-irrigation season months. The volume of SNI water is based on measurements from the North Platte River at Lewellen gage (USGS 06687500), which is located at the upstream end of the reservoir. The 10 percent SNI allocation is credited to the Lake McConaughy EA. **Table 13** presents SNI volumes credited to the Lake McConaughy EA starting in 2007.

Table 13. Lake McConaughy EA Storable Natural Inflows (SNI), 2007-2020

Year	SNI Credited to Lake McConaughy EA (AF)
2007	34,480
2008	37,367
2009	39,702
2010	37,548
2011	27,214
2012	43,813
2013	39,566
2014	45,048
2015	49,317
2016	53,743
2017	57,055
2018	47,198
2019	45,456
2020	54,915
Total	**612,422**
Average	**43,744**

B. Pathfinder EA and Pathfinder Municipal Account Lease

The Pathfinder EA, with a capacity of 33,493 AF, represents Wyoming's contribution to the initial state water projects for the Program. Completed as part of the Pathfinder Modification Project, the Pathfinder EA first made releases in 2012. The volume of water in the account is tracked daily in USBR's North Platte Ownership Accounting. Water that accrues to the account during the water year (starting the previous October) is released at the end of the irrigation season (late August or early September). Based on the ownership accounting, Pathfinder EA water is first transferred to Glendo Reservoir and transit losses are applied. Once the Pathfinder EA water is released from Guernsey Reservoir, NDNR tracks the flow down the North Platte River to Lake McConaughy, accounting for daily transit losses along the way.

In 2011, the Program signed an agreement with the Wyoming Water Development Office (WWDO) to lease water from the Pathfinder Municipal Account.[22] A new agreement extended the lease through the First Increment Extension from 2020-2032, with water available to the Program at $65/AF for the duration. The volume of water in the Pathfinder Municipal Account is tracked in USBR's North Platte Ownership Accounting. In the spring of each year, the WWDO provides an estimate of water available to the Program from the account. By mid-summer, the WWDO may revise the amount available based on runoff accruals to the account during the intervening months. If at least 4,800 AF is available, the Program is obligated to purchase that much at a minimum. Additional water may be available up to a total of 9,600 AF. If the WWDO determines that anything less than 4,800 AF is available in a given year, ranging from 0 to 4,799 AF, then that would be the amount the Program could lease that year.

Since water from the Pathfinder EA and Pathfinder Municipal Account is generally transferred from the reservoir at the same time, the EDO assumes for Program accounting that the relative proportions remain the same even as losses are accounted for in transit to Lake McConaughy. For example, in 2020 a total of 41,585 AF was released from Pathfinder Reservoir for the Program, of which 77% was Pathfinder EA water (31,985 AF) and 23% was from the Pathfinder Municipal Account (9,600 AF). Based on NDNR's tracking, 35,322 AF of that water reached Lake McConaughy and was assumed to be 77% (27,168 AF) from the Pathfinder EA and 23% (8,154 AF) from the Pathfinder Municipal Account. **Table 14** shows the history of Pathfinder EA and Pathfinder Municipal Account releases and volumes credited to the Lake McConaughy EA over the period 2012-2020. Values are not rounded because they are derived directly from USBR and NDNR records.

[22] The Pathfinder Municipal Account was also created as part of the Pathfinder Modification Project and has a capacity of 20,000 AF.

Table 14. Pathfinder EA and Municipal Account Yields, 2012-2020

Year	Releases from Pathfinder Reservoir (AF)		Volume Credited to Lake McConaughy EA (AF)	
	Pathfinder EA	Pathfinder Municipal Account	Pathfinder EA	Pathfinder Municipal Account
2012	21,592	4,800	19,660	4,370
2013	14,471	4,800	13,162	4,366
2014	32,401	9,600	28,774	8,525
2015	32,205	9,600	29,542	8,806
2016	32,740	4,800	28,160	4,129
2017	32,750	9,600	28,505	8,356
2018	20,469	8,100	15,537	6,148
2019	33,222	4,800	30,270	4,373
2020	31,985	9,600	27,168	8,154
Total	**251,835**	**65,700**	**220,779**	**57,228**
Average	**27,982**	**7,300**	**24,531**	**6,359**

C. No-Cost NCW

Net Controllable Conserved Water (NCCW) in Lake McConaughy was made available through the implementation of conservation projects in compliance with a 1992 settlement agreement between the CNPPID and the National Wildlife Federation. The project concept was defined in the 1997 Cooperative Agreement, and a portion of the NCCW yield made available through USBR funding was recognized as a WAP project with the inception of the Program in 2007.

The NCCW resulted from the following conservation measures implemented within the CNPPID irrigation systems:

- Canal distribution and delivery improvements such as installation of pipelines, canal compaction, canal lining, structure automation, etc.
- On-farm efficiency improvements including installation of center pivots and flow meters, modification of irrigation schedules, etc.
- Operational adjustments to Elwood Reservoir to minimize seepage losses.

These measures reduced irrigation water demands downstream of Lake McConaughy. As a result, water that would have been released from Lake McConaughy before the conservation measures now remains stored in the reservoir.

Per Article 402 of the CNPPID's 1998 FERC license for the Kingsley Dam Project, the volume of NCCW water resulting from conservation projects partially funded by the USBR is to be added to the Lake McConaughy EA each year at no cost to the Program. This volume was consistently found to be 314 AF in successive reviews over a period of 15 years. Each year, the CNPPID makes a request to the NDNR to add the No-Cost NCCW to the Lake McConaughy EA

on or about October 1. As shown in **Table 15**, a yield of 314 AFY has been credited to the Lake McConaughy EA in most years since 2007. No-Cost NCCW was not credited in 2010 and 2011 because it would have been lost to account resets.

Table 15. Yield from No-Cost NCCW, 2007-2020

Year	Project Yield Credited to Lake McConaughy EA (AF)
2007	314
2008	314
2009	314
2010	0
2011	0
2012	314
2013	314
2014	314
2015	314
2016	314
2017	314
2018	314
2019	314
2020	314

D. CNPPID Irrigator Lease

Beginning with the 2016 irrigation season, the Program and CNPPID entered into a series of agreements to lease water directly from irrigators within the CNPPID systems. Irrigators agree to fallow or dryland farm designated parcels, which are typically odd-shaped or otherwise difficult to irrigate. The project operated as a pilot program from 2016 to 2018, after which it was extended for 5 years through the 2023 irrigation season. In order to carry out the project, the CNPPID must declare a full allocation, in which case individual irrigators cannot trade water amongst themselves and the Program is the only potential customer for water leasing. The Program pays a fee to the CNPPID to administer the irrigator leasing program.

For each acre enrolled in the irrigator lease program, the Program is credited with 9 inches (0.75 AF) in the Lake McConaughy EA, on or about October 1 following the end of the irrigation season. The annual enrollment cap was set at 3,000 acres starting with the 2019 irrigation season, and payment was consistent at $220/acre ($293/AF) each year through 2020. **Table 16** shows the acres enrolled and volume credited to the Lake McConaughy EA each year.

Table 16. Enrollment and Yield from CNPPID Irrigator Lease Program, 2016-2020

Irrigation Season	Acres Enrolled	Volume Credited to Lake McConaughy EA (AF)
2016	1,037	778
2017	1,275	956
2018	2,055	1,541
2019	2,934	2,201
2020	2,989	2,242
Average	**2,058**	**1,544**

E. CPNRD and NPPD Surface Water Leases

Under the provisions of a December 2013 water use lease agreement, the CPNRD committed to provide up to 20,500 AF per year to the Program through a combination of transferred surface water and accretions from groundwater recharge in the Thirty Mile, Cozad, and Orchard-Alfalfa canals.[23] The agreement specified that the source of the transferred surface water was existing natural flow water rights held by the three canals for irrigation purposes, made available from irrigated lands that relinquished surface water supplies and instead irrigated with groundwater pumped from existing wells.

For the first three years of project operations, beginning in 2015, CPNRD calculated the net volume of transferrable surface water based on analyses of crop consumptive use and the depletions resulting from the switch to groundwater pumping. Invoiced transfer volumes were 15,718 AF in 2015; 15,777 AF in 2016; and 13,759 AF in 2017. During the irrigation season, available natural flow water was diverted and measured at the canal headgates, and appropriate volumes were immediately returned to the river in real time. This occurred regardless of whether the river was in excess or shortage relative to USFWS target flows, producing a scenario in which the Program was paying for significantly larger volumes of transferred surface water than actually served to reduce real-time target flow deficits.[24]

To better use the transferred surface water to meet Program objectives, the approach was modified in 2018 through implementation of a "pilot exchange project" in which natural flow water to which the CPNRD canals are entitled was not delivered to the canals (i.e., it was retained in Lake McConaughy) and credited to the Lake McConaughy EA following the end of

[23] The water use lease agreement was first amended effective January 1, 2017 to modify the rate structure for surface water transfers and groundwater accretions. The terms of the lease agreement specify that "CPNRD shall provide a minimum of fifty percent of all available water returned to the Platte River for instream use to the [Program]" but "CPNRD does not guarantee any minimum amount of stream flow augmentation through Transferred Surface Water or Ground Water Recharge."

[24] Based on analysis of available data, CPNRD recorded 67 days during the 2015 irrigation season on which at least one of the three canals was making river returns of transferred surface water. There were real-time target flow shortages at Grand Island on only 14 of those days (21%). CPNRD spreadsheets from 2016 show 71 days with surface water returns, and 23 of those days (32%) had shortages. Of the gross water volumes returned to the river from the CPNRD canals before adjusting for groundwater pumping depletions, approximately 17% (2015) and 39% (2016) occurred on those days with shortages at Grand Island. The EDO does not have this data for 2017.

the irrigation season. This pilot exchange project was executed under a Memorandum of Understanding (MOU) between CNPPID and CPNRD and with approval from the NDNR. The Program's water use lease agreement with CPNRD was also amended to accommodate the crediting of transferred surface water to the Lake McConaughy EA. The CPNRD surface water lease has continued with the same approach in subsequent years under successive one-year agreements. **Table 17** shows the volumes credited to the Lake McConaughy EA from each of the three CPNRD canals and in total for the years 2018-2020.

Table 17. Yield from CPNRD Surface Water Lease, 2018-2020

Year	Combined Acres Enrolled	Volume Credited to Lake McConaughy EA			
		Thirty Mile (AF)	Cozad (AF)	Orchard-Alfalfa (AF)	Total (AF)
2018	28,502.2	5,996	6,748	1,507	14,251
2019	28,191.4	6,018	6,568	1,510	14,096
2020	28,144.9	6,095	6,465	1,513	14,073
Average	**28,279.5**	6,036	6,594	1,510	**14,140**

Following the successful implementation of the CPNRD "pilot exchange project" in 2018, a virtually identical lease was initiated with NPPD in 2019 for surface water from the Gothenburg and Dawson County canals. Likewise, the NPPD surface water lease has been conducted under annual one-year agreements. **Table 18** shows credits to the Lake McConaughy EA from the first two years of the NPPD surface water lease.

Table 18. Yield from NPPD Surface Water Lease, 2019-2020

Year	Acres Enrolled	Volume Credited to Lake McConaughy EA (AF)
2019	6,243.2	3,121
2020	6,612.2	3,306
Average	**6,427.7**	**3,214**

F. Combined Accruals and Releases from the Lake McConaughy EA

As described previously, all sources of water credited to the Lake McConaughy EA become a common supply under the A-17695 permit. **Table 19** combines Tables 13-18 to show total accruals to the Lake McConaughy EA from all sources for the years 2007-2020.

Table 19. Accruals to the Lake McConaughy EA, 2007-2020

Year	SNI (AF)	No-Cost NCCW (AF)	Pathfinder EA (AF)	Pathfinder Municipal Account (AF)	CNPPID Irrigator Lease (AF)	CPNRD Surface Water Lease (AF)	NPPD Surface Water Lease (AF)	Total Accruals (AF)
2007	34,480	314	0	0	0	0	0	34,794
2008	37,367	314	0	0	0	0	0	37,681
2009	39,702	314	0	0	0	0	0	40,016
2010	37,548	0	0	0	0	0	0	37,548
2011	27,214	0	0	0	0	0	0	27,214
2012	43,813	314	19,660	4,370	0	0	0	68,157
2013	39,566	314	13,162	4,366	0	0	0	57,408
2014	45,048	314	28,774	8,525	0	0	0	82,662
2015	49,317	314	29,542	8,806	0	0	0	87,979
2016	53,743	314	28,160	4,129	778	0	0	87,124
2017	57,055	314	28,505	8,356	956	0	0	95,186
2018	47,198	314	15,537	6,148	1,541	14,251	0	84,989
2019	45,456	314	30,270	4,373	2,201	14,096	3,121	99,831
2020	54,915	314	27,168	8,154	2,242	14,073	3,306	110,172
Total, 2007-2020	**612,422**	**3,768**	**220,779**	**57,228**	**7,718**	**42,420**	**6,427**	**950,762**
Average, 2007-2020	**43,744**	**269**	**15,770**	**4,088**	**551**	**3,030**	**459**	**67,912**
Total, 2012-2020	**436,111**	**2,826**	**220,779**	**57,228**	**7,718**	**42,420**	**6,427**	**773,509**
Average, 2012-2020	**48,457**	**314**	**24,531**	**6,359**	**858**	**4,713**	**714**	**85,945**

Releases from the Lake McConaughy EA to benefit threatened and endangered species downstream are overseen by the USFWS in coordination with CNPPID and the EDO. The USFWS EA Manager prepares an Annual Operating Plan (AOP), which outlines priorities for the timing, target flow rates, and purpose of planned releases from the Lake McConaughy EA during the upcoming year. Releases are often timed to coincide with the spring and fall whooping crane migrations or to provide species benefits for interior least terns and piping plovers. Other releases are made for channel maintenance, germination suppression, or to facilitate one-time events such as the North Platte chokepoint test that was conducted in July 2020. While Lake McConaughy EA releases do contribute to target flow deficit reductions at times, the account is typically not operated specifically for that purpose.

The results of the Lake McConaughy EA accounting analysis are presented in **Table 20**. The calculations are done on a daily basis, then summed to get monthly and annual values. Total accruals correspond to the last column in Table 19 above. Losses include evaporation, seepage, and the account resets that occurred in 2011 and 2016 and are based on the Kingsley Summary spreadsheets periodically distributed by NDNR. EA releases can be tracked from Lake McConaughy to Grand Island in the PWAP daily reports generated by NDNR. Reported values based on NDNR records or modeling are not rounded, but the estimated reductions to target flow deficits are rounded to the nearest 100 AF. Total and average values are shown in Table 20 for all years since the start of the Program (2007-2020) as well as the period 2012-2020 to

730 emphasize the significant shift in Lake McConaughy EA operations once the Pathfinder
731 Modification Project was completed in 2012 and began making releases from the Pathfinder EA
732 and the Pathfinder Municipal Account.
733
734 **Table 20. Lake McConaughy EA Operations Accounting, 2007-2020**

Year	Total Accruals to EA (AF)	Net Losses (AF)	Total EA Releases (AF)	EA Volume Reaching Grand Island (AF)	Reductions to Target Flow Deficits (AF)
2007	34,794	17,282	34,374	24,406	13,000
2008	37,681	17,650	30,123	17,833	13,400
2009	40,016	9,199	22,953	13,313	8,200
2010	37,548	8,941	0	0	0
2011	27,214	47,194	0	0	0
2012	68,157	11,135	80,969	43,303	43,000
2013	57,408	5,449	74,642	56,025	28,900
2014	82,662	6,417	45,818	37,634	37,600
2015	87,979	9,296	51,459	43,452	42,600
2016	87,124	43,640	23,288	18,288	15,700
2017	95,186	7,566	142,336	118,175	90,100
2018	84,989	5,956	89,332	74,561	73,800
2019	99,831	9,746	5,653	5,105	900
2020	110,172	12,632	109,307	87,491	43,900
Total, 2007-2020	**950,762**	**212,104**	**710,253**	**539,586**	**411,000**
Average, 2007-2020	**67,912**	**15,150**	**50,732**	**38,542**	**29,400**
Total, 2012-2020	**773,509**	**111,838**	**622,804**	**484,034**	**376,400**
Average, 2012-2020	**85,945**	**12,426**	**69,200**	**53,782**	**41,800**

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