2015 RECHARGE REPORT

September 2015

NEBRASKA GROUNDWATER RECHARGE: 2014-2015 Phelps County Canal Recharge Report

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PLATTE RIVER
RECOVERY IMPLEMENTATION PROGRAM

Contents

FIGURES

TABLES

APPENDICES

ABBREVIATIONS

CNPPID: The Central Nebraska Public Power and Irrigation District
ED Office: PRRIP's Executive Director's Office
MP: Phelps County Canal mile post location (approximate distance in canal miles from the headgate to the mile post location)
MW: PRRIP monitoring well
NDNR: Nebraska Department of Natural Resources
PRRIP: Platte River Recovery Implementation Program (also referred to as the "Program")
TBNRD: Tri-Basin Natural Resources District
USFWS: United States Fish and Wildlife Service
USBR: United States Bureau of Reclamation
WAC: PRRIP's Water Advisory Committee
WAP: Water Action Plan

1. INTRODUCTION

This report has been prepared by the Executive Director's Office (ED Office) of the Platte River Recovery Implementation Program (Program or PRRIP) to summarize the fourth season of groundwater recharge operations in the Phelps County Canal during the non-irrigation season from fall 2014 through spring 2015. This report serves as the 2015 summary of recharge operations for the Program. Previous summaries of recharge operations were also completed by the ED Office in 2013[1] and 2014[2]. The Program completed a Pre-Feasibility Study[3] in 2010 and a Feasibility Study[4] in 2012 to support the advancement of the Nebraska Groundwater Recharge Water Action Plan (WAP) project.

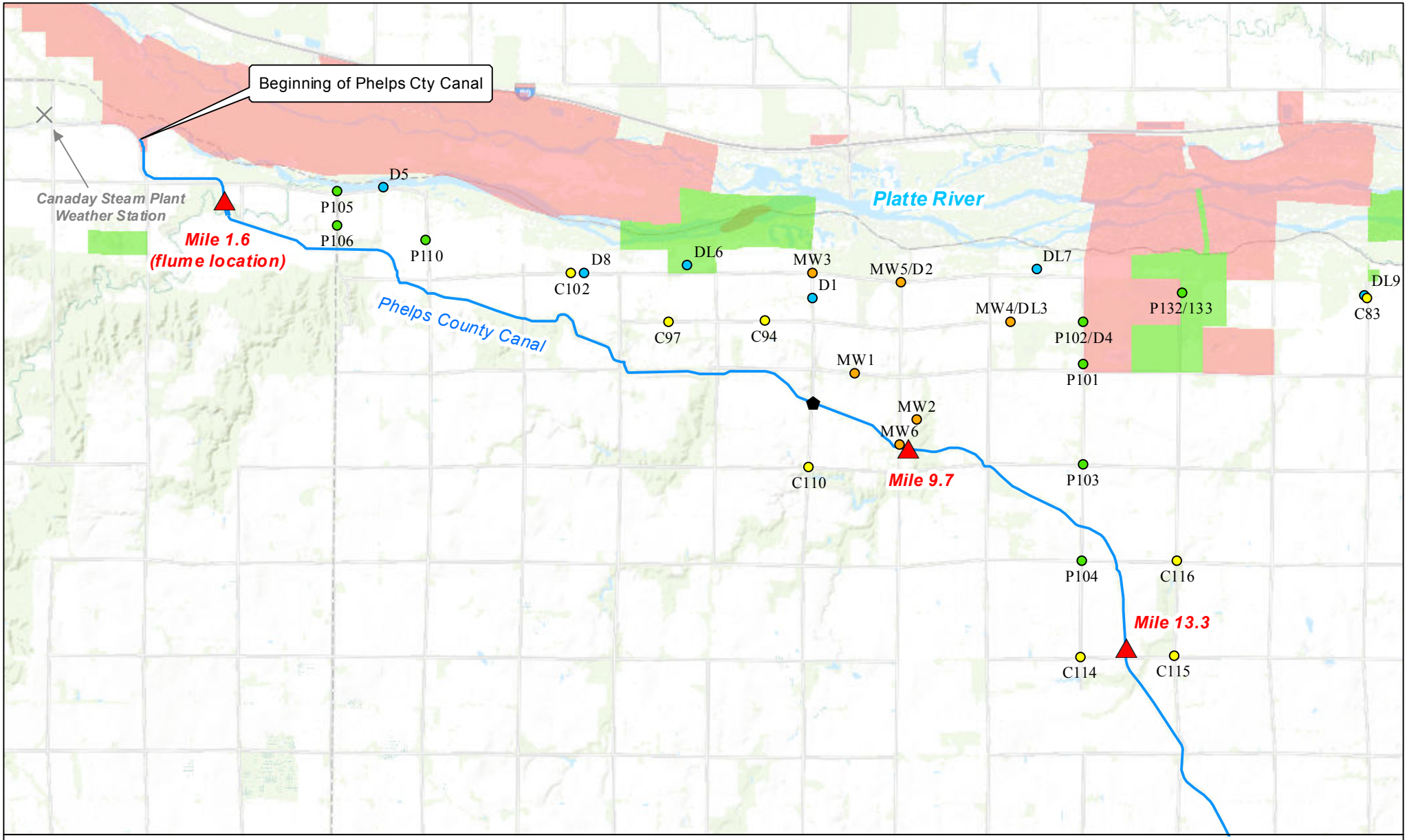
Several key organizations contribute to the success of the groundwater recharge project each year including the Central Nebraska Public Power and Irrigation District (CNPPID), the Tri-Basin Natural Resources District (TBNRD), the Nebraska Department of Natural Resources (NDNR), the U.S. Fish and Wildlife Service (USFWS) and the Program through consultation with the Water Advisory Committee (WAC) and support from the ED Office staff and Special Advisors.

2. METHODS & PROCEDURES

2.1. Overview

The Phelps County Canal is located within the CNPPID's system in Phelps and Gosper Counties, Nebraska, as shown on **Figure 1** (on the following page). Recharge operations for the 2014-2015 non-irrigation season commenced on November 26, 2014 and ended on February 15, 2015; recharge operations occurred each day throughout this season. A total of 4,544 acre-feet (AF)[5] of excess flows (flows in excess of the USFWS target flows) were delivered into the canal and measured by a continuous recorder at the flume located near mile post (MP) 1.6 in the canal. Recharge occurred in the canal up to mile post (MP) 13.3, when the canal check structure was closed to allow the excess flows in the canal to seep. The Program and the NDNR both utilize the deliveries into the canal for recharge purposes, and the Program's portion of the delivery is 2,544 AF[6] of the 4,544 AF total volume recharged. The Program had a temporary water service agreement with the CNPPID to deliver excess flows into the canal. The CNPPID obtained a temporary permit for recharge operations during the 2014-2015 season.

[1] (PRRIP Executive Director's Office, 2013)
[2] (PRRIP Executive Director's Office, 2014)
[3] (Office of the Executive Director, Water Advisory Committee, Hahn Water Resources LLC, and Ann Bleed and Associates, Inc., 2010)
[4] (EA Engineering, Science, and Technology, Inc and Daniel B. Stephens and Associates, Inc., 2012)
[5] As measured by the flume at approximately mile post 1.6 in the canal.
[6] The total deliveries into the Phelps County Canal for recharge operations was 4,544 AF and the Program's portion was 2, 544 AF of the total (or approximately 56%), based on the water service agreement with the CNPPID.



PLATTE RIVER
RECOVERY IMPLEMENTATION PROGRAM

Legend

- Mile Markers
- Program Monitoring Wells
- CNPPID Monitoring Wells
- TBNRD Monitoring Wells
- Drain Measurement Sites
- Temperature Sensor
- Phelps County Canal
- Program Lands
- Other Conservation Lands

N

0 0.5 1 2 Miles

FIGURE 1

GROUNDWATER RECHARGE MONITORING SITES

Date: 05/05/2014

By: SWS

2.2. Monitoring

Monitoring Wells

Groundwater levels were continuously monitored, recorded and collected for the Program's six monitoring wells, the TBNRD's Overton and Elm Creek Transect Wells and the CNPPID's eight monitoring wells. All wells are equipped with measuring and recording devices. All of these wells have been monitored since 2012 and some were monitored beginning in 2011 during the Feasibility Study. As shown in Figure 1, the network of wells extends over the length of the canal to MP 13.3, and includes wells in the Platte River floodplain and on the terrace south of the floodplain.

Drains

Drain stages were continuously monitored at four drain sites: DL-3 (Peterson Ditch), DL-6 (North Phelps County Ditch), DL-7 (Batie Ditch) and DL-9 (Peterson Ditch). Weekly manual staff gage readings were also measured at the continuous drain sites for comparison purposes. Weekly manual staff gage readings were recorded at five other drain sites: D-1 and D-2 (both Batie Ditch), D-4 (Peterson Ditch), D-5 (FX 3.1 Drain) and D-8 (North Phelps County Ditch). All of these drain sites have been monitored since 2011 during the Feasibility Study.

2.3. Permitting

The CNPPID obtained a temporary permit through the NDNR to appropriate water for groundwater recharge. The permit is valid for one year and allows the CNPPID to divert 600 cubic feet per second (cfs) into the Phelps County Canal for recharge operations. The permit is attached as **Appendix A**.

In September 2012, the CNPPID applied for a permanent permit with the NDNR to appropriate water for groundwater recharge in the Phelps County Canal[7] and the permanent application is pending. The permanent application requests a total diversion rate of 700 cfs, or 350 cfs in the Phelps County Canal and 350 cfs in the E65 Canal.

Operational Thresholds and Outreach

Operational thresholds were developed in coordination with the USFWS to serve as project termination triggers in accordance with the Program's "good neighbor policy". The water levels in the two wells with operational threshold levels (MW-1 and MW-2) remained below the threshold levels during the 2014-2015 recharge season. The following actions were decided for the operational thresholds in 2012[8]:

1. Potential termination of recharge operations would be discussed with the USFWS, the CNPPID and the Program's Nebraska Groundwater Recharge Workgroup if the groundwater levels in Program monitoring wells MW-1 and MW-2 reach elevations equal to those measured at the commencement of the 2011-2012

[7] The permit also includes recharge operations for recharge in the E65 Canal; however, this report only includes information regarding the Phelps County Canal.

[8] (PRRIP Executive Director's Office, 2012)

operations of 2,312.8 feet and 2,312.4 feet, respectively. These two wells are located near the lands where high groundwater was reported during the 2011-2012 recharge period, and their groundwater levels appeared to show a noticeable response to the pilot project recharge operations.

2. If groundwater levels in any of the Program monitoring wells consistently approach their initial elevation for 2011-2012 operations, then potential termination of recharge operations to prevent waterlogged fields would be discussed with the USFWS, the CNPPID, and the Program's Nebraska Groundwater Recharge Workgroup. Recharge operations would not be terminated because of short-term water level increases in response to precipitation events.

2.4. Staffing

Continuous monitoring data was collected for the six Program wells, nine TBNRD wells, eight CNPPID wells and the four drain sites. The ED Office staff also collected weekly staff gage readings at five additional drain sites, and the drain sites with continuous recorders. The Program's monitoring well data and drain stage data were downloaded by the Program's ED Office. The TBNRD and the CNPPID downloaded data from their wells and provided the data to the ED Office. The CNPPID operates the Phelps County Canal for the recharge operations each year and submits the permit application with the NDNR.

3. RECHARGE RESULTS AND DISCUSSION

3.1. Recharge Water Balance

Total Deliveries for Recharge

In total, the CNPPID delivered 4,544 AF[9] through the flume located at approximately MP 1.6 in the Phelps County Canal. The Program's portion of the delivery was 2,544 AF, per the Program's temporary water service agreement with the CNPPID. The NDNR and the Program both have water service agreements with the CNPPID to deliver water in the Phelps County Canal for recharge purposes. The 2014-2015 recharge season agreements stated the NDNR and the Program would each receive 50% of recharge deliveries up to 4,000 AF and the Program would receive 100% of the deliveries above 4,000 AF. The deliveries provided by the CNPPID are tabulated in **Appendix B**.

The daily delivery rates through the MP 1.6 flume for the 2014-2015 recharge season are shown in **Figure 2**. The CNPPID typically delivers flows at a higher rate in the beginning of the season to fill the canal, then lowers the rate once the canal is full. The average delivery rate after the canal is full approximately equals the seepage rate, as the CNPPID delivers flows required to maintain the canal level. The average delivery rate into the

[9] Note the Program's portion of this total is 2,544 AF, or approximately 56% of the total deliveries, per the water service agreement with the CNPPID.

canal after the initial fill was approximately 24 cfs[10] during the 2014-2015 recharge season. A comparison of the daily recharge rates from 2011 through 2015 is provided in **Figure 3**.

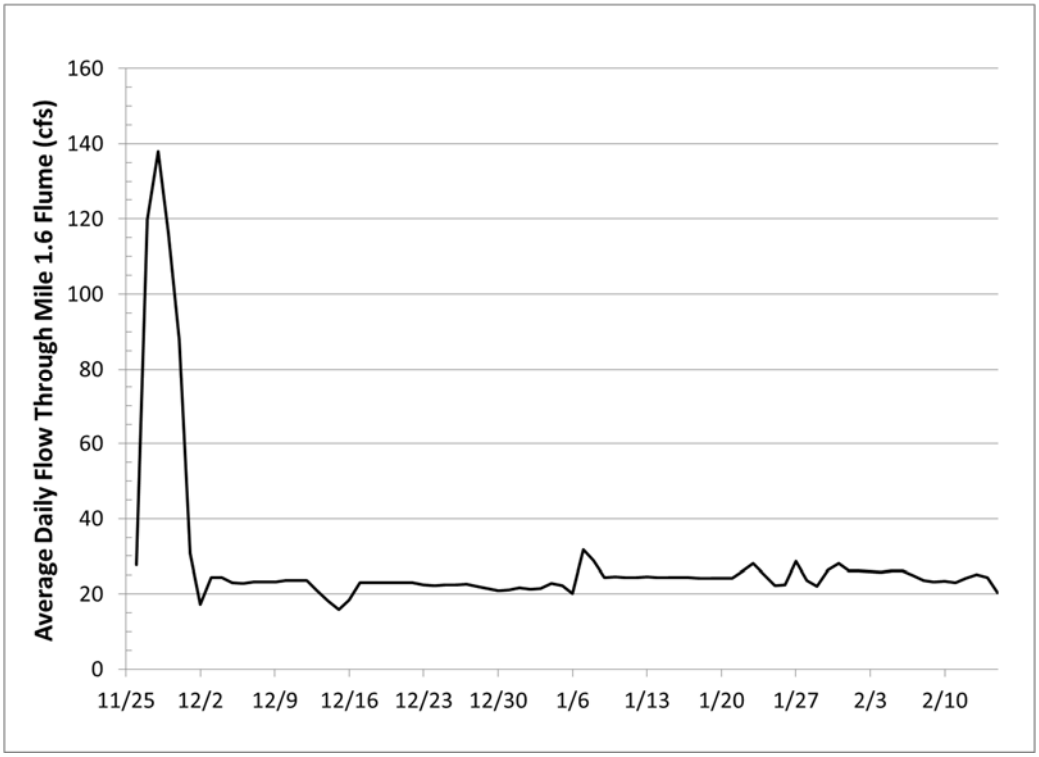


Figure 2. Daily delivery rates through the canal flume during the 2014-2015 recharge season. *Flume located at approximately MP 1.6.

[10] Average delivery rate from 12/2/14 (approximate date when the delivery rates lower to a steady level) through 2/14/15 (recharge does not occur the full day on 2/15/15 so it was omitted).

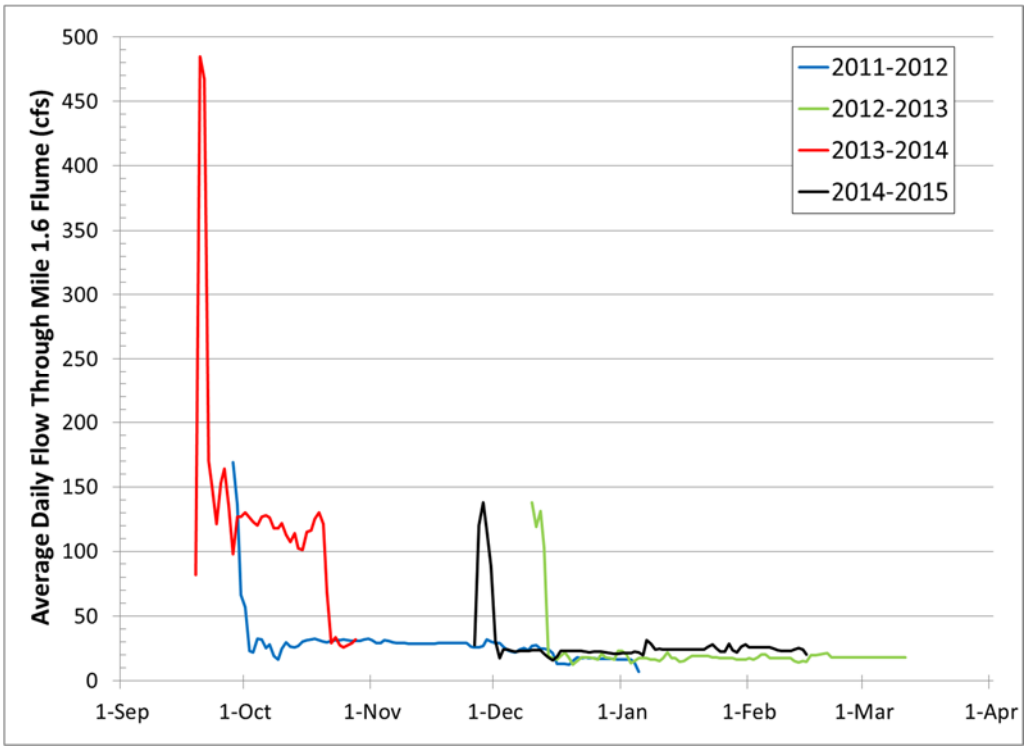


Figure 3. Comparison of daily delivery rates through the canal flume for recharge operations. *Flume located at approximately MP 1.6.

Evaporation

Evaporation was assessed during months when the average air temperature was above freezing using the same method as the Feasibility Study[11]. During times when the average air temperature was below freezing, it was assumed evaporation was negligible as an ice cap typically forms on the canal. Air temperature data from the Canaday Steam Plant, NE climate station is included in **Appendix C**. Evaporation was assessed using gross evaporation rates from the Natural Resources Conservation Service for Phelps County. The gross evaporation was applied to the canal surface area during days with recharge operations. **Table 1** is a summary of the mean air temperatures during recharge operations, gross evaporation in Phelps County and the evaporation calculated for the canal's water surface during recharge operations. Evaporation from the canal was 4.2 AF[12] during the 5 days of recharge operations in November. The Program's portion of evaporation was 50% of the total (2.1 AF) as 50% of the deliveries were assigned to the Program in November. Evaporation was assumed negligible during the remainder of recharge operations from December through February, as air temperatures were below freezing.

[11] The evaporation was assessed using the NRCS-NE-ENG-81 worksheet provided by EA Engineering, Science, and Technology, Inc.

[12] Note that the Program's portion of total evaporation is 50% in November as 50% of the deliveries were assigned to the Program, or approximately 2.1 AF.

Table 1. Summary of evaporation estimates on the canal during recharge operations.

Mo-Yr	Days in the month with recharge operations (A)	Mean temp °F (B)	Gross monthly evaporation (in) (C)	Gross monthly evaporation (ft) (D)	Calculated evaporation (ft) (E)	Calculated evaporation to MP 13.3 (AF) (F)	Program portion of evaporation to MP 13.3 (AF) (G)
Nov-14	5	35.6	2.5	0.21	0.03	4.2	2.1
Dec-14	31	26.9	1.2	0.10	0.00	0.0	0.0
Jan-15	31	26.9	1.0	0.08	0.00	0.0	0.0
Feb-15	15	29.5	1.1	0.09	0.00	0.0	0.0
Total	82	-	-	-	-	4	2

(A) Recharge operations occurred from 11/26/14 to 2/15/15; this column is the number of days in the month with delivery for recharge operations.

(B) Climate data from the Canaday Steam Plant, NE station from 11/26/2015 to 2/15/2015. Mean air temperatures based on daily data for days when recharge operations occurred during month.

(C) and (D) Monthly evaporation based on NRCS-NE-ENG-81 worksheet provided by EA Engineering, Science, and Technology, Inc.

(E) Gross monthly evaporation is proportioned based on the number of days with recharge in column (A). Evaporation was not assessed during months when the mean temperature is below freezing.

(F) Surface area based on average canal width of 85 feet, as used in the Feasibility Study. Calculation from the flume at MP 1.6 to Mile Post 13.3.

(G) Program portion of evaporation is 50% in November (50% of the deliveries are designated for the Program in November). No evaporation is assessed during months when the mean temperature is below freezing.

Water Balance Summary and Total Recharge

The total volume of water delivered through the flume at MP 1.6 during the 2014-2015 season was 4,544 AF, with 2,544 AF[13] of the total designated for the Program. The check structure at MP 13.3 was closed, allowing water to recharge the canal from the headgate to MP 13.3. The total volume of water recharged after evaporation losses from MP 1.6 to MP 13.3 is 2,542 AF for the Program, as shown in **Table 2**.

[13] The total deliveries for recharge operations totaled 4,544 AF. The NDNR was designated 2,000 AF and the Program was designated 2,544 AF of the total.

Table 2. Recharge season 2014-2015 water balance summary between MP 1.6 and MP 13.3. Values in AF.

Mo-Yr	Total volume of deliveries measured through flume at MP 1.6 (A)	Total evaporation (B)	Total volume recharged from MP 1.6 to MP 13.3 (C)	Program portion of recharge from MP 1.6 to MP 13.3 (D)
Nov-14	971	4	967	484
Dec-14	1,374	0	1,374	687
Jan-15	1,507	0	1,507	754
Feb-15	691	0	691	617
Total	4,544	4	4,540	2,542

(A) Total volume of measured deliveries for recharge operations; data provided by the CNPPID.

(B) Evaporation based on the method used in the Feasibility Study, NRCS-NE-ENG-81 worksheet.

(C) Columns (A - B).

(D) Per the agreement with the CNPPID, the Program received 50% of recharge deliveries up to 4,000 AF, and 100% of the deliveries above 4,000 AF. Note that additional recharge occurred from the Phelps Cty Canal headgate to MP 1.6 that was not measured. This column is the Program's portion less evaporative losses.

Since recharge deliveries are measured at the flume at approximately MP 1.6, recharge occurring in the section of the canal before the flume at MP 1.6 is not accounted for in Table 2. The following Section 3.2 describes the calculation of recharge occurring in the section of the canal from the headgate up to MP 1.6, in order to estimate a total WAP project credit for the Program.

3.2. Estimated Credit for the WAP Project

The recharge volumes in Table 2 do not account for recharge that occurs in the canal before the flume at MP 1.6 (where deliveries are measured). Therefore, the ED Office estimated the additional recharge from the initial section of the canal to obtain a total volume of credit for the WAP project during the 2014-2015 recharge season (for the full 13.3 miles of canal with recharge operations). The following paragraphs provide the estimated total recharge from the headgate to MP 13.3 (including seepage occurring in the canal before the flume at MP 1.6).

For the analysis, it was assumed both the canal width and the rate of seepage are uniform per mile in the canal. With this assumption, a unit recharge volume was calculated per mile of canal. The recharge volume per mile of canal during the recharge season was approximately 217 AF[14]. This volume was applied to the 1.6 miles of canal from the headgate to the flume location where the deliveries were measured, which resulted in an additional 348 AF[15] (estimated value) of recharge into the alluvium. In total, 2,889 AF[16]

[14] Calculation: 2,542 AF of recharge ÷ (11.7 canal miles from MP 1.6 to MP 13.3) = 217 AF of recharge per mile of canal.

[15] Calculation: 217 AF of recharge per canal mile × 1.6 miles of canal from the headgate to MP 1.6 = 348 AF of recharge (rounded values).

of excess flows were recharged in the canal from the headgate up to MP 13.3 (the full 13.3 miles of canal with recharge operations). The full calculations are shown in **Table 3**.

Table 3. Estimated total recharge from the Phelps County Canal headgate to MP 1.6 and MP 13.3. Values in AF; values rounded.

Mo-Yr	Total volume measured through the flume at MP 1.6 (A)	Cumulative volume delivered through flume at MP 1.6 (B)	Program portion of deliveries (C)	Evap on Program portion (D)	Volume of recharge from MP 1.6 to MP 13.3 (E)	Estimated recharge per mile of canal for the Program (F)	Estimated Program recharge from the headgate to MP 1.6 (G)	Estimated total Program recharge from the headgate to MP 13.3 (H)
Nov-14	971	971	486	2	484	41	66	550
Dec-14	1,374	2,345	687	0	687	59	94	781
Jan-15	1,507	3,853	754	0	754	64	103	857
Feb-15	691	4,544	617	0	617	53	84	702
Total	4,544	-	2,544	2	2,542	217	348	2,889

(A) Measured delivery data at the MP 1.6 flume, provided by the CNPPID.

(B) Cumulative deliveries in column (A).

(C) The Program's portion of the delivery is 50% up to 4,000 AF of diversions and 100% beyond 4,000 AF.

(D) Evaporation from the delivieries associated with the Program's portion. Calculated based on the method used in the Feasibility Study, the NRCS-NE-ENG-81 worksheet.

(E) Columns (C - D).

(F) Column (E) divided by 11.7 canal miles (from MP 1.6 to MP 13.3).

(G) Column (F) multiplied by 1.6 canal miles (from the headgate to MP 1.6).

(H) Columns (E + G).

3.3. Canal Recharge Rates

Daily recharge rates (also referred to as infiltration rates) were estimated using a water balance approach based on the delivery data, evaporation rates, precipitation data and canal geometry. Delivery data and evaporation were provided in the previous Section 3.1.

Precipitation

Precipitation data was obtained for the Canaday Steam Plant, NE climate station, located approximately one mile west of the Phelps County Canal (shown in Figure 1)[17]. Precipitation totaled 1.60 inches during the recharge season from November 26, 2014 through February 15, 2015. Monthly precipitation volumes on the canal were calculated using an average canal width of 85 feet, and the length of the canal between the flume at MP 1.6 and the check structure at MP 13.3. The total volume of precipitation during the recharge period was approximately 16 AF (see Appendix B). Daily precipitation data is included in Appendix C. Appendix C also shows historical monthly precipitation totals since 2010.

[16] Calculation: 2,542 AF of recharge from MP 1.6 to MP 13.3 + 348 AF from the headgate to MP 1.6 = 2,889 AF of recharge in the canal.

[17] (Northeast Regional Climate Center, 2015)

Unit Recharge Rate

Canal delivery rates are higher during the initial days recharge operations commence in order to fill the canal. In general, after the canal fills along its entire length during the first few days of diversions, the delivery rate becomes approximately equal to the recharge rate, as the CNPPID fills the canal based on the amount of seepage lost from the canal. The unit recharge rate averaged 2.0 cfs/mile, as shown in **Table 4**. The calculated daily unit recharge rates for the past three years of recharge operations are shown in Table 4 and **Figure 4**. Figure 4 also includes the rate of recharge the Program used to score the Phelps County Canal Groundwater Recharge as a WAP project.

Table 4. Summary of unit recharge rates and infiltration rates during the four recharge seasons.

Period	Parameter	Units	Minimum	Average	Maximum
2011-2012	Unit Recharge Rate	(cfs/mile/day)	1.4	3.1	3.9
	Infiltration Rate	(feet/day)	0.3	0.6	0.8
2012-2013	Unit Recharge Rate	(cfs/mile/day)	1.2	1.5	2.0
	Infiltration Rate	(feet/day)	0.2	0.3	0.4
2013-2014	Unit Recharge Rate	(cfs/mile/day)	-	2.4	-
	Infiltration Rate	(feet/day)	-	0.5	-
2014-2015	Unit Recharge Rate	(cfs/mile/day)	1.5	2.0	2.7
	Infiltration Rate	(feet/day)	0.3	0.4	0.5

Notes:

Unit recharge rate calculation provided in Appendix B. Infiltration rate calculated using the unit recharge rate converted to a volume of recharge per day, then divided by the canal area (canal width assumed 85 feet).

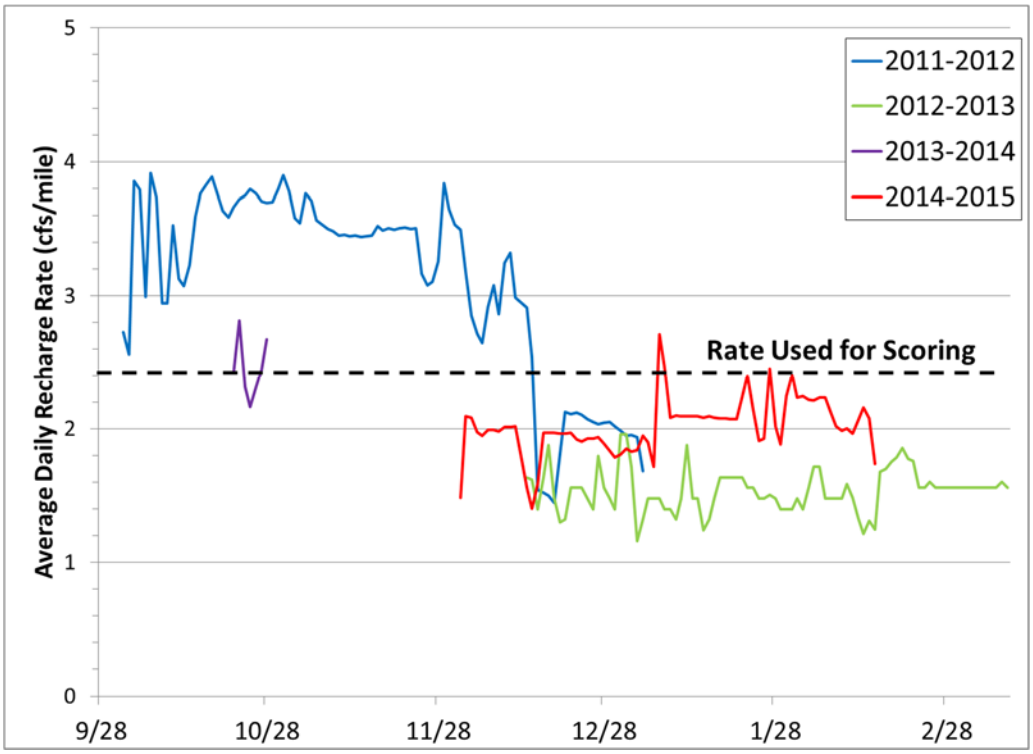


Figure 4. Daily unit recharge rates in the Phelps County Canal during the 2011 to 2015 operations.

3.4. Water Temperature

Water temperature data was collected in the Phelps County Canal during the 2014-2015 recharge operations. **Figure 5** shows the water temperatures in the canal and the air temperatures at the Canaday Stream Plant, NE climate station. The air temperature is shown to depict when the water level in the canal is below the sensor and the sensor is reading air temperatures. The canal sensor begins reading water temperature approximately when recharge operations begin in November, as the temperature stays relatively constant (without the highs and lows of air temperatures throughout the day). After deliveries end in February, there are approximately three weeks when the canal is likely draining and the sensor is reading water temperature. After the canal drains below the sensor level, the sensor begins reading air temperatures again.

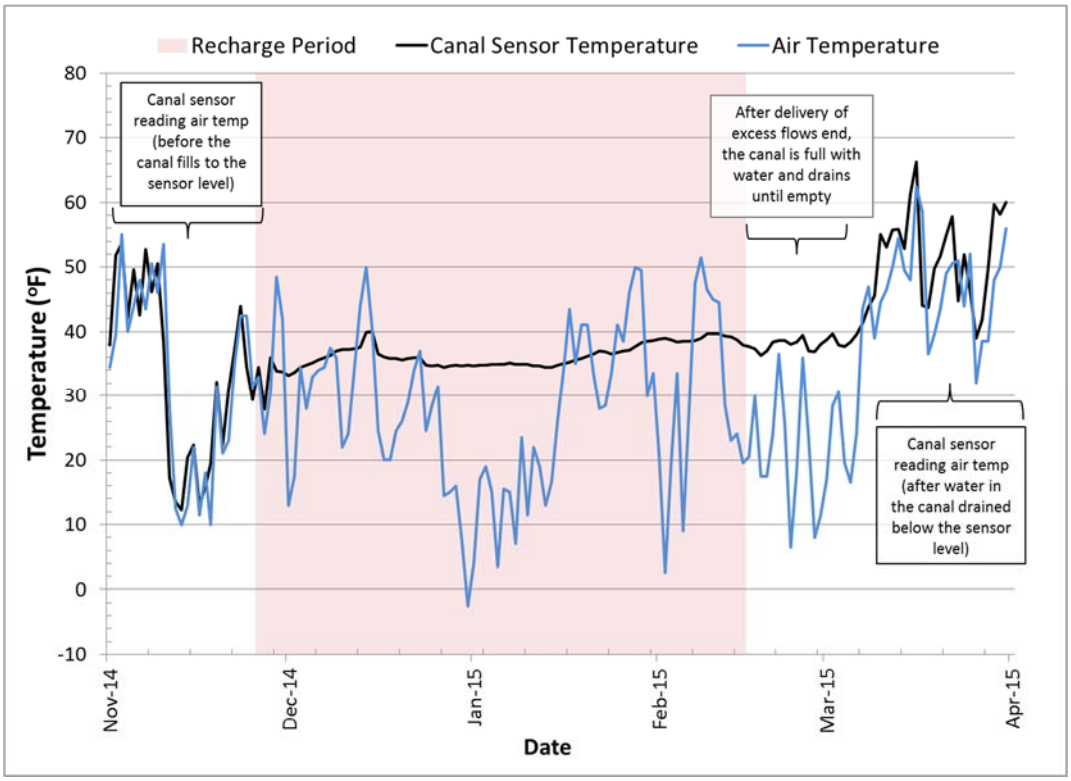


Figure 5. Water temperatures in Phelps County Canal compared to air temperatures at the Canaday Steam Plant, NE climate station.

3.5. Groundwater Level Response

The groundwater levels in the beginning of the 2014-2015 recharge season were higher in comparison to the initial elevations during recharge operations beginning in 2013 and similar to operations in 2011 and 2012. The water levels for the Program wells, the CNPPID wells and the TBNRD wells are described further below.

3.5.1. Program Wells

Groundwater levels in the six Program monitoring wells were 1.5 to 3.6 feet higher at the commencement of the fall 2014 recharge operations than the fall 2013 recharge operations. The initial water levels in the fall of 2014 were similar to the levels in 2011 and 2012 when recharge operations began. The start dates of recharge operations fluctuate each season, so this is not a direct comparison of water levels, but comparison of the water levels at the beginning of the recharge seasons. **Table 5** is a summary of the beginning water levels for each year of recharge.

Table 5. Summary of pre-recharge water levels in Program monitoring wells.

Date*	Initial Water Level Elevations (feet)					
	MW-1	MW-2	MW-3	MW-4	MW-5	MW-6
9/27/2011	2312.7	2312.4	2304.4	2292.3	2298.7	2320.1
12/9/2012	2310.2	2309.7	2303.4	2291.8	2297.9	2315.7
9/18/2013	2306.7	2305.6	2302.4	2289.6	2296.3	2313.4
11/25/2014	2310.3	2309.2	2303.9	2292.3	2298.4	2315.1
Change in Elevation (2014 value less 2013 value)	*3.6*	*3.6*	*1.5*	*2.7*	*2.1*	*1.7*

*These are the days before the deliveries into recharge began.

Appendix D includes the floodplain well graphs and a summary table of the water level increases in all of the Program wells during the period of recharge operations. As shown in Table D-1 in Appendix D, the water levels in the monitoring wells located on the terrace (MW-1, MW-2 and MW-6) show a more immediate response during recharge operations, as these wells are located near the canal. The well levels for the terrace wells (MW-1, MW-2 and MW-6) increased more than the wells located on the floodplain (MW-3, MW-4 and MW-5) during the recharge period, which is typical based on previous years of recharge activities in the Phelps County Canal. The largest increase was observed in MW-6, which is located adjacent to the Phelps County Canal (**Figure 6**) with a water level increase of 2.7 feet from November 25, 2014 (day before recharge operations began) and February 15, 2015 (last day of recharge deliveries). Note that the increase in water levels was calculated during the period when canal deliveries were made and does not reflect changes in well levels due to lagged return flows occurring after this period.

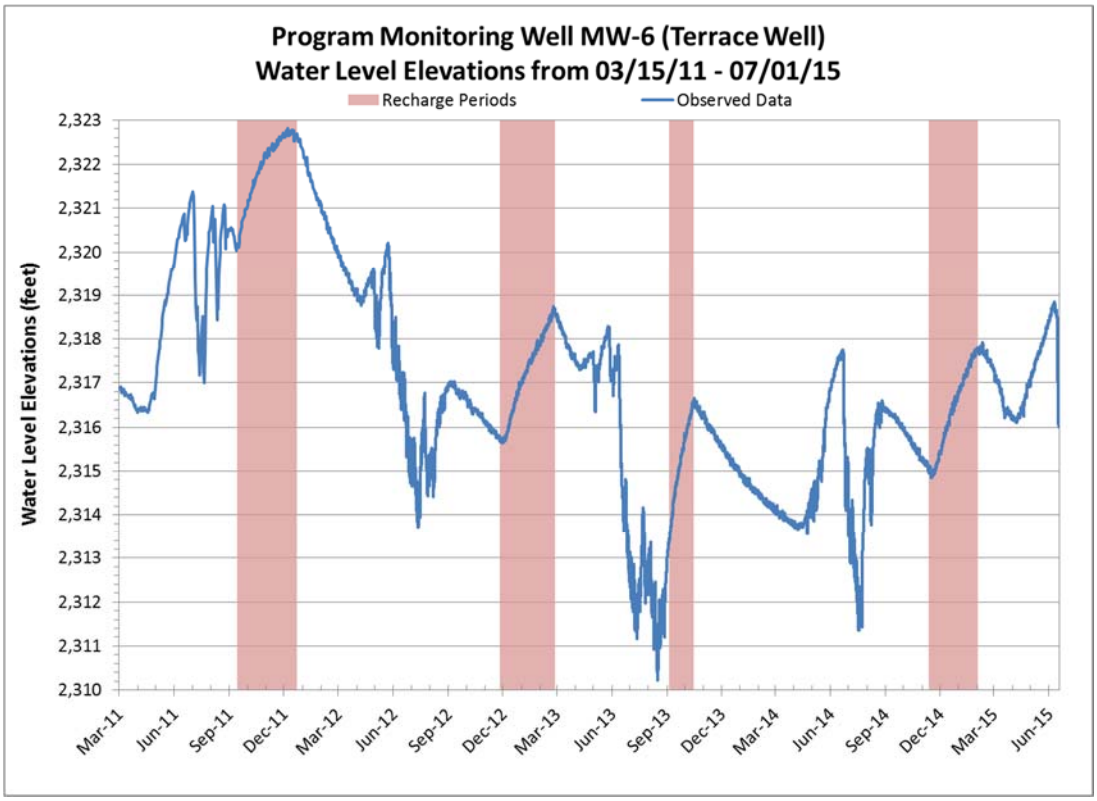


Figure 6. MW-6 water level elevations.

As stated previously in this report, the water levels in the MW-1 and MW-2 wells did not reach the operational thresholds set forth by the Program during the recharge period. The water level graphs for MW-1 and MW-2 are shown in **Figures 7 and 8**, respectively.

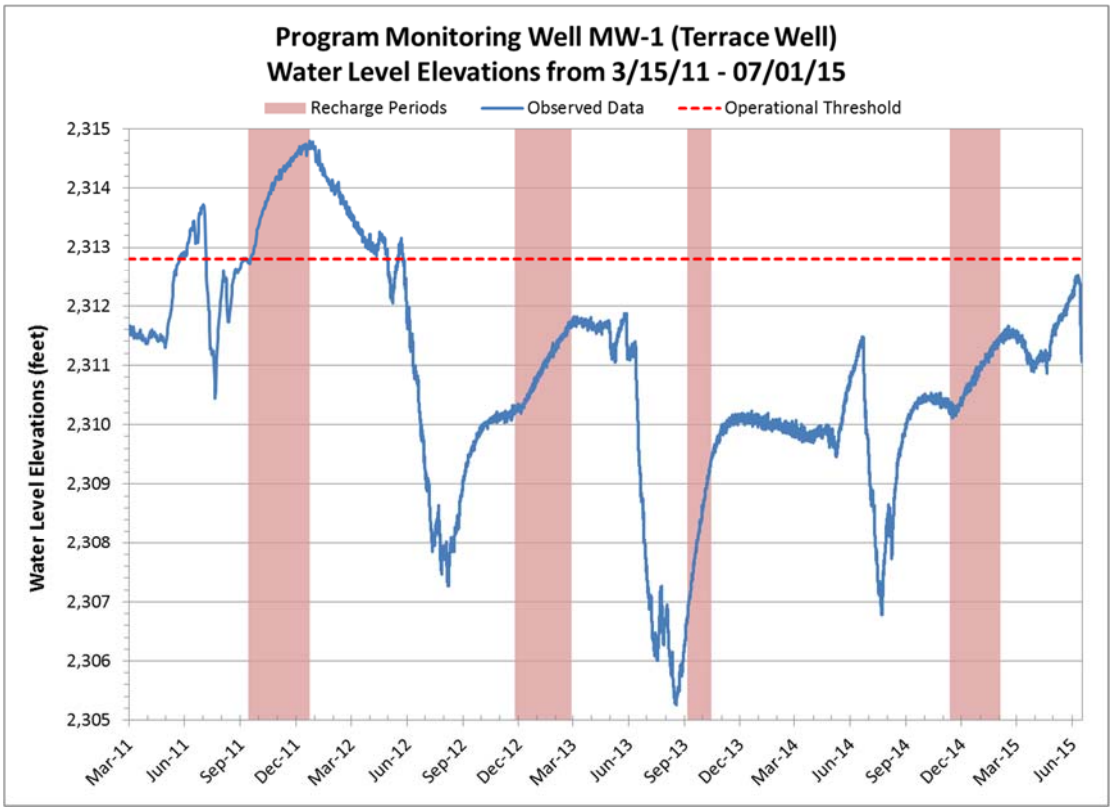


Figure 7. MW-1 water level elevations.

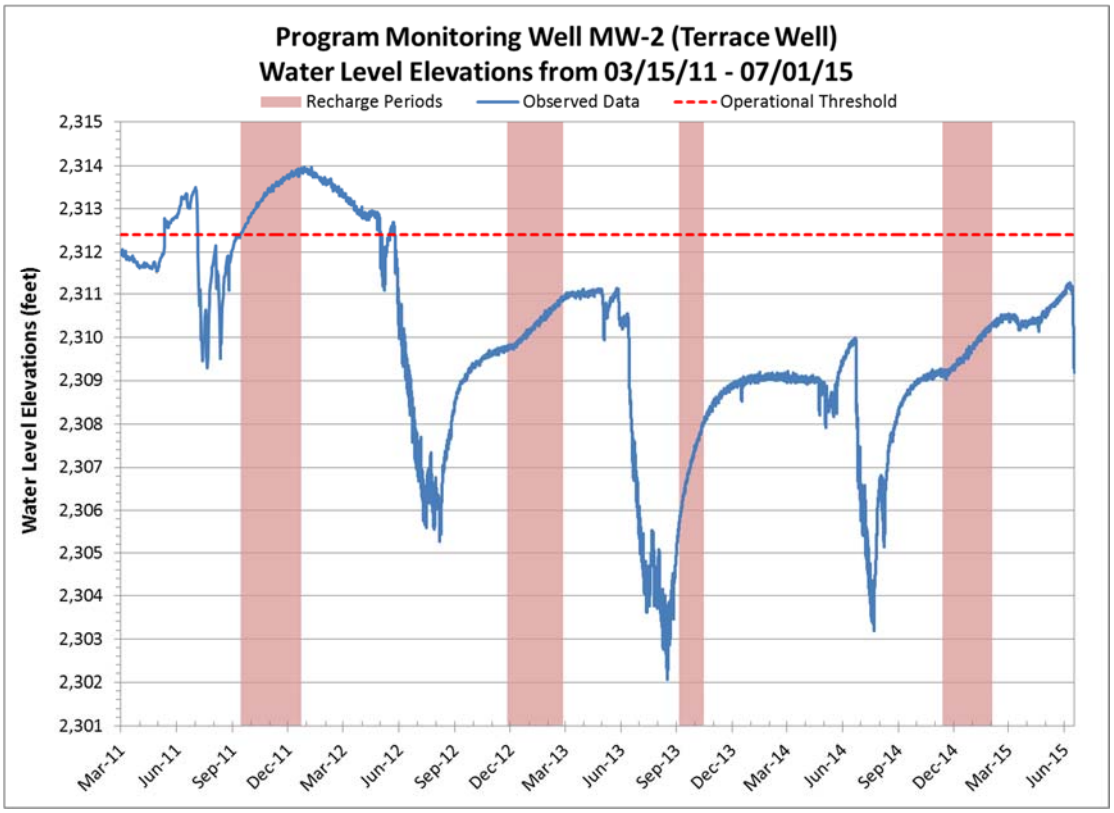


Figure 8. MW-2 water level elevations.

3.5.2. CNPPID Wells

There are eight CNPPID wells equipped with recording pressure transducers. Three wells, C-94, C-97 and C-102, are located between the canal and the river in the vicinity of lands identified as being potentially sensitive to recharge. Monitoring well level data for these wells is presented in **Figure 9**.

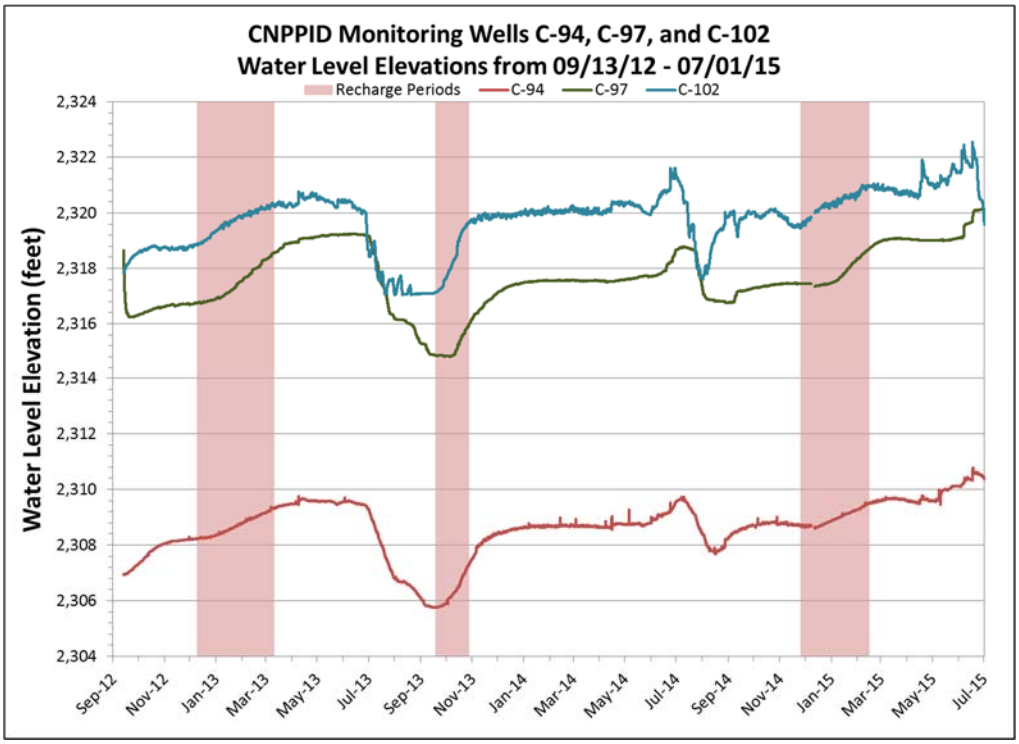


Figure 9. C-94, C-97 and C-102 water level elevations.

Water level graphs of the other CNPPID monitoring wells in the vicinity of the Phelps County Canal (C-83, C-110, C-114, C-115 and C-116) are provided in **Appendix E**. The locations of these wells are shown in Figure 1. Appendix E also contains a summary table of the water levels in each well during the recharge period.

3.5.3. TBNRD Wells

There are nine TBNRD monitoring wells. Three of the wells (P-105, P-106 and P-110) are included in the group of "Overton transect wells" and the remaining six wells (P-101 through P-104, P-132 and P-133) are included in the "Elm Creek transect wells". The three Overton transect wells are located in the floodplain between the canal and the river. **Figure 10** shows the water levels in the Overton transect wells. The Elm Creek transect well water level elevations are shown in **Figure 11**. Note that well P-104 is located up-gradient of the canal. The water level elevation data summaries for the TBNRD wells during the 2014-2015 recharge season are included as **Appendix F**.

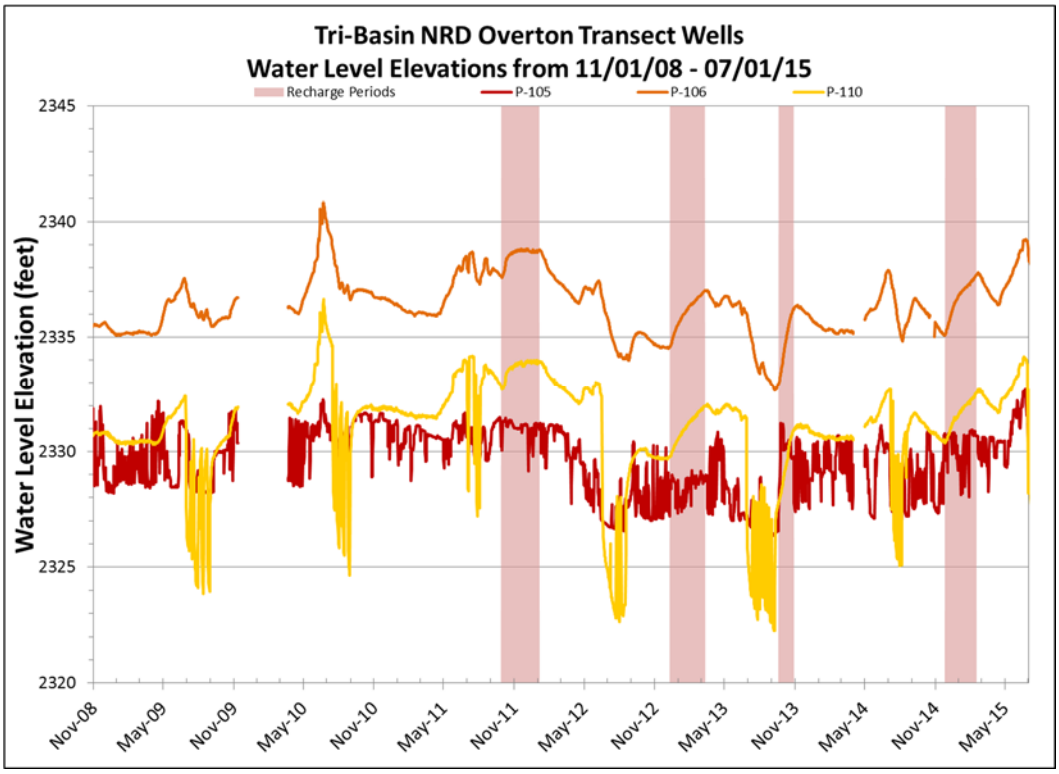


Figure 10. Overton transect well water level elevations.

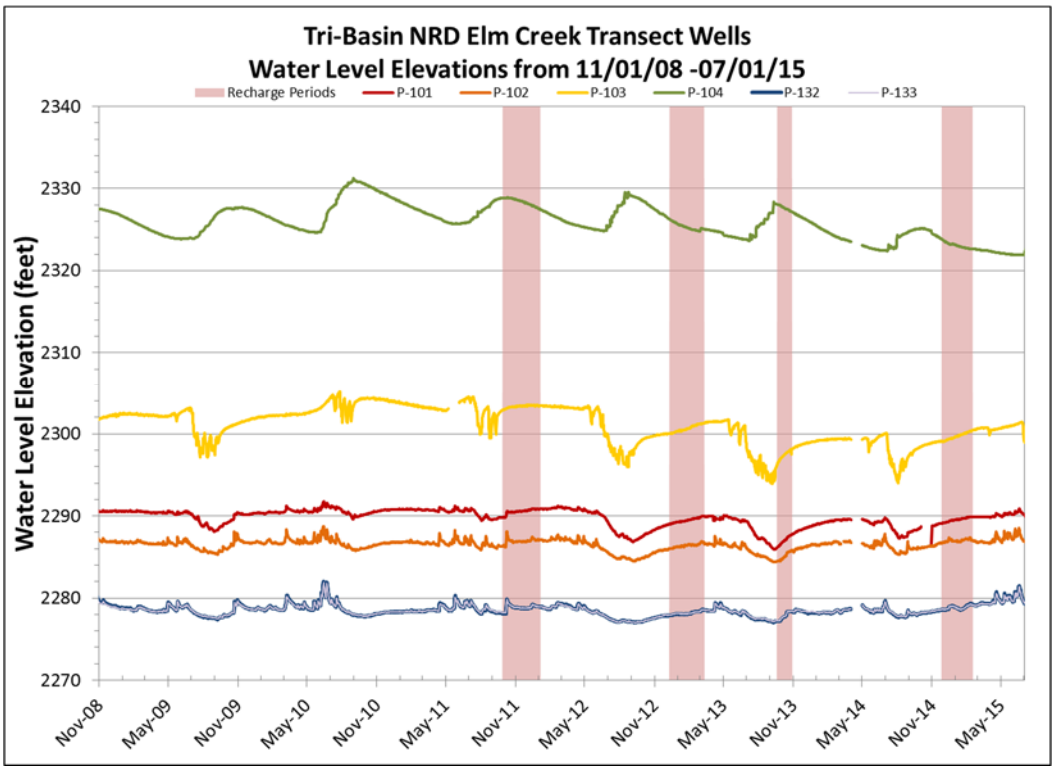


Figure 11. Elm Creek transect well water level elevations.

3.6. Drains

Stage was continuously monitored at four of the drain sites (DL-3, DL-6, DL-7 and DL-9) and weekly staff gage readings were recorded at the remaining five drain sites (D-1, D-2, D-4, D-5 and D-8). Manual readings of weekly staff gage data were also collected at continuously monitored sites by the ED Office staff. The weekly staff gage readings from the continuously monitored sites (weekly manual readings are at sites D-3, D-6, D-7 and D-9) are provided in **Appendix G**, for comparison with the continuous data. Drain data graphs for all of the monitored sites are included in Appendix G. The ED Office staff intends to resurvey the drain level base elevations to check the accuracy of the data for the 2015-2016 recharge season.

3.7. Streamflow

Streamflow at the USGS Platte River near Overton, NE station peaked at 15,900 cfs in June 2015. The high flows in the associated habitat reach of the Platte River were due to precipitation and snowmelt predominantly from the South Platte River. Although the high flow event does not impact recharge operations as high flows occurred during the irrigation season, streamflow data is provided as river levels may impact levels in the monitoring wells, especially wells in close proximity to the river. A graph of the streamflow is shown in **Appendix H**.

4. CONCLUSIONS

The Phelps County Canal Groundwater Recharge project continued to be successful in recharging excess surface water flows during the fall of 2014 though the spring of 2015. Flows in excess of the USFWS target flows were continuously delivered in the canal from November 26, 2014 through February 15, 2015 for recharge operations. Water deliveries were measured using the flume at approximately MP 1.6, and allowed to recharge in the canal up to the check structure at MP 13.3. A total of 4,544 AF of excess flows were delivered through the flume for use by the NDNR and the Program. The Program's portion of deliveries was 2,544 AF, per the water service agreement with the CNPPID. After evaporative losses were assessed on the canal, the total volume of deliveries for the Program was 2,542 AF[18] during the 2014-2015 season.

Based on the monitoring well level data collected to-date, there appear to be seasonal patterns of groundwater level fluctuations near the canal, with levels generally increasing during the non-irrigation season and decreasing during the irrigation season[19]. Although it is assumed a portion of the recharged water discharges into drains between the canal and the river, it is difficult to evaluate the volumetric impact of recharge operations on drain levels. Other factors, such as irrigation activities (surface water deliveries and/or groundwater pumping) and seasonal variations in water supply (streamflow fluctuations and local precipitation), may govern the groundwater level trends and drain level trends in this area.

[18] Volume based on deliveries measured at the flume at approximately MP 1.6 to the check structure at MP 13.3.

[19] Based on data for the Program wells near the canal, MW-6, MW-1 and MW-2.

The Program has completed several years of successful recharge operations in the Phelps County Canal, and anticipates recharge in the 2015-2016 season. The Program will continue to monitor groundwater levels during this time. The ED Office intends to resurvey the drain gage base elevations to check for accuracy before the next recharge summary report.

5. REFERENCES

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Office of the Executive Director, Water Advisory Committee, Hahn Water Resources LLC, and Ann Bleed and Associates, Inc. (2010). *Nebraska Ground Water Recharge Pre-Feasibility Study.*

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APPENDIX A:

NDNR PERMIT FOR RECHARGE OPERATIONS 2014-2015

STATE OF NEBRASKA

DEPARTMENT OF NATURAL RESOURCES

APPROVAL OF APPLICATION A-19254

WATER DIVISION 1-A

BACKGROUND

1. On July 14, 2004, the Department of Natural Resources (Department) issued a formal moratorium on all new surface water appropriations in the Platte River Basin upstream of the confluence with the Loup River near Columbus, Nebraska. The moratorium included all tributary streams above the Loup River confluence including the North and South Platte Rivers and tributaries.

2. On January 1, 2007, work officially commenced on the Platte River Recovery and Implementation Program (PRRIP or Program). PRRIP's goals include reducing shortages to U.S. Fish and Wildlife Service target flows and providing additional land habitat for endangered species in the Lexington to Chapman reach of the Platte River. In order to meet these goals, each signatory to PRRIP has adopted depletions plans to address the mitigation of the adverse impacts of water-related activities on streamflows in the Platte River. The State of Nebraska, through the Department will utilize the integrated management process to achieve the goals of PRRIP (BWIMP and IMPs).

3. On August 13, 2009, the initial integrated management plans (IMPs) were adopted by order of the Department, pursuant to *Neb. Rev. Stat.* § 46-718(2) for the following natural resources districts (NRDs): the North Platte NRD, the South Platte NRD, the Twin Platte NRD, the Central Platte NRD, and the Tri-Basin NRD. There have been subsequent revisions to the IMPs. As part of the surface water controls adopted by the Department pursuant to *Neb. Rev. Stat.* § 46-716(1)(b), the moratorium on issuing new surface water appropriations was continued.

4. On September 11, 2009, a Basin-Wide Integrated Management Plan (BWIMP) for the overappropriated area of the Platte River Basin was adopted by order of the Department. The BWIMP was also adopted by the following NRDs: the North Platte NRD, the South Platte NRD, the Twin Platte NRD, the Central Platte NRD, and the Tri-Basin NRD. These NRDs are collectively referred to in the BWIMP as the "Platte River Basin NRDs." The individual integrated management plans referenced in the next paragraph are required to be in conformance with the goals and objectives of the BWIMP.

5. On September 19, 2013, The Central Nebraska Public Power and Irrigation District, filed petition VAR-4828 for Leave to File or Consider an Application for a Permit to Appropriate Water within a Moratorium Area. The draft application attached to the petition is for a temporary permit to appropriate water from the Platte River for the purpose of groundwater recharge via the Phelps Canal and Funk Lagoon/Waterfowl Production Area.

6. On May 1, 2014, the Department granted leave to file an application for a permit to appropriate water by approving petition VAR-4828.

7. On May 19, 2014, The Central Nebraska Public Power and Irrigation District (CNPPID), filed in the Department application A-19254 for a temporary permit to appropriate water for the purpose of groundwater recharge through the Phelps Canal system. The application proposes to divert water from the Platte River at the headgate of the applicant's Tri-County Canal located in Section 8, Township 13 North, Range 29 West of the 6th P.M. in Lincoln County, which then connects to the Phelps Canal and Funk Lagoon/Waterfowl Production Area.

8. Temporary permits may not be granted for a term of more than one year.

CONCLUSIONS:

1. Construction of the Phelps Canal and Funk Lagoon/Waterfowl Production Area have been completed.

2. Applicant has demonstrated there may be unappropriated water in the Platte River. It is anticipated there will be water available for diversion for a brief period under this application in the near future.

3. The purpose of this application is to recharge the groundwater aquifer in order to mitigate stream depletions from groundwater pumping and possibly increase base flow into local streams, which are goals of the BWIMP, IMPs and PRRIP. Potential accretions to streamflow that may occur as a result of recharge under this appropriation will be considered as beneficial depletion mitigation only when and to the extent that CNPPID is diverting water for recharge purposes to achieve, in order of precedence, the goals of the BWIMP, IMPs or PRRIP, in accordance with terms of contractual agreements.

4. The temporary diversion project proposed by application A-19254 as realized through contractual agreement between the Department and CNPPID will contribute to achieving the goals of the BWIMP and the IMPs.

5. Diversions would mostly likely occur under the proposed project during the non-irrigation season; therefore, no adverse impacts to existing water users are expected.

6. This temporary diversion project will be operated pursuant to the BWIMP, IMPs and the PRRIP and will divert water only when U.S. Fish and Wildlife Service target flows are exceeded. As such, this project will not require an offset for the purpose of ensuring that these target flows are met.

7. The success of BWIMP, IMPs and the PRRIP are in the public interest. The State of Nebraska, through the Department and the NRDs as integrated management partners, is responsible for ensuring the success of these plans and agreements.

8. Projects such as this will facilitate increased baseflow to nearby streams, including the Platte River, through groundwater recharge. The benefits from this project may assist with achieving the goals of the

BWIMP and IMPs that the Department and the Platte River Basin NRDs have adopted.

9. For these reasons, the application is in the public interest and should be approved.

ORDER

IT IS HEREBY ORDERED that application A-19254 is APPROVED subject to the following limitations and conditions:

1. The source of water is the Platte River.

2. The water diverted under this temporary permit shall only be used for the purpose of groundwater recharge in support of the BWIMP and IMPs via the existing Phelps Canal and Funk Lagoon/Waterfowl Production Area.

3. The priority date is May 19, 2014.

4. When the specified conditions of this appropriation are met, water may be diverted, at a maximum rate of 600 cubic feet per second, into the headgate of the Tri-County Canal located in Section 8, Township 13 North, Range 29 West of the 6th P.M. in Lincoln County, and the same water less transit losses allowed to flow into and through the Parshall Flume at Milepost 1.6 located in Section 11, Township 8 North, Range 21 West of the 6th P.M. in Gosper County, on the Phelps Canal, and a portion of which may be supplied to Funk Lagoon/Waterfowl Production Area.

5. The water diverted under appropriation A-19254 may flow through the Applicant's Phelps canal and may be used for groundwater recharge via the canal and the Funk Lagoon/Waterfowl Production Area whenever the conditions of this permit allow.

6. If a relinquishment is not submitted first, then A-19254 will EXPIRE one year from the date of this Order and appropriation A-19254 will be CANCELLED without further action by the Department as of that date.

7. No diversion of water under this permit may occur if the U.S. Fish and Wildlife Service-specified target flows are not being met, averaged on a daily basis, at the time of the intended diversion. These target flows are specified in **Table A** on page 5. Appropriator must coordinate with the Department's field office in charge of water administration to confirm that this condition is met.

8. The Department reserves the right to make adjustments to the amounts listed in Table A.

9. No diversion shall occur if the Department determines that, at the time of intended diversion, there are no excess flows available in the Platte River or if the appropriation is out of priority. Total diversion into the Phelps Canal during use of this permit will be limited to the permitted amount of A-19254 less transit losses.

10. The water diverted under A-19254 through the Tri-County Canal and the Phelps Canal system **may not be used for direct irrigation** by The Central Nebraska Public Power and Irrigation District's customers. The

water diverted under A-19254 may flow only through the headgate, canal and lateral system. Any water diverted for the purpose authorized under this permit that does not seep into the groundwater aquifer shall be returned to the river at established spills and drains.

11. Within six months after the final date of diversion under this temporary permit, the appropriator shall file a map that depicts where the water was routed, and will provide in-depth quantitative analysis to the Department of the recharge achieved by utilizing the Phelps Canal and Funk Lagoon/Waterfowl Production Area, including all data provided to the Program pursuant to a contractual arrangement between CNPPID and the Department.

12. The appropriator must comply with all relevant statutes.

ADDITIONAL INFORMATION

Failure to comply with all laws and regulations pertaining to surface water appropriations, any orders issued by the Director of the Department of Natural Resources, or the provisions of this Approval may result in the cancellation of the appropriation, temporary closing of the appropriation, administrative penalty, criminal prosecution, or any combination thereof.

DEPARTMENT OF NATURAL RESOURCES

November 26, 2014

Brian P. Dunnigan, P.E., Director

The applicant and any person with sufficient legal interest who has been or may be substantially affected by this order may request a contested case hearing in accordance with the *Neb. Admin. Procedures Act* §§ 84-901 et. seq. RRS and the Department's *Rules of Practice and Procedure Title 454 Neb. Admin. Code* Chapter 7. The request must be received by the Department at its Lincoln office (Nebraska State Office Building, 4th Floor, 301 Centennial Mall South, P.O. Box 94676, Lincoln, Nebraska 68509-4676) within 30 days of the date of the order and be accompanied by a filing fee of $10.

A copy of this approval was posted on the Department's website and provided to the Department's field offices in Bridgeport and North Platte, Nebraska. A copy of this approval was mailed on November 26, 2014, to the following:

Don Kraus, P.E., General Manager
Central Nebraska Public Power and
Irrigation District
P.O. Box 740
Holdrege, Nebraska 68949-0740

Table A - Desired Minimum Discharge of the Platte River in cfs

Measured at the Grand Island Stream Gage Relevant to Appropriation A-19254

Period	PRRIP Target Flows Grand Island		
	Wet*	**Normal***	**Dry***
January 1 - January 31	1,000	1,000	600
February 1 - February 14	1,800	1,800	1,200
February 15 - February 28	3,350	3,350	2,250
March 1 - March 15	3,350	3,350	2,250
March 16 - March 22	1,800	1,800	1,200
March 23 - March 31	2,400	2,400	1,700
April 1 - April 14	2,400	2,400	1,700
April 15 - May 3	2,400	2,400	1,700
May 4 - May 10	2,400	2,400	1,700
May 11- May 19	1,200	1,200	800
May 20 - May 31	3,700	3,400	800
June 1 - June 20	3,700	3,400	**1,000****
June 21 - June 23	1,200	1,200	**1,000****
June 24 - July 31	1,200	1,200	**1,000****
August 1 - August 22	1,200	1,200	800
August 23 - August 31	1,200	1,200	800
September 1 - September 15	1,200	1,200	800
September 16 - September 30	1,000	1,000	600
October 1 - October 11	2,400	1,800	**1,350****
October 12 - November 10	2,400	1,800	**1,500****
November 11 - November 15	2,400	1,800	1,300
November 16 - December 31	1,000	1,000	600

* The current Hydrologic Condition, (Wet Normal or Dry) determined by PRRIP can be found at: *http://platteriverprogram.org/PubsAndData/Pages/CurrentHydrologicCondition.aspx*

**Represents the minimum discharge required by instream flow appropriation, which is greater than PRRIP Target Flows, and senior to A-19254

APPENDIX B:

SUMMARY OF UNIT RECHARGE RATE CALCULATIONS

Table B1: Summary of unit recharge rate calculations from MP 1.6 to MP 13.3.

Date	Delivery rate into canal for recharge at MP 1.6 flume (cfs)	Volume of diversions at the MP 1.6 flume (AF)	Evaporation from canal surface (AF)	Precipitation on canal surface (AF)	Total volume of recharge from MP 1.6-MP 13.3 (w/precip) (AF)	Unit recharge rate per mile (cfs/mile)
	(A)	(B)	(C)	(D)	(E)	(F)
11/26/2014	27.6	54.8	0.84	0.00	53.9	-
11/27/2014	119.8	237.7	0.84	0.00	236.9	-
11/28/2014	137.9	273.6	0.84	0.00	272.7	-
11/29/2014	116.4	230.9	0.84	0.00	230.0	-
11/30/2014	87.9	174.3	0.84	0.00	173.4	-
12/1/2014	30.8	61.0	0.00	0.00	61.0	-
12/2/2014	17.3	34.4	0.00	0.00	34.4	1.5
12/3/2014	24.5	48.5	0.00	0.00	48.5	2.1
12/4/2014	24.4	48.3	0.00	0.00	48.3	2.1
12/5/2014	23.1	45.9	0.00	0.00	45.9	2.0
12/6/2014	22.8	45.2	0.00	0.00	45.2	1.9
12/7/2014	23.3	46.2	0.00	0.00	46.2	2.0
12/8/2014	23.3	46.2	0.00	0.00	46.2	2.0
12/9/2014	23.2	46.0	0.00	0.00	46.0	2.0
12/10/2014	23.6	46.7	0.00	0.00	46.7	2.0
12/11/2014	23.6	46.7	0.00	0.00	46.7	2.0
12/12/2014	23.6	46.8	0.00	0.00	46.8	2.0
12/13/2014	21.0	41.6	0.00	0.00	41.6	1.8
12/14/2014	18.2	36.2	0.00	0.00	36.2	1.6
12/15/2014	16.0	31.7	0.00	8.14	39.8	1.7
12/16/2014	18.5	36.6	0.00	2.21	38.8	1.7
12/17/2014	23.0	45.6	0.00	0.00	45.6	2.0
12/18/2014	23.0	45.6	0.00	0.00	45.6	2.0
12/19/2014	23.0	45.6	0.00	0.00	45.6	2.0
12/20/2014	23.0	45.6	0.00	0.00	45.6	2.0
12/21/2014	23.0	45.6	0.00	0.00	45.6	2.0
12/22/2014	23.0	45.6	0.00	0.00	45.6	2.0
12/23/2014	22.4	44.5	0.00	0.00	44.5	1.9
12/24/2014	22.3	44.2	0.00	0.00	44.2	1.9
12/25/2014	22.5	44.7	0.00	0.00	44.7	1.9
12/26/2014	22.5	44.7	0.00	0.00	44.7	1.9
12/27/2014	22.6	44.8	0.00	1.00	45.8	2.0
12/28/2014	22.1	43.9	0.00	0.00	43.9	1.9
12/29/2014	21.5	42.6	0.00	0.00	42.6	1.8
12/30/2014	20.8	41.4	0.00	1.21	42.6	1.8
12/31/2014	21.1	41.9	0.00	0.00	41.9	1.8
1/1/2015	21.6	42.9	0.00	0.00	42.9	1.8
1/2/2015	21.4	42.4	0.00	0.00	42.4	1.8
1/3/2015	21.5	42.7	0.00	0.00	42.7	1.8
1/4/2015	22.8	45.1	0.00	0.00	45.1	1.9
1/5/2015	22.2	44.0	0.00	0.10	44.1	1.9
1/6/2015	20.1	39.8	0.00	0.00	39.8	1.7
1/7/2015	31.7	62.9	0.00	0.00	62.9	2.7
1/8/2015	28.8	57.1	0.00	0.00	57.1	2.5
1/9/2015	24.4	48.3	0.00	0.00	48.3	2.1
1/10/2015	24.5	48.7	0.00	0.00	48.7	2.1
1/11/2015	24.5	48.5	0.00	0.00	48.5	2.1
1/12/2015	24.5	48.5	0.00	0.00	48.5	2.1
1/13/2015	24.5	48.6	0.00	0.00	48.6	2.1
1/14/2015	24.4	48.5	0.00	0.00	48.5	2.1
1/15/2015	24.3	48.3	0.00	0.00	48.3	2.1

Date	Delivery rate into canal for recharge at MP 1.6 flume (cfs)	Volume of diversions at the MP 1.6 flume (AF)	Evaporation from canal surface (AF)	Precipitation on canal surface (AF)	Total volume of recharge from MP 1.6-MP 13.3 (w/precip) (AF)	Unit recharge rate per mile (cfs/mile)
	(A)	(B)	(C)	(D)	(E)	(F)
1/16/2015	24.4	48.5	0.00	0.00	48.5	2.1
1/17/2015	24.4	48.3	0.00	0.00	48.3	2.1
1/18/2015	24.3	48.1	0.00	0.00	48.1	2.1
1/19/2015	24.3	48.1	0.00	0.00	48.1	2.1
1/20/2015	24.3	48.1	0.00	0.00	48.1	2.1
1/21/2015	24.3	48.1	0.00	0.00	48.1	2.1
1/22/2015	26.2	52.0	0.00	0.00	52.0	2.2
1/23/2015	28.1	55.7	0.00	0.00	55.7	2.4
1/24/2015	25.1	49.7	0.00	0.00	49.7	2.1
1/25/2015	22.3	44.3	0.00	0.00	44.3	1.9
1/26/2015	22.5	44.7	0.00	0.00	44.7	1.9
1/27/2015	28.7	56.9	0.00	0.00	56.9	2.5
1/28/2015	23.6	46.9	0.00	0.00	46.9	2.0
1/29/2015	22.0	43.7	0.00	0.00	43.7	1.9
1/30/2015	26.2	52.0	0.00	0.00	52.0	2.2
1/31/2015	28.1	55.8	0.00	0.00	55.8	2.4
2/1/2015	26.1	51.8	0.00	0.00	51.8	2.2
2/2/2015	26.1	51.8	0.00	2.41	54.2	2.3
2/3/2015	25.9	51.5	0.00	0.00	51.5	2.2
2/4/2015	25.8	51.2	0.00	1.00	52.2	2.3
2/5/2015	26.2	51.9	0.00	0.00	51.9	2.2
2/6/2015	26.1	51.8	0.00	0.00	51.8	2.2
2/7/2015	24.9	49.4	0.00	0.00	49.4	2.1
2/8/2015	23.6	46.8	0.00	0.00	46.8	2.0
2/9/2015	23.2	46.1	0.00	0.00	46.1	2.0
2/10/2015	23.4	46.4	0.00	0.00	46.4	2.0
2/11/2015	23.0	45.6	0.00	0.00	45.6	2.0
2/12/2015	24.2	48.0	0.00	0.00	48.0	2.1
2/13/2015	25.2	50.1	0.00	0.00	50.1	2.2
2/14/2015	24.3	48.2	0.00	0.00	48.2	2.1
2/15/2015	20.3	0.4	0.00	0.00	0.4	-
Total	-	4,544	4	16	4,556	-

(A) and (B): delivery data measured at the flume at MP 1.6, provided by the CNPPID.

(C): Evaporation calculated using methodology in the Feasibility Study, the NRCS-NE-ENG-81 worksheet.

(D): Data from the Canaday Steam Plant, NE climate station.

(E): Columns (B - C + D).

(F): (Column E ÷ 1.9835) ÷ 11.7 miles of canal from the flume at MP 1.6 to the check structure at MP 13.3.

APPENDIX C:

DAILY AND MONTHLY CANADAY STEAM PLANT, NE STATION CLIMATE DATA

Table C1: Daily Canaday Steam Plant, NE climate station temperature and precipitation data.

Day of Month	Nov-14		Dec-14		Jan-15		Feb-15	
	Avg Temp (oF)	Total Precip (in)	Avg Temp (oF)	Total Precip (in)	Avg Temp (oF)	Total Precip (in)	Avg Temp (oF)	Total Precip (in)
1	34.5	0.00	13.0	0.00	4.0	0.00	20.5	0.00
2	39.5	0.00	17.5	0.00	17.0	0.00	2.5	0.24
3	55.0	0.00	34.5	0.00	19.0	0.00	19.5	0.00
4	40.0	0.00	28.0	0.00	15.0	0.00	33.5	0.10
5	44.0	0.00	33.0	0.00	3.5	0.01	9.0	0.00
6	48.0	0.00	34.0	0.00	15.5	0.00	28.0	0.00
7	43.5	0.00	34.5	0.00	15.0	0.00	47.5	0.00
8	50.5	0.00	37.5	0.00	7.0	0.00	51.5	0.00
9	46.0	0.00	36.0	0.00	23.5	0.00	46.5	0.00
10	53.5	0.00	22.0	0.00	11.5	0.00	45.0	0.00
11	28.0	0.00	24.0	0.00	22.0	0.00	44.5	0.00
12	12.5	0.00	34.0	0.00	19.0	0.00	28.5	0.00
13	10.0	0.00	44.0	0.00	13.0	0.00	23.0	0.00
14	13.0	0.00	50.0	0.00	16.5	0.00	24.0	0.00
15	22.0	0.03	40.5	0.81	26.0	0.00	19.5	0.00
16	11.5	0.01	24.5	0.22	34.0	0.00	20.5	0.00
17	18.0	0.00	20.0	0.00	43.5	0.00	30.0	0.00
18	10.0	0.00	20.0	0.00	35.0	0.00	17.5	0.00
19	31.5	0.00	24.5	0.00	41.0	0.00	17.5	0.00
20	21.0	0.00	26.0	0.00	41.0	0.00	24.0	0.00
21	23.0	0.00	29.0	0.00	33.5	0.00	36.5	0.00
22	35.0	0.00	34.0	0.00	28.0	0.00	25.5	0.00
23	42.5	0.00	37.0	0.00	28.5	0.00	6.5	0.00
24	42.5	0.00	24.5	0.00	33.5	0.00	18.5	0.00
25	31.5	0.00	28.5	0.00	41.0	0.00	36.0	0.00
26	33.0	0.00	31.5	0.00	38.5	0.00	23.0	0.00
27	24.0	0.00	14.5	0.10	46.0	0.00	8.0	0.00
28	30.5	0.00	15.0	0.00	50.0	0.00	11.5	0.00
29	48.5	0.00	16.0	0.00	49.5	0.00		
30	42.0	0.00	7.5	0.12	30.0	0.00		
31			-2.5	0.00	33.5	0.00		
Average	32.8	-	26.9	-	26.9	-	25.6	-
Total	-	0.04	-	1.25	-	0.01	-	0.34

Data obtained from http://climodtest.nrcc.cornell.edu/.

Table C2: Monthly summary of Canaday Steam Plant, NE climate station precipitation data.

Values in inches

Month	Year					
	2010	2011	2012	2013	2014	2015
Jan	0.19	0.64	0.02	0.06	0.26	0.01
Feb	0.54	0.28	0.75	1.31	0.45	0.36
Mar	1.89	0.58	0.49	0.52	0.38	0.03
Apr	2.87	3.41	3.34	3.45	1.76	2.92
May	3.46	3.84	1.88	1.99	1.44	3.37
Jun	7.71	3.64	1.36	3.19	9.45	4.19
Jul	2.31	3.91	0.36	0.63	0.6	-
Aug	2.52	5.28	1.52	1.97	5.84	-
Sep	0.7	0.84	0.3	2.47	1.98	-
Oct	0.6	3.83	0.24	2.26	0.77	-
Nov	0.44	T	T	0.7	0.04	-
Dec	0.15	0.59	0.83	0.03	1.25	-
Total	23.4	26.8	11.1	18.6	24.2	10.9

No data from July 2015 through December 2015 available. Data obtained from http://climodtest.nrcc.cornell.edu/.

APPENDIX D:

PROGRAM MONITORING WELL DATA

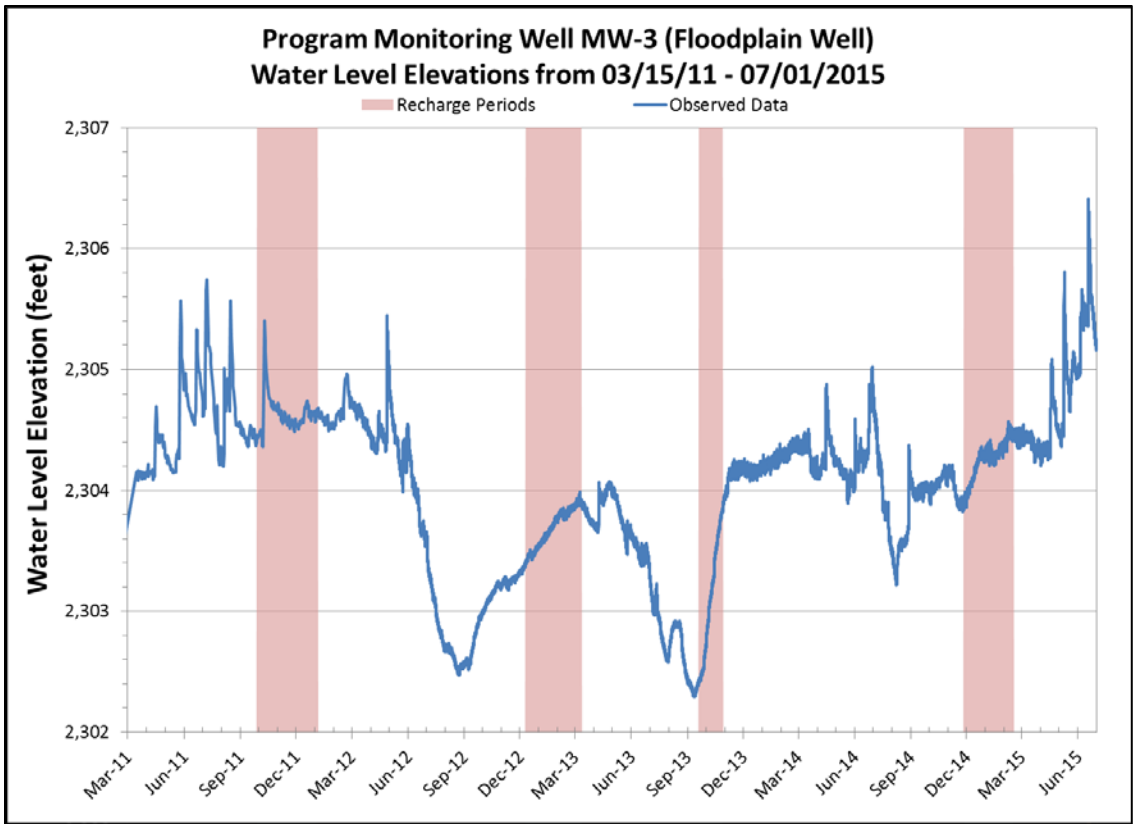

Figure D1: MW-3 water level elevations.

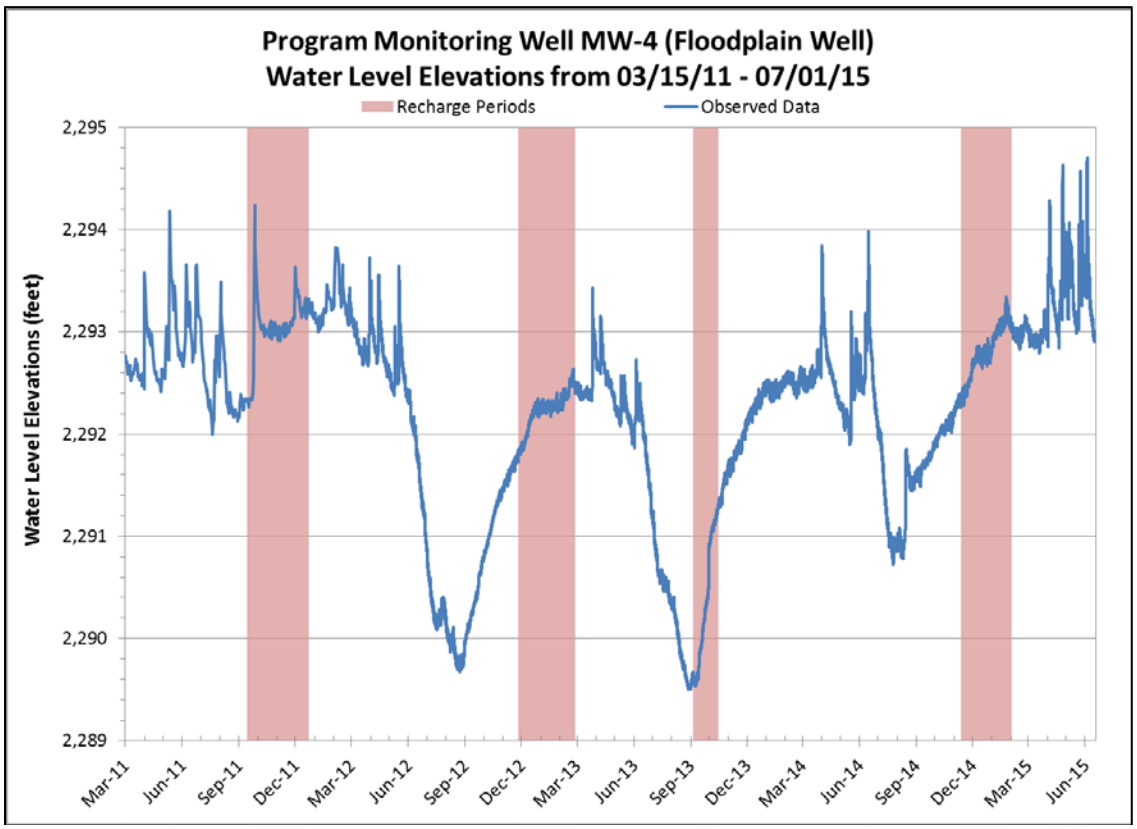

Figure D2: MW-4 water level elevations.

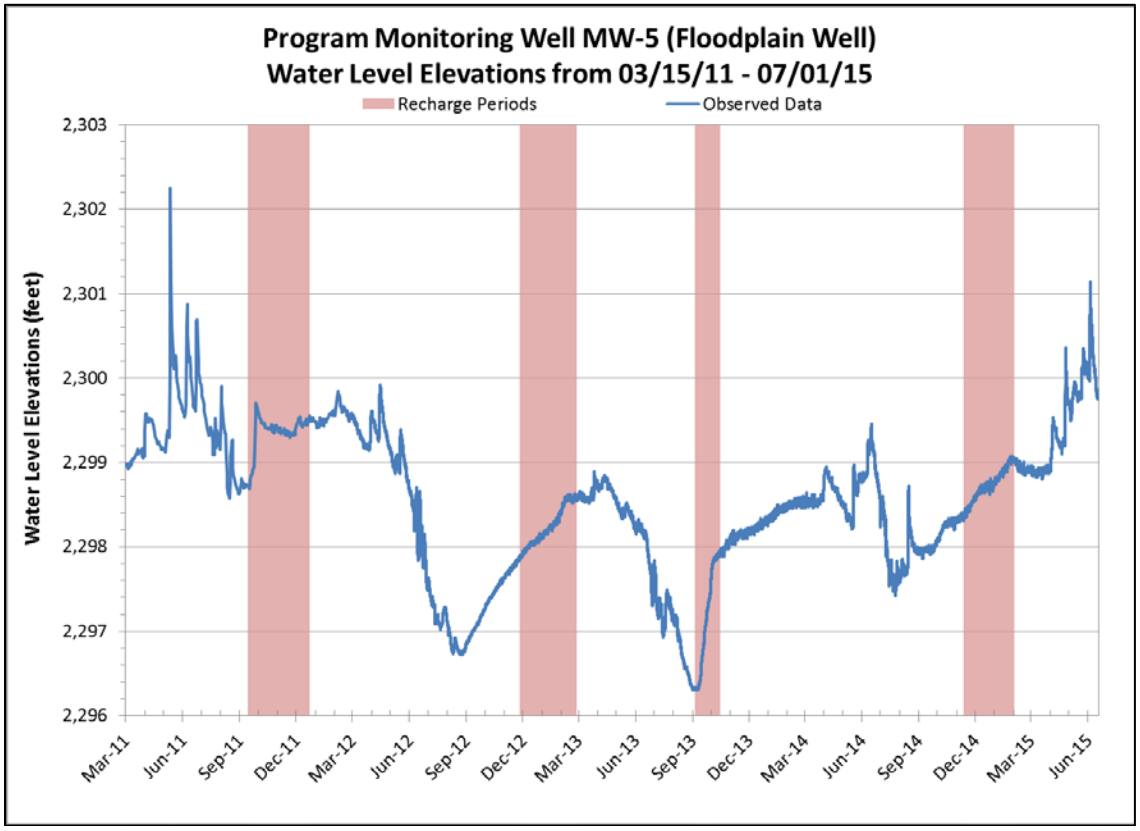

Figure D3: MW-5 water level elevations.

Table D1. Water level comparison in the Program monitoring wells pre-recharge operations and the last day of recharge operations.

Date	Water Level Elevations (feet)					
	MW-1	MW-2	MW-3	MW-4	MW-5	MW-6
11/25/2014	2310.3	2309.2	2303.9	2292.3	2298.4	2315.1
2/15/2015	2311.4	2310.3	2304.5	2293.1	2299.0	2317.8
Change in level	*1.1*	*1.1*	*0.6*	*0.8*	*0.6*	*2.7*

Notes: Canal deliveries for recharge operations occurred 11/26/2014 through 2/15/2015. Changes in water level elevations in the table are calculated during the period of canal deliveries only and do not consider lagged return flows that impact well levels after 2/15/2015.

APPENDIX E:

CNPPID MONITORING WELL DATA

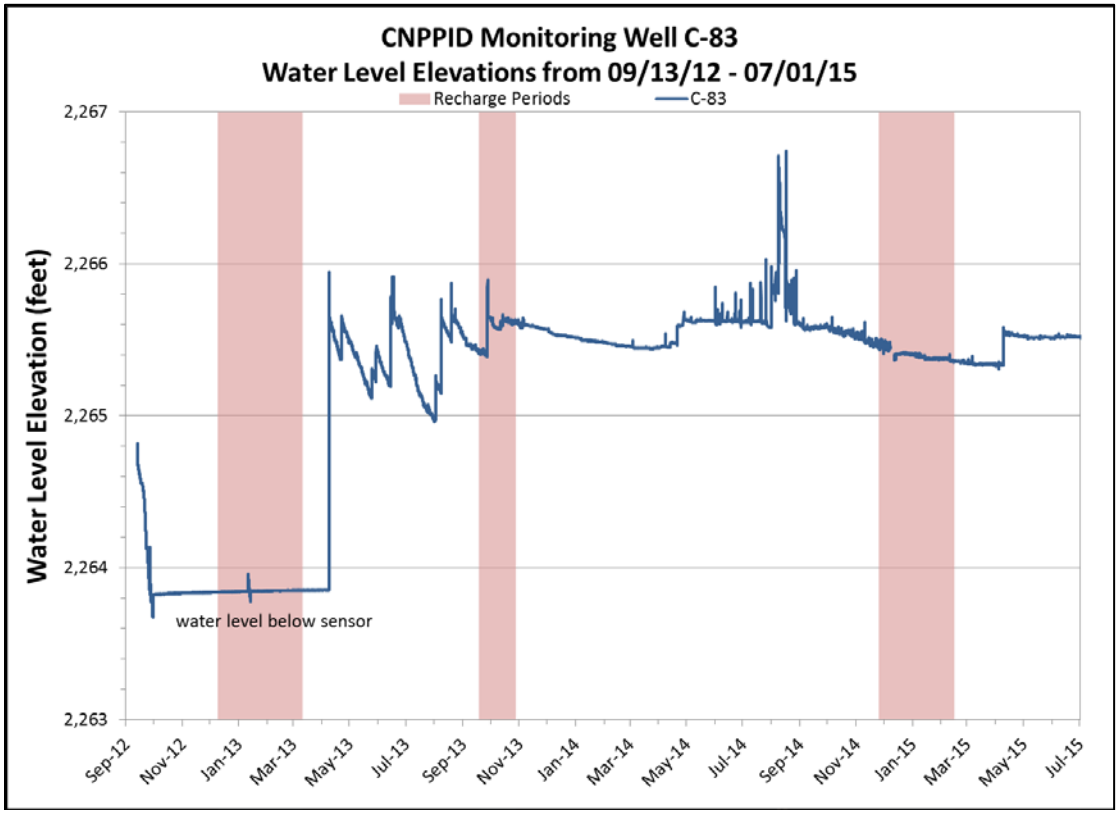

Figure E1: C-83 water level elevations.

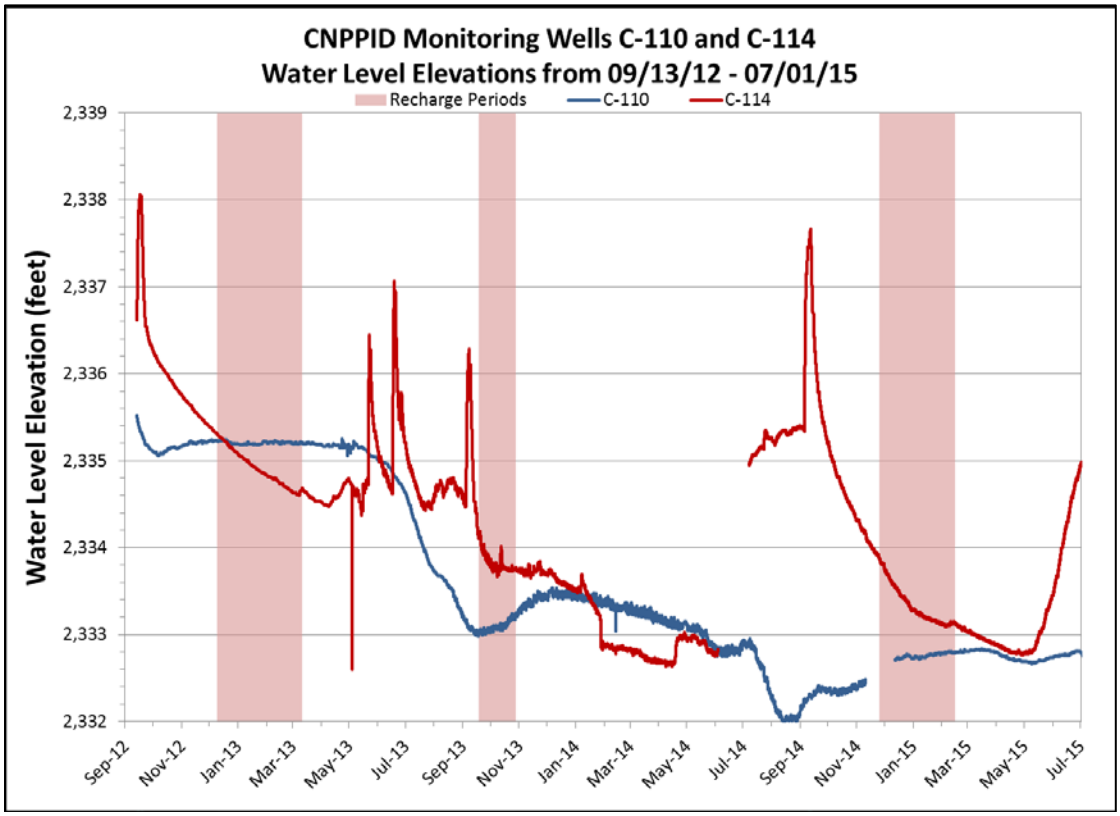

Figure E2: C-110 and C-114 water level elevations.

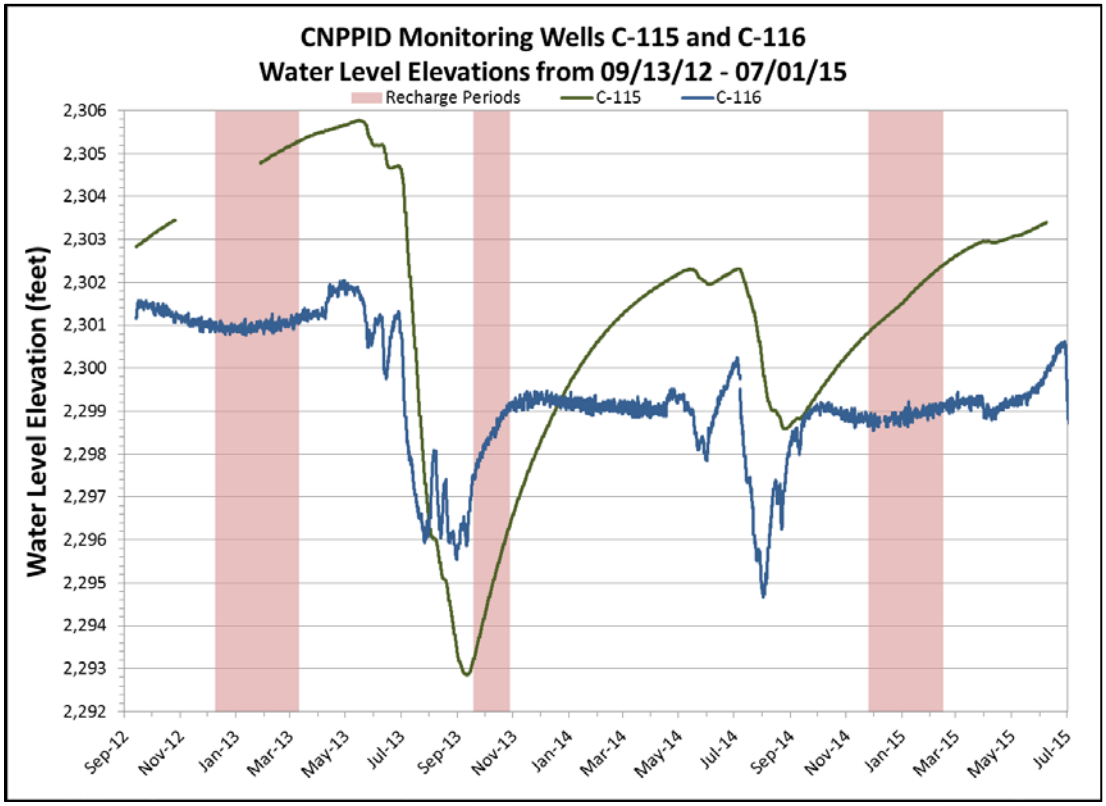

Figure E3: C-115 and C-116 water level elevations.

Table E1. Water level comparison in the CNPPID monitoring wells pre-recharge operations and the last day of recharge operations.

Date	Water Level Elevations (feet)							
	C-83	C-94	C-97	C-102	C-110	C-114	C-115	C-116
11/25/2014	2265.5	2308.7	2317.5	2319.5	2332.4[A]	2333.9	2300.8	2298.8
2/15/2015	2265.4	2309.5	2318.7	2320.9	2332.8	2333.1	2302.4	2299.1
Change in level	*-0.1*	*0.8*	*1.2*	*1.4*	*0.4*	*-0.8*	*1.6*	*0.3*

Notes: Canal deliveries for recharge operations occurred 11/26/2014 through 2/15/2015. Changes in water level elevations in the table are calculated during the period of canal deliveries only and do not consider lagged return flows that impact well levels after 2/15/2015. [A]The starting water level elevation for C-110 was taken on 11/10/2014 as there was a data gap and no available data on 11/25/2014.

APPENDIX F:

TBNRD MONITORING WELL DATA

Table F1. Water level comparison in the TBNRD Elm Creek monitoring wells pre-recharge operations and the last day of recharge operations.

Date	Water Level Elevations (feet)					
	P-101	P-102	P-103	P-104	P-132	P-133
11/25/2014	2289.1	2286.7	2299.1	2323.9	2278.6	2278.6
2/15/2015	2289.9	2287.0	2300.5	2322.6	2279.3	2279.2
Change in level	*0.8*	*0.3*	*1.4*	*-1.3*	*0.7*	*0.6*

Notes: Canal deliveries for recharge operations occurred 11/26/2014 through 2/15/2015. Changes in water level elevations in the table are calculated during the period of canal deliveries only and do not consider lagged return flows that impact well levels after 2/15/2015.

Table F2. Water level comparison in the TBNRD Overton monitoring wells pre-recharge operations and the last day of recharge operations.

Date	Water Level Elevations (feet)		
	P-105	P-106	P-110
11/25/2014	2330.8	2335.1	2330.4
2/15/2015	2330.7	2337.7	2332.6
Change in level	*-0.1*	*2.6*	*2.2*

Notes: Canal deliveries for recharge operations occurred 11/26/2014 through 2/15/2015. Changes in water level elevations in the table are calculated during the period of canal deliveries only and do not consider lagged return flows that impact well levels after 2/15/2015.

APPENDIX G:

PROGRAM DRAIN MONITORING DATA

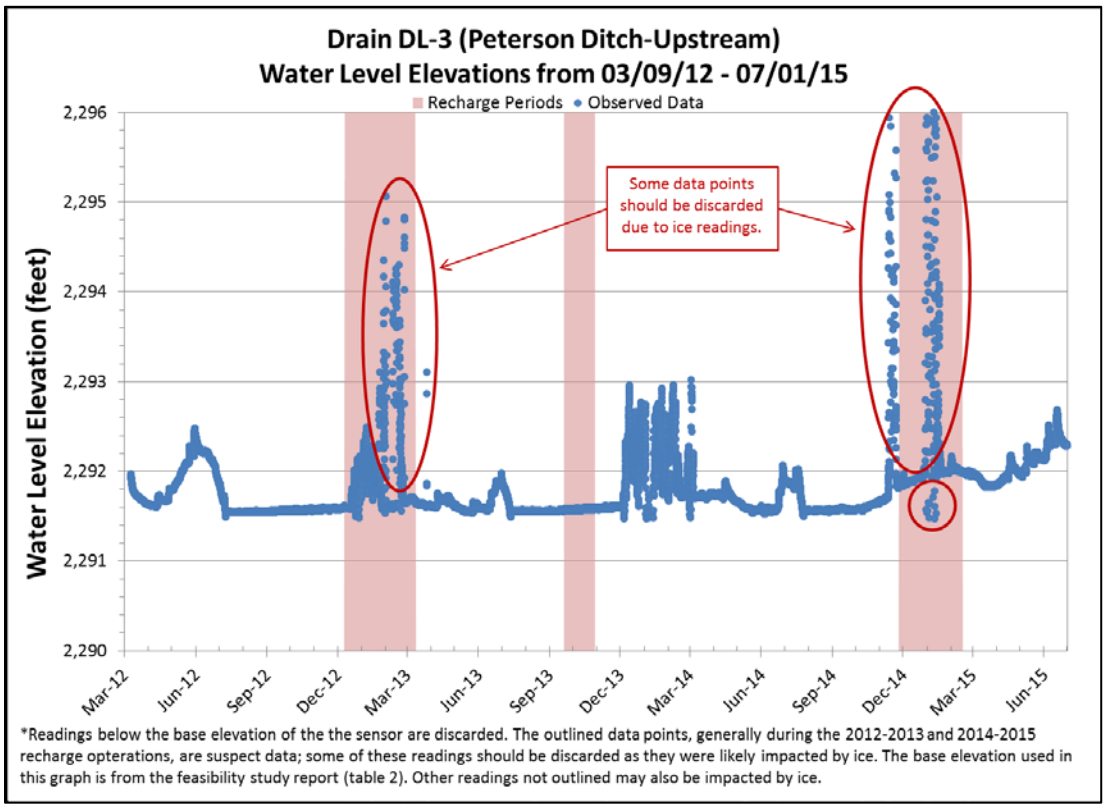

Figure G1: Drain DL-3 water level elevations: continuous recorder data.

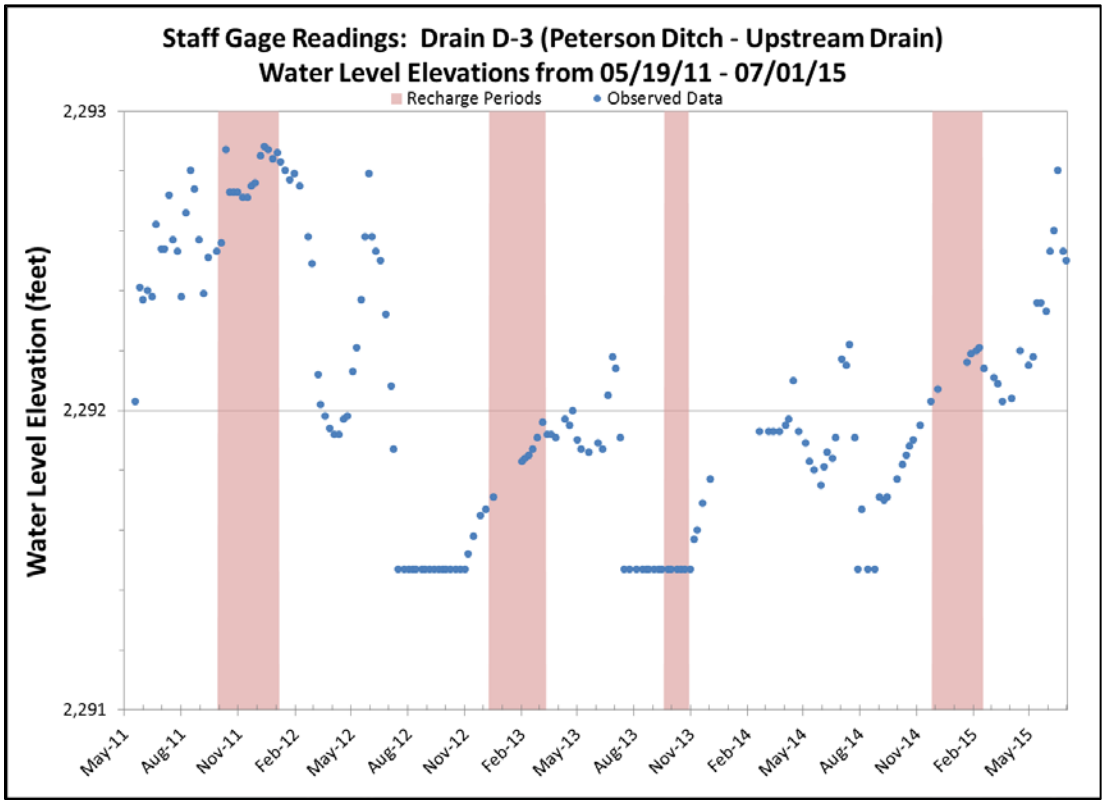

Figure G2: Drain D-3 water level elevations: weekly staff gage readings.

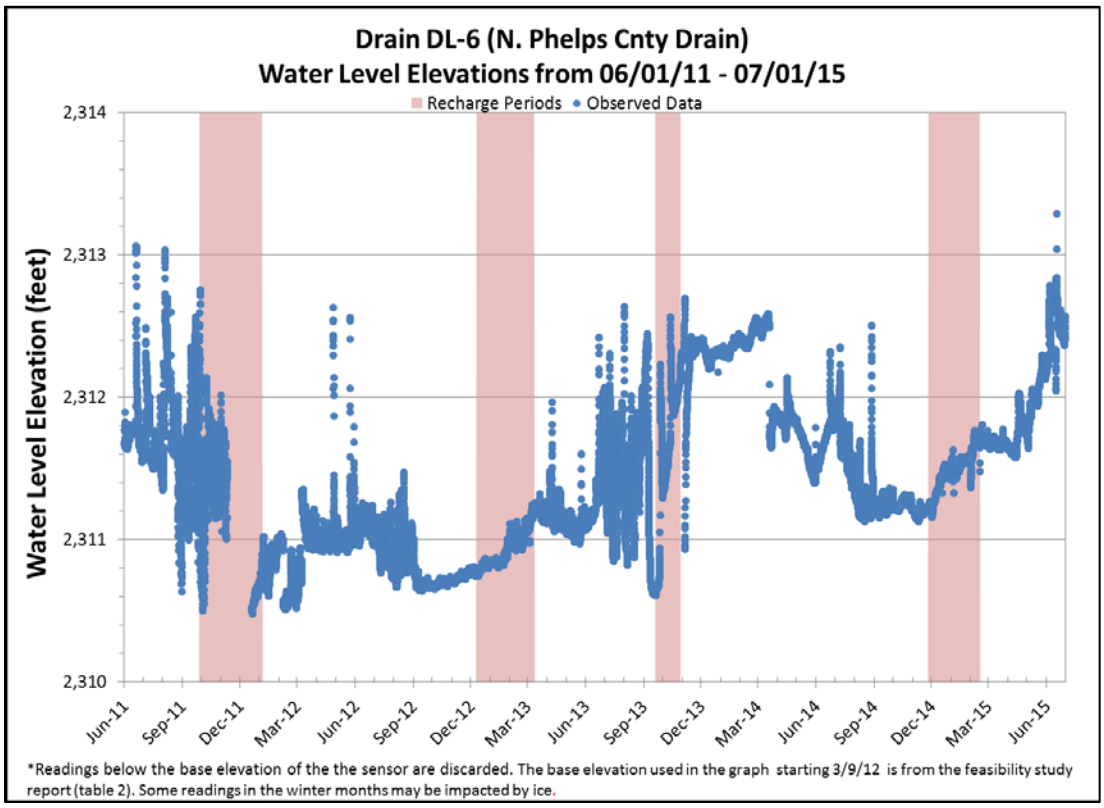

Figure G3: Drain DL-6 water level elevations: continuous recorder data.

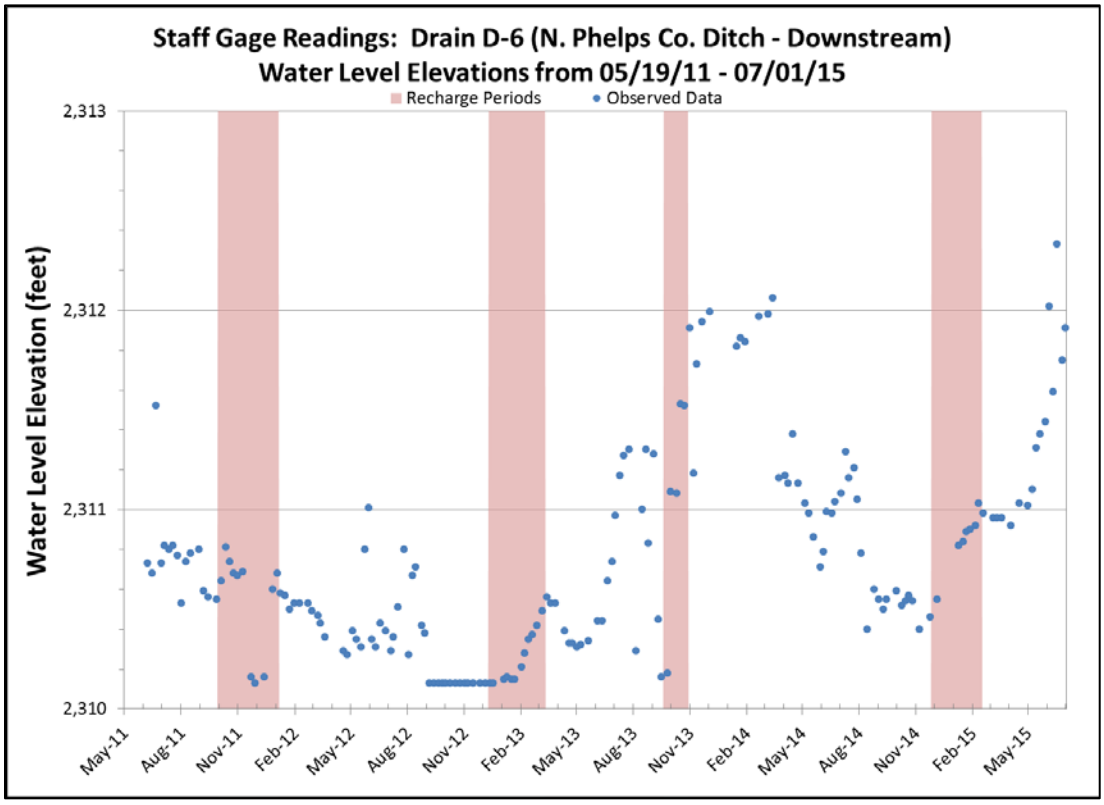

Figure G4: Drain D-6 water level elevations: weekly staff gage readings.

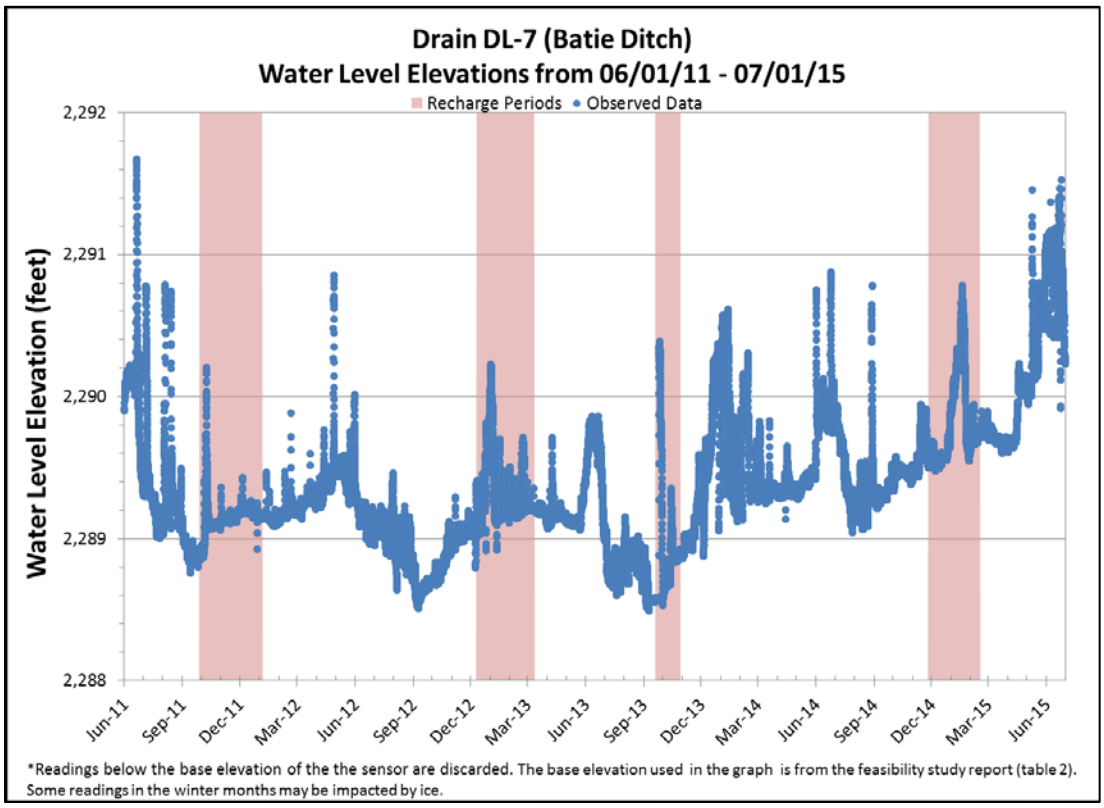

Figure G5: Drain DL-7 water level elevations: continuous recorder data.

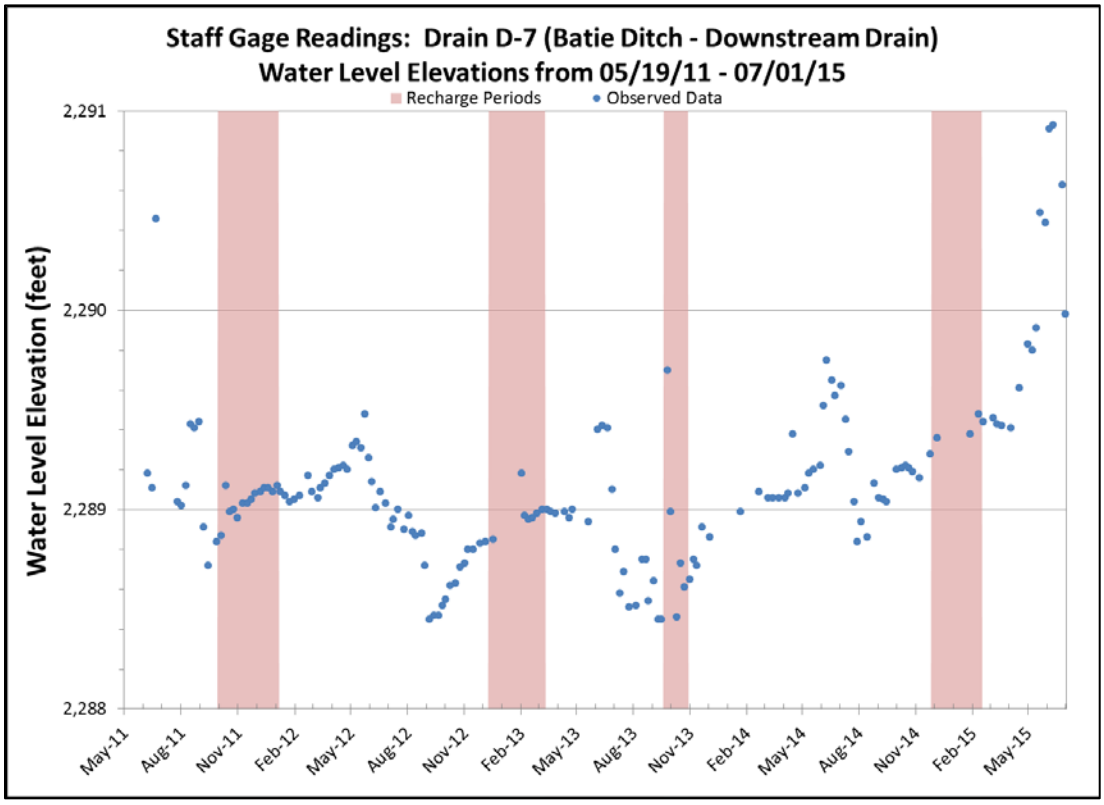

Figure G6: Drain D-7 water level elevations: weekly staff gage readings.

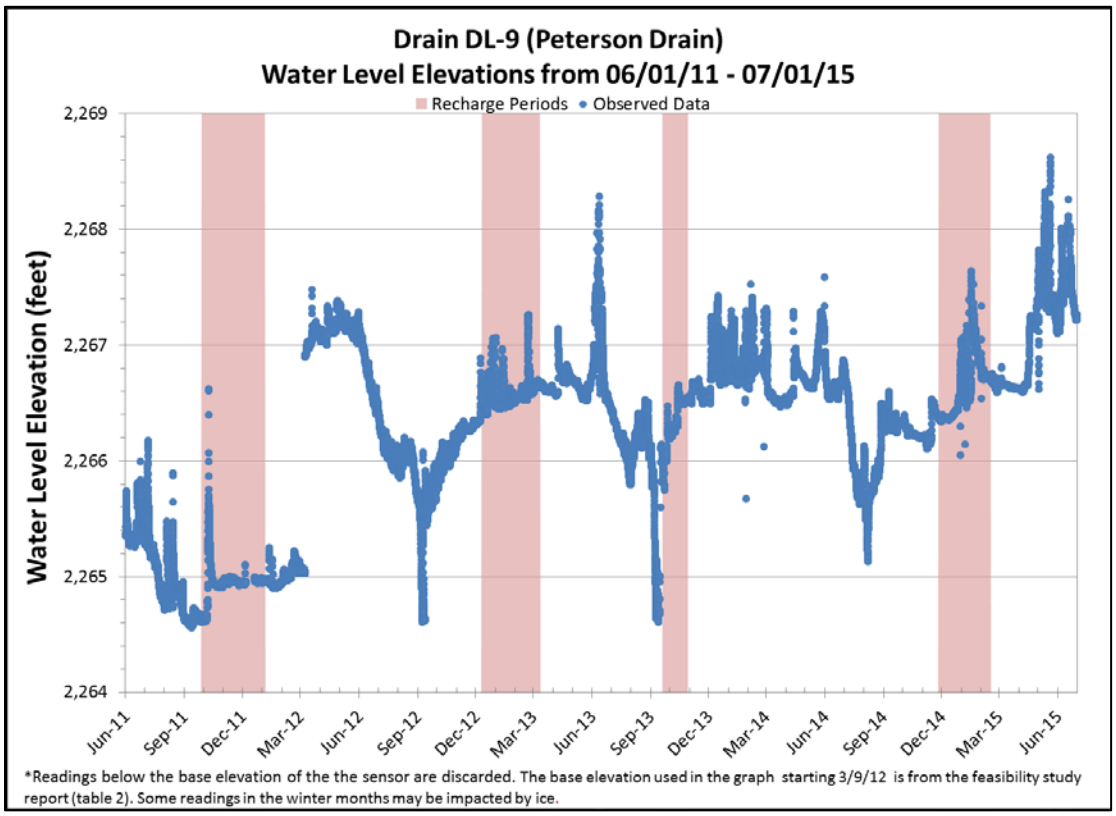

Figure G7: Drain DL-9 water level elevations: continuous recorder data.

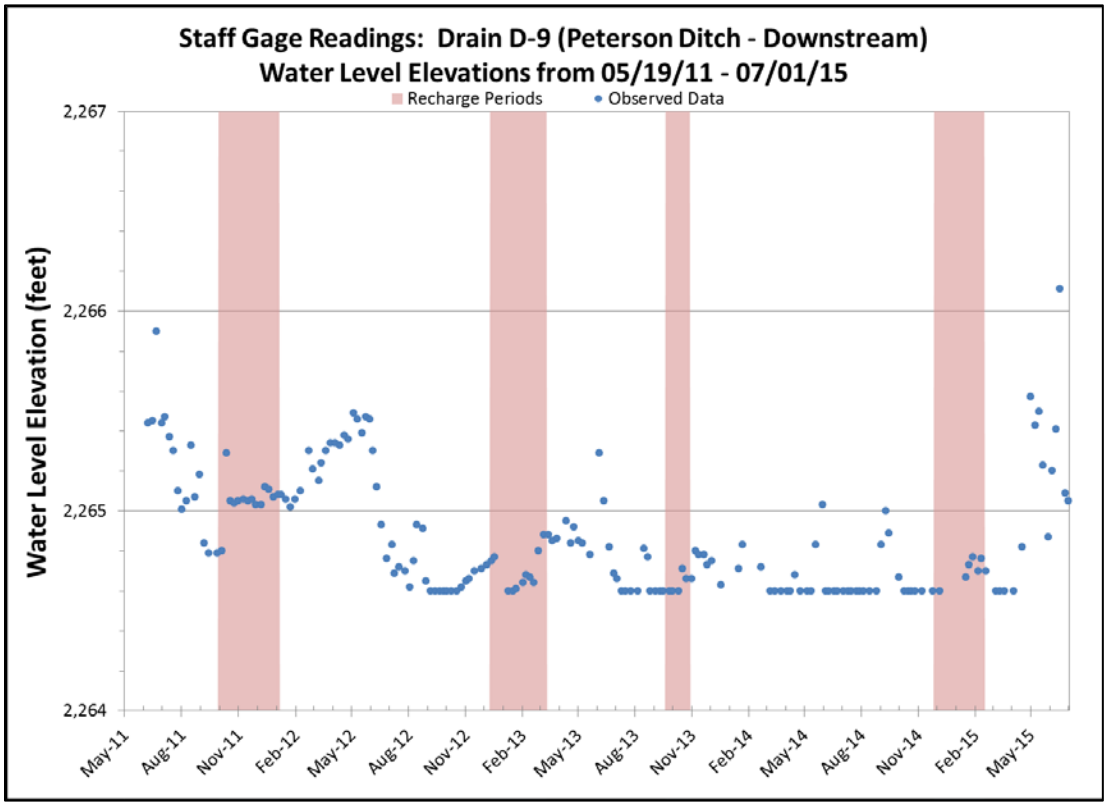

Figure G8: Drain D-9 water level elevations: weekly staff gage readings.

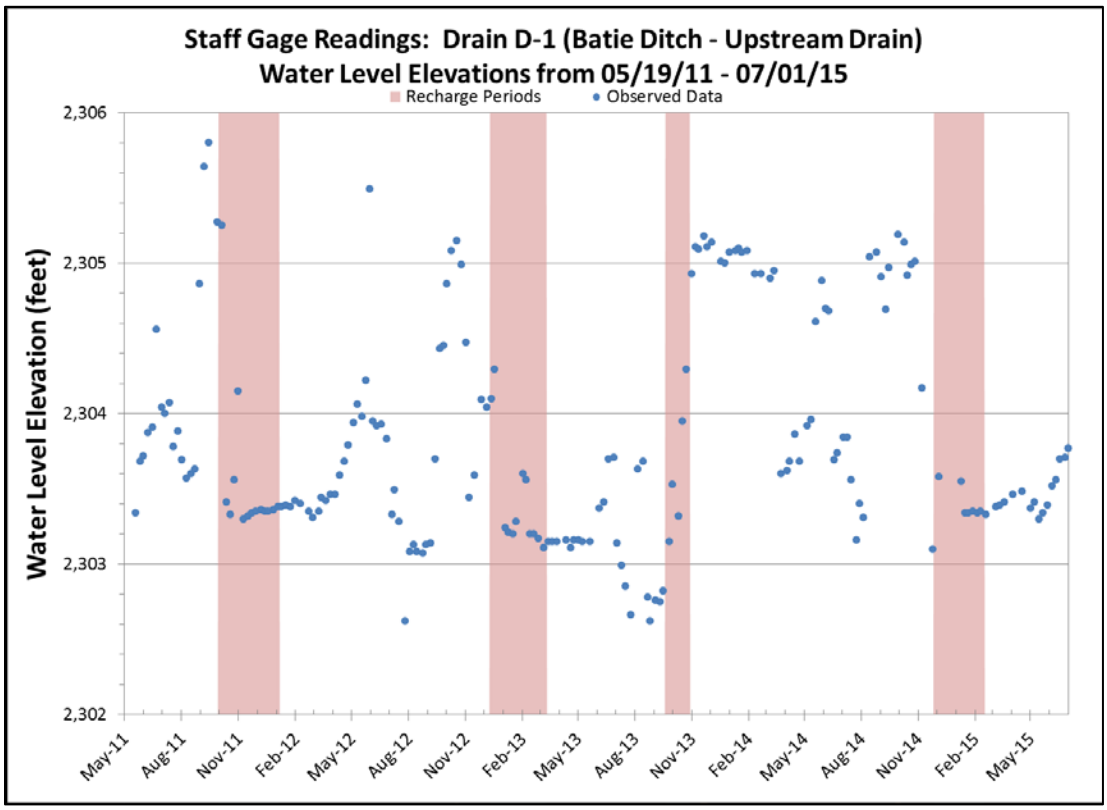

Figure G9: Drain D-1 water level elevations: weekly staff gage readings.

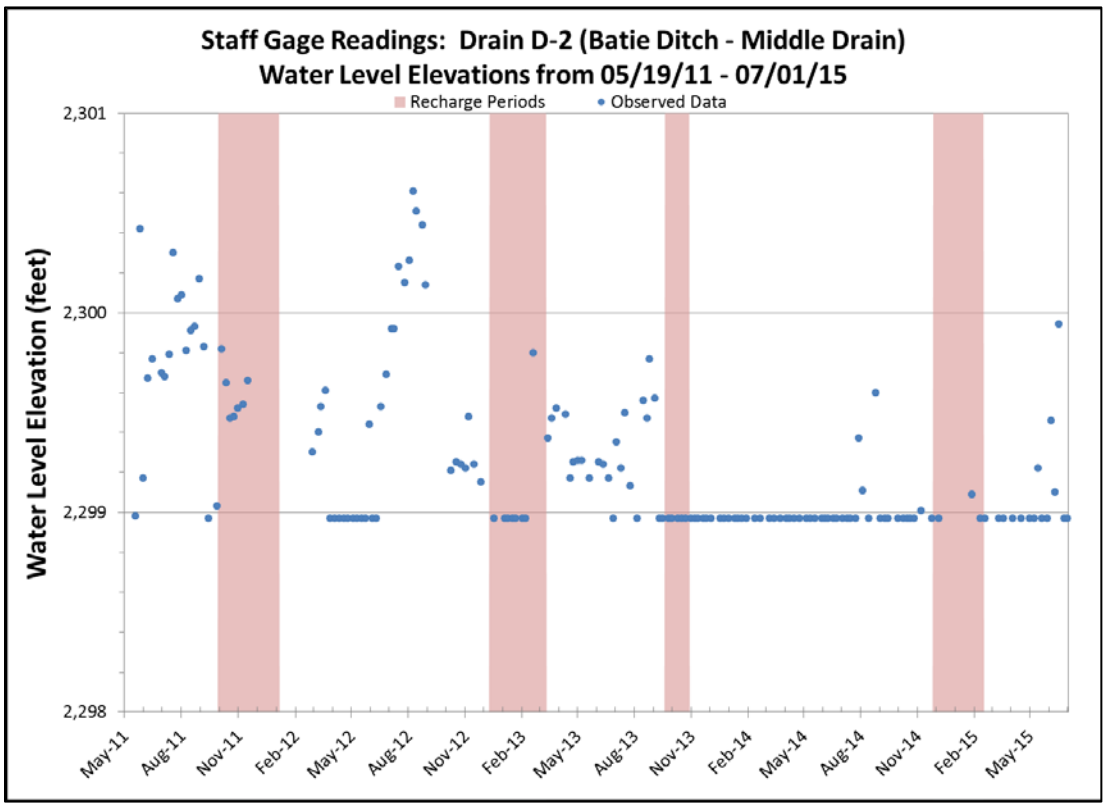

Figure G10: Drain D-2 water level elevations: weekly staff gage readings.

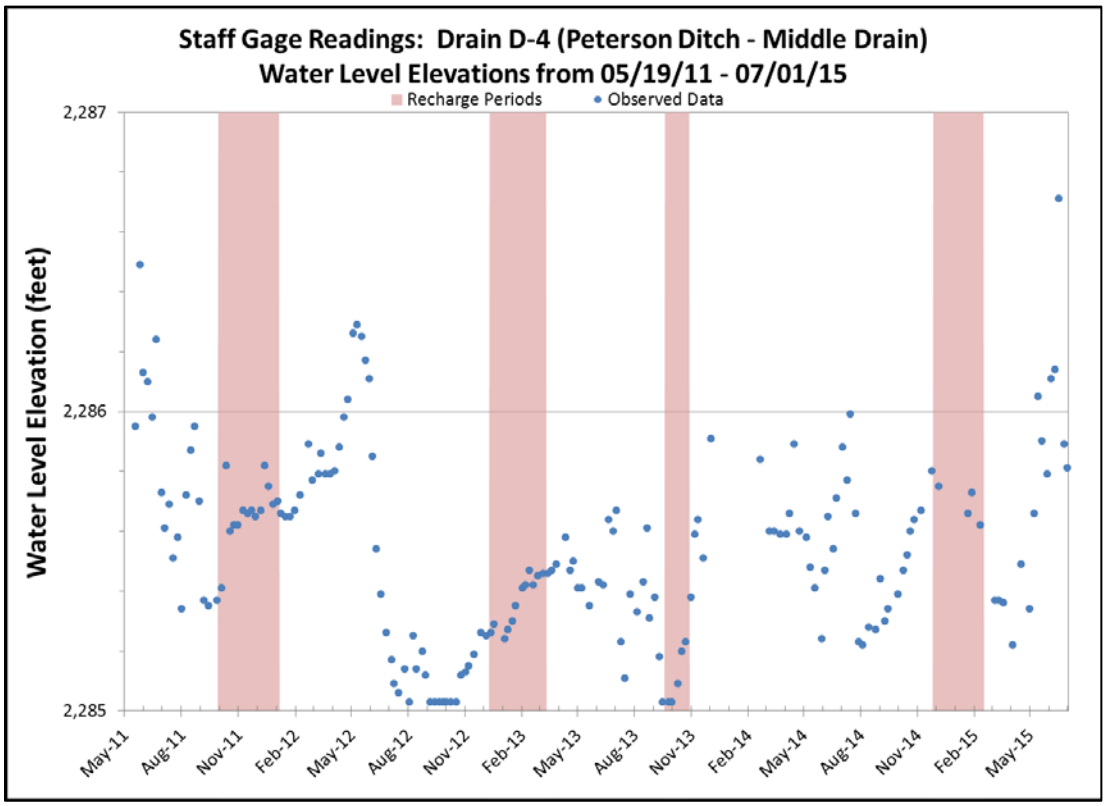

Figure G11: Drain D-4 water level elevations: weekly staff gage readings.

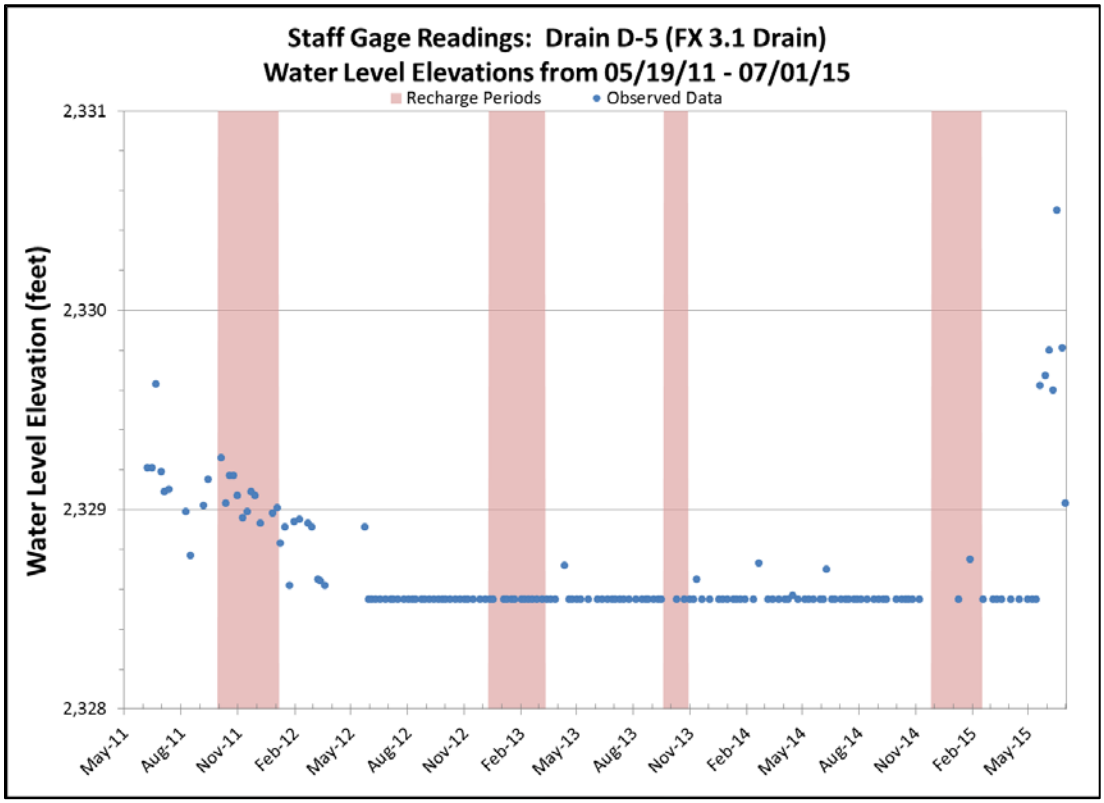

Figure G12: Drain D-5 water level elevations: weekly staff gage readings.

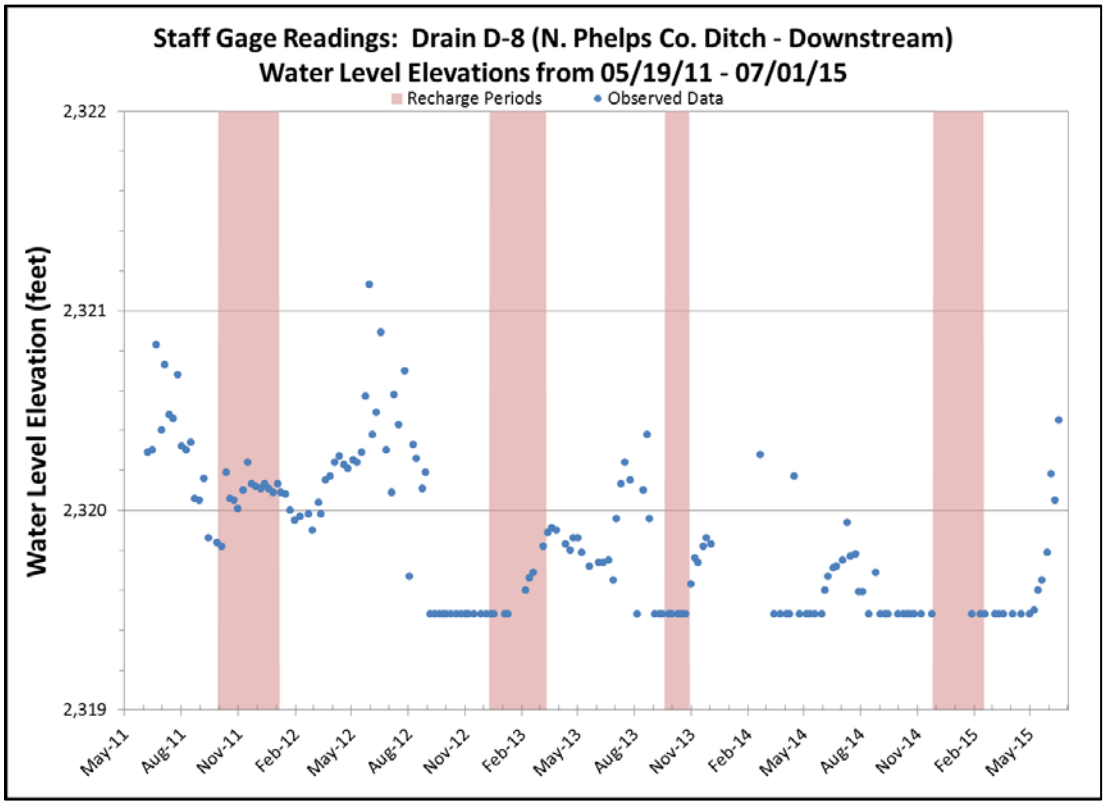

Figure G13: Drain D-8 water level elevations: weekly staff gage readings.

APPENDIX H:

PLATTE RIVER STREAMFLOW NEAR OVERTON, NE

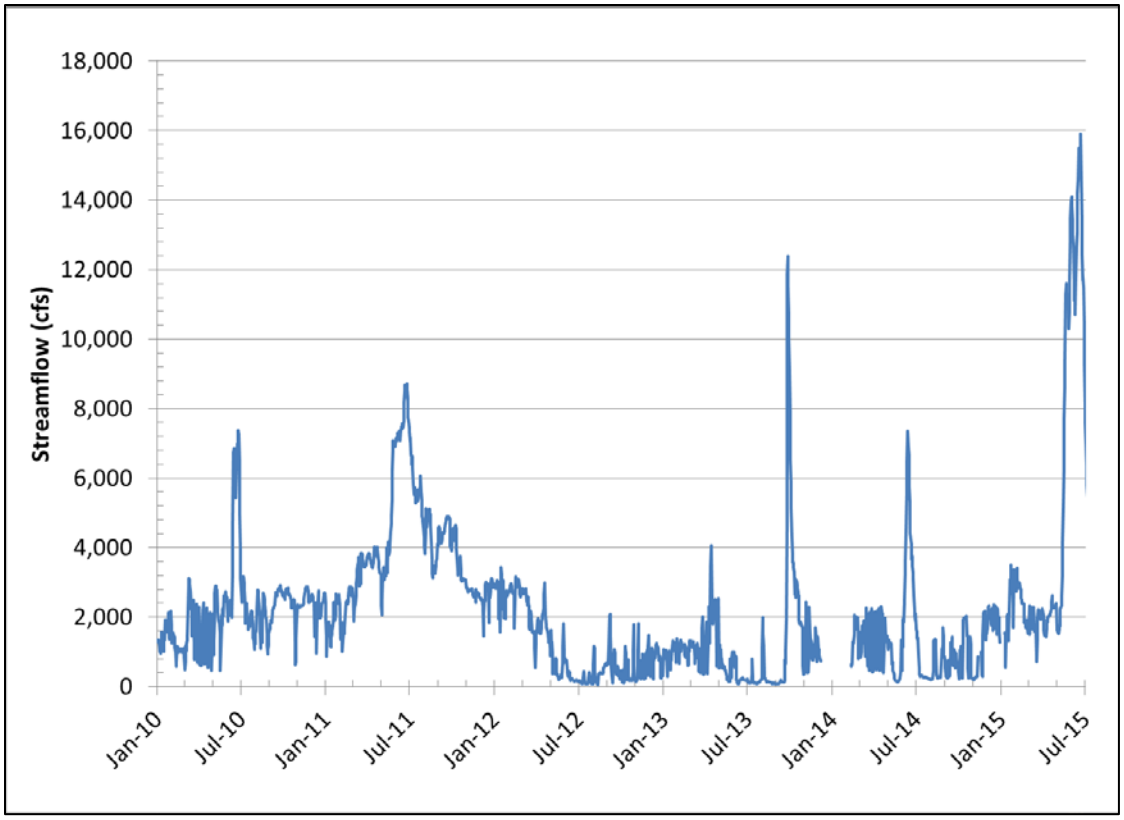

Figure H1. Platte River streamflow near Overton, NE (USGS Station No. 06768000) from January 1, 2010 through July 1, 2015.