DNR Form 638-2

STATE OF NEBRASKA
DEPARTMENT OF NATURAL RESOURCES

APPLICATION FOR A MUNICIPAL AND RURAL DOMESTIC GROUND WATER TRANSFERS PERMIT

Corrected filed 4-5-2013

INSTRUCTIONS

Complete items 1 through 10 by printing in ink or typing the appropriate information and by placing an (X) in the appropriate boxes.

The following information shall be provided on 8½ x 11 inch paper (or folded to such size). An answer is required for each item of A-H. Each answer must be clearly identified in the application. When using a ground water model, justify the applicability to the given geologic setting.

For Department Use Only

Application Number: MT-43
Date Filed: October 30, 2012
Receipt Number: G-173
Amount: $50.00

A. Discussion of impacts on surrounding ground water and surface water supplies. Include expected radius of cone of depression and how it was determined and location of any existing wells or water rights that may be impacted.
B. Statement of impacts on any existing threatened or endangered species in project area.
C. Pump test information, if available, including length of test, data from pump test, and location of observation wells.
D. Information on geology and hydrology of area such as thickness of aquifer, depth to water, aerial extent, transmissivity and how it was determined, and whether aquifer is confined or unconfined.
E. Description of type of well, including drawings.
F. Planned operation schedule. (Describe hours per day the wells will likely be pumped, whether there will be seasonal changes to schedule, whether there will be a rotation of wells pumped, and whether certain wells are only for backup purposes.)
G. Explanation of the basis for the amount of water requested. This should include current population and projected growth, daily per capita water use data, current industrial or other large uses and projected growth. The explanation should also include answers to the requirements for approval of the application stated in § 46-642, R.R.S., 1943, as amended, namely: whether request is reasonable, not contrary to the conservation and beneficial use of ground water, and not detrimental to the public welfare.
H. Map showing location of proposed wells, pipelines (exclusive of distribution lines) and the area of proposed use. The map shall be legible and at a scale of not less than one inch to the mile.

A non-refundable filing fee (payable to the Department of Natural Resources) can be computed from the table below and must accompany this application.

QUANTITY OF WATER REQUESTED (daily average)	COST
First 5,000,000 gallons per day	$50.00
Each additional increment (or portion) of 5,000,000 gallons per day	$20.00

1. Name, address and telephone number of Applicant:

City of Scottsbluff
2525 Circle Drive
Scottsbluff, NE 69361 (308) 630-6258

Name, address and telephone number of person to contact concerning application:

Jack Satur, Water System Supervisor
City of Scottsbluff, 2525 Circle Drive, Scottsbluff, NE 69361
(308) 630-6257

2. Identify the city, village, rural area or other entity to be supplied water:

City of Minatare

3. Maximum rate of withdrawal for which a permit is requested (complete both) 500 gallons per minute
678,000 gallons per day

Indicate whether the amount is for each well or a total rate for all wells.
All Wells

409
GP 04052013 app c (74)

4. The daily AVERAGE amount of water requested: 251,000 Gallons per day

5. Total quantity of water to be withdrawn annually (gallons). 92,000,000

6. Number of wells proposed: 2 Number of existing wells: 13

7. Location of the proposed ground water wells and existing wells:
(Indicate 40-acre government subdivision, Section, Township, Range and County, and registration number(s) if applicable):

See enclosed Table 1 and maps M-1 and M-2 of the City of Scottsbluff existing wells and distribution system.

8. Construction will start on or before April 26th, 20 12.

9. Construction will be completed on or before December 1st, 20 12.

10. If the permit is granted, does the applicant request imposition of statutory spacing protection for one year for test holes or wells to be constructed? ☐ Yes ■ No

If yes, indicate below the name and address of the owners and occupiers of land affected by the granting of such spacing protection, and a description of the land they own or occupy.

I certify that I am familiar with the information contained in this application, and that to the best of my knowledge and belief, such information is true.

Jack Sutton
Applicant (Signature and Title)

10-25-12
Date

Forward application and fee to:

State of Nebraksa
Department of Natural Resources
301 Centennial Mall South
P.O. Box 94676
Lincoln, Nebraska 68509-4676
(402)471-2363

The City of Scottsbluff Well Field/Minatare Notes

A. Discussion of impacts on surrounding ground water and surface water supplies. Include expected radius of cone of depression and how it was determined and location of any existing wells or water rights that may be impacted.

There will not be any new wells added to the City of Scottsbluff's well field. The expected radiuses of the cones of depressions for the City of Scottsbluff's wells are 1,000 feet. This was determined by monitoring the wells while they were pumping. There are no wells within 1,000 feet of any of the City of Scottsbluff's wells; however, surface water supplies will be impacted. These impacts are discussed under section I, additional ground water issues.

This permit is to obtain permission to transfer water from the City of Scottsbluff to the City of Minatare.

B. Statement of impacts on any existing or endangered species in the project area.

The new transmission main is positioned in the public rights-of-way; therefore, there is not expected to impact any threatened and endangered species.

C. Pump test information, if available, including length of test, location of observation wells.

At this time, there will not be any new wells added to the Scottsbluff Well Field. The existing wells are already on the City of Scottsbluff's system and have already been approved to transfer water from the well field to the City of Scottsbluff. The pump test information for the wells within the Scottsbluff Well Field are included in other transfer permits or well registrations.

D. Information on the geology and hydrology of area such as thickness of aquifer, depth to water, aerial extent, transmissivity and how it was determine, and whether the aquifer is confined or unconfined.

1. The Scottsbluff Well Field wells are located in an unconsolidated deposit of sands and gravels that form an unconfined water table aquifer. This aquifer, referred to as the Alluvial Aquifer, is a result of a channel cut by the North Platte over geologic time and subsequently filled by water borne sediments. The depth of the aquifer was found to be 135 feet when well 19 was installed and test pumped. The aquifer is underlain by the Cretaceous Period Pierre Shale, although remnants of the Oligocene Chadron Formation of less than a foot thickness have been encountered. The depth to water at the time of well installations in the area varied from five to seven feet. The water table elevation can be expected to change abruptly and radically when influenced by precipitation or flooding.

2. The transmissivity is estimated to be 50,000 square feet per day. The transmissivity was determined from test pumping data. This transmissivity was calculated and shown in other transfer permits and/or well registrations for the City of Scottsbluff's wells.

E. Description of the type of well including drawings.

At this time there are no new wells being added to the Scottsbluff Well Field. Description of types and well drawings of the existing wells can be found in past transfer permits or well registrations for the City of Scottsbluff.

F. Planned operation schedule. (describe hours per day the wells will likely be pumped, whether there will be seasonal changes to schedule, whether there will be a rotation of wells pumped, and whether certain wells are only for backup purposes.)

The City of Scottsbluff's public water supply wells run on a demand operated basis. A majority of the water pumped comes from the three wells (17, 18, and 19) in the city's West Well Field. However, to produce the additional water needed for the City of Minatare, the City of Scottsbluff stated that they will increase the demand evenly over all 10 wells of the City of Scottsbluff's well field.

G. Explanation for the basis of the amount of water requested. *This should include the population and projected growth, daily per capita water use data, current industrial or other large uses and projected growth. The explanation should also include answers to the requirements for approval of the application stated in §46-642 R.R.S., 1943, as amended, namely: whether it is reasonable, not contrary to the conservation and beneficial use of ground water, and not detrimental to the public welfare.*

1. The population of the City of Minatare has declined over the last several decades. The City of Minatare serves a trailer court located outside the city limits. The follow table shows the population since 1980 and the projected populations through 2026.

Table 1. City of Minatare Population

Year	Population
1980	969
1990	807
2000	917*
2016	947**
2026	965**

* Includes Trailer Court population of 107
**Indicates a projected population and Trailer Court

The City of Minatare anticipates growth in the future because of the close proximity to the City of Scottsbluff. Scottsbluff is located 7 miles northwest of Minatare. The projected population of 965 people in the year 2026 will be used as the basis for the amount of water requested. Also this population was used for design purposes in the Preliminary Engineering Report for the design of the improvements within the City of Minatare's distribution system conducted by M.C. Schaff & Associates.

2. The USDA average day per capita usage of 260 gallons and a multiplier of 2.7 for the maximum day when determining modesty was used to calculate average anticipated water

usage and maximum anticipated water usage. The following tables are for the City of Minatare showing the anticipated water usage.

Table 2. Minatare Water Usage

Projected Population in 2026	Water Use per Capita (Gallons/Day)	Average Daily Total (Gallons)		Max Daily Total (Gallons)
965	260	250,900	2.7	677,430
	Average Yearly Total	91,578,500	**Max Total per Minute**	470

The amounts requested will be as follows: Maximum Total per Minute of 500 gallons per minute, Maximum Daily Total of 678,000 gallons per day, Average Daily Total of 251,000 gallons per day, and Average Yearly Total of 92,000,000 gallons per year.

H. Map showing location of proposed wells, pipelines (exclusive of distribution lines) and the area of proposed use. The map shall be legible and at a scale of not less than one inch to the mile.

See attached maps M-1 and M-2.

I. Additional Ground Water Issues

§46-613.01 requires that the director of the Department of Natural Resources consider the following issues prior to issuing a Ground Water transfer Permit:

(1) The nature of the proposed use and whether it is a beneficial use of ground water;

The changeover from the current system of wells to the City of Scottsbluff's regional well field will provide a more efficient distribution and use of potable groundwater for the residents of the City of Minatare. It is a beneficial use in that it replaces the current water supplies that fail to meet current quality standards with a new source that meets current standards.

(2) The availability to the applicant of alternative sources of surface or ground water;

Alternative water sources available to the City of Minatare include the Brule Formation, the North Platte River and a new well field.

The Brule consist of consolidated beds of siltstone with occasional layers of sandstone. Groundwater movement in this type of subsurface is principally through fractures. In the Brule these fractures are neither sufficiently extensive nor sufficiently uniform to provide a dependable long term water supply.

The second potential alternative source, the North Platte River, already has all of its water appropriated.

The final potential alternative source would be a new well field for the City of Minatare. In the Preliminary Engineering Report conducted by M.C. Schaff & Associates, the greatest potential for a well field is located four miles north of the City of Minatare. Sampling and test well construction would be needed to determine the best location of a well field.

(3) Any negative effect of the proposed withdrawal on the ground water supplies needed to meet present or reasonable future demands for water in the area of the proposed withdrawal, to comply with any interstate compact or decree, or to fulfill the provisions of any other formal state contract or agreement;

There are no wells within 1,000 feet of the existing City of Scottsbluff wells. Therefore, there will not be any ground water wells that will be significantly impacted. The increased pumping could possibly lower the water table. However, the water table in the valley is very close to the surface, so a six inch to one foot lowering of the ground water table is considered a minimal impact.

(4) Any negative effect of the proposed withdrawal on surface water supplies needed to meet present or reasonable future demands within the state, to comply with any interstate compact decree or to fulfill the provisions of any other formal state contract or agreement;

Tables 6 and 7 show the impacts on the North Platte River and Winters Creek. These tables were taken from the report from the North Platte NRD's report. The North Platte NRD provided a report detailing depletions through Adaptive Resources, Inc. According to this report, the overall impact on the North Platter River will be negative in the first four to six months of the increased pumping then positive after that. The net positive impact will be approximately 10 acre-feet per month after one year of the increased pumping. However, the report states that there will be third party impacts from the increased pumping. Negatively impacted parties are Winters Creek Canal Company, Central Irrigation District and Minatare Mutual Canal and Irrigation Company. Positively impacted parties are Castle Rock, Nine Mile, Short Line and Chimney Rock Irrigation Districts.

(5) Any adverse environmental effect of the proposed withdrawal or transportation of ground water;

There is not expected to be any adverse environmental effects from the proposed withdrawal due to mitigation of the minimally reduced flow of the North Platte River and Winters Creek.

(6) The cumulative effect of the proposed withdrawal and transfer relative to the matters listed in subdivisions (3) through (6) of this section when considered in conjunction with all other transfers subject to this section;

Impacts on ground water supplies are considered to be minimal; therefore, significant impacts will only be those listed in Section 4, above. Mitigation will most likely be required to reduce or eliminate the impacts on the negatively impacted parties of Winters Creek Canal Company, Central Irrigation District and Minatare Mutual Canal and Irrigation Company.

(7) Any other factors consistent with the purpose of this section that the director deems relevant to protect the health, safety, and welfare of the State and its citizens;

It is important that the citizens of the City of Minatare receive water that meets Nebraska water quality standards. The City of Scottsbluff's well field meets these standards and is capable of producing enough water to supply the City of Scottsbluff and the City of Minatare.

Tables

Table 3. Minatare Historical Usage

Year	Population	Daily Per Capita Usage (gal/day)	All Months Usage (gal/yr)
2001	884	191	61,698,000
2002	879	214	68,718,000
2003	871	203	64,400,000
2004	864	191	60,355,000
2005	860	175	54,851,000
2006	856	216	67,376,000
2007	865	171	54,019,000
2008	867	142	45,053,000
2009	871	123	39,040,000
2010	818	140	41,869,000
2011	818	78	23,337,000
2026*	965	260	91,578,500

* amount requested in MT-43

Table 4. Typical Water Usage of Area Communities

	Population	Average Day (gpcpd)	Max Day (gpcpd)	Peak Factor
Gering	8,000	385	1000	2.6
Scottsbluff	14,800	300	600	2.0
Mitchell	1,830	321	732	2.3
Sidney	6,282	275	432	1.6

Table 5. Minatare's Sample Year Usage

Month	Gallons	Average Gallons/Day
January	2,368,000	76,387
February	2,202,000	78,643
March	2,355,000	75,968
April	3,858,000	128,600
May	6,430,000	207,419
June	8,415,000	280,500
July	11,344,000	365,935
August	10,538,000	339,935
September	4,404,000	146,800
October	3,407,000	109,903
November	2,394,000	79,800
December	3,007,000	97,000

Table 6. Maximum Change in Stream Flow per Zone during Irragtion Season (Acre-feet per Irrigation Season)

	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7	Zone 8	Zone 9
Scenario 1	-13	-72	-35	-17	+5	+109	+61	+69	+1
Scenario 2	-14	-82	-39	-19	+5	+114	+64	+73	+1

Table 7. Zone Descriptions

Zone	Description
1	Upstream of Winters Creek Canal diversion point (DP) on North Platte River (NPR)
2	Winters Creed Canal DP to Central Canal DP on NPR
3	Central Canal DP on NPR to Minatare Canal DP on NPR
4	Above Winters Creek Canal DP on Winters Creek
5	Minatare Canal DP on NPR to Castle Rock Canal DP on NPR
6	Castle Rock Canal DP on NPR to Nine Mile Canal DP on NPR
7	Nine Mile Canal DP on NPR to Short Line Canal DP on NPR
8	Above Nine Mile Canal DP on Nine Mile Creek
9	Short Line Canal DP on NPR to Eastern Boundary of Model

Table 8. Impacted Water Users

Zone	Water Users
1	Winters Creek Canal Company
2	Central Irrigation District
3	Minatare Mutual Canal and Irrigation Company
4	Winters Creek Canal Company
5	Castle Rock Irrigation District
6	Nine Mile Irrigation District
7	Short Line Irrigation District
8	Nine Mile Irrigation District
9	Chimney Rock Irrigation District

Adaptive Resources, Inc. analysis of the North Platte River and Winters Creek's depletions for the North Platte NRD

Adaptive Resources, Inc.

To: File

From: Thad Kuntz, P.G. and Joe Reedy

CC:

Date: 3/18/2013

Re: Scottsbluff – Minatare Ground Water Pumping Transfer Modeling Results

INTRODUCTION

The NPNRD requested that Adaptive Resources, Inc. analyze a transfer of ground water pumping from the Village of Minatare well field to ground water pumping at the City of Scottsbluff well field (Map 1). Minatare is in the process of constructing a pipeline from Scottsbluff to Minatare to provide the water for the community. The modeling analysis will provide the overall impact from the transfer of pumping on the entire North Platte River system streamflow and impacts on streamflow that may affect area surface water diverters. M.C. Schaff and Associates, Inc. provided details on the transfer during a meeting on November 29, 2012, written correspondence, emails, and other correspondence (Attachment A).

The following two scenarios were analyzed:

Scenario 1:

Minatare will decommission two of the three municipal wells while one well will be used for irrigation water for the Minatare School football field and nearby park. All potable water needs and other needs will be met by pumping from Scottsbluff's well field.

Scenario 2:

Minatare will decommission all municipal wells and all water use will be provided by Scottsbluff's well field.

VILLAGE OF MINATARE CURRENT AND ESTIMATED FUTURE WATER USE

M.C. Schaff and Associates, Inc. provided past water usage and estimated future water usage for both scenarios described above. Those data were used in this analysis which shows Minatare's usage decrease in the future. This decrease is attributed to placement of meters on users of Minatare's water which was recently completed. The data presented irrigation and non-irrigation season (May through September) values of water use where sixty five percent of the water is pumped during the irrigation season and thirty five percent in the non-irrigation season. Estimates of the park and football field irrigation were provided for use during the irrigation season. Past and estimated future water use for each scenario is provided in Table 1. Estimates were provided in gallons/year and converted to acre-feet/year.

Table 1		
Usage Description	**Irrigation Season Usage (Acre-Feet/Year)**	**Non-Irrigation Season Usage (Acre-Feet/Year)**
Minatare Past Water Usage	401	216
Scenario 1	**Irrigation Season Usage**	**Non-Irrigation Season Usage**
Scenario 1 - Estimated Future Minatare Well #3 Pumping	28	-
Scenario 1 - Estimated Future Pumping from the Scottsbluff Well Field	184	99
Scenario 2	**Irrigation Season Usage**	**Non-Irrigation Season Usage**
Scenario 2 - Estimated Future Minatare Well #3 Pumping	-	-
Scenario 2 - Estimated Future Pumping from the Scottsbluff Well Field	212	99

STREAM FLOW DEPLETION/ACCRETION ANALYSIS DETAILS

A North Platte River impact analysis was completed using the existing Cooperative Hydrology Study Western Model Unit (COHYST WMU) ground water model and the Groundwater Vistas modeling software hydrostratigraphic unit process. The hydrostratigraphic unit process was completed to determine the impacts to the river between the diversion points along the North Platte River. Table 2 is an explanation of the zones.

Table 2	
Zone	**Description**
1	Upstream of Winters Creek Canal diversion point (DP) on North Platte River (NPR)
2	Winters Creek Canal DP on NPR to Central Canal DP on NPR
3	Central Canal DP on NPR to Minatare Canal DP on NPR
4	Above Winters Creek Canal DP on Winters Creek
5	Minatare Canal DP on NPR to Castle Rock Canal DP on NPR
6	Castle Rock Canal DP on NPR to Ninemile Canal DP on NPR
7	Ninemile Canal DP on NPR to Shortline Canal DP on NPR
8	Above Ninemile Canal DP on Ninemile Creek
9	Shortline Canal DP on NPR to Eastern Boundary of Model

The model was run for 50 years using 100 stress periods. The stress periods include the pumping season (May through September) and the non-pumping season (October through April). Each pumping season has 5 time steps which represents 5 months of pumping. Each non-pumping season has 7 time steps which represents 7 months of non-pumping. Each year is 365 days except for leap year which is 366 days.

The pumping and non-pumping conditions represent the 1998 irrigation and non-irrigation seasons respectively which is the last modeled year of the current ground water model. These two 1998 stress periods were repeated 50 times to obtain 50 years of modeling data representing May 1, 2013 to April 30, 2063.

MODELING REPRESENTATION OF TRANSFER

The Minatare and Scottsbluff wells are located within the North Platte River alluvium and near numerous surface water diversions. As seen on Map 2, the Minatare Wells are located near Minatare Canal diversion along the North Platte River, Castle Rock Canal diversion along the North Platte River, Nine Mile Canal diversion along the North Platte River, Nine Mile Canal diversion along Nine Mile Creek, and Shortline Canal along the North Platte River. As seen on Map 3, the Scottsbluff wells are located near the Winter Creek Canal diversion along the North Platte River, Winter's Creek Canal diversion along Winter Creek, the Central Canal diversion along the North Platte River, and the Minatare Canal diversion along the North Platte River.

The model was run in five different configurations. The Baseline represented a continuation of conditions as they existed in 1998. Scenario 1 Pumping represents the increased ground water pumping from the Scottsbluff well field to supply water to Minatare without supplying irrigation water for the park and Minatare School football field. Scenario 1 Injection represents the decreased ground water pumping at the Minatare well field minus ground water pumping from Well #3 for irrigation of the park and Minatare School football field. Scenario 2 Pumping represents the increased ground water pumping from the Scottsbluff well field to supply water for all Minatare water needs including irrigation water for the park and Minatare School football field. Scenario 2 Injection represents the decreased ground water pumping at the Minatare well field. Table 3 provides the description of the model configurations.

Table 3

Model Configuration	Explanation
Baseline	50 year model run with no changes.
Scenario 1 Pumping	50 year model run to represent increased ground water pumping from the Scottsbluff well field without supplying irrigation water for park and football field.
Scenario 1 Injection	50 year model run to represent decreased ground water pumping (model injection) from the Minatare well field minus Well #3 irrigation pumping for park and football field.
Scenario 2 Pumping	50 year model run to represent increased ground water pumping from the Scottsbluff well field including supplying irrigation water for park and football field.
Scenario 2 Injection	50 year model run to represent decreased ground water pumping (model injection) from the Minatare well field.

Table 4 is a list of the model cell locations of the Minatare and Scottsbluff wells.

Table 4	
Locations of Wells	
Scottsbluff Wells	**Model Location (Row, Column)**
Well # A-1	92, 60
Well # 3	92, ,57
Well #9	91, 55
Well #10	93, 58
Well #11	88, 55
Well #12	90, 58
Well #13	93, 54
Well #17	92, 52
Well #18	92, 52
Well #19	92, 52
Well #20	92, 52
Minatare Wells	**Model Location (Row, Column)**
Well #1	102, 73
Well #2	101, 73
Well #3	101, 73

RESULTS

To calculate the change in stream flow to the North Platte River for the entire model and at each zone (described in Table 2), the change in streamflow were cumulatively summarized by month for the following ground water model components: ground water storage, rivers, streams, and evapotranspiration (ET). The rivers (mainstem of the North Platte River) and streams (tributaries to the North Platte River), were added together to calculate stream flow change. Then the following calculations were completed to determine impacts to the surface water system for each scenario:

- Scenario 1 Injection Run – Baseline Run = Impacts from Decreased Pumping at Minatare Well Field (minus pumping at Minatare Well #3 for park and football field irrigation).
- Scenario 1 Pumping Run – Baseline Run = Impacts from Increased Pumping at Scottsbluff Well Field
- Scenario 2 Injection Run – Baseline Run = Impacts from Decreased Pumping at Minatare Well Field (all Minatare pumping)
- Scenario 2 Pumping Run – Baseline Run = Impacts from Increased Pumping at Scottsbluff Well Field

Figure 1 shows the Scenario 1, 50-year cumulative impacts to the entire North Platte River within the model area in Acre-Feet per Day.

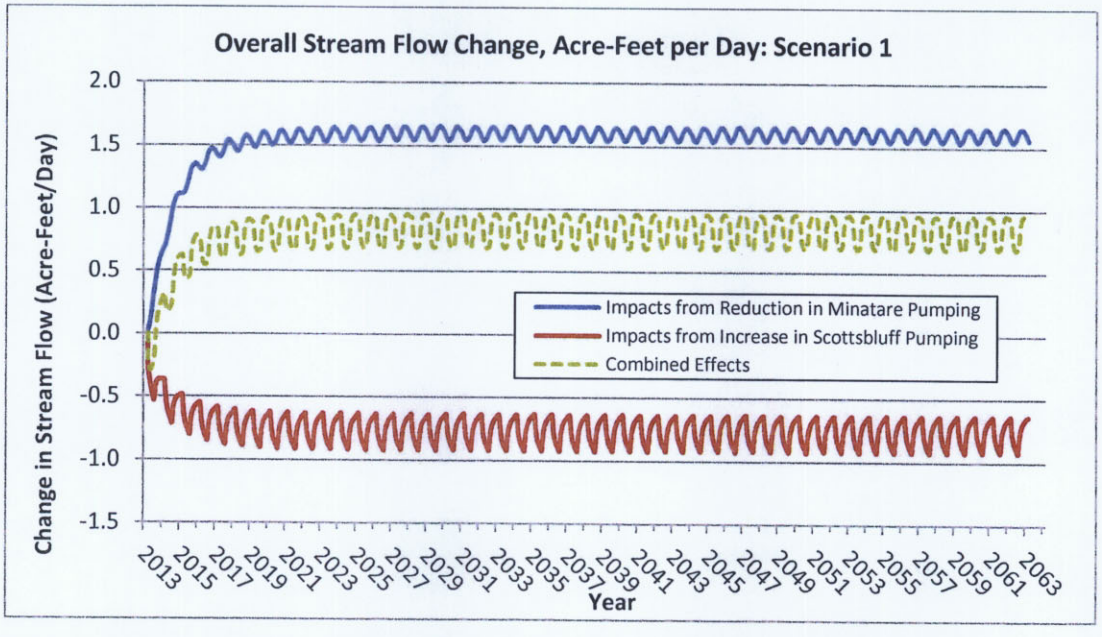


Figure 2 shows the Scenario 2, 50-year cumulative impacts to the entire North Platte River within the model area in Acre-Feet per Day.

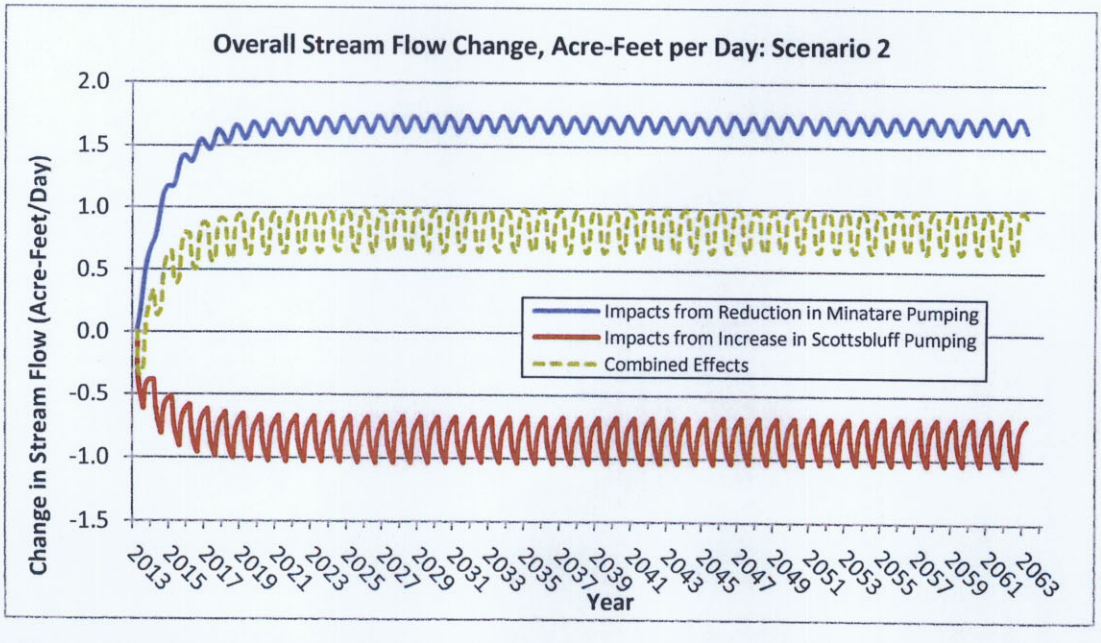
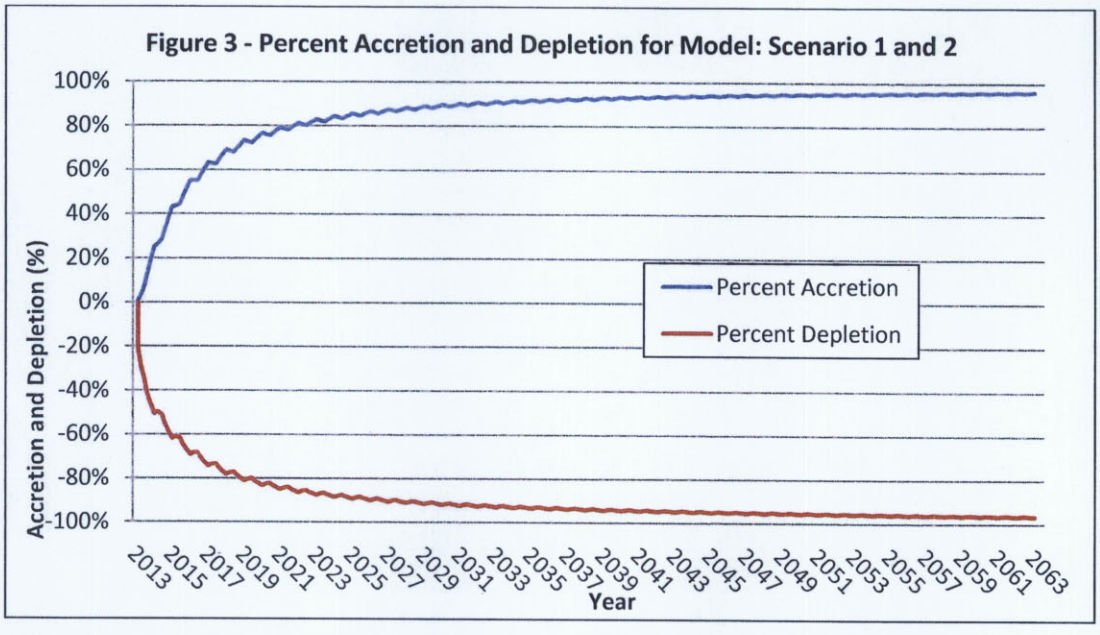


Figure 3 shows the Scenario 1 and 2 percent depletion curves.



From Figure 1 and 2, for each scenario, the overall combined impact to the North Platte River system is a net positive except for the first 5 to 6 months of the simulation where the Scottsbluff well field is impacting the river faster than the Minatare reduction in pumping. This is further demonstrated by Table 5 below. Table 5 shows the total change in stream flow for the North Platte River System for the first 12 months of both model scenarios.

Table 5

Total Change in Stream Flow for the System for the First Year (Acre-Feet per Month)

	5/13	6/13	7/13	8/13	9/13	10/13	11/13	12/13	1/14	2/14	3/14	4/14
Scenario 1	-7	-9	-9	-8	-6	+0.3	+4	+6	+7	+8	+9	+10
Scenario 2	-8	-11	-11	-10	-8	-0.4	+3	+6	+8	+9	+10	+10

Even though the impact to the North Platte River system is generally a net positive, locally near the Scottsbluff well field there are negative impacts to the river during the irrigation season above several surface water diversions. Table 6 shows the maximum monthly change in stream flow to the area surface water diversions during the irrigation season in Acre-Feet per Irrigation season for each Scenario.

Table 6

Maximum Change in Stream Flow per Zone during Irrigation Season (Acre-Feet per Irrigation Season)

	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7	Zone 8	Zone 9
Scenario 1	-13	-72	-35	-17	+5	+109	+61	+69	+1
Scenario 2	-14	-82	-39	-19	+5	+114	+64	+73	+1

These impacts represent the maximum monthly change in stream flow for the entire 50 year modeling analysis for the irrigation season data. This corresponds to the maximum depletion per zone in zones with net depletion and maximum accretion per zone in zones with net accretion. Only irrigation season data were analyzed as there is assumed to be no surface water diversion demand from canals during the non-irrigation season.

For graphs detailing the monthly impacts to the North Platte River system in each zone, refer to Appendix A.

MODEL ERRORS AND LIMITATIONS

The COHYST WMU ground water flow model used in this analysis is not a perfect representation of the natural system; however it is our opinion that it is a reasonable representation of it. The model was constructed using the current understanding of the natural system at the time and it is calibrated using measured water levels and estimated long-term average ground water flow to streams. The calibration indicated that the model is a reasonable representation of the natural system.

The model uses numerical techniques to simultaneously solve the ground water flow equation at each of the approximately 59,000 active model cells. The solution is not perfect, so it is possible in the model to create or destroy water. To measure the closure of the solution, a water budget was computed at the end of each time step. If the water budget closed within reasonable tolerances, the solution is thought to be reasonable. The error in the water budget is a measure of how much water is created or destroyed in the model.

The error in the baseline water budget ranged from -0.000000120 acre-feet per day to 0.00000158 acre-feet per day and averaged -0.000000256 acre-feet per day. The minimum, maximum, and average error in the injection and pumping water budgets for both scenarios are displayed in Table 7. All of these errors were a fraction of 1% of the inflows and outflows in the model.

Table 7

Pumping and Injection Water Budgets, Scenario 1 and Scenario 2 (Acre-Feet per Day)

Scenario 1	Minimum	Maximum	Average
Injection	-0.00000421	+0.00000156	-0.000000257
Pumping	-0.00000422	+0.00000158	-0.000000260
Scenario 2	**Minimum**	**Maximum**	**Average**
Injection	-0.00000421	+0.00000156	-0.000000258
Pumping	-0.00000422	+0.00000158	-0.000000257

The same mass balance errors probably occur in the baseline simulation, the injection simulation, and the pumping simulation over much of the model area and these errors are not related to the new injection or pumping wells. To estimate the model errors due to the new injection or pumping wells, the baseline water budget was subtracted from the injection water budget or the pumping water budget on a time-step by time-step basis.

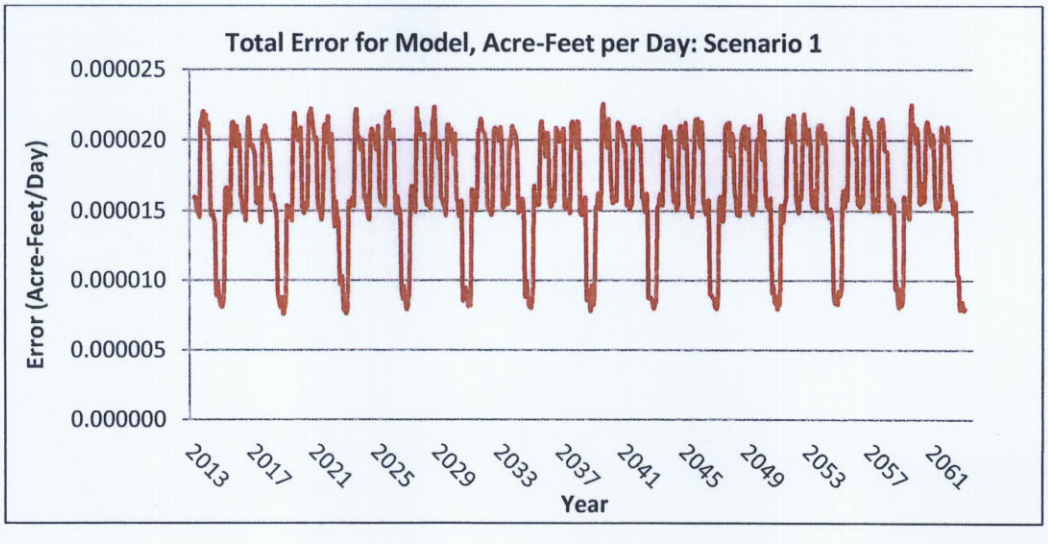
Table 8 shows the minimum, maximum, and average water budget range for the Scenario 1 analysis.

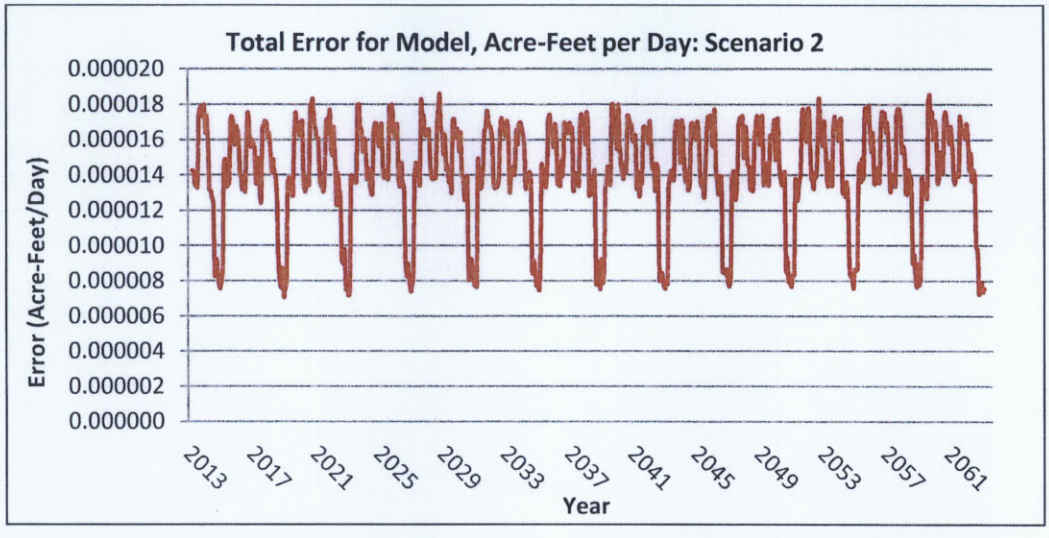
Table 8			
Difference in Water Budgets, Scenario 1 (Acre-Feet per Day)			
Run	Minimum	Maximum	Average
Injection	-0.00000957	+0.00000854	-0.0000000403
Pumping	-0.0000133	+0.0000122	-0.000000121

Table 9 shows the minimum, maximum, and average water budget range for the Scenario 2 analysis.

Table 9			
Difference in Water Budgets, Scenario 2 (Acre-Feet per Day)			
Run	Minimum	Maximum	Average
Injection	-0.00000907	+0.00000818	-0.0000000652
Pumping	-0.0000164	+0.0000146	-0.0000000371

These errors are several orders of magnitude smaller than the new or reduced pumping at the well fields, indicating that they have a negligible effect on the results. The cumulative error was added together to show the total error of the injection and pumping for the Scenario 1 and Scenario 2 analyses (Figure 4 and 5 respectively).





As the understanding of the ground water flow system improves in the future, the model may change and simulated results may change. Changes in simulated aquifer properties could change the timing of simulated depletions or accretions to the river. However, as the Scottsbluff and Minatare well fields are relatively close to the river which causes the simulated effects to stabilize in just a few years, and this is unlikely to change.

Other changes in the model in the future, such as changing simulated recharge or adding supplemental pumpage in surface-water irrigated areas, are not likely to have substantial effects in this analysis on the change in stream flow from the changes in the well fields.

MAPS

APR 0 5 2013

ARI
Water Resources for the West

N

0 3
Miles

Legend

- Scottsbluff Wells
- Minitare Wells
- Diversion Points
- Streams
- North Platte River

This map is for reference purposes only, accuracy is not guaranteed. This product should not be construed as a legal document or survey instrument.

Location of Wells and Surface Water Diversions for Scottsbluff to Minatare Transfer Analysis

Map 1

ARI
Water Resources for the West

N

0 1.1
Miles

Legend

- Minitare Wells
- Diversion Points
- Streams
- North Platte River

This map is for reference purposes only, accuracy is not guaranteed. This product should not be construed as a legal document or survey instrument.

Location of Minatare Well Field and Area Surface Water Diversions

Map 2

APR 05 2013

APR 0 5 2013

ARI
Water Resources for the West

N

0 1
Miles

Legend

- Scottsbluff Wells
- Diversion Points
- Streams
- North Platte River

This map is for reference purposes only, accuracy is not guaranteed. This product should not be construed as a legal document or survey instrument.

Location of Scottsbluff Well Field and Area Surface Water Diversions

Map 3

ATTACHMENT A

Thad Kuntz

From: Michael Olsen <MOlsen@mcschaff.com>
Sent: Thursday, February 14, 2013 3:28 PM
To: Thad Kuntz
Subject: RE: Minatare Transfer Permit Information

Thad,

As of now, with the new City Council and Mayor, the city would like to keep the existing wells to water the parks and football field. The amount of 25.7 acre-feet still seems reasonable enough of an estimate. When we spoke earlier, we were not sure what the new City Council and Mayor would want to do with the existing wells.

The historical annual pumping of 200.8 million gallons includes the irrigation of the football field of 800,000 gallons.

The city will use Well 781 (it is also call Well #3 and registered as G-095973). Sorry, I am not sure which labeling system Frank used to describe them the first time.

Thanks,

Michael Olsen
Engineering Intern

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mcschaff

M.C. Schaff & Associates, Inc - [illegible] - Enviro Service, Inc.

818 South Beltline Highway East - Scottsbluff, NE 69361
308.635.1926 phone - 308.635.7807 fax
www.mcschaff.com

simply [illegible] solutions

From: Thad Kuntz [mailto:thad@adaptiveresourcesinc.com]
Sent: Wednesday, February 13, 2013 3:05 PM
To: Michael Olsen
Subject: RE: Minatare Transfer Permit Information

Mike,

Two additional questions:

In the analysis where Minatare does not want to pump from their well for the football field, I will increase Minatare's usage from Scottsbluff by 800,000 gallons/irrigation season. Is that assumption correct in adding that to the pumping from Scottsbluff?

What well does Minatare plan on using for football field irrigation?

Thanks,

Thad

Thad Kuntz, P.G.
Principal Hydrogeologist
Adaptive Resources, Inc.
416 Valley View Drive STE 301
Scottsbluff, NE 69361-1420
Office # (308) 633-2890
Cell # (308) 641-9683

www.adaptiveresourcesinc.com

From: Thad Kuntz
Sent: Wednesday, February 13, 2013 2:51 PM
To: 'Michael Olsen'
Subject: RE: Minatare Transfer Permit Information

Hi Mike,

I wanted to update you on my progress with the modeling. I have fell behind what I thought I could get done last week but I have a good chunk of the modeling completed. I do have two questions for you which are below:

In the original informational letter from Frank Strong dated March 22, 2010 titled New Water Source – Minatare and Bayard, Nebraska, he shows that Minatare will be irrigating parks with their existing wells to the amount of 25.7 acre-feet, is the village still considering using their existing wells for this? In your letter to me there is no mention of this and I just want to make sure that Minatare isn't planning on doing this.

In your letter to me, you wanted two analyses with one having football field irrigation and one without. In the letter sited above from Frank Strong he sites historic annual pumping of 200.8 Million Gallons as Minatare's historic average usage. Is the football field irrigation considered in that average or do I need to add the 800,000 gallons/irrigation season to that historic usage?

That is all the questions I have for now.

Thanks,

Thad

Thad Kuntz, P.G.
Principal Hydrogeologist
Adaptive Resources, Inc.
416 Valley View Drive STE 301
Scottsbluff, NE 69361-1420
Office # (308) 633-2890
Cell # (308) 641-9683

www.adaptiveresourcesinc.com

From: Thad Kuntz
Sent: Friday, February 01, 2013 11:54 AM

To: 'Michael Olsen'
Subject: RE: Minatare Transfer Permit Information

Hey Mike,

I am in the middle of getting the analysis completed for the NRD. It should be delivered to the NRD by the middle of next week and I will let you know when I get it to them and then they will distribute it to you shortly thereafter.

Thanks,

Thad

Thad Kuntz, P.G.
Principal Hydrogeologist
Adaptive Resources, Inc.
416 Valley View Drive STE 301
Scottsbluff, NE 69361-1420
Office # (308) 633-2890
Cell # (308) 641-9683

www.adaptiveresourcesinc.com

From: Michael Olsen [mailto:MOlsen@mcschaff.com]
Sent: Thursday, January 31, 2013 8:13 AM
To: Thad Kuntz
Subject: RE: Minatare Transfer Permit Information

Hi Thad,

I was just wondering if you were able to get to the modeling for the NRD on the Minatare Transfer Permit? I just want to keep Tracy in to loop so she knows what's going on and that we are still actively pursuing the permit.

Thanks,

Michael Olsen
Engineering Intern

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308.635.1926 phone - 308.635.7807 fax
www.mcschaff.com

simply smart solutions

From: Thad Kuntz [mailto:thad@adaptiveresourcesinc.com]
Sent: Thursday, December 06, 2012 11:23 AM

To: Michael Olsen
Subject: RE: Minatare Transfer Permit Information

Hi Mike,

Thank you for the information and I will let you know if I have any other questions. Looking at my schedule to get this done before the holiday's arrive I don't think that will be possible as my schedule has filled up significantly since we spoke. It looks like the earliest opportunity to get this modeling done for the NRD will be by late January to early February. I know Tracy will work with you on this and let her know the situation and I would expect she could move the date you described. Please let me know if you have any questions.

Thank you,

Thad Kuntz, P.G.
Principal Hydrogeologist
Adaptive Resources, Inc.
416 Valley View Drive STE 301
Scottsbluff, NE 69361-1420
Office # (308) 633-2890
Cell # (308) 641-9683

www.adaptiveresourcesinc.com

From: Michael Olsen [mailto:MOlsen@mcschaff.com]
Sent: Friday, November 30, 2012 7:55 AM
To: Thad Kuntz
Subject: Minatare Transfer Permit Information

Thad,

I'm glad we could meet up yesterday. I have drafted the information that I gave you into a letter and added the irrigation and non-irrigation season totals to it.

Thanks,

Michael Olsen
Engineering Intern

Scottsbluff p 308.635.1926 f 308.635.7807
818 south beltline highway east, scottsbluff, ne 69361

mcs family of companies
www.mcschaff.com
HUB-Zone certified firm

p 307.635.2828 f 307.635.9902 Cheyenne
2116 pioneer avenue, cheyenne, wy 82001

Thad,

Here is the additional information that you requested from me.

1) Quantities that are being requested in the transfer permit are 500 gallons per minute maximum, 678,000 gallons per day maximum, 251,000 average gallons per day and 92,000,000 gallons per year. The usage was estimated as shown below.

Minatare Water Usage

Projected Population in 2026	Water Use per Capita (Gallons/Day)	Average Daily Total (Gallons)	Summer Peak Factor	Max Daily Total (Gallons)
965	260	250,900	2.7	677,430
	Average Yearly Total	91,578,500	**Max Total per Minute**	470

2) The additional demand will be distributed evenly throughout the City of Scottsbluff's system.

3) It is our understanding that either all three of the wells will be decommissioned or two will be decommissioned and one will be retained as an irrigation well for the football field. Our estimate is it will pump at max 800,000 gallons/year and will be operational from May to the end of September. This was the current Mayor and City Council's plan; however, there has been a new Mayor and City Council and we are not positive this is how they feel as well. We would like to see the model run with both of these scenarios.

4) After looking at past pumping records, on average the City of Minatare pumps approximately 65% of their yearly total during the irrigation season (May to September). Using this we estimate that during the irrigation season the City will pump a total of 59,800,000 gallons or 391,000 gallons per day. During non-irrigation months the City will pump a total of 32,200,000 gallons or 152,000 gallons per day.

If you need anything else let me know.

Thank you,

On behalf of the firm of M.C. Schaff & Associates

Michael Olsen
Engineering Intern

Principals
M. C. Schaff
D. A. Schaff
L. D. McCaslin
K. A. Beatty

M. C. SCHAFF & ASSOCIATES, INC.

ENGINEERS — PLANNERS — SURVEYORS

818 South Beltline Highway East
Scottsbluff, Nebraska 69361
308/635-1926 FAX: 308/635-7807

P.O. Box 1340
Douglas, Wyoming 82633
307/358-0128

March 22, 2010

Ron Cacek
North Platte NRD
P.O. Box 280
Scottsbluff, NE 69361

RE: New Water Source – Minatare and Bayard, Nebraska

Dear Mr. Cacek:

The Cities of Minatare and Bayard have agreed to construct a transmission main from Scottsbluff to Minatare to Bayard. This transmission main will be used to purchase water from Scottsbluff. The attached sheets show the past water usage and estimated future use. The estimated flows are based on current populations and 250 gallons per capitia per day. Attached is a map and table showing the location of Scottsbluff's wells.

The past water usage for Minatare is based on typically water usage in small communities with no water meters. The records for Minatare show flows well below 250 gallons per capitia per day. The reason for this is the water meter for Minatare's primary well is oversized and does not read the low flows produced by the VFD well.

Water Meters have been replaced and installed in Bayard. Minatare plans to bid out a project that includes water meters in the next couple of months. We expect a dramatic reduction in water use in Minatare with the installation of water meters for the first time.

Each city plans to utilize their existing wells to irrigate their own parks.

If you have any questions or require additional information, please contact me at 307.358.0128.

Respectfully

FOR THE FIRM OF
M.C. SCHAFF & ASSOCIATES

Frank A Strong IV, P.E.

CC: Michelle Fries, City of Bayard
Carolyn Nelson, City of Minatare.

APR 0 5 2013

Past Water Usage

Minatare

Well No. 1 - 201	250	gpm
Well No. 2 - 551	550	gpm
Well No. 3 - 781	1000	gpm-VFD
	1800	
Yearly Average	200.8	Million Gallons
Total	**349.1**	**Million Gallons**

Bayard

Well 683	500	gpm
Well 811	400	gpm
Well 812	370	gpm
	1270	
Yearly Average	148.3	Million Gallons

Estimated Future Water Use

Minatare - Nonpotable uses

Well No. 1 - 201	250	gpm
Well No. 2 - 551	550	gpm
Well No. 3 - 781	1000	gpm-VFD
	1800	
Park Irrigation	25.7	acre-feet
	8.4	Million Gallons
Total	**23.3**	**Million Gallons**

Bayard - Nonpotable use

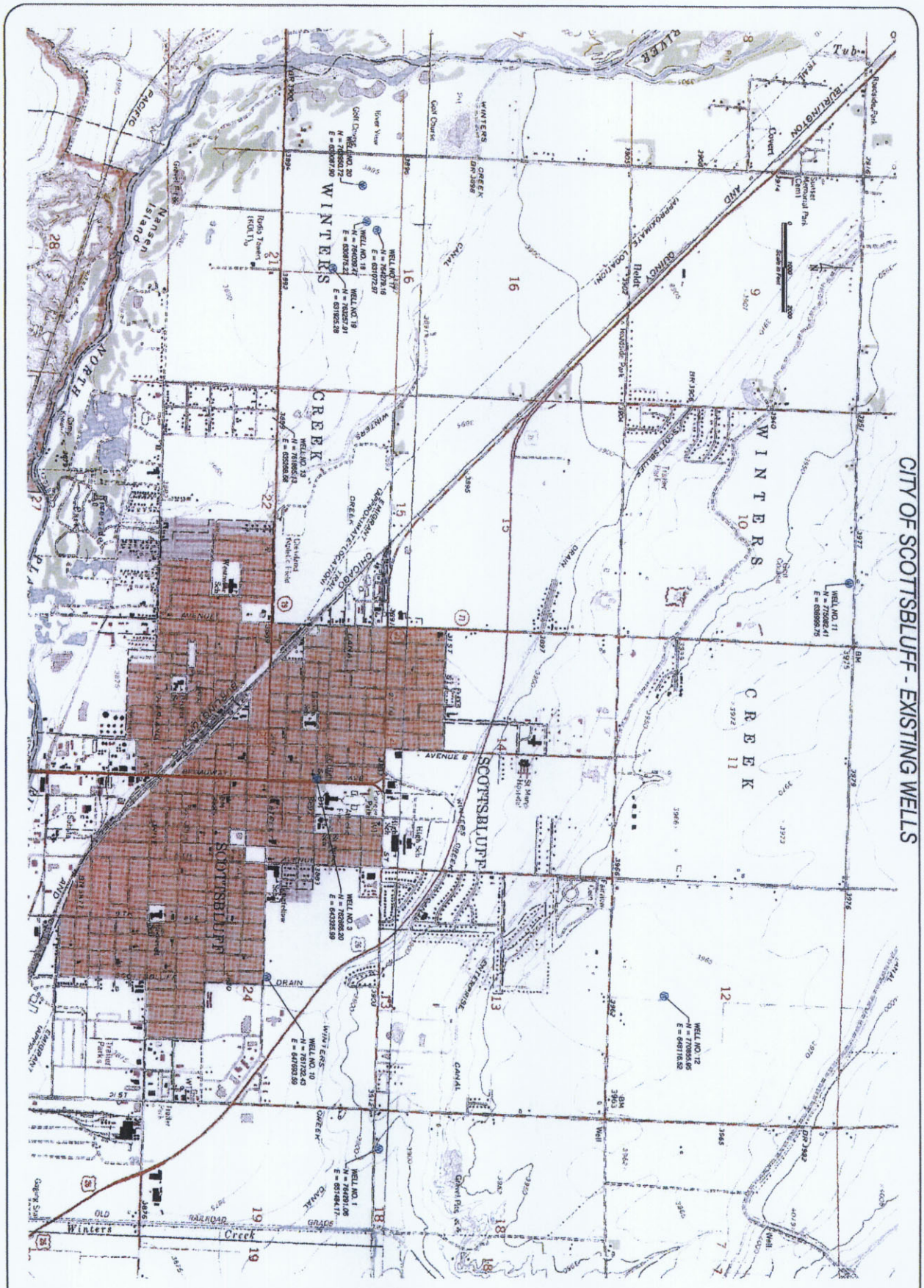
Well 683	500	gpm
Well 811	400	gpm
Well 812	370	gpm
	1270	gpm
Park Irrigation	45.9	acre-feet
	15.0	Million Gallons

Scottsbluff Wells

Well No. 1	750	gpm
Well No. 3	1200	gpm
Well No. 9	1100	gpm
Well No. 10	900	gpm
Well No.11	1100	gpm
Well No. 12	650	gpm
Well No. 13	1000	gpm
Well No. 17	2200	gpm
Well No. 18	2200	gpm
Well No. 19	2000	gpm
Well No. 20	2000	gpm
	15100	gpm

Minatare	83.7	Million Gallons
Bayard	113.8	Million Gallons
Total	**197.5**	**Million Gallons**

APR 05 2013



PROJECT: TRANSMISSION MAIN
MINATARE AND BAYARD
NERBASKA
NRD WELL MAP

CLIENT: BAYARD & MINATARE, NE

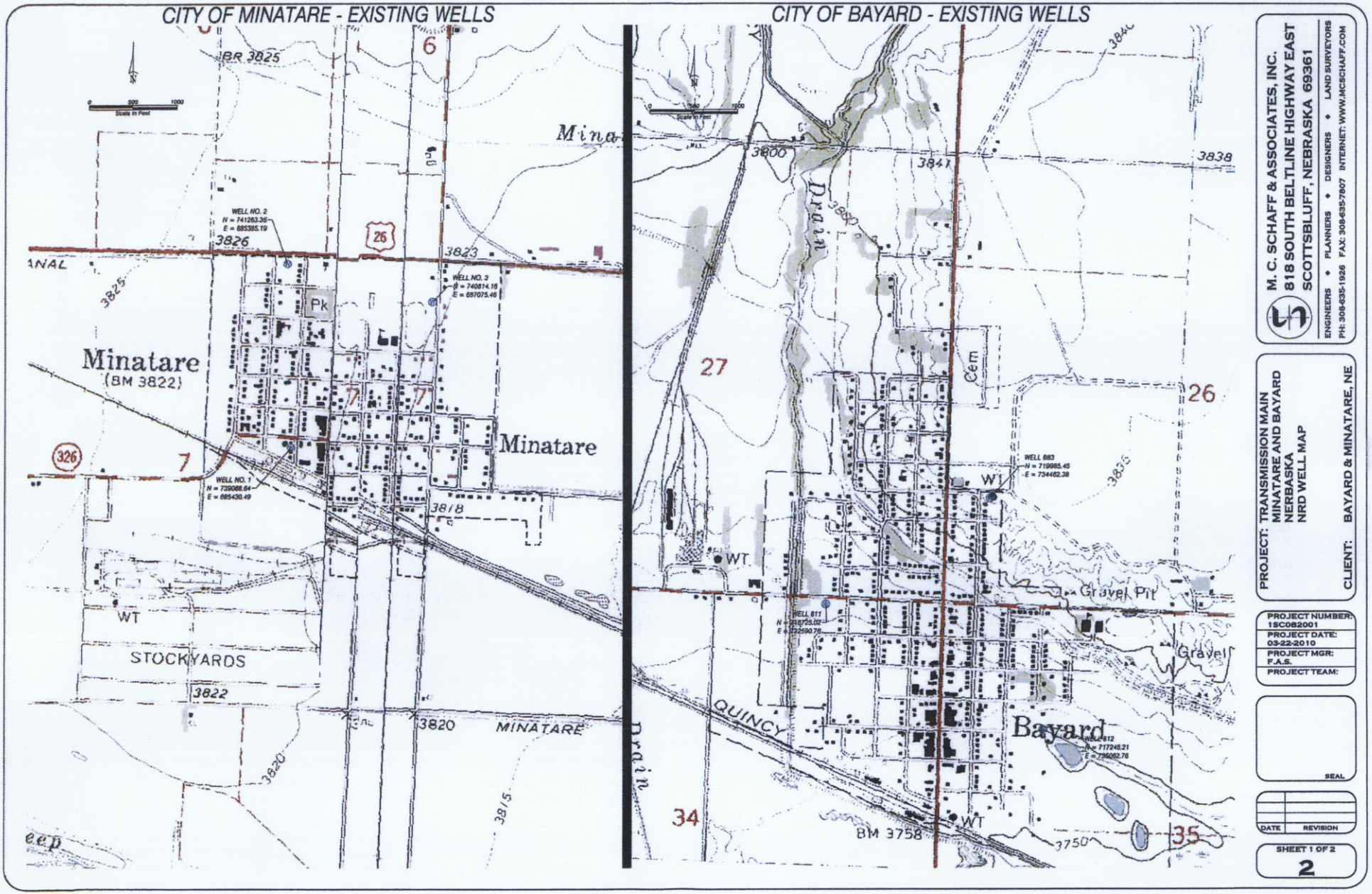
PROJECT NUMBER: ISCOBE001
PROJECT DATE: 03-22-2010
PROJECT MGR: F.A.S.
PROJECT TEAM:

DATE | REVISION

SEAL

SHEET 1 OF 1

M. C. SCHAFF & ASSOCIATES, INC.
818 SOUTH BELTLINE HIGHWAY EAST
SCOTTSBLUFF, NEBRASKA 69361
ENGINEERS ◆ PLANNERS ◆ DESIGNERS ◆ LAND SURVEYORS
PH: 308-635-1926 FAX: 308-635-7807 INTERNET: WWW.MCSCHAFF.COM



M. C. SCHAFF & ASSOCIATES, INC.
818 SOUTH BELTLINE HIGHWAY EAST
SCOTTSBLUFF, NEBRASKA 69361
ENGINEERS ◆ PLANNERS ◆ DESIGNERS ◆ LAND SURVEYORS
PH: 308-635-1926 FAX: 308-635-7807 INTERNET: WWW.MCSCHAFF.COM

PROJECT: TRANSMISSION MAIN
MINATARE AND BAYARD
NEBRASKA
NRD WELL MAP

CLIENT: BAYARD & MINATARE, NE

PROJECT NUMBER: 1SC082001
PROJECT DATE: 03-22-2010
PROJECT MGR: F.A.S.
PROJECT TEAM:

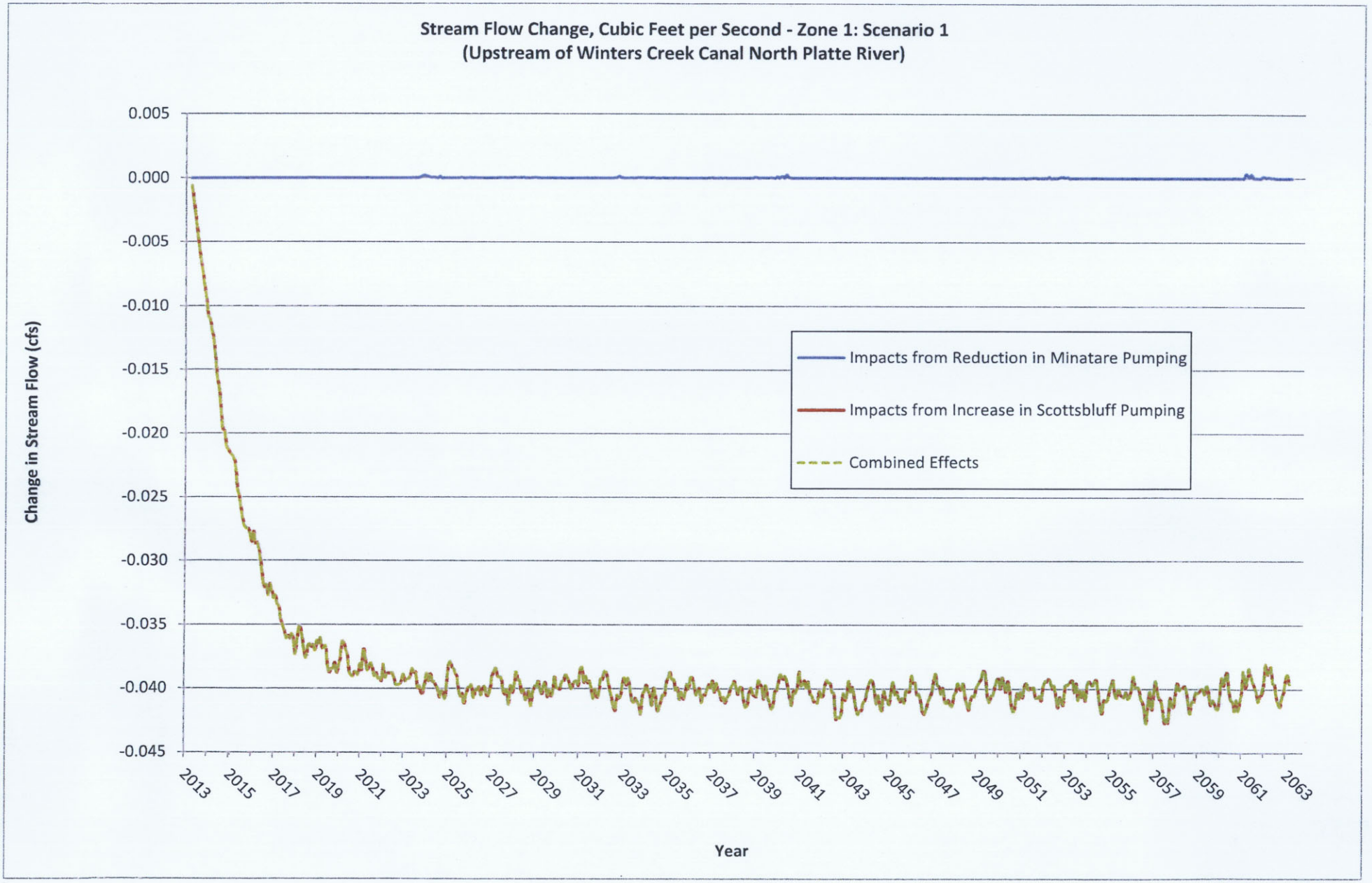
SEAL

DATE | REVISION

SHEET 1 OF 2
2

APR 0 5 2013

APPENDIX A


Stream Flow Change, Cubic Feet per Second - Zone 1: Scenario 1
(Upstream of Winters Creek Canal North Platte River)
Change in Stream Flow (cfs)
0.005
0.000
-0.005
-0.010
-0.015
-0.020
-0.025
-0.030
-0.035
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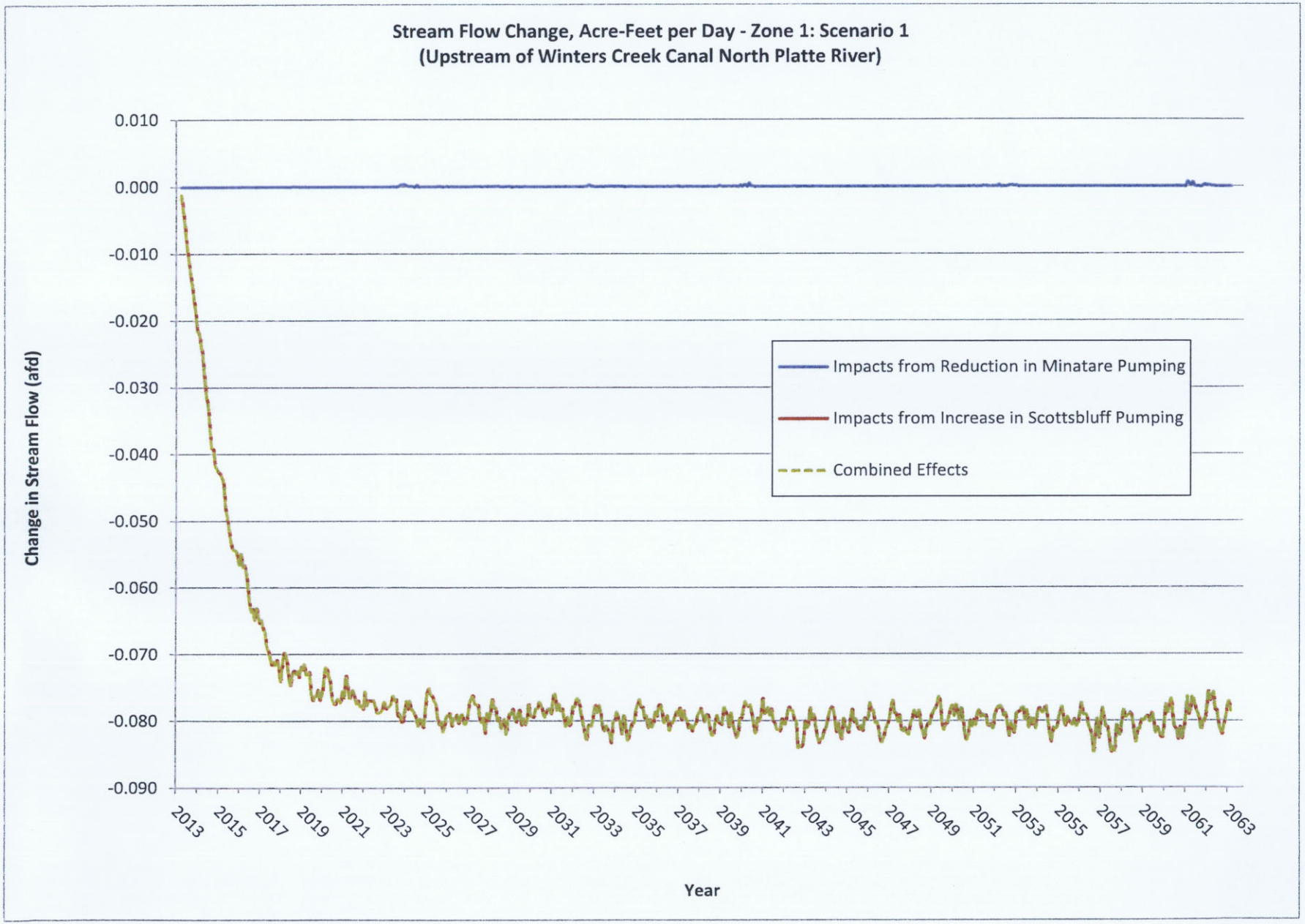
Year
Impacts from Reduction in Minatare Pumping
Impacts from Increase in Scottsbluff Pumping
Combined Effects


Stream Flow Change, Acre-Feet per Day - Zone 1: Scenario 1
(Upstream of Winters Creek Canal North Platte River)
Change in Stream Flow (afd)
0.010
0.000
-0.010
-0.020
-0.030
-0.040
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-0.060
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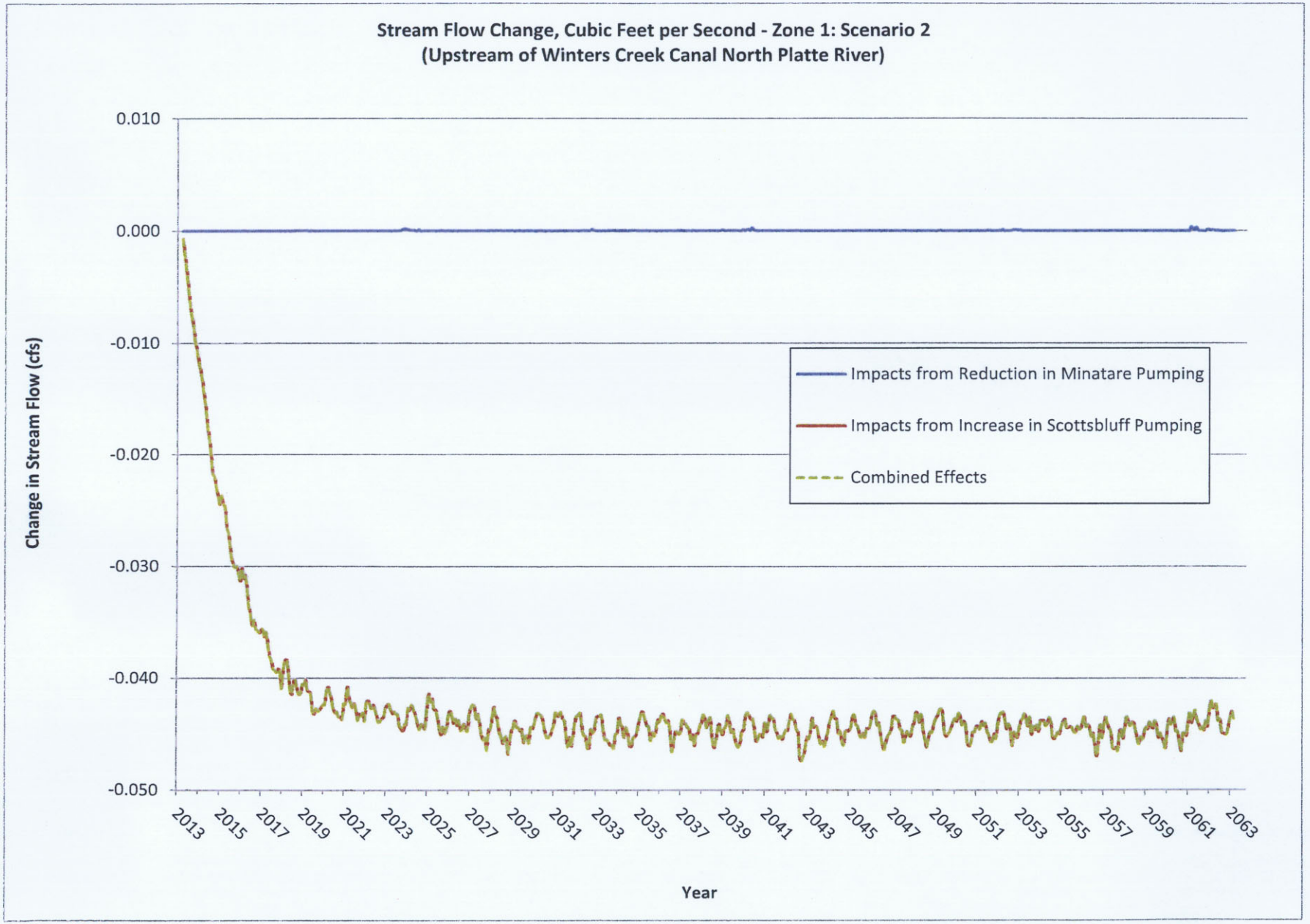
Year
Impacts from Reduction in Minatare Pumping
Impacts from Increase in Scottsbluff Pumping
Combined Effects


Stream Flow Change, Cubic Feet per Second - Zone 1: Scenario 2
(Upstream of Winters Creek Canal North Platte River)
Change in Stream Flow (cfs)
0.010
0.000
-0.010
-0.020
-0.030
-0.040
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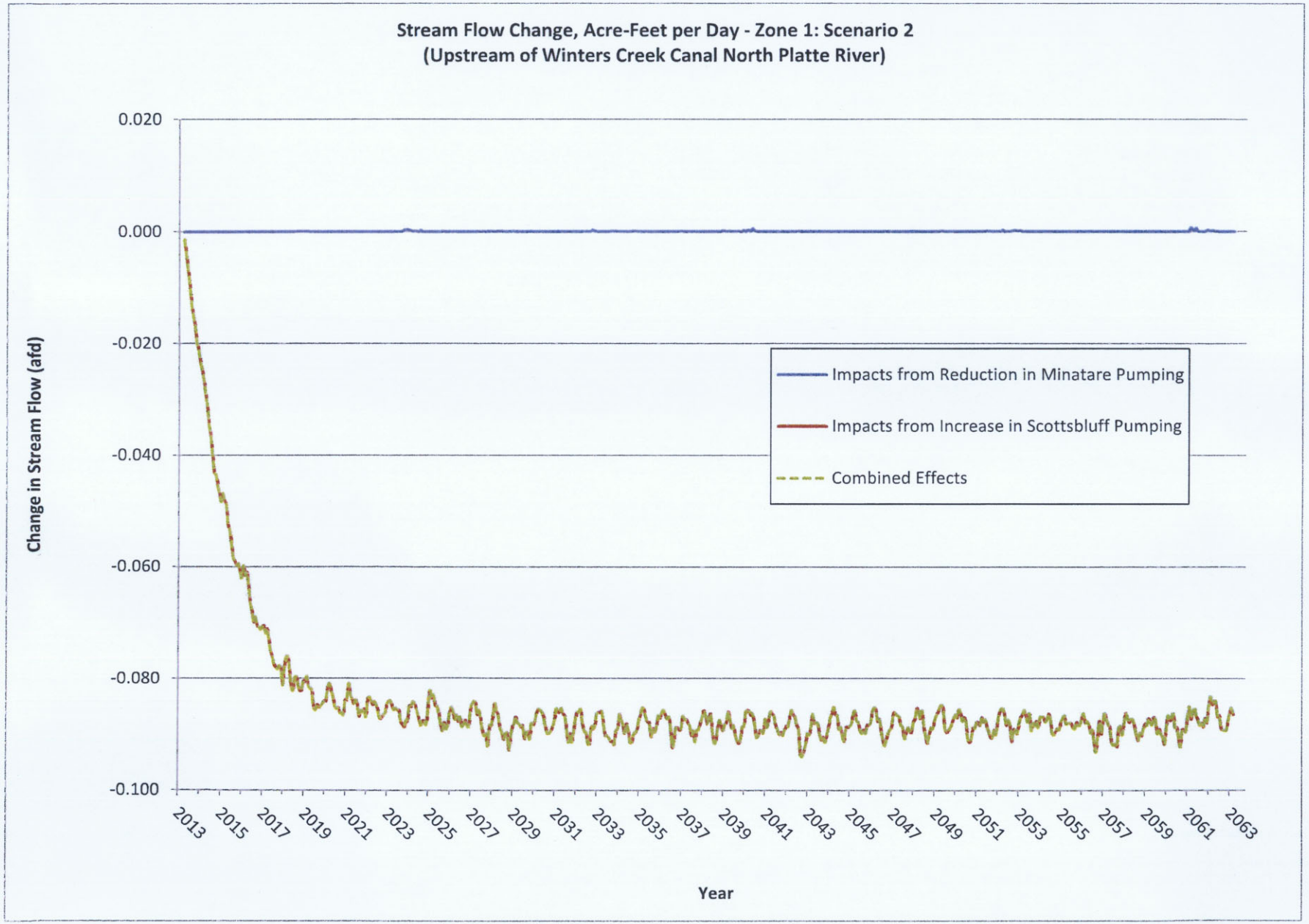
Year
Impacts from Reduction in Minatare Pumping
Impacts from Increase in Scottsbluff Pumping
Combined Effects


Stream Flow Change, Acre-Feet per Day - Zone 1: Scenario 2
(Upstream of Winters Creek Canal North Platte River)
Change in Stream Flow (afd)
0.020
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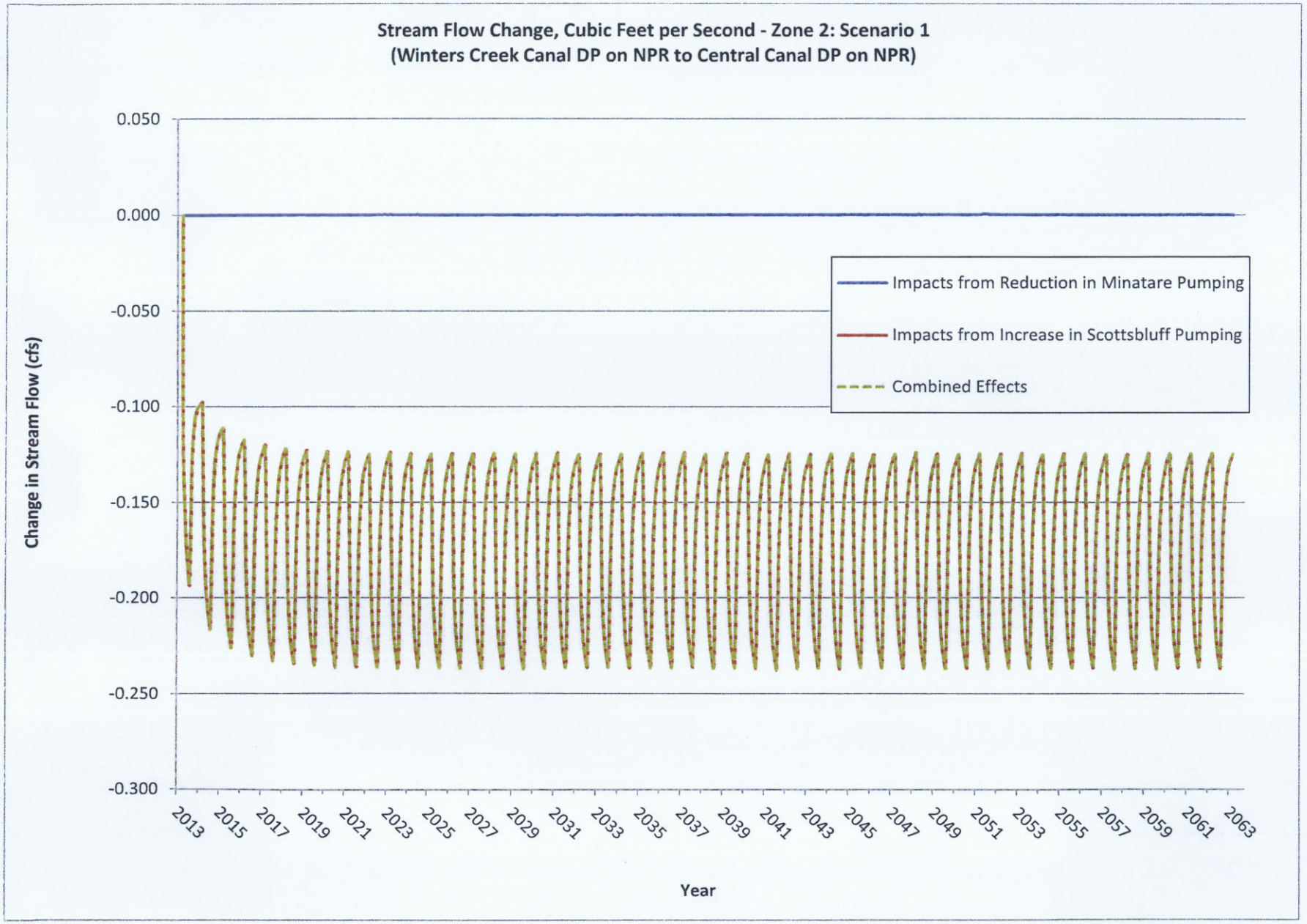
Year
Impacts from Reduction in Minatare Pumping
Impacts from Increase in Scottsbluff Pumping
Combined Effects


Stream Flow Change, Cubic Feet per Second - Zone 2: Scenario 1
(Winters Creek Canal DP on NPR to Central Canal DP on NPR)
Change in Stream Flow (cfs)
0.050
0.000
-0.050
-0.100
-0.150
-0.200
-0.250
-0.300
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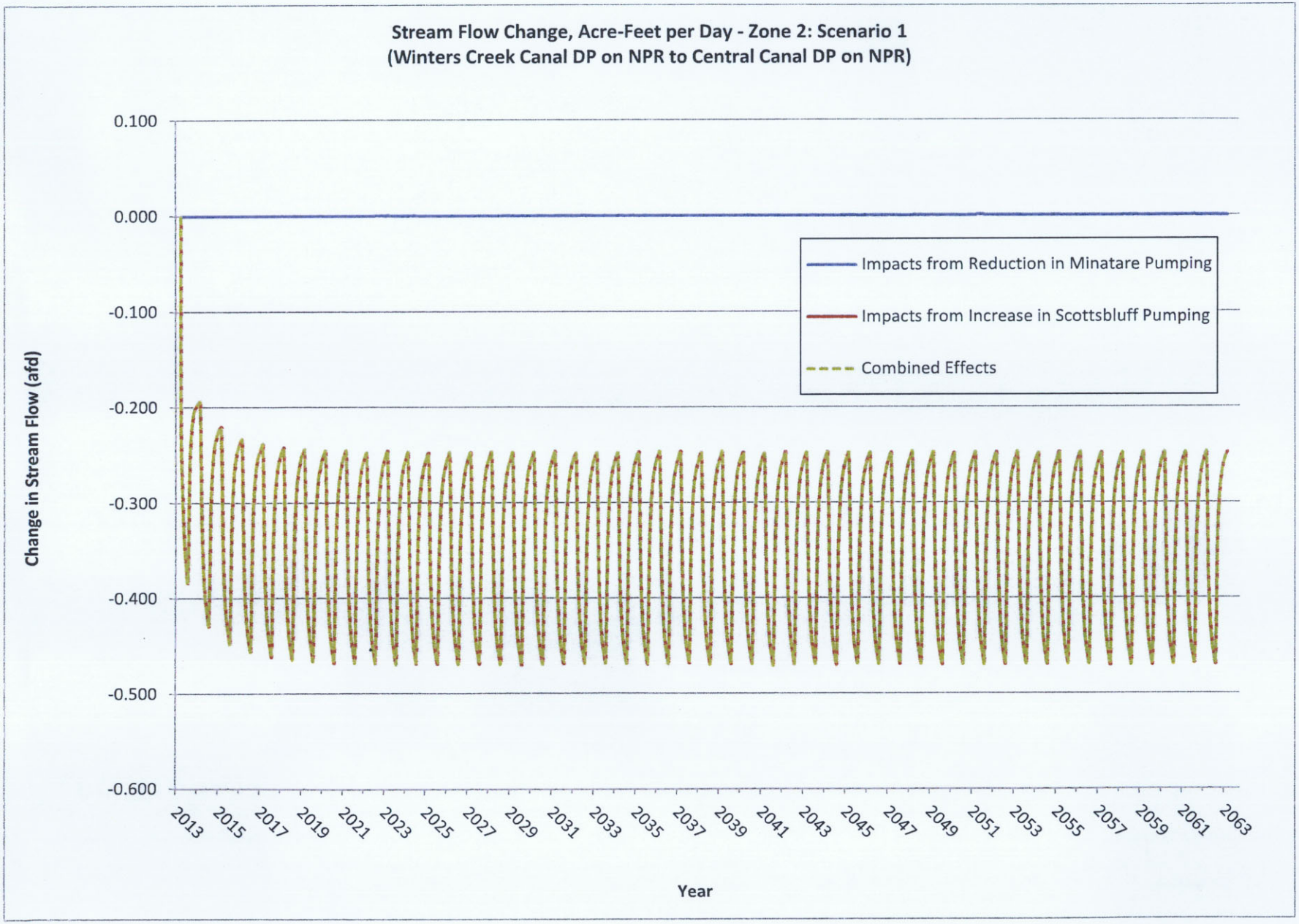
Year
Impacts from Reduction in Minatare Pumping
Impacts from Increase in Scottsbluff Pumping
Combined Effects


Stream Flow Change, Acre-Feet per Day - Zone 2: Scenario 1
(Winters Creek Canal DP on NPR to Central Canal DP on NPR)
Change in Stream Flow (afd)
0.100
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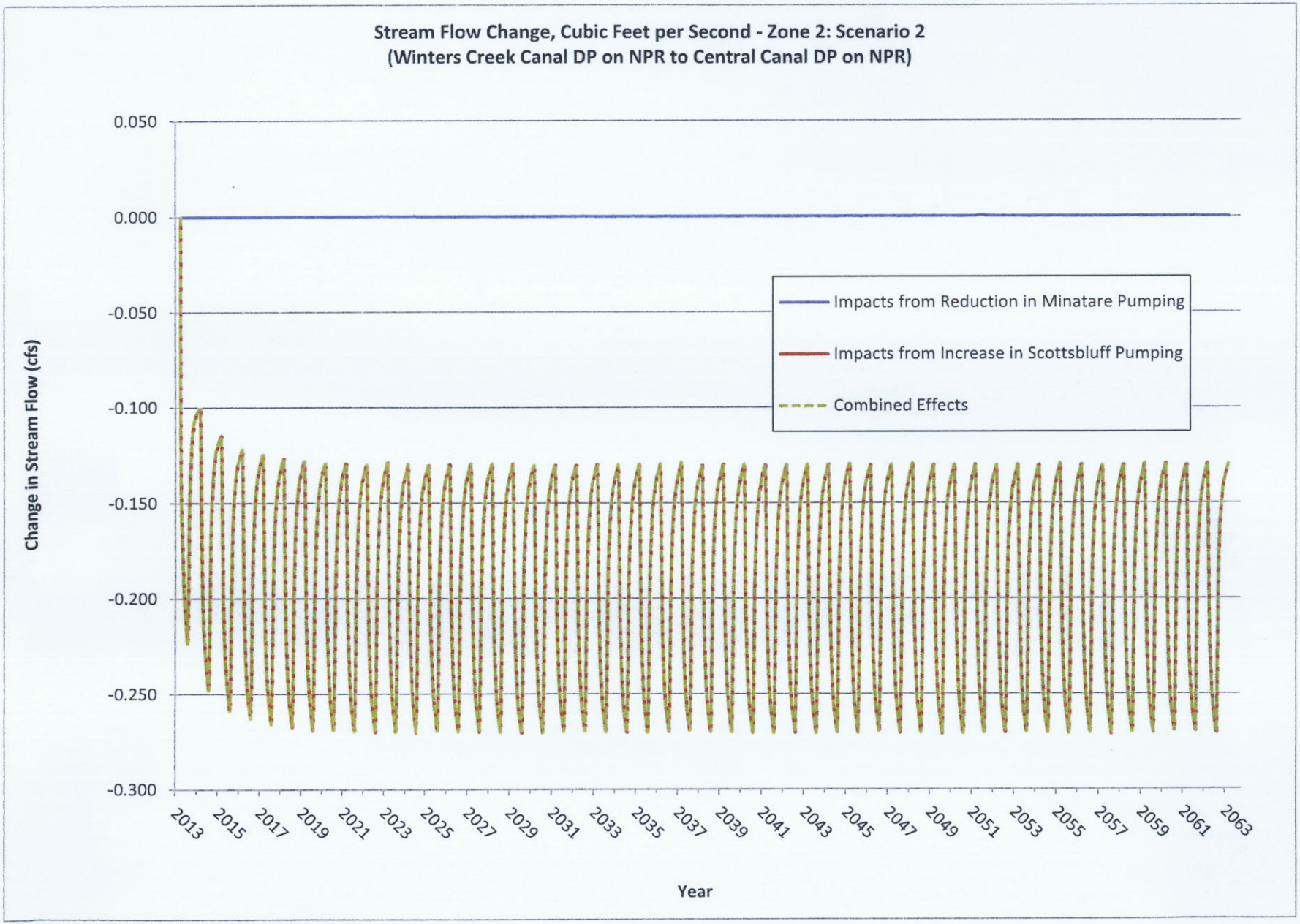
Impacts from Reduction in Minatare Pumping
Impacts from Increase in Scottsbluff Pumping
Combined Effects


Stream Flow Change, Cubic Feet per Second - Zone 2: Scenario 2
(Winters Creek Canal DP on NPR to Central Canal DP on NPR)
Change in Stream Flow (cfs)
0.050
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-0.050
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-0.250
-0.300
Impacts from Reduction in Minatare Pumping
Impacts from Increase in Scottsbluff Pumping
Combined Effects
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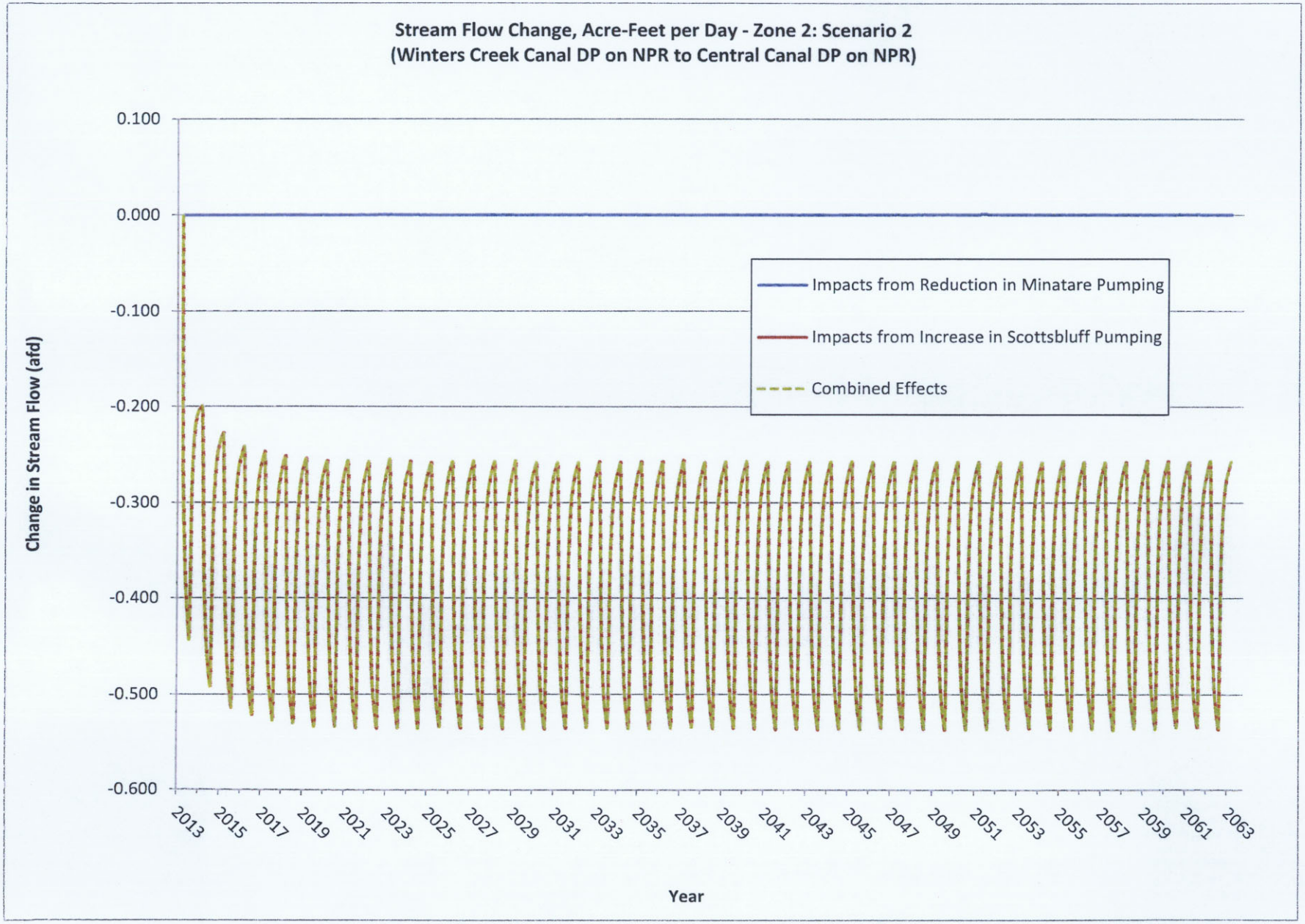
Stream Flow Change, Acre-Feet per Day - Zone 2: Scenario 2
(Winters Creek Canal DP on NPR to Central Canal DP on NPR)
Change in Stream Flow (afd)
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-0.200
-0.300
-0.400
-0.500
-0.600
Impacts from Reduction in Minatare Pumping
Impacts from Increase in Scottsbluff Pumping
Combined Effects
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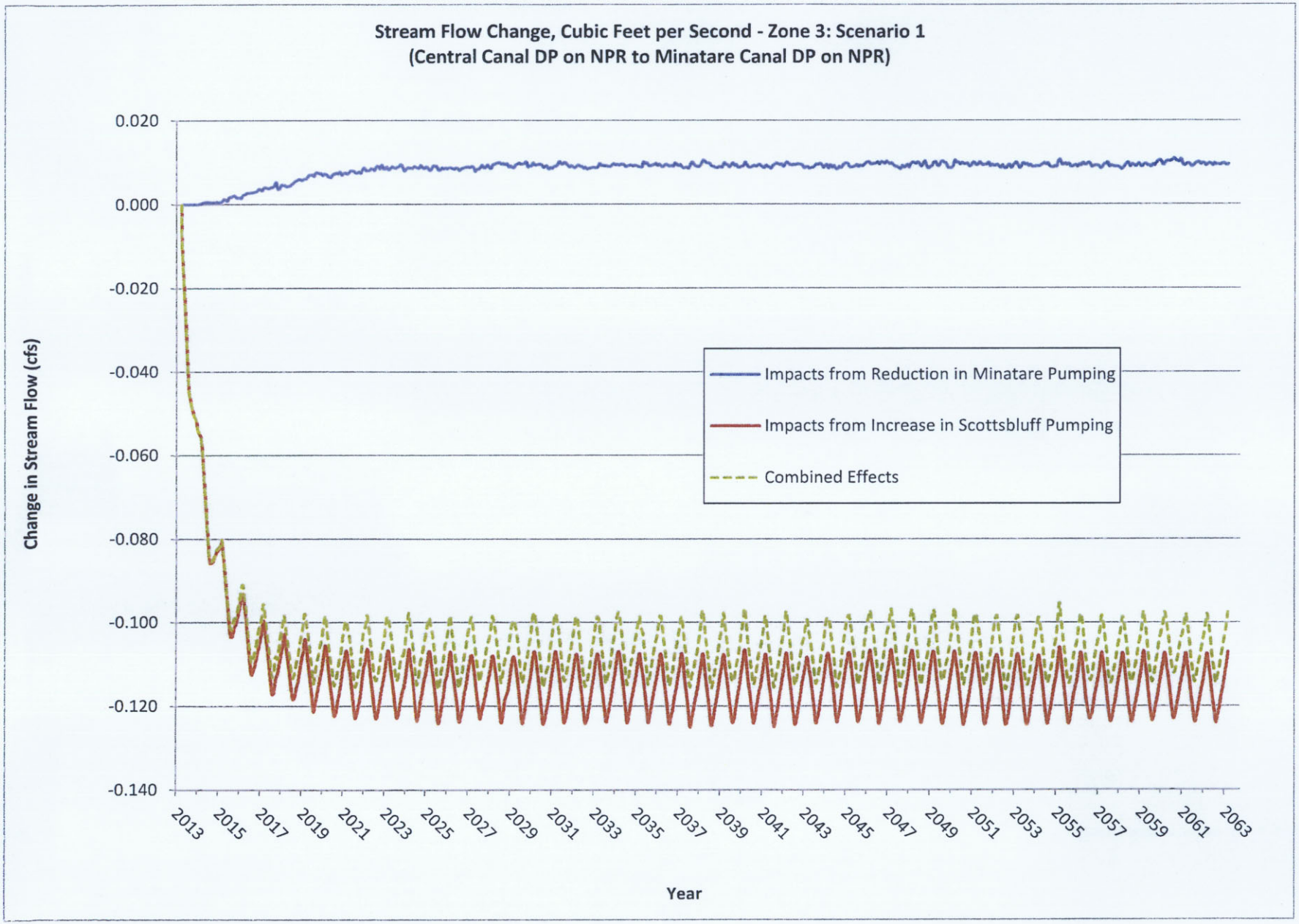
Stream Flow Change, Cubic Feet per Second - Zone 3: Scenario 1
(Central Canal DP on NPR to Minatare Canal DP on NPR)
Change in Stream Flow (cfs)
0.020
0.000
-0.020
-0.040
-0.060
-0.080
-0.100
-0.120
-0.140
2013
2015
2017
2019
2021
2023
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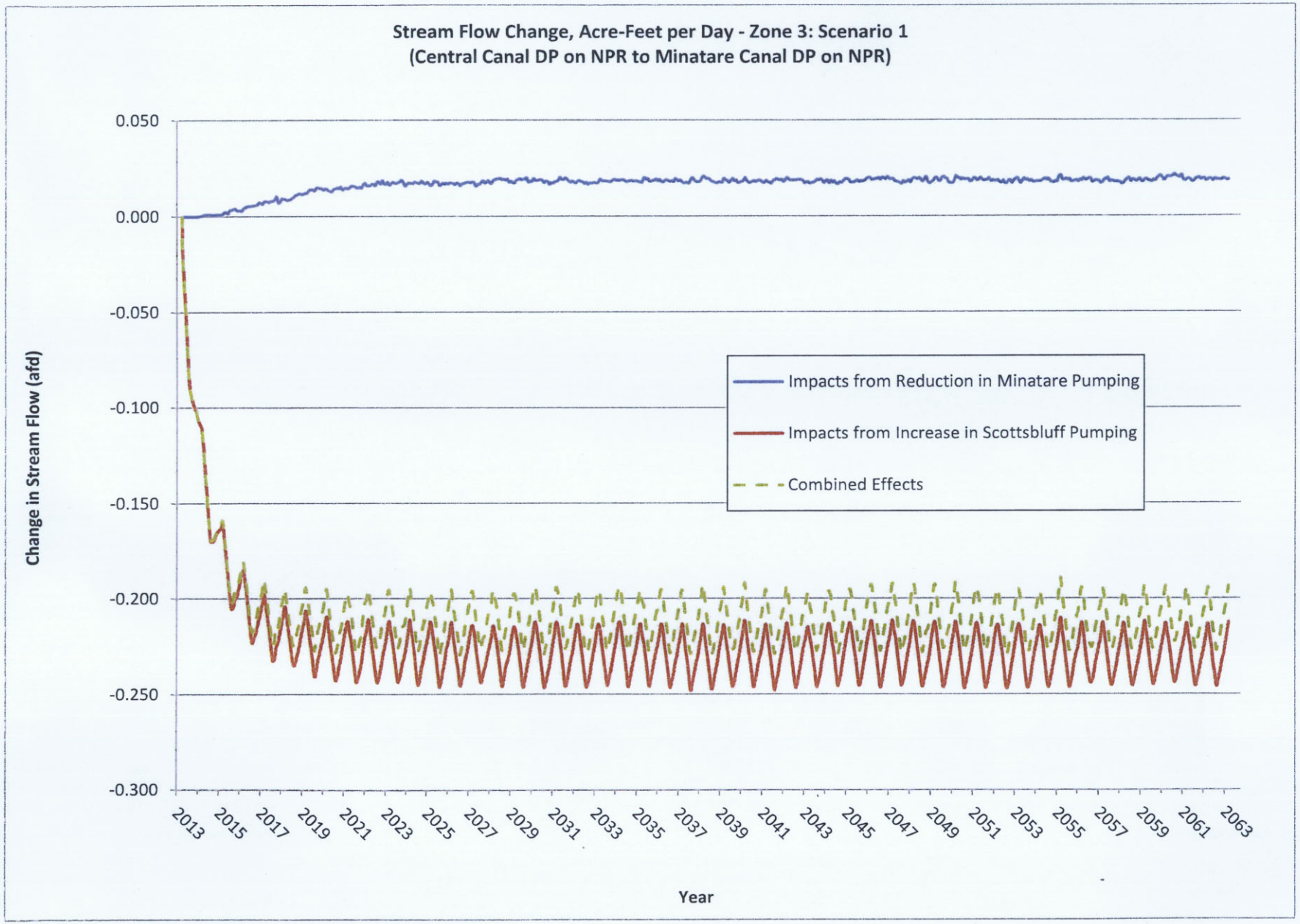
2061
2063
Year
Impacts from Reduction in Minatare Pumping
Impacts from Increase in Scottsbluff Pumping
Combined Effects


Stream Flow Change, Acre-Feet per Day - Zone 3: Scenario 1
(Central Canal DP on NPR to Minatare Canal DP on NPR)
Change in Stream Flow (afd)
0.050
0.000
-0.050
-0.100
-0.150
-0.200
-0.250
-0.300
2013
2015
2017
2019
2021
2023
2025
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2043
2045
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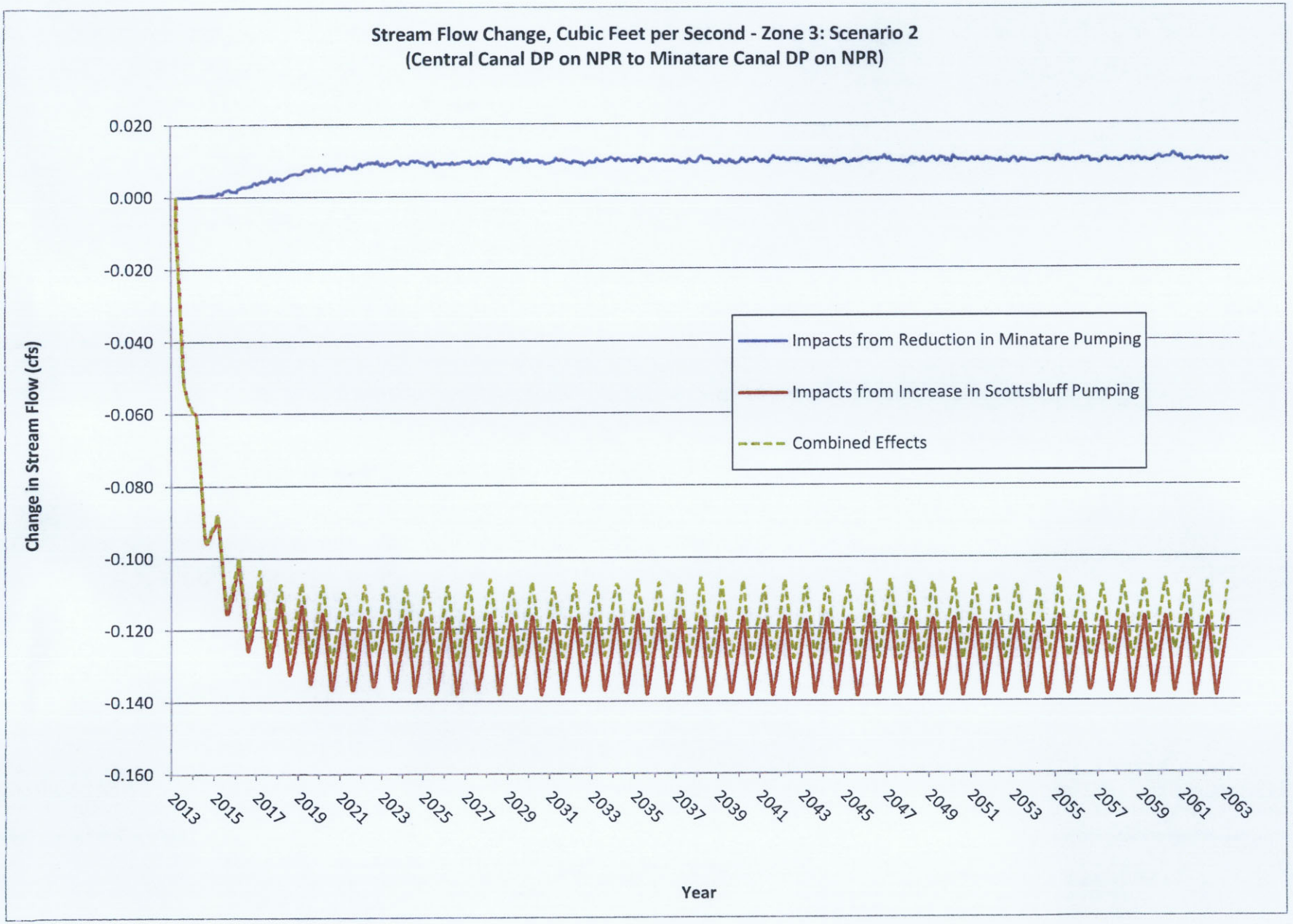
2059
2061
2063
Year
Impacts from Reduction in Minatare Pumping
Impacts from Increase in Scottsbluff Pumping
Combined Effects


Stream Flow Change, Cubic Feet per Second - Zone 3: Scenario 2
(Central Canal DP on NPR to Minatare Canal DP on NPR)
Change in Stream Flow (cfs)
0.020
0.000
-0.020
-0.040
-0.060
-0.080
-0.100
-0.120
-0.140
-0.160
2013
2015
2017
2019
2021
2023
2025
2027
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2031
2033
2035
2037
2039
2041
2043
2045
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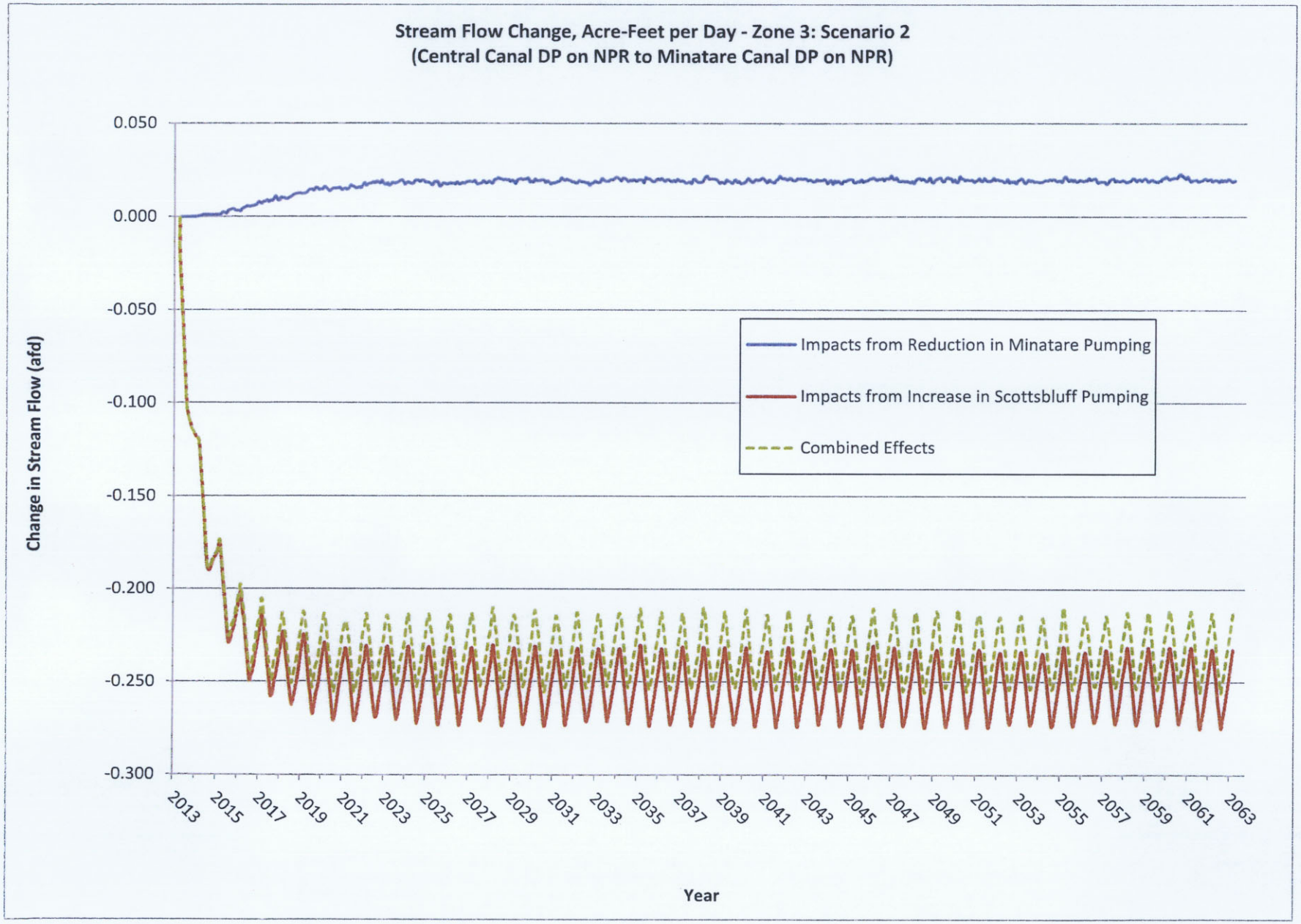
2061
2063
Year
Impacts from Reduction in Minatare Pumping
Impacts from Increase in Scottsbluff Pumping
Combined Effects


Stream Flow Change, Acre-Feet per Day - Zone 3: Scenario 2
(Central Canal DP on NPR to Minatare Canal DP on NPR)
Change in Stream Flow (afd)
0.050
0.000
-0.050
-0.100
-0.150
-0.200
-0.250
-0.300
2013
2015
2017
2019
2021
2023
2025
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2037
2039
2041
2043
2045
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2057
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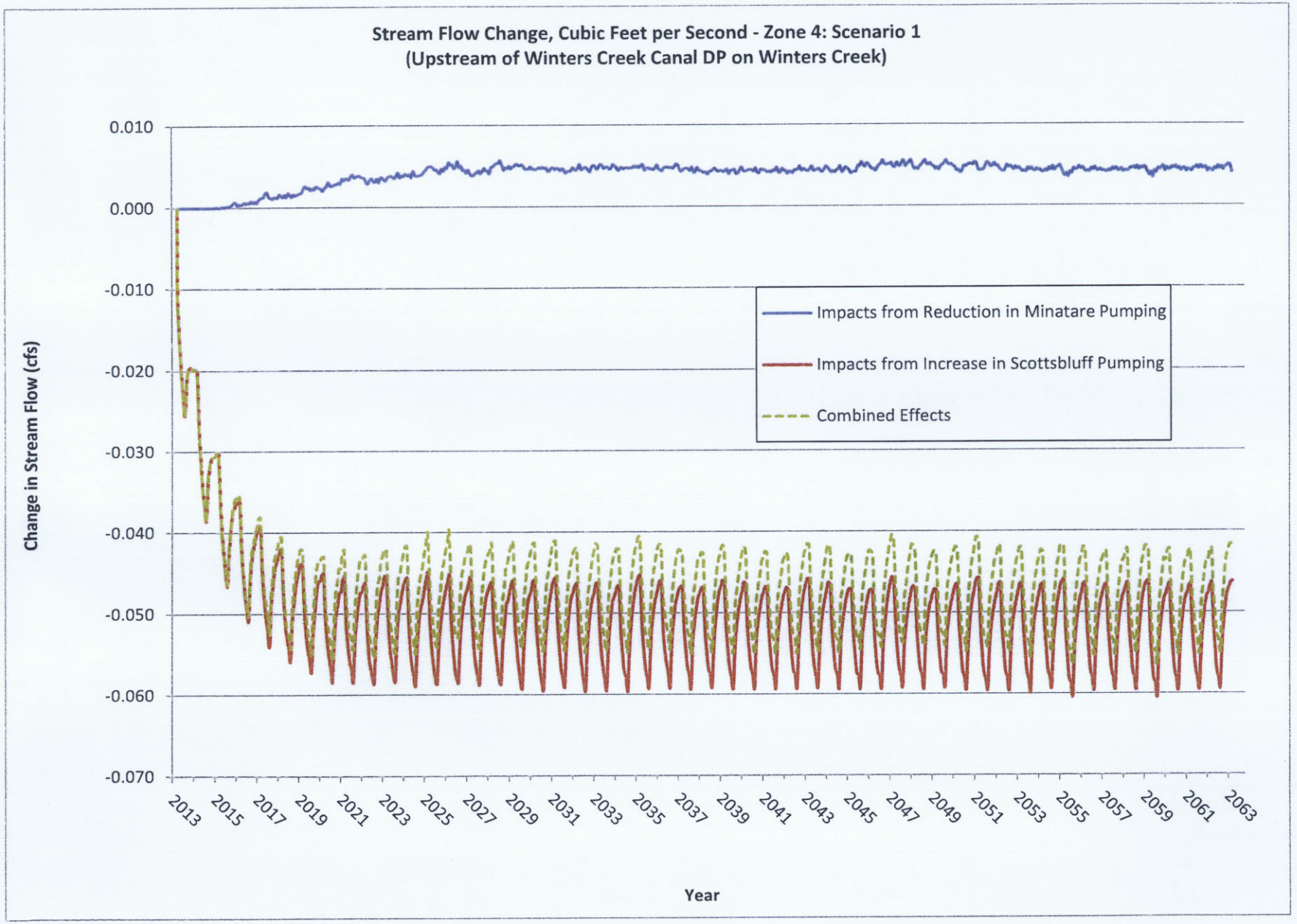
2061
2063
Year
Impacts from Reduction in Minatare Pumping
Impacts from Increase in Scottsbluff Pumping
Combined Effects


Stream Flow Change, Cubic Feet per Second - Zone 4: Scenario 1
(Upstream of Winters Creek Canal DP on Winters Creek)
Change in Stream Flow (cfs)
0.010
0.000
-0.010
-0.020
-0.030
-0.040
-0.050
-0.060
-0.070
2013
2015
2017
2019
2021
2023
2025
2027
2029
2031
2033
2035
2037
2039
2041
2043
2045
2047
2049
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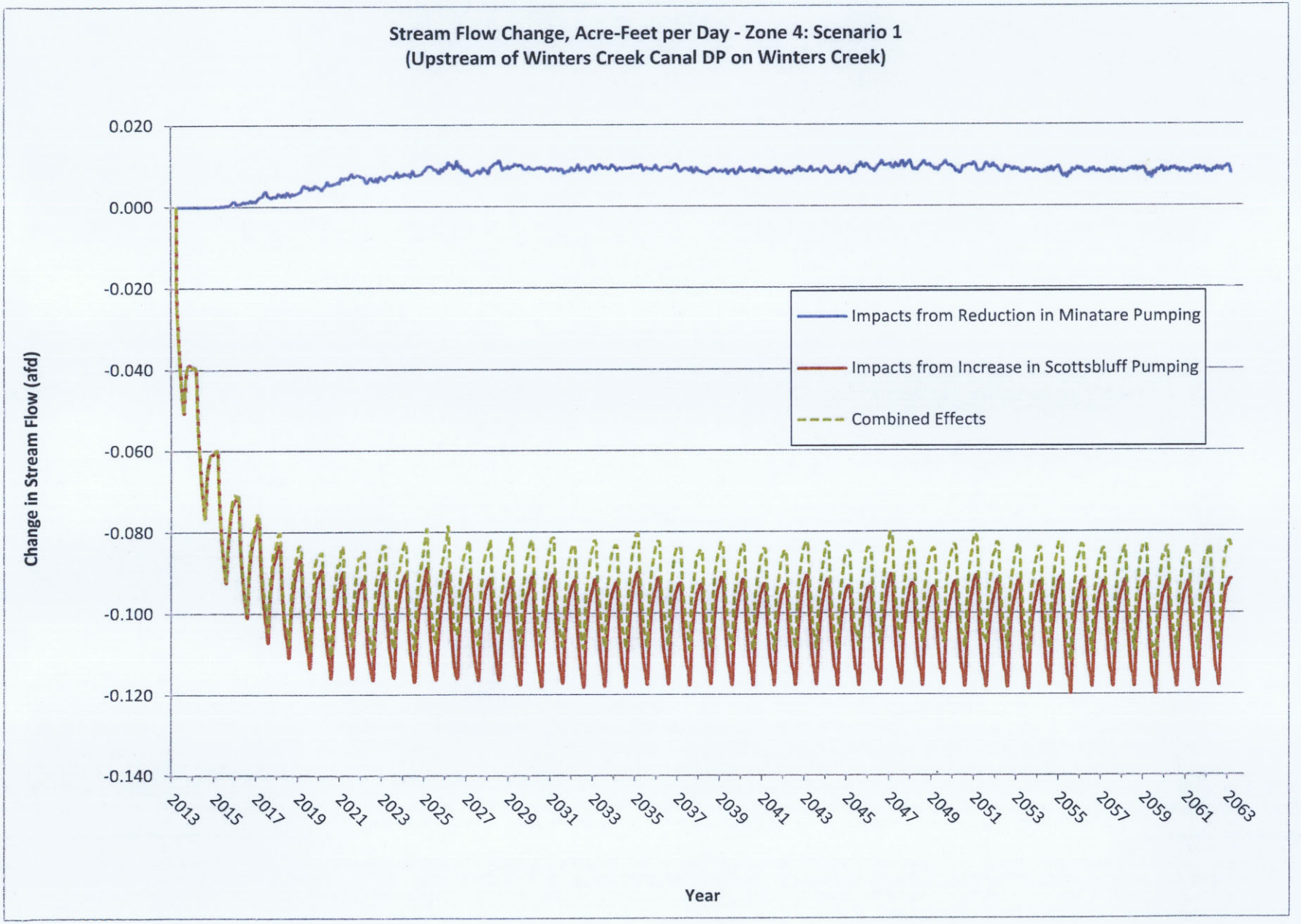
2053
2055
2057
2059
2061
2063
Year
Impacts from Reduction in Minatare Pumping
Impacts from Increase in Scottsbluff Pumping
Combined Effects


Stream Flow Change, Acre-Feet per Day - Zone 4: Scenario 1
(Upstream of Winters Creek Canal DP on Winters Creek)
Change in Stream Flow (afd)
0.020
0.000
-0.020
-0.040
-0.060
-0.080
-0.100
-0.120
-0.140
2013
2015
2017
2019
2021
2023
2025
2027
2029
2031
2033
2035
2037
2039
2041
2043
2045
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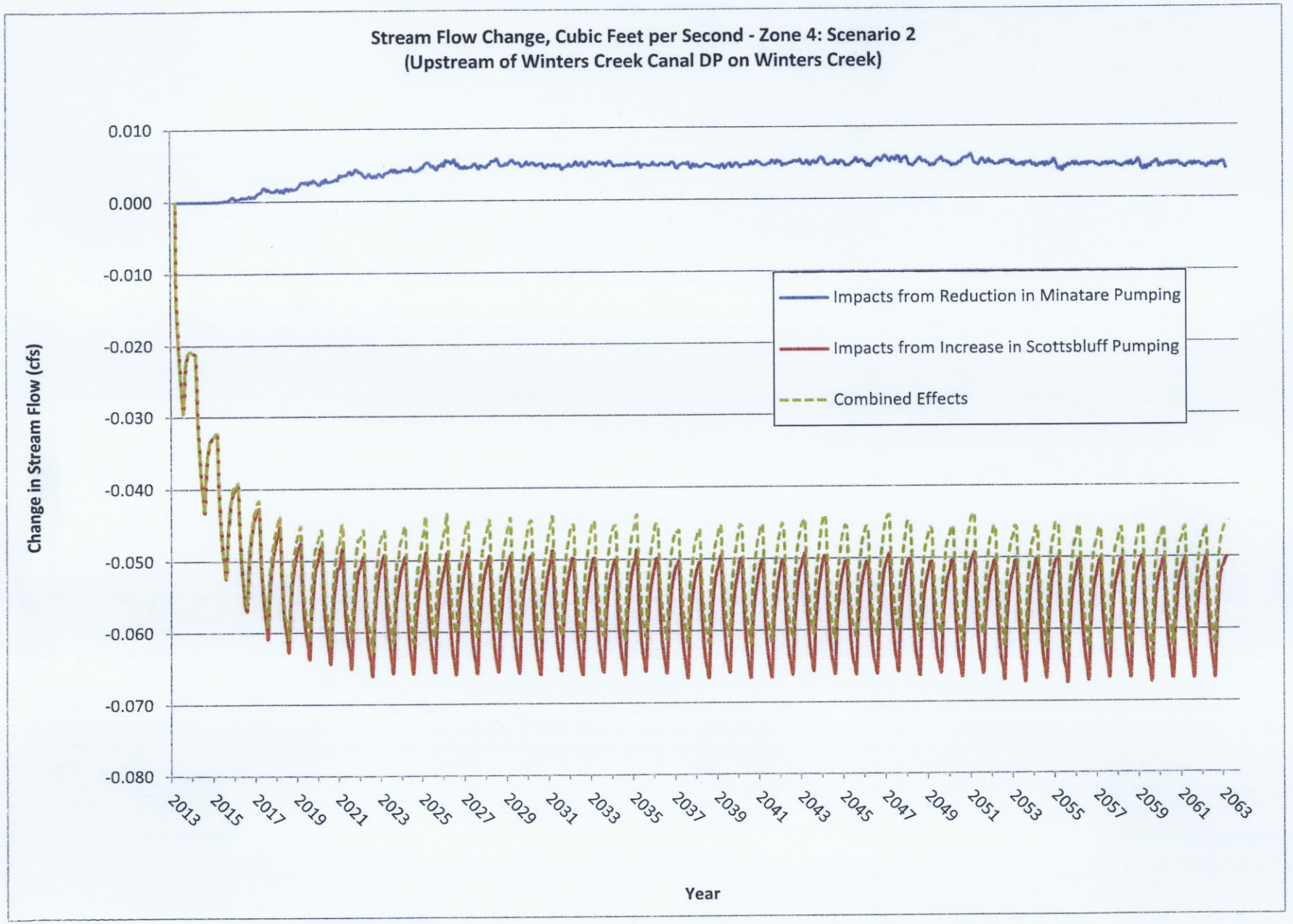
2055
2057
2059
2061
2063
Year
Impacts from Reduction in Minatare Pumping
Impacts from Increase in Scottsbluff Pumping
Combined Effects


Stream Flow Change, Cubic Feet per Second - Zone 4: Scenario 2
(Upstream of Winters Creek Canal DP on Winters Creek)
Change in Stream Flow (cfs)
0.010
0.000
-0.010
-0.020
-0.030
-0.040
-0.050
-0.060
-0.070
-0.080
2013
2015
2017
2019
2021
2023
2025
2027
2029
2031
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2035
2037
2039
2041
2043
2045
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2057
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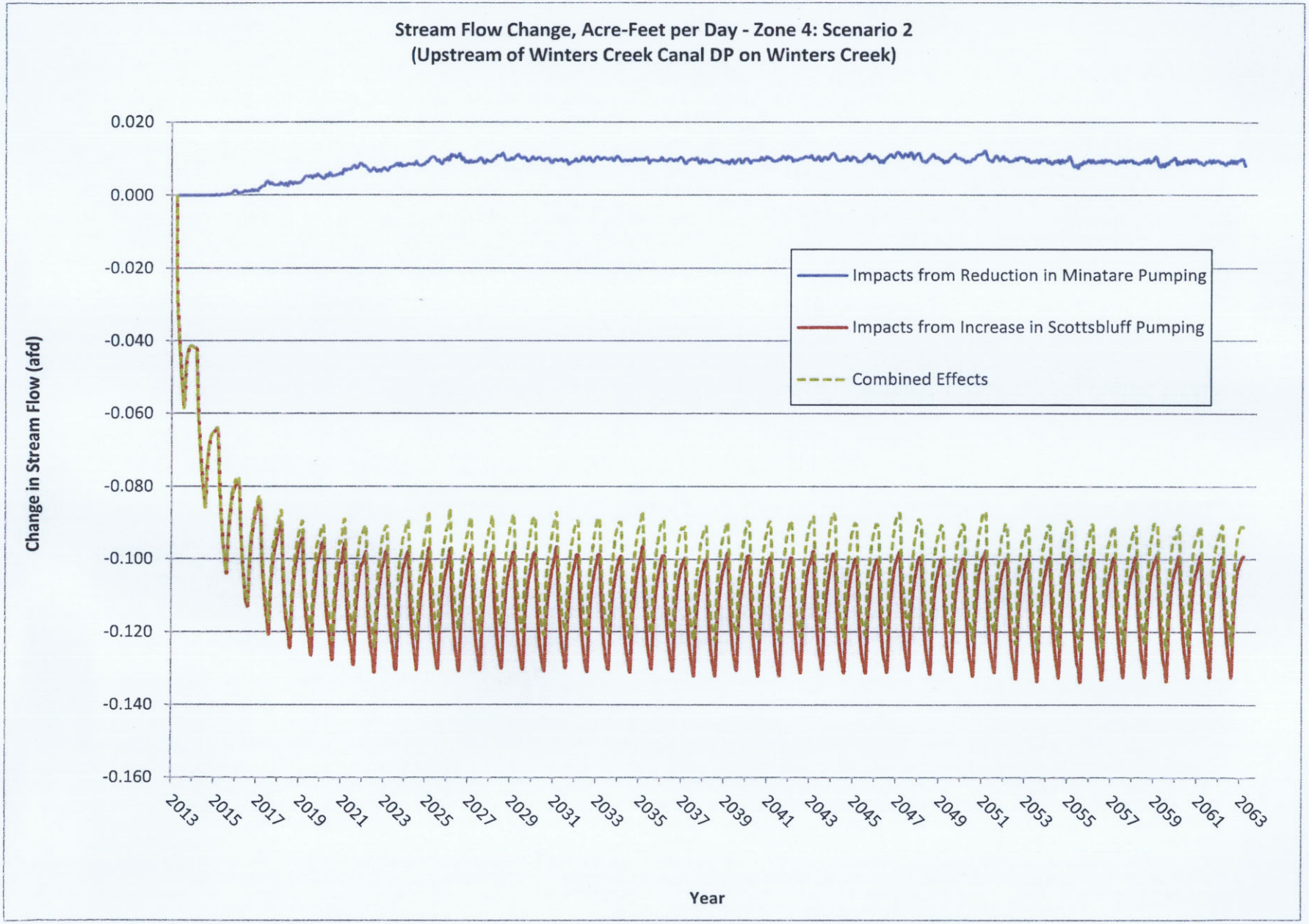
2061
2063
Year
Impacts from Reduction in Minatare Pumping
Impacts from Increase in Scottsbluff Pumping
Combined Effects


Stream Flow Change, Acre-Feet per Day - Zone 4: Scenario 2
(Upstream of Winters Creek Canal DP on Winters Creek)
Change in Stream Flow (afd)
0.020
0.000
-0.020
-0.040
-0.060
-0.080
-0.100
-0.120
-0.140
-0.160
2013
2015
2017
2019
2021
2023
2025
2027
2029
2031
2033
2035
2037
2039
2041
2043
2045
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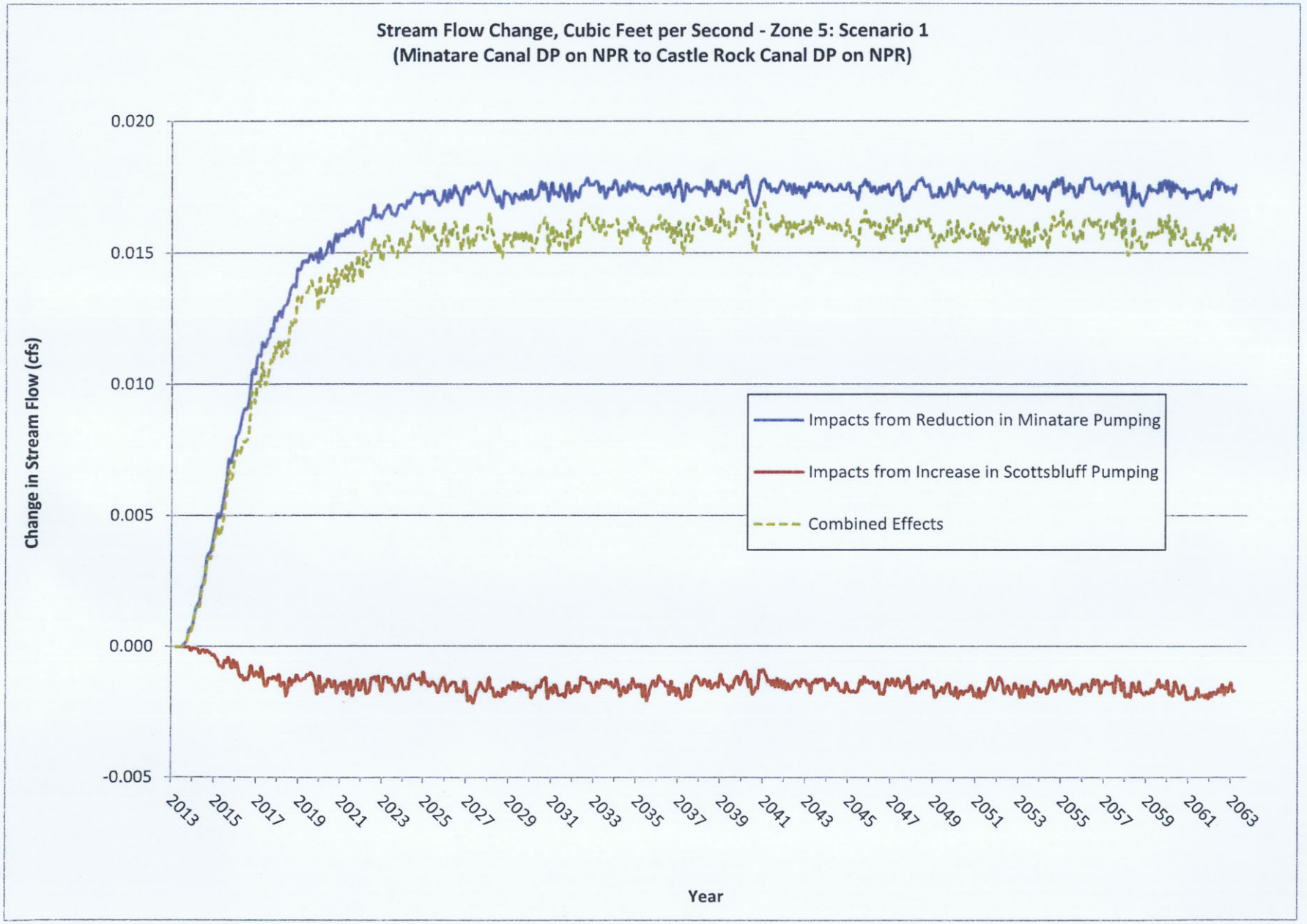
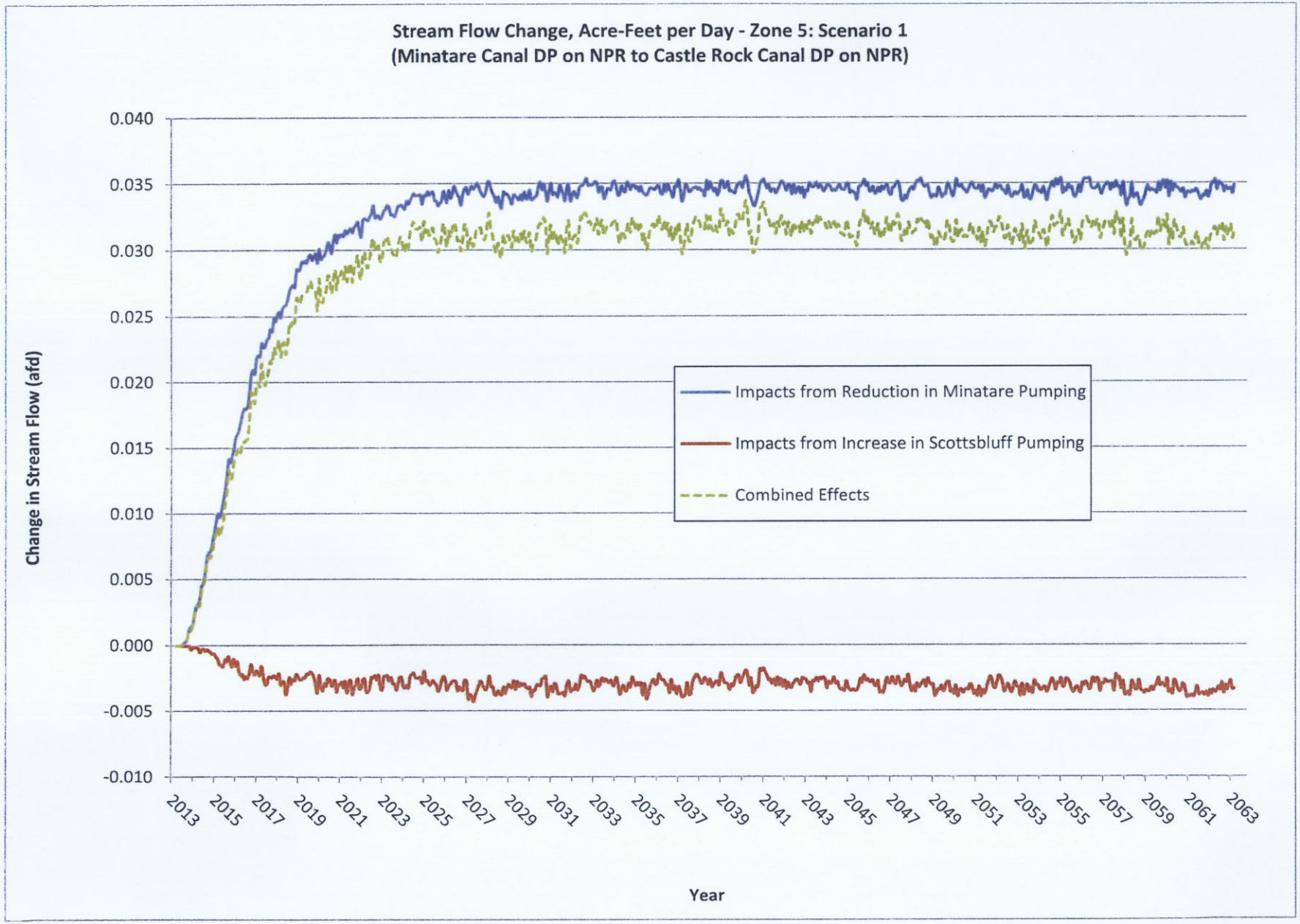
2061
2063
Year
Impacts from Reduction in Minatare Pumping
Impacts from Increase in Scottsbluff Pumping
Combined Effects


Stream Flow Change, Cubic Feet per Second - Zone 5: Scenario 1
(Minatare Canal DP on NPR to Castle Rock Canal DP on NPR)
Change in Stream Flow (cfs)
0.020
0.015
0.010
0.005
0.000
-0.005
2013
2015
2017
2019
2021
2023
2025
2027
2029
2031
2033
2035
2037
2039
2041
2043
2045
2047
2049
2051
2053
2055
2057
2059
2061
2063
Year
Impacts from Reduction in Minatare Pumping
Impacts from Increase in Scottsbluff Pumping
Combined Effects


Stream Flow Change, Acre-Feet per Day - Zone 5: Scenario 1
(Minatare Canal DP on NPR to Castle Rock Canal DP on NPR)
Change in Stream Flow (afd)
0.040
0.035
0.030
0.025
0.020
0.015
0.010
0.005
0.000
-0.005
-0.010
2013
2015
2017
2019
2021
2023
2025
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2031
2033
2035
2037
2039
2041
2043
2045
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2049
2051
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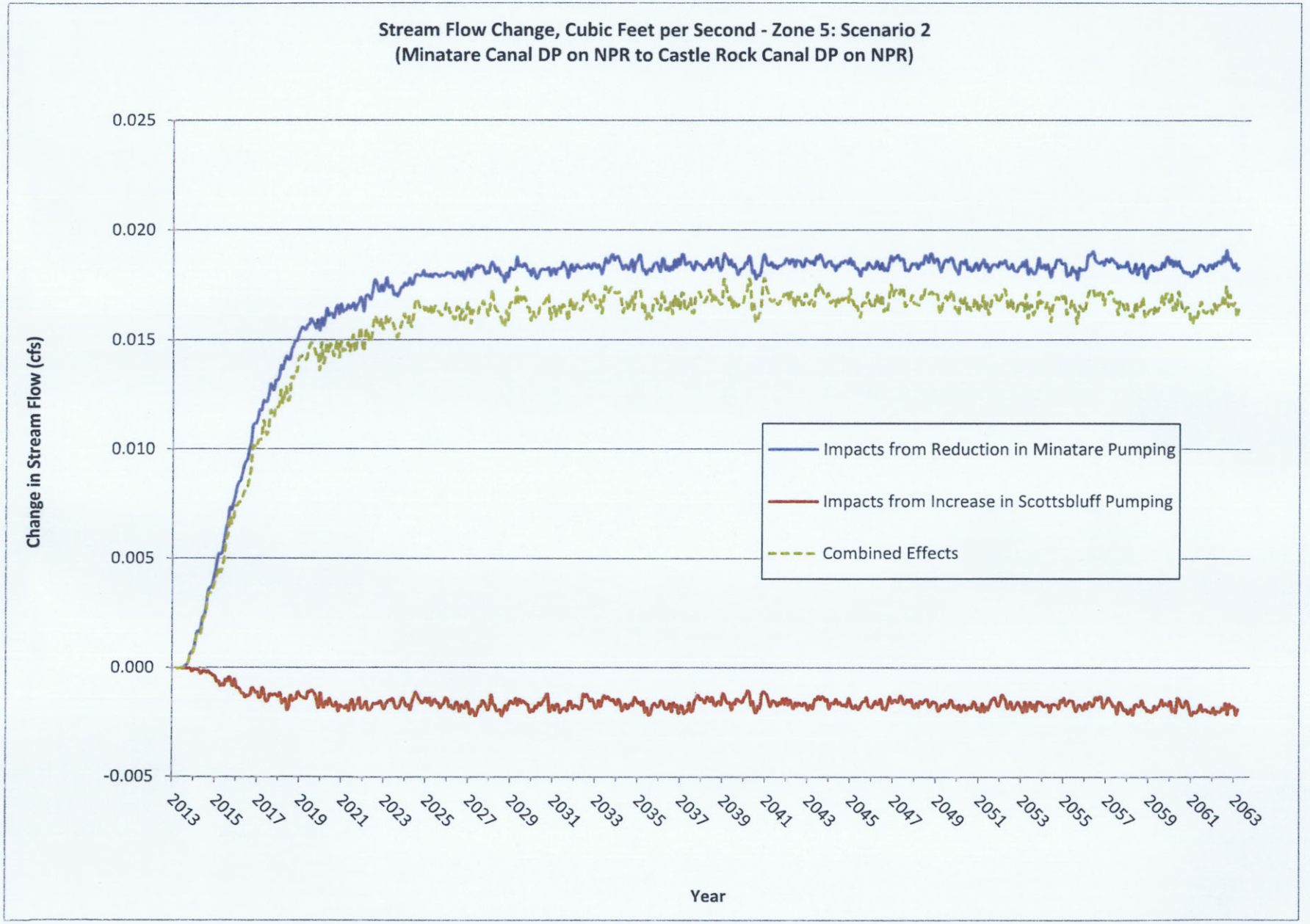
2057
2059
2061
2063
Year
Impacts from Reduction in Minatare Pumping
Impacts from Increase in Scottsbluff Pumping
Combined Effects


Stream Flow Change, Cubic Feet per Second - Zone 5: Scenario 2
(Minatare Canal DP on NPR to Castle Rock Canal DP on NPR)
Change in Stream Flow (cfs)
0.025
0.020
0.015
0.010
0.005
0.000
-0.005
2013
2015
2017
2019
2021
2023
2025
2027
2029
2031
2033
2035
2037
2039
2041
2043
2045
2047
2049
2051
2053
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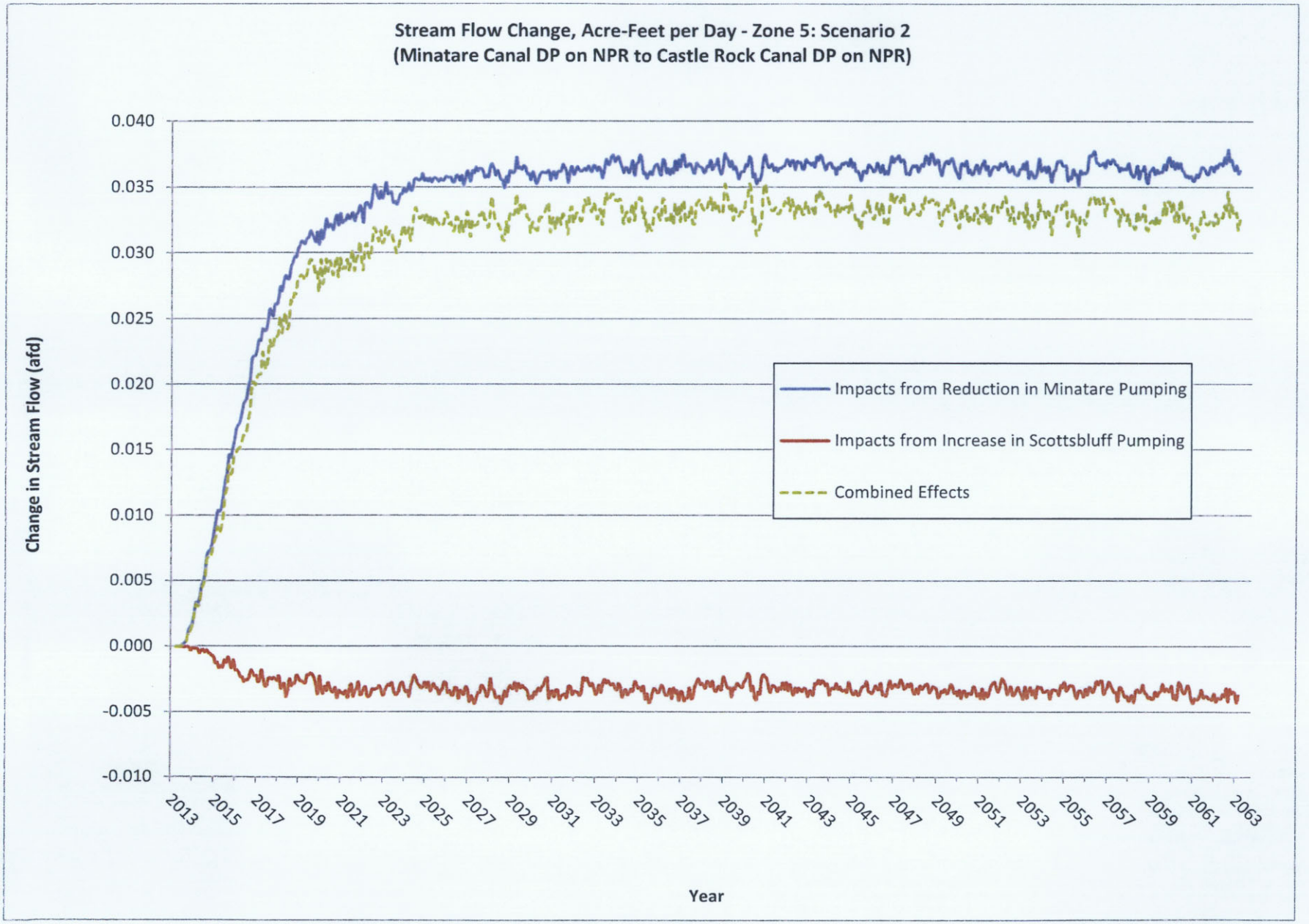
2057
2059
2061
2063
Year
Impacts from Reduction in Minatare Pumping
Impacts from Increase in Scottsbluff Pumping
Combined Effects


Stream Flow Change, Acre-Feet per Day - Zone 5: Scenario 2
(Minatare Canal DP on NPR to Castle Rock Canal DP on NPR)
Change in Stream Flow (afd)
0.040
0.035
0.030
0.025
0.020
0.015
0.010
0.005
0.000
-0.005
-0.010
2013
2015
2017
2019
2021
2023
2025
2027
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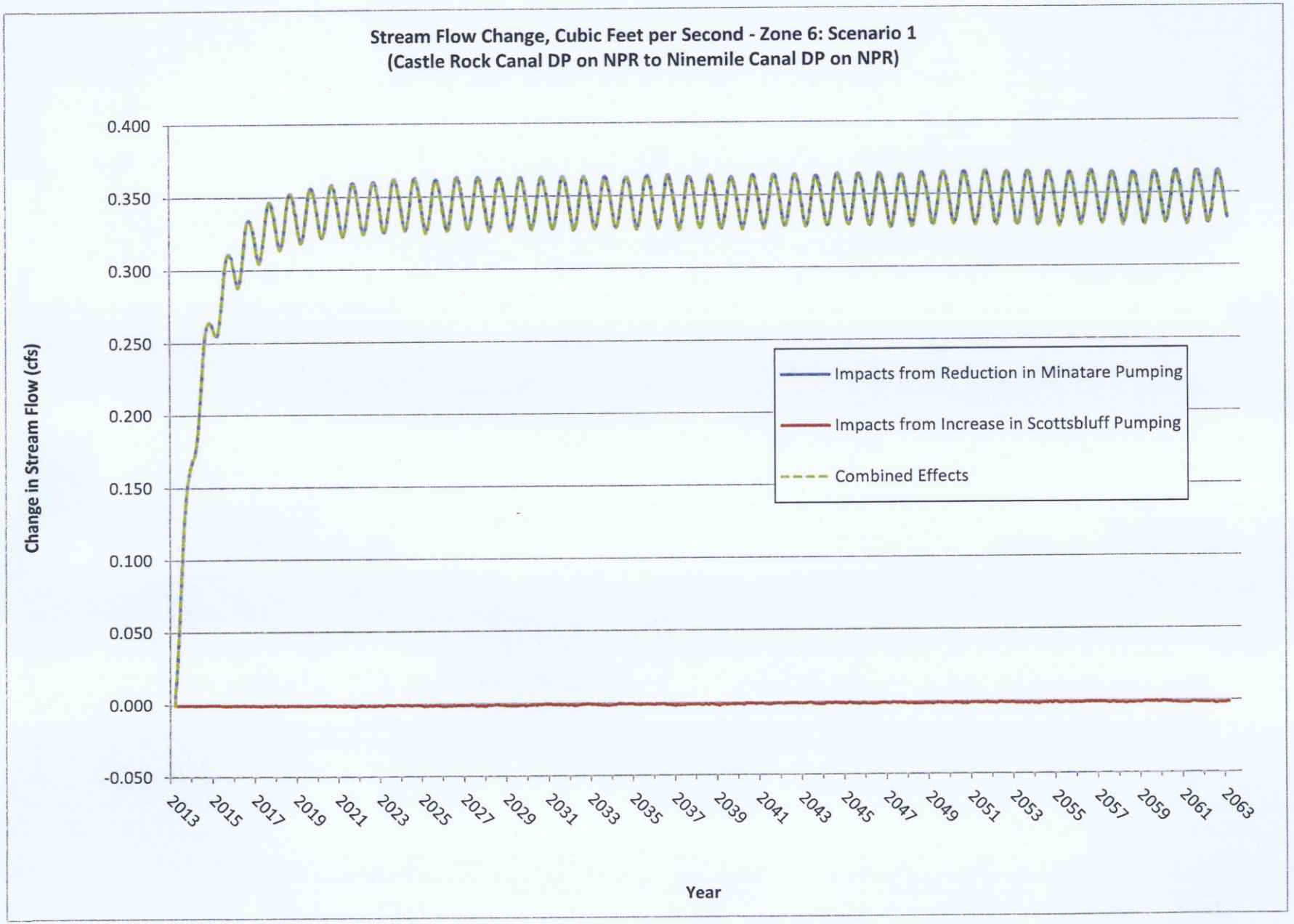
2031
2033
2035
2037
2039
2041
2043
2045
2047
2049
2051
2053
2055
2057
2059
2061
2063
Year
Impacts from Reduction in Minatare Pumping
Impacts from Increase in Scottsbluff Pumping
Combined Effects


Stream Flow Change, Cubic Feet per Second - Zone 6: Scenario 1
(Castle Rock Canal DP on NPR to Ninemile Canal DP on NPR)
Change in Stream Flow (cfs)
0.400
0.350
0.300
0.250
0.200
0.150
0.100
0.050
0.000
-0.050
2013
2015
2017
2019
2021
2023
2025
2027
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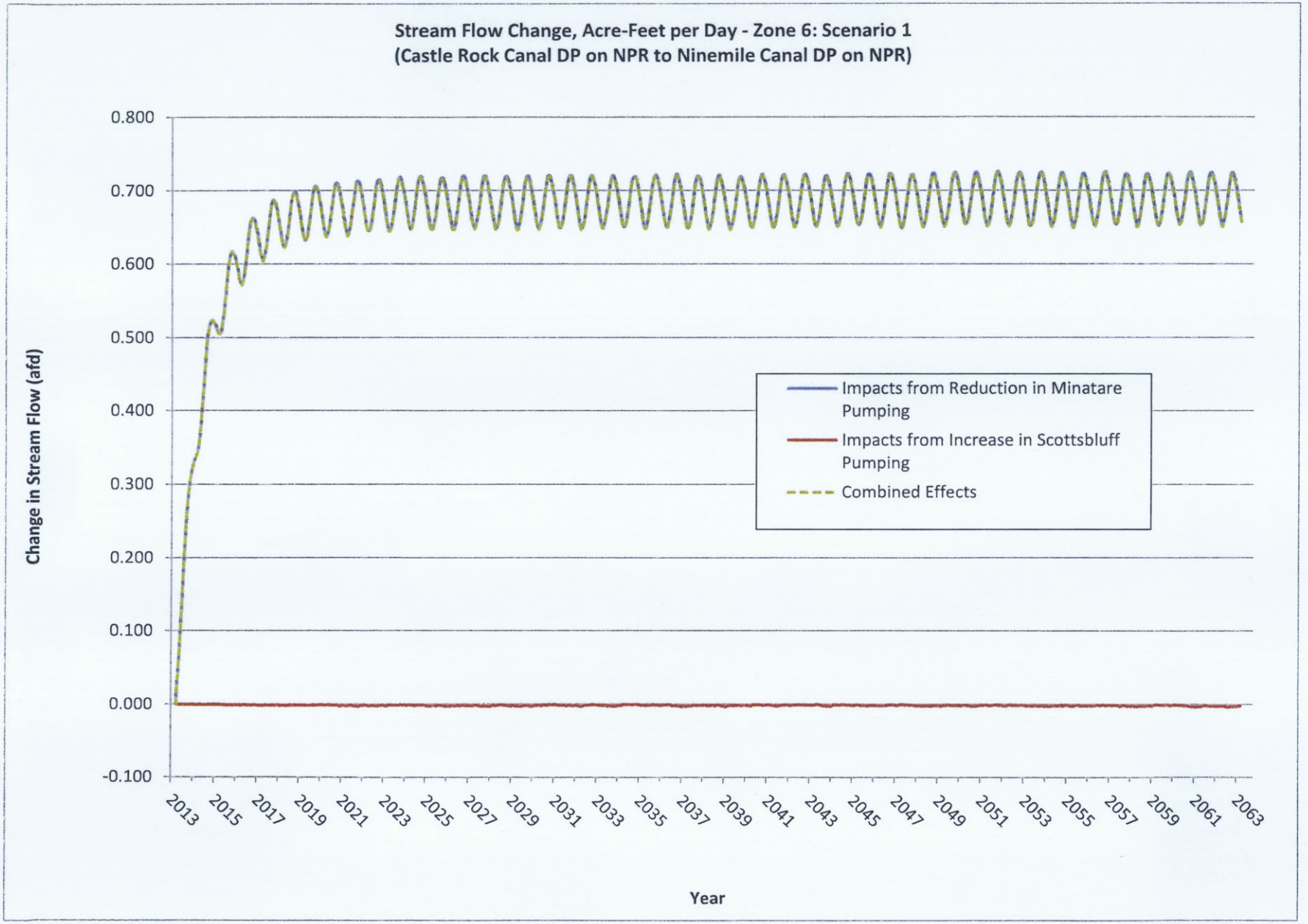
2039
2041
2043
2045
2047
2049
2051
2053
2055
2057
2059
2061
2063
Year
Impacts from Reduction in Minatare Pumping
Impacts from Increase in Scottsbluff Pumping
Combined Effects


Stream Flow Change, Acre-Feet per Day - Zone 6: Scenario 1
(Castle Rock Canal DP on NPR to Ninemile Canal DP on NPR)
Change in Stream Flow (afd)
0.800
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
-0.100
2013
2015
2017
2019
2021
2023
2025
2027
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2031
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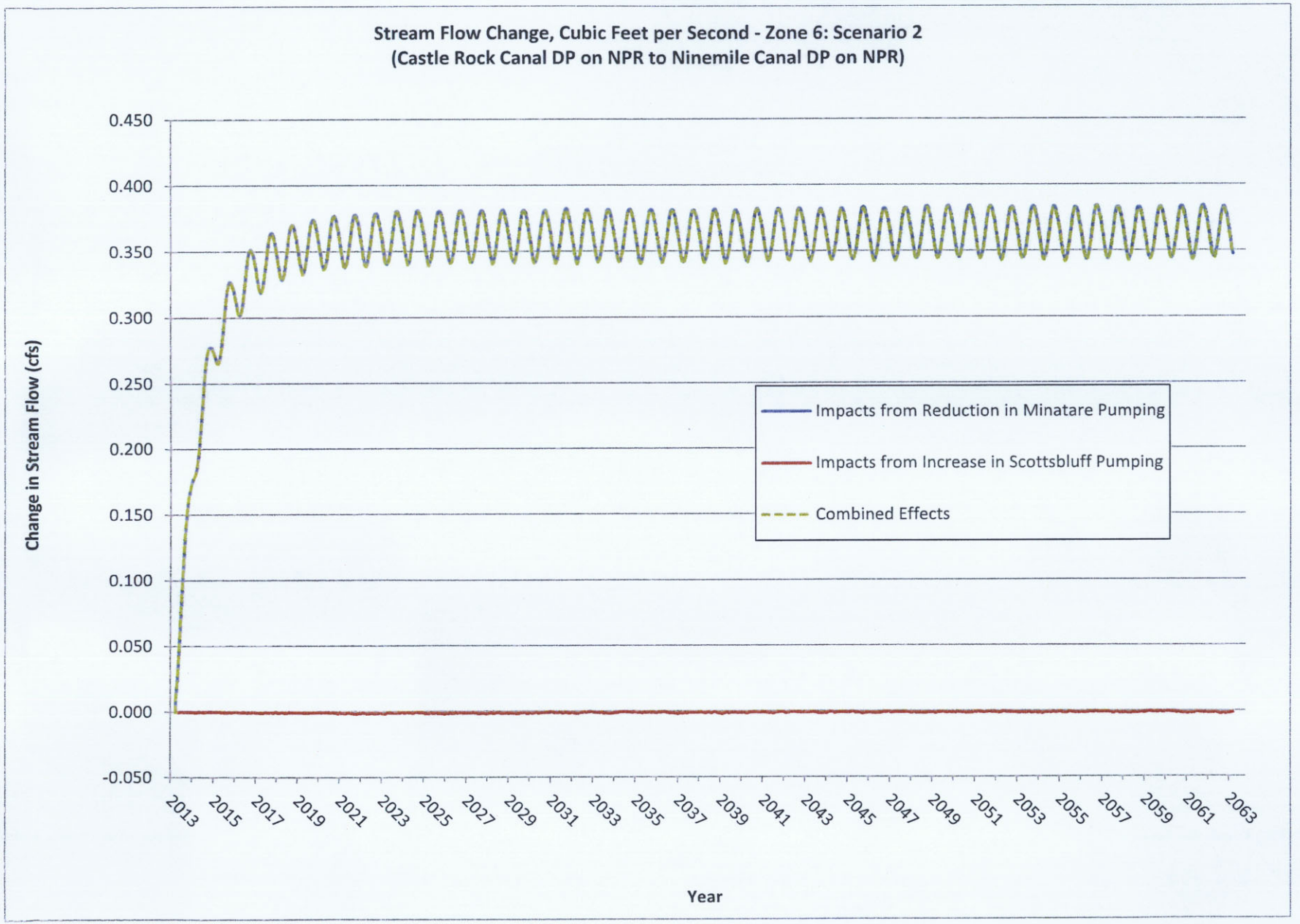
2041
2043
2045
2047
2049
2051
2053
2055
2057
2059
2061
2063
Year
Impacts from Reduction in Minatare Pumping
Impacts from Increase in Scottsbluff Pumping
Combined Effects


Stream Flow Change, Cubic Feet per Second - Zone 6: Scenario 2
(Castle Rock Canal DP on NPR to Ninemile Canal DP on NPR)
Change in Stream Flow (cfs)
0.450
0.400
0.350
0.300
0.250
0.200
0.150
0.100
0.050
0.000
-0.050
2013
2015
2017
2019
2021
2023
2025
2027
2029
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2035
2037
2039
2041
2043
2045
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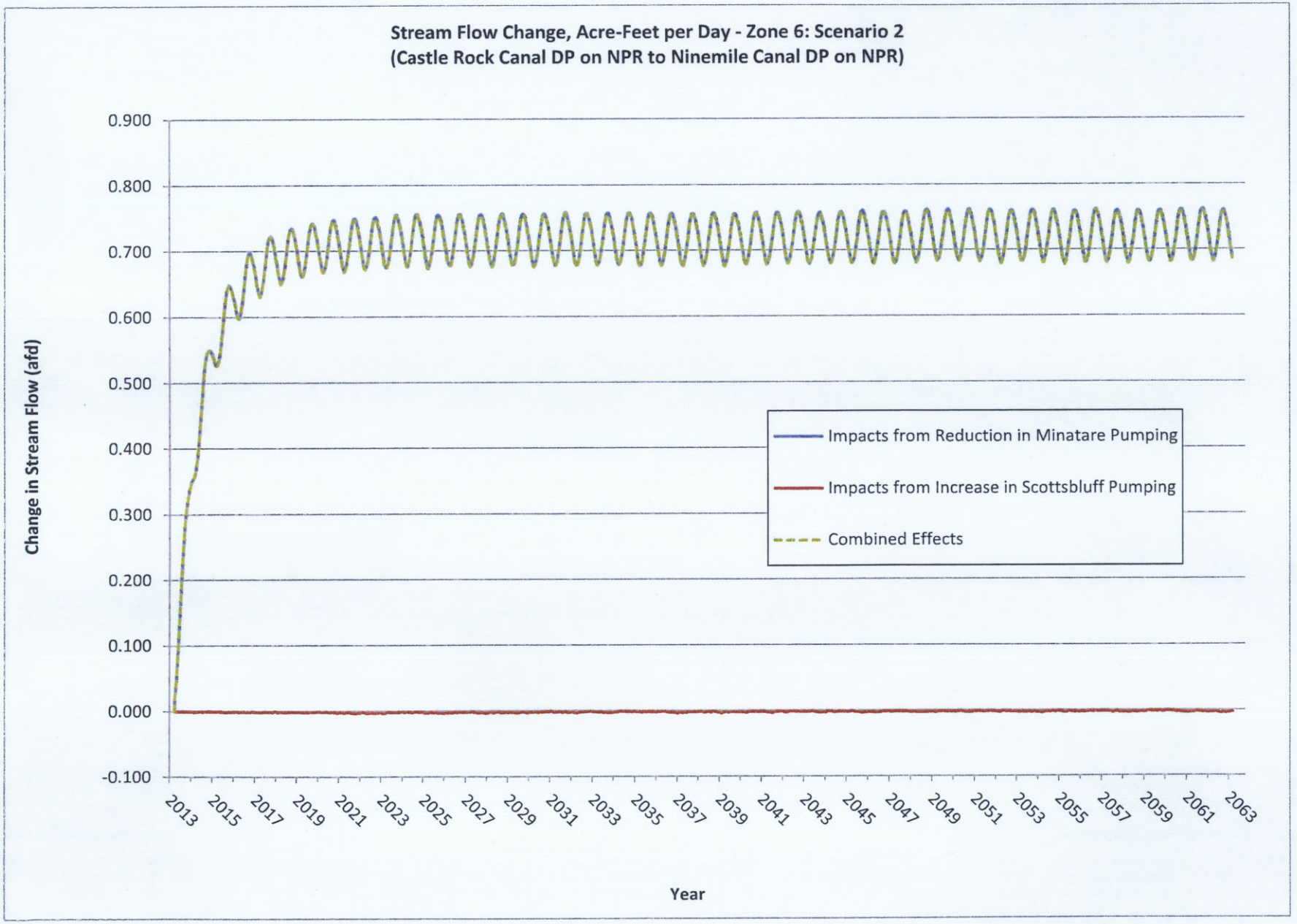
2049
2051
2053
2055
2057
2059
2061
2063
Year
Impacts from Reduction in Minatare Pumping
Impacts from Increase in Scottsbluff Pumping
Combined Effects


Stream Flow Change, Acre-Feet per Day - Zone 6: Scenario 2
(Castle Rock Canal DP on NPR to Ninemile Canal DP on NPR)
Change in Stream Flow (afd)
0.900
0.800
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
-0.100
2013
2015
2017
2019
2021
2023
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2041
2043
2045
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2051
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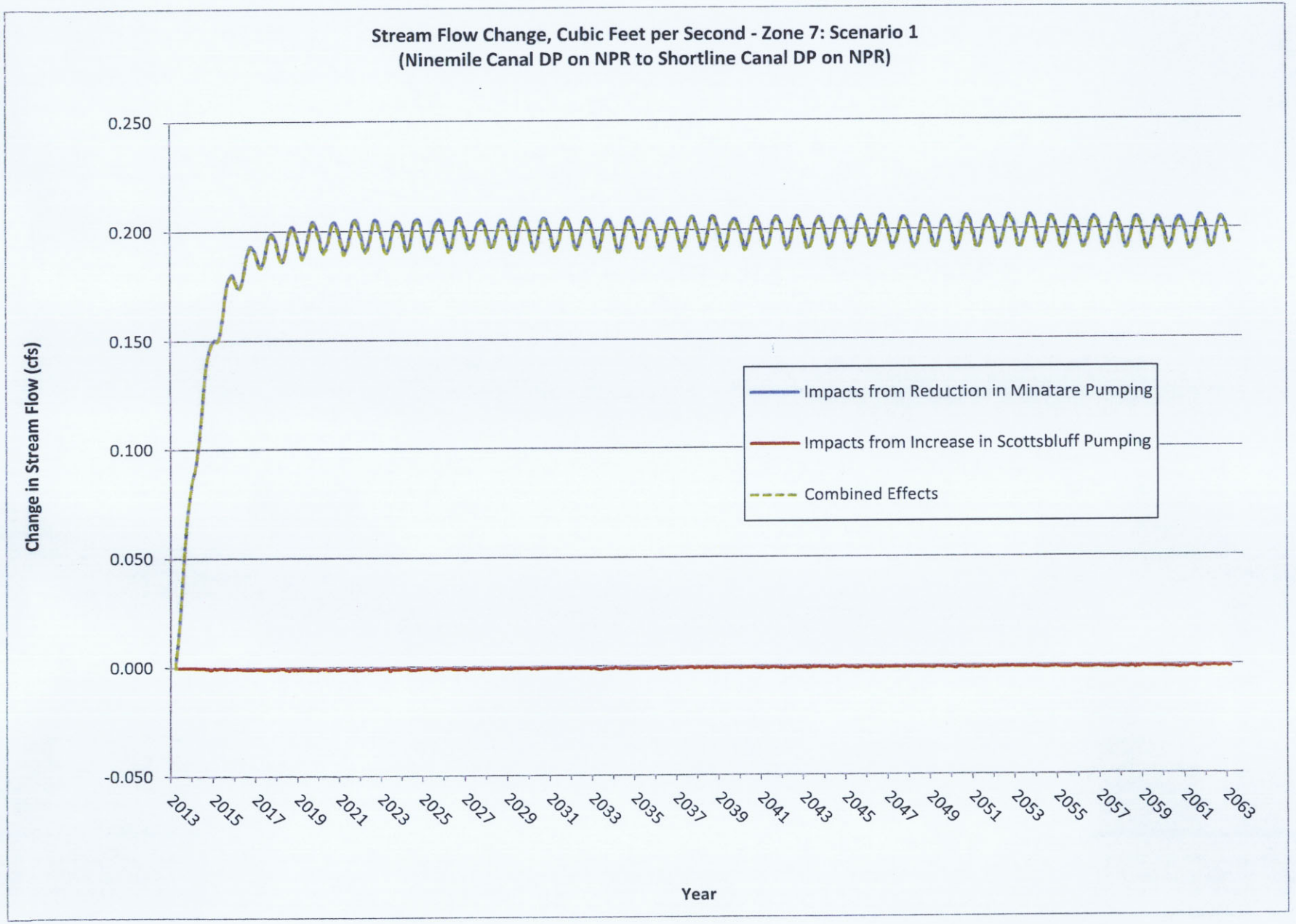
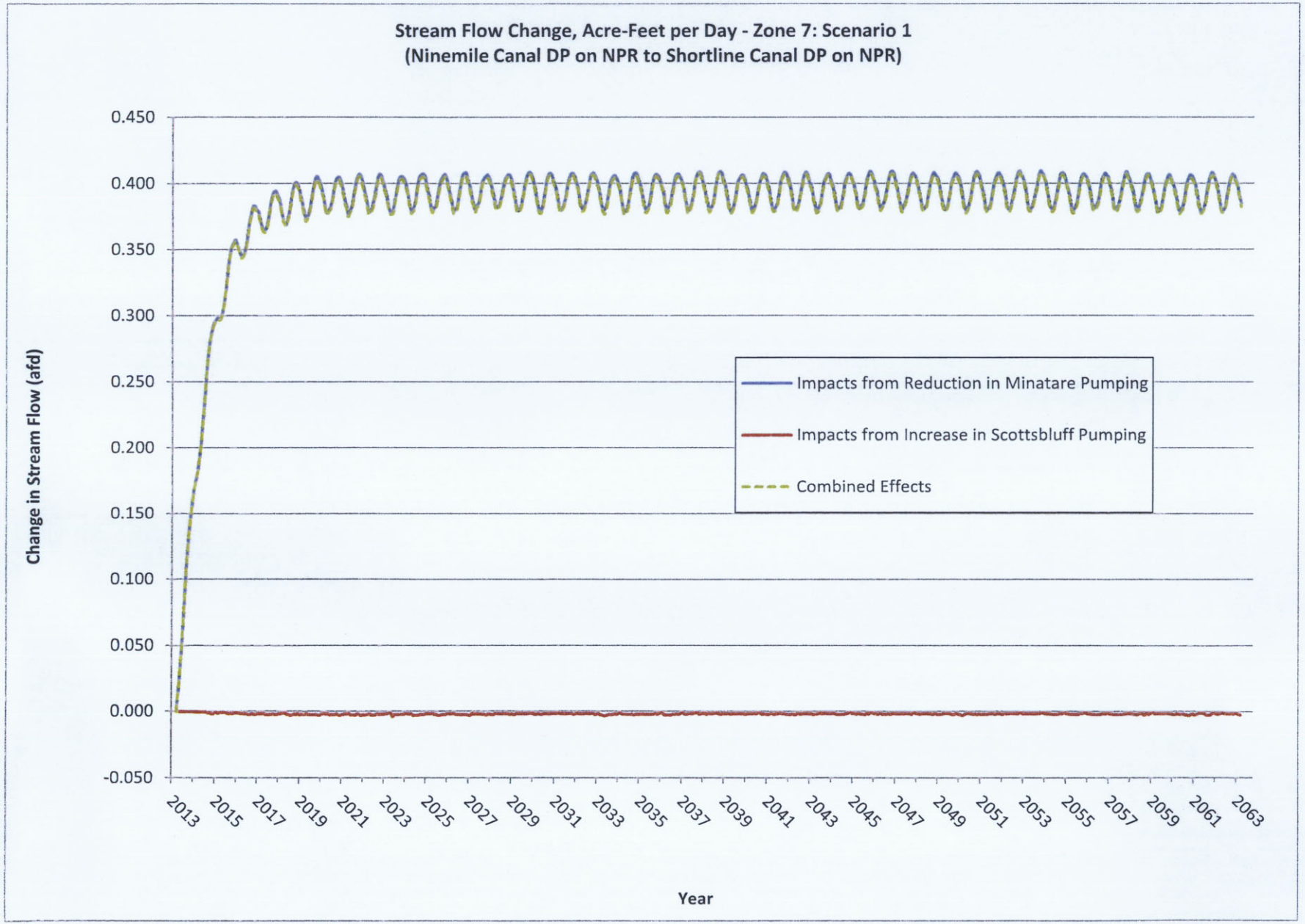
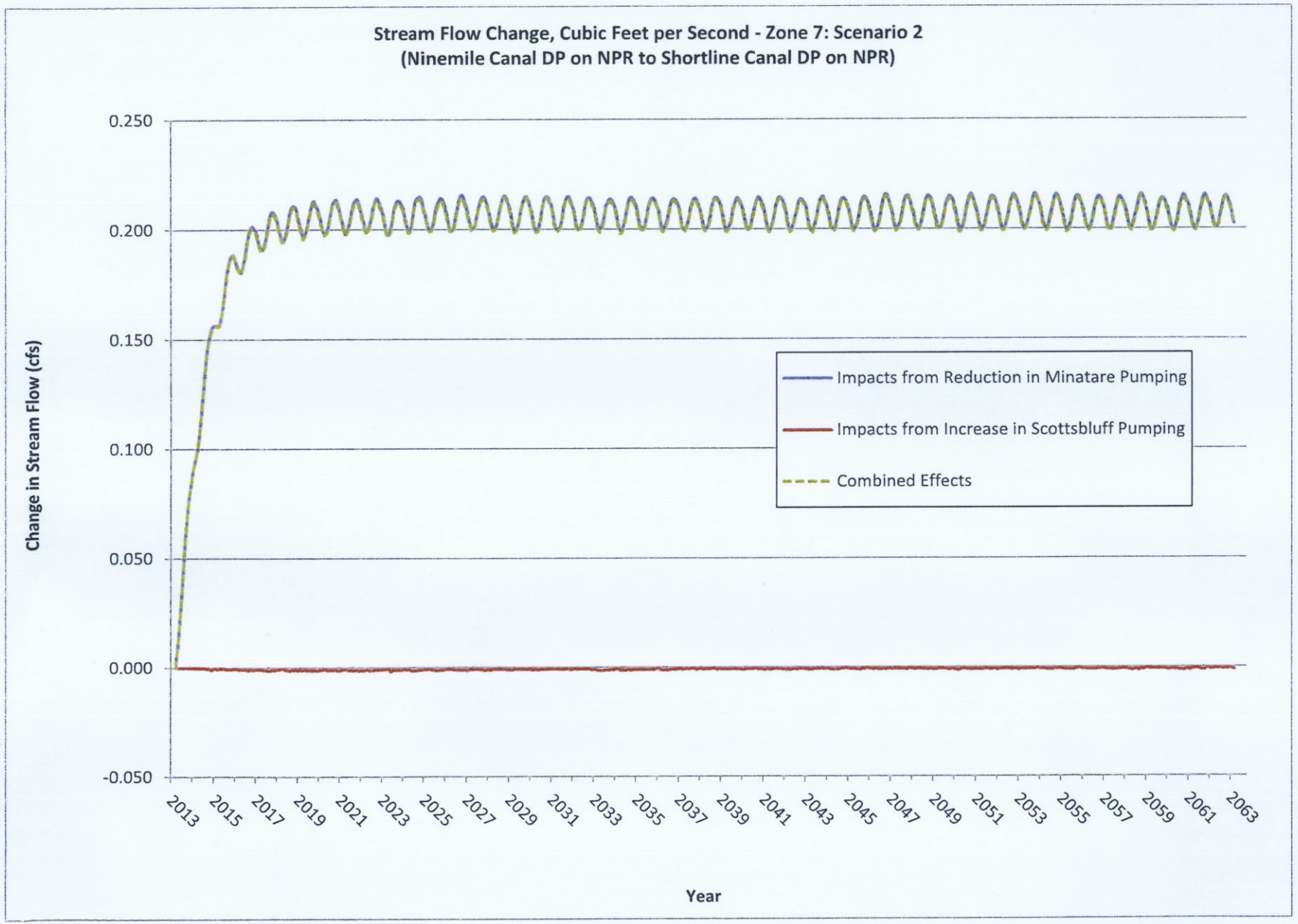
2057
2059
2061
2063
Year
Impacts from Reduction in Minatare Pumping
Impacts from Increase in Scottsbluff Pumping
Combined Effects


Stream Flow Change, Cubic Feet per Second - Zone 7: Scenario 1
(Ninemile Canal DP on NPR to Shortline Canal DP on NPR)
Change in Stream Flow (cfs)
0.250
0.200
0.150
0.100
0.050
0.000
-0.050
2013
2015
2017
2019
2021
2023
2025
2027
2029
2031
2033
2035
2037
2039
2041
2043
2045
2047
2049
2051
2053
2055
2057
2059
2061
2063
Year
Impacts from Reduction in Minatare Pumping
Impacts from Increase in Scottsbluff Pumping
Combined Effects


Stream Flow Change, Acre-Feet per Day - Zone 7: Scenario 1
(Ninemile Canal DP on NPR to Shortline Canal DP on NPR)
Change in Stream Flow (afd)
0.450
0.400
0.350
0.300
0.250
0.200
0.150
0.100
0.050
0.000
-0.050
2013
2015
2017
2019
2021
2023
2025
2027
2029
2031
2033
2035
2037
2039
2041
2043
2045
2047
2049
2051
2053
2055
2057
2059
2061
2063
Year
Impacts from Reduction in Minatare Pumping
Impacts from Increase in Scottsbluff Pumping
Combined Effects


Stream Flow Change, Cubic Feet per Second - Zone 7: Scenario 2
(Ninemile Canal DP on NPR to Shortline Canal DP on NPR)
Change in Stream Flow (cfs)
0.250
0.200
0.150
0.100
0.050
0.000
-0.050
2013
2015
2017
2019
2021
2023
2025
2027
2029
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2037
2039
2041
2043
2045
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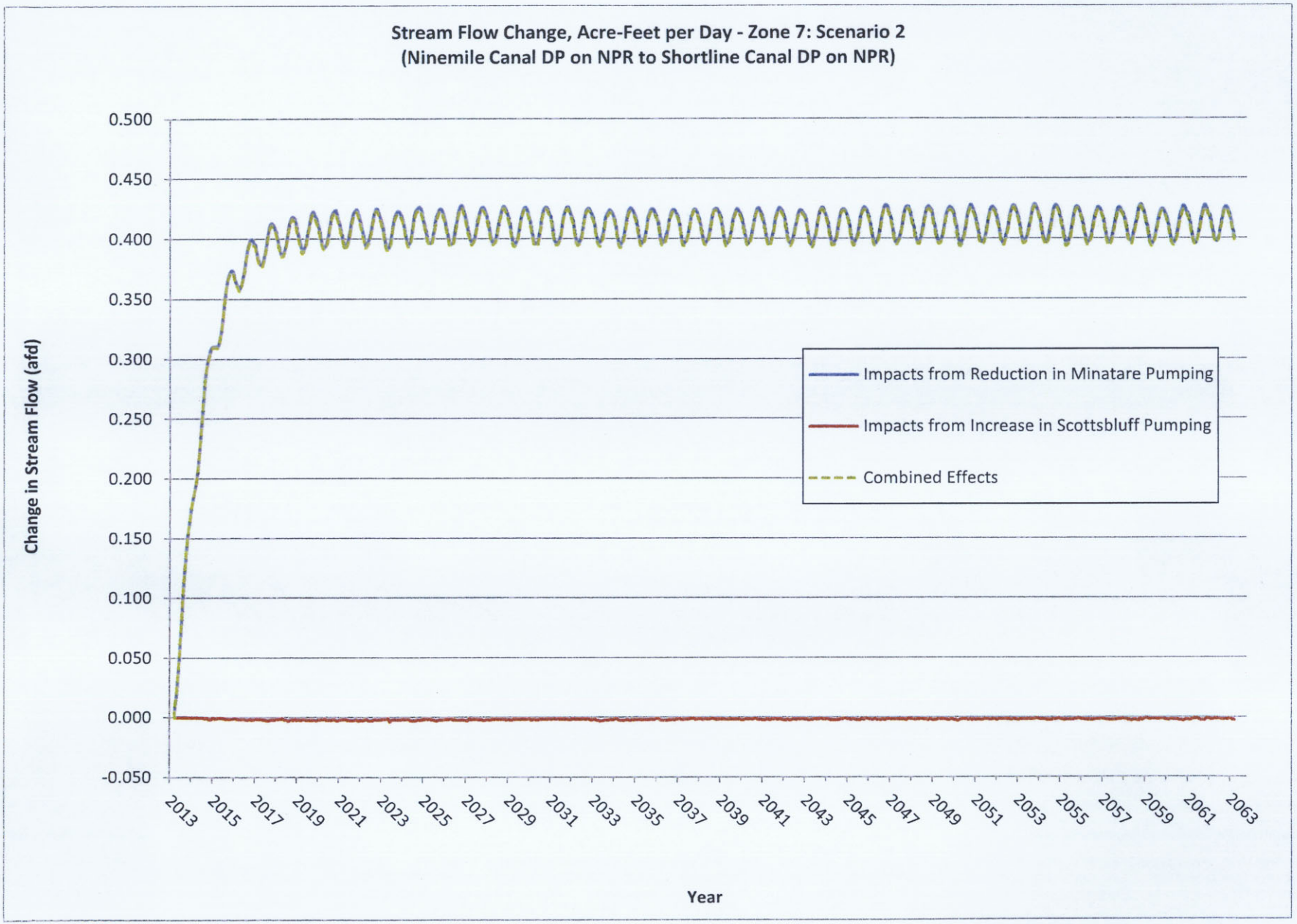
2061
2063
Year
Impacts from Reduction in Minatare Pumping
Impacts from Increase in Scottsbluff Pumping
Combined Effects


Stream Flow Change, Acre-Feet per Day - Zone 7: Scenario 2
(Ninemile Canal DP on NPR to Shortline Canal DP on NPR)
Change in Stream Flow (afd)
0.500
0.450
0.400
0.350
0.300
0.250
0.200
0.150
0.100
0.050
0.000
-0.050
2013
2015
2017
2019
2021
2023
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2037
2039
2041
2043
2045
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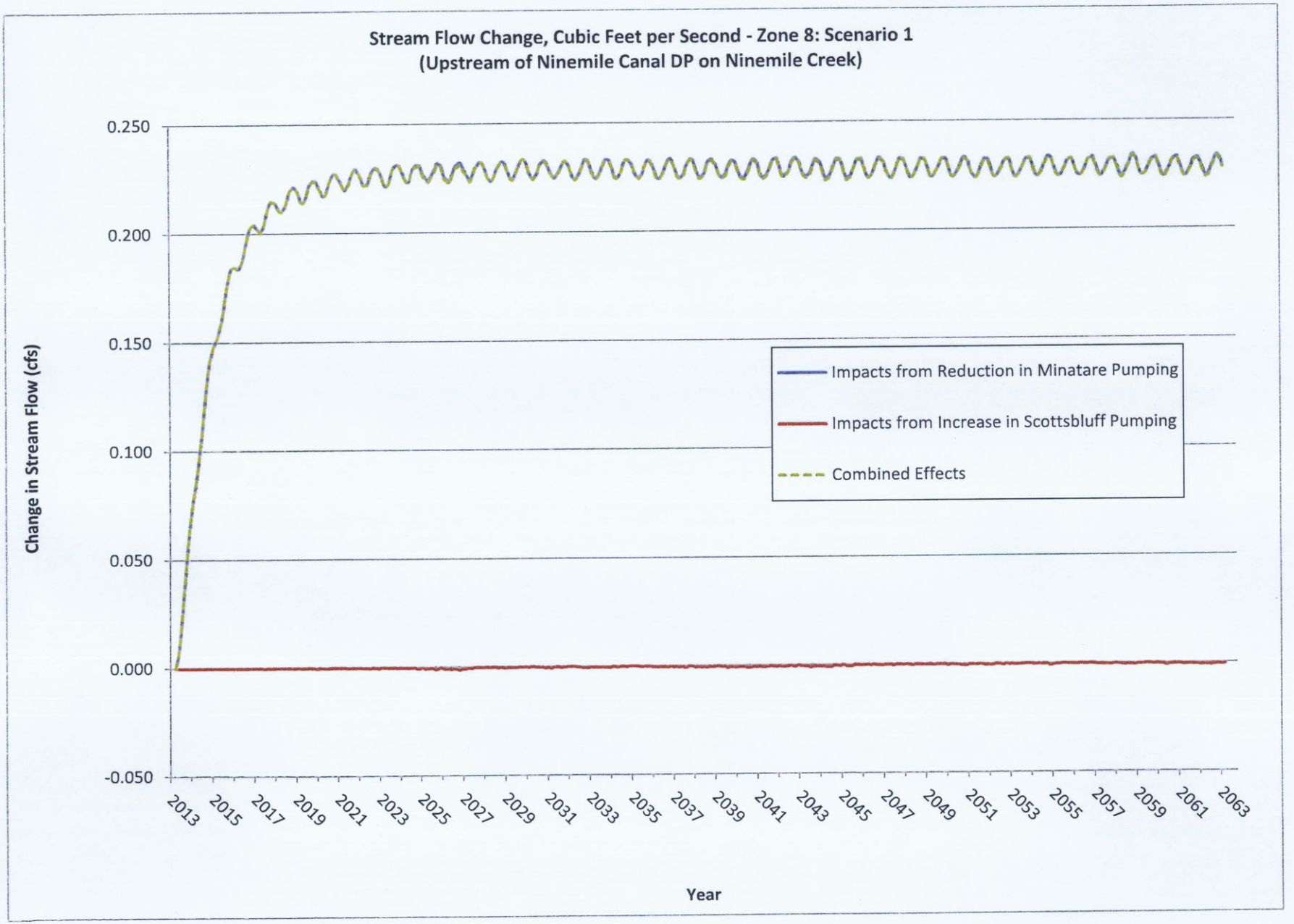
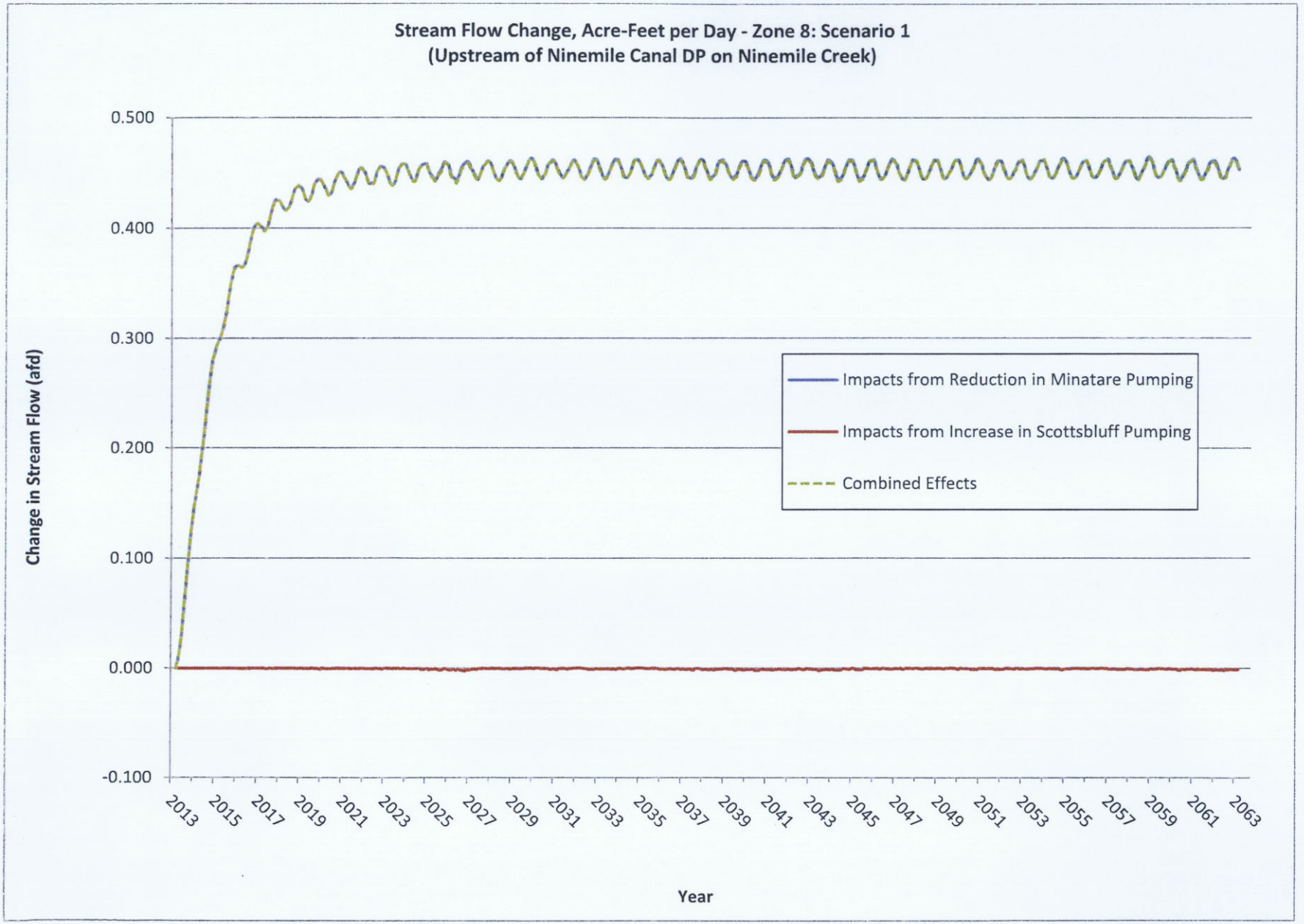
2063
Year
Impacts from Reduction in Minatare Pumping
Impacts from Increase in Scottsbluff Pumping
Combined Effects


Stream Flow Change, Cubic Feet per Second - Zone 8: Scenario 1
(Upstream of Ninemile Canal DP on Ninemile Creek)
Change in Stream Flow (cfs)
0.250
0.200
0.150
0.100
0.050
0.000
-0.050
2013
2015
2017
2019
2021
2023
2025
2027
2029
2031
2033
2035
2037
2039
2041
2043
2045
2047
2049
2051
2053
2055
2057
2059
2061
2063
Year
Impacts from Reduction in Minatare Pumping
Impacts from Increase in Scottsbluff Pumping
Combined Effects


Stream Flow Change, Acre-Feet per Day - Zone 8: Scenario 1
(Upstream of Ninemile Canal DP on Ninemile Creek)
Change in Stream Flow (afd)
0.500
0.400
0.300
0.200
0.100
0.000
-0.100
2013
2015
2017
2019
2021
2023
2025
2027
2029
2031
2033
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2037
2039
2041
2043
2045
2047
2049
2051
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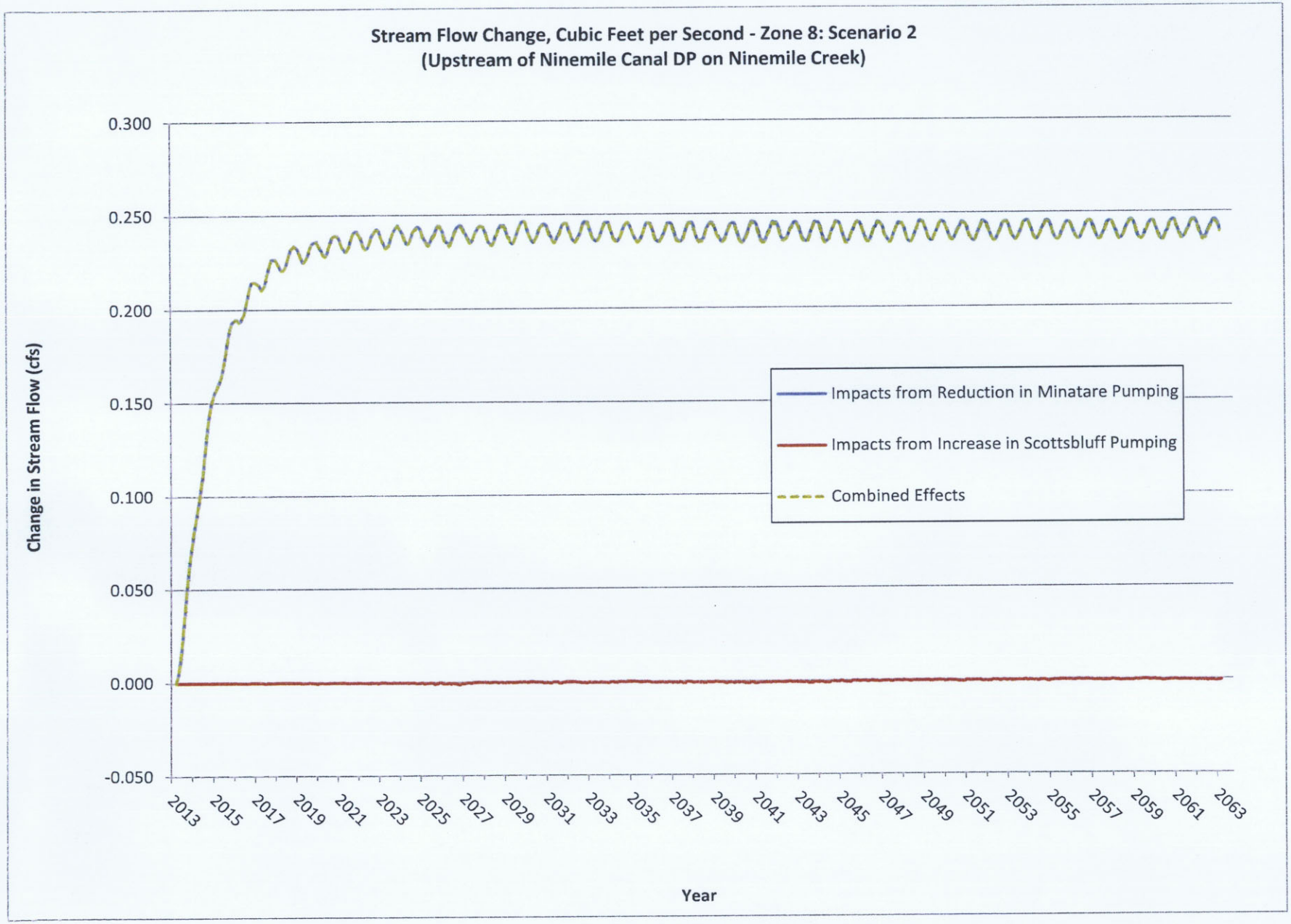
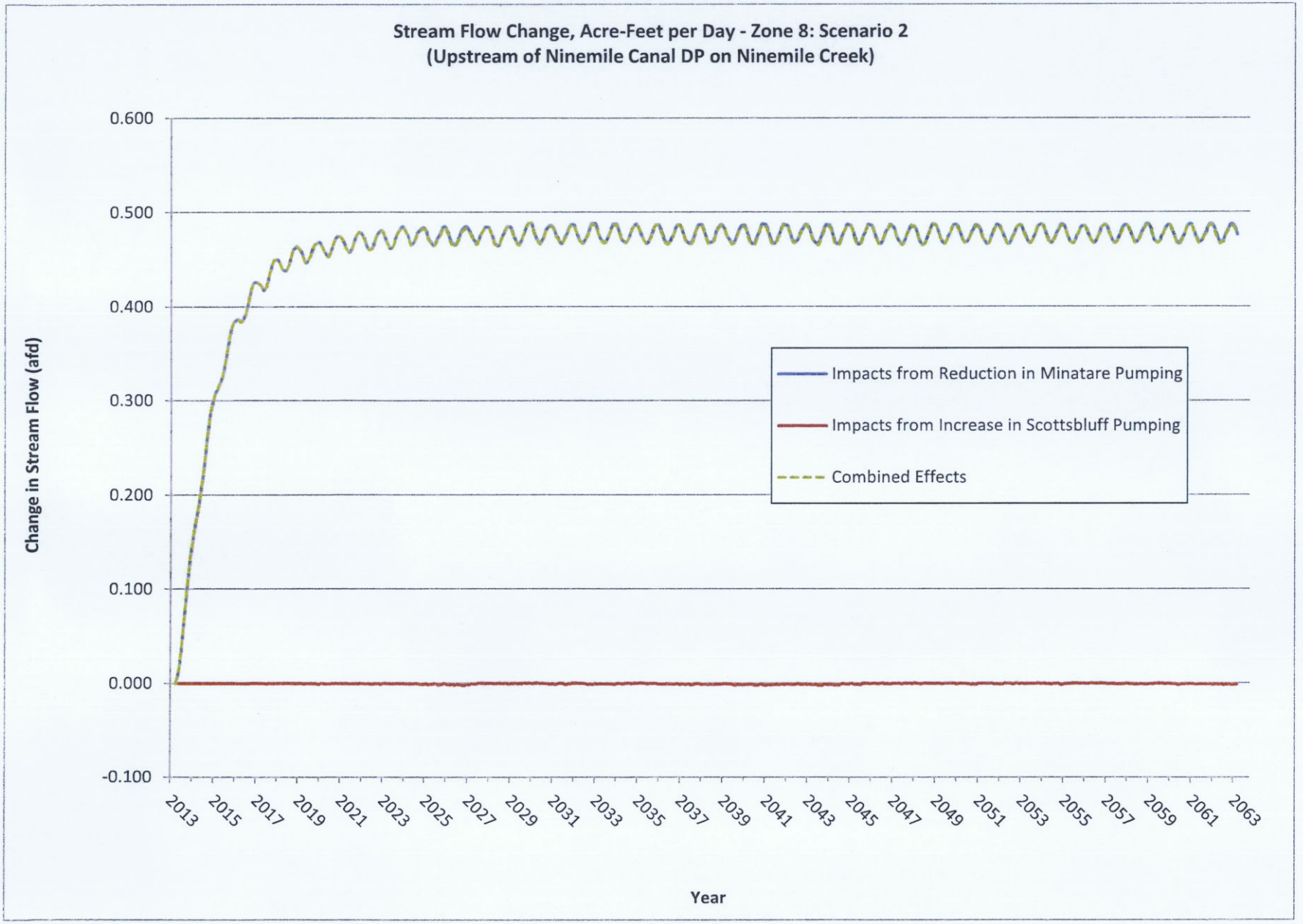
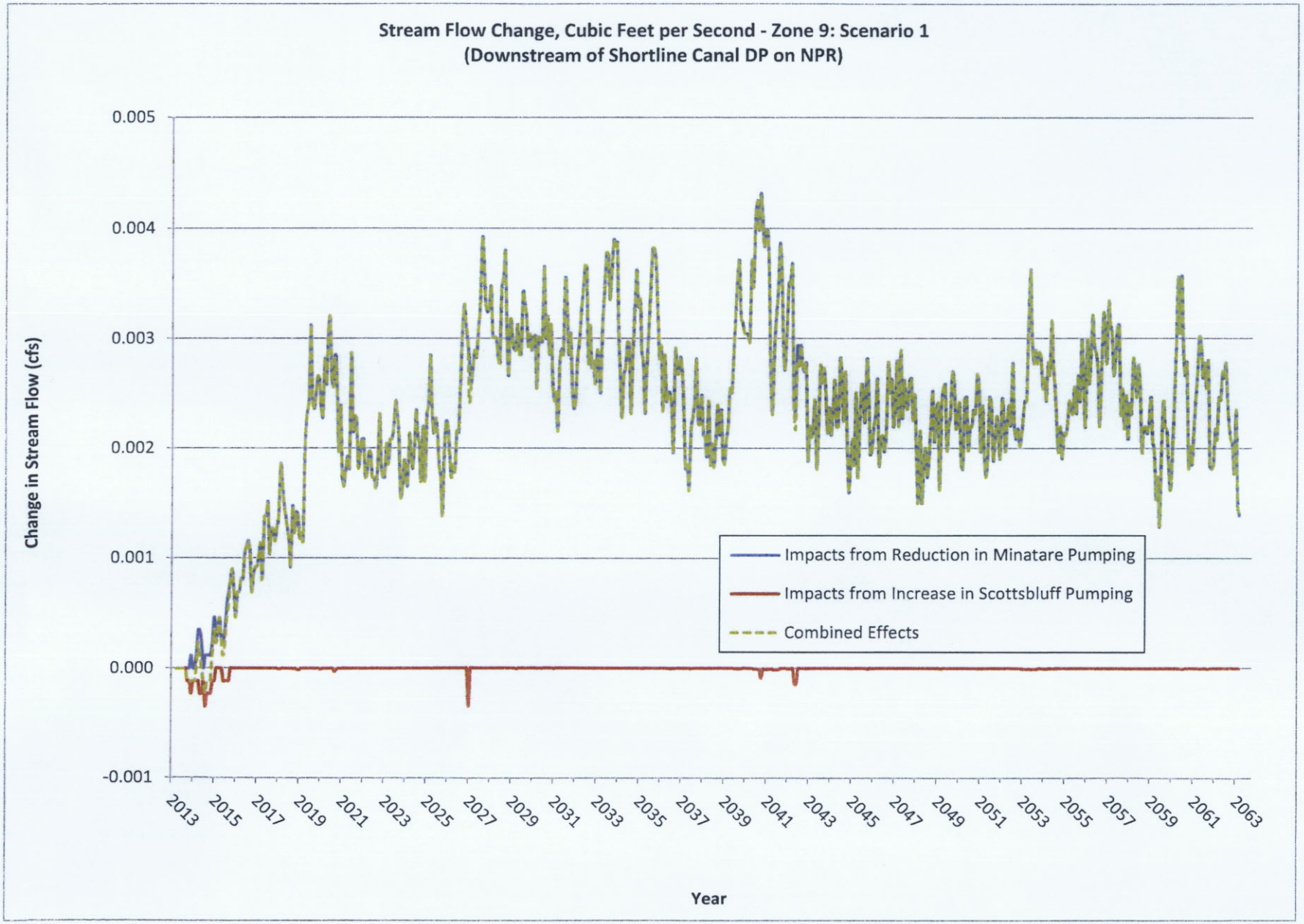
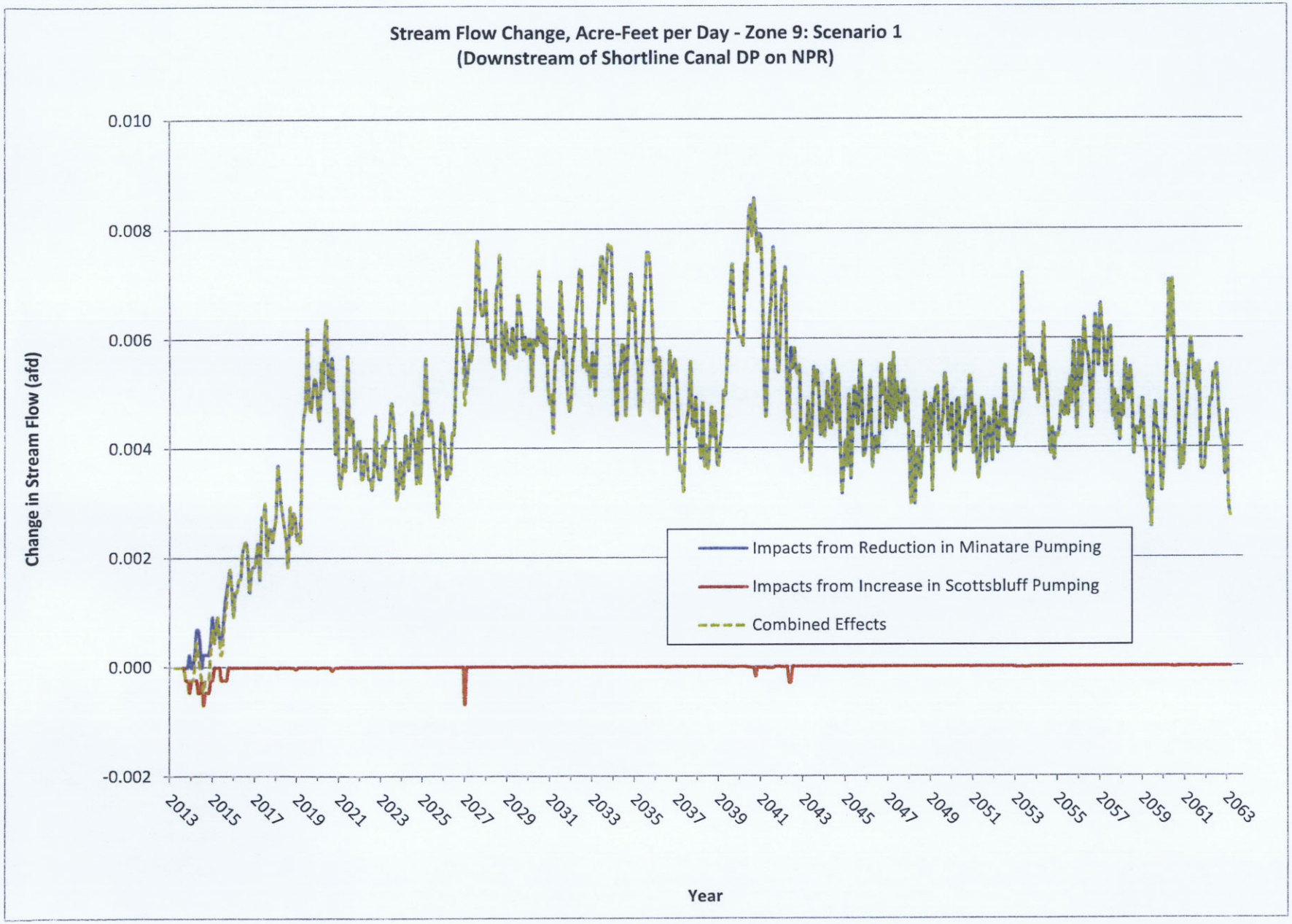
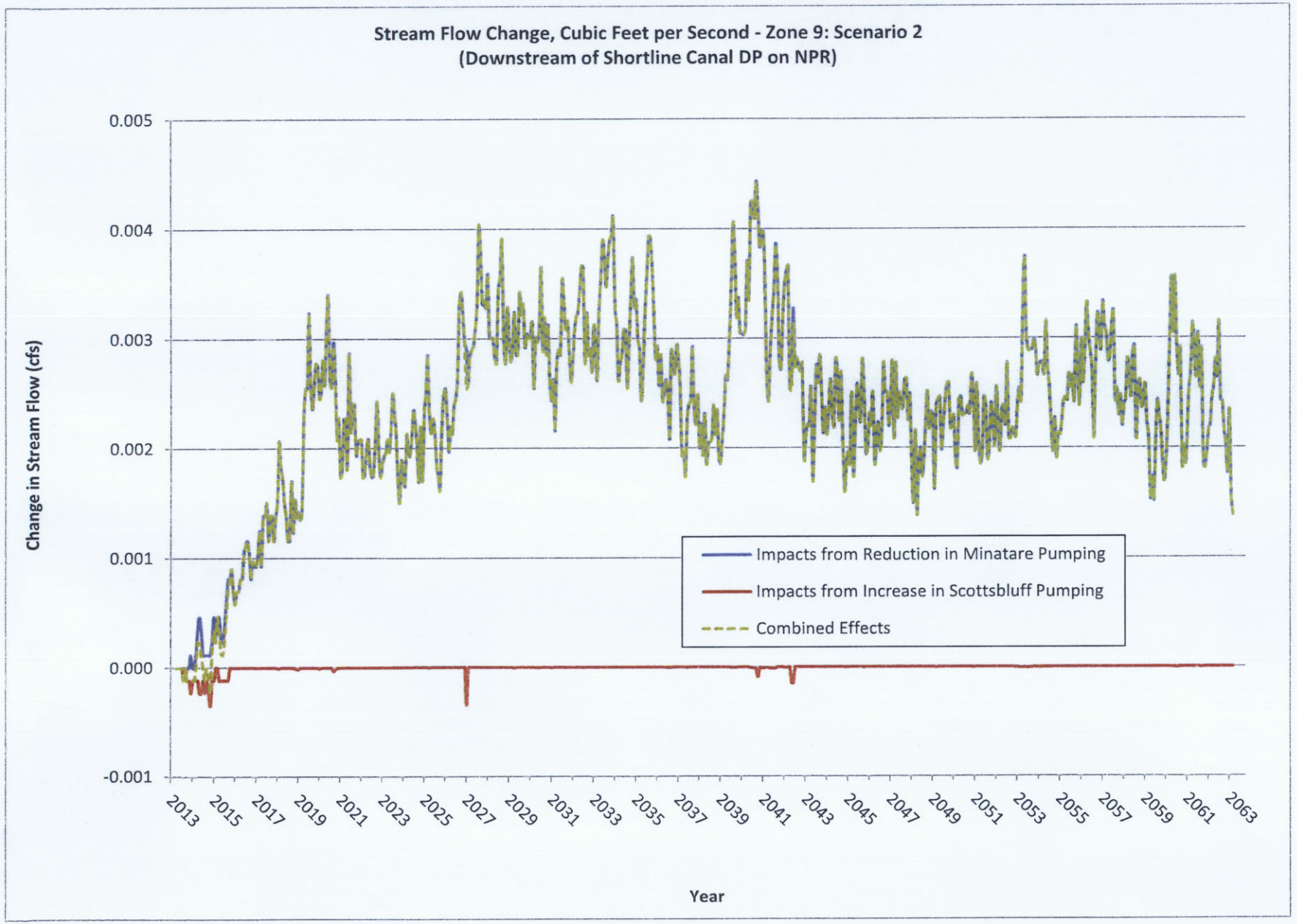
2057
2059
2061
2063
Year
Impacts from Reduction in Minatare Pumping
Impacts from Increase in Scottsbluff Pumping
Combined Effects

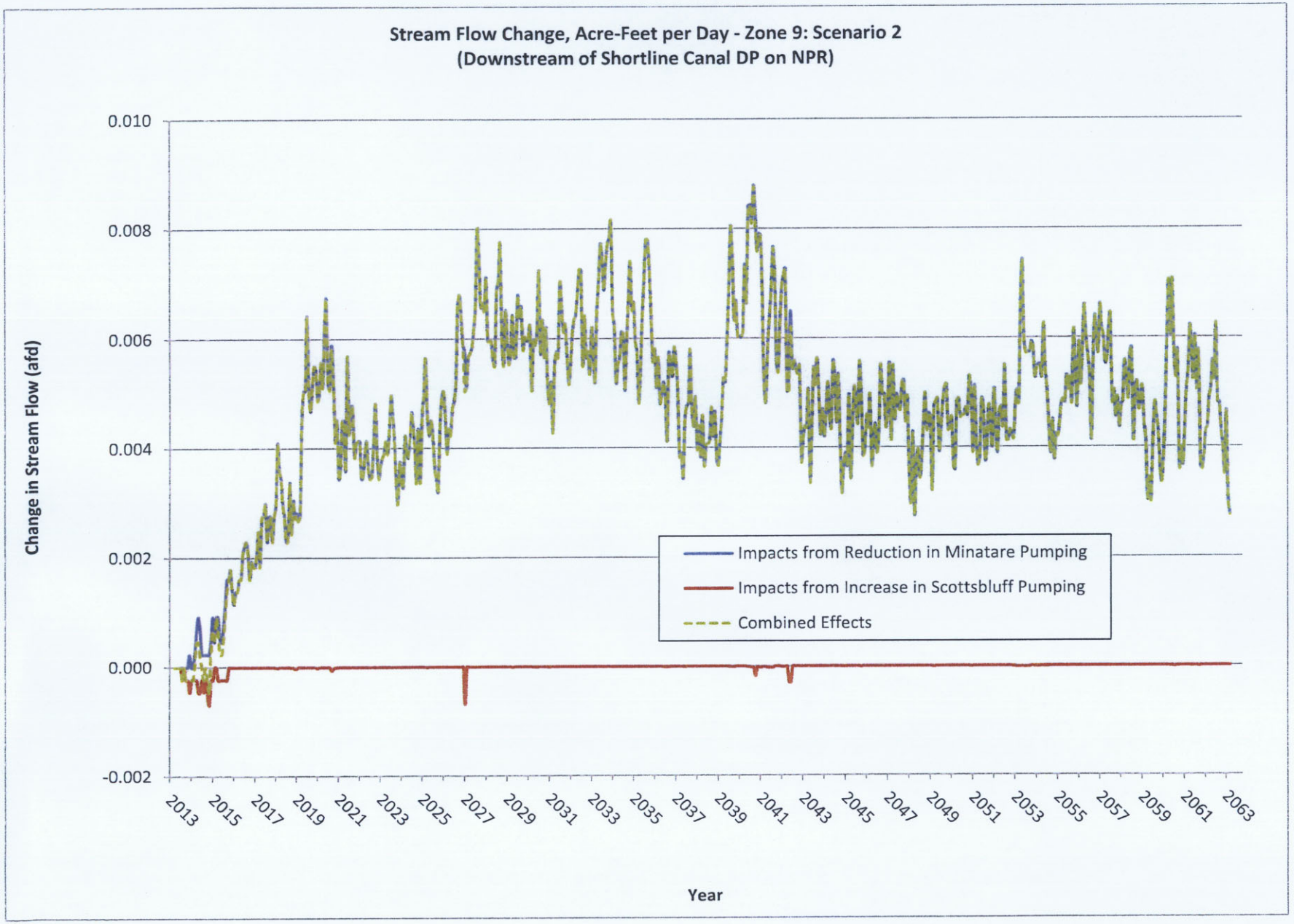

Stream Flow Change, Cubic Feet per Second - Zone 8: Scenario 2
(Upstream of Ninemile Canal DP on Ninemile Creek)
Change in Stream Flow (cfs)
0.300
0.250
0.200
0.150
0.100
0.050
0.000
-0.050
2013
2015
2017
2019
2021
2023
2025
2027
2029
2031
2033
2035
2037
2039
2041
2043
2045
2047
2049
2051
2053
2055
2057
2059
2061
2063
Year
Impacts from Reduction in Minatare Pumping
Impacts from Increase in Scottsbluff Pumping
Combined Effects


Stream Flow Change, Acre-Feet per Day - Zone 8: Scenario 2
(Upstream of Ninemile Canal DP on Ninemile Creek)
Change in Stream Flow (afd)
0.600
0.500
0.400
0.300
0.200
0.100
0.000
-0.100
2013
2015
2017
2019
2021
2023
2025
2027
2029
2031
2033
2035
2037
2039
2041
2043
2045
2047
2049
2051
2053
2055
2057
2059
2061
2063
Year
Impacts from Reduction in Minatare Pumping
Impacts from Increase in Scottsbluff Pumping
Combined Effects

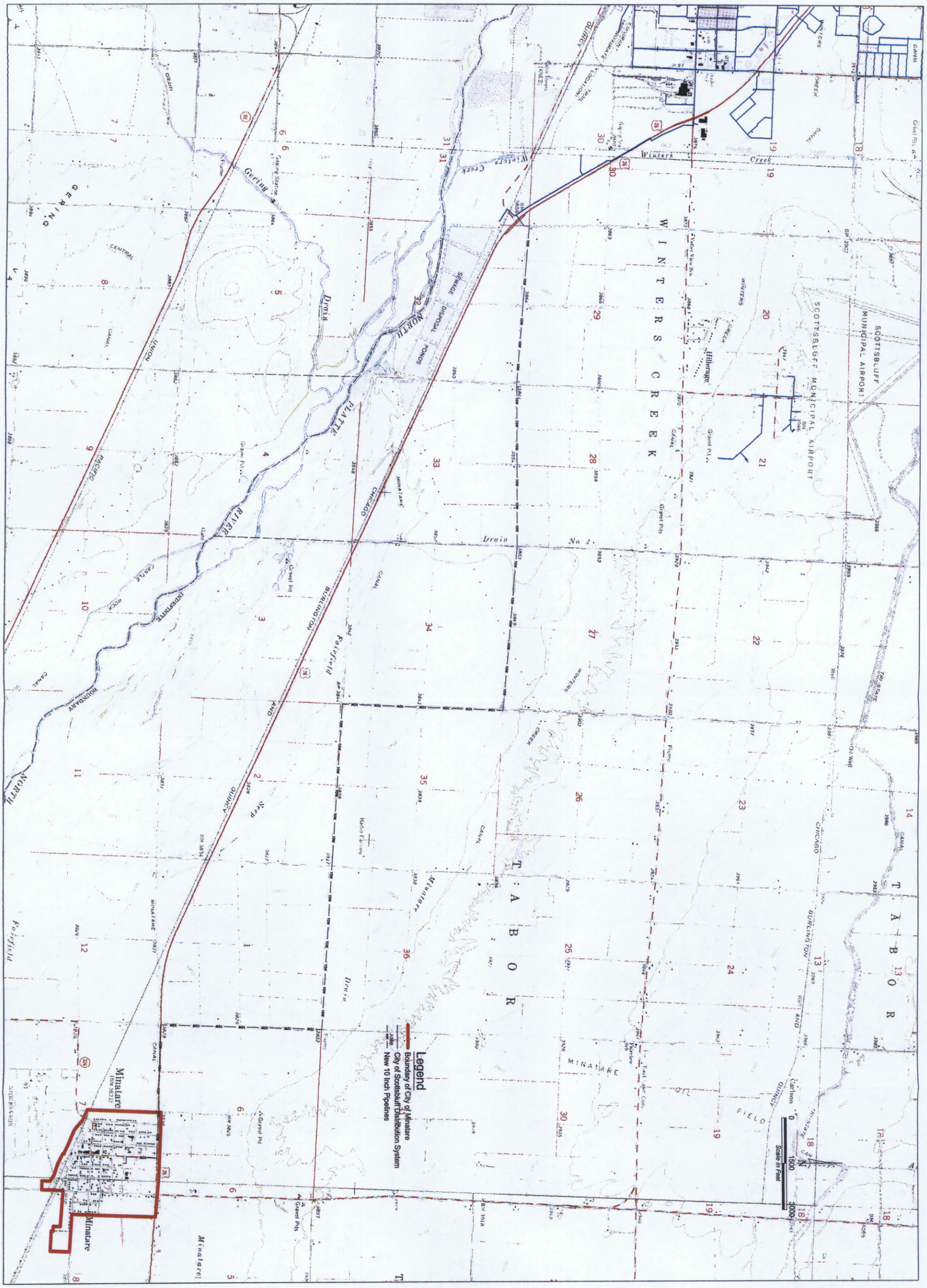

Stream Flow Change, Cubic Feet per Second - Zone 9: Scenario 1
(Downstream of Shortline Canal DP on NPR)
Change in Stream Flow (cfs)
0.005
0.004
0.003
0.002
0.001
0.000
-0.001
2013
2015
2017
2019
2021
2023
2025
2027
2029
2031
2033
2035
2037
2039
2041
2043
2045
2047
2049
2051
2053
2055
2057
2059
2061
2063
Year
Impacts from Reduction in Minatare Pumping
Impacts from Increase in Scottsbluff Pumping
Combined Effects


Stream Flow Change, Acre-Feet per Day - Zone 9: Scenario 1
(Downstream of Shortline Canal DP on NPR)
Change in Stream Flow (afd)
0.010
0.008
0.006
0.004
0.002
0.000
-0.002
2013
2015
2017
2019
2021
2023
2025
2027
2029
2031
2033
2035
2037
2039
2041
2043
2045
2047
2049
2051
2053
2055
2057
2059
2061
2063
Year
Impacts from Reduction in Minatare Pumping
Impacts from Increase in Scottsbluff Pumping
Combined Effects


Stream Flow Change, Cubic Feet per Second - Zone 9: Scenario 2
(Downstream of Shortline Canal DP on NPR)
Change in Stream Flow (cfs)
0.005
0.004
0.003
0.002
0.001
0.000
-0.001
2013
2015
2017
2019
2021
2023
2025
2027
2029
2031
2033
2035
2037
2039
2041
2043
2045
2047
2049
2051
2053
2055
2057
2059
2061
2063
Year
Impacts from Reduction in Minatare Pumping
Impacts from Increase in Scottsbluff Pumping
Combined Effects


Stream Flow Change, Acre-Feet per Day - Zone 9: Scenario 2
(Downstream of Shortline Canal DP on NPR)
Change in Stream Flow (afd)
0.010
0.008
0.006
0.004
0.002
0.000
-0.002
2013
2015
2017
2019
2021
2023
2025
2027
2029
2031
2033
2035
2037
2039
2041
2043
2045
2047
2049
2051
2053
2055
2057
2059
2061
2063
Year
Impacts from Reduction in Minatare Pumping
Impacts from Increase in Scottsbluff Pumping
Combined Effects

Maps



SHEET 1 OF 2

M-1

DATE | REVISION

SEAL

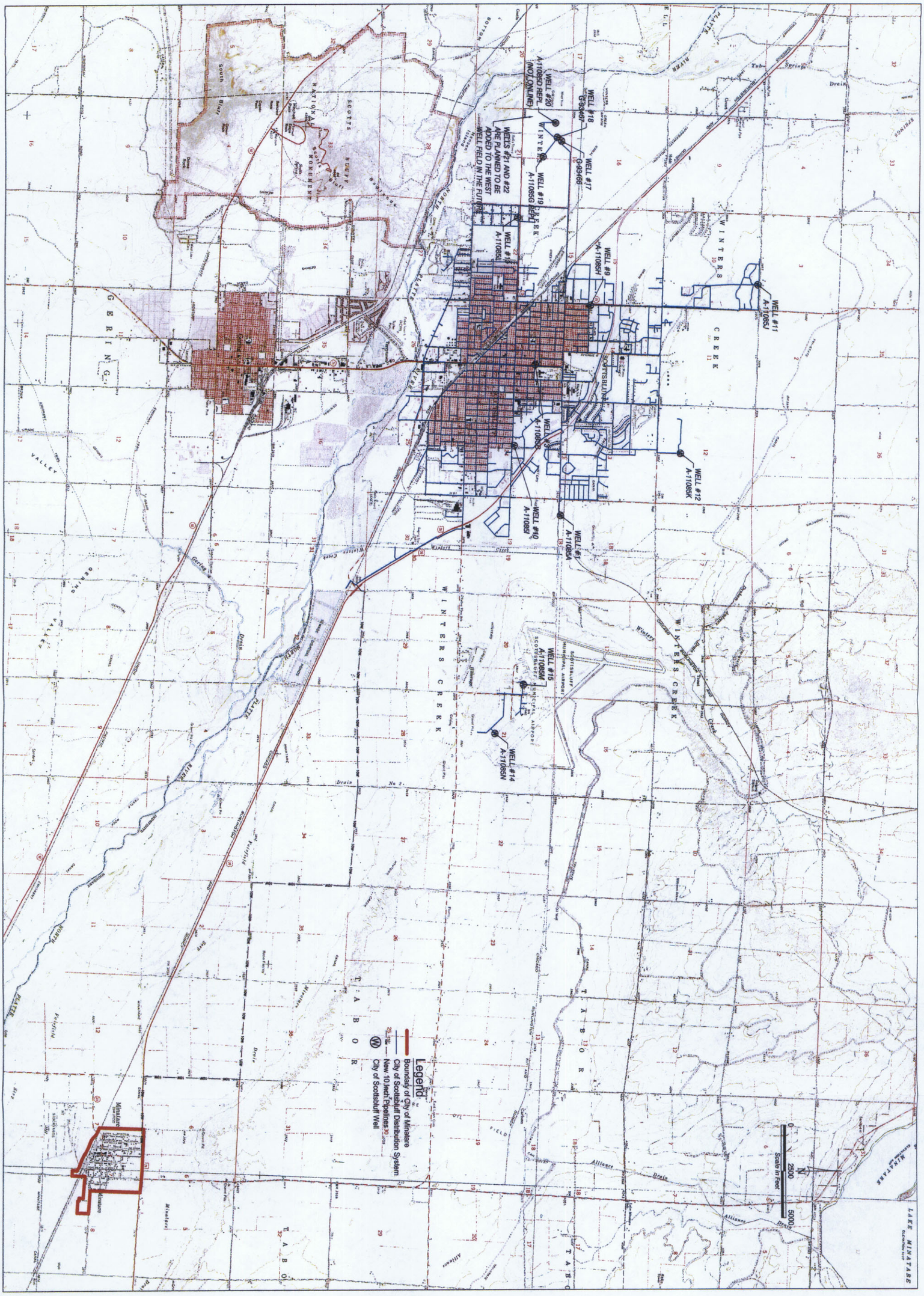
PROJECT NUMBER: RM110703-00
PROJECT DATE: 9-24-2012
PROJECT MGR: M.C.S
PROJECT TEAM: M.M.O.

PROJECT: MINATARE TRANSFER PERMIT
PROPOSED PIPELINES
AREA OF PROPOSED USE

CLIENT: CITY OF SCOTTSBLUFF

M. C. SCHAFF & ASSOCIATES, INC.
818 SOUTH BELTLINE HIGHWAY EAST
SCOTTSBLUFF, NEBRASKA 69361
ENGINEERS ◆ PLANNERS ◆ DESIGNERS ◆ LAND SURVEYORS
PH: 308-635-1926 FAX: 308-635-7807 INTERNET: WWW.MCSCHAFF.COM

APR 0 5 2013



PROJECT: MINATARE TRANSFER PERMIT
CITY OF SCOTTSBLUFF WELLS
AND DISTRIBUTION SYSTEM

CLIENT: CITY OF SCOTTSBLUFF

M. C. SCHAFF & ASSOCIATES, INC.
818 SOUTH BELTLINE HIGHWAY EAST
SCOTTSBLUFF, NEBRASKA 69361
ENGINEERS ◆ PLANNERS ◆ DESIGNERS ◆ LAND SURVEYORS
PH: 308-635-1926 FAX: 308-635-7807 INTERNET: WWW.MCSCHAFF.COM

PROJECT NUMBER: RM110703-00
PROJECT DATE: 9-25-2012
PROJECT MGR: M.C.S
PROJECT TEAM: M.M.O.

DATE | REVISION

SEAL

SHEET 2 OF 2
M-2

APR 05 2013