

Appendix B-9: Alternative 10

Spring Drawdown

HEC-ResSim Initial Alternative Assessment

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1. Alternative Description & Objective

This alternative tests the effect of different spring drawdown magnitudes for Rafferty, Grant Devine and Lake Darling reservoirs by shifting the spring drawdown plates defined in Annex A of the 1989 Agreement for each reservoir. The spring drawdown plates allow reservoir operators to compute the target drawdown elevation for each reservoir after February 1st based on the 90 percent, 90-day forecasted inflow volume. There are multiple ways to shift the spring drawdown plates; therefore, this alternative is split into 3 separate variants.

Alternative 10a involves shifting each plate up (10aU) or down (10aD). By shifting a plate up, the reservoir will be drawn down less for the same forecasted inflow volume, benefiting water supply. By shifting a plate down, the reservoir will be drawn down further for the same forecasted inflow volume, benefiting flood control. It is important to note that, while the plates are used to determine the reservoir's target spring drawdown (after Feb 1), shifting a plate up or down also affects the normal February 1st drawdown elevation, because, on each plate, a forecasted inflow of 0 ac-ft corresponds to the normal drawdown elevation.

Alternative 10b involves shifting each plate left (10bL) or right (10bR) by a moderate amount. By shifting a plate to the left, a larger inflow volume must be forecasted for the reservoir to target its maximum spring drawdown, benefiting water supply. By shifting a plate to the right, the reservoir will be drawn down to its maximum spring drawdown elevation with a lower forecasted inflow volume, benefiting flood control.

Alternative 10c is similar to Alternative 10b, except each plate is shifted to the left (10cL) or right (10cR) by twice as much volume.

Each alternative variant was analyzed using a simulation time window of 1930-2017 and normal initial reservoir pool elevations. Each alternative variant was also run using a simulation time window of 1930-1945 and low initial reservoir pool elevations. All alternative results were compared to the baseline model results, which reflect present day operations (Annex A & Annex B).

1.1 Alternative Development

A mock alternative run similar to Alternative 10a was presented at the March 2019 ISRSB workshop in Minot, ND (Minot Workshop, 2019). At the workshop, the study team received feedback from the Public Advisory Group (PAG) and Resource and Agency Advisory Group (RAAG) showing interest in further investigation into spring drawdown levels.

Originally, Alternative 10aD shifted the Rafferty and Grant Devine spring drawdown plates down 1 m (3.28 ft) for all forecasted inflow volumes. However, upon further discussion with Curtis Hallborg, Chanel Mueller and Rachel Weller (Mueller, 2019), 10aD was modified such that the least aggressive spring drawdown only shifted the plate down 0.5 m (3.14 ft). The shifts in volumes for Alternative 10b and 10c were originally discussed at the Minot workshop (Minot Workshop, 2019) and then finalized over email (Hallborg, 2019). Shifting the plates by elevation and volume was deemed necessary, because different elevation changes can have drastically different effects depending on the size of the reservoir and the reservoir's pre-drawdown elevation. The final spring drawdown plates used in each alternative simulation are defined below.

Table 1. Alternative 10a changes from baseline

Scenario	Changes to Spring Drawdown Plates (relative to baseline)
10aD	Rafferty: Raised plate 1 m (3.28 ft) Grant Devine: Raised plate 1 m (3.28 ft) Lake Darling: Raised plate 1 ft (0.31 m)
10aU	Rafferty: Lowered min. drawdown by 0.5 m (1.64 ft) and max. drawdown by 1 m (3.28 ft) Grant Devine: Lowered min. drawdown by 0.5 m (1.64 ft) and max. drawdown by 1 m (3.28 ft) Lake Darling: Lowered plate by 0.31 m (1 ft)

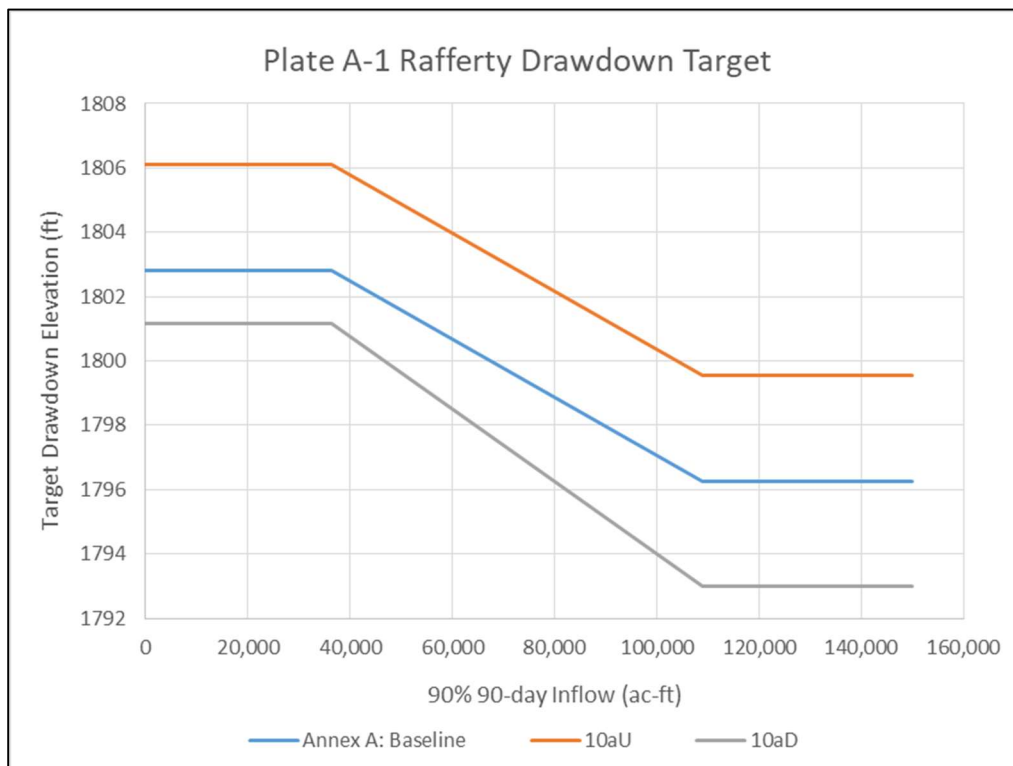


Figure 1. Plate A-1 Rafferty Drawdown Target, Alternative 10a

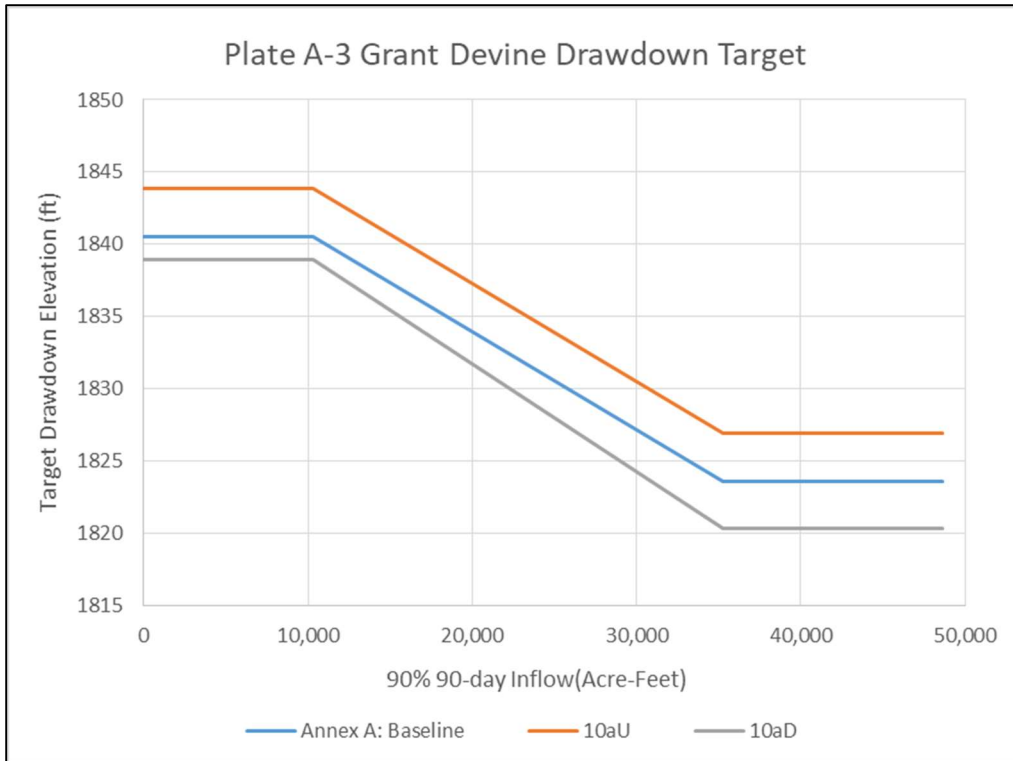


Figure 2. Plate A-3 Grant Devine Drawdown Target, Alternative 10a

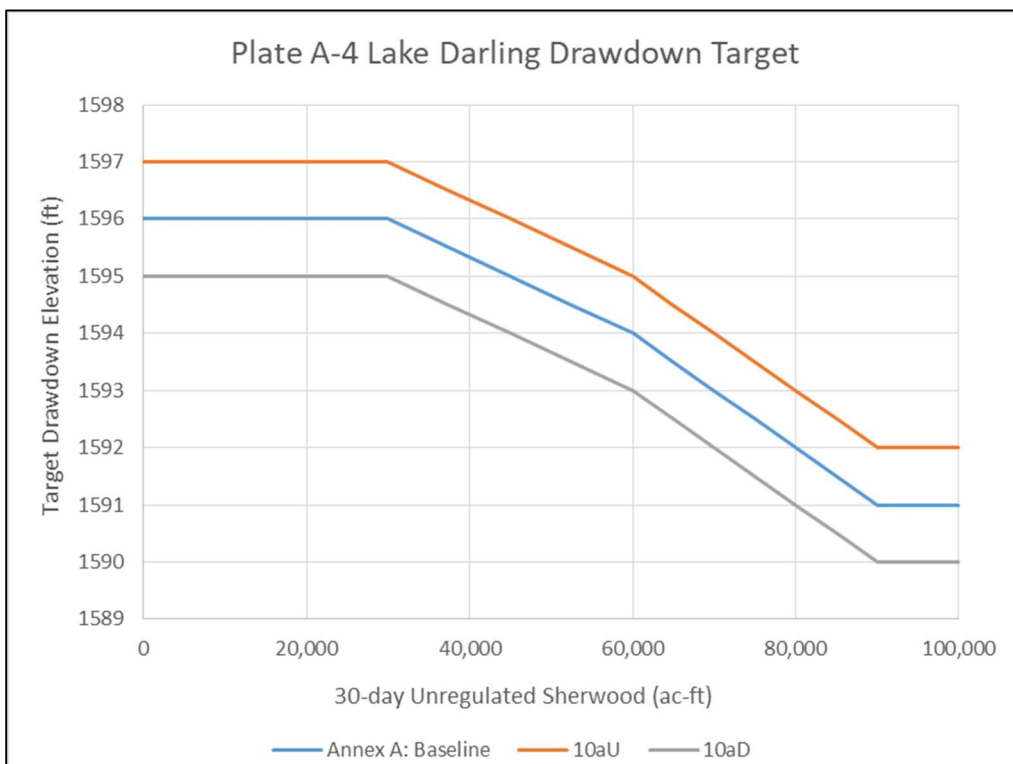


Figure 3. Plate A-4 Lake Darling Drawdown Target, Alternative 10a

Table 2. Alternative 10b changes from baseline

Scenario	Changes to Spring Drawdown Plates (relative to baseline)
10bL	Rafferty: Moved plate left 25,000 dam ³ (20,270 ac-ft) Grant Devine: Moved plate left 6,000 dam ³ (4,860 ac-ft) Lake Darling: Moved plate left 15,000 dam ³ (12,160 ac-ft)
10bR	Rafferty: Moved plate right 25,000 dam ³ (20,270 ac-ft) Grant Devine: Moved plate right 6,000 dam ³ (4,860 ac-ft) Lake Darling: Moved plate right 15,000 dam ³ (12,160 ac-ft)

Table 3. Alternative 10c changes from baseline

Scenario	Changes to Spring Drawdown Plates (relative to baseline)
10bL	Rafferty: Moved plate left 50,000 dam ³ (40,540 ac-ft) Grant Devine: Moved plate left 12,000 dam ³ (9,720 ac-ft) Lake Darling: Moved plate left 30,000 dam ³ (24,320 ac-ft)
10bR	Rafferty: Moved plate right 50,000 dam ³ (40,540 ac-ft) Grant Devine: Moved plate right 12,000 dam ³ (9,720 ac-ft) Lake Darling: Moved plate right 30,000 dam ³ (24,320 ac-ft)

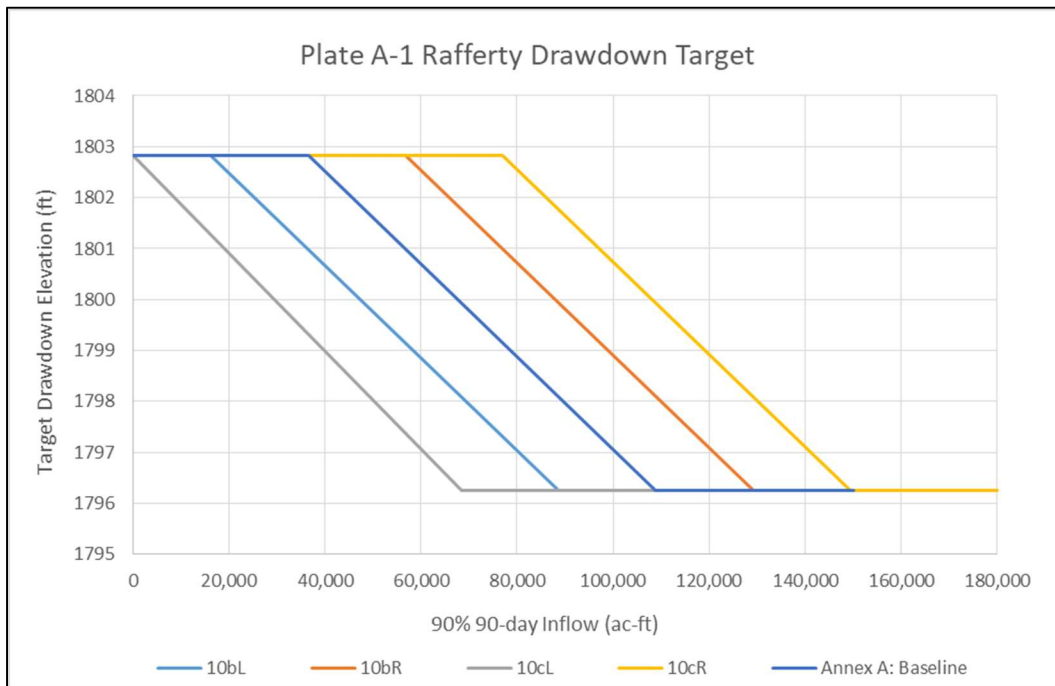


Figure 4. Plate A-1 Rafferty Drawdown Target, Alternative 10b and 10c

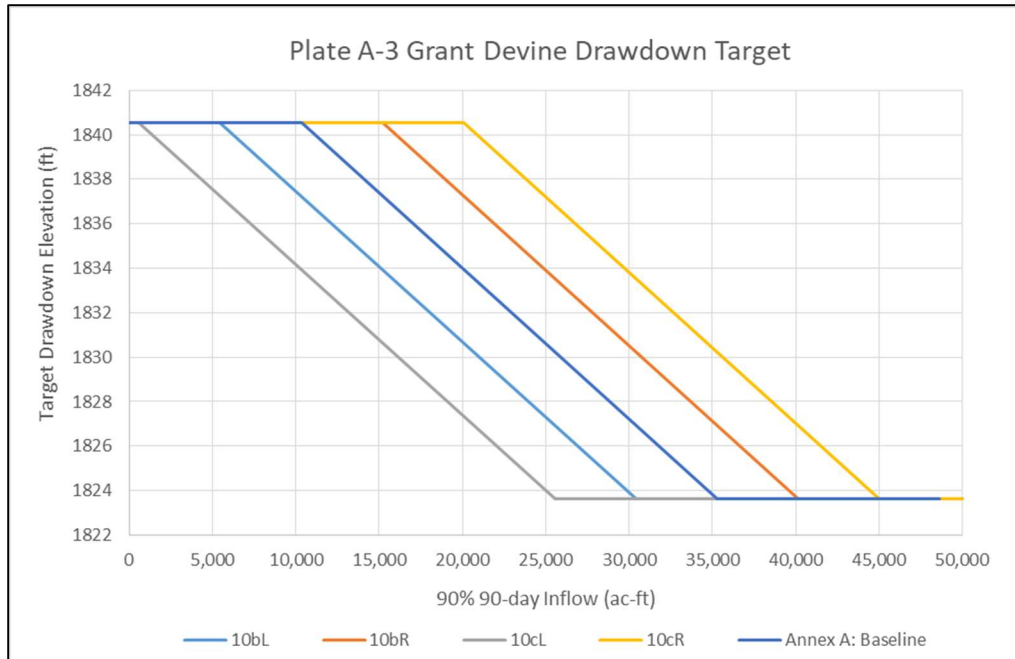


Figure 5. Plate A-3 Grant Devine Drawdown Target, Alternative 10b and 10c

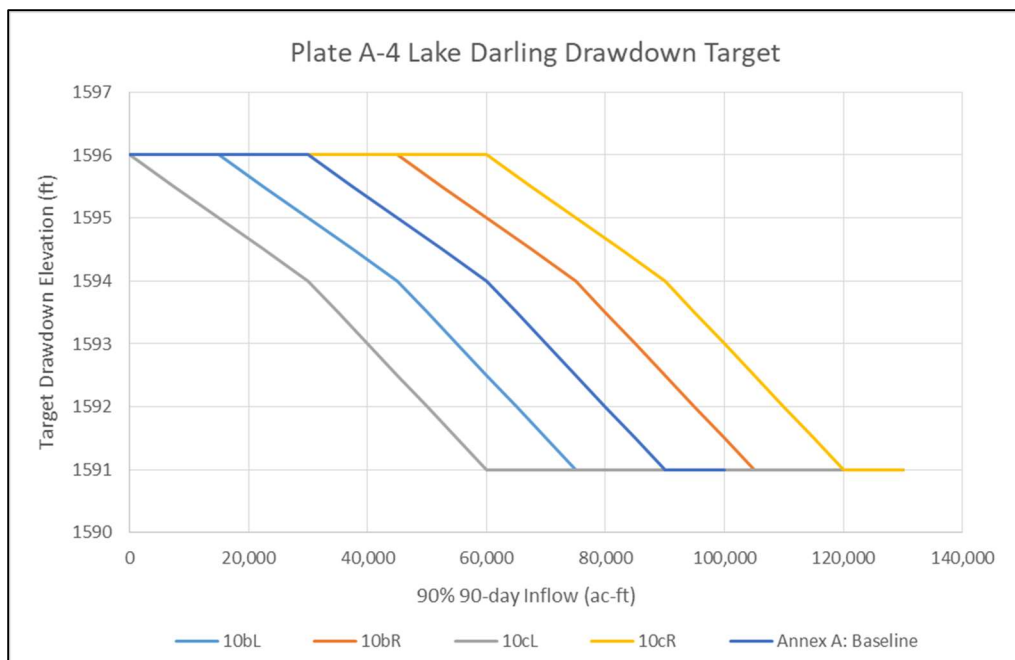


Figure 6. Plate A-4 Lake Darling Drawdown Target, Alternative 10b and 10c

1.2 HEC-ResSim Nomenclature

Within HEC-ResSim, a new network, alternative, and simulation run was generated to reflect each proposed alternative. To generate the alternative network, a copy of the base network was made and

modified to reflect the proposed alternative. A table indicating the nomenclature associated with the ResSim networks, alternatives and simulations used to model both baseline and alternative operations for the various index events are listed in Table 4.

Table 4. Model nomenclature

Scenario	Time Window	ResSIM Model Name	Network Name	Alternative Name	Simulation Name
Baseline	1930-2017	SourisRiverPoS	cal2Fsl	Base	00_BL_AnxA_46_17
Plates Down (10aD)	1930-2017	SourisRivePoS	10a_SpDD_Up	10a_Up_NRM	10a_SpDD_Up_30_17
	1930-1945			10a_Up_LP	10a_SpDD_Up_30_45
Plates Up (10aU)	1930-2017	SourisRivePoS	10a_SpDD_DWN	10a_DN_NRM	10a_SpDD_DWN_30_17
	1930-1945			10a_DN_LP	10a_SpDD_DWN_30_45
Plates Left (10bL)	1930-2017	SourisRiverPoS	10b_SpDD_L15K	10b_Ls_NRM	10b_SpDD_L15K_30_17
	1930-1945			10b_Ls_LP	10b_SpDD_L15K_30_45
Plates Right (10bR)	1930-2017	SourisRiverPoS	10b_SpDD_R15K	10b_Rs_NRM	10b_SpDD_R15K_30_17
	1930-1945			10b_Rs_LP	10b_SpDD_R15K_30_45
Plates Left (10cL)	1930-2017	SourisRiverPoS	10c_SpDD_L30K	10c_LI_NRM	10c_SpDD_L30K_30_17
	1930-1945			10c_LI_LP	10c_SpDD_L30K_30_45
Plates Right (10cR)	1930-2017	SourisRiverPoS	10c_SpDD_R30K	10c_RI_NRM	10c_SpDD_R30K_30_17
	1930-1945			10c_RI_LP	10c_SpDD_R30K_30_45

2. Operational Rules

Table 5 presents the operational rules that added to the base HEC-ResSim model to specifically reflect the changes required in support of the Spring Drawdown Changes alternative.

Table 5. Operation rules added specific to alternative

Name of Dam	Name of Rule, Outlet or IF Statement or State Variable Element	Rule Description
Rafferty Reservoir	a_fld_MASTER_gc_gd	Normal Drawdown adjusted
	a_fld_MASTER_gc_gd	Maximum Drawdown adjusted
	app_MASTER_min_release_GD	Normal Drawdown adjusted
Boundary Reservoir	a_fld_MASTER_gc_gd	Normal Drawdown adjusted
	a_fld_MASTER_gc_gd	Maximum Drawdown adjusted
Grant Devine Reservoir	a_fld_MASTER_gc_gd	Normal Drawdown adjusted
	a_fld_MASTER_gc_gd	Maximum Drawdown adjusted
	app_MASTER_min_release_GD	Normal Drawdown adjusted

Name of Dam	Name of Rule, Outlet or IF Statement or State Variable Element	Rule Description
Lake Darling Reservoir	a_fld_MASTER_gc_gd	Normal Drawdown adjusted
	a_fld_MASTER_gc_gd	Maximum Drawdown adjusted

To properly model this alternative, no changes to the operating rules or network needed to be made. The adjustments all occurred in the state variable script.

The elevations of the guide curves are hard coded into the state variable scripts. For this reason, Alternative 10a required changes to the scripts. The normal and maximum drawdowns needed to be changed for all four reservoirs in the a_fld_MASTER_gc_gd script, and the changes to the normal drawdown for the three Canadian reservoirs needed to be made to the app_MASTER_min_release_GD script. Figure 7 provides a screenshot of where the a_fld_MASTER_gc_gd state variable script was modified to change the normal and maximum drawdowns for each reservoir to model Alternative 10aD. Additionally, since the drawdown elevations are shifted up and down for alternative 10a, the variable maxDDoverrides was set to false to allow ResSim to use the shifted plates. Figure 8 shows the changes made to the initialization script to allow the model to get the different plates for the different variations of this alternative. Figure 9 shows where drawdowns were changed in the initialization script. Figure 10 shows changes to the Standard Drawdown (Normal Drawdown) coded into the app_MASTER_min_release_GD state variable to match what is being used in the rest of the alternative. Relevant lines of the state variable script are indicated by the red boxes.

For Alternatives 10b and 10c, the only change required to the script was the initialization tab changes shown in Figure 8, as the volumes are not hard coded into the script.

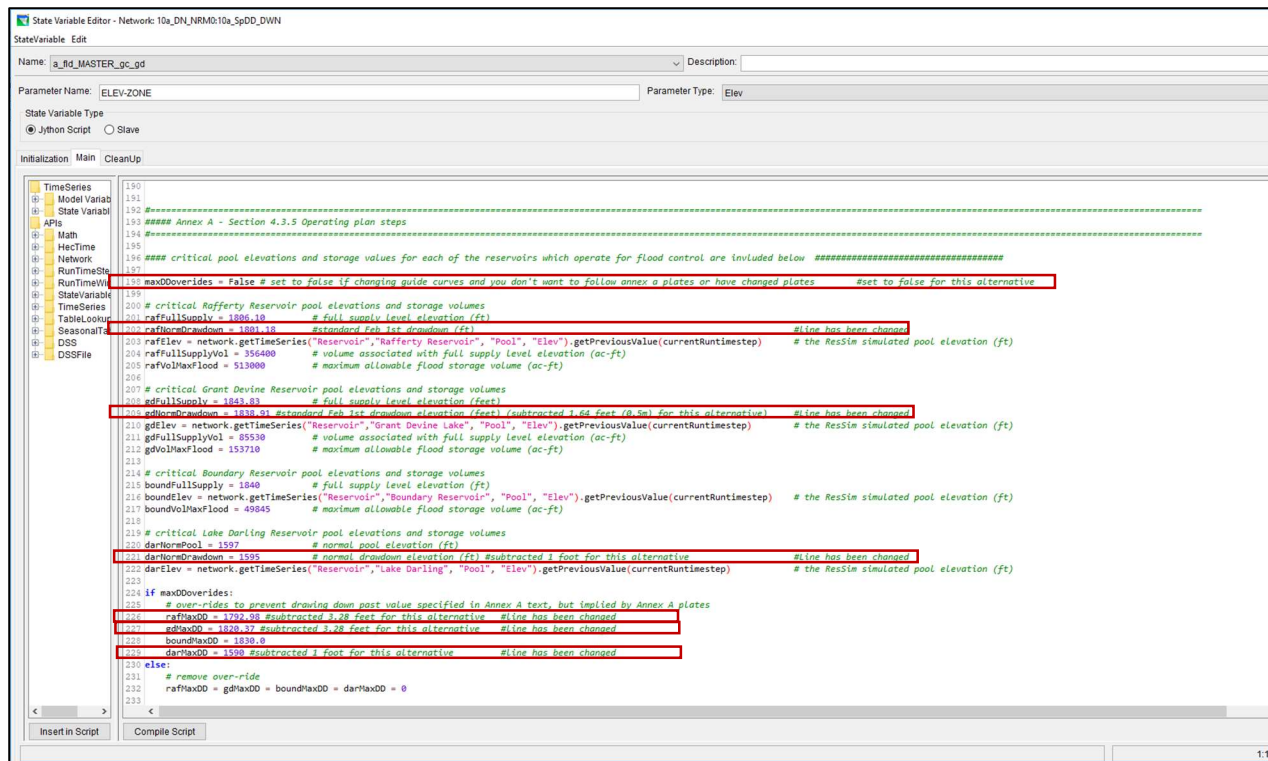


Figure 7. Changes made to Guide Curve State Variable script to redefine maximum allowable drawdown & normal drawdown

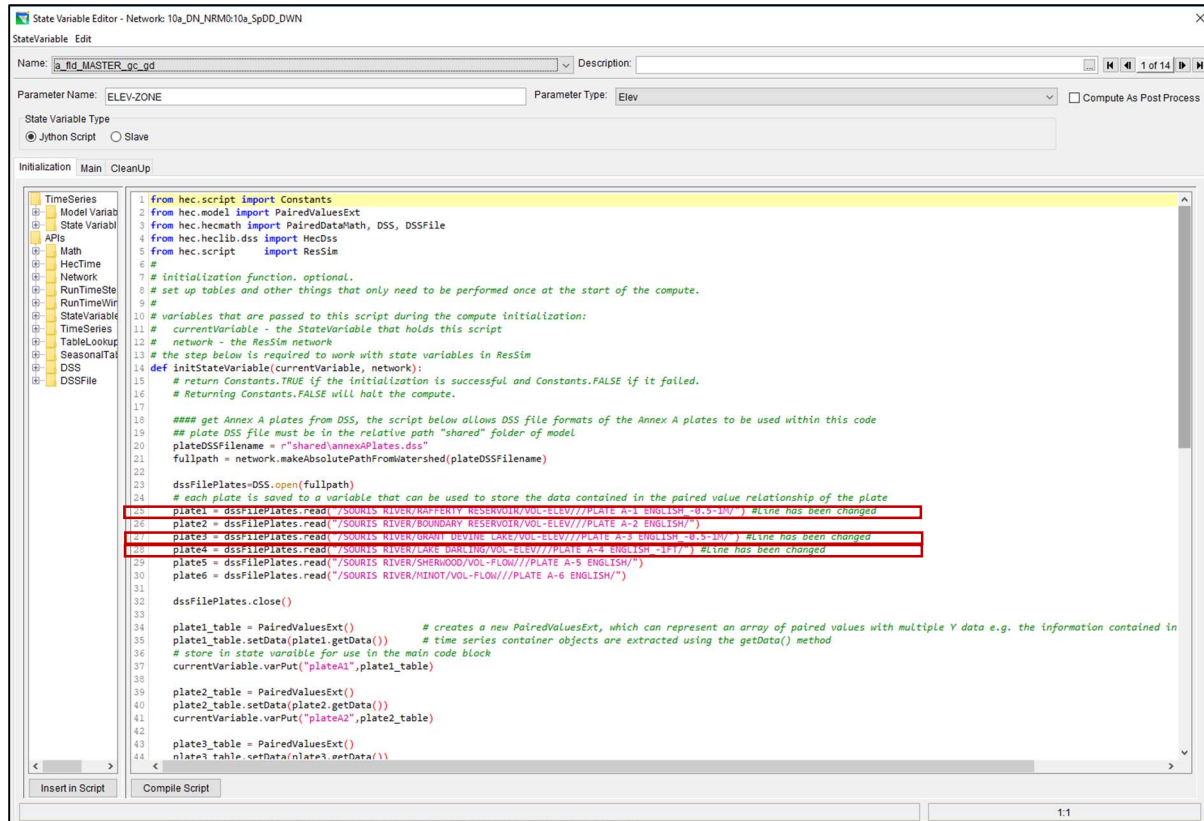


Figure 8. Changes to the initialization script to have the model run the updated plates

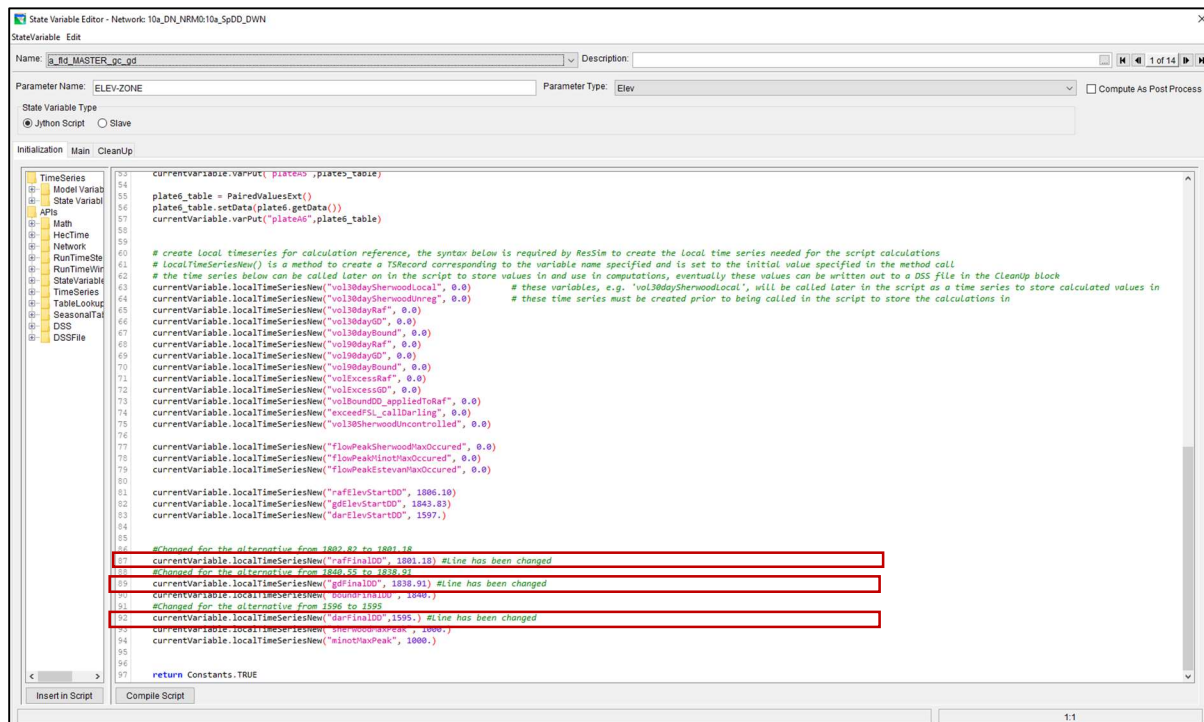


Figure 9. Changes to the initialization script to have the Final DD correct

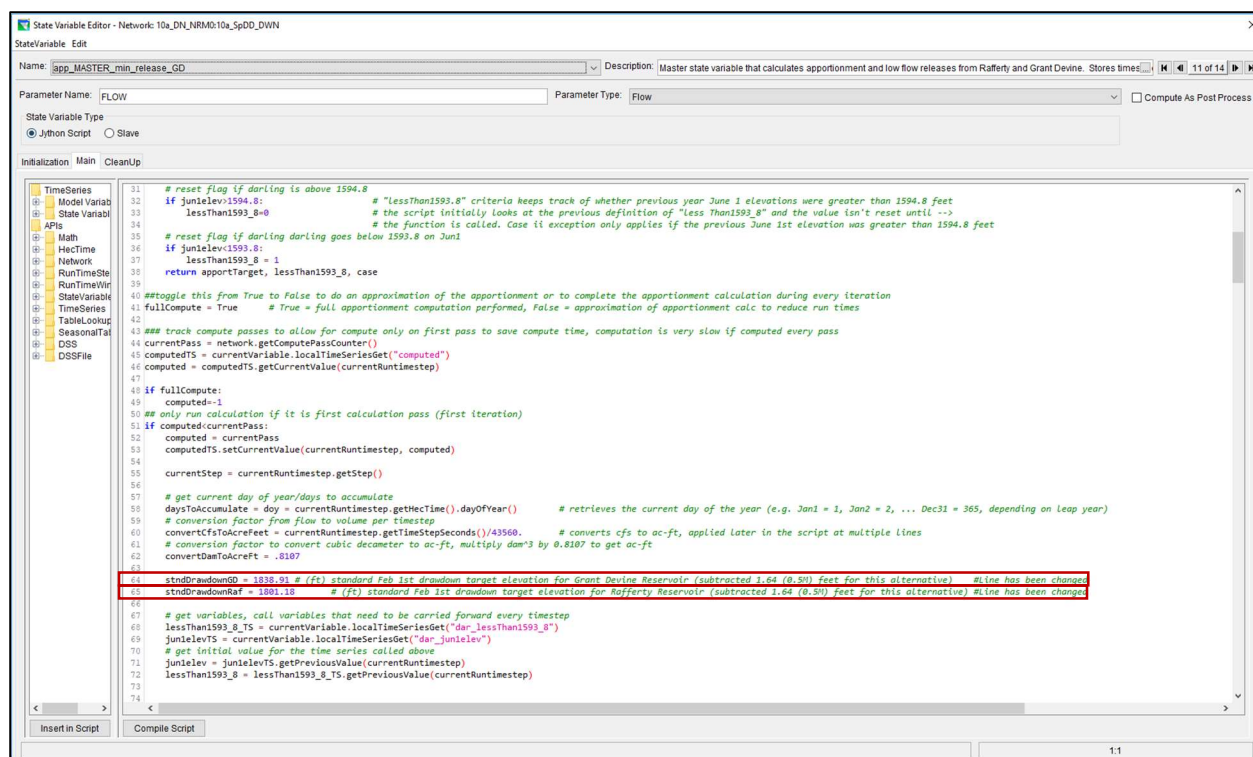


Figure 10. Change the Standard Drawdown coded into the app_MASTER_min_release_GD state variable

3. Alternative vs Baseline Scenario Results

Plates 01-08, 10-17, 19-26 and 28-35 show hydrographs detailing the results of Alternative 10 relative to the baseline scenario at Rafferty, Boundary, Grant Devine, and Lake Darling reservoirs, as well as seven critical mainstem flow locations, for select “index” years. Index years were selected to be representative of high, medium, and low flow years in the basin. High flow years include 2011, 1976, 1975, and 1969, medium flow years include 1987, 1952, and 1946, and low flow years include 1937, 1988, and two extended drought sequences: 1931-1937 and 1988-1991. For Alternative 10, one drought sequence (1988-1991), one normal year (1952), one moderate flood (1975) and one very large flood (2011) are plotted for each alternative variant.

Plates 09, 18, 27 and 36 display performance indicator results for all study reaches over the entire simulation (1930-2017) for each alternative variant. More information regarding performance indicator (PI) results and PI development can be found in the Data Collection for the Analysis of Alternatives Report (DW4) and Appendix A-5.

4. Summary of Results

For each alternative variant, the low pool initial conditions simulation from 1930 to 1945 showed no change from the baseline scenario. Since the 1930s are a drought period, the reservoirs did not reach an elevation high enough to require a spring drawdown. For this reason, the results of these simulations are not shown. A discussion of results from the full simulation (1930-2017) for each alternative variant are discussed in the following sections.

4.1 10aD (Plates Down)

By shifting each reservoir's spring drawdown plate down, both the normal drawdown and spring drawdown elevations decrease, often increasing releases from each reservoir from October 20th to February 1st. This change results in higher winter flows, lower reservoir elevations in the spring and slightly more storage available to capture spring runoff. Although additional storage allows the reservoirs to slightly reduce the duration of high flow events throughout the basin, large flood peaks are not reduced. In 2011, there is very little difference in flows from baseline throughout the basin, as Rafferty and Lake Darling reach MAFL only slightly before they do in the baseline scenario. During extended drought, lower normal drawdowns entering the drought period cause the Grant Devine and Lake Darling pools to stay lower than the baseline throughout the drought.

4.2 10aU (Plates Up)

By shifting each reservoir's spring drawdown plate up, both the normal drawdown and spring drawdown elevations increase, which often eliminates the winter drawdown that occurs in the baseline scenario from October 20th to February 1st. This change results in lower winter flows, higher reservoir elevations in the spring, and less storage available to attenuate spring flood peaks. As a result, flood peaks are generally higher. In 2011, there is very little difference in flows from baseline throughout the basin, as Rafferty and Lake Darling reach MAFL only slightly before they do in the baseline scenario. During extended drought, higher normal drawdowns entering the drought period allow Rafferty and Grant Devine to maintain slightly higher pool elevations throughout the drought, while Lake Darling's pool is slightly lower.

4.3 Performance Indicators (10a)

4.3.1 Reservoirs

Reducing the magnitude of the spring drawdown (10a Up) increases fish habitat and recreation at Rafferty Reservoir, increases fish habitat and water supply at Grant Devine, and increases flooding at Lake Darling. Conversely, increasing the spring drawdown (10a Down) reduces flood damages at Lake Darling, although water supply and fish and wildlife habitat is reduced at all reservoirs.

4.3.2 Riverine Reaches

As shown in **Error! Reference source not found.**, reducing the spring drawdown (10a Up) increases the number of low flow days at Minot and throughout the rest of the river. Since major flood peaks are not reduced, there are negative impacts to virtually all performance indicators. Increasing the spring drawdown (10a Down) results in a limited change to the flow regime throughout the river, although flood peaks are reduced by a small amount. As such, there are very limited positive impacts to most performance indicators in this scenario.

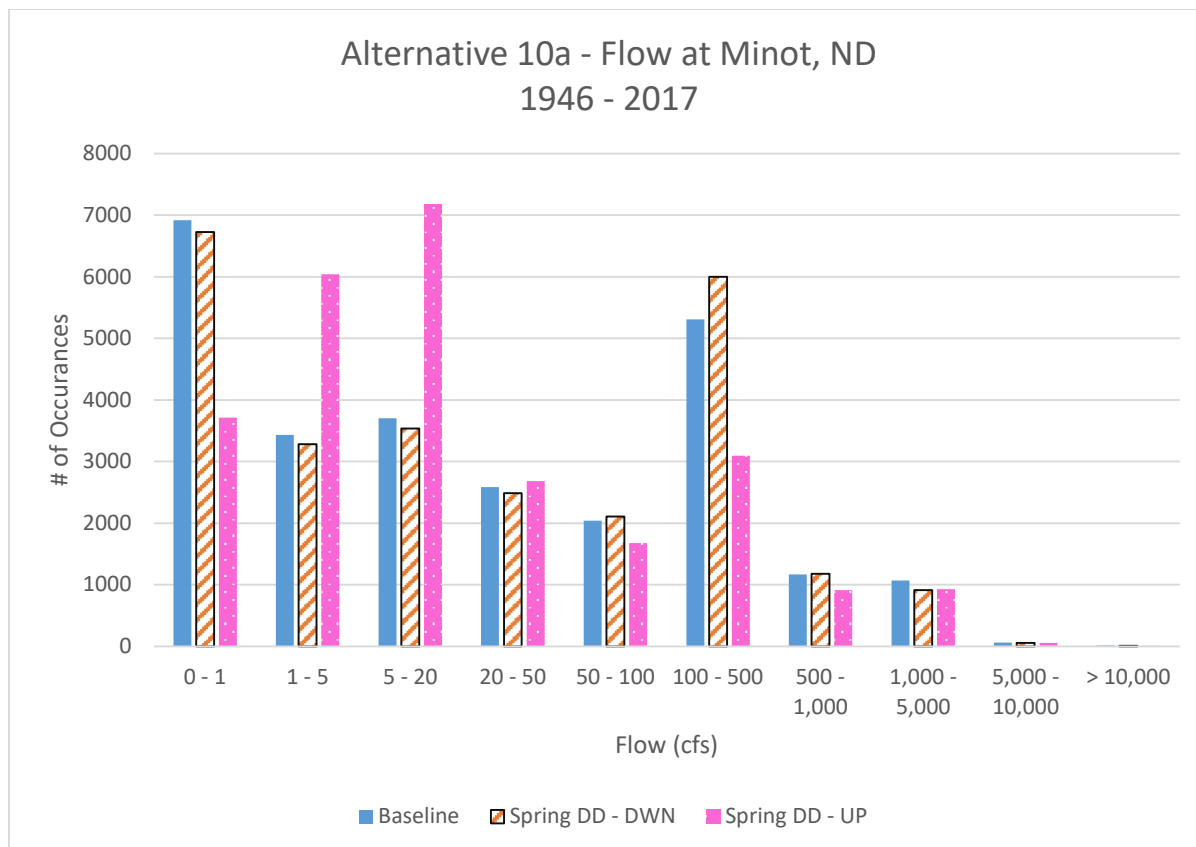


Figure 11. Flow distribution at Minot, ND (10a)

4.4 10bL (Plates Left – lesser)

By shifting the spring drawdown plates left a moderate amount (25,000 dam³, 6,000 dam³, and 15,000 ac-ft for Rafferty, Grant Devine and Lake Darling, respectively) each reservoir is drawn down further when the forecasted inflow volume calls for a spring drawdown less than the maximum spring drawdown, as is the case in 1975. In 1975, the computed spring drawdown elevation is lower than the baseline. Consequently, each reservoir is drawn down further after February 1st, which increases releases in February and March and provides some minor peak flow reduction upstream of Lake Darling. During larger flood years, such as 1976 and 2011, large forecasted inflow volumes cause each reservoir to draw down to its maximum spring drawdown elevation in both the baseline and alternative simulation, resulting in no change between the two scenarios. During normal and drought years, no spring drawdown is necessary, and there is no change from the baseline simulation.

4.5 10bR (Plates Right – lesser)

The results of this alternative variant are similar, but opposite to, the results of Alternative 10bL. Each reservoir is drawn down less when the forecasted inflow volume calls for a spring drawdown less than the maximum spring drawdown. In 1975, this leads to lower releases in February and March, higher reservoir elevations during the spring runoff period, and slightly higher flood peaks above Lake Darling. During large flood years, when the maximum spring drawdown is targeted, there is no change from the

baseline simulation. Likewise, during normal and drought years, when there is no spring drawdown initiated, there is no change from baseline.

4.6 Performance Indicators (10b)

4.6.1 Reservoirs

There are no significant impacts to performance indicators for any reservoir in the 10b Left or 10b Right scenarios.

4.6.2 Riverine Reaches

There are no significant impacts to performance indicators throughout the river in the 10b Left or 10b Right scenarios.

4.7 10cL (Plates Left – greater)

The results of this alternative variant are very similar to Alternative 10bL. Most years there is no change from baseline, as there is either the maximum spring drawdown (1976, 2011) or no spring drawdown (normal, drought years). During years in which the spring drawdown changes, such as 1975, there is a greater drawdown of each reservoir relative to Alternative 10bL. This corresponds to more outflow in February and March but no significant additional peak flow reduction throughout the basin when compared to Alternative 10bL.

4.8 10c Right

The results of this alternative variant are very similar to Alternative 10bR. During low and normal flow years, either the reservoirs are too low for this operational change to have an impact, or the forecasted inflow does not call for a spring drawdown. During moderate flood years, such as 1975, this alternative raises flood peaks above Lake Darling and increases the duration of high flows downstream of Lake Darling.

4.9 Performance Indicators (10c)

4.9.1 Reservoirs

There are no significant impacts to performance indicators for any reservoir in the 10c Left or 10c Right scenarios.

4.9.2 Riverine Reaches

There are no significant impacts to performance indicators throughout the river in the 10c Right scenario. The flow regime change and subsequent limited positive effects on the performance indicators seen in the 10a Down scenario are also seen in the 10c Left scenario, albeit to a lesser degree.

5. Suggested Further Alternative Fine Tuning

The maximum flow limits at Estevan may have been preventing drawdown of Rafferty Reservoir during these alternative simulations. Further analysis of the impacts of the flow restrictions at Estevan will be considered in Phase 3. Additionally, different variables (dates, elevation shifts, volume shifts, etc.) should be looked at to determine their individual effects on each of the reservoirs.

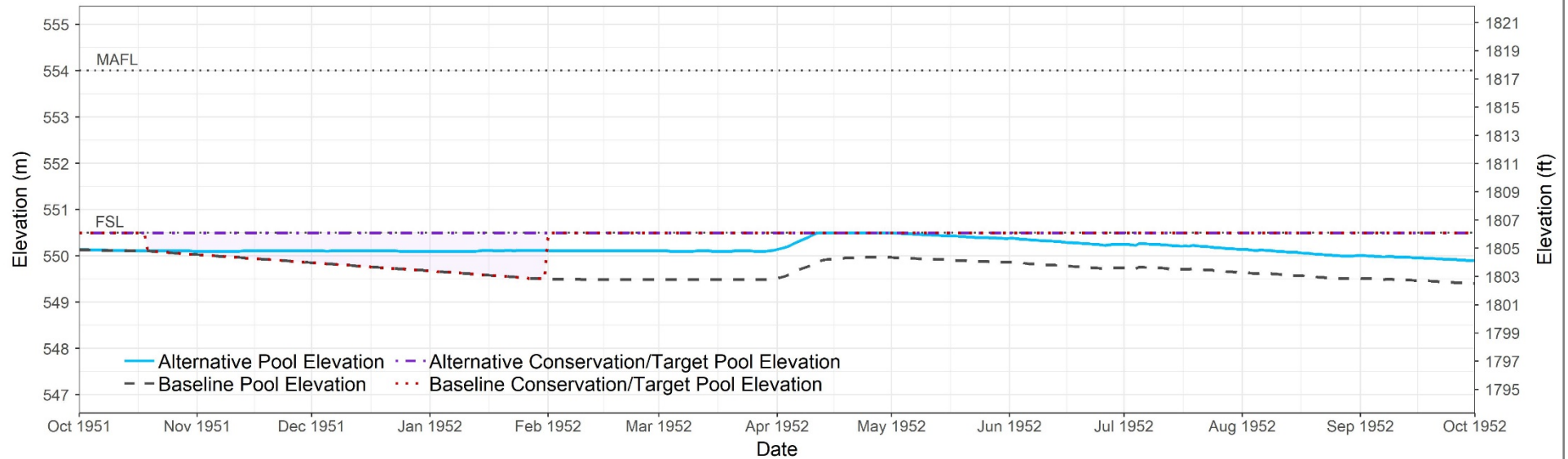
6. Path forward

This alternative will be carried forward as Alternative 308 and a sensitivity analysis will be used to look at individual variables (e.i dates, elevation shifts, volume shifts, etc.) for each reservoirs. Since no water supply benefits were observed shifting the plates up or to the right (10aU, 10bR and 10cR), Alternative 308 will only further explore shifting the plates down or to the left.

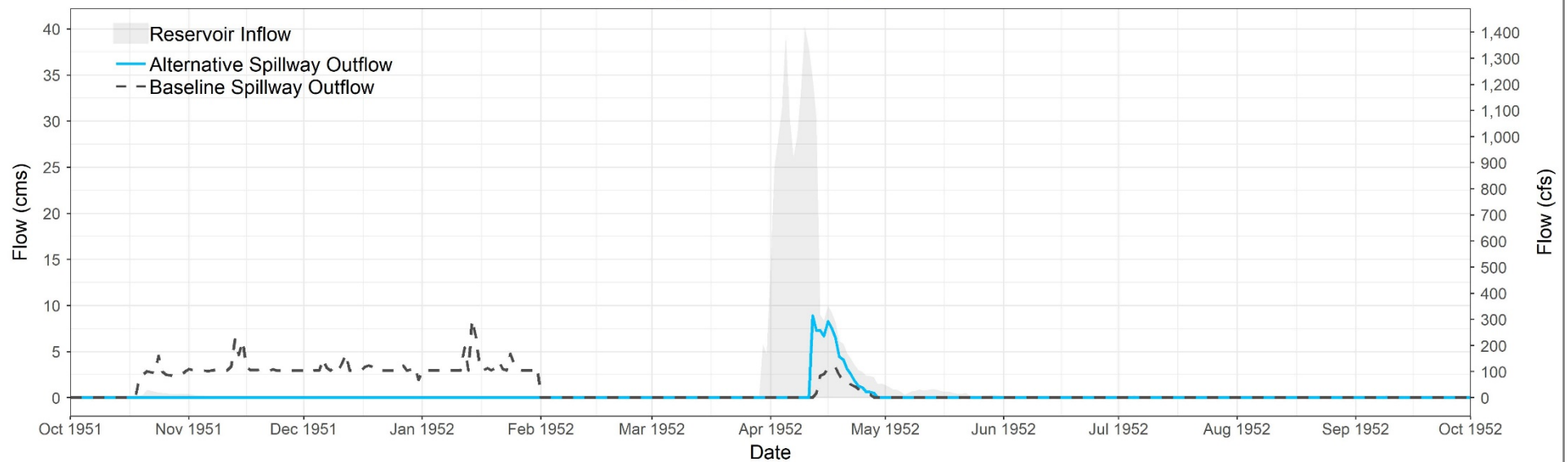
7. References

1. "HEC-DSSVue," U.S Army Corps of Engineers, Hydraulic Engineering Center, February 2010.
2. "HEC-ResSim, Reservoir System Simulation, Version 3.3", U.S Army Corps of Engineers, Hydraulic Engineering Center, December 2018.
3. Canada and USA, 1989. Agreement between the Government of Canada and the United States for Water Supply and Flood Control in the Souris River Basin.
4. Canada and USA, 2000. Interim Measures As Modified For Apportionment of the Souris River.
5. Chanel Mueller, Curtis Hallborg, Rachel Weller, U.S Army Corps of Engineers St. Paul District "Modellers workshop", April 17, 2019.
6. Curtis Hallborg, Frank Durbian, Elizabeth Nelson "Alternative 10 - change to spring drawdown" received by Rachel Weller, April 24 2019.
7. "Minot Workshop", Grand Hotel, Minot ND, March 18-21, 2019
8. Mitchell Weir "Alternative 10 Script" received by Rachel Weller, June 14 2019.

Rafferty Reservoir - Elevation

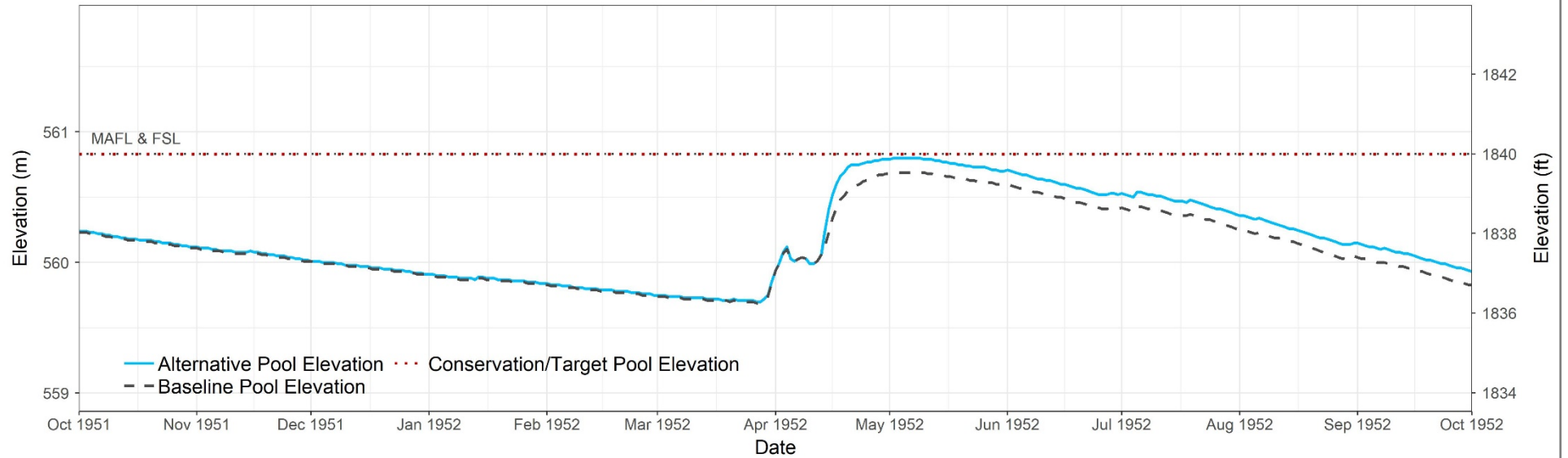


Rafferty Reservoir - Releases

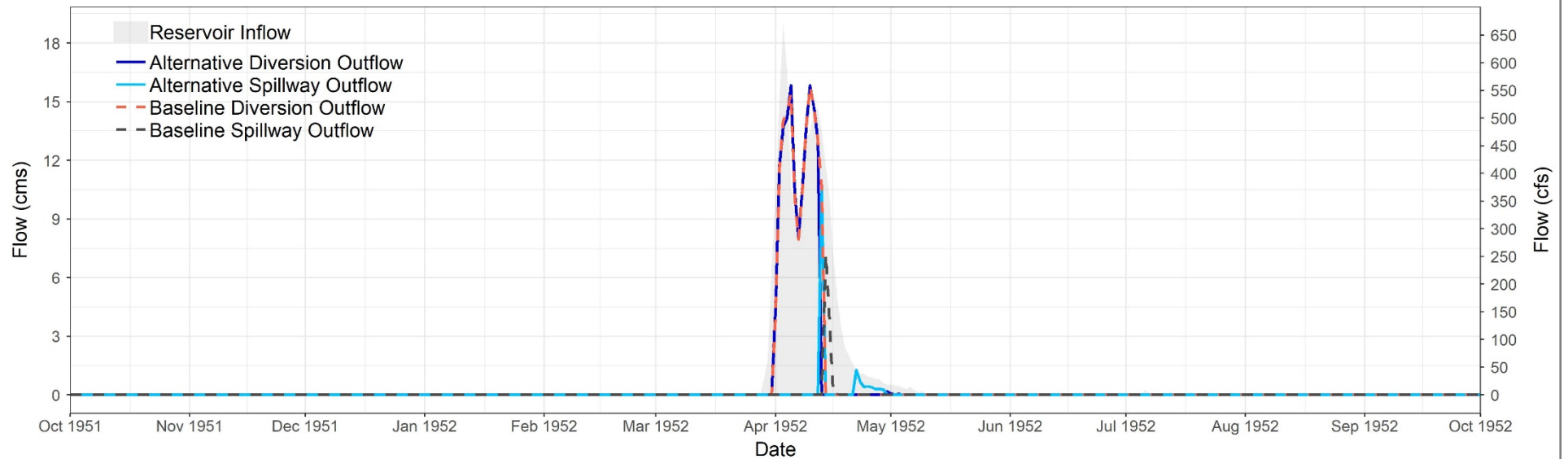


*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level

Boundary Reservoir - Elevation

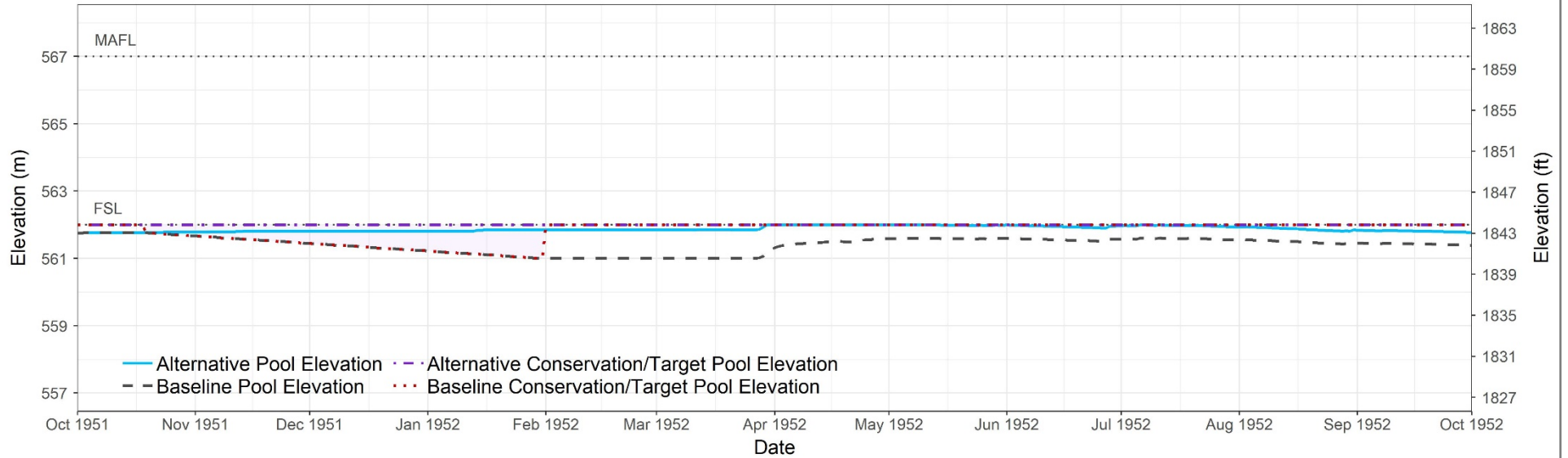


Boundary Reservoir - Releases

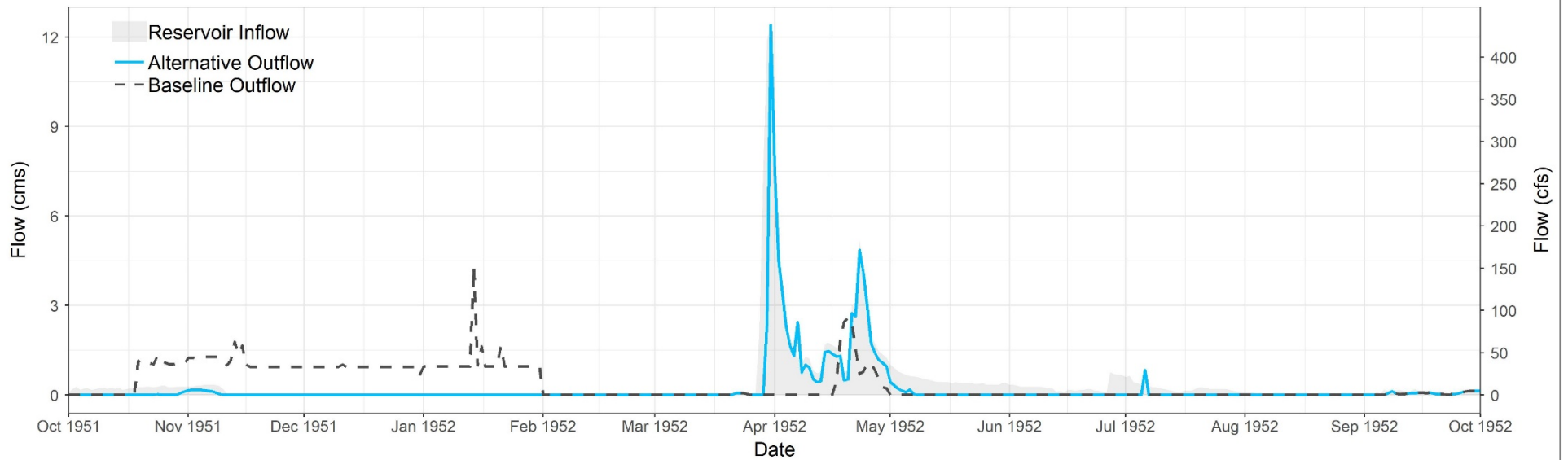


*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level

Grant Devine Reservoir - Elevation

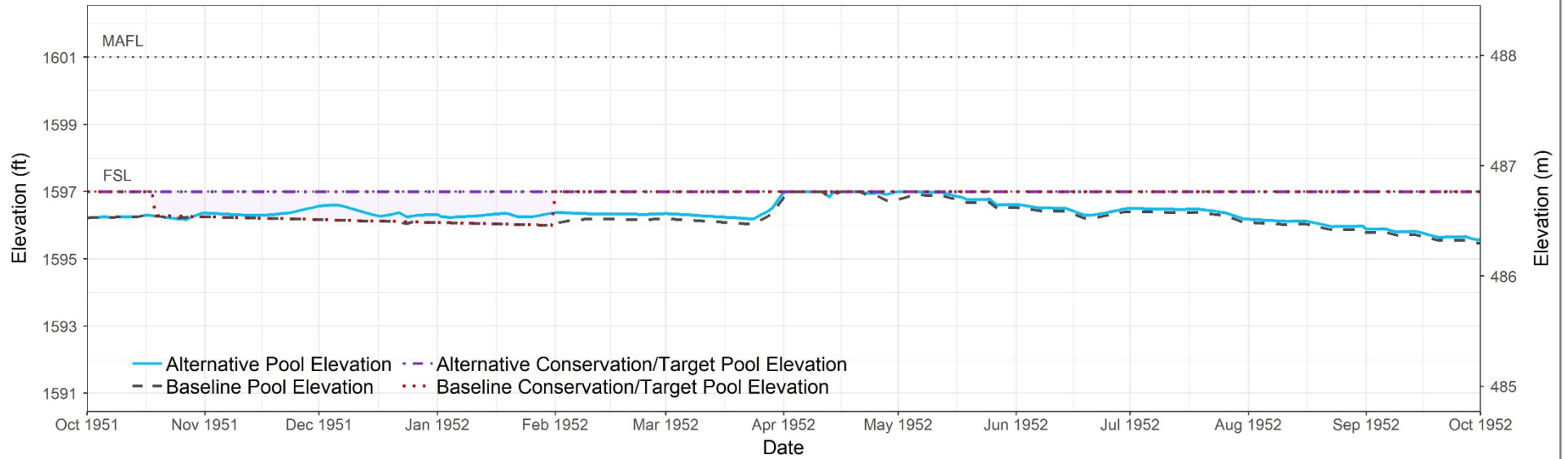


Grant Devine Reservoir - Releases

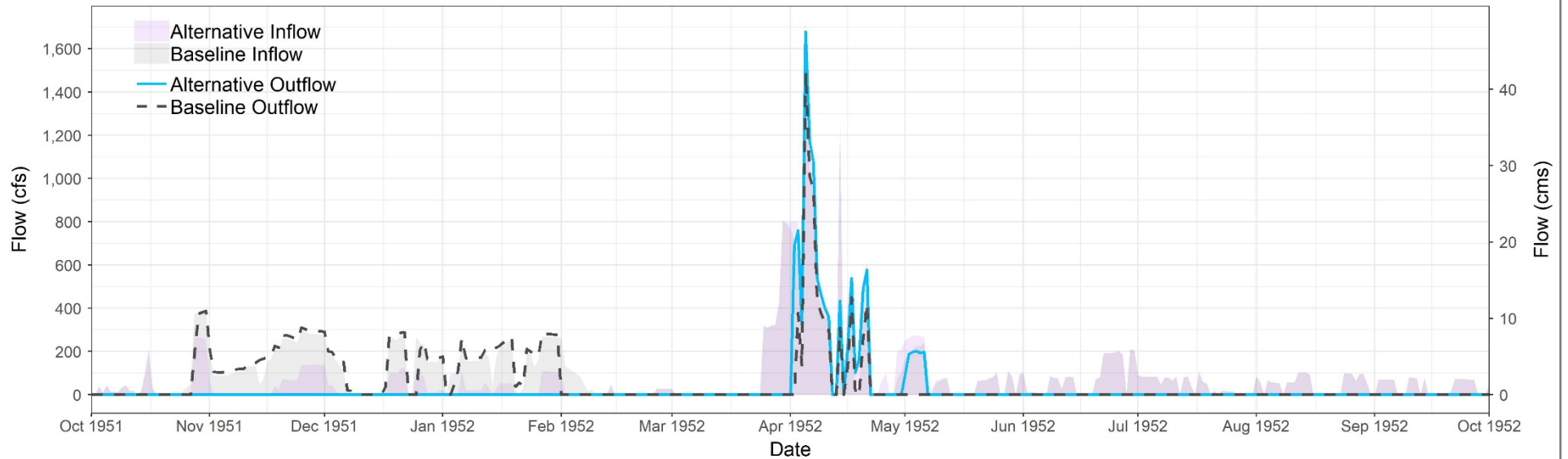


*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level

Lake Darling - Elevation



Lake Darling - Releases



*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level, IDFSL = Inflow Design Flood Supply Level

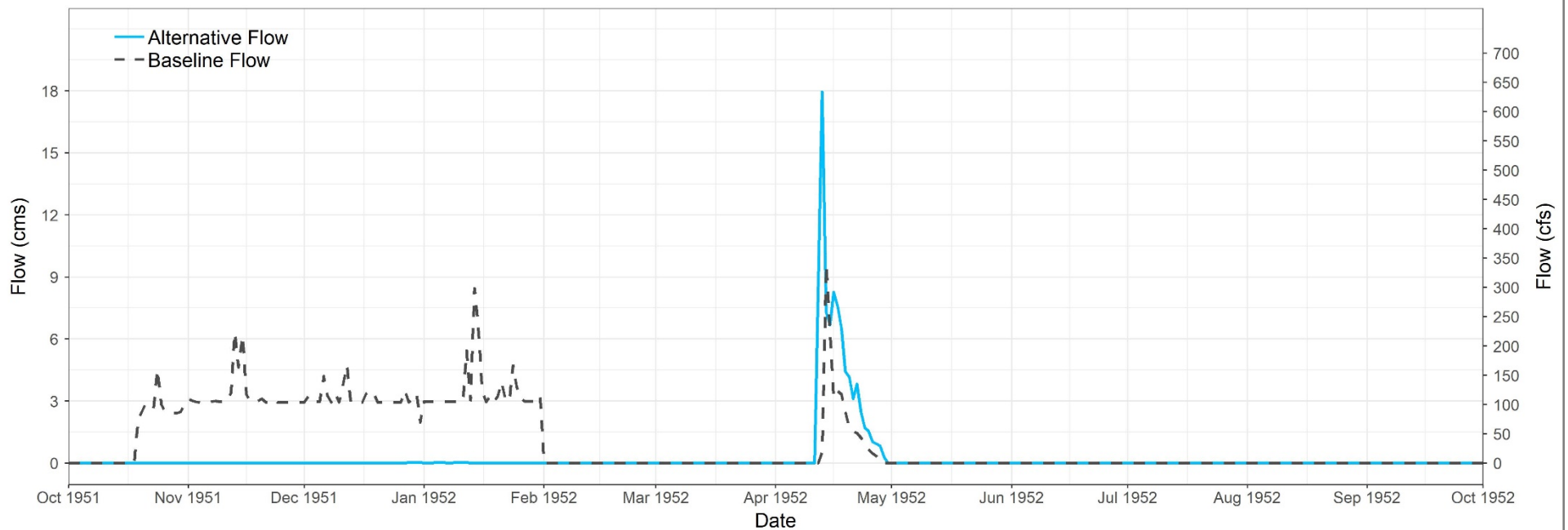
Plate 02

Critical Flow Locations – 1952

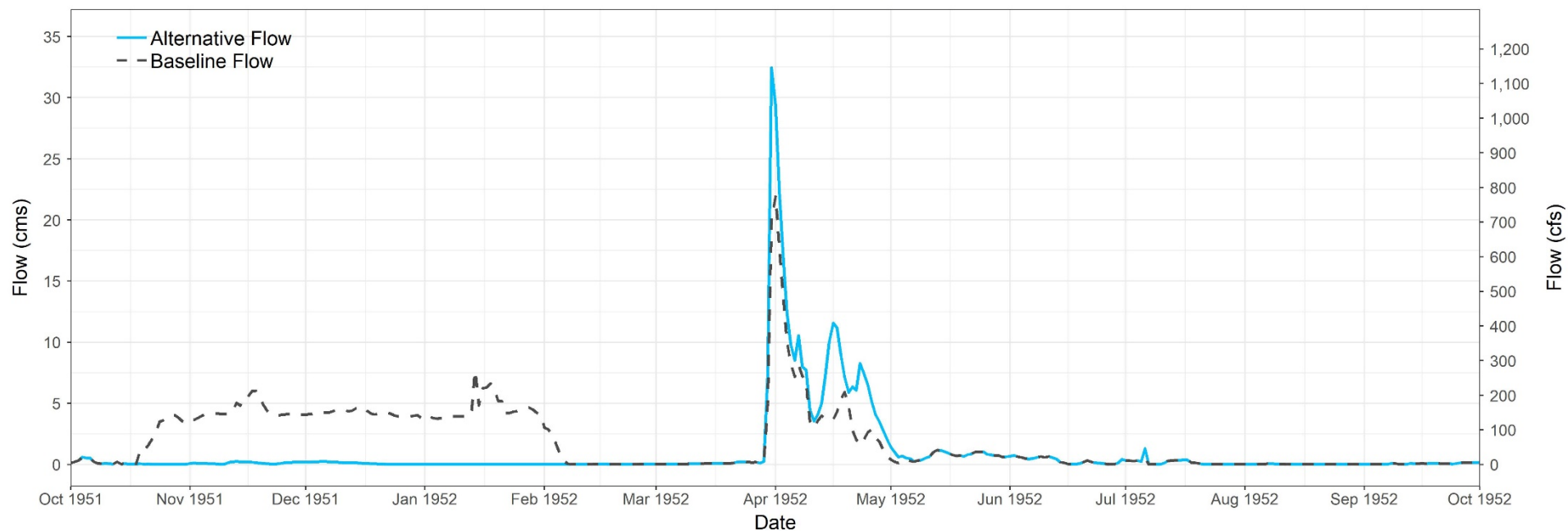
Alternative 10aU (Phase 2)

Souris River Plan of Study

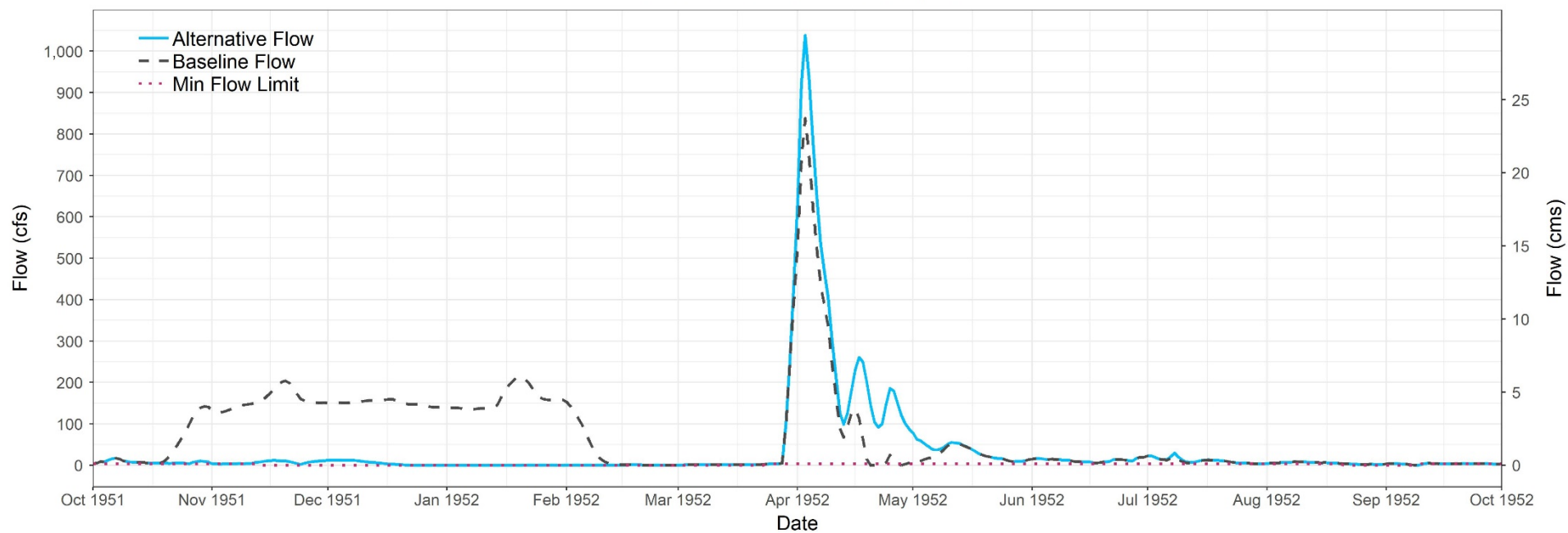
Souris River at Estevan, SK



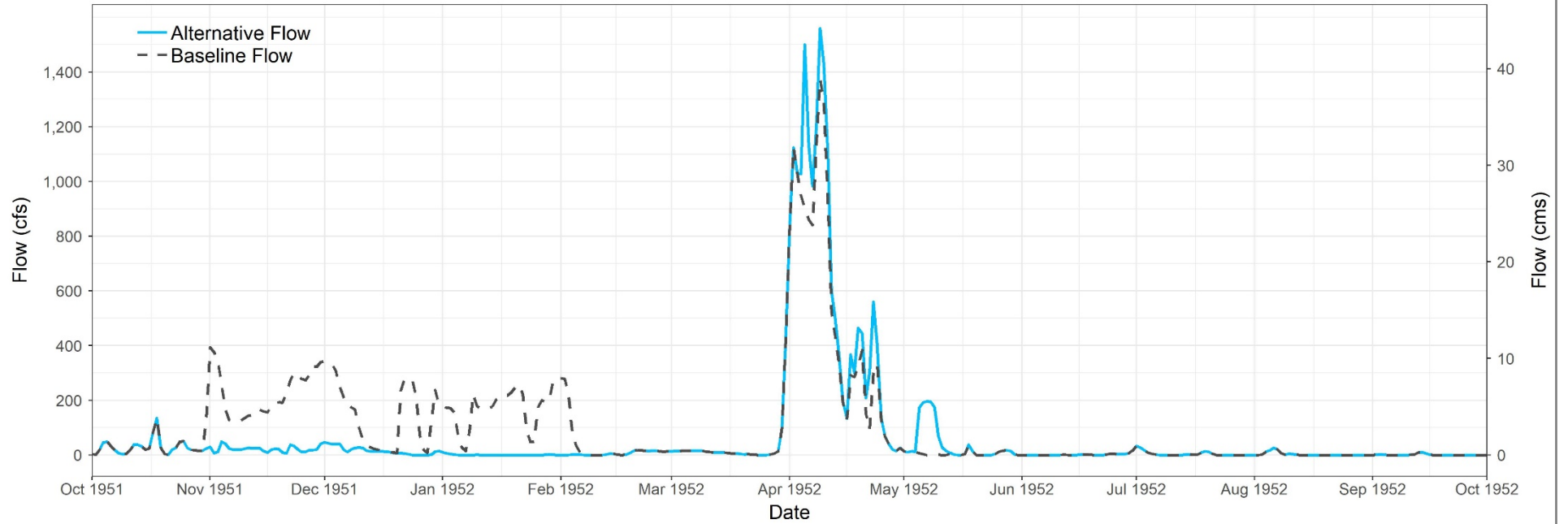
Souris River at Oxbow, SK



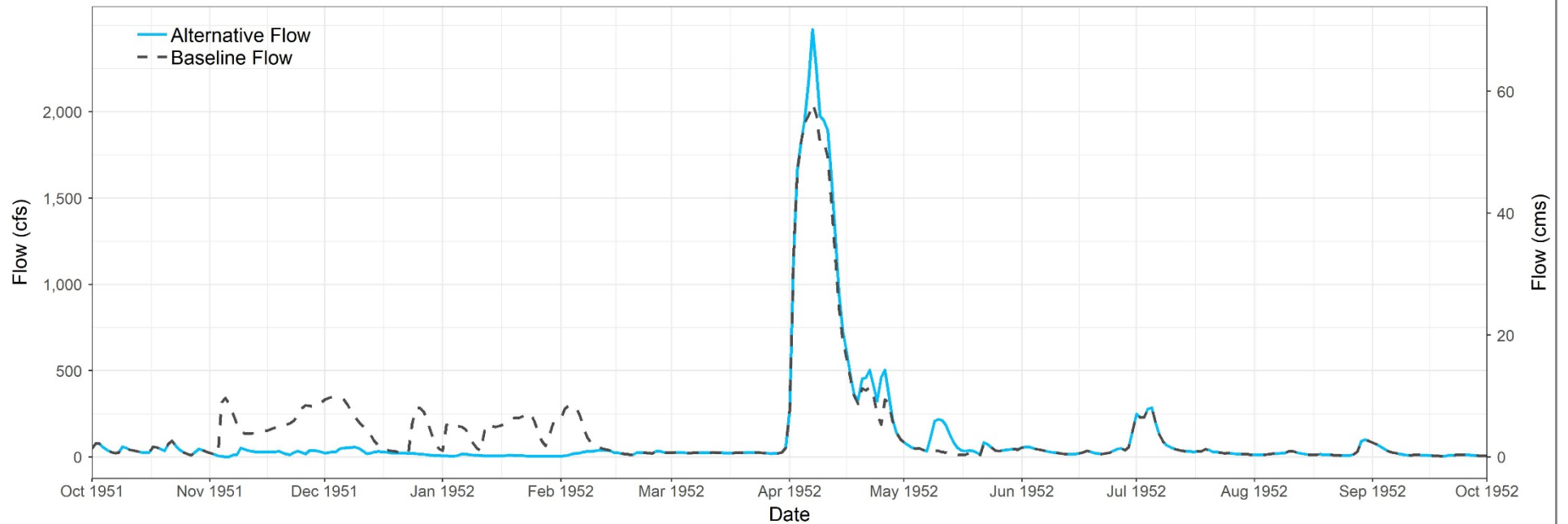
Souris River at Sherwood, ND



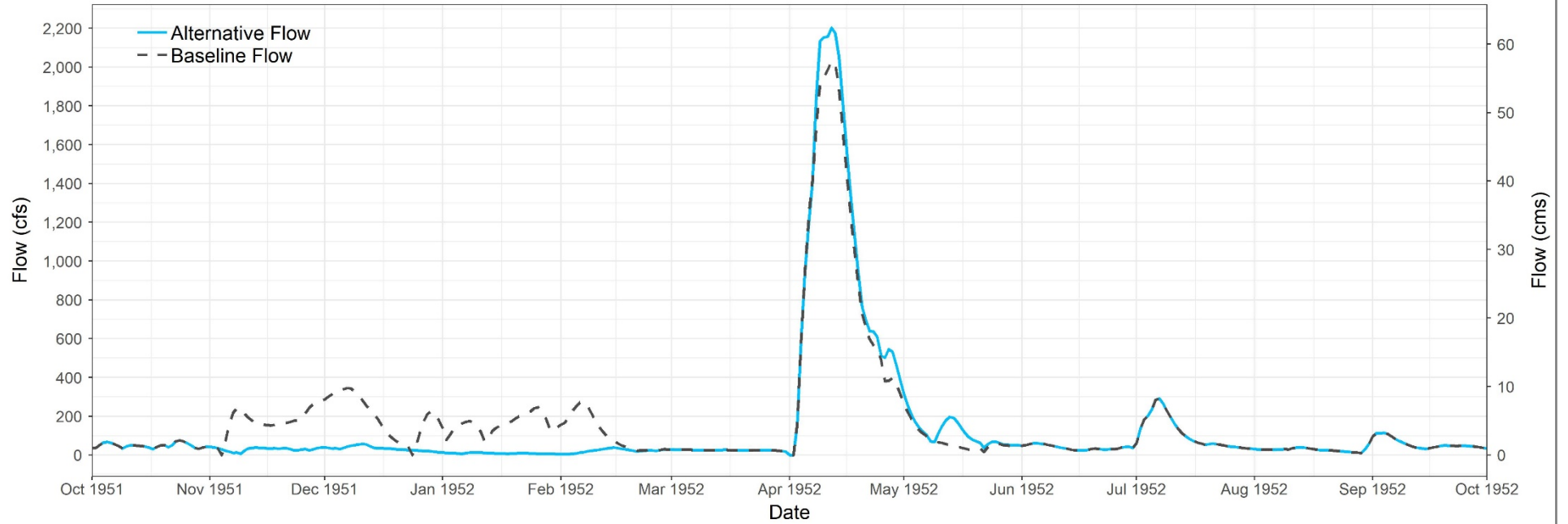
Souris River at Minot, ND - Flow



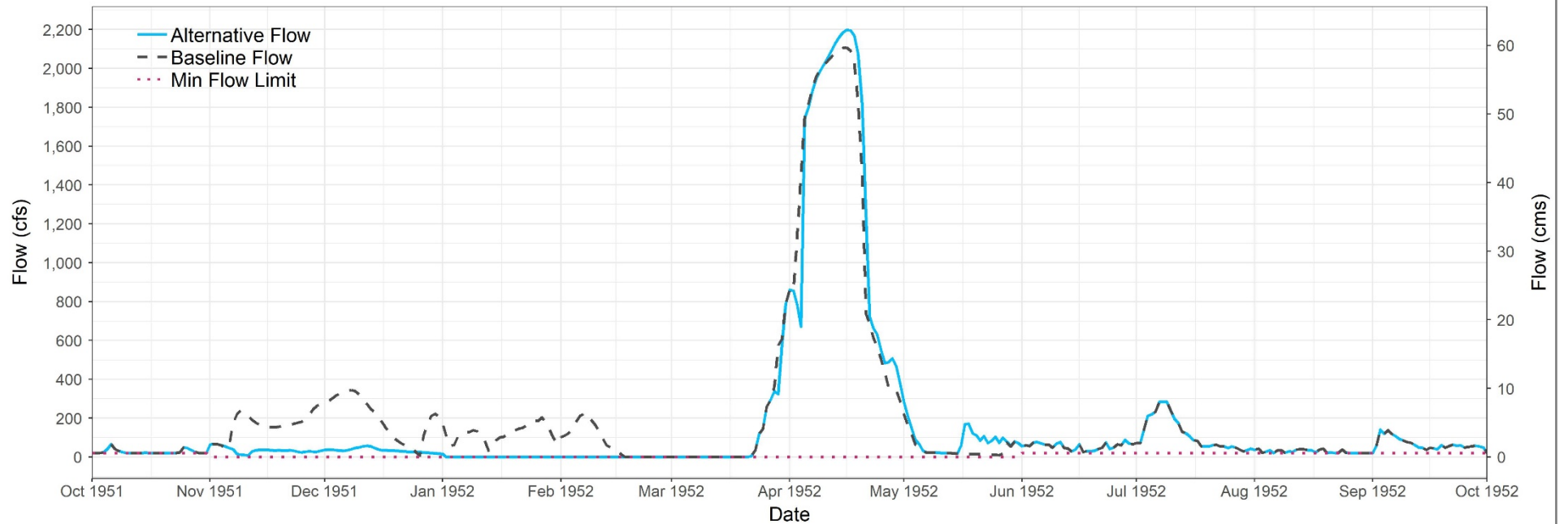
Souris River at Verendrye, ND



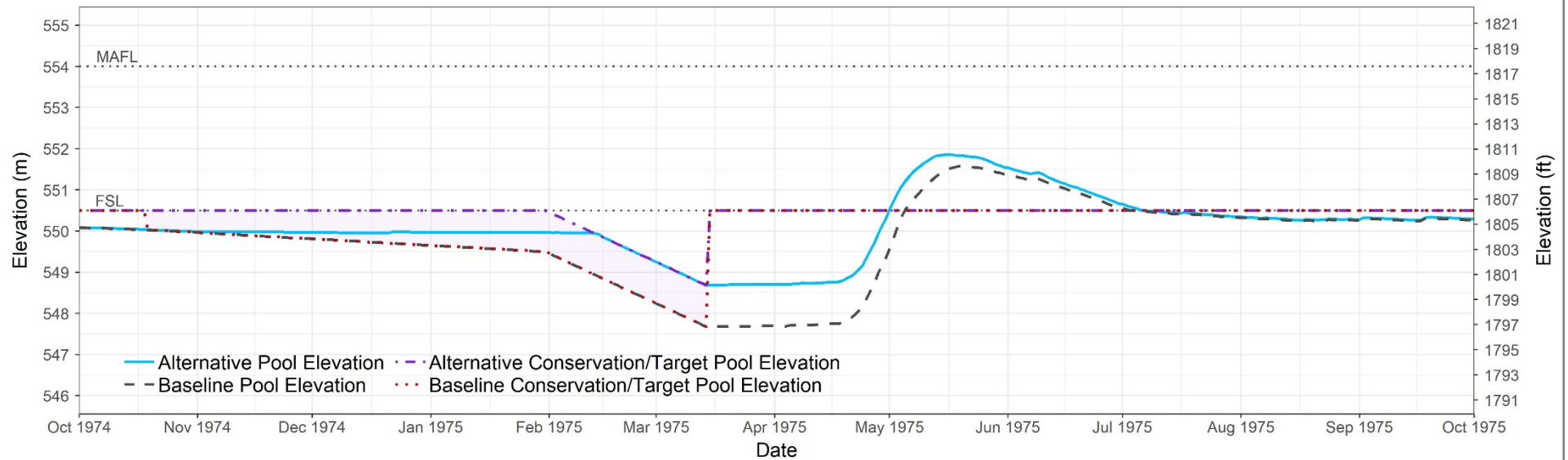
Souris River at Bantry, ND



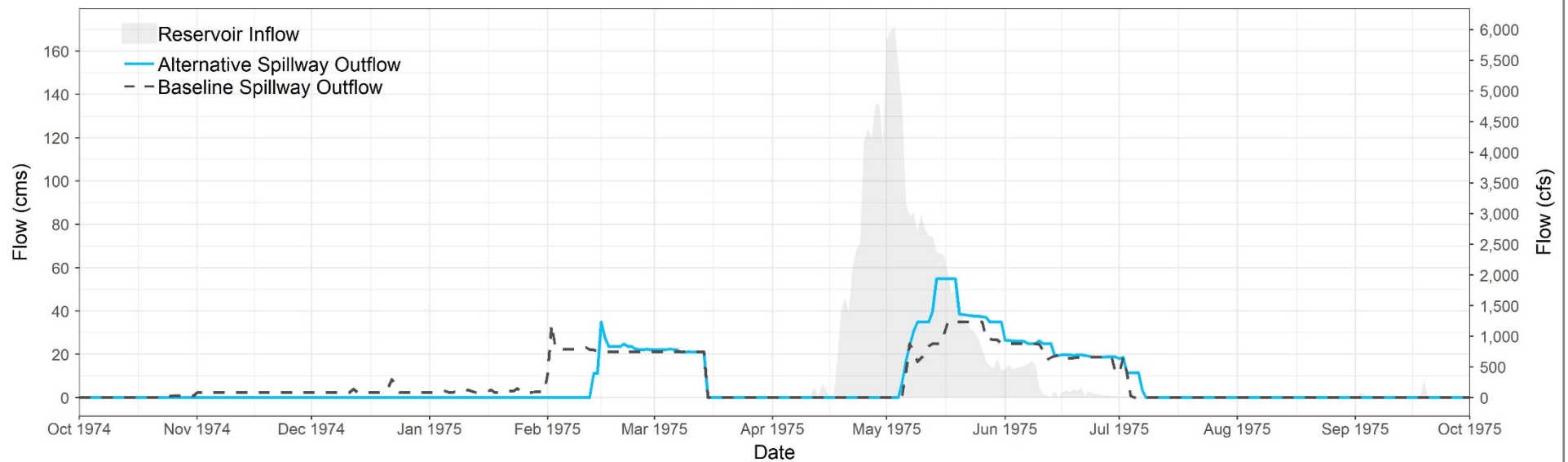
Souris River at Westhope, ND



Rafferty Reservoir - Elevation

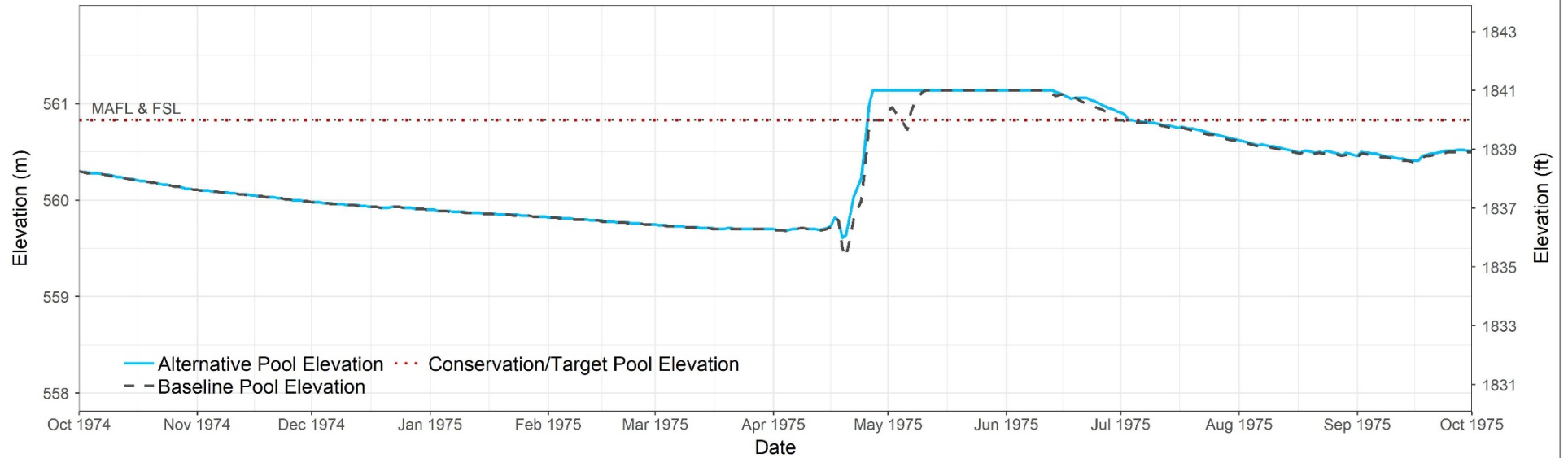


Rafferty Reservoir - Releases

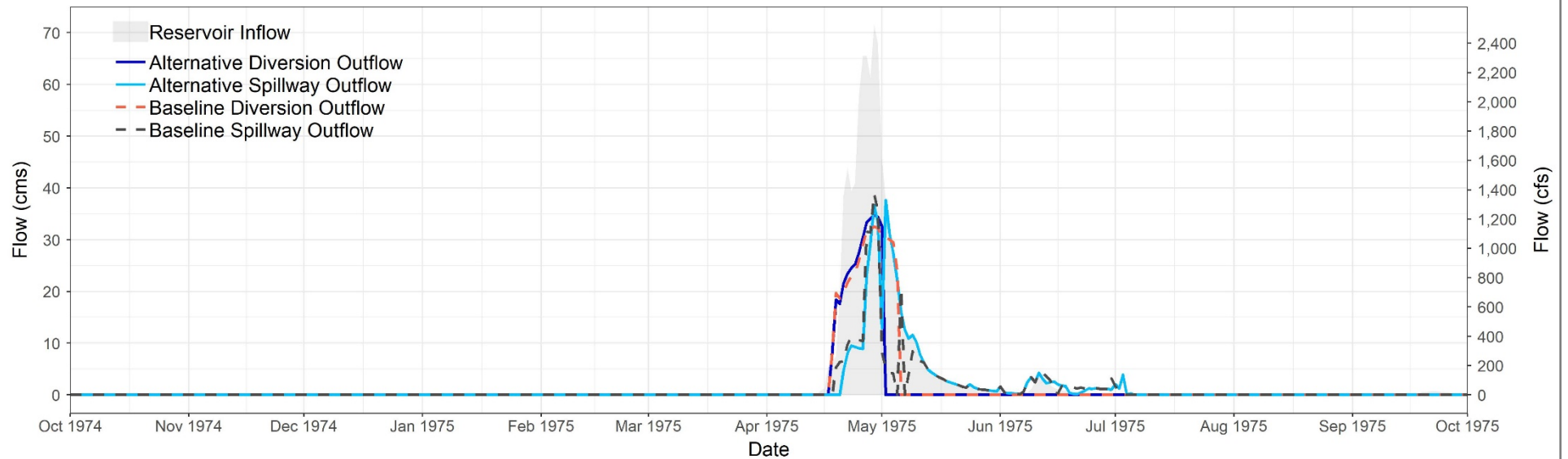


*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level

Boundary Reservoir - Elevation

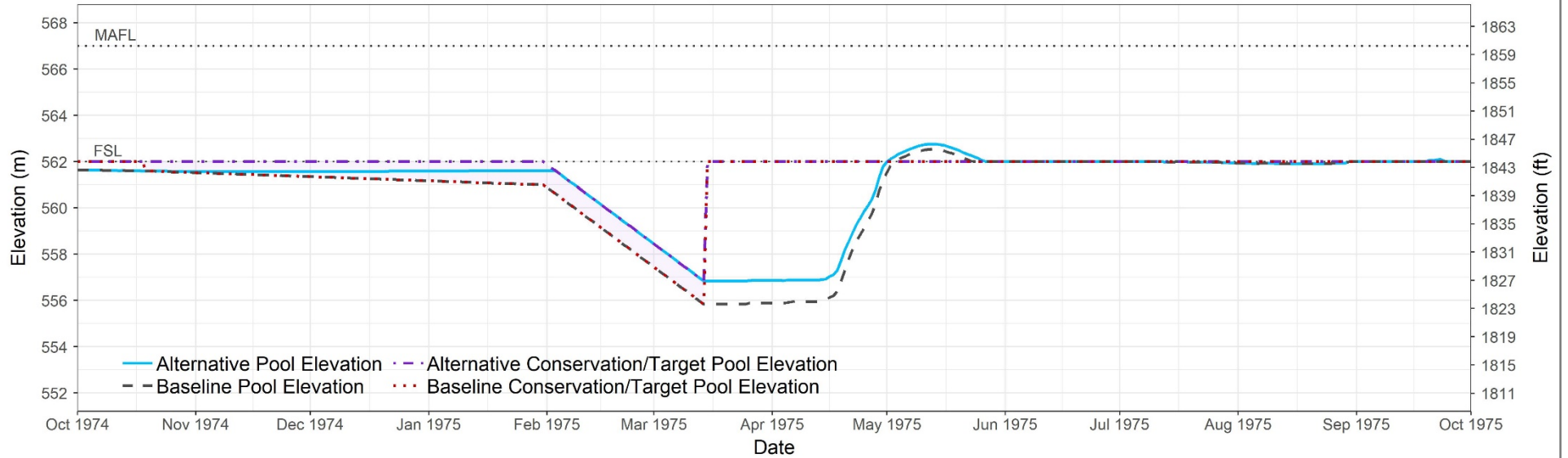


Boundary Reservoir - Releases

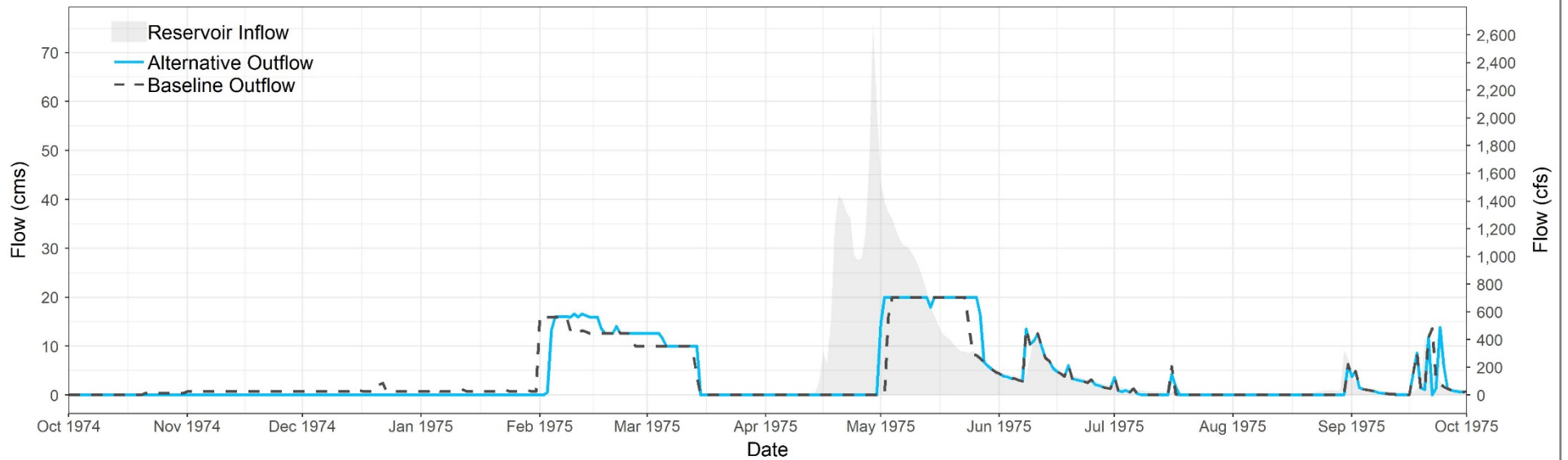


*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level

Grant Devine Reservoir - Elevation

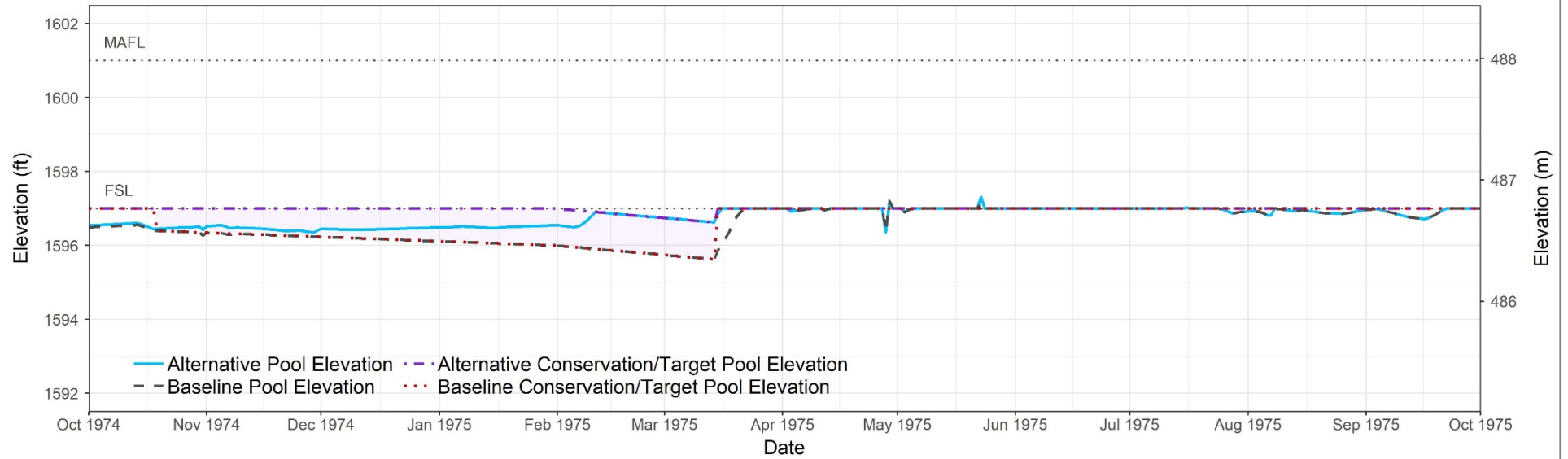


Grant Devine Reservoir - Releases

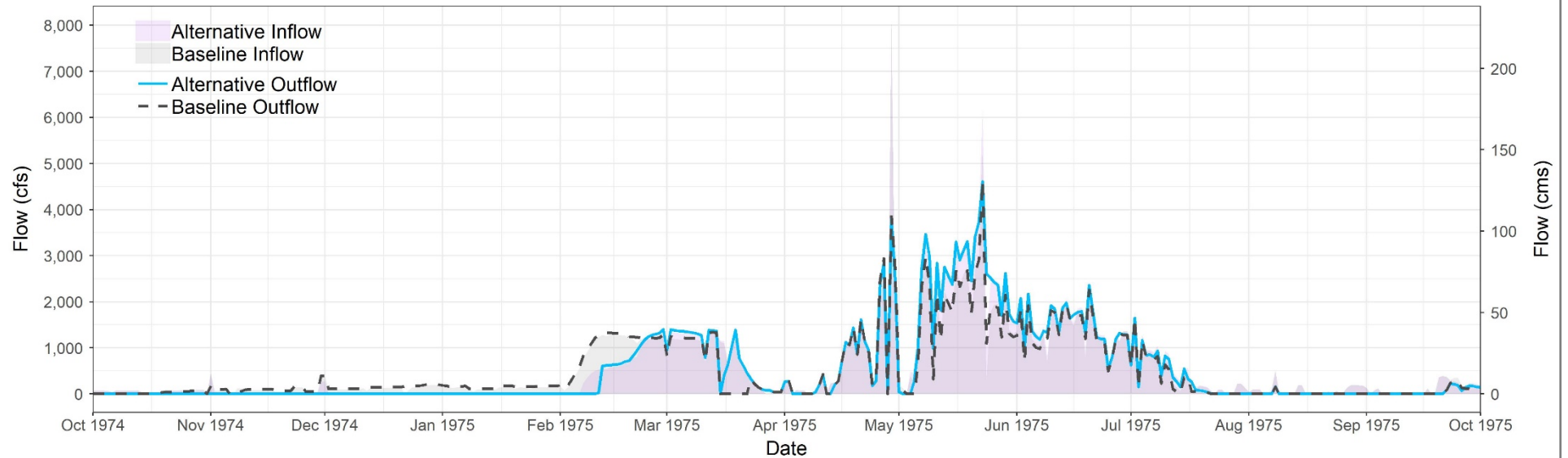


*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level

Lake Darling - Elevation



Lake Darling - Releases



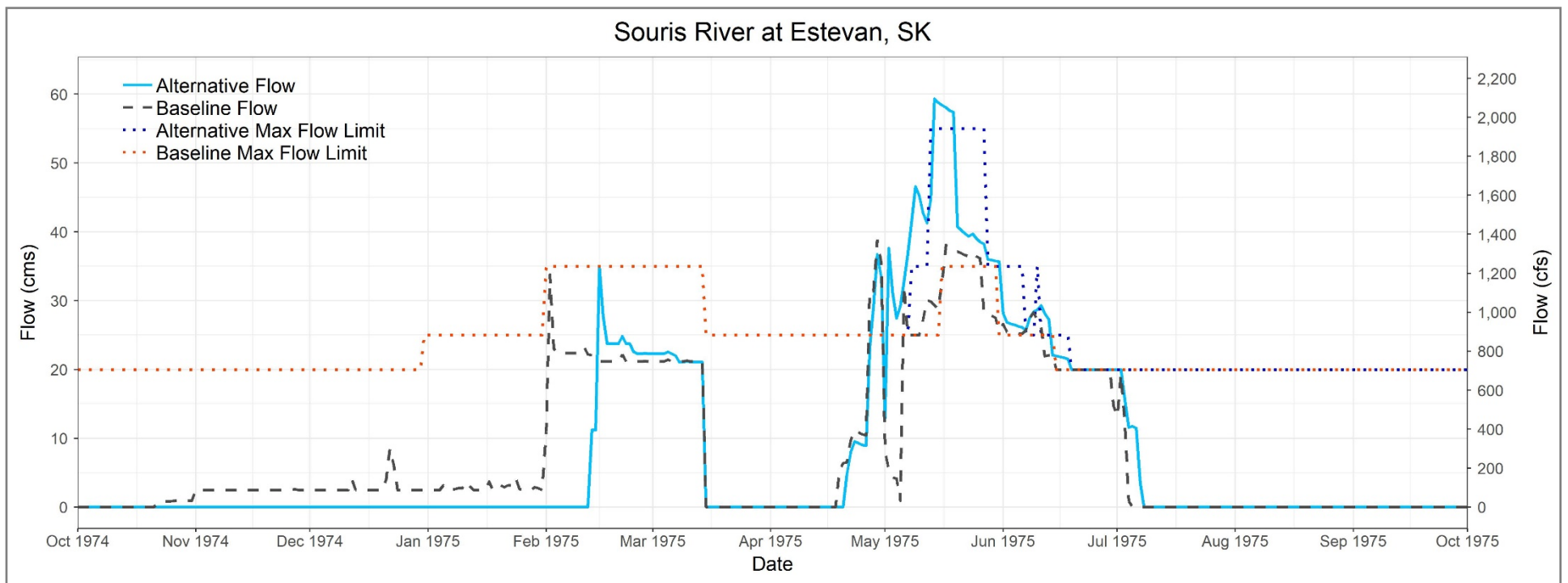
*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level, IDFSL = Inflow Design Flood Supply Level

Plate 04

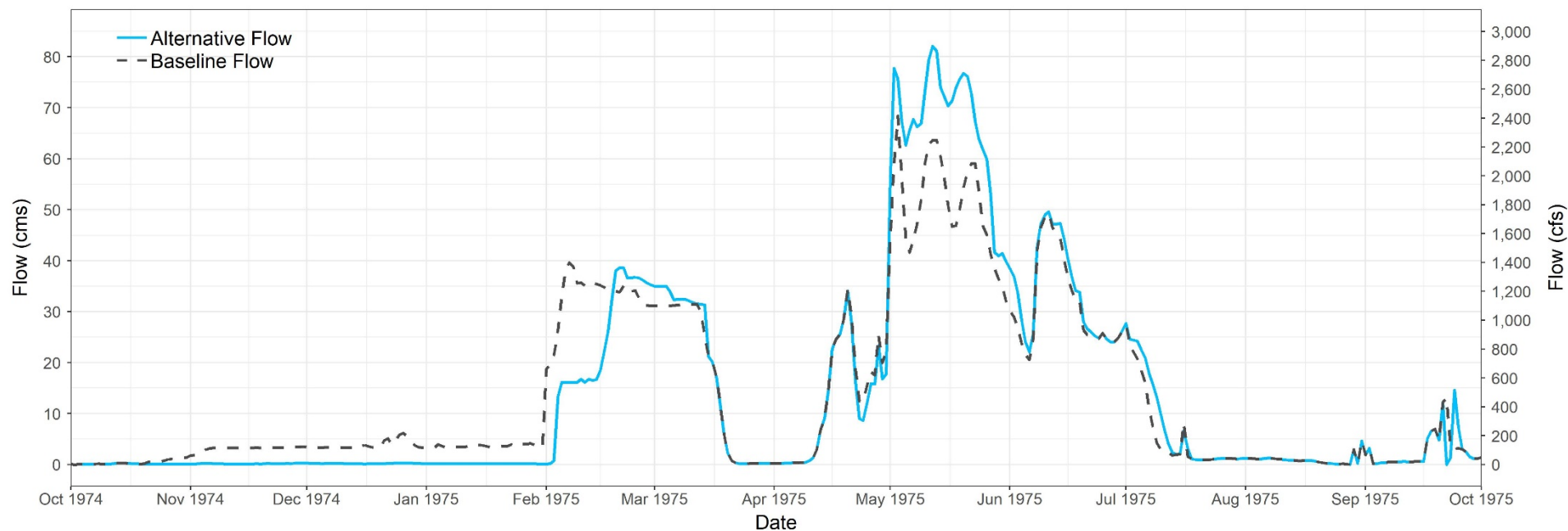
Critical Flow Locations – 1975

Alternative 10aU (Phase 2)

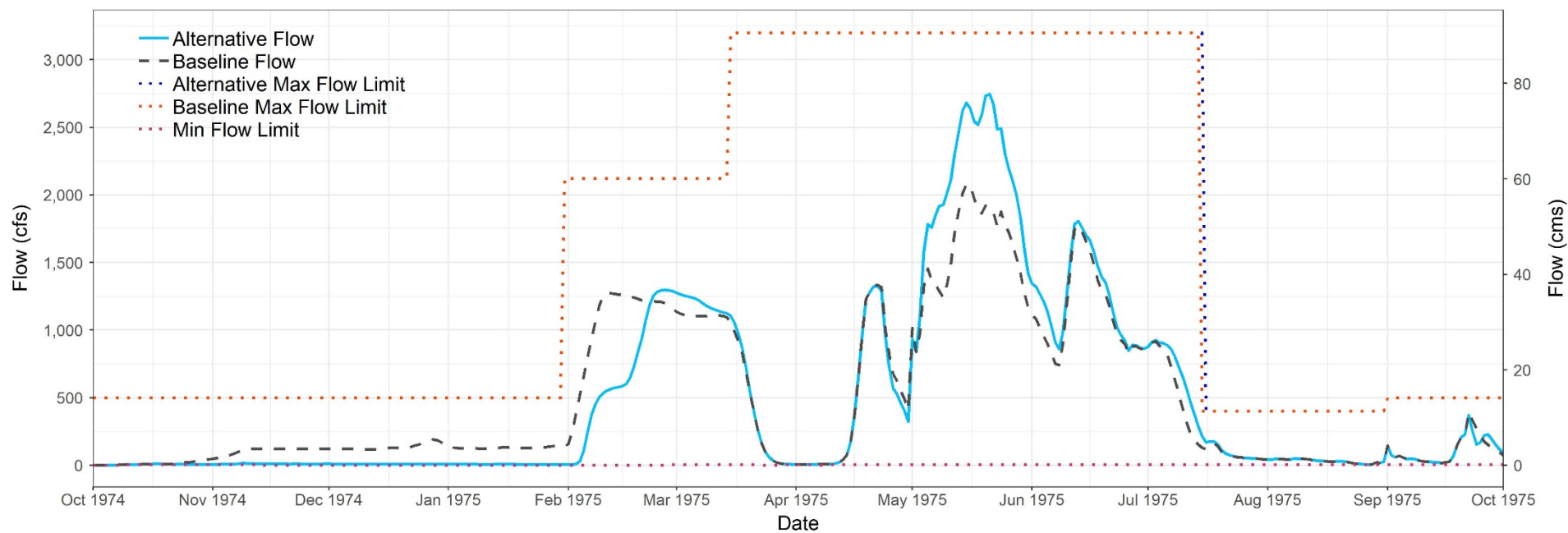
Souris River Plan of Study



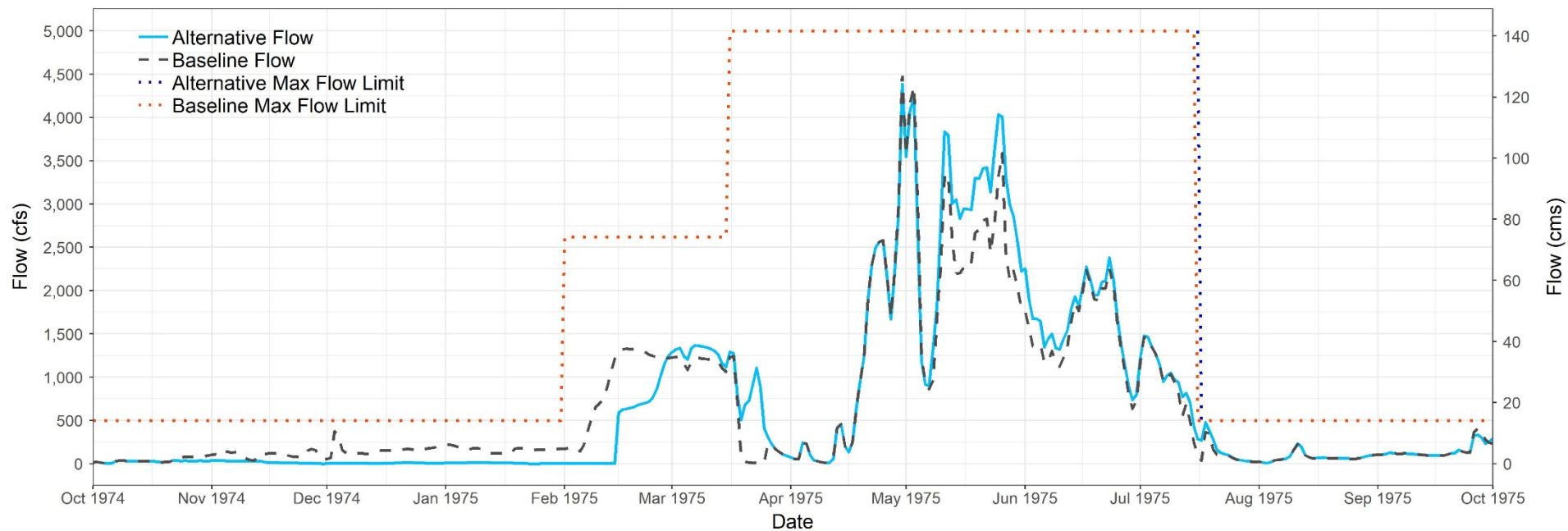
Souris River at Oxbow, SK



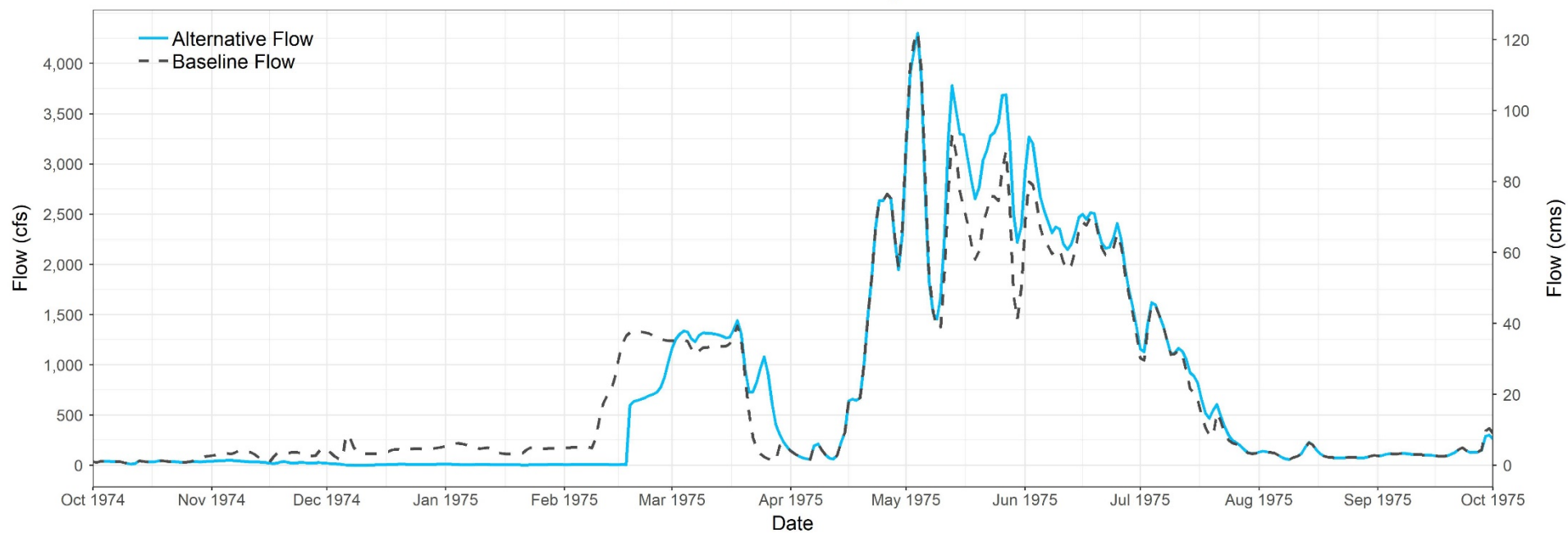
Souris River at Sherwood, ND



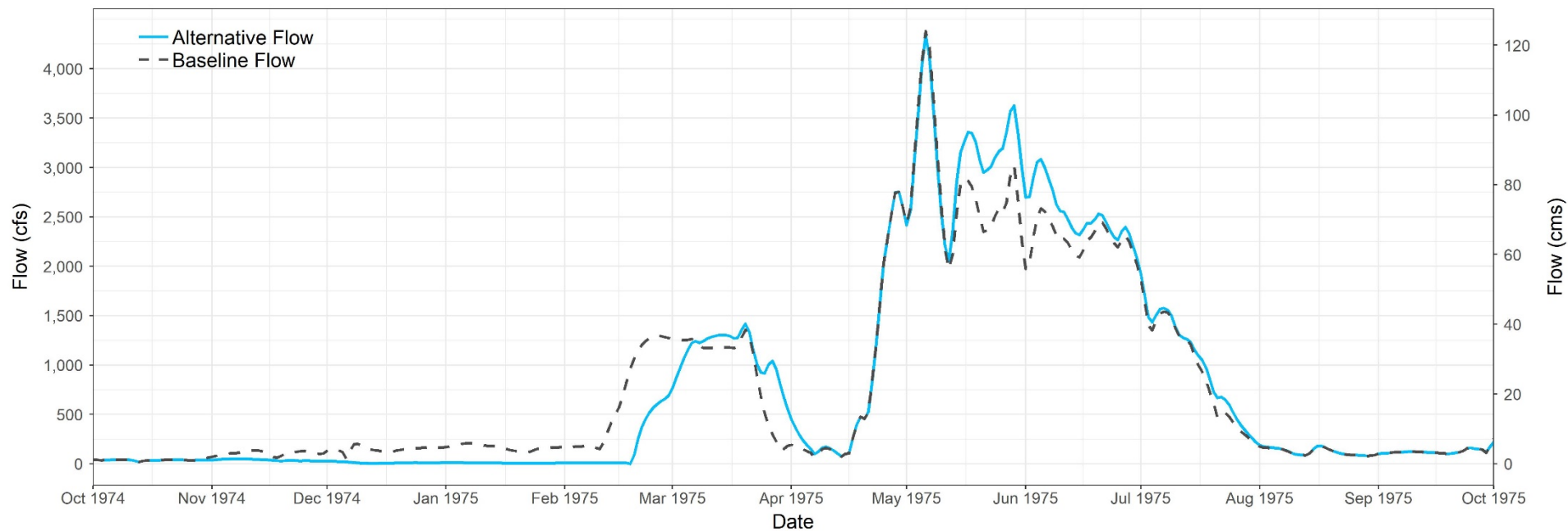
Souris River at Minot, ND - Flow



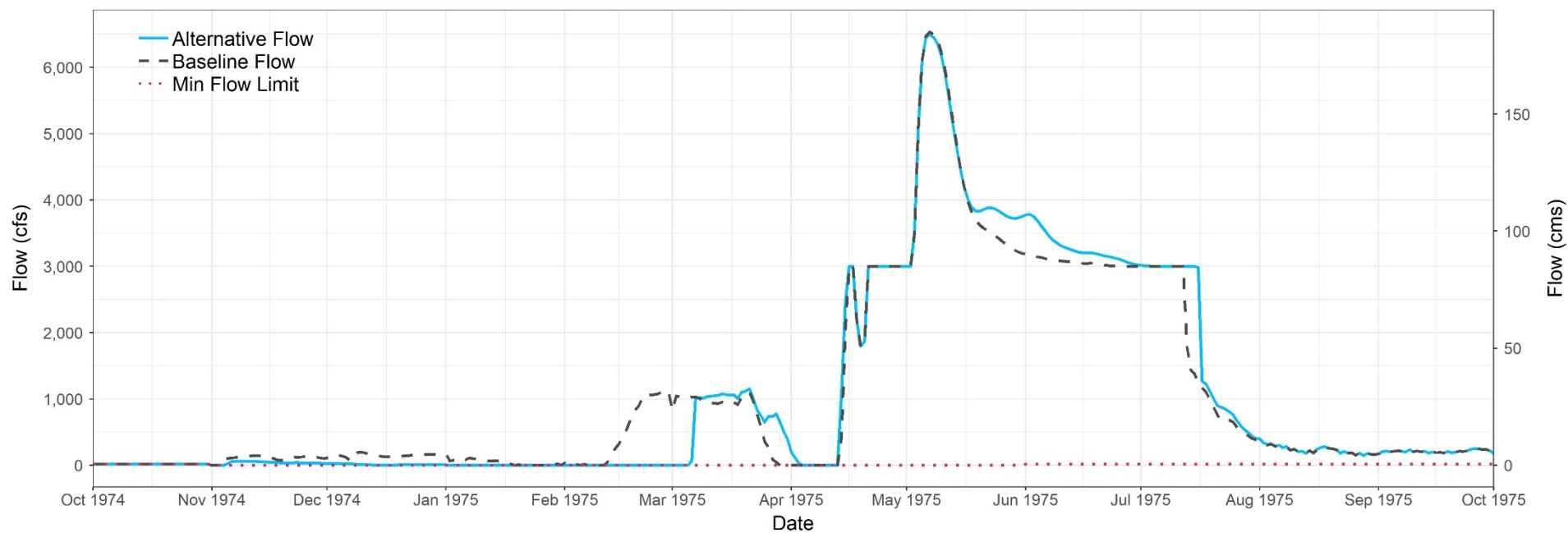
Souris River at Verendrye, ND



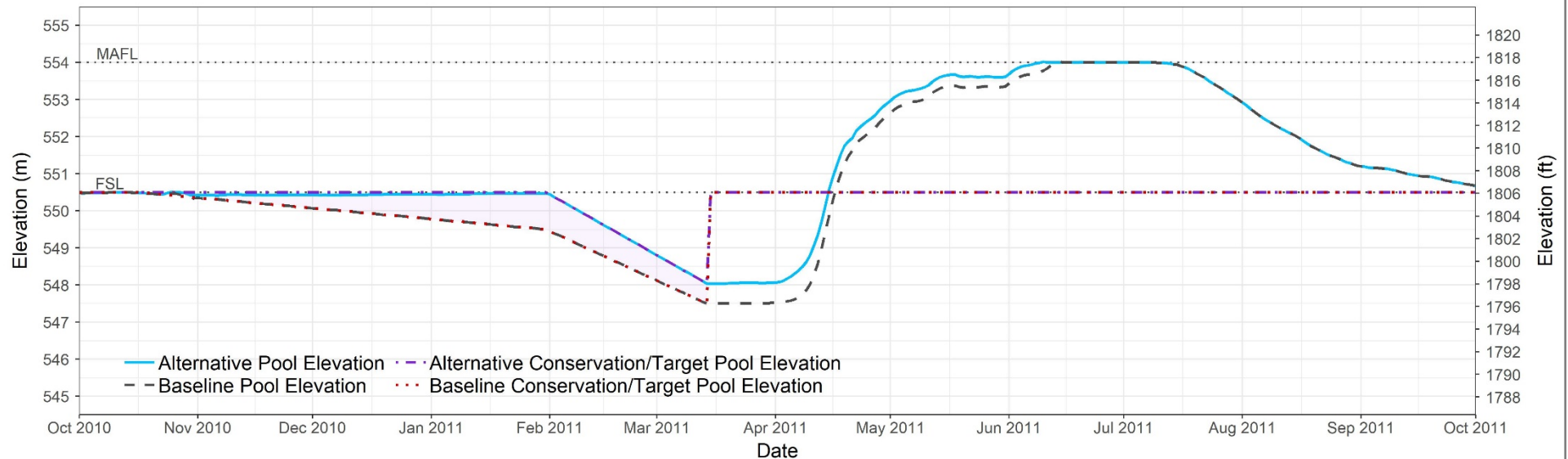
Souris River at Bantry, ND



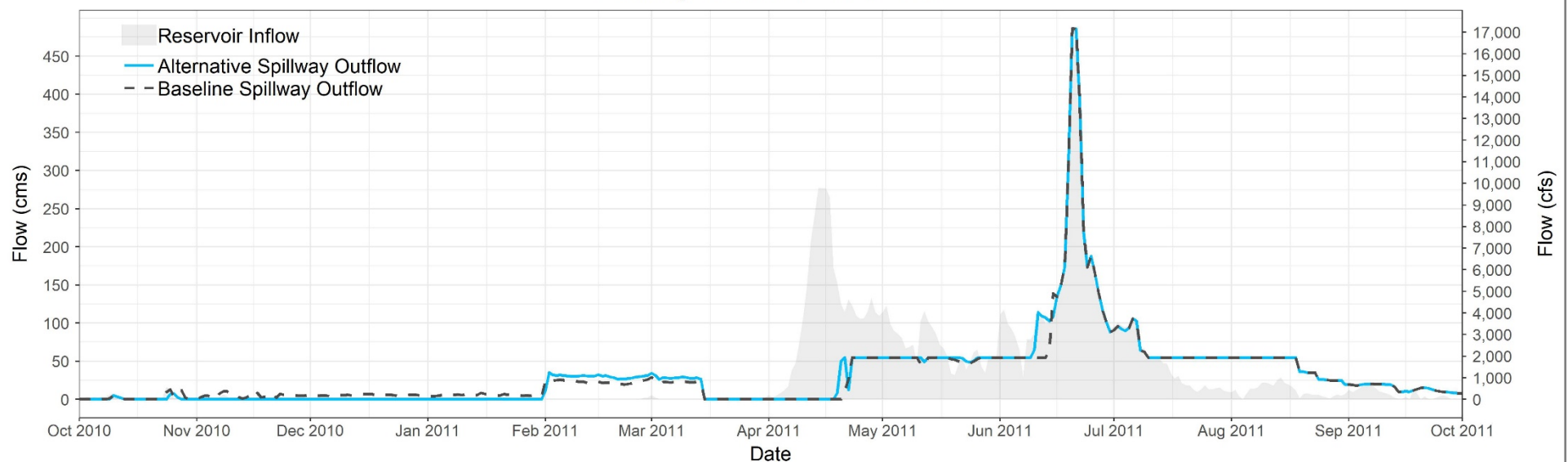
Souris River at Westhope, ND



Rafferty Reservoir - Elevation

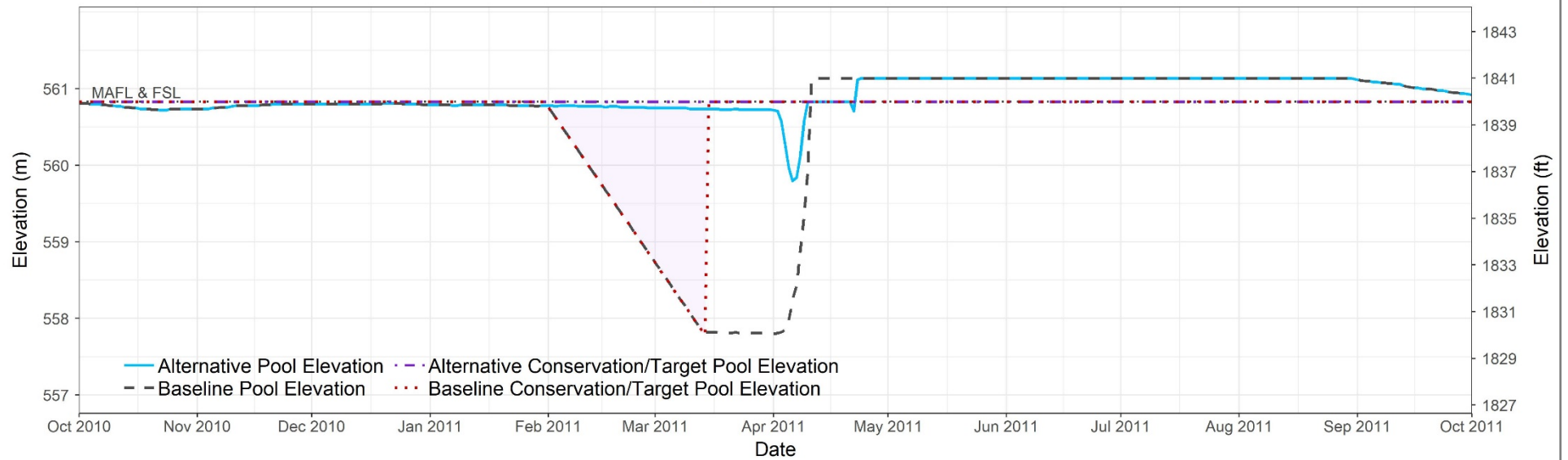


Rafferty Reservoir - Releases

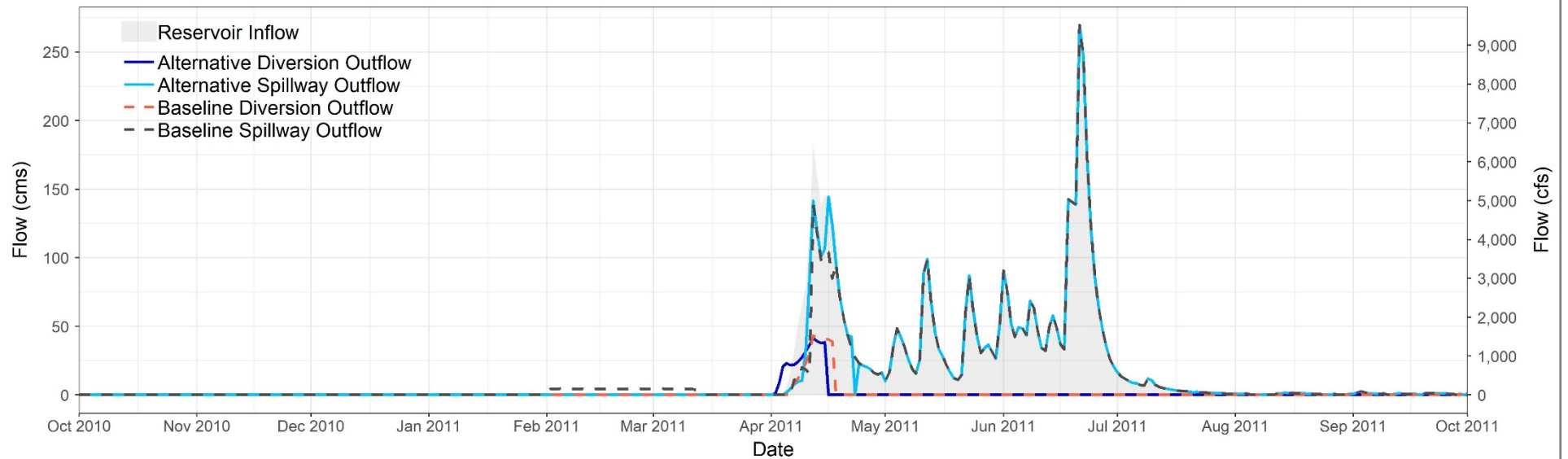


*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level

Boundary Reservoir - Elevation

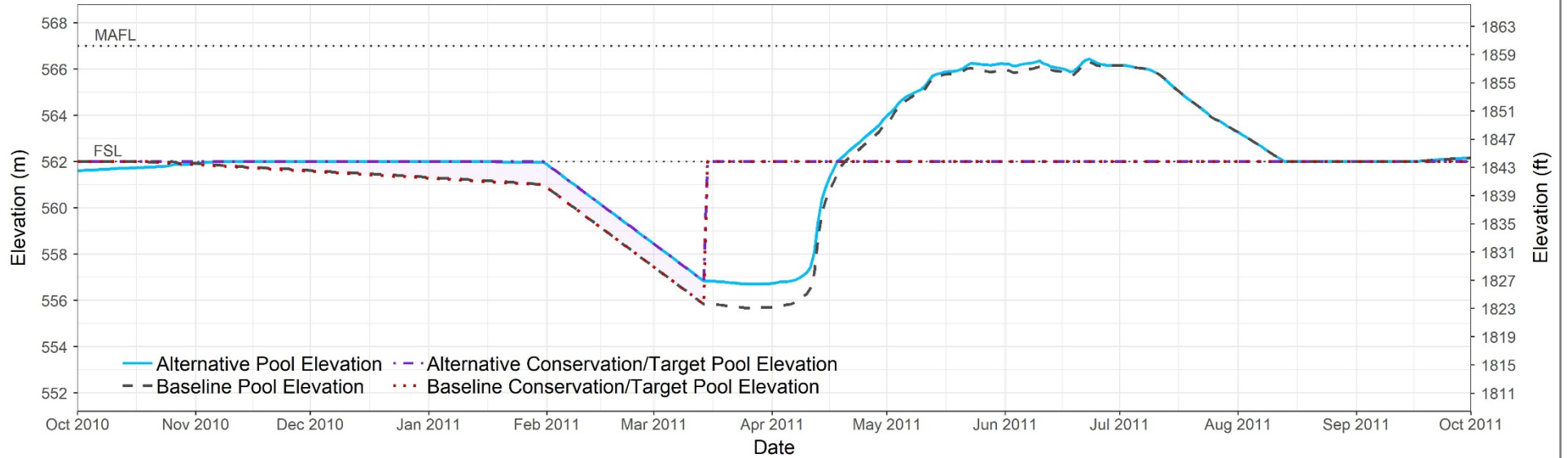


Boundary Reservoir - Releases

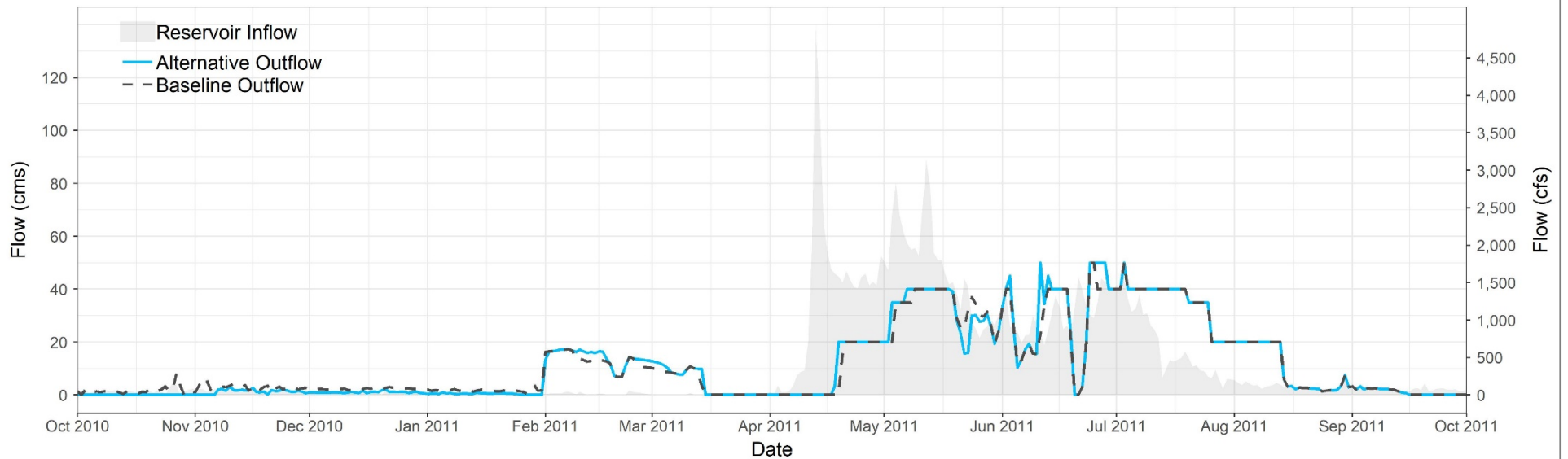


*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level

Grant Devine Reservoir - Elevation

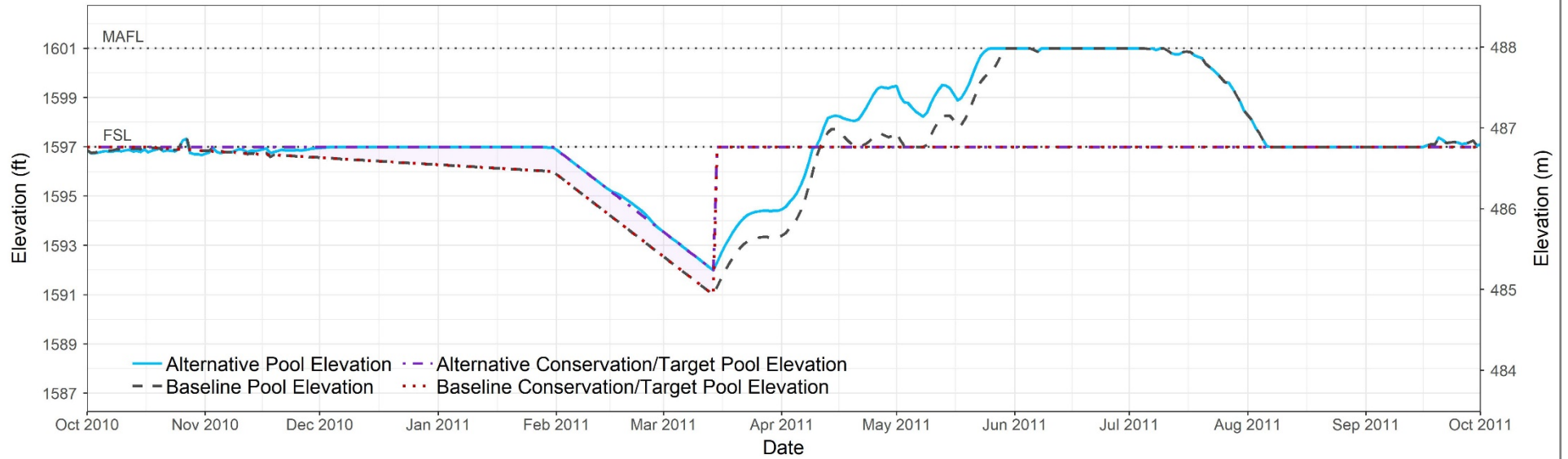


Grant Devine Reservoir - Releases

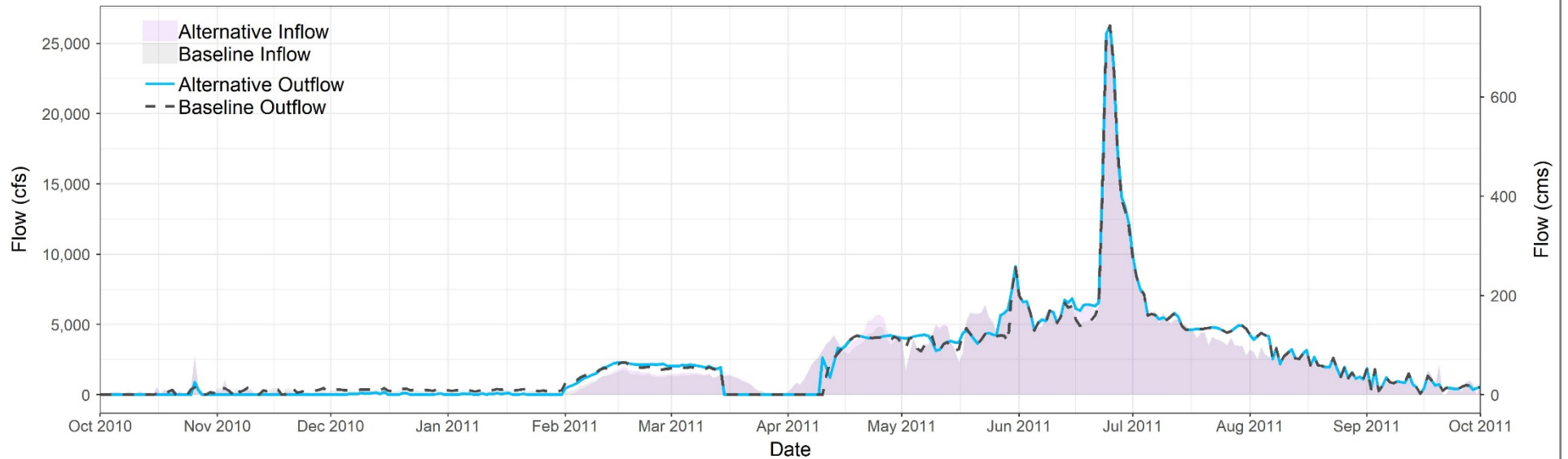


*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level

Lake Darling - Elevation



Lake Darling - Releases



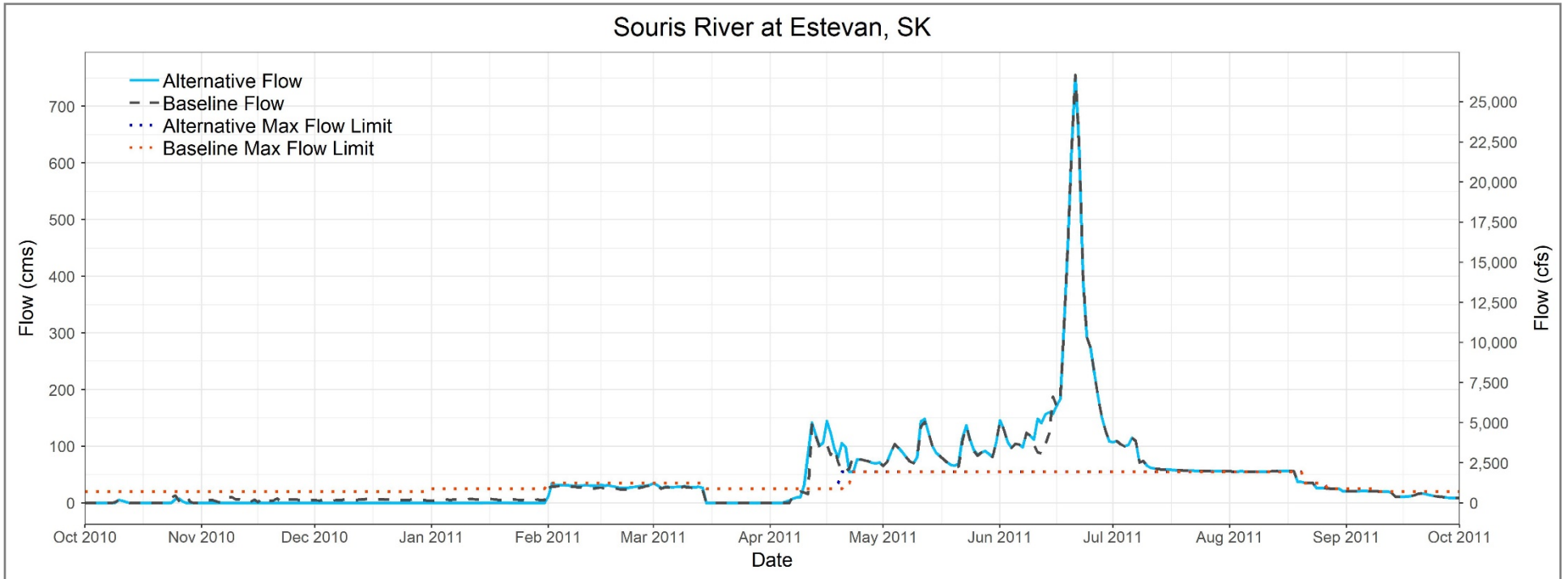
*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level, IDFSL = Inflow Design Flood Supply Level

Plate 06

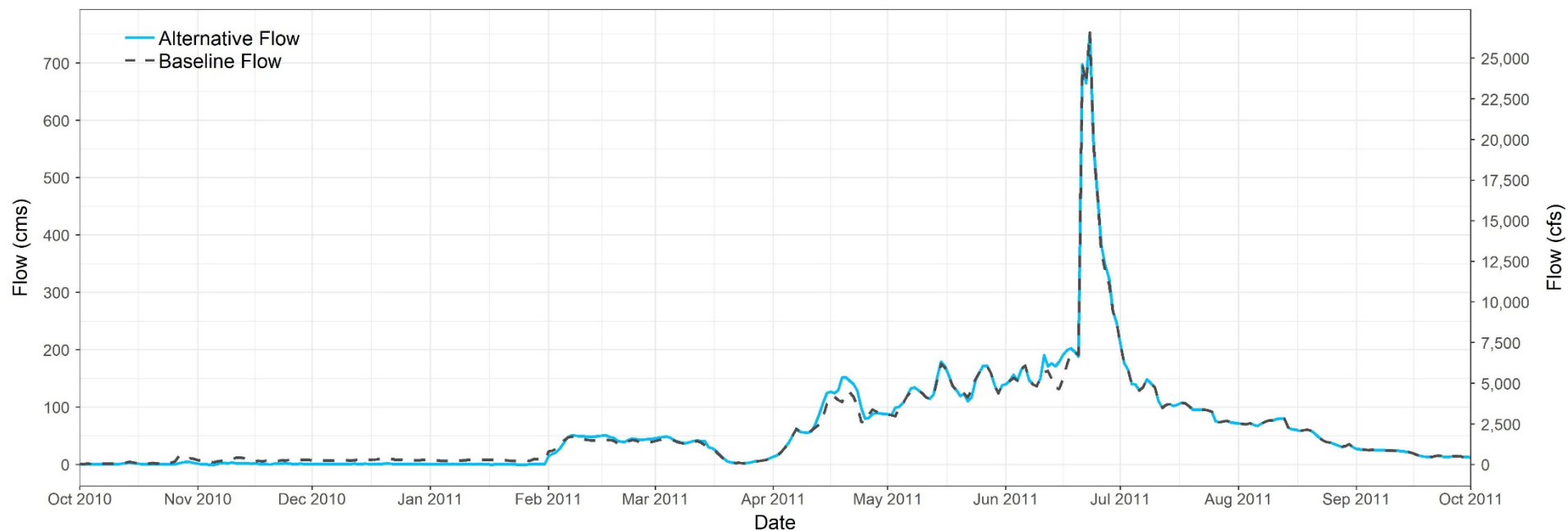
Critical Flow Locations – 2011

Alternative 10aU (Phase 2)

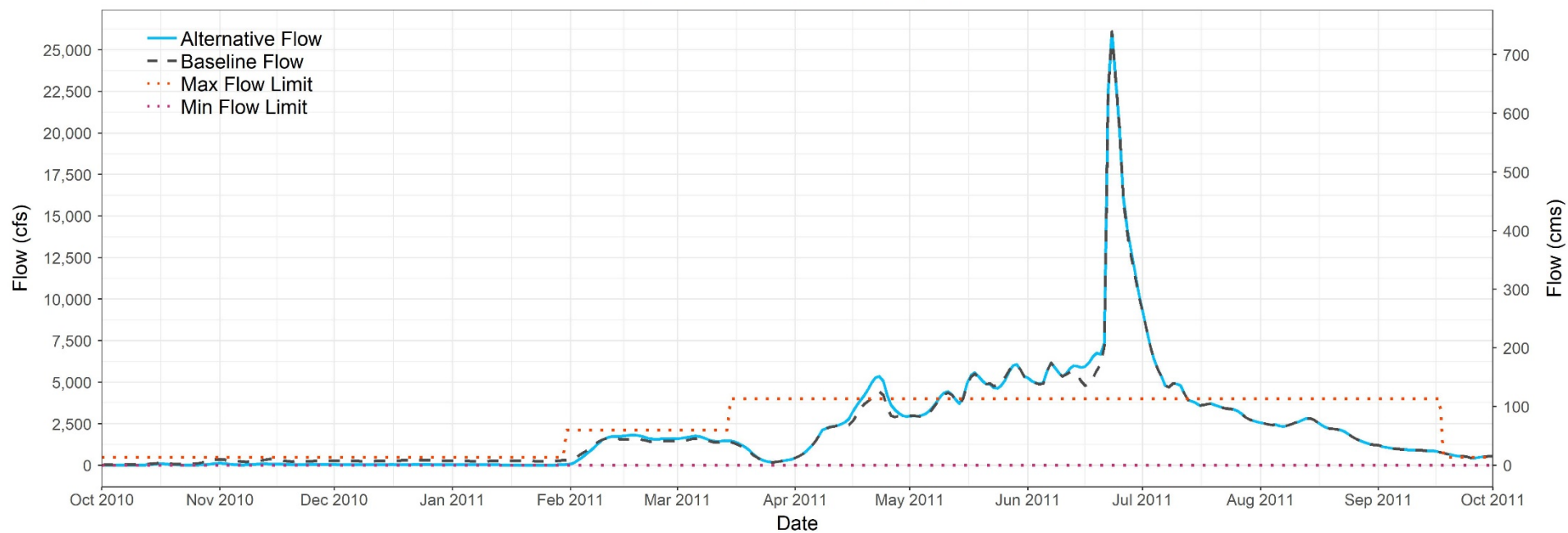
Souris River Plan of Study



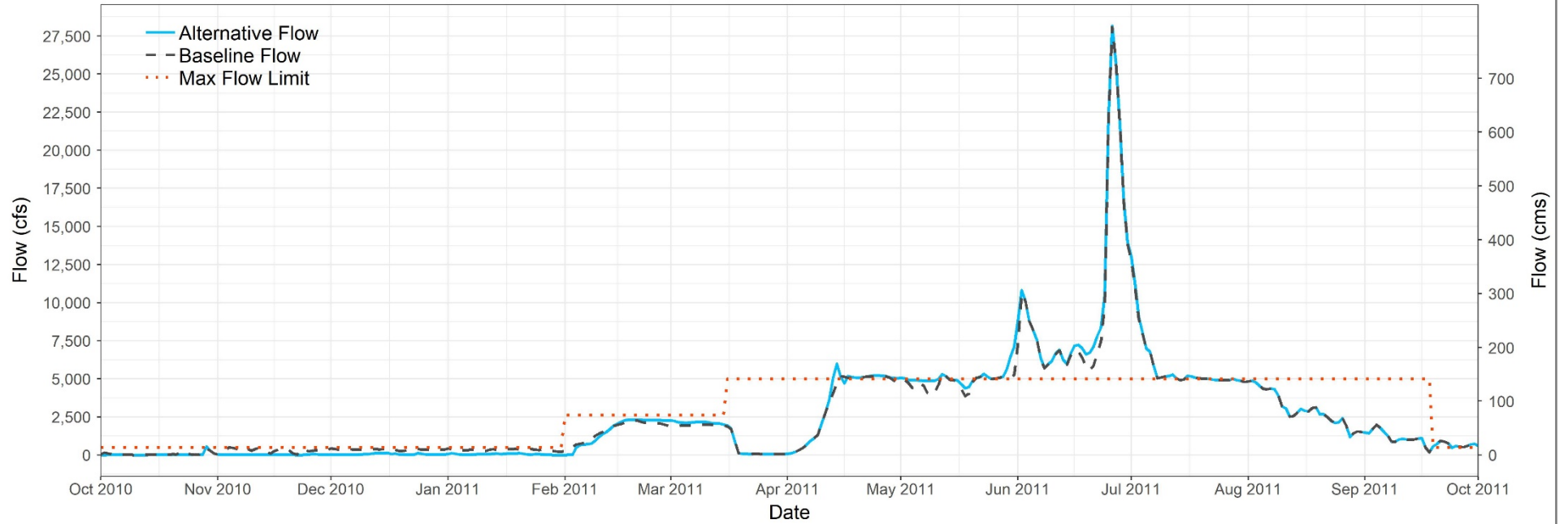
Souris River at Oxbow, SK



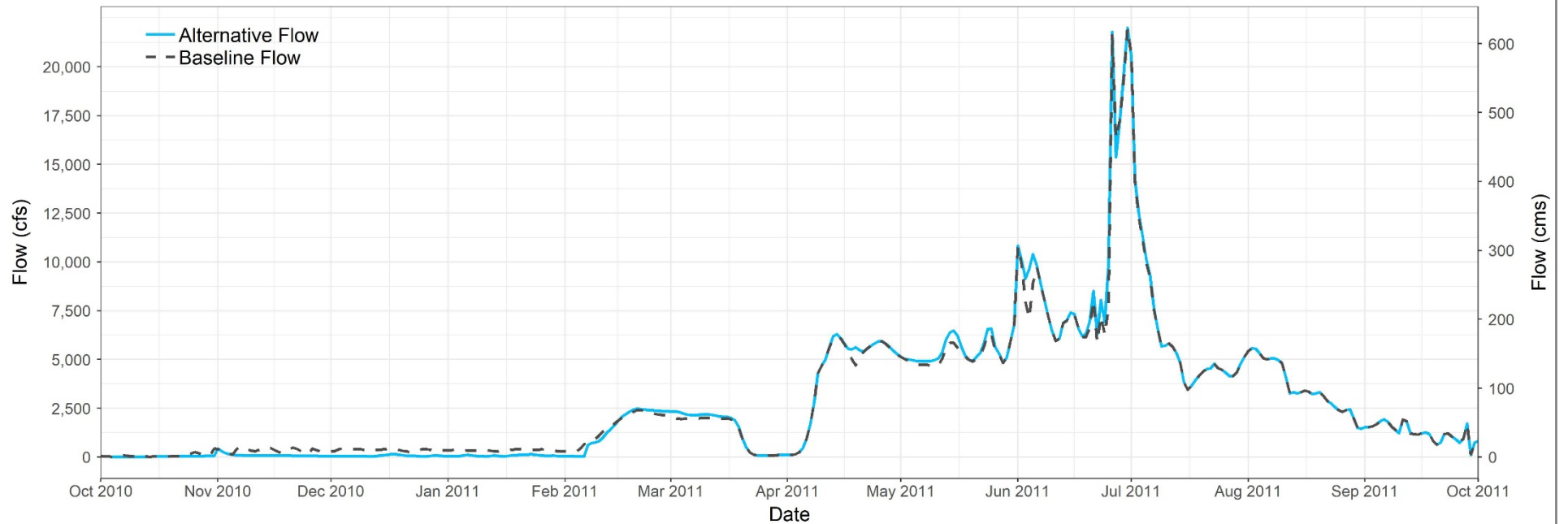
Souris River at Sherwood, ND



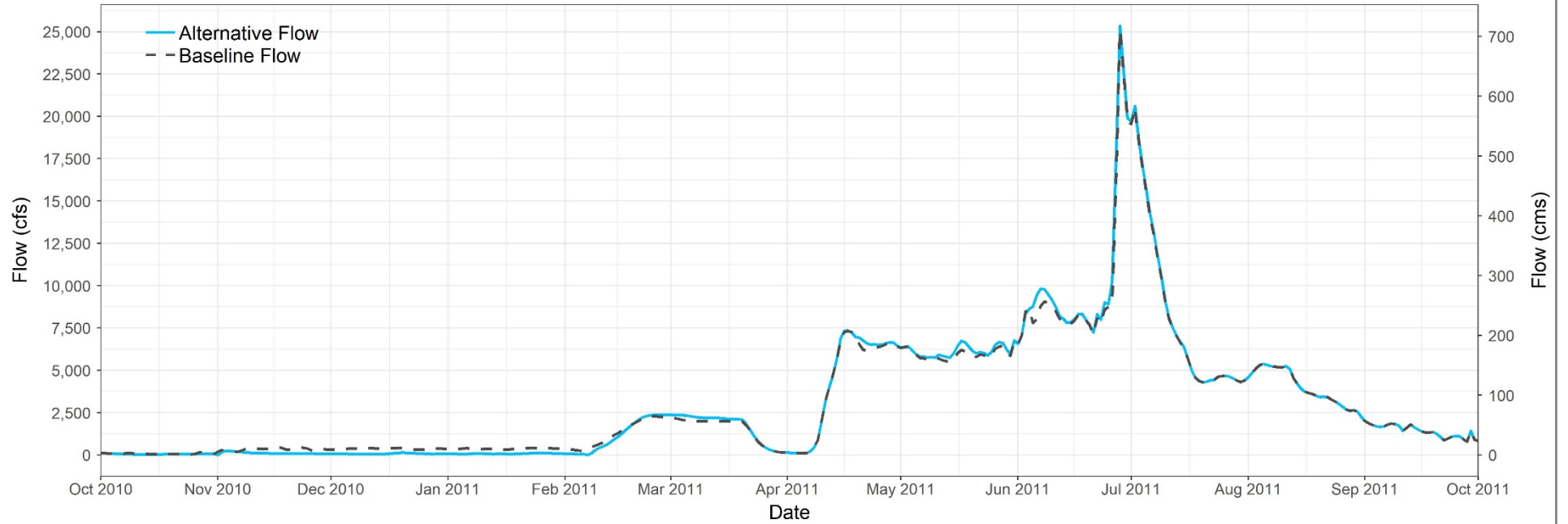
Souris River at Minot, ND - Flow



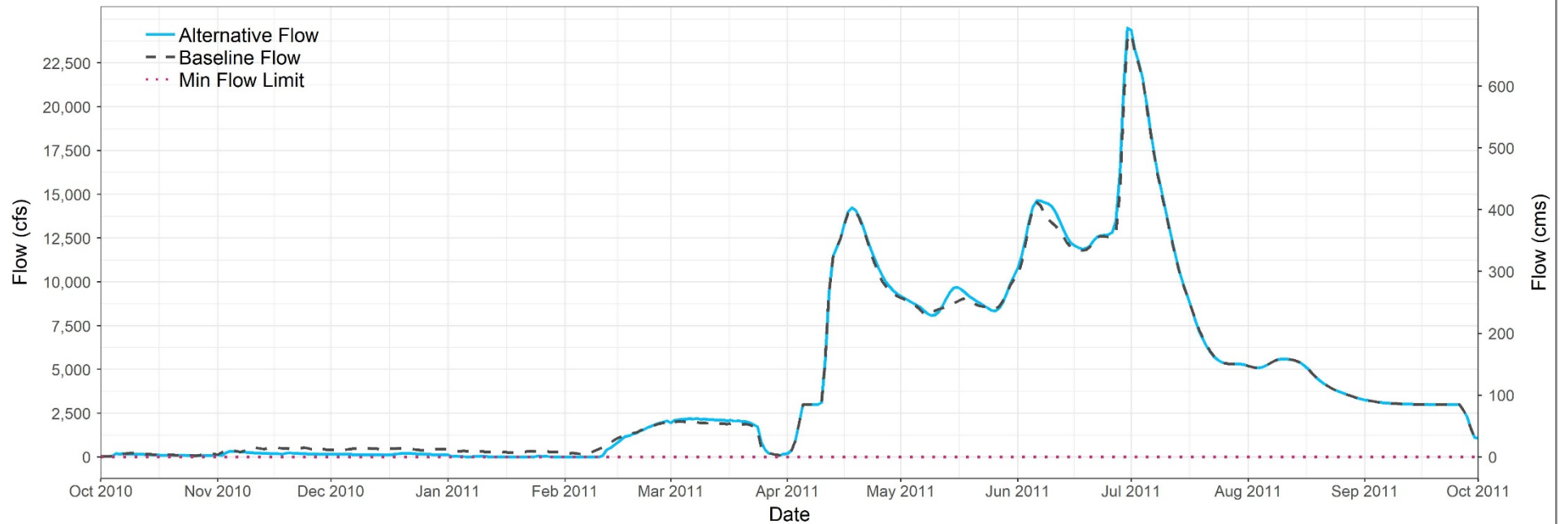
Souris River at Verendrye, ND



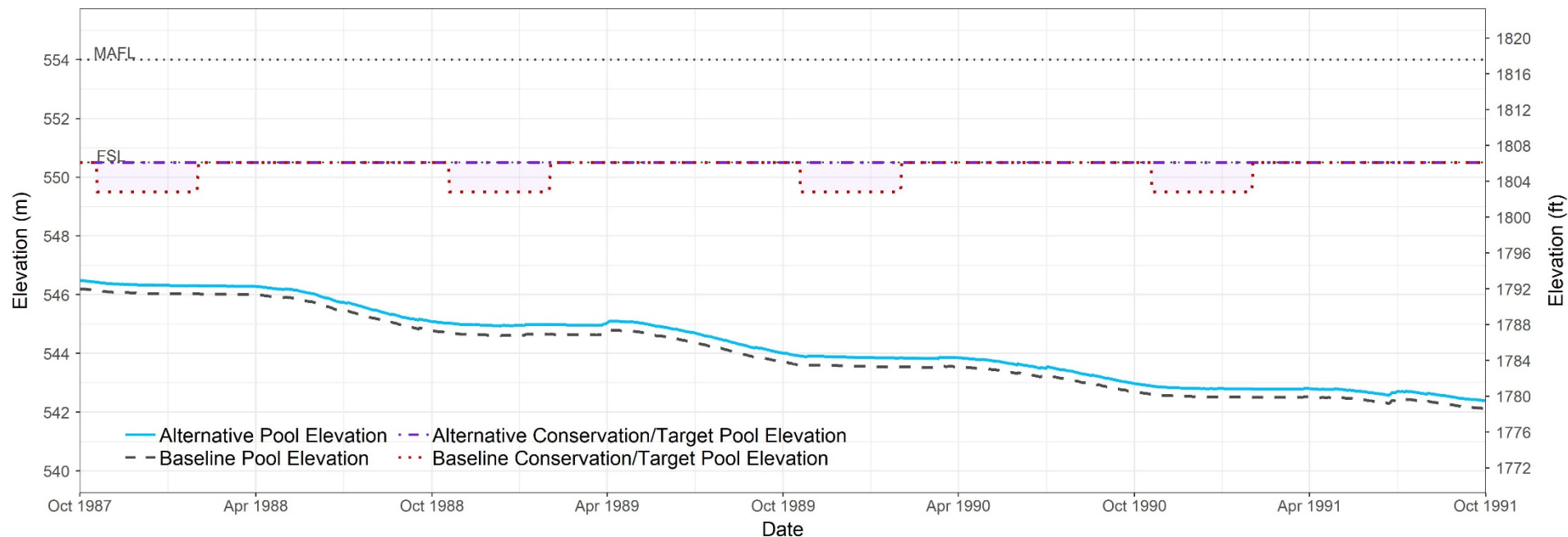
Souris River at Bantry, ND



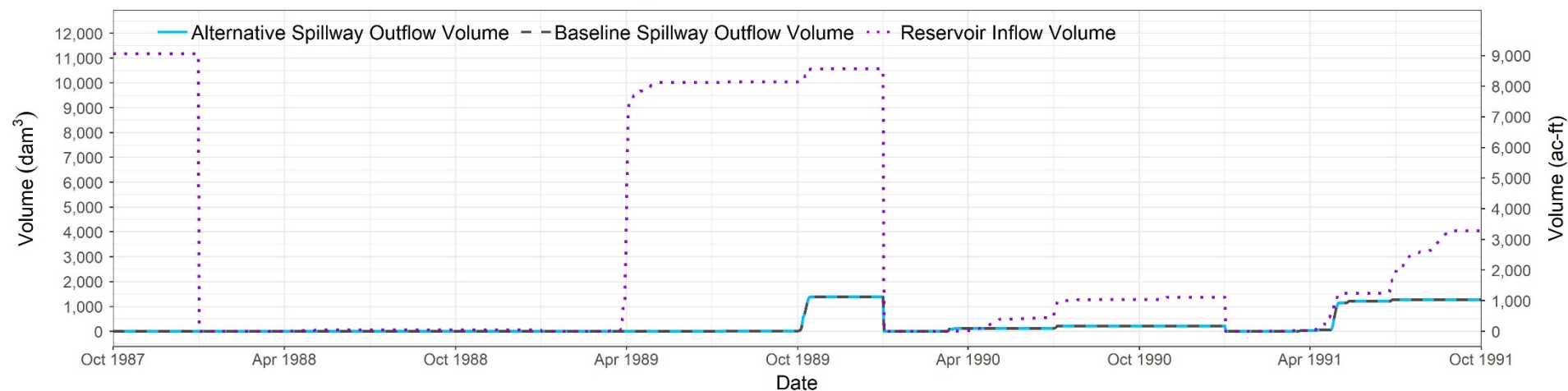
Souris River at Westhope, ND



Rafferty Reservoir - Elevation

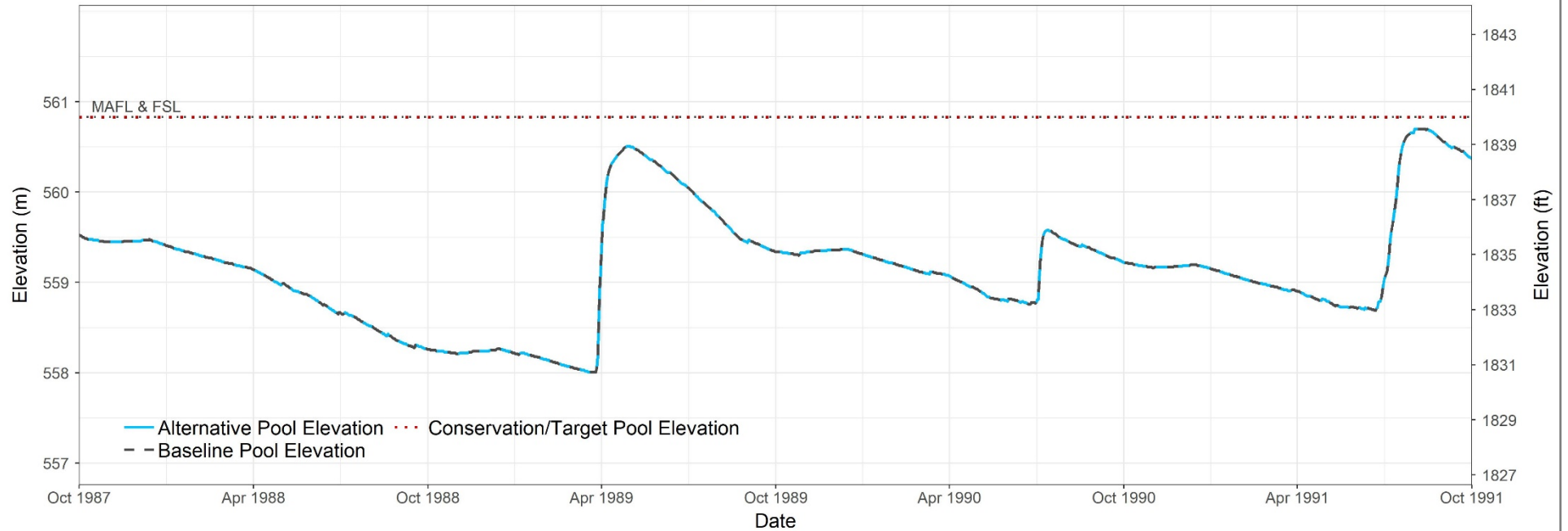


Rafferty Reservoir - Cumulative Volume

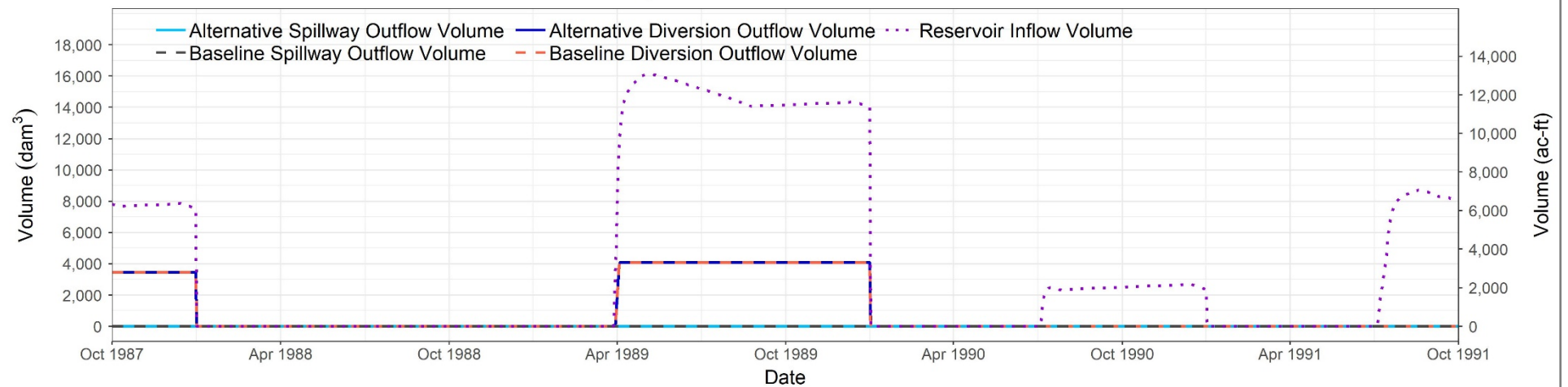


*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level

Boundary Reservoir - Elevation

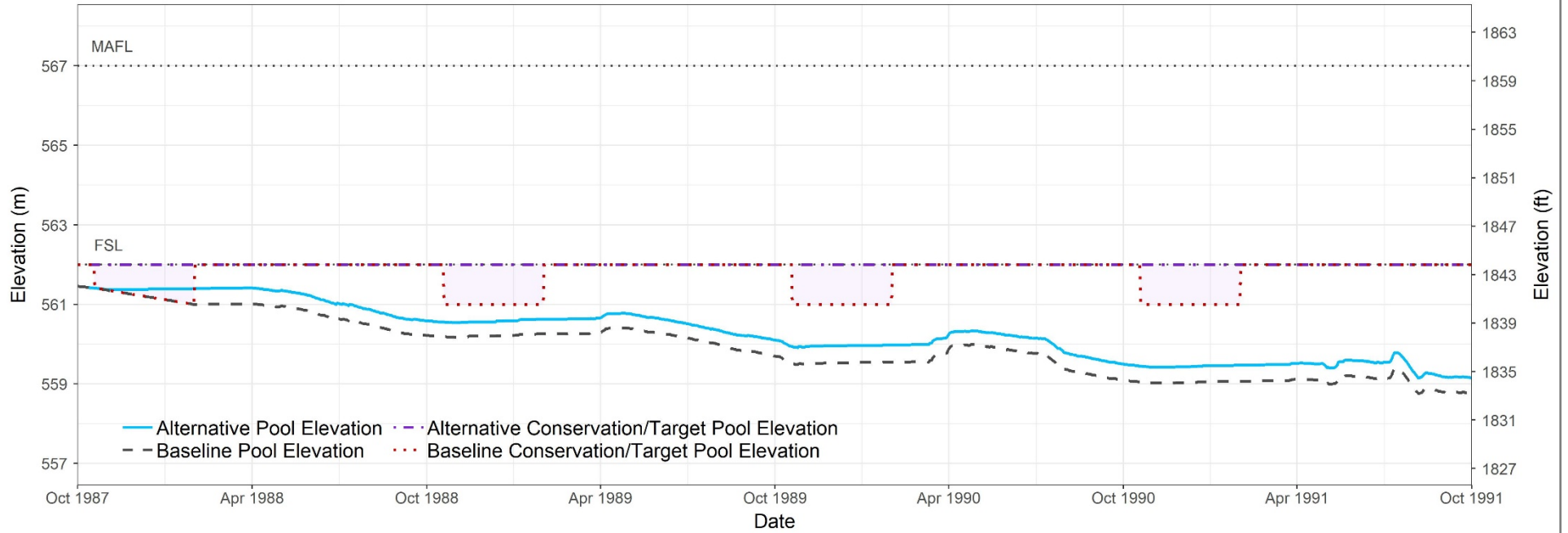


Boundary Reservoir - Cumulative Volume

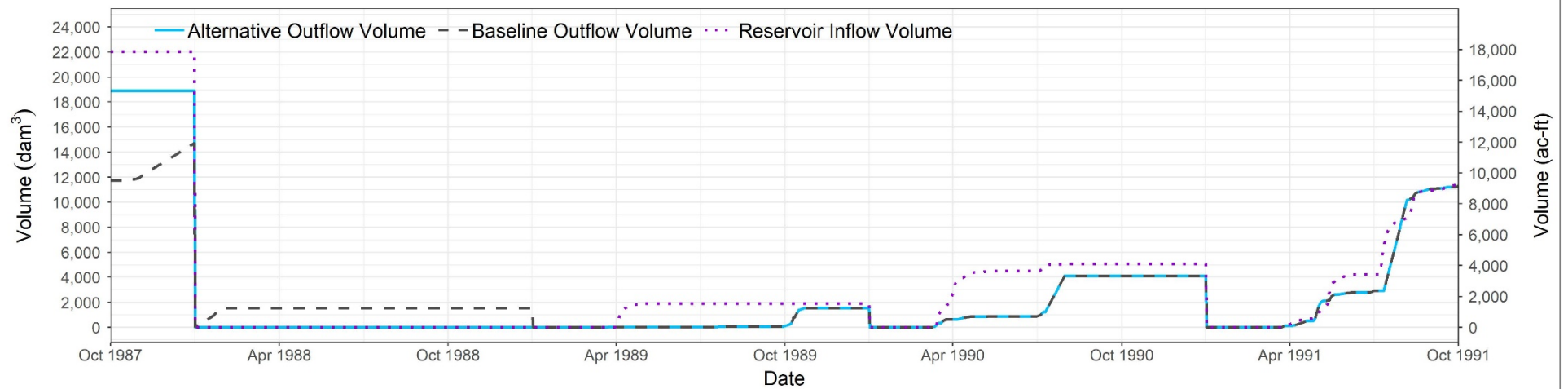


*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level

Grant Devine Reservoir - Elevation

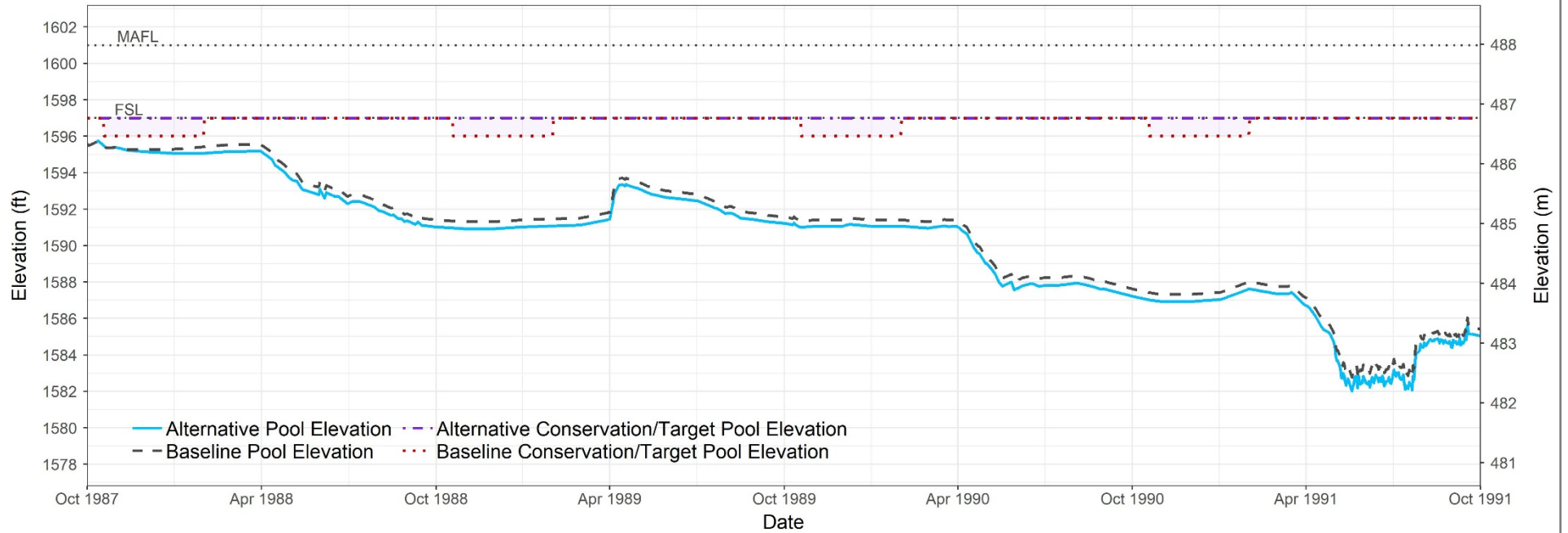


Grant Devine Reservoir - Cumulative Volume

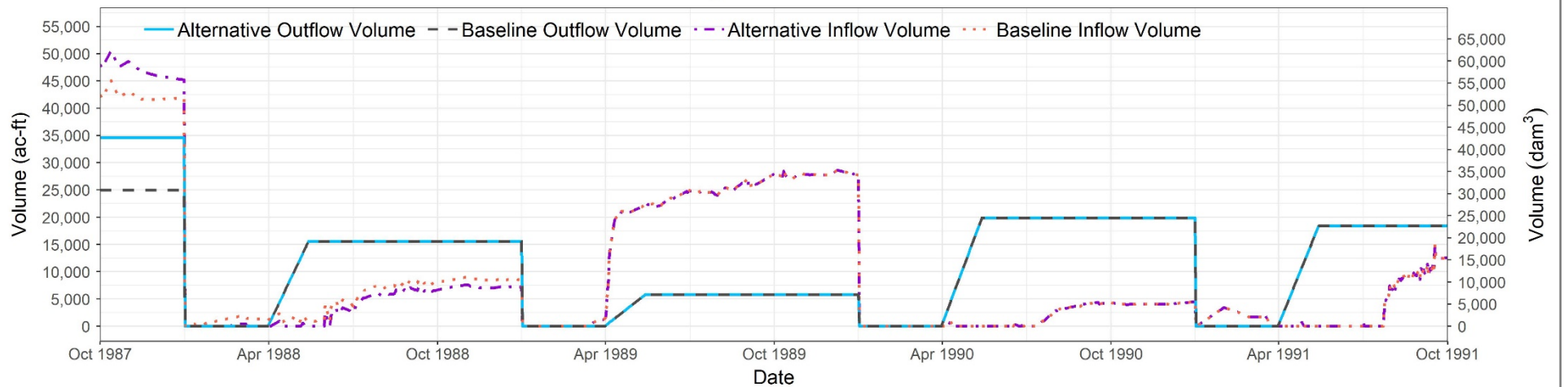


*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level

Lake Darling - Elevation



Lake Darling - Cumulative Volume



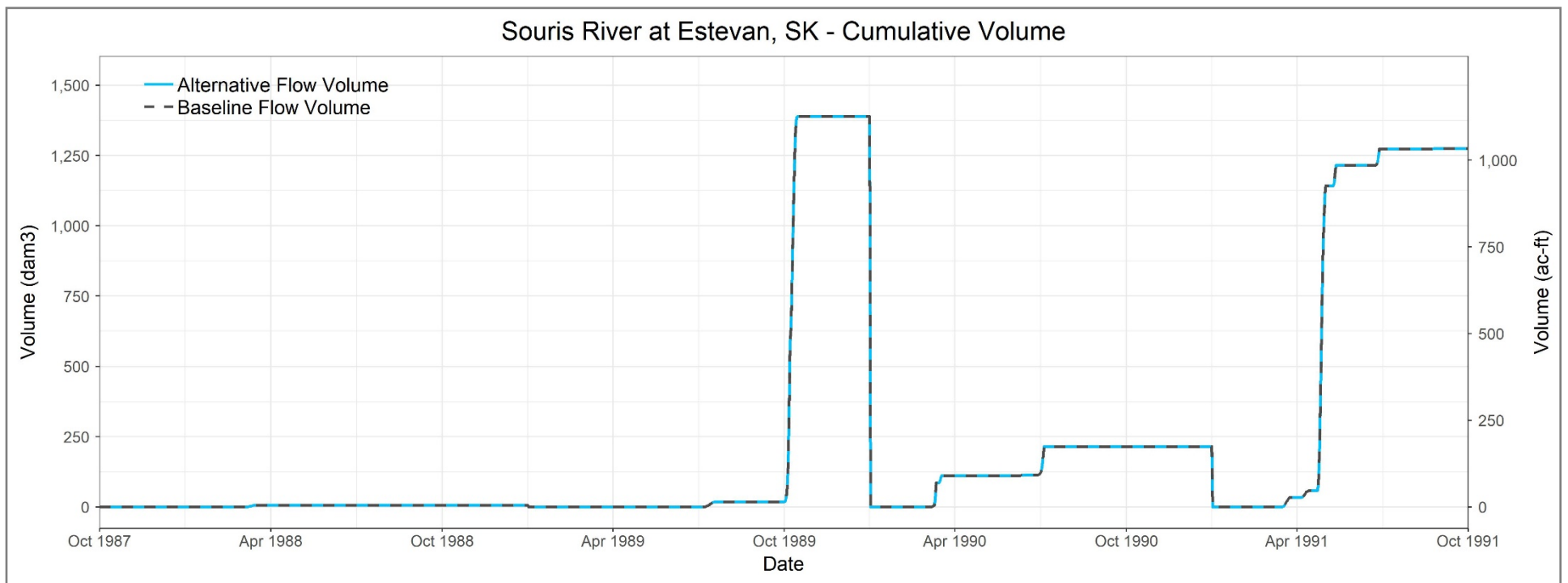
*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level, IDFSL = Inflow Design Flood Supply Level

Plate 08

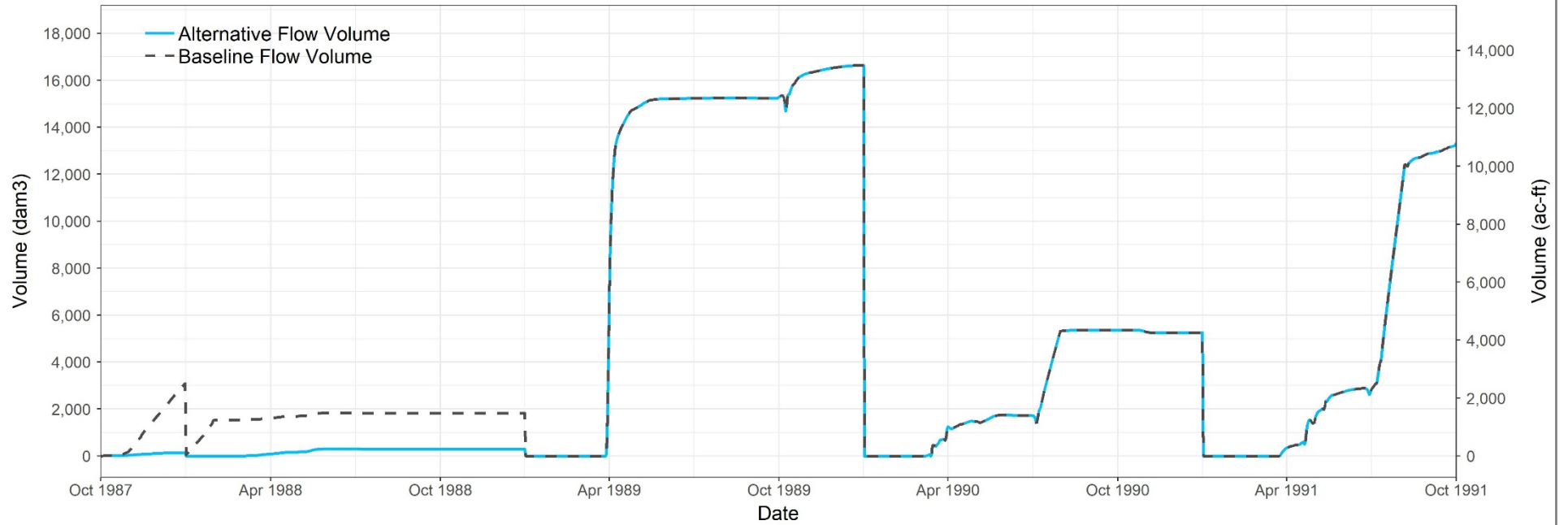
Critical Flow Locations – 1988-1991

Alternative 10aU (Phase 2)

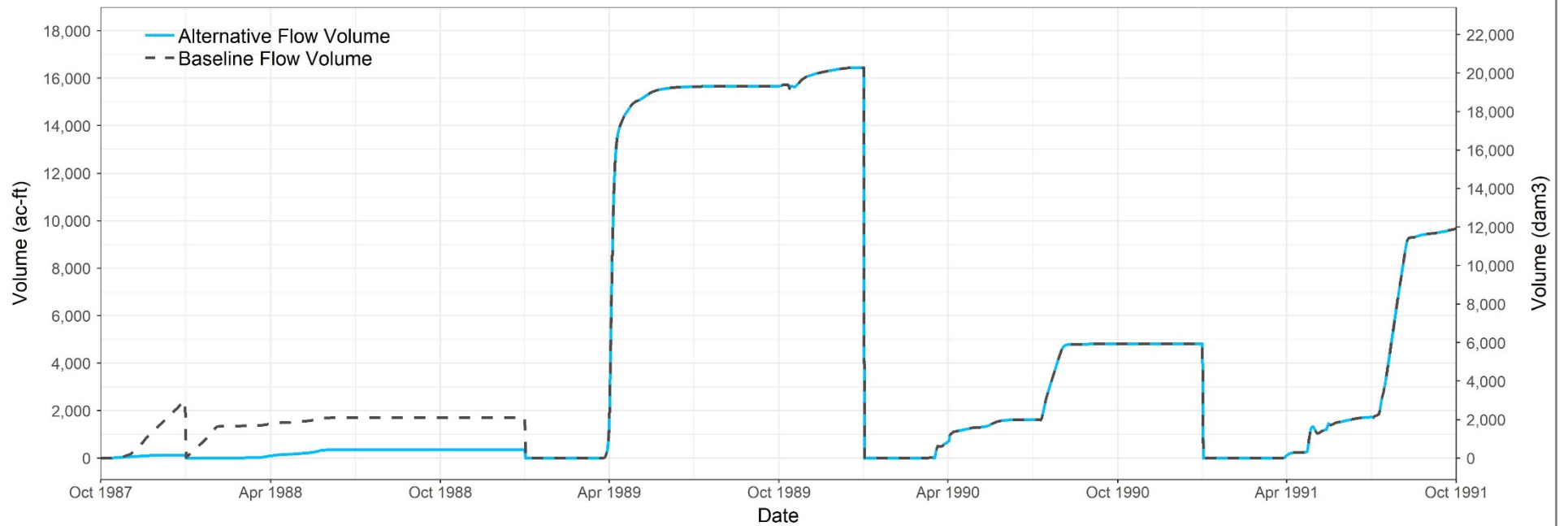
Souris River Plan of Study



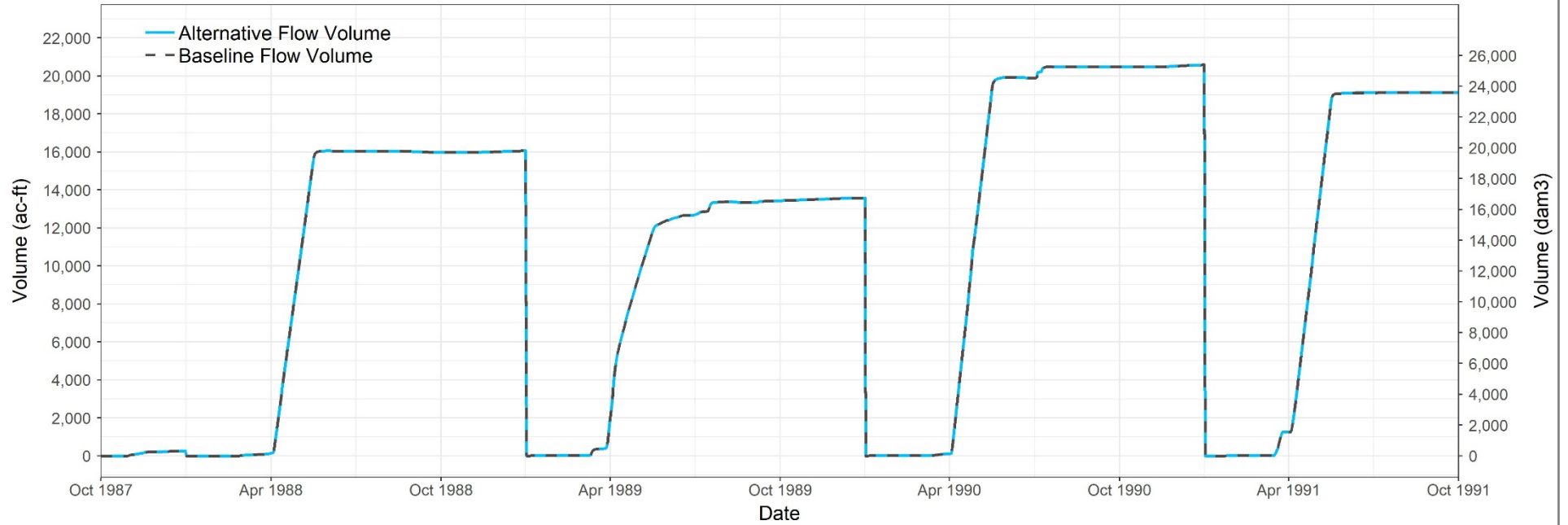
Souris River at Oxbow, SK - Cumulative Volume



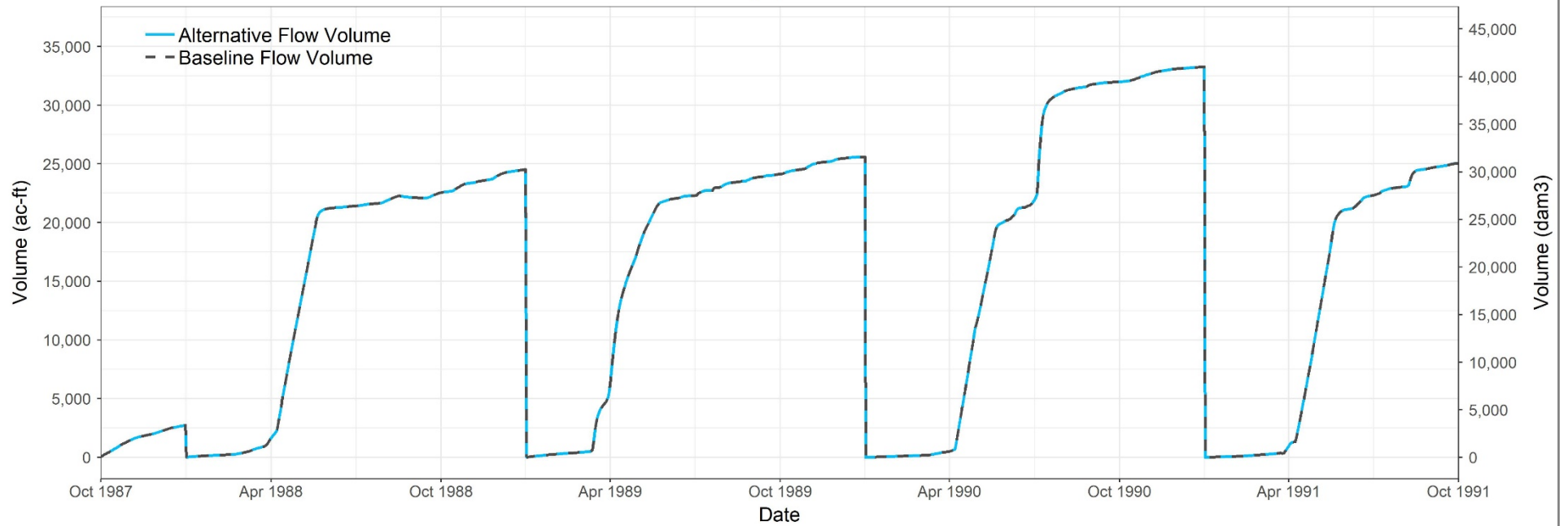
Souris River at Sherwood, ND - Cumulative Volume



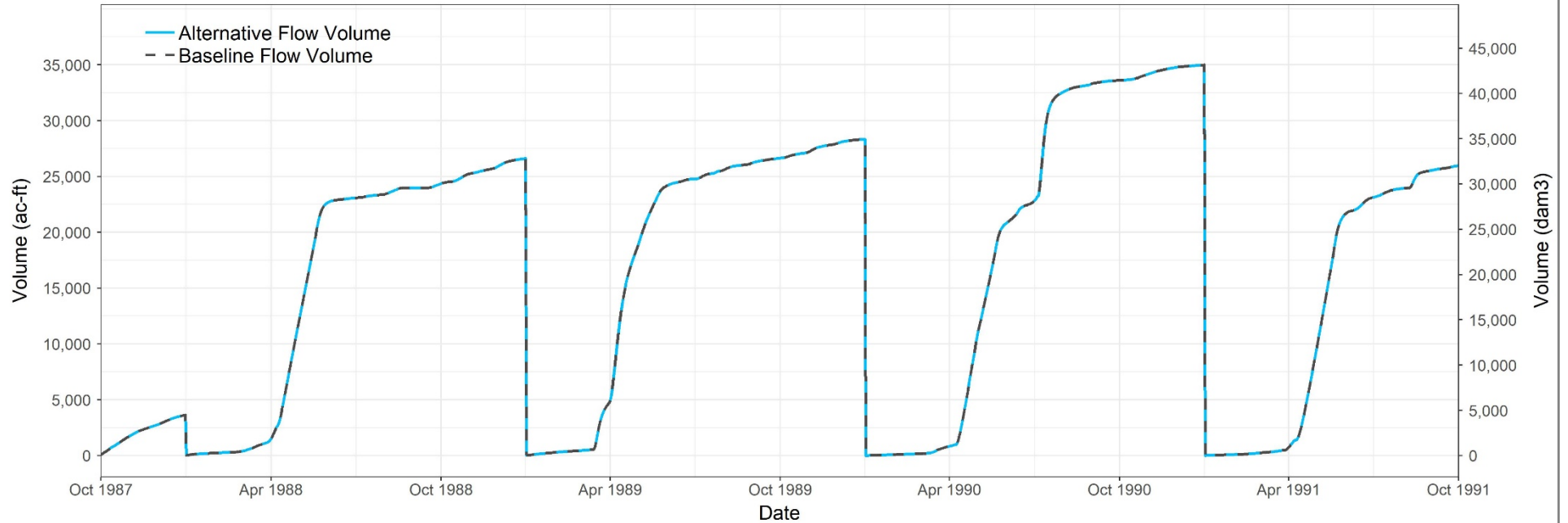
Souris River at Minot, ND - Cumulative Volume



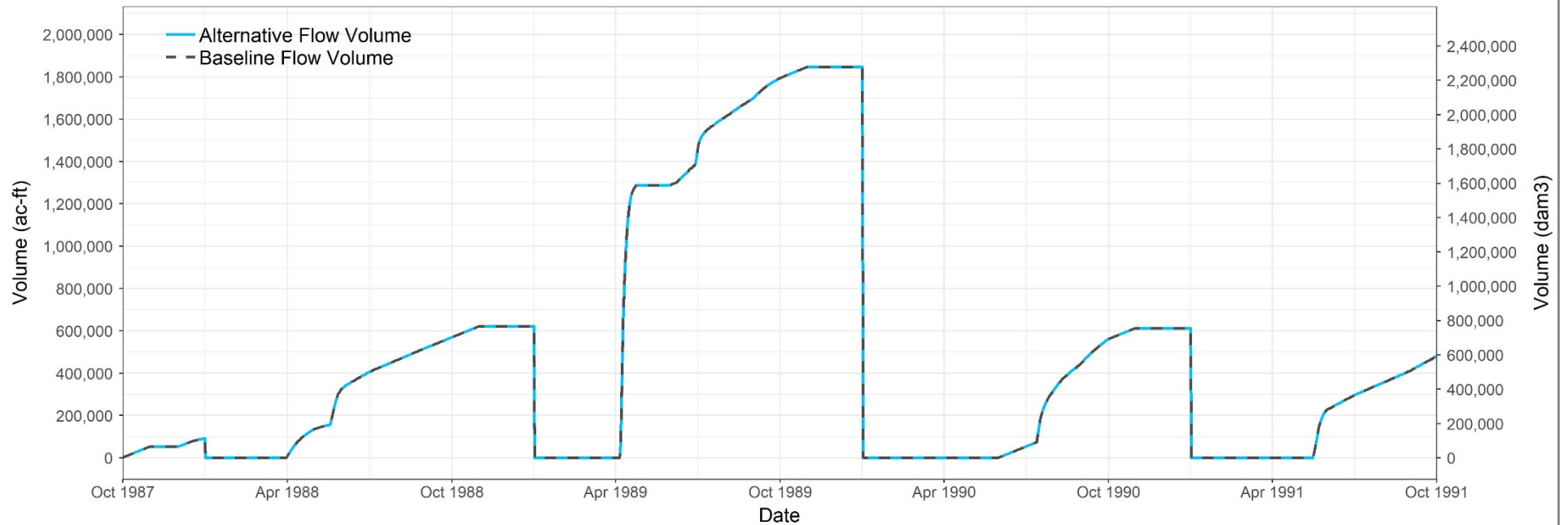
Souris River at Verendrye, ND - Cumulative Volume

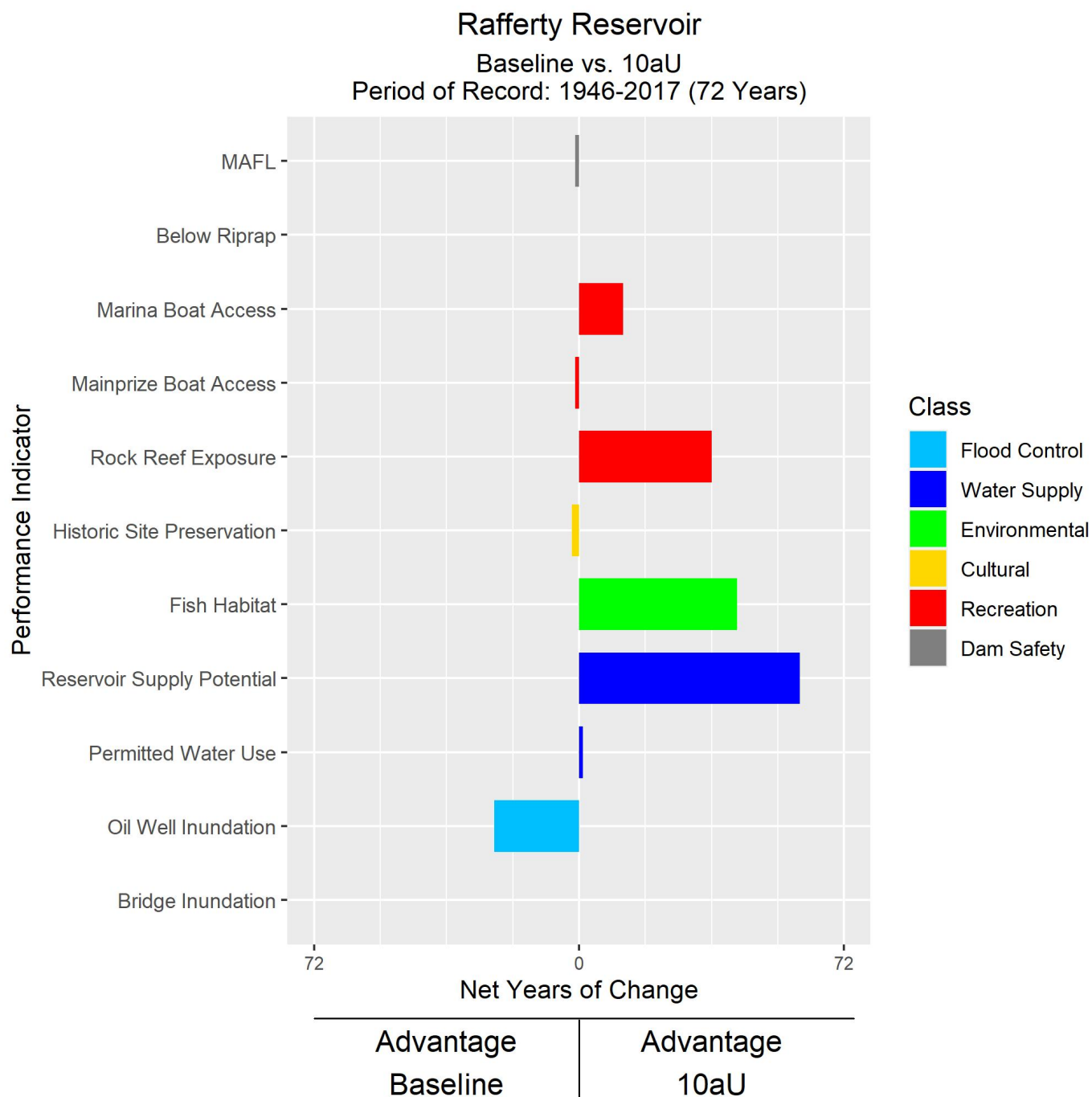


Souris River at Bantry, ND - Cumulative Volume

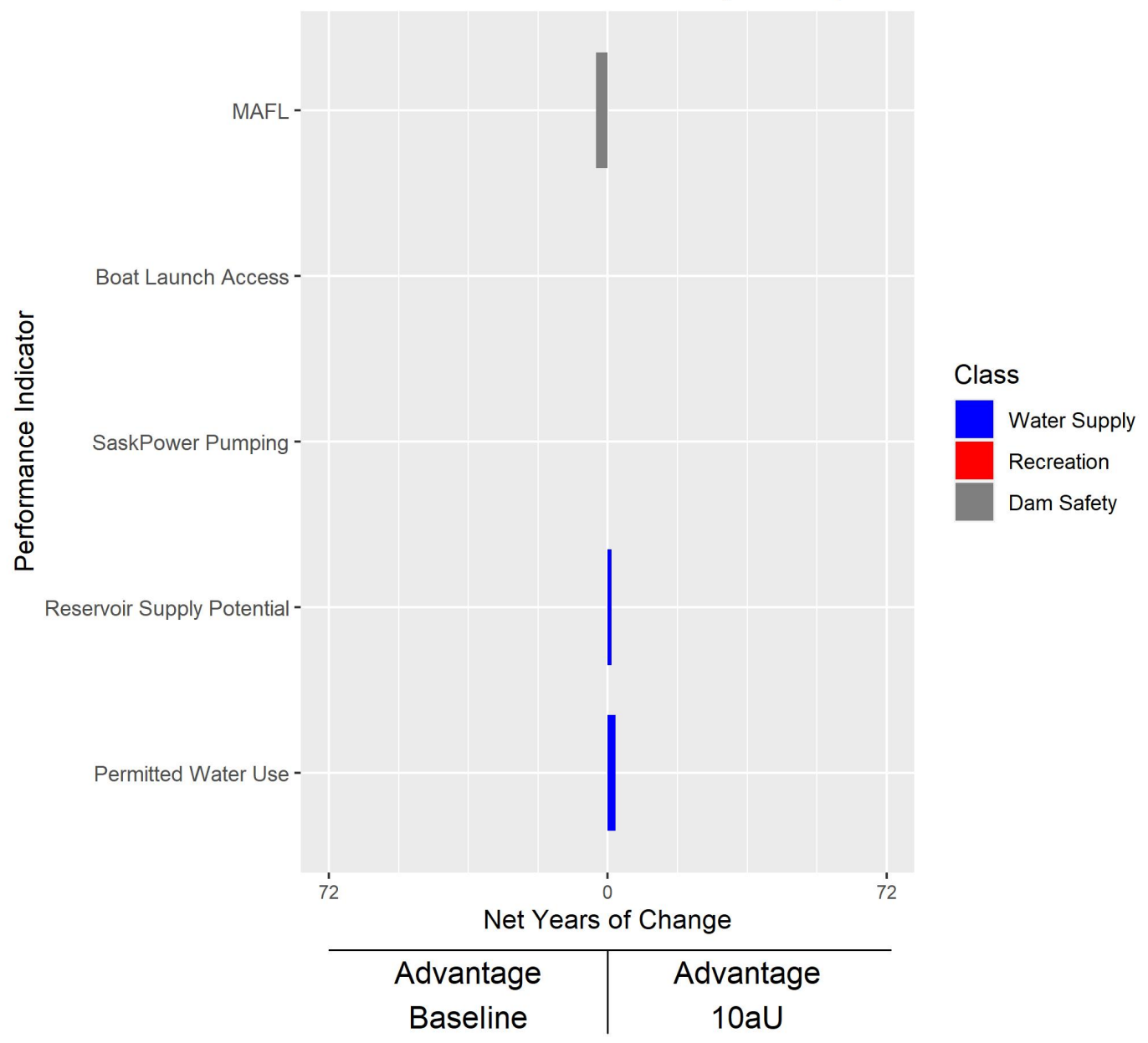


Souris River at Westhope, ND - Cumulative Volume

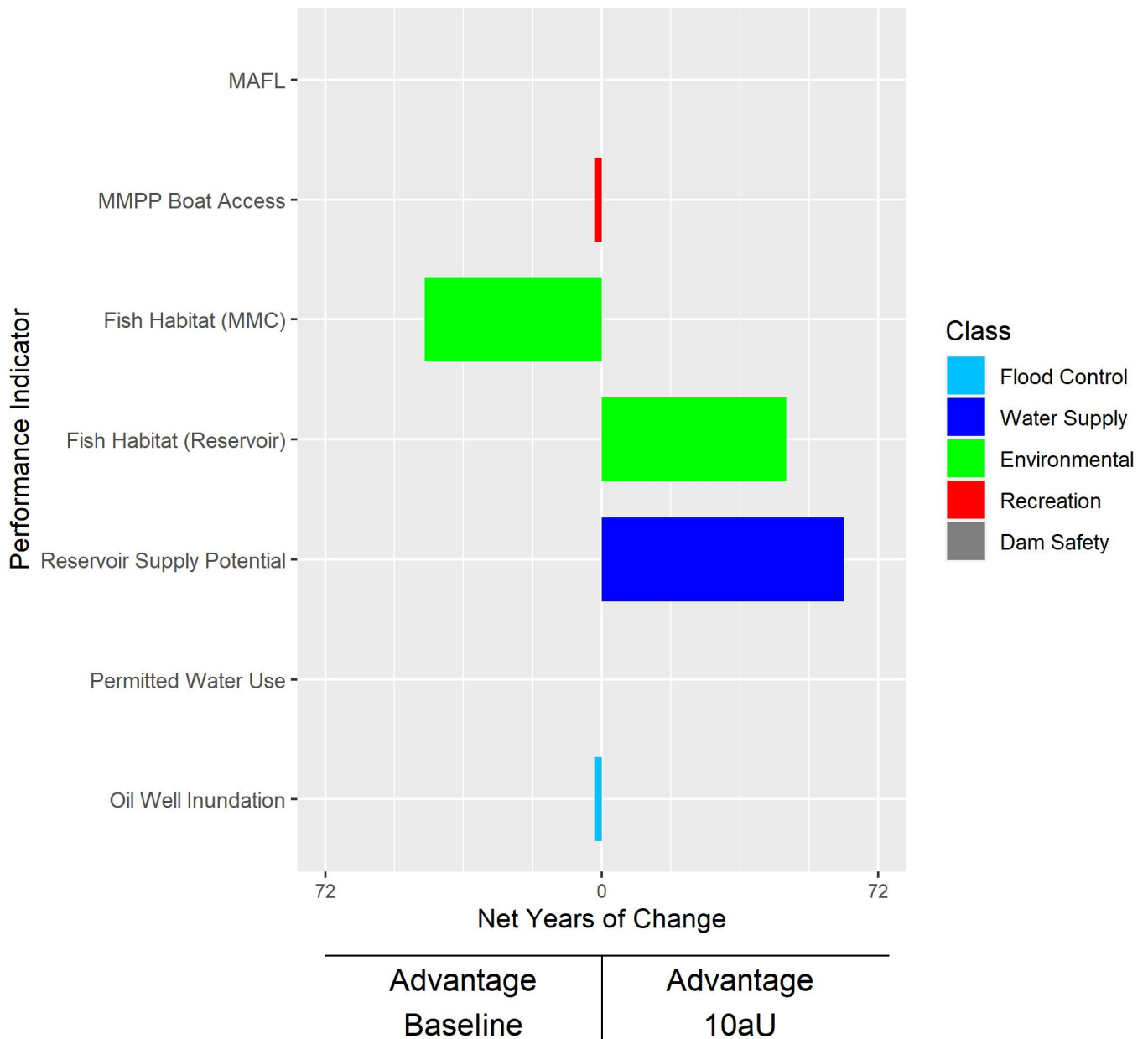




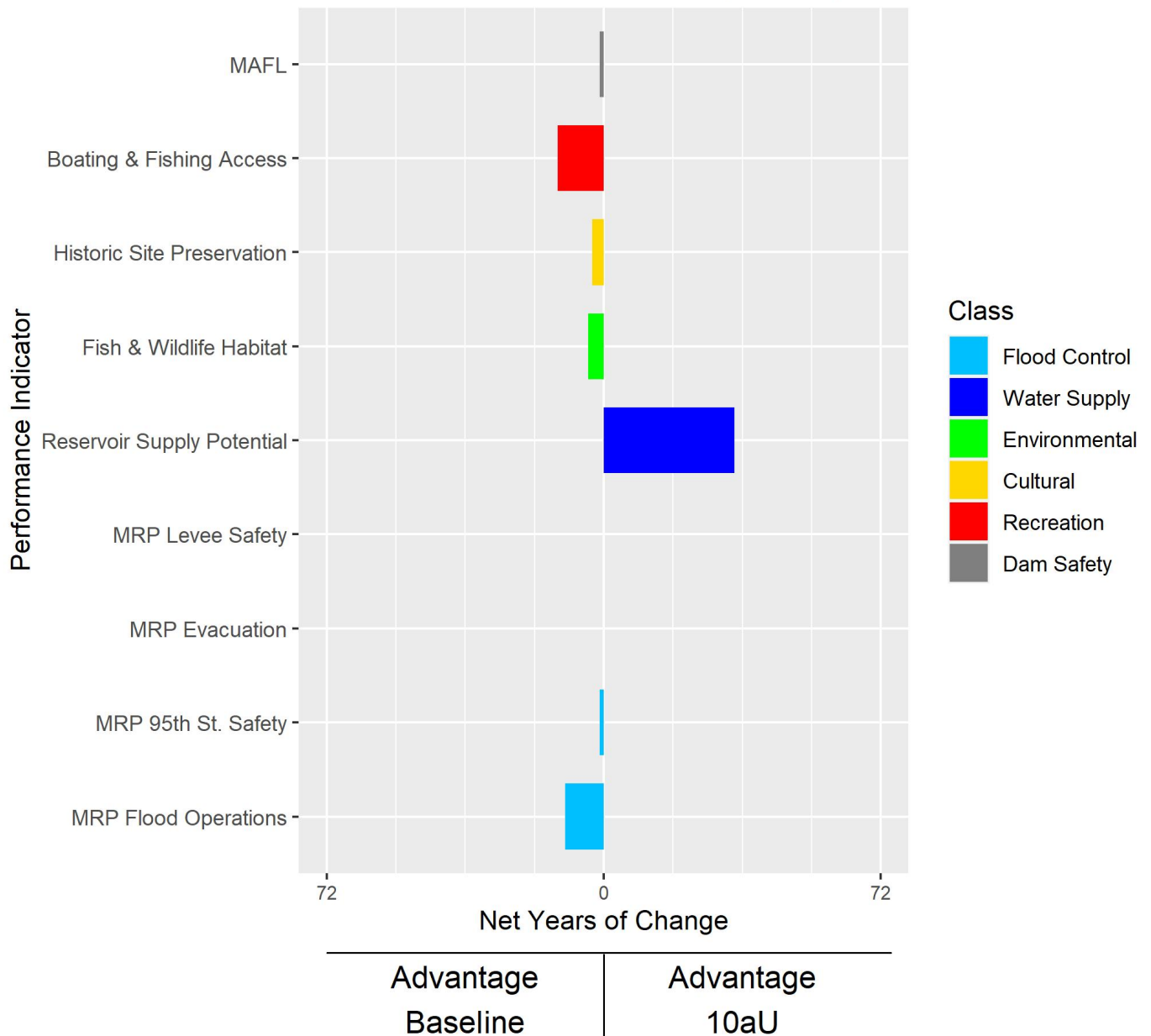
Boundary Reservoir
Baseline vs. 10aU
Period of Record: 1946-2017 (72 Years)



Grant Devine Reservoir
Baseline vs. 10aU
Period of Record: 1946-2017 (72 Years)

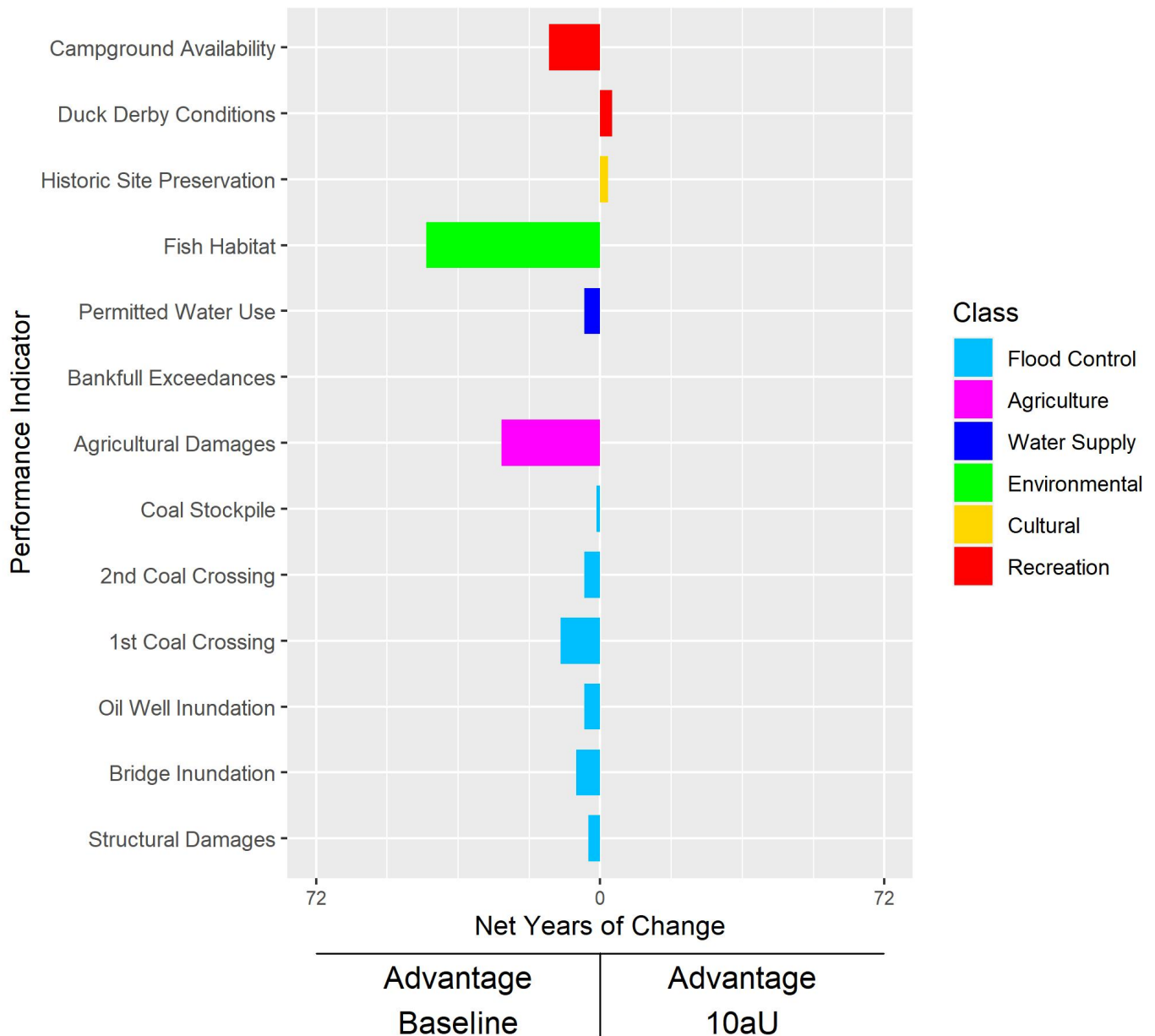


Lake Darling
Baseline vs. 10aU
Period of Record: 1946-2017 (72 Years)



Saskatchewan - All Riverine Reaches

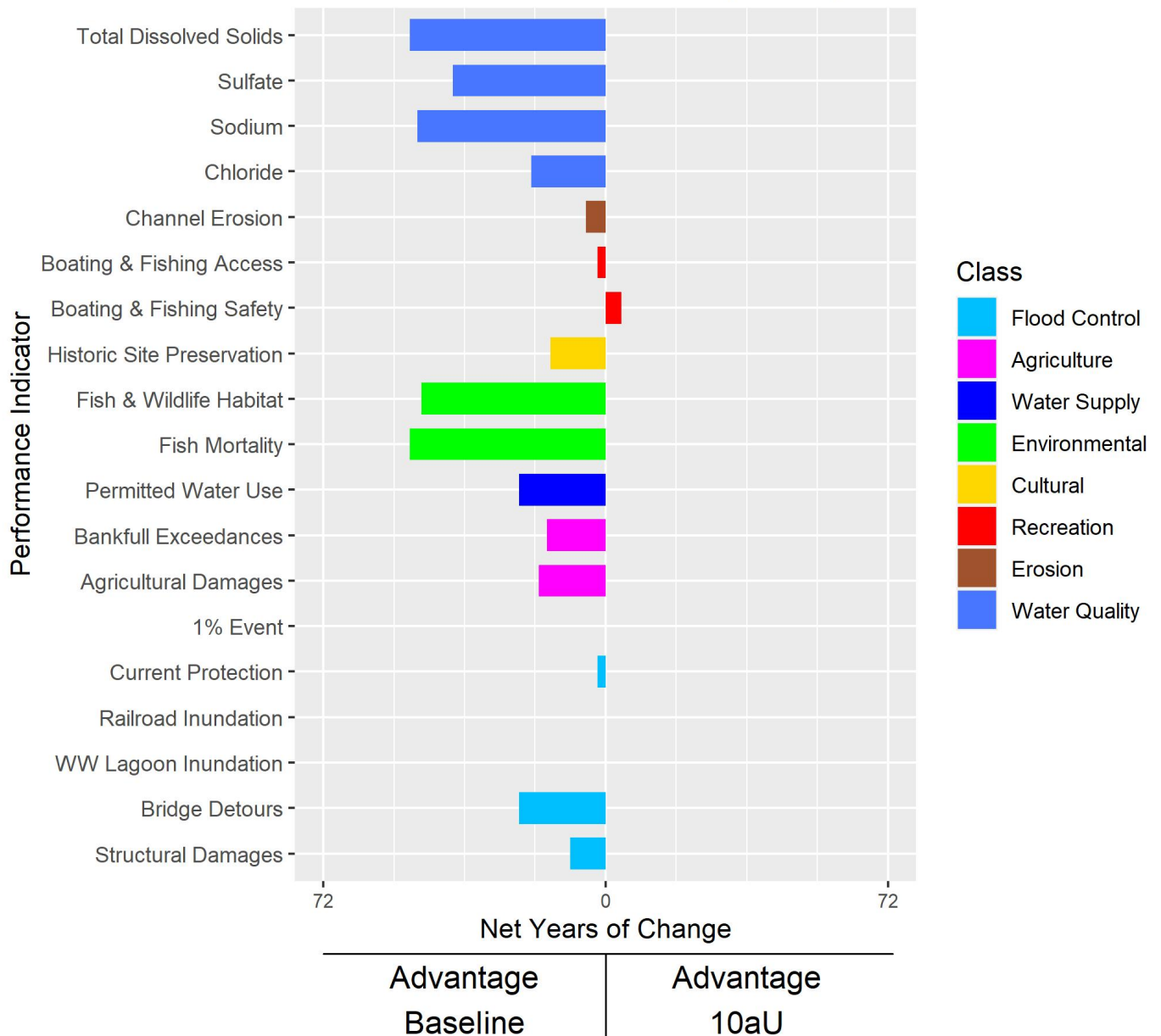
Baseline vs. 10aU
Period of Record: 1946-2017 (72 Years)



North Dakota - All Riverine Reaches

Baseline vs. 10aU

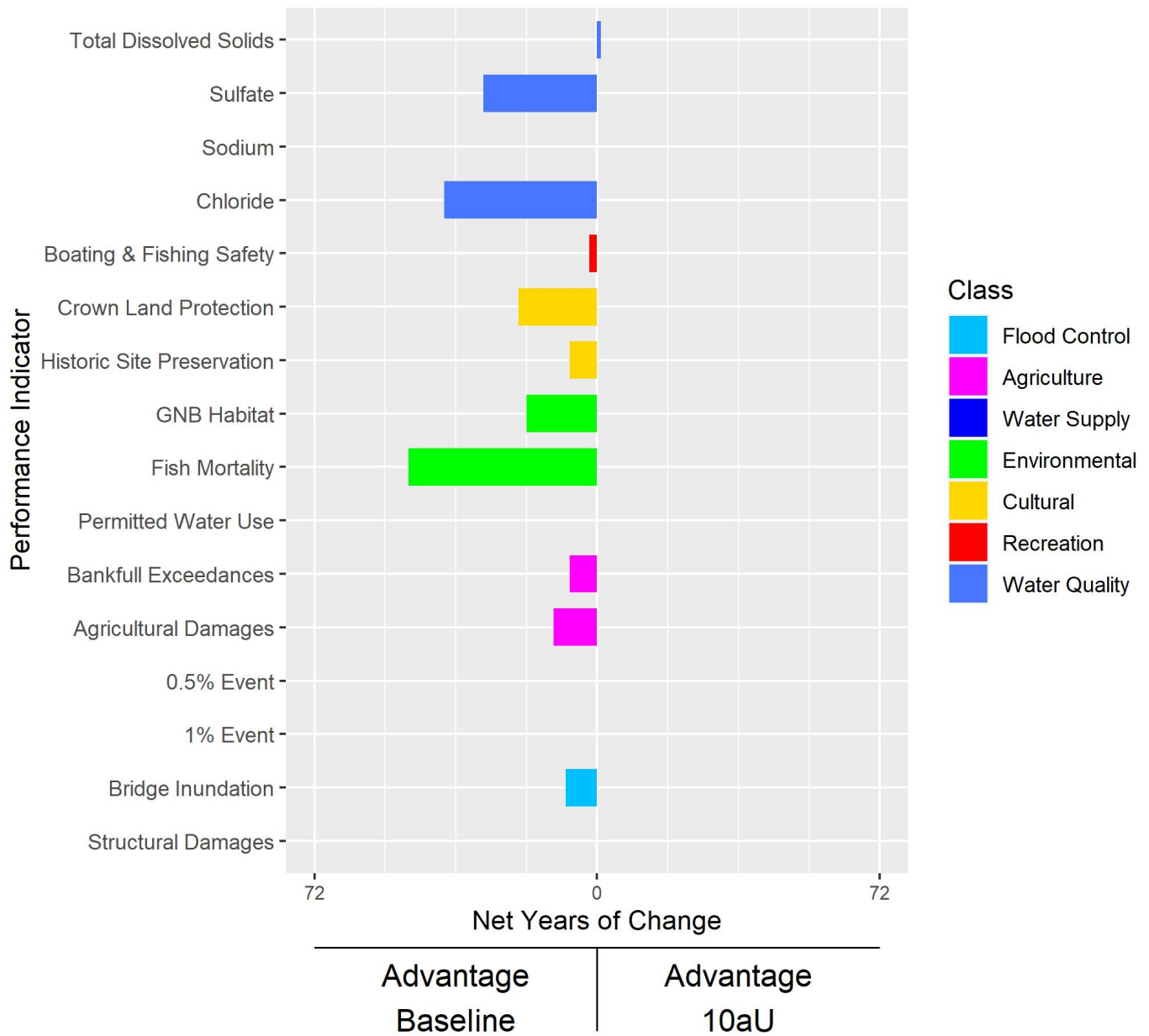
Period of Record: 1946-2017 (72 Years)



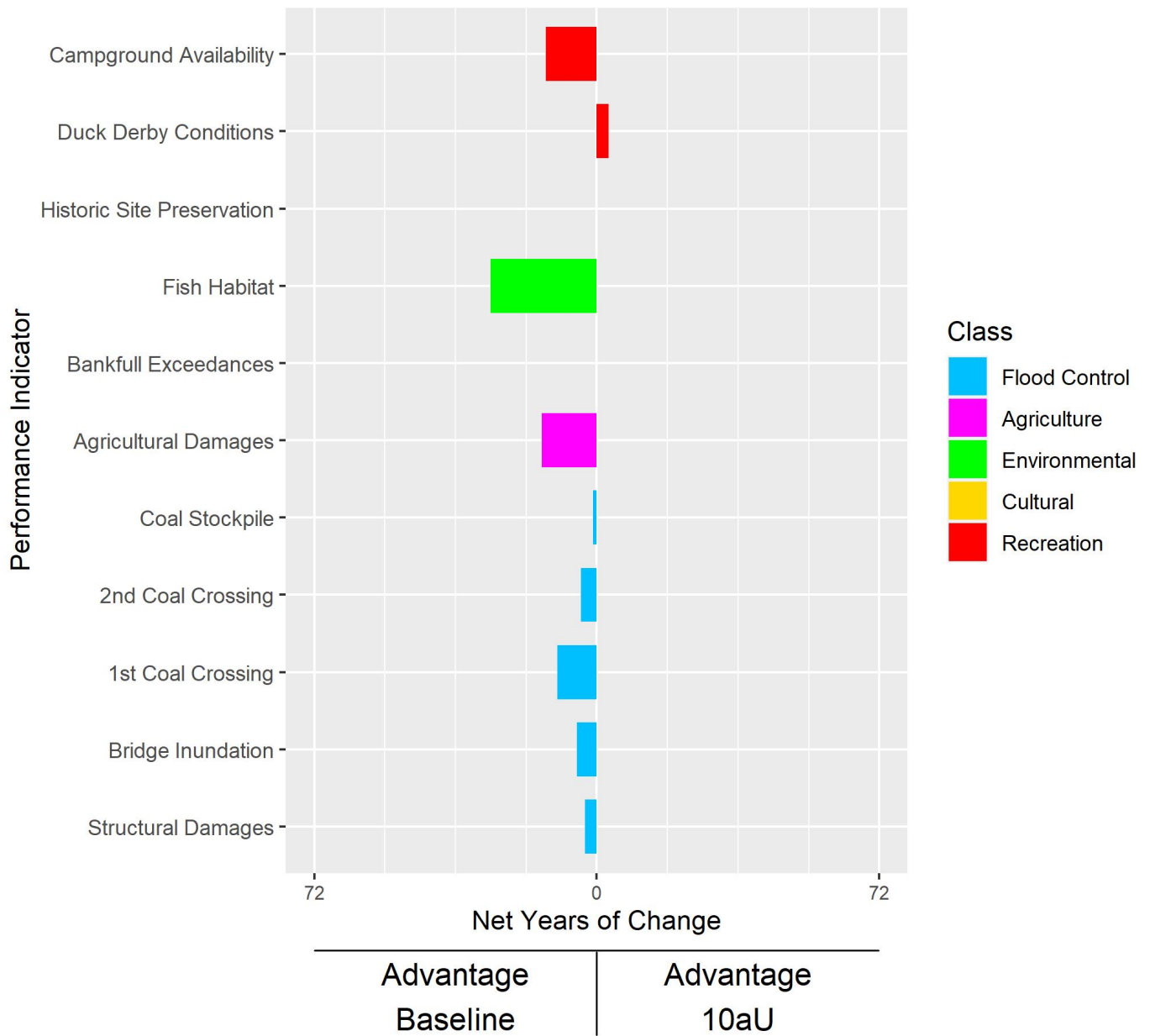
Westhope to Wawanesa

Baseline vs. 10aU

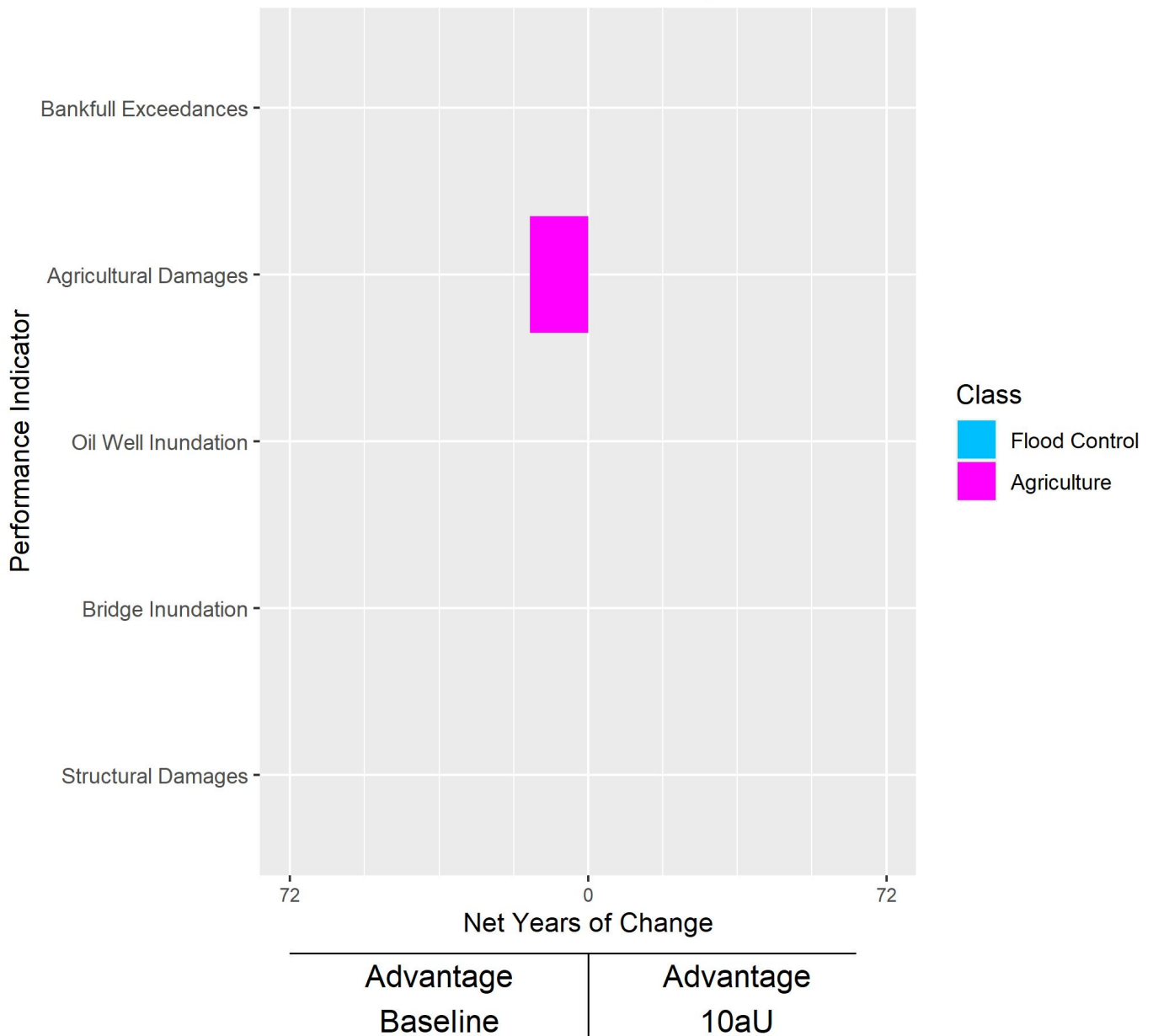
Period of Record: 1946-2017 (72 Years)



City of Estevan
Baseline vs. 10aU
Period of Record: 1946-2017 (72 Years)



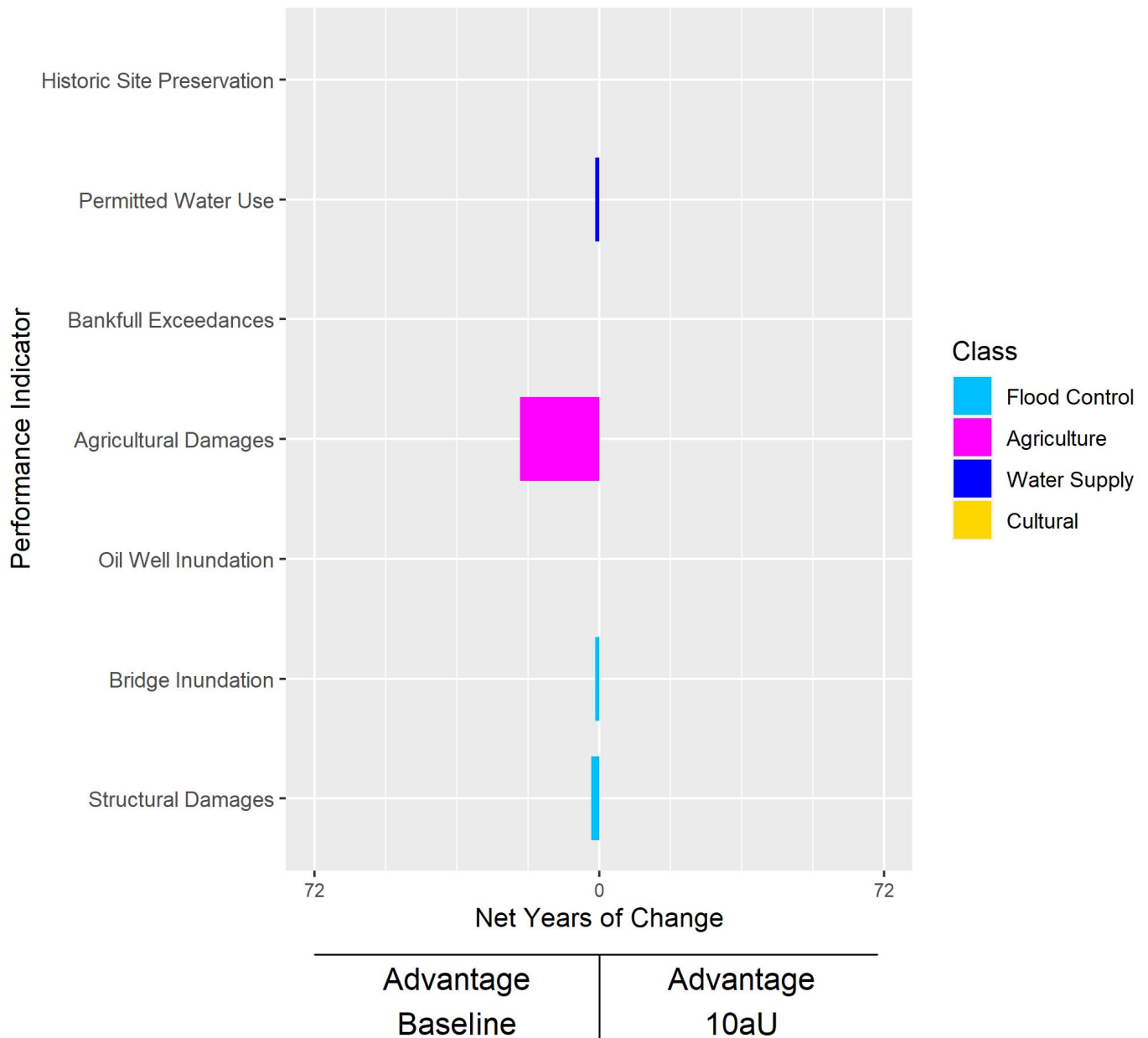
City of Roche Percee
Baseline vs. 10aU
Period of Record: 1946-2017 (72 Years)



Roche Percee to Moose Mountain Creek

Baseline vs. 10aU

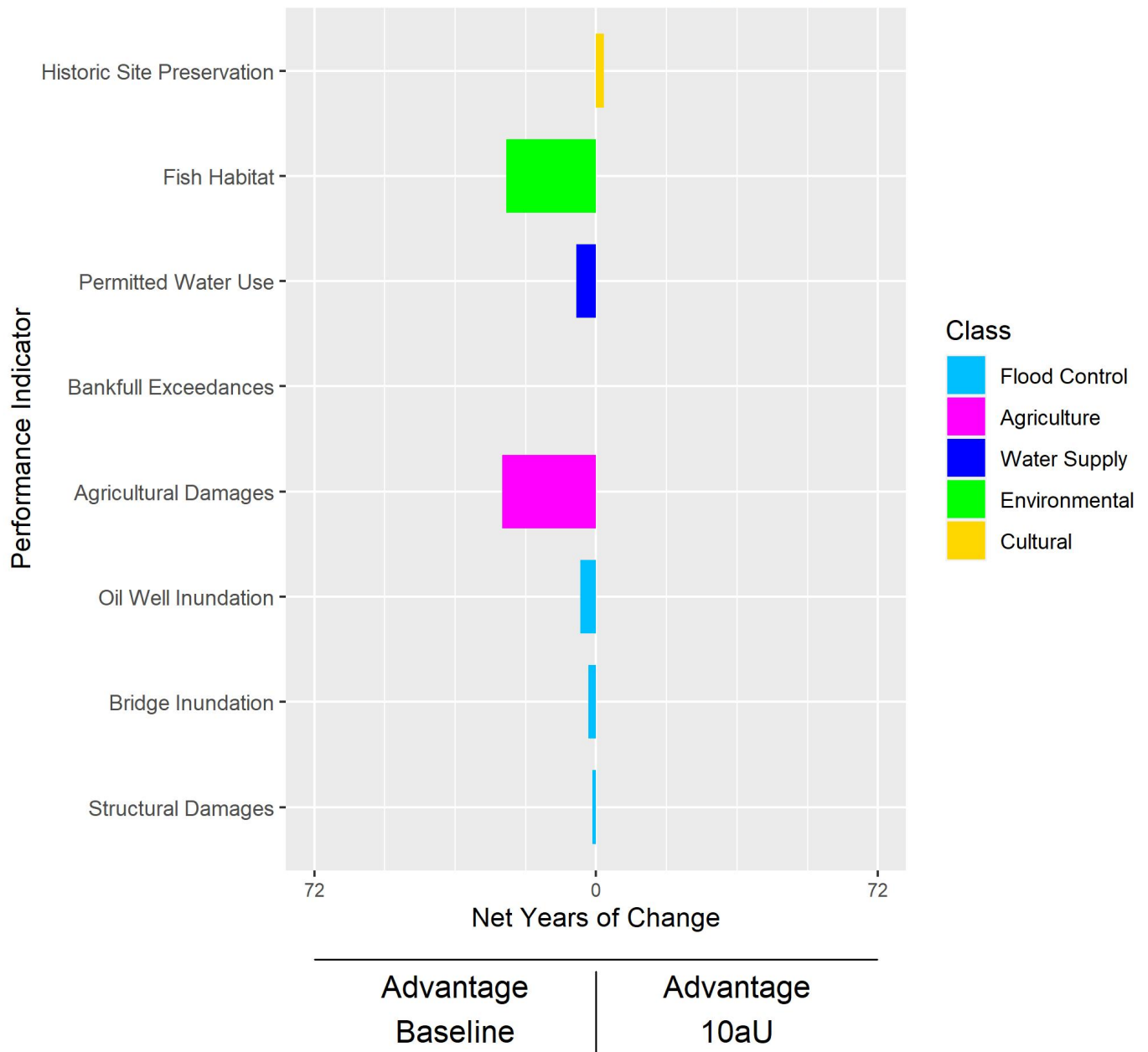
Period of Record: 1946-2017 (72 Years)



Moose Mountain Creek to Sherwood

Baseline vs. 10aU

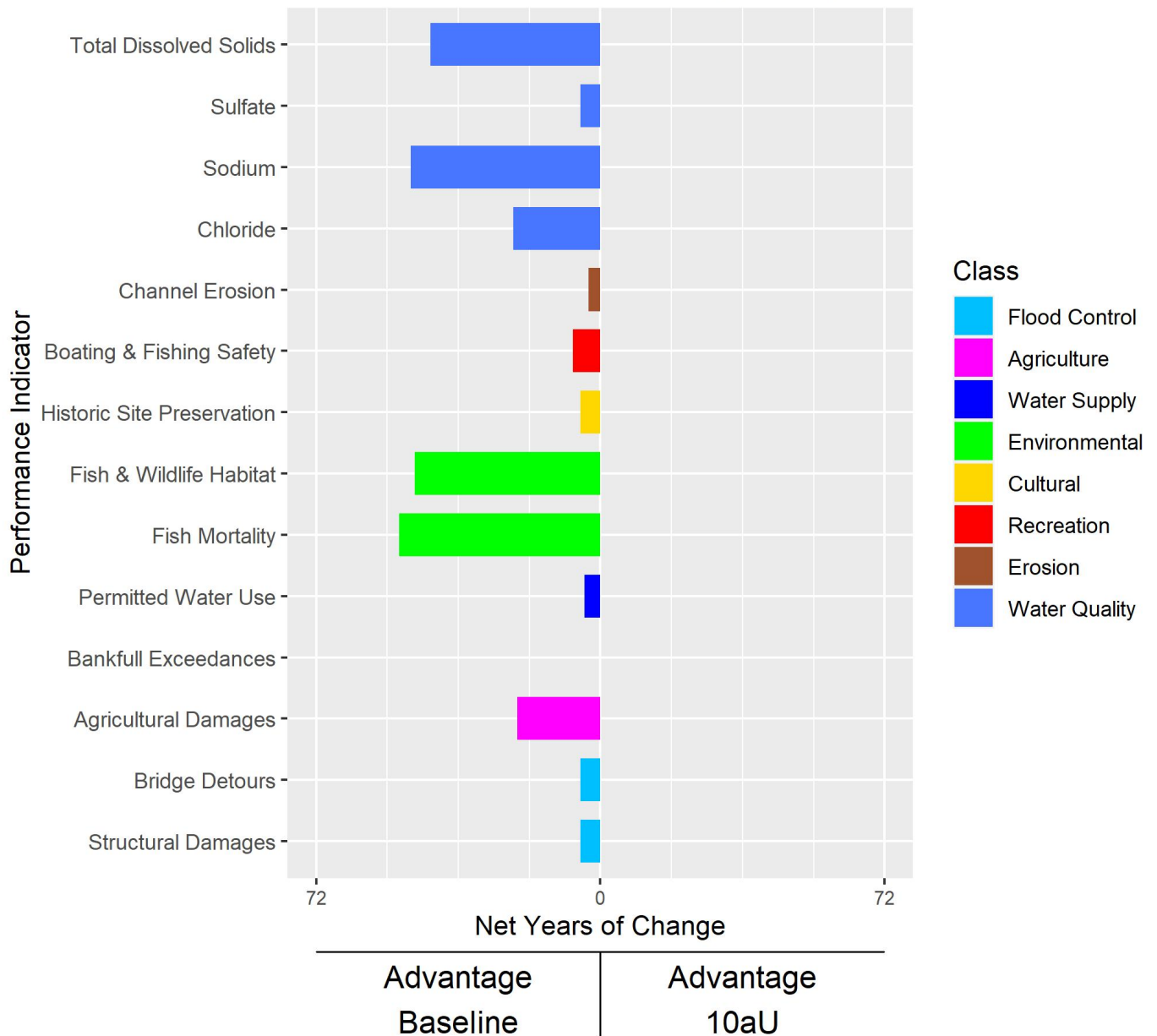
Period of Record: 1946-2017 (72 Years)



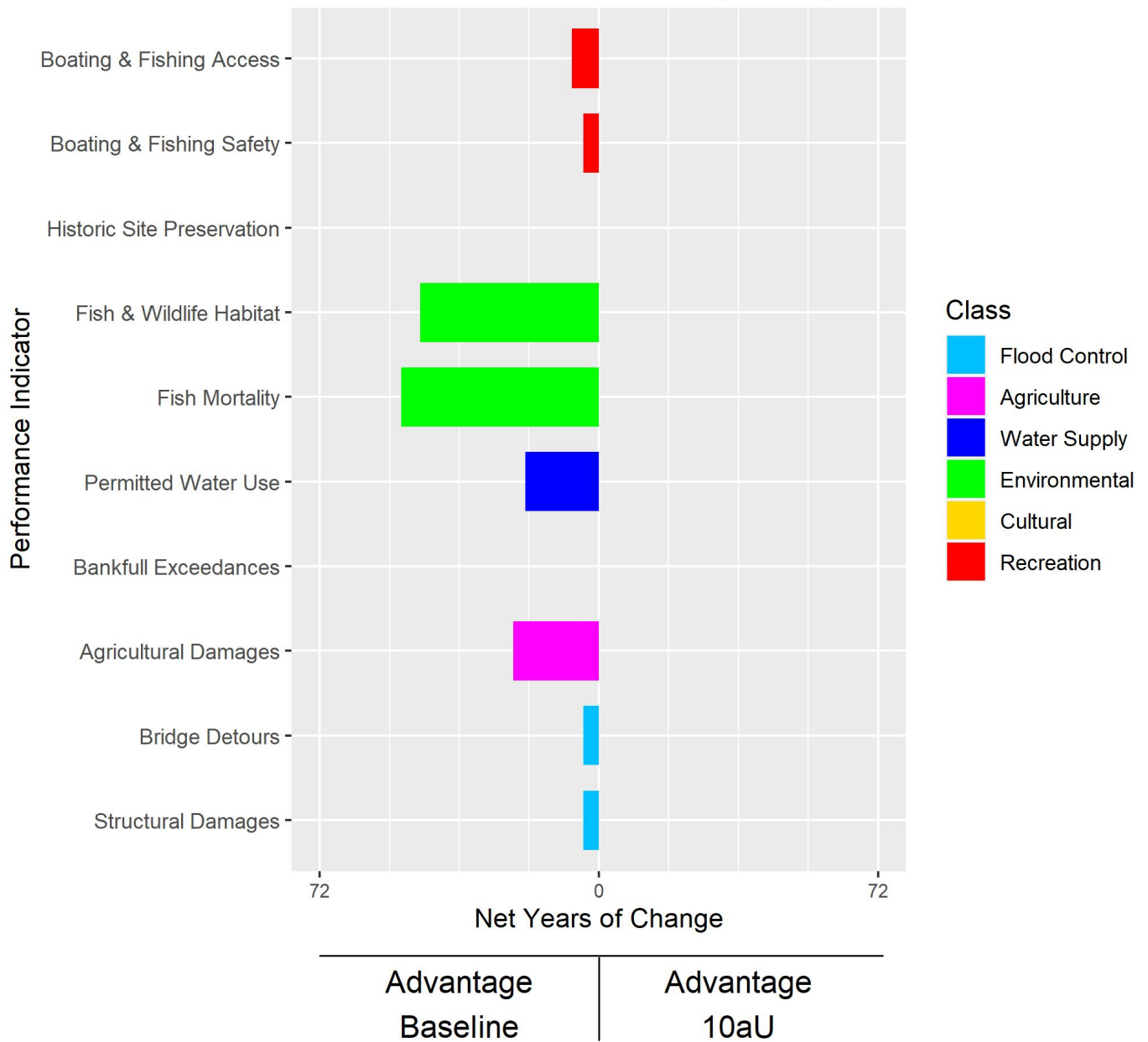
Sherwood to Mouse River Park

Baseline vs. 10aU

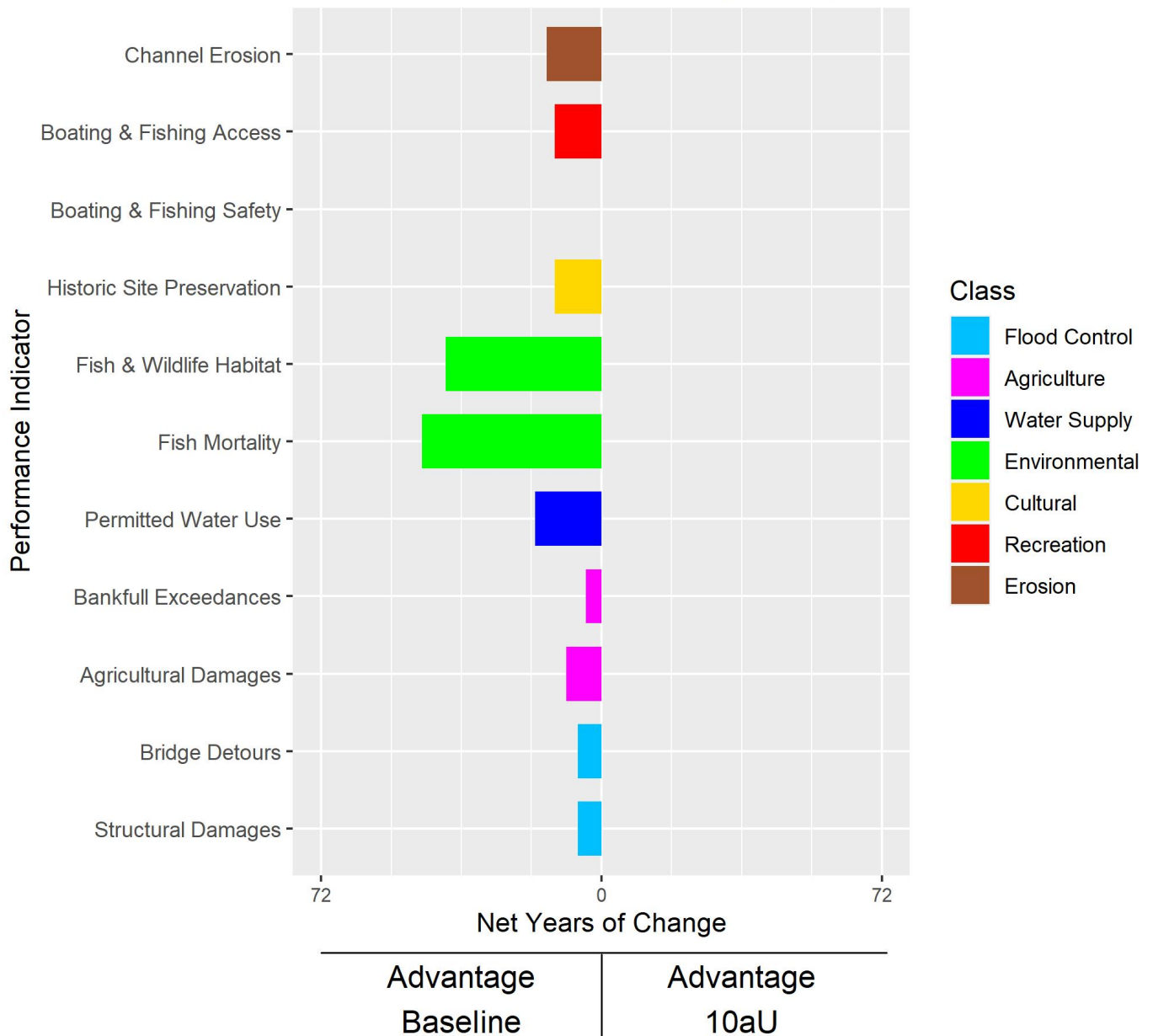
Period of Record: 1946-2017 (72 Years)



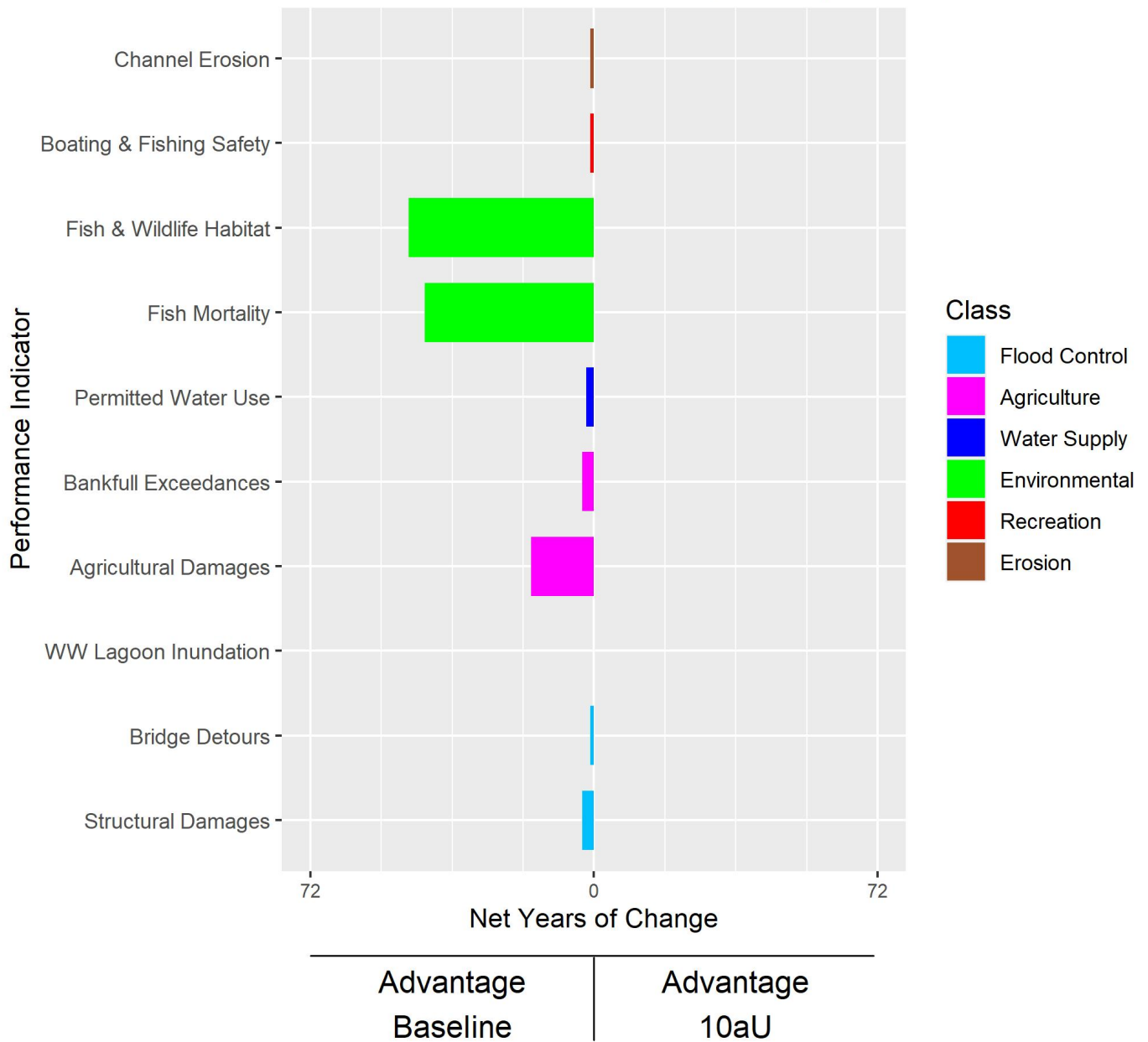
Mouse River Park
Baseline vs. 10aU
Period of Record: 1946-2017 (72 Years)



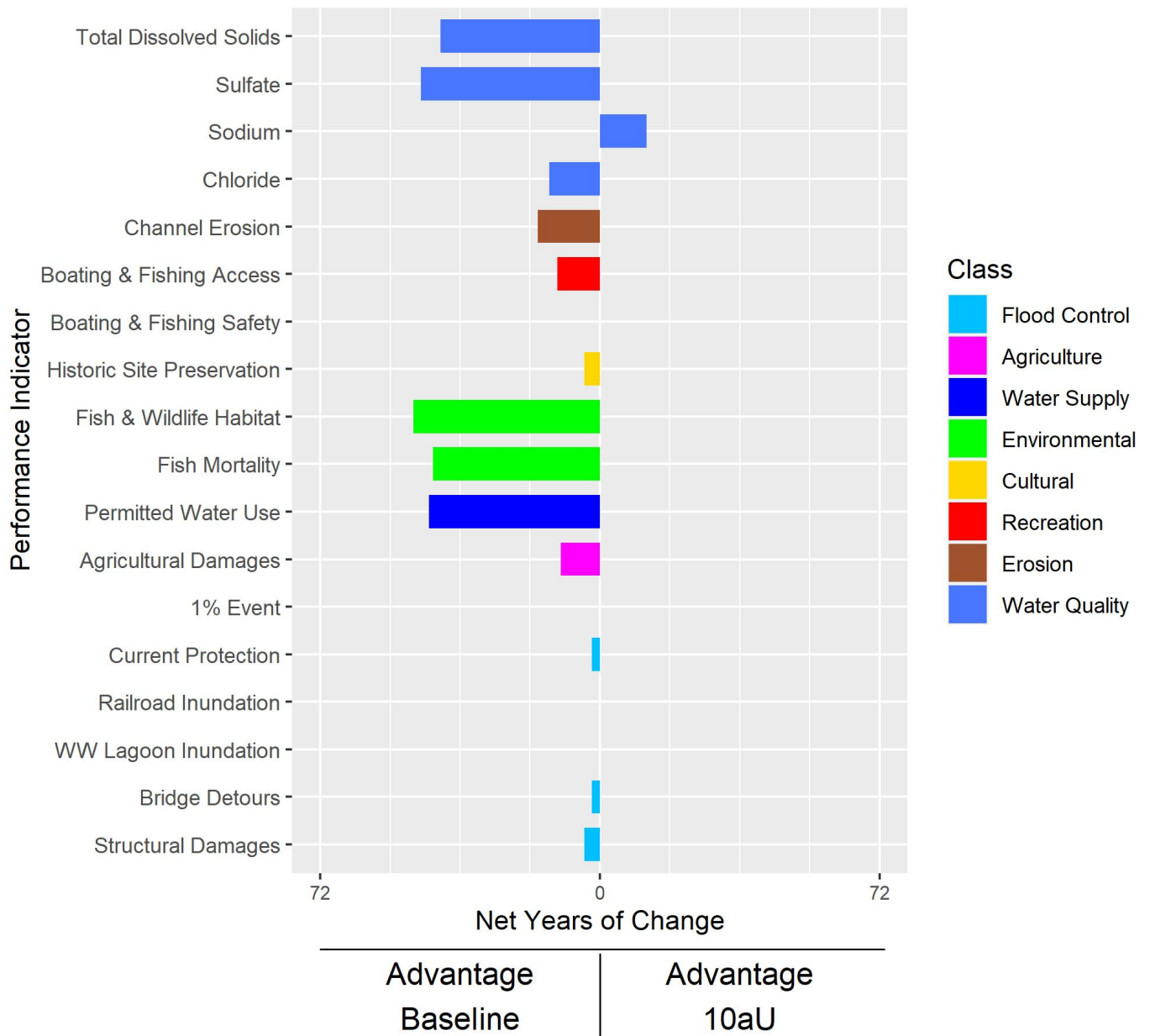
Lake Darling to Burlington
Baseline vs. 10aU
Period of Record: 1946-2017 (72 Years)



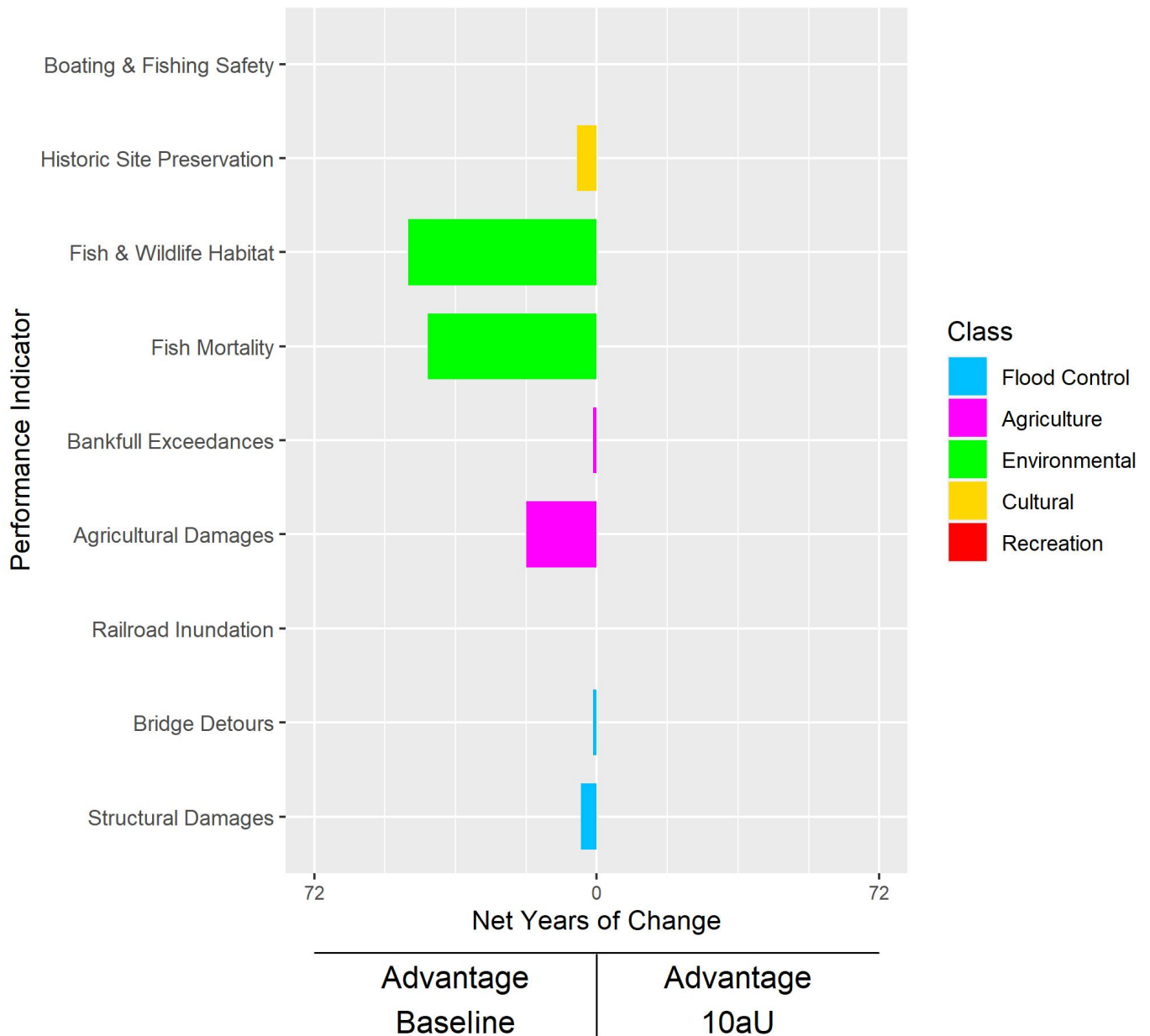
City of Burlington
Baseline vs. 10aU
Period of Record: 1946-2017 (72 Years)



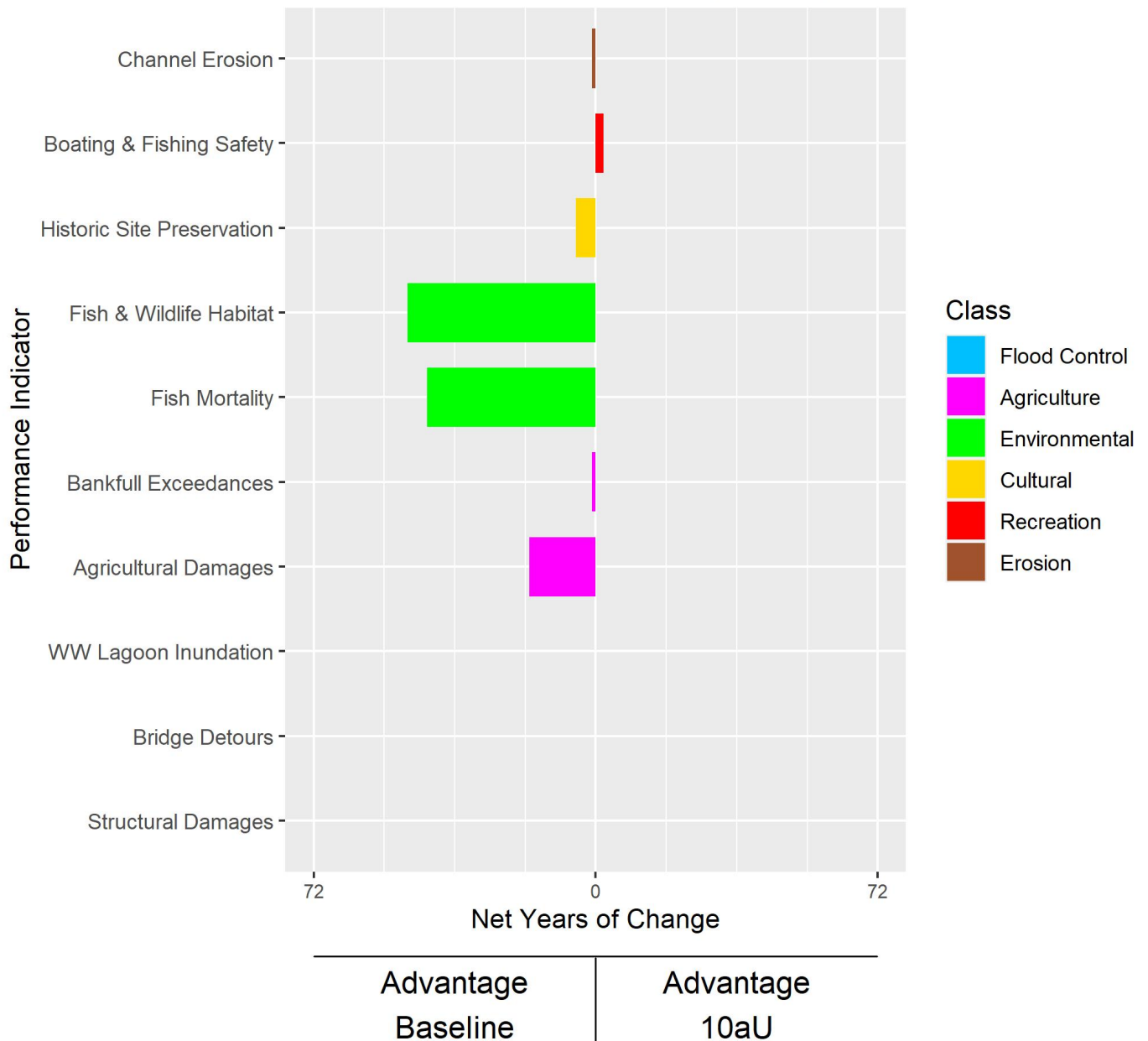
City of Minot
Baseline vs. 10aU
Period of Record: 1946-2017 (72 Years)



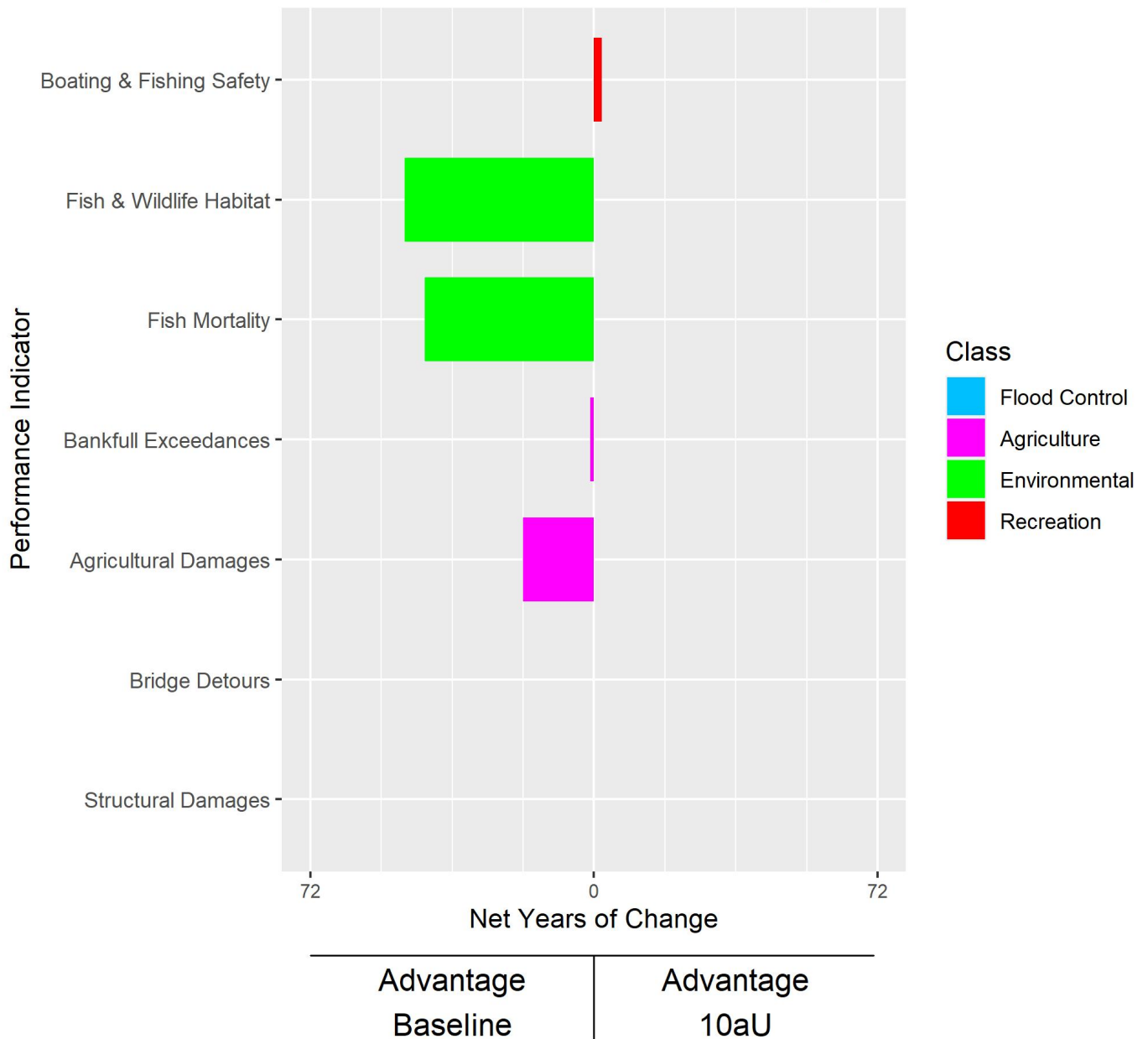
Minot to Sawyer
Baseline vs. 10aU
Period of Record: 1946-2017 (72 Years)



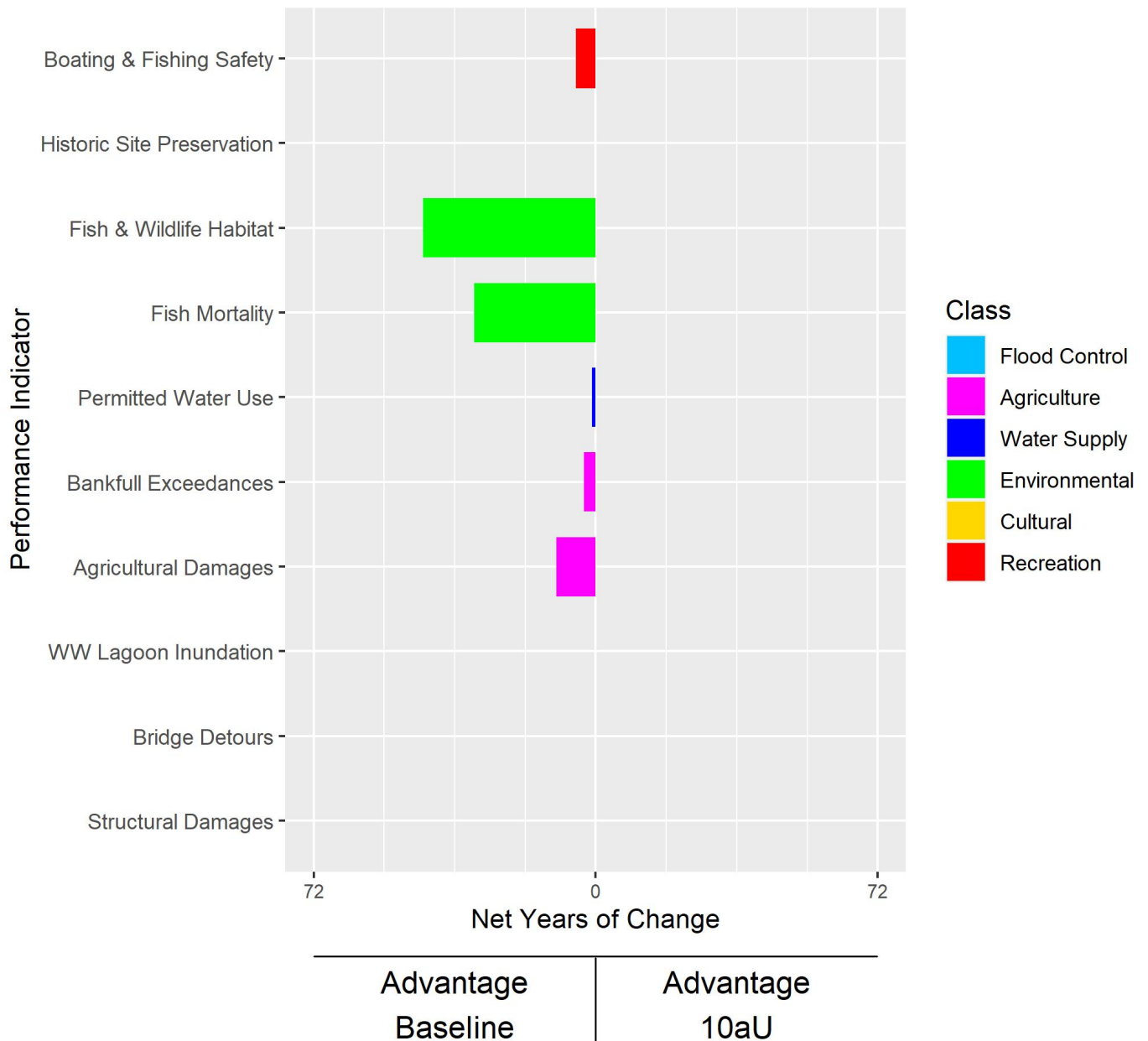
City of Sawyer
Baseline vs. 10aU
Period of Record: 1946-2017 (72 Years)



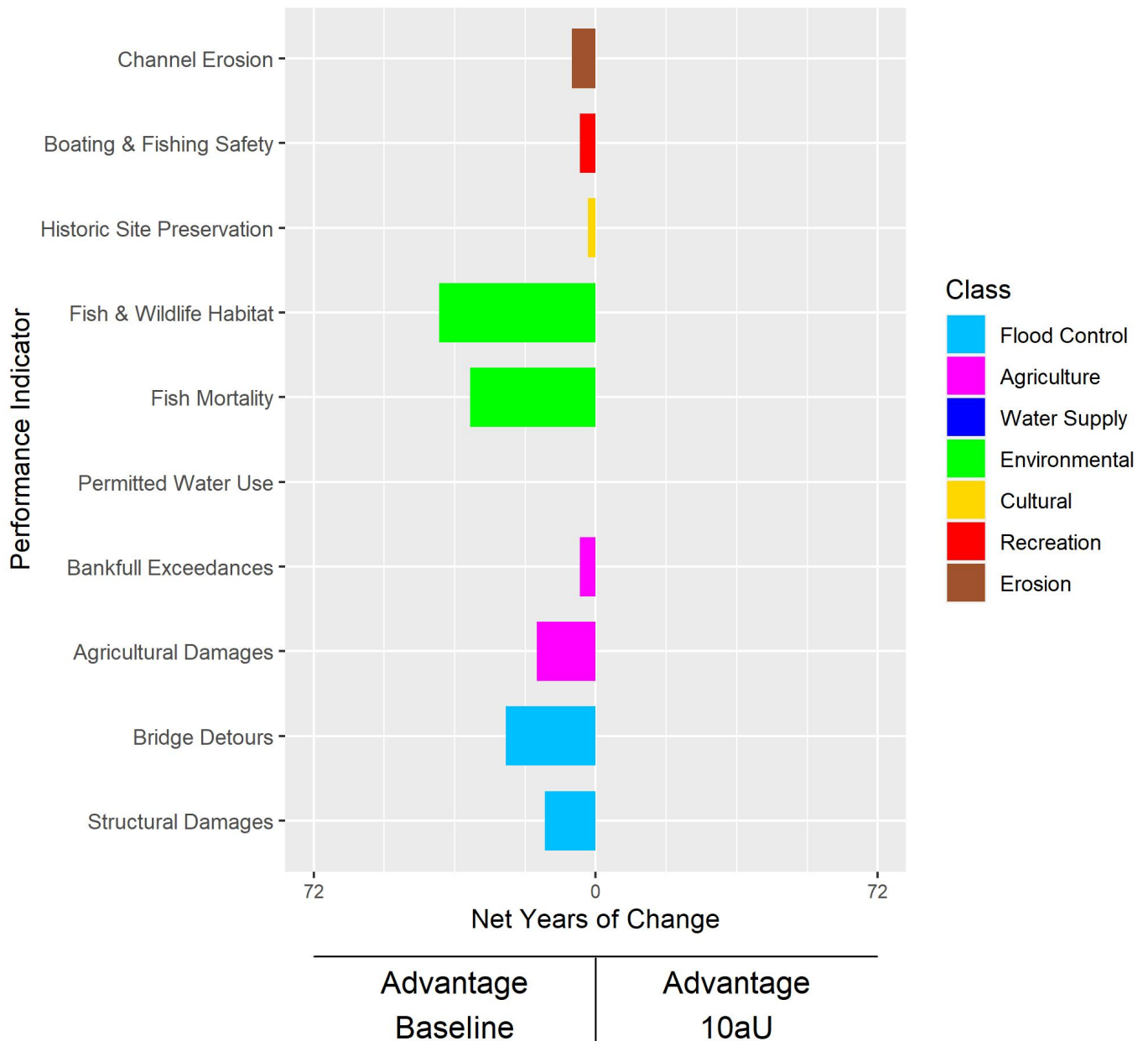
Sawyer to Velva
Baseline vs. 10aU
Period of Record: 1946-2017 (72 Years)



City of Velva
Baseline vs. 10aU
Period of Record: 1946-2017 (72 Years)



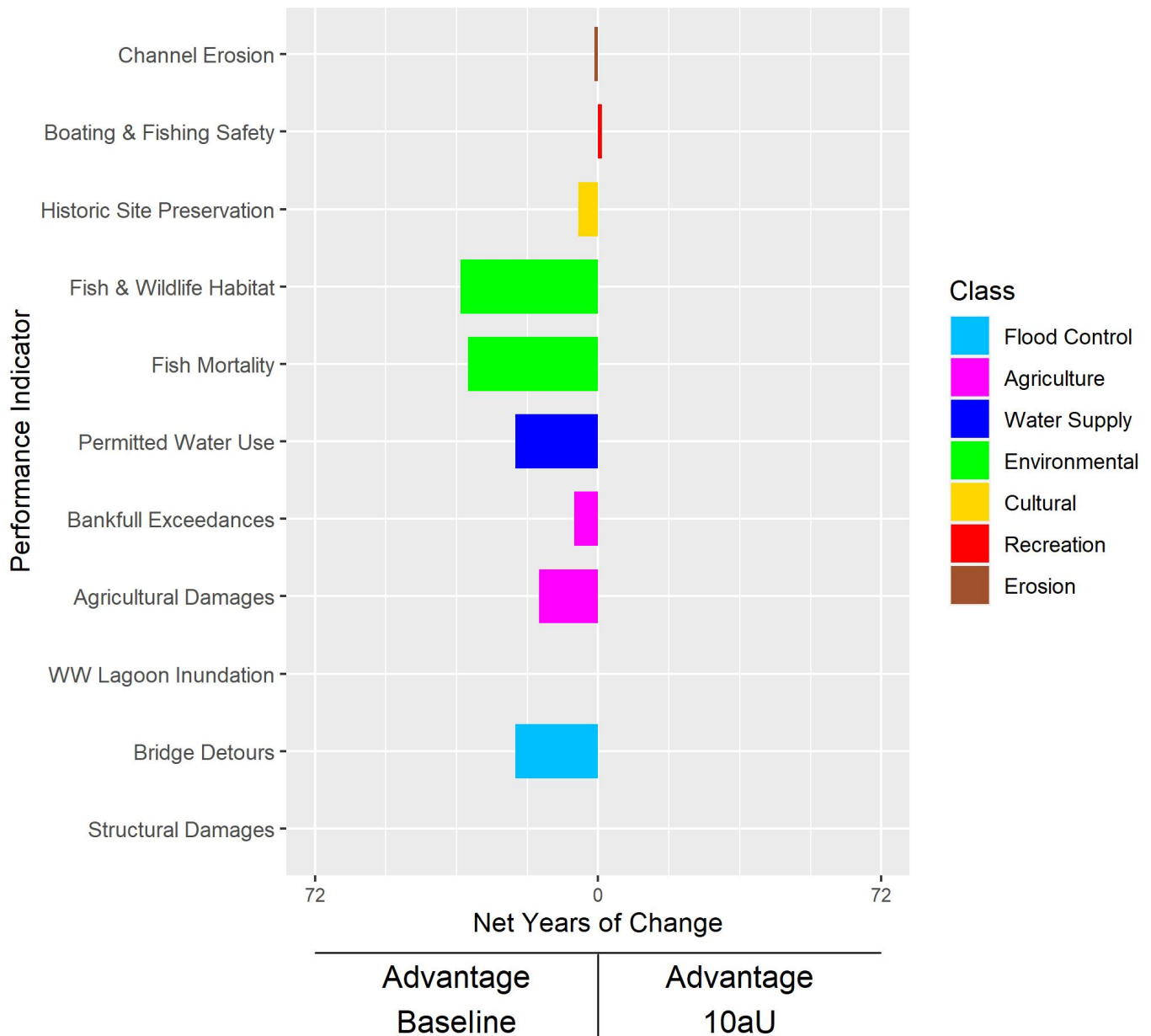
Velva to Eaton Irrigation
Baseline vs. 10aU
Period of Record: 1946-2017 (72 Years)



Eaton Irrigation District

Baseline vs. 10aU

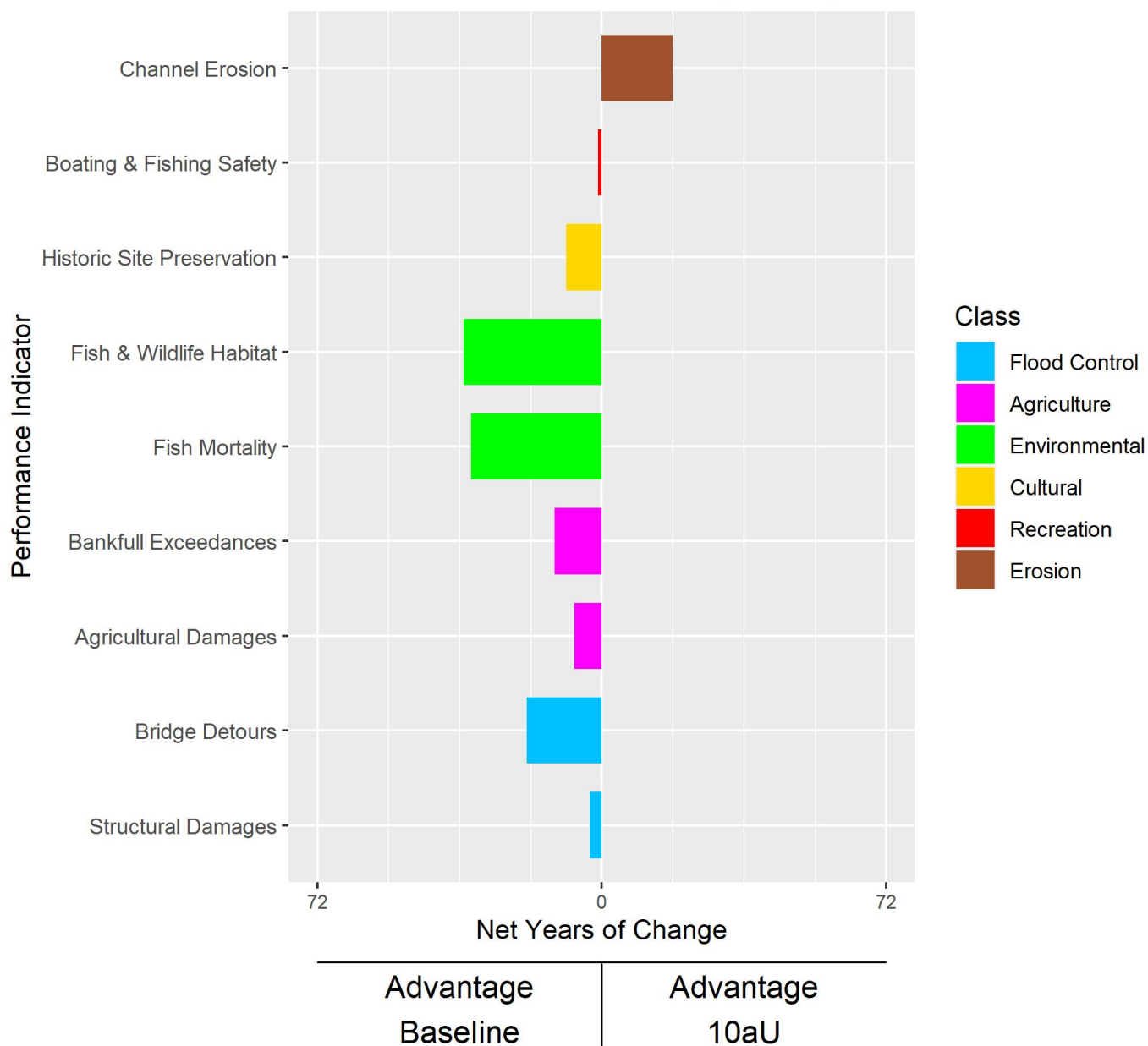
Period of Record: 1946-2017 (72 Years)



Downstream of Towner

Baseline vs. 10aU

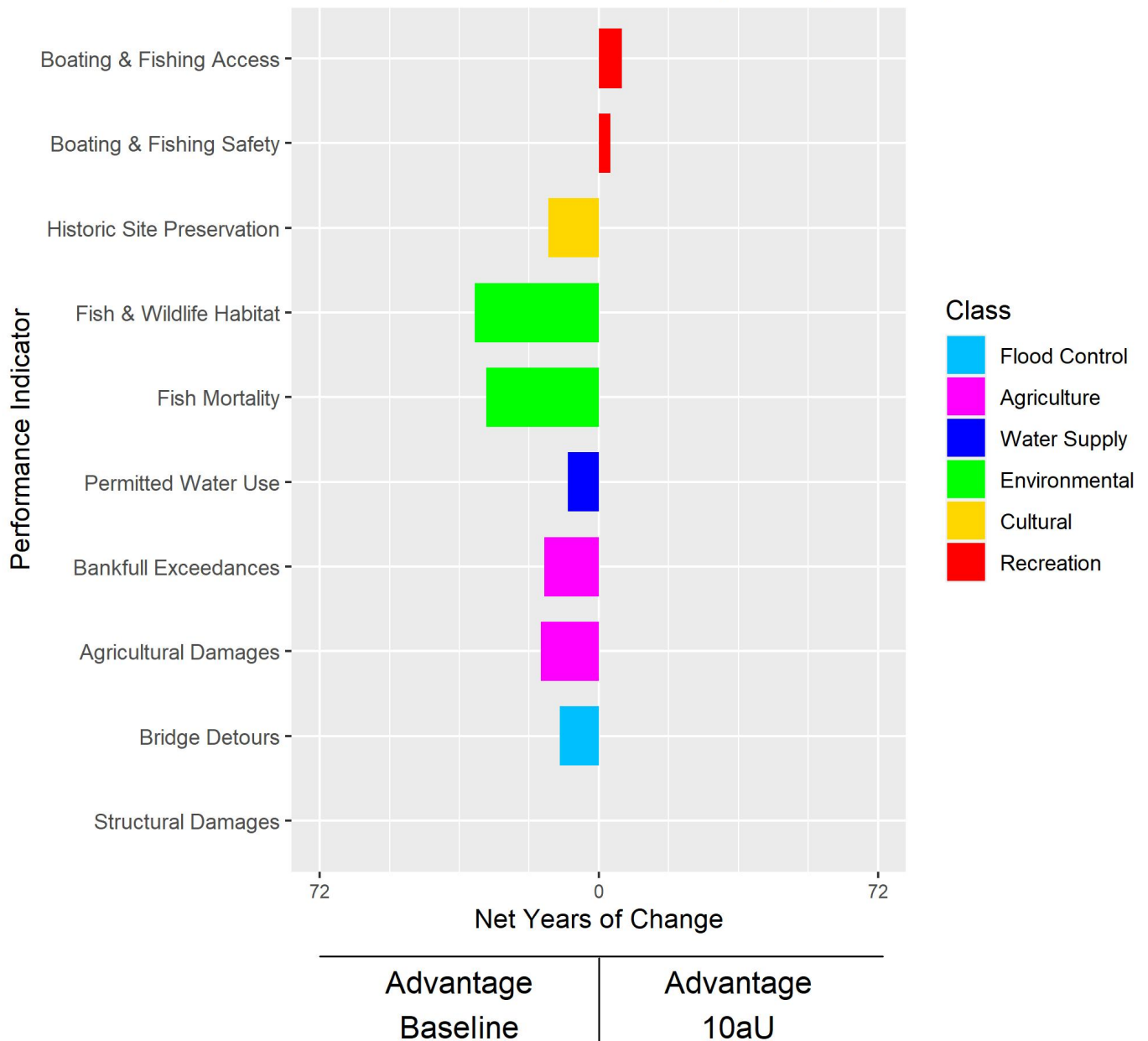
Period of Record: 1946-2017 (72 Years)



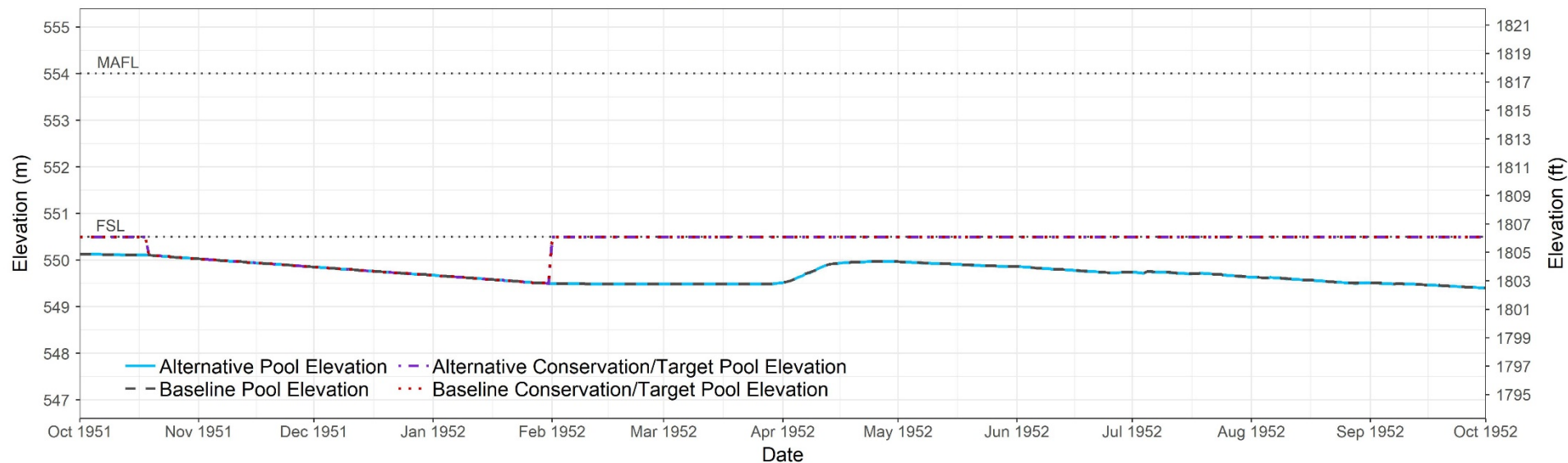
J. Clark Salyer National Wildlife Refuge

Baseline vs. 10aU

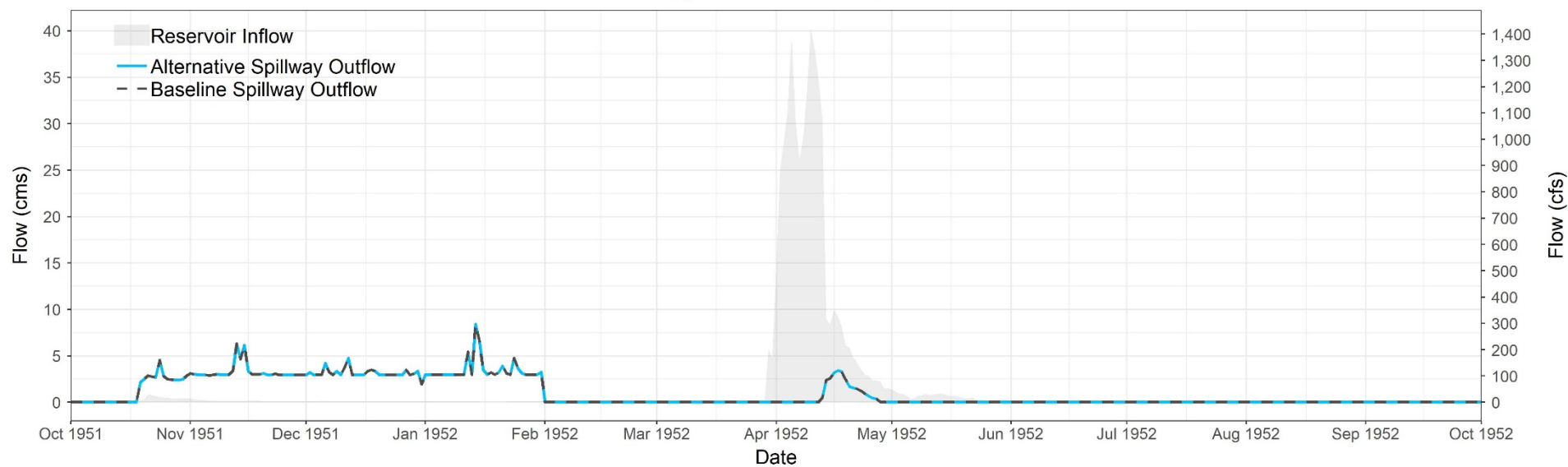
Period of Record: 1946-2017 (72 Years)



Rafferty Reservoir - Elevation

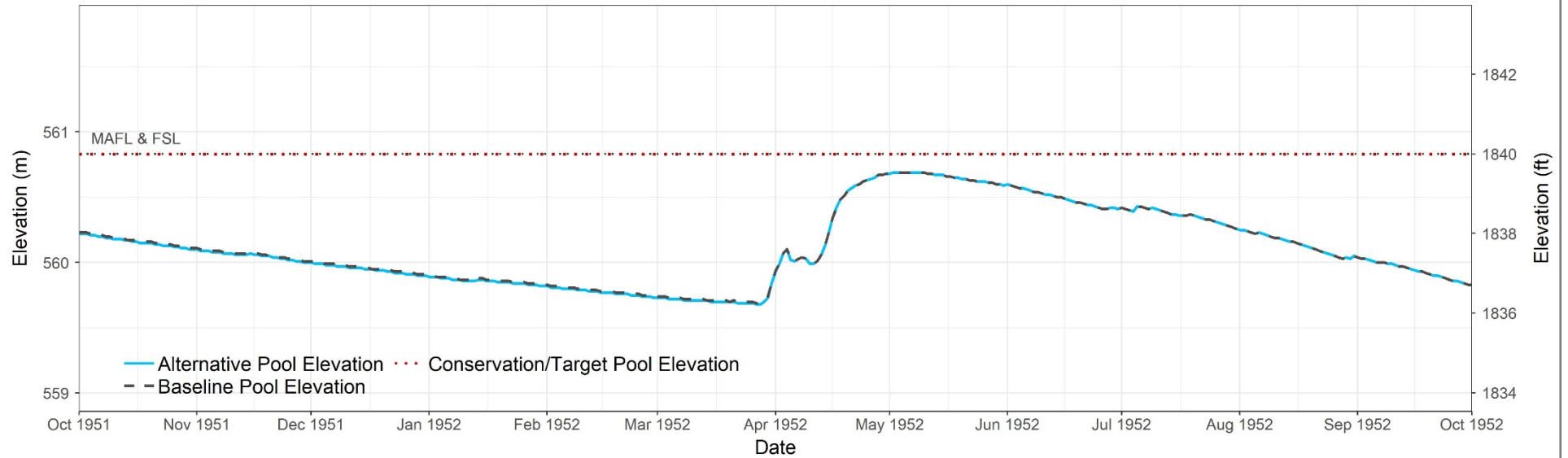


Rafferty Reservoir - Releases

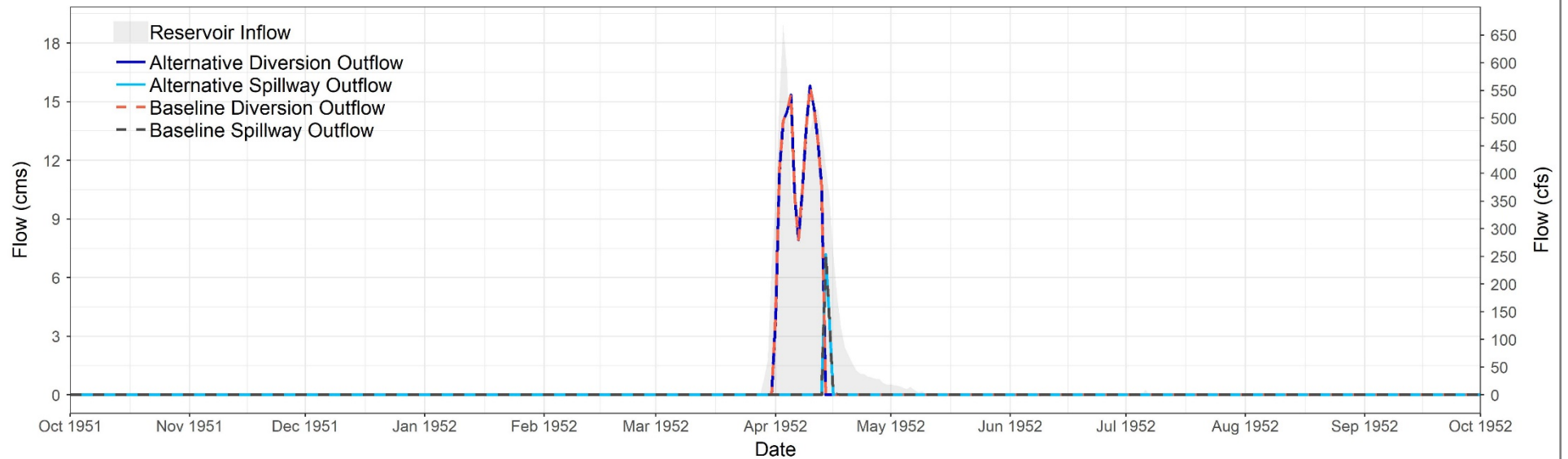


*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level

Boundary Reservoir - Elevation

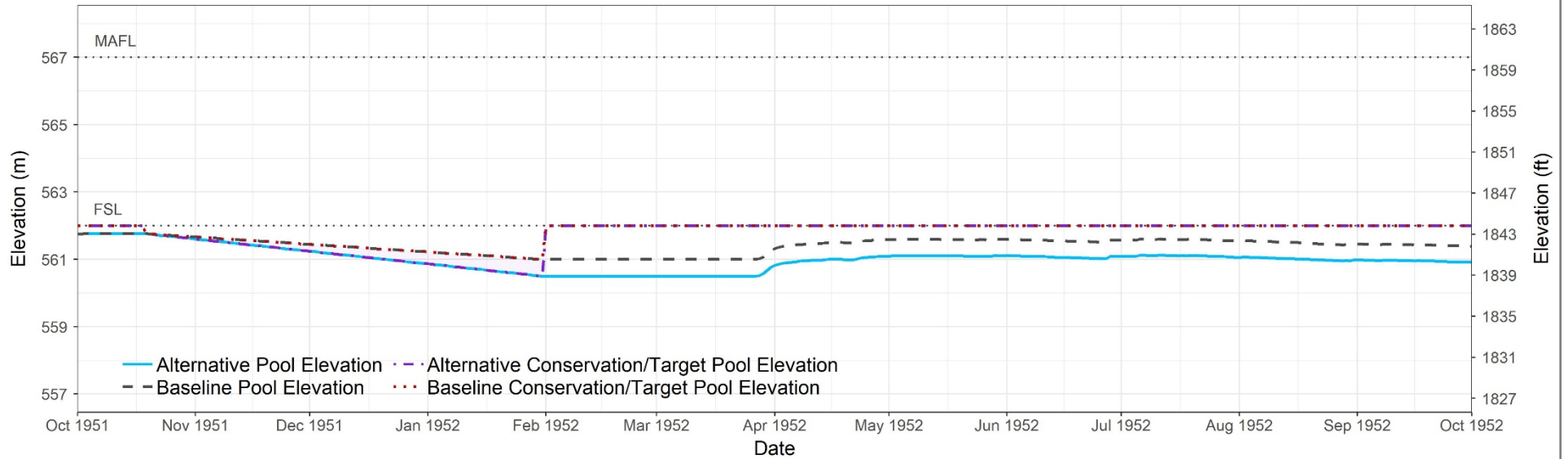


Boundary Reservoir - Releases

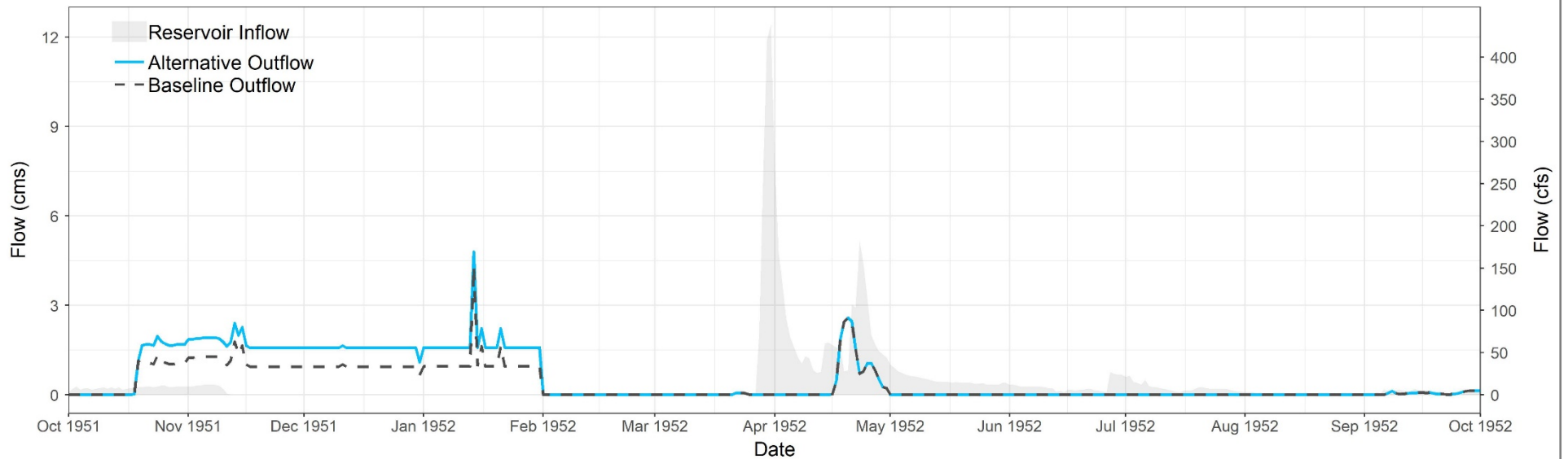


*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level

Grant Devine Reservoir - Elevation

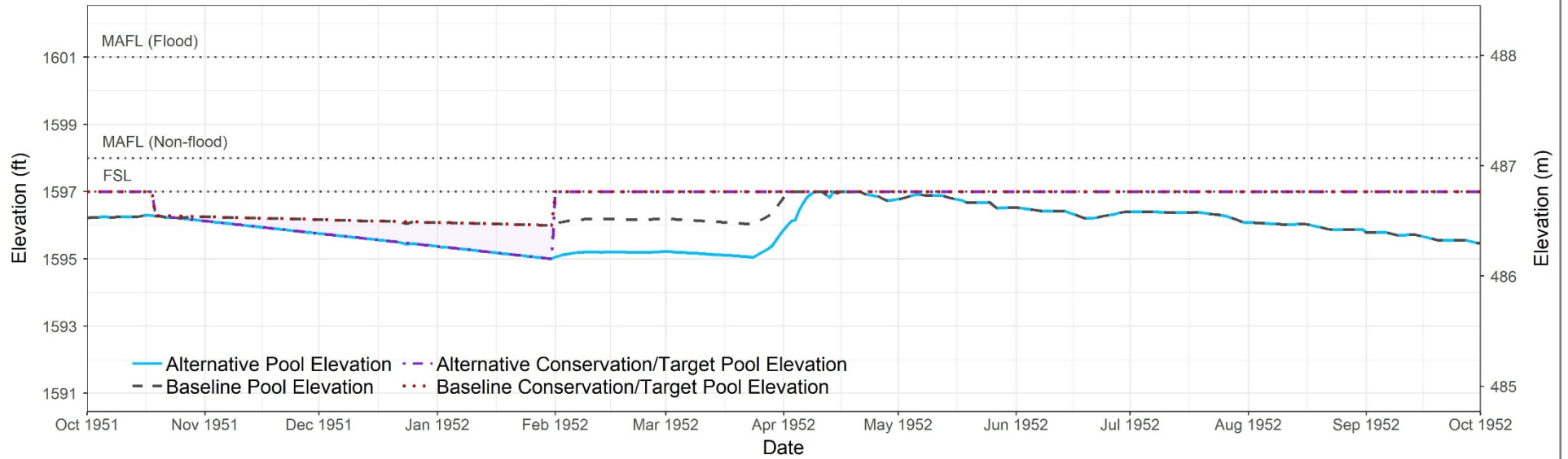


Grant Devine Reservoir - Releases

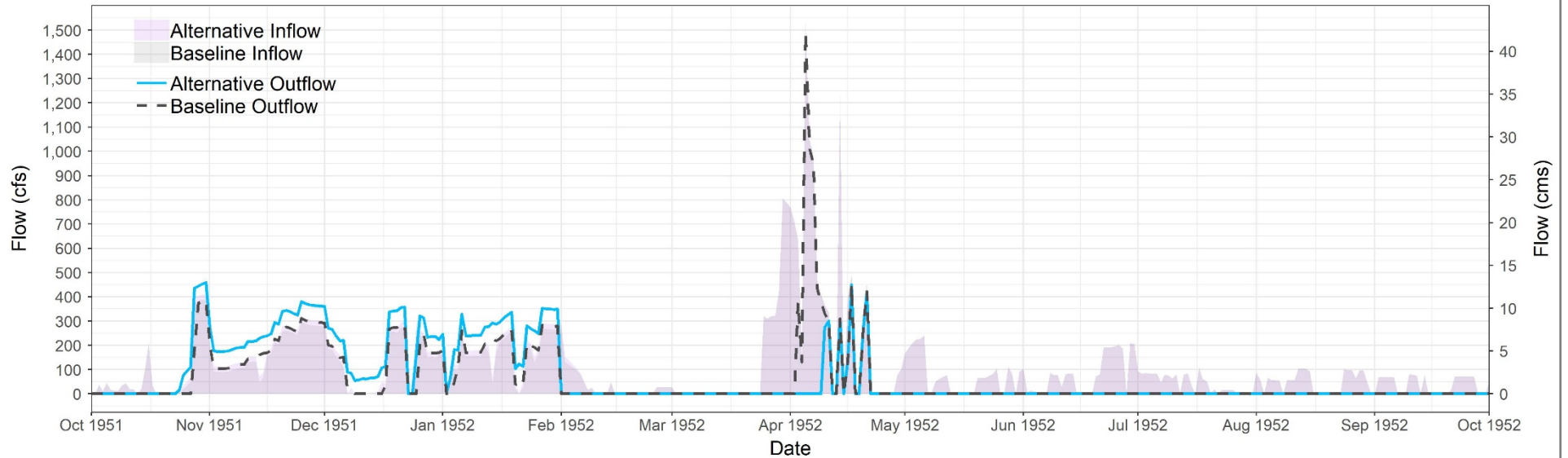


*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level

Lake Darling - Elevation



Lake Darling - Releases



*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level, IDFSL = Inflow Design Flood Supply Level

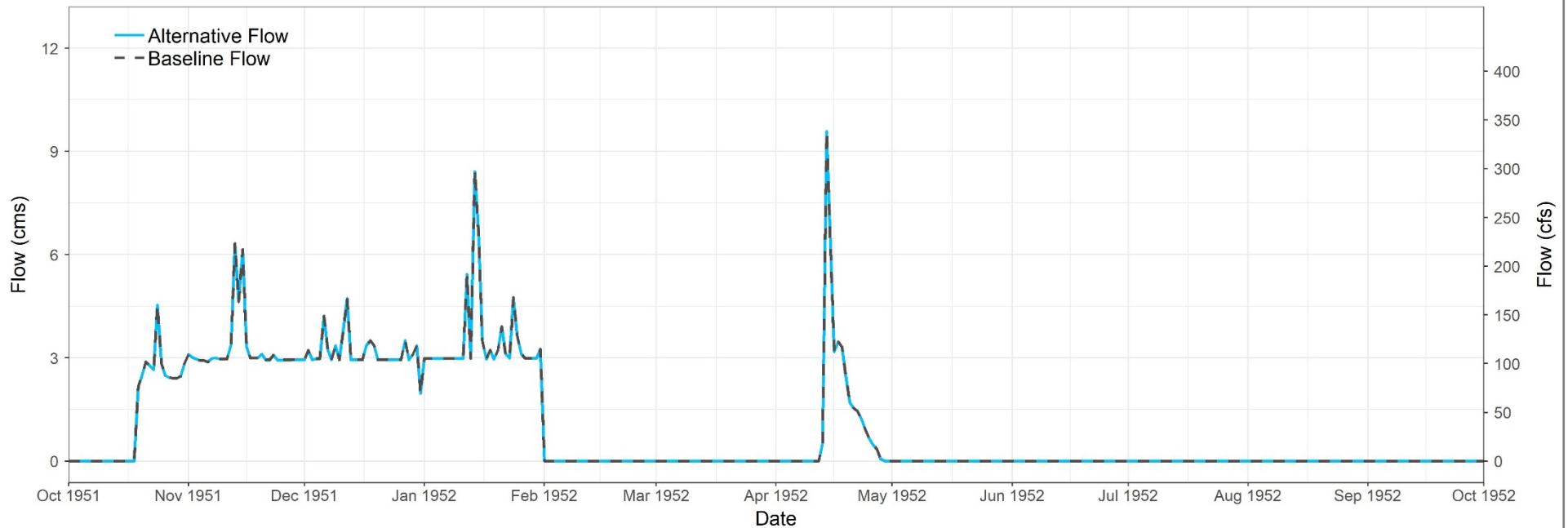
Plate 11

Critical Flow Locations – 1952

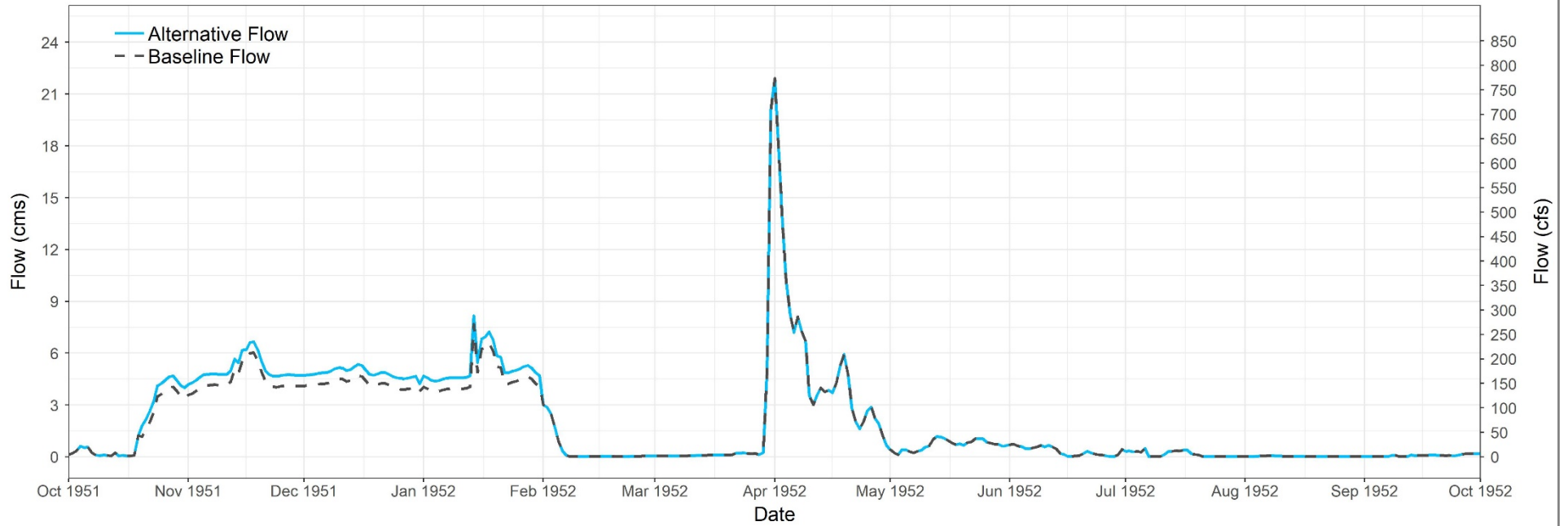
Alternative 10aD (Phase 2)

Souris River Plan of Study

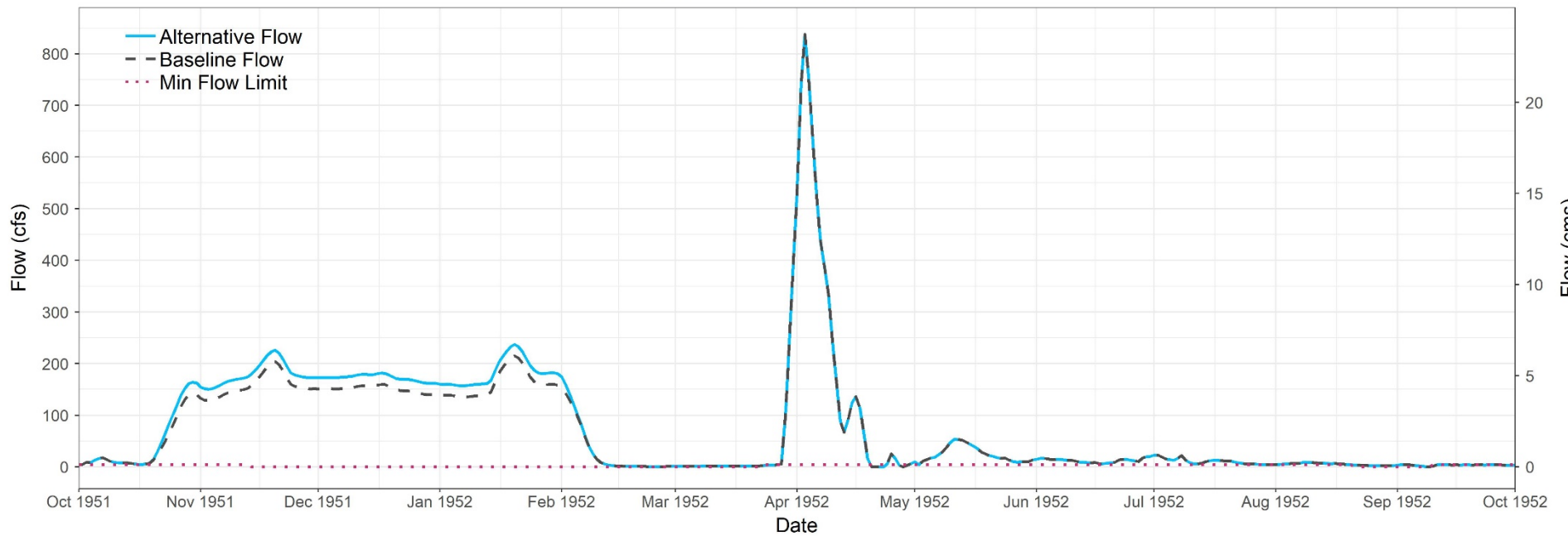
Souris River at Estevan, SK



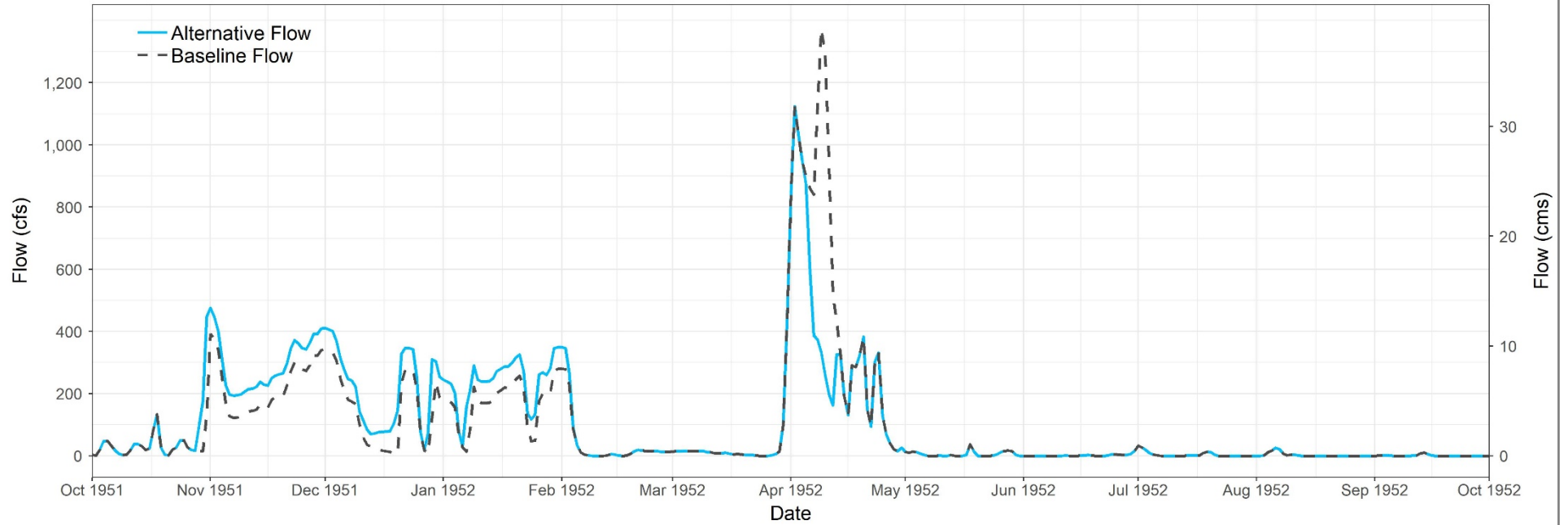
Souris River at Oxbow, SK



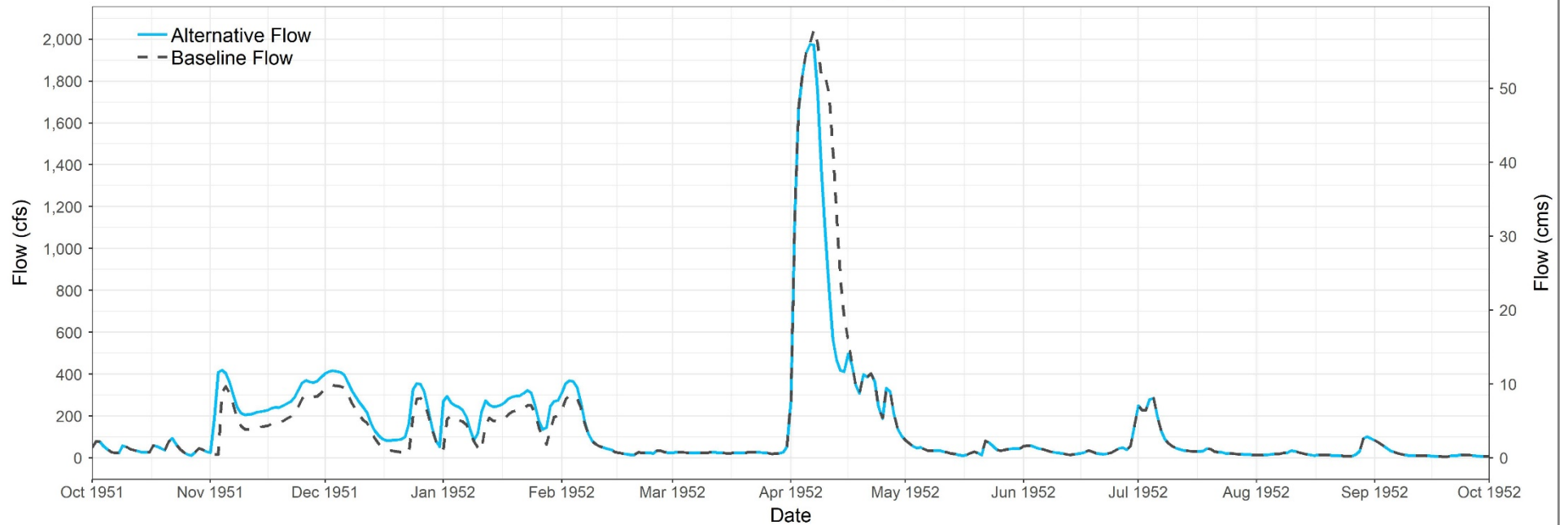
Souris River at Sherwood, ND



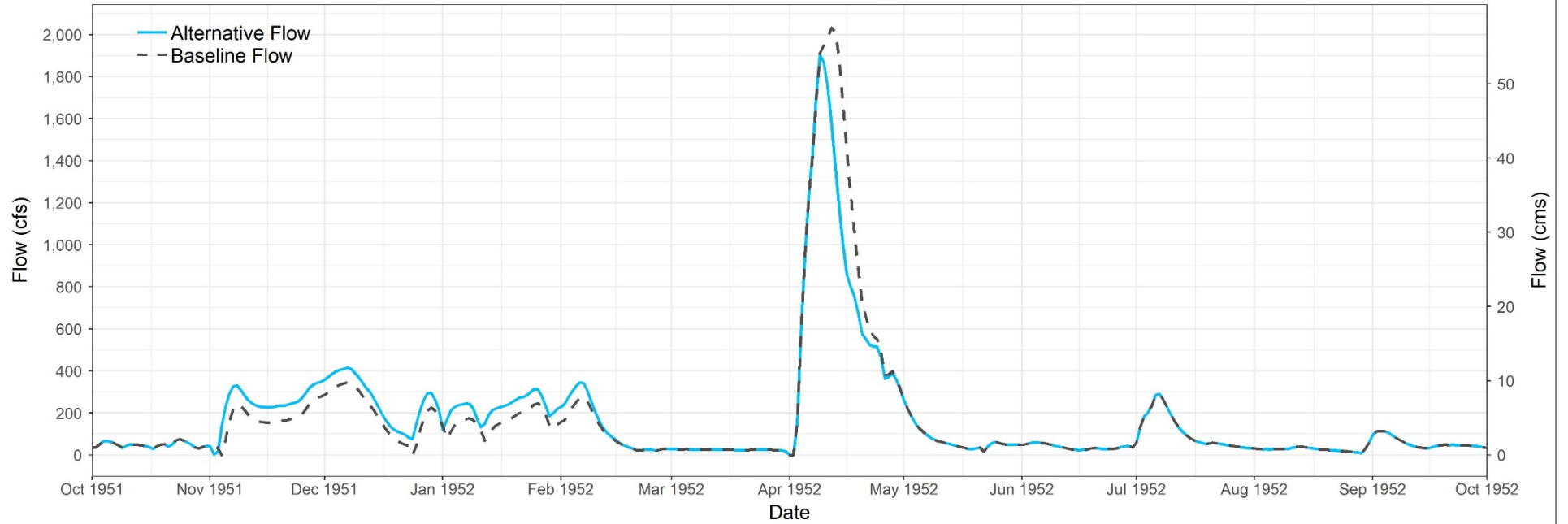
Souris River at Minot, ND - Flow



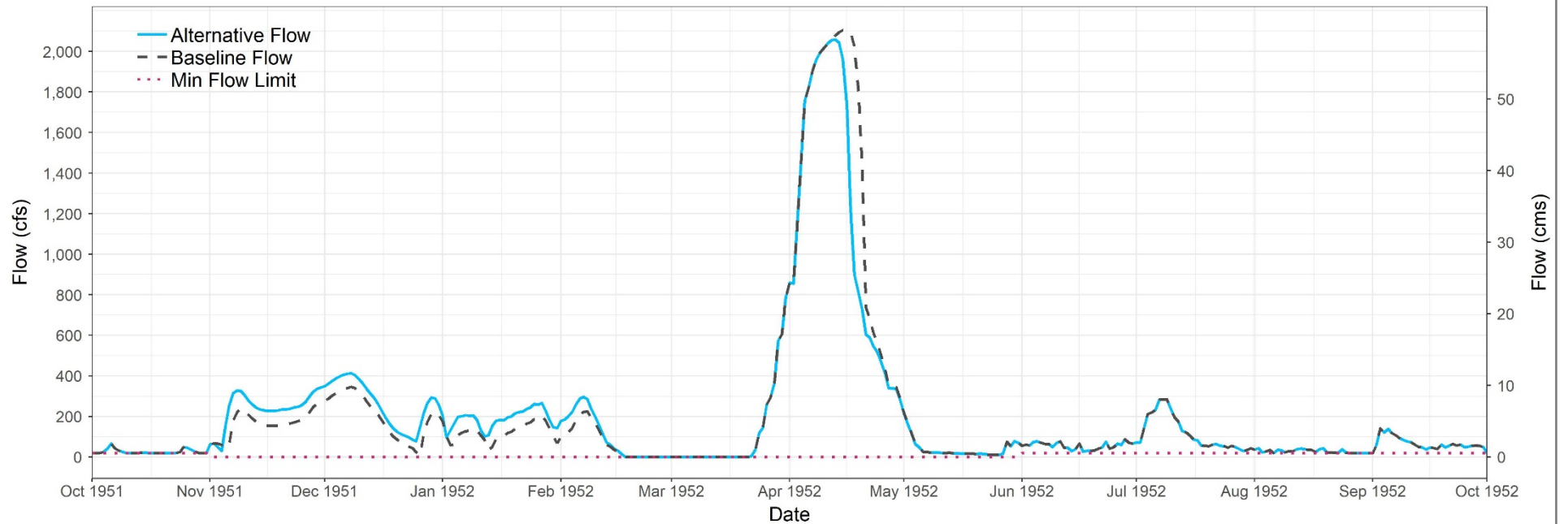
Souris River at Verendrye, ND



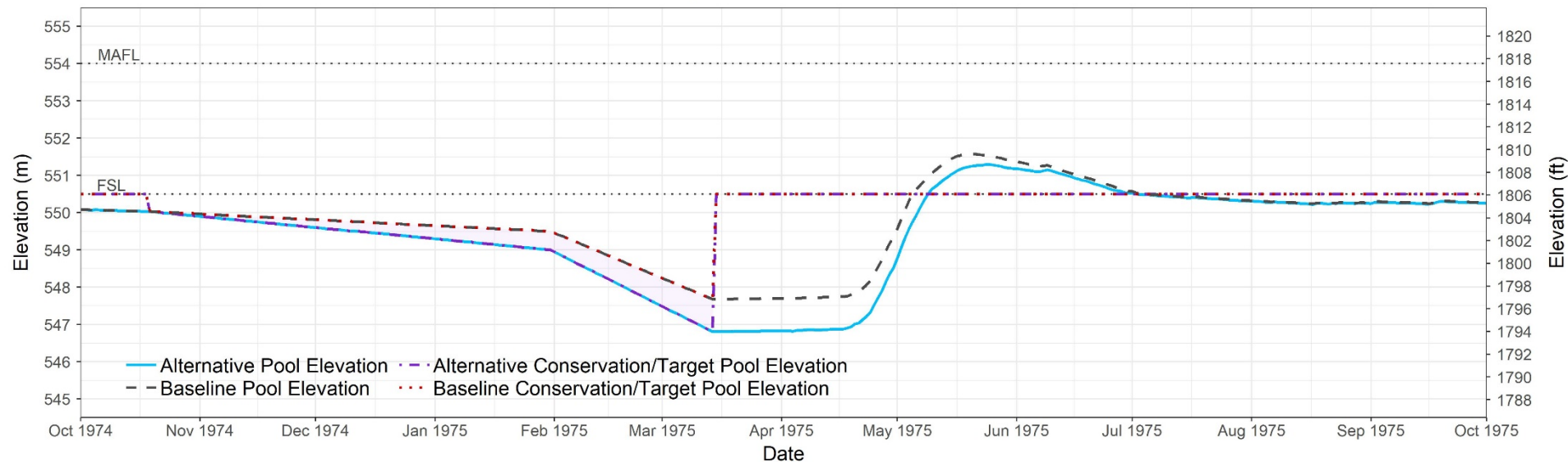
Souris River at Bantry, ND



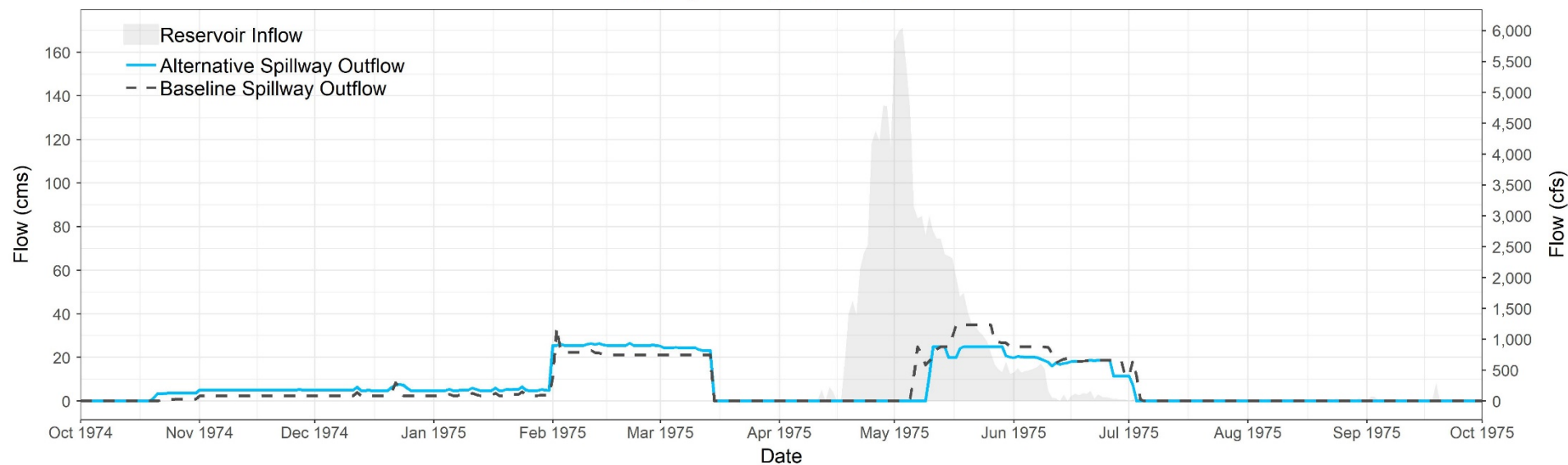
Souris River at Westhope, ND



Rafferty Reservoir - Elevation

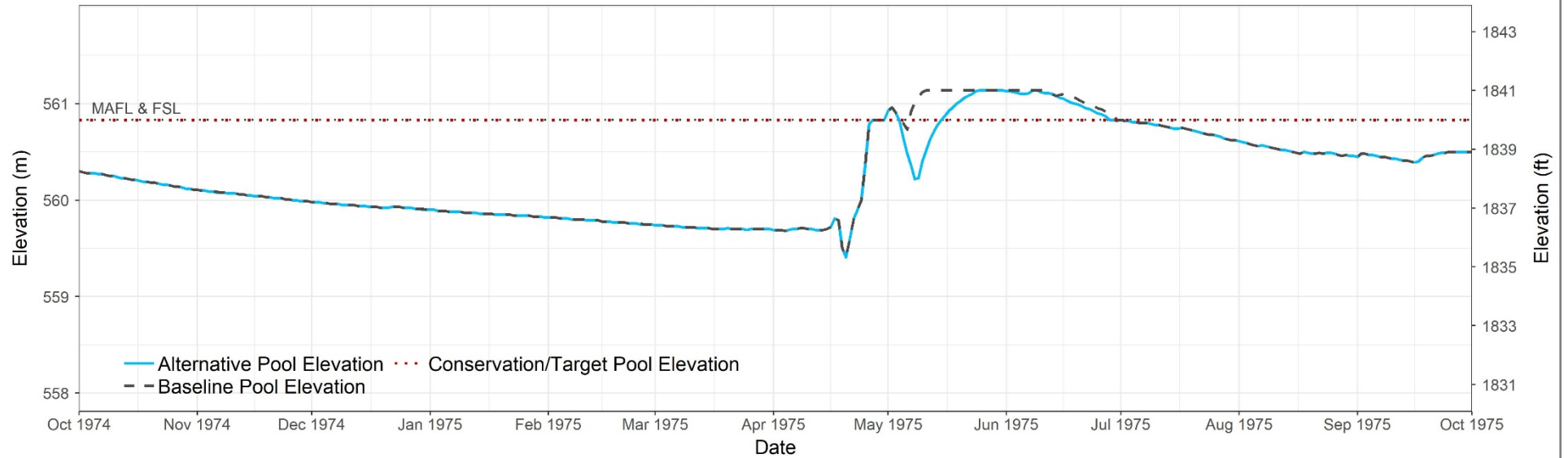


Rafferty Reservoir - Releases

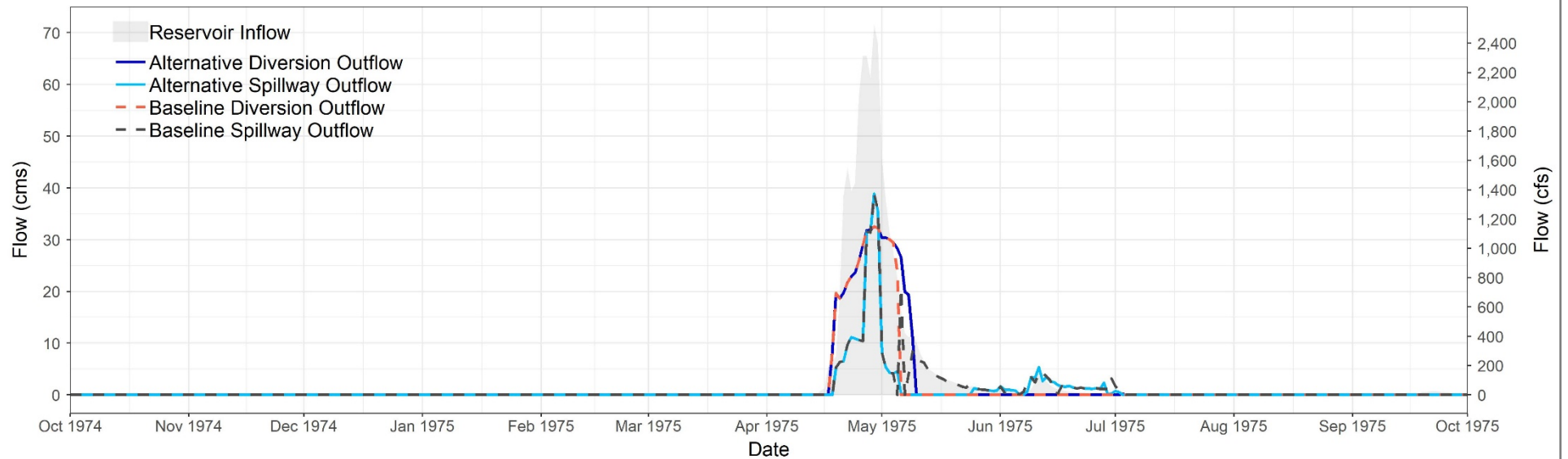


*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level

Boundary Reservoir - Elevation

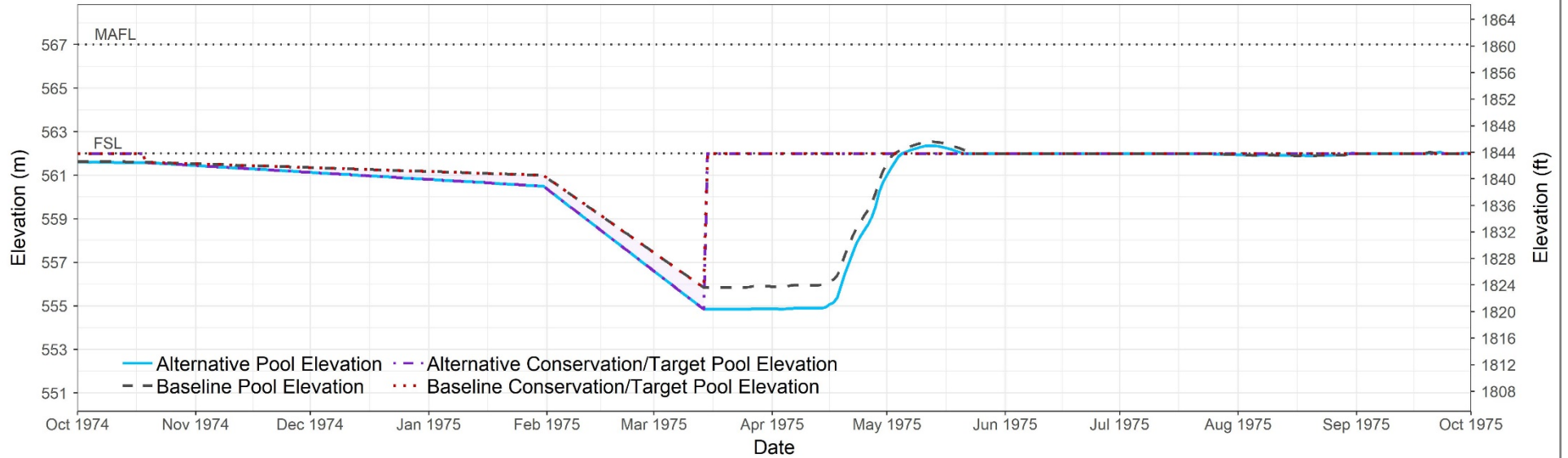


Boundary Reservoir - Releases

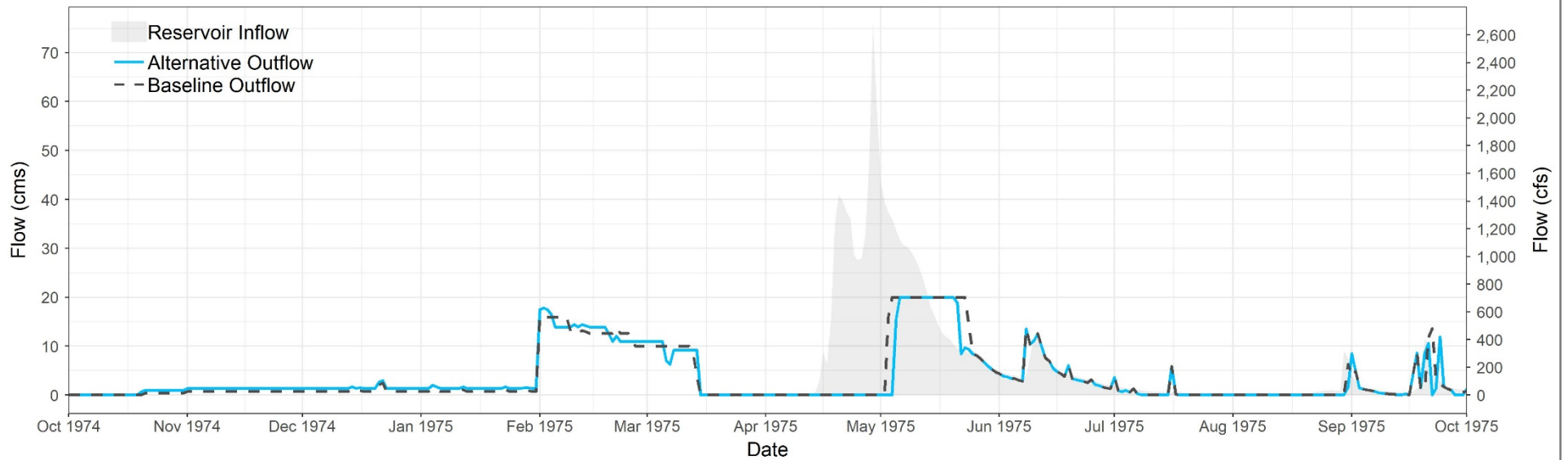


*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level

Grant Devine Reservoir - Elevation

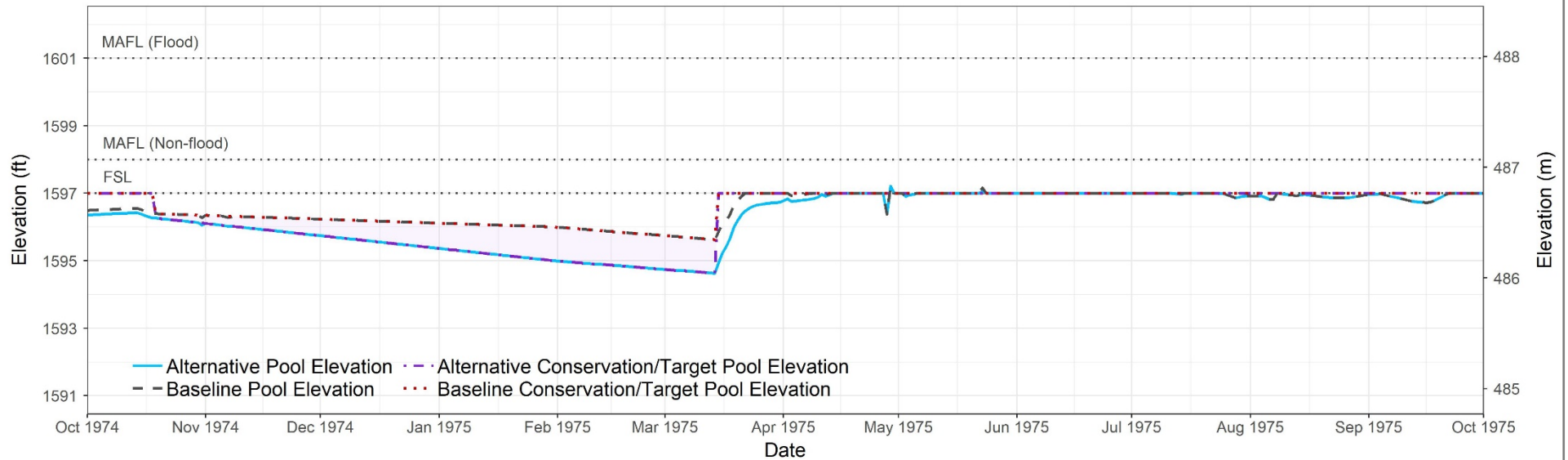


Grant Devine Reservoir - Releases

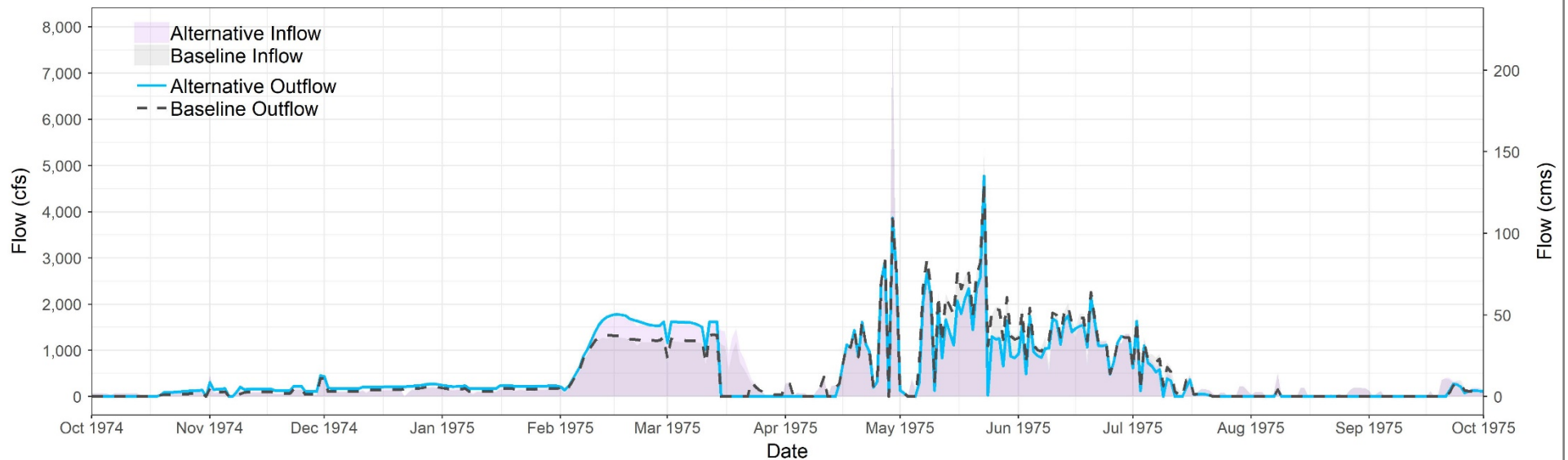


*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level

Lake Darling - Elevation



Lake Darling - Releases



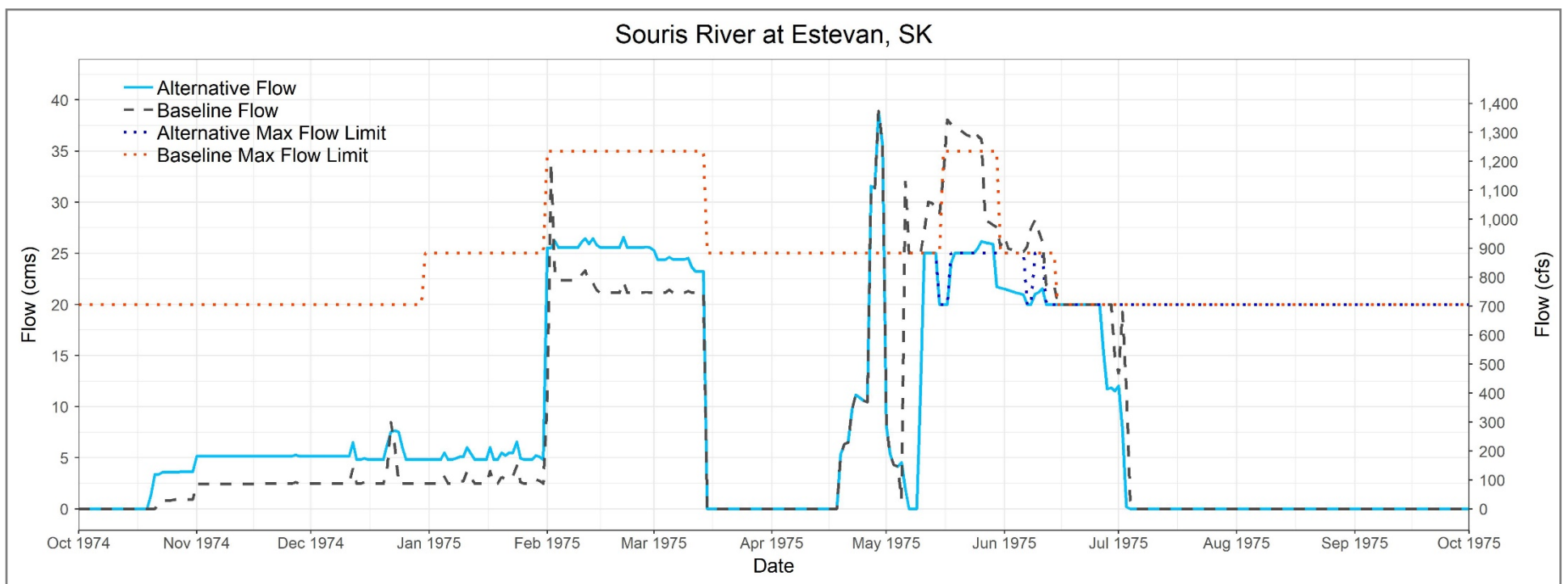
*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level, IDFSL = Inflow Design Flood Supply Level

Plate 13

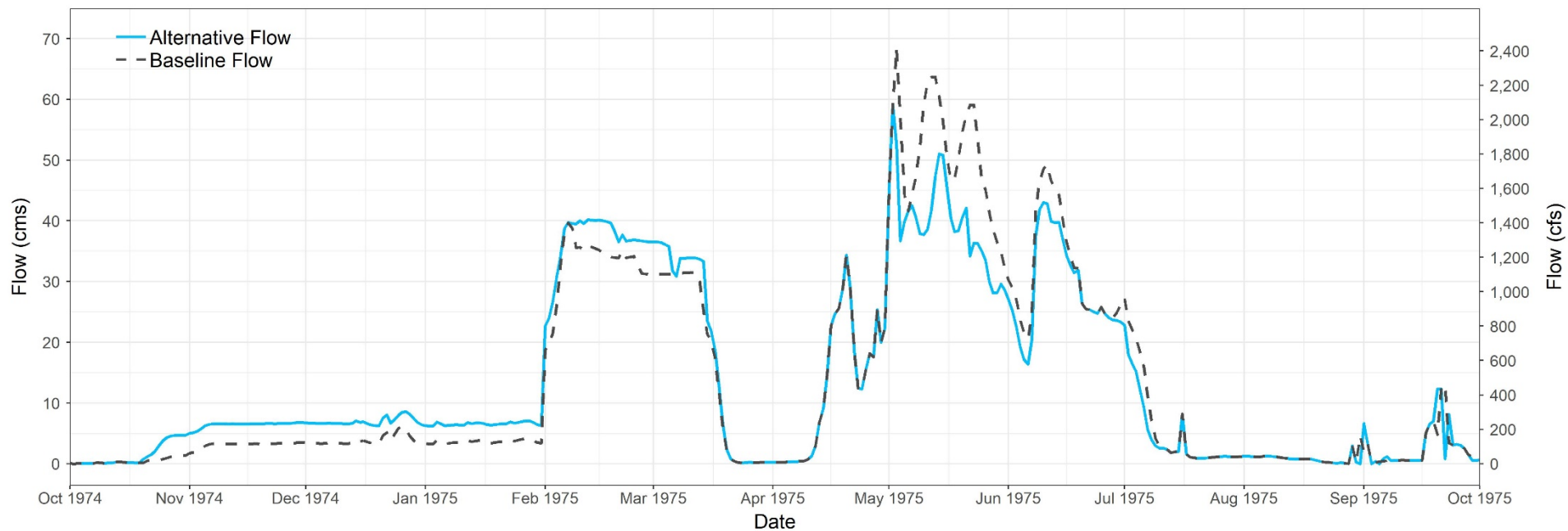
Critical Flow Locations – 1975

Alternative 10aD (Phase 2)

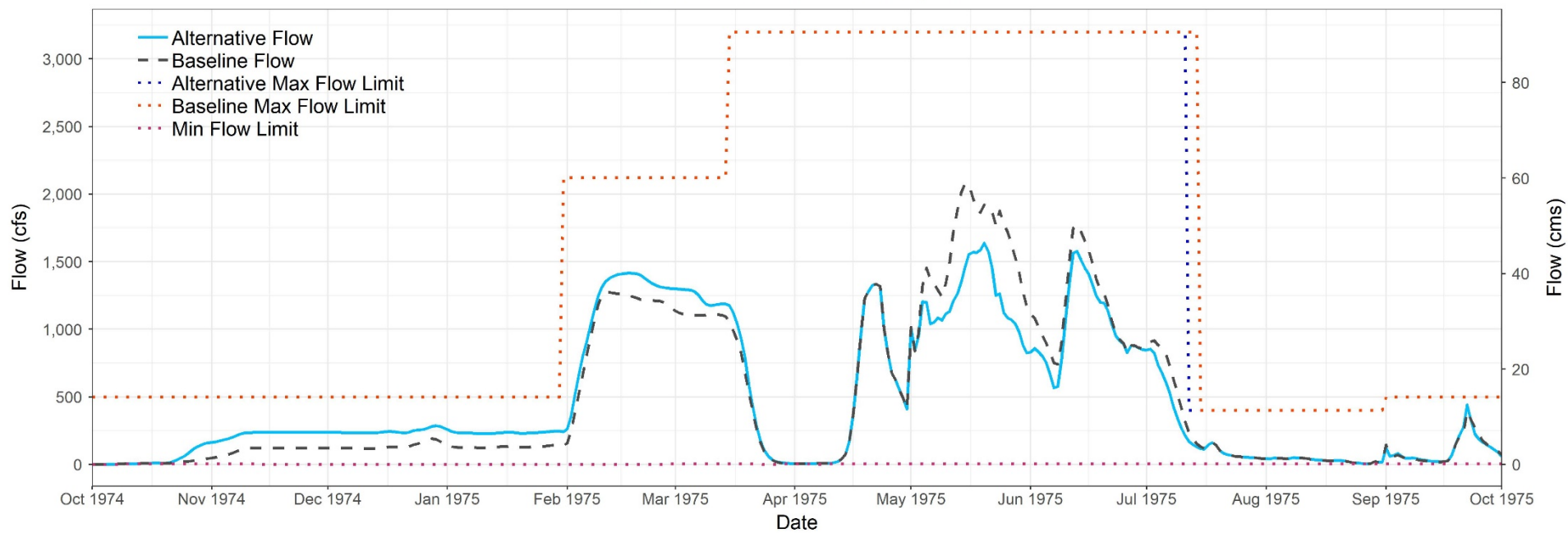
Souris River Plan of Study



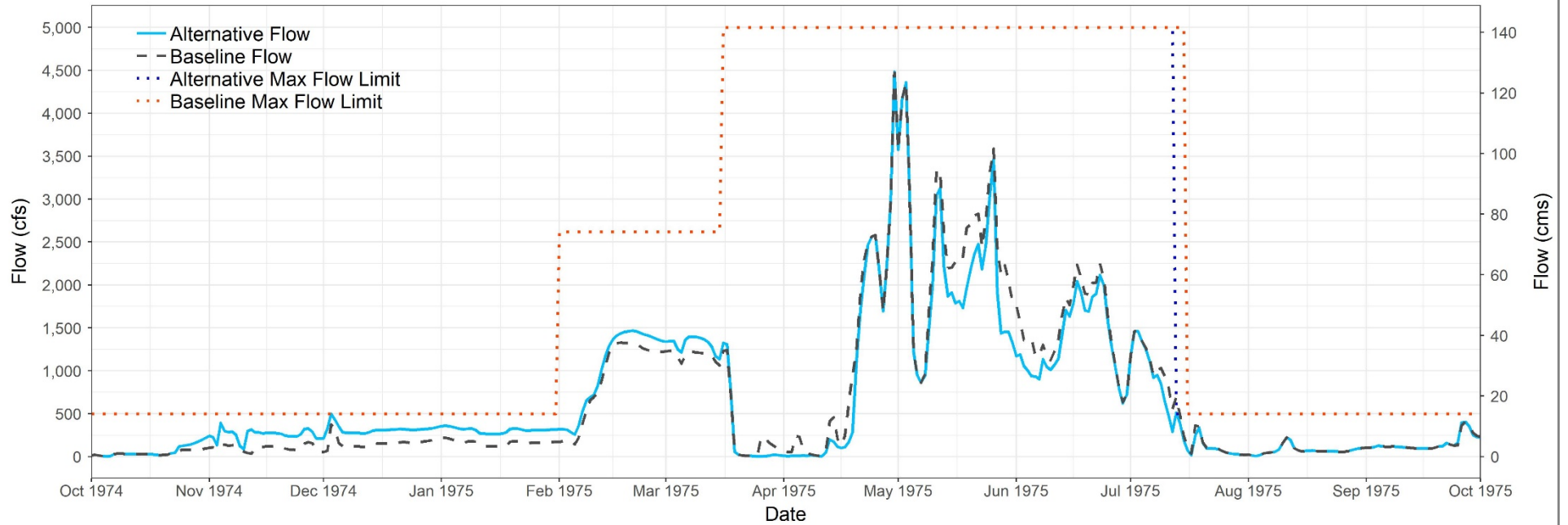
Souris River at Oxbow, SK



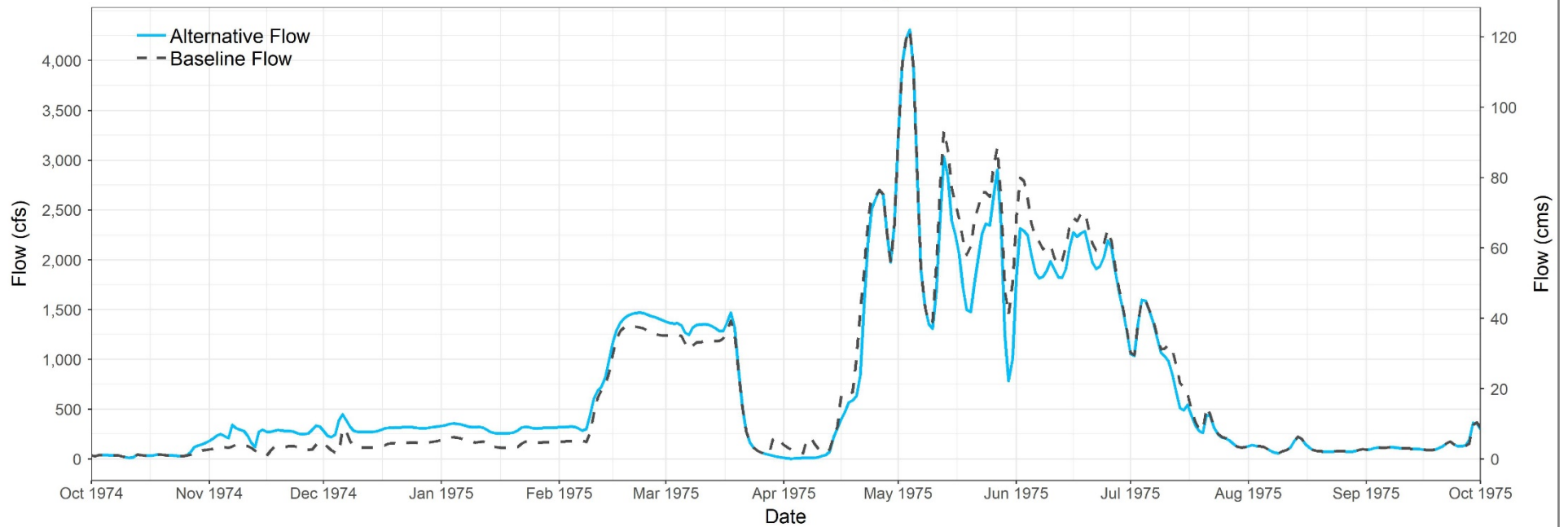
Souris River at Sherwood, ND



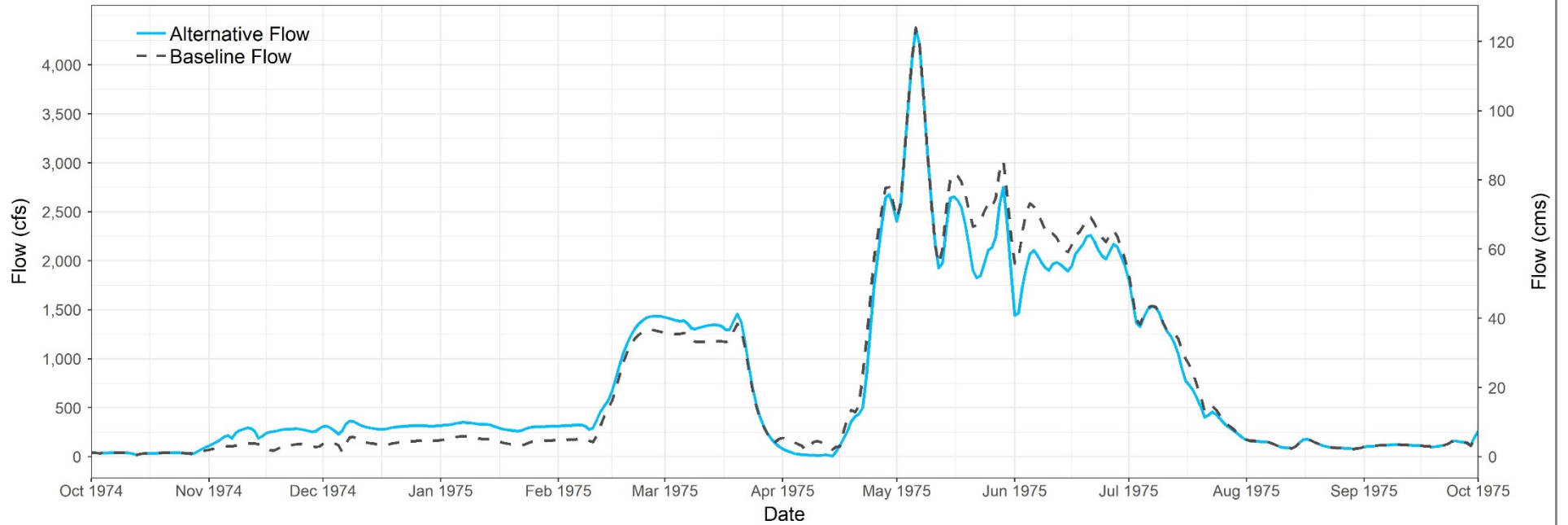
Souris River at Minot, ND - Flow



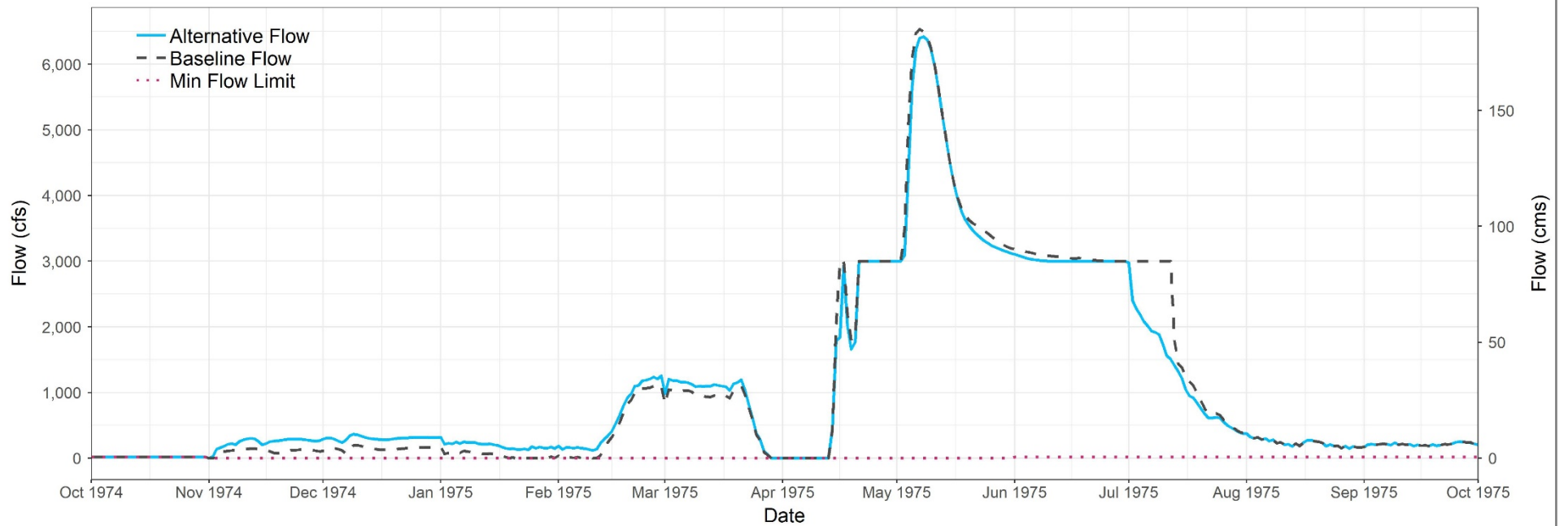
Souris River at Verendrye, ND



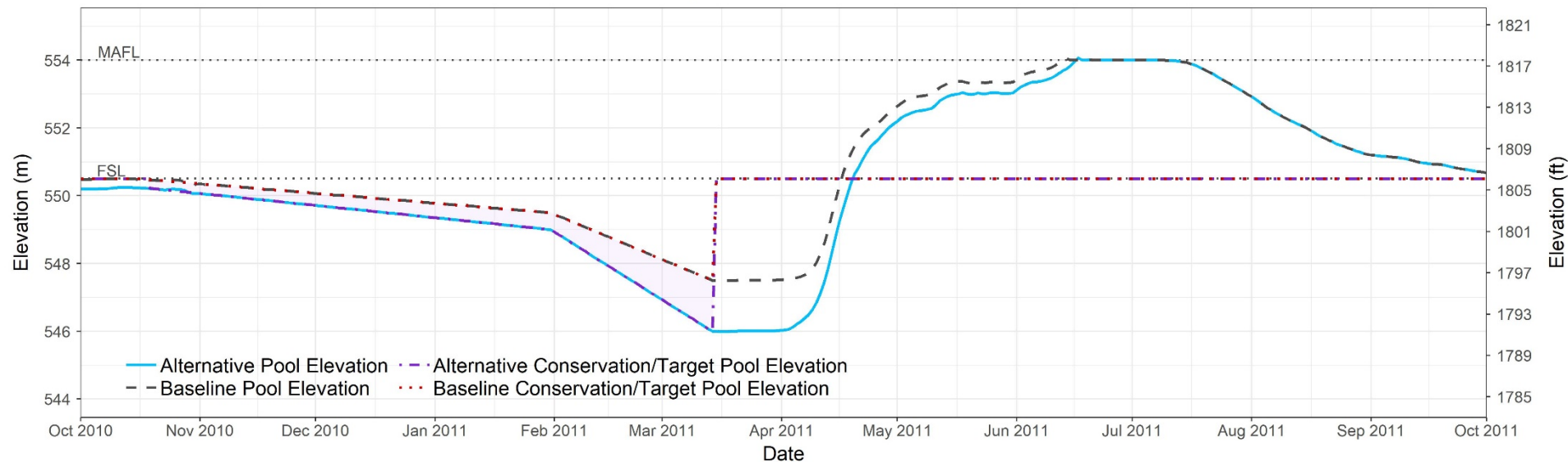
Souris River at Bantry, ND



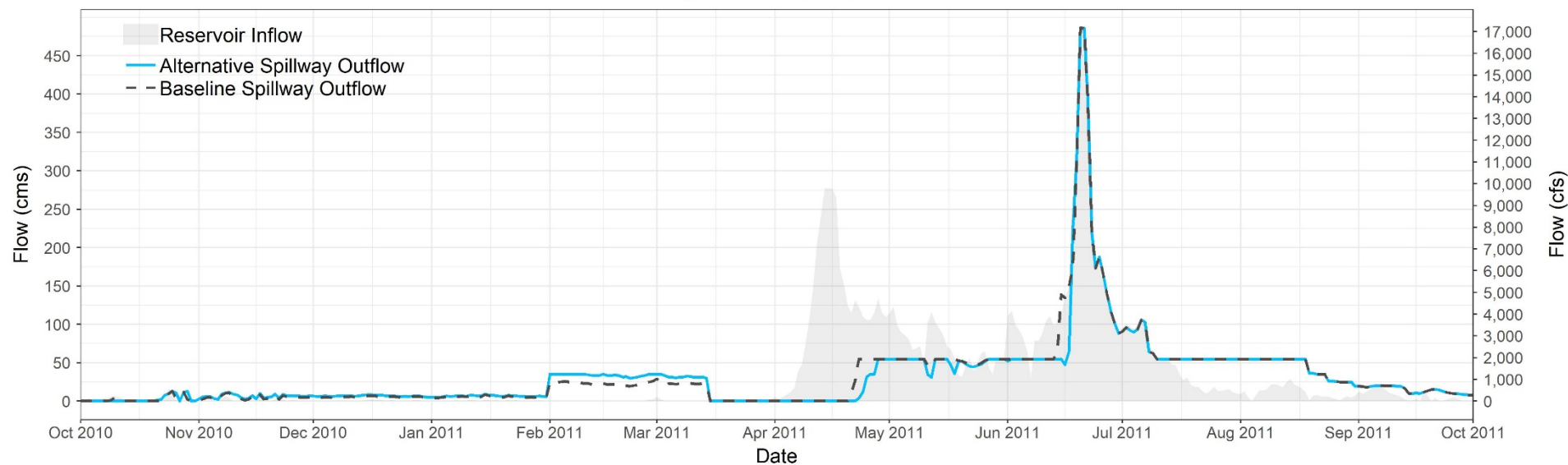
Souris River at Westhope, ND



Rafferty Reservoir - Elevation

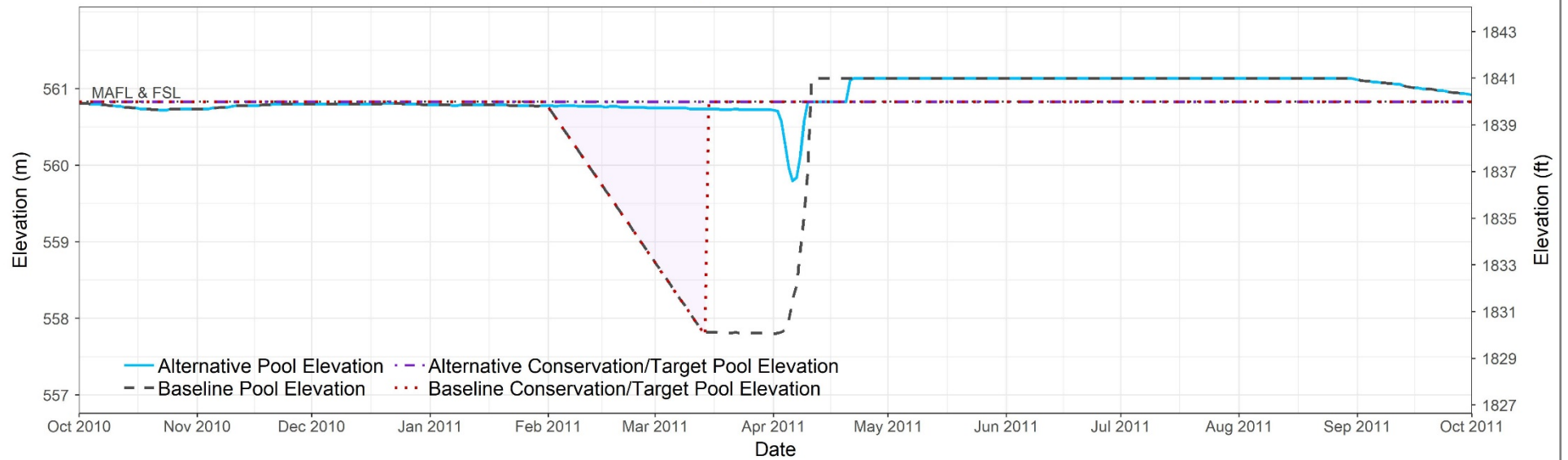


Rafferty Reservoir - Releases

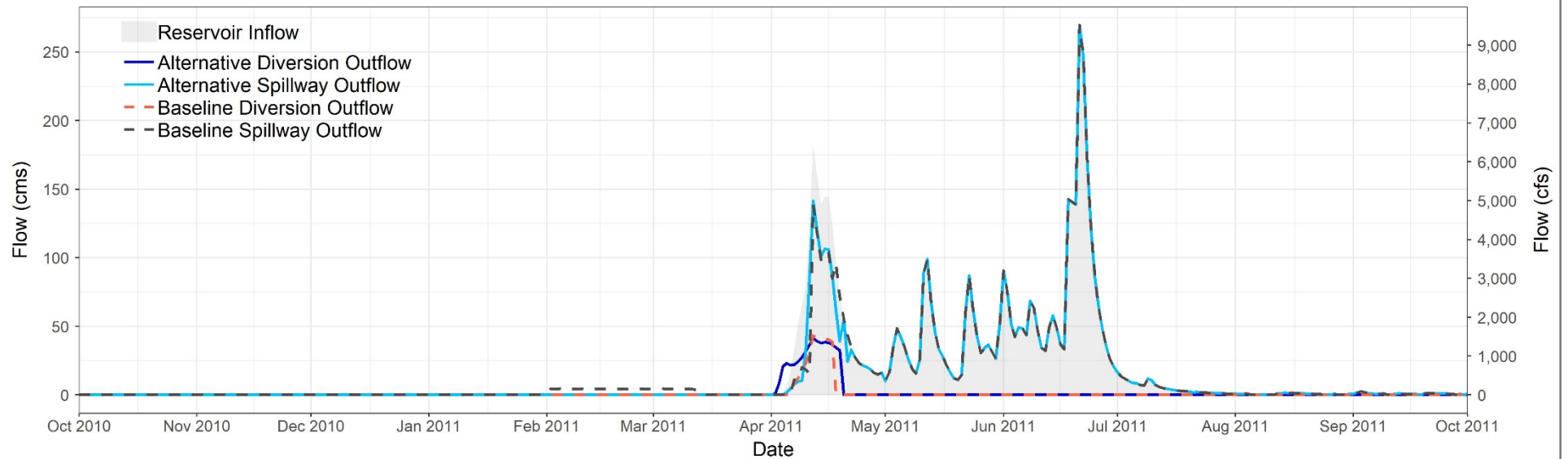


*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level

Boundary Reservoir - Elevation

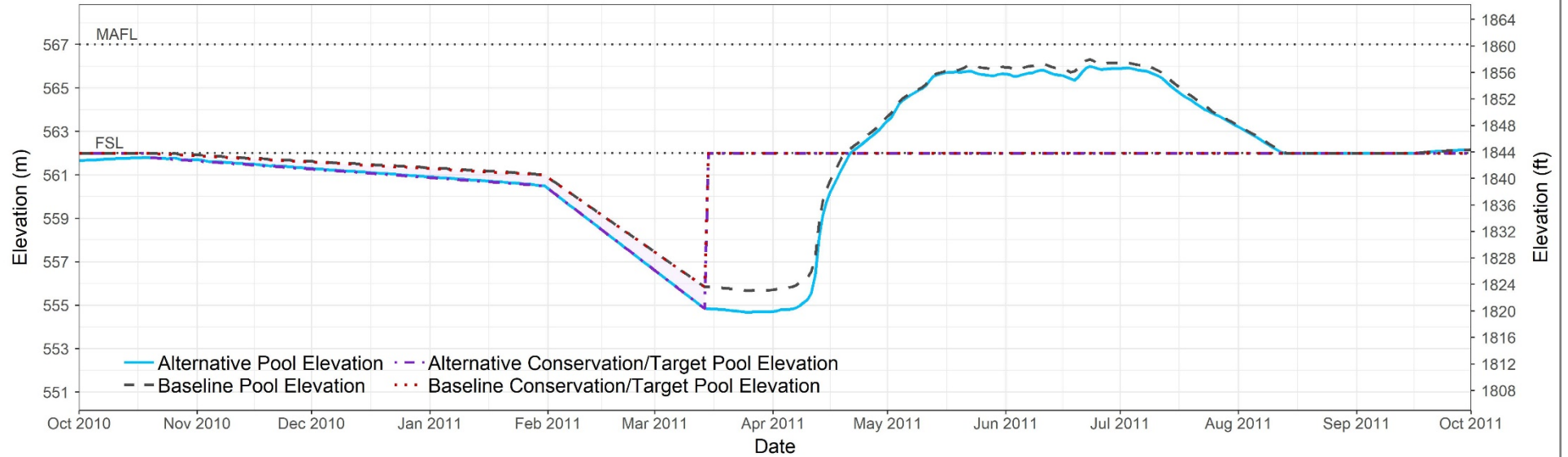


Boundary Reservoir - Releases

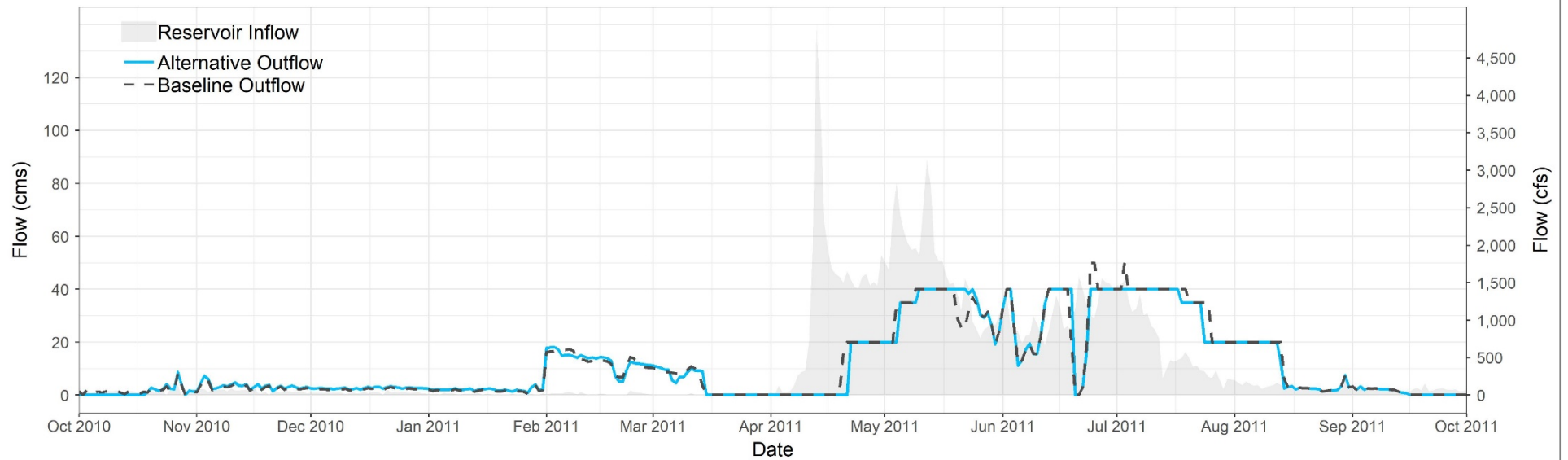


*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level

Grant Devine Reservoir - Elevation

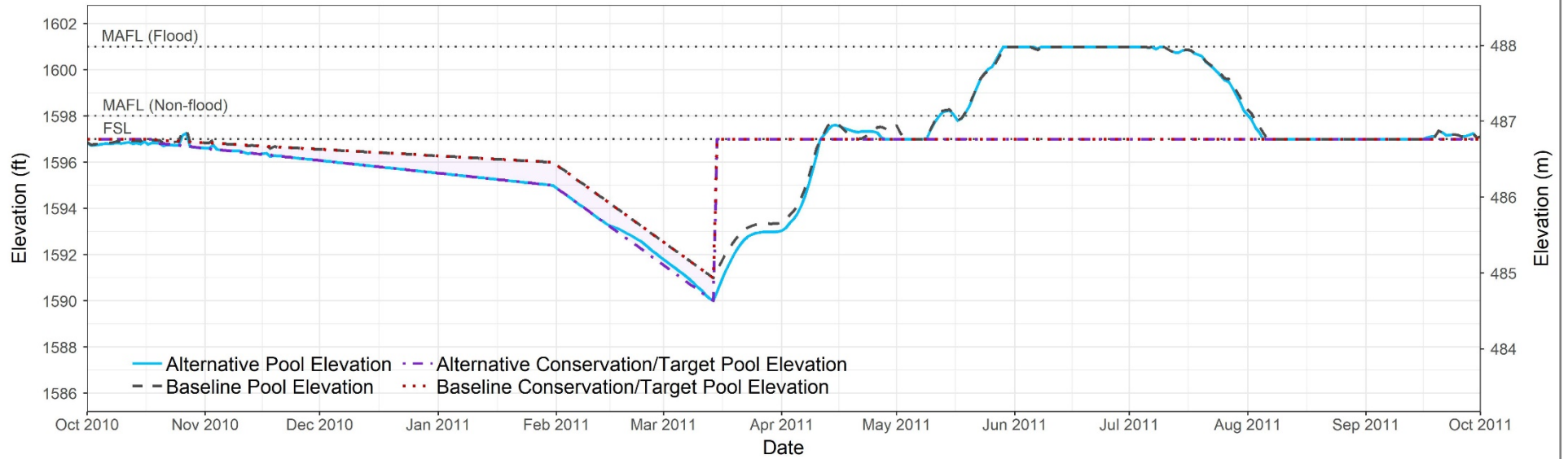


Grant Devine Reservoir - Releases

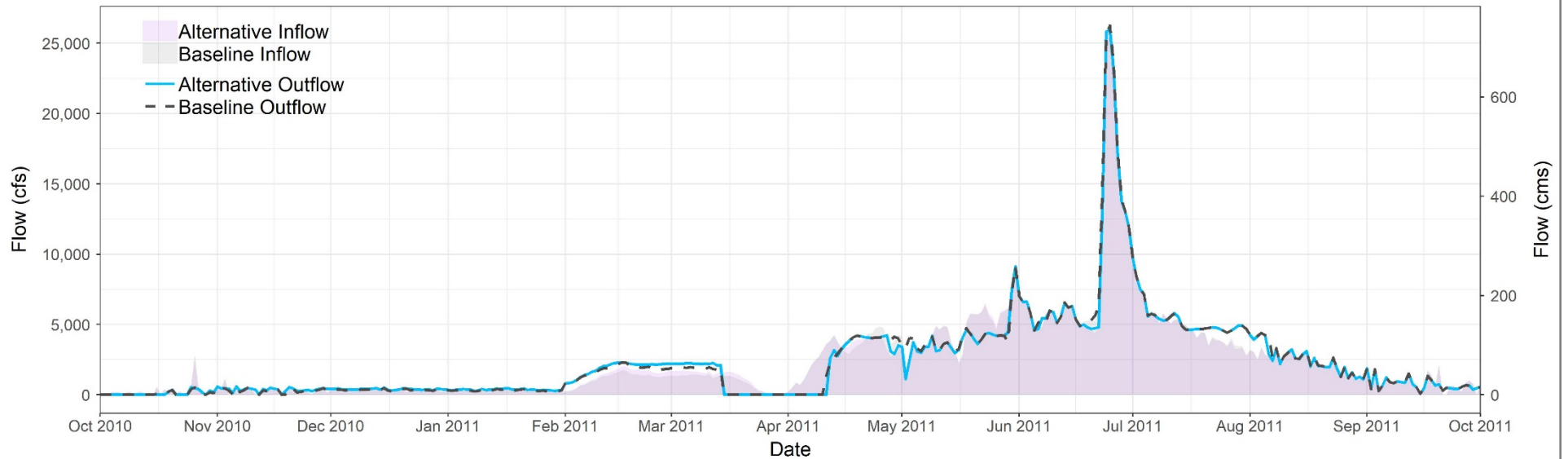


*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level

Lake Darling - Elevation



Lake Darling - Releases



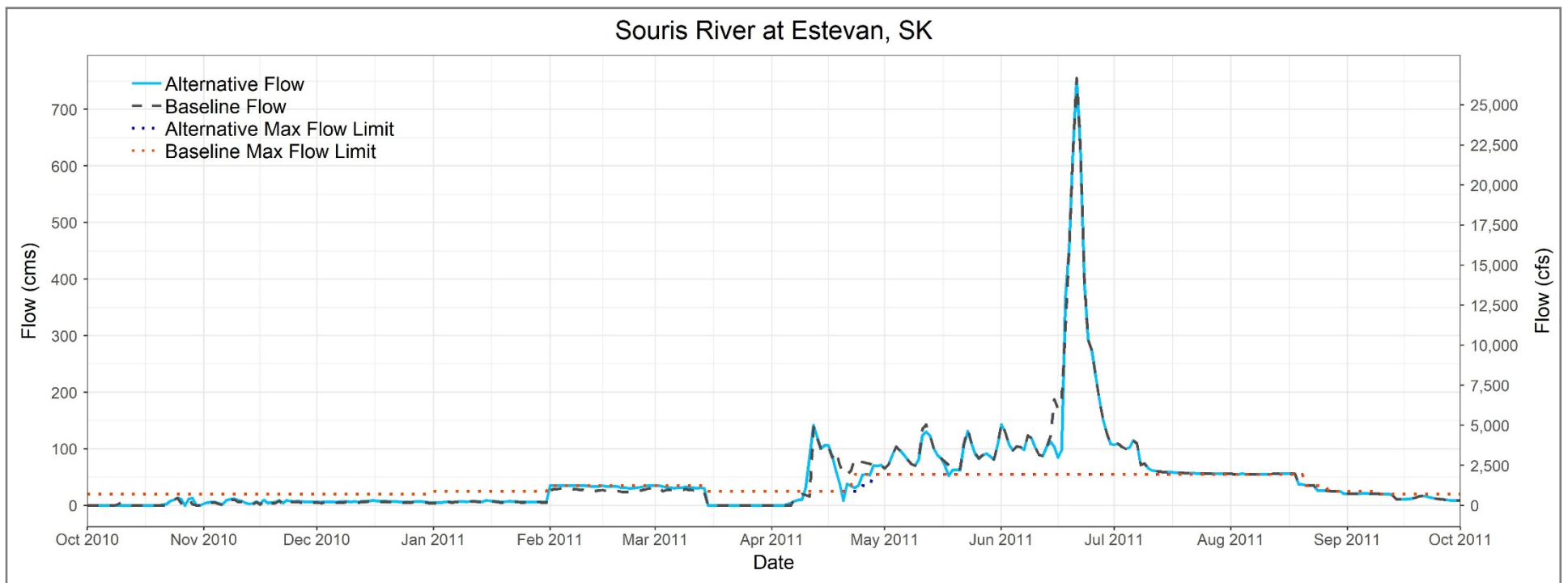
*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level, IDFSL = Inflow Design Flood Supply Level

Plate 15

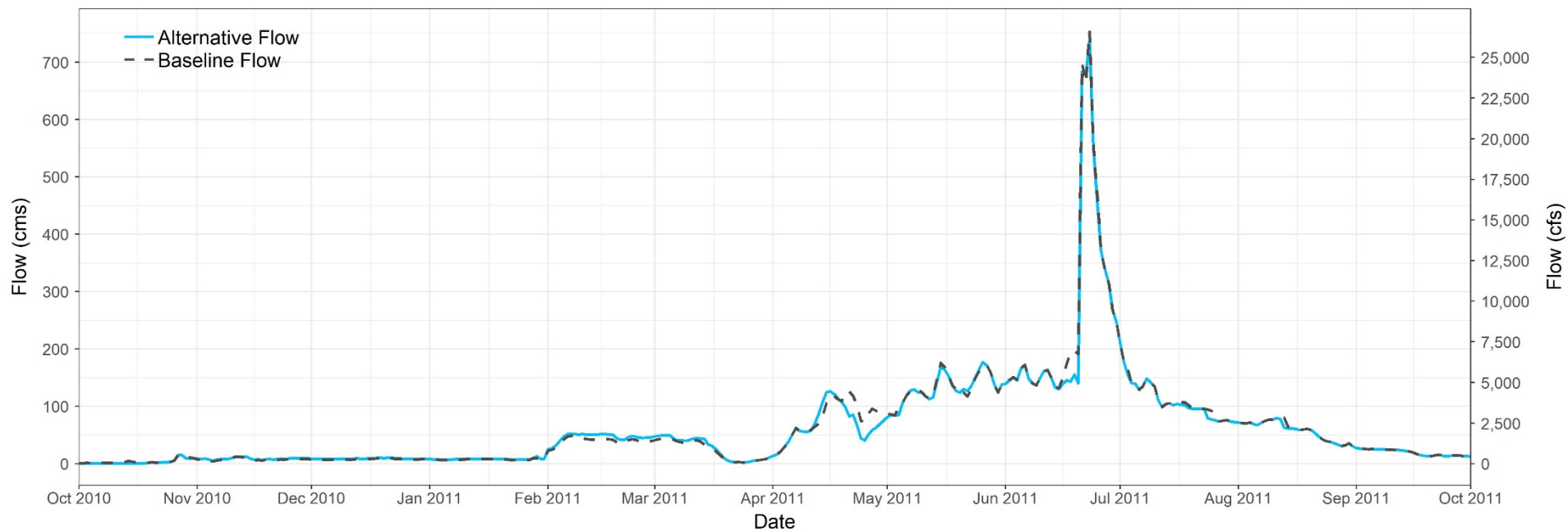
Critical Flow Locations – 2011

Alternative 10aD (Phase 2)

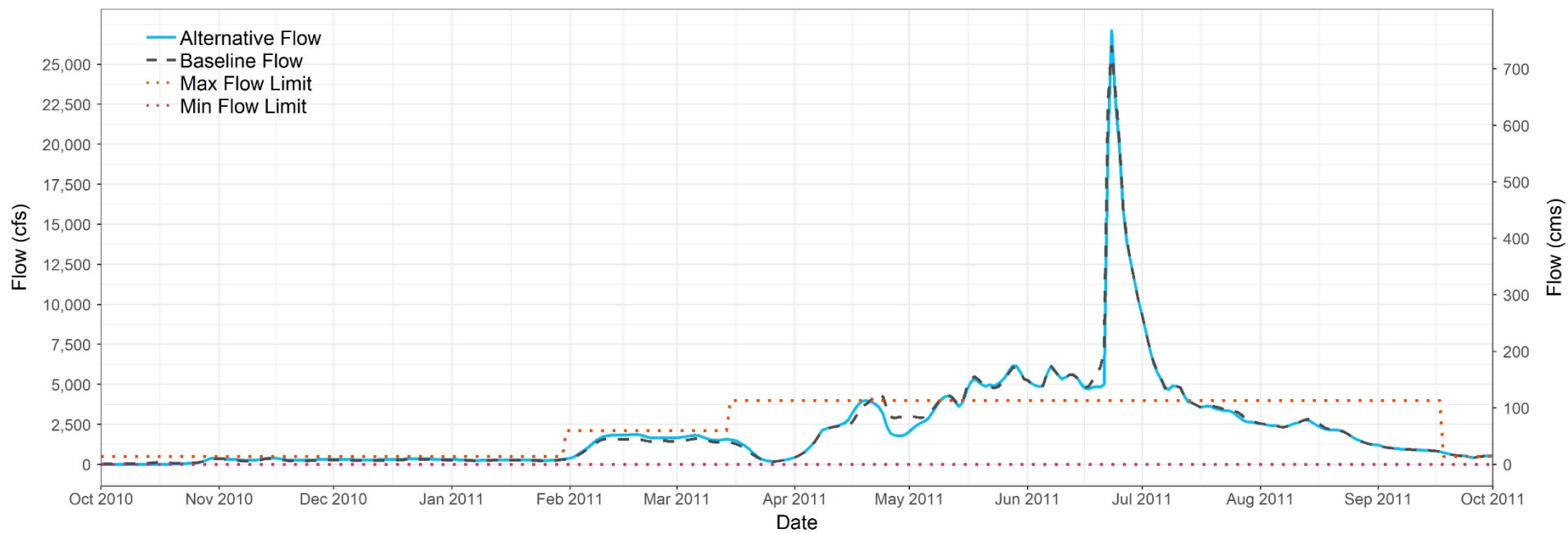
Souris River Plan of Study



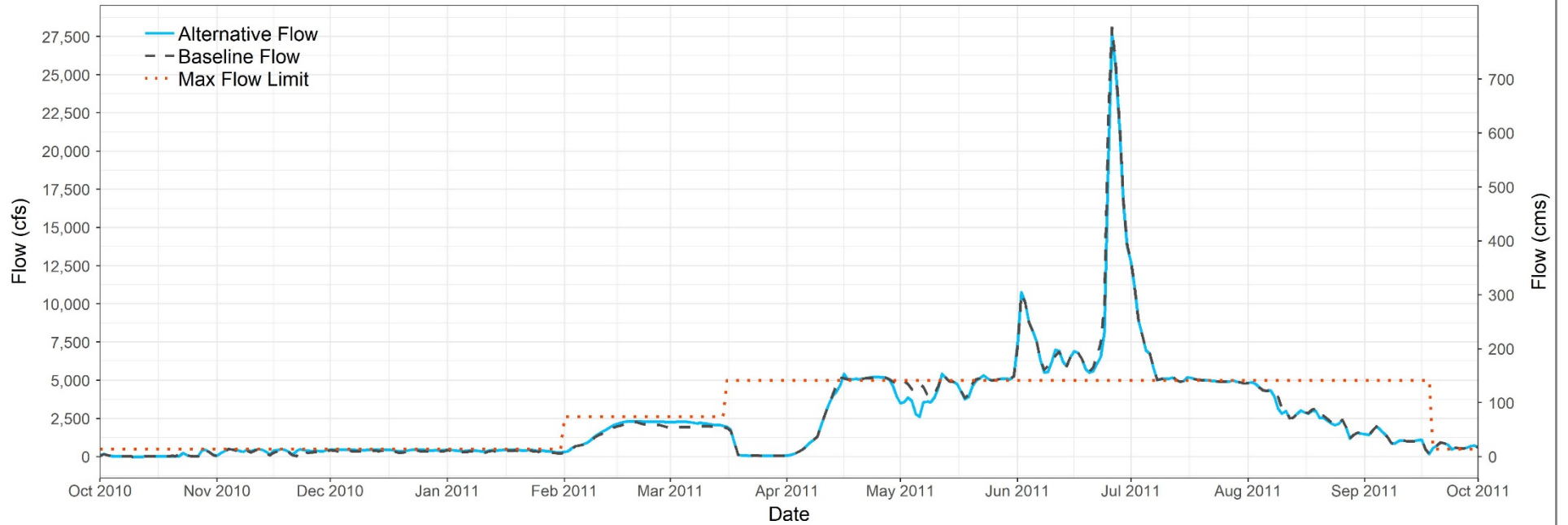
Souris River at Oxbow, SK



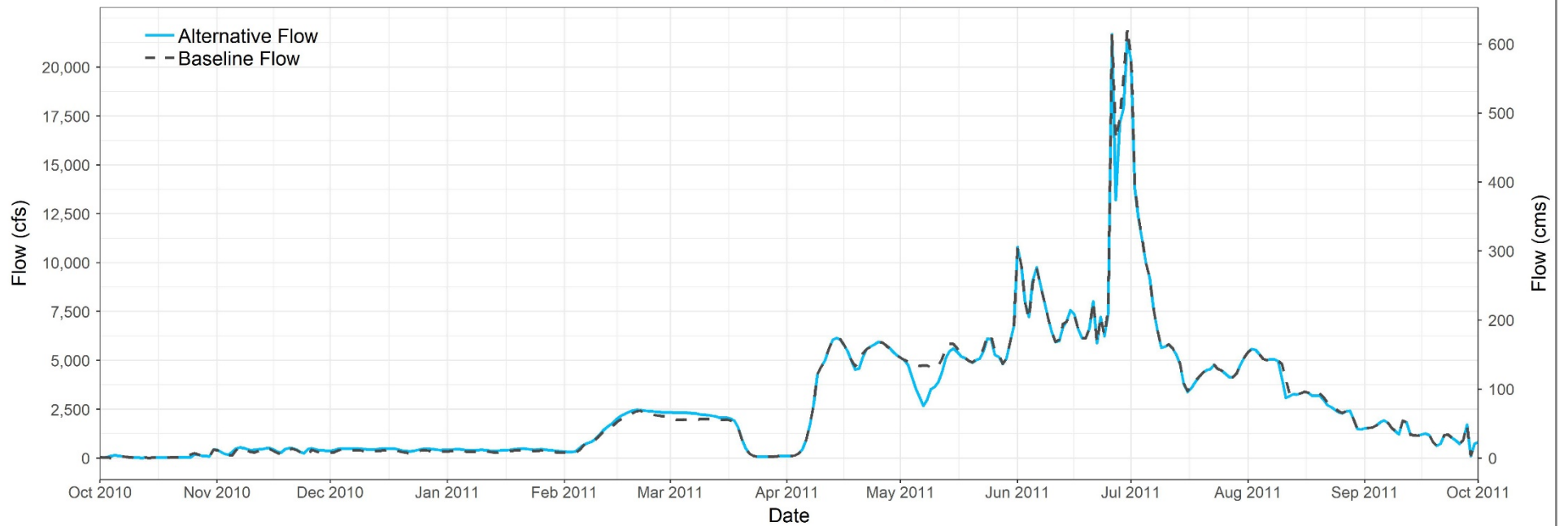
Souris River at Sherwood, ND



Souris River at Minot, ND - Flow



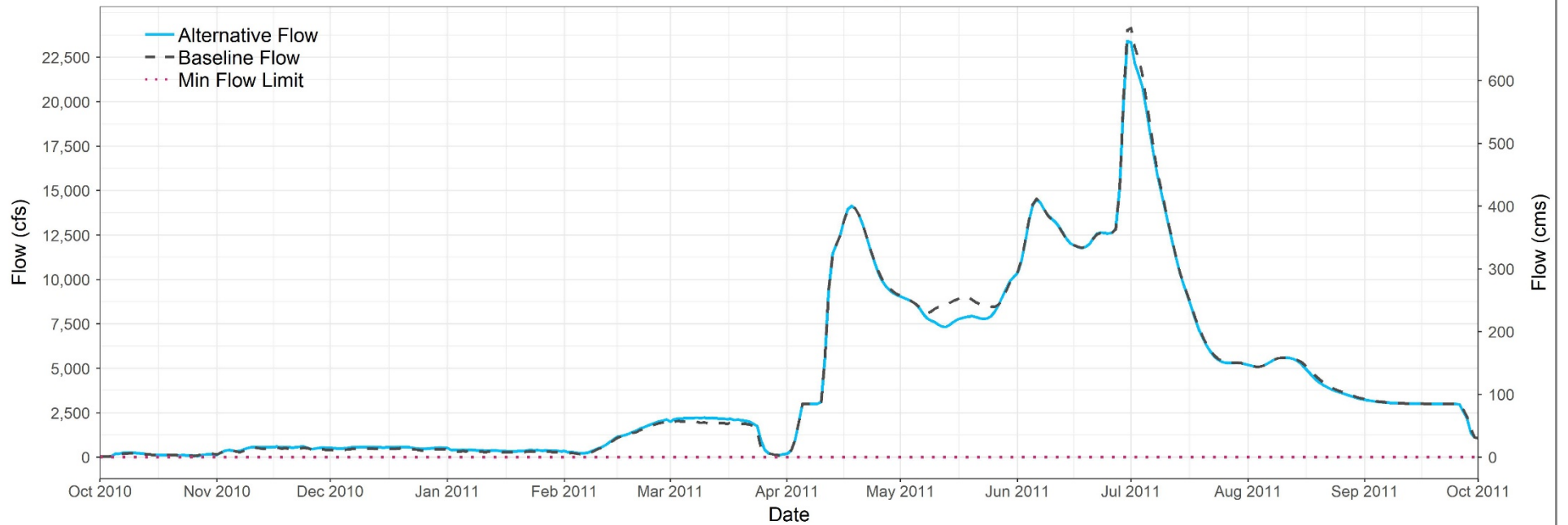
Souris River at Verendrye, ND



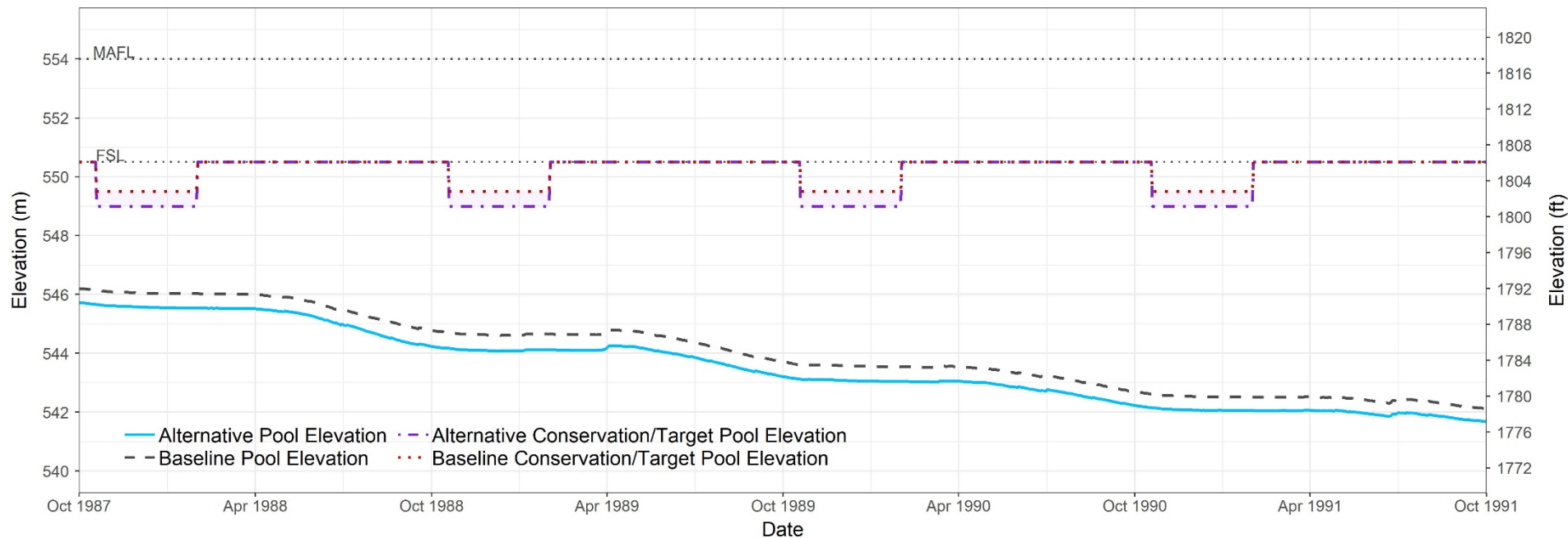
Souris River at Bantry, ND



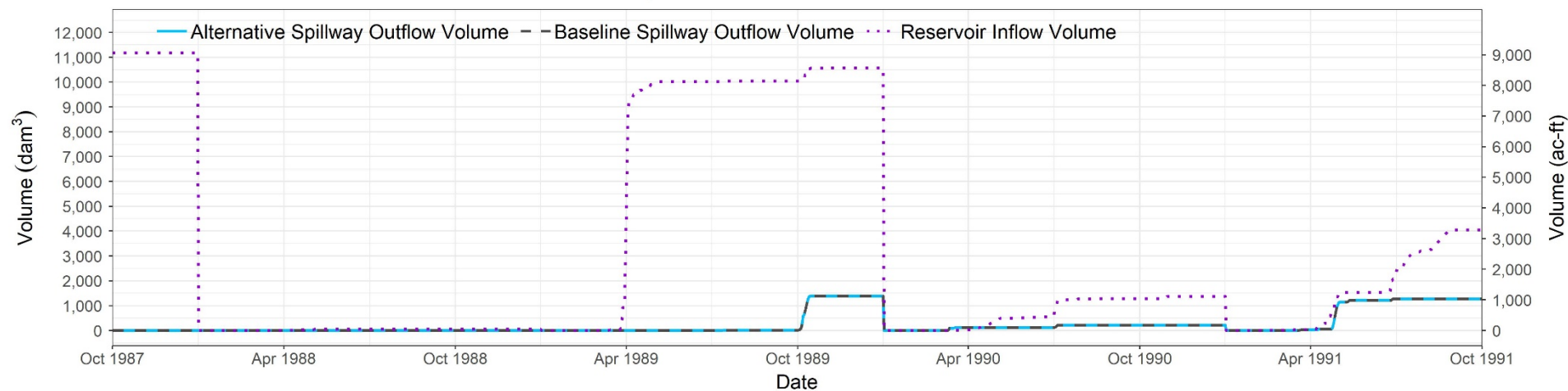
Souris River at Westhope, ND



Rafferty Reservoir - Elevation

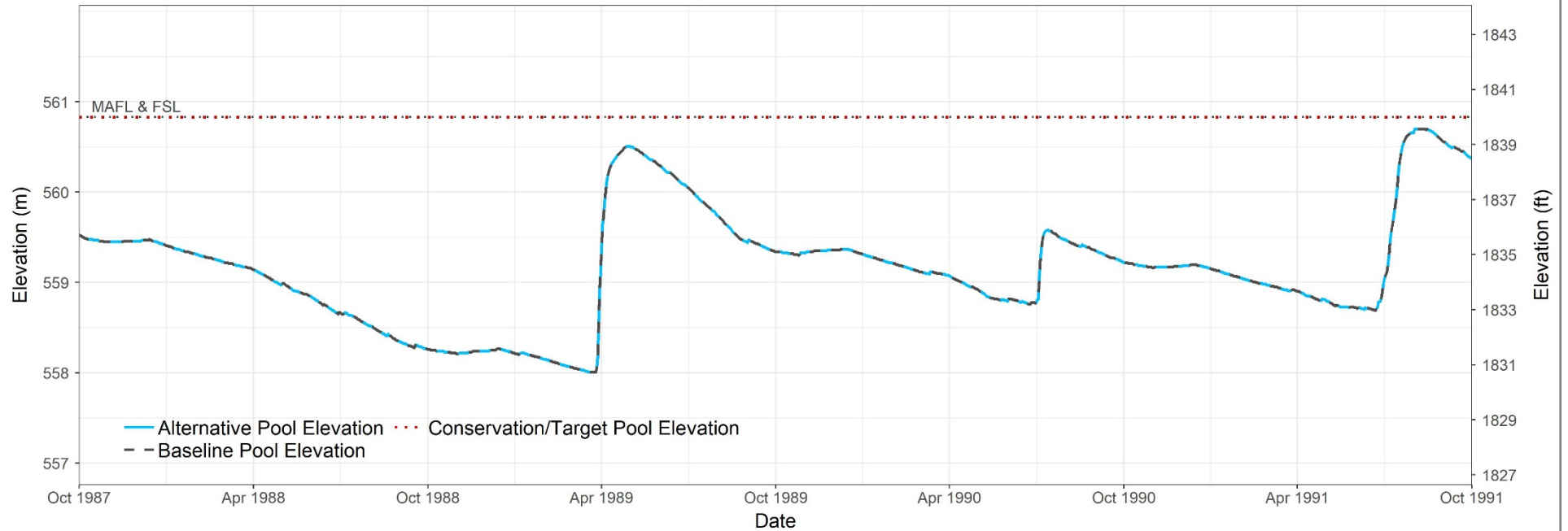


Rafferty Reservoir - Cumulative Volume

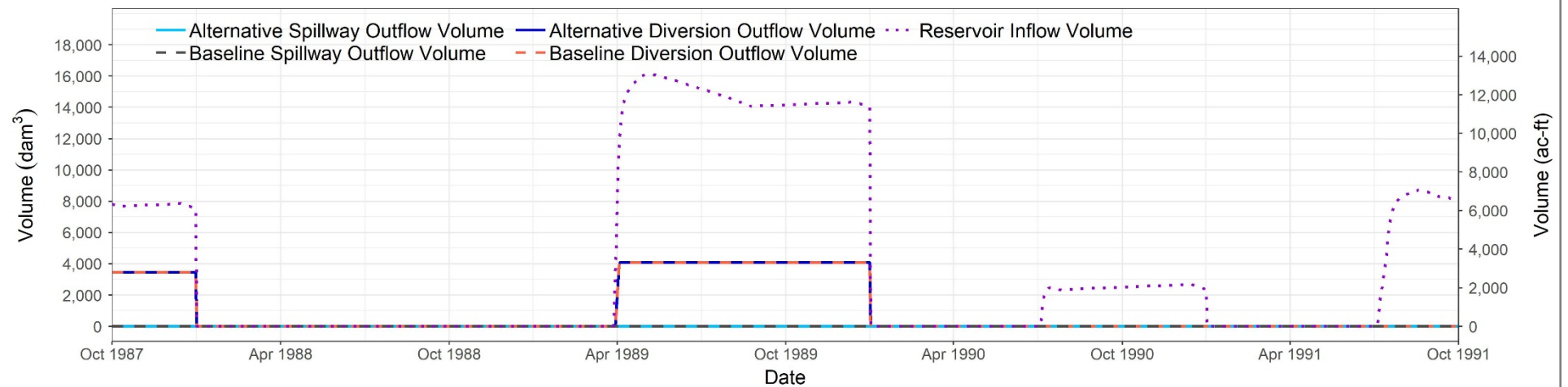


*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level

Boundary Reservoir - Elevation

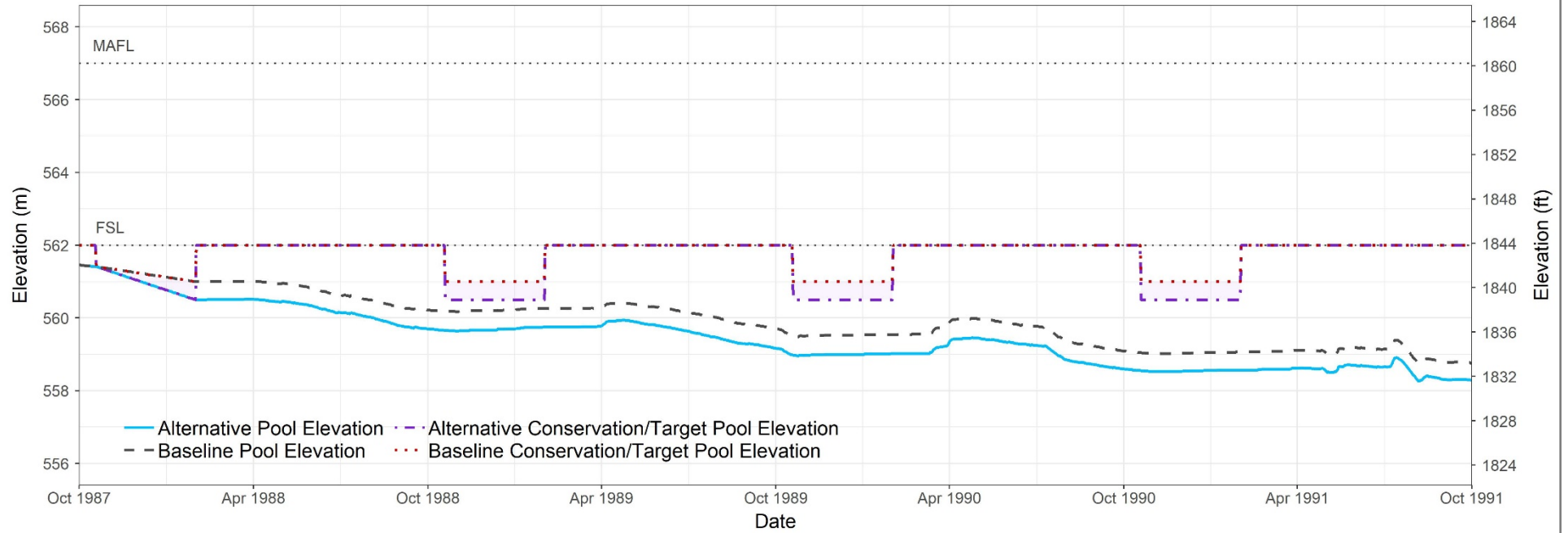


Boundary Reservoir - Cumulative Volume

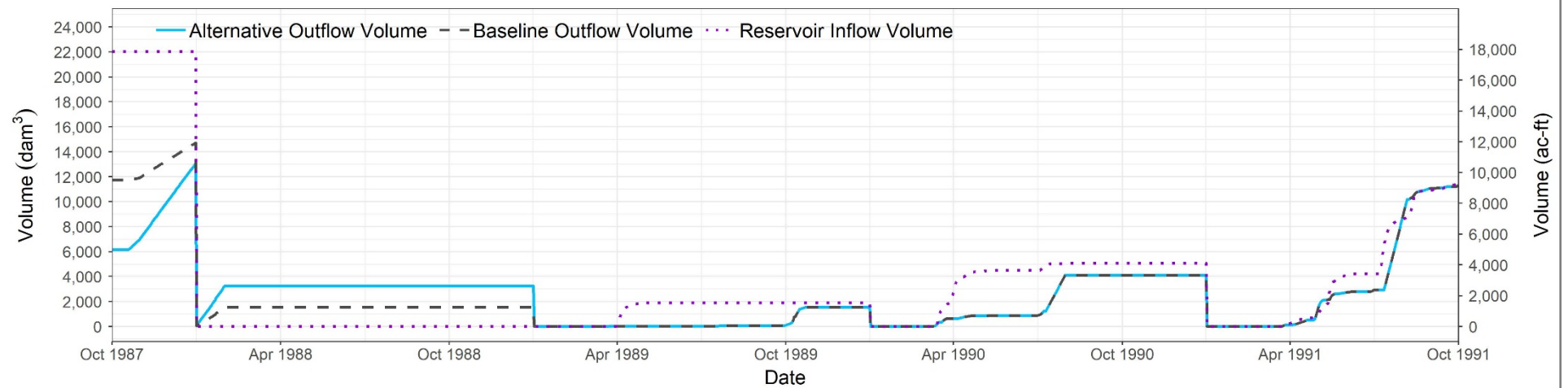


*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level

Grant Devine Reservoir - Elevation

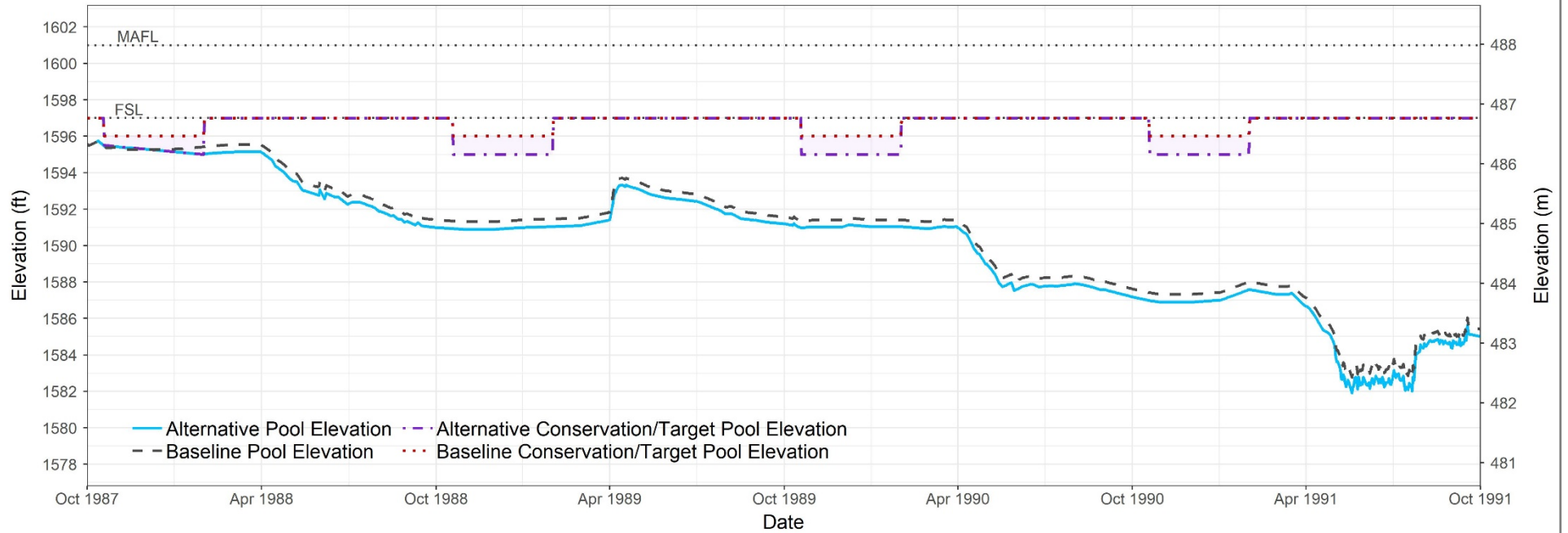


Grant Devine Reservoir - Cumulative Volume

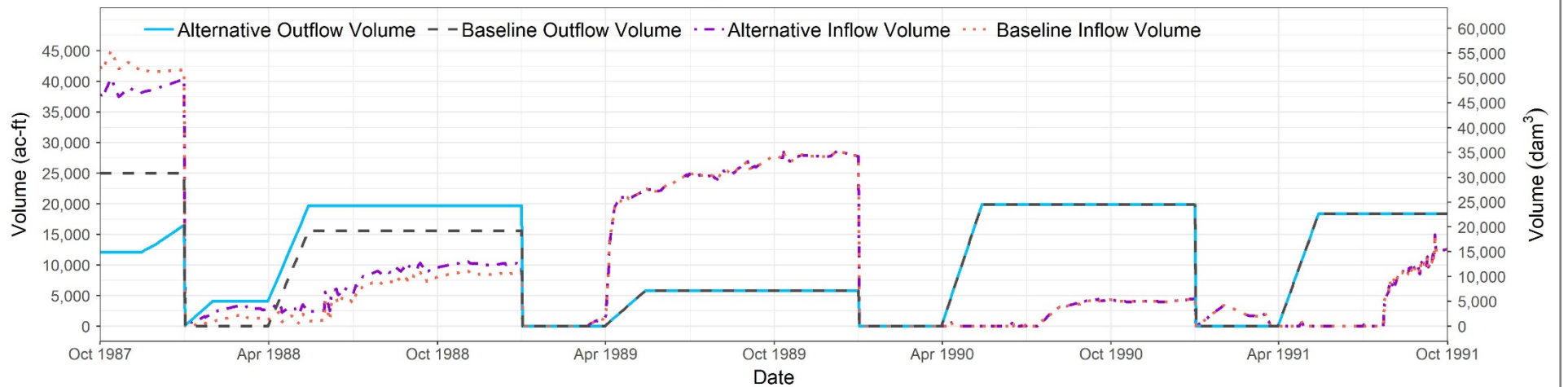


*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level

Lake Darling - Elevation



Lake Darling - Cumulative Volume



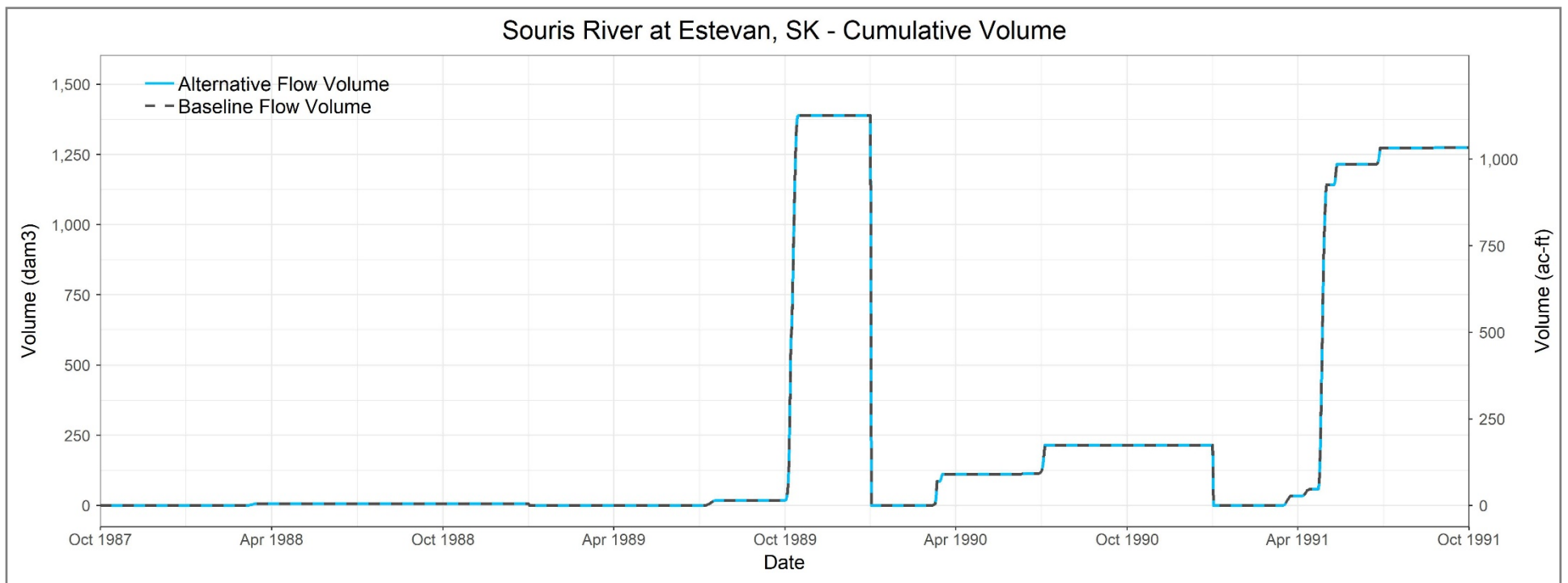
*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level, IDFSL = Inflow Design Flood Supply Level

Plate 17

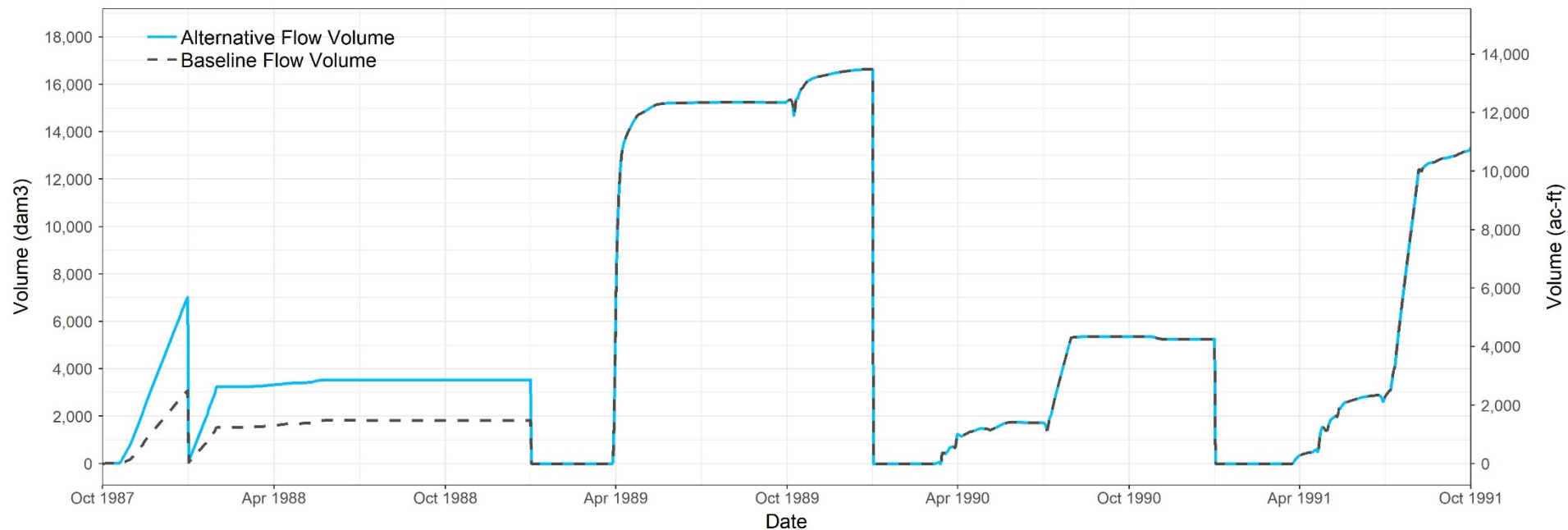
Critical Flow Locations – 1988-1991

Alternative 10aD (Phase 2)

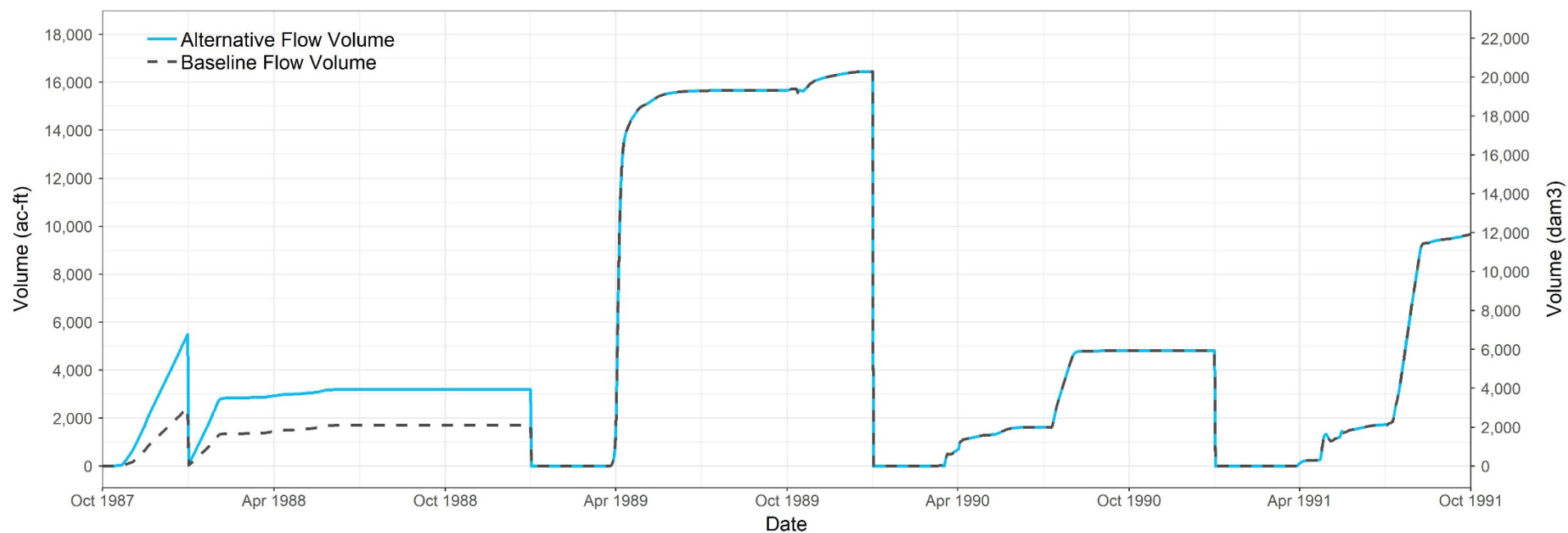
Souris River Plan of Study



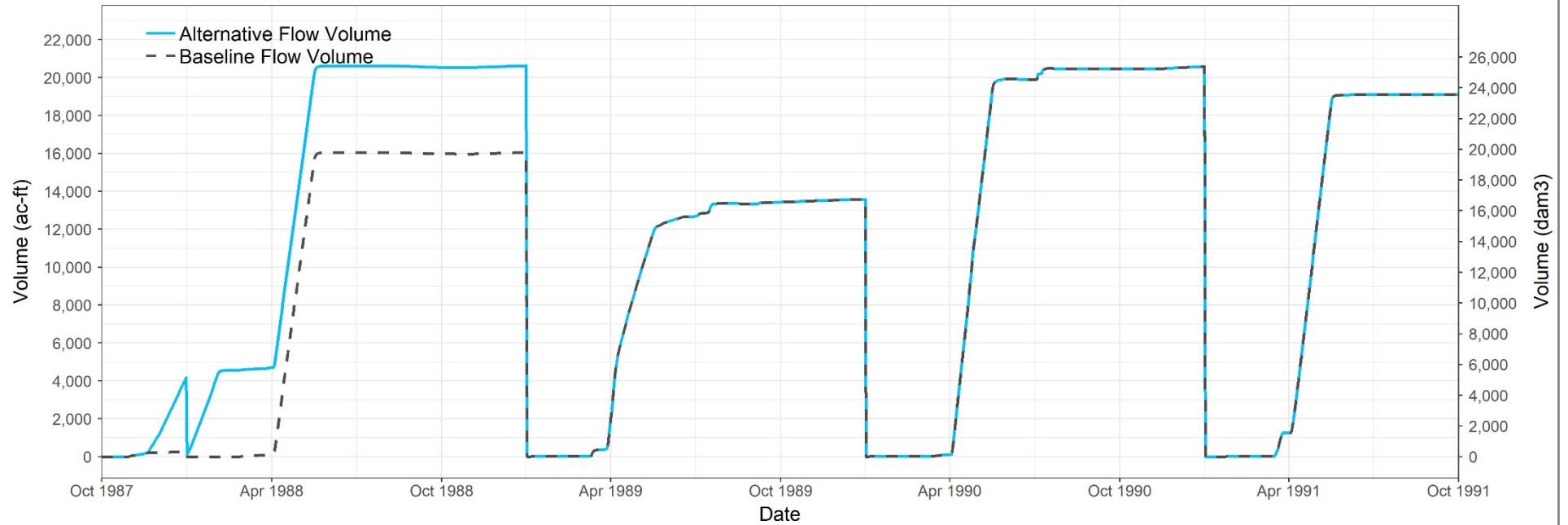
Souris River at Oxbow, SK - Cumulative Volume



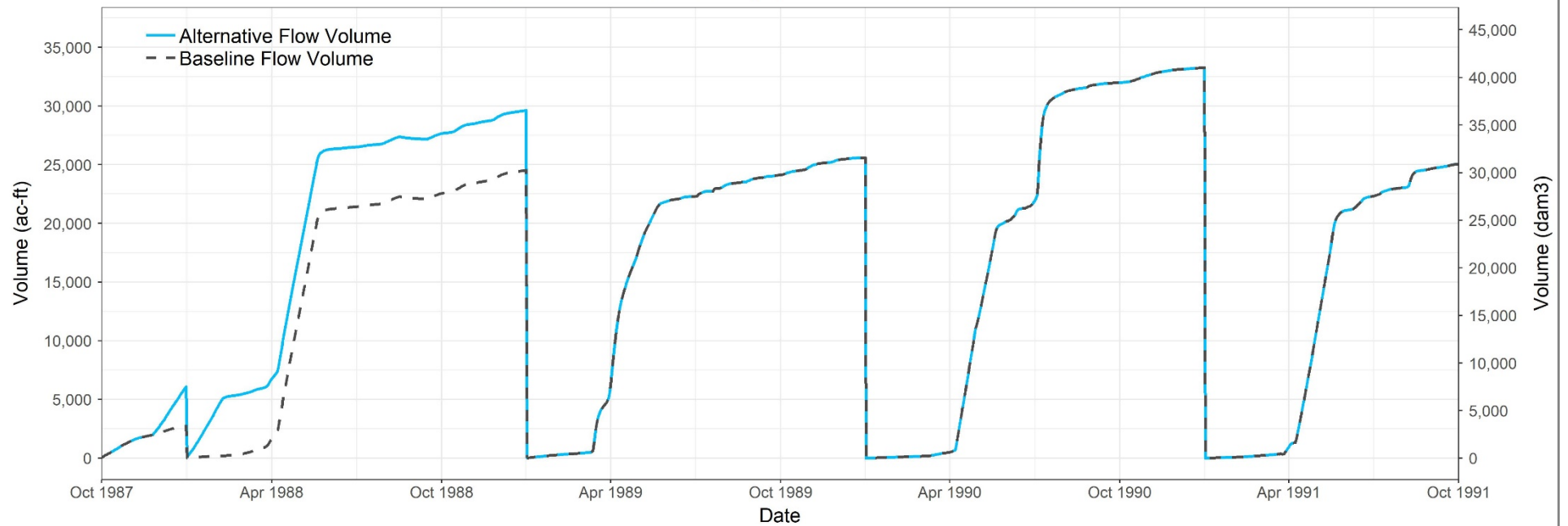
Souris River at Sherwood, ND - Cumulative Volume



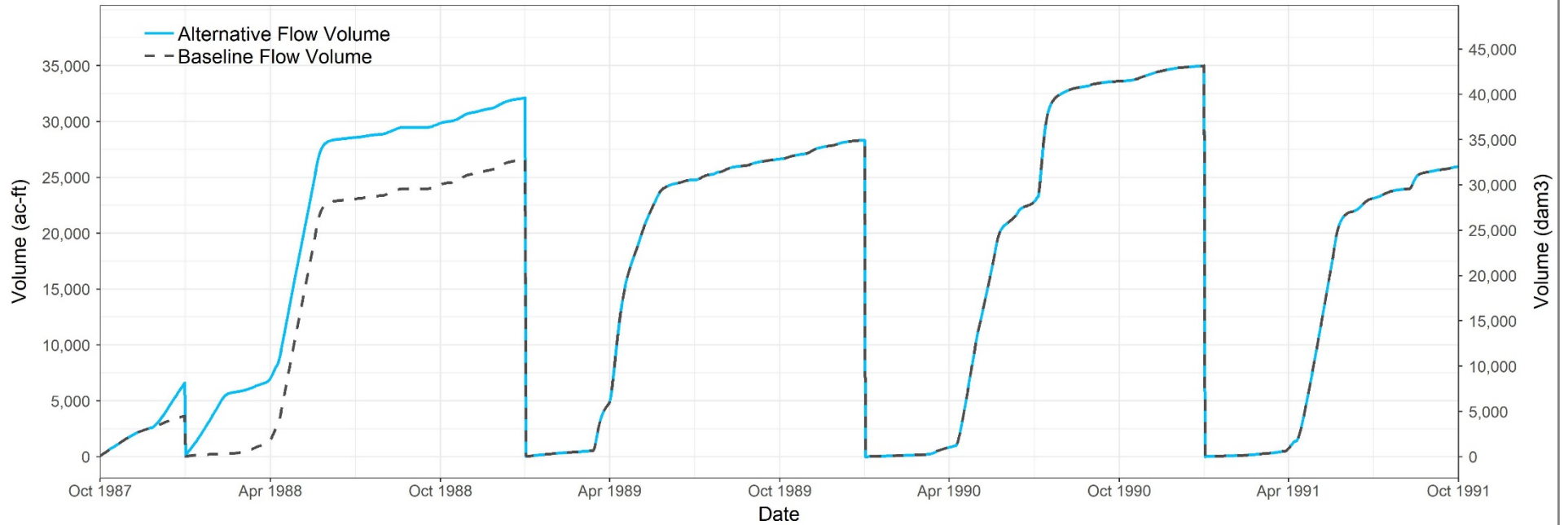
Souris River at Minot, ND - Cumulative Volume



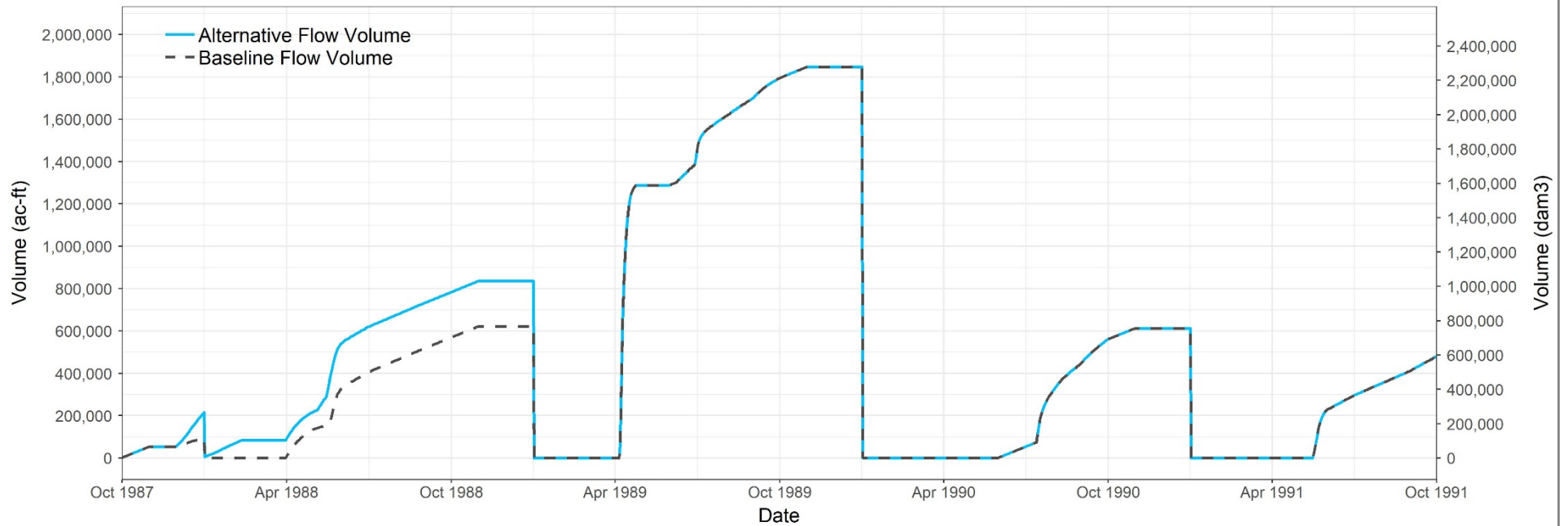
Souris River at Verendrye, ND - Cumulative Volume



Souris River at Bantry, ND - Cumulative Volume

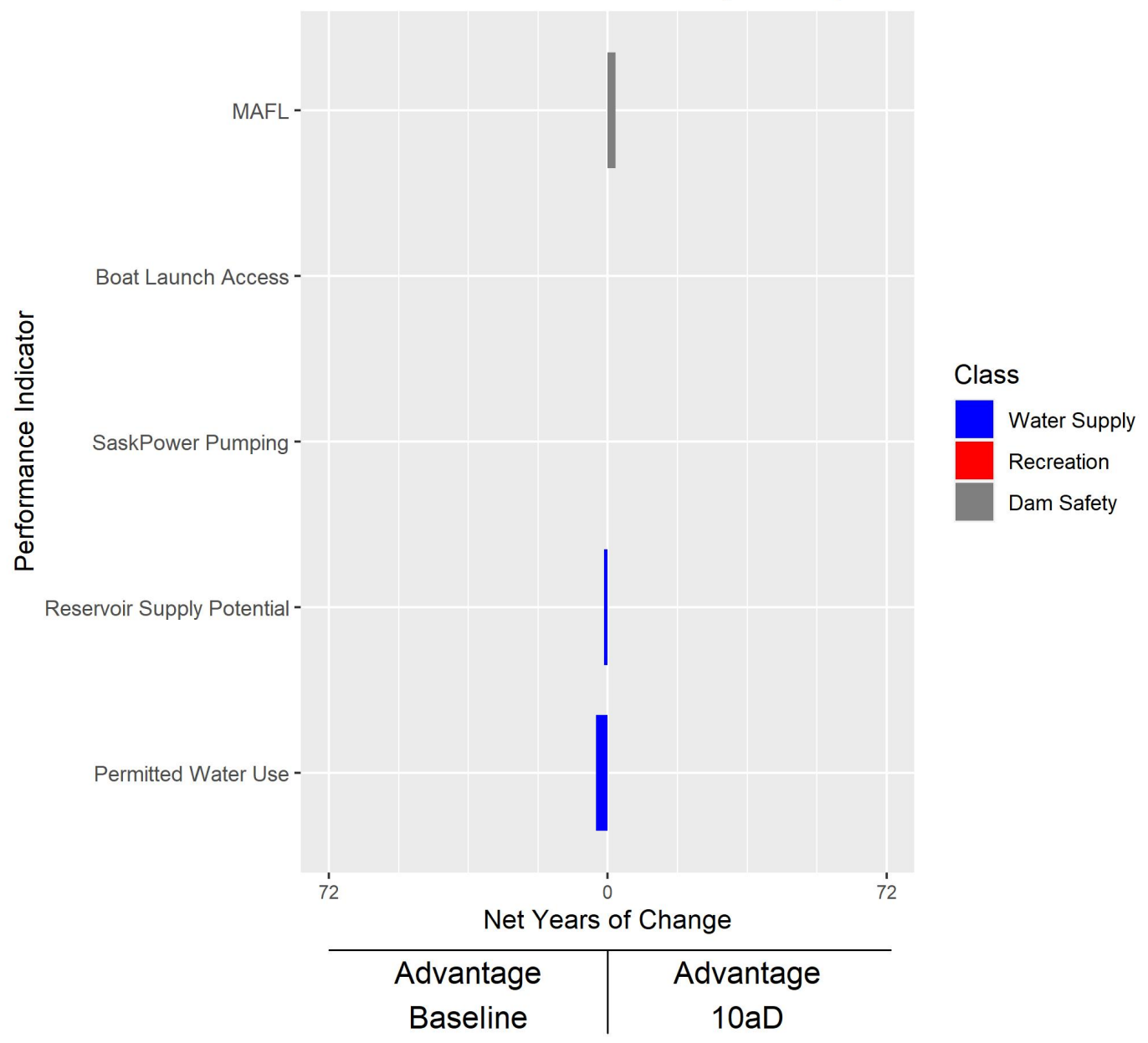


Souris River at Westhope, ND - Cumulative Volume

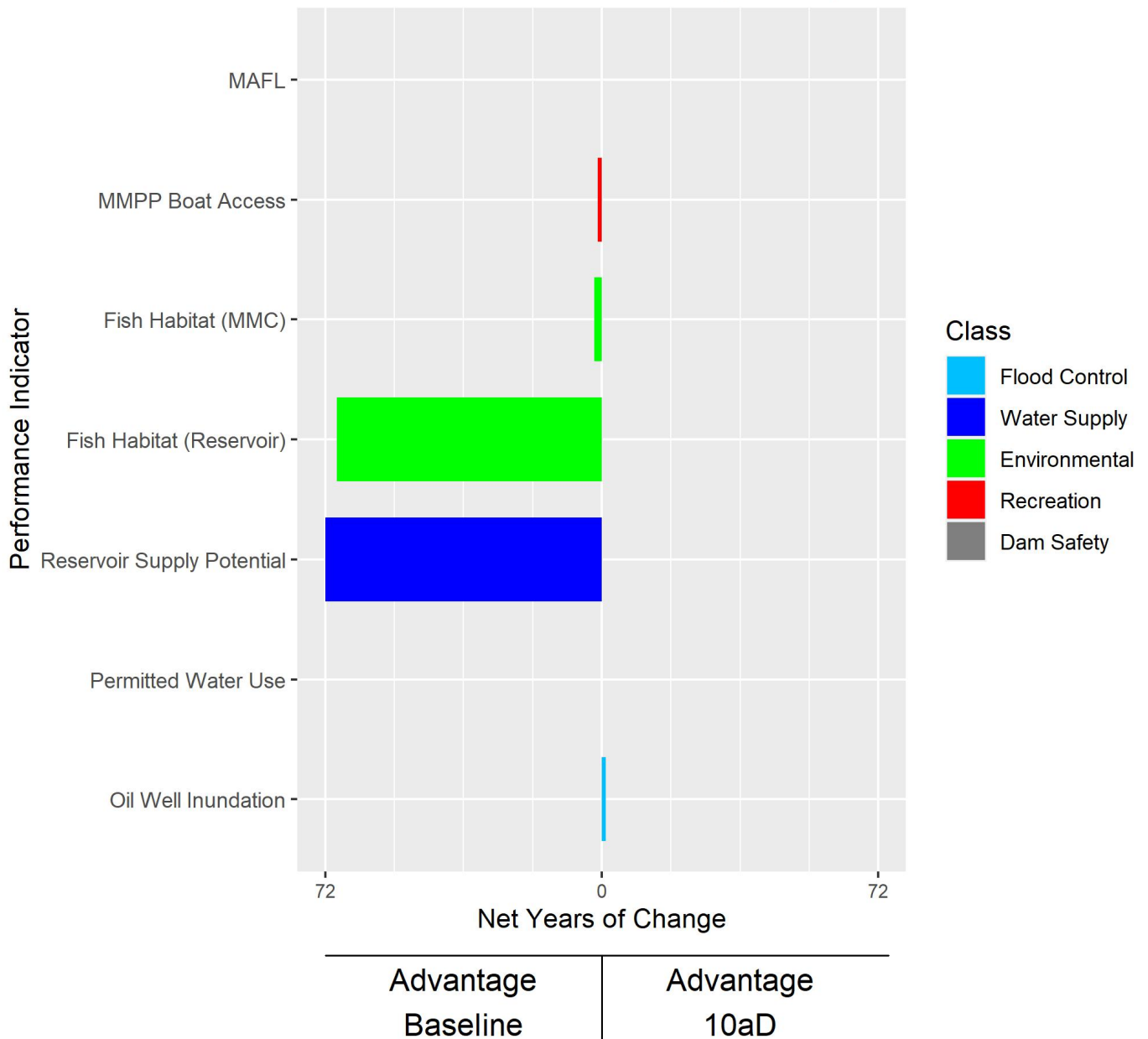




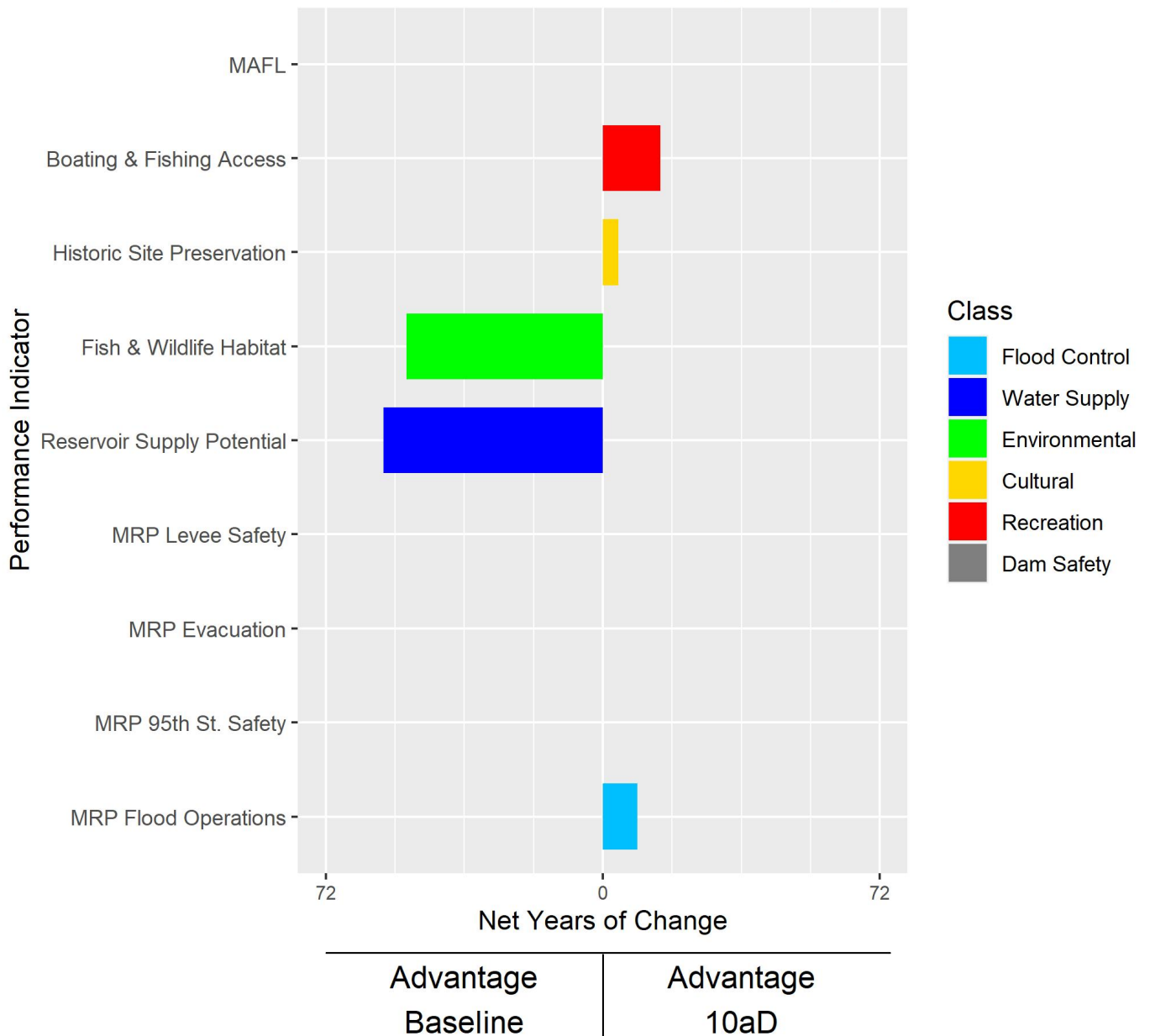
Boundary Reservoir
Baseline vs. 10aD
Period of Record: 1946-2017 (72 Years)



Grant Devine Reservoir
Baseline vs. 10aD
Period of Record: 1946-2017 (72 Years)



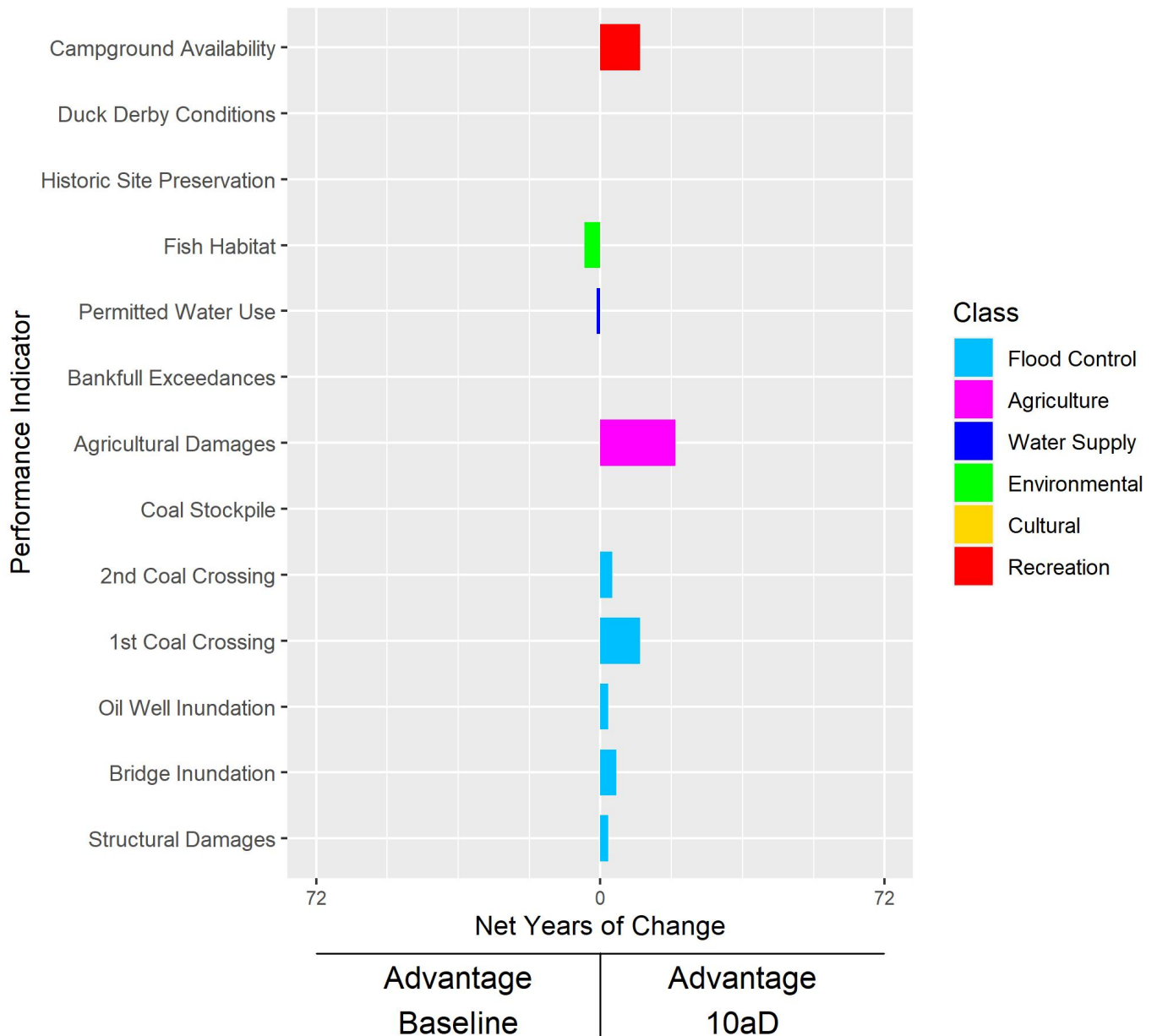
Lake Darling
Baseline vs. 10aD
Period of Record: 1946-2017 (72 Years)



Saskatchewan - All Riverine Reaches

Baseline vs. 10aD

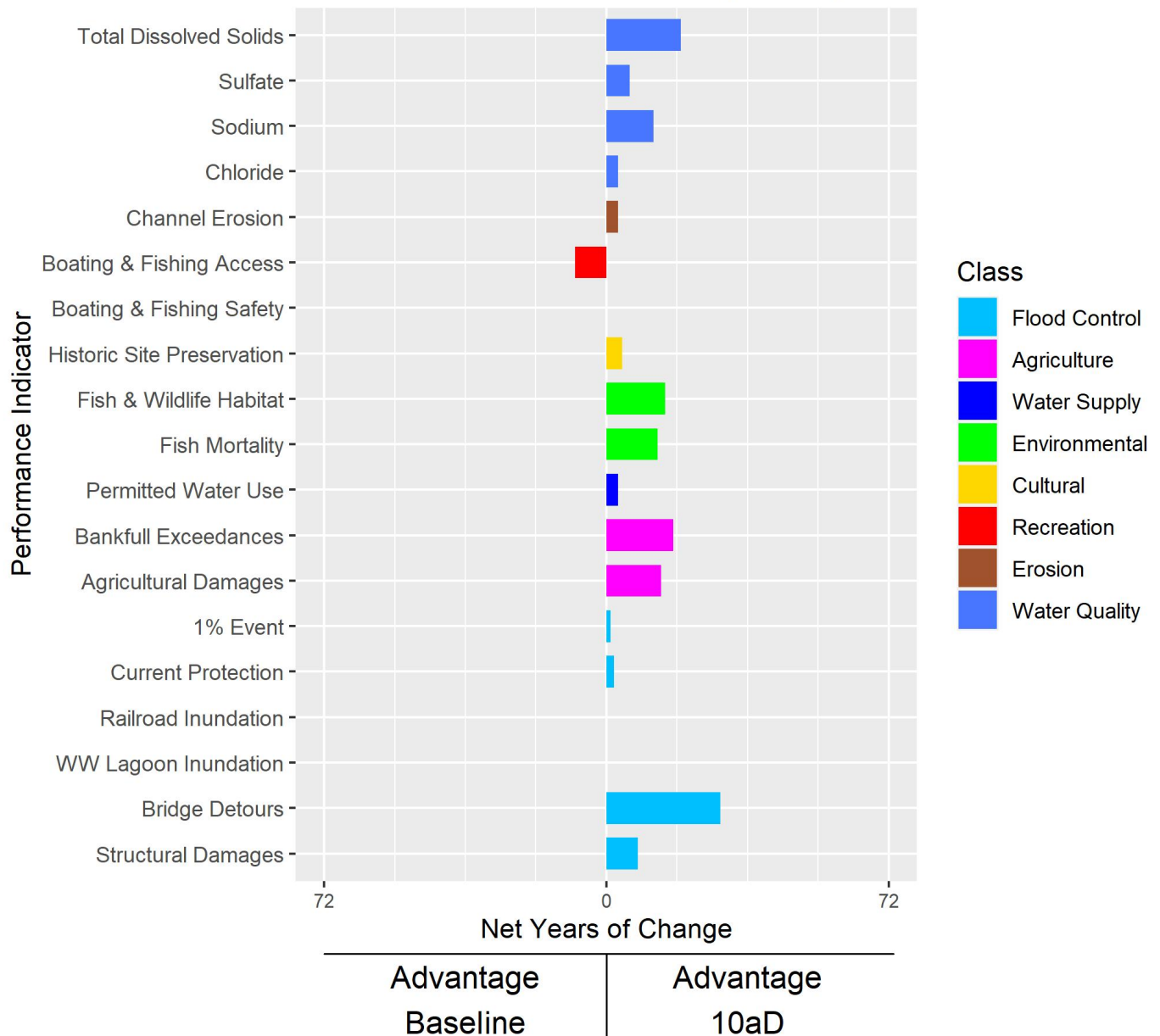
Period of Record: 1946-2017 (72 Years)



North Dakota - All Riverine Reaches

Baseline vs. 10aD

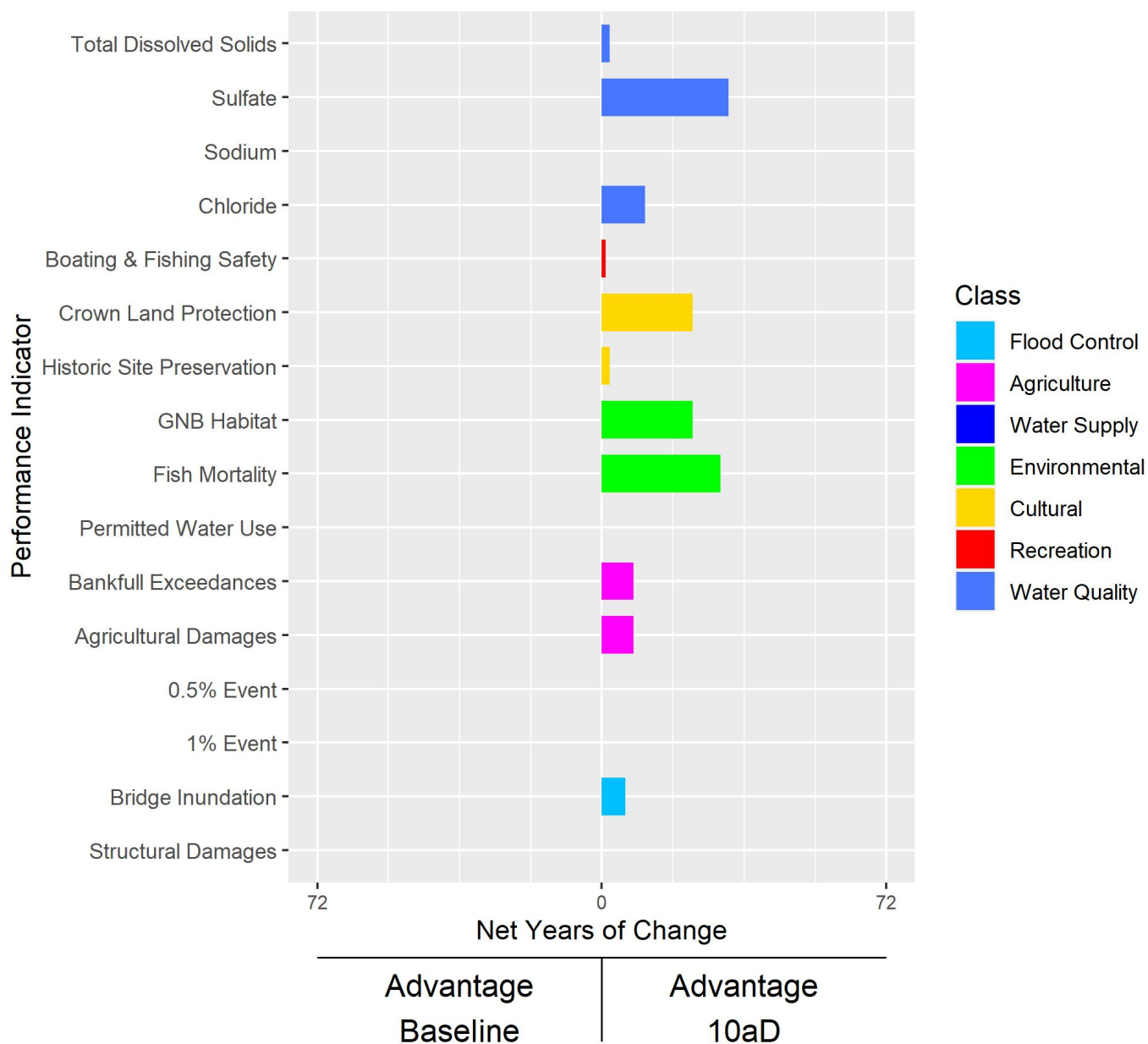
Period of Record: 1946-2017 (72 Years)



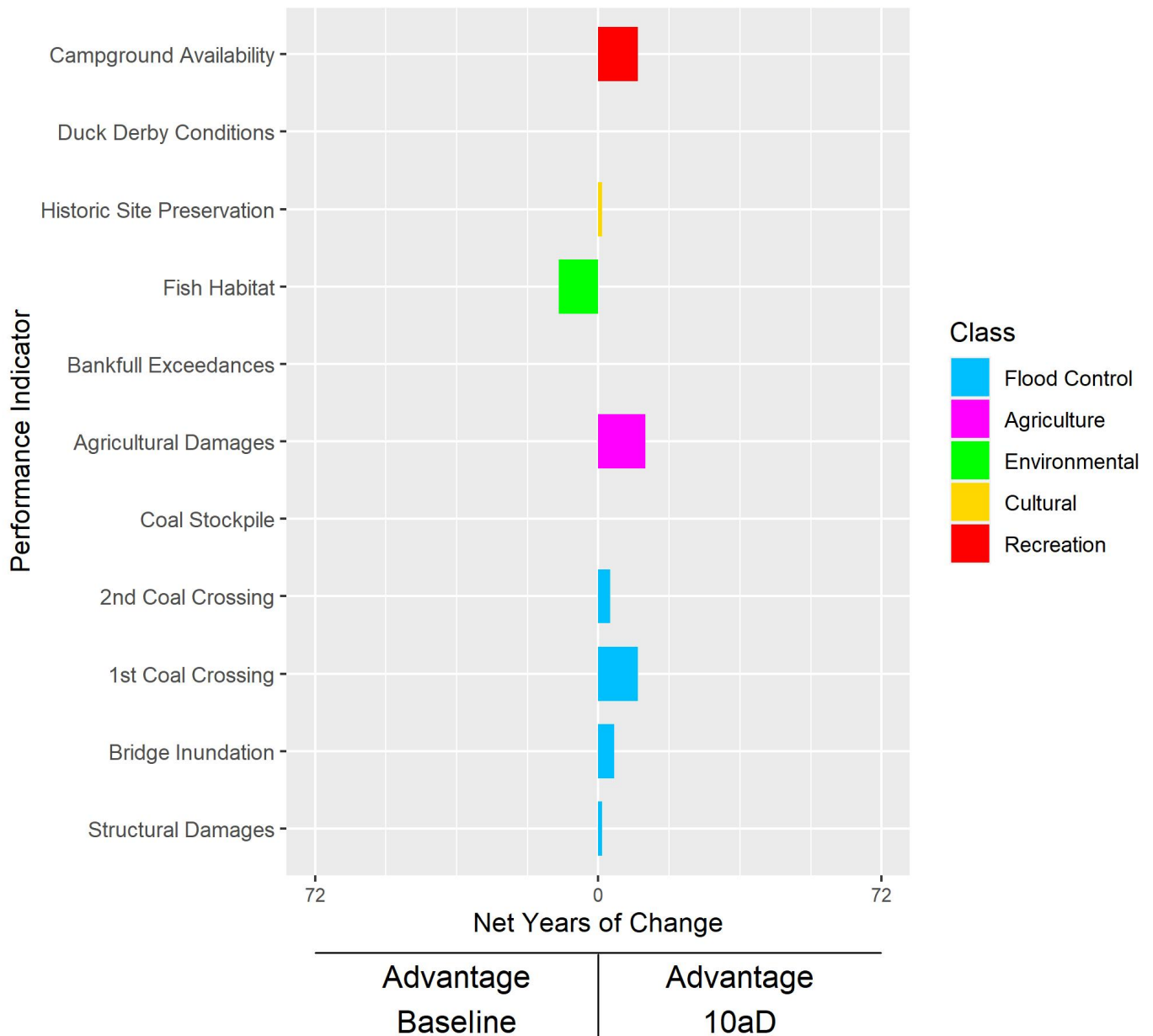
Westhope to Wawanesa

Baseline vs. 10aD

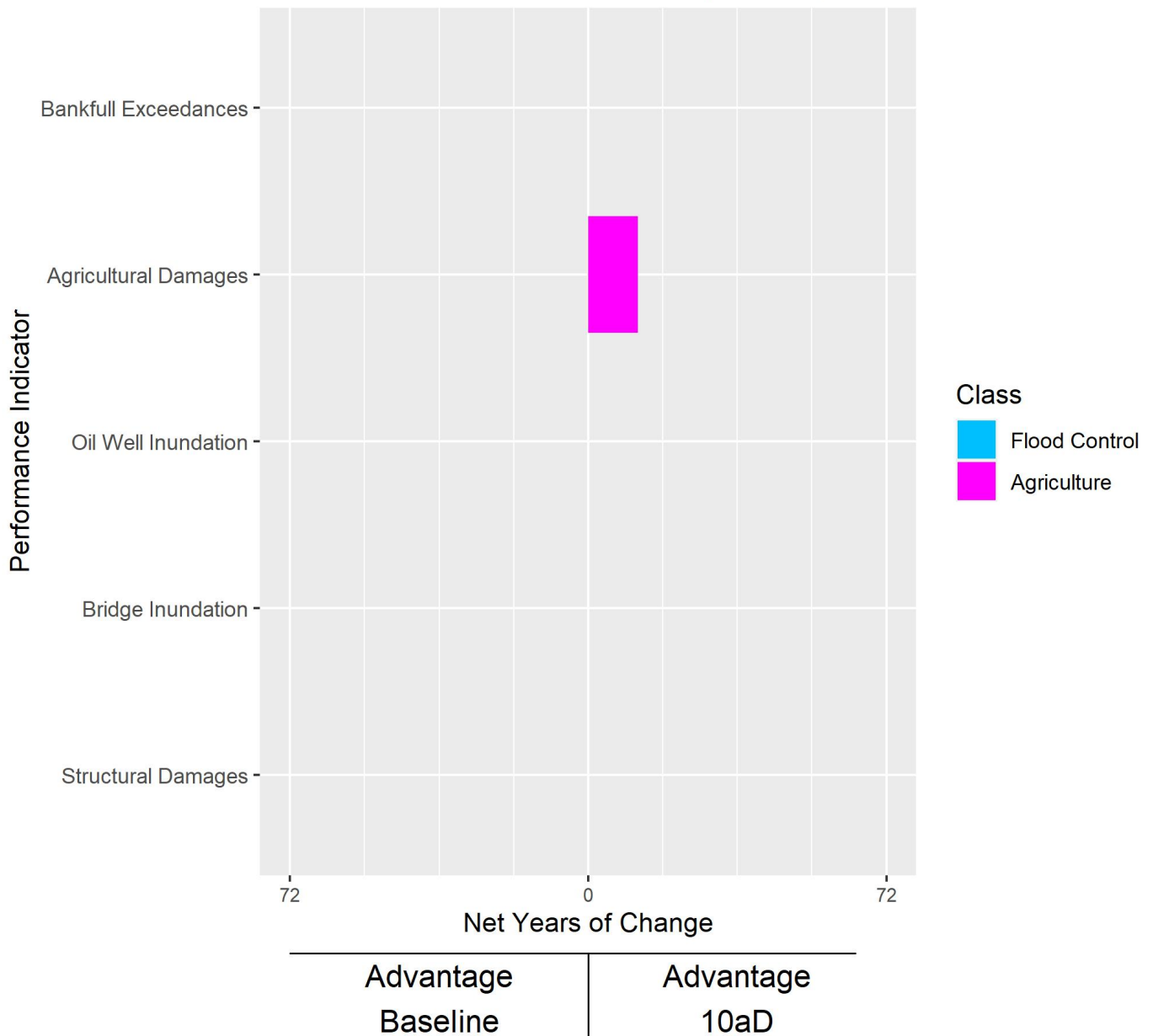
Period of Record: 1946-2017 (72 Years)



City of Estevan
Baseline vs. 10aD
Period of Record: 1946-2017 (72 Years)



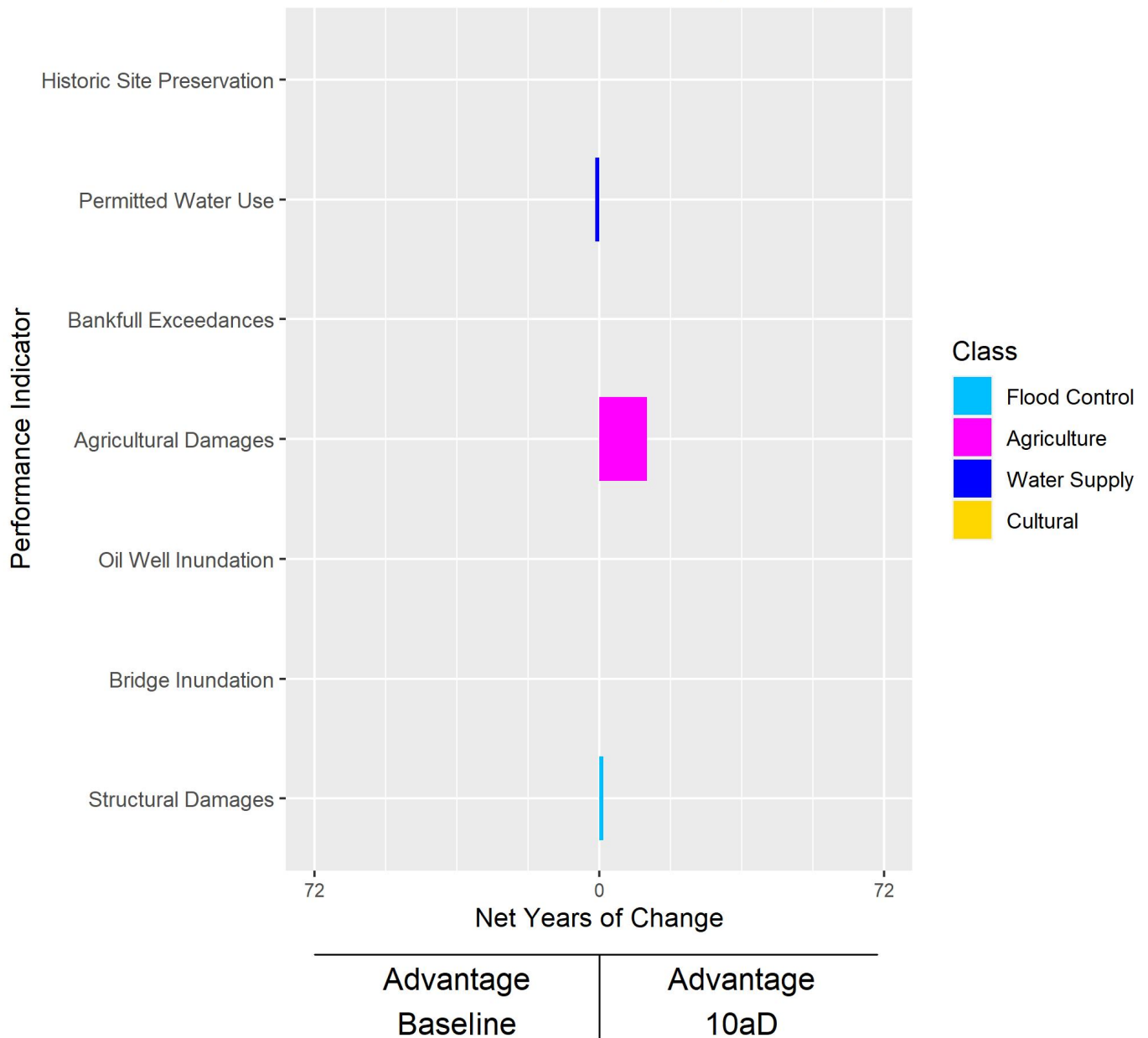
City of Roche Percee
Baseline vs. 10aD
Period of Record: 1946-2017 (72 Years)



Roche Percee to Moose Mountain Creek

Baseline vs. 10aD

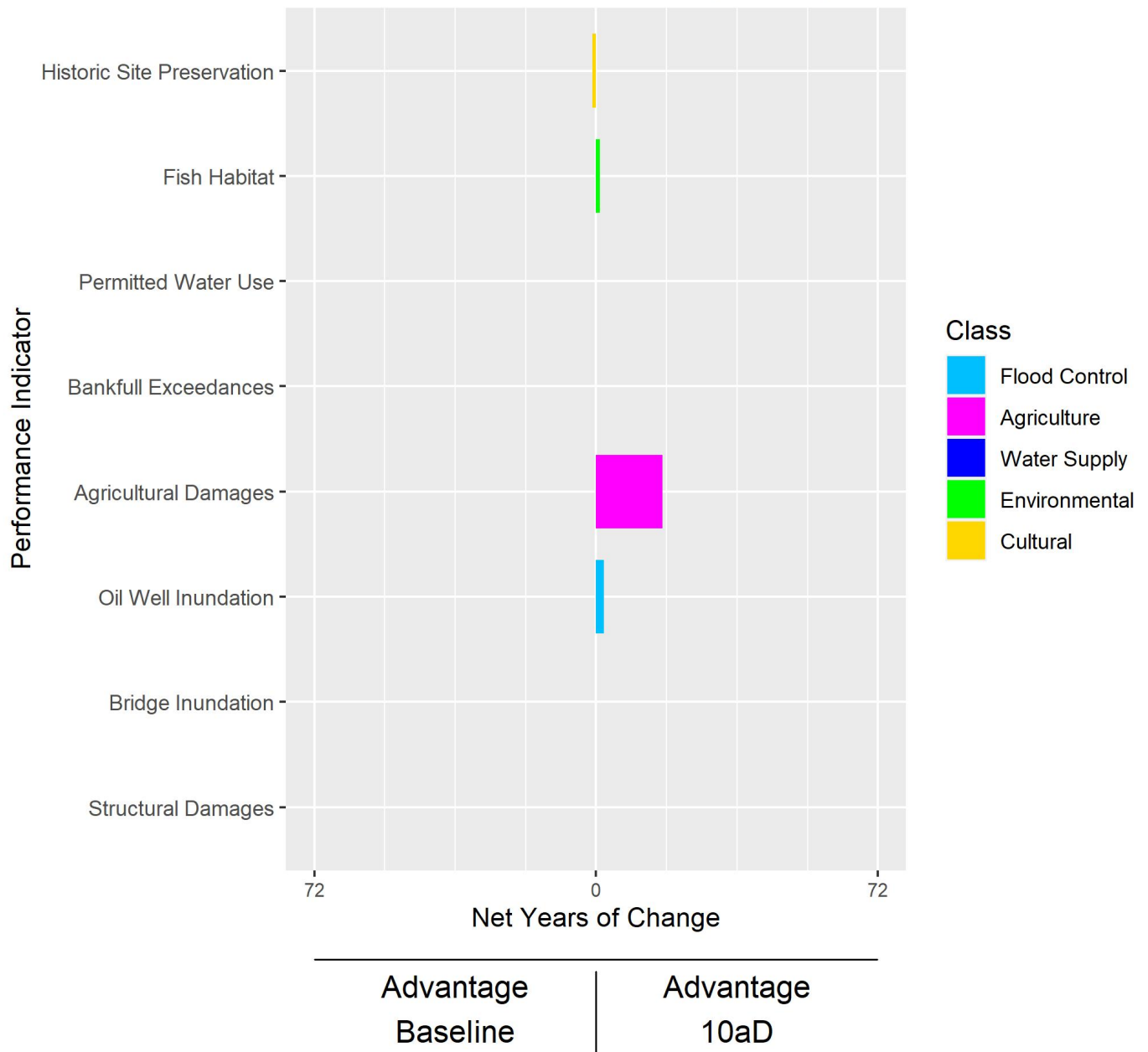
Period of Record: 1946-2017 (72 Years)



Moose Mountain Creek to Sherwood

Baseline vs. 10aD

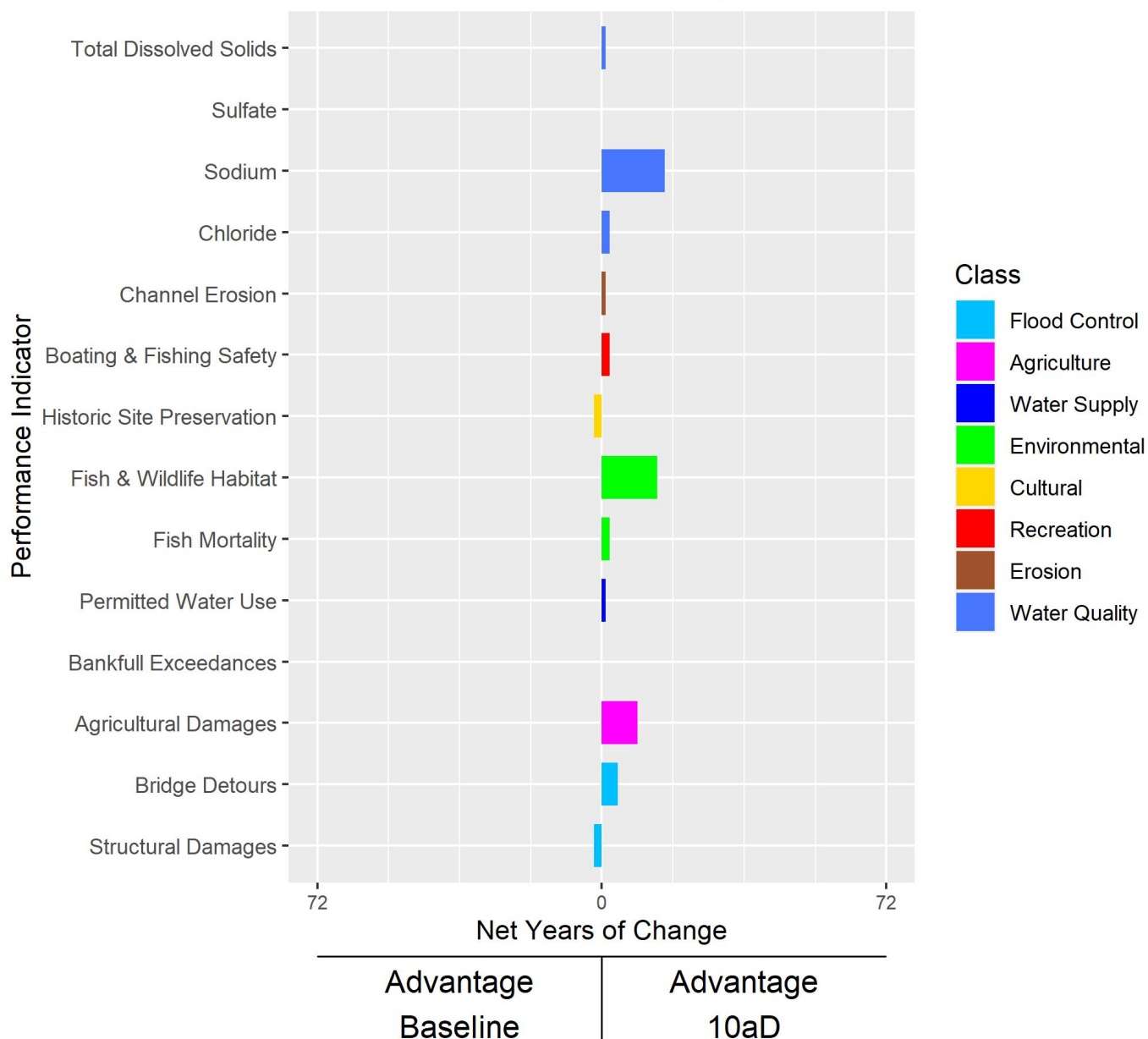
Period of Record: 1946-2017 (72 Years)



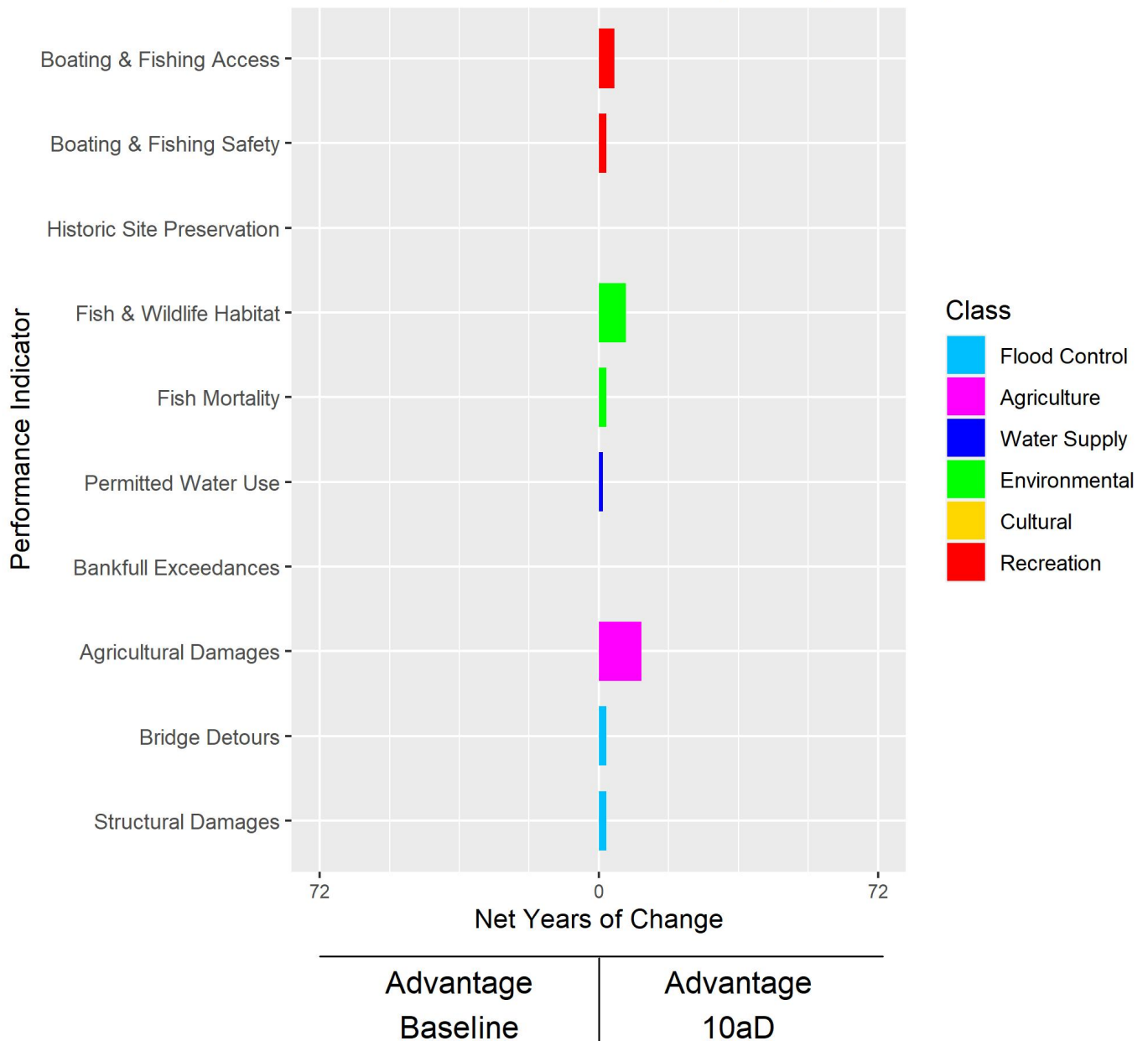
Sherwood to Mouse River Park

Baseline vs. 10aD

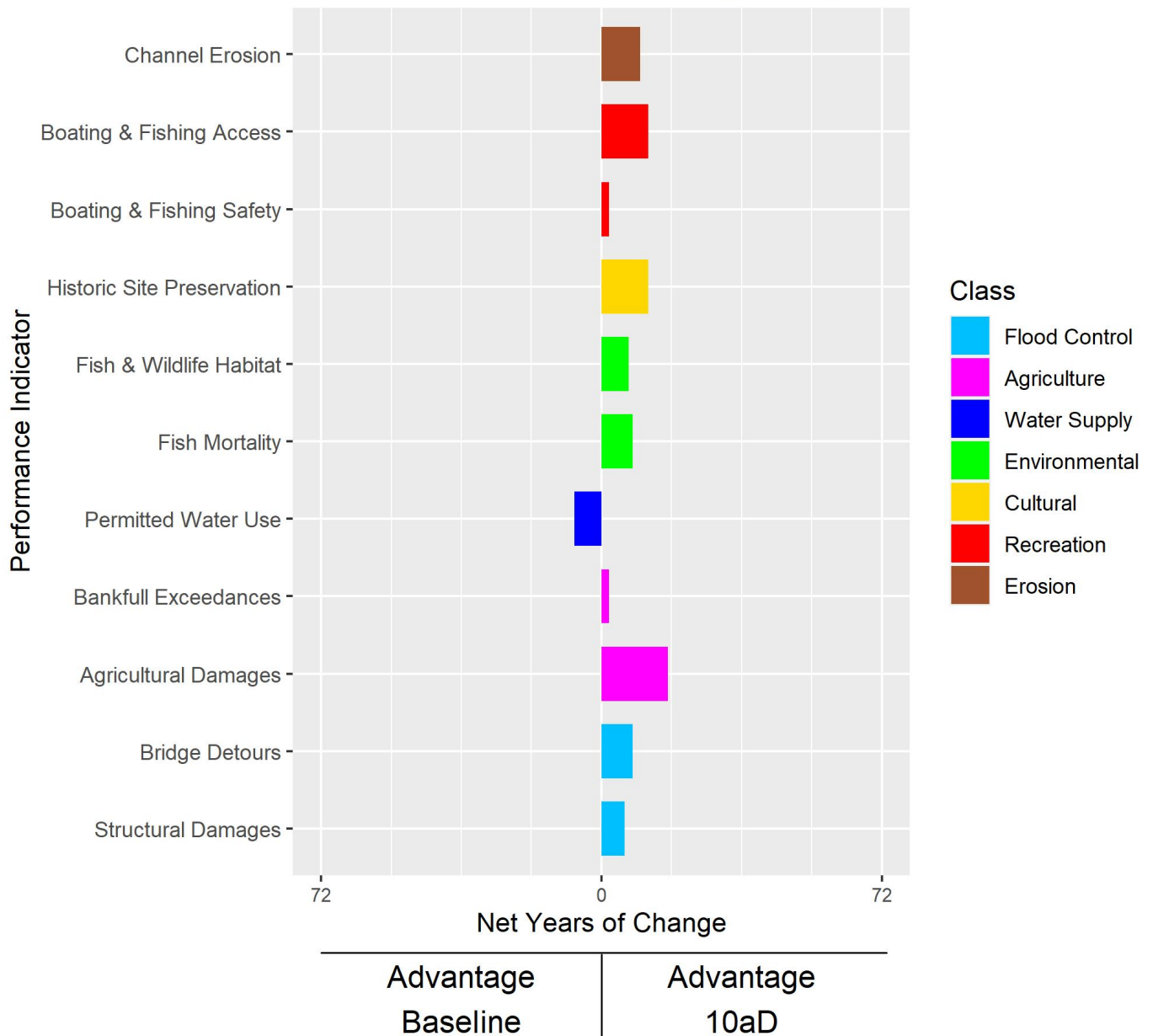
Period of Record: 1946-2017 (72 Years)



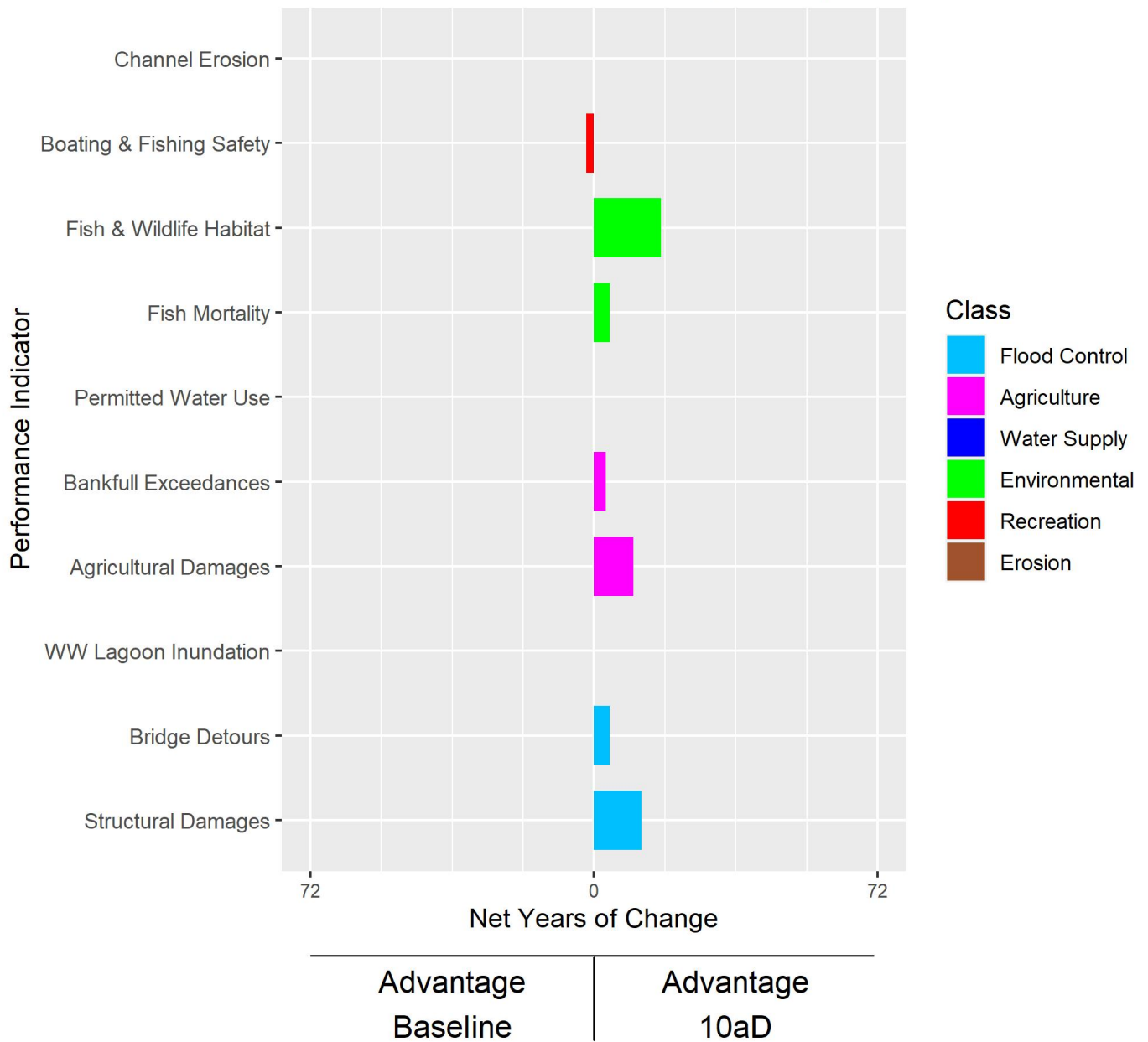
Mouse River Park
Baseline vs. 10aD
Period of Record: 1946-2017 (72 Years)



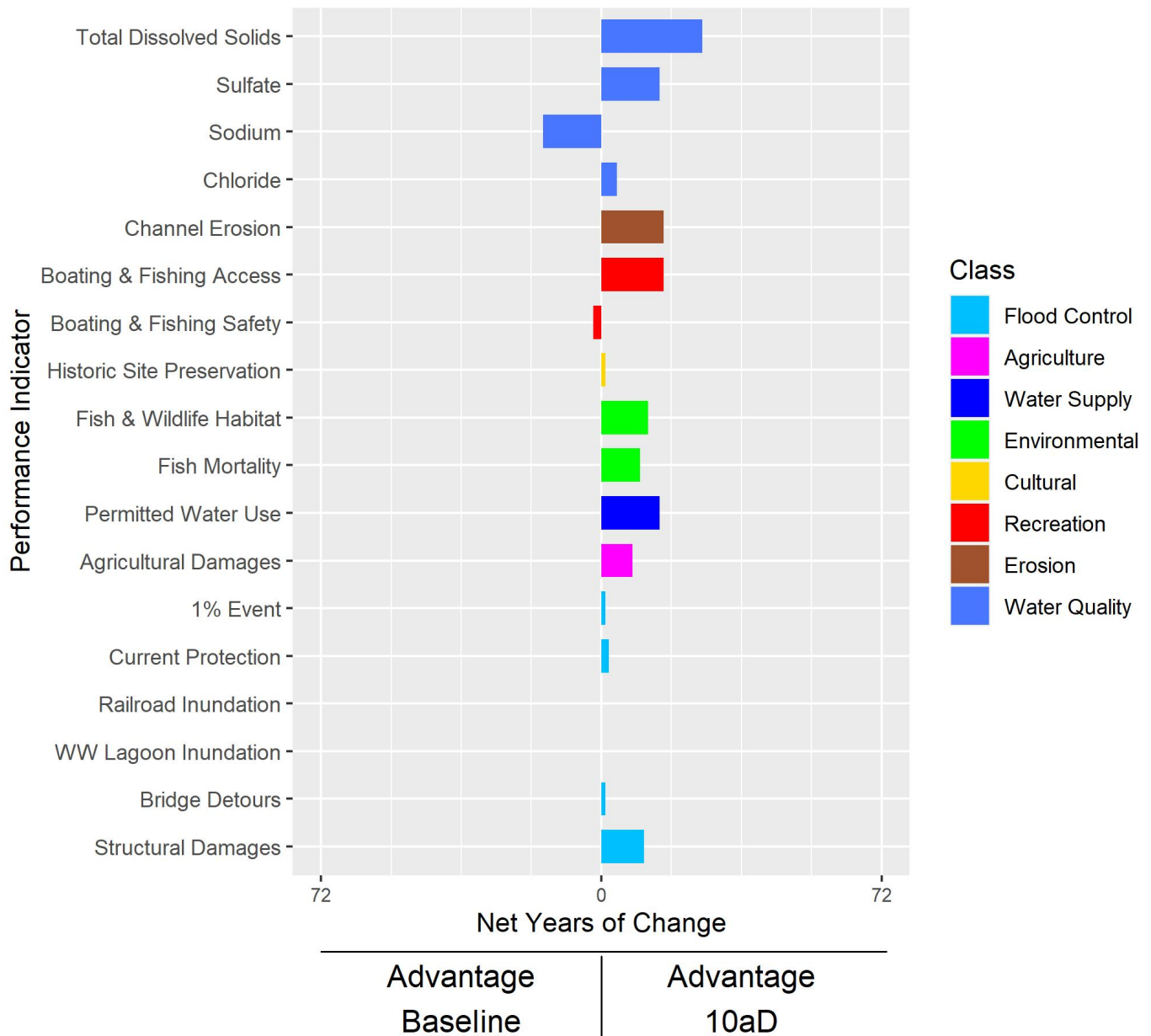
Lake Darling to Burlington
Baseline vs. 10aD
Period of Record: 1946-2017 (72 Years)



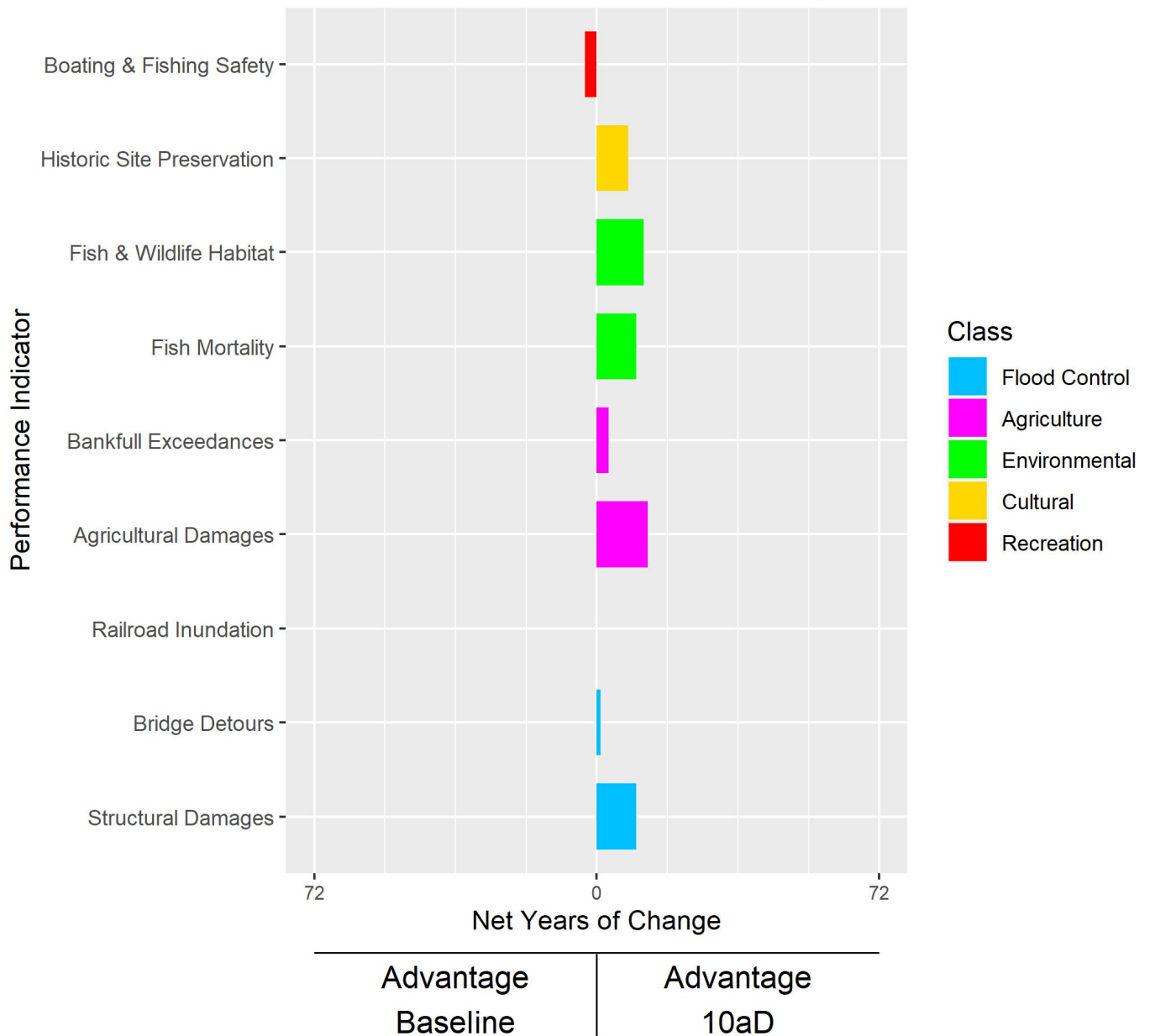
City of Burlington
Baseline vs. 10aD
Period of Record: 1946-2017 (72 Years)



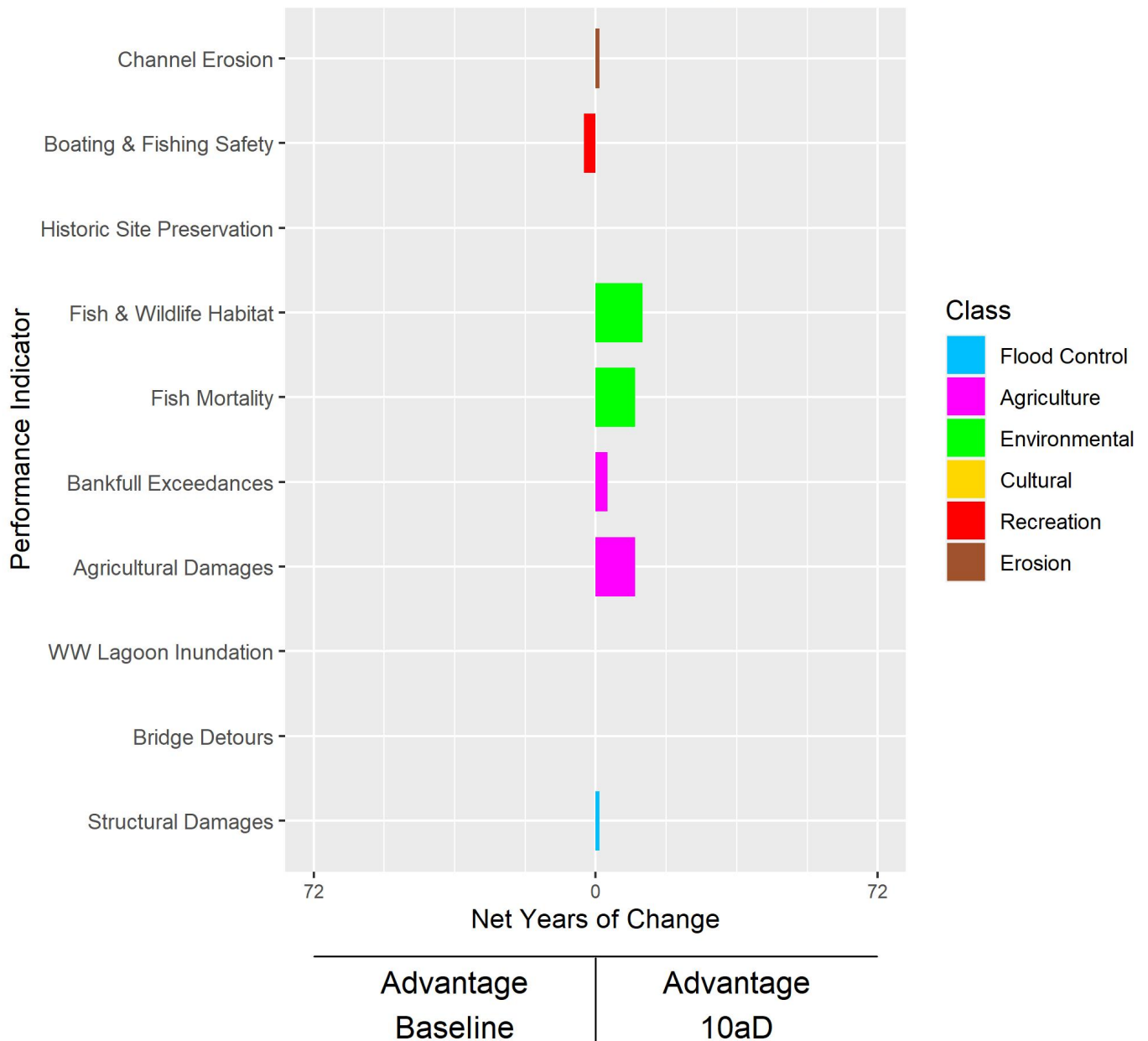
City of Minot
Baseline vs. 10aD
Period of Record: 1946-2017 (72 Years)



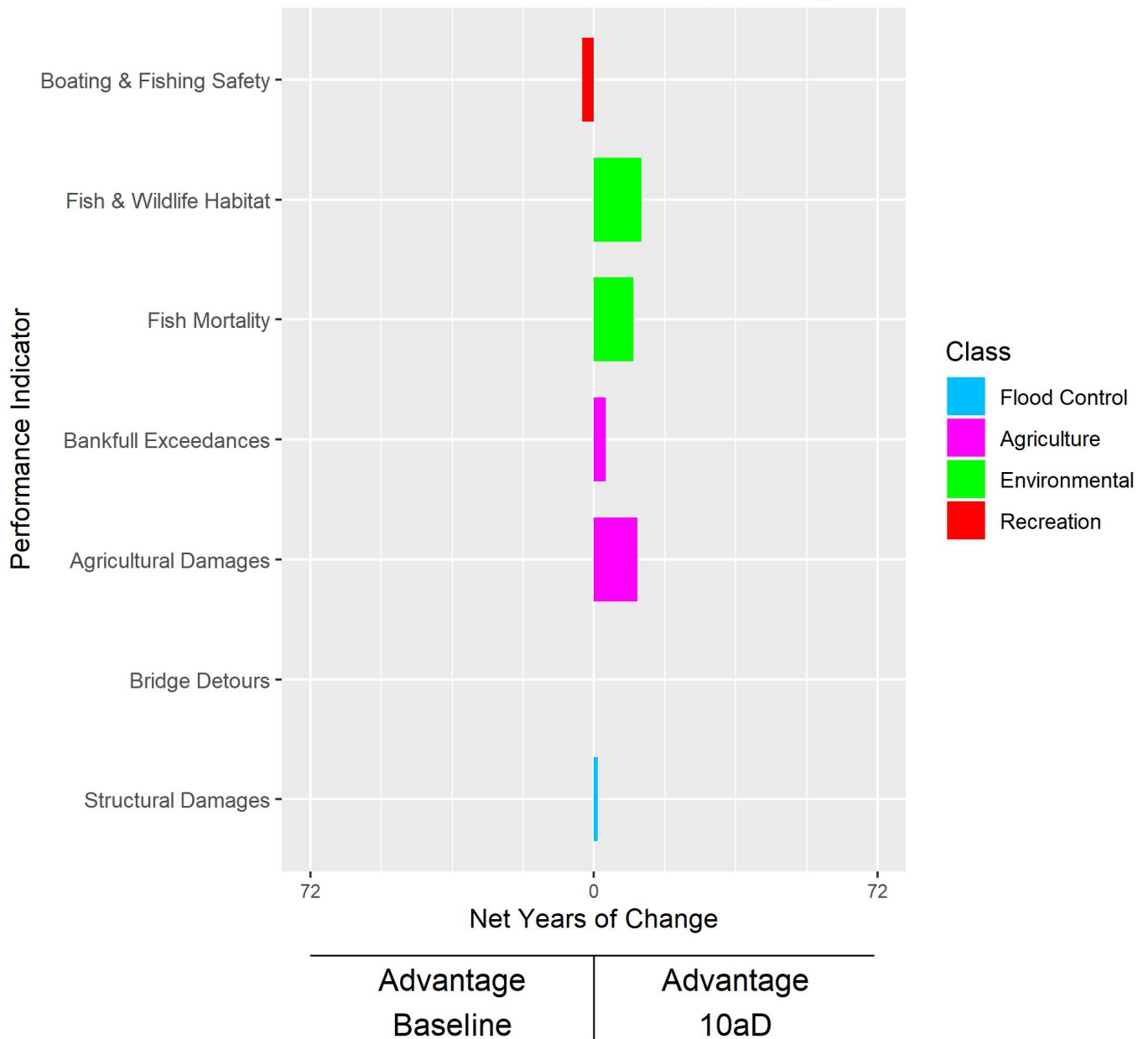
Minot to Sawyer
Baseline vs. 10aD
Period of Record: 1946-2017 (72 Years)



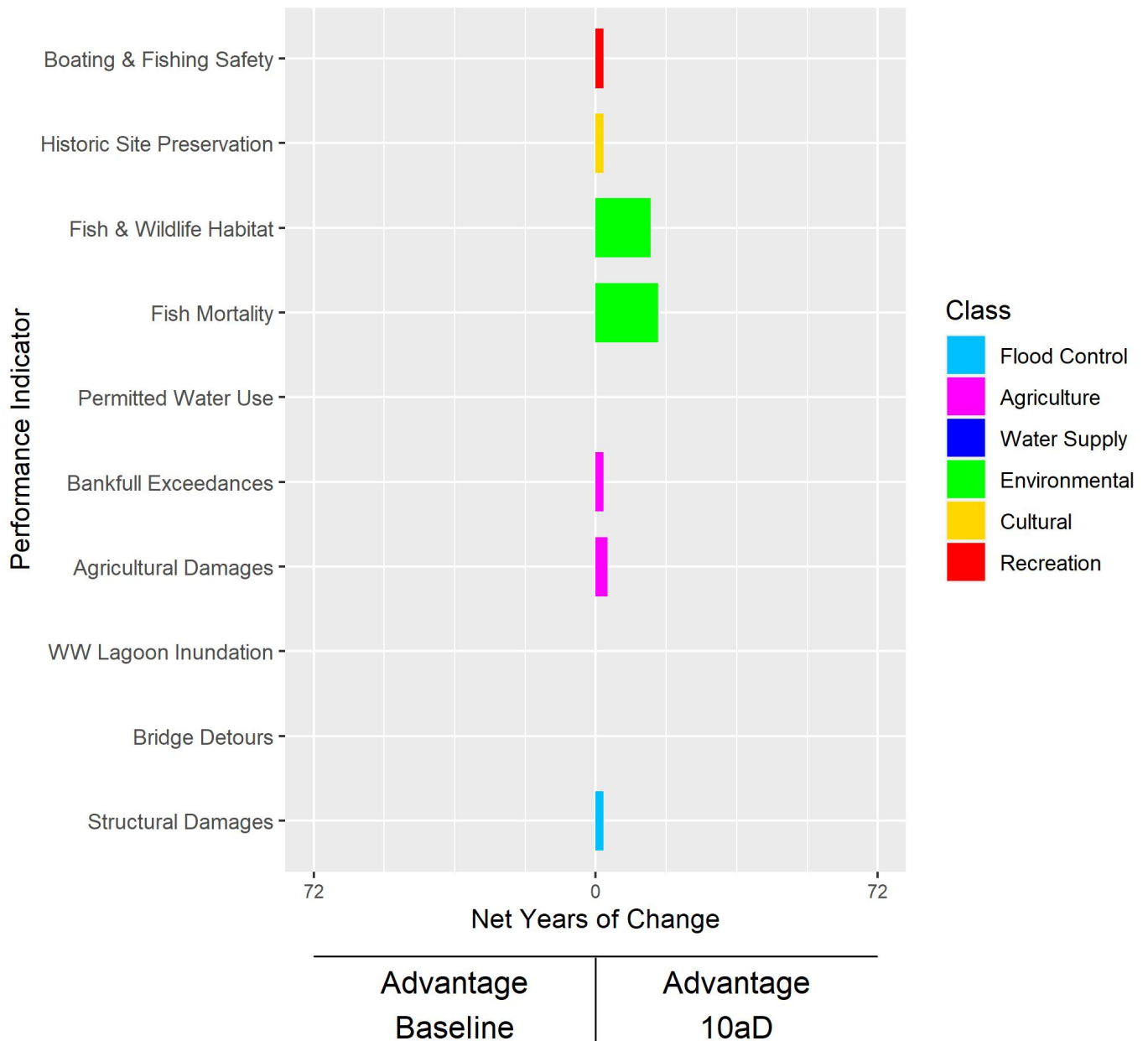
City of Sawyer
Baseline vs. 10aD
Period of Record: 1946-2017 (72 Years)



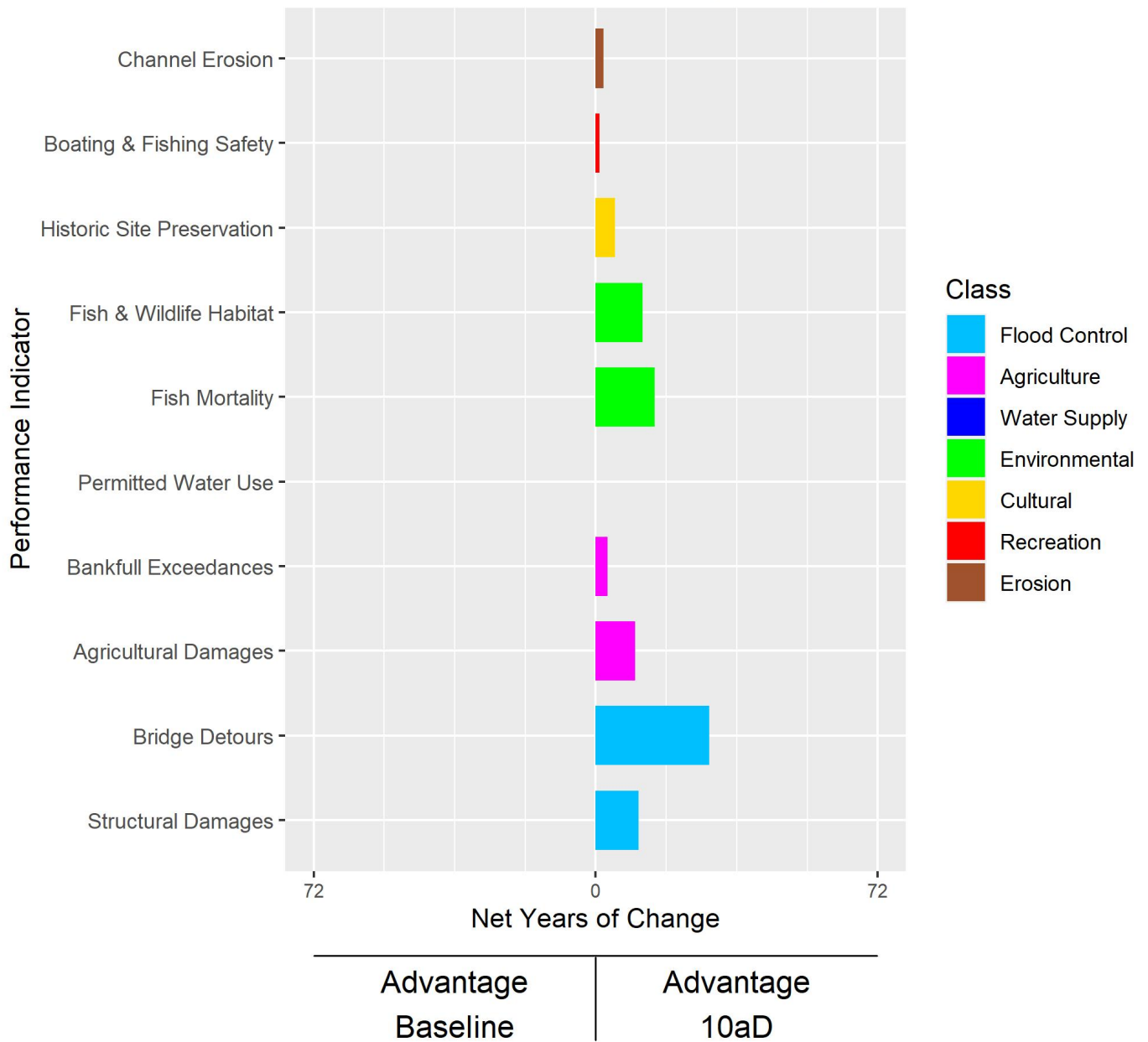
Sawyer to Velva
Baseline vs. 10aD
Period of Record: 1946-2017 (72 Years)



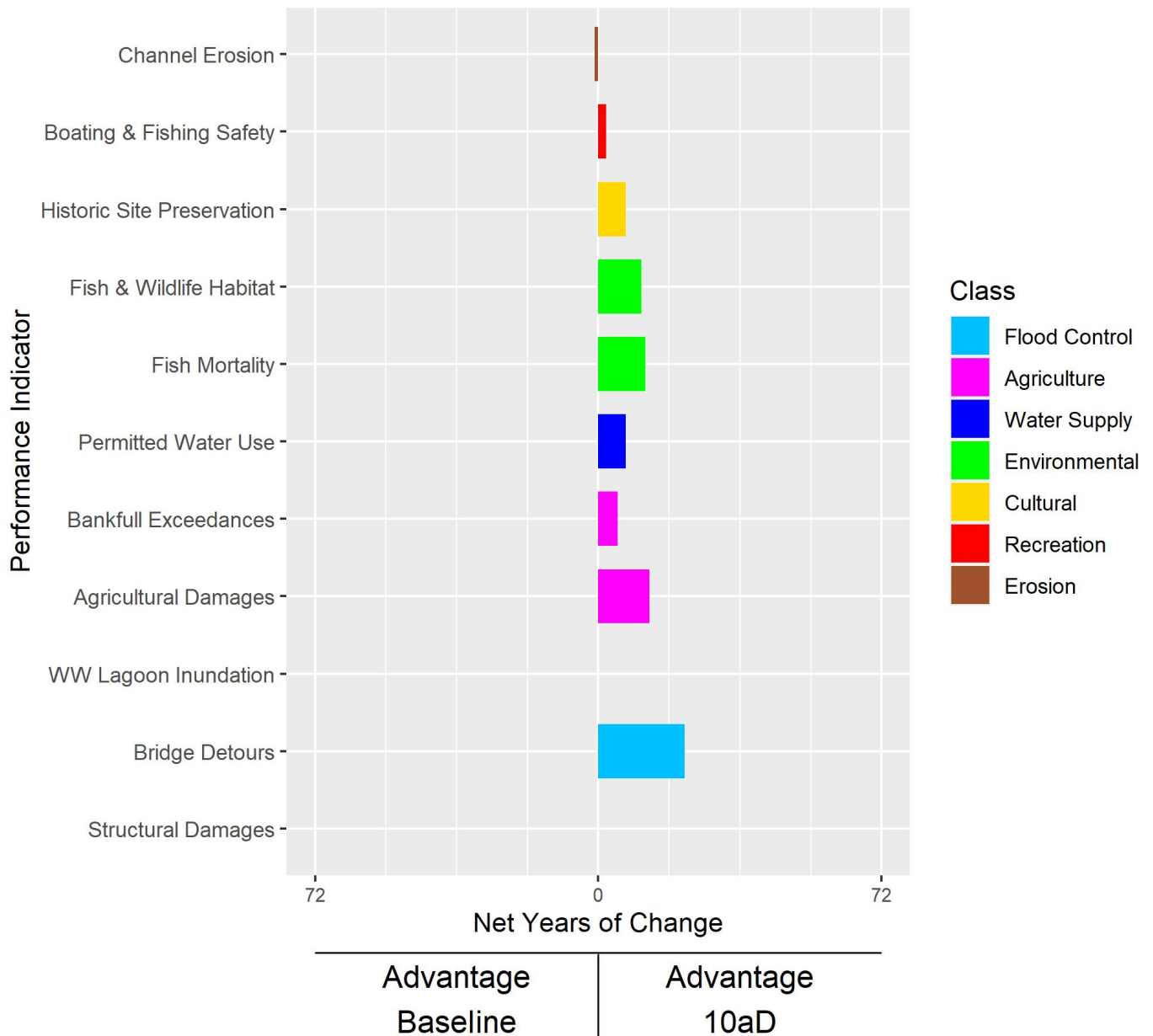
City of Velva
Baseline vs. 10aD
Period of Record: 1946-2017 (72 Years)



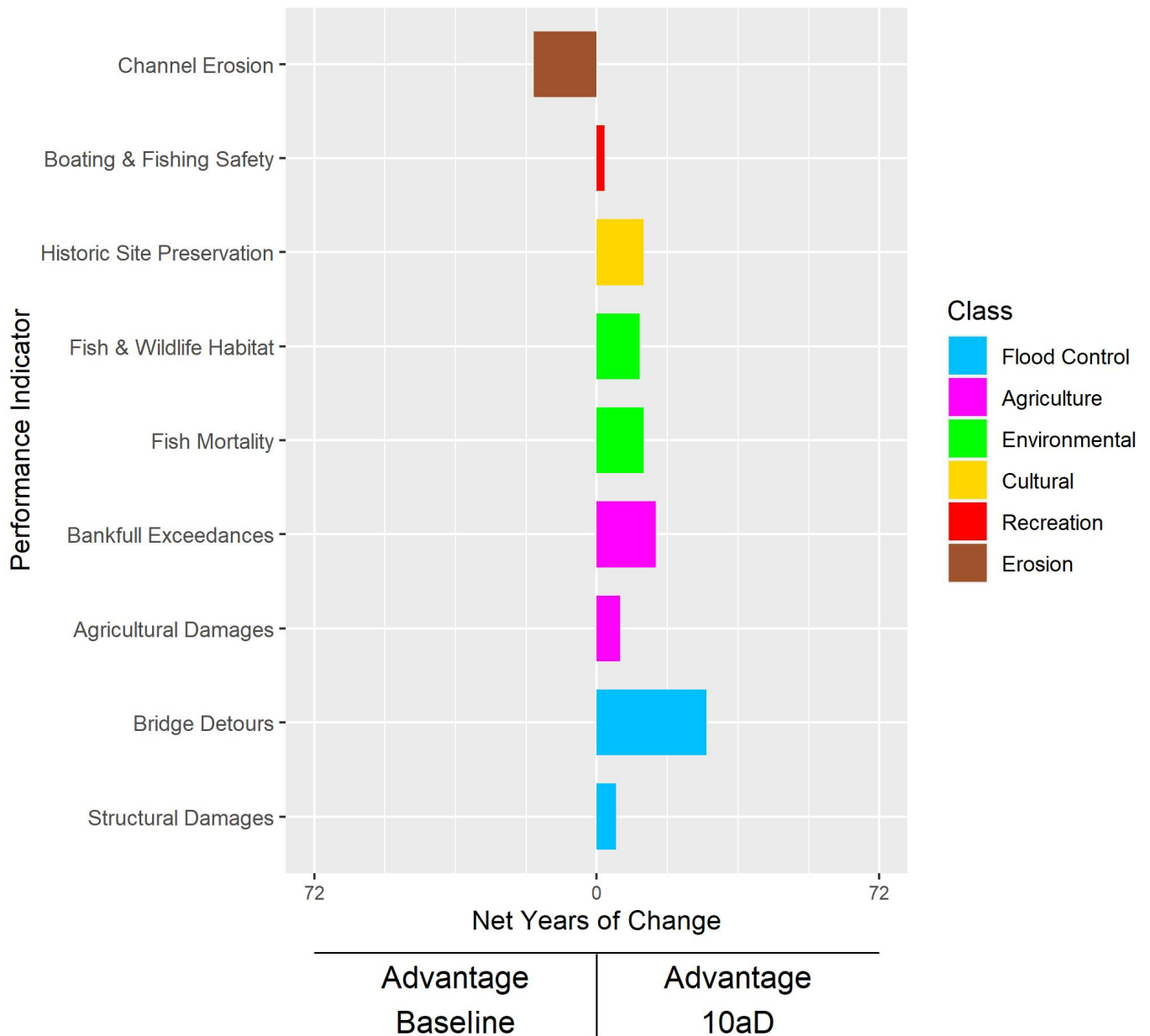
Velva to Eaton Irrigation
Baseline vs. 10aD
Period of Record: 1946-2017 (72 Years)



Eaton Irrigation District
Baseline vs. 10aD
Period of Record: 1946-2017 (72 Years)



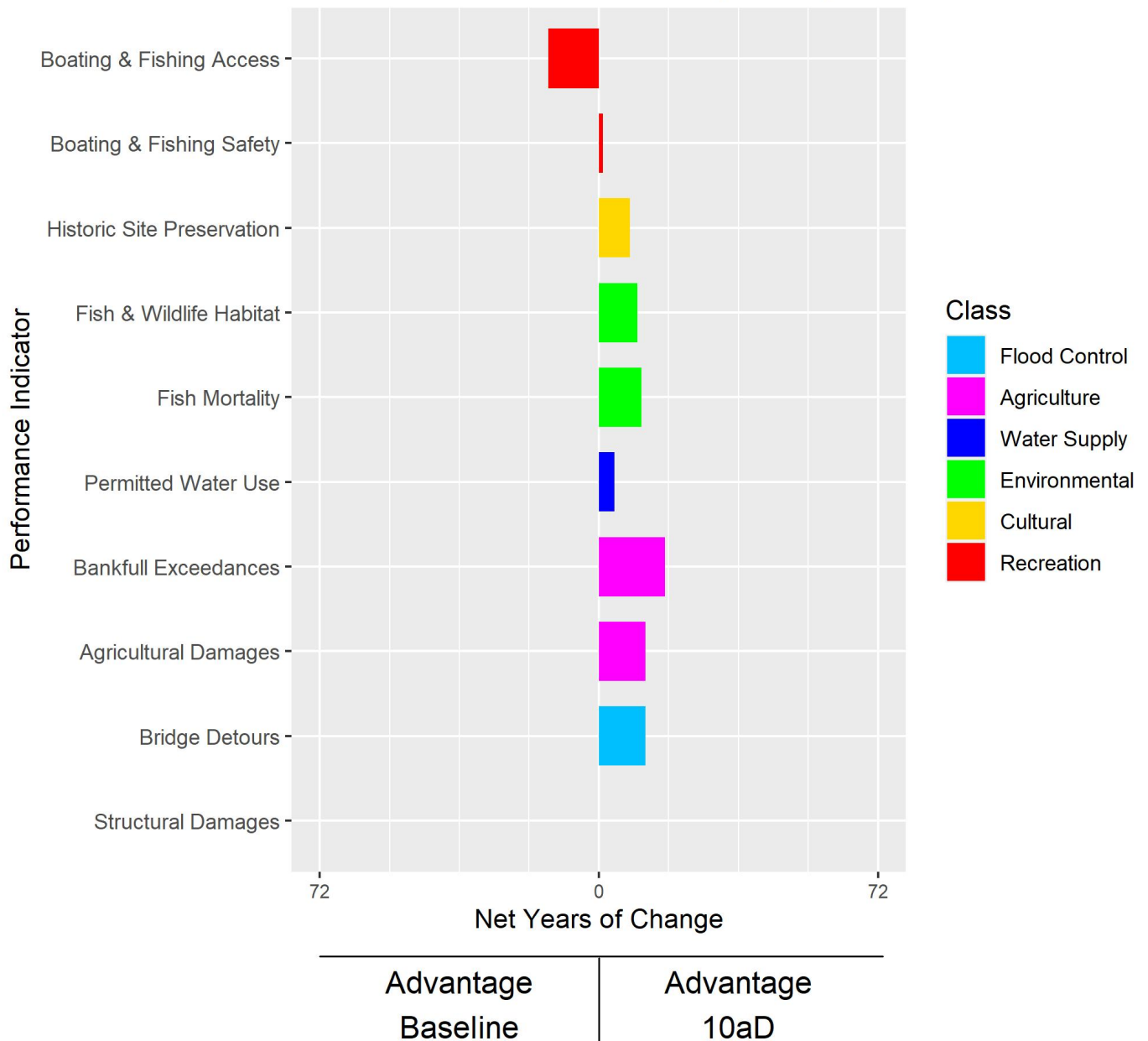
Downstream of Towner
Baseline vs. 10aD
Period of Record: 1946-2017 (72 Years)



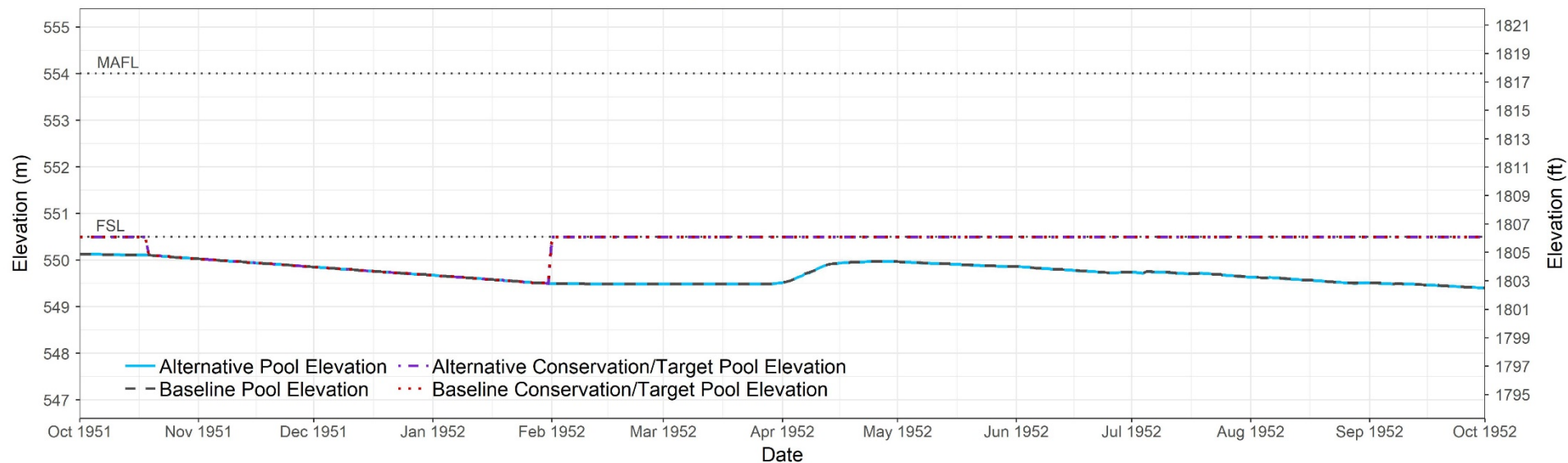
J. Clark Salyer National Wildlife Refuge

Baseline vs. 10aD

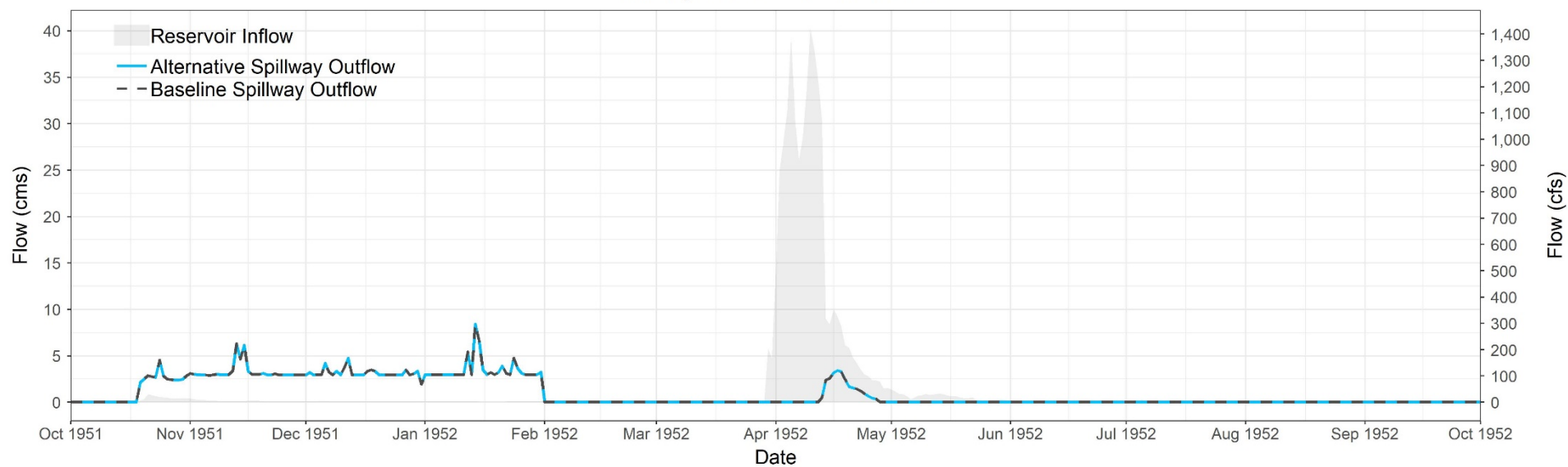
Period of Record: 1946-2017 (72 Years)



Rafferty Reservoir - Elevation

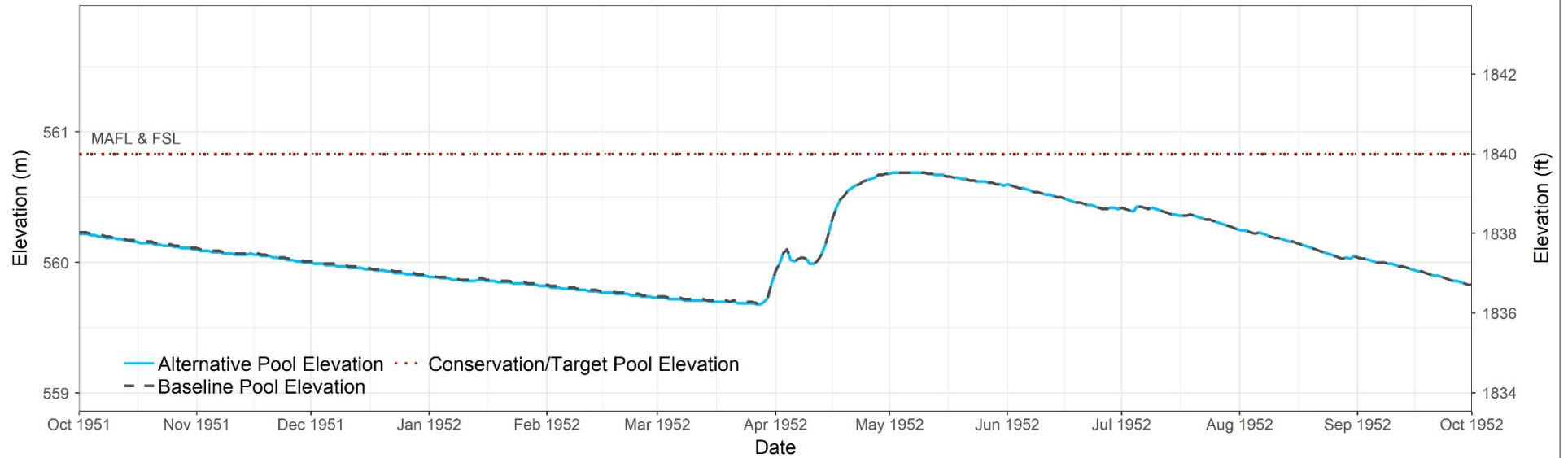


Rafferty Reservoir - Releases

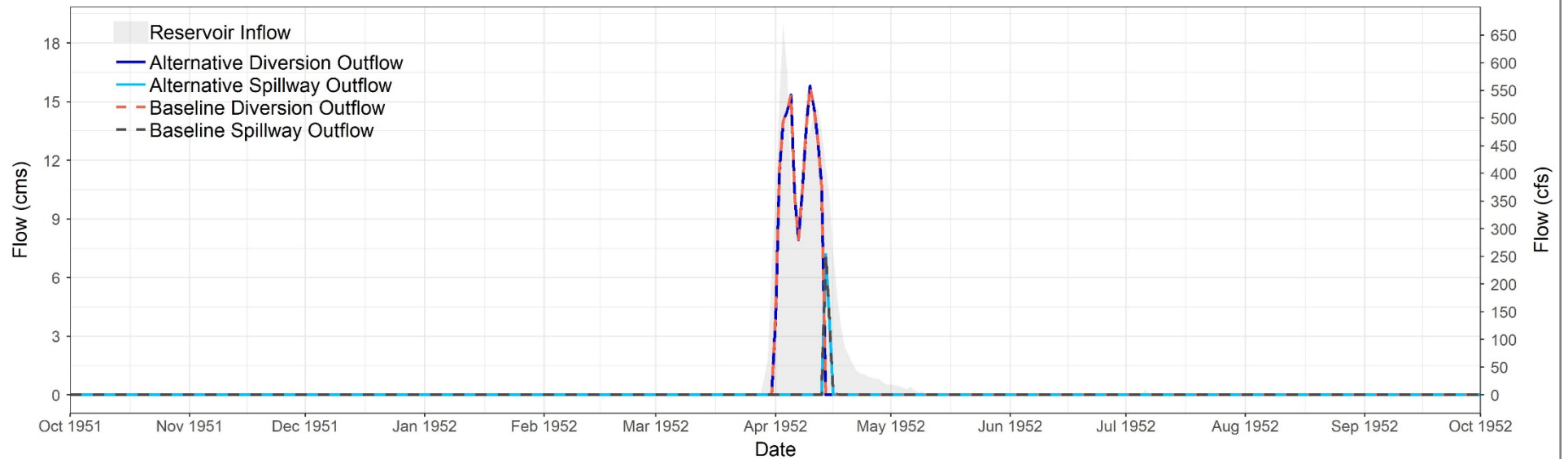


*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level

Boundary Reservoir - Elevation

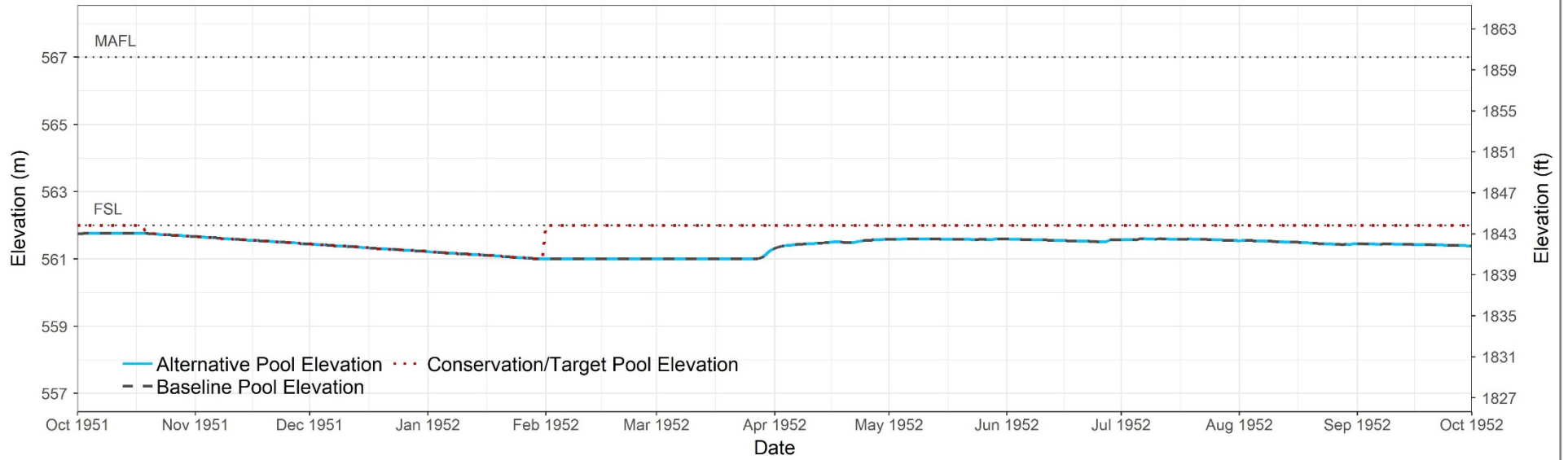


Boundary Reservoir - Releases

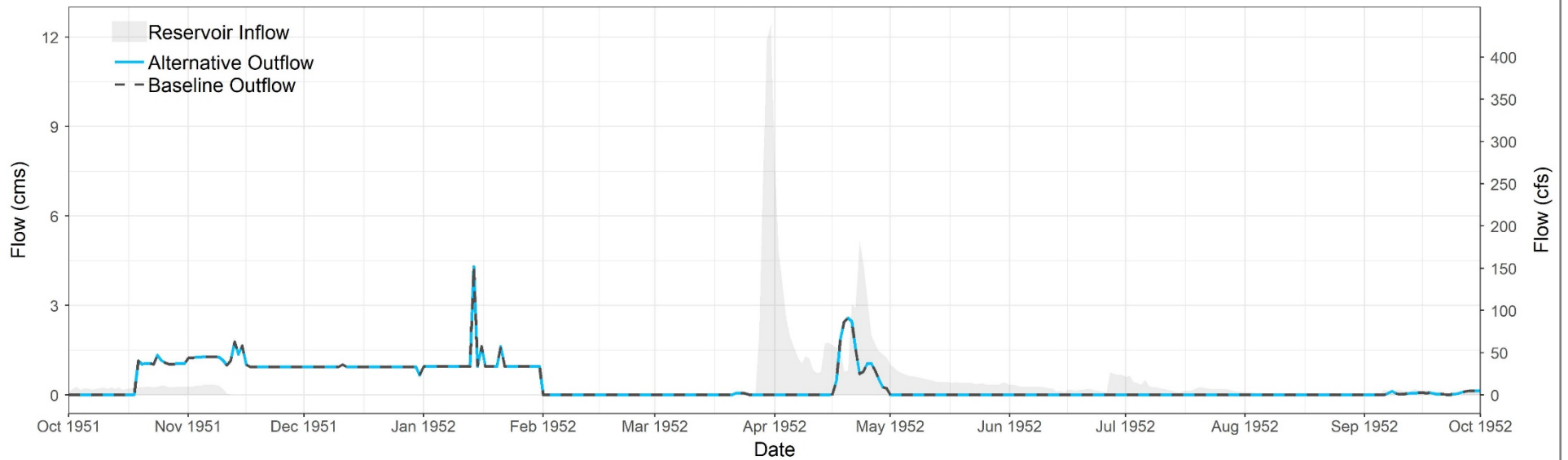


*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level

Grant Devine Reservoir - Elevation

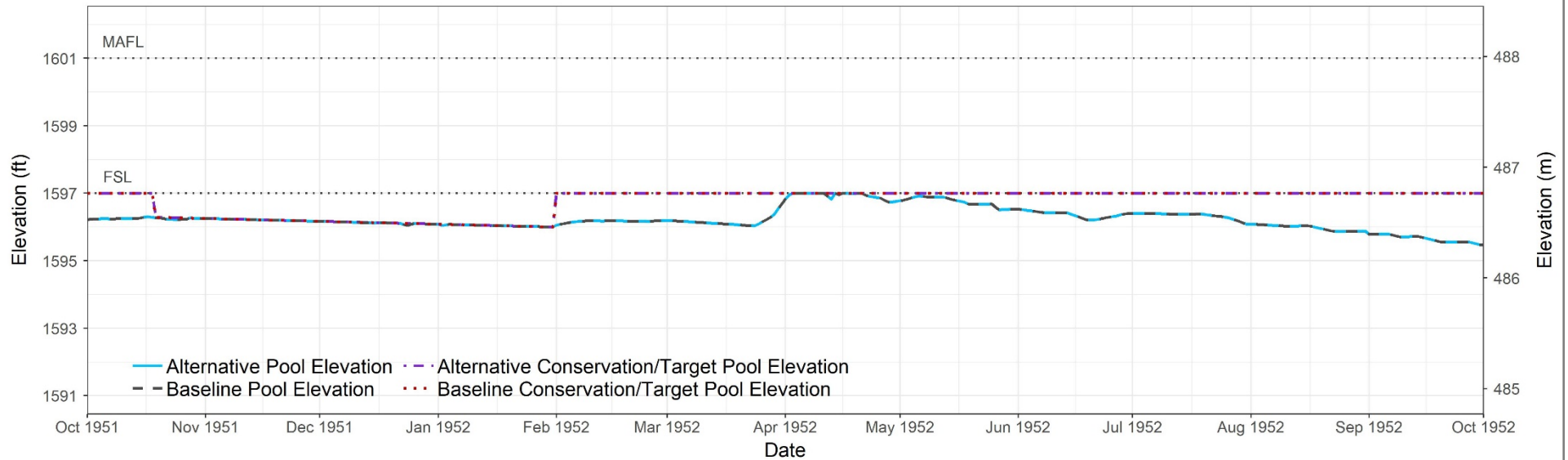


Grant Devine Reservoir - Releases

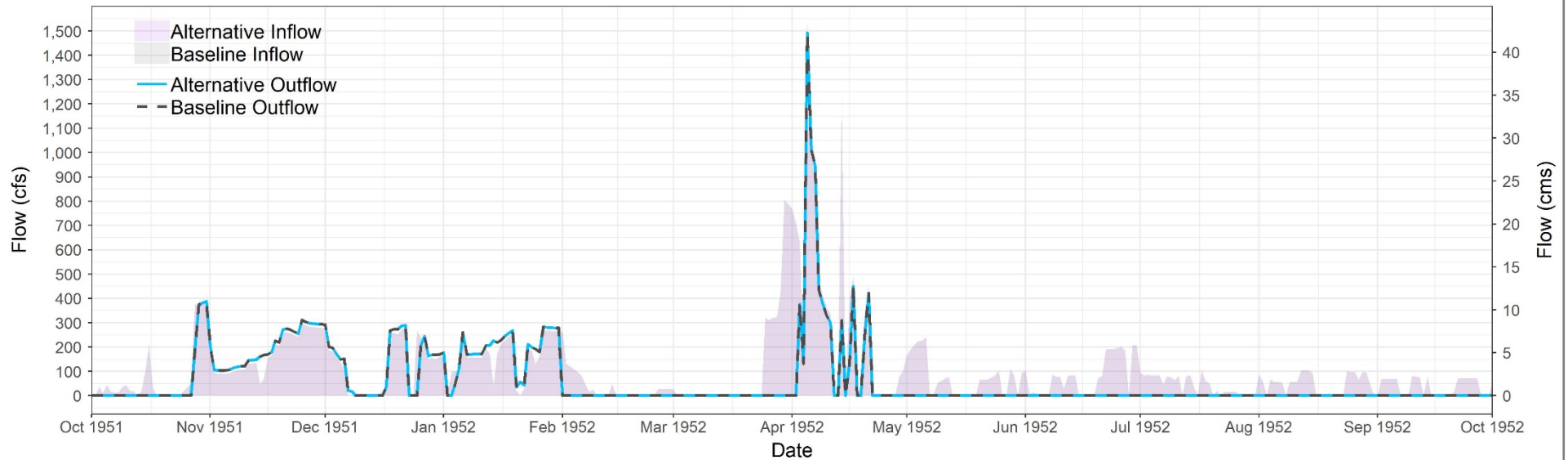


*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level

Lake Darling - Elevation



Lake Darling - Releases



*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level, IDFSL = Inflow Design Flood Supply Level

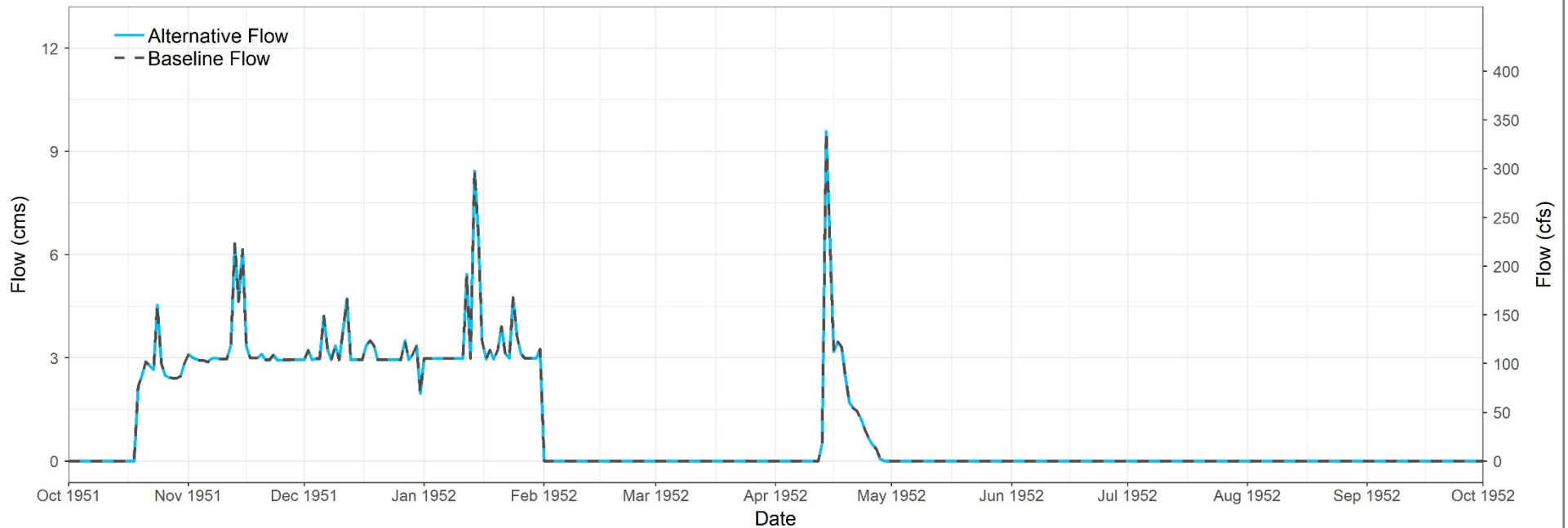
Plate 20

Critical Flow Locations – 1952

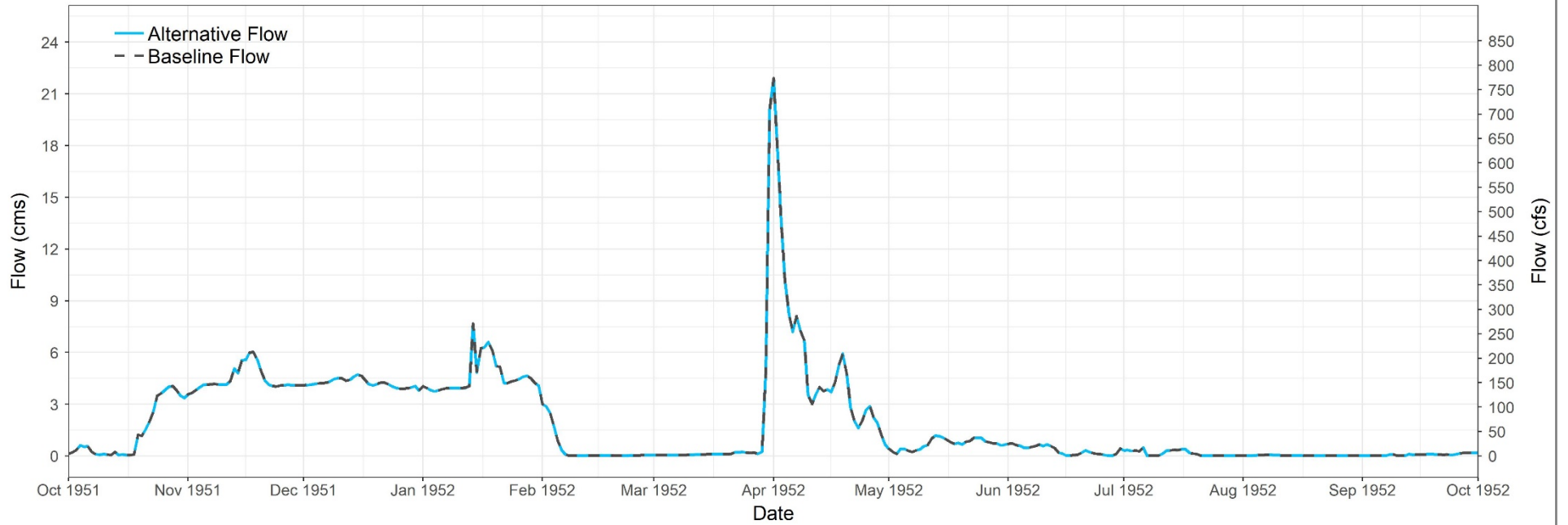
Alternative 10bL (Phase 2)

Souris River Plan of Study

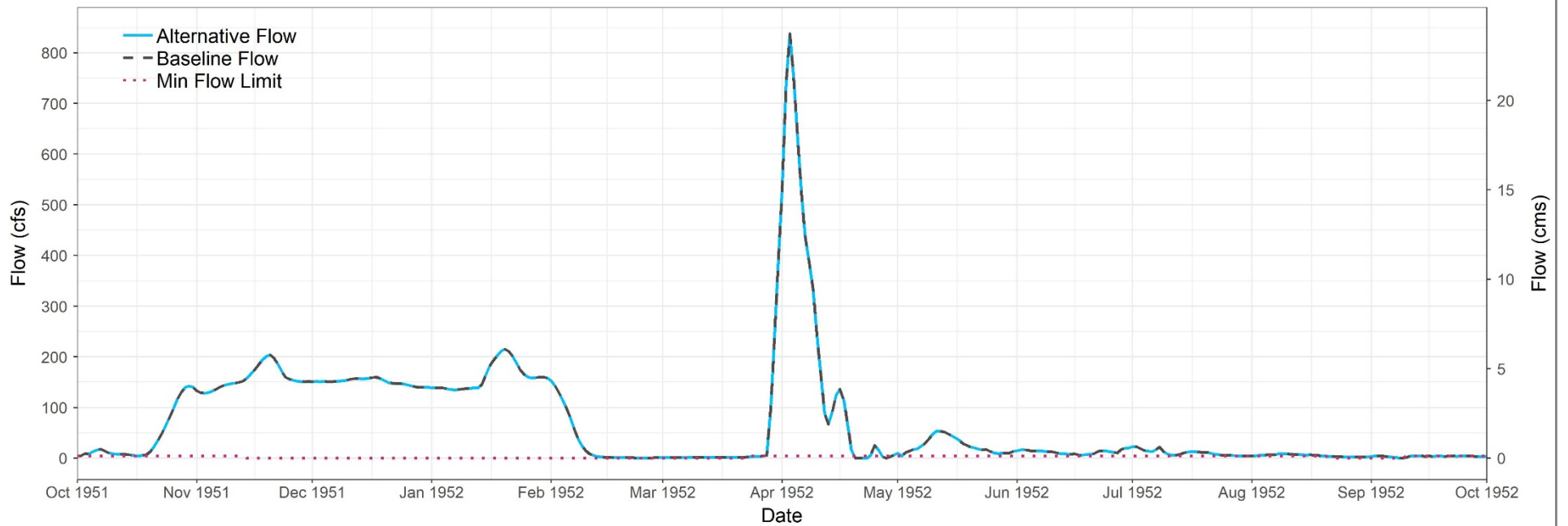
Souris River at Estevan, SK



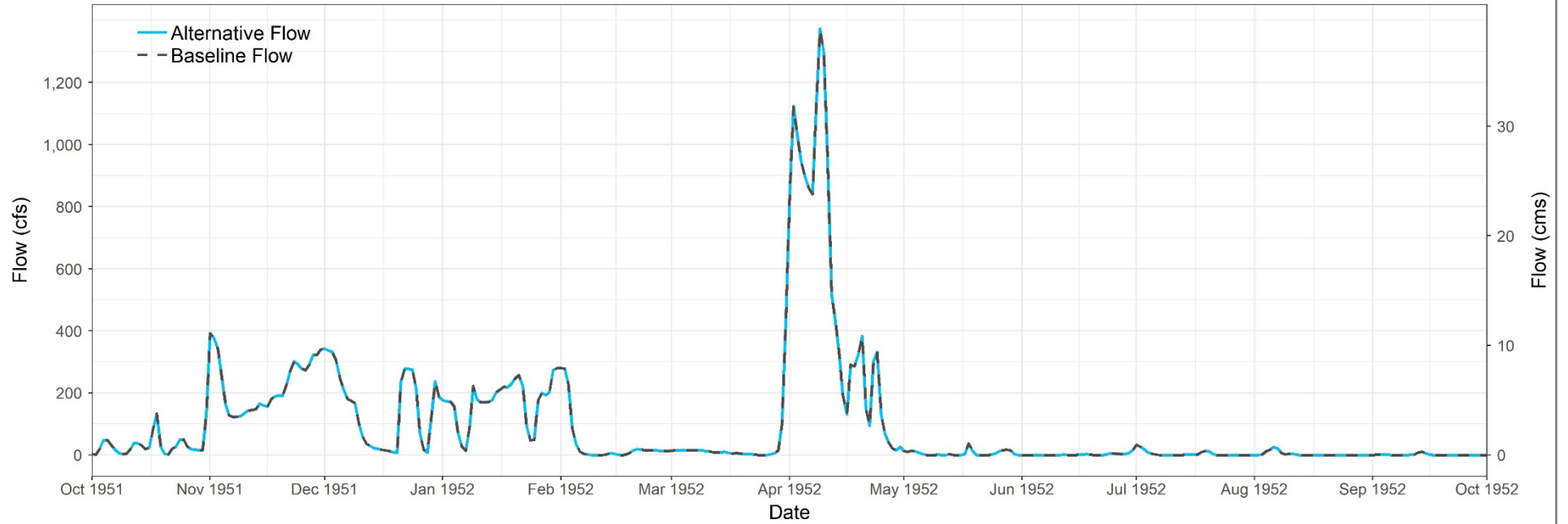
Souris River at Oxbow, SK



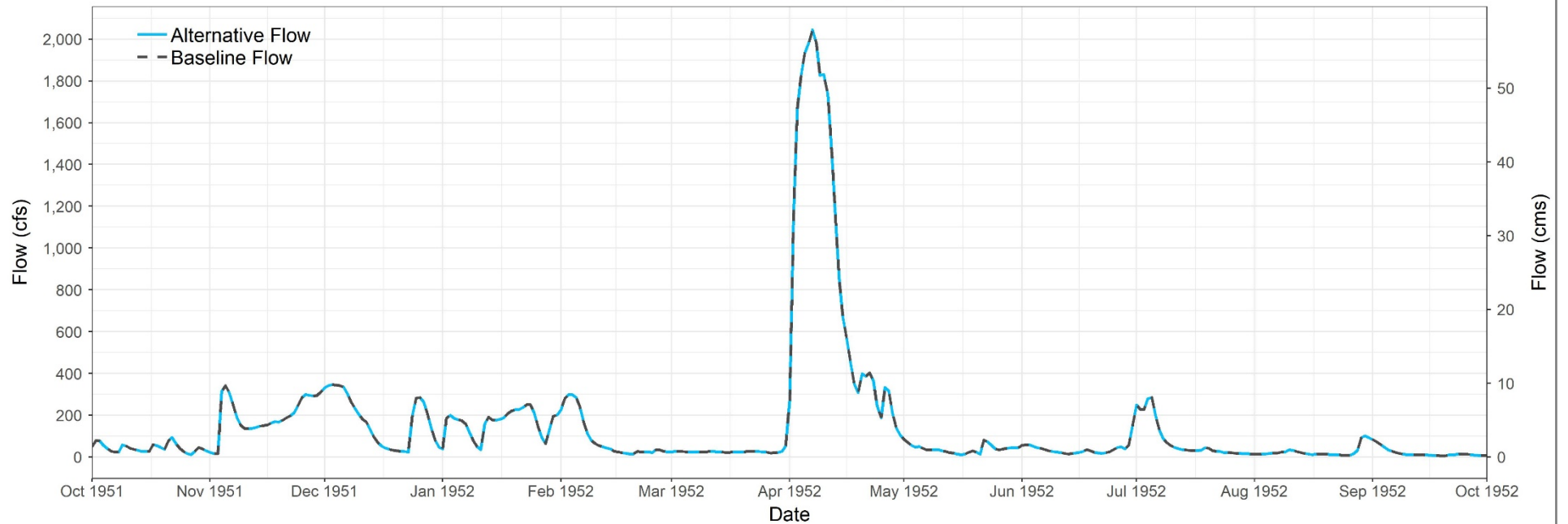
Souris River at Sherwood, ND



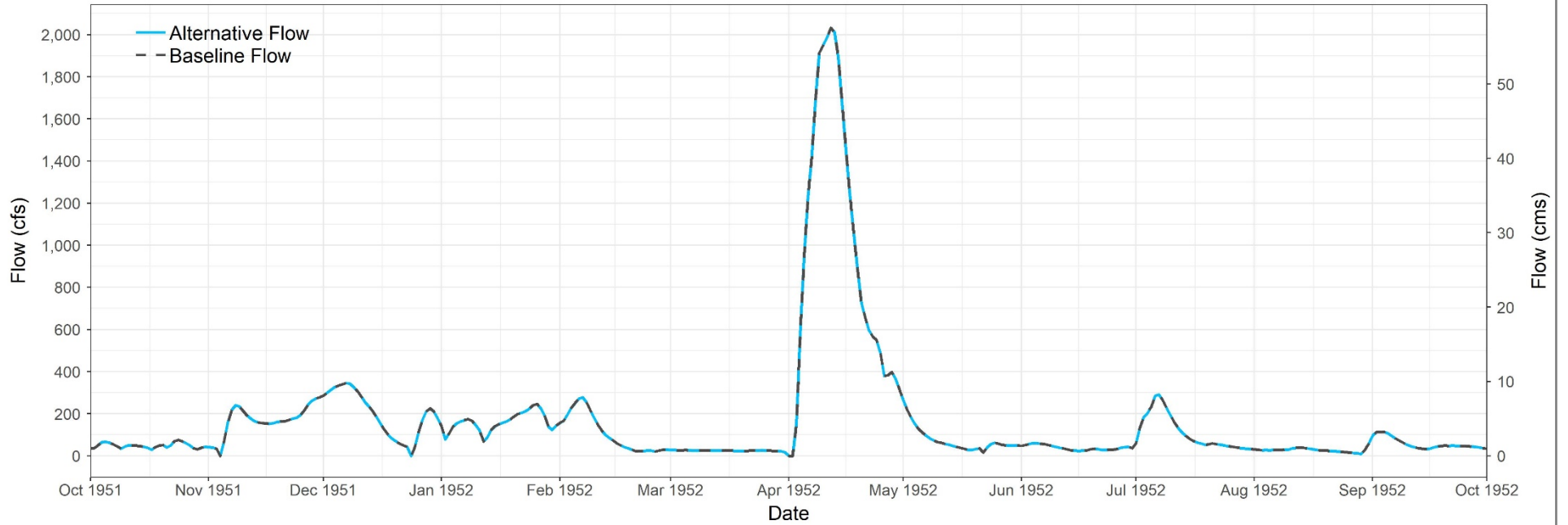
Souris River at Minot, ND - Flow



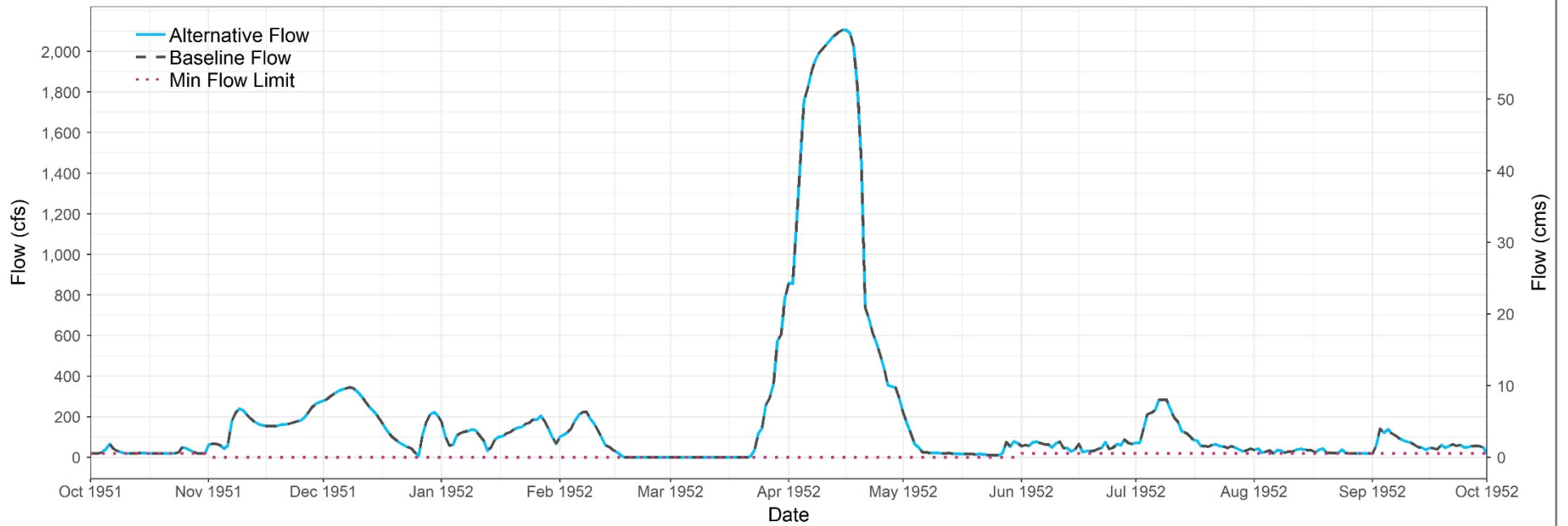
Souris River at Verendrye, ND



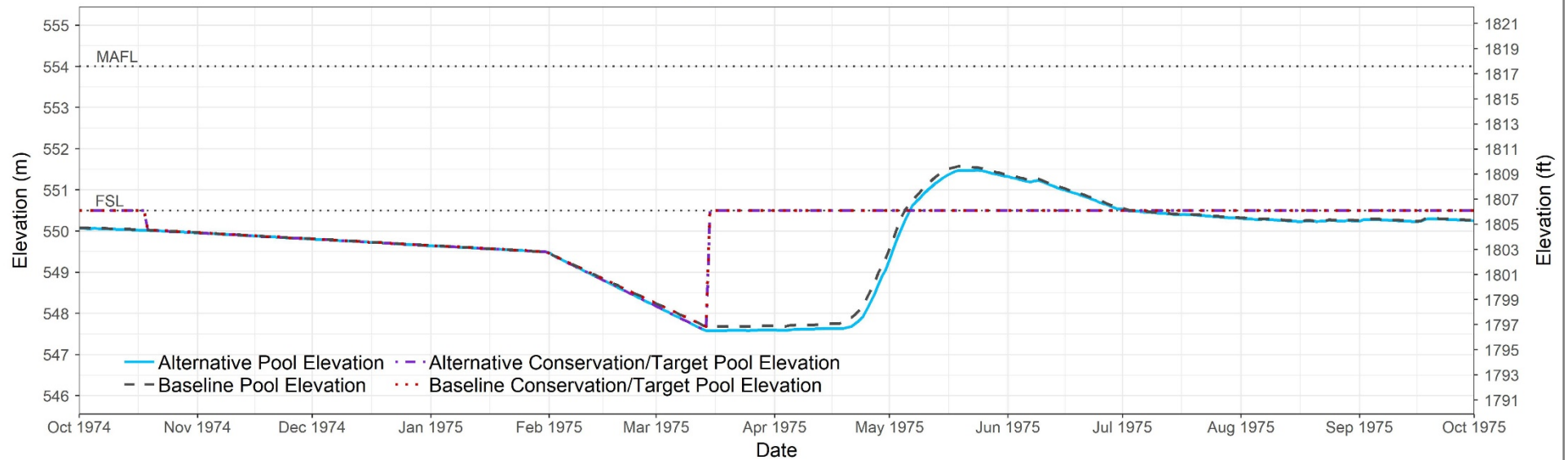
Souris River at Bantry, ND



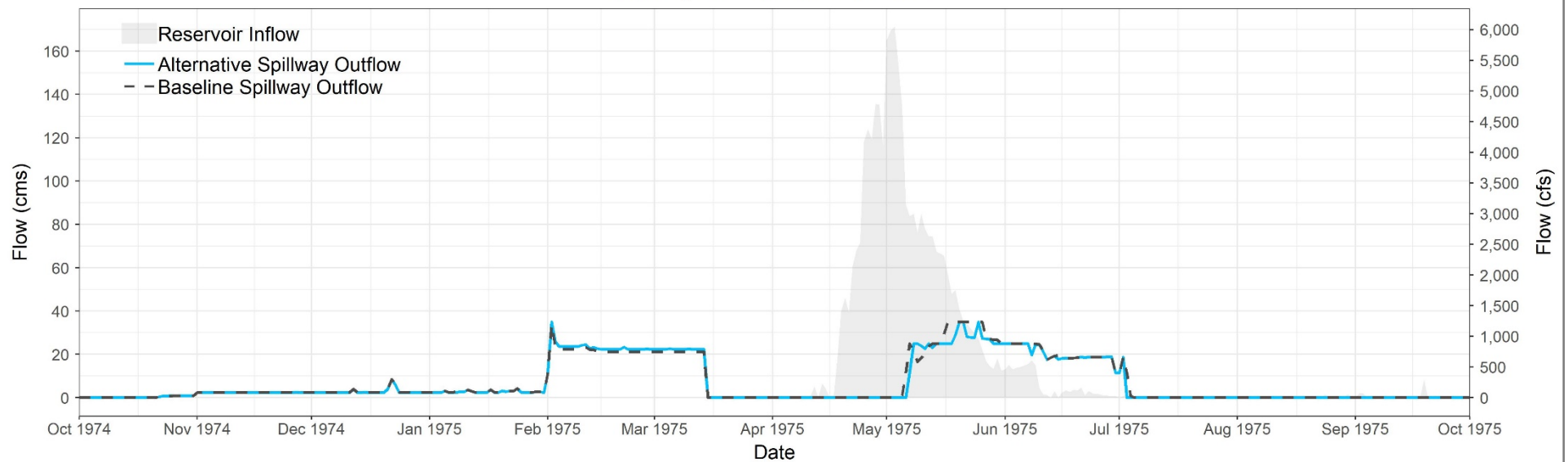
Souris River at Westhope, ND



Rafferty Reservoir - Elevation

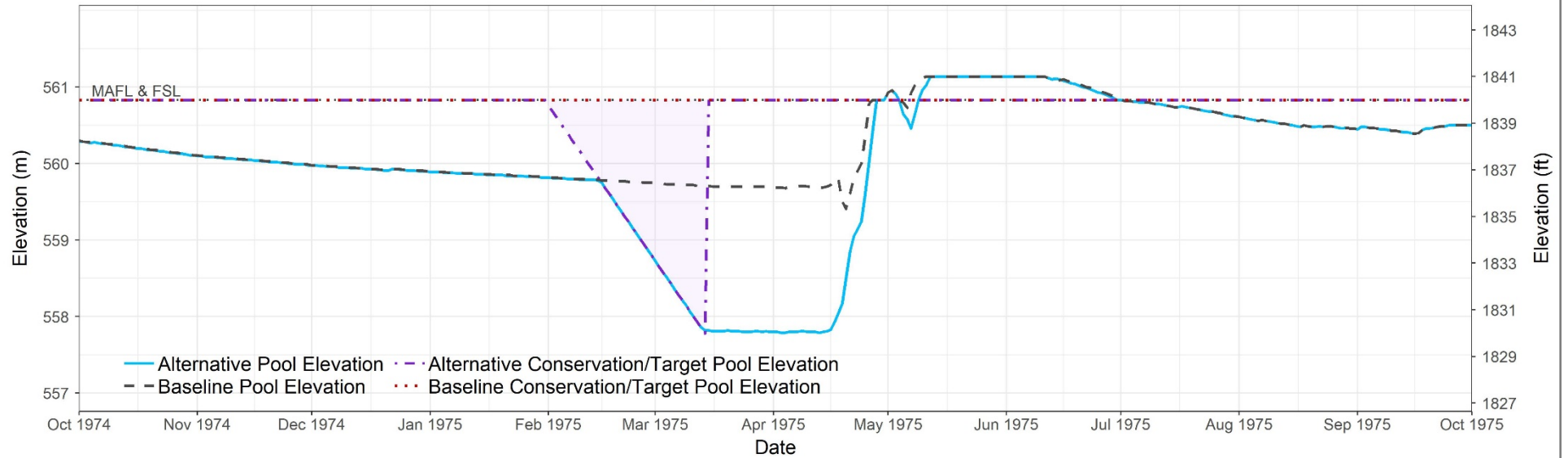


Rafferty Reservoir - Releases

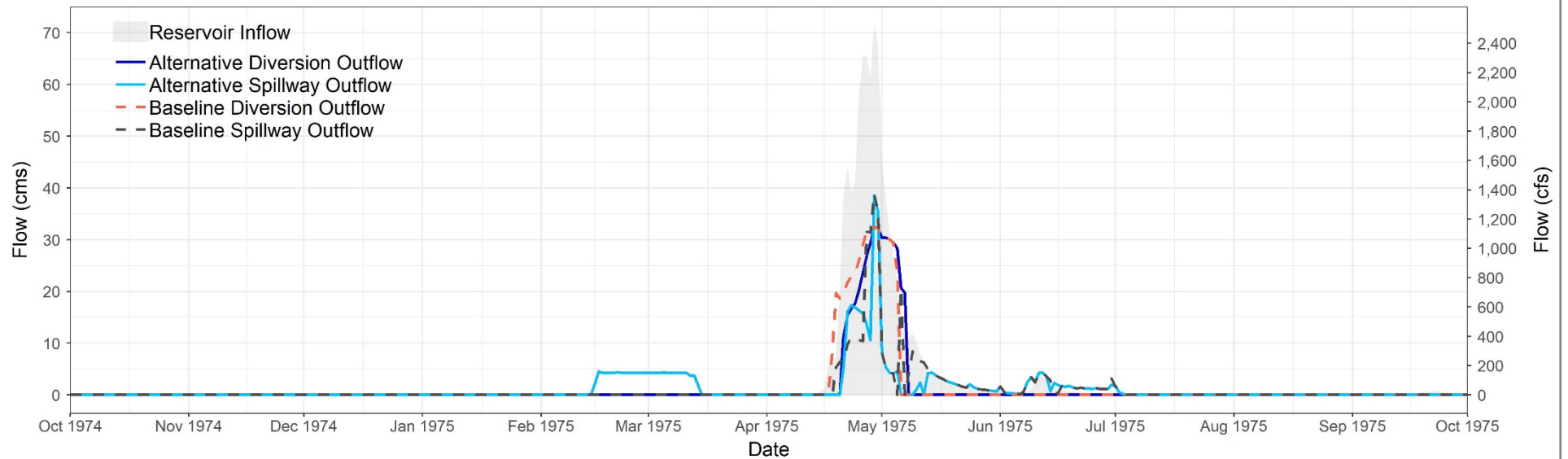


*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level

Boundary Reservoir - Elevation

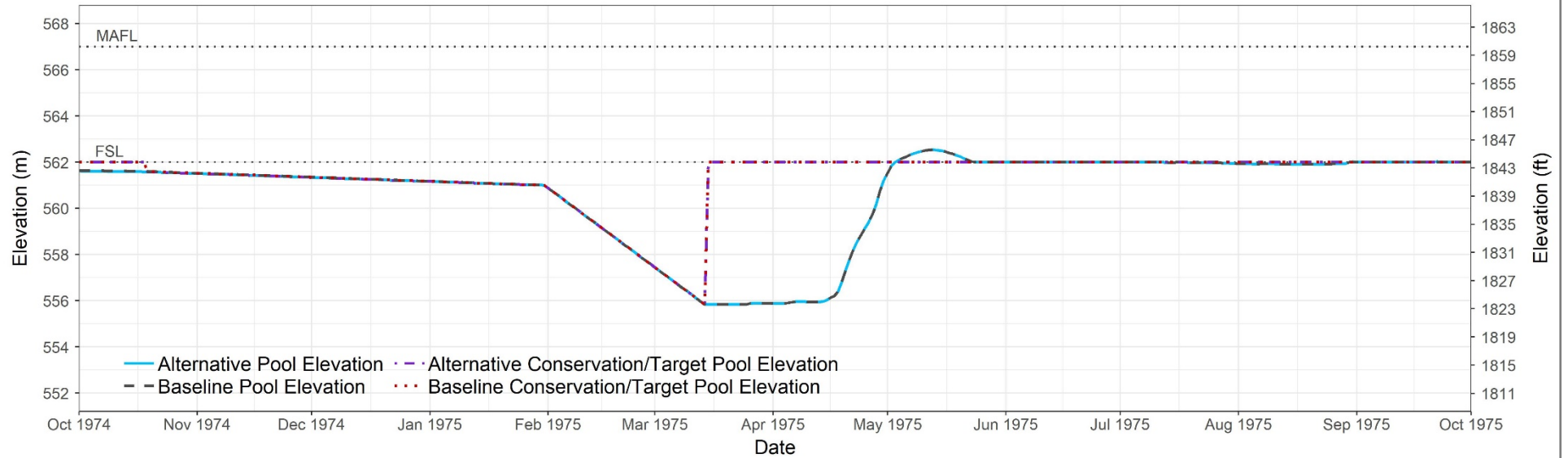


Boundary Reservoir - Releases

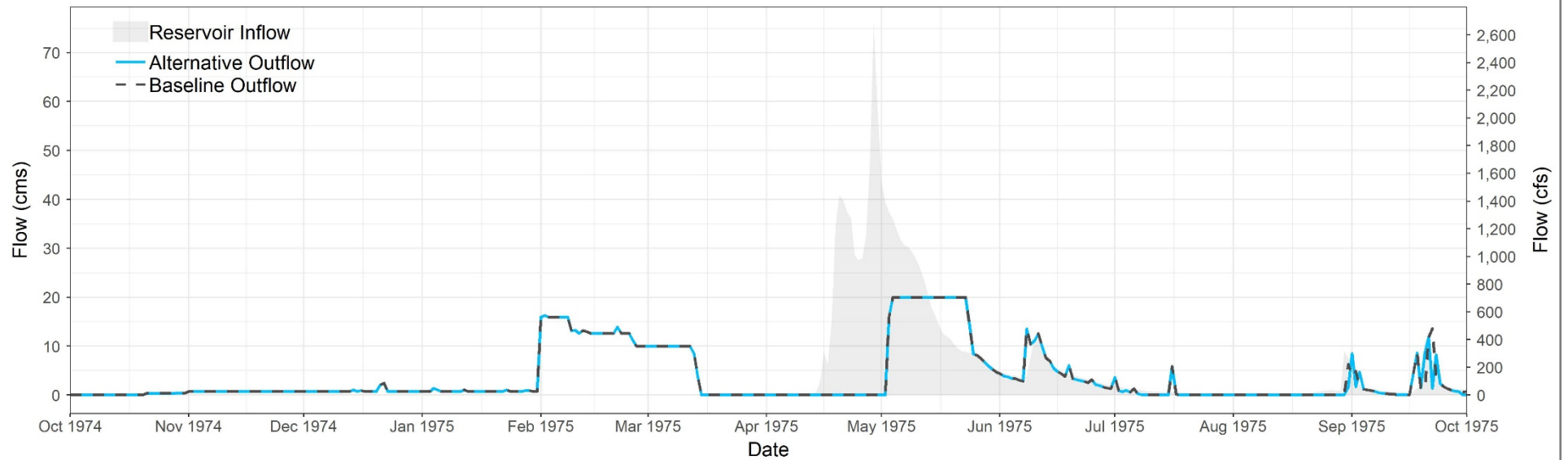


*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level

Grant Devine Reservoir - Elevation

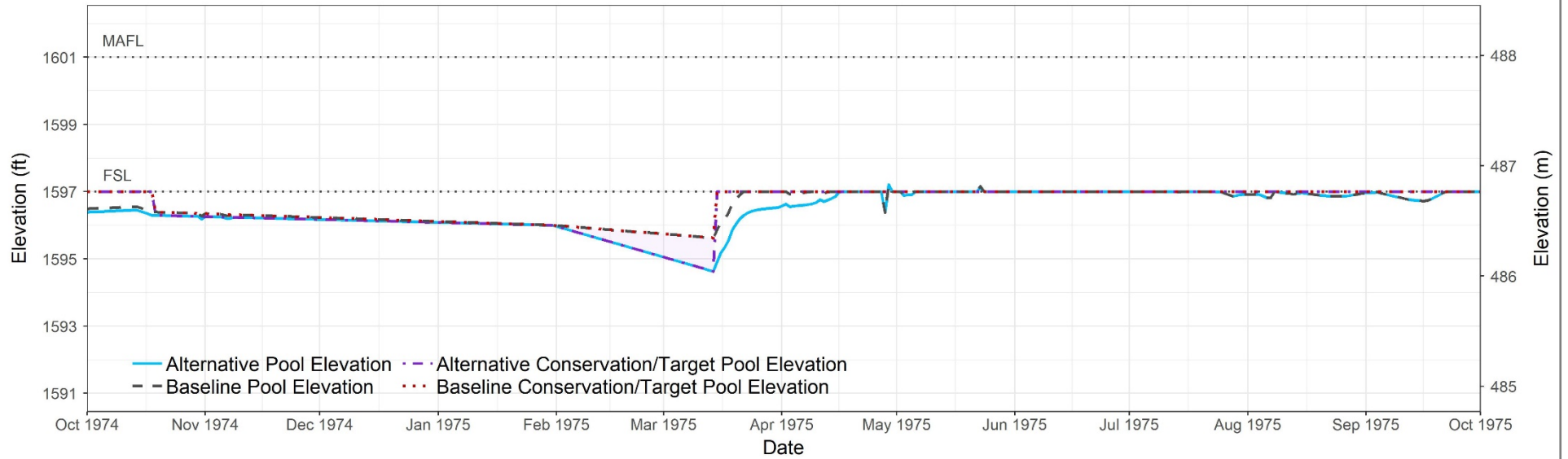


Grant Devine Reservoir - Releases

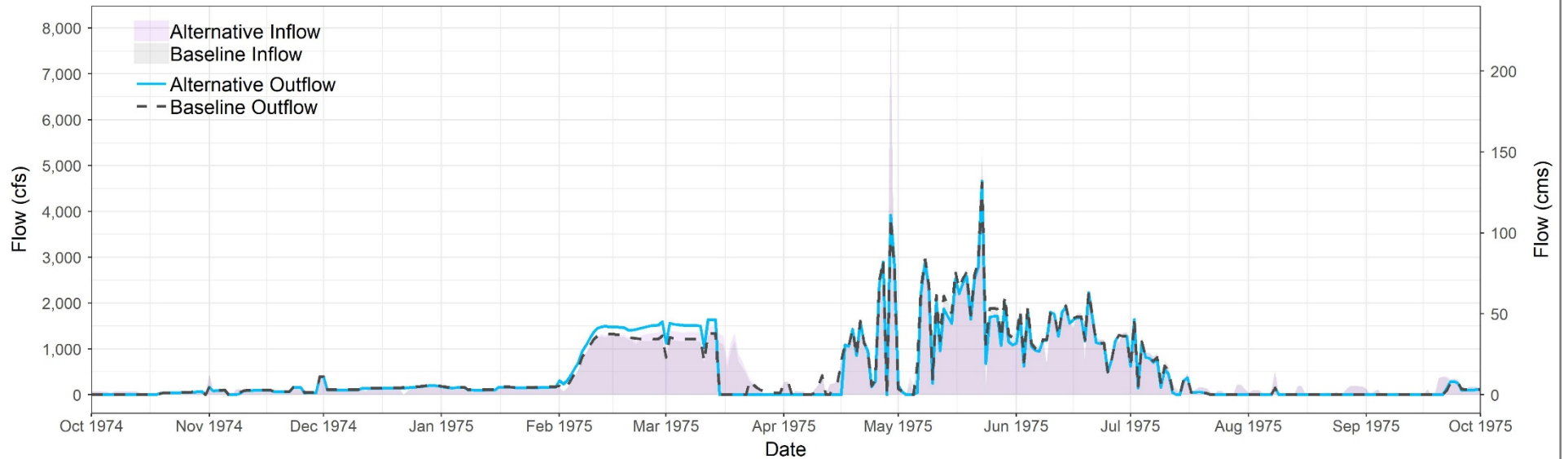


*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level

Lake Darling - Elevation



Lake Darling - Releases



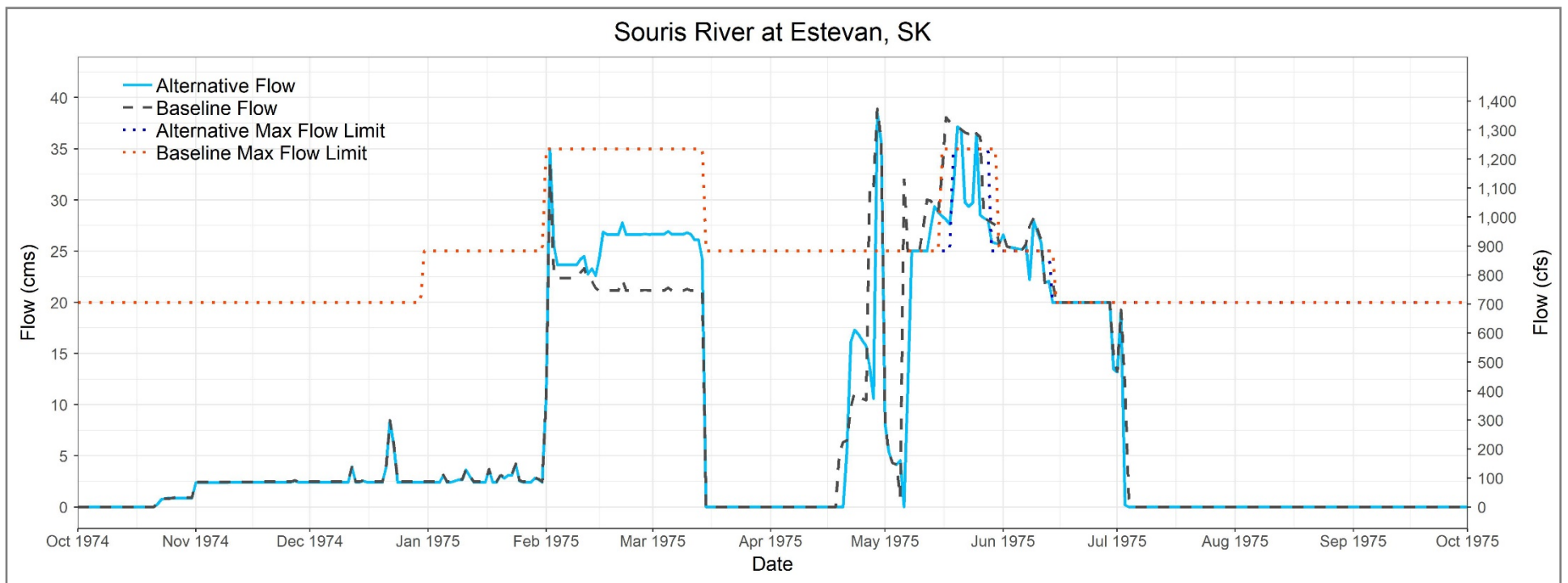
*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level, IDFSL = Inflow Design Flood Supply Level

Plate 22

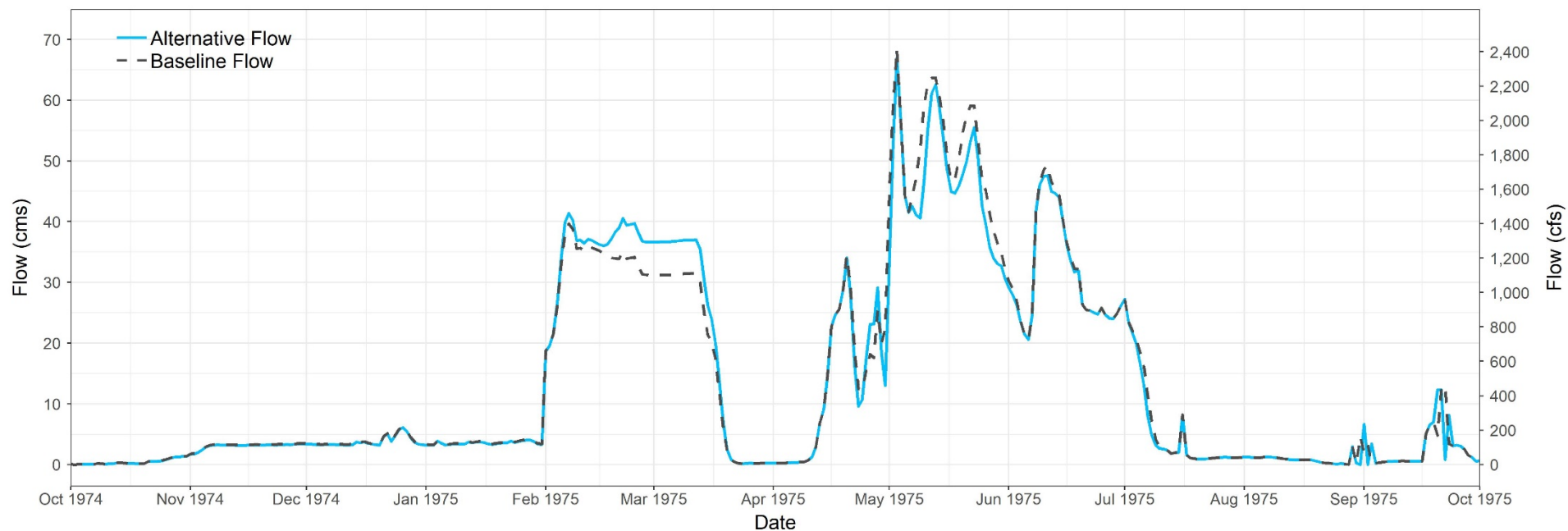
Critical Flow Locations – 1975

Alternative 10bL (Phase 2)

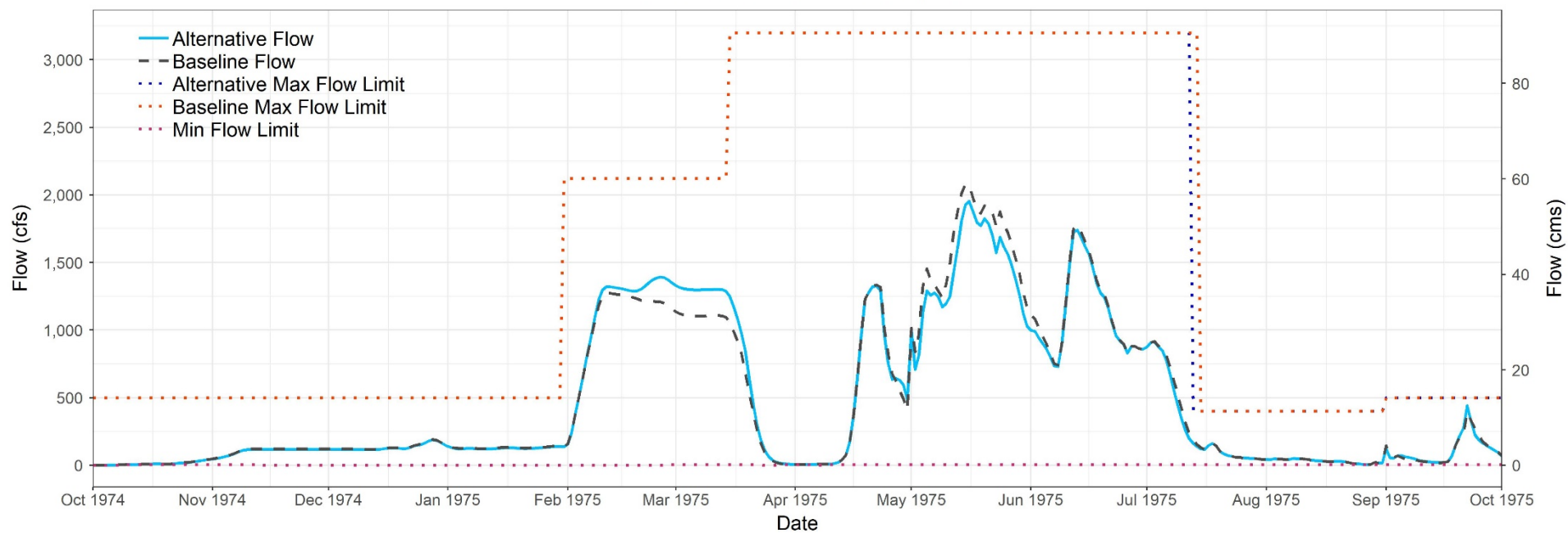
Souris River Plan of Study



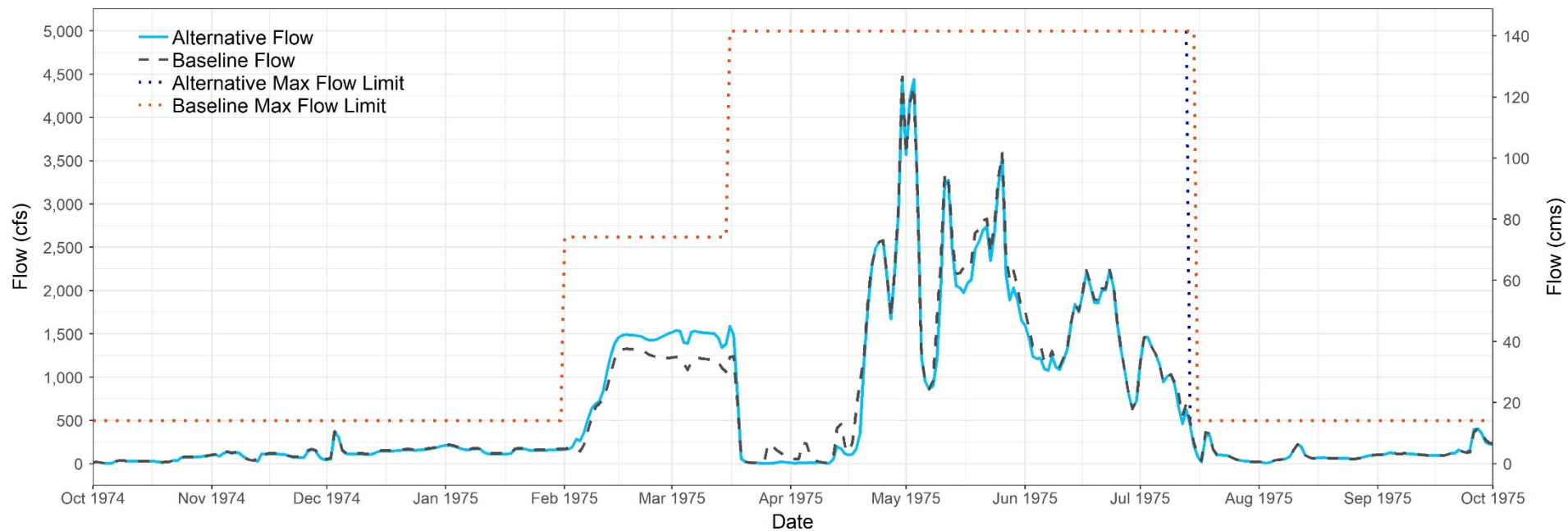
Souris River at Oxbow, SK



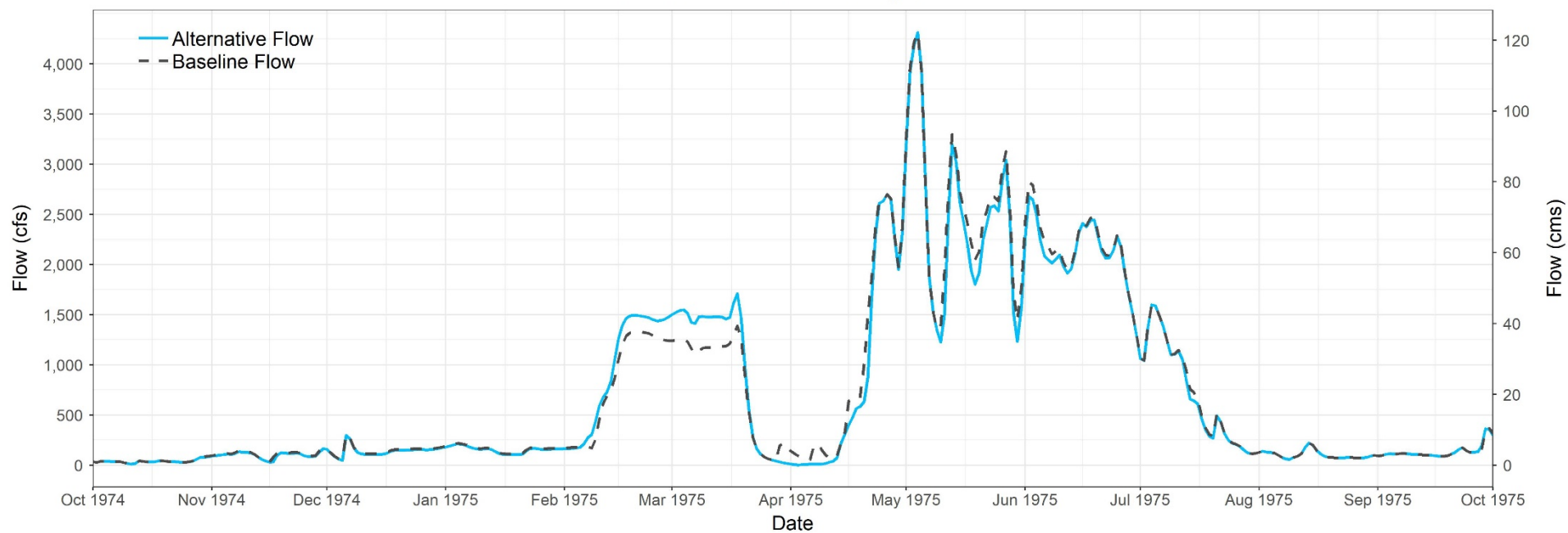
Souris River at Sherwood, ND



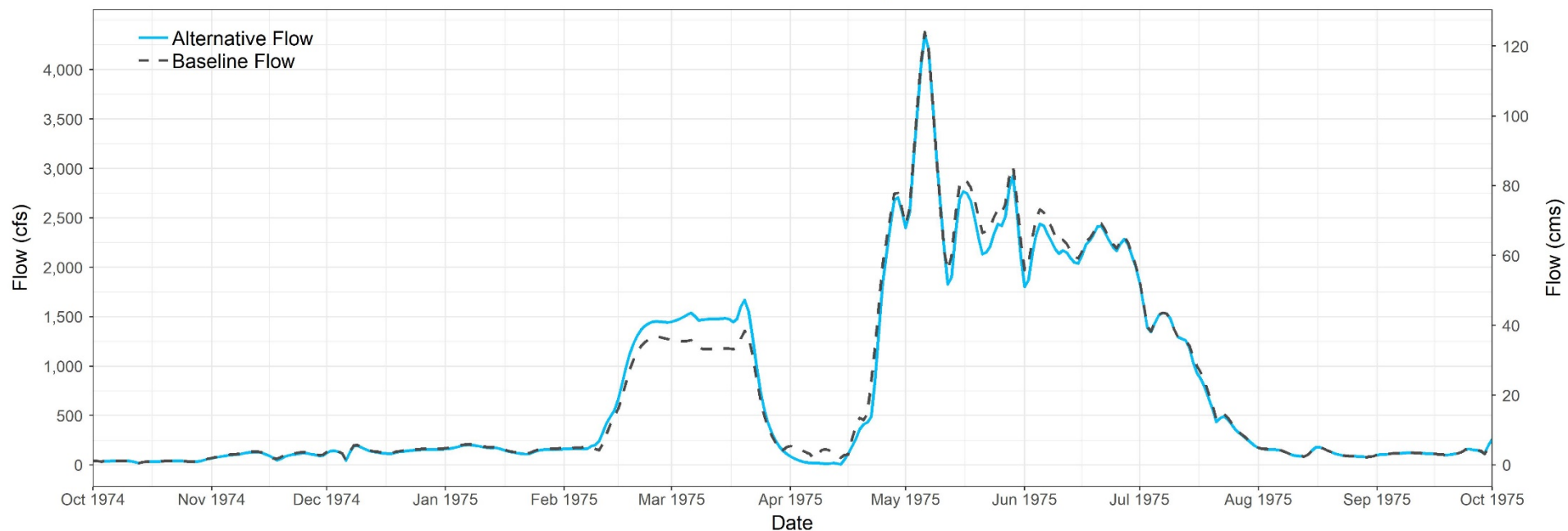
Souris River at Minot, ND - Flow



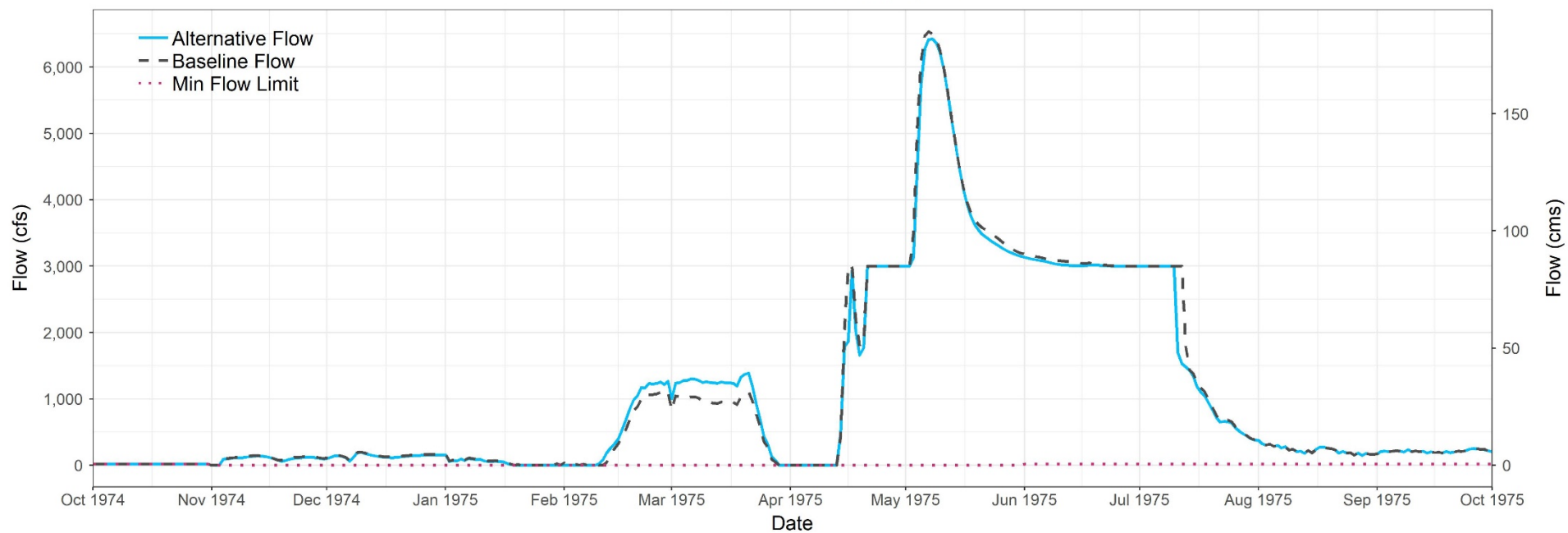
Souris River at Verendrye, ND



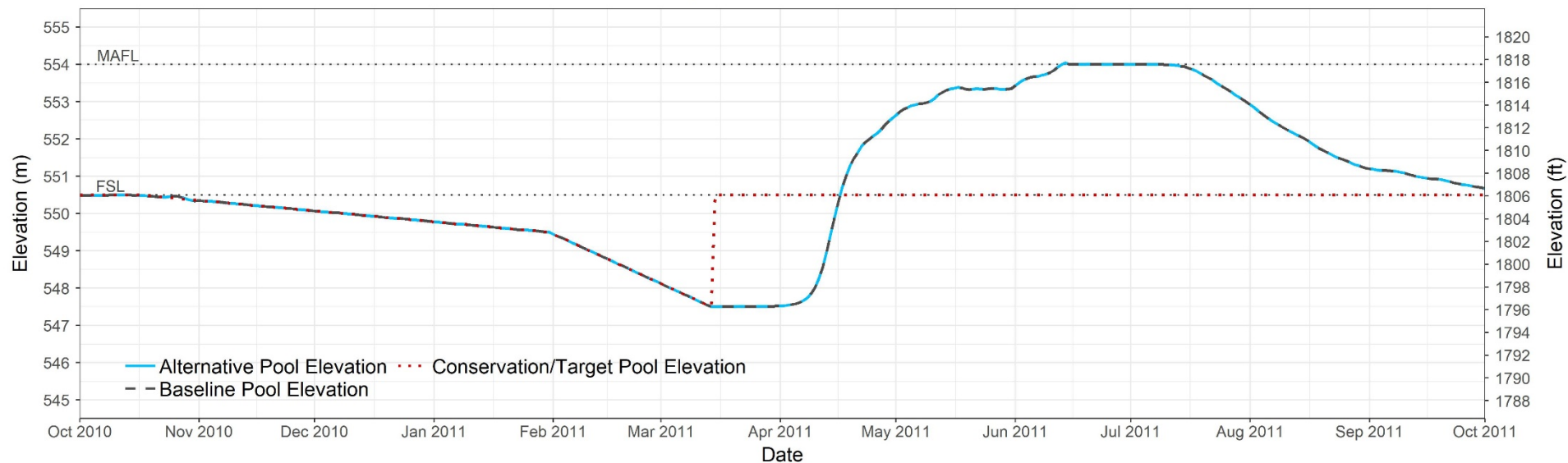
Souris River at Bantry, ND



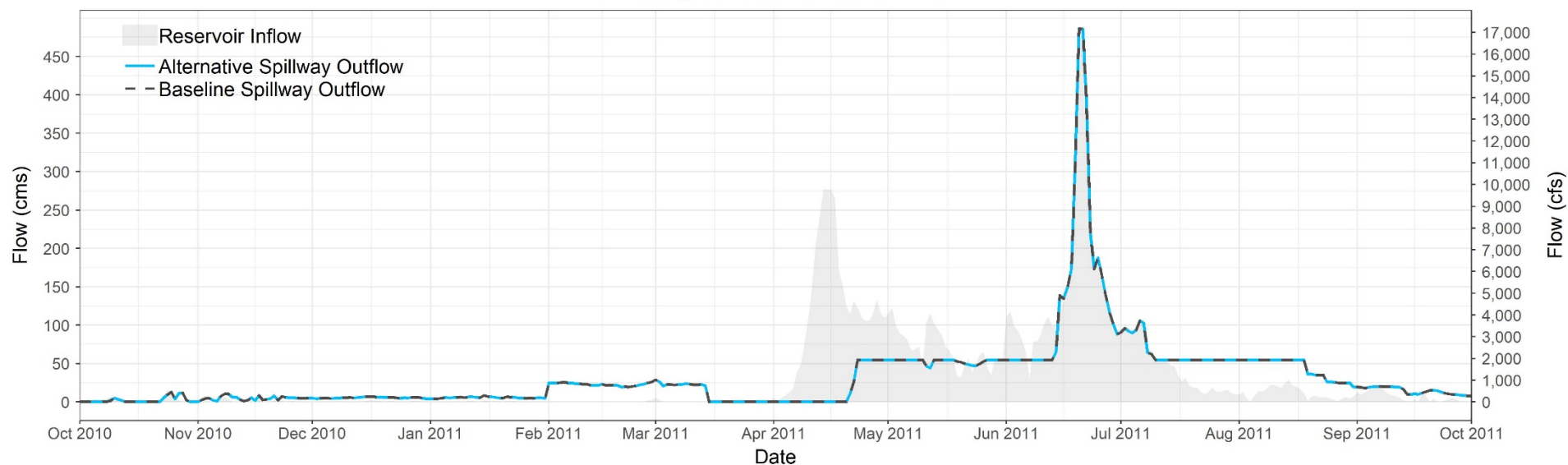
Souris River at Westhope, ND



Rafferty Reservoir - Elevation

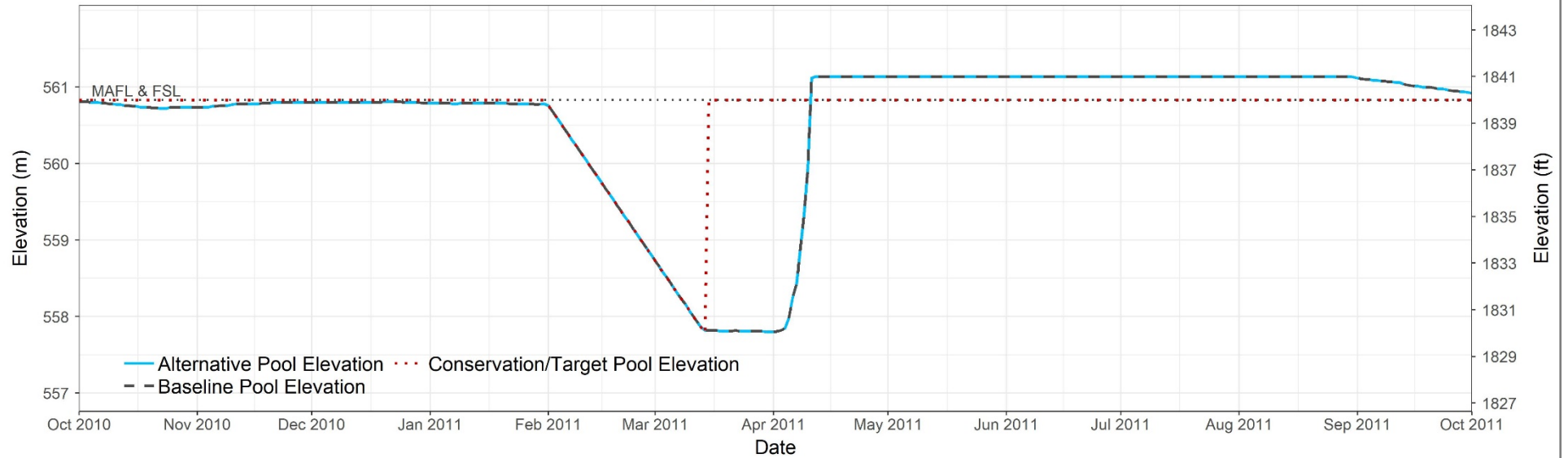


Rafferty Reservoir - Releases

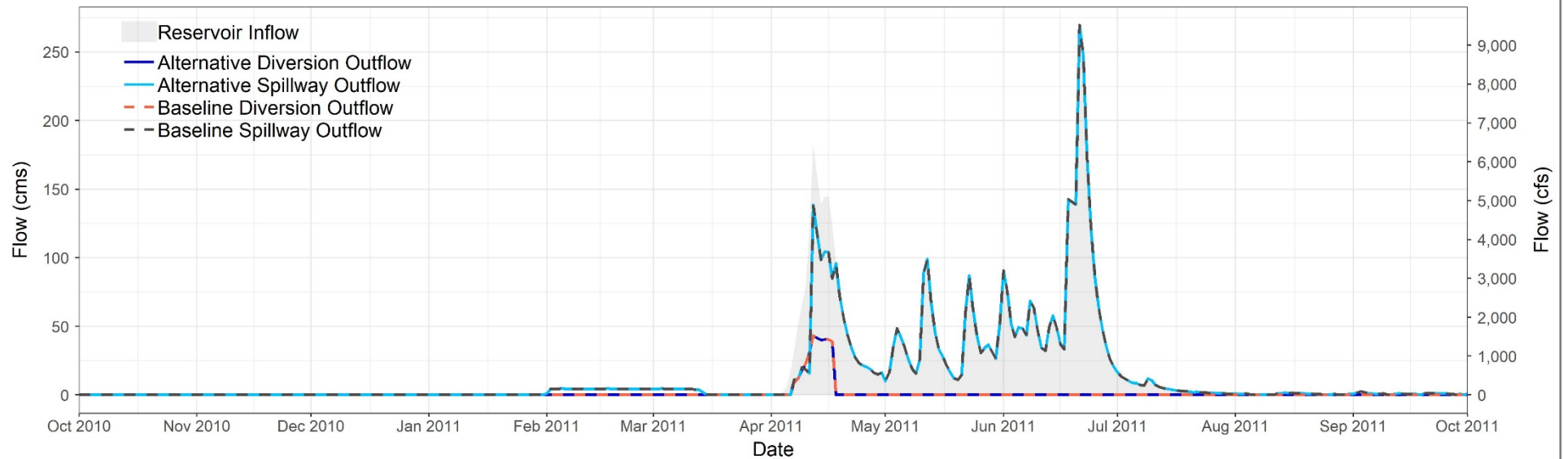


*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level

Boundary Reservoir - Elevation

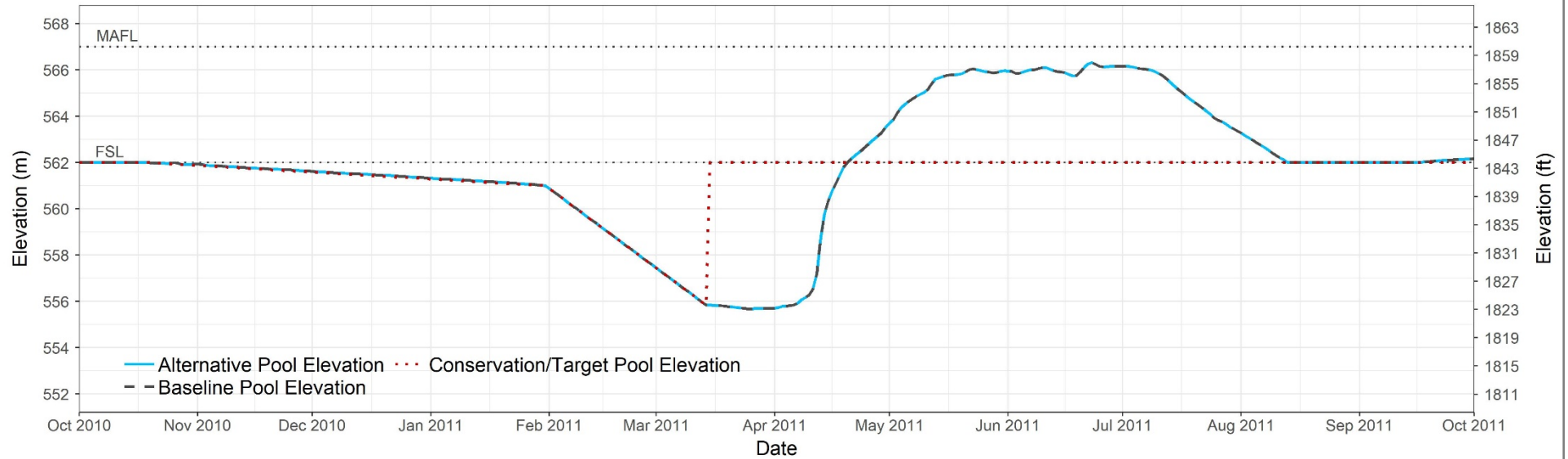


Boundary Reservoir - Releases

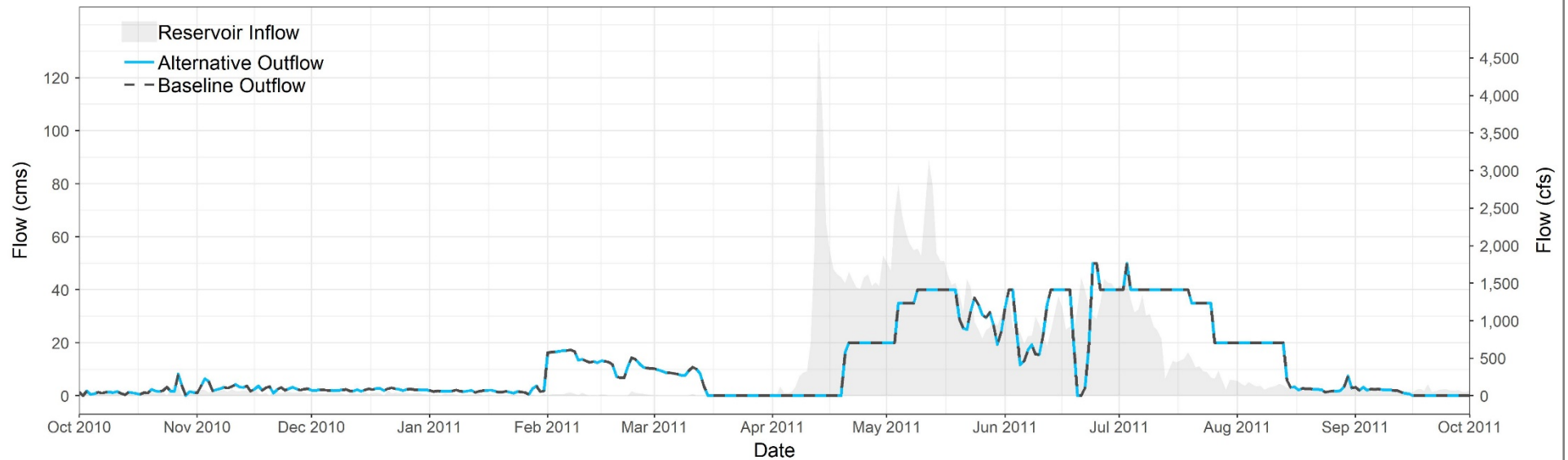


*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level

Grant Devine Reservoir - Elevation

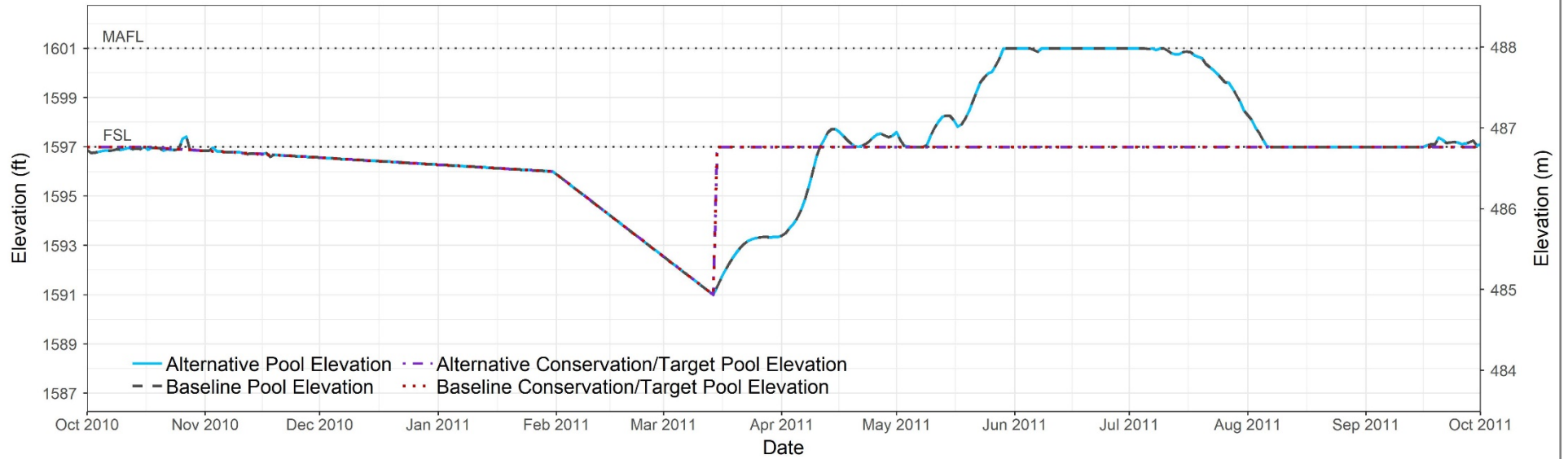


Grant Devine Reservoir - Releases

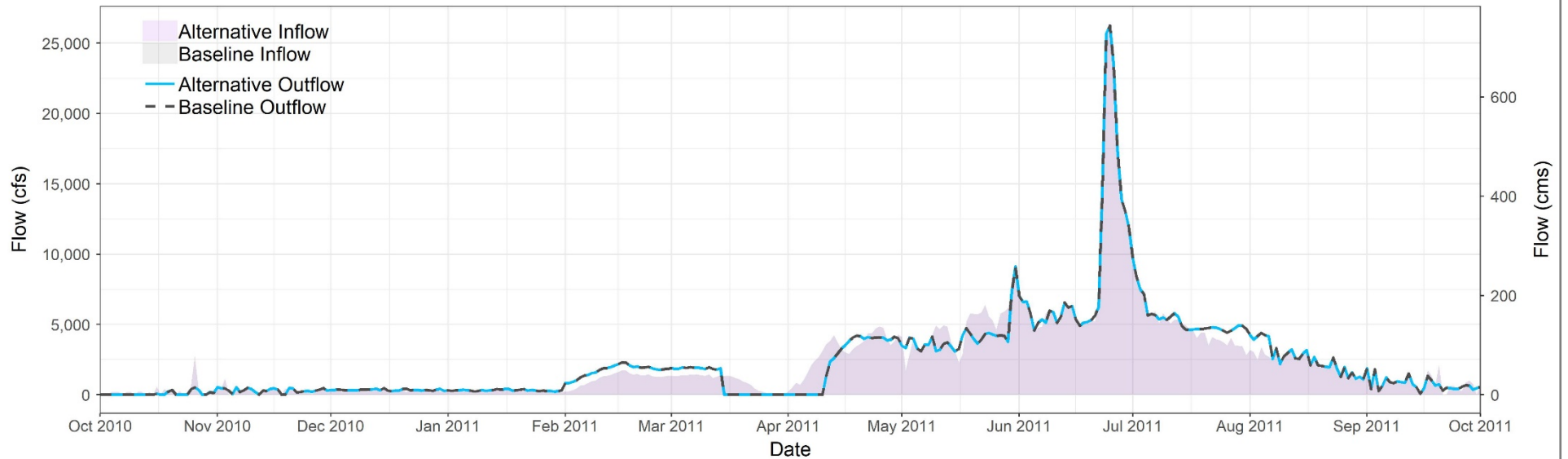


*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level

Lake Darling - Elevation



Lake Darling - Releases



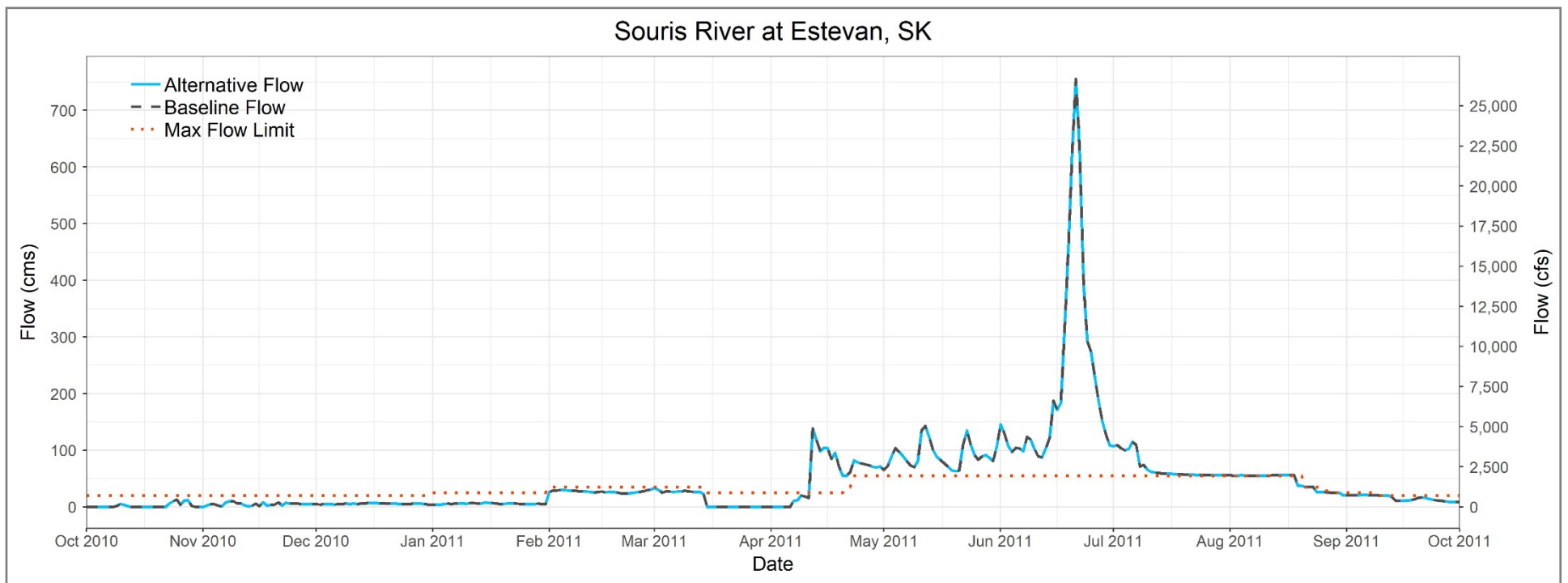
*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level, IDFSL = Inflow Design Flood Supply Level

Plate 24

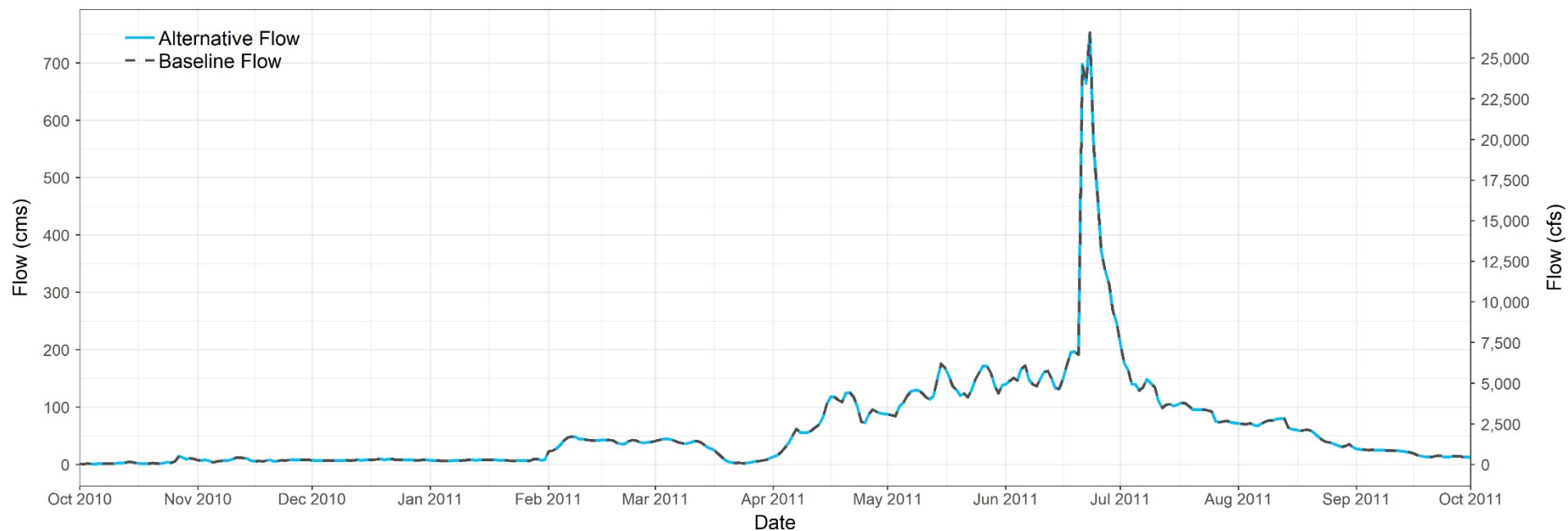
Critical Flow Locations – 2011

Alternative 10bL (Phase 2)

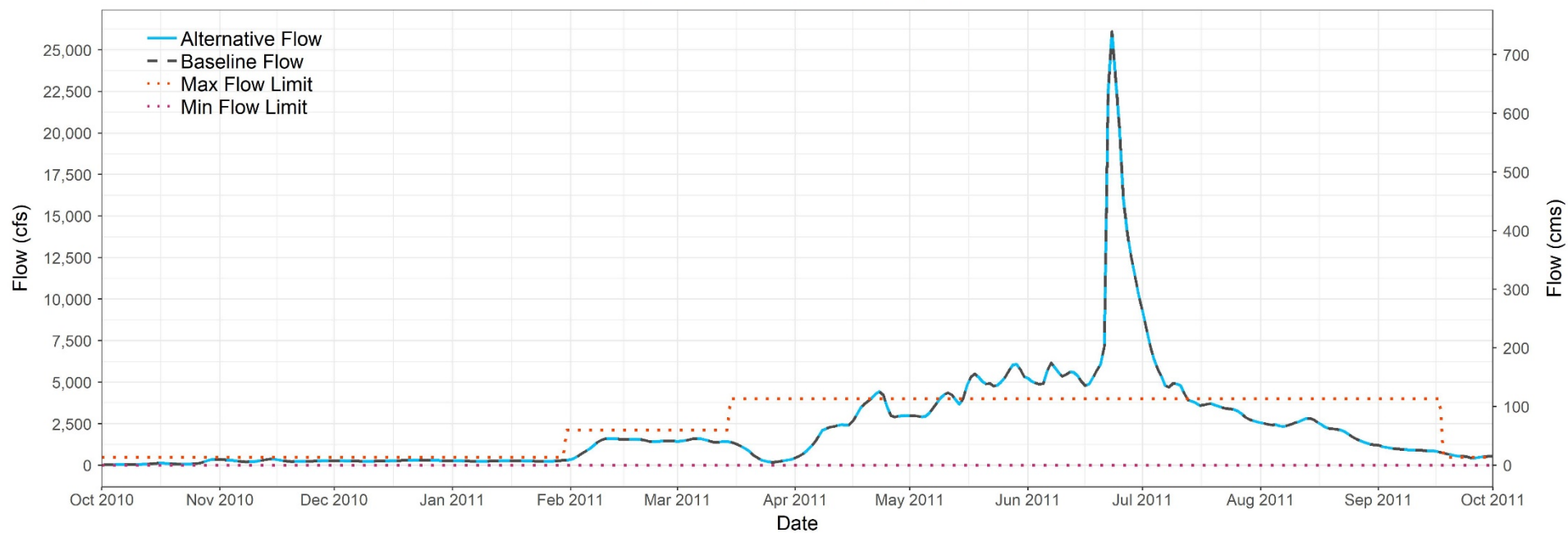
Souris River Plan of Study



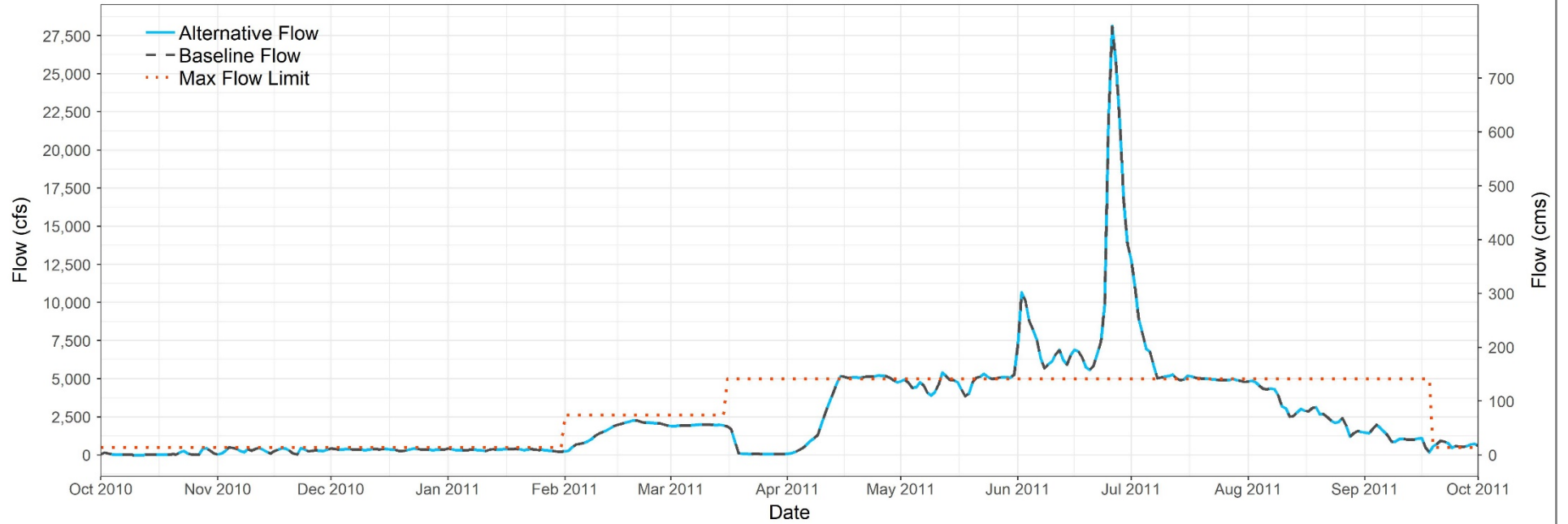
Souris River at Oxbow, SK



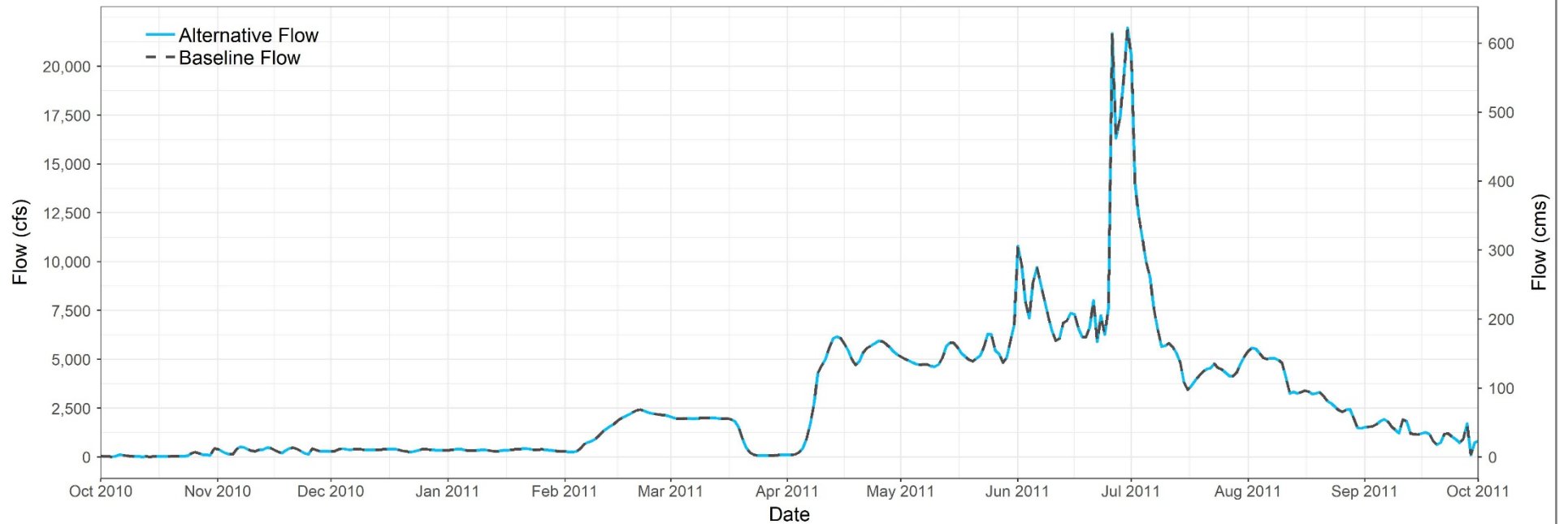
Souris River at Sherwood, ND



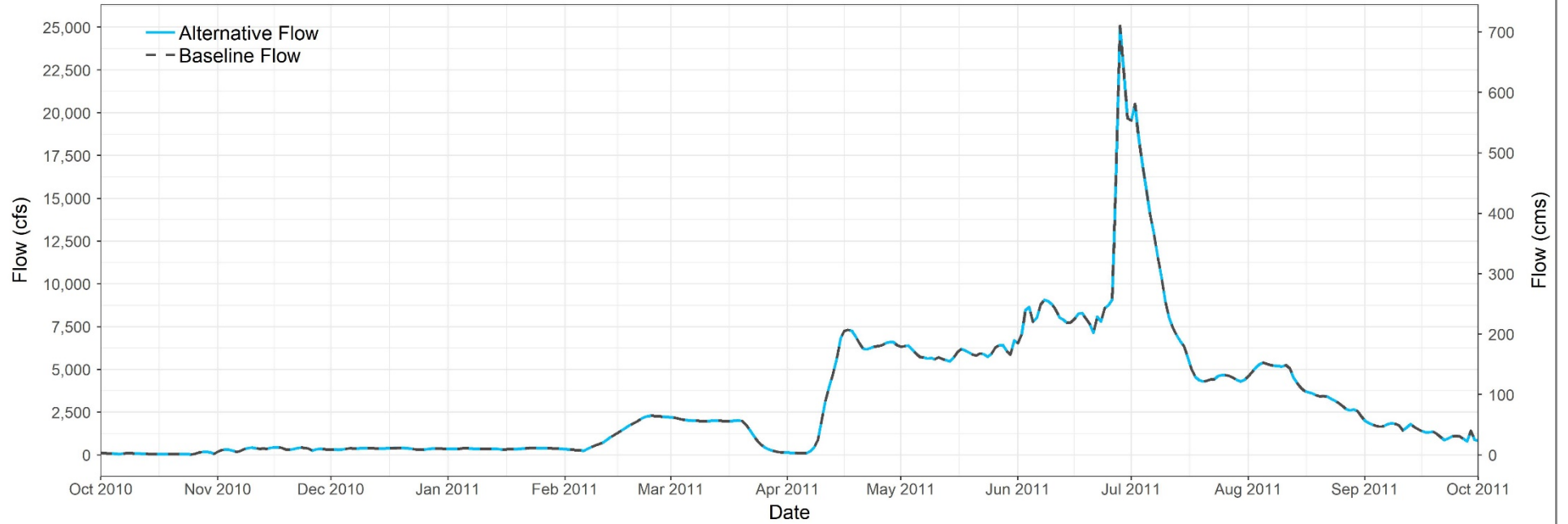
Souris River at Minot, ND - Flow



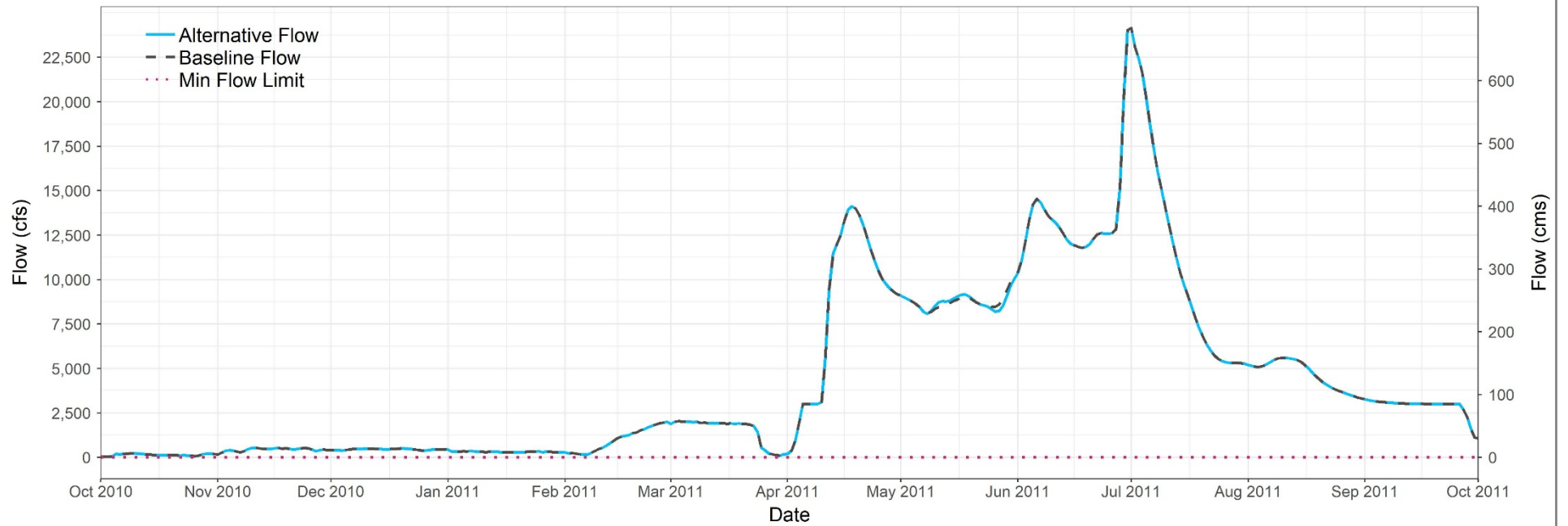
Souris River at Verendrye, ND



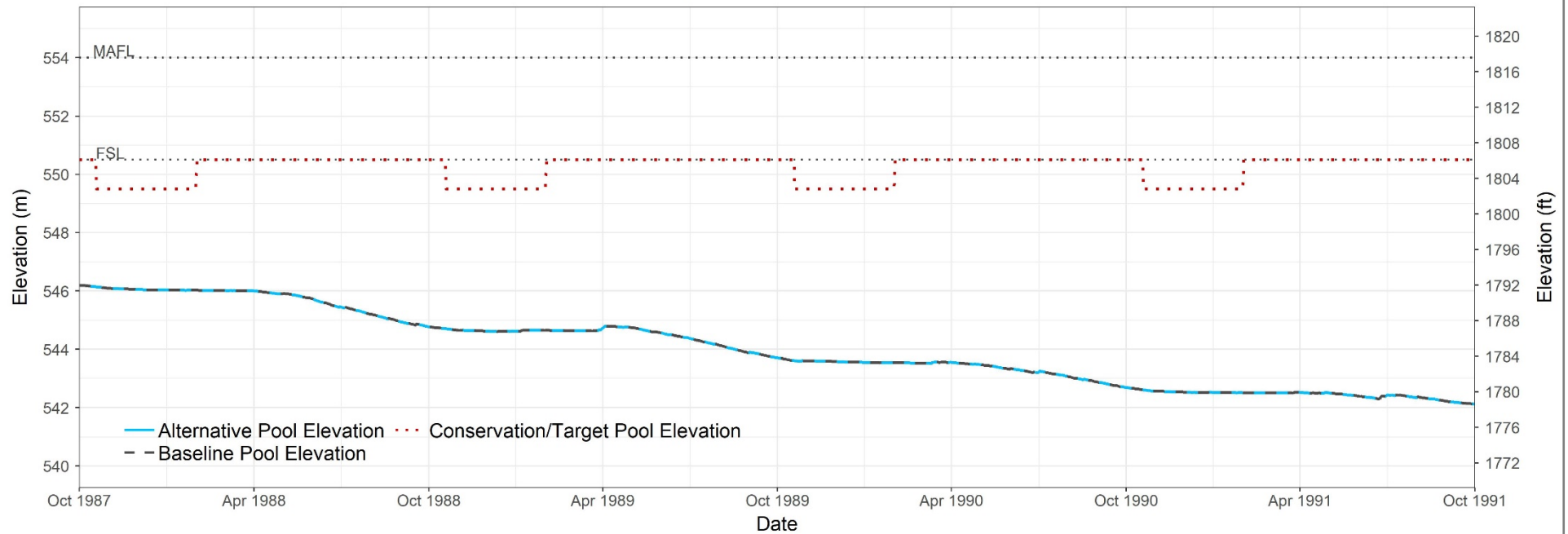
Souris River at Bantry, ND



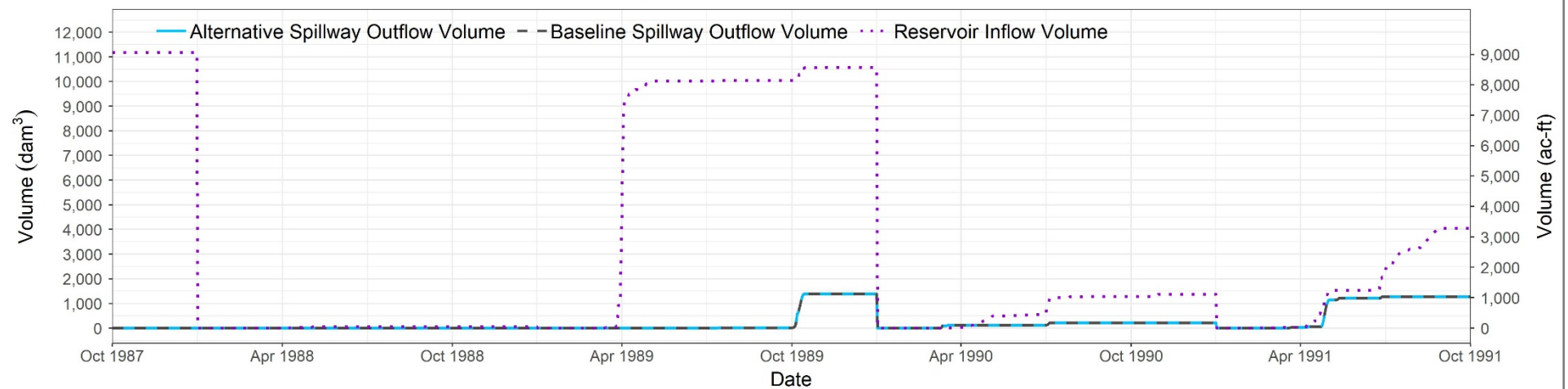
Souris River at Westhope, ND



Rafferty Reservoir - Elevation

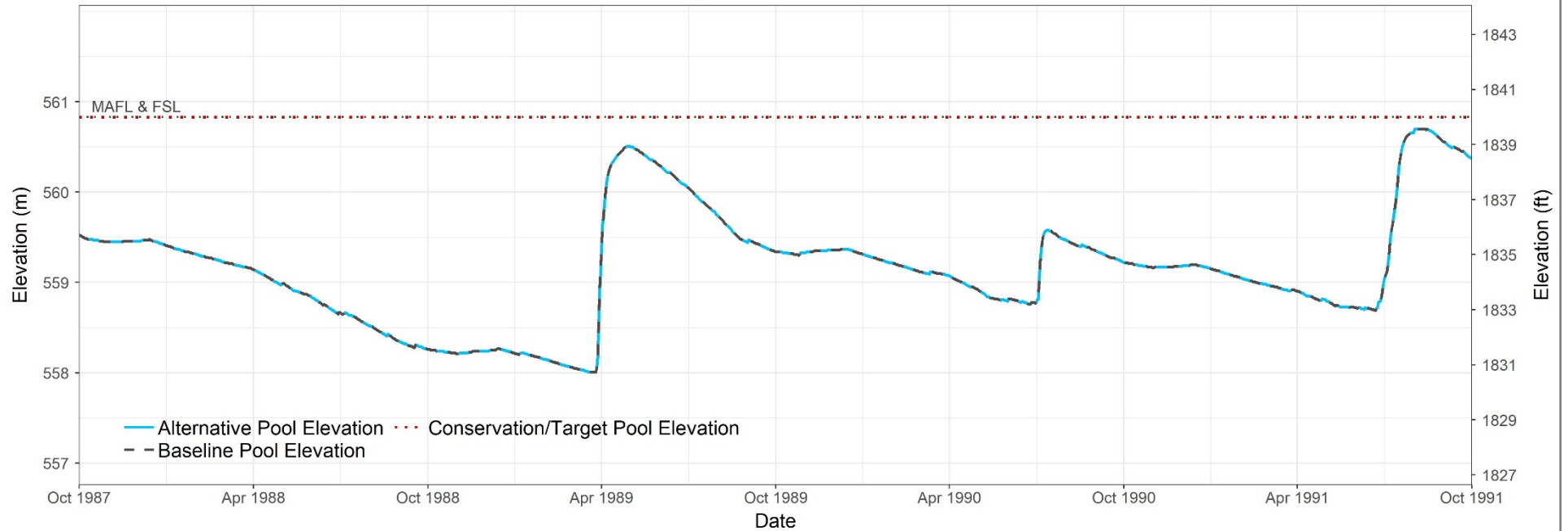


Rafferty Reservoir - Cumulative Volume

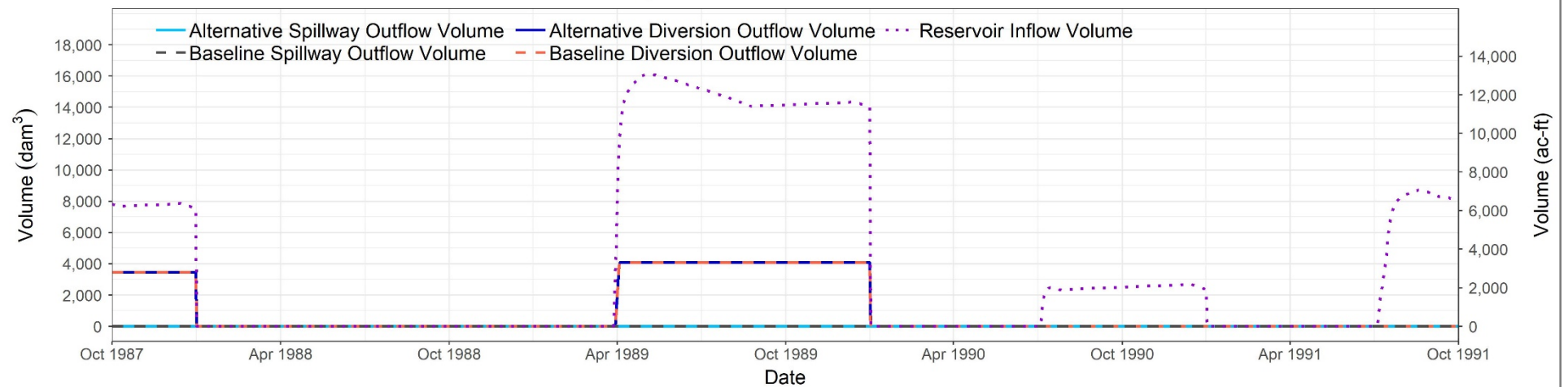


*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level

Boundary Reservoir - Elevation

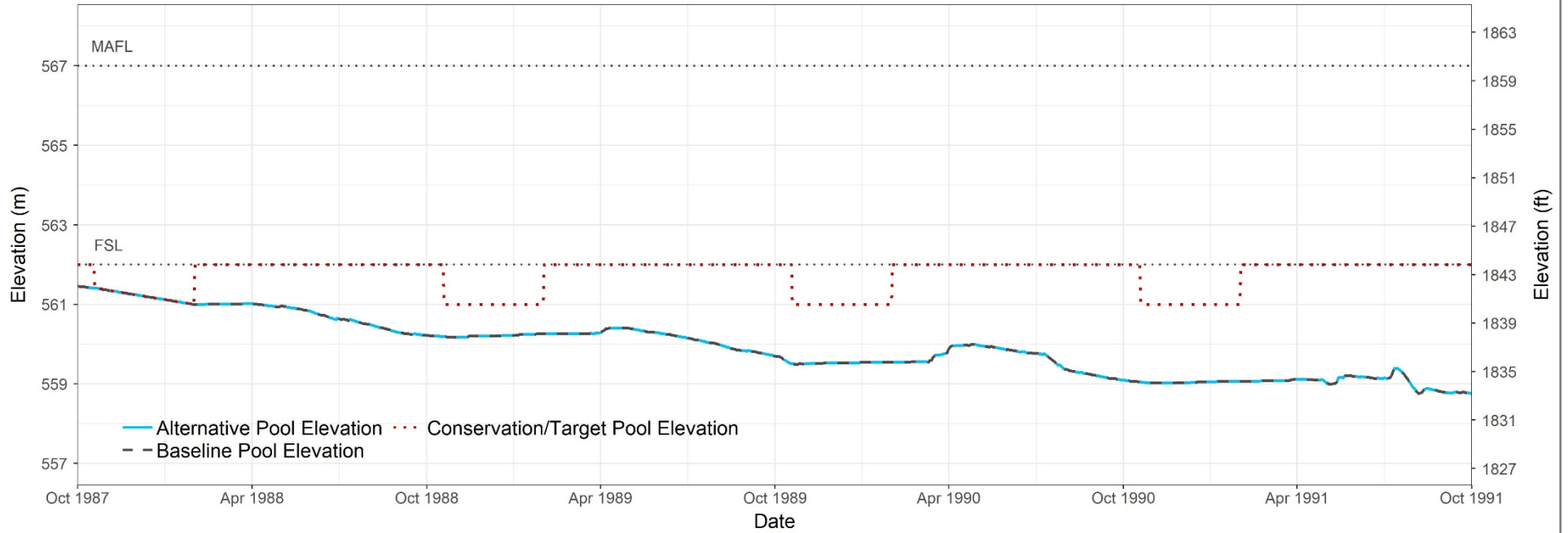


Boundary Reservoir - Cumulative Volume

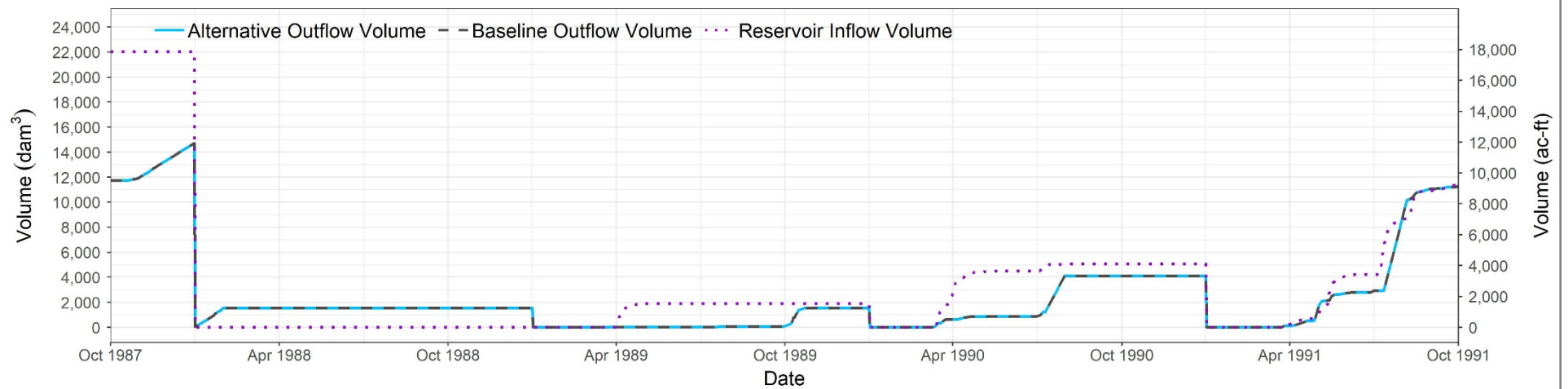


*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level

Grant Devine Reservoir - Elevation

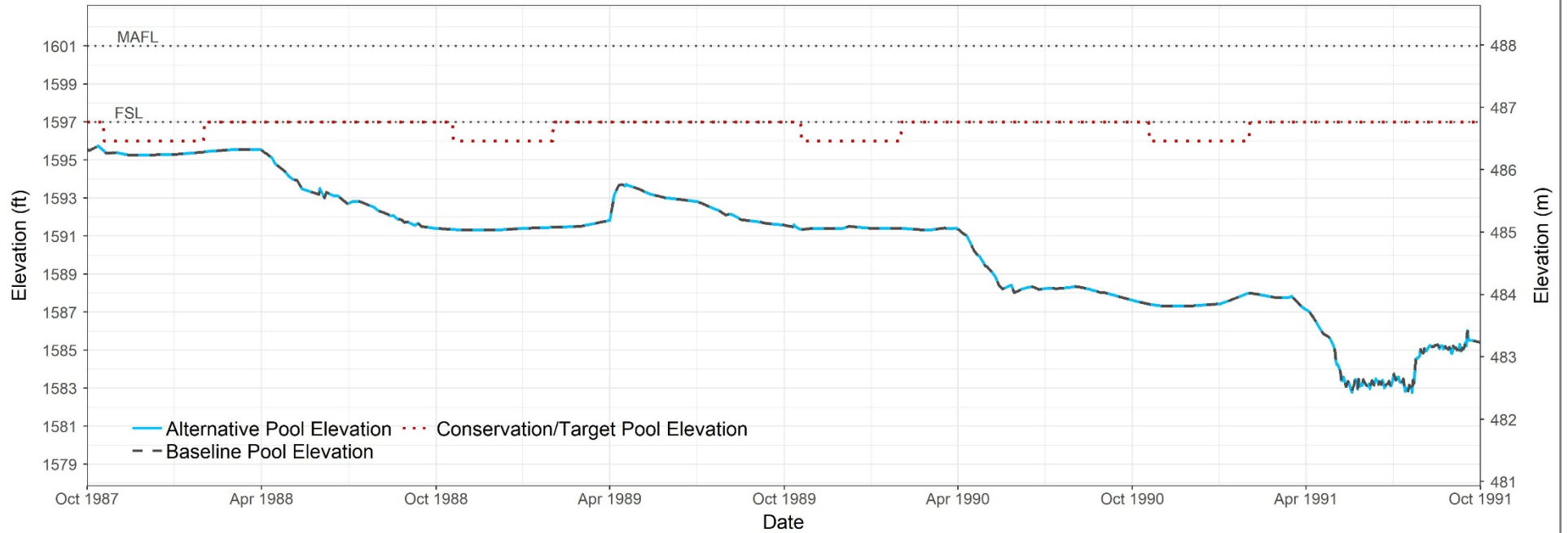


Grant Devine Reservoir - Cumulative Volume

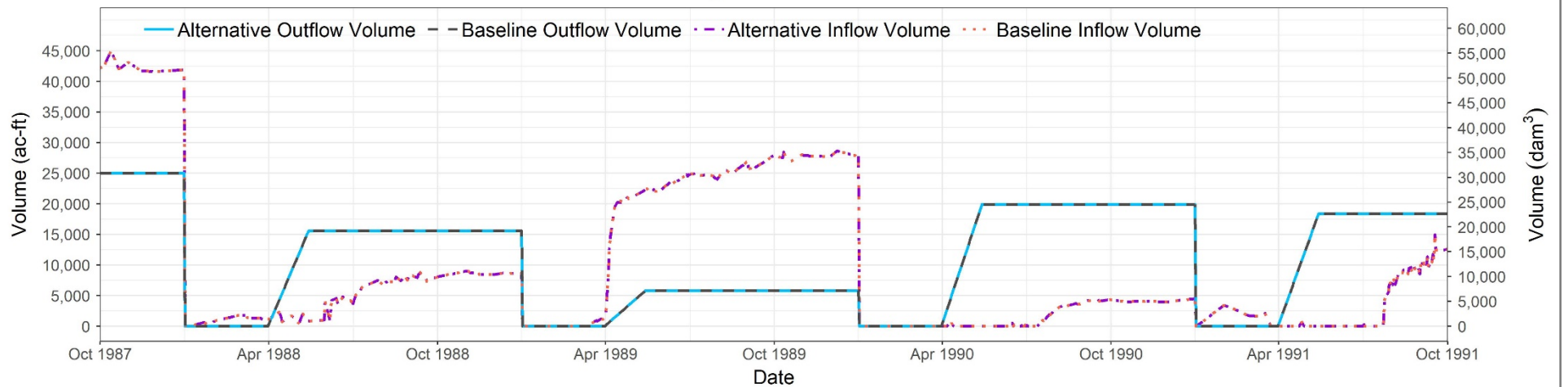


*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level

Lake Darling - Elevation



Lake Darling - Cumulative Volume



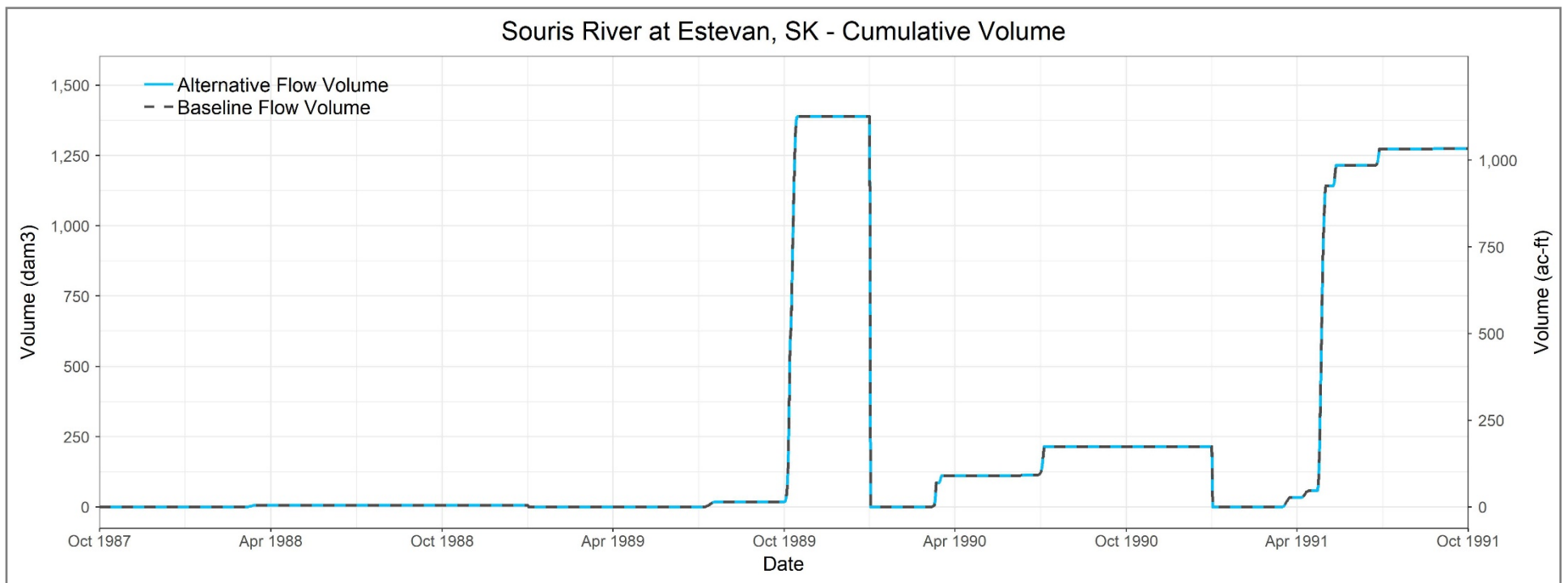
*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level, IDFSL = Inflow Design Flood Supply Level

Plate 26

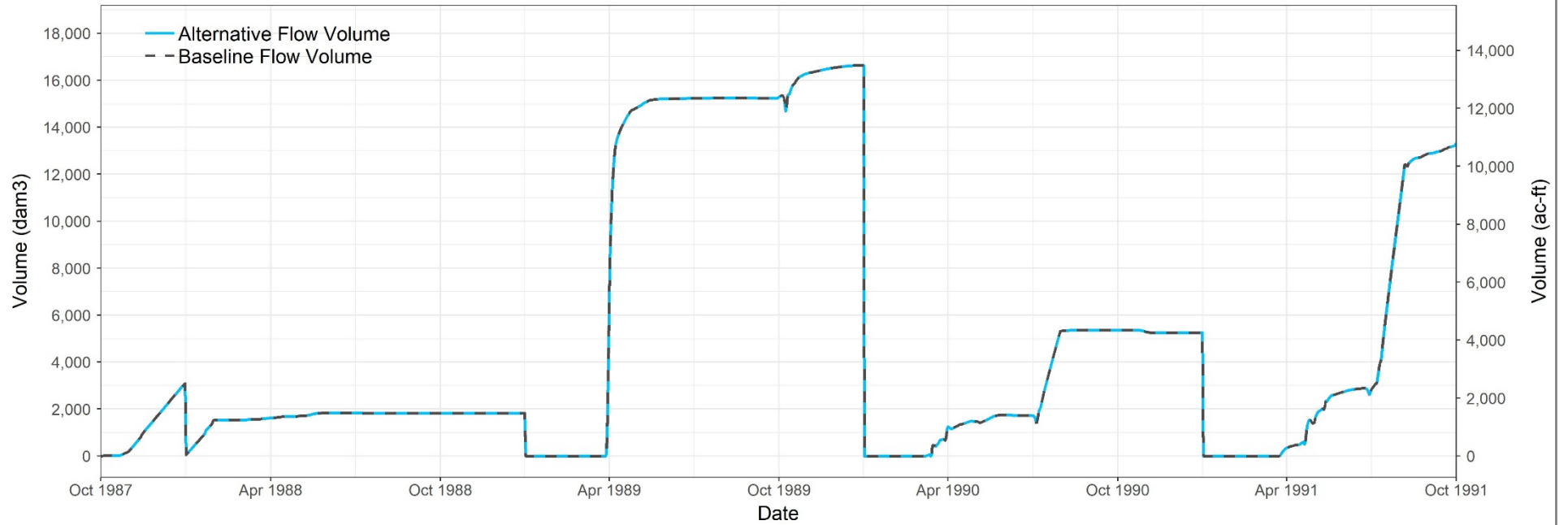
Critical Flow Locations – 1988-1991

Alternative 10bL (Phase 2)

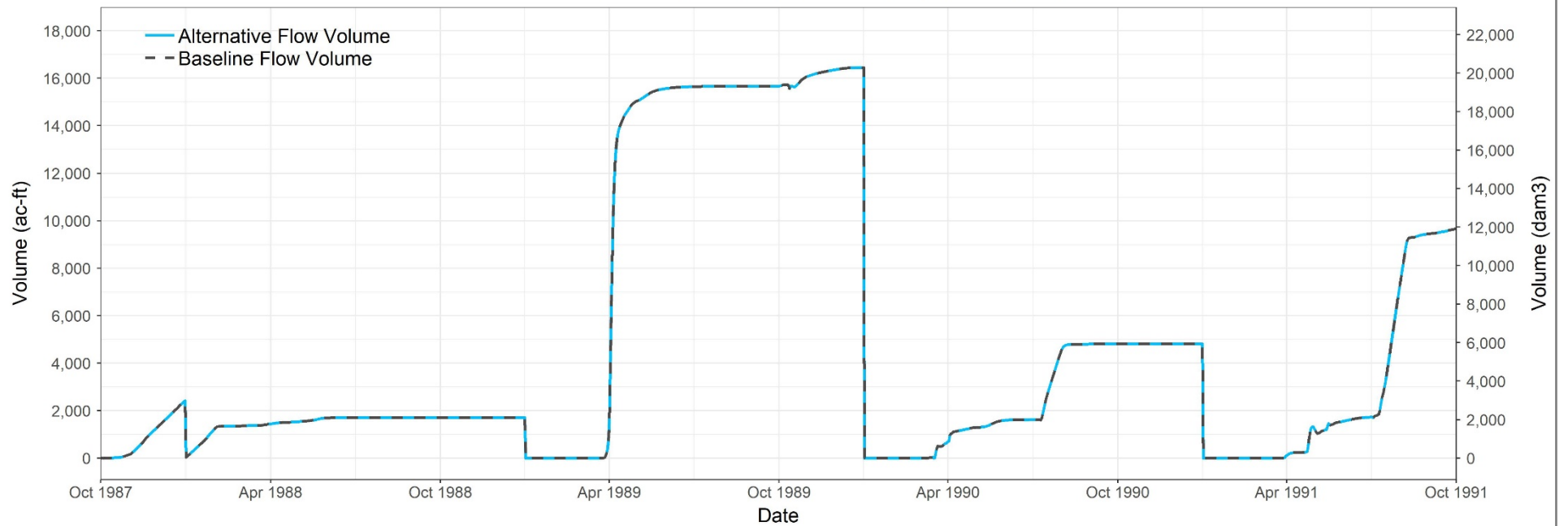
Souris River Plan of Study



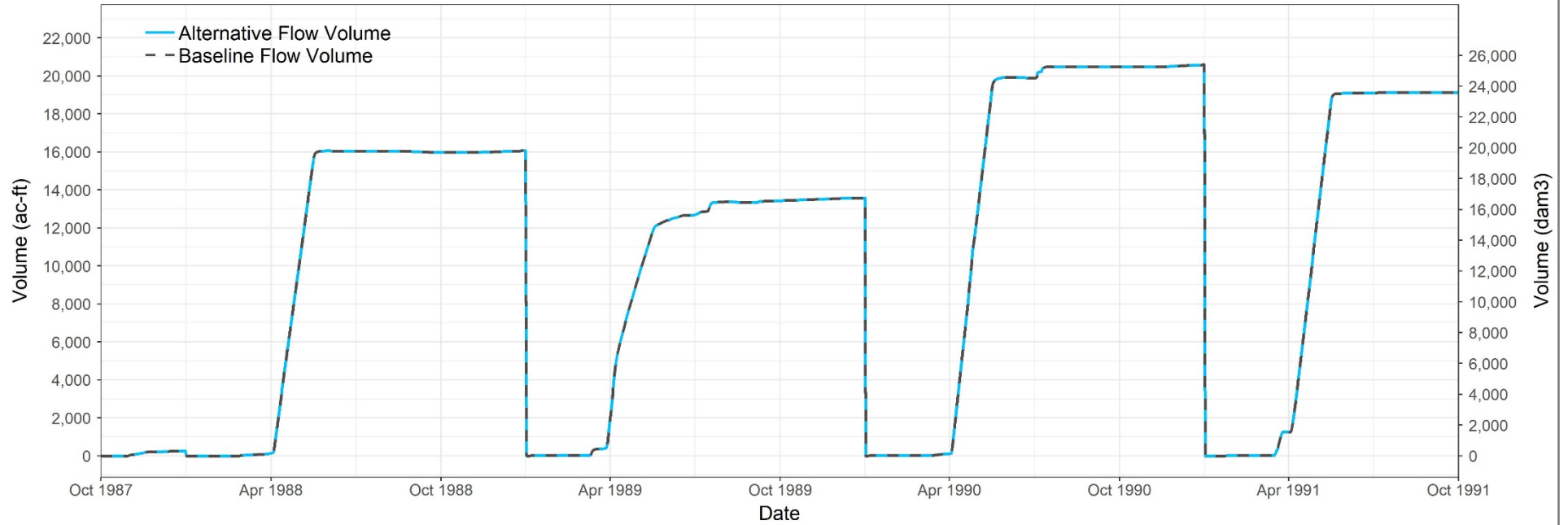
Souris River at Oxbow, SK - Cumulative Volume



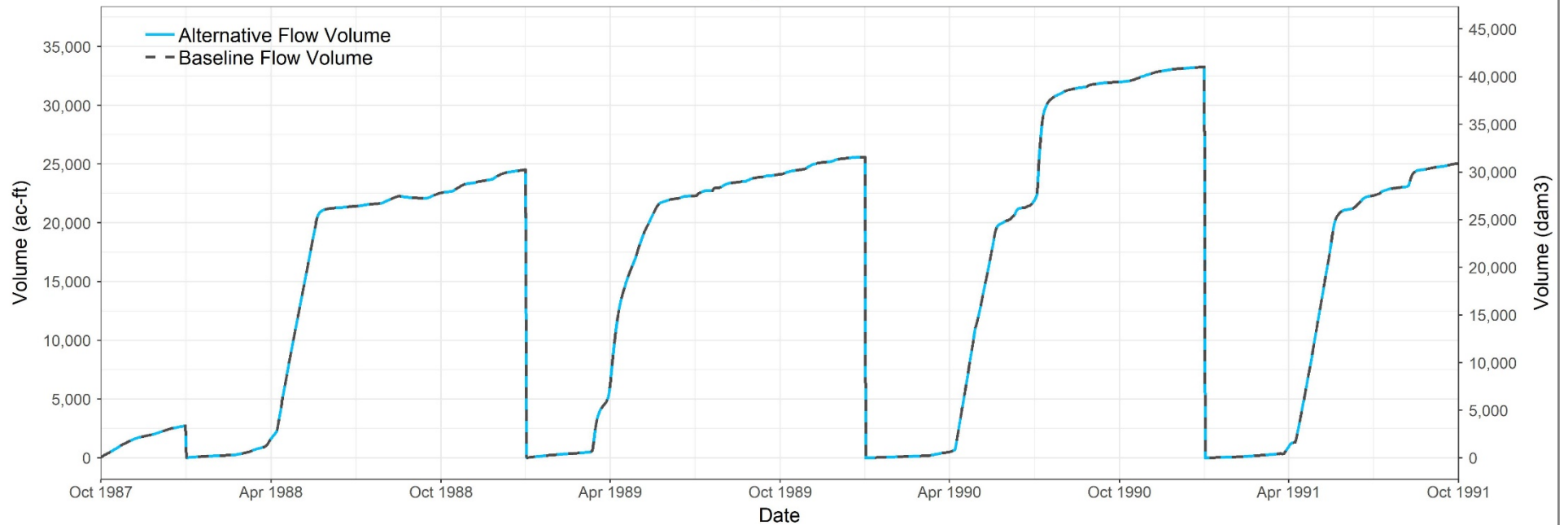
Souris River at Sherwood, ND - Cumulative Volume



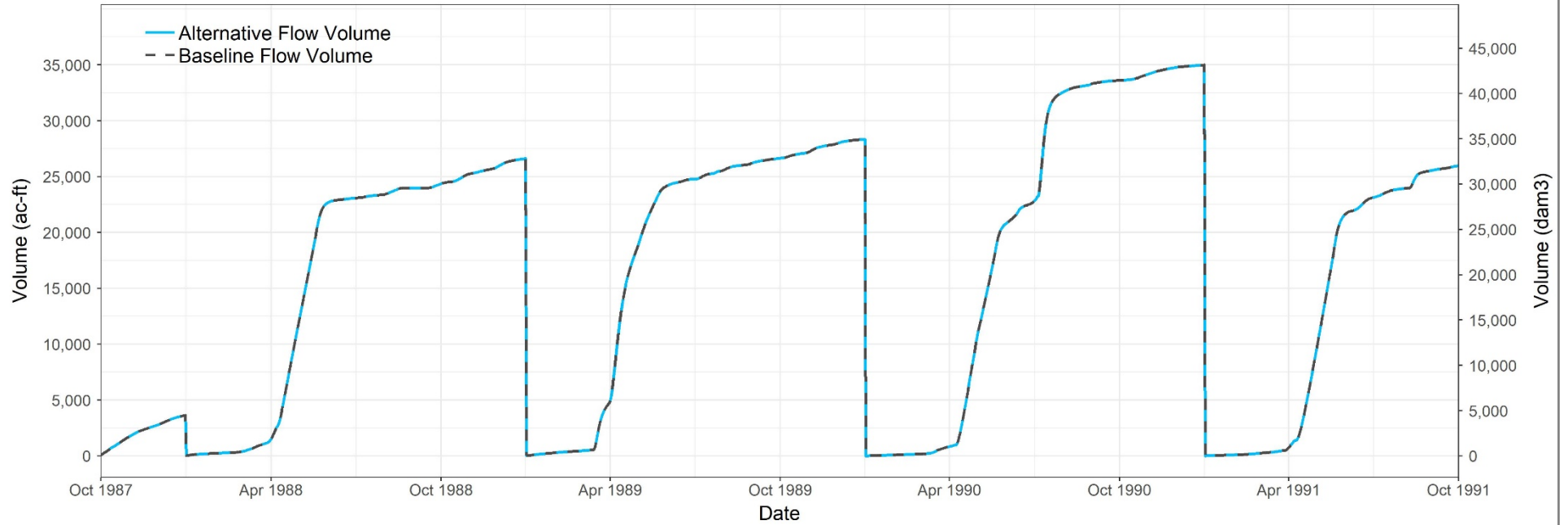
Souris River at Minot, ND - Cumulative Volume



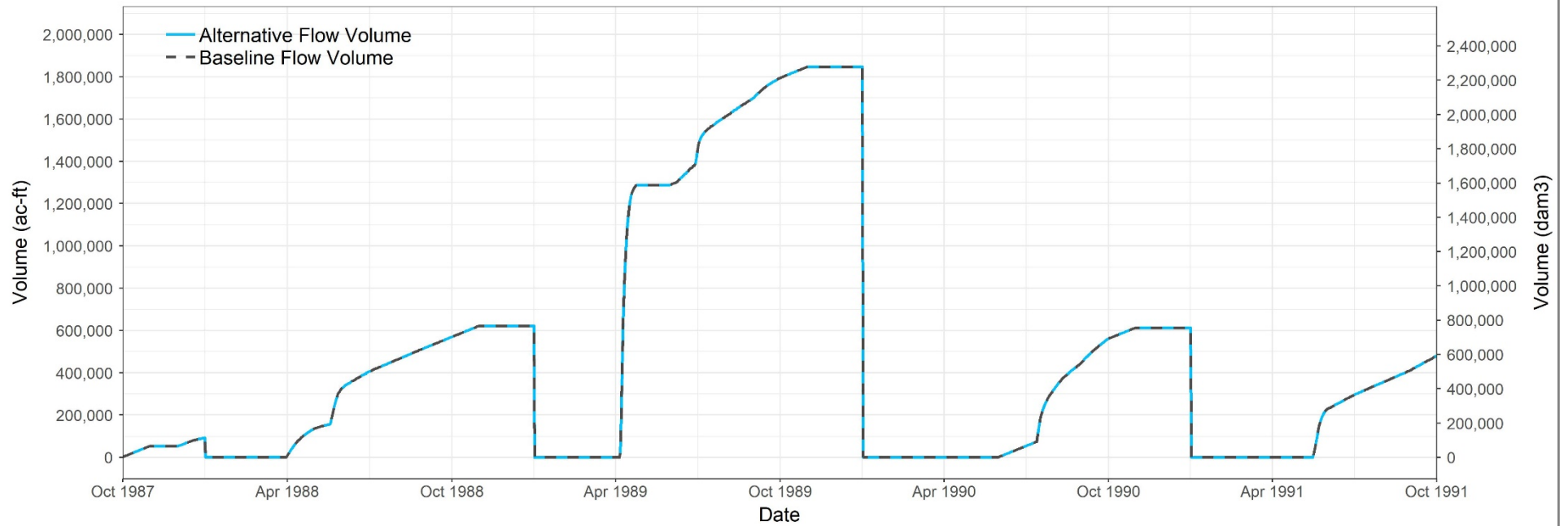
Souris River at Verendrye, ND - Cumulative Volume

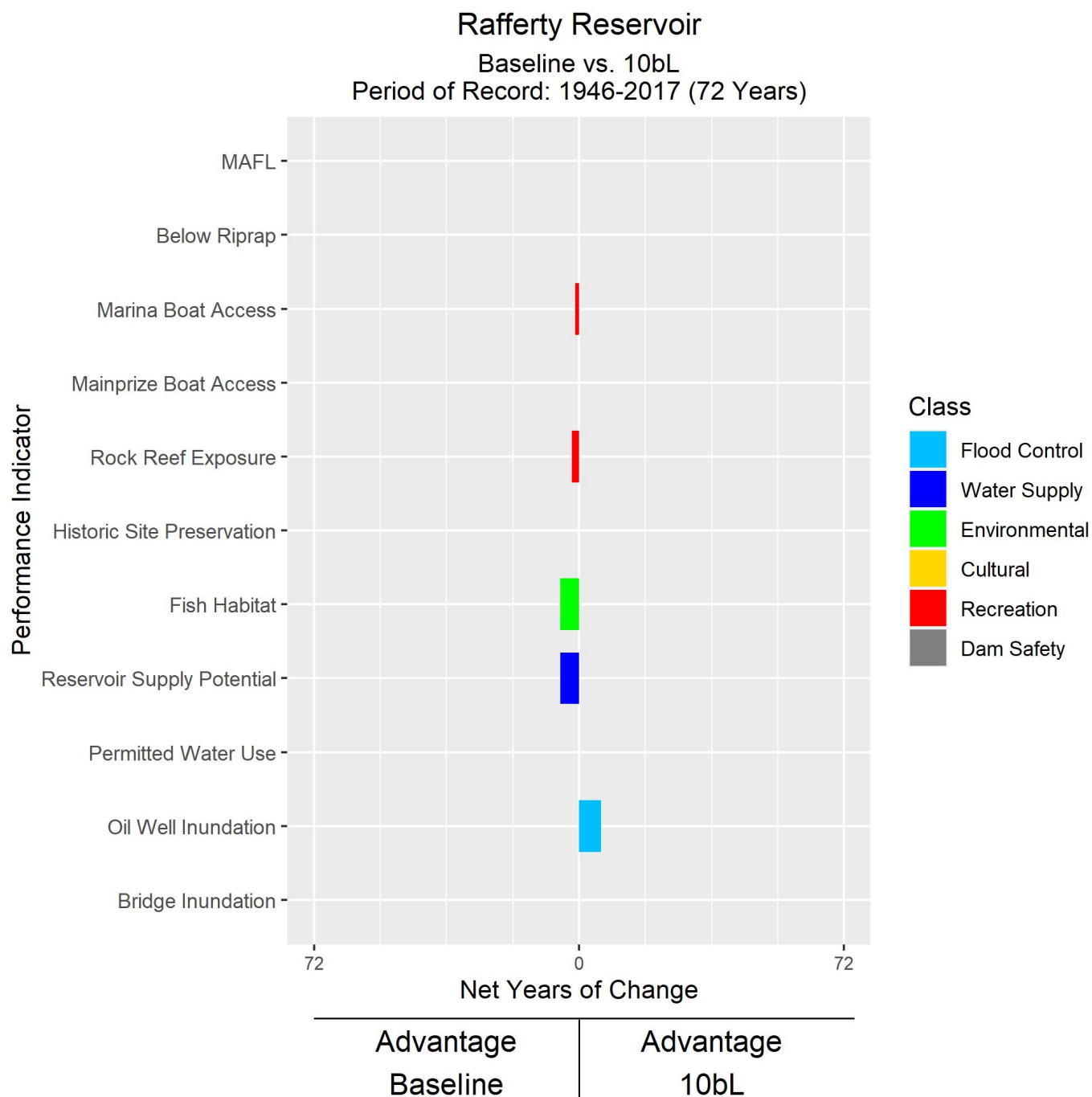


Souris River at Bantry, ND - Cumulative Volume

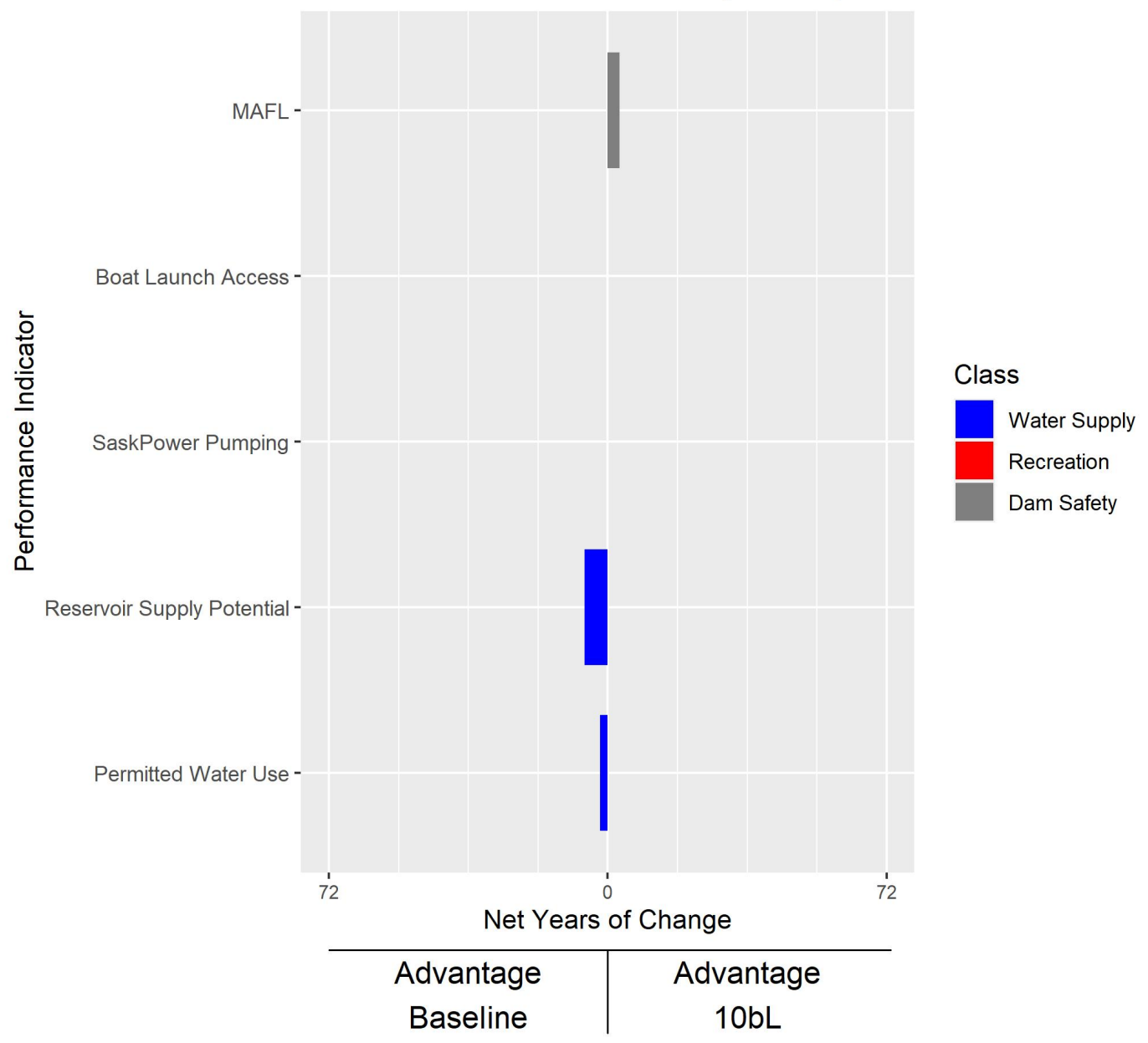


Souris River at Westhope, ND - Cumulative Volume

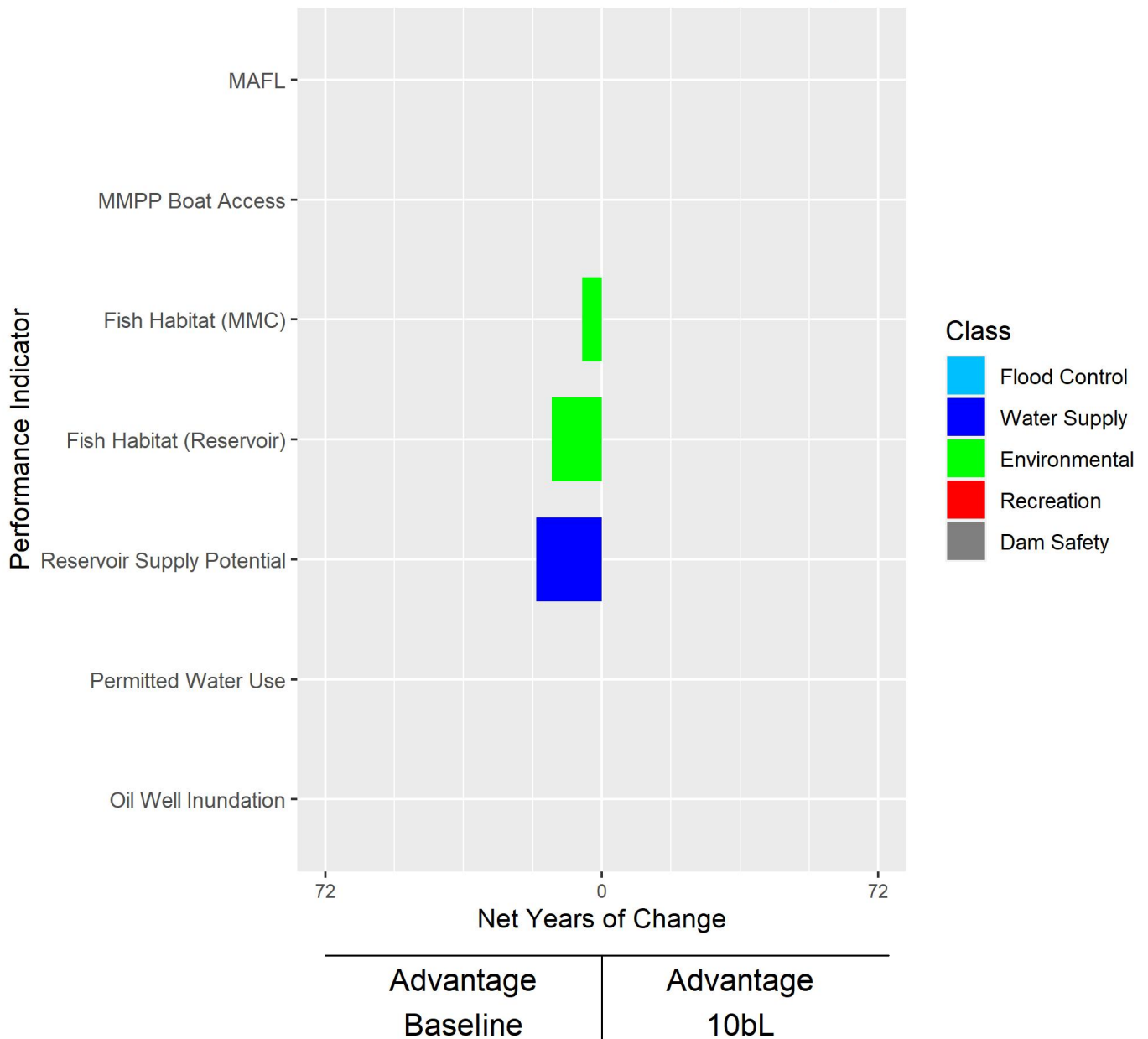




Boundary Reservoir
Baseline vs. 10bL
Period of Record: 1946-2017 (72 Years)



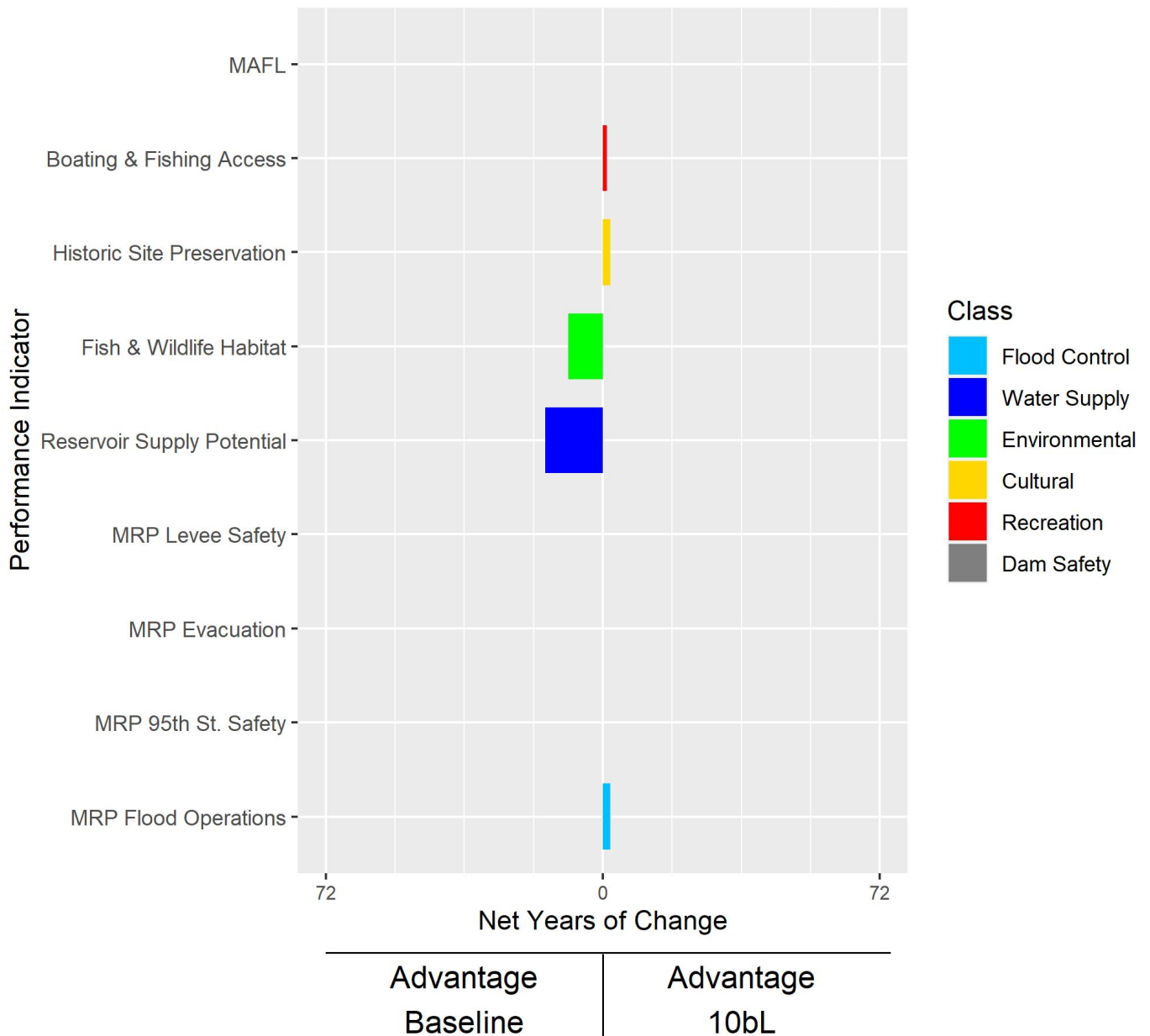
Grant Devine Reservoir
Baseline vs. 10bL
Period of Record: 1946-2017 (72 Years)



Lake Darling

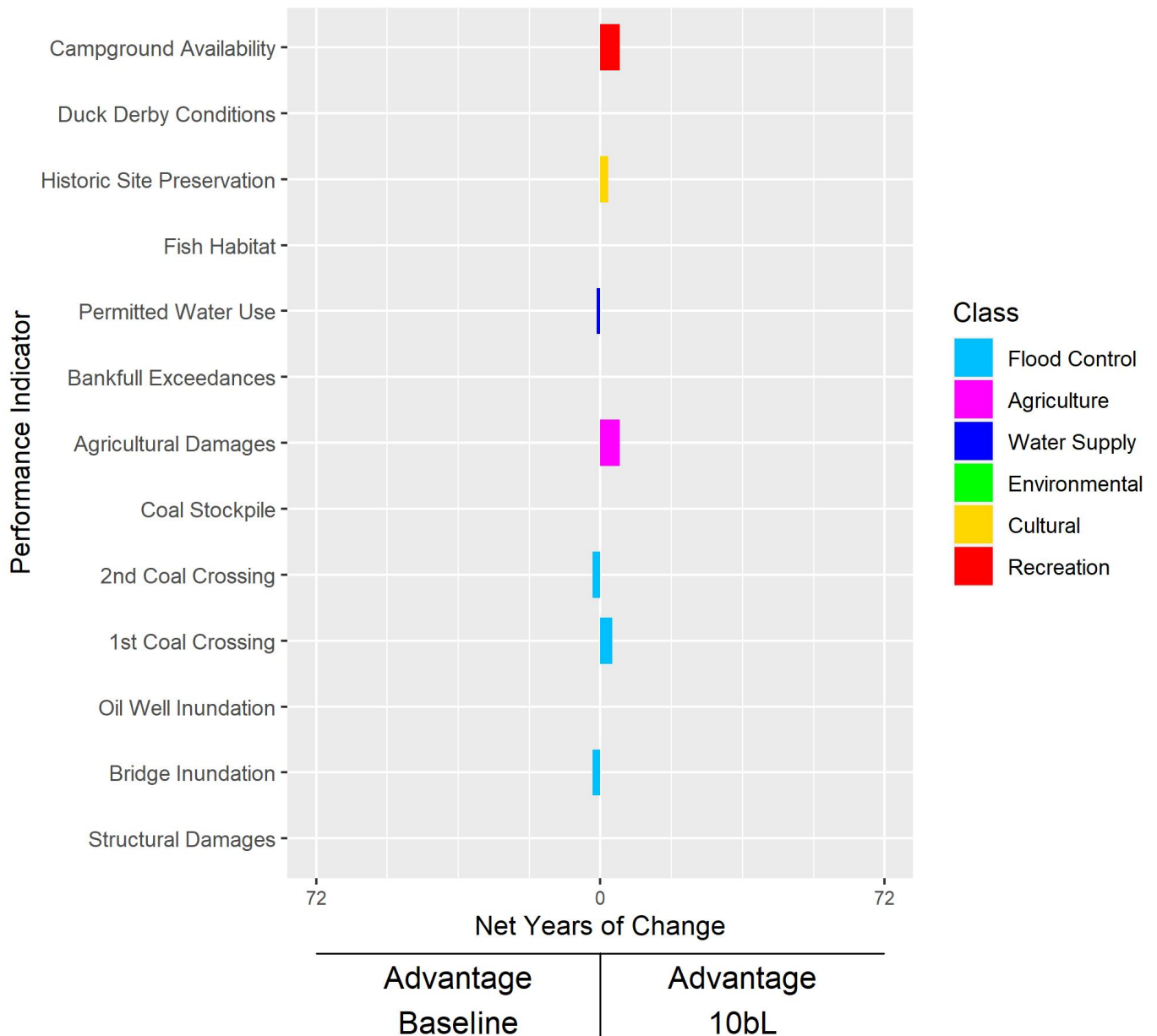
Baseline vs. 10bL

Period of Record: 1946-2017 (72 Years)



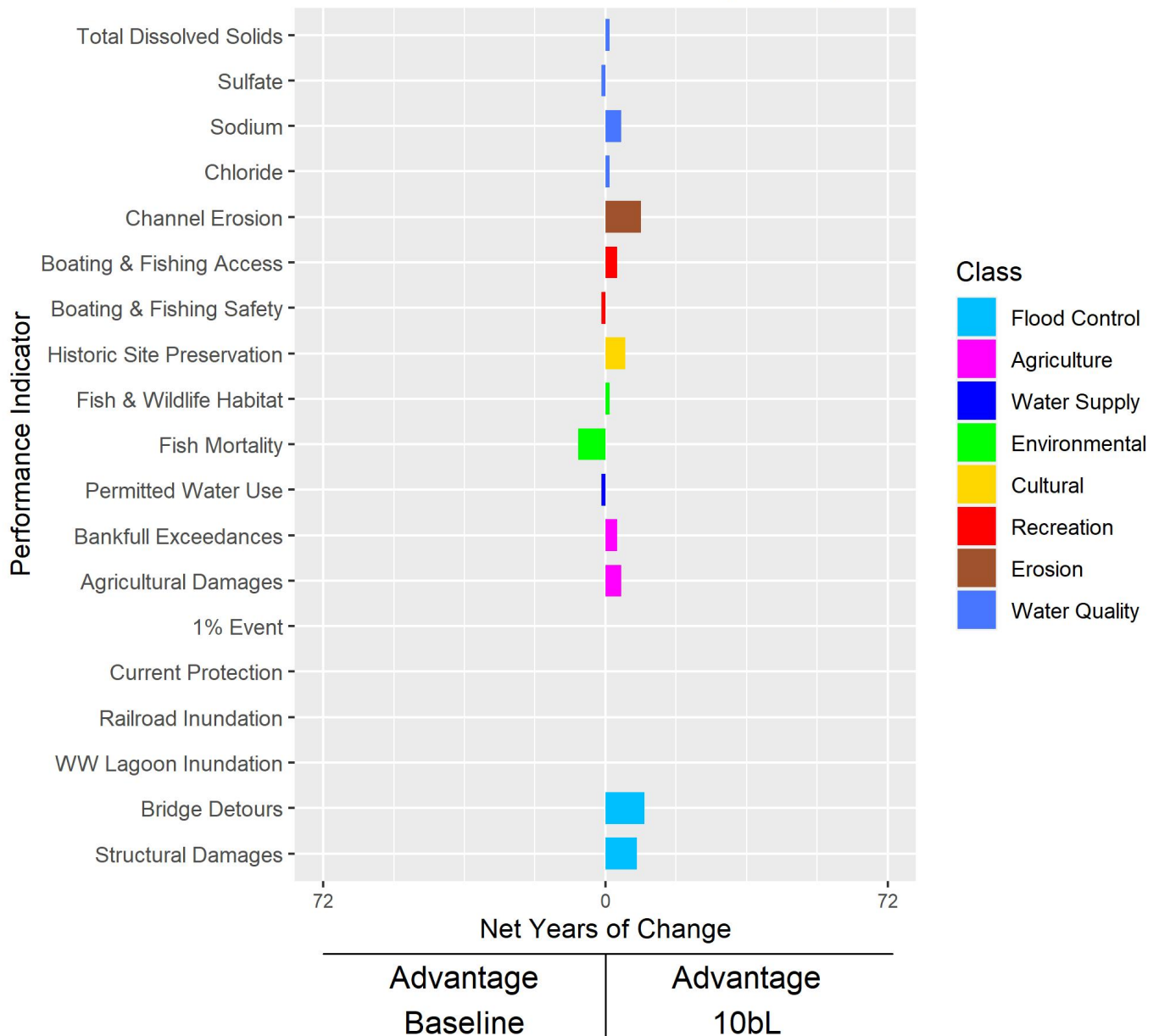
Saskatchewan - All Riverine Reaches

Baseline vs. 10bL
Period of Record: 1946-2017 (72 Years)



North Dakota - All Riverine Reaches

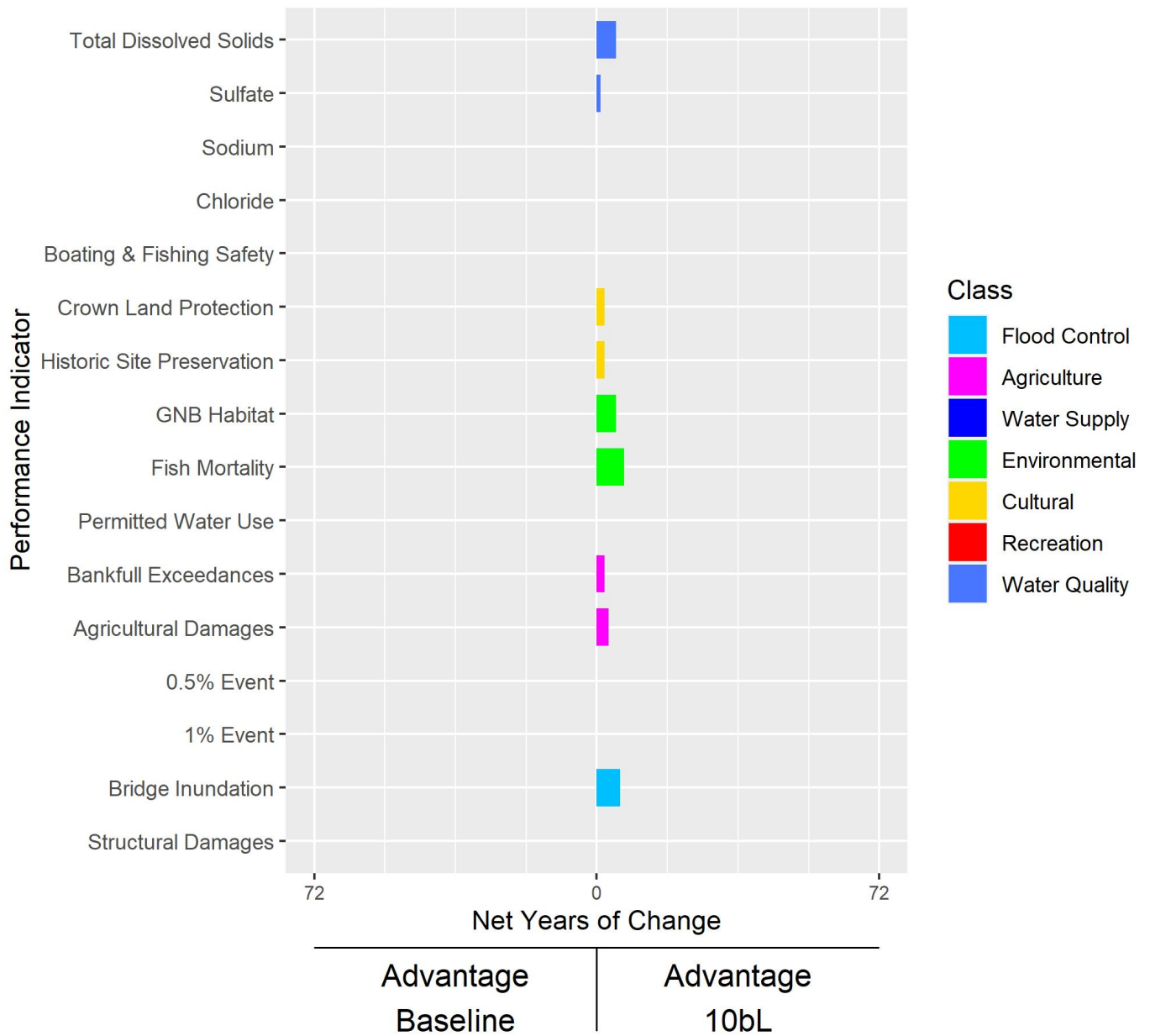
Baseline vs. 10bL
Period of Record: 1946-2017 (72 Years)



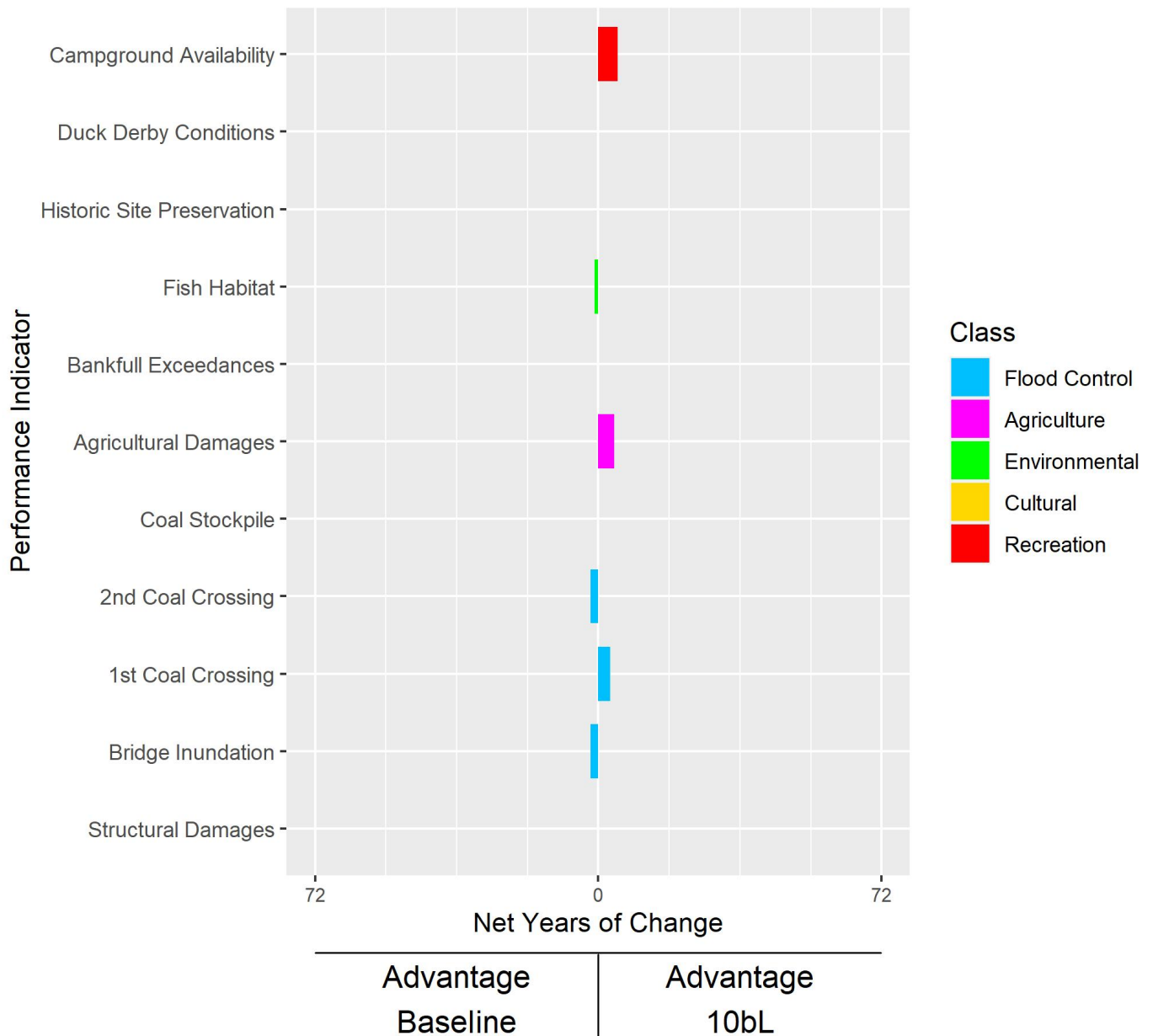
Westhope to Wawanesa

Baseline vs. 10bL

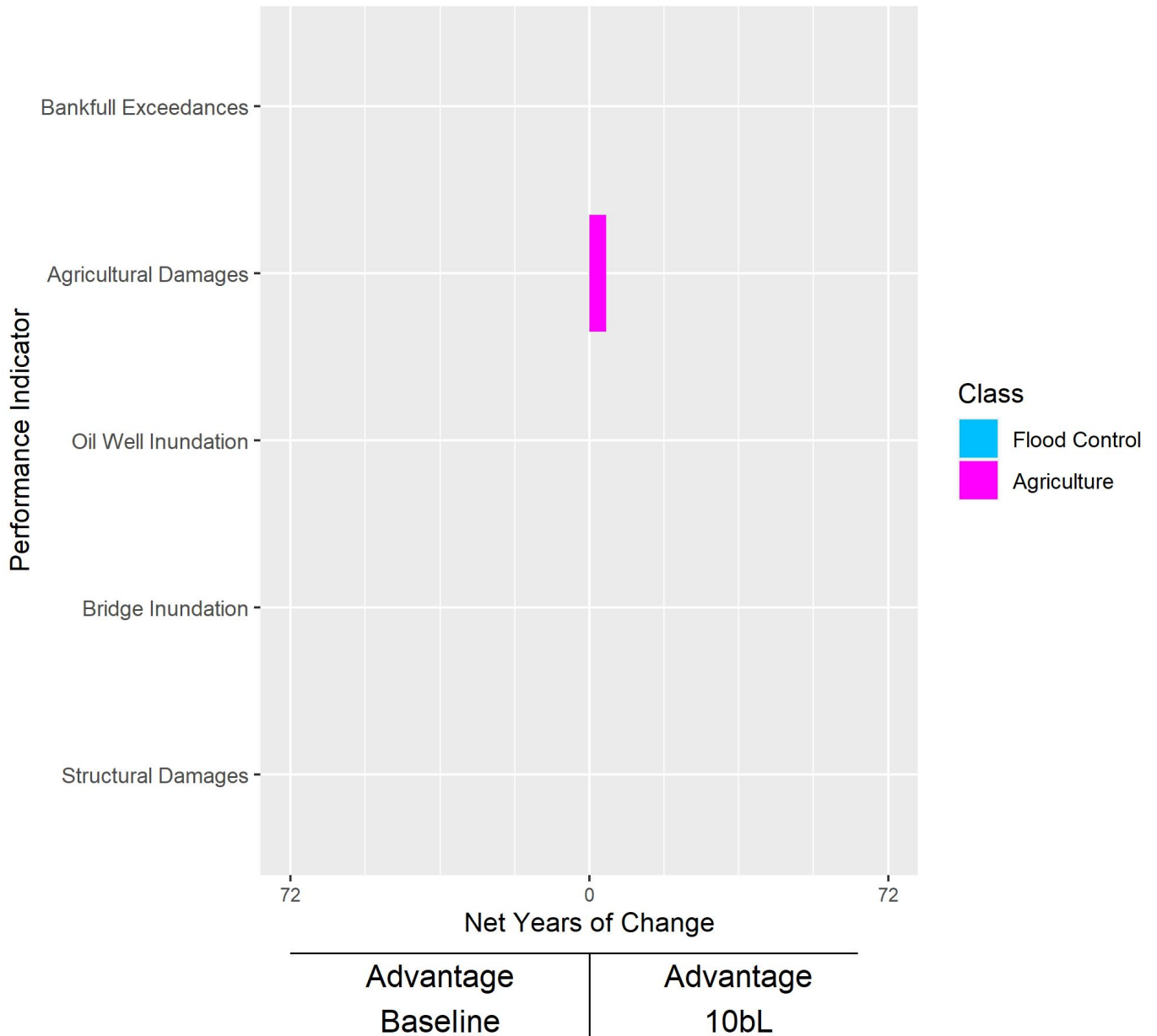
Period of Record: 1946-2017 (72 Years)



City of Estevan
Baseline vs. 10bL
Period of Record: 1946-2017 (72 Years)



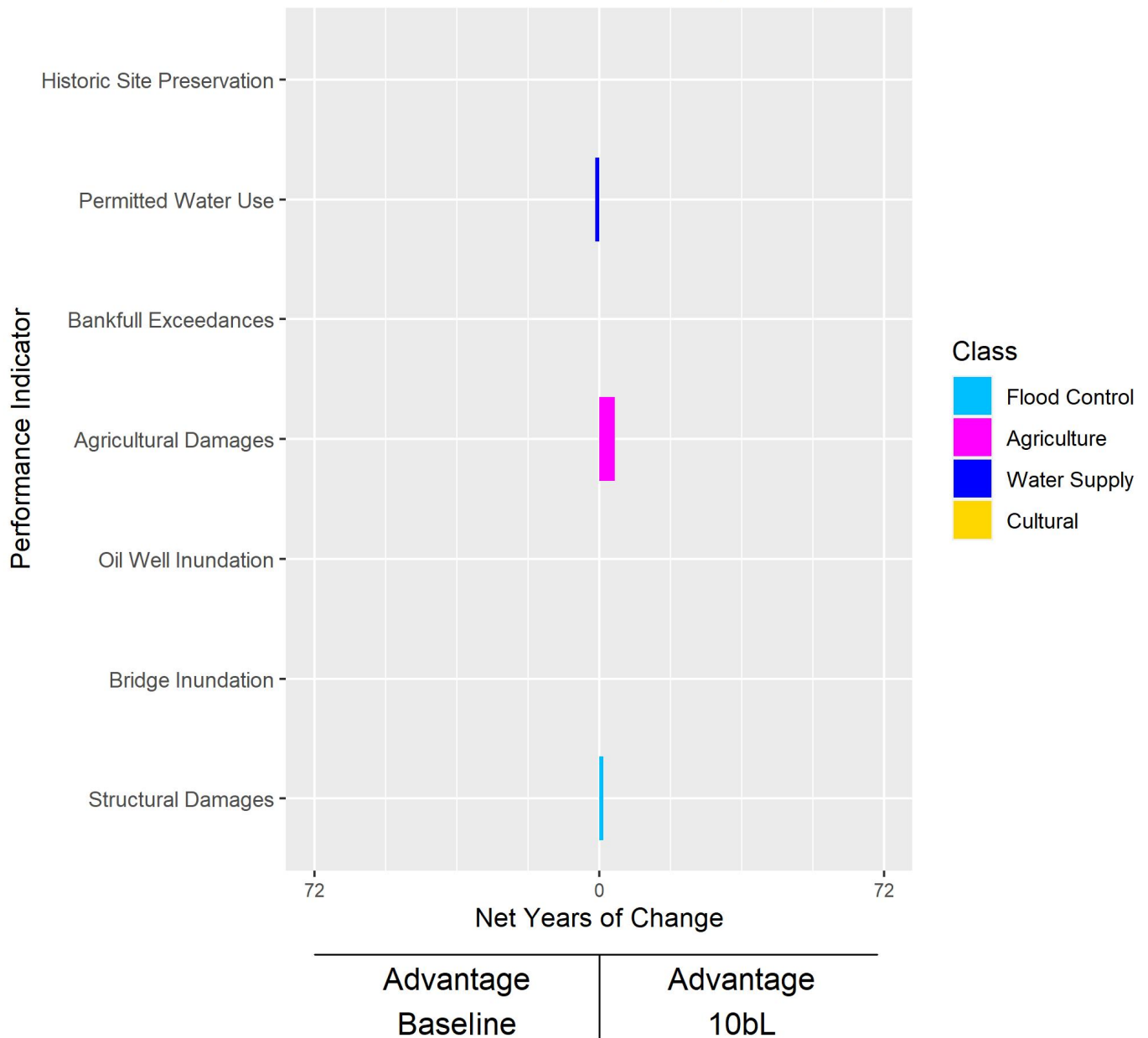
City of Roche Percee
Baseline vs. 10bL
Period of Record: 1946-2017 (72 Years)



Roche Percee to Moose Mountain Creek

Baseline vs. 10bL

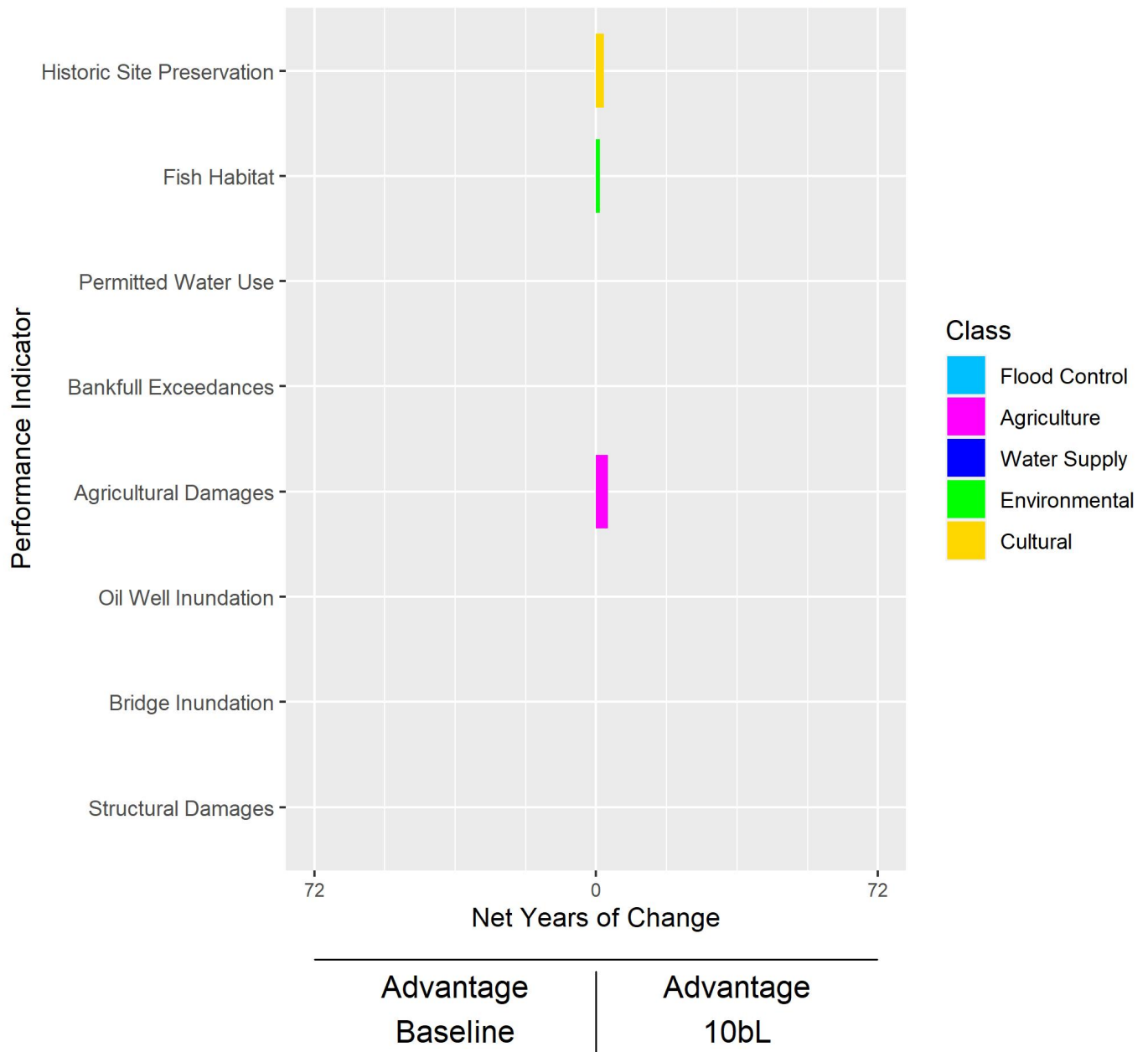
Period of Record: 1946-2017 (72 Years)



Moose Mountain Creek to Sherwood

Baseline vs. 10bL

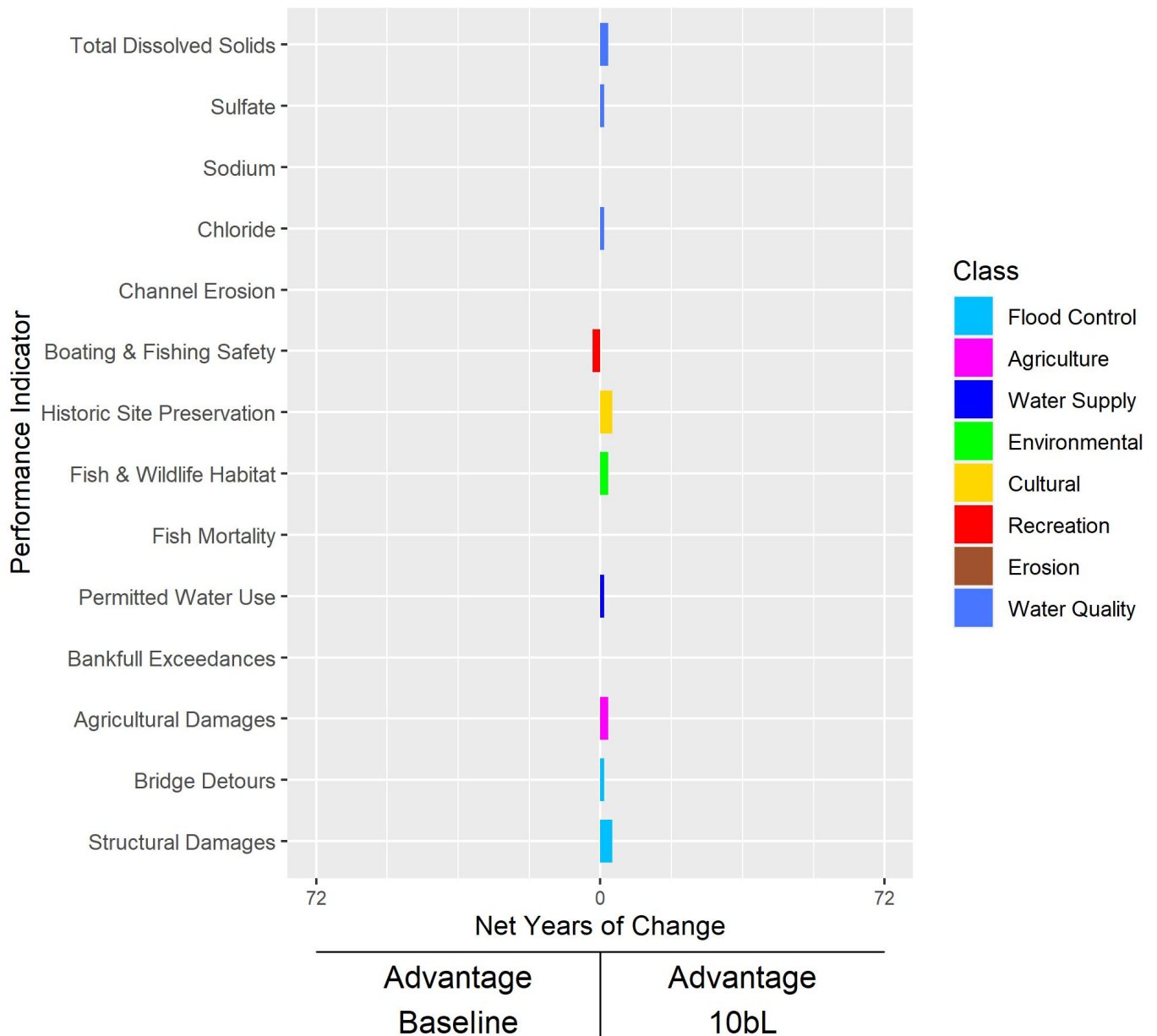
Period of Record: 1946-2017 (72 Years)



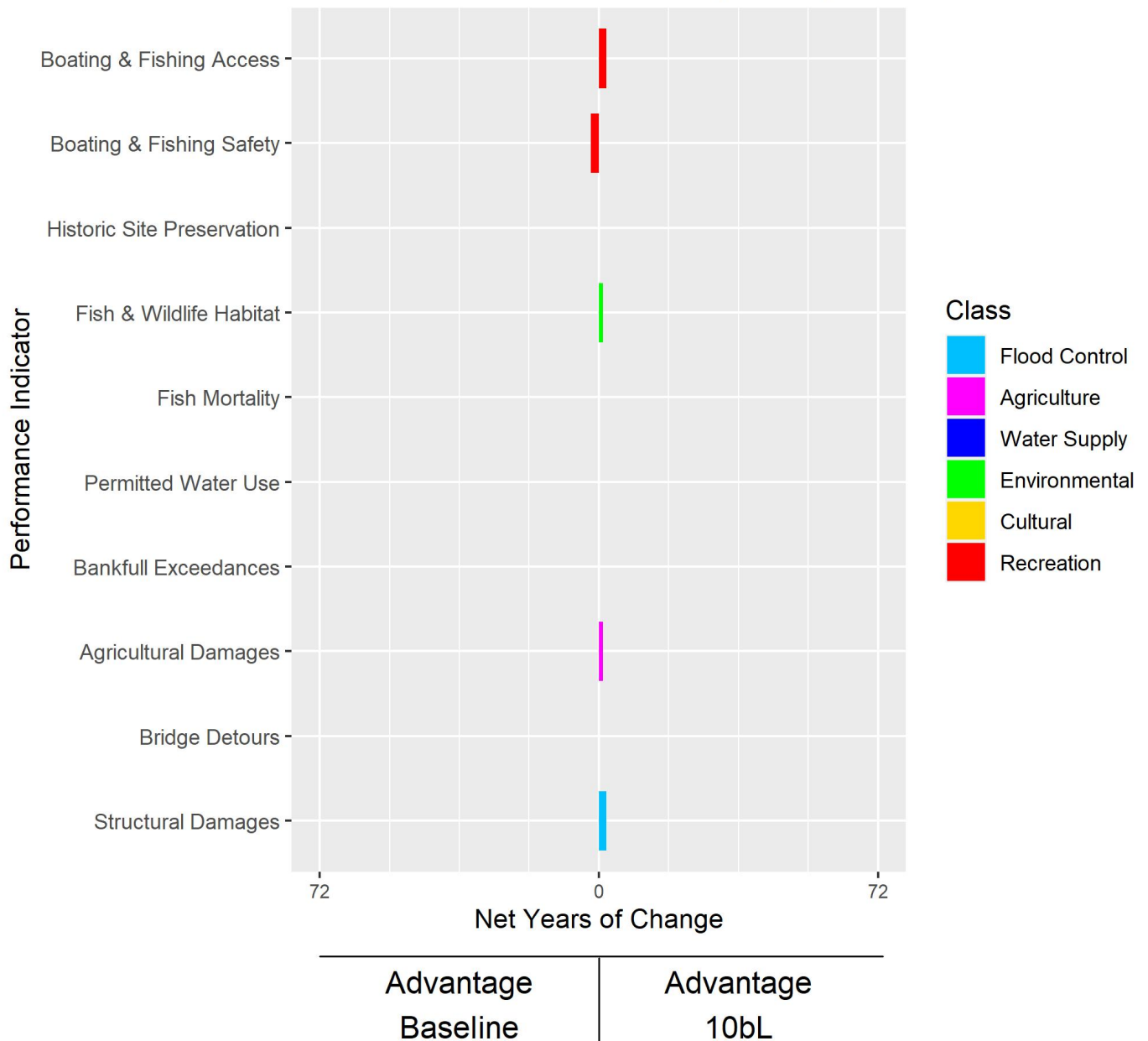
Sherwood to Mouse River Park

Baseline vs. 10bL

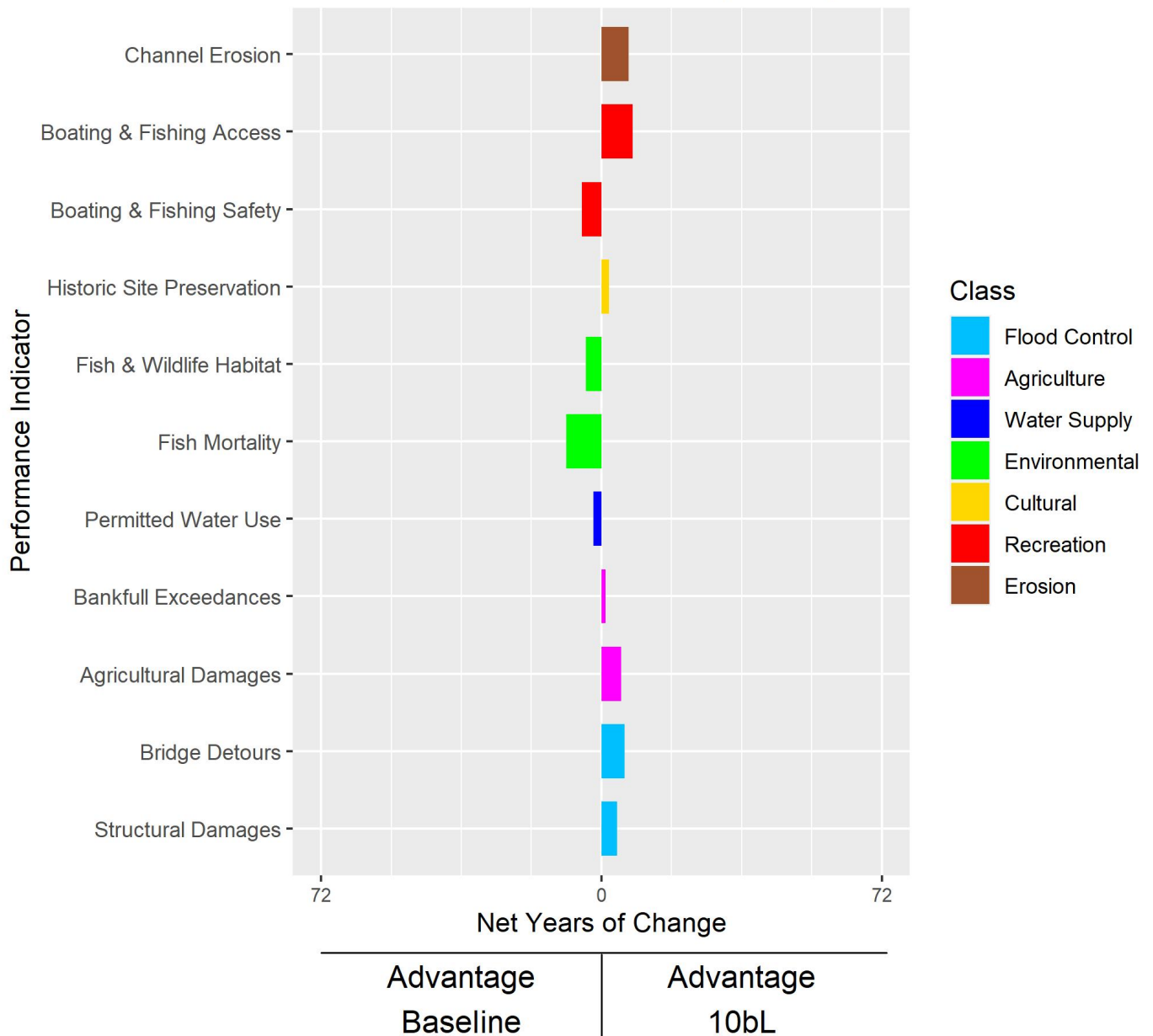
Period of Record: 1946-2017 (72 Years)



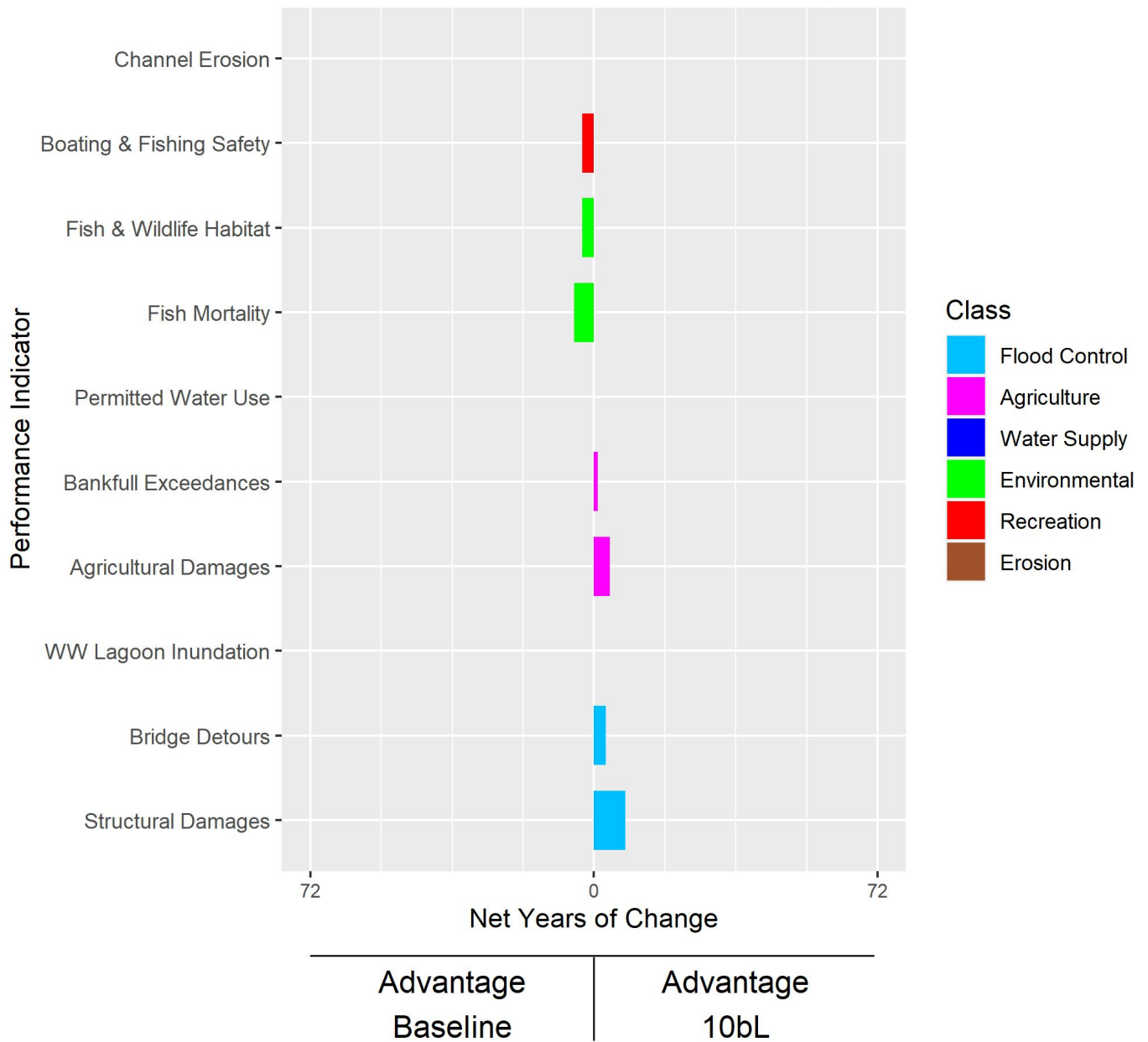
Mouse River Park
Baseline vs. 10bL
Period of Record: 1946-2017 (72 Years)



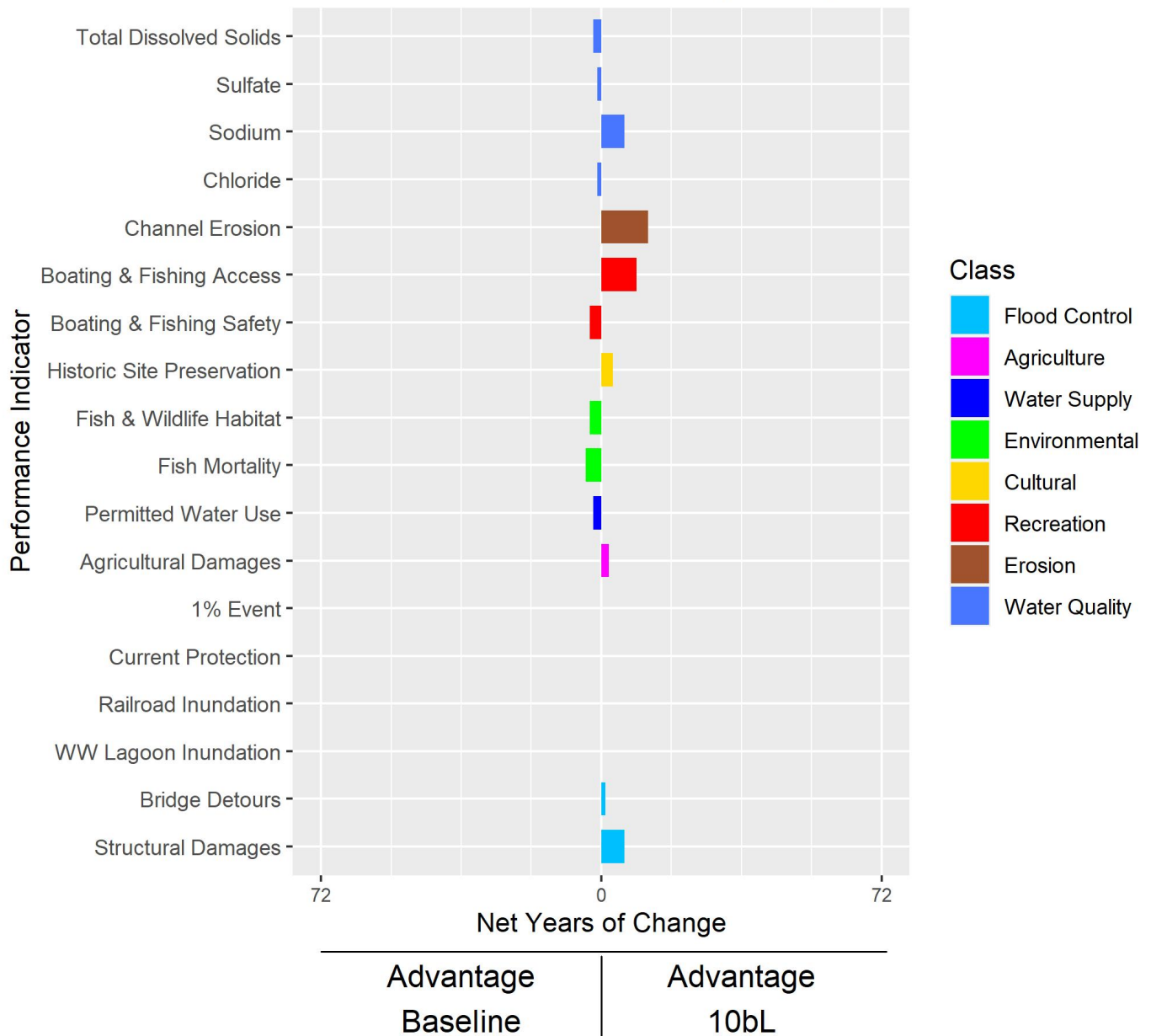
Lake Darling to Burlington
Baseline vs. 10bL
Period of Record: 1946-2017 (72 Years)



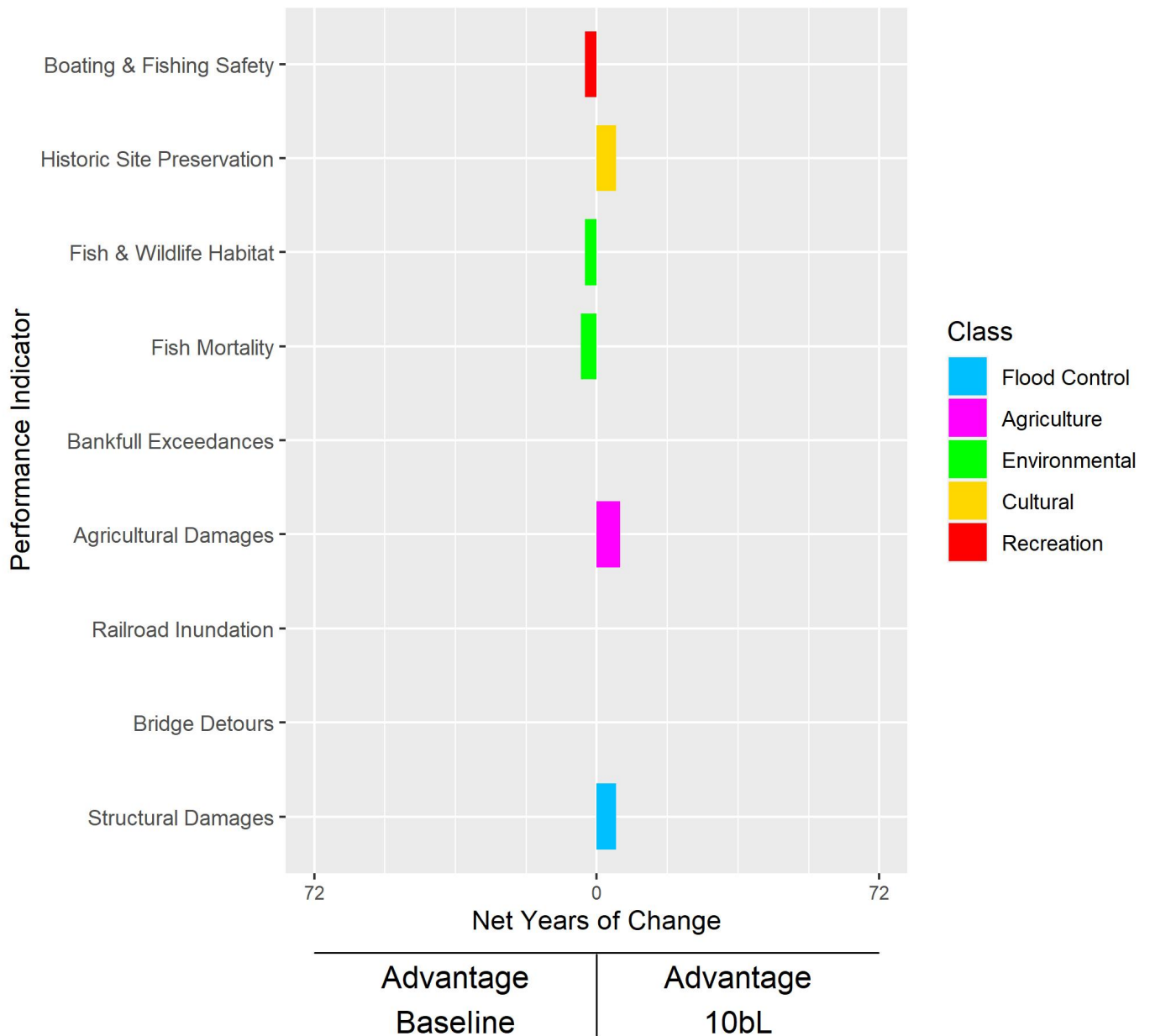
City of Burlington
Baseline vs. 10bL
Period of Record: 1946-2017 (72 Years)



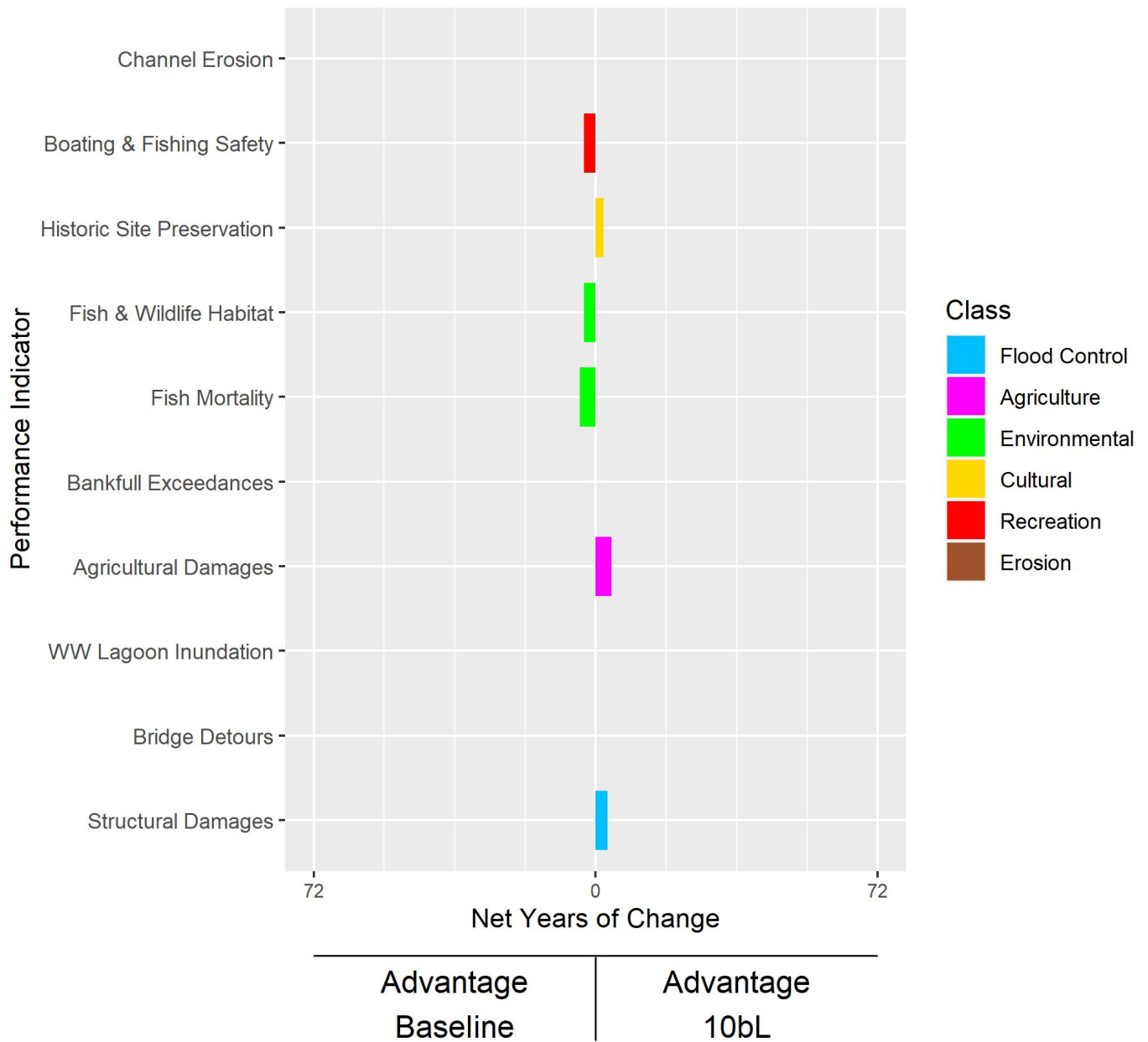
City of Minot
Baseline vs. 10bL
Period of Record: 1946-2017 (72 Years)



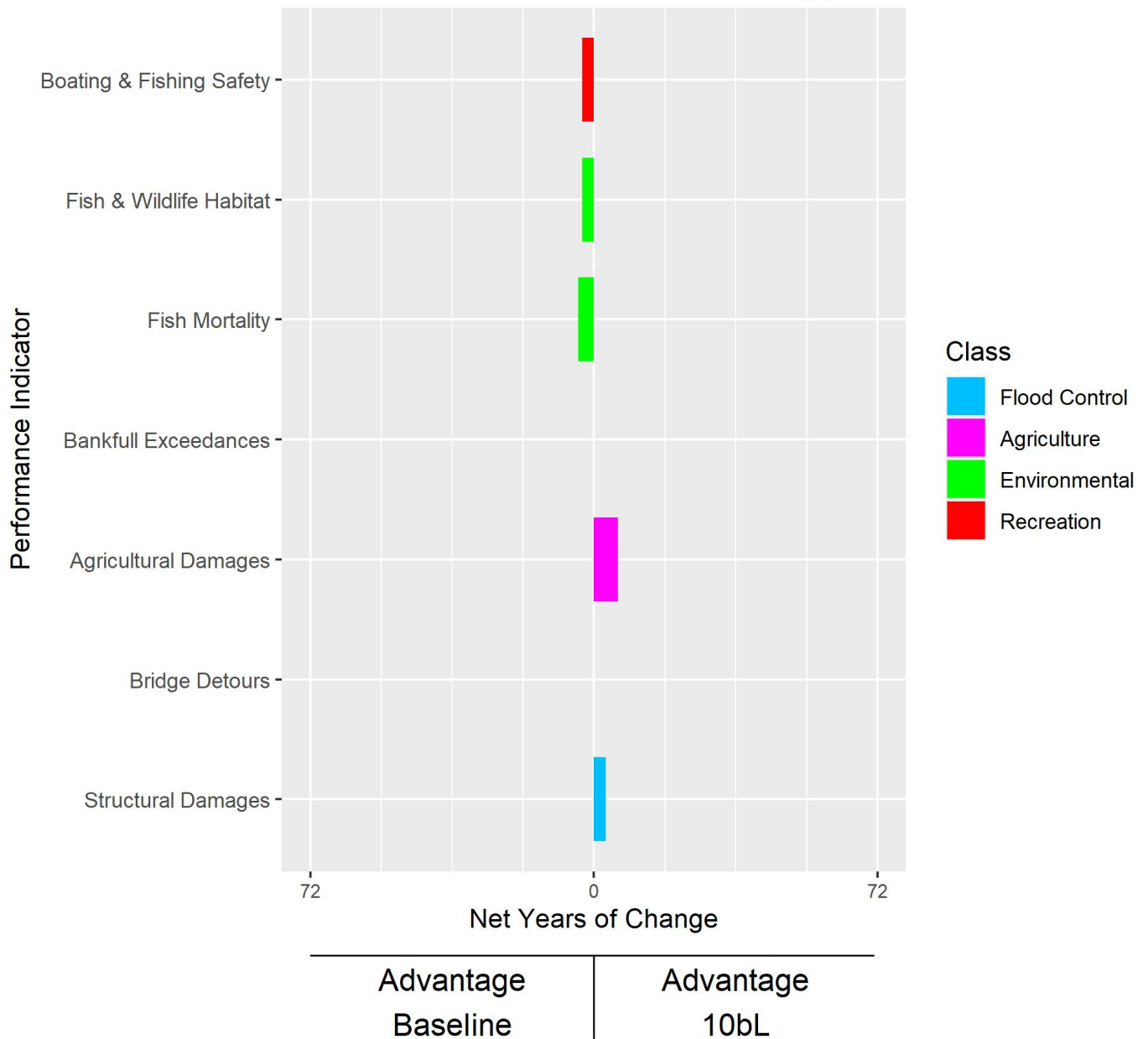
Minot to Sawyer
Baseline vs. 10bL
Period of Record: 1946-2017 (72 Years)



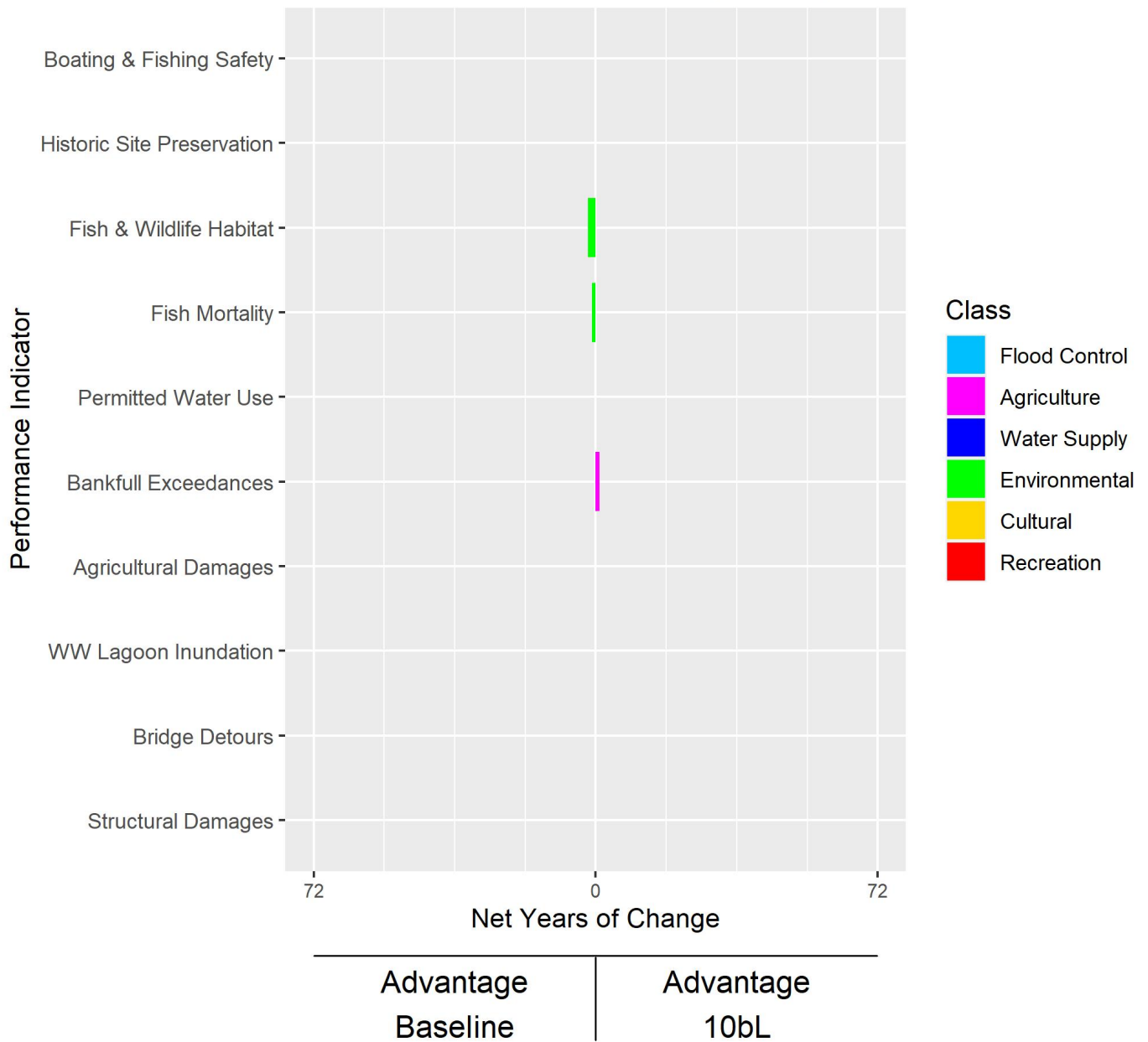
City of Sawyer
Baseline vs. 10bL
Period of Record: 1946-2017 (72 Years)



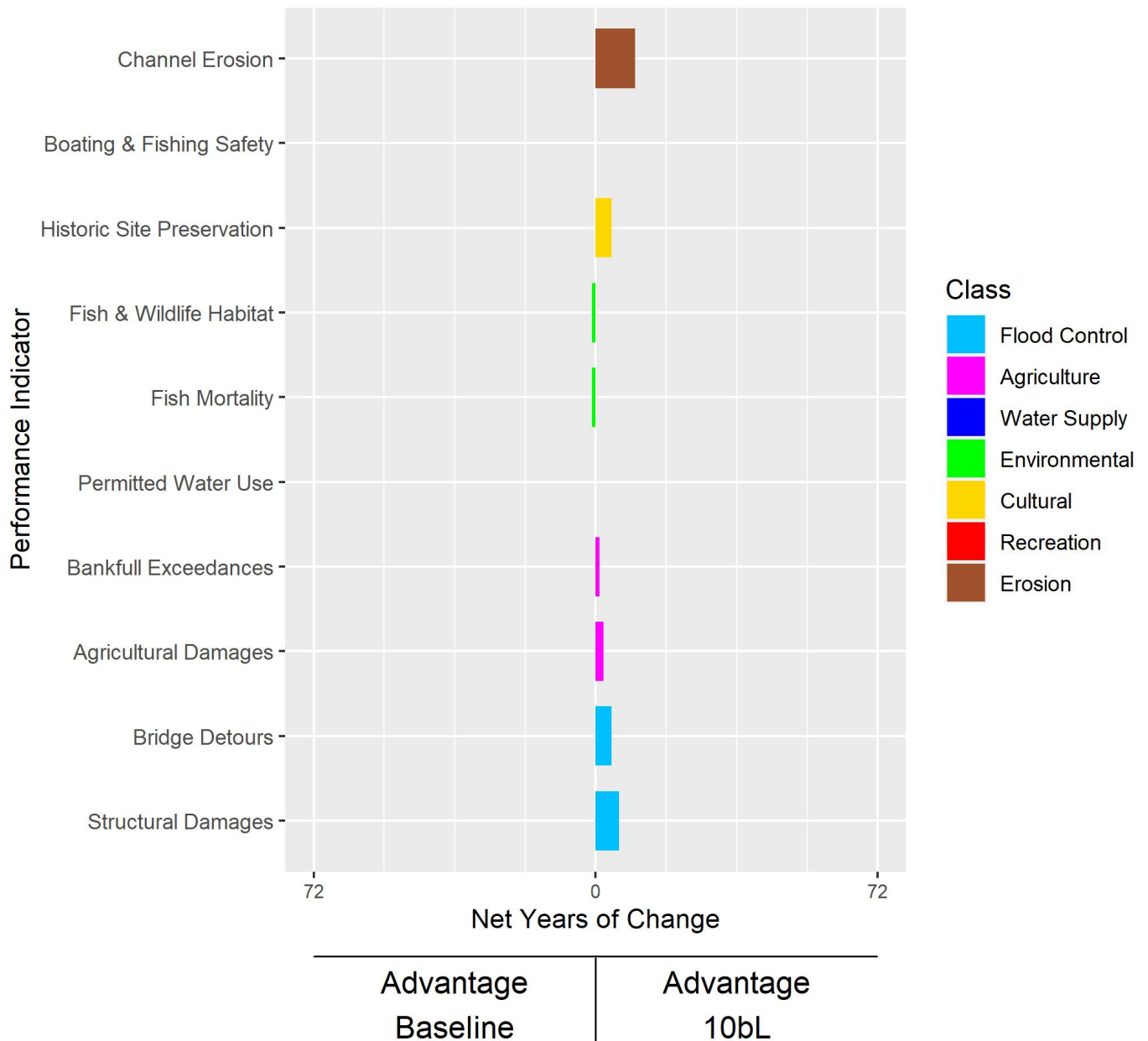
Sawyer to Velva
Baseline vs. 10bL
Period of Record: 1946-2017 (72 Years)



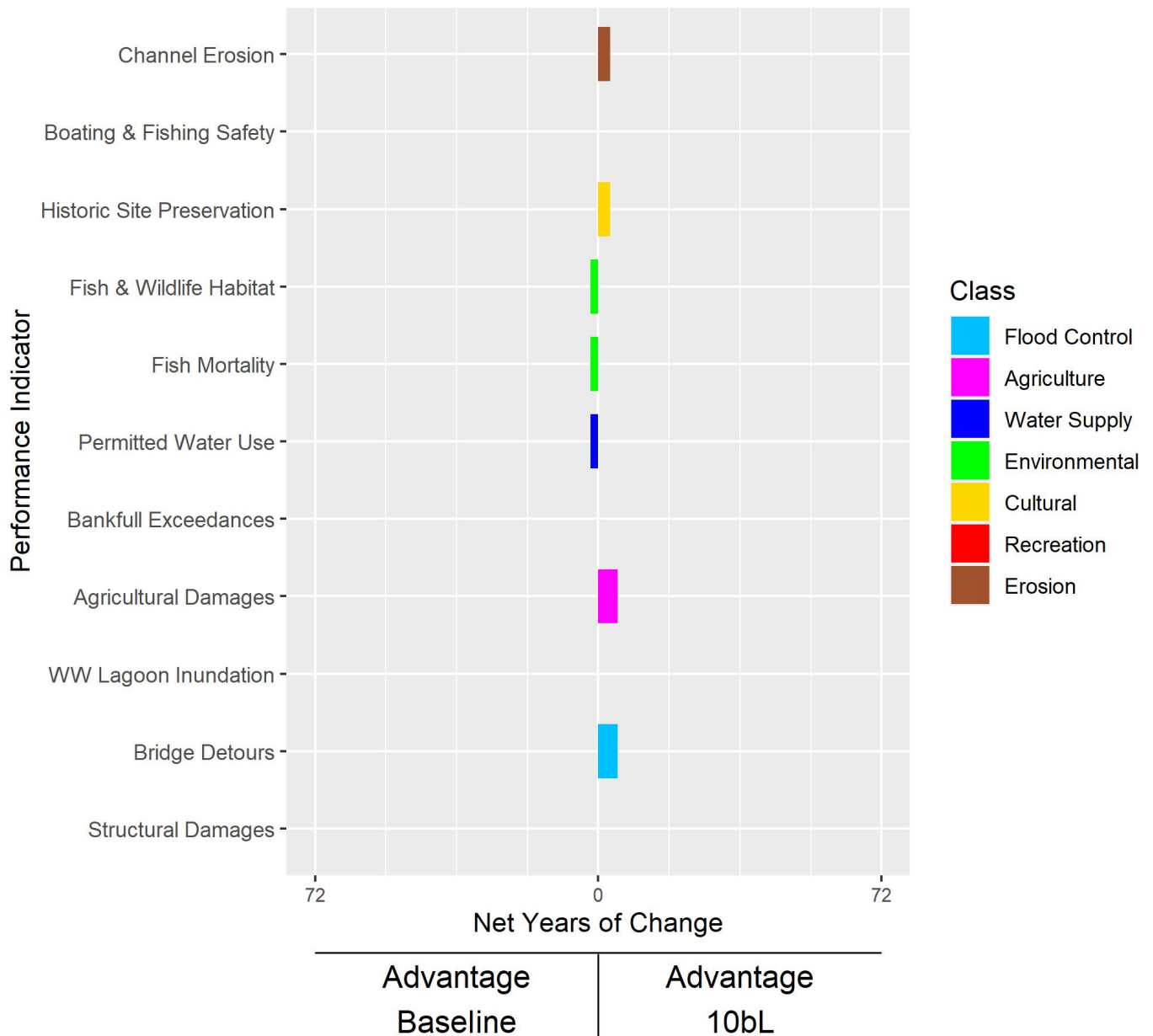
City of Velva
Baseline vs. 10bL
Period of Record: 1946-2017 (72 Years)



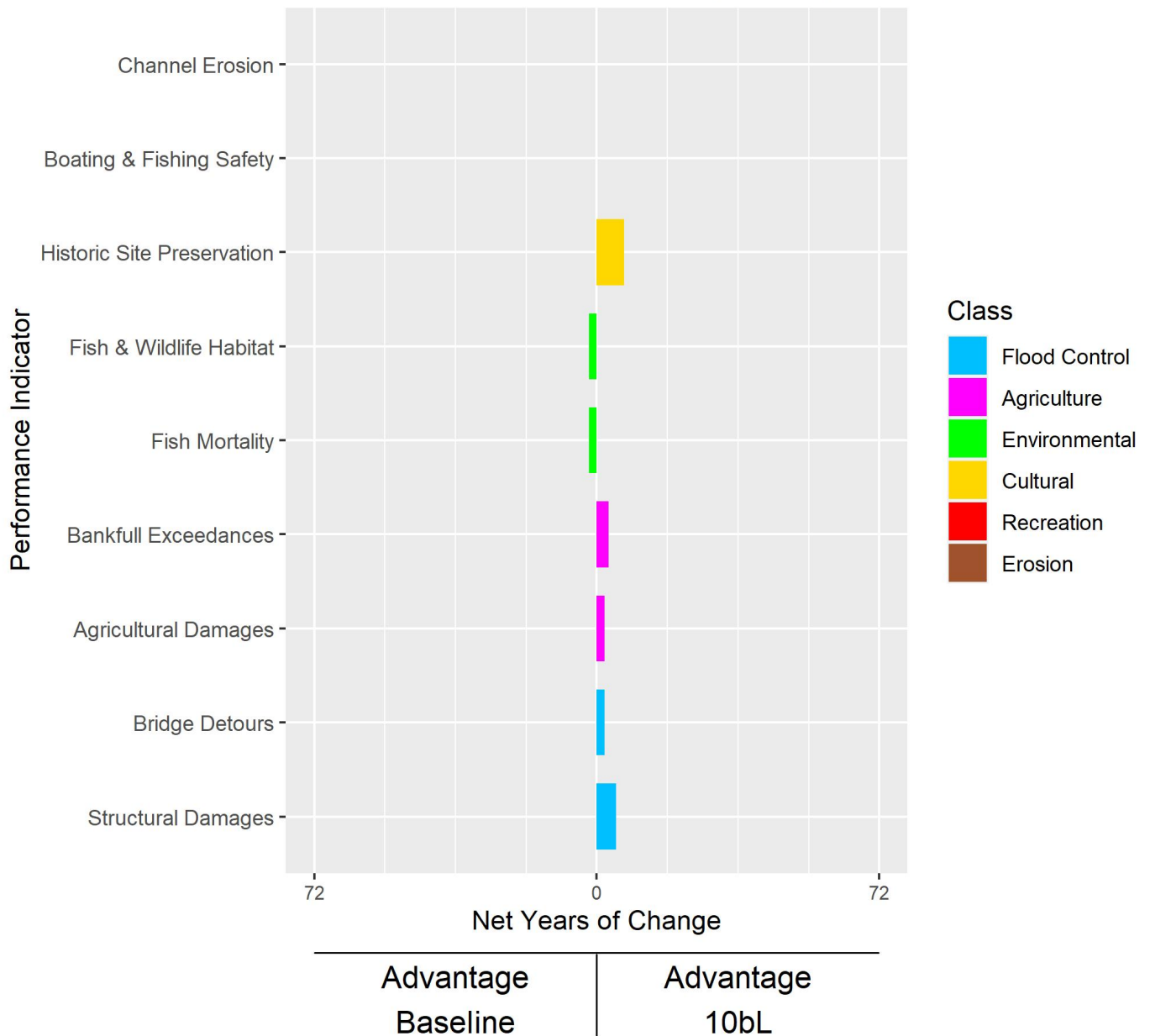
Velva to Eaton Irrigation
Baseline vs. 10bL
Period of Record: 1946-2017 (72 Years)



Eaton Irrigation District
Baseline vs. 10bL
Period of Record: 1946-2017 (72 Years)



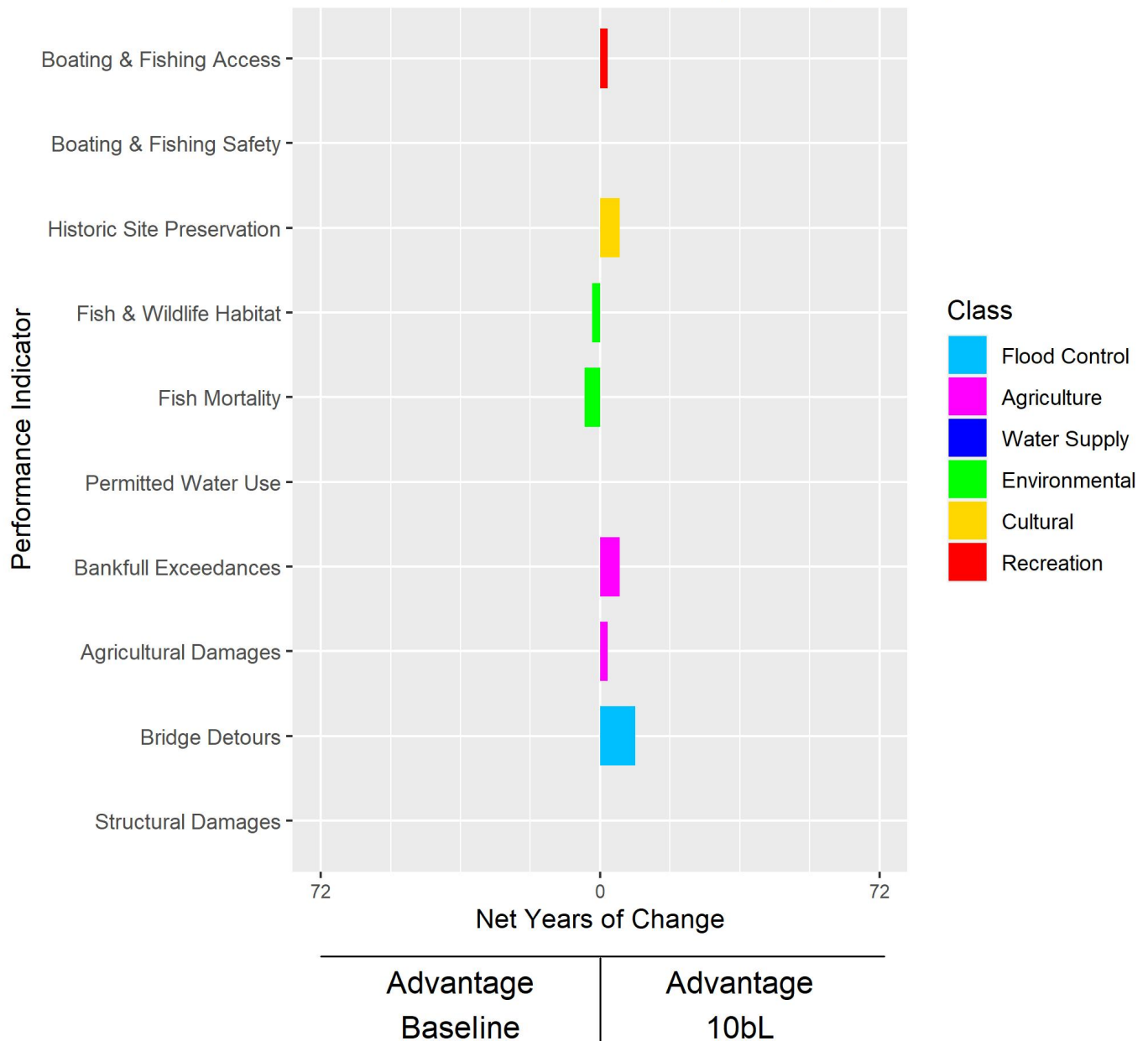
Downstream of Towner
Baseline vs. 10bL
Period of Record: 1946-2017 (72 Years)



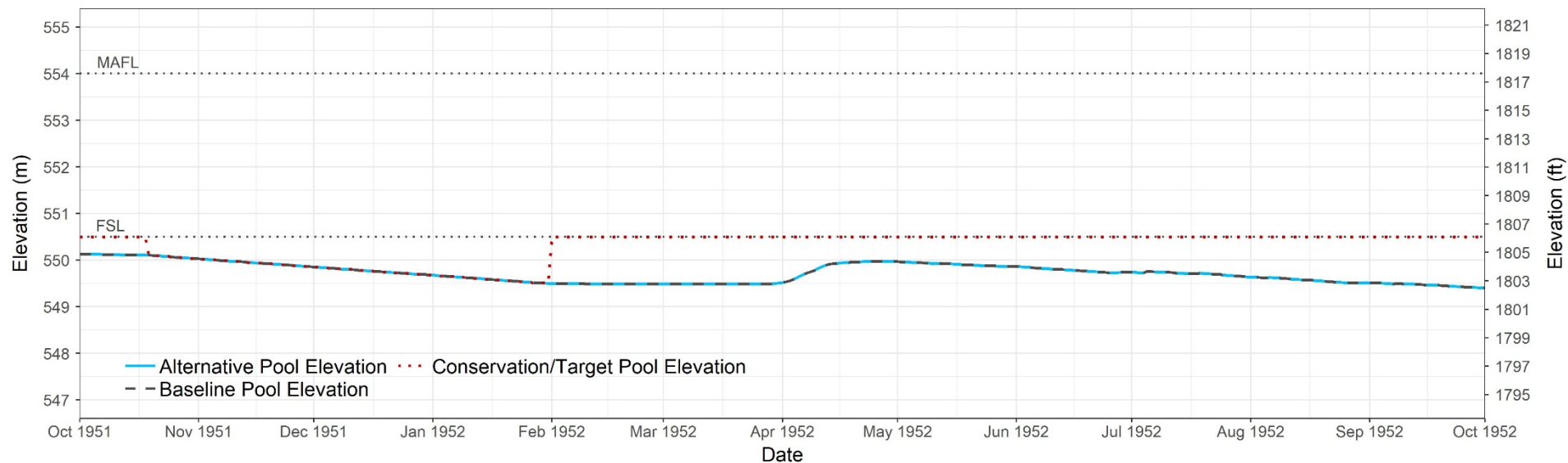
J. Clark Salyer National Wildlife Refuge

Baseline vs. 10bL

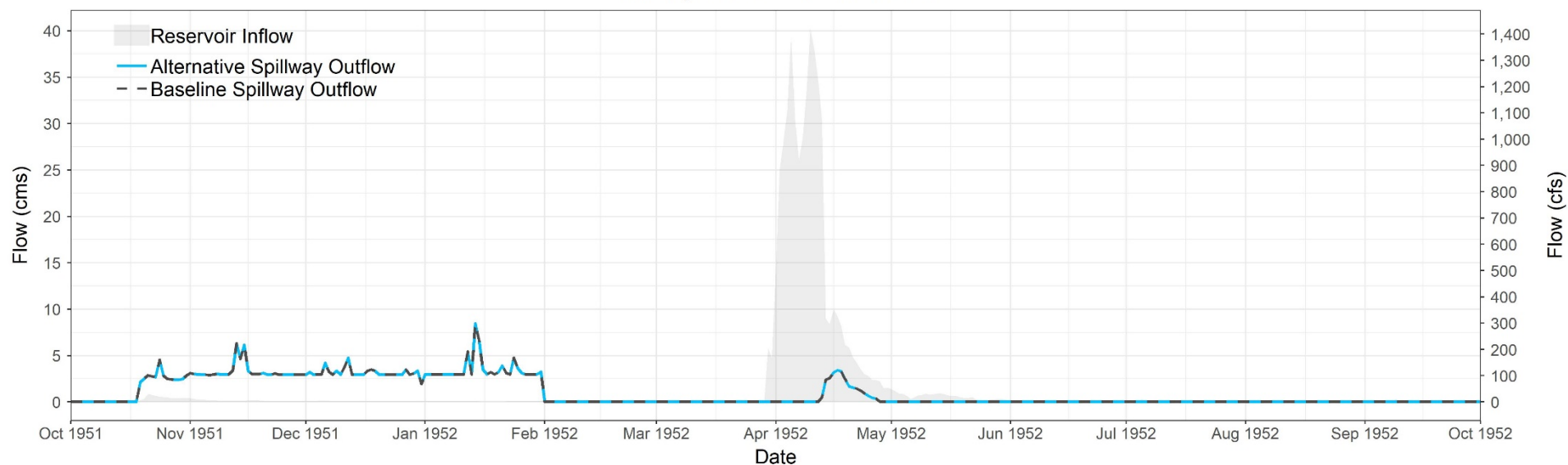
Period of Record: 1946-2017 (72 Years)



Rafferty Reservoir - Elevation

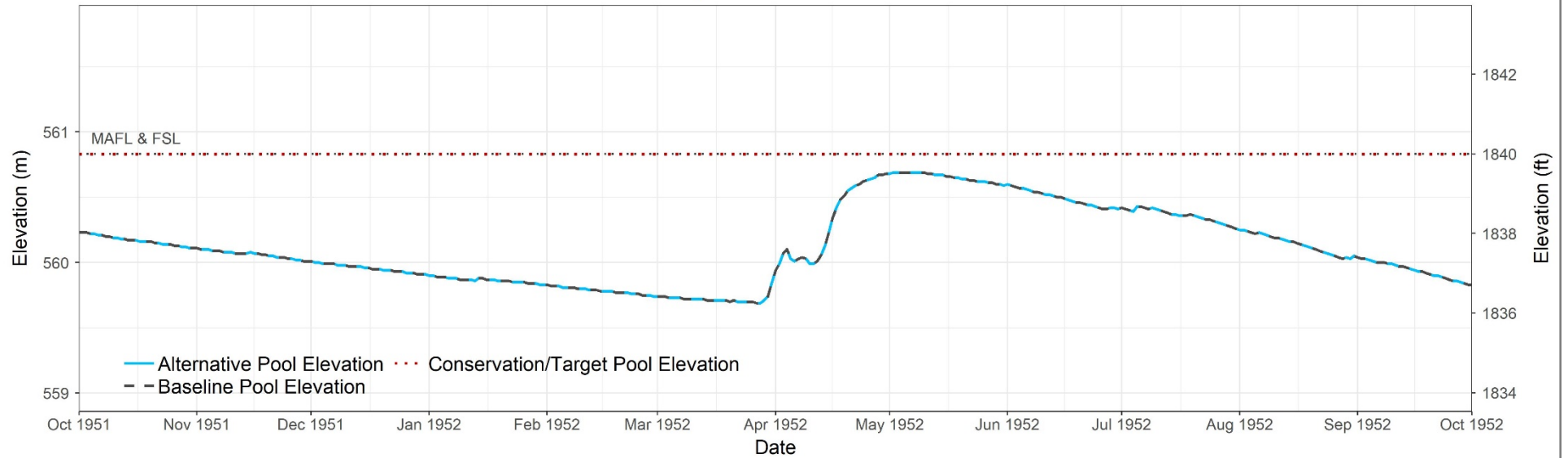


Rafferty Reservoir - Releases

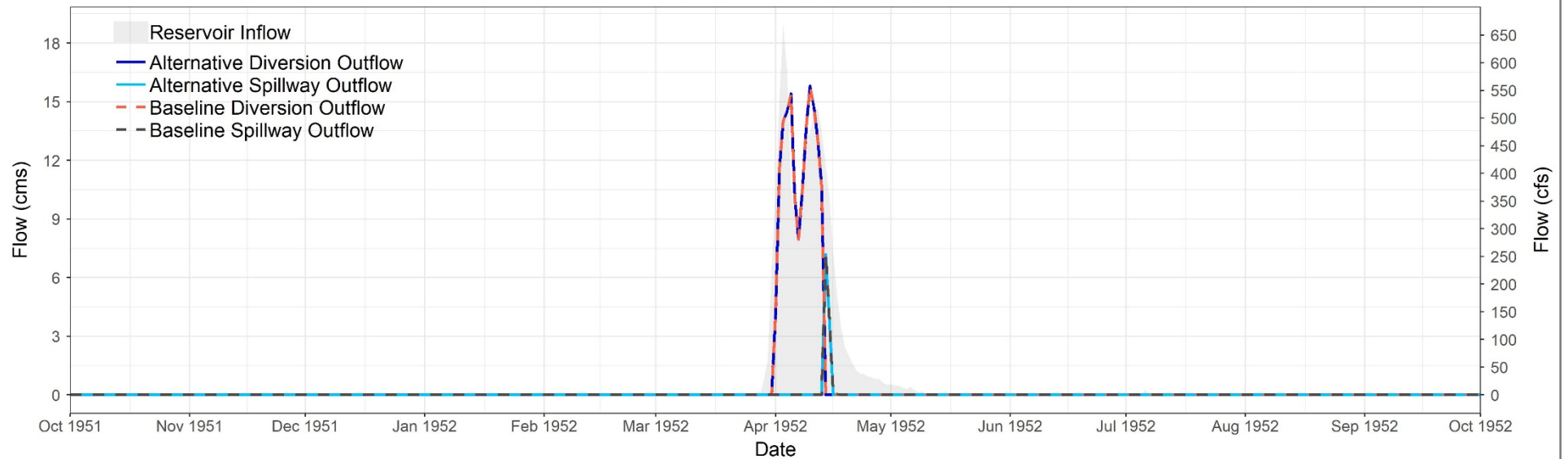


*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level

Boundary Reservoir - Elevation

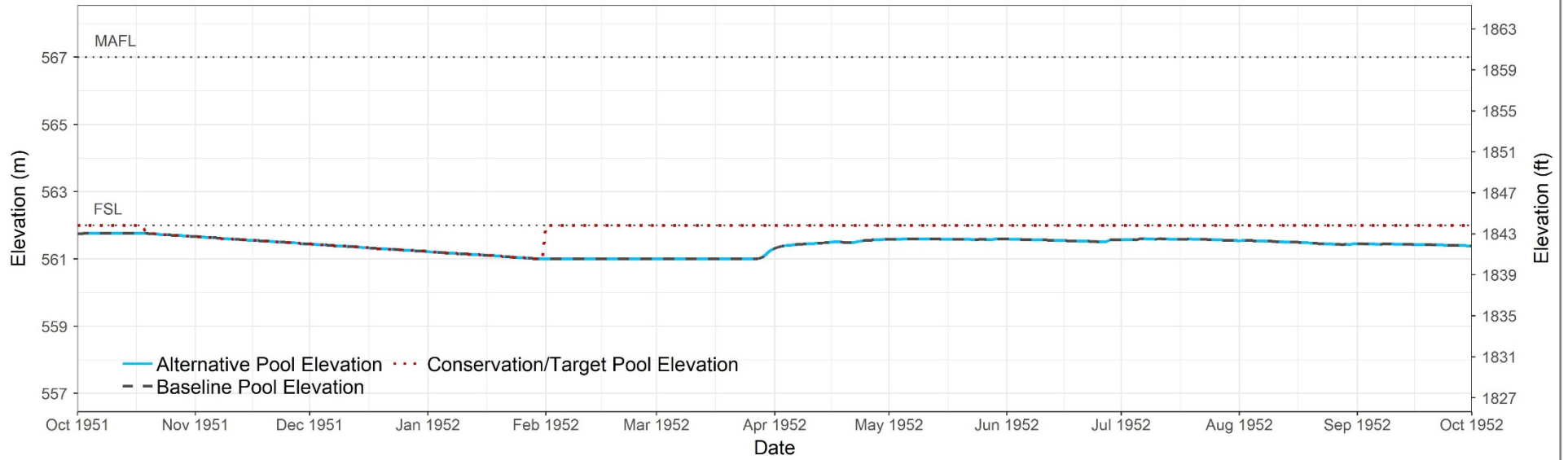


Boundary Reservoir - Releases

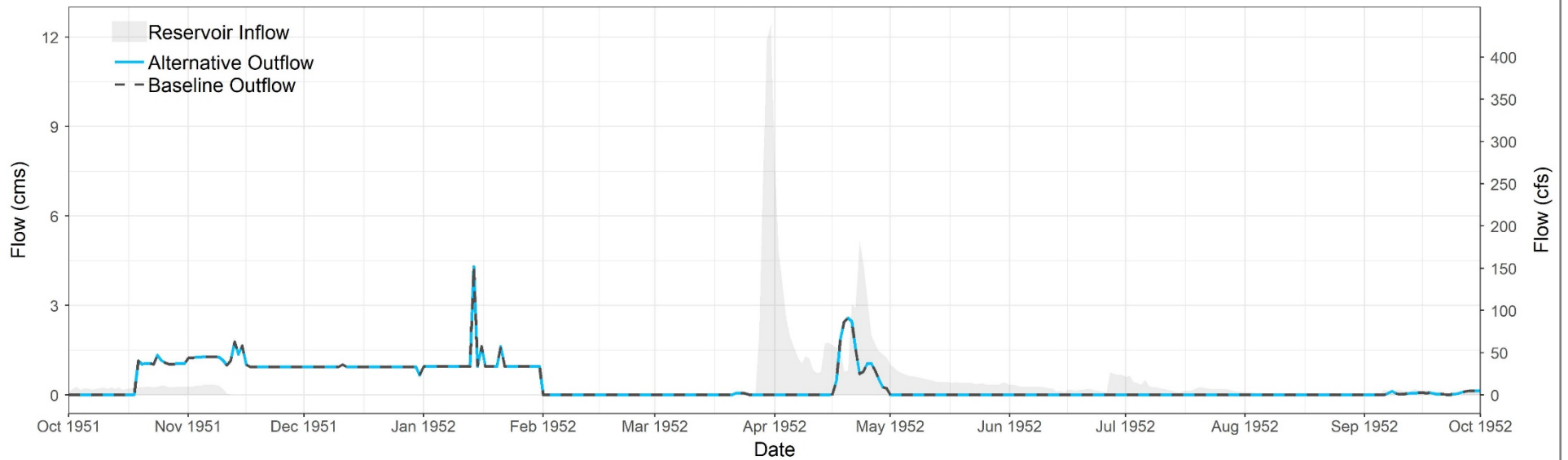


*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level

Grant Devine Reservoir - Elevation

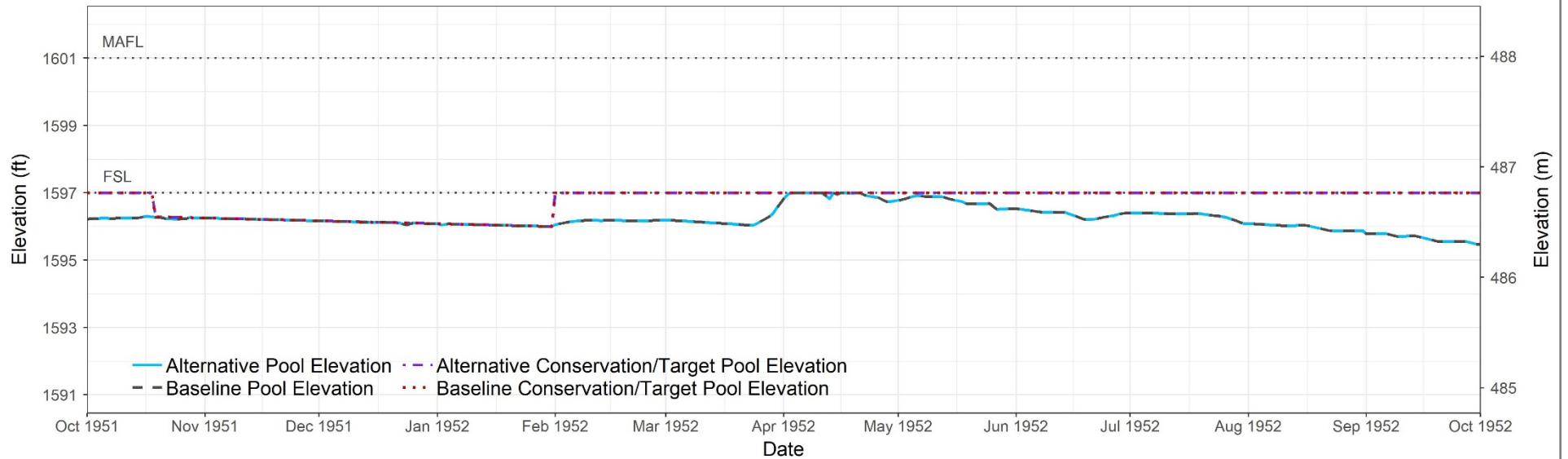


Grant Devine Reservoir - Releases

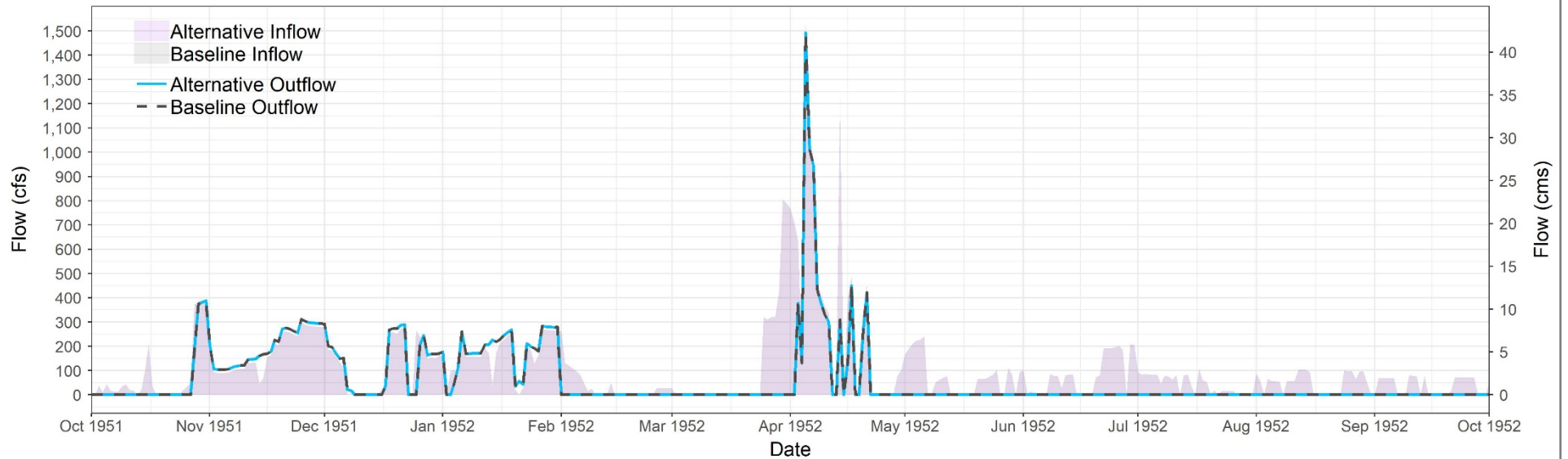


*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level

Lake Darling - Elevation



Lake Darling - Releases



*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level, IDFSL = Inflow Design Flood Supply Level

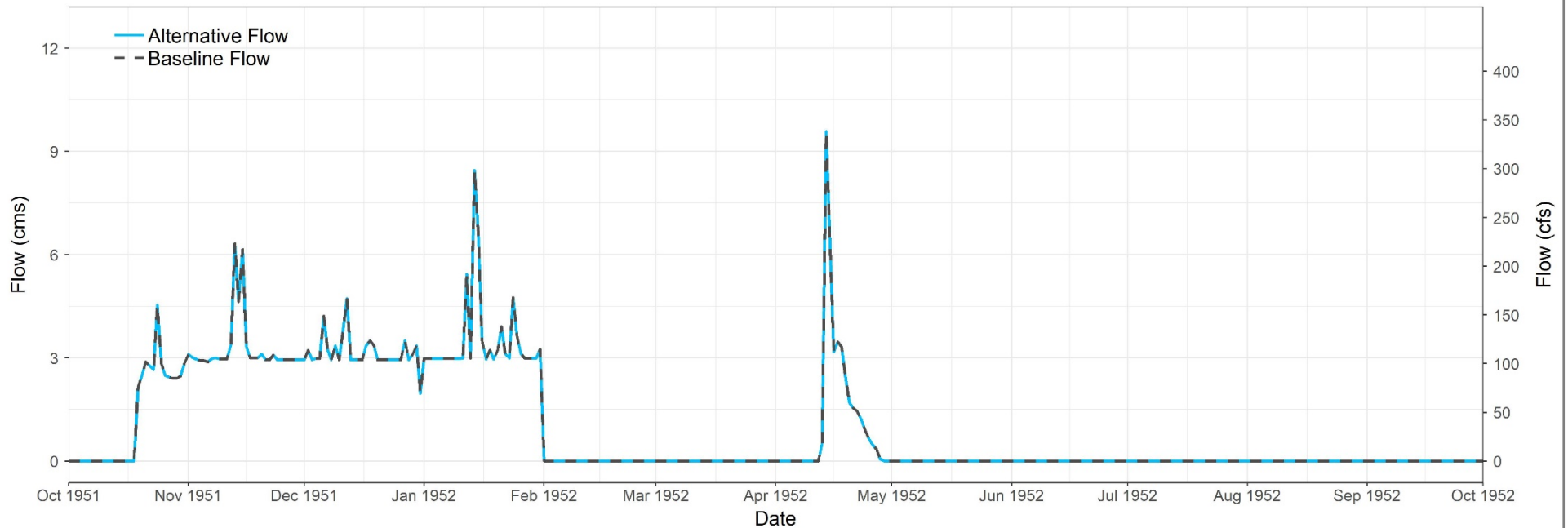
Plate 29

Critical Flow Locations – 1952

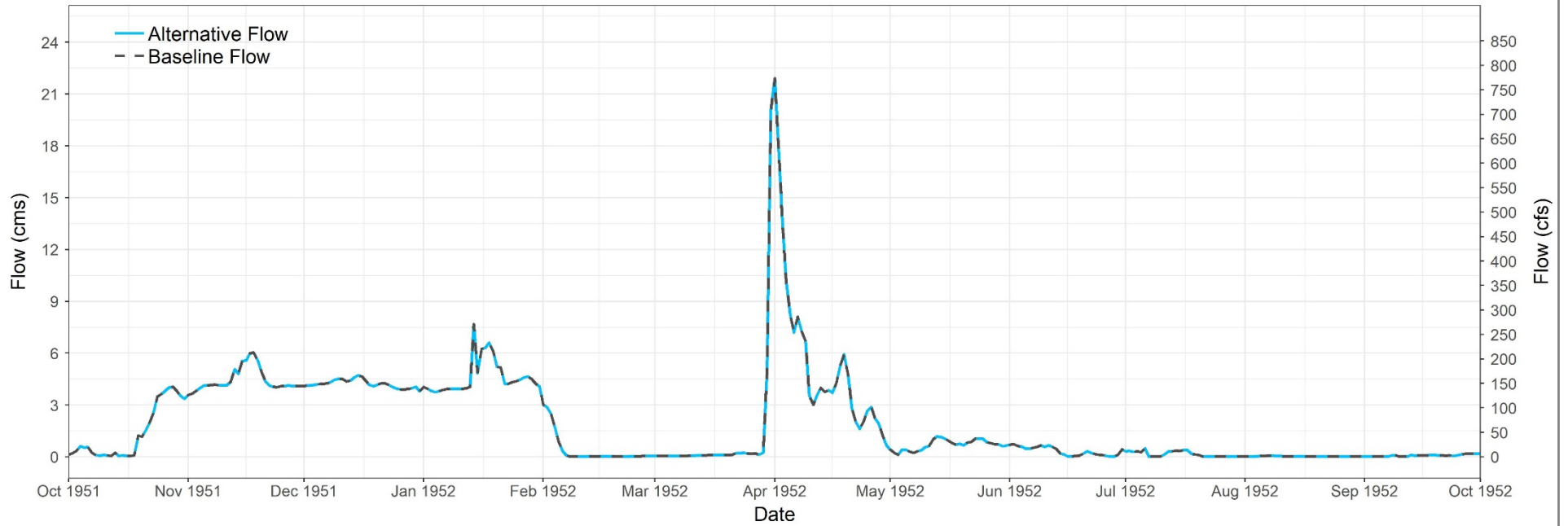
Alternative 10bR (Phase 2)

Souris River Plan of Study

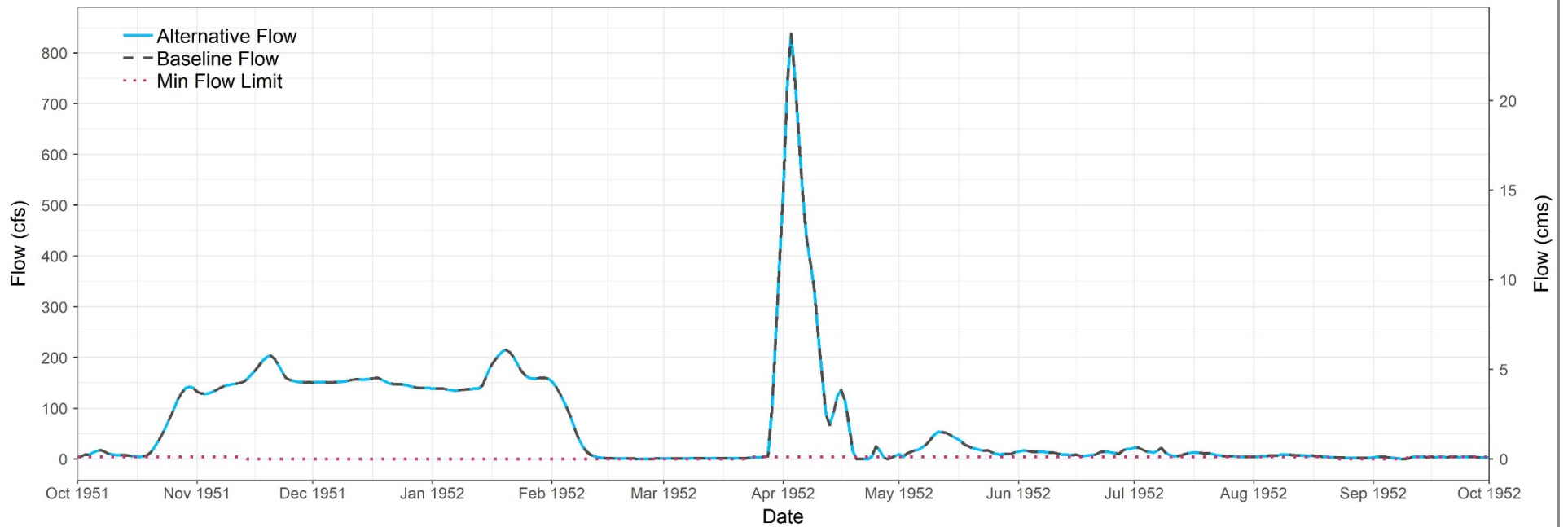
Souris River at Estevan, SK



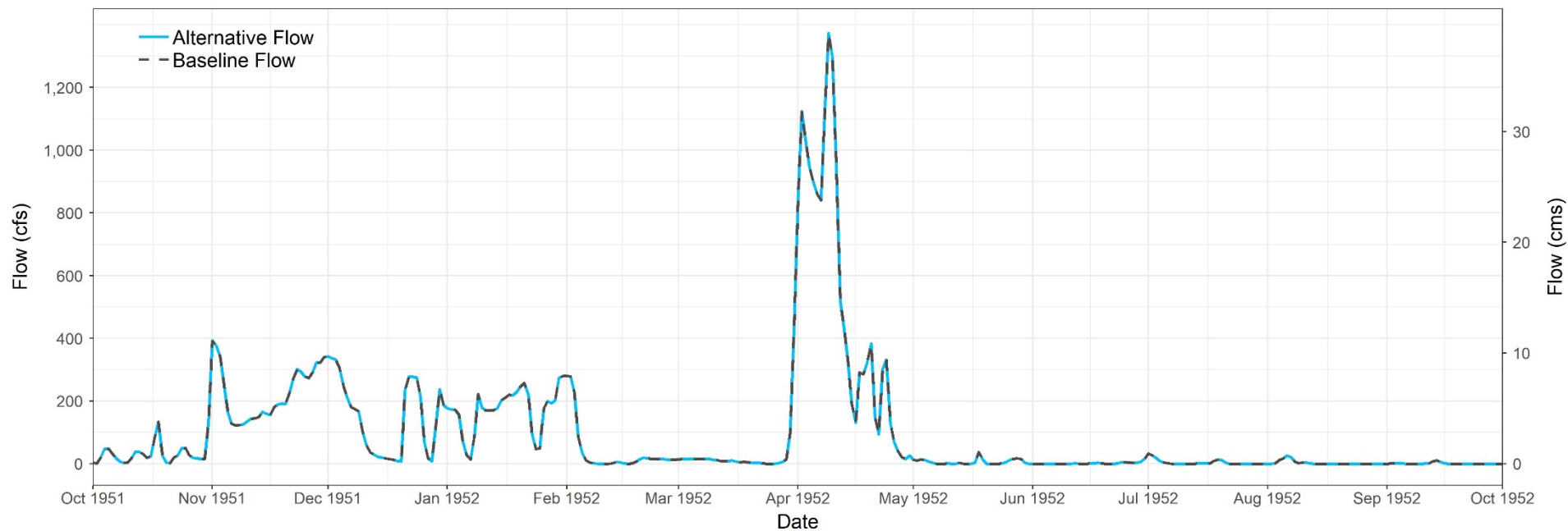
Souris River at Oxbow, SK



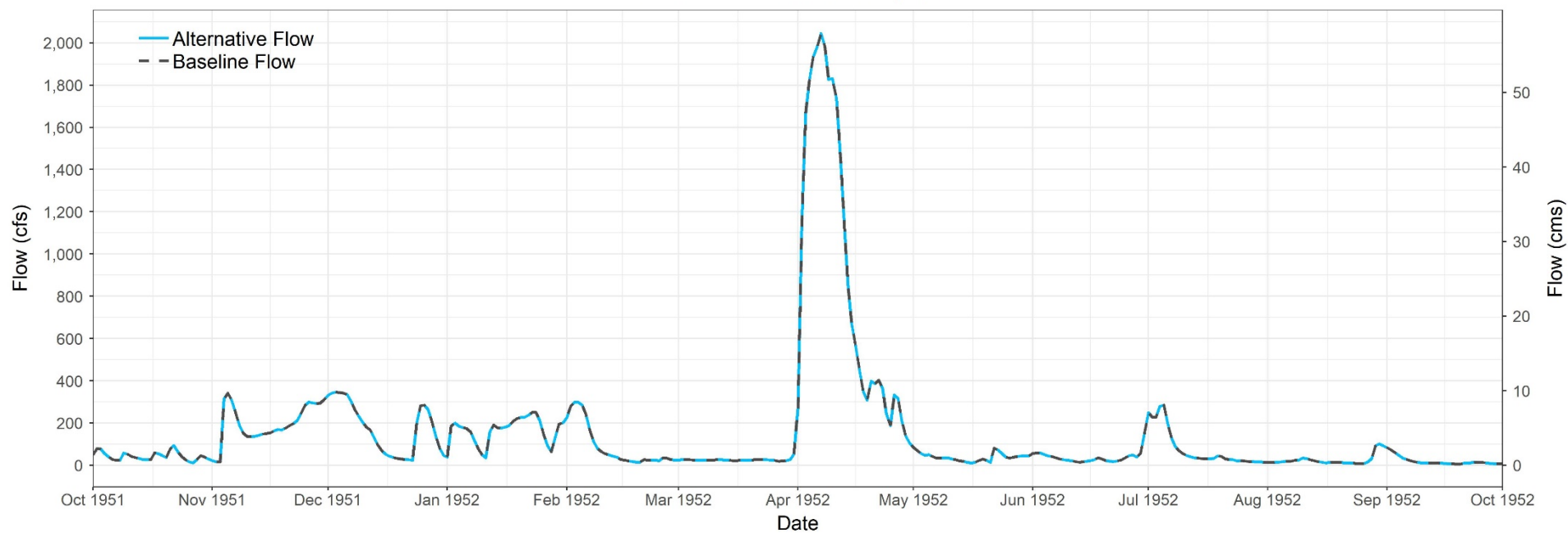
Souris River at Sherwood, ND



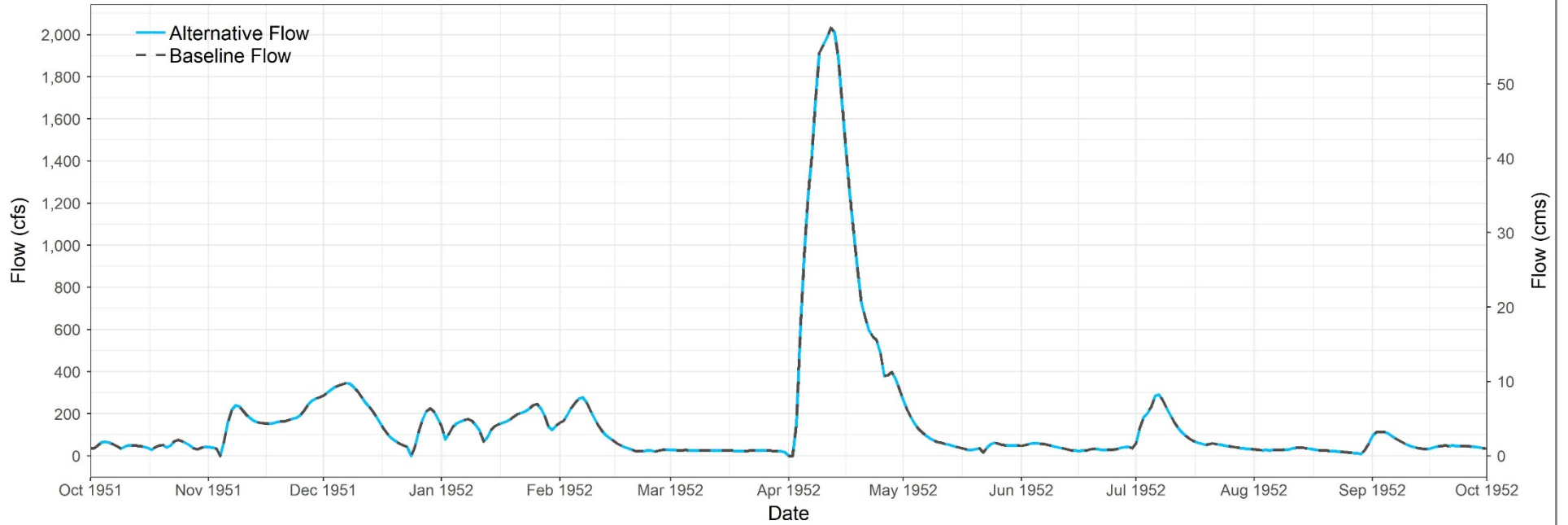
Souris River at Minot, ND - Flow



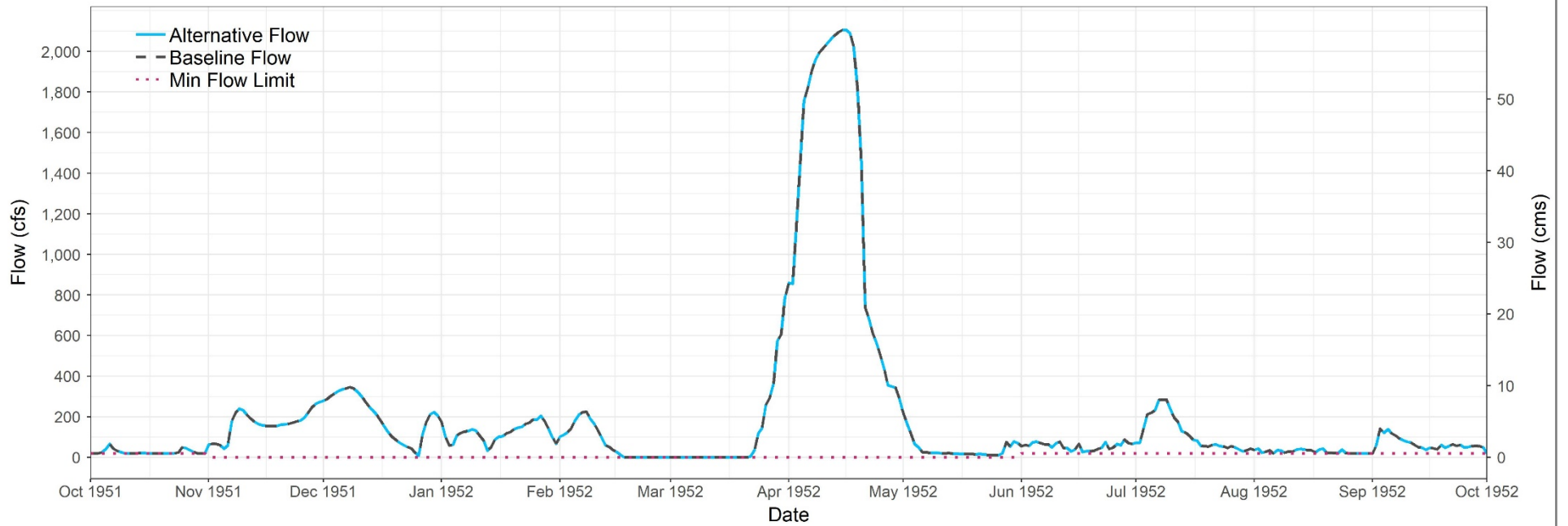
Souris River at Verendrye, ND



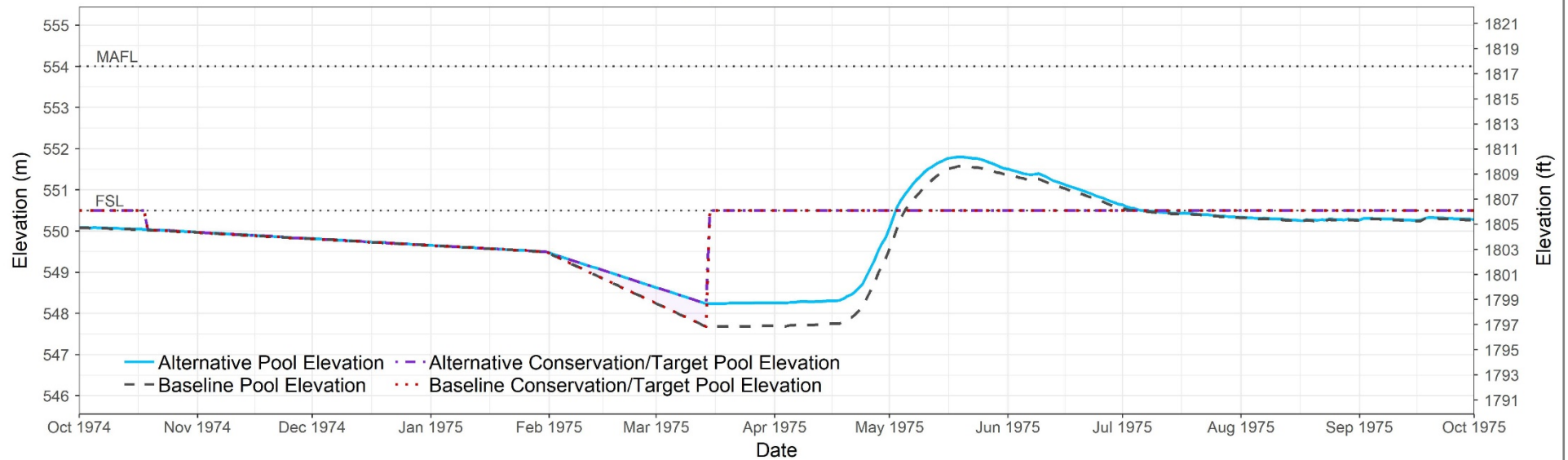
Souris River at Bantry, ND



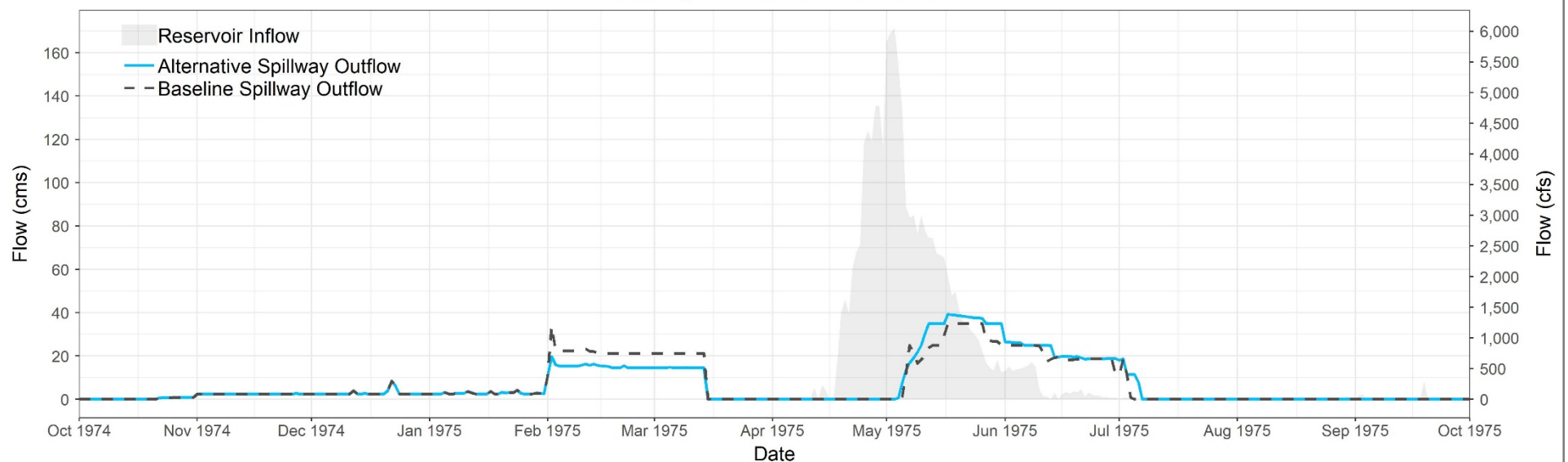
Souris River at Westhope, ND



Rafferty Reservoir - Elevation

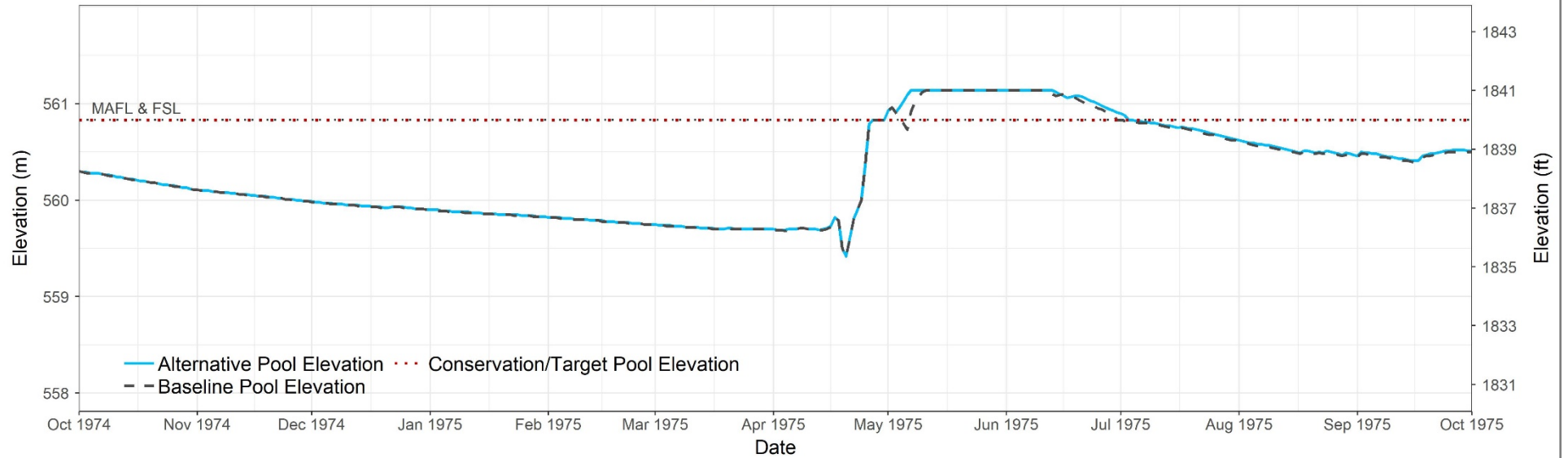


Rafferty Reservoir - Releases

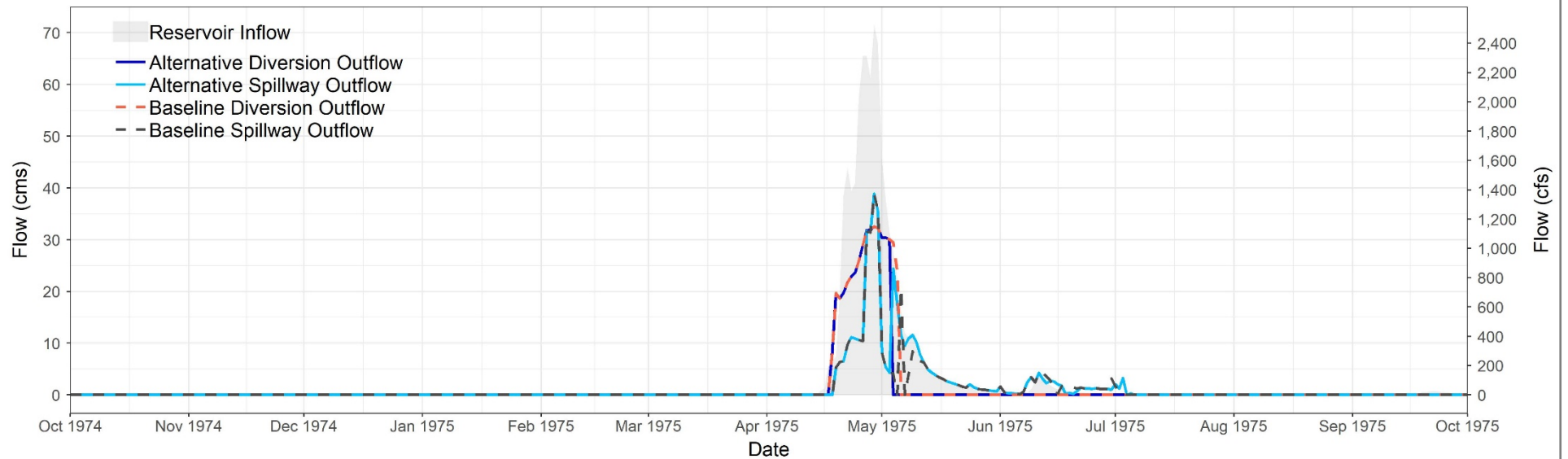


*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level

Boundary Reservoir - Elevation

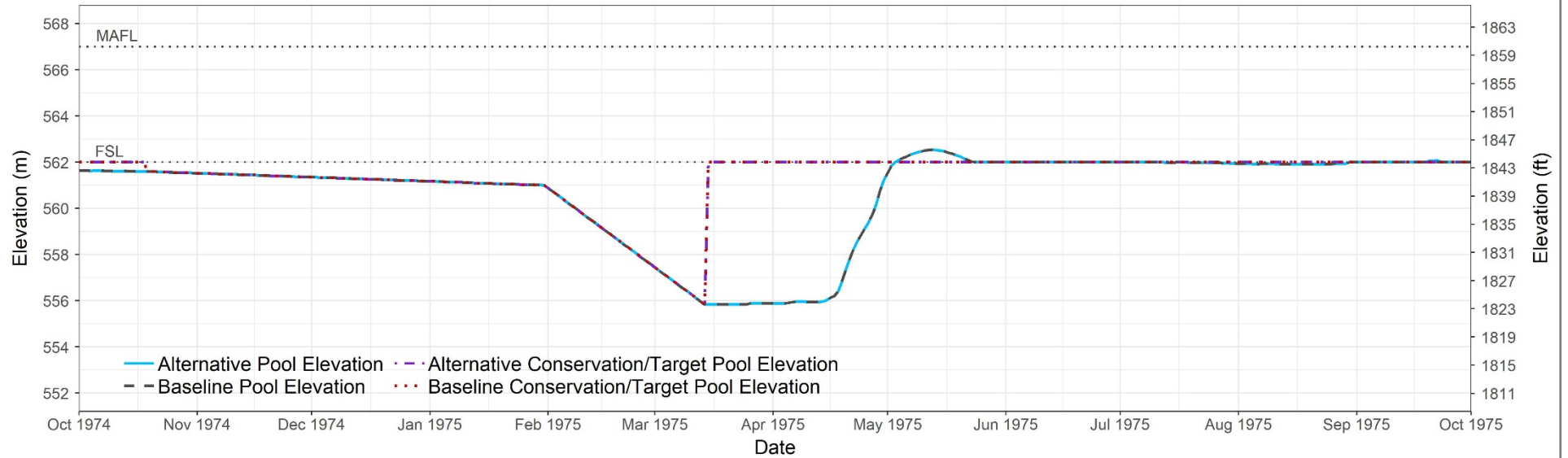


Boundary Reservoir - Releases

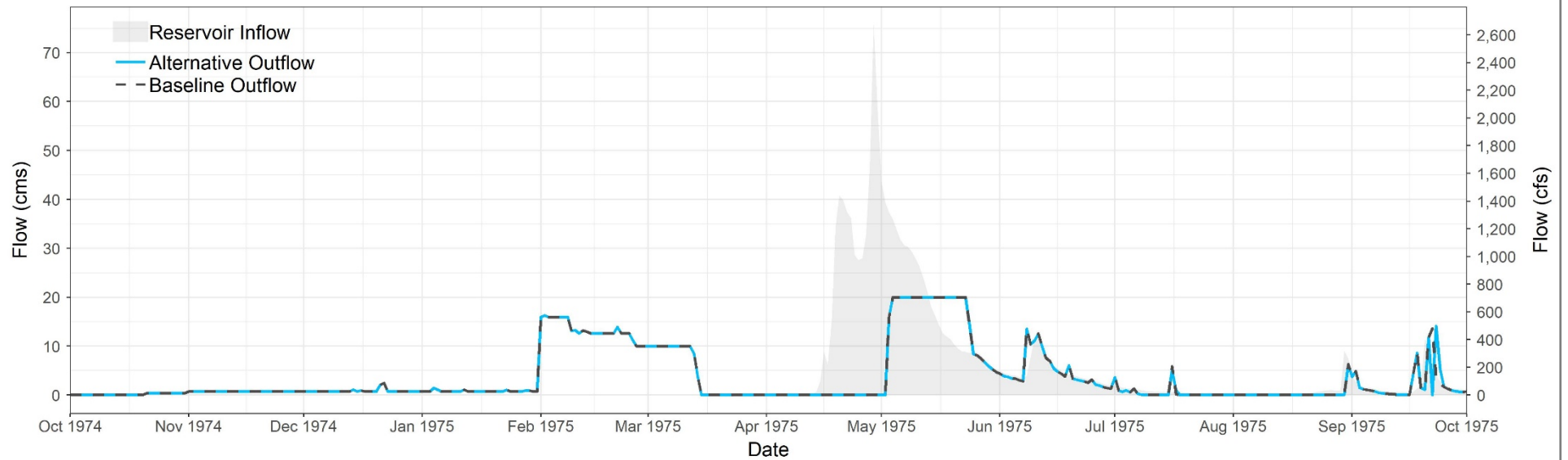


*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level

Grant Devine Reservoir - Elevation

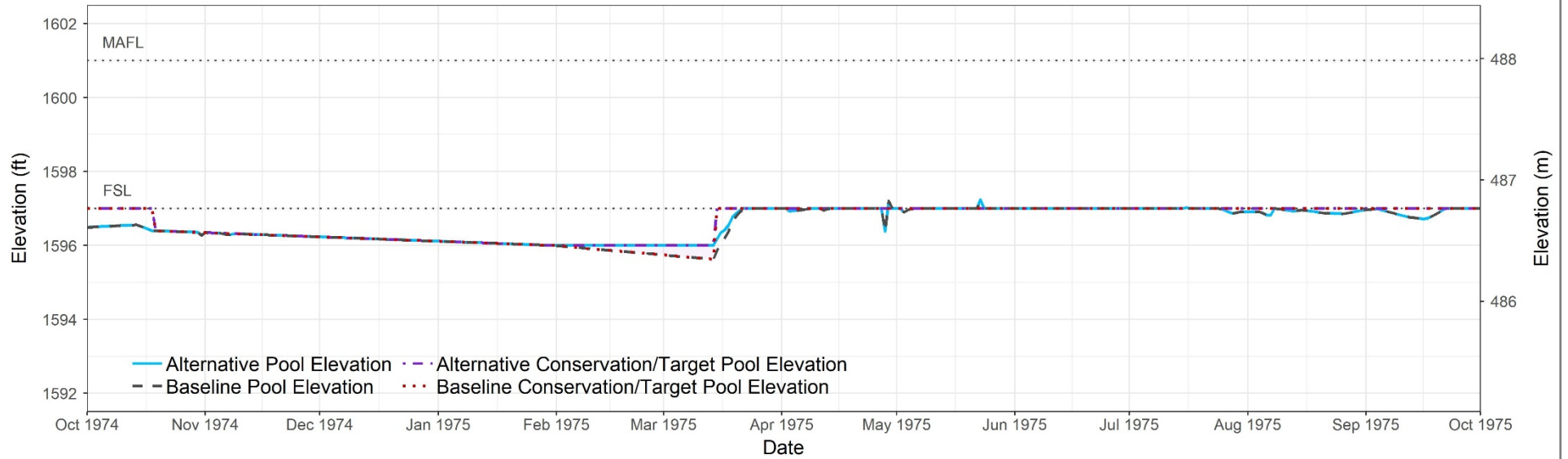


Grant Devine Reservoir - Releases

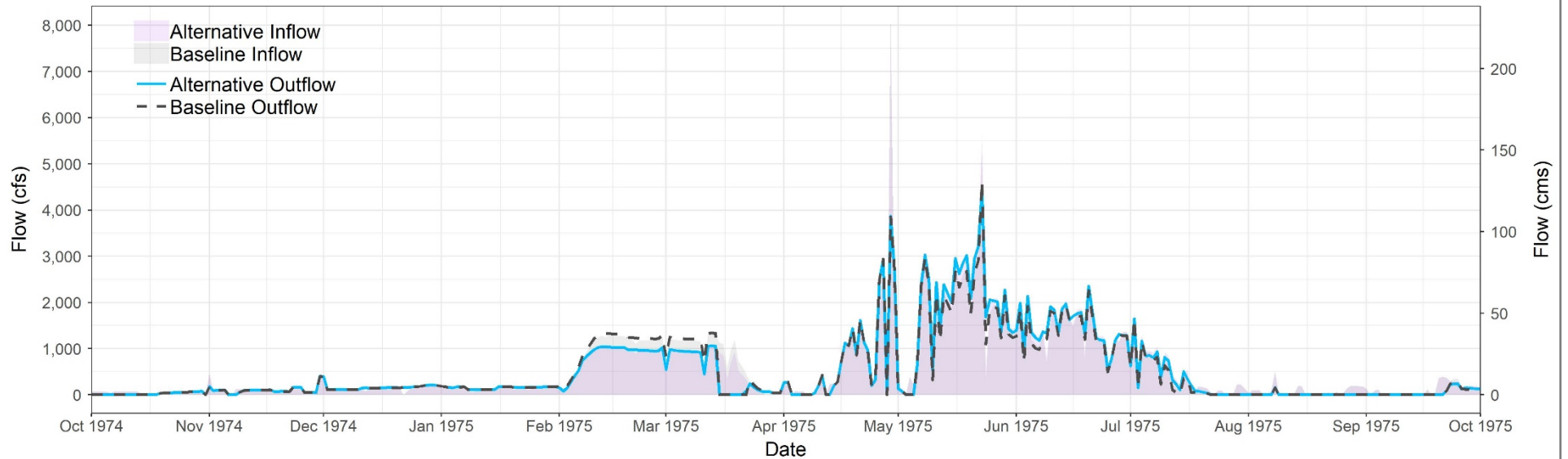


*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level

Lake Darling - Elevation



Lake Darling - Releases



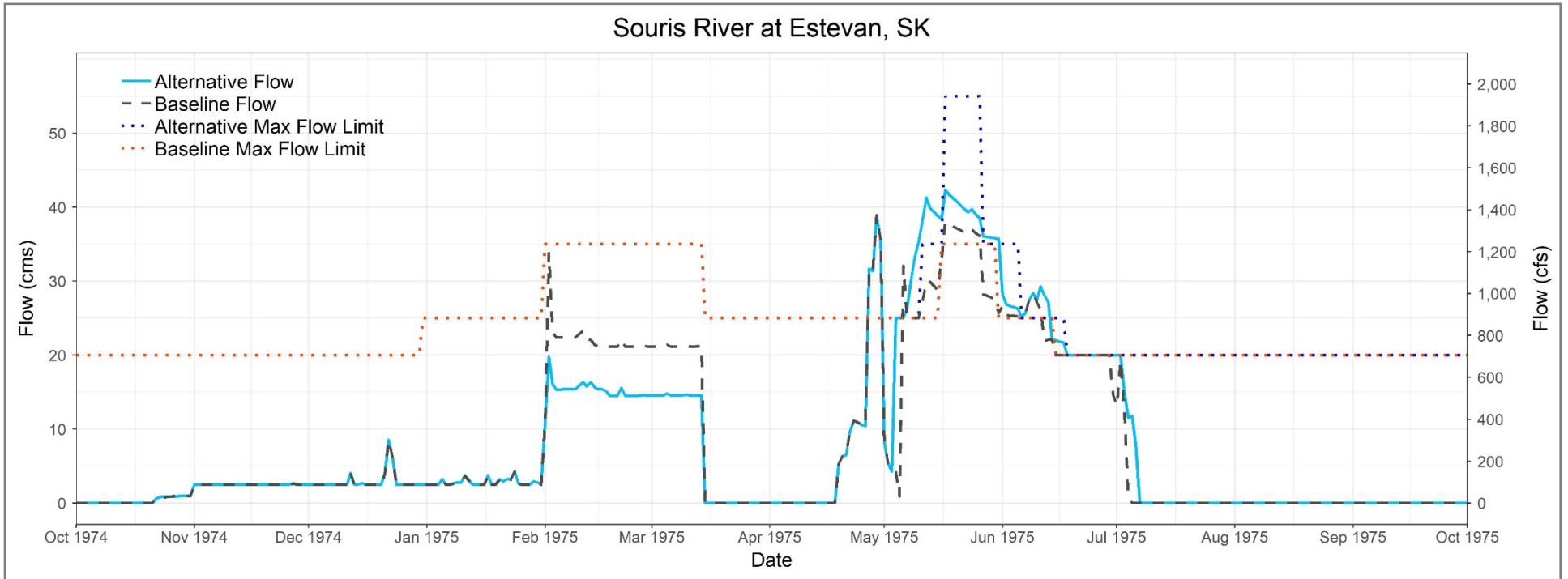
*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level, IDFSL = Inflow Design Flood Supply Level

Plate 31

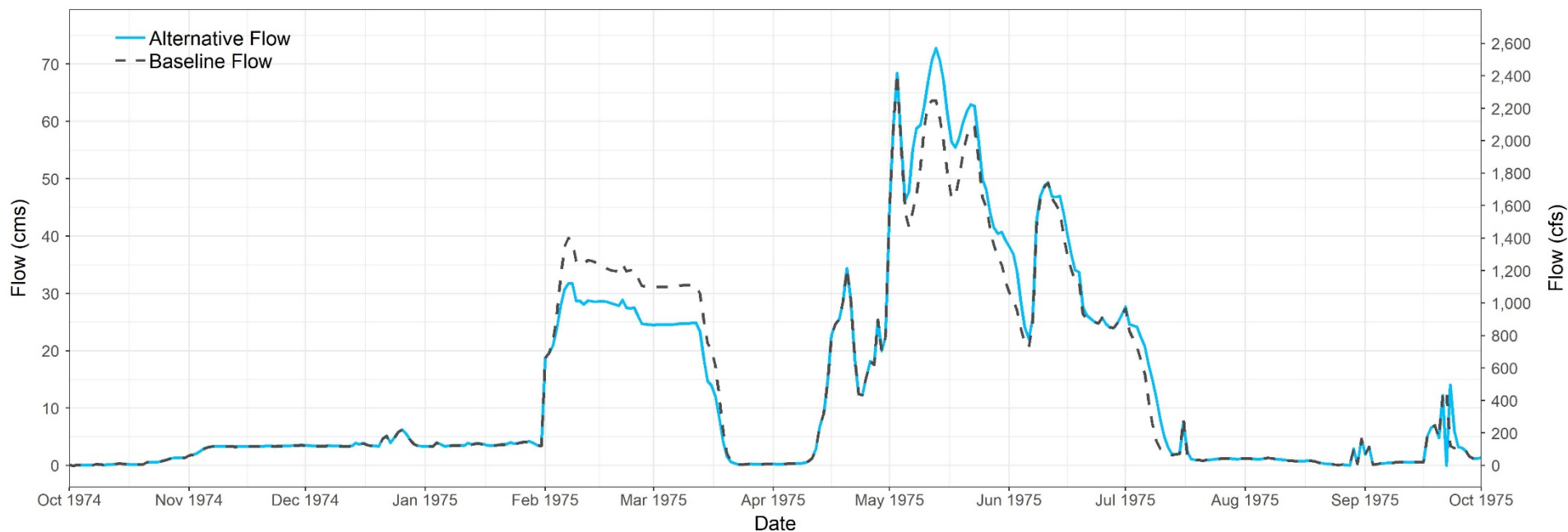
Critical Flow Locations – 1975

Alternative 10bR (Phase 2)

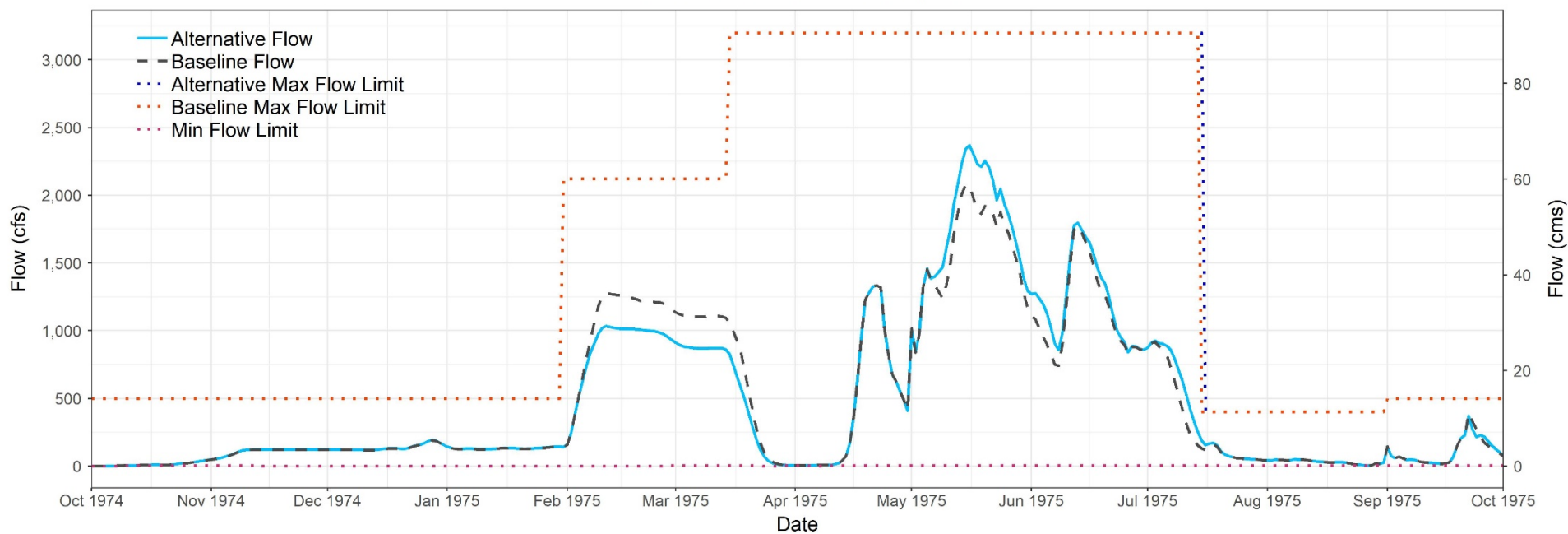
Souris River Plan of Study



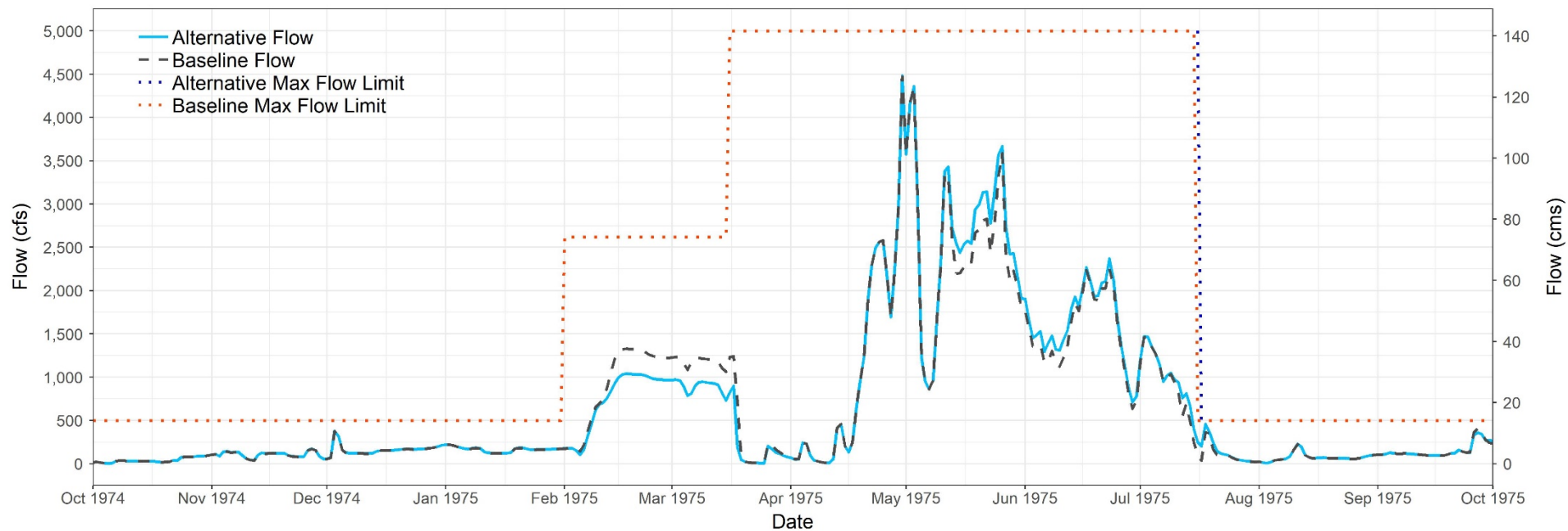
Souris River at Oxbow, SK



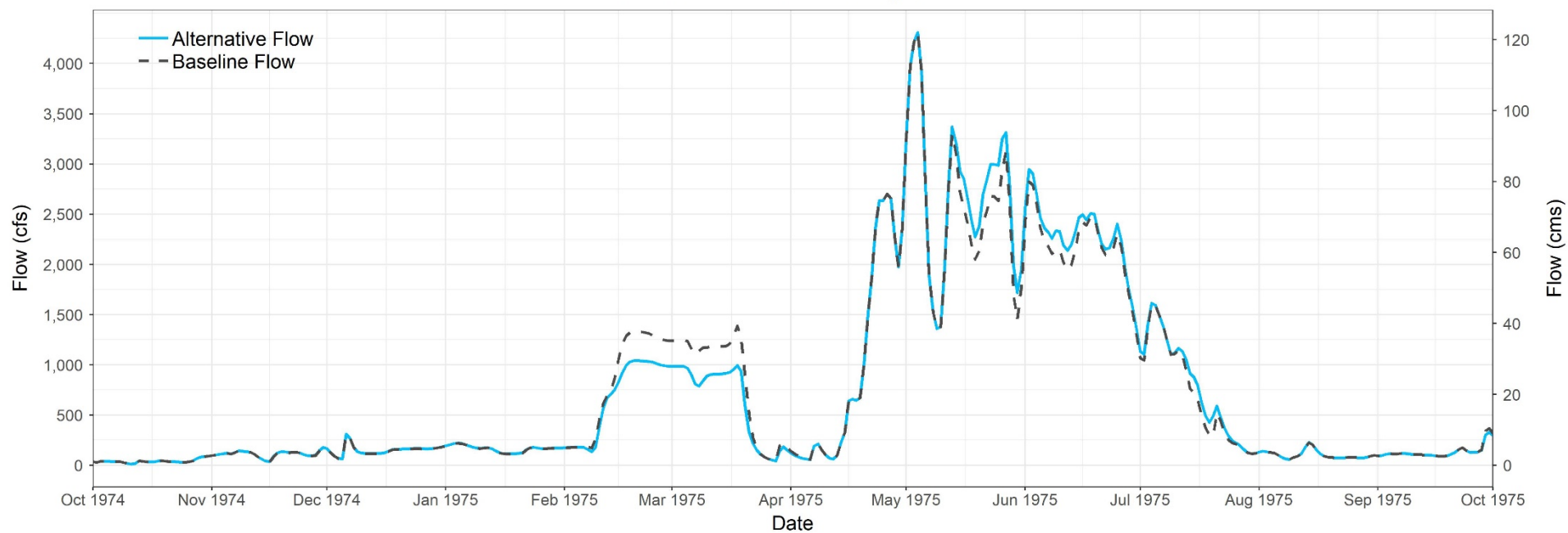
Souris River at Sherwood, ND



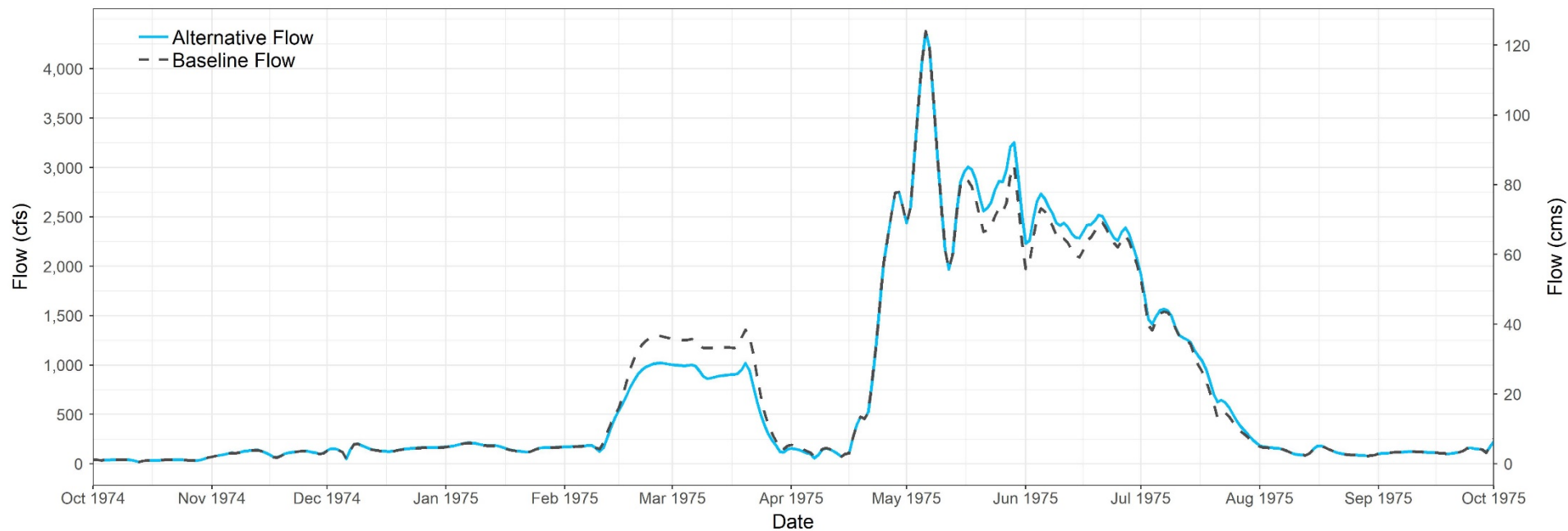
Souris River at Minot, ND - Flow



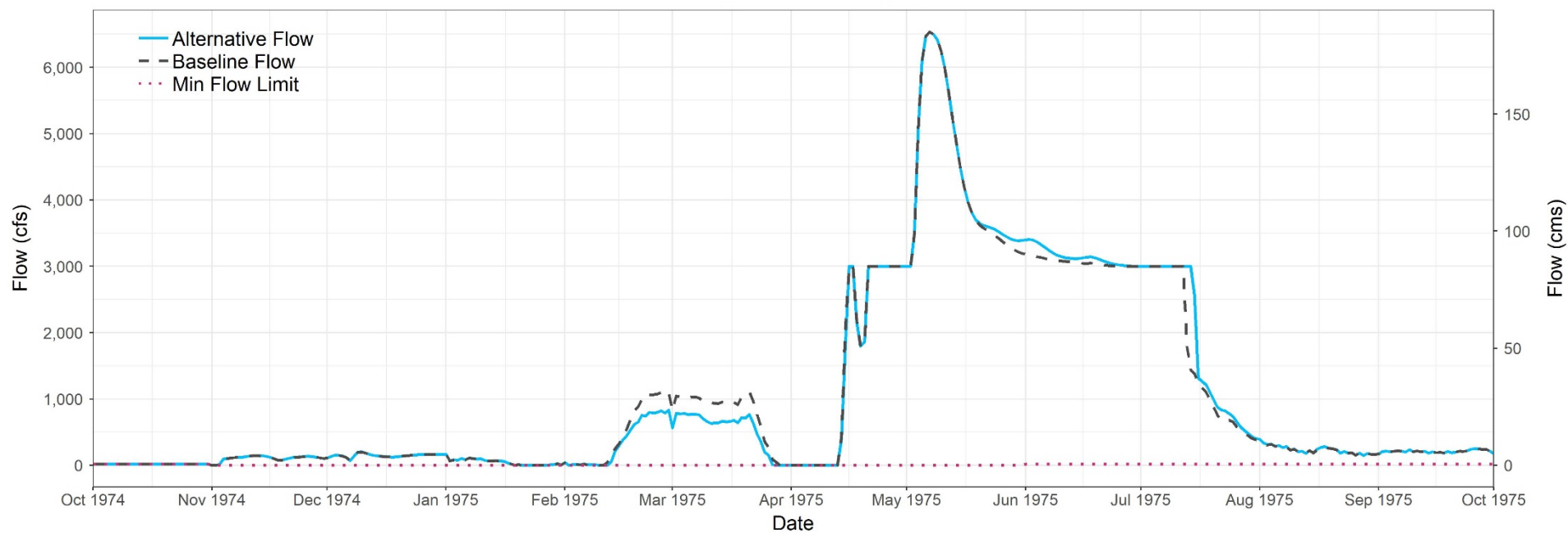
Souris River at Verendrye, ND



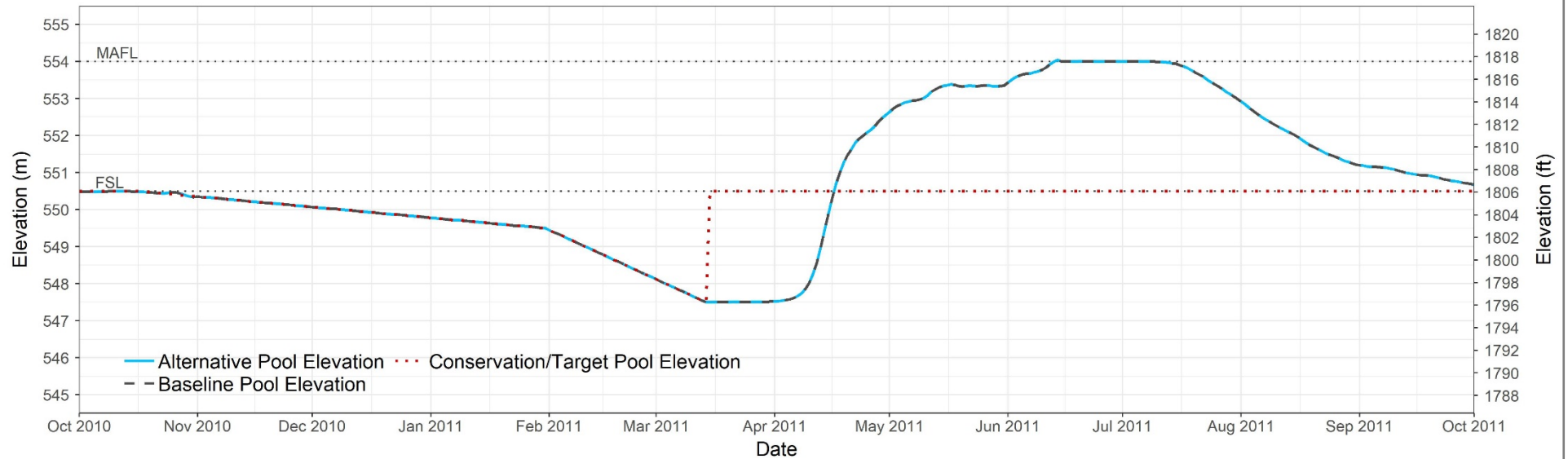
Souris River at Bantry, ND



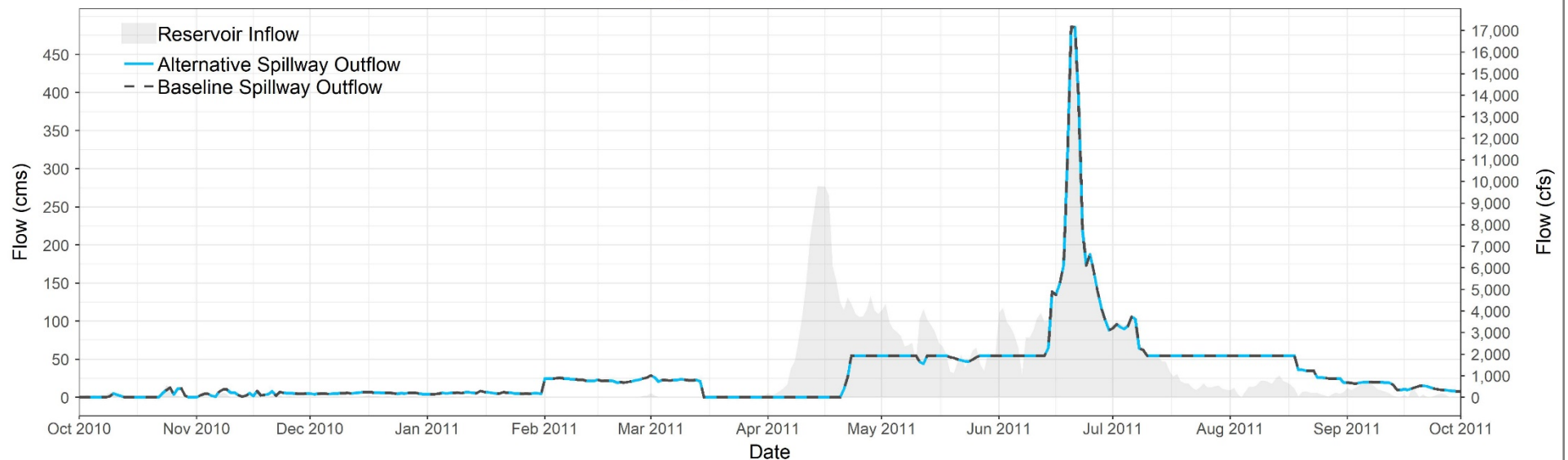
Souris River at Westhope, ND



Rafferty Reservoir - Elevation

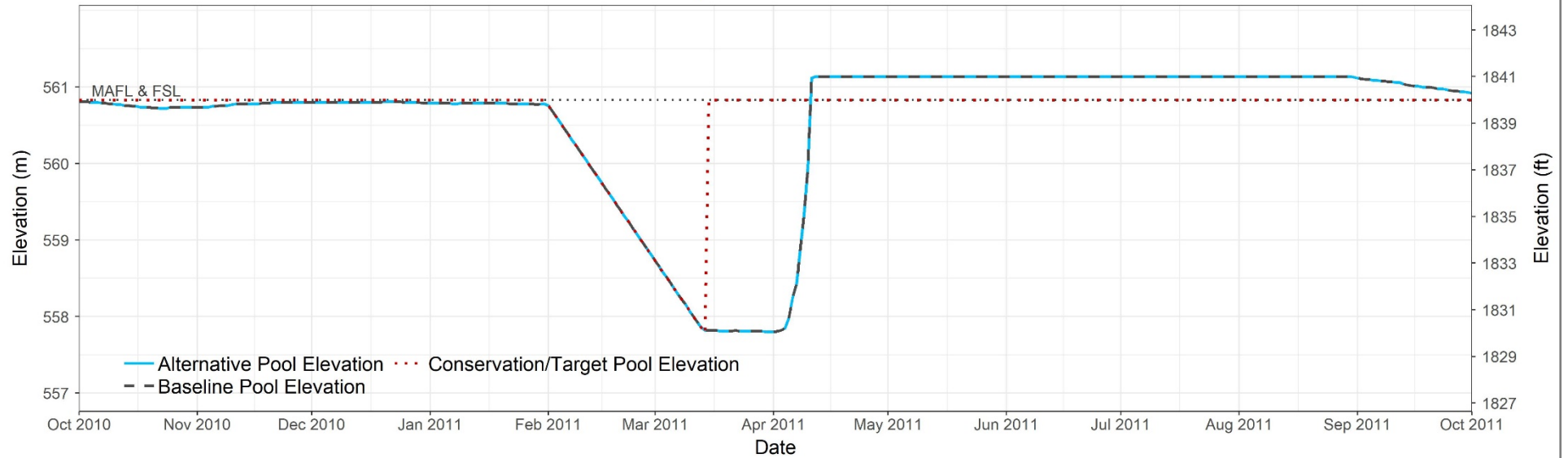


Rafferty Reservoir - Releases

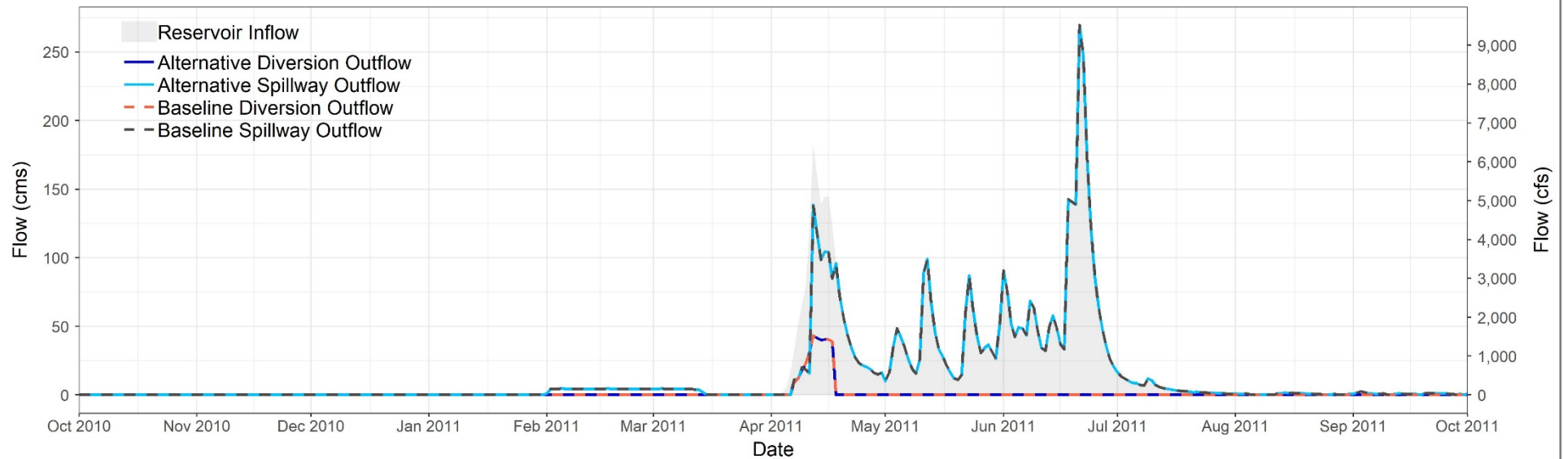


*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level

Boundary Reservoir - Elevation

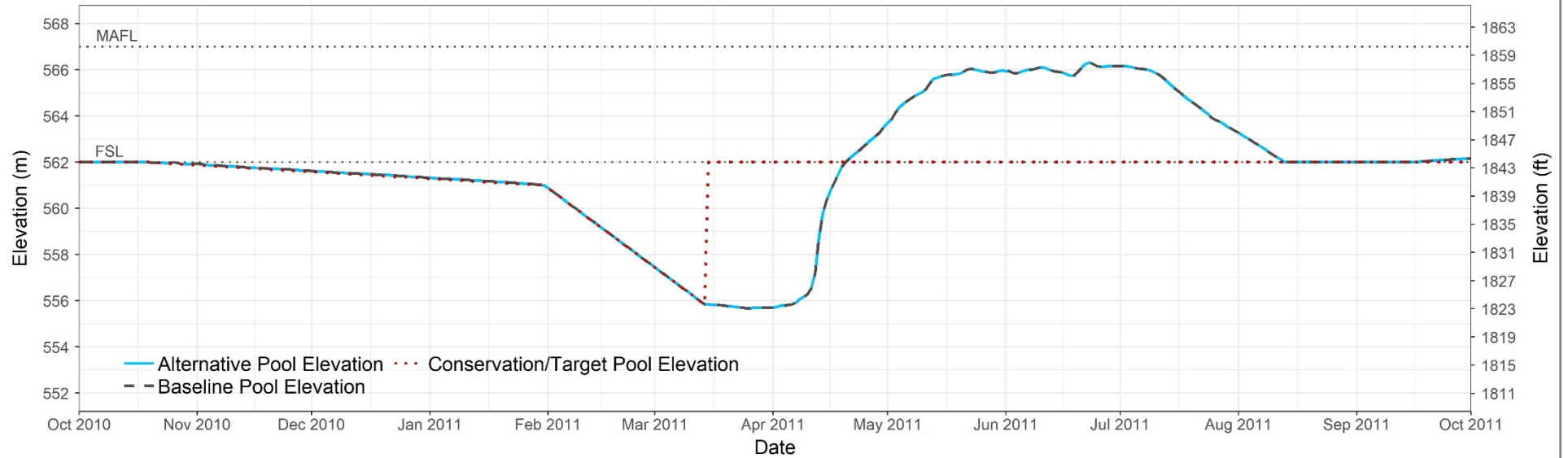


Boundary Reservoir - Releases

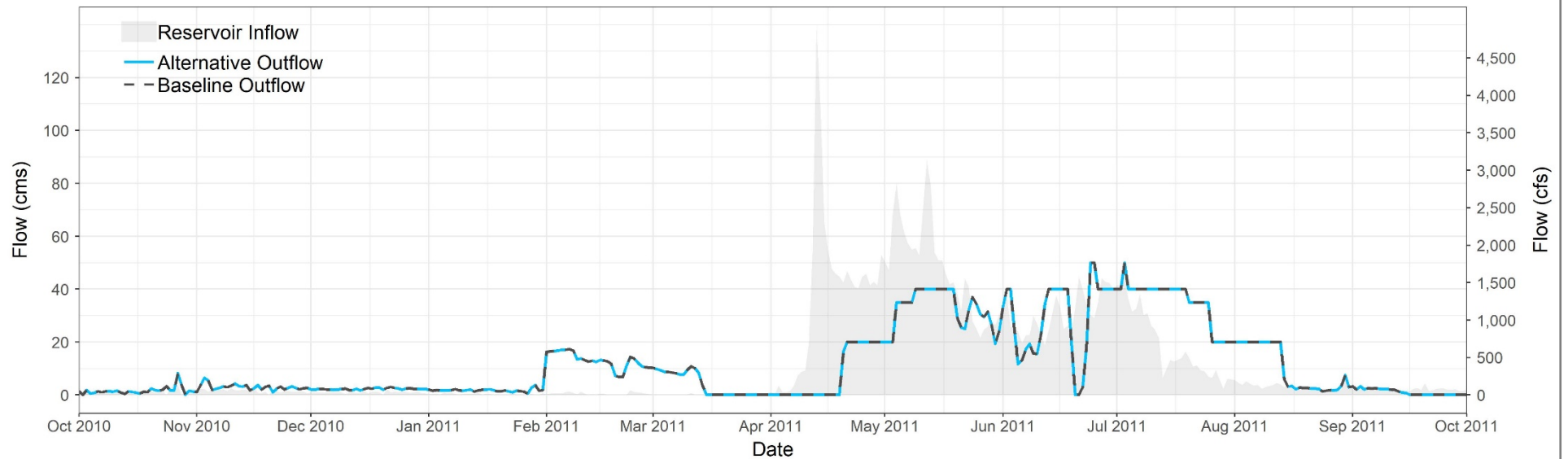


*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level

Grant Devine Reservoir - Elevation

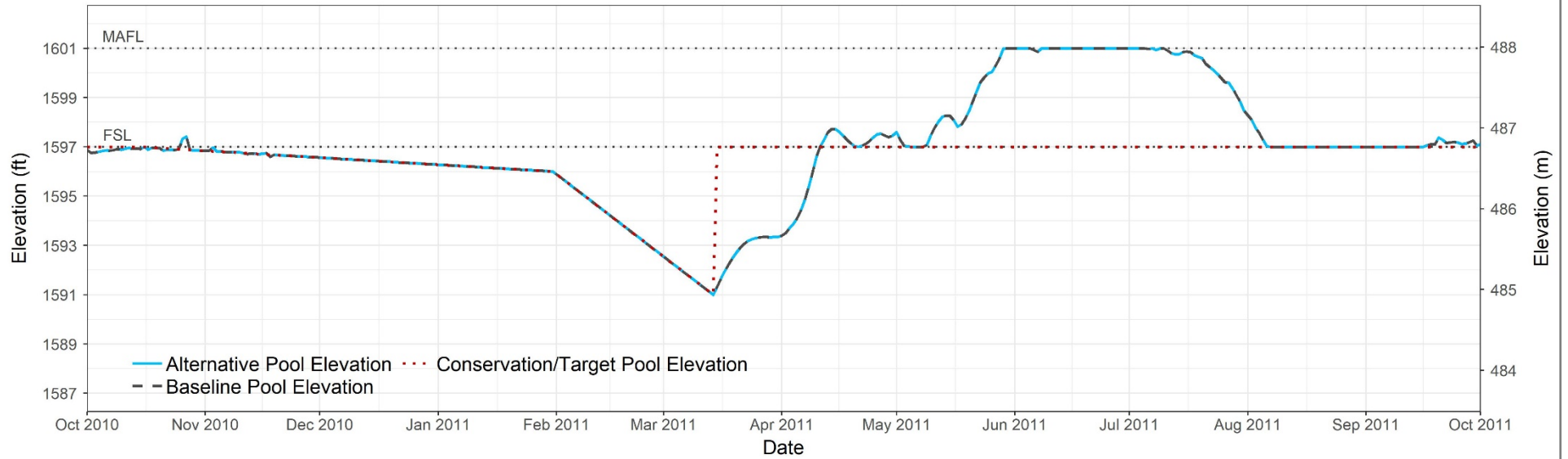


Grant Devine Reservoir - Releases

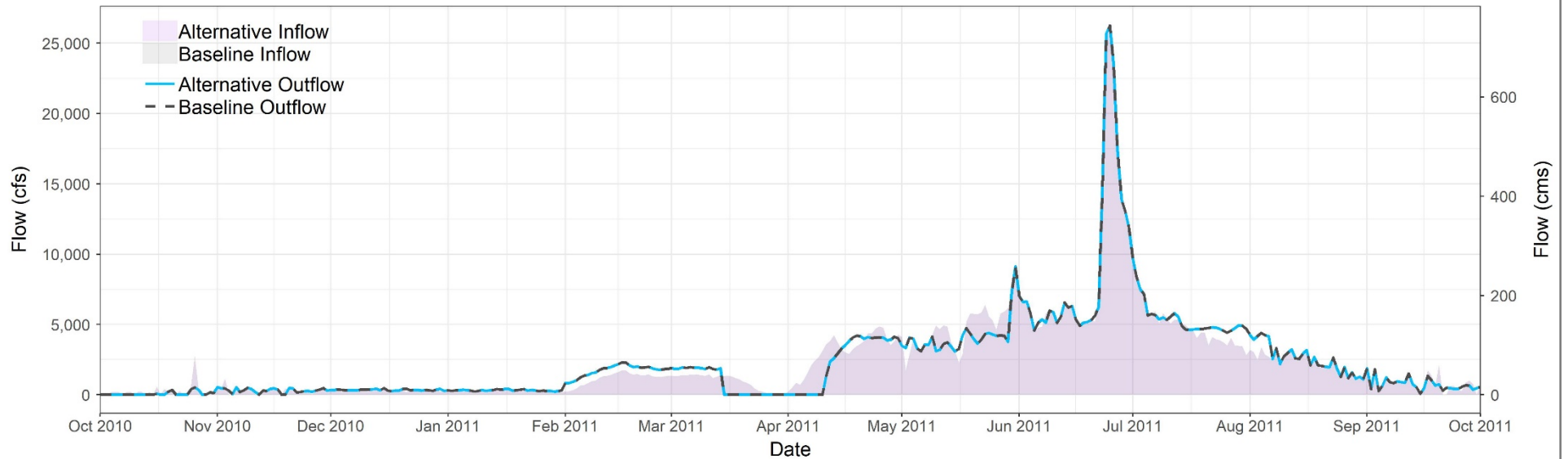


*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level

Lake Darling - Elevation



Lake Darling - Releases



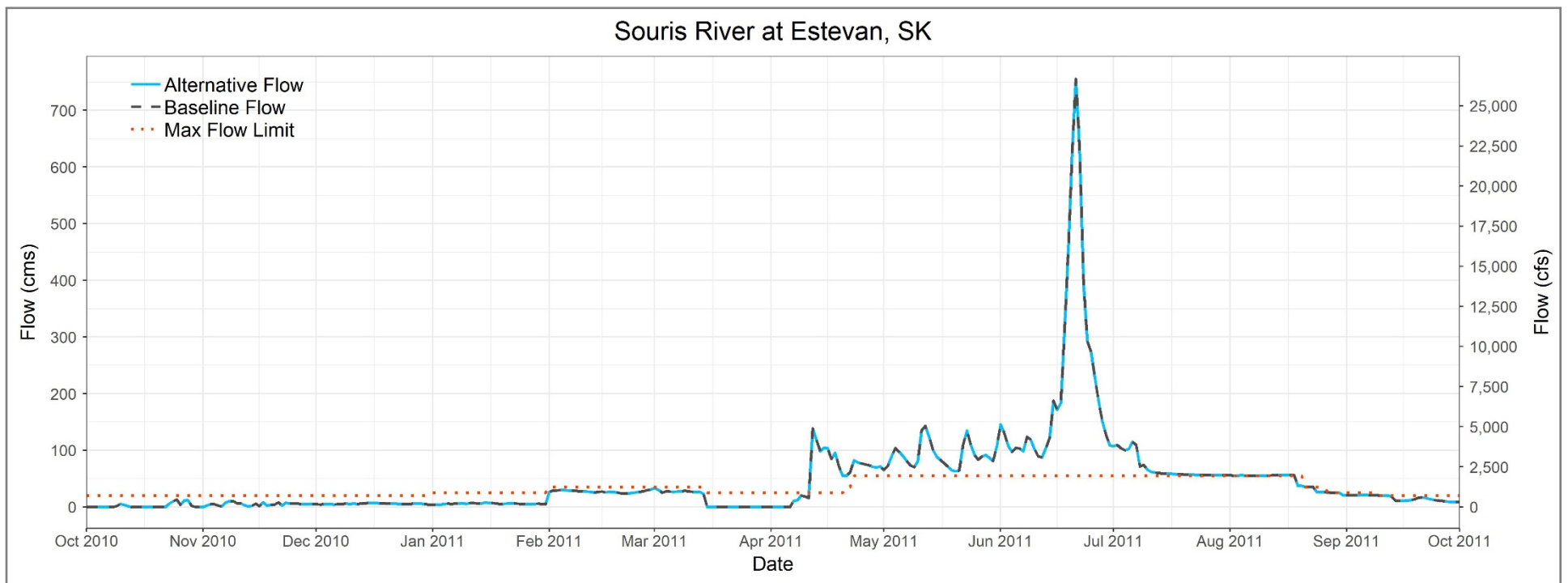
*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level, IDFSL = Inflow Design Flood Supply Level

Plate 33

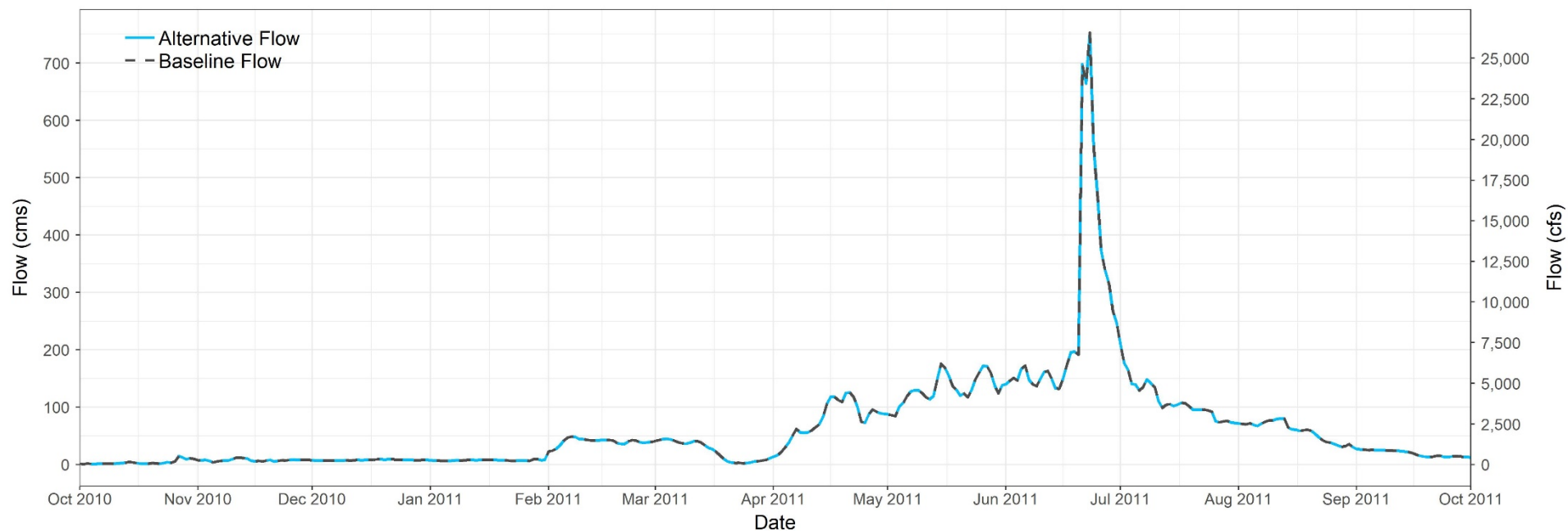
Critical Flow Locations – 2011

Alternative 10bR (Phase 2)

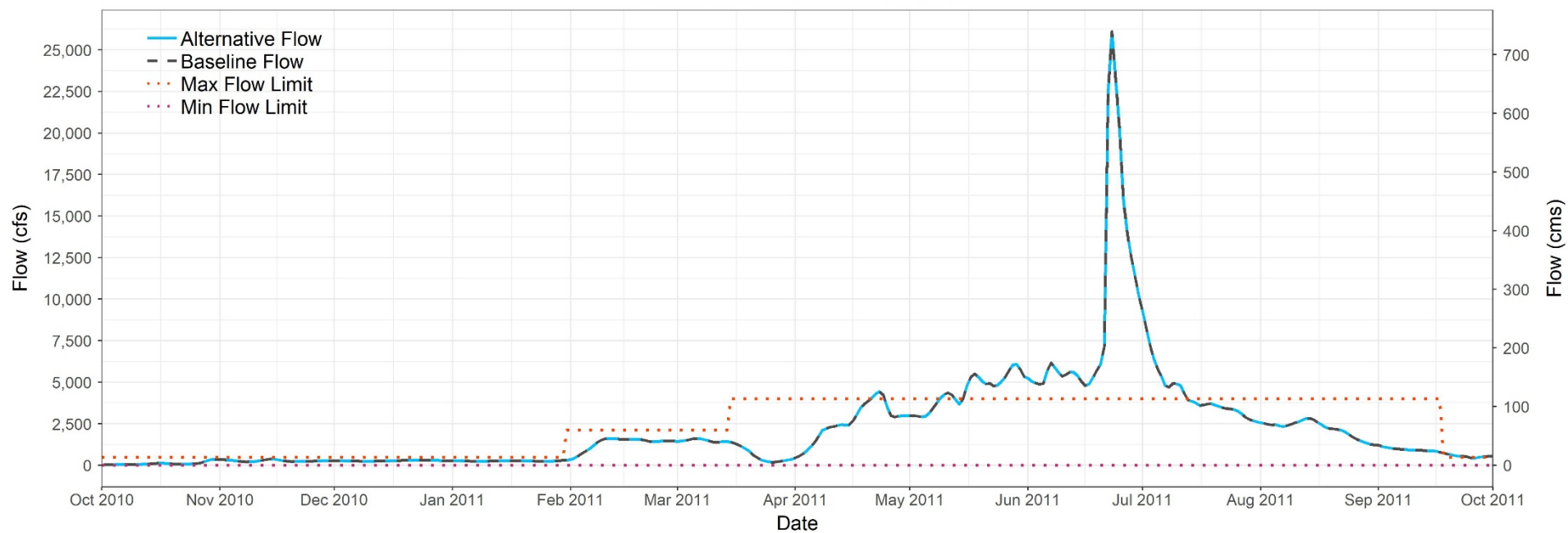
Souris River Plan of Study



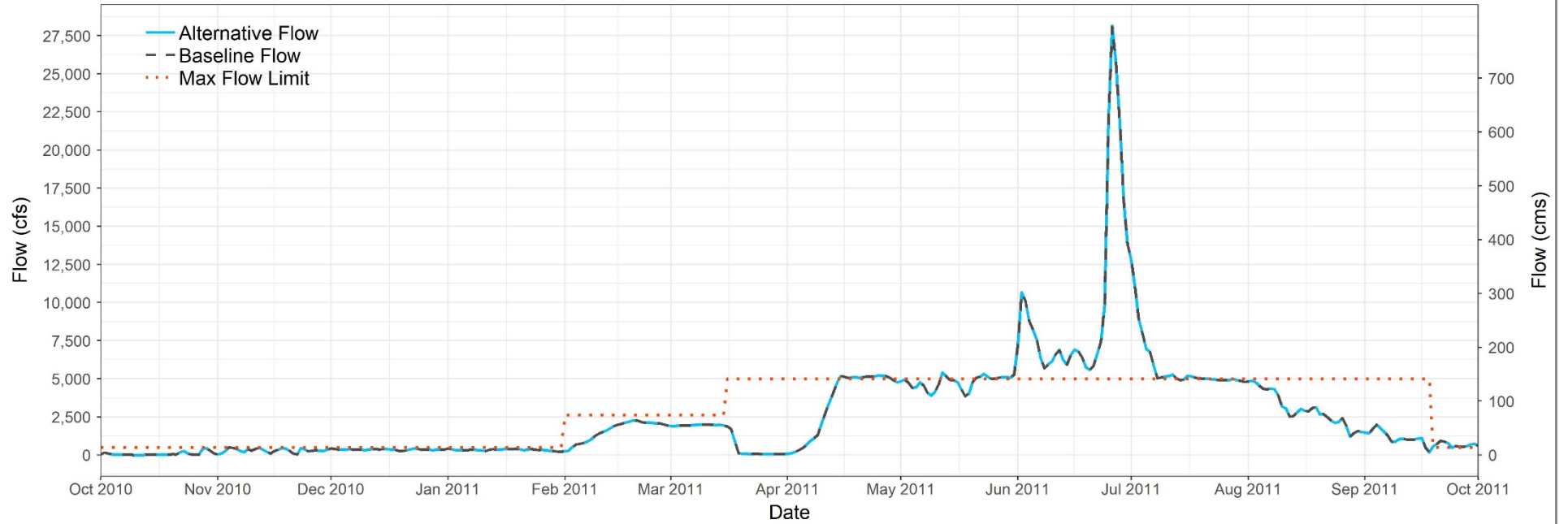
Souris River at Oxbow, SK



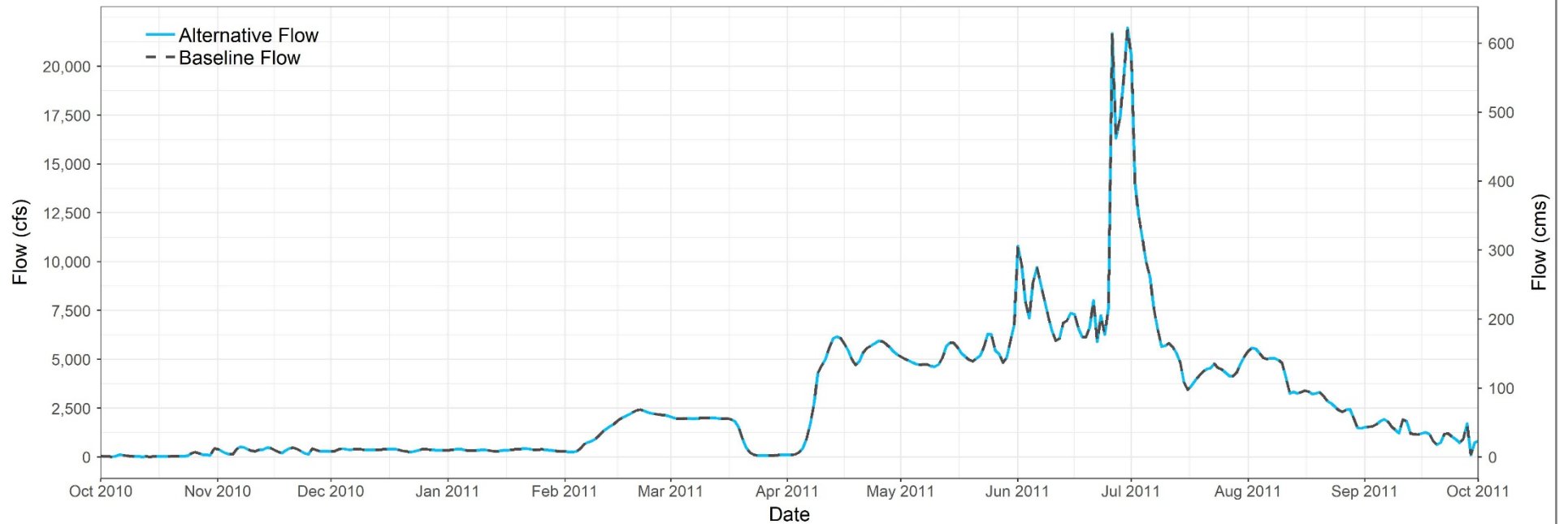
Souris River at Sherwood, ND



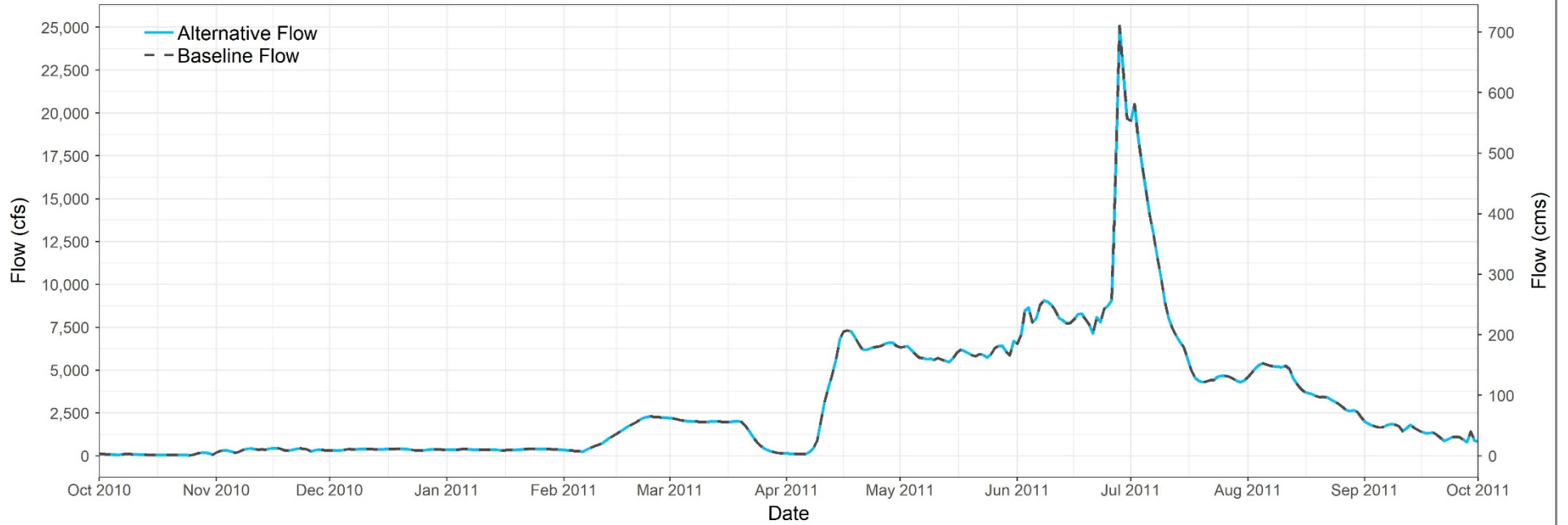
Souris River at Minot, ND - Flow



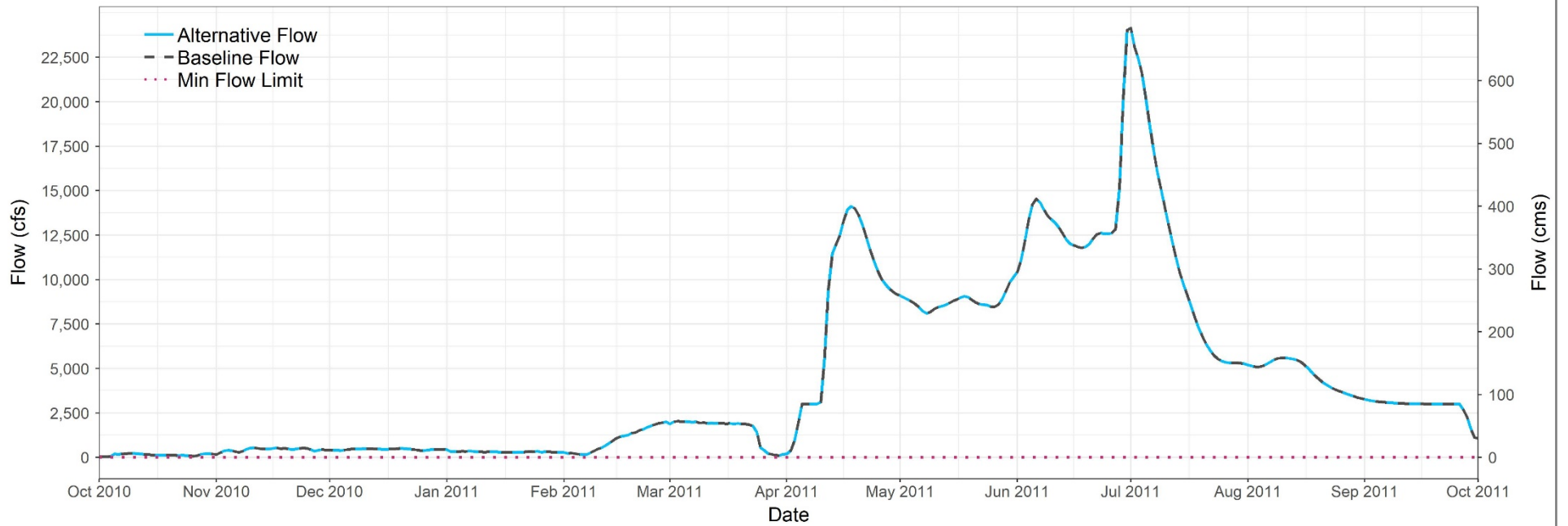
Souris River at Verendrye, ND



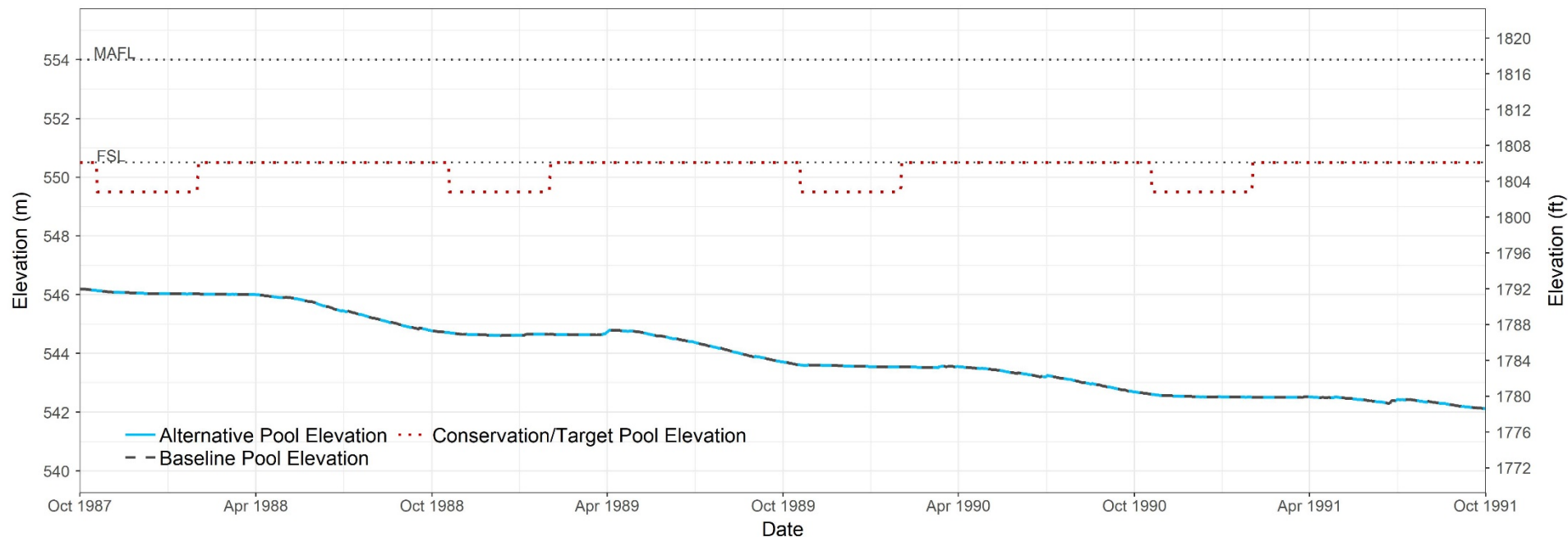
Souris River at Bantry, ND



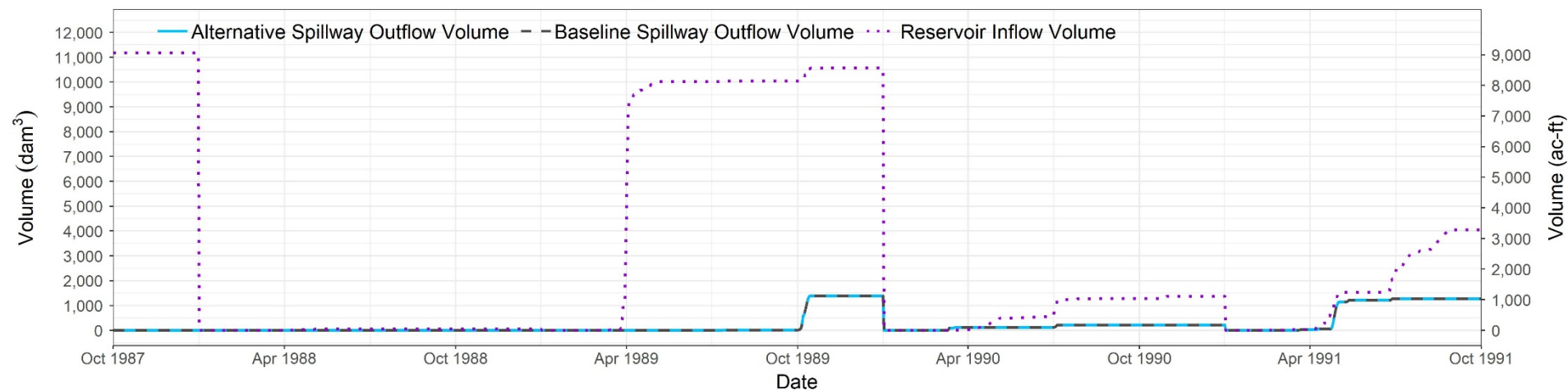
Souris River at Westhope, ND



Rafferty Reservoir - Elevation

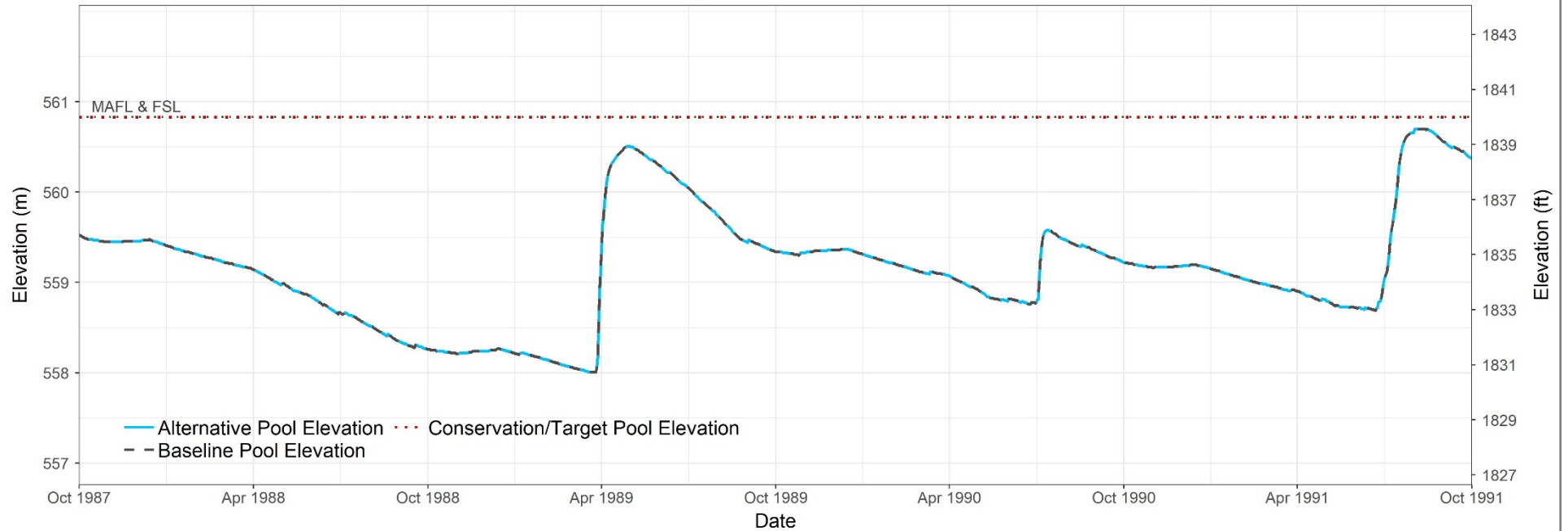


Rafferty Reservoir - Cumulative Volume

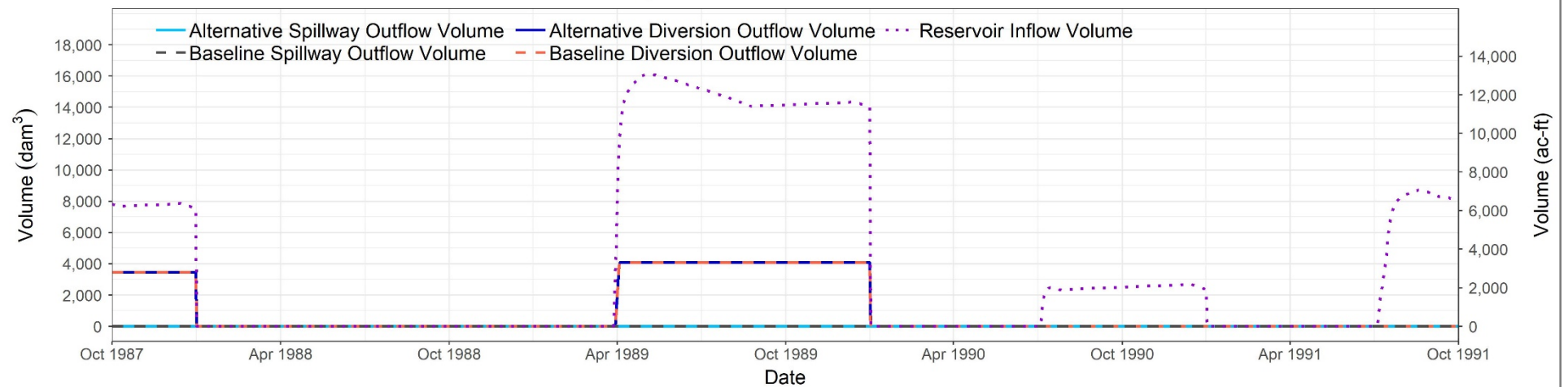


*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level

Boundary Reservoir - Elevation

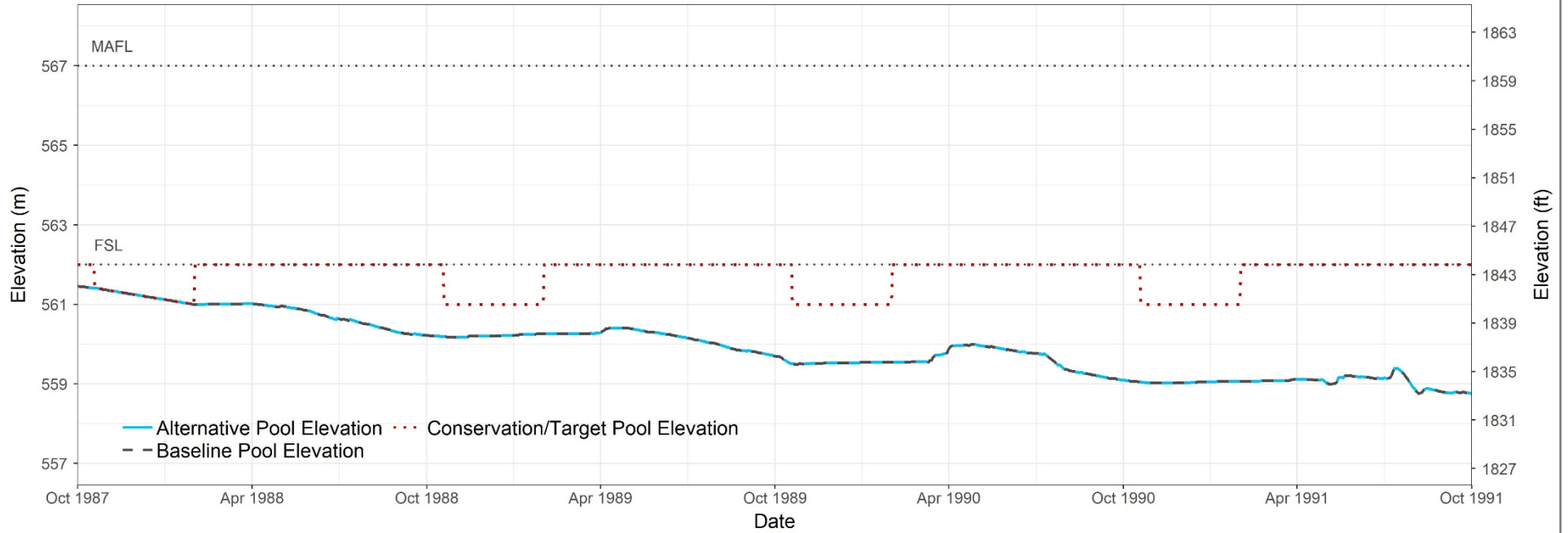


Boundary Reservoir - Cumulative Volume

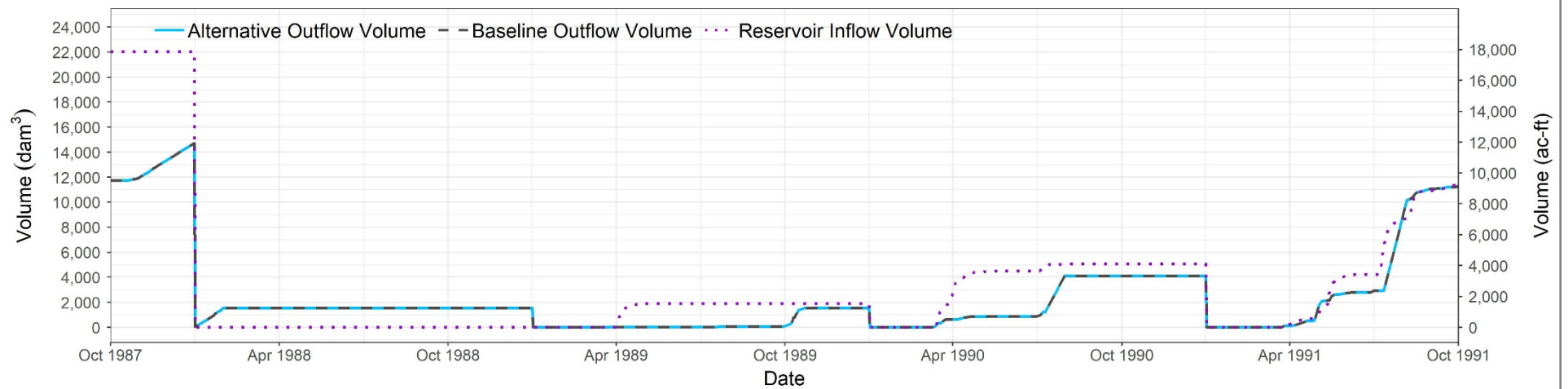


*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level

Grant Devine Reservoir - Elevation

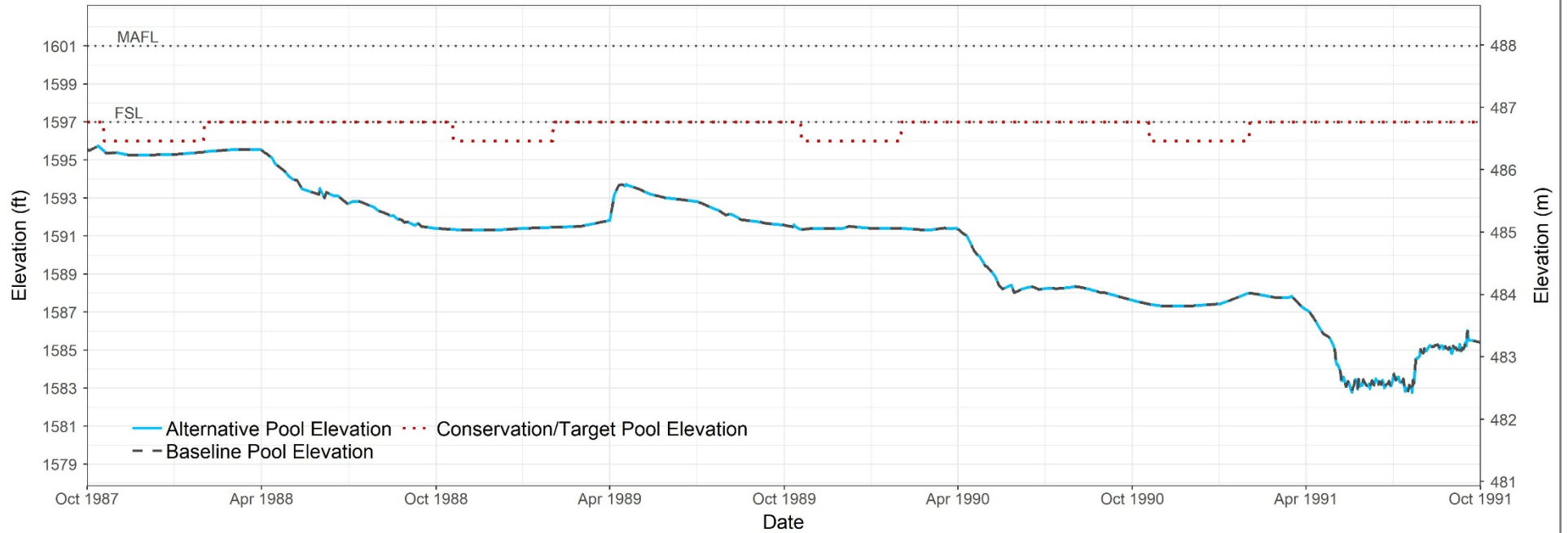


Grant Devine Reservoir - Cumulative Volume

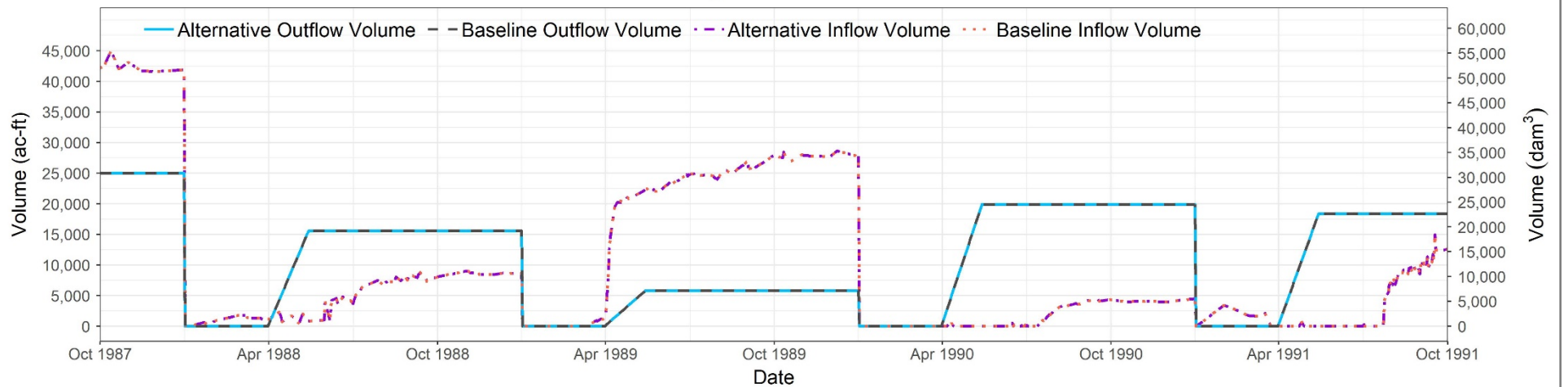


*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level

Lake Darling - Elevation



Lake Darling - Cumulative Volume



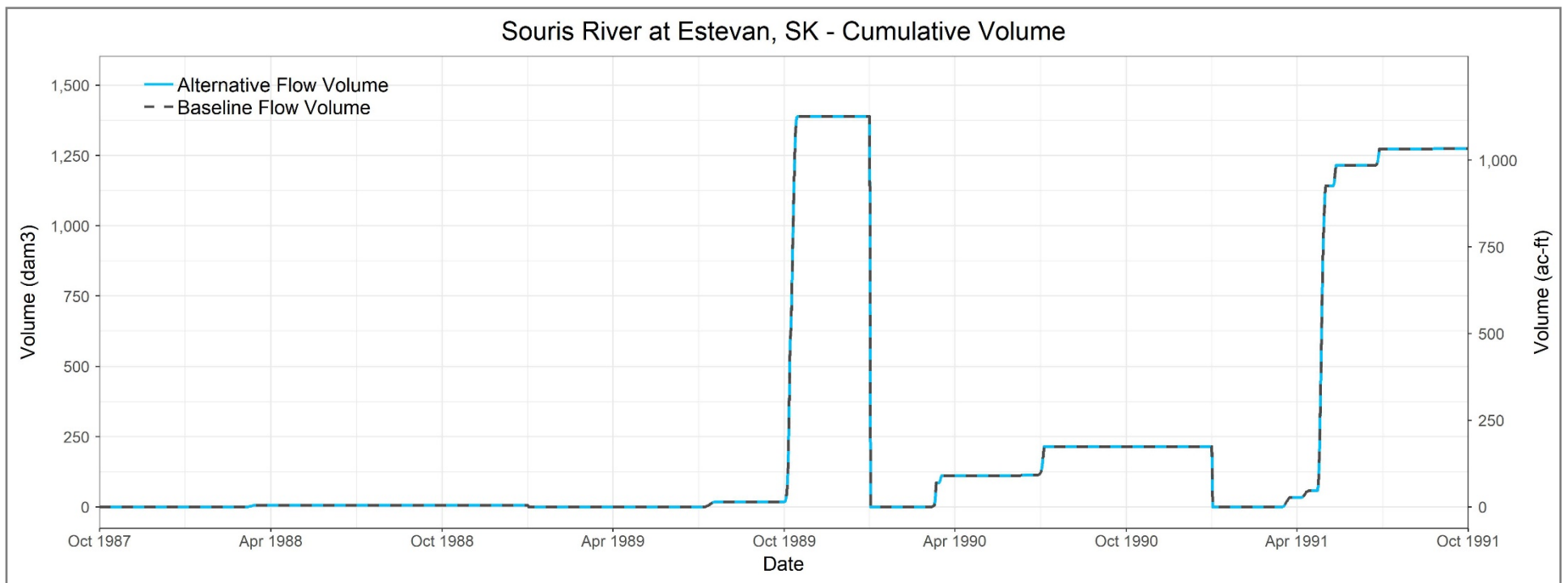
*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level, IDFSL = Inflow Design Flood Supply Level

Plate 35

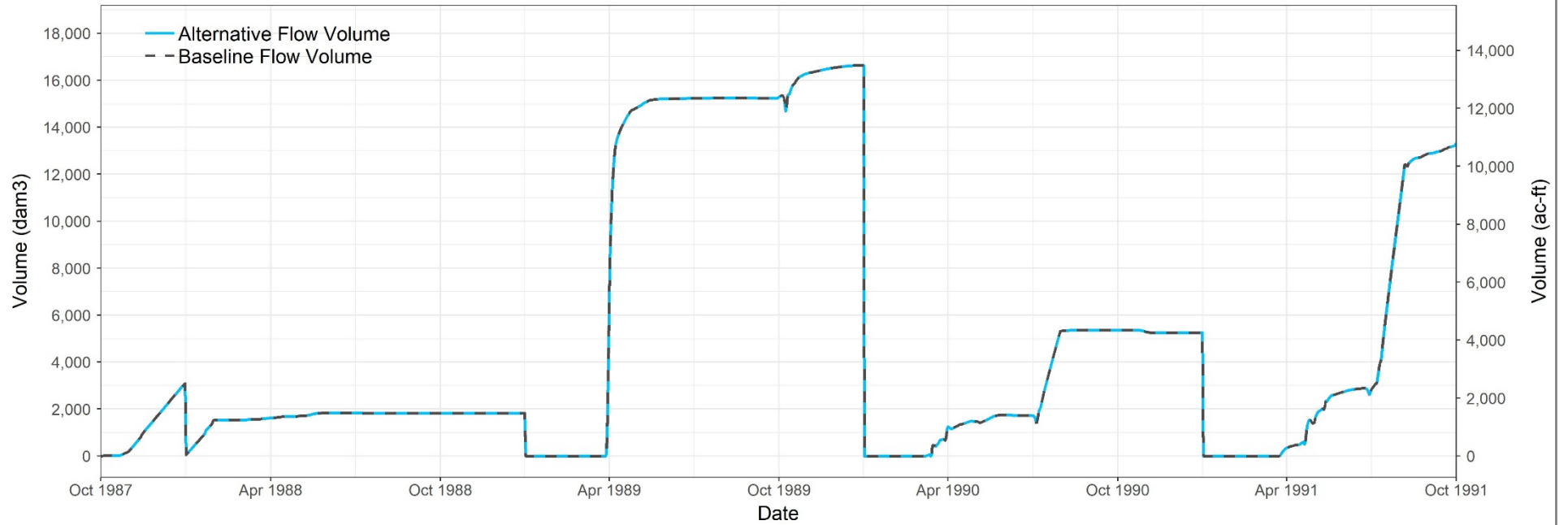
Critical Flow Locations – 1988-1991

Alternative 10bR (Phase 2)

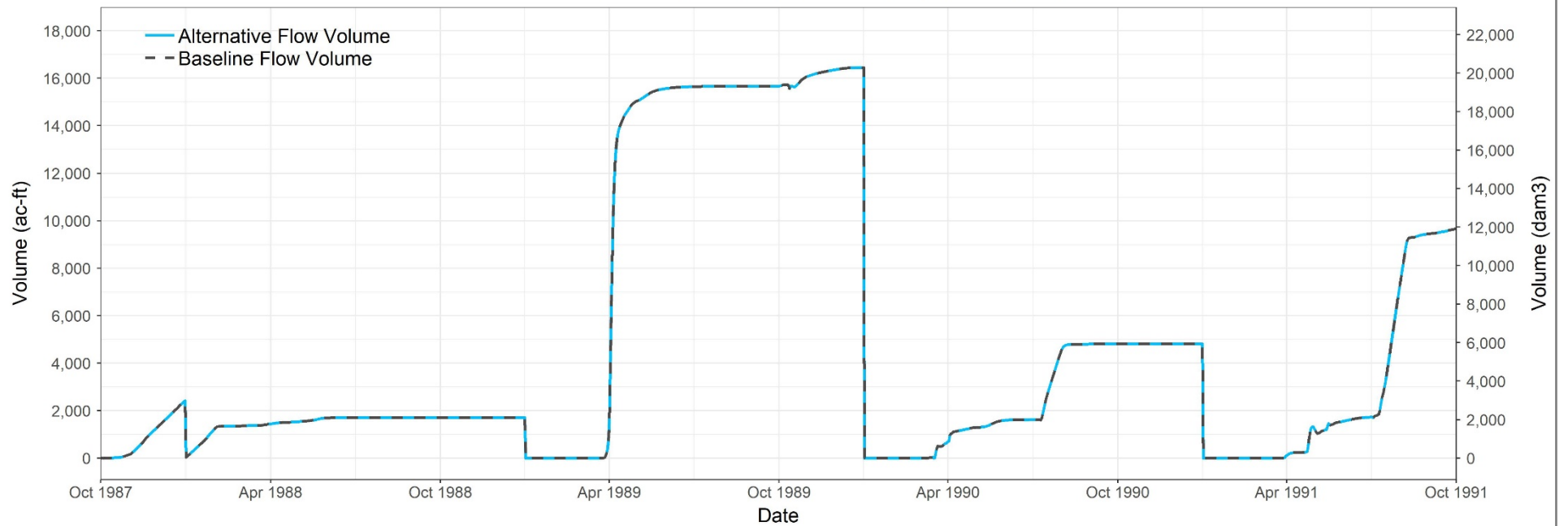
Souris River Plan of Study



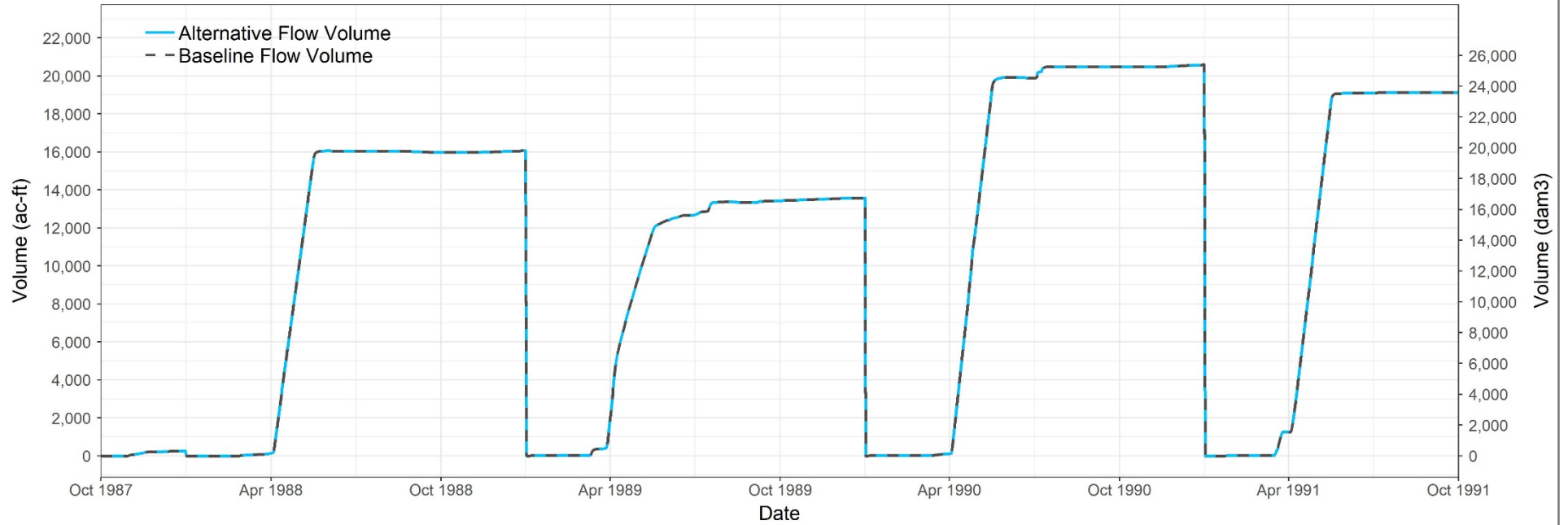
Souris River at Oxbow, SK - Cumulative Volume



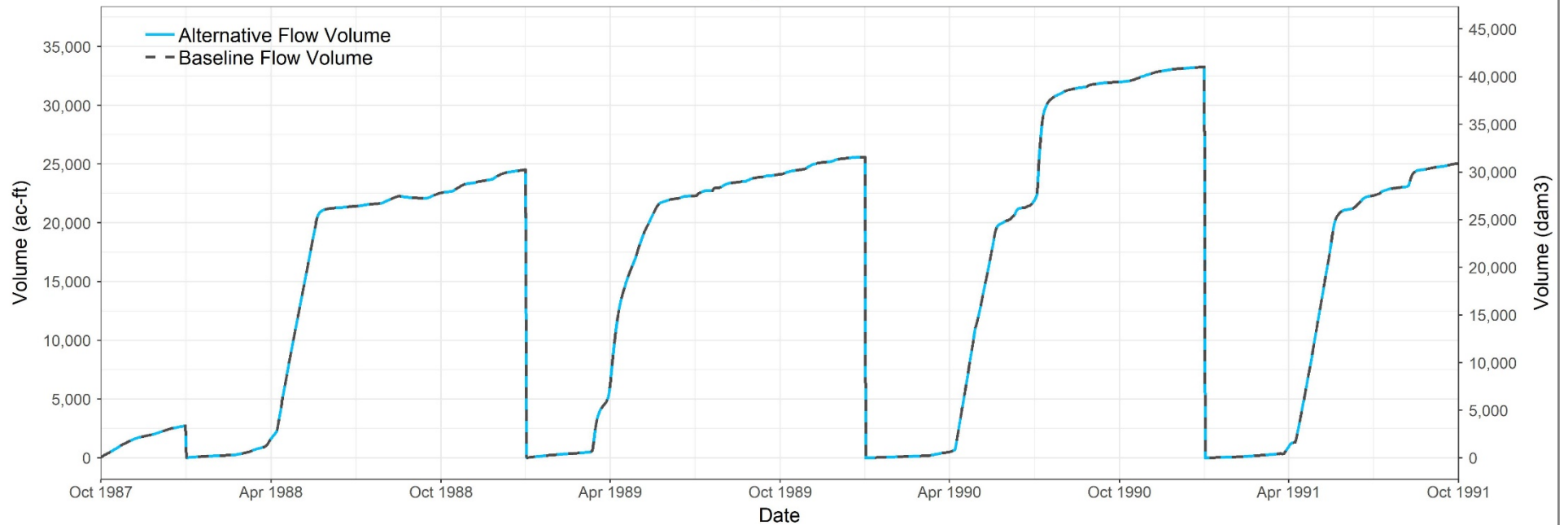
Souris River at Sherwood, ND - Cumulative Volume



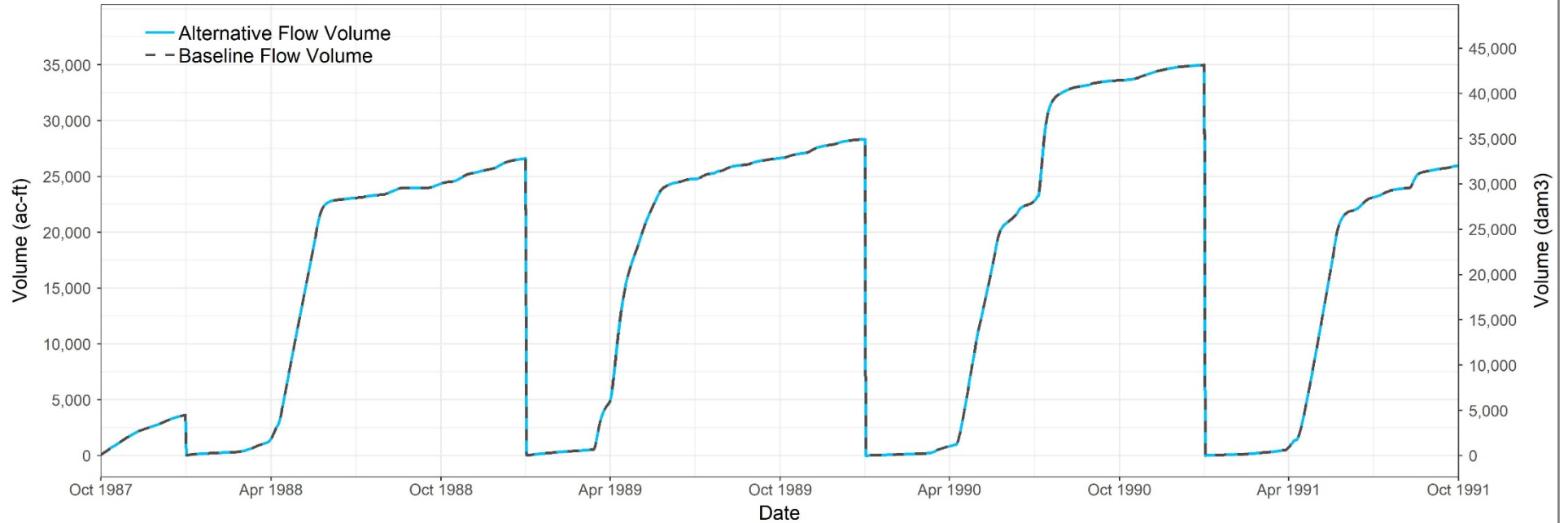
Souris River at Minot, ND - Cumulative Volume



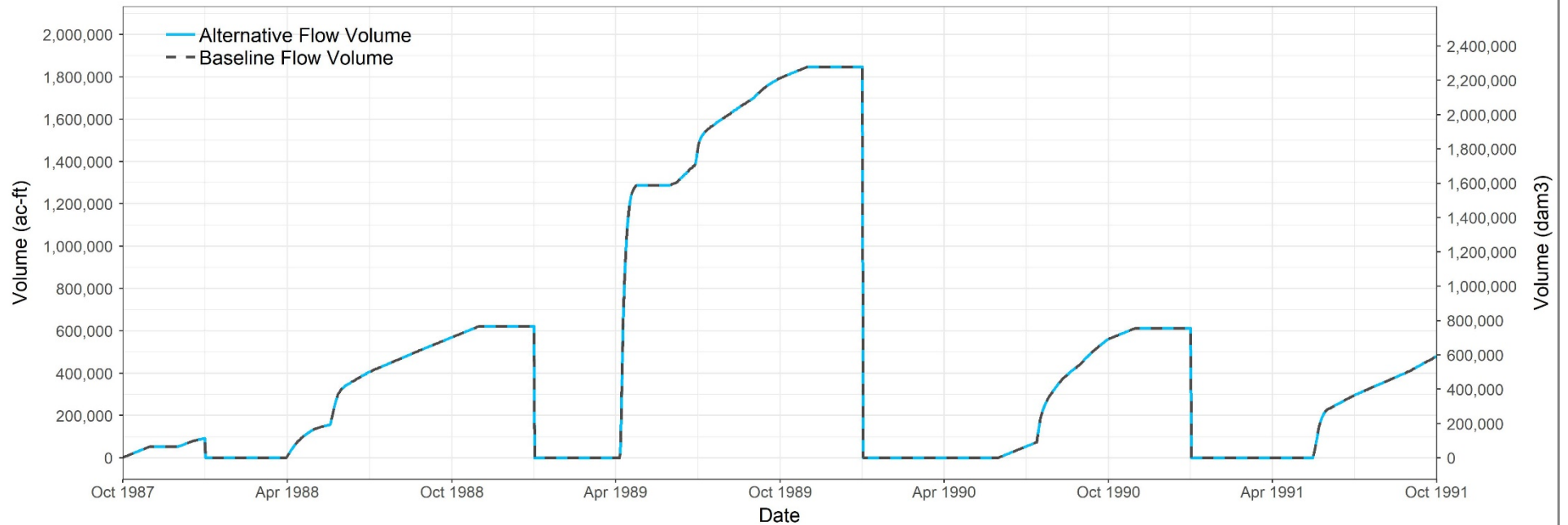
Souris River at Verendrye, ND - Cumulative Volume

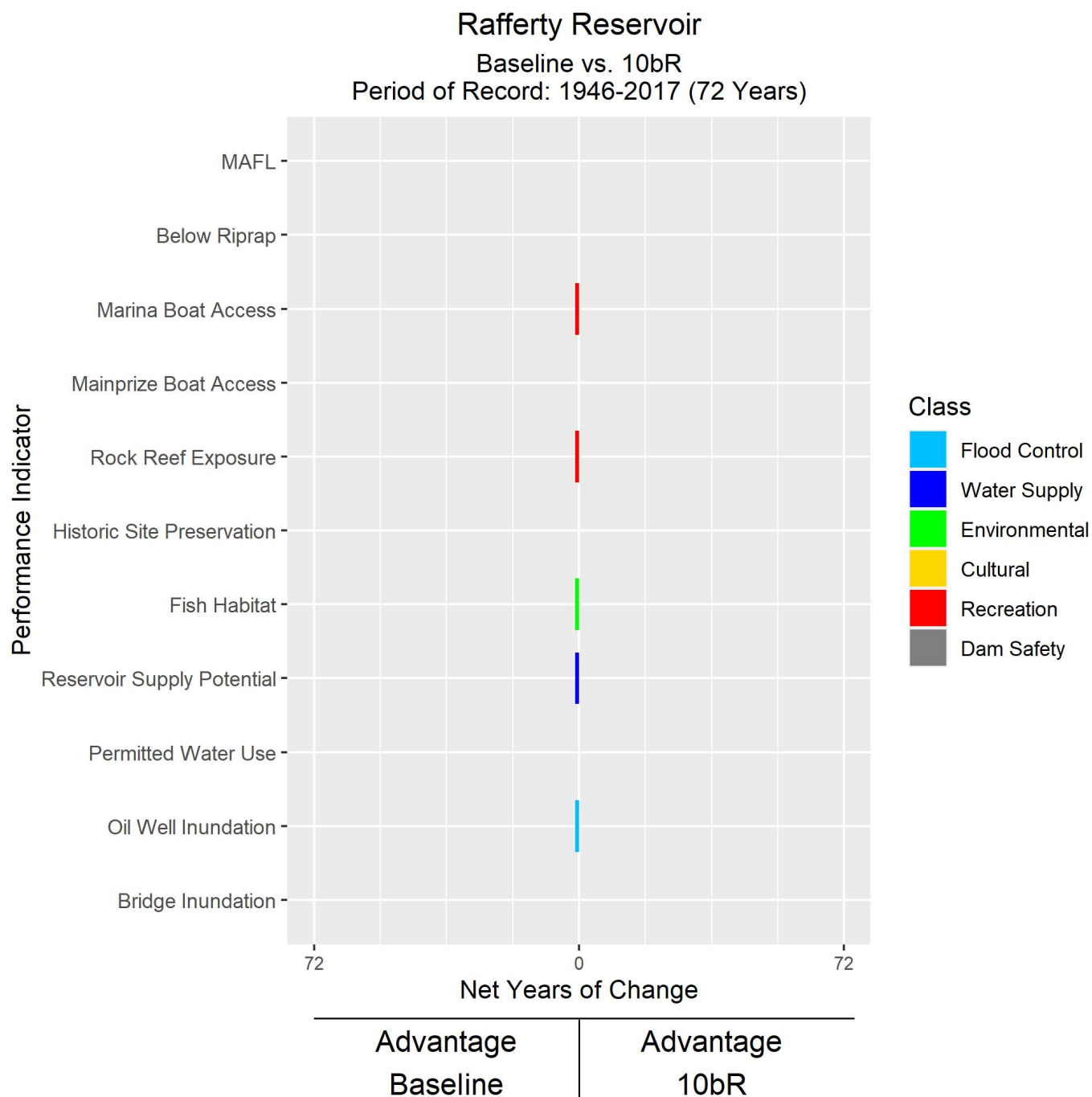


Souris River at Bantry, ND - Cumulative Volume

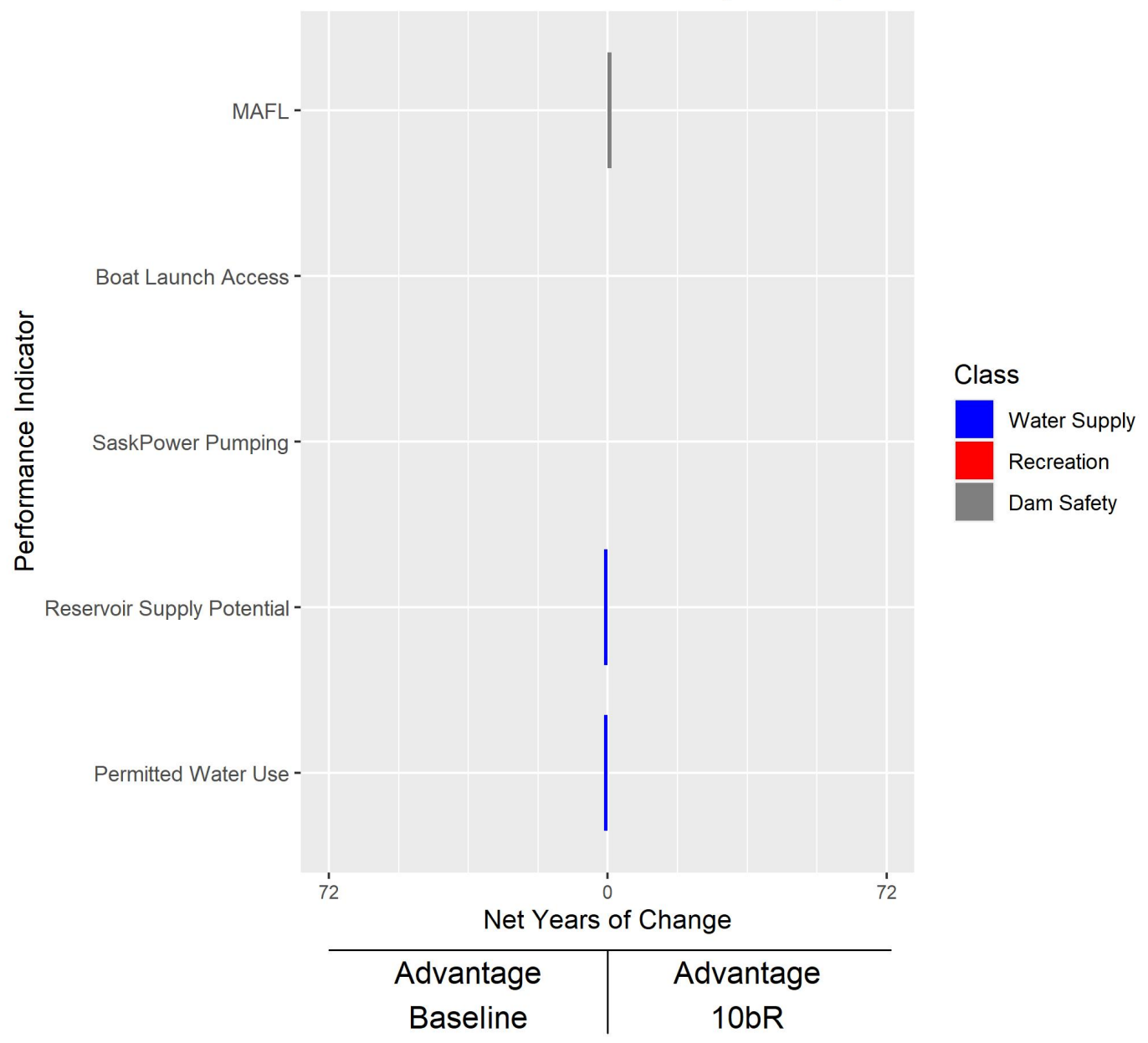


Souris River at Westhope, ND - Cumulative Volume

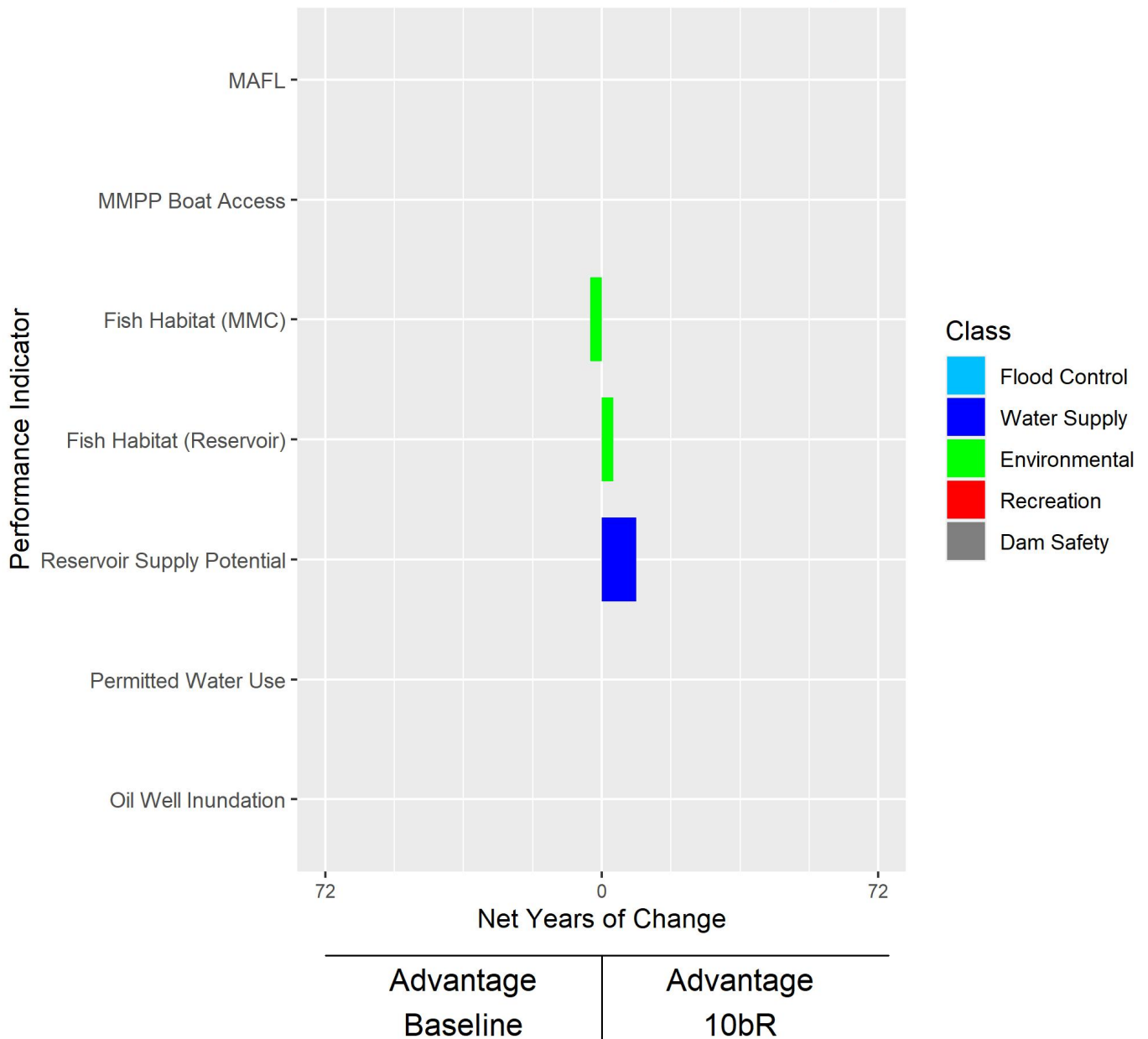




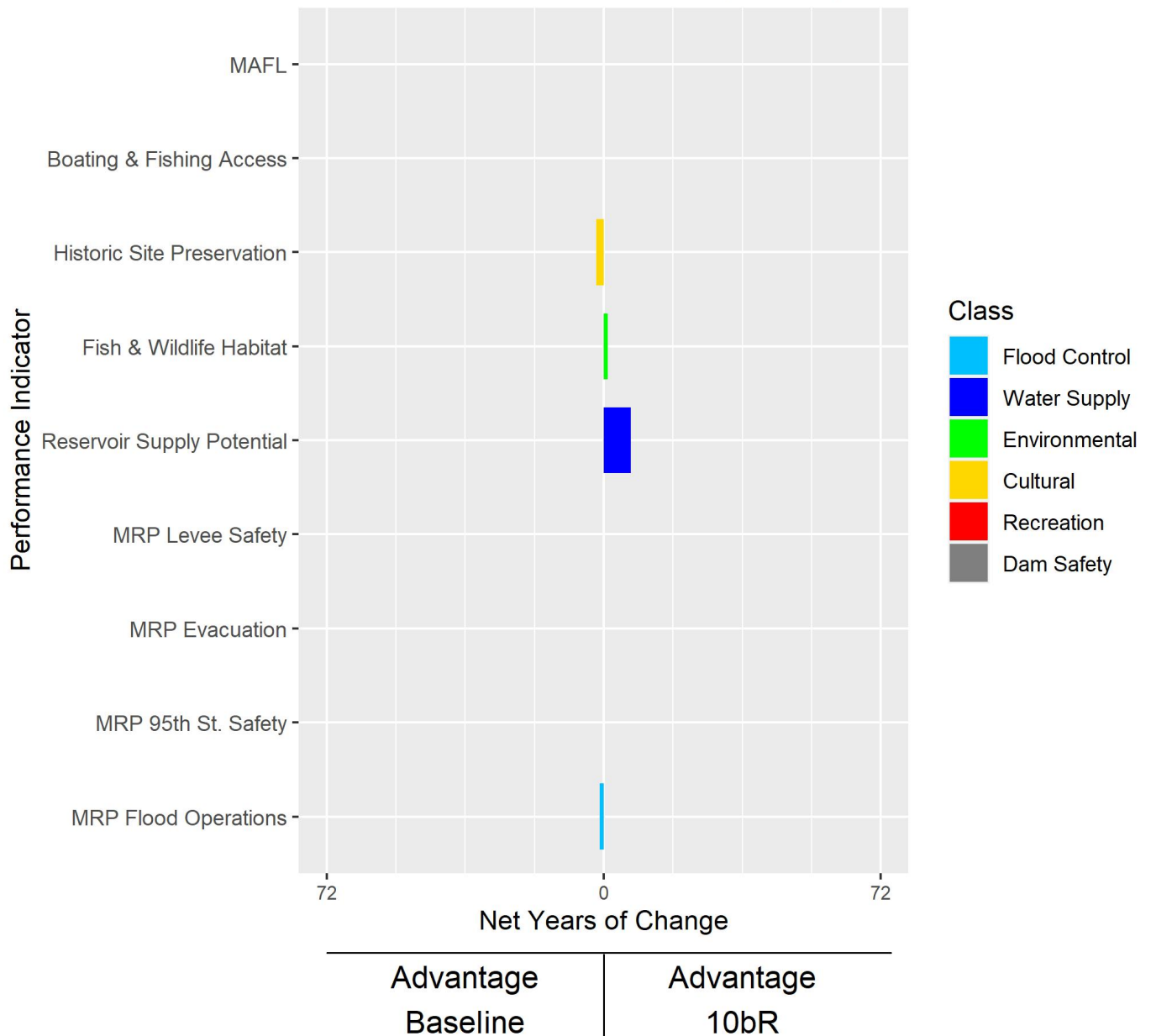
Boundary Reservoir
Baseline vs. 10bR
Period of Record: 1946-2017 (72 Years)



Grant Devine Reservoir
Baseline vs. 10bR
Period of Record: 1946-2017 (72 Years)



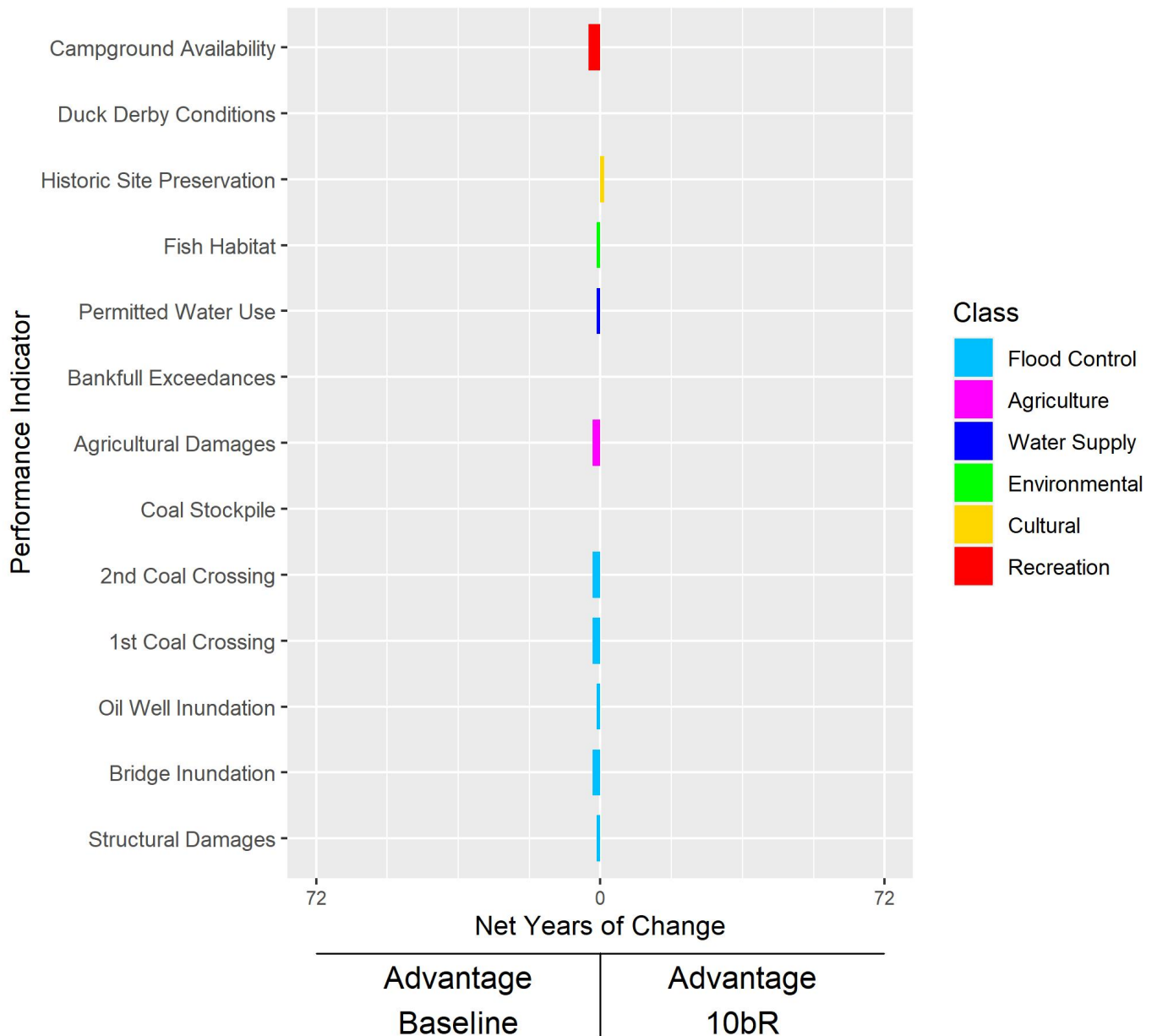
Lake Darling
Baseline vs. 10bR
Period of Record: 1946-2017 (72 Years)



Saskatchewan - All Riverine Reaches

Baseline vs. 10bR

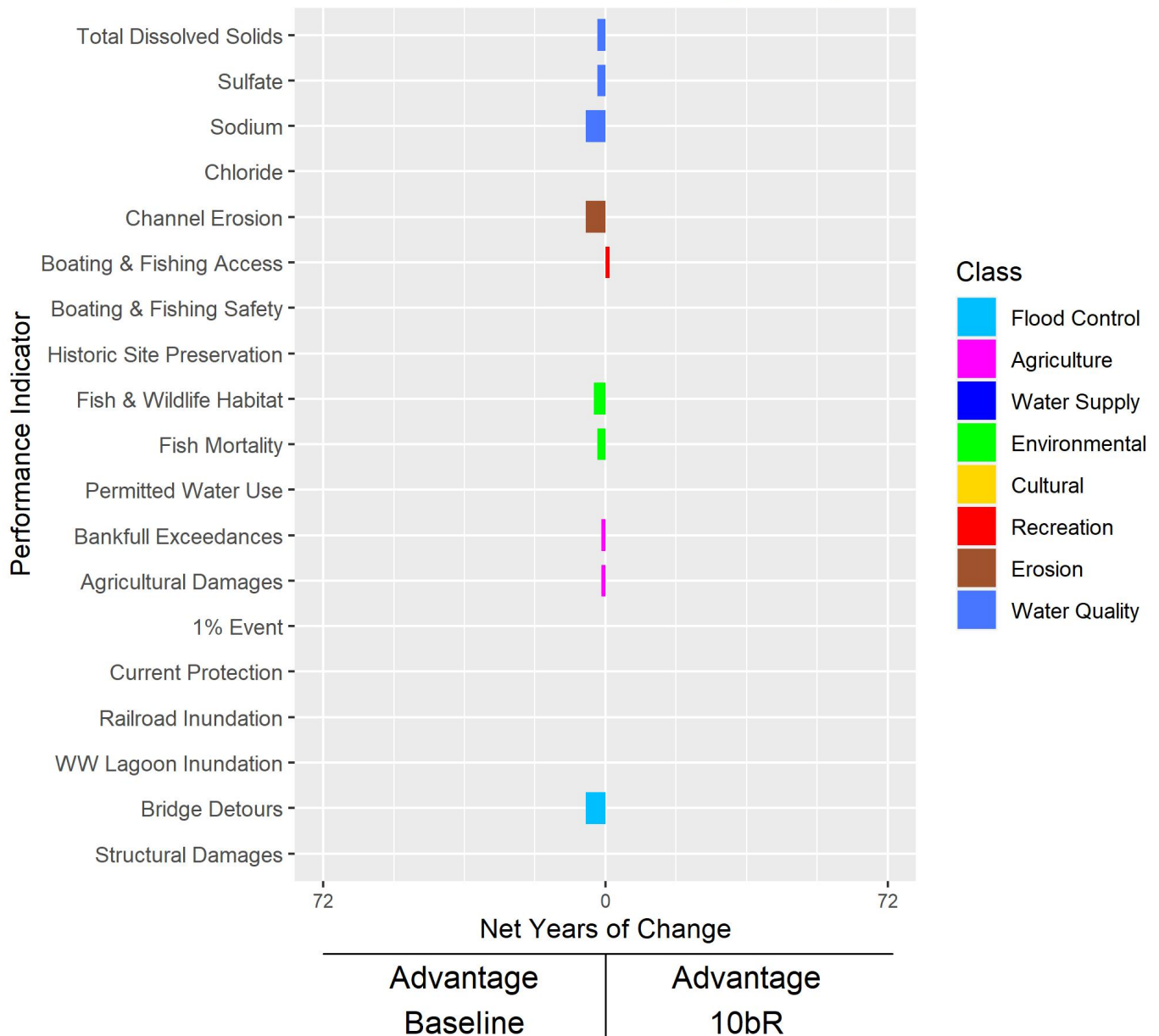
Period of Record: 1946-2017 (72 Years)



North Dakota - All Riverine Reaches

Baseline vs. 10bR

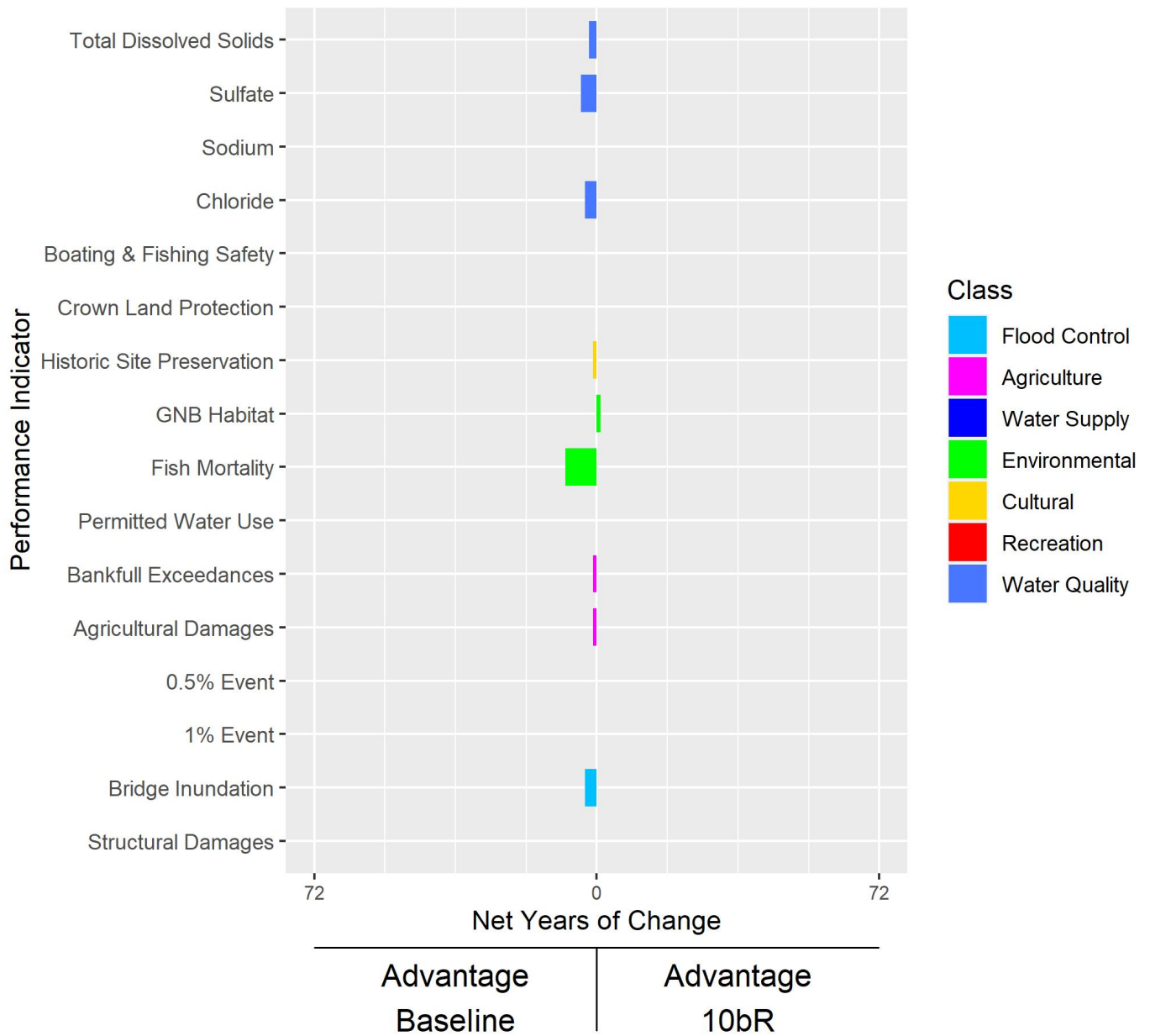
Period of Record: 1946-2017 (72 Years)



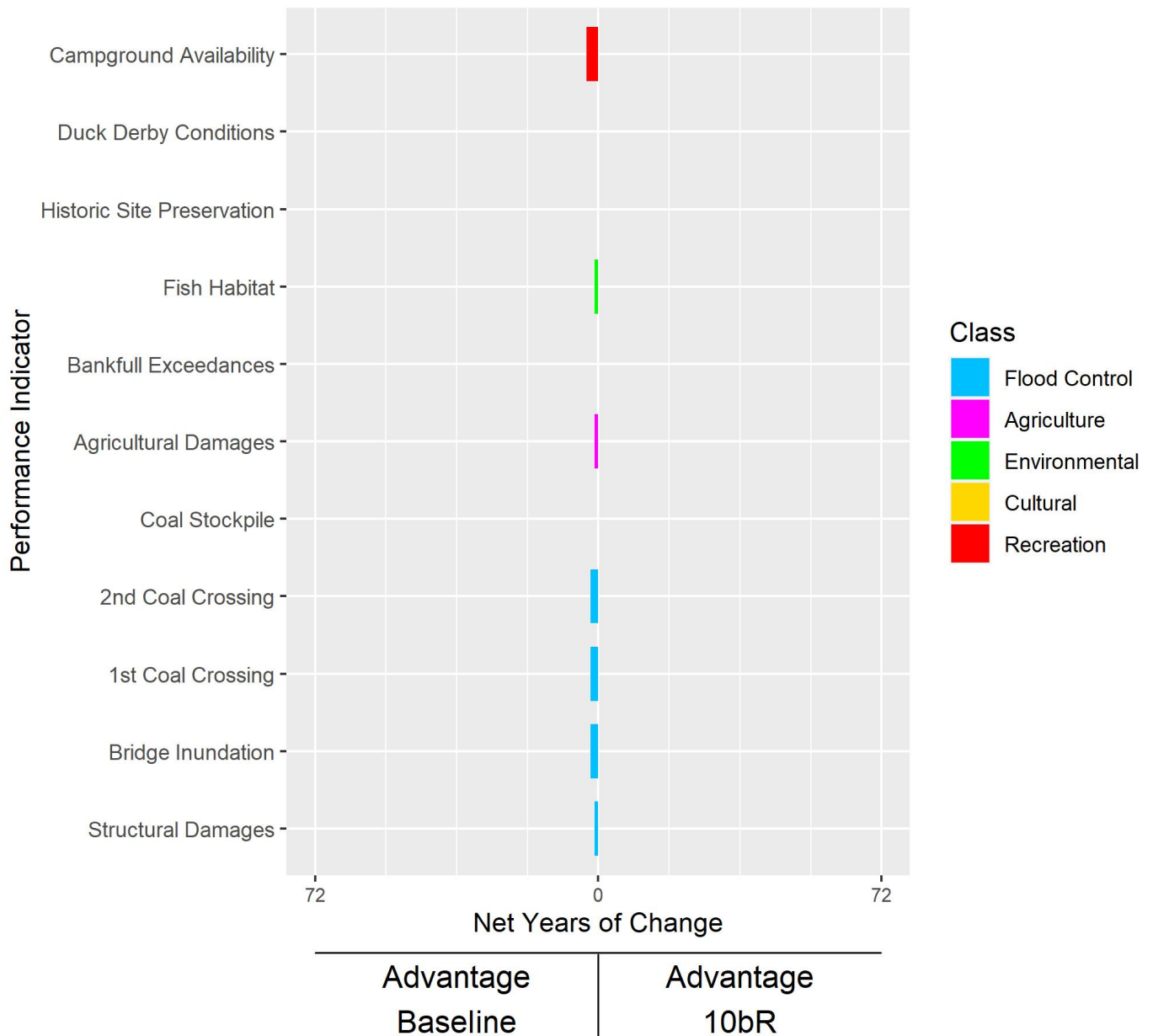
Westhope to Wawanesa

Baseline vs. 10bR

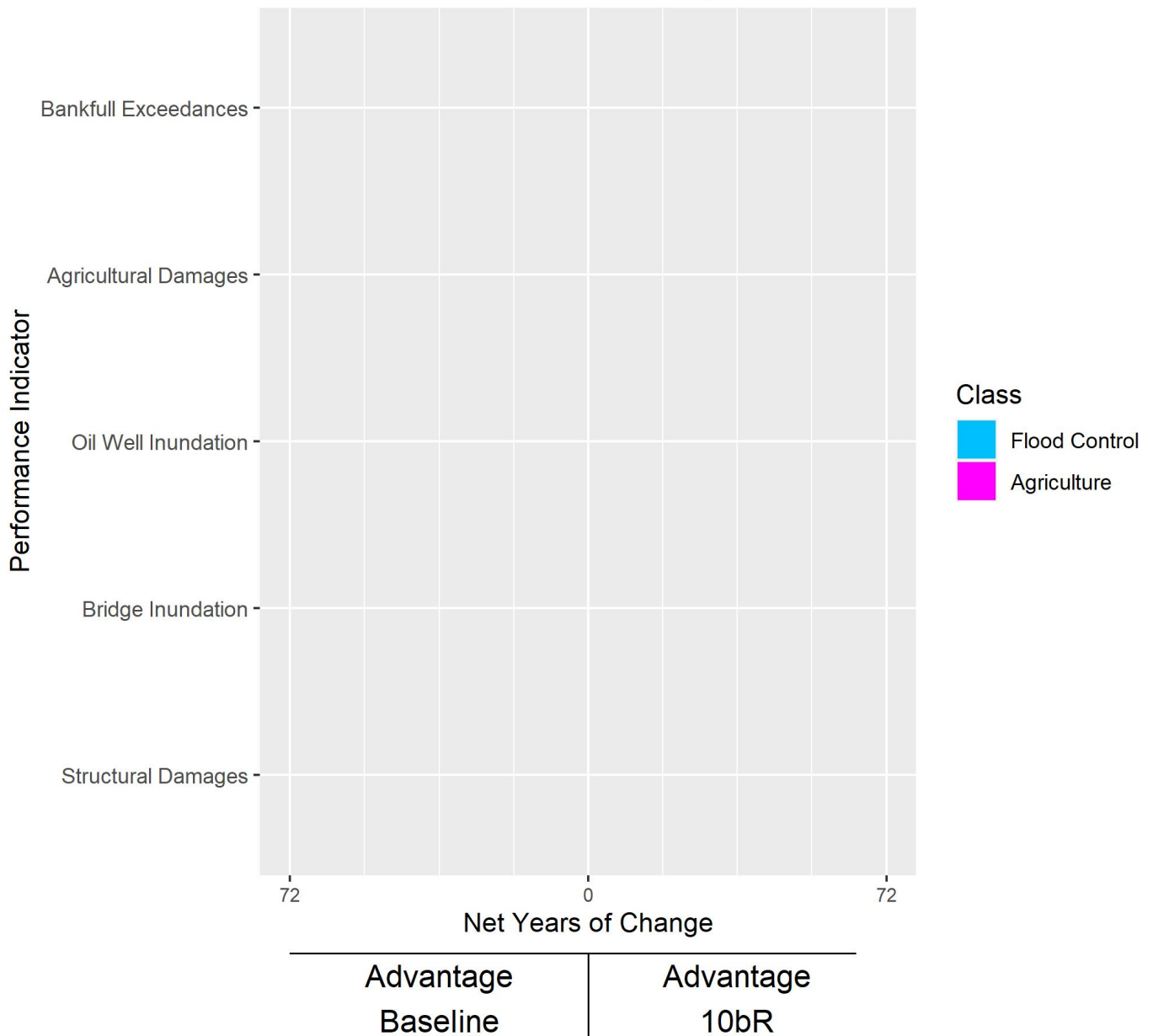
Period of Record: 1946-2017 (72 Years)



City of Estevan
Baseline vs. 10bR
Period of Record: 1946-2017 (72 Years)



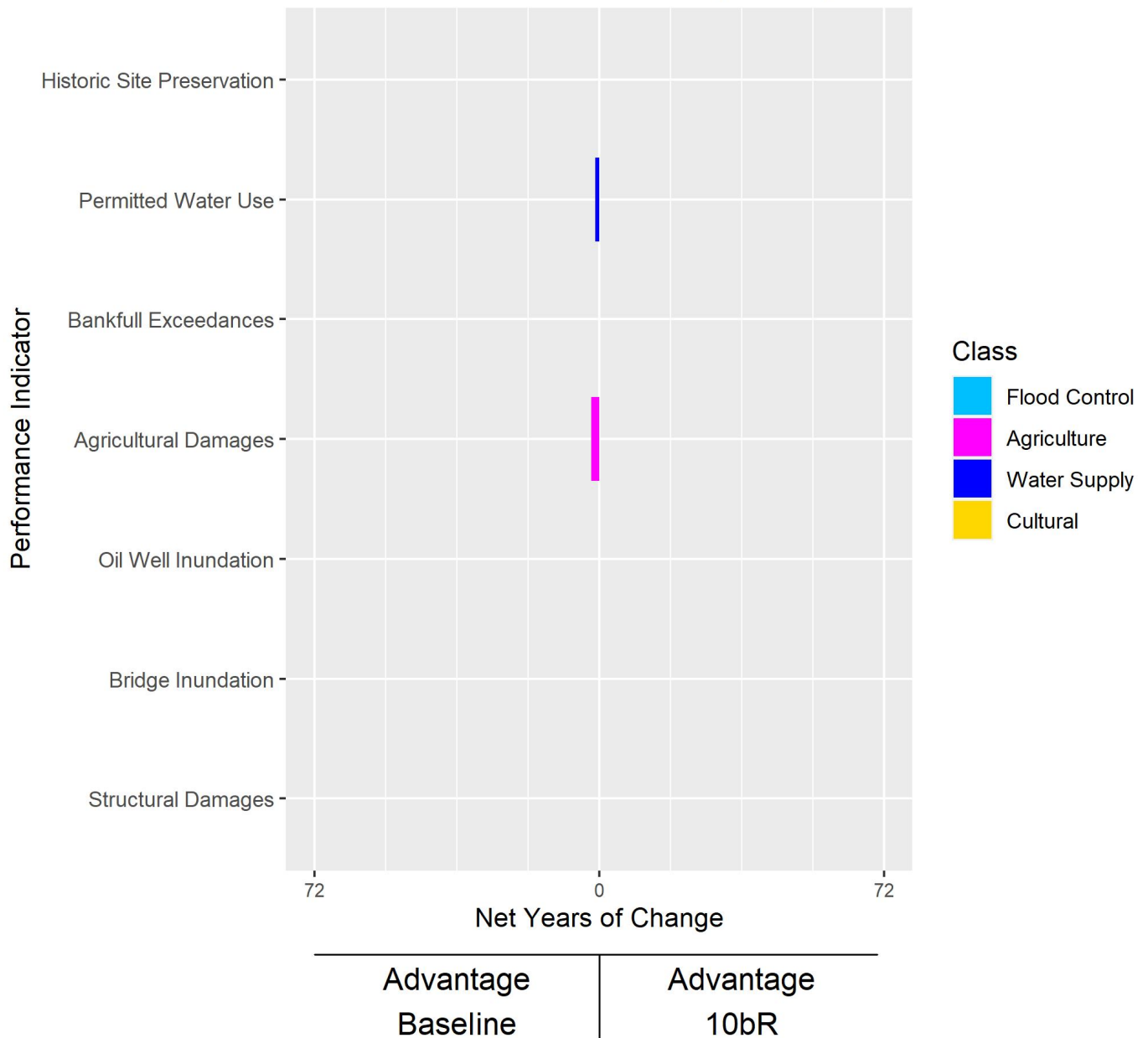
City of Roche Percee
Baseline vs. 10bR
Period of Record: 1946-2017 (72 Years)



Roche Percee to Moose Mountain Creek

Baseline vs. 10bR

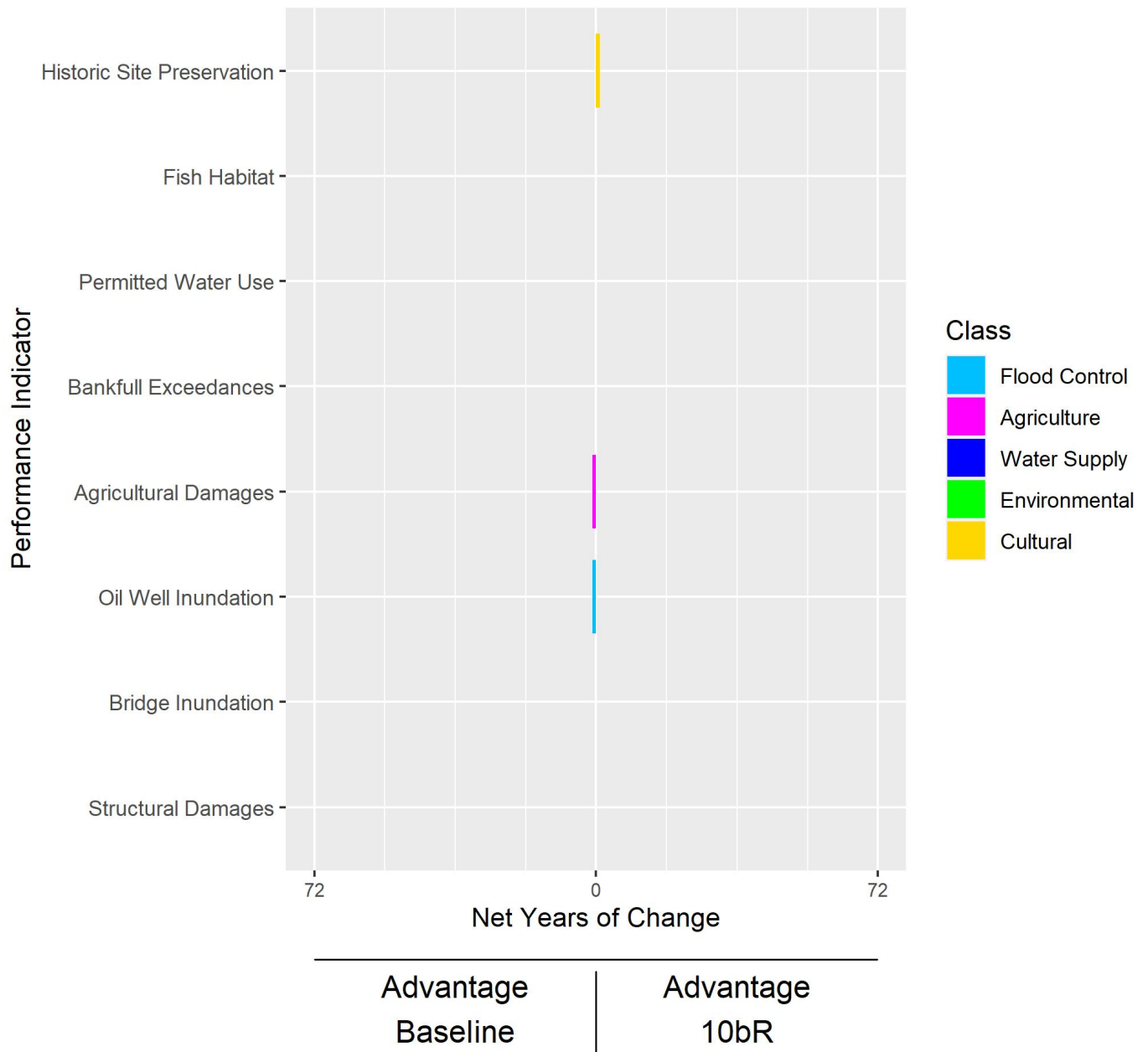
Period of Record: 1946-2017 (72 Years)



Moose Mountain Creek to Sherwood

Baseline vs. 10bR

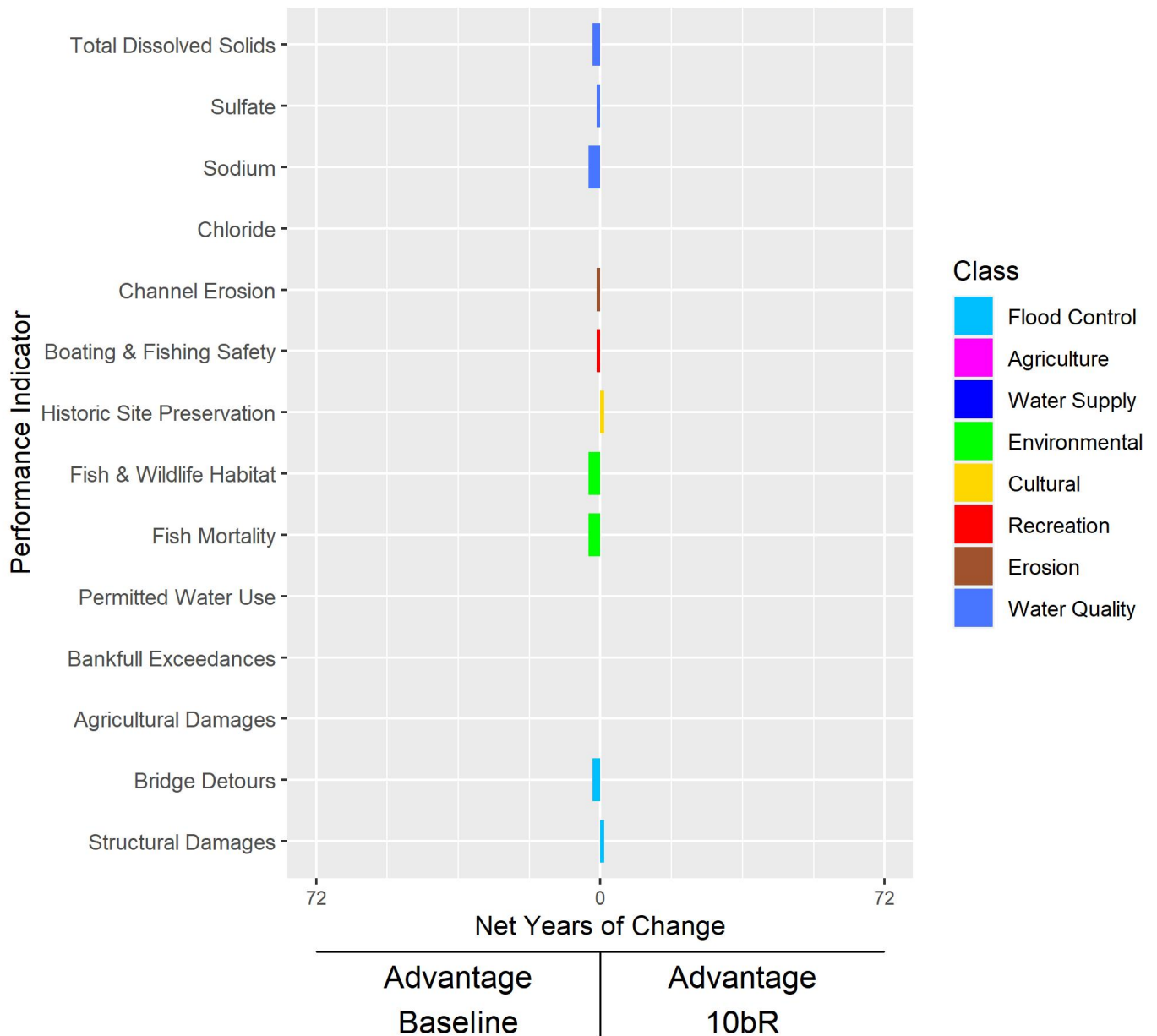
Period of Record: 1946-2017 (72 Years)



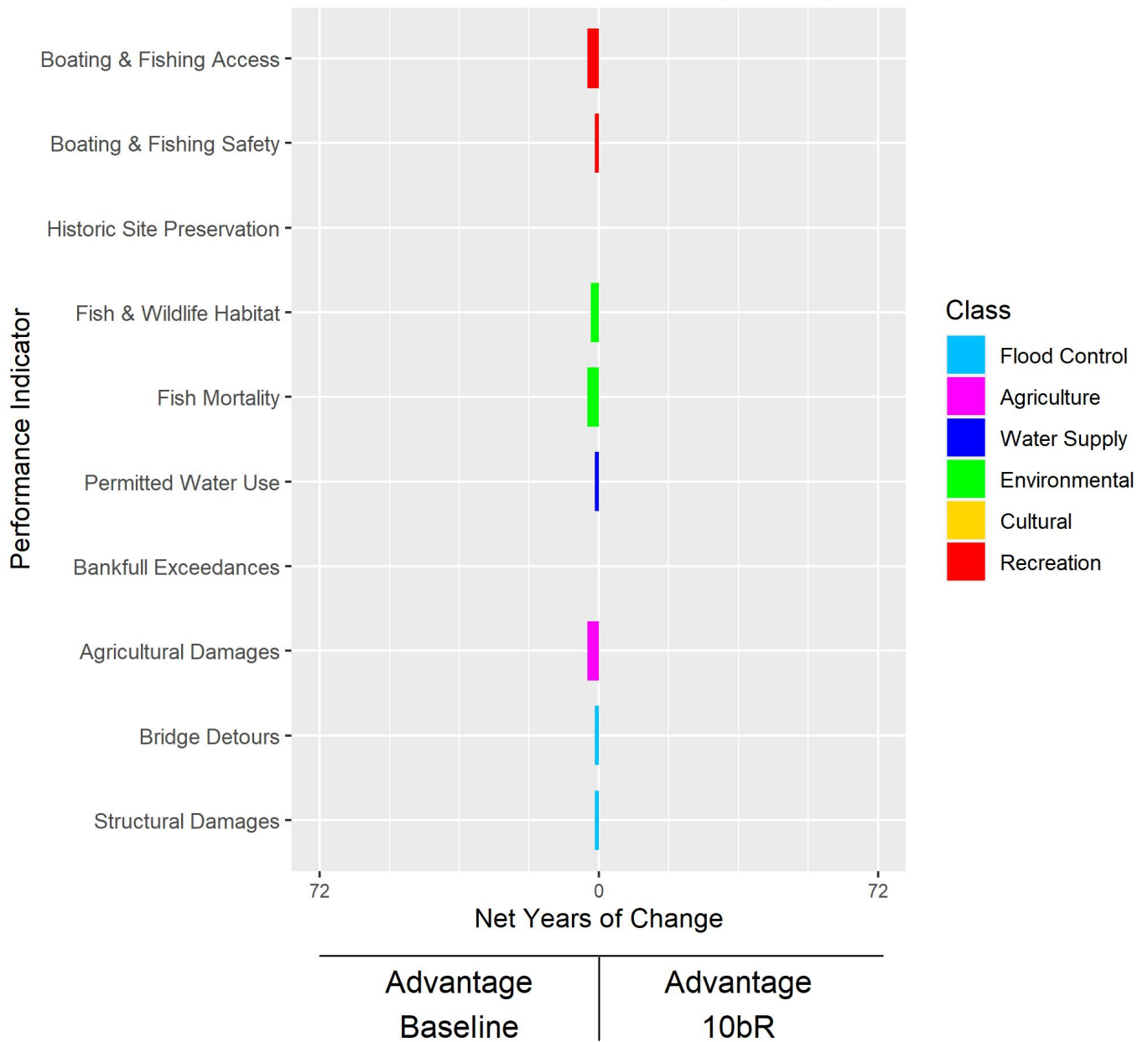
Sherwood to Mouse River Park

Baseline vs. 10bR

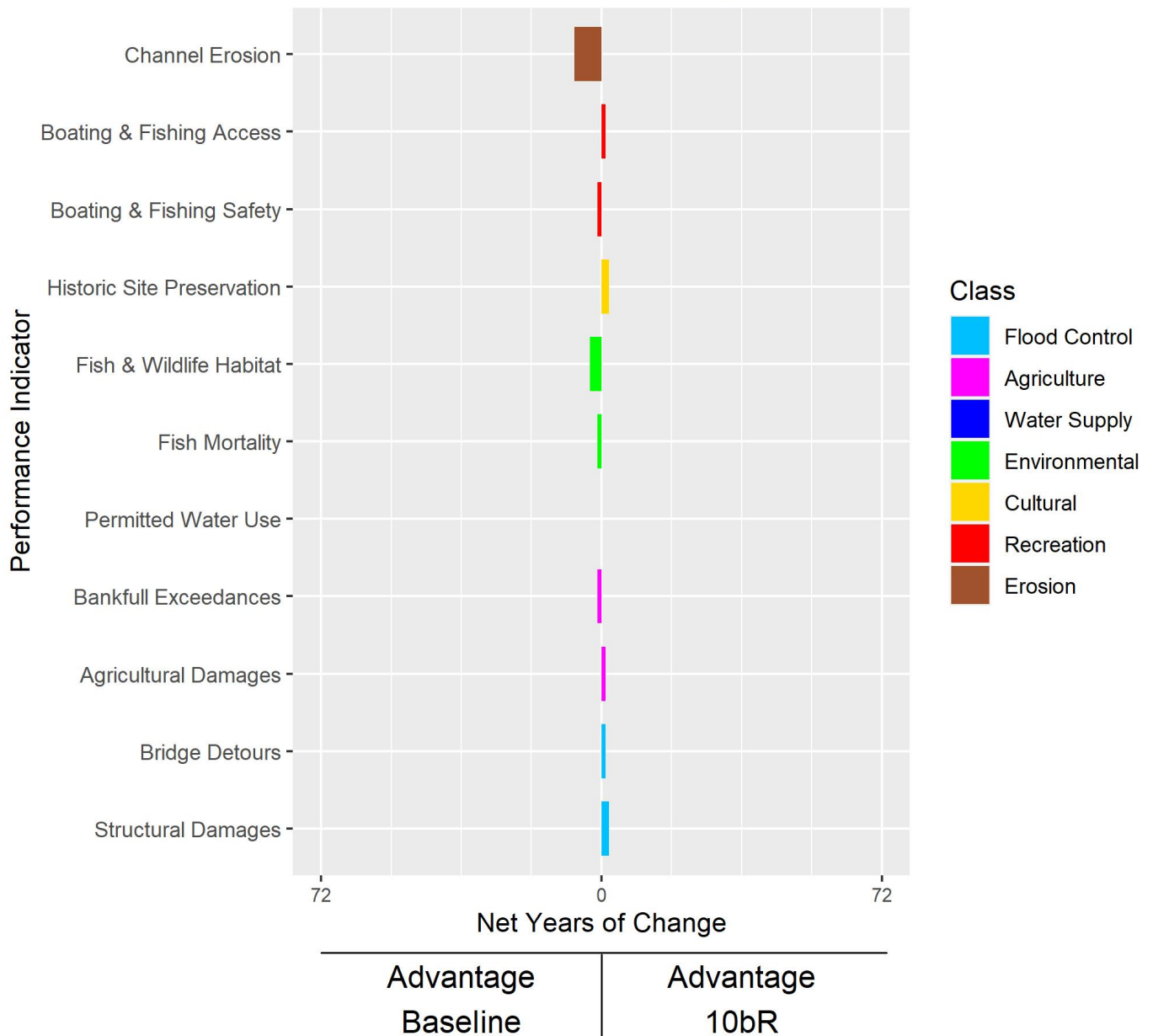
Period of Record: 1946-2017 (72 Years)



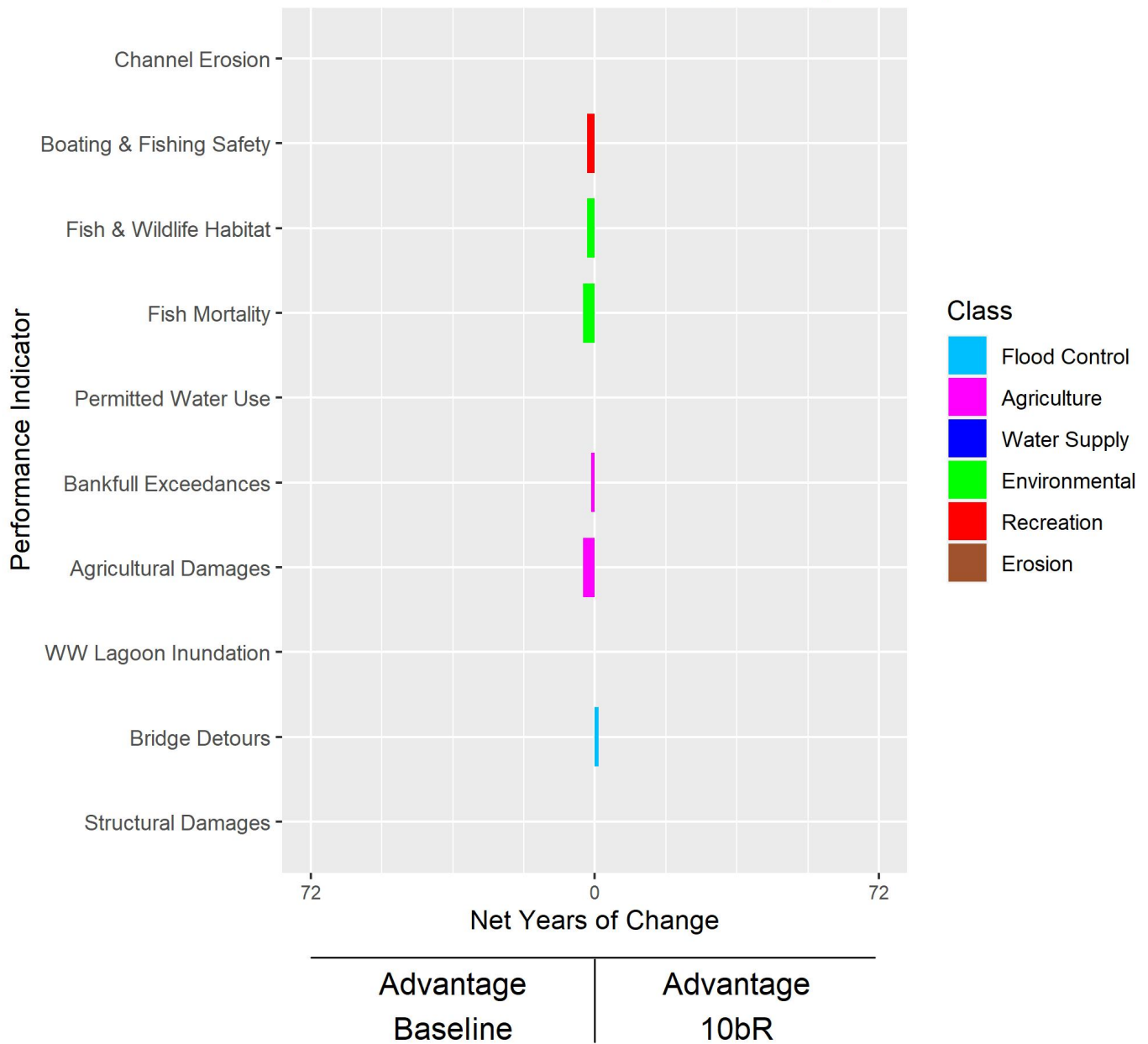
Mouse River Park
Baseline vs. 10bR
Period of Record: 1946-2017 (72 Years)



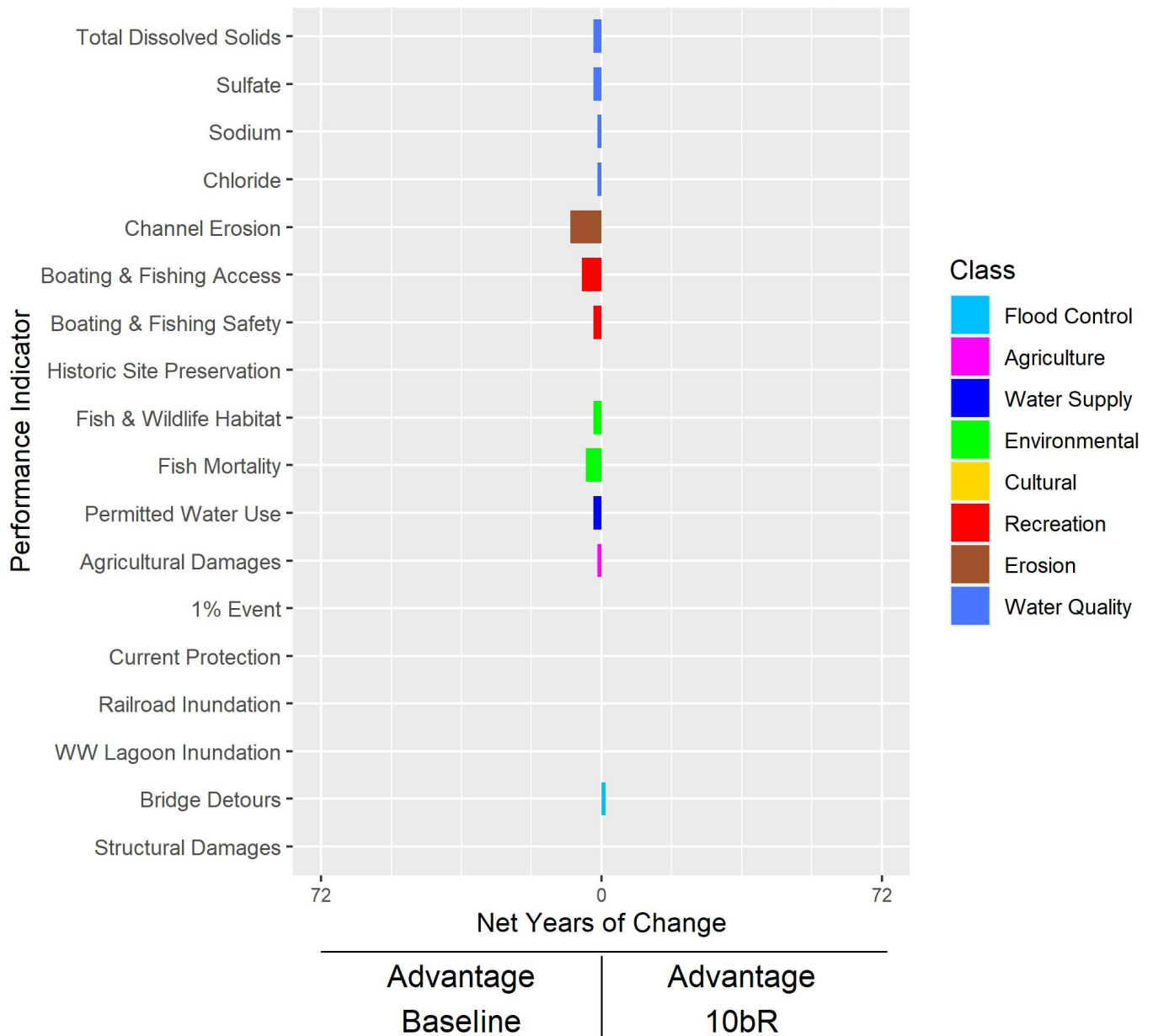
Lake Darling to Burlington
Baseline vs. 10bR
Period of Record: 1946-2017 (72 Years)



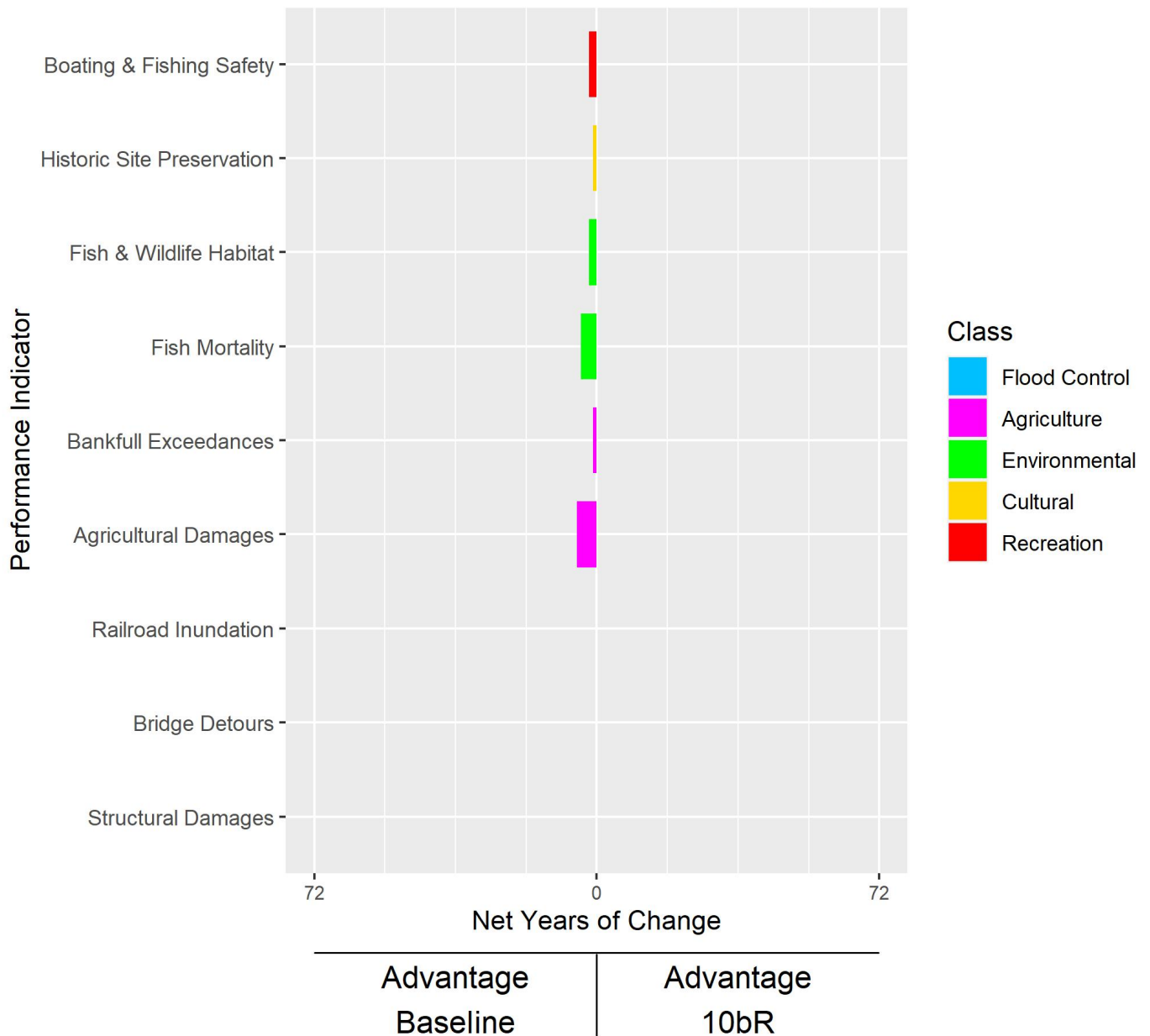
City of Burlington
Baseline vs. 10bR
Period of Record: 1946-2017 (72 Years)



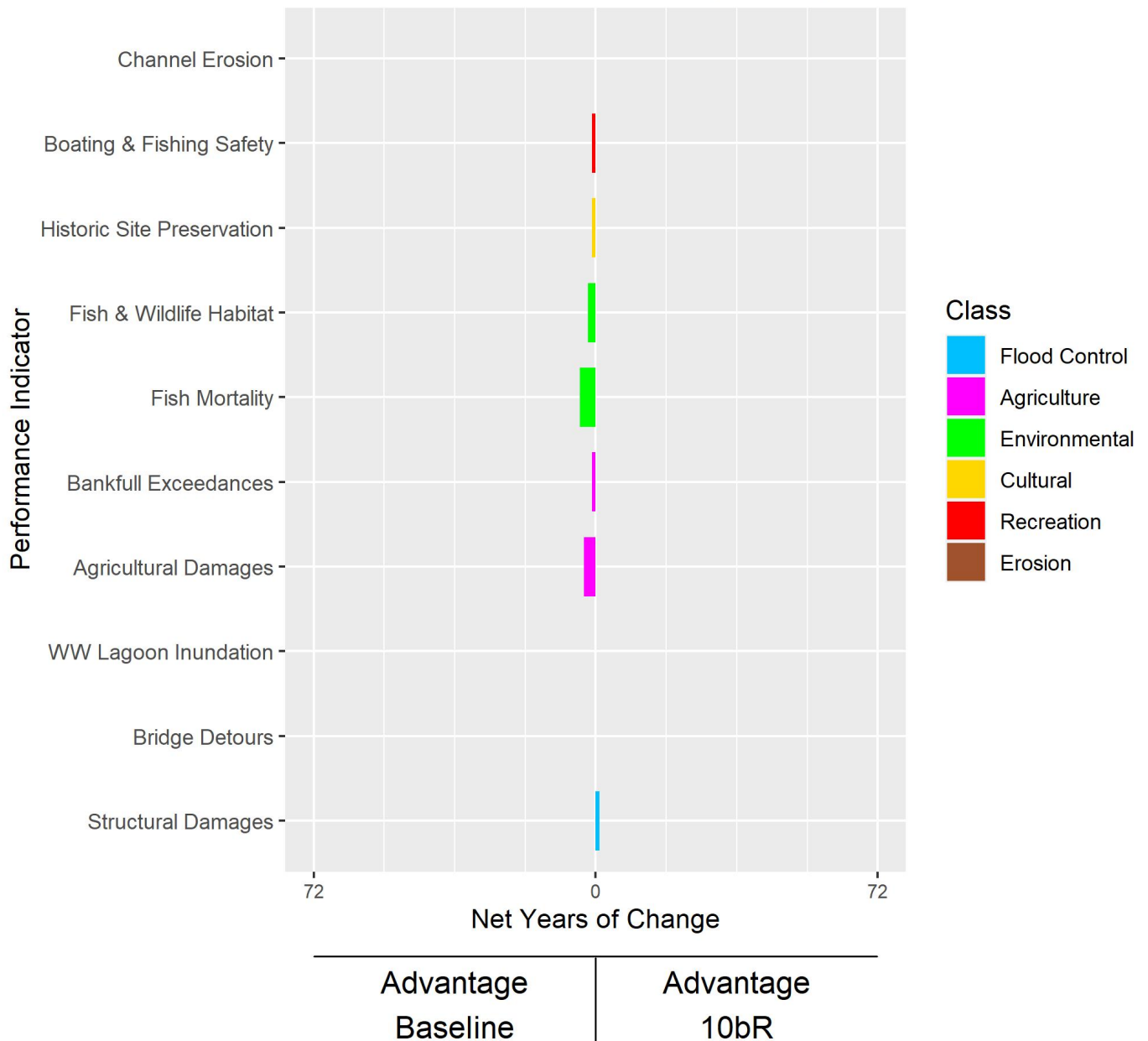
City of Minot
Baseline vs. 10bR
Period of Record: 1946-2017 (72 Years)



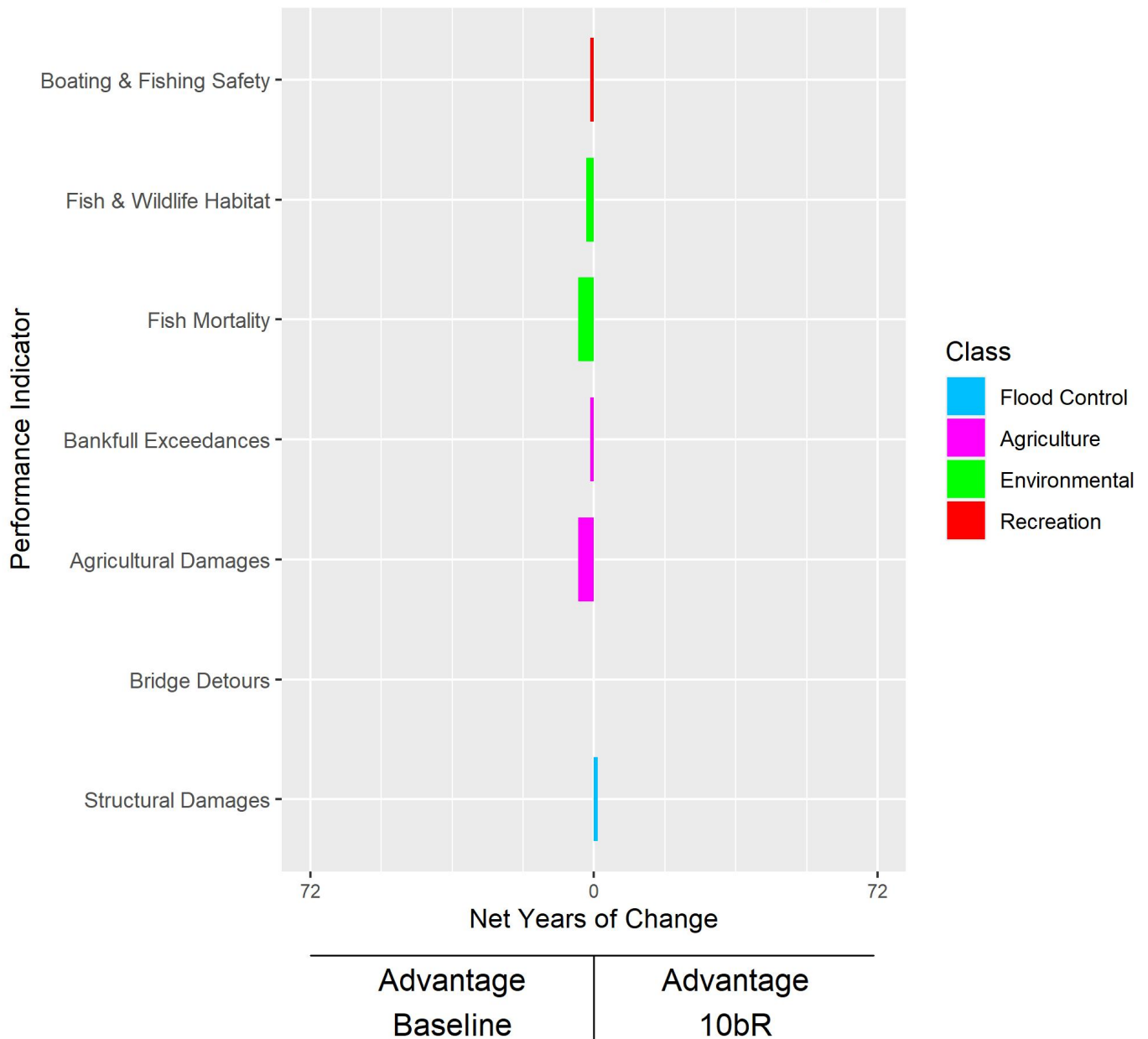
Minot to Sawyer
Baseline vs. 10bR
Period of Record: 1946-2017 (72 Years)



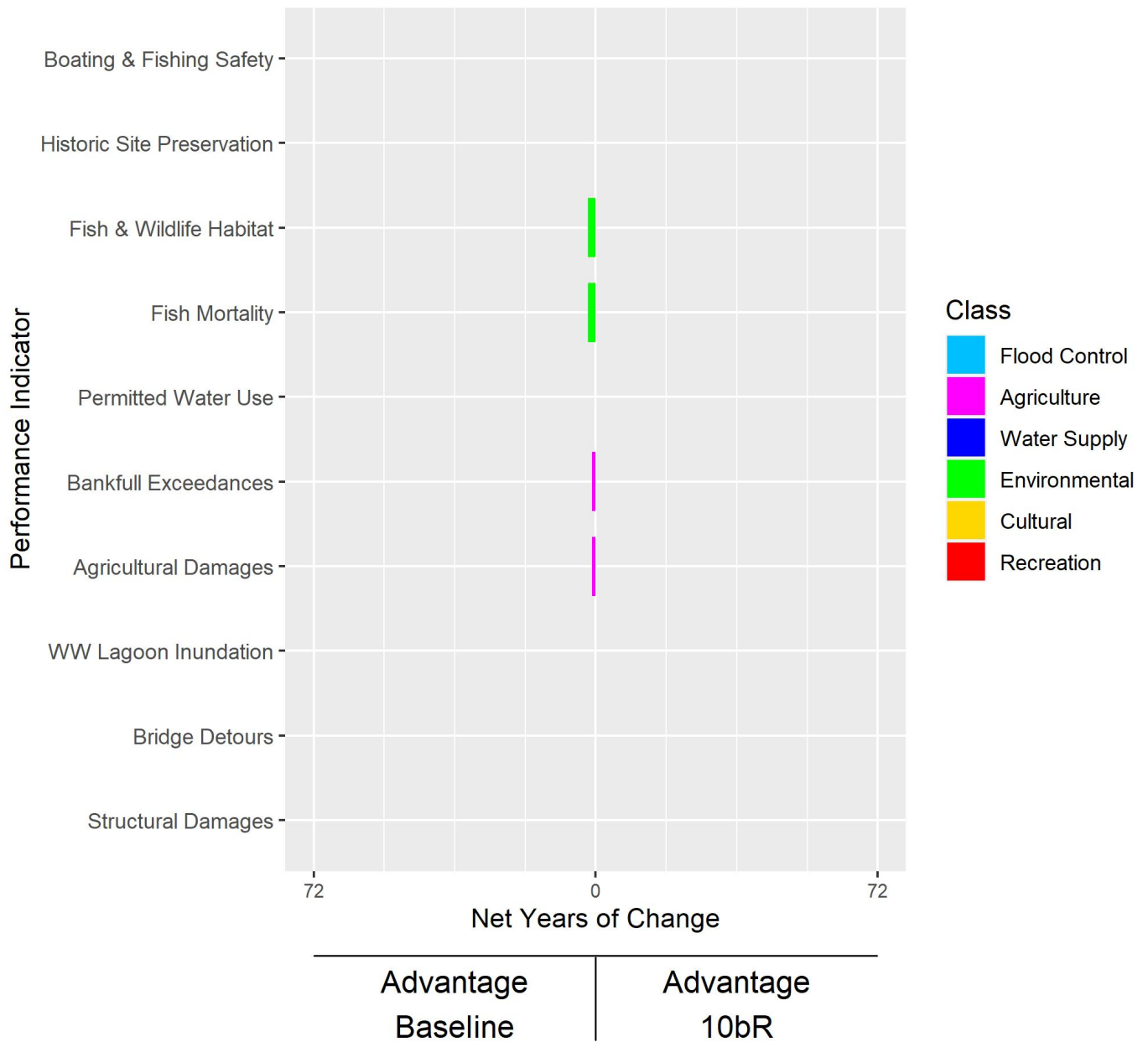
City of Sawyer
Baseline vs. 10bR
Period of Record: 1946-2017 (72 Years)



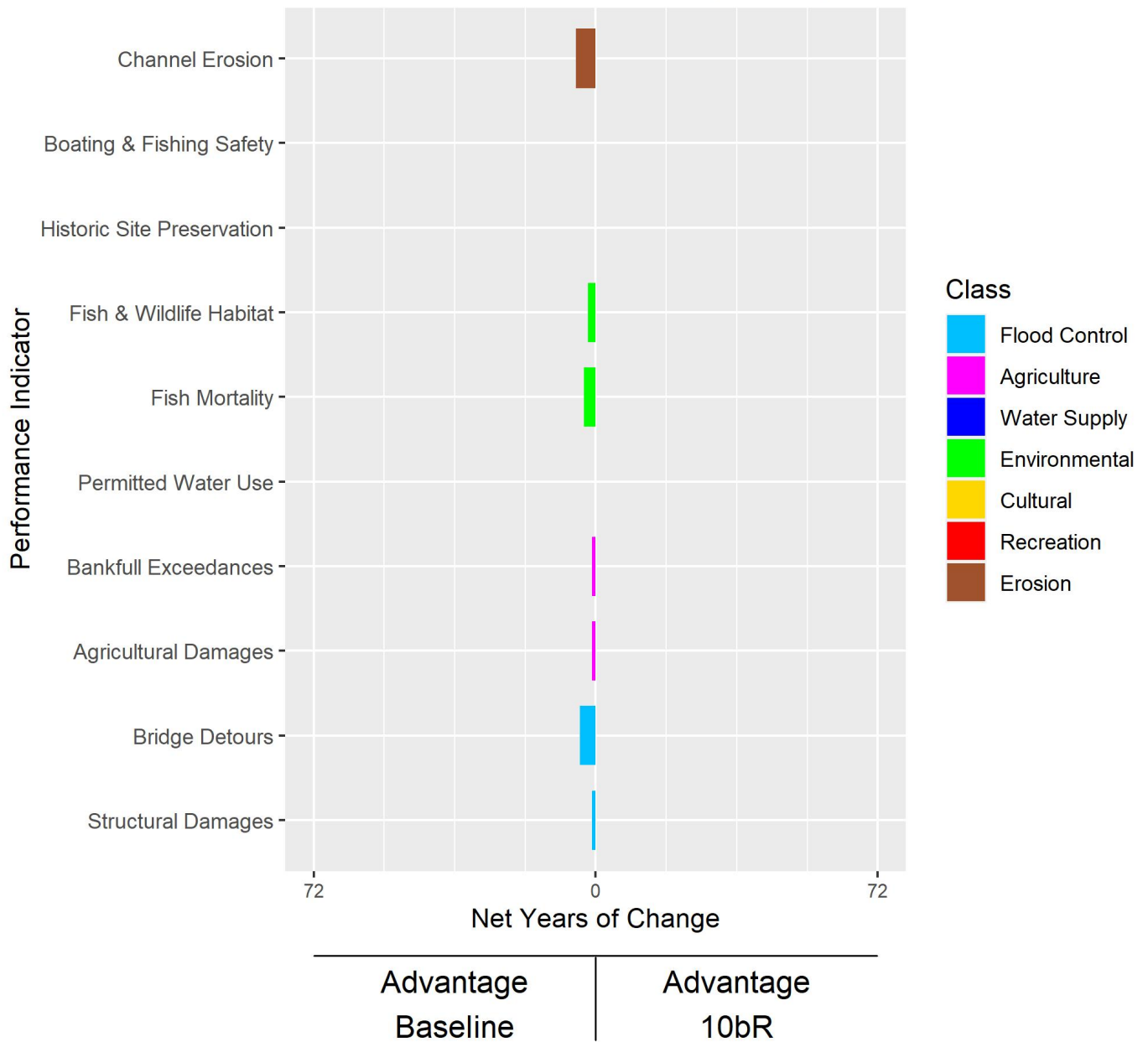
Sawyer to Velva
Baseline vs. 10bR
Period of Record: 1946-2017 (72 Years)



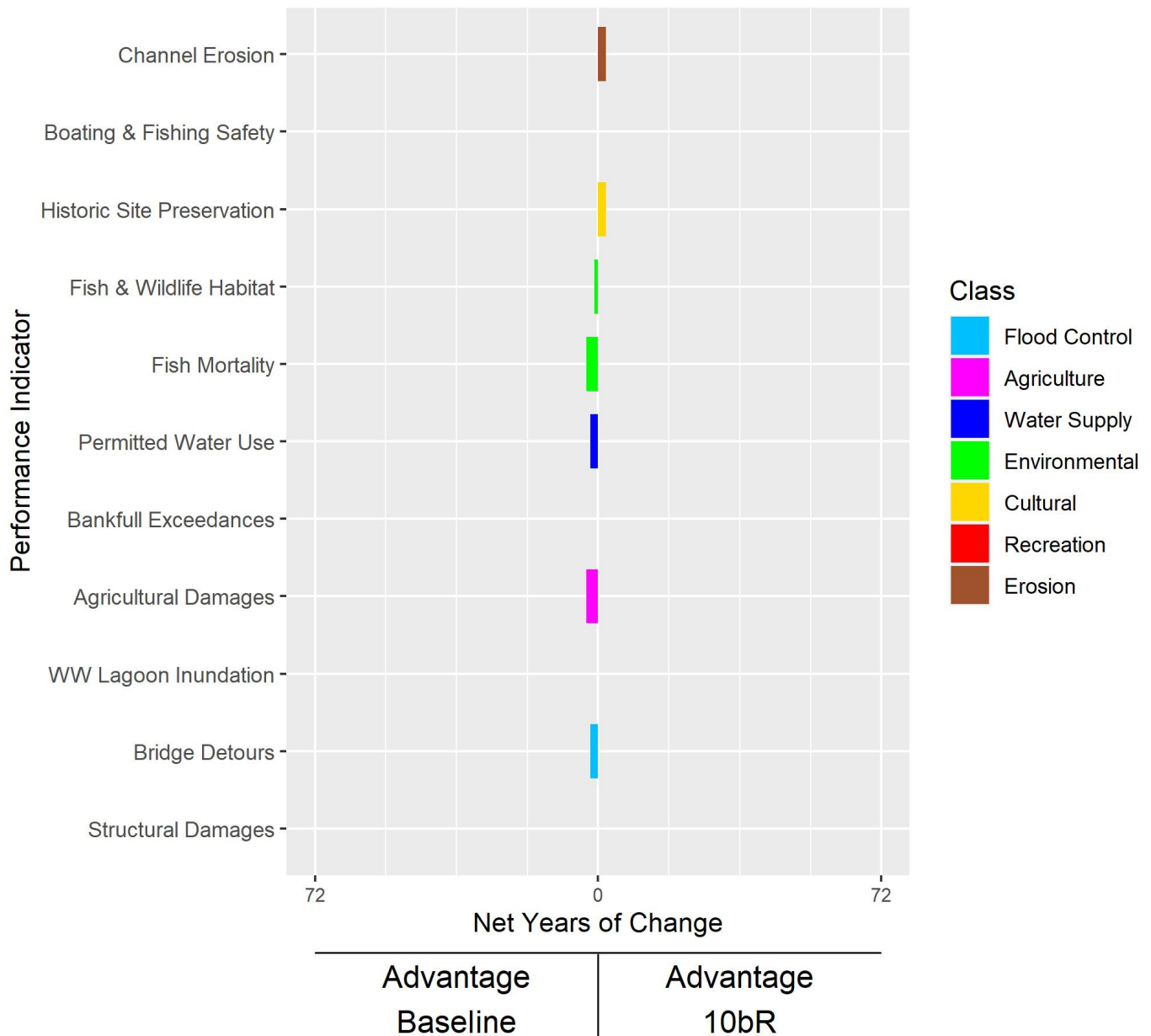
City of Velva
Baseline vs. 10bR
Period of Record: 1946-2017 (72 Years)



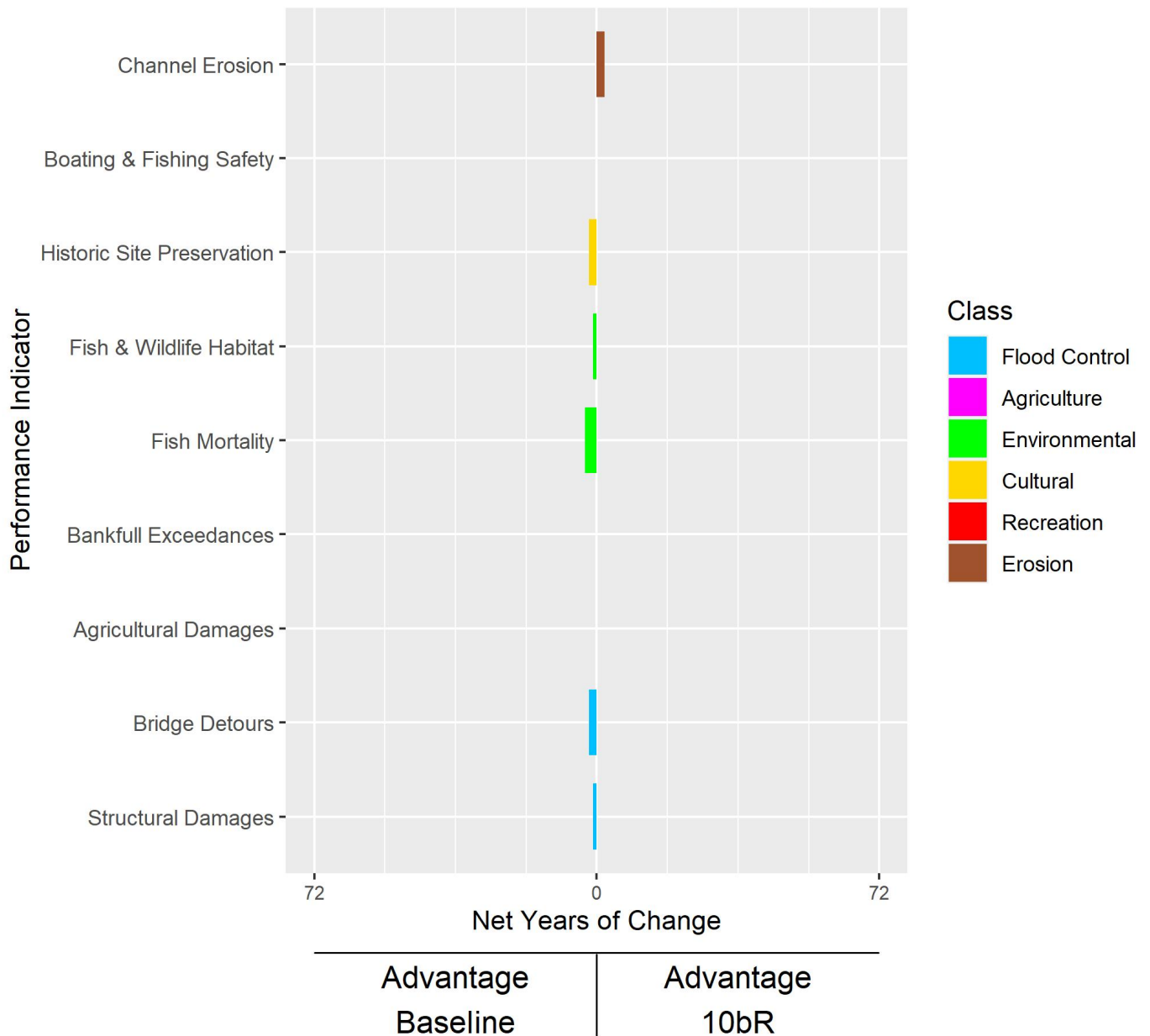
Velva to Eaton Irrigation
Baseline vs. 10bR
Period of Record: 1946-2017 (72 Years)



Eaton Irrigation District
Baseline vs. 10bR
Period of Record: 1946-2017 (72 Years)



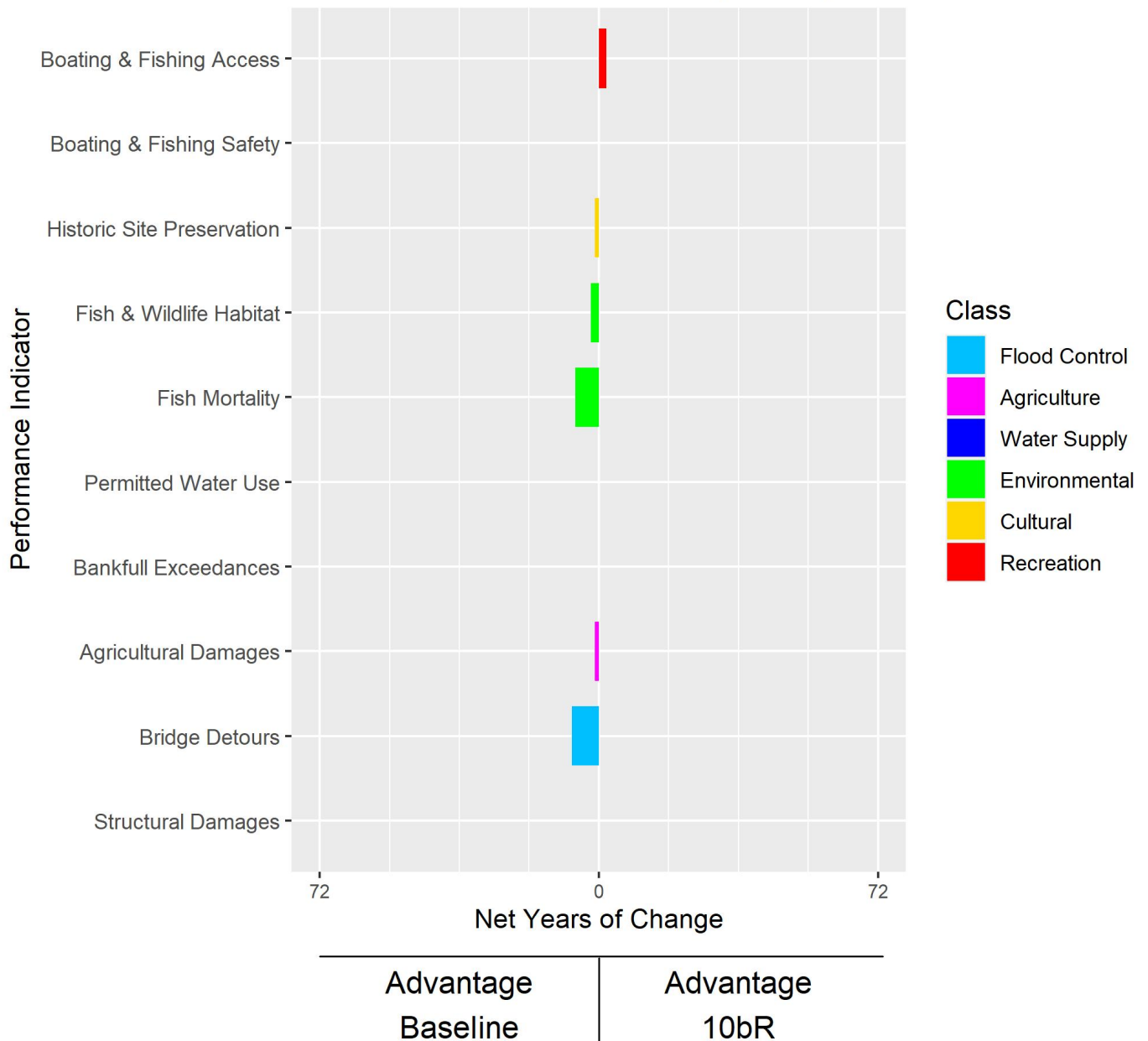
Downstream of Towner
Baseline vs. 10bR
Period of Record: 1946-2017 (72 Years)



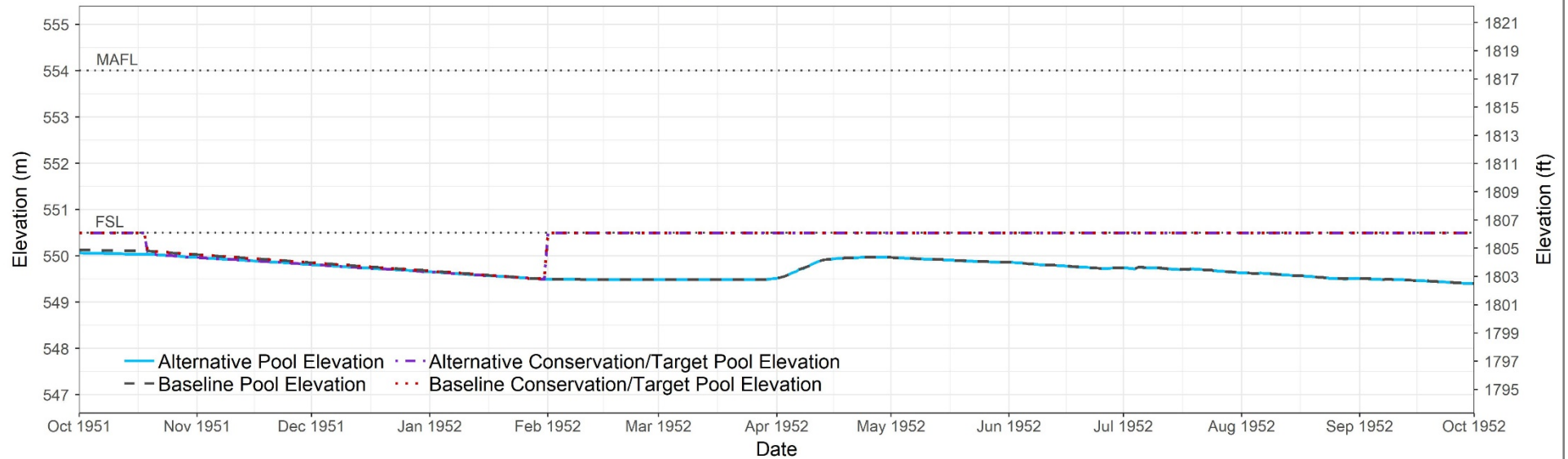
J. Clark Salyer National Wildlife Refuge

Baseline vs. 10bR

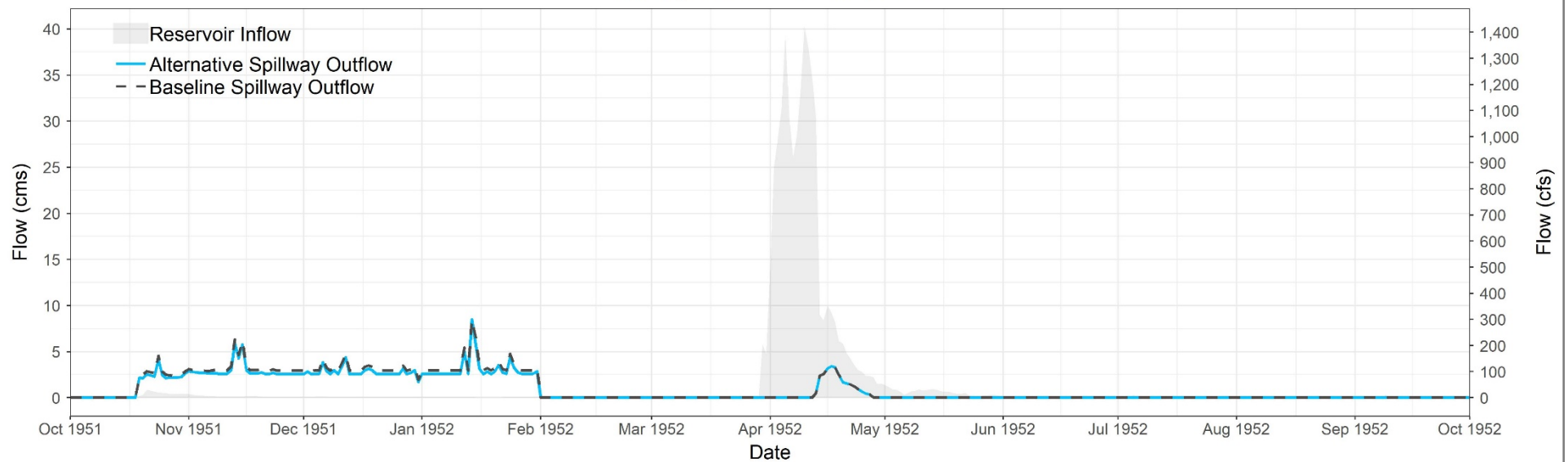
Period of Record: 1946-2017 (72 Years)



Rafferty Reservoir - Elevation

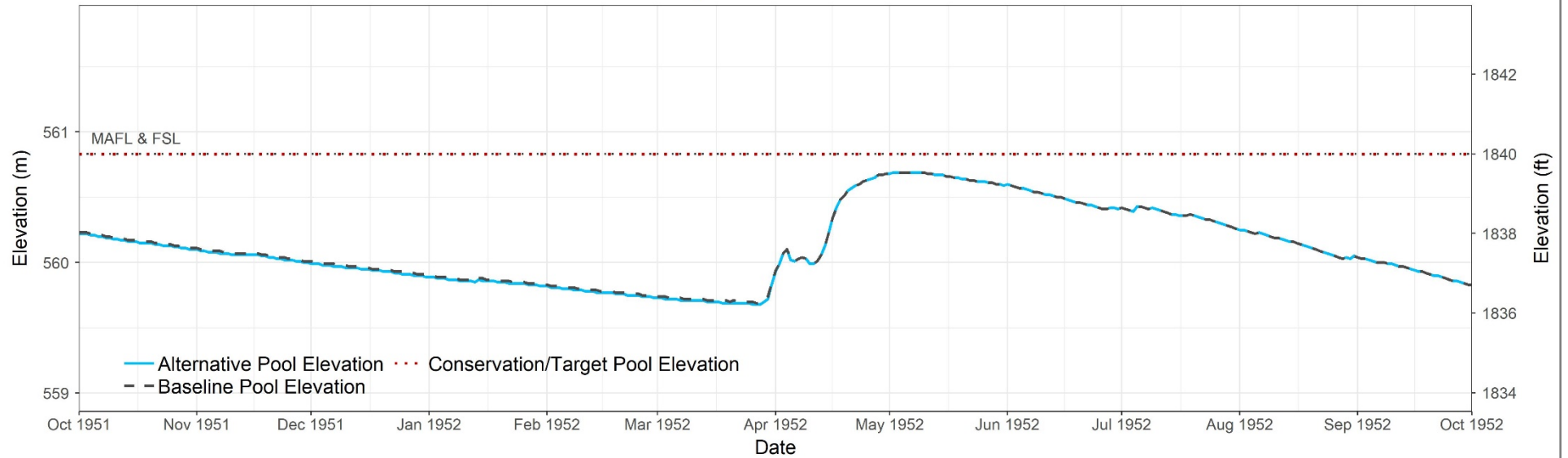


Rafferty Reservoir - Releases

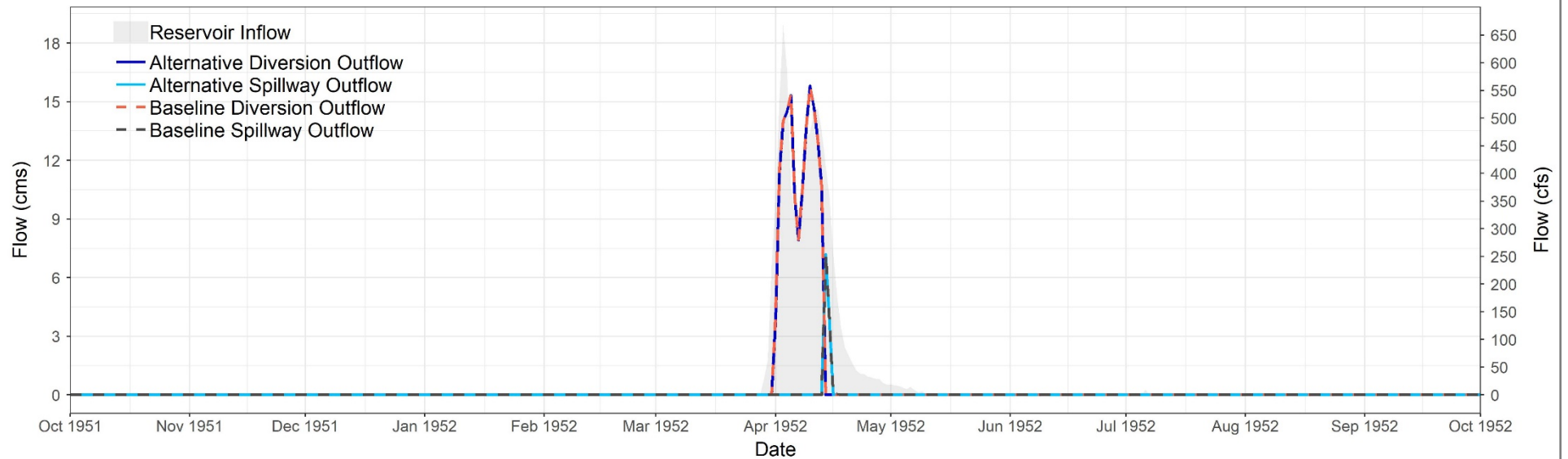


*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level

Boundary Reservoir - Elevation

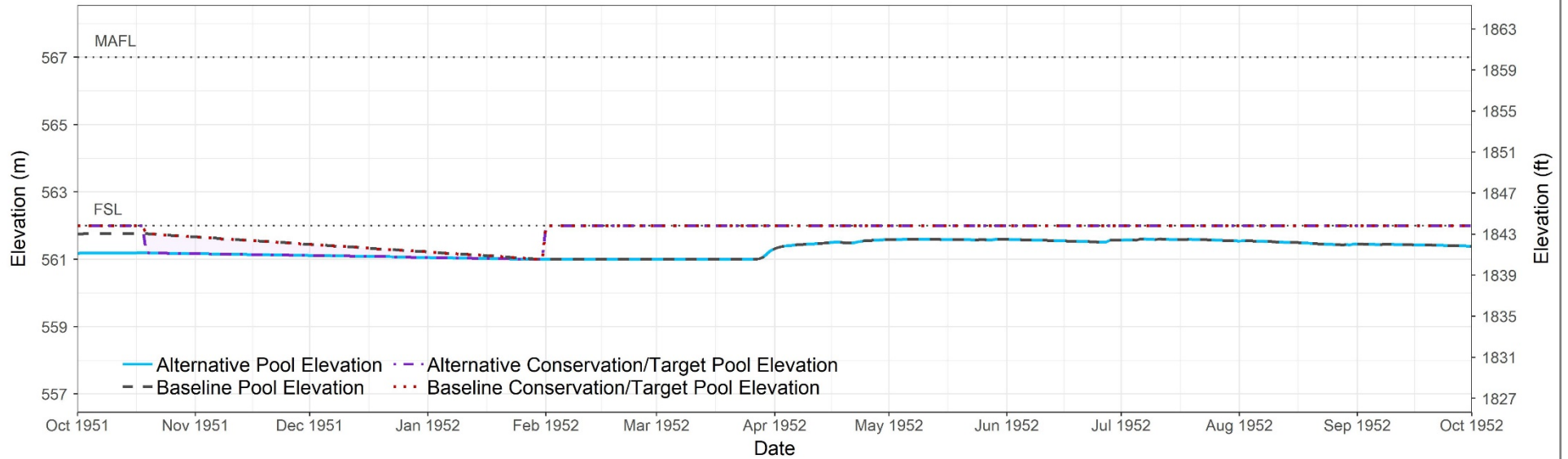


Boundary Reservoir - Releases

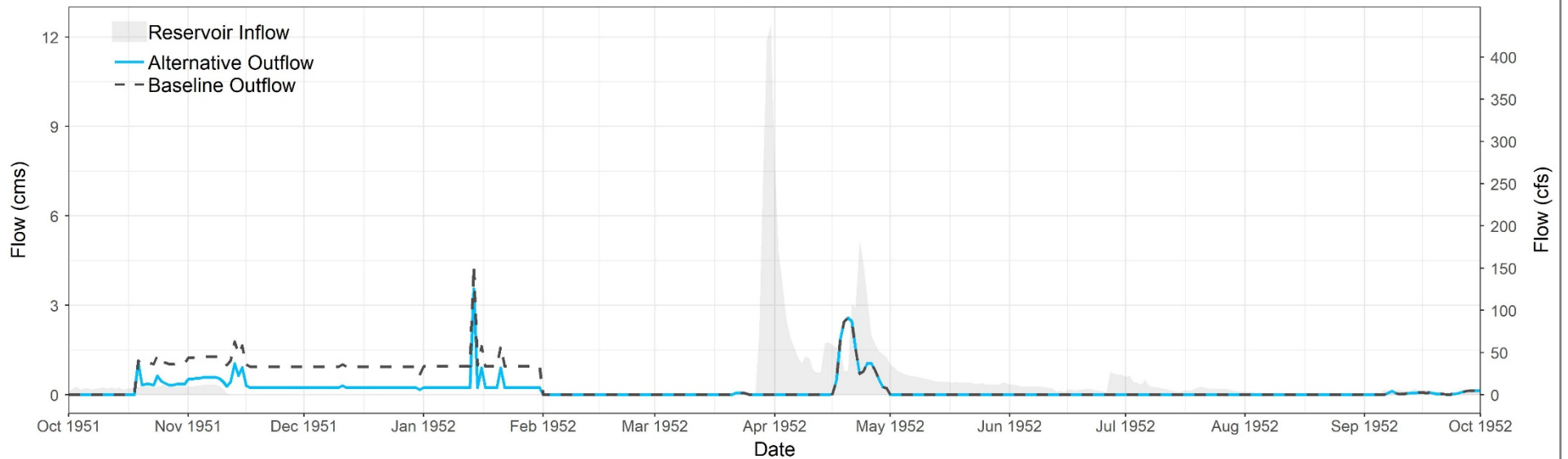


*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level

Grant Devine Reservoir - Elevation

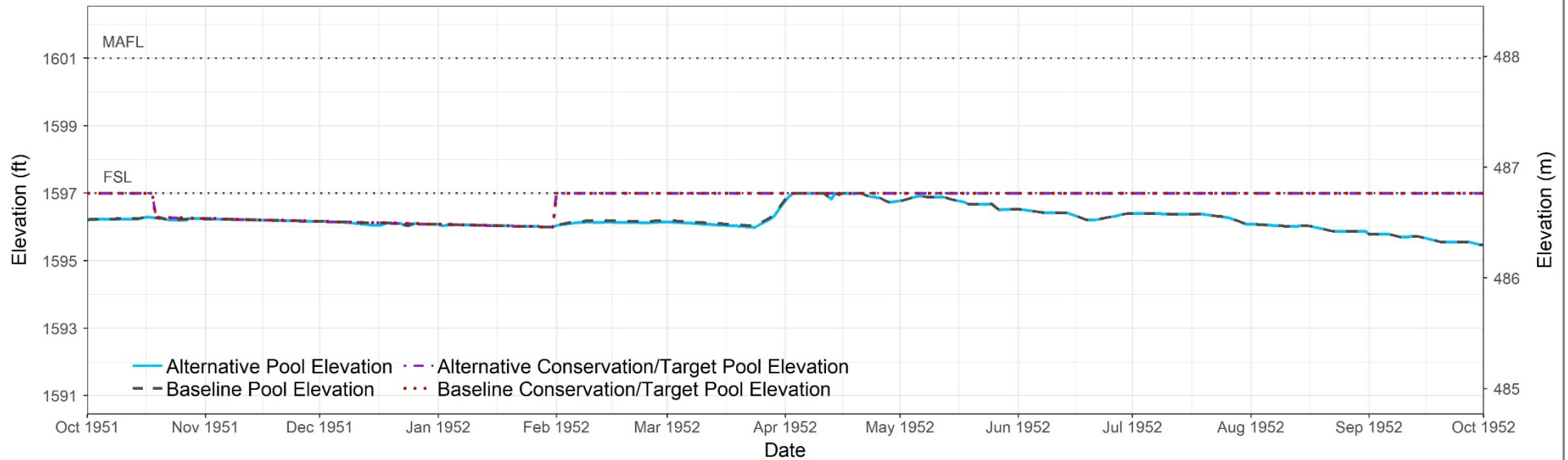


Grant Devine Reservoir - Releases

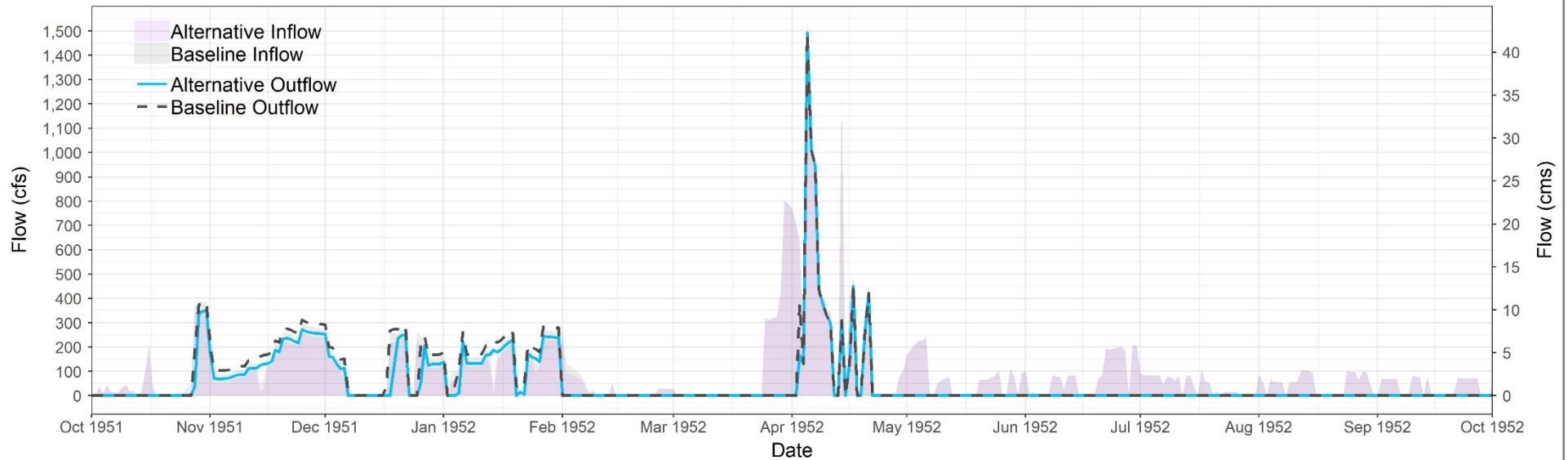


*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level

Lake Darling - Elevation



Lake Darling - Releases



*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level, IDFSL = Inflow Design Flood Supply Level

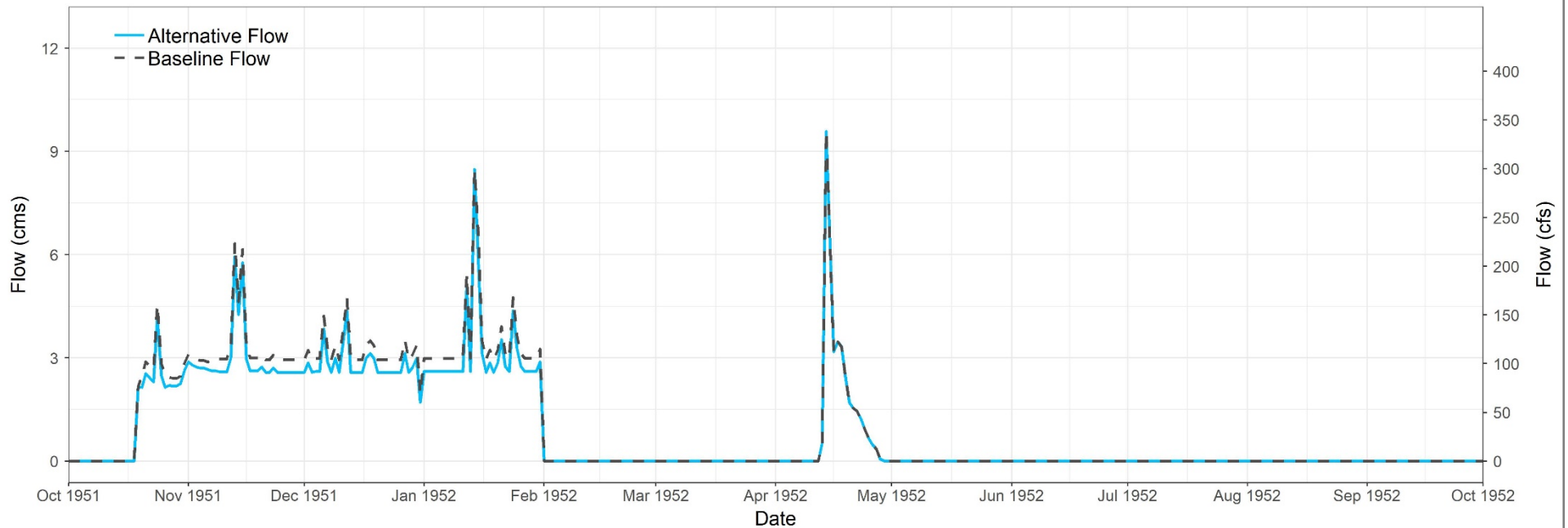
Plate 38

Critical Flow Locations – 1952

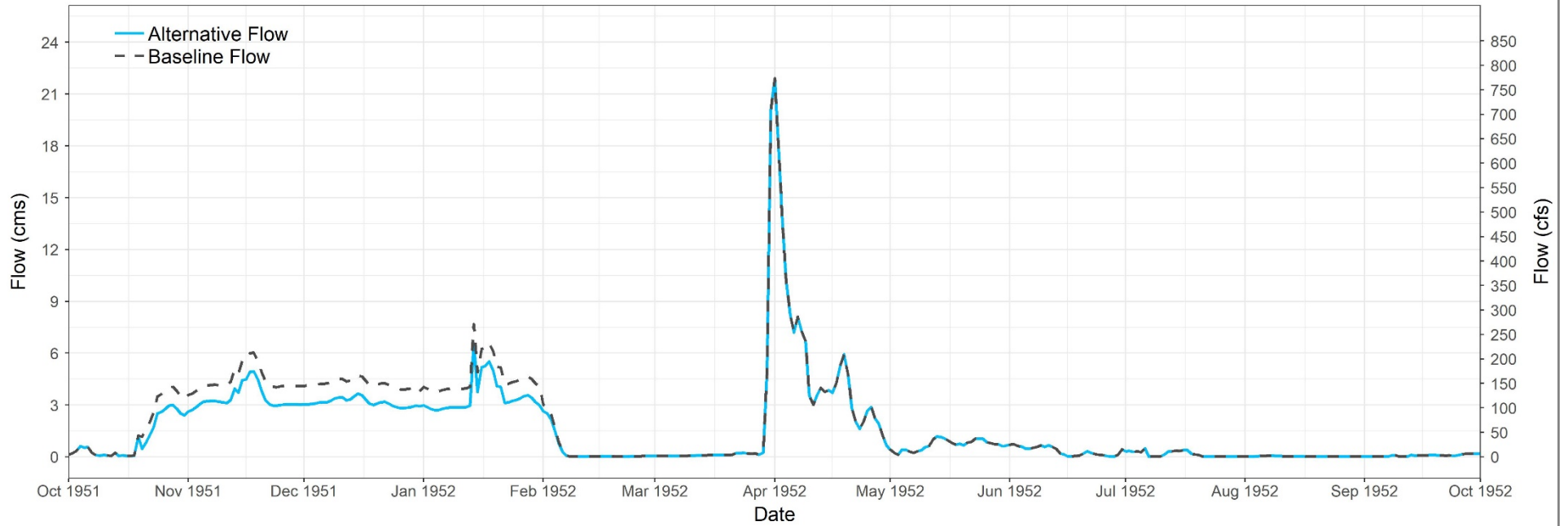
Alternative 10cL (Phase 2)

Souris River Plan of Study

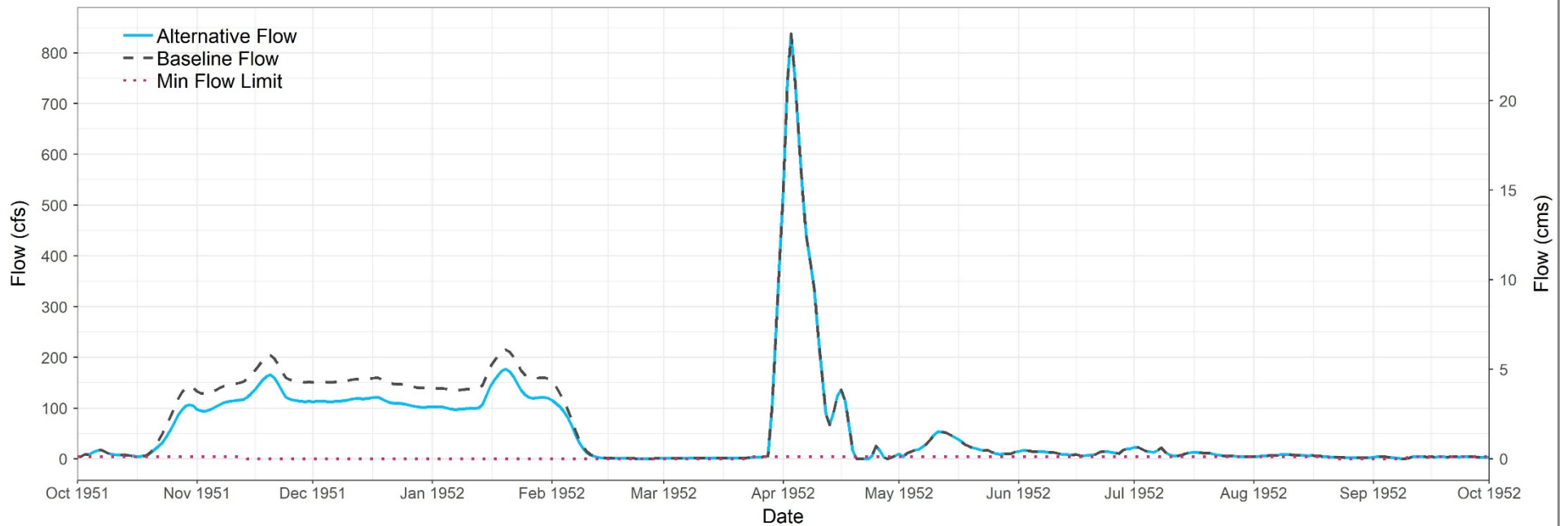
Souris River at Estevan, SK



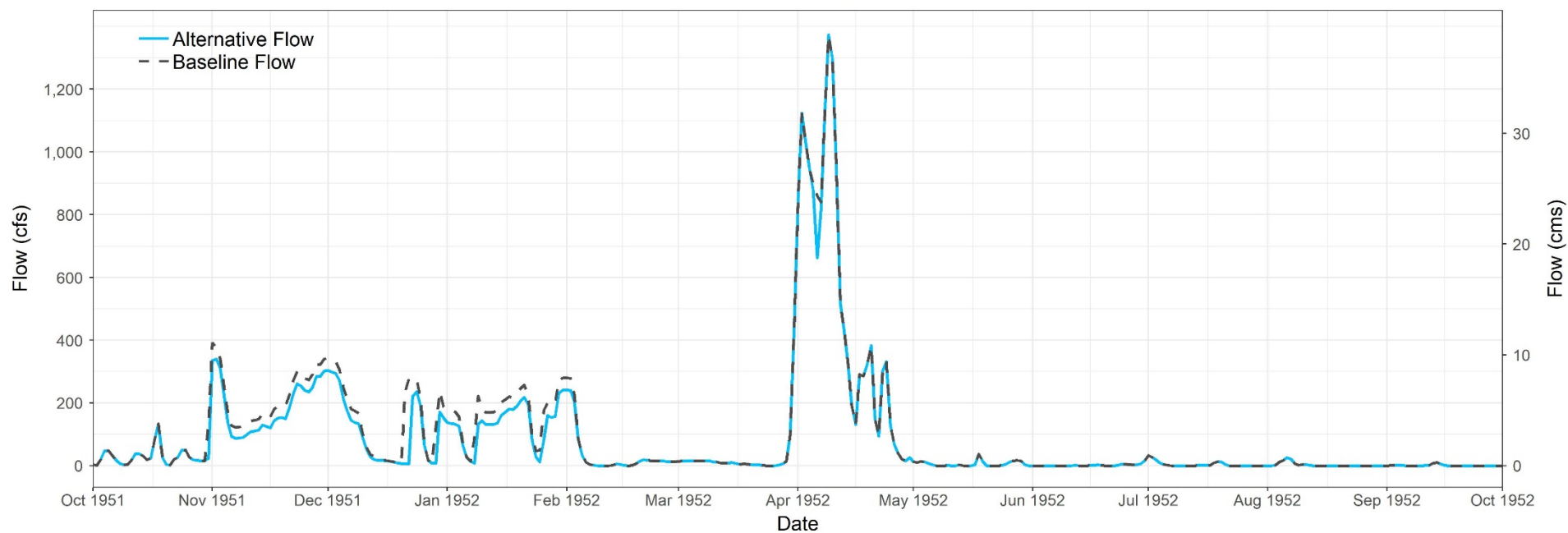
Souris River at Oxbow, SK



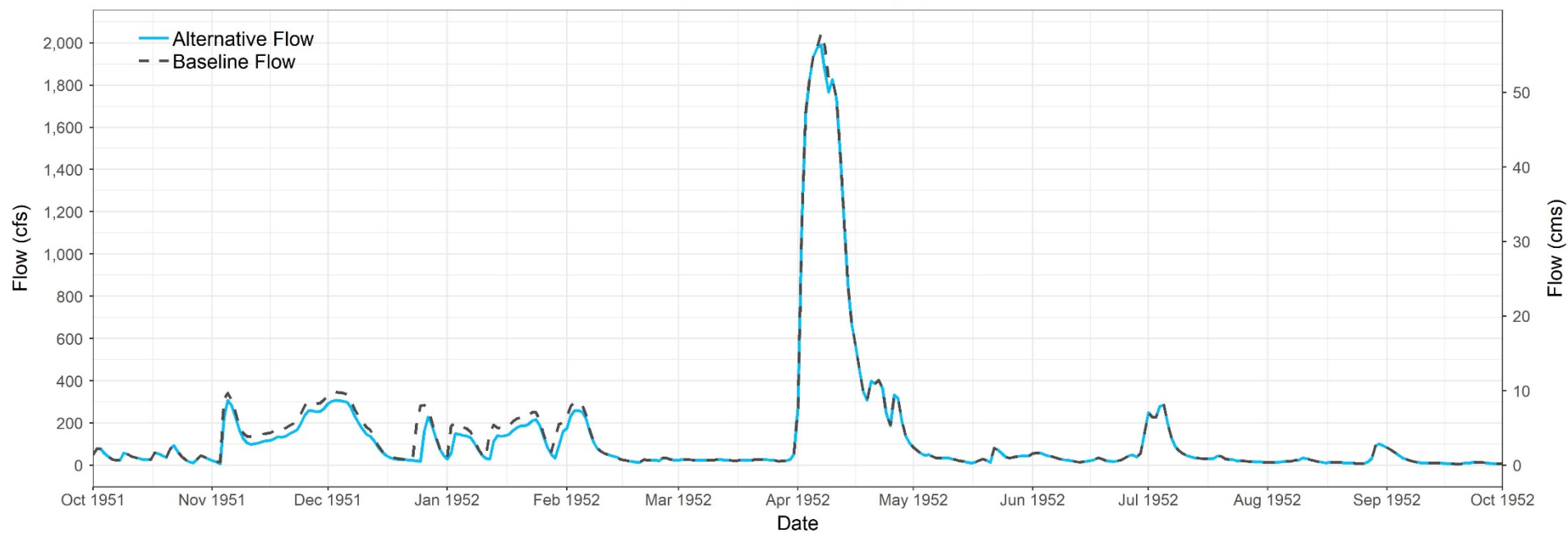
Souris River at Sherwood, ND



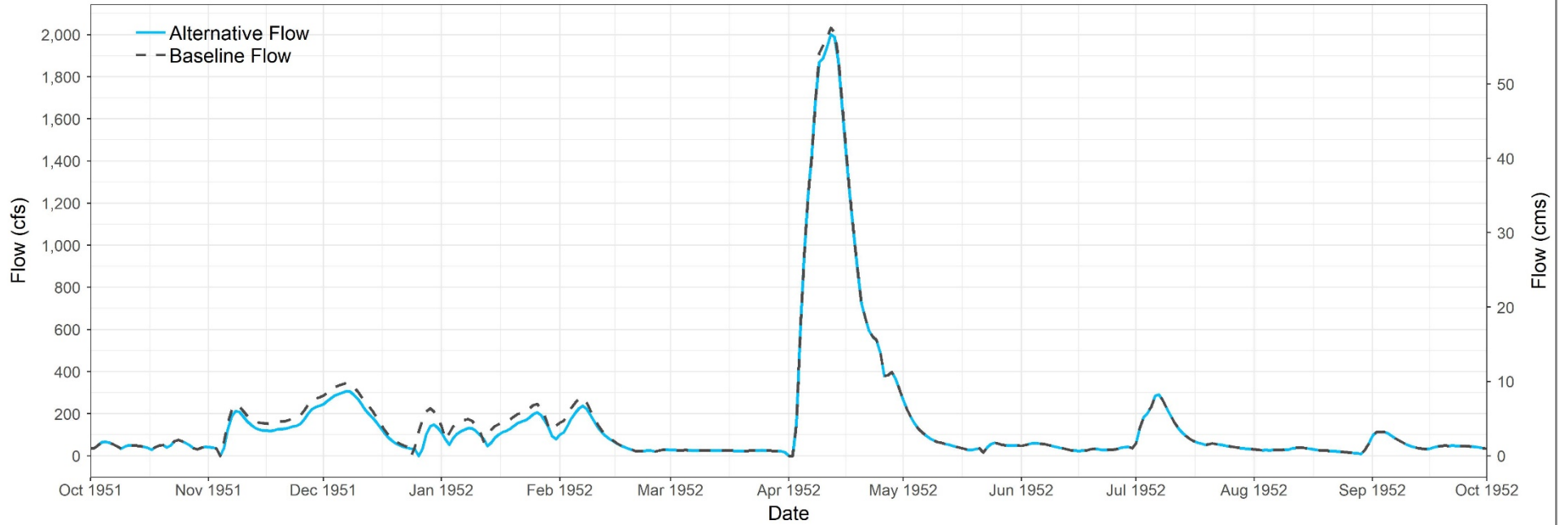
Souris River at Minot, ND - Flow



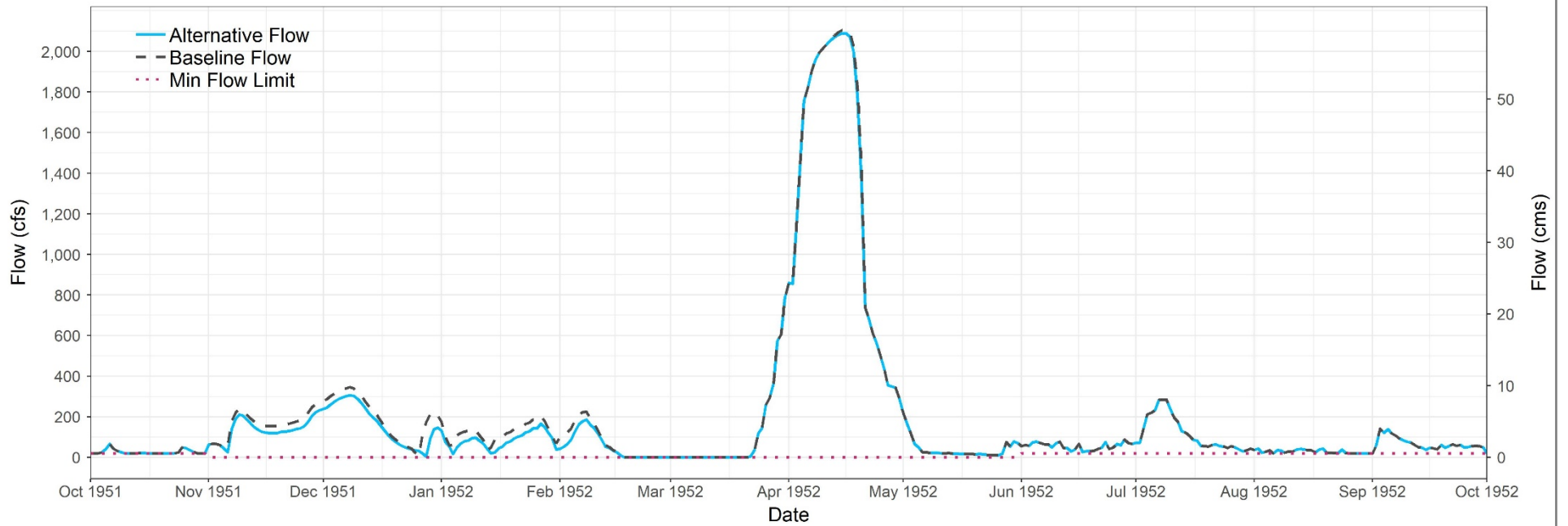
Souris River at Verendrye, ND



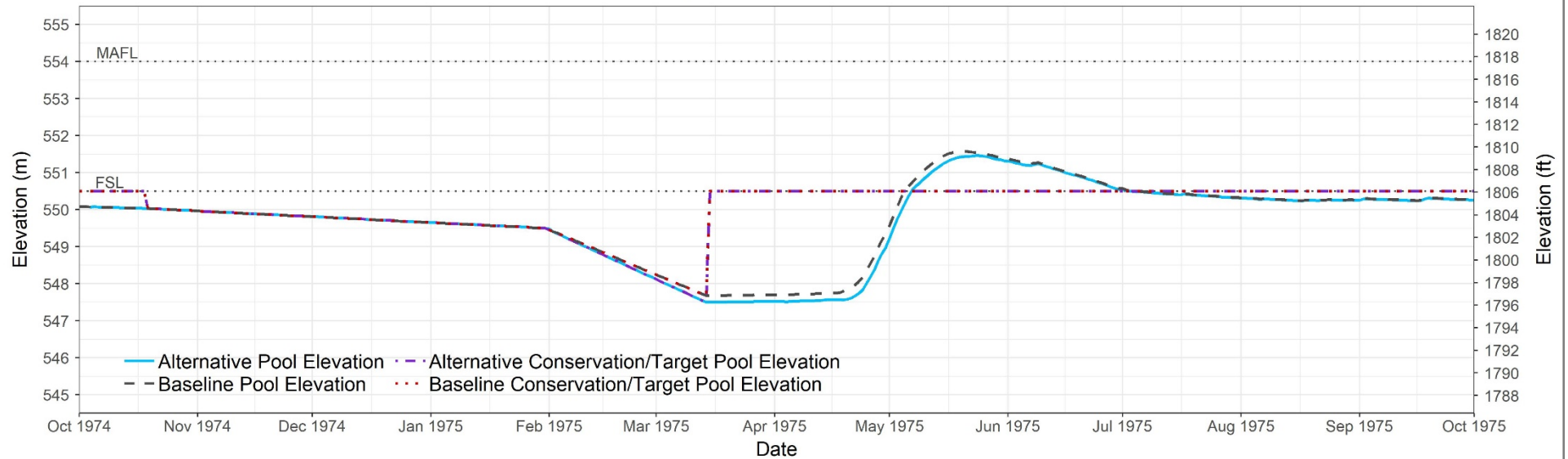
Souris River at Bantry, ND



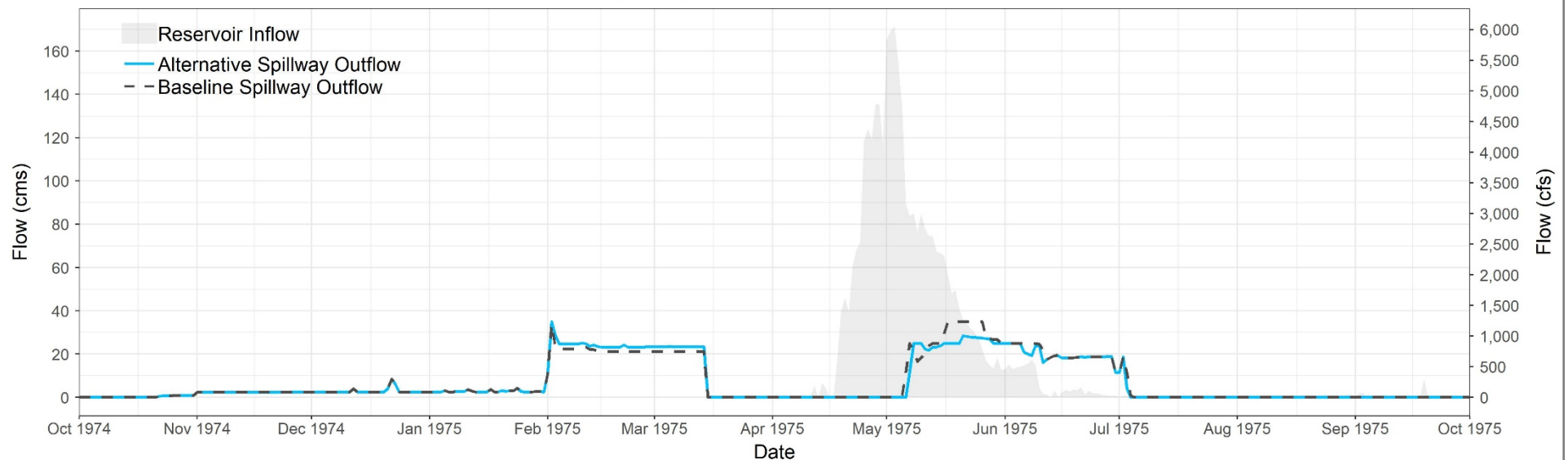
Souris River at Westhope, ND



Rafferty Reservoir - Elevation

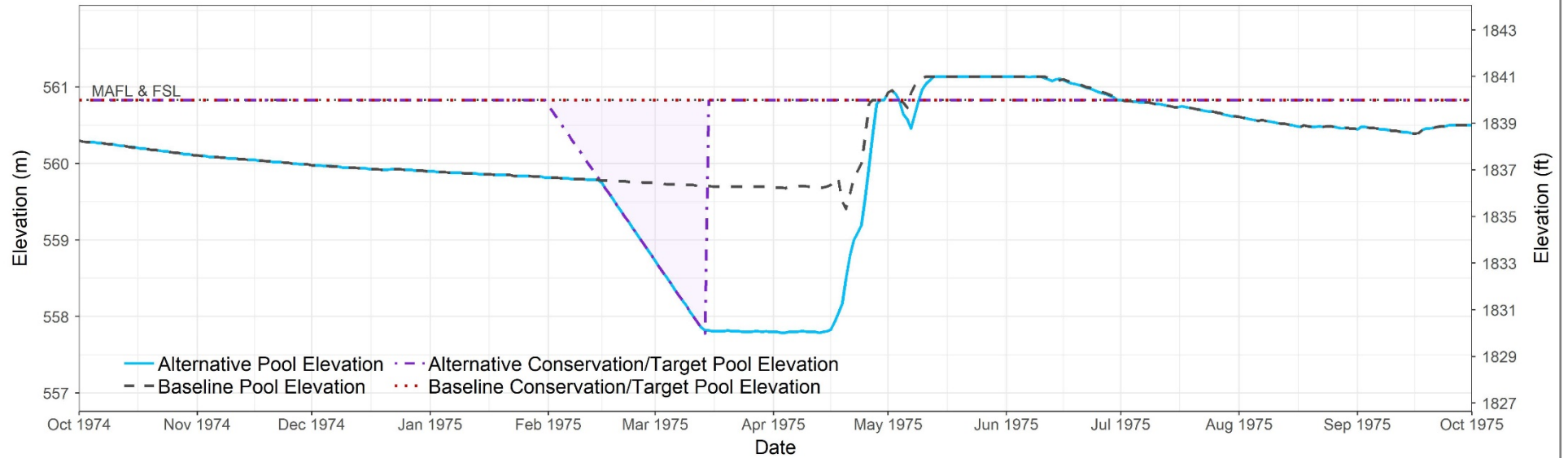


Rafferty Reservoir - Releases

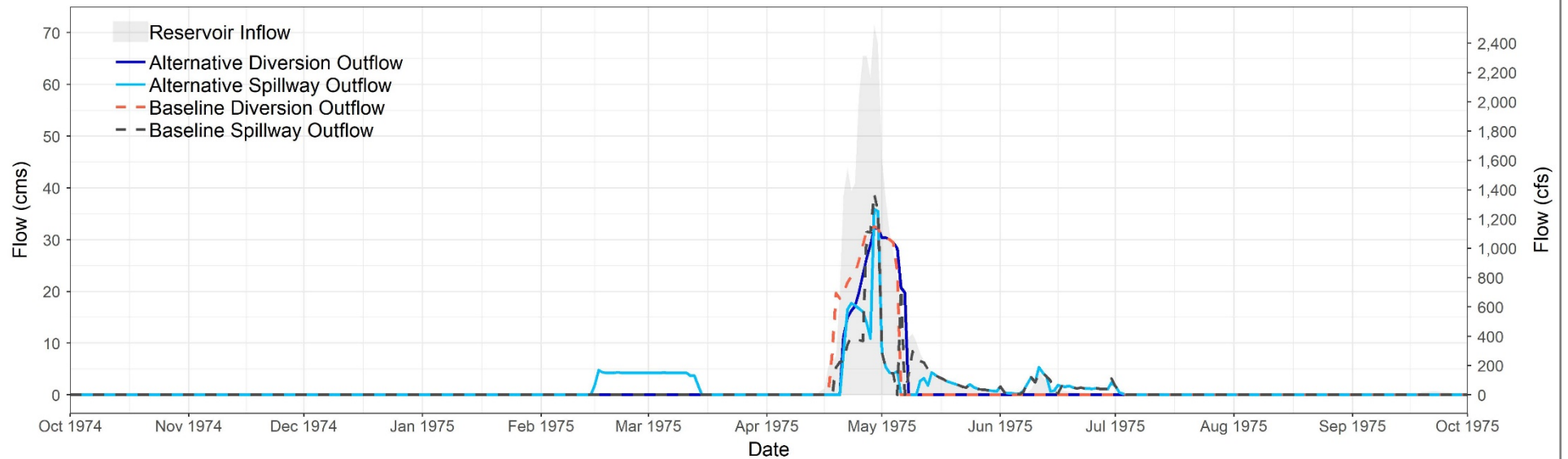


*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level

Boundary Reservoir - Elevation

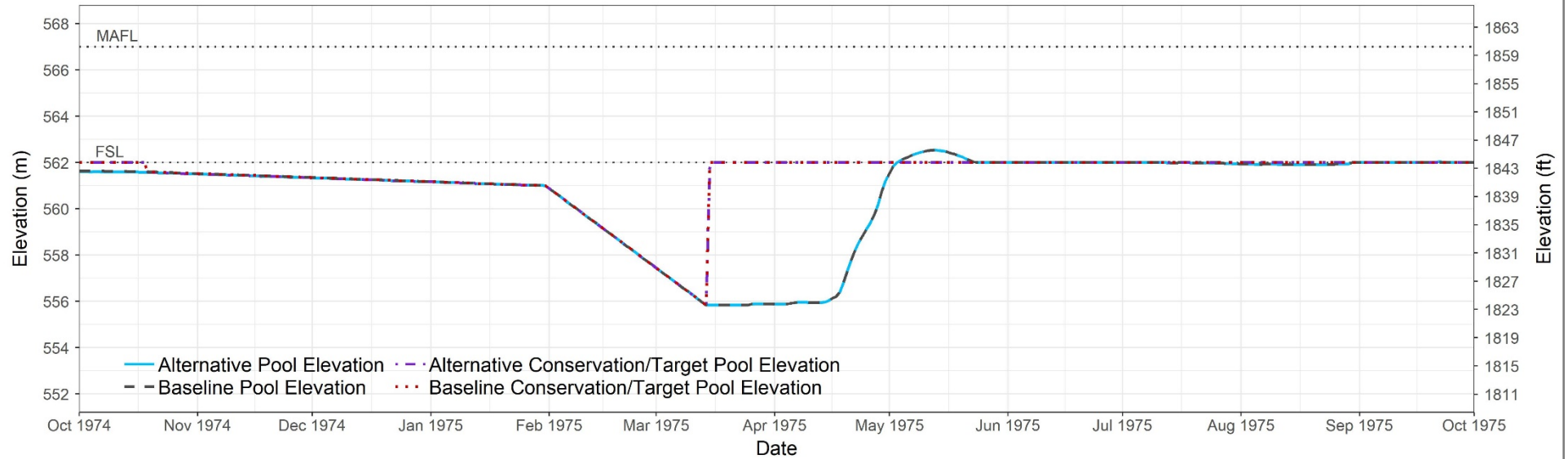


Boundary Reservoir - Releases

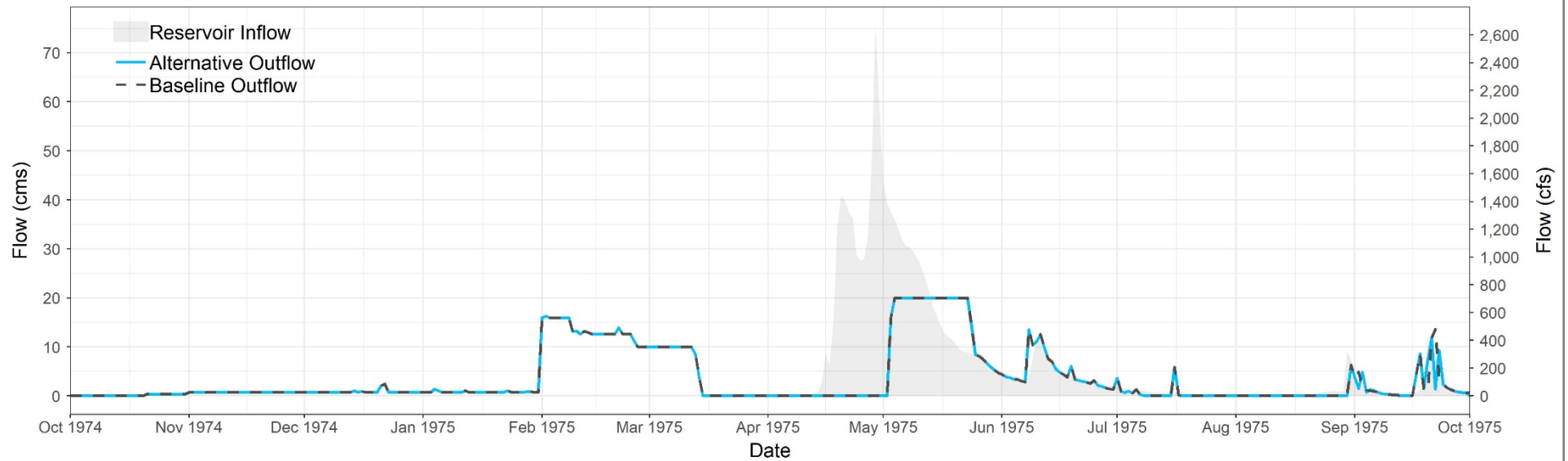


*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level

Grant Devine Reservoir - Elevation

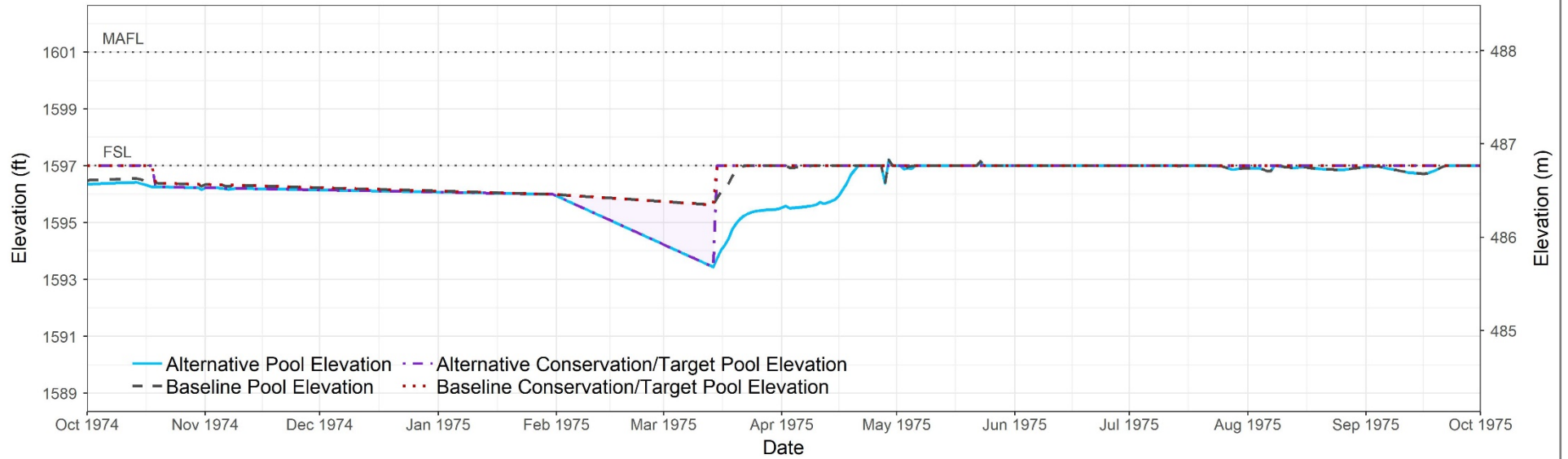


Grant Devine Reservoir - Releases

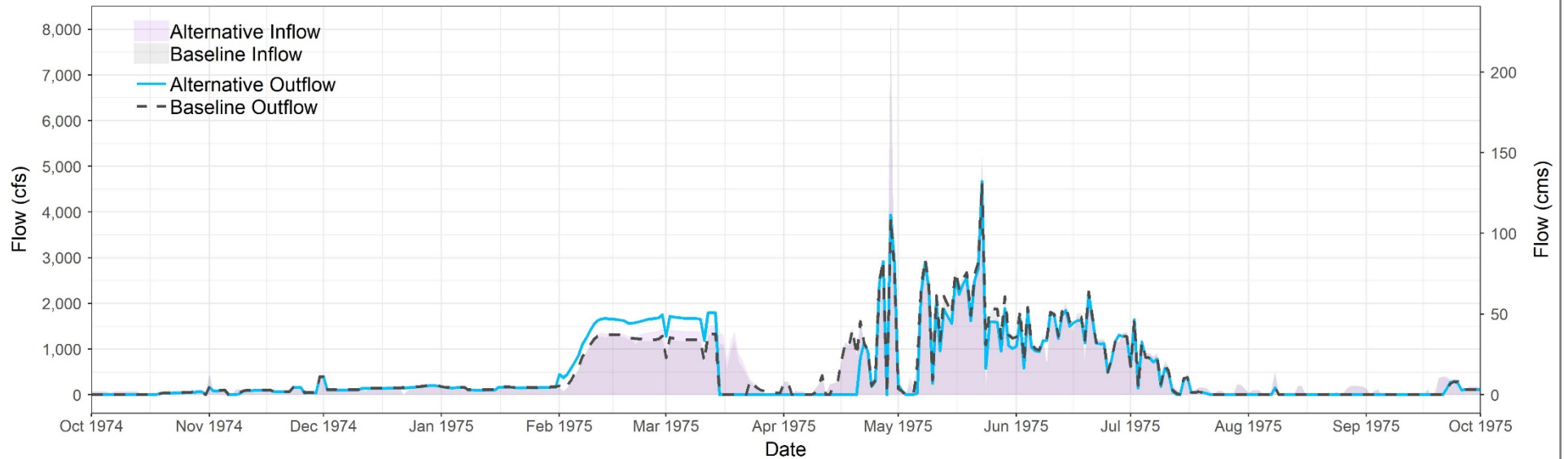


*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level

Lake Darling - Elevation



Lake Darling - Releases



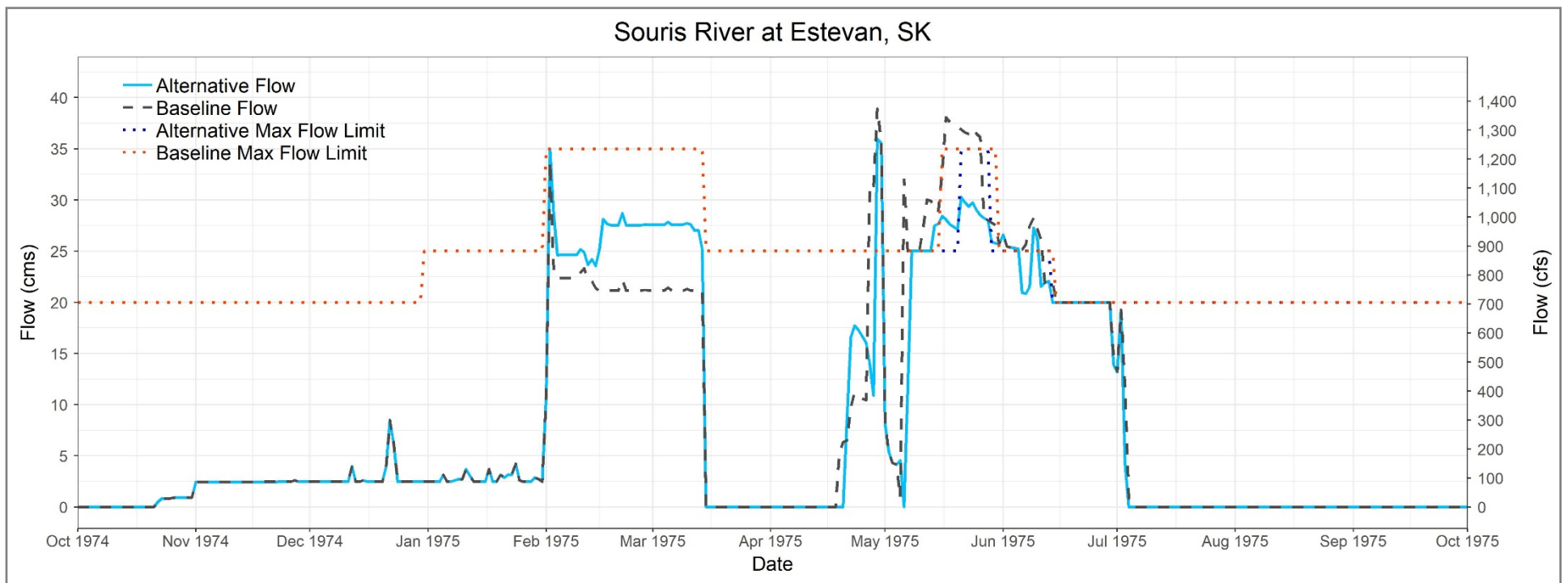
*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level, IDFSL = Inflow Design Flood Supply Level

Plate 40

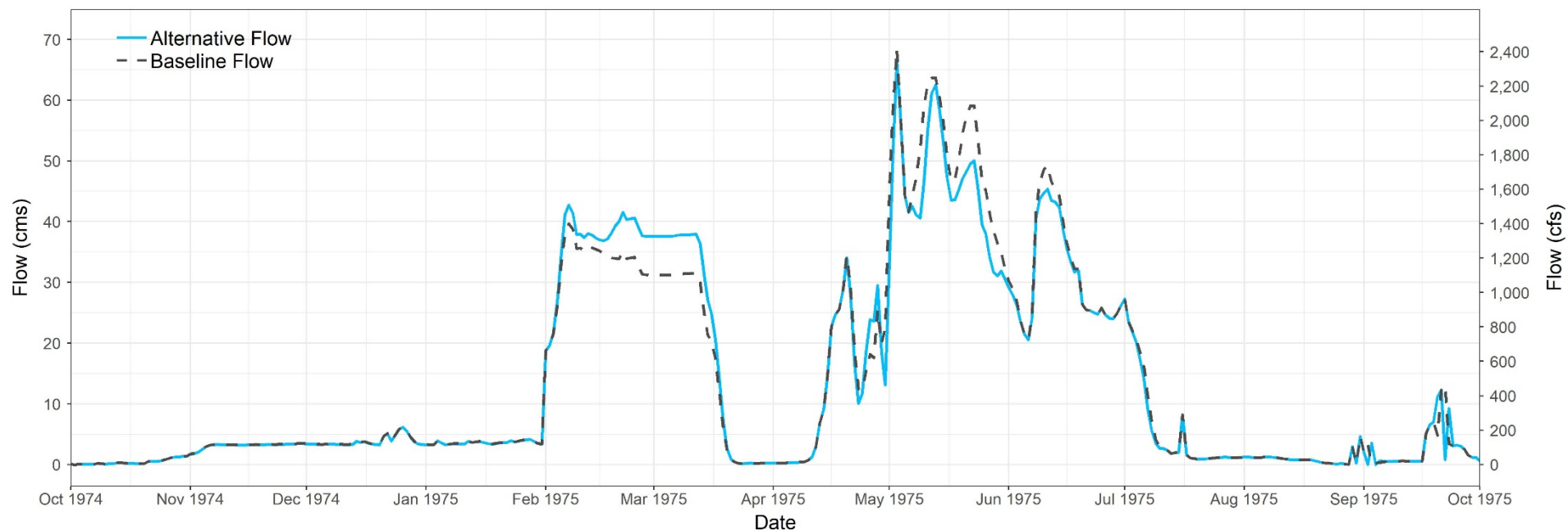
Critical Flow Locations – 1975

Alternative 10cL (Phase 2)

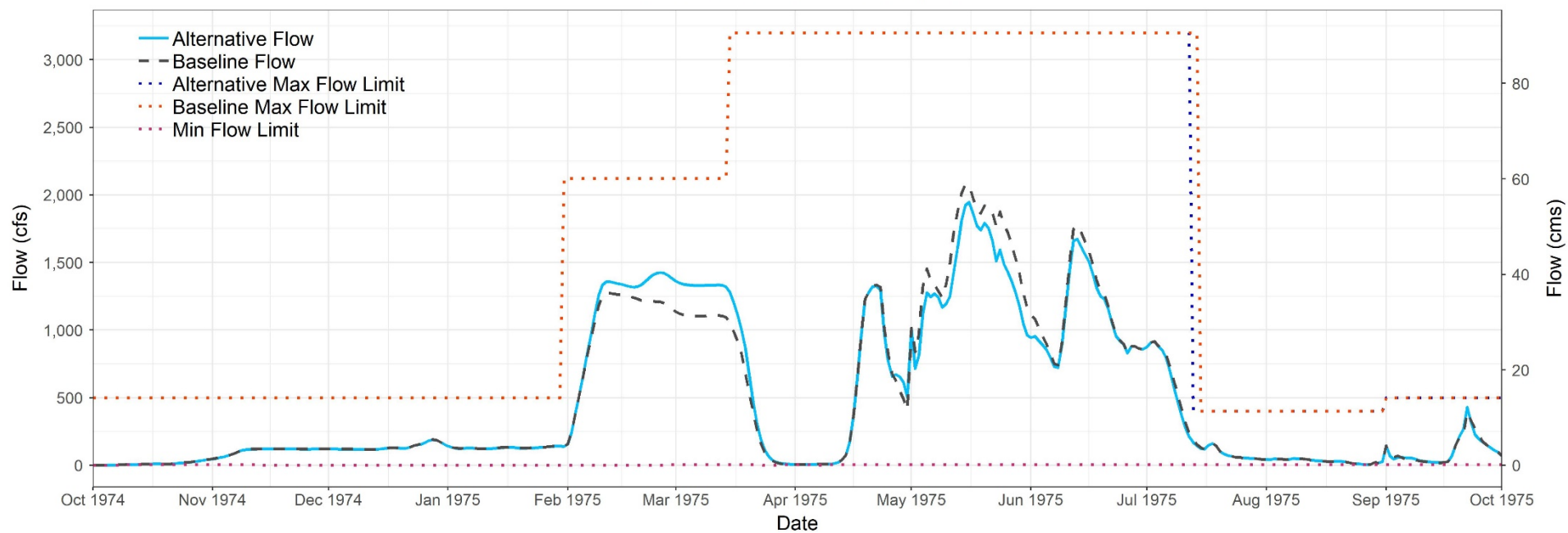
Souris River Plan of Study



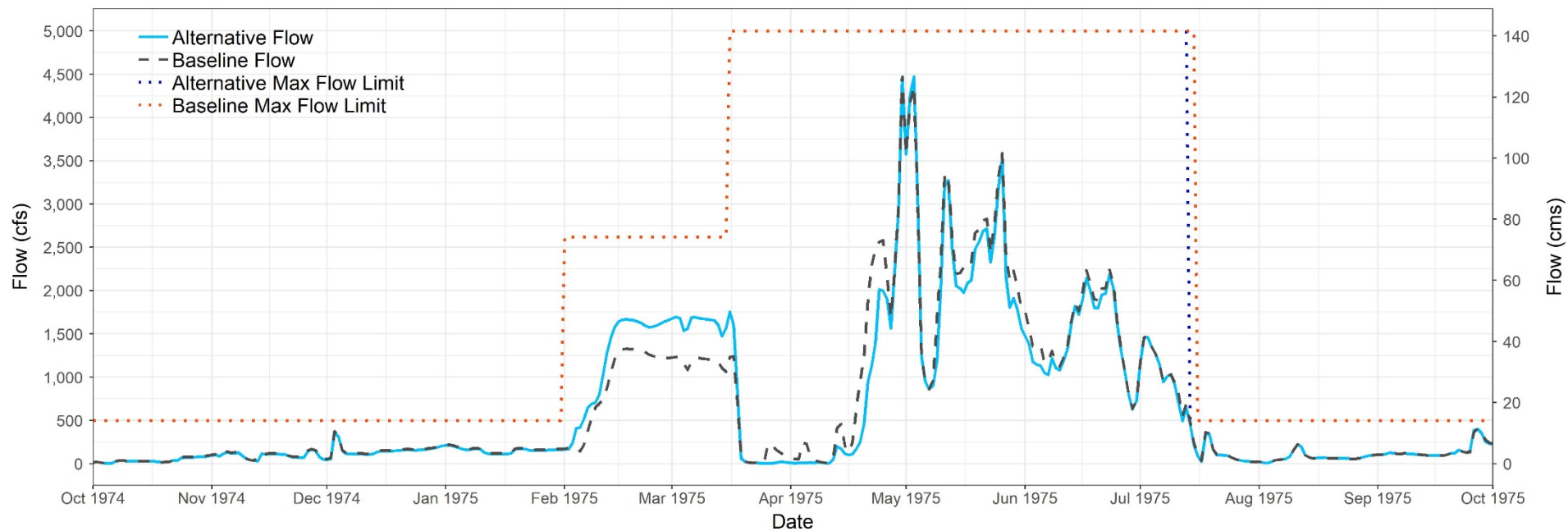
Souris River at Oxbow, SK



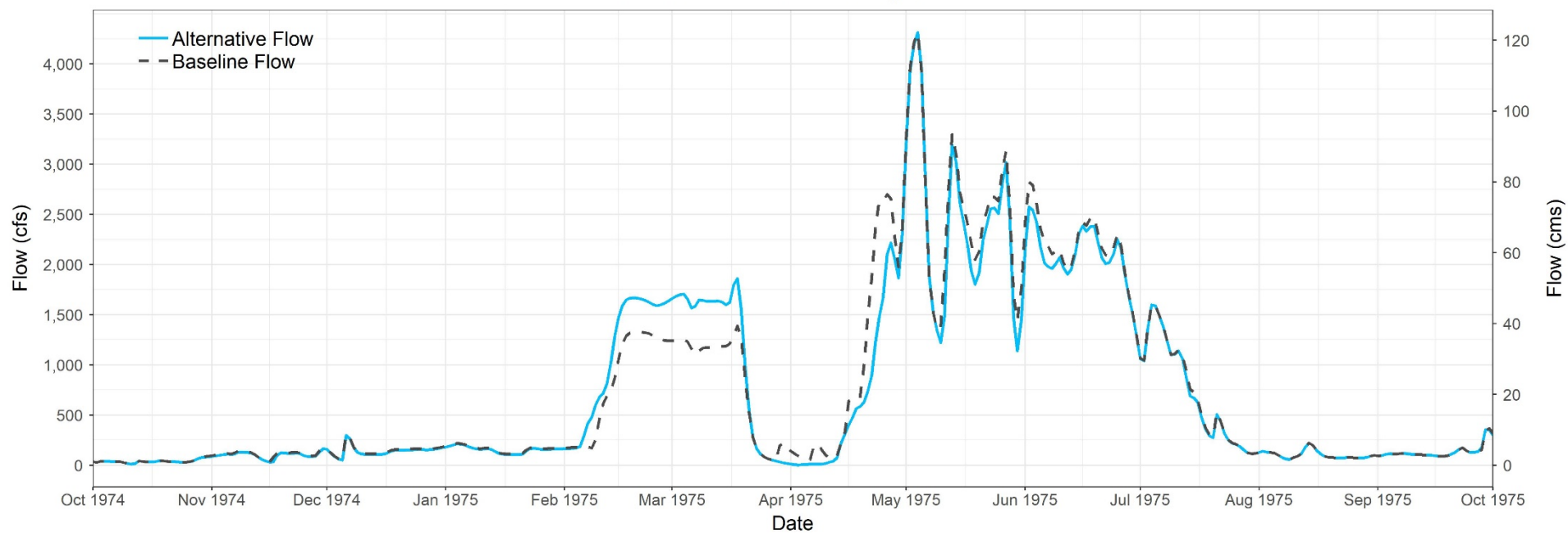
Souris River at Sherwood, ND



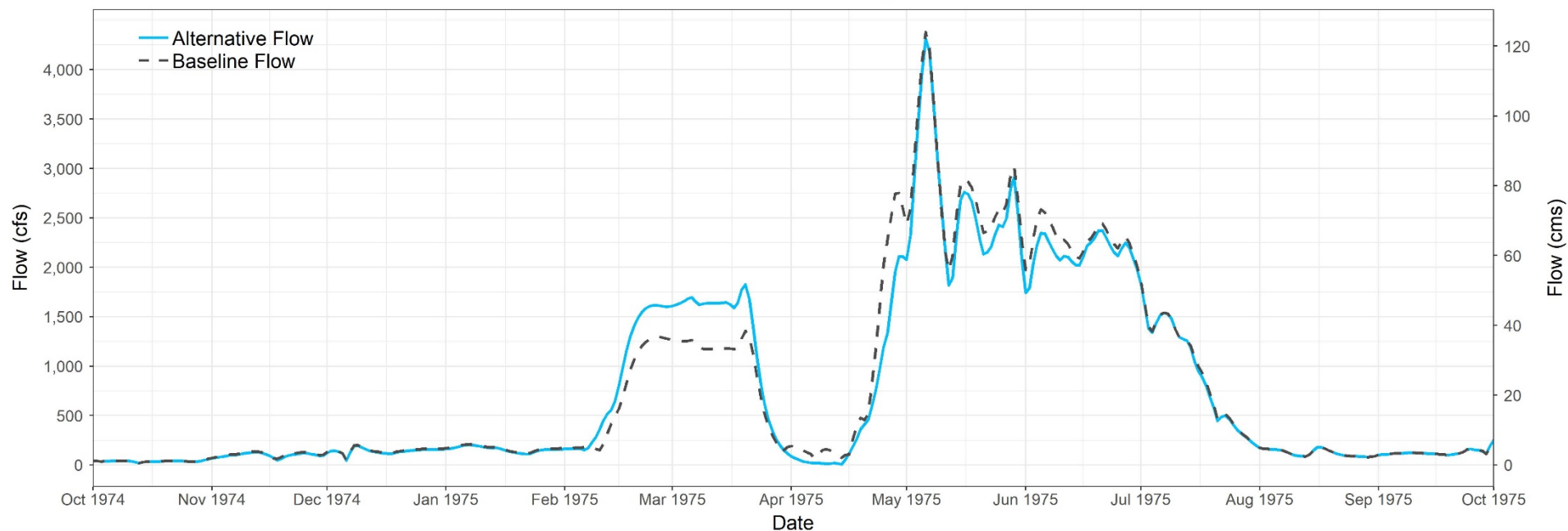
Souris River at Minot, ND - Flow



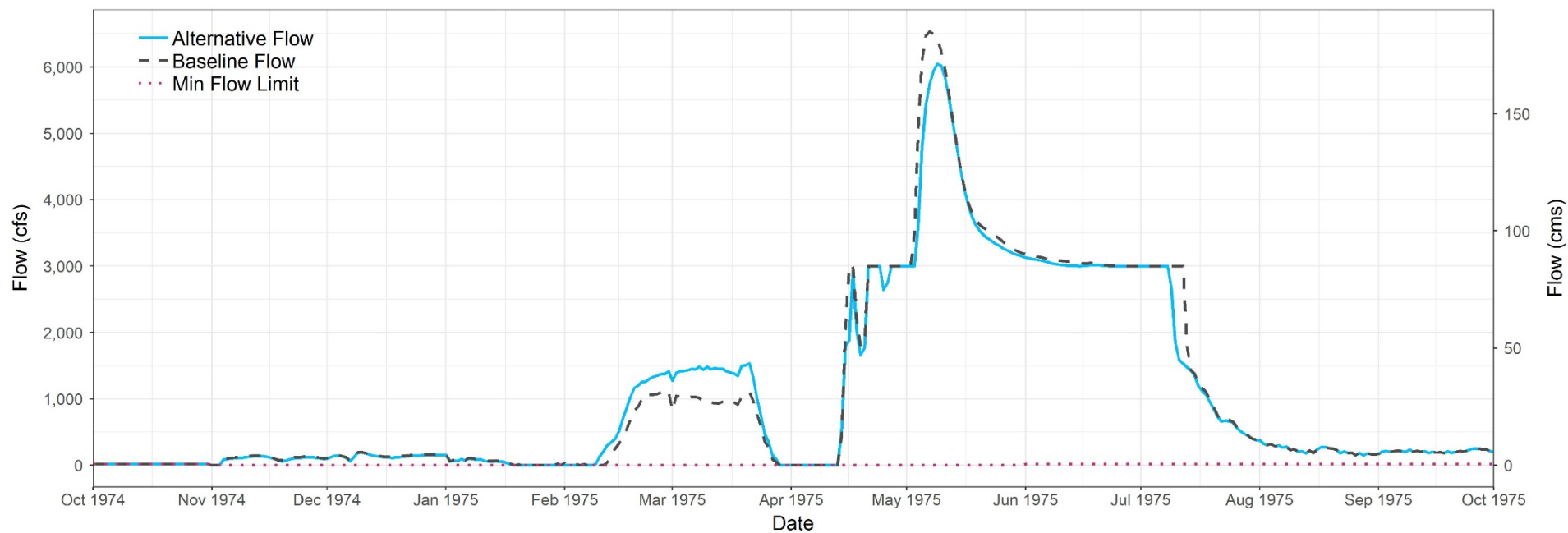
Souris River at Verendrye, ND



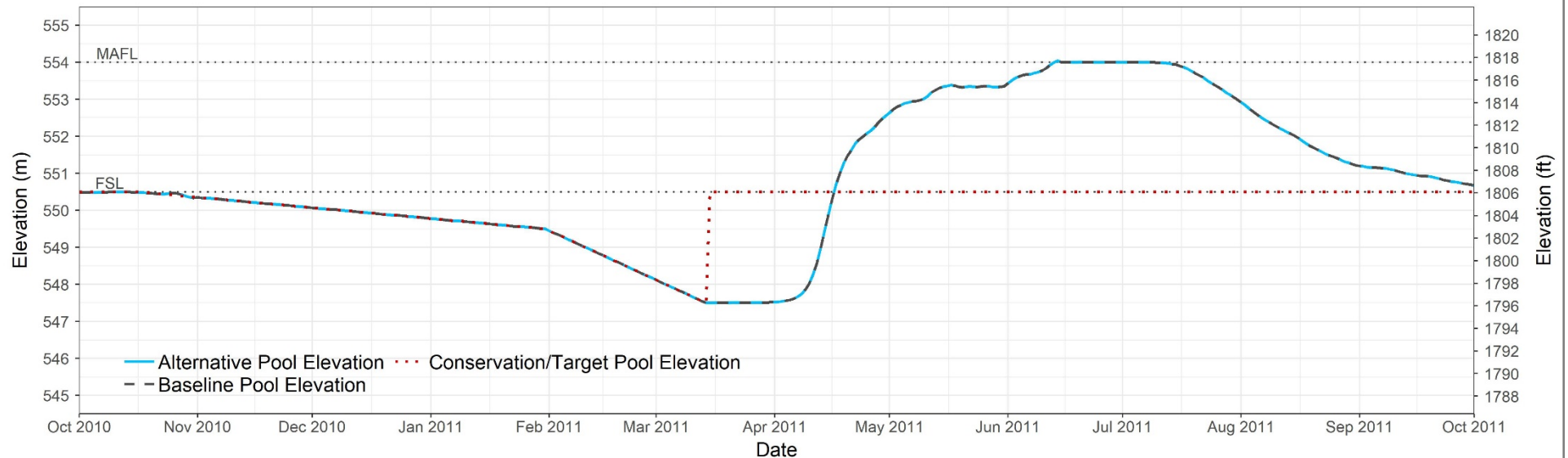
Souris River at Bantry, ND



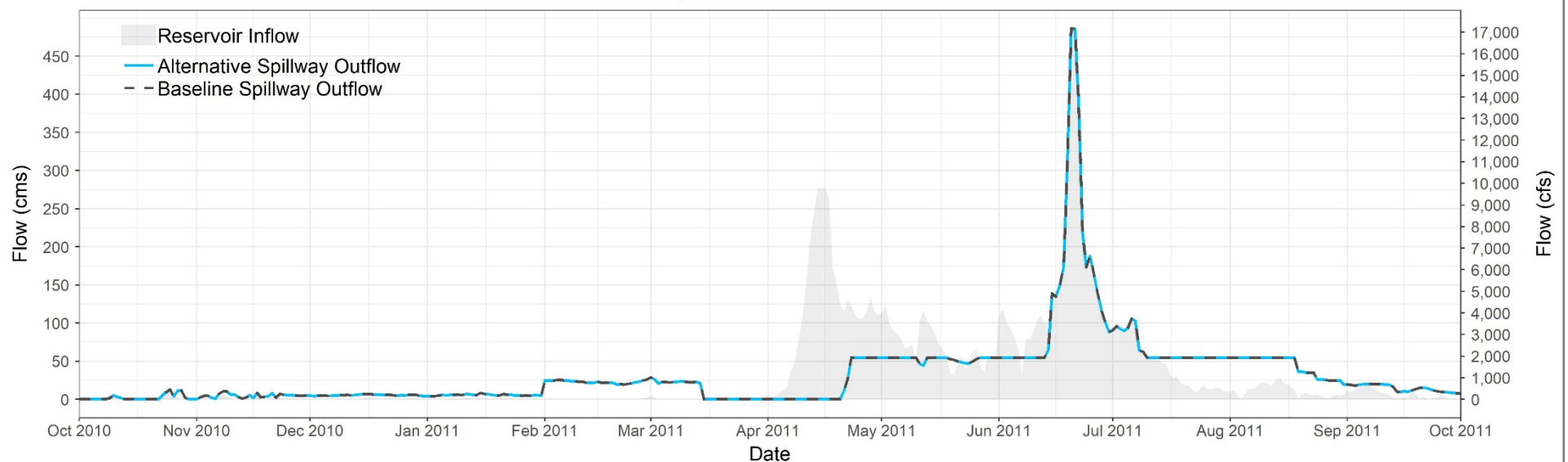
Souris River at Westhope, ND



Rafferty Reservoir - Elevation

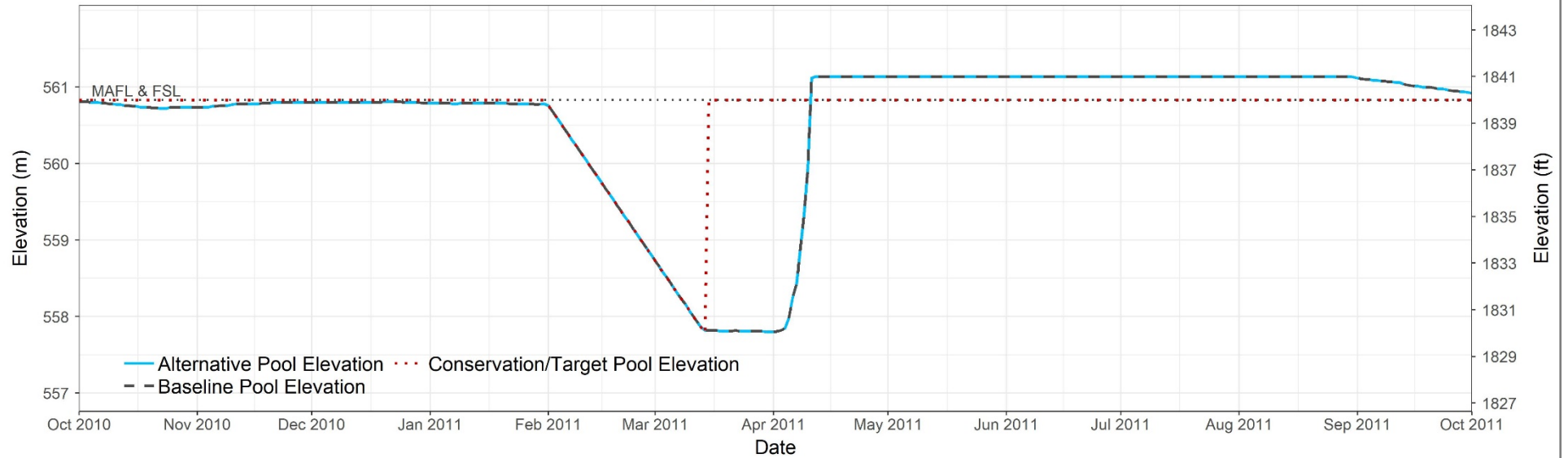


Rafferty Reservoir - Releases

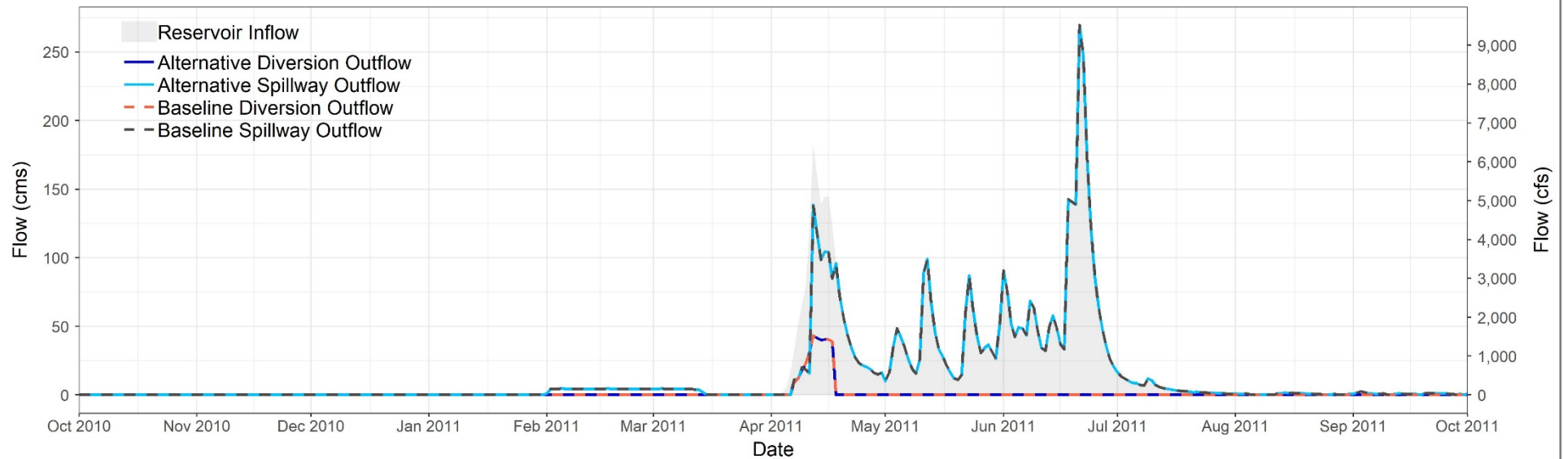


*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level

Boundary Reservoir - Elevation

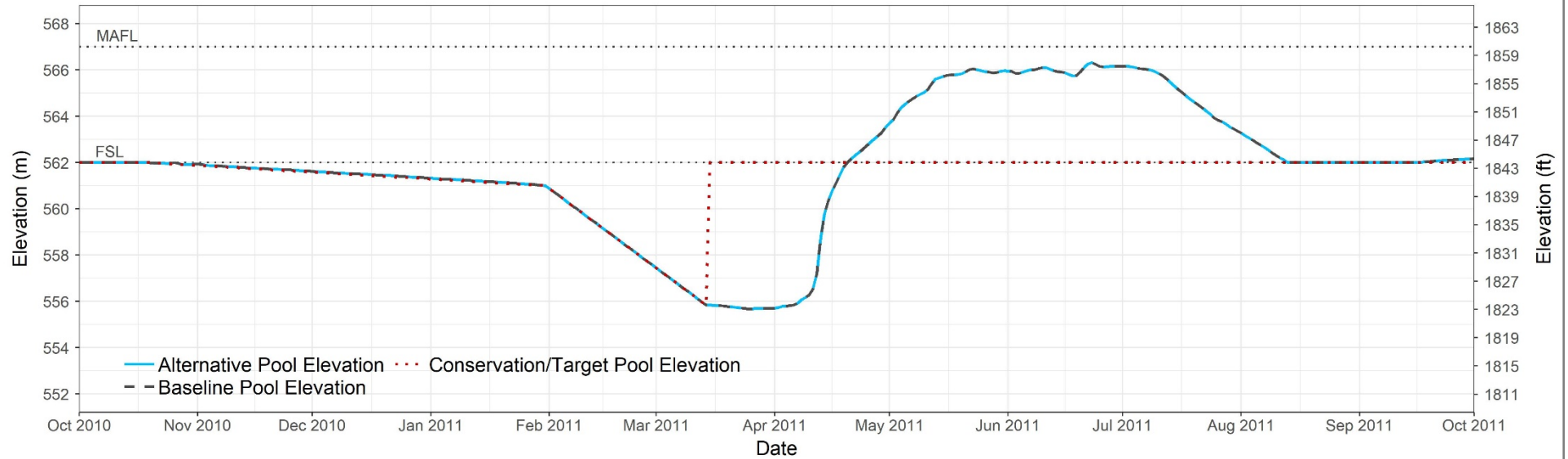


Boundary Reservoir - Releases

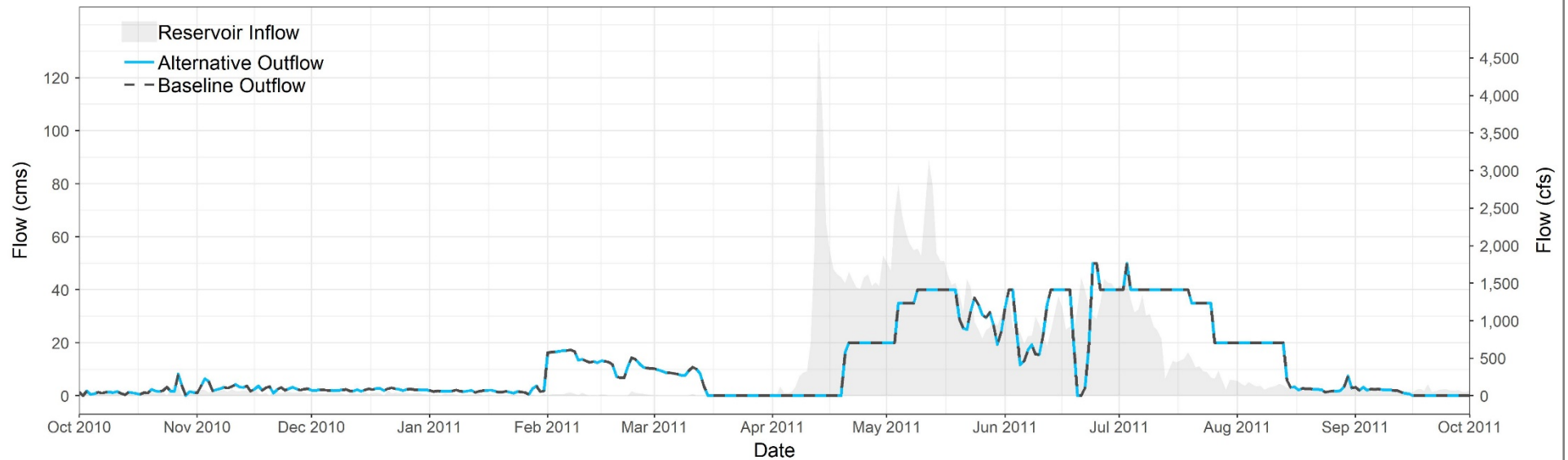


*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level

Grant Devine Reservoir - Elevation

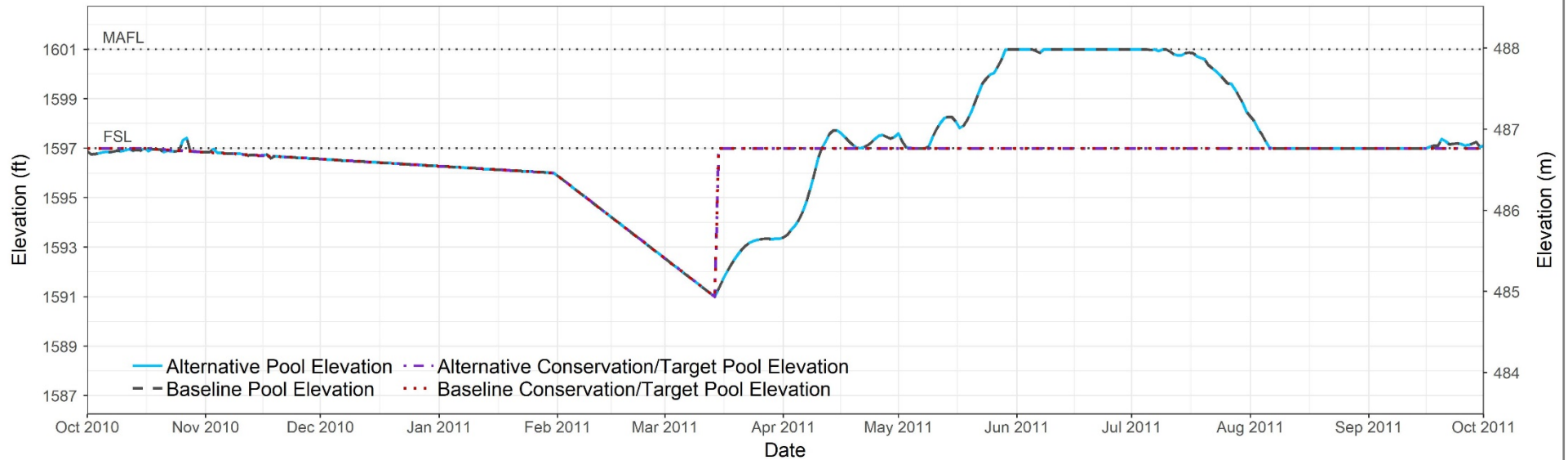


Grant Devine Reservoir - Releases

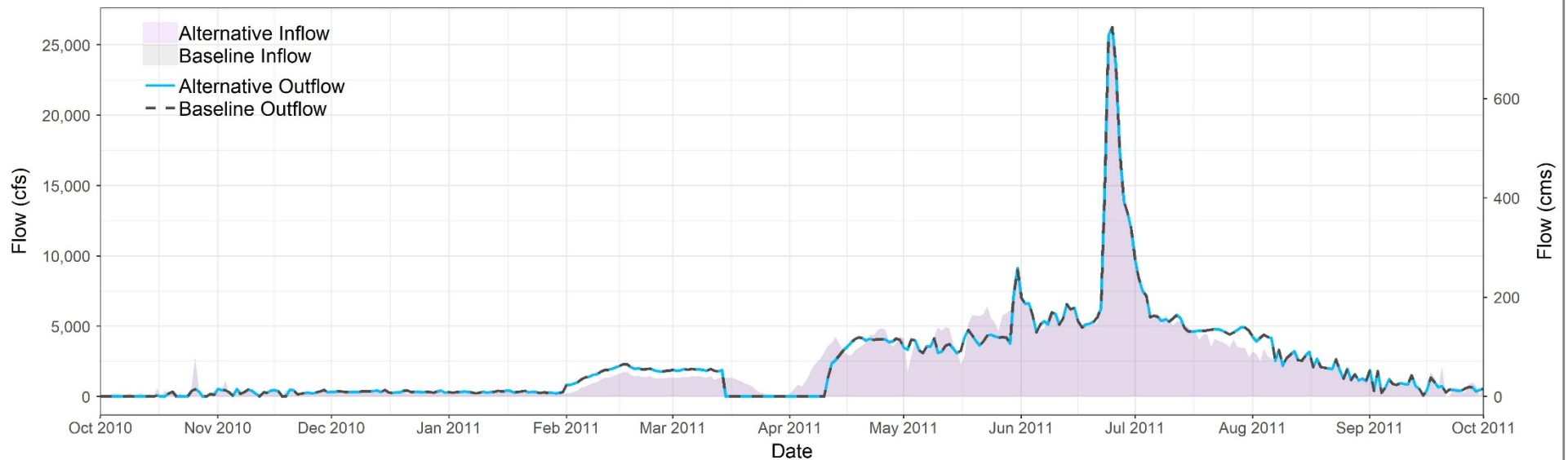


*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level

Lake Darling - Elevation



Lake Darling - Releases



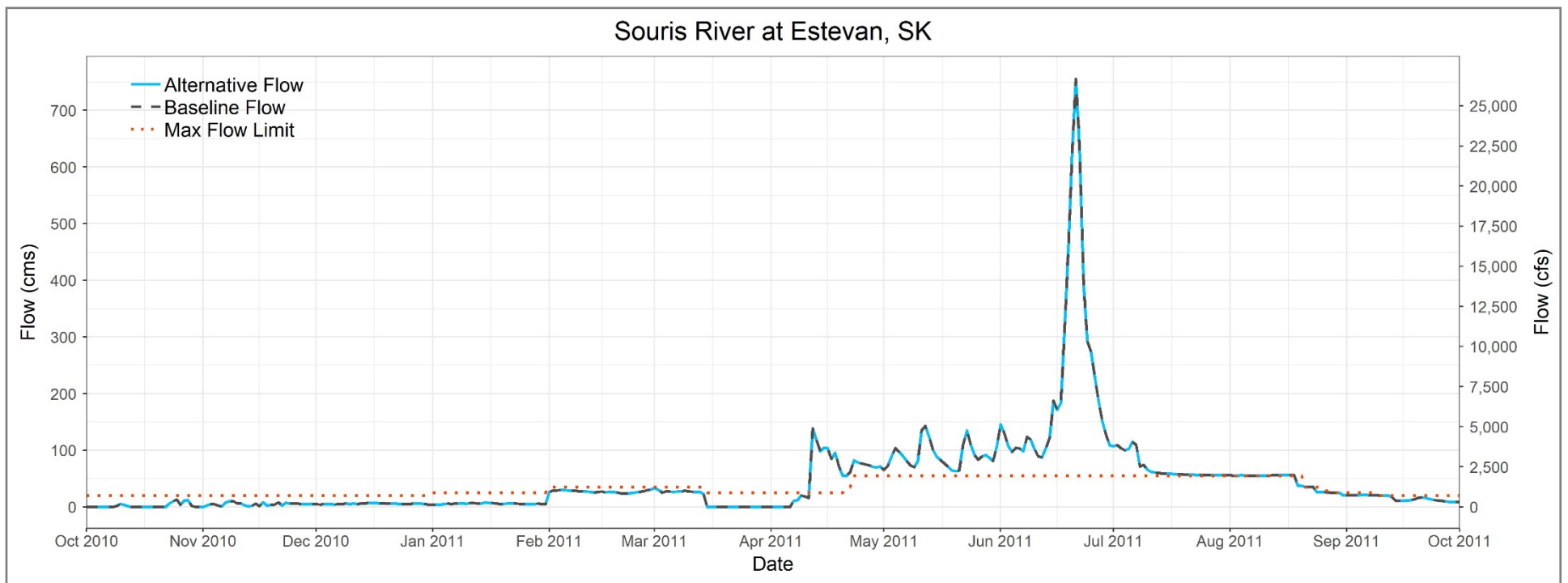
*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level, IDFSL = Inflow Design Flood Supply Level

Plate 42

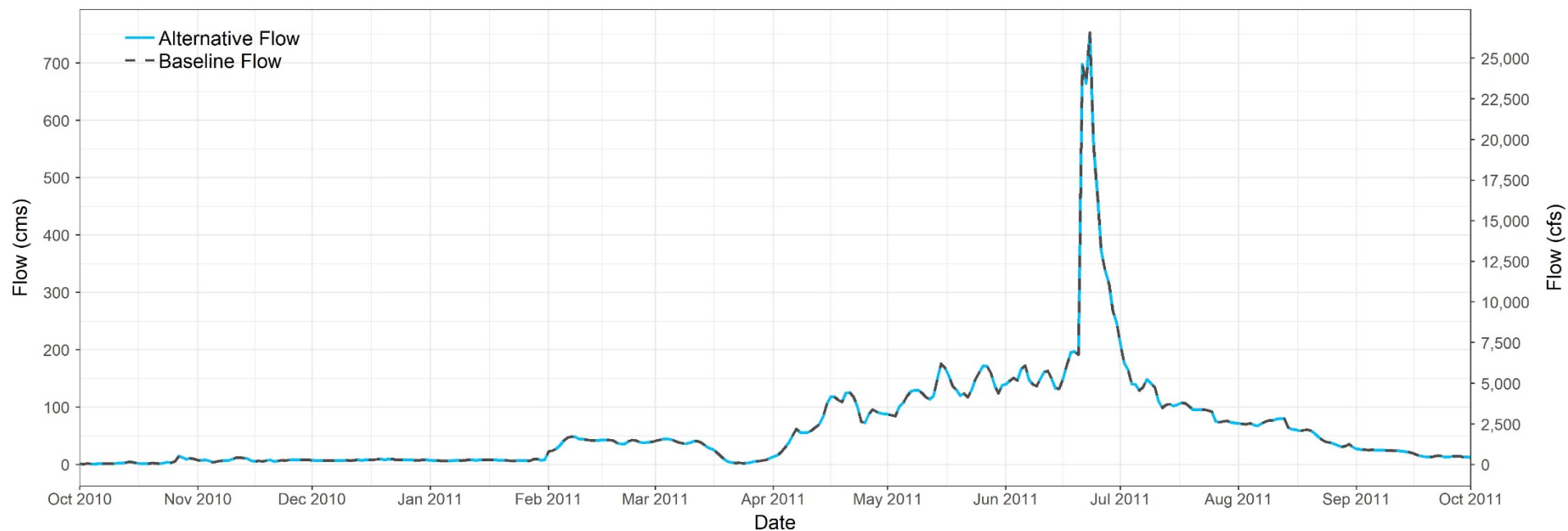
Critical Flow Locations – 2011

Alternative 10cL (Phase 2)

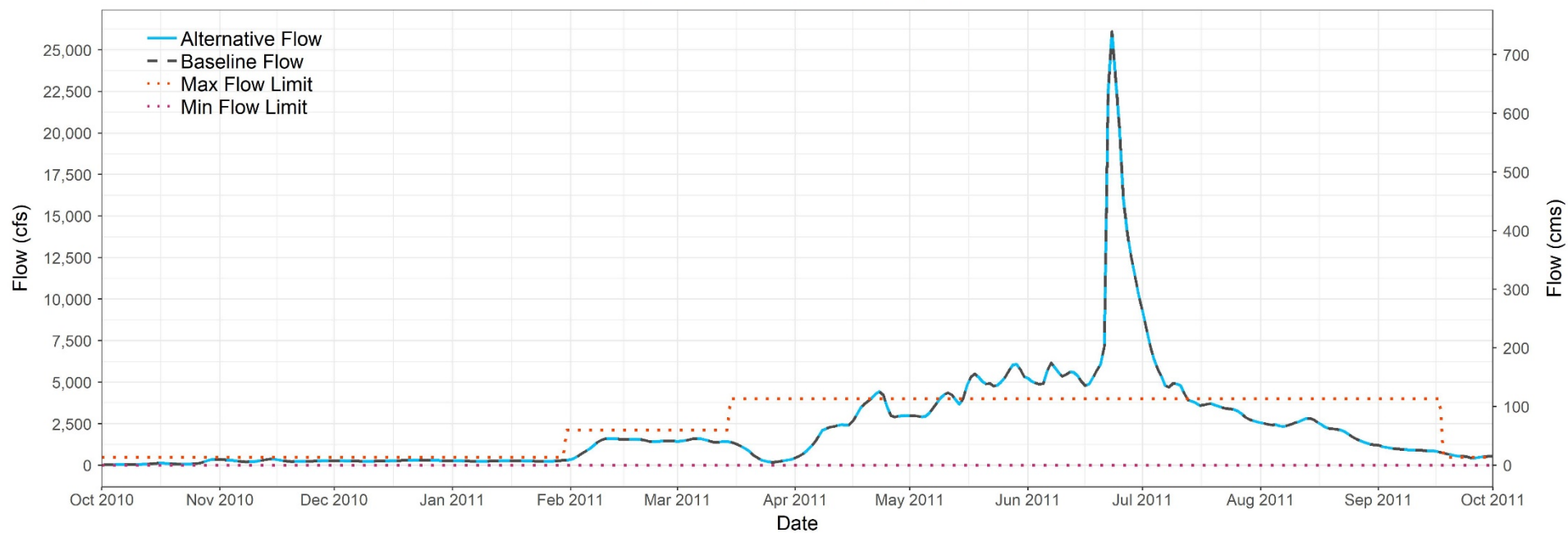
Souris River Plan of Study



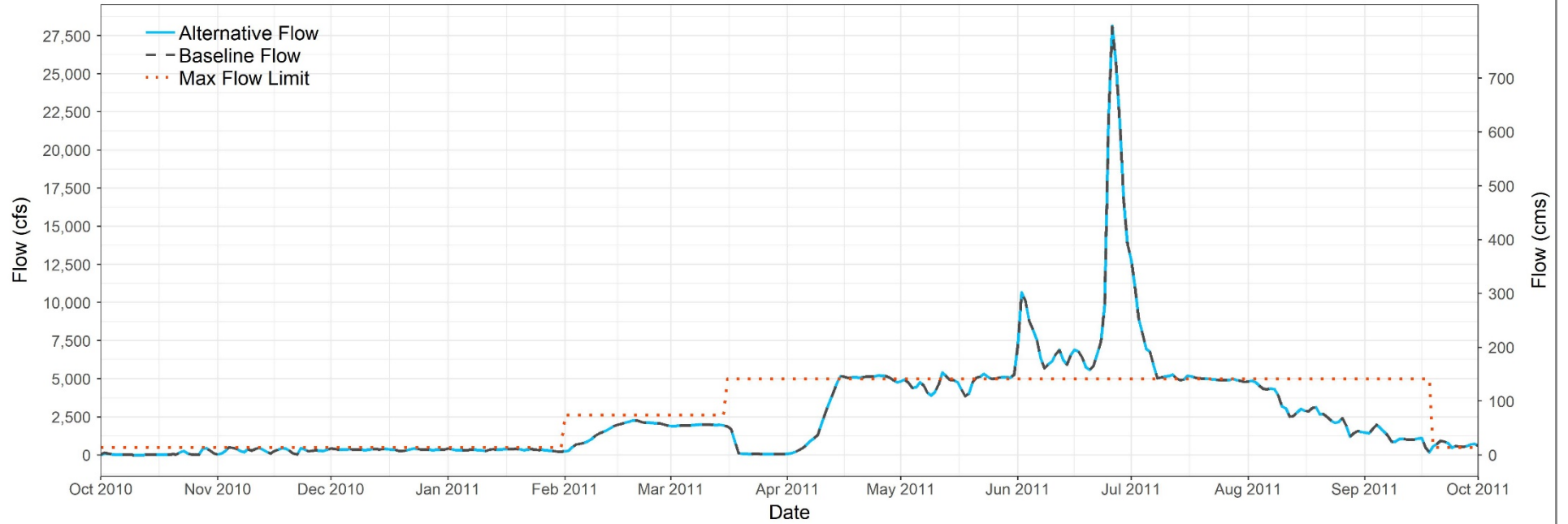
Souris River at Oxbow, SK



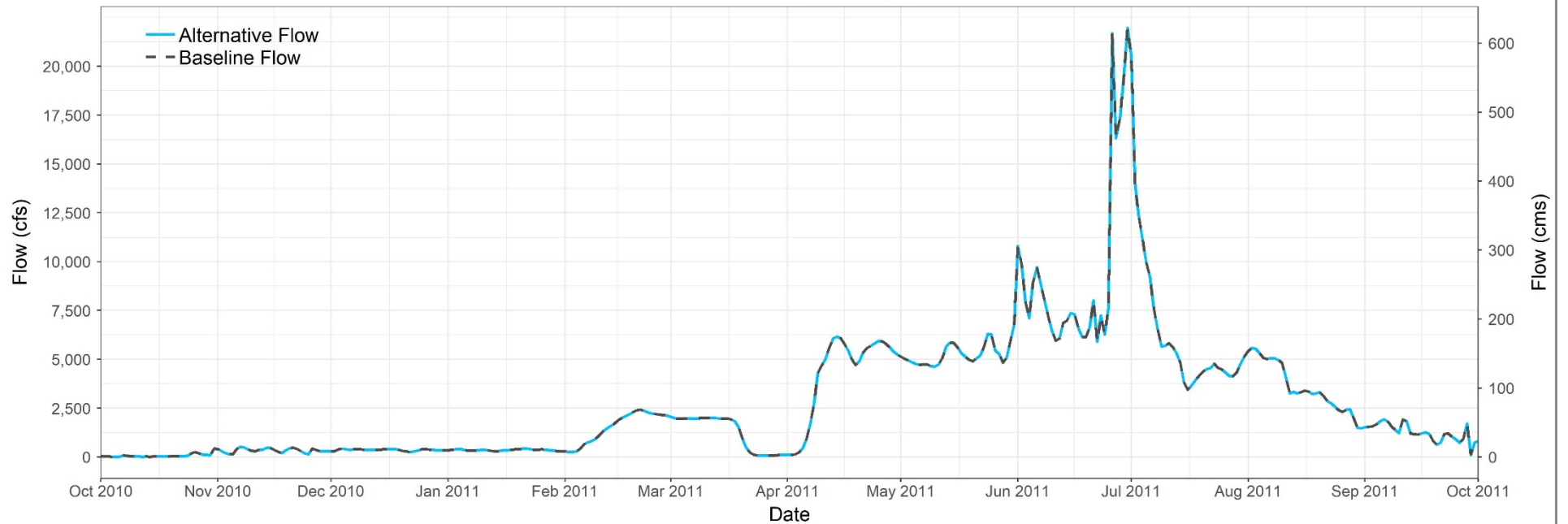
Souris River at Sherwood, ND



Souris River at Minot, ND - Flow



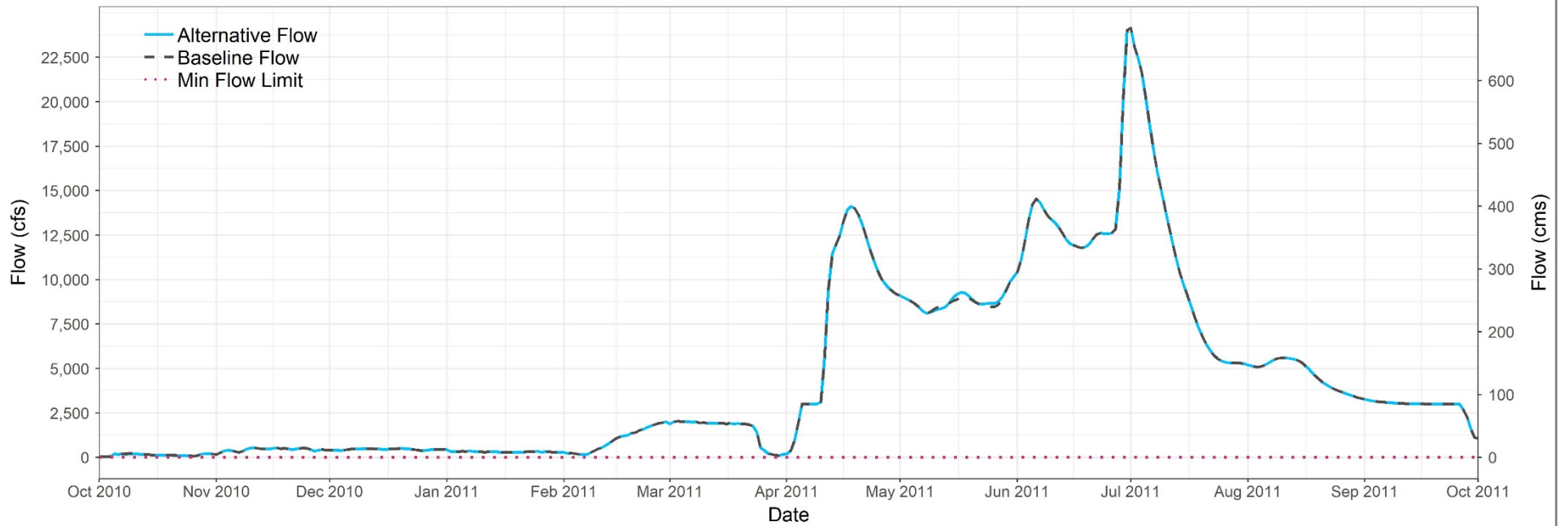
Souris River at Verendrye, ND



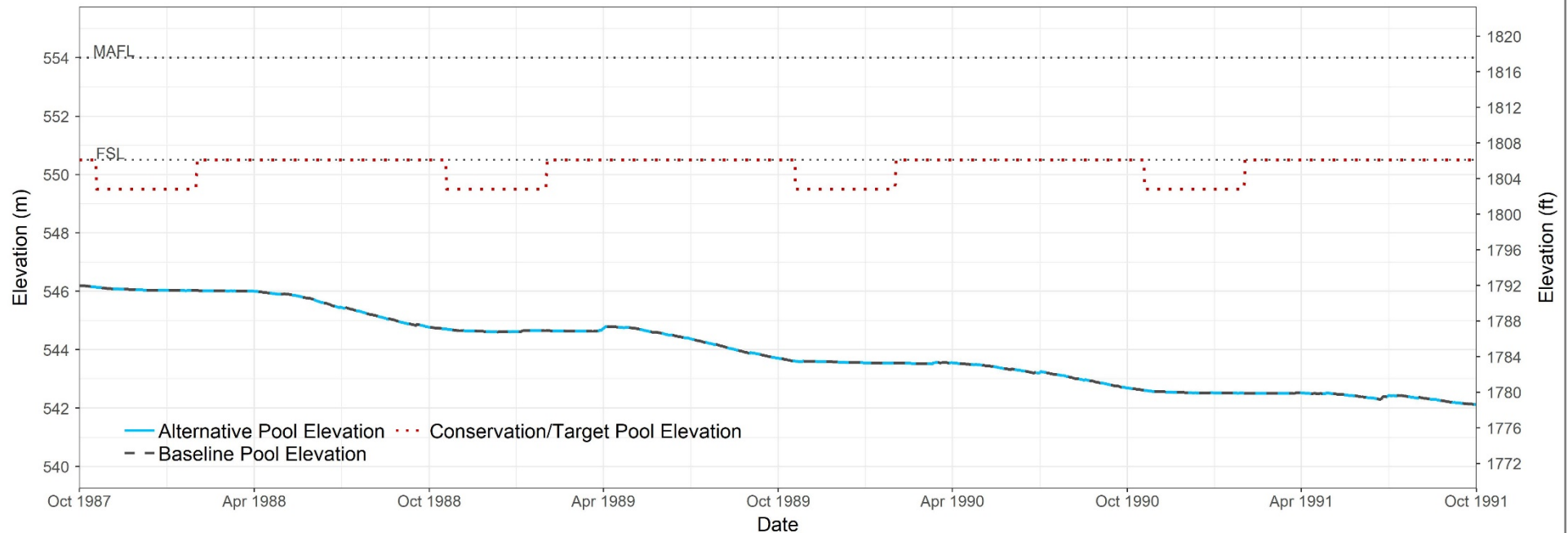
Souris River at Bantry, ND



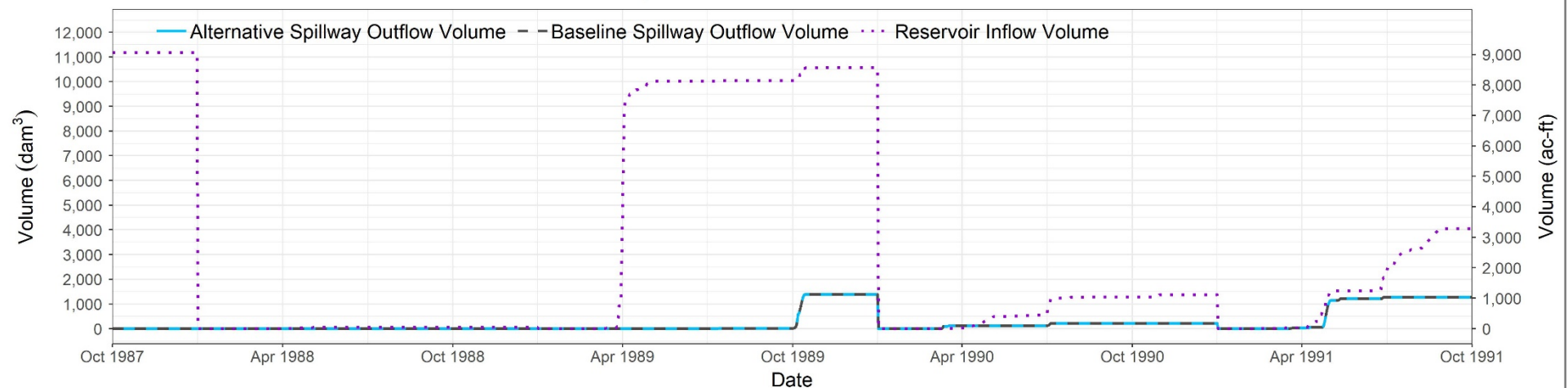
Souris River at Westhope, ND



Rafferty Reservoir - Elevation

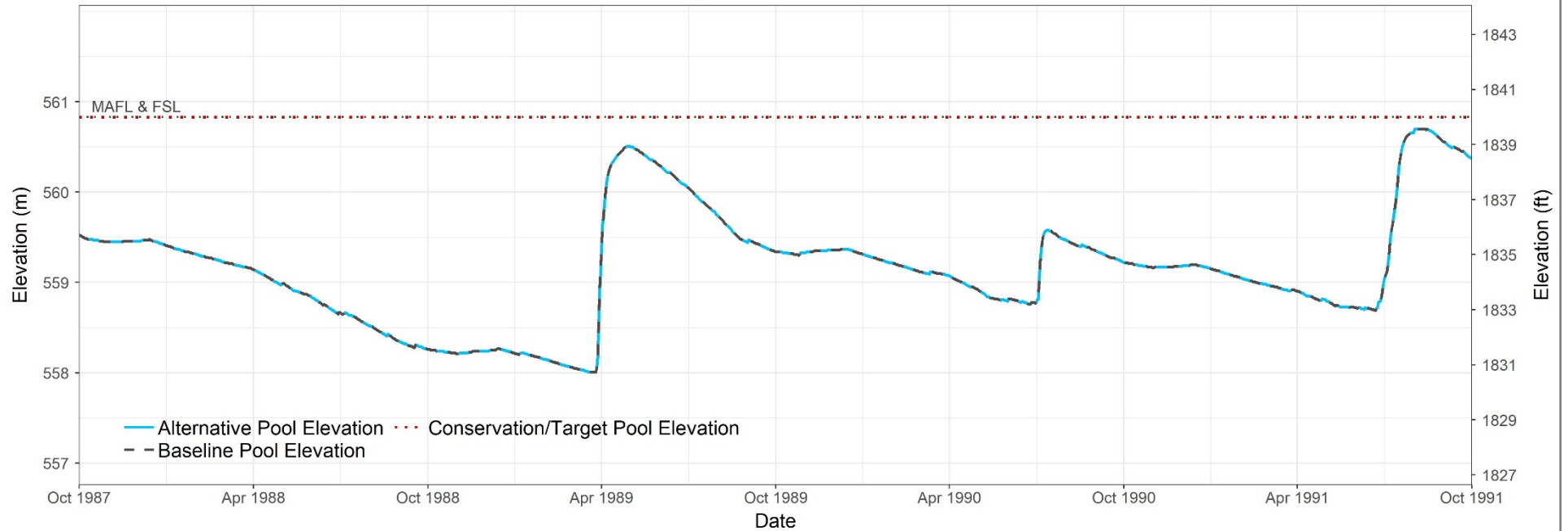


Rafferty Reservoir - Cumulative Volume

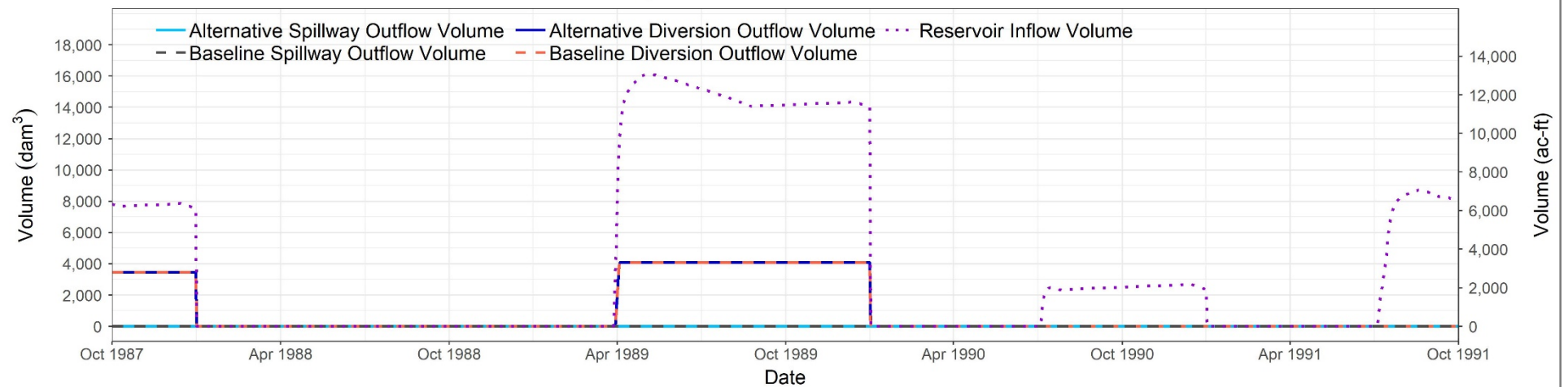


*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level

Boundary Reservoir - Elevation

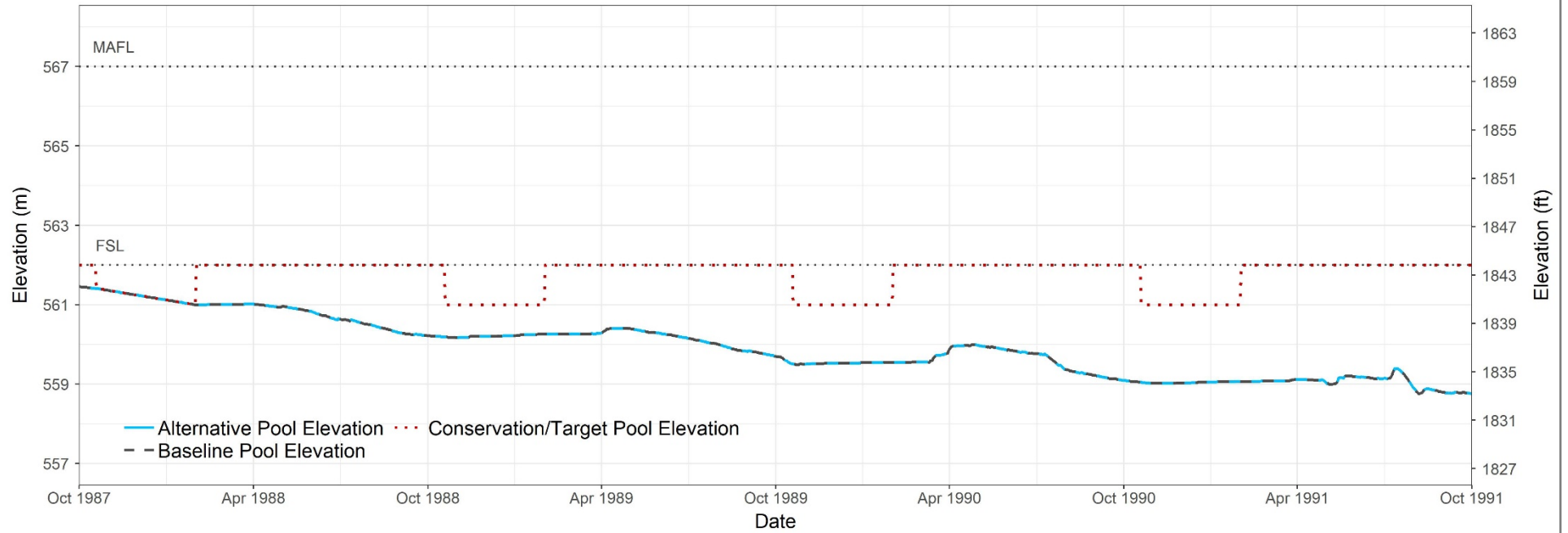


Boundary Reservoir - Cumulative Volume

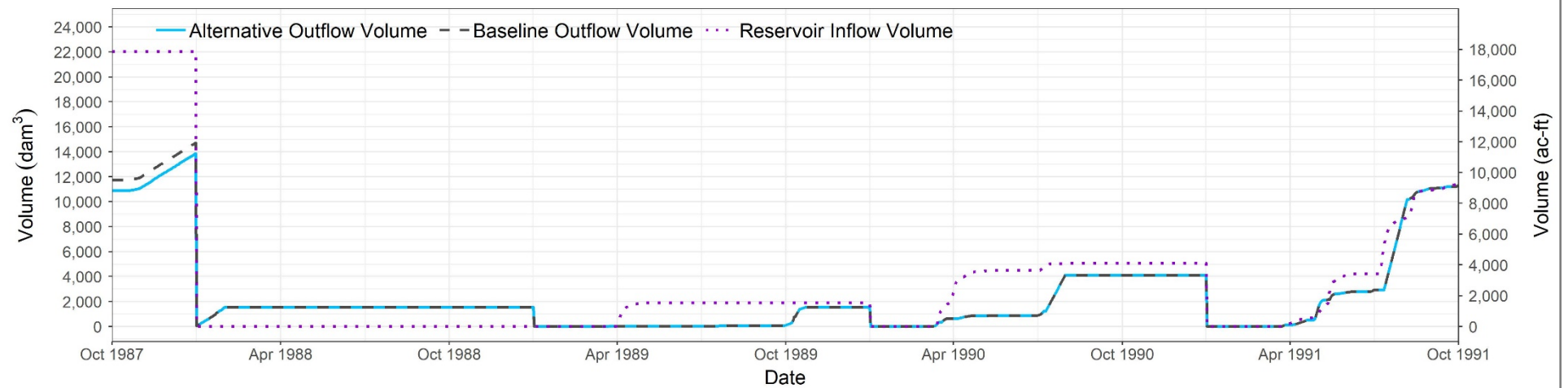


*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level

Grant Devine Reservoir - Elevation

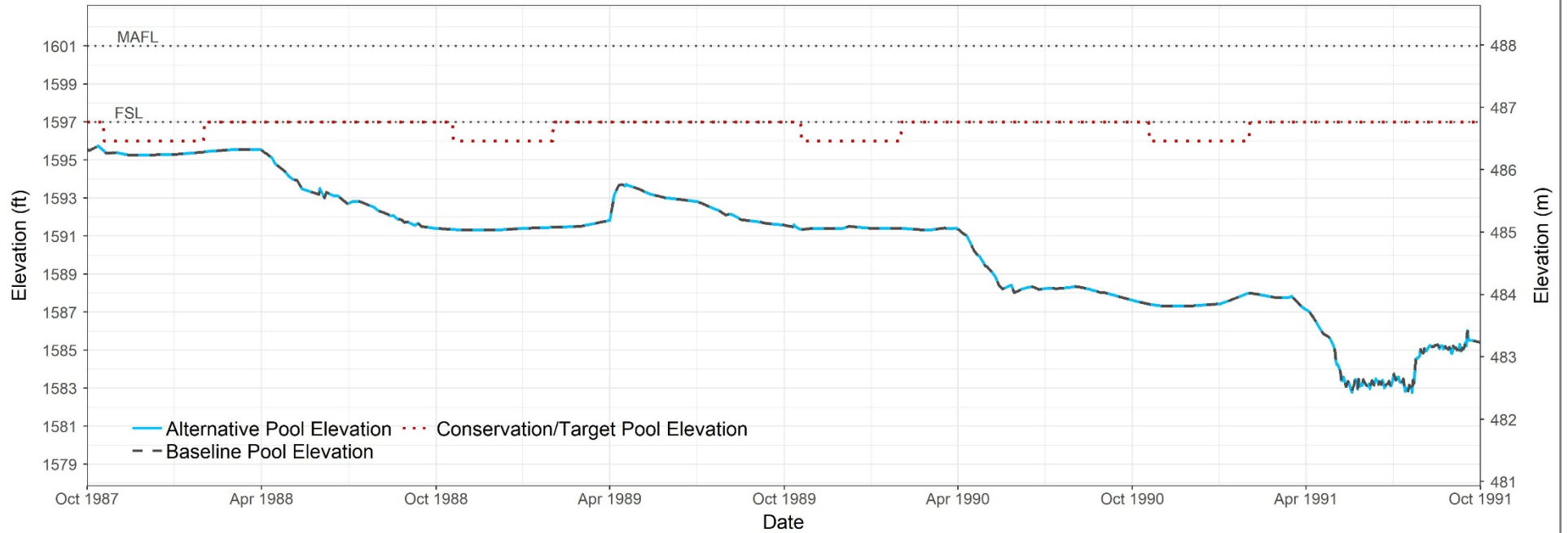


Grant Devine Reservoir - Cumulative Volume

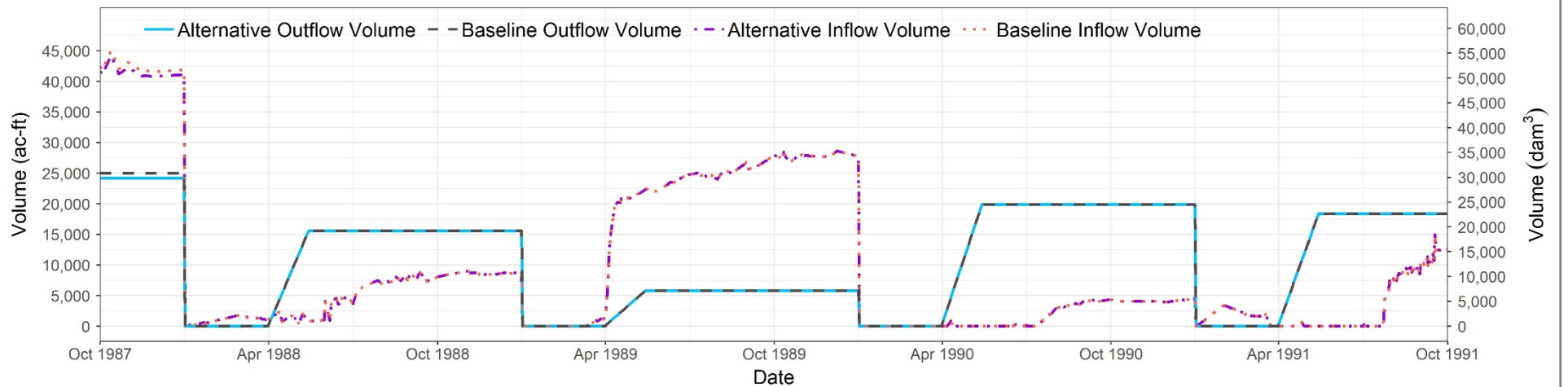


*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level

Lake Darling - Elevation



Lake Darling - Cumulative Volume



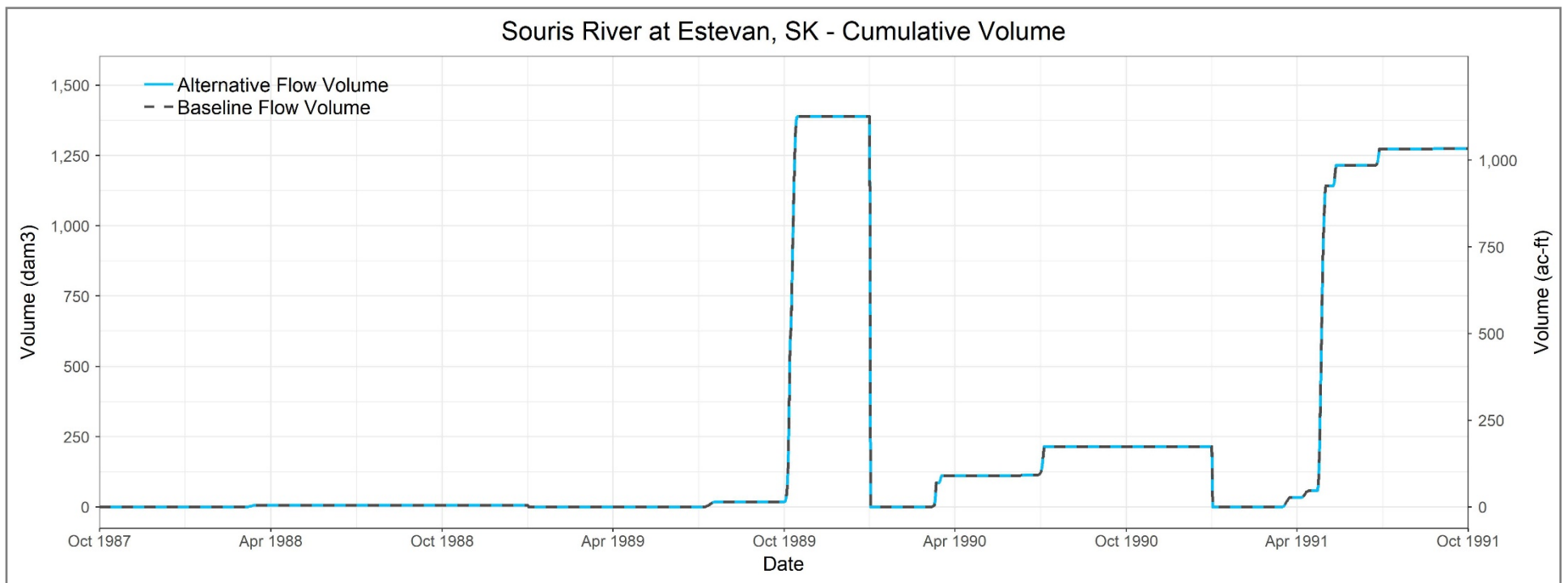
*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level, IDFSL = Inflow Design Flood Supply Level

Plate 44

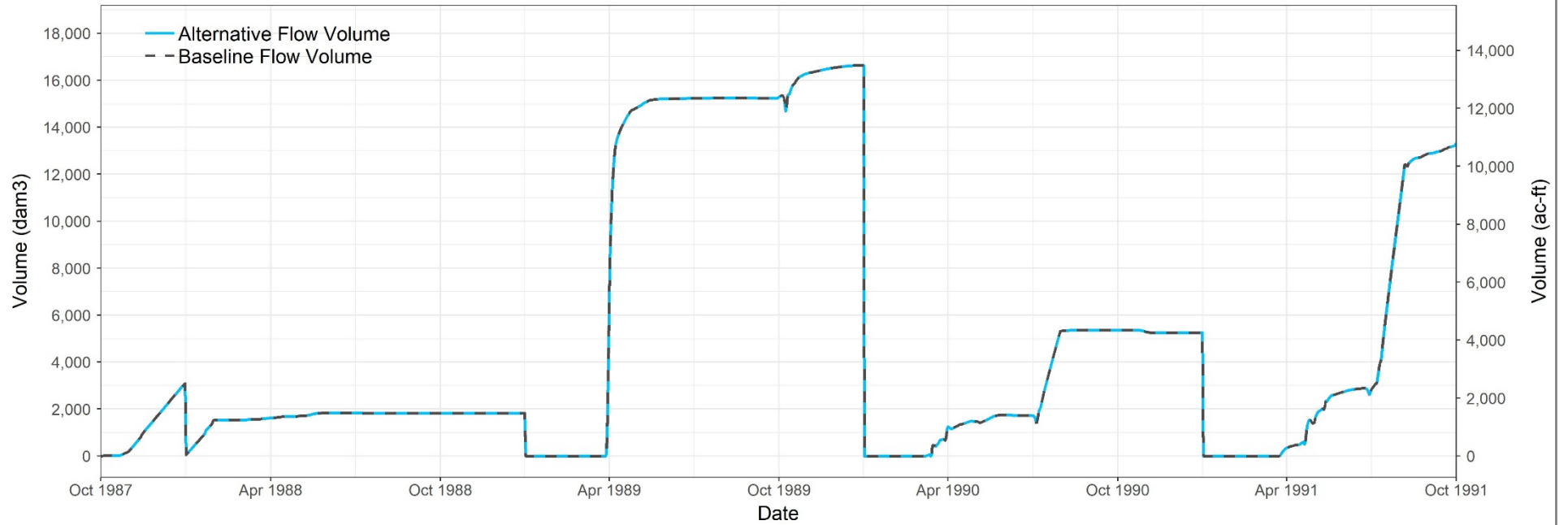
Critical Flow Locations – 1988-1991

Alternative 10cL (Phase 2)

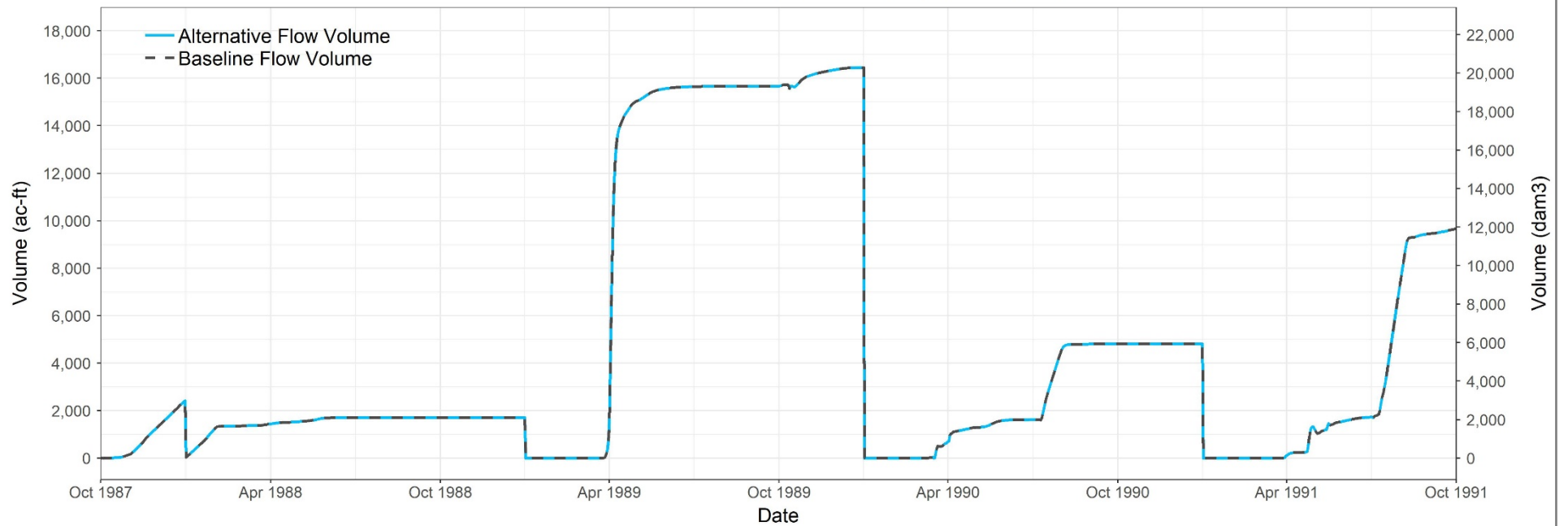
Souris River Plan of Study



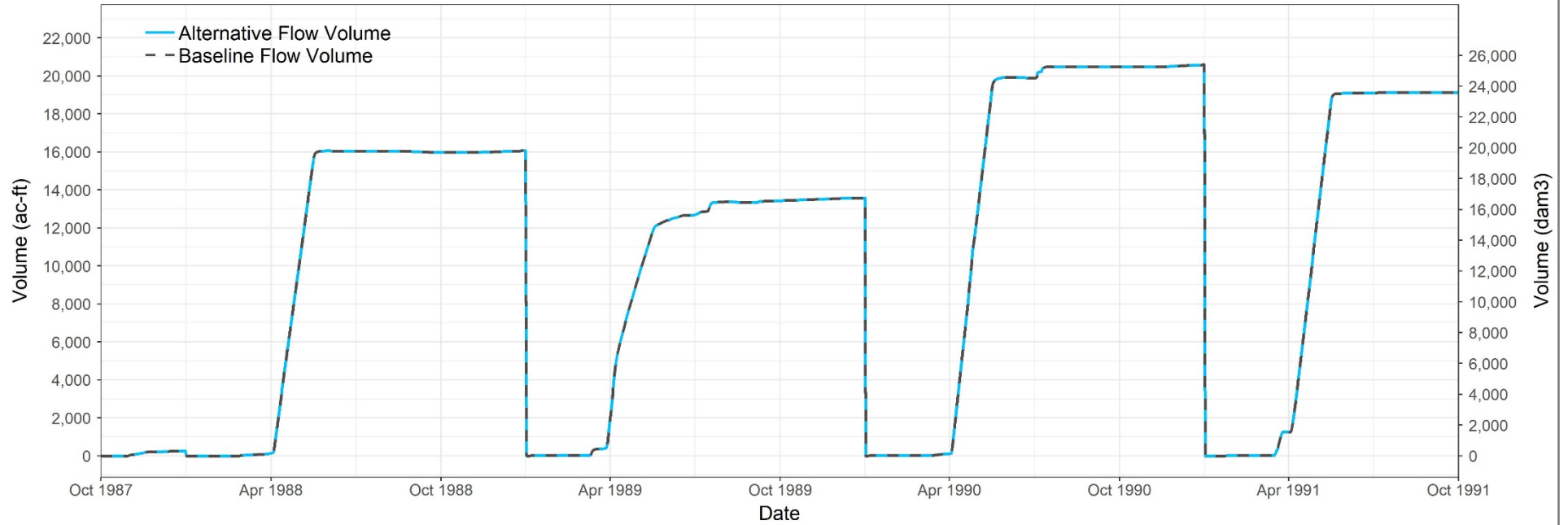
Souris River at Oxbow, SK - Cumulative Volume



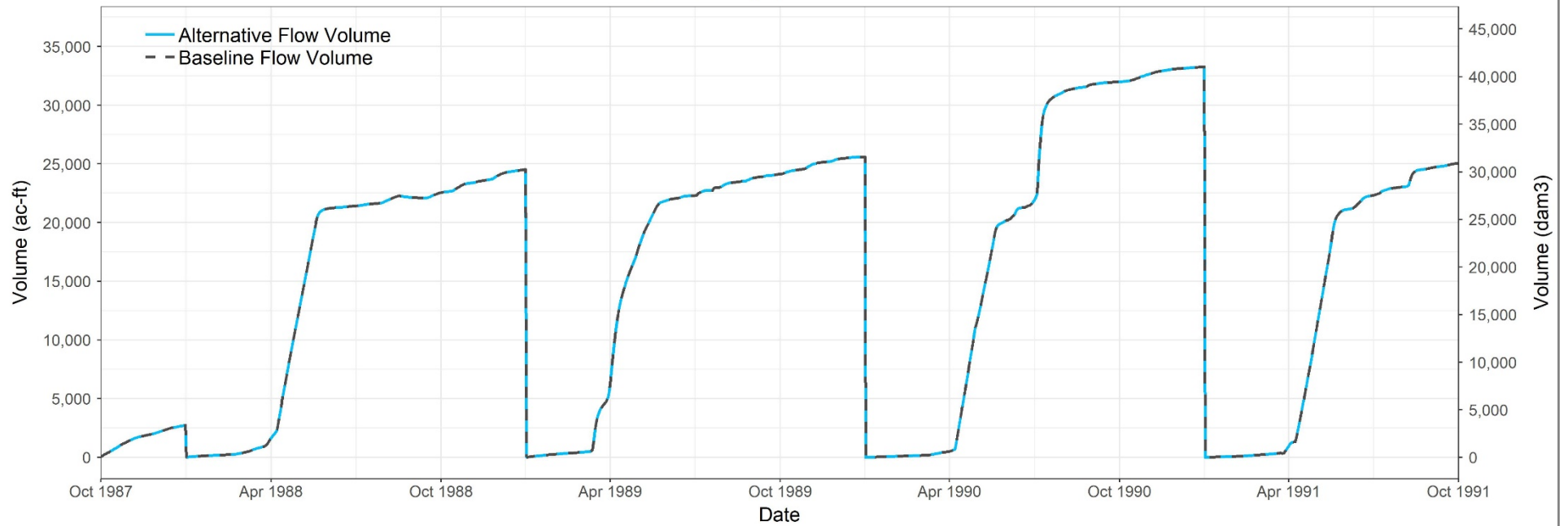
Souris River at Sherwood, ND - Cumulative Volume



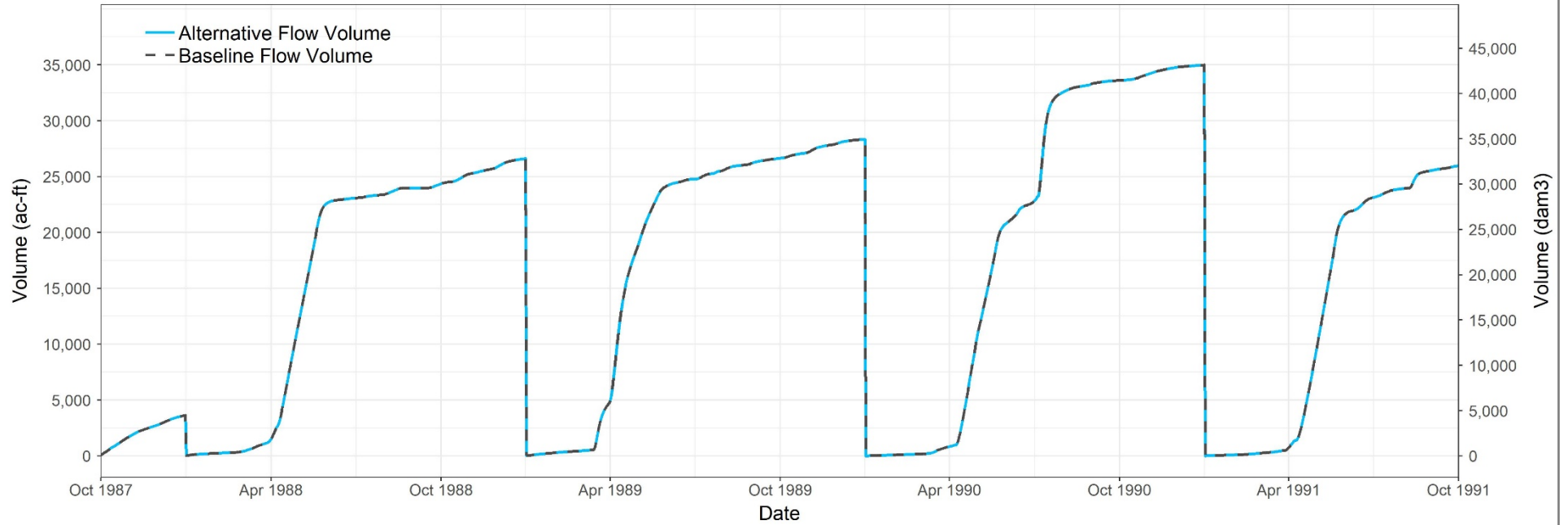
Souris River at Minot, ND - Cumulative Volume



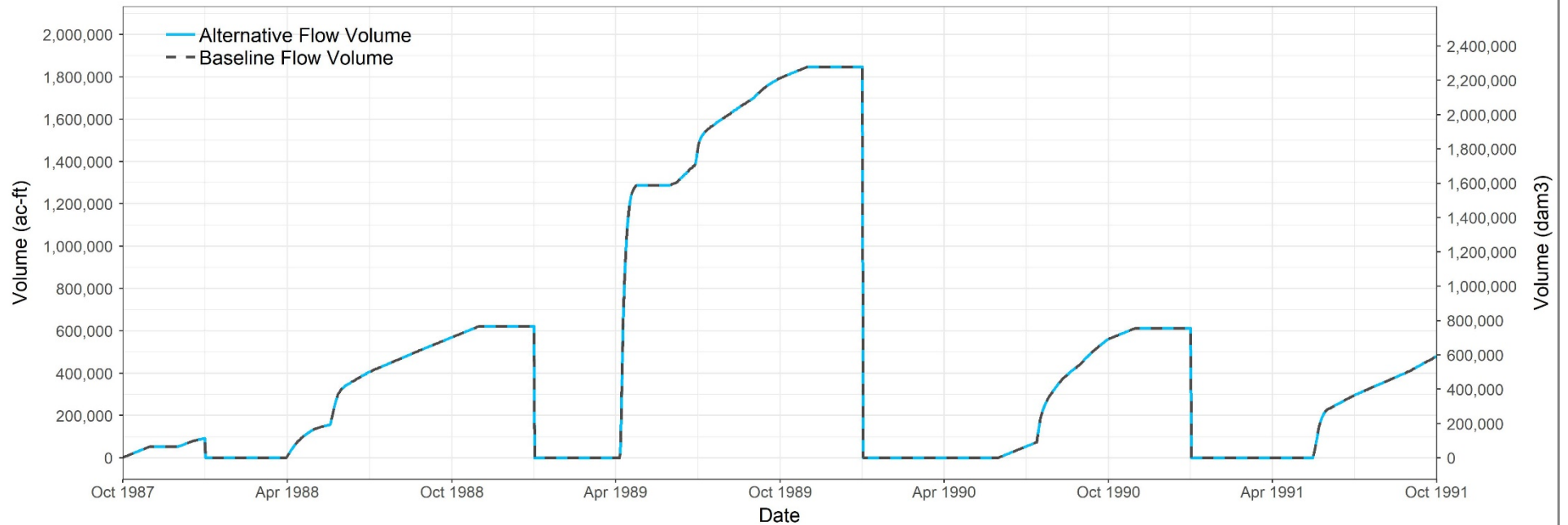
Souris River at Verendrye, ND - Cumulative Volume

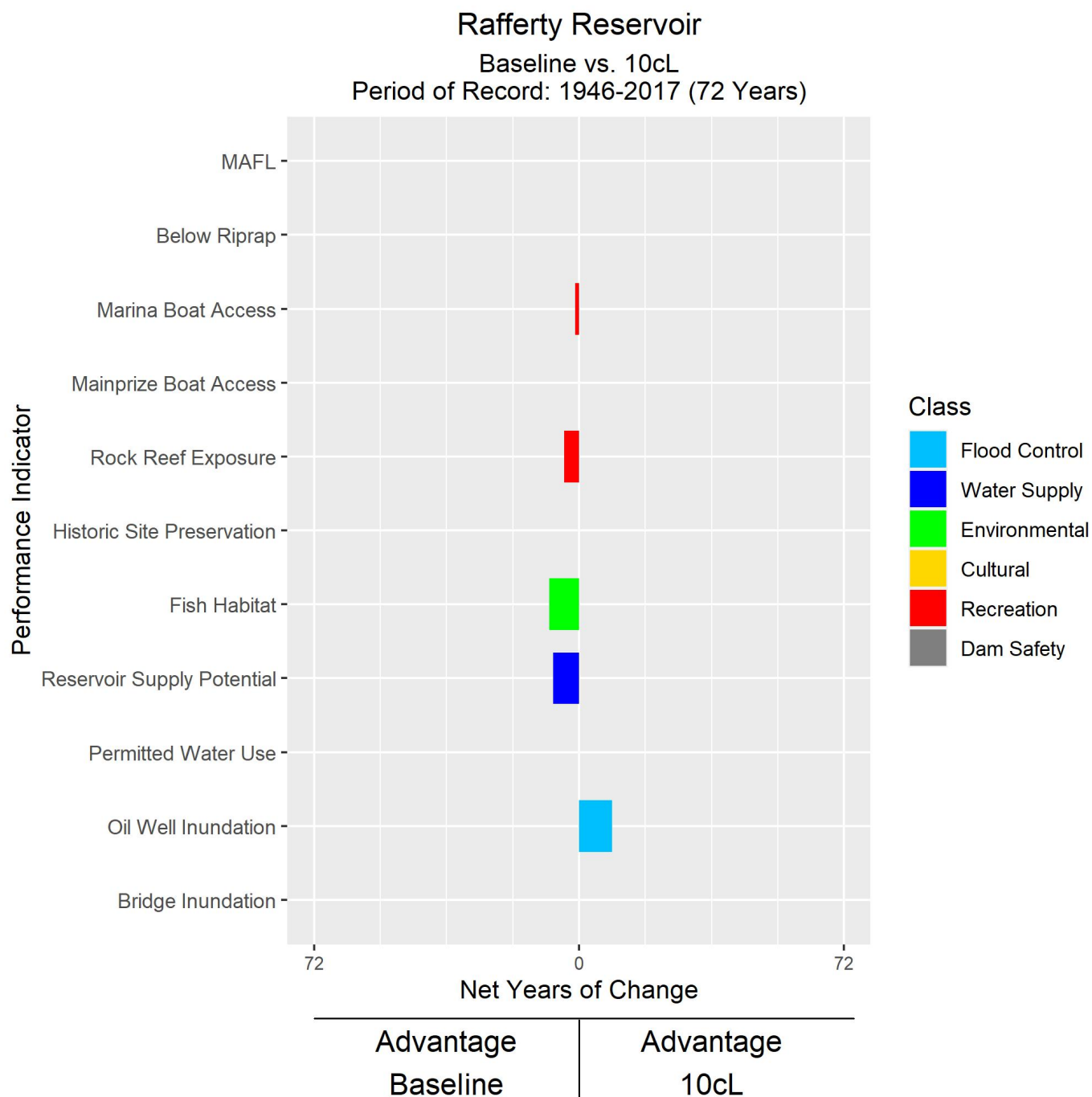


Souris River at Bantry, ND - Cumulative Volume

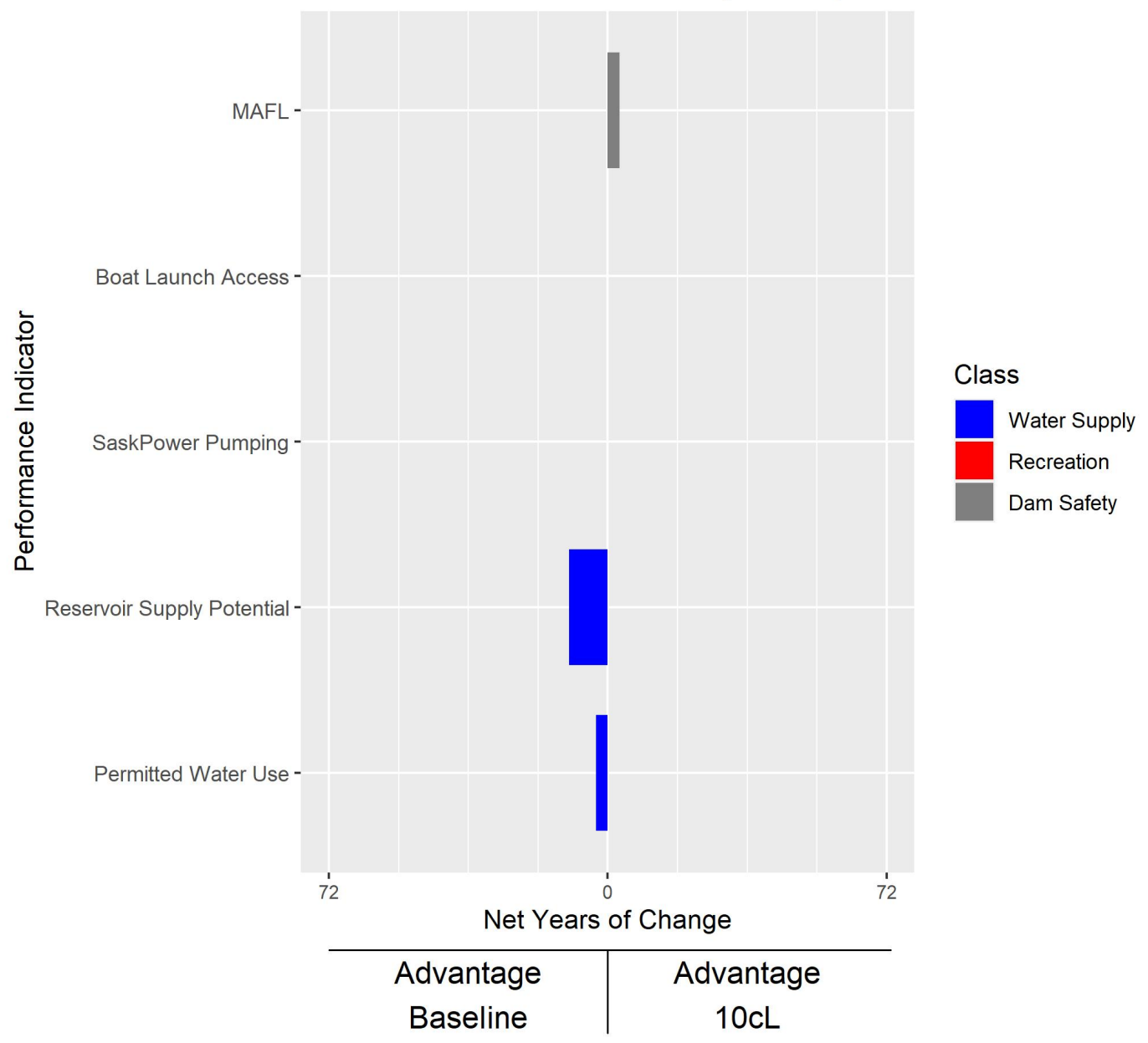


Souris River at Westhope, ND - Cumulative Volume

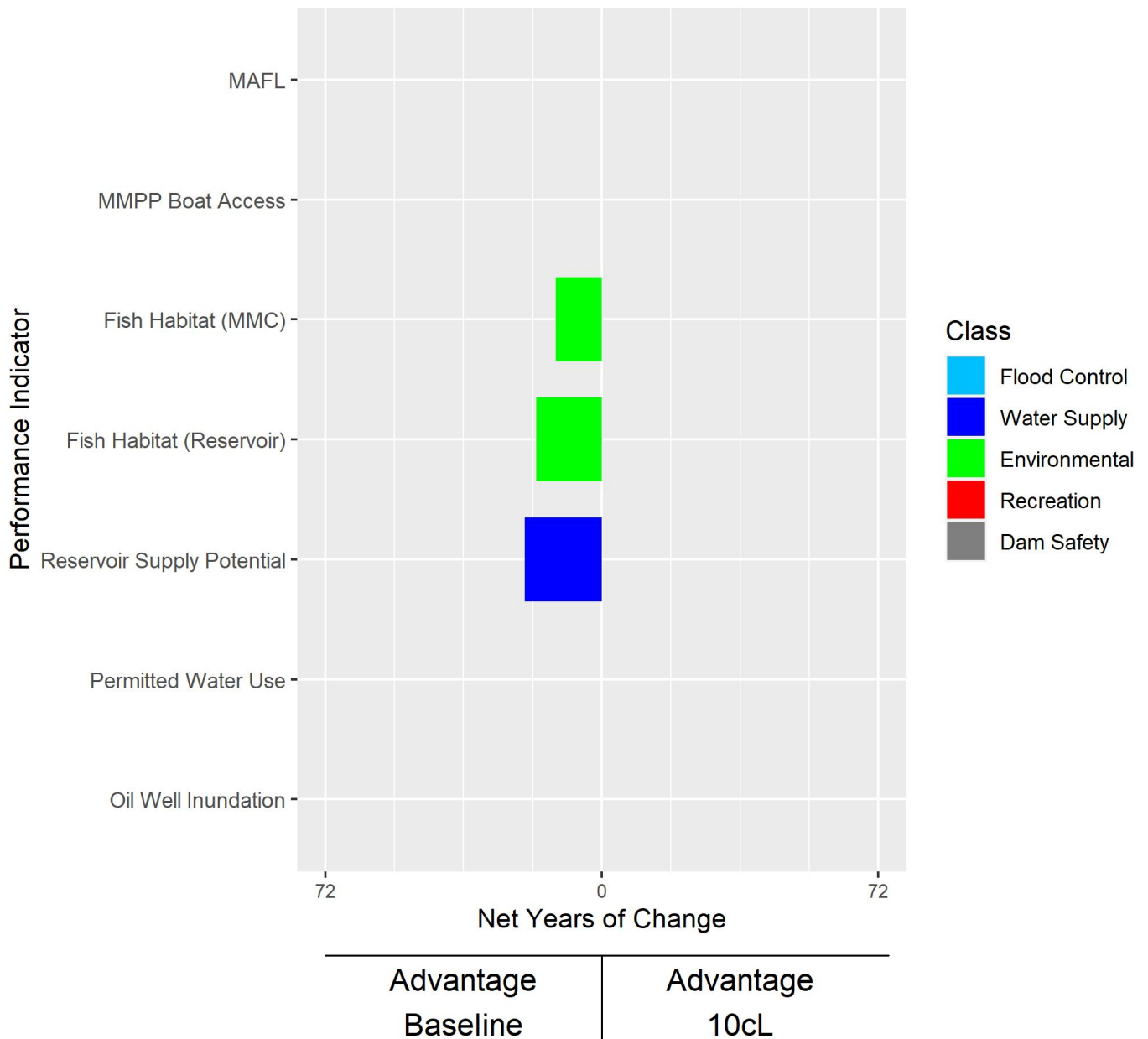




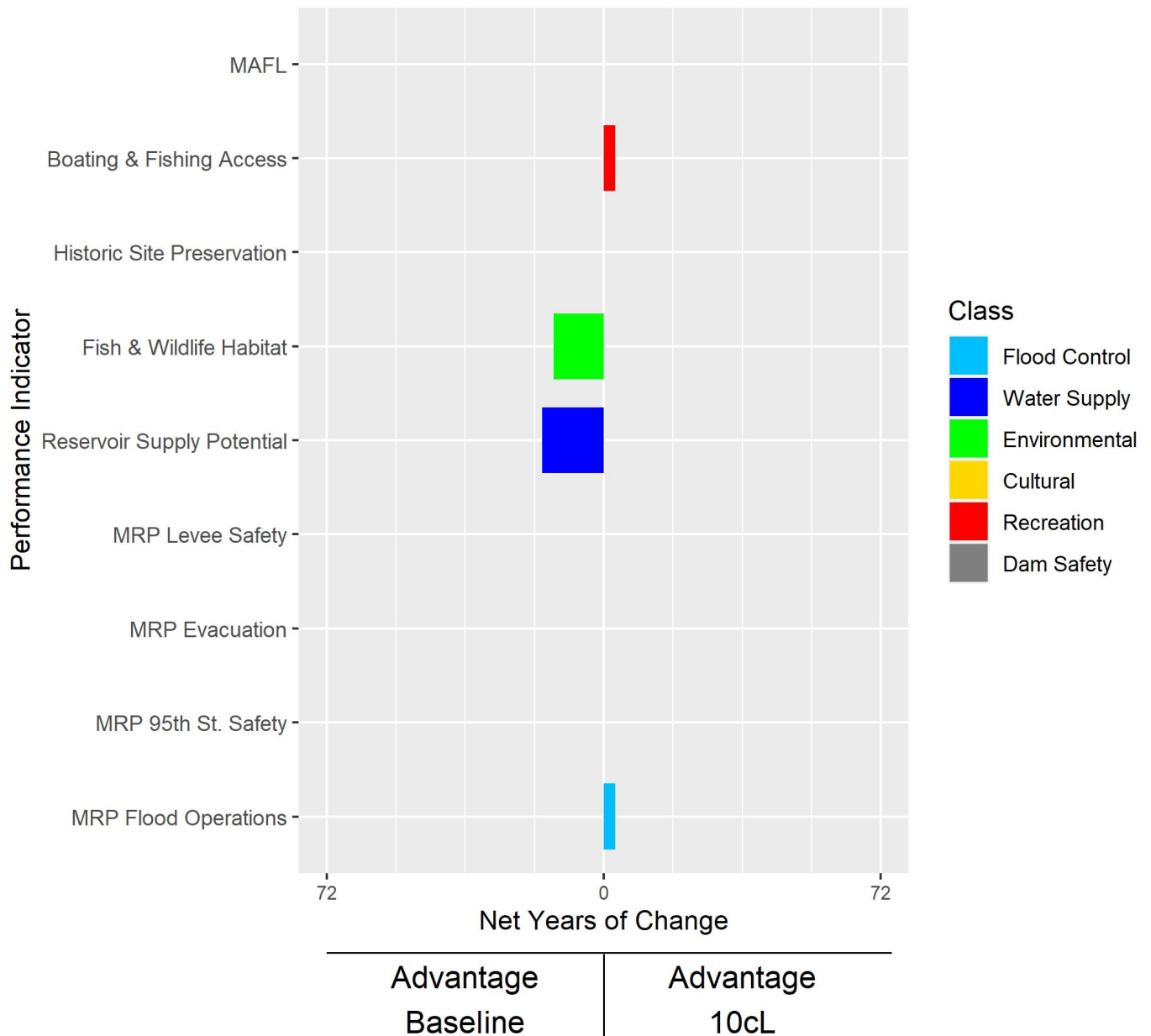
Boundary Reservoir
Baseline vs. 10cL
Period of Record: 1946-2017 (72 Years)



Grant Devine Reservoir
Baseline vs. 10cL
Period of Record: 1946-2017 (72 Years)

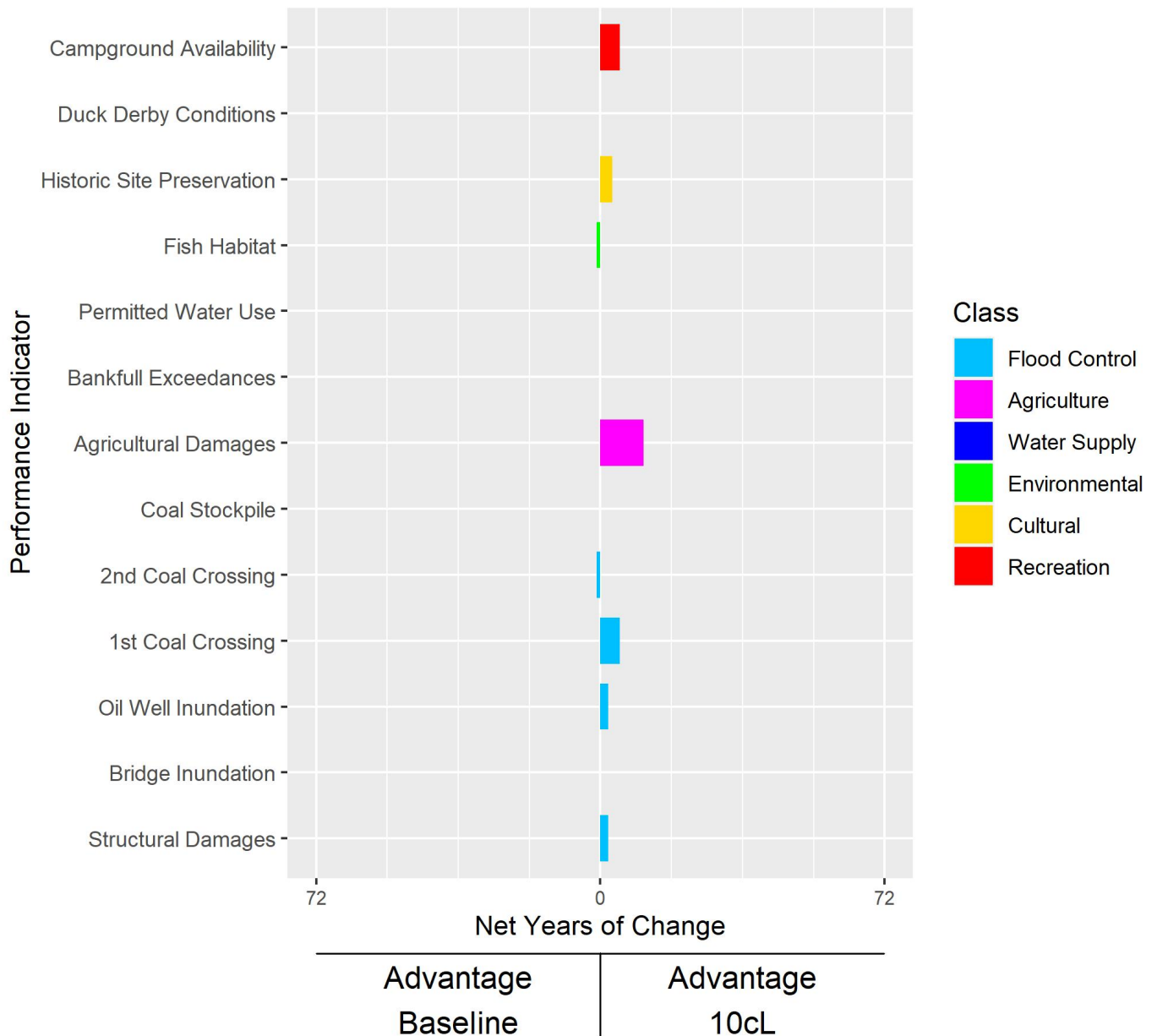


Lake Darling
Baseline vs. 10cL
Period of Record: 1946-2017 (72 Years)



Saskatchewan - All Riverine Reaches

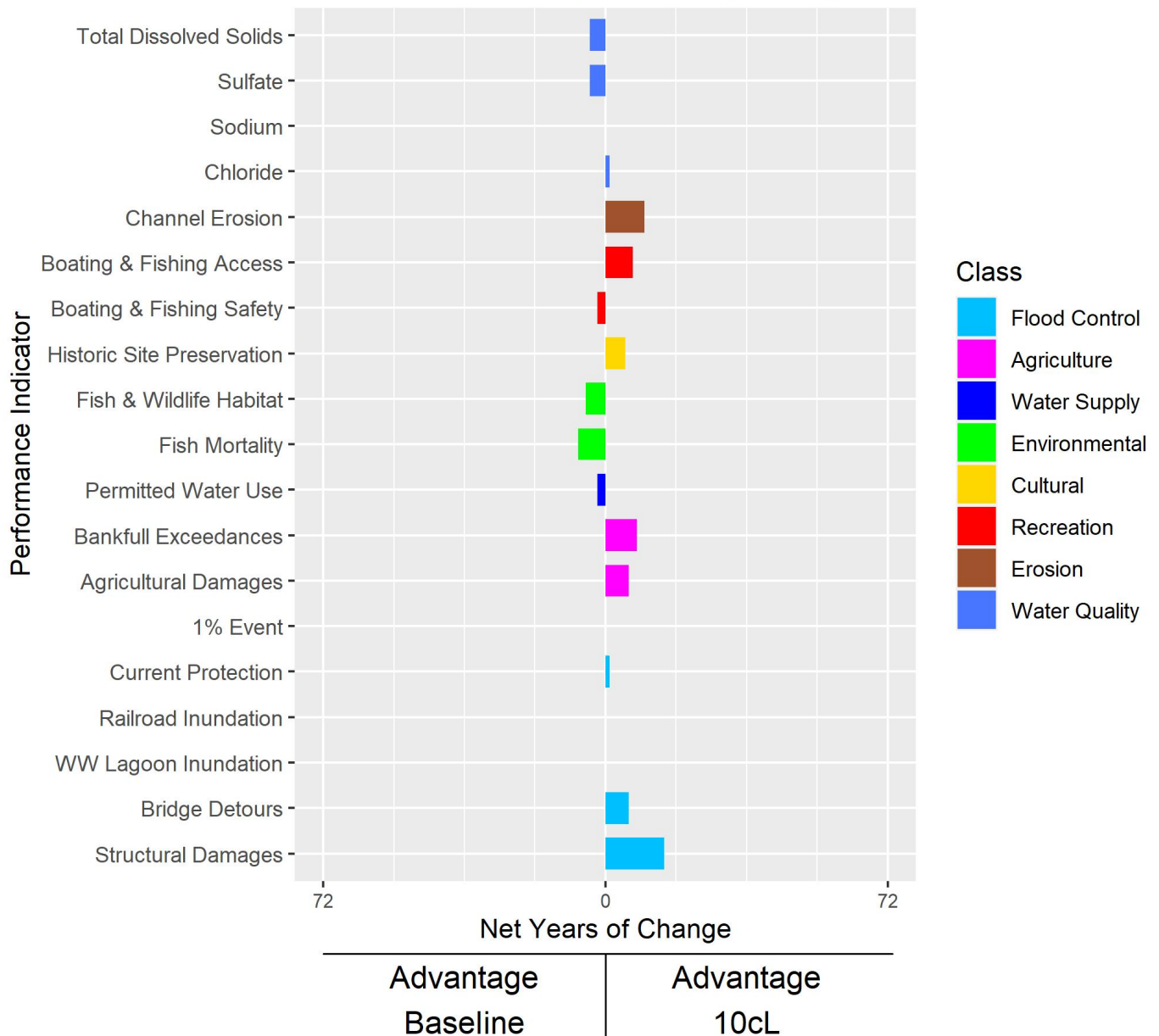
Baseline vs. 10cL
Period of Record: 1946-2017 (72 Years)



North Dakota - All Riverine Reaches

Baseline vs. 10cL

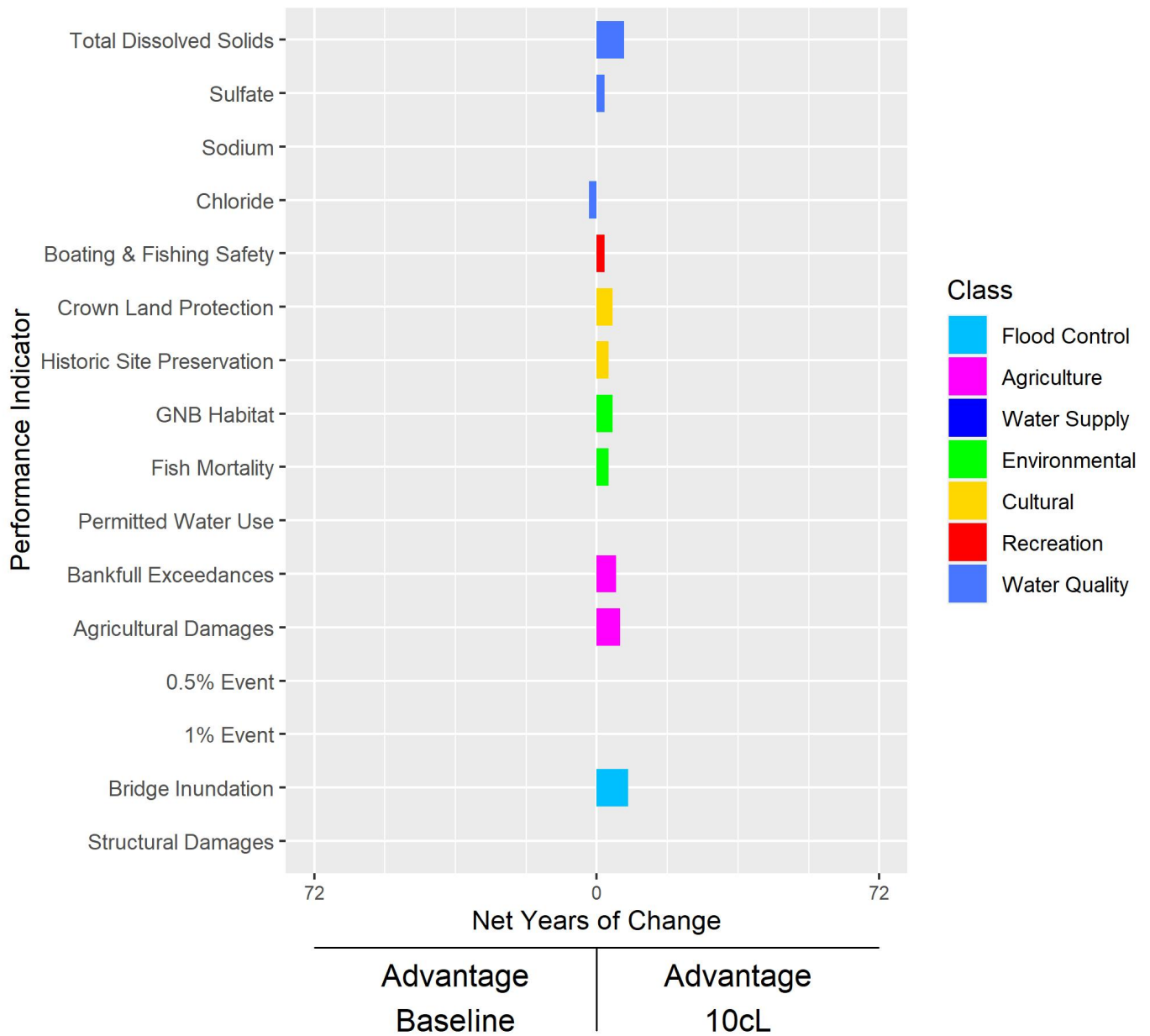
Period of Record: 1946-2017 (72 Years)



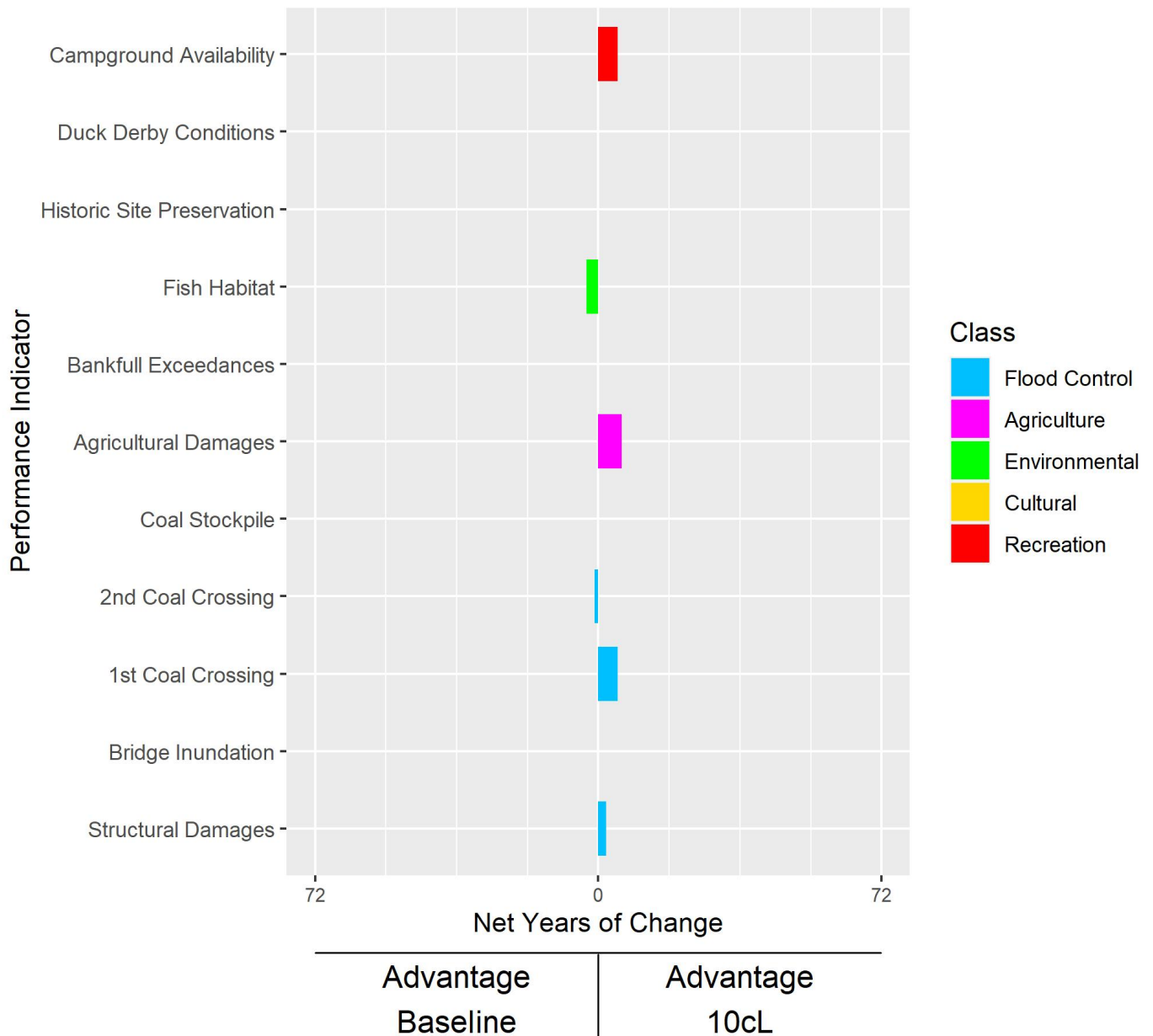
Westhope to Wawanesa

Baseline vs. 10cL

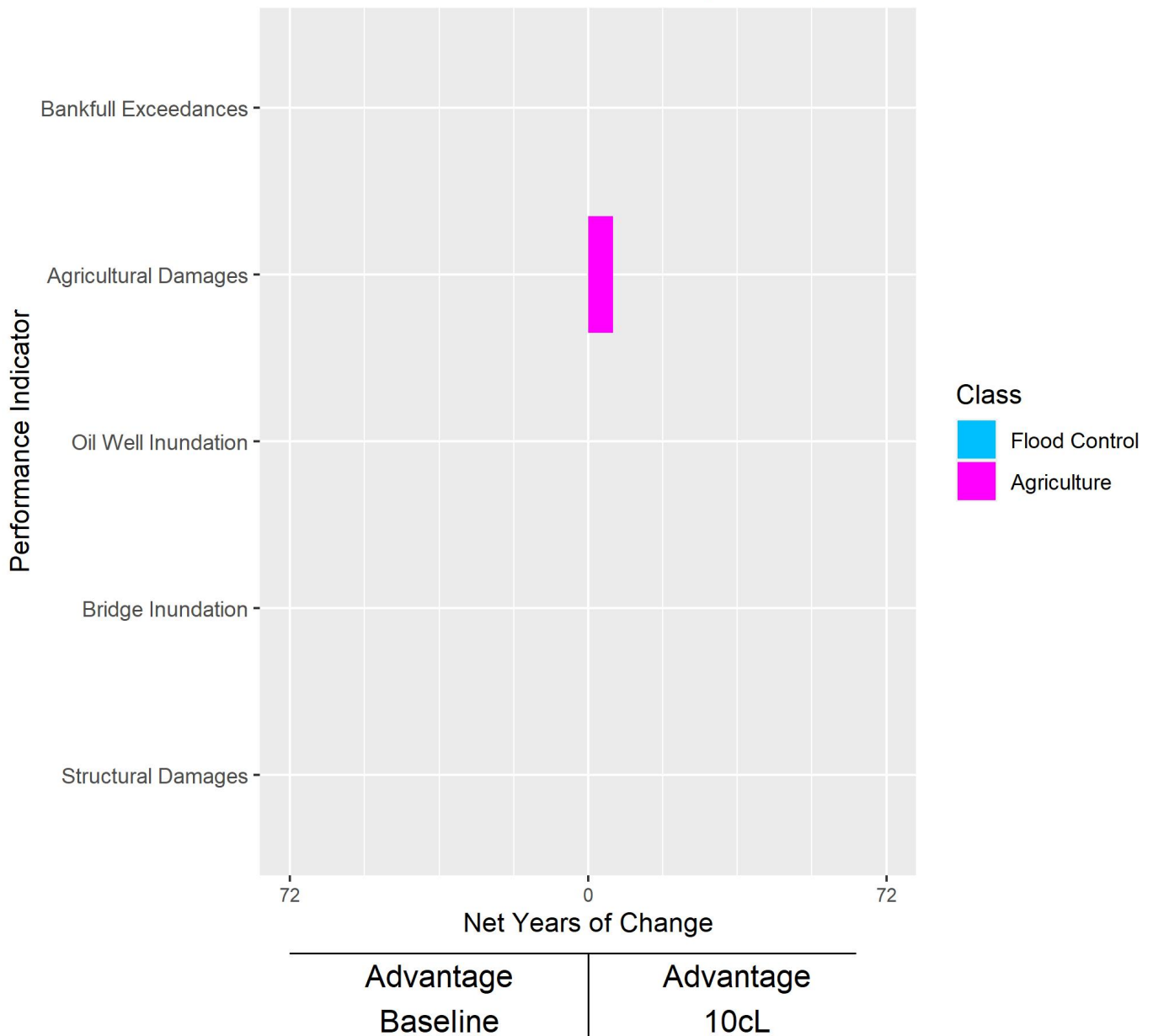
Period of Record: 1946-2017 (72 Years)



City of Estevan
Baseline vs. 10cL
Period of Record: 1946-2017 (72 Years)



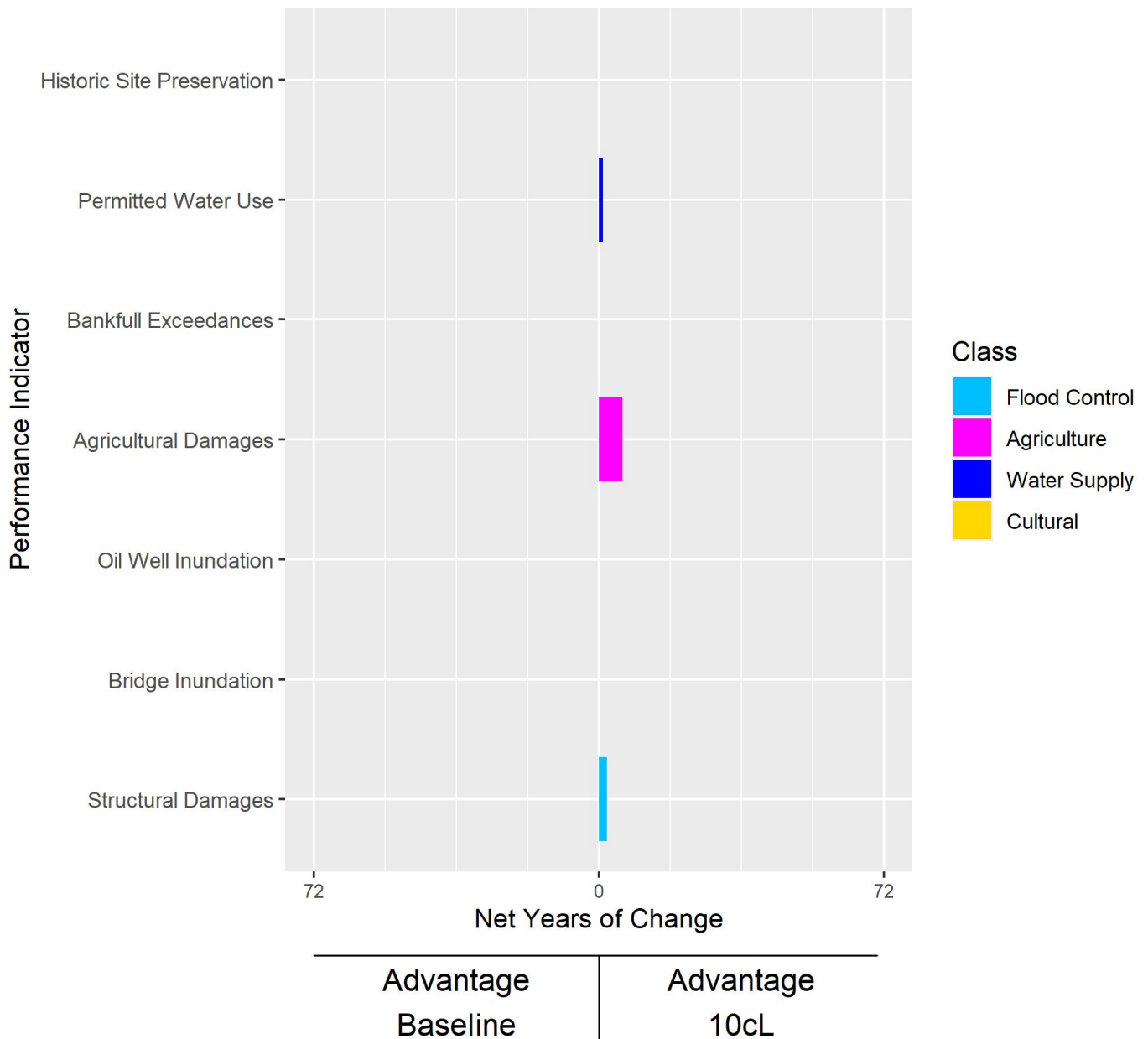
City of Roche Percee
Baseline vs. 10cL
Period of Record: 1946-2017 (72 Years)



Roche Percee to Moose Mountain Creek

Baseline vs. 10cL

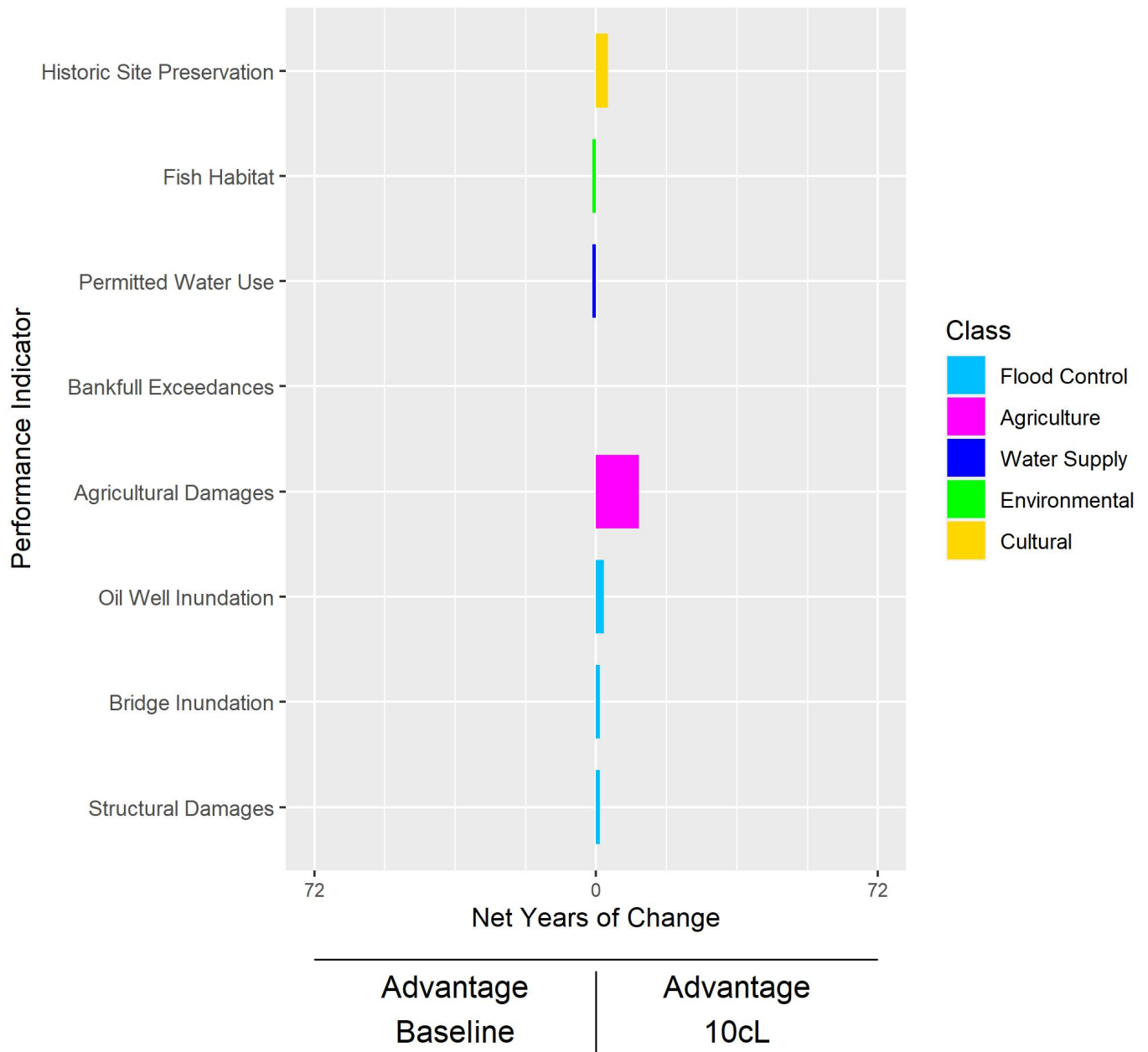
Period of Record: 1946-2017 (72 Years)



Moose Mountain Creek to Sherwood

Baseline vs. 10cL

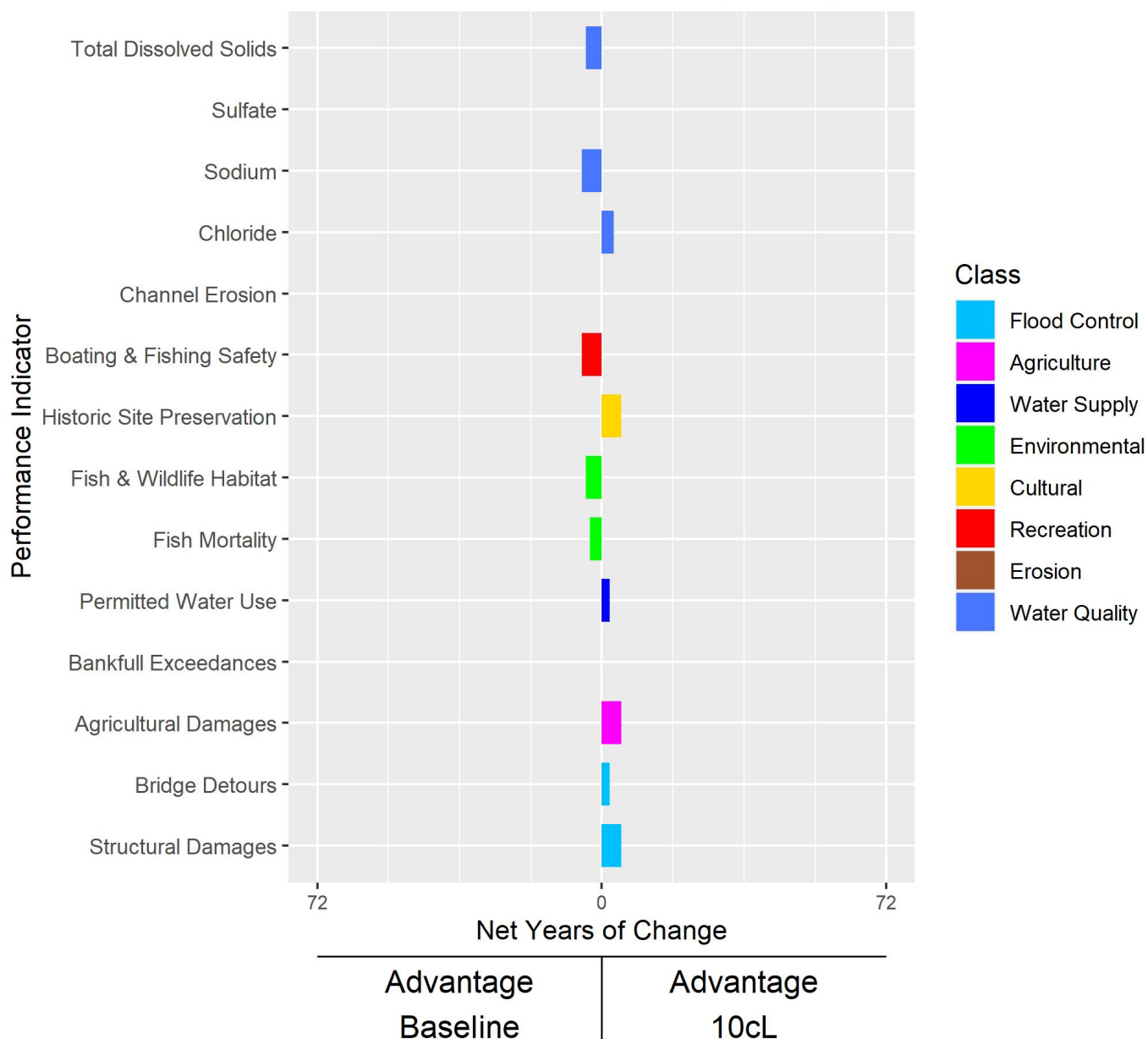
Period of Record: 1946-2017 (72 Years)



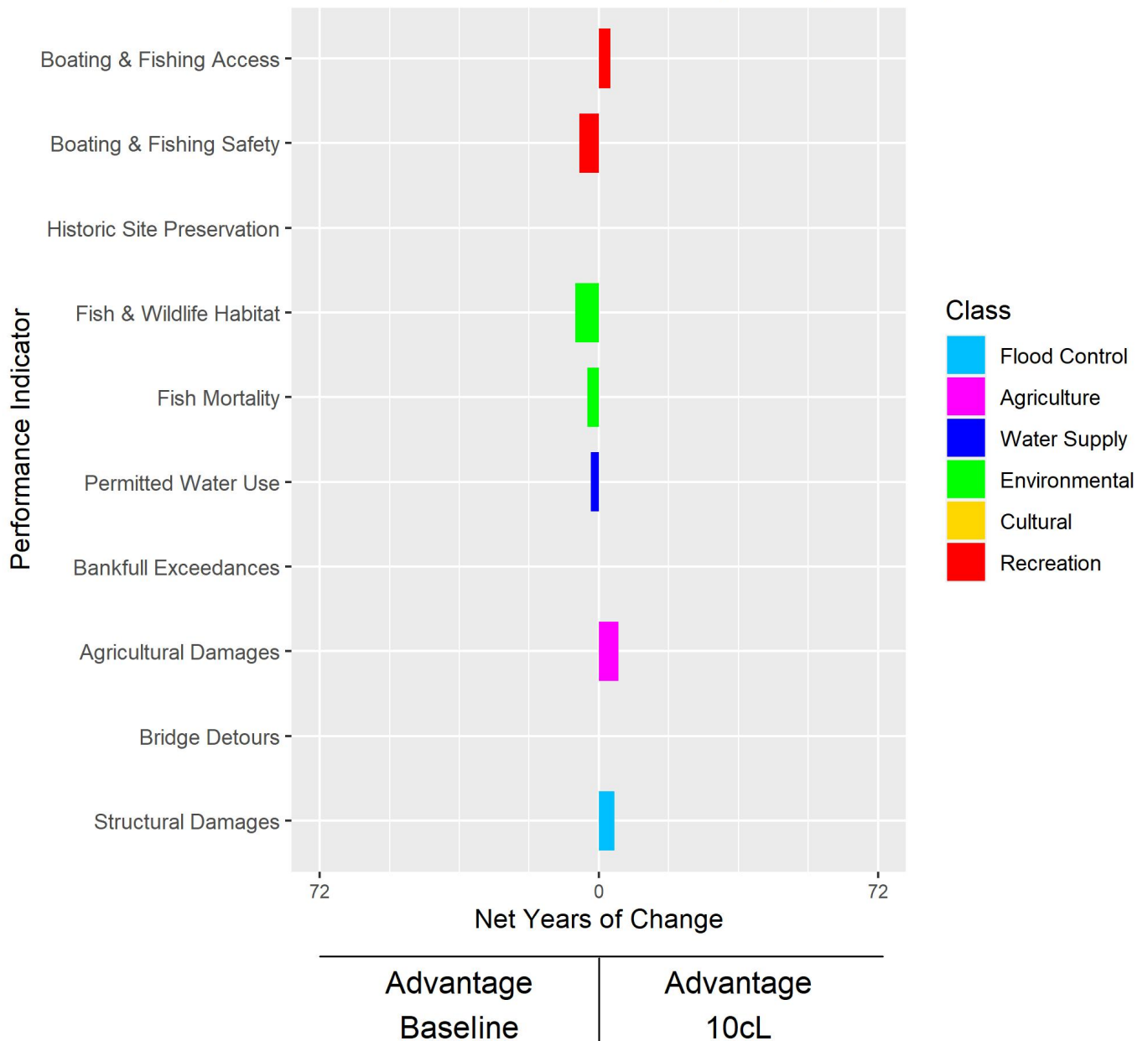
Sherwood to Mouse River Park

Baseline vs. 10cL

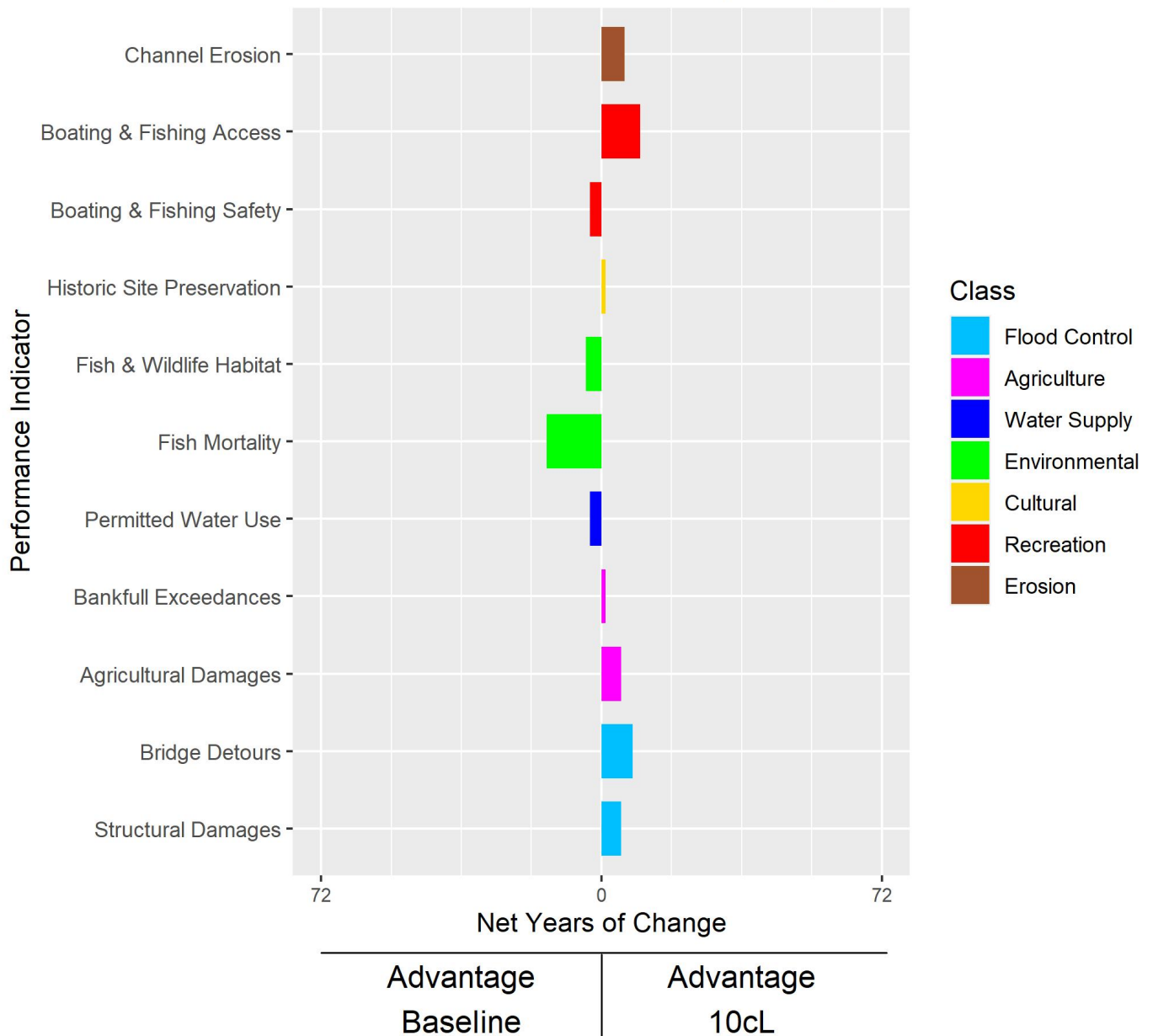
Period of Record: 1946-2017 (72 Years)



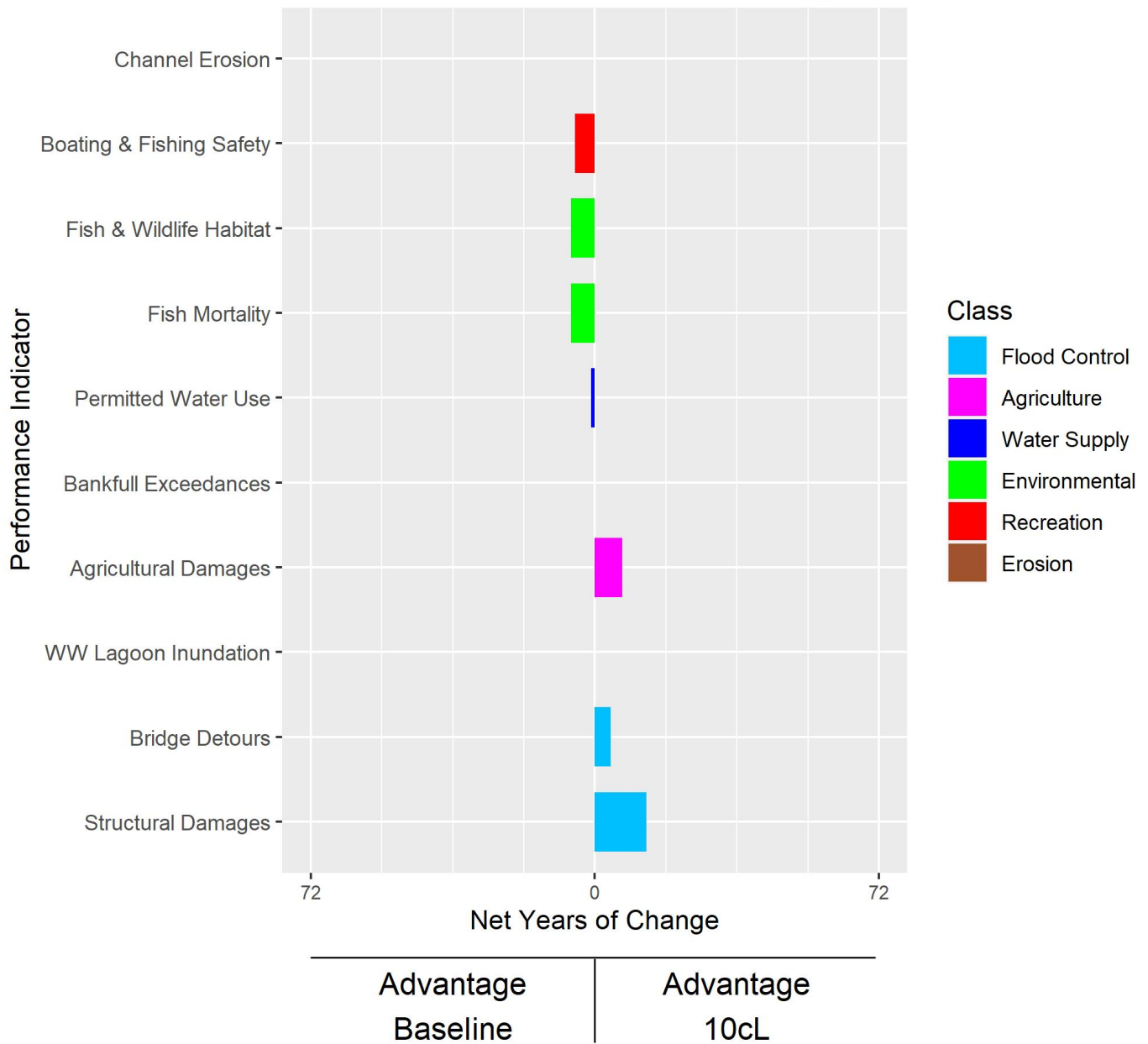
Mouse River Park Baseline vs. 10cL Period of Record: 1946-2017 (72 Years)



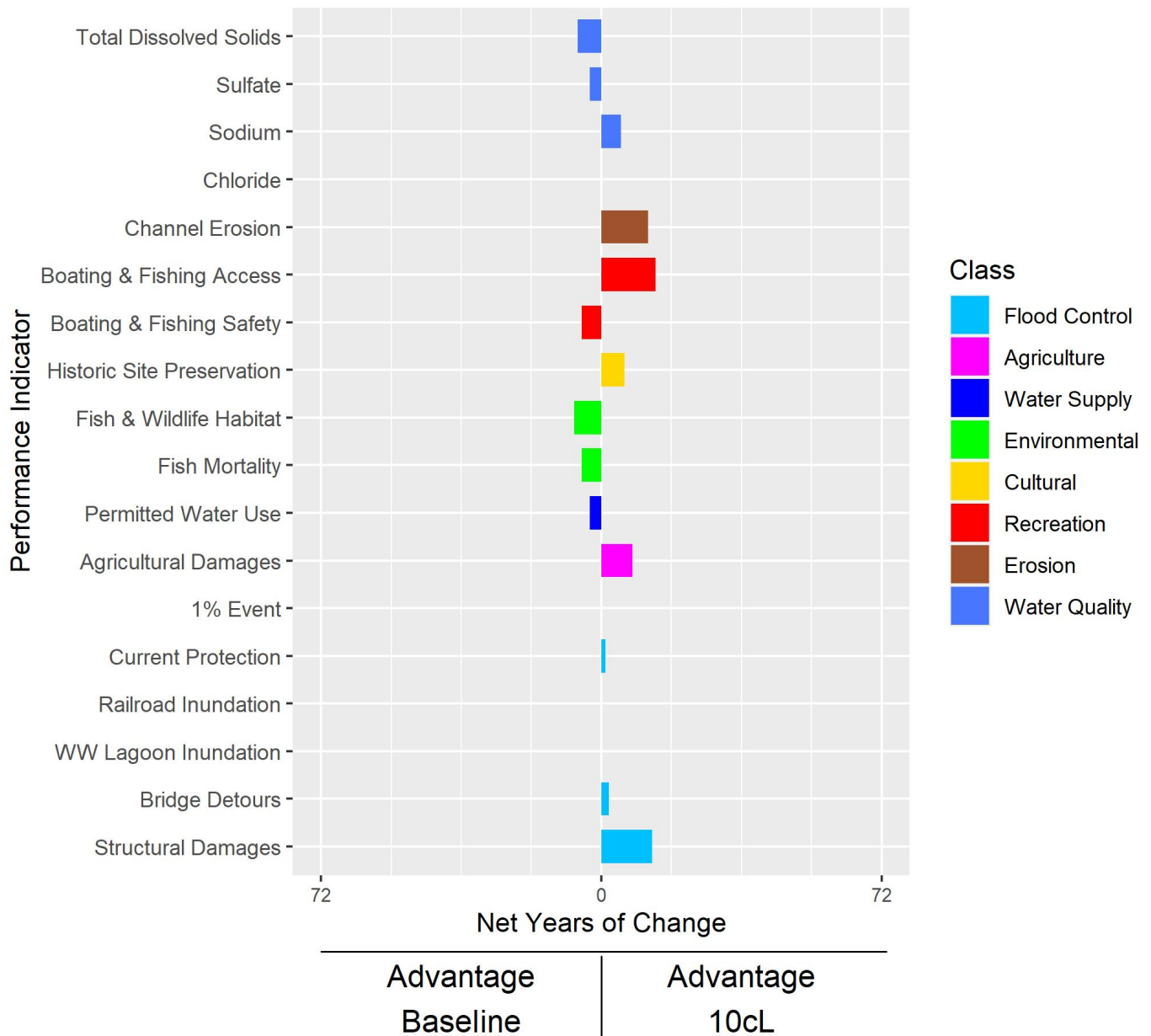
Lake Darling to Burlington
Baseline vs. 10cL
Period of Record: 1946-2017 (72 Years)



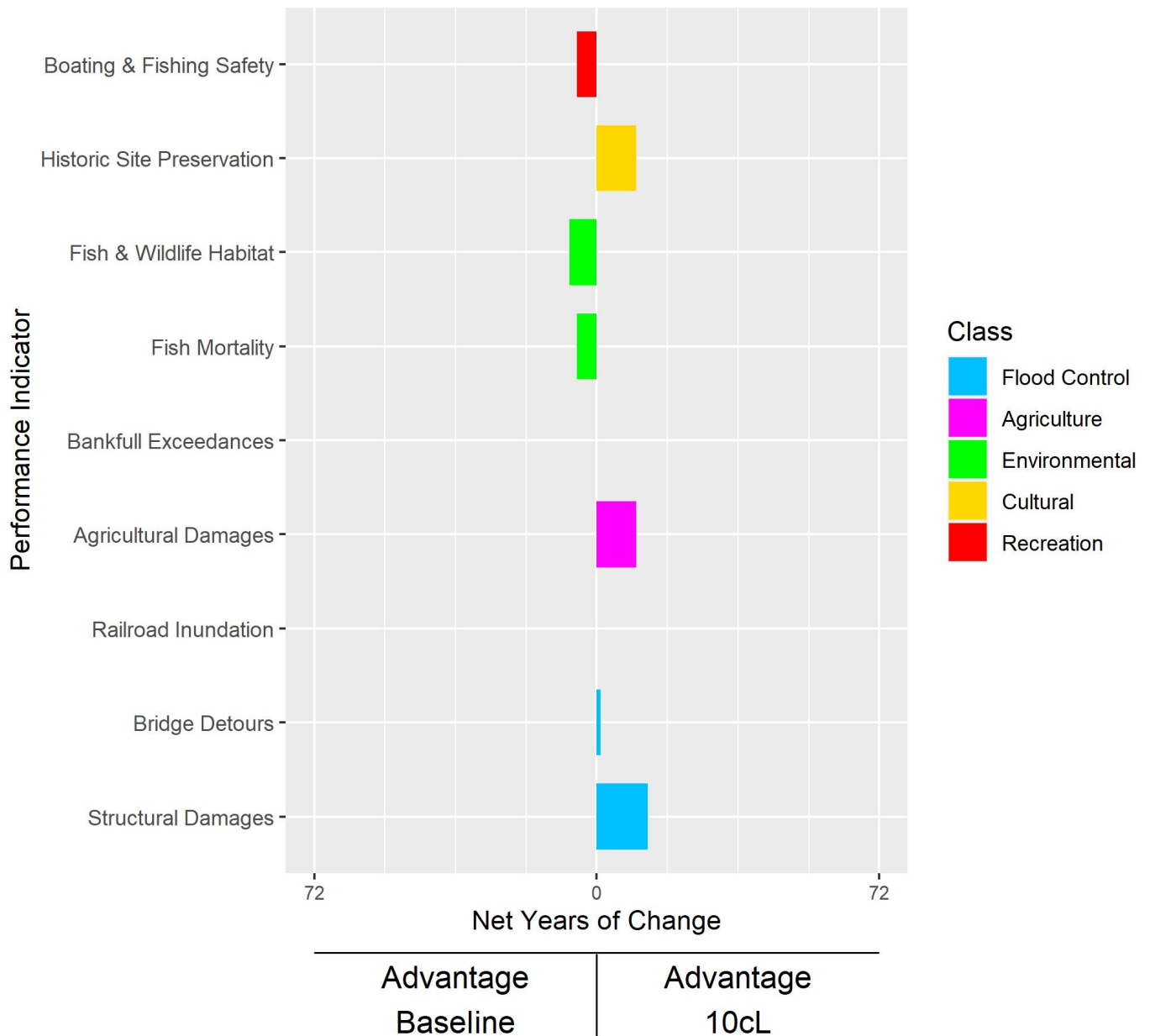
City of Burlington
Baseline vs. 10cL
Period of Record: 1946-2017 (72 Years)



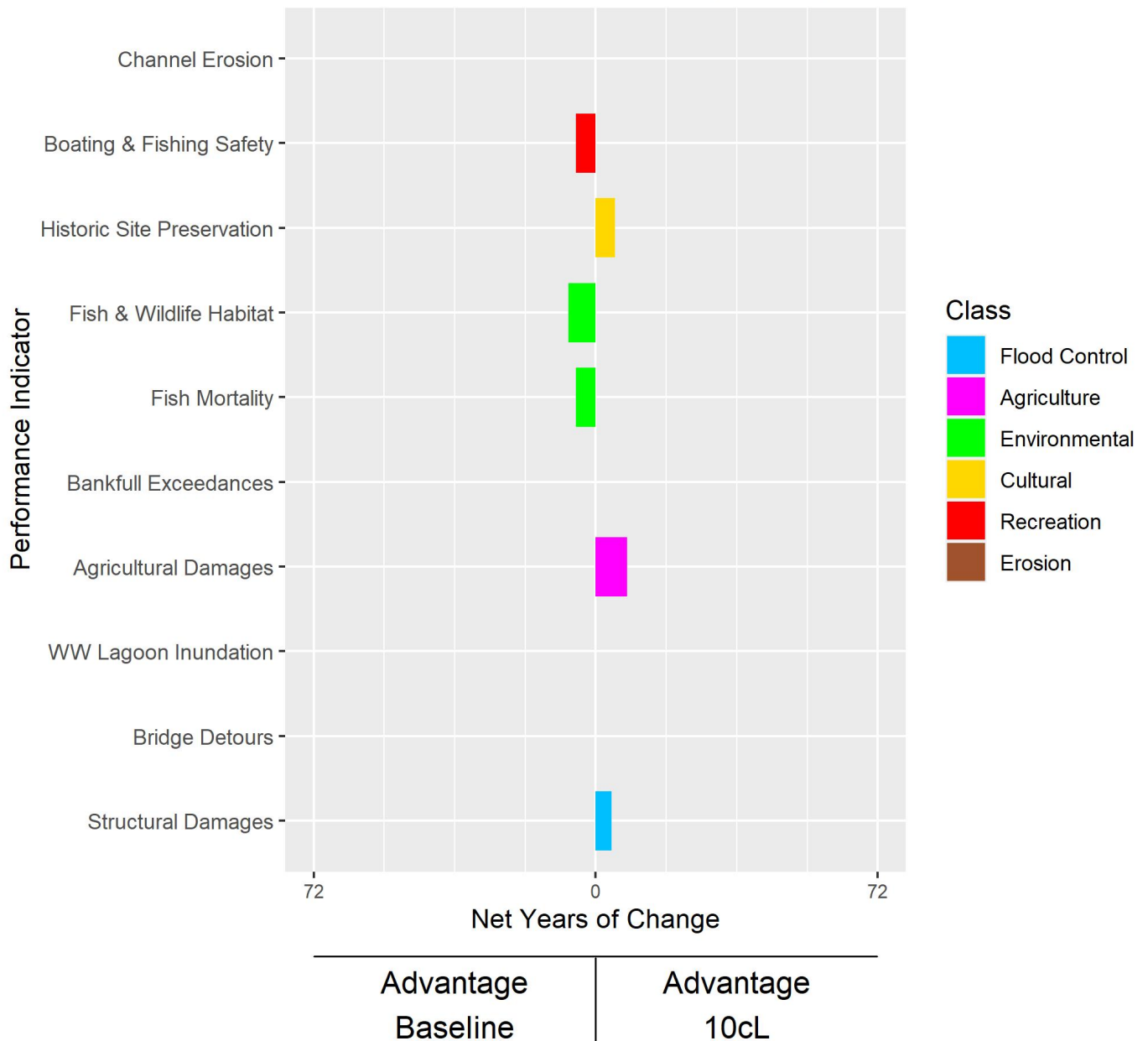
City of Minot
Baseline vs. 10cL
Period of Record: 1946-2017 (72 Years)



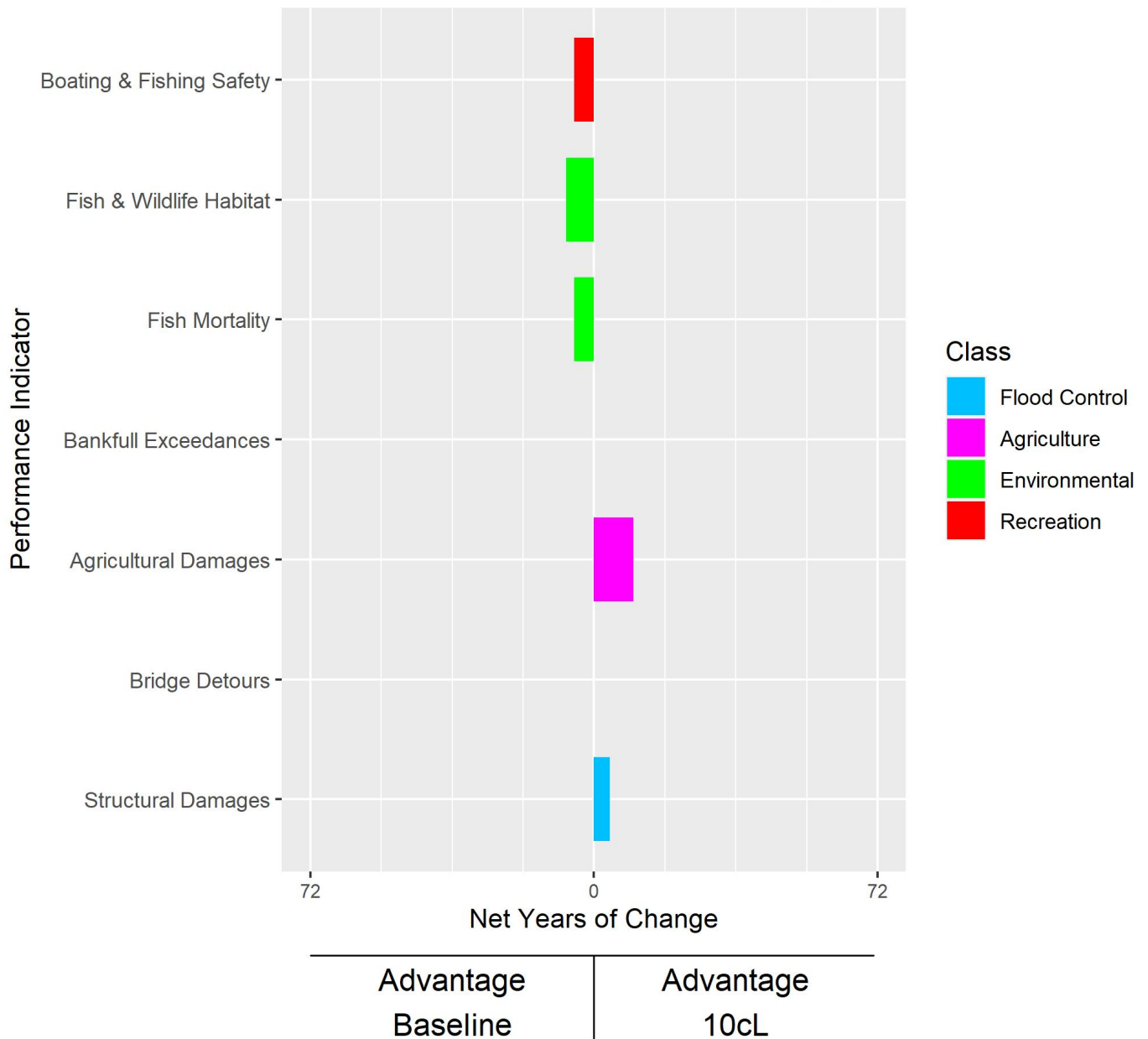
Minot to Sawyer
Baseline vs. 10cL
Period of Record: 1946-2017 (72 Years)



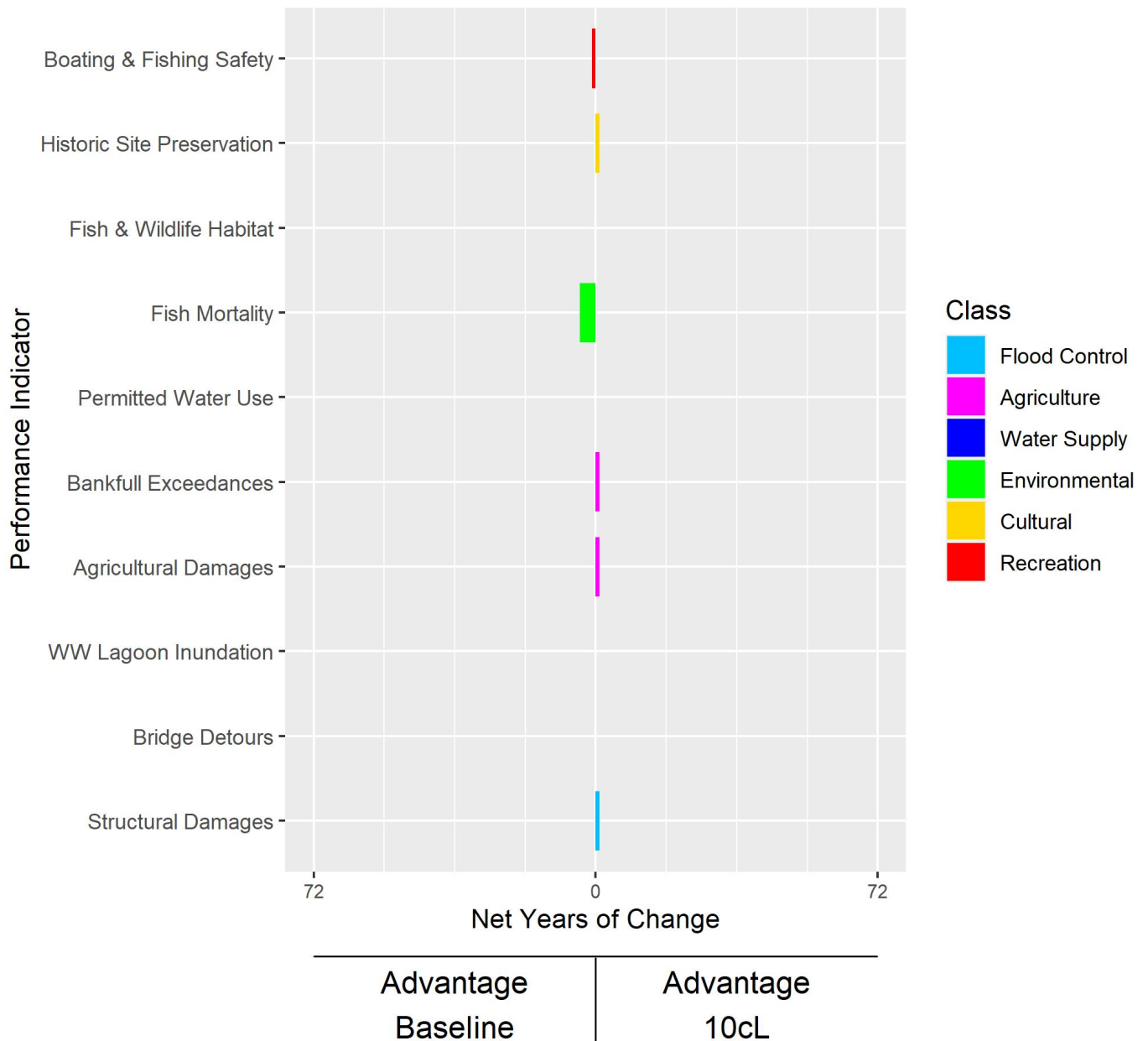
City of Sawyer
Baseline vs. 10cL
Period of Record: 1946-2017 (72 Years)



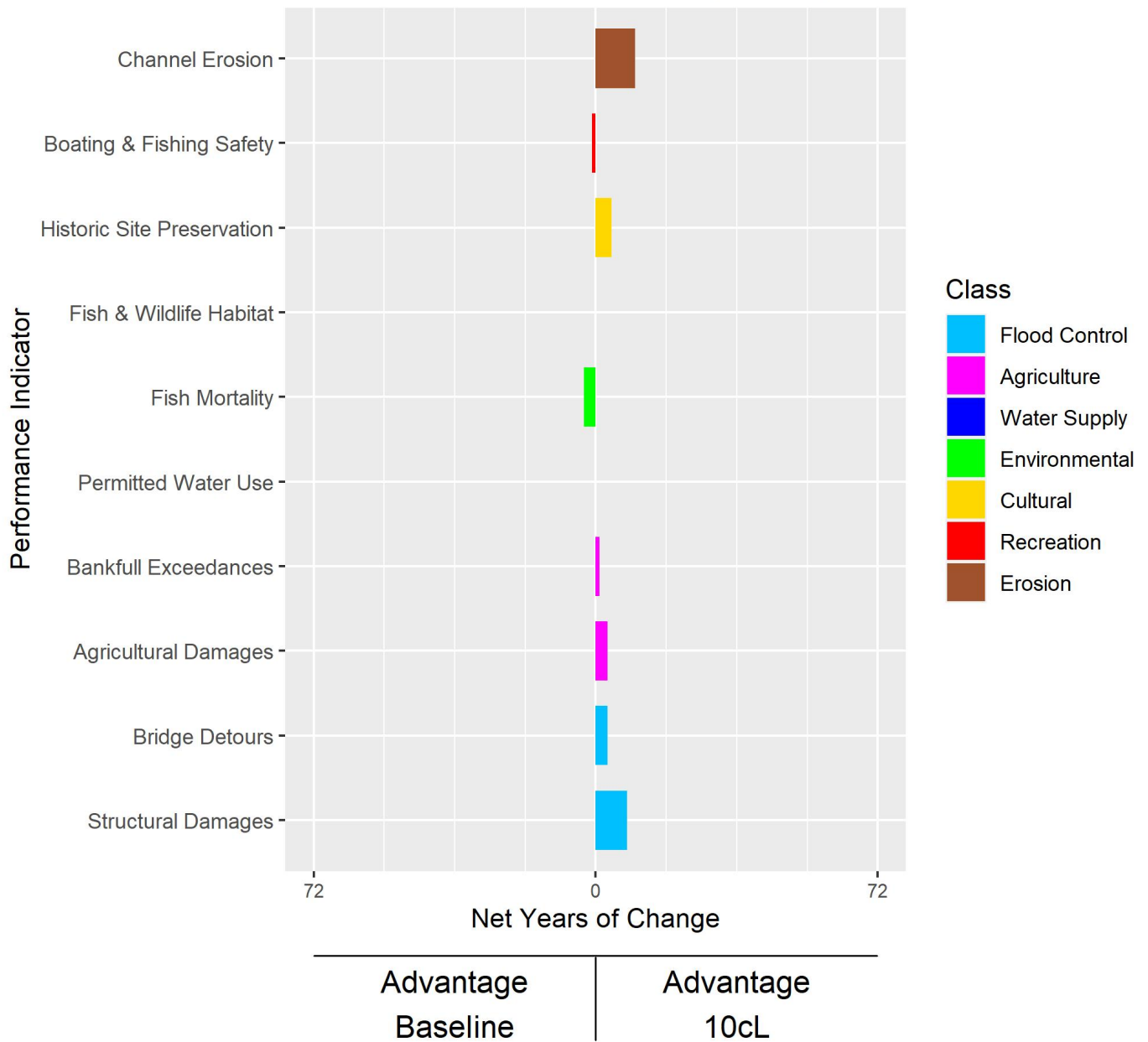
Sawyer to Velva
Baseline vs. 10cL
Period of Record: 1946-2017 (72 Years)



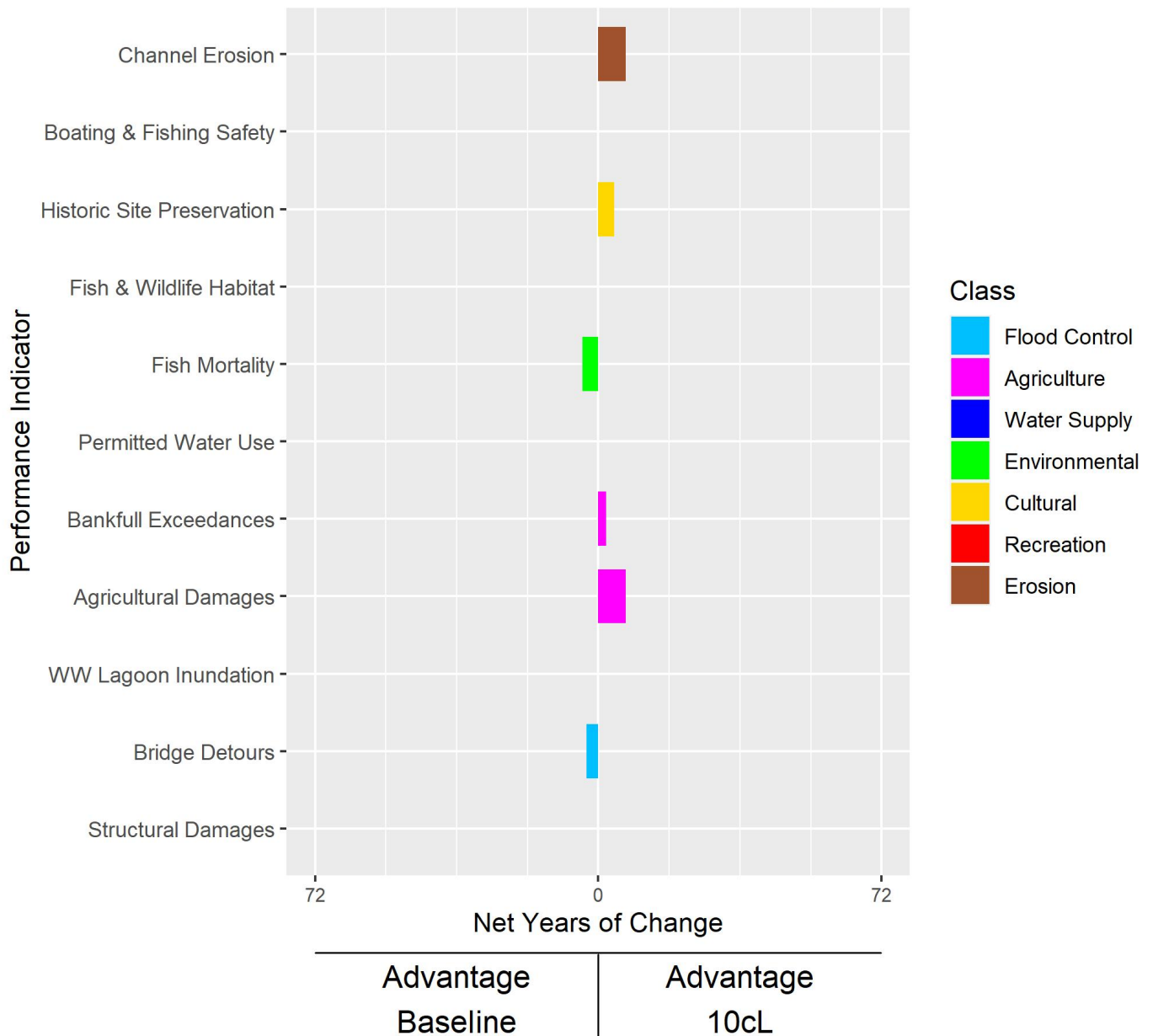
City of Velva
Baseline vs. 10cL
Period of Record: 1946-2017 (72 Years)



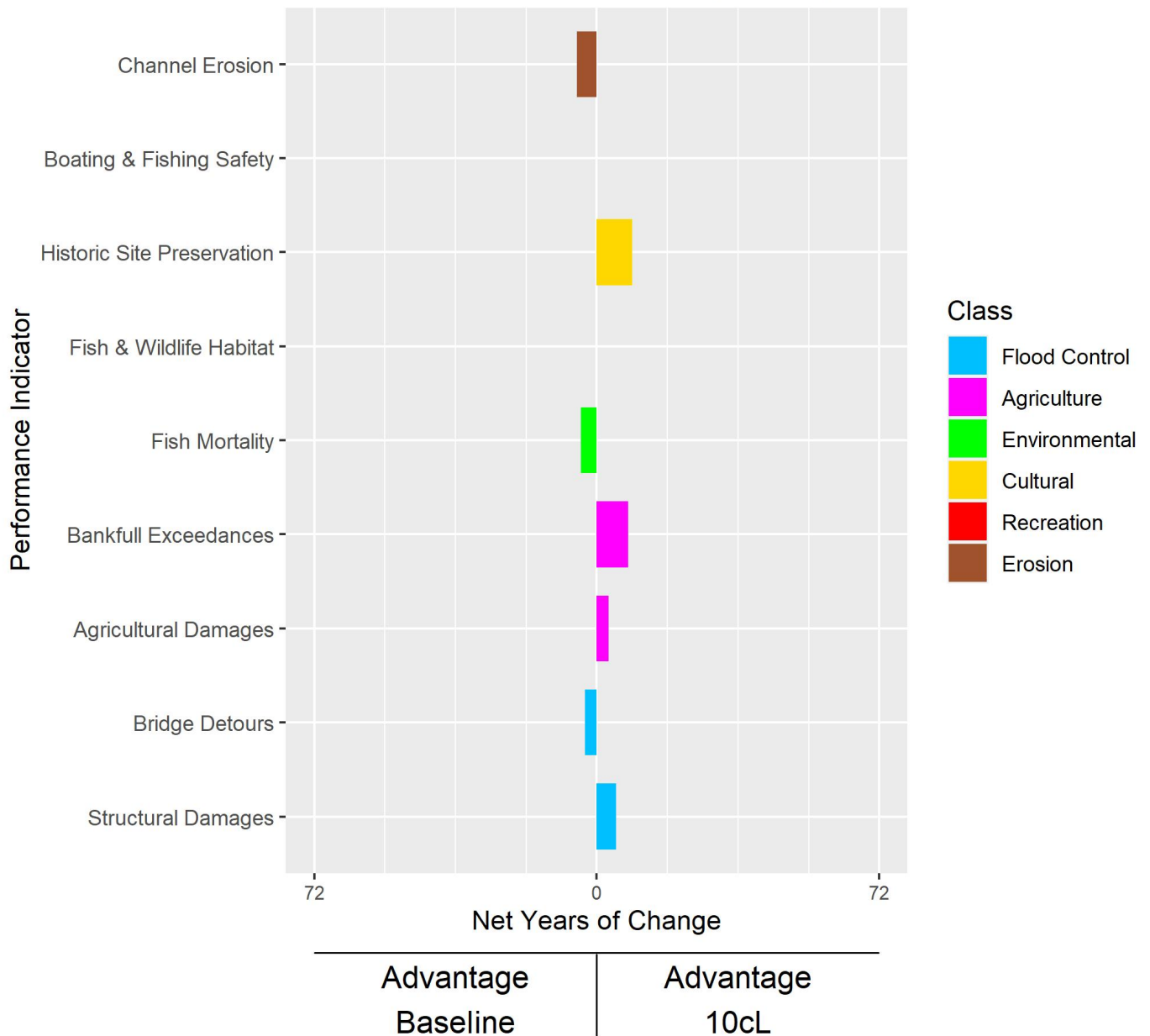
Velva to Eaton Irrigation
Baseline vs. 10cL
Period of Record: 1946-2017 (72 Years)



Eaton Irrigation District
Baseline vs. 10cL
Period of Record: 1946-2017 (72 Years)



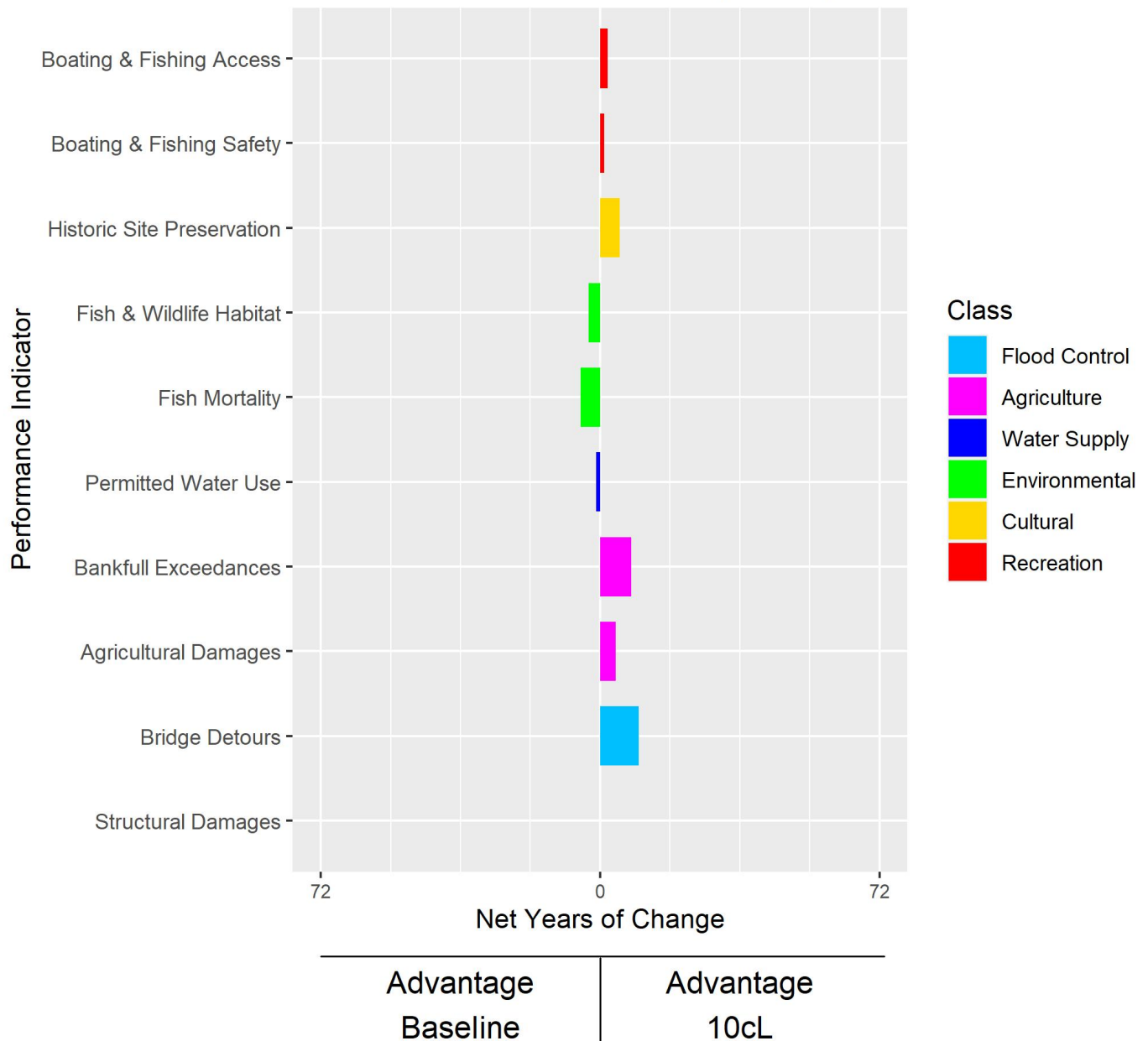
Downstream of Towner
Baseline vs. 10cL
Period of Record: 1946-2017 (72 Years)



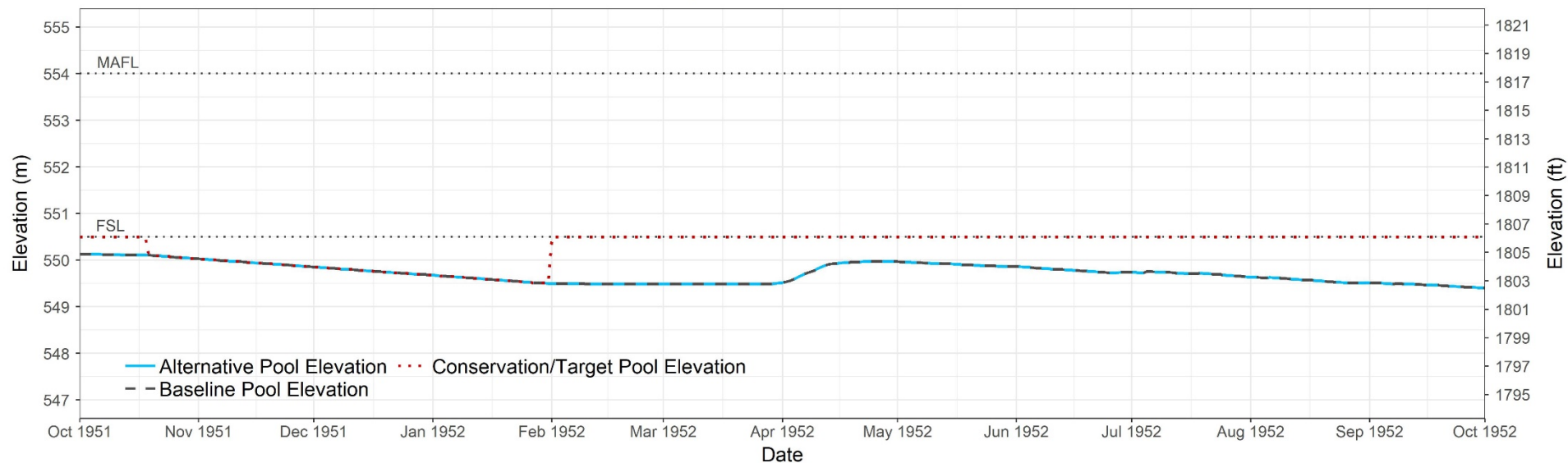
J. Clark Salyer National Wildlife Refuge

Baseline vs. 10cL

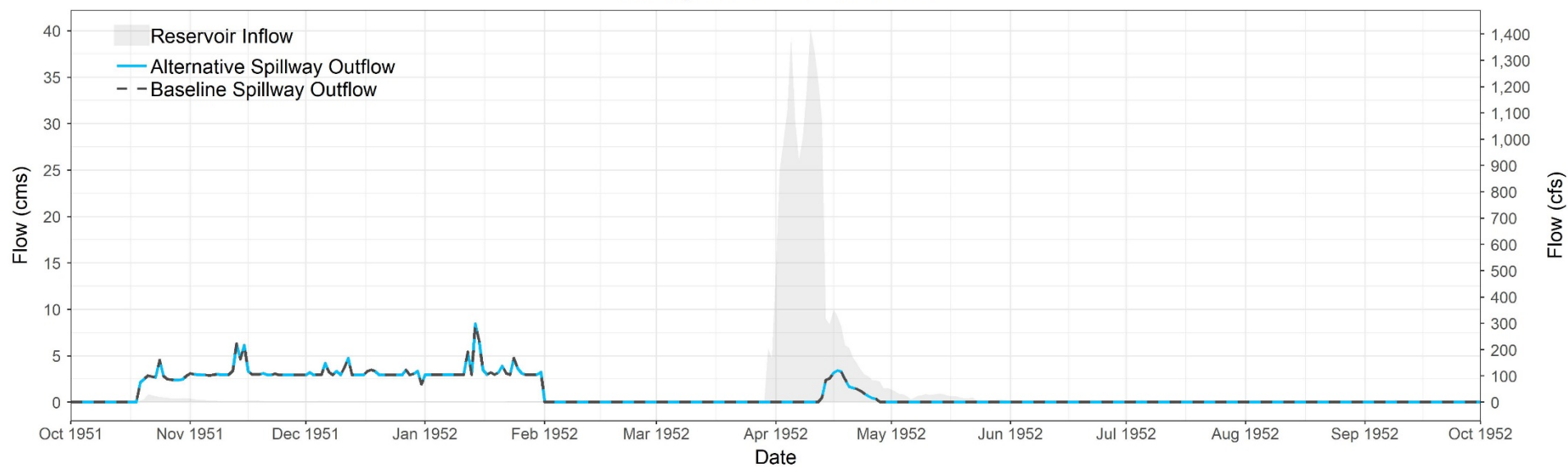
Period of Record: 1946-2017 (72 Years)



Rafferty Reservoir - Elevation

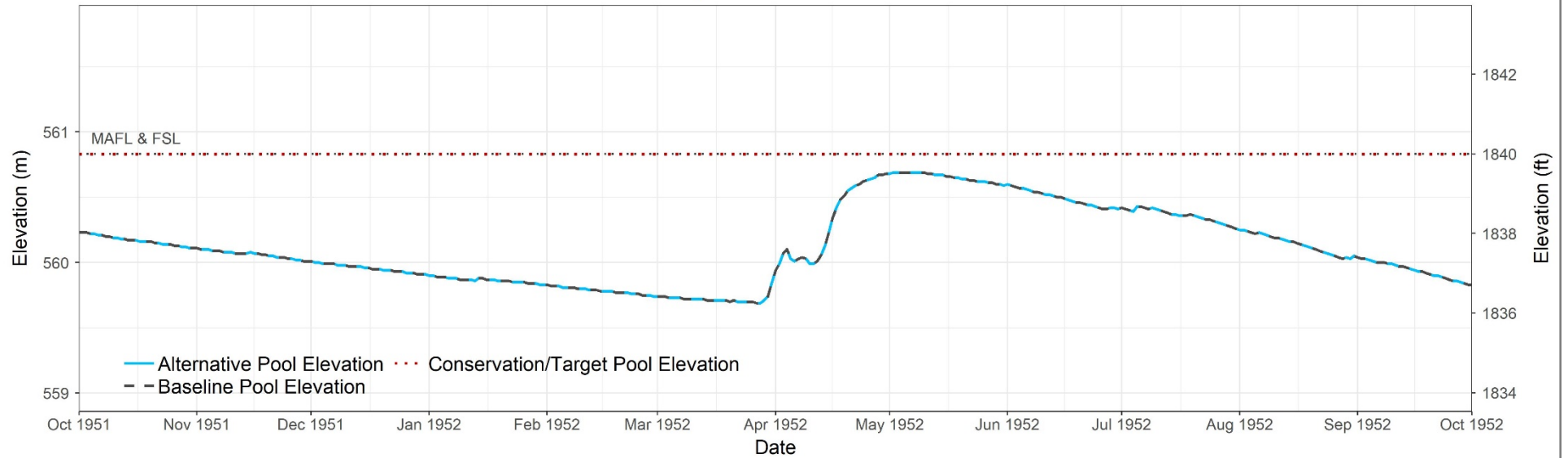


Rafferty Reservoir - Releases

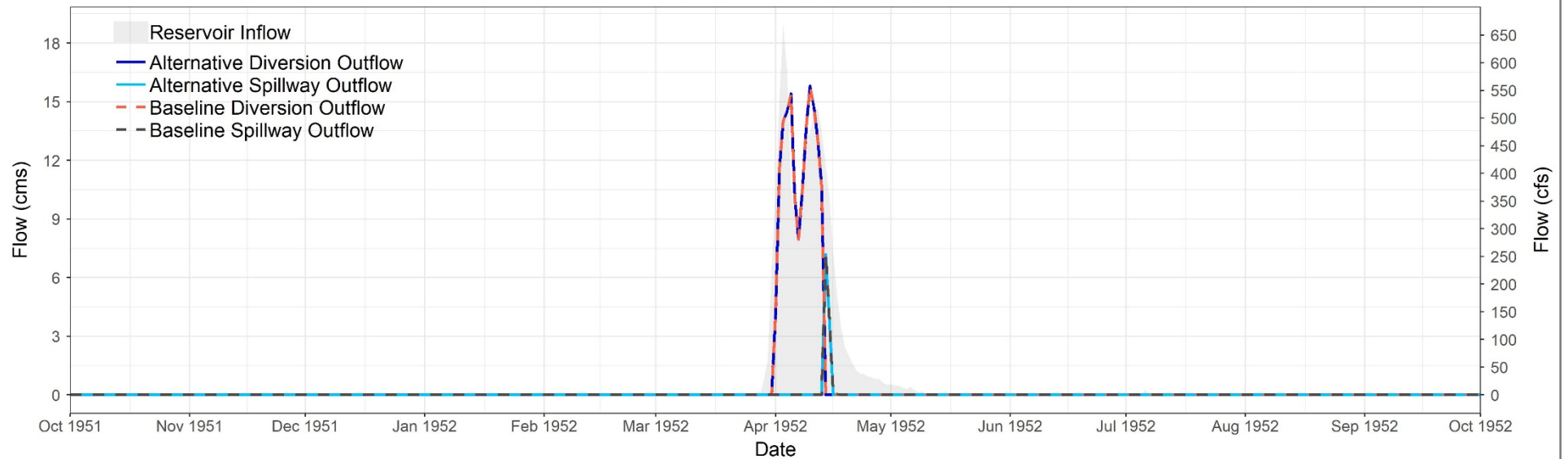


*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level

Boundary Reservoir - Elevation

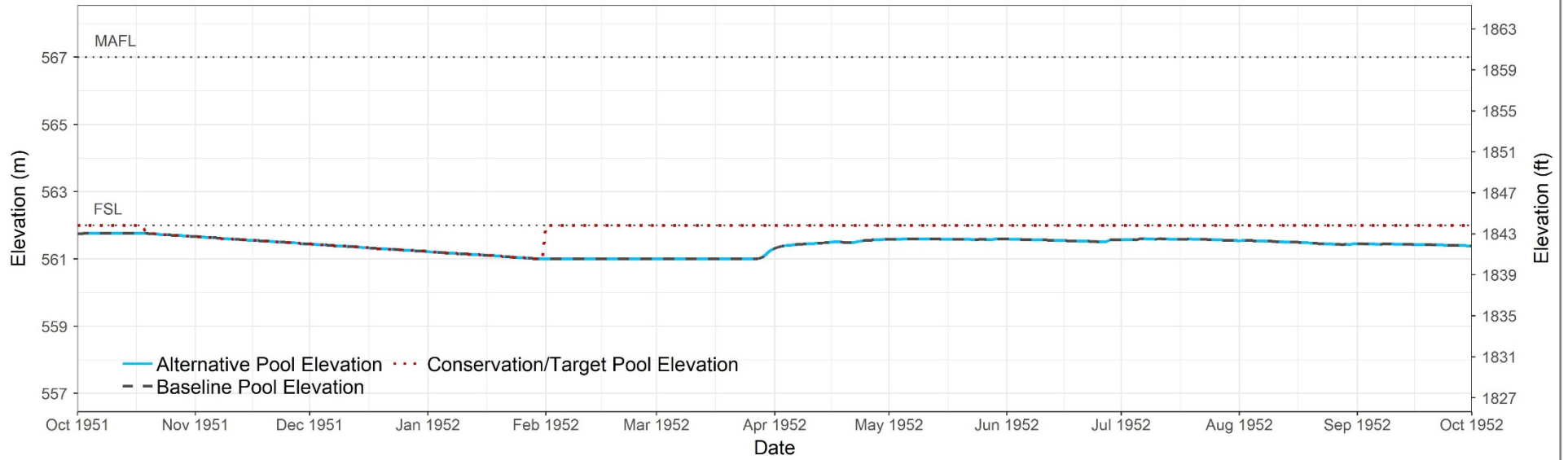


Boundary Reservoir - Releases

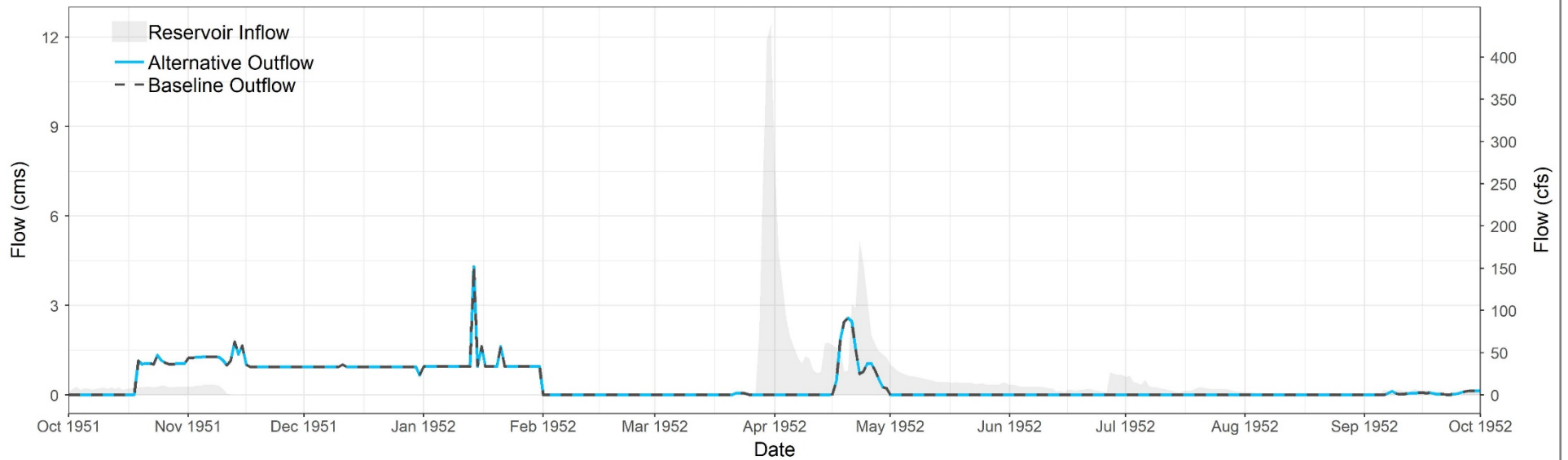


*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level

Grant Devine Reservoir - Elevation

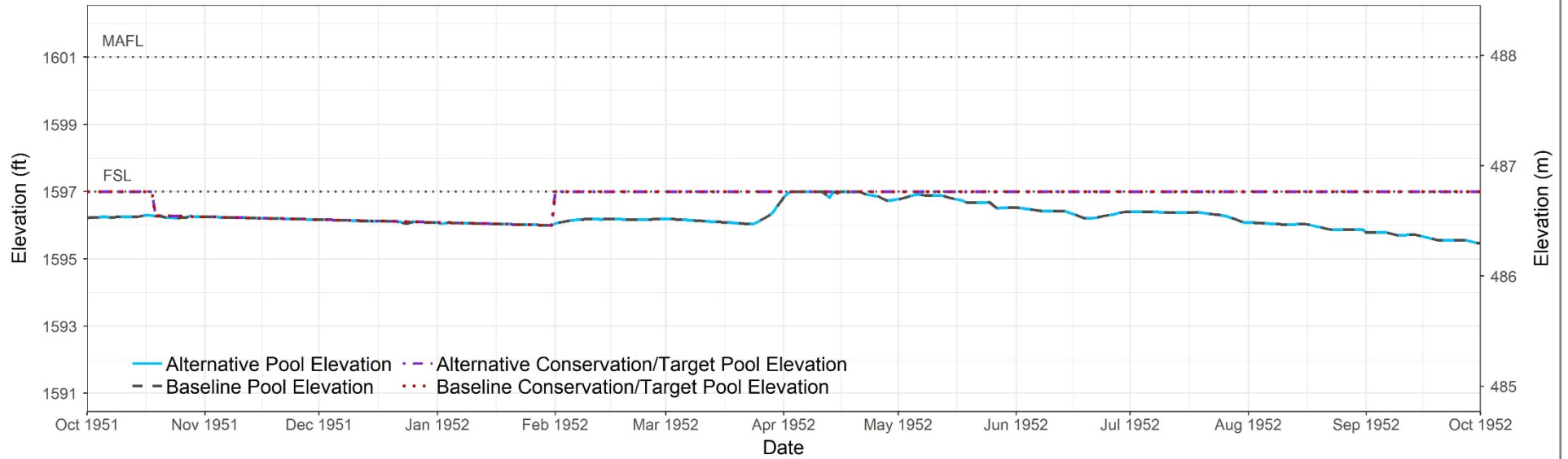


Grant Devine Reservoir - Releases

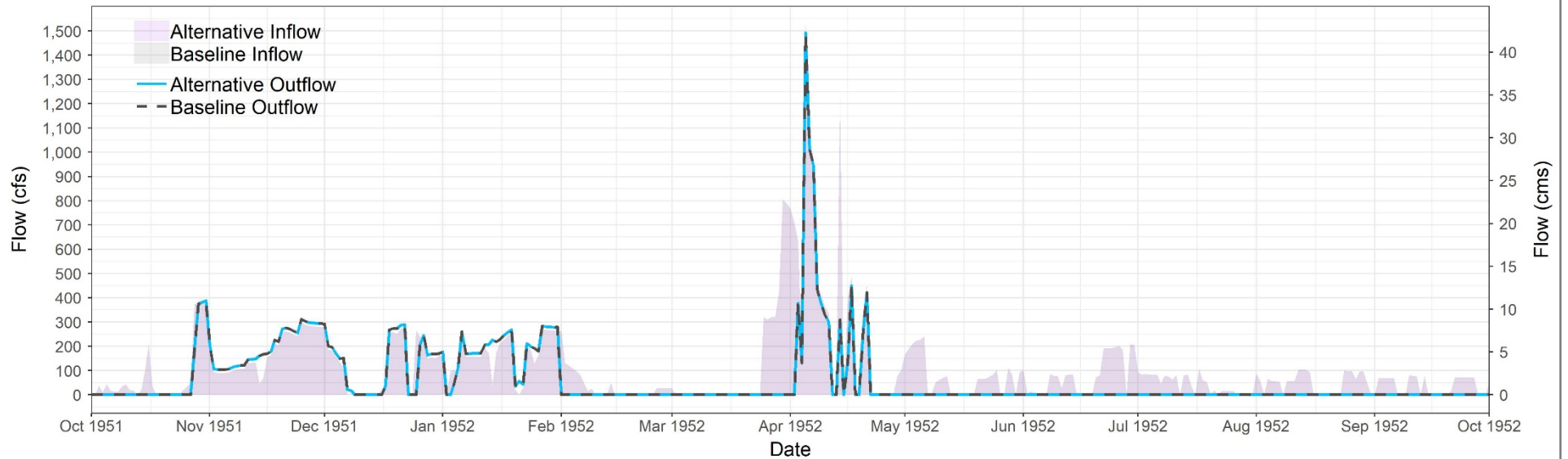


*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level

Lake Darling - Elevation



Lake Darling - Releases



*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level, IDFSL = Inflow Design Flood Supply Level

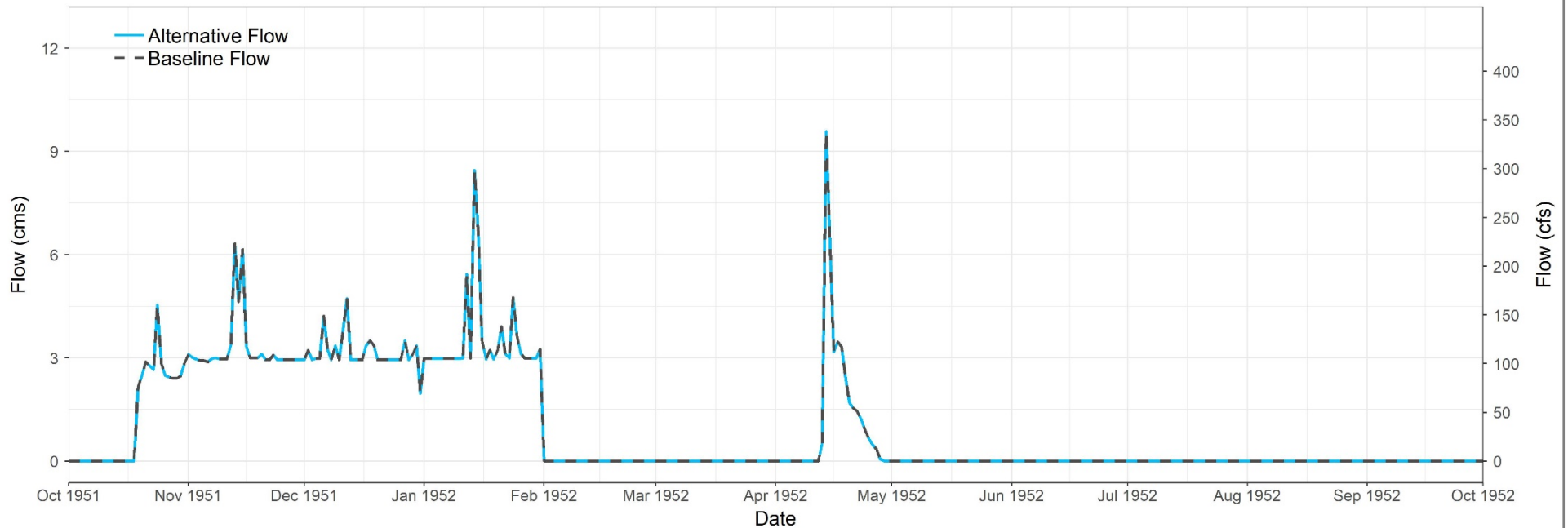
Plate 47

Critical Flow Locations – 1952

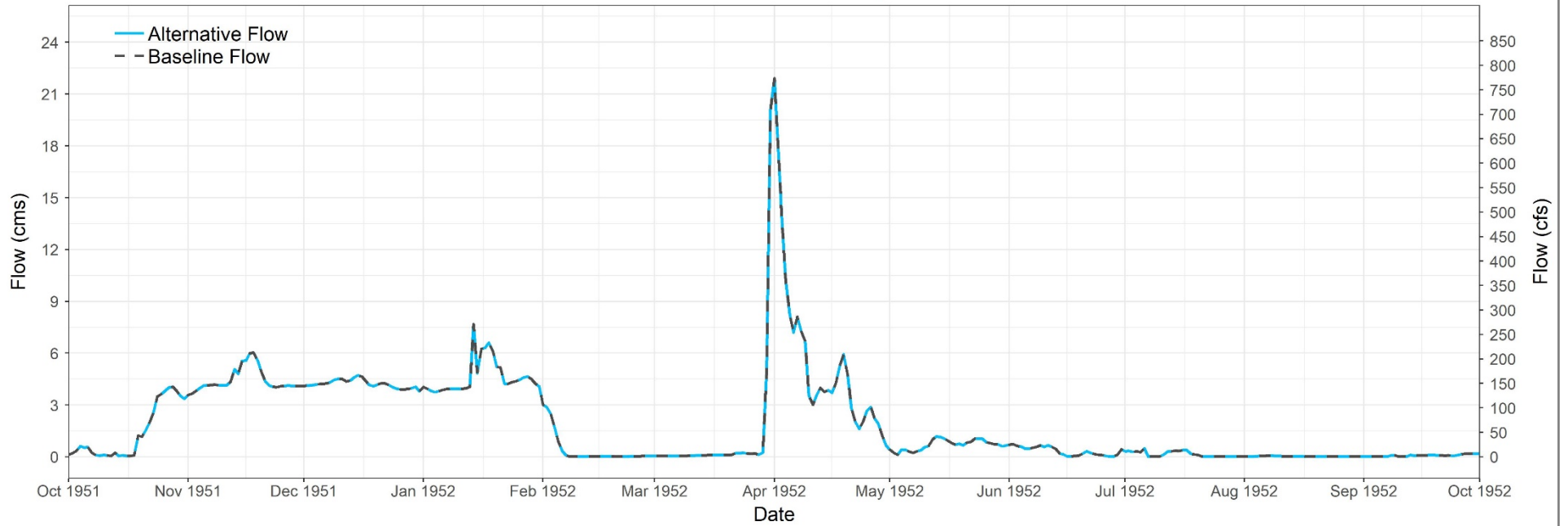
Alternative 10cR (Phase 2)

Souris River Plan of Study

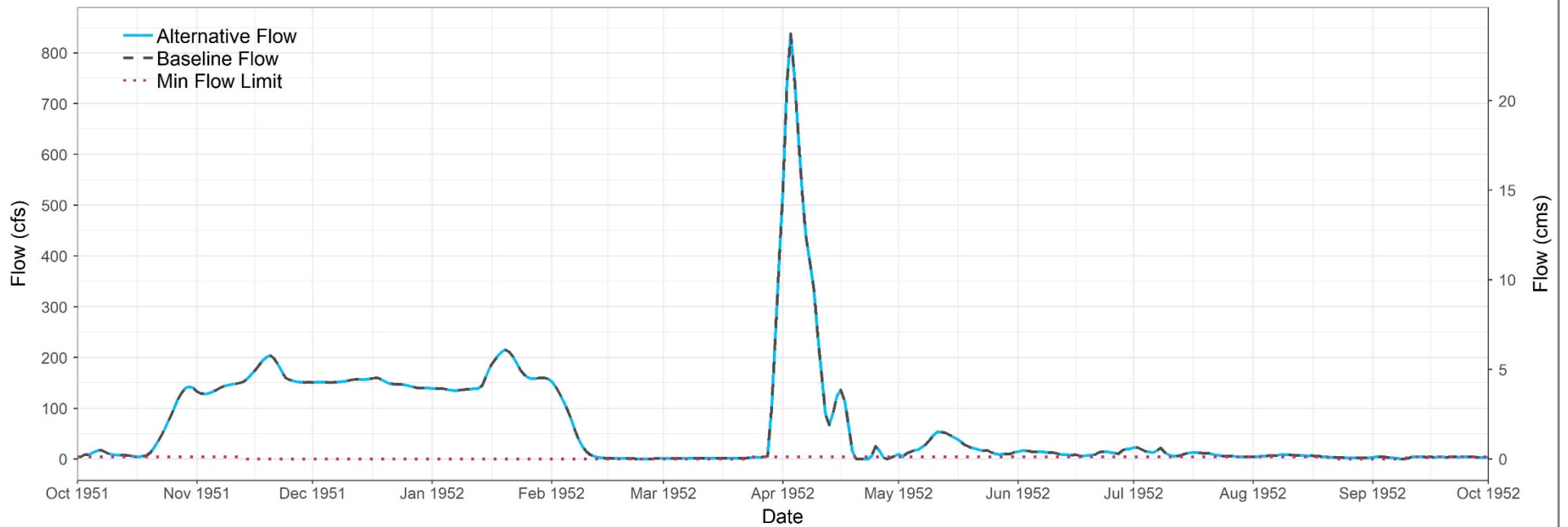
Souris River at Estevan, SK



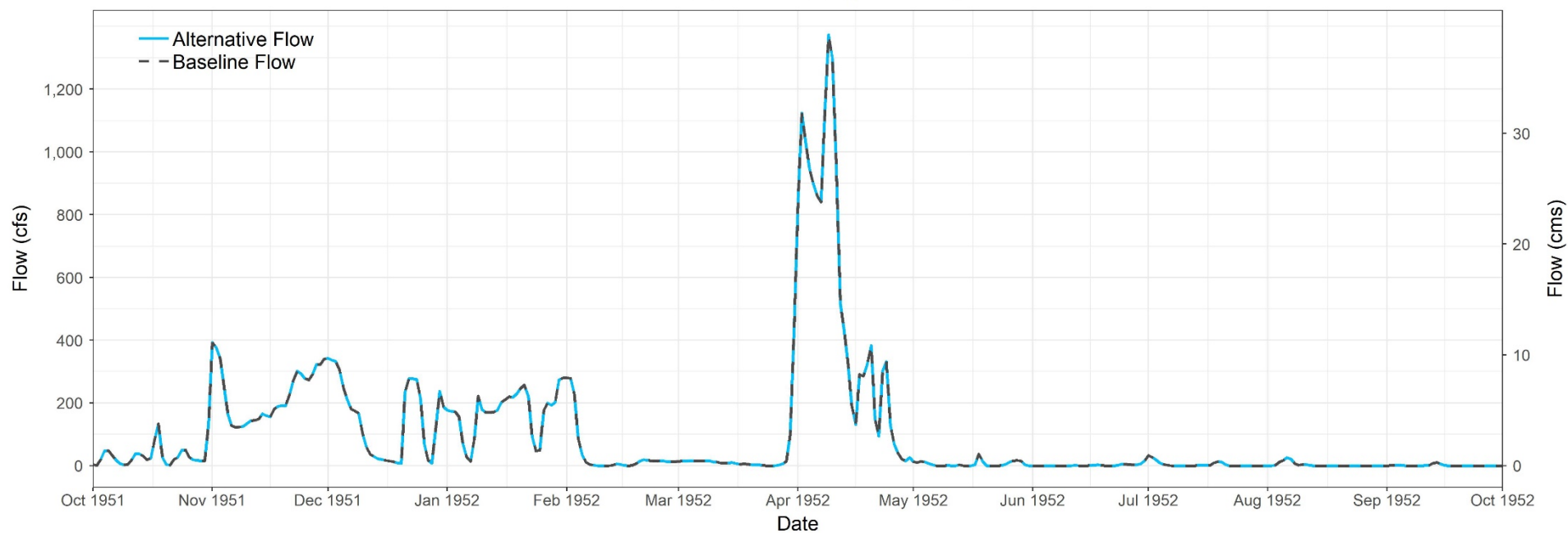
Souris River at Oxbow, SK



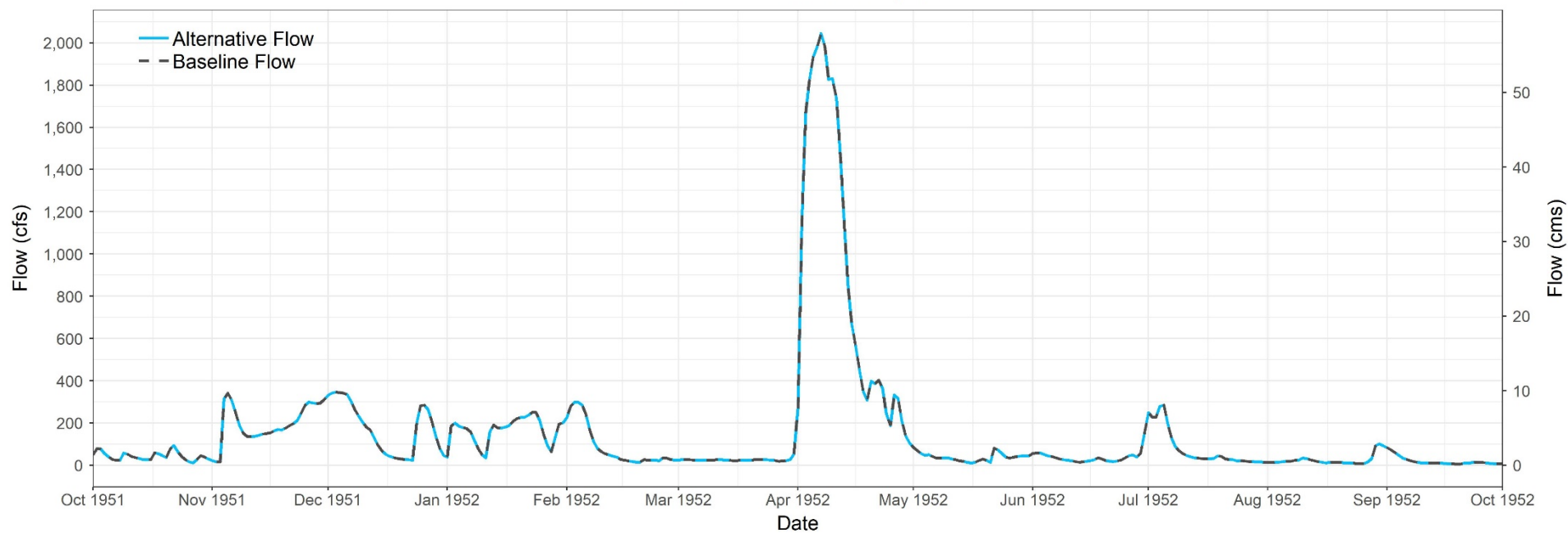
Souris River at Sherwood, ND



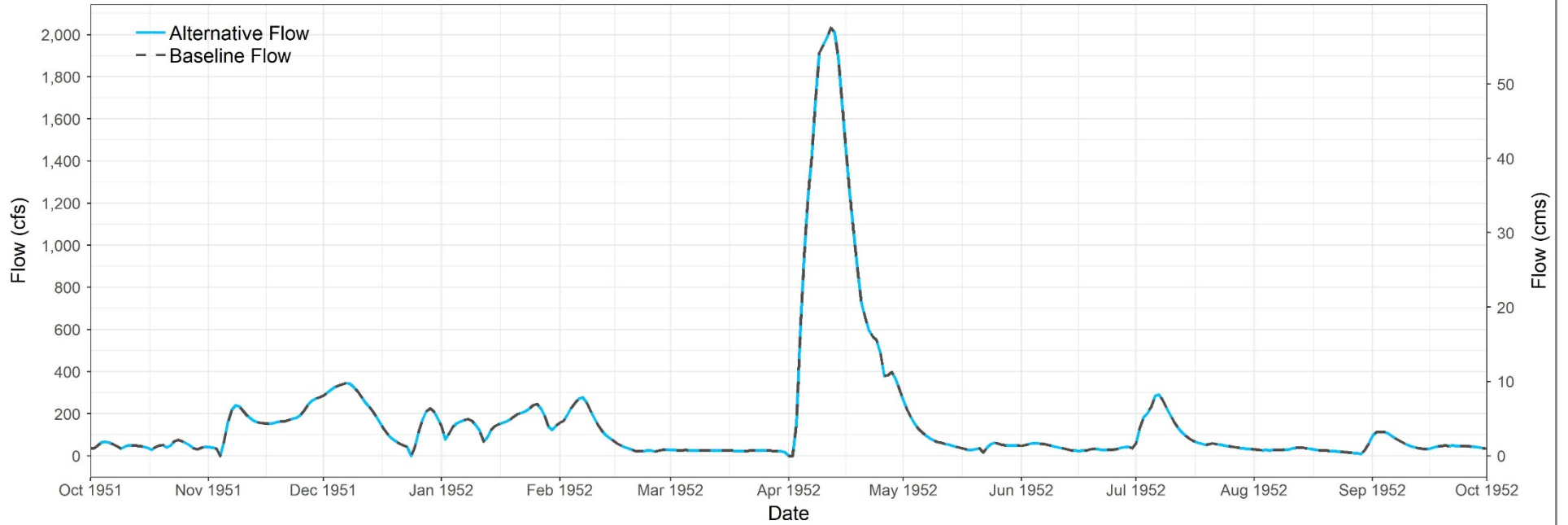
Souris River at Minot, ND - Flow



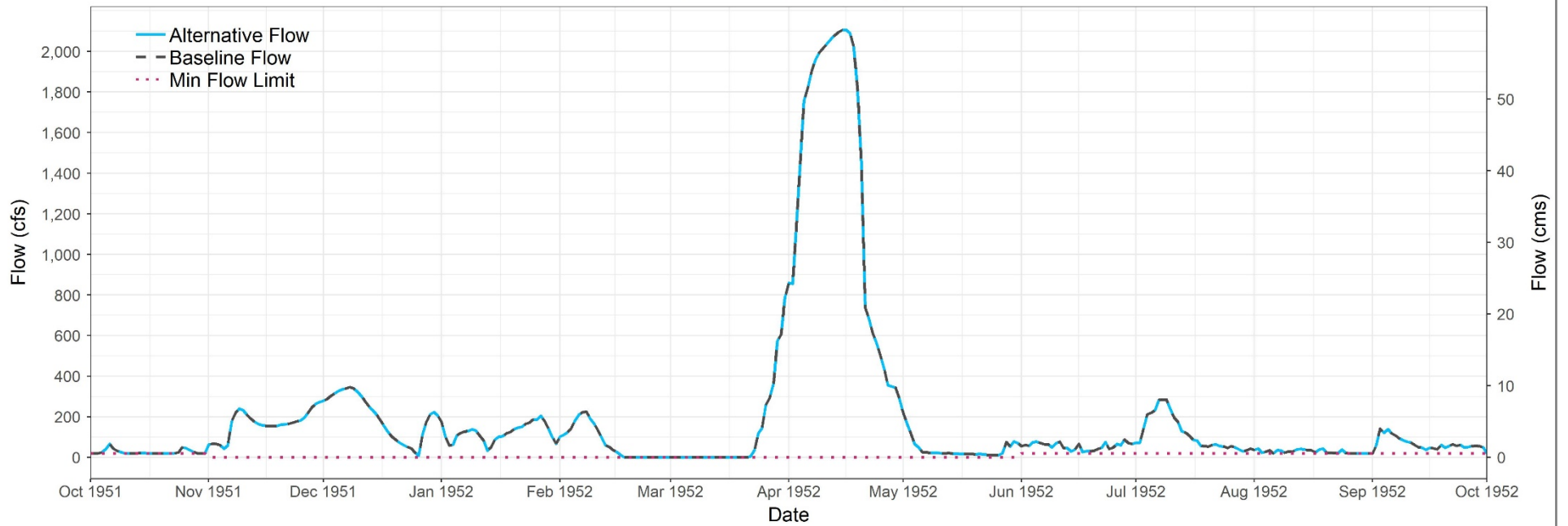
Souris River at Verendrye, ND



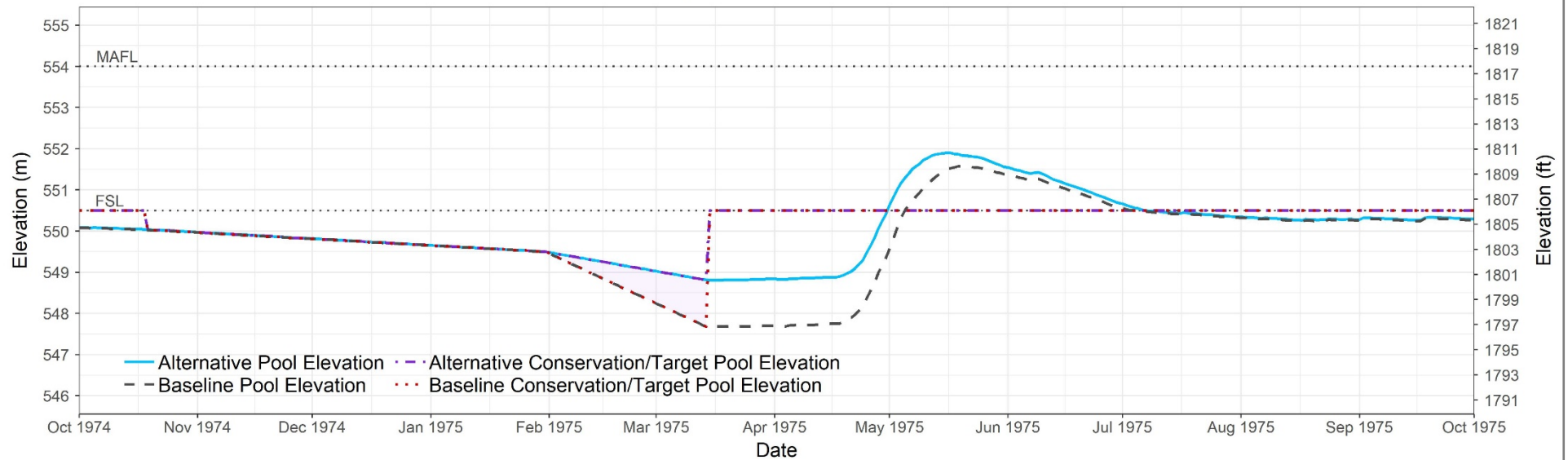
Souris River at Bantry, ND



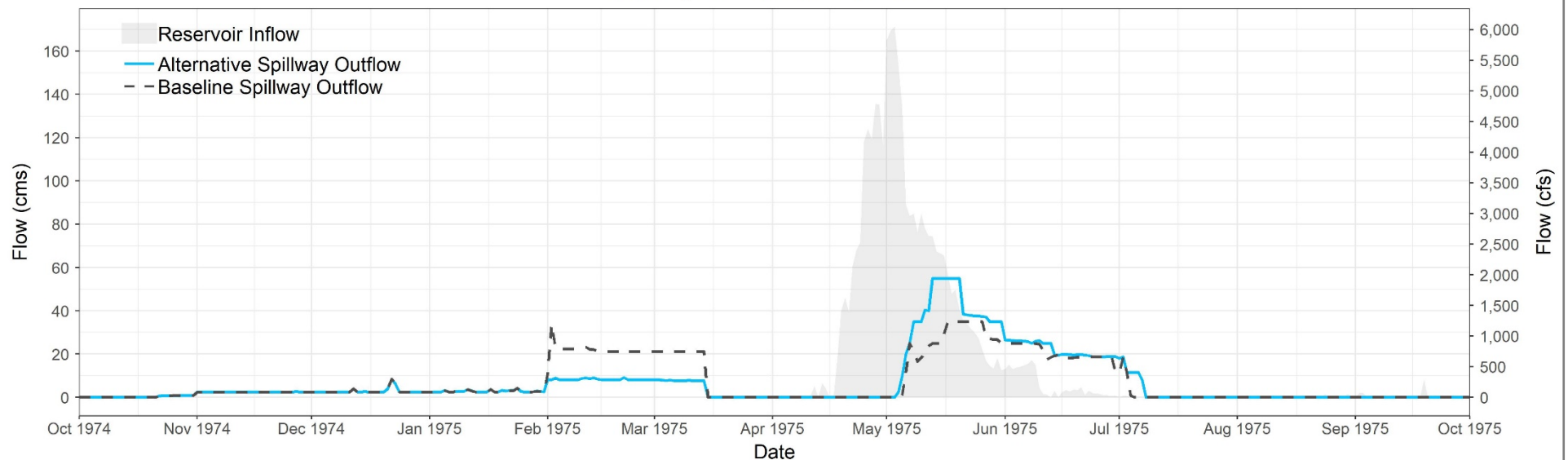
Souris River at Westhope, ND



Rafferty Reservoir - Elevation

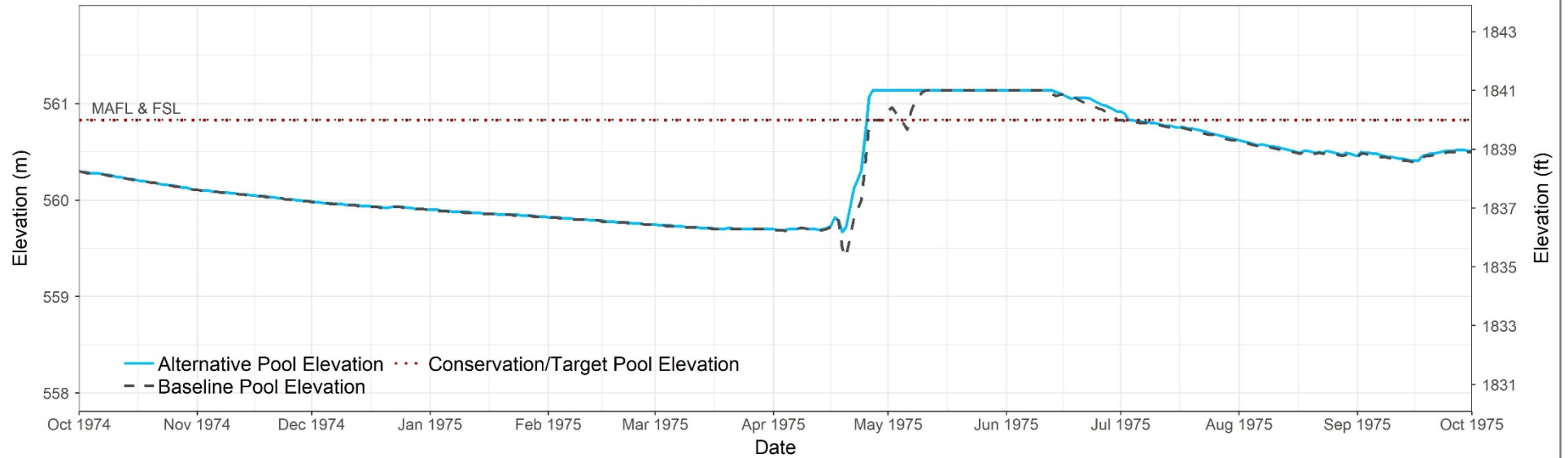


Rafferty Reservoir - Releases

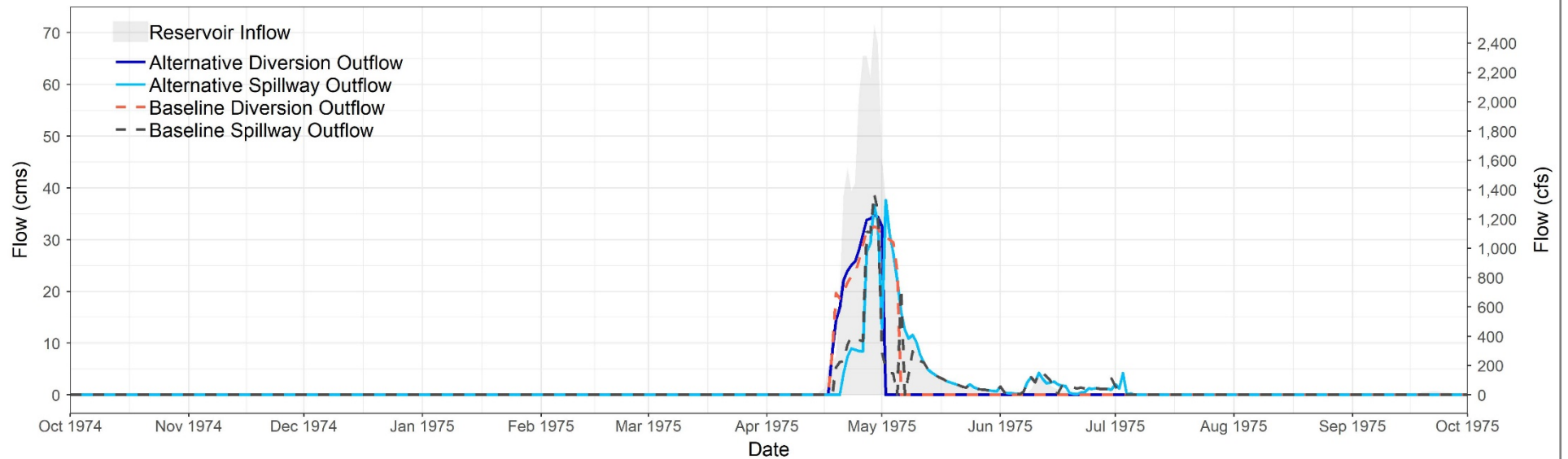


*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level

Boundary Reservoir - Elevation

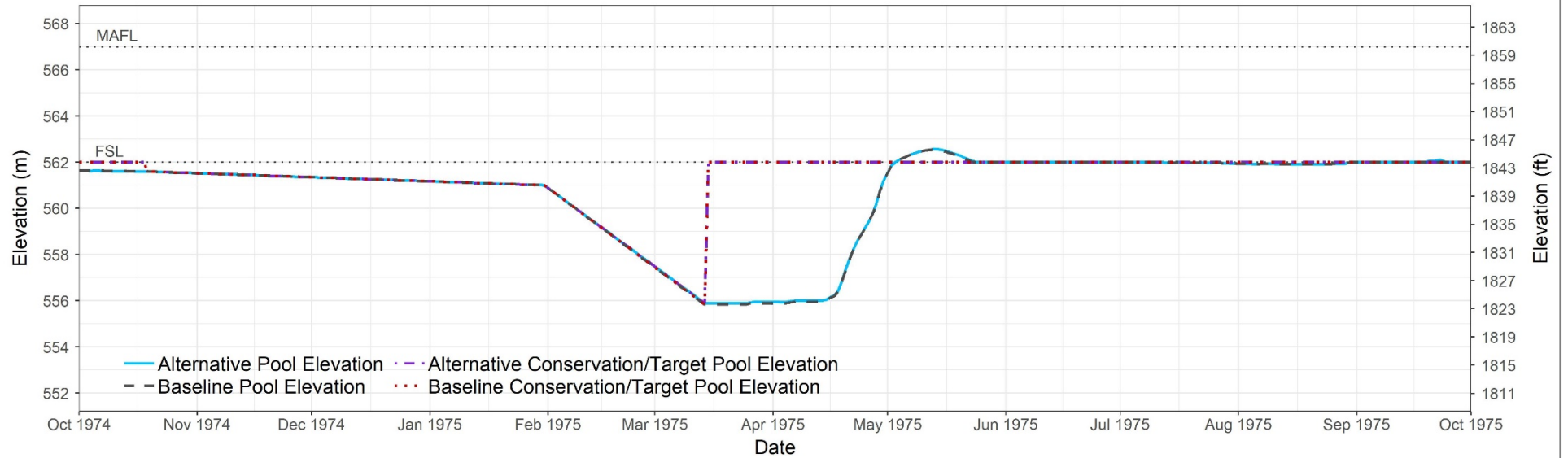


Boundary Reservoir - Releases

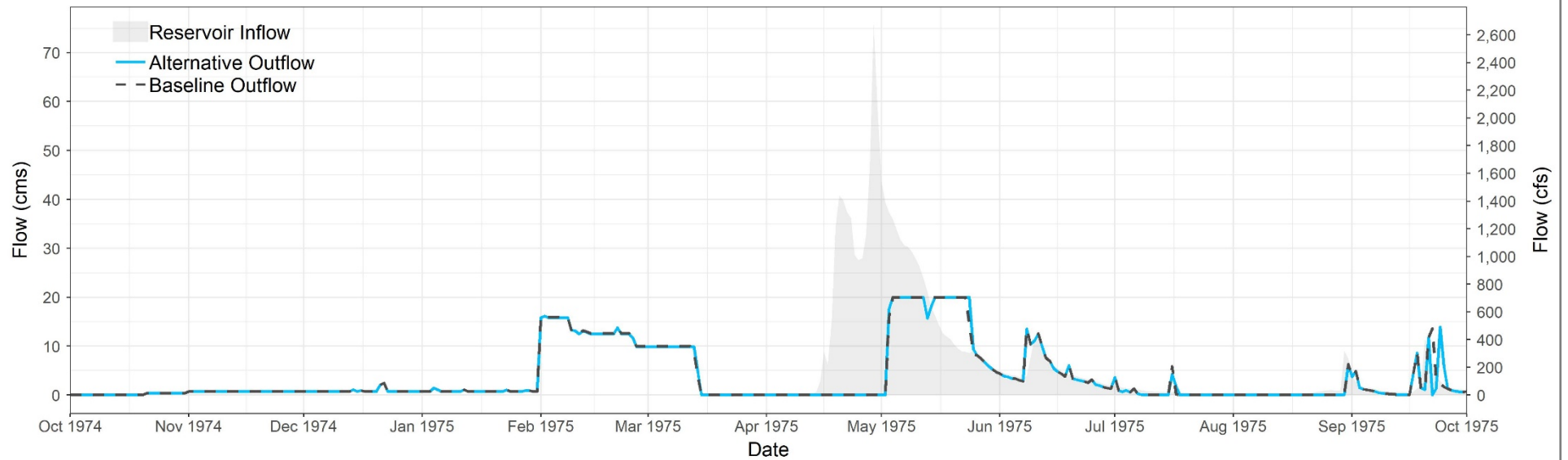


*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level

Grant Devine Reservoir - Elevation

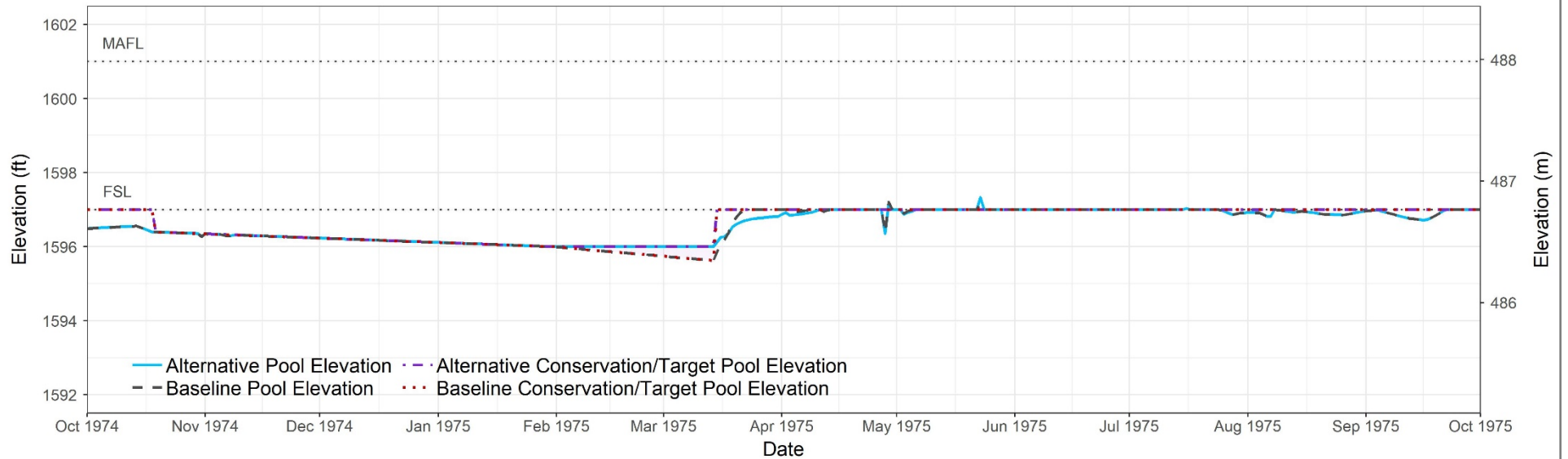


Grant Devine Reservoir - Releases

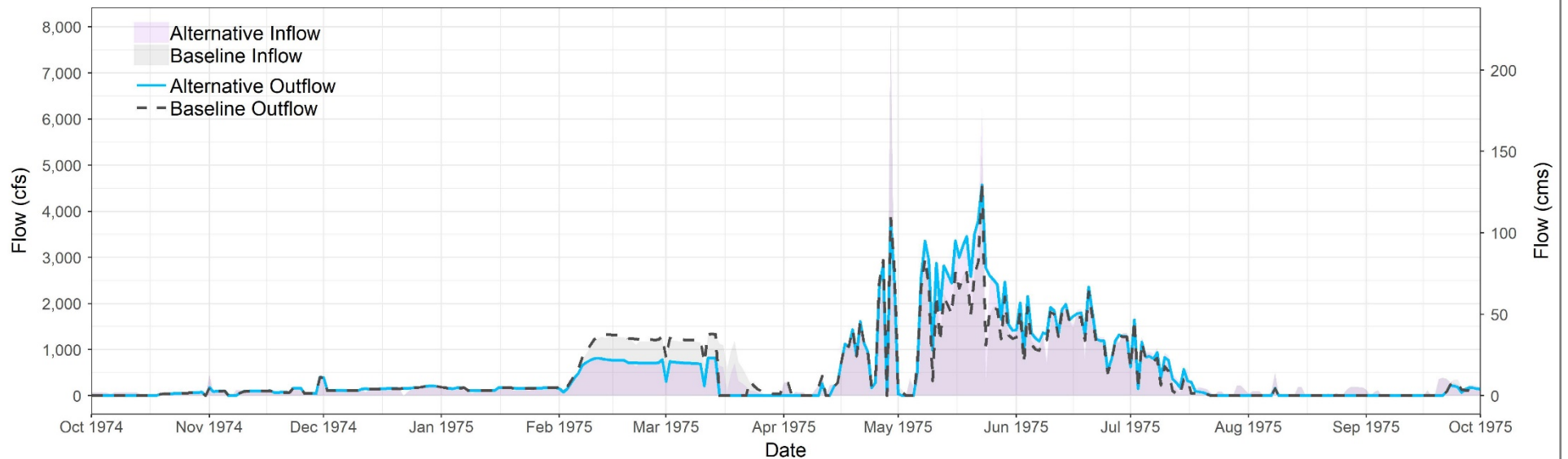


*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level

Lake Darling - Elevation



Lake Darling - Releases



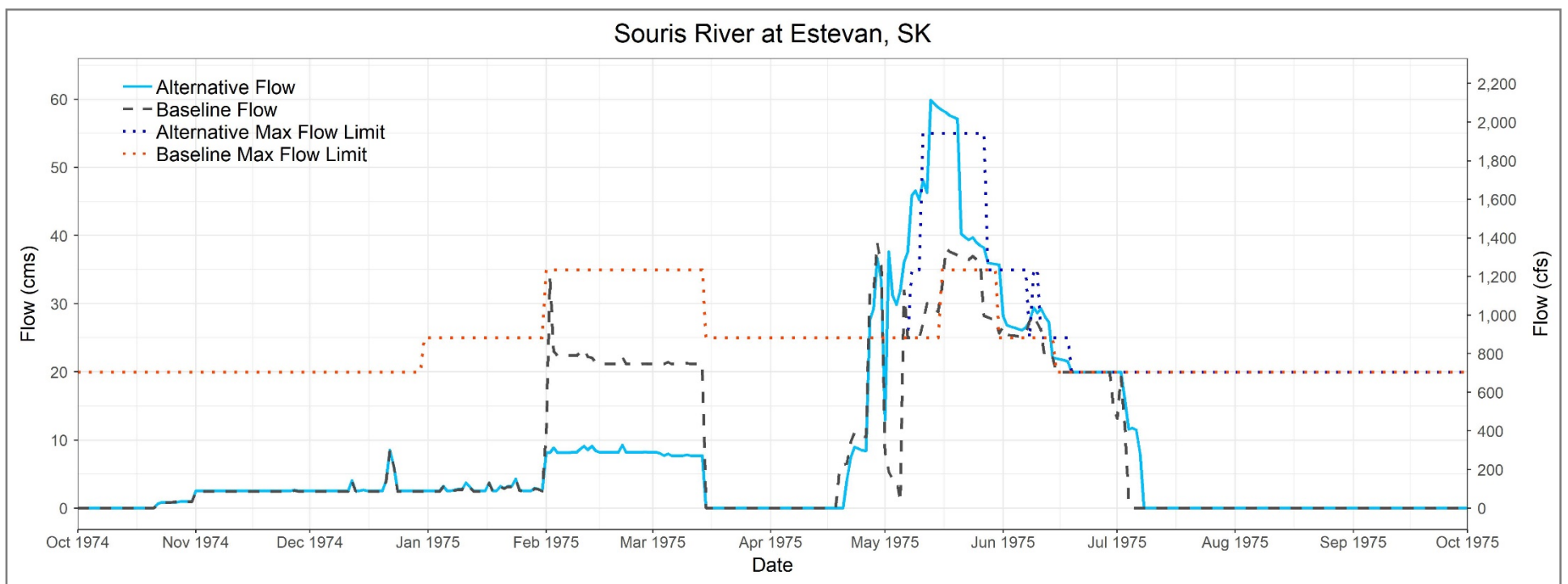
*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level, IDFSL = Inflow Design Flood Supply Level

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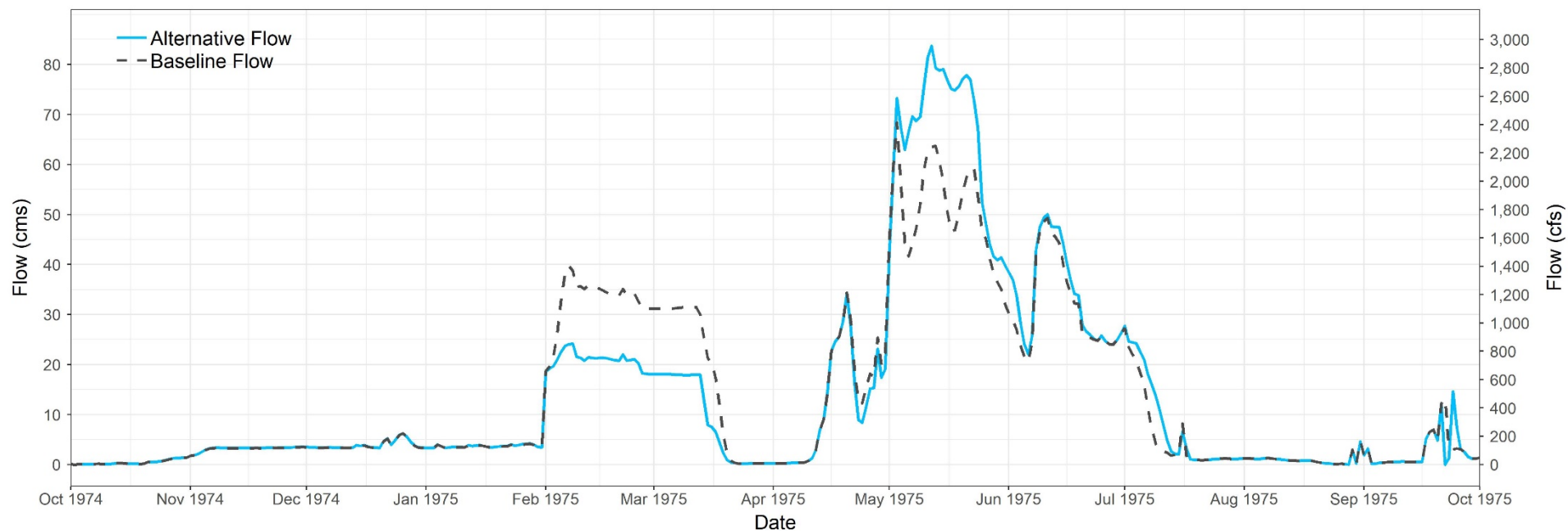
Critical Flow Locations – 1975

Alternative 10cR (Phase 2)

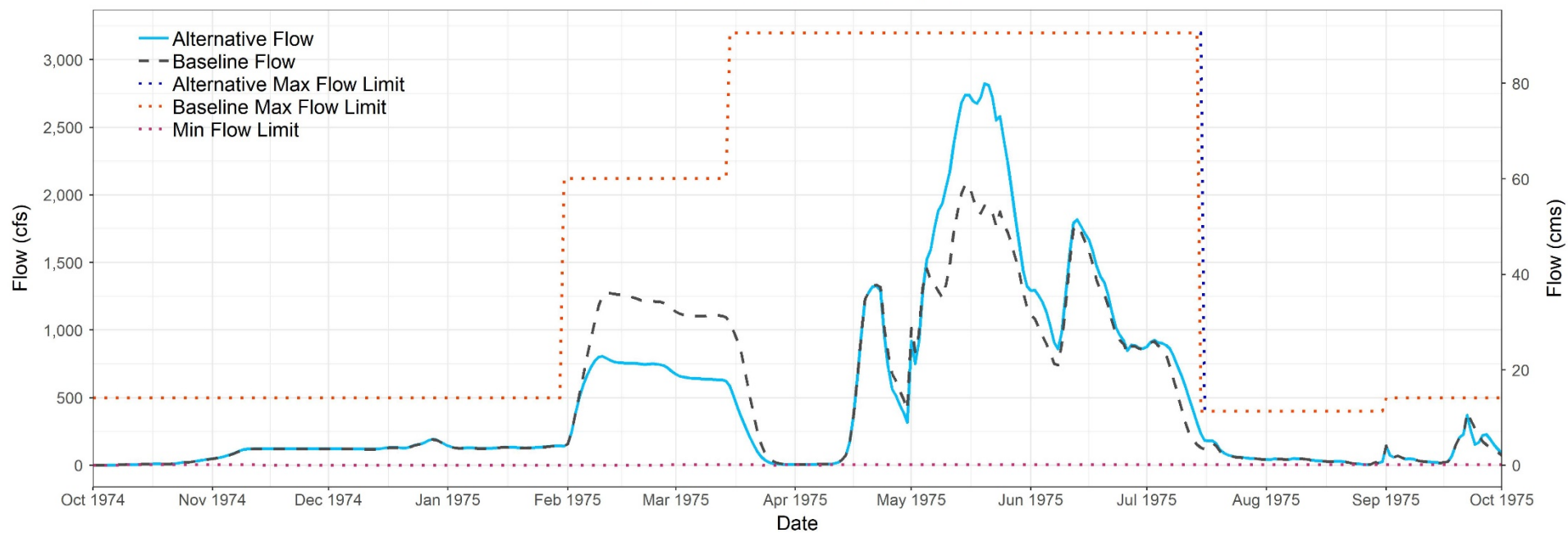
Souris River Plan of Study



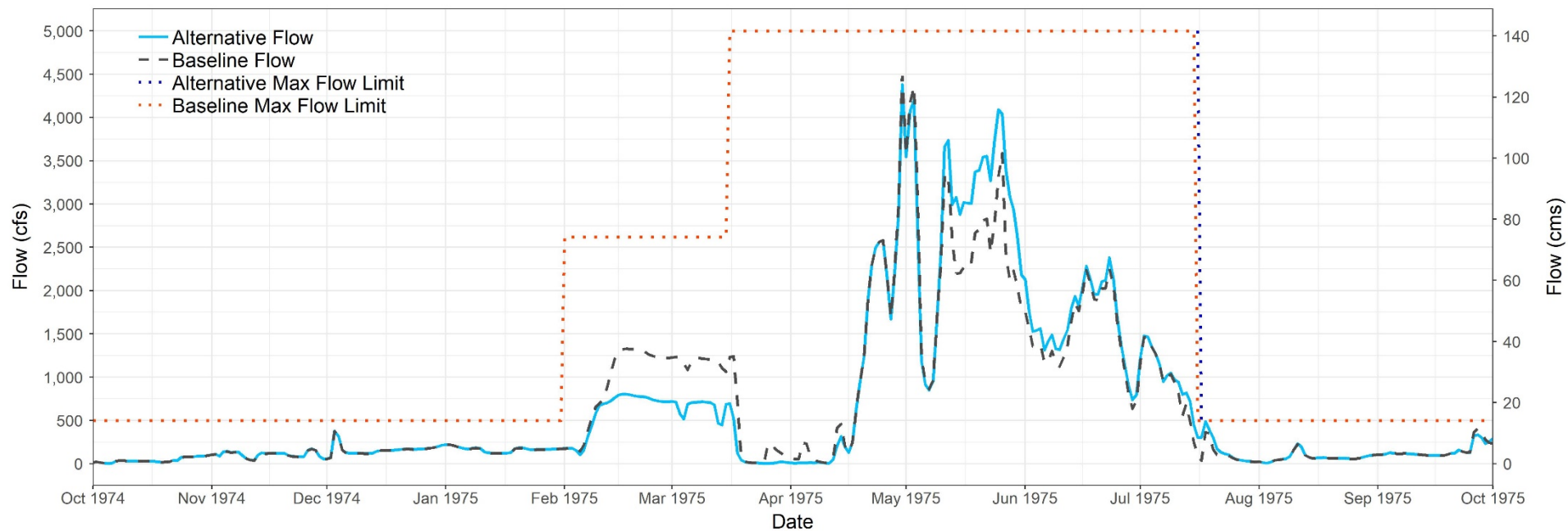
Souris River at Oxbow, SK



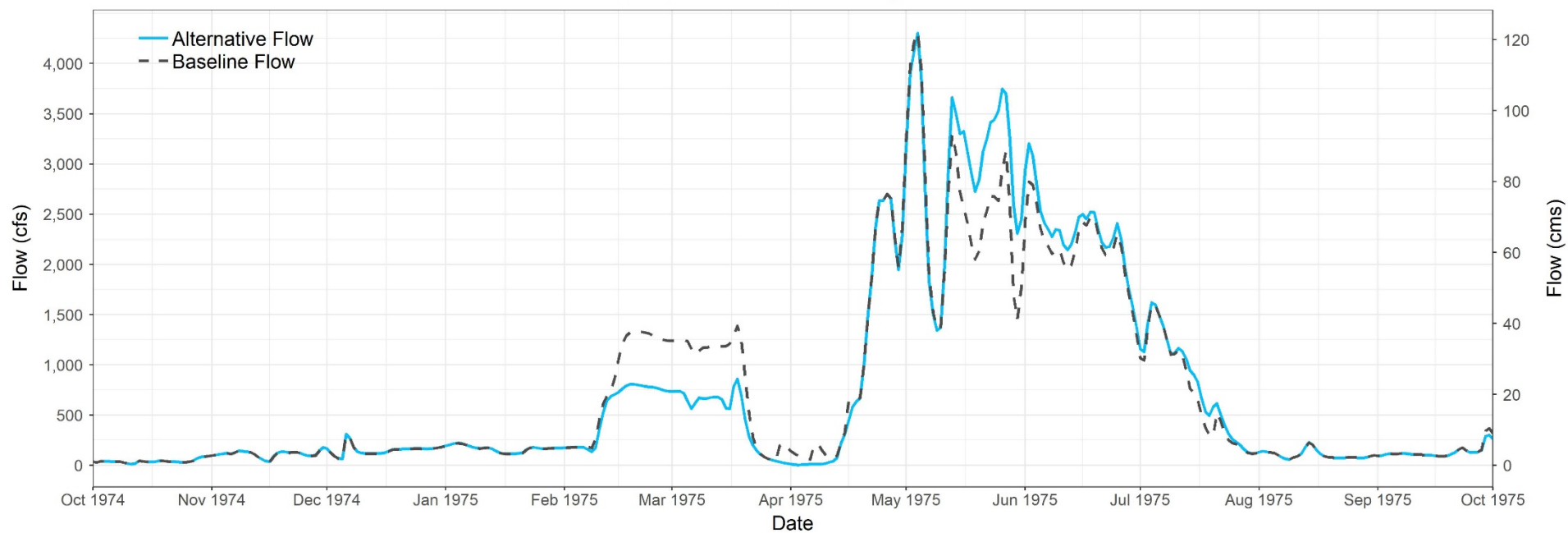
Souris River at Sherwood, ND



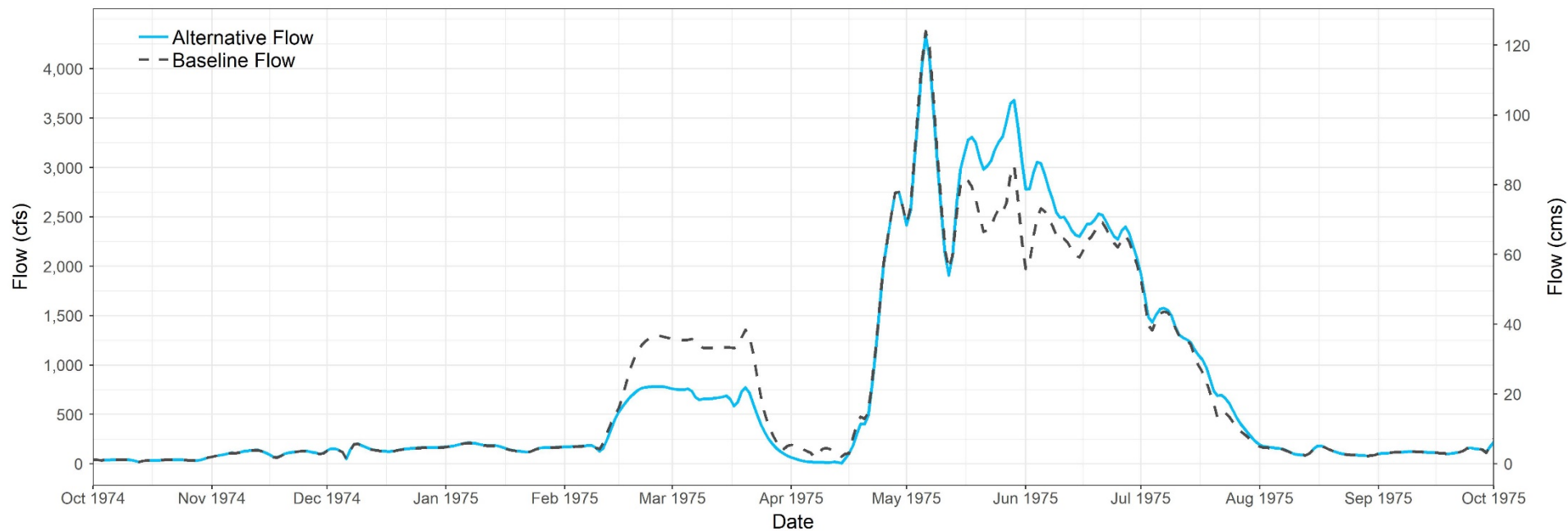
Souris River at Minot, ND - Flow



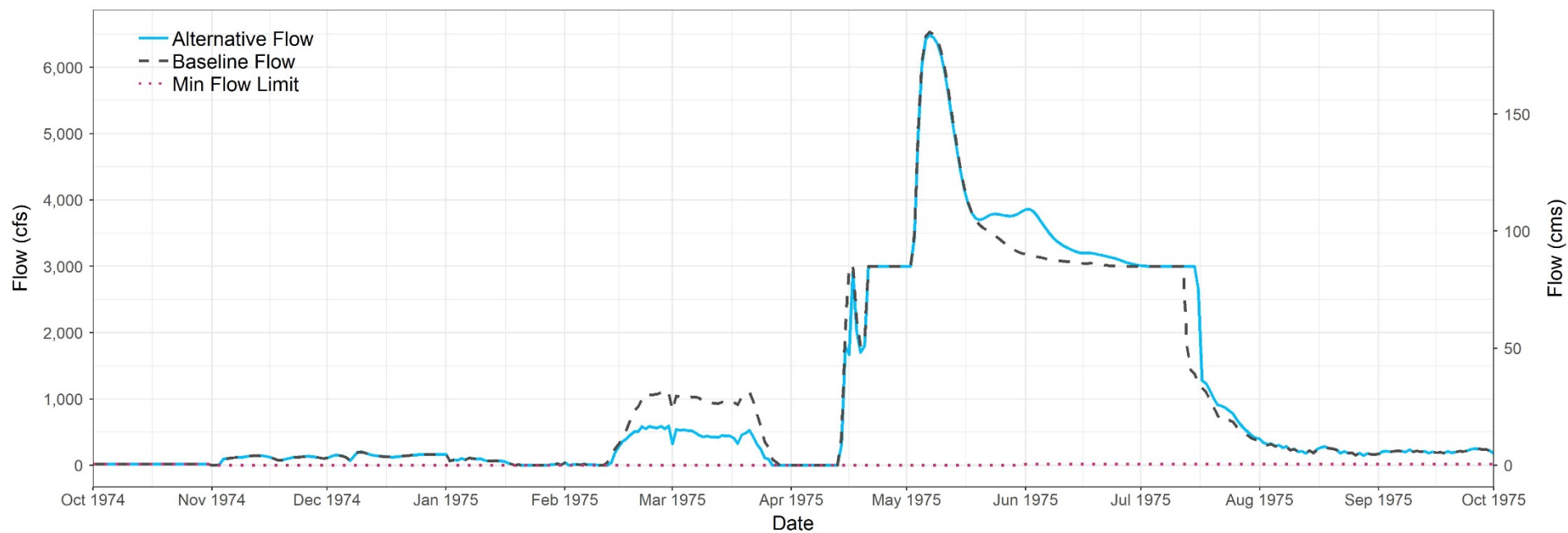
Souris River at Verendrye, ND



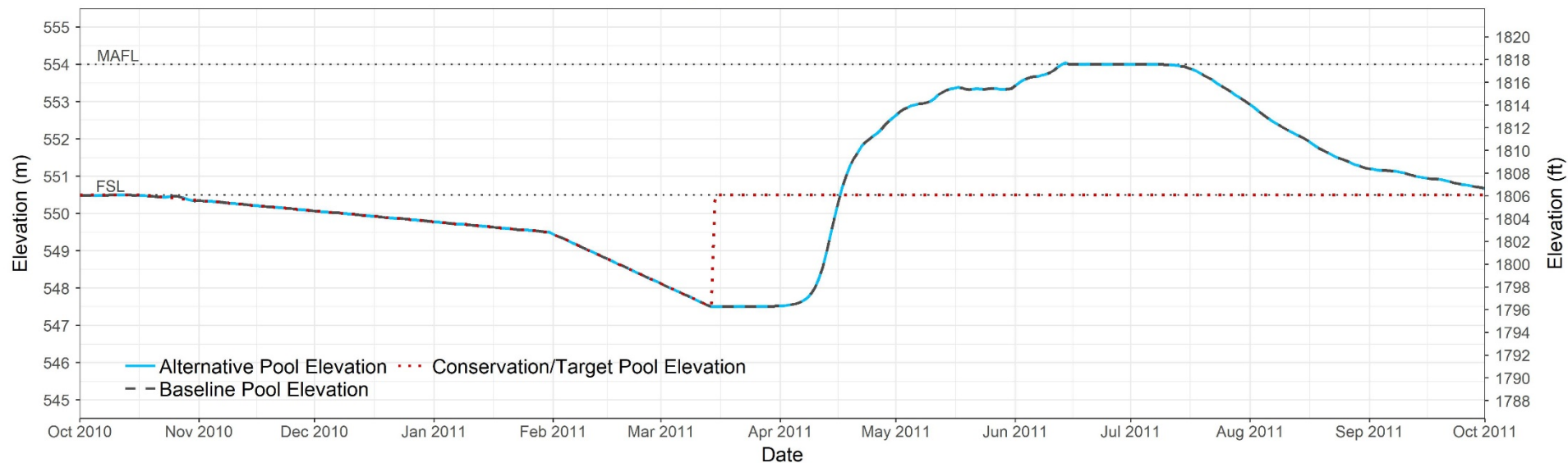
Souris River at Bantry, ND



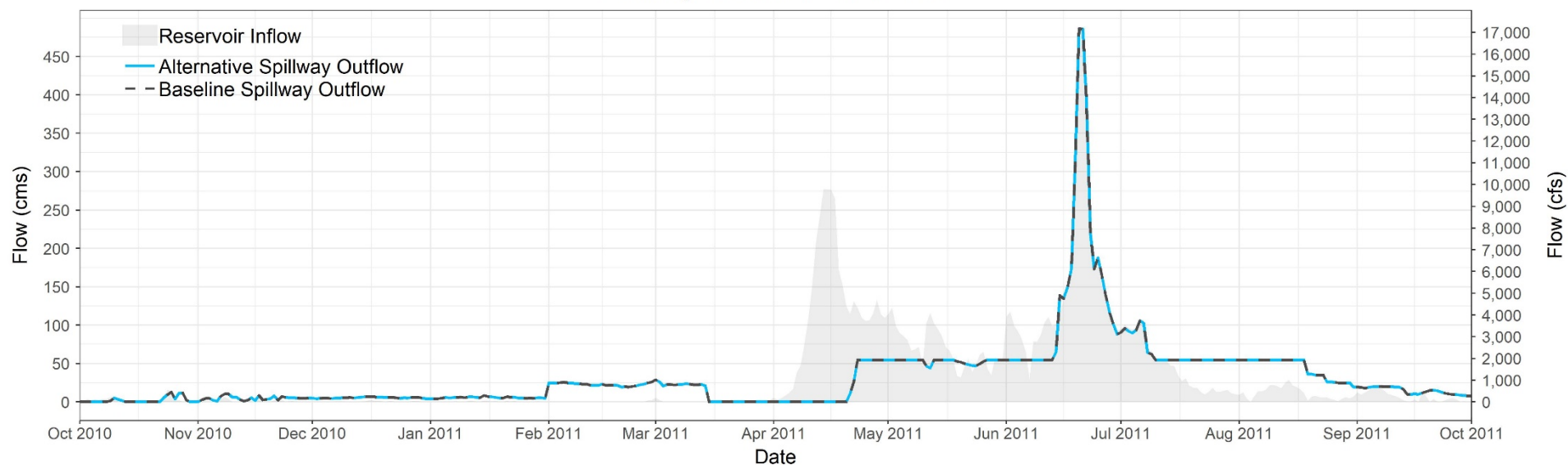
Souris River at Westhope, ND



Rafferty Reservoir - Elevation

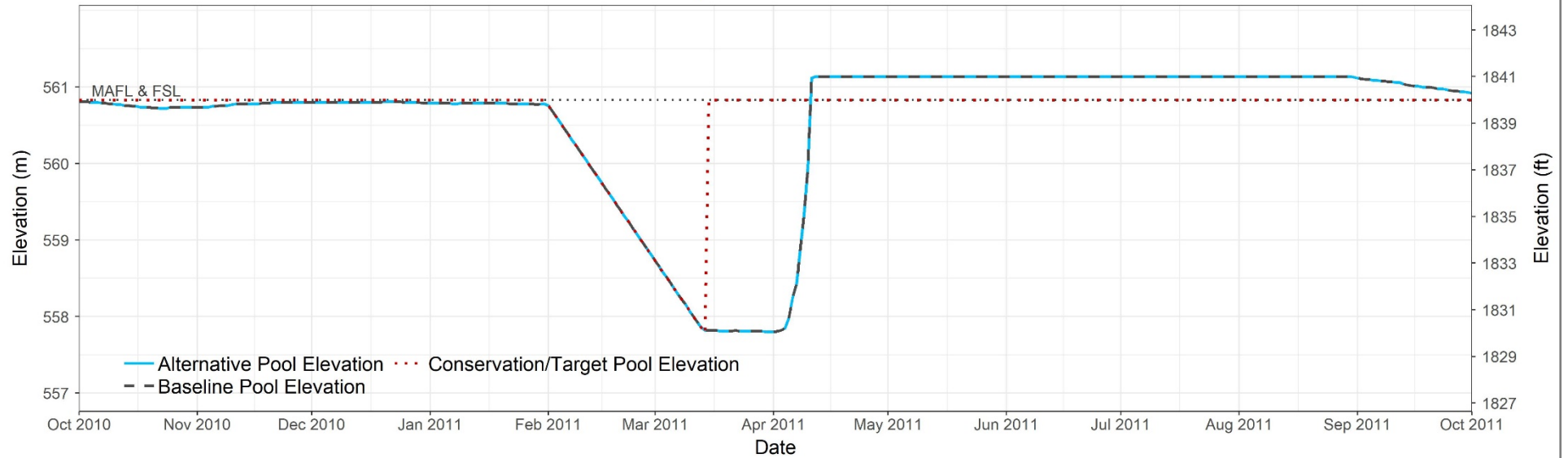


Rafferty Reservoir - Releases

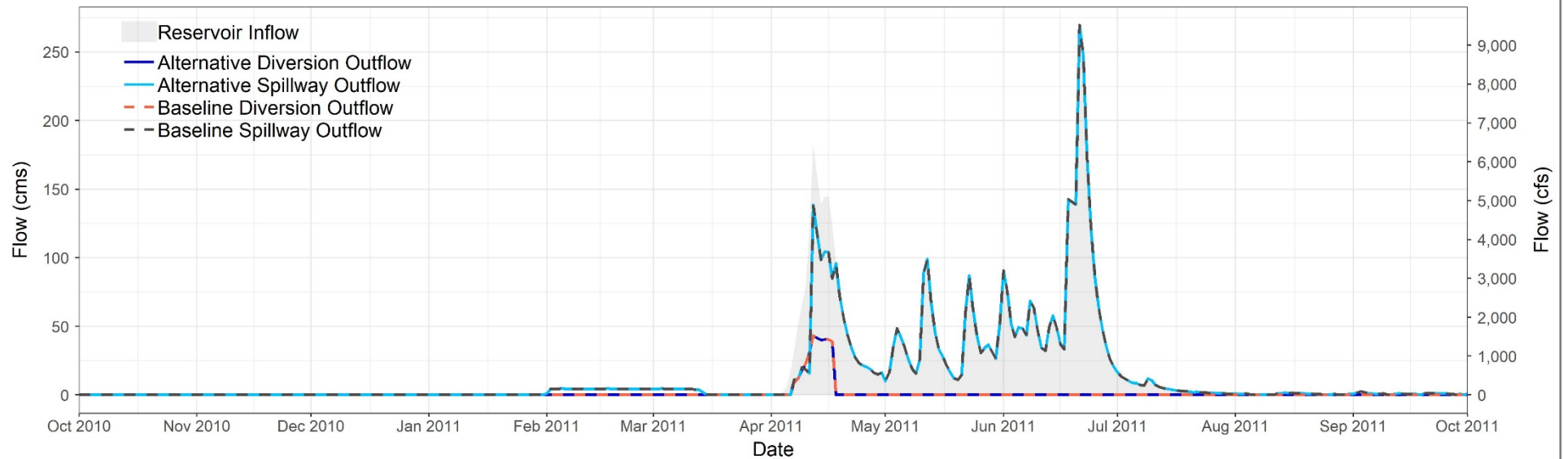


*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level

Boundary Reservoir - Elevation

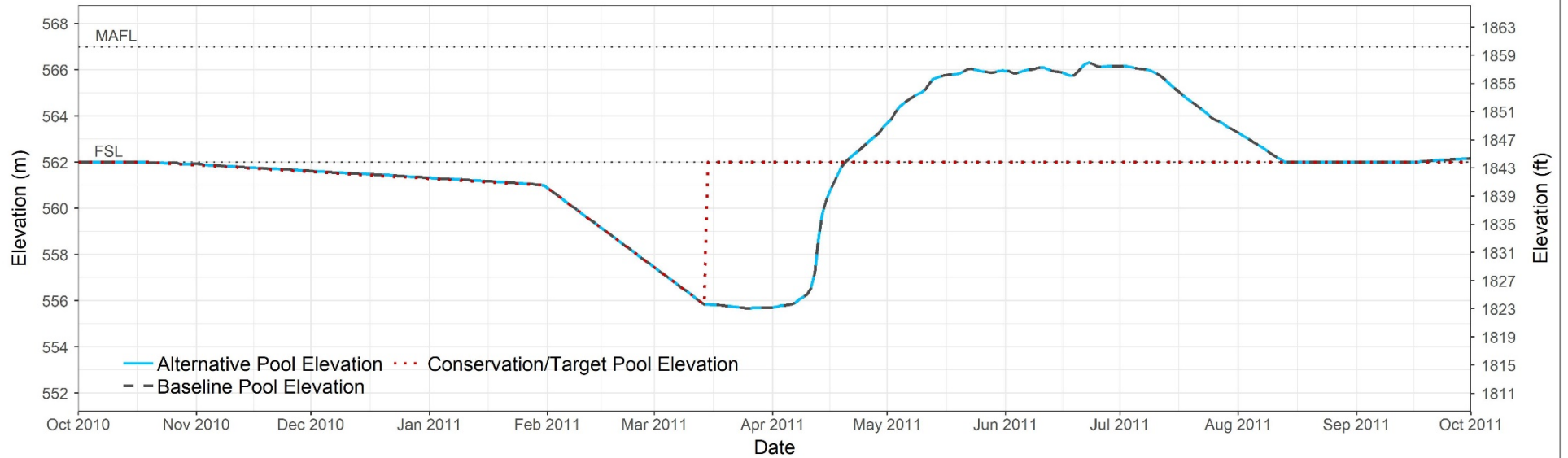


Boundary Reservoir - Releases

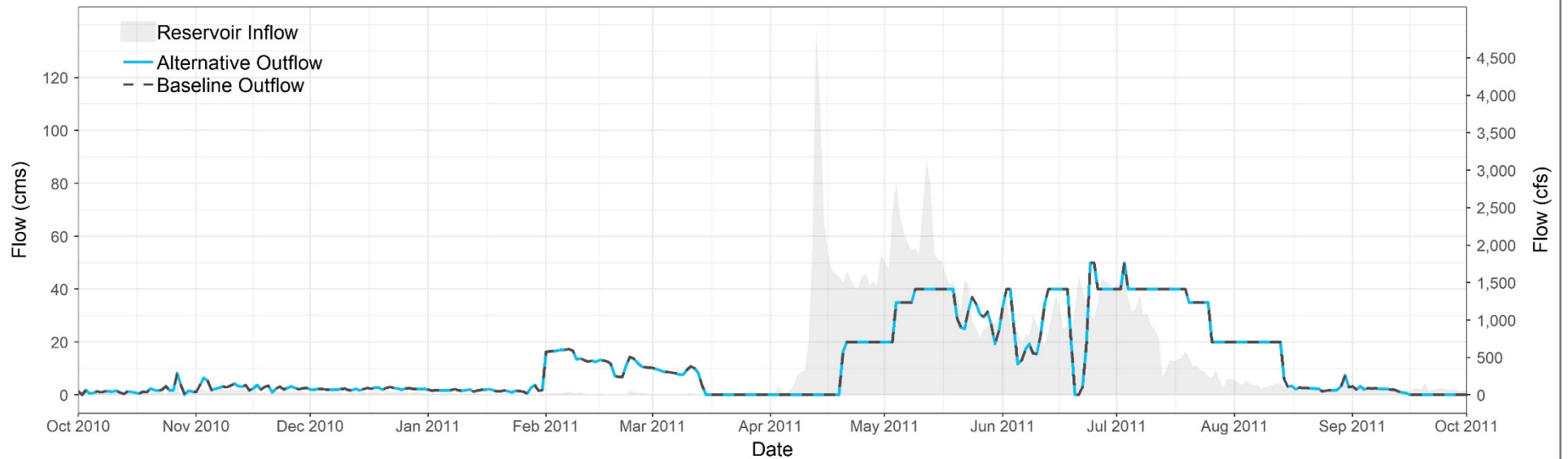


*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level

Grant Devine Reservoir - Elevation

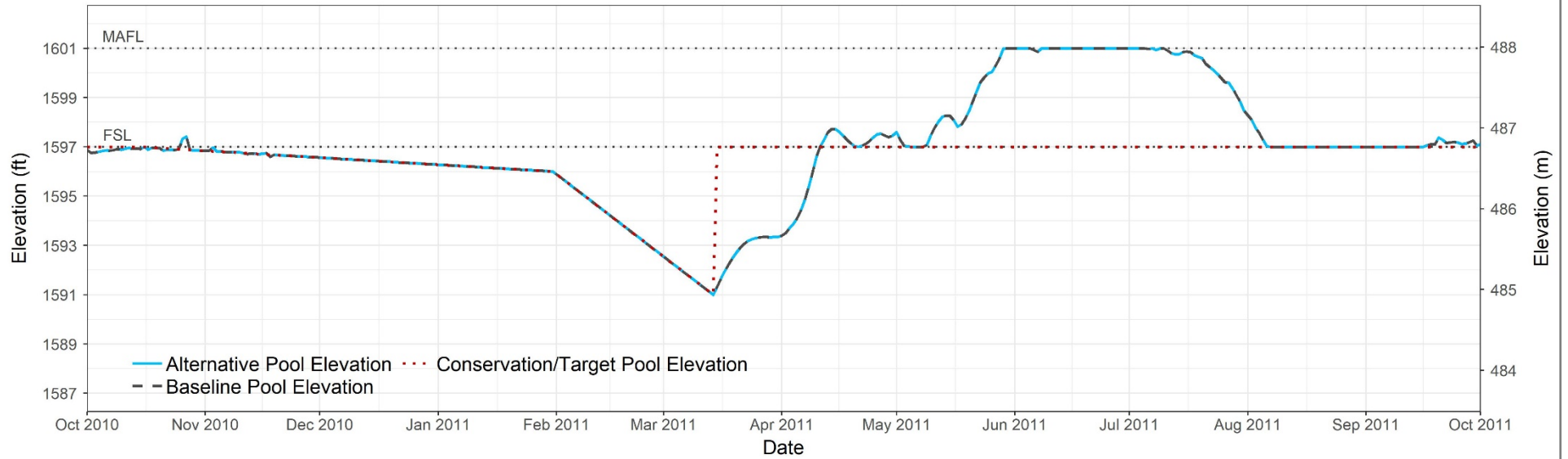


Grant Devine Reservoir - Releases

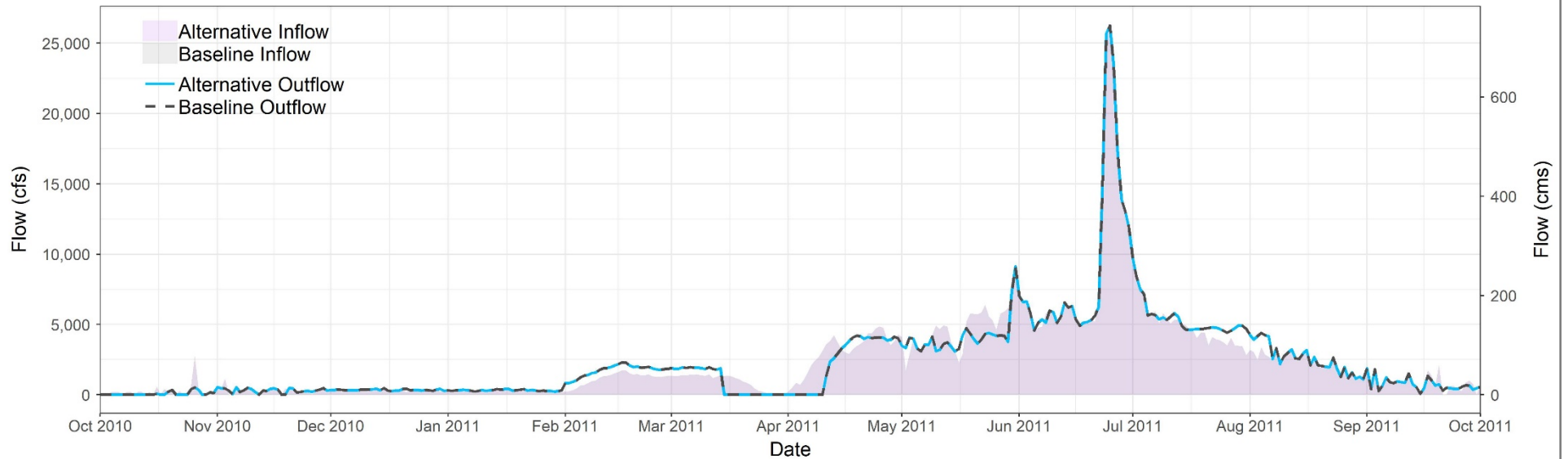


*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level

Lake Darling - Elevation



Lake Darling - Releases



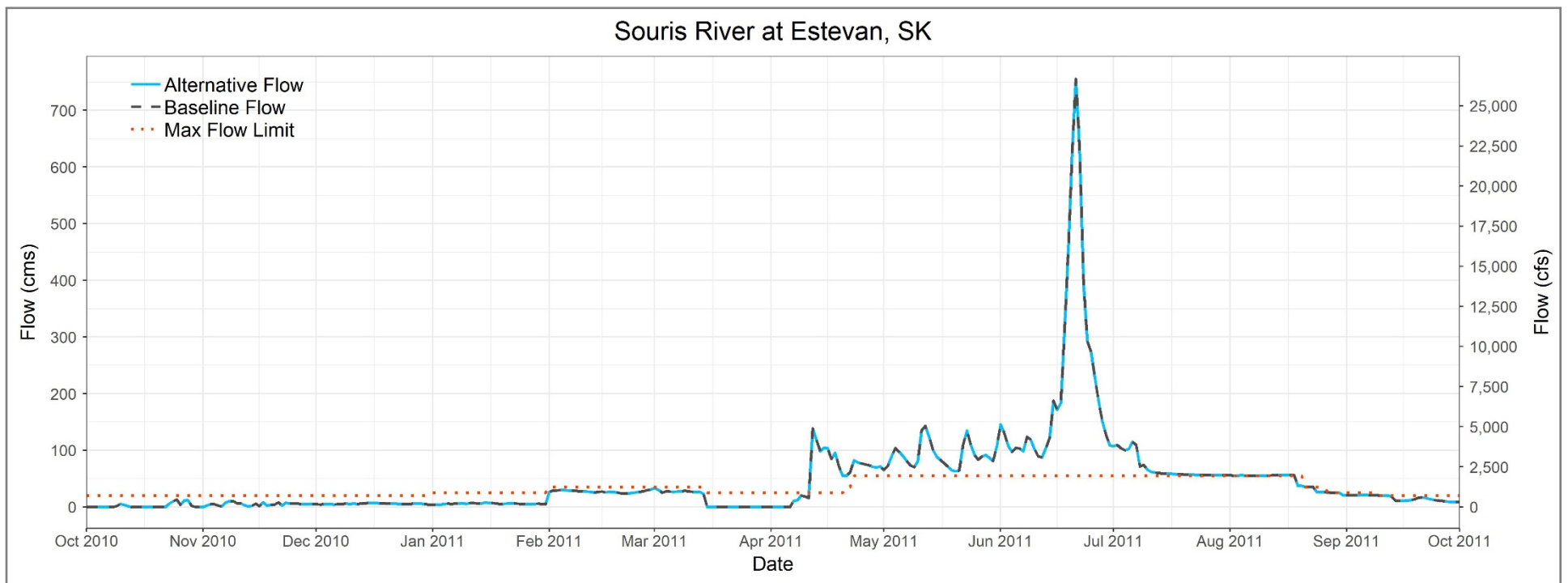
*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level, IDFSL = Inflow Design Flood Supply Level

Plate 51

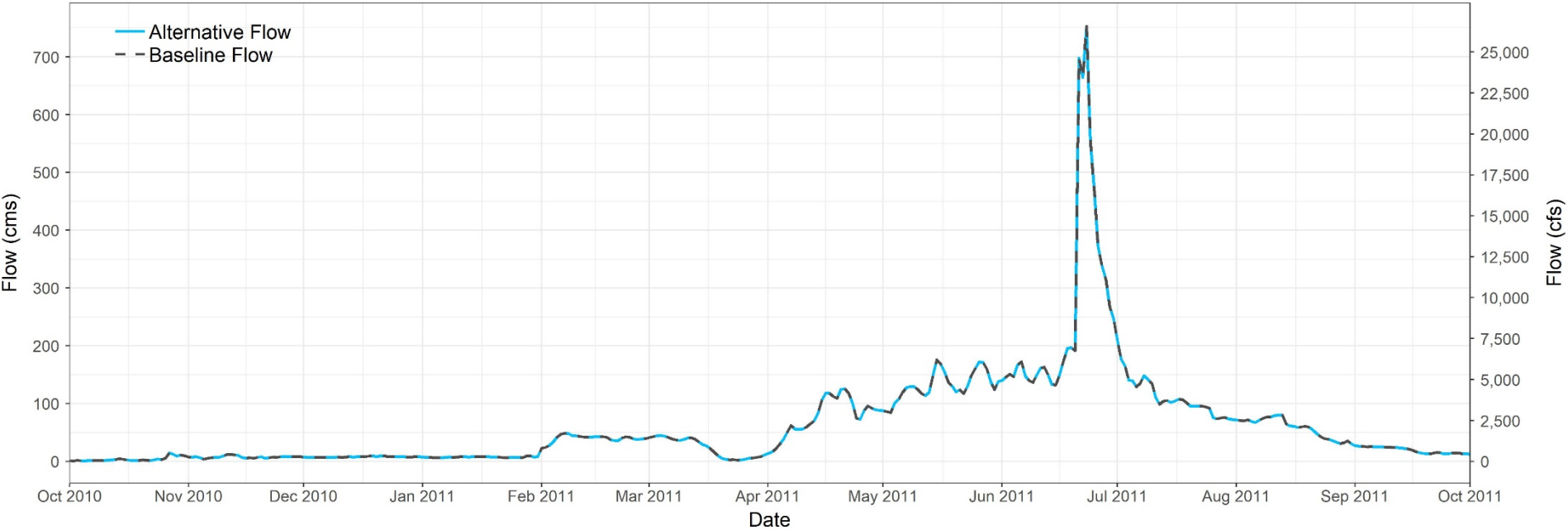
Critical Flow Locations – 2011

Alternative 10cR (Phase 2)

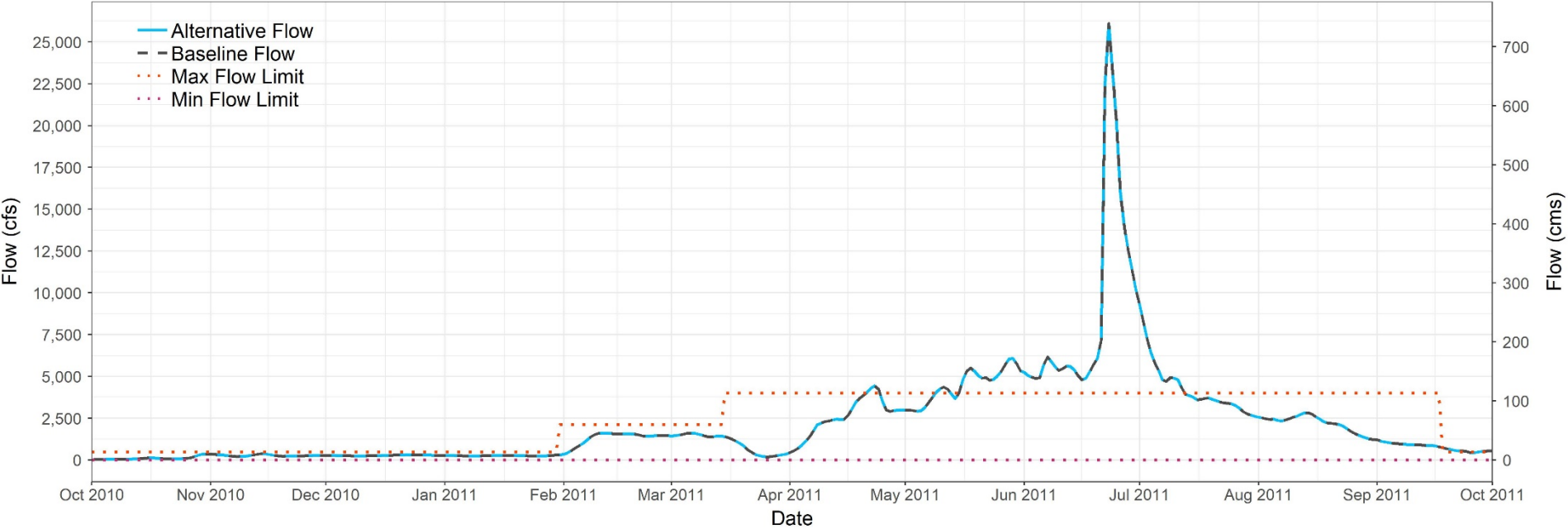
Souris River Plan of Study



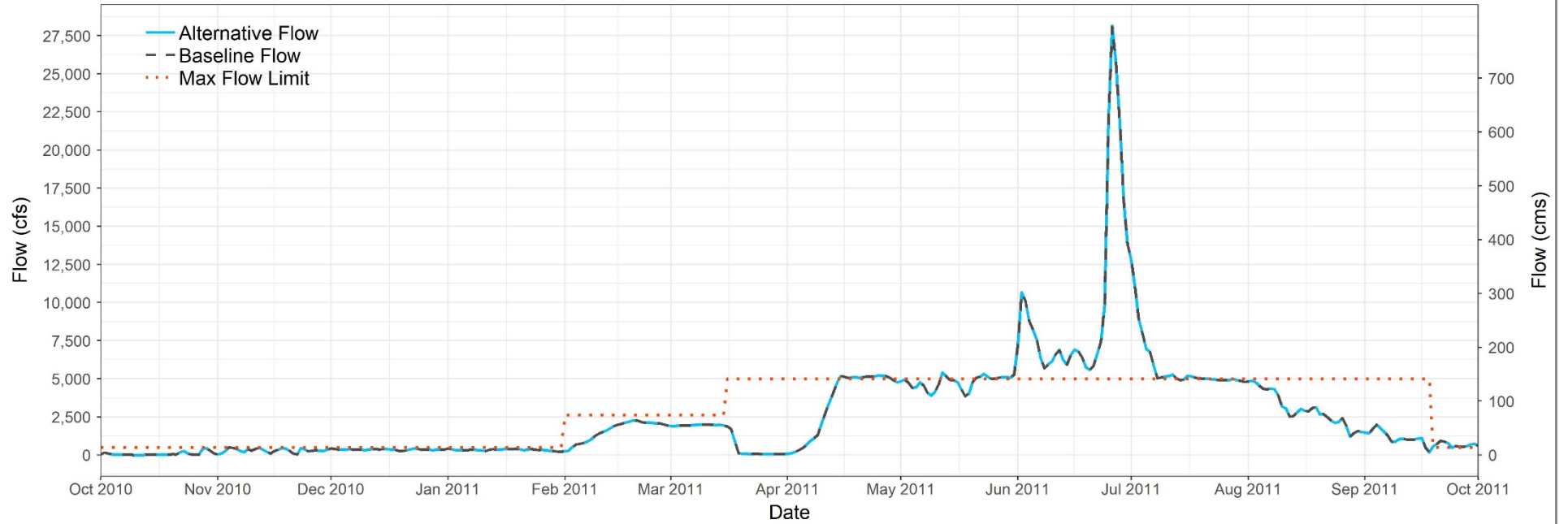
Souris River at Oxbow, SK



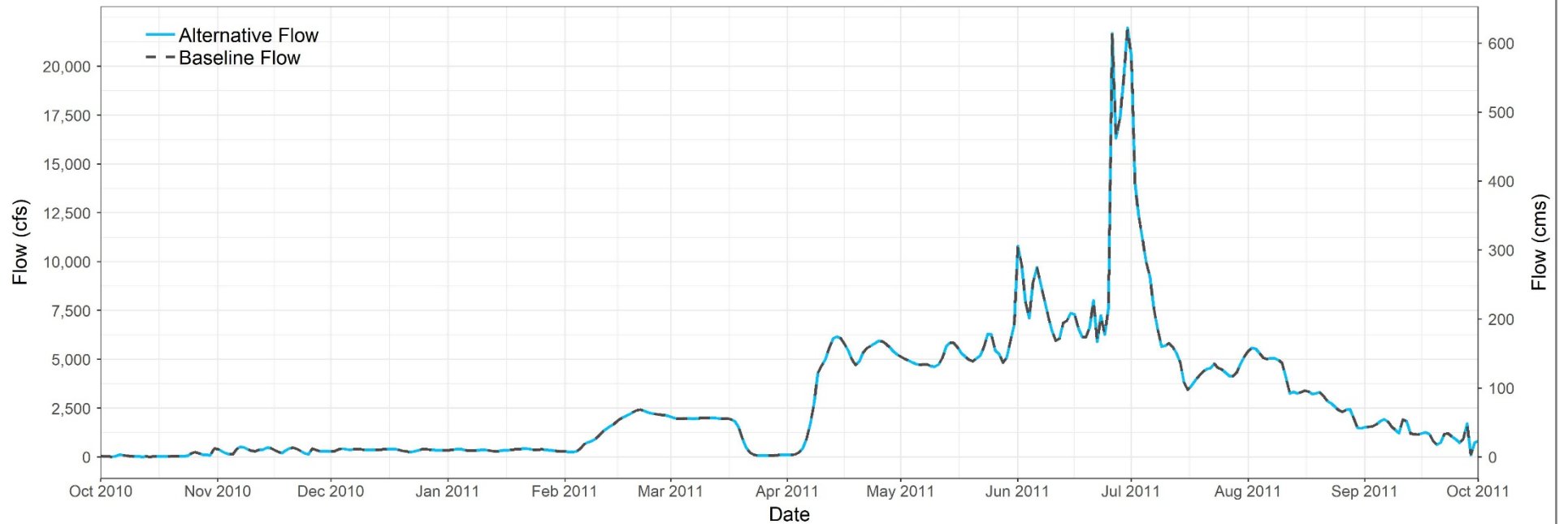
Souris River at Sherwood, ND



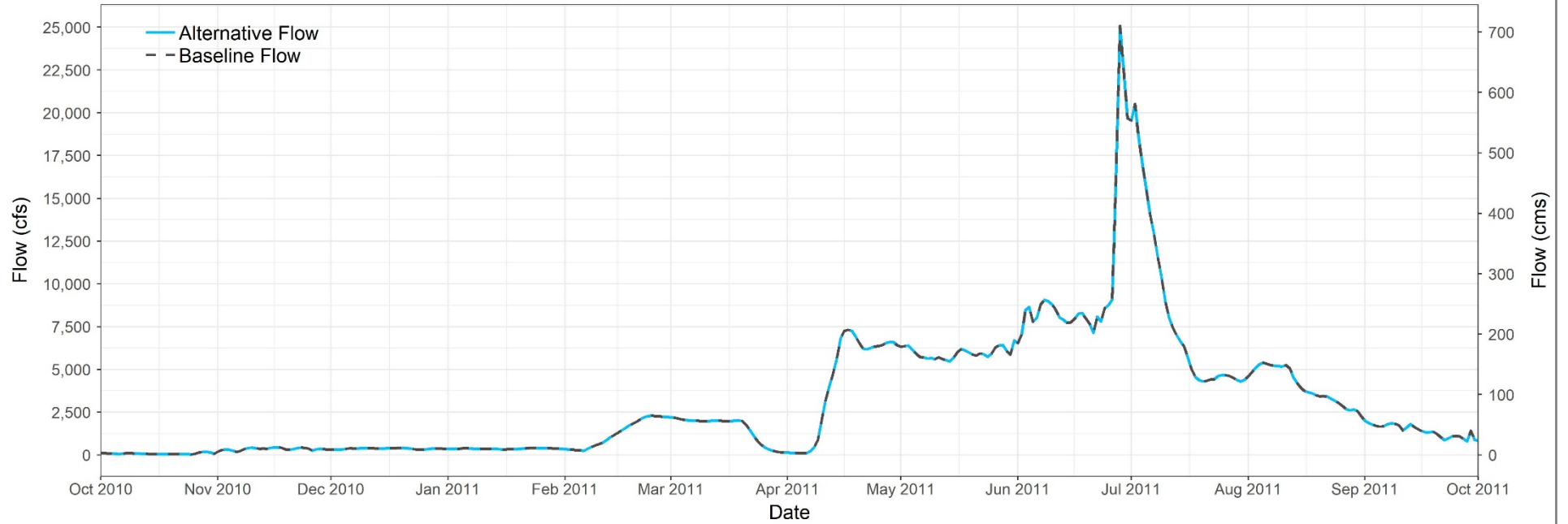
Souris River at Minot, ND - Flow



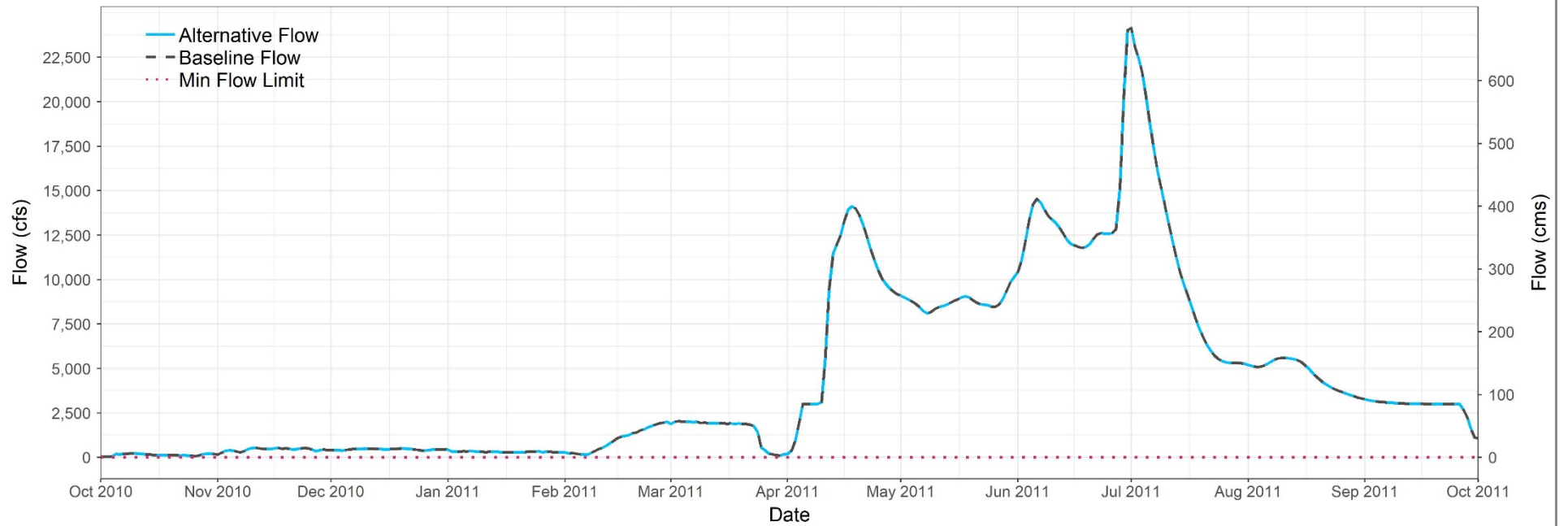
Souris River at Verendrye, ND



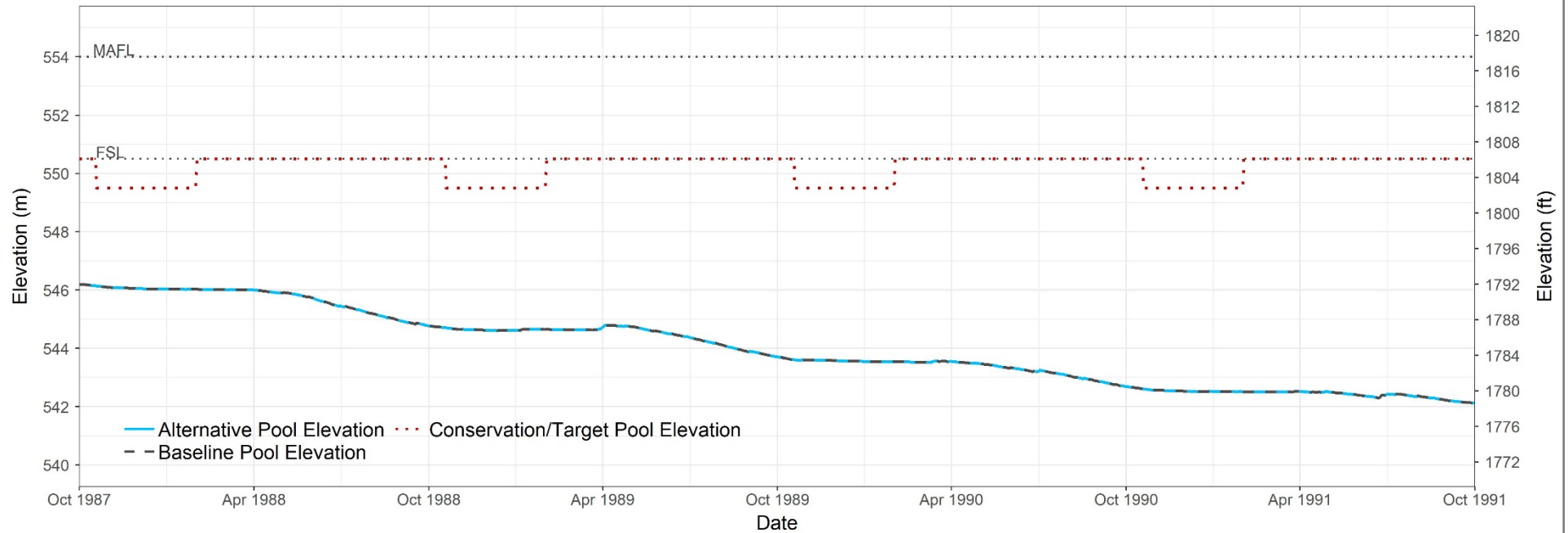
Souris River at Bantry, ND



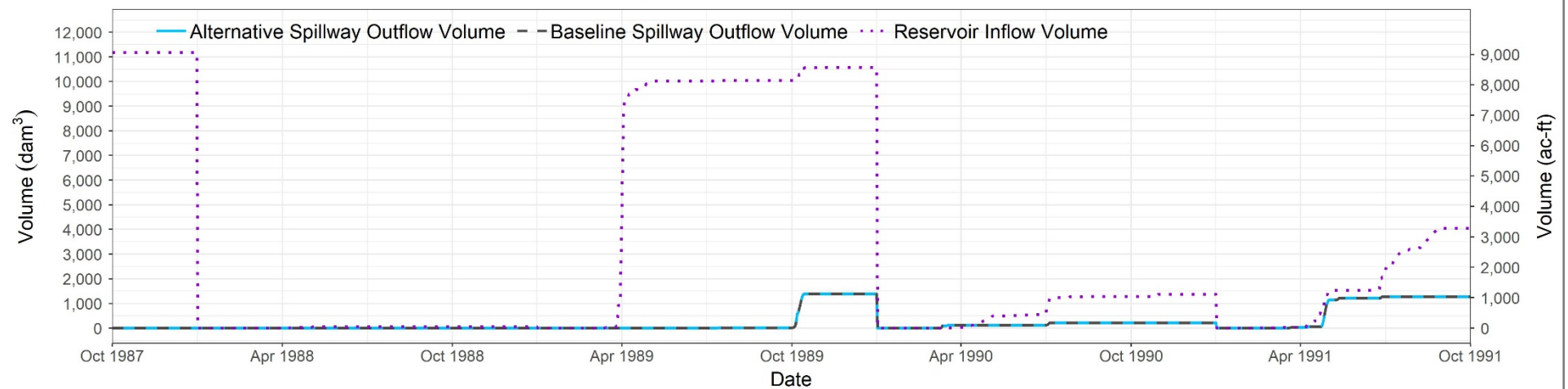
Souris River at Westhope, ND



Rafferty Reservoir - Elevation

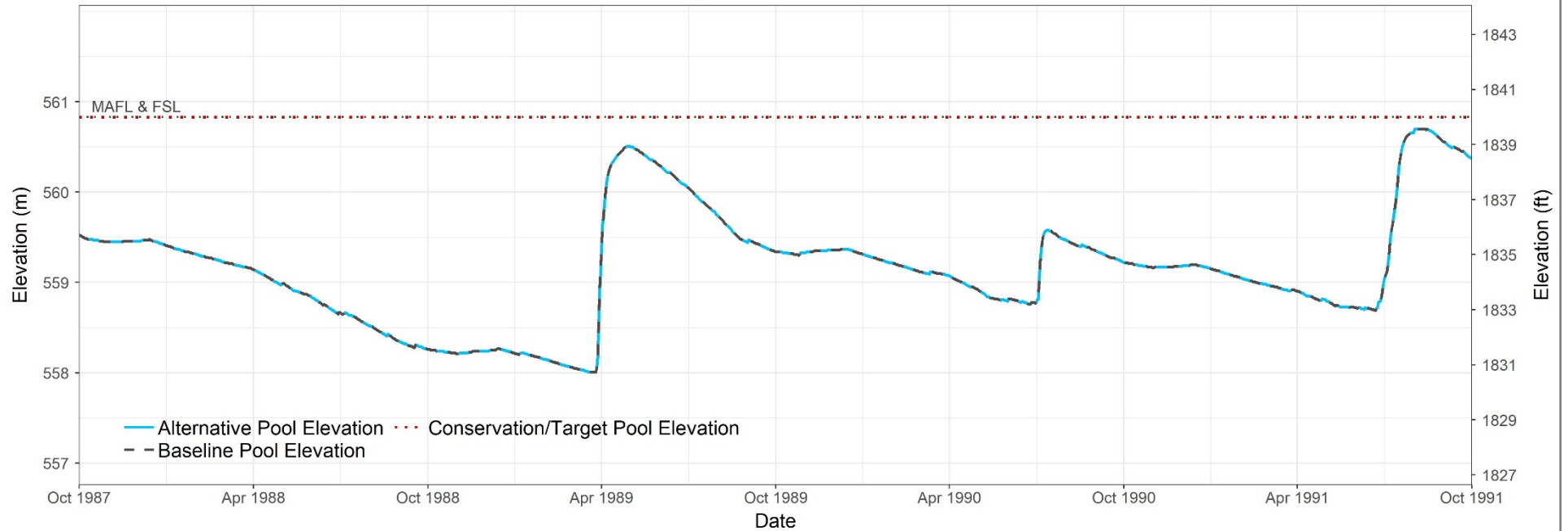


Rafferty Reservoir - Cumulative Volume

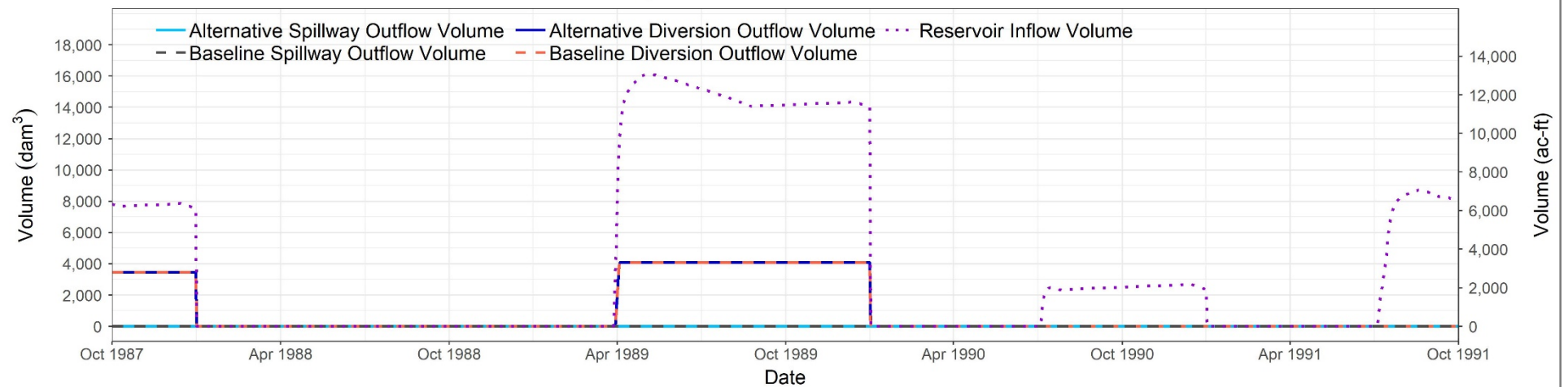


*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level

Boundary Reservoir - Elevation

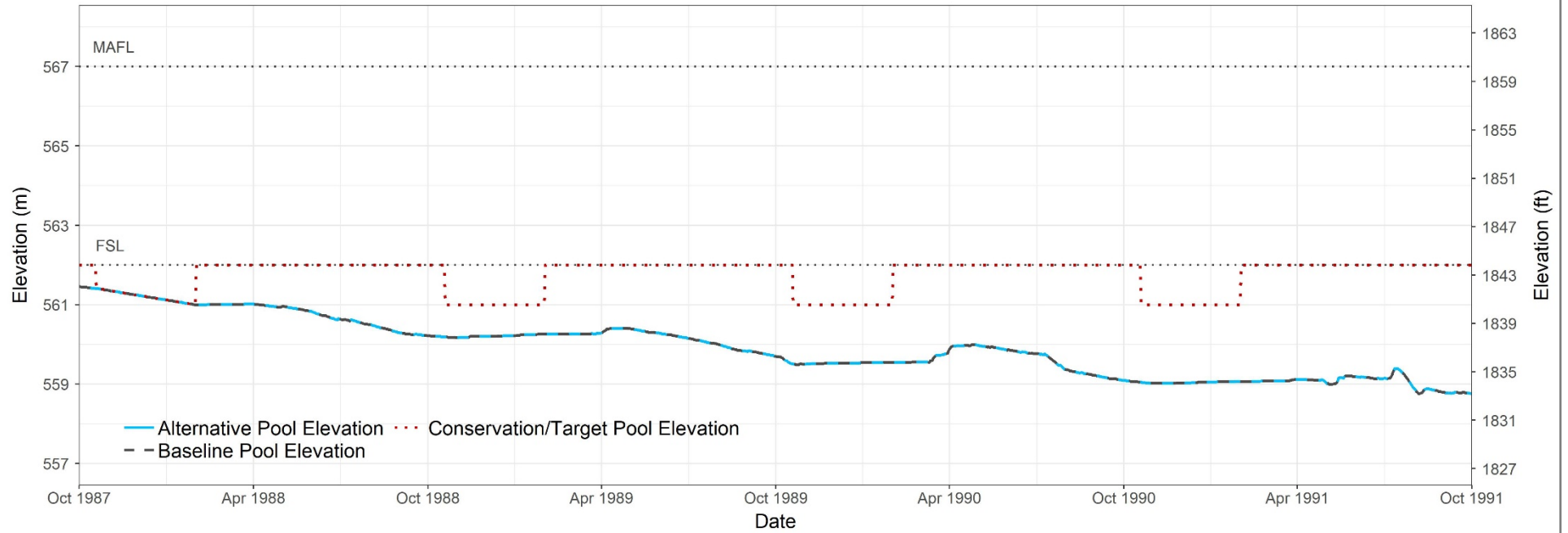


Boundary Reservoir - Cumulative Volume

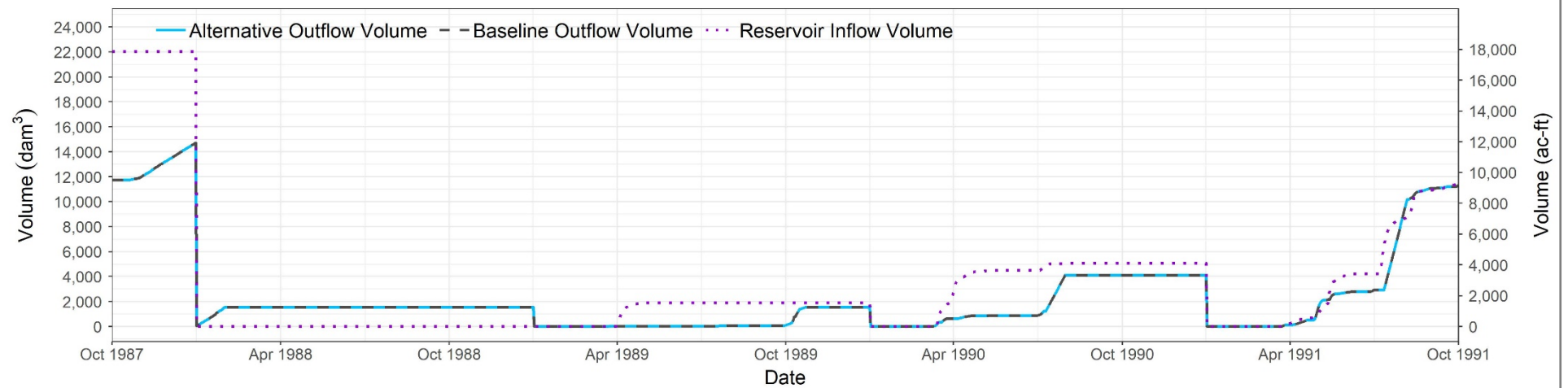


*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level

Grant Devine Reservoir - Elevation

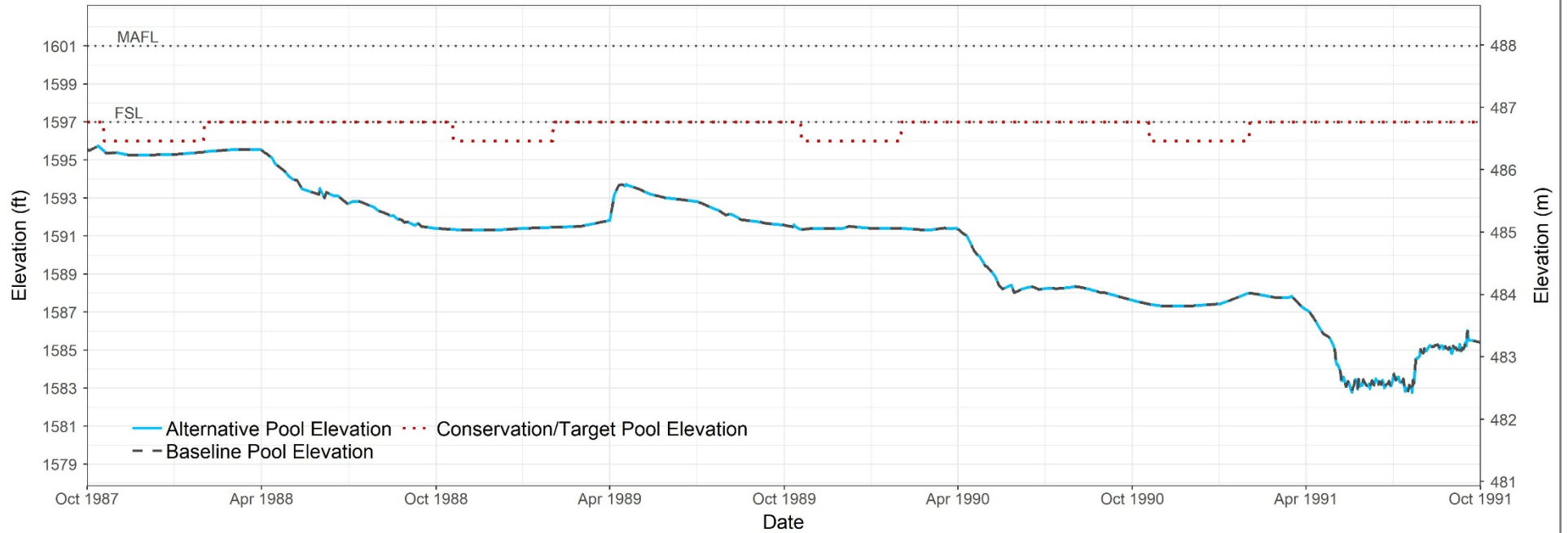


Grant Devine Reservoir - Cumulative Volume

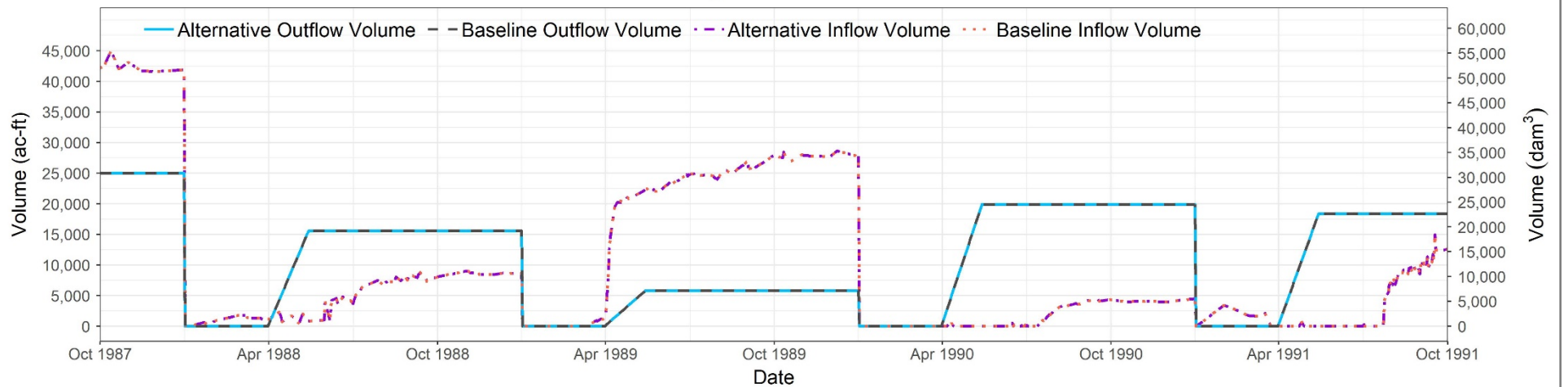


*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level

Lake Darling - Elevation



Lake Darling - Cumulative Volume



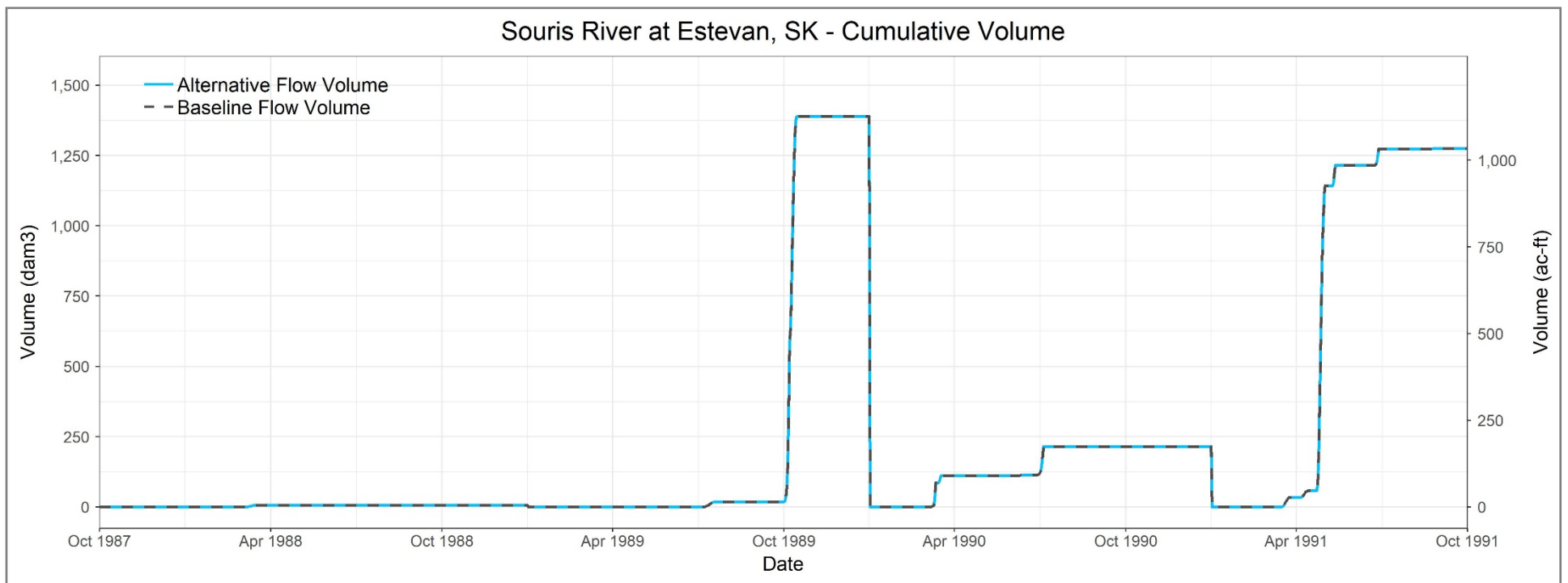
*MAFL = Maximum Allowable Flood Level, FSL = Full Supply Level, IDFSL = Inflow Design Flood Supply Level

Plate 53

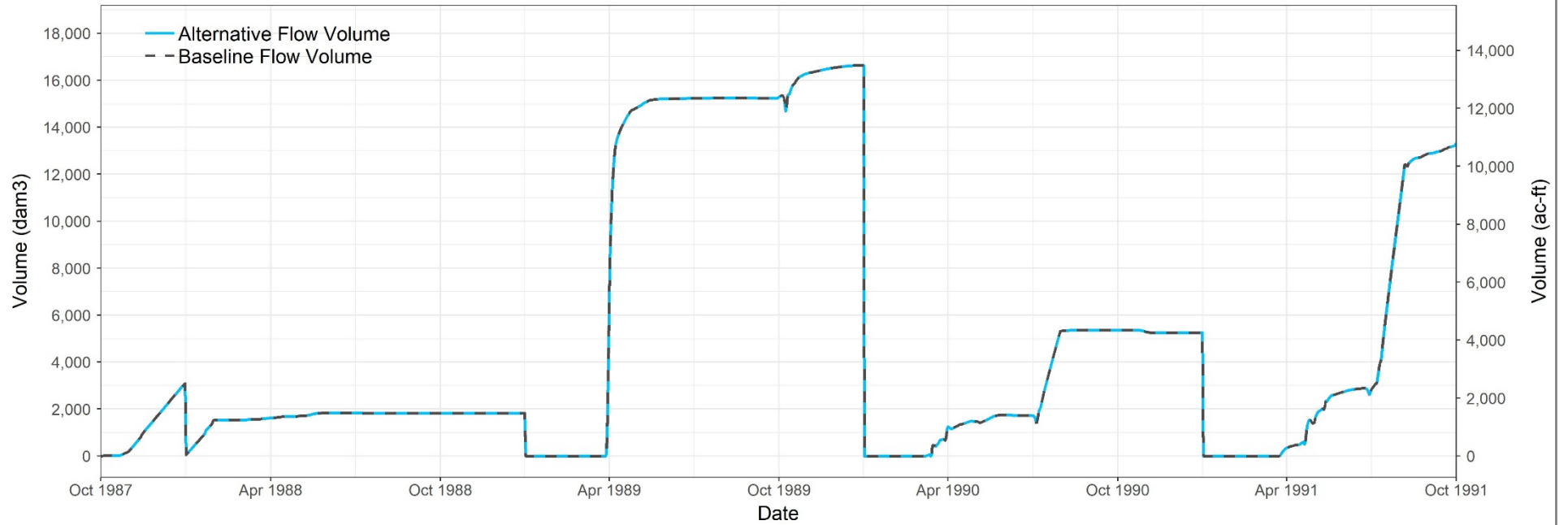
Critical Flow Locations – 1988-1991

Alternative 10cR (Phase 2)

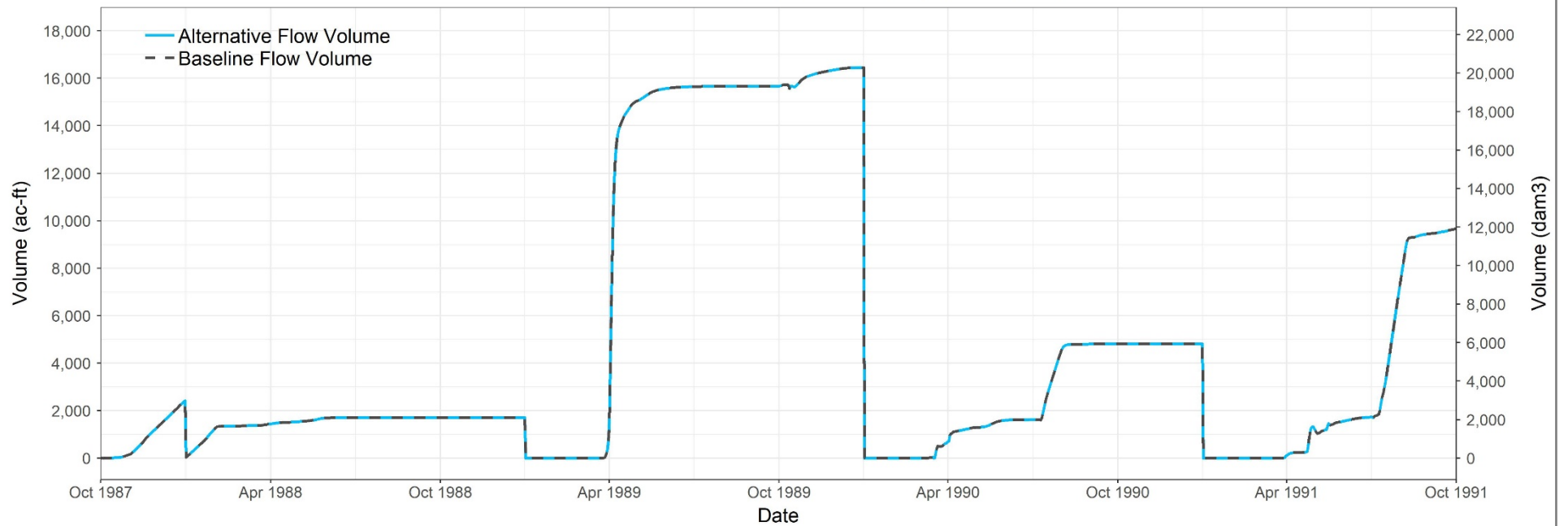
Souris River Plan of Study



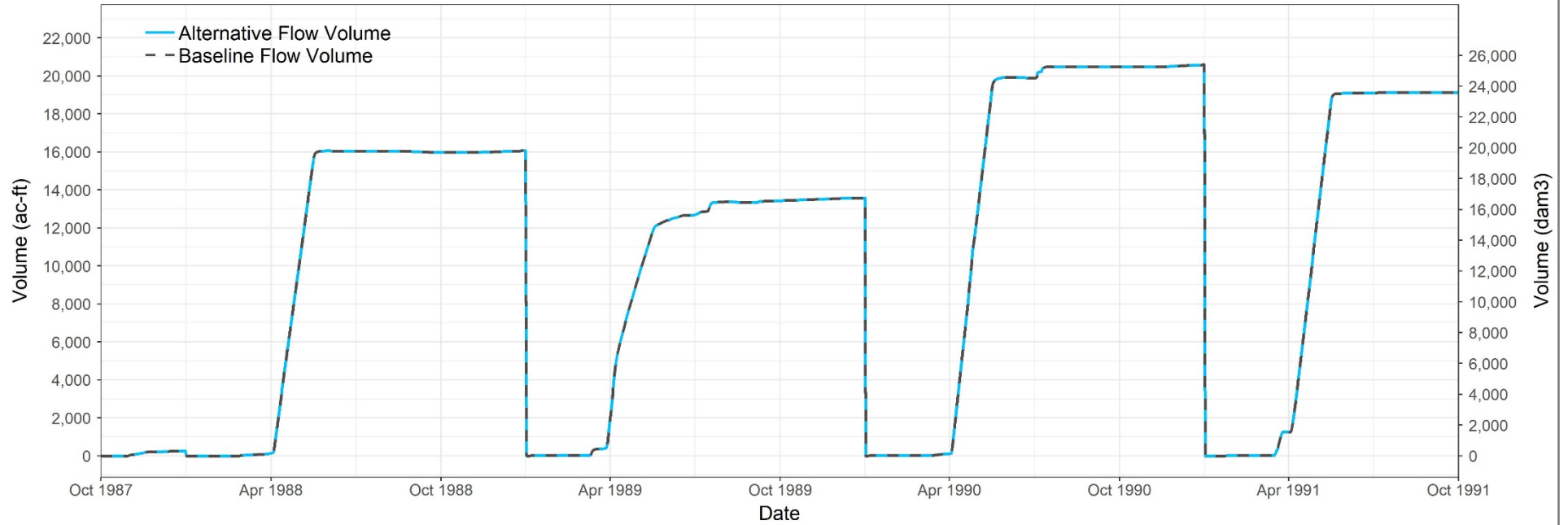
Souris River at Oxbow, SK - Cumulative Volume



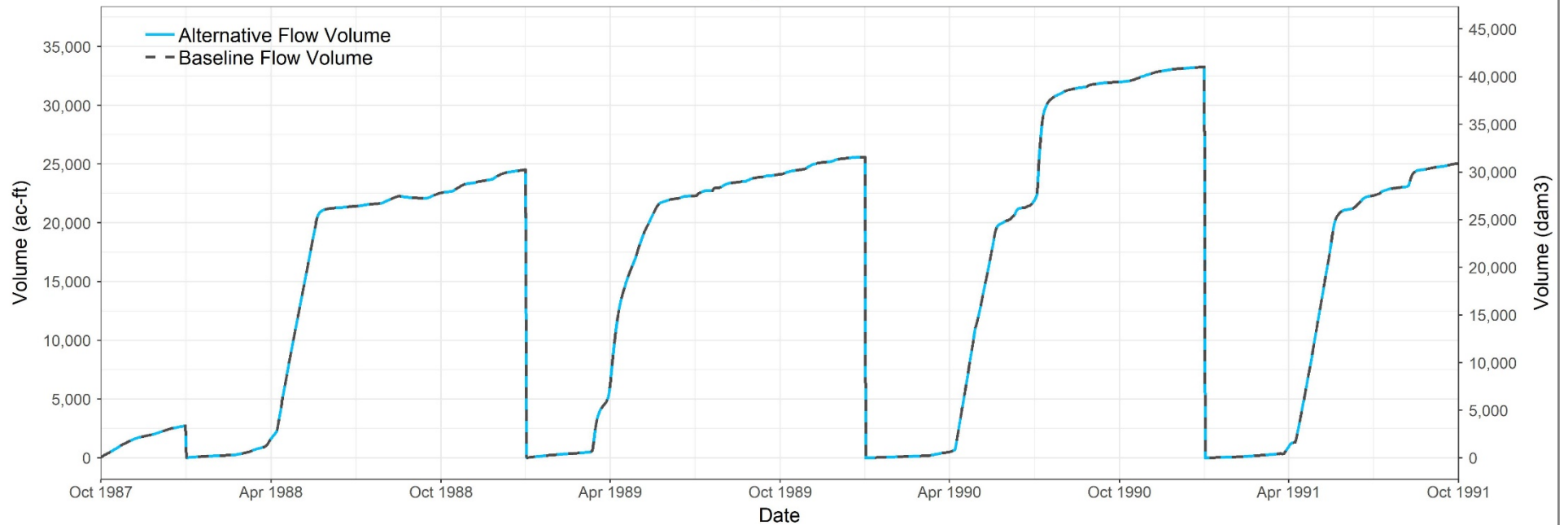
Souris River at Sherwood, ND - Cumulative Volume



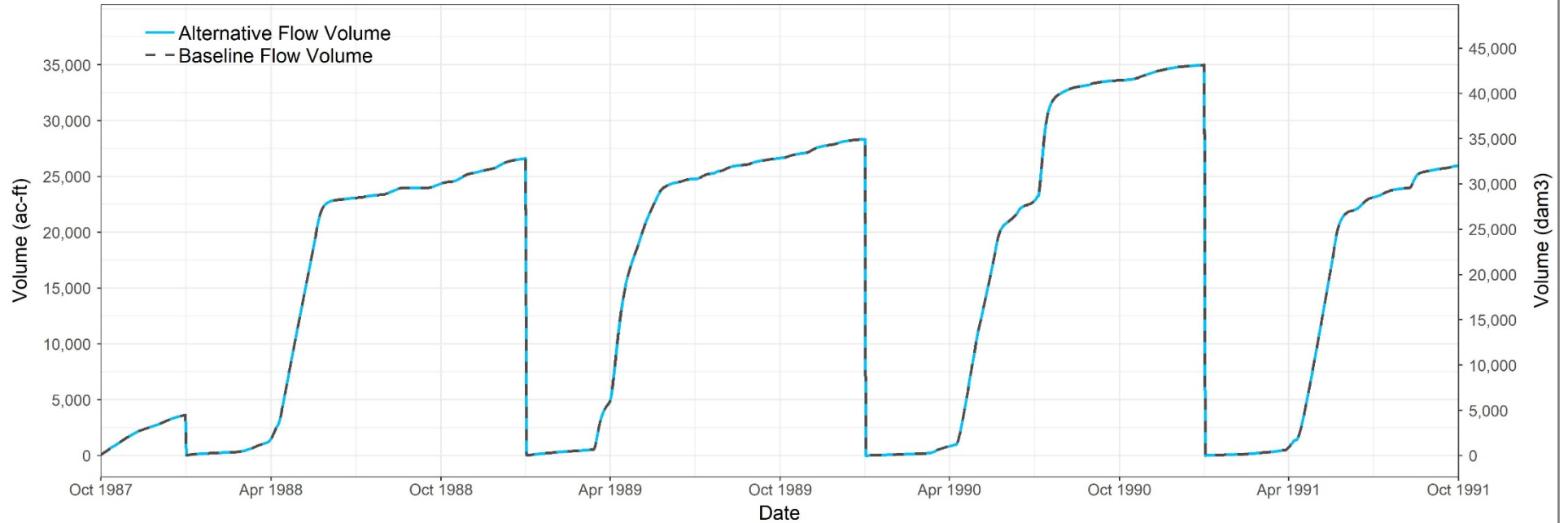
Souris River at Minot, ND - Cumulative Volume



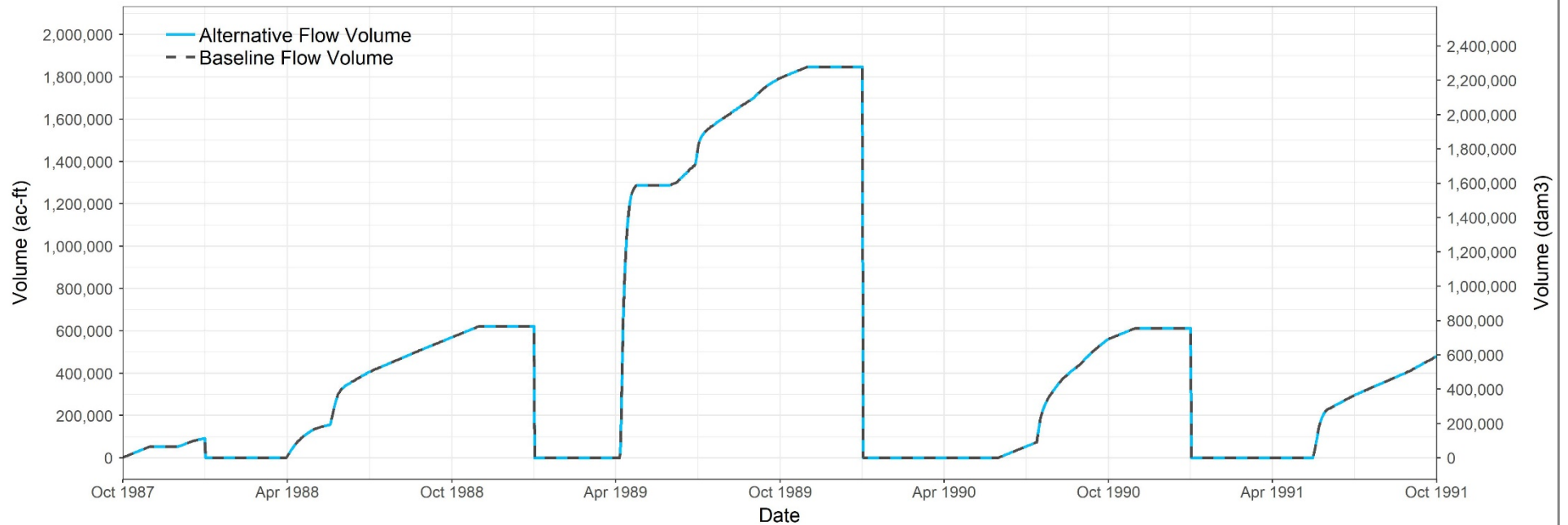
Souris River at Verendrye, ND - Cumulative Volume

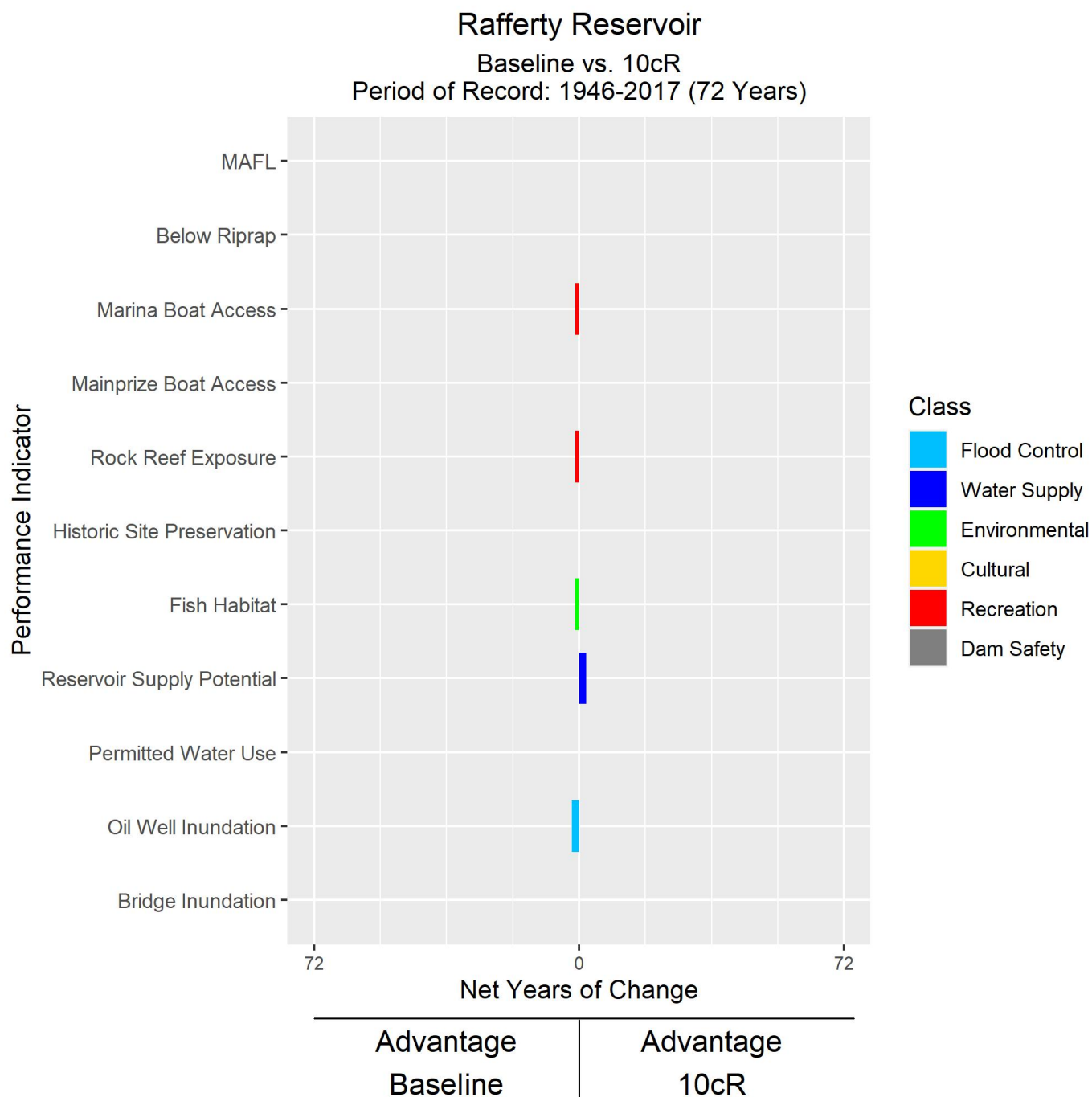


Souris River at Bantry, ND - Cumulative Volume

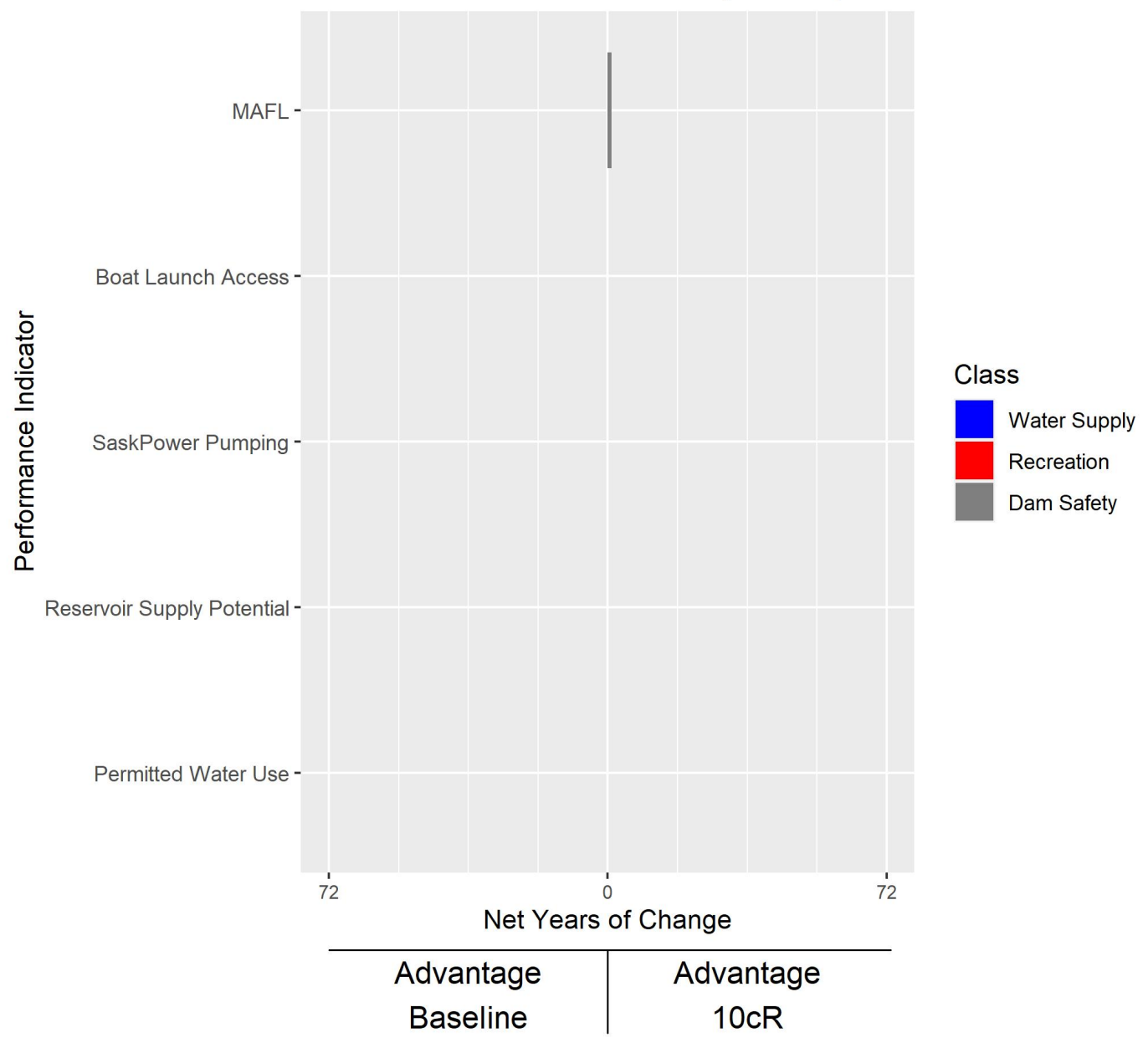


Souris River at Westhope, ND - Cumulative Volume





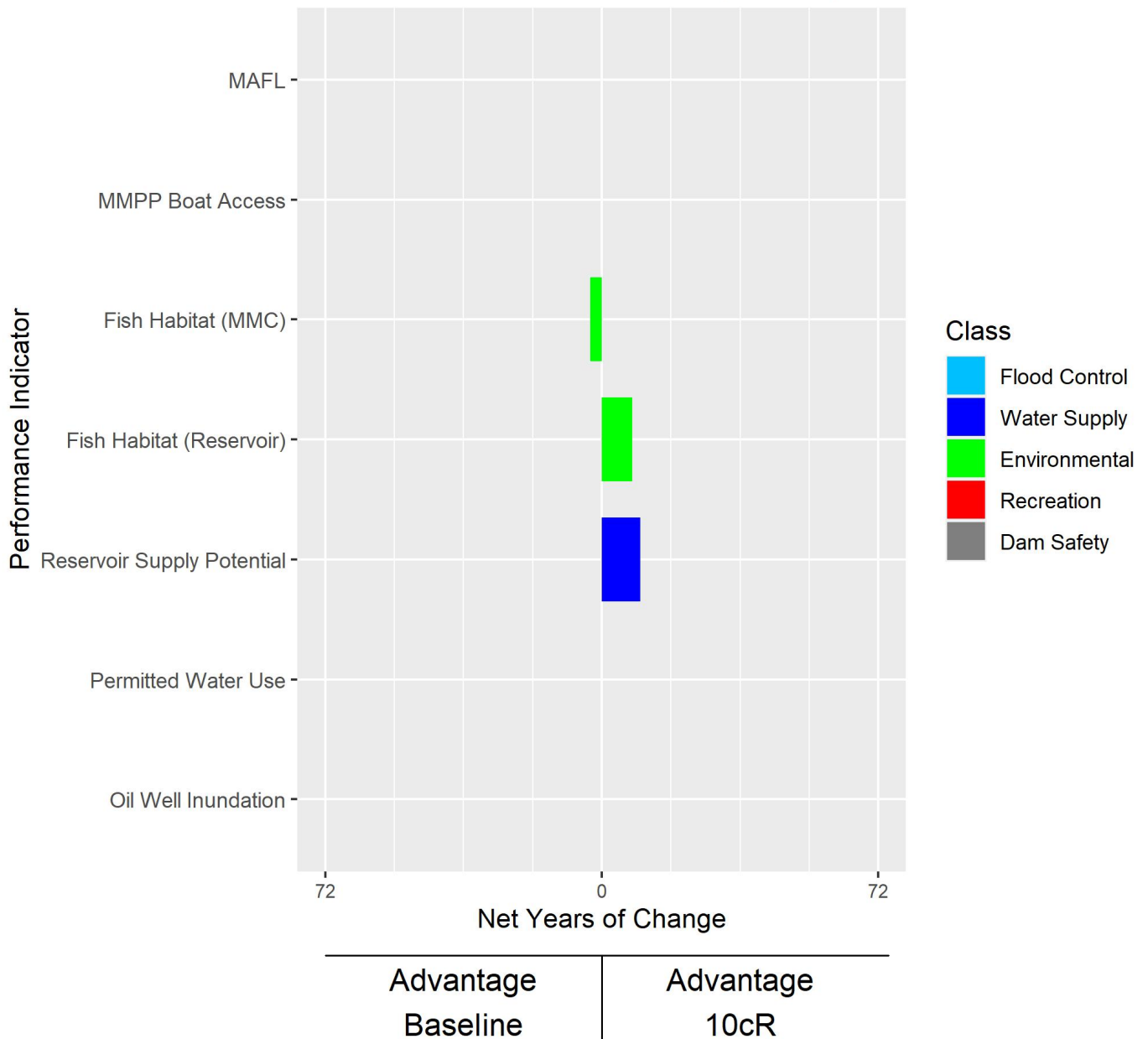
Boundary Reservoir
Baseline vs. 10cR
Period of Record: 1946-2017 (72 Years)



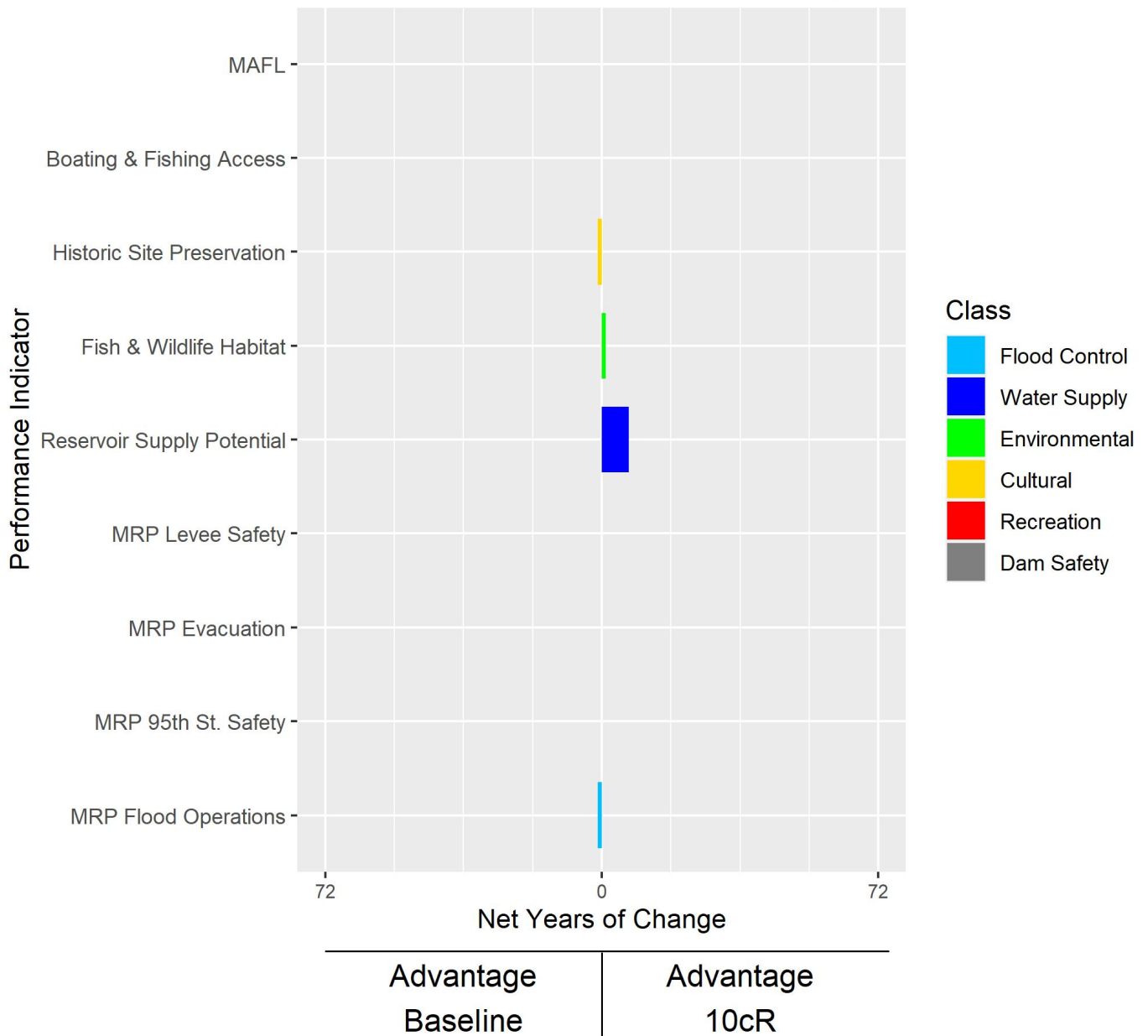
Grant Devine Reservoir

Baseline vs. 10cR

Period of Record: 1946-2017 (72 Years)



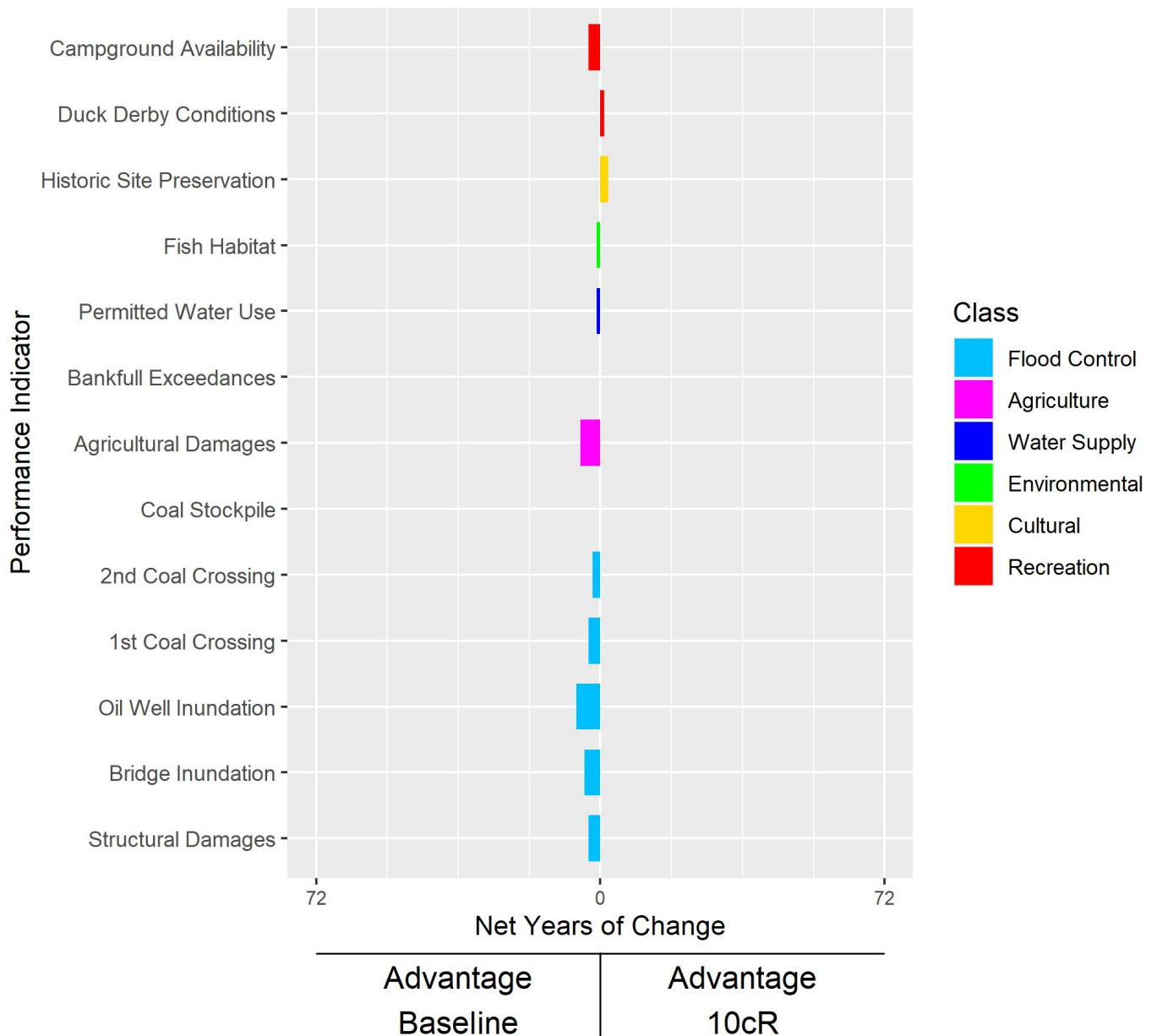
Lake Darling
Baseline vs. 10cR
Period of Record: 1946-2017 (72 Years)



Saskatchewan - All Riverine Reaches

Baseline vs. 10cR

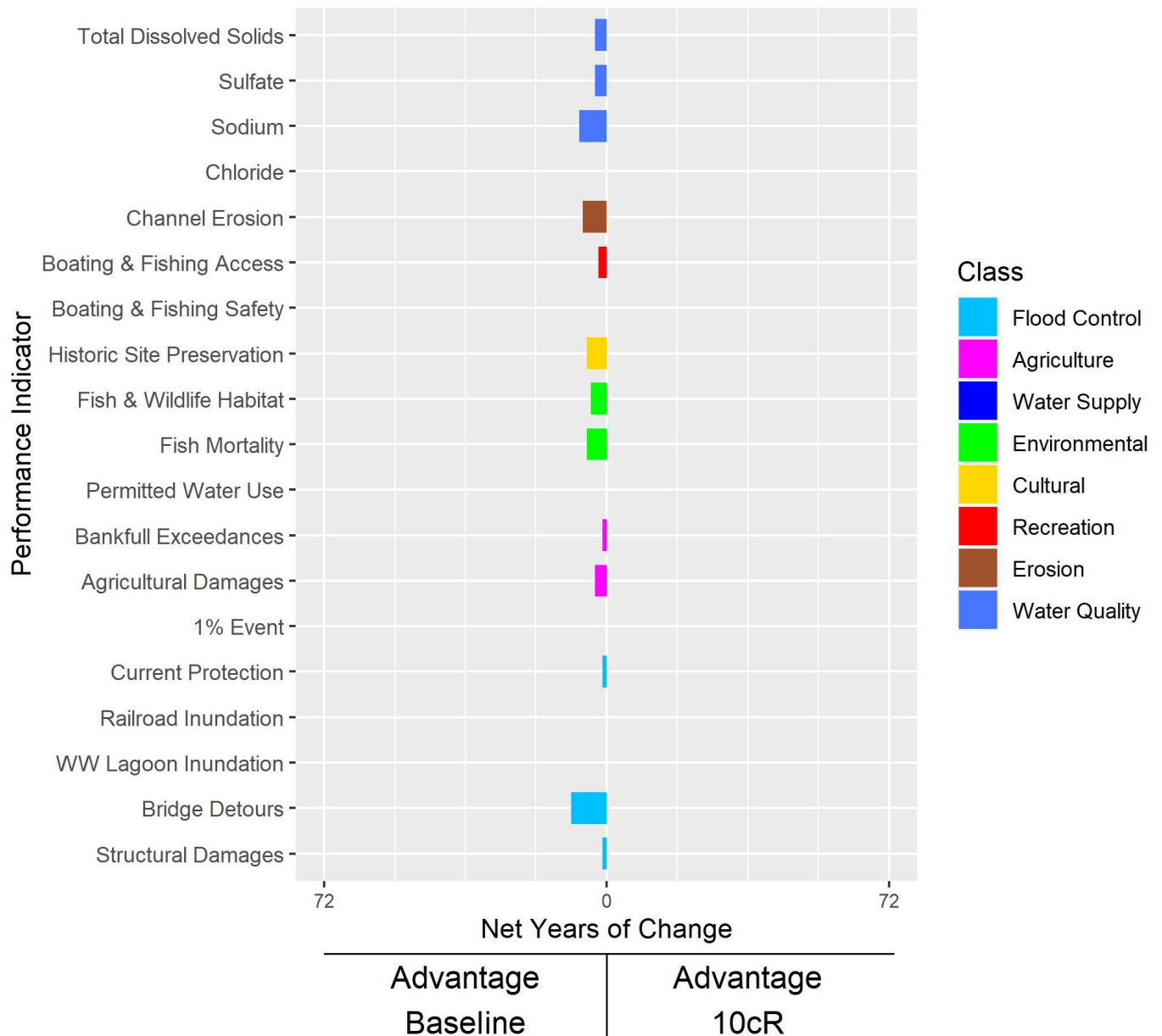
Period of Record: 1946-2017 (72 Years)



North Dakota - All Riverine Reaches

Baseline vs. 10cR

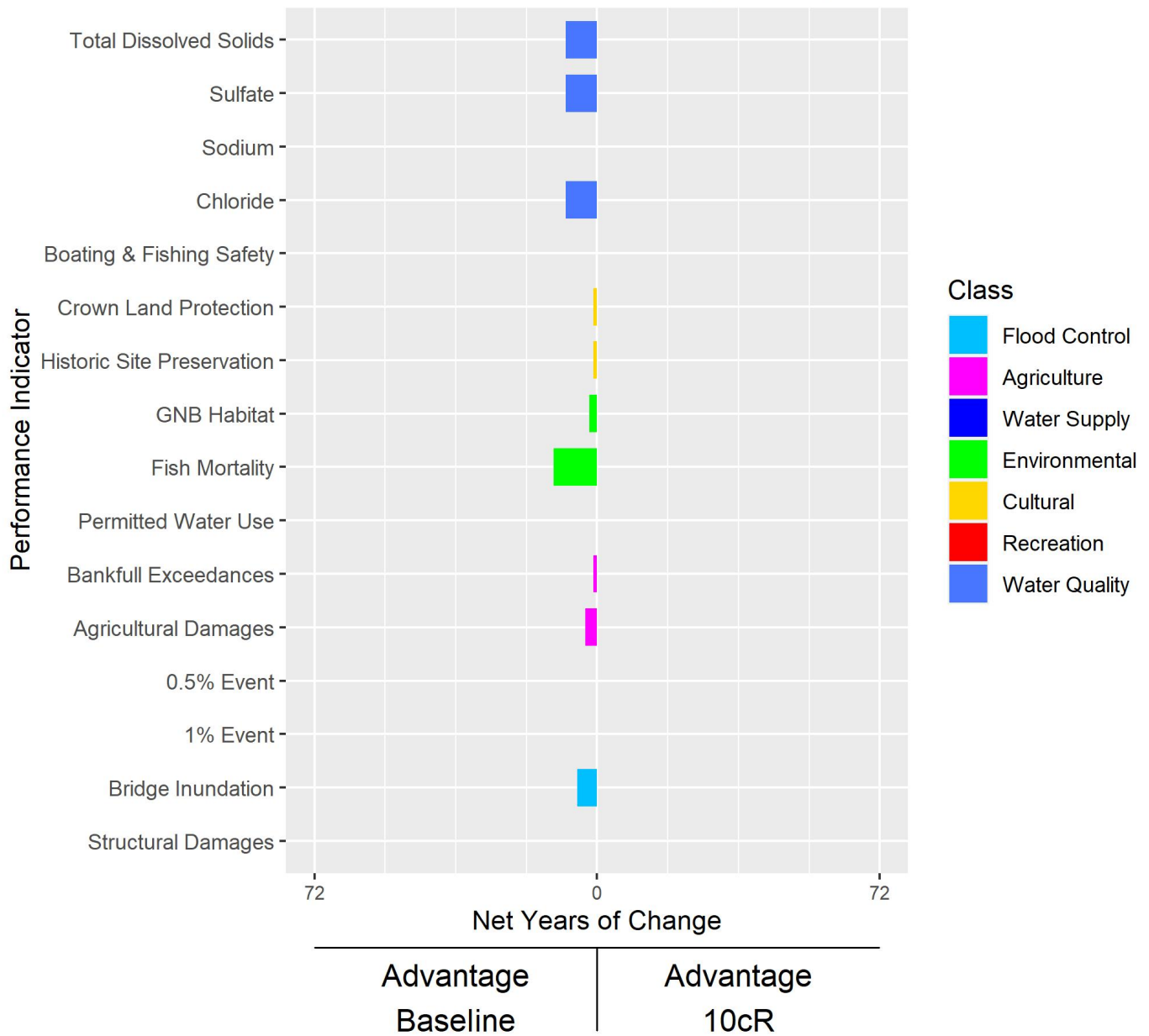
Period of Record: 1946-2017 (72 Years)



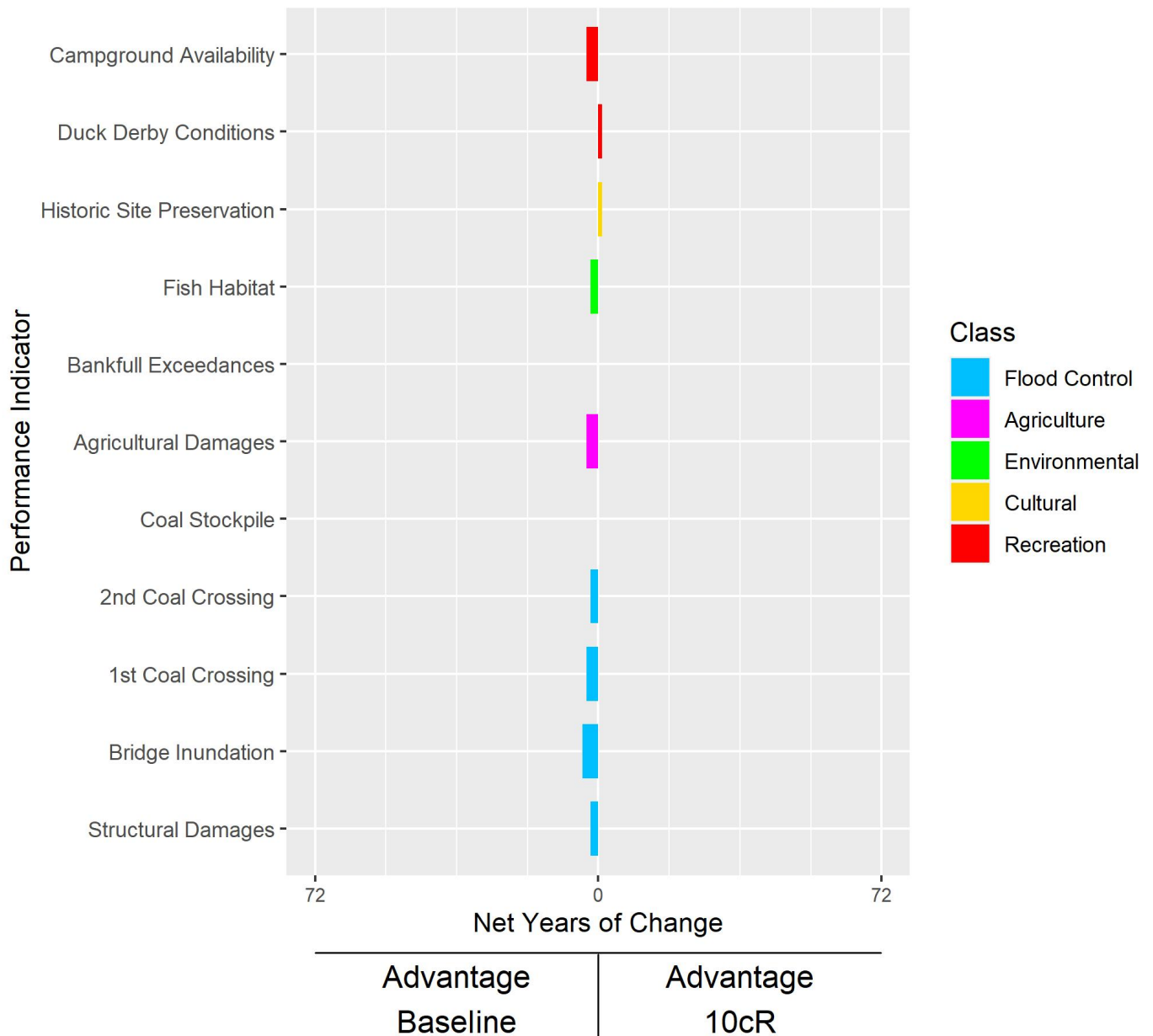
Westhope to Wawanesa

Baseline vs. 10cR

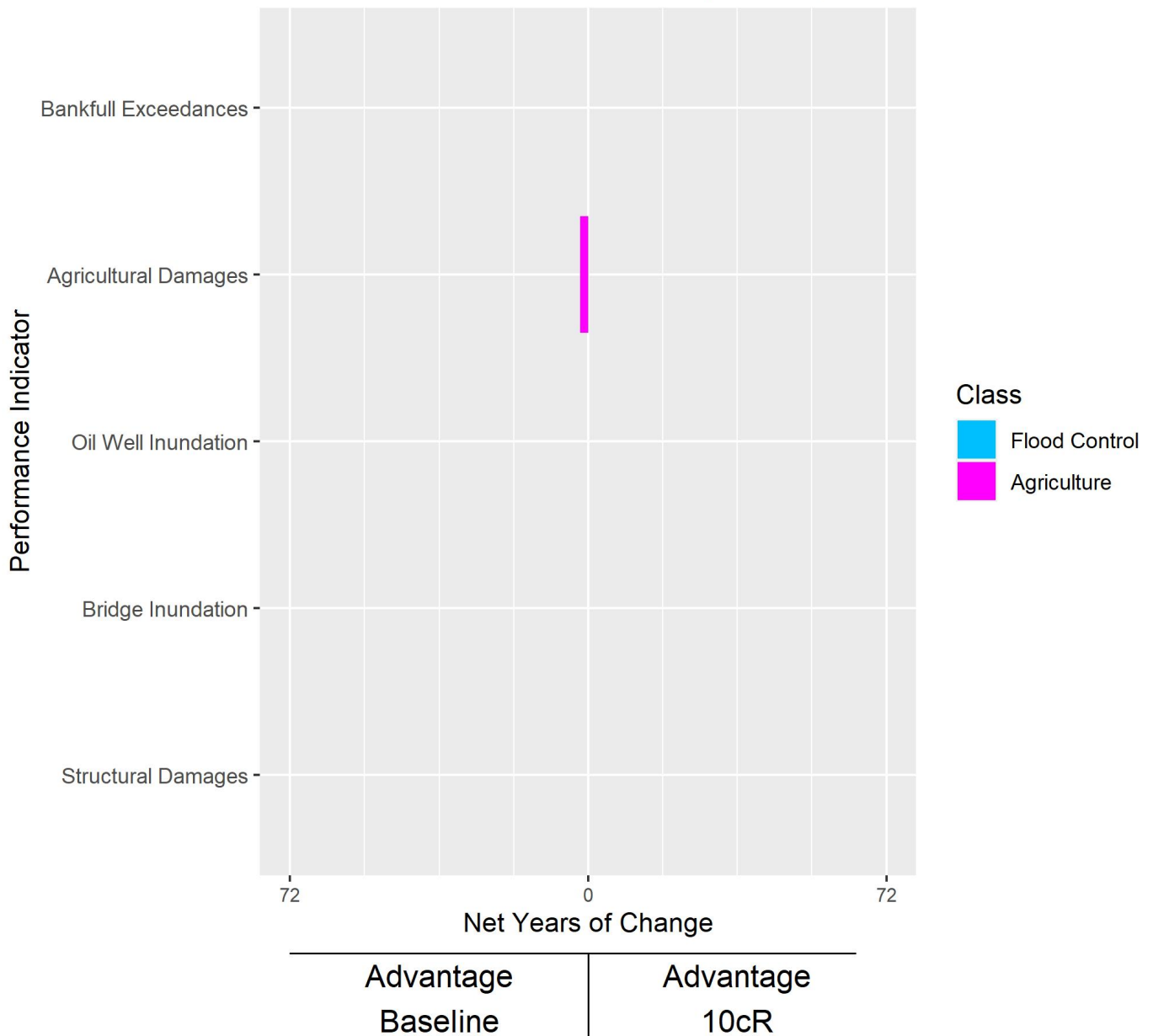
Period of Record: 1946-2017 (72 Years)



City of Estevan
Baseline vs. 10cR
Period of Record: 1946-2017 (72 Years)



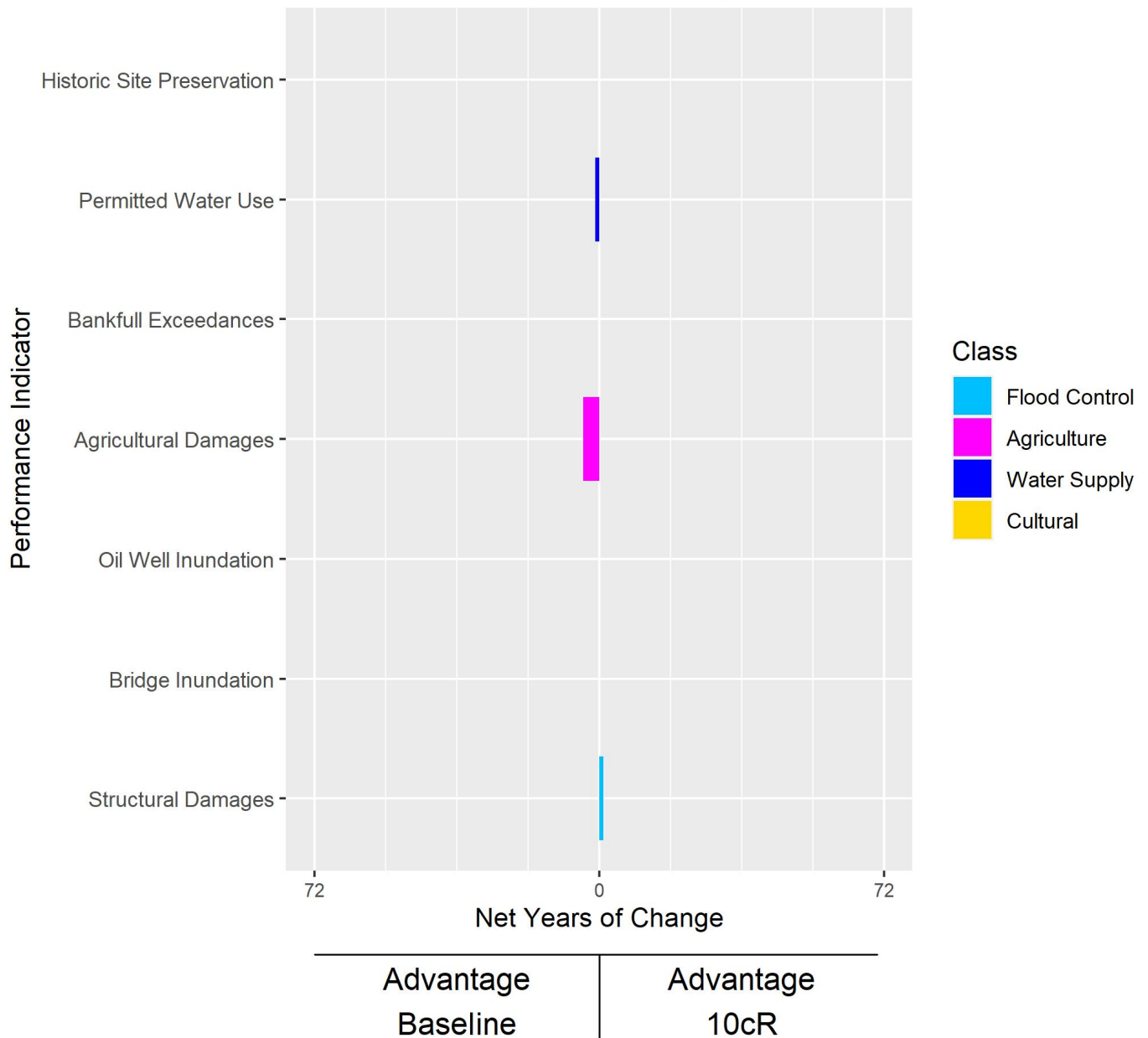
City of Roche Percee
Baseline vs. 10cR
Period of Record: 1946-2017 (72 Years)



Roche Percee to Moose Mountain Creek

Baseline vs. 10cR

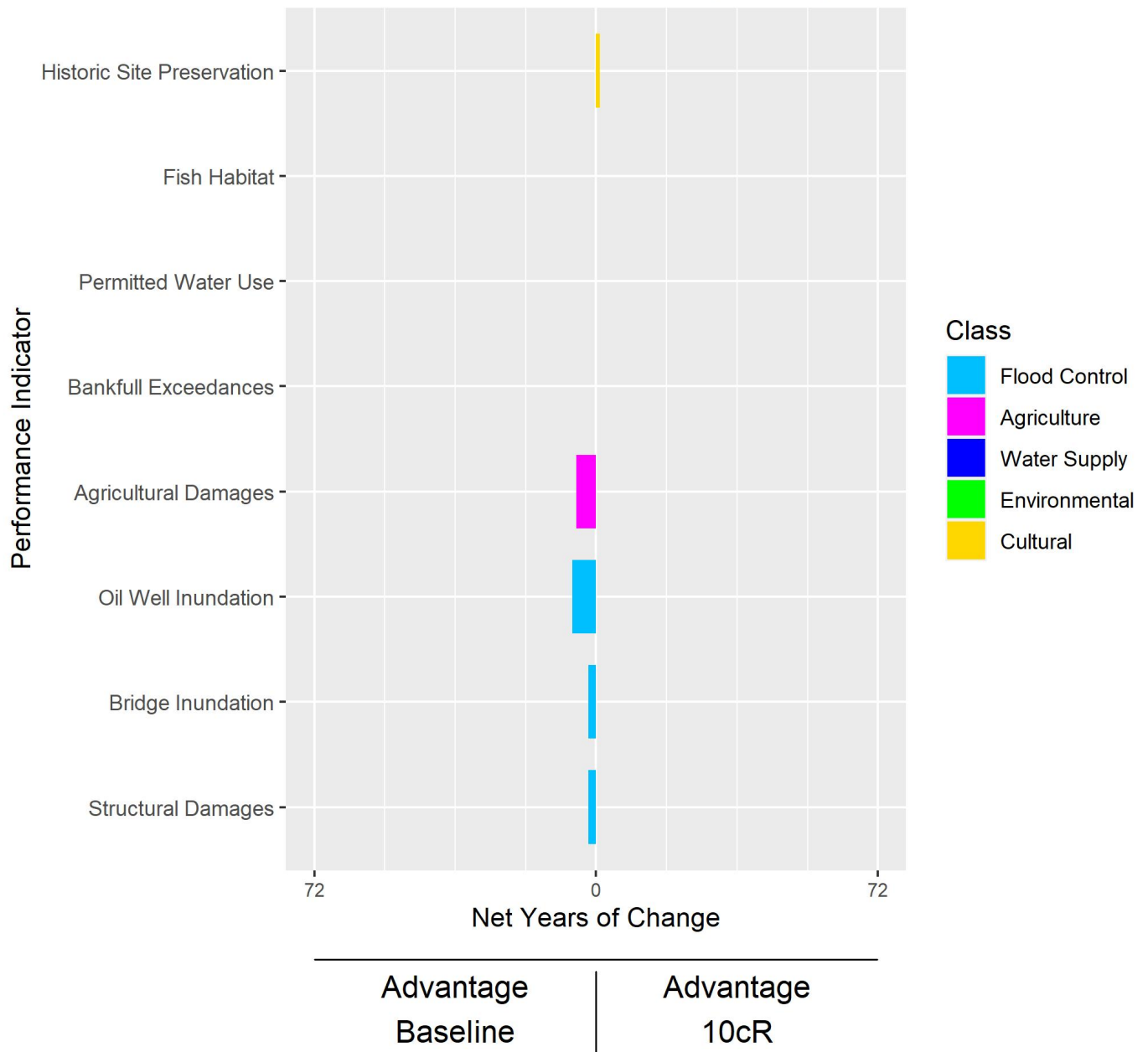
Period of Record: 1946-2017 (72 Years)



Moose Mountain Creek to Sherwood

Baseline vs. 10cR

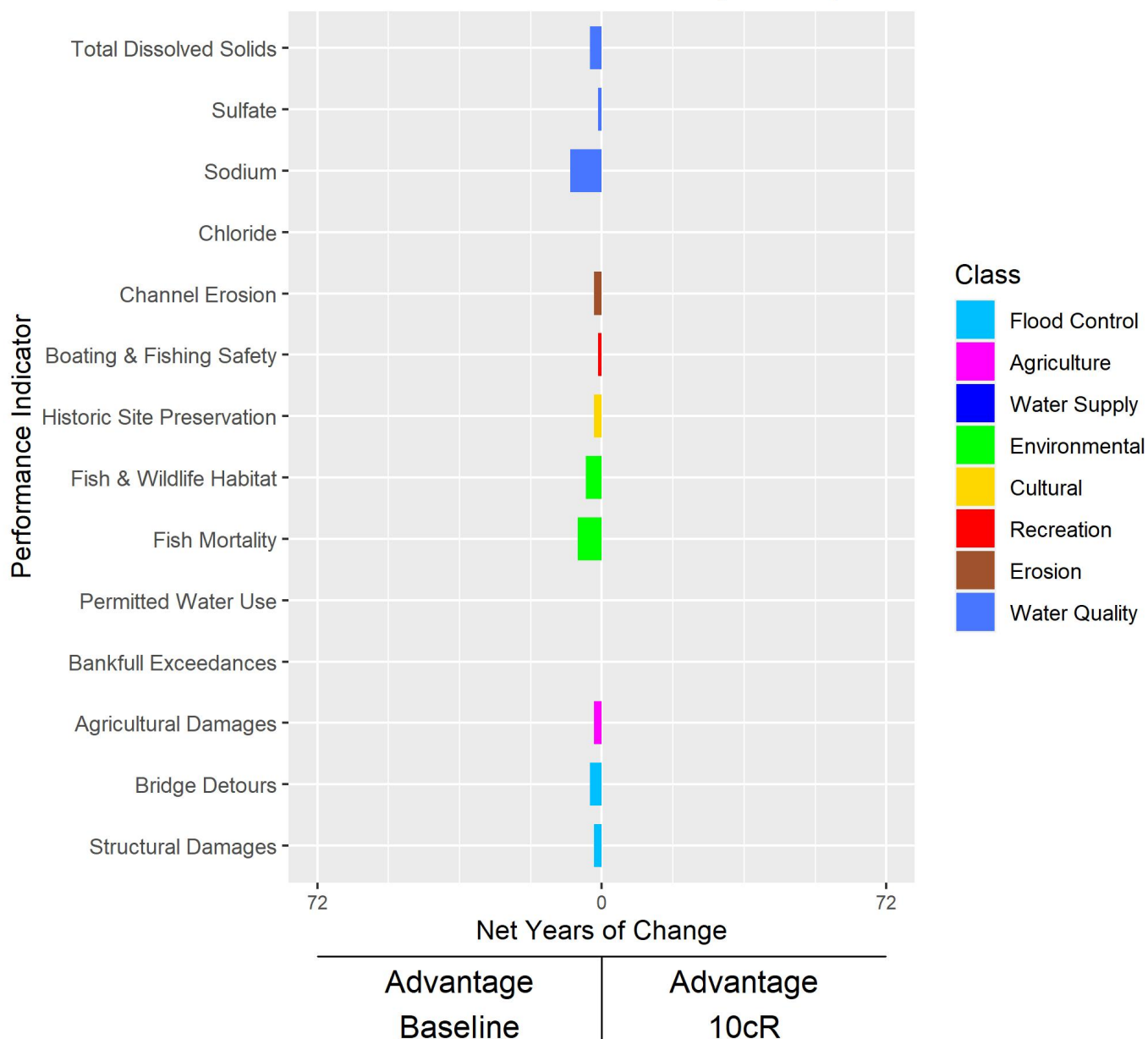
Period of Record: 1946-2017 (72 Years)



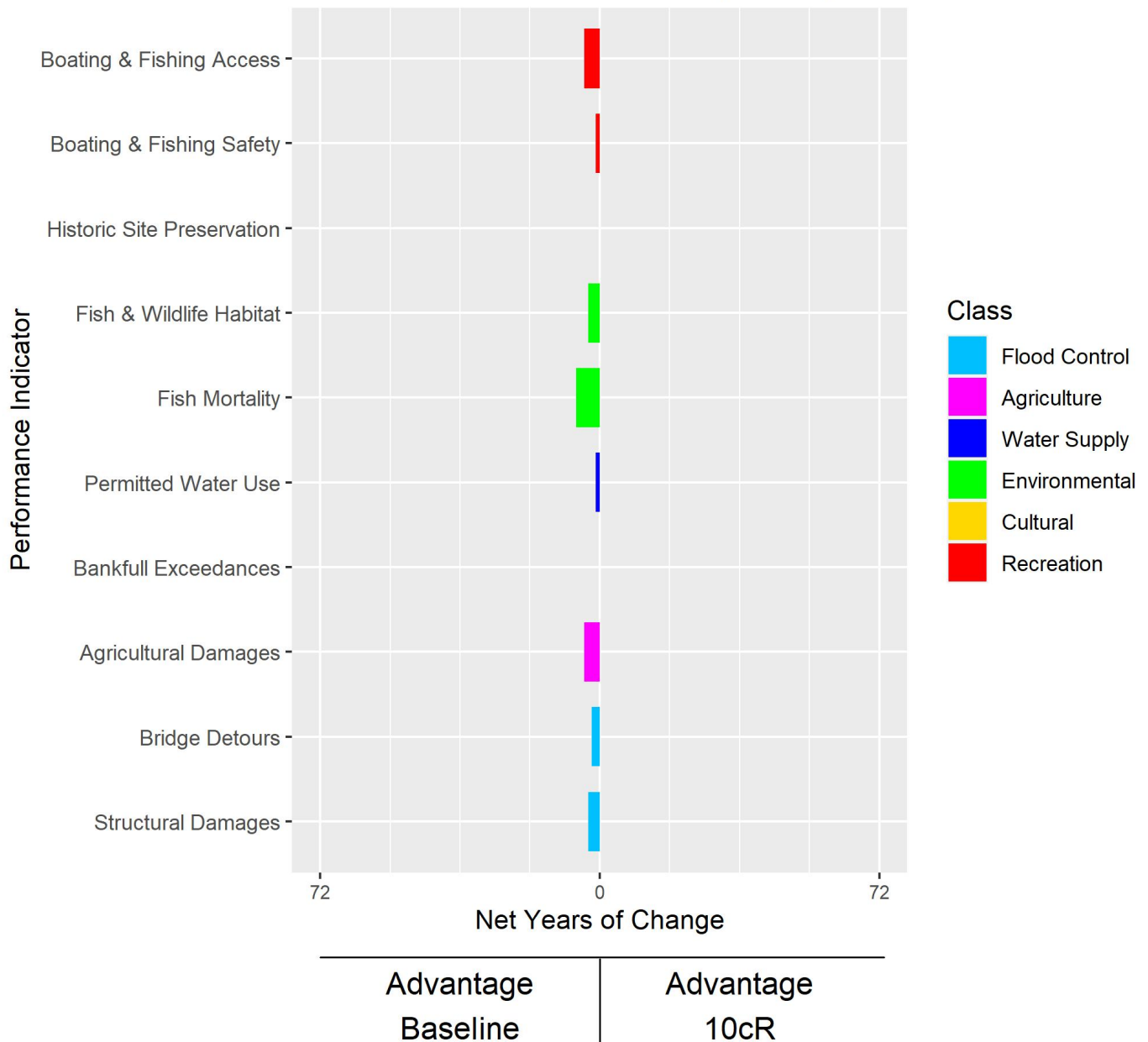
Sherwood to Mouse River Park

Baseline vs. 10cR

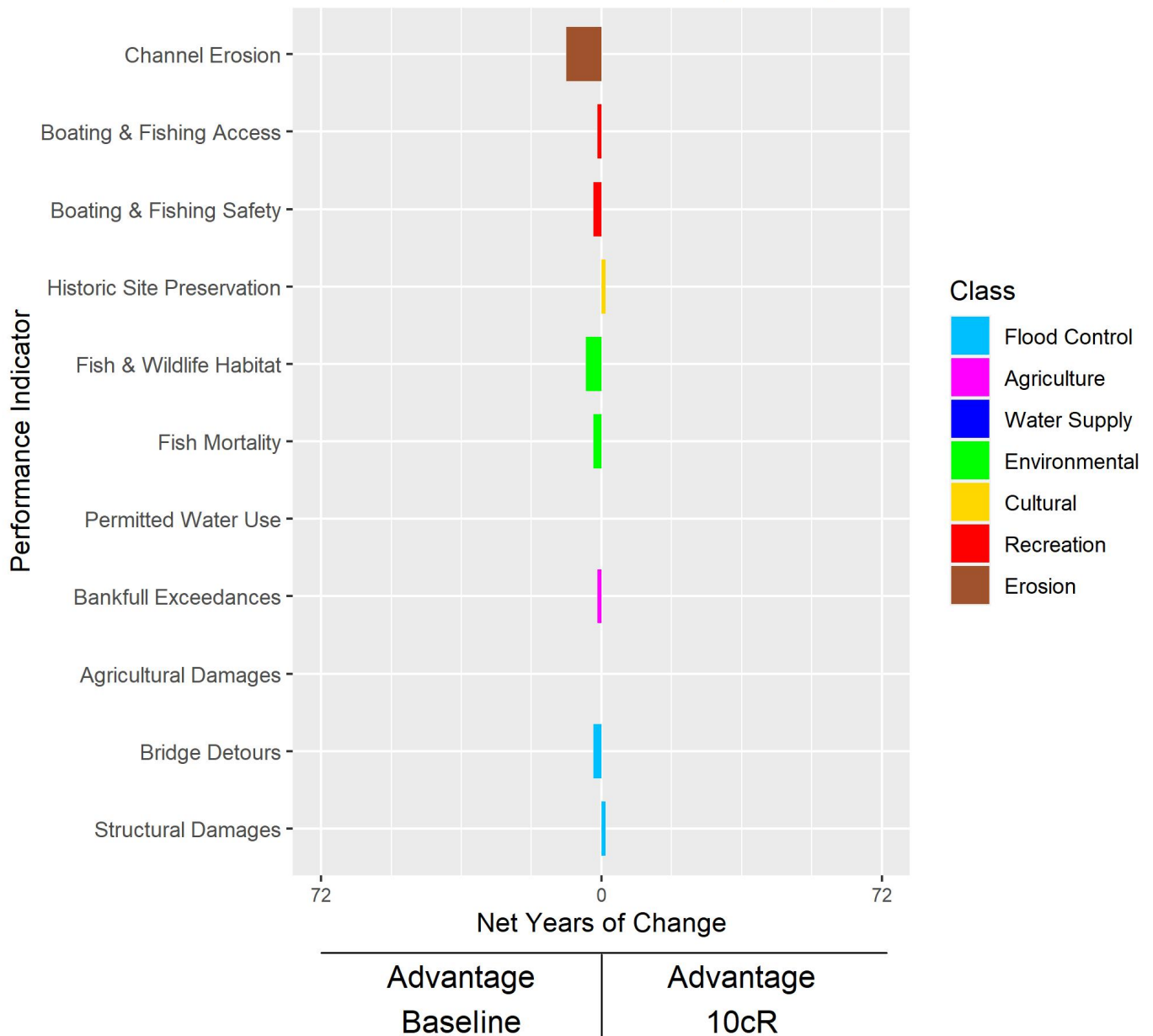
Period of Record: 1946-2017 (72 Years)



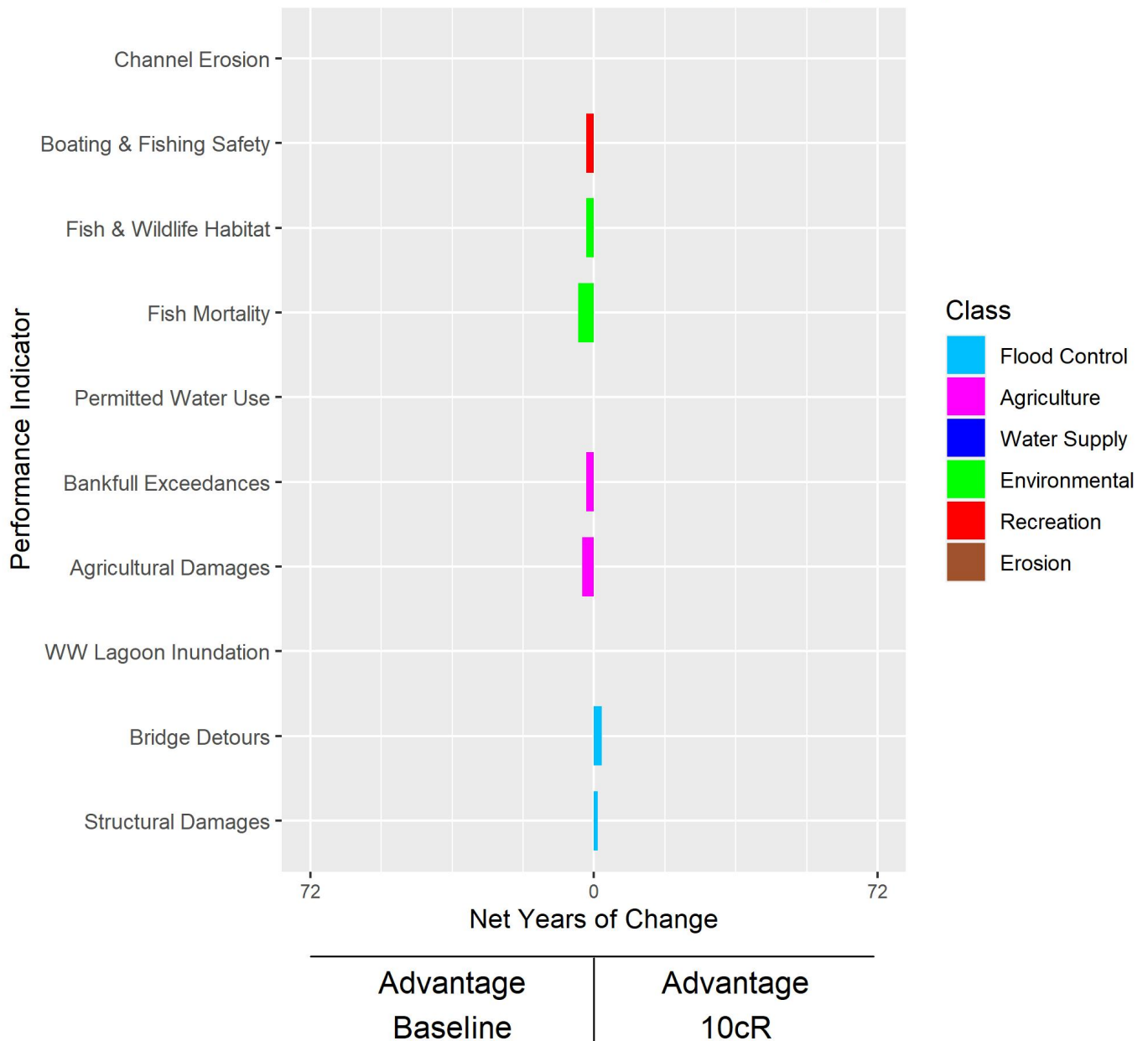
Mouse River Park
Baseline vs. 10cR
Period of Record: 1946-2017 (72 Years)



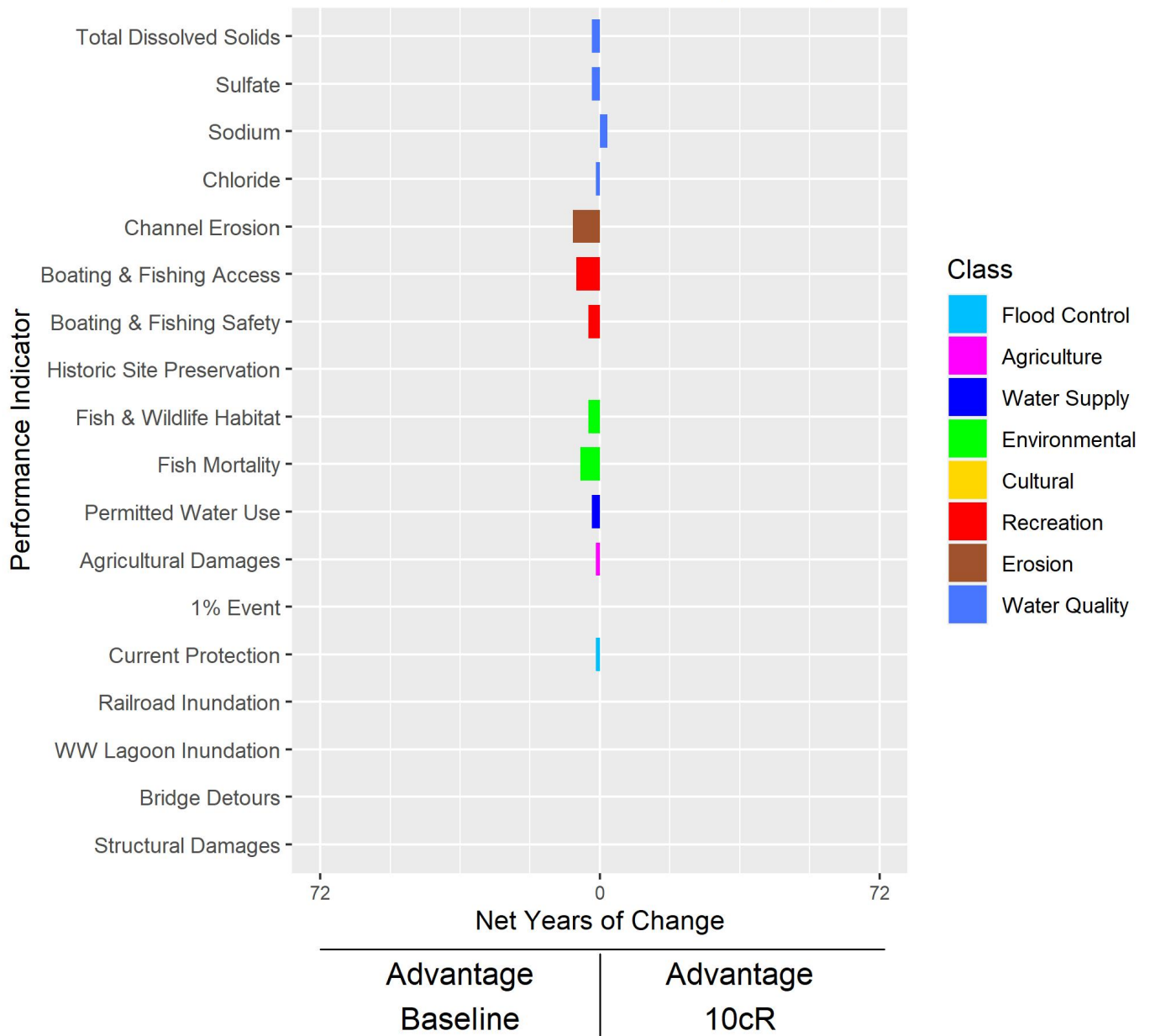
Lake Darling to Burlington
Baseline vs. 10cR
Period of Record: 1946-2017 (72 Years)



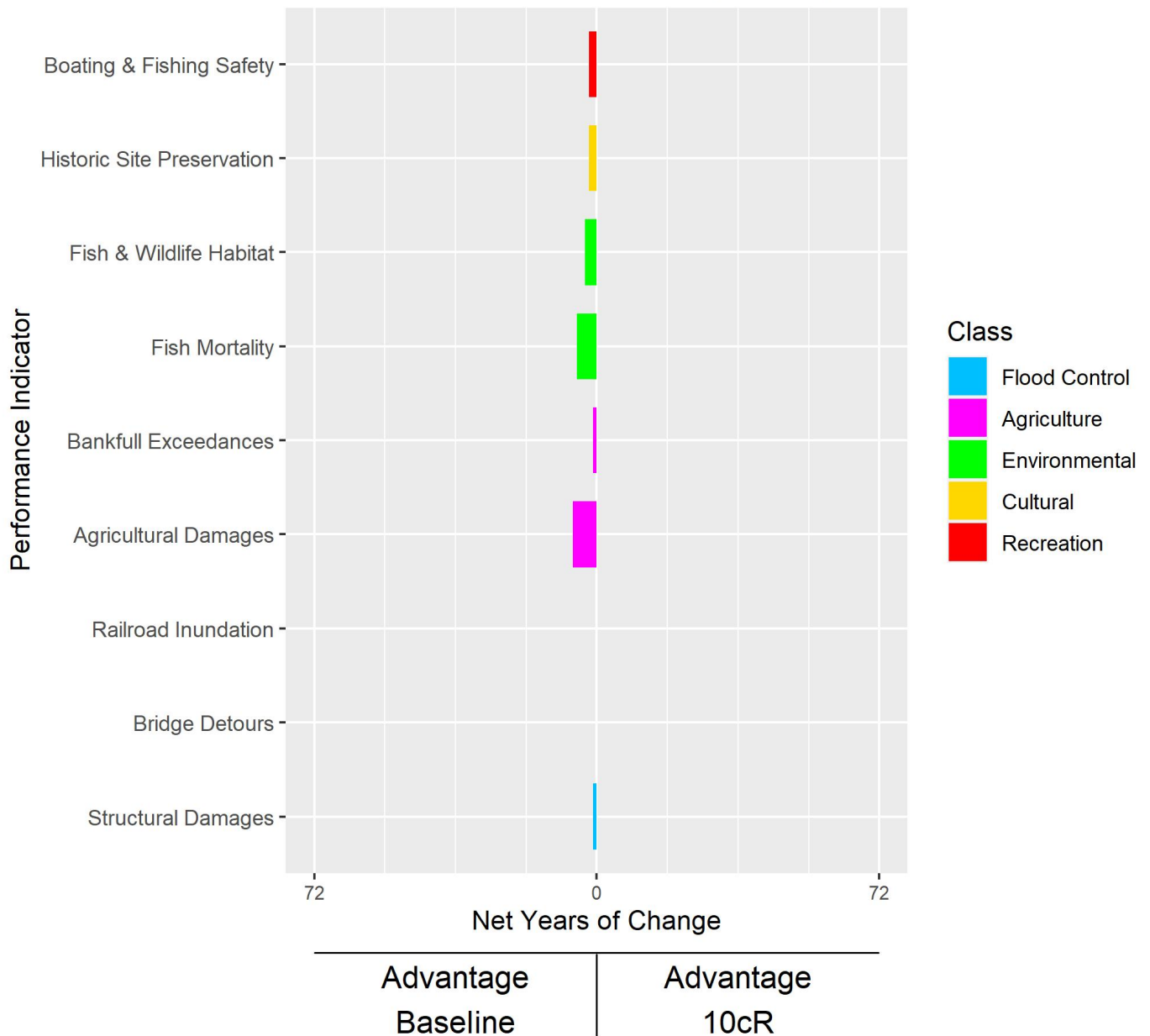
City of Burlington
Baseline vs. 10cR
Period of Record: 1946-2017 (72 Years)



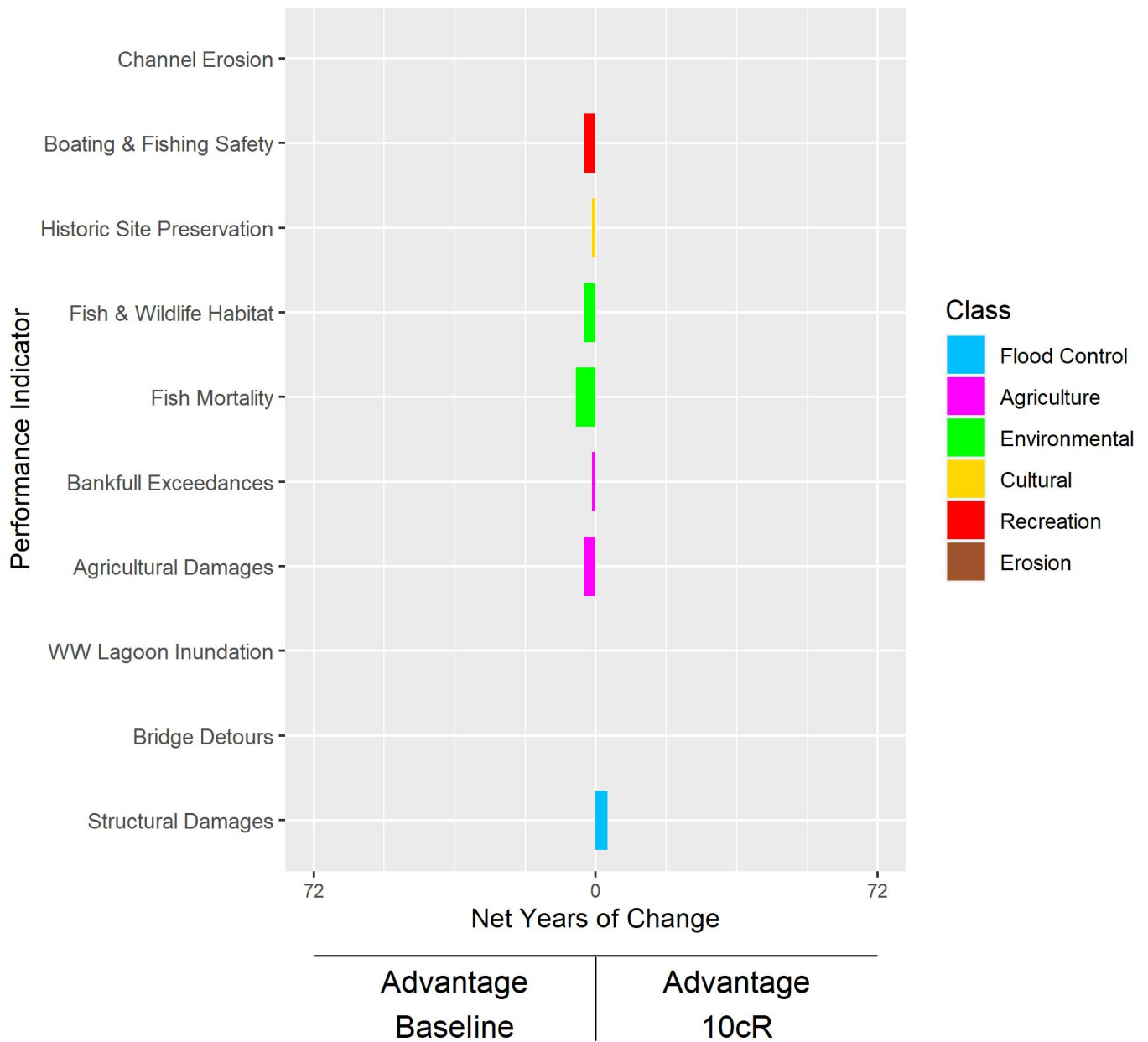
City of Minot
Baseline vs. 10cR
Period of Record: 1946-2017 (72 Years)



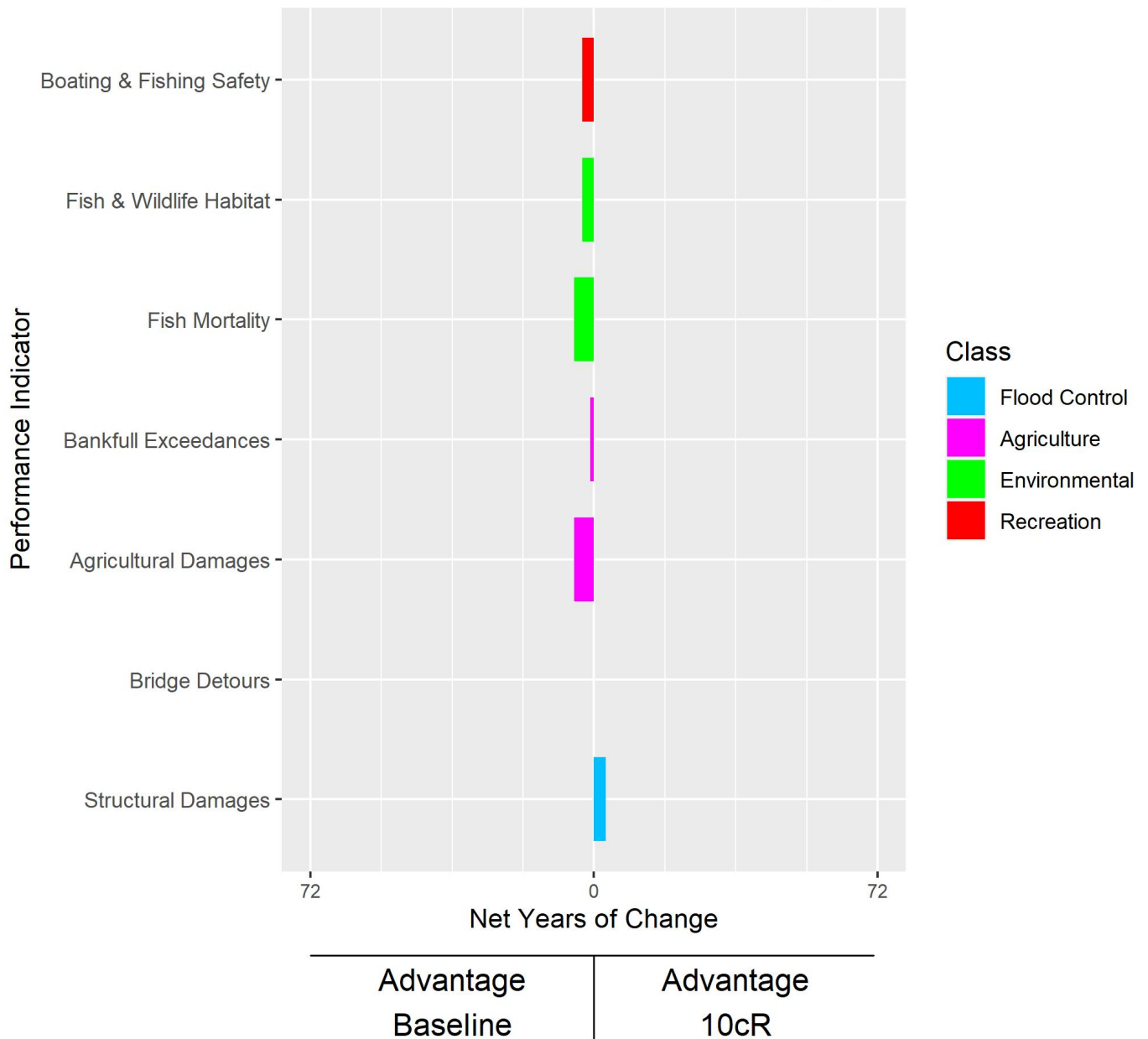
Minot to Sawyer
Baseline vs. 10cR
Period of Record: 1946-2017 (72 Years)



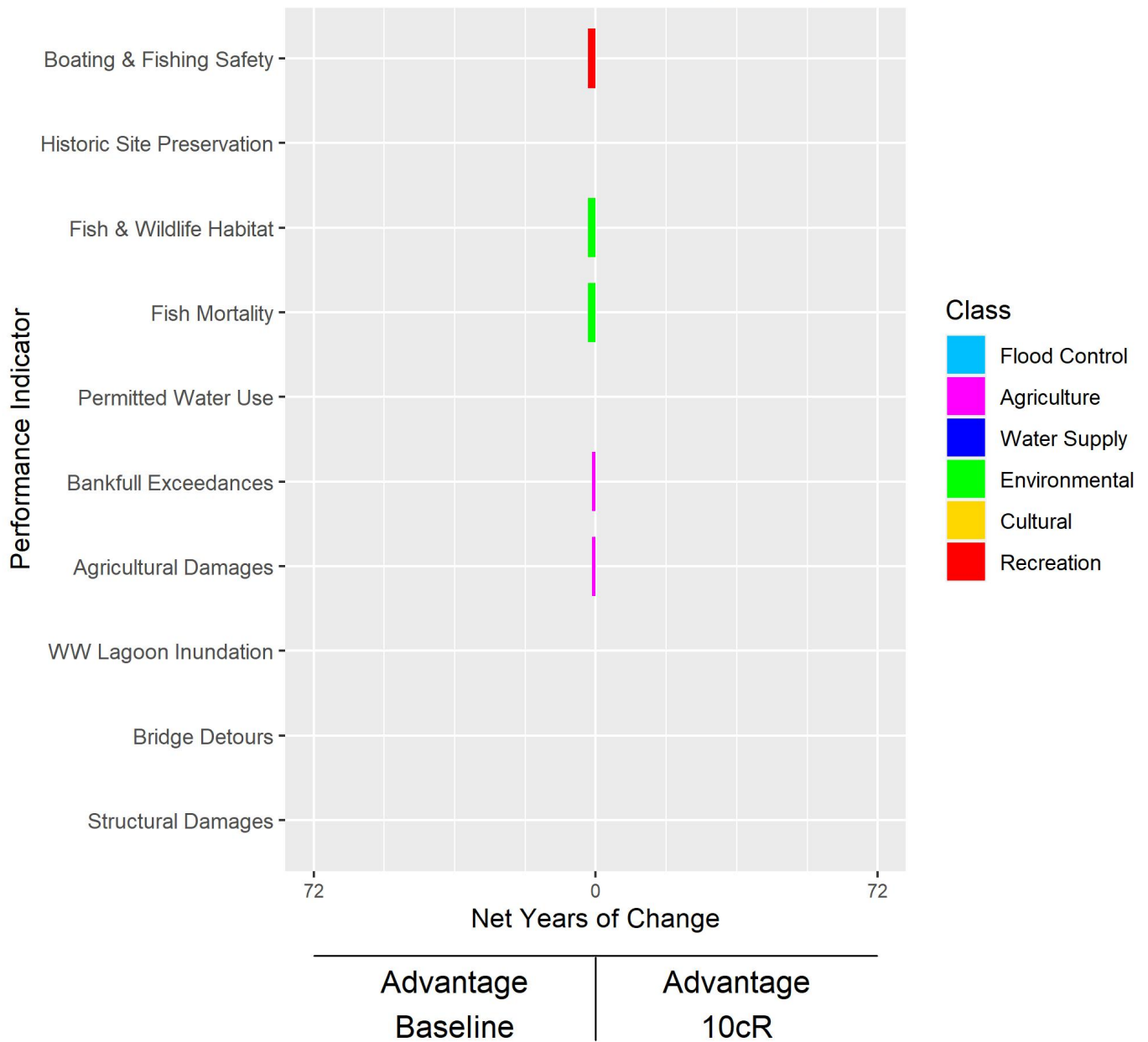
City of Sawyer
Baseline vs. 10cR
Period of Record: 1946-2017 (72 Years)



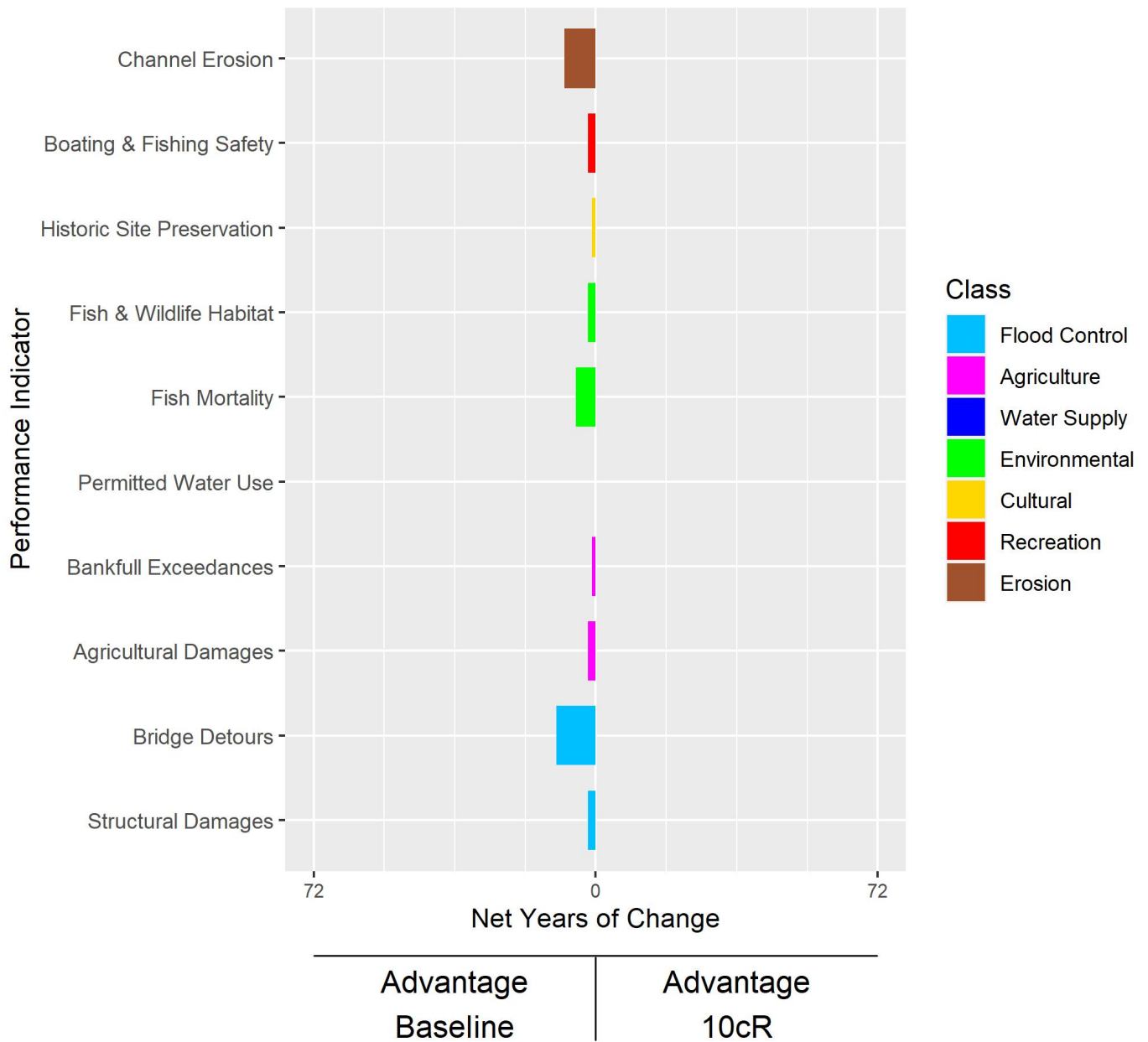
Sawyer to Velva
Baseline vs. 10cR
Period of Record: 1946-2017 (72 Years)



City of Velva
Baseline vs. 10cR
Period of Record: 1946-2017 (72 Years)



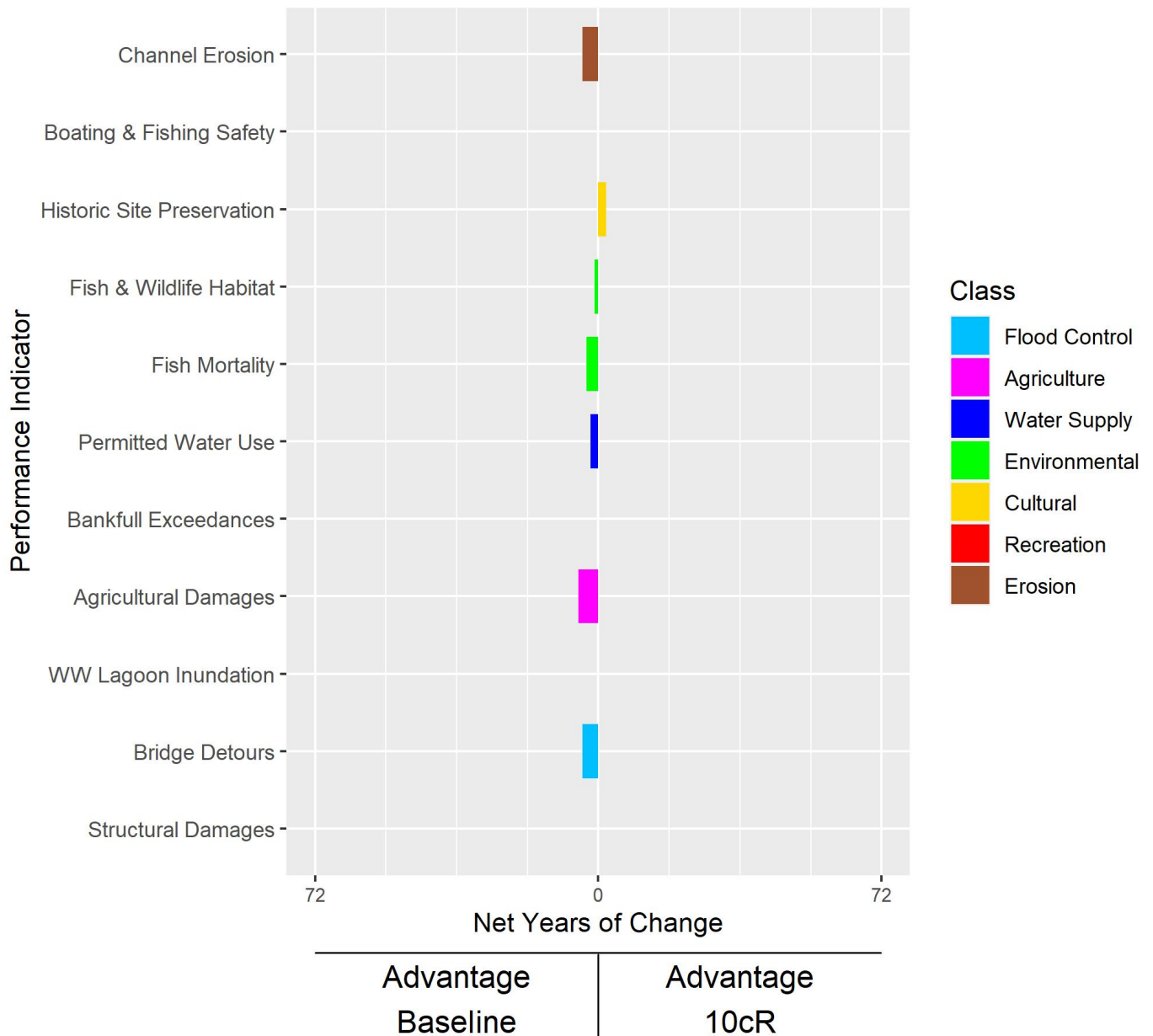
Velva to Eaton Irrigation
Baseline vs. 10cR
Period of Record: 1946-2017 (72 Years)



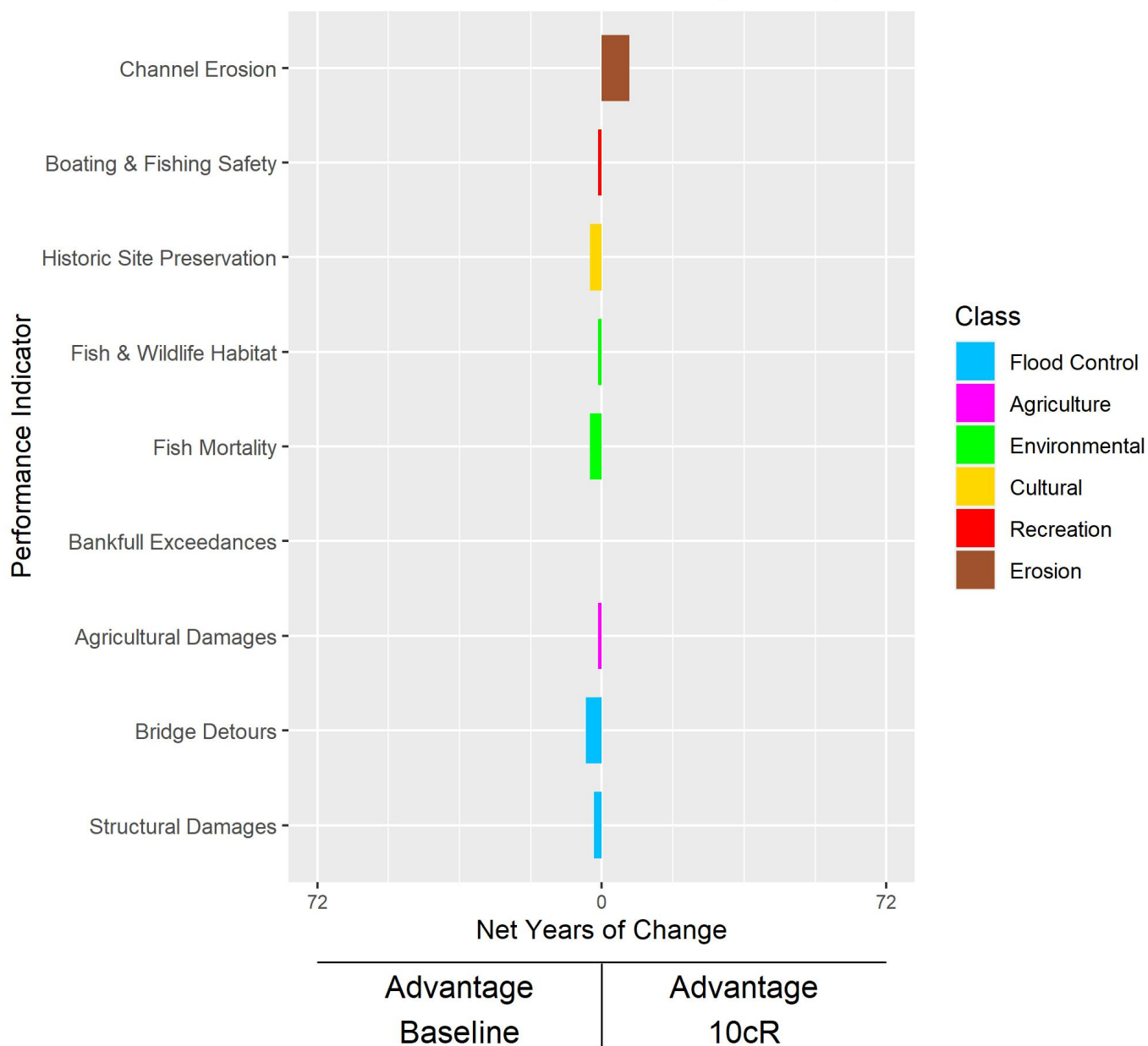
Eaton Irrigation District

Baseline vs. 10cR

Period of Record: 1946-2017 (72 Years)



Downstream of Towner
Baseline vs. 10cR
Period of Record: 1946-2017 (72 Years)



J. Clark Salyer National Wildlife Refuge

Baseline vs. 10cR

Period of Record: 1946-2017 (72 Years)

