SPNRD 2023 Robust Review

March 13, 2024

ADAPTIVE RESOURCES INC
WATER • GEOLOGY • MAPPING

Kimball Cheyenne Deuel
SOUTH PLATTE
NATURAL RESOURCES DISTRICT

NEBRASKA
DEPT. OF NATURAL RESOURCES

Presentation Overview

- Integrated Water Management Overview
- Robust Review Analysis
  - Introduction
  - Updates to Model
  - SPNRD Model Inputs
  - SPNRD Results
- Path Forward

Integrated Water Management Overview

IWM – Overview Statutes

- *Nebraska Revised Statute* § 46-713(3): A river basin, subbasin, or reach shall be deemed fully appropriated if
  - Current uses of hydrologically connected surface water and ground water… will cause insufficient streamflow / surface water supply for:
  - (a) existing surface water appropriations,
  - (b) dependent wells, or
  - (c) noncompliance with an interstate compact, decree, agreement, or applicable state or federal laws

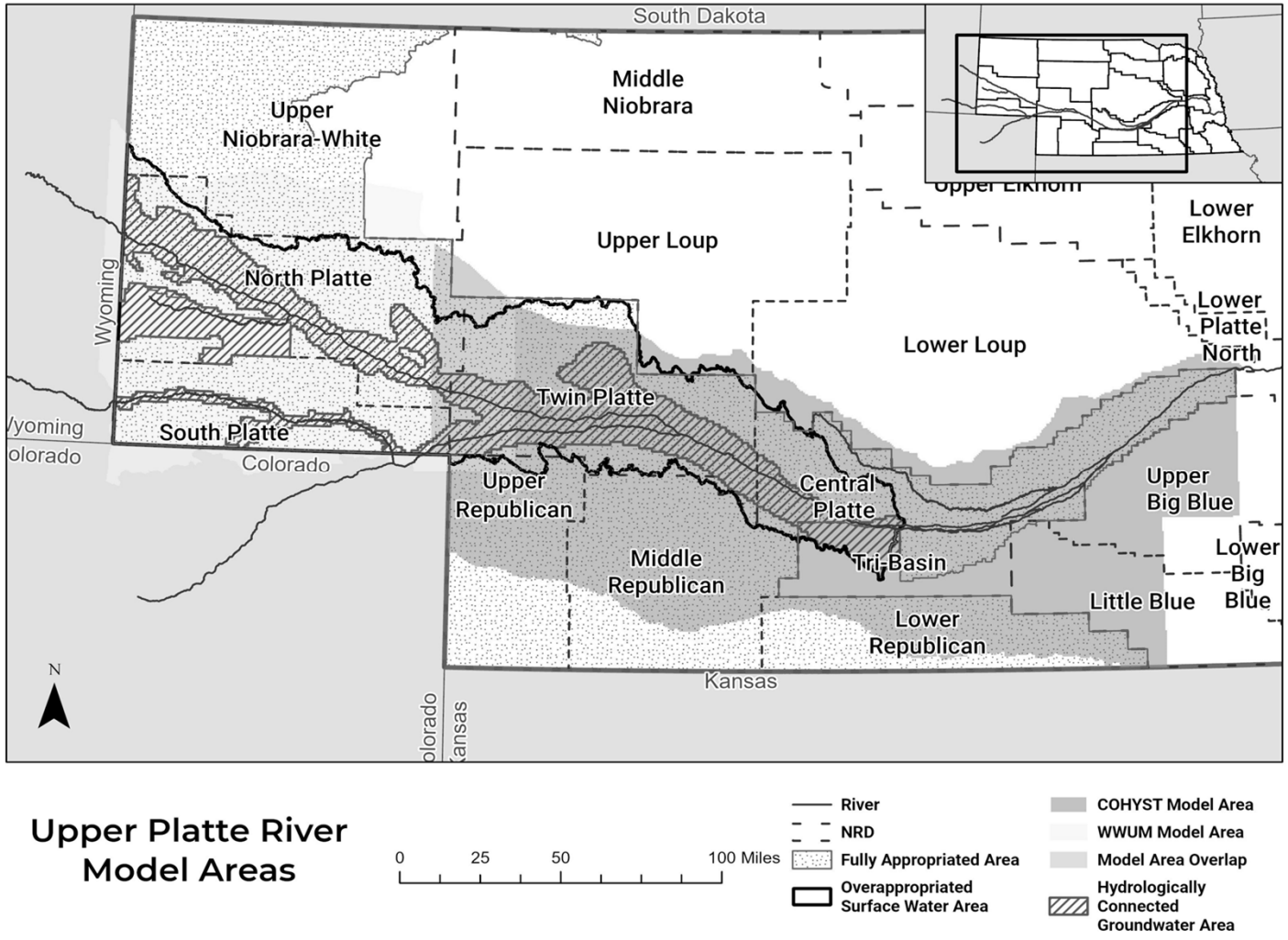
IWM – Overview Statutes

- *Nebraska Revised Statute* § 46-713(4)(a): A river basin, subbasin, or reach shall be deemed overappropriated if
  - Subject to an interstate cooperative agreement
  - and, the NeDNR has declared a moratorium on new surface water appropriations
  - and has requested each NRD
    - To close the issuance of additional water well permits

      Or to temporarily suspend the drilling of new water wells

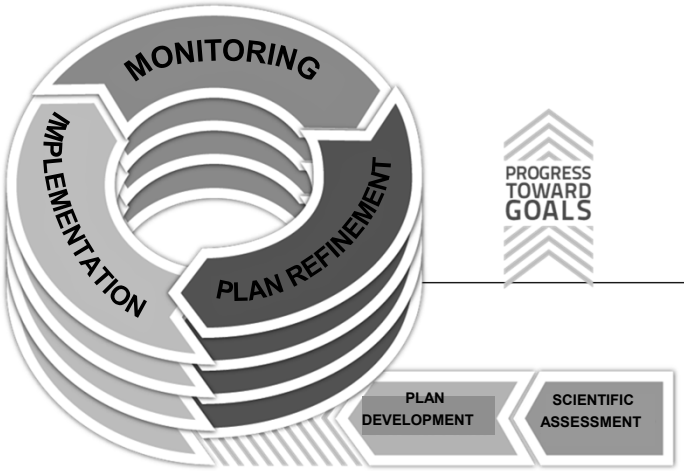
IWM - Overview

Fully and Overappropriated Areas within Model Area

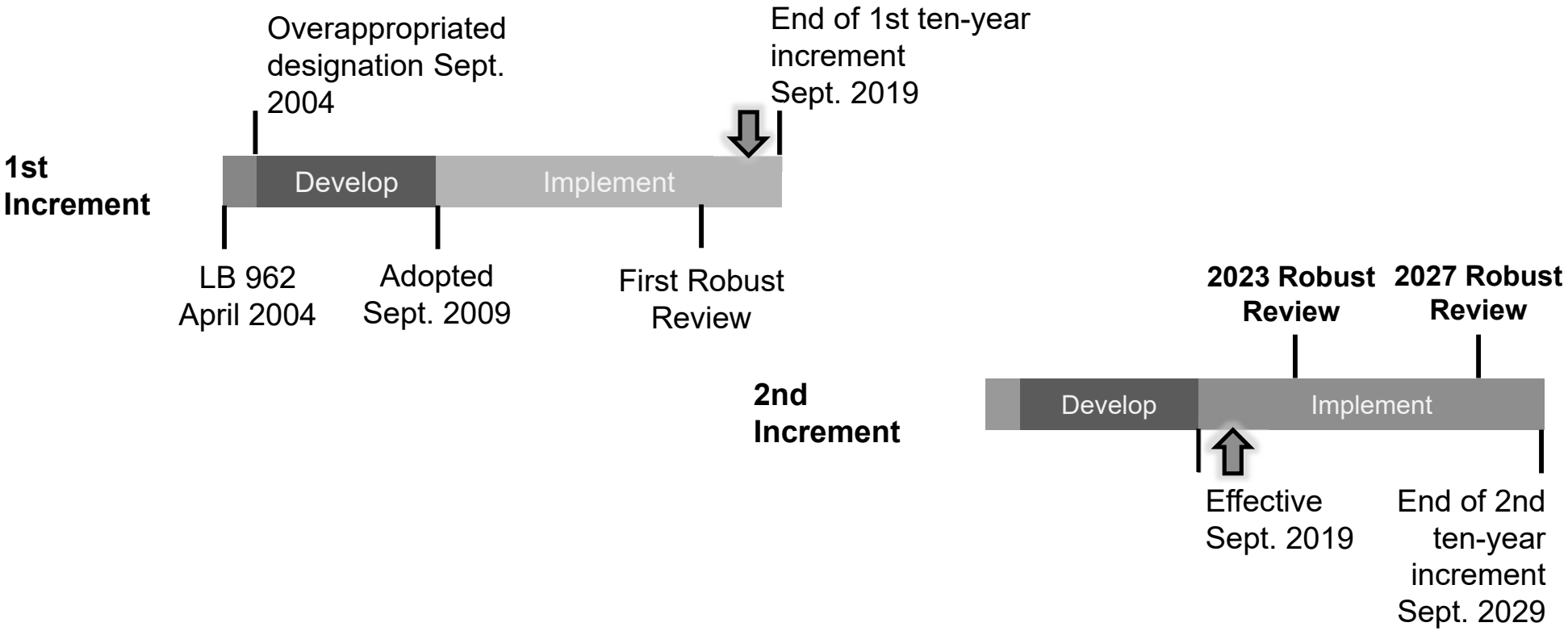


IWM – Overview Statutes

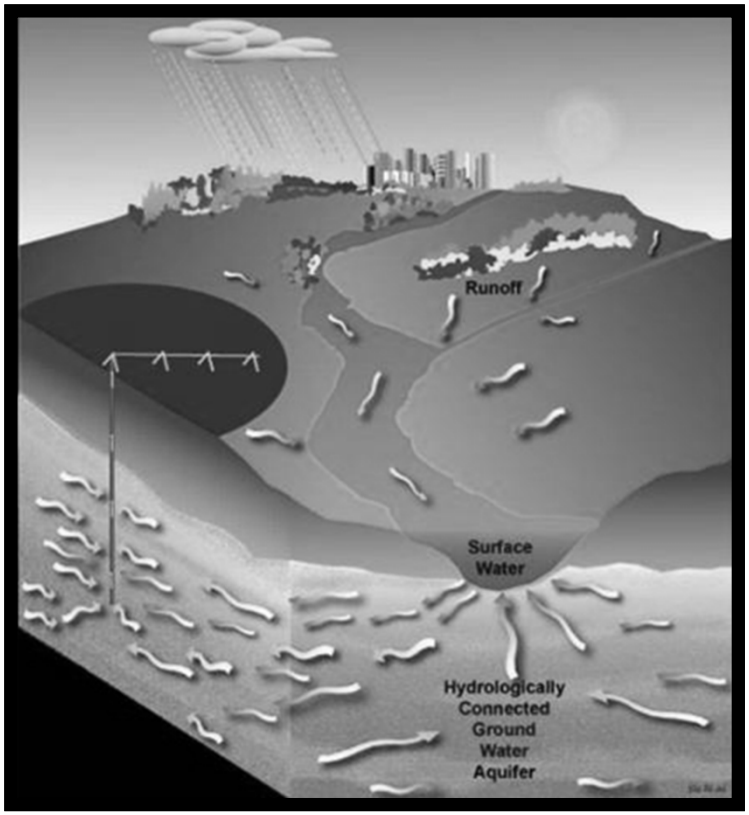
- *Nebraska Revised Statute* § 46-715(5):
  - ✓IMPs
  - ✓Basin-wide Plan
  - ✓Use Consultation & Collaboration Process w/Stakeholders
  - ✓Identify overall difference between Over and Fully appropriated
  - ✓Incremental (10 year) Approach to Fully Appropriated Impacts (stream depletion) of water use initiated after 7/1/1997 to existing users
  - ✓Technical Analysis to evaluate progress (Robust Review)
  - ✓Repeat Increments until Fully Appropriated
  - ✓Afterwards, maintain Fully Appropriated condition



IWM – Overview Timeline & Process



IWM – Overview
Surface & Ground Water Authorities



Surface Water

- Regulated by NeDNR
- Prior appropriations
- First in time is first in right

Integrated water management

Groundwater

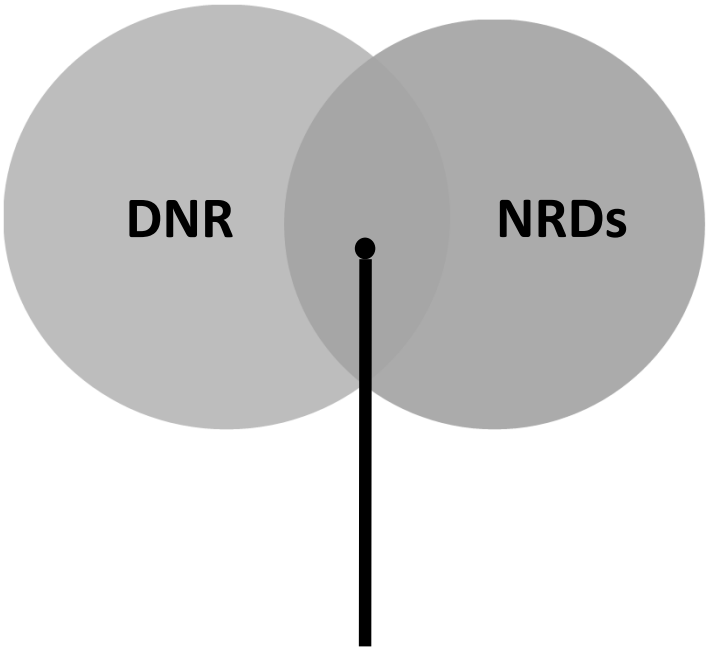
- Regulated by NRDs
- Correlative rights
- Share and share alike

- 46-715(1)(a): …jointly develop an IMP….
- 46-719: IWRB, resolving disputes between NRDs and NeDNR

IWM – Overview
Roles and Responsibilities

DNR'S INDIVIDUAL ROLES:

- Implement and enforce surface water controls
- Provide reports on new water use and permitting activities to the NRD
- Implement surface water monitoring and data collection activities



NRD'S INDIVIDUAL ROLES:

- Implement and enforce groundwater controls
- Provide reports on new water use and permitting activities to DNR
- Implement groundwater monitoring or data collection activities

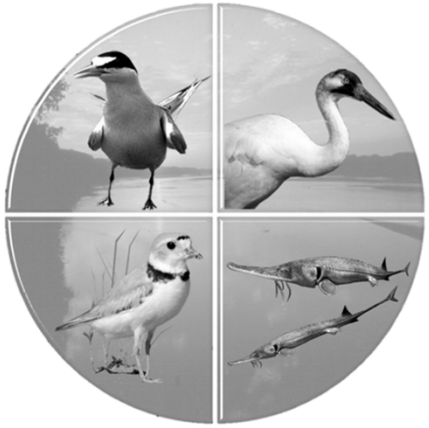
JOINT DNR/NRD ROLES:

- Coordinate on joint implementation aspects of the plan
- Review annual reports and data that is collected
- Conduct Robust Review and other IMP required analyses
- Keep stakeholders informed on progress towards fulfilling plan goals

IWM – Overview
Goals and Objectives

- Clear Goals & Objectives of BWPs & IMPs § 46-715(2)(a)
  - Protect existing uses from negative impacts of new uses
  - Ensure both the short-term and long-term balance of water supplies and uses to maintain
    - Economic viability
    - Social and environmental health
    - Safety
    - Overall welfare of the basin
- Meet interstate agreement compliance obligation

IWM – Overview
Interstate Compliance



Platte River Recovery Implementation Program (PRRIP) & Nebraska New Depletion Plan (NNDP)

- The Extended First Increment ends December 2032
- Associated Habitat Reach: Platte River from Lexington to Chapman, NE
- PRRIP Water Action Plan projects can be used to meet post-1997 offset requirements towards fully appropriated
- Prevent streamflow depletions that would cause non-compliance
- The Basin-wide Plan and IMPs have goals, objectives and action items to ensure compliance with the Program
- Requires annual reporting of new or expanded uses

✓ Requires basin-wide inventory/analysis of depletions and accretions from post-1997 new and expanded development every 5 years (Robust Review)

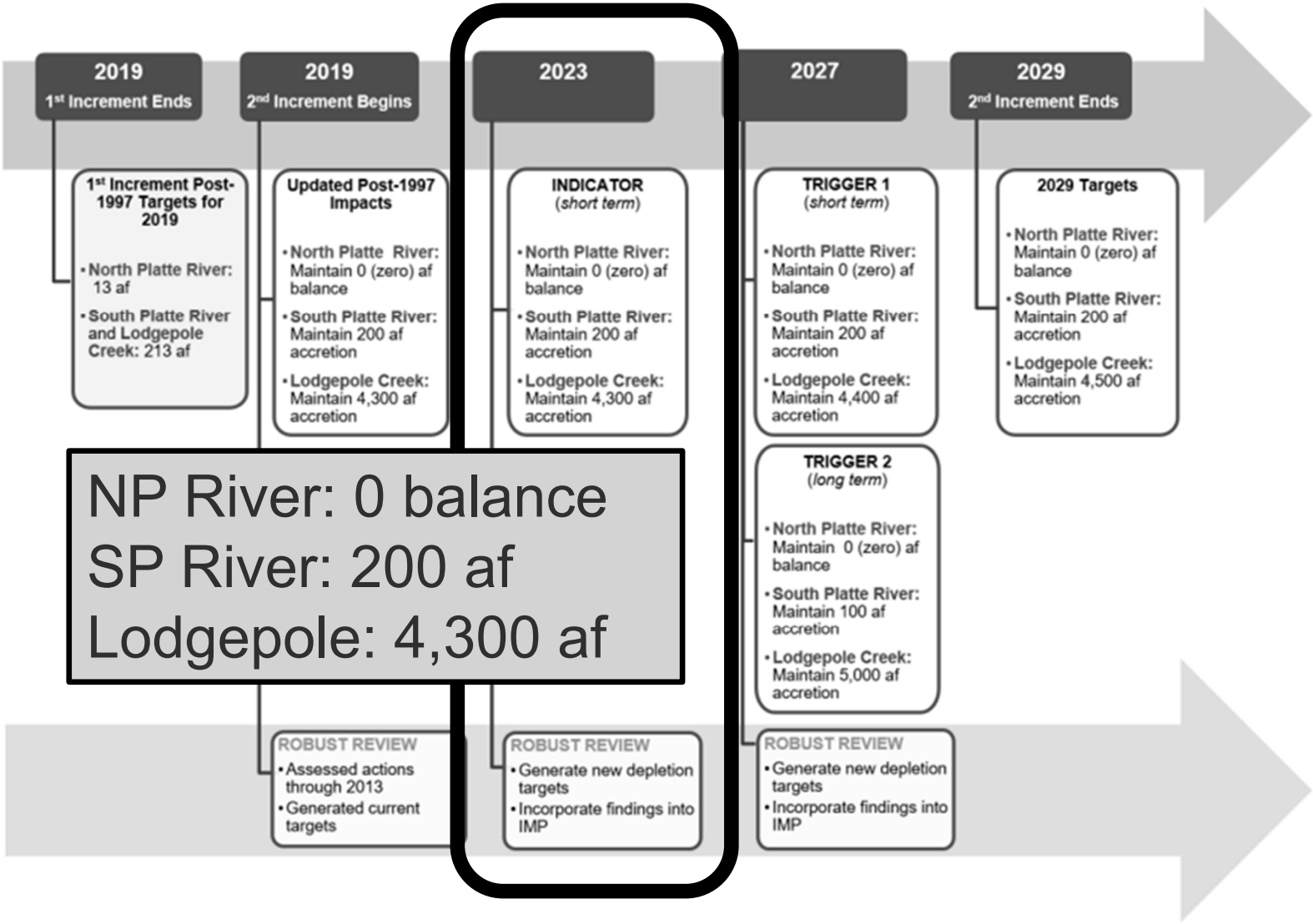
IWM – Overview

Relationship between Basin and NRD Plans

BWP	IMP
All basin NRDs and NeDNR	1 NRD and NeDNR
Overappropriated Area	Overappropriated and Fully Appropriated Areas
Goals & objectives: ○ Focus on regional, cross-boundary issues and opportunities ○ Consistency and collaboration among basin NRDs ○ A broad framework used for basing IMPs	Goals, objectives, & controls: ○ Specific to the one NRD ○ Tailored to local issues ○ Specific targets and actions

IWM – Overview

SPNRD IMP Requirements - Indicator



2023 Robust Review Analysis: Introduction

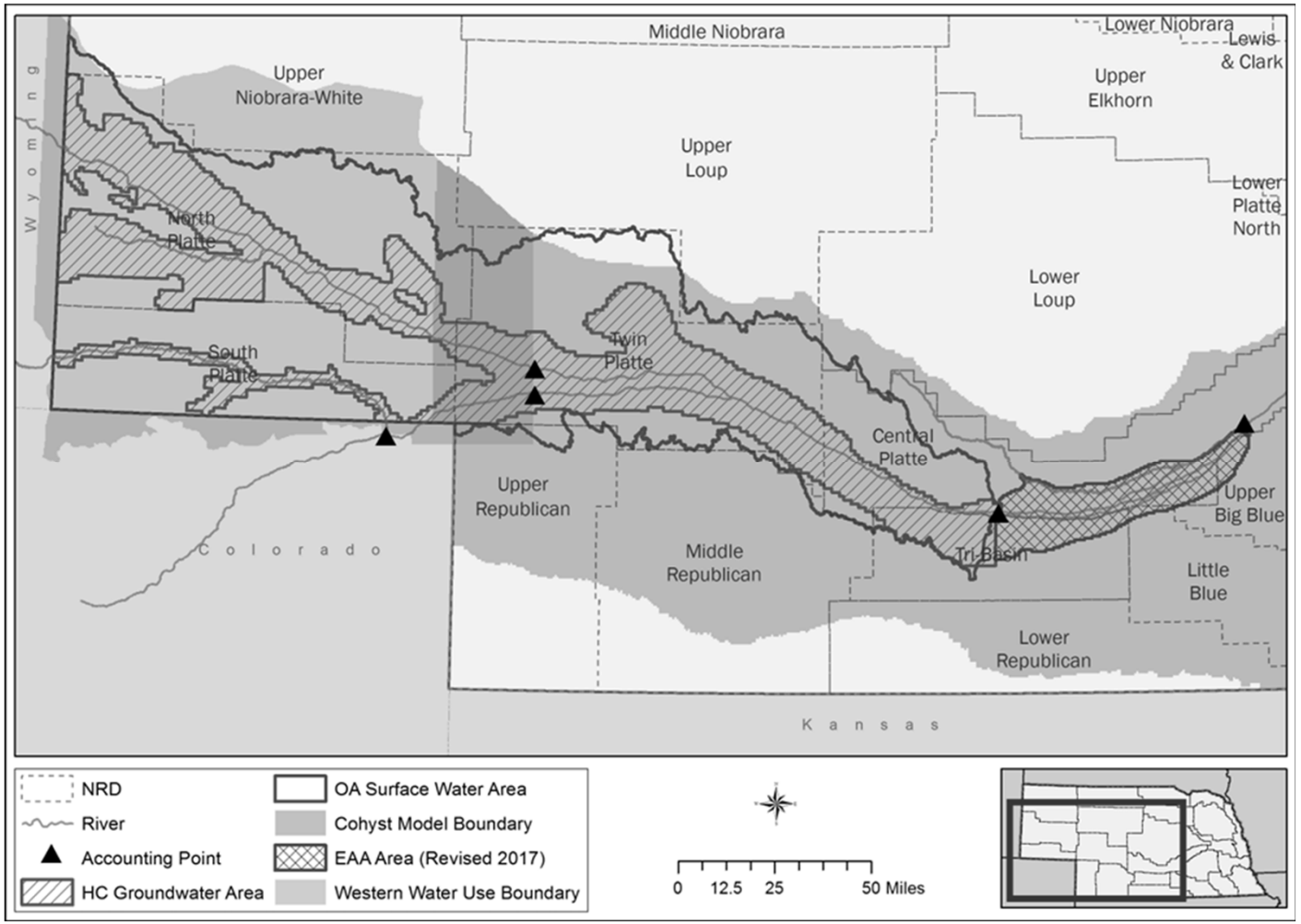
Robust Review
Introduction

Goals of Robust Review

- Assess progress on second increment goals and objectives (2023 Indicators)
- Assess compliance with PRRIP and NNDP
- Provide information for decision makers

Robust Review Introduction

Analysis Set-Up: Map (Model Area)



Robust Review Introduction

Simulation Set-Up

- Model simulation period:1953-2020, extended to 2070
- SPNRD Scenario repeat:
  - 2017-2019
  - Includes the most recent full allocation cycle before 2020
  - Captures a wetter than average climate period
- Results are summarized for:
  - South Platte River, Lodgepole Creek, and the North Platte River

2023 Robust Review Analysis: Updates to Model

Robust Review Analysis
Updates to Model

Western Water Use Management Modeling (WWUMM) Overview

CropSim

- Climate Data
- Run CropSim
- Output

ESC Model

Input Data

- CropSim files
- Landuse
- Canals
- Diversions
- Wells
- Model Grid
- Soils
- Pumping

Model Run

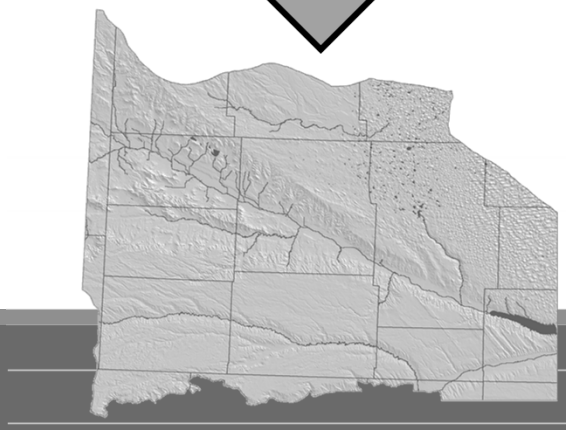
- Model is parcel based for irrigation, climate, crops
- WSPP from previous runs was recreated
- Many Options available, historical, Steady State, Post97 options

Output

- Output to local computer in SQLite Database
- Creates QC files that are summaries of parcel NIR, pumping, recharge and well pumping
- Creates wel, rch files for Modflow

GW Model

- ESC Well and Recharge Files
- Run Model



Robust Review Analysis
Updates to Model

Major Differences from 2019 Robust Review

- Update input data 2014 through 2020
  - Climate data
  - Land use
  - Crops
  - Meter data

- Update Cropsim/Watershed Model to ESC
  - Parcel based calculations
  - Modified crop growth specifications

- Update Groundwater Model to Modflow 6
  - New solver & pumping function / fixed dry cells
  - Brule Fractures
  - Base of Aquifer

Robust Review Analysis
Updates to Model

Impacts to Overall Water Budget (WWUMM)

- ESC Appears to have a net effect of reduced recharge
  - Replaced a weather station
  - Impacted by change from grass pasture to native vegetation

- More modeled groundwater pumping is occurring
  - Impacted by aquifer adjustments (base/fractures)
  - Dry cells resolved

Robust Review Analysis
Performance of Updates to Model

- Significant changes to aquifer properties & model update

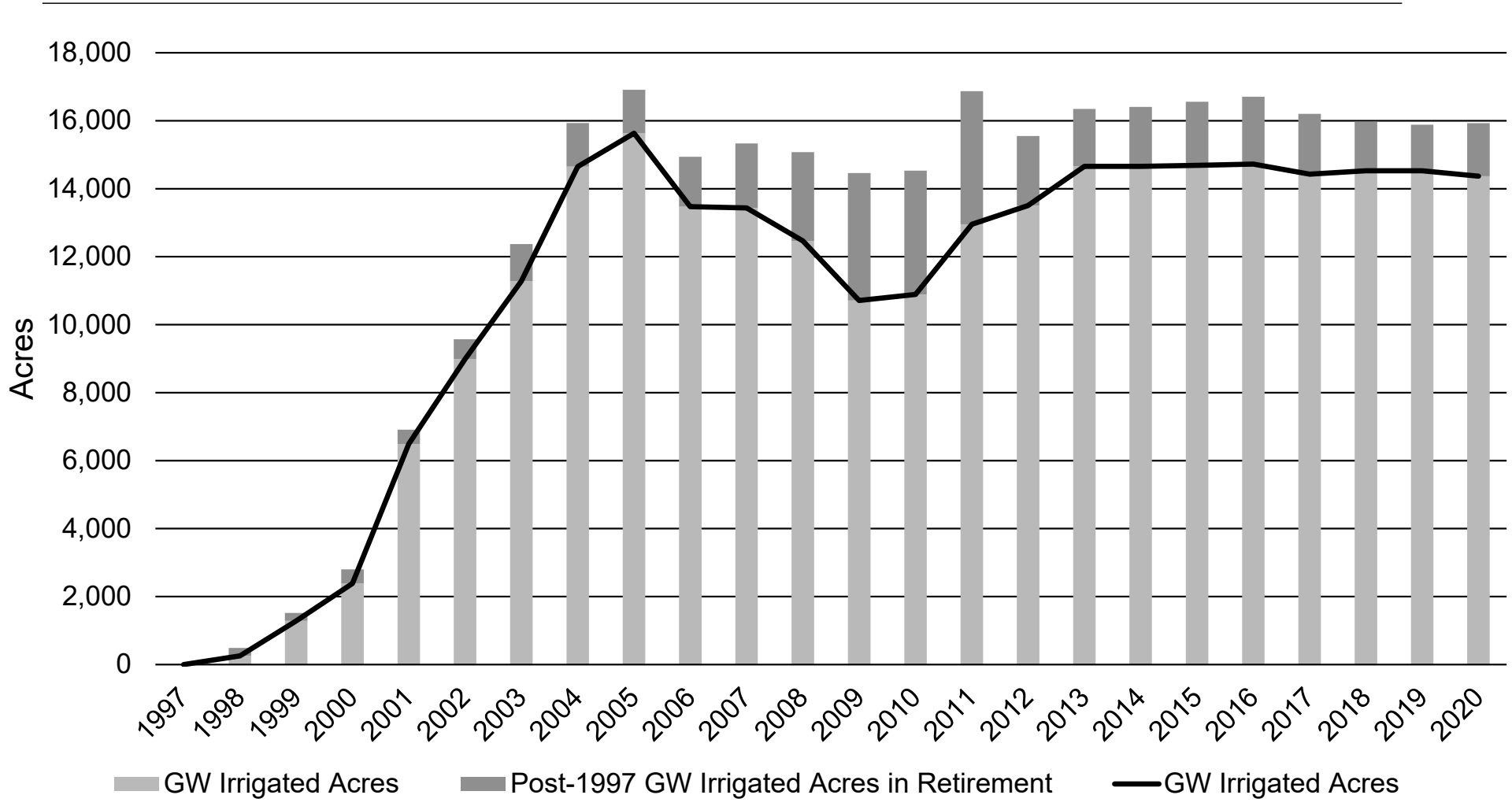
- Model performs comparatively well to the prior model
  - Underestimates groundwater levels in the vicinity of the South Platte River
  - Overestimated heads and underestimated baseflows in the last 10-15 years of the calibration period along the North Platte River in the western half of the model domain

- Recalibration is suggested before next robust review

2023 Robust Review: Management Actions & Model Inputs

Management Action & Model Input:

Net Change in Groundwater-Only Irrigated Acres 1997 to 2020



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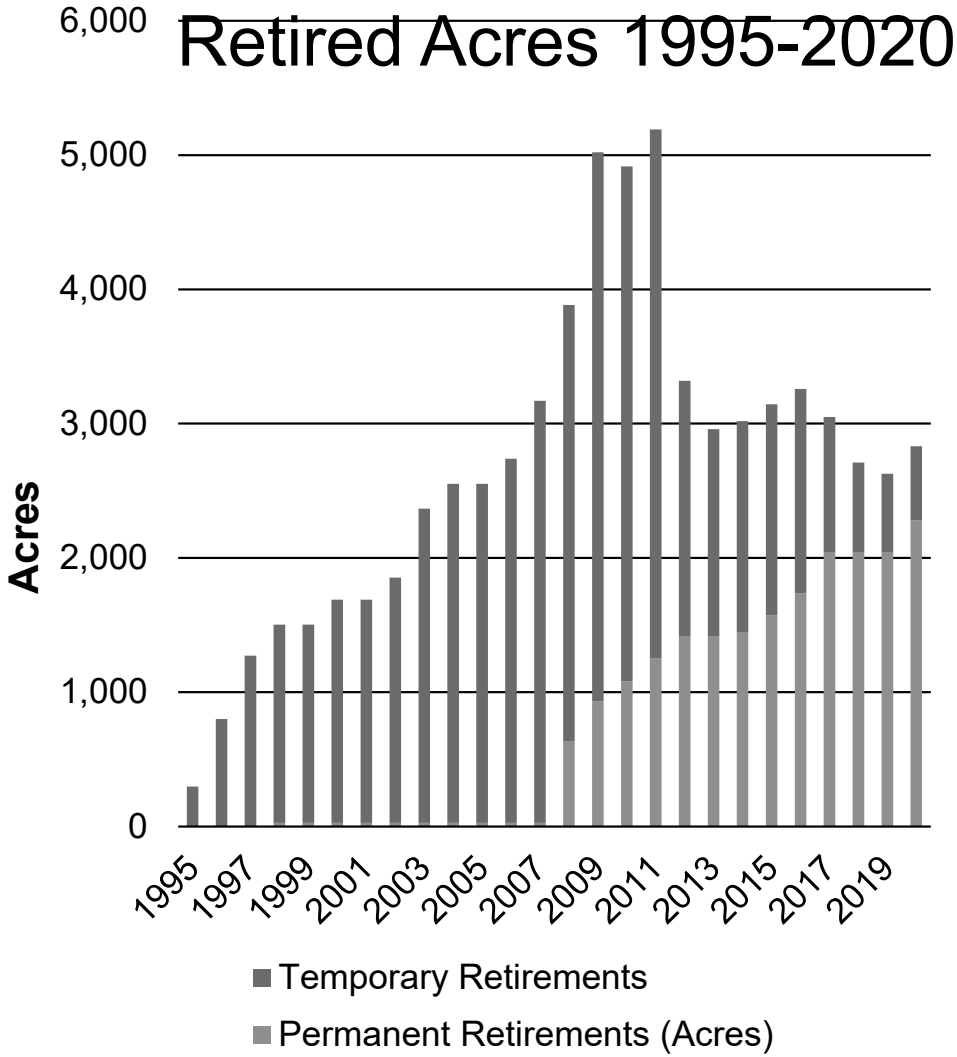
Management Action & Model Input:
Decertified groundwater only irrigated acres



- Temporary retirements began in 1995
- Permanent retirements began in 1998
- Modeled as net pumping
  - Allocation*efficiency*acres
- Average NRD-wide change in CU
  - ~10 Inches/Acre/Year

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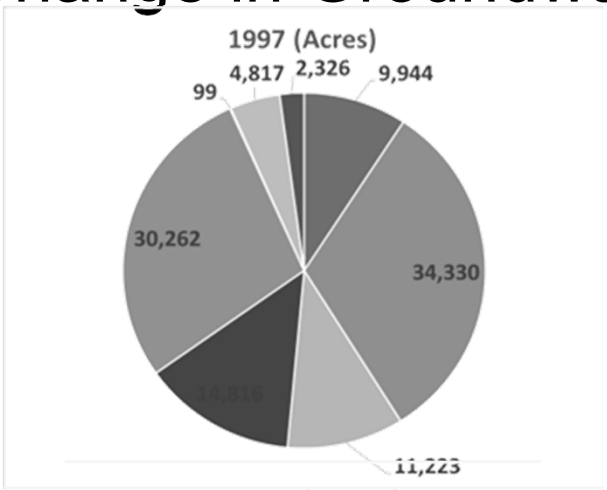
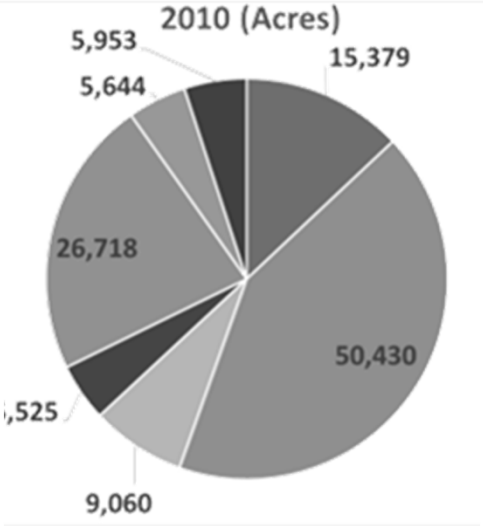
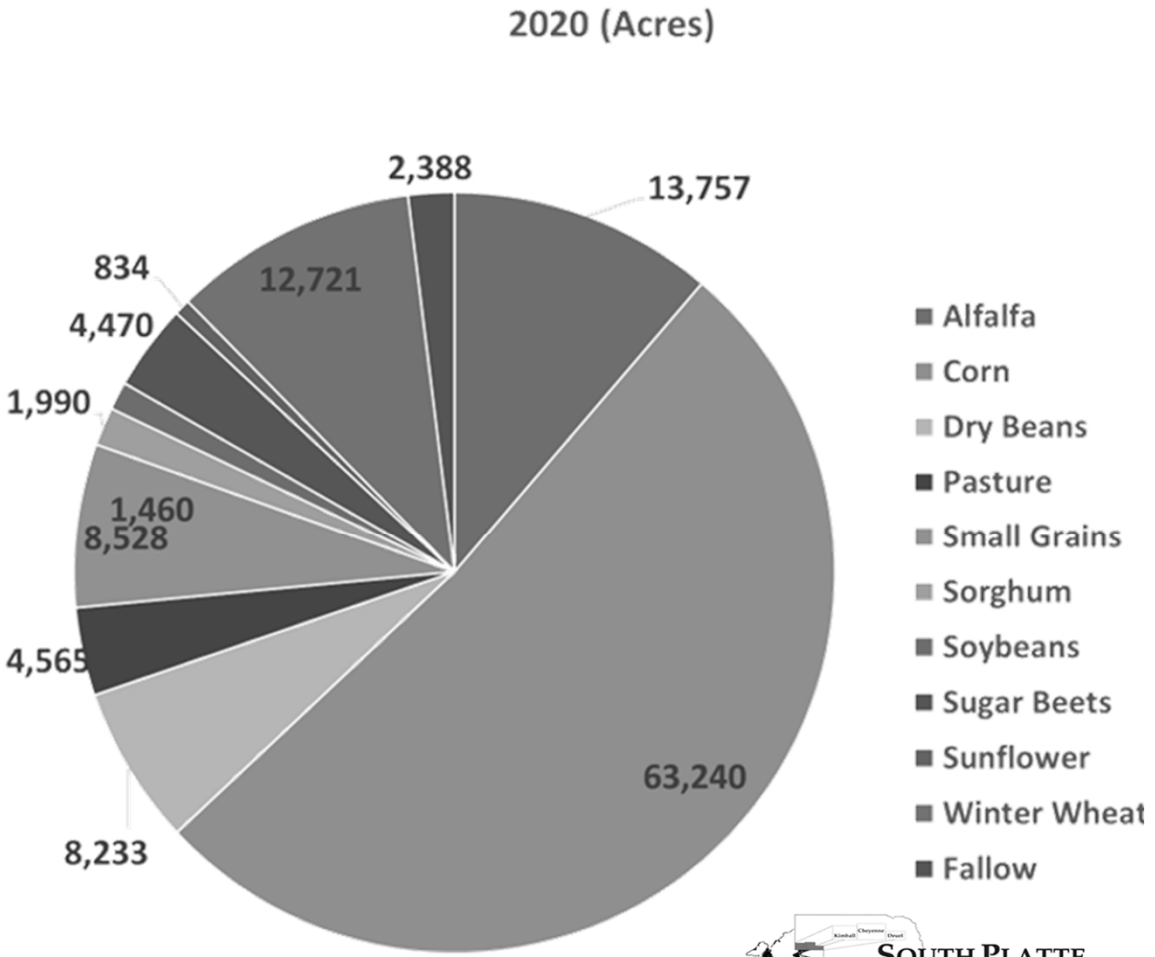
Management Action & Model Input:

Change in Groundwater-Only Irrigated Crop Types







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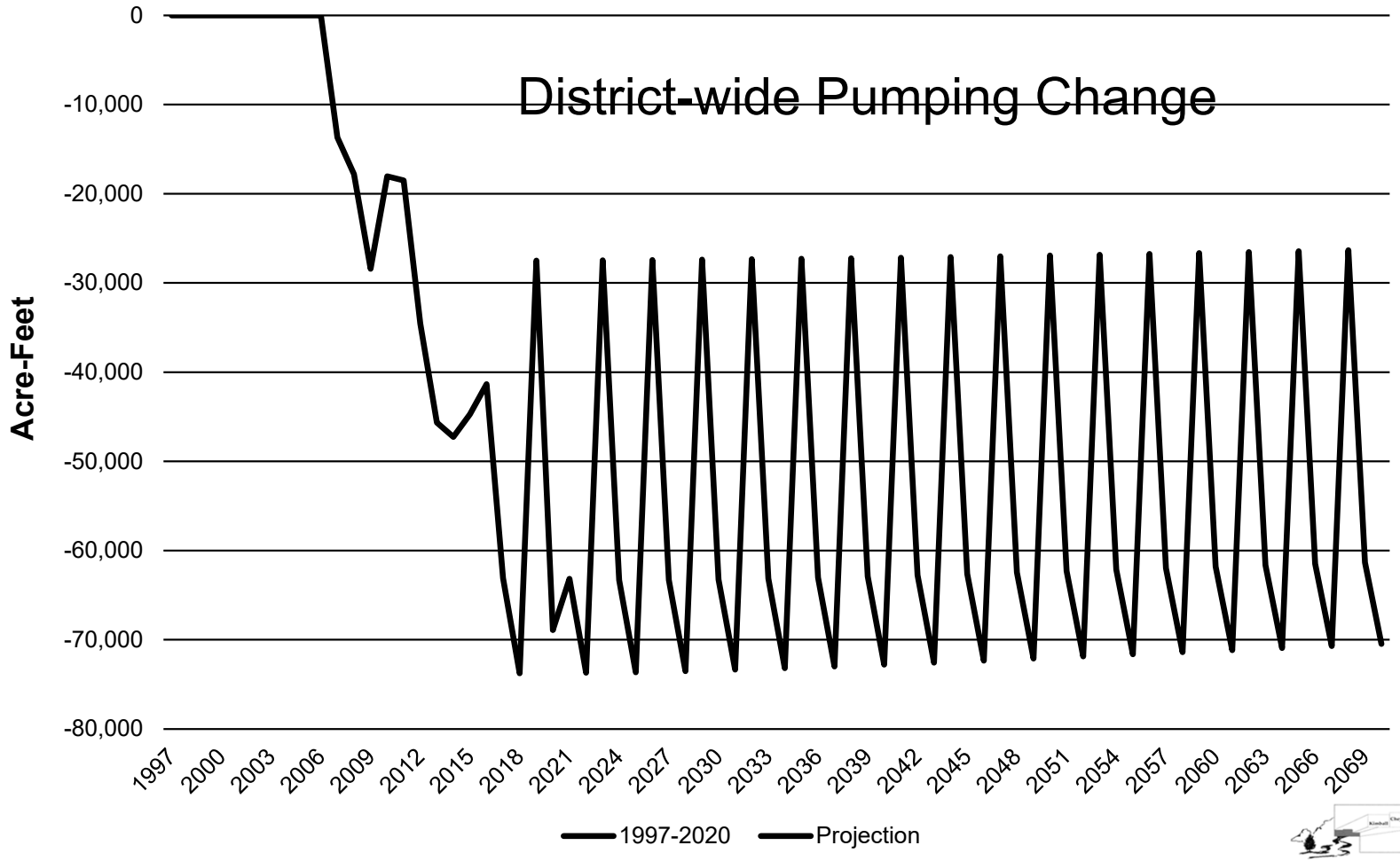
Management Action & Model Input: Allocations

Change in Groundwater-Only Irrigation **Pumping**: Allocations



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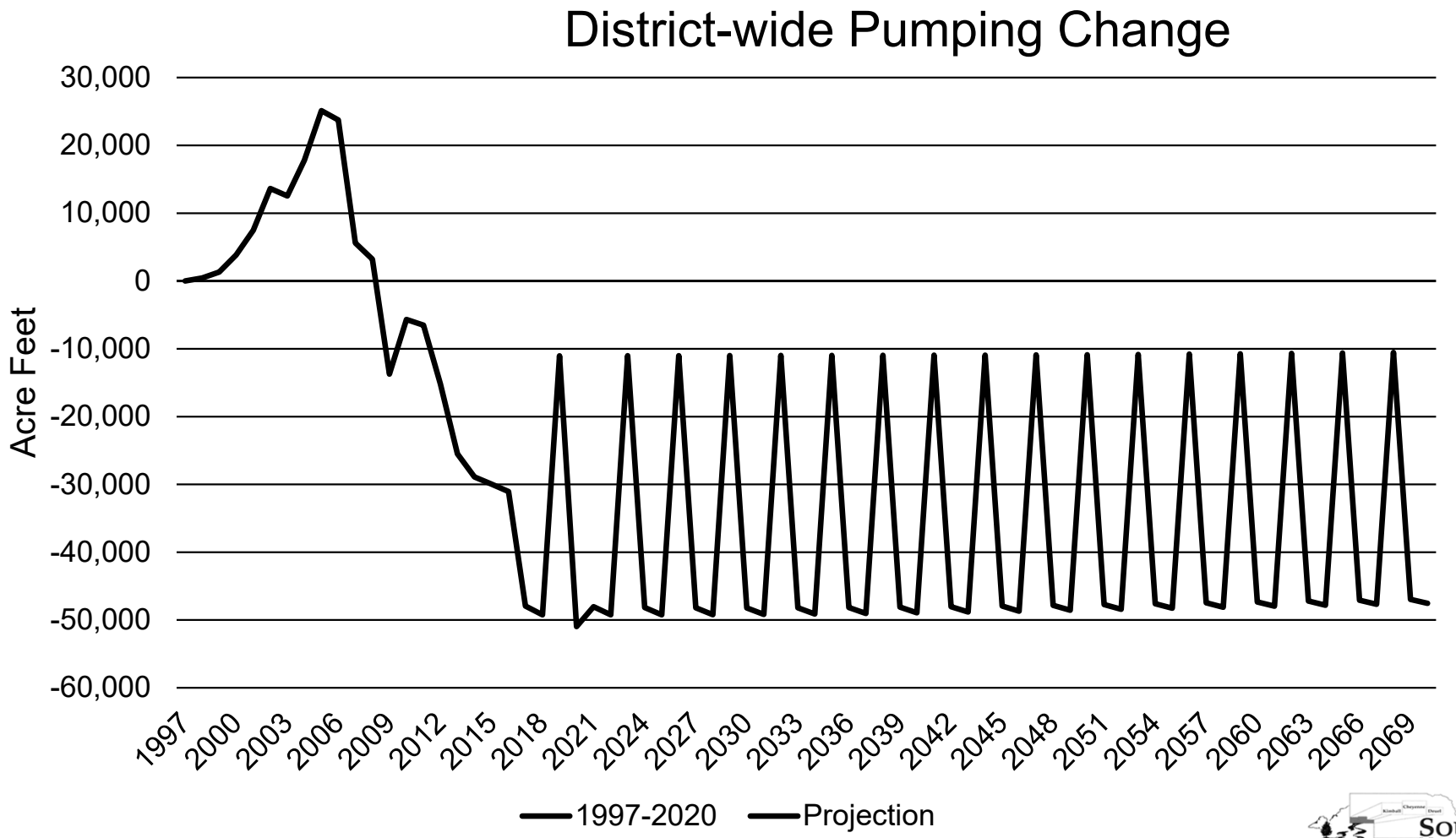
Management Action & Model Input:

Change in Post-1997 Groundwater-Only Irrigation **Pumping**: Total



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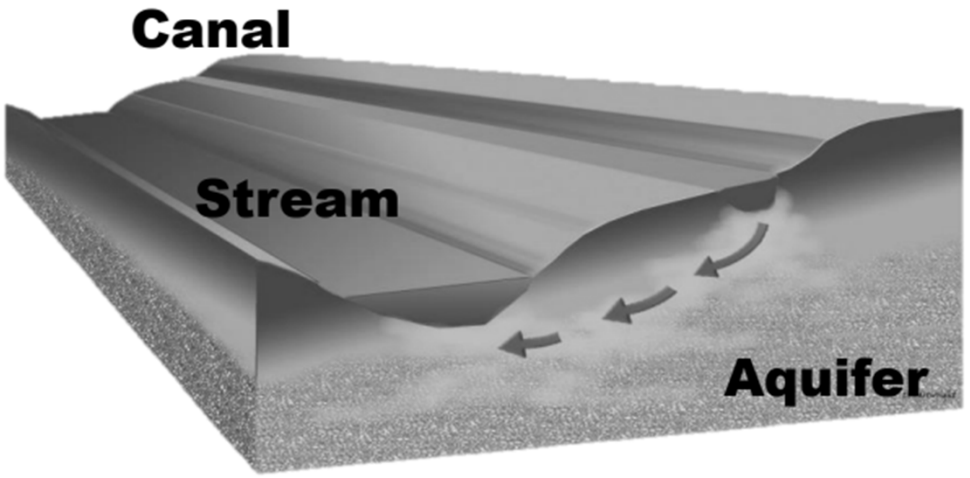
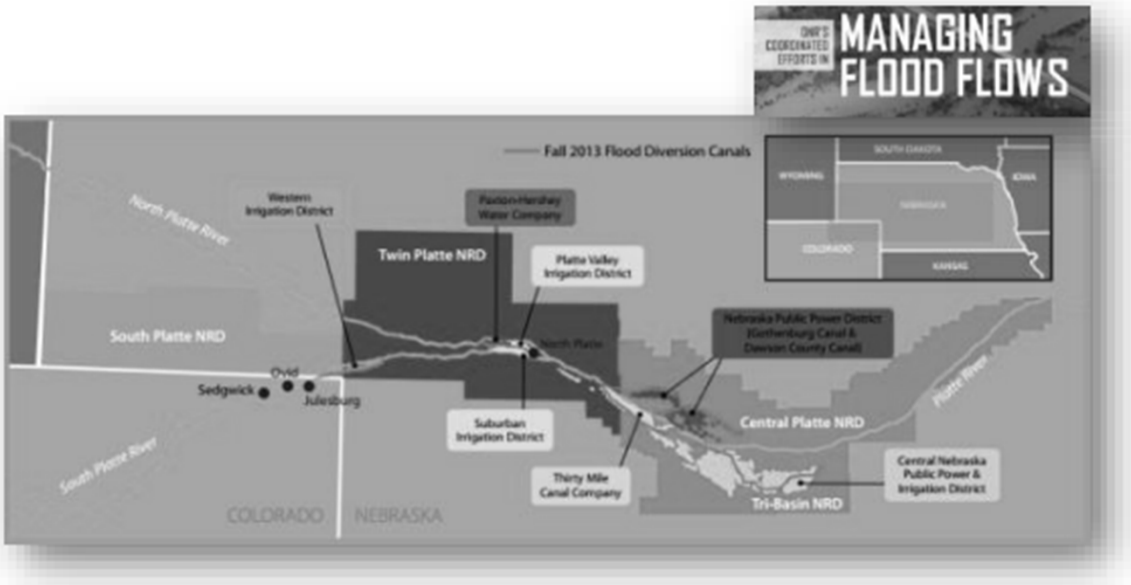
Management Action: Conjunctive Water Management (CWM)



Conjunctive Water Management is an *adaptive process* that utilizes the *connection* between surface water and groundwater to *maximize water use*, while *minimizing impacts* to streamflow and groundwater levels in an effort to increase the overall water supply of a region and improve the reliability of that supply.

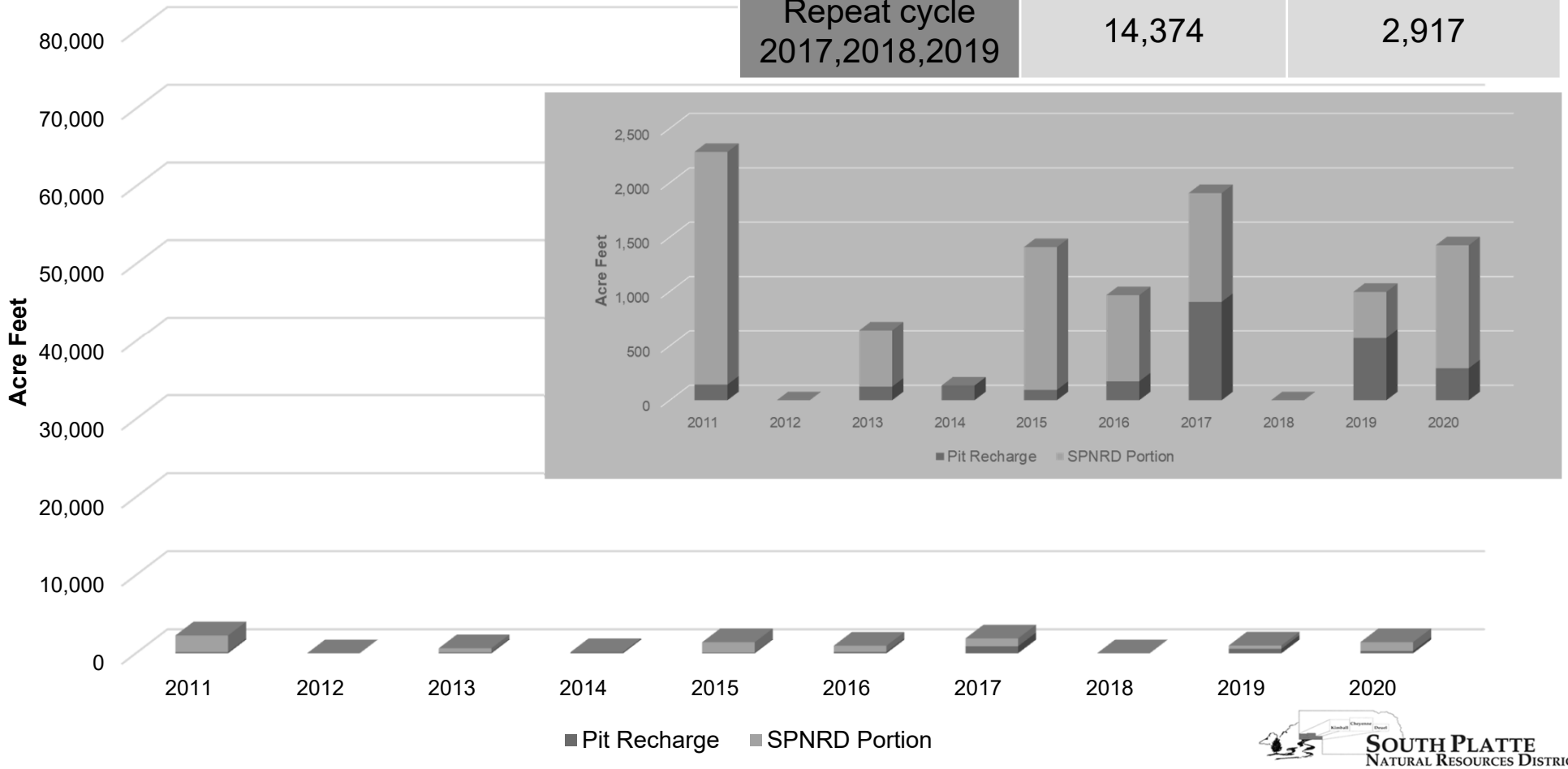
- Excess flow capture
- Augmentation
- Water leasing
- Water transfers
- Canal refurbishment



Management Action: CWM / Excess Flows

SPNRD	Acre-Feet of Excess Flow	
	Diversion	Recharge
2011-2020	47,955	9,781
Repeat cycle 2017,2018,2019	14,374	2,917

Excess Flow Recharge



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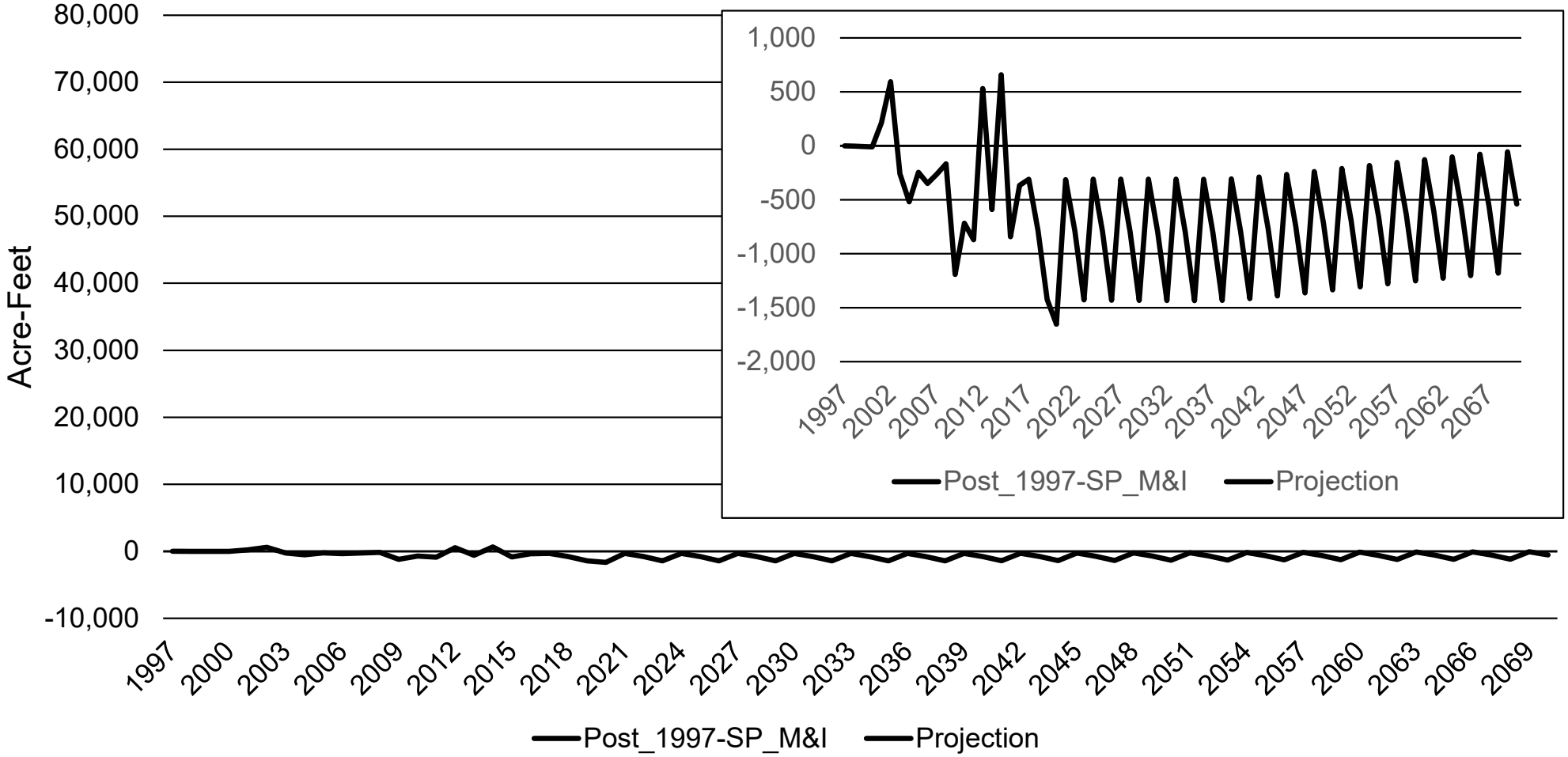
Management Action & Model Input:

Change in Municipal and Industrial Pumping from 1997



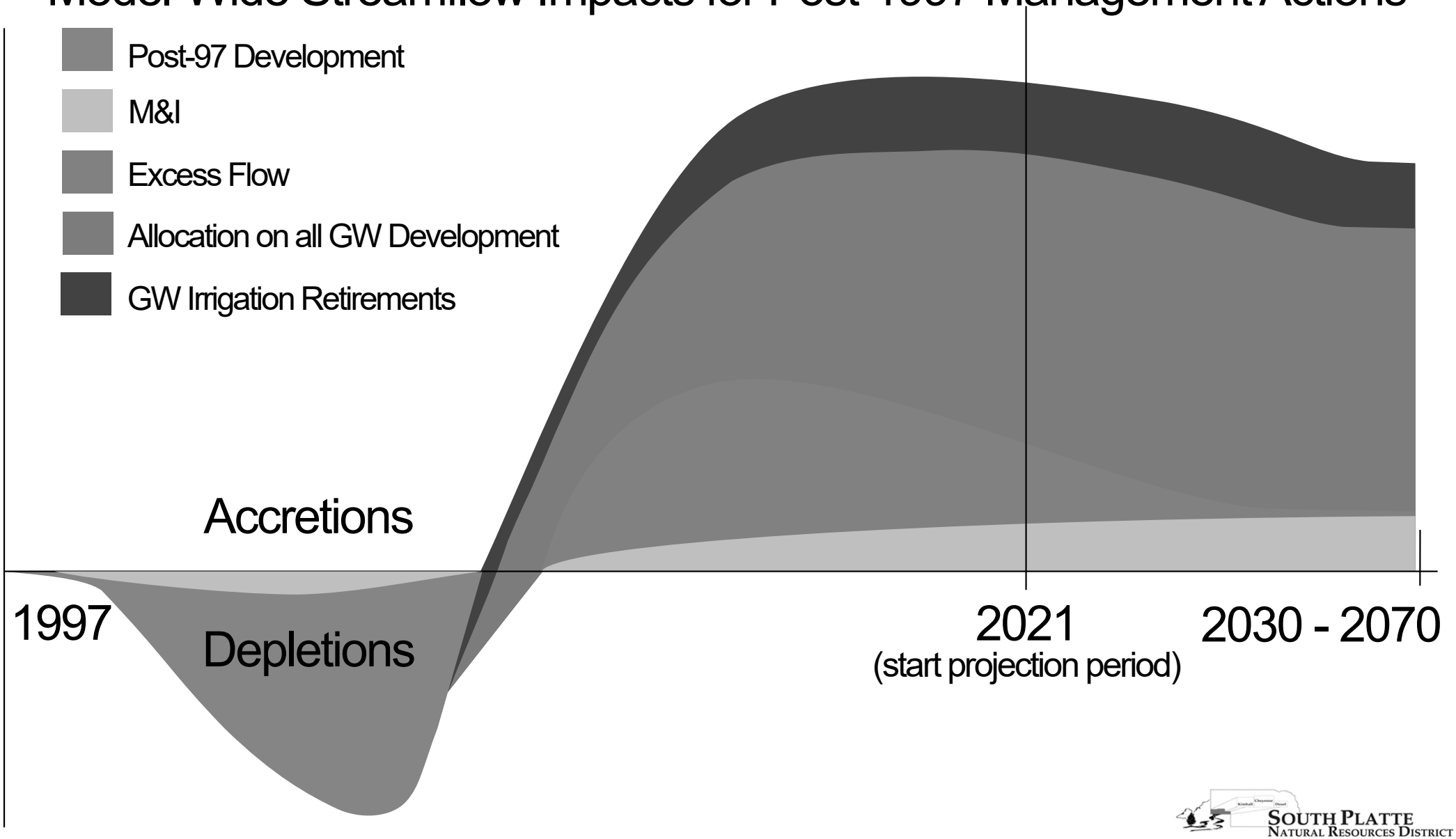
2023 Robust Review: Analysis – SPNRD Results

Robust Review Analyses

- Post-1997 Analysis
  - Historic Run (Same as last RR)
  - 1997 Development Run (Same as last RR)
  - Excess Flow Analysis (Same as last RR)
    - Included additional scenario with projected excess flows (New)
  - Allocation Effects Analysis (New to RR)
  - Ground Water Irrigation Retirements Analysis (New)
  - M&I Analysis (New)
- Total Depletions Analysis (Same as last RR)
- Livestock Analysis (Same as last RR)

WWUMM

Model-Wide Streamflow Impacts for Post-1997 Management Actions



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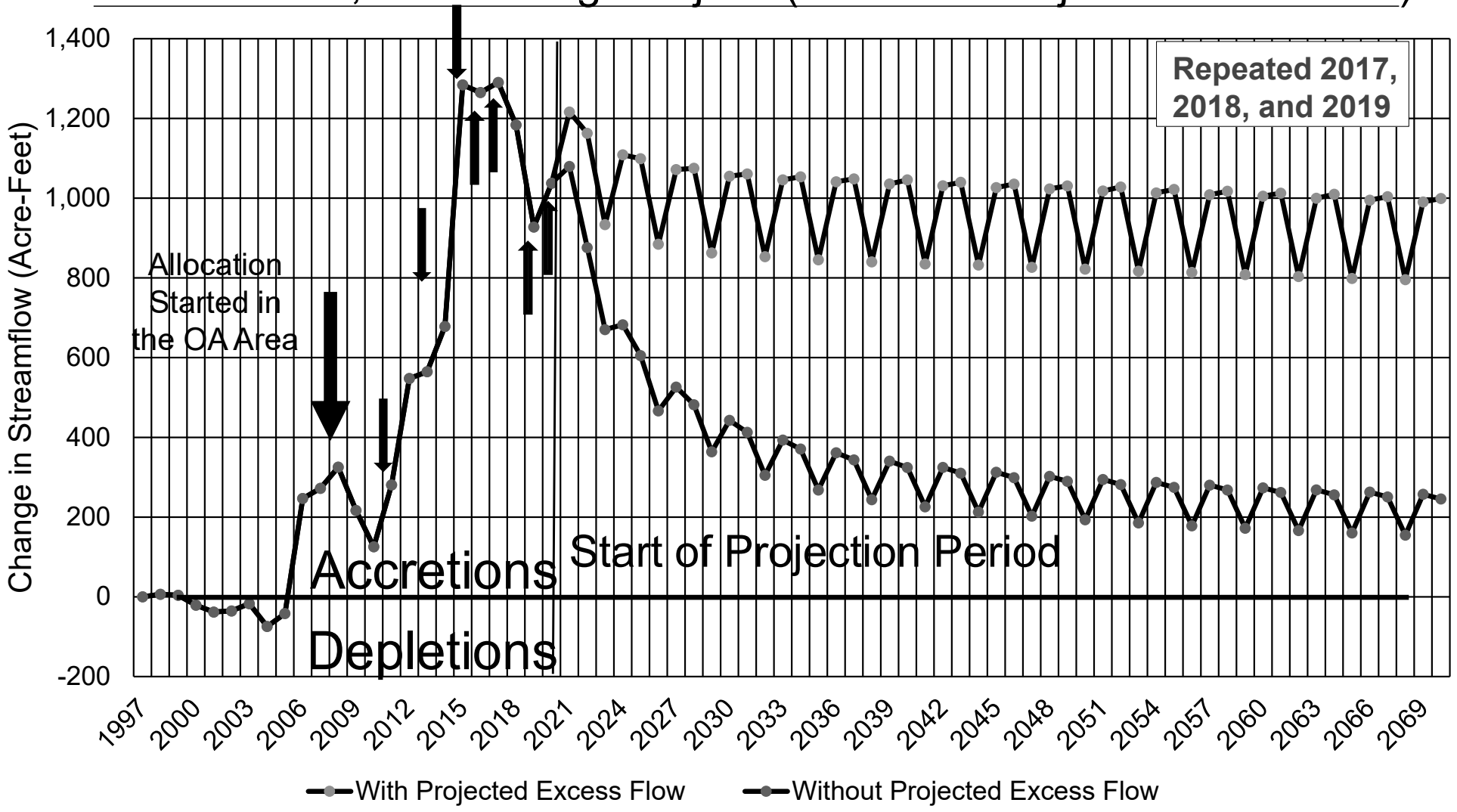
South Platte River

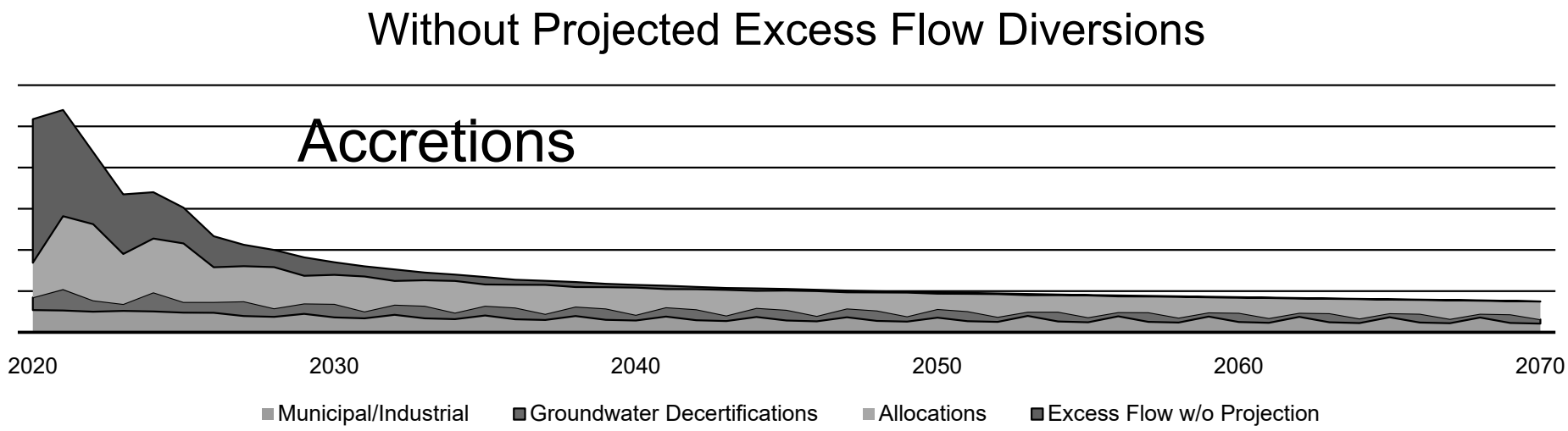
SPNRD Results:

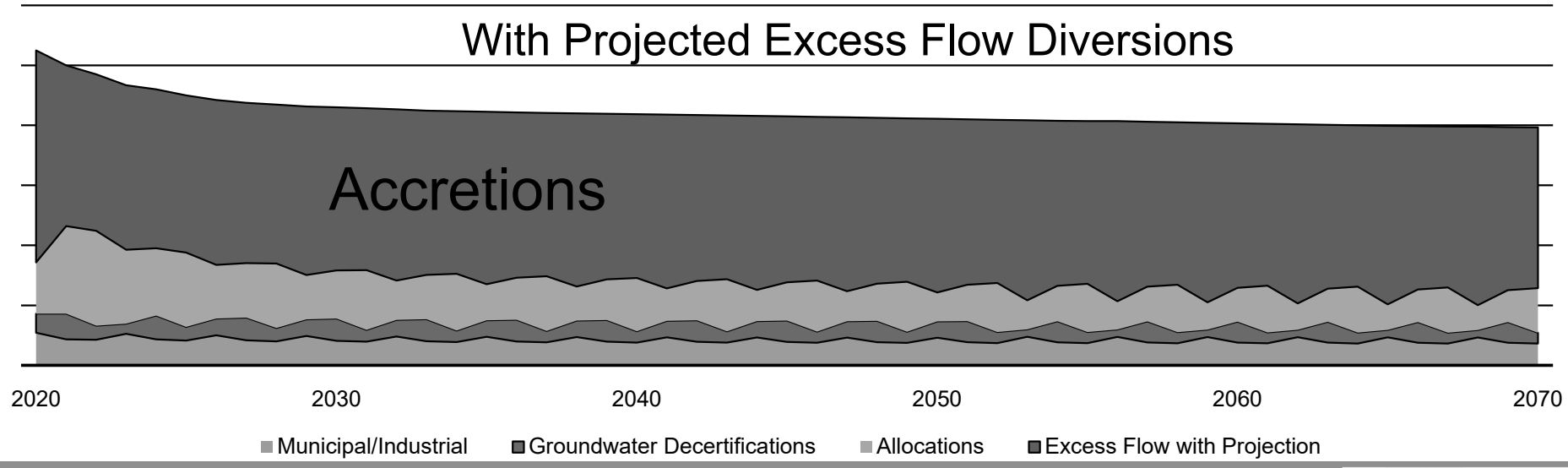
Robust Review Analysis Results: Post-1997 Analysis, includes M&I, Allocations, Decertifications, and Recharge Projects (with & w/o Projected Excess Flow)



SPNRD Results

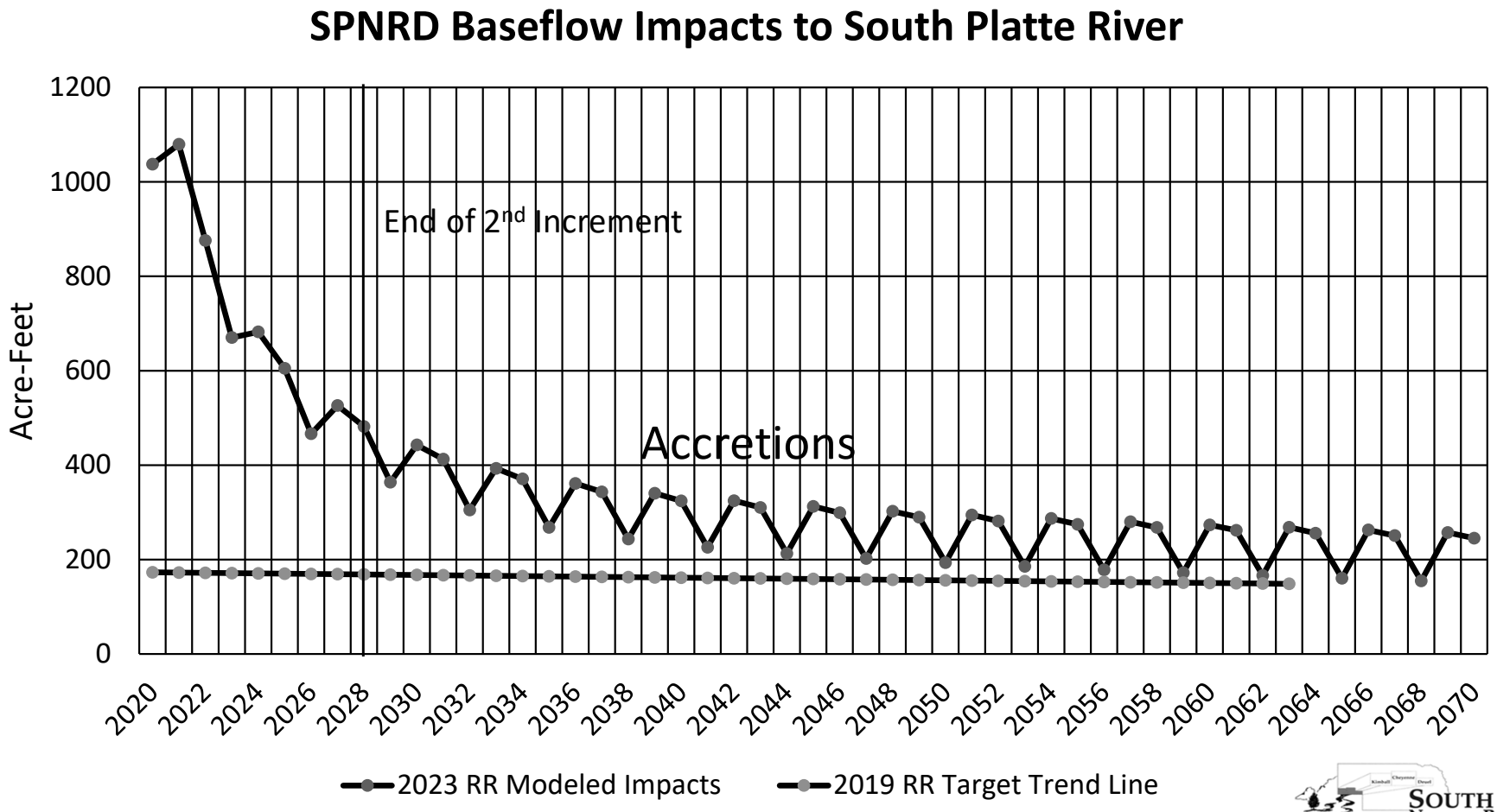
Future Projection Generalized Components





SPNRD Results

Target Comparison: South Platte River



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SPNRD Results

Indicator* Review: South Platte River

Year	Current IMP Targets	2023 Robust Review Results
2019	200	1000
2020	200	1000
2021	200	900
2022	200	900
2023*	**200**	**800**
2024	200	700
2025	200	700
2026	200	600
2027	200	500
2028	200	500
2029	200	400

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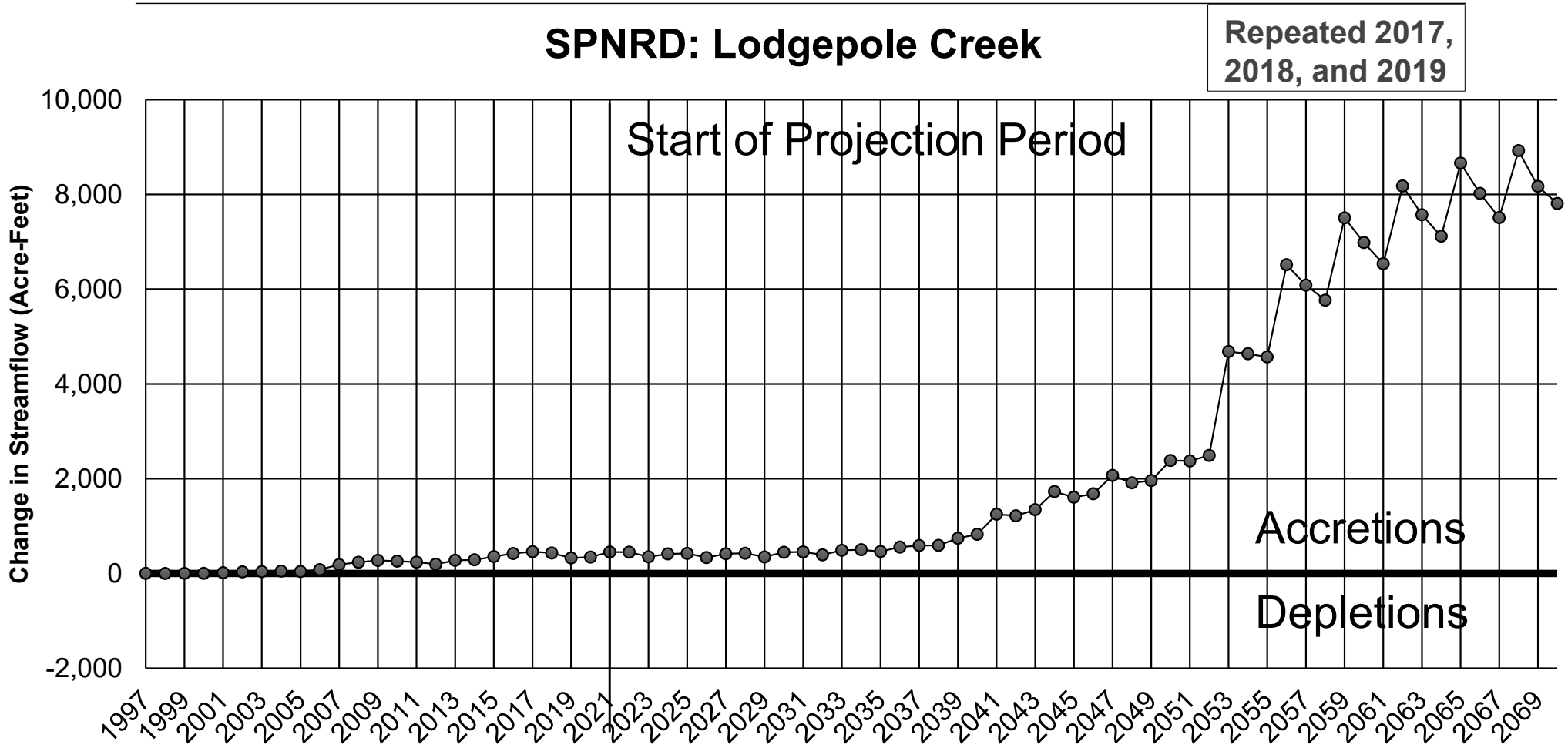
Lodgepole Creek

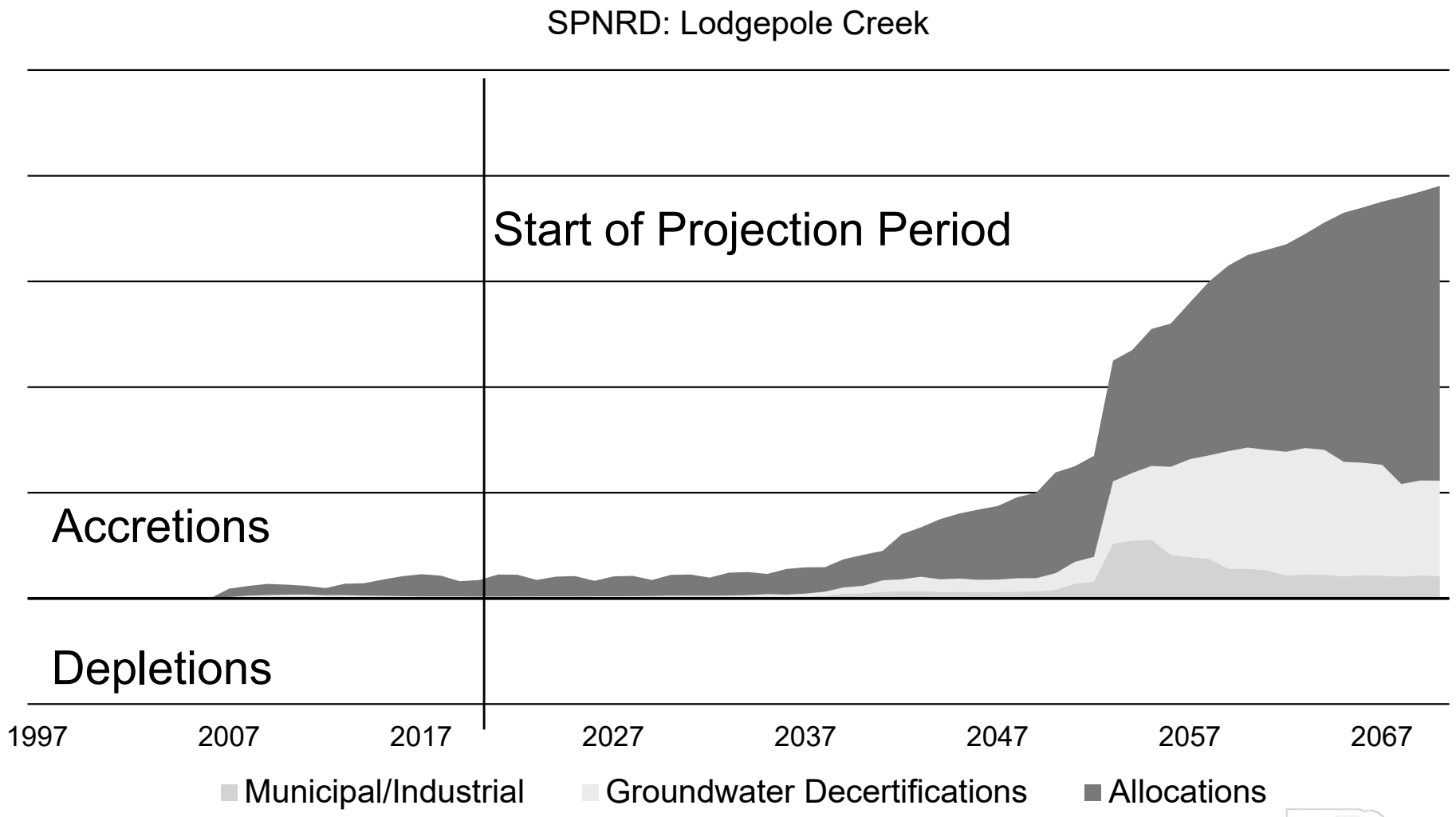
SPNRD Results

Robust Review Analysis Results: Post-1997 Combined



SPNRD Results

Robust Review Analysis Generalized Post-1997 Components



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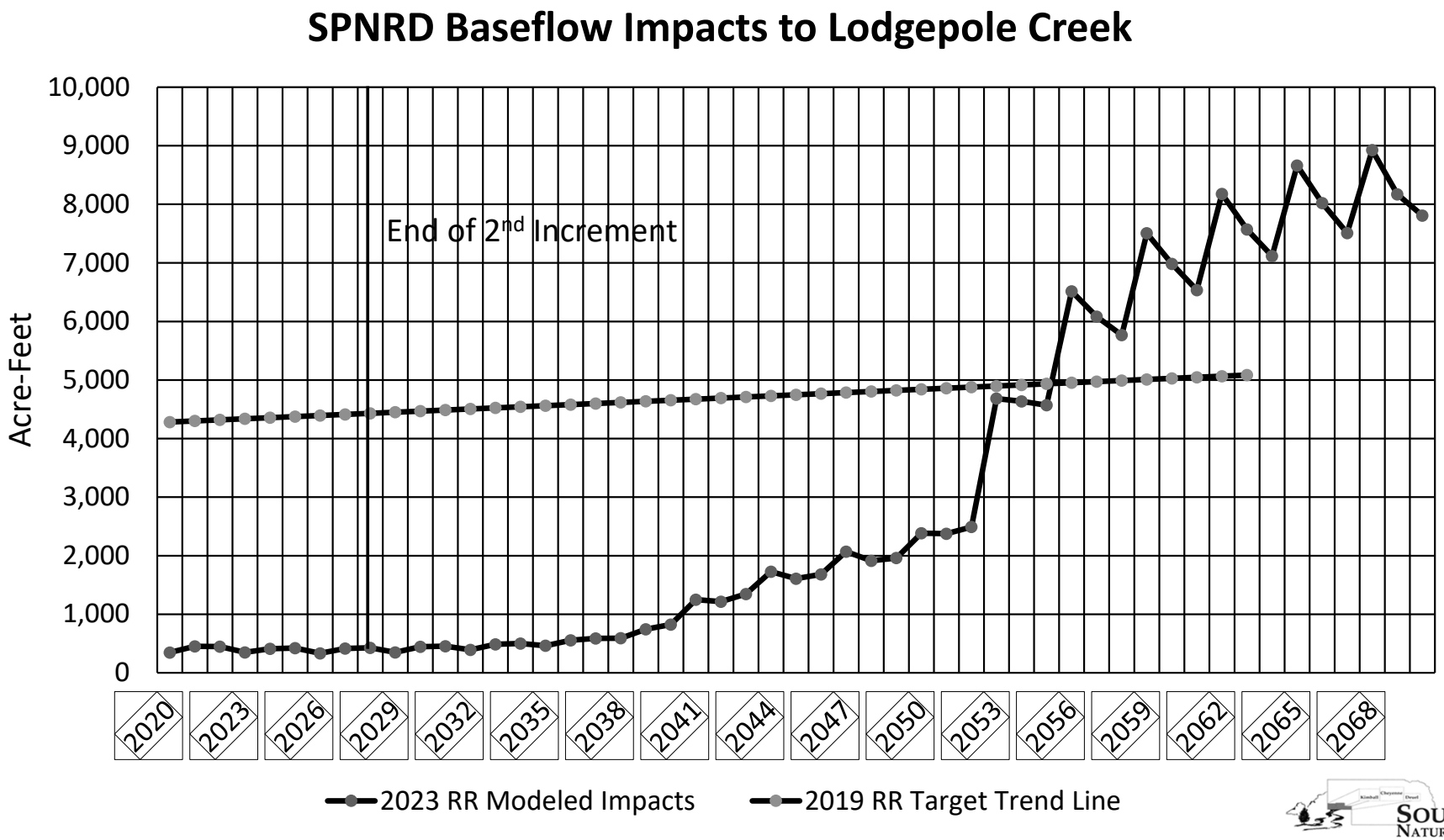
SPNRD Results

Target Comparison Lodgepole Creek



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SPNRD Results

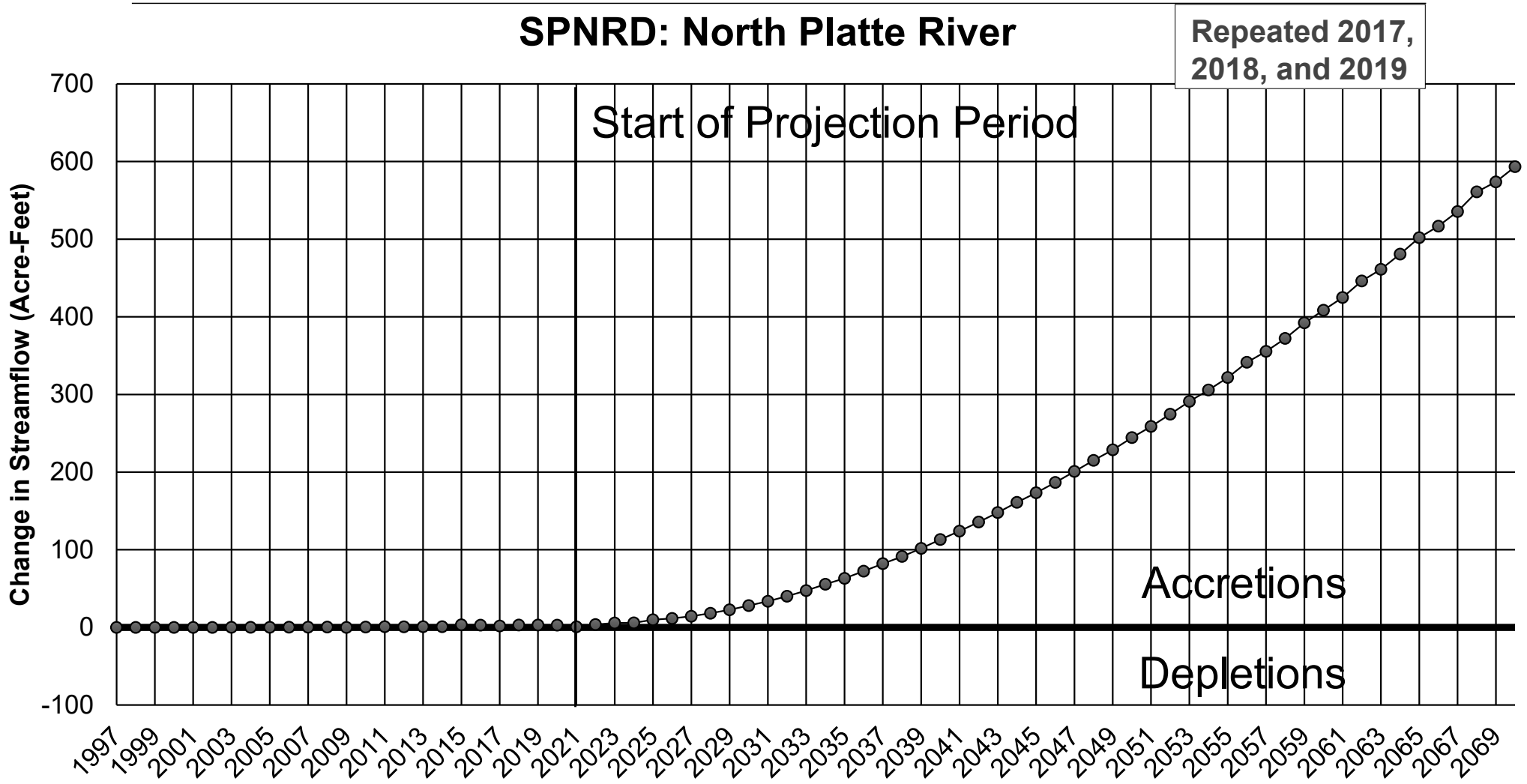
Indicator Review*: Lodgepole Creek

Year	Current IMP Targets	2023 Robust Review Results
2019	4,300	400
2020	4,300	400
2021	4,300	400
2022	4,300	400
2023*	**4,300**	**400**
2024	4,400	400
2025	4,400	400
2026	4,400	400
2027	4,400	400
2028	4,400	400
2029	4,500	400

North Platte River

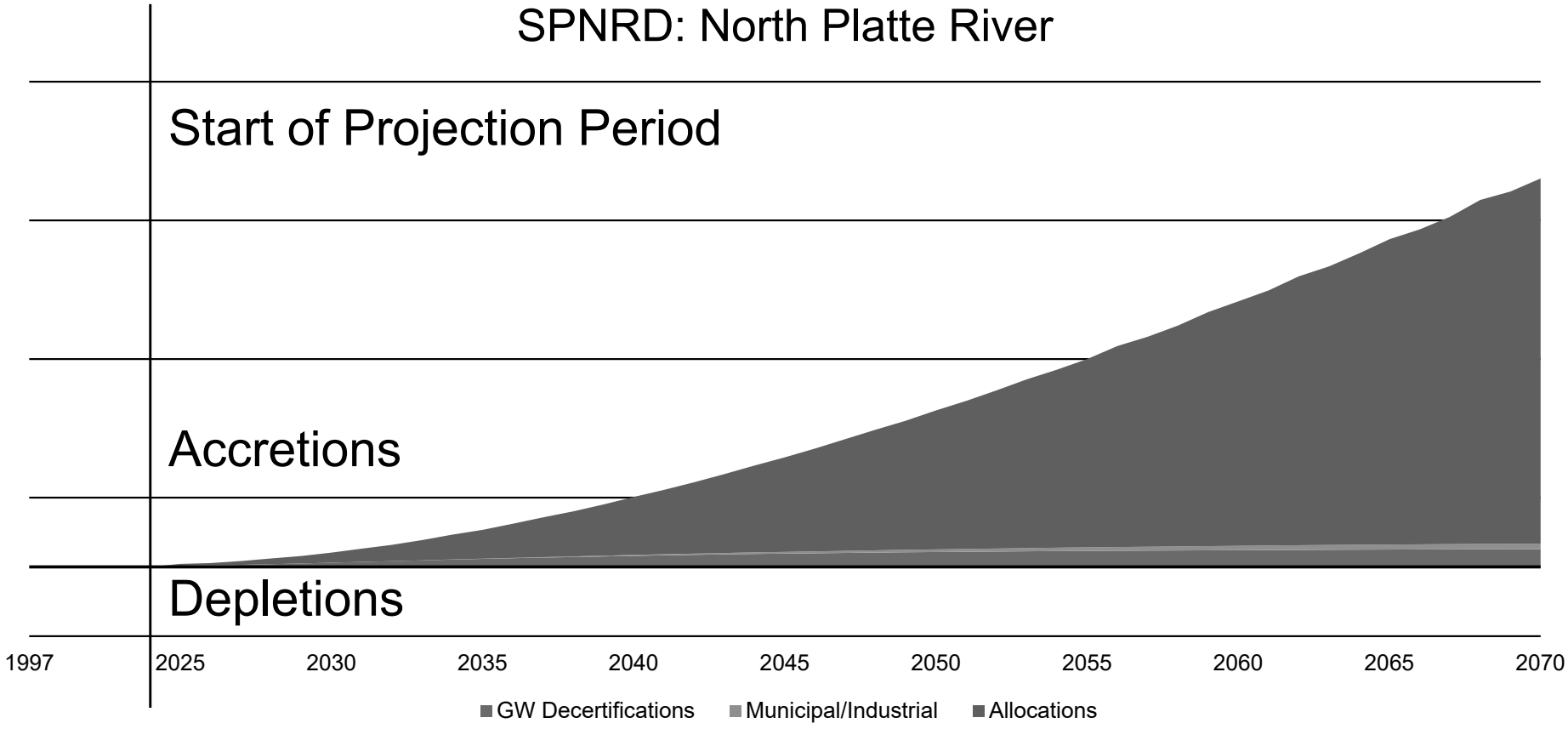
SPNRD Results

Robust Review Analysis Results: Post 1997 Combined



SPNRD Results:

Robust Review Analysis Generalized Post-1997 Components



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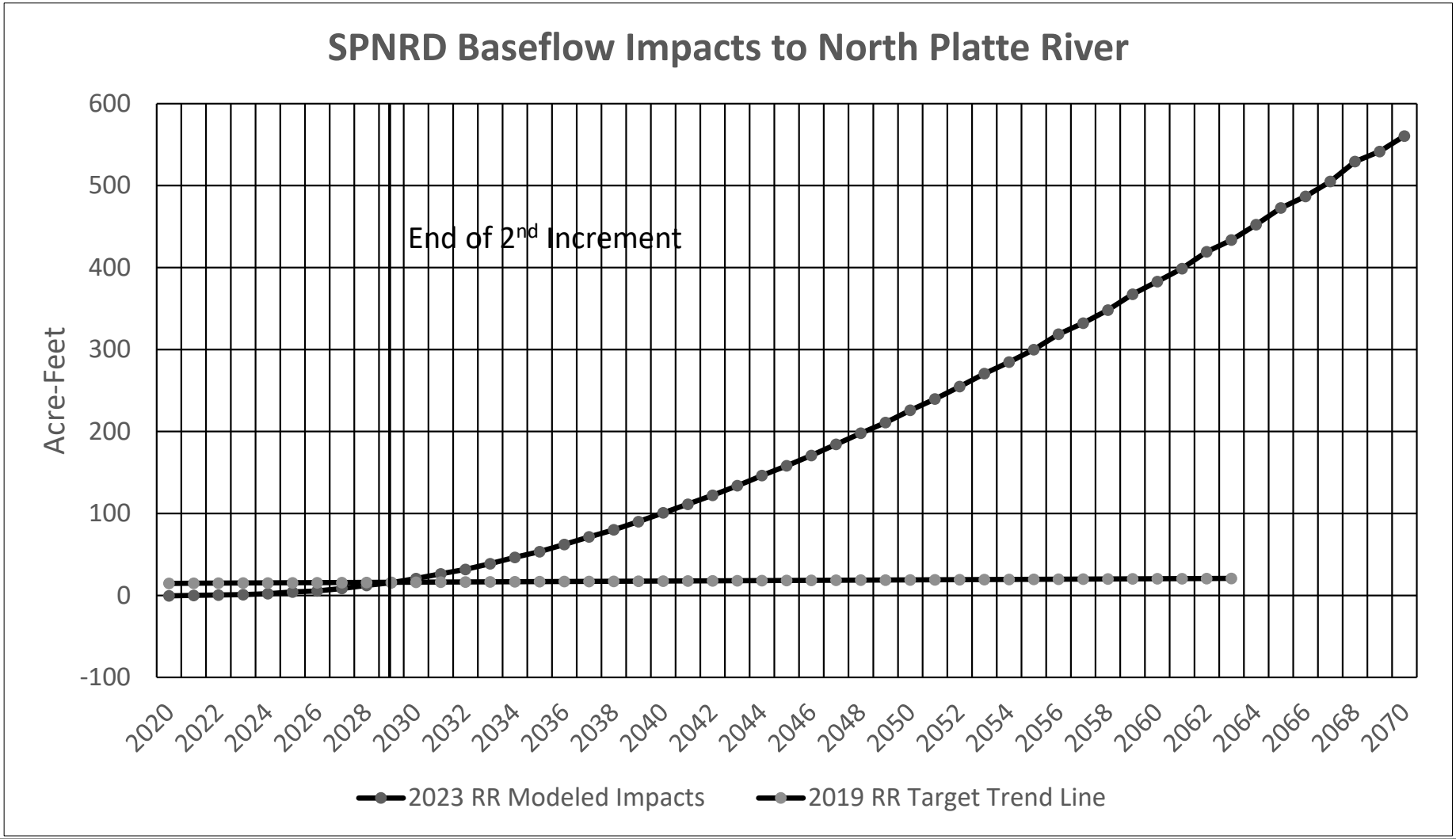
SPNRD Results

Target Comparison North Platte River



SPNRD Results

Indicator* Review: North Platte River

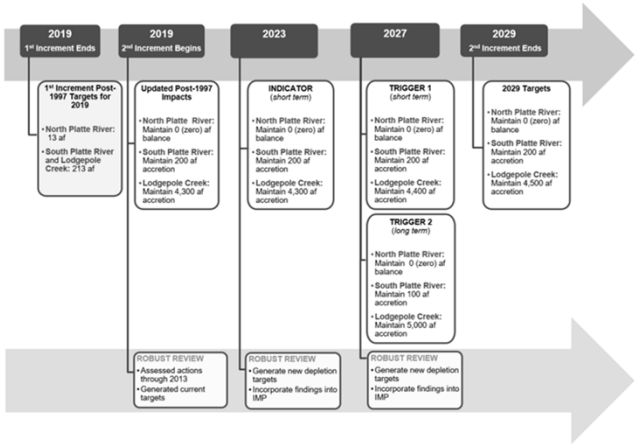
Year	Current IMP Targets	2023 Robust Review Results
2019	0	0
2020	0	0
2021	0	0
2022	0	0
2023*	**0**	**0**
2024	0	0
2025	0	0
2026	0	0
2027	0	0
2028	0	0
2029	0	0

IMP Target Summary

No Changes to the IMP are Necessary

"additional regulatory actions will not be required as long as either:

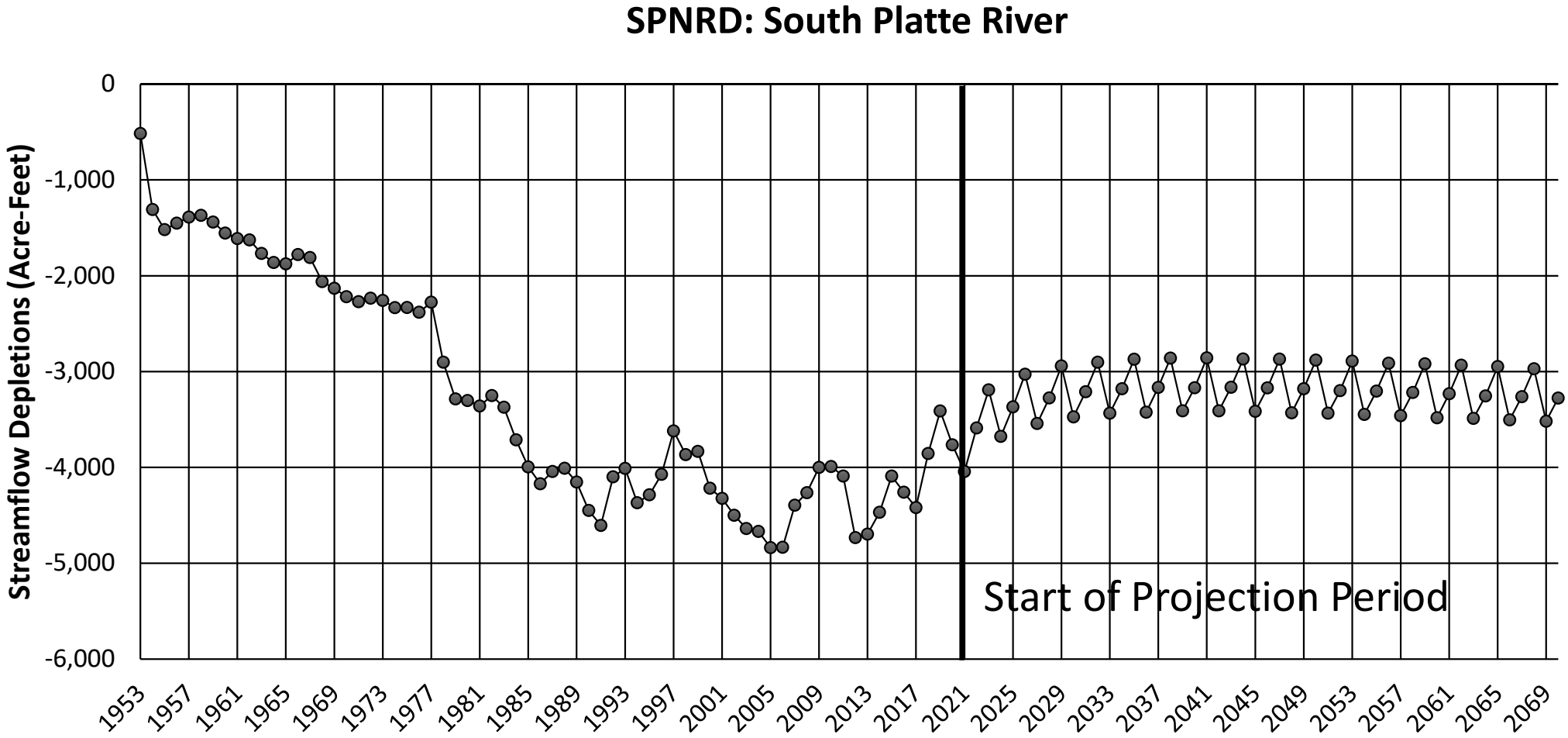
1) The 2023 Robust Review shows that management actions offset post-1997 depletions
2) The SPNRD maintains their management actions."



Total Depletions Results

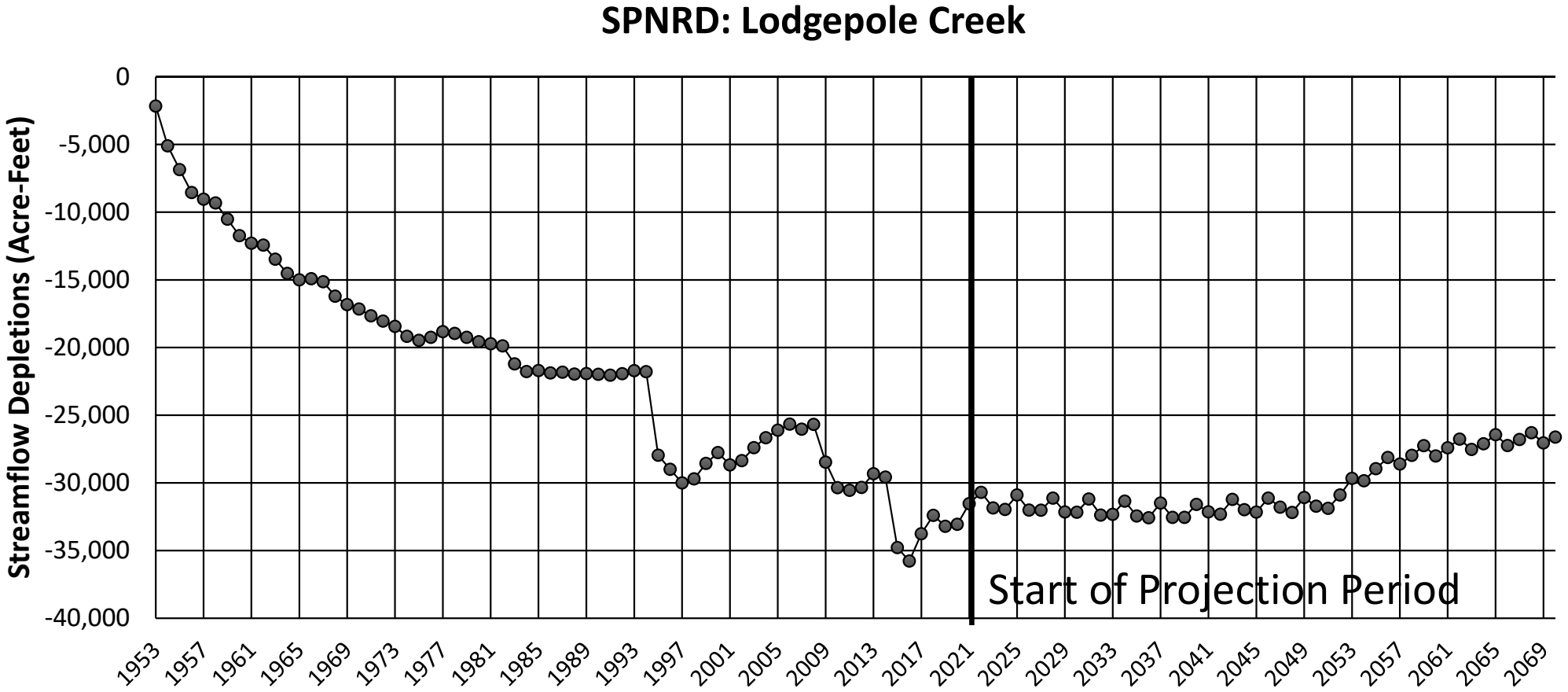
SPNRD Results – Total Depletions

Impacts from all Groundwater Pumping



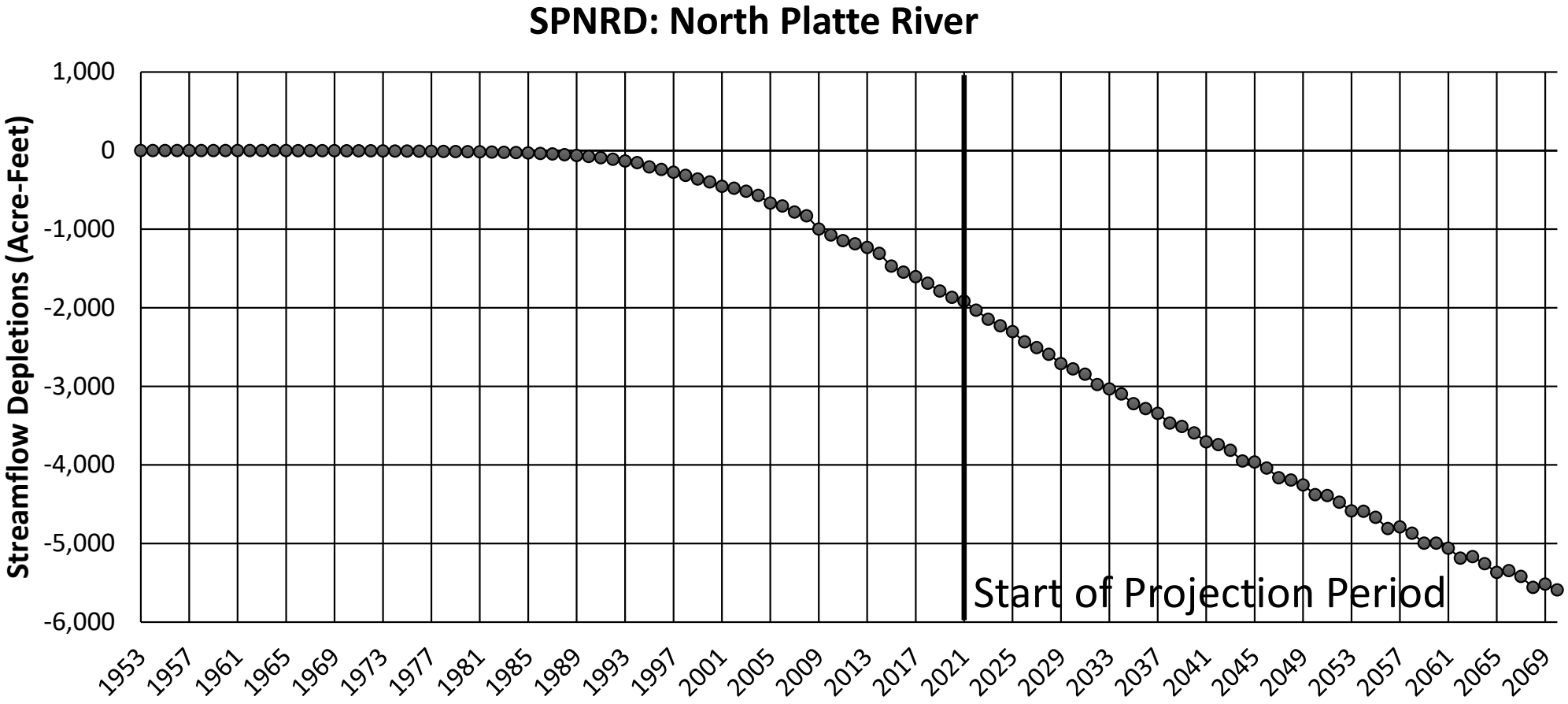
SPNRD Results – Total Depletions

Impacts from all Groundwater Pumping



SPNRD Results – Total Depletions

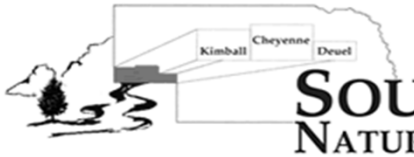
Impacts from all Groundwater Pumping



Path Forward

Path Forward / Next Steps

- Finish Documentation of Models and Analyses
- Present Results during May PRRIP meeting
- Present Results during August 1st BWP Stakeholder meeting
- Prepare for 2027 Robust Review in this Increment
  - Model Updates
    - Recalibration
    - Data
- Develop Basin-Wide and NRD drought plans
  - UPRDCP to be in place by end of 2024
- Changes to Municipal and Industrial offset requirements in 2026



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THANK YOU

Jennifer Schellpeper, Water Planning, NeDNR