NPNRD IMP

Meeting 2

NORTH PLATTE
Natural Resources District

NEBRASKA
DEPT. OF NATURAL RESOURCES

TODAY'S AGENDA

- Welcome
- Administration
  - June meeting recap
  - Decision making process
- Robust Review Results
- Second Increment Topics
  - Regulation
  - Conjunctive Management
- Public Comment

WELCOME

- Open meeting notice
- Safety & logistics
- Introductions

ADMINISTRATION

June meeting recap
Decision making process

ROBUST REVIEW RESULTS

Robust Review Analysis

NPNRD Results

NPNRD IMP Stakeholder Meeting #2

August 16, 2018

Robust Review Goals

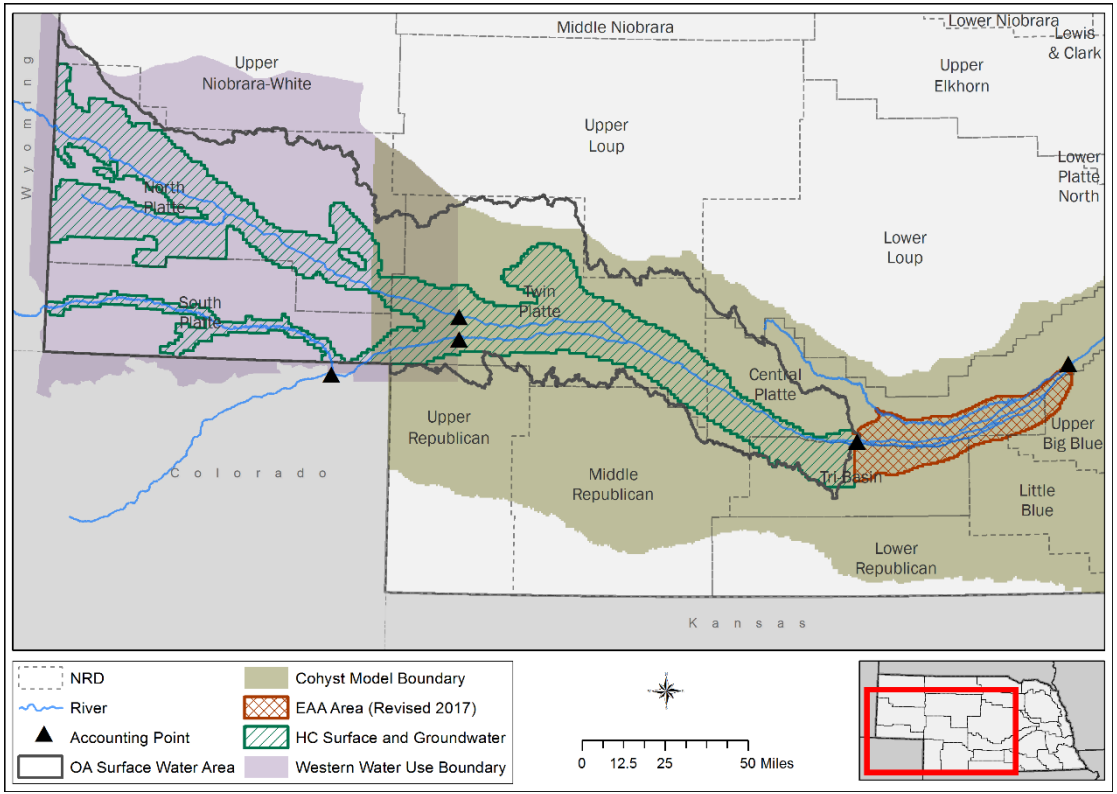
- **Complete monitoring activities outlined in the current IMP**
- **Assess progress on first increment goals and objectives**
- **Provide for more informed discussion of second increment objectives with the NPNRD IMP stakeholders**

Robust Review Model Simulation Setup

WWUMM Area Assumptions

- Used historical calibrated version of the groundwater and watershed models (Run 028/LU004/NIR set 2 for GW only lands)
- Model is simulated from 1953 – 2063
- Irrigation pumping repeats 2009-2013 in the baseline simulation and 1997 acres and crop types in the “1997” simulation with 2009-2013 weather repeated into the future
- Municipal and Industrial baseline simulation estimates use through time to 2013 and “1997” simulation is held constant
- Surface water and commingled acres remain constant in the baseline and 1997 simulations to cancel out commingled effects

Model Areas


Middle Niobrara
Lower Niobrara
Lewis & Clark
Upper Niobrara-White
Upper Elkhorn
Upper Loup
Lower Platte North
Lower Loup
North Platte
South Platte
Twin Platte
Central Platte
Upper Republican
Upper Big Blue
Middle Republican
Tri-Basin
Little Blue
Lower Republican
Wyoming
Colorado
Kansas
NRD
River
Accounting Point
OA Surface Water Area
Cohyst Model Boundary
EAA Area (Revised 2017)
HC Surface and Groundwater
Western Water Use Boundary
0 12.5 25 50 Miles

NPNRD Inputs
(Change in acres)

Change in groundwater-only irrigated acres 1997-2013

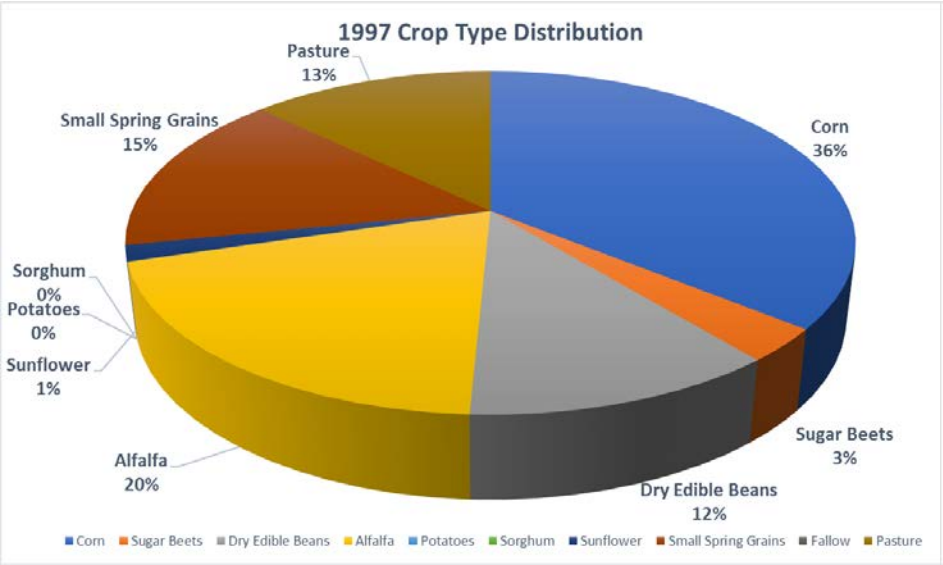
NPNRD	Total change (1997 to 2013)
District-Wide	**-3,400 acres**
OA	**-5,400 acres**

NPNRD Inputs

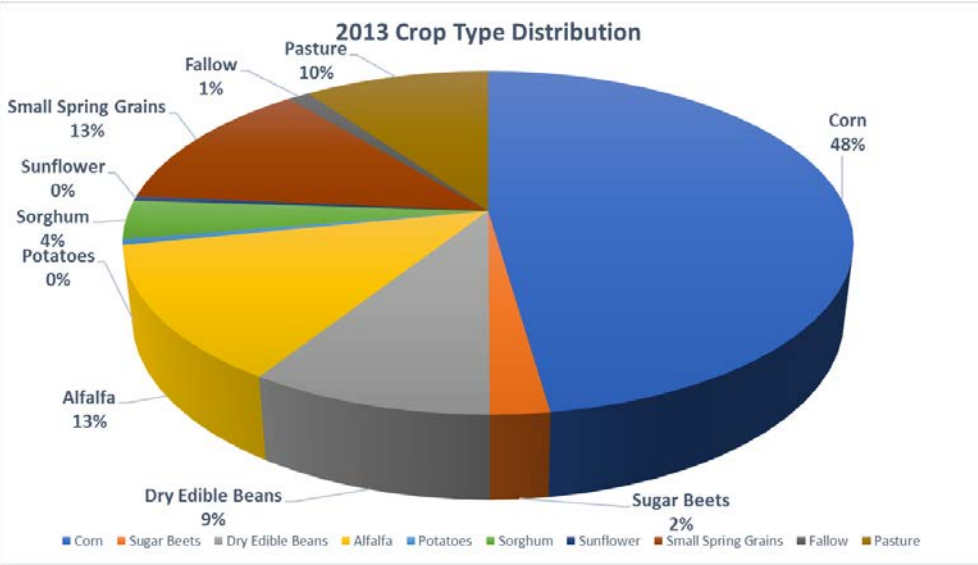
(Changes in crop type, district-wide)

Change in groundwater-only irrigated acre crop types 1997-2013

134,500 GW only irrigated acres



131,100 GW only irrigated acres

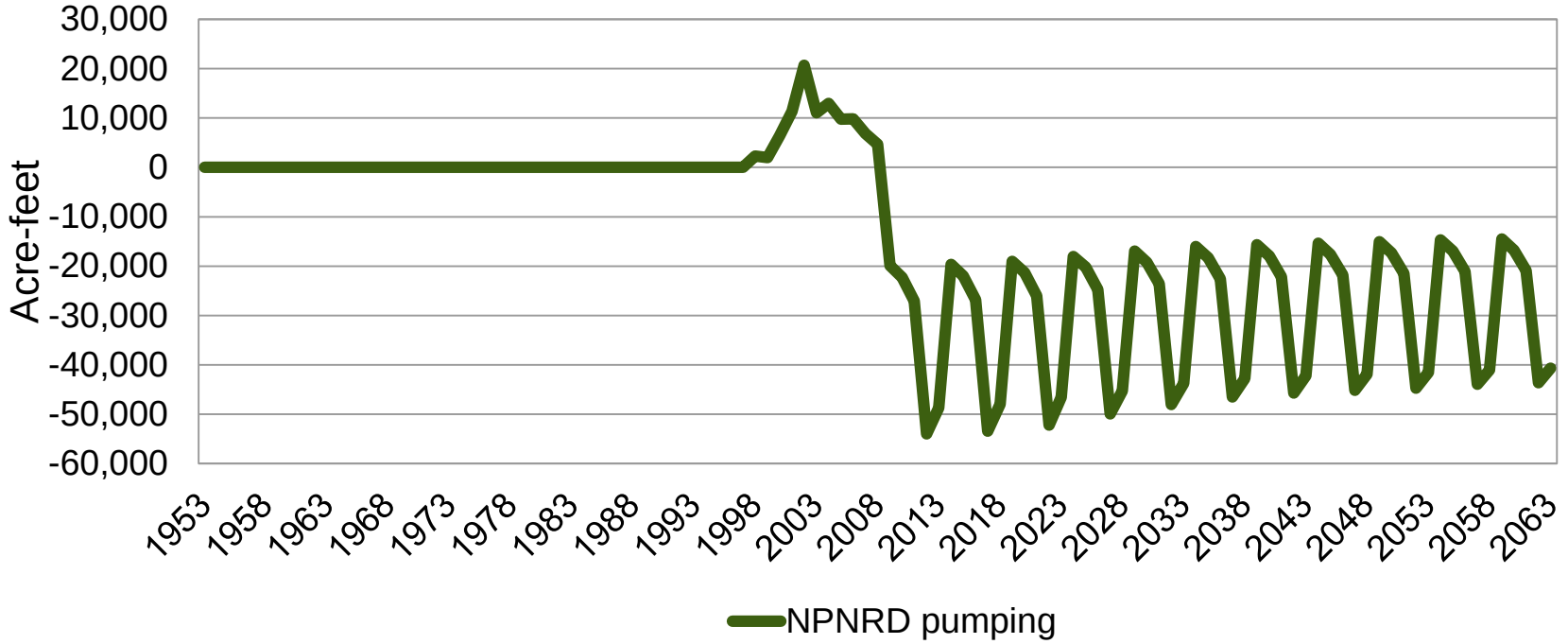


NPNRD Inputs

Current Estimates of Industrial and Municipal Pumping
Industrial average annual volume 14% lower (≈850 AF) compared to 1997.
Municipal average annual volume 4% lower (≈300 AF) compared to 1997
1997 = 5,472 AF industrial 7,639 AF municipal
2013 = 4,582 AF industrial 6,837 AF municipal

Changes to Post-1997 Pumping, District-Wide

Groundwater-only irrigation pumping (-3,400 acres) AND municipal/industrial uses



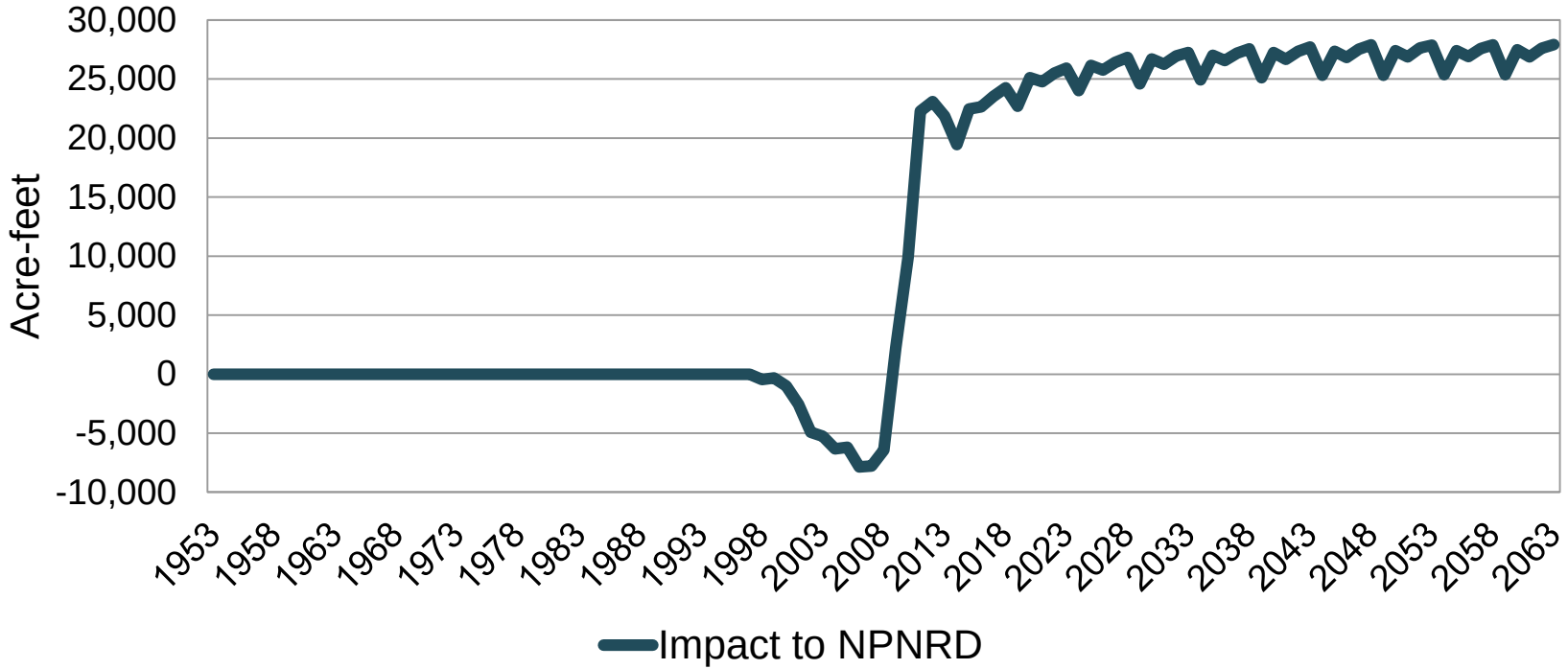
NPNRD Inputs
(Groundwater Recharge)

Excess Flows Diverted and Recharged into Canals in NPNRD

NPNRD	Acre-Feet of Excess Flow	
	Diversion	Recharge
2011	**61,260**	**28,739**

NPNRD Results

Total impact to NPNRD, from the Post-1997 **Changes** and Canal Recharge Event



NPNRD Summary

Post-1997 Estimates

NPNRD			
Year	**2019**	**2029**	**50-year**
Current IMP	-7,514		-8,000
Updated Estimate	22,000 – 24,500	24,000 - 26,000	25,000 -27,900

- All values in acre-feet/year

Robust Review Analysis

Was a requirement of the first increment
Must be maintained in the second increment
Deals with Post-1997 Changes and Management Actions
It is the first step toward reaching a fully appropriated condition

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Lincoln, NE 68509-4676
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2ND INCREMENT TOPICS

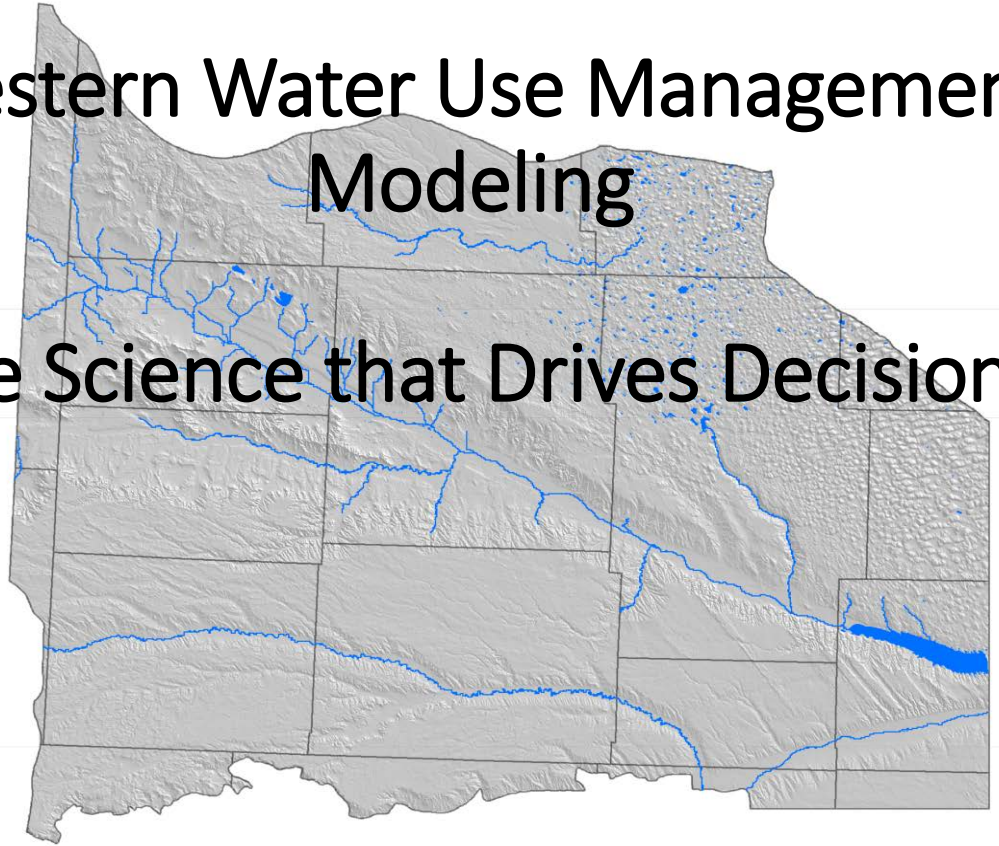
Regulation

Conjunctive Management

REGULATION

Western Water Use Management Modeling

The Science that Drives Decisions



NORTH PLATTE
Natural Resources District

The Western Water Use Management Model(WWUMM) is the most important tool that NPNRD uses to make management decisions by determining whether we are at a deficit level of irrigation

- Almost exclusively based on collection of actual land use data (from aerial imagery and field level inspections)
- collection of pumping data
- climate data

WWUMM is used to determine whether an incentive-based program will be advantageous to meeting our goals and obligations under the Integrated Management Plan

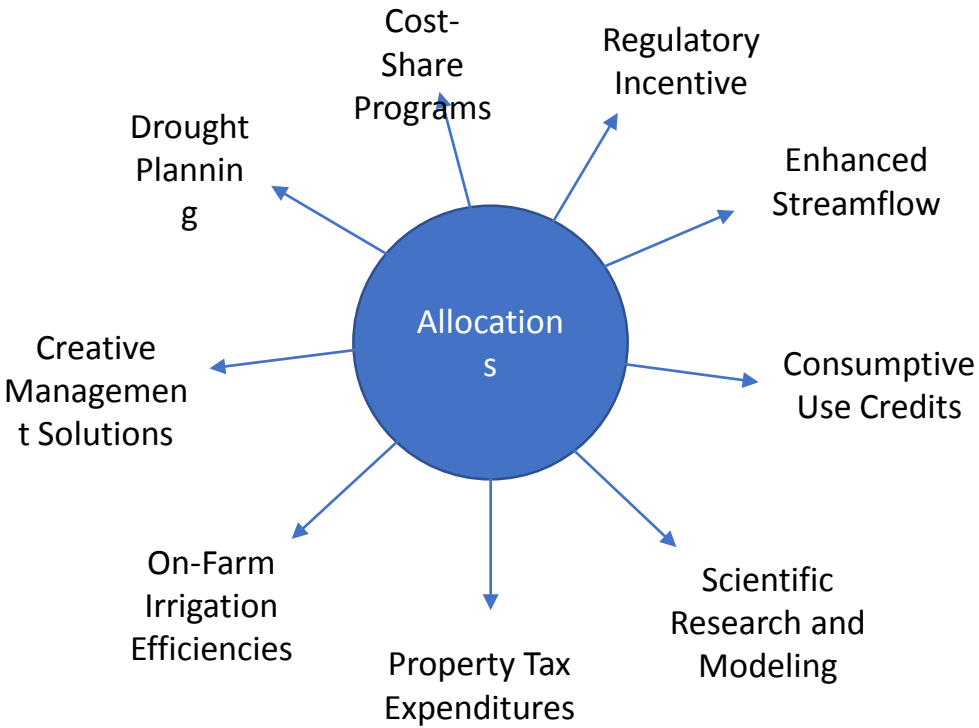
- Leases
- Retirements
- Recharge Facilities
- Allocation Buy Downs
- Cost-share investments

Allocations

Allocations are far and away the most beneficial to meeting our goals, and have, arguably, made agriculture in this District more efficient, and thereby more profitable through the reduction of pumping costs.

This more efficient application of water including more efficient timing of irrigation has also improved yields.

Allocations – The Hub of NPNRD Regulations



First IMP Increment Allocation Design

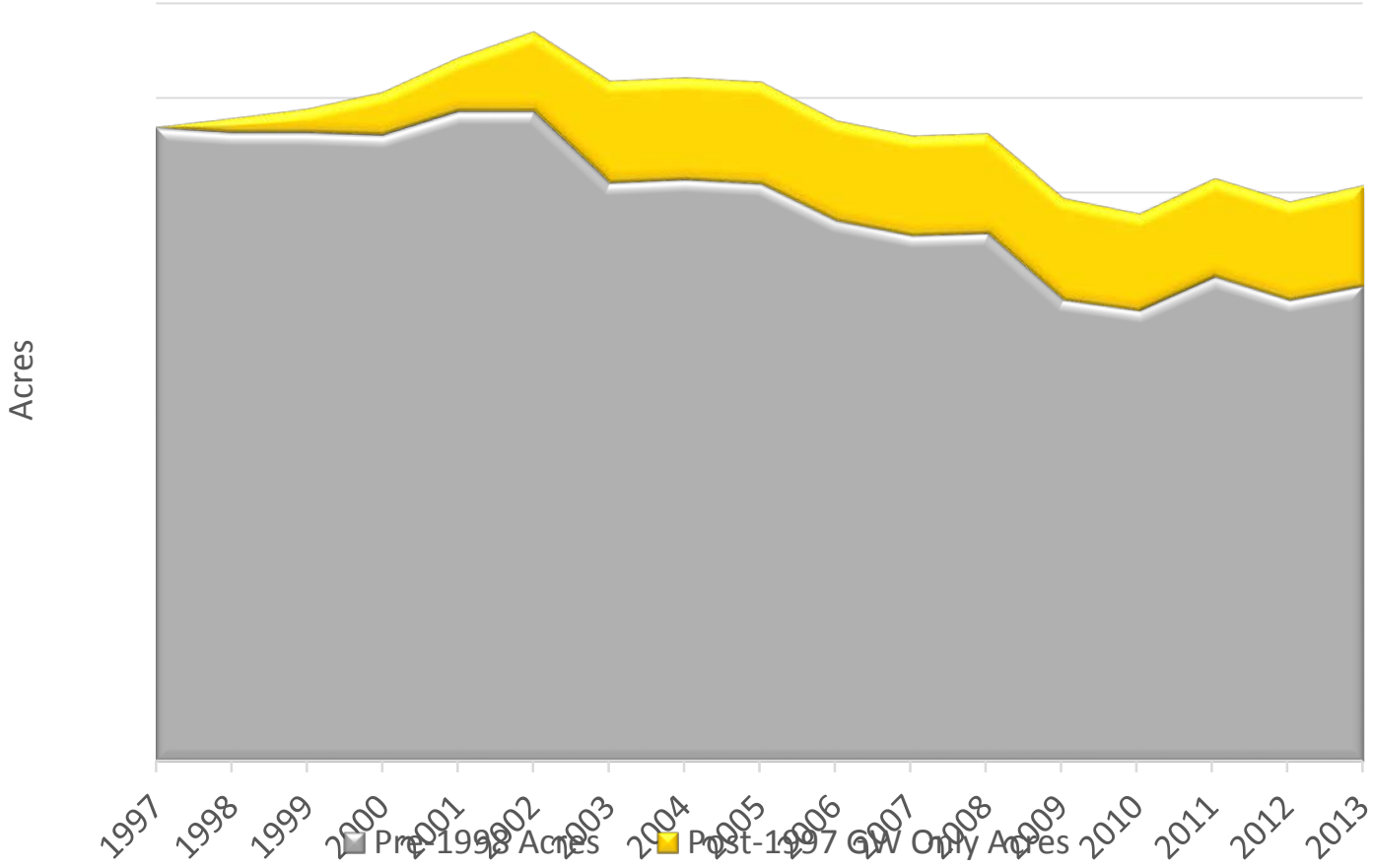
- 2008 COHYST Analyses
  - Established that NPNRD had 8,000 Acre-Feet of Post-1997 Depletions
  - Determined overall NPNRD crop mix net irrigation requirement (NIR) or irrigation consumptive use
    - 15 Acre-Inches / Acre
  - Post-1997 Depletions Mitigation
    - Place a 14 Acre-Inch / Acre pumping limit on all ground water irrigated lands
    - Goal to reduce crop consumptive use by 1 Acre-Inch / Acre
    - Estimated to make up the 8,000 acre-feet per acre
  - Management Style Unique in Platte Basin

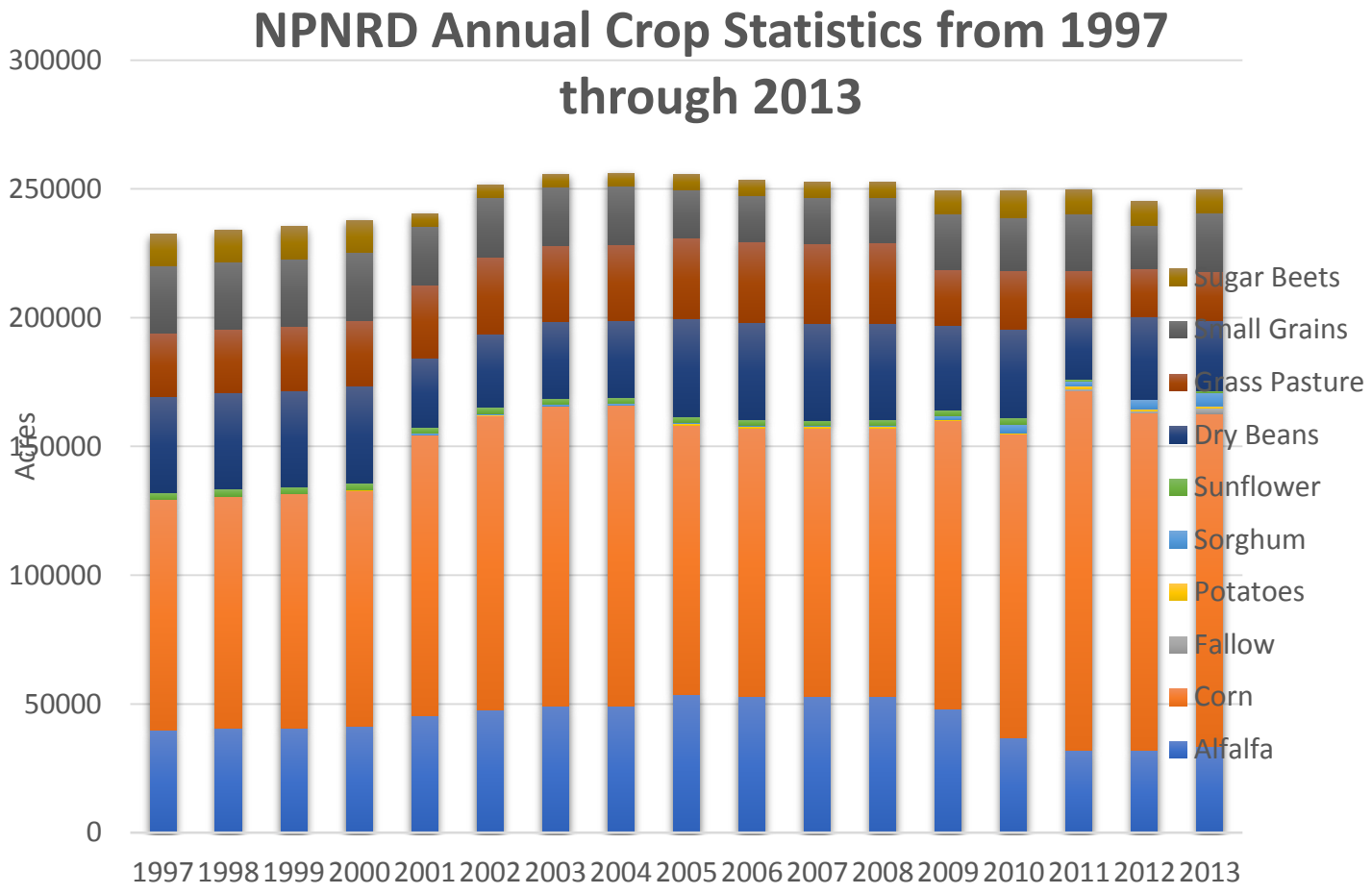
Beyond COHYST

- Enter **Western Water Use Management Modeling**
  - Highly data driven modeling
  - Extensive land use dataset with multiple data sources creating a robust understanding of water use
  - Integration of the metered data into modeling
    - Unique in Platte Basin
  - Used as a decision support tool for NPNRD and DNR

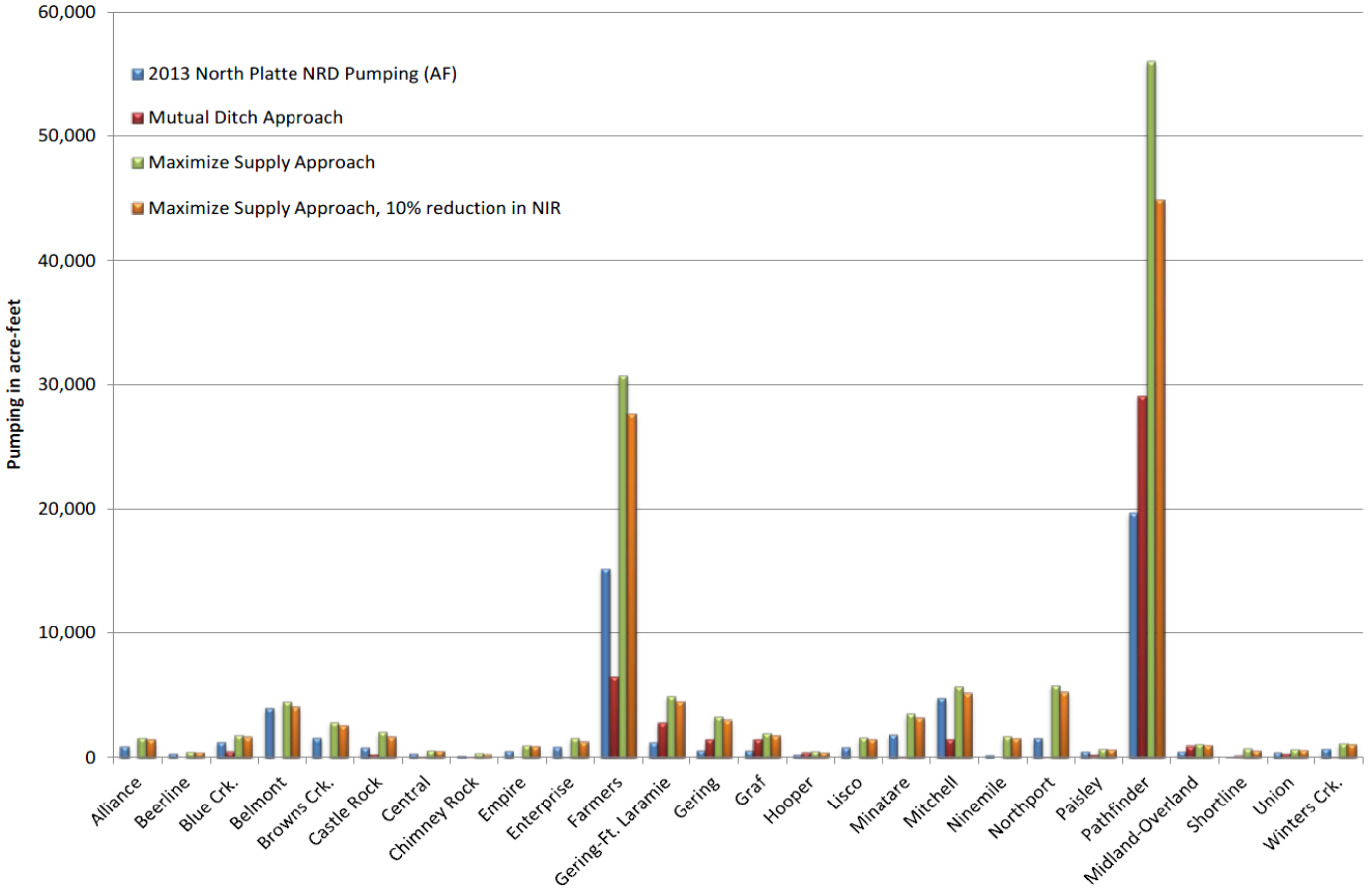
Land Use Dataset Information

NPNRD All Active Ground Water Only Land Use Development in OA Area




NPNRD Annual Crop Statistics from 1997 through 2013
300000
250000
200000
150000
100000
50000
0
Acres
1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
Sugar Beets
Small Grains
Grass Pasture
Dry Beans
Sunflower
Sorghum
Potatoes
Fallow
Corn
Alfalfa

Comingled Pumping Information (2013)



Change Modeling Discussion

Change Modeling Discussion

- Modeling Design
  - Baseline Model
    - Typically the historic model with everything that actually happened
  - Modified Model
    - Modify one feature of the model
    - Example: Remove irrigated lands from the model to determine the depletive affects
  - Analysis
    - Baseline Model – Modified Model = Change
    - Change is typically streamflow or baseflow

Unit Response Functions

Unit Response Functions

- Determine accretive impacts from retiring ground water irrigated acres, similar to depletion zone in the COHYST model

- Used for Evaluation of Incentive Based Programs (EPIC)

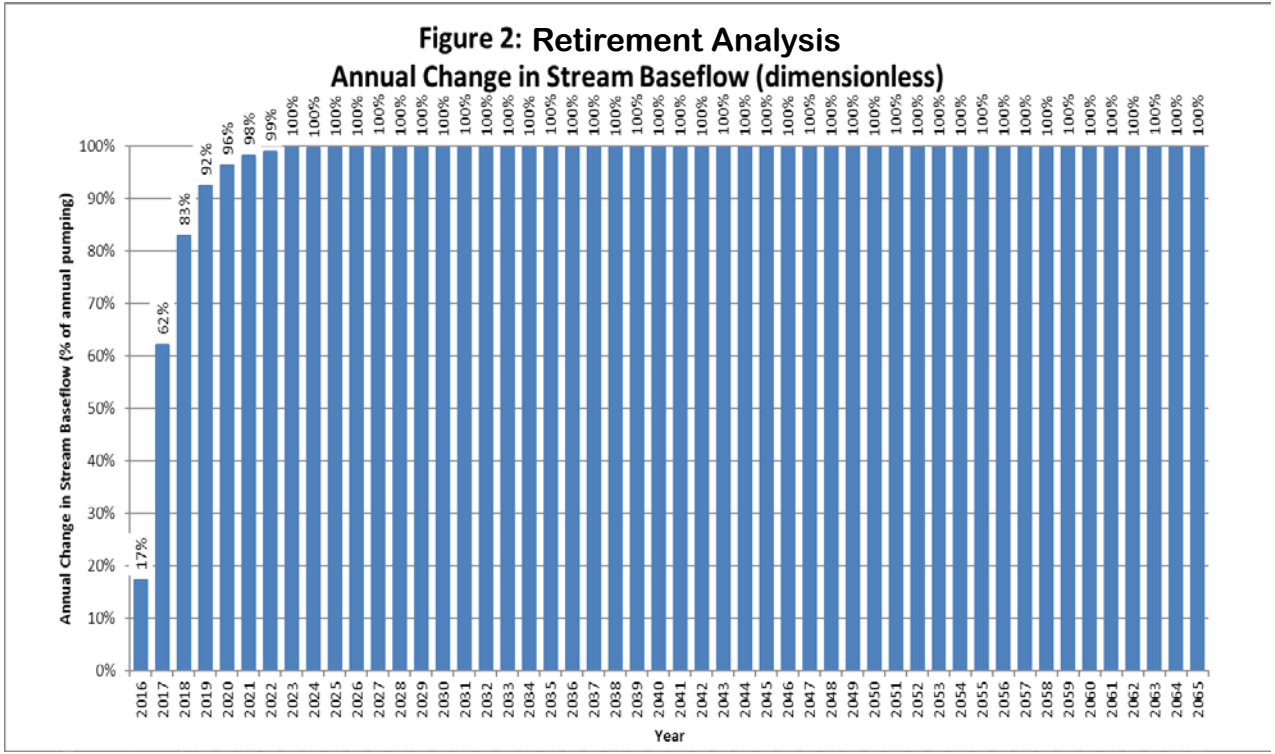


Figure 2: Retirement Analysis
Annual Change in Stream Baseflow (dimensionless)
Annual Change in Stream Baseflow (% of annual pumping)
Year
17%
62%
83%
92%
96%
98%
99%
100%

Allocation Analysis

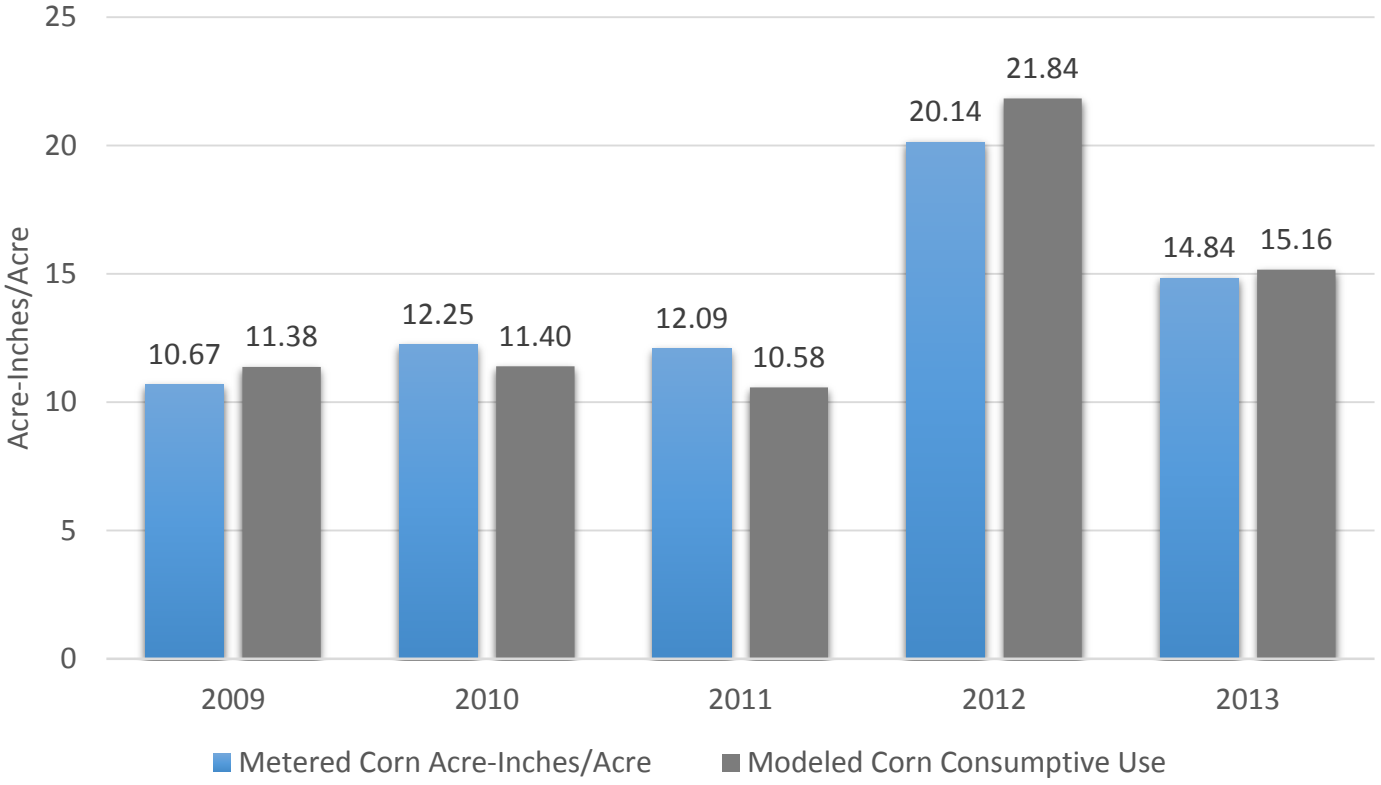
Allocation Analysis

- Generalized Concept
  - Determine the effectiveness of NPNRD's allocations at reducing consumptive use and depletions
  - Comparison of:
    - Metered Pumping from NPNRD
      - Actual pumping at each farm
    - Modeled Pumping created through WWUM Modeling
      - Pumping at the full consumptive use of the crops for the ground water only lands
    - **IMPORTANT** We assumed no benefit from allocations on commingled lands due to dual sources of water

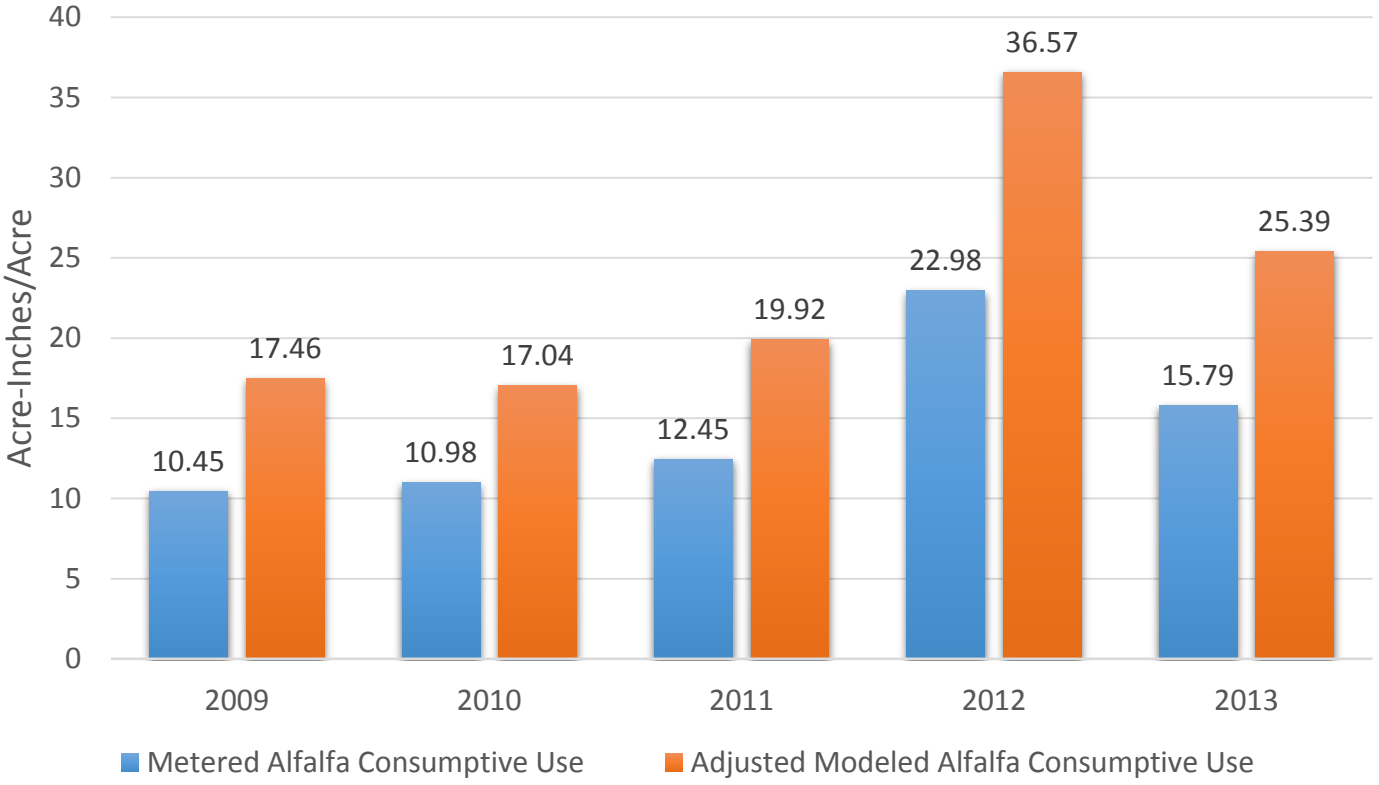
Allocation Analysis

- Generalized Concept
  - Comparison (cont.):
    - Completed by comparing two ground water model runs
  - Repeat recharge and pumping from 2009 through 2013 for 50 years into the future to provide a planning information for the District

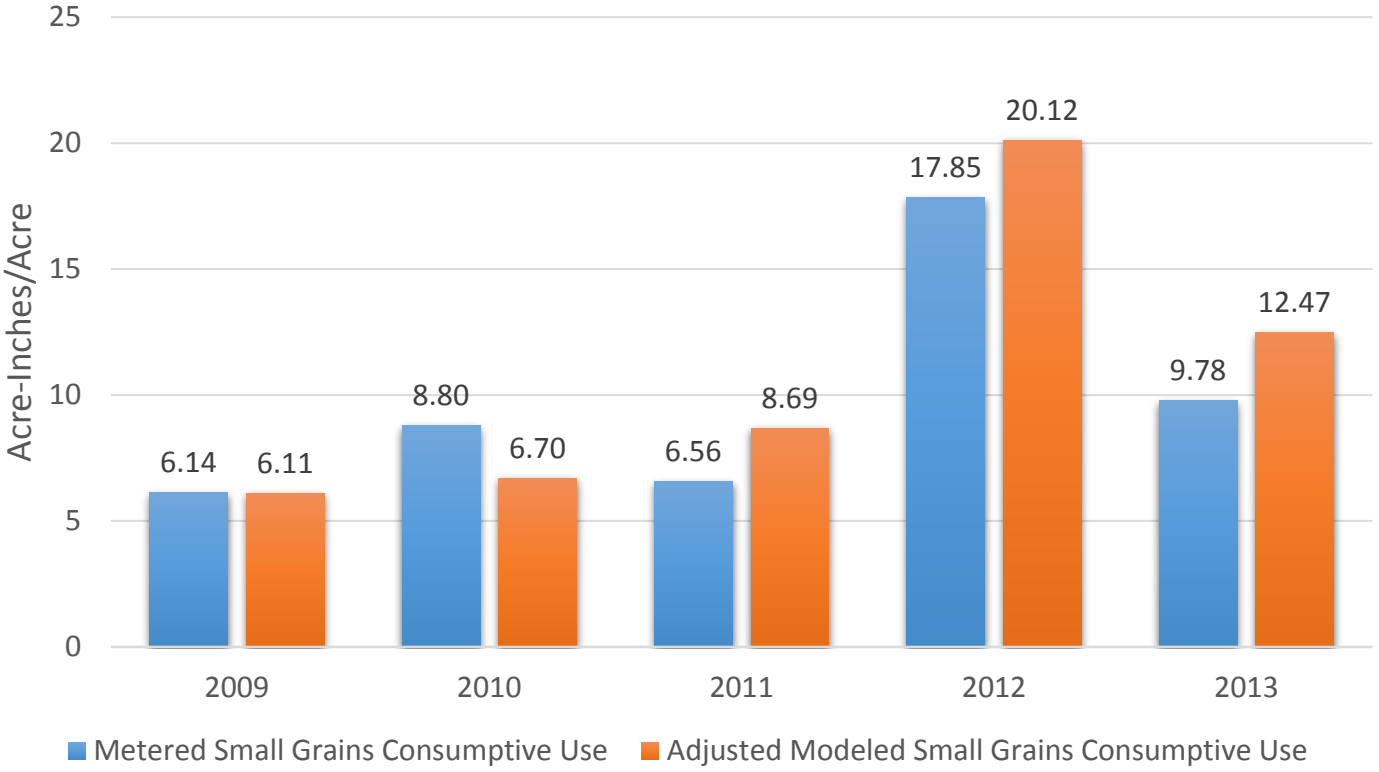
NPNRD Corn Only Lands
Metered CU vs. Modeled CU



NPNRD Alfalfa Only Lands
Metered CU vs. Modeled CU

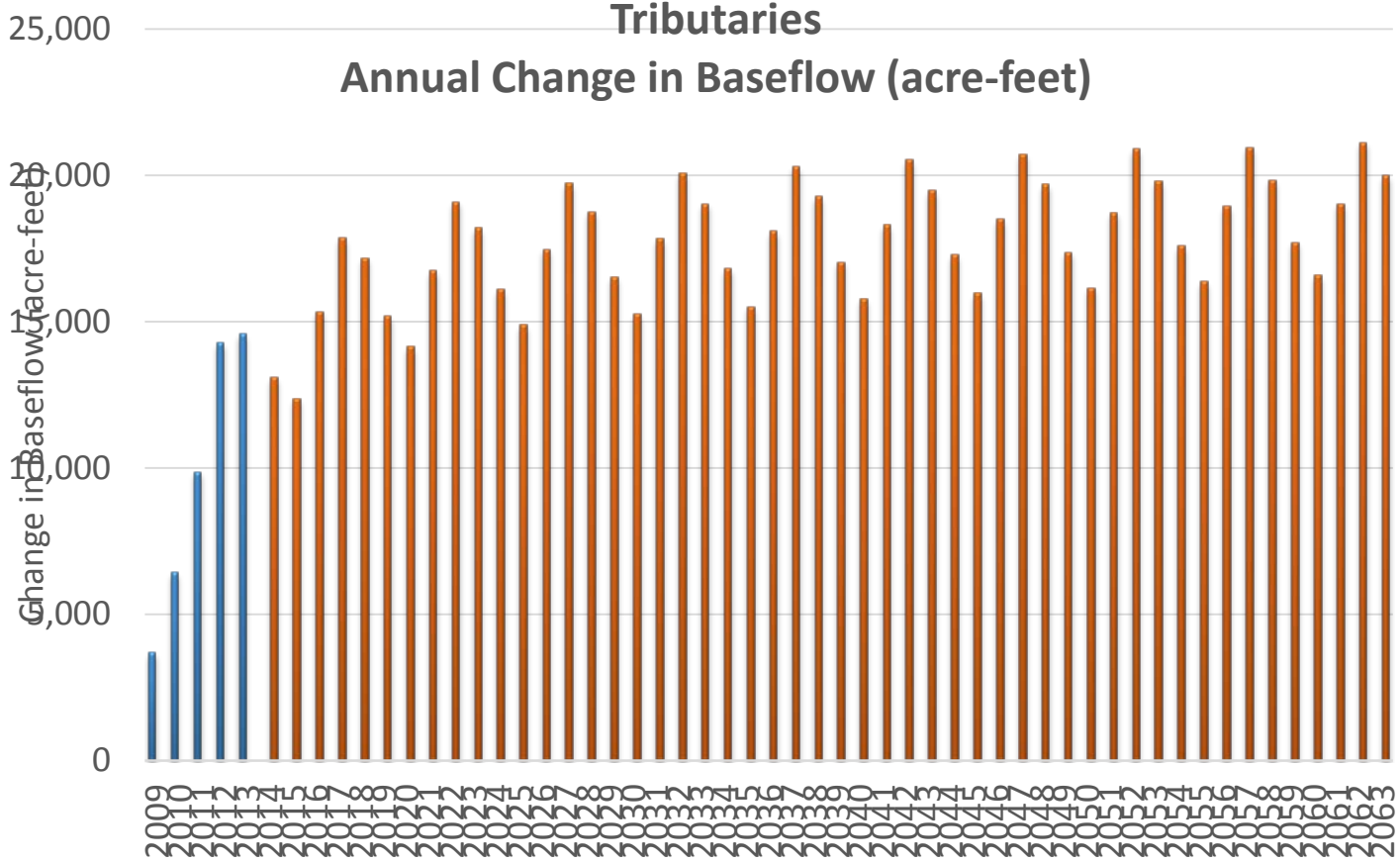


NPNRD Small Grains Only Lands
Metered CU vs. Modeled CU



NPNRD Allocation Analysis: North Platte River and All Tributaries

Annual Change in Baseflow (acre-feet)

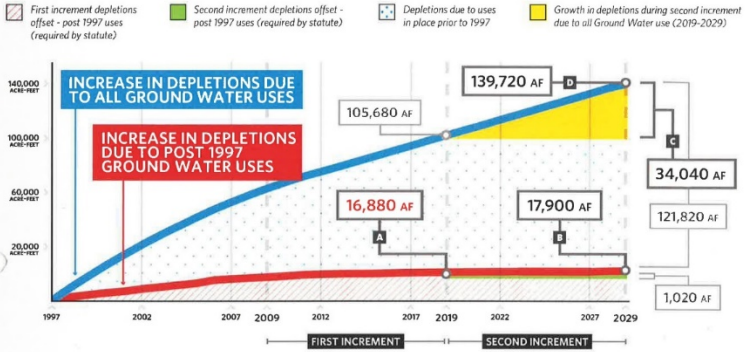


Platte Basin Depletions

UPPER PLATTE BASIN

Growth In Depletions

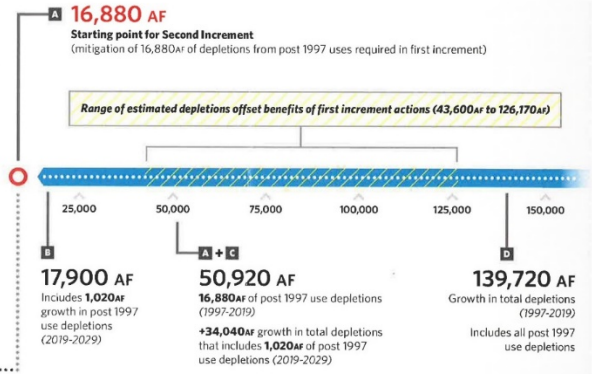
BACKGROUND: The First Increment of the Upper Platte basin-wide plan was adopted in 2009. It is a requirement that a technical analysis of the first basin-wide plan must occur in the ten years following its adoption. This technical analysis is needed to determine the path forward in order to achieve the goals and objectives set for the plan. First Increment efforts also worked to establish the overall difference between current and fully appropriated levels of development.



Total depletions from all Ground Water uses in 1997 estimated 391,470AF. Data used to estimate increases in depletions due to all Ground Water uses is from the results of the most recent COHYST and WWUM models (2015). Data used to estimate increases in depletions due to post-1997 Ground Water uses is from previous analysis conducted by R. R. Luckey (2008). The robust review currently underway will provide updated data for both of these depletions estimates.

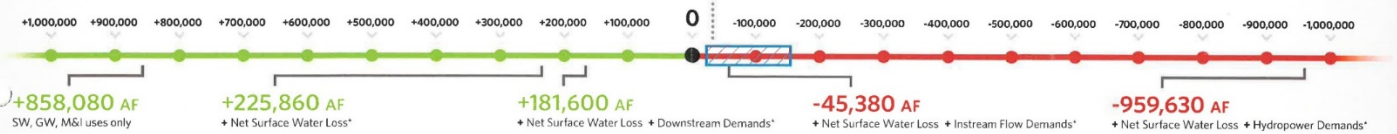
SECOND INCREMENT

The Single Planning Group will help define the progress towards fully appropriated conditions to be made during the second increment.



SUPPLY & DEMAND BALANCE

The Single Planning Group will help define the progress towards fully appropriated conditions to be made during the second increment. The scale below shows values taken from the Basin-Wide Supply and Demand Analysis.

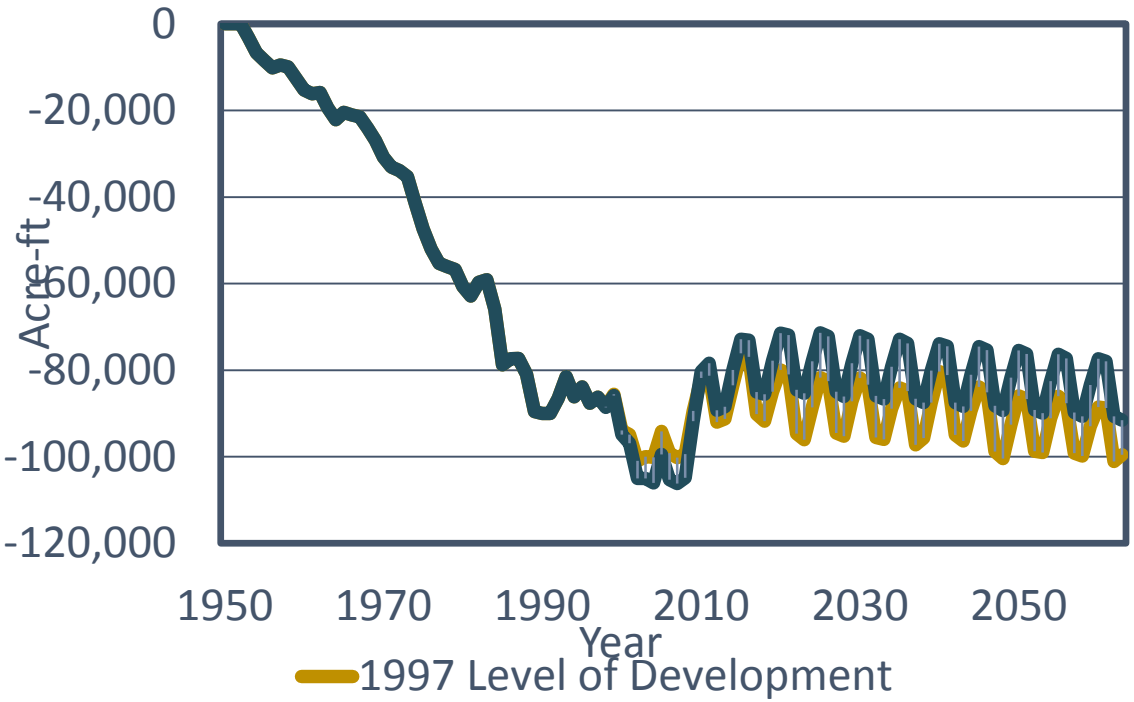


** All figures reflect the average annual difference when comparing supplies with Surface Water (SW), Ground Water (GW), and Municipal and Industrial (M&I) consumptive uses.*

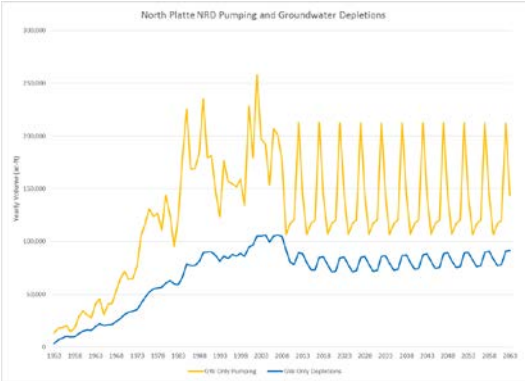
North Platte NRD Potential Depletions Moving Forward

NPNRD Total Depletions

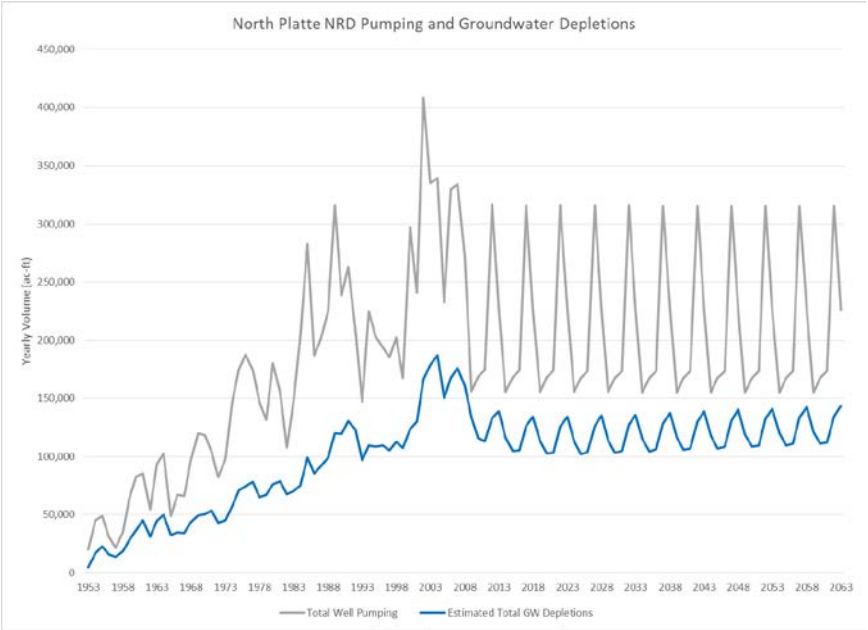
Groundwater Depletions Resulting from GW Only Wells



Total Depletions



GW Only



Total Pumping and Depletions with Commingled Wells

Thanks!

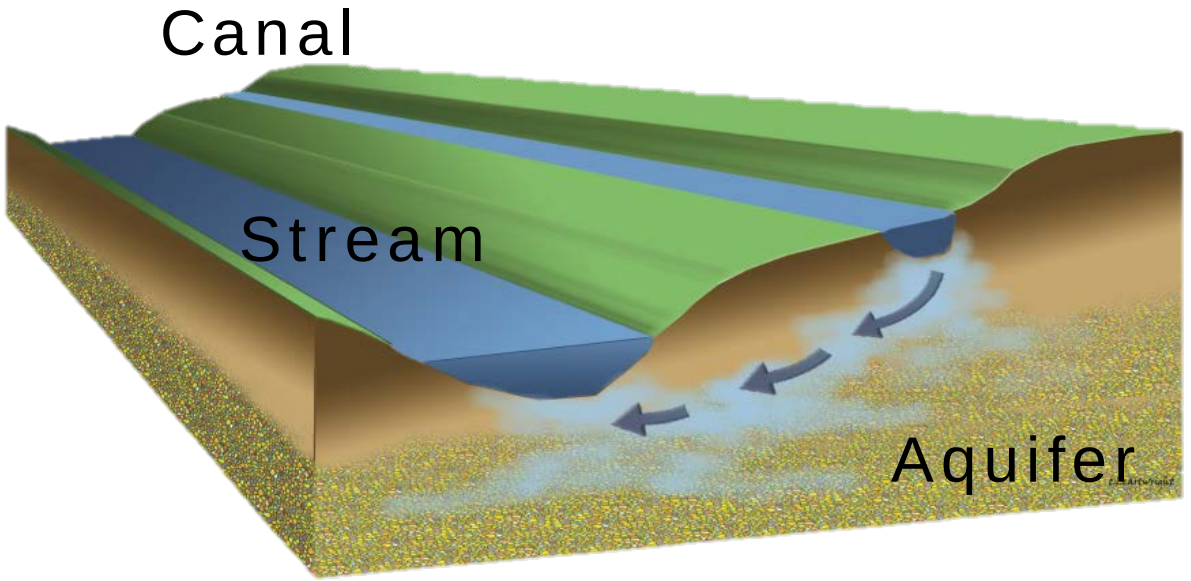
- Questions
- Comments

CONJUNCTIVE MANAGEMENT

UNDERLYING CONCEPTS OF CONJUNCTIVE WATER MANAGEMENT

(CWM)

- Surface and groundwater resources are interconnected
- Decisions to improve the management of one cannot be made properly without considering the other



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.

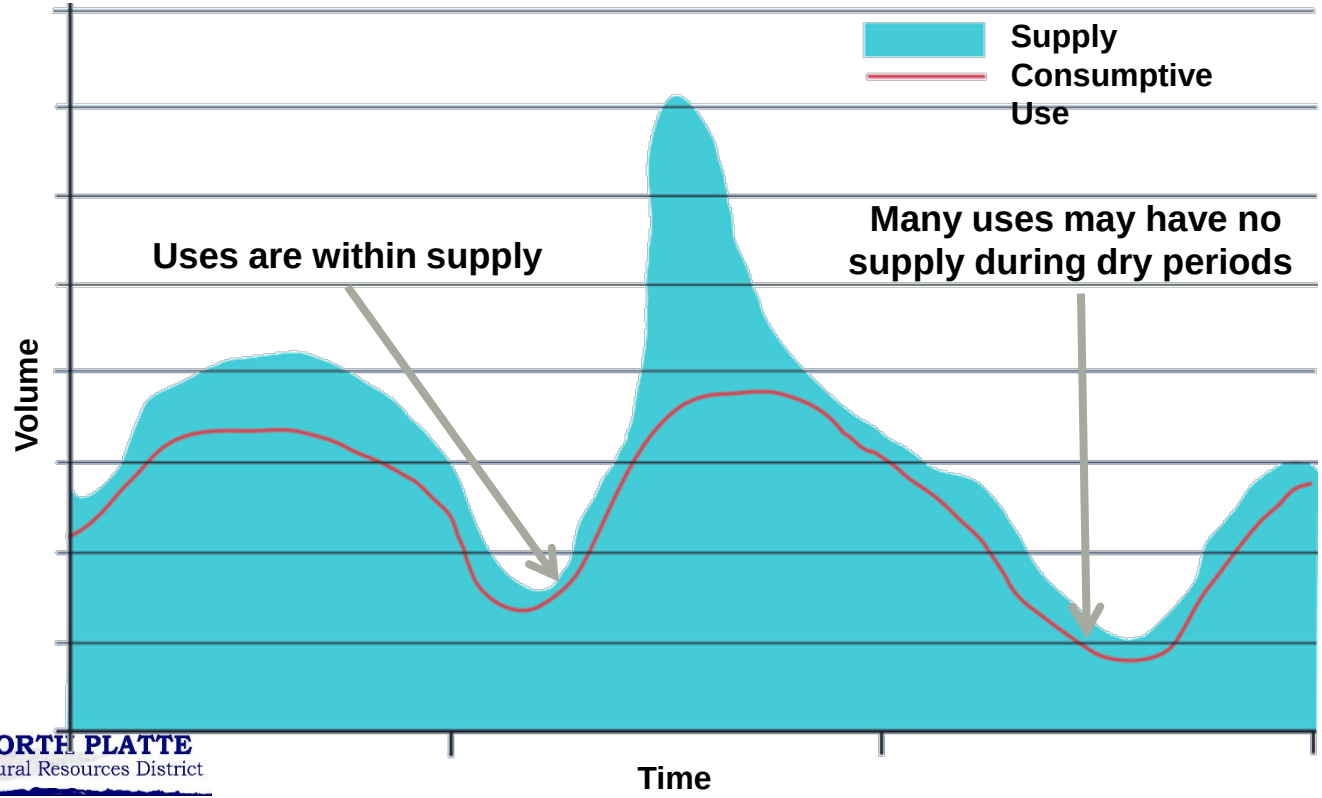
HOW IS CWM ACCOMPLISHED?

- Typically, by:
  - Using or storing additional surface water when it is plentiful
  - Relying more heavily on groundwater during dry periods

- Can change the timing and location of water for more efficient use

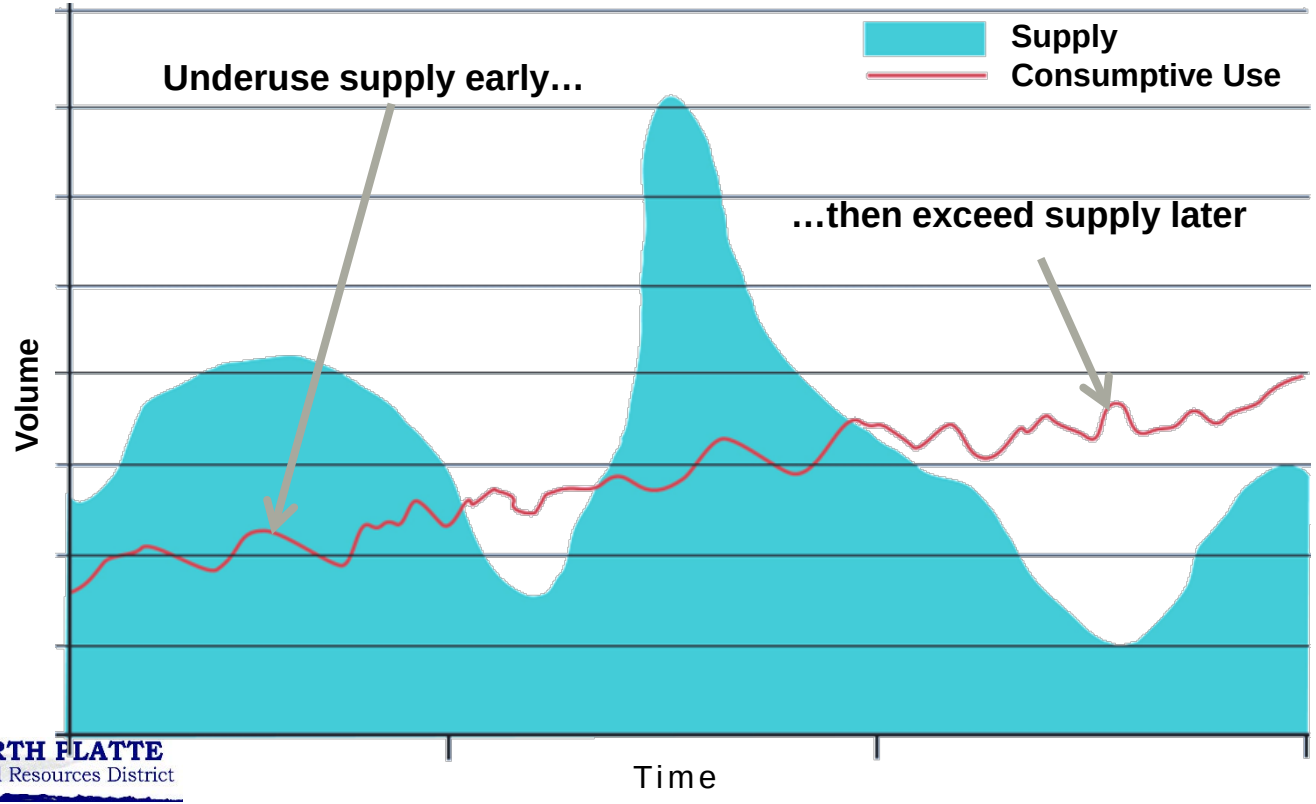
SCENARIO 1:

USING SURFACE WATER ONLY



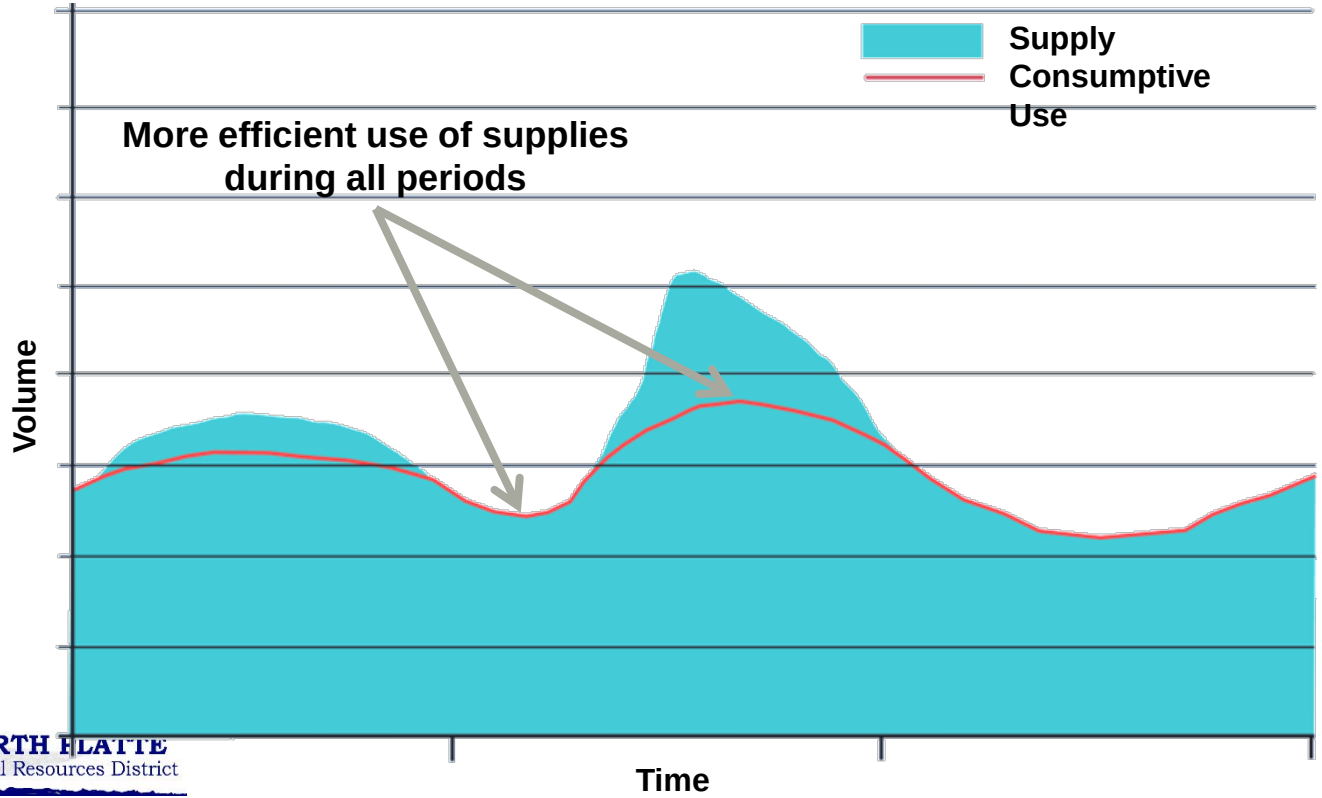
SCENARIO 2:

USING GROUNDWATER ONLY



SCENARIO 3:

MANAGING SUPPLIES THROUGH CWM

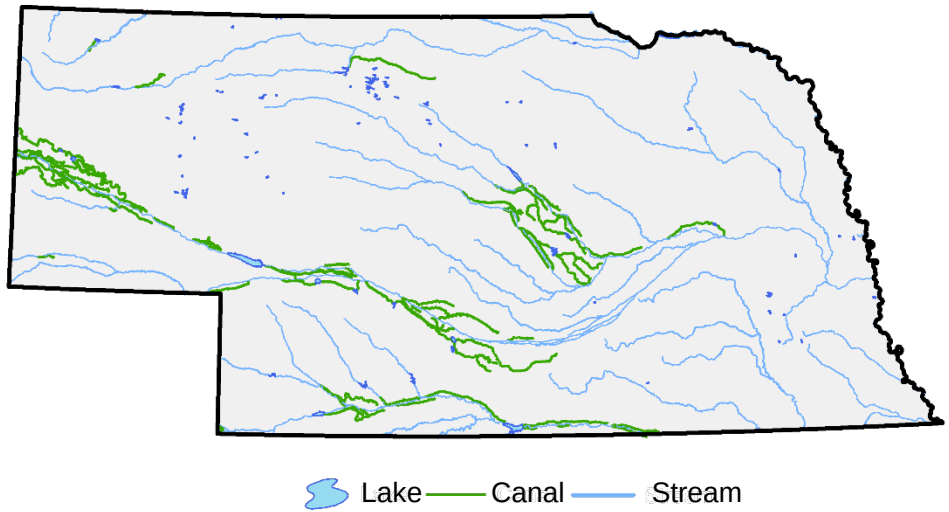


COMPONENTS OF CWM

- Surface water diversion and groundwater pumping
- Aquifer recharge
- Management of the timing of return flows
- Program for monitoring and evaluation

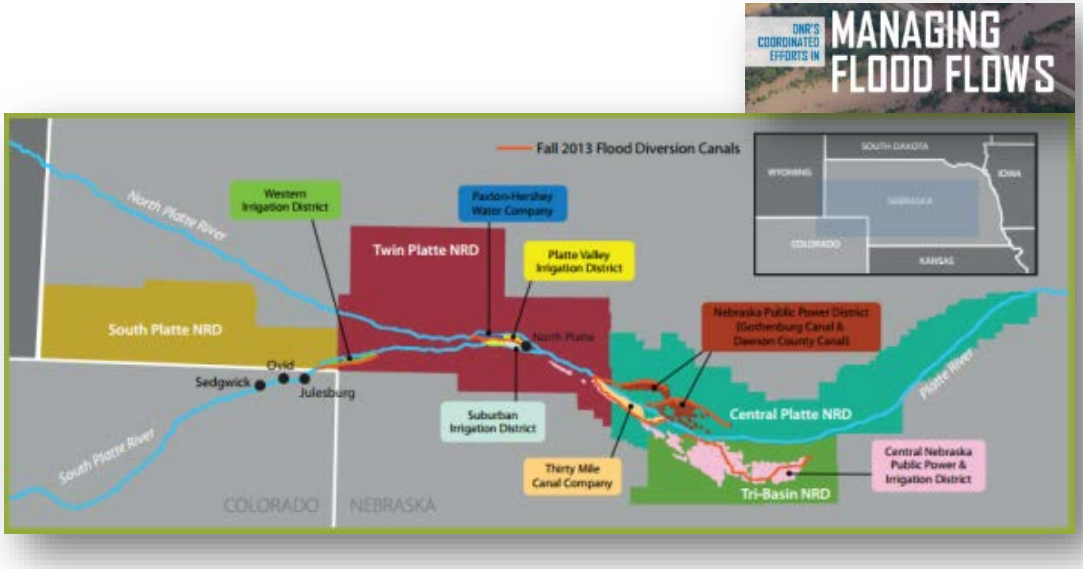
BENEFITS OF CWM

- Maximize available water supplies
- Leverage existing infrastructure
- Use existing planning framework
- Minimize the need for regulatory actions
- Customize to local opportunities or needs
- Maintain viability of existing uses



EXAMPLES OF CWM PROJECTS

- Augmentation projects
- Western canal conjunctive management study
- Water leasing arrangements
- CPNRD transfers and canal refurbishment
- Capturing excess flows using existing canal infrastructure (in partnership with irrigation districts)



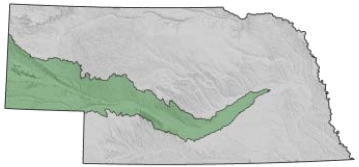
APPLYING CONJUNCTIVE MANAGEMENT

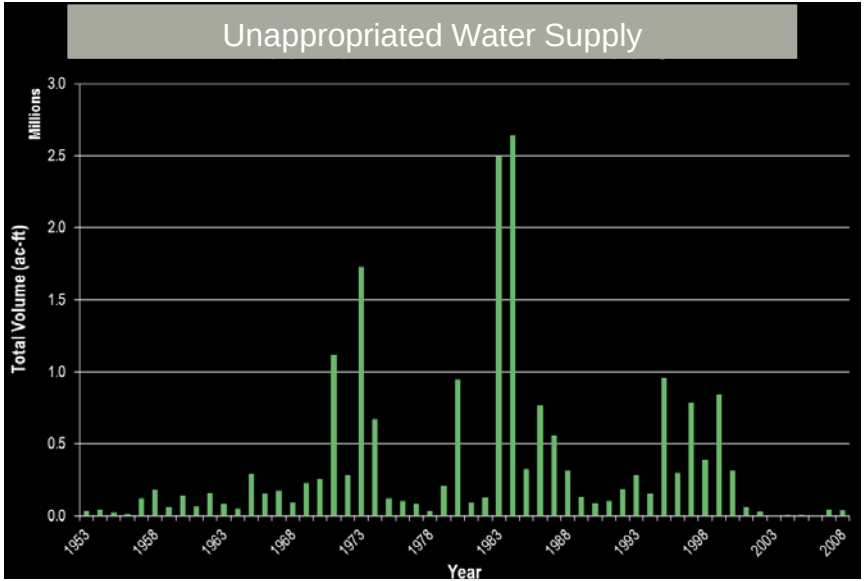
IN THE UPPER PLATTE RIVER BASIN

First Increment CWM Activities

UPPER PLATTE RIVER WATER SUPPLIES

- Receives average of 1 million ac-ft from snowmelt in Wyoming each year (North Platte Decree)
- More variable inflows in South Platte from Colorado
- Water is generally fully allocated, particularly above Elm Creek (overappropriated)
- Streamflows required to be shared under Endangered Species Act (Federal)
- Unappropriated water does occur during some very wet years, during shorter intervals, and outside of the irrigation season



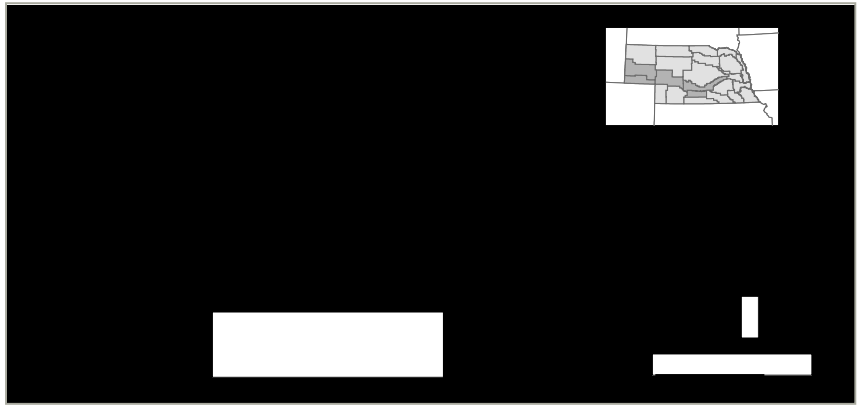


2011 PILOT PROJECT

- High flows in spring prior to irrigation season
- NeDNR coordinated with NRDs, Irrigation Districts/Canal Companies to divert excesses
- Acquisition of permits
- Contracts
- Monitor

2011 PILOT PROJECT

- 23 Canals and 5 NRDs
  - Diversion Total 142,000 acre-ft.
  - Recharge Total 64,000 acre-ft.
  - 2011-2019 Returns 15,000 acre-ft.
  - NPNRD Diversion Total 61,260 acre-ft.
  - NPNRD Recharge Total 28,739 acre-ft.



2013 FLOOD FLOWS

Friday, September 20, 2013

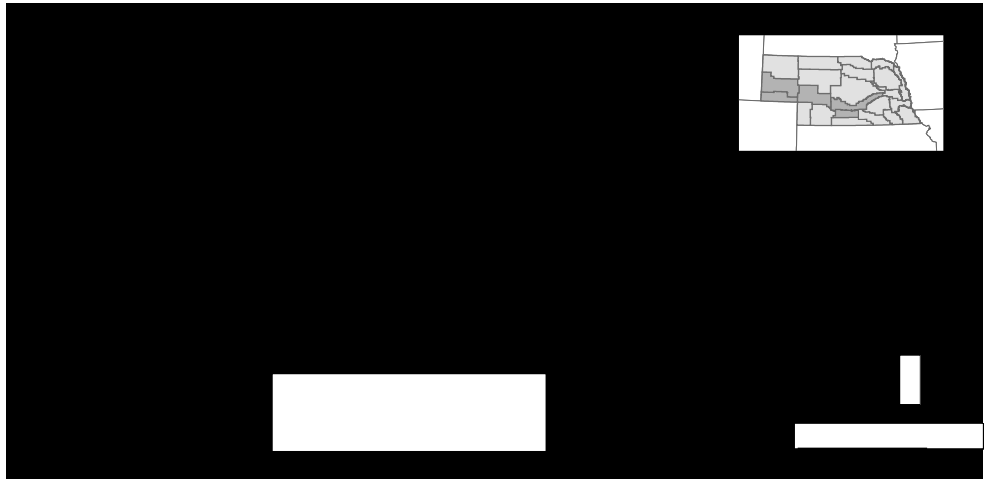
Saturday, September 21, 2013

South Platte River Highway 83 Bridge, North Platte, NE

South Platte River Buffalo Bill Road Bridge, North Platte, NE

2013 FLOOD FLOWS

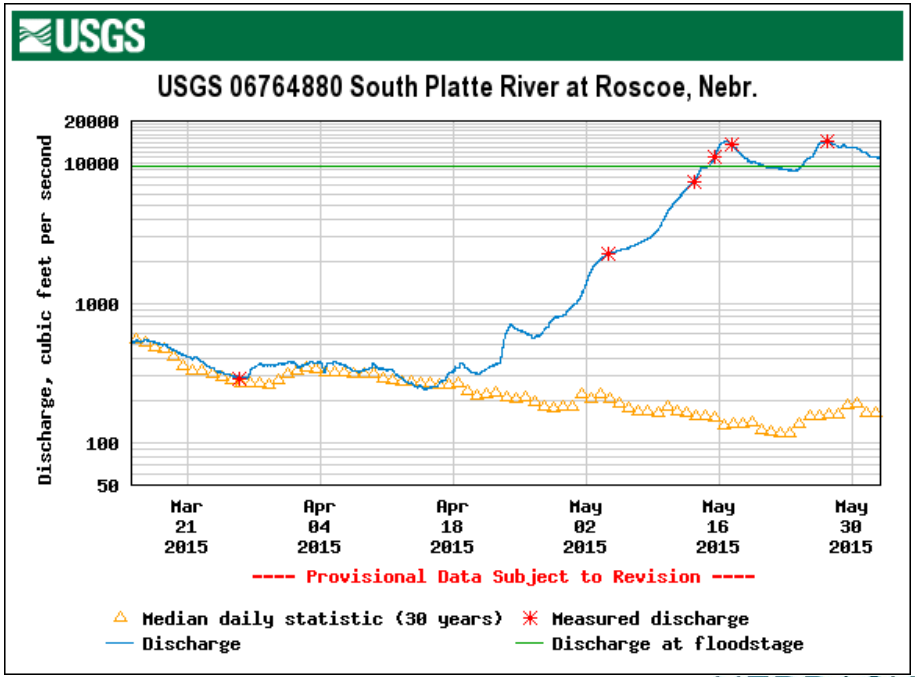
- 9 Canals and 4 NRDs
  - Diversion Total 44,000 ac-ft.
  - Recharge Total 27,000 ac-ft.
  - 2011-2019 Returns 5,600 ac-ft.



2015 FLOOD FLOWS

- Wet conditions during above average spring snowmelt
- Canals filled early
- Stored excess in lakes, reservoirs

30-Mile Canal Headworks,
June 2015



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2015 FLOOD FLOWS

- 7 Canals and 4 NRDs
  - Diversion Total 17,700 ac-ft.
  - Recharge Estimate 7,600 ac-ft.

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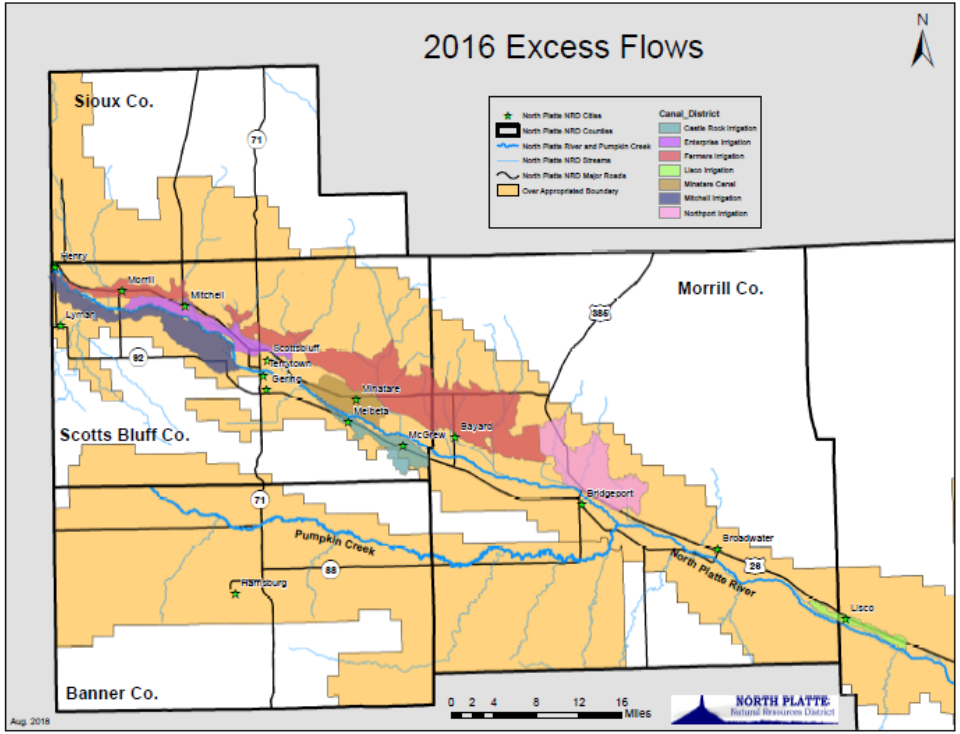
2016 FLOOD FLOWS

- 8 Irrigation Districts and Canal Companies
  - NPNRD Diversion Total

    30,369 ac-ft.
  - NPNRD Recharge Estimate

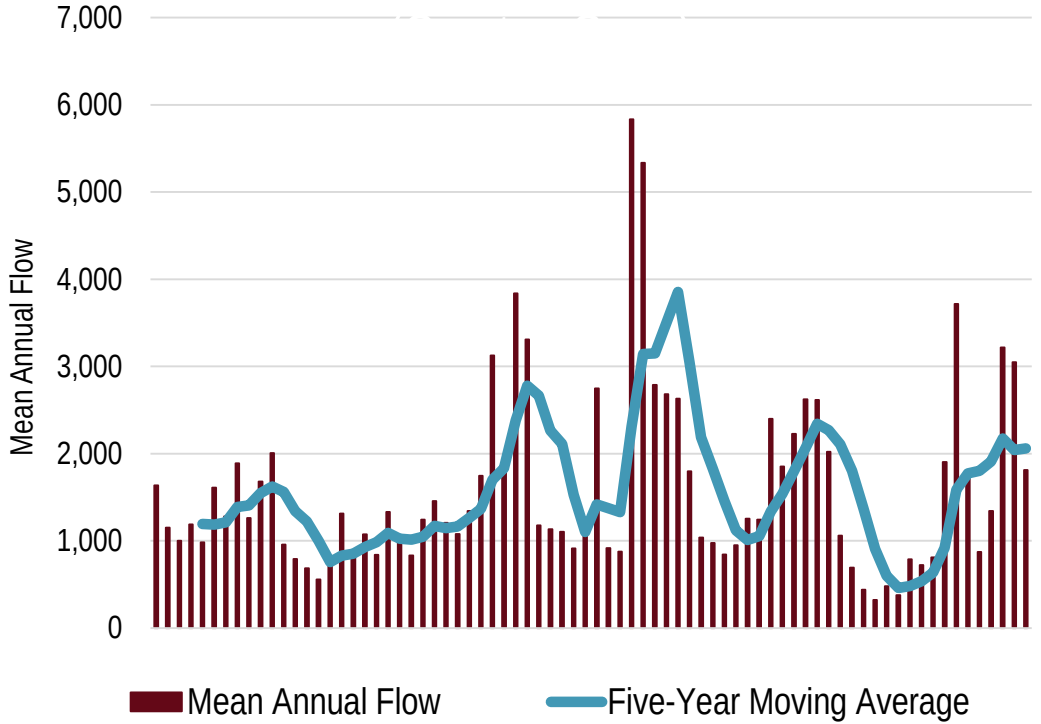
    13,812 ac-ft.



SUMMARY OF FLOOD FLOW DIVERSIONS

First Increment

- Over 200 Kaf of flood flows diverted since 2011
- Resulting recharge in excess of 100 Kaf
- Accretions will benefit Platte River flows for many years into the future
- Process in place for future successes
- Reduces the need for additional regulations
- Creates greater resiliency in future periods



NORTH PLATTE
Natural Resources District

NEBRASKA
DEPT. OF NATURAL RESOURCES

CWM FUTURE ACTIVITIES

- Expand implementation of CWM projects
- Enhance adaptation strategies based on management goals
- Support continued investment in maintaining and enhancing infrastructure
- Ensure that sound science and monitoring are available to support management decisions

Cozad Canal, Gothenberg, NE

CWM INFRASTRUCTURE EXAMPLES IN NPNRD

Schaneman Recharge Pits

- Have leased just over 100 acres on Enterprise Irrigation District
- Planning and will ultimately construct recharge pits to be used for surface water infiltration
- Project design has the capability of handling the entire diversion rate of the presently contracted acres, but will also allow for the construction of one or more recharge pits to allow for expansion

CWM INFRASTRUCTURE EXAMPLES IN NPNRD

Everett / Meyers Return

- Have leased four shares (320 acres) on Minatare Canal Company and have continued to divert water that would normally be delivered to those farms, but have built a direct return back to the river to gain consumptive use credit toward our goals and obligations under the IMP
- Designed with expansion in mind
- Project to date has returned back to the North Platte River 920 acre feet of water that would have otherwise been consumptively used by crops
- Annual operating cost of approximately $89,000.00 with 797 acre feet returned to the North Platte River in 2017
  - $112 per af

CWM INFRASTRUCTURE EXAMPLES IN NPNRD

Ducks Unlimited/NPNRD Recharge Project

- Actively searching for lands to temporarily lease the surface water appropriation from in order to divert that appropriation into man made recharge sites
- Those sites will not only benefit the recharging of the aquifer but will also provide needed habitat for migrating water flow
- Consumptive use credit from the temporary idling of crop acres to help NPNRD meet goals and obligations under the IMP

NEXT STEPS

MEETING DATES

- November 15, 2018
- January 17, 2019

PUBLIC COMMENT

Thank You

Documentation

- Graphics from slides 6-17 produced from data in spreadsheets titled
  - 20171129_Post97AnalysesSummary
  - 20180807_WWUM_RobustReview_ResultsSummary
    - Saved \\stndnrnas01.stone.ne.gov\Share\WaterPlanning\UpperPlatte\NRD\NorthPlatte\IMP\PlanDevelopment\Plan2019\PublicInvolvement\StakeholderAdvisory\SACMeetings\20180816Mtg\Presentation\RobustReveiwData