Nebraska's Innovative Approach: Recharging Aquifers through Floodwater Diversions

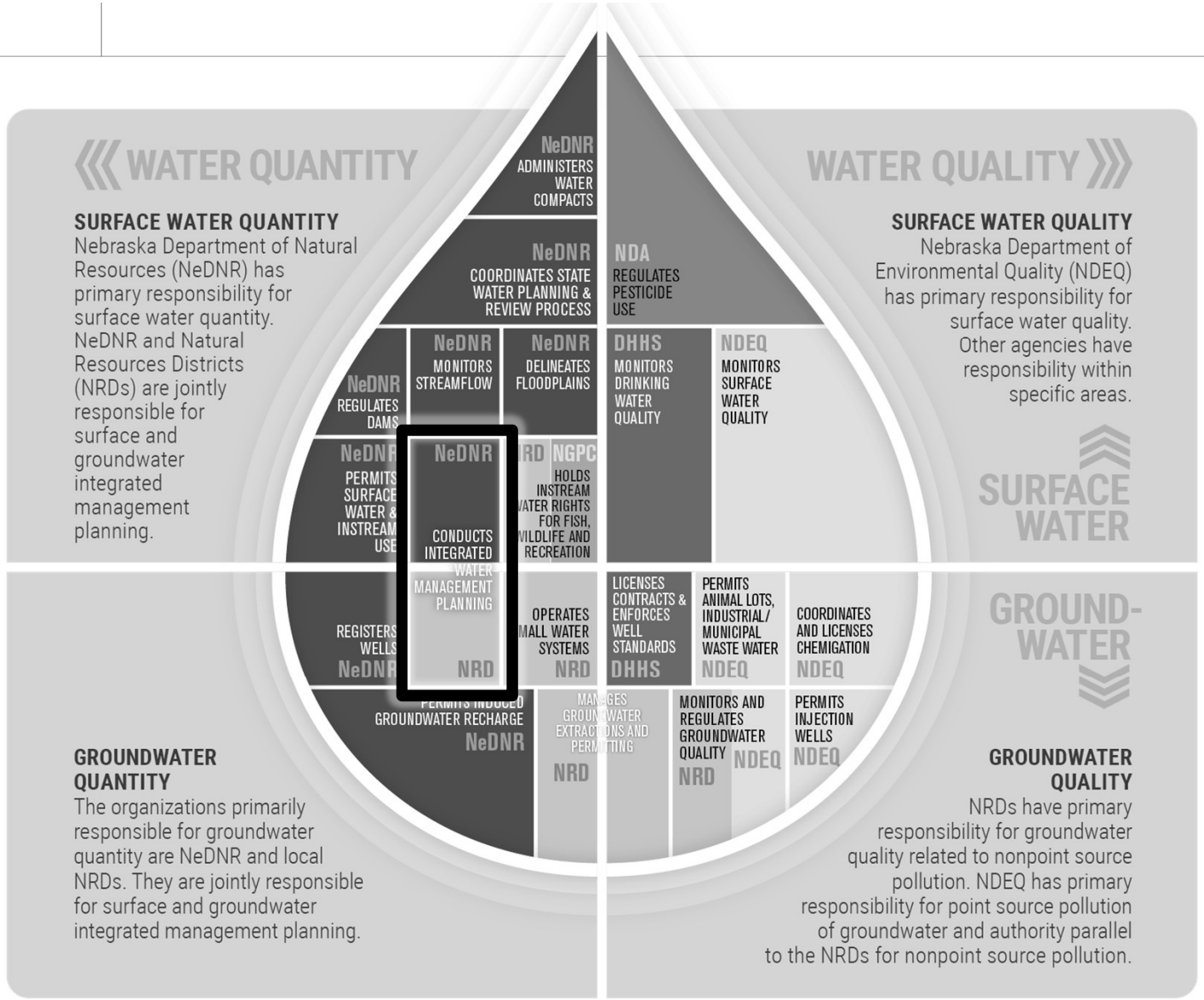
AWRA Spring Specialty Conference
March 25, 2019

Jessie Strom
Integrated Water Management Coordinator
Shuhai Zheng
Engineering Programs & Services Division Head

Recharging Aquifers through Excess Surface Water Diversions

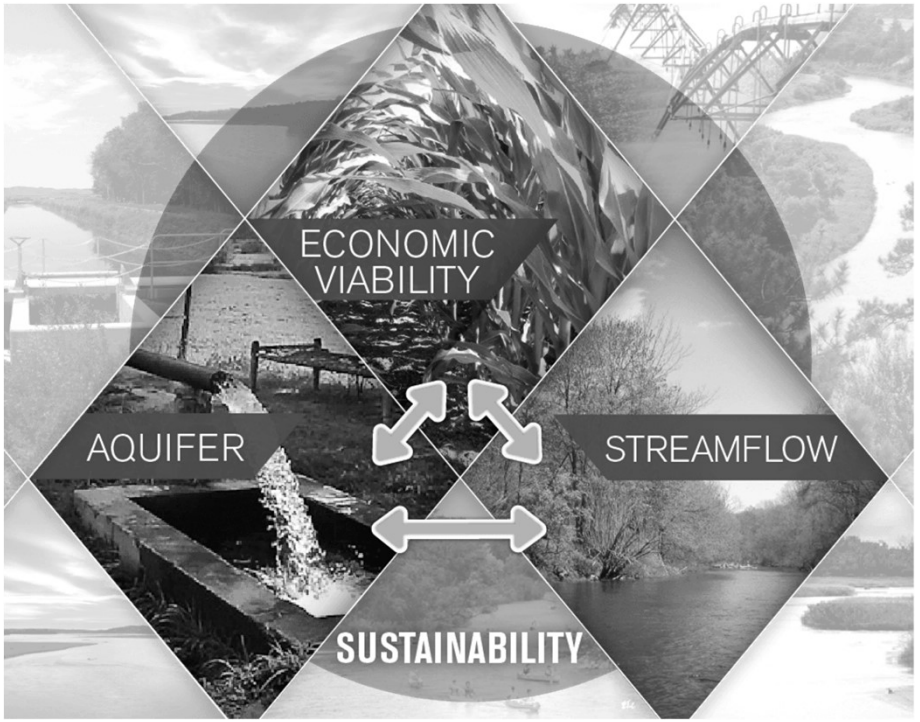
- Water Management in Nebraska
- Theory of Conjunctive Water Management
- Application in Nebraska
  - Upper Platte River Basin
- Results and future work

Providing the sound science and support for managing Nebraska's most precious resource


WATER QUANTITY
SURFACE WATER QUANTITY
Nebraska Department of Natural Resources (NeDNR) has primary responsibility for surface water quantity. NeDNR and Natural Resources Districts (NRDs) are jointly responsible for surface and groundwater integrated management planning.
WATER QUALITY
SURFACE WATER QUALITY
Nebraska Department of Environmental Quality (NDEQ) has primary responsibility for surface water quality. Other agencies have responsibility within specific areas.
SURFACE WATER
GROUND-WATER
GROUNDWATER QUANTITY
The organizations primarily responsible for groundwater quantity are NeDNR and local NRDs. They are jointly responsible for surface and groundwater integrated management planning.
GROUNDWATER QUALITY
NRDs have primary responsibility for groundwater quality related to nonpoint source pollution. NDEQ has primary responsibility for point source pollution of groundwater and authority parallel to the NRDs for nonpoint source pollution.
NeDNR ADMINISTERS WATER COMPACTS
NeDNR COORDINATES STATE WATER PLANNING & REVIEW PROCESS
NDA REGULATES PESTICIDE USE
NeDNR REGULATES DAMS
NeDNR MONITORS STREAMFLOW
NeDNR DELINEATES FLOODPLAINS
DHHS MONITORS DRINKING WATER QUALITY
NDEQ MONITORS SURFACE WATER QUALITY
NeDNR PERMITS SURFACE WATER & INSTREAM USE
NeDNR CONDUCTS INTEGRATED WATER MANAGEMENT PLANNING
NRD NGPC HOLDS INSTREAM WATER RIGHTS FOR FISH, WILDLIFE AND RECREATION
REGISTERS WELLS NeDNR
NRD OPERATES SMALL WATER SYSTEMS
DHHS LICENSES CONTRACTS & ENFORCES WELL STANDARDS
NDEQ PERMITS ANIMAL LOTS, INDUSTRIAL/ MUNICIPAL WASTE WATER
NDEQ COORDINATES AND LICENSES CHEMIGATION
NeDNR PERMITS INDUCED GROUNDWATER RECHARGE
NRD MANAGES GROUNDWATER EXTRACTIONS AND PERMITTING
NRD MONITORS AND REGULATES GROUNDWATER QUALITY
NDEQ
NDEQ PERMITS INJECTION WELLS

…An integrated management plan shall include… Clear goals and objectives with a purpose of sustaining a ***balance* between water uses and water supplies** so that the ***economic viability, social and environmental health, safety, and welfare*** of the river basin, subbasin, or reach can be ***achieved and maintained*** for both the near term and the long term…

from *Neb. Rev. Stat.* § 46-715 (2)

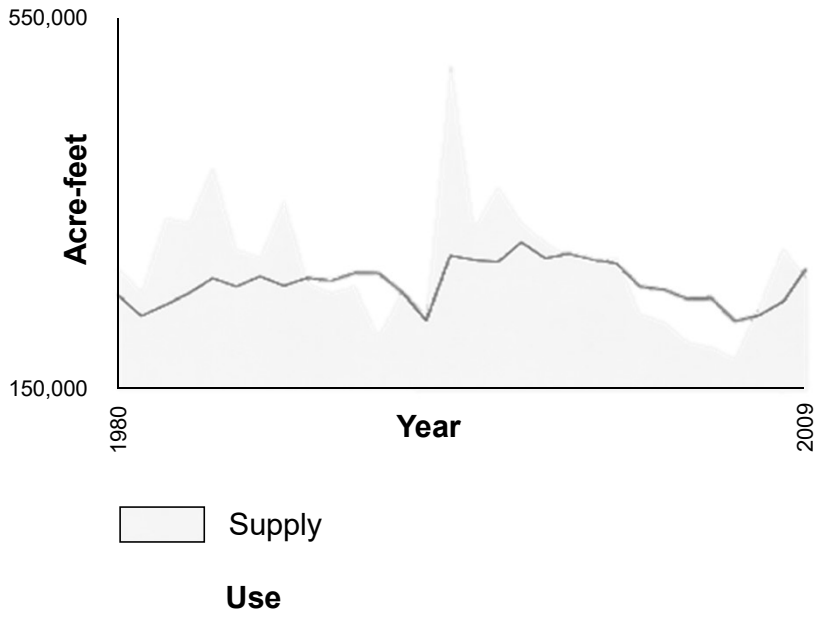


Conjunctive Water Management

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

- Use or store surface water when it is plentiful
- Rely more on groundwater when dry
- Change the timing and location of water for more efficient use
- Monitor and evaluate



Examples of CWM Projects

- Augmentation projects
- Water leasing arrangements
- Canal rehabilitation
- Capturing excess flows
- Broad scale recharge
- Slurry wall reservoirs

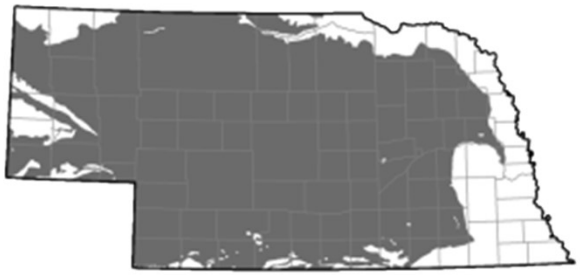
North Dry Creek Streamflow Augmentation Project, TBNRD

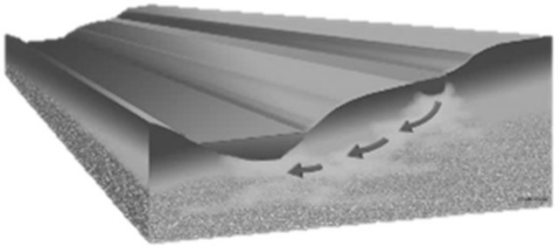
Applying Conjunctive Management

in the Upper Platte River Basin

Upper Platte River

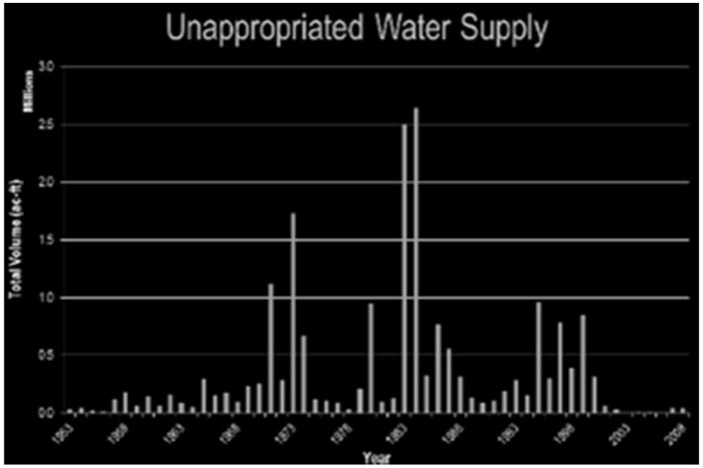
- Inflows from CO and WY
- Fully allocated
  - Offset depletions since 1997, offset any new use
  - Instream flow needs
- Occasionally unappropriated water available
- Underlain by Ogallala Aquifer and alluvial aquifers
- Extensive canal infrastructure





Development of Tools

- Analysis of unappropriated surface water
- Water leasing contract templates
- Conceptual design standard for a conjunctive management project



2011 Pilot Project

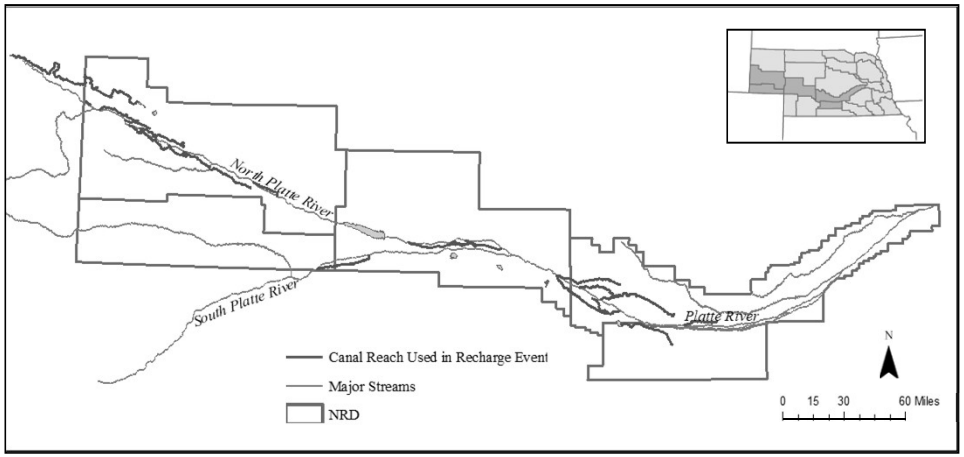
- High flows in spring through fall
  - Anticipated due to heavy snowpack
  - North Platte, South Platte, Platte
- NeDNR coordinated with NRDs, Irrigation Districts/Canal Companies to divert excesses
- Process
  - Acquisition of permits
  - Contracts
  - Monitor

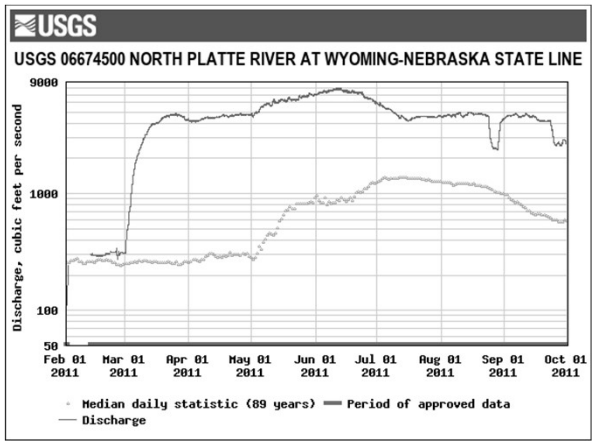
2011 Pilot Project

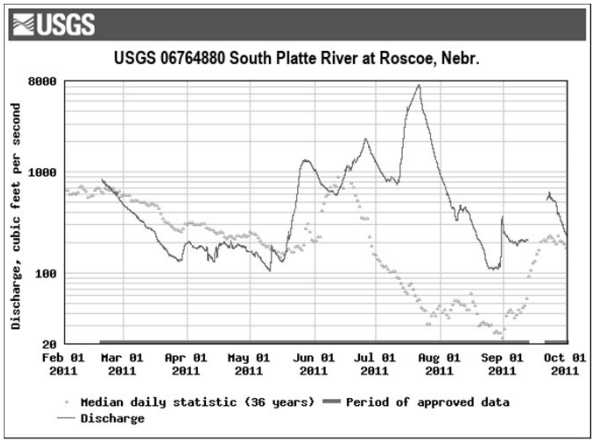
23 Canals and 5 NRDs

- **Diversion Total 145,500 acre-ft**
- **Recharge Total 96,000 acre-ft**

Also helped mitigate flooding impacts in the basin







Fall 2013 Flood Flows South Platte river at North Platte, NE

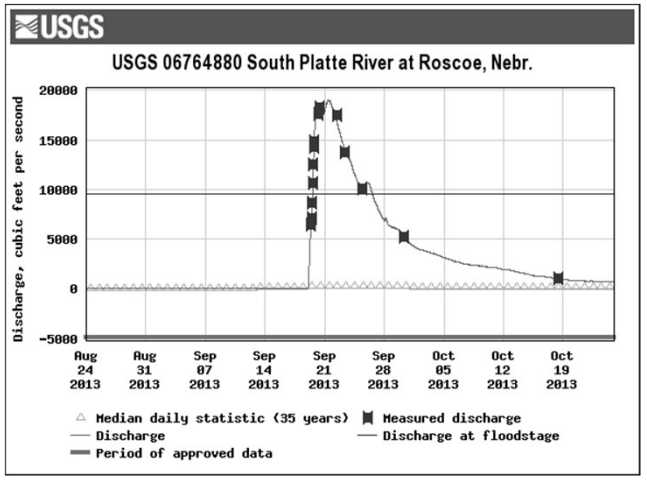
24 hours

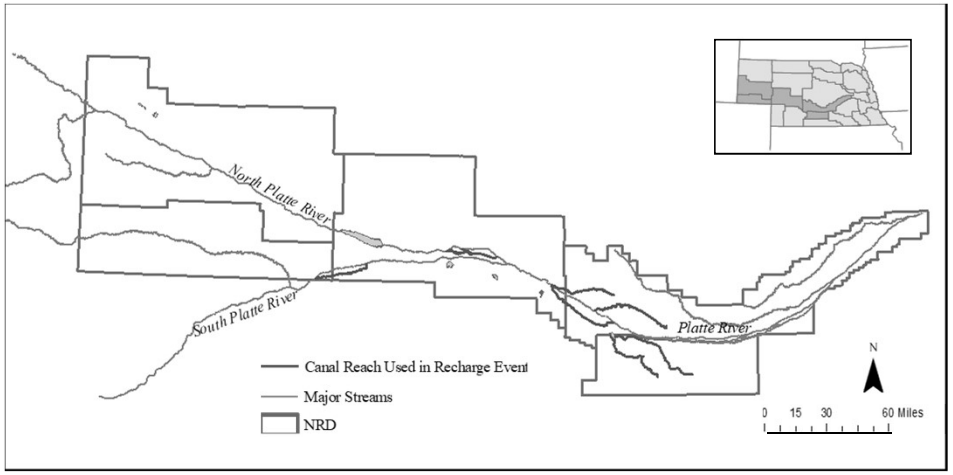
Fall 2013 Flood Flows

9 Canals and 4 NRDs

Diversion Total **27,300 acre-ft**

Recharge Total **21,800 acre-ft**



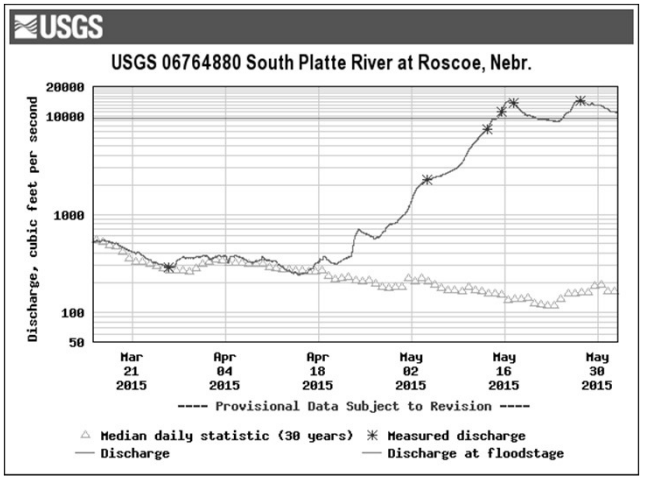


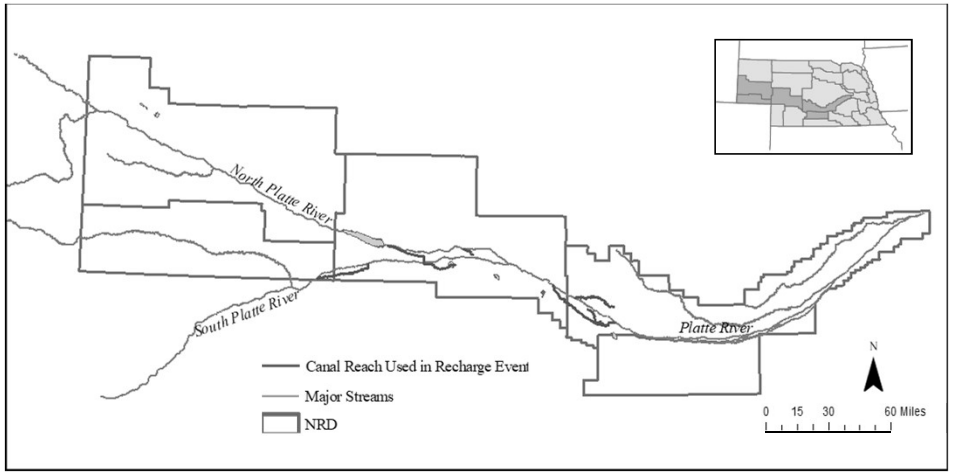
Spring 2015 Flood Flows

7 Canals and 4 NRDs

Diversion Total **17,600 acre-ft**

Recharge Total **11,100 acre-ft**

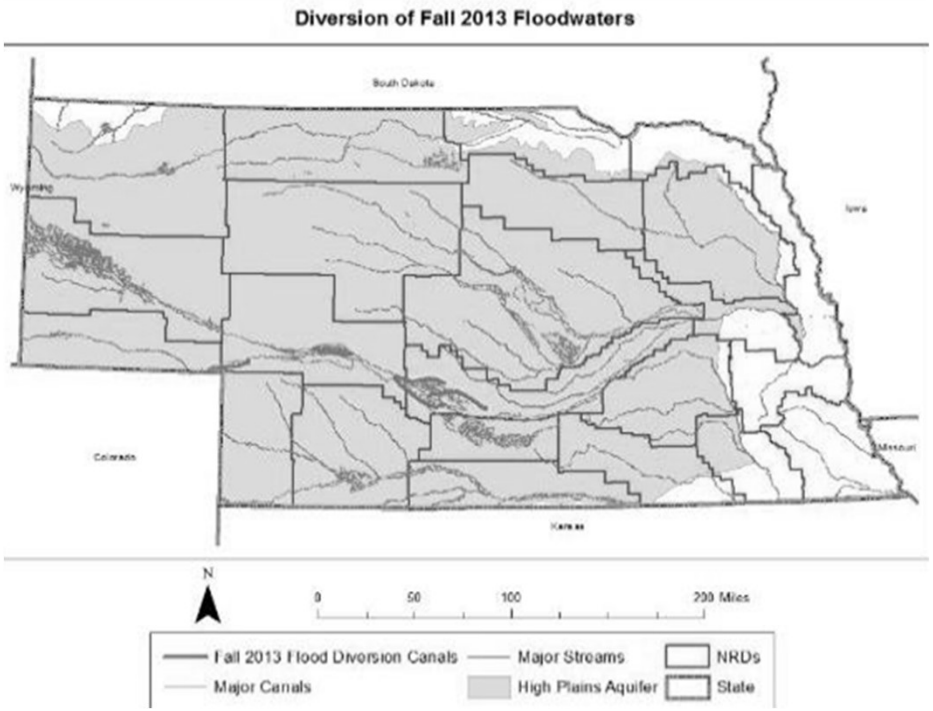




Additional Recharge Diversions

Canal Name	Total Diversion (AF) 2016	Total Diversion (AF) 2017	Total Diversion (AF) 2018
Western Canal	14826		
North Platte Canal	9246		
Paxton-Hershey Canal	7828		
Suburban Canal	6045		
Phelps Canal	6909	4916	4259
E65 Canal	1368	1665	1393

Diverting Floodwaters for Recharging the Aquifer



Estimated 2011 Average Rate of Floodwaters Diverted

Canal Name	Average Rate, cfs, 2011
Western Canal	80
North Platte Canal	60
Paxton-Hersey Canal	27
Suburban Canal	24
Phelps Canal	29
E65 Canal	-
Gothenburg Canal	83
Dawson Canal	52
30-Mile Canal	75
Total	**410**

Estimated 2013 Average Rate of Floodwaters Diverted

Canal Name	Average Rate, cfs
Western Canal	59
North Platte Canal	69
Paxton-Hersey Canal	35
Suburban Canal	12
Phelps Canal	123
E65 Canal	280
Gothenburg Canal	46
Dawson Canal	1,275
30-Mile Canal	1,797
Total	**3,696**

Estimated 2015 Average Rate of Floodwaters Diverted

Canal Name	Average Rate, cfs, 2015
Western Canal	1015
North Platte Canal	0
Paxton-Hershey Canal	0
Suburban Canal	479
Phelps Canal	29
E65 Canal	20
Gothenburg Canal	0
Dawson Canal	0
30-Mile Canal	70
Total	**1,593**

Summary of Excess Flow Diversions

- Over 260,000 af diverted since 2011
- Recharge in excess of 176,000 af
- Accretions will benefit Platte River flows for many years into the future
- Process in place
- Reduces the need for additional regulations
- Creates greater resiliency in future periods

CWM Future Activities

- Expand implementation
- Adapt strategies based on management goals
- Support continued investment in maintaining and enhancing infrastructure
- Sound science and monitoring to support management decisions
- DSS system to maximize excess flow recharge benefits

Lessons Learned

- Conjunctive Water Management can be effectively applied in Nebraska
- Lead to a more reliable water supply and supports economic viability.
- Provide benefits in flood risk reduction
- Local partners are key
- Monitoring and tracking is an important part of implementation

Questions?

301 Centennial Mall South, 4th Floor
PO Box 94676
Lincoln, NE 68509-4676
402-471-2363