

# Impact of Proposed Water Management Action Plans on Baseflow and Groundwater Levels along the Niobrara River in Nebraska

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DNR: Water Today. Water Tomorrow.

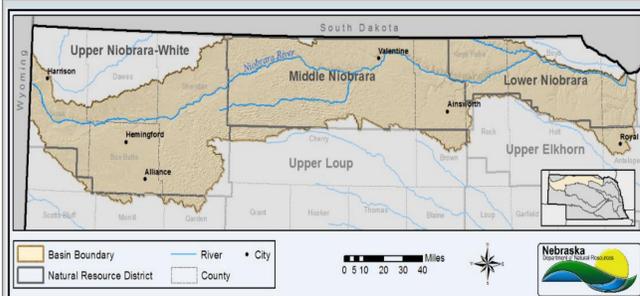
## Background and Purpose

The Niobrara River is an essential water source for irrigated farming in Northwestern Nebraska. Historical data has indicated reduction in streamflow, baseflow, and decline in groundwater elevations in the Niobrara Basin.

As a result, two alternative management action plans are under consideration to prolong the sustainability of the Niobrara River and the groundwater system in the region.

Integrated water management modeling is used to evaluate the impact of pumping station relocation (Alt 1) and canal recharge (Alt 2) on baseflow and groundwater elevation. Modeling assessments can help water managers make an informed decision in regards to these actions plans.

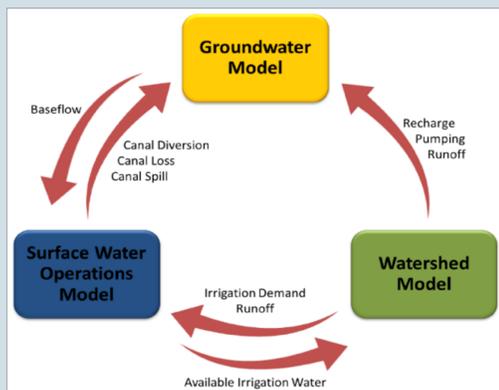
## Model Area



The modeling focuses on the Mirage Flats Irrigation District in the Upper Niobrara-White region, which contains an extensive canal system for irrigation surface water delivery.

## Model Integration

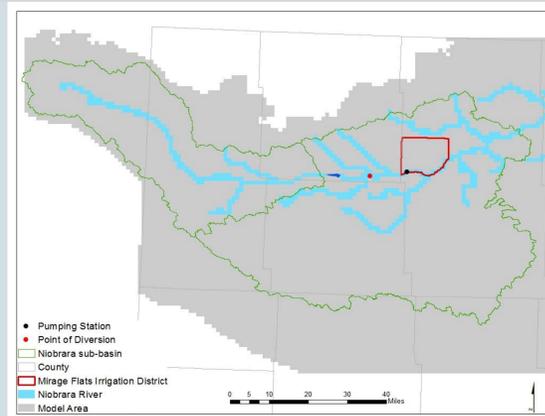
- Watershed model simulates and estimates crop irrigation demands and surface runoff
- The surface water operations model estimates water available for crop irrigation
- The amount of irrigation demand that is not met through surface water is assigned as groundwater pumping
- Canal seepage losses are incorporated into the groundwater model
- Groundwater model simulates baseflow and groundwater elevation



## Alternative Management Action Plans

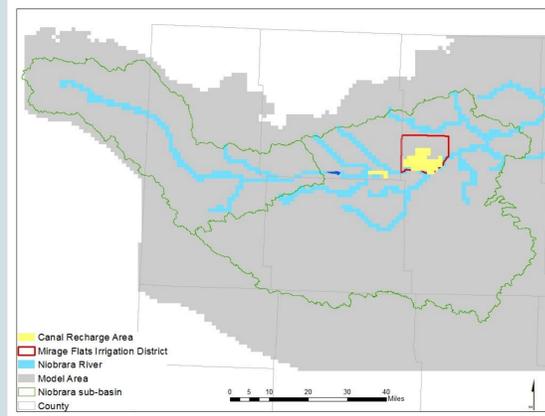
### Alternative Management Action Plan 1 (Alt 1)

- Alternative 1 plans to relocate the Mirage Flats Pumping Station location a few (~10) miles downstream from its current site closer to where the water is applied for irrigation
- The pumping station relocation plan is designed to shorten the current canal distance between the diversion point and delivery at the agricultural fields
- This proposed management action plan is intended to increase efficiency of water being delivered to the fields and reduce the high canal seepage and evaporation losses associated with the distance of the surface water irrigation canal systems



### Alternative Management Action Plan 2 (Alt 2)

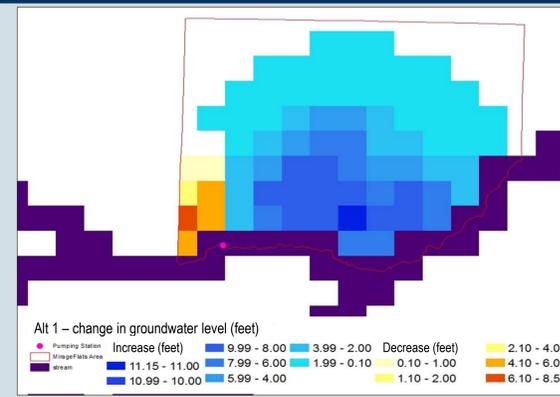
- Alternative 2 plans to use the Mirage Flats Irrigation Canal system to recharge the aquifer where water will be diverted to the existing canals and recharge the groundwater system
- The canal system will only be used for groundwater recharge and as such surface water delivery to the agricultural fields in the Mirage Flats Irrigation District will be discontinued under this management scenario
- This proposed management action plan is intended to supplement natural groundwater recharge from precipitation and increase groundwater elevation of the area



## Groundwater Elevation Changes Compared to Baseline

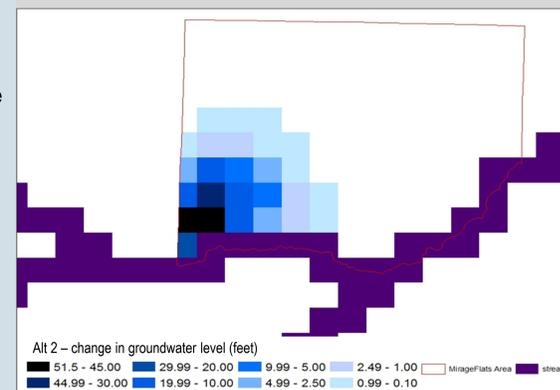
### Alternative Management Action Plan 1 (Alt 1)

- Surface water canal seepage losses are a significant source of localized groundwater recharge
- Shortening the canal distance increased the efficiency of delivery but reduced the contribution of canal seepage
- Increased efficiency of surface water delivery resulted in higher groundwater elevation in the agricultural fields as compared to the baseline



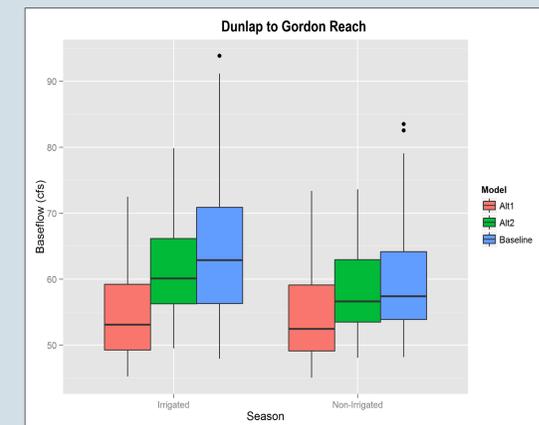
### Alternative Management Action Plan 2 (Alt 2)

- The surface water delivery canals are now used for groundwater recharge purposes only rather than crop irrigation water delivery
- In the absence of surface water delivery, irrigation now relies heavily on groundwater pumping in the area
- This alternative management action plan results in much higher groundwater elevation in parts of the agricultural fields compared to the baseline run



## Baseflow Comparisons

- The baseline which maintains current operations provides the highest amount of baseflow as canal seepage from diversion boosts groundwater levels
- Alternative 2, canals for recharge only, contributes less to baseflow than the baseline because groundwater is extracted in place of surface water
- Alternative 1, pumping station relocation, produces lower baseflow estimates as efficiency of canal distance shortening reduces canal seepage contribution to the groundwater
- In non-irrigated seasons, the order of contribution among plans is maintained with less differences in magnitude



## Summary and Conclusions

- Integrated water management modeling is used to evaluate two alternative management action plans
- The modeling results indicate that baseflow and groundwater levels are sensitive to the proposed plans
- The baseline which maintains current operations provides the highest amount of baseflow as canal seepage from diversions boosts groundwater levels
- Alternative 2, canal system for recharge only, increases groundwater elevations but contributes less baseflow than the baseline due to groundwater extraction for irrigation in place of surface water
- Alternative 1, pumping station relocation, increases local groundwater elevations but provides the least baseflow contribution to the river as efficiency of canal distance shortening reduces canal seepage
- Overall, management scenarios are expected to cause local rather than regional change in groundwater levels and baseflow

## Learn More

To learn more about integrated water management in Nebraska, please visit [www.dnr.nebraska.gov](http://www.dnr.nebraska.gov)