

A.1.1 Robust Review Project Analysis Scope of Work

Exhibit A

Memo

To: POAC Technical Committee
 From: Thad Kuntz (ARI) and Duane Woodward (CPNRD)
 Date: 8/2/2016
 Re: FINAL – Robust Review Project Analysis Scope of Work

Introduction

The Platte Overappropriated Area Committee (POAC) Technical Committee tasked Thad Kuntz from Adaptive Resources Inc. (ARI) and Duane Woodward from CPNRD to develop a scope of work for the Robust Review Analysis. The Districts included in this analysis are NPNRD, SPNRD, TPNRD, CPNRD, and TBNRD.

Robust Review General Scope of Work Description

A “change modeling” technique will be utilized for this analysis; this technique compares a baseline or reference model run (either the Western Water Use Management (WWUM) Model or Cooperative Hydrology Study (COHYST) Model) to a modified model run. The modified run introduces a change to a specific dataset in the baseline run and, when compared to the baseline, the difference is reflected in the stream baseflow, heads, or aquifer storage. The results from this technique do not represent actual estimates of future stream baseflow, streamflow, heads, or aquifer storage, but rather provide the estimated change in the stream baseflow, streamflow, heads, or aquifer storage.

Two phases of modeling will be completed to provide information for each District on post-1997 irrigated acreage development impacts, mitigation measures completed to offset those impacts, and effects of other water management actions each District has completed. Phase 1 modeling will encompass mitigation measures and management actions completed through 2013 while Phase 2 modeling will address additional analysis on surface water only and commingled acres, projects after 2013, and future water management planning for each District.

Phase 1 Modeling

The Phase I Robust Review modeling encompasses the post-1997 irrigated acreage development depletions and the management actions to mitigate these depletions. These actions include: excess flow canal recharge, ground water pumping allocations, certified acreage retirements, certified acreage transfers, surface water recharge projects, crop type changes, and municipal/industrial baseline changes. To complete Phase 1 Modeling, the POAC Technical Committee has identified the following baseline simulation and 7 individual analyses:

Baseline Run:

1. Existing Models
 - a. WWUM Modeling
 - i. Utilize the 1953 through 2014 Model
 - ii. Only use 1997 through 2013 for the analysis
 - iii. Modification to the Baseline Simulation
 1. Temporary retirements and transfers of certified ground water only irrigated acres occur in several NRDs and as a consequence the baseline simulation will need to be modified to

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incorporate the reactivation or movement of these acres. To account for this affect, the baseline model will add these acres or move them to the original location, represented as irrigated corn, in the simulation when their temporary location expires.

- iv. Repeat 2009 through 2013 climate into the future through 2063
- v. Repeat the 2009 through 2013 pumping and recharge into the future through 2063
- b. COHYST Modeling
 - i. Utilize the 1950 through 2013 Model
 - ii. Only use 1997 through 2013 for the analysis
 - iii. Repeat 1988 through 2013 climate through 2063
 - 1. Hold the 2013 land use dataset (this is the 2010 land use dataset repeated through 2013) constant for the projection
- c. Municipal, Industrial, and Livestock Pumping
 - i. To complete the municipal, industrial, and livestock transfer and baseline analyses, both modeling efforts may need to revise the current estimates and locations of pumping and if not already in place, revise with actual pumping estimates for each category.
- d. Canal Recharge Projects from Excess Flow
 - i. The baseline models will need modified to incorporate the excess flow diversions for recharge.
 - ii. To determine the amount of recharge from the diversion of excess flows a similar calculation to the NDNR Technical Memorandum for the 2011 Ground Water Recharge Demonstration Projects will need completed.

For all modified modeling analyses described below, each District will need to have separate analyses to determine their individual effects and compared to the baseline run described above. For the WWUM Modeling, each analysis using the regionalized soil water balance modeling will have only one run for both NPNRD and SPNRD. Post processing will split the run for each District.

Land Use Analysis:

1. *Increase in Post-1997 Irrigated Ground Water Only Acres*
 - a. WWUM Modeling
 - i. A set of model runs have been completed by ARI and the only additional work is two ground water model runs to separate out the effects of each NRD. No additional regionalized soil water balance modeling work will need to be completed. ARI will coordinate with NDNR, allowing NDNR to conduct the same analysis of increases in post-1997 irrigated groundwater only acres. NDNR will use the same input files and the same model version used by ARI to replicate the analysis, and the results of the two will be compared and evaluated to determine if the methods used meet the goals and objectives of the IMPs. This activity will take place as part of the Robust Review process.

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- b. COHYST Modeling
 - i. To complete the analysis for CPNRD, TPNRD, and TBNRD individually, within each District the irrigation portion of the irrigated acres developed after 1997 will be removed from the land use dataset and ran through the watershed and ground water models to provide a streamflow value.
- 2. *Certified Irrigated Acreage Retirements (PBHEP, AWEF, CREP, EQUIP, NRD, etc.)*
 - a. The retirement analyses will be completed separate from the Post-1997 depletions analysis. However, the effects from the retirements can be incorporated into the depletions analysis to provide the overall combined results.
 - b. WWUM Modeling Area
 - i. The retirement analysis will pump water at the retired parcel in the modified model each year using the projected pumping described in the baseline run.
 - 1. There is the possibility of double accounting for retirement effects if the lands were post-1997 developed lands. To mitigate this issue, the lands that were retired and developed after 1997 will not be analyzed in the retirement analysis. (SPNRD has no post-1997 retired acres, NPNRD estimates that 130 retired acres were post-1997 lands.)
 - c. COHYST Modeling Area
 - i. The retirement analysis will pump water at the retired parcel in the modified model each year as if the parcel grew corn from the retirement date to the end of the analysis.
 - 1. There is the possibility of double accounting for retirement effects if the lands were post-1997 developed lands. To mitigate this issue, the lands that were retired and developed after 1997 will not be analyzed in the retirement analysis.
- 3. *Certified Irrigated Acreage Transfers*
 - a. The transfer analyses will also be completed separate from the Post-1997 depletions analysis. However, the effects from the transfers can be incorporated into the depletions analysis to provide the overall concept of combining the results.
 - b. WWUM and COHYST Modeling Areas
 - i. In the modified model:
 - 1. Water will be pumped at the pre-transferred location using the crop type and pumping amount of the post-transferred location. New irrigation recharge will be estimated will be provided for each pre-transferred location. The future projection will be completed as described in the baseline run.
 - 2. The post-transferred location will be converted to dryland pasture in the WWUM Modeling and dryland crop in the COHYST Modeling.
 - 3. If the transfer is to an industrial use, then the efficiency of that new use must be estimated for the simulation.
- 4. *Variances Granted Since July 1, 1997*



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- a. Each variance will need individually conceptualized and an analysis will need to be completed.
- b. NDNR has compiled a list of the variances provided by the NRDs that have occurred over this timeframe. It is anticipated that each individual variance can be categorized into one of the previous categories: Increase in acres, retirements, or transfers.

Change in Crop Mix Analysis:

1. *Changes in Crop Consumptive Use from Changes in Crop Mix as Compared to 1997 Crop Mix*
 - a. This phase of the project will investigate the changes in crop consumptive use since 1997. This will be completed by determining the annual total consumptive use and comparing it to the 1997 annual consumptive use.

Canal Recharge Projects Analysis:

1. *2011 Ground Water Recharge Demonstration Project*
 - a. In the modified model, this will be completed by removing the amount of excess flow diversions and associated recharge.
2. *2013 South Platte River Flood Flow Diversion and Recharge*
 - a. In the modified model, this analysis can be completed by removing the recharge from the diversion of excess flows.
3. *Phelps County Canal Recharge Project*
 - a. In the modified model, this analysis can be completed by removing the recharge from the diversion of excess flows into Phelps canal during the winter months.
4. *Elwood Reservoir Ground Water Recharge Project*
 - a. In the modified model, this analysis can be completed by removing the recharge from the diversion of excess flows into Elwood Reservoir.

Augmentation Project Analysis:

1. *North Dry Creek Augmentation Project*
 - a. In the modified model, this analysis can be completed by removing the pumping into dry creek during the time period water was pumped.

Allocation Analysis (NPNRD and SPNRD Only):

1. *Ground Water Allocations (North Platte and South Platte NRDs Only)*
 - a. A set of model runs have been completed by ARI and the only additional work is two ground water model runs to separate out the effects of each NRD. No additional regionalized soil water balance modeling work will need to be completed. ARI will coordinate with NDNR, allowing NDNR to conduct the same analysis evaluating the allocations. NDNR will use the same input files and the same model version used by ARI to replicate the analysis, and the results of the two will be compared and evaluated to determine if the methods used meet the goals and objectives of the IMPs. This activity will take place as part of the Robust Review process.



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Municipal, Industrial, and Confined Livestock Feeding Operation Baseline and Transfer Analysis:

1. *Changes in Municipal, Industrial, and Confined Livestock Feeding Operations Consumptive Use and Location of Pumping as Compared to Their Baseline*
 - a. In the modified model:
 - i. For municipal baseline pumping from 1998 through 2013, the calculated baseline annual per capita consumptive use will be multiplied by the annual population of 1997 and will be compared to the baseline run's actual pumping amount.
 - ii. For industrial baselines from 1998 through 2013, the 1997 estimates of pumping for each industry will be fixed to compare against the actual pumping in the baseline run.
 - iii. For livestock baselines from 1998 through 2013, the average gallons/head/day will be multiplied against the 1997 cattle of feed for each NRD tracked livestock facility and compared to the baseline run's actual pumping.
 - b. To determine the effect of municipal, industrial, or livestock transfers, in the modified model, the pre-transferred pumping locations will be used. The post-transferred pumping locations will be removed from the modified model.

Overall Robust Review Analysis:

1. Overall analysis will combine each analysis into a single run.
 - a. The overall analysis will encompass the following changes:
 - i. Land Use Analysis
 - ii. Canal Recharge Projects Analysis
 - iii. Augmentation Projects Analysis
 - iv. Allocation Analysis (NPNRD and SPNRD Only)
 - v. Municipal Baseline and Transfer Analysis
 - b. **Some of these changes may not be able to be analyzed together so a composite of the combined and individual analyses may need to be utilized in order to complete this analysis.**

Documentation for All Analyses

The change results will be determined and presented for each of the individual analysis listed above (e.g. Land Use Analysis, Change in Crop Mix Analysis, etc.) and by District. Additionally, complete overall documentation for the process, assumptions, and results will be presented in a single document for the Platte Basin area.

Project Timeline

The Phase 1 modeling analyses need completed by December 31st, 2016. In early 2017, the information and draft documentation will be provided to the POAC Technical Committee and Administrators for review and discussion.

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Phase 2 Modeling

The Phase II modeling will be completed to provide each District with information on the post-1997 irrigated acre development impacts, projects, and management actions that are in the in development after 2013 that will effect stream baseflow or streamflow through the first increment and into the future. The future projects and management actions include canal recharge, allocations, certified acreage retirements, certified acreage transfers, surface water recharge projects, idled certified acres, crop type changes, and municipal/industrial baseline changes. Additionally, different climatic conditions may exist in the future that may include wet and dry scenarios and modeling can be completed to help inform each District's water resource management planning. Additionally, commingled pumping will be addressed in Phase 2 Modeling. The Phase 1 Modeling will be used as the modeling or a template of the modeling needed for this phase of the Robust Review Analysis.

Below is a list of potential projects being considered for Phase II modeling:

- Temporary Surface Water Only and Commingled Land Retirements
- Climatic Conditions
- Change in Crop Mix (If Needed)
- Commingled Acres
- Canal Rehabilitation: Cozad, Orchard-Alfalfa, Thirty-Mile
- Nebraska Cooperative Republican Platte Enhancement Project
- J-2 Regulating Reservoir
- Elm Creek Reservoir Potential Excess Flow Storage
- Surface Water Transfer Recharge/Stream Augmentation Projects (NPNRD)
- Future High Flow Canal Recharge Projects (Similar to the 2011 and 2013/2014 Recharge Projects)
- Planned Projects (after 2013)
- Conversion from Surface Water Only Irrigation to Commingled Irrigation
- Conversion from Surface Water Only Irrigation to Ground Water Only Irrigation (CPNRD)