Responses to the EERC

Comments on the
Draft Report on the Red River Valley Water Supply Project Needs and Options

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October 13, 2005

Ms. J. Signe Snortland
U.S. Bureau of Reclamation
Dakotas Area Office DK619
PO Box 1017
Bismarck, ND 58501-1017

Dear Ms. Snortland:

Subject: Draft Needs and Options Report

Enclosed are our comments regarding the U.S. Bureau of Reclamation's Draft Needs and Options Report. We are aware that the formal deadline for public input and comment has passed; however, we hope that you may still have use for further input and suggestions.

Please contact John Harju by phone at (701) 777-5157 or e-mail at jharju@undeerc.org or me by phone at (701) 777-5050 or e-mail at bbolles@undeerc.org if you need further clarification on our comments or if you have any questions.

Sincere regards,

Bethany Bolles

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REVIEW OF BUREAU OF RECLAMATION DRAFT REPORT ON RED RIVER VALLEY WATER NEEDS AND OPTIONS

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INTRODUCTION

The Dakota Water Resources Act of 2000 authorized the U.S. Bureau of Reclamation (BOR) to conduct the Red River Valley Water Supply Project, a comprehensive study of the future water quantity and quality needs of the Red River Valley in North Dakota, along with possible options to satisfy those needs. The BOR recently released a draft report entitled "Red River Valley Needs and Options," which essentially stated that adequate surface water sources exist to meet future demand under normal climatic conditions, but shortages would occur during periods of drought. In order to address future needs, seven options were evaluated to provide bulk water supply for municipal, rural, and industrial use to meet the demand for water shortages that would occur during a drought. Two of the options provided water from in-basin alternatives, one option involved water import from the Rainy River Basin (Lake of the Woods), and four options included imports of Missouri River water.

Options Evaluated

1. ***North Dakota In-Basin Alternative***
   This alternative proposes to divert Red River flows from downstream of Grand Forks to Lake Ashtabula via pipeline to meet municipal, rural, and industrial (MR&I) water demands. This option also includes development of new groundwater resources in southeastern North Dakota, purchase of irrigation permits in the Elk Valley Aquifer, and aquifer storage and recovery systems for Fargo, Moorhead, and West Fargo.

2. ***Red River Basin Alternative***
   This option would include the same features as the North Dakota In-Basin Alternative; however, it also proposes development of Minnesota groundwater supplies. Well fields would be developed and transported with an interconnecting conveyance pipeline serving the Fargo–Moorhead metropolitan area.

3. ***Lake of the Woods Alternative***
   The primary feature of this option is a pipeline from Lake of the Woods to the major population centers of the Red River Valley. It would include the same North Dakota and Moorhead groundwater features as the North Dakota In-Basin Alternative.

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4. ***Garrison Diversion Unit (GDU) Import to Sheyenne River Alternative***
   The key feature of this option is a pipeline from the McClusky Canal to Lake Ashtabula that would release treated Missouri River water into the Sheyenne River. The option would include a biota treatment plant at the McClusky Canal and a pipeline to serve industrial water demands in southeastern North Dakota.

5. ***GDU Import Pipeline Alternative***
   This alternative proposes a pipeline from the McClusky Canal to the Fargo and Grand Forks metropolitan areas sized to meet peak day shortages. It would include a biota treatment plant at the McClusky Canal and a pipeline to serve industrial water demands in southeastern North Dakota.

6. ***Missouri River to Red River Valley Import Alternative***
   This alternative proposes a pipeline from the Missouri River at Bismarck to the Fargo and Grand Forks metropolitan areas. The option includes a biota treatment plant at the Missouri River. The option also includes the same North Dakota and Moorhead groundwater features as in the North Dakota In-Basin Alternative.

7. ***GDU Water Supply Replacement Pipeline Alternative***
   This alternative proposes to use water imported from the Missouri River to replace other water supplies in the service area and to meet future water demands. The principal feature of this option is a pipeline from the McClusky Canal into the Red River Valley interconnecting most of the cities, rural water systems, and industries. The option includes a biota treatment plant at McClusky Canal and a water treatment plant to deliver water treated to Safe Drinking Water Act standards to locations throughout the Red River Valley.

The Energy & Environmental Research Center (EERC) conducted a comprehensive review of the BOR's report, including an evaluation of the assumptions, methodologies, and conclusions included in the report. While we are aware that the deadline for public comment has passed, we hope the BOR will consider the following questions, comments, and suggestions that we have prepared.

SECTION-SPECIFIC COMMENTS

The following comments are specific to various sections of the report. Although the entire report was reviewed, comments are not provided for every section, only those where we felt additional work or explanation was needed. The executive summary, introduction, and conclusions were also reviewed, and we determined that the material contained within the main body of the report is accurately reflected in those sections.

Chapter Two – Needs Assessment

Chapter Two presents the necessary information to begin answering the question of how much water is needed in the Red River Valley through 2050. It quantifies the needs identified in the Dakota Water Resources Act (DWRA) to the extent possible and focuses on municipal, rural,

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and industrial water supply. Water demand is calculated by multiplying the estimated 2050 population by per capita water demand minus water conservation (the amount of water that can be saved with water conservation measures). Industrial water demands and recreation consumptive uses are added to the equation to determine the future water demand of the service area. Monthly water demand scenarios were developed to input into the surface hydrology model to determine if there would be adequate future surface water supplies for surface water-dependent systems in 2050.

Red River Valley Water Systems (Section 2.1)

This section identifies the type and number of existing water systems in the Red River Valley and explains how these water systems would be served through 2050. The future water demand analysis is divided into three separate analyses: 1) municipal, 2) rural, and 3) industrial. Some municipal systems would be served in the future by rural water systems, and some would continue to maintain their present water treatment facilities through the planning horizon of 2050. Overall, this section makes numerous assumptions and presents numerical values that are not clearly referenced.

Comment 1

- In the paragraph on page 2-3 that begins with "The needs assessment assumes that 44 of the 60 municipalities or water associations that presently have water treatment capabilities would contract with a rural water system for bulk or metered water service by 2050," what is the basis for this assumption and others like it in the paragraph?

- There are numerous statements that rely on unclear assumptions in the paragraphs on pages 2-4 and 2-5. It is not clear how they were determined or whether or not they are reasonable.

Water Demand Calculation Methods (Section 2.2)

In this section, the methods for estimating various types of future water demands used in evaluating future water needs of municipal and rural water systems are described. Water demands for municipalities and rural water systems appear to be based predominately on future population projections and per capita demand estimates, although some city or rural systems include substantial bulk industrial demands. Interestingly, only two scenarios are presented for three population demand estimates. Numerous assumptions, lack of citations, vague statements, and arbitrary numerical references persist.

Comment 2

- Only two demand estimates are stated in the text on page 2-6, while the side note to the right does not address the Northwest Associates population projection estimates.

Comment 3

- "Water loss in some systems varied greatly from year to year depending on pipeline breaks and other factors." It is presented that other factors can greatly contribute to these losses; however, it is not clear what these other factors are.

- "When the actual water use was estimated, a factor for water losses of 10% was added back into the estimate to determine a total water demand for Fargo." There does not appear to be any documentation to support this value.

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Response to Comment 1

Small communities and rural water systems were combined for the purposes of evaluation, as discussed on page 2-35 of the Final Needs and Options Report. It is reasonably foreseeable that smaller communities and rural water systems will continue merging over time as their infrastructure ages and requires replacement in response to increasingly stringent water treatment regulations. Also, population estimates and water demands are based partially upon county population projections. The allocation of water demand between rural water systems and individual municipalities does not affect overall water demands.

Response to Comment 2

Reclamation revised the *Report on Red River Valley Water Supply Project Needs and Options, Current and Future Population of the Red River Valley Region 2000 through 2050, Final Report* to provide additional clarification on population projections. Reclamation used the "optimistic" population projection of 417,600 (table 9) for the 13 eastern counties in North Dakota, but this was only 15,100 more than the results with migration shown in table 8, or a 3.8 percent increase. The difference was 27,079 or 6.9% higher than the projections by Northwest Economics Associates. In either case, the difference in population minimally affects cost estimates of the options, so no changes were made to the Final Needs and Options Report.

Response to Comment 3

Most of the high unaccounted-for water losses were in smaller towns and rural water systems. Most of these water systems did not have identified future shortages, so they had no impact on option costs. All of the major municipal water users in the service area had unaccounted-for water losses at 10% or less.

- There does not appear to be any reference to support the following statement: "This assumption was validated in the city of Fargo's case as they attained significant reductions in unaccounted-for water loss by aggressively fixing leaks and replacing aging pipe distribution systems."
- On page 2-8, "In calculating water demands for each water user, Scenario One water uses Reclamation's 2050 population projections and Scenario Two uses water users' 2050 population projections, ..." Why was the third population projection from Northwest Economic Associates ignored? **Comment 4**

Comment 5

- "Table 2.2.10 outlines the process for estimating peak daily water demand including water conservation and water losses. In this example Fargo's water loss rates improved from 1988, so a lower loss rate of 10% was used." How is this 10% lower than Fargo's current 10% water loss rate? These assumptions and applications could be better explained.

Population Projections (Section 2.3)

Comment 6

Predicting future population growth is a key component in estimating future water demands. Three sources of population projection data are presented in this section and used in this assessment. These projections were developed by the BOR, Northwest Economic Associates, and individual Red River Valley municipalities. The BOR contracted with Northwest to independently estimate population growth to compare with the BOR's projections. However, it appears the foundation for the development of the two primary demand scenarios presents a conundrum. Of the three population estimates that were conducted and reported, two (BOR and Northwest) used identical methods and arrived at different population estimates. The Northwest estimate was ruled out and not considered as a possible scenario, with no explanation provided.

- On page 2-6, why does the Northwest prediction show "...a difference in population of 68,733 or approximately 11% lower than Reclamation's projection"?

- "...Reclamation developed two water demand scenarios to use as a range in hydrology modeling and in developing alternatives." Why were only two demand scenarios developed when three population projections were reported? What happened to the Northwest Economic Associates estimate?

Per Capita Water Demand (Section 2.4)

Comment 7

This section summarizes per capita water demands used in estimating future water demands for municipalities and rural systems. Per capita water demands were developed for three groups of water systems: 1) municipalities that would retain their own water treatment systems through 2050, 2) rural water systems, and 3) municipalities that would be served by a rural water system by 2050. The most notable points in this section are the rather large unaccounted-for water losses by each municipal water system that are not addressed and the unreferenced water use values for some of the municipal/industrial systems.

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Response to Comment 4
See response to Comment 2.

Response to Comment 5
See response to Comment 3.

Response to Comment 6
See response to Comment 2 regarding population estimates. The purpose of the Northwest Economic Associates report was to have an independent estimate of population growth to compare with Reclamation's population estimates and not to generate a third water demand scenario.

Response to Comment 7
See response to Comment 3.

- On page 2-27, "If a water system has an historic average less than 10%, a value of 10% was used in their analysis. The level of 10% is generally considered a reasonable water system water loss goal." Why is this value considered reasonable and where is the reference for this?

Comment 8

- On page 2-29, "The water demand analysis assumes that historic water use represents future water demand on a per capita basis. Per capita water use rates could increase over time due to the increased popularity of existing or new water use devices, such as high volume whirlpool baths. Per capita water use could also decrease in the future due to the improvement of water conserving devices. The water demand analysis assumes that both of these situations are equally likely to happen and therefore neutralize each other." How can this be possible? During what time of the year would this apply? What are the references for this?

Comment 9

- Where did this information originate? "Water use by American Crystal Sugar has been significantly reduced in the last 10 years. Drayton reported that American Crystal Sugar now uses about 60,000,000 gallons per year."

- The following statement needs to be verified for accuracy: "The study assumed that American Crystal Sugar would continue to receive water from Drayton, in addition to using their own water permit."

Comment 10

- "Unaccounted-for-water losses were estimated at 11% per year, but no actual data were provided." This claims a value that cannot be substantiated; how is it possible to base results on no data?

Comment 11

- From page 2-30, "The Air Force Base population was assumed to grow at the same rate as the city, so water demand for the Air Force Base was analyzed with the water demand for Grand Forks." Current events suggest this is no longer true; the air base is not related to the city of Grand Forks.

Comment 12

- The specific results for the city's historic water demands and unaccounted-for losses presented on pages 2-29 through 2-32 and 2-38 through 2-40 show the individual municipal unaccounted-for water losses can be quite large. Perhaps an investigation into how these can be minimized may help conserve a significant amount of water, which could reduce the in-basin needs of the future.

Water Conservation Measures (Section 2.5)

The Water Conservation Potential Assessment (WCPA) Final Report developed by the BOR evaluates potential water conservation measures and identifies reasonable and achievable water reduction activities. DWRA specifies that water conservation measures are to be used in quantifying the comprehensive water quality and quantity needs of the Red River Valley. The cost of implementing water conservation was also estimated in the WCPA.

Comment 13

- On page 2-41, the statement, "Annual costs of implementing water conservation programs range from $54,700 to $326,000.... The overall annual water conservation cost is estimated to be $780,000," should be referenced.

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Response to Comment 8
Please refer to the Final Needs and Options Report Appendix A for a complete description of the methods used in calculating water demands and assumptions used in that analysis.

Response to Comment 9
This information was based on historic reported use under existing permits. Data were provided by the North Dakota State Water Commission.

Response to Comment 10
Please refer to the response to comment 3.

Response to Comment 11
The Grand Forks Air Force Base is not closing, although its mission is changing. What this change in mission will ultimately be and how this change will affect the base's water demand is unknown. A reasonable assumption is that Grand Force Air Force Base will continue to function in the future.

Response to Comment 12
Please refer to the responses to comments 3 and 8.

Response to Comment 13
This entire section summarizes the *Water Conservation Potential Assessment Final Report* (Reclamation 2004b). Please consult Reclamation 2004b for further information.

Municipal Water Demand Analysis (Section 2.6)

Of nearly 175 municipal or water associations in the Red River Valley, only 16 are assumed to maintain their own water treatment capability through the 2050 planning horizon. Water system assessments were conducted for each of the municipal water systems to identify primary or secondary water quality regulation concerns that may affect the future viability of their present water sources. No municipal water systems were identified as having problems meeting the national primary drinking water standards. This section also presents some findings that appear to be different from a discussion given in a previous section.

Comment 14

- "Some municipal water systems report large system water losses. For those systems facing potential future water demand shortages, their water losses were evaluated to determine if improved system efficiencies could resolve their water supply problem. The WCPA established a water loss goal of 10% for municipal water systems." Is this a standard?

Comment 15

- "However, the population shown for Grand Forks includes only the city projection and not the Air Force Base projection. The Air Force Base water demand was part of bulk service in this analysis." This statement on page 2-48 should be compared to the method given on page 2-30.

Ground Water Hydrology (Sections 3.2–3.3)

The BOR conducted a review of existing groundwater sources and uses for the major aquifers in the RRB. They examined the potential for additional development, conversion of existing water permit use, and aquifer storage and recovery (ASR) in a select number of these aquifers. Inherent with the evaluation of groundwater supplies for future use are uncertainties in quantifying aquifer characteristics, such as total storage, annual recharge and discharge, aquifer extent, and connectivity to adjacent surface water and groundwater systems. Other factors that complicate the evaluation of groundwater supplies for future use include data gaps on historic uses, uncertainties surrounding future uses, and a high degree of difficulty in determining what constitutes sustainable use. Keeping the above issues in mind, we present the following comments and suggestions regarding the BOR's evaluation of groundwater supplies in the RRB.

Comment 16

- The assessment of groundwater resources in the RRB does not take into account the potential loss of supply during drought conditions due to decreased recharge or increased use by irrigators. We recommend that further study be conducted in this area.

Comment 17

- In many cases, it is not clear why some aquifers were or were not selected for further review of their potential to provide future water supplies or for ASR. A consistent framework should be applied to the selection process. The following illustrates examples of inconsistencies within the groundwater evaluation portion of the report:
  - In the discussion on conversion of existing irrigation permits for municipal use in the Elk Valley Aquifer (p. 3-27), it states that the average historic use for the 38 diversion points in the aquifer was approximately 87.5 ac-ft per year. This translates into 3325 ac-ft per year of historic use and appears adequate to meet the anticipated shortages for Grand Forks–Traill Water District and Grand Forks; however, when considering water supply options

Comment 18

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Response to Comment 14

Please refer to the response to comment 3. The water industry goal for unaccounted-for-water is 10% (U.S. Environmental Protection Agency, 2003, *Using Water Efficeintly: Ideas for Communities*).

Response to Comment 15

Please refer to the response to comment 11.

Response to Comment 16

The assessment of groundwater resources relies upon the permitting process of the North Dakota State Water Commission to validate that existing MR&I permits will be adequate during a drought.

Response to Comments 17, 18, and 19

Determining whether an aquifer has potential for conversion from one use to another is not a straight-forward analysis. The Elk Valley Aquifer feature is somewhat unique in that it clearly meets an identified shortage by proposing to convert existing irrigation permits within a reasonable distance from the municipal water user. However, the DEIS analysis shows that Elk Valley Aquifer conversion would have a negative economic impact. Conversion of irrigation on either the Sheyenne Delta or Page-Galesburg aquifers would have similar negative economic impacts.

Confined aquifers with few existing users are the best candidates to develop ASR projects to ensure that recharged water is not used by other aquifer permit holders or lost to natural discharges before the recharged water would be needed. Close proximity to water needs is also an important cost consideration. The West Fargo North, West Fargo South, and Moorhead Aquifers fit these criteria. The potential for an ASR project in the Wahpeton Buried Valley Aquifer was also discussed in chapter three, but was not included in any options.

The Page-Galesburg Aquifer has very limited groundwater available for additional permitting. It is also too far from Fargo to be economically feasible considering the minor amount of water that realistically could be developed. One of the reasons the Sheyenne Delta Aquifer was eliminated from consideration is concern over adverse effects to the Western Prairie Fringed Orchid on the Sheyenne National Grasslands. This species is protected by the Endangered Species Act, which is discussed in the DEIS. Also, the Sheyenne River receives inflow from the Sheyenne Delta Aquifer, and significant use of the aquifer adjacent to the river likely would reduce aquifer contribution to surface water flows. The Sheyenne River is a source of water in most Project options, so reducing flows in the river would be counter-productive.

Comment 19

for the Fargo–Moorhead area, other aquifers with even larger irrigation allocations are not considered, such as the Page–Galesburg and Sheyenne Delta Aquifers.

– There are two very large aquifers, the Sheyenne Delta and the Page–Galesburg, that are not further evaluated for expanded development to supply Fargo–Moorhead. The reasons for this are unclear. The Sheyenne Delta Aquifer's estimated water reserves are 4 million ac-ft and its estimated recharge is 50,000 ac-ft per year. Current irrigation and MR&I permits total 16,500 ac-ft/yr, leaving an estimated 33,500 ac-ft/yr available for sustainable withdrawals (in our current climatic conditions). The report states that "much of the aquifer is overlain by the Sheyenne National Grasslands" (p. 3-15) and suggests that well field development would be limited because it would be constrained to the areas outside of the grasslands. However, according to the report, the aerial extent of the aquifer is 750 square miles and the extent of the grasslands is approximately 110 square miles (70,000 acres); therefore, grasslands could at a minimum only overlay about 14.5% of the aquifer. The Page–Galesburg Aquifer is also quite large in aerial extent (400 square miles), with a thickness of up to 250 feet. Although the total water reserves are not given in the report, they are undoubtedly significant and warrant additional study. The study estimates a very conservative recharge rate of 1 inch per square mile per year, or approximately 21,330 ac-ft per year, which, when compared to current and pending permit appropriations, suggests that there is no opportunity for additional new well development in this aquifer. Given the uncertainty of the recharge estimate, which if underestimated by only 0.5 inch per square mile per year, translates into an additional 10,600 ac-ft per year of storage, additional study is needed.

– Three aquifer systems, the West Fargo, Moorhead, and Wahpeton Buried Valley, are investigated for their ASR potential. Why are the other aquifer systems not evaluated? The rationale for excluding other aquifer systems should be explained.

Comment 20

- Many of the aquifer water quality values reported in the text do not match those listed in Table 3.2.1. In addition, it is unclear where the values reported in the text or included in Table 3.2.1 come from. We suggest that a consistent framework be used in discussing water quality characteristics. We also suggest that references be provided or that the location of the source data be reported at the beginning of the section.

Comment 21

- On page 3-20, in the discussion of the Pineland Sands Area Aquifer, there are two statements that appear contradictory. In the fourth paragraph of the section, it states, "Groundwater model analyses of the Pineland Sands Area Aquifer demonstrated that much of the aquifer could support long-term, large-scale withdrawals." In the fifth paragraph, it states, "Although it holds a tremendous amount of water, its average saturated thickness of 40 ft makes this aquifer less attractive for water supply in a prolonged drought than aquifers of greater saturated thickness. Therefore, the Pineland Sands Surficial Aquifer is not being considered for further development." Further clarification should be provided to explain the contradictory message of these statements. In addition, if the basis for excluding this aquifer for supplemental MR&I water supplies during times of drought is its average thickness of 40 feet, then why are the Milnor Channel (average thickness ~40 feet) and Spiritwood (average thickness ~33 feet) Aquifers being considered as a supply for Wahpeton?

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Response to Comment 20

Water quality values reported in the text are often from published sources, including the county groundwater series. The county groundwater series provided scant information for some aquifers except for water quality, which may differ from Reclamation's compilation of more recent water quality data. The county groundwater series for eastern North Dakota dates to the late 1960s; however, more recent data may not be as well distributed through the aquifers as the county groundwater series and may not present a true understanding of the spatial variability of water quality within each aquifer.

Response to Comment 21

These statements are not necessarily contradictory. While some areas of the aquifer are considerably thicker than the 40 foot average and could contribute high yield wells, much of the remaining aquifer is less than 20 feet in thickness. It would be these areas that could have yield problems during a sustained drought and it would be difficult to envision a very large wellfield in the Pineland Sands as part of the Minnesota groundwater feature that could lie solely within the thicker area of the aquifer. Reclamation has not included the Pineland Sands Aquifer, because existing information shows that sufficient water could be supplied from the Pelican River Sand-Plain and Otter Tail Surficial Aquifers.

Surface Water Hydrology (Sections 3.4–3.6)

In this section of the report, the BOR conducted a comprehensive analysis of surface water quantity and quality for the Red River Valley to evaluate future water needs during a 1930s-type drought. They conducted this analysis in three main steps: 1) evaluation of the adequacy of the system's surface water permits, 2) estimation of surface water shortages using a water allocation and accounting model, and 3) analysis of peak day demand to determine if surface water supplies can meet future needs.

Comment 22

Before conducting an evaluation of water quantity, the BOR assessed the quality of surface water supplies using data collected by the U.S. Geological Survey (USGS). The assessment indicated that the surface water in the valley would meet the U.S. Environmental Protection Agency's (EPA's) drinking water standards and, thus, water quality would not be a major concern for the proposed project. To our knowledge, this conclusion is consistent with the findings of other studies.

Comment 23

The BOR used the StateMod modeling software to conduct a hydrologic analysis of the surface water supplies in the Red River Valley to predict future water shortages. StateMod, the state of Colorado's Water Resource Planning Model, is a water allocation and accounting model that uses the Prior Appropriation Doctrine for comparative analyses of historic and future river basin water management policies. It has been successfully applied in the western United States for water rights and water allocation modeling. In our opinion, StateMod is an appropriate modeling tool for the analysis. The basic inputs of StateMod included the river network, existing and proposed water supply features (e.g., reservoirs and pipelines), historic and naturalized flow data, historic and projected water use data, estimated water losses to evaporation, and water rights that are regulated by the relevant water laws of North Dakota and Minnesota. Although data on these inputs were from various sources, the BOR adopted a strict screening procedure to make the data as accurate and consistent as possible. According to the information provided in the report, the data appear to be appropriately preprocessed and utilized. For modeling purposes, the BOR made a number of assumptions and simplifications about the hydrologic and water supply system. Our review revealed that most of these assumptions appear reasonable for the current planning stage of this proposed project; however, we do have some comments/suggestions on the modeling analysis, which are summarized as follows:

Comment 24

- Throughout the analysis, one of the basic assumptions was that the flow conditions that occurred in 1930s drought would recur in the future in exactly the same manner. As a result, the flow data from 1930 to 1940 were used to estimate the amounts of available water. While possible, the chance for such an exact recurrence is very low because of hydrologic uncertainties. Provided that the overall drought condition over a 10-year period in the future would be similar to that during the 1930s, the drought conditions for a given year or for several consecutive years are unlikely to be identical, i.e., the flows would rarely recur in the historic sequence. Given that water shortages could be a result of insufficient water amount, mismatched timing, or both, several synthetic flow time series data sets should be generated from the flows observed in the 1930s. These data sets should be used to estimate the available surface water supplies in addition to the historic data that

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Response to Comment 22
Comment noted.

Response to Comment 23
Comment noted.

Response to Comment 24
Reclamation used historic 1930s flow data to model a future drought. While there are endless combinations of flows that could be synthesized to create a drought of any magnitude, Reclamation relied upon historic data. Reclamation recognizes that the next drought may not replicate the 1930s drought, but basing the model on the historic record reflects the river systems' dynamics and is the best available information.

were used in the report. The synthetic flow time series may be generated by resampling the historic flow data or by developing a priori statistical distribution.

Comment 25

- Another important assumption was that the hydraulic connection between the surface water system and the aquifers might be negligible. The evidence presented in this report to support this assumption seemed to be very weak. Pumping groundwater may often result in increased seepage of the rivers and reservoirs and lowering of the surface water supply capacity. We suggest a conjunctive modeling study be conducted for the areas surrounding the West Fargo and Elk Valley Aquifer systems, where the groundwater is currently or intended to be intensively used. This study should consider the surface water system and groundwater aquifers as an integrated, hydraulically connected modeling domain. The results from this study may be used either to verify this important assumption or adjust the results presented in this report.

Comment 26

- In the report, the BOR claimed that irrigation water was not a component of this proposed water supply project. In fact, the amount of water available in the system during a long-term drought may be overestimated by leaving out potential increases in agricultural water usage, a likely source of competition with MR&I use. In this regard, we suggest that long-term soil moisture information be generated using a watershed-scale, distributed hydrologic model such as SWAT (Soil and Water Assessment Tool). This information may be used to investigate the impacts of drought on agricultural water use and estimate the amount of competition for water supplies. This would allow a safety factor to be developed and incorporated into the current analysis and prospective design of the proposed project.

Comment 27

- As a basin-scale water supply project, there are many factors (e.g., availability of the planned water sources) that are difficult to predict and quantify. We suggest that three statistics, namely reliability, vulnerability, and resilience, be computed from the modeling results. The reliability is the probability that the planned water demands can be met, whereas, the vulnerability indicates how often the water supply system may fail to deliver the required water. The resilience measures the robustness of the water supply system to resist a failure. These statistics could provide very useful information for both decision makers and water managers and users.

Options (Sections 4.1–4.5)

Chapter 4 presents seven options to provide bulk water supply for municipal, rural, and industrial use to meet the demand for water shortages that would occur during a drought. Only two of the options provided water from in-basin alternatives of the RRB. One option involved water import from the Rainy River Basin (Lake of the Woods), and four options included imports of Missouri River water. Biota treatment is required for each of the import alternatives. Significant effort has gone into refining the alternatives along with the analyses of the respective features. However, as presented, it is often difficult to follow the rationale of why each option was developed the way it was.

Comment 28

Clearly, the import alternatives will face significant barriers to implementation in this politically complex, multijurisdictional, transboundary watershed. Downstream interests on both the

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Response to Comment 25

There is no evidence to suggest that the West Fargo Aquifer System is hydraulically connected to any surface water. To the contrary, all evidence suggests that about 90 feet of lakebed clays of very low permeability insulate the West Fargo Aquifer System from the Sheyenne and Red Rivers.

Because the Elk Valley Aquifer is a shallow and unconfined aquifer, this aquifer is probably connected to the Turtle River. However, Turtle River's confluence with the Red River lies downstream from Grand Forks; therefore, other service area MR&I water users would not be affected. Furthermore, MR&I conversion of irrigation permits to MR&I use is limited to historic use of that permit. It is likely that MR&I groundwater use during a drought would be less than irrigation use would be.

Response to Comment 26

Please refer to the response to comment 16.

Response to Comment 27

No additional statistical analysis on reliability, vulnerability, and resilience were developed for the Final Needs and Options Report. However, sensitivity analyses on hydrology modeling will be conducted for the FEIS.

Response to Comment 28

Political considerations are not a portion of the needs and options analysis.

Missouri and Red Rivers have voiced opposition to the interbasin transfer of water. Further, the import options included some of the highest construction costs. The political uncertainty of interbasin transfer warrants a more detailed investigation of in-basin alternatives. We appreciate the difficulties in establishing cost projections and contingencies that must be incorporated in the estimates, resulting in conservative (high) project cost estimates. Cost estimations at that level, however, make it difficult to reliably predict a more cost-effective alternative when the relative difference is small. The relative cost difference between the Garrison Diversion Unit (GDU) import to the Sheyenne River (the lowest-cost import alternative) and the in-basin alternatives is within 10% based on construction costs and within 15% on a total annualized cost basis. Considering the level of estimation required at this stage, these costs are very comparable.

The Red River Valley in-basin options provide some of the lower-cost alternatives but fail to adequately address several key issues, including industrial water conservation strategies, water reclamation and reuse strategies, aquifer storage and recovery, and utilization of marginal-quality groundwater resources.

Comment 29

- Expansion of several key conservation and reuse strategies does not appear to be adequately addressed. For example, the sugar beet industry is a key economic contributor to the region's economy as well as a net water producer. American Crystal Sugar Company, at its Moorhead, Minnesota, factory, is permitted to discharge 58 million gallons of effluent to irrigate the Meadows Golf Course and 22 million gallons to irrigate a sports complex. These discharges are effective for the period from April–November and coincide with peak demand periods for municipal uses. This is just one example of the potential for reuse of industrial effluent that would ultimately reduce the demand for potable waters. Additional opportunities including those of other industries need to be further considered.

Comment 30

- Industrial water conservation is another area that should be addressed in greater detail. A water conservation study was conducted through the RRWMC at a GF food processing facility in Grand Forks, North Dakota. The results of that investigation indicated that water conservation and reuse could result in freshwater savings approaching 1 MGD at that facility. This is equivalent to approximately 10% of the city of Grand Forks' current water treatment plant production. It is likely that numerous additional opportunities such as this exist, and detailed audits therein should be conducted and considered in meeting the water needs of the Red River Valley.

Comment 31

- Storage will certainly play a role in satisfying future peak water demands. Significant evaporative losses will occur during storage in surface impoundments, along with associated physical, chemical, and biological changes that will take place. These impacts can be reduced or eliminated through the effective use of ASR. Although this report investigated ASR in three aquifer systems adjacent to West Fargo, Fargo, and Moorhead and in one aquifer system near Wahpeton, we believe additional aquifers could be evaluated for their capacity for ASR. ASR can be integrated into existing water treatment facilities or within distribution systems and become a flexible tool to address increased water demands in the overall water management scheme. Combined with conjunctive water management, ASR can also be used for long-term replenishment of depleted aquifers and, potentially, for long-term "water banking" in the saline Dakota Aquifer. With the exception of a prefeasibility evaluation for

Responses to the EERC

Response to Comment 29 and 30

The analysis described in the *Water Conservation Potential Assessment* adequately addresses conservation of water by the Project. Reuse of wastewater discharge is implicit in the surface water modeling of the hydrology. Wastewater discharge is a key component of water supply for downstream water users.

Response to Comment 31

Please refer to the response to comment 17.

the Moorhead Aquifer conducted by the EERC in 2001, and in spite of its numerous advantages including its potential for long-term storage, no comprehensive evaluation of ASR in the RRB has been conducted to date. It is critical that a more detailed analysis of the potential of ASR be investigated under several scenarios.

Comment 32

- The RRB has enormous quantities of saline groundwater resources that could be upgraded to potable-quality water. Developments in membrane separation have overcome many of the issues relating to irreversible membrane fouling. Brine disposal issues can be addressed in an economically and environmentally acceptable manner. Novel technologies such as FTE® present a potentially viable method for economically treating saline groundwater to satisfy projected water shortages.

Responses to the EERC

Response to Comment 32

The *Red River Valley Water Needs Assessment Phase II; Appraisal of Alternatives to Meet Projected Shortages* report investigated desalination of saline groundwater. The Phase II report concluded that desalination was not economically viable compared to other water sources. The groundwater alternative, which included desalination, had an estimated cost of two to three times more than the cost of the lowest cost alternative in the Phase II report. However, a desalination feature may be investigated in the FEIS as a substitution for the Elk Valley Aquifer conversion feature.

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