1993 COMMUNITY NEEDS ASSESSMENT

Northwest Area Water Supply Project
Pre-final Design

Prepared For

North Dakota State Water Commission

and

Garrison Diversion Conservancy District

July 1993

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TABLE OF CONTENTS

APPENDICES

NORTHWEST AREA WATER SUPPLY PROJECT
1993 COMMUNITY NEEDS ASSESSMENT

1.0 INTRODUCTION

The community water supply needs within the original nine-county study area of Northwestern North Dakota were initially outlined in the *Summary Report - Needs Survey, Northwest Area Water Supply Study, June 1988.* The purpose of the 1993 Community Needs Assessment was to update the earlier study using information obtained and compiled through ten regional public meetings, special mailings and personal phone contacts. Many small communities were not contacted during this process and are only included as part of the general rural population. These smaller communities have populations of less than 50 and no municipal distribution systems; are currently served by rural water or by private wells; and in some cases are no longer incorporated.

Updated water quality information was obtained from the North Dakota State Department of Health and Consolidated Laboratories for all communities with municipal distribution systems as well as for the five operational rural water systems. Water use data for 1985-1992 was obtained through the North Dakota State Water Commission's water permit and appropriation records. Census data and population projections through 2010 were obtained through the North Dakota Census Data Center and Farmers Home Administration. This information has been included in the updated community data base.

2.0 NEEDS SURVEY OBJECTIVES

The objectives of the 1993 Community Needs Assessment are to update the information collected in 1988, to document current water quality standards, to update population projections, and to determine those communities with the greatest need. All the communities with municipal distribution systems and the five rural water associations were contacted to determine if any changes in the status of quantity, quality or supply facilities have occurred since the 1988 survey. In addition, Pierce County has been added to the Northwest Area Water Supply (NAWS) project area.

3.0 COMMUNITIES AND CURRENT WATER SERVICE

The 1988 Needs Survey identified 118 communities which were listed under one or more of three general or primary types of water supply systems as described below. This number has been increased to 125 with the addition of Pierce County. Subdivisions for each type were added to provide additional background about the various community systems. The number of communities in each type is provided in brackets. In the case of dual supplies a community is listed by its largest supply system; for example, a community served by rural water as well as private wells has been included under rural water.

1) **Municipal Distribution Systems**
   a) Community operated and supplied - [37]
   b) Not interested in NAWS - [7]

2) **Rural Water**
   a) Municipal systems supplied by rural water - [4]
   b) Municipal system supplied by rural water, supplemented by municipal wells - [1]
   c) Individually served by rural water - [18]
   d) On Private Wells with expressed interest in rural water - [3]

3) **Private Wells**
   a) Not Interested [2]
   b) No response received - [15]
   c) Not contacted [38]

The water demands and requirements for each community and rural water system are to be evaluated as part of the pre-final design. **Appendix A** provides a complete listing of communities within the ten-county area along with current populations, population projections, current water sources, water quality categories and sign-up status under the NAWS pre-final design. **Table 1** of **Appendix A** lists the communities with municipal distribution systems, while **Table 2** of **Appendix A** provides a list of communities served by rural water. In Pierce County only the City of Rugby has a municipal distribution system. It is assumed that the remaining rural communities would be served by the recently proposed Pierce County Rural Water Association. Therefore, additional information was not collected for Pierce County communities other than Rugby.

Table 3 of **Appendix A** lists smaller communities that were contacted and did not respond, were not interested, or were not contacted . Any previous interest in being served by rural water, based on the 1988 survey, has been noted.

4.0 RURAL WATER SYSTEMS

Presently, there are five operational and three organized rural water associations within the ten-county project area. In addition, during the course of the public involvement process, two additional rural water associations were being considered and local representatives have signed an *Agreement of Intent to Purchase* to be included in the NAWS pre-final design. A complete listing of existing, organized and proposed systems, households served, current water sources, water quality categories and agreement status is provided in **Table 4** of **Appendix A.**

The water supply needs vary for each rural water association. Some associations are looking for a complete water supply while others are looking to serve only one of several existing systems. Other situations that exist are where an association is seeking water to provide for the expansion of present facilities or the creation of a new distribution system. As an example, the McLean-Sheridan Rural Water Association has an adequate supply for its current system; however, it cannot expand into some areas due to the limitations of current distribution facilities.

5.0 OTHER INTERESTED INDIVIDUALS OR AGENCIES

Through the Public Involvement Program information about the NAWS project was mailed to individuals within the following groups who represent the various counties and communities located within the ten-county area in Northwestern North Dakota.

Garrison Diversion Conservancy District - Board of Directors
North Dakota State Water Commission - Members
State Legislators - Senators and Representatives
County Commissioners - Members
County Water Resource Districts - Managers
County Agents
Other Interested Individuals Upon Request

Input from these groups, individuals and the general public was requested during the ten regional meetings and throughout the public involvement process and will continue to be sought during pre-final design. Mailing lists have been created and are available for each of the various groups.

6.0 WATER QUANTITY

It was determined during the 1988 study that the quantity of water available within the ten-county area was generally sufficient to meet the basic needs of the people. A number of short-term shortages have occurred, however, due to a lack of adequate local supplies or treatment. By improving both water supply and water quality under a regional or local system, the average daily demand for water is expected to increase, although this may be offset by population changes or shifts as discussed in **Section 10.0**. Present sources in many cases will not be adequate to supply future water demands and may not meet the current or proposed Environmental Protection Agency (EPA) water quality standards without treatment.

The City of Minot has been especially concerned about the potential impacts from construction of the Raferty-Alameda Reservoir Projects in Canada. The primary impact will be reduced flows in the Souris River and its potential effect on groundwater recharge of the Sundre and Minot Aquifers near Minot. Both the Sundre and Minot Aquifers as well as the Souris River are Minot's primary water sources. The North Dakota State Water Commission is currently conducting an independent study of groundwater supplies in this area and the results are anticipated in early 1994.

Several concerns have been expressed about communities with shallow aquifers. The first is potential contamination from agricultural chemicals. This issue has been discussed for some time by EPA and is currently under review. Should contamination occur it could restrict or eliminate a source for domestic use. Some communities are currently participating in a well head protection program designed to implement local protective measures to prevent contamination and regulate development within the aquifer recharge area. The North Dakota Health Department and Consolidated Laboratories has recently implemented the process of testing and reviewing all municipal water supplies with greater than 150 service connections for evidence of these contaminants. This additional testing is being conducted as required under EPA's Phase V regulations which took effect January 1, 1993. A discussion of these regulations is contained in **Appendix B.**

Appendix B, is a report entitled *Northwest Area Water Supply Project - Pre-final Design, Summary of The Safe Drinking Water Act Existing and Proposed Standards, April 1993,* prepared by Montgomery Watson. This report provides a summary of current and proposed EPA Water Quality Standards and is also available under separate cover.

Another water quantity concern is what effect a prolonged drought might have on the level and availability of groundwater in local aquifers. During the drought of the late 1980's the incidences of shortages and rationing have increased prompting some communities to seek additional water supplies while others installed new or additional municipal wells. Throughout the project area many aquifers have shown a marked decline in water level or change in quality during this period thus raising questions about the future potential for water supply problems.

The conclusions presented in the *Final Report - Northwest Area Water Supply Project, November 30, 1988* were that plentiful water supplies do exist in the area from combined groundwater and surface water sources. However, the quantity and locations of available groundwater meeting EPA standards are very limited and, in most cases, would require costly treatment to meet those standards. The exclusive use of groundwater for a large regional water supply system is therefore considered impractical. A discussion of the groundwater aquifers is contained in Chapter 4 of the *1988 Final Report.*

The Missouri River system (including Lake Sakakawea and Lake Audubon) is considered to be an excellent surface water source while the Souris and Des Lacs Rivers are limited in quantity, with periods of zero flow, and not considered reliable for a regional water supply system. A discussion of surface water supplies is contained in Chapter 5 of the *1988 Final Report.*

Based on the evaluations completed for the *1988 Final Report* , the Missouri River was considered to be the only reliable long-term source for a large regional water supply system.

7.0 WATER QUALITY/TREATMENT

In order to evaluate the water quality for each community, information on their most recent treated water samples, where available, was obtained from the North Dakota Health Department and Consolidated Laboratories. The treated samples were then classified using the 1988 Needs Summary criteria which were modified to reflect current North Dakota and EPA standards. The intent of the classification system is to document the severity of existing water quality problems and to prioritize those communities with the most severe problems. Rural communities without municipal distribution systems are not required to test water from private wells; therefore, information for these communities was unavailable and their sources have not been classified.

The modified 1993 NAWS water quality classification system consists of seven categories. The classification for each municipal and rural water system is provided in either **Appendix C** or **Appendix D.** It is highly probable that without treatment each would be classified in a higher category. The seven categories, with the number of communities [44] and rural water systems {11} in each shown in brackets, are as follows:

[1], {0}	**CATEGORY I** -	Exceeds EPA **Primary** Water Quality Standards
[15], {0}	**CATEGORY II** -	Exceeds four (4) or more EPA **Secondary** Water Quality Standards and TDS is greater than 1000 milligrams/liter
[4], {2}	**CATEGORY III** -	Exceeds four (4) or more EPA **Secondary** Water Quality Standards and TDS is less than 1000 milligrams/liter but greater than 500 mg/l
[7], {3}	**CATEGORY IV** -	Exceeds less than four (4) EPA **Secondary** Standards and TDS is greater than 1000 mg/l
[7], {1}	**CATEGORY V** -	Exceeds Iron or Manganese EPA **Secondary** Standards.
[6], {2}	**CATEGORY VI** -	Exceeds **Minimum Standards** for either TDS, pH, Sulfate, Chloride or **Recommended Standard** for Sodium.
[4], {3}	**CATEGORY VII** -	No Violation of current EPA Standards

Category V was established to provide a listing of those systems that violate current iron or manganese standards and are not listed in other categories; iron and manganese are common groundwater problems that can be inexpensively treated through oxidation and filtration. Category VI was established as an indicator of constituents currently unregulated that could pose potential health risks. It is anticipated that with future regulatory restrictions the contaminants listed in Category VI could become more important.

The constituents analyzed for these categories, using EPA's water quality guidelines as presented in **Appendix B,** include: primary standards or maximum contaminant levels (**MCL's**), secondary standards or secondary maximum contaminant levels (**SMCL's**), and currently unregulated contaminants that pose potential health risks. Only the MCL's are enforceable under current EPA regulations. The SMCL's are recommended levels that are being monitored and may be regulated in the future.

Total Dissolved Solids (**TDS**) is a measure of the total ions in solution and thus an excellent indicator of water quality. Water high in TDS is generally inferior as a potable water supply and usually requires costly treatment to meet EPA standards. TDS also provides evidence of other potential contaminants that could cause water quality problems. The North Dakota Department of Health and Consolidated Laboratories uses the guidelines presented in **Table 7.1** in their reporting of TDS. EPA has established a SMCL of 500 mg/l for TDS.

TABLE 7.1
North Dakota Health Department and Consolidated Laboratories
Total Dissolved Solids (TDS)
Reporting Criteria

Measured TDS (mg/l)	Classification
< 200	Low
200 to 500	Fairly Low
500 to 1000	Satisfactory
1000 to 1450	Average
1450 to 2500	High
>2500	Very High

Since the Health Department considers a TDS level of from 500 to 1000 mg/l as satisfactory a value of 1000 mg/l was used in the classification criteria. Many municipal water systems in the study area currently exceed 1000 mg/l. This information is provided in the *Community and Rural Water System Needs Assessment Summary*, **Appendix C**, and in the *Water Quality Assessments - Municipal Water Systems, Rural Water Systems and Potential Surface and Groundwater Supplies*, **Appendix D**.

Over the past few years concerns have been growing about proposed EPA regulations for both sodium and sulfates. EPA has not presently established an MCL or SMCL for sodium although they have suggested a guidance level of 20 mg/l for high risk populations (e.g. individuals with a genetic predisposition to hypertension, pregnant women, and hypertensive patients) as recommended by the American Heart Association. The North Dakota Department of Health and Consolidated Laboratories has taken a position that 200 mg/l is a reasonable limit for the normal population. EPA may consider development of an MCL for sodium should additional information become available.

Currently the SMCL for sulfates has been established at 250 mg/l though EPA has deferred a final determination of a sulfate standard. EPA anticipates the proposal of a sulfate standard in October 1993 with a final determination by December of 1994.

8.0 EVALUATION OF PROPOSED EPA WATER QUALITY STANDARDS

As part of the 1993 Community Needs Assessment, a review of the potential impacts of the existing and proposed EPA water treatment/quality standards on water supplies was completed. The following is an abbreviated discussion for some of these standards. A detailed discussion is included in **Appendix B.**

A majority of consumers within the ten-county project area receive their water from municipal or private wells, with few using surface water. Groundwater has historically proven to be higher in mineral levels (hardness, total dissolved solids, chlorides, sulfates, sodium, iron, manganese, etc.) than surface water sources. Many groundwater supplies are not aesthetically pleasing and fail to meet current drinking water standards. A number of alternative groundwater and surface water sources were considered in the *Final Report - Northwest Area Water Supply Study, November 30, 1988* for potential development as potable water supplies. Included were the higher quantity and quality groundwater aquifers, such as the Grenora, Sundre and Minot aquifers, as well as surface water from Lake Sakakawea, Lake Audubon, and the Missouri, Souris and Des Lacs Rivers. Based on a review of the existing water quality information and a comparison with existing and proposed water quality standards, it appears that the primary constituents of concern include hardness, TDS, sodium, sulfates, iron, manganese, boron, strontium, chlorides, turbidity and trihalomethanes.

Tables 8.1 and **8.2** present summaries of water quality samples taken from selected surface and groundwater sources considered during the 1988 study.

TABLE 8.1
EXISTING SURFACE WATER QUALITY
Selected Samples [1]
Northwestern North Dakota

Constituent (mg/l)	Missouri River @ Williston, ND	Lake Sakakawea (Missouri River) @ Riverdale, ND	Lake Audubon (Missouri River)	Current EPA Standards
Hardness ($CaCO_3$)	255 mg/l	240 mg/l	269.9 mg/l	[2]
TDS	540 mg/l	332 mg/l	614 mg/l	500 mg/l
Sodium	64 mg/l	59 mg/l	106 mg/l	[2], [3]
Sulfates	213 mg/l	200 mg/l	279.1 mg/l	250 mg/l
Iron	Trace	0.012 mg/l	Not Reported	0.3 mg/l
Manganese	Not Reported	< 0.005 mg/l	Not Reported	0.05 mg/l

[1] For a detailed water quality breakdown and source of data see **Appendix D.**
[2] No EPA standard has been established.
[3] State of North Dakota considers a secondary standard of 200 mg/l as acceptable.

TABLE 8.2 EXISTING GROUNDWATER QUALITY Selected Samples [1] Northwestern North Dakota				
Constituent (mg/l)	**Sundre Aquifer (Minot Well #D)**	**Minot Aquifer (Minot Well #15)**	**Grenora Aquifer (City of Grenora)**	**Current EPA Standards**
Hardness ($CaCO_3$)	780 mg/l	510 mg/l	426 mg/l	[2]
TDS	1700 mg/l	952 mg/l	548 mg/l	500 mg/l
Sodium	260 mg/l	150 mg/l	24 mg/l	[2][3]
Sulfates	760 mg/l	180 mg/l	54 mg/l	250 mg/l
Iron	3.2 mg/l	0.43 mg/l	0.08 mg/l	0.3 mg/l
Manganese	0.7 mg/l	0.94 mg/l	Not Reported	0.05 mg/l

[1] For a detailed water quality breakdown and source of data see **Appendix D.**
[2] No EPA standard has been established.
[3] State of North Dakota considers a secondary standard of 200 mg/l as acceptable.

Based upon provisions of the Surface Water Treatment Rule (SWTR) in the 1986 Safe Drinking Water Act Amendments, water taken from the Missouri River or the Souris and Des Lacs Rivers would require treatment for turbidity removal and disinfection. Surface water sources typically have a high pH and can be very cold in winter. Warmer summer water temperatures increase the potential for development of high organic levels. Treatment facilities would need to be designed to account for these changing conditions. The high pH levels will require proper chemical coagulant selection, and cold water temperatures will necessitate proper design of mixing and settling facilities. Warm water temperatures and high total organic carbon (TOC) levels are indicators of potential taste and odor problems related to algal growths and chlorinated by-product formation, principally trihalomethanes. Treatment facilities will need to include appropriate chemical application facilities for taste and odor, compound oxidation and adsorption and trihalomethane reduction. Waters taken from Lake Audubon or Lake Sakakawea would have significantly reduced turbidity levels compared to those on the upper Missouri River near Williston and would provide a higher quality water.

Groundwater supplies have typically not required special treatment other than disinfection. With the many new constituents proposed to be regulated under the revised drinking water standards, this situation will be changing. Existing secondary standards (SMCL's) recommend limiting iron and manganese levels to 0.3 and 0.05 mg/l, respectively, to prevent tastes, odors, turbidity and staining. These secondary standards are not enforceable and were established as guidelines to ensure an aesthetically pleasing water. As can be seen in **Table 8.2** the limits for iron and manganese are exceeded by even the better quality groundwater sources. Reduction of objectionable iron and manganese levels would typically require oxidation and filtration.

Hardness levels in the better groundwater sources range from 300 to 1000 mg/l as $CaCO_3$. Waters with hardness levels over 250 mg/l are normally characterized as very hard. There is currently no standard for hardness and no future standard is anticipated although hardness increases soap usage and causes deposits on dishes, windows, etc. Moderate hardness levels have been shown to be a benefit to public health so acceptability of hardness levels is a local consideration dependent upon costs and historical conditions. Groundwater sources with higher hardness levels could be softened either by a municipal treatment facility or with individual home softeners.

Total dissolved solids, sulfates and sodium levels in groundwater supplies normally exceed drinking water standards. The EPA recommends that TDS be limited to 500 mg/l, sulfates to 250 mg/l, and sodium to 20 mg/l. As previously stated in **Section 7.0**, the standard for sulfates has been deferred until 1994 and that for sodium is only a guidance level for high risk populations. It is anticipated that a secondary maximum containment level (SMCL) for sulfates and sodium will be implemented at some time in the future.

As can be seen in **Table 8.1**, Missouri River water is of higher quality with respect to the shown constituents than either the Souris River or typical groundwater supplies. Two other constituents of concern, based upon existing water quality information, are boron and strontium. MCL's are expected for both of these by 1994. Recent discussions with EPA indicate that anticipated MCL's may impact the selection of water supply sources for this study.

A related water quality issue is the transportation of water between the Missouri River and Hudson Bay Watersheds and the potential for interbasin "Biota Transfer". Additional disinfection or treatment may be required before transportation of waters across this boundary. At this time it is unclear what may be required in order to comply with the 1909 Boundary Waters Treaty between the United States and Canada. Consultations to resolve this issue are anticipated to be included during the pre-final design process.

In summary, the use of surface water from the Missouri, Souris or Des Lacs Rivers will require treatment. Conventional water treatment processes should produce a high quality water if provisions are made for taste and odor removal, trihalomethane reduction, and facilities which are properly designed to deal with colder water temperatures. It appears, based on available water quality data, that additional treatment of the Souris River and perhaps the Des Lacs River would be necessary to reduce TDS, sodium, hardness and sulfate levels. Since the Souris and Des Lacs Rivers have been determined to be unreliable sources, additional evaluation of their water quality will not be completed during the pre-final design.

9.0 INDIAN RESERVATION WATER SUPPLIES

Since completion of the November 1988 NAWS Study, the Fort Berthold Indian Reservation has completed construction of several new water intakes and treatment facilities which are currently serving a large portion of the reservation. The Three Affiliated Tribes has in the past expressed an interest in working with the State of North Dakota and being served by the NAWS project. The resulting report entitled: *Final Report-NAWS/Fort Berthold Integrated Water Supply System Study, November 1990* was a product of these efforts. With the new water supply systems in place, the Three Affiliated Tribes is interested in service being provided to communities which have significant Indian populations not served by their new facilities. The 1993 community needs assessment for areas on the reservation was therefore limited to the communities of New Town and Parshall. Both communities have signed Agreements of Intent and will be included in the pre-final design.

10.0 POPULATION PROJECTIONS

According to the North Dakota Census Data Center, North Dakota's population declined by 2.3 percent during the decade from 1980 to 1990. This trend was more accelerated in the ten-county area in Northwestern North Dakota where the population declined by 7.3 percent during the same period. In 1980 it was projected that populations would increase from 12.3 to 13.0 percent during this same period. The 1990 census indicates that population trends projected in 1980 by the Census Data Center and as presented in the 1988 NAWS Final Report were inaccurate.

The population decline in Northwestern North Dakota was largely due to a downturn in energy industries, generally poor economic conditions, and a decrease in agricultural productivity due to an extended drought. Current projections call for this population decline to continue throughout the next two decades. Even the most optimistic projection by the Census Data Center predicts an 11.4 percent decline by the year 2010.

The Census Data Center's first population projections are made at the county level. Projections for smaller governmental units, which include all the larger communities, have proven inaccurate due to independent factors that often significantly impact local populations. Historic trends from 1960 though 1990 provided in the census report, *Population Change in North Dakota, 1970-1990,* indicate that the larger communities such as Minot and Williston will probably continue to experience growth with a continued decline occurring in the rural populations. A summary of the population trends for each community with a signed *Agreement of Intent* is provided in **Table 5** of **Appendix A.**

After reviewing the census information and trend data from 1960-1990 it was determined that 1990 populations would be used for the development of the NAWS pre-final design with the exception of communities with populations of greater than 500. At the request of the NAWS Advisory Committee a special mailing was sent to each of these communities requesting a local population projection to the year 2010. These community projections have been included in this assessment and are shown in **Table 1** of **Appendix A** and in **Appendix C.**

It was the general consensus that other shifts in population during this period would have only minor impacts on the pre-final design considering a regional distribution system. In addition, a design based on a declining population may be inadequate should an increase actually occur.

A review of the census data indicates that approximately sixty-eight percent (68%) of the area population is located within the communities having municipal distribution systems. The remaining thirty-two percent (32%) are considered rural and include smaller communities, farm and non-farm residences currently served by private wells or rural water. It is recommended that prior to final design an evaluation be conducted to determine what population shifts may have occurred since the completion of this assessment. A summary of the county populations and current projections to the year 2010 are provided in **Table 10.1.**

TABLE 10.1
NORTHWEST AREA WATER SUPPLY PROJECT
COUNTY POPULATIONS AND PROJECTIONS

COUNTY	1980 COUNTY CENSUS	1990 COUNTY CENSUS	NAWS PROJECTED DESIGN POPULATION 2010	NORTH DAKOTA CENSUS DATA CENTER[1]	
				SERIES I PROJECTIONS 2010	SERIES II PROJECTIONS 2010
BOTTINEAU	9,239	8,011	8,063	6,262	6,400
BURKE	3,822	3,002	3,002	2,142	2,206
DIVIDE	3,494	2,899	2,899	2,079	2,122
McHENRY	7,858	6,428	6,428	5,395	5,235
McLEAN	12,383	10,457	10,457	8,187	8,432
MOUNTRAIL	7,679	7,021	7,394	6,317	6,457
PIERCE	6,166	5,052	5,744	3,661	3,775
RENVILLE	3,608	3,160	3,253	2,489	2,540
WARD	58,392	57,921	61,582	54,111	55,426
WILLIAMS	22,237	21,129	21,788	17,781	18,272
Total Population	**134,878**	**125,080**	**130,610**	**108,424**	**110,865**
		7.3% Decrease	4.4 % Increase	13.3% Decrease	11.4% Decrease

1. *North Dakota Population Projections by Age and Gender, 1995-2010, North Dakota Census Data Center, January 1993,*. The two series of projections presented in this report reflect different migration rates. The Series I is based on $^1/_3$ of the out migration rate of the 1980-90 period while Series II is more optimistic and assumes this rate will be reduced to $^1/_4$ of the 1980-90 level.

It is anticipated that additional information will be obtained during the evaluation of the existing and proposed rural water associations on the demands required to serve the general rural population. This information will be included with the final report on the NAWS Pre-final Design. The total number of farms within the ten-county study area, however, is one indicator of current population trends. The total farm counts for 1982 and 1987, as provided by the Agricultural Statistics Service, are presented here in **Table 10.2.** The 1987 data is considered the best available information at the time of this assessment with new farm counts unavailable until late 1993. Generally, the number of farms has been in decline, falling 12.7 percent during the period from 1978 to 1987. Information on the number of rural homes unrelated to farming operations is not directly available. **Table 10.2** also indicates that the number of non-reported farms has declined dramatically. This is probably due to better recording methods which have influenced the changes that occurred from 1982 to 1987.

TABLE 10.2
NORTH DAKOTA TOTAL FARM COUNT
Information Provided by the Agricultural Statistics Service

COUNTY	TOTAL FARMS		ON-FARM OPERATED		OFF-FARM OPERATED		NOT REPORTED	
	1982	1987	1982	1987	1982	1987	1982	1987
BOTTINEAU	967	929	617	612	250	246	100	71
BURKE	580	525	356	304	154	175	70	45
DIVIDE	612	599	401	394	160	165	51	46
McHENRY	974	964	663	682	174	187	137	95
McLEAN	1149	1058	789	724	224	258	136	76
MOUNTRAIL	881	873	585	600	190	200	106	72
PIERCE	589	578	425	423	106	94	70	47
RENVILLE	480	454	305	304	108	122	67	28
WARD	1256	1215	865	814	278	327	113	74
WILLIAMS	971	948	585	581	276	294	110	73
TOTALS	8,459	8,143 Decline - 3.7%	5,591	5,538 Decline - 0.1%	1,920	2,068 Increase + 7.7%	960	627 Decline -34.7%

11.0 WATER DEMANDS

The 1988 study report projected community water demands based on an average use of 100 gallons per capita per day (gpcd) for communities with populations less than 500, and 130 gpcd for communities with populations greater than 500. In order to adequately size the supply facilities, the average daily demands were converted to maximum daily demands using a peaking factor of 2.5, which is a standard generally applied to this region of the country. Larger peaking factors were used for communities with special high-use industries such as Towner with its cheese plant.

Tables 11.1 provides the current average per capita demands and peaking factors, as determined through the 1993 community needs assessment, for communities with municipal distribution systems and populations under 500. **Table 11.2** provides the same information for those communities with populations over 500. The average daily use was based on average annual raw water use as reported to the North Dakota State Water Commission (1985-1992); the peak daily use was provided by each community; and the average per capita use was determined using the 1990 Census populations. The communities included on these tables represent the best regional information available and are not limited to those with signed Agreements of Intent. The average annual use represents the total system demands as measured from the supply source and, therefore, any system losses are included in the per capita demands.

These tables indicate that the design criteria used in the 1988 study closely approximate the actual recorded demands with few exceptions. It should be noted, however, that the peak flows for communities with populations under 500 were often provided based on a peak monthly use or the best judgement of the individual contacted. Many smaller communities do not record water use on a daily basis; therefore, it is our opinion that in most cases their peak daily use has been underestimated and the use of a 2.5 peaking factor is still appropriate. For communities with populations greater than 500, the average per capita daily use is disproportionally influenced by the larger communities or local industries. If these communities and industries are removed, the demands are similar to the 1988 projections.

TABLE 11.1
WATER SUPPLY DEMAND RATES
COMMUNITY NEEDS ASSESSMENT DATA
USAGE FROM 1985-1992

Communities With Populations Under 500

Community	County	Population 1990 Census	Average Daily Use Gallons	Average Use Per Capita Gallons/Day	Peak Daily Use Gallons	Peaking Factor
Anamoose	McHenry	277	34,000	124	60,000	1.8
Berthold	Ward	409	26,000	64	40,000	1.5
Bowbells	Burke	498	34,000	68	90,000	2.6
Columbus	Burke	223	26,000	118	35,000	1.3
Deering	McHenry	99	8,000	81	15,000	1.9
Drake	McHenry	361	44,000	123	103,000	2.3
Falxton	Burke	121	10,000	79	20,000	2.0
Fortuna	Divide	53	4,000	74	7,000	1.8
Granville	McHenry	236	22,000	94	28,000	1.3
Grenora	Williams	261	8,000	31	13,000	1.6
Karlsruhe	McHenry	143	20,000	142	30,000	1.5
Lignite	Burke	242	53,000	221	80,000	1.5
Makoti	Ward	145	22,000	149	45,000	2.0
Maxbass	Bottineau	123	12,000	95	20,000	1.7
Noonan	Divide	231	11,000	49	15,000	1.4
Plaza	Mountrail	193	19,000	98	30,000	1.6
Powers lake	Burke	408	38,000	93	60,000	1.6
Ross	Mountrail	61	6,000	105	15,000	2.5
Ryder	Ward	121	9,000	65	14,000	1.6
Sawyer	Ward	319	38,000	120	40,000	1.1
Sherwood	Renville	286	40,000	139	60,000	1.5
Souris	Bottineau	97	8,000	82	14,000	1.8
Trenton	Williams	425	38,000	89	51,000	1.3
Upham	McHenry	205	14,000	70	25,000	1.8
Wildrose	Williams	193	31,000	162	40,000	1.3
Willow City	Bottineau	281	27,000	97	60,000	2.2

Total Population	**6,011**	**Average Daily Use Per Capita**	**100**
		Average Peaking Factor	**1.7**

Notes:

The average and peak daily uses have been rounded to the nearest 1,000 gallons.

The City of Lignite's average daily use per capita is high due to a local gas plant. If Lignite is removed, the average daily per capita use and peaking factors would be as follows:

		Average Daily Use Per Capita	**95**
		Average Peaking Factor	**1.7**

TABLE 11.2
WATER SUPPLY DEMAND RATES
COMMUNITY NEEDS ASSESSMENT DATA
USAGE FROM 1985-1992

Communities With Populations Over 500

Community	County	Population 1990 Census	Average Daily Use Gallons	Average Use Per Capita Gallons/Day	Peak Daily Use Gallons	Peaking Factor
Bottineau	Bottineau	2,598	343,000	132	780,000	2.3
Burlington	Ward	995	132,000	133	250,000	1.9
Crosby	Divide	1,312	185,000	141	500,000	2.7
Garrison	McLean	1,530	156,000	102	500,000	3.2
Kenmare	Ward	1,214	137,000	113	226,000	1.6
Minot AFB [2]	Ward	9,095	1,630,000	179	2,500,000	1.5
Minot [1]	Ward	34,544	4,400,000	127	10,024,000	2.3
Mohall	Renville	931	113,000	122	300,000	2.7
New Town	Mountrail	1,388	186,000	134	550,000	3.0
Parshall	Mountrail	943	104,000	111	150,000	1.4
Ray-Tioga [2]	Williams	1,881	250,000	139	1,370,000	5.5
Rugby	Pierce	2,909	421,000	145	1,200,000	2.9
Stanley	Mountrail	1,371	138,000	93	300,000	2.2
Towner [2]	McHenry	669	150,000	225	400,000	2.7
Velva	McHenry	968	110,000	113	170,000	1.5
Westhope	Bottineau	578	68,000	117	175,000	2.6
Williston [1]	Williams	13,131	2,346,000	179	7,742,000	3.3

Total Population	76,057	Average Daily Use Per Capita	143
		Average Peaking Factor	2.5

Notes:

The average and peak daily uses have been rounded to the nearest 1,000 gallons.

The figures for Minot and Williston represent only the use by the city and not other users of the system such as rural water associations and/or other communities.

The larger communities [1] and those with industrial users [2], have larger average daily uses per capita. The Ray-Tioga System supplies a gas plant and the City of Towner supplies a local cheese plant. Williston and Minot are the largest communties and the Minot AFB is considered an industrial user. If communties designated [1] and [2] are removed, the average daily use and peaking factors would be as follows:

Average Daily Use Per Capita	125	Average Peaking Factor	2.4

The 1988 study estimated the average use for rural water systems at around 250 to 300 gallons per day per household with a peaking factor of 2.0. **Table 11.3** provides the current per household demands and peaking factors for the operational rural water associations based on information they have provided. The total population served by these systems is based on factors ranging from 2.5 to 3.0 persons per household. In some cases actual peak flows were unavailable because uses were only recorded on a monthly basis. The 1988 report projected a greater use per household and a lower peak than the regional values determined during the 1993 needs assessment. It is anticipated that demand for both domestic and livestock water uses on these systems will increase with improvements in water quality and supply reliability. It is our opinion, therefore, that the use of 250 gallons per day per household and a peaking factor of 2.2 should be considered.

It needs to be clearly understood that the average daily per capita or household uses represented in these tables are influenced by a number of factors including the following:

Population changes (1985-1992)
Local industry
Reported usage and peaks (monthly vs daily records)
Climate changes (i.e. drought)
Water quality
Shortages and/or water rationing
Source and/or system changes

A review of the records for any one of these communities or rural water associations will indicate some influence from one or all of these factors. The 1988 design criteria are still appropriate, for both the communities and rural water systems, if adjustments are made for larger communities and those with regional industries. Special meetings will be conducted with each community and rural water association during the final design phase to establish their specific need based on past, current and projected uses.

TABLE 11.3
WATER SUPPLY DEMAND RATES
COMMUNITY NEEDS ASSESSMENT DATA
USAGE FROM 1985-1992

Operational Rural Water Associations

Rural Water System	County	Estimated Number of Households	Average Daily Use Gallons	Average Use Per Household Gallons/Day	Peak Daily Use Gallons	Peaking Factor
All Seasons WUA - System I	Bottineau	242	43,000	178	100,000	2.3
All Seasons WUA - System II	Bottineau	85	12,000	141	20,000	1.7
All Seasons WUA - System III	Bottineau	304	51,000	168	120,000	2.4
All Seasons WUA - System IV	Bottineau	144	29,000	201	60,000	2.1
North Prairie - System I	Ward	1,151	263,000	228	393,000	1.5
North Prairie - System II	Ward	268	53,000	198	83,000	1.6
North Prairie - System III	Ward	152	31,000	204	50,000	1.6
Upper Souris WUA - System I	Ward/	460	82,000	178	130,000	1.6
Upper Souris WUA - System II	Ward/Renville	373	68,000	182	105,000	1.5
Williams Rural Water Users	Williams	530	98,000	181	228,000	2.3
McLean-Sheridan	McLean/Sheridan	N/A	N/A	N/A	N/A	N/A
	Total Households	***3,709***	***Average Daily Use Per Household***	***197***	***Average Peaking Factor***	***1.8***

Notes:

The average and peak daily uses have been rounded to the nearest 1,000 gallons.

Upper Souris - System II serves Glenburn and Lansford as bulk users. The population for each of these communities was converted to a number of households by dividing by 2.7.

North Prairie - System I serves Max & Surrey as bulk users. The population for each of these communities was coverted to a number of households by dividing by 2.7.

Williams Rural Water is served by and peaking information was obtained from the City of Williston.

The peaking factors for North Prairie are based on peak montly flows, and those for Upper Souris were based a short sample period in 1993; therefore both are underestimated. If these systems were removed the peaking factor would be as follows:

Average Peaking Factor	***2.2***

12.0 SUMMARY

Appendix C contains the community and rural water association summary sheets. Upon completion of the 1993 Community Needs Assessment a letter noting the completion of the needs assessment will be mailed to each of the communities and rural water users associations with signed *Agreements of Intent* along with a copy of their respective community summary. They will be requested to review and comment on the information and provide any additional data or corrections that may be required. A completed copy of the 1993 Needs Assessment will be provided to each community by request only. A general thank you for their assistance will be included.

The signed *Agreements of Intent* are an indication that a community or rural water association is interested in being included in the NAWS pre-final design process. The tables in **Appendix A** list those communities and rural water associations that have signed the agreements and will be included in the NAWS pre-final design. These communities and rural water associations represent approximately 73 percent of the total population within the ten-county project area or a population of about 92,000 people. These agreements do not elaborate on the reason for or type of interest. Based on communications with these communities, their interests vary from receiving water from a regional system to upgrading the quality of present rural water service to providing new rural water service. This information will be evaluated during the pre-final design to determine the level of service necessary for each community.

Based on the Community Needs Assessment, many communities within the NAWS project area are currently in need of some type of service to improve water supply, storage, quality or a combination of the three. As presently proposed, the regional supply systems will provide water to the local municipal distribution systems and existing rural water distribution supply points. A water supply for the development of new rural water systems or expansion of existing systems will be included in the pre-final design. The actual design of these new distribution systems is not part of this study.

APPENDIX A

Community and Rural Water Association Listings

TABLE 1	-	Communities with Municipal Distribution Systems
TABLE 2	-	Communities Served by Rural Water, with and without municipal systems, and those communities not currently served by rural water requesting service from NAWS or Rural Water
TABLE 3	-	Communities Not Contacted or No Response Received Under the NAWS Pre-Final Design Process
TABLE 4	-	Rural Water Distribution Systems
TABLE 5	-	Population trends for communities with signed Agreements of Intent, 1960-1990.

TABLE 1
Communities With Local Municipal Distribution Systems
Page -1-

Community	County	Population		Water Source	Water Quality Category	Status of Agreement
		1990 Census	2010 Projected		I, II, III, IV, V, VI or VIII	
Anamoose	McHenry	277	277	Municipal Wells	VI	Signed
Benedict ✓	McLean	52	52	Municipal Wells	II	Not Interested
Berthold	Ward	409	409	Municipal Wells	IV	Signed
Bottineau	Bottineau	2,598	2,650[1]	Municipal Wells	V	Signed
Bowbells	Burke	498	498	Municipal Wells	II	Signed
Burlington	Ward	995	1,200[1]	Municipal Wells	I	Signed
Columbus	Burke	223	223	Municipal Wells	II	Signed
Crosby	Divide	1,312	1,312[1]	Municipal Wells	VI	Signed
Deering	McHenry	99	99	Municipal Wells	V	Signed
Drake	McHenry	361	361	Municipal Wells	II	Signed
Flaxton	Burke	121	121	Municipal Wells	IV	Signed
Fortuna	Divide	53	53	Municipal Wells	II	Signed
Garrison ✓	McLean	1,530	1,530	Lake Sakakawea	II	Not Interested
Granville	McHenry	236	236	Municipal Wells	IV	Signed
Grenora	Williams	261	261	Municipal Wells	V	Signed
Karlsruhe	McHenry	143	143	Municipal Wells	V	Signed
Kenmare	Ward	1,214	1,214[1]	Municipal Wells	IV	Signed
Lignite ✓	Divide	242	242	Municipal Wells	II	Not Interested
Makoti	Ward	145	145	Municipal Wells	V	Signed
Maxbass	Bottineau	123	123	Municipal Wells	III	Signed
Minot Minot USAF	Ward	34,544 9,095	38,000[1] 9,095	Souris River & Municipal Wells	III	Signed
Mohall	Renville	931	1,024[1]	Municipal Wells	VI	Signed
New Town	Mountrail	1,388	1,450[1]	Municipal Wells	IV	Signed

[1] Projections for communities with populations greater than 500 are based on local estimates requested through a special mailing. Where no response was received the 1990 Census figure was used.

TABLE 1
Communities With Local Municipal Distribution Systems
Page -2-

Community	County	Population		Current Water Source	Water Quality Category	Status of Agreement
		1990 Census	2010 Projected		I, II, III, IV, V, VI or VII	
Noonan	Divide	231	231	Municipal Wells	VI	Signed
Parshall	Mountrail	943	1,037[1]	Lake Sakakawea	VI	Signed
Plaza	Mountrail	193	193	Municipal Wells	IV	Signed
Portal	Burke	192	192	Municipal Wells	IV	Not Interested
Powers Lake	Burke	408	408	Municipal Wells	II	Signed
Ray	Williams	603	603[1]	R &T Water	III	Signed R&T
Ross	Mountrail	61	61	Municipal Wells	V	Not Interested
Rugby	Pierce	2,908	3,600[1]	Municipal Wells	VII	Signed
Ryder	Ward	121	121	Municipal Wells	V	Not Interested
Sawyer	Ward	319	319	Municipal Wells	II	Signed
Sherwood	Renville	286	286	Municipal Wells	VII	Signed
Souris	Bottineau	97	97	Municipal Wells	II	Signed
Stanley	Mountrail	1,371	1,577[1]	Municipal Wells Future R&T	II	Signed R&T
Tioga	Williams	1,278	1,278[1]	R & T Water	II	Signed R&T
Towner	McHenry	669	669[1]	Municipal Wells	VII	Signed
Upham	Bottineau	205	205	Municipal Wells	II	Signed
Velva	McHenry	968	968	Municipal Wells	VII	Not Interested
Westhope	Bottineau	578	578[1]	Souris River	II	Signed
Wildrose	Williams	193	193	Municipal Wells	II	Signed
Williston	Williams	13,131	13,788[1]	Missouri River	VI	Signed
Willow City	Bottineau	281	281	Municipal Wells	III	Signed
Total Population		81,886	87,403			37 Signed 7 Unsigned

[1] Projections for communities with populations greater than 500 are based on local estimates requested through a special mailing. Where no response was received the 1990 Census figure was used.

TABLE 2
Communities Served by Rural Water Associations

Communities With Municipal Distribution Systems

Community	County	Population		Water Quality Category by Water Source
		1990 Census	2010 Projected	
Glenburn	Renville	439	439	Upper Souris - System II
Lansford	Bottineau	249	249	Upper Souris - System II
Max	McLean	301	301	North Prairie - System I
Newburg	Bottineau	104	104	All Seasons - System III
Surrey	Ward	856	856	North Prairie - System I
Total Population		1,949	1,949	

Communities Without Municipal Distribution Systems

Antler	Bottineau	74	74	All Seasons - System III
Carbury	Bottineau	4[1]	4[1]	All Seasons - System II
Des Lacs	Ward	216	216	North Prairie - System I
Donnybrook	Ward	106	106	Upper Souris - System I
Douglas	Ward	93	93	North Prairie - System I
Epping	Williams	64	64	Williams Rural Water
Gardena	Bottineau	41	41	All Seasons - System II
Grano	Renville	9	9	Upper Souris - System I
Kramer	Bottineau	51	51	All Seasons - System II
Landa	Bottineau	38	38	All Seasons - System III
Loraine	Renville	21	15	Upper Souris - System I
Norma	Renville	18 [1]	18 [1]	Upper Souris - System I
Norwich	McHenry	55 [1]	55 [1]	North Prairie - System III
Overly	Bottineau	25	25	All Seasons - System I
Russell	Bottineau	14	14	All Seasons - System III
Tolley	Renville	79	79	Upper Souris - System I
Trenton	Williams	480 [1]	480 [1]	City of Williston
Voltaire	McHenry	63	63	North Prairie - System I
Total Population		1,451	1,451	[1] 1988 Populations

Communities on Private Wells Requesting NAWS or Rural Water Service

Alamo	Williams	69	69	**Signed Agreement**
Carpio	Ward	245	178	**Private Wells**
Larson	Burke	26	26	**Signed Agreement**
Ruso	McLean	8	8	**Signed Agreement**
Total Population		103	103	

TABLE 3
Communities Not Contacted or No Response Received
Under The NAWS Pre-Final Design Process

Community	County	1988 Population	1990 Population	Water Source	Expressed Interest in Rural Water
Alakbo	Divide	4	[NA]	Private Wells	
*Ambrose	Divide	65	48	Private Wells	No Response
Appam	Williams	10	[NA]	Private Wells	
*Balfour	McHenry	36	33	Private Wells	No Response
Balta	Pierce	139	79	Private Wells	
*Bantry	McHenry	24	16	Private Wells	No Response
Barton	Pierce	38	24	Private Wells	
*Battleview	Burke	50	[NA]	Private Wells	No Response
Belden	Mountrail	10	[NA]	Private Wells	Yes (1988)
*Bergen	McHenry	26	12	Private Wells	No Response
Berwick	McHenry	13	[NA]	Private Wells	
Blaisdell	Mountrail	15	[NA]	Private Wells	
Bonetraill	Williams	6	[NA]	Private Wells	
Buford	Williams	0	[NA]	Private Wells	
*Butte	McLean	157	129	Private Wells	Not Interested
Colgan	Ward	2	[NA]	Private Wells	
Corinth	Williams	12	[NA]	Private Wells	
Coteau	Burke	10	[NA]	Private Wells	No Response
Coulee	Mountrail	20	[NA]	Private Wells	Yes (1988)
*Denbigh	McLean	25	[NA]	Private Wells	No Response
Eckman	Bottineau	2	[NA]	Private Wells	
Emmet	McLean	4	[NA]	Private Wells	
*Foxholm	Ward	38	[NA]	Private Wells	No Response
Hamlet	Williams	11	[NA]	Private Wells	Yes (1988)
Hanks	Williams	8	11	Private Wells	
Hartland	Ward	0	[NA]	Private Wells	
*Kenaston	Ward	13	[NA]	Private Wells	Yes (1988)
*Kief	McHenry	26	24	Private Wells	No Response
Kongsberg	McHenry	2	[NA]	Private Wells	
Lonetree	Ward	20	[NA]	Private Wells	Yes (1988)

* COMMUNITIES CONTACTED THROUGH INFORMATIONAL MAILINGS

TABLE 3
Communities Not Contacted or No Response Received
Under The NAWS Pre-Final Design Process
Page -2-

Community	County	1988 Population	1990 Population	Water Source	Expressed Interest in Rural Water
Lostwood	Mountrail	0	[NA]	Private Wells	
Marely	Williams	0	[NA]	Private Wells	
*McGregor	Williams	90	[NA]	Private Wells	No Response
Niobe	Ward	22	[NA]	Private Wells	Yes (1988)
Northgate	Burke	0	0	Private Wells	
Omemee	Bottineau	2	[NA]	Private Wells	
Orrin	Pierce	[NA]	[NA]	Private Wells	
*Palermo	Mountrail	104	95	Private Wells	Not Interested
Raub	McLean	4	[NA]	Private Wells	Yes (1988)
Roseglen	McLean	8	[NA]	Private Wells	Yes (1988)
Roth	Bottineau	0	0	Private Wells	
Selz	Pierce	[NA]	[NA]	Private Wells	
Silvia	Pierce	[NA]	[NA]	Private Wells	
Simco	McHenry	10	[NA]	Private Wells	
*Spring Brook	Williams	43	29	Private Wells	No Response
Tagus	Mountrail	10	[NA]	Private Wells	
Temple	Williams	2	[NA]	Private Wells	
Verendrye	McHenry	0	0	Private Wells	
*Wheelock	Williams	15	23	Private Wells	No Response
*White Earth	McLean	25	73	Private Wells	No Response
White Shield	McLean	270	[NA]	Indian MR&I	Yes (1988)
Wolford	Pierce	76	56	Private Wells	
Wolseth	Ward	0	0	Private Wells	
Zahl	Williams	20	[NA]	Private Wells	
Total Population		3,722			

*** COMMUNITIES CONTACTED THROUGH INFORMATIONAL MAILINGS**

TABLE 4
Rural Water Distribution Systems

Rural Water System	Counties Served	Households Served 1993	Water Quality Category and Source	Status of Agreement
Operational Rural Water Associations				
All Seasons Water Users Association - I	Bottineau	242	VI - Wells	Signed
All Seasons Water Users Association - II	Bottineau	85	VII - Wells	Signed
All Seasons Water Users Association - III	Bottineau	304	VI - Wells	Signed
All Seasons Water Users Association - IV	Bottineau	144	VII - Wells	Signed
North Prairie Rural Water Association - I	Ward/McHenry	1,151[1]	III - Minot	Signed
North Prairie Rural Water Association - II	Ward/McHenry	268	III - Minot	Signed
North Prairie Rural Water Association - III	Ward/McHenry	152	V - Wells	Signed
McLean-Sheridan RWA	McLean/Sheridan	N/A	VII - Wells	Signed
Upper Souris Water Users Association - I	Burke/Renville Ward	460	IV - Wells	Signed
Upper Souris Water Users Association - II	Bottineau/McHenry Renville/Ward	373[2]	IV - Wells	Signed
Williams Rural Water Users Association	Williams	530	VI - Williston	Signed
Total Households		3,709		
Organized Rural Water Associations				
Mountrail Rural Water Association	Mountrail	796 est	NAWS	Pending
Writing Rock Rural Water Association	Divide/Burke	150 est	NAWS	Signed
Proposed Rural Water Associations				
Garrison Rural Water	McLean	[N/A]	City of Garrison	Not Interested
Lake Mitegoshe Rural Water	Bottineau	[N/A]	NAWS	Signed
Pierce County Rural Water	Pierce	[N/A]	NAWS	Signed

[1] North Prairie - System I serves Max and Surrey as bulk users. The population for each of these communities was converted to a number of households by dividing by 2.7.

[2] Upper Souris - System II serves Glenburn and Lansford as bulk users. The population for each of these communities was converted to a number of households by dividing by 2.7.

TABLE 5
Population Trends for Communities in Northwestern North Dakota[1]
Page -1-

Place	Population			Percent Change		
	1990	1980	1970	1980-90	1970-80	1960-70
Alamo	69	122	124	-43	-2	-32
Anamoose	277	355	401	-22	-11	-20
Antler	74	101	135	-27	-25	-36
Benedict	52	68	72	-24	-6	-44
Berthold	409	485	398	-16	22	-8
Bottineau	2598	2829	2760	-8	3	6
Bowbells	498	587	584	-15	1	-15
Burlington	995	762	247	31	209	-6
Carbury	4[2]					
Columbus	223	325	465	-31	-30	-31
Crosby	1312	1469	1545	-11	-5	-12
Deering	99	85	75	16	13	-36
Des Lacs	216	212	197	2	8	6
Donnybrook	106	139	163	-24	-15	-17
Douglas	93	112	144	-17	-22	-31
Drake	361	479	636	-25	-25	-15
Epping	64	104	140	-38	-26	-7
Flaxton	121	182	286	-34	-36	-24
Fortuna	53	98	216	-46	-55	17
Gardena	41	66	84	-38	-21	-26
Garrison	1530	1830	1614	-16	13	-10
Glenburn	439	454	381	-3	19	5
Grano	9	6	4	50	50	-71
Granville	236	281	282	-16	-0	-30
Grenora	261	362	401	-28	-10	-10
Karlsruhe	143	164	172	-13	-5	-22
Kenmare	1214	1456	1515	-17	-4	-11
Kramer	51	84	125	-39	-33	-29
Landa	38	62	61	-39	2	-45
Lansford	249	294	296	-15	-1	-23
Larson	26	21	35	24	-40	-44
Lignite	242	332	354	-27	-6	-0
Loraine	15	21	33	-29	-36	-39
Makoti	145	199	159	-27	25	-26
Max	301	330	301	-9	10	-27

1 Trends from the North Dakota Census Data Center 1960-1990 for communities with signed Agreements of Intent or signed through service by a rural water association.

2 Population from 1988 Needs Survey, community served by rural water.

TABLE 5
Population Trends for Communities in Northwestern North Dakota[1]
Page -2-

Place	Population			Percent Change		
	1990	1980	1970	1980-90	1970-80	1960-70
Maxbass	123	141	174	-13	-19	-20
Minot	34544	32843	32290	5	2	6
Minot USAF	9095	9088		-8	[na]	[na]
Mohall	931	1049	950	-11	10	-1
New Town	1388	1335	1428	4	-7	-10
Newburg	104	151	125	-31	21	-21
Noonan	231	283	403	-18	-30	-36
Norma	18[2]					
Norwich	55[2]					
Overly	25	25	28	0	-11	-57
Parshall	943	1059	1246	-11	-15	2
Plaza	193	222	291	-13	-24	-24
Powers Lake	408	466	523	-12	-11	-17
Ray	603	766	776	-21	-1	-26
Ross	61	104	125	-41	-17	-25
Rugby	2909	3335	2889	-13	15	-3
Ruso	8	12	15	-33	-20	-52
Russell	14	18	14	-22	29	-44
Ryder	121	158	211	-23	-25	-20
Sawyer	319	417	373	-24	12	-4
Sherwood	286	294	369	-3	-20	3
Souris	97	122	151	-20	-19	-29
Stanley	1371	1631	1581	-16	3	-12
Surrey	856	999	361	-14	177	17
Tioga	1278	1597	1667	-20	-4	-20
Tolley	79	103	163	-23	-37	-14
Towner	669	867	870	-23	-0	-8
Trenton	480[2]					
Upham	205	227	272	-10	-17	-18
Velva	968	1101	1241	-12	-11	-7
Voltaire	63	65	54	-3	20	-23
Westhope	578	741	705	-22	5	-14
Wildrose	193	214	235	-10	-9	-35
Williston	13131	13336	11280	-2	18	-5
Willow City	281	329	403	-15	-18	-18

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[1] Trends from the North Dakota Census Data Center 1960-1990 for communities with signed Agreements of Intent or signed through service by a rural water association.

[2] Population from 1988 Needs Survey, community served by rural water.

APPENDIX B

Northwest Area Water Supply Project
Pre-Final Design

Summary of
The Safe Drinking Water Act
Existing and Proposed Standards

April 1993

Northwest Area Water Supply Project - Pre-final Design

Summary of

Safe Drinking Water Act Existing and Proposed Standards

April 1993

Houston Engineering, Inc. in association with
American Engineering, P.C.
Montgomery Watson

INTRODUCTION

The enactment of the Safe Drinking Water Act (SDWA) in 1974 signaled the beginning of a new age in public water supply. Passage of the SDWA was spurred by the detection of organic contaminants in drinking water throughout the United States. Under the SDWA, Congress charged the federal government with proposing National Interim Primary Drinking Water Regulations (NIPDWRs) by March 1975. Revised primary regulations were to be promulgated by September 1977. Interim regulations were proposed according to schedule, but the adoption of final National Primary Drinking Water Regulations (NPDWRs) was eclipsed by the 1986 Amendments to the SDWA. In these SDWA Amendments, Congress outlined a schedule for NPDWR promulgation. This booklet was prepared to update and summarize the existing and proposed federal drinking water regulations. This discussion is current to April 1993.

For the sake of brevity, the following paragraphs include acronyms and/or abbreviations of words or terms which are repeated often in the text. These acronyms and abbreviations are presented in Appendix A as an aid to the reader.

REGULATORY OVERVIEW

Drinking water quality is regulated in the United States by the Environmental Protection Agency (EPA). Under provisions of the SDWA, the EPA may delegate primary enforcement responsibility for water quality control to the State. North Dakota has primacy under the SDWA. The State Agency responsible for implementing drinking water regulations is the Department of Health, Division of Municipal Facilities. To maintain primacy (authority to enforce drinking water regulations) under the SDWA, a State must adopt drinking water regulations at least as stringent as the federal regulations. State drinking water regulations can be more stringent than federal regulations, but they cannot be less stringent. Conversations with Department of Health staff indicate the current drinking water regulations for North Dakota are identical to the federal drinking water regulations.

SAFE DRINKING WATER ACT (SDWA)

The Safe Drinking Water Act (SDWA, Public Law 99-339), originally enacted in 1974, gave the federal government, through the EPA, the authority to set standards for drinking water quality in water delivered by community (public) water suppliers.

In 1986, Congress passed sweeping amendments to the SDWA. In the amendments to the SDWA, Congress established specific deadlines for new regulations to be promulgated. Included in the 1986 amendments were requirements for EPA to set standards for 83 compounds within 3 years, requirements to establish criteria for filtration of surface water supplies, as well as requirements for all public water systems to provide disinfection. (Appendix B contains the Congressional list of 83 compounds.)

The 1986 amendments banned the use of lead pipes and solder, and required water utilities to go through a one-time public education program notifying consumers of the health effects and sources of lead in drinking water and steps that individuals can take to reduce exposure. In addition to requiring EPA to establish 83 standards within 3 years, Congress mandated that EPA establish 25 additional standards every three years. The first step towards establishing the additional 25 standards was an SDWA requirement that EPA create a "list of contaminants". Referred to as EPA's Drinking Water Priority List, the first list was published in January 1988 and a revised priority list was published January 14, 1991.

The EPA has established the following water quality regulations that apply to water treatment plants and distribution systems:

- The EPA National Primary Drinking Water Regulations (NPDWR, 1975), originally adopted as "interim" standards in 1975, no longer referred to as "interim" standards after the 1986 Amendments to the SDWA (some of the standards have been revised by recent EPA promulgations);

- The EPA secondary drinking water regulations (EPA, 1979, 1991) which are advisory in nature and are to be applied as determined by the states;

- EPA's trihalomethane regulation (EPA, 1979);

- EPA requirements for special monitoring (EPA, 1980) for sodium and corrosivity characteristics;

- EPA's Phase I regulations for 8 VOCs adopted in July 1987. Phase I package included requirements for monitoring unregulated compounds;

- EPA's Surface Water Treatment Rule (SWTR) final June 29, 1989, with compliance due by June 29, 1993 for filtering systems;

- EPA's revised Total Coliform Rule (TCR), final June 29, 1989, effective December 31, 1990;

- EPA's Phase II regulations (covering SOCs and IOCs) which were final January 30, 1991, and July 1991 with compliance monitoring to begin January 1993. Phase II package included requirement for monitoring unregulated compounds. Several of the Phase II standards replaced National Primary Drinking Water Regulations;

- EPA's Lead and Copper Rule which was final June 7, 1991; and

- EPA's Phase V Drinking Water Regulations covering 23 inorganic and organic compounds which were final on July 17, 1992.

Under the Safe Drinking Water Act, EPA must specify a maximum contaminant level goal (MCLG) for each contaminant that it regulates. EPA must then set the maximum contaminant level (MCL) as close to the MCLG as is technically and economically feasible and must specify in the rule the best available technology (BAT). Systems do not have to install BAT to comply with an MCL. Systems unable to meet an MCL after installation of BAT, however, can receive a variance. If EPA determines that it is not economically and technically feasible to measure the level of a contaminant in water, EPA can establish a treatment technique in lieu of an MCL.

As of March 1993, EPA had not established standards for all 83 compounds identified by Congress for regulation. The 1986 amendments, however, have led to a significant increase in the number of regulated compounds in drinking water. In addition, a number of regulations are under development and are anticipated to be final in the near future.

A calendar of dates when regulations have been completed and anticipated dates for upcoming regulations is presented in Table 1 and Figure 1. Utilities were required to begin monitoring for the Phase II contaminants starting January 1, 1993, using the EPA's three 3-year compliance period format (referred to as the Standardized Monitoring Format.). Systems with over 150 service connections were required to begin monitoring for the Phase V contaminants starting January 1, 1993.

PRIMARY DRINKING WATER REGULATIONS

National Interim Primary Drinking Water Regulations

In December 1975, EPA adopted National Interim Primary Drinking Water Regulations (NIPDWR) which were effective June 1977. Maximum contaminant levels (MCLs) were established for a number of inorganic chemicals, organic chemicals, physical parameters, radioactivity, and bacteriological factors. The primary standards are based on health effects to the consumer and are mandatory standards. MCLs are set as limits never to be exceeded.

Standard for Trihalomethanes

In 1979, EPA published an amendment to the NIPDWR which established an MCL for trihalomethanes (THMs). The MCL was set at 0.1 mg/L and was based on the sum of concentrations of chloroform, bromodichloromethane, dibromochloromethane, and bromoform. Since THMs can continue to form after the application of disinfectant, compliance with the MCL is based on a running annual average of at least four sampling points for each treatment plant with 25% of the samples taken at locations within the distribution system representing the maximum residence time of water in the system, and with at least 75% of the samples being collected from representative sites in the distribution system (taking into account number of persons served, different sources of water, and different treatment methods employed).

TABLE 1

STATUS OF DRINKING WATER REGULATIONS

Regulation	Contaminants	Status
Final Rules		
VOCs (Phase I)	8 VOCs (plus unregulated)	Rule final 1987
SWTR	Filtration, disinfection turbidity, *Giardia lamblia*, viruses, Legionella, heterotrophic bacteria	Rule final 6/29/89, Compliance required 6/29/93
TCR	Total coliforms, fecal coliforms, *E. coli*	Rule final 6/29/89 Rule effective 12/31/90
Lead, Copper	Lead, copper	Rule final 5/91
SOCs, IOCs Phase II	8 IOCs, 11 SOCs, 17 pesticides, epichlorohydrin acrylamide (unregulated)	MCLs, final 1/92, 7/92
SOCs, IOCs (Phase V)	5 IOCs, 18 SOCs	Rule proposed 7/25/90 MCLs final 3/92 (Compliance monitoring phased in under SMF,[a] >150 service connections must monitor 1/93-12/95.)

TABLE 1 (continued)

STATUS OF DRINKING WATER REGULATIONS

Regulation	Contaminants	Status
Proposed Rules		
Radionuclides	Uranium, radon, radium 226 & 228, gross beta, and gross alpha	MCLs proposed 7/18/91 Final MCLs 10/93
Future Rules		
D/DBPs	Disinfectants, disinfection by-products (additional IOCs, SOCs)	Proposal mid-1993 Final mid-1995[b]
Groundwater Disinfection	Virus, groundwater disinfection	Draft 7/92. Proposal 9/94. Final 9/96.
Arsenic	Arsenic	EPA to propose September 1994, final September 1996
Sulfate	Sulfate (deferred from Phase V)	Proposal 10/93, Final 12/94

[a] SMF - "Standardized Monitoring Format" - When EPA promulgates a final regulation, under the Safe Drinking Water Act, the primacy agency has 18 months to adopt the regulation in the State. The Phase II package included the SMF which is an attempt by EPA to streamline the monitoring requirements for unregulated compounds, VOCs, inorganics, and pesticides. It is not clear if the D/DBP regulation will be included in the SMF.

[b] Negotiated rule-making (Reg Neg) meetings in March 1993 produced a conceptual framework for a D/DBP Rule agreed to by all negotiating parties. The committee will meet again in late April 1993 to seek final agreement.

PROMULGATED RULES	1989	1990	1991	1992
Volatile Organic Contaminants (VOCs) (Phase I)	Effective date: Jan 9			
Fluoride		Request for information: Jan 3		
Public Notification	Effective date: Apr 28			
Surface Water Treatment Rule (SWTR)	Final rule: June 29 (54 FR 27488)	Effective date: Dec 31		
Total Coliform Rule (TCR)	Final rule: June 29 (54 FR 27547)	Effective date: Dec 31		
Stay of TCR Variance Provisions			Final rule: Jan 15 (56 FR 1556) Effective date: Jan 15	
Analytical Methods for *E. Coli*			Final rule: Jan 8 Effective date: Jan 8 (56 FR 636)	Colilert approval: June 10 (57 FR 24744)
Synthetic Organic Chemicals (SOCs) and Inorganic Chemicals (Phase II)			Final rule: Jan 30 (56 FR 3526)	Effective date: July 30
Reproposed Phase II Maximum Contaminant Levels (MCLs)	Proposed rule: May 22 (54 FR 22062)		Reproposed rule: Jan 30 Final rule: July (56 FR 30266)	
Postponement of effective date for aldicarb, aldicarb sulfoxide, aldicarb sulfone MCLs				Notice of postponement: May (57 FR 22178)
1991 Drinking Water Priority List (DWPL)			Final rule: Jan 14 (56 FR 1470) Effective date: Jan 14	
Lead and Copper		Proposed options: Oct 19	Final rule: June 7 (56 FR 26460)	
Reconsideration of Primacy Withdrawal Language		Proposed rule: Nov 28 (55 FR 49398)	Final rule: June 3 (56 FR 25046)	
Synthetic Organic Chemicals (SOCs) and Inorganic Chemicals (Phase V)		Proposed rule: July 25 (55 FR 30370)	Notice of availability: Nov	Final rule: July 17
Approval of MMO-MUG Test for *E. Coli*			Notice of intent: Sept 27 (56 FR 49153)	Final rule: June 10 (57 FR 24744)

PROPOSED RULES	1990	1991	1992	1993
Radionuclides		Proposed rule: July 18 (56 FR 33050)		Final rule exptd: Apr

ANTICIPATED RULES	1992	1993	1994	1995	1996
Disinfection/Disinfection By-products (Phase VI)	Notice of intent: Sept 15 (57 FR 42533)	Proposed rule exptd: June		Final rule exptd: June	
Balance of 25 Contaminants from the DWPL (Phase VI)		Proposed rule exptd: June		Final rule exptd: June	
Updated Analytical Methods for VOCs and THMs		Proposed rule exptd: Spring			
Arsenic		Proposed rule exptd: Sept		Final rule exptd: Sept	
Sulfate		Proposed rule exptd: Oct	Final rule exptd: Dec		
Groundwater Disinfection	Draft rule: July		Proposed rule exptd: Sept		Final rule exptd: Sept

Safe Drinking Water Act (SDWA) Regulations

Figure 1

Requirements for Special Monitoring for Corrosivity and Sodium

In 1980, EPA adopted monitoring requirements for sodium and corrosivity characteristics. The regulation did not adopt MCLs or specify limits for sodium or corrosivity. According to the regulations, corrosivity characteristics may be described by pH, alkalinity, hardness, temperature, total dissolved solids, and Langelier Index data. Surface water systems are required to collect an annual sample for sodium analysis. The following language addresses steps regarding evaluating corrosivity for a particular system:

- Determining the presence of specific materials of construction in the distribution system, service lines, and home plumbing; and reporting this information within 12 months. Utilities were to report the occurrence of the following materials: lead, copper, galvanized metal, iron or ferrous materials, and asbestos-cement pipe.

- Monitoring various parameters to determine corrosivity characteristics.

Regulations for SOCs and IOCs

Working from the Congressional list of 83 compounds to be regulated, EPA has promulgated a series of regulations for synthetic organic chemicals (SOCs) and inorganic chemicals (IOCs).

In July 1987, EPA published final drinking water standards for 8 volatile organic chemicals (VOCs). In January 1991, EPA published final standards for 33 compounds and in July 1991, EPA published final standards for an additional 5 compounds. In July 1992, EPA promulgated an additional 23 drinking water standards (Phase V). Tables 2 and 3 contain the current list of regulated compounds.

Surface Water Treatment Rule

The Surface Water Treatment Rule (SWTR) was promulgated on June 29, 1989. In establishing filtration criteria, Congress required that EPA consider source water quality, watershed management programs, existing treatment techniques, length of water storage, and other factors relevant to protection of human health.

The SWTR addresses surface water disinfection. The Congressional list of 83 contaminants for regulation included turbidity and microbiological contaminants which are addressed by the SWTR: *Giardia lamblia,* viruses, *Legionella*, and heterotrophic plate count (HPC) bacteria.

TABLE 2

CURRENT NATIONAL PRIMARY DRINKING WATER STANDARDS (40 CFR 141)

Parameter	Federal MCL[a]
Inorganics	
Arsenic[b]	0.05
Asbestos - MFL[c]	7
Lead[d]	Treatment Technique
Barium (reproposed)[e]	2
Cadmium (revised)[f]	0.005
Chromium (revised)[f]	0.1
Fluoride	4
Mercury (revised)[f]	0.002
Nitrate (as N) (revised)[f]	10
Nitrite (as N)	1
Total Nitrate and Nitrite (as N)	10
Selenium (selenium)	0.05
Organics	
Alachlor	0.002
Aldicarb (reproposed)[e,g]	0.003
Aldicarb sulfoxide (reproposed)[e,g]	0.004
Aldicarb sulfone (reproposed)[e,g]	0.002
Atrazine	0.003
Benzene	0.005
Carbon Tetrachloride	0.005
Carbofuran	0.04
Chlordane	0.002
1,2-Dibromo-3-chloropropane (DBCP)	0.0002
p-Dichlorobenzene	0.075
o-Dichlorobenzene	0.6
cis-1,2-Dichloroethylene	0.07
trans-1,2-Dichloroethylene	0.1
1,2-Dichloroethane	0.005
1,1-Dichloroethylene	0.007
1,2-Dichloropropane	0.005

TABLE 2 (continued)

CURRENT NATIONAL PRIMARY DRINKING WATER STANDARDS
(40 CFR 141)

Parameter	Federal MCL[a]
Organics (continued)	
2,4-D (revised)	0.07
Endrin[h]	0.0002
Ethylbenzene	0.7
Ethylene Dibromide	0.00005
Heptachlor	0.0004
Heptachlor epoxide	0.0002
Lindane (revised)[f]	0.0002
Methoxychlor (revised)[f]	0.04
Monochlorobenzene	0.1
Pentachlorophenol (reproposed)[e]	0.001
Polychlorinated biphenyls (PCBs)	0.0005
Styrene	0.1
Tetrachloroethylene	0.005
Toluene	1
Toxaphene (revised)[f]	0.003
1,1,1-Trichloroethane	0.20
Trichloroethylene	0.005
Trihalomethanes (total)	0.10
2,4,5-TP (revised)[f]	0.05
Vinyl Chloride	0.002
Xylenes (total)	10
Organics (Treatment Techniques)	
Acrylamide[i]	
Epichlorohydrin[j]	
Physical Parameters	
Turbidity (NTU)	1[k]

TABLE 2 (continued)

CURRENT NATIONAL PRIMARY DRINKING WATER STANDARDS (40 CFR 141)

Parameter	Federal MCL[a]
Microbiological	
Coliforms	5% (presence/absence)
Radiological	
Gross Alpha-pCi/L[l]	15
Radium 226 & 228-pCi/L	5
Strontium-90-pCi/L	8
Tritium-pCi/L	20000

a All units in mg/L, unless otherwise indicated.
b EPA's current schedule is to propose a revised arsenic standard in September 1994 and publish a final standard 2 years later.
c MFL = million fibers per liter (greater than 10 microns in length).
d Lead (and copper) are regulated by a treatment technique, with systems required to optimize corrosion control treatment. The action levels for lead and copper are 0.015 mg/L and 1.3 mg/L, respectively.
e (reproposed) means five compounds from the first Phase II proposal were dropped from the final Phase II package and final standards for the five were published July 1, 1991.
f (revised) means the Phase II standard replaced an existing drinking water standard.
g On May 27, 1992, EPA issued a stay on the MCLs for aldicarb, aldicarb sulfone, and aldicarb sulfoxide. As of March 1993, EPA continues to review the health effects data. Utilities are required to conduct monitoring.
h Endrin standard was revised to 0.002 mg/L in the Phase V regulations. See Table 3.
i 0.05% dosed at 1 ppm (or equivalent).
j 0.01% dosed at 20 ppm (or equivalent).
k For filtered systems, the current turbidity standard is in effect until June 29, 1993; under certain circumstances 5 NTU may be allowed.
l Including Radium-226, but excluding Radon or Uranium.

TABLE 3

NATIONAL PRIMARY DRINKING WATER REGULATIONS
FINAL JULY 17, 1992
(Phase V)[a]

Parameter	Federal MCL[b]
Inorganic	
Antimony	0.006
Beryllium	0.004
Cyanide (as free cyanide)	0.2
Nickel	0.1
Thallium	0.002
Sulfate[c]	deferred
Organics	
Dalapon	0.2
Di(ethylhexyl) adipate	0.4
Di(ethyhexyl) phthalate	0.006
Dichloromethane	0.005
Dinoseb	0.007
Diquat	0.02
Endothall	0.1
Endrin	0.002
Glyphosate	0.7
Hexachlorobenzene	0.001
Hexachlorocyclopentadiene	0.05
Oxamyl(Vydate)	0.2
PAHs [Benzo(a)pyrene]	0.0002
Picloram	0.5
Simazine	0.004
1,2,4-Trichlorobenzene	0.07
1,1,2-Trichlorethane	0.005
2,3,7,8-TCDD (Dioxin)	$3x10^{-8}$

a Systems with greater than 150 service connections are to begin monitoring for the Phase V compounds in the three-year compliance cycle beginning January 1, 1993.

b All units in mg/L.

c EPA's current schedule for sulfate is to propose a standard by October 1993 and publish a final standard by December 1994.

Systems with very clean and protected source waters that have low total coliform, fecal coliform, and turbidity levels, as well as those systems which practice specific measures to maintain that quality (e.g. watershed management), would only be required to disinfect to achieve removal requirements. The system would be required to demonstrate the ability to meet specific residual concentration and contact time requirements. This quantity is defined in the Rule as the product of residual, "C", in mg/L, times the contact time, "T", in minutes.

The federal requirements for compliance under the SWTR are fairly straightforward. There is an important distinction between the requirements contained in the Rule itself and the language presented in EPA's Guidance Manual. The language contained in the Guidance Manual is not enforceable and does not carry the weight of penalties or violations.

For filtering systems, the general requirements of the SWTR are to provide treatment to ensure at least "...99.9 percent (3 log) removal and/or inactivation of *Giardia lamblia* cysts..." and at least "...99.99 percent (4 log) removal and/or inactivation of viruses..."

In the federal SWTR, for systems that filter there are several specific requirements for turbidity and disinfection. For conventional filtration systems, the turbidity requirements are:

a. "...the turbidity of representative samples of a system's filtered water must be less than or equal to 0.5 NTU in at least 95 percent of the measurements taken each month...except that if the State determines that the system is capable of achieving at least 99.9 percent removal and/or inactivation of *Giardia lamblia* cysts at some turbidity level higher than 0.5 NTU." (Section 141.73(a)(1), 54 FR 27530).

b. "The turbidity level of representative samples of a system's filtered water must at no time exceed 5 NTU..." (Section 141.73(a)(2), 54 FR 27530).

The disinfection requirements for systems that filter are as follows:

a. "The disinfection treatment must be sufficient to ensure that the total treatment processes of that system achieve at least 99.9 percent (3-log) inactivation and/or removal of Giardia lamblia cysts and at least 99.99 percent (4-log) inactivation and/or removal of viruses, as determined by the State." (emphasis added). (Section 141.72(b)(1), 54 FR 27529).

b. "The residual disinfectant concentration in the water entering the distribution system...cannot be less than 0.2 mg/L for more than 4 hours." (Section 141.72(b)(2), 54 FR 27530).

c. "The residual disinfectant concentration in the distribution system, measured as total chlorine, combined chlorine, or chlorine dioxide, as specified in 141.74(a)(5) and (c)(3), cannot be undetectable in more than 5 percent of the samples each month,

for any two consecutive months that the system serves water to the public. Water in the distribution system with a heterotrophic bacteria concentration less than or equal to 500/mL, measured as heterotrophic plate count (HPC)...is deemed to have a detectable disinfectant residual for purposes of determining compliance with this requirement." (Section 141.72(b)(3)(i), 54 FR 27530).

Determination of CT According to the EPA Guidance Manual. The 1989 SWTR Guidance Manual states (page 4-3) that "...conventional treatment without disinfection is capable of achieving up to a 3-log removal of Giardia cysts and up to 3-log removal of viruses...Factors which can adversely affect removal efficiencies include: raw water turbidities less than 1 NTU, cold water conditions, non-optimal or no coagulation, improper filter operation including no filter-to-waste, intermittent operation, sudden rate changes...."

In addition, the EPA Guidance Manual states "...well-operated conventional treatment plants which have been optimized for turbidity removal can be expected to achieve at least a 2.5 log removal of *Giardia* cysts....EPA recommends that conventional filtration systems provide sufficient disinfection to achieve a minimum of 0.5 log *Giardia* cyst and 2-log virus inactivation."

To determine the amount of "credit" a utility can get through disinfection, EPA has introduced the concept of "CT." "C" is the residual concentration of the disinfectant (in mg/L) and "T" is the time (in minutes) the disinfectant is in contact with the water. EPA has prepared CT tables that relate specific CT values to log removals of *Giardia* and viruses under different temperatures and pHs. Tables have been prepared for ozone, chlorine, chloramines, and chlorine dioxide. When determining the "T" value, page 5-15 of the Guidance Manual states "The time determined from the tracer study to be used for calculating CT is T_{10}. T_{10} represents the time that 90 percent of the water (and microorganisms within the water) will be exposed to disinfection within the disinfectant contact chamber."

Appendix E of EPA's Guidance Manual entitled "Inactivation Achieved By Various Disinfectants," consists of a series of "CT" tables presenting CT values (at different pHs and temperatures) needed to achieve a certain log inactivation. As an example, for chloramines, at 10° C, and a pH range of 6 to 9, a CT of 310 mg-min/L would be required to achieve 0.5 log inactivation of Giardia cysts. If the residual chloramine concentration were 2 mg/L, then a contact time (T_{10}) of 155 minutes would need to be achieved. Under the same conditions of temperature and pH, a "CT" value of 643 mg-min/L is required to achieve the needed 2 logs inactivation of viruses.

The CT values contained in Table E-13 are based on studies using preformed chloramines. In Appendix F of the Guidance Manual, EPA states that utilities that utilize chloramines can use the protocol contained in Appendix G of the Guidance Manual to demonstrate lower CTs for *Giardia* and virus inactivation than those contained in Table E-13. Appendix G presents protocols for performing inactivation studies using chloramines.

Enhanced SWTR

EPA has been developing and collecting data for several years in anticipation of promulgating a revised standard for trihalomethanes, as well as standards for additional disinfection by-products and disinfectants.

As part of the process, EPA developed a disinfection by-product regulatory analysis model (DBP-RAM). Using raw water quality data; risk assessments for disinfectants, disinfection by-products, and microbiological indicators; and predictive equations for trihalomethanes and two haloacetic acids, the DBP-RAM attempts to predict the health and economic implications of various regulatory scenarios for disinfection by-products.

One of the outcomes of utilizing the DBP-RAM indicates that the existing requirements of the SWTR may not be providing adequate protection against *Giardia*. EPA staff have been considering development of an "enhanced" SWTR which at a minimum would take language from the SWTR Guidance Manual recommending higher log removal of *Giardia* based on poorer source water quality and adopting the higher log removals into the Rule itself. (See additional discussion under D/DBP rule.)

Total Coliform Rule

In June 1989, EPA promulgated a revised regulation for total coliforms (TCR). Where the previous regulation was based on the density of coliforms in a given volume of water, the revised rule is based on the presence/absence of coliforms. Under the TCR, utilities must develop a monitoring plan to collect samples representative of water throughout the distribution system. Monitoring frequency is based on population served. For a system which collects more than 40 samples per month, compliance is based on no more than 5% of the samples collected during the month being coliform positive. Additionally, coliform positive samples must be analyzed for fecal coliforms and/or *E. coli*. Follow-up samples collected for positive coliforms, must also be analyzed for fecal coliforms and/or *E. coli*. The TCR was effective December 31, 1990.

Concerns were raised about the TCR because no variances or exemptions were allowed. The concern was that biofilms in the distribution system may lead to violations of the TCR even though there would not be a demonstrable risk to public health. In August 1989, the American Water Works Association (AWWA) filed a legal petition to review the rule in the U.S. Court of Appeals. As a result of those activities, EPA agreed to allow variances to systems not at risk for fecal or pathogenic contamination. EPA developed interim criteria as guidance to states seeking to identify systems that could operate under a variance without posing an unreasonable risk to health. In the future, EPA will establish variance criteria. Public notification is required for a system operating under a variance.

If a routine sample is total coliform-positive, the water system must collect a set of repeat samples (three samples) within 24 hours of the positive sample. One of the follow-up samples must be from the same tap as the positive sample, and one repeat sample must be from a site within 5 service connections upstream of the positive site, and one repeat

sample must be within 5 service connections downstream of the positive site. If one or more of the repeat samples is coliform positive, the utility must collect an additional set of repeat samples. The system must repeat this process until no coliforms are detected or the system is in violation of the coliform rule. All repeat samples are to be collected on the same day.

If any routine sample, or repeat sample is total coliform positive, the system must analyze the total coliform-positive culture medium to determine if fecal coliforms are present. The system can test for *E. coli* in lieu of fecal coliforms. A violation of the total coliform MCL occurs when: 1) a repeat sample tests positive for fecal coliform or *E. coli*, or 2) an original sample is positive for fecal coliform and/or *E. coli* and is followed by a total coliform positive repeat sample.

The State can invalidate a positive total coliform sample under three conditions: 1) a laboratory determines that improper sample analysis caused the total coliform-positive result, 2) the State determines that a positive total coliform sample resulted from a domestic or other non-distribution system plumbing problem (the State cannot invalidate a sample on the basis of repeat sample results unless all repeat samples collected at the same tap as the original total coliform-positive sample are also total coliform-positive and all repeat samples collected within five service connections of the original tap are total coliform-negative), and 3) the State has substantial grounds to believe that a total coliform-positive result is due to a circumstance or condition which does not reflect water quality in the distribution system. A laboratory must invalidate a total coliform sample (unless total coliforms are detected) if the sample produces a turbid culture in the absence of gas production using an analytical method where gas formation is examined.

***E. Coli* Analytical Methods.** When the TCR was first proposed, there was no EPA approved analytical method for *E. coli* analysis. EPA proposed three analytical methods on June 1, 1990, based on the ability of *E. coli* to produce the enzyme beta-glucuronidase, which hydrolyzes the 4-methylumbelliferyl-beta-D-glucuronide (MUG) contained in the medium to form 4-methylumbelliferane, which fluoresces when exposed to ultraviolet light. EPA has given final approval to all three of the proposed methods: 1) EC medium plus MUG, 2) nutrient agar plus MUG, and 3) the minimal medium ONPG-MUG (MMO-MUG) test.

Disinfectants/Disinfection By-products (D/DBP) Rule

For several years, EPA staff have been developing information in anticipation of establishing a revised THM standard as well as standards for disinfectants and additional disinfection by-products.

On September 15, 1992, EPA published a notice in the Federal Register that the Agency intended to form a committee to develop the D/DBP regulation through a negotiated rule-making ("Reg Neg") process. The Federal Register notice stated:

"EPA is considering establishing an Advisory Committee under the Federal Advisory Committee Act (FACA), and the Negotiated Rule-making Act of 1990. The Committee's purpose would be to negotiate National Primary Drinking Water Regulations for disinfectants and disinfection by-products under Section 1412 of the Safe Drinking Water Act (SDWA). The Committee would consist of representatives of parties that are substantially affected by the outcome of the proposed rule."

"This rule is intended to limit the concentrations of disinfectants and their by-products in United States drinking water systems. These limits conflict with other regulations, such as the Surface Water Treatment Rule, which establish minimum levels of disinfection needed to ensure that human exposure to microbiological contaminants is also limited. Therefore, in developing regulations for disinfection by-products, EPA needs to ensure that drinking water utilities can effectively provide treatment that controls concentrations of both disinfection by-products and microbiological organisms."

The membership of the committee includes: EPA and State regulators, water suppliers, health professionals, environmental organizations, consumer representatives, and other state and local officials. The goal of the negotiating committee is to develop the D/DBP Rule that EPA will publish for public comment.

The Reg Neg committee met in November and December 1992, and January, February and March 1993. The committee is scheduled to meet in late April 1993 for what may be the last meeting of the committee.

At the March 1993 meetings, the Reg Neg committee agreed in concept to a D/DBP Rule. While several issues are yet to be resolved at the April meeting, the D/DBP Rule under discussion contains the following components:

MCLs for Disinfection By-products. The maximum contaminant levels for the disinfection by-products listed below are:

DBPs	Concentration
Trihalomethanes (THMs)	80 ug/L
Haloacetic Acids (HAAs)	60 ug/L
bromate	5-20 ug/L
chlorite	0.3 mg/L

(MCLGs would be set for additional compounds, including: chloroform, bromodichloromethane, bromoform, dichloroacetic acid, bromate, trichloroacetic acid, chloral hydrate, chlorite, and dibromochloromethane. However, at the present time, the committee is not considering MCLs for all of these individual compounds.)

Maximum Residual Disinfectant Levels (MRDLs). The D/DBP Rule also may limit disinfectant residuals to the following concentrations:

Parameter	Concentration
Chlorine	4 mg/L
Chloramines	4-6 mg/L
Chlorine Dioxide	0.8 mg/L

It is not yet clear what would be the difference between an MCL and an MRDL, but the intent of the Reg Neg committee was to convey a message that disinfectants are needed, are not contaminants, and that exceeding the limit should not contain the same "stigma" as exceeding an MCL for a contaminant.

Treatment Technique Requirement for Total Organic Carbon (TOC). In the D/DBP Rule under discussion, all systems with conventional treatment would be required to implement enhanced coagulation. While a technology subcommittee to the full Reg Neg committee is developing a working definition of "enhanced coagulation", the term is often taken to mean modifying coagulation practices to improve the removal of THM and HAA precursors. This is typically achieved through the use of higher coagulant doses and/or lower coagulation pH.

Systems will be required to achieve a percent reduction of TOC between the raw water source and the treated water prior to continuous disinfection based on the TOC levels measured and the alkalinity of the water.

If a system believes that due to unique water quality parameters or operating conditions the above removals are not appropriate for their source water, the system could petition the State for approval of alternative performance standards. The technology subcommittee is also developing criteria for systems to make an application for alternative performance standards. The technology subcommittee anticipates developing language defining "enhanced coagulation" for conventional treatment plants that practice softening.

Systems that have a TOC level of 2.0 mg/L or less are already considered to have enhanced coagulation in place. If, after installation of enhanced coagulation, a system measures TOC above 2.0 mg/L TOC (measured at the point just prior to continuous disinfection), the system is required to conduct a treatment study. The treatment study must examine one additional candidate technology (either GAC or membranes) for achieving greater removal of TOC. If a system uses chlorine as primary disinfectant, and has levels of THMs and HAAs less than 40 ug/L and 30 ug/L, respectively, the system is not required to conduct a treatment study. A system is not required to install the technology studied.

At the same time the D/DBP Rule described above is proposed, EPA would indicate its intent to establish long-term standards for THMs and HAAs of 40 ug/L and 30 ug/L, respectively. This could be done through EPA releasing an "Advanced Notice of Proposed Rule-making." The D/DBP Rule as being discussed by the Reg Neg committee would

contain a requirement that EPA convene a second Reg Neg committee ("Reg Neg 2"). There would be no commitment to finalize the long-term THM and HAA standards until after Reg Neg 2. Before the Reg Neg 2 process begins, the negotiating parties want to support and develop a large, well-funded (e.g. 5 year, $30 million) research program to address many of the unknowns surrounding the regulation of DBPs.

A possible scenario is that EPA will propose the D/DBP Rule for public comment in 1993 and publish a final standard by 1995. Large systems serving over 10,000 people could start compliance monitoring by 1997. Groundwater systems and surface water systems serving less than 10,000 people could begin compliance monitoring in 1999.

Enhanced Surface Water Treatment Rule. The D/DBP Reg Neg committee also has discussed including pieces of an enhanced surface water treatment rule in the D/DBP Rule. The discussion has focused on the SWTR Guidance Manual language that recommends utilities achieve greater reductions in *Giardia* (above the required 3 log) based on source water levels.

The discussions at the Reg Neg meetings have taken a direction towards requiring monitoring in raw and finished water by large systems as a first step before going to an enhanced surface water treatment rule. The monitoring could include *Giardia*, *Cryptosporidium*, total coliforms, fecal coliforms or *E. coli* and viruses (for 1-2 years). At the present time, monitoring frequency is envisioned to be monthly for systems with greater than 100,000 people, and bimonthly for systems with greater than 10,000 people served. The data from the monitoring would be used to develop an enhanced surface water treatment rule.

Lead and Copper Rule

Though copper and lead can be removed by treatment at the source (if there are significant quantities in the raw water), the amount of lead and copper in drinking water depends largely on water corrosivity, and distribution and home piping materials. All water is corrosive to plumbing materials to some degree. Corrosivity is influenced by such chemical parameters as the pH and alkalinity of the water. Low pH (<7.5) and low carbonate alkalinity (<20 mg/L as $CaCO_3$) water is generally more aggressive toward lead and copper than water with higher pH values (8.5 to 9.5) and higher carbonate alkalinity (>50 mg/L as $CaCO_3$). Many other factors influence water corrosivity and lead and copper concentrations such as: other water quality parameters, the number and age of lead soldered joints, workmanship of solder, the length and diameter of the pipes, contact time between water and pipes, and water temperature. The age of the solder or lead containing plumbing has the most influence on lead levels at the tap.

The federal Lead and Copper Rule contains specific deadlines that utilities must meet. The requirements of the Lead and Copper Rule are phased in based on the size of the system. Time-frames are contained in the Lead and Copper Rule for initial home tap sampling, corrosion control studies, installation of optimal corrosion control treatment, and follow-up monitoring. Lead and copper samples are to be collected from a prescribed number (based

on population served) of "worst case" home sites (Tier 1 sites). A utility may also be required to analyze for water quality parameters (pH, alkalinity, calcium, conductivity, water temperature, etc.) in the distribution system. The goal of the Lead and Copper Rule is for utilities to optimize their corrosion control treatment.

EPA has established action levels for lead and copper. The action levels for lead and copper are 0.015 mg/L and 1.3 mg/L, respectively. Action levels are to serve as triggers to determine: whether utilities have optimized corrosion control in their systems, whether systems need to perform corrosion control studies, whether public education is required, whether a system needs to conduct source water monitoring, and whether a system needs to begin replacing lead service lines. If the 90th percentile of home tap samples is greater than the lead action level, then the utility must conduct a public education program.

In May 1992, EPA released a document entitled Lead and Copper Rule, Definitions and Federal Reporting for Milestones, Violations and SNCs. Included in the document are definitions of significant non-compliers (SNCs) under the Lead and Copper Rule. In the past, EPA has targeted SNCs with efforts to bring these systems into compliance. (According to EPA, the designation of SNC is reserved "...for those systems that are considered to pose the most serious threats to public health.")

On October 20, 1992, EPA held a press conference on initial monitoring by large systems under the Lead and Copper Rule. EPA distributed a list of utilities who had not completed and/or submitted the results of the initial monitoring within 3 months of the date the results were due to the State (EPA considers such a utility a "significant non-complier" under the Lead and Copper Rule). In addition, EPA released a list of utilities who had 90th percentile lead and copper levels above the EPA action levels. 130 large systems (serving >50,000 people) across the country were listed by EPA with 90th percentile lead levels above the lead action level. EPA identified an additional 50 of the large systems across the country who had not completed and/or submitted the results of the first six-month monitoring period. These utilities were in violation of the Lead and Copper Rule. 27 large utilities were also identified by EPA as exceeding the copper action level.

EPA has defined SNCs for the corrosion control demonstration and installation phase to include not meeting the deadlines as well as those systems with 90th percentile lead levels of >0.030 mg/l in their most recent tap samples. EPA also has decided not to provide a period of time before the system becomes a SNC, but instead to make the system a SNC in the same quarter that it incurs the violation.

Radionuclides

On July 18, 1991, the EPA published proposed standards for radionuclides in drinking water, including a proposed standard of 300 pCi/L for radon. Table 4 presents the proposed radionuclide standards. Surface water systems would be required to monitor at each entry point into the distribution system after treatment beginning January 1, 1996. (Groundwater systems must take one sample at each entry point to the distribution system which is representative of each well after treatment.) Surface water systems will not be

required to monitor for radon (however the State may require it). Groundwater systems or systems that use both surface and groundwater sources will be required to take four consecutive quarterly samples (for radon) during the first year of each three-year compliance period. (Annual samples are required during the second and third years). Compliance monitoring for radium-226, radium-228, uranium, and adjusted gross alpha is based on annual samples for all systems. (If all samples are below the MCL for three years, then monitoring can be reduced to once every three years.) Only systems determined to be vulnerable will be required to sample for beta and photon emitters. Systems will be required to conduct a one-time monitoring for lead-210 (a decay product of radon). These are proposed standards and final enforceable standards are anticipated in October 1993. Compliance monitoring is likely to be phased in under the standardized monitoring framework.

TABLE 4

PROPOSED AND CURRENT DRINKING WATER STANDARDS FOR RADIONUCLIDES (56 FR 33050)

Constituent	Proposed MCL	Current MCL
Radon-222	300 pCi/L	---
Radium-226 pCi/L[a]	20 pCi/L	5
Radium-228 pCi/L[b]	20 pCi/L	5
Uranium	20 ug/L	---
Adjusted gross alpha	15 pCi/L	15 pCi/L
Beta particles/photon emitters mrem/yr	4 mrem ede/yr[c]	4

[a] Combined with Radium-228.
[b] Combined with Radium-226.
[c] mrem ede/yr = millirem effective dose equivalent per year.

Groundwater Disinfection

A draft Groundwater Disinfection Rule was released in July 1992. EPA anticipates proposing the Rule for public comment in September 1994 and finalizing the Rule in September 1996. It is clear from the draft document, that several issues are as yet unresolved regarding the Groundwater Disinfection Rule.

Under the draft Rule, systems would be required to maintain continuous disinfection of water entering the distribution system and to maintain a detectable disinfectant residual (or HPC <500/mL) in the distribution system (unless the system is not vulnerable to external contamination or significant bacterial growth). Systems must be operated by qualified operators as determined by the State.

The Rule will not include any MCLs, but will be a treatment technique, that will cover viruses, heterotrophic plate count bacteria, and possibly *Legionella.*

EPA also has introduced the concept of a system qualifying as having "natural disinfection" (under specific conditions) thus allowing the system to avoid the disinfection requirements. Examples of natural disinfection would include situations where the nearest potential source of fecal contamination is an adequate distance removed from source water, or if historically the well has not been identified as a source of a waterborne disease outbreak.

For source water disinfection requirements, one option EPA is considering would be to establish specific levels of inactivation to be achieved at each well in a system. Systems then would be required to meet State specified design and operating criteria to ensure compliance with EPA requirements.

Unless the State determines that a system's distribution system is not vulnerable to external contamination or significant bacterial growth, systems must demonstrate a detectable (it is as yet undetermined what will constitute "detectable") disinfectant residual in the distribution system or HPC levels of <500/mL in 95% of samples.

The draft document presents discussions on: analytical requirements, reporting requirements, compliance, and criteria for granting variances and exemptions.

Within 18 months of promulgation of the Rule, systems seeking to avoid the source water disinfection requirements would have to submit a report to the State "...that specifies the process and criteria by which the system proposes to avoid source water disinfection" (e.g. the system qualifies for "natural disinfection" or a variance, and information that supports the proposal).

All community water systems would have to meet the monitoring and performance requirements within 18 and 36 months, respectively, after the Rule is final.

Arsenic

The current MCL for arsenic is 0.05 mg/L. EPA was under a court-ordered deadline to propose a revised arsenic standard by November 1992. EPA sought and received an extension until January 1993 to try and establish a schedule for developing a revised arsenic standard. Currently, the Agency intends to propose a revised standard for arsenic by September 1994 and publish a final standard by September 1996.

Up to now, arsenic has been regulated in drinking water based on its potential to cause skin cancer (usually a non-fatal disease). A recently released study ("Cancer Risks from Arsenic in Drinking Water, Environmental Health Perspectives, Smith et al, 1992) concludes that "...Arsenic can also cause liver, lung, kidney, and bladder cancer and that the population cancer risks due to arsenic in U.S. water supplies may be comparable to those from environmental tobacco smoke and radon in homes....It was estimated that at the current EPA standard of 50 ug/L, the lifetime risk of dying from cancer of the liver, lung, kidney, or bladder from drinking 1 L/day of water would be as high as 13 per 1000 persons."

EPA staff have indicated that a revised standard for arsenic could be proposed as low as 2-5 ug/L.

Sulfate

Sulfate was originally included in the Phase V group of compounds (final standards published July 1992). In 1990, EPA proposed standards of either 400 mg/L or 500 mg/L. When the final Phase V standards were published in July 1992, EPA stated its reason for deferring on a sulfate standard:

> "Sulfate's high treatment cost, low risk, and impact primarily on the transient consumer, combine to create a different set of regulatory challenges than posed by most other drinking water contaminants. For these reasons, EPA is deferring the sulfate standard for a current undetermined period. Specifically, EPA is seeking to extend the legal deadline for establishing the sulfate standard for a period that would allow the Agency to resolve the following issues: 1) Whether further research is needed on how long it takes infants to acclimate to high sulfate-containing water, 2) whether new regulatory approaches need to be established for regulating a contaminant whose health effect is confined largely to transient populations, and 3) whether the Agency should revise its definition of Best Available Technology for small systems (i.e. what should be considered affordable for transient noncommunity water systems)."

The sulfate standard will be proposed in October 1993 and a final standard is anticipated in December 1994.

Standardized Monitoring Framework

As part of the Phase II regulations, EPA adopted a "Standardized Monitoring Framework" to simplify and synchronize monitoring requirements for the various regulated contaminants. Beginning in 1993, a nine-year compliance cycle (divided into 3-three year compliance periods) will be established. After 1993, EPA no longer intends to phase in regulations by system size. Instead, approximately one-third of the systems within a state would begin monitoring during each year of a three year monitoring period (which systems begin monitoring is at the State's discretion). Once a system is scheduled to begin the monitoring during the 3 year monitoring period, the system must monitor during the same

year of the next monitoring period (when required). When a regulation is promulgated during the nine-year compliance cycle, the initial round of monitoring is scheduled to begin during the first full three-year compliance period which begins 18 months after the date of promulgation (the effective date of the regulation).

Secondary Drinking Water Regulations

Table 5 presents the current National Secondary Drinking Water Regulations (NSDWR). Secondary standards are non-enforceable. The secondary standards represent "...reasonable goals for drinking water quality. The States may establish higher or lower levels which may be appropriate dependent upon local conditions such as unavailability of alternate source waters or other compelling factors, provided that public health and welfare are not adversely affected (Code of Federal Regulations, 41 CFR 143.3)." Public notification is required if the secondary standard for fluoride of 2.0 mg/L is exceeded.

Sodium. While no federal secondary standard exists for sodium, EPA did establish special monitoring requirements in 1980 which require community water systems to monitor and report sodium levels in finished drinking water. EPA has suggested a guidance level for sodium of 20 mg/l in drinking water for high risk populations (e.g. individuals with a genetic predisposition to hypertension, pregnant women, and hypertensive patients) as recommended by the American Heart Association (AHA). The North Dakota Department of Health has taken a position that 200 mg/l is a reasonable limit for the normal population. EPA has noted it will reconsider the development of a recommended maximum contaminant level for sodium if additional data become available.

TABLE 5

NATIONAL SECONDARY DRINKING WATER REGULATIONS

Constituent	Federal MCL[a]
Inorganics	
Aluminum (Phase II)	0.05 to 0.2
Chloride	250
Color-Color Units	15
Corrosivity, Sat. Index	Non-corrosive
Fluoride	2.0
Foaming Agents	0.5
Iron	0.3
Manganese	0.05
Odor-TON[b]	3
pH	6.5-8.5
Silver	0.1
Sulfate	250
Total Dissolved Solids	500
Zinc	5

[a] Units in mg/L, except for color, odor, and pH.
[b] Threshold Odor Number.

APPENDIX A

APPENDIX A

ACRONYMS AND ABBREVIATIONS

AHA	American Heart Association
AWWA	American Water Works Association
BAT	best available technology
CFR	Code of Federal Regulations
CT	contact time
D/DBP	Disinfectants/Disinfection by-Products
DBCP	Dibromo-3-chloropropane
DBP-RAM	disinfection by-product regulatory analysis model
EPA	Environmental Protection Agency
FACA	Federal Advisory Committee Act
GAC	granular activated carbon
HAA	haloacetic acids
HPC	heterotrophic plate count
IOC	inorganic chemicals
L/day	liter(s) per day
MCL	maximum contaminant level
MCLG	maximum contaminant level goal
MFL	million fibers per liter
mg-min/L	milligram-minutes per liter
mg/L	milligram per liter
MMO-MUG	minimal medium ONPG-4-methylumbelliferyl-beta-D glucuronide
MRDL	maximum residual disinfectant level
mrem ede/yr	millirem effective dose equivalent per year
MUG	4-methylumbelliferyl-beta-D-glucuronide
NIPDWR	National Interim Primary Drinking Water Regulations
NPDWR	National Primary Drinking Water Regulations
NSDWR	National Secondary Drinking Water Regulations
NTU	nephelometric turbidity unit
ONPG-MUG	*o*-nitrophenyl-*ß*-D-galactopyranoside-MUG
PCB	polychlorinated biphenyls
pCi/L	picocuries per liter
ppm	parts per million
Reg Neg	Negotiated Rule-making process
SDWA	Safe Drinking Water Act
SMF	Standardized Monitoring Format
SNC	significant non-compliers
SOC	synthetic organic chemicals
SWTR	Surface Water Treatment Rule
TCR	Total Coliform Rule
THM	trihalomethanes
ug/L	micrograms per liter
VOC	volatile organic chemicals

APPENDIX B

APPENDIX B

CONTAMINANT LIST (83 CHEMICALS)

Volatile Organic Chemicals

Benzene
Carbon Tetrachloride
Chlorobenzene
Dichlorobenzene
1,2-dichloroethane
1,1-dichloroethylene
cis-1,2,-dichloroethylene
trans 1,2-dichloroethylene
Methylene chloride
Tetrachloroethylene
Trichlorobenzene
Trichloroethylene
1,1,,1-Trichloroethane
Vinyl chloride

Organic Chemicals

Acrylamide
Adipates
Alachlor
Aldicarb
Aldicarb sulfone
Aldicarb sulfoxide
Atrazine
Carbofuran
Chlordane
2,4-D
Dalapon
Dibromochloropropane (DBCP)
1,2-Dichloropropane
Dinoseb
Diquat
Endothall
Endrin
Epichlorohydrin
Ethylbenzene
Ethylene Dibromide (EDB)
Aluminum
antimony
Arsenic
Asbestos
Barium
Beryllium
Cadmium
Chromium
Glyphosate
Heptachlor
Heptachlor epoxide
Hexachlorocyclopentadiene
Lindane
Methoxychlor
PAHs
PCBs
Pentachlorophenol
Phthlates
Picloram
Simazine
Styrene
2,3,7,8-TCDD (dioxin)
Toluene
Toxaphene
2,4,5-TP
1,1,2-Trichloroethane
Vydate
Xylene
Mercury
Molybdenum
Nickel
Nitrate
Nitrite
Selenium
Silver
Sodium

APPENDIX B

CONTAMINANT LIST (83 CHEMICALS) (continued)

Inorganics

Copper
Cyanide
Fluoride
Lead
Sulfate
Thallium
Vanadium
Zinc

Radionuclides

Beta particle and photon radioactivity
Gross alpha particle activity
Radium 226 and 228
Radon
Uranium

Microbiological

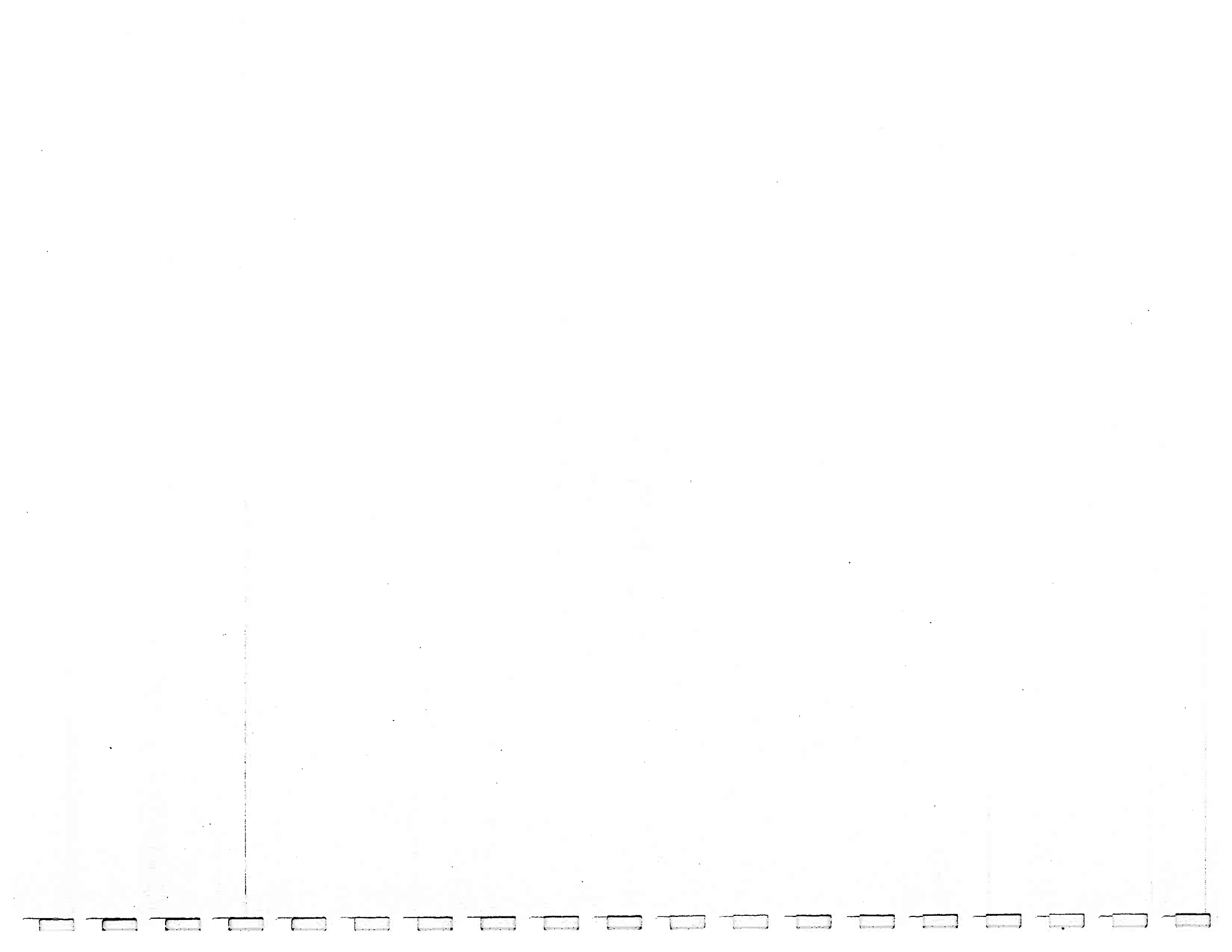
Giardia Lamblia
Legionella
Standard plate count bacteria
Total coliforms
Viruses

Physical parameter

Turbidity

APPENDIX C

Community and Rural Water Systems Needs Assessment Summary



Communities with Signed Agreements of Intent or those served by Rural Water Associations with Signed Agreements

Alamo
Anamoose
Antler (RW)
Berthold
Bottineau
Bowbells
Burlington
Carbury (RW)
Carpio
Columbus
Crosby
Deering
Des Lacs (RW)
Donnybrook (RW)
Douglas (RW)
Drake
Epping (RW)
Flaxton
Fortuna
Gardena (RW)
Glenburn (RW)
Grano (RW)
Granville
Grenora
Karlsruhe
Kenmare
Kramer (RW)
Landa (RW)
Lansford (RW)
Larson
Loraine (RW)
Makoti
Max (RW)
Maxbass
Minot
Mohall
New Town
Newburg (RW)
Noonan
Norma (RW)
Norwich (RW)
Overly (RW)
Parshall
Plaza
Powers Lake
Ray and Tioga (R & T)
Rugby
Ruso
Russell (RW)
Sawyer
Sherwood
Souris
Stanley
Surrey (RW)
Tolley (RW)
Towner
Trenton
Upham
Voltaire (RW)
Westhope
Wildrose
Williston
Willow City

NORTHWEST AREA WATER SUPPLY - COMMUNITY NEEDS ASSESSMENT

Alamo
Williams County

Updated May 1993 from 3/15/88
Missouri River Watershed

1988 Population : 122
1990 Census Data: 69
2010 Projection : 69
Population Trend: Decreasing

Leonard Halvorson - Mayor
Box 43
Alamo, ND 58830
Phone: 528-3362

Number of Residential Users: N/A
Municipal/Industrial Users: N/A

RESPONSE TO AGREEMENT OF INTENT: Signed Agreement

WATER SOURCE, USE, DEMANDS AND QUALITY SUMMARY:

Source: **Private Wells**
Approx. depth of wells: ?

Dependable Water Supply: NO

Community Perception of Water Quality

Is water quality good? ___ fair? YES poor? ___

TREATMENT FACILITIES, STORAGE AND ADDITIONAL DEMANDS:

Water Treatment: N/A

Capacity of system: N/A

Existing Storage [gal]: 0 Elevated 0 Ground

Additional Demands
Industrial Requirements: 0 gal/day
Fire Requirements: 0 gal/hour

WATER RATE STRUCTURE:

Water Rates: N/A
Comments: The community is interested in being served by NAWS through a rural water supply system or directly. The community would need to construct its own distribution facilities if it were not part of a rural water system.

NORTHWEST AREA WATER SUPPLY - COMMUNITY NEEDS ASSESSMENT

Anamoose
McHenry County

Updated May 1993 from 03/16/88
Hudson Bay Watershed

1988 Population : 355
1990 Census Data: 277
2010 Projection : 277
Population Trend: Decreasing

Stan Martin - Auditor
PO Box 767
Anamoose, ND 58710
Phone: 465-3613

Number of Residential Users: 154 Households
Municipal/Industrial Users: 2

RESPONSE TO AGREEMENT OF INTENT: Signed Agreement

WATER SOURCE, USE, DEMANDS AND QUALITY SUMMARY:

Source: **Groundwater**

1985 Use:	0.000 MG	1989 Use:	15.180 MG
1986 Use:	11.088 MG	1990 Use:	13.134 MG
1987 Use:	9.702 MG	1991 Use:	11.715 MG
1988 Use:	15.444 MG	1992 Use:	11.814 MG

Average Annual Groundwater Use: 12.582 MG
Average Daily Use: 0.034 MG
Peak Daily Use: 0.060 MG
Average Daily Use Per Capita 124 gallons
Dependable Water Supply: YES

Water Quality Evaluation and Categorization - 1990

Category VI - Exceeds Minimum Standard for TDS, Sulfate Chloride, pH, and/or Recommended Standard for Sodium.

TDS	937.0 mg/l	>	500 mg/l
Sodium	224.0 mg/l	>	200 mg/l

Community Perception of Water Quality:

Is water quality good? ___ fair? YES poor? ___
Comments: Manganese and iron.

TREATMENT FACILITIES, STORAGE AND ADDITIONAL DEMANDS:

Water Treatment: Iron, sand filtration, fluoride testing.

Capacity of system: 100 gal/min (144,000 gal/day)

Existing Storage [gal]: 50,000 Elevated 50,000 Ground

Additional Demands
Industrial Requirements: 0 gal/day
Fire Requirements: 0 gal/hour

WATER RATE STRUCTURE:

Water Rates: $17.00/first 2000 gallons; $1.30/each additional 1000 gal
Comments: New treatment facility operational in 1988. Storage was increased by installing a 50,000 gallon storage reservoir under the new treatment plant.

NORTHWEST AREA WATER SUPPLY - COMMUNITY NEEDS ASSESSMENT

Antler
Bottineau County

Updated May 1993 from 03/15/88
Hudson Bay Watershed

1988 Population : 80
1990 Census Data: 74
2010 Projection : 74
Population Trend: Decreasing

Diane Johnson - Auditor
P.O. Box 23
Antler, ND 58711
Phone: 267-3671

Number of Residential Users: N/A
Municipal/Industrial Users: N/A

RESPONSE TO AGREEMENT OF INTENT: Signed (Rural Water)

WATER SOURCE, USE, DEMANDS AND QUALITY SUMMARY:

Source: **All Seasons WUA - System III**

Dependable Water Supply: YES

Community Perception of Water Quality:

Is water quality good? ___ fair? ___ poor? YES
Comments: All Seasons WUA System - III; Poor quality rural water

TREATMENT FACILITIES, STORAGE AND ADDITIONAL DEMANDS:

Water Treatment: N/A

Capacity of system: N/A

Existing Storage [gal]: 0 Elevated 0 Ground

Additional Demands
Industrial Requirements: 0 gal/day
Fire Requirements: 0 gal/hour

WATER RATE STRUCTURE:

Water Rates: Rural Water Rates
Comments: Request in 1988 to improve rural water supply and quality. Members of Rural Water System on an individual basis.

NORTHWEST AREA WATER SUPPLY - COMMUNITY NEEDS ASSESSMENT

Berthold
Ward County

Updated May 1993 from 03/24/88
Hudson Bay Watershed

1988 Population : 450
1990 Census Data: 409
2010 Projection : 409
Population Trend: Decreasing

Neadene Schwope - Auditor
P.O. Box 126
Berthold, ND 58718
Phone: 453-3641

Number of Residential Users: 150 Households
Municipal/Industrial Users: 19

RESPONSE TO AGREEMENT OF INTENT: Signed Agreement

WATER SOURCE, USE, DEMANDS AND QUALITY SUMMARY:

Source: **Groundwater**

1985 Use:	10.494 MG	1989 Use:	9.900 MG
1986 Use:	8.745 MG	1990 Use:	9.174 MG
1987 Use:	8.646 MG	1991 Use:	8.316 MG
1988 Use:	10.890 MG	1992 Use:	9.669 MG

Average Annual Groundwater Use: 9.479 MG
Average Daily Use: 0.026 MG
Peak Daily Use: 0.040 MG
Average Daily Use Per Capita 64 gallons
Dependable Water Supply: YES

Water Quality Evaluation and Categorization - 1992

Category IV - Exceeds Less Than Four Secondary Standards and TDS is greater than 1000.

TDS	2340.0 mg/l >	1000 mg/l
Sodium	979.0 mg/l >	200 mg/l
Chloride	351.0 mg/l >	250 mg/l

Community Perception of Water Quality:

Is water quality good? YES fair? ___ poor? ___
Comments: Soda water, hard on faucets

TREATMENT FACILITIES, STORAGE AND ADDITIONAL DEMANDS:

Water Treatment: none

Capacity of system: Limited to well capacity

Existing Storage [gal]: 50,000 Elevated 3,000 Ground

Additional Demands
Industrial Requirements: 0 gal/day
Fire Requirements: 0 gal/hour

WATER RATE STRUCTURE:

Water Rates: $7/first 1000 gallons; $1/1000 additional
Comments: 1988 - Onetime member of Mountrail Rural Water. Drinking water hauled to door by Mr. Berg ($1.50/5 gal; $10/100 gal; $30/500 gal), still in business 1993. Water supply is located six to seven miles west of town.

NORTHWEST AREA WATER SUPPLY - COMMUNITY NEEDS ASSESSMENT

Bottineau Updated May 1993 from 03/15/88
Bottineau County Hudson Bay Watershed

1988 Population : 2829
1990 Census Data: 2598
2010 Projection : 2650 (+2%)
Population Trend: Increasing

Norm Larson - Mayor
115 W. 6th Street
Bottineau, ND 58318
Phone: 228-3232

Number of Residential Users: 1000 Households
Municipal/Industrial Users: 100

RESPONSE TO AGREEMENT OF INTENT: Signed Agreement

WATER SOURCE, USE, DEMANDS AND QUALITY SUMMARY:

Source: **Groundwater**

1985 Use:	139.557 MG	1989 Use:	127.050 MG
1986 Use:	125.532 MG	1990 Use:	120.450 MG
1987 Use:	121.770 MG	1991 Use:	119.625 MG
1988 Use:	123.552 MG	1992 Use:	0.000 MG Not Reported

Average Annual Groundwater Use: 125.362 MG
Average Daily Use: 0.343 MG
Peak Daily Use: 0.780 MG
Average Daily Use Per Capita 132 gallons
Dependable Water Supply: YES

Water Quality Evaluation and Categorization - 1991

Category V - Exceeds Iron or Manganese Secondary Standards

Manganese	1.450 mg/l	> 0.05 mg/l
Sulfates	388.0 mg/l	> 250 mg/l

Community Perception of Water Quality:

Is water quality good? ___ fair? YES poor? ___
Comments: Manganese; problems with pipe deposits breaking loose after repairs are made.

TREATMENT FACILITIES, STORAGE AND ADDITIONAL DEMANDS:

Water Treatment: Chlorine & polyphosphate

Capacity of system: 1,000,000

Existing Storage [gal]: 0 Elevated 2,000,000 Ground

Additional Demands
Industrial Requirements: 0 gal/day
Fire Requirements: 0 gal/hour

WATER RATE STRUCTURE:

Water Rates: $5.50/first 2000 gallons; $1.20/additional 1000 gallons.
Comments: Interest in water is dependent upon final cost. Application was submitted in 1988 for upgrading their treatment plant. They would also have been able to supply a portion of All Seasons RWU System - I with these improvements. This application currently is on hold. Second contact is Keith Fulsebakke, Water Superintendent (228-3620).

NORTHWEST AREA WATER SUPPLY - COMMUNITY NEEDS ASSESSMENT

Bowbells
Burke County

Updated May 1993 from 03/17/88
Hudson Bay Watershed

1988 Population : 587
1990 Census Data: 498
2010 Projection : 498
Population Trend: Decreasing

Ken Nelson
~~Gary~~ Melby - Mayor
P.O. Box ~~100~~ 127
Bowbells, ND 58721
Phone: 377-2608

Number of Residential Users: 266 Households
Municipal/Industrial Users: N/A

RESPONSE TO AGREEMENT OF INTENT: Signed Agreement

WATER SOURCE, USE, DEMANDS AND QUALITY SUMMARY:

Source: **Groundwater**

1985 Use:	0.000 MG	1989 Use:	0.000 MG
1986 Use:	0.000 MG	1990 Use:	0.000 MG
1987 Use:	0.000 MG	1991 Use:	12.606 MG
1988 Use:	0.000 MG	1992 Use:	12.177 MG

Average Annual Groundwater Use: 12.391 MG
Average Daily Use: 0.034 MG
Peak Daily Use: 0.090 MG
Average Daily Use Per Capita 68 gallons
Dependable Water Supply: YES
(No meters on wells prior to 1990)

Water Quality Evaluation and Categorization - 1991

Category II - Exceeds Four (4) or More Secondary Standards and TDS is greater than 1000 mg/l.

TDS	2170.0 mg/l	>	1000 mg/l
Iron	0.478 mg/l	>	0.3 mg/l
Sodium	884.0 mg/l	>	200 mg/l
Chloride	314.0 mg/l	>	250 mg/l

Community Perception of Water Quality:

Is water quality good? ___ fair? YES poor? ___
Comments: Iron and manganese

TREATMENT FACILITIES, STORAGE AND ADDITIONAL DEMANDS:

Water Treatment: none

Capacity of system: approx. 114 gal/min (165,000 gal/day)

Existing Storage [gal]: 50,000 Elevated 0 Ground

Additional Demands
Industrial Requirements: 0 gal/day
Fire Requirements: 0 gal/hour

WATER RATE STRUCTURE:

Water Rates: $7.50/2000 gal; $1.50/1000 additional
Comments: Once voted Upper Souris RWS down. Drinking water hauled by Jeff Kalmbach in Flaxton. MR&I Study by Upper Souris (KBM) to add Bowbells to the rural system. This study was requested by the city and is being reviewed again in 1993.

NORTHWEST AREA WATER SUPPLY - COMMUNITY NEEDS ASSESSMENT

Burlington
Ward County

Updated May 1993 from 03/18/88
Hudson Bay Watershed

1988 Population : 1,180
1990 Census Data: 995
2010 Projection : 1,200 (+20%)
Population Trend: Decreasing

Devra Smestad - Auditor
225 Wallace, Box 159
Burlington, ND 58722
Phone: 852-5233

Number of Residential Users: 482 Households
Municipal/Industrial Users: 14

RESPONSE TO AGREEMENT OF INTENT: Signed Agreement

WATER SOURCE, USE, DEMANDS AND QUALITY SUMMARY:

Source: **Groundwater**

1985 Use:	41.910 MG	1989 Use:	56.760 MG
1986 Use:	45.672 MG	1990 Use:	46.596 MG
1987 Use:	36.696 MG	1991 Use:	51.150 MG
1988 Use:	52.404 MG	1992 Use:	55.308 MG

Average Annual Groundwater Use: 48.312 MG
Average Daily Use: 0.132 MG
Peak Daily Use: 0.250 MG
Average Daily Use Per Capita 133 gallons
Dependable Water Supply: YES

Water Quality Evaluation and Categorization - 1990

Category I - COMMUNITY EXCEEDS PRIMARY STANDARDS
Sample Exceeds Primary Quality Standards for Nitrogen, Fluoride or Lead.

Lead	0.0200 mg/l >	0.015 mg/l
Iron	2.150 mg/l >	0.3 mg/l
Manganese	0.140 mg/l >	0.05 mg/l
Sodium	240.0 mg/l >	200 mg/l

Community Perception of Water Quality:
Is water quality good? YES fair? ___ poor? ___
Comments: High iron and manganese, Good when filtered to remove both iron and manganese

TREATMENT FACILITIES, STORAGE AND ADDITIONAL DEMANDS:

Water Treatment: Reservoir - Chlorine

Capacity of system: 500,000 gpd

Existing Storage [gal]: 0 Elevated 600,000 Ground

Additional Demands
Industrial Requirements: 0 gal/day
Fire Requirements: 30,000 gal/hour

WATER RATE STRUCTURE:

Water Rates: $8/2000 gal; $1.50/1000 additional.
Comments: Requested $500,000 in MR&I funding for construction of a treatment plant. Funds were not received but a plant was constructed in September 1992 through a local bond issue. The treatment and filtration plant included an additional 300,000 gallons of storage under the plant. Approx. 480,000 gal/month needed to serve the Dakota Boys Ranch and a 100+ housing development located near the Minot Country Club.

NORTHWEST AREA WATER SUPPLY - COMMUNITY NEEDS ASSESSMENT

Carbury
Bottineau County

Updated May 1993 from 03/88
Hudson Bay Watershed

1988 Population : 4
1990 Census Data: N/A
2010 Projection :
Population Trend: Decreasing

No Contact

Souris, ND 58783
Phone:

Number of Residential Users: N/A
Municipal/Industrial Users: N/A

RESPONSE TO AGREEMENT OF INTENT: Signed (Rural Water)

WATER SOURCE, USE, DEMANDS AND QUALITY SUMMARY:

Source: **All Seasons RWU System - II**

Dependable Water Supply: NO

Community Perception of Water Quality:

Is water quality good? ___ fair? ___ poor? ___
Comments:

TREATMENT FACILITIES, STORAGE AND ADDITIONAL DEMANDS:

Water Treatment: N/A

Capacity of system: N/A

Existing Storage [gal]: 0 Elevated 0 Ground

Additional Demands
Industrial Requirements: 0 gal/day
Fire Requirements: 0 gal/hour

WATER RATE STRUCTURE:

Water Rates: Rural Water Rates
Comments: Some rural water connections in place but not in use.

NORTHWEST AREA WATER SUPPLY - COMMUNITY NEEDS ASSESSMENT

Carpio
Ward County

Updated May 1993 from 03/17/88
Missouri River Watershed

1988 Population : 245
1990 Census Data: 178
2010 Projection : 178
Population Trend: Decreasing

Colleen Peterson - Auditor
Box 159
Carpio, ND 58725
Phone: 468-5487

Number of Residential Users: 75 Households
Municipal/Industrial Users: 1

RESPONSE TO AGREEMENT OF INTENT: Signed Agreement

WATER SOURCE, USE, DEMANDS AND QUALITY SUMMARY:

Source: **Private Wells.**
Approx. depth of wells: 25 to 30 feet

Dependable Water Supply: YES

Community Perception of Water Quality:

Is water quality good? ___ fair? ___ poor? YES
Comments: Would like a central water system

TREATMENT FACILITIES, STORAGE AND ADDITIONAL DEMANDS:

Water Treatment: N/A

Capacity of system: N/A

Existing Storage [gal]: 0 Elevated 0 Ground

Additional Demands
Industrial Requirements: 0 gal/day
Fire Requirements: 0 gal/hour

WATER RATE STRUCTURE:

Water Rates: N/A
Comments: KBM completed a preliminary study several years ago for a central system which would have used the Upper Souris Rural Water System for a supply.

NORTHWEST AREA WATER SUPPLY - COMMUNITY NEEDS ASSESSMENT

Columbus
Burke County

Updated May 1993 from 04/15/88
Missouri River Watershed

1988 Population : 325
1990 Census Data: 223
2010 Projection : 223
Population Trend: Decreasing

David W. Peterson - Mayor
P.O. Box 63
Columbus, ND 58727
Phone: 939-5632

Number of Residential Users: 134 Households
Municipal/Industrial Users: 6

RESPONSE TO AGREEMENT OF INTENT: Signed Agreement

WATER SOURCE, USE, DEMANDS AND QUALITY SUMMARY:

Source: **Groundwater**

1985 Use:	1.716 MG	1989 Use:	12.540 MG
1986 Use:	11.550 MG	1990 Use:	9.009 MG
1987 Use:	10.527 MG	1991 Use:	8.283 MG
1988 Use:	15.807 MG	1992 Use:	7.755 MG

Average Annual Groundwater Use:	9.648 MG
Average Daily Use:	0.026 MG
Peak Daily Use:	0.035 MG
Average Daily Use Per Capita	118 gallons
Dependable Water Supply: YES	

Water Quality Evaluation and Categorization - 1991

Category II - Exceeds Four (4) or More Secondary Standards and TDS is greater than 1000 mg/l.

TDS	1960.0 mg/l	> 1000 mg/l
Iron	1.340 mg/l	> 0.3 mg/l
Manganese	0.669 mg/l	> 0.05 mg/l
Sodium	449.0 mg/l	> 200 mg/l
Sulfates	851.0 mg/l	> 250 mg/l

Community Perception of Water Quality:

Is water quality good? ___ fair? ___ poor? YES
Comments: Water is rusty and very hard.

TREATMENT FACILITIES, STORAGE AND ADDITIONAL DEMANDS:

Water Treatment: Chemical suspension system.

Capacity of system: 75 gpm (108,000 gal/day)

Existing Storage [gal]: 50,000 Elevated 10,000 Ground

Additional Demands
Industrial Requirements: 0 gal/day
Fire Requirements: 0 gal/hour

WATER RATE STRUCTURE:

Water Rates: $12/quarter ($48 min); $1.75/1000 gallon summer rate.
Comments: Their well is rated at around 150 gpm but has not been serviced to remove sediments. They are interested in a new water supply if the costs are reasonable.

NORTHWEST AREA WATER SUPPLY - COMMUNITY NEEDS ASSESSMENT

Crosby
Divide County

Updated May 1993 from 03/14/88
Missouri River Watershed

1988 Population : 1,469
1990 Census Data: 1,312
2010 Projection : 1,312 (+0%)
Population Trend: Decreasing

Number of Residential Users: 555 Households
Municipal/Industrial Users: 98

Richard Anderson - Water Works Supt.
Box 67
Crosby, ND 58730
Phone: 965-6029

RESPONSE TO AGREEMENT OF INTENT: Signed Agreement

WATER SOURCE, USE, DEMANDS AND QUALITY SUMMARY:

Source: **Groundwater**

1985 Use:	61.248 MG	1989 Use:	84.579 MG
1986 Use:	67.848 MG	1990 Use:	67.452 MG
1987 Use:	73.656 MG	1991 Use:	35.013 MG
1988 Use:	83.358 MG	1992 Use:	67.221 MG

Average Annual Groundwater Use: 67.547 MG
Average Daily Use: 0.185 MG
Peak Daily Use: 0.500 MG
Average Daily Use Per Capita 141 gallons
Dependable Water Supply: YES

Water Quality Evaluation and Categorization - 1991

Category VI - Exceeds Minimum Standard for TDS, Sulfate Chloride, pH, and or Recommended Standard for Sodium.

TDS	684.0 mg/l	> 500 mg/l
Sodium	254.0 mg/l	> 200 mg/l
pH	8.92	Exceeds 8.5 or Below 6.5

Community Perception of Water Quality:

Is water quality good? ___ fair? YES poor? ___

TREATMENT FACILITIES, STORAGE AND ADDITIONAL DEMANDS:

Water Treatment: Liquid alum, chlorine; lime softening

Capacity of system: 450 gal/min

Existing Storage [gal]: 25,000 Elevated 500,000 Ground

Additional Demands
Industrial Requirements: 0 gal/day
Fire Requirements: 0 gal/hour

WATER RATE STRUCTURE:

Water Rates: $5/first 1000; $3/1000 additional
Comments: 1988 comment: Some mixed feelings on need for water.
Population projection from phone call to city auditor.

NORTHWEST AREA WATER SUPPLY - COMMUNITY NEEDS ASSESSMENT

Deering
McHenry County

Updated May 1993 from 03/23/88
Hudson Bay Watershed

1988 Population : 175
1990 Census Data: 99
2010 Projection : 99
Population Trend: Decreasing

Laurie Herslip - Auditor
P.O. Box 12
Deering, ND 58731
Phone: 728-6405

Number of Residential Users: 60 Households
Municipal/Industrial Users: 5

RESPONSE TO AGREEMENT OF INTENT: Signed Agreement

WATER SOURCE, USE, DEMANDS AND QUALITY SUMMARY:

Source: **Groundwater**

1985 Use:	2.706 MG	1989 Use:	3.465 MG
1986 Use:	2.310 MG	1990 Use:	2.739 MG
1987 Use:	2.838 MG	1991 Use:	2.805 MG
1988 Use:	4.224 MG	1992 Use:	2.376 MG

Average Annual Groundwater Use: 2.933 MG
Average Daily Use: 0.008 MG
Peak Daily Use: 0.015 MG
Average Daily Use Per Capita 81 gallons
Dependable Water Supply: YES

Water Quality Evaluation and Categorization - 1990

Category V - Exceeds Iron or Manganese Secondary Standards

Iron	0.755 mg/l	> 0.3 mg/l
Manganese	0.238 mg/l	> 0.05 mg/l

Community Perception of Water Quality:

Is water quality good? YES fair? ___ poor? ___
Comments: Iron and manganese
Current water stains; needs additional treatment

TREATMENT FACILITIES, STORAGE AND ADDITIONAL DEMANDS:

Water Treatment: Chlorination and rust-inhibiting chemicals

Capacity of system: Limited to well capacity

Existing Storage [gal]: 0 Elevated 0 Ground

Additional Demands
Industrial Requirements: 0 gal/day
Fire Requirements: 0 gal/hour

WATER RATE STRUCTURE:

Water Rates: $9.75/first 2000 gallons; $1/1000 gallons additional
Comments: Have good water supply, just need to take care of iron and manganese. City applied in 1988 for funding for a treatment plant: MR&I 75% or a Community Development Block Grant 80%. Plant was not constructed. Supply is a pressure system without storage.

NORTHWEST AREA WATER SUPPLY - COMMUNITY NEEDS ASSESSMENT

Des Lacs
Ward County

Updated May 1993 from 03/16/88
Missouri River Watershed

1988 Population : 212
1990 Census Data: 216
2010 Projection : 216
Population Trend: Decreasing

Robert Eillis - Auditor
PO Box 96
Des Lacs, ND 58733
Phone: 725-4315

Number of Residential Users: 68 Households
Municipal/Industrial Users: 1 School

RESPONSE TO AGREEMENT OF INTENT: Signed (Rural Water)

WATER SOURCE, USE, DEMANDS AND QUALITY SUMMARY:

Source: **North Prairie RWA - System I and Private Wells**
Individual Users

Non-Domestic Source: **Des Lacs Reservoir** (Reported to State Water Commission)

1985 Use:	0.792 MG	1989 Use:	1.518 MG
1986 Use:	0.627 MG	1990 Use:	0.924 MG
1987 Use:	1.023 MG	1991 Use:	0.000 MG
1988 Use:	0.792 MG	1992 Use:	0.000 MG

Average Annual Surface Water Use: 0.946 MG
Dependable Water Supply: YES

Community Perception of Water Quality:

Is water quality good? YES fair? ___ poor? ___
Comments: Chlorine smell and/or taste.
Some don't use rural water for coffee.

TREATMENT FACILITIES, STORAGE AND ADDITIONAL DEMANDS:

Water Treatment: N/A

Capacity of system: N/A

Existing Storage [gal]: 0 Elevated 0 Ground

Additional Demands
Industrial Requirements: 0 gal/day
Fire Requirements: 0 gal/hour

WATER RATE STRUCTURE:

Water Rates: Rural Water Rates
Comments: Have city lawn irrigation system. The city has permit for water from Des Lacs Reservoir from May through October; this water is stored in a 100,000 gal water tower purchased from BN for $1. There is a separate distribution system for this water; over the past several years, with the low lake levels, its use has been restricted.

NORTHWEST AREA WATER SUPPLY - COMMUNITY NEEDS ASSESSMENT

Donnybrook
Ward County

Updated May 1993 from 03/17/88
Missouri River Watershed

1988 Population : 139
1990 Census Data: 106
2010 Projection : 106
Population Trend: Decreasing

Marshall Johnson - Mayor
Box 57
Donnybrook, ND 58734
Phone: 482-7848

Number of Residential Users: 49 Households
Municipal/Industrial Users: N/A

RESPONSE TO AGREEMENT OF INTENT: Signed (Rural Water)

WATER SOURCE, USE, DEMANDS AND QUALITY SUMMARY:

Source: **Upper Souris RWA System - I and Private Wells**
Approx. depth of private wells: ?

Dependable Water Supply: YES

Community Perception of Water Quality:

Is water quality good? YES fair? ___ poor? ___
Comments: 42 homes hooked up to Upper Souris RWS on individual basis.
Well water is poor quality.

TREATMENT FACILITIES, STORAGE AND ADDITIONAL DEMANDS:

Water Treatment: N/A

Capacity of system: N/A

Existing Storage [gal]: 0 Elevated 0 Ground

Additional Demands
Industrial Requirements: 0 gal/day
Fire Requirements: 0 gal/hour

WATER RATE STRUCTURE:

Water Rates: Rural Water Rates
Comments: Members of Rural Water System on an individual basis.

NORTHWEST AREA WATER SUPPLY - COMMUNITY NEEDS ASSESSMENT

Douglas
Ward County

Updated May 1993 from 03/15/88
Missouri River Watershed

1988 Population : 121
1990 Census Data: 93
2010 Projection : 93
Population Trend: Decreasing

Florine Knudtson - Auditor

Douglas, ND 58735
Phone: 529-4427

Number of Residential Users: 30 Households
Municipal/Industrial Users: N/A

RESPONSE TO AGREEMENT OF INTENT: Signed (Rural Water)

WATER SOURCE, USE, DEMANDS AND QUALITY SUMMARY:

Source: **North Prairie RWA System - I and Private Wells**
Approx. depth of private wells: 80 to 90 feet

Dependable Water Supply: YES

Community Perception of Water Quality:

Is water quality good? YES fair? ___ poor? ___
Comments: Individually belong to North Prairie RWS

TREATMENT FACILITIES, STORAGE AND ADDITIONAL DEMANDS:

Water Treatment: N/A

Capacity of system: N/A

Existing Storage [gal]: 0 Elevated 0 Ground

Additional Demands
Industrial Requirements: 0 gal/day
Fire Requirements: 0 gal/hour

WATER RATE STRUCTURE:

Water Rates: Rural Water Rates
Comments: Committed to North Prairie RWS

NORTHWEST AREA WATER SUPPLY - COMMUNITY NEEDS ASSESSMENT

Drake
McHenry County

Updated May 1993 from 03/18/88
Hudson Bay Watershed

1988 Population : 479
1990 Census Data: 361
2010 Projection : 361
Population Trend: Decreasing

Betty Bruner - Auditor
Box 202
Drake, ND 58736
Phone: 465-3794

Number of Residential Users: 194 Households
Municipal/Industrial Users: 12

RESPONSE TO AGREEMENT OF INTENT: Signed Agreement

WATER SOURCE, USE, DEMANDS AND QUALITY SUMMARY:

Source: **Groundwater**

1985 Use:	17.886 MG	1989 Use:	13.530 MG
1986 Use:	17.820 MG	1990 Use:	13.134 MG
1987 Use:	15.411 MG	1991 Use:	13.563 MG
1988 Use:	23.562 MG	1992 Use:	14.487 MG

Average Annual Groundwater Use: 16.174 MG
Average Daily Use: 0.044 MG
Peak Daily Use: 0.103 MG
Average Daily Use Per Capita 123 gallons
Dependable Water Supply: NO, past problem with frozen water tower.

Water Quality Evaluation and Categorization - 1990

Category II - Exceeds Four (4) or More Secondary Standards and TDS is greater than 1000 mg/l.

TDS	1200.0 mg/l	> 1000 mg/l
Iron	0.403 mg/l	> 0.3 mg/l
Manganese	0.114 mg/l	> 0.05 mg/l
Sodium	215.0 mg/l	> 200 mg/l
Sulfates	456.0 mg/l	> 250 mg/l

Community Perception of Water Quality:

Is water quality good? ___ fair? YES poor? ___
Comments: Iron, regular distribution test available; rusty & corrosive

TREATMENT FACILITIES, STORAGE AND ADDITIONAL DEMANDS:

Water Treatment: Chlorinator

Capacity of system: 225 gpm (well pump capacity)

Existing Storage [gal]: 50,000 Elevated 0 Ground

Additional Demands
Industrial Requirements: 0 gal/day
Fire Requirements: 0 gal/hour

WATER RATE STRUCTURE:

Water Rates: $10/first 1000 gallons; $1/1000 gallons additional (summer rate is $0.06/1000 gallons)
Comments: Interested in system if rates are beneficial to the city. The city is currently using a single well.

NORTHWEST AREA WATER SUPPLY - COMMUNITY NEEDS ASSESSMENT

Epping
Williams County

Updated May 1993 from 03/15/88
Missouri River Watershed

1988 Population : 105
1990 Census Data: 64
2010 Projection : 64
Population Trend: Decreasing

Cindy Garaas - Auditor
P.O. Box 123
Epping, ND 58843
Phone: 859-4473

Number of Residential Users: 45 Households
Municipal/Industrial Users: N/A

RESPONSE TO AGREEMENT OF INTENT: Signed (Rural Water)

WATER SOURCE, USE, DEMANDS AND QUALITY SUMMARY:

Source: **Williams Rural Water Association and Private Wells**
Approx. depth of private wells: 60 to 90 feet

Dependable Water Supply: NO

Community Perception of Water Quality:

Is water quality good? ___ fair? ___ poor? YES
Comments: Well water very poor; hard, iron, high sulfur & odor

TREATMENT FACILITIES, STORAGE AND ADDITIONAL DEMANDS:

Water Treatment: Some private water softeners which do not help much.

Capacity of system: N/A

Existing Storage [gal]: 0 Elevated 0 Ground

Additional Demands
Industrial Requirements: 0 gal/day
Fire Requirements: 0 gal/hour

WATER RATE STRUCTURE:

Water Rates: Rural Water Rates
Comments: 1988 - Town installed a new sewer system replacing private septic systems. Fear of groundwater contamination from septic systems may have convinced people to go to rural water system hookup.

NORTHWEST AREA WATER SUPPLY - COMMUNITY NEEDS ASSESSMENT

Flaxton
Burke County

Updated May 1993 from 03/23/88
Hudson Bay Watershed

1988 Population : 182
1990 Census Data: 121
2010 Projection : 121
Population Trend: Decreasing

Judy Olney - Auditor
P.O. Box 18
Flaxton, ND 58737
Phone: 596-3511 or 467-3265

Number of Residential Users: 67 Households
Municipal/Industrial Users: 6

RESPONSE TO AGREEMENT OF INTENT: Signed Agreement

WATER SOURCE, USE, DEMANDS AND QUALITY SUMMARY:

Source: **Groundwater**

1985 Use:	4.059 MG	1989 Use:	3.399 MG
1986 Use:	3.927 MG	1990 Use:	3.168 MG
1987 Use:	3.696 MG	1991 Use:	3.102 MG
1988 Use:	3.729 MG	1992 Use:	2.706 MG

Average Annual Groundwater Use: 3.473 MG
Average Daily Use: 0.010 MG
Peak Daily Use: 0.020 MG
Average Daily Use Per Capita 79 gallons
Dependable Water Supply: YES

Water Quality Evaluation and Categorization - 1991

Category IV - Exceeds Less Than Four Secondary Standards and TDS is greater than 1000.

TDS	2280.0	mg/l >	1000 mg/l
Sodium	937.0	mg/l >	200 mg/l
Chloride	513.0	mg/l >	250 mg/l

Community Perception of Water Quality:

Is water quality good? ___ fair? YES poor? ___
Comments: High sodium; poor for gardens & lawn, poor for coffee
Most residents do not use softeners. OK for laundry.

TREATMENT FACILITIES, STORAGE AND ADDITIONAL DEMANDS:

Water Treatment: Chlorination (when necessary); well @ 700 feet deep

Capacity of system: 19 gpm (27,500 gpd)

Existing Storage [gal]: 40,000 Elevated 0 Ground

Additional Demands
Industrial Requirements: 10,000 gal/day
Fire Requirements: 0 gal/hour

WATER RATE STRUCTURE:

Water Rates: $5.50/1000; $1/1000 gal additional monthly
Comments: Jeff Kalmbach operates system and leases a well one-half mile southwest of town. Hauls drinking water to Flaxton, Bowbells and local farms.

NORTHWEST AREA WATER SUPPLY - COMMUNITY NEEDS ASSESSMENT

Fortuna
Divide County

Updated May 1993 from 03/15/88
Missouri River Watershed

1988 Population : 79
1990 Census Data: 53
2010 Projection : 53
Population Trend: Decreasing

Doug Grote - Mayor
P.O. Box 17
Fortuna, ND 58844
Phone: 834-2213

Number of Residential Users: 25 Households
Municipal/Industrial Users: N/A

RESPONSE TO AGREEMENT OF INTENT: Signed Agreement

WATER SOURCE, USE, DEMANDS AND QUALITY SUMMARY:

Source: **Groundwater**

1985 Use:	1.782 MG	1989 Use:	0.693 MG
1986 Use:	1.716 MG	1990 Use:	0.429 MG
1987 Use:	2.343 MG	1991 Use:	0.561 MG
1988 Use:	2.046 MG	1992 Use:	1.914 MG

Average Annual Groundwater Use: 1.436 MG
Average Daily Use: 0.004 MG
Peak Daily Use: 0.007 MG
Average Daily Use Per Capita 74 gallons
Dependable Water Supply: NO

Water Quality Evaluation and Categorization - 1991

Category II - Exceeds Four (4) or More Secondary Standards and TDS is greater than 1000 mg/l.

TDS	1310.0 mg/l	> 1000 mg/l
Manganese	0.488 mg/l	> 0.05 mg/l
Sodium	242.0 mg/l	> 200 mg/l
Sulfates	601.0 mg/l	> 250 mg/l

Community Perception of Water Quality:

Is water quality good? ___ fair? ___ poor? YES
Comments:

TREATMENT FACILITIES, STORAGE AND ADDITIONAL DEMANDS:

Water Treatment: Aquamag, Chlorination Suspension System (installed 1990)

Capacity of system: 18-20 gpm (29,000 gpd)

Existing Storage [gal]: 0 Elevated 20,000 Ground

Additional Demands
Industrial Requirements: 0 gal/day
Fire Requirements: 0 gal/hour

WATER RATE STRUCTURE:

Water Rates: Flat rate $11 - Family; $11.50 - Two Person; $6 - Single
Comments: With the closure of the radar station, the town has gone down hill. Water storage tank recently re-sided.

NORTHWEST AREA WATER SUPPLY - COMMUNITY NEEDS ASSESSMENT

Gardena
Bottineau County

Updated May 1993 from 03/17/88
Hudson Bay Watershed

1988 Population : 50
1990 Census Data: 41
2010 Projection : 41
Population Trend: Decreasing

Glen Milbrath - Auditor
P.O. Box 82
Gardena, ND 58739
Phone: 228-3413

Number of Residential Users: 14 Households
Municipal/Industrial Users: N/A

RESPONSE TO AGREEMENT OF INTENT: Signed (Rural Water)

WATER SOURCE, USE, DEMANDS AND QUALITY SUMMARY:

Source: **All Seasons RWU System - II and Private Wells**
Approx. depth of private wells:

Dependable Water Supply: YES

Community Perception of Water Quality:

Is water quality good? ___ fair? ___ poor? YES
Comments: Sodium, Iron and white scaling.
Very poor after system repairs.

TREATMENT FACILITIES, STORAGE AND ADDITIONAL DEMANDS:

Water Treatment: Drinking water must be hauled in from other sources.
Rural water.

Capacity of system: N/A

Existing Storage [gal]: 0 Elevated 0 Ground

Additional Demands
Industrial Requirements: 0 gal/day
Fire Requirements: 0 gal/hour

WATER RATE STRUCTURE:

Water Rates: Rural Water Rates
Comments: 1988 - Requested to improve rural water quality and price.

NORTHWEST AREA WATER SUPPLY - COMMUNITY NEEDS ASSESSMENT

Glenburn
Renville County

Updated May 1993 from 3/88
Hudson Bay Watershed

1988 Population : 454
1990 Census Data: 439
2010 Projection : 439
Population Trend: Decreasing

Tony Alef - Mayor
P.O. Box 97
Glenburn, ND 58740
Phone: 362-7544

Number of Residential Users: N/A
Municipal/Industrial Users: N/A

RESPONSE TO AGREEMENT OF INTENT: Signed (Rural Water)

WATER SOURCE, USE, DEMANDS AND QUALITY SUMMARY:

Source: **Upper Souris RWA System - II (Bulk User)**
Additional Source: **Groundwater**

1985 Use:	0.000 MG	1989 Use:	0.000 MG
1986 Use:	0.000 MG	1990 Use:	11.682 MG
1987 Use:	0.000 MG	1991 Use:	9.504 MG
1988 Use:	0.000 MG	1992 Use:	0.000 MG

Average Annual Groundwater Use: 10.593 MG
Average Daily Use: 0.029 MG
Peak Daily Use: 0.040 MG
Dependable Water Supply: NO

Community Perception of Water Quality:

Is water quality good? ___ fair? ___ poor? YES
Comments:

TREATMENT FACILITIES, STORAGE AND ADDITIONAL DEMANDS:

Water Treatment: Chlorinated groundwater supply

Capacity of system: N/A

Existing Storage [gal]: 50,000 Elevated 0 Ground

Additional Demands
Industrial Requirements: 0 gal/day
Fire Requirements: 0 gal/hour

WATER RATE STRUCTURE:

Water Rates: $9 Minimum/first 1000 gallons; $4.3/additional 1000 gallons
Comments: The community was first connected with the Upper Souris RWA in 1978. Until recently, groundwater was used to supplement the rural water during peak demands to reduce overall costs. The present well system has been abandoned and complete supply is now provided by rural water.

NORTHWEST AREA WATER SUPPLY - COMMUNITY NEEDS ASSESSMENT

Grano
Renville County

Updated May 1993 from 3/88
Hudson Bay Watershed

1988 Population : 6
1990 Census Data: 9
2010 Projection : 9
Population Trend: Decreasing

James Gehringer - Mayor
RR 1, Box 41, Grano
Lansford, ND 58750
Phone: 784-5993

Number of Residential Users: 4 Households
Municipal/Industrial Users: N/A

RESPONSE TO AGREEMENT OF INTENT: Signed (Rural Water)

WATER SOURCE, USE, DEMANDS AND QUALITY SUMMARY:

Source: **Upper Souris RWA System - I and Private Wells**

Dependable Water Supply: YES

Community Perception of Water Quality:

Is water quality good? ___ fair? ___ poor? ___
Comments:

TREATMENT FACILITIES, STORAGE AND ADDITIONAL DEMANDS:

Water Treatment: N/A

Capacity of system: N/A

Existing Storage [gal]: 0 Elevated 0 Ground

Additional Demands
Industrial Requirements: 0 gal/day
Fire Requirements: 0 gal/hour

WATER RATE STRUCTURE:

Water Rates: Rural Water Rates
Comments: Members of Rural Water System on an individual basis.

NORTHWEST AREA WATER SUPPLY - COMMUNITY NEEDS ASSESSMENT

Granville
McHenry County

Updated May 1993 from 03/23/88
Hudson Bay Watershed

1988 Population : 281
1990 Census Data: 236
2010 Projection : 236
Population Trend: Decreasing

Nancy Mueller - Auditor
P.O. Box 39
Granville, ND 58741
Phone: 728-6369

Number of Residential Users: 120 Households
Municipal/Industrial Users: N/A

RESPONSE TO AGREEMENT OF INTENT: Signed Agreement

WATER SOURCE, USE, DEMANDS AND QUALITY SUMMARY:

Source: **Groundwater**

1985 Use:	11.220 MG	1989 Use:	7.986 MG
1986 Use:	9.735 MG	1990 Use:	6.072 MG
1987 Use:	10.164 MG	1991 Use:	5.049 MG
1988 Use:	9.207 MG	1992 Use:	5.412 MG

Average Annual Groundwater Use: 8.106 MG
Average Daily Use: 0.022 MG
Peak Daily Use: 0.028 MG
Average Daily Use Per Capita 94 gallons
Dependable Water Supply: YES

Water Quality Evaluation and Categorization - 1991

Category IV - Exceeds Less Than Four Secondary Standards and TDS is greater than 1000.

TDS	2390.0 mg/l	> 1000 mg/l
Sodium	905.0 mg/l	> 200 mg/l
Chloride	1100.0 mg/l	> 250 mg/l

Community Perception of Water Quality:

Is water quality good? YES fair? ___ poor? ___
Comments: Has deteriorated in the past few years - reason for new well.

TREATMENT FACILITIES, STORAGE AND ADDITIONAL DEMANDS:

Water Treatment: Chlorination (liquid)

Capacity of system: Two New Wells at Approx. 50 gpm/each

Existing Storage [gal]: 60,000 Elevated 0 Ground

Additional Demands
Industrial Requirements: 0 gal/day
Fire Requirements: 0 gal/hour

WATER RATE STRUCTURE:

Water Rates: $8/2000 gal;$1.5/1000 additional; Will change to $15.30 minimum after new wells go on-line in September 1993.

Comments: City sewer system upgraded in 1987-88. New wells and water supply line (6"PVC) under construction due to shortages and rationing during the past three years. Water in the aquifer north of town is very soft; both quality and levels were declining. New well field, located 3 $^{1}/_{2}$ miles west along Highway #2, supplies spring water of better quality.

NORTHWEST AREA WATER SUPPLY - COMMUNITY NEEDS ASSESSMENT

Grenora
Williams County

Updated May 1993 from 03/20/88
Missouri River Watershed

1988 Population : 350
1990 Census Data: 261
2010 Projection : 261
Population Trend: Decreasing

Jane Schenstad - Auditor
Box 296
Grenora, ND 58845
Phone: 694-3391

Number of Residential Users: 140 Households
Municipal/Industrial Users: 20

RESPONSE TO AGREEMENT OF INTENT: Signed Agreement

WATER SOURCE, USE, DEMANDS AND QUALITY SUMMARY:

Source: **Groundwater**

1985 Use:	3.663 MG	1989 Use:	3.630 MG
1986 Use:	3.267 MG	1990 Use:	2.772 MG
1987 Use:	3.069 MG	1991 Use:	1.980 MG
1988 Use:	4.323 MG	1992 Use:	1.056 MG

Average Annual Groundwater Use: 2.970 MG
Average Daily Use: 0.008 MG
Peak Daily Use: 0.013 MG
Average Daily Use Per Capita 31 gallons
Dependable Water Supply: YES

Water Quality Evaluation and Categorization - 1991

Category V - Exceeds Iron or Manganese Secondary Standards

Manganese 0.561 mg/l > 0.05 mg/l

Community Perception of Water Quality:

Is water quality good? YES fair? ___ poor? ___
Comments:

TREATMENT FACILITIES, STORAGE AND ADDITIONAL DEMANDS:

Water Treatment: Chlorination

Capacity of system: Limited to well capacity

Existing Storage [gal]: 50,000 Elevated 0 Ground

Additional Demands
Industrial Requirements: 0 gal/day
Fire Requirements: 0 gal/hour

WATER RATE STRUCTURE:

Water Rates: $10.50 minimum/ first 3,500 gallons; $0.50/additional 1000
Comments: Water has gotten harder as the drought continues. The drop in water use from the late 1980's is due to a significant loss in population. No raw water quality data available from city wells, only that reported to the ND State Health and Consolidated Laboratories.

NORTHWEST AREA WATER SUPPLY - COMMUNITY NEEDS ASSESSMENT

Karlsruhe
McHenry County

Updated May 1993 from 03/18/88
Hudson Bay Watershed

1988 Population : 168
1990 Census Data: 143
2010 Projection : 143
Population Trend: Decreasing

Lorraine Bossert - Auditor
P.O. Box 319
Karlsruhe, ND 58744
Phone: 525-6383

Number of Residential Users: 58 Households
Municipal/Industrial Users: 12

RESPONSE TO AGREEMENT OF INTENT: Signed Agreement

WATER SOURCE, USE, DEMANDS AND QUALITY SUMMARY:

Source: **Groundwater**

1985 Use:	5.511 MG	1989 Use:	7.920 MG
1986 Use:	7.359 MG	1990 Use:	7.557 MG
1987 Use:	7.953 MG	1991 Use:	6.897 MG
1988 Use:	10.098 MG	1992 Use:	6.105 MG

Average Annual Groundwater Use: 7.425 MG
Average Daily Use: 0.020 MG
Peak Daily Use: 0.030 MG
Average Daily Use Per Capita 142 gallons
Dependable Water Supply: YES

Water Quality Evaluation and Categorization - 1990

Category V - Exceeds Iron or Manganese Secondary Standards

Iron	0.380 mg/l >	0.3 mg/l
Manganese	0.173 mg/l >	0.05 mg/l

Community Perception of Water Quality:

Is water quality good? YES fair? ___ poor? ___
Comments: Iron and manganese; algae in lines
Hydrants flushed to clean.

TREATMENT FACILITIES, STORAGE AND ADDITIONAL DEMANDS:

Water Treatment: Chlorination

Capacity of system: 75 gal/min (108,000 gal/day)

Existing Storage [gal]: 0 Elevated 1,200 Ground

Additional Demands
Industrial Requirements: 0 gal/day
Fire Requirements: 0 gal/hour

WATER RATE STRUCTURE:

Water Rates: $3.5/1st 1000; $1/next 2000; $.60 each additional 1000
Comments: System lines not suitable for fire use. No changes since 1988 survey.

NORTHWEST AREA WATER SUPPLY - COMMUNITY NEEDS ASSESSMENT

Kenmare
Ward County

Updated May 1993 from 03/17/88
Missouri River Watershed

1988 Population : 1456
1990 Census Data: 1214
2010 Projection : 1214 (+0%)
Population Trend: Decreasing

James Ackerman - Auditor
Box 816
Kenmare, ND 58746
Phone: 385-4232

Number of Residential Users: 600 Households
Municipal/Industrial Users: 1

RESPONSE TO AGREEMENT OF INTENT: Signed Agreement

WATER SOURCE, USE, DEMANDS AND QUALITY SUMMARY:

Source: **Groundwater**

1985 Use:	61.875 MG	1989 Use:	50.160 MG
1986 Use:	46.200 MG	1990 Use:	43.758 MG
1987 Use:	45.408 MG	1991 Use:	56.661 MG
1988 Use:	44.253 MG	1992 Use:	50.655 MG

Average Annual Groundwater Use: 49.871 MG
Average Daily Use: 0.137 MG
Peak Daily Use: 0.226 MG
Average Daily Use Per Capita 113 gallons
Dependable Water Supply: YES

Water Quality Evaluation and Categorization - 1991

Category IV - Exceeds Less Than Four Secondary Standards and TDS is greater than 1000.

TDS	1420.0 mg/l	> 1000 mg/l
Iron	0.789 mg/l	> 0.3 mg/l
Sodium	555.0 mg/l	> 200 mg/l

Community Perception of Water Quality:

Is water quality good? ___ fair? YES poor? ___
Comments: Iron; some use distillers for drinking and coffee water.

TREATMENT FACILITIES, STORAGE AND ADDITIONAL DEMANDS:

Water Treatment: Chlorination

Capacity of system: Limited to well capacity (30 gpm?)

Existing Storage [gal]: 55,000 Elevated 157,729 Ground

Additional Demands
Industrial Requirements: 0 gal/day
Fire Requirements: 0 gal/hour

WATER RATE STRUCTURE:

Water Rates: $20/2000 gal; $2.5/1000 gal additional
Comments: Many haul drinking water from a well in the highway right-of-way five miles north of town. The 150,000 gallon ground storage was completed in 1989.

NORTHWEST AREA WATER SUPPLY - COMMUNITY NEEDS ASSESSMENT

Kramer
Bottineau County

Updated May 1993 from 03/22/88
Hudson Bay Watershed

1988 Population : 55
1990 Census Data: 51
2010 Projection : 51
Population Trend: Decreasing

Violet Gust - Auditor
PO Box 25
Kramer, ND 58748
Phone: 359-4388

Number of Residential Users: N/A
Municipal/Industrial Users: N/A

RESPONSE TO AGREEMENT OF INTENT: Signed (Rural Water)

WATER SOURCE, USE, DEMANDS AND QUALITY SUMMARY:

Source: **All Seasons RWU System - II and Private Wells**
Approx. depth of private wells:

Dependable Water Supply: NO

Community Perception of Water Quality:

Is water quality good? ____ fair? YES poor? ___
Comments: Well water hard/iron; rural water hard, corrosive, dark & smelly water, some treat it with softeners.

TREATMENT FACILITIES, STORAGE AND ADDITIONAL DEMANDS:

Water Treatment: N/A

Capacity of system: N/A

Existing Storage [gal]: 0 Elevated 0 Ground

Additional Demands
Industrial Requirements: 0 gal/day
Fire Requirements: 0 gal/hour

WATER RATE STRUCTURE:

Water Rates: Rural Water Rates
Comments: 1988 - Requested to improve quality and cost of water from All Seasons Rural Water System - II.

NORTHWEST AREA WATER SUPPLY - COMMUNITY NEEDS ASSESSMENT

Landa
Bottineau County

Updated May 1993 from 03/22/88
Hudson Bay Watershed

1988 Population : 47
1990 Census Data: 38
2010 Projection : 38
Population Trend: Decreasing

Connie Engh - Auditor
P.O. Box 25
Landa, ND 58783
Phone: 245-9692

Number of Residential Users: N/A
Municipal/Industrial Users: N/A

RESPONSE TO AGREEMENT OF INTENT: Signed (Rural Water)

WATER SOURCE, USE, DEMANDS AND QUALITY SUMMARY:

Source: **All Seasons RWU System - III and Private Wells**
Approx. depth of private wells:

Dependable Water Supply: NO

Community Perception of Water Quality:

Is water quality good? ___ fair? ___ poor? ___
Comments:

TREATMENT FACILITIES, STORAGE AND ADDITIONAL DEMANDS:

Water Treatment: N/A

Capacity of system: N/A

Existing Storage [gal]: 0 Elevated 0 Ground

Additional Demands
Industrial Requirements: 0 gal/day
Fire Requirements: 0 gal/hour

WATER RATE STRUCTURE:

Water Rates: Rural Water Rates
Comments: Rural water system had 24 users in 1988. Interested in improvements to rural water quality.

NORTHWEST AREA WATER SUPPLY - COMMUNITY NEEDS ASSESSMENT

Lansford
Bottineau County

Updated May 1993 from 03/22/88
Hudson Bay Watershed

1988 Population : 298
1990 Census Data: 249
2010 Projection : 249
Population Trend: Decreasing

Ron Mathews - Auditor
P.O. Box 98
Lansford, ND 58750
Phone: 784-5592

Number of Residential Users: 99 Households
Municipal/Industrial Users: 14

RESPONSE TO AGREEMENT OF INTENT: Signed (Rural Water)

WATER SOURCE, USE, DEMANDS AND QUALITY SUMMARY:

Source: **Upper Souris RWA - System II (Bulk User)**

Additional Source: **Groundwater**

1985 Use: ? MG 1989 Use: ? MG
1986 Use: ? MG 1990 Use: ? MG
1987 Use: ? MG 1991 Use: ? MG
1988 Use: ? MG 1992 Use: ? MG

No water permit is recorded with the State Water Commission. They are a bulk user from Upper Souris Rural Water. See comments under water rates.

Dependable Water Supply: YES

Community Perception of Water Quality:

Is water quality good? YES fair? ___ poor? ___
Comments: High in Sodium

TREATMENT FACILITIES, STORAGE AND ADDITIONAL DEMANDS:

Water Treatment: Chlorine

Capacity of system: Limited to well capacity

Existing Storage [gal]: 50,000 Elevated 0 Ground

Additional Demands
Industrial Requirements: 0 gal/day
Fire Requirements: 0 gal/hour

WATER RATE STRUCTURE:

Water Rates: $11/first 2000 gallons; $4/1000 additional.
Comments: The primary water supply is from Upper Souris Rural Water. The city well is used as a backup should the level in the water tower drop due to high use by the fertilizer plant. The fertilizer plant has a demand of around 50,000 to 75,000 gal/day causing pressure to drop during some periods. Tower mixes water from rural water and the city well system. Additional flows from the city well are chlorinated.

NORTHWEST AREA WATER SUPPLY - COMMUNITY NEEDS ASSESSMENT

Larson
Burke County

Updated May 1993 from 03/15/88
Missouri River Watershed

1988 Population : 15
1990 Census Data: 26
2010 Projection : 26
Population Trend: Increasing

Debra Watterud - Auditor
P.O. Box 206
Larson, ND 58727
Phone: 939-7121

Number of Residential Users: 9 Households
Municipal/Industrial Users: N/A

RESPONSE TO AGREEMENT OF INTENT: Signed Agreement

WATER SOURCE, USE, DEMANDS AND QUALITY SUMMARY:

Source: **Private Wells.**
Approx. depth of well:

Dependable Water Supply: NO

Community Perception of Water Quality:

Is water quality good? ___ fair? ___ poor? YES
Comments: Terrible water, $CaCO_3$ hardness = 164 gr. Not for coffee.
They would like good water; probably rural water system.

TREATMENT FACILITIES, STORAGE AND ADDITIONAL DEMANDS:

Water Treatment: N/A

Capacity of system: N/A

Existing Storage [gal]: 0 Elevated 0 Ground

Additional Demands
Industrial Requirements: 0 gal/day
Fire Requirements: 0 gal/hour

WATER RATE STRUCTURE:

Water Rates: N/A
Comments: A clean town with several very nice homes. The mine east of town closed in 1988. The community is interested in being served by NAWS through a rural water supply system or directly; would need to construct its own distribution facilities if not part of a rural water system.

NORTHWEST AREA WATER SUPPLY - COMMUNITY NEEDS ASSESSMENT

Loraine
Renville County

Updated May 1993 from 3/88
Hudson Bay Watershed

1988 Population : 21
1990 Census Data: 15
2010 Projection : 15
Population Trend: Decreasing

Gene Jensen - Mayor
Rt. 2, Box 54F, Loraine
Mohall, ND 58761
Phone: 756-6956

Number of Residential Users: N/A
Municipal/Industrial Users: N/A

RESPONSE TO AGREEMENT OF INTENT: Signed (Rural Water)

WATER SOURCE, USE, DEMANDS AND QUALITY SUMMARY:

Source: **Upper Souris RWS System - I and Private Wells**
Approx. depth of private wells:

Dependable Water Supply: NO

Community Perception of Water Quality:

Is water quality good? ___ fair? ___ poor? ___
Comments:

TREATMENT FACILITIES, STORAGE AND ADDITIONAL DEMANDS:

Water Treatment: N/A

Capacity of system: N/A

Existing Storage [gal]: 0 Elevated 0 Ground

Additional Demands
Industrial Requirements: 0 gal/day
Fire Requirements: 0 gal/hour

WATER RATE STRUCTURE:

Water Rates: Rural Water Rates
Comments: Members of Rural Water System on an individual basis.

NORTHWEST AREA WATER SUPPLY - COMMUNITY NEEDS ASSESSMENT

Makoti
Ward County

Updated May 1993 from 03/15/88
Missouri River Watershed

1988 Population : 190
1990 Census Data: 145
2010 Projection : 145
Population Trend: Decreasing

Richard Rensch - Mayor
PO Box 22
Makoti, ND 58756
Phone: 726-5639

Number of Residential Users: 75 Households
Municipal/Industrial Users: 1

RESPONSE TO AGREEMENT OF INTENT: Signed Agreement

WATER SOURCE, USE, DEMANDS AND QUALITY SUMMARY:

Source: **Groundwater**

1985 Use:	7.326 MG	1989 Use:	7.953 MG
1986 Use:	5.643 MG	1990 Use:	8.019 MG
1987 Use:	6.303 MG	1991 Use:	8.052 MG
1988 Use:	12.012 MG	1992 Use:	0.000 MG

Average Annual Groundwater Use: 7.901 MG
Average Daily Use: 0.022 MG
Peak Daily Use: 0.045 MG
Average Daily Use Per Capita 149 gallons
Dependable Water Supply: YES

Water Quality Evaluation and Categorization - 1991

Category V - Exceeds Iron or Manganese Secondary Standards

Manganese 0.225 mg/l > 0.05 mg/l

Community Perception of Water Quality:

Is water quality good? YES fair? ___ poor? ___
Comments: The two city wells, five miles northeast of town, are approximately 30 feet in depth and supply 125 gpd and 100 gpd.

TREATMENT FACILITIES, STORAGE AND ADDITIONAL DEMANDS:

Water Treatment: New chlorination system installed in 1993.

Capacity of system: 225 gpd maximum based on well data

Existing Storage [gal]: 0 Elevated 20,000 Ground

Additional Demands
Industrial Requirements: 0 gal/day
Fire Requirements: 0 gal/hour

WATER RATE STRUCTURE:

Water Rates: $3/first 2000 gallons; $1.00/additional 1000 gallons
Comments: We have good water.

NORTHWEST AREA WATER SUPPLY - COMMUNITY NEEDS ASSESSMENT

Max
McLean County

Updated May 1993 from 3/88
Missouri River Watershed

1988 Population : 300
1990 Census Data: 301
2010 Projection : 301
Population Trend: Decreasing

C. T. Jacobson - Auditor
P.O. Box 116
Max, ND 58759
Phone: 679-2770

Number of Residential Users: 130 Households
Municipal/Industrial Users: 10

RESPONSE TO AGREEMENT OF INTENT: Signed (Rural Water)

WATER SOURCE, USE, DEMANDS AND QUALITY SUMMARY:

Source: **North Prairie RWA - System II**

Dependable Water Supply: YES

Community Perception of Water Quality:

Is water quality good? YES fair? ___ poor? ___
Comments: Bulk user of North Prairie RWA.
Some bad leaks occurred in the city distribution system in 1987.

TREATMENT FACILITIES, STORAGE AND ADDITIONAL DEMANDS:

Water Treatment: N/A

Capacity of system: N/A

Existing Storage [gal]: 50,000 Elevated 0 Ground

Additional Demands
Industrial Requirements: 0 gal/day
Fire Requirements: 0 gal/hour

WATER RATE STRUCTURE:

Water Rates: 1988 - $8.25/1000 gallon for the first million gallons per month; then a $2.85/1000 gallons overage charge.

Comments: They are committed to North Prairie Rural Water Association for 25 years. Replaced water mains with PVC approximately 20 years ago. No contact made to update water rates to 1993.

NORTHWEST AREA WATER SUPPLY - COMMUNITY NEEDS ASSESSMENT

Maxbass
Bottineau County

Updated May 1993 from 03/22/88
Hudson Bay Watershed

1988 Population : 132
1990 Census Data: 123
2010 Projection : 123
Population Trend: Decreasing

Alyce Spencer - Auditor
P.O. Box 134
Maxbass, ND 58760
Phone: 268-3338

Number of Residential Users: 62 Households
Municipal/Industrial Users: N/A

RESPONSE TO AGREEMENT OF INTENT: Signed Agreement

WATER SOURCE, USE, DEMANDS AND QUALITY SUMMARY:

Source: **Groundwater**

1985 Use:	3.993 MG	1989 Use:	4.950 MG
1986 Use:	3.960 MG	1990 Use:	4.488 MG
1987 Use:	3.531 MG	1991 Use:	4.125 MG
1988 Use:	4.620 MG	1992 Use:	4.653 MG

Average Annual Groundwater Use: 4.290 MG
Average Daily Use: 0.012 MG
Peak Daily Use: 0.020 MG
Average Daily Use Per Capita 95 gallons
Dependable Water Supply: YES

Water Quality Evaluation and Categorization - 1991

Category III - Exceeds Four (4) or More Secondary Standards and TDS is less than 1000 mg/l.

TDS	947.0 mg/l	< 1000 mg/l
Iron	0.422 mg/l	> 0.3 mg/l
Manganese	0.524 mg/l	> 0.05 mg/l
Sulfates	258.0 mg/l	> 250 mg/l

Community Perception of Water Quality:

Is water quality good? YES fair? ___ poor? ___
Comments: Shallow well; fear of contamination, some has occurred.

TREATMENT FACILITIES, STORAGE AND ADDITIONAL DEMANDS:

Water Treatment: Chlorination. Liquid Sodium Hydrochloride.

Capacity of system: small (not available)

Existing Storage [gal]: 0 Elevated 75 Ground (Pressure System)

Additional Demands
Industrial Requirements: 0 gal/day
Fire Requirements: 0 gal/hour

WATER RATE STRUCTURE:

Water Rates: $8/2000 gal; $1.8/1000 gal additional
Comments: Chemical contamination of rural water is a concern (Tordon). Problems with poor water during the summer. No farm use of city water. City reported some pressure problems at the fringes of the new distribution system in 1988. Also had a new sewer system in 1988. The city school has its own well.

NORTHWEST AREA WATER SUPPLY - COMMUNITY NEEDS ASSESSMENT

Minot Updated May 1993 from 03/24/88
Ward County Hudson Bay Watershed

1988 Population : 33,000
1990 Census Data: 34,544
2010 Projection : 38,000 (+10%)
Population Trend: Increasing

R. A. Schempp - City Manager
512 2nd Street SW
Minot, ND 58701
Phone: 857-4784

Number of Residential Users: 11,000 Households
Municipal/Industrial Users: 2 USAF and Rural Water

RESPONSE TO AGREEMENT OF INTENT: Signed Agreement

WATER SOURCE, USE, DEMANDS AND QUALITY SUMMARY:

Source: Groundwater and Souris River

Groundwater Use

1985 Use:	1,498.497 MG	1989 Use:	1,910.040 MG
1986 Use:	1,457.973 MG	1990 Use:	2,218.458 MG
1987 Use:	1,366.893 MG	1991 Use:	2,066.823 MG
1988 Use:	2,535.489 MG	1992 Use:	2,278.749 MG

Average Annual Groundwater Use: 1,916.615 MG

Surface Water Use

1985 Use:	691.812 MG	1989 Use:	617.760 MG
1986 Use:	831.930 MG	1990 Use:	511.170 MG
1987 Use:	1,005.840 MG	1991 Use:	0.000 MG
1988 Use:	154.011 MG	1992 Use:	18.942 MG

Average Annual Surface Water Use: 547.352 MG

Average Annual Combined Water Use: 2,314.402 MG [1]
Average Daily Use: 6.340 MG [1]
Peak Daily Use: 13.000 MG [1]
Average Daily Use Per Capita 127 gallons (City use only)
Dependable Water Supply: YES

Water Quality Evaluation and Categorization - 1992
Category III - Exceeds Four (4) or More Secondary Standards and TDS is less than 1000 mg/l.

TDS	731.0 mg/l	< 1000 mg/l
Sodium	239.0 mg/l	> 200 mg/l
Sulfates	306.0 mg/l	> 250 mg/l
pH	9.46	Exceeds 8.5 or Below 6.5

Community Perception of Water Quality:
Is water quality good? ___ fair? YES poor? ___

TREATMENT FACILITIES, STORAGE AND ADDITIONAL DEMANDS:

Water Treatment: Lime softening; Recently updated and in good shape.

Capacity of system: 18,000,000 GPD
Existing Storage [gal]: 2,000,000 Elevated 12,000,000 Ground
Additional Demands
Industrial Requirement 0 gal/day (Considered in normal use)
Fire Requirements: 30,000 to 180,000 gal/hour

WATER RATE STRUCTURE:

Water Rates: 300 cubic feet for $7.24; $1.07/100 cubic feet additional.
Comments: Although present water supply is dependable, plans for reservoirs on the upper Souris River could seriously affect this supply. The Minot USAF Base is billed at $0.94/first 100 cu ft and North Prairie RWA at $7.24/first 100 cu ft then $1.07/additional 100 cu ft. Per capita use rates for the city are based on 25.7% use by the USAF and 4.9% by North Prairie Rural Water.

[1] Based on information provided by Minot on their system.

NORTHWEST AREA WATER SUPPLY - COMMUNITY NEEDS ASSESSMENT

Mohall
Renville County

Updated May 1993 from 03/23/88
Hudson Bay Watershed

1988 Population : 1,049
1990 Census Data: 931
2010 Projection : 1.024 (+10%)
Population Trend: Decreasing

Wanda Emerson - Mayor
P.O. Box 476
Mohall, ND 58761
Phone: 756-6464

Number of Residential Users: 450 Households
Municipal/Industrial Users: 3

RESPONSE TO AGREEMENT OF INTENT: Signed Agreement

WATER SOURCE, USE, DEMANDS AND QUALITY SUMMARY:

Source: **Groundwater**

1985 Use:	95.172 MG	1989 Use:	33.594 MG
1986 Use:	48.774 MG	1990 Use:	23.760 MG
1987 Use:	48.774 MG	1991 Use:	36.531 MG
1988 Use:	41.514 MG	1992 Use:	3.234 MG

Average Annual Groundwater Use: 41.419 MG
Average Daily Use: 0.113 MG
Peak Daily Use: 0.300 MG
Average Daily Use Per Capita 122 gallons
Dependable Water Supply: YES

Water Quality Evaluation and Categorization - 1991

Category VI - Exceeds Minimum Standard for TDS, Sulfate Chloride, Ph, and or Recommended Standard for Sodium.

pH 8.72 Exceeds 8.5 or Below 6.5

Community Perception of Water Quality:

Is water quality good? ___ fair? YES poor? ___
Comments: High iron content

TREATMENT FACILITIES, STORAGE AND ADDITIONAL DEMANDS:

Water Treatment: Lime/Soda Ash treatment; would like to add activated carbon for color removal.

Capacity of system: 300,000 gal/day

Existing Storage [gal]: 50,000 Elevated 100,000 Ground

Additional Demands
Industrial Requirements: 0 gal/day
Fire Requirements: 0 gal/hour

WATER RATE STRUCTURE:

Water Rates: $10.00/first 1000 gallons; $1.30/1000 additional
Comments: (1988) M. Baska, operator for 10-12 yrs, worries about farm chemicals in the water supply. Wells are near a dam seven miles east of the city and farmland drains into this area. Water has a green color getting darker as years pass. They feel that consumption will increase with a supply from the NAWS system as watering restrictions would be lifted

NORTHWEST AREA WATER SUPPLY - COMMUNITY NEEDS ASSESSMENT

New Town
Mountrail County

Updated May 1993 from 05/12/88
Missouri River Watershed

1988 Population : 1328
1990 Census Data: 1388
2010 Projection : 1450 (+4.5%)
Population Trend: Decreasing

Warren D. Bratvold - Auditor
PO Box 309
New Town, ND 58763
Phone: 627-4812

Number of Residential Users: 550 Households
Municipal/Industrial Users: N/A

RESPONSE TO AGREEMENT OF INTENT: Signed Agreement

WATER SOURCE, USE, DEMANDS AND QUALITY SUMMARY:

Source: **Groundwater**

1985 Use:	54.978 MG	1989 Use:	74.712 MG
1986 Use:	61.413 MG	1990 Use:	81.048 MG
1987 Use:	71.049 MG	1991 Use:	70.620 MG
1988 Use:	55.869 MG	1992 Use:	72.765 MG

Average Annual Groundwater Use: 67.807 MG
Average Daily Use: 0.186 MG
Peak Daily Use: 0.550 MG
Average Daily Use Per Capita 134 gallons
Dependable Water Supply: YES

Water Quality Evaluation and Categorization - 1990

Category IV - Exceeds Less Than Four Secondary Standards and TDS is greater than 1000.

TDS	1020.0 mg/l	> 1000 mg/l
Sodium	218.0 mg/l	> 200 mg/l
Sulfates	393.0 mg/l	> 250 mg/l

Community Perception of Water Quality:

Is water quality good? ___ fair? YES poor? ___
Comments: Very high sulphates; very hard

TREATMENT FACILITIES, STORAGE AND ADDITIONAL DEMANDS:

Water Treatment: Lime treatment

Capacity of system: 648,000 GPD

Existing Storage [gal]: 50,000 Elevated (not in use) 650,000 Ground

Additional Demands
Industrial Requirements: 0 gal/day
Fire Requirements: 36,000 gal/hour

WATER RATE STRUCTURE:

Water Rates: $11.50/first 1000 gallons; $1.40/1000 additional
Comments: Quality of water is poor with high sodium. Hardness also makes it very expensive to treat. A new 550,000 gallon storage tank was added in 1990. Another city well is being drilled and should deliver 600 to 700 gallons/minute. Northrup Industries is planning an expansion and increasing their work force by 50 people.

NORTHWEST AREA WATER SUPPLY - COMMUNITY NEEDS ASSESSMENT

Newburg
Bottineau County

Updated May 1993 from 03/22/88
Hudson Bay Watershed

1988 Population : 151
1990 Census Data: 104
2010 Projection : 104
Population Trend: Decreasing

Bill Deschamp - Water Works Supt.
PO Box 426
Newburg, ND 58762
Phone: 272-6312

Number of Residential Users: 44 Households
Municipal/Industrial Users: 8

RESPONSE TO AGREEMENT OF INTENT: Signed (Rural Water)

WATER SOURCE, USE, DEMANDS AND QUALITY SUMMARY:

Source: **Groundwater**

1985 Use: ? MG	1989 Use: ? MG	Water use is not metered and no use information is available. See comments under water rates! No water permit recorded with the State Water Commission	
1986 Use: ? MG	1990 Use: ? MG		
1987 Use: ? MG	1991 Use: ? MG		
1988 Use: ? MG	1992 Use: ? MG		

Additional Source: **All Seasons Rural Water Users System - III**
Dependable Water Supply: YES

Community Perception of Water Quality:
Is water quality good? ___ fair? YES poor? ___
Comments: Groundwater is very rusty and high sodium.

WATER QUALITY EVALUATION AND CATEGORIZATION (Groundwater Supply)

Category II - Exceeds Four (4) or More Secondary Standards and TDS is greater than 1000 mg/l.

TDS	1490.0 mg/l	> 1000 mg/l
Iron	4.440 mg/l	> 0.3 mg/l
Manganese	0.122 mg/l	> 0.05 mg/l
Sodium	418.0 mg/l	> 200 mg/l
Sulfates	325.0 mg/l	> 250 mg/l
Chloride	330.0 mg/l	> 250 mg/l

TREATMENT FACILITIES, STORAGE AND ADDITIONAL DEMANDS:

Water Treatment: none
Capacity of system: Limited to well capacity (single well about 30 gpm)

Existing Storage [gal]: 0 Elevated 1,250 Ground

Additional Demands
Industrial Requirements: 0 gal/day
Fire Requirements: 0 gal/hour

WATER RATE STRUCTURE:

Water Rates: Residences $3/month for those on rural water; $7/month for those on the city system; Businesses $5/month if on rural water and $10/month for those on the city system.

Comments: Rural water supplies all but about 4 out of the 44 residences and is considered to be expensive. Newburg has two completely separate distribution systems. Each residence has a two valve system where after they have used the minimum amount of rural water they can turn a valve and use water directly from the city system. The city has five 250 gallon bladder tanks for storage.

NORTHWEST AREA WATER SUPPLY - COMMUNITY NEEDS ASSESSMENT

Noonan
Divide County

Updated May 1993 from 3/88
Hudson Bay Watershed

1988 Population : 275
1990 Census Data: 231
2010 Projection : 231
Population Trend: Decreasing

Cyndie Fagerbakke - Mayor
PO Box 97
Noonan, ND 58765
Phone: 925-5687

Number of Residential Users: N/A
Municipal/Industrial Users: N/A

RESPONSE TO AGREEMENT OF INTENT: Signed Agreement

WATER SOURCE, USE, DEMANDS AND QUALITY SUMMARY:

Source: **Groundwater**

1985 Use:	3.696 MG	1989 Use:	4.719 MG
1986 Use:	4.356 MG	1990 Use:	4.158 MG
1987 Use:	3.729 MG	1991 Use:	3.993 MG
1988 Use:	4.026 MG	1992 Use:	4.059 MG

Average Annual Groundwater Use: 4.092 MG
Average Daily Use: 0.011 MG
Peak Daily Use: 0.015 MG
Average Daily Use Per Capita 49 gallons
Dependable Water Supply: YES

Water Quality Evaluation and Categorization - 1991

Category IV - Exceeds Less Than Four Secondary Standards and TDS is greater than 1000.

TDS	1980.0	mg/l >	1000 mg/l
Fluoride	3.20	mg/l >	2 mg/l
Sodium	878.0	mg/l >	200 mg/l

Community Perception of Water Quality:

Is water quality good? ___ fair? ___ poor? YES
Comments:

TREATMENT FACILITIES, STORAGE AND ADDITIONAL DEMANDS:

Water Treatment: System is chlorinated at least twice a year

Capacity of system: 26 gpm (pump capacity)

Existing Storage [gal]: 50,000 Elevated (est) 0 Ground

Additional Demands
Industrial Requirements: 0 gal/day
Fire Requirements: 0 gal/hour

WATER RATE STRUCTURE:

Water Rates: $18/Month for water and garbage
Comments: Information obtained from Arnold Eide 925-5661.

city owned drinking water well

NORTHWEST AREA WATER SUPPLY - COMMUNITY NEEDS ASSESSMENT

Norma
Renville County

Updated May 1993 from 03/17/88
Hudson Bay Watershed

1988 Population : 18
1990 Census Data: N/A
2010 Projection :
Population Trend: Decreasing

Merv Gottschall
RR 1, Box 99A, Norma
Kenmare, ND 58746
Phone: 467-3317

Number of Residential Users: 9 Households
Municipal/Industrial Users: N/A

RESPONSE TO AGREEMENT OF INTENT: Signed Agreement

WATER SOURCE, USE, DEMANDS AND QUALITY SUMMARY:

Source: **Upper Souris RWA System - I**

Dependable Water Supply: YES

Community Perception of Water Quality:

Is water quality good? ___ fair? ___ poor? ___
Comments: Use Upper Souris Rural Water. Feel it tastes of chlorine.
Haul their drinking/coffee water from wells by Kenmare.

TREATMENT FACILITIES, STORAGE AND ADDITIONAL DEMANDS:

Water Treatment: N/A

Capacity of system: N/A

Existing Storage [gal]: 0 Elevated 0 Ground

Additional Demands
Industrial Requirements: 0 gal/day
Fire Requirements: 0 gal/hour

WATER RATE STRUCTURE:

Water Rates: Rural Water Rates
Comments:

NORTHWEST AREA WATER SUPPLY - COMMUNITY NEEDS ASSESSMENT

Norwich
McHenry County

Updated May 1993 from 03/16/88
Hudson Bay Watershed

1988 Population : 55
1990 Census Data: N/A
2010 Projection :
Population Trend: Decreasing

Ruby Morgard
Rural Route
Norwich, ND 58768
Phone: 728-6721

Number of Residential Users: N/A
Municipal/Industrial Users: N/A

RESPONSE TO AGREEMENT OF INTENT: Signed (Rural Water)

WATER SOURCE, USE, DEMANDS AND QUALITY SUMMARY:

Source: **North Prairie RWA - System III and Private Wells**
Approx. depth of private wells:

Dependable Water Supply: YES

Community Perception of Water Quality:

Is water quality good? ___ fair? YES poor? ___
Comments: Water is too soft. Most are on private wells. Many rural water users have water softeners.

TREATMENT FACILITIES, STORAGE AND ADDITIONAL DEMANDS:

Water Treatment: N/A

Capacity of system: N/A

Existing Storage [gal]: 0 Elevated 0 Ground

Additional Demands
Industrial Requirements: 0 gal/day
Fire Requirements: 0 gal/hour

WATER RATE STRUCTURE:

Water Rates: Rural Water Rates
Comments: Interest on behalf of Rural Water users to improve system. Private well users might hook up if rates were reduced and quality improved.

NORTHWEST AREA WATER SUPPLY - COMMUNITY NEEDS ASSESSMENT

Overly
Bottineau County

Updated May 1993 from 03/17/88
Hudson Bay Watershed

1988 Population : 28
1990 Census Data: 25
2010 Projection : 25
Population Trend: Decreasing

Ida Wittmayer - Auditor
PO Box B
Overly, ND 58360
Phone: 366-4307

Number of Residential Users: N/A
Municipal/Industrial Users: N/A

RESPONSE TO AGREEMENT OF INTENT: Signed (Rural Water)

WATER SOURCE, USE, DEMANDS AND QUALITY SUMMARY:

Source: **All Seasons RWU System - I and Private Wells**
Approx. depth of private wells: 30-120 feet

Dependable Water Supply: NO Rural water pH is high. Sand in meters.

Community Perception of Water Quality:

Is water quality good? ___ fair? ___ poor? YES
Comments: Shallow well: hard, Iron & Manganese Deep: Soft, Iron
30 to 120 feet wells. Rural water corrosive, scum & discolor

TREATMENT FACILITIES, STORAGE AND ADDITIONAL DEMANDS:

Water Treatment: N/A

Capacity of system: N/A

Existing Storage [gal]: 0 Elevated 0 Ground

Additional Demands
Industrial Requirements: 0 gal/day
Fire Requirements: 0 gal/hour

WATER RATE STRUCTURE:

Water Rates: Rural Water Rates
Comments: Members of Rural Water System on an individual basis.

NORTHWEST AREA WATER SUPPLY - COMMUNITY NEEDS ASSESSMENT

Parshall
Mountrail County

Updated May 1993 from 03/15/88
Missouri River Watershed

1988 Population : 1,050
1990 Census Data: 943
2010 Projection : 1,037 (+10)
Population Trend: Decreasing

Wade F. Williamson - Mayor
Box 239
Parshall, ND 58770-0239
Phone: 862-3459

Number of Residential Users: 400 Households
Municipal/Industrial Users: N/A

RESPONSE TO AGREEMENT OF INTENT: Signed Agreement

WATER SOURCE, USE, DEMANDS AND QUALITY SUMMARY:

Source: **Missouri River (Lake Sakakawea)**

1985 Use:	0.000 MG	1989 Use:	34.320 MG
1986 Use:	39.633 MG	1990 Use:	35.706 MG
1987 Use:	40.491 MG	1991 Use:	37.719 MG
1988 Use:	38.973 MG	1992 Use:	39.963 MG

Average Annual Surface Water Use: 38.115 MG
Average Daily Use: 0.104 MG
Peak Daily Use: 0.150 MG
Average Daily Use Per Capita 111 gallons
Dependable Water Supply: YES

Water Quality Evaluation and Categorization - 1992

Category VI - Exceeds Minimum Standard for TDS, Sulfate Chloride, pH and or Recommended Standard for Sodium.

Sulfates	258.0 mg/l >	250 mg/l
pH	9.12 Exceeds	8.5 or Below 6.5

Community Perception of Water Quality:
Is water quality good? YES fair? ___ poor? ___
Comments: Water has taste and odor problems when lake levels fall.

TREATMENT FACILITIES, STORAGE AND ADDITIONAL DEMANDS:

Water Treatment: Lime - soda ash

Capacity of system: 400,000 gpd

Existing Storage [gal]: 0 Elevated 800,000 Ground

Additional Demands
Industrial Requirements: 0 gal/day
Fire Requirements: 0 gal/hour

WATER RATE STRUCTURE:

Water Rates: $26/month + $1.5/1000 gal for all water used.
Comments: Water rates include all the costs with no special assessment against the homeowners. Parshall is operating at less than 50% of capacity with excess which they'd like to sell. Lake Sakakawea intake is at 1812.5 msl or 1810 msl with riser removed. Problems occur with supply when the lake is near 1816 msl. Ground storage was modified to increase tank capacity by 300,000 gallons to a total of 800,000 gallons. Jim Ebersol is the plant manger 862-3385. They have been discussing the possibility of selling water to New Town and have a $3 Million debt on the current plant. Population projection from city Auditor.

NORTHWEST AREA WATER SUPPLY - COMMUNITY NEEDS ASSESSMENT

Plaza
Mountrail County

Updated May 1993 from 03/15/88
Missouri River Watershed

1988 Population : 250
1990 Census Data: 193
2010 Projection : 193
Population Trend: Decreasing

Peter E. Westgard - Mayor
Box 188
Plaza, ND 58771
Phone: 497-3387 or 493-3352

Number of Residential Users: 102 Households
Municipal/Industrial Users: 1

RESPONSE TO AGREEMENT OF INTENT: Signed Agreement

WATER SOURCE, USE, DEMANDS AND QUALITY SUMMARY:

Source: **Groundwater**

1985 Use:	0.000 MG	1989 Use:	11.220 MG
1986 Use:	0.000 MG	1990 Use:	0.825 MG
1987 Use:	0.000 MG	1991 Use:	8.778 MG
1988 Use:	6.666 MG	1992 Use:	0.000 MG

Average Annual Groundwater Use: 6.872 MG
Average Daily Use: 0.019 MG
Peak Daily Use: 0.030 MG
Average Daily Use Per Capita 98 gallons
Dependable Water Supply: YES

Water Quality Evaluation and Categorization - 1991

Category IV - Exceeds Less Than Four Secondary Standards and TDS is greater than 1000.

TDS	1520.0 mg/l	> 1000 mg/l
Sodium	336.0 mg/l	> 200 mg/l
Sulfates	579.0 mg/l	> 250 mg/l

Community Perception of Water Quality:

Is water quality good? ___ fair? ___ poor? YES
Comments: Rust, iron and manganese

TREATMENT FACILITIES, STORAGE AND ADDITIONAL DEMANDS:

Water Treatment: New Iron and Manganese filtration plant completed in 1988.

Capacity of system: 50 gpm (72,000 gpd)

Existing Storage [gal]: 50,000 Elevated 0 Ground

Additional Demands
Industrial Requirements: 0 gal/day
Fire Requirements: 0 gal/hour

WATER RATE STRUCTURE:

Water Rates: $21.70 flat rate not based on use.
Comments: We're in the process of drilling wells and putting in treatment plant. CBDG project. Interstate Engineering is the consulting engineer for the plant.

NORTHWEST AREA WATER SUPPLY - COMMUNITY NEEDS ASSESSMENT

Powers Lake
Burke County

Updated May 1993 from 03/15/88
Missouri River Watershed

1988 Population : 463
1990 Census Data: 408
2010 Projection : 408
Population Trend: Decreasing

Bernice Jorgenson - Mayor
Box 198
Powers Lake, ND 58773
Phone: 464-5602

Number of Residential Users: 150 Households
Municipal/Industrial Users: 26

RESPONSE TO AGREEMENT OF INTENT: Signed Agreement

WATER SOURCE, USE, DEMANDS AND QUALITY SUMMARY:

Source: **Groundwater**

1985 Use:	15.510 MG	1989 Use:	15.609 MG
1986 Use:	13.530 MG	1990 Use:	13.398 MG
1987 Use:	13.431 MG	1991 Use:	11.418 MG
1988 Use:	15.609 MG	1992 Use:	12.540 MG

Average Annual Groundwater Use: 13.881 MG
Average Daily Use: 0.038 MG
Peak Daily Use: 0.060 MG
Average Daily Use Per Capita 93 gallons
Dependable Water Supply: YES

Water Quality Evaluation and Categorization - 1991

Category II - Exceeds Four (4) or More Secondary Standards and TDS is greater than 1000 mg/l.

TDS	1140.0 mg/l	> 1000 mg/l
Iron	1.440 mg/l	> 0.3 mg/l
Manganese	0.194 mg/l	> 0.05 mg/l
Sodium	268.0 mg/l	> 200 mg/l
Sulfates	404.0 mg/l	> 250 mg/l

Community Perception of Water Quality:

Is water quality good? YES fair? ___ poor? ___
Comments: Water is a little hard; rust stains

TREATMENT FACILITIES, STORAGE AND ADDITIONAL DEMANDS:

Water Treatment: Chlorine and phosphate

Capacity of system: 90,000 gpd

Existing Storage [gal]: 50,000 Elevated 0 Ground

Additional Demands
Industrial Requirements: 0 gal/day
Fire Requirements: 0 gal/hour

WATER RATE STRUCTURE:

Water Rates: $16 Minimum/0 to 7000 gallons; $1.30/additional 1000 gal.
Comments: We have our own supply.

NORTHWEST AREA WATER SUPPLY - COMMUNITY NEEDS ASSESSMENT

Ray
Williams County

Updated May 1993 from 03/11/88
Missouri River Watershed

1988 Population : 760
1990 Census Data: 603
2010 Projection : 603 (+0%)
Population Trend: Decreasing

Richard Ross - Auditor
Box 67
Ray, ND 58849
Phone: 568-2204

Number of Residential Users: 376 Households
Municipal/Industrial Users: 36

RESPONSE TO AGREEMENT OF INTENT: Signed Agreement (R&T Water Users)

WATER SOURCE, USE, DEMANDS AND QUALITY SUMMARY:

Source: **Groundwater (Supplies the R&T Water Users Association)**

1985 Use:	97.647 MG	1989 Use:	94.875 MG
1986 Use:	87.318 MG	1990 Use:	88.275 MG
1987 Use:	83.358 MG	1991 Use:	102.069 MG
1988 Use:	84.480 MG	1992 Use:	126.226 MG

Average Annual Groundwater Use: 95.536 MG
Average Daily Use: 0.250 MG
Peak Daily Use: 1.370 MG
Average Daily Use Per Capita 139 gallons (Ray & Tioga)
Dependable Water Supply: YES

Water Quality Evaluation and Categorization - 1991

Category III - Exceeds Four (4) or More Secondary Standards and TDS is less than 1000 mg/l.

TDS	571.0 mg/l	< 1000 mg/l
Iron	0.303 mg/l	> 0.3 mg/l
Sulfates	296.0 mg/l	> 250 mg/l
pH	9.5	Exceeds 8.5 or below 6.5

Community Perception of Water Quality:

Is water quality good? ___ fair? YES poor? ___

TREATMENT FACILITIES, STORAGE AND ADDITIONAL DEMANDS:

Water Treatment: Lime-soda ash; two stage densator

Capacity of system: 1,200,000 gpd

Existing Storage [gal]: 50,000 Elevated 750,000 Ground (@ plant)

Additional Demands
Industrial Requirements: 0 gal/day
Fire Requirements: 0 gal/hour

WATER RATE STRUCTURE:

Water Rates: $15 minimum plus $2.70/1000 gallons.
Comments: Interested in selling water to other communities in the area. Currently supply water to Tioga through the R&T System and will be connected with Stanley by October 1. The dramatic increase in water use shown in 1991 and 1992 is attributed to the Amerada Hess Gas Plant. It is anticipated that the use may increase again in the next few years. Population projection obtained by phone from Richard Ross.

NORTHWEST AREA WATER SUPPLY - COMMUNITY NEEDS ASSESSMENT

Rugby May 1993, Not contacted in 1988
Pierce County Hudson Bay Watershed

1988 Population : 3,335
1990 Census Data: 2,909
2010 Projection : 3,578 (+23%)
Population Trend: Increasing

Howard Burns - Auditor
223 South Main Avenue
Rugby, ND 58368
Phone: 776-6181

Number of Residential Users: 1,700
Municipal/Industrial Users: 175

RESPONSE TO AGREEMENT OF INTENT: Signed Agreement

WATER SOURCE, USE, DEMANDS AND QUALITY SUMMARY:

Source: Groundwater

1985 Use:	144.441 MG	1989 Use:	153.021 MG
1986 Use:	133.881 MG	1990 Use:	187.374 MG
1987 Use:	132.198 MG	1991 Use:	151.173 MG
1988 Use:	179.124 MG	1992 Use:	147.048 MG

Average Annual Groundwater Use: 153.532 MG
Average Daily Use: 0.421 MG
Peak Daily Use: 1.200 MG (1989)
Average Daily Use Per Capita 145 gallons
Dependable Water Supply: YES (Pleasant Lake Aquifer)

Water Quality Evaluation and Categorization - 1990

Category VII - No Standards Exceeded With Reported Sample. Treated water is adequate for domestic supply.

Community Perception of Water Quality:

Is water quality good? YES fair? ___ poor? ___

TREATMENT FACILITIES, STORAGE AND ADDITIONAL DEMANDS:

Water Treatment: Sand Filtration, lime softening and chlorination

Capacity of system: 900,000 gpd

Existing Storage [gal]: 350,000 Elevated 1,180,000 Ground

Additional Demands
Industrial Requirements: 75,000 gal/day
Fire Requirements: 60,000 gal/hour

WATER RATE STRUCTURE:

Water Rates: $6/first 1000 gallons minimum; $1.75/next 5000 gallons; $1.50/1000 gallons additional.

Comments: MR&I money ($330,000) received for installation of an automated lime handling system. No drought shortages on wells. Currently planning phased expansions: 1993-added well ($100,000), and CO_2/pH balancing system ($25,000); 1994-new pipeline to treatment plant from current wells. Two sets of wells: two located five miles and two nine miles out of town. The furthest are newer and have better quality. Possible expansion in 1996-97 of treatment capacity to 1.5 MG/day ($1.7 Million). Population projection for the year 2010 obtained was from the city. They have a new company moving to town called Robodine (250 to 300 new employees). Also with recent improvements to the hospital ($2 million new wing), which is their primary employer, they are very confident about the community's growth.

NORTHWEST AREA WATER SUPPLY - COMMUNITY NEEDS ASSESSMENT

Ruso
McLean County

Updated May 1993 from 03/14/88
Missouri River Watershed

1988 Population : 7
1990 Census Data: 8
2010 Projection : 8
Population Trend: Decreasing

Bruce Lorenz - Mayor
PO Box 82
Ruso, ND 58778
Phone: 626-7541

Number of Residential Users: 5 Households
Municipal/Industrial Users: N/A

RESPONSE TO AGREEMENT OF INTENT: Signed Agreement

WATER SOURCE, USE, DEMANDS AND QUALITY SUMMARY:

Source: **Private Wells.**
Approx. depth of well: 40-190 feet

Dependable Water Supply: NO

Community Perception of Water Quality:

Is water quality good? ___ fair? ___ poor? YES
Comments: Have hard water. Feel the water is very poor.

TREATMENT FACILITIES, STORAGE AND ADDITIONAL DEMANDS:

Water Treatment: N/A

Capacity of system: N/A

Existing Storage [gal]: 0 Elevated 0 Ground

Additional Demands
Industrial Requirements: 0 gal/day
Fire Requirements: 0 gal/hour

WATER RATE STRUCTURE:

Water Rates: N/A
Comments: The community is interested in being served by NAWS through a rural water supply system or directly. The community would need to construct its own distribution facilities if it were not part of a rural water system.

NORTHWEST AREA WATER SUPPLY - COMMUNITY NEEDS ASSESSMENT

Russell
Bottineau County

Updated May 1993 from 03/22/88
Hudson Bay Watershed

1988 Population : 15
1990 Census Data: 14
2010 Projection : 14
Population Trend: Decreasing

Number of Residential Users:
Municipal/Industrial Users:

Paulette Bullinger - Auditor
RR, Russell
Newburg, ND 58762
Phone: 272-6313

N/A
N/A

RESPONSE TO AGREEMENT OF INTENT: Signed (Rural Water)

WATER SOURCE, USE, DEMANDS AND QUALITY SUMMARY:

Source: **All Seasons RWU System - III and Private Wells**
Approx. depth of private wells:

Dependable Water Supply: NO

Community Perception of Water Quality:

Is water quality good? YES fair? ___ poor? ___
Comments:

TREATMENT FACILITIES, STORAGE AND ADDITIONAL DEMANDS:

Water Treatment: N/A

Capacity of system: N/A

Existing Storage [gal]: 0 Elevated 0 Ground

Additional Demands
Industrial Requirements: 0 gal/day
Fire Requirements: 0 gal/hour

WATER RATE STRUCTURE:

Water Rates: Rural Water Rates
Comments: In 1988 there were five users on Rural Water including the elevator.

NORTHWEST AREA WATER SUPPLY - COMMUNITY NEEDS ASSESSMENT

Sawyer
Ward County

Updated May 1993 from 03/24/88
Missouri River Watershed

1988 Population : 415
1990 Census Data: 319
2010 Projection : 319
Population Trend: Decreasing

Charlyn Anfinson - Auditor
PO Box 227
Sawyer, ND 58781
Phone: 624-5649

Number of Residential Users: 124 Households
Municipal/Industrial Users: 1

RESPONSE TO AGREEMENT OF INTENT: Signed Agreement

WATER SOURCE, USE, DEMANDS AND QUALITY SUMMARY:

Source: **Groundwater**

1985 Use:	14.025 MG	1989 Use:	14.652 MG
1986 Use:	14.025 MG	1990 Use:	14.586 MG
1987 Use:	14.355 MG	1991 Use:	14.586 MG
1988 Use:	14.388 MG	1992 Use:	10.725 MG

Average Annual Groundwater Use: 13.918 MG
Average Daily Use: 0.038 MG
Peak Daily Use: 0.040 MG
Average Daily Use Per Capita 120 gallons
Dependable Water Supply: YES

Water Quality Evaluation and Categorization - 1990

Category II - Exceeds Four (4) or More Secondary Standards and TDS is greater than 1000 mg/l.

TDS	1410.0 mg/l	> 1000 mg/l
Iron	0.683 mg/l	> 0.3 mg/l
Manganese	0.174 mg/l	> 0.05 mg/l
Sodium	468.0 mg/l	> 200 mg/l

Community Perception of Water Quality:

Is water quality good? ___ fair? YES poor? ___
Comments: Sodium, manganese, iron, alkalinity, dissolved solids.
Most drinking water comes from Velva.

TREATMENT FACILITIES, STORAGE AND ADDITIONAL DEMANDS:

Water Treatment: Chlorination

Capacity of system: 50,000 gpd (well at 210 gpm)

Existing Storage [gal]: 50,000 Elevated 0 Ground

Additional Demands
Industrial Requirements: 0 gal/day
Fire Requirements: 6,000 gal/hour

WATER RATE STRUCTURE:

Water Rates: $6/first 2000 gal (minimum); $0.30/1000 additional
Comments: Turned down North Prairie Rural Water at one time. They are only 3/4 mile from a 4" or 6" rural water line. 1988 - Requested MR&I money for new water main to water tower. Drop in 1992 water use due to rate change.

NORTHWEST AREA WATER SUPPLY - COMMUNITY NEEDS ASSESSMENT

Sherwood
Renville County

Updated May 1993 from 03/22/88
Hudson Bay Watershed

1988 Population : 294
1990 Census Data: 286
2010 Projection : 286
Population Trend: Decreasing

Shirley Ritter - Auditor
PO Box 177
Sherwood, ND 58782
Phone: 459-2261

Number of Residential Users: 130 Households
Municipal/Industrial Users: 1

RESPONSE TO AGREEMENT OF INTENT: Signed Agreement

WATER SOURCE, USE, DEMANDS AND QUALITY SUMMARY:

Source: **Groundwater**

1985 Use:	8.283 MG	1989 Use:	26.070 MG
1986 Use:	10.923 MG	1990 Use:	12.309 MG
1987 Use:	16.830 MG	1991 Use:	11.715 MG
1988 Use:	16.401 MG	1992 Use:	13.563 MG

Average Annual Groundwater Use: 14.512 MG
Average Daily Use: 0.040 MG
Peak Daily Use: 0.060 MG
Average Daily Use Per Capita 139 gallons
Dependable Water Supply: YES

Water Quality Evaluation and Categorization - 1991

Category VII - No Standards Exceeded With Reported Sample.
Treated water is adequate for domestic supply.

Community Perception of Water Quality:

Is water quality good? YES fair? ___ poor? ___
Comments: Mineral buildup. Some individuals use softeners; water is excellent

TREATMENT FACILITIES, STORAGE AND ADDITIONAL DEMANDS:

Water Treatment: none (note: Category VII water quality)

Capacity of system: Limited to well capacity

Existing Storage [gal]: 50,000 Elevated 0 Ground

Additional Demands
Industrial Requirements: 0 gal/day
Fire Requirements: 0 gal/hour

WATER RATE STRUCTURE:

Water Rates: $7/first 5000 gallons (minimum); $1/1000 gallons additional up to 15,000 gallons then $2/1000 gallons.
Comments: Good quality water but a little hard (20 grains). The industrial user is the school. A new well has been installed since 1988 and is to be used as a backup. Local aquifer levels have not declined and are good.

NORTHWEST AREA WATER SUPPLY - COMMUNITY NEEDS ASSESSMENT

Souris
Bottineau County

Updated May 1993 from 03/15/88
Hudson Bay Watershed

1988 Population : 122
1990 Census Data: 97
2010 Projection : 97
Population Trend: Decreasing

Lana Lindstrom - Auditor
PO Box 134
Souris, ND 58783
Phone: 243-6422

Number of Residential Users: 62 Households
Municipal/Industrial Users: N/A

RESPONSE TO AGREEMENT OF INTENT: Signed Agreement

WATER SOURCE, USE, DEMANDS AND QUALITY SUMMARY:

Source: **Groundwater**

1985 Use:	3.234 MG	1989 Use:	3.432 MG
1986 Use:	3.201 MG	1990 Use:	3.003 MG
1987 Use:	3.564 MG	1991 Use:	3.234 MG
1988 Use:	3.168 MG	1992 Use:	3.300 MG

Average Annual Groundwater Use: 3.267 MG
Average Daily Use: 0.009 MG
Peak Daily Use: 0.014 MG
Average Daily Use Per Capita 92 gallons
Dependable Water Supply: YES

Water Quality Evaluation and Categorization - 1991

Category II - Exceeds Four (4) or More Secondary Standards and TDS is greater than 1000 mg/l.

TDS	1130.0 mg/l	> 1000 mg/l
Iron	1.690 mg/l	> 0.3 mg/l
Manganese	0.330 mg/l	> 0.05 mg/l
Sodium	248.0 mg/l	> 200 mg/l
Sulfates	465.0 mg/l	> 250 mg/l

Community Perception of Water Quality:

Is water quality good? ___ fair? YES poor? ___
Comments: Manganese, No major problems

TREATMENT FACILITIES, STORAGE AND ADDITIONAL DEMANDS:

Water Treatment: 1988 none; Well to tap; Monthly Health Dept. reports.

Capacity of system: Limited to well capacity

Existing Storage [gal]: 50,000 Elevated 0 Ground

Additional Demands
Industrial Requirements: 0 gal/day
Fire Requirements: 30,000 gal/hour

WATER RATE STRUCTURE:

Water Rates: 1988 - $18/first 2000 gal;$2/1000 over; $1/1000 summer
Comments: Agricultural use includes some filling of tanks. A second well may be necessary in future because of sand problems.

NORTHWEST AREA WATER SUPPLY - COMMUNITY NEEDS ASSESSMENT

Stanley
Mountrail County

Updated May 1993 from 04/20/88
Missouri River Watershed

1988 Population : 1,631
1990 Census Data: 1,371
2010 Projection : 1,577 (+15%)
Population Trend: Decreasing

Mary Eliason - Auditor
PO Box 38
Stanley, ND 58784
Phone: 628-2225

Number of Residential Users: 550 Households
Municipal/Industrial Users: N/A

RESPONSE TO AGREEMENT OF INTENT: Signed Agreement (R&T)

WATER SOURCE, USE, DEMANDS AND QUALITY SUMMARY:

Source: **Groundwater**

Groundwater Use

1985 Use:	60.951 MG	1989 Use:	46.365 MG
1986 Use:	59.268 MG	1990 Use:	44.121 MG
1987 Use:	51.381 MG	1991 Use:	44.748 MG
1988 Use:	47.982 MG	1992 Use:	48.576 MG

Average Annual Surface Water Use: 50.424 MG

Average Daily Use: 0.138 MG
Peak Daily Use: 0.300 MG
Average Daily Use Per Capita 93 gallons
Dependable Water Supply: YES

Water Quality Evaluation and Categorization - 1992

Category II - Exceeds Four (4) or More Secondary Standards and TDS is greater than 1000 mg/l.

TDS	1980.0 mg/l	> 1000 mg/l
Iron	0.311 mg/l	> 0.3 mg/l
Manganese	0.269 mg/l	> 0.05 mg/l
Sodium	549.0 mg/l	> 200 mg/l
Sulfates	868.0 mg/l	> 250 mg/l

Community Perception of Water Quality:
Is water quality good? ___ fair? ___ poor? YES
Comments: High in iron, manganese and sodium

TREATMENT FACILITIES, STORAGE AND ADDITIONAL DEMANDS:

Water Treatment: Chlorination, Fluoridation & Polyphosphates

Capacity of system: 560,000 gpd

Existing Storage [gal]: 60,000 Elevated 500,000 Ground

Additional Demands
Industrial Requirements: 0 gal/day
Fire Requirements: 72,000 gal/hour

WATER RATE STRUCTURE:

Water Rates: $5.7/first 1500 gal; $3.8/1000 gal (1,500 to 20,000 gal)
Comments: Stanley's current water is very poor quality. They will be connected to the R&T Water Users System by October 1st. A new 100,000-gallon ground storage facility will be located near the White Earth Valley. Population projection from phone call to city auditor.

NORTHWEST AREA WATER SUPPLY - COMMUNITY NEEDS ASSESSMENT

Surrey
Ward County

Updated May 1993 from 03/18/88
Hudson Bay Watershed

1988 Population : 999
1990 Census Data: 856
2010 Projection : 856
Population Trend: Decreasing

Gordon Owens - Water Supt.
City Hall, Box 98
Surrey, ND 58785-0098
Phone: 852-4154

Number of Residential Users: 275 Households
Municipal/Industrial Users: 2

RESPONSE TO AGREEMENT OF INTENT: Signed (Rural Water)

WATER SOURCE, USE, DEMANDS AND QUALITY SUMMARY:

Source: **North Prairie RWA - System II (Bulk User)**

Prior Use Source: **Groundwater**

1985 Use:	20.460 MG	1989 Use:	20.262 MG
1986 Use:	0.264 MG	1990 Use:	19.998 MG
1987 Use:	2.013 MG	1991 Use:	0.000 MG [1]
1988 Use:	2.013 MG	1992 Use:	0.000 MG [1]

Average Annual Groundwater Use: 10.835 MG [1]
Average Daily Use: 0.030 MG
Peak Daily Use: N/A MG
Average Daily Use Per Capita 35 gallons [1]

Dependable Water Supply: YES

Community Perception of Water Quality:

Is water quality good? ___ fair? YES poor? ___
Comments:

TREATMENT FACILITIES, STORAGE AND ADDITIONAL DEMANDS:

Water Treatment: Chlorination (now based on rural water)

Capacity of system: 70 gal/min - well (unused with rural water)

Existing Storage [gal]: 50,000 Elevated 250,000 Ground

Additional Demands
Industrial Requirements: 0 gal/day
Fire Requirements: 0 gal/hour

WATER RATE STRUCTURE:

Water Rates: $8/2000 min; $3.25/1000 additional
Comments: Community is now converted to 100% rural water. The average annual use data is flawed due to partial use of groundwater. No water quality data was reported to the Health Department on groundwater used.

NORTHWEST AREA WATER SUPPLY - COMMUNITY NEEDS ASSESSMENT

Tioga
Williams County

Updated May 1993 from 03/15/88
Missouri River Watershed

1988 Population : 1550
1990 Census Data: 1278
2010 Projection : 1278 (+0%)
Population Trend: Decreasing

Donald Zacharias - Auditor
Box 218
Tioga, ND 58852
Phone: 664-2807

Number of Residential Users: 500 Households
Municipal/Industrial Users: 70

RESPONSE TO AGREEMENT OF INTENT: Signed Agreement (R&T)

WATER SOURCE, USE, DEMANDS AND QUALITY SUMMARY:

Source: **Groundwater (Supplies the R&T Water Users Association)**

1985 Use:	97.647 MG	1989 Use:	94.875 MG
1986 Use:	87.318 MG	1990 Use:	88.275 MG
1987 Use:	83.358 MG	1991 Use:	102.069 MG
1988 Use:	84.480 MG	1992 Use:	126.226 MG

Average Annual Groundwater Use: 95.536 MG
Average Daily Use: 0.250 MG
Peak Daily Use: 1.370 MG
Average Daily Use Per Capita 139 gallons (Ray & Tioga)
Dependable Water Supply: YES

Water Quality Evaluation and Categorization - 1991

Category III - Exceeds Four (4) or More Secondary Standards and TDS is less than 1000 mg/l.

TDS	571.0 mg/l	< 1000 mg/l
Iron	0.303 mg/l	> 0.3 mg/l
Sulfates	296.0 mg/l	> 250 mg/l
pH	9.5	Exceeds 8.5 or below 6.5

Community Perception of Water Quality:

Is water quality good? ___ fair? YES poor? ___

TREATMENT FACILITIES, STORAGE AND ADDITIONAL DEMANDS:

Water Treatment: lime - soda ash; two stage densator

Capacity of system: 1,200,000 gpd (R&T System)

Existing Storage [gal]: 118,000 Elevated 0 Ground

Additional Demands
Industrial Requirements: 0 gal/day
Fire Requirements: 0 gal/hour

WATER RATE STRUCTURE:

Water Rates: $10 Base minimum plus $1.75/1000 gallons.
Comments: Tioga is provided water by the R&T Water Users Association. City groundwater permits show continued use. This is attributed to use of local supplies from these wells for commercial drill rigs and agricultural use. Four wells are still in place and remain operational. They were not hooked into the R&T System. Population projection obtained by phone from Richard Ross (R&T System)

NORTHWEST AREA WATER SUPPLY - COMMUNITY NEEDS ASSESSMENT

Tolley
Renville County

Updated May 1993 from 03/22/88
Hudson Bay Watershed

1988 Population : 90
1990 Census Data: 79
2010 Projection : 79
Population Trend: Decreasing

Richard O'Clair - Mayor
Box 73
Tolley, ND 58787
Phone: 386-2269

Number of Residential Users: 50 Households
Municipal/Industrial Users: N/A

RESPONSE TO AGREEMENT OF INTENT: Signed (Rural Water)

WATER SOURCE, USE, DEMANDS AND QUALITY SUMMARY:

Source: **Upper Souris RWA System - I**

Dependable Water Supply: YES

Community Perception of Water Quality:

Is water quality good? YES fair? ___ poor? ___
Comments: Rural water is good.

TREATMENT FACILITIES, STORAGE AND ADDITIONAL DEMANDS:

Water Treatment: N/A

Capacity of system: N/A

Existing Storage [gal]: 0 Elevated 0 Ground

Additional Demands
Industrial Requirements: 0 gal/day
Fire Requirements: 0 gal/hour

WATER RATE STRUCTURE:

Water Rates: Rural Water Rates
Comments: Members of Rural Water System on an individual basis. Most homes are on rural water.

NORTHWEST AREA WATER SUPPLY - COMMUNITY NEEDS ASSESSMENT

Towner
McHenry County

Updated May 1993 from 03/16/88
Hudson Bay Watershed

1988 Population : 867
1990 Census Data: 669
2010 Projection : 669 (+0)
Population Trend: Decreasing

Larry Kuk - Sanitation Eng.
PO Box 269, Water Dept.
Towner, ND 58788
Phone: 537-5834

Number of Residential Users: 334 Households
Municipal/Industrial Users: 36

RESPONSE TO AGREEMENT OF INTENT: Signed Agreement

WATER SOURCE, USE, DEMANDS AND QUALITY SUMMARY:

Source: **Groundwater**

1985 Use:	55.275 MG	1989 Use:	55.440 MG
1986 Use:	49.368 MG	1990 Use:	49.962 MG
1987 Use:	58.740 MG	1991 Use:	54.813 MG
1988 Use:	54.384 MG	1992 Use:	60.621 MG

Average Annual Groundwater Use: 54.825 MG
Average Daily Use: 0.150 MG
Peak Daily Use: 0.400 MG
Average Daily Use Per Capita 225 gallons
Dependable Water Supply: YES

Water Quality Evaluation and Categorization - 1990

Category VII - No Standards Exceeded with Reported Sample.
Treated water is adequate for domestic supply.

Community Perception of Water Quality:

Is water quality good? YES fair? ___ poor? ___
Comments: Hard water. Scale forming. High Fe and Mn

TREATMENT FACILITIES, STORAGE AND ADDITIONAL DEMANDS:

Water Treatment: Sand filter. Iron and Manganese. Chlorine and Fluoride.

Capacity of system: 432,000

Existing Storage [gal]: 50,000 Elevated 200,000 Ground (under treatment plant)

Additional Demands
Industrial Requirements: 44,000 gal/day
Fire Requirements: 60,000 gal/hour

WATER RATE STRUCTURE:

Water Rates: $13/first 2000 gallons; $1/additional 1000 gal
[$1.10 (Cheese Plant), $2.50 (Cafe and Laundry)]

Comments: Approved for MR&I grant program 75% of $210,000, begin December 1988; January 89 new addition of 200 gpm unit onto existing sand filtration system. The cheese plant uses approximately 60,000 gpd or 1.75 MG/month and is their primary water user. No response received on population projection request assumed 0% increase was adequate.

NORTHWEST AREA WATER SUPPLY - COMMUNITY NEEDS ASSESSMENT

Trenton
Williams County

Updated May 1993 from 03/11/88
Missouri River Watershed

1988 Population : 480
1990 Census Data: N/A
2010 Projection :
Population Trend: Decreasing

Gordon Falcon - Water Manager
PO Box 236
Trenton, ND 58853
Phone: 572-2606

Number of Residential Users: 138 Households
Municipal/Industrial Users: N/A

RESPONSE TO AGREEMENT OF INTENT: Signed (City of Williston)

WATER SOURCE, USE, DEMANDS AND QUALITY SUMMARY:

Source: **City of Williston** (since 1991)
Groundwater (1985-91 use not reported to State Water Commission)

1985 Use:	12.644 MG	1989 Use:	unavailable MG
1986 Use:	12.600 MG	1990 Use:	unavailable MG
1987 Use:	11.800 MG	1991 Use:	unavailable MG
1988 Use:	unavailable MG	1992 Use:	13.870 MG

Average Annual Groundwater Use: 12.700 MG
Average Daily Use: 0.038 MG
Peak Daily Use: 0.051 MG
Average Daily Use Per Capita 89 gallons

Dependable Water Supply: YES

Community Perception of Water Quality:

Is water quality good? ___ fair? YES poor? ___
Comments: Groundwater was high in sodium, chlorides, alkali, very high in fluoride, and exceeded the primary drinking water standards. Potatoes turned black while cooking. Drinking water purchased.

TREATMENT FACILITIES, STORAGE AND ADDITIONAL DEMANDS:

Water Treatment: N/A

Capacity of system: N/A

Existing Storage [gal]: 0 Elevated 250,000 Ground

Additional Demands
Industrial Requirements: 0 gal/day
Fire Requirements: 0 gal/hour

WATER RATE STRUCTURE:

Water Rates: 1988 - $10/first 2000 gallons; $3/additional 1000 gallons
Comments: The community converted from groundwater to a water supply from the City of Williston in 1991. Water is delivered at a bulk rate from a 125,000 gallon storage facility just west of Williston.

NORTHWEST AREA WATER SUPPLY - COMMUNITY NEEDS ASSESSMENT

Upham
McHenry County

Updated May 1993 from 03/17/88
Hudson Bay Watershed

1988 Population : 200
1990 Census Data: 205
2010 Projection : 205
Population Trend: Decreasing

Rodney Lunde - Mayor
PO Box 7
Upham, ND 58789
Phone: 768-2588

Number of Residential Users: 110 Households
Municipal/Industrial Users: N/A

RESPONSE TO AGREEMENT OF INTENT: Signed Agreement

WATER SOURCE, USE, DEMANDS AND QUALITY SUMMARY:

Source: **Groundwater**

1985 Use:	8.283 MG	1989 Use:	4.851 MG
1986 Use:	4.686 MG	1990 Use:	4.752 MG
1987 Use:	3.894 MG	1991 Use:	5.082 MG
1988 Use:	5.148 MG	1992 Use:	0.000 MG

Average Annual Groundwater Use: 5.242 MG
Average Daily Use: 0.014 MG
Peak Daily Use: 0.025 MG
Average Daily Use Per Capita 70 gallons
Dependable Water Supply: YES

Water Quality Evaluation and Categorization - 1992

Category II - Exceeds Four (4) or More Secondary Standards and TDS is greater than 1000 mg/l.

TDS	1090.0 mg/l	> 1000 mg/l
Iron	0.367 mg/l	> 0.3 mg/l
Manganese	0.075 mg/l	> 0.05 mg/l
Sodium	382.0 mg/l	> 200 mg/l

Community Perception of Water Quality:

Is water quality good? ___ fair? YES poor? ___
Comments: High Sodium content.

TREATMENT FACILITIES, STORAGE AND ADDITIONAL DEMANDS:

Water Treatment: Chlorine only.

Capacity of system: Limited to well capacity with no problems

Existing Storage [gal]: 50,000 Elevated 14,000 Ground

Additional Demands
Industrial Requirements: 0 gal/day
Fire Requirements: 0 gal/hour

WATER RATE STRUCTURE:

Water Rates: $8.70/3000 gal.; $1/additional 1000 gal
Comments: Interested in NAWS for future if cost effective. Currently the city has five operational wells that have worked fine.

NORTHWEST AREA WATER SUPPLY - COMMUNITY NEEDS ASSESSMENT

Voltaire
McHenry County

Updated May 1993 from 01/23/88
Hudson Bay Watershed

1988 Population : 90
1990 Census Data: 63
2010 Projection : 63
Population Trend: Decreasing

Milfred Telehey - Mayor
PO Box 185
Voltaire, ND 58792
Phone: 338-2041

Number of Residential Users: N/A
Municipal/Industrial Users: N/A

RESPONSE TO AGREEMENT OF INTENT: Signed (Rural Water)

WATER SOURCE, USE, DEMANDS AND QUALITY SUMMARY:

Source: **North Prairie RWA - System II and Private Wells**
Approx. depth of private wells: 14 - 16 feet

Dependable Water Supply: YES

Community Perception of Water Quality:

Is water quality good? YES fair? ___ poor? ___
Comments: Wells are a very shallow 14 to 16 feet; direct pump, no storage
Septic drain fields are allowed within 8 feet of well

TREATMENT FACILITIES, STORAGE AND ADDITIONAL DEMANDS:

Water Treatment: N/A

Capacity of system: N/A

Existing Storage [gal]: 0 Elevated 0 Ground

Additional Demands
Industrial Requirements: 0 gal/day
Fire Requirements: 0 gal/hour

WATER RATE STRUCTURE:

Water Rates: N/A
Comments: 1988 - No interest in city-wide system. The possibility exists to expand rural water to better serve this area if requested.

NORTHWEST AREA WATER SUPPLY - COMMUNITY NEEDS ASSESSMENT

Westhope
Bottineau County

Updated May 1993 from 03/15/88
Hudson Bay Watershed

1988 Population : 600
1990 Census Data: 578
2010 Projection : 578 (+0%)
Population Trend: Decreasing

Margo Helgerson - Mayor
PO Box 412
Westhope, ND 58793
Phone: 245-6316

Number of Residential Users: 200 Households
Municipal/Industrial Users: N/A

RESPONSE TO AGREEMENT OF INTENT: Signed Agreement

WATER SOURCE, USE, DEMANDS AND QUALITY SUMMARY:

Source: **Souris River**

1985 Use:	31.746 MG	1989 Use:	23.694 MG
1986 Use:	23.496 MG	1990 Use:	28.908 MG
1987 Use:	22.341 MG	1991 Use:	21.945 MG
1988 Use:	23.694 MG	1992 Use:	21.747 MG

Average Annual Surface Water Use: 24.696 MG
Average Daily Use: 0.068 MG
Peak Daily Use: 0.175 MG
Average Daily Use Per Capita 117 gallons
Dependable Water Supply: YES

Water Quality Evaluation and Categorization - 1992

Category II - Exceeds Four (4) or More Secondary Standards and TDS is greater than 1000 mg/l.

TDS	1230.0 mg/l	> 1000 mg/l
Sodium	317.0 mg/l	> 200 mg/l
Sulfates	634.0 mg/l	> 250 mg/l
pH	10.20	Exceeds 8.5 or Below 6.5

Community Perception of Water Quality:

Is water quality good? YES fair? ___ poor? ___

TREATMENT FACILITIES, STORAGE AND ADDITIONAL DEMANDS:

Water Treatment: Lime softening

Capacity of system: 350,000 gpd

Existing Storage [gal]: 40,000 Elevated 90,000 Ground

Additional Demands
Industrial Requirements: 0 gal/day
Fire Requirements: 0 gal/hour

WATER RATE STRUCTURE:

Water Rates: $12/first 2000 gal; $2.50/additional 1000 gallons
Comments: The water is not really good; 1988 comment - applied for MR&I money for an automated pump system.

NORTHWEST AREA WATER SUPPLY - COMMUNITY NEEDS ASSESSMENT

Wildrose
Williams County

Updated May 1993 from 03/20/88
Missouri River Watershed

1988 Population : 206
1990 Census Data: 193
2010 Projection : 193
Population Trend: Decreasing

Marlyn Vatne - Auditor
PO Box 506
Wildrose, ND 58795
Phone: 539-2271

Number of Residential Users: 92 Households
Municipal/Industrial Users: N/A

RESPONSE TO AGREEMENT OF INTENT: Signed Agreement

WATER SOURCE, USE, DEMANDS AND QUALITY SUMMARY:

Source: **Groundwater**

1985 Use:	10.296 MG	1989 Use:	0.000 MG (missing data)
1986 Use:	9.042 MG	1990 Use:	11.748 MG
1987 Use:	10.725 MG	1991 Use:	11.154 MG
1988 Use:	14.124 MG	1992 Use:	12.639 MG

Average Annual Groundwater Use: 11.390 MG
Average Daily Use: 0.031 MG
Peak Daily Use: 0.040 MG
Average Daily Use Per Capita 162 gallons
Dependable Water Supply: YES

Water Quality Evaluation and Categorization - 1991

Category II - Exceeds Four (4) or More Secondary Standards and TDS is greater than 1000 mg/l.

TDS	1100.0 mg/l	> 1000 mg/l
Iron	1.280 mg/l	> 0.3 mg/l
Manganese	0.765 mg/l	> 0.05 mg/l
Sulfates	489.0 mg/l	> 250 mg/l

Community Perception of Water Quality:
Is water quality good? YES fair? ___ poor? ___

TREATMENT FACILITIES, STORAGE AND ADDITIONAL DEMANDS:

Water Treatment: Chlorination and a new rust suspension system purchased from MonDak Chemical, Washburn.

Capacity of system: 130 gpm

Existing Storage [gal]: 55,000 Elevated 0 Ground

Additional Demands
Industrial Requirements: 0 gal/day
Fire Requirements: 0 gal/hour

WATER RATE STRUCTURE:

Water Rates: $4/4000 gal; $.50/1000 additional; $48 annual minimum
Comments: They have a good system which works well and an ample supply of water.

NORTHWEST AREA WATER SUPPLY - COMMUNITY NEEDS ASSESSMENT

Williston
Williams County

Updated May 1993 from 03/15/88
Missouri River Watershed

1988 Population : 15,000
1990 Census Data: 13,131
2010 Projection : 13,788 (+5%)
Population Trend: Increasing

Monte C. Meiers - City Engineer
PO Box 1306
Williston, ND 58802-1306
Phone: 572-8161 or 572-6368

Number of Residential Users: 4,357 Households
Municipal/Industrial Users: N/A

RESPONSE TO AGREEMENT OF INTENT: Signed Agreement

WATER SOURCE, USE, DEMANDS AND QUALITY SUMMARY:

Source: **Missouri River**

1985 Use:	1,004.223 MG	1989 Use:	964.425 MG
1986 Use:	790.548 MG	1990 Use:	890.637 MG
1987 Use:	861.399 MG	1991 Use:	843.249 MG
1988 Use:	1,076.757 MG	1992 Use:	811.404 MG

Average Annual Surface Water Use: 905.330 MG
Average Daily Use: 2.480 MG
Peak Daily Use: 8.000 MG
Average Daily Use Per Capita 179 gallons (City use only)
Dependable Water Supply: YES

Water Quality Evaluation and Categorization - 1992

Category VI - Exceeds Minimum Standard for TDS, Sulfate Chloride, pH, and or Recommended Standard for Sodium.
pH 9.29 Exceeds 8.5 or Below 6.5

Community Perception of Water Quality:

Is water quality good? ___ fair? YES poor? ___
Comments: Taste, odor & turbidity during spring melt & June rise. May have problems with trihalomethanes.

TREATMENT FACILITIES, STORAGE AND ADDITIONAL DEMANDS:

Water Treatment: Lime, soda ash

Capacity of system: 6 to 7 Million gallons per day

Existing Storage [gal]: 750,000 Elevated 7,650,000 Ground

Additional Demands
Industrial Requirements: 500,000 gal/day
Fire Requirements: 180,000 gal/hour

WATER RATE STRUCTURE:

Water Rates: $3.05 base plus 1.25/1000-3000 gallons; $0.90/1000 additional, summer rate of $0.70/1000 gallons.

Comments: Requested funding for required treatment plant capacity expansion. They also supply water to the Williams Rural Water System and the City of Trenton as of 1991. There is an additional 125,000 gallon storage tank to service Trenton. Some minor problems with turbidity of Missouri River water after spring melt and during the June rise; these place them near to or sometimes in excess of the 0.5 NTU level. Trenton represents about 1.5% of the total annual use for Williston while Williams Rural Water represents about 3.9%.

NORTHWEST AREA WATER SUPPLY - COMMUNITY NEEDS ASSESSMENT

Willow City
Bottineau County

Updated May 1993 from 03/17/88
Hudson Bay Watershed

1988 Population : 329
1990 Census Data: 281
2010 Projection : 281
Population Trend: Decreasing

Diana Sanderson - Auditor
PO Box 224
Willow City, ND 58384
Phone: 366-4710

Number of Residential Users: 148 Households
Municipal/Industrial Users: 1

RESPONSE TO AGREEMENT OF INTENT: Signed Agreement

WATER SOURCE, USE, DEMANDS AND QUALITY SUMMARY:

Source: **Groundwater**

1985 Use:	6.072 MG	1989 Use:	10.890 MG
1986 Use:	10.626 MG	1990 Use:	10.890 MG
1987 Use:	10.626 MG	1991 Use:	10.032 MG
1988 Use:	11.022 MG	1992 Use:	9.768 MG

Average Annual Groundwater Use: 9.991 MG
Average Daily Use: 0.027 MG
Peak Daily Use: 0.060 MG
Average Daily Use Per Capita 98 gallons
Dependable Water Supply: YES

Water Quality Evaluation and Categorization - 1991

Category III - Exceeds Four (4) or More Secondary Standards and TDS is less than 1000 mg/l.

TDS	891.0 mg/l	< 1000 mg/l
Iron	0.478 mg/l	> 0.3 mg/l
Manganese	0.755 mg/l	> 0.05 mg/l
Sulfates	260.0 mg/l	> 250 mg/l

Community Perception of Water Quality:

Is water quality good? YES fair? ___ poor? ___
Comments: High iron

TREATMENT FACILITIES, STORAGE AND ADDITIONAL DEMANDS:

Water Treatment: Chlorine replaced recently with NA 9194 Oxidizer.

Capacity of system: Limited to Well Capacity

Existing Storage [gal]: 55,000 Elevated 0 Ground

Additional Demands
Industrial Requirements: 0 gal/day
Fire Requirements: 0 gal/hour

WATER RATE STRUCTURE:

Water Rates: $6/2500 gal; $.80/additional, decreasing
Comments: Good water already; do not perceive a major need for a new supply. The two existing shallow wells have been in place for many years and they have not been a problem.

Rural Water Associations with Signed Agreements of Intent

All Seasons Water Users Association
Lake Metigoshe Rural Water
McLean-Sheridan Water Users Association
Mountrail Rural Water Association
North Prairie Rural Water Association
Pierce County Rural Water
Upper Souris Water Users Association
Williams Rural Water Users Association
Writing Rock Rural Water Association

NORTHWEST AREA WATER SUPPLY - RURAL WATER NEEDS ASSESSMENT

All Seasons WUA-System I
Bottineau County

Updated June 1993 from 03/17/88
Hudson Bay Watershed

1988 Population : 702 est
1990 Census Data: 605 est
2010 Projection : 605 est
Population Trend: Decreasing

Dan Schefer - Acting Manager
103 11th Street East
Bottineau, ND 58318
Phone: 228-3663

Number of Residential Users: 242 Households
Municipal/Industrial Users: none

RESPONSE TO AGREEMENT OF INTENT: Signed Agreement

WATER SOURCE, USE, DEMANDS AND QUALITY SUMMARY:

Source: **Groundwater**

1985 Use:	15.300 MG	1989 Use:	17.000 MG
1986 Use:	14.900 MG	1990 Use:	17.300 MG
1987 Use:	14.200 MG	1991 Use:	15.300 MG
1988 Use:	14.600 MG	1992 Use:	16.700 MG

Average Annual Groundwater Use: 15.633 MG
Average Daily Use: 0.043 MG
Peak Daily Use: 0.100 MG
Average Daily Use Per Household 178 gallons
Dependable Water Supply: No

Water Quality Evaluation and Categorization - 1992

Category IV - Exceeds Less Than Four Secondary Standards and TDS is greater than 1000.

TDS	1190.0 mg/l	> 1000 mg/l
Sulfates	458.0 mg/l	> 250 mg/l

Community Perception of Water Quality:

Is water quality good? ___ fair? YES poor? ___
Comments: Plan to install two new wells in 1993. The system should be more dependable when completed, with fewer shortages.

TREATMENT FACILITIES, STORAGE AND ADDITIONAL DEMANDS:

Water Treatment: Fe & Mn removal, green sand gravity filters & chlorination

Capacity of system: 80 gpm (115,200 gpd)

Existing Storage [gal]: 0 Elevated 40,000 Ground

Additional Demands
Industrial Requirements: N/A gal/day
Fire Requirements: N/A gal/hour

WATER RATE STRUCTURE:

Water Rates: $29 Min.; $5/1000 to 25,000 gal.; $3.5/additional 1000 gal.
Comments: Populations are based on an average of 2.5 people per household. They are very interested in a dependable supply.

NORTHWEST AREA WATER SUPPLY - RURAL WATER NEEDS ASSESSMENT

All Seasons WUA-System II
Bottineau County

Updated June 1993 from 03/17/88
Hudson Bay Watershed

1988 Population : 285 est
1990 Census Data: 212 est
2010 Projection : 212 est
Population Trend: Decreasing

Dan Schefer - Acting Manager
103 11th Street East
Bottineau, ND 58318
Phone: 228-3663

Number of Residential Users: 85 Households
Municipal/Industrial Users: none

RESPONSE TO AGREEMENT OF INTENT: Signed Agreement

WATER SOURCE, USE, DEMANDS AND QUALITY SUMMARY:

Source: **Groundwater**

1985 Use:	3.800 MG	1989 Use:	4.600 MG
1986 Use:	4.000 MG	1990 Use:	4.500 MG
1987 Use:	4.100 MG	1991 Use:	4.100 MG
1988 Use:	4.400 MG	1992 Use:	4.100 MG

Average Annual Groundwater Use: 4.200 MG
Average Daily Use: 0.012 MG
Peak Daily Use: 0.020 MG
Average Daily Use Per Household 141 gallons
Dependable Water Supply: YES

Water Quality Evaluation and Categorization - 1990

Category VII - No Standards Exceeded With Reported Sample.
Treated water is adequate for domestic supply.

Community Perception of Water Quality:

Is water quality good? YES fair? ___ poor? ___
Comments: High Manganese and Sodium
This is the best unit of the All Seasons System

TREATMENT FACILITIES, STORAGE AND ADDITIONAL DEMANDS:

Water Treatment: none

Capacity of system: Limited to well capacity

Existing Storage [gal]: 0 Elevated 0 Ground
(Wells pump directly into a small pressure tank)

Additional Demands
Industrial Requirements: 0 gal/day
Fire Requirements: 0 gal/hour

WATER RATE STRUCTURE:

Water Rates: $29 Min.; $5/1000 to 25,000 gal.; $3.5/additional 1000 gal.
Comments: Populations are based on an average of 2.5 people per household. They are very interested in a dependable supply.

NORTHWEST AREA WATER SUPPLY - COMMUNITY NEEDS ASSESSMENT

All Seasons WUA-System III
Bottineau County

Updated June 1993 from 03/17/88
Hudson Bay Watershed

1988 Population : 975 est
1990 Census Data: 760 est
2010 Projection : 760 est
Population Trend: Decreasing

Dan Schefer - Manager
103 11th Street East
Bottineau, ND 58318
Phone: 228-3663

Number of Residential Users: 304 Households
Municipal/Industrial Users: none

RESPONSE TO AGREEMENT OF INTENT: Signed Agreement

WATER SOURCE, USE, DEMANDS AND QUALITY SUMMARY:

Source: **Groundwater**

1985 Use:	19.800 MG	1989 Use:	21.000 MG
1986 Use:	17 700 MG	1990 Use:	19.800 MG
1987 Use:	17.600 MG	1991 Use:	18.400 MG
1988 Use:	18.600 MG	1992 Use:	16.400 MG

Average Annual Groundwater Use: 18.663 MG
Average Daily Use: 0.051 MG
Peak Daily Use: 0.120 MG
Average Daily Use Per Household 168 gallons
Dependable Water Supply: YES

Water Quality Evaluation and Categorization - 1990

Category VI - Exceeds Minimum Standard for TDS, Sulfate Chloride, pH, and or Recommended Standard for Sodium.

TDS 507 mg/l > 500 mg/l

Community Perception of Water Quality:

Is water quality good? ___ fair? YES poor? ___
Comments: High in Manganese and Iron. This is the worst system for quality of the All Seasons facilities.

TREATMENT FACILITIES, STORAGE AND ADDITIONAL DEMANDS:

Water Treatment: Fe & Mn removal, green sand gravity filters & chlorination

Capacity of system: 150 gpm (216,000 gpd)

Existing Storage [gal]: 0 Elevated 98,000 Ground

Additional Demands
Industrial Requirements: 0 gal/day
Fire Requirements: 0 gal/hour

WATER RATE STRUCTURE:

Water Rates: $29 Min.; $5/1000 to 25,000 gal.; $3.5/additional 1000 gal.
Comments: Populations are based on an average of 2.5 people per household. They are very interested in a water supply. Water quality data reported by All Seasons varies from the State Health Department; (TDS 1040 mg/l, Sulfate 135 mg/l, Chloride 207 mg/l, Sodium 200 mg/l, etc.) may need to be further reviewed.

NORTHWEST AREA WATER SUPPLY - COMMUNITY NEEDS ASSESSMENT

All Seasons WUA-System IV
Bottineau County

Updated June 1993 from 03/17/88
Hudson Bay Watershed

1988 Population : 417 est
1990 Census Data: 360 est
2010 Projection : 360 est
Population Trend: Decreasing

Dan Schefer - Acting Manager
103 11th Street East
Bottineau, ND 58318
Phone: 228-3663

Number of Residential Users: 144 Households
Municipal/Industrial Users: N/A

RESPONSE TO AGREEMENT OF INTENT: Signed Agreement

WATER SOURCE, USE, DEMANDS AND QUALITY SUMMARY:

Source: **Groundwater**

1985 Use:	10.300 MG	1989 Use:	12.000 MG
1986 Use:	9.000 MG	1990 Use:	12.600 MG
1987 Use:	10.000 MG	1991 Use:	10.300 MG
1988 Use:	9.800 MG	1992 Use:	10.300 MG

Average Annual Groundwater Use: 10650 MG
Average Daily Use: 0.029 MG
Peak Daily Use: 0.060 MG
Average Daily Use Per Household 201 gallons
Dependable Water Supply: YES

Water Quality Evaluation and Categorization - 1991

Category VII - No Standards Exceeded With Reported Sample.
Treated water is adequate for domestic supply.

Community Perception of Water Quality:

Is water quality good? YES fair? ___ poor? ___
Comments: Water is high in Manganese. This system is outside study area.

TREATMENT FACILITIES, STORAGE AND ADDITIONAL DEMANDS:

Water Treatment: Fe & Mn removal, green sand gravity filters & chlorination

Capacity of system: 80 gpm (115,200 gpd)

Existing Storage [gal]: 0 Elevated 50,000 Ground

Additional Demands
Industrial Requirements: 0 gal/day
Fire Requirements: 0 gal/hour

WATER RATE STRUCTURE:

Water Rates: $29 Min.; $5/1000 to 25,000 gal.; $3.5/additional 1000 gal.
Comments: Populations are based on an average of 2.5 people per household. They are very interested in a dependable supply. This system serves an area outside of Bottineau County in the western edge of Rollette County.

NORTHWEST AREA WATER SUPPLY - RURAL WATER NEEDS ASSESSMENT

Lake Metigoshe Rural Water
Bottineau County

June 1993
Hudson Bay Watershed

1988 Population : N/A
1990 Census Data: N/A
2010 Projection : N/A
Population Trend: Decreasing

Stanley Romos
Oak Creek Water Resource District
524 Main Street
Bottineau, ND 58318
Phone: 228-3161 or 228-2464

Number of Residential Users: N/A Households
Municipal/Industrial Users: N/A

RESPONSE TO AGREEMENT OF INTENT: Signed Agreement

WATER SOURCE, USE, DEMANDS AND QUALITY SUMMARY:

No water permit or use data reported

Dependable Water Supply: NO

Community Perception of Water Quality:

Is water quality good? ___ fair? ___ poor? ___
Comments: This system was not included in the 1988 Survey

TREATMENT FACILITIES, STORAGE AND ADDITIONAL DEMANDS:

Water Treatment: N/A

Capacity of system: N/A

Existing Storage [gal]: 0 Elevated 0 Ground

Additional Demands
Industrial Requirements: 0 gal/day
Fire Requirements: 0 gal/hour

WATER RATE STRUCTURE:

Water Rates: N/A
Comments: The agreement for this proposed rural water system was signed through a joint powers agreement between the Bottineau and Oak Creek Water Resource Districts on behalf of the rural residents located in and around Lake Metigoshe, Bottineau County. They felt that the development of a rural water system in this region would be beneficial and should be included in the NAWS pre-final design process.

NORTHWEST AREA WATER SUPPLY - RURAL WATER NEEDS ASSESSMENT

McLean-Sheridan RWA
McLean and Sheridan Counties

June 1993
Missouri River Watershed

1988 Population : N/A
1990 Census Data: N/A
2010 Projection : N/A
Population Trend: Decreasing

Rocky Thomas - Manager
RR #1 Box 170A
Turtle Lake, ND 58575-0170
Phone: 448-2686

Number of Residential Users: N/A Households
Municipal/Industrial Users: N/A

RESPONSE TO AGREEMENT OF INTENT: Signed Agreement

WATER SOURCE, USE, DEMANDS AND QUALITY SUMMARY:

Source: **Groundwater**

1985 Use:	0.000 MG	1989 Use:	0.000 MG
1986 Use:	0.000 MG	1990 Use:	18.216 MG
1987 Use:	0.000 MG	1991 Use:	57.123 MG
1988 Use:	0.000 MG	1992 Use:	76.890 MG

Average Annual Groundwater Use: 50.743 MG
Average Daily Use: 0.139 MG
Peak Daily Use: N/A MG
Average Daily Use Per Household N/A gallons
Dependable Water Supply: YES

Water Quality Evaluation and Categorization - 1991

Category VII - No Standards Exceeded With Reported Sample.
Treated water is adequate for domestic supply.

Community Perception of Water Quality:

Is water quality good? YES fair? ____ poor? ___
Comments: <u>This system was not surveyed in 1988</u>.

TREATMENT FACILITIES, STORAGE AND ADDITIONAL DEMANDS:

Water Treatment: N/A

Capacity of system: N/A

Existing Storage [gal]: 0 Elevated 0 Ground

Additional Demands
Industrial Requirements: 0 gal/day
Fire Requirements: 0 gal/hour

WATER RATE STRUCTURE:

Water Rates: N/A
Comments: They are not interested in service to their present system, however, they are considering additional service areas located in western and northern McLean County. Their system capacity is limited and they would like a water supply from the NAWS project to serve these areas. Since this system was still in the development stages the number of users varied each year and a per household use was not determined. This change is shown in the significant increase in water use over the three years of record.

NORTHWEST AREA WATER SUPPLY - RURAL WATER NEEDS ASSESSMENT

Mountrail Rural Water
Mountrail County

Updated June 1993 from 05/12/88
Hudson Bay/Miss Watershed

1988 Population : N/A
1990 Census Data: N/A
2010 Projection : N/A
Population Trend: Decreasing

Gerald Leeson - Mountrail RWA
HCR 2, Box 37
Berthold, ND 58718
Phone: 453-3314

Number of Residential Users: 796 Households
Municipal/Industrial Users: none

RESPONSE TO AGREEMENT OF INTENT: Pending

WATER SOURCE, USE, DEMANDS AND QUALITY SUMMARY:

No water permit or use data reported

Dependable Water Supply: NO - need a water supply

Community Perception of Water Quality:

Is water quality good? ___ fair? ___ poor? YES
Comments: Most of the proposed well sites have hard water with high Fe and Mn. Water which is soft is often high in sodium. Deep wells are high in minerals.

TREATMENT FACILITIES, STORAGE AND ADDITIONAL DEMANDS:

Water Treatment: Well water would need treatment to be useable.

Capacity of system: N/A

Existing Storage [gal]: 0 Elevated 0 Ground

Additional Demands
Industrial Requirements: 0 gal/day
Fire Requirements: 0 gal/hour

WATER RATE STRUCTURE:

Water Rates: N/A
Comments: A February 1979 Estimate of proposed project cost was $17,597,025 with a potential membership of around 800 households. No miles of pipeline or number of pumping stations were provided. Currently, some of the farmers in the Stanley area are considering a request to hook up to the R&T System. As of 7/12/93 a signed agreement had not been received. Though communications with local representatives of this association they indicated it will be submitted.

NORTHWEST AREA WATER SUPPLY - RURAL WATER NEEDS ASSESSMENT

North Prairie RWA-System I Updated June 1993 from 03/18/88
Ward County Hudson Bay Watershed

1988 Population : N/A
1990 Census Data: 3,108 est
2010 Projection : 3,108 est
Population Trend: Decreasing

Jason Betterley - Manager
RR 5, Box 4
Minot, ND 58701-9311
Phone: 852-1886

Number of Residential Users: 1,151 Households
Municipal/Industrial Users: 1 Missle Site
2 Cities (Surrey and Max)

RESPONSE TO AGREEMENT OF INTENT: Signed Agreement

WATER SOURCE, USE, DEMANDS AND QUALITY SUMMARY:

Source: **City of Minot**

1985 Use:	48.710 MG	1989 Use:	92.842 MG
1986 Use:	68.368 MG	1990 Use:	94 787 MG
1987 Use:	91.182 MG	1991 Use:	156.119 MG
1988 Use:	102.752 MG	1992 Use:	112.840 MG

Average Annual Groundwater Use: 85.289 MG
Average Daily Use: 0.263 MG
Peak Daily Use: Monthly peak/30 days 0.393 MG
Average Daily Use Per Household 228 gallons
Dependable Water Supply: YES

Community Perception of Water Quality:

Is water quality good? YES fair? ___ poor? ___
Comments: The City of Minot contracts with North Prairie to pump & treat water and provides service to both Systems I & II.

TREATMENT FACILITIES, STORAGE AND ADDITIONAL DEMANDS:

Water Treatment: See Minot

Capacity of system: Provided by Minot

Existing Storage [gal]: 0 Elevated 346,000 Ground

Additional Demands
Industrial Requirements: 10,000 gal/day
Fire Requirements: 0 gal/hour

WATER RATE STRUCTURE:

Water Rates: Rural & Residential: $24 min/first 1000 gal; $4/1000 gal 1000 to 40,000; $3/additional 1000 gallons.
Commercial: $27.80 min/first 1000 gal; $4/1000 gal 1000 to 40,000; $3/additional 1000 gallons.
Public: $156 Annual minimum/first 1000 gal; $4/1000 gal 1000 to 40,000; $3/additional 1000 gallons.

Comments: Towns & Communities Served: Max, Surrey and Ruthville as a Bulk User; Douglas, Des Lacs, Voltaire as Individual Users

NORTHWEST AREA WATER SUPPLY - RURAL WATER NEEDS ASSESSMENT

North Prairie RWA-System II
Ward County

Updated June 1993 from 03/18/88
Hudson Bay Watershed

1988 Population : N/A
1990 Census Data: 724 est
2010 Projection : 724 est
Population Trend: Decreasing

Jason Betterley - Manager
RR 5, Box 4
Minot, ND 58701-9311
Phone: 852-1886

Number of Residential Users: 268 Households
Municipal/Industrial Users: none

RESPONSE TO AGREEMENT OF INTENT: Signed Agreement

WATER SOURCE, USE, DEMANDS AND QUALITY SUMMARY:

Source: **City of Minot**

1985 Use:	14.833 MG	1989 Use:	21.902 MG
1986 Use:	17.116 MG	1990 Use:	20.043 MG
1987 Use:	16.480 MG	1991 Use:	20.765 MG
1988 Use:	20.747 MG	1992 Use:	21.841 MG

Average Annual Groundwater Use: 25,272 MG
Average Daily Use: 0.053 MG
Peak Daily Use: Monthly peak/30 days 0.083 MG
Average Daily Use Per Household 198 gallons
Dependable Water Supply: YES

Community Perception of Water Quality:

Is water quality good? YES fair? ___ poor? ___
Comments: The City of Minot contracts with North Prairie to pump & treat water and provides service to both Systems I & II.

TREATMENT FACILITIES, STORAGE AND ADDITIONAL DEMANDS:

Water Treatment: See Minot

Capacity of system: Provided by Minot

Existing Storage [gal]: 500,000 Elevated (Minot Tower) 0 Ground

Additional Demands
Industrial Requirements: 0 gal/day
Fire Requirements: 0 gal/hour

WATER RATE STRUCTURE:

Water Rates: Rural & Residential: $24 min/first 1000 gal; $4/1000 gal 1000 to 40,000; $3/additional 1000 gallons.
Commercial: $27.80 min/first 1000 gal; $4/1000 gal 1000 to 40,000; $3/additional 1000 gallons.
Public: $156 Annual minimum/first 1000 gal; $4/1000 gal 1000 to 40,000; $3/additional 1000 gallons.

NORTHWEST AREA WATER SUPPLY - RURAL WATER NEEDS ASSESSMENT

North Prairie RWA-System III Updated June 1993 from 03/18/88
Ward County Hudson Bay Watershed

1988 Population : N/A
1990 Census Data: 410 est
2010 Projection : 410 est
Population Trend: Decreasing

Jason Betterley - Manager
RR 5, Box 4
Minot , ND 58701
Phone: 852-1886

Number of Residential Users: 152 Households
Municipal/Industrial Users: 1 Missle Site

RESPONSE TO AGREEMENT OF INTENT: Signed Agreement

WATER SOURCE, USE, DEMANDS AND QUALITY SUMMARY:

Source: **Groundwater**

1985 Use:	N/A MG	1989 Use:	14.787 MG
1986 Use:	N/A MG	1990 Use:	8.695 MG
1987 Use:	N/A MG	1991 Use:	8.780 MG
1988 Use:	14.673 MG	1992 Use:	9.471 MG

Average Annual Groundwater Use: 11 281 MG
Average Daily Use: 0.031 MG
Peak Daily Use: 0.050 MG
Average Daily Use Per Household 203 gallons
Dependable Water Supply: YES

Water Quality Evaluation and Categorization - 1992

Category V - Exceeds Iron or Manganese Secondary Standards

TDS	546.0 mg/l	> 500.0 mg/l
Manganese	0.515 mg/l	> 0.05 mg/l

Community Perception of Water Quality:

Is water quality good? YES fair? ___ poor? YES
Comments: Iron removal required. Well field is located in Velva Township in McHenry County.

TREATMENT FACILITIES, STORAGE AND ADDITIONAL DEMANDS:

Water Treatment: Iron and Manganese removal as well as Chlorination

Capacity of system: 400,000 gpd

Existing Storage [gal]: 0 Elevated 76,000 Ground

Additional Demands
Industrial Requirements: 0 gal/day
Fire Requirements: 0 gal/hour

WATER RATE STRUCTURE:

Water Rates: Rural & Residential: $24 min/first 1000 gal; $4/1000 gal 1000 to 40,000; $3/additional 1000 gallons.
Commercial: $27.80 min/first 1000 gal; $4/1000 gal 1000 to 40,000; $3/additional 1000 gallons.
Public: $156 Annual minimum/first 1000 gal; $4/1000 gal 1000 to 40,000; $3/additional 1000 gallons.
Comments: Serves Norwich - 4 Individual Users.

NORTHWEST AREA WATER SUPPLY - RURAL WATER NEEDS ASSESSMENT

Pierce County Rural Water June 1993
Pierce County Hudson Bay

1988 Population : N/A
1990 Census Data: N/A
2010 Projection : N/A
Population Trend: Decreasing

Yvonne Stutrud, Auditor
Pierce County Commission
240 SE Second Street
Rugby, ND 58368 Phone: 776-5225

Number of Residential Users: N/A Households
Municipal/Industrial Users: N/A

RESPONSE TO AGREEMENT OF INTENT: Signed Agreement

WATER SOURCE, USE, DEMANDS AND QUALITY SUMMARY:

No water permit or use data reported

Dependable Water Supply: NO

Community Perception of Water Quality:

Is water quality good? ___ fair? ___ poor? ___
Comments: This system was not included in the 1988 Survey

TREATMENT FACILITIES, STORAGE AND ADDITIONAL DEMANDS:

Water Treatment: N/A

Capacity of system: N/A

Existing Storage [gal]: 0 Elevated 0 Ground

Additional Demands
Industrial Requirements: 0 gal/day
Fire Requirements: 0 gal/hour

WATER RATE STRUCTURE:

Water Rates: N/A
Comments: The agreement for this proposed rural water system was signed by the Pierce County Commission on behalf of the rural residents of Pierce County. They felt that the development of a rural water system in their county would be beneficial and should be included in the NAWS pre-final design process.

NORTHWEST AREA WATER SUPPLY - RURAL WATER NEEDS ASSESSMENT

Upper Souris WUA-System I
Renville, Burke and
Ward Counties

Updated June 1993 from 03/22/88
Hudson Bay Watershed

1988 Population : N/A
1990 Census Data: 1,240 est
2010 Projection : 1,240 est
Population Trend: Decreasing

Gary Hager - Manager
PO Box 397
Kenmare, ND 58746-0397
Phone: 385-4093

Number of Residential Users: 460 Households
Municipal/Industrial Users: none

RESPONSE TO AGREEMENT OF INTENT: Signed Agreement

WATER SOURCE, USE, DEMANDS AND QUALITY SUMMARY:

Source: **Groundwater**

1985 Use:	26.622 MG	1989 Use:	26.844 MG
1986 Use:	24.451 MG	1990 Use:	32.741 MG
1987 Use:	25.056 MG	1991 Use:	34.741 MG
1988 Use:	35.484 MG	1992 Use:	34.388 MG

Average Annual Groundwater Use: 29.928 MG
Average Daily Use: 0.082 MG
Peak Daily Use: 0.132 MG [1]
Average Daily Use Per Household 178 gallons
Dependable Water Supply: YES

Water Quality Evaluation and Categorization - 1991

Category IV - Exceeds Less Than Four Secondary Standards and TDS is greater than 1000.

TDS	1240.0 mg/l	> 1000 mg/l
Sodium	445.0 mg/l	> 200 mg/l
Chloride	299.0 mg/l	> 250 mg/l

Community Perception of Water Quality:

Is water quality good? ___ fair? YES poor? ___
Comments: High Sodium content

TREATMENT FACILITIES, STORAGE AND ADDITIONAL DEMANDS:

Water Treatment: Iron and Manganese removal as well as Chlorination

Capacity of system: 150,000 gpd

Existing Storage [gal]: 0 Elevated 150,000 Ground

Additional Demands
Industrial Requirements: 0 gal/day
Fire Requirements: 0 gal/hour

WATER RATE STRUCTURE:

Water Rates: $24 minimum/month; $4.4/1000 gallons; $288 annual minimum
Comments: Cost will determine interest. They are concerned about cities staying on rural water. Donnybrook, Tolley, Grano, Loraine and Norma are currently served by System I. Populations are based on 2.7 persons per household. Discussions are also underway for this system to begin service to the community of Bowbells.

[1] Based on 1993 sample measurements.

NORTHWEST AREA WATER SUPPLY - RURAL WATER NEEDS ASSESSMENT

Upper Souris WUA-System II
Bottineau, Renville, Ward and McHenry Counties

Updated June 1993 from 03/22/88
Hudson Bay Watershed

1988 Population : N/A
1990 Census Data: 880
2010 Projection : 880
Population Trend: Decreasing

Gary Hager - Manager
PO Box 397
Kenmare, ND 58746-0397
Phone: 385-4093

Number of Residential Users: 70 Households
Municipal/Industrial Users: 2 Glenburn and Lansford

RESPONSE TO AGREEMENT OF INTENT: Signed Agreement

WATER SOURCE, USE, DEMANDS AND QUALITY SUMMARY:

Source: **Groundwater**

1985 Use:	23.505 MG	1989 Use:	24.426 MG
1986 Use:	23.602 MG	1990 Use:	26.247 MG
1987 Use:	20.849 MG	1991 Use:	25.724 MG
1988 Use:	28.421 MG	1992 Use:	26.190 MG

Average Annual Groundwater Use: 24.870 MG
Average Daily Use: 0.068 MG
Peak Daily Use: 0.105 MG [1]
Average Daily Use Per Household 182 gallons
Dependable Water Supply: YES

Water Quality Evaluation and Categorization - 1991

Category IV - Exceeds Less Than Four Secondary Standards and TDS is greater than 1000.

TDS	1240.0 mg/l	> 1000 mg/l
Sodium	445.0 mg/l	> 200 mg/l
Chloride	299.0 mg/l	> 250 mg/l

Community Perception of Water Quality:

Is water quality good? ___ fair? YES poor? ___
Comments: High Sodium content

TREATMENT FACILITIES, STORAGE AND ADDITIONAL DEMANDS:

Water Treatment: Iron and Manganese removal as well as Chlorination

Capacity of system: 110,000 gpd

Existing Storage [gal]: 0 Elevated 50,000 Ground

Additional Demands
Industrial Requirements: 0 gal/day
Fire Requirements: 0 gal/hour

WATER RATE STRUCTURE:

Water Rates: $24 minimum/month; $4.4/1000 gallons; $288 annual minimum
Comments: Cost would determine interest. They are concerned about cities staying on rural water. Glenburn and Lansford, with populations of 440 and 250, are currently served by this system. Their populations were converted to a per household basis using the 1990 census to determine the daily use rate.

[1] Based on 1993 sample measurements.

NORTHWEST AREA WATER SUPPLY - RURAL WATER NEEDS ASSESSMENT

Writing Rock RW Users
Divide County

Updated June 1993 from 03/15/88
Missouri River Watershed

1988 Population : N/A
1990 Census Data: N/A
2010 Projection : N/A
Population Trend: Decreasing

Emery Olsen
HC 1, Box 25
Fortuna, ND 58844
Phone: 982-3501

Number of Residential Users: 190 Households
Municipal/Industrial Users: N/A

RESPONSE TO AGREEMENT OF INTENT: Signed Agreement

WATER SOURCE, USE, DEMANDS AND QUALITY SUMMARY:

No water permit or use data reported

Dependable Water Supply: NO

Community Perception of Water Quality:

Is water quality good? ___ fair? ___ poor? ___
Comments:

TREATMENT FACILITIES, STORAGE AND ADDITIONAL DEMANDS:

Water Treatment: N/A

Capacity of system: N/A

Existing Storage [gal]: 0 Elevated 0 Ground

Additional Demands
Industrial Requirements: 0 gal/day
Fire Requirements: 0 gal/hour

WATER RATE STRUCTURE:

Water Rates: N/A
Comments: Writing Rock RWU has been in the planning stages for many years. Initial sign up was between 180-200; final paid hookups: 88 residents plus Ambrose, Fortuna & border station. During initial planning the costs were beyond what FmHA would cover. The primary drawback for the development of this system is cost.

APPENDIX D

Water Quality Assessments

Municipal Water Systems, Rural Water Systems and Potential Surface and Groundwater Supplies

Note: Current EPA standards require that water quality samples be tested annually for surface water supplies and every three years for groundwater supplies causing the water quality sample data to vary from 1989 -1992.

Community - Water Quality Assessments

Anamoose
Benedict
Berthold
Bottineau
Bowbells
Burlington
Columbus
Crosby
Deering
Drake
Flaxton
Fortuna
Garrison
Granville
Grenora
Karlsruhe
Kenmare
Lignite
Makoti
Maxbass
Minot
Mohall
New Town
Newburg
Noonan
Parshall
Plaza
Portal
Powers Lake
Ray and Tioga (R & T)
Ross
Rugby
Ryder
Sawyer
Sherwood
Souris
Stanley
Towner
Upham
Velva
Westhope
Wildrose
Williston
Willow City

Anamoose, McHenry County

Water Quality Chemical Analysis

Report for Fiscal Year = 1990

Water Source: Treated Groundwater

Arsenic(As)	0.0100	mg/l
Barium(Ba)	0.0456	mg/l
Cadmium(Cd)	0.00000	mg/l
Chromium(Cr)	0.00000	mg/l
Lead(Pb)	0.0000	mg/l
Mercury(Hg)	0.00000	mg/l
Nitrate (as N)	0.00	mg/l
Selenium(Se)	0.000	mg/l
Fluoride(F)	1.20	mg/l
Silver(Ag)	0.00000	mg/l
pH	7.70	
Conductivity	1436.0	umhos/cm
Total Dissolved Solids (TDS)	937.0	mg/l
Total Alkalinity ($CaCO_3$)	493.0	mg/l
Total Hardness (as $CaCO_3$)	376.0	mg/l
Calcium (Ca)	102.000	mg/l
Magnesium (Mg)	29.4	mg/l
Sodium (Na)	224.0	mg/l
Potassium (K)	12.500	mg/l
Iron (Fe)	0.029	mg/l
Manganese (Mn)	0.000	mg/l
Carbonate (CO_3)	0.0	mg/l
Bicarbonate (HCO_3)	602	mg/l
Sulfate as (SO_4)	166.0	mg/l
Chloride (Cl)	106.0	mg/l
Copper (Cu)	0.0261	mg/l
Zinc (Zn)	0.0090	mg/l
Total Hardness (as $CaCO_3$)	22.0	Grains/gal
Langelier Index	0.60	

** NOTE: 1) Langelier Index - Indicates Corrosion Rating (When less than 0.0, water tends to be corrosive).

2) A TDS of less than 1000 mg/l is considered satisfactory.

Water Quality Evaluation and Categorization

Category VI - Exceeds minimum standard for TDS, Sulfate, Chloride, pH, and/or recommended standard for Sodium.

TDS	937.0 mg/l	> 500 mg/l
Sodium	224.0 mg/l	> 200 mg/l

*** NOTE: Data is for treated samples only and was provided by the North Dakota Department of Health and Consolidated Laboratories.

Benedict, McLean County

Water Quality Chemical Analysis

Report for Fiscal Year = 1992

Water Source: Treated Groundwater

Arsenic(As)	0.0008	mg/l
Barium(Ba)	0.0088	mg/l
Cadmium(Cd)	0.00020	mg/l
Chromium(Cr)	0.00020	mg/l
Lead(Pb)	0.0006	mg/l
Mercury(Hg)	0.00020	mg/l
Nitrate (as N)	0.00	mg/l
Selenium(Se)	0.001	mg/l
Fluoride(F)	0.06	mg/l
Silver(Ag)	0.00020	mg/l
pH	7.06	
Conductivity	2000.0	umhos/cm
Total Dissolved Solids (TDS)	1430.0	mg/l
Total Alkalinity ($CaCO_3$)	615.0	mg/l
Total Hardness (as $CaCO_3$)	778.0	mg/l
Calcium (Ca)	171.000	mg/l
Magnesium (Mg)	85.2	mg/l
Sodium (Na)	190.0	mg/l
Potassium (K)	10.800	mg/l
Iron (Fe)	2.630	mg/l
Manganese (Mn)	0.156	mg/l
Carbonate (CO_3)	0.0	mg/l
Bicarbonate (HCO_3)	751	mg/l
Sulfate as (SO_4)	589.0	mg/l
Chloride (Cl)	17.3	mg/l
Copper (Cu)	0.0140	mg/l
Zinc (Zn)	0.0490	mg/l
Total Hardness (as $CaCO_3$)	45.0	Grains/gal
Langelier Index	0.28	

** NOTE: 1) Langelier Index - Indicates Corrosion Rating (When less than 0.0, water tends to be corrosive).

2) A TDS of less than 1000 mg/l is considered satisfactory.

Water Quality Evaluation and Categorization

Category II - Exceeds Four (4) or More Secondary Standards and TDS is greater than 1000 mg/l.

TDS	1430.0	mg/l >	1000 mg/l
Iron	2.630	mg/l >	0.3 mg/l
Manganese	0.156	mg/l >	0.05 mg/l
Sulfates	589.0	mg/l >	250 mg/l

*** NOTE: Data is for treated samples only and was provided by the North Dakota Department of Health and Consolidated Laboratories.

Berthold, Ward County

Water Quality Chemical Analysis

Report for Fiscal Year = 1992

Water Source: Treated Groundwater

Arsenic(As)	0.0005	mg/l
Barium(Ba)	0.2890	mg/l
Cadmium(Cd)	0.00020	mg/l
Chromium(Cr)	0.00020	mg/l
Lead(Pb)	0.0009	mg/l
Mercury(Hg)	0.00020	mg/l
Nitrate (as N)	0.00	mg/l
Selenium(Se)	0.004	mg/l
Fluoride(F)	1.75	mg/l
Silver(Ag)	0.00020	mg/l
pH	7.65	
Conductivity	3810.0	umhos/cm
Total Dissolved Solids (TDS)	2340.0	mg/l
Total Alkalinity ($CaCO_3$)	1640.0	mg/l
Total Hardness (as $CaCO_3$)	22.0	mg/l
Calcium (Ca)	4.650	mg/l
Magnesium (Mg)	2.6	mg/l
Sodium (Na)	979.0	mg/l
Potassium (K)	2.940	mg/l
Iron (Fe)	0.089	mg/l
Manganese (Mn)	0.001	mg/l
Carbonate (CO_3)	11.0	mg/l
Bicarbonate (HCO_3)	1980	mg/l
Sulfate as (SO_4)	11.0	mg/l
Chloride (Cl)	351.0	mg/l
Copper (Cu)	0.0140	mg/l
Zinc (Zn)	0.0600	mg/l
Total Hardness (as $CaCO_3$)	1.0	Grains/gal
Langelier Index	-0.27	

** NOTE: 1) Langelier Index - Indicates Corrosion Rating (When less than 0.0, water tends to be corrosive).

2) A TDS of less than 1000 mg/l is considered satisfactory.

Water Quality Evaluation and Categorization

Category IV - Exceeds Less Than Four Secondary Standards and TDS is greater than 1000.

TDS	2340.0 mg/l	>	1000 mg/l
Sodium	979.0 mg/l	>	200 mg/l
Chloride	351.0 mg/l	>	250 mg/l

*** NOTE: Data is for treated samples only and was provided by the North Dakota Department of Health and Consolidated Laboratories.

Bottineau, Bottineau County

Water Quality Chemical Analysis

Report for Fiscal Year = 1991

Water Source: Treated Groundwater

Arsenic(As)	0.0013	mg/l
Barium(Ba)	0.0130	mg/l
Cadmium(Cd)	0.00020	mg/l
Chromium(Cr)	0.00020	mg/l
Lead(Pb)	0.0012	mg/l
Mercury(Hg)	0.00020	mg/l
Nitrate (as N)	0.28	mg/l
Selenium(Se)	0.003	mg/l
Fluoride(F)	1.21	mg/l
Silver(Ag)	0.00049	mg/l
pH	7.22	
Conductivity	1454.0	umhos/cm
Total Dissolved Solids (TDS)	994.0	mg/l
Total Alkalinity ($CaCO_3$)	471.0	mg/l
Total Hardness (as $CaCO_3$)	762.0	mg/l
Calcium (Ca)	197.000	mg/l
Magnesium (Mg)	65.5	mg/l
Sodium (Na)	43.8	mg/l
Potassium (K)	7.150	mg/l
Iron (Fe)	0.047	mg/l
Manganese (Mn)	1.450	mg/l
Carbonate (CO_3)	0.0	mg/l
Bicarbonate (HCO_3)	575	mg/l
Sulfate as (SO_4)	388.0	mg/l
Chloride (Cl)	8.2	mg/l
Copper (Cu)	0.0595	mg/l
Zinc (Zn)	0.0150	mg/l
Total Hardness (as $CaCO_3$)	45.0	Grains/gal
Langelier Index	0.39	

** NOTE: 1) Langelier Index - Indicates Corrosion Rating (When less than 0.0, water tends to be corrosive).

2) A TDS of less than 1000 mg/l is considered satisfactory.

Water Quality Evaluation and Categorization

Category V - Exceeds Iron or Manganese Secondary Standards

Manganese	1.450 mg/l	> 0.05 mg/l
Sulfates	388.0 mg/l	> 250 mg/l

*** NOTE: Data is for treated samples only and was provided by the North Dakota Department of Health and Consolidated Laboratories.

Bowbells, Burke County

Water Quality Chemical Analysis

Report for Fiscal Year = 1991

Water Source: Treated Groundwater

Arsenic(As)	0.0010	mg/l
Barium(Ba)	0.2250	mg/l
Cadmium(Cd)	0.00020	mg/l
Chromium(Cr)	0.00020	mg/l
Lead(Pb)	0.0010	mg/l
Mercury(Hg)	0.00020	mg/l
Nitrate (as N)	0.04	mg/l
Selenium(Se)	0.012	mg/l
Fluoride(F)	0.77	mg/l
Silver(Ag)	0.00020	mg/l
pH	7.83	
Conductivity	3190.0	umhos/cm
Total Dissolved Solids (TDS)	2170.0	mg/l
Total Alkalinity ($CaCO_3$)	1220.0	mg/l
Total Hardness (as $CaCO_3$)	128.0	mg/l
Calcium (Ca)	31.300	mg/l
Magnesium (Mg)	12.0	mg/l
Sodium (Na)	884.0	mg/l
Potassium (K)	5.260	mg/l
Iron (Fe)	0.478	mg/l
Manganese (Mn)	0.019	mg/l
Carbonate (CO_3)	0.0	mg/l
Bicarbonate (HCO_3)	1490	mg/l
Sulfate as (SO_4)	194.0	mg/l
Chloride (Cl)	314.0	mg/l
Copper (Cu)	0.0140	mg/l
Zinc (Zn)	0.0290	mg/l
Total Hardness (as $CaCO_3$)	7.0	Grains/gal
Langelier Index	0.61	

** NOTE: 1) Langelier Index - Indicates Corrosion Rating (When less than 0.0, water tends to be corrosive).

2) A TDS of less than 1000 mg/l is considered satisfactory.

Water Quality Evaluation and Categorization

Category II - Exceeds Four (4) or More Secondary Standards and TDS is greater than 1000 mg/l.

TDS	2170.0	mg/l >	1000 mg/l
Iron	0.478	mg/l >	0.3 mg/l
Sodium	884.0	mg/l >	200 mg/l
Chloride	314.0	mg/l >	250 mg/l

*** NOTE: Data is for treated samples only and was provided by the North Dakota Department of Health and Consolidated Laboratories.

Burlington, Ward County

Water Quality Chemical Analysis

Report for Fiscal Year = 1990

Water Source: Treated Groundwater

Arsenic(As)	0.0000	mg/l
Barium(Ba)	0.0540	mg/l
Cadmium(Cd)	0.00000	mg/l
Chromium(Cr)	0.00000	mg/l
Lead(Pb)	0.0200	mg/l
Mercury(Hg)	0.00000	mg/l
Nitrate (as N)	0.10	mg/l
Selenium(Se)	0.000	mg/l
Fluoride(F)	1.10	mg/l
Silver(Ag)	0.00000	mg/l
pH	7.70	
Conductivity	1411.0	umhos/cm
Total Dissolved Solids (TDS)	877.0	mg/l
Total Alkalinity ($CaCO_3$)	566.0	mg/l
Total Hardness (as $CaCO_3$)	361.0	mg/l
Calcium (Ca)	88.300	mg/l
Magnesium (Mg)	34.1	mg/l
Sodium (Na)	240.0	mg/l
Potassium (K)	5.400	mg/l
Iron (Fe)	2.150	mg/l
Manganese (Mn)	0.140	mg/l
Carbonate (CO_3)	0.0	mg/l
Bicarbonate (HCO_3)	691	mg/l
Sulfate as (SO_4)	60.0	mg/l
Chloride (Cl)	109.0	mg/l
Copper (Cu)	1.2800	mg/l
Zinc (Zn)	0.3340	mg/l
Total Hardness (as $CaCO_3$)	21.0	Grains/gal
Langelier Index	0.60	

** NOTE: 1) Langelier Index - Indicates Corrosion Rating (When less than 0.0, water tends to be corrosive).

2) A TDS of less than 1000 mg/l is considered satisfactory.

Water Quality Evaluation and Categorization

Category I - COMMUNITY EXCEEDS PRIMARY STANDARDS

Sample Exceeds Primary Quality Standards for Nitrogen or Fluoride, or Lead.

Lead	0.0200	mg/l >	0.015	mg/l
Iron	2.150	mg/l >	0.3	mg/l
Manganese	0.140	mg/l >	0.05	mg/l
Sodium	240.0	mg/l >	200	mg/l

*** NOTE: Data is for treated samples only and was provided by the North Dakota Department of Health and Consolidated Laboratories.

Columbus, Burke County

Water Quality Chemical Analysis

Report for Fiscal Year = 1991

Water Source: Treated Groundwater

Arsenic(As)	0.0102	mg/l
Barium(Ba)	0.0116	mg/l
Cadmium(Cd)	0.00020	mg/l
Chromium(Cr)	0.00095	mg/l
Lead(Pb)	0.0010	mg/l
Mercury(Hg)	0.00020	mg/l
Nitrate (as N)	0.06	mg/l
Selenium(Se)	0.002	mg/l
Fluoride(F)	1.01	mg/l
Silver(Ag)	0.00020	mg/l
pH	7.51	
Conductivity	2640.0	umhos/cm
Total Dissolved Solids (TDS)	1960.0	mg/l
Total Alkalinity ($CaCO_3$)	656.0	mg/l
Total Hardness (as $CaCO_3$)	637.0	mg/l
Calcium (Ca)	157.000	mg/l
Magnesium (Mg)	59.5	mg/l
Sodium (Na)	449.0	mg/l
Potassium (K)	8.340	mg/l
Iron (Fe)	1.340	mg/l
Manganese (Mn)	0.669	mg/l
Carbonate (CO_3)	0.0	mg/l
Bicarbonate (HCO_3)	801	mg/l
Sulfate as (SO_4)	851.0	mg/l
Chloride (Cl)	42.2	mg/l
Copper (Cu)	0.0570	mg/l
Zinc (Zn)	0.0210	mg/l
Total Hardness (as $CaCO_3$)	37.0	Grains/gal
Langelier Index	0.72	

** NOTE: 1) Langelier Index - Indicates Corrosion Rating (When less than 0.0, water tends to be corrosive).

2) A TDS of less than 1000 mg/l is considered satisfactory.

Water Quality Evaluation and Categorization

Category II - Exceeds Four (4) or More Secondary Standards and TDS is greater than 1000 mg/l.

TDS	1960.0	mg/l >	1000 mg/l
Iron	1.340	mg/l >	0.3 mg/l
Manganese	0.669	mg/l >	0.05 mg/l
Sodium	449.0	mg/l >	200 mg/l
Sulfates	851.0	mg/l >	250 mg/l

*** NOTE: Data is for treated samples only and was provided by the North Dakota Department of Health and Consolidated Laboratories.

Crosby, Divide County

Water Quality Chemical Analysis

Report for Fiscal Year = 1991

Water Source: Treated Groundwater

Arsenic(As)	0.0085	mg/l
Barium(Ba)	0.0252	mg/l
Cadmium(Cd)	0.00020	mg/l
Chromium(Cr)	0.00020	mg/l
Lead(Pb)	0.0010	mg/l
Mercury(Hg)	0.00020	mg/l
Nitrate (as N)	0.12	mg/l
Selenium(Se)	0.001	mg/l
Fluoride(F)	0.80	mg/l
Silver(Ag)	0.00020	mg/l
pH	8.92	
Conductivity	1064.0	umhos/cm
Total Dissolved Solids (TDS)	684.0	mg/l
Total Alkalinity ($CaCO_3$)	477.0	mg/l
Total Hardness (as $CaCO_3$)	133.0	mg/l
Calcium (Ca)	11.700	mg/l
Magnesium (Mg)	25.1	mg/l
Sodium (Na)	254.0	mg/l
Potassium (K)	7.700	mg/l
Iron (Fe)	0.045	mg/l
Manganese (Mn)	0.002	mg/l
Carbonate (CO_3)	48.0	mg/l
Bicarbonate (HCO_3)	485	mg/l
Sulfate as (SO_4)	26.0	mg/l
Chloride (Cl)	71.8	mg/l
Copper (Cu)	0.0140	mg/l
Zinc (Zn)	0.0150	mg/l
Total Hardness (as $CaCO_3$)	8.0	Grains/gal
Langelier Index	0.87	

** NOTE: 1) Langelier Index - Indicates Corrosion Rating (When less than 0.0, water tends to be corrosive).

2) A TDS of less than 1000 mg/l is considered satisfactory.

Water Quality Evaluation and Categorization

Category VI - Exceeds minimum standard for TDS, Sulfate, Chloride, pH, and/or recommended standard for Sodium.

TDS	684.0	mg/l > 500 mg/l
Sodium	254.0	mg/l > 200 mg/l
pH	8.92	Exceeds 8.5 or Below 6.5

*** NOTE: Data is for treated samples only and was provided by the North Dakota Department of Health and Consolidated Laboratories.

Deering, McHenry County

Water Quality Chemical Analysis

Report for Fiscal Year = 1990

Water Source: Treated Groundwater

Arsenic(As)	0.0000	mg/l
Barium(Ba)	0.0896	mg/l
Cadmium(Cd)	0.00000	mg/l
Chromium(Cr)	0.00000	mg/l
Lead(Pb)	0.0000	mg/l
Mercury(Hg)	0.00000	mg/l
Nitrate (as N)	0.00	mg/l
Selenium(Se)	0.010	mg/l
Fluoride(F)	0.10	mg/l
Silver(Ag)	0.00000	mg/l
pH	7.40	
Conductivity	700.0	umhos/cm
Total Dissolved Solids (TDS)	438.0	mg/l
Total Alkalinity ($CaCO_3$)	202.0	mg/l
Total Hardness (as $CaCO_3$)	365.0	mg/l
Calcium (Ca)	88.900	mg/l
Magnesium (Mg)	34.6	mg/l
Sodium (Na)	20.5	mg/l
Potassium (K)	5.300	mg/l
Iron (Fe)	0.755	mg/l
Manganese (Mn)	0.238	mg/l
Carbonate (CO_3)	0.0	mg/l
Bicarbonate (HCO_3)	247	mg/l
Sulfate as (SO_4)	154.0	mg/l
Chloride (Cl)	12.8	mg/l
Copper (Cu)	0.0579	mg/l
Zinc (Zn)	0.0150	mg/l
Total Hardness (as $CaCO_3$)	21.0	Grains/gal
Langelier Index	-0.14	

** NOTE: 1) Langelier Index - Indicates Corrosion Rating (When less than 0.0, water tends to be corrosive).

2) A TDS of less than 1000 mg/l is considered satisfactory.

Water Quality Evaluation and Categorization

Category V - Exceeds Iron or Manganese Secondary Standards

Iron	0.755 mg/l >	0.3 mg/l
Manganese	0.238 mg/l >	0.05 mg/l

*** NOTE: Data is for treated samples only and was provided by the North Dakota Department of Health and Consolidated Laboratories.

Drake, McHenry County

Water Quality Chemical Analysis

Report for Fiscal Year = 1990

Water Source: Treated Groundwater

Arsenic(As)	0.0000	mg/l
Barium(Ba)	0.0549	mg/l
Cadmium(Cd)	0.00000	mg/l
Chromium(Cr)	0.00000	mg/l
Lead(Pb)	0.0000	mg/l
Mercury(Hg)	0.00000	mg/l
Nitrate (as N)	0.00	mg/l
Selenium(Se)	0.000	mg/l
Fluoride(F)	0.20	mg/l
Silver(Ag)	0.00000	mg/l
pH	7.60	
Conductivity	1660.0	umhos/cm
Total Dissolved Solids (TDS)	1200.0	mg/l
Total Alkalinity ($CaCO_3$)	511.0	mg/l
Total Hardness (as $CaCO_3$)	625.0	mg/l
Calcium (Ca)	96.700	mg/l
Magnesium (Mg)	93.2	mg/l
Sodium (Na)	215.0	mg/l
Potassium (K)	14.100	mg/l
Iron (Fe)	0.403	mg/l
Manganese (Mn)	0.114	mg/l
Carbonate (CO_3)	0.0	mg/l
Bicarbonate (HCO_3)	624	mg/l
Sulfate as (SO_4)	456.0	mg/l
Chloride (Cl)	18.8	mg/l
Copper (Cu)	0.0229	mg/l
Zinc (Zn)	0.2170	mg/l
Total Hardness (as $CaCO_3$)	37.0	Grains/gal
Langelier Index	0.49	

** NOTE: 1) Langelier Index - Indicates Corrosion Rating (When less than 0.0, water tends to be corrosive).

2) A TDS of less than 1000 mg/l is considered satisfactory.

Water Quality Evaluation and Categorization

Category II - Exceeds Four (4) or More Secondary Standards and TDS is greater than 1000 mg/l.

TDS	1200.0	mg/l	> 1000 mg/l
Iron	0.403	mg/l	> 0.3 mg/l
Manganese	0.114	mg/l	> 0.05 mg/l
Sodium	215.0	mg/l	> 200 mg/l
Sulfates	456.0	mg/l	> 250 mg/l

*** NOTE: Data is for treated samples only and was provided by the North Dakota Department of Health and Consolidated Laboratories.

Flaxton, Burke County

Water Quality Chemical Analysis

Report for Fiscal Year = 1991

Water Source: Treated Groundwater

Arsenic(As)	0.0020	mg/l
Barium(Ba)	0.2600	mg/l
Cadmium(Cd)	0.00020	mg/l
Chromium(Cr)	0.00050	mg/l
Lead(Pb)	0.0010	mg/l
Mercury(Hg)	0.00020	mg/l
Nitrate (as N)	0.05	mg/l
Selenium(Se)	0.020	mg/l
Fluoride(F)	0.90	mg/l
Silver(Ag)	0.00020	mg/l
pH	8.11	
Conductivity	3770.0	umhos/cm
Total Dissolved Solids (TDS)	2280.0	mg/l
Total Alkalinity ($CaCO_3$)	1360.0	mg/l
Total Hardness (as $CaCO_3$)	21.0	mg/l
Calcium (Ca)	5.900	mg/l
Magnesium (Mg)	1.6	mg/l
Sodium (Na)	937.0	mg/l
Potassium (K)	3.310	mg/l
Iron (Fe)	0.056	mg/l
Manganese (Mn)	0.001	mg/l
Carbonate (CO_3)	0.0	mg/l
Bicarbonate (HCO_3)	1660	mg/l
Sulfate as (SO_4)	0.0	mg/l
Chloride (Cl)	513.0	mg/l
Copper (Cu)	0.0140	mg/l
Zinc (Zn)	0.0390	mg/l
Total Hardness (as $CaCO_3$)	1.0	Grains/gal
Langelier Index	0.21	

** NOTE: 1) Langelier Index - Indicates Corrosion Rating (When less than 0.0, water tends to be corrosive).

2) A TDS of less than 1000 mg/l is considered satisfactory.

Water Quality Evaluation and Categorization

Category IV - Exceeds Less Than Four Secondary Standards and TDS is greater than 1000.

TDS	2280.0 mg/l	> 1000 mg/l
Sodium	937.0 mg/l	> 200 mg/l
Chloride	513.0 mg/l	> 250 mg/l

*** NOTE: Data is for treated samples only and was provided by the North Dakota Department of Health and Consolidated Laboratories.

Fortuna, Divide County

Water Quality Chemical Analysis

Report for Fiscal Year = 1991

Water Source: Treated Groundwater

Arsenic(As)	0.0031	mg/l
Barium(Ba)	0.0168	mg/l
Cadmium(Cd)	0.00020	mg/l
Chromium(Cr)	0.00045	mg/l
Lead(Pb)	0.0010	mg/l
Mercury(Hg)	0.00020	mg/l
Nitrate (as N)	0.29	mg/l
Selenium(Se)	0.001	mg/l
Fluoride(F)	0.19	mg/l
Silver(Ag)	0.00020	mg/l
pH	7.42	
Conductivity	1707.0	umhos/cm
Total Dissolved Solids (TDS)	1310.0	mg/l
Total Alkalinity ($CaCO_3$)	397.0	mg/l
Total Hardness (as $CaCO_3$)	604.0	mg/l
Calcium (Ca)	148.000	mg/l
Magnesium (Mg)	56.8	mg/l
Sodium (Na)	242.0	mg/l
Potassium (K)	9.700	mg/l
Iron (Fe)	0.026	mg/l
Manganese (Mn)	0.488	mg/l
Carbonate (CO_3)	0.0	mg/l
Bicarbonate (HCO_3)	485	mg/l
Sulfate as (SO_4)	601.0	mg/l
Chloride (Cl)	8.7	mg/l
Copper (Cu)	0.0391	mg/l
Zinc (Zn)	0.0500	mg/l
Total Hardness (as $CaCO_3$)	35.0	Grains/gal
Langelier Index	0.39	

** NOTE: 1) Langelier Index - Indicates Corrosion Rating (When less than 0.0, water tends to be corrosive).

2) A TDS of less than 1000 mg/l is considered satisfactory.

Water Quality Evaluation and Categorization

Category II - Exceeds Four (4) or More Secondary Standards and TDS is greater than 1000 mg/l.

TDS	1310.0	mg/l >	1000 mg/l
Manganese	0.488	mg/l >	0.05 mg/l
Sodium	242.0	mg/l >	200 mg/l
Sulfates	601.0	mg/l >	250 mg/l

*** NOTE: Data is for treated samples only and was provided by the North Dakota Department of Health and Consolidated Laboratories.

Garrison, McLean County

Water Quality Chemical Analysis

Report for Fiscal Year = 1992

Water Source: Treated Groundwater

Arsenic(As)	0.0024	mg/l
Barium(Ba)	0.0049	mg/l
Cadmium(Cd)	0.00020	mg/l
Chromium(Cr)	0.00087	mg/l
Lead(Pb)	0.0047	mg/l
Mercury(Hg)	0.00020	mg/l
Nitrate (as N)	0.92	mg/l
Selenium(Se)	0.001	mg/l
Fluoride(F)	0.40	mg/l
Silver(Ag)	0.00020	mg/l
pH	7.80	
Conductivity	2010.0	umhos/cm
Total Dissolved Solids (TDS)	1260.0	mg/l
Total Alkalinity ($CaCO_3$)	753.0	mg/l
Total Hardness (as $CaCO_3$)	130.0	mg/l
Calcium (Ca)	32.400	mg/l
Magnesium (Mg)	11.9	mg/l
Sodium (Na)	414.0	mg/l
Potassium (K)	4.370	mg/l
Iron (Fe)	0.972	mg/l
Manganese (Mn)	0.039	mg/l
Carbonate (CO_3)	0.0	mg/l
Bicarbonate (HCO_3)	920	mg/l
Sulfate as (SO_4)	328.0	mg/l
Chloride (Cl)	16.1	mg/l
Copper (Cu)	0.0848	mg/l
Zinc (Zn)	0.0510	mg/l
Total Hardness (as $CaCO_3$)	8.0	Grains/gal
Langelier Index	0.39	

** NOTE: 1) Langelier Index - Indicates Corrosion Rating (When less than 0.0, water tends to be corrosive).

2) A TDS of less than 1000 mg/l is considered satisfactory.

Water Quality Evaluation and Categorization

Category II - Exceeds Four (4) or More Secondary Standards and TDS is greater than 1000 mg/l.

TDS	1260.0	mg/l >	1000 mg/l
Iron	0.972	mg/l >	0.3 mg/l
Sodium	414.0	mg/l >	200 mg/l
Sulfates	328.0	mg/l >	250 mg/l

*** NOTE: Data is for treated samples only and was provided by the North Dakota Department of Health and Consolidated Laboratories.

Granville, McHenry County

Water Quality Chemical Analysis

Report for Fiscal Year = 1991

Water Source: Treated Groundwater

Arsenic(As)	0.0014	mg/l
Barium(Ba)	0.2220	mg/l
Cadmium(Cd)	0.00020	mg/l
Chromium(Cr)	0.00020	mg/l
Lead(Pb)	0.0014	mg/l
Mercury(Hg)	0.00020	mg/l
Nitrate (as N)	0.17	mg/l
Selenium(Se)	0.001	mg/l
Fluoride(F)	0.26	mg/l
Silver(Ag)	0.00010	mg/l
pH	7.74	
Conductivity	4310.0	umhos/cm
Total Dissolved Solids (TDS)	2390.0	mg/l
Total Alkalinity ($CaCO_3$)	470.0	mg/l
Total Hardness (as $CaCO_3$)	173.0	mg/l
Calcium (Ca)	42.900	mg/l
Magnesium (Mg)	16.0	mg/l
Sodium (Na)	905.0	mg/l
Potassium (K)	3.200	mg/l
Iron (Fe)	0.095	mg/l
Manganese (Mn)	0.015	mg/l
Carbonate (CO_3)	0.0	mg/l
Bicarbonate (HCO_3)	574	mg/l
Sulfate as (SO_4)	39.0	mg/l
Chloride (Cl)	1100.0	mg/l
Copper (Cu)	0.0140	mg/l
Zinc (Zn)	0.0220	mg/l
Total Hardness (as $CaCO_3$)	10.0	Grains/gal
Langelier Index	0.24	

** NOTE: 1) Langelier Index - Indicates Corrosion Rating (When less than 0.0, water tends to be corrosive).

2) A TDS of less than 1000 mg/l is considered satisfactory.

Water Quality Evaluation and Categorization

Category IV - Exceeds Less Than Four Secondary Standards and TDS is greater than 1000.

TDS	2390.0 mg/l	>	1000 mg/l
Sodium	905.0 mg/l	>	200 mg/l
Chloride	1100.0 mg/l	>	250 mg/l

*** NOTE: Data is for treated samples only and was provided by the North Dakota Department of Health and Consolidated Laboratories.

Grenora, Williams County

Water Quality Chemical Analysis

Report for Fiscal Year = 1991

Water Source: Treated Groundwater

Arsenic(As)	0.0011	mg/l
Barium(Ba)	0.2270	mg/l
Cadmium(Cd)	0.00020	mg/l
Chromium(Cr)	0.00020	mg/l
Lead(Pb)	0.0005	mg/l
Mercury(Hg)	0.00020	mg/l
Nitrate (as N)	2.23	mg/l
Selenium(Se)	0.005	mg/l
Fluoride(F)	0.14	mg/l
Silver(Ag)	0.00020	mg/l
pH	7.42	
Conductivity	1110.0	umhos/cm
Total Dissolved Solids (TDS)	613.0	mg/l
Total Alkalinity ($CaCO_3$)	296.0	mg/l
Total Hardness (as $CaCO_3$)	475.0	mg/l
Calcium (Ca)	127.000	mg/l
Magnesium (Mg)	38.2	mg/l
Sodium (Na)	44.7	mg/l
Potassium (K)	11.900	mg/l
Iron (Fe)	0.097	mg/l
Manganese (Mn)	0.561	mg/l
Carbonate (CO_3)	0.0	mg/l
Bicarbonate (HCO_3)	362	mg/l
Sulfate as (SO_4)	98.0	mg/l
Chloride (Cl)	105.0	mg/l
Copper (Cu)	0.1540	mg/l
Zinc (Zn)	0.0640	mg/l
Total Hardness (as $CaCO_3$)	28.0	Grains/gal
Langelier Index	0.20	

** NOTE: 1) Langelier Index - Indicates Corrosion Rating (When less than 0.0, water tends to be corrosive).

2) A TDS of less than 1000 mg/l is considered satisfactory.

Water Quality Evaluation and Categorization

Category V - Exceeds Iron or Manganese Secondary Standards

Manganese 0.561 mg/l > 0.05 mg/l

*** NOTE: Data is for treated samples only and was provided by the North Dakota Department of Health and Consolidated Laboratories.

Karlsruhe, McHenry County

Water Quality Chemical Analysis

Report for Fiscal Year = 1990

Water Source: Treated Groundwater

Arsenic(As)	0.0000	mg/l
Barium(Ba)	0.0950	mg/l
Cadmium(Cd)	0.00000	mg/l
Chromium(Cr)	0.00000	mg/l
Lead(Pb)	0.0000	mg/l
Mercury(Hg)	0.00000	mg/l
Nitrate (as N)	0.00	mg/l
Selenium(Se)	0.000	mg/l
Fluoride(F)	0.20	mg/l
Silver(Ag)	0.00000	mg/l
pH	7.80	
Conductivity	853.0	umhos/cm
Total Dissolved Solids (TDS)	560.0	mg/l
Total Alkalinity ($CaCO_3$)	293.0	mg/l
Total Hardness (as $CaCO_3$)	368.0	mg/l
Calcium (Ca)	90.100	mg/l
Magnesium (Mg)	34.7	mg/l
Sodium (Na)	81.8	mg/l
Potassium (K)	5.600	mg/l
Iron (Fe)	0.380	mg/l
Manganese (Mn)	0.173	mg/l
Carbonate (CO_3)	0.0	mg/l
Bicarbonate (HCO_3)	358	mg/l
Sulfate as (SO_4)	133.0	mg/l
Chloride (Cl)	38.4	mg/l
Copper (Cu)	0.0140	mg/l
Zinc (Zn)	0.0090	mg/l
Total Hardness (as $CaCO_3$)	21.0	Grains/gal
Langelier Index	0.43	

** NOTE: 1) Langelier Index - Indicates Corrosion Rating (When less than 0.0, water tends to be corrosive).

2) A TDS of less than 1000 mg/l is considered satisfactory.

Water Quality Evaluation and Categorization

Category V - Exceeds Iron or Manganese Secondary Standards

Iron	0.380 mg/l >	0.3 mg/l
Manganese	0.173 mg/l >	0.05 mg/l

*** NOTE: Data is for treated samples only and was provided by the North Dakota Department of Health and Consolidated Laboratories.

Kenmare, Ward County

Water Quality Chemical Analysis

Report for Fiscal Year = 1991

Water Source: Treated Groundwater

Arsenic(As)	0.0054	mg/l
Barium(Ba)	0.0461	mg/l
Cadmium(Cd)	0.00020	mg/l
Chromium(Cr)	0.00050	mg/l
Lead(Pb)	0.0010	mg/l
Mercury(Hg)	0.00020	mg/l
Nitrate (as N)	0.07	mg/l
Selenium(Se)	0.003	mg/l
Fluoride(F)	1.15	mg/l
Silver(Ag)	0.00020	mg/l
pH	7.84	
Conductivity	2230.0	umhos/cm
Total Dissolved Solids (TDS)	1420.0	mg/l
Total Alkalinity ($CaCO_3$)	958.0	mg/l
Total Hardness (as $CaCO_3$)	147.0	mg/l
Calcium (Ca)	35.800	mg/l
Magnesium (Mg)	13.9	mg/l
Sodium (Na)	555.0	mg/l
Potassium (K)	5.420	mg/l
Iron (Fe)	0.789	mg/l
Manganese (Mn)	0.021	mg/l
Carbonate (CO_3)	0.0	mg/l
Bicarbonate (HCO_3)	1170	mg/l
Sulfate as (SO_4)	100.0	mg/l
Chloride (Cl)	130.0	mg/l
Copper (Cu)	0.2290	mg/l
Zinc (Zn)	0.0910	mg/l
Total Hardness (as $CaCO_3$)	9.0	Grains/gal
Langelier Index	0.57	

** NOTE: 1) Langelier Index - Indicates Corrosion Rating (When less than 0.0, water tends to be corrosive).

2) A TDS of less than 1000 mg/l is considered satisfactory.

Water Quality Evaluation and Categorization

Category IV - Exceeds Less Than Four Secondary Standards and TDS is greater than 1000.

TDS	1420.0	mg/l >	1000 mg/l
Iron	0.789	mg/l >	0.3 mg/l
Sodium	555.0	mg/l >	200 mg/l

*** NOTE: Data is for treated samples only and was provided by the North Dakota Department of Health and Consolidated Laboratories.

Lignite, Burke County

Water Quality Chemical Analysis

Report for Fiscal Year = 1991

Water Source: Treated Groundwater

Arsenic(As)	0.0012	mg/l
Barium(Ba)	0.0325	mg/l
Cadmium(Cd)	0.00020	mg/l
Chromium(Cr)	0.00053	mg/l
Lead(Pb)	0.0010	mg/l
Mercury(Hg)	0.00020	mg/l
Nitrate (as N)	0.04	mg/l
Selenium(Se)	0.008	mg/l
Fluoride(F)	0.00	mg/l
Silver(Ag)	0.00020	mg/l
pH	7.30	
Conductivity	2020.0	umhos/cm
Total Dissolved Solids (TDS)	1490.0	mg/l
Total Alkalinity ($CaCO_3$)	373.0	mg/l
Total Hardness (as $CaCO_3$)	1110.0	mg/l
Calcium (Ca)	279.000	mg/l
Magnesium (Mg)	99.8	mg/l
Sodium (Na)	127.0	mg/l
Potassium (K)	9.670	mg/l
Iron (Fe)	0.680	mg/l
Manganese (Mn)	1.350	mg/l
Carbonate (CO_3)	0.0	mg/l
Bicarbonate (HCO_3)	456	mg/l
Sulfate as (SO_4)	546.0	mg/l
Chloride (Cl)	205.0	mg/l
Copper (Cu)	0.0238	mg/l
Zinc (Zn)	0.0180	mg/l
Total Hardness (as $CaCO_3$)	65.0	Grains/gal
Langelier Index	0.52	

** NOTE: 1) Langelier Index - Indicates Corrosion Rating (When less than 0.0, water tends to be corrosive).

2) A TDS of less than 1000 mg/l is considered satisfactory.

Water Quality Evaluation and Categorization

Category II - Exceeds Four (4) or More Secondary Standards and TDS is greater than 1000 mg/l.

TDS	1490.0 mg/l	> 1000 mg/l
Iron	0.680 mg/l	> 0.3 mg/l
Manganese	1.350 mg/l	> 0.05 mg/l
Sulfates	546.0 mg/l	> 250 mg/l

*** NOTE: Data is for treated samples only and was provided by the North Dakota Department of Health and Consolidated Laboratories.

Makoti, Ward County

Water Quality Chemical Analysis

Report for Fiscal Year = 1991

Water Source: Treated Groundwater

Arsenic(As)	0.0038	mg/l
Barium(Ba)	0.0766	mg/l
Cadmium(Cd)	0.00020	mg/l
Chromium(Cr)	0.00027	mg/l
Lead(Pb)	0.0010	mg/l
Mercury(Hg)	0.00020	mg/l
Nitrate (as N)	0.57	mg/l
Selenium(Se)	0.002	mg/l
Fluoride(F)	0.13	mg/l
Silver(Ag)	0.00020	mg/l
pH	7.59	
Conductivity	511.0	umhos/cm
Total Dissolved Solids (TDS)	283.0	mg/l
Total Alkalinity ($CaCO_3$)	219.0	mg/l
Total Hardness (as $CaCO_3$)	258.0	mg/l
Calcium (Ca)	59.000	mg/l
Magnesium (Mg)	26.8	mg/l
Sodium (Na)	14.4	mg/l
Potassium (K)	2.200	mg/l
Iron (Fe)	0.239	mg/l
Manganese (Mn)	0.225	mg/l
Carbonate (CO_3)	0.0	mg/l
Bicarbonate (HCO_3)	267	mg/l
Sulfate as (SO_4)	44.0	mg/l
Chloride (Cl)	2.1	mg/l
Copper (Cu)	0.0381	mg/l
Zinc (Zn)	0.0100	mg/l
Total Hardness (as $CaCO_3$)	15.0	Grains/gal
Langelier Index	-0.06	

** NOTE: 1) Langelier Index - Indicates Corrosion Rating (When less than 0.0, water tends to be corrosive).

2) A TDS of less than 1000 mg/l is considered satisfactory.

Water Quality Evaluation and Categorization

Category V - Exceeds Iron or Manganese Secondary Standards

Manganese 0.225 mg/l > 0.05 mg/l

*** NOTE: Data is for treated samples only and was provided by the North Dakota Department of Health and Consolidated Laboratories.

Maxbass, Bottineau County

Water Quality Chemical Analysis

Report for Fiscal Year = 1991

Water Source: Treated Groundwater

Arsenic(As)	0.0019	mg/l
Barium(Ba)	0.0722	mg/l
Cadmium(Cd)	0.00020	mg/l
Chromium(Cr)	0.00012	mg/l
Lead(Pb)	0.0011	mg/l
Mercury(Hg)	0.00020	mg/l
Nitrate (as N)	0.87	mg/l
Selenium(Se)	0.009	mg/l
Fluoride(F)	0.16	mg/l
Silver(Ag)	0.00010	mg/l
pH	7.32	
Conductivity	1485.0	umhos/cm
Total Dissolved Solids (TDS)	947.0	mg/l
Total Alkalinity ($CaCO_3$)	420.0	mg/l
Total Hardness (as $CaCO_3$)	654.0	mg/l
Calcium (Ca)	122.000	mg/l
Magnesium (Mg)	84.8	mg/l
Sodium (Na)	108.0	mg/l
Potassium (K)	23.800	mg/l
Iron (Fe)	0.422	mg/l
Manganese (Mn)	0.524	mg/l
Carbonate (CO_3)	0.0	mg/l
Bicarbonate (HCO_3)	513	mg/l
Sulfate as (SO_4)	258.0	mg/l
Chloride (Cl)	94.1	mg/l
Copper (Cu)	0.0145	mg/l
Zinc (Zn)	0.0150	mg/l
Total Hardness (as $CaCO_3$)	38.0	Grains/gal
Langelier Index	0.23	

** NOTE: 1) Langelier Index - Indicates Corrosion Rating (When less than 0.0, water tends to be corrosive).

2) A TDS of less than 1000 mg/l is considered satisfactory.

Water Quality Evaluation and Categorization

Category III - Exceeds Four (4) or More Secondary Standards and TDS is less than 1000 mg/l.

TDS	947.0 mg/l	<	1000 mg/l
Iron	0.422 mg/l	>	0.3 mg/l
Manganese	0.524 mg/l	>	0.05 mg/l
Sulfates	258.0 mg/l	>	250 mg/l

*** NOTE: Data is for treated samples only and was provided by the North Dakota Department of Health and Consolidated Laboratories.

Minot, Ward County

Water Quality Chemical Analysis

Report for Fiscal Year = 1992

Water Source: Treated Ground & Surface Water (Souris River)

Arsenic(As)	0.0021	mg/l
Barium(Ba)	0.0036	mg/l
Cadmium(Cd)	0.00020	mg/l
Chromium(Cr)	0.00058	mg/l
Lead(Pb)	0.0005	mg/l
Mercury(Hg)	0.00020	mg/l
Nitrate (as N)	0.00	mg/l
Selenium(Se)	0.001	mg/l
Fluoride(F)	0.97	mg/l
Silver(Ag)	0.00020	mg/l
pH	9.46	
Conductivity	1167.0	umhos/cm
Total Dissolved Solids (TDS)	731.0	mg/l
Total Alkalinity ($CaCO_3$)	145.0	mg/l
Total Hardness (as $CaCO_3$)	75.0	mg/l
Calcium (Ca)	8.740	mg/l
Magnesium (Mg)	12.9	mg/l
Sodium (Na)	239.0	mg/l
Potassium (K)	5.710	mg/l
Iron (Fe)	0.017	mg/l
Manganese (Mn)	0.000	mg/l
Carbonate (CO_3)	38.0	mg/l
Bicarbonate (HCO_3)	100	mg/l
Sulfate as (SO_4)	306.0	mg/l
Chloride (Cl)	71.6	mg/l
Copper (Cu)	0.0140	mg/l
Zinc (Zn)	0.0170	mg/l
Total Hardness (as $CaCO_3$)	4.0	Grains/gal
Langelier Index	0.77	

** NOTE: 1) Langelier Index - Indicates Corrosion Rating (When less than 0.0, water tends to be corrosive).

2) A TDS of less than 1000 mg/l is considered satisfactory.

Water Quality Evaluation and Categorization

Category III - Exceeds Four (4) or More Secondary Standards and TDS is less than 1000 mg/l.

TDS	731.0 mg/l	< 1000 mg/l
Sodium	239.0 mg/l	> 200 mg/l
Sulfates	306.0 mg/l	> 250 mg/l
pH	9.46	Exceeds 8.5 or Below 6.5

*** NOTE: Data is for treated samples only and was provided by the North Dakota Department of Health and Consolidated Laboratories.

Mohall, Renville County

Water Quality Chemical Analysis

Report for Fiscal Year = 1991

Water Source: Treated Groundwater

Arsenic(As)	0.0010	mg/l
Barium(Ba)	0.0320	mg/l
Cadmium(Cd)	0.00020	mg/l
Chromium(Cr)	0.00102	mg/l
Lead(Pb)	0.0010	mg/l
Mercury(Hg)	0.00020	mg/l
Nitrate (as N)	0.44	mg/l
Selenium(Se)	0.001	mg/l
Fluoride(F)	1.27	mg/l
Silver(Ag)	0.00020	mg/l
pH	8.72	
Conductivity	504.0	umhos/cm
Total Dissolved Solids (TDS)	316.0	mg/l
Total Alkalinity ($CaCO_3$)	93.0	mg/l
Total Hardness (as $CaCO_3$)	179.0	mg/l
Calcium (Ca)	38.700	mg/l
Magnesium (Mg)	19.9	mg/l
Sodium (Na)	47.3	mg/l
Potassium (K)	10.600	mg/l
Iron (Fe)	0.122	mg/l
Manganese (Mn)	0.009	mg/l
Carbonate (CO_3)	8.0	mg/l
Bicarbonate (HCO_3)	97	mg/l
Sulfate as (SO_4)	103.0	mg/l
Chloride (Cl)	38.6	mg/l
Copper (Cu)	0.0140	mg/l
Zinc (Zn)	0.0220	mg/l
Total Hardness (as $CaCO_3$)	10.0	Grains/gal
Langelier Index	0.51	

** NOTE: 1) Langelier Index - Indicates Corrosion Rating (When less than 0.0, water tends to be corrosive).

2) A TDS of less than 1000 mg/l is considered satisfactory.

Water Quality Evaluation and Categorization

Category VI - Exceeds minimum standard for TDS, Sulfate, Chloride, pH, and/or recommended standard for Sodium.

pH 8.72 Exceeds 8.5 or Below 6.5

*** NOTE: Data is for treated samples only and was provided by the North Dakota Department of Health and Consolidated Laboratories.

New Town, Mountrail County

Water Quality Chemical Analysis

Report for Fiscal Year = 1990

Water Source: Treated Groundwater

Arsenic(As)	0.0100	mg/l
Barium(Ba)	0.0061	mg/l
Cadmium(Cd)	0.00000	mg/l
Chromium(Cr)	0.00000	mg/l
Lead(Pb)	0.0000	mg/l
Mercury(Hg)	0.00000	mg/l
Nitrate (as N)	0.20	mg/l
Selenium(Se)	0.000	mg/l
Fluoride(F)	1.10	mg/l
Silver(Ag)	0.00000	mg/l
pH	7.90	
Conductivity	1536.0	umhos/cm
Total Dissolved Solids (TDS)	1020.0	mg/l
Total Alkalinity ($CaCO_3$)	412.0	mg/l
Total Hardness (as $CaCO_3$)	385.0	mg/l
Calcium (Ca)	83.400	mg/l
Magnesium (Mg)	42.9	mg/l
Sodium (Na)	218.0	mg/l
Potassium (K)	6.130	mg/l
Iron (Fe)	0.011	mg/l
Manganese (Mn)	0.011	mg/l
Carbonate (CO_3)	0.0	mg/l
Bicarbonate (HCO_3)	503	mg/l
Sulfate as (SO_4)	393.0	mg/l
Chloride (Cl)	27.5	mg/l
Copper (Cu)	0.0258	mg/l
Zinc (Zn)	0.0180	mg/l
Total Hardness (as $CaCO_3$)	22.0	Grains/gal
Langelier Index	0.63	

** NOTE: 1) Langelier Index - Indicates Corrosion Rating (When less than 0.0, water tends to be corrosive).

2) A TDS of less than 1000 mg/l is considered satisfactory.

Water Quality Evaluation and Categorization

Category IV - Exceeds Less Than Four Secondary Standards and TDS is greater than 1000.

TDS	1020.0 mg/l	> 1000 mg/l
Sodium	218.0 mg/l	> 200 mg/l
Sulfates	393.0 mg/l	> 250 mg/l

*** NOTE: Data is for treated samples only and was provided by the North Dakota Department of Health and Consolidated Laboratories.

Newburg, Bottineau County

Note: Also supplied by All Seasons Rural Water Users - System III

Water Quality Chemical Analysis

Report for Fiscal Year = 1991

Water Source: Treated Groundwater

Arsenic(As)	0.0010	mg/l
Barium(Ba)	0.2160	mg/l
Cadmium(Cd)	0.00020	mg/l
Chromium(Cr)	0.00020	mg/l
Lead(Pb)	0.0010	mg/l
Mercury(Hg)	0.00020	mg/l
Nitrate (as N)	0.02	mg/l
Selenium(Se)	0.011	mg/l
Fluoride(F)	0.29	mg/l
Silver(Ag)	0.00010	mg/l
pH	7.66	
Conductivity	2390.0	umhos/cm
Total Dissolved Solids (TDS)	1490.0	mg/l
Total Alkalinity ($CaCO_3$)	469.0	mg/l
Total Hardness (as $CaCO_3$)	369.0	mg/l
Calcium (Ca)	95.800	mg/l
Magnesium (Mg)	31.5	mg/l
Sodium (Na)	418.0	mg/l
Potassium (K)	7.190	mg/l
Iron (Fe)	4.440	mg/l
Manganese (Mn)	0.122	mg/l
Carbonate (CO_3)	0.0	mg/l
Bicarbonate (HCO_3)	573	mg/l
Sulfate as (SO_4)	325.0	mg/l
Chloride (Cl)	330.0	mg/l
Copper (Cu)	0.0140	mg/l
Zinc (Zn)	0.0140	mg/l
Total Hardness (as $CaCO_3$)	22.0	Grains/gal
Langelier Index	0.51	

** NOTE: 1) Langelier Index - Indicates Corrosion Rating (When less than 0.0, water tends to be corrosive).

2) A TDS of less than 1000 mg/l is considered satisfactory.

Water Quality Evaluation and Categorization

Category II - Exceeds Four (4) or More Secondary Standards and TDS is greater than 1000 mg/l.

TDS	1490.0	mg/l >	1000 mg/l
Iron	4.440	mg/l >	0.3 mg/l
Manganese	0.122	mg/l >	0.05 mg/l
Sodium	418.0	mg/l >	200 mg/l
Sulfates	325.0	mg/l >	250 mg/l
Chloride	330.0	mg/l >	250 mg/l

*** NOTE: Data is for treated samples only and was provided by the North Dakota Department of Health and Consolidated Laboratories.

Noonan, Divide County

Water Quality Chemical Analysis

Report for Fiscal Year = 1991

Water Source: Treated Groundwater

Arsenic(As)	0.0020	mg/l
Barium(Ba)	0.1760	mg/l
Cadmium(Cd)	0.00020	mg/l
Chromium(Cr)	0.00050	mg/l
Lead(Pb)	0.0010	mg/l
Mercury(Hg)	0.00020	mg/l
Nitrate (as N)	0.05	mg/l
Selenium(Se)	0.003	mg/l
Fluoride(F)	3.20	mg/l
Silver(Ag)	0.00020	mg/l
pH	8.34	
Conductivity	2990.0	umhos/cm
Total Dissolved Solids (TDS)	1980.0	mg/l
Total Alkalinity ($CaCO_3$)	1550.0	mg/l
Total Hardness (as $CaCO_3$)	13.0	mg/l
Calcium (Ca)	3.000	mg/l
Magnesium (Mg)	1.3	mg/l
Sodium (Na)	878.0	mg/l
Potassium (K)	2.800	mg/l
Iron (Fe)	0.044	mg/l
Manganese (Mn)	0.001	mg/l
Carbonate (CO_3)	34.0	mg/l
Bicarbonate (HCO_3)	1820	mg/l
Sulfate as (SO_4)	5.0	mg/l
Chloride (Cl)	164.0	mg/l
Copper (Cu)	0.0140	mg/l
Zinc (Zn)	0.0230	mg/l
Total Hardness (as $CaCO_3$)	1.0	Grains/gal
Langelier Index	0.21	

** NOTE: 1) Langelier Index - Indicates Corrosion Rating (When less than 0.0, water tends to be corrosive).

2) A TDS of less than 1000 mg/l is considered satisfactory.

Water Quality Evaluation and Categorization

Category IV - Exceeds Less Than Four Secondary Standards and TDS is greater than 1000.

TDS	1980.0 mg/l	>	1000 mg/l
Fluoride	3.20 mg/l	>	2 mg/l
Sodium	878.0 mg/l	>	200 mg/l

*** NOTE: Data is for treated samples only and was provided by the North Dakota Department of Health and Consolidated Laboratories.

Parshall, Mountrail County

Water Quality Chemical Analysis

Report for Fiscal Year = 1992

Water Source: Treated Surface Water from Lake Sakakawea

Arsenic(As)	0.0013	mg/l
Barium(Ba)	0.0200	mg/l
Cadmium(Cd)	0.00020	mg/l
Chromium(Cr)	0.00039	mg/l
Lead(Pb)	0.0039	mg/l
Mercury(Hg)	0.00020	mg/l
Nitrate (as N)	0.00	mg/l
Selenium(Se)	0.001	mg/l
Fluoride(F)	1.28	mg/l
Silver(Ag)	0.00020	mg/l
pH	9.12	
Conductivity	635.0	umhos/cm
Total Dissolved Solids (TDS)	418.0	mg/l
Total Alkalinity ($CaCO_3$)	29.0	mg/l
Total Hardness (as $CaCO_3$)	182.0	mg/l
Calcium (Ca)	57.900	mg/l
Magnesium (Mg)	9.1	mg/l
Sodium (Na)	60.1	mg/l
Potassium (K)	3.200	mg/l
Iron (Fe)	0.161	mg/l
Manganese (Mn)	0.003	mg/l
Carbonate (CO_3)	5.0	mg/l
Bicarbonate (HCO_3)	25	mg/l
Sulfate as (SO_4)	258.0	mg/l
Chloride (Cl)	12.0	mg/l
Copper (Cu)	0.0140	mg/l
Zinc (Zn)	0.0720	mg/l
Total Hardness (as $CaCO_3$)	11.0	Grains/gal
Langelier Index	0.55	

** NOTE: 1) Langelier Index - Indicates Corrosion Rating (When less than 0.0, water tends to be corrosive).

2) A TDS of less than 1000 mg/l is considered satisfactory.

Water Quality Evaluation and Categorization

Category VI - Exceeds minimum standard for TDS, Sulfate, Chloride, pH, and/or recommended standard for Sodium.

Sulfates	258.0 mg/l >	250 mg/l
pH	9.12 Exceeds	8.5 or Below 6.5

*** NOTE: Data is for treated samples only and was provided by the North Dakota Department of Health and Consolidated Laboratories.

Plaza, Mountrail County

Water Quality Chemical Analysis

Report for Fiscal Year = 1991

Water Source: Treated Groundwater

Arsenic(As)	0.0012	mg/l
Barium(Ba)	0.0083	mg/l
Cadmium(Cd)	0.00020	mg/l
Chromium(Cr)	0.00020	mg/l
Lead(Pb)	0.0010	mg/l
Mercury(Hg)	0.00020	mg/l
Nitrate (as N)	0.03	mg/l
Selenium(Se)	0.004	mg/l
Fluoride(F)	0.15	mg/l
Silver(Ag)	0.00020	mg/l
pH	7.12	
Conductivity	2190.0	umhos/cm
Total Dissolved Solids (TDS)	1520.0	mg/l
Total Alkalinity ($CaCO_3$)	663.0	mg/l
Total Hardness (as $CaCO_3$)	531.0	mg/l
Calcium (Ca)	92.200	mg/l
Magnesium (Mg)	73.1	mg/l
Sodium (Na)	336.0	mg/l
Potassium (K)	10.700	mg/l
Iron (Fe)	0.101	mg/l
Manganese (Mn)	0.014	mg/l
Carbonate (CO_3)	0.0	mg/l
Bicarbonate (HCO_3)	809	mg/l
Sulfate as (SO_4)	579.0	mg/l
Chloride (Cl)	27.5	mg/l
Copper (Cu)	0.0991	mg/l
Zinc (Zn)	0.0200	mg/l
Total Hardness (as $CaCO_3$)	31.0	Grains/gal
Langelier Index	0.10	

** NOTE: 1) Langelier Index - Indicates Corrosion Rating (When less than 0.0, water tends to be corrosive).

2) A TDS of less than 1000 mg/l is considered satisfactory.

Water Quality Evaluation and Categorization

Category IV - Exceeds Less Than Four Secondary Standards and TDS is greater than 1000.

TDS	1520.0 mg/l	>	1000 mg/l
Sodium	336.0 mg/l	>	200 mg/l
Sulfates	579.0 mg/l	>	250 mg/l

*** NOTE: Data is for treated samples only and was provided by the North Dakota Department of Health and Consolidated Laboratories.

Portal, Burke County

Water Quality Chemical Analysis

Report for Fiscal Year = 1991

Water Source: Treated Groundwater

Arsenic(As)	0.0010	mg/l
Barium(Ba)	0.1970	mg/l
Cadmium(Cd)	0.00020	mg/l
Chromium(Cr)	0.00050	mg/l
Lead(Pb)	0.0010	mg/l
Mercury(Hg)	0.00020	mg/l
Nitrate (as N)	0.00	mg/l
Selenium(Se)	0.005	mg/l
Fluoride(F)	1.40	mg/l
Silver(Ag)	0.00020	mg/l
pH	8.37	
Conductivity	2560.0	umhos/cm
Total Dissolved Solids (TDS)	1590.0	mg/l
Total Alkalinity ($CaCO_3$)	1140.0	mg/l
Total Hardness (as $CaCO_3$)	14.0	mg/l
Calcium (Ca)	4.000	mg/l
Magnesium (Mg)	0.9	mg/l
Sodium (Na)	656.0	mg/l
Potassium (K)	2.130	mg/l
Iron (Fe)	0.088	mg/l
Manganese (Mn)	0.002	mg/l
Carbonate (CO_3)	33.0	mg/l
Bicarbonate (HCO_3)	1320	mg/l
Sulfate as (SO_4)	77.0	mg/l
Chloride (Cl)	166.0	mg/l
Copper (Cu)	0.0140	mg/l
Zinc (Zn)	0.0260	mg/l
Total Hardness (as $CaCO_3$)	1.0	Grains/gal
Langelier Index	0.23	

** NOTE: 1) Langelier Index - Indicates Corrosion Rating (When less than 0.0, water tends to be corrosive).

2) A TDS of less than 1000 mg/l is considered satisfactory.

Water Quality Evaluation and Categorization

Category IV - Exceeds Less Than Four Secondary Standards and TDS is greater than 1000.

TDS	1590.0 mg/l	> 1000 mg/l
Sodium	656.0 mg/l	> 200 mg/l

*** NOTE: Data is for treated samples only and was provided by the North Dakota Department of Health and Consolidated Laboratories.

Powers Lake, Burke County

Water Quality Chemical Analysis

Report for Fiscal Year = 1991

Water Source: Treated Groundwater

Arsenic(As)	0.0002	mg/l
Barium(Ba)	0.0147	mg/l
Cadmium(Cd)	0.00020	mg/l
Chromium(Cr)	0.00020	mg/l
Lead(Pb)	0.0010	mg/l
Mercury(Hg)	0.00020	mg/l
Nitrate (as N)	0.05	mg/l
Selenium(Se)	0.001	mg/l
Fluoride(F)	0.28	mg/l
Silver(Ag)	0.00020	mg/l
pH	7.30	
Conductivity	1566.0	umhos/cm
Total Dissolved Solids (TDS)	1140.0	mg/l
Total Alkalinity ($CaCO_3$)	532.0	mg/l
Total Hardness (as $CaCO_3$)	399.0	mg/l
Calcium (Ca)	85.100	mg/l
Magnesium (Mg)	45.3	mg/l
Sodium (Na)	268.0	mg/l
Potassium (K)	4.150	mg/l
Iron (Fe)	1.440	mg/l
Manganese (Mn)	0.194	mg/l
Carbonate (CO_3)	0.0	mg/l
Bicarbonate (HCO_3)	649	mg/l
Sulfate as (SO_4)	404.0	mg/l
Chloride (Cl)	10.2	mg/l
Copper (Cu)	0.0158	mg/l
Zinc (Zn)	0.0170	mg/l
Total Hardness (as $CaCO_3$)	23.0	Grains/gal
Langelier Index	0.15	

** NOTE: 1) Langelier Index - Indicates Corrosion Rating (When less than 0.0, water tends to be corrosive).

2) A TDS of less than 1000 mg/l is considered satisfactory.

Water Quality Evaluation and Categorization

Category II - Exceeds Four (4) or More Secondary Standards and TDS is greater than 1000 mg/l.

TDS	1140.0	mg/l >	1000 mg/l
Iron	1.440	mg/l >	0.3 mg/l
Manganese	0.194	mg/l >	0.05 mg/l
Sodium	268.0	mg/l >	200 mg/l
Sulfates	404.0	mg/l >	250 mg/l

*** NOTE: Data is for treated samples only and was provided by the North Dakota Department of Health and Consolidated Laboratories.

Ray and Tioga (R&T) System, Williams County

Water Quality Chemical Analysis

Report for Fiscal Year = 1990

Water Source: Treated Groundwater

Arsenic(As)	0.0000	mg/l
Barium(Ba)	0.0020	mg/l
Cadmium(Cd)	0.00000	mg/l
Chromium(Cr)	0.00000	mg/l
Lead(Pb)	0.0000	mg/l
Mercury(Hg)	0.00000	mg/l
Nitrate (as N)	0.20	mg/l
Selenium(Se)	0.000	mg/l
Fluoride(F)	1.30	mg/l
Silver(Ag)	0.00000	mg/l
pH	9.50	
Conductivity	885.0	umhos/cm
Total Dissolved Solids (TDS)	571.0	mg/l
Total Alkalinity ($CaCO_3$)	85.0	mg/l
Total Hardness (as $CaCO_3$)	120.0	mg/l
Calcium (Ca)	25.000	mg/l
Magnesium (Mg)	14.0	mg/l
Sodium (Na)	141.0	mg/l
Potassium (K)	8.100	mg/l
Iron (Fe)	0.303	mg/l
Manganese (Mn)	0.003	mg/l
Carbonate (CO_3)	27.0	mg/l
Bicarbonate (HCO_3)	49	mg/l
Sulfate as (SO_4)	296.0	mg/l
Chloride (Cl)	34.5	mg/l
Copper (Cu)	0.0140	mg/l
Zinc (Zn)	0.0100	mg/l
Total Hardness (as $CaCO_3$)	7.0	Grains/gal
Langelier Index	1.04	

** NOTE: 1) Langelier Index - Indicates Corrosion Rating (When less than 0.0, water tends to be corrosive).

2) A TDS of less than 1000 mg/l is considered satisfactory.

Water Quality Evaluation and Categorization

Category III - Exceeds Four (4) or More Secondary Standards and TDS is less than 1000 mg/l.

TDS	571.0 mg/l	< 1000 mg/l
Iron	0.303 mg/l	> 0.3 mg/l
Sulfates	296.0 mg/l	> 250 mg/l
pH	9.50	Exceeds 8.5 or Below 6.5

*** NOTE: Data is for treated samples only and was provided by the North Dakota Department of Health and Consolidated Laboratories.

Ross, Mountrail County

Water Quality Chemical Analysis

Report for Fiscal Year = 1992

Water Source: Treated Groundwater

Arsenic(As)	0.0005	mg/l
Barium(Ba)	0.0700	mg/l
Cadmium(Cd)	0.00020	mg/l
Chromium(Cr)	0.00046	mg/l
Lead(Pb)	0.0044	mg/l
Mercury(Hg)	0.00020	mg/l
Nitrate (as N)	3.03	mg/l
Selenium(Se)	0.004	mg/l
Fluoride(F)	0.19	mg/l
Silver(Ag)	0.00020	mg/l
pH	7.39	
Conductivity	1170.0	umhos/cm
Total Dissolved Solids (TDS)	806.0	mg/l
Total Alkalinity ($CaCO_3$)	308.0	mg/l
Total Hardness (as $CaCO_3$)	663.0	mg/l
Calcium (Ca)	164.000	mg/l
Magnesium (Mg)	61.6	mg/l
Sodium (Na)	15.9	mg/l
Potassium (K)	5.350	mg/l
Iron (Fe)	0.372	mg/l
Manganese (Mn)	0.026	mg/l
Carbonate (CO_3)	0.0	mg/l
Bicarbonate (HCO_3)	376	mg/l
Sulfate as (SO_4)	346.0	mg/l
Chloride (Cl)	14.5	mg/l
Copper (Cu)	0.0140	mg/l
Zinc (Zn)	0.0430	mg/l
Total Hardness (as $CaCO_3$)	39.0	Grains/gal
Langelier Index	0.29	

** NOTE: 1) Langelier Index - Indicates Corrosion Rating (When less than 0.0, water tends to be corrosive).

2) A TDS of less than 1000 mg/l is considered satisfactory.

Water Quality Evaluation and Categorization

Category V - Exceeds Iron or Manganese Secondary Standards

Iron	0.372 mg/l	>	0.3 mg/l
Sulfates	346.0 mg/l	>	250 mg/l

*** NOTE: Data is for treated samples only and was provided by the North Dakota Department of Health and Consolidated Laboratories.

Rugby, Pierce County

Water Quality Chemical Analysis

Report for Fiscal Year = 1990

Water Source: Treated Groundwater

Arsenic(As)	0.0000	mg/l
Barium(Ba)	0.0106	mg/l
Cadmium(Cd)	0.00000	mg/l
Chromium(Cr)	0.00000	mg/l
Lead(Pb)	0.0000	mg/l
Mercury(Hg)	0.00000	mg/l
Nitrate (as N)	0.00	mg/l
Selenium(Se)	0.000	mg/l
Fluoride(F)	1.30	mg/l
Silver(Ag)	0.00000	mg/l
pH	8.30	
Conductivity	370.0	umhos/cm
Total Dissolved Solids (TDS)	218.0	mg/l
Total Alkalinity ($CaCO_3$)	98.0	mg/l
Total Hardness (as $CaCO_3$)	137.0	mg/l
Calcium (Ca)	30.100	mg/l
Magnesium (Mg)	15.1	mg/l
Sodium (Na)	33.6	mg/l
Potassium (K)	4.750	mg/l
Iron (Fe)	0.004	mg/l
Manganese (Mn)	0.001	mg/l
Carbonate (CO_3)	0.0	mg/l
Bicarbonate (HCO_3)	120	mg/l
Sulfate as (SO_4)	67.0	mg/l
Chloride (Cl)	8.3	mg/l
Copper (Cu)	0.0140	mg/l
Zinc (Zn)	0.0170	mg/l
Total Hardness (as $CaCO_3$)	8.0	Grains/gal
Langelier Index	0.01	

** NOTE: 1) Langelier Index - Indicates Corrosion Rating (When less than 0.0, water tends to be corrosive).

2) A TDS of less than 1000 mg/l is considered satisfactory.

Water Quality Evaluation and Categorization

Category VII - No Standards Exceeded With Reported Sample. Treated water is adequate for domestic supply.

*** NOTE: Data is for treated samples only and was provided by the North Dakota Department of Health and Consolidated Laboratories.

Ryder, Ward County

Water Quality Chemical Analysis

Report for Fiscal Year = 1991

Water Source: Treated Groundwater

Arsenic(As)	0.0024	mg/l
Barium(Ba)	0.0010	mg/l
Cadmium(Cd)	0.00020	mg/l
Chromium(Cr)	0.00017	mg/l
Lead(Pb)	0.0010	mg/l
Mercury(Hg)	0.00020	mg/l
Nitrate (as N)	0.06	mg/l
Selenium(Se)	0.002	mg/l
Fluoride(F)	0.31	mg/l
Silver(Ag)	0.00020	mg/l
pH	7.41	
Conductivity	1045.0	umhos/cm
Total Dissolved Solids (TDS)	647.0	mg/l
Total Alkalinity ($CaCO_3$)	389.0	mg/l
Total Hardness (as $CaCO_3$)	1.0	mg/l
Calcium (Ca)	0.400	mg/l
Magnesium (Mg)	0.0	mg/l
Sodium (Na)	257.0	mg/l
Potassium (K)	0.900	mg/l
Iron (Fe)	0.349	mg/l
Manganese (Mn)	0.004	mg/l
Carbonate (CO_3)	0.0	mg/l
Bicarbonate (HCO_3)	475	mg/l
Sulfate as (SO_4)	143.0	mg/l
Chloride (Cl)	11.3	mg/l
Copper (Cu)	0.0615	mg/l
Zinc (Zn)	0.0140	mg/l
Total Hardness (as $CaCO_3$)	0.0	Grains/gal
Langelier Index	-2.19	

** NOTE: 1) Langelier Index - Indicates Corrosion Rating (When less than 0.0, water tends to be corrosive).

2) A TDS of less than 1000 mg/l is considered satisfactory.

Water Quality Evaluation and Categorization

Category V - Exceeds Iron or Manganese Secondary Standards

Iron	0.349 mg/l	>	0.3 mg/l
Sodium	257.0 mg/l	>	200 mg/l

*** NOTE: Data is for treated samples only and was provided by the North Dakota Department of Health and Consolidated Laboratories.

Sawyer, Ward County

Water Quality Chemical Analysis

Report for Fiscal Year = 1990

Water Source: Treated Groundwater

Arsenic(As)	0.0000	mg/l
Barium(Ba)	0.1070	mg/l
Cadmium(Cd)	0.00000	mg/l
Chromium(Cr)	0.00000	mg/l
Lead(Pb)	0.0000	mg/l
Mercury(Hg)	0.00000	mg/l
Nitrate (as N)	0.00	mg/l
Selenium(Se)	0.010	mg/l
Fluoride(F)	0.40	mg/l
Silver(Ag)	0.00000	mg/l
pH	8.00	
Conductivity	2410.0	umhos/cm
Total Dissolved Solids (TDS)	1410.0	mg/l
Total Alkalinity ($CaCO_3$)	868.0	mg/l
Total Hardness (as $CaCO_3$)	159.0	mg/l
Calcium (Ca)	35.000	mg/l
Magnesium (Mg)	17.3	mg/l
Sodium (Na)	468.0	mg/l
Potassium (K)	2.800	mg/l
Iron (Fe)	0.683	mg/l
Manganese (Mn)	0.174	mg/l
Carbonate (CO_3)	0.0	mg/l
Bicarbonate (HCO_3)	1060	mg/l
Sulfate as (SO_4)	199.0	mg/l
Chloride (Cl)	162.0	mg/l
Copper (Cu)	0.3560	mg/l
Zinc (Zn)	0.0350	mg/l
Total Hardness (as $CaCO_3$)	9.0	Grains/gal
Langelier Index	0.68	

** NOTE: 1) Langelier Index - Indicates Corrosion Rating (When less than 0.0, water tends to be corrosive).

2) A TDS of less than 1000 mg/l is considered satisfactory.

Water Quality Evaluation and Categorization

Category II - Exceeds Four (4) or More Secondary Standards and TDS is greater than 1000 mg/l.

TDS	1410.0 mg/l	> 1000 mg/l
Iron	0.683 mg/l	> 0.3 mg/l
Manganese	0.174 mg/l	> 0.05 mg/l
Sodium	468.0 mg/l	> 200 mg/l

*** NOTE: Data is for treated samples only and was provided by the North Dakota Department of Health and Consolidated Laboratories.

Sherwood, Renville County

Water Quality Chemical Analysis

Report for Fiscal Year = 1991

Water Source: Treated Groundwater

Arsenic(As)	0.0010	mg/l
Barium(Ba)	0.1280	mg/l
Cadmium(Cd)	0.00020	mg/l
Chromium(Cr)	0.00050	mg/l
Lead(Pb)	0.0010	mg/l
Mercury(Hg)	0.00020	mg/l
Nitrate (as N)	0.13	mg/l
Selenium(Se)	0.002	mg/l
Fluoride(F)	0.12	mg/l
Silver(Ag)	0.00020	mg/l
pH	7.52	
Conductivity	615.0	umhos/cm
Total Dissolved Solids (TDS)	376.0	mg/l
Total Alkalinity ($CaCO_3$)	274.0	mg/l
Total Hardness (as $CaCO_3$)	351.0	mg/l
Calcium (Ca)	84.000	mg/l
Magnesium (Mg)	34.3	mg/l
Sodium (Na)	20.3	mg/l
Potassium (K)	7.360	mg/l
Iron (Fe)	0.026	mg/l
Manganese (Mn)	0.003	mg/l
Carbonate (CO_3)	0.0	mg/l
Bicarbonate (HCO_3)	335	mg/l
Sulfate as (SO_4)	52.0	mg/l
Chloride (Cl)	12.8	mg/l
Copper (Cu)	0.4200	mg/l
Zinc (Zn)	0.0540	mg/l
Total Hardness (as $CaCO_3$)	21.0	Grains/gal
Langelier Index	0.12	

** NOTE: 1) Langelier Index - Indicates Corrosion Rating (When less than 0.0, water tends to be corrosive).

2) A TDS of less than 1000 mg/l is considered satisfactory.

Water Quality Evaluation and Categorization

Category VII - No Standards Exceeded With Reported Sample. Treated water is adequate for domestic supply.

*** NOTE: Data is for treated samples only and was provided by the North Dakota Department of Health and Consolidated Laboratories.

Souris, Bottineau County

Water Quality Chemical Analysis

Report for Fiscal Year = 1991

Water Source: Treated Groundwater

Arsenic(As)	0.0011	mg/l
Barium(Ba)	0.0415	mg/l
Cadmium(Cd)	0.00020	mg/l
Chromium(Cr)	0.00013	mg/l
Lead(Pb)	0.0013	mg/l
Mercury(Hg)	0.00020	mg/l
Nitrate (as N)	0.03	mg/l
Selenium(Se)	0.006	mg/l
Fluoride(F)	0.17	mg/l
Silver(Ag)	0.00011	mg/l
pH	7.39	
Conductivity	1665.0	umhos/cm
Total Dissolved Solids (TDS)	1130.0	mg/l
Total Alkalinity ($CaCO_3$)	378.0	mg/l
Total Hardness (as $CaCO_3$)	413.0	mg/l
Calcium (Ca)	106.000	mg/l
Magnesium (Mg)	36.0	mg/l
Sodium (Na)	248.0	mg/l
Potassium (K)	3.740	mg/l
Iron (Fe)	1.690	mg/l
Manganese (Mn)	0.330	mg/l
Carbonate (CO_3)	0.0	mg/l
Bicarbonate (HCO_3)	461	mg/l
Sulfate as (SO_4)	465.0	mg/l
Chloride (Cl)	40.5	mg/l
Copper (Cu)	0.0140	mg/l
Zinc (Zn)	0.0200	mg/l
Total Hardness (as $CaCO_3$)	24.0	Grains/gal
Langelier Index	0.19	

** NOTE: 1) Langelier Index - Indicates Corrosion Rating (When less than 0.0, water tends to be corrosive).

2) A TDS of less than 1000 mg/l is considered satisfactory.

Water Quality Evaluation and Categorization

Category II - Exceeds Four (4) or More Secondary Standards and TDS is greater than 1000 mg/l.

TDS	1130.0	mg/l >	1000 mg/l
Iron	1.690	mg/l >	0.3 mg/l
Manganese	0.330	mg/l >	0.05 mg/l
Sodium	248.0	mg/l >	200 mg/l
Sulfates	465.0	mg/l >	250 mg/l

*** NOTE: Data is for treated samples only and was provided by the North Dakota Department of Health and Consolidated Laboratories.

Stanley, Mountrail County

Water Quality Chemical Analysis

Report for Fiscal Year = 1992

Water Source: Treated Groundwater

Arsenic(As)	0.0012	mg/l
Barium(Ba)	0.0112	mg/l
Cadmium(Cd)	0.00030	mg/l
Chromium(Cr)	0.00020	mg/l
Lead(Pb)	0.0025	mg/l
Mercury(Hg)	0.00020	mg/l
Nitrate (as N)	0.00	mg/l
Selenium(Se)	0.001	mg/l
Fluoride(F)	1.74	mg/l
Silver(Ag)	0.00020	mg/l
pH	7.54	
Conductivity	2850.0	umhos/cm
Total Dissolved Solids (TDS)	1980.0	mg/l
Total Alkalinity ($CaCO_3$)	686.0	mg/l
Total Hardness (as $CaCO_3$)	388.0	mg/l
Calcium (Ca)	80.900	mg/l
Magnesium (Mg)	45.2	mg/l
Sodium (Na)	549.0	mg/l
Potassium (K)	4.580	mg/l
Iron (Fe)	0.311	mg/l
Manganese (Mn)	0.269	mg/l
Carbonate (CO_3)	0.0	mg/l
Bicarbonate (HCO_3)	838	mg/l
Sulfate as (SO_4)	868.0	mg/l
Chloride (Cl)	19.0	mg/l
Copper (Cu)	0.1210	mg/l
Zinc (Zn)	0.0360	mg/l
Total Hardness (as $CaCO_3$)	23.0	Grains/gal
Langelier Index	0.48	

** NOTE: 1) Langelier Index - Indicates Corrosion Rating (When less than 0.0, water tends to be corrosive).

2) A TDS of less than 1000 mg/l is considered satisfactory.

Water Quality Evaluation and Categorization

Category II - Exceeds Four (4) or More Secondary Standards and TDS is greater than 1000 mg/l.

TDS	1980.0	mg/l >	1000 mg/l
Iron	0.311	mg/l >	0.3 mg/l
Manganese	0.269	mg/l >	0.05 mg/l
Sodium	549.0	mg/l >	200 mg/l
Sulfates	868.0	mg/l >	250 mg/l

*** NOTE: Data is for treated samples only and was provided by the North Dakota Department of Health and Consolidated Laboratories.

Towner, McHenry County

Water Quality Chemical Analysis

Report for Fiscal Year = 1990

Water Source: Treated Groundwater

Arsenic(As)	0.0000	mg/l
Barium(Ba)	0.1750	mg/l
Cadmium(Cd)	0.00000	mg/l
Chromium(Cr)	0.00000	mg/l
Lead(Pb)	0.0000	mg/l
Mercury(Hg)	0.00000	mg/l
Nitrate (as N)	0.10	mg/l
Selenium(Se)	0.000	mg/l
Fluoride(F)	1.30	mg/l
Silver(Ag)	0.00000	mg/l
pH	7.70	
Conductivity	876.0	umhos/cm
Total Dissolved Solids (TDS)	464.0	mg/l
Total Alkalinity ($CaCO_3$)	309.0	mg/l
Total Hardness (as $CaCO_3$)	372.0	mg/l
Calcium (Ca)	89.400	mg/l
Magnesium (Mg)	36.2	mg/l
Sodium (Na)	56.5	mg/l
Potassium (K)	3.500	mg/l
Iron (Fe)	0.091	mg/l
Manganese (Mn)	0.013	mg/l
Carbonate (CO_3)	0.0	mg/l
Bicarbonate (HCO_3)	377	mg/l
Sulfate as (SO_4)	38.0	mg/l
Chloride (Cl)	54.6	mg/l
Copper (Cu)	0.1520	mg/l
Zinc (Zn)	0.0140	mg/l
Total Hardness (as $CaCO_3$)	22.0	Grains/gal
Langelier Index	0.35	

** NOTE: 1) Langelier Index - Indicates Corrosion Rating (When less than 0.0, water tends to be corrosive).

2) A TDS of less than 1000 mg/l is considered satisfactory.

Water Quality Evaluation and Categorization

Category VII - No Standards Exceeded With Reported Sample. Treated water is adequate for domestic supply.

*** NOTE: Data is for treated samples only and was provided by the North Dakota Department of Health and Consolidated Laboratories.

Upham, McHenry County

Water Quality Chemical Analysis

Report for Fiscal Year = 1992

Water Source: Treated Groundwater

Arsenic(As)	0.0092	mg/l
Barium(Ba)	0.2260	mg/l
Cadmium(Cd)	0.00020	mg/l
Chromium(Cr)	0.00020	mg/l
Lead(Pb)	0.0012	mg/l
Mercury(Hg)	0.00020	mg/l
Nitrate (as N)	0.06	mg/l
Selenium(Se)	0.002	mg/l
Fluoride(F)	0.52	mg/l
Silver(Ag)	0.00020	mg/l
pH	7.94	
Conductivity	1320.0	umhos/cm
Total Dissolved Solids (TDS)	1090.0	mg/l
Total Alkalinity ($CaCO_3$)	615.0	mg/l
Total Hardness (as $CaCO_3$)	145.0	mg/l
Calcium (Ca)	38.600	mg/l
Magnesium (Mg)	11.8	mg/l
Sodium (Na)	382.0	mg/l
Potassium (K)	4.820	mg/l
Iron (Fe)	0.367	mg/l
Manganese (Mn)	0.075	mg/l
Carbonate (CO_3)	0.0	mg/l
Bicarbonate (HCO_3)	751	mg/l
Sulfate as (SO_4)	67.0	mg/l
Chloride (Cl)	214.0	mg/l
Copper (Cu)	0.0140	mg/l
Zinc (Zn)	0.0430	mg/l
Total Hardness (as $CaCO_3$)	8.0	Grains/gal
Langelier Index	0.51	

** NOTE: 1) Langelier Index - Indicates Corrosion Rating (When less than 0.0, water tends to be corrosive).

2) A TDS of less than 1000 mg/l is considered satisfactory.

Water Quality Evaluation and Categorization

Category II - Exceeds Four (4) or More Secondary Standards and TDS is greater than 1000 mg/l.

TDS	1090.0	mg/l >	1000 mg/l
Iron	0.367	mg/l >	0.3 mg/l
Manganese	0.075	mg/l >	0.05 mg/l
Sodium	382.0	mg/l >	200 mg/l

*** NOTE: Data is for treated samples only and was provided by the North Dakota Department of Health and Consolidated Laboratories.

Velva, McHenry County

Water Quality Chemical Analysis

Report for Fiscal Year = 1992

Water Source: Treated Groundwater

Arsenic(As)	0.0008	mg/l
Barium(Ba)	0.0894	mg/l
Cadmium(Cd)	0.00020	mg/l
Chromium(Cr)	0.00043	mg/l
Lead(Pb)	0.0019	mg/l
Mercury(Hg)	0.00020	mg/l
Nitrate (as N)	5.22	mg/l
Selenium(Se)	0.001	mg/l
Fluoride(F)	1.45	mg/l
Silver(Ag)	0.00020	mg/l
pH	7.47	
Conductivity	658.0	umhos/cm
Total Dissolved Solids (TDS)	362.0	mg/l
Total Alkalinity ($CaCO_3$)	224.0	mg/l
Total Hardness (as $CaCO_3$)	266.0	mg/l
Calcium (Ca)	62.800	mg/l
Magnesium (Mg)	26.4	mg/l
Sodium (Na)	31.3	mg/l
Potassium (K)	3.250	mg/l
Iron (Fe)	0.003	mg/l
Manganese (Mn)	0.010	mg/l
Carbonate (CO_3)	0.0	mg/l
Bicarbonate (HCO_3)	274	mg/l
Sulfate as (SO_4)	74.0	mg/l
Chloride (Cl)	5.8	mg/l
Copper (Cu)	0.0543	mg/l
Zinc (Zn)	0.0430	mg/l
Total Hardness (as $CaCO_3$)	16.0	Grains/gal
Langelier Index	-0.14	

** NOTE: 1) Langelier Index - Indicates Corrosion Rating (When less than 0.0, water tends to be corrosive).

2) A TDS of less than 1000 mg/l is considered satisfactory.

Water Quality Evaluation and Categorization

Category VII - No Standards Exceeded With Reported Sample
Treated water is adequate for domestic supply

*** NOTE: Data is for treated samples only and was provided by the North Dakota Department of Health and Consolidated Laboratories.

Westhope, Bottineau County

Water Quality Chemical Analysis

Report for Fiscal Year = 1992

Water Source: Treated Surface Water From The Souris River

Arsenic(As)	0.0039	mg/l
Barium(Ba)	0.1680	mg/l
Cadmium(Cd)	0.00020	mg/l
Chromium(Cr)	0.00372	mg/l
Lead(Pb)	0.0012	mg/l
Mercury(Hg)	0.00020	mg/l
Nitrate (as N)	0.00	mg/l
Selenium(Se)	0.001	mg/l
Fluoride(F)	1.09	mg/l
Silver(Ag)	0.00020	mg/l
pH	10.20	
Conductivity	1813.0	umhos/cm
Total Dissolved Solids (TDS)	1230.0	mg/l
Total Alkalinity ($CaCO_3$)	105.0	mg/l
Total Hardness (as $CaCO_3$)	239.0	mg/l
Calcium (Ca)	88.500	mg/l
Magnesium (Mg)	4.4	mg/l
Sodium (Na)	317.0	mg/l
Potassium (K)	25.300	mg/l
Iron (Fe)	0.002	mg/l
Manganese (Mn)	0.001	mg/l
Carbonate (CO_3)	61.0	mg/l
Bicarbonate (HCO_3)	0	mg/l
Sulfate as (SO_4)	634.0	mg/l
Chloride (Cl)	101.0	mg/l
Copper (Cu)	0.0379	mg/l
Zinc (Zn)	0.0270	mg/l
Total Hardness (as $CaCO_3$)	14.0	Grains/gal
Langelier Index	2.37	

** NOTE: 1) Langelier Index - Indicates Corrosion Rating (When less than 0.0, water tends to be corrosive).

2) A TDS of less than 1000 mg/l is considered satisfactory.

Water Quality Evaluation and Categorization

Category II - Exceeds Four (4) or More Secondary Standards and TDS is greater than 1000 mg/l.

TDS	1230.0 mg/l	> 1000 mg/l
Sodium	317.0 mg/l	> 200 mg/l
Sulfates	634.0 mg/l	> 250 mg/l
pH	10.20	Exceeds 8.5 or Below 6.5

*** NOTE: Data is for treated samples only and was provided by the North Dakota Department of Health and Consolidated Laboratories.

Wildrose, Williams County

Water Quality Chemical Analysis

Report for Fiscal Year = 1991

Water Source: Treated Groundwater

Arsenic(As)	0.0079	mg/l
Barium(Ba)	0.0115	mg/l
Cadmium(Cd)	0.00020	mg/l
Chromium(Cr)	0.00106	mg/l
Lead(Pb)	0.0010	mg/l
Mercury(Hg)	0.00020	mg/l
Nitrate (as N)	0.03	mg/l
Selenium(Se)	0.001	mg/l
Fluoride(F)	0.21	mg/l
Silver(Ag)	0.00020	mg/l
pH	7.28	
Conductivity	1561.0	umhos/cm
Total Dissolved Solids (TDS)	1100.0	mg/l
Total Alkalinity ($CaCO_3$)	393.0	mg/l
Total Hardness (as $CaCO_3$)	521.0	mg/l
Calcium (Ca)	132.000	mg/l
Magnesium (Mg)	46.3	mg/l
Sodium (Na)	171.0	mg/l
Potassium (K)	7.780	mg/l
Iron (Fe)	1.280	mg/l
Manganese (Mn)	0.765	mg/l
Carbonate (CO_3)	0.0	mg/l
Bicarbonate (HCO_3)	480	mg/l
Sulfate as (SO_4)	489.0	mg/l
Chloride (Cl)	12.6	mg/l
Copper (Cu)	0.0198	mg/l
Zinc (Zn)	0.1150	mg/l
Total Hardness (as $CaCO_3$)	30.0	Grains/gal
Langelier Index	0.19	

** NOTE: 1) Langelier Index - Indicates Corrosion Rating (When less than 0.0, water tends to be corrosive).

2) A TDS of less than 1000 mg/l is considered satisfactory.

Water Quality Evaluation and Categorization

Category II - Exceeds Four (4) or More Secondary Standards and TDS is greater than 1000 mg/l.

TDS	1100.0 mg/l	> 1000 mg/l
Iron	1.280 mg/l	> 0.3 mg/l
Manganese	0.765 mg/l	> 0.05 mg/l
Sulfates	489.0 mg/l	> 250 mg/l

*** NOTE: Data is for treated samples only and was provided by the North Dakota Department of Health and Consolidated Laboratories.

Williston, Williams County

Water Quality Chemical Analysis

Report for Fiscal Year = 1992

Water Source: Treated Surface Water From The Missouri River

Arsenic(As)	0.0007	mg/l
Barium(Ba)	0.0133	mg/l
Cadmium(Cd)	0.00020	mg/l
Chromium(Cr)	0.00020	mg/l
Lead(Pb)	0.0005	mg/l
Mercury(Hg)	0.00020	mg/l
Nitrate (as N)	0.00	mg/l
Selenium(Se)	0.001	mg/l
Fluoride(F)	0.99	mg/l
Silver(Ag)	0.00020	mg/l
pH	9.29	
Conductivity	530.7	umhos/cm
Total Dissolved Solids (TDS)	348.0	mg/l
Total Alkalinity ($CaCO_3$)	65.0	mg/l
Total Hardness (as $CaCO_3$)	150.0	mg/l
Calcium (Ca)	31.800	mg/l
Magnesium (Mg)	17.2	mg/l
Sodium (Na)	62.6	mg/l
Potassium (K)	3.650	mg/l
Iron (Fe)	0.077	mg/l
Manganese (Mn)	0.006	mg/l
Carbonate (CO_3)	14.0	mg/l
Bicarbonate (HCO_3)	51	mg/l
Sulfate as (SO_4)	181.0	mg/l
Chloride (Cl)	13.0	mg/l
Copper (Cu)	0.0140	mg/l
Zinc (Zn)	0.0470	mg/l
Total Hardness (as $CaCO_3$)	9.0	Grains/gal
Langelier Index	0.84	

** NOTE: 1) Langelier Index - Indicates Corrosion Rating (When less than 0.0, water tends to be corrosive).

2) A TDS of less than 1000 mg/l is considered satisfactory.

Water Quality Evaluation and Categorization

Category VI - Exceeds minimum standard for TDS, Sulfate, Chloride, pH, and/or recommended standard for Sodium.

pH 9.29 Exceeds 8.5 or Below 6.5

*** NOTE: Data is for treated samples only and was provided by the North Dakota Department of Health and Consolidated Laboratories.

Willow City, Bottineau County

Water Quality Chemical Analysis

Report for Fiscal Year = 1991

Water Source: Treated Groundwater

Arsenic(As)	0.0013	mg/l
Barium(Ba)	0.1190	mg/l
Cadmium(Cd)	0.00020	mg/l
Chromium(Cr)	0.00020	mg/l
Lead(Pb)	0.0010	mg/l
Mercury(Hg)	0.00045	mg/l
Nitrate (as N)	0.49	mg/l
Selenium(Se)	0.004	mg/l
Fluoride(F)	0.21	mg/l
Silver(Ag)	0.00010	mg/l
pH	7.18	
Conductivity	1353.0	umhos/cm
Total Dissolved Solids (TDS)	891.0	mg/l
Total Alkalinity ($CaCO_3$)	433.0	mg/l
Total Hardness (as $CaCO_3$)	649.0	mg/l
Calcium (Ca)	166.000	mg/l
Magnesium (Mg)	56.9	mg/l
Sodium (Na)	87.1	mg/l
Potassium (K)	8.170	mg/l
Iron (Fe)	0.478	mg/l
Manganese (Mn)	0.755	mg/l
Carbonate (CO_3)	0.0	mg/l
Bicarbonate (HCO_3)	529	mg/l
Sulfate as (SO_4)	260.0	mg/l
Chloride (Cl)	49.7	mg/l
Copper (Cu)	0.0140	mg/l
Zinc (Zn)	0.0180	mg/l
Total Hardness (as $CaCO_3$)	38.0	Grains/gal
Langelier Index	0.23	

** NOTE: 1) Langelier Index - Indicates Corrosion Rating (When less than 0.0, water tends to be corrosive).

2) A TDS of less than 1000 mg/l is considered satisfactory.

Water Quality Evaluation and Categorization

Category III - Exceeds Four (4) or More Secondary Standards and TDS is less than 1000 mg/l.

TDS	891.0 mg/l	< 1000 mg/l
Iron	0.478 mg/l	> 0.3 mg/l
Manganese	0.755 mg/l	> 0.05 mg/l
Sulfates	260.0 mg/l	> 250 mg/l

*** NOTE: Data is for treated samples only and was provided by the North Dakota Department of Health and Consolidated Laboratories.

Rural Water Systems - Water Quality Assessments

All Seasons WUA - System I
All Seasons WUA - System II
All Seasons WUA - System III
All Seasons WUA - System IV

North Prairie RWA - System III

McLean-Sheridan RWA

Upper Souris WUA - System I
Upper Souris WUA - System II

All Seasons WUA-System I, Bottineau County

Water Quality Chemical Analysis

Report for Fiscal Year = 1992

Water Source: Treated Groundwater

Arsenic(As)	0.0002	mg/l
Barium(Ba)	0.0058	mg/l
Cadmium(Cd)	0.00020	mg/l
Chromium(Cr)	0.00140	mg/l
Lead(Pb)	0.0012	mg/l
Mercury(Hg)	0.00020	mg/l
Nitrate (as N)	0.22	mg/l
Selenium(Se)	0.001	mg/l
Fluoride(F)	0.21	mg/l
Silver(Ag)	0.00020	mg/l
pH	8.09	
Conductivity	1165.0	umhos/cm
Total Dissolved Solids (TDS)	1190.0	mg/l
Total Alkalinity ($CaCO_3$)	529.0	mg/l
Total Hardness (as $CaCO_3$)	580.0	mg/l
Calcium (Ca)	150.000	mg/l
Magnesium (Mg)	49.9	mg/l
Sodium (Na)	189.0	mg/l
Potassium (K)	5.720	mg/l
Iron (Fe)	0.000	mg/l
Manganese (Mn)	0.001	mg/l
Carbonate (CO_3)	0.0	mg/l
Bicarbonate (HCO_3)	646	mg/l
Sulfate as (SO_4)	458.0	mg/l
Chloride (Cl)	19.0	mg/l
Copper (Cu)	0.0140	mg/l
Zinc (Zn)	0.0360	mg/l
Total Hardness (as $CaCO_3$)	34.0	Grains/gal
Langelier Index	1.19	

** NOTE: 1) Langelier Index - Indicates Corrosion Rating (When less than 0.0, water tends to be corrosive).

2) A TDS of less than 1000 mg/l is considered satisfactory.

Water Quality Evaluation and Categorization

Category IV - Exceeds Less Than Four Secondary Standards and TDS is greater than 1000.

TDS	1190.0	mg/l >	1000 mg/l
Sulfates	458.0	mg/l >	250 mg/l

*** NOTE: Data is for treated samples only and was provided by the North Dakota Department of Health and Consolidated Laboratories.

All Seasons WUA-System II, Bottineau County

Water Quality Chemical Analysis

Report for Fiscal Year = 1990

Water Source: Treated Groundwater

Arsenic(As)	0.0000	mg/l
Barium(Ba)	0.0324	mg/l
Cadmium(Cd)	0.00000	mg/l
Chromium(Cr)	0.00000	mg/l
Lead(Pb)	0.0000	mg/l
Mercury(Hg)	0.00000	mg/l
Nitrate (as N)	0.20	mg/l
Selenium(Se)	0.000	mg/l
Fluoride(F)	0.10	mg/l
Silver(Ag)	0.00000	mg/l
pH	7.60	
Conductivity	770.0	umhos/cm
Total Dissolved Solids (TDS)	500.0	mg/l
Total Alkalinity ($CaCO_3$)	271.0	mg/l
Total Hardness (as $CaCO_3$)	295.0	mg/l
Calcium (Ca)	74.800	mg/l
Magnesium (Mg)	26.2	mg/l
Sodium (Na)	79.8	mg/l
Potassium (K)	2.400	mg/l
Iron (Fe)	0.007	mg/l
Manganese (Mn)	0.000	mg/l
Carbonate (CO_3)	0.0	mg/l
Bicarbonate (HCO_3)	331	mg/l
Sulfate as (SO_4)	139.0	mg/l
Chloride (Cl)	13.9	mg/l
Copper (Cu)	0.0276	mg/l
Zinc (Zn)	0.0600	mg/l
Total Hardness (as $CaCO_3$)	17.0	Grains/gal
Langelier Index	0.11	

** NOTE: 1) Langelier Index - Indicates Corrosion Rating (When less than 0.0, water tends to be corrosive).

2) A TDS of less than 1000 mg/l is considered satisfactory.

Water Quality Evaluation and Categorization

Category VII - No Standards Exceeded With Reported Sample
Treated water is adequate for domestic supply

*** NOTE: Data is for treated samples only and was provided by the North Dakota Department of Health and Consolidated Laboratories.

All Seasons WUA-System III, Bottineau County

Water Quality Chemical Analysis

Report for Fiscal Year = 1990

Water Source: Treated Groundwater

Arsenic(As)	0.0000	mg/l
Barium(Ba)	0.2100	mg/l
Cadmium(Cd)	0.00000	mg/l
Chromium(Cr)	0.00000	mg/l
Lead(Pb)	0.0000	mg/l
Mercury(Hg)	0.00000	mg/l
Nitrate (as N)	0.40	mg/l
Selenium(Se)	0.010	mg/l
Fluoride(F)	0.10	mg/l
Silver(Ag)	0.00000	mg/l
pH	7.40	
Conductivity	835.0	umhos/cm
Total Dissolved Solids (TDS)	507.0	mg/l
Total Alkalinity ($CaCO_3$)	381.0	mg/l
Total Hardness (as $CaCO_3$)	493.0	mg/l
Calcium (Ca)	120.000	mg/l
Magnesium (Mg)	47.0	mg/l
Sodium (Na)	24.4	mg/l
Potassium (K)	5.100	mg/l
Iron (Fe)	0.003	mg/l
Manganese (Mn)	0.001	mg/l
Carbonate (CO_3)	0.0	mg/l
Bicarbonate (HCO_3)	465	mg/l
Sulfate as (SO_4)	53.0	mg/l
Chloride (Cl)	26.7	mg/l
Copper (Cu)	0.2080	mg/l
Zinc (Zn)	0.0430	mg/l
Total Hardness (as $CaCO_3$)	29.0	Grains/gal
Langelier Index	0.27	

** NOTE: 1) Langelier Index - Indicates Corrosion Rating (When less than 0.0, water tends to be corrosive).

2) A TDS of less than 1000 mg/l is considered satisfactory.

Water Quality Evaluation and Categorization

Category VI - Exceeds minimum standard for TDS, Sulfate, Chloride, pH, and/or recommended standard for Sodium.

TDS 507.0 mg/l > 500 mg/l

*** NOTE: Data is for treated samples only and was provided by the North Dakota Department of Health and Consolidated Laboratories.

All Seasons WUA-System IV, Bottineau County

Water Quality Chemical Analysis

Report for Fiscal Year = 1991

Water Source: Treated Groundwater

Arsenic(As)	0.0010	mg/l
Barium(Ba)	0.0572	mg/l
Cadmium(Cd)	0.00020	mg/l
Chromium(Cr)	0.00020	mg/l
Lead(Pb)	0.0044	mg/l
Mercury(Hg)	0.00020	mg/l
Nitrate (as N)	0.14	mg/l
Selenium(Se)	0.004	mg/l
Fluoride(F)	0.17	mg/l
Silver(Ag)	0.00026	mg/l
pH	7.43	
Conductivity	680.0	umhos/cm
Total Dissolved Solids (TDS)	420.0	mg/l
Total Alkalinity ($CaCO_3$)	255.0	mg/l
Total Hardness (as $CaCO_3$)	364.0	mg/l
Calcium (Ca)	86.100	mg/l
Magnesium (Mg)	36.1	mg/l
Sodium (Na)	15.5	mg/l
Potassium (K)	3.230	mg/l
Iron (Fe)	0.007	mg/l
Manganese (Mn)	0.001	mg/l
Carbonate (CO_3)	0.0	mg/l
Bicarbonate (HCO_3)	311	mg/l
Sulfate as (SO_4)	119.0	mg/l
Chloride (Cl)	6.2	mg/l
Copper (Cu)	0.0177	mg/l
Zinc (Zn)	0.0170	mg/l
Total Hardness (as $CaCO_3$)	21.0	Grains/gal
Langelier Index	-0.02	

** NOTE: 1) Langelier Index - Indicates Corrosion Rating (When less than 0.0, water tends to be corrosive).

2) A TDS of less than 1000 mg/l is considered satisfactory.

Water Quality Evaluation and Categorization

Category VII - No Standards Exceeded With Reported Sample. Treated water is adequate for domestic supply.

*** NOTE: Data is for treated samples only and was provided by the North Dakota Department of Health and Consolidated Laboratories.

McLean-Sheridan RWA, McLean County

Water Quality Chemical Analysis

Report for Fiscal Year = 1991

Water Source: Treated Groundwater

Arsenic(As)	0.0013	mg/l
Barium(Ba)	0.1520	mg/l
Cadmium(Cd)	0.00048	mg/l
Chromium(Cr)	0.00013	mg/l
Lead(Pb)	0.0018	mg/l
Mercury(Hg)	0.00020	mg/l
Nitrate (as N)	2.19	mg/l
Selenium(Se)	0.002	mg/l
Fluoride(F)	1.37	mg/l
Silver(Ag)	0.00020	mg/l
pH	7.56	
Conductivity	512.0	umhos/cm
Total Dissolved Solids (TDS)	316.0	mg/l
Total Alkalinity ($CaCO_3$)	210.0	mg/l
Total Hardness (as $CaCO_3$)	297.0	mg/l
Calcium (Ca)	72.900	mg/l
Magnesium (Mg)	27.8	mg/l
Sodium (Na)	7.3	mg/l
Potassium (K)	3.360	mg/l
Iron (Fe)	0.088	mg/l
Manganese (Mn)	0.017	mg/l
Carbonate (CO_3)	0.0	mg/l
Bicarbonate (HCO_3)	256	mg/l
Sulfate as (SO_4)	65.0	mg/l
Chloride (Cl)	3.4	mg/l
Copper (Cu)	0.2840	mg/l
Zinc (Zn)	0.1660	mg/l
Total Hardness (as $CaCO_3$)	17.0	Grains/gal
Langelier Index	-0.02	

** NOTE: 1) Langelier Index - Indicates Corrosion Rating (When less than 0.0, water tends to be corrosive).

2) A TDS of less than 1000 mg/l is considered satisfactory.

Water Quality Evaluation and Categorization

Category VII - No Standards Exceeded With Reported Sample. Treated water is adequate for domestic supply.

*** NOTE: Data is for treated samples only and was provided by the North Dakota Department of Health and Consolidated Laboratories.

North Prairie RWA-System III, Ward County

Water Quality Chemical Analysis

Report for Fiscal Year = 1992

Water Source: Treated Groundwater

Arsenic(As)	0.0002	mg/l
Barium(Ba)	0.0928	mg/l
Cadmium(Cd)	0.00020	mg/l
Chromium(Cr)	0.00020	mg/l
Lead(Pb)	0.0022	mg/l
Mercury(Hg)	0.00020	mg/l
Nitrate (as N)	0.12	mg/l
Selenium(Se)	0.001	mg/l
Fluoride(F)	0.96	mg/l
Silver(Ag)	0.00020	mg/l
pH	7.67	
Conductivity	829.0	umhos/cm
Total Dissolved Solids (TDS)	546.0	mg/l
Total Alkalinity ($CaCO_3$)	243.0	mg/l
Total Hardness (as $CaCO_3$)	285.0	mg/l
Calcium (Ca)	73.700	mg/l
Magnesium (Mg)	24.4	mg/l
Sodium (Na)	104.0	mg/l
Potassium (K)	6.270	mg/l
Iron (Fe)	0.299	mg/l
Manganese (Mn)	0.515	mg/l
Carbonate (CO_3)	0.0	mg/l
Bicarbonate (HCO_3)	297	mg/l
Sulfate as (SO_4)	183.0	mg/l
Chloride (Cl)	7.3	mg/l
Copper (Cu)	0.0140	mg/l
Zinc (Zn)	0.0470	mg/l
Total Hardness (as $CaCO_3$)	17.0	Grains/gal
Langelier Index	0.13	

** NOTE: 1) Langelier Index - Indicates Corrosion Rating (When less than 0.0, water tends to be corrosive).

2) A TDS of less than 1000 mg/l is considered satisfactory.

Water Quality Evaluation and Categorization

Category V - Exceeds Iron or Manganese Secondary Standards

Manganese 0.515 mg/l > 0.05 mg/l

*** NOTE: Data is for treated samples only and was provided by the North Dakota Department of Health and Consolidated Laboratories.

Upper Souris WUA-System I, Ward County

Water Quality Chemical Analysis

Report for Fiscal Year = 1991

Water Source: Treated Groundwater

Arsenic(As)	0.0008	mg/l
Barium(Ba)	0.3370	mg/l
Cadmium(Cd)	0.00020	mg/l
Chromium(Cr)	0.00020	mg/l
Lead(Pb)	0.0010	mg/l
Mercury(Hg)	0.00020	mg/l
Nitrate (as N)	0.10	mg/l
Selenium(Se)	0.005	mg/l
Fluoride(F)	1.32	mg/l
Silver(Ag)	0.00020	mg/l
pH	8.00	
Conductivity	2170.0	umhos/cm
Total Dissolved Solids (TDS)	1350.0	mg/l
Total Alkalinity ($CaCO_3$)	999.0	mg/l
Total Hardness (as $CaCO_3$)	61.0	mg/l
Calcium (Ca)	16.000	mg/l
Magnesium (Mg)	5.0	mg/l
Sodium (Na)	526.0	mg/l
Potassium (K)	3.830	mg/l
Iron (Fe)	0.012	mg/l
Manganese (Mn)	0.003	mg/l
Carbonate (CO_3)	0.0	mg/l
Bicarbonate (HCO_3)	1220	mg/l
Sulfate as (SO_4)	0.0	mg/l
Chloride (Cl)	197.0	mg/l
Copper (Cu)	0.1210	mg/l
Zinc (Zn)	0.0120	mg/l
Total Hardness (as $CaCO_3$)	4.0	Grains/gal
Langelier Index	0.40	

** NOTE: 1) Langelier Index - Indicates Corrosion Rating (When less than 0.0, water tends to be corrosive).

2) A TDS of less than 1000 mg/l is considered satisfactory.

Water Quality Evaluation and Categorization

Category IV - Exceeds Less Than Four Secondary Standards and TDS is greater than 1000.

TDS	1350.0 mg/l	> 1000 mg/l
Sodium	526.0 mg/l	> 200 mg/l

*** NOTE: Data is for treated samples only and was provided by the North Dakota Department of Health and Consolidated Laboratories.

Upper Souris WUA-System II, Ward County

Water Quality Chemical Analysis

Report for Fiscal Year = 1991

Water Source: Treated Groundwater

Arsenic(As)	0.0085	mg/l
Barium(Ba)	0.1020	mg/l
Cadmium(Cd)	0.00020	mg/l
Chromium(Cr)	0.00292	mg/l
Lead(Pb)	0.0010	mg/l
Mercury(Hg)	0.00020	mg/l
Nitrate (as N)	0.08	mg/l
Selenium(Se)	0.009	mg/l
Fluoride(F)	0.72	mg/l
Silver(Ag)	0.00020	mg/l
pH	7.61	
Conductivity	1995.0	umhos/cm
Total Dissolved Solids (TDS)	1240.0	mg/l
Total Alkalinity ($CaCO_3$)	669.0	mg/l
Total Hardness (as $CaCO_3$)	254.0	mg/l
Calcium (Ca)	61.800	mg/l
Magnesium (Mg)	24.1	mg/l
Sodium (Na)	445.0	mg/l
Potassium (K)	8.910	mg/l
Iron (Fe)	0.087	mg/l
Manganese (Mn)	0.012	mg/l
Carbonate (CO_3)	0.0	mg/l
Bicarbonate (HCO_3)	817	mg/l
Sulfate as (SO_4)	0.0	mg/l
Chloride (Cl)	299.0	mg/l
Copper (Cu)	0.0140	mg/l
Zinc (Zn)	0.0180	mg/l
Total Hardness (as $CaCO_3$)	15.0	Grains/gal
Langelier Index	0.42	

** NOTE: 1) Langelier Index - Indicates Corrosion Rating (When less than 0.0, water tends to be corrosive).

2) A TDS of less than 1000 mg/l is considered satisfactory.

Water Quality Evaluation and Categorization

Category IV - Exceeds Less Than Four Secondary Standards and TDS is greater than 1000.

TDS	1240.0 mg/l	> 1000 mg/l
Sodium	445.0 mg/l	> 200 mg/l
Chloride	299.0 mg/l	> 250 mg/l

*** NOTE: Data is for treated samples only and was provided by the North Dakota Department of Health and Consolidated Laboratories.

Potential Water Supplies - Water Quality Assessments

Surface Water Sources

Lake Audubon, McLean County
Lake Sakakawea (at Garrison), McLean County
Lake Sakakawea (at Riverdale), McLean County
Missouri River (at Williston), Williams County

Groundwater Sources

Grenora Aquifer (City Well)
Minot Aquifer (City Wells #5 and #15)
Sundre Aquifer (City Well #D)

Lake Audubon, McLean County
Raw Water Sample
Water Quality Chemical Analysis

Bureau of Reclamation Quarterly Report (November 17, 1992)

Water Source: Surface Water - Missouri River

Arsenic(As)	NR	mg/l
Barium(Ba)	NR	mg/l
Cadmium(Cd)	NR	mg/l
Chromium(Cr)	NR	mg/l
Lead(Pb)	NR	mg/l
Mercury(Hg)	NR	mg/l
Nitrate (as N)	NR	mg/l
Selenium(Se)	NR	mg/l
Fluoride(F)	NR	mg/l
Silver(Ag)	NR	mg/l
pH	8.18	
Conductivity	NR	umhos/cm
Total Dissolved Solids (TDS)	614.0	mg/l
Total Alkalinity ($CaCO_3$)	202.1	mg/l
Total Hardness (as $CaCO_3$)	269.9	mg/l
Calcium (Ca)	52.000	mg/l
Magnesium (Mg)	34.0	mg/l
Sodium (Na)	106.0	mg/l
Potassium (K)	6.500	mg/l
Iron (Fe)	NR	mg/l
Manganese (Mn)	NR	mg/l
Carbonate (CO_3)	NR	mg/l
Bicarbonate (HCO_3)	NR	mg/l
Sulfate as (SO_4)	279.1	mg/l
Chloride (Cl)	15.3	mg/l
Copper (Cu)	NR	mg/l
Zinc (Zn)	NR	mg/l
Total Hardness (as $CaCO_3$)	NR	mg/l
Grains/gal	NR	Grains/gal
Langelier Index	NR	

** NOTE: 1) Langelier Index - Indicates Corrosion Rating (When less than 0.0, water tends to be corrosive).

2) A TDS of less than 1000 mg/l is considered satisfactory.

3) **NR** = Not Reported

Water Quality Evaluation and Categorization

Category VI - Exceeds minimum standard for TDS, Sulfate, Chloride, pH, and/or recommended standard for Sodium.

TDS	614.0 mg/l	>	500 mg/l
Sulfates	279.1 mg/l	>	250 mg/l

*** NOTE: Data is for an untreated raw water sample taken from Lake Audubon (Missouri River) by the Bureau of Reclamation, Bismarck, North Dakota.

Lake Sakakawea (at Garrison) McLean County
Raw Water Sample
Water Quality Chemical Analysis

Report by MVTL (December 7, 1990)

Water Source: Surface Water - Missouri River

Arsenic(As)	0.0030	mg/l
Barium(Ba)	0.1000	mg/l
Cadmium(Cd)	< 0.01000	mg/l
Chromium(Cr)	< 0.05000	mg/l
Lead(Pb)	0.0050	mg/l
Mercury(Hg)	< 0.00020	mg/l
Nitrate (as N)	< 1	mg/l
Selenium(Se)	< 0.002	mg/l
Fluoride(F)	0.60	mg/l
Silver(Ag)	< 0.01000	mg/l
pH	8.40	
Conductivity	686.0	umhos/cm
Total Dissolved Solids(TDS)	432.0	mg/l
Total Alkalinity ($CaCO_3$)	162.0	mg/l
Total Hardness (as $CaCO_3$)	240.0	mg/l
Calcium (Ca)	55.000	mg/l
Magnesium (Mg)	24.9	mg/l
Sodium (Na)	58.0	mg/l
Potassium (K)	4.400	mg/l
Iron (Fe)	1.240	mg/l
Manganese (Mn)	0.060	mg/l
Carbonate (CO_3)	0.0	mg/l
Bicarbonate (HCO_3)	162	mg/l
Sulfate as (SO_4)	181.0	mg/l
Chloride (Cl)	11.6	mg/l
Copper (Cu)	**NR**	mg/l
Zinc (Zn)	**NR**	mg/l
Total Hardness (as $CaCO_3$)	14.0	Grains/gal
Langelier Index	**NR**	

** NOTE: 1) Langelier Index - Indicates Corrosion Rating (When less than 0.0, water tends to be corrosive).

2) A TDS of less than 1000 mg/l is considered satisfactory.

3) **NR** = Not Reported

Water Quality Evaluation and Categorization

Category V - Exceeds Iron or Manganese Secondary Standards

Iron 1.240 mg/l > 0.3 mg/l

*** NOTE: Data is for an untreated raw water sample from Lake Sakakawea (Missouri River) near the City of Garrison. Testing was completed by Minnesota Valley Testing Laboratories (MVTL) and submitted to the North Dakota Department of Health and Consolidated Laboratories.

Lake Sakakawea (at Riverdale), McLean County
Raw Water Sample
Water Quality Chemical Analysis
USGS Report (August 10, 1992)

Water Source: Surface Water - Missouri River

Arsenic(As)	**NR**	mg/l
Barium(Ba)	0.049	mg/l
Cadmium(Cd)	< 0.004	mg/l
Chromium(Cr)	< 0.01	mg/l
Lead(Pb)	**NR**	mg/l
Mercury(Hg)	**NR**	mg/l
Nitrate (as N)	0.11	mg/l
Selenium(Se)	**NR**	mg/l
Fluoride(F)	0.50	mg/l
Silver(Ag)	< 10	mg/l
pH	8.40	
Conductivity	545	umhos/cm
Total Dissolved Solids (TDS)	332.0	mg/l
Total Alkalinity ($CaCO_3$)	145.0	mg/l
Total Hardness (as $CaCO_3$)	240.0	mg/l
Calcium (Ca)	58.000	mg/l
Magnesium (Mg)	22.0	mg/l
Sodium (Na)	59.0	mg/l
Potassium (K)	4.000	mg/l
Iron (Fe)	0.0120	mg/l
Manganese (Mn)	< 0.005	mg/l
Carbonate (CO_3)	**NR**	mg/l
Bicarbonate (HCO_3)	**NR**	mg/l
Sulfate as (SO_4)	200.0	mg/l
Chloride (Cl)	7.0	mg/l
Copper (Cu)	**NR**	mg/l
Zinc (Zn)	< 0.002	mg/l
Total Hardness (as $CaCO_3$)	**NR**	Grains/gal
Langelier Index	**NR**	

** NOTE: 1) Langelier Index - Indicates Corrosion Rating (When less than 0.0, water tends to be corrosive).

2) A TDS of less than 1000 mg/l is considered satisfactory.

3) **NR** = Not Reported

Water Quality Evaluation and Categorization

Category VII - No Standards Exceeded With Reported Sample
Treated water is adequate for domestic supply

*** NOTE: Data is for an untreated raw water sample from Lake Sakakawea (Missouri River). Information obtained from USGS records Gage #06337995, Lake Sakakawea at Riverdale, North Dakota.

Missouri River (at Williston) Williams County
Raw Water Sample
Water Quality Chemical Analysis
Reported by the City of Williston (1964)

Water Source: Surface Water - Missouri River

Arsenic(As)	NR	mg/l
Barium(Ba)	NR	mg/l
Cadmium(Cd)	NR	mg/l
Chromium(Cr)	NR	mg/l
Lead(Pb)	NR	mg/l
Mercury(Hg)	NR	mg/l
Nitrate (as N)	0	mg/l
Selenium(Se)	NR	mg/l
Fluoride(F)	0.30	mg/l
Silver(Ag)	NR	mg/l
pH	7.6	
Conductivity	1480	umhos/cm
Total Dissolved Solids(TDS)	590	mg/l
Total Alkalinity ($CaCO_3$)	170	mg/l
Total Hardness (as $CaCO_3$)	255	mg/l
Calcium (Ca)	46	mg/l
Magnesium (Mg)	34	mg/l
Sodium (Na)	64	mg/l
Potassium (K)	5.6	mg/l
Iron (Fe)	trace	mg/l
Manganese (Mn)	0	mg/l
Carbonate (CO_3)	0	mg/l
Bicarbonate (HCO_3)	207	mg/l
Sulfate as (SO_4)	213	mg/l
Chloride (Cl)	8	mg/l
Copper (Cu)	NR	mg/l
Zinc (Zn)	NR	mg/l
Total Hardness (as $CaCO_3$)	NR	Grains/gal
Langelier Index	NR	

** NOTE: 1) Langelier Index - Indicates Corrosion Rating (When less than 0.0, water tends to be corrosive).

2) A TDS of less than 1000 mg/l is considered satisfactory.

3) **NR** = Not Reported

Water Quality Evaluation and Categorization

Category VI - Exceeds minimum standard for TDS, Sulfate, Chloride, pH, and/or recommended standard for Sodium.

TDS 590.0 mg/l > 500 mg/l

*** NOTE: Data is for an untreated raw water sample from the Missouri River near the City of Williston. Information provided by the city along with the average reports and ranges over the last ten years for Total Hardness, alkalinity, Ca, pH an TDS.

Grenora Aquifer, Williams County
Raw Water Sample
Water Quality Chemical Analysis
North Dakota State Water Commission (July 13, 1965)

Water Source: Surface Water - Missouri River

Arsenic(As)	NR	mg/l
Barium(Ba)	NR	mg/l
Cadmium(Cd)	NR	mg/l
Chromium(Cr)	NR	mg/l
Lead(Pb)	NR	mg/l
Mercury(Hg)	NR	mg/l
Nitrate (as N)	0.7	mg/l
Selenium(Se)	NR	mg/l
Fluoride(F)	0.1	mg/l
Silver(Ag)	NR	mg/l
pH	NR	
Conductivity	740	umhos/cm
Total Dissolved Solids (TDS)	548.0	mg/l
Total Alkalinity ($CaCO_3$)	NR	mg/l
Total Hardness (as $CaCO_3$)	426.0	mg/l
Calcium (Ca)	122	mg/l
Magnesium (Mg)	30	mg/l
Sodium (Na)	24	mg/l
Potassium (K)	14	mg/l
Iron (Fe)	0.08	mg/l
Manganese (Mn)	NR	mg/l
Carbonate (CO_3)	0	mg/l
Bicarbonate (HCO_3)	481	mg/l
Sulfate as (SO_4)	54	mg/l
Chloride (Cl)	42	mg/l
Copper (Cu)	NR	mg/l
Zinc (Zn)	NR	mg/l
Total Hardness (as $CaCO_3$)	NR	Grains/gal
Langelier Index	NR	

** NOTE: 1) Langelier Index - Indicates Corrosion Rating (When less than 0.0, water tends to be corrosive).

2) A TDS of less than 1000 mg/l is considered satisfactory.

3) NR = Not Reported

Water Quality Evaluation and Categorization

Category VI - Exceeds minimum standard for TDS, Sulfate, Chloride, pH, and/or recommended standard for Sodium.

TDS 548.0 mg/l > 500 mg/l

*** NOTE: Data was obtained from the North Dakota State Water Commission records for wells in the Grenora Aquifer. This City of Grenora well is located in Section 12, T159N R103W and is about 38 feet in depth. The test data is old; newer information was unavailable.

Minot Aquifer, Ward County
Raw Water Sample - City of Minot Well #5
Water Quality Chemical Analysis

North Dakota State Water Commission (September 22, 1992)

Water Source: Surface Water - Missouri River		
Arsenic(As)	NR	mg/l
Barium(Ba)	NR	mg/l
Cadmium(Cd)	NR	mg/l
Chromium(Cr)	NR	mg/l
Lead(Pb)	NR	mg/l
Mercury(Hg)	3.3	mg/l
Nitrate (as N)	NR	mg/l
Selenium(Se)	0.5	mg/l
Fluoride(F)	NR	mg/l
Silver(Ag)	7.68	
pH	1590	umhos/cm
Conductivity	1020	mg/l
Total Dissolved Solids (TDS)	NR	mg/l
Total Alkalinity ($CaCO_3$)	410.0	mg/l
Total Hardness (as $CaCO_3$)	98.0	mg/l
Calcium (Ca)	39.0	mg/l
Magnesium (Mg)	210.0	mg/l
Sodium (Na)	6.800	mg/l
Potassium (K)	1.8	mg/l
Iron (Fe)	0.28	mg/l
Manganese (Mn)	NR	mg/l
Carbonate (CO_3)	548.0	mg/l
Bicarbonate (HCO_3)	260.0	mg/l
Sulfate as (SO_4)	120.0	mg/l
Chloride (Cl)	NR	mg/l
Copper (Cu)	NR	mg/l
Zinc (Zn)	NR	Grains/gal
Total Hardness (as $CaCO_3$)	NR	
Langelier Index		

** NOTE: 1) Langelier Index - Indicates Corrosion Rating (When less than 0.0, water tends to be corrosive).

2) A TDS of less than 1000 mg/l is considered satisfactory.

3) NR = Not Reported

Water Quality Evaluation and Categorization

Category IV - Exceeds Less Than Four Secondary Standards and TDS is greater than 1000.

TDS	1020.0 mg/l	> 1000 mg/l
Sulfates	260.0 mg/l	> 250 mg/l
Iron	1.8 mg/l	> 0.5 mg/l

*** NOTE: Data is for an untreated raw water sample taken by the North Dakota State Water Commission from Minot City Well #5 located in the Minot Aquifer.

Minot Aquifer, Ward County
Raw Water Sample - City of Minot Well #15
Water Quality Chemical Analysis
North Dakota State Water Commission (September 22, 1992)

Water Source: Surface Water - Missouri River		
Arsenic(As)	**NR**	mg/l
Barium(Ba)	**NR**	mg/l
Cadmium(Cd)	**NR**	mg/l
Chromium(Cr)	**NR**	mg/l
Lead(Pb)	**NR**	mg/l
Mercury(Hg)	**NR**	mg/l
Nitrate (as N)	0.6	mg/l
Selenium(Se)	**NR**	mg/l
Fluoride(F)	0.1	mg/l
Silver(Ag)	**NR**	mg/l
pH	7.42	
Conductivity	1500	umhos/cm
Total Dissolved Solids (TDS)	952.0	mg/l
Total Alkalinity ($CaCO_3$)	**NR**	mg/l
Total Hardness (as $CaCO_3$)	510.0	mg/l
Calcium (Ca)	120.0	mg/l
Magnesium (Mg)	50.0	mg/l
Sodium (Na)	150.0	mg/l
Potassium (K)	8.40	mg/l
Iron (Fe)	0.43	mg/l
Manganese (Mn)	0.94	mg/l
Carbonate (CO_3)	0	mg/l
Bicarbonate (HCO_3)	733	mg/l
Sulfate as (SO_4)	180.0	mg/l
Chloride (Cl)	72.0	mg/l
Copper (Cu)	**NR**	mg/l
Zinc (Zn)	**NR**	mg/l
Total Hardness (as $CaCO_3$)	**NR**	Grains/gal
Langelier Index	**NR**	

** NOTE: 1) Langelier Index - Indicates Corrosion Rating (When less than 0.0, water tends to be corrosive).

2) A TDS of less than 1000 mg/l is considered satisfactory.

3) **NR** = Not Reported

Water Quality Evaluation and Categorization

Category V - Exceeds Iron or Manganese Secondary Standards

TDS	952.0 mg/l	>	500 mg/l
Manganese	0.94 mg/l	>	0.5 mg/l

*** NOTE: Data is for an untreated raw water sample taken by the North Dakota State Water Commission from Minot City Well #15 located in the Minot Aquifer.

Sundre Aquifer, Ward County
Raw Water Sample - City of Minot Well #D
Water Quality Chemical Analysis
North Dakota State Water Commission (September 22, 1992)

Water Source: Surface Water - Missouri River

Arsenic(As)	NR	mg/l
Barium(Ba)	NR	mg/l
Cadmium(Cd)	NR	mg/l
Chromium(Cr)	NR	mg/l
Lead(Pb)	NR	mg/l
Mercury(Hg)	NR	mg/l
Nitrate (as N)	4.2	mg/l
Selenium(Se)	NR	mg/l
Fluoride(F)	0.2	mg/l
Silver(Ag)	NR	mg/l
pH	7.41	
Conductivity	2290	umhos/cm
Total Dissolved Solids (TDS)	1700.0	mg/l
Total Alkalinity ($CaCO_3$)	NR	mg/l
Total Hardness (as $CaCO_3$)	780.0	mg/l
Calcium (Ca)	210.00	mg/l
Magnesium (Mg)	61.0	mg/l
Sodium (Na)	260.0	mg/l
Potassium (K)	9.40	mg/l
Iron (Fe)	3.2	mg/l
Manganese (Mn)	0.7	mg/l
Carbonate (CO_3)	0	mg/l
Bicarbonate (HCO_3)	673	mg/l
Sulfate as (SO_4)	760.0	mg/l
Chloride (Cl)	50.0	mg/l
Copper (Cu)	NR	mg/l
Zinc (Zn)	NR	mg/l
Total Hardness (as $CaCO_3$)	NR	Grains/gal
Langelier Index	NR	

** NOTE: 1) Langelier Index - Indicates Corrosion Rating (When less than 0.0, water tends to be corrosive).

2) A TDS of less than 1000 mg/l is considered satisfactory.

3) **NR** = Not Reported

Water Quality Evaluation and Categorization

Category II - Exceeds Four (4) or More Secondary Standards and TDS is greater than 1000 mg/l.

TDS	1700.0 mg/l	< 1000 mg/l
Iron	3.2 mg/l	> 0.3 mg/l
Manganese	0.700 mg/l	> 0.05 mg/l
Sulfates	760.0 mg/l	> 250 mg/l

*** NOTE: Data is for an untreated raw water sample taken by the North Dakota State Water Commission from Minot City Well #D located in the Sundre Aquifer.