City of Grand Forks

Drought Management and Demand Reduction Plan

July 2007
City of Grand Forks
Drought Management and Demand Reduction Plan

Table of Contents

I. Introduction 3

II. Water Supply 4
   A. Current Water Supplies
      1. Red River
      2. Red Lake River
      3. Reservoir Storage
   B. Alternate Supplies
   C. Permits
      1. North Dakota and Minnesota
   D. Water Law and Reservoir Operations
      1. North Dakota (Red River of the North and Lake Ashtabula)
      2. Minnesota (Red Lake River)

III. Water Shortage Definitions and Indicators 9

IV. Drought Levels - Monitoring 10

V. Demand Reduction Policies - Drought Conditions 13

VI. Demand Reduction Policies - Insufficient or Failing Infrastructure 19

VII. Plan Implementation Procedures 22

VII References 27

Appendix A - Water Permits for City of Grand Forks
Appendix B - Lake Ashtabula Water Storage
Appendix C - Description of Drought Indicators/Tables of Streamflows/Reservoir Levels/Standardized Precipitation Index (SPI)
Appendix D - Drought Advisory Committee
Appendix E - Public Education and Conservation Practices
Appendix F - User Agreements Pertaining to Water Demand Reduction
Appendix G - Map Stream Flow Gauge Locations N.D. & Minnesota
Appendix H - Sample Press Releases
## LIST OF TABLES

<table>
<thead>
<tr>
<th>TABLE</th>
<th>Description</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1</td>
<td>Red River of the North Reservoir Storage</td>
<td>4</td>
</tr>
<tr>
<td>2.2</td>
<td>Red Lake River Reservoir Storage</td>
<td>5</td>
</tr>
<tr>
<td>2.3</td>
<td>Grand Forks Water Supply Alternatives</td>
<td>6</td>
</tr>
<tr>
<td>2.4</td>
<td>Permit Summary</td>
<td>6</td>
</tr>
<tr>
<td>2.5</td>
<td>Red River Water Permit Seniority</td>
<td>7</td>
</tr>
</tbody>
</table>
City of Grand Forks
Drought Management and Demand Reduction Plan

I. Introduction

A sufficient water supply is fundamental to the growth, development, and on-going vitality of the City of Grand Forks. Currently two challenges are facing the City of Grand Forks in terms of maintaining a sufficient water supply for its customers. The first challenge is associated with the possibility of a drought that results in source water shortages. A drought is defined as a normal, recurring feature of nature that results in water shortages affecting municipal, industrial, recreational, and environmental sectors. The water needs of the residential, commercial, and industrial users are met with surface water from the Red and Red Lake Rivers. Under normal conditions, surplus quantities are available in both rivers. In part, the goal of this document is to plan for drought conditions and anticipate drought events to improve the City of Grand Forks Water Utility’s ability to address and minimize impacts to the users.

The second challenge facing the City of Grand Forks is related to the treatment capacity of the Grand Forks Water Treatment Plant (GFWTP), which is a 16.5 million gallon per day (MGD) facility. This capacity has been exceeded in the past, and as the community continues to grow and the existing GFWTP continues to age, the possibility that a failure at the plant or water demands might exceed production becomes increasingly likely. This document will also provide a plan for addressing an infrastructure production shortage and improve the City of Grand Forks Water Utility’s ability to address and minimize the impacts of this possibility to its users as well.

The Grand Forks Water Utility Drought Management and Demand Reduction Plan will compile information that will be used to determine the appropriate triggers and appropriate water demand reduction measures leading up to and during drought conditions. In addition, triggers and water demand reduction measures will also be identified for implementation during a shortage of treated water due to failed or insufficient infrastructure. The following outlines criteria to be included in the plan as the basis for establishing operating parameters:

- Definition of available water supplies
- Discussion of treatment and storage capacities in the Grand Forks system
- Definition of water users and demand patterns for the City of Grand Forks
- Drought indicators
- Demand reduction measures for drought as well as insufficient or failing infrastructure conditions
- Plan implementation procedures
II. WATER SUPPLY

A. CURRENT WATER SUPPLIES

The City of Grand Forks relies upon two rivers, the Red River of the North and the Red Lake River, to supply its residential, commercial, and industrial water demands. Water stored in Lake Ashtabula behind Baldhill Dam at Valley City, North Dakota is also available to the City of Grand Forks, via releases into the Red River drainage basin. Information for this discussion was taken from the Draft 50-Year Water Quantity and Needs Survey, prepared by Advanced Engineering and Environmental Services (AE2S) in 1994.

A.1 Red River of the North

The Red River of the North originates where the Ottertail River and the Bois de Sioux combine near Wahpeton and flows north into Lake Winnipeg in Manitoba, Canada. The contributing drainage area of the Grand Forks gauging station on the Red River of the North is 26,300 square miles.

The discharge at the Grand Forks gauging station is monitored after the Red Lake River has joined the Red River and after the Grand Forks water treatment plant has withdrawn the water required to supply the City’s demand. Prior to the mid 1900’s, the flow pattern of the Red River was very unpredictable. The highest and lowest annual mean flows prior to construction of reservoirs were 7580 cubic feet per second (cfs) in 1950 and 244 cfs in 1934, respectively. Three reservoirs, built during the 1940’s and early 1950’s, have altered the flow of the Red River of the North. These reservoirs include Lake Traverse, Lake Ashtabula, and Orwell Lake. Since the construction of the reservoirs, the flow in the Red River has been maintained to minimize the extreme high and low flow fluctuations to the extent possible. The storage of each of these reservoirs and the year that construction was completed are presented in Table 2.1.

<table>
<thead>
<tr>
<th>Storage (acre-ft)</th>
<th>Lake Ashtabula</th>
<th>Orwell Lake</th>
<th>Traverse Lake</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top of Flood Level</td>
<td>70,700</td>
<td>14,100</td>
<td>249,500</td>
</tr>
<tr>
<td>Top of Flood Control Level</td>
<td>70,700</td>
<td>14,100</td>
<td>112,500</td>
</tr>
<tr>
<td>Top of Conservation Pool</td>
<td>28,000</td>
<td>7,550</td>
<td>-----</td>
</tr>
<tr>
<td>Top of Buffer (1/2)</td>
<td>1,200</td>
<td>1,000</td>
<td>112,500</td>
</tr>
<tr>
<td>Minimum Conservation Pool</td>
<td>1,200</td>
<td>210</td>
<td>112,500</td>
</tr>
<tr>
<td>Year Constructed</td>
<td>1951</td>
<td>1941</td>
<td>1953</td>
</tr>
</tbody>
</table>

TABLE 2.1: RED RIVER OF THE NORTH RESERVOIR STORAGE

A low-head dam at Riverside Park in Grand Forks pools water on the Red River of the North. The dam was reconstructed in 1991 by the North Dakota State Water Commission (NDSWC) and creates a consistent reservoir pool and provides storage volume during low-flow conditions.
A.2 Red Lake River

The Red Lake River originates at the Red Lake on the Red Lake Indian Reservation in Beltrami County, Minnesota and flows southwest into the Red River at Grand Forks. The contributing drainage area for the Red Lake River is 5,750 square miles. Flow in the Red Lake River is controlled by the discharge from Red Lake via an outlet structure operated by the Army Corps of Engineers. There is also a low-head dam located on the Red Lake River near the outflow into the Red River of the North. Like its counterpart on the Red River, the low-head dam creates a consistent pool for withdrawing water through the Grand Forks intake and provides limited storage volume during extreme low-flow conditions.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Elevation (feet)</th>
<th>Storage (acre-feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top of Flood Control Level</td>
<td>1,176.4</td>
<td>2,510,000</td>
</tr>
<tr>
<td>Top of Conservation Pool</td>
<td>1,174.0</td>
<td>1,810,000</td>
</tr>
<tr>
<td>Top of Buffer (1/2)</td>
<td>-----</td>
<td>1,386,500</td>
</tr>
<tr>
<td>Minimum Conservation Pool</td>
<td>1,171.0</td>
<td>963,000</td>
</tr>
<tr>
<td>Bottom Level of Control</td>
<td>1,169.6</td>
<td>570,000</td>
</tr>
<tr>
<td>Year Constructed</td>
<td></td>
<td>1952</td>
</tr>
</tbody>
</table>

*aDrawdown of conservation pool begins in November and ends in March at a level of 1,667,500 acre-feet to provide 842,500 acre-feet of storage for flood control.

*bThe storage between the top of buffer and the bottom level of control can only be used to meet the basic withdrawal requirements and not the much higher desired flows needed to maintain sanitary and aesthetic in-stream conditions.

**TABLE 2.2: RED LAKE RIVER RESERVOIR STORAGE**

A.3 Reservoir Storage

Balchill Dam on Lake Ashtabula at Valley City, North Dakota was constructed during the early 1950's. The purpose of the dam is to control the amount of discharge from Lake Ashtabula, thereby, reducing flooding during periods of high-flow and providing stored water for permitted users during periods of low-flow. The City of Grand Forks maintains an allocation of 20,023 acre-ft of water behind Bald Hill Dam having contributed financially to the original construction and subsequent improvements.

B. ALTERNATE WATER SUPPLIES

Alternative water supplies, such as additional surface water sources, groundwater and wastewater treatment return flows have been considered as a source of water to meet the City's needs. The Army Corps of Engineers, St. Paul District studied each of the alternatives included in Table 2.3.² This report concluded that none of the surface water sources would be a viable alternative. Of the aquifers in the area, the Elk Valley Aquifer located to the west of Grand Forks would have the most potential, although this aquifer has reached its maximum permitted withdrawal. This finding has been confirmed by the most recent study done by the United States Bureau of Reclamation (USBR) and the Garrison Diversion Conservancy District in the Draft Environmental Impact Statement, Red River Valley Water Needs Assessment.³
<table>
<thead>
<tr>
<th>Alternative Type</th>
<th>Name of Alternative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface Water:</td>
<td>Turtle River</td>
</tr>
<tr>
<td></td>
<td>English Coulee</td>
</tr>
<tr>
<td>Aquifers:</td>
<td>Elk Valley Aquifer</td>
</tr>
<tr>
<td></td>
<td>Inkster Aquifer</td>
</tr>
<tr>
<td></td>
<td>Fordville Aquifer</td>
</tr>
<tr>
<td></td>
<td>Beach Ridge Aquifer</td>
</tr>
<tr>
<td></td>
<td>Dakota Aquifer</td>
</tr>
<tr>
<td>Wastewater Treatment Lagoons:</td>
<td>Grand Forks Wastewater Treatment Lagoons</td>
</tr>
<tr>
<td></td>
<td>Other area Wastewater Treatment Lagoons</td>
</tr>
</tbody>
</table>

**TABLE 2.3: GRAND FORKS WATER SUPPLY ALTERNATIVES**

**C. PERMITS**

The NDSWC has authority over the allocation of water in North Dakota, while the Minnesota Department of Natural Resources (DNR) has a similar role in Minnesota. Table 2.4 summarizes the water permits held by the City of Grand Forks through these two agencies. Copies of the permits can be found in Appendix A.

<table>
<thead>
<tr>
<th>PERMIT #</th>
<th>WATER SOURCE</th>
<th>PERMITTED VOLUME</th>
</tr>
</thead>
<tbody>
<tr>
<td>835</td>
<td>Red River of the North</td>
<td>33,600 acre-ft/yr</td>
</tr>
<tr>
<td>835A</td>
<td>Lake Ashtabula</td>
<td>20,023 acre-ft/yr</td>
</tr>
<tr>
<td>4354</td>
<td>Red River behind Riverside Dam</td>
<td>0 acre-ft/yr</td>
</tr>
<tr>
<td>63-449</td>
<td>Red Lake River</td>
<td>10,500 acre-ft/yr</td>
</tr>
</tbody>
</table>

**TABLE 2.4: PERMIT SUMMARY**

The City of Grand Forks has two permits issued by the NDSWC for water withdrawals. Permit #835 allows the City of Grand Forks to withdraw 33,600 acre-ft of water annually from the Red River of the North to be utilized for municipal use at a withdrawal rate not to exceed 33,600 gallons per minute (gpm).

Permit 835A allocates 20,023 acre-ft of water annually from the storage in Lake Ashtabula for use by the City of Grand Forks. This water would be released into the Sheyenne River Basin and flow into the Red River of the North near Fargo, North Dakota.

The City of Grand Forks also has been issued a separate permit by the NDSWC for storage behind the Riverside low-head dam on the Red River of the North in Grand Forks. Permit #4354 sets aside 5250 acre-ft of water for storage, out of which 422 acre-ft will be used annually for evaporation losses. This storage allocation, however, does not authorize additional withdrawals from the Red River.
The City also has one permit issued by the Minnesota DNR. Permit #63-0449 allocates 10,500 acre-ft of water annually from the Red Lake River at a withdrawal rate not to exceed 17,400 gpm.

D. WATER LAW AND RESERVOIR OPERATIONS

D.1 Red River of the North

North Dakota water law is based upon the prior appropriation doctrine, commonly described as, “first in time, first in right”. If there is inadequate water available from a source to satisfy all existing water rights, the user who holds the longest standing water right would have first right to the available water. The City of Grand Forks ranks seventh on the list of appropriated users.

<table>
<thead>
<tr>
<th>SENIORITY</th>
<th>PERMIT 3</th>
<th>USER</th>
<th>APPROPRIATED USAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>454</td>
<td>Larry Brown</td>
<td>26.1 acre-ft</td>
</tr>
<tr>
<td>2</td>
<td>617</td>
<td>Thelma Olson</td>
<td>2 acre-ft</td>
</tr>
<tr>
<td>3</td>
<td>669</td>
<td>City of Drayton</td>
<td>5100 acre-ft</td>
</tr>
<tr>
<td>4</td>
<td>749</td>
<td>City of Fargo</td>
<td>109,500 acre-ft</td>
</tr>
<tr>
<td>5</td>
<td>788</td>
<td>Steve Orr</td>
<td>1 acre-ft</td>
</tr>
<tr>
<td>6</td>
<td>196</td>
<td>Fargo Country Club</td>
<td>65 acre-ft</td>
</tr>
<tr>
<td>7</td>
<td>835</td>
<td>City of Grand Forks</td>
<td>33,600 acre-ft</td>
</tr>
</tbody>
</table>

TABLE 2.5: RED RIVER WATER PERMIT SENIORITY

D.2 Lake Ashtabula (Appendix B)

The City of Grand Forks acquired 20,023 acre-ft of storage behind the Baldhill Dam at Valley City, North Dakota in 1960. To date, this allocation has never been utilized by the City of Grand Forks.

The NDSWC controls water appropriations within the State of North Dakota, while the Corps of Engineers controls the Bald Hill Dam. Should the city desire to use water stored behind Baldhill Dam, a request would have to be submitted to the NDSWC, who in turn would request a release from the Corps of Engineers. Within the jurisdiction of the Lake Agassiz Water Authority (LAWA), an updated operations plan is being discussed (LAWA Board of Directors June 20, 2006, meeting packet).

D.3 Red Lake River

Discharges from the Red Lake are regulated in accordance with a treaty with the Red Lake Band of Chippewa Indians. When the level of the Red Lake is between 1173.5 and 1172 feet, the outflow is regulated not to exceed 50,000 acre-ft annually which equates to 69 cfs. When the lake level is below 1171 feet, the maximum release from the reservoir is 15 cfs and the minimum is 5 cfs as specified in the treaty. With estimated channel losses of 15 cfs between the Red Lake discharge point and the City of East Grand Forks, flows would be expected to decrease
significantly or cease from the point of release to the point of withdrawal at Grand Forks under low-flow conditions.

The main function of the Red Lake Dam is to stabilize flows within the Red Lake River and to meet the municipal needs of East Grand Forks and Grand Forks. The MN DNR has communicated that, under emergency conditions, water could be released into the Red Lake River to meet municipal needs by the order of the Corps of Engineers.

Riparian water rights, or eastern water law, state that the owner of land containing a natural stream or abutting a stream is entitled to receive the full natural flow of the stream without change in quality or quantity. The riparian owner is protected against the diversion of water except for domestic purposes upstream from his property and from the diversion of excess floodwaters toward his property. During drought conditions, under eastern water law, all users along the Red Lake River would be limited to withdrawals deemed essential for domestic use in an effort to ensure an adequate water supply.
III. WATER SHORTAGE DEFINITIONS AND INDICATORS

Drought Definition:

A drought has been defined as a normal, recurring feature of nature that results when precipitation is deficient over an extended period of time and an ensuing water shortage occurs. A drought can have significant impacts on municipal, industrial, recreational, and environmental sectors of a region. It can be short-term or extended and caused by seasonal or multi-year weather conditions. In a drought, the City of Grand Forks would not only face challenges associated with an insufficient quantity of water, but water quality challenges would need to be addressed.

Infrastructure Water Shortage Definition:

An infrastructure water shortage is defined as a supply deficiency due to water supply system structural failure, or insufficient infrastructure to treat and deliver potable water to the end users of the community. The criteria established in Section VI of this document would apply to water shortages caused by system failures.

Drought Indicators:

During a drought emergency, the severity of the event evolves over time and therefore presents the opportunity to develop and implement appropriate measures before the situation worsens. Several indicators are available to monitor and assess the severity of a drought, or drought level. For continuity of monitoring in the Red River watershed, the format used in Fargo’s Drought Management Plan has been adapted to include areas immediately upstream of Grand Forks. As established in the City of Fargo’s Drought Management Plan, the same indicators will be used in Grand Forks to monitor conditions that may impact the quantity and quality of water available to the City. These include the Standardized Precipitation Index (SDI), the Palmer Drought Severity Index (PDSI), Streamflow Conditions, and Reservoir Storage. A description taken from Fargo’s plan has been included in Appendix C.

Infrastructure Water Shortage Indicators:

In the event of infrastructure failure, a water shortage event is much less predictable than under drought conditions. However, optimizing operations, maintenance, and proactive planning can minimize potential problems at the treatment facility. The Grand Forks water treatment staff is diligent and committed to identifying areas of potential infrastructure failure and incorporating corrective measures into emergency planning to minimize impacts to the community. Mitigating these situations is becoming increasingly difficult as portions of the GFWTP are over 50-years old. By reviewing water usage trends over time it is expected that water demands will begin to increase to levels greater than the GFWTP production capacity. When water use in the community begins to surpass predefined production capacity limits, implementation of demand reduction strategies would be required.
IV. DROUGHT LEVELS – MONITORING

One goal of a drought management plan is to establish the criteria for action at each stage of shortage. Criteria must have the least negative impact possible on the end users and the economy, share hardships equitably, and maximize all available benefits from the limited supply. Criteria are used to minimize impacts from drought delaying the need for more restrictive levels of water use. In addition, the plan must be flexible, allowing the water utility to react quickly, implementing appropriate restrictions early, and make allowances for different types of use and the needs of different users.

The format for this plan is based on a variation of a plan format provided by the American Waterworks Association in their Drought Management Handbook. The classification scheme is modeled after the National Weather Service's Watch/Warning Program. Five levels of drought have been identified for the purpose of assessing, communicating, and responding to drought conditions. The drought levels are progressive based on continuation and/or worsening of drought conditions. Likewise, as drought conditions improve, the drought levels retreat progressively as the drought criteria for the level are no longer met.

Following is a description of the drought levels to be used by the City of Grand Forks Drought Management and Demand Reduction Plan. Drought response efforts for each drought level are discussed in more detail in Section V – Drought Reduction Policies. Appendix C provides copies of Drought Management spreadsheets defining triggers for establishing drought phases as defined in this section.

- **Phase 1 – Normal Conditions:** When the water supply for the City of Grand Forks is not in a drought condition. Normal conditions are depicted by adequate water supply and acceptable water quality in the areas upstream in the drainage area. Normal conditions are defined by the following indices:

<table>
<thead>
<tr>
<th>Index</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPI</td>
<td>-0.99 and higher</td>
</tr>
<tr>
<td>PDSI</td>
<td>-1.99 and higher</td>
</tr>
<tr>
<td>Stream Flow</td>
<td>Flow is greater than 65% exceedence monthly flow duration value.</td>
</tr>
<tr>
<td>Reservoir Levels</td>
<td>Normal Operation for Baldhill Dam, Orwell Dam, and Lake Traverse.</td>
</tr>
</tbody>
</table>

- **Phase 2 – Drought Advisory:** This level of response is initiated by an early indication of developing drought conditions and a possible supply shortage. It is characterized by lower than normal precipitation and declining streamflows. Indicators show that possible water shortages may occur if conditions continue. A Drought Advisory Committee (DAC) will be activated when a Drought Advisory is adopted. A definition of the DAC
is included in Appendix D. At the Phase 2 - Drought Advisory level, drought monitoring will increase, and the DAC will be notified of the potential for a more severe condition as defined by a Phase 3 - Drought Watch. Voluntary conservation measures are recommended and general press announcements are developed. The response goal for a Drought Advisory is a 5-10% annual equivalent demand reduction. A Drought Advisory is defined by the following conditions:

<table>
<thead>
<tr>
<th>Index</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPI</td>
<td>-1.0 to -1.49</td>
</tr>
<tr>
<td>PDSI</td>
<td>-2.0 to -2.9</td>
</tr>
<tr>
<td>Stream Flow</td>
<td>Flow is between the 65% and 75% exceedance monthly flow duration values.</td>
</tr>
<tr>
<td>Reservoir Levels</td>
<td>Runoff is insufficient to maintain the conservation pool levels for Baldhill Dam, Orwell Dam, and Lake Traverse.</td>
</tr>
</tbody>
</table>

**Phase 3 – Drought Watch:** This level of response is initiated as drought conditions worsen and there is a continued deterioration in water quantities and water quality. Indicators show that possible water shortages will occur if conditions continue. The DAC will begin meeting on a regular basis and determine when conditions warrant a change to a Drought Watch condition. Under a watch condition, there will be regular communications with the North Dakota State Water Commission (NDSWC), U.S. Army Corps of Engineers (US ACOE) and North Dakota State Climatologist regarding water availability and overall drought conditions. Increased public information and voluntary reduction of water use for commercial and residential users will be encouraged. The response goal is a 10-20% demand reduction in water use. A Drought Watch is defined by the following conditions:

<table>
<thead>
<tr>
<th>Index</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPI</td>
<td>-1.5 to -1.99</td>
</tr>
<tr>
<td>PDSI</td>
<td>-3.0 to -3.9</td>
</tr>
<tr>
<td>Stream Flow</td>
<td>Flow is between the 75% and 90% exceedance monthly flow duration values.</td>
</tr>
<tr>
<td>Reservoir Levels</td>
<td>Conditions indicate Baldhill Dam, Orwell Dam, and Lake Traverse will be drawn down to their maximum drawdown (minimum pool) levels. Runoff projections into the reservoirs are low.</td>
</tr>
</tbody>
</table>
• **Phase 4 – Drought Warning:** This level of response is initiated when conditions indicate a severe situation and the possibility that a Drought Emergency may be necessary. Water supplies are insufficient to meet all demands. Mandatory measures are developed to reduce water use and protect public and vital health, economic, and environmental interests. A Drought Warning is effective upon declaration by the DAC. A press strategy is implemented to keep the media and public informed about the situation. The DAC continues to coordinate response efforts with the NDSWC, US ACOE, and the North Dakota State Climatologist. The response goal for a Drought Warning is a 20-30% demand reduction. A Drought Warning is defined by the following conditions:

<table>
<thead>
<tr>
<th>Index</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPI</td>
<td>-2.0 and below</td>
</tr>
<tr>
<td>PDSI</td>
<td>-4.0 and below</td>
</tr>
<tr>
<td>Stream Flow</td>
<td>Flow is between the 90% and 95% exceedence monthly flow duration values.</td>
</tr>
<tr>
<td>Reservoir Levels</td>
<td>Baldhill Dam, Orwell Dam, and Lake Traverse have been drawn down to their maximum drawdown (minimum pool) levels. Runoff projections remain low.</td>
</tr>
</tbody>
</table>

• **Phase 5 – Drought Emergency:** This level of response is initiated when water supplies are so limited that failure of the supply system is imminent. Severe water supply or water quality problems exist and highest priority water needs are not being met. Water rationing is initiated and industrial and some commercial uses are curtailed. Supplies for essential health and safety related uses are reserved. A Drought Emergency is effective upon declaration by the DAC with input from NDSWC, US ACOE, and the North Dakota State Climatologist. The response goal for a Drought Emergency is a 30% or more demand reduction. A Drought Emergency is defined by the following conditions:

<table>
<thead>
<tr>
<th>Index</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPI</td>
<td>-2.0 and below</td>
</tr>
<tr>
<td>PDSI</td>
<td>-4.0 and below</td>
</tr>
<tr>
<td>Stream Flow</td>
<td>Flow is less than 95% exceedence monthly duration values.</td>
</tr>
<tr>
<td>Reservoir Levels</td>
<td>Baldhill Dam, Orwell Dam, and Lake Traverse have been drawn down to their maximum drawdown (minimum pool) levels. Runoff projections remain low.</td>
</tr>
</tbody>
</table>
V: DEMAND REDUCTION POLICIES -- DROUGHT CONDITIONS

A drought declaration triggers a number of program responses. All on-going demand reduction efforts will receive additional emphasis. The level of drought response will vary depending on the level of the drought. Generally, measures placed in effect at lower response level will remain in effect at more stringent response levels, and additional measures or actions added. Demand reduction goals were discussed briefly in Section IV – Drought Level. This Section contains a more detailed discussion of drought response and contains drought response efforts for each drought phase. This list is not definitive, and other items may be added, as appropriate. Demand reduction policies would also be used in response to infrastructure failures.

- **Phase 1 – Normal Conditions:** This phase is active unless a formal drought declaration or an infrastructure driven need is established. Public education programs will emphasize conservation practices that need to be incorporated into our daily water use. These practices are outlined in Appendix E. The City of Grand Forks will address enforcement of all existing city ordinances that influence water use or misuse.

  **Voluntary Sprinkling Recommendations:**
  1. Recommend sprinkling between hours of 4 am to 11 am twice a week.
  2. Follow recommendations outlined in Appendix E.

- **Phase 2 – Drought Advisory:** The Phase 2 – Drought Advisory triggers activation of the DAC and a more intensive monitoring review of climatic conditions, river flows, and reservoir levels. The water utility will implement a public information program to provide customers with an understanding of the state of the water shortage conditions and the need for voluntary action to be initiated.

  Grand Forks Water Department staff will direct their resources to enforcement of all existing city ordinances that influence water use or misuse. City departments will assist the utility in their efficiency efforts. Other demand reduction measures are as follows:

<table>
<thead>
<tr>
<th>Water Use</th>
<th>Demand Reduction Elements of Drought Advisory Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Essential Uses:</td>
<td>Fire fighting and medical uses – no restrictions.</td>
</tr>
<tr>
<td>Water Department:</td>
<td>Mandatory system conservation.</td>
</tr>
<tr>
<td>Other City Departments:</td>
<td>Mandatory implementation of individual department response efforts for targeted 5-10% reduction in water use.</td>
</tr>
<tr>
<td>Residential:</td>
<td>Voluntary reduction of use by compliance with outdoor watering schedule as designated. Calls and reminders of the policy will be used to remind consumers of the drought advisory condition.</td>
</tr>
</tbody>
</table>
Voluntary residential and commercial sprinkling policy:
1. Odd numbered houses – limit sprinkling to Monday and Thursday between hours of 4 am to 11 am (limited to twice a week).
2. Even numbered houses – limit sprinkling to Tuesday and Friday between hours of 4 am to 11 am (limited to twice a week).

Commercial:
Voluntary reduction of use by compliance with designated outdoor use schedule, plumbing retrofit, employee awareness, and water use planning.

Industrial:
Voluntary reduction of use by compliance with designated outdoor use schedule, plumbing retrofit, employee awareness, and water use planning.

Landscape Watering:
Voluntary reduction of use by compliance with designated outdoor watering schedule.

Golf Courses:
Voluntary compliance with designated golf course irrigation schedule established by the Water Department for golf courses (Lincoln, Ray Richards and Grand Forks Air Force Base (GFAFB) Golf Course). Water Department to notify golf courses and request reduced golf course watering in compliance with the reduced watering schedule and to avoid water waste.

Vegetable Gardens:
Voluntary compliance with designated watering schedule.

Other Outdoor Uses:
Allowing water to run off into a street, alley, right-of-way, gutter or drain, or failure to repair a controllable leak is prohibited. These are perception issues and are defined as “waste.” Hoses should not be used to clean hard surfaced areas except to alleviate health or fire hazards. It is highly recommended that hoses used for washing vehicles of any kind, or any other uses, must have positive shut off valves.

Construction:
Voluntary compliance with designated watering schedule.

- **Phase 3 – Drought Watch:** Upon declaration by the DAC of a Phase 3 – Drought Watch, some drought response elements will become mandatory and will be enforced. If and when the Water Department becomes aware of any water misuse, the Department has the authority to take action, including installation of flow reduction devices, rationing, or other mandatory measures up to and including disconnection of service. The Department also has the authority to take other enforcement actions as necessary to assure compliance with the required water use reduction. Demand reduction measures are as follows:
## Water Use

### Essential Uses:
Same as Phase 2 – Drought Advisory.

### Water Department:
Same as Phase 2 – Drought Advisory. Intensify public education programs. Expansion of leak detection and repair program and mandatory operational demand reduction by department personnel.

### Other City Departments:
Mandatory implementation of individual department response efforts for targeted 10-20% reduction in water use.

### Residential:
Mandatory reduction in water use from compliance with outdoor designated water use schedule for targeted 10-20% reduction in water use.

**Mandatory residential and commercial sprinkling policy:**
1. Odd numbered houses – limit sprinkling to Monday and Thursday between hours of 4 am to 11 am (limited to twice a week).
2. Even numbered houses – limit sprinkling to Tuesday and Friday between hours of 4 am to 11 am (limited to twice a week). Violators will be issued written warnings.

### Commercial:
Mandatory reduction of use by 10-20%. Includes reduction achieved in voluntary outdoor water use restrictions and plumbing retrofits. Restaurants asked to serve water to customers only on request. Display public notice.

### Industrial:
Motivate voluntary reduction of use by 10-20%. Includes reduction achieved in voluntary outdoor water use restrictions.

### Landscape Watering:
Same as Phase 2 – Drought Advisory.

### Golf Courses:
Same as Phase 2 – Drought Advisory.

### Vegetable Gardens:
Same as Phase 2 – Drought Advisory.

### Other Outdoor Uses:
Washing of hard surfaces is prohibited, except washing to alleviate health or fire hazards. Washing personal and commercial vehicles is limited to the assigned watering day with hand-held hose with a positive shut-off valve, bucket, or commercial washers.

### Construction:
Same as Phase 2 – Drought Advisory.
- **Phase 4 – Drought Warning:** The DAC may declare a Phase 4 – Drought Warning when a supply insufficiency has occurred, and Phase 3 water use reduction measures and other water supply augmentation measures will be insufficient to meet water demands in the service area without further restrictions. Upon implementation by the Water Department, mandatory water use reduction programs will be implemented and the appropriate surcharge or surcharges will be recalculated and applied to increase demand reduction and to meet the increased regulation and enforcement expenses (Level 2 Demand Reduction). Demand reduction measures are as follows:

<table>
<thead>
<tr>
<th>Water Use</th>
<th>Elements of Drought Warning Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Essential Uses:</td>
<td>Same as Phase 2 – Drought Advisory.</td>
</tr>
<tr>
<td>Water Department:</td>
<td>Same as Phase 3 – Drought Advisory, plus increased surcharges to meet escalated drought expenses and to motivate increased demand reduction. Surcharges may be uniform or selective in nature, in keeping with the drought ordinance.</td>
</tr>
<tr>
<td>Other City Departments:</td>
<td>Mandatory implementation of individual department response efforts for targeted 20-30% reduction in water use.</td>
</tr>
<tr>
<td>Residential:</td>
<td>Mandatory restriction on outdoor water use in compliance with schedule designated by the Water Department. Increased emphasis on voluntary changes in water use behavior. Warnings and fines will be issued.</td>
</tr>
<tr>
<td></td>
<td><strong>Mandatory Restrictions:</strong></td>
</tr>
<tr>
<td></td>
<td>1. No lawn watering – essential home use only.</td>
</tr>
<tr>
<td></td>
<td>2. No personal car washing or outdoor water use – essential home use only.</td>
</tr>
<tr>
<td>Commercial:</td>
<td>Mandatory restriction of outdoor water use. Mandatory re-evaluation of all water use processes to gain maximum resource efficiency. Continue employee awareness. May ask for voluntary shut down of some operations. Restaurants to withhold water service to tables, except upon request. Display public notice.</td>
</tr>
<tr>
<td>Industrial:</td>
<td>Mandatory restriction of outdoor water use, as in residential and commercial. Mandatory re-evaluation of all water use processes to gain maximum resource efficiency. Continue employee awareness. Ask for voluntary shut down of some operations or a 5% reduction in water use.</td>
</tr>
</tbody>
</table>
Landscape Watering: A mandatory restriction on lawn watering consistent with those limits set for residential water use will be applied. New installation to be discouraged during drought.

Vegetable Gardens: Mandatory compliance with designated outdoor watering schedule.

Other Outdoor Uses: Same as Phase 3 – Drought Watch. Personal and commercial vehicles only to be washed at a commercial facility.

Construction: A water service connection for new construction to be approved only if low flow fixtures and appliances are used for indoor plumbing. Construction water for consolidation of backfill, dust control, or other uses would be reviewed by the Water Department on an individual basis. Fire hydrant use for construction water to be prohibited. Existing permittees shall be subject to random audit and time of day restrictions. Violations of restrictions shall result in loss of permit and possible fines.

- **Phase 5 – Drought Emergency:** The DAC shall initiate a Phase 5 – Drought Emergency when Phase 4 supply and use reduction programs are insufficient to stay within available water demands. In addition to any other remedy available, the Department is authorized to implement surcharges for water use other than those approved by the DAC. Goal is to reduce demand to match available supplies. Phase 5 programs will be terminated when supplies return to Phase 4 levels (Drought Warning). Demand reduction measures are as follows:

<table>
<thead>
<tr>
<th>Water Use</th>
<th>Elements of Drought Emergency Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Essential Uses:</td>
<td>Same as Phase 2 – Drought Advisory. Uses are subject to review and re-evaluation of criticality.</td>
</tr>
<tr>
<td>Water Department:</td>
<td>Implementation of all measures and increased surveillance of compliance with water restrictions.</td>
</tr>
<tr>
<td>Other City Departments:</td>
<td>Mandatory 30 percent decrease in water consumption. Departments subject to water use auditing and potential; loss of connection for violations.</td>
</tr>
<tr>
<td>Residential:</td>
<td>Ban on outdoor water use. Will ask for voluntary shut down of some operations. Will require compliance and enforce shutdown with limited hours of outdoor water use.</td>
</tr>
</tbody>
</table>
Mandatory Restrictions:
1. No lawn watering – essential home use only.
2. No personal car washing or outdoor water use – essential home use only.

Commercial: Ban on outdoor water use. May ask for voluntary shut down of some operations and require limited hours of use.

Industrial: Ban on outdoor water use, as in residential and commercial. Mandatory re-evaluation of all water use processes and/or exemptions to gain maximum resource efficiency. Continue employee awareness. May ask for voluntary shut down of some operations. May require and enforce shutdowns or limit hours of use. Goal of 5-10% reduction by major industrial users.

Landscape Watering: A mandatory restriction on lawn watering consistent with those limits set for residential water use will be applied. No golf course watering will be allowed using treated water. Enforcement fines will be issued. New landscape installation to be banned.

Vegetable Gardens: Mandatory compliance with designated outdoor watering schedule.

Other Outdoor Uses: Same as Phase 3 – Drought Watch. Personal and commercial vehicles would only be washed at a commercial facility. All water waste would be avoided.

Construction: A water service connection for new construction will not be approved. Fire hydrant use for construction water will be prohibited.
VI. DEMAND REDUCTION POLICIES - INSUFFICIENT OR FAILING INFRASTRUCTURE

15% DEMAND REDUCTION

Activation Triggers for Insufficient Infrastructure:

Activated when:
- Plant production is operating at 11,460 GPM = 16.5 MGD, 100% design capacity, and operations staff are unable to fill overhead storage to 50-60% or greater. Peak high service demand exceeds plant production by 1500 GPM, or 13,000 GPM (peak usually occurs at 5-10 PM).

Activation Triggers for Infrastructure Failure:

Activated when:
- Infrastructure failure warrants a 15% reduction in water demand due to failure of one softening basin, 1-2 filters, or a condition calling for reduction in pretreatment flows. Plant production is limited to 9,720 GPM = 14.0 MGD = 85% design capacity and unable to fill overhead storage to 50-60% or greater. Peak high service demand exceeds plant production by 2000 GPM, or 11,720 GPM (peak usually occurs at 5-10 PM).

City Departments: Elements of Demand Reduction

No restrictions on essential uses (Fire and Medical) other City Departments are notified and asked to minimize water use for non-essential functions.

Residential, Commercial, and Golf Courses: Elements of Demand Reduction (Summer):

Voluntary Sprinkling Restrictions: Warnings issued
1. Odd numbered houses – limit sprinkling to Monday and Thursday between hours of 4 am to 11 am (limited to twice a week).
2. Even numbered houses – limit sprinkling to Tuesday and Friday between hours of 4 am to 11 am (limited to twice a week).
3. Golf courses asked to follow same sprinkling schedule as residential users.

Residential and Commercial: Elements of Demand Reduction (Winter):

Residential and commercial users notified of the need to curtail water use form 5 - 10 PM during peak demand.
Industrial, Institutional, and Consecutive Users: Elements of Demand Reduction:

During summer months industrial users will be asked to follow outside water use restrictions and may be asked to curtail water use by decreasing production based on the nature of the request and time required to address infrastructure insufficiencies or failure.

33% DEMAND REDUCTION

Activation Triggers for Insufficient Infrastructure:

Activated when:
Plant production is sustained and 15% reduction fails to relieve the strain on plant production. WTP is operating at 11,460 GPM = 16.5 MGD, 100% design capacity and operations staff are unable to fill overhead storage to 40-50% or greater. Peak high service demand exceeds plant production by 2000 GPM, or 12,460 GPM (peak usually occurs at 5-10 PM).

Activation Triggers for Infrastructure Failure:

Activated when:
Infrastructure failure warrants a 33% reduction in water demand due to failure of two softening basins, 2-4 filters, or a one-third of pretreatment flows. Plant production is limited to 9,720 GPM = 14.0 MGD = 85% design capacity and unable to fill overhead storage to 50-60% or greater. Peak high service demand exceeds plant production by 2000 GPM, or 11,720 GPM (peak usually occurs at 5-10 PM).

City Departments: Elements of Demand Reduction

No restrictions on essential uses (Fire and Medical) other City Departments are notified and asked to minimize water use for non-essential functions

Residential, Commercial, and Golf Courses: Elements of Demand Reduction:

Eliminate all outdoor water use. Residential users notified of the need to curtail water use from 5 – 10 PM during peak demand.

Industrial, Institutional, and Consecutive Users: Elements of Water Demand Reduction:

Notification to major water users (UND, Altru, Simplot, GFAFB) of the condition and request a 10- 20% reduction in water demand. Request may vary with the ability to return failed components to service. During summer months, industrial, institutional and consecutive users will be asked to eliminate all outdoor water use. Utility will work with individual industrial users to curtail water use by decreasing production and or closing portions of the facility. Institutional users will be asked to conserve when conservation does not have a direct affect on health and well being of residents (hospital, eldercare).
Emergency response measures:

Activation of GF-EGF Water Transfer Station: As outlined in station procedure manual. Contact vendors of package plants and or the ND National Guard for supplemental water treatment equipment and mobilize to Grand Forks.

INFRASTRUCTURE EMERGENCY: Activated when a major portion of the infrastructure is damaged and or fails.

Mandatory Restrictions: Warnings/Fines will be issued.

Residential, Commercial, and Golf Courses: Elements of Demand Reduction:

Eliminate all outdoor water use. Residential and commercial users notified of the need to curtail water use from 5 – 10 PM during peak demand.

Industrial, Institutional, and Consecutive User Water Demand
Notification to major water users (UND, Altru, Simplot, GFAFB) of the condition and request a 50% reduction in water demand. Request may vary with the ability to return failed components to service. During summer months, industrial, institutional and consecutive users will be asked to follow outside water use restrictions. Utility will work with individual industrial users to curtail water use by decreasing production and or closing portions of the facility. Institutional users will be asked to conserve when conservation does not have a direct affect on health and well being of residents (hospital, elder care).

Emergency response measures:

Activation of GF-EGF Water Transfer Station: As outlined in station procedure manual. Contact vendors of package plants and or the ND National Guard for supplemental water treatment equipment and mobilize to Grand Forks.
VII. PLAN IMPLEMENTATION PROCEDURES

A. Procedure and Chain of Command

Procedure:

1. Water Utility Superintendent monitors drought parameters and notifies Director of Public Works, Director of Public Works notifies City Administrator who notifies the Mayor. (If a person in the chain of command is unavailable, contact the person next up the chain). DAC is advised of drought status. For infrastructure driven implementation, the plant operator initiates implementation procedures.

2. When approval received through chain of command, Plant Superintendent (or in his/her absence the operator in charge of shift) will telephone the info center to contact radio and television stations and the GF Herald to notify them of activation the Drought Watch and each subsequent phases and demand reduction status.

3. Mayor’s office will issue Press Release to all media on their contact list.
CITY PUBLIC WORKS - CHAIN OF COMMAND

Mayor

City Administrator

Director of Public Works

City Engineer

Electricians Support

Public Health

Street Superintendent

Sanitation Superintendent

Water Utility Superintendent

Wastewater Superintendent

Wastewater Treatment Superintendent

Supervisor Water Distribution

Service Workers

Supervisor Water Treatment

Operations Staff

Lab Support
### B. Contact Information

**GRAND FORKS:**

<table>
<thead>
<tr>
<th>Title</th>
<th>Name</th>
<th>Phone: Work</th>
<th>Home</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public Safety Answering Point</td>
<td>Operator</td>
<td>9-911</td>
<td></td>
</tr>
<tr>
<td>Mayor</td>
<td>Michael Brown</td>
<td>746-2607</td>
<td>775-0930</td>
</tr>
<tr>
<td>City Administrator</td>
<td>Richard Duquette</td>
<td>787-3750</td>
<td>775-9351</td>
</tr>
<tr>
<td>Emergency Management</td>
<td>Jim Campbell</td>
<td>780-8213</td>
<td></td>
</tr>
<tr>
<td>Director of Public Works</td>
<td>Todd Feland</td>
<td>738-8747</td>
<td>772-1139</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cell 701-740-0739</td>
<td></td>
</tr>
<tr>
<td>Water Utility Superintendent</td>
<td>Hazel Sletten</td>
<td>746-2595</td>
<td>701-343-2013</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cell 218-779-9965</td>
<td></td>
</tr>
<tr>
<td>Public Health Dept.</td>
<td>Don Shields</td>
<td>787-8100</td>
<td>775-5310</td>
</tr>
<tr>
<td></td>
<td></td>
<td>cell 701-740-5234</td>
<td></td>
</tr>
</tbody>
</table>

Mayor's Office/Info Center → Notification of Media

**CONTACTS: EAST GRAND FORKS**

<table>
<thead>
<tr>
<th>Title</th>
<th>Name</th>
<th>Phone: Work</th>
<th>Home</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mayor</td>
<td>Lynn Stauss</td>
<td>773-2987</td>
<td>773-2775</td>
</tr>
<tr>
<td>Civil Defense Dir./Fire Chief</td>
<td>Randy Gust</td>
<td>773-2403</td>
<td>773-7261</td>
</tr>
<tr>
<td>Supt. Water Treatment</td>
<td>Gary Hultberg</td>
<td>773-1511</td>
<td>773-0047</td>
</tr>
<tr>
<td></td>
<td></td>
<td>cell 701-739-3168</td>
<td></td>
</tr>
<tr>
<td>Supt. Water Distribution</td>
<td>Scott Gravseth</td>
<td>773-0515</td>
<td>773-4261</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cell-701-739-2308</td>
<td></td>
</tr>
<tr>
<td>General Mgr./Water &amp; Light Department</td>
<td>Dan Boyce</td>
<td>773-1163</td>
<td>773-2762</td>
</tr>
<tr>
<td></td>
<td></td>
<td>cell 701-739-3167</td>
<td></td>
</tr>
</tbody>
</table>

**CONTACTS: REGULATORY**

North Dakota Department of Health – Larry Thelen  701-328-5210

Minnesota Department of Health - Todd Johnson 218-308-2110

Cell # 1-218-766-7520

**VERIFIED 01-05-10**
C. Enforcement Policy for Drought/Demand Reduction Plan

Watering Restrictions

Time-of-Day Watering Ordinance
Annually, April 1 – September 30
No sprinkler usage from 11 am to 6 pm

Watering during our hot, windy spring and summer days can cause over half of your water to miss its mark due to evaporation and wind drift! Research shows that the best time to water is in the early morning between midnight and sunrise, when humidity is high but temperatures and wind speed are low. If morning watering isn’t practical for you, try watering in the evening. If you were watering during the daytime before, you’ll find you are now able to water less while keeping your plants healthy and attractive.

Time-of-day provisions do not apply to the following circumstances:

1. Using drip irrigation, bubblers, hand watering, or other systems that do not propel water through the air;
2. Outdoor irrigation necessary for the establishment of newly sodded lawns and landscaping within the first 30 days of planting or watering of newly seeded turf within the first year of planting (subject to verification);
3. Irrigation necessary for one day only where treatment with an application of chemicals requires immediate watering to preserve an existing landscape or to establish a new landscape (subject to verification);
4. Water used to control dust or compact soil;
5. Visually-supervised operation of watering systems for short periods of time to check system condition and effectiveness.

Enforcement of Watering Restrictions

1. Call from the public or water utility service worker.
2. Water waste is observed and documented by water distribution staff.
3. A call is placed to water billing contact for a specific address (verbal warning).
4. Failure to comply following verbal warning: a notice-of-violation will be mailed to the water billing address. This is a second warning. Failure to comply after the second warning will result in a fee of $20.00 per drought response billing process.
5. A customer may contact the water distribution department to ask questions or arrange to view the documentation.
6. A customer who has received a notice-of-violation may contest the fee assessment by filing a written request for a hearing with the Mayor.
7. The Mayor must receive the request within seven days of the notice-of-violation (see “How do I contest the fee assessment?”).
8. If the fee assessment is not contested or if the fee assessment is upheld by the Hearing Officer, the fee is billed based on the drought response billing process. Water waste fees must be paid like any other charges on the water bill.

**Enforcement Fee Schedule.**

1\textsuperscript{st} violation - Verbal Warning – follow-up monitoring (2-week period)

2\textsuperscript{nd} violation - 2\textsuperscript{nd} Warning (written) – follow-up monitoring (2-week period)

3\textsuperscript{rd} violation - $50.00 - bill issued 6 weeks after date of first violation

4\textsuperscript{th} violation - $100.00 – bill issued 8 weeks after first violation (Certified Notification)

5\textsuperscript{th} violation - Water Shut Off - at 10 weeks of no response
REFERENCES


Appendix C: Drought Indicators

- **Standardized Precipitation Index (SPI):** Precipitation records are one of the most useful and readily available data for monitoring drought conditions on a meteorological basis. Such records are available on national, state, and regional levels, and long-term historical patterns of rainfall can be determined.

The two most significant characteristics of precipitation in relation to drought are the magnitude and duration of deficits. Precipitation deficits are the difference between actual precipitation and the long-term average precipitation for the specified period. Precipitation data and statistics are available from the National Weather Service and State Climatologist.

The Standardized Precipitation Index (SPI) was developed with the understanding that a deficit of precipitation has different impacts on the water resources in an area and was designed to quantify the precipitation deficit for multiple time scales. The SPI calculation for any location is based on the long-term precipitation record for a desired period. This long-term record is fitted to a probability distribution, which is then transformed into a normal distribution so that the mean SPI for the location and desired period is zero. Positive SPI values indicate a greater than median precipitation, and negative values indicate less than median precipitation. The SPI quantifies the precipitation deficit for multiple time scales. These time scales reflect the impact of drought on the availability of the different water resources. The SPI is available for the 1-, 3-, 6-, and 12-month time periods electronically on-line (Reference). Table 1 summarized drought severity based on the SPI.

<table>
<thead>
<tr>
<th>SPI Value</th>
<th>Drought Severity</th>
</tr>
</thead>
<tbody>
<tr>
<td>+2.0 or more</td>
<td>Extremely Wet</td>
</tr>
<tr>
<td>+1.5 to +1.99</td>
<td>Very Wet</td>
</tr>
<tr>
<td>+1.0 to +1.49</td>
<td>Moderately Wet</td>
</tr>
<tr>
<td>-0.99 to +0.99</td>
<td>Near Normal</td>
</tr>
<tr>
<td>-1.0 to –1.49</td>
<td>Moderately Dry</td>
</tr>
<tr>
<td>-1.5 to –1.99</td>
<td>Severely Dry</td>
</tr>
<tr>
<td>-2 and below</td>
<td>Extremely Dry</td>
</tr>
</tbody>
</table>

- **Palmer Drought Severity Index (PDSI):** The PDSI is a widely used scale for measuring drought conditions. The PDSI provides a standardized means of depicting drought throughout the continental United States. It measures the departure of water supply (in terms of precipitation and stored soil moisture) from demand (the amount of water required to recharge solid and keep rivers, lakes and reservoirs at normal levels). The PDSI calculations are made for 350 climatic divisions in the United States and disseminated by the US National Weather Service on a weekly basis. This data is available electronically on-line.
Normal weather has an index value of zero in all seasons in any climatic region. Droughts have negative index values, while wet periods have positive values. Consecutive negative values can provide initial warning of a developing drought. During drought, the magnitude of negative values indicates drought severity. Table 2 summarizes the drought severity based on the PDSI.

<table>
<thead>
<tr>
<th>PDSI Range</th>
<th>Drought Severity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Above +4.0</td>
<td>Extreme Moist Spell</td>
</tr>
<tr>
<td>+3.0 to +3.9</td>
<td>Very Moist Spell</td>
</tr>
<tr>
<td>+2.0 to +2.9</td>
<td>Unusual Moist Spell</td>
</tr>
<tr>
<td>+0.5 to +0.9</td>
<td>Incipient Moist Spell</td>
</tr>
<tr>
<td>1.0 to +1.9</td>
<td>Moist Spell</td>
</tr>
<tr>
<td>+0.4 to –0.3</td>
<td>Near Normal</td>
</tr>
<tr>
<td>-0.4 to –0.9</td>
<td>Incipient Drought</td>
</tr>
<tr>
<td>-1.0 to –1.9</td>
<td>Mild Drought</td>
</tr>
<tr>
<td>-2.0 to –2.9</td>
<td>Moderate Drought</td>
</tr>
<tr>
<td>-3.0 to –3.9</td>
<td>Severe Drought</td>
</tr>
<tr>
<td>Below –4.0</td>
<td>Extreme Drought</td>
</tr>
</tbody>
</table>

North Dakota is divided into 9 climatic divisions. PDSI values are calculated for each division based on the average precipitation and temperature. The Red River of the North is contained within divisions 3, 6, and 9. The Bois de Sioux River is contained within division 9. Baldhill Dam and Lake Ashtabula are contained in division 6.

Minnesota is also divided into 9 climatic divisions. The Otter Tail River and Orwell Reservoir are contained within division 4. The Red River of the North is contained within divisions 1 and 4. The Red Lake River and reservoir are contained in division 4.

South Dakota is divided into 9 climatic divisions. The Bois de Sioux River and Lake Traverse are contained within division 3.

- **Streamflow Conditions:** Streamflow gauging station data may be analyzed statistically in a number of different ways for possible indication of drought conditions. Monthly flow duration data is one of the most useful. It shows the percent of time given flows are equaled or exceed on a monthly basis during the period of record.

The monthly flow duration table is a magnitude and frequency analysis of daily discharge values. It is computed by tabulating the number of daily discharge values that fall within preselected class limits, computing the percentage of values within each class, and interpolating discharge values for the percentages shown in the table. Drought status is determined from stream flows based on exceedances, which are similar to percentiles. A 75 percent exceedance flow value means that the current monthly flow is exceeded in the stream 75 percent of the time, or the monthly average flow in the stream is less than that value only 25 percent of the time. By using monthly flow-duration data, seasonal
variability is considered and various ranges can be established equivalent to drought stages.

The U.S. Geological Survey (USGS) maintains a network of stream gauges across the Red River Valley. Current discharge data for these stream gauges is available electronically on-line. The discharge data, along with monthly flow duration tables for the stream gauges can be used to monitor drought conditions and help determine the drought stage. The following stream gauges should be monitored for drought purposes:

1. Sheyenne River below Bald Hill Dam, ND – USGS Gauge Number 05058000
2. Sheyenne River near Kindred, ND – USGS Gauge Number 05058000
3. Otter Tail River below Orwell Dam near Fergus Falls, MN – USGS Gauge Number 05046000
4. Bois De Sioux River near White Rock, SD – USGS Gauge Number 05050000
5. Red River of the North at Fargo, ND – USGS Gauge Number 05054000

Additional Sites Specific to the Grand Forks Water Utility Drought Management and Conservation Plan
6. Red River at Halstad – USGS Gauge Number 05064500
7. Red River at Grand Forks – USGS Gauge Number 05082500
8. Red Lake River at Crookston – USGS Gauge Number 05079000

It should be noted the flows at a majority of these stream gauges are impacted by the operation of Baldhill Dam, Orwell Dam, and the Lake Traverse Project. Therefore, stream flow conditions should be used in conjunction with the other parameters outlined in this plan to monitor drought conditions.

- **Reservoir Storage:** Reservoir or lake storage is a common indicator of drought conditions and potential water shortages. The water supply for Fargo and Grand Forks is influenced by three reservoirs operated by the U.S. Army Corps of Engineers (Corps of Engineers). They include Baldhill Dam and Lake Ashtabula on the Sheyenne River, Orwell Dam and Reservoir on the Ottertail River, and the Lake Traverse Project on the Bois De Sioux River. These reservoirs were discussed in detail earlier in the Upstream Reservoir Discussion under Section II – Water Supply and Use. Water levels for these reservoirs are available electronically on-line.
Appendix D: Drought Advisory Committee

The Water Utility Superintendent will be tasked to monitor drought indicators monthly. When indicators begin indicating a potential drought concern the Water Utility Superintendent will notify the Director of Public Works and initiate the DAC. DAC members shall include representatives from the following departments or groups:

- Mayor, City Administrator, and/or their designee
- City Council Member, Public Services Committee Chair
- Information Center
- Fire Department designee
- Public Health designee
- Engineering and Inspections
- Public Works
  - Wastewater/Stormwater Collections Superintendent
  - Wastewater Treatment Superintendent
  - Water Utility Superintendent
  - Street Department Superintendent
- Industrial Users (Simplot)
- Commercial Users representative
- Altru
- UND

Committee will be chaired by the Public Works Director. Designees will be named as part of the plan’s annual update.
Appendix E: Public Education

Outdoor Use

1. Check your sprinkler system frequently and adjust sprinklers so only your lawn is watered and not the house, sidewalk, or street.
2. Avoid planting turf in areas that are hard to water such as steep inclines and isolated strips along sidewalks and driveways.
3. Install covers on pools and spas and check for leaks around your pumps.
4. Check your water meter and bill to track your water usage.
5. Minimize evaporation by watering during the early morning hours, when temperatures are cooler and winds are lighter.
6. Use a layer of organic mulch around plants to reduce evaporation and save hundreds of gallons of water a year.
7. Use a broom instead of a hose to clean your driveway or sidewalk.
8. Divide your watering cycle into shorter periods to reduce runoff and allow for better absorption every time you water.
9. Check indoor and outdoor faucets, pipes, and hoses for leaks and repair promptly.
10. Periodically check your pool for leaks if you have an automatic refilling device.
11. Only water your lawn when needed. You can tell this by simply walking across your lawn. If you leave footprints, it’s time to water.
12. Direct downspouts and other runoff towards shrubs and trees, or collect and use for your garden.
13. Install a rain shut-off device on your automatic sprinklers to eliminate unnecessary watering.
14. Choose a water-efficient drip irrigation system for trees, shrubs, and flowers.
15. Use a screwdriver as a soil probe to test soil moisture. If it goes in easily, don’t water.
16. Wash your car on the grass.

Saving Water Indoors

1. Verify that your home is leak free. Many homes have hidden water leaks. Read your water meter before and after a two-hour period when no water is being used. If the meter does not read exactly the same, there is a leak.
2. Repair dripping faucets by replacing washers. If your faucet is dripping at a rate of one drop per second, you can expect to waste gallons per year. This adds to the cost of water and sewer utilities and adds to your utility bill.
3. Check for toilet tank leaks by adding food coloring to the tank. If the toilet is leaking, color will appear in the toilet bowl within minutes. Check the toilet for worn out, corroded, or bent parts. Most replacement parts are inexpensive, readily available and easily installed. (Flush as soon as test is done, since food coloring may stain tank.)
4. If the toilet handle frequently sticks in the flush position letting water run constantly, replace or adjust it.
5. Install a toilet dam or displacement device such as a bag or bottle to cut down on the amount of water needed for each flush. Be sure installation does not interfere with the
operating parts. When purchasing new replacement toilets, consider low-volume units with less than half the water use of older models. In many areas, low-volume units are required by local building codes.

6. When rinsing vegetables in the sink save the water and use this to water plants.
7. Store drinking water in the refrigerator. Don’t let the tap run while you are waiting for cool water to flow.
Appendix F: User Agreements

Sample letters requesting industrial water demand reduction for drought conditions and failed or insufficient infrastructure.

TO: Selected Water Users to be Determined by DAC

From: Grand Forks Water Utility

Re: Request curtailment in water use at your facility due to shortages in water supply.

The Water Utility is experiencing water shortages in our water supply (Red and Red Lake Rivers) due to drought conditions. The City has defined five levels of drought in the Drought Monitoring and Demand Reduction Plan adopted by city council in January 2007. I have attached sections IV and V of the Plan. Each level has a potential industrial component, beginning with internal audits of water use and ending with a significant reduction in water use during drought emergency conditions. In all cases, we would like to invite a representative of your facility to participate on the Drought Advisory Committee. This committee will be tasked with analyzing conditions and making decisions regarding adoption of each level of the drought and demand reductions measures to be implemented.

Please call me at 701 746-2595 with any questions. Thank you for your cooperation.

A. Pertaining to Infrastructure Failure

TO: Selected Water Users

From: Grand Forks Water Utility

Re: Request curtailment in water use at your facility due to failure of a portion of the Water System infrastructure.

The Water Utility is experiencing water shortages due to failure of existing infrastructure to meet water demands. (Add description of the condition)

As part of the Drought Monitoring and Demand Reduction Plan adopted by City Council in January 2007, the Water Utility outlined demand reduction strategies to address failed or insufficient infrastructure. A copy of these strategies, as outlined in Section VI of the Plan, are attached to this correspondence. The Water Utility plans to work closely with your production team to define potential water savings at your facility while corrective actions are taking place.

Thank you for your cooperation.
NEWS RELEASE

Water Demand Reduction Drought Advisory

CONTACT: City of Grand Forks Water Treatment Plant, 746-2595

FOR IMMEDIATE RELEASE

Grand Forks, ND – The City of Grand Forks has declared a Drought Advisory to be in effect as of _______________. The Advisory level involves voluntary sprinkling restrictions.

Residential: Voluntary Sprinkling Restrictions:

1. Odd numbered houses – limit sprinkling to Monday and Thursday between hours of 4 am to 11 am (limited to twice a week).
2. Even numbered houses – limit sprinkling to Tuesday and Friday between hours of 4 am to 11 am (limited to twice a week).
3. Notify golf courses and request reduced golf course watering (Lincoln and GFAFB).

Commercial: Voluntary reduction of use by compliance with designated outdoor use schedule, plumbing retrofit, employee awareness, and water use planning.

Industrial: Voluntary reduction of use by compliance with designated outdoor use schedule, plumbing retrofit, employee awareness, and water use planning.

Activated When a Drought Advisory is in effect
NEWS RELEASE

Water Demand Reduction Drought Watch

CONTACT: City of Grand Forks Water Treatment Plant, 746-2595

FOR IMMEDIATE RELEASE

Grand Forks, ND – The City of Grand Forks has declared a Drought Watch to be in effect as of _____________. The Watch level involves mandatory sprinkling restrictions.

Residential: Voluntary Sprinkling Restrictions: Mandatory

1. Odd numbered houses – limit sprinkling to Monday and Thursday between hours of 4 am to 11 am (limited to twice a week).
2. Even numbered houses – limit sprinkling to Tuesday and Friday between hours of 4 am to 11 am (limited to twice a week).
3. Notify golf courses and request reduced golf course watering (Lincoln and GFAFB).

Commercial: Mandatory reduction of use by 10-20%. Includes reduction achieved in voluntary outdoor water use restrictions and plumbing retrofits. Restaurants asked to serve water to customers only on request. Display public notice.

Industrial: Motivate voluntary reduction of use by 10-20%. Includes reduction achieved in voluntary outdoor water use restrictions.

Activated When a Drought Watch is in effect
NEWS RELEASE

Water Demand Reduction Drought Warning Issued

CONTACT: City of Grand Forks Water Treatment Plant, 746-2595

Grand Forks, ND – The City of Grand Forks has declared a Drought Warning to be in effect as of _______________. The Warning level involves mandatory sprinkling restrictions.

FOR IMMEDIATE RELEASE

Residential: Mandatory restriction on outdoor water use in compliance with schedule designated by the Water Department. Increased emphasis on voluntary changes in water use behavior. Warnings and fines will be issued.

Mandatory Restrictions:
1. No lawn watering – essential home use only.
2. No personal car washing or outdoor water use – essential home use only.

Commercial: Mandatory restriction of outdoor water use. Mandatory re-evaluation of all water use processes to gain maximum resource efficiency. Continue employee awareness. May ask for voluntary shut down of some operations. Restaurants to withhold water service to tables, except upon request. Display public notice.

Industrial: Mandatory restriction of outdoor water use, as in residential and commercial. Mandatory re-evaluation of all water use processes to gain maximum resource efficiency. Continue employee awareness. Ask for voluntary shut down of some operations or a 5% reduction in water use.

Activated When: Phase 4 - Drought Warning and/or Infrastructure Failure
NEWS RELEASE

Water Demand Reduction Drought Emergency Issued

CONTACT: City of Grand Forks Water Treatment Plant, 746-2595

FOR IMMEDIATE RELEASE

Grand Forks, ND – The City of Grand Forks has issued a Drought Emergency as of _______________. The Emergency involves mandatory water use restrictions.

Residential: Ban on outdoor water use. Will ask for voluntary shut down of some operations. Will require compliance and enforce shutdown with limited hours of outdoor water use.

Mandatory Restrictions:
1. No lawn watering – essential home use only.
2. No personal car washing or outdoor water use – essential home use only.

Commercial: Ban on outdoor water use. May ask for voluntary shut down of some operations and require limited hours of use.

Industrial: Ban on outdoor water use, as in residential and commercial. Mandatory re-evaluation of all water use processes and/or exemptions to gain maximum resource efficiency. Continue employee awareness. May ask for voluntary shut down of some operations. May require and enforce shutdowns or limit hours of use. Goal of 5–10% reduction by major industrial users.

Activated When: Phase 5 – Drought Emergency