



PEMBINA VALLEY
WATER COOPERATIVE INC.

PVWC

Drought Plan

DECEMBER 2018



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Landmark
Planning & Design Inc.



PVWC Drought Plan

Prepared by Landmark Planning and Design on behalf of the Pembina Valley Water Co-Op

With collaboration from the PVWC Drought Plan Working Group

Approved by the Pembina Valley Water Co-Op Board on December 7, 2018

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1 Drought Plan Overview

1.1 Introduction

Drought is a tangible concern for southern Manitoba including the Pembina Valley Water Co-Op (PVWC) and its membership. Historic records indicate cyclical instances of drought in southern Manitoba and upstream in the Red River Valley, which is the PVWC's primary source of water. Furthermore, scientific analysis suggests the effects of climate change in the region may result in more frequent and protracted drought events. This Drought Plan will help the PVWC plan for, mitigate the impacts of, and respond to drought events. It is intended that the customers of the PVWC, whether municipalities or independents, will prepare and adopt corresponding plans to follow during drought events

Drought is a unique natural disaster in that it can may have a slow onset and last for several seasons. These traits contrast with other emergency "events" such as flooding, which is a common occurrence experienced by most of the PVWC's Customers. Furthermore, the PVWC represents a unique "jurisdiction" for drought mitigation and response planning. The PVWC has 14 Member Municipalities and 4 other non-member customers purchasing PVWC water (hereby collectively referred to in the Plan as "Customers"). Furthermore, some Customers rely solely on PVWC-provided water whilst others have additional sources, comprising varying proportions of their total water supply. The *PVWC Drought Plan* attempts to account for the unique composition of the PVWC by providing a framework for the PVWC organization to follow in order to prepare for, mitigate, respond and recover when droughts occur. While the PVWC's Customers will ultimately prepare local drought plans that correspond to the unique needs of each locality, **Appendix D** of this Plan contains helpful information which could inform the local drought plans.

1.2 Background

The PVWC serves over 59,000 customers within 14 municipalities over an area of southern Manitoba covering over 9,000 square kilometres. The Co-Op draws water from the Red River and Stephenfield Reservoir (Boyne River) and distributes raw water to three treatment plants. The Red River generally represents a plentiful source of water for the PVWC, however, like most natural resources the supply is finite and susceptible to natural events. Historically the flow of the Red River has been significantly reduced during drought events. Furthermore, no international agreements are in place requiring upstream jurisdictions in the United States to provide flow north into Manitoba. Both the Red River and the Stephenfield Reservoir have been identified as being vulnerable to drought.

A period of substantial drought occurred in the 1980's and the drought-of-record in the 1930's caused the Red River to dry up, almost completely. While droughts are cyclical in southern Manitoba, research indicates the climate uncertainty resulting from a warming climate may result in more severe and sustained droughts. One of the key factors leading to the formation of the PVWC was risk of drought in the Pembina Valley. The PVWC has identified drought as a concern which may pose a threat to the Co-Op and its members, and as a result has begun to pursue infrastructure improvements and explore secondary water sources as a means of building resilience within its system.

1.3 Purpose

The ultimate objective of this Plan is to provide the PVWC with direction prior to and during drought conditions and to provide longer-term guidance to mitigate the impacts of a drought. In other words, the Plan addresses drought events both in proactive and reactive approaches offering direction for all aspects of drought planning. The five key components of this plan are as follows:

- **Drought Monitoring** involves utilizing primary and secondary data regarding water supply levels at PVWC facilities as well as upstream water sources.
- **Drought Mitigation** involves proactive action and planning to reduce the long-term risks and potential impacts of drought events by identifying principle activities and possible susceptibilities and developing mitigation actions and programs to reduce these vulnerabilities to drought.
- **Drought Preparedness** refers to the directed policies, plans and actions which must be implemented prior to a drought event occurring in order to increase forecasting accuracy, ensure the Plan is fully implementable and that the PVWC is fully prepared to respond during a drought event.
- **Drought Response** encompasses the actions taken during a drought event to reduce its immediate impacts on environment or society through enactive temporary adjustments to normal practices until normal climatic conditions return. Drought response also includes the communication process used to convey information internally and externally.
- **Drought Recovery** is the process of returning operations to a normal state when a drought event has dissipated in order to restore or improve pre-drought conditions and working to further mitigate the impacts of any future drought events.

1.4 Scope

The scope of this Plan applies to the PVWC as a water utility. The Plan is intended to set the framework for the following:

- Monitoring, triggering and declaration of drought events;
- Preparedness, mitigation and response to drought events; and
- Recovery from drought events.

The plan contains roles and responsibility of Provincial departments which were based on consultation with the relevant departments. The Plan is intended to adhere to and compliment all relevant Provincial Acts and Policies (See Figure 1).

The PVWC as an organization has no authority over the use of water purchased by Customers. Furthermore, each Customer has unique traits in terms of access to additional water sources (groundwater, surface water), rural and urban composition and shares of water used for industry, agriculture or other non-domestic users. The Plan therefore outlines the PVWC's responsibilities in order to provide clarity for their Customers. Each Customer (especially municipal members) is intended to

prepare and adopt a local drought plan specific to their needs which addresses the PVWC's Drought Responses detailed in Section 3.5. **Appendix D** of this Plan includes reference materials for the preparation of a local drought plan.

While the individual plans will govern the PVWC and its Customers, collaboration and cooperation are intended to be paramount in drought planning efforts. Representatives from Customers will participate on the PVWC Drought Committee (Section 3.4.2.1) which will work closely with the PVWC on joint Mitigation (Section 3.3) and Preparedness (Section 3.4.2) items.

The PVWC Plan and corresponding Customer plans are intended to compliment and accompany the municipal emergency plans which are adopted by all municipalities in Manitoba and this Plan contains several recommended updates to the emergency plans that should be considered for adoption. This Plan, however, does not govern the Province or Customers, and the stated roles and responsibilities for departments contained within this Plan could change.

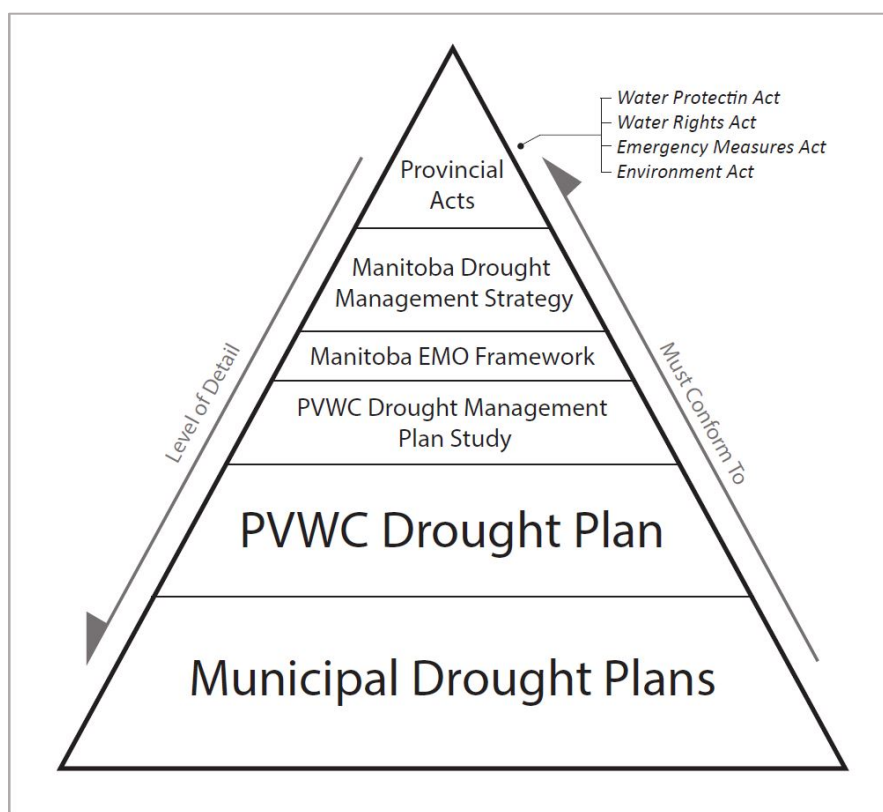


Figure 1: Hierarchy of Drought-Related Policies/Guidelines

1.5 Living Document

This Plan is intended to be a living document, meaning it will be reviewed every 4 years. Additionally, after each drought event the Plan will be reviewed by the PVWC Drought Committee and the PVWC Board for effectiveness and performance. The review should include, at a minimum, the following elements:

- What lessons were learned during the drought event?
 - Were reduction targets achievable?

- Were reduction measures appropriate?
- Was the Plan effective?
- Were any components missing?
 - E.g. Major water users that were not considered.
- What elements were successful?
- What improvements can be made?

Based on the post-drought review any required updates or improvements will be made to the Plan and communicated with the PVWC Customers.

1.6 Plan Structure

This Plan is structured in a manner that provides the background to the planning process and general drought planning elements in Section 1 and Section 2. Section 3 serves as the action and response plan for consultation in preparation for and during declared drought events. The *PVWC Drought Management Plan Study* (2018), prepared by Associated Engineering, is a crucial companion piece to this Plan.

1.7 PVWC Membership and Structure

The PVWC is comprised of 14 Member Municipalities and 4 other non-member customers (collectively referred to in this Plan as “Customers”). The composition of the PVWC presents a unique jurisdiction for drought monitoring, mitigation and response and the Co-Op’s membership and customers have varying levels of reliance on the PVWC. Some customers have additional sources of water while others are completely reliant on PVWC water. Furthermore, some Customers are urban, offering a range of civic amenities (including splash pads) while others use nearly 100% of their water for residential and business purposes. Furthermore, due to the rural nature of some Customers, PVWC water is used for agricultural purposes, including spraying and livestock.

The PVWC membership consists of the following municipalities:

1. Town of Altona
2. Town of Carman
3. RM of Dufferin
4. RM of Emerson-Franklin
5. RM of Grey
6. RM of Montcalm
7. City of Morden
8. RM of Morris
9. Town of Morris
10. Municipality of Rhineland
11. RM of Roland
12. RM of Stanley
13. RM of Thompson
14. City of Winkler

In addition to the members, the PVWC has several non-member customers, including:

- Altona Rural Water Services
- Blumengart Colony
- Halbstadt Marais Water Co-Op
- Roseau River Tribal Council

The share of total PVWC supply consumed by the Customers is demonstrated in Figure 2. Customers rely on PVWC water for varying proportions of their total water supply, ranging from 100% to less than 5%, as illustrated in Figure 3.

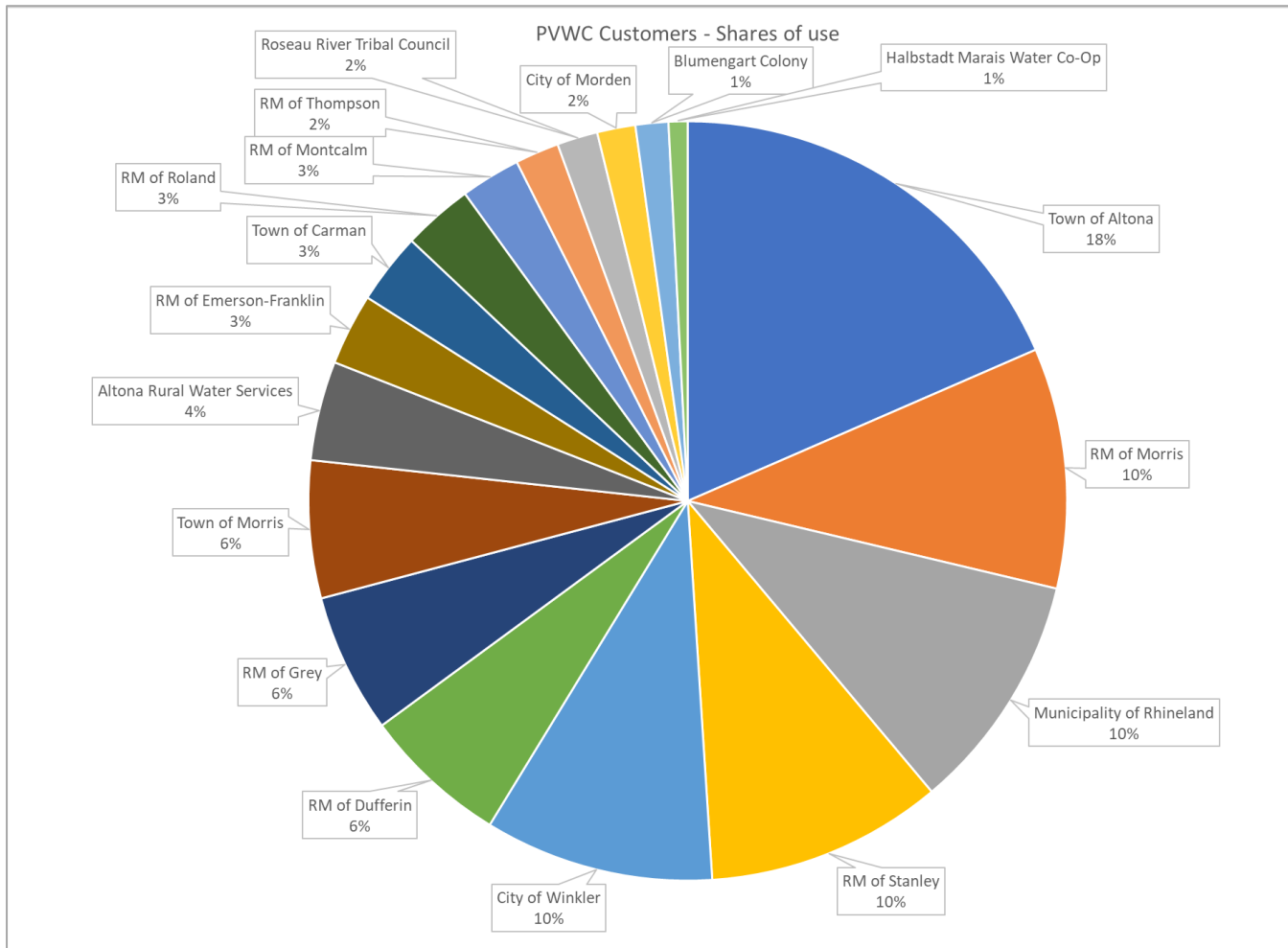


Figure 2: Percentage of PVWC water consumed by members and customers (2017)

The following chart illustrates the share of PVWC water used by each member municipality compared with the proportion of their total water provided by the PVWC:

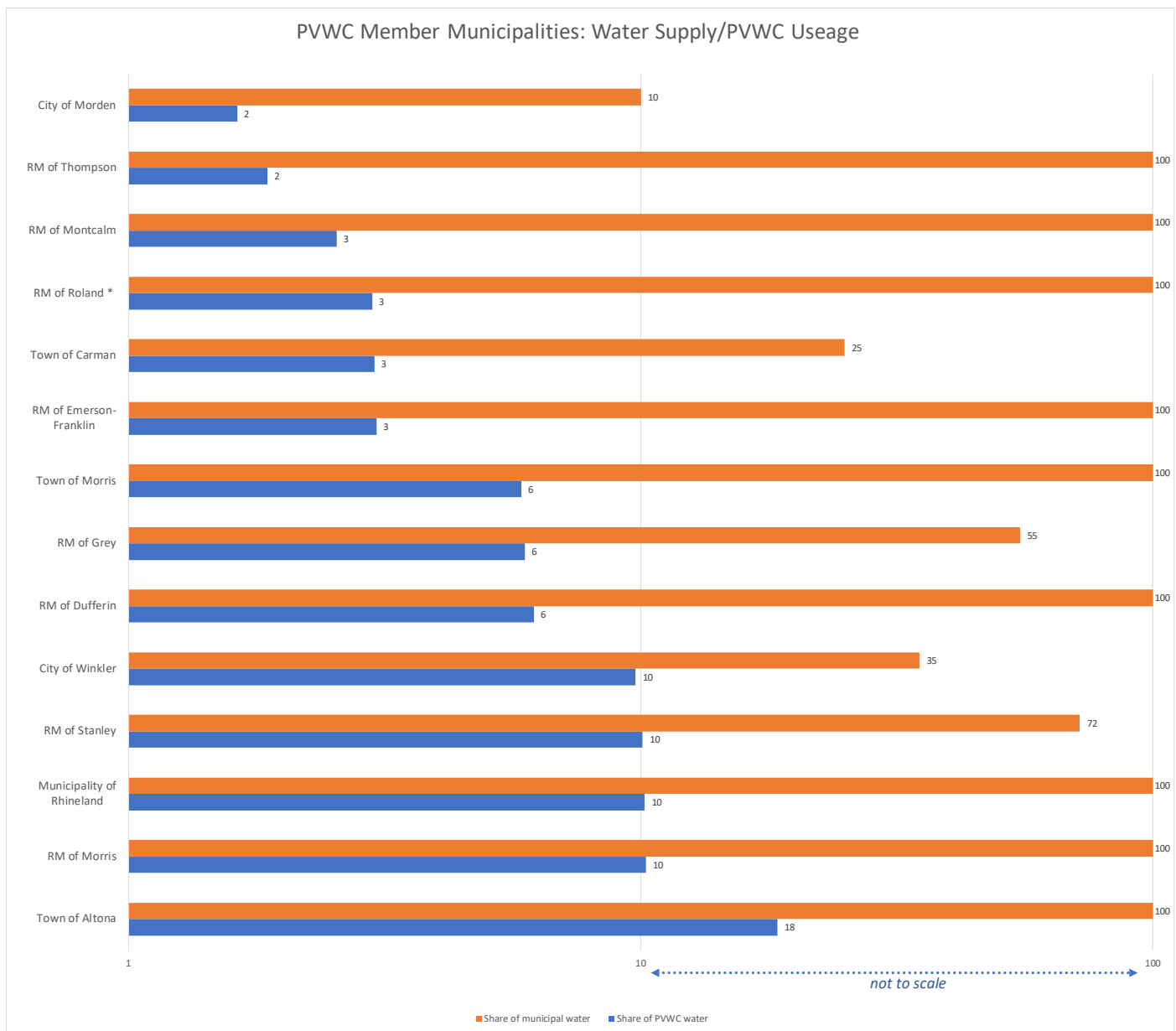


Figure 3: Percentage of PVWC water consumed by Member Municipalities compared to total water consumed (2017)
Note: X-axis is scaled for readability

1.8 Drought Plan Elements

1.8.1 Provincial Drought Management Strategy

The Province of Manitoba's *Drought Management Strategy* sets the framework and action strategies for an integrated approach to minimize the impacts of drought on Manitoba's people, economy and environmental resources. The strategy provides historical background on droughts in the Province, measuring and declaring droughts, committee formation, response actions and mitigation strategies. The Strategy's formal process for declaring and responding to a drought event which is carried through to the *PVWC Drought Management Plan Study* and is largely adopted within this Plan.

1.8.2 Drought Management Plan Study

The origins of the *PVWC Drought Plan* lie with the *PVWC Drought Management Plan Study*. The Study was completed by Associated Engineering (AE) in May 2018 and serves as a background study to this Plan. The Study contains a detailed engineering analysis of PVWC infrastructure, drought vulnerability and summary of the Province of Manitoba's *Drought Management Study*.

1.8.3 Engagement Process

On November 1, 2017 as part of the PVWC master planning process, AE hosted a stakeholder workshop for PVWC members. As part of this workshop members were provided an update on the Province's *Drought Management Strategy* and a group exercise was conducted to raise awareness of drought issues and identify current gaps in drought response. This background exercise established that PVWC's Customers have identified drought as a potential threat to their water security that must be planned for, both in terms of preparedness and mitigation.

In summer of 2018 Landmark Planning & Design began working with the PVWC and their Customers to build off the *PVWC Drought Management Plan Study*, which was prepared by AE, and roll it forward into an implementable plan.

Landmark Planning & Design undertook a comprehensive approach to crafting the *PVWC Drought Plan* grounded in thorough review of resources and a robust member engagement program. Crafting this Plan involved working with Customer representatives to find common interests and goals in how to prepare for, mitigate the impacts of, and respond to drought events in southern Manitoba. A key component of the project was to find shared interests to help identify priorities which to help safeguard the PVWC's water system and ensure needs are met in drought situations.

The *PVWC Drought Plan* is ultimately informed by, and fits within, the Province's *Manitoba Drought Management Strategy* to provide guidance for the PVWC membership at the local level. Furthermore, the *M60 Manual of Water Supply Practices: Drought Preparedness and Response* will help frame the process and eventual Plan to be adopted by the PVWC.¹

In order to facilitate the transition from "Study" to "Plan" in an organized fashion, Landmark Planning and the PVWC established a **Drought Plan Working Group** consisting of 7 representatives from the PVWC membership consisting of a mix of elected officials and operations-based representatives including public works officials, CAOs and others whose roles include a working knowledge of relevant issues. Key representatives from Provincial departments including Manitoba Sustainable Development and Manitoba Emergency Measures Organization (EMO) were consulted at the beginning of the project and participated in the Working Group.

Landmark Planning & Design facilitated three **Drought Plan Working Group** sessions to refine the content of the *PVWC Drought Management Plan Study* into an action plan. The dates and summaries of the sessions were:

- August 28th, 2018 – Introduction and project implementation
- September 18th, 2018 – Drought planning and response workshop

¹ American Water Works Association. 2011. *Drought Preparedness and Response: Manual of Water Supply Practices (M60)*.

- October 15th, 2018 – Draft plan workshop

Finally, an event was conducted on November 19th with representatives (elected and administrative) from the PVWC Customers. The November 19th event served as an opportunity for the PVWC Management to present their draft Plan and had three key goals:

1. To receive input into the Plan from PVWC Customers (members and non-members);
2. To gain joint-involvement in the PVWC Drought Committee and Drought Plan Working Group to pursue the preparedness, mitigation and implementation of the Plan; and
3. To ensure Customers have a local drought plan in place by 2020 to align with the *Local Authorities Emergency Planning and Preparedness Regulation* for continuity requirements.

The **Drought Plan Working Group** is intended to play a key role in the implementation component of this Plan, working with the PVWC on preparedness (see Section 3.4) in the first 6-12 months after the Plan is adopted.

1.9 Key Principles of the PVWC Drought Plan

The following Key Principles for the Plan were proposed within the *PVWC Drought Management Plan Study* (see Section 1.8.2) and were refined and adopted during the Working Group sessions (see Section 1.8.3). The Key Principles guiding this Plan are as follows:

1. *The Plan must be fair and equitable to members and customers:*
 - Water allocation when demand exceeds supply shall be by percentage based on past usage (average of highest 3 of past 5-years, based on yearly billings)
 - There is no seniority or priority for the PVWC Members versus non-member customers
 - There is no geographic seniority for the PVWC Members:
 - Being closer to supply does not have precedence over farther from the supply
2. *Members and customers must act to manage demands based on the percent of water used to each area:*
 - Implement programs to reduce demand or eliminate high-demand activities
 - Municipalities and customers should conserve water and manage demand on an ongoing basis
 - New customers or additional demand from existing customers should not be permitted without consent of the PVWC
3. *The success of the Plan is based on cooperation, common goals and communication:*
 - Cooperation with Provincial and Municipal Governments
 - Active participation in PVWC Drought Committee
 - Preparation and implementation of local drought plans compatible with PVWC Plan
 - Regional system focus:
 - Share infrastructure operations, maintenance, and optimization
 - Share information on system status
 - Share information on plant treatment components including:
 - Treatment plant capacity and production
 - Reservoir capacity and levels
 - Distribution pressures (averages and minimums)
 - Free chlorine residuals (averages, maximums and minimums)

4. *Prudent Investment and management*

- Strive to invest, operate and plan so the complete system is in 'High' drought preparedness. The system is currently a combination of 'Low' to 'Medium' preparedness.
- Keep water rates competitive
- Pursue grants and funding from higher levels of government for upgrades and capital projects
- Prioritize demand management
- Improve and maintain system resiliency
- Manage system with asset-management based best practices
- Seek system-wide optimization
- Provide reliable water service

5. *Education and awareness*

- Educate PVWC customers and their rate-payers on the importance of water conservation, drought planning and the role of the PVWC as their water provider.

6. *Comply with Regulations and Acts in all situations*

- Provide potable water that meets the Guidelines for Canadian drinking water quality.

2 Drought Planning Considerations

Drought is a potential threat in most geographic areas of the world. Water is the source of life and prosperity and droughts present risks to communities in three key ways:

- **Economic** – Impacts on industry, recreation and tourism, agricultural production, energy production, reduced cash-flow for water utilities;
- **Ecological** – loss of wetland, impact on fisheries and wildlife, drawdown of wells and aquifers, reduced soil quality, dust and fire risk; and
- **Social** – health implications, quality of life, community aesthetics, and in some cases, conflict.

There are several key characteristics which make planning for drought a vital exercise for the PVWC, including a changing climate, the historic and projected growth of the Member Municipalities, and available water sources. This Section provides insight into these factors.

2.1 Types of Drought

Droughts begin due to a lack of precipitation over an extended period of time. The severity of a drought is determined by the geography, duration and intensity of drought conditions. There are different classifications of drought based upon the observed hydro-meteorological conditions as well as impacts to society and the environment. The *Manitoba Drought Management Strategy* defines the types of drought as follows: ²

Meteorological drought

Meteorological drought occurs when the rainfall in a particular place and at a particular time is less than the average rainfall for that location. Meteorological droughts only consider the reduction in rainfall amounts and do not take into account the effects of the lack of water on water reservoirs, human needs

² Province of Manitoba. 2016. Manitoba Drought Management Strategy.

or on agriculture. Meteorological drought leads to a depletion of soil moisture and this almost always has an impact on agricultural production. A meteorological drought can occur without immediately impacting streamflow, groundwater, or human needs. If a meteorological drought continues, it will eventually begin to affect other water resources.

Agricultural drought

Agricultural drought occurs when there is not enough water available for a particular crop to grow at a particular time. Agricultural drought depends not only on the amount of rainfall but also on the use of that water. Agricultural droughts are typically detected after meteorological drought but before a hydrological drought. If agricultural drought continues, plants will begin to protect themselves by reducing their water use, which can potentially reduce crop yields.

Hydrological drought

Hydrological drought occurs when lack of precipitation results in declining water levels in rivers, reservoirs, lakes, and aquifers. Hydrological droughts are usually noticed some time after meteorological droughts. First, precipitation decreases and after some time, water levels in rivers and lakes drop. Hydrological drought affects uses that depend on water levels. Changes in water levels affect ecosystems, hydroelectric power generation, and recreational, industrial and urban water use. A minor drought may affect small streams causing low streamflows or drying. A major drought could impact surface storage, lakes, and reservoirs thereby affecting water quality and causing municipal and agricultural water supply problems. Rainfall also recharges groundwater aquifers through infiltration through the soil and run-off into streams and rivers. Aquifer declines can range from a quick response (shallow sand) to impacts extending over multiple years. Impacts can include depletion of shallow depth wells, drying of farm dugouts or irrigation reservoirs, and changes to ground water quality.

Socioeconomic drought

Socioeconomic drought occurs when the supply fails to meet the demand for an economic good(s) such as domestic water supplies, hay / forage, food grains, fish, and hydroelectric power, due to weather related water supply shortages from one or both of natural or managed water systems. At any time during meteorological, hydrological, or agricultural droughts, a socioeconomic drought can occur.

The four types of drought explained above are interrelated and linked, as demonstrated in Figure 4. This figure also underscores the interrelated nature of water sources during a drought. For example, a surface water source may be impacted by drought almost immediately during a drought event, but as a drought event is prolonged, a complimentary groundwater source may also be depleted as it is relied upon more heavily and/or as recharge decreases.

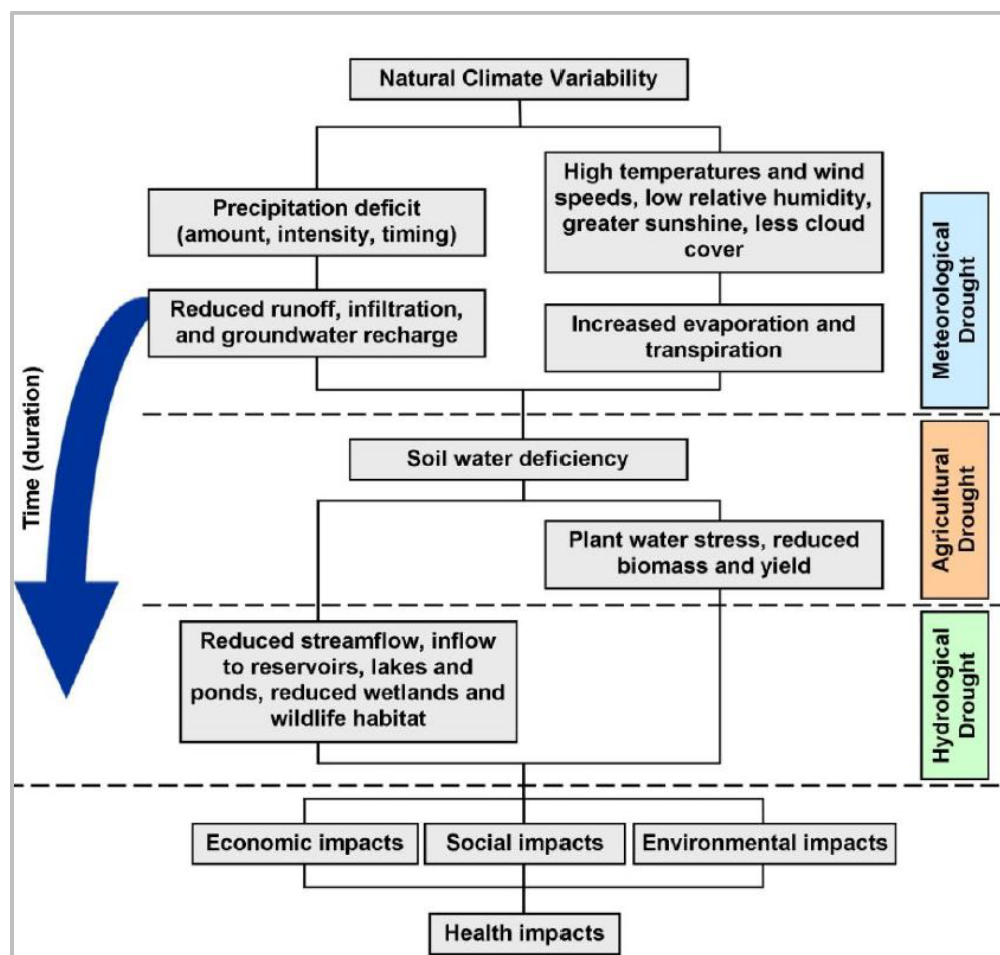


Figure 4 Drought Classifications
(Source: Manitoba Drought Management Plan)

In addition to the four drought types, other events, such as a treatment plant or distribution failure could precipitate water shortages in which the Plan may need to be implemented.

2.2 Climate Change

Drought is a natural, recurring process which has been present throughout recorded history, and according to tree-ring analysis and other data, pre-dates recorded history. While droughts are a natural function, it is expected that climate change may increase the severity and/or frequency of droughts on the Canadian Prairies.

According to the *Climate Atlas of Canada*³, Manitoba is expected to warm at a greater rate than the global average. This is due to Manitoba's northern latitude and continental climate. There are two key elements that are projected to impact Manitoba in terms of drought. First, southern Manitoba is expected to experience hotter summers. Second, precipitation is expected to increase in winter and spring but decrease in summer. The *Climate Atlas* concludes, "given that many communities in the south

Climate Atlas of Canada – Climate Change and Manitoba. 2018.
https://climateatlas.ca/sites/default/files/Manitoba-Report_FINAL_EN.pdf

are projected to see a tripling or even quadrupling in the number of very hot days, even minor declines in summer precipitation will create the perfect recipe for drought.” Furthermore, “the combination of wetter springs and drier summers means that southern regions may have to cope with flooding and drought in the same year. We can foster community resilience to these conditions by adapting infrastructure, enhancing water and drought management, and refining emergency planning.”

2.3 PVWC Characteristics

2.3.1 Population Growth

The PVWC’s Customers include several municipalities which have experienced substantial population and economic growth over the last several decades and are projected to maintain steady growth in the coming years. The *PVWC Master Plan Update Study* included an analysis of Census data detailing historic and projected population growth for the PVWC membership. The key takeaway from this analysis is that based on Census data, and using the established growth rate of 1.8%, the PVWC membership is expected to continue the robust population growth of the last decade and grow from a current combined population of 59,581 people in 2016 to 85,135 people in 2036 and 131,895 in 2061, as demonstrated in Figure 5.

The projected growth for the PVWC service area population requires planning, not only for drought events, but for general supply. In order to supply water for a population of over 100,000 as per the projections, the PVWC and its membership will need to explore additional sources of water, reduce per capita water use and undertake some of the same actions and principles which are key to planning for drought.

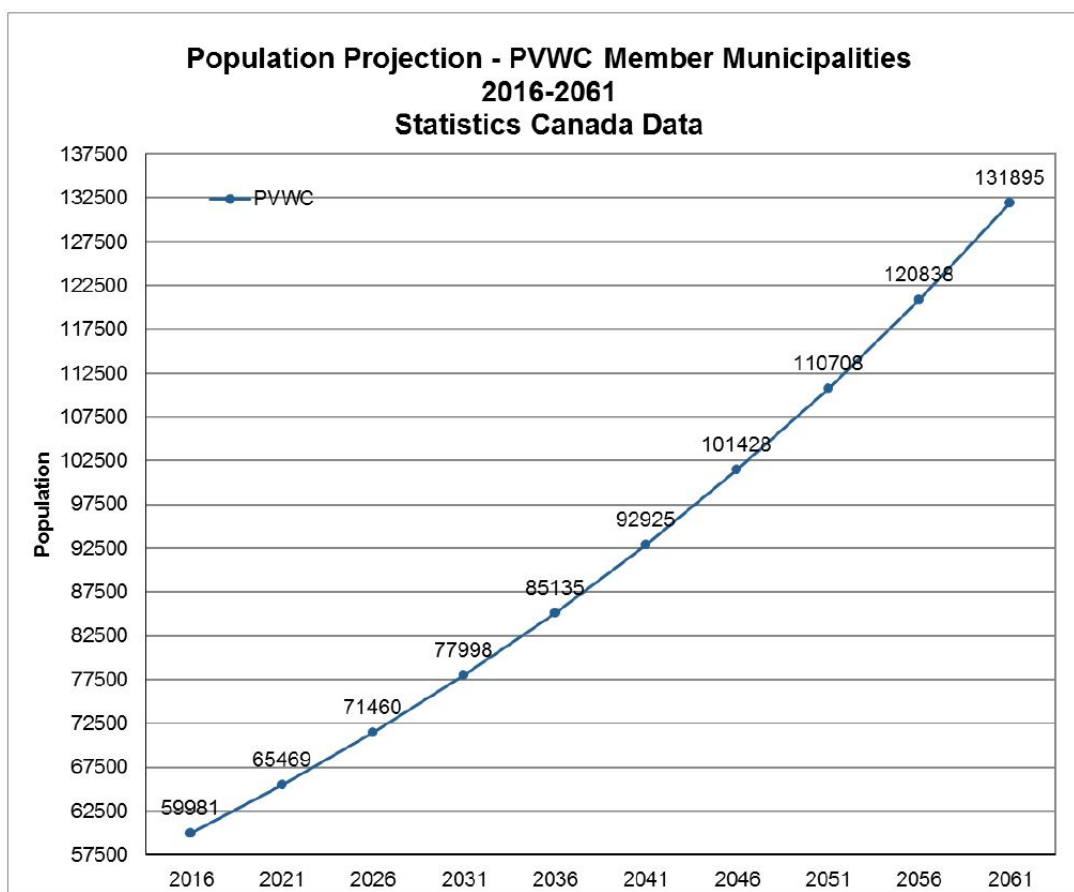


Figure 5: Projected growth of PVWC Member Municipalities 2016-2061.
(Source: PVWC Master Plan Update Study)

2.4 Water Licensing

The PVWC holds three Water Use Licenses for its water treatment facilities. Two licenses for the Red River (Morris Red River Regional WTPs) and one license for Lake Stephenfield (Stephenfield WTP). The precedence of water rights licenses is determined by the submission date of the license application, which is referred to in practice as “first-in-time, first-in-right”. Where license submission dates are identical, the order of priority of the purposes for which water may be used or diverted, or works constructed, established or maintained, in accordance with the *Water Rights Act* is as follows:

1. Domestic purposes
2. Municipal purposes
3. Agricultural purposes
4. Industrial purposes
5. Irrigation purposes
6. Other purposes

In an instance where water supply is unable to meet the required demand for all water use licenses, Manitoba law holds that the most junior license would be restricted first, followed by the next most junior license and so on, but only if it made sense to do so. During a serious water shortage, The *Water Protection Act* prevails over The *Water Rights Act*, meaning the Provincial Minister can declare a “serious

water shortage” and take any action, make any regulation, or issue any order to prevent, minimize, or alleviate the water shortage. The Provincial Minister could potentially use *The Water Rights Act* to make allocation decisions based on the most appropriate use of water in the public’s best interest during a serious water shortage.

2.4.1 Sources of Water

The PVWC is unique in that it draws water from a river which crosses an international border (Red River) and has 18 Customers with varying levels of dependence on the Co-Op’s water supply. Much of the groundwater on the west side of the Red River is brackish to saline and therefore most of the aquifers within the PVWC geographic area are presently seen as less-economical sources of water. Furthermore, the Red River upstream of the PVWC’s geographic area is across an international border and there are no agreements in place to ensure flow of water north from the United States into Canada.

Both of the PVWC’s sources of water are surface water sources. The Co-Op draws water from the Red River and Stephenfield Lake (Boyne River). Both the Red River and the Stephenfield Lake have been identified as being vulnerable to drought. A unique aspect of the PVWC’s main water source is that if there are drought conditions upstream in the Dakotas and Minnesota the Red River flows could be greatly reduced, even while Manitoba receives normal rainfall. Conversely, Manitoba could be experiencing meteorological drought conditions while Red River flows remain ample due to upstream precipitation.

While the PVWC only draws water from two sources, some Customers have access to additional sources. For example, the City of Winkler draws water from the Winkler Aquifer and the City of Morden draws water from Lake Minnewasta and some municipalities receive additional water from other co-ops. While these two sources of water are not technically part of PVWC’s water supply, they result in Winkler and Morden requiring less water from the Co-Op. During a prolonged drought event it is conceivable that these two sources could also be drawn down.

2.4.2 Infrastructure

The *PVWC Drought Management Plan Study* provides an analysis of the PVWC infrastructure and grades each main component according to a level of preparedness. The analysis performed by Associated Engineering found that, as of 2017, the key components of PVWC infrastructure have preparedness levels ranging between “low” and “medium” (see Figure 6). More information on preparedness levels is discussed in Section 3.1.6.

PVWC Drought Preparedness Levels		
	Preparedness Level	Comments
Letellier WTP / Distribution	Low	<ul style="list-style-type: none"> • Water source vulnerable to drought • Minimal off channel storage • Plant capacity does not meet current or future peak demands • Limited plant redundancy • Aging equipment • Process not resilient to possible water quality changes in drought conditions
Morris WTP / Distribution	Medium	<ul style="list-style-type: none"> • Water source vulnerable to drought • Off channel storage mitigates drought impacts • Plant capacity exceeds supply • Process resilient to possible water quality changes in drought conditions
Stephenfield WTP / Distribution	Medium	<ul style="list-style-type: none"> • Water source vulnerable to drought • Reservoir mitigates drought impacts • Plant capacity exceeds supply • Process resilient to possible water quality changes in drought conditions

Figure 6: PVWC Drought Preparedness Levels
(Source: PVWC Drought Management Plan Study)

3 PVWC Drought Plan

3.1 Drought Stages

There are four Drought Stages used in this Plan which were established as part of the *Manitoba Drought Management Strategy* and were incorporated into the *PVWC Drought Management Plan Study*. Each Drought Stage is a factor of the severity and duration of a drought event, coupled with the level of preparedness.

Section 3.5 of this Plan contains a detailed description of the responses and actions associated with each Drought Stage. In order to declare a particular Drought Stage, PVWC Management and the PVWC Drought Committee will work with relevant Provincial departments, and when warranted, will make a recommendation to the PVWC Board to declare the appropriate drought stage. The declaration of a Drought Stage will be communicated to Customers and the public as detailed in Section 3.5.3 of this Plan. The water reductions and actions of this Plan, coupled with local drought plans, are intended to prevent shortage scenarios, by gradually reducing water supply in a planned, predictable manner.

<u>PVWC Drought Plan: Drought Stages</u>	
Normal Conditions	25-75th Percentile Conditions
Moderate Drought Stage	25-10th Percentile Conditions
Severe Drought Stage	< 10th Percentile Conditions
Extreme Drought Stage	< 10th Percentile Conditions For At Least 6 months

Table 3-1: Summary of Drought Stages

Each Drought Stage includes delivery reductions (see Section 3.5) to Member Municipalities.

3.1.1 Normal (Green) Conditions

During Normal Conditions it is anticipated that there are no water shortages and that the demands of the PVWC members and customers will be met. Mitigation, Education, Preparedness and Monitoring will occur, and continued updates on drought indicators will be made. Continued water conservation measures will be pursued, and education and awareness efforts will continue in order to foster a general sense of water issues amongst the general public and build resiliency to drought events.

3.1.2 Moderate (Blue) Drought Stage

During the Moderate Drought Stage there will be increased emphasis and frequency in updates on water availability and drought indicators, the mobilization of the Provincial and PVWC Drought Committees and implementation of drought responses. Beginning at the Moderate Drought Stage, the PVWC will implement some water reductions. It is anticipated that local drought plans may implement voluntary water restrictions and some mandatory restrictions are introduced for discretionary water uses, such as lawn watering. During this stage there is modest risk of water shortages in all or parts of the Red River Basin, where demands from human, agriculture, industrial and ecosystem needs may not be fully met.

3.1.3 Severe (Yellow) Drought Stage

During the Severe Drought Stage increased updates and communication on water availability and drought indicators will continue, while the next level of drought responses will be implemented including further reductions in water supply by the PVWC. Municipal plans may include voluntary restrictions and the introduction of mandatory restrictions for discretionary water uses, such as landscape and lawn watering and recreational uses. The Severe Drought Stage could introduce temporary drought pricing to encourage water conservation and preserve PVWC revenues. During the Severe Drought Stage there is potential for water shortages in all or parts of the Red River Basin, where

demands for human, agriculture, industrial and ecosystem needs may not be fully met. It is possible that a local state of emergency may be called.

3.1.4 Extreme (Red) Drought Stage

During the Extreme Drought Stage increased updates and communication on water availability and drought indicators will continue, while the next level of drought responses and water reductions will be implemented. Local drought plans may incorporate mandatory restrictions for discretionary water uses, such as landscape and lawn watering, recreational uses and some industrial operations. During the Extreme Drought Stage there is potential for serious water shortages in all or parts of the Red River Basin, where demands for human, agriculture, industrial and ecosystem needs may not be fully met. It is likely that a local state of emergency may be called and possible that a Provincial state of emergency may be called during this stage.

3.1.5 Water Shortages

In the case of a severe and/or prolonged drought if demand for water is greater than supply the PVWC may experience water shortages. The reductions and actions in the Moderate, Severe and Extreme Drought Stages as detailed in Section 3.5, coupled with corresponding local drought plans at the Customer-level, are intended to prevent experiencing water shortages. If a shortage occurs water will be allocated to the PVWC membership on a pre-determined basis. Water shortages could occur within any of the Drought Stages.

In the case of a shortage, water will be shared proportionally according to the average of the highest three years of customers' water purchases from the last five years. If shortages are experienced a Provincial state of emergency would likely be in place. Furthermore, it is likely that the Provincial Minister may declare a "serious water shortage" under the *Water Protection Act* during this Stage.

3.1.6 Drought Stages and Level of Preparedness

Drought Preparedness refers to the directed policies, plans and actions which must be implemented prior to a drought event occurring in order to increase forecasting accuracy and ensure the Plan is fully implementable and effective during a Drought Event. The *Manitoba Drought Management Strategy* linked the Drought Stages detailed in Sections 3.1.1 through 3.1.4, and coupled these with the preparedness-levels presented in Section 2.4.2 of this plan. Table 3-2 (below) demonstrates the impact the level of drought preparedness can have on the potential impact of a drought event. Increased preparedness, achieved through mitigation efforts, can decrease the potential impact of a drought event in each Drought Stage.

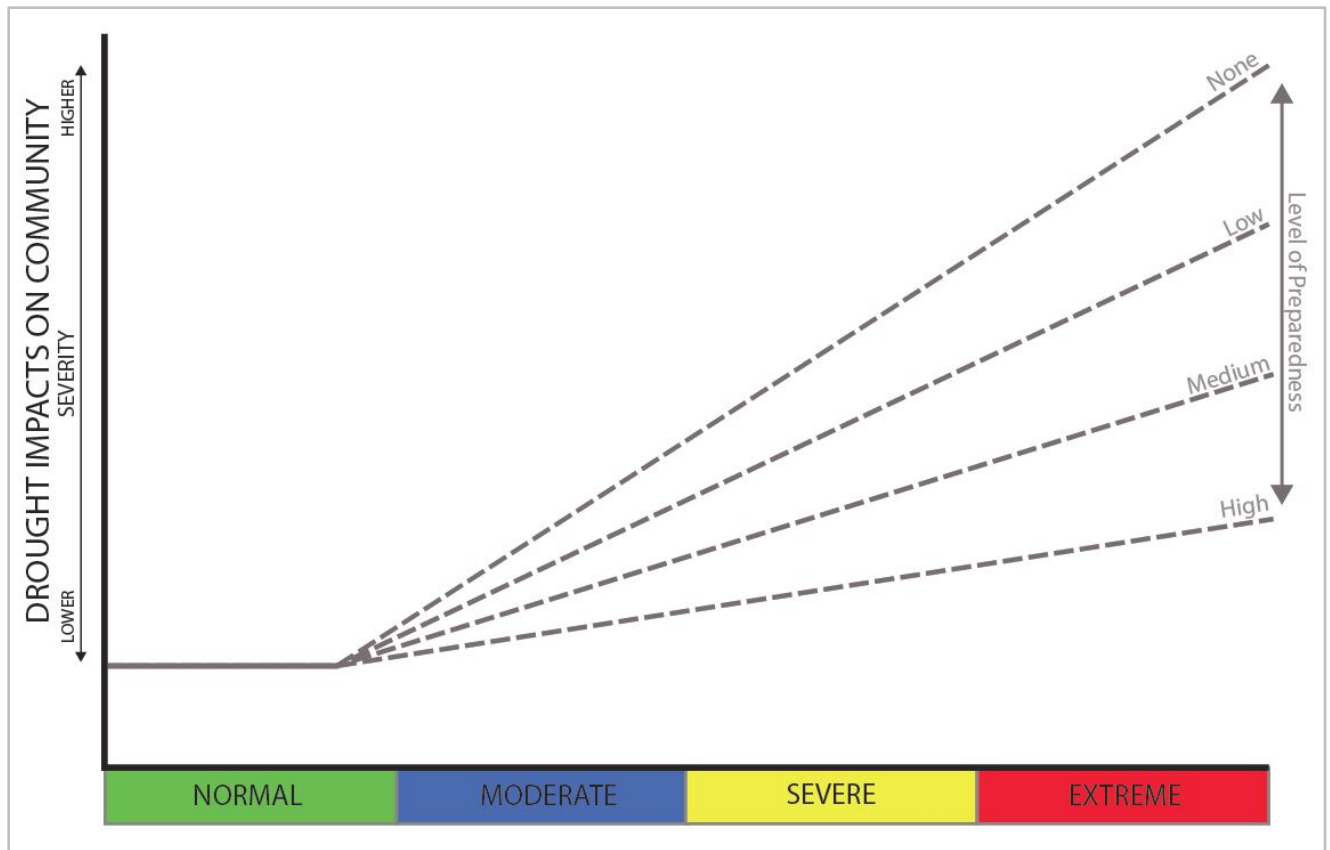


Table 3-2: Drought Stage and level of preparedness

As displayed on Figure 6 (Section 2.4.2), Associated Engineering’s analysis of PVWC infrastructure was found to range between “Low” and “Medium” in terms of drought preparedness. While there is not an established quantitative means of measuring the drought preparedness level of the entire PVWC system, or specific infrastructure components of the system, this Plan includes a matrix of factors to consider when evaluating preparedness levels (Table 3-3). Factors can be included or excluded according to the specific traits of the entity being evaluated. A weighted measure can be applied to each evaluation component to help determine the level of preparedness.

Drought Level of Preparedness Matrix	
Factors	Evaluation
Water Source Vulnerability to Drought	low/medium/high
Availability of additional Water Source(s)	yes/no
Off-Channel Storage Availability	yes/no
Off-Channel Storage Capacity	none/low/medium/high
Excess treatment Plant Capacity	none/low/medium/high
Treatment Plant Redundancy	yes/no
Age/state of Treatment Plant Equipment	poor/moderate/good
Treatment Process' Drought Resilience	low/medium/high
Distribution System Condition - Leaks etc.	poor/moderate/good
Mitigation Programs Implemented	yes/no
Refined Monitoring System Implemented	yes/no

Table 3-3: Drought Level of Preparedness Matrix

3.2 Monitoring

Monitoring is a critical component of the Drought Plan and is a fixture during normal conditions and all drought stages. At this time there are two established monitoring points which are used to determine Drought Stage. Both the Red River at Emerson and the Stephenfield Reservoir are monitored by the Province and have flow thresholds established to determine the corresponding Drought Stage, as determined in the *PVWC Drought Management Plan Study*.

There are additional monitoring sources which the PVWC can utilize to supplement the Red River at Emerson and the Stephenfield Reservoir monitoring points, both in order to gain a more robust understanding of drought severity and to provide better forecasting of potential drought events.

3.2.1 Provincial Monitoring

The *PVWC Drought Management Plan Study* set the framework for drought monitoring by establishing drought level triggers for the Red River at Emerson and the Stephenfield Reservoir.

Red River at Emerson

The Red River is the source of water for both the Morris and Red River Regional Water Treatment Plants (WTPs) and is considered a vulnerable water source as flows have been near zero in the historic record. The *PVWC Drought Management Plan Study* established the upstream monitoring station at Emerson as the monitoring point for the Plan. The Emerson station has been collecting data since 1912 and thus

recorded the record lows during the 1930's. The daily streamflow indicator compares the current value to the historical streamflow and provides a corresponding condition compared with the level of preparedness in order to determine the Drought Stage.

Table 3-4 demonstrates the daily stream flow indicator thresholds for each Drought Stage for the Red River at Emerson with corresponding Preparedness Level accommodations.

Drought Stage Table Red River at Emerson	
Daily Water Level Indicator	Drought Stage
Normal 25-75th Percentile Conditions	Normal Conditions
Moderately Dry 25-10th Percentile Conditions	Moderate Drought Stage
Severely Dry < 10th Percentile Conditions	Severe Drought Stage
Extremely Dry < 10th Percentile Conditions For At Least 6 months	Extreme Drought Stage

*Table 3-4: Red River at Emerson Drought Stage Table.
Source: PVWC Drought Management Plan Study*

Stephenfield Reservoir and Spillway (Boyne River)

The Boyne River (including the Stephenfield Reservoir) is the water source for the Stephenfield Water Treatment Plant. The Reservoir was constructed in 1963 with full supply level increased from 970 ft. to 972 ft. in 1990/1991. Within the Boyne River, Water Use Licenses are issued from either firm flows or surplus flows. Firm flow license holders can withdraw water throughout the entire year, while surplus flow license holders may only make withdrawals during the spring (March-April-May) months. A rule curve is in place for the Stephenfield Reservoir to manage license allocations under the drought of record scenario (See Figure 7).

Table 3-5 demonstrates the daily stream flow indicator thresholds for each Drought Stage for the Stephenfield Reservoir with corresponding Preparedness Level accommodations:

Drought Stage Table Stephenfield Reservoir	
Daily Water Level Indicator	Drought Stage
Normal 25-75th Percentile Conditions	Normal Conditions
Moderately Dry 25-10th Percentile Conditions	Moderate Drought Stage
Severely Dry < 10th Percentile Conditions	Severe Drought Stage
Extremely Dry < 10th Percentile Conditions For At Least 6 months	Extreme Drought Stage

Table 3-5: Stephenfield Reservoir Drought Stage Table.
Source: PVWC Drought Management Plan Study

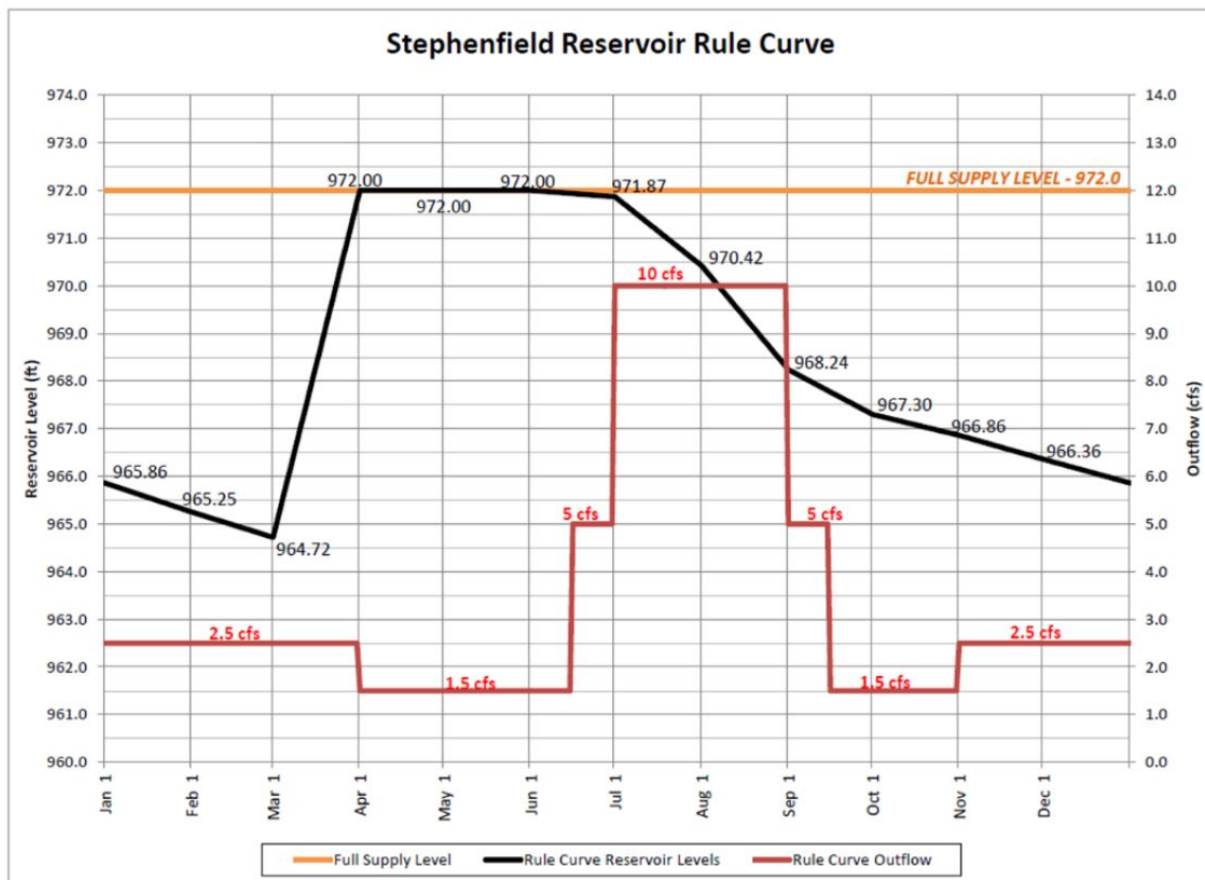


Figure 7: The Stephenfield Reservoir's Rule Curve
(Source: Manitoba Drought Management Strategy)

It has been suggested by the Drought Plan Working Group that the existing Stephenfield water level indicators and rule curve may be insufficient in practice. For example, the existing rule curve is based on a recharge model which is dependent on significant snow melt, a phenomenon which may not occur during a substantial drought.

3.2.2 PVWC

The PVWC can incorporate additional monitoring sources to ensure the effects of a drought are fully understood, supplement the Red River and Stephenfield data, and to assist forecasting of future drought events. The following monitoring elements will therefore be incorporated into the PVWC's monitoring practices.

Upstream Monitoring

While the Emerson monitoring station has been selected as the point of measurement for the Plan it is imperative that other upstream sources be consulted including:

- Roseau River at Dominion City, Manitoba
- The Pembina River at Neche, North Dakota
- Precipitation levels via the Manitoba Agriculture weather station data and North Dakota/Minnesota resources
- Soil moisture indicators
- Water levels of upstream sources (e.g. Devil's Lake and Lake Traverse)
- Off-stream raw water impoundments

Incorporating additional upstream points of measurement into drought assessments for the PVWC will help provide advance warning of stream flows and prolonged periods without precipitation upstream in the Red River Basin.

Morris and Letellier Raw Water Reservoirs

The PVWC's two impoundment ponds at Morris and Letellier will be monitored to ensure adequate storage is available. A formal system for monitoring and drought triggering levels will need to be established.

Groundwater

While the PVWC does not currently obtain any supply from groundwater sources, many communities in southern Manitoba draw water from groundwater aquifers. The City of Winkler purchases 10% of the PVWC's water (2017). While not technically part of the PVWC's supply, the Winkler Aquifer represents a substantial component of Winkler's water supply and is thus a substantial source of water within the PVWC's geographic area which could be drawn down if PVWC supply was restricted. Conversely, there would be an increased demand from the PVWC if the Winkler aquifer was restricted. Therefore, monitoring the Winkler aquifer and other groundwater sources used by PVWC Customers is of relevance to understanding drought risk for the PVWC. Manitoba Sustainable Development monitors the Winkler Aquifer levels and will provide measurements on a monthly basis.

Soil Moisture

Soil moisture measurements are available from Provincial resources and will be consulted by the PVWC in order to help gauge the severity of a drought. While not a key factor directly tied to the PVWC's ability to provide water to southern Manitoba, this information has direct relevance as supplementary monitoring data.

Population Growth and Demand

As outlined in Section 2.3.1 the Member Municipalities of the PVWC are expected to experience population growth. Growth data for the PVWC should be continually monitored as new Census data is available and using municipally-collected data for interim periods.

Drought Early Warning System (DEWS)

The PVWC and the Red River Basin Commission should work to establish a Drought Early Warning System (DEWS) for the Red River Basin. This would involve international cooperation and could prove valuable for the PVWC and all other water utilities within the Basin. The Drought Early Warning System at the United States Drought Portal does not currently include the Red River Basin.⁴

3.3 Mitigation

Mitigation encompasses ongoing, proactive actions and planning to reduce the long-term risk and potential impact of drought events, by identifying principle activities and possible susceptibilities and developing mitigation actions and programs to reduce these vulnerabilities to drought. Therefore, Mitigation should always be occurring during Normal Conditions, although planning and programming would likely continue as drought stages are entered. However, as drought severity and duration increase focus will shift towards ensuring adequate responses, reductions and communication.

The mitigation components contained within this Section are ideas generated by review of best practices and Drought Plan Working Group sessions and should be explored by the PVWC and Member Municipalities for adoption. The *PVWC Master Plan* document speaks to required infrastructure upgrades and could also incorporate additional mitigation items.

The following list of mitigation categories includes actions under the sole purview of the PVWC and some items that are joint mitigation efforts (between the PVWC and Customers and/or the Province) which are identified as such.

3.3.1 Education

Education is an essential aspect of drought mitigation and response. The importance of education was a reoccurring theme during the Working Group sessions and could include collaboration with local Conservation Districts. Educational approaches to be explored by the PVWC should include:

Role of PVWC in supplying water in southern Manitoba

Working Group participants suggested that the essential role of the PVWC in water provision may not be fully understood by the population served by the Co-Op. For mitigation, educational approaches should see the PVWC attempt to increase their public profile and engage residential, commercial and industrial customers in the importance of the PVWC, where their water comes from, and water conservation.

The PVWC should work to increase their profile by advertising and public service announcements and working with local school divisions to ensure water education is included in their curriculum.

⁴ National Integrated Drought Information System. United States Drought Portal. 2018.
<https://www.drought.gov/drought/regions/dews>

Agricultural water use (joint mitigation effort – PVWC, Customers, Province)

An emerging issue identified during the Working Group sessions is the increasing reliance of agricultural operations, including livestock producers, on PVWC water. Education on the importance of water resilience, including the maintenance of dugouts for livestock watering should be employed to help increase drought resilience.

Drought Stages and water conservation (joint mitigation effort – PVWC, Customers)

This Plan includes water reduction ranges for each Drought Stage and identifies overall water conservation practices as being central to drought mitigation and resilience. Prior to and during drought events the PVWC should work with Customers to educate the public on the drought stages and municipal response measures, which will be of vital importance as water use reduction actions are employed. This will be imperative in ensuring reduction measures are met and the public understands the importance of these actions. In order to mitigate the impacts of drought events encouraging water conservation educating the public on the importance of water conservation, and tactics to achieve water conservation could be implemented.

3.3.2 Monitoring Improvements (joint mitigation effort – PVWC, Province)

Section 3.2 presents the established monitoring points and drought triggers, as well as additional measures to supplement data and improve forecasting. As part of the PVWC's ongoing mitigation efforts, additional points for water source monitoring and system capabilities should be pursued and official triggering levels for Drought Stage indicators should be established.

3.3.3 Conservation and use reduction

While the Drought Response actions within this Plan outline the potential supply reductions from the PVWC to their Customers for each Drought Stage, in order to increase resiliency in the PVWC, increase sustainability within the Red River Basin, and accommodate projected growth within the PVWC Customers it will be imperative to incorporate conservation measures.

Set target water reduction (joint mitigation effort – PVWC, Customers)

In order to provide a tangible goal for water conservation, a target annual per-capita or overall water reduction should be set. Substantial reductions in per-capita water consumption can be achieved via conservation efforts which will mitigate drought impacts and allow the PVWC and their Customers to serve a larger population and growing economy.

3.3.4 Infrastructure

Ensuring the PVWC's water treatment and delivery infrastructure is operating efficiently and provides adequate capacity is a core component of drought mitigation. The *PVWC Master Plan* identifies current infrastructure needs and targets specific projects and a series of projects are recently completed, entering planning stages or targeted for funding. As part of the PVWC's ongoing operations infrastructure upgrades, repairs and expansions will be continually reviewed. The overall goal of infrastructure improvements will be to upgrade the preparedness level (See Section 3.1.6) to "high" for all components of the PVWC system.

A non-exhaustive overview of potential drought-related infrastructure items includes:

- Reservoir expansion (raw and treated water) to increase storage;

- Long-term storage and impoundment solutions (e.g. establishing new lakes/reservoirs);
 - Impounding excess spring flows for reservoirs and/or aquifer recharge;
 - Ensuring treatment plant intakes are positioned in a manner which will allow operation during low water levels;
 - Increasing treatment plant capacities;
 - Increasing system efficiencies such as installing additional meters, completing looping of water lines and leak reduction to prevent water loss;
 - Installing valves and gauges to ensure adequate water pressure is maintained;
 - Mitigating potential impacts of winter ice on water flows and WTP intakes during drought events with reduced flow;
 - Ensuring all water treatment plants are operating efficiently in full working order to plant rating; and
 - Larger engineering projects such as dams and weirs which could increase compounding and storage at the source, including on the Red River, Rosseau River and the Morris River.
- Consultation with Provincial departments and the Department of Fisheries and Oceans will be crucial in any such endeavour.

3.3.5 Additional Water Sources

The PVWC has two key sources of water, the Red River and the Boyne River. Incorporating additional water sources is a means of increasing resilience and drought resistance for the Co-Op. It is worth noting, however, that in a prolonged drought water sources from the same geographic area will likely be impacted by the same drought event. For example, a surface water source may be impacted by drought almost immediately during a drought event, but as a drought is prolonged a complimentary groundwater source may also be depleted as it is relied upon more heavily and/or as recharge decreases. As such, increasing the variety of water sources available to the PVWC is a means of drought mitigation and increasing resilience, but will not necessarily result in being resistant to the risks of drought events. Additional water sources could include:

Groundwater

Much of the groundwater on the west side of the Red River is brackish or saline, with a few exceptions. Furthermore, of the groundwater sources in the geographic area of the PVWC, all are either fully licensed or have little available capacity. While it may be possible to obtain some water from groundwater sources during a drought event, groundwater sources on the west side of the Red River are not viable additional sources available to the PVWC for long-range mitigation planning, without desalination equipment. Groundwater sources from farther afield could be explored for feasibility as part of a long-range planning effort.

Desalination

Desalination is presently an expensive option for the PVWC, however technological advances may increase the viability of desalination operations in the future. The City of Winkler presently uses Reverse-Osmosis to desalinate brackish water drawn from wells in their water system. Salinity of groundwater sources east of the Red River vary by location. While presently expensive, desalination should be seen as a potential mitigation option in the medium to distant future. A longer-term mitigation component could include exploring the addition of desalination equipment to the Morris WTP.

Water Recycling (joint mitigation effort – PVWC, Customers, Province)

The recycling of all clean water, regardless of previous use, should be further explored as a potential source of potable water and/or means of aquifer recharge or filling raw water aquifers. Using all available sources of clean water could also be a means of providing clean but not completely treated water for agricultural purposes.

3.3.6 Maintaining Reservoir Levels

The PVWC has at times used temporary pumps to maintain water levels at the Letellier and Morris raw water reservoirs. This practice could be explored as a structured practice as conditions warrant to ensure reservoir levels are maintained at a set level, as established in Section 3.3.2.

3.3.7 Aquifer and Reservoir recharge (joint mitigation effort – PVWC, Customers, Province)

The practice of using recycled water, or water pumped from another surface water source to the recharge area of the Winkler Aquifer could be explored as a feasible means of recharging the aquifer or filling raw water reservoirs. Using excess spring freshet and floodwaters could also be explored to recharge other water sources within the PVWC membership including the Stephenfield Reservoir and Lake Minnewasta.

3.3.8 Partnerships

The PVWC can discuss partnerships with other water authorities from neighbouring geographies. This could include other water co-operatives or utilities. Linking water distribution networks, especially ones which have supply from other surface or groundwater sources will increase the system resilience of both systems and mitigate the impacts of drought events.

3.3.9 Improved Data and Statistics (joint mitigation effort – PVWC, Customers)

The PVWC should develop and maintain detailed water consumption data and raw/treated reservoir storage in order to gain a better understanding of water consumption and potential conservation within their membership. Collecting and interpreting a wide range of data including per-capita water consumption (with and without industrial and agricultural users) and water supply will provide the PVWC with better decision-making capacity. A full understanding of reservoir capacity and evaporation rates will also provide a greater understanding of existing storage capacity and help set targets for storage expansion. The ability to determine robust consumption data and track the success of any conservation measures or use restrictions is imperative to drought mitigation and response measures.

3.4 Drought Preparedness

The following programs are intended to be established upon adoption of this Plan, prior to a Drought Stage being declared. The areas of responsibility are broken down according to PVWC and Member Municipalities. A prioritization and timeframe for Preparedness items is included in **Appendix B**.

3.4.1 PVWC Responsibilities

3.4.1.1 Update PVWC Emergency Plan

The PVWC will update their existing emergency plan to include drought-related actions. The emergency plan should refer to this Plan in the case of a drought event, identify any relevant temporary water

sources and include the addition of drought-specific items to the “resources and capabilities” sections including:

- Pumping companies
- Pipe distributors
- Trucking operators
- Drilling companies

3.4.1.2 Hazard Analysis

The PVWC will undertake a Hazard Analysis for each Drought Stage in order to predict potential impacts of each stage on infrastructure, quality of life and other considerations. Manitoba EMO’s “*APPENDIX A – Hazard Analysis*” can serve as the template for this exercise.

3.4.1.3 Establish mechanism to distribute water according to reductions

The PVWC will need to establish how water will be fairly distributed proportionally amongst Customers when reductions are in place. Ensuring accurate, measured delivery of the designated water volumes is essential.

3.4.1.4 Identify any emergency sources of water that may be available to use during drought events

During Severe and Extreme Drought Stages it may be imperative to use emergency sources of water for temporary use. The PVWC should evaluate potential sources for temporary use during such events. Potential actions may include:

- Temporary pipeline(s) from surface water source(s)
- Temporary use of groundwater source(s)
- Trucking water from adjacent areas
- Use of recycled, treated water from alternate source(s)

3.4.1.5 Collect and analyze detailed data

Section 3.3.9 discusses the important role that data and statistics can play in anticipating, monitoring and responding to drought events. Detailed analysis of per-capita and total water use by sector and overall can provide great insight into water use, reduction and drought mitigation. This work can be undertaken immediately and will ultimately be an ongoing effort.

3.4.1.6 Perform water audit(s) to identify system weakness and losses

Performing water audits will help identify water losses in the system and establish baselines for future evaluation.

3.4.1.7 Training and Development

The PVWC will ensure staff have adequate disaster response and management training, such as Incident Command System (ICS) training, emergency management training through the Justice Institute of British Columbia (JIBC) and Manitoba EMO’s training programs

3.4.1.8 Establish criteria for evaluating proposed new users and uses

As part of preparedness and mitigation efforts and to align with the Key Principles outlined in Section 1.9, the PVWC will establish refined criteria for evaluating proposed new customers and water uses, such as recreational amenities and industries.

3.4.1.9 Formalize Drought Preparedness Matrix

Section 3.1.6 of the Plan presents the role of preparedness in mitigating the potential impacts of a drought event, with Table 3-3 demonstrating a qualitative means of ranking drought preparedness. As part of the formal implementation of this Plan the PVWC will work to formalize this matrix and assign quantitative values to the matrix elements in order to establish a formal preparedness. Customers may also use the matrix to evaluate their drought preparedness.

3.4.2 Joint PVWC-Customer Responsibilities

3.4.2.1 Establish PVWC Drought Committee

The PVWC Drought Committee is a vital component of the Drought Plan's implementation and maintenance. Furthermore, the Committee will provide guidance and coordinate activities at the co-op level. The PVWC Drought Committee will work closely with and compliment the Manitoba Drought Assessment Committee and Basin Assessment Groups which operate at higher-scale geographies.

The Drought Committee will be comprised as follows:

- Chair – PVWC CEO
- 23 Members:
 - 2 PVWC Staff – e.g. administrative, plant, operations etc.
 - 14 Member municipality representatives (1 from each) – e.g. CAO, Public Works, etc.
 - 4 Non-member customer representatives (1 from each)
 - 2 Province of Manitoba representatives. One each from:
 - Manitoba Sustainable Development representative
 - Manitoba Emergency Measures Organization (EMO) representative
 - 1 Professional facilitator/planner (from Member Municipality or consultant)

Mandate:

- The PVWC Drought Committee will serve an advisory role providing a broad range of expertise to make Drought Stage declaration recommendations to the PVWC Board and to facilitate the continued implementation of the Drought Plan.

Activities:

- Review Monitoring data and recommend Drought Stage declarations to Board
- Coordinate with Province, PVWC, Local Government, Manitoba EMO
- Coordinate Drought Response according to each Drought Stage
- Implementing communication process
- Pursuing joint mitigation efforts
- Maintaining the Drought Status Report
- Coordinating local drought plans
- Undertaking “table-top” scenario exercises
- Reviewing/Revising PVWC drought plan every 4 years and/or after each drought event
- Coordinate with Basin Drought Assessment Groups through PVWC CEO
- Establish consistent approach to communication, outreach, education
- Reviewing “state of emergency” conditions
- Review plan every 4 years and after each drought event

3.4.2.2 Work with Public Utilities Board (PUB) on rate structures

There are two key items which could be explored with the PUB. First, temporary rate increases could be implemented during the Severe and Extreme Drought Stages. Second, it was indicated by Working Group members that current PUB structures do not facilitate rate structures which can encourage water conservation. Both of these items warrant further exploration and consultation with the PUB.

3.4.2.3 Establish Drought Funding Approach

In order to fund the activities of the PVWC Drought Committee and obtain any required engineering or research services related to drought mitigation and preparedness, the PVWC and Member Municipalities may consider establishing a Drought Fund charge on water bills to establish a pool of money for said uses. Any such charge would be levied equally amongst Member Municipalities. This concept may also require approval of the PUB.

3.4.2.4 Establish Demand Management Strategy

In order to meet the goals of mitigation and the Key Principles as outlined in Section 1.9, the PVWC will work with customers to establish demand management criteria and goals. Demand management refers to efforts to reduce demand for limited resources and working to ensure supply can meet demand. Demand Management efforts will ultimately encompass the overall mitigation efforts and will require more refined data analysis, as envisioned elsewhere in this Plan. Establishing a formal hierarchy of water uses in terms of priority will be the first step in this approach.

3.4.3 PVWC Drought Working Group Responsibilities

The PVWC Drought Working Group will play a crucial role implementing the Drought Plan and undertaking preparedness items. The Working Group will meet several times after the plan is adopted to participate in Key Preparedness tasks, including:

3.4.3.1 Drought Status Report

The Drought Status Report will provide a summary of monitoring information during Drought Stages and a detailed summary of when the Drought Stage was declared, what actions have been implemented and other pertinent data. The Drought Status Report will be maintained and completed by the PVWC Drought Committee. The Drought Status Reports can inform the regular plan reviews and post-drought reviews described in Section 1.5.

3.4.3.2 Ensure data is in compatible format

At present water use data within the PVWC Customer-base is of various levels of accuracy and communicated in different ways. As improved data is collected (Sections 3.3.9 and 3.4.1.5) efforts will be made to ensure data is compatible across all Customers and the PVWC for ease of interpretation and analysis.

3.4.3.3 Procure communication software/hardware for internal communication

In order to facilitate effective, private communication between the PVWC and Member Municipalities, an established communication model will be required, including hardware/software for fast, efficient, confidential internal communication, prior to public releases.

3.4.4 Joint PVWC - Provincial Responsibilities

3.4.4.1 Review and update monitoring and triggering elements

The Red River and Stephenfield Reservoir are identified as monitoring points and have set triggering mechanisms. The Province and PVWC should work together to refine and tests these systems and work to determine which other Provincially-managed monitoring info could be utilized with established triggering mechanisms.

Established monitoring and triggering elements, such as the Stephenfield Reservoir “rule curve,” may be reviewed, at the discretion of the relevant Provincial departments, to ensure relevance to current climate conditions. The proposed duration of 6 months which is used to determine the Extreme Drought Stage at the Red River and Stephenfield should also be modelled and evaluated. If necessary, triggering and monitoring should be updated.

3.4.4.2 Calculate storage capacity, establish monitoring regimen and triggering levels for Reservoirs

As discussed in Section 3.2.1 the Morris and Letellier Reservoirs do not have established monitoring systems and drought-trigger levels. Establishing a full understanding of the amount of storage, and duration of supply will also be essential. An engineering analysis, with cooperation from Manitoba Sustainable Development should be undertaken to create a formal monitoring and triggering mechanism.

3.4.4.3 Refine monitoring process for upstream conditions and supplemental data

The PVWC should work with Manitoba Sustainable Development, the Red River Basin Commission and retain other relevant expertise to refine the use of upstream (e.g. Lake Traverse levels) and supplemental data/information (e.g. soil moisture) in order to refine the monitoring process.

3.5 Response Actions

3.5.1 Overview

Mitigation and Preparation are fundamental during the Normal Conditions in order to build resilience and lessen the impacts of a drought event as discussed in Section 3.1.6. However, when a drought event occurs response measures will be implemented to ensure the supply of water is continued and to limit negative health, social and economic impacts of a drought.

The drought response actions are based on the initial work of the *PVWC Drought Management Plan Study* and further refined with the Drought Plan Working Group.

During each Drought Stage the PVWC may restrict water supply up to each threshold as indicated in Table 3-6. Normal conditions account for a reduction of 5 percent as part of continued conservation efforts. If demand is greater than supply and the stated reductions are insufficient water will be proportionally shared as per Section 3.1.5. Each Customer is responsible for enacting response plans which determine how water will be used within their jurisdiction in response to these reductions.

	Overall Water Reduction
Normal Conditions	Up to 5%
Moderate Drought Stage	5% to 10%
Severe Drought Stage	10% to 25%
Extreme Drought Stage	25% to 30%

Table 3-6: PVWC Drought Response Water Reductions

3.5.2 Drought Response

When Monitoring measures indicate conditions are leading to a drought event the following response actions will be implemented:

1. MBSD will alert PVWC Management when monitoring data comes within 15% of triggering a drought stage:
 - PVWC Management and MBSD will review additional upstream data and monitor relevant monitoring data or triggers.
 - PVWC Management will alert PVWC Drought Committee of conditions.
2. PVWC Drought Committee will convene and review data. When conditions warrant, PVWC Drought Committee will make recommendation to PVWC Board to make a drought stage declaration.
3. If Drought Stage is declared the PVWC Board will initiate the formation of Drought Command Centre (DCC)⁵:
 - The DCC will be headquartered at the PVWC Altona office.
 - PVWC appointed Emergency Coordinator will be engaged.
 - The DCC will serve as communications “hub” during drought event.
 - The DCC will facilitate internal and external communication of Drought Stage declaration to Customers.
 - The DCC will be established using the incident command system (ICS) format
4. Internal Communication:
 - The DCC will immediately alert Customers and Manitoba EMO of drought declaration.
 - Internal communication between Customers, the Drought Committee and Manitoba EMO will be carried out as detailed per their local drought plan and/or emergency plan.
 - PVWC Customers will communicate directly with rate-payers via social media and other established forms of communication according to the local drought plan.
 - Municipal contact will generally occur with the Customer’s Municipal Emergency Coordinator (MEC), or equivalent as established in the local drought plan.

⁵ The DCC will be established based on the ICS-Type Structure, as outlined in the Manitoba EMO *Municipal Emergency Plan template*.

5. External Communication:
 - The DCC will prepare a press release for drought stage declaration and release to media outlets for public dissemination.
6. Water reductions will be implemented as outlined in Table 3-6.
7. The PVWC will continually monitor water sources as outlined in Table 3-7 through Table 3-10.
8. Communication and meetings with Groups and Committees will occur as outlined in Tables Table 3-7 through Table 3-10.
9. PVWC Customers will refer to their local drought plan and communicate with Manitoba EMO regarding local emergency operations and collaboration as detailed in their local drought plan:
 - Emergency Management framework will be followed by municipalities as per their local drought plan and local emergency plan.

3.5.3 Communication and Reporting

Communication is a vital component of drought response and mitigation, as public buy-in is ultimately the determining factor of the Plan's success. Communication refers to both "inter" and "intra" communication during drought events. The goal is to facilitate effective, efficient communication with clear messaging in the following ways:

- Within the PVWC organization
- Between PVWC and Member Municipalities (and customers)
- Between PVWVC/Member Municipalities and Provincial Departments
- Between PVWC/Member Municipalities and the public/media.

In order to ensure clear, concise and consistent messaging, the PVWC will serve as the "hub" for communication during a declared drought event. While the flow of information regarding a Drought Stage declaration is generally linear (as shown in Figure 8), day-to-day communication leading up to, and during, a drought event will be more fluid.

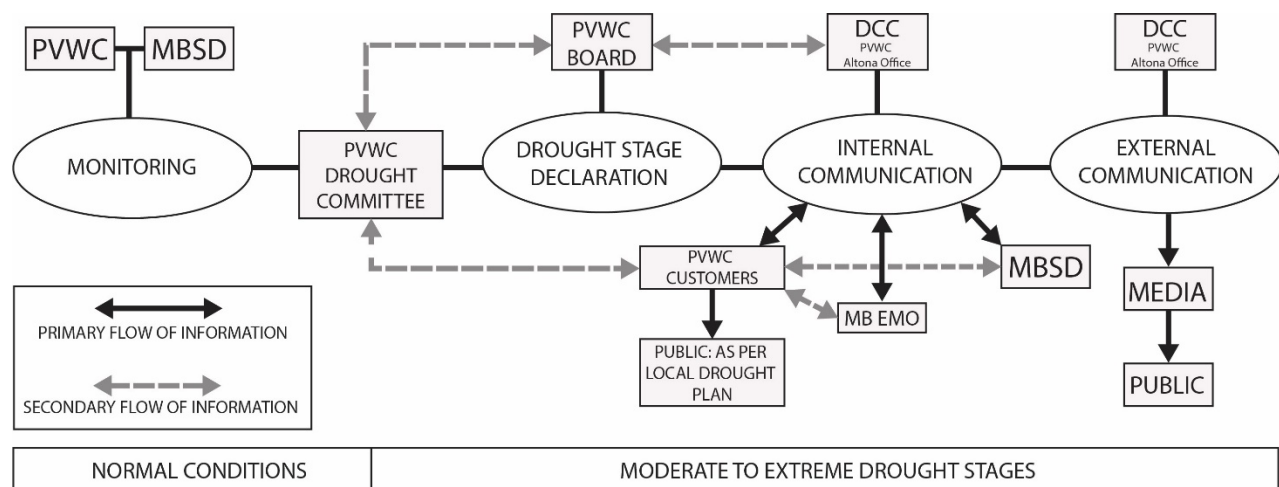


Figure 8: Communication Flow for Drought Monitoring and Drought Stage Declaration

Table 3-7 through Table 3-10 detail the monitoring and reporting steps for each Drought Stage.

Normal Conditions Monitoring and Reporting		
Entity	Action	Frequency
PVWC	Correspond with Basin Drought Assessment Group	Bi-Annual
PVWC	Meet with Red River Basin Commission Water Supply Working Group	Bi-Annual
PVWC	PVWC Drought Committee Meeting	Annually
PVWC	Update PVWC Drought Status Report	Annually
PVWC	Meet with Provincial departments (Sustainable Development, Infrastructure, Drinking Water Office, Chief Health	As required
PVWC	Review / Monitor: • Water source monitoring points • Water demands, trends, storage volumes • Water quality and treatment capacity	Weekly
Municipality	• Communicate water demand needs to the PVWC (new connections, infrastructure changes, shut-downs, peak water needs) • Share system information on storage levels, flows, pressures, etc. at key points in the distribution	Quarterly
Media and Communication		
PVWC	News Release to communicate any pertinent information	As required

Frequency may be increased at the discretion of the Group, Committee or responsible authority

Table 3-7: Normal Conditions Monitoring, Communication and Reporting

Moderate Drought Stage Monitoring and Reporting		
Entity	Action	Frequency
PVWC	Correspond with Basin Drought Assessment Group	Quarterly
PVWC	Meet with Red River Basin Commission Water Supply Working Group	Quarterly
PVWC	Update PVWC Drought Status Report	Quarterly
PVWC	Meet with irrigators and other large water users to discuss reduction strategies and restrictions	At least once
PVWC	Meet with Provincial departments (Sustainable Development, Infrastructure, Drinking Water Office, Chief Health	As required
PVWC	PVWC Drought Committee Meeting	Monthly
PVWC	Review / Monitor: • Water source monitoring points • Water demands, trends, storage volumes • Water quality and treatment capacity • System water demands, trends, ADD, PDD • Water storage volumes in complete system	Weekly
Media and Communication		
PVWC	News Release to communicate any pertinent information - Drought Stage declaration, updates to members, regional message, demand reduction strategies	As required (at least monthly)
PVWC	Notify Manitoba EMO of Drought Stage declaration	As required

Frequency may be increased at the discretion of the Group, Committee or responsible authority

Table 3-8: Moderate Drought Stage Monitoring, Communication and Reporting

Severe Drought Stage Monitoring and Reporting		
Entity	Action	Frequency
PVWC	Correspond with Basin Drought Assessment Group	Weekly
PVWC	Meet with Red River Basin Commission Water Supply Working Group	Bi-Weekly
PVWC	Update PVWC Drought Status Report	Weekly
PVWC	Meet with irrigators and other large water users to discuss reduction strategies and restrictions	At least once
PVWC	Meet with Provincial departments (Sustainable Development, MB EMO, Infrastructure, Drinking Water Office, Chi	As required
PVWC	Advocate to Minister regarding declaration of "serious water shortage" under the <i>Water Protection Act</i>	As required
PVWC	PVWC Drought Committee Meeting	Weekly
PVWC	Review / Monitor:	Daily
	· Water source monitoring points	
	· Water demands, trends, storage volumes	
	· Water quality and treatment capacity	
	· System water demands, trends, ADD, PDD	
	· Water storage volumes in complete system	
Media and Communication		
PVWC	News Release to communicate any pertinent information - Drought Stage declaration, updates to members, regional message, demand reduction strategies	As required (at least bi-weekly)
PVWC	Notify Manitoba EMO of Drought Stage declaration	As required
MB EMO	Public Alerting of Drought-related emergency messages	As required

Frequency may be increased at the discretion of the Group, Committee or responsible authority

Table 3-9: Severe Drought Stage Monitoring, Communication and Reporting

Extreme Drought Stage Monitoring and Reporting		
Entity	Action	Frequency
PVWC	Correspond with Basin Drought Assessment Group	Weekly
PVWC	Meet with Red River Basin Commission Water Supply Working Group	Bi-Weekly
PVWC	Update PVWC Drought Status Report	Daily
PVWC	Meet with irrigators and other large water users to discuss reduction strategies and restrictions	At least once
PVWC	Meet with Provincial departments (Sustainable Development, MBEMO, Infrastructure, Drinking Water Office, Chi	As required
PVWC	Advocate to Minister regarding declaration of "serious water shortage" under the <i>Water Protection Act</i>	As required
PVWC	PVWC Drought Committee Meeting	Daily
PVWC	Review / Monitor:	Daily
	· Water source monitoring points	
	· Water demands, trends, storage volumes	
	· Water quality and treatment capacity	
	· System water demands, trends, ADD, PDD	
	· Water storage volumes in complete system	
Media and Communication		
PVWC	News Release to communicate any pertinent information - Drought Stage declaration, updates to members, regional message, demand reduction strategies	As required (at least weekly)
PVWC	Notify Manitoba EMO of Drought Stage declaration	As required
MB EMO	Public Alerting of Drought-related emergency messages	As required

Frequency may be increased at the discretion of the Group, Committee or responsible authority

Table 3-10: Extreme Drought Stage Monitoring, Communication and Reporting

3.6 RECOVERY

Following a drought event, when conditions return to Normal Conditions, or recede to the Moderate Stage after a more serious event, the recovery process may begin. A review, as detailed in Section 1.5 should be undertaken. In the post-drought period the PVWC will ensure infrastructure is in suitable shape to accommodate a return to normal operations. Temporary measures, such as above-ground pipelines, may need to be removed and a prolonged drought may have had substantial impact on the PVWC's finances. Elements for consideration would include:

- Continually pursuing mitigation components of the Plan
- Continually testing and refining monitoring and triggering mechanisms
- Maintain and monitor Water Budgets for continued relevance
- Review resources and financial plans related to the drought framework

The PVWC will work collaboratively with their Customers in order to develop plans of recovery. As part of the Recovery Phase the PVWC and Customers will

- Hold a de-brief session
- Conduct an "after-action report".

APPENDIX A: DEFINITIONS AND ACRONYMS

DCC: Drought Command Centre

EMO: Manitoba Emergency Measures Organization

MBSD: Manitoba Sustainable Development

MEC: Municipal Emergency Coordinator

MI: Manitoba Infrastructure

PSI: Pounds per square inch – unit of measuring water pressure

PVWC: Pembina Valley Water Co-Op

Drought Mitigation involves proactive action and planning to reduce the long-term risks and potential impacts of drought events, by identifying principle activities and possible susceptibilities and developing mitigation actions and programs to reduce these vulnerabilities to drought.

Drought Monitoring involves utilizing primary and secondary data regarding water supply levels at PVWC facilities as well as upstream water sources.

Drought Preparedness refers to the directed policies, plans and actions which must be implemented prior to a drought event occurring in order to increase forecasting accuracy and ensure the Plan is fully implementable and the PVWC is fully prepared to respond during a drought event.

Drought Recovery is the process of returning operations to a normal state when a drought event has dissipated in order to restore or improve pre-drought conditions and working to further mitigate the impacts of any future drought events.

Drought Response encompasses the actions taken during a drought event to reduce its immediate impacts on environment or society through enactive temporary adjustments to normal practices until normal climatic conditions return. Drought response also includes the communication process used to convey information internally and externally.

APPENDIX B: PREPAREDNESS PRIORITIZATION

Item	Responsibility	Timeframe
Update Emergency Plan	PVWC	0-6 months
Perform Hazard Analysis	PVWC	0-6 months
Establish mechanism to distribute water according to reductions	PVWC	0-6 months
Identify any emergency sources of water that may be available to use during drought events	PVWC	0-6 months
Training and Development of emergency personnel	PVWC	0-12 months
Establish criteria for evaluating proposed new users and uses	PVWC	0-12 months
Formalize Drought Preparedness Matrix	PVWC	0-12 months
Prioritize mitigation and joint-mitigation efforts according to timeframe, feasibility and effectiveness	PVWC	6-18 months
Collect and analyze detailed data	PVWC	6-18 months
Perform water audit(s) to identify system weakness and losses	PVWC	12-18 months
Ensure data is compatible format	PVWC DC	12-18 months
Procure communication software/hardware for internal communication	PVWC DC	12-24 months
Establish PVWC Drought Committee	Joint PVWC-Customer	0-2 months
Work with Public Utilities Board on temporary rate increases	Joint PVWC-Customer	6-12 months
Establish Demand Management Strategy	Joint PVWC-Customer	6-18 months
Establish Drought Funding Approach	Joint PVWC-Customer	12-24 months
Refine monitoring process for upstream conditions and supplemental data	Joint PVWC-Province	0-6 months
Review and update monitoring and triggering elements	Joint PVWC-Province	0-6 months
Further refine measurement/triggering mechanisms	Joint PVWC-Province	0-12 months
Calculate storage capacity, establish monitoring regimen and triggering levels for Reservoirs	Joint PVWC-Province	6-18 months

The above items will be reviewed with the Drought Plan Working Group after the Plan is implemented.

APPENDIX C: SUMMARY OF ROLES AND RESPONSIBILITIES

Entity	Role in PVWC Drought Plan
PVWC	<ul style="list-style-type: none"> • Provide water to Customers • Analysis of monitoring data • Host EOC and facilitate PVWC DC • Implement the Drought Plan
PVWC Drought Committee	<ul style="list-style-type: none"> • Implement the Drought Plan • Make recommendation on Drought Stage Declaration to Board • Maintain Drought Status Report • Review Plan every 4 years and post drought event
PVWC Board	<ul style="list-style-type: none"> • Declare Drought Stage based on DC recommendation • Initiate EOC upon Drought Stage declaration • Provide support to PVWC • Review Plan every 4 years and post drought event
PVWC Drought Plan Working Group	<ul style="list-style-type: none"> • Assisting PVWC with Drought Preparedness
Manitoba Sustainable Development (MBSD)	<ul style="list-style-type: none"> • Provide monitoring data • Analysis of monitoring data • Participate in joint mitigation and preparedness
Manitoba Emergency Measures Organization (EMO)	<ul style="list-style-type: none"> • Provide support regarding emergency measures • Take active role when state of emergency is declared
Customers	<ul style="list-style-type: none"> • Implement LDC • Participate in PVWC DC • Participate in joint mitigation and joint preparedness

The Drought Plan Working Group played an integral role in developing the Drought Plan and will continue to work with the PVWC on Plan Implementation and Preparedness items. It is anticipated the Working Group will meet several times over a 6 month period after the Plan is adopted in order to achieve the items noted in **Appendix B**.

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Appendix D

LOCAL DROUGHT PLAN GUIDE

Similar to the PVWC Drought Plan, the following elements could be essential to a local drought plan:

- Monitoring
- Mitigation
- Preparedness
- Response
- Recovery

All communities in Manitoba will be required to adopt business continuity plans as part of Section 11 of the *Local Authorities Emergency Planning and Preparedness Regulation*. The local drought plan may serve as a component of this planning.

Public engagement and stakeholder consultation should be fully integrated into the preparation of any local drought plan. The following are suggested elements to be included in the local drought plan which should be prepared by each of the PVWC's Customers:

1. Monitoring

Customers may require varying levels of Monitoring in their local drought plan. If 100% of a municipality's water is obtained from the PVWC the only monitoring required may be in relation to the impacts of a drought, such as soil moisture. However, if a Customer receives water from other surface or groundwater sources it is highly recommended that a monitoring and triggering process be established.

2. Mitigation

Mitigation is a key component of drought planning. The following items represent mitigation ideas identified by the Drought Plan Working Group which would fall under municipal/customer jurisdiction.

Joint-mitigation efforts as identified in PVWC Drought Plan

The PVWC Drought Plan identifies several joint-mitigation efforts that will require collaboration between the Co-Op and Customers. These are strongly encouraged to be included in any corresponding plans.

Promote conservation through action

In order to achieve water conservation targets and increase public awareness, the PVWC should take an active role in promoting water conservation through rebates, subsidies and advocating for standards.

Potential actions based on best practices and identified in the Working Group sessions include:

- Encouraging use of rain barrels for collecting water by offering discounted items;
- Offering rebates and incentives for replacements and retrofits such as low-flow plumbing fixtures and appliances, drought-resistant planting and turf, or partnering with Manitoba Hydro to encourage PVWC households to utilize existing programs;
- Offering rebates and incentives for achieving water reduction goals;
- Offering free or discounted water audits for residential, commercial, industrial or institutional properties;

- Working with Member Municipalities and other levels of jurisdiction to encourage water efficient features in new home construction and renovations, such as low-flow plumbing fixtures, greywater recycling and drought-resistant landscaping.

Water bills as an educational tool

Residential and commercial water bills could be utilized to help educate the public on water use and conservation goals. For example, water bills could detail the customers water use compared to the average per-capita water use and identify the conservation goal set for per capita water use.

3. Preparedness

Preparedness is a key component of drought planning. The following items represent mitigation ideas identified by the Drought Plan Working Group which would fall under municipal/customer jurisdiction.

Joint PVWC-Municipal Responsibilities as identified in PVWC Drought Plan

The PVWC Drought Plan identifies several joint PVWC-Customer Responsibilities that will require collaboration between the Co-Op and Member Municipalities. These are strongly encouraged to be included in any corresponding plans.

Update Municipal Emergency Plan

The PVWC's municipal Customers should update their existing emergency plans to include drought-related actions. The local emergency plans should refer to this Plan in the case of a drought event and include the addition of drought-specific items to the "resources and capabilities" sections including:

- Pumping companies
- Pipe distributors
- Drilling companies

Section 11 of the *Local Authorities Emergency Planning and Preparedness Regulation* mandates that all municipalities in Manitoba must have a "business continuity plan" in place by 2020. Planning for droughts, and ensuring water can be delivered during drought events is a component of continuity planning.

Establish Enforcement By-laws

Each municipal Customer should establish a local by-law to provide an enforcement mechanism to address any failure to comply with the water restrictions outlined in Section 3.5 of this Plan.

Establish Water Budgets for allocation during Drought Stages

The PVWC's response actions include potential supply reductions identified for each Drought Stage. Customers should establish Water Budgets for implementation during each Drought Stage which determine the amount of water consumption allotted for essential uses, residential uses and other uses. The Water Budget will also ultimately determine which uses may not receive water during a water shortage where demand exceeds supply.

Establish Zones/Schedules for use during water restrictions

Beginning in the Moderate Drought Stage, restrictions are introduced on certain activities such as lawn watering. Municipalities should establish criteria for use during restrictions, including which days uses

(e.g. splash pads) will be operational or watering can occur, and dividing the municipality into zones for water use.

Hazard Analysis

Customers may incorporate a Hazard Analysis for each Drought Stage in order to predict potential impacts of each stage on infrastructure, quality of life and other considerations. The Manitoba Emergency Measures Organization's "APPENDIX A – Hazard Analysis" can serve as the template for this exercise.

Perform water audit(s) to identify system weakness and losses

Performing water audits will help identify water losses in the system and establish baselines for future evaluation.

Engage local industries if industrial reductions are contemplated

One approach to reducing water consumption found in drought plans is to limit industrial operations as Drought Stages progress. If this approach is contemplated, it is crucial that local industries be consulted as part of the local drought plan preparation process.

Establish framework for reducing industrial operations in Drought Stages

Customers will need to determine how restrictions on industrial operations will work in Drought Stages if industrial reductions are contemplated.

4. Response

Municipalities may consider using the priorities of use established in the *Water Rights Act* to form their responses. These include:

1. Domestic purposes
2. Municipal purposes
3. Agricultural purposes
4. Industrial purposes
5. Irrigation purposes
6. Other purposes

The following tables outline potential municipal response actions during each Drought Stage. These may be used as general guidelines for the preparation of a local drought plan. Each municipality will ultimately need to determine the response actions that best reflect their local conditions. Any water users which will be impacted by reductions should be consulted as part of the drought plan preparation process. General tenets of the response actions could include:

- Restricting discretionary uses prior to essential uses
- Preserving day-to-day residential water use as much as possible
- Making decisions that affect small groups of people and special interests prior to the general population
- Limiting the economic impacts of drought

Normal Conditions	
Peak Water Use Reduction Target: 5%	
Component	Action
Residential/Commercial	No restriction
Industrial	No restriction
Landscape Watering	Voluntary Odd/Even watering
Garden Watering (food production)	No restriction - voluntary reduction
Other Outdoor/Leisure Uses	No restriction
Vehicle Washing	No restriction
Agriculture	No restriction
Construction	No restriction
Operations	No restriction
New Plantings/Landscaping	No restriction
Lodging/Restaurant	No restriction

Moderate Drought Stage	
Peak Water Use Reduction Target: 10%	
Component	Action
Residential/Commercial	Voluntary conservation request
Industrial	Voluntary conservation request
Landscape Watering	Mandatory Odd/Even schedule
Garden Watering (food production)	Voluntary Odd/Even schedule
Other Outdoor/Leisure Uses	Mandatory maximum 3 days per week schedule at splash pads
Vehicle Washing	Voluntary reduction
Agriculture	Voluntary conservation request
Construction	Metered use
Operations	Hydrant flushing only if necessary
New Plantings/Landscaping	No restriction - watering restrictions apply
Lodging/Restaurant	Voluntary signage/communication, voluntary serve water on request, voluntary laundry reduction

Severe Drought Stage	
Peak Water Use Reduction Target: 25%	
PVWC to implement temporary rate increase of 15%	
Component	Action
Residential/Commercial	Voluntary conservation request
Industrial	Non-essential operations not permitted
Industrial: Water rich	Voluntary restriction of water consumption
Landscape Watering	Mandatory maximum 1 day per week schedule
Garden Watering (food production)	Mandatory Odd/Even schedule
Other Outdoor/Leisure Uses	Mandatory maximum 1 day per week schedule at splash pads. No pool filling. Any activities which result in water spraying/draining onto a street or public right-of way are not permitted
Vehicle Washing	Not permitted at private residences: commercial car washes only
Agriculture	Spraying and Irrigation not permitted from PVWC sources. Livestock expansion not permitted
Construction	Metered use - hours of operation may be reduced
Operations	Hydrant flushing not permitted
New Plantings/Landscaping	Not Permitted
Lodging/Restaurant	Voluntary signage/communication, mandatory serve water on request, voluntary laundry reduction

Extreme Drought Stage	
Peak Water Use Reduction Target: 30% or greater	
PVWC to implement temporary rate increase of 20%	
Component	Action
Residential/Commercial	Voluntary conservation request
Industrial	Non-essential operations not permitted, Mandatory restriction to 80% of past water consumption
Industrial: Water rich	Mandatory restriction to 80% of past water consumption
Landscape Watering	Mandatory complete restriction
Garden Watering (food production)	Mandatory maximum 1 day per week schedule
Other Outdoor/Leisure Uses	Mandatory maximum 1 day per week schedule at splash pads. No pool filling. Any activities which result in water spraying/draining onto a street or public right-of way are not permitted
Vehicle Washing	Not permitted at private residences. Mandatory reduction of hours of operation by 20% at commercial car washes
Agriculture	Spraying and Irrigation not permitted from PVWC sources. Livestock expansion not permitted
Construction	Not permitted
Operations	Hydrant flushing not permitted
New Plantings/Landscaping	Not Permitted
Lodging/Restaurant	Mandatory signage/communication, restaurants mandatory serve water on request, voluntary laundry reduction

Monitoring and Reporting are key components of Drought Response. The following table demonstrate potential actions for inclusion in local drought plans:

Normal Conditions Monitoring and Reporting		
Entity	Action	Frequency
Municipality	<ul style="list-style-type: none"> • Communicate water demand needs to the PVWC (new connections, infrastructure changes, shut-downs, peak water needs) • Share system information on storage levels, flows, pressures, etc. at key points in the distribution 	Quarterly
Moderate Drought Stage Monitoring and Reporting		
Entity	Action	Frequency
Municipality	<ul style="list-style-type: none"> • Communicate water demand needs to the PVWC (new connections, infrastructure changes, shut-downs, peak water needs) • Share system information on storage levels, flows, pressures, etc. at key points in the distribution 	Monthly
Media and Public Communication		
Municipality	Inserts in water bills, social media updates corresponding with PVWC releases	As required
Severe Drought Stage Monitoring and Reporting		
Entity	Action	Frequency
Municipality	<ul style="list-style-type: none"> • Communicate water demand needs to the PVWC (new connections, infrastructure changes, shut-downs, peak water needs) • Share system information on storage levels, flows, pressures, etc. at key points in the distribution 	Weekly
Media and Public Communication		
Municipality	Inserts in water bills, social media updates corresponding with PVWC releases	As required
Extreme Drought Stage Monitoring and Reporting		
Entity	Action	Frequency
Municipality	<ul style="list-style-type: none"> • Communicate water demand needs to the PVWC (new connections, infrastructure changes, shut-downs, peak water needs) • Share system information on storage levels, flows, pressures, etc. at key points in the distribution 	Weekly
Media and Public Communication		
Municipality	Inserts in water bills, social media updates corresponding with PVWC releases	As required
Municipality	Coordinate with PVWC and Manitoba EMO - Declare local state of emergency if necessary, Advocate for Provincial state of emergency, if necessary	As required

Frequency may be increased at the discretion of the Group, Committee or responsible authority

5. Recovery

When a drought event is over, or conditions reduce from more severe to less severe Drought Stages plans of recover should be established and implemented. Municipalities should survey any damage to local ecosystems or agricultural lands and take stock of any impacts on the local economy. Municipalities should collaborate with the PVWC on ensuring infrastructure and delivery networks are able to operate under Normal Conditions and create detailed recovery plans which to address any damages/impacts of the drought event.

APPENDIX E: KEY PLANS REVIEWED

American Water Works Association. (2011) *Drought Preparedness and Response: Manual of Water Supply Practices (M60)*.

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Province of British Columbia - Ministry of Environment and Climate Change Strategy. (2016) *Dealing with Drought: A Handbook for Water Suppliers in British Columbia*.

Province of British Columbia - Deputy Ministers' Committee on Drought. (2018) *British Columbia Drought Response Plan*.

Province of Manitoba – Manitoba Sustainable Development. (2016) *Manitoba Drought Management Strategy*.

