Herbert Surface Water Testing Protocol

Final Report March 15, 2018

Produced by Swift Current Creek Watershed Stewards







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**Executive Summary**

The Herbert Source Water Protection Plan Committee was formed to ensure that residents of the town and water users will have a safe and abundant supply of drinking water now and into the long term future. The committee identified the risks to both of the surface water and ground water that make up the town’s water supply. After the risks were identified, the committee then scored the likelihood of the event happening and the consequences of the event after it happened. These scores were then combined to determine the rankings for each of the potential risks identified. Once the potential risks of contamination to the water supply were ranked, management actions to eliminate or mitigate the risks were identified.

One of the potential risks that were identified by the planning committee was that use of surface water to meet water demands and the issues that it creates for the Reverse Osmosis System at Herbert’s Water Treatment Plant. The management actions that were identified to eliminate or mitigate this risk were the development of a water testing regimen and the development of a water use plan.

After consultation with the committee and water quality scientists the following water quality testing regimen was created. This plan sets out the parameters to be tested and the testing locations to create a regimen that Herbert can use to fully understand the quality of the surface water going into the treatment plant. This plan when used in conjunction with the water use plan developed will allow Herbert to create blends of surface and ground water that meet supply needs, maintain good quality water and allow for efficient Water Treatment Plant operation.

1. **Background**

In late 2016 the Swift Current Creek Watershed Stewards (SCCWS) were contracted by the Water Security Agency to perform Risk Assessments of the source water for communities in southwest Saskatchewan. Assessments completed on the source water of the Town of Herbert showed several risk factors and that a Source Water Protection Plan (SWPP) for the town would be beneficial. After a presentation made to Herbert Town Council by SCCWS, they voted to undertake SWPP. At the organizational meeting of the SWPP Committee it was decided that before the planning process could start a regimen of testing the surface water source for quality factors be implemented to determine issues with the surface sources. After the original testing regimen was completed, the SWPP Committee determined that an ongoing water quality testing regimen needed to be developed to help Herbert’s Water Treatment Plant (WTP) make decisions regarding how much of each water source to use at a given time to ensure that there is a safe and abundant supply of good quality water for town residents.

Herbert uses both surface water and ground water sources for its water supply. The water supply had been surface water only until 2011 when wells were developed and the WTP was updated to treat ground water. Unfortunately the wells cannot supply enough good quality water to meet the demands of the town during periods of peak demand, so surface water is added to the ground water to meet supply needs. This however causes issues with the WTP as organic matter in the surface water causes filters in the reverse osmosis (RO) system to become plugged and inoperable.

The surface water is pumped into the WTP from a small reservoir north of the town, which for the purpose of this report we will call the Herbert Dug-out. The water in the dug-out is in turn pumped from an Agriculture and Agri-Food Canada (AAFC) reservoir, called the Herbert Reservoir six kilometres west of town via pipeline. The dug-out is filled from the Herbert Reservoir two or three times a year depending on the water demands of the town. The Herbert Reservoir is also used for irrigation with a number of center pivot irrigation systems that pump water out of the reservoir. There is a small amount of local run off into the Herbert Reservoir; however most of the water in this reservoir is moved from Highfield Dam with the water conveyed via the Herbert Main Canal. The Herbert Main Canal was built in 1953 to move water from Highfield Dam to Herbert Reservoir as efforts to pump water from the newly established Rush Lake Irrigation Project (RLIP) to the Herbert Reservoir were unsuccessful. The water in this canal is also used for flood irrigation in the RLIP in late May and early June of each year. There was irrigation from this canal using mostly wheel move and hand move systems, but at this point there is no irrigation water taken from the canal.

The Herbert Main Canal runs approximately 26 kilometres from Highfield Dam to the Herbert Reservoir, mostly through pasture land with some crop and tame forage land included. Highfield Dam is on the Rush Lake Creek which accounts for most of the water in the dam. If the water level in Highfield Dam is not sufficient for the RLIP intensive irrigation, irrigation from the Herbert Reservoir and the Town of Herbert’s water needs; it can be augmented with water from the Swift Current Creek Watershed. This water is moved via the Swift Current Main Canal which gets water from the Swift Current Creek south of Swift Current. This canal is 30 kilometres long with a mix of cropland, pasture and tame forage adjacent to it. This canal also supplies water for the Waldeck Irrigation Project and some other small irrigation projects. Water Security Agency records show that Highfield Dam water levels have not been augmented by water from the Swift Current Creek Watershed since 2010, however current low rainfall amounts may require augmentation in the near future.

Herbert is located in the Rush Lake Sub-Basin which is part of the Old Wives Watershed. The possible involvement of water from the Swift Current Creek Watershed and the risks involved with moving water from watershed to watershed had the potential to widen the scope of the Herbert SWPP Committee to the point where it could overwhelm the committee with a large number of risks that may or may not be applicable to protecting Herbert’s source water. This increased the possibility that a plan that met the specific needs of the Town of Herbert would not be completed.

Although AAFC has been involved in all aspects of the development of the system of waterbodies and water conveyance systems to get water to the WTP, they have not implemented any regimen of water quality testing in the system. Water Security Agency and the Town of Herbert also have not done such widespread water testing as well, so there is limited historical data available to aid in the development of the Herbert SWPP Water Testing Protocol.

1. **Water Quality Factors**

Organic matter is the most important downside to using of surface water in the WTP. Filters within the RO system used by the WTP become plugged with this organic matter, reducing the effectiveness of the plant and increasing operating costs to replace the filters of the RO systems. SCCWS consulted Water Quality Scientist John Mark Davies of Water Security Agency to discuss what factors should be included in this project. After much back and forth discussion with John Mark, it was agreed that the water testing regimen must include sampling of the factors that indicate the possibility of organic matter. These factors include chlorophyll levels in the water as well as measurements of oxygen demand such as carbonaceous biochemical oxygen demand (cBOD), chemical oxygen demand (COD) and total organic arbon (TOC). In addition to these tests the water sampling regimen needs to include testing for the parameters that indicate the suitability of the water for drinking water purposes. The most economical monitoring panel that includes the all of the water quality parameters required is the Waste Water/Receiving Water Panel tested by the Saskatchewan Disease Control Laboratory. The parameters that are analyzed in this panel include:

* Bicarbonate
* Biochemical Oxygen Demand (BOD)
* Carbonate
* Chloride
* Conductivity
* Magnesium
* Nitrate-N
* pH
* Sulfate
* Total and Phenol Alkalinity
* Total Hardness
* Total Kjeldahl Nitrogen
* Total Phosphorous
* Total Nitrogen
* Dissolved Oxygen Carbon
* MPN (Total coliforms and *E. coli*)
* Ortho-Phosphorous
* Suspended Solids
* Total Dissolved Solids
* Fluoride

1. **Water Sampling Locations**

To get Water Quality information to create a proper water usage plan sampling must be completed at locations that have significance to the water quality and quantity of source water for the Town of Herbert. The Herbert Source Water Protection Planning Committee decided on the following locations for the reasons indicated:

* Swift Current Main Canal just before it empties into Highfield Dam. This will help to determine the quality of the water coming into the system from the Swift Current Creek Watershed and its impact on the quality of source water. This location is required only if there is a significant amount of water that is transferred from the Swift Current Creek Watershed to Highfield Dam.
* Rush Lake Creek just before it empties into Highfield Dam. This will help to determine the quality of the water coming into the system from Rush Lake Creek south of Highfield Dam. This location is required as long as there is a significant amount of water from the Rush Lake Creek flowing into Highfield Dam.
* Highfield Dam. To determine if there are quality issues from the dam itself and to determine quality before water is transported to the AAFC Herbert Reservoir via Herbert Main Canal. Sampling at Highfield Dam should be completed at the south and north ends each to determine if there are differences in water quality between these areas in the reservoir.
* Herbert Reservoir. To determine impact of water coming into reservoir from Main Canal and possibly overland run-off into the reservoir and canal. Sampling at the Herbert Reservoir should be completed at the west and east ends of the reservoir to determine if there are differences in water quality in those areas in the reservoir
* Herbert Dug-out where the intake is located. To determine impact of water storage in dug-out on water quality and to determine the quality of the water that is entering the WTP.

1. **Timing of Water Sampling**

One of the end products of the water sampling protocol is the development of a Water Use Plan for the Town of Herbert. Therefore water samples need to be taken at times that provides the best information to create this plan. Not all water bodies need to be tested at the same time. Using information gathered during the Herbert Source Water Protection Planning Committee sampling should be completed at the following times at sampling locations.

* Swift Current Main Canal just before it empties into Highfield Dam only needs to be tested if there is water flowing from the Swift Current Creek Watershed to Highfield Dam. This will determine the impact of water coming in from the Swift Current Creek Watershed on water quality of Herbert’s source water.
* Rush Lake Creek just before it empties into Highfield Dam needs to be tested when water is flowing into Highfield Dam. The creek flow is dependent on run-off and rainfall. This will determine the impact of water coming in from the Rush Lake Sub-Basin below Highfield Dam on water quality of Herbert’s source water.
* Highfield Dam should be tested starting in spring as soon as it is safe to get samples. Sampling needs to be done on a monthly basis until fall when it is no longer safe to do so. This will show the impact of water coming in from Highfield Dam on water quality of Herbert’s source water. This will set a baseline of water quality in Highfield Dam and allow comparisons to water quality in Herbert Reservoir to determine if there are impacts of running water in the Herbert Main Canal from Highfield Dam to Herbert Reservoir.
* Herbert Reservoir should be tested starting in spring as soon as it is safe to get samples. Sampling needs to be done on a monthly basis until fall when it is no longer safe to do so. This will give a baseline of water quality and will allow for comparison to water quality after water is ran into Herbert Reservoir from Highfield Dam in the Herbert Main Canal.
* The Herbert Reservoir also should be tested before water is run into it from the Herbert Main Canal. Testing should also take place while water is being run and immediately after water is done running into the reservoir from the Herbert Main Canal. This will show the impact of water coming in from Highfield Dam on water quality of Herbert’s source water. This will set a baseline of water quality in Highfield Dam and determine if there are water quality impacts on the Herbert Reservoir by running water in the Herbert Main Canal from Highfield Dam to Herbert Reservoir.
* The Herbert Dug-out should be tested monthly as this is where water is directly drawn from into the WTP. Testing should also be done before and after water is pumped into the dug-out from the Reservoir. This will help determine the impact of water quality in the Herbert Dug-out when getting water from the Herbert Reservoir.

1. **Table 1: Proposed Water Testing Schedule**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Swift Current Main Canal | Rush Lake Creek | Highfield Dam | Herbert Reservoir | Herbert Dug-out |
| January |  |  |  |  | Yes and before and after water pumped in from Herbert Reservoir |
| February |  |  |  |  | Yes and before and after water pumped in from Herbert Reservoir |
| March |  |  |  |  | Yes and before and after water pumped in from Herbert Reservoir |
| April |  |  |  |  | Yes and before and after water pumped in from Herbert Reservoir |
| May | If water running into Highfield Dam | If water running into Highfield Dam | Yes  Samples at south and north ends of dam | Yes and before and during water running  Samples from east and west ends of reservoir | Yes and before and after water pumped in from Herbert Reservoir |
| June | If water running into Highfield Dam | If water running into Highfield Dam | Yes  Samples at south and north ends of dam | Yes and during and after water running  Samples from east and west ends of reservoir | Yes and before and after water pumped in from Herbert Reservoir |
| July | If water running into Highfield Dam | If water running into Highfield Dam | Yes  Samples at south and north ends of dam | Yes and before and during water running  Samples from east and west ends of reservoir | Yes and before and after water pumped in from Herbert Reservoir |

**Table 1 continued: Proposed Water Testing Schedule**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Swift Current Main Canal | Rush Lake Creek | Highfield Dam | Herbert Reservoir | Herbert Dug-out |
| September | If water running into Highfield Dam | If water running into Highfield Dam | Yes  Samples at south and north ends of dam | Yes  Samples from east and west ends of reservoir | Yes and before and after water pumped in from Herbert Reservoir |
| October |  |  | Yes  Samples at south and north ends of dam | Yes  Samples from east and west ends of reservoir | Yes and before and after water pumped in from Herbert Reservoir |
| November |  |  |  |  | Yes and before and after water pumped in from Herbert Reservoir |
| December |  |  |  |  | Yes and before and after water pumped in from Herbert Reservoir |

**6. Conclusion**

The Town of Herbert formed a committee to undertake a Source Water Protection Plan. The source Water Protection planning process identified the potential risks to Herbert’s source water. Once the risks were identified, the likelihood and consequence of these risks were determined and risk management actions to eliminate or mitigate these risks were identified. One of the risks identified was the use of surface water and the issues it causes with the RO system at the WTP. Two of the management actions to eliminate or mitigate these risks were to develop a water quality testing regimen and the creation of a water use plan. The water sampling protocol listed in this report is a preliminary plan based on the needs of Herbert’s WTP to understand the quality of the surface water used in the WTP and how the system that brings water to the Herbert Dug-out affects the quality of the surface water pumped into the WTP. This protocol is a starting point for Herbert to get information on the quality of the surface water that is used by the WTP. As testing continues and the needs of the town evolve, water quality scientists need to be consulted. This will ensure that the testing protocol is still relevant and what changes in parameters tested need to be made to ensure that the testing protocol reflects the needs of the WTP to know what the quality of the surface water going into the plant is.