

Grand River Conservation Authority

Report number: GM-12-21-99

Date: December 17, 2021

To: Members of the Grand River Conservation Authority

Subject: Current Watershed Conditions as of December 8, 2021

Recommendation:

THAT Report Number GM-12-21-99 – Current Watershed Conditions as of December 8, 2021 be received as information.

Summary:

Dry conditions in the first five months of the year affected groundwater recharge, stream flow and reservoir levels. By the end of May, most of the watershed had received only about 70% of normal precipitation. Low water conditions were declared by June and augmentation from the reservoirs increased to reach maximum levels during a dry period in August.

The second five months were quite a bit wetter with September having roughly twice the normal precipitation. There were major storms in September and minor flooding in areas without reservoir control. October continued to be wet, but was also very warm with the average monthly temperature approximately four degrees higher than normal. November saw the return of snow and freezing conditions to the watershed.

Lake Erie continued to be high in 2021, but was below levels in 2020 until November when the average level increased due to higher precipitation in the early fall months.

The upcoming winter forecast is for warm and wet conditions with periodic mid-winter thaws and an active storm track over the lower Great Lakes.

Report:

Precipitation

Annually, precipitation in 2021 was near normal in the southern part of the watershed and slightly below normal in the north. However, total annual precipitation does not tell the whole story of 2021 conditions. Precipitation was split with the first half of the year very dry and the second half very wet.

The first five months were dry. By the end of May, only 70% of normal precipitation was recorded across the watershed. The Shand Dam climate station saw especially dry conditions and recorded only 62% of the long term average up to the end of May with an overall deficit of 132mm. A dry winter and spring can affect water resources beyond their seasons due to reduced groundwater recharge, low wetland water levels and challenges filling reservoirs. These can result in low water levels for an extended period even once normal precipitation returns.

After a dry start to the year, the June to October period was wet with approximately 133% of normal precipitation. Precipitation during the summer months was mostly from convective storms with short bursts of rain over limited areas. September saw a return of watershed wide large storm systems starting with a series of repeated large frontal systems delivering rain, wind and lightning across the watershed. Then a large, multi-day storm event occurred on September

21 and 22nd, which delivered a month's worth of rain to many parts of the watershed over a three day period. Total precipitation in September was over 200mm in parts of the watershed.

Drier conditions returned in November along with mixed precipitation and snow with the first snow survey of this season conducted on November 15. The first week of December has seen all types of precipitation including rain, snow, freezing rain and sleet. Precipitation amounts for December to date, as shown in Table 1, are close to the long term average for the first half of the month.

Table 1: Current monthly precipitation for climate stations across the watershed up to December 8, 2021 including the long term average precipitation for half of December.

Climate Station	Current Month Precipitation (mm)	Long Term Average Precipitation (mm)	Percentage of Long Term Average (%)
Shand	35.8	37.1	97%
Conestogo	37.0	42.4	87%
Guelph	26.7	35.1	76%
Luther	37.2	39.4	94%
Woolwich	27.6	34.8	79%
Laurel	27.1	37.1	73%
Shades	25.6	35.3	72%
Brantford	29.0	28.8	101%

Very high rainfall in September and October is shown in Table 2 by the high percentage of precipitation over the last three months, while the last 12 months show that the overall precipitation for 2021 is close to the long term average. A visual representation of these trends for the Shand climate station is also given in Figure 1.

Table 2: Precipitation trends as a percentage of the long term average over the last 18 months

Climate Station	Last Month	Last 3 Months	Last 6 Months	Last 12 Months	Last 18 Months
Shand	64%	124%	109%	100%	101%
Conestogo	70%	132%	117%	96%	95%
Guelph	65%	145%	133%	110%	111%
Luther	97%	124%	115%	110%	107%
Woolwich	62%	103%	100%	78%	97%
Laurel	59%	144%	136%	101%	102%
Shades	61%	163%	141%	103%	109%
Brantford	78%	164%	130%	104%	108%

Air Temperatures

2021 generally had above normal temperatures, although some months were cooler than others. January started winter with warm temperatures and then February was colder than the long term average. March and April were warm followed by a cool May.

In the summer, July was on the cool side with temperatures about half a degree below the long term average. While August was hot with an average monthly temperature over two degrees above normal. The last part of August saw many days with temperatures over 30 degrees across the watershed.

The transition to fall temperatures started in September with average monthly temperatures near to the long term average. Summer conditions returned in October with the average monthly temperature near four degrees above the long term average. Many days recorded high temperatures in the mid-twenties and overnight lows in the high teens.

Cooler and more seasonal temperatures returned in November bringing frost, freezing conditions and snow. The first week of December was well above the long term average. A visual representation of these trends for the Shand climate station is given in Figure 2.

Groundwater Resources

Groundwater levels in the Provincial Groundwater Monitoring Network and Grand River Conservation Authority monitoring wells across the watershed were analyzed to the end of November and are shown in Figure 3. After very low monitored groundwater levels this past summer, most sites have recovered to their normal levels resulting from above normal fall precipitation.

This past year saw unusually low groundwater conditions that are now returning to normal levels. The spring of 2021 was much drier than usual which resulted in very little groundwater recharge. This in turn resulted in very low groundwater levels throughout the summer months. The low groundwater levels reduced baseflows within cold water streams such as Whitemans Creek and the Eramosa River. High amounts of precipitation received in July and August did not greatly affect groundwater levels as it was largely intercepted, and absorbed, by plant roots as it infiltrated into the ground. Groundwater levels began to recover this fall as plant growth ceased and infiltrating precipitation made its way into the groundwater system.

Figure 4 shows water levels in the Burford overburden monitoring well over the past four years. In 2021, water levels did not follow the normal seasonal pattern with no increase to levels over the winter and spring period. Levels have stayed fairly steady throughout the year with a slight decline over time and then levels started to recover in November.

Lake Erie Water Levels

Lake Erie levels continued to be high in 2021. Throughout most of the year the average lake level at Port Colborne was approximately 0.5m above the long term average and about 0.3m below the same levels in 2020.

Levels started to increase again in November back to similar levels recorded in 2019 and 2020. The average lake level in November was 174.71m, which is 0.71m above the long term average and 0.02m above November 2020. There was a lake surge event on December 6 due to high winds. There was minor flooding in Lake Shore Flood Zone 1 in Haldimand County.

The long range forecast for Lake Erie, Figure 5, is for the lake level to decrease through to the end of the year and then increase again early in 2022. A High Lake Level Conditions Statements remains in effect.

Reservoir Conditions

The large reservoirs were used for both of their main purposes in 2021: flood damage reduction and low flow augmentation.

The reservoirs were filled with snowmelt and rainfall beginning in March. It was a challenge to fill the reservoirs this year due to lower than normal snowmelt and spring precipitation. The augmentation season began early in May and continued right through to September. Augmentation was highest in August. During dry periods, augmentation accounted for upwards

of 80% of flow through Kitchener, 40% of the flow through Brantford and 70% of the flow on the Speed River through Guelph.

Water was taken into storage during the large rainfall events in September and resulted in reducing downstream flood peaks by approximately 50 percent. The reservoirs were actively managed through the fall period to reduce flood peaks and release water to prepare for winter freeze up. As of December 8, the large reservoirs were slightly above their normal operating level due to a large rain event in recent days prior to this report.

The reservoirs will continue to be operated throughout the late fall to stabilize water levels before winter freeze up. Year to date reservoir levels and operating rule curves are shown in Figures 6 and 7 for the four largest reservoirs

Low Water Response

The Grand River Low Water Response Team put the watershed into a Level 1 condition on June 4th due to low precipitation over the previous three months. Although precipitation increased through the next few months, low natural base flows and groundwater levels kept the watershed in a Level 1 condition until October.

Long Range Forecast

Three long range forecasts were consulted for the winter period. All three forecasts are calling for a warm and wet winter season. Temperatures will not be consistent with short periods of cold followed by extended mid-winter thaws. Precipitation will be mixed with an active storm track setting up over the Great Lakes. There is also a high probability of heavy lake effect snow events due to the warm lake waters and lack of ice cover.

Flood Preparedness

Conditions are being monitored closely. Staff continue to hold weekly meetings as part of overall succession planning initiatives, dam operations and flood emergency preparedness.

A meeting was held with municipal flood coordinators, community emergency management coordinators, police, other agencies and GRCA staff involved with the GRCA flood warning system. The meeting was well attended and described in a separate board report.

An updated Grand River Flood Warning System guide is being published and will be mailed to municipalities, police and other agencies involved with the GRCA flood warning system. The updated guide will provide updated contact information. A new sharepoint site has been created, where flood resource information will be shared and an electronic copy of the Grand River Flood Warning System guide will be maintained throughout the year.

Hosting a prewinter municipal flood coordinators meeting is intended to improve preparedness heading into the winter season and is an example of adapting to climate change in response to large winter floods experienced in February 2018 and January 2020. It is important to have contact information up to date and readily available.

Financial Implications:

Not applicable

Other Department Considerations:

Not applicable

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Figures:

Figure 1: Shand Dam Monthly Precipitation 2017 to December 8, 2021

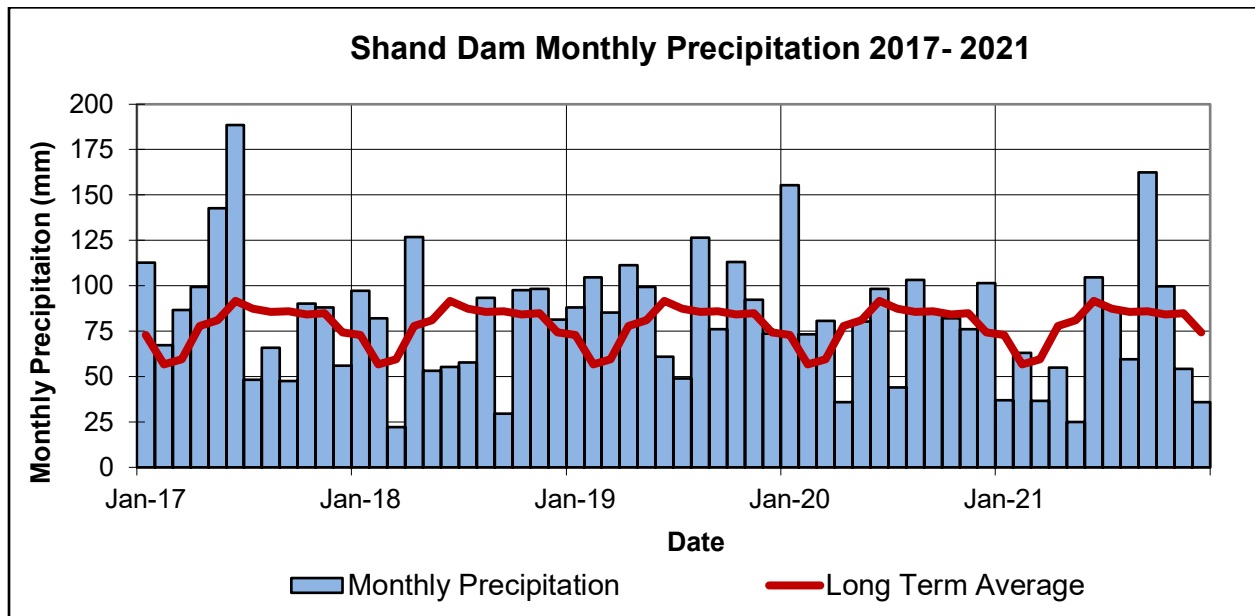


Figure 2: Monthly Average Air Temperatures at Shand Dam from 2017 to December 8, 2021

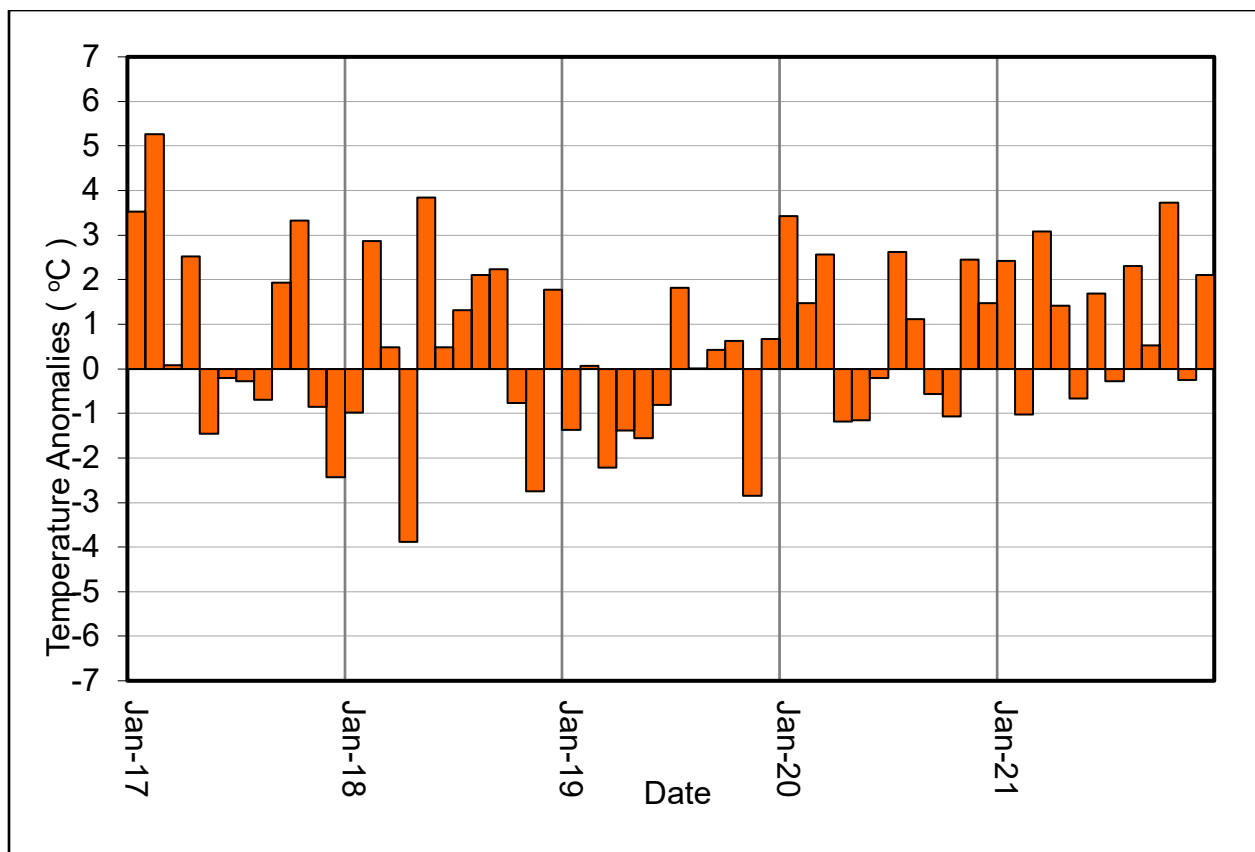


Figure 3: Groundwater conditions at GRCA monitored groundwater wells November 2021

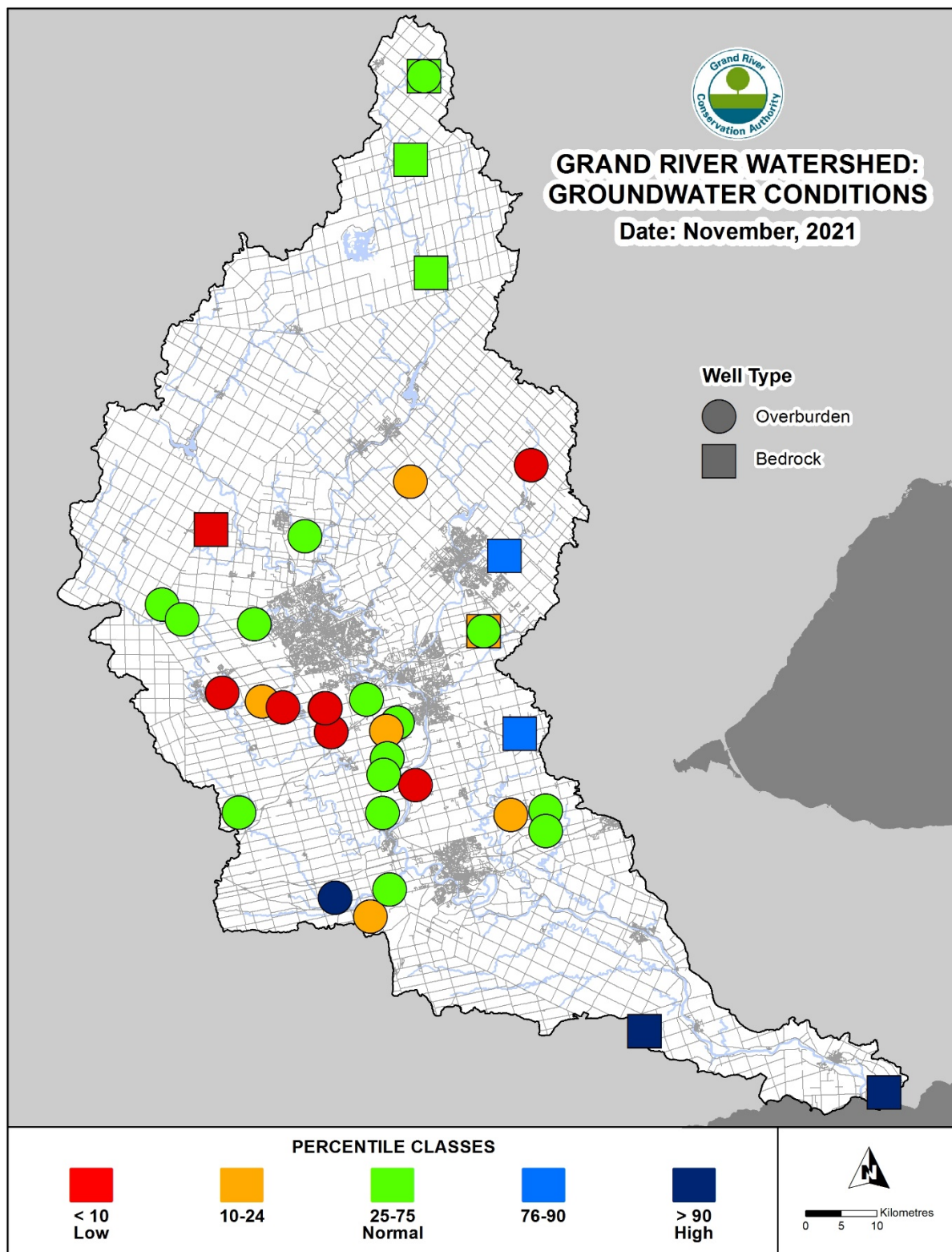


Figure 4: Groundwater conditions at Burford Monitoring Well W065-4

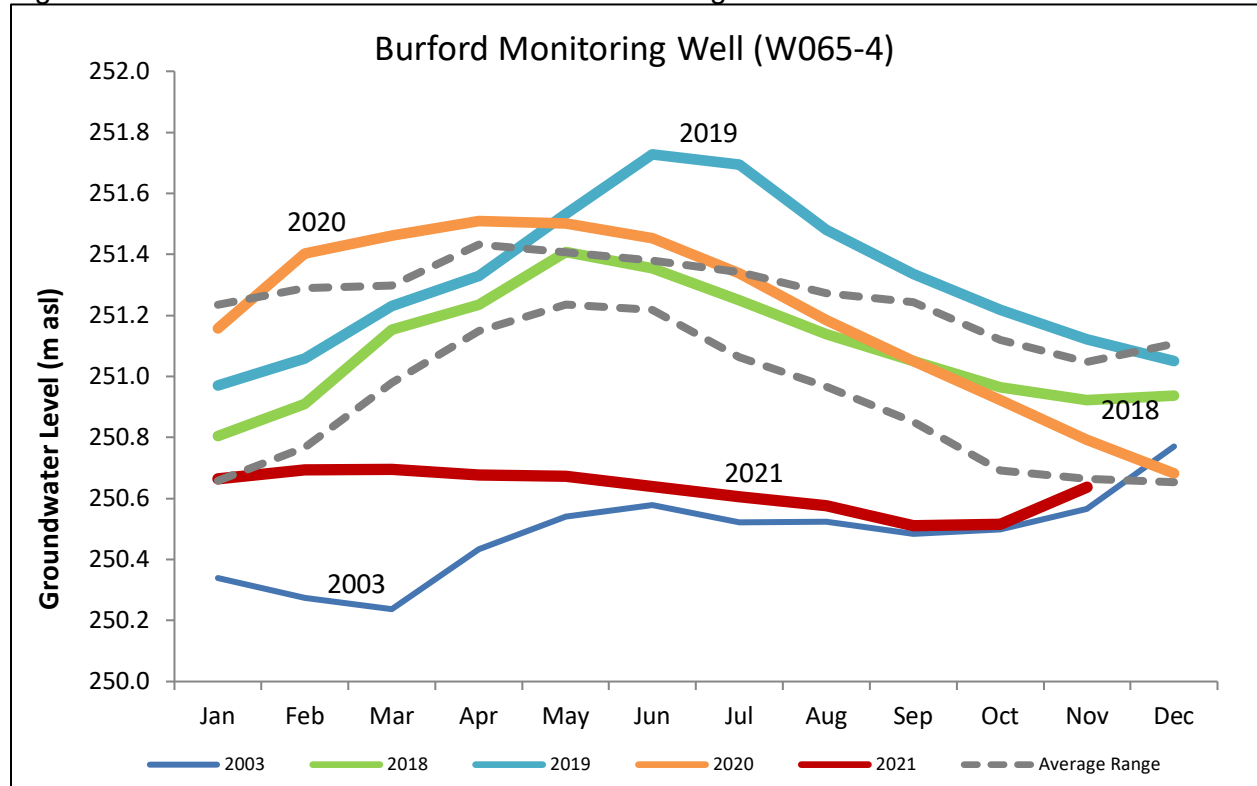


Figure 5: Water levels for Lake Erie at Port Colborne

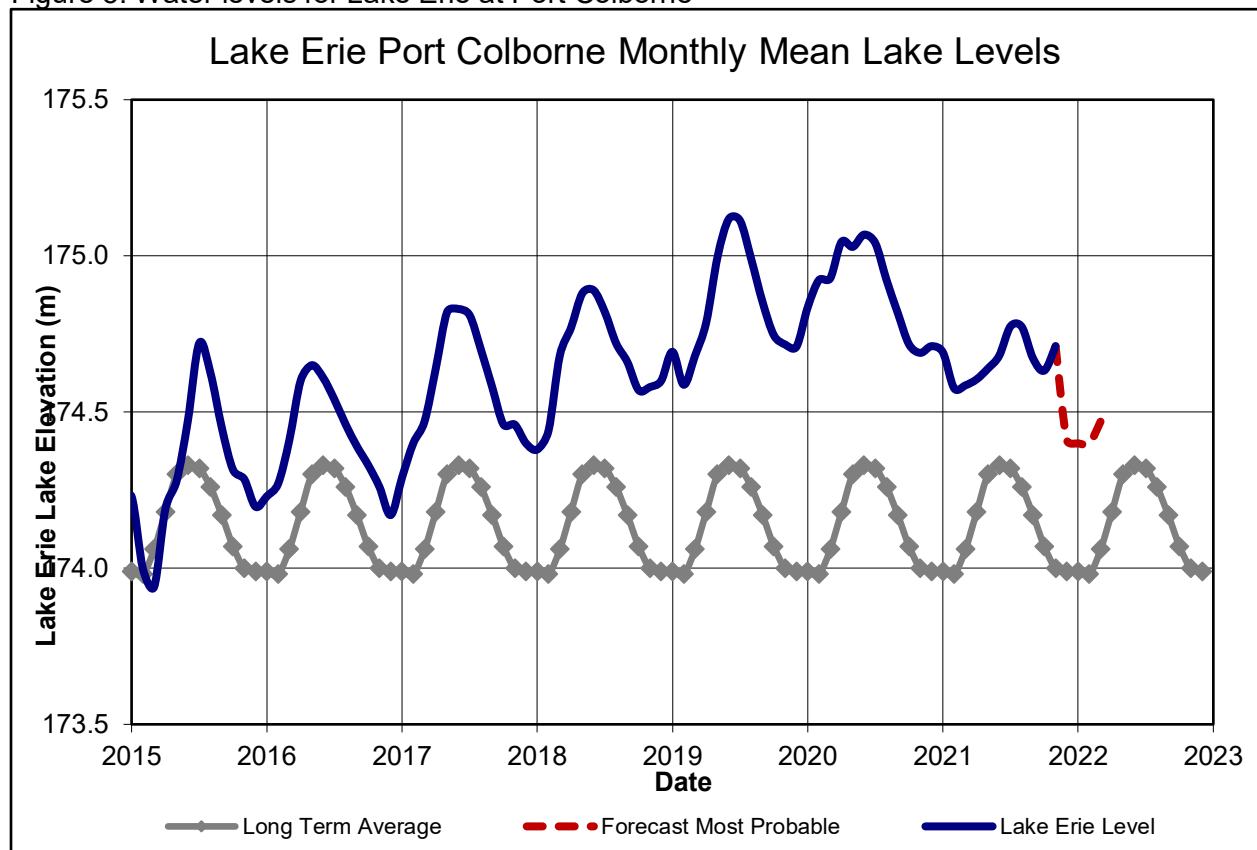


Figure 6: Shand and Conestogo Reservoir Elevation Plots for 2021

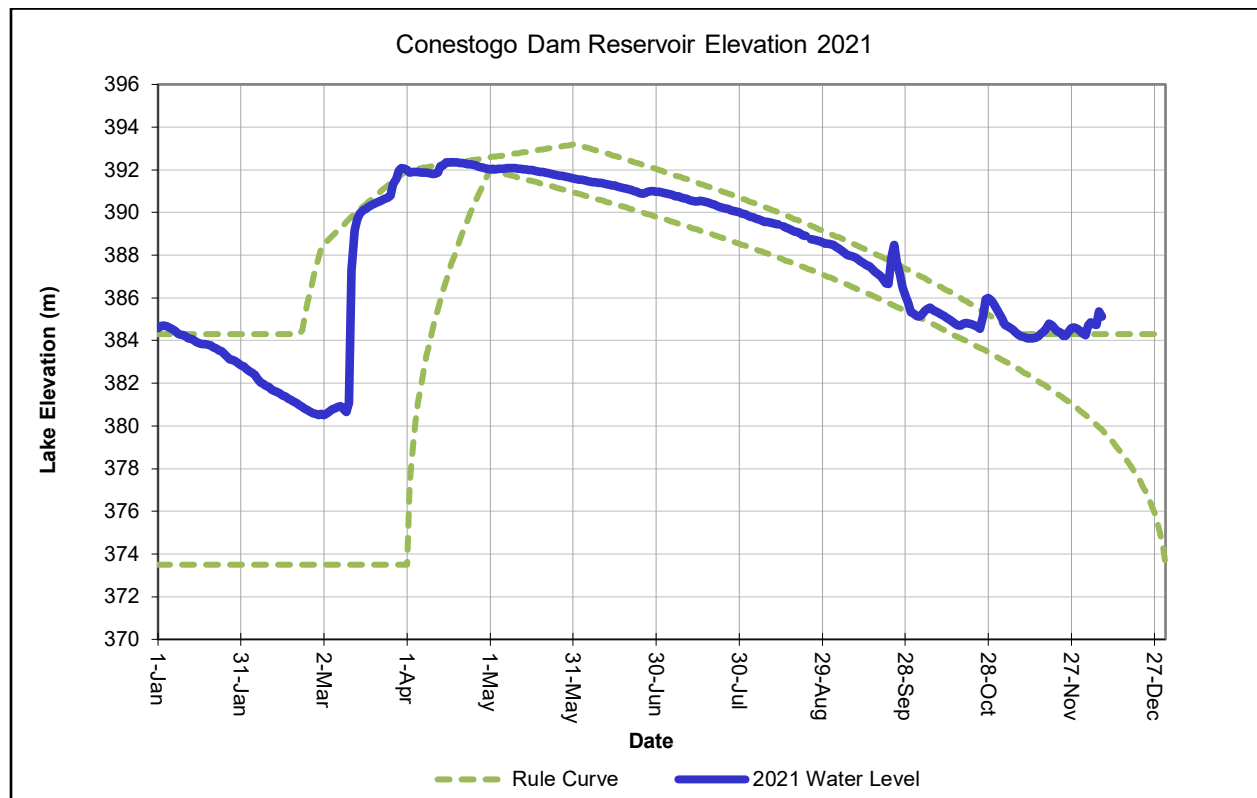
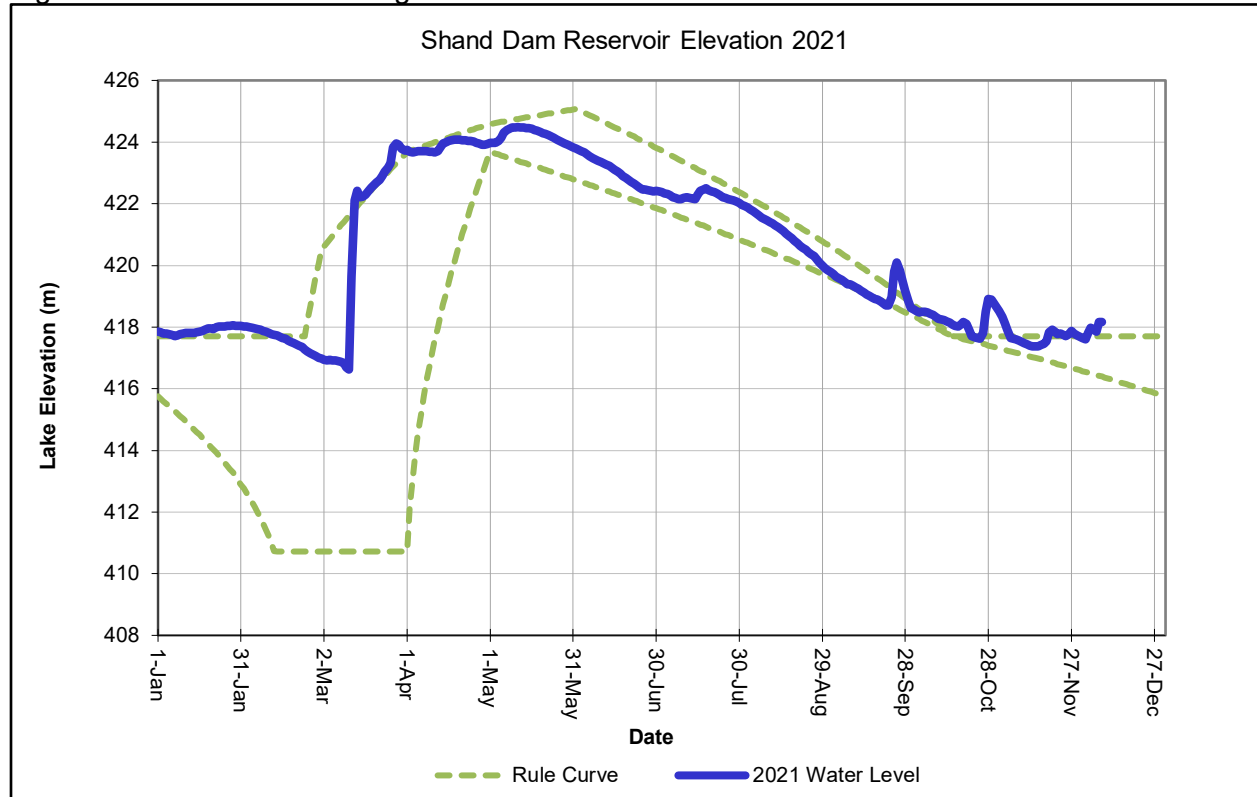


Figure 7: Guelph and Luther Reservoir Elevation Charts for 2021

