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| Subject | City of Waukesha Post-Return Flow Root River Monitoring Program | | |
| Client | City of Waukesha | Date | November 18, 2020 |
| Project | Waukesha Water Utility (WWU) Great Lakes Water Supply Program | | |
| Project No. | D3235900 | | |

Condition I of Application Approval:

Monitoring of Root River Flow. For a minimum of 10 years from the beginning of return flow to the Basin, the Applicant must implement a scientifically sound plan to monitor the mainstem of the Root River to determine changes that may have resulted from return flow (such as volumes, water temperatures, water quality and periodicity of discharge) in order to adapt future return flow to minimize potential adverse impacts or maximize potential benefits to water dependent resources of the Basin source watershed (i.e., Lake Michigan).

Monitoring Objective:

Monitor the mainstem of Root River upstream and downstream of the return flow discharge location to assess the impact and need of adaptively managing the return flow as required in Condition I of the Application Approval.

Monitoring Program:

The monitoring will be completed under a Quality Assurance Project Plan (QAPP) and will utilize certified laboratories. The City of Waukesha (City) and field teams will collaborate with the Wisconsin Department of Natural Resources (Department) if deviation from standard protocols are needed to accommodate site specific conditions. The monitoring will support assessing Condition I through answering the following questions:

- Volume and Periodicity of Discharge
 - What impact did return flow have on the flow rate change in the Root River upstream and downstream of return flow?
 - What impact did the return flow have on the water level?
- Water Temperature
 - Has the river temperature changed upstream and downstream of return flow?
 - Are there seasonal differences to changes in temperature?
 - If there is a temperature change (i.e. increase) with return flow, what is the spatial extent of the impact caused by return flow?

- Water Quality
 - Has the river water quality changed upstream and downstream of return flow with the addition of return flow?
 - Are there seasonal differences to changes?
 - Are there other known upstream watershed impacts that may be influencing these changes?
- Water Dependent Resources
 - Is the macroinvertebrate, fish, or diatom (as provided by the Department) community different in the mainstem of Root River at upstream and downstream locations compared to pre-return flow conditions? What is the spatial extent of the impact caused by return flow?
 - Are the changes natural variability, an indication of potential upstream watershed impacts, or an indication of changes resulting from return flow?

Monitoring Locations:

The City will include monitoring locations upstream and downstream of the return flow outfall. Sample locations near the return flow outfall, including current pre-return flow Sites A, B, C, and D are shown in Figure 1. Post-return flow monitoring locations will be consistent with these locations, and potentially expand to include locations of closer proximity to the return flow outfall. However, because the return flow discharge does not yet exist, and access to Root River must also consider land ownership and permissions, the exact locations of monitoring may be adjusted. To support answering monitoring program questions above, monitoring locations may be added or removed during preparation of the QAPP.

Monitoring Parameters:

The following parameters are anticipated to support the monitoring objectives. To supplement these efforts, the City may incorporate data from third parties, such as the Department and Milwaukee Metropolitan Sewerage District data. Other parameters may be added as necessary to achieve the monitoring objectives. The City will present the Department a final monitoring plan with QAPP procedures prior to commencement of monitoring.

- Volumes and Periodicity of Discharge (Flow Monitoring)
 - The City will continuously measure the return flow rate at the Clean Water Plant (CWP) as described in the WPDES permit. When return flow starts, the pipeline will be new and will have passed all pressure testing requirements. The pipe will also only convey return flow.
 - Since October 2016, the City of Waukesha has contracted with the USGS to collect and host continuous flow data for the Root River Site C, immediately upstream of the return flow outfall. Flow measurement is anticipated to continue at this location.
 - The City anticipates that the CWP return flow measurement and the upstream flow measurement will be equivalent to a downstream flow measurement. The City will measure Root River flow downstream of the return flow discharge (e.g. Site D), after consulting with the USGS. The purpose of this measurement is to directly quantify river flow that includes return flow and to confirm that the Root River flow rate downstream of the return flow is equivalent to the summation of flow from measured a Site C plus the return flow measured at the CWP. The monitoring may be discontinued after a correlation is confirmed for the full range of flow conditions.

- Temperature
 - The City will continuously monitor temperature of return flow at the CWP and in the return flow discharge structure at the Root River as described in the WPDES permit.
 - Continuous in-stream temperature monitoring of the Root River is anticipated up- and downstream of the return flow outfall and will determine the spatial extent of temperature impacts.
- Water Quality Parameters (Water Chemistry)
 - The City will complete instream water quality monitoring up- and downstream of the return flow outfall using parameters consistent with other similar surface water quality monitoring programs including dissolved oxygen, pH, turbidity, specific conductance, chlorophyll-a, total suspended solids, total phosphorus, ammonia-nitrogen, E-coli, and chlorides.
- Impacts on Water Dependent Resources (Habitat and Biological Monitoring)
 - Habitat assessments and fish and macro-invertebrate sampling will be conducted at various sites to answer the monitoring objectives.
 - Biological monitoring proposed for the post-return flow monitoring will be consistent with the biological monitoring currently being completed for pre-return flow conditions.
 - The City will follow the recommendations within the sampling protocols and collaborate with the Department if site specific conditions require unique considerations.
 - Habitat assessments are anticipated to be completed annually at a time close to the fish sampling. Habitat assessments will include using an algae viewing bucket and following Department protocols for use and data recording. After the first three years of monitoring, habitat assessments may be reduced to once every three years, or annually if significant flow/flood events or changes in habitat are observed in that year. Estimating flow rates will be completed during each monitoring event, regardless if a full habitat assessment is scheduled.
 - The Department has indicated it plans to conduct diatom monitoring on the Root River. The City will include these results in their reporting as available. The City and Department will coordinate monitoring efforts on the Root River.

Reporting and Modifications:

The City will complete an annual assessment of the data and submit a report of the findings to the Department annually by March 1. The report will include return flow monitoring data completed through the WPDES permit. The data used in the annual report will be made available to the public and will be submitted to the Department’s SWIMS database with continuous river flow data hosted by USGS.

As the post-return flow monitoring is implemented, some locations and parameters may be adjusted after data is reviewed and statistical trends are evaluated. As the City has done in the past, Department input will continue to be sought when details warrant such collaboration and assistance, and monitoring protocols (such as the Wisconsin Consolidated Assessment and Listing Methodology (WisCALM)) will be considered for adaptively managing the monitoring program.

Figure 1: Locations of Historic and Proposed Root River Monitoring Sites

