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Ms. Laatch and Mr. Utrup:

Wisconsin Public Service Peshtigo River Hydroelectric Projects – 2016 Water Quality Monitoring Report

Pursuant to the water quality monitoring plans for the Wisconsin Public Service (WPS) Hydroelectric facilities along the Peshtigo River, WPS is submitting water quality monitoring data collected during the 2016 monitoring season for your review and comment. Water quality monitoring was conducted at the following projects: Caldron Falls (FERC No. 2525), High Falls (FERC No. 2595), Johnson Falls (FERC No. 2522), Sandstone Rapids (FERC No.2546), Potato Rapids (FERC No. 2560), and Peshtigo River (FERC No. 2581).

The water quality monitoring plan requirements at all facilities except Johnson Falls are as follows:

Ensure flow releases from the project, as measured immediately downstream from the dam and maintain the following standards, except when natural conditions prohibit attainment of the standards:

- (1) Dissolved Oxygen (DO) concentrations shall not be less than 5.0 milligrams per liter (mg/L) (minus the precision of the monitoring equipment) for more than 24 hours per year;
- (2) Water temperature shall not exceed 89 degrees Fahrenheit (F), and;
- (3) The pH shall be within the range of 6.0 to 9.0 standard units, with no change greater than 0.5 units outside the natural seasonal maximum and minimum.

Natural conditions include inflows to the project less than the 95 percent exceedances flow.

At the Johnson Falls Hydroelectric Project, the water quality monitoring plan requirements are as follows:

Ensure flow releases from the project, as measured immediately downstream from the dam and maintain the following standards, except when natural conditions prohibit attainment of the standards:

- (1) DO concentrations shall not be less than 6.0 milligrams per liter (mg/L) at any time or 7.0 mg/L during the spawning season (minus the precision of the monitoring equipment) for more than 24 hours per year;

- (2) Water temperature shall not be altered from natural background to the extent that trout populations are adversely affected, and
- (3) The pH shall be within the range of 6.0 to 9.0, with no change greater than 0.5 units outside the estimated natural seasonal maximum and minimum.

During the 2016 monitoring season, data was collected using portable water quality monitoring equipment manufactured by YSI, Inc. Monitoring for DO, temperature, and pH was conducted continuously on an hourly basis from June 1 through September 30. As described in the water quality monitoring plans for the projects, the instrumentation was cleaned and calibrated according to manufacturer specification; every 14 days during the monitoring period. A post deployment calibration was conducted to determine the extent of calibration drift. Raw data was adjusted assuming a linear degradation of calibration based upon a post calibration of the equipment. The water quality monitoring equipment used to monitor DO has an accuracy of +/- 0.1 mg/l, per the manufacturer. For compliance purposes, DO concentrations more than 0.1 mg/l below the applicable water quality standard are potential deviations.

The following is a summary of the monitoring results for the 2016 monitoring season:

#### Caldron Falls Hydroelectric Project

Water quality monitoring at the Caldron Falls Hydroelectric project was conducted at the following locations:

- Upstream monitoring shall consist of bi-monthly DO, temperature, and pH profiles of the Caldron Falls Reservoir. Readings were taken at 0.5 meter intervals just above the dam near the powerhouse intake.
- Monitoring downstream of the Project shall occur approximately 770' downstream of the powerhouse in a location that is unaffected by changes in water elevation due to fluctuations in release flow volumes (NW ¼ of NE ¼, T33N, R18E, Section 10, approximately at 88° 13' 39.9"N, 45° 21' 25.7"W).

During the monitoring season, two hourly readings were observed to be below the DO water quality standard. The first reading below the water quality standard was recorded on July 7 at 23:00, and the second occurred on July 11 at 06:00. The DO readings were 4.2 mg/l and 4.7 mg/l, respectively. When the low DO readings were observed, the facility was in a reservoir refill period following limited peaking operation. Dissolved oxygen readings the hour before and after the low reading were above the water quality standard, indicating that both periods of low DO were short duration events.

A contributor to the low DO levels observed was the natural stratification of the reservoir and warmer water temperatures. As the reservoir stratifies in the summer, lower DO levels are observed on the bottom of the impoundment. With the powerhouse intake located on the bottom of the reservoir, lower DO water is being withdrawn and released through the powerhouse. DO profiles conducted at the Caldron Falls dam on June 28, 2016 and July 12, 2016 indicated that the reservoir was stratified near the bottom 1-1.5 meters where water DO concentrations were below the water quality standard. Water temperatures at the thermocline in the water column were at or above 70F.

Please note that historical monitoring data indicated periods of low DO levels typically occur between July 15 and September 1. Therefore, in accordance with the Water Quality Monitoring Plan, on an annual basis WPS releases a minimum flow of 56 CFS out of a sluice gate to mitigate low DO concentrations downstream of the facility during the time period between July 15 and September 1. WPS began releasing aeration flow through the sluice gate on July 14. After the onset of releasing aeration flow, no additional DO deviations were observed. There are no temperature or pH deviations during the monitoring season at this location to note.

#### High Falls Hydroelectric Project

Water quality monitoring at the High Falls Hydroelectric project was conducted at the following locations:

- Upstream monitoring occurs on a five-year basis and is conducted with the same equipment utilized for the downstream monitoring of the Caldron Falls project.
- The downstream monitoring equipment shall be located on the High Falls Road Bridge near the middle of the river.

During the monitoring season, there were two hourly readings below the water quality standard as described above. At the monitoring location downstream of the High Falls Powerhouse, no deviations from the DO, pH or temperature water quality standards were observed during the monitoring season.

#### Johnson Falls Hydroelectric Project

Water quality monitoring at the Johnson Falls Hydroelectric project was conducted at the following locations:

- At the Johnson Falls Hydroelectric Project, upstream monitoring is conducted with the same equipment as the downstream monitor at High Falls. The downstream monitor at Johnson Falls is located in the tailrace, approximately 15 feet downstream of the powerhouse.

During the monitoring season, fifteen hourly readings were observed to be below the DO water quality standard. Two hourly readings below the DO water quality standard were observed on August 13, while thirteen hourly readings below the DO water quality standard were observed between August 20 at 04:00 and August 21 at 05:00. No deviations from the pH water quality standards were observed during the monitoring season. The lowest DO reading observed was 5.8 mg/l. At the time of the low DO readings, the facility was in run-of-river operation. The likely cause of the low DO readings is warm water temperatures in the Peshtigo River. During the month of August, the daily average water temperature measured downstream of the powerhouse has been 73F or higher, with daily maximum temperatures reaching 76F.

Based upon monitoring experience at the Caldron Falls Hydroelectric Project and past monitoring at Johnson Falls, WPS believes DO levels are increasing with distance from the powerhouse and that the water quality standard is being met within a short distance from the powerhouse. In 2011, in stream readings were taken below the Johnson Falls powerhouse with a handheld DO monitor to determine how much DO levels improve with distance from the powerhouse. Readings were taken at four locations: immediately downstream of the powerhouse, 40 to 60 feet downstream of the powerhouse,

approximately 250 feet downstream of the powerhouse, and approximately 500 feet downstream of the powerhouse. The readings showed that DO levels increased 0.4 mg/l within approximately 500 feet of the powerhouse. Therefore, monitoring immediately in the tailrace of the Powerhouse may not reflect conditions in the riverine environment downstream of the facility.

#### Sandstone Rapids Hydroelectric Project

Water quality monitoring at the Sandstone Rapids Hydroelectric project was conducted at the following locations:

- The upstream monitoring is conducted with the same equipment as the downstream monitor at Johnson Falls.
- The downstream monitor at Sandstone Rapids is located in the tailrace.

At the Sandstone monitoring location, no deviations from the pH or temperature water quality standards were observed during the monitoring season. Dissolved oxygen water quality readings below the water quality standard of 5.0 mg/l were observed from August 17 through 12:00 on August 23 when the monitor was retrieved and from September 4 at 18:00 through September 6 at 11:00 when the water quality monitor was retrieved. WPS believes the low DO readings observed were due to malfunction of the DO sensor on the monitoring equipment and the readings are not representative of actual riverine conditions.

On August 15, there was a sharp drop in DO levels between 20:00 and 22:00 hours, followed by a rapid and linear decrease in DO to less than 2 mg/l. A similar sudden, sharp drop in DO was observed on August 29, which was subsequently followed by a steady decrease in the DO levels recorded to less than the water quality standard from September 4 at 18:00 through September 6 at 11:00. Both periods of low DO readings occurred at the end of a two week deployment period. During the periods that low DO levels were observed, the facility was in run-of-river operation and there were no operational changes that could have caused or contributed to the rapid drop in DO levels. After retrieving the monitors and replacing them with a different, calibrated monitor, the first hourly reading with the replacement monitor was above 8 mg/l.

To verify whether the low DO readings may have been valid, WPS took DO readings at the monitoring location with a portable water quality meter on August 23 at 14:50. Readings with the hand held meter indicated DO levels were above 8 mg/l, which matches the data collected by the continuous water quality monitor. In addition, a vertical DO profile was conducted near the powerhouse intake on September 9 to determine if low DO water was present in the reservoir. The DO profile showed that there was some oxygen depletion with depth in the water column, however; the DO levels measured upstream of the powerhouse were above the water quality standard at all depths. Based on the data collected, the likely cause of the low DO readings was an equipment malfunction.

#### Potato Rapids Hydroelectric Project

Water quality monitoring at the Potato Rapids Hydroelectric project was conducted at the following locations:

- Upstream monitoring shall consist of bi-monthly DO, temperature, and pH profiles of the Potato Rapids Reservoir. Readings were taken at half (0.5) meter intervals just above the dam near the powerhouse intake.
- The downstream monitor is located in the tailrace below the dam

Profile data collected upstream of the powerhouse did not reveal stratification in the impoundment or potential deviations from the water quality standards. Downstream of the Potato Rapids powerhouse, there are no deviations from the DO, pH or temperature water quality standards to note.

#### Peshtigo Hydroelectric Project

Water quality monitoring at the Peshtigo Hydroelectric project was conducted at the following locations:

- The upstream monitoring is conducted with the same equipment as the downstream monitor at Potato Rapids.
- The downstream monitor at Peshtigo Rapids is located in the tailrace.

No deviations from the DO, pH, or temperature water quality standards were observed during the 2016 monitoring season.

Please review the enclosed data and provide any comments you may have within 30 days of this letter. Should you have any questions or concerns, please do not hesitate to call me at (920) 433-1833.

Sincerely,



Mark Metcalf  
Environmental Consultant – Air & Water

Enc.

cc: Mr. Ed Brandt - WPS  
Mr. Bill Bosacki – WPS