Wisconsin Public Service Corporation
700 North Adams Street
P.O. Box 19001
Green Bay, WI 54307-9001
www.wisconsinpublicservice.com

November 26, 2019

Ms. Kimberly D. Bose, Secretary
The Federal Energy Regulatory Commission
888 First Street, NE
Washington, DC 20426

Dear Ms. Bose:

SUBJECT: 2019 Water Quality Monitoring Report

Hydro	FERC Project No.	NATDAM No.	License Article
Grand Rapids	**2433**	**MI00022**	**407**

In accordance with the Order Approving Water Quality Monitoring Plan under Article 407, dated April 7, 1999, Wisconsin Public Service Corporation (WPS) is submitting water quality monitoring data collected during the 2019 monitoring season at the Grand Rapids Hydroelectric project.

At the Grand Rapids facility, WPS is required to ensure that flow releases from the Grand Rapids Project maintain the state standards listed below except when the river flow in the Menominee River is less than the 95 percent exceedance flow or when natural conditions prohibit attainment of the standards:

(1) Monthly average temperatures downstream of the Grand Rapids Dam shall be no greater than those listed below:

January	38°F	July	83°F
February	38°F	August	81°F
March	41°F	September	74°F
April	56°F	October	64°F
May	70°F	November	49°F
June	80°F	December	39°F

(2) Temperature downstream of the Grand Rapids Project Dam shall not exceed 89°F at any time.
(3) DO concentrations downstream of the project powerhouse must not be less than 5.0 milligrams per liter (mg/L) at any time.

(4) Maintain pH 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.

As described in the water quality monitoring plan, monitoring was conducted upstream and downstream of the powerhouse from June 1 through September 30. Monitoring for DO, temperature, and pH was conducted continuously on an hourly basis using portable water quality monitoring equipment manufactured by YSI, Inc. The instrumentation was cleaned and calibrated according to manufacturer specification at least once 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.

No deviations from the dissolved oxygen, pH or temperature water quality standards were observed downstream of the facility during the monitoring season. At the upstream monitoring location, WPS did not observe any deviations from the water quality standards, however; WPS did experience an equipment malfunction that resulted in a period of missing data and a period when DO monitoring data does not appear to be representative of actual conditions. Monitoring data is enclosed with this report in Attachment A.

During the monitor deployment period of August 20 to September 3, 2019, the monitor at the upstream monitoring location malfunctioned and did not collect monitoring data. WPS contacted the equipment manufacturer to determine the cause and it was discovered that the dissolved oxygen sensor had failed and was continually resetting itself which resulted in the monitor not starting the program to log monitoring data. During the monitoring period of September 3 through September 17, DO levels continued to climb slowly throughout the monitoring period and did not show diel fluctuations as were observed at the downstream monitoring location. Consequently the upstream monitoring data is likely not representative of actual conditions.

Please note that for each monitoring location, WPS has two separate water quality monitors. While one monitor is deployed, the second monitor is maintained and calibrated before being used in the field. Prior to deployment, WPS conducts a test program to verify the monitor is accurately calibrated and working properly. The test programs conducted on August 20 and September 3 did not indicate issues with the water quality monitoring equipment prior to deployment. Upon retrieving the monitors, the periods of missing and suspicious data were discovered. Whenever monitor issues are discovered, the monitoring equipment is removed from service until the equipment is repaired or replaced. Field quality assurance data is enclosed in Attachment B.

Future Monitoring

As outlined in a FERC letter to WPSC dated December 19, 2017, water quality monitoring at the facility is scheduled to occur in 2021, then again in 2024 and every five years thereafter for the term of the permit.

Agency Consultation

WPS provided the 2019 water quality monitoring data to the Wisconsin Department of Natural Resources (WDNR), the Michigan Department of Natural Resources (MDNR) and the U.S. Fish and Wildlife Service (FWS) on October 3, 2019 for review and comment. WPS did not receive comments from the WDNR or FWS on the 2019 water quality monitoring report. Documentation of Agency Consultation can be found in Attachment C.

Should you have any questions or concerns with this submittal, please do not hesitate to call Mr. Mark Metcalf at (920) 433-1833.

Sincerely,

Todd P. Jastremski
Asset Manager Hydro Operations
We Energies
800 Industrial Park Drive
Iron Mountain, MI 49801

MWM/ace

Enc: Attachment A – 2019 Water Quality Monitoring Data (75 pages)
Attachment B – Quality Assurance Data (39 Pages)
Attachment C – Documentation of Agency Consultation (24 pages)

cc: Mr. John Zygaj, FERC – CRO
Mr. Nick Utrup, FWS
Ms. Cheryl Laatsch, WDNR
Ms. Elle Gulloty, MDNR

ATTACHMENT A

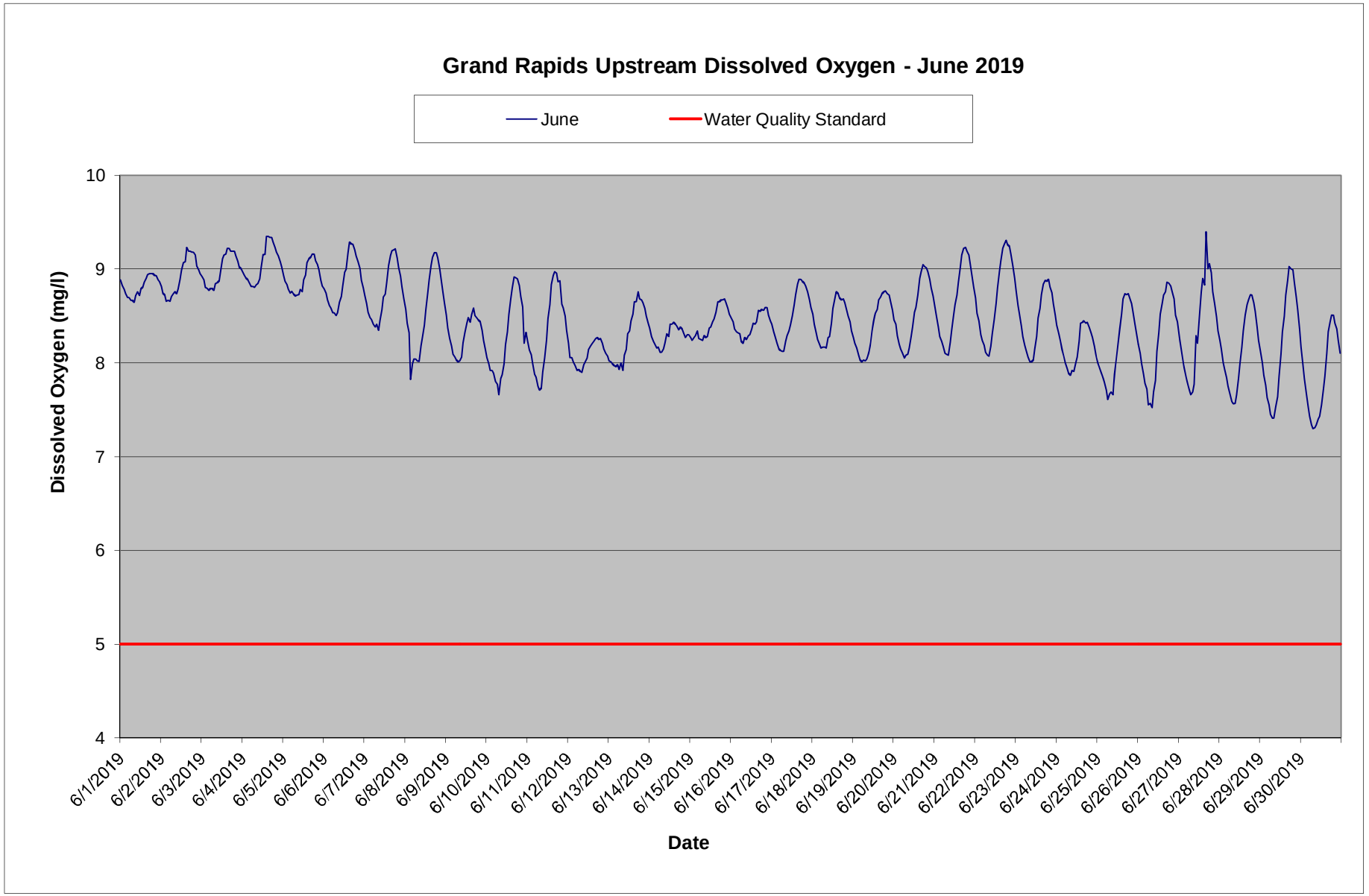
Wisconsin Public Service Corporation

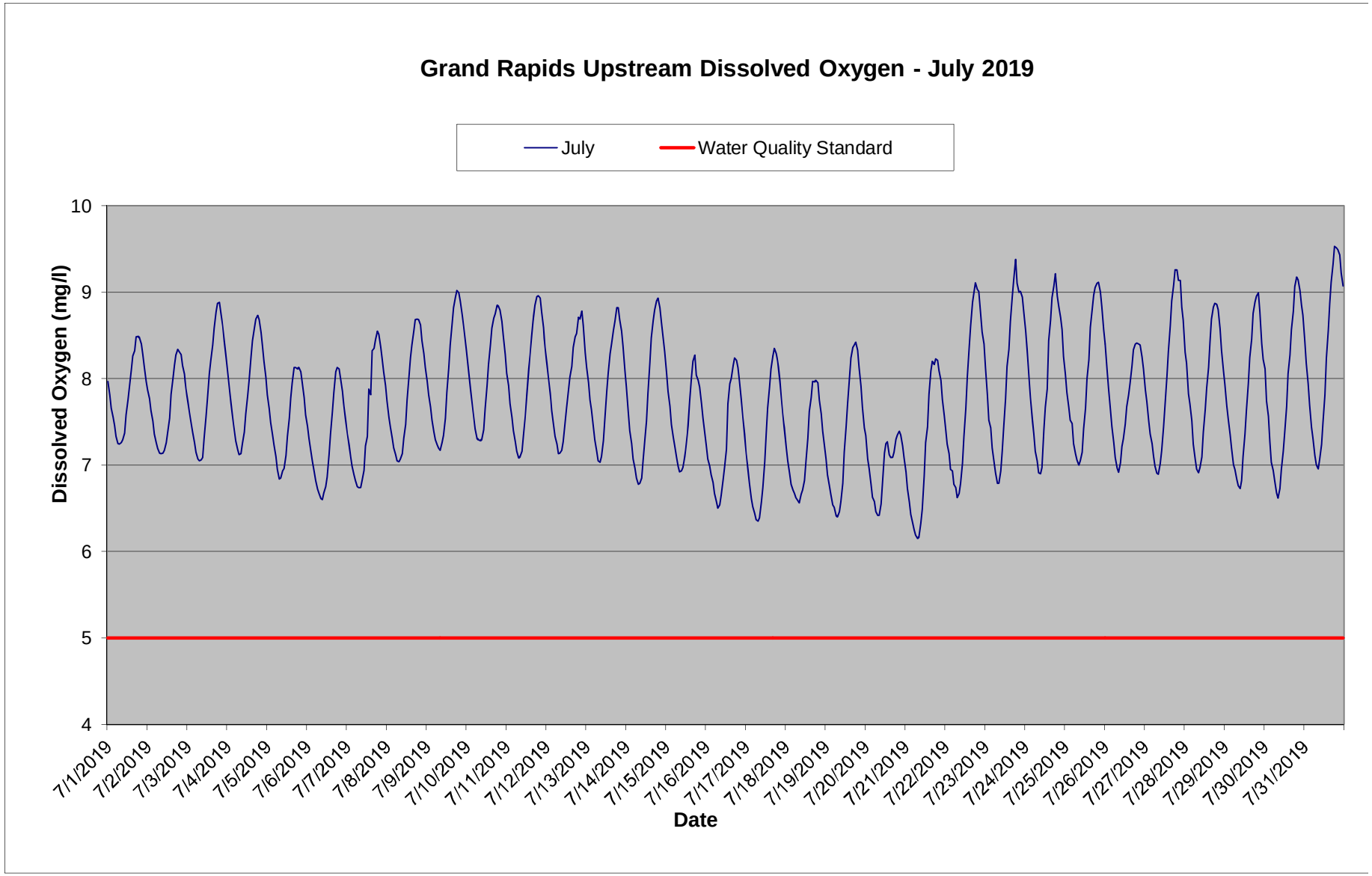
Grand Rapids Hydroelectric Project

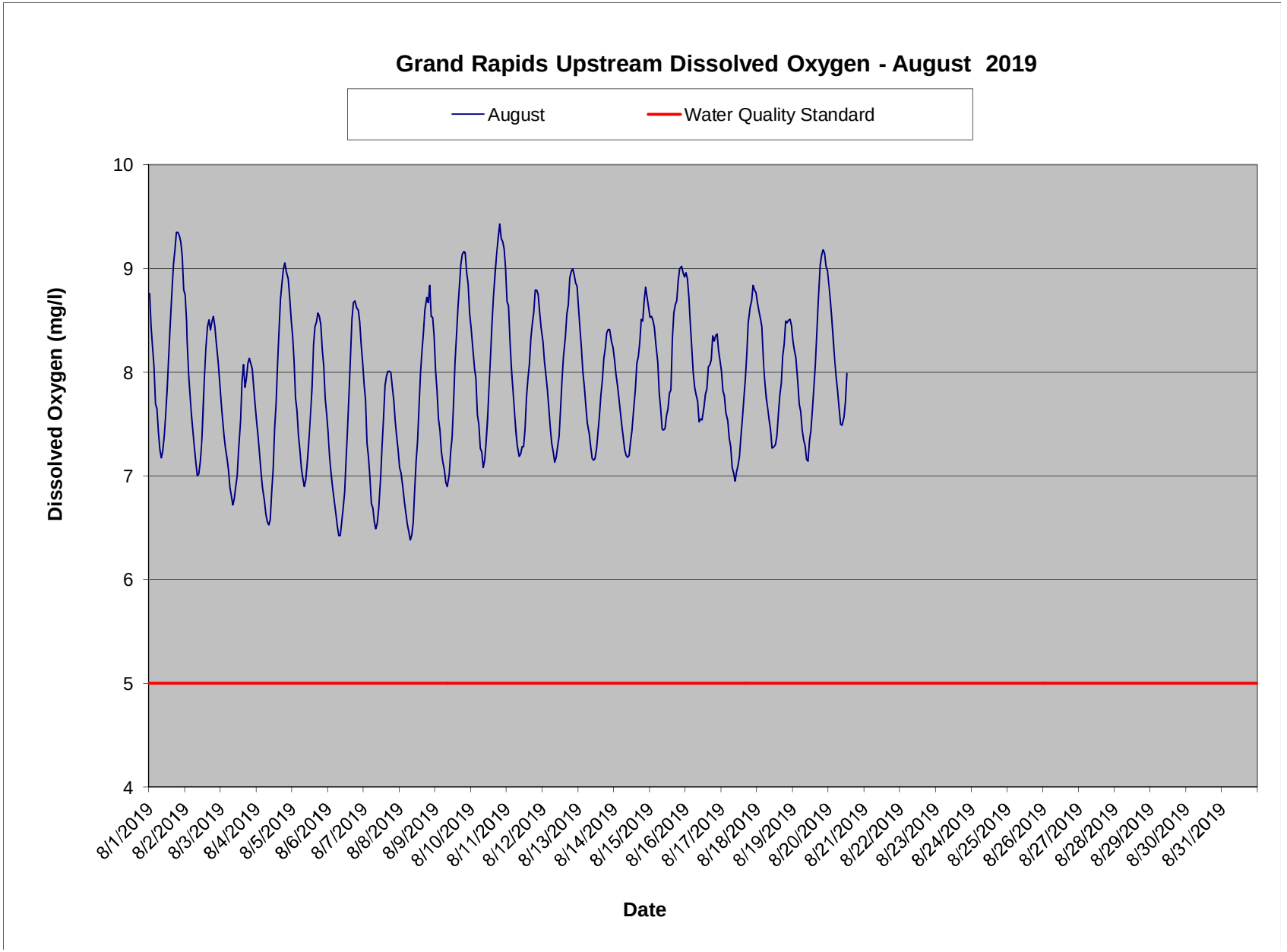
FERC Project No. 2433

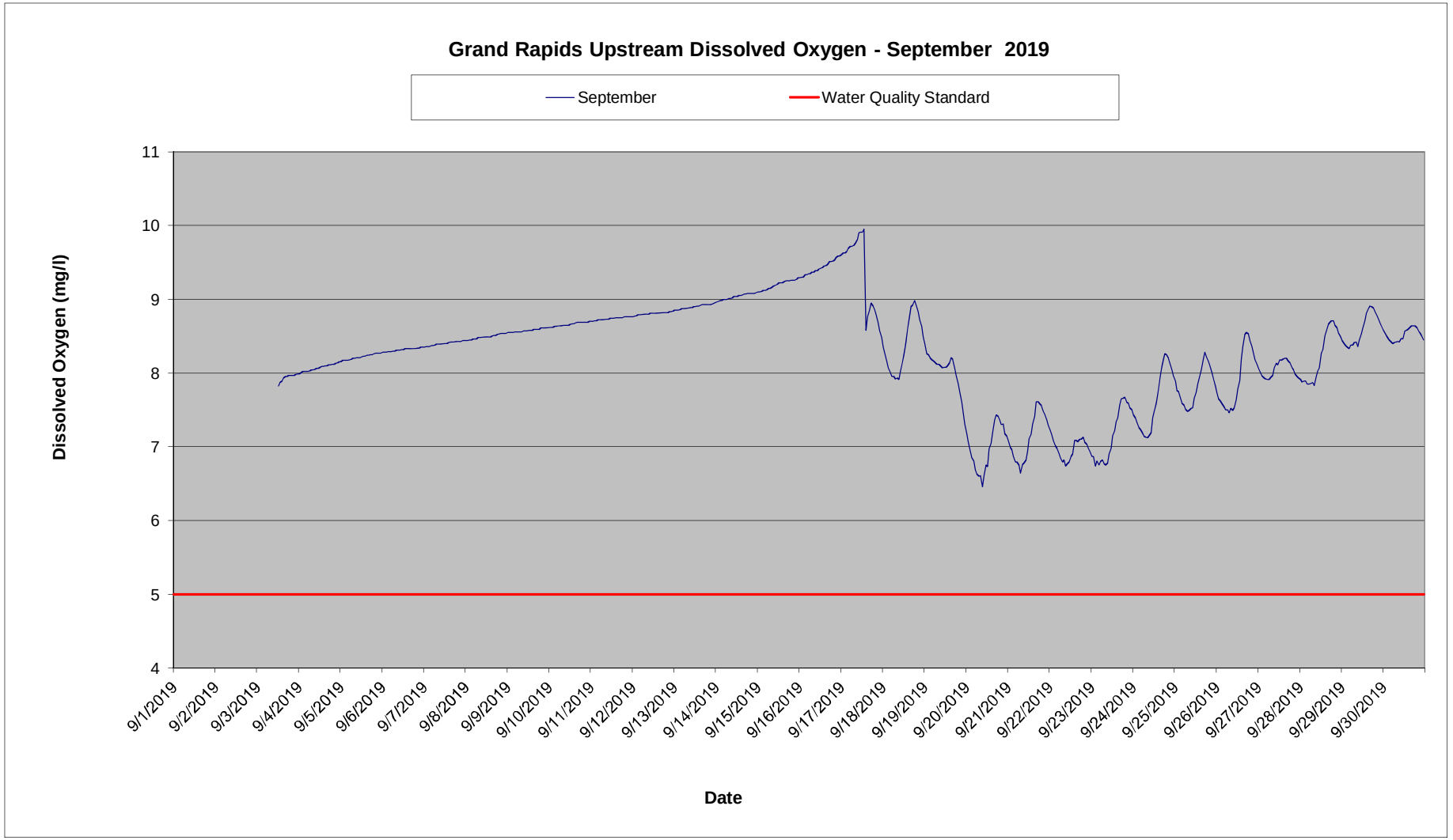
2019 Water Quality Monitoring Data

Upstream Monitoring Location









Grand Rapids Upstream Dissolved Oxygen Summary - June 2019

Time HHMMSS	06/01/19	06/02/19	06/03/19	06/04/19	06/05/19	06/06/19	06/07/19	06/08/19	06/09/19	06/10/19	06/11/19	06/12/19	06/13/19	06/14/19	06/15/19	06/16/19
0	8.9	8.8	8.9	9.0	8.9	8.8	8.7	8.6	8.5	8.1	8.2	8.2	8.0	8.4	8.3	8.5
10000	8.8	8.7	8.9	8.9	8.9	8.7	8.6	8.4	8.4	8.0	8.1	8.1	8.0	8.3	8.2	8.4
20000	8.8	8.7	8.8	8.9	8.8	8.7	8.5	8.3	8.3	7.9	8.1	8.1	8.0	8.2	8.3	8.4
30000	8.7	8.7	8.8	8.9	8.8	8.6	8.5	7.8	8.2	7.9	8.0	8.0	8.0	8.2	8.3	8.3
40000	8.7	8.7	8.8	8.8	8.7	8.6	8.5	8.0	8.1	7.9	7.9	8.0	8.0	8.2	8.3	8.3
50000	8.7	8.7	8.8	8.8	8.8	8.5	8.4	8.0	8.1	7.8	7.8	7.9	8.0	8.2	8.3	8.3
60000	8.7	8.7	8.8	8.8	8.7	8.5	8.4	8.0	8.0	7.8	7.7	7.9	7.9	8.1	8.3	8.2
70000	8.7	8.7	8.8	8.8	8.7	8.5	8.4	8.0	8.0	7.7	7.7	7.9	8.0	8.1	8.2	8.2
80000	8.6	8.8	8.8	8.8	8.7	8.5	8.3	8.0	8.0	7.8	7.7	7.9	7.9	8.2	8.3	8.3
90000	8.7	8.7	8.9	8.8	8.7	8.6	8.5	8.2	8.1	7.9	7.9	8.0	8.1	8.2	8.3	8.3
100000	8.8	8.8	8.9	8.9	8.8	8.7	8.6	8.3	8.2	8.0	8.1	8.0	8.1	8.3	8.3	8.3
110000	8.7	8.9	9.0	9.0	8.8	8.8	8.7	8.4	8.3	8.2	8.2	8.1	8.3	8.3	8.4	8.3
120000	8.8	9.0	9.1	9.2	8.9	9.0	8.7	8.6	8.4	8.3	8.5	8.1	8.3	8.4	8.4	8.4
130000	8.8	9.1	9.1	9.2	8.9	9.0	8.9	8.7	8.5	8.5	8.6	8.2	8.5	8.4	8.4	8.4
140000	8.9	9.1	9.2	9.3	9.1	9.2	9.0	8.9	8.4	8.7	8.8	8.2	8.5	8.4	8.5	8.4
150000	8.9	9.2	9.2	9.3	9.1	9.3	9.1	9.0	8.5	8.8	8.9	8.2	8.7	8.4	8.5	8.4
160000	8.9	9.2	9.2	9.3	9.1	9.3	9.2	9.1	8.6	8.9	9.0	8.3	8.7	8.4	8.7	8.6
170000	9.0	9.2	9.2	9.3	9.2	9.3	9.2	9.2	8.5	8.9	9.0	8.3	8.8	8.4	8.7	8.6
180000	9.0	9.2	9.2	9.3	9.2	9.2	9.2	9.2	8.5	8.9	8.9	8.3	8.7	8.4	8.7	8.6
190000	9.0	9.2	9.2	9.2	9.1	9.1	9.1	9.1	8.5	8.8	8.9	8.3	8.7	8.4	8.7	8.6
200000	8.9	9.2	9.1	9.2	9.0	9.1	9.0	9.0	8.4	8.7	8.6	8.2	8.6	8.3	8.7	8.6
210000	8.9	9.0	9.1	9.1	9.0	9.0	8.9	8.9	8.3	8.6	8.6	8.2	8.6	8.3	8.6	8.6
220000	8.9	9.0	9.0	9.1	8.9	8.9	8.8	8.7	8.2	8.2	8.5	8.1	8.5	8.3	8.6	8.5
230000	8.9	9.0	9.0	9.0	8.8	8.8	8.7	8.6	8.1	8.3	8.3	8.1	8.4	8.3	8.5	8.5
Daily Max	9.0	9.2	9.2	9.3	9.2	9.3	9.2	9.2	8.6	8.9	9.0	8.3	8.8	8.4	8.7	8.6
Daily Min	8.6	8.7	8.8	8.8	8.7	8.5	8.3	7.8	8.0	7.7	7.7	7.9	7.9	8.1	8.2	8.2
Average	8.8	8.9	9.0	9.0	8.9	8.9	8.8	8.6	8.3	8.3	8.3	8.1	8.3	8.3	8.4	8.4

License Minimum DO: 5.0 mg/l

Grand Rapids Upstream Dissolved Oxygen Summary - June 2019

Time HHMMSS	06/17/19	06/18/19	06/19/19	06/20/19	06/21/19	06/22/19	06/23/19	06/24/19	06/25/19	06/26/19	06/27/19	06/28/19	06/29/19	06/30/19
0	8.4	8.5	8.3	8.5	8.6	8.7	8.8	8.4	8.0	8.2	8.3	8.2	8.1	8.2
10000	8.3	8.4	8.2	8.4	8.5	8.5	8.6	8.3	8.0	8.1	8.2	8.2	8.0	8.0
20000	8.3	8.3	8.2	8.3	8.4	8.5	8.5	8.2	7.9	8.0	8.1	8.0	7.9	7.8
30000	8.2	8.3	8.1	8.2	8.3	8.3	8.4	8.1	7.9	7.9	7.9	7.9	7.8	7.7
40000	8.2	8.2	8.0	8.2	8.2	8.2	8.3	8.1	7.8	7.8	7.9	7.8	7.6	7.5
50000	8.1	8.2	8.0	8.1	8.2	8.2	8.2	8.0	7.7	7.7	7.8	7.8	7.6	7.4
60000	8.1	8.2	8.0	8.1	8.1	8.1	8.1	7.9	7.6	7.6	7.7	7.7	7.5	7.3
70000	8.1	8.2	8.0	8.1	8.1	8.1	8.1	7.9	7.7	7.6	7.7	7.6	7.4	7.3
80000	8.2	8.2	8.0	8.1	8.1	8.1	8.0	7.9	7.7	7.5	7.7	7.6	7.4	7.3
90000	8.3	8.3	8.1	8.2	8.2	8.2	8.0	7.9	7.7	7.7	7.8	7.6	7.5	7.3
100000	8.3	8.3	8.2	8.3	8.4	8.3	8.0	7.9	7.9	7.8	8.3	7.7	7.6	7.4
110000	8.4	8.4	8.3	8.4	8.5	8.5	8.2	8.0	8.0	8.1	8.2	7.8	7.9	7.4
120000	8.5	8.6	8.5	8.5	8.6	8.6	8.3	8.1	8.2	8.3	8.5	8.0	8.1	7.6
130000	8.6	8.7	8.5	8.6	8.7	8.8	8.5	8.2	8.4	8.5	8.8	8.2	8.3	7.7
140000	8.7	8.8	8.6	8.7	8.9	9.0	8.6	8.4	8.5	8.6	8.9	8.3	8.5	7.9
150000	8.8	8.7	8.7	8.9	9.0	9.1	8.7	8.4	8.7	8.7	8.8	8.5	8.7	8.1
160000	8.9	8.7	8.7	9.0	9.2	9.2	8.8	8.5	8.7	8.8	9.4	8.6	8.9	8.3
170000	8.9	8.7	8.7	9.1	9.2	9.3	8.9	8.4	8.7	8.9	9.0	8.7	9.0	8.4
180000	8.9	8.7	8.8	9.0	9.2	9.3	8.9	8.4	8.7	8.9	9.1	8.7	9.0	8.5
190000	8.9	8.6	8.8	9.0	9.2	9.3	8.9	8.4	8.7	8.8	9.0	8.7	9.0	8.5
200000	8.8	8.6	8.7	9.0	9.2	9.2	8.8	8.3	8.6	8.8	8.8	8.6	8.9	8.4
210000	8.8	8.5	8.7	8.9	9.1	9.2	8.8	8.3	8.5	8.7	8.6	8.6	8.7	8.4
220000	8.7	8.4	8.7	8.8	8.9	9.0	8.6	8.2	8.4	8.5	8.5	8.4	8.6	8.2
230000	8.6	8.3	8.6	8.7	8.8	8.9	8.5	8.1	8.3	8.4	8.3	8.2	8.4	8.1
Daily Max	8.9	8.8	8.8	9.1	9.2	9.3	8.9	8.5	8.7	8.9	9.4	8.7	9.0	8.5
Daily Min	8.1	8.2	8.0	8.1	8.1	8.1	8.0	7.9	7.6	7.5	7.7	7.6	7.4	7.3
Average	8.5	8.4	8.4	8.5	8.6	8.7	8.5	8.2	8.2	8.2	8.4	8.1	8.2	7.9

Grand Rapids Upstream Dissolved Oxygen Summary - July 2019

Time HHMMSS	07/01/19	07/02/19	07/03/19	07/04/19	07/05/19	07/06/19	07/07/19	07/08/19	07/09/19	07/10/19	07/11/19	07/12/19	07/13/19	07/14/19	07/15/19	07/16/19
0	8.0	7.9	7.7	8.1	7.8	7.5	7.4	7.7	8.0	8.3	8.1	8.2	8.1	7.9	8.1	7.2
10000	7.8	7.8	7.6	7.9	7.7	7.3	7.2	7.6	7.8	8.1	7.9	8.0	8.0	7.6	7.9	7.1
20000	7.7	7.6	7.5	7.7	7.5	7.2	7.1	7.4	7.7	7.9	7.7	7.8	7.8	7.4	7.7	7.0
30000	7.6	7.5	7.4	7.6	7.4	7.1	7.0	7.3	7.5	7.7	7.6	7.6	7.6	7.3	7.5	6.9
40000	7.5	7.4	7.3	7.4	7.2	6.9	6.9	7.2	7.4	7.6	7.4	7.5	7.4	7.1	7.3	6.8
50000	7.3	7.3	7.2	7.3	7.1	6.8	6.8	7.1	7.3	7.4	7.3	7.3	7.3	7.0	7.2	6.7
60000	7.3	7.2	7.1	7.2	7.0	6.7	6.8	7.1	7.2	7.3	7.2	7.2	7.2	6.9	7.1	6.6
70000	7.2	7.1	7.1	7.1	6.8	6.7	6.7	7.0	7.2	7.3	7.1	7.1	7.1	6.8	7.0	6.5
80000	7.3	7.1	7.1	7.1	6.9	6.6	6.7	7.1	7.2	7.3	7.1	7.1	7.0	6.8	6.9	6.5
90000	7.3	7.1	7.1	7.3	6.9	6.6	6.8	7.1	7.3	7.3	7.2	7.2	7.1	6.9	6.9	6.7
100000	7.4	7.2	7.3	7.4	7.0	6.7	6.9	7.3	7.3	7.4	7.3	7.3	7.3	7.1	7.0	6.8
110000	7.6	7.3	7.6	7.6	7.1	6.8	7.2	7.5	7.5	7.7	7.6	7.5	7.5	7.3	7.1	7.0
120000	7.8	7.4	7.8	7.8	7.3	6.9	7.3	7.8	7.8	7.9	7.8	7.7	7.9	7.5	7.2	7.2
130000	7.9	7.5	8.1	8.0	7.5	7.1	7.9	8.0	8.1	8.2	8.1	7.9	8.1	7.8	7.5	7.7
140000	8.1	7.8	8.2	8.3	7.8	7.4	7.8	8.2	8.4	8.4	8.3	8.0	8.3	8.2	7.7	7.9
150000	8.3	8.0	8.4	8.4	8.0	7.6	8.3	8.4	8.6	8.6	8.5	8.1	8.4	8.5	8.0	8.0
160000	8.3	8.2	8.6	8.6	8.1	7.8	8.4	8.6	8.8	8.7	8.7	8.4	8.6	8.7	8.2	8.2
170000	8.5	8.3	8.8	8.7	8.1	8.1	8.5	8.7	8.9	8.8	8.9	8.5	8.7	8.8	8.3	8.2
180000	8.5	8.3	8.9	8.7	8.1	8.1	8.6	8.7	9.0	8.9	9.0	8.5	8.8	8.9	8.0	8.2
190000	8.5	8.3	8.9	8.7	8.1	8.1	8.5	8.7	9.0	8.8	9.0	8.7	8.8	8.9	8.0	8.1
200000	8.4	8.3	8.8	8.5	8.1	8.0	8.4	8.6	8.9	8.8	8.9	8.7	8.7	8.8	7.9	8.0
210000	8.3	8.2	8.6	8.4	8.0	7.9	8.2	8.4	8.7	8.7	8.8	8.8	8.6	8.7	7.7	7.8
220000	8.1	8.1	8.4	8.2	7.8	7.7	8.1	8.3	8.6	8.5	8.6	8.6	8.4	8.5	7.5	7.6
230000	8.0	7.9	8.2	8.0	7.6	7.5	7.9	8.1	8.4	8.3	8.4	8.3	8.1	8.3	7.4	7.4
Daily Max	8.5	8.3	8.9	8.7	8.1	8.1	8.6	8.7	9.0	8.9	9.0	8.8	8.8	8.9	8.3	8.2
Daily Min	7.2	7.1	7.1	7.1	6.8	6.6	6.7	7.0	7.2	7.3	7.1	7.1	7.0	6.8	6.9	6.5
Average	7.8	7.7	7.9	7.9	7.5	7.3	7.6	7.8	8.0	8.1	8.0	7.9	7.9	7.8	7.5	7.3

License Minimum Dissolved Oxygen: 5.0 mg/l

Grand Rapids Upstream Dissolved Oxygen Summary - July 2019

Time HHMMSS	07/17/19	07/18/19	07/19/19	07/20/19	07/21/19	07/22/19	07/23/19	07/24/19	07/25/19	07/26/19	07/27/19	07/28/19	07/29/19	07/30/19	07/31/19
0	7.1	7.2	7.1	7.3	6.9	7.4	8.1	8.6	8.0	8.4	7.9	8.3	7.9	8.1	8.4
10000	7.0	7.1	6.9	7.1	6.7	7.2	7.8	8.3	7.8	8.1	7.7	8.2	7.7	7.7	8.2
20000	6.8	6.9	6.8	7.0	6.6	7.1	7.5	8.0	7.7	7.9	7.5	7.8	7.5	7.6	7.9
30000	6.6	6.8	6.7	6.8	6.4	7.0	7.4	7.8	7.5	7.6	7.4	7.7	7.4	7.3	7.7
40000	6.5	6.7	6.5	6.6	6.3	6.9	7.2	7.5	7.5	7.4	7.2	7.5	7.2	7.0	7.4
50000	6.4	6.7	6.5	6.6	6.3	6.8	7.0	7.4	7.2	7.3	7.1	7.2	7.0	6.9	7.3
60000	6.4	6.6	6.4	6.5	6.2	6.7	6.9	7.2	7.1	7.1	7.0	7.1	7.0	6.8	7.1
70000	6.4	6.6	6.4	6.4	6.2	6.6	6.8	7.1	7.1	7.0	6.9	7.0	6.8	6.7	7.0
80000	6.4	6.6	6.5	6.4	6.2	6.7	6.8	6.9	7.0	6.9	6.9	6.9	6.8	6.6	7.0
90000	6.6	6.7	6.6	6.6	6.3	6.8	6.9	6.9	7.0	7.0	7.0	7.0	6.7	6.7	7.1
100000	6.7	6.7	6.8	6.8	6.5	7.0	7.2	7.0	7.1	7.2	7.2	7.1	6.8	6.9	7.2
110000	7.0	6.8	7.2	7.1	6.9	7.3	7.4	7.4	7.4	7.3	7.4	7.4	7.1	7.2	7.5
120000	7.4	7.0	7.5	7.3	7.3	7.7	7.8	7.7	7.7	7.5	7.7	7.6	7.4	7.4	7.8
130000	7.7	7.3	7.7	7.3	7.4	8.0	8.1	7.9	8.0	7.7	8.0	7.9	7.6	7.7	8.2
140000	7.9	7.6	8.0	7.1	7.8	8.4	8.3	8.4	8.2	7.8	8.3	8.1	7.9	8.1	8.6
150000	8.1	7.8	8.2	7.1	8.1	8.6	8.7	8.7	8.6	7.9	8.6	8.4	8.2	8.3	8.9
160000	8.3	8.0	8.4	7.1	8.2	8.9	9.0	8.9	8.8	8.1	8.9	8.7	8.5	8.6	9.1
170000	8.4	8.0	8.4	7.2	8.2	9.0	9.1	9.1	9.0	8.3	9.1	8.8	8.8	8.8	9.3
180000	8.3	8.0	8.4	7.3	8.2	9.1	9.4	9.2	9.1	8.4	9.3	8.9	8.9	9.1	9.5
190000	8.2	8.0	8.3	7.4	8.2	9.0	9.1	9.0	9.1	8.4	9.3	8.9	9.0	9.2	9.5
200000	8.0	7.8	8.1	7.4	8.1	9.0	9.0	8.8	9.1	8.4	9.1	8.8	9.0	9.1	9.5
210000	7.8	7.6	7.9	7.4	8.0	8.7	9.0	8.7	9.0	8.4	9.1	8.6	8.8	9.0	9.4
220000	7.6	7.4	7.7	7.2	7.8	8.5	8.9	8.6	8.8	8.2	8.8	8.3	8.4	8.9	9.2
230000	7.4	7.2	7.4	7.1	7.6	8.4	8.8	8.3	8.6	8.1	8.7	8.1	8.2	8.7	9.1
Daily Max	8.4	8.0	8.4	7.4	8.2	9.1	9.4	9.2	9.1	8.4	9.3	8.9	9.0	9.2	9.5
Daily Min	6.4	6.6	6.4	6.4	6.2	6.6	6.8	6.9	7.0	6.9	6.9	6.9	6.7	6.6	7.0
Average	7.3	7.2	7.3	7.0	7.2	7.8	8.0	8.0	8.0	7.8	8.0	7.9	7.8	7.8	8.3

Grand Rapids Upstream Dissolved Oxygen Summary - August 2019

Time HHMMSS	08/01/19	08/02/19	08/03/19	08/04/19	08/05/19	08/06/19	08/07/19	08/08/19	08/09/19	08/10/19	08/11/19	08/12/19	08/13/19	08/14/19	08/15/19	08/16/19
0	8.8	8.7	7.7	7.5	8.4	7.4	7.9	7.1	8.0	8.4	8.7	8.3	8.6	8.1	8.5	9.0
10000	8.4	8.5	7.5	7.4	8.1	7.2	7.7	7.0	7.8	8.2	8.6	8.1	8.4	8.0	8.5	8.9
20000	8.2	8.1	7.4	7.2	7.7	7.0	7.3	6.9	7.6	8.0	8.3	8.0	8.2	7.9	8.5	8.7
30000	8.0	7.8	7.3	7.0	7.6	6.9	7.2	6.8	7.4	7.9	8.0	7.8	8.0	7.8	8.4	8.5
40000	7.7	7.7	7.2	6.9	7.4	6.7	7.0	6.6	7.2	7.6	7.8	7.7	7.9	7.6	8.3	8.2
50000	7.6	7.5	7.1	6.8	7.2	6.6	6.7	6.5	7.1	7.5	7.7	7.5	7.7	7.5	8.1	8.0
60000	7.4	7.3	6.9	6.6	7.1	6.5	6.7	6.5	7.1	7.3	7.4	7.3	7.5	7.4	7.8	7.9
70000	7.3	7.1	6.8	6.6	7.0	6.4	6.6	6.4	6.9	7.2	7.3	7.2	7.4	7.3	7.7	7.8
80000	7.2	7.0	6.7	6.5	6.9	6.4	6.5	6.4	6.9	7.1	7.2	7.1	7.3	7.2	7.5	7.7
90000	7.2	7.0	6.8	6.6	7.0	6.6	6.5	6.6	7.0	7.2	7.2	7.2	7.2	7.2	7.4	7.5
100000	7.4	7.1	6.9	6.8	7.1	6.7	6.7	6.9	7.2	7.3	7.3	7.3	7.2	7.2	7.5	7.6
110000	7.6	7.3	7.0	7.1	7.3	6.8	7.0	7.1	7.4	7.5	7.3	7.4	7.2	7.3	7.6	7.5
120000	7.8	7.7	7.3	7.5	7.6	7.2	7.3	7.3	7.7	7.9	7.5	7.6	7.3	7.4	7.7	7.7
130000	8.1	8.0	7.5	7.7	7.8	7.5	7.6	7.7	8.1	8.2	7.8	7.9	7.4	7.6	7.8	7.8
140000	8.4	8.3	7.9	8.1	8.3	7.8	7.9	8.0	8.4	8.5	7.9	8.2	7.6	7.8	7.8	7.8
150000	8.8	8.4	8.1	8.4	8.4	8.2	8.0	8.2	8.6	8.7	8.1	8.3	7.8	8.1	8.3	8.1
160000	9.0	8.5	7.9	8.7	8.5	8.5	8.0	8.4	8.8	9.0	8.3	8.6	7.9	8.2	8.6	8.1
170000	9.2	8.4	7.9	8.9	8.6	8.7	8.0	8.6	9.0	9.2	8.5	8.7	8.1	8.3	8.7	8.1
180000	9.3	8.5	8.1	9.0	8.5	8.7	8.0	8.7	9.1	9.3	8.6	8.9	8.2	8.5	8.7	8.4
190000	9.3	8.5	8.1	9.1	8.5	8.6	7.9	8.7	9.2	9.4	8.8	9.0	8.4	8.5	8.9	8.3
200000	9.3	8.4	8.1	9.0	8.2	8.6	7.7	8.8	9.2	9.3	8.8	9.0	8.4	8.7	9.0	8.4
210000	9.3	8.3	8.0	8.9	8.1	8.5	7.5	8.5	9.0	9.3	8.8	8.9	8.4	8.8	9.0	8.4
220000	9.1	8.1	7.9	8.7	7.7	8.3	7.4	8.5	8.9	9.2	8.6	8.9	8.3	8.7	9.0	8.2
230000	8.8	7.9	7.7	8.5	7.6	8.1	7.3	8.4	8.6	9.0	8.4	8.8	8.2	8.6	8.9	8.1
Daily Max	9.3	8.7	8.1	9.1	8.6	8.7	8.0	8.8	9.2	9.4	8.8	9.0	8.6	8.8	9.0	9.0
Daily Min	7.2	7.0	6.7	6.5	6.9	6.4	6.5	6.4	6.9	7.1	7.2	7.1	7.2	7.2	7.4	7.5
Average	8.3	7.9	7.5	7.7	7.8	7.5	7.3	7.5	8.0	8.3	8.0	8.1	7.9	7.9	8.3	8.1

License Minimum Dissolved Oxygen: 5.0 mg/l

Grand Rapids Upstream Dissolved Oxygen Summary - August 2019

Time HHMMSS	08/17/19	08/18/19	08/19/19	08/20/19	08/21/19	08/22/19	08/23/19	08/24/19	08/25/19	08/26/19	08/27/19	08/28/19	08/29/19	08/30/19	08/31/19
0	8.0	8.7	8.3	8.8											
10000	7.8	8.6	8.2	8.7											
20000	7.8	8.5	8.1	8.5											
30000	7.6	8.4	7.9	8.3											
40000	7.5	8.1	7.7	8.1											
50000	7.4	7.9	7.6	8.0											
60000	7.3	7.8	7.4	7.8											
70000	7.1	7.7	7.4	7.7											
80000	7.0	7.5	7.3	7.5											
90000	7.0	7.4	7.2	7.5											
100000	7.0	7.3	7.1	7.6											
110000	7.1	7.3	7.3	7.7											
120000	7.2	7.3	7.4	8.0											
130000	7.4	7.4	7.6												
140000	7.6	7.6	7.9												
150000	7.7	7.8	8.1												
160000	7.9	7.9	8.4												
170000	8.2	8.2	8.7												
180000	8.5	8.3	9.0												
190000	8.6	8.5	9.1												
200000	8.7	8.5	9.2												
210000	8.8	8.5	9.2												
220000	8.8	8.5	9.0												
230000	8.8	8.5	9.0												
Daily Max	8.8	8.7	9.2	8.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Daily Min	7.0	7.3	7.1	7.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Average	7.8	8.0	8.1	8.0	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

Missing data due to equipment malfunction

Grand Rapids Upstream Dissolved Oxygen Summary - September 2019

Time HHMMSS	09/01/19	09/02/19	09/03/19	09/04/19	09/05/19	09/06/19	09/07/19	09/08/19	09/09/19	09/10/19	09/11/19	09/12/19	09/13/19	09/14/19	09/15/19	09/16/19
0				8.0	8.2	8.3	8.4	8.4	8.6	8.6	8.7	8.8	8.9	9.0	9.1	9.3
10000				8.0	8.2	8.3	8.4	8.4	8.6	8.6	8.7	8.8	8.9	9.0	9.1	9.3
20000				8.0	8.2	8.3	8.4	8.5	8.6	8.6	8.7	8.8	8.9	9.0	9.1	9.3
30000				8.0	8.2	8.3	8.4	8.5	8.6	8.6	8.7	8.8	8.9	9.0	9.1	9.3
40000				8.0	8.2	8.3	8.4	8.5	8.6	8.6	8.7	8.8	8.9	9.0	9.1	9.3
50000				8.0	8.2	8.3	8.4	8.5	8.6	8.6	8.7	8.8	8.9	9.0	9.1	9.4
60000				8.0	8.2	8.3	8.4	8.5	8.6	8.6	8.7	8.8	8.9	9.0	9.2	9.4
70000				8.0	8.2	8.3	8.4	8.5	8.6	8.6	8.7	8.8	8.9	9.0	9.2	9.4
80000				8.0	8.2	8.3	8.4	8.5	8.6	8.7	8.7	8.8	8.9	9.0	9.2	9.4
90000				8.1	8.2	8.3	8.4	8.5	8.6	8.7	8.7	8.8	8.9	9.0	9.2	9.4
100000				8.1	8.2	8.3	8.4	8.5	8.6	8.7	8.7	8.8	8.9	9.0	9.2	9.4
110000				8.1	8.2	8.3	8.4	8.5	8.6	8.7	8.7	8.8	8.9	9.0	9.2	9.4
120000			7.8	8.1	8.2	8.3	8.4	8.5	8.6	8.7	8.7	8.8	8.9	9.0	9.2	9.4
130000			7.9	8.1	8.2	8.3	8.4	8.5	8.6	8.7	8.7	8.8	8.9	9.1	9.2	9.4
140000			7.9	8.1	8.2	8.3	8.4	8.5	8.6	8.7	8.8	8.8	8.9	9.1	9.2	9.5
150000			7.9	8.1	8.2	8.3	8.4	8.5	8.6	8.7	8.8	8.8	8.9	9.1	9.2	9.5
160000			8.0	8.1	8.2	8.3	8.4	8.5	8.6	8.7	8.8	8.8	8.9	9.1	9.3	9.5
170000			8.0	8.1	8.3	8.3	8.4	8.5	8.6	8.7	8.8	8.8	8.9	9.1	9.3	9.5
180000			8.0	8.1	8.3	8.3	8.4	8.5	8.6	8.7	8.8	8.8	8.9	9.1	9.3	9.5
190000			8.0	8.1	8.3	8.3	8.4	8.5	8.6	8.7	8.8	8.8	8.9	9.1	9.3	9.5
200000			8.0	8.1	8.3	8.3	8.4	8.5	8.6	8.7	8.8	8.8	8.9	9.1	9.3	9.5
210000			8.0	8.1	8.3	8.3	8.4	8.5	8.6	8.7	8.8	8.8	8.9	9.1	9.3	9.6
220000			8.0	8.1	8.3	8.4	8.4	8.5	8.6	8.7	8.8	8.8	8.9	9.1	9.3	9.6
230000			8.0	8.2	8.3	8.4	8.4	8.5	8.6	8.7	8.8	8.8	9.0	9.1	9.3	9.6
Daily Max	0.0	0.0	8.0	8.2	8.3	8.4	8.4	8.5	8.6	8.7	8.8	8.8	9.0	9.1	9.3	9.6
Daily Min	0.0	0.0	7.8	8.0	8.2	8.3	8.4	8.4	8.6	8.6	8.7	8.8	8.9	9.0	9.1	9.3
Average	#DIV/0!	#DIV/0!	7.9	8.1	8.2	8.3	8.4	8.5	8.6	8.7	8.7	8.8	8.9	9.0	9.2	9.4

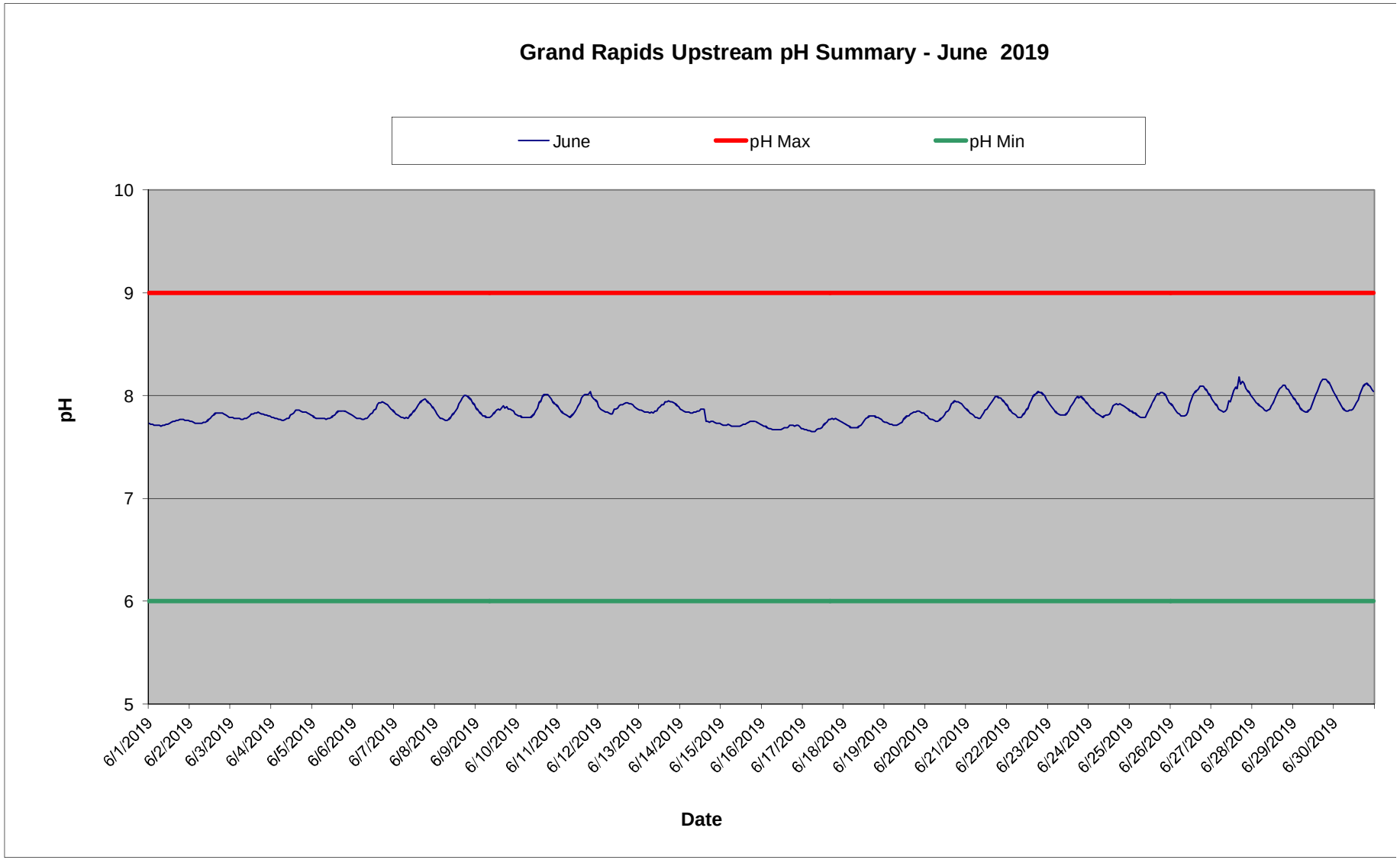
License Minimum Dissolved Oxygen: 5.0 mg/l

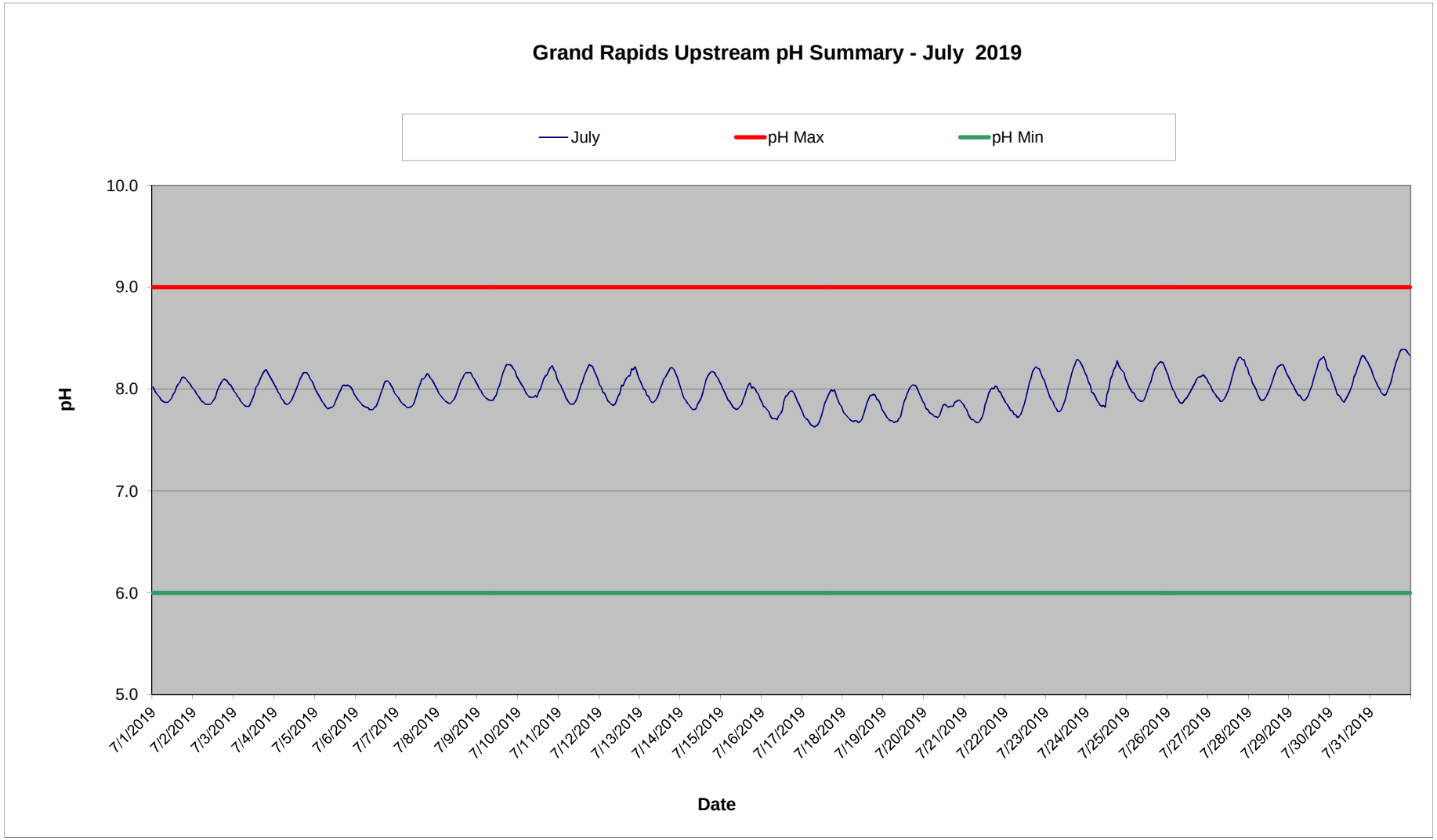
Missing data due to equipment malfunction

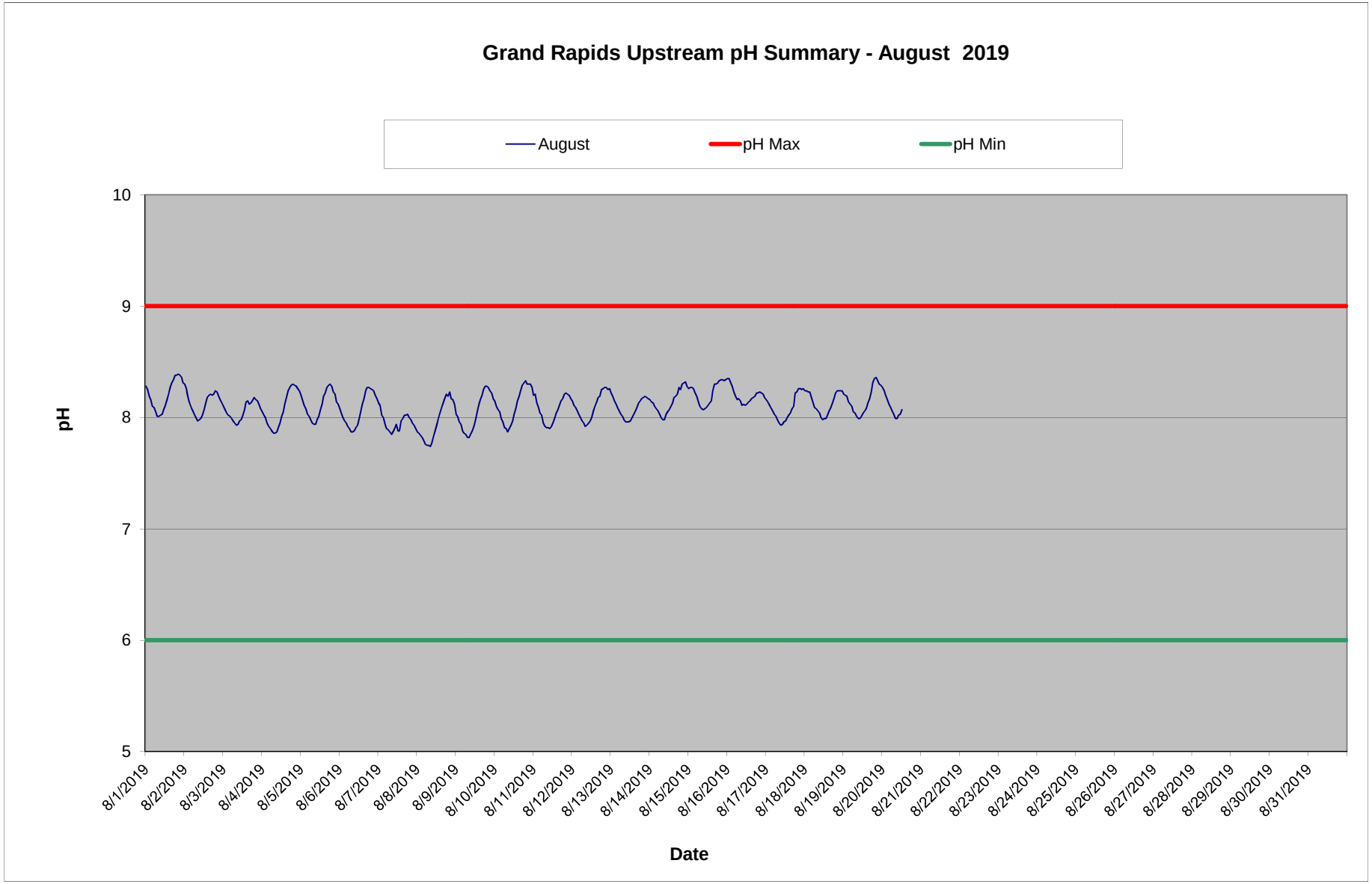
Suspect data. Potential monitor issue.

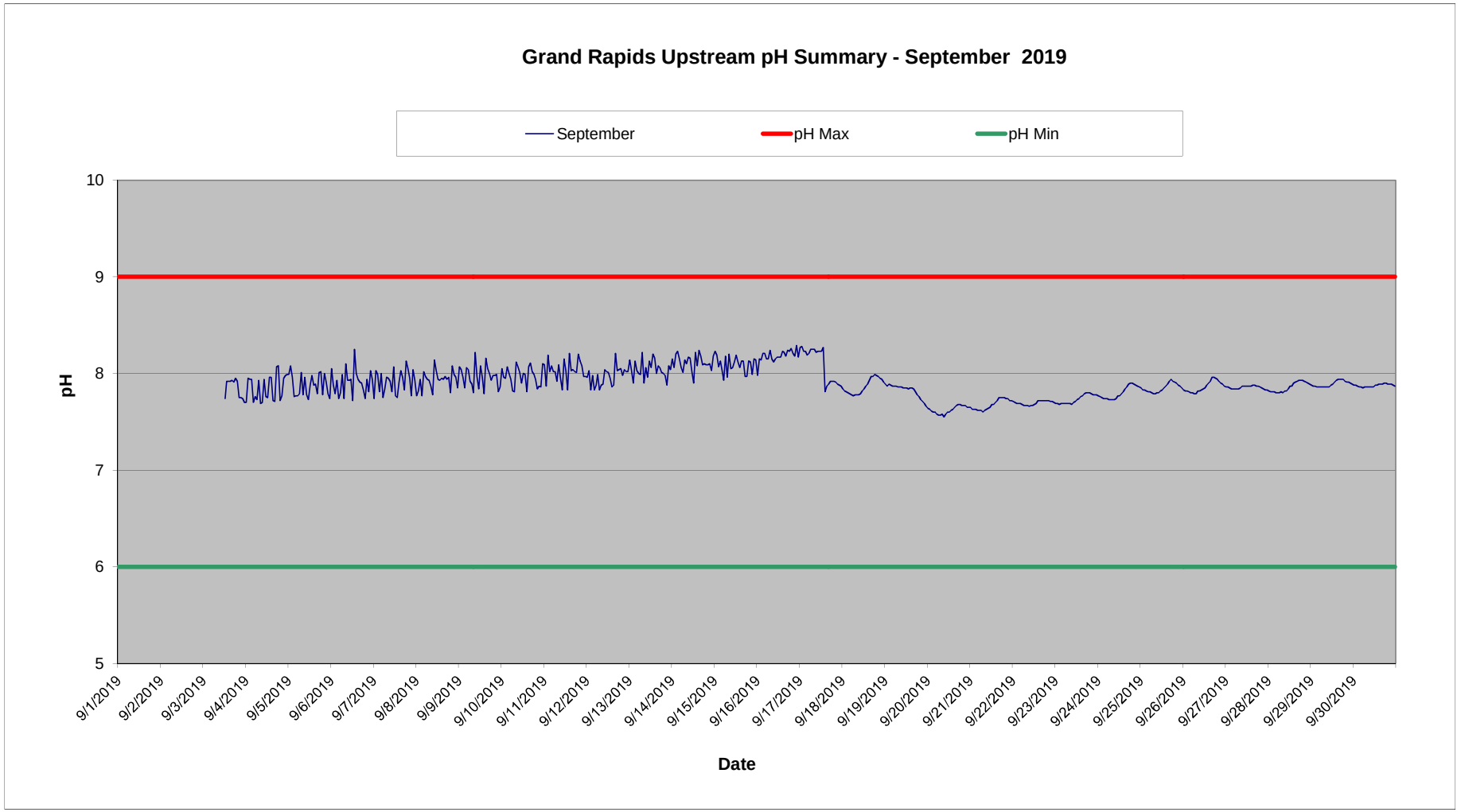
Grand Rapids Upstream Dissolved Oxygen Summary - September 2019

Time HHMMSS	09/17/19	09/18/19	09/19/19	09/20/19	09/21/19	09/22/19	09/23/19	09/24/19	09/25/19	09/26/19	09/27/19	09/28/19	09/29/19	09/30/19
0	9.6	8.4	8.4	7.2	7.1	7.2	6.9	7.4	7.9	7.7	8.1	7.9	8.4	8.6
10000	9.6	8.2	8.3	7.1	7.0	7.2	6.9	7.4	7.8	7.7	8.0	7.9	8.4	8.5
20000	9.6	8.2	8.3	6.9	7.0	7.1	6.7	7.3	7.8	7.6	8.0	7.9	8.4	8.5
30000	9.7	8.1	8.2	6.9	6.9	7.0	6.8	7.3	7.7	7.6	7.9	7.9	8.4	8.5
40000	9.7	8.0	8.2	6.8	6.8	7.0	6.8	7.2	7.6	7.5	7.9	7.9	8.3	8.4
50000	9.7	8.0	8.2	6.7	6.8	6.9	6.8	7.2	7.6	7.5	7.9	7.9	8.4	8.4
60000	9.7	8.0	8.1	6.6	6.8	6.9	6.8	7.1	7.5	7.5	7.9	7.9	8.4	8.4
70000	9.7	7.9	8.1	6.6	6.6	6.8	6.8	7.1	7.5	7.5	7.9	7.9	8.4	8.4
80000	9.8	7.9	8.1	6.6	6.8	6.8	6.8	7.1	7.5	7.5	8.0	7.8	8.4	8.4
90000	9.8	7.9	8.1	6.5	6.8	6.7	6.8	7.2	7.5	7.5	8.1	8.0	8.4	8.4
100000	9.9	8.0	8.1	6.6	6.8	6.8	6.9	7.2	7.5	7.5	8.1	8.0	8.5	8.5
110000	9.9	8.2	8.1	6.8	6.9	6.8	7.0	7.4	7.7	7.6	8.1	8.1	8.5	8.5
120000	9.9	8.3	8.1	6.7	7.1	6.9	7.2	7.5	7.7	7.8	8.2	8.3	8.6	8.6
130000	10.0	8.4	8.1	7.0	7.2	6.9	7.2	7.6	7.9	7.9	8.2	8.3	8.7	8.6
140000	8.6	8.6	8.1	7.1	7.3	7.1	7.3	7.7	8.0	8.2	8.2	8.5	8.8	8.6
150000	8.8	8.8	8.2	7.2	7.4	7.1	7.4	7.9	8.0	8.4	8.2	8.6	8.9	8.6
160000	8.9	8.9	8.2	7.4	7.6	7.1	7.6	8.0	8.2	8.5	8.2	8.7	8.9	8.6
170000	9.0	8.9	8.1	7.4	7.6	7.1	7.7	8.2	8.3	8.6	8.2	8.7	8.9	8.6
180000	8.9	9.0	8.0	7.4	7.6	7.1	7.7	8.3	8.2	8.5	8.1	8.7	8.9	8.6
190000	8.9	8.9	7.9	7.4	7.6	7.1	7.7	8.3	8.2	8.4	8.1	8.7	8.8	8.6
200000	8.8	8.8	7.8	7.3	7.5	7.1	7.6	8.2	8.1	8.4	8.0	8.7	8.8	8.6
210000	8.7	8.7	7.6	7.3	7.4	7.0	7.6	8.1	8.0	8.3	8.0	8.6	8.7	8.5
220000	8.6	8.6	7.5	7.2	7.4	7.0	7.5	8.0	7.9	8.2	8.0	8.5	8.7	8.5
230000	8.5	8.5	7.3	7.1	7.3	6.9	7.5	8.0	7.8	8.1	7.9	8.5	8.6	8.5
Daily Max	10.0	9.0	8.4	7.4	7.6	7.2	7.7	8.3	8.3	8.6	8.2	8.7	8.9	8.6
Daily Min	8.5	7.9	7.3	6.5	6.6	6.7	6.7	7.1	7.5	7.5	7.9	7.8	8.3	8.4
Average	9.3	8.4	8.0	7.0	7.1	7.0	7.2	7.6	7.8	7.9	8.0	8.2	8.6	8.5









Grand Rapids Upstream pH Summary - June 2019

Time HHMMSS	06/01/19	06/02/19	06/03/19	06/04/19	06/05/19	06/06/19	06/07/19	06/08/19	06/09/19	06/10/19	06/11/19	06/12/19	06/13/19	06/14/19	06/15/19	06/16/19
0	7.7	7.8	7.8	7.8	7.8	7.8	7.8	7.9	7.9	7.8	7.9	7.9	7.9	7.9	7.7	7.7
10000	7.7	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.9	7.8	7.9	7.9	7.9	7.9	7.7	7.7
20000	7.7	7.7	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.9	7.9	7.9	7.9	7.7	7.7
30000	7.7	7.7	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.9	7.8	7.8	7.7	7.7
40000	7.7	7.7	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.7	7.7
50000	7.7	7.7	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.7	7.7
60000	7.7	7.7	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.7	7.7
70000	7.7	7.7	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.7	7.7
80000	7.7	7.7	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.7	7.7
90000	7.7	7.7	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.9	7.9	7.8	7.7	7.7
100000	7.7	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.9	7.9	7.9	7.7	7.7
110000	7.7	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.9	7.9	7.9	7.9	7.9	7.7	7.7
120000	7.7	7.8	7.8	7.8	7.8	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.7	7.7
130000	7.7	7.8	7.8	7.8	7.8	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.7	7.7
140000	7.8	7.8	7.8	7.9	7.8	7.9	7.9	7.9	7.9	8.0	8.0	7.9	7.9	7.9	7.7	7.7
150000	7.8	7.8	7.8	7.9	7.9	7.9	7.9	8.0	7.9	8.0	8.0	7.9	7.9	7.8	7.7	7.7
160000	7.8	7.8	7.8	7.9	7.9	7.9	8.0	8.0	7.9	8.0	8.0	7.9	7.9	7.8	7.7	7.7
170000	7.8	7.8	7.8	7.9	7.9	7.9	8.0	8.0	7.9	8.0	8.0	7.9	8.0	7.7	7.8	7.7
180000	7.8	7.8	7.8	7.8	7.9	7.9	8.0	8.0	7.9	8.0	8.0	7.9	7.9	7.8	7.8	7.7
190000	7.8	7.8	7.8	7.8	7.9	7.9	8.0	8.0	7.9	8.0	8.0	7.9	7.9	7.8	7.8	7.7
200000	7.8	7.8	7.8	7.8	7.8	7.9	7.9	8.0	7.9	8.0	8.0	7.9	7.9	7.7	7.8	7.7
210000	7.8	7.8	7.8	7.8	7.8	7.9	7.9	8.0	7.9	7.9	8.0	7.9	7.9	7.7	7.7	7.7
220000	7.8	7.8	7.8	7.8	7.8	7.9	7.9	7.9	7.9	7.9	8.0	7.9	7.9	7.7	7.7	7.7
230000	7.8	7.8	7.8	7.8	7.8	7.9	7.9	7.9	7.8	7.9	7.9	7.9	7.9	7.7	7.7	7.7
Daily Max	7.8	7.8	7.8	7.9	7.9	7.9	8.0	8.0	7.9	8.0	8.0	7.9	8.0	7.9	7.8	7.7
Daily Min	7.7	7.7	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.7	7.7	7.7
Average	7.7	7.8	7.8	7.8	7.8	7.8	7.9	7.9	7.8	7.9	7.9	7.9	7.9	7.8	7.7	7.7

License maximum pH: 9
License minimum pH: 6

Grand Rapids Upstream pH Summary - June 2019

Time HHMMSS	06/17/19	06/18/19	06/19/19	06/20/19	06/21/19	06/22/19	06/23/19	06/24/19	06/25/19	06/26/19	06/27/19	06/28/19	06/29/19	06/30/19
0	7.7	7.7	7.7	7.8	7.9	7.9	7.9	7.9	7.9	7.9	8.0	8.0	8.0	8.0
10000	7.7	7.7	7.7	7.8	7.9	7.9	7.9	7.9	7.9	7.9	7.9	8.0	8.0	8.0
20000	7.7	7.7	7.7	7.8	7.8	7.9	7.9	7.9	7.8	7.9	7.9	7.9	7.9	8.0
30000	7.7	7.7	7.7	7.8	7.8	7.8	7.9	7.9	7.8	7.9	7.9	7.9	7.9	7.9
40000	7.7	7.7	7.7	7.8	7.8	7.8	7.9	7.8	7.8	7.8	7.9	7.9	7.9	7.9
50000	7.7	7.7	7.7	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.9	7.9	7.9	7.9
60000	7.7	7.7	7.7	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.9	7.9	7.9	7.9
70000	7.7	7.7	7.7	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.9	7.8	7.9
80000	7.7	7.7	7.7	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.9	7.9	7.8	7.9
90000	7.7	7.7	7.7	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.9	7.9	7.9	7.9
100000	7.7	7.7	7.7	7.8	7.8	7.8	7.8	7.8	7.8	7.8	8.0	7.9	7.9	7.9
110000	7.7	7.7	7.8	7.8	7.9	7.9	7.8	7.8	7.9	7.9	7.9	7.9	7.9	7.9
120000	7.7	7.8	7.8	7.8	7.9	7.9	7.9	7.8	7.9	8.0	8.0	7.9	8.0	7.9
130000	7.7	7.8	7.8	7.9	7.9	7.9	7.9	7.9	7.9	8.0	8.1	8.0	8.0	7.9
140000	7.7	7.8	7.8	7.9	7.9	8.0	7.9	7.9	8.0	8.0	8.1	8.0	8.0	8.0
150000	7.8	7.8	7.8	7.9	7.9	8.0	7.9	7.9	8.0	8.1	8.1	8.0	8.1	8.0
160000	7.8	7.8	7.8	7.9	8.0	8.0	8.0	7.9	8.0	8.1	8.2	8.1	8.1	8.1
170000	7.8	7.8	7.8	8.0	8.0	8.0	8.0	7.9	8.0	8.1	8.1	8.1	8.2	8.1
180000	7.8	7.8	7.8	7.9	8.0	8.0	8.0	7.9	8.0	8.1	8.1	8.1	8.2	8.1
190000	7.8	7.8	7.9	7.9	8.0	8.0	8.0	7.9	8.0	8.1	8.1	8.1	8.2	8.1
200000	7.8	7.8	7.9	7.9	8.0	8.0	8.0	7.9	8.0	8.1	8.1	8.1	8.1	8.1
210000	7.8	7.8	7.8	7.9	8.0	8.0	8.0	7.9	8.0	8.1	8.1	8.1	8.1	8.1
220000	7.8	7.8	7.8	7.9	7.9	8.0	7.9	7.9	8.0	8.0	8.0	8.0	8.1	8.1
230000	7.7	7.8	7.8	7.9	7.9	8.0	7.9	7.9	7.9	8.0	8.0	8.0	8.1	8.0
Daily Max	7.8	7.8	7.9	8.0	8.0	8.0	8.0	7.9	8.0	8.1	8.2	8.1	8.2	8.1
Daily Min	7.7	7.7	7.7	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.9	7.8	7.9
Average	7.7	7.7	7.8	7.8	7.9	7.9	7.9	7.9	7.9	7.9	8.0	8.0	8.0	8.0

Grand Rapids Upstream pH Summary - July 2019

Time HHMMSS	07/01/19	07/02/19	07/03/19	07/04/19	07/05/19	07/06/19	07/07/19	07/08/19	07/09/19	07/10/19	07/11/19	07/12/19	07/13/19	07/14/19	07/15/19	07/16/19
0	8.0	8.0	8.0	8.0	8.0	7.9	7.9	8.0	8.0	8.1	8.1	8.0	8.1	8.0	8.0	7.9
10000	8.0	8.0	8.0	8.0	8.0	7.9	7.9	8.0	8.0	8.1	8.0	8.0	8.0	8.0	8.0	7.8
20000	8.0	8.0	7.9	8.0	7.9	7.9	7.9	7.9	8.0	8.0	8.0	8.0	8.0	7.9	8.0	7.8
30000	7.9	7.9	7.9	8.0	7.9	7.9	7.9	7.9	8.0	8.0	8.0	8.0	8.0	7.9	7.9	7.8
40000	7.9	7.9	7.9	7.9	7.9	7.8	7.9	7.9	7.9	8.0	7.9	7.9	7.9	7.9	7.9	7.8
50000	7.9	7.9	7.9	7.9	7.9	7.8	7.8	7.9	7.9	8.0	7.9	7.9	7.9	7.8	7.9	7.7
60000	7.9	7.9	7.8	7.9	7.8	7.8	7.8	7.9	7.9	7.9	7.9	7.9	7.9	7.8	7.9	7.7
70000	7.9	7.9	7.8	7.9	7.8	7.8	7.8	7.9	7.9	7.9	7.9	7.9	7.9	7.8	7.8	7.7
80000	7.9	7.9	7.8	7.9	7.8	7.8	7.8	7.9	7.9	7.9	7.9	7.8	7.9	7.8	7.8	7.7
90000	7.9	7.9	7.8	7.9	7.8	7.8	7.8	7.9	7.9	7.9	7.9	7.9	7.9	7.8	7.8	7.7
100000	7.9	7.9	7.9	7.9	7.8	7.8	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.8	7.7
110000	7.9	7.9	7.9	7.9	7.8	7.8	7.9	7.9	7.9	7.9	7.9	7.9	8.0	7.9	7.8	7.8
120000	8.0	7.9	8.0	8.0	7.9	7.8	8.0	8.0	8.0	8.0	8.0	8.0	8.0	7.9	7.9	7.8
130000	8.0	7.9	8.0	8.0	7.9	7.9	8.0	8.0	8.0	8.0	8.0	8.0	8.1	8.0	7.9	7.9
140000	8.0	8.0	8.0	8.1	8.0	7.9	8.1	8.1	8.1	8.1	8.1	8.0	8.1	8.0	7.9	7.9
150000	8.1	8.0	8.1	8.1	8.0	8.0	8.1	8.1	8.2	8.1	8.1	8.1	8.1	8.1	8.0	7.9
160000	8.1	8.1	8.1	8.1	8.0	8.0	8.1	8.1	8.2	8.1	8.2	8.1	8.2	8.1	8.0	8.0
170000	8.1	8.1	8.2	8.2	8.0	8.1	8.1	8.2	8.2	8.1	8.2	8.1	8.2	8.2	8.1	8.0
180000	8.1	8.1	8.2	8.2	8.0	8.1	8.2	8.2	8.2	8.2	8.2	8.1	8.2	8.2	8.0	8.0
190000	8.1	8.1	8.2	8.2	8.0	8.1	8.1	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.0	8.0
200000	8.1	8.1	8.2	8.1	8.0	8.1	8.1	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.0	7.9
210000	8.1	8.1	8.1	8.1	8.0	8.0	8.1	8.1	8.2	8.2	8.2	8.2	8.2	8.1	8.0	7.9
220000	8.1	8.0	8.1	8.1	8.0	8.0	8.1	8.1	8.2	8.2	8.1	8.2	8.1	8.1	8.0	7.9
230000	8.0	8.0	8.1	8.0	8.0	8.0	8.0	8.1	8.1	8.1	8.1	8.1	8.1	8.1	7.9	7.8
Daily Max	8.1	8.1	8.2	8.2	8.0	8.1	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.1	8.0
Daily Min	7.9	7.9	7.8	7.9	7.8	7.8	7.8	7.9	7.9	7.9	7.9	7.8	7.9	7.8	7.8	7.7
Average	8.0	8.0	8.0	8.0	7.9	7.9	8.0	8.0	8.1	8.0	8.0	8.0	8.0	8.0	7.9	7.8

License maximum pH: 9
License minimum pH: 6

Grand Rapids Upstream pH Summary - July 2019

Time HHMMSS	07/17/19	07/18/19	07/19/19	07/20/19	07/21/19	07/22/19	07/23/19	07/24/19	07/25/19	07/26/19	07/27/19	07/28/19	07/29/19	07/30/19	07/31/19
0	7.8	7.8	7.8	7.9	7.8	7.9	8.0	8.1	8.1	8.1	8.1	8.1	8.1	8.2	8.2
10000	7.7	7.8	7.8	7.8	7.8	7.9	8.0	8.1	8.0	8.1	8.0	8.1	8.1	8.1	8.2
20000	7.7	7.7	7.7	7.8	7.8	7.8	7.9	8.0	8.0	8.0	8.0	8.1	8.0	8.1	8.1
30000	7.7	7.7	7.7	7.8	7.7	7.8	7.9	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.1
40000	7.7	7.7	7.7	7.8	7.7	7.8	7.9	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
50000	7.7	7.7	7.7	7.8	7.7	7.8	7.8	7.9	7.9	7.9	7.9	8.0	7.9	7.9	8.0
60000	7.6	7.7	7.7	7.7	7.7	7.8	7.8	7.9	7.9	7.9	7.9	7.9	7.9	7.9	8.0
70000	7.6	7.7	7.7	7.7	7.7	7.7	7.8	7.9	7.9	7.9	7.9	7.9	7.9	7.9	8.0
80000	7.6	7.7	7.7	7.7	7.7	7.7	7.8	7.8	7.9	7.9	7.9	7.9	7.9	7.9	7.9
90000	7.7	7.7	7.7	7.7	7.7	7.8	7.8	7.8	7.9	7.9	7.9	7.9	7.9	7.9	8.0
100000	7.7	7.7	7.7	7.8	7.7	7.8	7.8	7.8	7.9	7.9	7.9	7.9	7.9	7.9	8.0
110000	7.7	7.7	7.8	7.8	7.8	7.9	7.9	7.8	7.9	7.9	8.0	8.0	7.9	8.0	8.0
120000	7.8	7.8	7.9	7.9	7.9	7.9	7.9	8.0	8.0	7.9	8.0	8.0	8.0	8.0	8.1
130000	7.9	7.8	7.9	7.8	7.9	8.0	8.0	8.0	8.0	8.0	8.1	8.0	8.0	8.1	8.2
140000	7.9	7.9	8.0	7.8	8.0	8.1	8.1	8.1	8.1	8.0	8.1	8.1	8.1	8.1	8.2
150000	7.9	7.9	8.0	7.8	8.0	8.1	8.1	8.1	8.1	8.0	8.2	8.1	8.2	8.2	8.3
160000	8.0	7.9	8.0	7.8	8.0	8.2	8.2	8.2	8.2	8.1	8.2	8.2	8.2	8.2	8.3
170000	8.0	7.9	8.0	7.8	8.0	8.2	8.2	8.2	8.2	8.1	8.3	8.2	8.3	8.3	8.4
180000	8.0	8.0	8.0	7.9	8.0	8.2	8.3	8.3	8.2	8.1	8.3	8.2	8.3	8.3	8.4
190000	8.0	7.9	8.0	7.9	8.0	8.2	8.3	8.2	8.3	8.1	8.3	8.2	8.3	8.3	8.4
200000	7.9	7.9	8.0	7.9	8.0	8.2	8.3	8.2	8.3	8.1	8.3	8.2	8.3	8.3	8.4
210000	7.9	7.9	8.0	7.9	8.0	8.2	8.2	8.2	8.3	8.1	8.3	8.2	8.3	8.3	8.4
220000	7.9	7.9	7.9	7.9	7.9	8.1	8.2	8.2	8.2	8.1	8.2	8.2	8.2	8.3	8.4
230000	7.8	7.8	7.9	7.9	7.9	8.1	8.2	8.1	8.2	8.1	8.2	8.1	8.2	8.2	8.3
Daily Max	8.0	8.0	8.0	7.9	8.0	8.2	8.3	8.3	8.3	8.1	8.3	8.2	8.3	8.3	8.4
Daily Min	7.6	7.7	7.7	7.7	7.7	7.7	7.8	7.8	7.9	7.9	7.9	7.9	7.9	7.9	7.9
Average	7.8	7.8	7.8	7.8	7.8	8.0	8.0	8.0	8.1	8.0	8.1	8.1	8.1	8.1	8.2

Grand Rapids Upstream pH Summary - August 2019

Time HHMMSS	08/01/19	08/02/19	08/03/19	08/04/19	08/05/19	08/06/19	08/07/19	08/08/19	08/09/19	08/10/19	08/11/19	08/12/19	08/13/19	08/14/19	08/15/19	08/16/19
0	8.3	8.3	8.1	8.1	8.2	8.1	8.1	7.9	8.0	8.2	8.2	8.2	8.2	8.2	8.3	8.4
10000	8.3	8.3	8.1	8.0	8.2	8.0	8.1	7.9	8.0	8.1	8.2	8.1	8.2	8.1	8.3	8.4
20000	8.2	8.2	8.0	8.0	8.1	8.0	8.0	7.8	8.0	8.1	8.1	8.1	8.2	8.1	8.3	8.3
30000	8.2	8.1	8.0	8.0	8.1	8.0	8.0	7.8	7.9	8.1	8.1	8.1	8.1	8.1	8.3	8.3
40000	8.1	8.1	8.0	7.9	8.0	8.0	7.9	7.8	7.9	8.0	8.0	8.0	8.1	8.1	8.2	8.2
50000	8.1	8.1	8.0	7.9	8.0	7.9	7.9	7.8	7.9	8.0	8.0	8.0	8.1	8.1	8.2	8.2
60000	8.1	8.0	8.0	7.9	8.0	7.9	7.9	7.8	7.9	7.9	8.0	8.0	8.0	8.0	8.1	8.2
70000	8.0	8.0	8.0	7.9	8.0	7.9	7.9	7.8	7.8	7.9	7.9	8.0	8.0	8.0	8.1	8.2
80000	8.0	8.0	7.9	7.9	7.9	7.9	7.9	7.7	7.8	7.9	7.9	7.9	8.0	8.0	8.1	8.2
90000	8.0	8.0	7.9	7.9	7.9	7.9	7.9	7.8	7.9	7.9	7.9	7.9	8.0	8.0	8.1	8.1
100000	8.0	8.0	8.0	7.9	8.0	7.9	7.9	7.8	7.9	7.9	7.9	8.0	8.0	8.0	8.1	8.1
110000	8.1	8.0	8.0	8.0	8.0	7.9	7.9	7.9	7.9	8.0	7.9	8.0	8.0	8.1	8.1	8.1
120000	8.1	8.1	8.0	8.0	8.1	8.0	7.9	7.9	8.0	8.0	8.0	8.0	8.0	8.1	8.1	8.1
130000	8.2	8.1	8.1	8.1	8.1	8.1	7.9	8.0	8.0	8.1	8.0	8.1	8.0	8.1	8.1	8.1
140000	8.2	8.2	8.1	8.1	8.2	8.1	8.0	8.0	8.1	8.2	8.0	8.1	8.0	8.1	8.2	8.2
150000	8.3	8.2	8.2	8.2	8.2	8.2	8.0	8.1	8.2	8.2	8.1	8.1	8.1	8.2	8.2	8.2
160000	8.3	8.2	8.1	8.2	8.3	8.2	8.0	8.1	8.2	8.2	8.1	8.2	8.1	8.2	8.3	8.2
170000	8.3	8.2	8.1	8.3	8.3	8.3	8.0	8.2	8.3	8.3	8.2	8.2	8.1	8.2	8.3	8.2
180000	8.4	8.2	8.2	8.3	8.3	8.3	8.0	8.2	8.3	8.3	8.2	8.3	8.2	8.3	8.3	8.2
190000	8.4	8.2	8.2	8.3	8.3	8.3	8.0	8.2	8.3	8.3	8.2	8.3	8.2	8.3	8.3	8.2
200000	8.4	8.2	8.2	8.3	8.2	8.3	8.0	8.2	8.3	8.3	8.2	8.3	8.2	8.3	8.3	8.2
210000	8.4	8.2	8.2	8.3	8.2	8.2	8.0	8.2	8.2	8.3	8.2	8.3	8.2	8.3	8.3	8.2
220000	8.4	8.2	8.1	8.3	8.1	8.2	7.9	8.2	8.2	8.3	8.2	8.3	8.2	8.3	8.3	8.2
230000	8.3	8.1	8.1	8.2	8.1	8.2	7.9	8.1	8.2	8.3	8.2	8.3	8.2	8.3	8.3	8.2
Daily Max	8.4	8.3	8.2	8.3	8.3	8.3	8.1	8.2	8.3	8.3	8.2	8.3	8.2	8.3	8.3	8.4
Daily Min	8.0	8.0	7.9	7.9	7.9	7.9	7.9	7.7	7.8	7.9	7.9	7.9	8.0	8.0	8.1	8.1
Average	8.2	8.1	8.1	8.1	8.1	8.1	8.0	8.0	8.0	8.1	8.1	8.1	8.1	8.1	8.2	8.2

License maximum pH: 9
License minimum pH: 6

Grand Rapids Upstream pH Summary - August 2019

Time HHMMSS	08/17/19	08/18/19	08/19/19	08/20/19	08/21/19	08/22/19	08/23/19	08/24/19	08/25/19	08/26/19	08/27/19	08/28/19	08/29/19	08/30/19	08/31/19
0	8.2	8.2	8.2	8.3											
10000	8.1	8.2	8.2	8.2											
20000	8.1	8.2	8.2	8.2											
30000	8.1	8.2	8.1	8.2											
40000	8.1	8.2	8.1	8.1											
50000	8.0	8.1	8.1	8.1											
60000	8.0	8.1	8.1	8.1											
70000	8.0	8.1	8.0	8.0											
80000	8.0	8.1	8.0	8.0											
90000	7.9	8.0	8.0	8.0											
100000	7.9	8.0	8.0	8.0											
110000	8.0	8.0	8.0	8.0											
120000	8.0	8.0	8.0	8.1											
130000	8.0	8.0	8.1												
140000	8.0	8.0	8.1												
150000	8.0	8.1	8.1												
160000	8.1	8.1	8.2												
170000	8.1	8.1	8.2												
180000	8.2	8.2	8.3												
190000	8.2	8.2	8.4												
200000	8.3	8.2	8.4												
210000	8.3	8.2	8.3												
220000	8.3	8.2	8.3												
230000	8.3	8.2	8.3												
Daily Max	8.3	8.2	8.4	8.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Daily Min	7.9	8.0	8.0	8.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Average	8.1	8.1	8.2	8.1	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

Missing data due to equipment malfunction

Grand Rapids Upstream pH Summary - September 2019

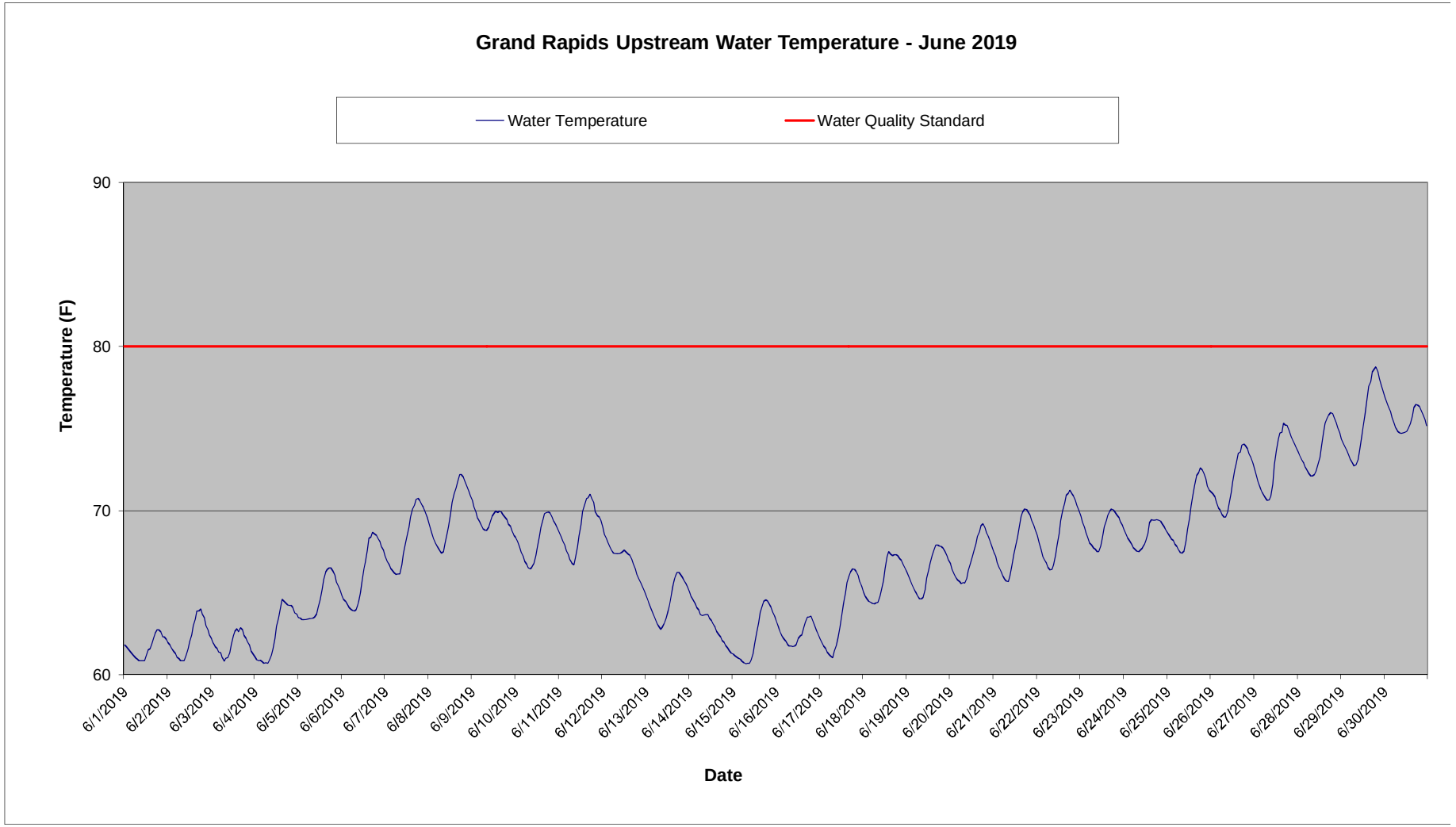
Time HHMMSS	09/01/19	09/02/19	09/03/19	09/04/19	09/05/19	09/06/19	09/07/19	09/08/19	09/09/19	09/10/19	09/11/19	09/12/19	09/13/19	09/14/19	09/15/19	09/16/19
0				7.7	8.0	8.1	7.7	7.8	8.1	8.1	8.1	8.0	8.1	8.2	8.2	8.0
10000				8.0	8.1	7.9	8.0	7.8	8.0	8.0	7.9	8.0	8.0	8.1	8.2	8.2
20000				7.9	8.0	7.8	8.0	7.9	8.0	8.0	8.2	7.8	7.9	8.2	8.1	8.1
30000				7.9	7.8	7.9	7.8	7.8	7.9	8.1	8.0	8.0	8.1	8.2	8.1	8.2
40000				7.7	7.8	7.7	8.0	8.0	8.1	8.0	8.1	7.8	8.0	8.2	8.0	8.2
50000				7.8	7.8	7.8	7.8	8.0	8.0	7.9	8.0	7.9	8.0	8.1	7.9	8.2
60000				7.7	7.8	8.0	7.8	7.9	7.9	7.8	8.0	8.0	8.0	8.0	8.2	8.2
70000				7.9	8.0	7.7	8.0	7.9	7.9	7.8	7.9	7.8	8.2	8.1	8.0	8.2
80000				7.7	7.8	8.1	8.0	7.9	7.8	8.1	8.1	7.9	7.9	8.1	8.2	8.2
90000				7.7	8.0	7.9	7.9	7.8	8.2	8.1	8.0	7.9	8.1	8.2	8.1	8.1
100000				7.9	7.8	7.9	7.8	8.1	8.0	8.0	7.8	8.0	8.0	8.2	8.1	8.2
110000				7.8	7.7	7.9	8.1	8.0	7.8	7.9	8.2	8.0	8.1	8.0	8.1	8.2
120000			7.7	7.8	7.9	7.7	7.8	7.9	8.1	8.0	8.0	8.0	8.1	7.9	8.2	8.2
130000			7.9	8.0	8.0	8.3	7.8	7.9	8.0	8.0	7.8	8.0	8.2	8.2	8.1	8.2
140000			7.9	8.0	7.9	8.0	7.9	8.0	7.8	7.8	8.2	7.9	8.2	8.1	8.1	8.2
150000			7.9	7.7	7.9	7.9	8.0	7.9	8.2	8.1	8.0	7.9	8.0	8.2	8.1	8.2
160000			7.9	7.7	7.8	7.9	8.0	8.0	8.1	8.1	8.0	8.2	8.1	8.2	8.1	8.2
170000			7.9	8.1	8.0	7.9	7.8	7.9	8.0	8.0	8.0	8.0	8.1	8.1	8.0	8.2
180000			8.0	8.1	8.0	7.8	8.1	8.0	7.9	8.0	8.0	8.0	8.0	8.1	8.0	8.2
190000			7.9	7.7	7.8	7.7	8.1	7.8	8.0	7.9	8.2	8.1	8.0	8.1	8.1	8.3
200000			7.8	7.8	8.0	7.9	8.0	8.1	8.0	7.8	8.1	8.0	8.0	8.1	8.1	8.2
210000			7.8	8.0	7.9	7.8	7.8	8.0	8.0	7.9	8.1	8.0	7.9	8.1	8.0	8.2
220000			7.7	8.0	7.8	8.0	8.0	8.0	7.8	7.9	8.0	8.0	8.1	8.0	8.2	8.3
230000			7.7	8.0	7.7	7.9	7.9	7.9	7.9	8.1	8.0	8.0	8.0	8.2	8.1	8.2
Daily Max	0.0	0.0	8.0	8.1	8.1	8.3	8.1	8.1	8.2	8.1	8.2	8.2	8.2	8.2	8.2	8.3
Daily Min	0.0	0.0	7.7	7.7	7.7	7.7	7.7	7.8	7.8	7.8	7.8	7.8	7.9	7.9	7.9	8.0
Average	#DIV/0!	#DIV/0!	7.8	7.9	7.9	7.9	7.9	7.9	8.0	8.0	8.0	8.0	8.0	8.1	8.1	8.2

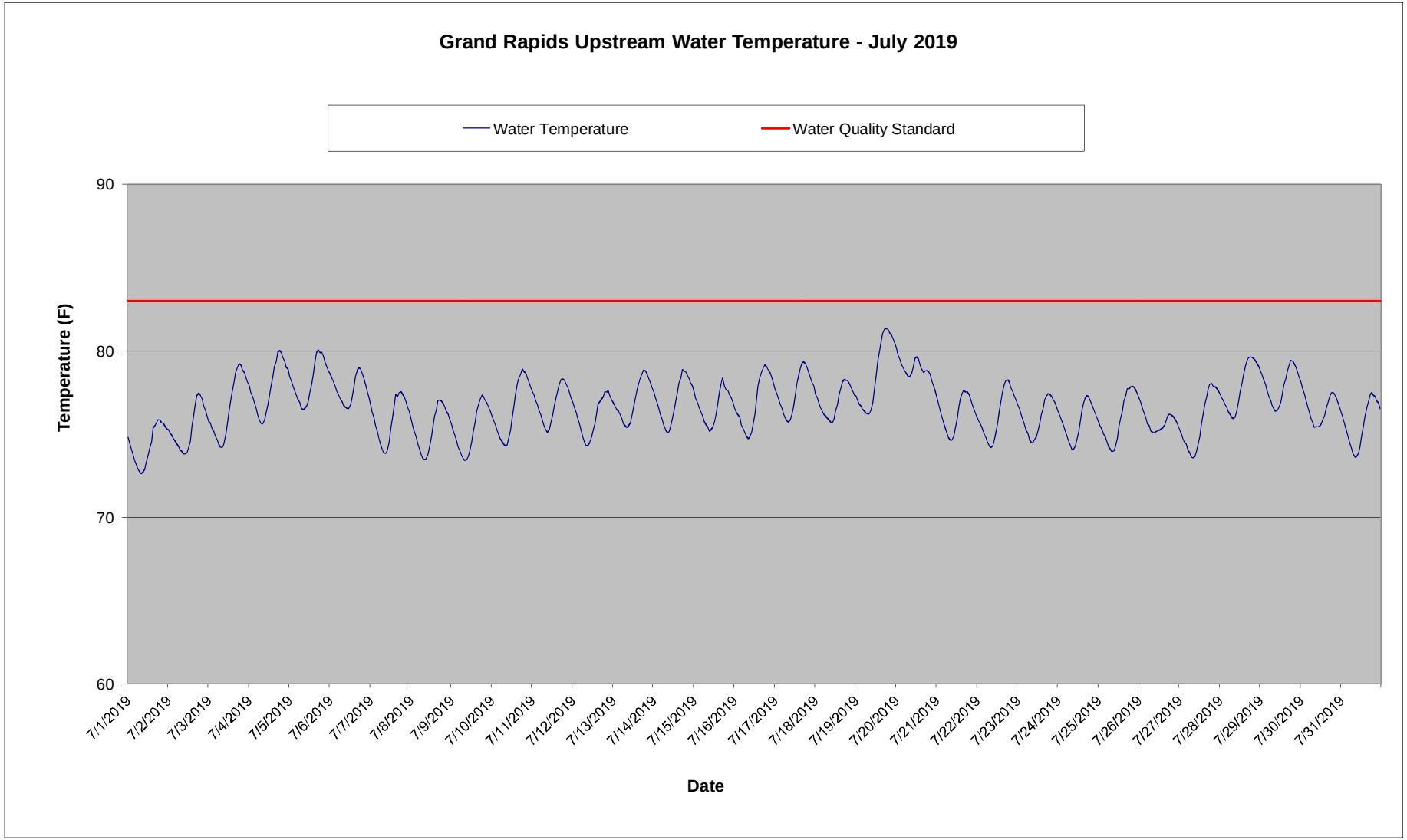
License maximum pH: 9
License minimum pH: 6

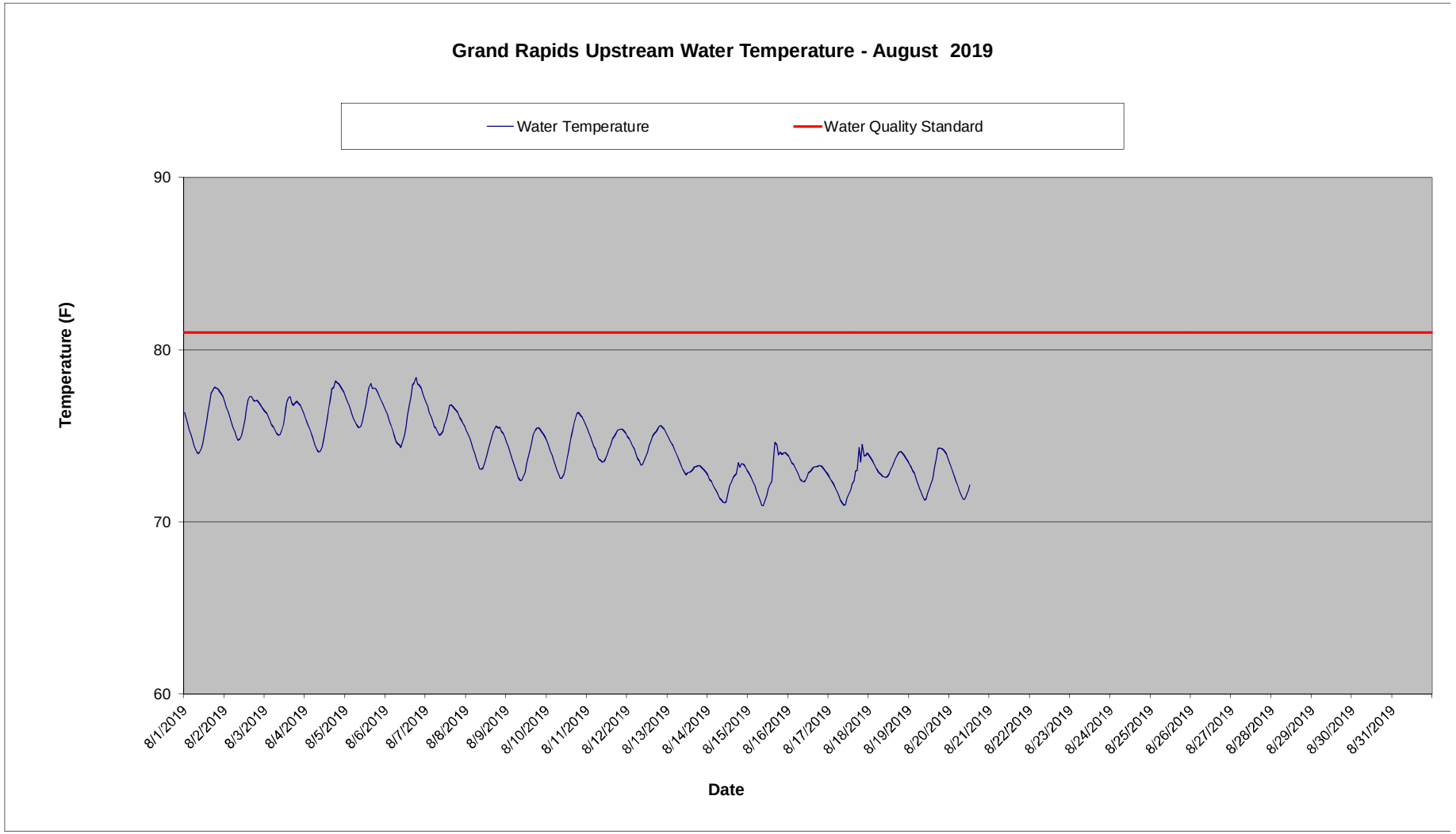
Missing data due to equipment malfunction

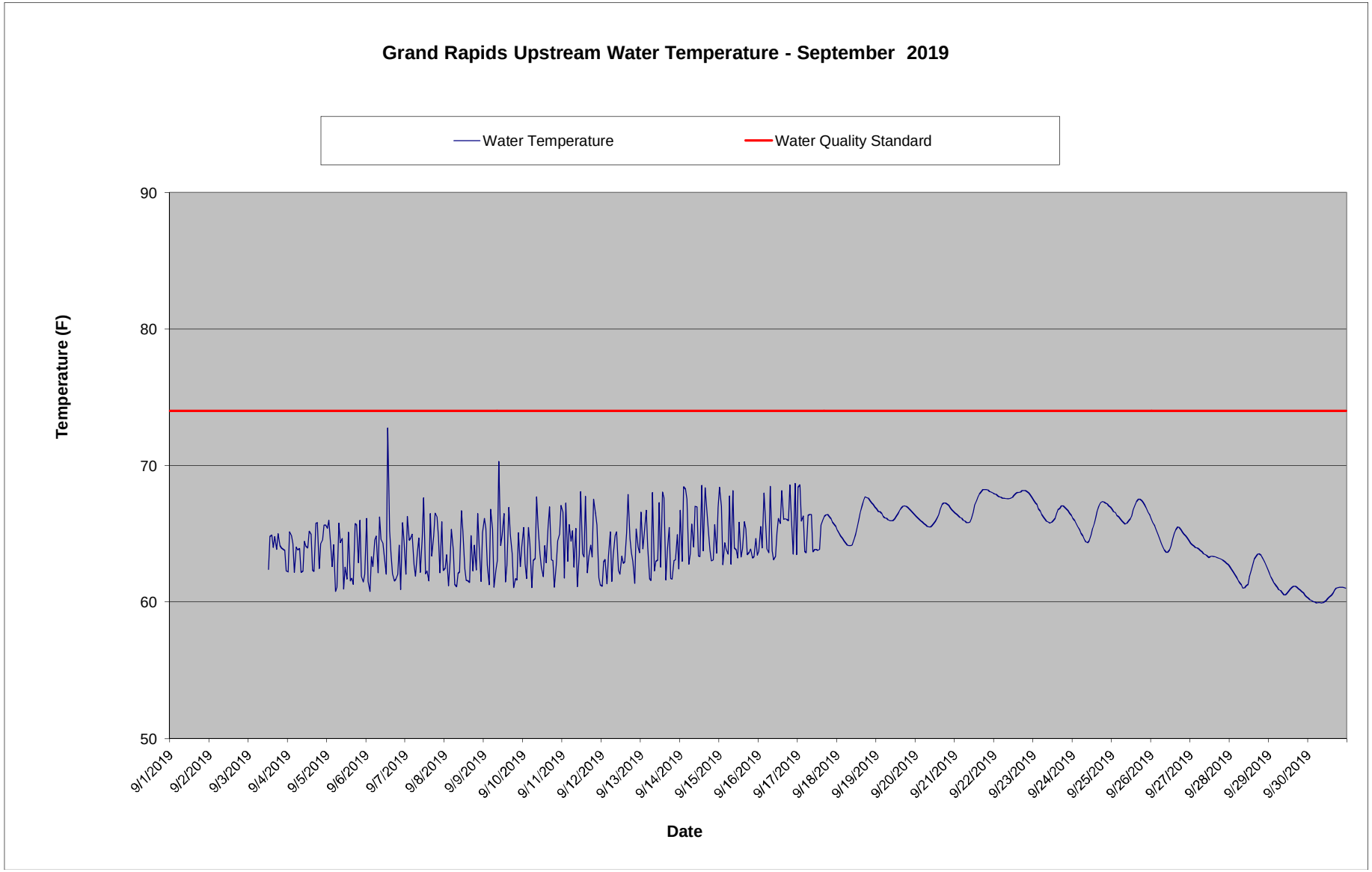
Grand Rapids Upstream pH Summary - September 2019

Time HHMMSS	09/17/19	09/18/19	09/19/19	09/20/19	09/21/19	09/22/19	09/23/19	09/24/19	09/25/19	09/26/19	09/27/19	09/28/19	09/29/19	09/30/19
0	8.3	7.8	7.9	7.6	7.7	7.7	7.7	7.8	7.9	7.8	7.9	7.8	7.9	7.9
10000	8.3	7.8	7.9	7.6	7.6	7.7	7.7	7.8	7.8	7.8	7.9	7.8	7.9	7.9
20000	8.2	7.8	7.9	7.6	7.6	7.7	7.7	7.8	7.8	7.8	7.9	7.8	7.9	7.9
30000	8.2	7.8	7.9	7.6	7.6	7.7	7.7	7.7	7.8	7.8	7.8	7.8	7.9	7.9
40000	8.2	7.8	7.9	7.6	7.6	7.7	7.7	7.7	7.8	7.8	7.8	7.8	7.9	7.9
50000	8.2	7.8	7.9	7.6	7.6	7.7	7.7	7.7	7.8	7.8	7.8	7.8	7.9	7.9
60000	8.3	7.8	7.9	7.6	7.6	7.7	7.7	7.7	7.8	7.8	7.8	7.8	7.9	7.9
70000	8.3	7.8	7.9	7.6	7.6	7.7	7.7	7.7	7.8	7.8	7.8	7.8	7.9	7.9
80000	8.3	7.8	7.9	7.6	7.6	7.7	7.7	7.7	7.8	7.8	7.9	7.8	7.9	7.9
90000	8.2	7.8	7.9	7.6	7.6	7.7	7.7	7.7	7.8	7.8	7.9	7.8	7.9	7.9
100000	8.2	7.8	7.9	7.6	7.6	7.7	7.7	7.7	7.8	7.8	7.9	7.8	7.9	7.9
110000	8.2	7.8	7.9	7.6	7.7	7.7	7.7	7.8	7.8	7.8	7.9	7.8	7.9	7.9
120000	8.2	7.8	7.9	7.6	7.7	7.7	7.7	7.8	7.8	7.9	7.9	7.9	7.9	7.9
130000	8.3	7.9	7.8	7.6	7.7	7.7	7.7	7.8	7.9	7.9	7.9	7.9	7.9	7.9
140000	7.8	7.9	7.9	7.6	7.7	7.7	7.8	7.8	7.9	7.9	7.9	7.9	7.9	7.9
150000	7.9	7.9	7.9	7.7	7.7	7.7	7.8	7.8	7.9	7.9	7.9	7.9	7.9	7.9
160000	7.9	8.0	7.8	7.7	7.8	7.7	7.8	7.9	7.9	8.0	7.9	7.9	7.9	7.9
170000	7.9	8.0	7.8	7.7	7.8	7.7	7.8	7.9	7.9	8.0	7.9	7.9	7.9	7.9
180000	7.9	8.0	7.8	7.7	7.8	7.7	7.8	7.9	7.9	8.0	7.9	7.9	7.9	7.9
190000	7.9	8.0	7.8	7.7	7.8	7.7	7.8	7.9	7.9	7.9	7.9	7.9	7.9	7.9
200000	7.9	8.0	7.7	7.7	7.7	7.7	7.8	7.9	7.9	7.9	7.9	7.9	7.9	7.9
210000	7.9	8.0	7.7	7.7	7.7	7.7	7.8	7.9	7.9	7.9	7.8	7.9	7.9	7.9
220000	7.9	7.9	7.7	7.7	7.7	7.7	7.8	7.9	7.9	7.9	7.8	7.9	7.9	7.9
230000	7.9	7.9	7.7	7.7	7.7	7.7	7.8	7.9	7.9	7.9	7.8	7.9	7.9	7.9
Daily Max	8.3	8.0	7.9	7.7	7.8	7.7	7.8	7.9	7.9	8.0	7.9	7.9	7.9	7.9
Daily Min	7.8	7.8	7.7	7.6	7.6	7.7	7.7	7.7	7.8	7.8	7.8	7.8	7.9	7.9
Average	8.1	7.9	7.8	7.6	7.7	7.7	7.7	7.8	7.8	7.9	7.9	7.9	7.9	7.9









Grand Rapids Upstream Temperature Summary - June 2019

Time HHMMSS	06/01/19	06/02/19	06/03/19	06/04/19	06/05/19	06/06/19	06/07/19	06/08/19	06/09/19	06/10/19	06/11/19	06/12/19	06/13/19	06/14/19	06/15/19	06/16/19
0	61.8	62.0	62.2	61.1	63.5	64.8	67.2	69.2	70.6	68.4	68.7	69.0	64.8	65.0	61.2	63.2
10000	61.7	61.8	61.9	60.9	63.4	64.6	66.9	68.8	70.2	68.1	68.4	68.6	64.5	64.7	61.1	62.9
20000	61.6	61.6	61.7	60.9	63.4	64.5	66.7	68.5	69.9	67.8	68.1	68.3	64.2	64.5	61.1	62.6
30000	61.4	61.4	61.6	60.9	63.4	64.3	66.5	68.2	69.5	67.5	67.9	68.1	64.0	64.3	61.0	62.4
40000	61.3	61.3	61.4	60.8	63.4	64.1	66.3	68.0	69.3	67.2	67.6	67.8	63.7	64.1	60.9	62.2
50000	61.2	61.1	61.3	60.7	63.4	64.0	66.2	67.7	69.1	66.9	67.3	67.6	63.4	63.9	60.8	62.0
60000	61.0	61.0	61.0	60.7	63.4	63.9	66.1	67.5	68.9	66.7	67.0	67.4	63.1	63.7	60.7	61.8
70000	60.9	60.8	60.8	60.7	63.4	63.9	66.1	67.4	68.8	66.5	66.8	67.4	62.9	63.6	60.7	61.7
80000	60.8	60.9	61.0	60.9	63.5	64.0	66.1	67.5	68.8	66.5	66.7	67.4	62.8	63.6	60.7	61.7
90000	60.8	60.8	61.0	61.2	63.5	64.3	66.7	68.0	69.0	66.5	67.1	67.4	62.9	63.7	60.7	61.7
100000	60.8	61.2	61.3	61.6	63.7	64.9	67.4	68.6	69.3	66.8	67.8	67.4	63.1	63.7	60.9	61.8
110000	60.8	61.6	61.8	62.2	64.1	65.6	68.0	69.1	69.7	67.2	68.5	67.5	63.5	63.4	61.3	61.8
120000	61.1	62.0	62.4	62.9	64.6	66.4	68.4	69.8	69.8	67.8	69.1	67.6	63.8	63.3	61.9	62.2
130000	61.5	62.4	62.6	63.4	65.2	66.8	69.0	70.5	70.0	68.4	69.9	67.5	64.3	63.1	62.6	62.4
140000	61.6	63.0	62.8	64.1	65.8	67.6	69.6	71.0	69.9	69.0	70.3	67.4	64.9	62.9	63.2	62.4
150000	61.9	63.4	62.6	64.6	66.2	68.3	70.1	71.4	70.0	69.4	70.7	67.3	65.5	62.6	63.8	62.9
160000	62.2	63.9	62.8	64.5	66.4	68.4	70.3	71.8	69.9	69.8	70.8	67.0	65.9	62.4	64.2	63.2
170000	62.5	63.9	62.7	64.4	66.5	68.7	70.7	72.2	69.8	69.9	71.0	66.8	66.2	62.3	64.5	63.5
180000	62.7	64.0	62.4	64.2	66.5	68.6	70.7	72.2	69.6	69.9	70.8	66.5	66.2	62.1	64.6	63.5
190000	62.7	63.7	62.2	64.2	66.3	68.5	70.6	72.0	69.4	69.8	70.5	66.1	66.1	62.0	64.5	63.6
200000	62.6	63.5	62.0	64.2	66.1	68.3	70.4	71.8	69.2	69.6	69.9	65.8	65.9	61.8	64.3	63.3
210000	62.3	63.0	61.8	64.1	65.6	68.1	70.2	71.5	69.0	69.4	69.7	65.6	65.7	61.6	64.1	63.0
220000	62.3	62.7	61.4	63.8	65.4	67.8	69.9	71.2	68.8	69.1	69.6	65.4	65.5	61.5	63.8	62.7
230000	62.2	62.4	61.3	63.7	65.2	67.6	69.6	70.9	68.5	68.9	69.4	65.1	65.3	61.3	63.5	62.5
Daily Max	62.7	64.0	62.8	64.6	66.5	68.7	70.7	72.2	70.6	69.9	71.0	69.0	66.2	65.0	64.6	63.6
Daily Min	60.8	60.8	60.8	60.7	63.4	63.9	66.1	67.4	68.5	66.5	66.7	65.1	62.8	61.3	60.7	61.7
Average	61.7	62.2	61.8	62.5	64.7	66.2	68.3	69.8	69.5	68.2	68.9	67.1	64.5	63.1	62.3	62.5

Monthly Average Temp: 67.7
License Maximum Temperature: 80 F

Grand Rapids Upstream Temperature Summary - June 2019

Time HHMMSS	06/17/19	06/18/19	06/19/19	06/20/19	06/21/19	06/22/19	06/23/19	06/24/19	06/25/19	06/26/19	06/27/19	06/28/19	06/29/19	06/30/19
0	62.2	65.1	66.3	66.8	67.5	68.5	69.7	68.8	68.6	71.1	72.5	73.6	74.4	76.9
10000	62.0	64.8	65.9	66.4	67.2	68.0	69.3	68.6	68.5	71.0	72.1	73.3	74.1	76.6
20000	61.8	64.6	65.7	66.2	66.8	67.7	69.0	68.3	68.3	70.8	71.7	73.1	73.8	76.3
30000	61.6	64.5	65.4	66.0	66.5	67.2	68.6	68.1	68.2	70.5	71.4	72.9	73.7	76.0
40000	61.4	64.4	65.2	65.8	66.3	67.0	68.3	67.9	68.0	70.2	71.1	72.6	73.3	75.7
50000	61.2	64.3	65.0	65.7	66.0	66.8	68.0	67.8	67.8	70.0	70.9	72.4	73.1	75.3
60000	61.1	64.3	64.8	65.5	65.8	66.5	67.9	67.6	67.6	69.8	70.8	72.2	72.9	75.1
70000	61.0	64.4	64.6	65.6	65.7	66.4	67.7	67.5	67.4	69.6	70.6	72.1	72.7	74.8
80000	61.4	64.4	64.6	65.6	65.7	66.4	67.6	67.5	67.4	69.6	70.7	72.1	72.8	74.7
90000	61.8	64.8	64.7	65.9	66.0	66.7	67.5	67.6	67.5	69.9	70.9	72.2	73.1	74.7
100000	62.4	65.2	65.2	66.4	66.6	67.3	67.5	67.7	68.2	70.4	71.6	72.4	73.7	74.7
110000	62.9	65.7	65.9	66.8	67.4	67.9	67.8	67.9	68.9	71.1	72.8	72.8	74.4	74.8
120000	63.7	66.4	66.4	67.2	67.8	68.6	68.3	68.2	69.5	71.8	73.6	73.3	75.1	74.8
130000	64.3	67.2	66.8	67.5	68.4	69.4	69.0	68.6	70.3	72.5	74.4	73.9	75.9	75.0
140000	65.0	67.5	67.3	68.0	68.9	70.0	69.4	69.3	71.0	72.9	74.7	74.8	76.7	75.3
150000	65.6	67.4	67.7	68.4	69.6	70.5	69.7	69.5	71.6	73.5	74.8	75.3	77.6	75.8
160000	66.0	67.2	67.9	68.7	69.9	70.9	70.0	69.4	72.1	73.5	75.3	75.6	77.9	76.3
170000	66.3	67.3	67.9	69.1	70.1	71.1	70.1	69.4	72.3	74.0	75.2	75.8	78.5	76.5
180000	66.4	67.3	67.8	69.2	70.1	71.2	70.0	69.4	72.6	74.1	75.2	76.0	78.6	76.4
190000	66.4	67.2	67.8	69.0	69.9	71.0	69.9	69.4	72.5	74.0	74.9	75.9	78.7	76.3
200000	66.3	67.0	67.7	68.6	69.7	70.9	69.7	69.3	72.3	73.8	74.5	75.7	78.5	76.1
210000	66.1	67.0	67.5	68.4	69.4	70.6	69.6	69.2	72.0	73.5	74.3	75.3	78.0	75.8
220000	65.7	66.7	67.2	68.1	69.1	70.3	69.3	69.0	71.5	73.2	74.1	75.0	77.6	75.5
230000	65.4	66.4	67.0	67.8	68.8	70.0	69.1	68.8	71.2	72.9	73.8	74.7	77.2	75.2
Daily Max	66.4	67.5	67.9	69.2	70.1	71.2	70.1	69.5	72.6	74.1	75.3	76.0	78.7	76.9
Daily Min	61.0	64.3	64.6	65.5	65.7	66.4	67.5	67.5	67.4	69.6	70.6	72.1	72.7	74.7
Average	63.7	65.9	66.3	67.2	67.9	68.8	68.9	68.5	69.8	71.8	73.0	73.9	75.5	75.6

Grand Rapids Upstream Temperature Summary - July 2019

Time HHMMSS	07/01/19	07/02/19	07/03/19	07/04/19	07/05/19	07/06/19	07/07/19	07/08/19	07/09/19	07/10/19	07/11/19	07/12/19	07/13/19	07/14/19	07/15/19	07/16/19
0	74.8	75.3	75.8	77.9	78.5	78.6	76.8	76.0	75.6	76.1	77.5	76.9	76.9	77.5	77.5	76.6
10000	74.5	75.1	75.6	77.5	78.2	78.4	76.4	75.5	75.2	75.8	77.3	76.6	76.7	77.2	77.1	76.3
20000	74.1	74.9	75.3	77.2	77.9	78.1	76.0	75.2	74.9	75.6	77.0	76.3	76.5	76.9	76.9	76.2
30000	73.8	74.8	75.1	76.9	77.6	77.9	75.5	74.8	74.6	75.3	76.8	75.9	76.4	76.6	76.6	76.0
40000	73.5	74.6	74.9	76.5	77.3	77.6	75.1	74.4	74.3	74.9	76.4	75.6	76.2	76.2	76.3	75.6
50000	73.2	74.4	74.6	76.2	77.1	77.4	74.7	74.1	74.0	74.7	76.2	75.2	76.0	75.9	76.1	75.3
60000	72.9	74.3	74.4	75.9	76.9	77.1	74.3	73.8	73.7	74.5	75.8	74.8	75.6	75.6	75.7	75.1
70000	72.7	74.1	74.2	75.6	76.6	76.9	74.0	73.6	73.5	74.4	75.4	74.5	75.5	75.2	75.6	74.9
80000	72.6	74.0	74.2	75.6	76.5	76.7	73.9	73.5	73.4	74.3	75.2	74.3	75.4	75.1	75.4	74.7
90000	72.7	73.8	74.4	75.8	76.5	76.6	73.8	73.5	73.5	74.3	75.1	74.3	75.5	75.1	75.2	74.8
100000	72.9	73.8	74.9	76.3	76.7	76.6	74.0	73.8	73.7	74.7	75.3	74.5	75.7	75.5	75.3	75.1
110000	73.3	73.9	75.6	76.8	77.0	76.5	74.6	74.2	74.0	75.2	75.7	74.8	76.0	75.9	75.4	75.6
120000	73.8	74.2	76.4	77.3	77.5	76.7	75.3	74.9	74.5	75.9	76.2	75.2	76.6	76.4	75.7	76.2
130000	74.1	74.6	77.0	77.9	78.0	77.2	76.1	75.5	75.1	76.7	76.7	75.7	77.1	76.9	76.2	77.1
140000	74.5	75.4	77.5	78.5	78.5	77.8	76.7	76.0	75.7	77.4	77.2	76.2	77.6	77.5	76.8	77.9
150000	75.4	76.2	78.1	79.1	79.4	78.4	77.4	76.5	76.4	78.0	77.6	76.8	78.0	78.1	77.6	78.4
160000	75.5	76.8	78.7	79.4	79.9	78.9	77.3	77.0	76.8	78.4	78.0	77.0	78.3	78.4	78.1	78.7
170000	75.7	77.3	79.0	79.9	80.0	79.0	77.5	77.1	77.1	78.6	78.3	77.1	78.6	78.9	78.4	79.0
180000	75.9	77.5	79.2	80.0	79.9	78.9	77.5	77.0	77.3	78.9	78.3	77.3	78.8	78.8	77.9	79.2
190000	75.8	77.4	79.1	79.9	80.0	78.7	77.4	76.9	77.2	78.8	78.2	77.5	78.8	78.7	77.7	79.0
200000	75.7	77.1	78.9	79.6	79.7	78.4	77.2	76.6	77.1	78.7	78.0	77.5	78.6	78.5	77.6	78.8
210000	75.6	76.7	78.7	79.4	79.3	78.0	77.0	76.4	76.9	78.4	77.8	77.6	78.4	78.3	77.4	78.7
220000	75.5	76.4	78.4	79.0	79.0	77.6	76.6	76.2	76.6	78.1	77.5	77.3	78.1	78.1	77.1	78.4
230000	75.3	76.1	78.1	78.9	78.8	77.2	76.3	75.9	76.4	77.8	77.2	77.0	77.8	77.8	76.9	78.1
Daily Max	75.9	77.5	79.2	80.0	80.0	79.0	77.5	77.1	77.3	78.9	78.3	77.6	78.8	78.9	78.4	79.2
Daily Min	72.6	73.8	74.2	75.6	76.5	76.5	73.8	73.5	73.4	74.3	75.1	74.3	75.4	75.1	75.2	74.7
Average	74.3	75.4	76.6	77.8	78.2	77.7	75.9	75.3	75.3	76.5	76.9	76.1	77.0	77.0	76.7	76.9

Monthly Average Temp: 76.6
License Maximum Temperature: 83 F

Grand Rapids Upstream Temperature Summary - July 2019

Time HHMMSS	07/17/19	07/18/19	07/19/19	07/20/19	07/21/19	07/22/19	07/23/19	07/24/19	07/25/19	07/26/19	07/27/19	07/28/19	07/29/19	07/30/19	07/31/19
0	77.7	77.4	77.3	80.2	77.3	76.0	76.8	76.4	75.7	77.2	75.3	77.4	78.8	78.1	76.3
10000	77.5	77.2	77.0	79.8	76.8	75.8	76.5	76.1	75.5	76.9	75.1	77.2	78.5	77.7	75.9
20000	77.1	76.9	76.8	79.5	76.4	75.5	76.2	75.8	75.3	76.5	74.7	77.0	78.3	77.4	75.6
30000	76.8	76.6	76.7	79.2	76.0	75.3	75.9	75.5	75.0	76.2	74.5	76.8	78.0	77.0	75.2
40000	76.5	76.4	76.5	79.0	75.7	75.1	75.6	75.2	74.8	76.0	74.4	76.6	77.6	76.6	74.9
50000	76.2	76.2	76.4	78.8	75.3	74.8	75.2	74.9	74.5	75.6	74.0	76.4	77.2	76.3	74.5
60000	76.0	76.1	76.3	78.6	75.0	74.5	75.0	74.6	74.2	75.5	73.9	76.2	77.0	76.0	74.1
70000	75.8	76.0	76.2	78.5	74.8	74.3	74.7	74.3	74.1	75.2	73.6	76.0	76.7	75.7	73.8
80000	75.7	75.9	76.2	78.4	74.6	74.2	74.5	74.1	73.9	75.1	73.6	75.9	76.5	75.4	73.6
90000	75.9	75.7	76.4	78.6	74.6	74.3	74.5	74.1	74.0	75.1	73.6	76.0	76.4	75.5	73.6
100000	76.2	75.7	76.9	79.0	74.9	74.6	74.6	74.2	74.3	75.2	73.9	76.4	76.4	75.4	73.9
110000	76.7	75.9	77.7	79.5	75.4	75.0	74.9	74.6	74.8	75.2	74.4	77.0	76.6	75.5	74.2
120000	77.3	76.4	78.6	79.6	76.0	75.6	75.2	75.1	75.4	75.2	74.9	77.5	76.9	75.6	74.8
130000	78.0	76.8	79.4	79.5	76.6	76.3	75.7	75.7	76.0	75.3	75.6	78.1	77.4	75.8	75.5
140000	78.5	77.4	80.1	79.2	77.1	77.0	76.2	76.5	76.4	75.4	76.2	78.6	78.0	76.1	76.0
150000	78.9	77.8	80.6	78.9	77.5	77.5	76.6	76.8	77.0	75.5	76.8	79.1	78.3	76.5	76.6
160000	79.3	78.1	81.1	78.7	77.6	78.0	77.1	77.1	77.3	75.8	77.3	79.4	78.8	76.9	76.9
170000	79.3	78.3	81.3	78.8	77.5	78.2	77.3	77.3	77.7	76.2	77.7	79.6	79.2	77.2	77.4
180000	79.2	78.2	81.3	78.8	77.6	78.3	77.4	77.3	77.7	76.2	78.0	79.6	79.4	77.5	77.5
190000	79.0	78.2	81.3	78.8	77.4	78.1	77.4	77.0	77.8	76.2	78.0	79.6	79.4	77.5	77.4
200000	78.7	78.0	81.1	78.5	77.1	77.8	77.3	76.7	77.9	76.1	77.9	79.5	79.2	77.4	77.2
210000	78.4	77.9	80.9	78.2	76.8	77.6	77.1	76.5	77.8	76.0	77.9	79.4	79.0	77.2	77.0
220000	78.1	77.6	80.7	77.9	76.5	77.3	76.9	76.2	77.7	75.8	77.8	79.2	78.7	76.9	76.9
230000	77.9	77.4	80.4	77.6	76.2	77.0	76.6	76.0	77.4	75.6	77.6	79.0	78.4	76.6	76.5
Daily Max	79.3	78.3	81.3	80.2	77.6	78.3	77.4	77.3	77.9	77.2	78.0	79.6	79.4	78.1	77.5
Daily Min	75.7	75.7	76.2	77.6	74.6	74.2	74.5	74.1	73.9	75.1	73.6	75.9	76.4	75.4	73.6
Average	77.5	77.0	78.6	78.9	76.3	76.2	76.0	75.8	75.9	75.8	75.7	77.8	77.9	76.6	75.6

Grand Rapids Upstream Temperature Summary - August 2019

Time HHMMSS	08/01/19	08/02/19	08/03/19	08/04/19	08/05/19	08/06/19	08/07/19	08/08/19	08/09/19	08/10/19	08/11/19	08/12/19	08/13/19	08/14/19	08/15/19	08/16/19
0	76.3	77.0	76.4	76.0	77.3	76.5	76.9	75.3	74.6	74.7	75.4	75.0	75.0	72.7	72.9	73.8
10000	76.0	76.7	76.3	75.8	77.0	76.2	76.7	75.1	74.3	74.4	75.2	74.8	74.8	72.5	72.7	73.6
20000	75.7	76.4	76.1	75.5	76.8	75.9	76.3	74.9	74.1	74.1	74.9	74.6	74.6	72.3	72.5	73.4
30000	75.4	76.1	75.9	75.3	76.5	75.6	76.1	74.6	73.8	73.9	74.6	74.4	74.4	72.1	72.3	73.3
40000	75.0	75.8	75.6	75.0	76.2	75.3	75.8	74.3	73.4	73.6	74.4	74.2	74.2	72.0	72.1	73.1
50000	74.7	75.5	75.5	74.7	76.0	75.0	75.5	73.9	73.1	73.3	74.2	74.0	74.0	71.8	71.7	73.0
60000	74.4	75.2	75.3	74.4	75.7	74.7	75.4	73.6	72.9	73.0	73.8	73.7	73.7	71.6	71.6	72.7
70000	74.1	74.9	75.2	74.2	75.6	74.6	75.2	73.4	72.6	72.8	73.6	73.5	73.5	71.4	71.2	72.5
80000	74.0	74.7	75.0	74.0	75.5	74.5	75.0	73.1	72.4	72.5	73.6	73.3	73.3	71.2	71.0	72.4
90000	74.0	74.8	75.1	74.1	75.5	74.3	75.1	73.0	72.4	72.5	73.5	73.3	73.1	71.1	70.9	72.3
100000	74.2	75.0	75.3	74.3	75.8	74.6	75.3	73.1	72.6	72.7	73.5	73.5	72.8	71.1	71.2	72.4
110000	74.6	75.4	75.7	74.8	76.2	75.0	75.6	73.4	72.9	73.1	73.6	73.8	72.7	71.2	71.5	72.6
120000	75.1	75.9	76.3	75.3	76.8	75.5	75.9	73.8	73.4	73.6	73.9	74.0	72.8	71.7	71.9	72.8
130000	75.8	76.6	76.9	76.0	77.3	76.2	76.3	74.2	73.8	74.2	74.2	74.4	72.9	72.1	72.1	72.9
140000	76.4	77.1	77.2	76.6	77.8	76.8	76.8	74.5	74.2	74.7	74.4	74.7	72.9	72.3	72.3	73.0
150000	76.9	77.3	77.3	77.1	78.0	77.3	76.8	74.9	74.6	75.1	74.8	75.0	73.0	72.6	73.5	73.2
160000	77.4	77.3	76.9	77.7	77.7	77.9	76.7	75.2	75.1	75.7	74.9	75.1	73.2	72.7	74.6	73.2
170000	77.6	77.1	76.8	77.8	77.8	78.1	76.5	75.4	75.3	76.0	75.1	75.2	73.2	72.8	74.5	73.2
180000	77.8	77.0	76.9	78.2	77.7	78.4	76.5	75.6	75.4	76.3	75.3	75.4	73.3	73.4	73.9	73.3
190000	77.8	77.1	77.0	78.1	77.5	78.0	76.3	75.4	75.5	76.3	75.4	75.5	73.2	73.2	74.0	73.3
200000	77.7	77.0	76.9	78.0	77.3	77.9	76.1	75.5	75.4	76.2	75.4	75.6	73.2	73.4	73.9	73.2
210000	77.5	76.9	76.8	77.9	77.1	77.8	75.9	75.3	75.2	76.1	75.4	75.5	73.1	73.4	74.0	73.1
220000	77.4	76.6	76.5	77.7	76.9	77.5	75.7	75.1	75.1	75.9	75.3	75.4	73.0	73.2	74.0	72.9
230000	77.2	76.5	76.3	77.5	76.7	77.2	75.5	74.9	74.9	75.7	75.1	75.2	72.8	73.1	73.9	72.8
Daily Max	77.8	77.3	77.3	78.2	78.0	78.4	76.9	75.6	75.5	76.3	75.4	75.6	75.0	73.4	74.6	73.8
Daily Min	74.0	74.7	75.0	74.0	75.5	74.3	75.0	73.0	72.4	72.5	73.5	73.3	72.7	71.1	70.9	72.3
Average	76.0	76.2	76.2	76.1	76.8	76.3	76.0	74.5	74.0	74.4	74.6	74.5	73.4	72.3	72.7	73.0

Monthly Average Temp: 74.4
License Maximum Temperature: 81 F

Grand Rapids Upstream Temperature Summary - August 2019

Time HHMMSS	08/17/19	08/18/19	08/19/19	08/20/19	08/21/19	08/22/19	08/23/19	08/24/19	08/25/19	08/26/19	08/27/19	08/28/19	08/29/19	08/30/19	08/31/19
0	72.7	73.9	73.3	73.4											
10000	72.5	73.7	73.2	73.2											
20000	72.3	73.5	73.0	72.9											
30000	72.2	73.4	72.8	72.6											
40000	72.0	73.1	72.5	72.3											
50000	71.7	73.0	72.3	72.1											
60000	71.5	72.8	71.9	71.8											
70000	71.2	72.8	71.7	71.5											
80000	71.1	72.7	71.5	71.3											
90000	71.0	72.6	71.3	71.3											
100000	71.0	72.6	71.3	71.5											
110000	71.4	72.6	71.7	71.8											
120000	71.6	72.8	71.9	72.1											
130000	71.8	73.0	72.2												
140000	72.2	73.3	72.5												
150000	72.4	73.5	73.1												
160000	73.0	73.7	73.7												
170000	73.0	73.9	74.2												
180000	74.3	74.1	74.3												
190000	73.5	74.1	74.3												
200000	74.5	74.0	74.2												
210000	73.8	73.8	74.1												
220000	73.8	73.7	73.9												
230000	74.0	73.5	73.7												
Daily Max	74.5	74.1	74.3	73.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Daily Min	71.0	72.6	71.3	71.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Average	72.4	73.3	72.9	72.1	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

Missing data due to equipment malfunction

Grand Rapids UpstreamTemperature Summary - September 2019

Time HHMMSS	09/01/19	09/02/19	09/03/19	09/04/19	09/05/19	09/06/19	09/07/19	09/08/19	09/09/19	09/10/19	09/11/19	09/12/19	09/13/19	09/14/19	09/15/19	09/16/19
0				62.2	65.4	66.1	62.0	62.5	66.1	65.5	66.6	61.2	66.6	66.7	68.4	63.7
10000				65.2	66.0	61.5	66.3	63.5	65.4	62.8	61.7	63.0	63.9	63.0	67.0	65.6
20000				64.9	64.1	60.8	64.5	61.2	62.7	61.7	67.3	63.1	65.1	68.4	62.7	64.0
30000				64.3	62.6	63.3	64.7	62.9	61.3	65.5	63.0	61.3	66.7	68.3	64.4	68.0
40000				62.2	64.2	62.6	65.0	65.3	66.8	64.2	65.7	63.3	64.1	67.5	63.8	66.0
50000				64.0	60.8	64.6	62.7	63.8	65.3	61.1	64.4	65.1	61.7	62.8	63.5	63.9
60000				63.8	61.1	64.8	61.9	61.3	61.1	63.1	65.2	61.5	61.6	63.6	67.8	63.6
70000				63.9	65.8	62.1	63.6	61.1	62.4	63.2	62.6	63.4	68.0	65.7	62.8	68.5
80000				62.2	64.4	66.2	64.7	62.1	63.0	67.7	65.4	64.9	62.3	64.0	68.2	63.8
90000				62.3	64.7	64.6	62.2	62.2	70.3	65.5	61.1	65.2	63.0	67.0	64.0	63.1
100000				64.4	60.9	64.3	64.6	66.7	64.1	63.5	63.4	62.3	63.1	67.0	63.8	63.3
110000				64.1	62.6	63.3	67.6	65.2	64.9	62.5	68.1	62.0	67.3	63.4	63.2	65.1
120000			62.4	63.9	61.7	62.0	62.1	62.4	66.5	61.9	63.6	63.4	62.5	63.3	65.8	66.1
130000			64.8	65.2	65.1	72.8	62.3	61.6	61.5	64.1	63.3	62.8	68.1	68.6	63.3	65.8
140000			64.9	65.0	61.5	65.2	61.5	61.6	62.7	62.9	67.7	63.0	67.6	63.8	63.9	68.2
150000			64.0	62.3	61.7	63.5	66.5	61.4	66.9	65.5	62.1	65.1	61.6	68.4	65.9	66.1
160000			64.8	62.3	61.3	62.1	63.4	64.9	65.0	67.0	63.3	67.9	63.7	67.0	65.4	66.1
170000			63.9	65.8	65.8	61.5	64.8	62.3	63.5	63.1	64.2	64.7	65.5	65.1	63.5	66.0
180000			65.0	65.8	65.6	61.7	66.5	64.2	61.1	63.0	63.3	63.6	61.7	63.8	63.7	66.0
190000			64.1	62.5	62.9	62.0	66.2	62.3	61.7	61.1	67.5	63.0	61.7	63.0	63.9	68.6
200000			64.0	64.3	66.0	64.2	64.8	66.5	61.6	62.7	66.5	61.4	63.0	63.1	63.2	65.5
210000			63.9	64.6	61.9	60.9	62.1	64.0	65.1	64.5	65.7	65.3	63.1	65.7	63.3	63.5
220000			63.8	65.6	61.5	65.8	65.9	61.5	62.6	65.0	61.8	64.0	64.9	63.6	64.7	68.7
230000			62.3	65.6	62.0	64.5	62.3	65.1	64.1	67.1	61.2	63.6	62.4	66.9	63.4	63.5
Daily Max	0.0	0.0	65.0	65.8	66.0	72.8	67.6	66.7	70.3	67.7	68.1	67.9	68.1	68.6	68.4	68.7
Daily Min	0.0	0.0	62.3	62.2	60.8	60.8	61.5	61.1	61.1	61.1	61.1	61.2	61.6	62.8	62.7	63.1
Average	#DIV/0!	#DIV/0!	64.0	64.0	63.3	63.8	64.1	63.1	64.0	63.9	64.4	63.5	64.1	65.4	64.6	65.5

Monthly Average Temp: 64.6

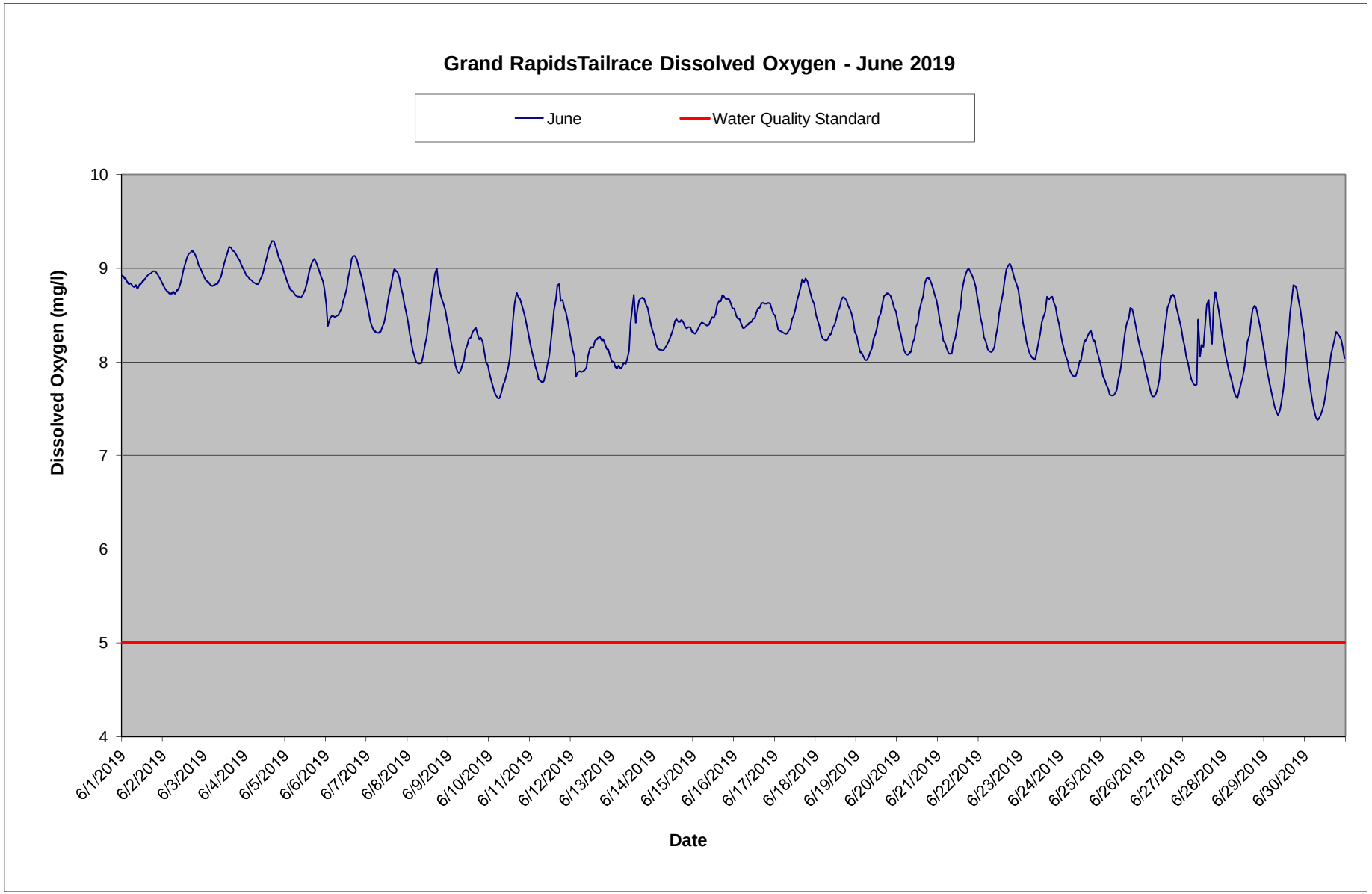
License Maximum Temperature: 74 F

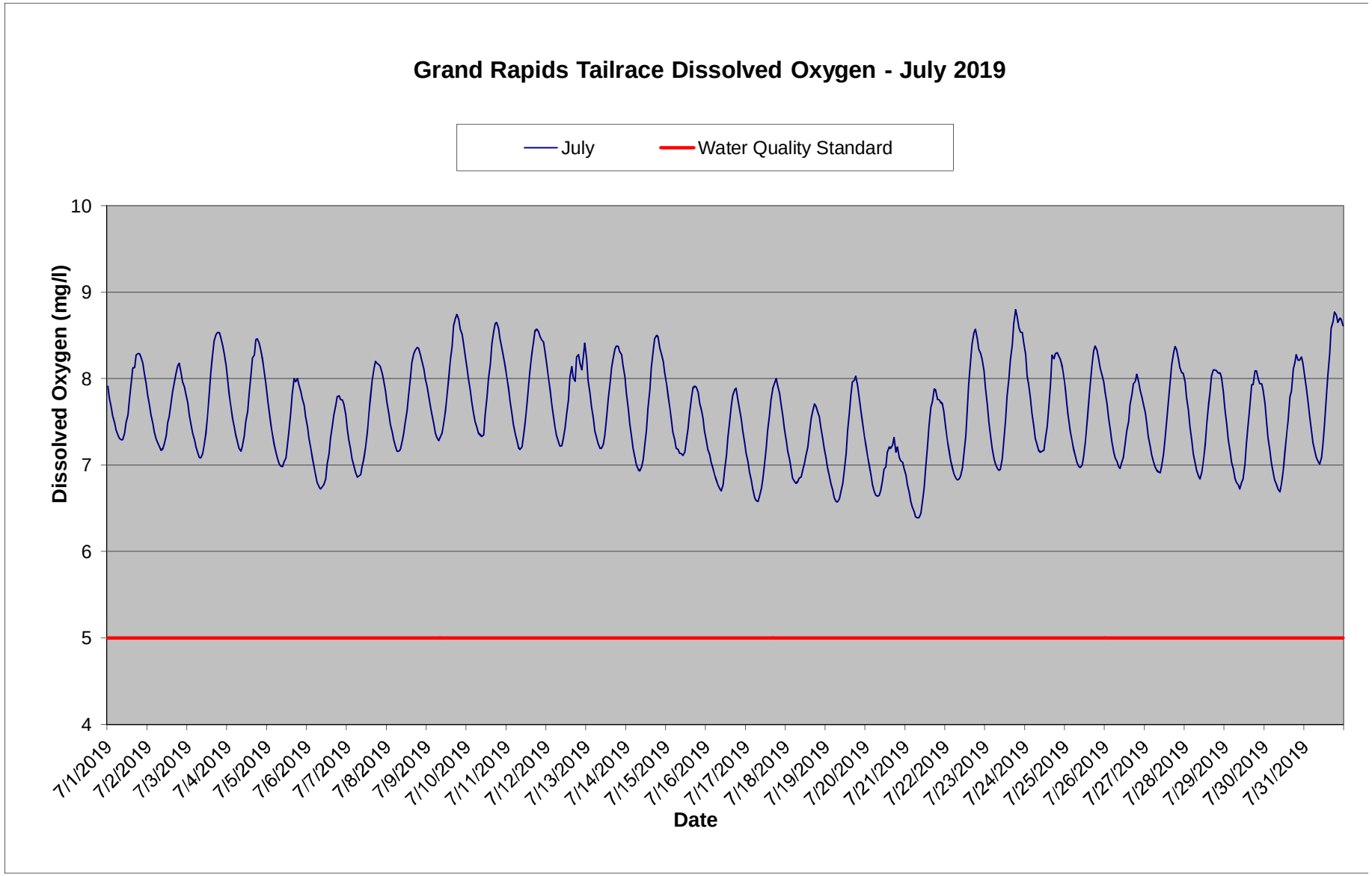
Missing data due to equipment malfunction

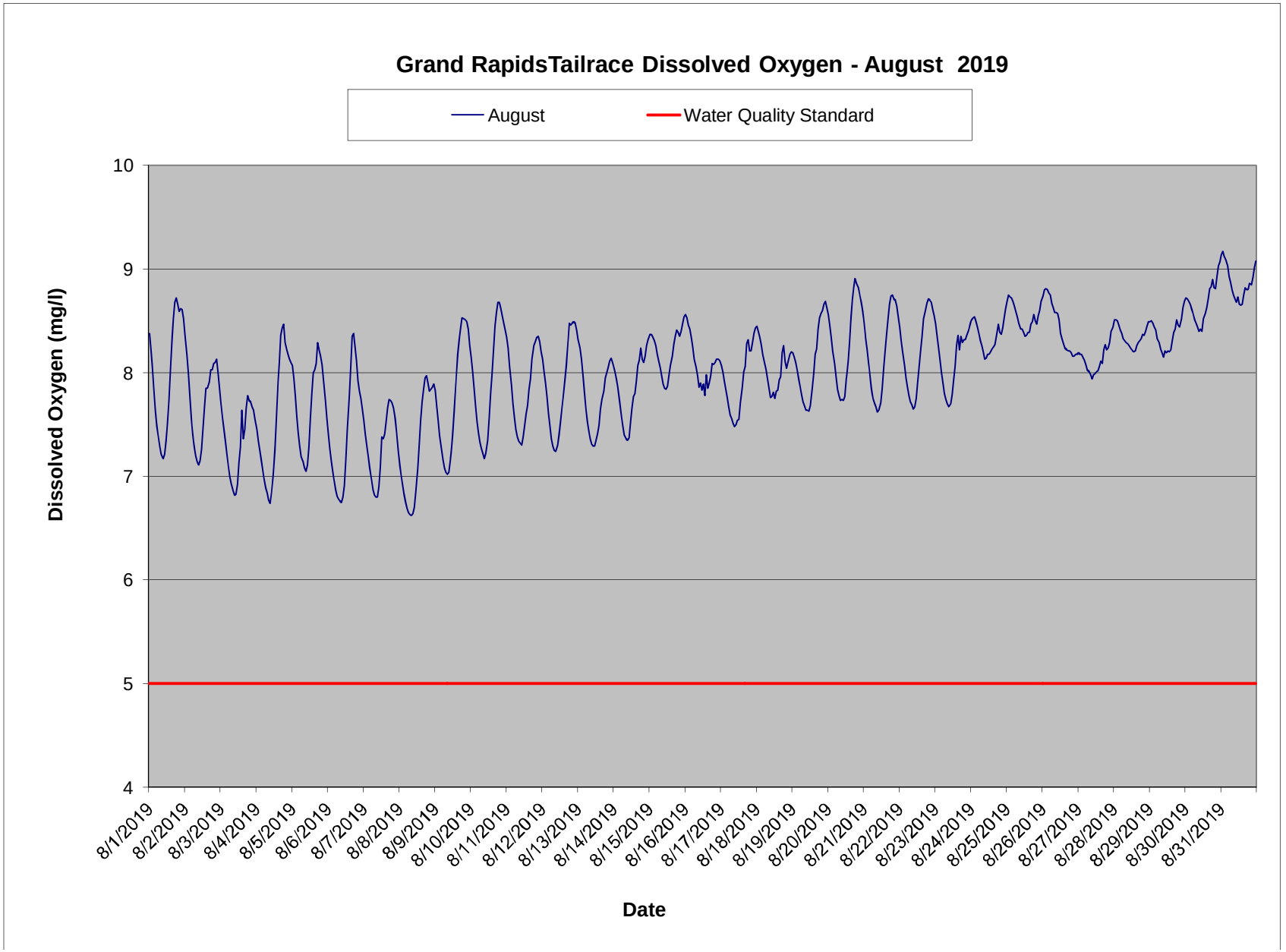
Grand Rapids UpstreamTemperature Summary - September 2019

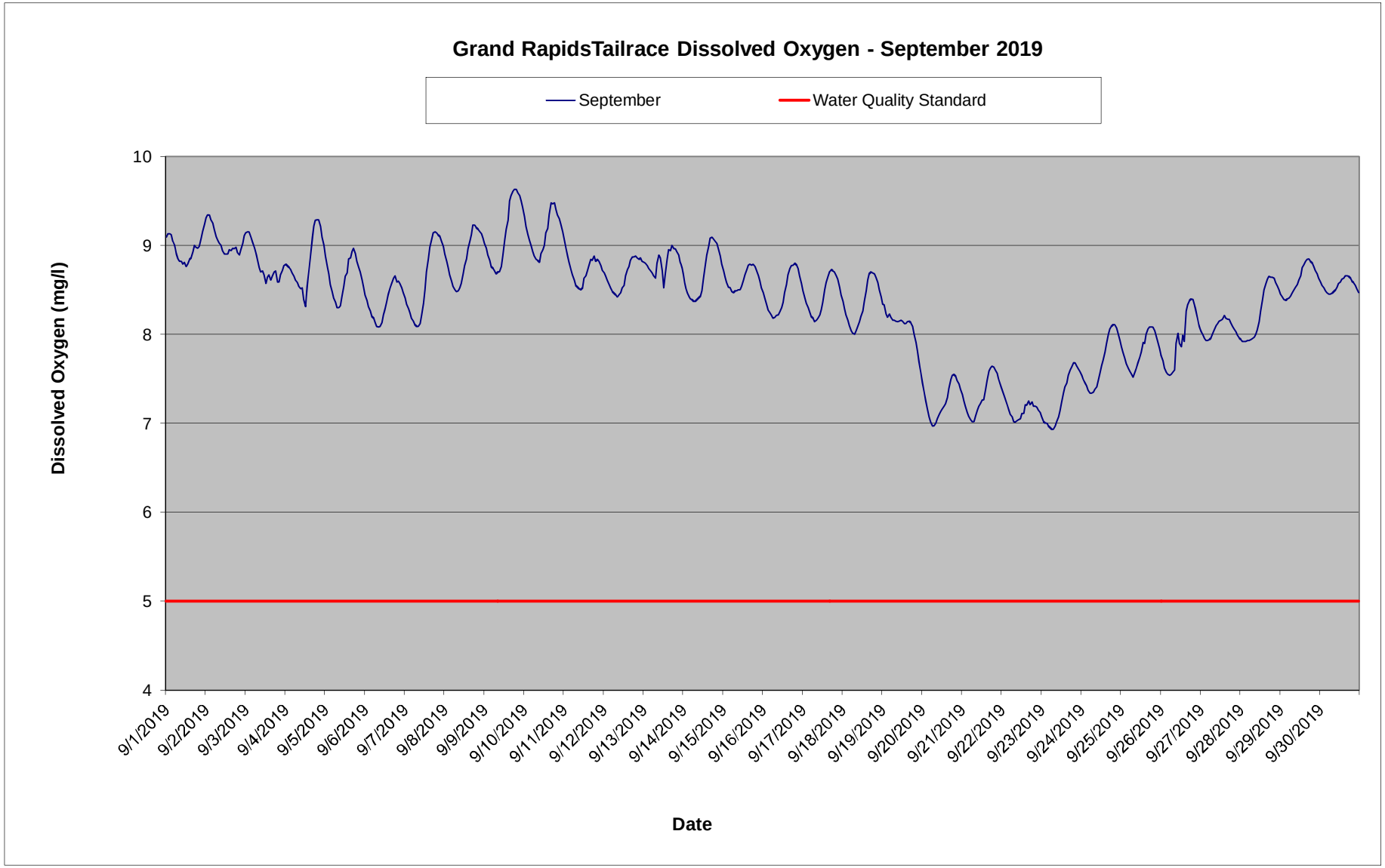
Time HHMMSS	09/17/19	09/18/19	09/19/19	09/20/19	09/21/19	09/22/19	09/23/19	09/24/19	09/25/19	09/26/19	09/27/19	09/28/19	09/29/19	09/30/19
0	68.4	65.2	66.8	66.3	66.5	67.9	67.5	66.1	66.8	66.1	64.3	62.6	62.2	60.3
10000	68.6	65.0	66.6	66.2	66.4	67.9	67.3	65.9	66.6	65.8	64.2	62.4	61.9	60.2
20000	65.9	64.8	66.6	66.1	66.3	67.8	67.1	65.8	66.6	65.6	64.1	62.2	61.6	60.1
30000	66.3	64.7	66.5	66.0	66.2	67.7	66.8	65.6	66.3	65.3	64.0	62.0	61.4	60.0
40000	63.7	64.5	66.3	65.8	66.1	67.7	66.7	65.3	66.2	64.9	64.0	61.8	61.2	60.0
50000	63.6	64.3	66.2	65.7	66.0	67.6	66.4	65.1	66.1	64.6	63.9	61.6	61.1	59.9
60000	66.3	64.2	66.1	65.6	65.9	67.6	66.2	64.8	65.9	64.3	63.8	61.4	60.9	60.0
70000	66.4	64.1	66.0	65.5	65.8	67.6	66.1	64.6	65.8	64.0	63.7	61.3	60.8	60.0
80000	66.4	64.1	66.0	65.5	65.8	67.6	65.9	64.4	65.7	63.8	63.6	61.0	60.7	59.9
90000	63.7	64.2	65.9	65.5	65.9	67.6	65.8	64.3	65.8	63.6	63.5	61.1	60.5	60.0
100000	63.9	64.5	66.0	65.6	66.1	67.6	65.8	64.5	65.9	63.6	63.4	61.2	60.5	60.0
110000	63.9	64.9	66.1	65.8	66.6	67.7	65.8	64.9	66.1	63.8	63.3	61.3	60.6	60.1
120000	63.8	65.4	66.3	65.9	67.1	67.8	66.0	65.4	66.3	64.1	63.3	61.9	60.8	60.3
130000	63.8	66.0	66.5	66.2	67.4	67.9	66.1	65.8	66.7	64.5	63.4	62.3	60.9	60.4
140000	65.6	66.6	66.7	66.4	67.7	68.0	66.5	66.2	67.1	65.1	63.3	62.8	61.1	60.5
150000	66.0	67.1	66.9	66.8	67.9	68.0	66.8	66.7	67.4	65.3	63.3	63.1	61.1	60.6
160000	66.3	67.5	67.0	67.1	68.1	68.1	66.9	67.1	67.5	65.5	63.3	63.4	61.2	60.9
170000	66.4	67.7	67.1	67.2	68.2	68.2	67.0	67.3	67.5	65.5	63.2	63.5	61.1	61.0
180000	66.4	67.7	67.0	67.2	68.2	68.2	67.1	67.3	67.4	65.3	63.2	63.6	61.0	61.1
190000	66.3	67.6	66.9	67.2	68.2	68.2	67.0	67.3	67.3	65.1	63.1	63.4	60.9	61.1
200000	66.1	67.4	66.8	67.1	68.2	68.1	66.8	67.3	67.1	65.0	63.0	63.2	60.8	61.1
210000	65.9	67.2	66.7	66.9	68.1	68.0	66.7	67.2	66.8	64.8	62.9	63.0	60.7	61.1
220000	65.7	67.2	66.6	66.8	68.1	67.9	66.5	67.0	66.6	64.7	62.9	62.7	60.5	61.1
230000	65.5	66.9	66.4	66.6	68.0	67.6	66.3	66.9	66.3	64.5	62.7	62.4	60.4	61.0
Daily Max	68.6	67.7	67.1	67.2	68.2	68.2	67.5	67.3	67.5	66.1	64.3	63.6	62.2	61.1
Daily Min	63.6	64.1	65.9	65.5	65.8	67.6	65.8	64.3	65.7	63.6	62.7	61.0	60.4	59.9
Average	65.6	65.8	66.5	66.3	67.0	67.8	66.5	66.0	66.6	64.8	63.5	62.3	61.0	60.4

Downstream Monitoring Location









Grand Rapids Tailrace Dissolved Oxygen Summary - June 2019

Time HHMMSS	06/01/19	06/02/19	06/03/19	06/04/19	06/05/19	06/06/19	06/07/19	06/08/19	06/09/19	06/10/19	06/11/19	06/12/19	06/13/19	06/14/19	06/15/19	06/16/19
0	8.9	8.8	8.9	9.0	8.9	8.6	8.6	8.4	8.4	7.9	8.2	8.2	8.0	8.3	8.3	8.6
10000	8.9	8.8	8.9	8.9	8.9	8.4	8.5	8.3	8.3	7.8	8.1	8.1	8.0	8.3	8.3	8.5
20000	8.9	8.8	8.9	8.9	8.8	8.5	8.4	8.2	8.2	7.7	8.0	8.1	8.0	8.2	8.3	8.5
30000	8.9	8.8	8.8	8.9	8.8	8.5	8.4	8.1	8.1	7.7	8.0	7.8	7.9	8.1	8.4	8.5
40000	8.8	8.7	8.8	8.9	8.8	8.5	8.3	8.1	8.0	7.6	7.9	7.9	8.0	8.1	8.4	8.4
50000	8.8	8.7	8.8	8.9	8.7	8.5	8.3	8.0	7.9	7.6	7.8	7.9	7.9	8.1	8.4	8.4
60000	8.8	8.8	8.8	8.8	8.7	8.5	8.3	8.0	7.9	7.6	7.8	7.9	7.9	8.1	8.4	8.4
70000	8.8	8.7	8.8	8.8	8.7	8.5	8.3	8.0	7.9	7.7	7.8	7.9	8.0	8.1	8.4	8.4
80000	8.8	8.8	8.8	8.8	8.7	8.5	8.3	8.0	8.0	7.8	7.8	7.9	8.0	8.2	8.4	8.4
90000	8.8	8.8	8.9	8.9	8.7	8.6	8.4	8.1	8.0	7.8	7.9	7.9	8.0	8.2	8.4	8.4
100000	8.8	8.8	8.9	8.9	8.7	8.6	8.4	8.2	8.1	7.9	8.0	8.1	8.1	8.2	8.4	8.4
110000	8.8	8.9	9.0	9.0	8.8	8.7	8.5	8.3	8.2	7.9	8.1	8.1	8.4	8.3	8.5	8.5
120000	8.9	9.0	9.1	9.1	8.8	8.8	8.6	8.4	8.3	8.1	8.2	8.2	8.6	8.3	8.5	8.5
130000	8.9	9.1	9.1	9.1	8.9	8.9	8.7	8.5	8.3	8.2	8.4	8.2	8.7	8.4	8.5	8.5
140000	8.9	9.1	9.2	9.2	9.0	9.0	8.8	8.7	8.3	8.5	8.6	8.2	8.4	8.5	8.6	8.6
150000	8.9	9.2	9.2	9.3	9.0	9.1	8.9	8.8	8.3	8.6	8.7	8.2	8.5	8.4	8.6	8.6
160000	8.9	9.2	9.2	9.3	9.1	9.1	9.0	8.9	8.4	8.7	8.8	8.3	8.7	8.4	8.6	8.6
170000	9.0	9.2	9.2	9.3	9.1	9.1	9.0	9.0	8.3	8.7	8.8	8.3	8.7	8.4	8.7	8.6
180000	9.0	9.2	9.2	9.3	9.1	9.1	9.0	8.8	8.2	8.7	8.7	8.2	8.7	8.4	8.7	8.6
190000	9.0	9.1	9.1	9.2	9.0	9.0	8.9	8.7	8.3	8.6	8.7	8.2	8.7	8.4	8.7	8.6
200000	9.0	9.1	9.1	9.1	9.0	9.0	8.8	8.7	8.2	8.6	8.6	8.2	8.6	8.4	8.7	8.6
210000	8.9	9.0	9.1	9.1	8.9	8.9	8.7	8.6	8.1	8.5	8.5	8.1	8.6	8.4	8.7	8.6
220000	8.9	9.0	9.0	9.0	8.9	8.8	8.6	8.6	8.0	8.4	8.4	8.1	8.5	8.4	8.6	8.6
230000	8.9	9.0	9.0	9.0	8.8	8.7	8.5	8.5	8.0	8.3	8.3	8.1	8.4	8.3	8.6	8.5
Daily Max	9.0	9.2	9.2	9.3	9.1	9.1	9.0	9.0	8.4	8.7	8.8	8.3	8.7	8.5	8.7	8.6
Daily Min	8.8	8.7	8.8	8.8	8.7	8.4	8.3	8.0	7.9	7.6	7.8	7.8	7.9	8.1	8.3	8.4
Average	8.9	8.9	9.0	9.0	8.9	8.7	8.6	8.4	8.1	8.1	8.2	8.1	8.3	8.3	8.5	8.5

License Minimum DO: 5.0 mg/l

Grand Rapids Tailrace Dissolved Oxygen Summary - June 2019

Time HHMMSS	06/17/19	06/18/19	06/19/19	06/20/19	06/21/19	06/22/19	06/23/19	06/24/19	06/25/19	06/26/19	06/27/19	06/28/19	06/29/19	06/30/19
0	8.5	8.5	8.3	8.5	8.5	8.6	8.7	8.3	7.9	8.1	8.3	8.2	8.1	8.2
10000	8.4	8.4	8.2	8.3	8.4	8.5	8.5	8.2	7.8	8.0	8.2	8.1	8.0	8.0
20000	8.3	8.4	8.1	8.3	8.3	8.4	8.4	8.1	7.8	7.9	8.1	8.0	7.9	7.8
30000	8.3	8.3	8.1	8.2	8.2	8.3	8.3	8.1	7.8	7.8	8.0	7.9	7.8	7.7
40000	8.3	8.2	8.1	8.1	8.2	8.2	8.2	8.0	7.7	7.8	7.9	7.8	7.7	7.6
50000	8.3	8.2	8.0	8.1	8.1	8.1	8.1	7.9	7.7	7.7	7.8	7.8	7.6	7.5
60000	8.3	8.2	8.0	8.1	8.1	8.1	8.1	7.9	7.6	7.6	7.8	7.7	7.5	7.4
70000	8.3	8.2	8.1	8.1	8.1	8.1	8.1	7.9	7.6	7.6	7.8	7.6	7.5	7.4
80000	8.3	8.3	8.1	8.1	8.1	8.1	8.0	7.8	7.7	7.7	7.8	7.6	7.4	7.4
90000	8.4	8.3	8.1	8.2	8.2	8.2	8.0	7.9	7.7	7.7	8.5	7.7	7.5	7.4
100000	8.5	8.4	8.2	8.3	8.3	8.3	8.1	7.9	7.8	7.8	8.1	7.8	7.6	7.5
110000	8.5	8.4	8.3	8.4	8.4	8.4	8.2	8.0	7.9	8.0	8.2	7.8	7.7	7.6
120000	8.6	8.5	8.4	8.4	8.5	8.5	8.3	8.0	8.0	8.2	8.2	7.9	7.9	7.7
130000	8.6	8.5	8.5	8.5	8.6	8.6	8.4	8.1	8.2	8.3	8.4	8.1	8.1	7.8
140000	8.7	8.6	8.5	8.6	8.8	8.7	8.5	8.2	8.3	8.5	8.6	8.2	8.3	7.9
150000	8.8	8.7	8.6	8.7	8.9	8.9	8.5	8.2	8.4	8.6	8.7	8.3	8.5	8.1
160000	8.9	8.7	8.7	8.8	8.9	9.0	8.7	8.3	8.5	8.6	8.4	8.5	8.7	8.2
170000	8.9	8.7	8.7	8.9	9.0	9.0	8.7	8.3	8.6	8.7	8.2	8.6	8.8	8.2
180000	8.9	8.7	8.7	8.9	9.0	9.0	8.7	8.3	8.6	8.7	8.6	8.6	8.8	8.3
190000	8.9	8.6	8.7	8.9	9.0	9.0	8.7	8.2	8.5	8.7	8.8	8.6	8.8	8.3
200000	8.8	8.6	8.7	8.8	8.9	8.9	8.6	8.2	8.4	8.6	8.7	8.5	8.7	8.3
210000	8.7	8.5	8.6	8.8	8.9	8.9	8.6	8.1	8.3	8.5	8.6	8.4	8.6	8.2
220000	8.7	8.4	8.6	8.7	8.8	8.8	8.5	8.1	8.2	8.4	8.4	8.3	8.4	8.2
230000	8.6	8.3	8.5	8.7	8.7	8.8	8.4	8.0	8.1	8.4	8.3	8.2	8.3	8.0
Daily Max	8.9	8.7	8.7	8.9	9.0	9.0	8.7	8.3	8.6	8.7	8.8	8.6	8.8	8.3
Daily Min	8.3	8.2	8.0	8.1	8.1	8.1	8.0	7.8	7.6	7.6	7.8	7.6	7.4	7.4
Average	8.6	8.4	8.4	8.5	8.5	8.6	8.4	8.1	8.0	8.2	8.2	8.1	8.1	7.9

Grand Rapids Tailrace Dissolved Oxygen Summary - July 2019

Time HHMMSS	07/01/19	07/02/19	07/03/19	07/04/19	07/05/19	07/06/19	07/07/19	07/08/19	07/09/19	07/10/19	07/11/19	07/12/19	07/13/19	07/14/19	07/15/19	07/16/19
0	7.9	7.8	7.7	8.0	7.8	7.4	7.4	7.7	7.9	8.1	8.0	8.2	8.2	7.8	7.9	7.3
10000	7.8	7.7	7.6	7.8	7.6	7.3	7.3	7.6	7.8	8.0	7.9	8.0	8.0	7.7	7.8	7.2
20000	7.7	7.6	7.5	7.7	7.5	7.2	7.2	7.5	7.7	7.9	7.7	7.9	7.8	7.5	7.7	7.1
30000	7.6	7.5	7.4	7.6	7.4	7.1	7.1	7.4	7.6	7.7	7.6	7.7	7.7	7.3	7.5	7.0
40000	7.5	7.4	7.3	7.4	7.2	7.0	7.0	7.3	7.5	7.6	7.5	7.6	7.5	7.2	7.4	7.0
50000	7.4	7.3	7.2	7.4	7.2	6.9	6.9	7.2	7.4	7.5	7.4	7.4	7.4	7.1	7.3	6.9
60000	7.4	7.3	7.1	7.3	7.1	6.8	6.9	7.2	7.3	7.4	7.3	7.3	7.3	7.0	7.2	6.8
70000	7.3	7.2	7.1	7.2	7.0	6.8	6.9	7.2	7.3	7.4	7.2	7.3	7.3	7.0	7.2	6.8
80000	7.3	7.2	7.1	7.2	7.0	6.7	6.9	7.2	7.3	7.4	7.2	7.2	7.2	6.9	7.1	6.7
90000	7.3	7.2	7.1	7.2	7.0	6.8	7.0	7.3	7.4	7.3	7.2	7.2	7.2	7.0	7.1	6.7
100000	7.4	7.3	7.2	7.3	7.0	6.8	7.1	7.4	7.5	7.4	7.3	7.3	7.2	7.1	7.1	6.8
110000	7.5	7.3	7.4	7.5	7.1	6.8	7.2	7.5	7.6	7.6	7.5	7.4	7.4	7.2	7.2	6.9
120000	7.6	7.5	7.6	7.6	7.2	7.0	7.4	7.6	7.8	7.8	7.7	7.6	7.6	7.4	7.3	7.1
130000	7.8	7.6	7.8	7.8	7.4	7.1	7.6	7.8	8.0	8.0	7.9	7.8	7.8	7.7	7.4	7.3
140000	8.0	7.7	8.1	8.1	7.6	7.3	7.8	8.0	8.2	8.2	8.1	8.0	8.0	7.9	7.6	7.5
150000	8.1	7.8	8.3	8.2	7.8	7.5	8.0	8.2	8.4	8.4	8.3	8.1	8.1	8.1	7.8	7.7
160000	8.1	8.0	8.4	8.3	8.0	7.6	8.1	8.3	8.6	8.6	8.4	8.0	8.2	8.3	7.9	7.8
170000	8.3	8.1	8.5	8.5	8.0	7.7	8.2	8.3	8.7	8.6	8.6	8.0	8.3	8.5	7.9	7.9
180000	8.3	8.2	8.5	8.5	8.0	7.8	8.2	8.4	8.7	8.7	8.6	8.3	8.4	8.5	7.9	7.9
190000	8.3	8.2	8.5	8.4	7.9	7.8	8.2	8.4	8.7	8.6	8.6	8.3	8.4	8.5	7.8	7.8
200000	8.3	8.1	8.5	8.3	7.9	7.8	8.1	8.3	8.6	8.5	8.5	8.2	8.3	8.4	7.7	7.7
210000	8.2	8.0	8.4	8.2	7.8	7.8	8.1	8.2	8.5	8.4	8.5	8.1	8.3	8.3	7.6	7.5
220000	8.1	7.9	8.3	8.1	7.7	7.7	8.0	8.1	8.4	8.3	8.4	8.3	8.2	8.2	7.5	7.4
230000	7.9	7.8	8.2	7.9	7.6	7.6	7.9	8.0	8.3	8.1	8.3	8.4	8.0	8.1	7.4	7.3
Daily Max	8.3	8.2	8.5	8.5	8.0	7.8	8.2	8.4	8.7	8.7	8.6	8.4	8.4	8.5	7.9	7.9
Daily Min	7.3	7.2	7.1	7.2	7.0	6.7	6.9	7.2	7.3	7.3	7.2	7.2	7.2	6.9	7.1	6.7
Average	7.8	7.6	7.8	7.8	7.5	7.3	7.5	7.7	8.0	8.0	7.9	7.8	7.8	7.7	7.5	7.2

License Minimum Dissolved Oxygen: 5.0 mg/l

Grand Rapids Tailrace Dissolved Oxygen Summary - July 2019

Time HHMMSS	07/17/19	07/18/19	07/19/19	07/20/19	07/21/19	07/22/19	07/23/19	07/24/19	07/25/19	07/26/19	07/27/19	07/28/19	07/29/19	07/30/19	07/31/19
0	7.1	7.3	7.1	7.2	6.9	7.4	7.9	8.3	7.9	7.8	7.6	8.0	7.7	7.7	8.0
10000	7.0	7.2	7.0	7.1	6.8	7.3	7.7	8.0	7.7	7.7	7.5	7.8	7.5	7.5	7.9
20000	6.9	7.1	6.9	7.0	6.7	7.2	7.5	7.9	7.5	7.6	7.3	7.6	7.3	7.3	7.7
30000	6.8	7.0	6.8	6.9	6.6	7.1	7.3	7.8	7.4	7.4	7.2	7.5	7.2	7.2	7.6
40000	6.7	6.9	6.7	6.8	6.5	7.0	7.2	7.6	7.3	7.3	7.1	7.3	7.0	7.0	7.4
50000	6.6	6.8	6.6	6.7	6.5	6.9	7.1	7.5	7.2	7.2	7.0	7.1	7.0	6.9	7.3
60000	6.6	6.8	6.6	6.7	6.4	6.9	7.0	7.3	7.1	7.1	7.0	7.0	6.9	6.8	7.2
70000	6.6	6.8	6.6	6.6	6.4	6.8	7.0	7.2	7.0	7.0	6.9	6.9	6.8	6.8	7.1
80000	6.6	6.9	6.6	6.7	6.4	6.8	6.9	7.2	7.0	7.0	6.9	6.9	6.8	6.7	7.0
90000	6.7	6.9	6.7	6.7	6.4	6.9	7.0	7.2	7.0	7.0	6.9	6.8	6.7	6.7	7.0
100000	6.8	6.9	6.8	6.8	6.6	7.0	7.1	7.2	7.0	7.0	7.0	6.9	6.8	6.8	7.1
110000	7.0	7.0	6.9	7.0	6.7	7.1	7.3	7.2	7.1	7.1	7.1	7.1	6.8	6.9	7.3
120000	7.2	7.1	7.1	7.0	7.0	7.3	7.5	7.3	7.3	7.3	7.3	7.2	7.0	7.1	7.5
130000	7.4	7.2	7.4	7.2	7.2	7.6	7.8	7.5	7.5	7.4	7.5	7.5	7.3	7.3	7.8
140000	7.6	7.4	7.6	7.2	7.5	7.9	8.0	7.7	7.7	7.5	7.7	7.6	7.5	7.5	8.0
150000	7.8	7.5	7.8	7.2	7.7	8.2	8.2	8.0	7.9	7.7	8.0	7.8	7.7	7.8	8.3
160000	7.9	7.6	8.0	7.2	7.7	8.4	8.4	8.3	8.1	7.8	8.2	8.0	7.9	7.9	8.6
170000	7.9	7.7	8.0	7.3	7.9	8.5	8.6	8.2	8.3	7.9	8.3	8.1	7.9	8.1	8.7
180000	8.0	7.7	8.0	7.2	7.9	8.6	8.8	8.3	8.4	8.0	8.4	8.1	8.1	8.2	8.8
190000	7.9	7.6	7.9	7.2	7.8	8.5	8.7	8.3	8.3	8.1	8.3	8.1	8.1	8.3	8.7
200000	7.8	7.6	7.8	7.1	7.8	8.3	8.6	8.3	8.2	8.0	8.2	8.1	8.0	8.2	8.7
210000	7.7	7.4	7.6	7.1	7.7	8.3	8.5	8.2	8.1	7.9	8.1	8.1	7.9	8.2	8.7
220000	7.6	7.3	7.5	7.0	7.7	8.2	8.5	8.2	8.1	7.8	8.1	8.0	7.9	8.3	8.7
230000	7.4	7.2	7.3	7.0	7.6	8.1	8.4	8.0	8.0	7.7	8.1	7.8	7.9	8.2	8.6
Daily Max	8.0	7.7	8.0	7.3	7.9	8.6	8.8	8.3	8.4	8.1	8.4	8.1	8.1	8.3	8.8
Daily Min	6.6	6.8	6.6	6.6	6.4	6.8	6.9	7.2	7.0	7.0	6.9	6.8	6.7	6.7	7.0
Average	7.2	7.2	7.2	7.0	7.1	7.6	7.8	7.8	7.6	7.5	7.6	7.6	7.4	7.5	7.9

Grand Rapids Tailrace Dissolved Oxygen Summary - August 2019

Time HHMMSS	08/01/19	08/02/19	08/03/19	08/04/19	08/05/19	08/06/19	08/07/19	08/08/19	08/09/19	08/10/19	08/11/19	08/12/19	08/13/19	08/14/19	08/15/19	08/16/19
0	8.4	8.4	7.7	7.5	8.1	7.4	7.5	7.1	7.8	8.2	8.3	8.1	8.3	8.0	8.4	8.6
10000	8.2	8.2	7.6	7.3	8.0	7.3	7.4	7.0	7.7	8.0	8.2	8.0	8.2	8.0	8.4	8.5
20000	8.0	8.0	7.5	7.3	7.8	7.2	7.3	6.9	7.5	7.9	8.1	7.9	8.1	7.9	8.3	8.5
30000	7.8	7.8	7.4	7.2	7.6	7.1	7.2	6.8	7.4	7.7	7.9	7.8	8.0	7.8	8.3	8.4
40000	7.6	7.6	7.2	7.1	7.4	7.0	7.1	6.8	7.3	7.5	7.7	7.6	7.8	7.7	8.3	8.3
50000	7.5	7.4	7.1	7.0	7.3	6.9	7.0	6.7	7.2	7.4	7.6	7.5	7.7	7.6	8.2	8.3
60000	7.4	7.3	7.0	6.9	7.2	6.8	6.9	6.7	7.1	7.3	7.5	7.4	7.5	7.5	8.1	8.1
70000	7.3	7.2	6.9	6.8	7.1	6.8	6.8	6.6	7.0	7.3	7.4	7.3	7.4	7.4	8.1	8.1
80000	7.2	7.1	6.9	6.8	7.1	6.8	6.8	6.6	7.0	7.2	7.3	7.3	7.4	7.4	8.0	8.0
90000	7.2	7.1	6.8	6.7	7.1	6.8	6.8	6.6	7.0	7.2	7.3	7.2	7.3	7.4	7.9	7.9
100000	7.2	7.2	6.8	6.8	7.1	6.8	6.9	6.7	7.2	7.2	7.3	7.3	7.3	7.4	7.9	7.9
110000	7.3	7.3	6.9	7.0	7.3	6.9	7.1	6.9	7.3	7.4	7.4	7.4	7.3	7.5	7.8	7.8
120000	7.5	7.5	7.1	7.2	7.6	7.2	7.4	7.1	7.5	7.6	7.5	7.5	7.4	7.7	7.9	7.9
130000	7.7	7.7	7.3	7.5	7.8	7.5	7.4	7.3	7.7	7.8	7.6	7.7	7.4	7.8	8.0	7.8
140000	8.0	7.9	7.6	7.7	8.0	7.8	7.4	7.5	7.9	8.0	7.7	7.8	7.5	7.8	8.1	8.0
150000	8.3	7.9	7.4	8.1	8.0	8.0	7.5	7.7	8.2	8.2	7.8	7.9	7.7	7.9	8.2	7.9
160000	8.5	7.9	7.5	8.4	8.1	8.4	7.7	7.8	8.3	8.5	7.9	8.1	7.7	8.1	8.3	7.9
170000	8.7	8.0	7.7	8.4	8.3	8.4	7.7	8.0	8.4	8.6	8.1	8.3	7.8	8.1	8.4	8.0
180000	8.7	8.0	7.8	8.5	8.2	8.3	7.7	8.0	8.5	8.7	8.3	8.5	8.0	8.2	8.4	8.1
190000	8.7	8.1	7.7	8.3	8.2	8.1	7.7	7.9	8.5	8.7	8.3	8.5	8.0	8.1	8.4	8.1
200000	8.6	8.1	7.7	8.2	8.1	7.9	7.7	7.8	8.5	8.6	8.3	8.5	8.1	8.1	8.4	8.1
210000	8.6	8.1	7.7	8.2	7.9	7.8	7.6	7.8	8.5	8.6	8.4	8.5	8.1	8.2	8.4	8.1
220000	8.6	8.0	7.6	8.1	7.7	7.8	7.4	7.9	8.4	8.5	8.3	8.5	8.1	8.3	8.5	8.1
230000	8.5	7.9	7.6	8.1	7.6	7.7	7.2	7.9	8.3	8.4	8.2	8.4	8.1	8.3	8.5	8.1
Daily Max	8.7	8.4	7.8	8.5	8.3	8.4	7.7	8.0	8.5	8.7	8.4	8.5	8.3	8.3	8.5	8.6
Daily Min	7.2	7.1	6.8	6.7	7.1	6.8	6.8	6.6	7.0	7.2	7.3	7.2	7.3	7.4	7.8	7.8
Average	8.0	7.7	7.3	7.5	7.7	7.4	7.3	7.3	7.8	7.9	7.8	7.9	7.8	7.8	8.2	8.1

License Minimum Dissolved Oxygen: 5.0 mg/l

Grand Rapids Tailrace Dissolved Oxygen Summary - August 2019

Time HHMMSS	08/17/19	08/18/19	08/19/19	08/20/19	08/21/19	08/22/19	08/23/19	08/24/19	08/25/19	08/26/19	08/27/19	08/28/19	08/29/19	08/30/19	08/31/19
0	8.1	8.5	8.2	8.6	8.5	8.4	8.5	8.5	8.7	8.7	8.2	8.5	8.5	8.7	9.1
10000	8.0	8.4	8.2	8.5	8.3	8.3	8.4	8.5	8.8	8.8	8.2	8.5	8.5	8.7	9.2
20000	7.9	8.3	8.1	8.3	8.2	8.2	8.2	8.5	8.7	8.8	8.2	8.5	8.5	8.7	9.1
30000	7.8	8.3	8.0	8.2	8.1	8.1	8.1	8.5	8.7	8.8	8.2	8.5	8.4	8.7	9.1
40000	7.8	8.2	7.9	8.1	8.0	8.0	8.0	8.4	8.7	8.8	8.1	8.4	8.4	8.6	9.0
50000	7.7	8.1	7.9	8.0	7.8	7.9	7.9	8.4	8.6	8.8	8.1	8.4	8.3	8.6	8.9
60000	7.6	8.0	7.8	7.8	7.8	7.8	7.8	8.3	8.6	8.7	8.0	8.3	8.3	8.5	8.9
70000	7.6	7.9	7.7	7.8	7.7	7.7	7.7	8.3	8.5	8.6	8.0	8.3	8.2	8.5	8.8
80000	7.5	7.9	7.7	7.7	7.7	7.7	7.7	8.2	8.5	8.6	8.0	8.3	8.2	8.4	8.8
90000	7.5	7.8	7.6	7.7	7.6	7.7	7.7	8.1	8.4	8.6	7.9	8.3	8.2	8.4	8.7
100000	7.5	7.8	7.6	7.7	7.6	7.7	7.7	8.1	8.4	8.6	8.0	8.3	8.2	8.4	8.7
110000	7.5	7.8	7.6	7.8	7.7	7.8	7.8	8.2	8.4	8.5	8.0	8.2	8.2	8.4	8.7
120000	7.6	7.8	7.7	7.9	7.9	7.9	7.9	8.2	8.4	8.4	8.0	8.2	8.2	8.5	8.7
130000	7.7	7.8	7.9	8.1	8.0	8.1	8.1	8.2	8.4	8.3	8.0	8.2	8.2	8.6	8.7
140000	7.9	7.8	8.0	8.2	8.2	8.2	8.3	8.2	8.4	8.3	8.1	8.2	8.2	8.6	8.7
150000	8.0	7.9	8.2	8.5	8.4	8.4	8.4	8.3	8.4	8.2	8.1	8.3	8.3	8.7	8.8
160000	8.1	8.0	8.2	8.7	8.5	8.5	8.2	8.3	8.5	8.2	8.1	8.3	8.4	8.8	8.8
170000	8.3	8.2	8.4	8.8	8.7	8.6	8.4	8.4	8.5	8.2	8.2	8.3	8.4	8.8	8.8
180000	8.3	8.3	8.5	8.9	8.7	8.7	8.3	8.5	8.6	8.2	8.3	8.3	8.5	8.9	8.8
190000	8.2	8.1	8.6	8.9	8.8	8.7	8.3	8.4	8.5	8.2	8.2	8.4	8.5	8.8	8.9
200000	8.2	8.0	8.6	8.8	8.7	8.7	8.3	8.4	8.5	8.2	8.2	8.4	8.4	8.8	8.9
210000	8.3	8.1	8.7	8.7	8.7	8.7	8.4	8.4	8.6	8.2	8.3	8.4	8.5	8.9	8.9
220000	8.4	8.2	8.7	8.7	8.6	8.6	8.4	8.5	8.6	8.2	8.4	8.5	8.6	9.0	9.0
230000	8.4	8.2	8.6	8.6	8.5	8.6	8.5	8.6	8.7	8.2	8.4	8.5	8.7	9.1	9.1
Daily Max	8.4	8.5	8.7	8.9	8.8	8.7	8.5	8.6	8.8	8.8	8.4	8.5	8.7	9.1	9.2
Daily Min	7.5	7.8	7.6	7.7	7.6	7.7	7.7	8.1	8.4	8.2	7.9	8.2	8.2	8.4	8.7
Average	7.9	8.1	8.1	8.3	8.2	8.2	8.1	8.4	8.5	8.5	8.1	8.3	8.4	8.7	8.9

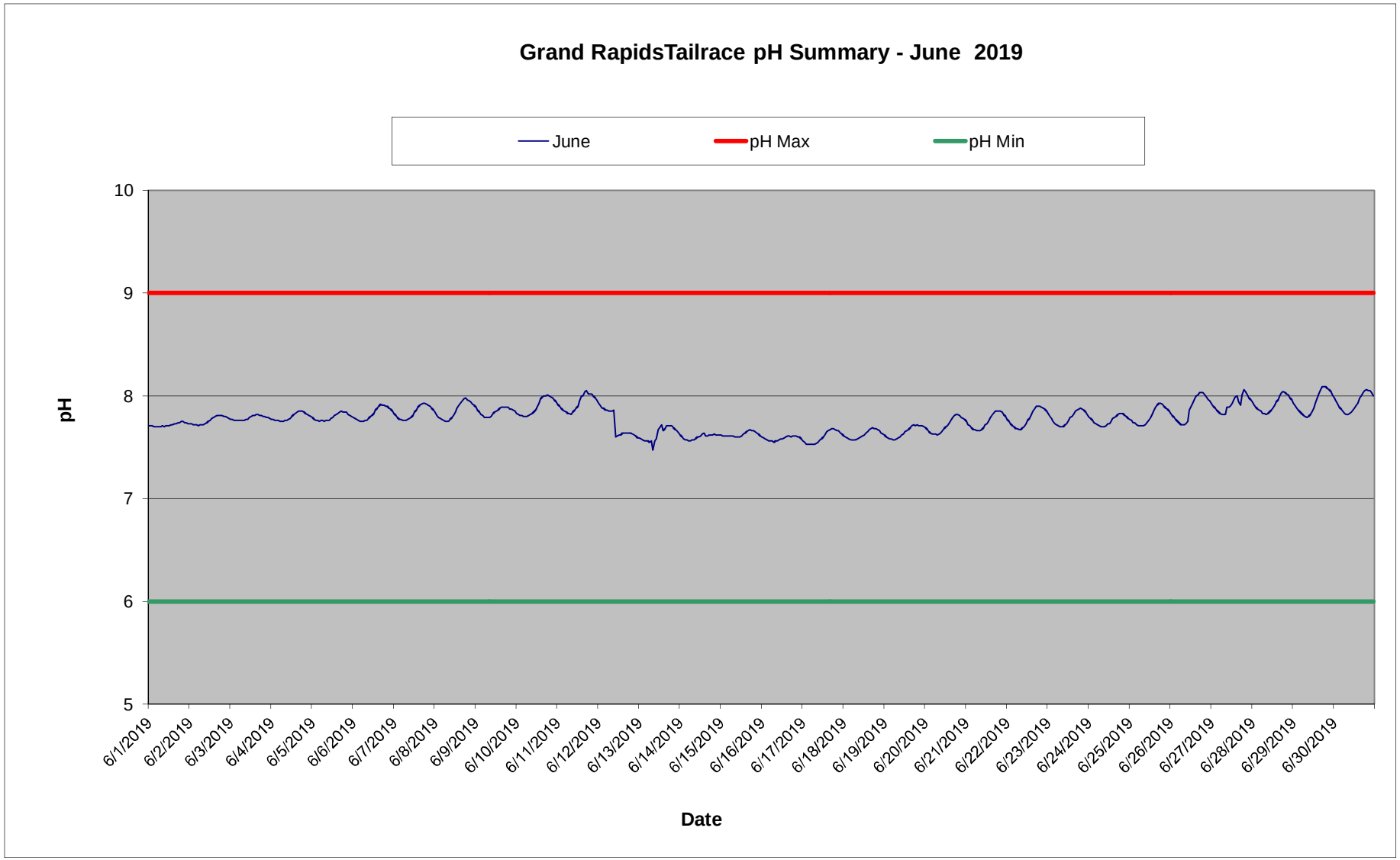
Grand Rapids Tailrace Dissolved Oxygen Summary - September 2019

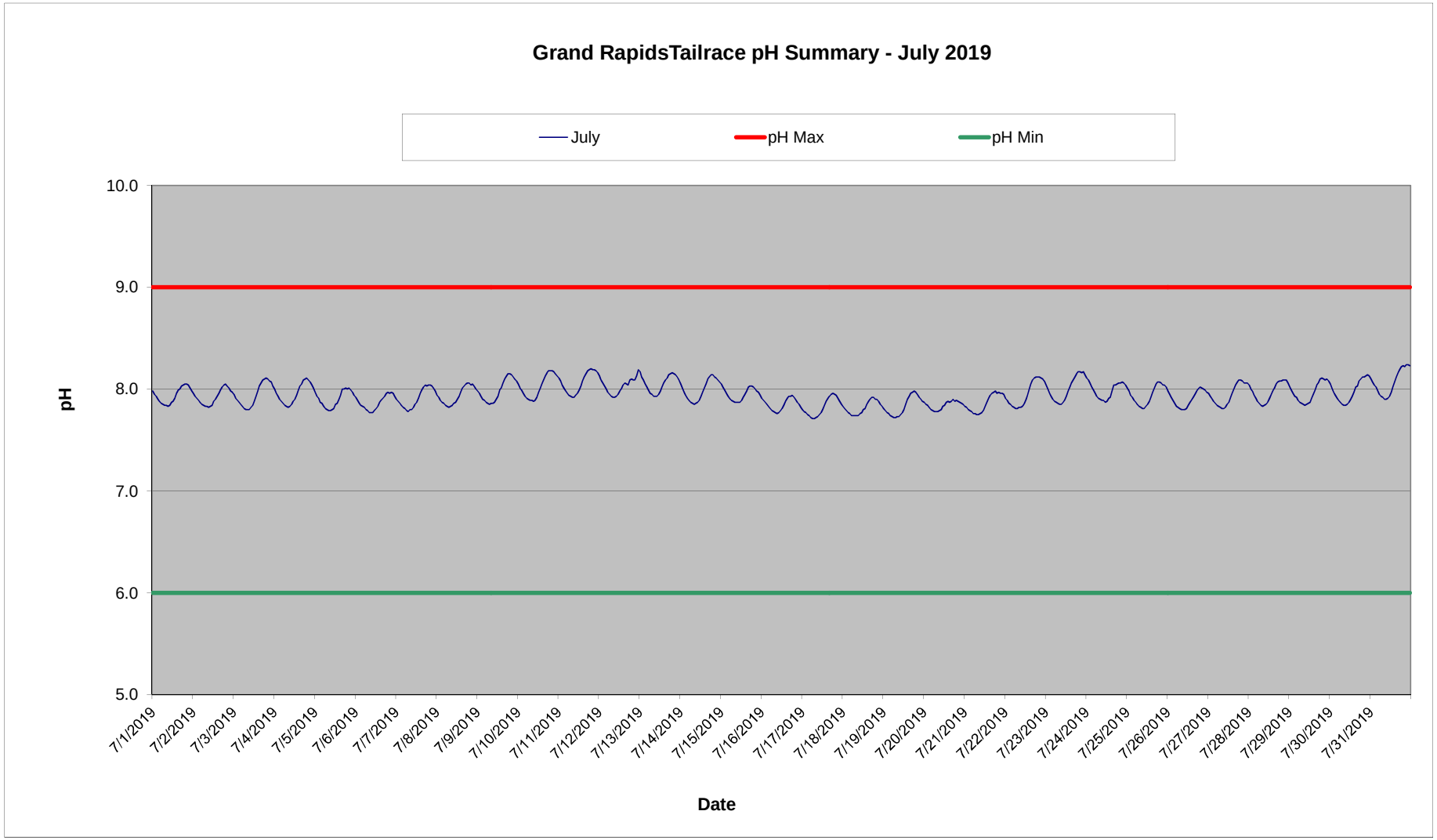
Time HHMMSS	09/01/19	09/02/19	09/03/19	09/04/19	09/05/19	09/06/19	09/07/19	09/08/19	09/09/19	09/10/19	09/11/19	09/12/19	09/13/19	09/14/19	09/15/19	09/16/19
0	9.1	9.3	9.1	8.8	8.9	8.4	8.4	8.9	9.0	9.3	9.1	8.7	8.8	8.7	8.7	8.5
10000	9.1	9.3	9.2	8.8	8.8	8.4	8.3	8.8	9.0	9.2	9.0	8.7	8.8	8.5	8.6	8.4
20000	9.1	9.3	9.2	8.8	8.7	8.3	8.3	8.8	8.9	9.1	8.9	8.6	8.8	8.5	8.6	8.3
30000	9.1	9.3	9.1	8.7	8.6	8.3	8.2	8.7	8.8	9.1	8.8	8.6	8.7	8.4	8.5	8.3
40000	9.1	9.3	9.0	8.7	8.5	8.2	8.2	8.6	8.8	9.0	8.7	8.5	8.7	8.4	8.5	8.2
50000	9.0	9.2	9.0	8.7	8.4	8.2	8.2	8.5	8.7	8.9	8.7	8.5	8.7	8.4	8.5	8.2
60000	8.9	9.1	8.9	8.6	8.4	8.1	8.1	8.5	8.7	8.9	8.6	8.5	8.7	8.4	8.5	8.2
70000	8.9	9.1	8.9	8.6	8.3	8.1	8.1	8.5	8.7	8.8	8.6	8.4	8.6	8.4	8.5	8.2
80000	8.8	9.0	8.8	8.5	8.3	8.1	8.1	8.5	8.7	8.8	8.5	8.4	8.8	8.4	8.5	8.2
90000	8.8	9.0	8.7	8.5	8.3	8.1	8.1	8.5	8.7	8.8	8.5	8.4	8.9	8.4	8.5	8.2
100000	8.8	8.9	8.7	8.5	8.4	8.1	8.2	8.6	8.8	8.9	8.5	8.5	8.9	8.4	8.5	8.3
110000	8.8	8.9	8.7	8.4	8.5	8.2	8.4	8.7	8.9	9.0	8.5	8.5	8.7	8.5	8.5	8.3
120000	8.8	8.9	8.6	8.3	8.7	8.3	8.5	8.8	9.1	9.0	8.6	8.6	8.5	8.6	8.6	8.4
130000	8.8	8.9	8.6	8.5	8.7	8.4	8.7	8.9	9.2	9.1	8.7	8.7	8.7	8.8	8.7	8.5
140000	8.8	9.0	8.7	8.7	8.9	8.5	8.9	9.0	9.3	9.2	8.7	8.7	8.8	8.9	8.7	8.6
150000	8.9	8.9	8.6	8.9	8.9	8.5	9.0	9.1	9.5	9.4	8.8	8.8	9.0	9.0	8.8	8.7
160000	8.9	9.0	8.7	9.1	8.9	8.6	9.1	9.1	9.6	9.5	8.8	8.8	8.9	9.1	8.8	8.7
170000	9.0	9.0	8.7	9.2	9.0	8.6	9.1	9.2	9.6	9.5	8.8	8.9	9.0	9.1	8.8	8.8
180000	9.0	9.0	8.7	9.3	8.9	8.7	9.2	9.2	9.6	9.5	8.9	8.9	9.0	9.1	8.8	8.8
190000	9.0	8.9	8.6	9.3	8.8	8.6	9.1	9.2	9.6	9.4	8.8	8.9	9.0	9.1	8.8	8.8
200000	9.0	8.9	8.6	9.3	8.8	8.6	9.1	9.2	9.6	9.3	8.8	8.9	8.9	9.0	8.7	8.8
210000	9.1	9.0	8.7	9.2	8.7	8.6	9.1	9.2	9.6	9.3	8.8	8.8	8.9	9.0	8.7	8.7
220000	9.2	9.0	8.7	9.1	8.6	8.5	9.1	9.1	9.5	9.2	8.8	8.9	8.8	8.9	8.6	8.7
230000	9.2	9.1	8.8	9.0	8.5	8.5	9.0	9.1	9.4	9.2	8.7	8.8	8.8	8.8	8.5	8.6
Daily Max	9.2	9.3	9.2	9.3	9.0	8.7	9.2	9.2	9.6	9.5	9.1	8.9	9.0	9.1	8.8	8.8
Daily Min	8.8	8.9	8.6	8.3	8.3	8.1	8.1	8.5	8.7	8.8	8.5	8.4	8.5	8.4	8.5	8.2
Average	9.0	9.1	8.8	8.8	8.6	8.4	8.6	8.9	9.1	9.1	8.7	8.7	8.8	8.7	8.6	8.5

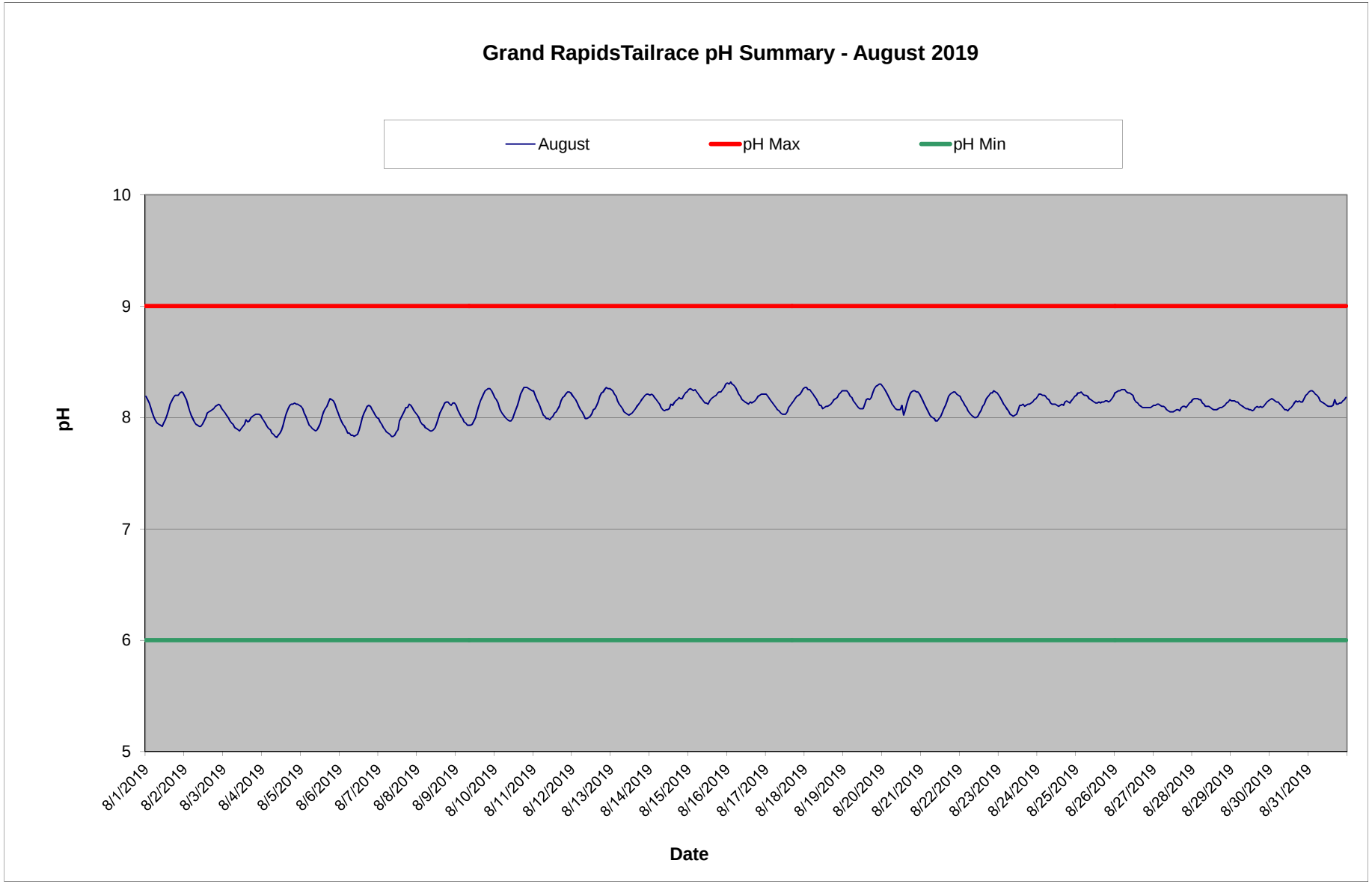
License Minimum Dissolved Oxygen: 5.0 mg/l

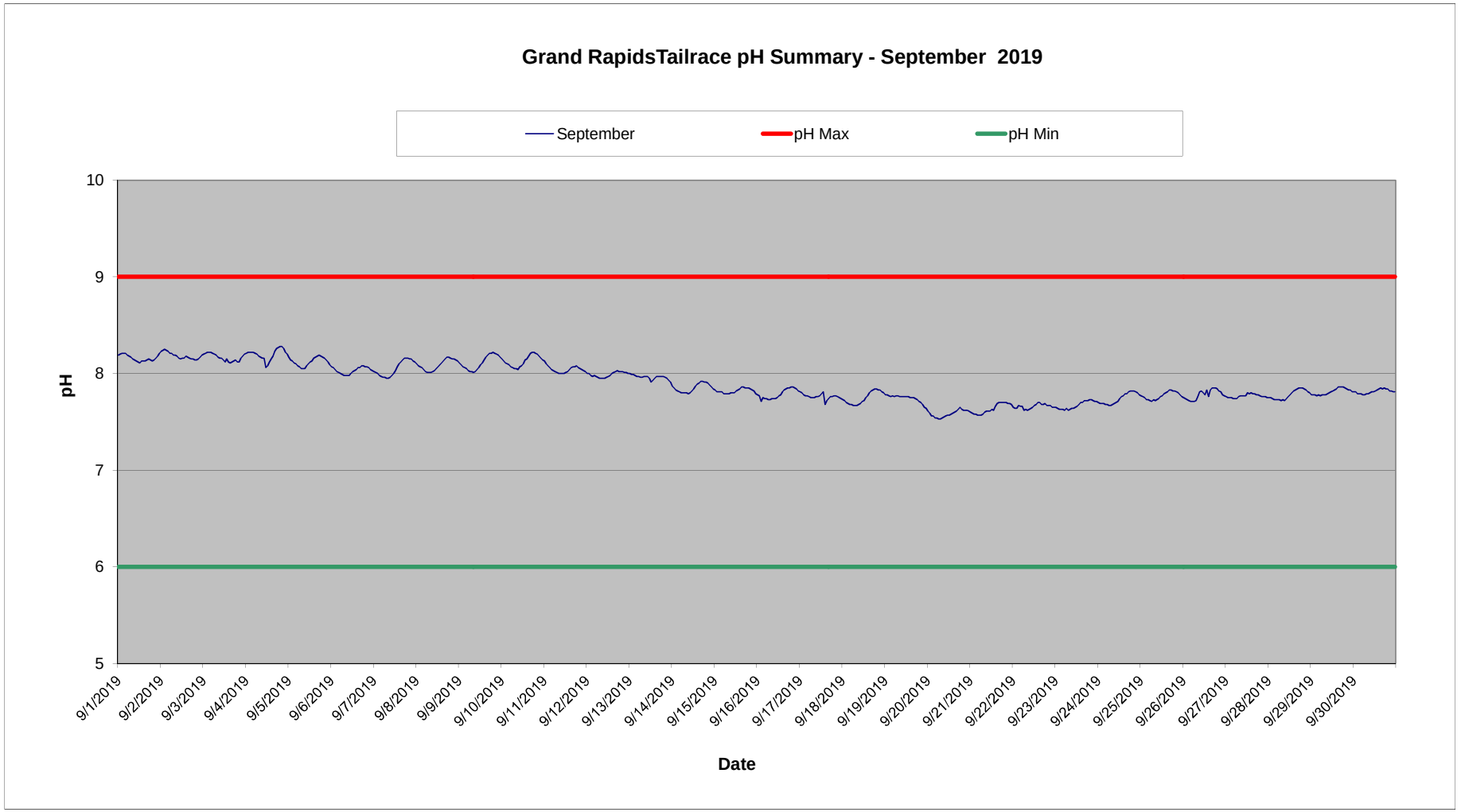
Grand Rapids Tailrace Dissolved Oxygen Summary - September 2019

Time HHMMSS	09/17/19	09/18/19	09/19/19	09/20/19	09/21/19	09/22/19	09/23/19	09/24/19	09/25/19	09/26/19	09/27/19	09/28/19	09/29/19	09/30/19
0	8.5	8.4	8.3	7.5	7.3	7.4	7.1	7.5	7.9	7.8	8.0	7.9	8.5	8.6
10000	8.4	8.3	8.3	7.4	7.3	7.3	7.0	7.5	7.8	7.7	8.0	7.9	8.4	8.6
20000	8.4	8.2	8.2	7.3	7.2	7.3	7.0	7.5	7.7	7.6	8.0	7.9	8.4	8.5
30000	8.3	8.2	8.2	7.2	7.1	7.2	7.0	7.4	7.7	7.6	7.9	7.9	8.4	8.5
40000	8.3	8.1	8.2	7.1	7.1	7.2	7.0	7.4	7.6	7.6	7.9	7.9	8.4	8.5
50000	8.2	8.0	8.2	7.0	7.0	7.1	7.0	7.3	7.6	7.5	7.9	7.9	8.4	8.5
60000	8.2	8.0	8.2	7.0	7.0	7.1	6.9	7.3	7.6	7.6	8.0	7.9	8.4	8.5
70000	8.1	8.0	8.2	7.0	7.0	7.0	6.9	7.4	7.5	7.6	8.0	8.0	8.5	8.5
80000	8.2	8.0	8.2	7.0	7.1	7.0	7.0	7.4	7.6	7.6	8.1	8.0	8.5	8.5
90000	8.2	8.1	8.1	7.1	7.2	7.0	7.0	7.4	7.6	7.9	8.1	8.0	8.5	8.5
100000	8.2	8.1	8.2	7.1	7.2	7.0	7.1	7.5	7.7	8.0	8.1	8.1	8.6	8.5
110000	8.3	8.2	8.2	7.1	7.2	7.1	7.1	7.6	7.7	7.9	8.2	8.1	8.6	8.6
120000	8.4	8.3	8.2	7.2	7.3	7.1	7.2	7.7	7.8	7.9	8.2	8.3	8.7	8.6
130000	8.5	8.4	8.1	7.2	7.3	7.1	7.3	7.7	7.9	8.0	8.2	8.4	8.8	8.6
140000	8.6	8.5	8.1	7.2	7.4	7.2	7.4	7.8	7.9	7.9	8.2	8.5	8.8	8.6
150000	8.7	8.6	8.1	7.3	7.5	7.2	7.5	7.9	8.0	8.3	8.2	8.6	8.8	8.7
160000	8.7	8.7	8.2	7.4	7.6	7.3	7.5	8.0	8.1	8.3	8.2	8.6	8.8	8.7
170000	8.7	8.7	8.1	7.5	7.6	7.2	7.6	8.1	8.1	8.4	8.2	8.7	8.9	8.7
180000	8.7	8.7	8.1	7.5	7.6	7.2	7.6	8.1	8.1	8.4	8.1	8.6	8.8	8.6
190000	8.7	8.7	8.0	7.6	7.6	7.2	7.7	8.1	8.1	8.4	8.1	8.6	8.8	8.6
200000	8.7	8.6	7.9	7.5	7.6	7.2	7.7	8.1	8.0	8.3	8.1	8.6	8.8	8.6
210000	8.6	8.6	7.8	7.5	7.6	7.2	7.7	8.1	8.0	8.3	8.0	8.6	8.7	8.6
220000	8.5	8.5	7.7	7.4	7.5	7.2	7.6	8.0	7.9	8.2	8.0	8.5	8.7	8.5
230000	8.4	8.4	7.6	7.4	7.4	7.1	7.6	7.9	7.8	8.1	8.0	8.5	8.6	8.5
Daily Max	8.7	8.7	8.3	7.6	7.6	7.4	7.7	8.1	8.1	8.4	8.2	8.7	8.9	8.7
Daily Min	8.1	8.0	7.6	7.0	7.0	7.0	6.9	7.3	7.5	7.5	7.9	7.9	8.4	8.5
Average	8.4	8.3	8.1	7.3	7.3	7.2	7.3	7.7	7.8	7.9	8.1	8.3	8.6	8.6









Grand Rapids Tailrace pH Summary - June 2019

Time HHMMSS	06/01/19	06/02/19	06/03/19	06/04/19	06/05/19	06/06/19	06/07/19	06/08/19	06/09/19	06/10/19	06/11/19	06/12/19	06/13/19	06/14/19	06/15/19	06/16/19
0	7.7	7.7	7.8	7.8	7.8	7.8	7.8	7.8	7.9	7.8	7.9	7.9	7.6	7.6	7.6	7.6
10000	7.7	7.7	7.8	7.8	7.8	7.8	7.8	7.8	7.9	7.8	7.9	7.9	7.6	7.6	7.6	7.6
20000	7.7	7.7	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.9	7.9	7.6	7.6	7.6	7.6
30000	7.7	7.7	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.9	7.9	7.6	7.6	7.6	7.6
40000	7.7	7.7	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.9	7.9	7.6	7.6	7.6	7.6
50000	7.7	7.7	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.9	7.6	7.6	7.6	7.6
60000	7.7	7.7	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.9	7.6	7.6	7.6	7.6
70000	7.7	7.7	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.9	7.6	7.6	7.6	7.6
80000	7.7	7.7	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.9	7.5	7.6	7.6	7.6
90000	7.7	7.7	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.9	7.6	7.6	7.6	7.6
100000	7.7	7.7	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.9	7.6	7.6	7.6	7.6	7.6
110000	7.7	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.9	7.9	7.6	7.7	7.6	7.6	7.6
120000	7.7	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.9	7.9	7.9	7.6	7.7	7.6	7.6	7.6
130000	7.7	7.8	7.8	7.8	7.8	7.9	7.9	7.9	7.9	7.9	8.0	7.6	7.7	7.6	7.6	7.6
140000	7.7	7.8	7.8	7.8	7.8	7.9	7.9	7.9	7.9	8.0	8.0	7.6	7.7	7.6	7.6	7.6
150000	7.7	7.8	7.8	7.8	7.8	7.9	7.9	7.9	7.9	8.0	8.0	7.6	7.7	7.6	7.7	7.6
160000	7.7	7.8	7.8	7.9	7.8	7.9	7.9	8.0	7.9	8.0	8.0	7.6	7.7	7.6	7.7	7.6
170000	7.7	7.8	7.8	7.9	7.9	7.9	7.9	8.0	7.9	8.0	8.1	7.6	7.7	7.6	7.7	7.6
180000	7.7	7.8	7.8	7.9	7.8	7.9	7.9	8.0	7.9	8.0	8.0	7.6	7.7	7.6	7.7	7.6
190000	7.8	7.8	7.8	7.8	7.8	7.9	7.9	8.0	7.9	8.0	8.0	7.6	7.7	7.6	7.7	7.6
200000	7.8	7.8	7.8	7.8	7.8	7.9	7.9	8.0	7.9	8.0	8.0	7.6	7.7	7.6	7.7	7.6
210000	7.7	7.8	7.8	7.8	7.8	7.9	7.9	7.9	7.9	8.0	8.0	7.6	7.7	7.6	7.6	7.6
220000	7.7	7.8	7.8	7.8	7.8	7.9	7.9	7.9	7.9	8.0	8.0	7.6	7.7	7.6	7.6	7.6
230000	7.7	7.8	7.8	7.8	7.8	7.9	7.9	7.9	7.9	7.9	8.0	7.6	7.6	7.6	7.6	7.6
Daily Max	7.8	7.8	7.8	7.9	7.9	7.9	7.9	8.0	7.9	8.0	8.1	7.9	7.7	7.6	7.7	7.6
Daily Min	7.7	7.7	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.6	7.5	7.6	7.6	7.6
Average	7.7	7.8	7.8	7.8	7.8	7.8	7.8	7.9	7.8	7.9	7.9	7.7	7.6	7.6	7.6	7.6

License maximum pH: 9
License minimum pH: 6

Grand Rapids Tailrace pH Summary - June 2019

Time HHMMSS	06/17/19	06/18/19	06/19/19	06/20/19	06/21/19	06/22/19	06/23/19	06/24/19	06/25/19	06/26/19	06/27/19	06/28/19	06/29/19	06/30/19
0	7.6	7.6	7.6	7.7	7.8	7.8	7.8	7.8	7.8	7.8	7.9	7.9	7.9	8.0
10000	7.6	7.6	7.6	7.7	7.7	7.8	7.8	7.8	7.8	7.8	7.9	7.9	7.9	8.0
20000	7.5	7.6	7.6	7.7	7.7	7.7	7.8	7.8	7.7	7.8	7.9	7.9	7.9	7.9
30000	7.5	7.6	7.6	7.6	7.7	7.7	7.8	7.7	7.7	7.8	7.9	7.9	7.9	7.9
40000	7.5	7.6	7.6	7.6	7.7	7.7	7.7	7.7	7.7	7.8	7.8	7.9	7.8	7.9
50000	7.5	7.6	7.6	7.6	7.7	7.7	7.7	7.7	7.7	7.7	7.8	7.9	7.8	7.9
60000	7.5	7.6	7.6	7.6	7.7	7.7	7.7	7.7	7.7	7.7	7.8	7.8	7.8	7.8
70000	7.5	7.6	7.6	7.6	7.7	7.7	7.7	7.7	7.7	7.7	7.8	7.8	7.8	7.8
80000	7.5	7.6	7.6	7.6	7.7	7.7	7.7	7.7	7.7	7.7	7.8	7.8	7.8	7.8
90000	7.6	7.6	7.6	7.6	7.7	7.7	7.7	7.7	7.7	7.7	7.9	7.8	7.8	7.8
100000	7.6	7.6	7.6	7.7	7.7	7.7	7.7	7.7	7.7	7.8	7.9	7.8	7.8	7.8
110000	7.6	7.6	7.6	7.7	7.7	7.7	7.7	7.7	7.8	7.9	7.9	7.9	7.8	7.9
120000	7.6	7.6	7.7	7.7	7.7	7.8	7.8	7.7	7.8	7.9	7.9	7.9	7.9	7.9
130000	7.6	7.6	7.7	7.7	7.8	7.8	7.8	7.8	7.8	7.9	8.0	7.9	7.9	7.9
140000	7.7	7.7	7.7	7.7	7.8	7.8	7.8	7.8	7.9	8.0	8.0	7.9	8.0	7.9
150000	7.7	7.7	7.7	7.8	7.8	7.9	7.8	7.8	7.9	8.0	8.0	8.0	8.0	8.0
160000	7.7	7.7	7.7	7.8	7.8	7.9	7.9	7.8	7.9	8.0	7.9	8.0	8.1	8.0
170000	7.7	7.7	7.7	7.8	7.9	7.9	7.9	7.8	7.9	8.0	7.9	8.0	8.1	8.0
180000	7.7	7.7	7.7	7.8	7.9	7.9	7.9	7.8	7.9	8.0	8.0	8.0	8.1	8.1
190000	7.7	7.7	7.7	7.8	7.9	7.9	7.9	7.8	7.9	8.0	8.1	8.0	8.1	8.1
200000	7.7	7.7	7.7	7.8	7.9	7.9	7.9	7.8	7.9	8.0	8.0	8.0	8.1	8.1
210000	7.7	7.7	7.7	7.8	7.8	7.9	7.9	7.8	7.9	8.0	8.0	8.0	8.1	8.1
220000	7.6	7.6	7.7	7.8	7.8	7.9	7.8	7.8	7.9	8.0	8.0	8.0	8.0	8.0
230000	7.6	7.6	7.7	7.8	7.8	7.9	7.8	7.8	7.9	8.0	8.0	8.0	8.0	8.0
Daily Max	7.7	7.7	7.7	7.8	7.9	7.9	7.9	7.8	7.9	8.0	8.1	8.0	8.1	8.1
Daily Min	7.5	7.6	7.6	7.6	7.7	7.7	7.7	7.7	7.7	7.7	7.8	7.8	7.8	7.8
Average	7.6	7.6	7.6	7.7	7.8	7.8	7.8	7.8	7.8	7.9	7.9	7.9	7.9	7.9

Grand Rapids Tailrace pH Summary - July 2019

Time HHMMSS	07/01/19	07/02/19	07/03/19	07/04/19	07/05/19	07/06/19	07/07/19	07/08/19	07/09/19	07/10/19	07/11/19	07/12/19	07/13/19	07/14/19	07/15/19	07/16/19
0	8.0	8.0	8.0	8.0	8.0	7.9	7.9	7.9	8.0	8.1	8.1	8.1	8.2	8.1	8.1	7.9
10000	8.0	7.9	7.9	8.0	7.9	7.9	7.9	7.9	8.0	8.0	8.1	8.1	8.1	8.0	8.0	7.9
20000	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	8.0	8.0	8.1	8.1	8.0	8.0	7.9
30000	7.9	7.9	7.9	7.9	7.9	7.8	7.8	7.9	7.9	8.0	8.0	8.0	8.1	7.9	8.0	7.9
40000	7.9	7.9	7.9	7.9	7.9	7.8	7.8	7.9	7.9	7.9	8.0	8.0	8.0	7.9	7.9	7.8
50000	7.9	7.9	7.8	7.9	7.8	7.8	7.8	7.8	7.9	7.9	8.0	8.0	8.0	7.9	7.9	7.8
60000	7.9	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.9	7.9	7.9	8.0	8.0	7.9	7.9	7.8
70000	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.9	7.9	7.9	7.9	8.0	7.9	7.9	7.8
80000	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.8
90000	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.8
100000	7.8	7.8	7.8	7.9	7.8	7.8	7.8	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.8
110000	7.9	7.8	7.8	7.9	7.8	7.8	7.9	7.9	7.9	7.9	8.0	8.0	8.0	7.9	7.9	7.8
120000	7.9	7.9	7.9	7.9	7.9	7.8	7.9	7.9	7.9	8.0	8.0	8.0	8.0	7.9	7.9	7.8
130000	7.9	7.9	7.9	7.9	7.9	7.8	7.9	7.9	8.0	8.0	8.0	8.0	8.0	8.0	7.9	7.8
140000	8.0	7.9	8.0	8.0	7.9	7.9	8.0	8.0	8.0	8.1	8.1	8.0	8.1	8.0	8.0	7.9
150000	8.0	8.0	8.0	8.0	7.9	7.9	8.0	8.0	8.1	8.1	8.1	8.1	8.1	8.1	8.0	7.9
160000	8.0	8.0	8.1	8.1	8.0	7.9	8.0	8.0	8.1	8.1	8.2	8.1	8.1	8.1	8.0	7.9
170000	8.0	8.0	8.1	8.1	8.0	7.9	8.0	8.1	8.1	8.2	8.2	8.0	8.1	8.1	8.0	7.9
180000	8.0	8.0	8.1	8.1	8.0	8.0	8.0	8.1	8.2	8.2	8.2	8.1	8.2	8.1	8.0	7.9
190000	8.1	8.1	8.1	8.1	8.0	8.0	8.0	8.1	8.2	8.2	8.2	8.1	8.2	8.1	8.0	7.9
200000	8.1	8.0	8.1	8.1	8.0	8.0	8.0	8.0	8.1	8.2	8.2	8.1	8.2	8.1	8.0	7.9
210000	8.0	8.0	8.1	8.1	8.0	8.0	8.0	8.1	8.1	8.2	8.2	8.1	8.1	8.1	8.0	7.9
220000	8.0	8.0	8.1	8.0	8.0	8.0	8.0	8.0	8.1	8.2	8.2	8.1	8.1	8.1	8.0	7.9
230000	8.0	8.0	8.0	8.0	7.9	7.9	8.0	8.0	8.1	8.1	8.2	8.2	8.1	8.1	7.9	7.8
Daily Max	8.1	8.1	8.1	8.1	8.0	8.0	8.0	8.1	8.2	8.2	8.2	8.2	8.2	8.1	8.1	7.9
Daily Min	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.8
Average	7.9	7.9	7.9	8.0	7.9	7.9	7.9	7.9	8.0	8.0	8.1	8.0	8.1	8.0	8.0	7.9

License maximum pH: 9
License minimum pH: 6

Grand Rapids Tailrace pH Summary - July 2019

Time HHMMSS	07/17/19	07/18/19	07/19/19	07/20/19	07/21/19	07/22/19	07/23/19	07/24/19	07/25/19	07/26/19	07/27/19	07/28/19	07/29/19	07/30/19	07/31/19
0	7.8	7.8	7.8	7.9	7.8	7.9	8.0	8.1	8.0	8.0	8.0	8.0	8.0	8.1	8.1
10000	7.8	7.8	7.8	7.9	7.8	7.9	8.0	8.1	8.0	8.0	7.9	8.0	8.0	8.0	8.1
20000	7.8	7.8	7.8	7.8	7.8	7.9	8.0	8.1	7.9	7.9	7.9	8.0	8.0	8.0	8.0
30000	7.8	7.8	7.8	7.8	7.8	7.9	7.9	8.0	7.9	7.9	7.9	7.9	7.9	7.9	8.0
40000	7.7	7.8	7.7	7.8	7.8	7.8	7.9	8.0	7.9	7.9	7.9	7.9	7.9	7.9	8.0
50000	7.7	7.7	7.7	7.8	7.8	7.8	7.9	8.0	7.9	7.8	7.8	7.9	7.9	7.9	8.0
60000	7.7	7.7	7.7	7.8	7.8	7.8	7.9	7.9	7.9	7.8	7.8	7.9	7.9	7.9	7.9
70000	7.7	7.7	7.7	7.8	7.8	7.8	7.9	7.9	7.8	7.8	7.8	7.8	7.9	7.9	7.9
80000	7.7	7.7	7.7	7.8	7.8	7.8	7.9	7.9	7.8	7.8	7.8	7.8	7.9	7.8	7.9
90000	7.7	7.7	7.7	7.8	7.8	7.8	7.9	7.9	7.8	7.8	7.8	7.8	7.8	7.8	7.9
100000	7.8	7.8	7.8	7.8	7.8	7.8	7.9	7.9	7.8	7.8	7.8	7.9	7.9	7.9	7.9
110000	7.8	7.8	7.8	7.8	7.8	7.9	7.9	7.9	7.8	7.8	7.9	7.9	7.9	7.9	7.9
120000	7.8	7.8	7.8	7.8	7.8	7.9	7.9	7.9	7.9	7.8	7.9	7.9	7.9	7.9	8.0
130000	7.8	7.8	7.9	7.9	7.9	7.9	8.0	7.9	7.9	7.9	7.9	7.9	7.9	7.9	8.0
140000	7.9	7.9	7.9	7.9	7.9	8.0	8.0	7.9	7.9	7.9	8.0	8.0	8.0	8.0	8.1
150000	7.9	7.9	7.9	7.9	7.9	8.1	8.1	8.0	8.0	7.9	8.0	8.0	8.0	8.0	8.1
160000	7.9	7.9	8.0	7.9	8.0	8.1	8.1	8.0	8.0	8.0	8.0	8.1	8.0	8.0	8.2
170000	8.0	7.9	8.0	7.9	8.0	8.1	8.1	8.0	8.1	8.0	8.1	8.1	8.1	8.1	8.2
180000	8.0	7.9	8.0	7.9	8.0	8.1	8.2	8.1	8.1	8.0	8.1	8.1	8.1	8.1	8.2
190000	8.0	7.9	8.0	7.9	8.0	8.1	8.2	8.1	8.1	8.0	8.1	8.1	8.1	8.1	8.2
200000	7.9	7.9	8.0	7.9	8.0	8.1	8.2	8.1	8.1	8.0	8.1	8.1	8.1	8.1	8.2
210000	7.9	7.9	7.9	7.9	8.0	8.1	8.2	8.1	8.0	8.0	8.1	8.1	8.1	8.1	8.2
220000	7.9	7.9	7.9	7.9	8.0	8.1	8.2	8.1	8.0	8.0	8.1	8.1	8.1	8.1	8.2
230000	7.9	7.8	7.9	7.9	8.0	8.1	8.1	8.0	8.0	8.0	8.1	8.1	8.1	8.1	8.2
Daily Max	8.0	7.9	8.0	7.9	8.0	8.1	8.2	8.1	8.1	8.0	8.1	8.1	8.1	8.1	8.2
Daily Min	7.7	7.7	7.7	7.8	7.8	7.8	7.9	7.9	7.8	7.8	7.8	7.8	7.8	7.8	7.9
Average	7.8	7.8	7.8	7.8	7.9	8.0	8.0	8.0	7.9	7.9	7.9	8.0	8.0	8.0	8.1

Grand Rapids Tailrace pH Summary - August 2019

Time HHMMSS	08/01/19	08/02/19	08/03/19	08/04/19	08/05/19	08/06/19	08/07/19	08/08/19	08/09/19	08/10/19	08/11/19	08/12/19	08/13/19	08/14/19	08/15/19	08/16/19
0	8.2	8.2	8.1	8.0	8.1	8.0	8.0	8.0	8.1	8.2	8.2	8.2	8.3	8.2	8.3	8.3
10000	8.2	8.2	8.0	8.0	8.1	8.0	8.0	8.0	8.1	8.2	8.2	8.2	8.2	8.2	8.3	8.3
20000	8.1	8.1	8.0	8.0	8.0	7.9	7.9	8.0	8.0	8.1	8.2	8.2	8.2	8.2	8.3	8.3
30000	8.1	8.1	8.0	7.9	8.0	7.9	7.9	7.9	8.0	8.1	8.1	8.1	8.2	8.2	8.2	8.3
40000	8.0	8.0	8.0	7.9	8.0	7.9	7.9	7.9	8.0	8.1	8.1	8.1	8.2	8.2	8.3	8.3
50000	8.0	8.0	8.0	7.9	7.9	7.9	7.9	7.9	8.0	8.0	8.1	8.1	8.1	8.1	8.2	8.3
60000	8.0	8.0	7.9	7.9	7.9	7.9	7.9	7.9	8.0	8.0	8.0	8.1	8.1	8.1	8.2	8.2
70000	8.0	7.9	7.9	7.9	7.9	7.8	7.9	7.9	7.9	8.0	8.0	8.0	8.1	8.1	8.2	8.2
80000	7.9	7.9	7.9	7.8	7.9	7.8	7.8	7.9	7.9	8.0	8.0	8.0	8.1	8.1	8.2	8.2
90000	7.9	7.9	7.9	7.8	7.9	7.8	7.8	7.9	7.9	8.0	8.0	8.0	8.0	8.1	8.2	8.2
100000	7.9	7.9	7.9	7.8	7.9	7.8	7.8	7.9	7.9	8.0	8.0	8.0	8.0	8.1	8.1	8.2
110000	8.0	7.9	7.9	7.9	7.9	7.9	7.9	7.9	8.0	8.0	8.0	8.0	8.0	8.1	8.1	8.1
120000	8.0	8.0	7.9	7.9	8.0	7.9	7.9	8.0	8.0	8.0	8.0	8.0	8.0	8.1	8.1	8.1
130000	8.0	8.0	7.9	7.9	8.0	7.9	8.0	8.0	8.1	8.1	8.0	8.1	8.0	8.1	8.2	8.1
140000	8.1	8.0	8.0	8.0	8.1	8.0	8.0	8.0	8.1	8.1	8.1	8.1	8.1	8.1	8.2	8.1
150000	8.1	8.1	8.0	8.0	8.1	8.0	8.0	8.1	8.2	8.2	8.1	8.1	8.1	8.1	8.2	8.1
160000	8.2	8.1	8.0	8.1	8.1	8.1	8.1	8.1	8.2	8.2	8.1	8.1	8.1	8.2	8.2	8.1
170000	8.2	8.1	8.0	8.1	8.1	8.1	8.1	8.1	8.2	8.2	8.2	8.2	8.1	8.2	8.2	8.2
180000	8.2	8.1	8.0	8.1	8.2	8.1	8.1	8.1	8.2	8.3	8.2	8.2	8.1	8.2	8.2	8.2
190000	8.2	8.1	8.0	8.1	8.2	8.1	8.1	8.1	8.3	8.3	8.2	8.2	8.2	8.2	8.2	8.2
200000	8.2	8.1	8.0	8.1	8.2	8.1	8.1	8.1	8.3	8.3	8.2	8.3	8.2	8.2	8.2	8.2
210000	8.2	8.1	8.0	8.1	8.1	8.1	8.1	8.1	8.3	8.3	8.2	8.3	8.2	8.2	8.3	8.2
220000	8.2	8.1	8.0	8.1	8.1	8.0	8.1	8.1	8.2	8.3	8.2	8.3	8.2	8.2	8.3	8.2
230000	8.2	8.1	8.0	8.1	8.0	8.0	8.0	8.1	8.2	8.2	8.2	8.3	8.2	8.2	8.3	8.2
Daily Max	8.2	8.2	8.1	8.1	8.2	8.1	8.1	8.1	8.3	8.3	8.2	8.3	8.3	8.2	8.3	8.3
Daily Min	7.9	7.9	7.9	7.8	7.9	7.8	7.8	7.9	7.9	8.0	8.0	8.0	8.0	8.1	8.1	8.1
Average	8.1	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.1	8.1	8.1	8.1	8.1	8.1	8.2	8.2

License maximum pH: 9
License minimum pH: 6

Grand Rapids Tailrace pH Summary - August 2019

Time HHMMSS	08/17/19	08/18/19	08/19/19	08/20/19	08/21/19	08/22/19	08/23/19	08/24/19	08/25/19	08/26/19	08/27/19	08/28/19	08/29/19	08/30/19	08/31/19
0	8.2	8.3	8.2	8.3	8.2	8.2	8.2	8.2	8.2	8.2	8.1	8.2	8.2	8.2	8.2
10000	8.2	8.3	8.2	8.3	8.2	8.2	8.2	8.2	8.2	8.2	8.1	8.2	8.2	8.2	8.2
20000	8.2	8.3	8.2	8.2	8.1	8.1	8.2	8.2	8.2	8.2	8.1	8.2	8.2	8.2	8.2
30000	8.2	8.3	8.2	8.2	8.1	8.1	8.1	8.2	8.2	8.2	8.1	8.2	8.1	8.2	8.2
40000	8.1	8.2	8.2	8.2	8.1	8.1	8.1	8.2	8.2	8.3	8.1	8.2	8.1	8.1	8.2
50000	8.1	8.2	8.2	8.2	8.0	8.1	8.1	8.2	8.2	8.3	8.1	8.2	8.1	8.1	8.2
60000	8.1	8.2	8.2	8.1	8.0	8.0	8.1	8.2	8.2	8.3	8.1	8.1	8.1	8.1	8.2
70000	8.1	8.2	8.1	8.1	8.0	8.0	8.0	8.2	8.2	8.2	8.1	8.1	8.1	8.1	8.2
80000	8.1	8.1	8.1	8.1	8.0	8.0	8.0	8.1	8.2	8.2	8.1	8.1	8.1	8.1	8.1
90000	8.0	8.1	8.1	8.1	8.0	8.0	8.0	8.1	8.2	8.2	8.1	8.1	8.1	8.1	8.1
100000	8.0	8.1	8.1	8.1	8.0	8.0	8.0	8.1	8.2	8.2	8.1	8.1	8.1	8.1	8.1
110000	8.0	8.1	8.1	8.1	8.0	8.0	8.0	8.1	8.1	8.2	8.1	8.1	8.1	8.1	8.1
120000	8.0	8.1	8.1	8.1	8.0	8.0	8.1	8.1	8.1	8.2	8.1	8.1	8.1	8.1	8.1
130000	8.1	8.1	8.1	8.0	8.0	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1
140000	8.1	8.1	8.2	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1
150000	8.1	8.1	8.2	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1
160000	8.1	8.1	8.2	8.2	8.2	8.2	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.2	8.2
170000	8.2	8.1	8.2	8.2	8.2	8.2	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1
180000	8.2	8.2	8.2	8.2	8.2	8.2	8.1	8.2	8.2	8.1	8.1	8.1	8.1	8.2	8.1
190000	8.2	8.2	8.3	8.2	8.2	8.2	8.1	8.1	8.2	8.1	8.1	8.1	8.1	8.1	8.1
200000	8.2	8.2	8.3	8.2	8.2	8.2	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1
210000	8.2	8.2	8.3	8.2	8.2	8.2	8.1	8.2	8.2	8.1	8.1	8.1	8.1	8.2	8.2
220000	8.2	8.2	8.3	8.2	8.2	8.2	8.2	8.2	8.2	8.1	8.1	8.1	8.1	8.2	8.2
230000	8.3	8.2	8.3	8.2	8.2	8.2	8.2	8.2	8.2	8.1	8.1	8.2	8.2	8.2	8.2
Daily Max	8.3	8.3	8.3	8.3	8.2	8.2	8.2	8.2	8.2	8.3	8.1	8.2	8.2	8.2	8.2
Daily Min	8.0	8.1	8.1	8.0	8.0	8.0	8.0	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1
Average	8.1	8.2	8.2	8.2	8.1	8.1	8.1	8.2	8.2	8.2	8.1	8.1	8.1	8.1	8.2

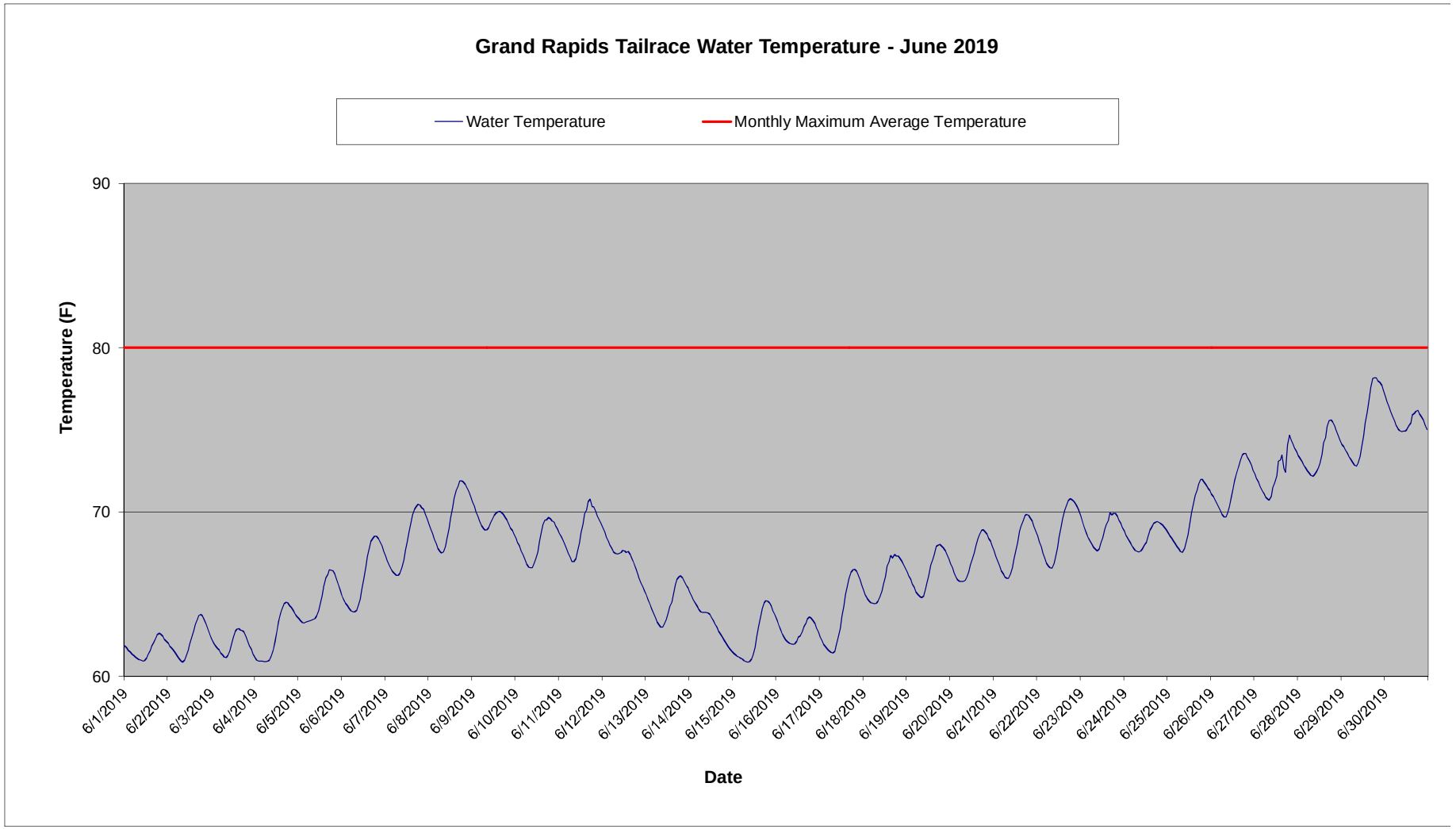
Grand Rapids Tailrace pH Summary - September 2019

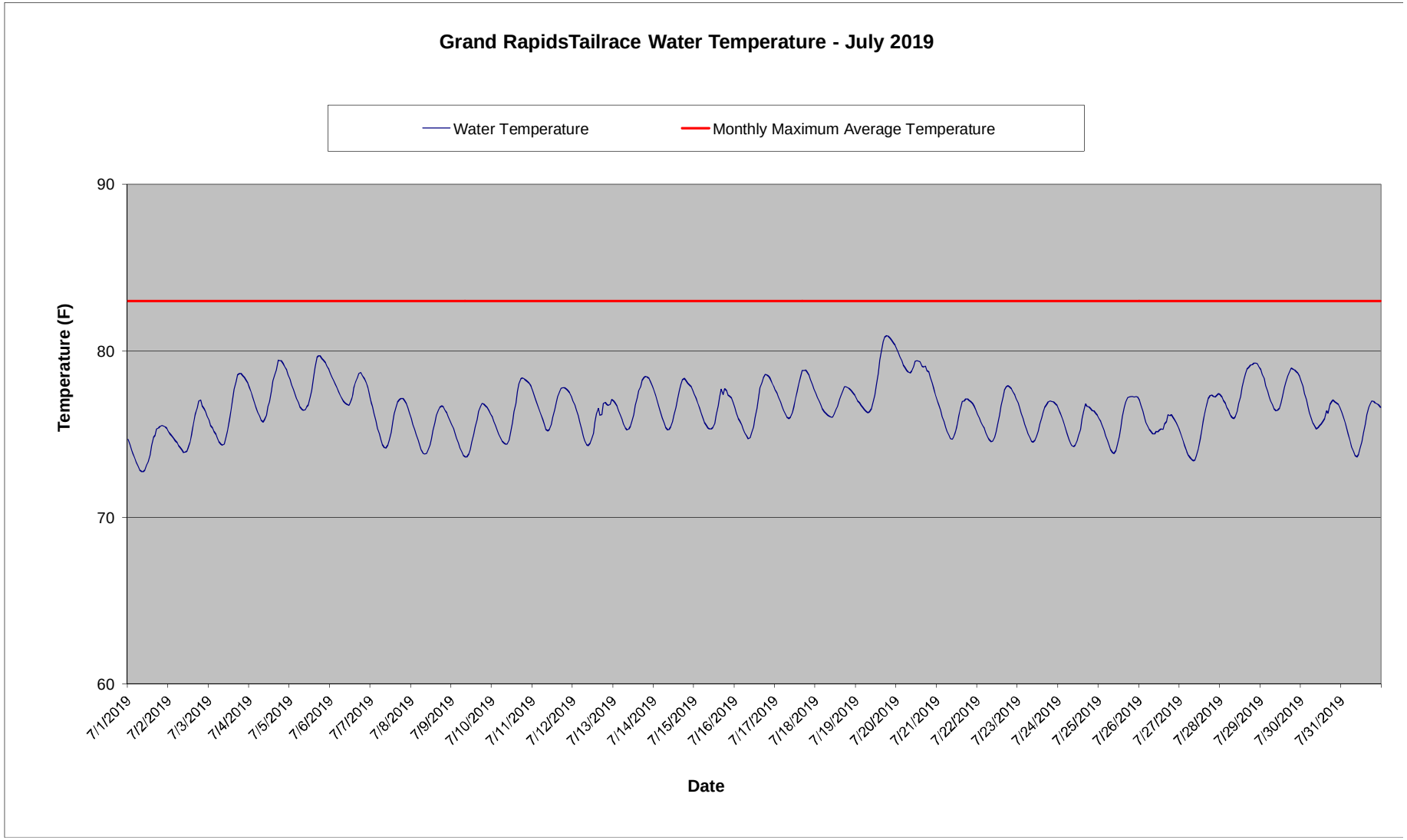
Time HHMMSS	09/01/19	09/02/19	09/03/19	09/04/19	09/05/19	09/06/19	09/07/19	09/08/19	09/09/19	09/10/19	09/11/19	09/12/19	09/13/19	09/14/19	09/15/19	09/16/19
0	8.2	8.2	8.2	8.2	8.2	8.1	8.0	8.1	8.1	8.2	8.1	8.0	8.0	7.9	7.8	7.8
10000	8.2	8.2	8.2	8.2	8.1	8.1	8.0	8.1	8.1	8.1	8.1	8.0	8.0	7.9	7.8	7.8
20000	8.2	8.3	8.2	8.2	8.1	8.0	8.0	8.1	8.1	8.1	8.1	8.0	8.0	7.8	7.8	7.7
30000	8.2	8.2	8.2	8.2	8.1	8.0	8.0	8.1	8.1	8.1	8.1	8.0	8.0	7.8	7.8	7.8
40000	8.2	8.2	8.2	8.2	8.1	8.0	8.0	8.0	8.1	8.1	8.0	8.0	8.0	7.8	7.8	7.7
50000	8.2	8.2	8.2	8.2	8.1	8.0	8.0	8.0	8.0	8.1	8.0	8.0	8.0	7.8	7.8	7.7
60000	8.2	8.2	8.2	8.2	8.1	8.0	8.0	8.0	8.0	8.1	8.0	8.0	8.0	7.8	7.8	7.7
70000	8.2	8.2	8.2	8.2	8.1	8.0	8.0	8.0	8.0	8.1	8.0	8.0	8.0	7.8	7.8	7.7
80000	8.2	8.2	8.2	8.2	8.1	8.0	8.0	8.0	8.0	8.1	8.0	8.0	8.0	7.8	7.8	7.7
90000	8.1	8.2	8.2	8.2	8.1	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	7.8	7.8	7.7
100000	8.1	8.2	8.2	8.2	8.1	8.0	8.0	8.0	8.0	8.1	8.0	8.0	8.0	7.8	7.8	7.7
110000	8.1	8.2	8.1	8.1	8.1	8.0	8.0	8.1	8.1	8.1	8.0	8.0	8.0	7.8	7.8	7.8
120000	8.1	8.2	8.1	8.1	8.1	8.0	8.0	8.1	8.1	8.1	8.0	8.0	7.9	7.8	7.8	7.8
130000	8.1	8.2	8.2	8.1	8.1	8.0	8.1	8.1	8.1	8.1	8.0	8.0	7.9	7.9	7.8	7.8
140000	8.1	8.2	8.1	8.2	8.2	8.0	8.1	8.1	8.1	8.2	8.0	8.0	8.0	7.9	7.8	7.8
150000	8.1	8.2	8.1	8.2	8.2	8.1	8.1	8.1	8.2	8.2	8.1	8.0	8.0	7.9	7.9	7.8
160000	8.1	8.2	8.1	8.2	8.2	8.1	8.1	8.2	8.2	8.2	8.1	8.0	8.0	7.9	7.9	7.8
170000	8.2	8.2	8.1	8.3	8.2	8.1	8.2	8.2	8.2	8.2	8.1	8.0	8.0	7.9	7.9	7.9
180000	8.1	8.2	8.1	8.3	8.2	8.1	8.2	8.2	8.2	8.2	8.1	8.0	8.0	7.9	7.9	7.9
190000	8.1	8.1	8.1	8.3	8.2	8.1	8.2	8.2	8.2	8.2	8.1	8.0	8.0	7.9	7.9	7.9
200000	8.1	8.1	8.1	8.3	8.2	8.1	8.2	8.2	8.2	8.2	8.1	8.0	8.0	7.9	7.8	7.9
210000	8.2	8.2	8.2	8.3	8.1	8.1	8.2	8.2	8.2	8.2	8.0	8.0	8.0	7.9	7.8	7.9
220000	8.2	8.2	8.2	8.2	8.1	8.0	8.1	8.1	8.2	8.2	8.0	8.0	7.9	7.9	7.8	7.8
230000	8.2	8.2	8.2	8.2	8.1	8.0	8.1	8.1	8.2	8.1	8.0	8.0	7.9	7.8	7.8	7.8
Daily Max	8.2	8.3	8.2	8.3	8.2	8.1	8.2	8.2	8.2	8.2	8.1	8.0	8.0	7.9	7.9	7.9
Daily Min	8.1	8.1	8.1	8.1	8.1	8.0	8.0	8.0	8.0	8.0	8.0	8.0	7.9	7.8	7.8	7.7
Average	8.2	8.2	8.2	8.2	8.1	8.0	8.1	8.1	8.1	8.1	8.0	8.0	8.0	7.9	7.8	7.8

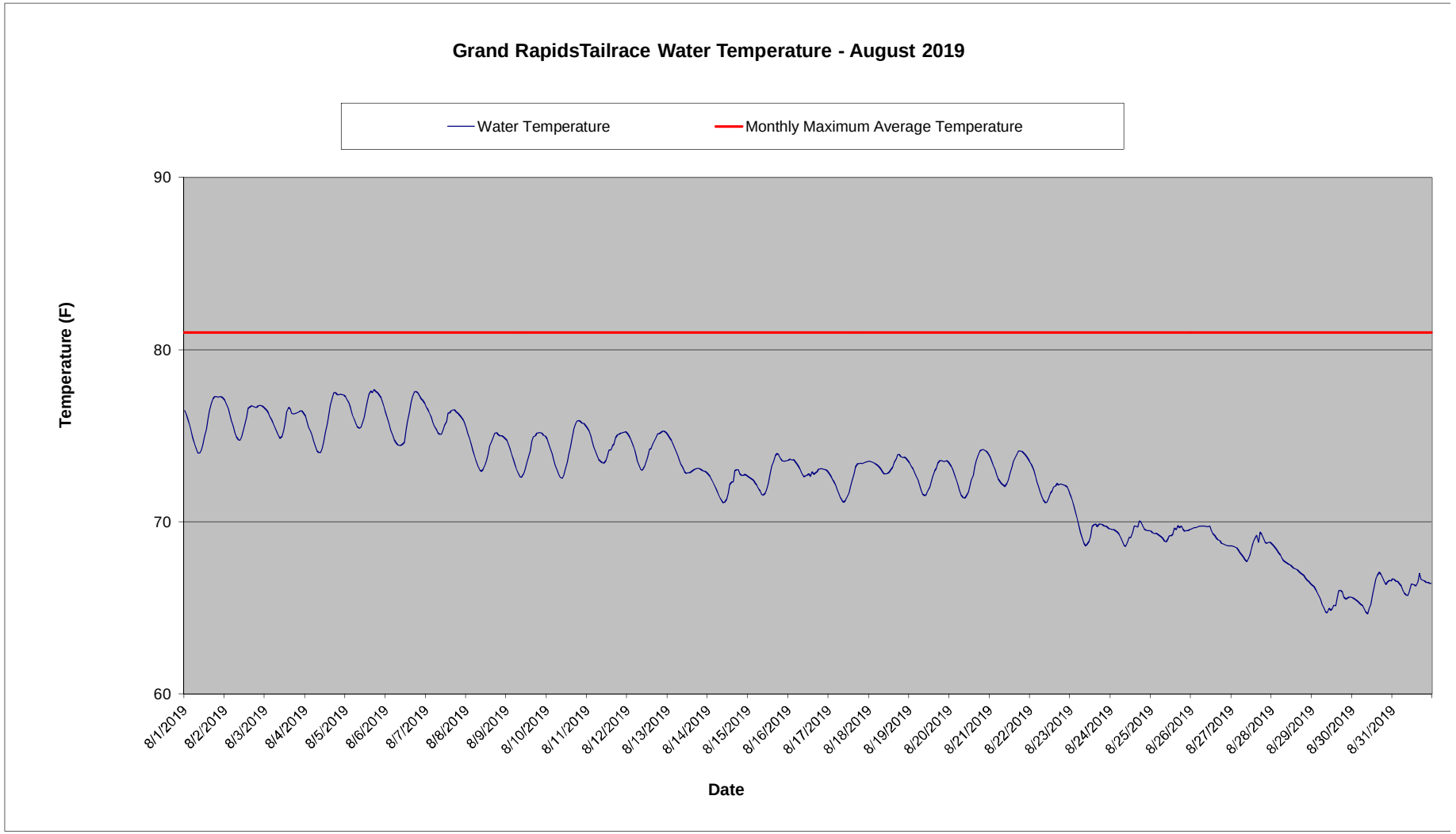
License maximum pH: 9
License minimum pH: 6

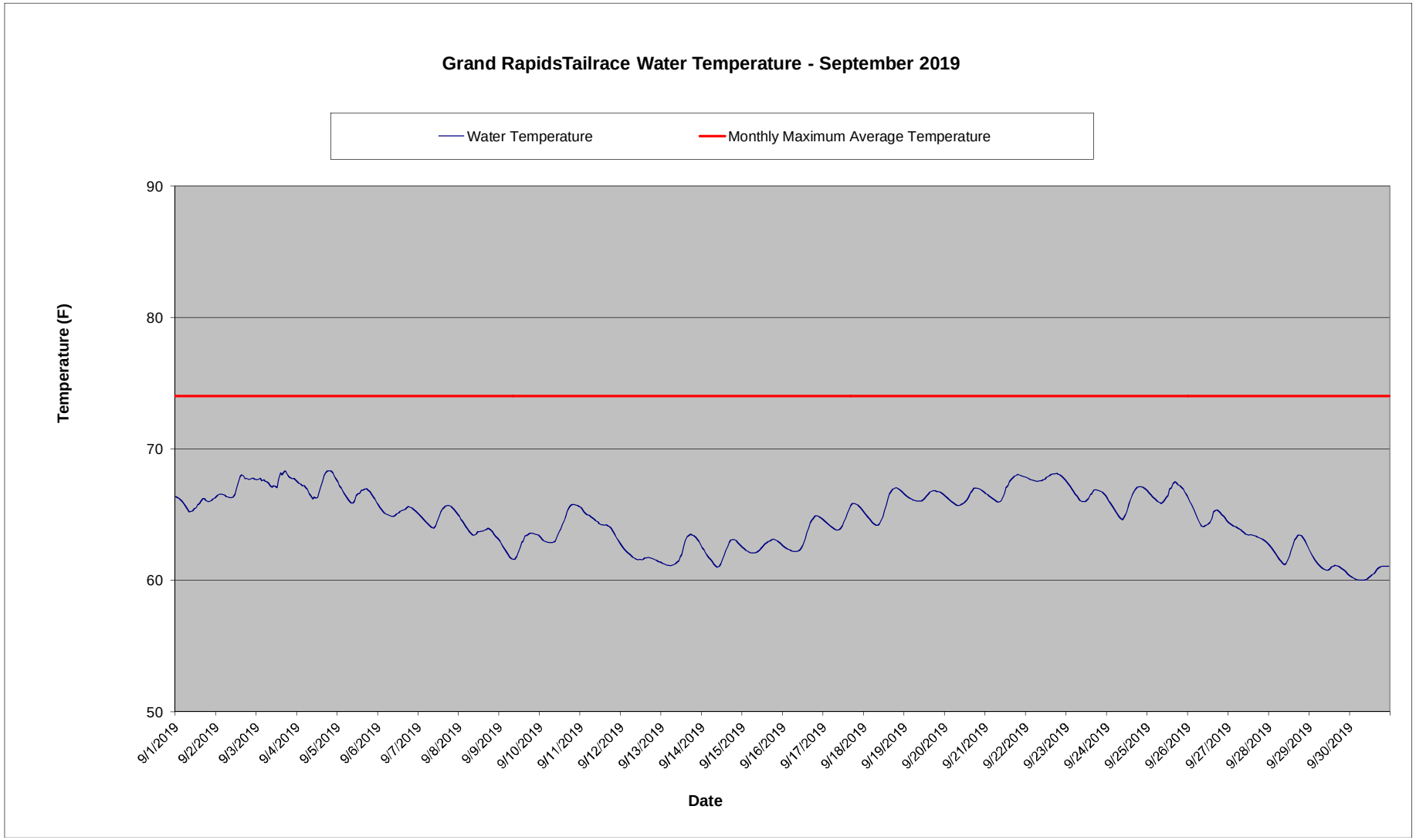
Grand Rapids Tailrace pH Summary - September 2019

Time HHMMSS	09/17/19	09/18/19	09/19/19	09/20/19	09/21/19	09/22/19	09/23/19	09/24/19	09/25/19	09/26/19	09/27/19	09/28/19	09/29/19	09/30/19
0	7.8	7.7	7.8	7.6	7.6	7.7	7.7	7.7	7.8	7.8	7.8	7.8	7.8	7.8
10000	7.8	7.7	7.8	7.6	7.6	7.6	7.6	7.7	7.8	7.7	7.8	7.8	7.8	7.8
20000	7.8	7.7	7.8	7.6	7.6	7.6	7.6	7.7	7.8	7.7	7.8	7.7	7.8	7.8
30000	7.8	7.7	7.8	7.6	7.6	7.7	7.6	7.7	7.7	7.7	7.8	7.7	7.8	7.8
40000	7.8	7.7	7.8	7.5	7.6	7.7	7.6	7.7	7.7	7.7	7.7	7.7	7.8	7.8
50000	7.8	7.7	7.8	7.5	7.6	7.7	7.6	7.7	7.7	7.7	7.7	7.7	7.8	7.8
60000	7.8	7.7	7.8	7.5	7.6	7.6	7.6	7.7	7.7	7.7	7.7	7.7	7.8	7.8
70000	7.8	7.7	7.8	7.5	7.6	7.6	7.6	7.7	7.7	7.7	7.8	7.7	7.8	7.8
80000	7.8	7.7	7.8	7.5	7.6	7.6	7.6	7.7	7.7	7.8	7.8	7.7	7.8	7.8
90000	7.8	7.7	7.8	7.6	7.6	7.6	7.6	7.7	7.7	7.8	7.8	7.7	7.8	7.8
100000	7.8	7.7	7.8	7.6	7.6	7.6	7.6	7.7	7.7	7.8	7.8	7.7	7.8	7.8
110000	7.8	7.7	7.8	7.6	7.6	7.7	7.7	7.7	7.8	7.8	7.8	7.8	7.8	7.8
120000	7.8	7.7	7.8	7.6	7.6	7.7	7.7	7.7	7.8	7.8	7.8	7.8	7.8	7.8
130000	7.8	7.8	7.8	7.6	7.6	7.7	7.7	7.8	7.8	7.8	7.8	7.8	7.8	7.8
140000	7.7	7.8	7.8	7.6	7.7	7.7	7.7	7.8	7.8	7.8	7.8	7.8	7.8	7.8
150000	7.7	7.8	7.8	7.6	7.7	7.7	7.7	7.8	7.8	7.8	7.8	7.8	7.9	7.9
160000	7.7	7.8	7.8	7.6	7.7	7.7	7.7	7.8	7.8	7.9	7.8	7.8	7.9	7.8
170000	7.8	7.8	7.7	7.6	7.7	7.7	7.7	7.8	7.8	7.9	7.8	7.9	7.9	7.9
180000	7.8	7.8	7.7	7.7	7.7	7.7	7.7	7.8	7.8	7.9	7.8	7.9	7.9	7.8
190000	7.8	7.8	7.7	7.6	7.7	7.7	7.7	7.8	7.8	7.8	7.8	7.9	7.9	7.8
200000	7.8	7.8	7.7	7.6	7.7	7.7	7.7	7.8	7.8	7.8	7.8	7.8	7.8	7.8
210000	7.8	7.8	7.7	7.6	7.7	7.7	7.7	7.8	7.8	7.8	7.8	7.8	7.8	7.8
220000	7.8	7.8	7.7	7.6	7.7	7.7	7.7	7.8	7.8	7.8	7.8	7.8	7.8	7.8
230000	7.7	7.8	7.6	7.6	7.7	7.7	7.7	7.8	7.8	7.8	7.8	7.8	7.8	7.8
Daily Max	7.8	7.8	7.8	7.7	7.7	7.7	7.7	7.8	7.8	7.9	7.8	7.9	7.9	7.9
Daily Min	7.7	7.7	7.6	7.5	7.6	7.6	7.6	7.7	7.7	7.7	7.7	7.7	7.8	7.8
Average	7.8	7.7	7.7	7.6	7.6	7.7	7.7	7.7	7.8	7.8	7.8	7.8	7.8	7.8









Grand Rapids Tailrace Temperature Summary - June 2019

Time HHMMSS	06/01/19	06/02/19	06/03/19	06/04/19	06/05/19	06/06/19	06/07/19	06/08/19	06/09/19	06/10/19	06/11/19	06/12/19	06/13/19	06/14/19	06/15/19	06/16/19
0	61.8	62.0	62.3	61.1	63.5	64.9	67.3	69.3	70.6	68.4	68.7	69.1	64.9	65.1	61.4	63.4
10000	61.7	61.8	62.0	61.0	63.4	64.6	67.0	69.0	70.3	68.1	68.5	68.8	64.7	64.9	61.3	63.1
20000	61.6	61.7	61.9	60.9	63.3	64.4	66.7	68.6	70.0	67.9	68.3	68.5	64.4	64.6	61.2	62.9
30000	61.5	61.6	61.7	60.9	63.3	64.3	66.5	68.3	69.7	67.6	68.0	68.2	64.1	64.4	61.2	62.6
40000	61.4	61.4	61.6	60.9	63.3	64.1	66.4	68.0	69.5	67.4	67.7	68.0	63.8	64.2	61.1	62.4
50000	61.3	61.2	61.4	60.9	63.3	64.0	66.2	67.8	69.2	67.1	67.5	67.8	63.5	64.1	61.0	62.2
60000	61.2	61.1	61.3	60.9	63.4	63.9	66.1	67.6	69.0	66.8	67.2	67.6	63.3	63.9	60.9	62.1
70000	61.1	60.9	61.2	60.9	63.4	63.9	66.1	67.5	68.9	66.6	67.0	67.5	63.1	63.9	60.9	62.0
80000	61.0	60.9	61.1	61.0	63.5	64.0	66.3	67.6	68.9	66.6	67.0	67.4	63.0	63.9	60.9	62.0
90000	61.0	61.0	61.3	61.2	63.5	64.3	66.6	67.9	69.1	66.6	67.2	67.5	63.0	63.9	60.9	62.0
100000	60.9	61.2	61.5	61.6	63.7	64.7	67.1	68.4	69.3	66.8	67.6	67.5	63.2	63.9	61.0	62.0
110000	60.9	61.6	61.9	62.1	64.0	65.3	67.7	69.0	69.6	67.2	68.1	67.7	63.5	63.8	61.3	62.1
120000	61.1	62.0	62.4	62.7	64.4	65.9	68.2	69.6	69.8	67.6	68.7	67.6	63.9	63.6	61.8	62.4
130000	61.3	62.4	62.7	63.3	64.9	66.6	68.8	70.3	69.9	68.2	69.3	67.5	64.3	63.4	62.4	62.5
140000	61.5	62.8	62.9	63.8	65.5	67.3	69.3	70.8	70.0	68.8	69.9	67.6	64.5	63.2	63.1	62.7
150000	61.8	63.1	62.9	64.1	66.0	67.8	69.8	71.3	70.0	69.2	70.1	67.4	65.0	63.0	63.6	63.0
160000	62.0	63.5	62.8	64.4	66.2	68.2	70.2	71.6	70.0	69.5	70.6	67.2	65.6	62.8	64.1	63.2
170000	62.3	63.7	62.8	64.5	66.5	68.4	70.3	71.9	69.9	69.5	70.8	66.9	65.9	62.6	64.5	63.5
180000	62.5	63.7	62.7	64.5	66.5	68.5	70.5	71.9	69.7	69.7	70.3	66.6	66.1	62.3	64.6	63.6
190000	62.6	63.7	62.4	64.3	66.4	68.5	70.4	71.8	69.5	69.6	70.3	66.3	66.1	62.2	64.6	63.6
200000	62.6	63.4	62.1	64.2	66.2	68.4	70.3	71.7	69.3	69.5	70.0	66.0	66.0	62.0	64.5	63.4
210000	62.4	63.1	61.8	64.0	65.9	68.2	70.2	71.5	69.0	69.4	69.8	65.7	65.8	61.8	64.3	63.2
220000	62.2	62.8	61.6	63.8	65.6	67.9	69.9	71.2	68.9	69.2	69.5	65.4	65.6	61.7	64.0	62.9
230000	62.1	62.5	61.3	63.6	65.2	67.6	69.6	70.9	68.6	68.9	69.3	65.2	65.4	61.5	63.7	62.7
Daily Max	62.6	63.7	62.9	64.5	66.5	68.5	70.5	71.9	70.6	69.7	70.8	69.1	66.1	65.1	64.6	63.6
Daily Min	60.9	60.9	61.1	60.9	63.3	63.9	66.1	67.5	68.6	66.6	67.0	65.2	63.0	61.5	60.9	62.0
Average	61.7	62.2	62.0	62.5	64.6	66.1	68.2	69.7	69.5	68.2	68.8	67.3	64.5	63.4	62.4	62.7

Monthly average Temp: 67.7

License Monthly Maximum Average Temperature: 80 F

Grand Rapids Tailrace Temperature Summary - June 2019

Time HHMMSS	06/17/19	06/18/19	06/19/19	06/20/19	06/21/19	06/22/19	06/23/19	06/24/19	06/25/19	06/26/19	06/27/19	06/28/19	06/29/19	06/30/19
0	62.4	65.2	66.3	66.9	67.6	68.5	69.7	68.8	68.8	71.1	72.3	73.4	74.1	77.0
10000	62.2	64.9	66.1	66.6	67.3	68.2	69.3	68.6	68.6	70.9	72.0	73.3	74.0	76.7
20000	61.9	64.7	65.9	66.3	67.0	67.9	69.0	68.3	68.4	70.8	71.8	73.0	73.8	76.4
30000	61.8	64.6	65.6	66.0	66.7	67.5	68.7	68.2	68.2	70.5	71.6	72.9	73.6	76.1
40000	61.6	64.5	65.4	65.9	66.4	67.2	68.4	68.0	68.1	70.3	71.3	72.7	73.4	75.8
50000	61.5	64.4	65.1	65.8	66.2	66.9	68.2	67.8	67.9	70.1	71.1	72.5	73.2	75.5
60000	61.4	64.4	65.0	65.8	66.1	66.7	68.0	67.7	67.8	69.9	70.9	72.4	73.0	75.3
70000	61.4	64.4	64.8	65.8	66.0	66.6	67.8	67.6	67.6	69.7	70.8	72.2	72.8	75.0
80000	61.5	64.6	64.8	65.8	66.0	66.6	67.7	67.6	67.5	69.7	70.7	72.2	72.8	74.9
90000	61.9	64.8	64.9	66.0	66.2	66.8	67.6	67.6	67.7	70.0	70.9	72.3	73.0	74.9
100000	62.4	65.2	65.2	66.4	66.6	67.2	67.8	67.7	68.1	70.4	71.5	72.4	73.4	74.9
110000	62.9	65.6	65.7	66.8	67.1	67.8	68.1	68.0	68.6	70.9	71.8	72.7	73.9	74.9
120000	63.6	66.1	66.1	67.1	67.7	68.5	68.4	68.1	69.2	71.5	72.2	73.0	74.6	75.0
130000	64.3	66.7	66.8	67.5	68.1	69.1	68.9	68.5	70.0	71.9	73.1	73.5	75.4	75.2
140000	65.0	67.0	67.1	67.9	68.8	69.6	69.2	68.9	70.4	72.4	73.2	74.2	76.1	75.4
150000	65.5	67.4	67.4	68.4	69.1	70.1	69.5	69.1	71.0	72.8	73.5	74.5	76.9	75.9
160000	66.0	67.2	67.9	68.6	69.4	70.4	70.0	69.3	71.3	73.1	72.6	75.2	77.6	76.0
170000	66.3	67.4	68.0	68.9	69.8	70.7	69.8	69.4	71.7	73.5	72.4	75.6	78.1	76.1
180000	66.5	67.3	68.0	68.9	69.9	70.8	69.9	69.4	72.0	73.6	74.1	75.6	78.2	76.2
190000	66.5	67.3	67.9	68.8	69.8	70.8	69.9	69.4	72.0	73.6	74.7	75.5	78.2	76.0
200000	66.4	67.2	67.8	68.6	69.6	70.7	69.7	69.3	71.8	73.3	74.4	75.2	78.0	75.8
210000	66.2	67.0	67.6	68.4	69.4	70.5	69.5	69.2	71.7	73.1	74.1	75.0	77.9	75.6
220000	65.9	66.8	67.4	68.2	69.1	70.3	69.3	69.1	71.5	72.8	73.9	74.7	77.7	75.3
230000	65.6	66.6	67.1	67.9	68.8	70.0	69.0	68.9	71.3	72.5	73.7	74.4	77.4	75.0
Daily Max	66.5	67.4	68.0	68.9	69.9	70.8	70.0	69.4	72.0	73.6	74.7	75.6	78.2	77.0
Daily Min	61.4	64.4	64.8	65.8	66.0	66.6	67.6	67.6	67.5	69.7	70.7	72.2	72.8	74.9
Average	63.8	65.9	66.4	67.2	67.9	68.7	68.9	68.5	69.6	71.6	72.4	73.7	75.3	75.6

Grand Rapids Tailrace Temperature Summary - July 2019

Time HHMMSS	07/01/19	07/02/19	07/03/19	07/04/19	07/05/19	07/06/19	07/07/19	07/08/19	07/09/19	07/10/19	07/11/19	07/12/19	07/13/19	07/14/19	07/15/19	07/16/19
0	74.7	75.2	75.8	77.8	78.3	78.6	77.1	75.9	75.6	76.0	77.6	77.0	77.0	77.6	77.4	76.6
10000	74.4	75.0	75.5	77.5	78.0	78.4	76.6	75.6	75.3	75.8	77.3	76.8	76.9	77.3	77.2	76.3
20000	74.1	74.9	75.4	77.2	77.7	78.2	76.2	75.3	75.0	75.5	77.0	76.4	76.7	77.0	76.9	75.9
30000	73.8	74.8	75.2	76.9	77.4	78.0	75.8	74.9	74.8	75.2	76.7	76.1	76.4	76.6	76.6	75.8
40000	73.5	74.6	75.0	76.6	77.2	77.8	75.4	74.6	74.5	75.0	76.4	75.7	76.2	76.3	76.3	75.6
50000	73.3	74.5	74.8	76.3	76.9	77.5	75.0	74.3	74.2	74.8	76.1	75.3	75.9	76.0	75.9	75.3
60000	73.0	74.3	74.5	76.1	76.7	77.3	74.7	74.0	73.9	74.6	75.9	74.9	75.6	75.7	75.7	75.1
70000	72.8	74.2	74.4	75.8	76.5	77.1	74.4	73.8	73.7	74.5	75.6	74.6	75.4	75.4	75.5	74.9
80000	72.8	74.0	74.3	75.7	76.4	76.9	74.2	73.8	73.6	74.4	75.3	74.4	75.2	75.2	75.4	74.7
90000	72.7	73.9	74.4	75.9	76.5	76.9	74.2	73.8	73.6	74.4	75.2	74.3	75.3	75.3	75.3	74.8
100000	72.8	73.9	74.7	76.1	76.6	76.8	74.3	74.0	73.8	74.6	75.3	74.4	75.5	75.4	75.3	75.1
110000	73.2	74.0	75.2	76.7	76.8	76.7	74.6	74.3	74.1	75.1	75.6	74.7	75.8	75.8	75.4	75.4
120000	73.3	74.3	75.8	76.9	77.2	76.9	75.1	74.7	74.5	75.7	76.0	75.0	76.2	76.2	75.6	76.0
130000	73.8	74.6	76.5	77.6	77.6	77.3	75.7	75.2	75.0	76.3	76.5	75.7	76.7	76.6	76.2	76.6
140000	74.3	75.3	77.1	78.2	78.4	77.8	76.2	75.7	75.4	76.9	76.9	76.2	77.2	77.1	76.7	77.2
150000	74.8	75.7	77.7	78.6	79.0	78.2	76.6	76.1	75.9	77.6	77.2	76.6	77.6	77.6	77.3	77.8
160000	74.9	76.2	78.1	78.8	79.6	78.4	76.9	76.4	76.4	78.0	77.6	76.1	77.9	78.0	77.7	78.1
170000	75.3	76.6	78.5	79.4	79.7	78.7	77.1	76.6	76.7	78.3	77.8	76.2	78.2	78.3	77.4	78.4
180000	75.4	77.0	78.6	79.4	79.7	78.7	77.2	76.7	76.8	78.4	77.8	76.9	78.4	78.4	77.7	78.6
190000	75.4	77.0	78.6	79.4	79.5	78.5	77.1	76.6	76.8	78.3	77.8	76.9	78.5	78.2	77.6	78.5
200000	75.5	76.7	78.5	79.2	79.4	78.3	77.0	76.5	76.7	78.2	77.7	76.8	78.4	78.1	77.3	78.5
210000	75.5	76.5	78.4	79.0	79.3	78.2	76.8	76.3	76.6	78.2	77.6	76.7	78.3	78.0	77.3	78.3
220000	75.4	76.3	78.3	78.8	79.1	77.8	76.6	76.1	76.4	78.0	77.5	76.8	78.1	77.8	77.2	78.1
230000	75.3	76.1	78.1	78.6	78.9	77.5	76.3	75.8	76.2	77.9	77.3	77.1	77.9	77.7	76.9	77.9
Daily Max	75.5	77.0	78.6	79.4	79.7	78.7	77.2	76.7	76.8	78.4	77.8	77.1	78.5	78.4	77.7	78.6
Daily Min	72.7	73.9	74.3	75.7	76.4	76.7	74.2	73.8	73.6	74.4	75.2	74.3	75.2	75.2	75.3	74.7
Average	74.2	75.2	76.4	77.6	78.0	77.8	75.9	75.3	75.2	76.3	76.7	75.9	76.9	76.9	76.6	76.6

Monthly average Temp: 76.5

License Monthly Maximum Average Temperature: 83 F

Grand Rapids Tailrace Temperature Summary - July 2019

Time HHMMSS	07/17/19	07/18/19	07/19/19	07/20/19	07/21/19	07/22/19	07/23/19	07/24/19	07/25/19	07/26/19	07/27/19	07/28/19	07/29/19	07/30/19	07/31/19
0	77.6	77.4	77.2	80.1	77.0	76.2	76.9	76.5	76.0	77.0	75.2	77.4	78.9	78.2	76.3
10000	77.4	77.2	77.0	79.9	76.8	75.9	76.6	76.3	75.8	76.7	74.9	77.2	78.6	77.9	76.0
20000	77.2	77.0	76.9	79.6	76.4	75.7	76.3	76.0	75.5	76.4	74.6	77.0	78.3	77.4	75.7
30000	76.9	76.7	76.7	79.4	76.1	75.5	75.9	75.7	75.2	76.0	74.3	76.8	77.9	77.1	75.4
40000	76.7	76.5	76.6	79.2	75.7	75.3	75.6	75.4	74.9	75.7	74.0	76.6	77.6	76.7	75.0
50000	76.4	76.3	76.4	79.0	75.4	75.1	75.3	75.0	74.6	75.5	73.8	76.4	77.3	76.3	74.6
60000	76.2	76.2	76.3	78.8	75.2	74.8	75.0	74.7	74.3	75.3	73.6	76.1	77.0	75.9	74.2
70000	76.0	76.2	76.3	78.7	74.9	74.7	74.8	74.5	74.1	75.1	73.5	76.0	76.8	75.7	74.0
80000	75.9	76.1	76.3	78.7	74.7	74.5	74.6	74.3	73.9	75.0	73.4	75.9	76.5	75.5	73.7
90000	76.0	76.0	76.5	78.8	74.7	74.6	74.5	74.3	73.8	75.0	73.5	76.0	76.4	75.3	73.6
100000	76.3	76.0	76.9	79.0	74.9	74.8	74.6	74.3	74.0	75.2	73.7	76.4	76.4	75.4	73.8
110000	76.6	76.2	77.3	79.4	75.2	75.1	74.8	74.6	74.4	75.1	74.1	76.8	76.6	75.5	74.1
120000	77.1	76.5	77.9	79.4	75.6	75.6	75.2	74.9	74.9	75.3	74.6	77.3	76.9	75.6	74.6
130000	77.6	76.7	78.6	79.4	76.1	76.1	75.6	75.3	75.4	75.3	75.3	77.8	77.2	75.8	75.1
140000	78.0	77.1	79.4	79.4	76.6	76.7	76.0	75.9	76.1	75.3	75.8	78.3	77.8	75.9	75.6
150000	78.5	77.3	80.1	79.1	77.0	77.2	76.3	76.4	76.6	75.6	76.4	78.6	78.1	76.4	76.2
160000	78.8	77.6	80.6	79.0	77.0	77.6	76.6	76.8	76.9	75.7	76.8	78.9	78.5	76.3	76.6
170000	78.8	77.8	80.8	79.1	77.1	77.9	76.8	76.7	77.2	76.2	77.1	79.0	78.7	76.8	76.8
180000	78.9	77.9	80.9	78.8	77.1	77.9	76.9	76.6	77.2	76.1	77.3	79.1	79.0	76.9	77.0
190000	78.7	77.8	80.9	78.7	77.0	77.9	77.0	76.6	77.3	76.2	77.4	79.2	78.9	77.1	77.0
200000	78.5	77.7	80.8	78.4	77.0	77.7	77.0	76.4	77.3	76.0	77.3	79.2	78.8	76.9	76.9
210000	78.3	77.6	80.6	78.1	76.9	77.6	76.9	76.4	77.2	75.9	77.2	79.3	78.8	76.9	76.8
220000	78.0	77.5	80.5	77.7	76.7	77.3	76.9	76.3	77.3	75.7	77.3	79.2	78.7	76.8	76.8
230000	77.7	77.4	80.4	77.4	76.4	77.1	76.7	76.1	77.2	75.4	77.4	79.1	78.5	76.6	76.6
Daily Max	78.9	77.9	80.9	80.1	77.1	77.9	77.0	76.8	77.3	77.0	77.4	79.3	79.0	78.2	77.0
Daily Min	75.9	76.0	76.3	77.4	74.7	74.5	74.5	74.3	73.8	75.0	73.4	75.9	76.4	75.3	73.6
Average	77.4	76.9	78.4	79.0	76.1	76.2	75.9	75.7	75.7	75.7	75.4	77.7	77.8	76.5	75.5

Grand Rapids Tailrace Temperature Summary - August 2019

Time HHMMSS	08/01/19	08/02/19	08/03/19	08/04/19	08/05/19	08/06/19	08/07/19	08/08/19	08/09/19	08/10/19	08/11/19	08/12/19	08/13/19	08/14/19	08/15/19	08/16/19
0	76.5	77.1	76.6	76.1	77.3	76.3	76.7	75.4	74.7	74.8	75.5	75.1	75.1	72.8	72.6	73.6
10000	76.3	76.8	76.5	75.8	77.1	76.0	76.5	75.1	74.5	74.6	75.3	75.0	74.9	72.6	72.6	73.6
20000	76.0	76.6	76.3	75.5	76.9	75.7	76.3	74.8	74.3	74.3	75.0	74.8	74.7	72.5	72.5	73.6
30000	75.6	76.2	76.1	75.3	76.6	75.3	76.1	74.5	73.9	74.0	74.7	74.5	74.5	72.3	72.4	73.6
40000	75.2	75.9	75.9	75.0	76.3	75.0	75.8	74.1	73.6	73.6	74.4	74.2	74.3	72.1	72.3	73.5
50000	74.8	75.5	75.7	74.7	76.0	74.8	75.5	73.7	73.3	73.3	74.0	73.9	74.1	71.9	72.1	73.4
60000	74.5	75.2	75.5	74.4	75.7	74.6	75.4	73.5	73.0	73.0	73.8	73.5	73.8	71.6	72.0	73.2
70000	74.2	74.9	75.2	74.1	75.5	74.5	75.2	73.2	72.8	72.7	73.6	73.2	73.6	71.4	71.8	73.0
80000	74.0	74.8	75.0	74.0	75.5	74.4	75.1	73.0	72.6	72.6	73.5	73.0	73.3	71.2	71.6	72.8
90000	74.0	74.7	74.9	74.0	75.5	74.4	75.1	72.9	72.6	72.5	73.4	73.0	73.1	71.1	71.5	72.6
100000	74.2	74.9	75.0	74.3	75.7	74.5	75.3	73.0	72.8	72.7	73.4	73.2	72.9	71.1	71.7	72.7
110000	74.5	75.2	75.3	74.6	76.1	74.6	75.6	73.3	73.1	73.0	73.5	73.5	72.8	71.3	71.9	72.7
120000	74.9	75.7	75.8	75.1	76.6	75.3	75.8	73.6	73.4	73.5	73.8	73.7	72.8	71.6	72.2	72.8
130000	75.4	76.1	76.4	75.7	77.0	75.8	76.3	73.9	73.8	73.9	74.2	74.2	72.8	72.2	72.9	72.6
140000	76.0	76.6	76.6	76.2	77.4	76.4	76.3	74.4	74.1	74.3	74.2	74.3	72.9	72.3	73.2	72.9
150000	76.5	76.7	76.6	76.8	77.6	76.9	76.4	74.7	74.7	74.8	74.4	74.5	73.0	72.3	73.5	72.8
160000	76.9	76.7	76.3	77.2	77.5	77.3	76.5	74.9	74.9	75.4	74.5	74.7	73.1	73.0	73.8	72.8
170000	77.1	76.7	76.3	77.5	77.7	77.5	76.5	75.1	75.0	75.7	74.9	74.9	73.1	73.0	74.0	72.9
180000	77.3	76.6	76.3	77.5	77.6	77.6	76.4	75.2	75.2	75.9	75.1	75.1	73.1	73.0	73.9	73.1
190000	77.3	76.7	76.3	77.4	77.5	77.5	76.3	75.0	75.2	75.9	75.1	75.1	73.1	72.8	73.7	73.1
200000	77.2	76.7	76.4	77.4	77.4	77.3	76.2	75.0	75.2	75.8	75.1	75.2	73.0	72.7	73.5	73.1
210000	77.3	76.8	76.4	77.4	77.2	77.1	76.1	75.0	75.1	75.7	75.2	75.3	73.0	72.7	73.5	73.0
220000	77.3	76.7	76.4	77.4	76.9	77.0	75.9	74.9	75.0	75.7	75.2	75.3	72.9	72.7	73.5	73.0
230000	77.2	76.7	76.3	77.4	76.7	76.9	75.7	74.8	75.0	75.6	75.2	75.2	72.9	72.7	73.6	73.0
Daily Max	77.3	77.1	76.6	77.5	77.7	77.6	76.7	75.4	75.2	75.9	75.5	75.3	75.1	73.0	74.0	73.6
Daily Min	74.0	74.7	74.9	74.0	75.5	74.4	75.1	72.9	72.6	72.5	73.4	73.0	72.8	71.1	71.5	72.6
Average	75.8	76.1	76.0	75.9	76.7	75.9	76.0	74.3	74.1	74.3	74.5	74.3	73.4	72.2	72.8	73.1

Monthly average Tem	Monthly Average Temp:	72.4
License Monthly Maxi	License Maximum Temperature:	81 F

Grand Rapids Tailrace Temperature Summary - August 2019

Time HHMMSS	08/17/19	08/18/19	08/19/19	08/20/19	08/21/19	08/22/19	08/23/19	08/24/19	08/25/19	08/26/19	08/27/19	08/28/19	08/29/19	08/30/19	08/31/19
0	72.8	73.5	73.4	73.4	73.8	73.4	71.5	69.6	69.4	69.6	68.6	68.7	66.3	65.6	66.7
10000	72.7	73.5	73.2	73.2	73.5	73.3	71.3	69.6	69.4	69.6	68.6	68.6	66.2	65.5	66.7
20000	72.5	73.4	73.1	73.0	73.3	73.0	70.9	69.5	69.3	69.7	68.5	68.5	66.1	65.5	66.5
30000	72.3	73.4	72.9	72.7	73.0	72.7	70.6	69.4	69.3	69.7	68.5	68.4	65.9	65.4	66.5
40000	72.1	73.3	72.7	72.4	72.7	72.3	70.2	69.4	69.3	69.7	68.4	68.2	65.7	65.3	66.4
50000	71.9	73.3	72.4	72.1	72.5	72.0	69.8	69.3	69.2	69.7	68.2	68.1	65.5	65.2	66.3
60000	71.6	73.2	72.1	71.8	72.3	71.7	69.4	69.0	69.1	69.8	68.1	67.9	65.2	65.1	66.0
70000	71.4	73.0	71.8	71.6	72.2	71.5	69.0	68.8	69.0	69.7	67.9	67.7	65.0	65.0	65.8
80000	71.2	72.9	71.6	71.4	72.1	71.3	68.8	68.6	68.9	69.7	67.8	67.7	64.8	64.8	65.7
90000	71.1	72.8	71.5	71.4	72.1	71.1	68.6	68.6	68.8	69.7	67.7	67.6	64.7	64.7	65.7
100000	71.2	72.8	71.6	71.5	72.2	71.1	68.7	68.8	69.0	69.7	67.8	67.6	65.0	65.0	65.9
110000	71.5	72.8	71.8	71.7	72.4	71.3	68.9	69.1	69.2	69.7	68.1	67.5	64.9	65.2	66.4
120000	71.7	72.9	72.0	72.0	72.8	71.7	69.2	69.1	69.2	69.5	68.5	67.4	64.9	65.8	66.4
130000	72.0	73.0	72.3	72.4	73.2	71.8	69.7	69.4	69.3	69.3	68.9	67.3	65.1	66.3	66.3
140000	72.5	73.2	72.6	72.7	73.5	72.0	69.8	69.8	69.6	69.2	69.0	67.3	65.1	66.7	66.3
150000	72.8	73.4	73.0	73.2	73.7	72.1	69.9	69.8	69.5	69.0	69.2	67.2	65.6	66.9	66.5
160000	73.2	73.6	73.1	73.6	73.9	72.2	69.7	69.7	69.8	69.0	68.8	67.1	66.0	67.1	67.0
170000	73.4	73.9	73.4	73.9	74.1	72.1	69.9	70.0	69.7	68.9	69.4	67.0	66.0	66.9	66.6
180000	73.4	73.9	73.5	74.1	74.1	72.2	69.9	70.0	69.7	68.8	69.3	67.0	65.9	66.8	66.6
190000	73.4	73.8	73.5	74.2	74.1	72.2	69.8	69.8	69.6	68.7	69.0	66.9	65.6	66.5	66.6
200000	73.4	73.7	73.5	74.2	74.0	72.1	69.7	69.6	69.4	68.7	68.8	66.7	65.5	66.4	66.5
210000	73.4	73.7	73.5	74.1	73.9	72.1	69.7	69.5	69.5	68.6	68.8	66.6	65.6	66.5	66.5
220000	73.5	73.7	73.5	74.1	73.8	72.0	69.7	69.5	69.5	68.6	68.8	66.5	65.6	66.6	66.4
230000	73.5	73.6	73.5	74.0	73.6	71.8	69.6	69.5	69.5	68.6	68.8	66.4	65.6	66.6	66.4
Daily Max	73.5	73.9	73.5	74.2	74.1	73.4	71.5	70.0	69.8	69.8	69.4	68.7	66.3	67.1	67.0
Daily Min	71.1	72.8	71.5	71.4	72.1	71.1	68.6	68.6	68.8	68.6	67.7	66.4	64.7	64.7	65.7
Average	72.4	73.4	72.7	72.9	73.2	72.0	69.8	69.4	69.3	69.3	68.6	67.5	65.5	65.9	66.4

Grand Rapids Tailrace Temperature Summary - September 2019

Time HHMMSS	09/01/19	09/02/19	09/03/19	09/04/19	09/05/19	09/06/19	09/07/19	09/08/19	09/09/19	09/10/19	09/11/19	09/12/19	09/13/19	09/14/19	09/15/19	09/16/19
0	66.3	66.4	67.7	67.5	67.5	65.7	65.0	64.9	63.0	63.3	65.5	62.6	61.3	62.5	62.5	62.6
10000	66.3	66.5	67.7	67.4	67.2	65.5	64.9	64.6	62.8	63.1	65.4	62.5	61.2	62.3	62.4	62.5
20000	66.2	66.5	67.7	67.3	67.0	65.3	64.7	64.4	62.6	63.0	65.2	62.3	61.2	62.1	62.3	62.4
30000	66.1	66.6	67.6	67.2	66.8	65.2	64.6	64.2	62.3	62.9	65.1	62.2	61.1	61.9	62.2	62.3
40000	66.0	66.5	67.6	67.2	66.6	65.1	64.5	64.1	62.1	62.9	65.0	62.1	61.1	61.7	62.1	62.3
50000	65.8	66.5	67.5	67.1	66.4	65.0	64.3	63.9	61.9	62.9	64.9	62.0	61.1	61.5	62.1	62.2
60000	65.6	66.4	67.5	66.9	66.2	65.0	64.2	63.7	61.7	62.8	64.8	61.9	61.1	61.4	62.1	62.2
70000	65.4	66.3	67.4	66.6	66.0	64.9	64.1	63.5	61.6	62.8	64.7	61.8	61.2	61.2	62.1	62.2
80000	65.2	66.3	67.2	66.4	65.9	64.9	64.0	63.4	61.6	62.9	64.6	61.7	61.3	61.1	62.1	62.2
90000	65.2	66.3	67.1	66.2	65.9	64.9	64.0	63.4	61.6	63.0	64.5	61.6	61.4	61.0	62.2	62.2
100000	65.3	66.3	67.2	66.3	66.1	64.9	64.1	63.5	61.8	63.3	64.4	61.6	61.5	61.0	62.3	62.4
110000	65.4	66.6	67.2	66.3	66.4	65.0	64.5	63.7	62.1	63.6	64.3	61.6	61.8	61.2	62.4	62.5
120000	65.5	67.0	67.0	66.3	66.6	65.1	64.9	63.7	62.5	63.9	64.2	61.5	62.0	61.5	62.6	62.7
130000	65.7	67.4	67.7	66.7	66.6	65.2	65.2	63.7	62.9	64.2	64.2	61.6	62.6	61.9	62.7	63.2
140000	65.8	67.9	68.2	67.2	66.9	65.3	65.4	63.7	63.0	64.4	64.2	61.7	63.0	62.3	62.8	63.6
150000	66.0	68.0	68.0	67.5	66.8	65.4	65.5	63.8	63.4	64.8	64.2	61.7	63.3	62.6	63.0	64.0
160000	66.2	68.0	68.2	67.9	66.9	65.4	65.6	63.8	63.4	65.2	64.2	61.7	63.4	62.9	63.0	64.4
170000	66.2	67.7	68.3	68.2	67.0	65.5	65.7	63.9	63.5	65.5	64.1	61.7	63.5	63.0	63.0	64.6
180000	66.1	67.7	68.1	68.3	66.9	65.6	65.7	63.9	63.6	65.7	63.9	61.7	63.4	63.1	63.1	64.7
190000	66.0	67.7	67.9	68.3	66.7	65.5	65.6	63.8	63.6	65.8	63.8	61.6	63.4	63.1	63.1	64.9
200000	66.0	67.7	67.8	68.3	66.5	65.5	65.5	63.6	63.5	65.8	63.5	61.6	63.3	63.0	63.0	64.9
210000	66.1	67.8	67.7	68.1	66.3	65.4	65.4	63.4	63.5	65.7	63.3	61.5	63.1	62.9	63.0	64.9
220000	66.2	67.8	67.7	67.9	66.2	65.3	65.2	63.3	63.5	65.7	63.1	61.4	62.9	62.7	62.8	64.8
230000	66.3	67.7	67.6	67.7	66.0	65.1	65.0	63.2	63.4	65.6	62.8	61.4	62.7	62.6	62.7	64.7
Daily Max	66.3	68.0	68.3	68.3	67.5	65.7	65.7	64.9	63.6	65.8	65.5	62.6	63.5	63.1	63.1	64.9
Daily Min	65.2	66.3	67.0	66.2	65.9	64.9	64.0	63.2	61.6	62.8	62.8	61.4	61.1	61.0	62.1	62.2
Average	65.9	67.1	67.6	67.3	66.5	65.2	64.9	63.8	62.7	64.1	64.3	61.8	62.2	62.1	62.6	63.3

Monthly average Temp: 64.7

License Monthly Maximum Average Temperature: 74 F

Grand Rapids Tailrace Temperature Summary - September 2019

Time HHMMSS	09/17/19	09/18/19	09/19/19	09/20/19	09/21/19	09/22/19	09/23/19	09/24/19	09/25/19	09/26/19	09/27/19	09/28/19	09/29/19	09/30/19
0	64.6	65.2	66.5	66.4	66.6	67.8	67.5	66.3	66.8	66.2	64.4	62.7	62.2	60.3
10000	64.4	65.0	66.4	66.3	66.5	67.7	67.3	66.0	66.6	66.0	64.3	62.5	62.0	60.2
20000	64.3	64.8	66.3	66.2	66.4	67.7	67.1	65.8	66.5	65.7	64.2	62.3	61.7	60.1
30000	64.2	64.7	66.2	66.1	66.3	67.6	66.9	65.6	66.3	65.4	64.1	62.1	61.5	60.1
40000	64.1	64.5	66.2	66.0	66.2	67.6	66.7	65.4	66.2	65.1	64.1	62.0	61.4	60.0
50000	64.0	64.4	66.1	65.9	66.1	67.5	66.6	65.2	66.1	64.8	64.0	61.8	61.2	60.0
60000	63.9	64.2	66.1	65.8	66.0	67.5	66.4	65.0	66.0	64.6	63.9	61.6	61.1	60.0
70000	63.9	64.2	66.0	65.7	66.0	67.5	66.2	64.8	65.9	64.3	63.9	61.4	61.0	60.0
80000	63.8	64.2	66.0	65.7	66.0	67.6	66.1	64.7	65.8	64.1	63.7	61.3	60.9	60.0
90000	63.8	64.3	66.0	65.7	66.0	67.6	66.0	64.6	65.9	64.1	63.6	61.2	60.8	60.1
100000	63.9	64.5	66.0	65.8	66.2	67.6	66.0	64.8	66.1	64.2	63.5	61.3	60.7	60.1
110000	64.1	64.8	66.2	65.9	66.6	67.7	66.0	65.1	66.3	64.2	63.5	61.5	60.8	60.2
120000	64.4	65.3	66.3	66.0	67.0	67.8	66.1	65.4	66.5	64.3	63.4	61.9	60.9	60.3
130000	64.7	65.7	66.4	66.2	67.2	67.9	66.2	65.8	66.9	64.4	63.4	62.3	61.0	60.4
140000	65.1	66.2	66.6	66.3	67.5	68.0	66.5	66.2	67.1	64.7	63.4	62.7	61.0	60.5
150000	65.4	66.6	66.7	66.6	67.6	68.1	66.6	66.5	67.3	65.2	63.4	63.1	61.1	60.6
160000	65.7	66.8	66.8	66.8	67.8	68.1	66.8	66.8	67.5	65.3	63.3	63.3	61.1	60.8
170000	65.8	66.9	66.8	67.0	67.9	68.1	66.9	67.0	67.4	65.4	63.3	63.4	61.1	61.0
180000	65.8	67.0	66.8	67.0	68.0	68.1	66.8	67.1	67.3	65.3	63.3	63.4	61.0	61.0
190000	65.8	67.0	66.8	67.0	68.0	68.1	66.8	67.1	67.2	65.1	63.2	63.4	60.9	61.0
200000	65.7	67.0	66.7	67.0	68.0	68.0	66.8	67.1	67.1	65.0	63.1	63.2	60.8	61.0
210000	65.6	66.9	66.7	66.9	68.0	67.9	66.7	67.1	66.9	64.9	63.0	63.0	60.7	61.1
220000	65.5	66.8	66.6	66.8	67.9	67.8	66.6	67.0	66.7	64.7	62.9	62.8	60.5	61.1
230000	65.3	66.7	66.5	66.7	67.9	67.6	66.4	66.9	66.5	64.5	62.8	62.5	60.4	61.1
Daily Max	65.8	67.0	66.8	67.0	68.0	68.1	67.5	67.1	67.5	66.2	64.4	63.4	62.2	61.1
Daily Min	63.8	64.2	66.0	65.7	66.0	67.5	66.0	64.6	65.8	64.1	62.8	61.2	60.4	60.0
Average	64.8	65.6	66.4	66.3	67.0	67.8	66.6	66.0	66.6	64.9	63.6	62.4	61.1	60.5

ATTACHMENT B

Wisconsin Public Service Corporation

Grand Rapids Hydroelectric Project

FERC Project No. 2433

Water Quality Monitoring Quality Assurance Data

Field Notes for Datasonde Deployment

Date/Time: 5/29/19 0915 Analyst: MGM

Location: Grand Rapids upstream Datasonde Serial #: ~~13E100588~~ 13C100327

Calibration Information Datasonde Battery [volts]: 3.2

pH (s.u.)	Before Cal.	After Cal.
7.00 Std	6.69	7.00
10.00 Std	9.61	10.00

pH Cal. Temp.: 68.7

Conductivity (mS/cm)	Before Cal.	After Cal.	Cell Constant
0.291 Std	0.2805	0.2910	5.51

Barometric Pressure (mm Hg) 737

YSI Datasonde Dissolved Oxygen	Before Calibration	After Calibration	DO Probe Gain
% Saturation	83.4	96.9	1.10
mg/L D.O.	7.42	8.62	
Temp – °F	70.0	70.0	

DO Handheld Meter Calibration - DO Meter Model: Hach HQ30d Meter # 1

	Before Calibration	After Calibration
% Saturation	95.8	100.0
mg/L D.O.	7.93	8.28
Temp – °F	74.3	74.4

Post Calibration Slope = 105.2 %

Create File for Test Program ✓ **Start Test:** 0930 **End Test:** 0942

Test Program Readings

	YSI Datasonde	Hach HQ30d Meter	**(Must be within 0.5 mg/L D.O.)**
% Saturation	96.6	93.3	ok - Deploy
mg/L D.O.	9.31	9.25	
Temp – °F	57.4	57.9	

Create File for Datasonde ✓ **Remove calibration cup, Replace with weight** ✓

Re-calibration - REQUIRED if outside 0.5 mg/l limit

	Before Cal.	After Cal.	Datasonde	Hach HQ30d Meter
% Saturation				
mg/L D.O.				
Temp – °F				

Check File Status

File Start 5-29-19 10:00 Battery Life (Number of Days): Collect

Notes: Deployed for 2019 monitoring season

Field Notes for Datasonde Deployment

Date/Time: 6-12-19 0805 Analyst: MWM

Location: GRAND upstream Datasonde Serial #: 13E100688

Calibration Information Datasonde Battery [volts]: 2.5 V

pH (s.u.)	Before Cal.	After Cal.
7.00 Std	6.53	700
10.00 Std	9.76	1000

pH Cal. Temp.: 64.3

Conductivity (mS/cm)	Before Cal.	After Cal.	Cell Constant
0.291 Std	0.2953	0.2911	5.46

Barometric Pressure (mm Hg) 742

YSI Datasonde Dissolved Oxygen	Before Calibration	After Calibration	DO Probe Gain
% Saturation	100.0	97.7	
mg/L D.O.	9.51	9.30	0.97
Temp – °F	64.1	63.9	

DO Handheld Meter Calibration - DO Meter Model: Hach HQ30d Meter # 2 - Cal on 6/11/19

	Before Calibration	After Calibration
% Saturation	100.5	100.0
mg/L D.O.	8.84	8.78
Temp – °F	69.5	69.5

Post Calibration Slope = 99.4

Create File for Test Program ✓ **Start Test:** 0824 **End Test:**

Test Program Readings

	YSI Datasonde	Hach HQ30d Meter
% Saturation	86.2	83.2
mg/L D.O.	7.89	7.91
Temp – °F	67.3	67.2

(Must be within 0.5 mg/L D.O.)

Create File for Datasonde **Remove calibration cup, Replace with weight**

Re-calibration - REQUIRED if outside 0.5 mg/l limit

	Before Cal.	After Cal.	Datasonde	Hach HQ30d Meter
% Saturation				
mg/L D.O.				
Temp – °F				

Check File Status

File Start 6-12-19 0900 Battery Life (Number of Days): 4106

Notes:

Field Notes for Datasonde Post Calibration

Date/Time: 6-12-19 Analyst: MWM

Location: 6 RAND upstream Datasonde Serial #: 13C108327

Ending Datasonde Battery [volts]: 3.0

Calibration Information

pH (s.u.):	Observed
7.00 Std.	7.24
10.00 Std.	10.13

pH Temp Reading.: 61.5°F

Conductivity (mS/cm) : 0.291 Std. Conc. 0.2634 Observed

Barometric Pressure (mm Hg) 742

Dissolved Oxygen	Before Calibrate	After Calibrate	Gain
% Saturation	96.7	97.8	
mg/L D.O.	9.45	9.58	1.11
Temp – °F	61.6	61.4	

Notes:

lots of macroinvertebrates on probe – sensors 50% covered

335 readings - All D.O. ↑ 7.5 mg/L

Field Notes for Datasonde Deployment

Date/Time: 6-14-19 1210 Analyst: MWM

Location: GRAND upstream Datasonde Serial #: 13L100327

Calibration Information Datasonde Battery [volts]: 3.0

pH (s.u.)	Before Cal.	After Cal.
7.00 Std	7.16	7.00
10.00 Std	10.10	10.00

pH Cal. Temp.: 68.4

Conductivity (mS/cm)	Before Cal.	After Cal.	Cell Constant
0.292 Std	0.2870	0.2921	5.58

Barometric Pressure (mm Hg) 741

YSI Datasonde Dissolved Oxygen	Before Calibration	After Calibration	DO Probe Gain
% Saturation	98.5	97.6	1.10
mg/L D.O.	9.00	8.89	
Temp – °F	67.5	67.9	

DO Handheld Meter Calibration - DO Meter Model: Hach HQ30d Meter #

	Before Calibration	After Calibration
% Saturation		
mg/L D.O.		
Temp – °F		

Post Calibration Slope = _____

Create File for Test Program _____ **Start Test:** _____ **End Test:** _____

Test Program Readings Not conducted - Calibrated in Lab

	YSI Datasonde	Hach HQ30d Meter	**(Must be within 0.5 mg/L D.O.)**
% Saturation			
mg/L D.O.			
Temp – °F			

Create File for Datasonde _____ **Remove calibration cup, Replace with weight** _____

Re-calibration - REQUIRED if outside 0.5 mg/l limit

	Before Cal.	After Cal.	Datasonde	Hach HQ30d Meter
% Saturation				
mg/L D.O.				
Temp – °F				

Check File Status

File Start 6-14-19 1300 Battery Life (Number of Days): 601.8

Notes: Calibrated in lab for swapout with 13L100683.
13L100688 battery voltage was low on 6/12/19

Field Notes for Datasonde Post Calibration

Date/Time: 6-14-19 1600 Analyst: MWM

Location: 6 Bands Upstream Datasonde Serial #: 13C100688

Ending Datasonde Battery [volts]: 2.5

Calibration Information

pH (s.u.):	Observed
7.00 Std.	7.07
10.00 Std.	9.98

pH Temp Reading.: 68.4

Conductivity (mS/cm) : 0.292 Std. Conc. 0.2938 Observed

Barometric Pressure (mm Hg) 740

Dissolved Oxygen	Before Calibrate	After Calibrate	Gain
% Saturation	98.0	97.4	
mg/L D.O.	9.02	8.94	0.96
Temp – °F	66.9	67.2	

Notes:

* Battery Voltage + Cable Voltage were low at the time of deployment.
YSI Technical staff indicated this was a sign of equipment failure.
Removed sonde from service + will replace with another MWM 6/14/19

Field Notes for Datasonde Deployment

Date/Time: 6-26-19 0907 Analyst: MWM

Location: Grand Rapids Upstream Datasonde Serial #: 14D101264

Calibration Information Datasonde Battery [volts]: 3.2

pH (s.u.)	Before Cal.	After Cal.
7.00 Std	7.12	7.0
10.00 Std	10.01	10.0

pH Cal. Temp.: 68.4°

Conductivity (mS/cm)	Before Cal.	After Cal.	Cell Constant
0.292 Std	0.2855	0.2921	5.57

Barometric Pressure (mm Hg) 737

YSI Datasonde Dissolved Oxygen	Before Calibration	After Calibration	DO Probe Gain
% Saturation	96.6	97.1	
mg/L D.O.	8.75	8.79	0.97
Temp – °F	68.3	68.5	

DO Handheld Meter Calibration - DO Meter Model: Hach HQ30d Meter #

	Before Calibration	After Calibration
% Saturation		
mg/L D.O.		
Temp – °F		

Post Calibration Slope = _____

Create File for Test Program ✓ **Start Test:** 0815 **End Test:** 0842

Test Program Readings

	YSI Datasonde	Hach HQ30d Meter	(Must be within 0.5 mg/L D.O.)
% Saturation	83.7	85.2	
mg/L D.O.	7.67	~~7.57~~ 7.57	ok- Deploy
Temp – °F	67.3	67.5	

Create File for Datasonde ✓ **Remove calibration cup, Replace with weight** ✓

Re-calibration - REQUIRED if outside 0.5 mg/l limit

	Before Cal.	After Cal.	Datasonde	Hach HQ30d Meter
% Saturation				
mg/L D.O.				
Temp – °F				

Check File Status

File Start 6-26-19 0900 Battery Life (Number of Days): 616.4

Notes: Calibrated @ High Falls - Deployed @ 10:10 a.m.

Field Notes for Datasonde Post Calibration

Date/Time: 6-26-19 Analyst: MGM

Location: Grand upstream Datasonde Serial #: 13A10327

Ending Datasonde Battery [volts]: 2.9

Calibration Information

pH (s.u.):	Observed
7.00 Std.	7.09
10.00 Std.	10.01

pH Temp Reading.: 72°

Conductivity (mS/cm) : 0.292 Std. Conc. 0.2774 Observed

Barometric Pressure (mm Hg) 742

Dissolved Oxygen	Before Calibrate	After Calibrate	Gain
% Saturation	97.9	97.7	
mg/L D.O.	8.47	8.40	1.09
Temp – °F	72.6	73.2	

Notes:

All D.O. + 7 mg/L

Field Notes for Datasonde Deployment

Date/Time: 7/10/19 0803 Analyst: MWH

Location: GRAND RAPIDS upStream Datasonde Serial #: 14D16/261

Calibration Information Datasonde Battery [volts]: 3.0

pH (s.u.)	Before Cal.	After Cal.
7.00 Std	6.98	7.00
10.00 Std	9.97	10.00

pH Cal. Temp.: 71.0

Conductivity (mS/cm)	Before Cal.	After Cal.	Cell Constant	Zero Conductivity Calibration (optional)
0.1292 Std	0.3138	0.2921	5.48	Before — After ✓

Barometric Pressure (mm Hg) 733 734

YSI Datasonde Dissolved Oxygen	Before Calibration	After Calibration	DO Probe Gain
% Saturation	95.5	96.7	1.08
mg/L D.O.	8.38	8.47	
Temp – °F	71.3	71.4	

DO Handheld Meter Calibration - DO Meter Model: Hach HQ30d Meter #

	Before Calibration	After Calibration
% Saturation		
mg/L D.O.		
Temp – °F		

Post Calibration Slope = _____

Create File for Test Program ✓ **Start Test:** 0815 **End Test:** 0845

Test Program Readings

	YSI Datasonde	Hach HQ30d Meter	(Must be within 0.5 mg/L D.O.)
% Saturation	77.3	78.4	
mg/L D.O.	6.69	6.50	OK - Deploy
Temp – °F	72.6	72.6	

Create File for Datasonde ✓ **Remove calibration cup, Replace with weight** ✓

Re-calibration - REQUIRED if outside 0.5 mg/l limit

	Before Cal.	After Cal.	Datasonde	Hach HQ30d Meter
% Saturation				
mg/L D.O.				
Temp – °F				

Check File Status

File Start 7/10/19 0900 Battery Life (Number of Days): 611.8

Notes: Calibrated @ High Falls. Deployed @ 1005

Field Notes for Datasonde Post Calibration

Date/Time: 7/10/19 10:25 Analyst: MWM

Location: GRAND upstream Datasonde Serial #: 14D KC 264

Ending Datasonde Battery [volts]: 3.0

Calibration Information

pH (s.u.):	Observed
7.00 Std.	7.03
10.00 Std.	9.98

pH Temp Reading.: 74.6

Conductivity (mS/cm) : 0.292 Std. Conc. 0.2949 Observed

Barometric Pressure (mm Hg) 739

Dissolved Oxygen	Before Calibrate	After Calibrate	Gain
% Saturation	97.5	97.2	
mg/L D.O.	8.04	8.00	0.96
Temp – °F	77.2	77.4	

Notes:

338 Parallel - All D.O. ↑ 6.5 mg/L

Field Notes for Datasonde Deployment

Date/Time: 7/24/19 0845 Analyst: MWM

Location: GRAND upstream Datasonde Serial #: 14D 101264

Calibration Information Datasonde Battery [volts]: 3.0

pH (s.u.)	Before Cal.	After Cal.
7.00 Std	7.11	7.00
10.00 Std	10.11	10.00

pH Cal. Temp.: 68.7

Conductivity (mS/cm)	Before Cal.	After Cal.	Cell Constant
0.292 Std	0.2888	0.2920	5.62

Barometric Pressure (mm Hg) 743

YSI Datasonde Dissolved Oxygen	Before Calibration	After Calibration	DO Probe Gain
% Saturation	95.9	97.7	
mg/L D.O.	8.65	8.81	0.98
Temp – °F	68.7	68.8	

DO Handheld Meter Calibration - DO Meter Model: Hach HQ30d Meter #

	Before Calibration	After Calibration
% Saturation		
mg/L D.O.		
Temp – °F		

Post Calibration Slope = _____

Create File for Test Program ✓ **Start Test:** 08:51 **End Test:** 0906

Test Program Readings

	YSI Datasonde	Hach HQ30d Meter
% Saturation	99.5	100.8
mg/L D.O.	8.36	8.23
Temp – °F	75.3	75.8

(Must be within 0.5 mg/L D.O.) ok - Deploy

Create File for Datasonde ✓ **Remove calibration cup, Replace with weight** ✓

Re-calibration - REQUIRED if outside 0.5 mg/l limit

	Before Cal.	After Cal.	Datasonde	Hach HQ30d Meter
% Saturation				
mg/L D.O.				
Temp – °F				

Check File Status

File Start 7/24/19 10:00 Battery Life (Number of Days): 605.5

Notes: Calibrated @ High Falls Deployed @ ~ 10:40

Field Notes for Datasonde Post Calibration

Date/Time: 7/24/19 11:00 Analyst: MWM

Location: Grand Rapids upstream Datasonde Serial #: 14D10226

Ending Datasonde Battery [volts]: 3.0

Calibration Information

pH (s.u.):	Observed
7.00 Std.	6.92
10.00 Std.	9.87

pH Temp Reading.: 73.1°F

Conductivity (mS/cm) : 0.292 Std. Conc. 0.3826 Observed

Barometric Pressure (mm Hg) 746

Dissolved Oxygen	Before Calibrate	After Calibrate	Gain
% Saturation	99.1	98.1	
mg/L D.O.	8.44	8.34	1.06
Temp – °F	73.7	73.8	

Notes:

339 readings - All D.O. ↑ 6 mg/L

Removed from water ~ 10:40 on 7/24/19

Heavy biofouling on probe + sensors

Field Notes for Datasonde Deployment

Date/Time: 8/7/19 9:30am Analyst: JRR

Location: Grand Rapids Upstream Datasonde Serial #: 14D101261

Calibration Information Datasonde Battery [volts]: 3.0

pH (s.u.)	Before Cal.	After Cal.
7.00 Std	7.00	7.05
10.00 Std	10.00	10.05

pH Cal. Temp.: 76.0

Conductivity (mS/cm)	Before Cal.	After Cal.	Cell Constant
0.295 Std	0.3085	0.2953	5.23

Barometric Pressure (mm Hg) 731.0

YSI Datasonde Dissolved Oxygen	Before Calibration	After Calibration	DO Probe Gain
% Saturation	95.5	96.3	1.07
mg/L D.O.	7.92	7.95	
Temp – °F	76.6°	77.0°	

DO Handheld Meter Calibration - DO Meter Model: Hach HQ30d Meter #

	Before Calibration	After Calibration
% Saturation		
mg/L D.O.		
Temp – °F		

Post Calibration Slope = _____

Create File for Test Program ✓ **Start Test:** 9:51am **End Test:** 10:15am

Test Program Readings

	YSI Datasonde	Hach HQ30d Meter	**(Must be within 0.5 mg/L D.O.)**
% Saturation	96.9	101.1	
mg/L D.O.	8.15	8.17	
Temp – °F	75.3°	75.5°	

Create File for Datasonde _____ **Remove calibration cup, Replace with weight**_____

Re-calibration - REQUIRED if outside 0.5 mg/l limit

	Before Cal.	After Cal.	Datasonde	Hach HQ30d Meter
% Saturation				
mg/L D.O.				
Temp – °F				

Check File Status

File Start 11:00am 8/7/19 Battery Life (Number of Days): 598.60

Notes: _____

Field Notes for Datasonde Post Calibration

Date/Time: 8/7/19 Analyst: JLR

Location: Grand Rapids Upstream Datasonde Serial #: 14D101264

Ending Datasonde Battery [volts]: 2.9

Calibration Information

pH (s.u.):	Observed
7.00 Std.	7.06
10.00 Std.	9.86

pH Temp Reading.: 78°

Conductivity (mS/cm) : 0.295 Std. Conc. 0.328 Observed

Barometric Pressure (mm Hg) 736

Dissolved Oxygen	Before Calibrate	After Calibrate	Gain
% Saturation	98.9	96.9	
mg/L D.O.	8.01	7.84	0.96
Temp – °F	79.0	79.0°	

Notes:

All D.O. is over 6.

Field Notes for Datasonde Deployment

Date/Time: Aug. 20, 2019 Analyst: DJA/JRR

Location: Grand Rapids Headwater Datasonde Serial #: 14D101264

Calibration Information Datasonde Battery [volts]: 2.9

pH (s.u.)	Before Cal.	After Cal.
7.00 Std	7.05	7.00
10.00 Std	10.06	10.00

pH Cal. Temp.: 70.2

Conductivity (mS/cm)	Before Cal.	After Cal.	Cell Constant
0.295 Std	0.3300	0.295	4.93

Barometric Pressure (mm Hg) 738.8

YSI Datasonde Dissolved Oxygen	Before Calibration	After Calibration	DO Probe Gain
% Saturation	97.0	97.3	0.96
mg/L D.O.	8.66	8.63	
Temp – °F	69.6	70.33	

DO Handheld Meter Calibration - DO Meter Model: Hach HQ30d Meter # 1

	Before Calibration	After Calibration
% Saturation	99.4%	100.0%
mg/L D.O.	8.71 mg/L	8.76 mg/L
Temp – °F	69.5°F	69.5°F

Post Calibration Slope = 103.4%

Create File for Test Program ✓ **Start Test:** 10:27am **End Test:** 11:12

Test Program Readings

	YSI Datasonde	Hach HQ30d Meter
% Saturation	97.3	102.7
mg/L D.O.	8.52	8.68
Temp – °F	71.5	71.7

(Must be within 0.5 mg/L D.O.) Grand Tailwater Test

Create File for Datasonde ✓ **Remove calibration cup, Replace with weight**

Re-calibration - REQUIRED if outside 0.5 mg/l limit

	Before Cal.	After Cal.	Datasonde	Hach HQ30d Meter
% Saturation				
mg/L D.O.				
Temp – °F				

Deployed

Check File Status

File Start 8/20/19 13:00 Battery Life (Number of Days): 614

Notes:

Field Notes for Datasonde Post Calibration

Date/Time: 8/20/19 1:10pm Analyst: JRR / PJA

Location: Grand Rapids Headwater Datasonde Serial #: 14D101261

Ending Datasonde Battery [volts]: 2.9

Calibration Information

pH (s.u.):	Observed
7.00 Std.	7.10
10.00 Std.	10.04

pH Temp Reading.: 76.8

Conductivity (mS/cm) : 0.295 Std. Conc. 0.339 Observed

Barometric Pressure (mm Hg) 742.0

Dissolved Oxygen	Before Calibrate	After Calibrate	Gain
% Saturation	98.2	97.7	
mg/L D.O.	8.15	8.08	1.00
Temp – °F	76.5	76.9	

Notes:

All D.O. above 6.0.

Field Notes for Datasonde Deployment

Date/Time: Sept 3, 2019 Analyst: JRR

Location: Grand Rapids Upper Datasonde Serial #: 14D10126l

Calibration Information Datasonde Battery [volts]: 3.2

pH (s.u.)	Before Cal.	After Cal.
7.00 Std	7.03	7.0
10.00 Std	10.06	10.0

pH Cal. Temp.: 67.04

Conductivity (mS/cm)	Before Cal.	After Cal.	Cell Constant
0.290 Std	~~0.302~~ 0.232	0.2902	5.165

Barometric Pressure (mm Hg) 730.0

YSI Datasonde Dissolved Oxygen	Before Calibration	After Calibration	DO Probe Gain
% Saturation	95.6	96.0	1.07
mg/L D.O.	8.74	8.71	
Temp – °F	67.58	68.29	

DO Handheld Meter Calibration - DO Meter Model: Hach HQ30d Meter #

	Before Calibration	After Calibration
% Saturation	102.1	100.0
mg/L D.O.	9.0	8.79
Temp – °F	69.3	69.5

Post Calibration Slope = 101.3%

Create File for Test Program ✓ **Start Test:** 11:30am Actual time in: 11:36am **End Test:** 11:51am

Test Program Readings

	YSI Datasonde	Hach HQ30d Meter	**(Must be within 0.5 mg/L D.O.)**
% Saturation	~~8.81~~ 96.4	~~97.7~~ 99.6	
mg/L D.O.	8.81	~~8.66~~ 8.70	
Temp – °F	67.43	~~67.73~~ 67.8	

Create File for Datasonde ✓ **Remove calibration cup, Replace with weight**_____

Re-calibration - REQUIRED if outside 0.5 mg/l limit

	Before Cal.	After Cal.	Datasonde	Hach HQ30d Meter
% Saturation				
mg/L D.O.				
Temp – °F				

Check File Status

File Start 12:00pm Battery Life (Number of Days): ~~50.6~~ 616.4

Notes:

Field Notes for Datasonde Post Calibration

Date/Time: Sept 3, 2019 Analyst: JRR

Location: Grand Rapids Upper Datasonde Serial #: 14D10 1264

Ending Datasonde Battery [volts]: _____

Calibration Information

pH (s.u.):	Observed	
7.00 Std.	7.09	pH Temp Reading.: 73.38
10.00 Std.	10.02	

Conductivity (mS/cm) : 0.290 Std. Conc. 0.268 Observed

Barometric Pressure (mm Hg) 733.3

Dissolved Oxygen	Before Calibrate (Running Mean)	After Calibrate	Gain
% Saturation	97.5	96.4	
mg/L D.O.	8.14	8.04	0.95
Temp – °F	76.06	76.12	

Notes:

No data came up in transfer.

I did Stop deployment first before trying to transfer.

* Battery voltage is low, Sonde did not collect data. Power failure after Sonde calibrated on 8/20/19. Pre-deployment test program shows battery voltage of 2.7 V. When Sonde retrieved, voltage < 2.

Field Notes for Datasonde Deployment

Date/Time: Sept 17, 2019 10:40am Analyst: JRR

Location: Grand Rapids Head Datasonde Serial #: 14D101264

Calibration Information Datasonde Battery [volts]: 3.2

pH (s.u.)	Before Cal.	After Cal.
7.00 Std	7.03	10.05
10.00 Std	7.00	~~10.00~~ 10.02

pH Cal. Temp.: 72.6°F

Conductivity (mS/cm)	Before Cal.	After Cal.	Cell Constant
0.292 Std	0.2682	0.2922	5.34

Barometric Pressure (mm Hg) 742. 743

YSI Datasonde Dissolved Oxygen	Before Calibration	After Calibration	DO Probe Gain
% Saturation	100.5	97.7	0.99
mg/L D.O.	8.42	8.14	
Temp – °F	75.78	76.26	

DO Handheld Meter Calibration - DO Meter Model: Hach HQ30d Meter #

	Before Calibration	After Calibration
% Saturation	98.3	100.0
mg/L D.O.	8.66	8.81
Temp – °F	69.5	69.6

Post Calibration Slope = 102.9

Create File for Test Program ✓ **Start Test:** 11:00am **End Test:** 11:18am

Test Program Readings

	YSI Datasonde	Hach HQ30d Meter
% Saturation	99.5	101.8
mg/L D.O.	9.58	9.55
Temp – °F	62.85	63.0

(Must be within 0.5 mg/L D.O.)

Create File for Datasonde ✓ **Remove calibration cup, Replace with weight**_____

Re-calibration - REQUIRED if outside 0.5 mg/l limit

	Before Cal.	After Cal.	Datasonde	Hach HQ30d Meter
% Saturation				
mg/L D.O.				
Temp – °F				

Check File Status

File Start 12:00pm Battery Life (Number of Days): 616.4

Notes:

Field Notes for Datasonde Post Calibration

Date/Time: Sept 17, 2019 1:27pm Analyst: JRR

Location: Grand Rapids Head Datasonde Serial #: 14D101261

Ending Datasonde Battery [volts]: 3.0

Calibration Information

pH (s.u.):	Observed
7.00 Std.	7.03
10.00 Std.	10.04

pH Temp Reading.: 75.26

Conductivity (mS/cm) : 0.292 Std. Conc. 0.3003 Observed

Barometric Pressure (mm Hg) 747.0

Dissolved Oxygen	Before Calibrate	After Calibrate	Gain
% Saturation	98.4	98.3	
mg/L D.O.	8.25	8.21	1.07
Temp – °F	75.64	75.95	

Notes:

All D.O. above 7.5

Field Notes for Datasonde Post Calibration

Date/Time: 10/1/19 12:45 Analyst: MWM

Location: GRAND upstream Datasonde Serial #: 14D 16/264

Ending Datasonde Battery [volts]: 3.1

Calibration Information

pH (s.u.):	Observed
7.00 Std.	7.13
10.00 Std.	10.15

pH Temp Reading.: 68.7 °F

Conductivity (mS/cm) : 6.291 Std. Conc. 0.2864 Observed

Barometric Pressure (mm Hg) 741

Dissolved Oxygen	Before Calibrate	After Calibrate	Gain
% Saturation	96.8	97.5	
mg/L D.O.	8.80	8.87	0.99
Temp – °F	68.0	68.0	

Notes:

Removed for 2019 Monitoring Season

337 readings - All D.O. ↑ 6 mg/L

Field Notes for Datasonde Deployment

Date/Time: 5-29-19 0935 Analyst: MWM

Location: Grand Tailrace Datasonde Serial #: 13L100691

Calibration Information Datasonde Battery [volts]: 3.2

pH (s.u.)	Before Cal.	After Cal.
7.00 Std	6.65	7.00
10.00 Std	9.71	10.00

pH Cal. Temp.: 68.9

Conductivity (mS/cm)	Before Cal.	After Cal.	Cell Constant
6.291 Std	0.2763	0.2912	5.53

Barometric Pressure (mm Hg) 737

YSI Datasonde Dissolved Oxygen	Before Calibration	After Calibration	DO Probe Gain
% Saturation	93.3	97.0	1.07
mg/L D.O.	8.42	8.75	
Temp – °F	68.7	68.7	

DO Handheld Meter Calibration - DO Meter Model: Hach HQ30d Meter #

	Before Calibration	After Calibration
% Saturation		
mg/L D.O.		
Temp – °F		

Post Calibration Slope = _____

Create File for Test Program ✓ **Start Test:** 0945 **End Test:** 10:00

Test Program Readings

	YSI Datasonde	Hach HQ30d Meter	**(Must be within 0.5 mg/L D.O.)**
% Saturation	91.9	93.6	
mg/L D.O.	9.43	9.26	OK - Deploy
Temp – °F	57.6	57.9	

Create File for Datasonde ✓ **Remove calibration cup, Replace with weight** ✓

Re-calibration - REQUIRED if outside 0.5 mg/l limit

	Before Cal.	After Cal.	Datasonde	Hach HQ30d Meter
% Saturation				
mg/L D.O.				
Temp – °F				

Check File Status

File Start 5.29-19 11:00 Battery Life (Number of Days): 616.4

Notes: Deployed for 2019 season.

Field Notes for Datasonde Deployment

Date/Time: 6-12-19 Analyst: AWG

Location: Grand Rapids Tailrace Datasonde Serial #: 14D 101261

Calibration Information Datasonde Battery [volts]: 3.1

pH (s.u.)	Before Cal.	After Cal.
7.00 Std	6.79	7.00
10.00 Std	9.84	10.00

pH Cal. Temp.: 62.9

Conductivity (mS/cm)	Before Cal.	After Cal.	Cell Constant
0.291 Std	0.2840	0.2911	5.91

Barometric Pressure (mm Hg) 742

YSI Datasonde Dissolved Oxygen	Before Calibration	After Calibration	DO Probe Gain
% Saturation	89.6	97.6	1.09
mg/L D.O.	8.70	9.51	
Temp – °F	62.2	62.0	

DO Handheld Meter Calibration - DO Meter Model: Hach HQ30d Meter #

	Before Calibration	After Calibration
% Saturation		
mg/L D.O.		
Temp – °F		

Post Calibration Slope = _____

Create File for Test Program ✓ **Start Test:** 0939 **End Test:** 0957

Test Program Readings

	YSI Datasonde	Hach HQ30d Meter	(Must be within 0.5 mg/L D.O.)
% Saturation	86.7	87.7	
mg/L D.O.	7.94	7.85	OL. Duffy
Temp – °F	67.3	67.5	

Create File for Datasonde ✓ **Remove calibration cup, Replace with weight** ✓

Re-calibration - REQUIRED if outside 0.5 mg/l limit

	Before Cal.	After Cal.	Datasonde	Hach HQ30d Meter
% Saturation				
mg/L D.O.				
Temp – °F				

Check File Status

File Start 6.12.19 10:00 Battery Life (Number of Days): 6/6.4

Notes: _____

Field Notes for Datasonde Post Calibration

Date/Time: 6-12-19 10:35 Analyst: BMWM

Location: Grand Tailrace Datasonde Serial #: 13C100691

Ending Datasonde Battery [volts]: 3.0

Calibration Information

pH (s.u.):	Observed
7.00 Std.	7.15
10.00 Std.	10.11

pH Temp Reading.: 60.7°

Conductivity (mS/cm) : 0.291 Std. Conc. 0.2931 Observed

Barometric Pressure (mm Hg) 737

Dissolved Oxygen	Before Calibrate	After Calibrate	Gain
% Saturation	97.4	97.1	
mg/L D.O.	9.62	9.60	1.07
Temp – °F	60.7	60.7	

Notes:

Removed @ 9:30 a.m Post cal @ High Falls

3rd reading - last one when out of the water

All D.O. ↑ 7.5 mg/L

* Tailrace elevation ↓ about 2 ½' since deployment.

Field Notes for Datasonde Deployment

Date/Time: 6-26-19 Analyst: HOM

Location: 6 BAND Tailrace Datasonde Serial #: 13L100691

Calibration Information Datasonde Battery [volts]: 3.0

pH (s.u.)	Before Cal.	After Cal.
7.00 Std	6.97.15	7.0
10.00 Std	10.08	10.0

pH Cal. Temp.: 69

Conductivity (mS/cm)	Before Cal.	After Cal.	Cell Constant
0.297 Std	0.2934	0.2922	5.49

Barometric Pressure (mm Hg) 737

YSI Datasonde Dissolved Oxygen	Before Calibration	After Calibration	DO Probe Gain
% Saturation	96.5	97.0	
mg/L D.O.	8.59	8.63	1.07
Temp – °F	69.9	70.0	

DO Handheld Meter Calibration - DO Meter Model: Hach HQ30d Meter #

	Before Calibration	After Calibration
% Saturation	~~83.8~~	~~85.2~~
mg/L D.O.	~~7.66~~	~~7.81~~
Temp – °F	67.4	67.5

HOM 6-26-19

Post Calibration Slope = _____

Create File for Test Program ✓ **Start Test:** 0948 **End Test:** 0900

Test Program Readings

	YSI Datasonde	Hach HQ30d Meter	**(Must be within 0.5 mg/L D.O.)**
% Saturation	83.8	85.2	
mg/L D.O.	7.66	7.97	Ok - Deploy
Temp – °F	67.4	67.5	

Create File for Datasonde ✓ **Remove calibration cup, Replace with weight** ✓

Re-calibration - REQUIRED if outside 0.5 mg/l limit

	Before Cal.	After Cal.	Datasonde	Hach HQ30d Meter
% Saturation				
mg/L D.O.				
Temp – °F				

Check File Status

File Start 6-26-19 10:00 Battery Life (Number of Days): 608.3

Notes: Calibrated @ HF. Deployed @ 10:18 a.m.

Field Notes for Datasonde Post Calibration

Date/Time: 6-26-19 10:34 Analyst: MWM

Location: Grand Tailrace Datasonde Serial #: 14D10121601

Ending Datasonde Battery [volts]: 3.0

Calibration Information

pH (s.u.):	Observed
7.00 Std.	7.01
10.00 Std.	9.97

pH Temp Reading.: 73 °F

Conductivity (mS/cm) : 0.292 Std. Conc. 0.2750 Observed

Barometric Pressure (mm Hg) 742

Dissolved Oxygen	Before Calibrate	After Calibrate	Gain
% Saturation	99.2	97.1	
mg/L D.O.	8.52	8.37	1.07
Temp – °F	73.3	73.6	

Notes:

All D.O. ↑ 1 mg/L

Field Notes for Datasonde Deployment

Date/Time: 7/10/19 0814 Analyst: MGM

Location: GRAND Tailrace Datasonde Serial #: 13L 100327

Calibration Information Datasonde Battery [volts]: 2.8

pH (s.u.)	Before Cal.	After Cal.
7.00 Std	7.02	7.00
10.00 Std	10.05	10.00

pH Cal. Temp.: 71°F

Conductivity (mS/cm)	Before Cal.	After Cal.	Cell Constant	Zero Conductivity Calibration (optional)
0.292 Std	0.2996	0.2921	5.40	Before — After —

Barometric Pressure (mm Hg) 734

YSI Datasonde Dissolved Oxygen	Before Calibration	After Calibration	DO Probe Gain
% Saturation	95.2	96.6	1.11
mg/L D.O.	8.31	8.42	
Temp – °F	71.9	71.9	

DO Handheld Meter Calibration - DO Meter Model: Hach HQ30d Meter #

	Before Calibration	After Calibration
% Saturation		
mg/L D.O.		
Temp – °F		

Post Calibration Slope = _____

Create File for Test Program ✓ **Start Test:** 0824 **End Test:** 0845

Test Program Readings

	YSI Datasonde	Hach HQ30d Meter	(Must be within 0.5 mg/L D.O.)
% Saturation	75.8	78.4	
mg/L D.O.	6.56	6.50	ok - Deploy
Temp – °F	72.4	72.6	

Create File for Datasonde ✓ **Remove calibration cup, Replace with weight** ✓

Re-calibration - REQUIRED if outside 0.5 mg/l limit

	Before Cal.	After Cal.	Datasonde	Hach HQ30d Meter
% Saturation				
mg/L D.O.				
Temp – °F				

Check File Status

File Start 7/10/19 0900 Battery Life (Number of Days): 564.1

Notes: Calibrated @ High Falls. Deployed @

Field Notes for Datasonde Post Calibration

Date/Time: 7/10/19 1034 Analyst: MWM

Location: GRAND Rapids Terrace Datasonde Serial #: 13C102691

Ending Datasonde Battery [volts]: 2.9

Calibration Information

pH (s.u.):	Observed
7.00 Std.	7.08
10.00 Std.	10.02

pH Temp Reading.: 76°F

Conductivity (mS/cm) : 0.292 Std. Conc. 0.3056 Observed

Barometric Pressure (mm Hg) 738

Dissolved Oxygen	Before Calibrate	After Calibrate	Gain
% Saturation	98.0	97.2	
mg/L D.O.	8.18	~~7.09~~ 8.09	1.06
Temp – °F	76.1	76.3	

Notes:

337 readings - All D.O. ↑ 6.5 mg/L

Field Notes for Datasonde Deployment

Date/Time: 7/24/19 0855 Analyst: MWH

Location: GRAND Tailrace Datasonde Serial #: 14BK1641

Calibration Information Datasonde Battery [volts]: 3.1

pH (s.u.)	Before Cal.	After Cal.
7.00 Std	7.12	7.00
10.00 Std	10.03	10.00

pH Cal. Temp.: 69.6°

Conductivity (mS/cm)	Before Cal.	After Cal.	Cell Constant
0.292 Std	0.2913	0.2921	5.63

Barometric Pressure (mm Hg) 743

YSI Datasonde Dissolved Oxygen	Before Calibration	After Calibration	DO Probe Gain
% Saturation	97.1	97.9	
mg/L D.O.	8.72	8.77	1.06
Temp – °F	69.2	69.3	

DO Handheld Meter Calibration - DO Meter Model: Hach HQ30d Meter #

	Before Calibration	After Calibration
% Saturation		
mg/L D.O.		
Temp – °F		

Post Calibration Slope = _____

Create File for Test Program ✓ **Start Test:** 0906 **End Test:** 0933

Test Program Readings

	YSI Datasonde	Hach HQ30d Meter
% Saturation	98.7	101.0
mg/L D.O.	8.29	8.23
Temp – °F	75.4	75.9

(Must be within 0.5 mg/L D.O.) ok - Deploy

Create File for Datasonde ✓ **Remove calibration cup, Replace with weight** ✓

Re-calibration - REQUIRED if outside 0.5 mg/l limit

	Before Cal.	After Cal.	Datasonde	Hach HQ30d Meter
% Saturation				
mg/L D.O.				
Temp – °F				

Check File Status

File Start 7/24/19 10:00 Battery Life (Number of Days): 616.4

Notes: Calibrated @ high flow. Deployed @ ~ 10:50

Field Notes for Datasonde Post Calibration

Date/Time: 7/24/19 1110 Analyst: MWM

Location: Grand Teton Race Datasonde Serial #: 13L 1CB327

Ending Datasonde Battery [volts]: 2.8

Calibration Information

pH (s.u.):	Observed
7.00 Std.	7.20
10.00 Std.	10.09

pH Temp Reading.: 72.7

Conductivity (mS/cm) : 0.292 Std. Conc. 0.2970 Observed

Barometric Pressure (mm Hg) 746

Dissolved Oxygen	Before Calibrate	After Calibrate	Gain
% Saturation	99.6	98.2	
mg/L D.O.	8.53	8.39	1.09
Temp – °F	73.5	73.7	

Notes:

339 readings. All D.O. > 6 mg/L

Field Notes for Datasonde Deployment

Date/Time: 8/7/19 10:00am Analyst: JRR

Location: Grand Rapids Downstream Datasonde Serial #: 13L100327

Calibration Information Datasonde Battery [volts]: 2.8

pH (s.u.)	Before Cal.	After Cal.
7.00 Std	7.04	7.00
10.00 Std	10.02	10.00

pH Cal. Temp.: 77.3°

Conductivity (mS/cm)	Before Cal.	After Cal.	Cell Constant
0.295 Std	.2804	.2953	5.67

Barometric Pressure (mm Hg) 731

YSI Datasonde Dissolved Oxygen	Before Calibration	After Calibration	DO Probe Gain
% Saturation	96.3	96.3	1.08
mg/L D.O.	7.72	7.69	
Temp – °F	80.077°	80.308	

DO Handheld Meter Calibration - DO Meter Model: Hach HQ30d Meter #

	Before Calibration	After Calibration
% Saturation		
mg/L D.O.		
Temp – °F		

Post Calibration Slope = _____

Create File for Test Program ✓ **Start Test:** 10:15am **End Test:** 10:48am

Test Program Readings

	YSI Datasonde	Hach HQ30d Meter
% Saturation	96.9	101.1
mg/L D.O.	8.15	8.17
Temp – °F	75.2	75.5

(Must be within 0.5 mg/L D.O.)

Create File for Datasonde _____ **Remove calibration cup, Replace with weight**_____

Re-calibration - REQUIRED if outside 0.5 mg/l limit

	Before Cal.	After Cal.	Datasonde	Hach HQ30d Meter
% Saturation				
mg/L D.O.				
Temp – °F				

Check File Status

546.6

File Start 11:00am 8/7/19 Battery Life (Number of Days): 598.6

Notes: _____

Field Notes for Datasonde Post Calibration

Date/Time: 8/7/19 Analyst: JRL

Location: Grand Rapids Downstream Datasonde Serial #: 14010164

Ending Datasonde Battery [volts]: 3.0

Calibration Information

pH (s.u.):	Observed
7.00 Std.	7.03
10.00 Std.	10.06

pH Temp Reading.: 77.7°

Conductivity (mS/cm) : 0.295 Std. Conc. 0.309 Observed

Barometric Pressure (mm Hg) 736

Dissolved Oxygen	Before Calibrate	After Calibrate	Gain
% Saturation	97.4	96.9	
mg/L D.O.	7.98	7.93	1.06
Temp – °F	77.8°	78°	

Notes:

All D.O. is over 6

Field Notes for Datasonde Deployment

Date/Time: Aug. 20, 2019 Analyst: ~~PJA~~ / JBR

Location: Grand Rapids Tailwater Datasonde Serial #: 14D0164

Calibration Information Datasonde Battery [volts]: 3.0V

pH (s.u.)	Before Cal.	After Cal.
7.00 Std	7.01	7.00
10.00 Std	10.04	10.00

pH Cal. Temp.: 72.1 °F

Conductivity (mS/cm)	Before Cal.	After Cal.	Cell Constant
0.295 Std	0.3342	0.2954	5.06 ✓

Barometric Pressure (mm Hg) 738.2

YSI Datasonde Dissolved Oxygen	Before Calibration	After Calibration	DO Probe Gain
% Saturation	97.4%	97.2%	✓ 1.05
mg/L D.O.	8.59 mg/L	8.48 mg/L	
Temp – °F	71.0°F	71.9°F	

DO Handheld Meter Calibration - DO Meter Model: Hach HQ30d Meter # 1

	Before Calibration	After Calibration
% Saturation	99.4%	100.0%
mg/L D.O.	8.71 mg/L	8.76 mg/L
Temp – °F	69.5°F	69.5°F

Post Calibration Slope = 103.4%

Create File for Test Program ✓ **Start Test:** 11:15 **End Test:** ~~11:42~~ 11:30 11:27

Test Program Readings

	YSI Datasonde	Hach HQ30d Meter	**(Must be within 0.5 mg/L D.O.)**
% Saturation	98.5%	102.7%	> Grand Headwater Test
mg/L D.O.	8.62 mg/L	8.68 mg/L	
Temp – °F	71.5	71.8°F	

Create File for Datasonde ✓ **Remove calibration cup, Replace with weight**

Re-calibration - REQUIRED if outside 0.5 mg/l limit

	Before Cal.	After Cal.	Datasonde	Hach HQ30d Meter
% Saturation				
mg/L D.O.				
Temp – °F				

Check File Status

File Start 8/20/19 @ 1300 Battery Life (Number of Days): 588.4

Notes:

Field Notes for Datasonde Post Calibration

Date/Time: Aug. 20, 2019 1250 Analyst: RJA/JRR

Location: Grand Rapids Tail Datasonde Serial #: 13L100327

Ending Datasonde Battery [volts]: 2.7

Calibration Information

pH (s.u.):	Observed
7.00 Std.	7.15
10.00 Std.	10.04

pH Temp Reading.: 78.14

Conductivity (mS/cm) : 0.295 Std. Conc. 0.406 Observed

Barometric Pressure (mm Hg) 742.0

Dissolved Oxygen	Before Calibrate	After Calibrate	Gain
% Saturation	98.2	~~97.7~~ 97.6	
mg/L D.O.	8.10	8.02	1.08
Temp – °F	77.2	77.6	

Notes:

All D.O. is above 6.5

Field Notes for Datasonde Deployment

Date/Time: Sept 3, 2019 Analyst: JRR

Location: Grand Rapids Tail Datasonde Serial #: 13L100327

Calibration Information Datasonde Battery [volts]: 3.0

pH (s.u.)	Before Cal.	After Cal.
7.00 Std	7.03	10.06
10.00 Std	7.03	10.0

pH Cal. Temp.: 67.11

Conductivity (mS/cm)	Before Cal.	After Cal.	Cell Constant
0.290 Std	0.270	0.290	6.04

Barometric Pressure (mm Hg) 730.2

YSI Datasonde Dissolved Oxygen	Before Calibration	After Calibration	DO Probe Gain
% Saturation	95.9	96.1	1.08
mg/L D.O.	8.72	8.73	
Temp – °F	67.99	68.05	

DO Handheld Meter Calibration - DO Meter Model: Hach HQ30d Meter #

	Before Calibration	After Calibration
% Saturation	102.1	100.0
mg/L D.O.	9.0	8.79
Temp – °F	69.3	69.5

Post Calibration Slope = 101.3%

Create File for Test Program ✓ **Start Test:** ~~11:30am~~ 11:51am ~~Actual time in: 11:32am~~ **End Test:** 12:04pm

Test Program Readings

	YSI Datasonde	Hach HQ30d Meter	**(Must be within 0.5 mg/L D.O.)**
% Saturation	96.9	99.6	
mg/L D.O.	~~8.77~~ 8.86	8.68	
Temp – °F	~~68.9~~ 67.4	67.9	

Create File for Datasonde ✓ **Remove calibration cup, Replace with weight**_____

Re-calibration - REQUIRED if outside 0.5 mg/l limit

	Before Cal.	After Cal.	Datasonde	Hach HQ30d Meter
% Saturation				
mg/L D.O.				
Temp – °F				

Check File Status

File Start 1:00pm Battery Life (Number of Days): ~~14.3~~ 598.1

Notes:

Field Notes for Datasonde Post Calibration

Date/Time: Sept 3, 2019, 1:40pm Analyst: JRL

Location: Grand Rapids Tail Datasonde Serial #: 14D101641

Ending Datasonde Battery [volts]: 3.0

Calibration Information

pH (s.u.):	Observed
7.00 Std.	7.04
10.00 Std.	10.03

pH Temp Reading.: 72.97

Conductivity (mS/cm) : 0.290 Std. Conc. ~~0.2739~~ 0.2757 Observed

Barometric Pressure (mm Hg) 733.2

Dissolved Oxygen	Before Calibrate (Spreadsheet)	Before Calibrate (Running mean)	After Calibrate	Gain
% Saturation	94.8	96.9	96.6	
mg/L D.O.	8.64	8.17	8.10	1.05
Temp – °F	67.66	75.06	75.58	

Barometric – 733.2

Notes:

All above 7.50

Field Notes for Datasonde Deployment

Date/Time: Sept 17, 2019 10:18am Analyst: JRR

Location: #Grand Rapids Tail Datasonde Serial #: 14010641

Calibration Information Datasonde Battery [volts]: 3.0

pH (s.u.)	Before Cal.	After Cal.
7.00 Std	7.07	10.07
10.00 Std	7.00	10.00

pH Cal. Temp.: 71.9

Conductivity (mS/cm)	Before Cal.	After Cal.	Cell Constant
0.292 Std	0.2236	0.2921	0.60

Barometric Pressure (mm Hg) 742.6

YSI Datasonde Dissolved Oxygen	Before Calibration	After Calibration	DO Probe Gain
% Saturation	96.9	97.7	1.05
mg/L D.O.	8.22	8.24	
Temp – °F	74.56	75.05	

DO Handheld Meter Calibration - DO Meter Model: Hach HQ30d Meter #

	Before Calibration	After Calibration
% Saturation	98.3	100.0
mg/L D.O.	8.66	8.81
Temp – °F	69.5	69.6

Post Calibration Slope = 102.9

Create File for Test Program ✓ **Start Test:** 10:32am **End Test:** 10:56am 47

Test Program Readings

	YSI Datasonde	Hach HQ30d Meter
% Saturation	99.5	101.5
mg/L D.O.	9.58	9.50
Temp – °F	62.82	63.2

(Must be within 0.5 mg/L D.O.)

Create File for Datasonde ✓ **Remove calibration cup, Replace with weight**_____

Re-calibration - REQUIRED if outside 0.5 mg/l limit

	Before Cal.	After Cal.	Datasonde	Hach HQ30d Meter
% Saturation				
mg/L D.O.				
Temp – °F				

Check File Status

File Start 12:00pm Battery Life (Number of Days): 597.9

Notes:

Field Notes for Datasonde Post Calibration

Date/Time: Sept 17, 2019 1:37pm Analyst: JRR

Location: Grand Rapids Tail Datasonde Serial #: 13L100327

Ending Datasonde Battery [volts]: 2.9

Calibration Information

pH (s.u.):	Observed
7.00 Std.	7.08
10.00 Std.	10.02

pH Temp Reading.: 75.33

Conductivity (mS/cm) : 0.292 Std. Conc. 0.3687 Observed

Barometric Pressure (mm Hg) 746.8

Dissolved Oxygen	Before Calibrate	After Calibrate	Gain
% Saturation	98.9	98.3	
mg/L D.O.	8.33	8.26	1.07
Temp – °F	75.15	75.32	

Notes:

All D.O. above 80

Field Notes for Datasonde Post Calibration

Date/Time: 10/1/19 1300 Analyst: MM

Location: Ground Tailrace Datasonde Serial #: 14D101641

Ending Datasonde Battery [volts]: 2.9

Calibration Information

pH (s.u.):	Observed
7.00 Std.	7.07
10.00 Std.	10.10

pH Temp Reading.: 68.7

Conductivity (mS/cm) : 0.291 Std. Conc. 0.3323 Observed

Barometric Pressure (mm Hg) 741

Dissolved Oxygen	Before Calibrate	After Calibrate	Gain
% Saturation	97.5	97.5	
mg/L D.O.	9.00	8.99	1.05
Temp – °F	66.7	66.7	

Notes:

337 readings - All D.O. @ 6 mg/L

Removed for 2019 monitoring season

ATTACHMENT C

Wisconsin Public Service Corporation

Grand Rapids Hydroelectric Project

FERC Project No. 2433

Documentation of Agency Consultation

From:	Metcalf, Mark W
To:	Laatsch, Cheryl
Cc:	Schott, Katie J; Bosacki, William K; Grisar, Mike L
Subject:	Grand Rapids Hydroelectric Project (FERC Project No 2433) - 2019 water quality monitoring report.
Date:	Thursday, October 03, 2019 9:22:21 AM
Attachments:	20191003 WDNR GRR Annual WQM Rpt.pdf Grand Rapids Upstream DO Summary 2019.xlsx Grand Rapids Upstream pH Summary 2019.xlsx Grand Rapids Upstream Temp Summary 2019.xlsx Grand Rapids Tailrace DO Summary 2019.xlsx Grand Rapids Tailrace pH Summary 2019.xlsx Grand Rapids Tailrace Temp Summary 2019.xlsx

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Good morning Cheryl,

Pursuant to the water quality monitoring plan for the Wisconsin Public Service (WPS) Grand Rapids hydroelectric facility, WPS is submitting water quality monitoring data collected during the 2019 monitoring season for your review and comment.

No deviations from the water quality standards for dissolved oxygen, pH, or temperature were observed upstream or downstream of the project. The monitoring data can be found in the attached excel spreadsheets. Please review the enclosed monitoring report and data, and provide any comments you may have within 30 days.

Should you have any questions or concerns, please do not hesitate to call me at (920) 433-1833.

Mark

Mark Metcalf
Principal Environmental Consultant
920-433-1833
920-246-2717

Wisconsin Public Service Corporation
700 North Adams Street
P.O. Box 19001
Green Bay, WI 54307-9001
www.wisconsinpublicservice.com

October 3, 2019

Ms. Cheryl Laatsch
Statewide FERC Coordinator
Wisconsin Department of Natural Resources
N7725 Hwy 28
Horicon, WI 53032

Dear Ms. Laatch:

SUBJECT: 2019 Water Quality Monitoring Report

Hydro	FERC Project No.	NATDAM No.	License Article
Grand Rapids	**2433**	**MI00022**	**407**

In accordance with the Order Approving Water Quality Monitoring Plan under Article 407, dated April 7, 1999, Wisconsin Public Service Corporation (WPS) is submitting water quality monitoring data collected during the 2019 monitoring season at the Grand Rapids Hydroelectric project for your review and comment.

At the Grand Rapids facility, WPS is required to ensure that flow releases from the Grand Rapids Project maintain the state standards listed below except when the river flow in the Menominee River is less than the 95 percent exceedance flow or when natural conditions prohibit attainment of the standards:

(1) Monthly average temperatures downstream of the Grand Rapids Dam shall be no greater than those listed below:

January & February	38°F	August	81°F
March	41°F	September	74°F
April	56°F	October	64°F
May	70°F	November	49°F
June	80°F	December	39°F
July	83°F		

(2) Temperature downstream of the Grand Rapids Project Dam shall not exceed 89°F at any time.
(3) DO concentrations downstream of the project powerhouse must not be less than 5.0 milligrams per liter (mg/L) at any time.

(4) Maintain pH 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.

As described in the water quality monitoring plan, monitoring was conducted upstream and downstream of the powerhouse from June 1 through September 30. A photo showing the monitoring locations can be found in Figure 1. Monitoring for DO, temperature, and pH was conducted continuously on an hourly basis using portable water quality monitoring equipment manufactured by YSI, Inc. The instrumentation was cleaned and calibrated according to manufacturer specification at least once 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.

No deviations from the dissolved oxygen, pH or temperature water quality standards were observed at the upstream or downstream monitoring locations during the 2019 monitoring season. During the monitoring season WPS did experience an equipment malfunction at the Grand Rapids upstream monitoring location. As a result of the malfunction no monitoring data was collected during the equipment deployment period of August 20 to September 3, 2019. Prior to deployment of the monitors WPS calibrates the equipment and conducts a test program to verify the equipment is calibrated and working properly. The test program on August 20 did not indicate issues with the water quality monitoring equipment. WPS contacted the equipment manufacturer to determine the cause and it was discovered that the dissolved oxygen sensor was continually resetting itself which resulted in the monitor not starting the program to log monitoring data.

Future Monitoring

Water quality monitoring at the facility is scheduled to occur in 2021, then again in 2024, and every five years thereafter for the term of the permit.

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, feel free to call me at (920) 433-1833.

Sincerely,

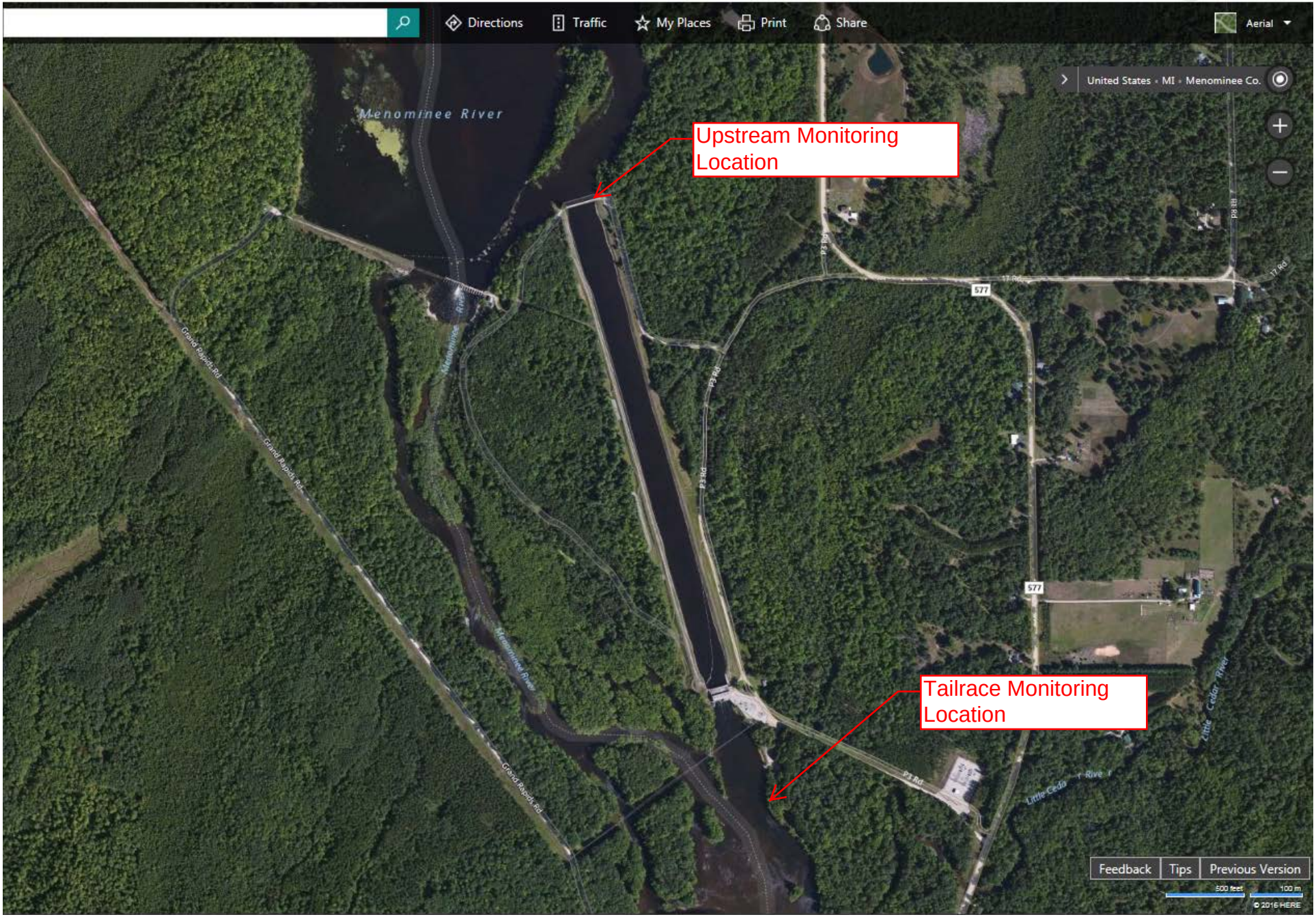
Mark Metcalf

Mark Metcalf
Principal Environmental Consultant

Enc. 2019 Water quality monitoring data (6 spreadsheets)

cc: Ms. Katie Schott
Mr. Bill Bosacki
Mr. Mike Grisar

Figure 1 - Grand Rapids Hydroelectric Project - Water Quality Monitoring Locations



Upstream Monitoring Location: Approx. 45 21'49", 87 39' 9"

Tailrace Monitoring Location: Approx. 45 21'10", 87 38' 53"

Response to Comments from the Wisconsin Department of Natural Resources

The Wisconsin Department of Natural Resources did not provide comments on the 2019 water quality monitoring report.

From:	Metcalf, Mark W
To:	Utrup, Nick
Cc:	Schott, Katie J; Bosacki, William K; Grisar, Mike L
Subject:	Grand Rapids Hydroelectric Project (FERC Project No 2433) - 2019 water quality monitoring report.
Date:	Thursday, October 03, 2019 9:24:06 AM
Attachments:	20191003 FWS GRR Annual WQM Rpt.pdf Grand Rapids Upstream DO Summary 2019.xlsx Grand Rapids Upstream pH Summary 2019.xlsx Grand Rapids Upstream Temp Summary 2019.xlsx Grand Rapids Tailrace DO Summary 2019.xlsx Grand Rapids Tailrace pH Summary 2019.xlsx Grand Rapids Tailrace Temp Summary 2019.xlsx

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Good morning Nick,

Pursuant to the water quality monitoring plan for the Wisconsin Public Service (WPS) Grand Rapids hydroelectric facility, WPS is submitting water quality monitoring data collected during the 2019 monitoring season for your review and comment.

No deviations from the water quality standards for dissolved oxygen, pH, or temperature were observed upstream or downstream of the project. The monitoring data can be found in the attached excel spreadsheets. Please review the enclosed monitoring report and data, and provide any comments you may have within 30 days.

Should you have any questions or concerns, please do not hesitate to call me at (920) 433-1833.

Mark

Mark Metcalf
Principal Environmental Consultant
920-433-1833
920-246-2717

Wisconsin Public Service Corporation
700 North Adams Street
P.O. Box 19001
Green Bay, WI 54307-9001
www.wisconsinpublicservice.com

October 3, 2019

Mr. Nicholas Utrup
U.S. Fish & Wildlife Service
4101 American Blvd East
Bloomington, MN 55425

Dear Mr. Utrup:

SUBJECT: 2019 Water Quality Monitoring Report

Hydro	FERC Project No.	NATDAM No.	License Article
Grand Rapids	**2433**	**MI00022**	**407**

In accordance with the Order Approving Water Quality Monitoring Plan under Article 407, dated April 7, 1999, Wisconsin Public Service Corporation (WPS) is submitting water quality monitoring data collected during the 2019 monitoring season at the Grand Rapids Hydroelectric project for your review and comment.

At the Grand Rapids facility, WPS is required to ensure that flow releases from the Grand Rapids Project maintain the state standards listed below except when the river flow in the Menominee River is less than the 95 percent exceedance flow or when natural conditions prohibit attainment of the standards:

(1) Monthly average temperatures downstream of the Grand Rapids Dam shall be no greater than those listed below:

January & February	38°F	August	81°F
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April	56°F	October	64°F
May	70°F	November	49°F
June	80°F	December	39°F
July	83°F		

(2) Temperature downstream of the Grand Rapids Project Dam shall not exceed 89°F at any time.
(3) DO concentrations downstream of the project powerhouse must not be less than 5.0 milligrams per liter (mg/L) at any time.
(4) Maintain pH 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.

As described in the water quality monitoring plan, monitoring was conducted upstream and downstream of the powerhouse from June 1 through September 30. A photo showing the monitoring locations can be found in Figure 1. Monitoring for DO, temperature, and pH was conducted continuously on an hourly basis using portable water quality monitoring equipment manufactured by YSI, Inc. The instrumentation was cleaned and calibrated according to manufacturer specification at least once 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.

No deviations from the dissolved oxygen, pH or temperature water quality standards were observed at the upstream or downstream monitoring locations during the 2019 monitoring season. During the monitoring season WPS did experience an equipment malfunction at the Grand Rapids upstream monitoring location. As a result of the malfunction no monitoring data was collected during the equipment deployment period of August 20 to September 3, 2019. Prior to deployment of the monitors WPS calibrates the equipment and conducts a test program to verify the equipment is calibrated and working properly. The test program on August 20 did not indicate issues with the water quality monitoring equipment. WPS contacted the equipment manufacturer to determine the cause and it was discovered that the dissolved oxygen sensor was continually resetting itself which resulted in the monitor not starting the program to log monitoring data.

Future Monitoring

Water quality monitoring at the facility is scheduled to occur in 2021, then again in 2024, and every five years thereafter for the term of the permit.

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, feel free to call me at (920) 433-1833.

Sincerely,

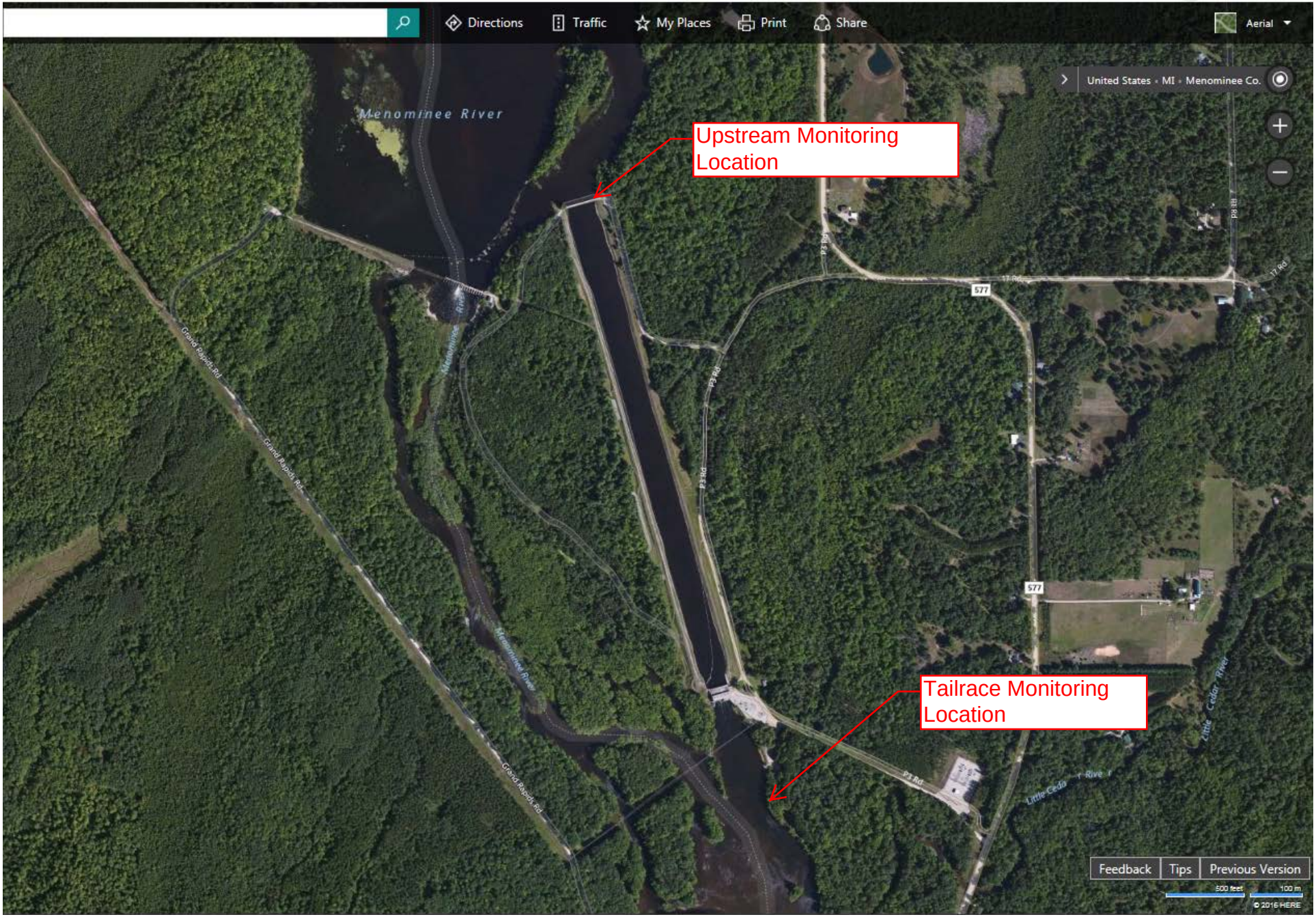
Mark Metcalf

Mark Metcalf
Principal Environmental Consultant

Enc. 2019 Water quality monitoring data (6 spreadsheets)

cc: Ms. Katie Schott
Mr. Bill Bosacki
Mr. Mike Grisar

Figure 1 - Grand Rapids Hydroelectric Project - Water Quality Monitoring Locations



Upstream Monitoring Location: Approx. 45 21'49", 87 39' 9"

Tailrace Monitoring Location: Approx. 45 21'10", 87 38' 53"

Response to Comments from the United States Fish & Wildlife Service

The US Fish & Wildlife Service did not provide comments on the 2019 water quality monitoring report.

From: Metcalf, Mark W
To: GulottyE@michigan.gov
Cc: Schott, Katie J; Bosacki, William K; Grisar, Mike L; Oun, Amira
Subject: Grand Rapids Hydroelectric Project (FERC Project No 2433) - 2019 water quality monitoring report.
Date: Thursday, October 03, 2019 9:25:33 AM
Attachments: 20191003 MDNR GRR Annual WQM Rpt.pdf
Grand Rapids Upstream DO Summary 2019.xlsx
Grand Rapids Upstream pH Summary 2019.xlsx
Grand Rapids Upstream Temp Summary 2019.xlsx
Grand Rapids Tailrace DO Summary 2019.xlsx
Grand Rapids Tailrace pH Summary 2019.xlsx
Grand Rapids Tailrace Temp Summary 2019.xlsx

Good morning Elle,

Pursuant to the water quality monitoring plan for the Wisconsin Public Service (WPS) Grand Rapids hydroelectric facility, WPS is submitting water quality monitoring data collected during the 2019 monitoring season for your review and comment.

No deviations from the water quality standards for dissolved oxygen, pH, or temperature were observed upstream or downstream of the project. The monitoring data can be found in the attached excel spreadsheets. Please review the enclosed monitoring report and data, and provide any comments you may have within 30 days.

Should you have any questions or concerns, please do not hesitate to call me at (920) 433-1833.

Mark

Mark Metcalf
Principal Environmental Consultant
920-433-1833
920-246-2717

Wisconsin Public Service Corporation
700 North Adams Street
P.O. Box 19001
Green Bay, WI 54307-9001
www.wisconsinpublicservice.com

October 3, 2019

Ms. Elle Gulotty
Michigan Department of Natural Resources
Marquette Customer Service Center
1990 US Hwy 41 South
Marquette, MI 49855

Dear Ms. Gulotty:

SUBJECT: 2019 Water Quality Monitoring Report

Hydro	FERC Project No.	NATDAM No.	License Article
Grand Rapids	**2433**	**MI00022**	**407**

In accordance with the Order Approving Water Quality Monitoring Plan under Article 407, dated April 7, 1999, Wisconsin Public Service Corporation (WPSC) is submitting water quality monitoring data collected during the 2019 monitoring season at the Grand Rapids Hydroelectric project for your review and comment.

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Future Monitoring

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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, feel free to call me at (920) 433-1833.

Sincerely,

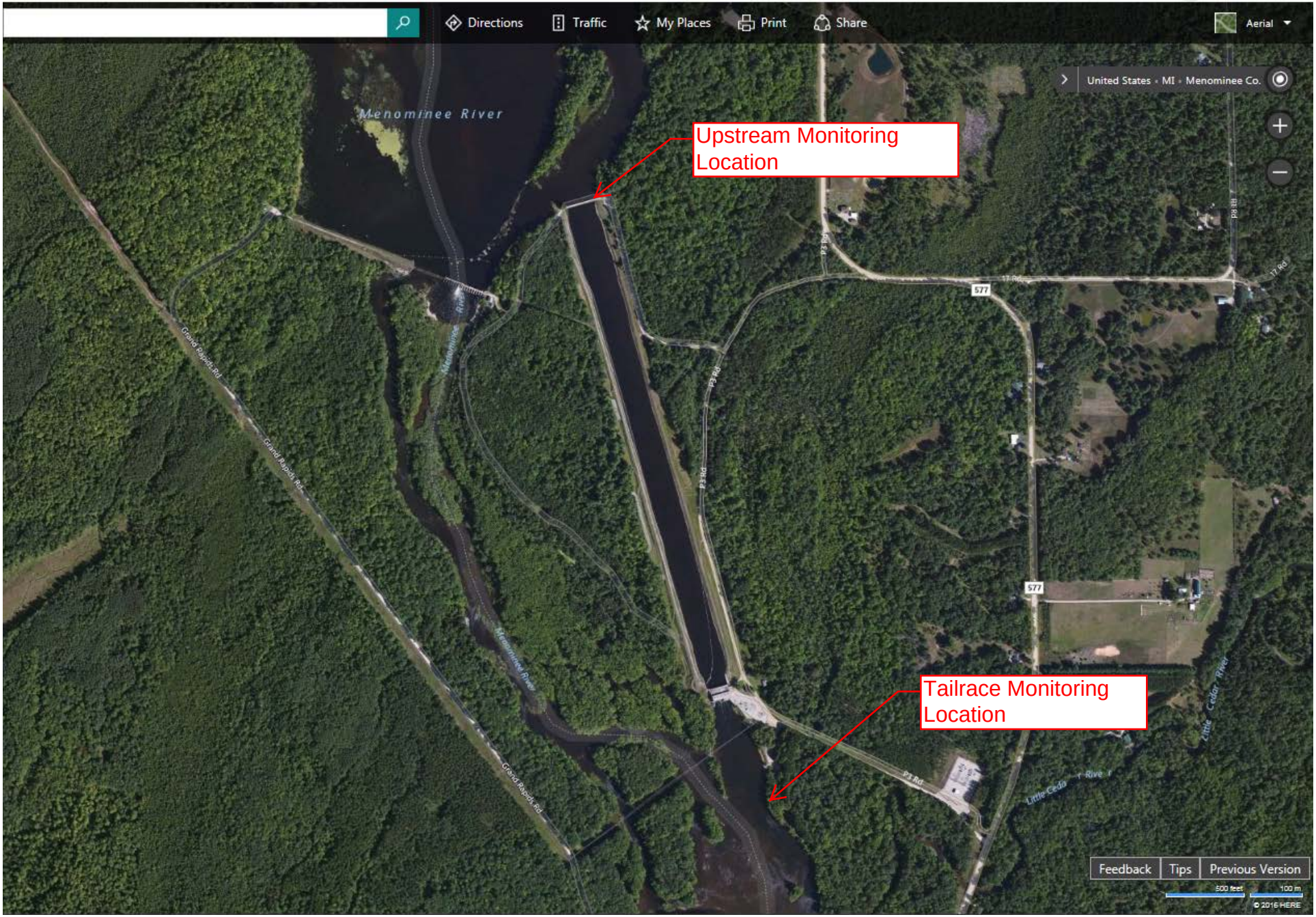
Mark Metcalf

Mark Metcalf
Principal Environmental Consultant

Enc. 2019 Water quality monitoring data (6 spreadsheets)

cc: Ms. Katie Schott
Mr. Bill Bosacki
Mr. Mike Grisar
Ms. Amira Oun

Figure 1 - Grand Rapids Hydroelectric Project - Water Quality Monitoring Locations



Upstream Monitoring Location: Approx. 45 21'49", 87 39' 9"

Tailrace Monitoring Location: Approx. 45 21'10", 87 38' 53"

From: Gulotty, Elle (DNR)
To: Metcalf, Mark W
Cc: Schott, Katie J; Bosacki, William K; Grisar, Mike L; Oun, Amira (EGLE)
Subject: RE: Grand Rapids Hydroelectric Project (FERC Project No 2433) - 2019 water quality monitoring report.
Date: Monday, October 21, 2019 2:50:54 PM

Thank you for the report Mark,

Can you take a look at the Upstream Temperature data from September 3 to September 16th after the August 20- Sept 2 malfunction was detected, and provide a little context for the difference in temperature variability? The DO recordings for the same period do not make sense to me either.

Thank you,
Elle

From: Metcalf, Mark W <mark.metcalf@wecenergygroup.com>
Sent: Thursday, October 03, 2019 10:26 AM
To: Gulotty, Elle (DNR) <GulottyE@michigan.gov>
Cc: Schott, Katie J <katie.schott@wisconsinpublicservice.com>; Bosacki, William K <william.bosacki@wisconsinpublicservice.com>; Grisar, Mike L <mike.grisar@wecenergygroup.com>; Oun, Amira (EGLE) <OunA@michigan.gov>
Subject: Grand Rapids Hydroelectric Project (FERC Project No 2433) - 2019 water quality monitoring report.

Good morning Elle,

Pursuant to the water quality monitoring plan for the Wisconsin Public Service (WPS) Grand Rapids hydroelectric facility, WPS is submitting water quality monitoring data collected during the 2019 monitoring season for your review and comment.

No deviations from the water quality standards for dissolved oxygen, pH, or temperature were observed upstream or downstream of the project. The monitoring data can be found in the attached excel spreadsheets. Please review the enclosed monitoring report and data, and provide any comments you may have within 30 days.

Should you have any questions or concerns, please do not hesitate to call me at (920) 433-1833.

Mark

Mark Metcalf
Principal Environmental Consultant
920-433-1833
920-246-2717

From: Metcalf, Mark W
To: "Gulotty, Elle (DNR)"
Cc: Schott, Katie J; Bosacki, William K; Grisar, Mike L; Oun, Amira (EGLE)
Subject: RE: Grand Rapids Hydroelectric Project (FERC Project No 2433) - 2019 water quality monitoring report.
Date: Tuesday, October 22, 2019 9:21:12 AM
Attachments: Grand Rapids Hydroelectric Project - FERC # 2433 - 2019 Water Quality Monitoring data 93 to 91719.msg
GRR Hydro June July 2019 DO Comparison.xlsx

Good morning Elle,

The monitoring data collected at the upstream monitoring location during the period of September 3 through 17, specifically the DO data, is suspicious and may not be representative of actual conditions. As part of the water quality monitoring plan, WPS calibrates the monitoring equipment and conducts a test program to verify the equipment is calibrated and working properly. The test program from September 3 did not indicate issues with the water quality monitoring equipment. When the monitoring equipment is retrieved, WPS conducts a post deployment calibration verification to determine if the monitoring equipment drifted over the deployment period. The post deployment check did not indicate the monitor had drifted or malfunctioned. However, the monitoring data recorded at the upstream monitoring location was not consistent with what would be expected based on the data recorded at the downstream monitoring location. Since the post deployment calibration verification did not reveal issues with the monitoring equipment, we cannot say for certain what may have caused the unusual readings. The temperature and pH monitoring data recorded at the upstream location during this time period were slightly erratic (although within the range of temperatures and pH values observed at the downstream monitoring location). In my experience, a buildup of weeds or debris around the monitor could cause the erratic temperature and pH readings by limiting flow past the sensors.

As shown in the monitoring data collected during the 2019 monitoring season, DO and temperature typically show diel fluctuations. When comparing the upstream and downstream DO monitoring data for June and July, the concentrations and diel variations track very closely (see the attached spreadsheet). During the period of September 3 through 17, the monitoring data collected downstream of the powerhouse did show diel fluctuations while DO data at the upstream location continued to climb slowly throughout the monitoring period. In general, when WPS has observed a DO sensor fail in the past the monitor either shuts down or we see DO concentrations drop to zero. An electrical malfunction of the monitor may have occurred, however; when sensor failures happen we typically lose data or see drastic drops in the concentration of parameter being monitored and not a steady increase in the concentration. As the pre and post deployment equipment checks did not indicate a problem with the monitoring equipment, we cannot say for certain what caused the unusual readings, however; the upstream DO monitoring data is suspicious and is likely not indicative of actual conditions.

Please let me know if you have additional questions or need additional information.

Thanks,
Mark

Mark Metcalf

Principal Environmental Consultant
920-433-1833
920-246-2717

From: Gulotty, Elle (DNR) [mailto:GulottyE@michigan.gov]
Sent: Monday, October 21, 2019 2:51 PM
To: Metcalf, Mark W
Cc: Schott, Katie J; Bosacki, William K; Grisar, Mike L; Oun, Amira (EGLE)
Subject: RE: Grand Rapids Hydroelectric Project (FERC Project No 2433) - 2019 water quality monitoring report.

Thank you for the report Mark,

Can you take a look at the Upstream Temperature data from September 3 to September 16th after the August 20- Sept 2 malfunction was detected, and provide a little context for the difference in temperature variability? The DO recordings for the same period do not make sense to me either.

Thank you,
Elle

From: Metcalf, Mark W <mark.metcalf@wecenergygroup.com>
Sent: Thursday, October 03, 2019 10:26 AM
To: Gulotty, Elle (DNR) <GulottyE@michigan.gov>
Cc: Schott, Katie J <katie.schott@wisconsinpublicservice.com>; Bosacki, William K <william.bosacki@wisconsinpublicservice.com>; Grisar, Mike L <mike.grisar@wecenergygroup.com>; Oun, Amira (EGLE) <OunA@michigan.gov>
Subject: Grand Rapids Hydroelectric Project (FERC Project No 2433) - 2019 water quality monitoring report.

Good morning Elle,

Pursuant to the water quality monitoring plan for the Wisconsin Public Service (WPS) Grand Rapids hydroelectric facility, WPS is submitting water quality monitoring data collected during the 2019 monitoring season for your review and comment.

No deviations from the water quality standards for dissolved oxygen, pH, or temperature were observed upstream or downstream of the project. The monitoring data can be found in the attached excel spreadsheets. Please review the enclosed monitoring report and data, and provide any comments you may have within 30 days.

Should you have any questions or concerns, please do not hesitate to call me at (920) 433-1833.

Mark

Mark Metcalf
Principal Environmental Consultant
920-433-1833
920-246-2717

From: Gulotty, Elle (DNR)
To: Metcalf, Mark W
Cc: Schott, Katie J; Bosacki, William K; Grisar, Mike L; Oun, Amira (EGLE)
Subject: RE: Grand Rapids Hydroelectric Project (FERC Project No 2433) - 2019 water quality monitoring report.
Date: Tuesday, October 22, 2019 9:34:44 AM

Mark,

Thank you for taking a look and making an assessment for yourself. That's in line with what I figured (recorded values do not reflect conditions on the ground). I noticed I misstated the days/dates.

My impression is that data for upstream Temp/DO are missing or unreliable from August 20 or so to September 17 or so.
Visually checking data may be a useful step in addition to the calibration verification you described.
If you haven't already done so, it may be worthwhile to retire/replace the likely-faulty logger.

Elle

From: Metcalf, Mark W <mark.metcalf@wecenergygroup.com>
Sent: Tuesday, October 22, 2019 10:21 AM
To: Gulotty, Elle (DNR) <GulottyE@michigan.gov>
Cc: Schott, Katie J <katie.schott@wisconsinpublicservice.com>; Bosacki, William K <william.bosacki@wisconsinpublicservice.com>; Grisar, Mike L <mike.grisar@wecenergygroup.com>; Oun, Amira (EGLE) <OunA@michigan.gov>
Subject: RE: Grand Rapids Hydroelectric Project (FERC Project No 2433) - 2019 water quality monitoring report.

Good morning Elle,

The monitoring data collected at the upstream monitoring location during the period of September 3 through 17, specifically the DO data, is suspicious and may not be representative of actual conditions. As part of the water quality monitoring plan, WPS calibrates the monitoring equipment and conducts a test program to verify the equipment is calibrated and working properly. The test program from September 3 did not indicate issues with the water quality monitoring equipment. When the monitoring equipment is retrieved, WPS conducts a post deployment calibration verification to determine if the monitoring equipment drifted over the deployment period. The post deployment check did not indicate the monitor had drifted or malfunctioned. However, the monitoring data recorded at the upstream monitoring location was not consistent with what would be expected based on the data recorded at the downstream monitoring location. Since the post deployment calibration verification did not reveal issues with the monitoring equipment, we cannot say for certain what may have caused the unusual readings. The temperature and pH monitoring data recorded at the upstream location during this time period were slightly erratic (although within the range of temperatures and pH values observed at the downstream monitoring location). In my

experience, a buildup of weeds or debris around the monitor could cause the erratic temperature and pH readings by limiting flow past the sensors.

As shown in the monitoring data collected during the 2019 monitoring season, DO and temperature typically show diel fluctuations. When comparing the upstream and downstream DO monitoring data for June and July, the concentrations and diel variations track very closely (see the attached spreadsheet). During the period of September 3 through 17, the monitoring data collected downstream of the powerhouse did show diel fluctuations while DO data at the upstream location continued to climb slowly throughout the monitoring period. In general, when WPS has observed a DO sensor fail in the past the monitor either shuts down or we see DO concentrations drop to zero. An electrical malfunction of the monitor may have occurred, however; when sensor failures happen we typically lose data or see drastic drops in the concentration of parameter being monitored and not a steady increase in the concentration. As the pre and post deployment equipment checks did not indicate a problem with the monitoring equipment, we cannot say for certain what caused the unusual readings, however; the upstream DO monitoring data is suspicious and is likely not indicative of actual conditions.

Please let me know if you have additional questions or need additional information.

Thanks,
Mark

Mark Metcalf
Principal Environmental Consultant
920-433-1833
920-246-2717

From: Gulotty, Elle (DNR) [mailto:GulottyE@michigan.gov]
Sent: Monday, October 21, 2019 2:51 PM
To: Metcalf, Mark W
Cc: Schott, Katie J; Bosacki, William K; Grisar, Mike L; Oun, Amira (EGLE)
Subject: RE: Grand Rapids Hydroelectric Project (FERC Project No 2433) - 2019 water quality monitoring report.

Thank you for the report Mark,

Can you take a look at the Upstream Temperature data from September 3 to September 16th after the August 20- Sept 2 malfunction was detected, and provide a little context for the difference in temperature variability? The DO recordings for the same period do not make sense to me either.

Thank you,
Elle

From: Metcalf, Mark W <mark.metcalf@wecenergygroup.com>
Sent: Thursday, October 03, 2019 10:26 AM
To: Gulotty, Elle (DNR) <GulottyE@michigan.gov>
Cc: Schott, Katie J <katie.schott@wisconsinpublicservice.com>; Bosacki, William K <william.bosacki@wisconsinpublicservice.com>; Grisar, Mike L <mike.grisar@wecenergygroup.com>; Oun, Amira (EGLE) <OunA@michigan.gov>
Subject: Grand Rapids Hydroelectric Project (FERC Project No 2433) - 2019 water quality monitoring report.

Good morning Elle,

Pursuant to the water quality monitoring plan for the Wisconsin Public Service (WPS) Grand Rapids hydroelectric facility, WPS is submitting water quality monitoring data collected during the 2019 monitoring season for your review and comment.

No deviations from the water quality standards for dissolved oxygen, pH, or temperature were observed upstream or downstream of the project. The monitoring data can be found in the attached excel spreadsheets. Please review the enclosed monitoring report and data, and provide any comments you may have within 30 days.

Should you have any questions or concerns, please do not hesitate to call me at (920) 433-1833.

Mark

Mark Metcalf
Principal Environmental Consultant
920-433-1833
920-246-2717

Response to Comments from the Michigan Department of Natural Resources

Comment: "Can you take a look at the Upstream Temperature data from September 3 to September 16th after the August 20- Sept 2 malfunction was detected, and provide a little context for the difference in temperature variability? The DO recordings for the same period do not make sense to me either."

Response: The monitoring data collected at the upstream monitoring location during the period of September 3 through 17, specifically the DO data, is suspicious and may not be representative of actual conditions. As part of the water quality monitoring plan, WPS calibrates the monitoring equipment and conducts a test program to verify the equipment is calibrated and working properly. The test program from September 3 did not indicate issues with the water quality monitoring equipment. When the monitoring equipment is retrieved, WPS conducts a post deployment calibration verification to determine if the monitoring equipment drifted over the deployment period. The post deployment check did not indicate the monitor had drifted or malfunctioned. However, the monitoring data recorded at the upstream monitoring location was not consistent with what would be expected based on the data recorded at the downstream monitoring location. Since the post deployment calibration verification did not reveal issues with the monitoring equipment, we cannot say for certain what may have caused the unusual readings. The temperature and pH monitoring data recorded at the upstream location during this time period were slightly erratic (although within the range of temperatures and pH values observed at the downstream monitoring location). In my experience, a buildup of weeds or debris around the monitor could cause the erratic temperature and pH readings by limiting flow past the sensors.

As shown in the monitoring data collected during the 2019 monitoring season, DO and temperature typically show diel fluctuations. When comparing the upstream and downstream DO monitoring data for June and July, the concentrations and diel variations track very closely (see the attached spreadsheet). During the period of September 3 through 17, the monitoring data collected downstream of the powerhouse did show diel fluctuations while DO data at the upstream location continued to climb slowly throughout the monitoring period. In general, when WPS has observed a DO sensor fail in the past the monitor either shuts down or we see DO concentrations drop to zero. An electrical malfunction of the monitor may have occurred, however; when sensor failures happen we typically lose data or see drastic drops in the concentration of parameter being monitored and not a steady increase in the concentration. As the pre and post deployment equipment checks did not indicate a problem with the monitoring equipment, we cannot say for certain what caused the unusual readings, however; the upstream DO monitoring data is suspicious and is likely not indicative of actual conditions.

Comment: "Thank you for taking a look and making an assessment for yourself. That's in line with what I figured (recorded values do not reflect conditions on the ground). I noticed I misstated the days/dates.

My impression is that data for upstream Temp/DO are missing or unreliable from August 20 or so to September 17 or so.
Visually checking data may be a useful step in addition to the calibration verification you described. If you haven't already done so, it may be worthwhile to retire/replace the likely-faulty logger."

Response: Comment Noted. For each monitoring location, WPS has two separate water quality monitors. While one monitor is deployed, the second monitor is maintained and calibrated prior to use in the field. The monitor deployed between August 20 and September 3 experienced a DO sensor failure and the monitor was removed from service for the remainder of the year. The second monitor, which was deployed from September 3 through September 17, was not utilized after the deployment period and is scheduled to have the DO sensor replaced prior to the next monitoring season.

Document Content(s)