



1414 West Hamilton Avenue
PO Box 8
Eau Claire, WI 54702-0008

January 28, 2022

VIA Electronic Filing

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

**Subject: 2021 Water Quality Monitoring Report – Articles 404 & 406
Big Falls Hydro (P-2390-01) and Thornapple Hydro (P-2475)**

Dear Secretary:

Enclosed is the 2021 Water Quality Monitoring Report for the Big Falls and Thornapple hydroelectric projects. The report is being filed pursuant to license articles 404 (Big Falls) and 406 (Thornapple). The results, summarized for the past five years, depict normal variability among the various parameters sampled. Northern States Power Company – Wisconsin (NSPW), licensee for the projects, has also confirmed that the water quality monitoring results for Turtle Flambeau Reservoir (P-2390-02) have been posted on the WDNR's website.

Licensee provided a copy of the report to the WDNR and USFWS for comment via e-mail on December 17, 2021. The WDNR did not provide comments. The USFWS responded that they had no comments. Documentation of agency correspondence is included in Appendix D of the enclosed report.

Should you have any questions, feel free to contact Matthew Miller at (715) 737-1353 or by e-mail at matthew.j.miller@xcelenergy.com.

Sincerely,

**Scott
Crotty**

Digitally signed by
Scott Crotty
Date: 2022.01.28
12:00:36 -06'00'

Scott Crotty
Senior Operations Manager

Enclosure: Water Quality Monitoring Report

c: Cheryl Laatsch – WDNR (cover letter only – via e-mail)
Darin Simpkins – USFWS (cover letter only – via e-mail)
Project Files

2021 Water Quality Monitoring Report for Big Falls Flowage (P-2390-01) and Thornapple Flowage (P-2475)

Northern States Power Company – WI
An Xcel Energy Company

December 2021

APPENDIX A

2021 Water Quality Lab Analysis For Big Falls and Thornapple Flowages



Minneapolis Testing Laboratory
 1518 Chestnut Ave N
 Minneapolis, MN 55043
 Certification # MN-027-053-197
 WI-999071150

Christine Keefe, Manager (612) 630-4506

Big Falls Hydro	Project Name/Location: Phosphorus	
1400 Western Ave		Reported:
Eau Claire WI, 54701	Project Manager: Matt J Miller	05/06/2021 09:29

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Sample Qualifier	Laboratory ID	Matrix	Sampled	Received
[REDACTED]		MGE0003-01	Water	[REDACTED] 11:07	05/03/2021 6:30
[REDACTED]		MGE0003-02	Water	[REDACTED] 11:13	05/03/2021 6:30



Minneapolis Testing Laboratory
 1518 Chestnut Ave N
 Minneapolis, MN 55043
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 WI-999071150
 Christine Keefe, Manager (612) 630-4506

Big Falls Hydro	Project Name/Location: Phosphorus	
1400 Western Ave		Reported:
Eau Claire WI, 54701	Project Manager: Matt J Miller	09:29

MGE0003-01 (Water) - Chain of Custody Number: 249477

Analyte	Result	LOD	LOQ	Units	Analyte Qualifier	Dilution	Batch	Prepared	Analyzed	Method	Analyst
		0.00200	0.00667	mg/L		1	BGE0014	5/3/21 10:38	5/4/21 13:24	EPA 365.1	HRD

Wet Chemistry



Minneapolis Testing Laboratory
 1518 Chestnut Ave N
 Minneapolis, MN 55043
 Certification # MN-027-053-197
 WI-999071150
 Christine Keefe, Manager (612) 630-4506

Big Falls Hydro	Project Name/Location: Phosphorus	
1400 Western Ave		Reported:
Eau Claire WI, 54701	Project Manager: Matt J Miller	09:29

MGE0003-02 (Water) - Chain of Custody Number: 249477

Analyte	Result	LOD	LOQ	Units	Analyte Qualifier	Dilution	Batch	Prepared	Analyzed	Method	Analyst
		0.00200	0.00667	mg/L		1	BGE0014	5/3/21 10:38	5/4/21 13:25	EPA 365.1	HRD

Wet Chemistry



Minneapolis Testing Laboratory
 1518 Chestnut Ave N
 Minneapolis, MN 55043
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 WI-999071150

Christine Keefe, Manager (612) 630-4506

Big Falls Hydro	Project Name/Location: Phosphorus	
1400 Western Ave		Reported:
Eau Claire WI, 54701	Project Manager: Matt J Miller	05/06/2021 09:29

Wet Chemistry - Quality Control

Analyte	Result	LOD	LOQ	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
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Batch BGE0014 - Wet Prep

Blank (BGE0014-BLK1)					Prepared: 05/03/2021 Analyzed: 05/04/2021						
Phosphate, Total as P	<0.00200	0.00200	0.0066666	mg/L							
LCS (BGE0014-BS1)					Prepared: 05/03/2021 Analyzed: 05/04/2021						
Phosphate, Total as P	0.54000	0.00200	0.0066666	mg/L	0.49700		109	90-110			
Duplicate (BGE0014-DUP1)					Source: MGD0172-03 Prepared: 05/03/2021 Analyzed: 05/04/2021						
Phosphate, Total as P	0.092000	0.00200	0.0066666	mg/L		0.092000			0.00	20	
Duplicate (BGE0014-DUP2)					Source: MGD0198-03 Prepared: 05/03/2021 Analyzed: 05/04/2021						
Phosphate, Total as P	0.076000	0.00200	0.0066666	mg/L		0.076000			0.00	20	
Matrix Spike (BGE0014-MS1)					Source: MGD0172-03 Prepared: 05/03/2021 Analyzed: 05/04/2021						
Phosphate, Total as P	0.63600	0.00200	0.0066666	mg/L	0.49700	0.092000	109	90-110			
Matrix Spike (BGE0014-MS2)					Source: MGD0198-03 Prepared: 05/03/2021 Analyzed: 05/04/2021						
Phosphate, Total as P	0.60800	0.00200	0.0066666	mg/L	0.49700	0.076000	107	90-110			
Matrix Spike Dup (BGE0014-MSD1)					Source: MGD0172-03 Prepared: 05/03/2021 Analyzed: 05/04/2021						
Phosphate, Total as P	0.63900	0.00200	0.0066666	mg/L	0.49700	0.092000	110	90-110	0.471	20	
Matrix Spike Dup (BGE0014-MSD2)					Source: MGD0198-03 Prepared: 05/03/2021 Analyzed: 05/04/2021						
Phosphate, Total as P	0.62500	0.00200	0.0066666	mg/L	0.49700	0.076000	110	90-110	2.76	20	



Minneapolis Testing Laboratory
 1518 Chestnut Ave N
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 Christine Keefe, Manager (612) 630-4506

Thornapple Hydro	Project Name/Location: Phosphorus	
W 5506 Dam Road		Reported:
Glen Flora WI, 54563	Project Manager: Matt J Miller	05/06/2021 09:31

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Sample Qualifier	Laboratory ID	Matrix	Sampled	Received
[REDACTED]		MGE0004-01	Water	[REDACTED] 13:00	05/03/2021 6:30
[REDACTED]		MGE0004-02	Water	[REDACTED] 13:08	05/03/2021 6:30



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Thornapple Hydro	Project Name/Location: Phosphorus	
W 5506 Dam Road		Reported:
Glen Flora WI, 54563	Project Manager: Matt J Miller	09:31

MGE0004-01 (Water) - Chain of Custody Number: 249477

Analyte	Result	LOD	LOQ	Units	Analyte Qualifier	Dilution	Batch	Prepared	Analyzed	Method	Analyst
		0.00200	0.00667	mg/L		1	BGE0014	5/3/21 10:38	5/4/21 13:26	EPA 365.1	HRD

Wet Chemistry



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Thornapple Hydro	Project Name/Location: Phosphorus	
W 5506 Dam Road		Reported:
Glen Flora WI, 54563	Project Manager: Matt J Miller	09:31

MGE0004-02 (Water) - Chain of Custody Number: 249477

Analyte	Result	LOD	LOQ	Units	Analyte Qualifier	Dilution	Batch	Prepared	Analyzed	Method	Analyst
		0.00200	0.00667	mg/L		1	BGE0014	5/3/21 10:38	5/4/21 13:27	EPA 365.1	HRD

Wet Chemistry



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Christine Keefe, Manager (612) 630-4506

Thornapple Hydro	Project Name/Location: Phosphorus	
W 5506 Dam Road		Reported:
Glen Flora WI, 54563	Project Manager: Matt J Miller	05/06/2021 09:31

Wet Chemistry - Quality Control

Analyte	Result	LOD	LOQ	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
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Batch BGE0014 - Wet Prep

Blank (BGE0014-BLK1)					Prepared: 05/03/2021 Analyzed: 05/04/2021						
Phosphate, Total as P	<0.00200	0.00200	0.0066666	mg/L							
LCS (BGE0014-BS1)					Prepared: 05/03/2021 Analyzed: 05/04/2021						
Phosphate, Total as P	0.54000	0.00200	0.0066666	mg/L	0.49700		109	90-110			
Duplicate (BGE0014-DUP1)					Source: MGD0172-03 Prepared: 05/03/2021 Analyzed: 05/04/2021						
Phosphate, Total as P	0.092000	0.00200	0.0066666	mg/L		0.092000			0.00	20	
Duplicate (BGE0014-DUP2)					Source: MGD0198-03 Prepared: 05/03/2021 Analyzed: 05/04/2021						
Phosphate, Total as P	0.076000	0.00200	0.0066666	mg/L		0.076000			0.00	20	
Matrix Spike (BGE0014-MS1)					Source: MGD0172-03 Prepared: 05/03/2021 Analyzed: 05/04/2021						
Phosphate, Total as P	0.63600	0.00200	0.0066666	mg/L	0.49700	0.092000	109	90-110			
Matrix Spike (BGE0014-MS2)					Source: MGD0198-03 Prepared: 05/03/2021 Analyzed: 05/04/2021						
Phosphate, Total as P	0.60800	0.00200	0.0066666	mg/L	0.49700	0.076000	107	90-110			
Matrix Spike Dup (BGE0014-MSD1)					Source: MGD0172-03 Prepared: 05/03/2021 Analyzed: 05/04/2021						
Phosphate, Total as P	0.63900	0.00200	0.0066666	mg/L	0.49700	0.092000	110	90-110	0.471	20	
Matrix Spike Dup (BGE0014-MSD2)					Source: MGD0198-03 Prepared: 05/03/2021 Analyzed: 05/04/2021						
Phosphate, Total as P	0.62500	0.00200	0.0066666	mg/L	0.49700	0.076000	110	90-110	2.76	20	

NORTHERN LAKE SERVICE, INC.
 Analytical Laboratory and Environmental Services
 400 North Lake Avenue - Crandon, WI 54520
 Ph: (715)-478-2777 Fax: (715)-478-3060

ANALYTICAL REPORT

WDNR Laboratory ID No. 721026460
 WDATCP Laboratory Certification No. 105-330
 EPA Laboratory ID No. WI00034

Printed: 05/17/21 Page 1 of 1

Client: Xcel Energy
 Attn: Matt Miller (reports)
 1414 W. Hamilton Ave
 P.O. Box 8
 Eau Claire, WI 54702

NLS Project: 365297
 NLS Customer: 96708
 Phone: 715 737 1353

Project: Big Falls - Thornapple

Big Falls Flowage NLS ID: 1251512

COC: 247750:1 Matrix: SW
 Collected: 04/28/21 11:07 Received: 04/30/21

Parameter	Result	Units	Dilution	LOD	LOQ	Analyzed	Method	Lab
Chlorophyll, all species	See Attached					05/14/21	10200-H	721026460
Lab filtration for Chlorophyll	yes					05/02/21	NA	721026460

Thornapple Floeage NLS ID: 1251513

COC: 247750:2 Matrix: SW
 Collected: 04/28/21 13:00 Received: 04/30/21

Parameter	Result	Units	Dilution	LOD	LOQ	Analyzed	Method	Lab
Chlorophyll, all species	See Attached					05/14/21	10200-H	721026460
Lab filtration for Chlorophyll	yes					05/02/21	NA	721026460

Values in brackets represent results greater than or equal to the LOD but less than the LOQ and are within a region of "Less-Certain Quantitation". Results greater than or equal to the LOQ are considered to be in the region of "Certain Quantitation". LOD and/or LOQ tagged with an asterisk(*) are considered Reporting Limits. All LOD/LOQs adjusted to reflect dilution and/or solids content.

ND = Not Detected (< LOD) LOD = Limit of Detection LOQ = Limit of Quantitation NA = Not Applicable
 DWB = Dry Weight Basis %DWB = (mg/kg DWB) / 10000 1000 ug/L = 1 mg/L
 MCL = Maximum Contaminant Levels for Drinking Water Samples. Shaded results indicate >MCL.

Reviewed by:



Authorized by:
 R. T. Krueger
 President

Customer: Xcel Energy**Project:** 365297

Big Falls - Thornapple

<u>Sample</u>	<u>Description</u>	<u>CC a</u>	<u>Pheo a</u>	<u>TC a</u>	<u>TC b</u>	<u>TC c</u>
1251512	Big Falls Flowage	0.77	0.69	1.2	0.5	0.6
1251513	Thornapple Floeage	0.65	0.89	1.2	0.057	0.28

CC a = Corrected Chlorophyll a

Pheo a = Pheophytin a

TC a = Trichromatic Chlorophyll a

TC b = Trichromatic Chlorophyll b

TC c = Trichromatic Chlorophyll c

Units = ug/L for Water, ug/cm² for periphyton samplers

*: The complex calculations used to differentiate the various chlorophyll species magnify error at low concentrations and sometimes produce negative values, which are reported as 0.0 on this report.



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Christine Keefe, Manager (612) 630-4506

Big Falls Hydro	Project Name/Location: Phosphorus	
1400 Western Ave		Reported:
Eau Claire WI, 54701	Project Manager: Matt J Miller	08/09/2021 06:34

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Sample Qualifier	Laboratory ID	Matrix	Sampled	Received
[REDACTED]		MGG0212-01	Water	[REDACTED] 9:26	07/23/2021 11:06
[REDACTED]		MGG0212-02	Water	[REDACTED] 9:35	07/23/2021 11:06



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 WI-999071150
 Christine Keefe, Manager (612) 630-4506

Big Falls Hydro	Project Name/Location: Phosphorus	
1400 Western Ave		Reported:
Eau Claire WI, 54701	Project Manager: Matt J Miller	06:34

MGG0212-01 (Water) - Chain of Custody Number: 249476

Analyte	Result	LOD	LOQ	Units	Analyte Qualifier	Dilution	Batch	Prepared	Analyzed	Method	Analyst
		0.00200	0.00667	mg/L		1	BGH0018	8/2/21 12:38	8/3/21 10:56	EPA 365.1	HRD

Wet Chemistry



Minneapolis Testing Laboratory
 1518 Chestnut Ave N
 Minneapolis, MN 55043
 Certification # MN-027-053-197
 WI-999071150
 Christine Keefe, Manager (612) 630-4506

Big Falls Hydro	Project Name/Location: Phosphorus	
1400 Western Ave		Reported:
Eau Claire WI, 54701	Project Manager: Matt J Miller	06:34

MGG0212-02 (Water) - Chain of Custody Number: 249476

Analyte	Result	LOD	LOQ	Units	Analyte		Batch	Prepared	Analyzed	Method	Analyst
					Qualifier	Dilution					
		0.00200	0.00667	mg/L		1	BGH0018	8/2/21 12:38	8/3/21 10:57	EPA 365.1	HRD

Wet Chemistry



Minneapolis Testing Laboratory
 1518 Chestnut Ave N
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 Certification # MN-027-053-197
 WI-999071150

Christine Keefe, Manager (612) 630-4506

Big Falls Hydro	Project Name/Location: Phosphorus	
1400 Western Ave		Reported:
Eau Claire WI, 54701	Project Manager: Matt J Miller	08/09/2021 06:34

Wet Chemistry - Quality Control

Analyte	Result	LOD	LOQ	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
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Batch BGH0018 - Wet Prep

Blank (BGH0018-BLK1)					Prepared: 08/02/2021 Analyzed: 08/03/2021						
Phosphate, Total as P	<0.00200	0.00200	0.0066666	mg/L							
LCS (BGH0018-BS1)					Prepared: 08/02/2021 Analyzed: 08/03/2021						
Phosphate, Total as P	0.52300	0.00200	0.0066666	mg/L	0.49700		105	90-110			
Duplicate (BGH0018-DUP1)					Source: MGG0229-03 Prepared: 08/02/2021 Analyzed: 08/03/2021						
Phosphate, Total as P	0.20800	0.00200	0.0066666	mg/L		0.20900			0.480	20	
Duplicate (BGH0018-DUP2)					Source: MGG0229-04 Prepared: 08/02/2021 Analyzed: 08/03/2021						
Phosphate, Total as P	0.035000	0.00200	0.0066666	mg/L		0.035000			0.00	20	
Matrix Spike (BGH0018-MS1)					Source: MGG0229-03 Prepared: 08/02/2021 Analyzed: 08/03/2021						
Phosphate, Total as P	0.72000	0.00200	0.0066666	mg/L	0.49700	0.20900	103	90-110			
Matrix Spike (BGH0018-MS2)					Source: MGG0229-04 Prepared: 08/02/2021 Analyzed: 08/03/2021						
Phosphate, Total as P	0.55400	0.00200	0.0066666	mg/L	0.49700	0.035000	104	90-110			
Matrix Spike Dup (BGH0018-MSD1)					Source: MGG0229-03 Prepared: 08/02/2021 Analyzed: 08/03/2021						
Phosphate, Total as P	0.73200	0.00200	0.0066666	mg/L	0.49700	0.20900	105	90-110	1.65	20	
Matrix Spike Dup (BGH0018-MSD2)					Source: MGG0229-04 Prepared: 08/02/2021 Analyzed: 08/03/2021						
Phosphate, Total as P	0.55500	0.00200	0.0066666	mg/L	0.49700	0.035000	105	90-110	0.180	20	



Minneapolis Testing Laboratory
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 Minneapolis, MN 55043
 Certification # MN-027-053-197
 WI-999071150
 Christine Keefe, Manager (612) 630-4506

Thornapple Hydro	Project Name/Location: Phosphorus	
W 5506 Dam Road		Reported:
Glen Flora WI, 54563	Project Manager: Matt J Miller	08/09/2021 06:36

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Sample Qualifier	Laboratory ID	Matrix	Sampled	Received
[REDACTED]		MGG0211-01	Water	[REDACTED] 11:17	07/23/2021 11:06
[REDACTED]		MGG0211-02	Water	[REDACTED] 11:23	07/23/2021 11:06



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 WI-999071150
 Christine Keefe, Manager (612) 630-4506

Thornapple Hydro	Project Name/Location: Phosphorus	
W 5506 Dam Road		Reported:
Glen Flora WI, 54563	Project Manager: Matt J Miller	06:36

MGG0211-01 (Water) - Chain of Custody Number: 249476

Analyte	Result	LOD	LOQ	Units	Analyte Qualifier	Dilution	Batch	Prepared	Analyzed	Method	Analyst
		0.00200	0.00667	mg/L		1	BGH0018	8/2/21 12:38	8/3/21 10:52	EPA 365.1	HRD

Wet Chemistry



Minneapolis Testing Laboratory
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 Certification # MN-027-053-197
 WI-999071150
 Christine Keefe, Manager (612) 630-4506

Thornapple Hydro	Project Name/Location: Phosphorus	
W 5506 Dam Road		Reported:
Glen Flora WI, 54563	Project Manager: Matt J Miller	06:36

MGG0211-02 (Water) - Chain of Custody Number: 249476

Analyte	Result	LOD	LOQ	Units	Analyte Qualifier	Dilution	Batch	Prepared	Analyzed	Method	Analyst
		0.00200	0.00667	mg/L		1	BGH0018	8/2/21 12:38	8/3/21 10:55	EPA 365.1	HRD

Wet Chemistry



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WI-999071150

Christine Keefe, Manager (612) 630-4506

Thornapple Hydro	Project Name/Location: Phosphorus	
W 5506 Dam Road		Reported:
Glen Flora WI, 54563	Project Manager: Matt J Miller	08/09/2021 06:36

Wet Chemistry - Quality Control

Analyte	Result	LOD	LOQ	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
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Batch BGH0018 - Wet Prep

Blank (BGH0018-BLK1)					Prepared: 08/02/2021 Analyzed: 08/03/2021						
Phosphate, Total as P	<0.00200	0.00200	0.0066666	mg/L							
LCS (BGH0018-BS1)					Prepared: 08/02/2021 Analyzed: 08/03/2021						
Phosphate, Total as P	0.52300	0.00200	0.0066666	mg/L	0.49700		105	90-110			
Duplicate (BGH0018-DUP1)					Source: MGG0229-03 Prepared: 08/02/2021 Analyzed: 08/03/2021						
Phosphate, Total as P	0.20800	0.00200	0.0066666	mg/L		0.20900			0.480	20	
Duplicate (BGH0018-DUP2)					Source: MGG0229-04 Prepared: 08/02/2021 Analyzed: 08/03/2021						
Phosphate, Total as P	0.035000	0.00200	0.0066666	mg/L		0.035000			0.00	20	
Matrix Spike (BGH0018-MS1)					Source: MGG0229-03 Prepared: 08/02/2021 Analyzed: 08/03/2021						
Phosphate, Total as P	0.72000	0.00200	0.0066666	mg/L	0.49700	0.20900	103	90-110			
Matrix Spike (BGH0018-MS2)					Source: MGG0229-04 Prepared: 08/02/2021 Analyzed: 08/03/2021						
Phosphate, Total as P	0.55400	0.00200	0.0066666	mg/L	0.49700	0.035000	104	90-110			
Matrix Spike Dup (BGH0018-MSD1)					Source: MGG0229-03 Prepared: 08/02/2021 Analyzed: 08/03/2021						
Phosphate, Total as P	0.73200	0.00200	0.0066666	mg/L	0.49700	0.20900	105	90-110	1.65	20	
Matrix Spike Dup (BGH0018-MSD2)					Source: MGG0229-04 Prepared: 08/02/2021 Analyzed: 08/03/2021						
Phosphate, Total as P	0.55500	0.00200	0.0066666	mg/L	0.49700	0.035000	105	90-110	0.180	20	

NORTHERN LAKE SERVICE, INC.
 Analytical Laboratory and Environmental Services
 400 North Lake Avenue - Crandon, WI 54520
 Ph: (715)-478-2777 Fax: (715)-478-3060

ANALYTICAL REPORT

WDNR Laboratory ID No. 721026460
 WDATCP Laboratory Certification No. 105-330
 EPA Laboratory ID No. WI00034

Printed: 08/02/21 Page 1 of 1

Client: Xcel Energy
 Attn: Matt Miller (reports)
 1414 W. Hamilton Ave
 P.O. Box 8
 Eau Claire, WI 54702

NLS Project: 369965
NLS Customer: 96708
Phone: 715 737 1353

Project: Big Falls-Thornapple

Big Falls Flowage NLS ID: 1267096

COC: 256395:1 Matrix: SW
 Collected: 07/21/21 09:26 Received: 07/23/21

Parameter	Result	Units	Dilution	LOD	LOQ	Analyzed	Method	Lab
Chlorophyll, all species	See Attached					07/30/21	10200-H	721026460
Lab filtration for Chlorophyll	yes					07/27/21	NA	721026460

Thornapple Flowage NLS ID: 1267097

COC: 256395:2 Matrix: SW
 Collected: 07/21/21 11:17 Received: 07/23/21

Parameter	Result	Units	Dilution	LOD	LOQ	Analyzed	Method	Lab
Chlorophyll, all species	See Attached					07/30/21	10200-H	721026460
Lab filtration for Chlorophyll	yes					07/27/21	NA	721026460

Values in brackets represent results greater than or equal to the LOD but less than the LOQ and are within a region of "Less-Certain Quantitation". Results greater than or equal to the LOQ are considered to be in the region of "Certain Quantitation". LOD and/or LOQ tagged with an asterisk(*) are considered Reporting Limits. All LOD/LOQs adjusted to reflect dilution and/or solids content.

ND = Not Detected (< LOD) LOD = Limit of Detection LOQ = Limit of Quantitation NA = Not Applicable
 DWB = Dry Weight Basis %DWB = (mg/kg DWB) / 10000 1000 ug/L = 1 mg/L
 MCL = Maximum Contaminant Levels for Drinking Water Samples. Shaded results indicate >MCL.

Reviewed by:



Authorized by:
 R. T. Krueger
 President

Customer: Xcel Energy**Project:** 369965

Big Falls-Thornapple

<u>Sample</u>	<u>Description</u>	<u>CC a</u>	<u>Pheo a</u>	<u>TC a</u>	<u>TC b</u>	<u>TC c</u>
1267096	Big Falls Flowage	4.7	2.6	6.5	0.0*	0.45
1267097	Thornapple Flowage	1.9	0.77	2.5	0.0052	0.13

CC a = Corrected Chlorophyll a

Pheo a = Pheophytin a

TC a = Trichromatic Chlorophyll a

TC b = Trichromatic Chlorophyll b

TC c = Trichromatic Chlorophyll c

Units = ug/L for Water, ug/cm² for periphyton samplers

*: The complex calculations used to differentiate the various chlorophyll species magnify error at low concentrations and sometimes produce negative values, which are reported as 0.0 on this report.



Minneapolis Testing Laboratory
 1518 Chestnut Ave N
 Minneapolis, MN 55043
 Certification # MN-027-053-197
 WI-999071150
 Christine Keefe, Manager (612) 630-4506

Big Falls Hydro	Project Name/Location: Phosphorus	
1400 Western Ave		Reported:
Eau Claire WI, 54701	Project Manager: Matt J Miller	09/22/2021 10:02

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Sample Qualifier	Laboratory ID	Matrix	Sampled	Received
[REDACTED]		MGH0257-01	Water	[REDACTED] 9:07	08/30/2021 6:15
[REDACTED]		MGH0257-02	Water	[REDACTED] 9:17	08/30/2021 6:15



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 1518 Chestnut Ave N
 Minneapolis, MN 55043
 Certification # MN-027-053-197
 WI-999071150
 Christine Keefe, Manager (612) 630-4506

Big Falls Hydro	Project Name/Location: Phosphorus	
1400 Western Ave		Reported:
Eau Claire WI, 54701	Project Manager: Matt J Miller	10:02

MGH0257-01 (Water) - Chain of Custody Number: 275727

Analyte	Result	LOD	LOQ	Units	Analyte		Batch	Prepared	Analyzed	Method	Analyst
					Qualifier	Dilution					
		0.00200	0.00667	mg/L		1	BGI0090	9/21/21 9:00	9/21/21 15:54	EPA 365.1	HRD

Wet Chemistry



Minneapolis Testing Laboratory
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 Minneapolis, MN 55043
 Certification # MN-027-053-197
 WI-999071150
 Christine Keefe, Manager (612) 630-4506

Big Falls Hydro	Project Name/Location: Phosphorus	
1400 Western Ave		Reported:
Eau Claire WI, 54701	Project Manager: Matt J Miller	10:02

MGH0257-02 (Water) - Chain of Custody Number: 275727

Analyte	Result	LOD	LOQ	Units	Analyte Qualifier	Dilution	Batch	Prepared	Analyzed	Method	Analyst
		0.00200	0.00667	mg/L		1	BGI0090	9/21/21 9:00	9/21/21 15:57	EPA 365.1	HRD

Wet Chemistry



Minneapolis Testing Laboratory
 1518 Chestnut Ave N
 Minneapolis, MN 55043
 Certification # MN-027-053-197
 WI-999071150

Christine Keefe, Manager (612) 630-4506

Big Falls Hydro	Project Name/Location: Phosphorus	
1400 Western Ave		Reported:
Eau Claire WI, 54701	Project Manager: Matt J Miller	09/22/2021 10:02

Wet Chemistry - Quality Control

Analyte	Result	LOD	LOQ	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
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Batch BGI0090 - Wet Prep

Blank (BGI0090-BLK1)					Prepared & Analyzed: 09/21/2021						
Phosphate, Total as P	<0.00200	0.00200	0.0066666	mg/L							
LCS (BGI0090-BS1)					Prepared & Analyzed: 09/21/2021						
Phosphate, Total as P	0.49900	0.00200	0.0066666	mg/L	0.49700		100	90-110			
Duplicate (BGI0090-DUP1)					Source: MGI0074-03 Prepared & Analyzed: 09/21/2021						
Phosphate, Total as P	0.17300	0.00200	0.0066666	mg/L		0.17000			1.75	20	
Duplicate (BGI0090-DUP2)					Source: MGI0074-04 Prepared & Analyzed: 09/21/2021						
Phosphate, Total as P	0.032000	0.00200	0.0066666	mg/L		0.031000			3.17	20	
Matrix Spike (BGI0090-MS1)					Source: MGI0074-03 Prepared & Analyzed: 09/21/2021						
Phosphate, Total as P	0.66900	0.00200	0.0066666	mg/L	0.49700	0.17000	100	90-110			
Matrix Spike (BGI0090-MS2)					Source: MGI0074-04 Prepared & Analyzed: 09/21/2021						
Phosphate, Total as P	0.53900	0.00200	0.0066666	mg/L	0.49700	0.031000	102	90-110			
Matrix Spike Dup (BGI0090-MSD1)					Source: MGI0074-03 Prepared & Analyzed: 09/21/2021						
Phosphate, Total as P	0.67600	0.00200	0.0066666	mg/L	0.49700	0.17000	102	90-110	1.04	20	
Matrix Spike Dup (BGI0090-MSD2)					Source: MGI0074-04 Prepared & Analyzed: 09/21/2021						
Phosphate, Total as P	0.53800	0.00200	0.0066666	mg/L	0.49700	0.031000	102	90-110	0.186	20	



Minneapolis Testing Laboratory
 1518 Chestnut Ave N
 Minneapolis, MN 55043
 Certification # MN-027-053-197
 WI-999071150
 Christine Keefe, Manager (612) 630-4506

Thornapple Hydro	Project Name/Location: Phosphorus	
W 5506 Dam Road		Reported:
Glen Flora WI, 54563	Project Manager: Matt J Miller	09/22/2021 10:09

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Sample Qualifier	Laboratory ID	Matrix	Sampled	Received
[REDACTED]		MGH0258-01	Water	[REDACTED] 11:05	08/30/2021 6:15
[REDACTED]		MGH0258-02	Water	[REDACTED] 11:10	08/30/2021 6:15



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 Certification # MN-027-053-197
 WI-999071150
 Christine Keefe, Manager (612) 630-4506

Thornapple Hydro	Project Name/Location: Phosphorus	
W 5506 Dam Road		Reported:
Glen Flora WI, 54563	Project Manager: Matt J Miller	10:09

MGH0258-01 (Water) - Chain of Custody Number: 275727

Analyte	Result	LOD	LOQ	Units	Analyte Qualifier	Dilution	Batch	Prepared	Analyzed	Method	Analyst
		0.00200	0.00667	mg/L		1	BGI0090	9/21/21 9:00	9/21/21 15:58	EPA 365.1	HRD

Wet Chemistry



Minneapolis Testing Laboratory
 1518 Chestnut Ave N
 Minneapolis, MN 55043
 Certification # MN-027-053-197
 WI-999071150
 Christine Keefe, Manager (612) 630-4506

Thornapple Hydro	Project Name/Location: Phosphorus	
W 5506 Dam Road		Reported:
Glen Flora WI, 54563	Project Manager: Matt J Miller	10:09

MGH0258-02 (Water) - Chain of Custody Number: 275727

Analyte	Result	LOD	LOQ	Units	Analyte Qualifier	Dilution	Batch	Prepared	Analyzed	Method	Analyst
		0.00200	0.00667	mg/L		1	BGI0090	9/21/21 9:00	9/21/21 15:59	EPA 365.1	HRD

Wet Chemistry



Minneapolis Testing Laboratory
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 Certification # MN-027-053-197
 WI-999071150

Christine Keefe, Manager (612) 630-4506

Thornapple Hydro	Project Name/Location: Phosphorus	
W 5506 Dam Road		Reported:
Glen Flora WI, 54563	Project Manager: Matt J Miller	09/22/2021 10:09

Wet Chemistry - Quality Control

Analyte	Result	LOD	LOQ	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
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Batch BGI0090 - Wet Prep

Blank (BGI0090-BLK1)					Prepared & Analyzed: 09/21/2021						
Phosphate, Total as P	<0.00200	0.00200	0.0066666	mg/L							
LCS (BGI0090-BS1)					Prepared & Analyzed: 09/21/2021						
Phosphate, Total as P	0.49900	0.00200	0.0066666	mg/L	0.49700		100	90-110			
Duplicate (BGI0090-DUP1)					Source: MGI0074-03 Prepared & Analyzed: 09/21/2021						
Phosphate, Total as P	0.17300	0.00200	0.0066666	mg/L		0.17000			1.75	20	
Duplicate (BGI0090-DUP2)					Source: MGI0074-04 Prepared & Analyzed: 09/21/2021						
Phosphate, Total as P	0.032000	0.00200	0.0066666	mg/L		0.031000			3.17	20	
Matrix Spike (BGI0090-MS1)					Source: MGI0074-03 Prepared & Analyzed: 09/21/2021						
Phosphate, Total as P	0.66900	0.00200	0.0066666	mg/L	0.49700	0.17000	100	90-110			
Matrix Spike (BGI0090-MS2)					Source: MGI0074-04 Prepared & Analyzed: 09/21/2021						
Phosphate, Total as P	0.53900	0.00200	0.0066666	mg/L	0.49700	0.031000	102	90-110			
Matrix Spike Dup (BGI0090-MSD1)					Source: MGI0074-03 Prepared & Analyzed: 09/21/2021						
Phosphate, Total as P	0.67600	0.00200	0.0066666	mg/L	0.49700	0.17000	102	90-110	1.04	20	
Matrix Spike Dup (BGI0090-MSD2)					Source: MGI0074-04 Prepared & Analyzed: 09/21/2021						
Phosphate, Total as P	0.53800	0.00200	0.0066666	mg/L	0.49700	0.031000	102	90-110	0.186	20	

NORTHERN LAKE SERVICE, INC.
 Analytical Laboratory and Environmental Services
 400 North Lake Avenue - Crandon, WI 54520
 Ph: (715)-478-2777 Fax: (715)-478-3060

ANALYTICAL REPORT

WDNR Laboratory ID No. 721026460
 WDATCP Laboratory Certification No. 105-330
 EPA Laboratory ID No. WI00034

Printed: 09/07/21 Page 1 of 1

Client: Xcel Energy
 Attn: Matt Miller (reports)
 1414 W. Hamilton Ave.
 PO Box 8
 Eau Claire, WI 54702

NLS Project: 372133
NLS Customer: 96708
Phone: 715 737 1353

Project: Big Falls- Thornapple

Big Falls Flowage NLS ID: 1274204

COC: 257314:1 Matrix: SW

Collected: 08/26/21 09:07 Received: 08/30/21

Notes: Noncompliance: Sample received beyond EPA holding time for Chlorophyll A. Noncompliance: Sample received at 22.6 degrees C, which is above WDNR protocol of 6 degrees C.

Parameter	Result	Units	Dilution	LOD	LOQ	Analyzed	Method	Lab
Chlorophyll, all species	See Attached					09/02/21	10200-H	721026460
Lab filtration for Chlorophyll	yes					08/31/21	NA	721026460

Thornapple Flowage NLS ID: 1274205

COC: 257314:2 Matrix: SW

Collected: 08/26/21 11:05 Received: 08/30/21

Notes: Noncompliance: Sample received beyond EPA holding time for Chlorophyll A. Noncompliance: Sample received at 22.6 degrees C, which is above WDNR protocol of 6 degrees C.

Parameter	Result	Units	Dilution	LOD	LOQ	Analyzed	Method	Lab
Chlorophyll, all species	See Attached					09/02/21	10200-H	721026460
Lab filtration for Chlorophyll	yes					08/31/21	NA	721026460

Values in brackets represent results greater than or equal to the LOD but less than the LOQ and are within a region of "Less-Certain Quantitation". Results greater than or equal to the LOQ are considered to be in the region of "Certain Quantitation". LOD and/or LOQ tagged with an asterisk(*) are considered Reporting Limits. All LOD/LOQs adjusted to reflect dilution and/or solids content.

ND = Not Detected (< LOD) LOD = Limit of Detection LOQ = Limit of Quantitation NA = Not Applicable
 DWB = Dry Weight Basis %DWB = (mg/kg DWB) / 10000 1000 ug/L = 1 mg/L
 MCL = Maximum Contaminant Levels for Drinking Water Samples. Shaded results indicate >MCL.

Reviewed by:



Authorized by:
 R. T. Krueger
 President

Customer: Xcel Energy**Project:** 372133

Big Falls- Thornapple

<u>Sample</u>	<u>Description</u>	<u>CC a</u>	<u>Pheo a</u>	<u>TC a</u>	<u>TC b</u>	<u>TC c</u>
1274204	Big Falls Flowage	7.1	3.3	9.4	0.0*	0.54
1274205	Thornapple Flowage	0.88	1.3	1.7	0.18	0.32

CC a = Corrected Chlorophyll a

Pheo a = Pheophytin a

TC a = Trichromatic Chlorophyll a

TC b = Trichromatic Chlorophyll b

TC c = Trichromatic Chlorophyll c

Units = ug/L for Water, ug/cm² for periphyton samplers

*: The complex calculations used to differentiate the various chlorophyll species magnify error at low concentrations and sometimes produce negative values, which are reported as 0.0 on this report.

APPENDIX B

Summary Of Total Phosphorous And Chlorophyll A Data For Big Falls And Thornapple Flowages 2017 - 2021

Summary of Water Quality Data for Big Falls and Thornapple Flowages (2017-2021)

Date	<u>Big Falls Flowage</u>			<u>Thornapple Flowage</u>		
	Surface	Surface	Bottom	Surface	Surface	Bottom
	Total Phosphorus (mg/L P)	Chlorophyll-A (CCa) (ug/L)	Total Phosphorus (mg/L P)	Total Phosphorus (mg/L P)	Chlorophyll-A (CCa) (ug/L)	Total Phosphorus (mg/L P)
4/24/2017	0.020	3.60	0.030	0.020	2.50	0.030
7/24/2017	0.030	1.60	0.050	0.030	1.30	0.040
8/29/2017	0.020	3.10	0.060	0.030	1.10	0.030
5/8/2018	0.030	7.80	0.030	0.020	2.50	0.020
7/24/2018	0.040	7.80	0.040	0.040	13.00	0.040
8/29/2018	0.040	8.10	0.040	0.030	0.90	0.030
5/7/2019	0.030	2.10	0.020	0.020	2.90	0.030
7/23/2019	0.050	n/a*	0.060	0.040	n/a*	0.050
8/27/2019	0.030	2.30	0.040	0.040	1.70	0.040
April**	n/a	n/a	n/a	n/a	n/a	n/a
July**	n/a	n/a	n/a	n/a	n/a	n/a
8/18/2020	0.040	2.80	0.050	0.040	0.40	0.040
4/28/2021	0.026	0.77	0.027	0.031	0.65	0.033
7/21/2021	0.033	4.70	0.032	0.026	1.90	0.026
8/26/2021***	0.033	7.10	0.040	0.032	0.88	0.033
Average (Ice-out sample)	0.027	3.57	0.027	0.023	2.14	0.028
Average (July sample)	0.038	4.700	0.046	0.034	5.400	0.039
Average (August sample)	0.033	4.680	0.046	0.034	0.996	0.035

* Lab lost samples during analysis - see analytical report

** Sampling suspended due to COVID-19 restrictions

*** Chlorophylla-A Samples received out of temperature range (overnight mail delivery failed)

APPENDIX C

Summary Of Dissolved Oxygen and Temperature Data for Big Falls Flowage and Thornapple Flowage 2017-2021

Dissolved Oxygen and Temperature Profiles for the Big Falls Flowage in 2017.

Date: 4/24/2017

Secchi Disk (ft.): 4.0

Depth of Bottom Sample (ft): 34

Weather Conditions: Overcast, south wind @ 15

Temperature (F): 55

Date: 7/24/2017

Secchi Disk (ft.): 4.0

Depth of Bottom Sample (ft): 36

Weather Conditions: Partly cloudy, light winds

Temperature (F): 62

Date: 8/29/2017

Secchi Disk (ft.): 5.0

Depth of Bottom Sample: 34

Weather Conditions: Overcast, calm winds

Temperature (F): 58

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)	Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)	Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	11.6	11.09	Surface	24.5	6.27	Surface	18.7	8.25
2	11.4	11.06	2	24.1	6.23	2	18.7	8.23
4	11.3	11.05	4	24.1	6.23	4	18.5	8.20
6	11.3	11.02	6	24.1	6.25	6	18.5	8.18
8	11.3	11.00	8	24.1	6.26	8	18.4	8.17
10	11.3	10.98	10	24.0	6.26	10	18.4	8.13
12	11.3	10.98	12	24.0	6.26	12	18.4	8.09
14	11.2	10.97	14	24.0	6.25	14	18.4	8.08
16	11.2	10.96	16	24.0	6.24	16	18.4	8.08
18	11.2	10.95	18	23.9	6.25	18	18.4	8.07
20	11.2	10.95	20	23.9	6.27	20	18.4	8.07
22	11.2	10.94	22	23.8	6.26	22	18.4	8.07
24	11.2	10.94	24	23.7	6.28	24	18.4	8.05
26	11.2	10.93	26	23.7	6.28	26	18.4	8.04
28	11.1	10.92	28	23.7	6.25	28	18.3	8.01
30	11.1	10.90	30	23.7	6.27	30	18.3	8.01
32	11.1	10.89	32	23.7	6.25	32	18.3	8.01
34	11.1	10.87	34	23.7	6.22	34	18.2	7.84
36	Bottom	Bottom	36	23.7	6.13	36	Bottom	Bottom
			38	Bottom	Bottom			

Dissolved Oxygen and Temperature Profiles for the Big Falls Flowage in 2018.

Date: 5/8/2018
 Secchi Disk (ft.): 4.5
 Depth of Bottom Sample (ft): 34
 Weather Conditions: overcast, calm wind
 Temperature (F): 73

Date: 7/24/2018
 Secchi Disk (ft.): 5.0
 Depth of Bottom Sample (ft): 36
 Weather Conditions: mostly sunny, winds NW @ 5-10
 Temperature (F): 72

Date: 8/29/2018
 Secchi Disk (ft.): 5.0
 Depth of Bottom Sample (ft): 36
 Weather Conditions: partly sunny, winds N @ 5-10
 Temperature (F): 59

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)	Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)	Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	17.6	9.88	Surface	24.0	8.35	Surface	21.6	7.33
2	16.6	10.00	2	23.7	8.34	2	21.6	7.31
4	16.6	9.97	4	23.4	8.22	4	21.6	7.30
6	16.4	9.96	6	23.3	8.20	6	21.6	7.29
8	16.2	9.92	8	23.3	8.16	8	21.6	7.27
10	16.2	9.92	10	23.3	8.15	10	21.5	7.23
12	16.2	9.92	12	23.3	8.14	12	21.5	7.24
14	16.2	9.92	14	23.1	7.95	14	21.4	7.27
16	16.2	9.91	16	23.0	7.94	16	21.4	7.28
18	16.2	9.91	18	23.0	7.90	18	21.4	7.26
20	16.2	9.90	20	23.0	7.77	20	21.4	7.22
22	16.2	9.90	22	22.7	7.74	22	21.4	7.22
24	16.2	9.89	24	22.5	7.60	24	21.4	7.23
26	16.2	9.91	26	22.5	7.57	26	21.4	7.23
28	16.2	9.90	28	22.4	7.51	28	21.4	7.24
30	16.2	9.90	30	22.3	7.47	30	21.4	7.21
32	16.2	9.89	32	22.2	7.29	32	21.4	7.15
34	16.1	9.91	34	22.2	7.24	34	21.4	6.92
36	Bottom	Bottom	36	22.2	7.18	36	21.3	6.7
			38	Bottom	Bottom		Bottom	Bottom

Dissolved Oxygen and Temperature Profiles for the Big Falls Flowage in 2019.

Date: 5/7/2019

Secchi Disk (ft.): 5.5

Depth of Bottom Sample (ft): 36

Weather Conditions: mostly sunny, wind NW @ 5 mph

Temperature (F): 47

Date: 7/23/2019

Secchi Disk (ft.): 4.5

Depth of Bottom Sample (ft): 34

Weather Conditions: mostly sunny, wind NW @ 5 mph

Temperature (F): 73

Date: 8/27/2019

Secchi Disk (ft.): 5.0

Depth of Bottom Sample (ft): 30

Weather Conditions: partly sunny, winds SW @ 5-10

Temperature (F): 60

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	12.3	10.65
2	12.2	10.64
4	12.1	10.66
6	11.9	10.63
8	11.8	10.62
10	11.8	10.61
12	11.8	10.60
14	11.7	10.59
16	11.4	10.60
18	11.4	10.59
20	11.4	10.59
22	11.4	10.58
24	11.4	10.58
26	11.4	10.57
28	11.4	10.57
30	11.4	10.57
32	11.4	10.56
34	11.3	10.56
36	11.3	10.54
38	Bottom	Bottom

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	23.4	7.77
2	23.3	7.65
4	23.1	7.58
6	23.0	7.64
8	23.0	7.68
10	23.0	7.68
12	23.0	7.68
14	23.0	7.68
16	23.0	7.67
18	23.0	7.67
20	23.0	7.67
22	23.0	7.66
24	23.0	7.57
26	23.0	7.55
28	23.0	7.52
30	23.0	7.50
32	22.9	7.44
34	22.9	7.44
36	Bottom	Bottom

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	19.8	8.06
2	19.8	8.08
4	19.8	8.06
6	19.8	8.04
8	19.8	8.05
10	19.8	8.05
12	19.8	8.04
14	19.8	8.04
16	19.8	8.05
18	19.8	8.03
20	19.8	8.04
22	19.8	8.03
24	19.8	8.03
26	19.8	8.01
28	19.8	7.99
30	19.7	7.88
32	Bottom	Bottom

Dissolved Oxygen and Temperature Profiles for the Big Falls Flowage in 2020.

Date: April
No Sampling due to Covid-19 Restrictions

July
No Sampling due to Covid-19 Restrictions

Date: August
No Sampling due to faulty DO/temp. meter

Dissolved Oxygen and Temperature Profiles for the Big Falls Flowage in 2021.

Date: 4/28/2021

Secchi Disk (ft.): 4.5

Depth of Bottom Sample (ft): 38

Weather Conditions: partly sunny, wind NE 5-10

Temperature (F): 46

Date: 7/21/2021

Secchi Disk (ft.): 5.0

Depth of Bottom Sample (ft): 38

Weather Conditions: cloudy, SE wind 5-10

Temperature (F): 64

Date: 8/26/2021

Secchi Disk (ft.): 5.0

Depth of Bottom Sample (ft): 36

Weather Conditions: mostly sunny

Temperature (F): 65

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)	Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)	Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	8.1	11.47	Surface	25.0	7.43	Surface	24.1	7.99
2	7.9	11.50	2	25.1	7.40	2	24.1	8.09
4	7.9	11.47	4	25.1	7.35	4	24.1	8.15
6	7.8	11.45	6	25.0	7.18	6	24.1	8.16
8	7.9	11.43	8	25.0	7.09	8	24.1	8.17
10	7.9	11.40	10	24.9	7.05	10	24.1	8.17
12	7.8	11.36	12	24.9	7.01	12	23.8	7.65
14	7.8	11.36	14	24.8	6.94	14	23.6	7.52
16	7.8	11.35	16	24.8	6.89	16	23.4	7.34
18	7.8	11.35	18	24.8	6.85	18	23.3	7.26
20	7.8	11.36	20	24.7	6.82	20	23.2	7.22
22	7.8	11.35	22	24.7	6.80	22	23.2	7.11
24	7.8	11.35	24	24.7	6.77	24	23.1	7.00
26	7.9	11.35	26	24.5	6.60	26	23.1	6.84
28	7.9	11.36	28	24.5	6.50	28	23.1	6.82
30	7.9	11.34	30	24.5	6.48	30	23.1	6.78
32	7.9	11.33	32	24.5	6.50	32	23.0	6.72
34	7.9	11.33	34	24.5	6.47	34	23.0	6.64
36	7.8	11.32	36	24.5	6.46	36	23.0	6.6
38	Bottom	Bottom	38	24.5	6.42	38	Bottom	Bottom
			40	Bottom	Bottom			

Dissolved Oxygen and Temperature Profiles for the Thornapple Flowage in 2017.

Date: 4/24/2017
 Secchi Disk (ft.): 4.0
 Depth of Bottom Sample (ft): 20
 Weather Conditions: overcast, windy
 Temperature (F): 60

Date: 7/24/2017
 Secchi Disk (ft.): 5.0
 Depth of Bottom Sample (ft): 20
 Weather Conditions: mostly sunny, light winds
 Temperature (F): 72

Date: 8/29/2017
 Secchi Disk (ft.): 6.0
 Depth of Bottom Sample (ft): 18
 Weather Conditions: cloudy, light winds
 Temperature (F): 62

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)	Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)	Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	10.1	11.15	Surface	24.5	6.82	Surface	21.6	7.59
2.0	10.1	11.05	2.0	23.4	6.84	2.0	21.3	7.47
4.0	10.1	10.95	4.0	23.1	6.83	4.0	21.2	7.42
6.0	10.0	10.97	6.0	23.0	6.80	6.0	21.1	7.39
8.0	10.0	10.94	8.0	22.9	6.79	8.0	21.1	7.35
10.0	10.0	10.97	10.0	22.9	6.79	10.0	21.0	7.33
12.0	10.0	10.95	12.0	22.9	6.77	12.0	21.0	7.30
14.0	10.0	10.90	14.0	22.9	6.76	14.0	21.0	7.24
16.0	10.0	10.95	16.0	22.9	6.73	16.0	21.0	7.23
18.0	10.0	10.90	18.0	22.9	6.72	18.0	20.9	7.21
20.0	10.0	10.9	20.0	22.9	6.69	20.0	Bottom	Bottom
22.0	Bottom	Bottom	22.0	Bottom	Bottom			

Dissolved Oxygen and Temperature Profiles for the Thornapple Flowage in 2018.

Date: 5/8/2018
 Secchi Disk (ft.): 5.0
 Depth of Bottom Sample (ft): 20
 Weather Conditions: cloudy, south wind @ 5-10
 Temperature (F): 73

Date: 7/24/2018
 Secchi Disk (ft.): 5.0
 Depth of Bottom Sample (ft): 18
 Weather Conditions: mostly sunny, wind NW @ 5-10
 Temperature (F):

Date: 8/29/2018
 Secchi Disk (ft.): 5.5
 Depth of Bottom Sample (ft): 20
 Weather Conditions: partly cloudy, light winds
 Temperature (F):

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)	Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)	Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	12.5	11.55	Surface	26.2	7.90	Surface	21.5	6.20
2.0	12.1	11.62	2.0	25.7	7.67	2.0	21.5	6.18
4.0	12.0	11.61	4.0	25.6	7.48	4.0	21.4	6.17
6.0	12.0	11.59	6.0	25.4	7.26	6.0	21.4	6.16
8.0	11.9	11.58	8.0	25.3	7.14	8.0	21.4	6.17
10.0	11.8	11.59	10.0	25.3	7.19	10.0	21.4	6.16
12.0	11.7	11.58	12.0	25.3	7.16	12.0	21.4	6.14
14.0	11.7	11.56	14.0	25.3	7.16	14.0	21.4	6.15
16.0	11.7	11.55	16.0	25.0	7.16	16.0	21.4	6.14
18.0	11.7	11.53	18.0	23.8	6.78	18.0	21.4	6.13
20.0	11.6	11.5	20.0	Bottom	Bottom	20.0	21.4	6.1
22.0	Bottom	Bottom				22.0	Bottom	Bottom

Dissolved Oxygen and Temperature Profiles for the Thornapple Flowage in 2019.

Date: 5/7/2019

Secchi Disk (ft.): 6

Depth of Bottom Sample (ft): 20

Weather Conditions: sunny, winds N @ 5 mph

Temperature (F): 56

Date: 7/23/2019

Secchi Disk (ft.): 6

Depth of Bottom Sample (ft): 20

Weather Conditions: mostly sunny, NW wind @ 5 mph

Temperature (F): 74

Date: 8/27/2019

Secchi Disk (ft.): 5.0

Depth of Bottom Sample (ft) 18

Weather Conditions: partly sunny, SW wind at 15 mph

Temperature (F):

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)	Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)	Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	9.4	12.23	Surface	25.3	6.45	Surface	20.8	7.33
2.0	9.3	12.28	2.0	24.6	6.36	2.0	20.8	7.30
4.0	9.2	12.26	4.0	24.3	6.25	4.0	20.8	7.29
6.0	9.2	12.25	6.0	24.2	6.21	6.0	20.7	7.26
8.0	9.2	12.23	8.0	24.2	6.20	8.0	20.7	7.25
10.0	9.2	12.22	10.0	24.2	6.20	10.0	20.7	7.24
12.0	9.2	12.23	12.0	24.2	6.19	12.0	20.7	7.28
14.0	9.2	12.22	14.0	24.2	6.18	14.0	20.7	7.31
16.0	9.1	12.21	16.0	24.2	6.18	16.0	20.6	7.26
18.0	9.1	12.20	18.0	24.2	6.16	18.0	20.6	7.21
20.0	9.1	12.1	20.0	24.2	6.10	20.0	Bottom	Bottom
22.0	Bottom	Bottom	22.0	Bottom	Bottom			

Dissolved Oxygen and Temperature Profiles for the Thornapple Flowage in 2020.

Date:

April

No Sampling due to Covid-19 Restrictions

July

No Sampling due to Covid-19 Restrictions

August

No Sampling due to faulty DO/temp. meter

Dissolved Oxygen and Temperature Profiles for the Thornapple Flowage in 2021.

Date: 4/28/2021

Secchi Disk (ft.): 5

Depth of Bottom Sample (ft): 20

Weather Conditions: partly sunny, NE wind 5-10

Temperature (F): 56

Date: 7/21/2021

Secchi Disk (ft.): 6

Depth of Bottom Sample (ft): 20

Weather Conditions: mostly cloudy, light winds

Temperature (F): 64

Date: 8/26/2021

Secchi Disk (ft.): 6.0

Depth of Bottom Sample (ft): 18

Weather Conditions: hazy sunshine, light winds

Temperature (F): 71

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)	Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)	Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	9.2	10.64	Surface	23.8	6.36	Surface	23.4	6.92
2.0	9.0	10.68	2.0	23.8	6.20	2.0	23.2	6.91
4.0	9.0	10.62	4.0	23.8	6.10	4.0	23.1	6.86
6.0	8.9	10.68	6.0	23.8	6.04	6.0	23.1	6.83
8.0	8.9	10.68	8.0	23.8	6.01	8.0	23.1	6.76
10.0	8.9	10.67	10.0	23.7	6.00	10.0	23.0	6.60

APPENDIX D

Agency Correspondence

Miller, Matthew J

From: Simpkins, Darin <Darin_Simpkins@fws.gov>
Sent: Tuesday, January 25, 2022 12:43 PM
To: Miller, Matthew J
Subject: Re: [EXTERNAL] RE: 2021 Annual Water Quality Report

EXTERNAL - STOP & THINK before opening links and attachments.

Hi Matt -

I don't have any comments at this time.

Thanks for sharing the data,

Darin

From: Miller, Matthew J <Matthew.J.Miller@xcelenergy.com>
Sent: Tuesday, January 25, 2022 11:14 AM
To: Laatsch, Cheryl - DNR <Cheryl.Laatsch@wisconsin.gov>; Simpkins, Darin <Darin_Simpkins@fws.gov>
Cc: macaulay.haller@wisconsin.gov <macaulay.haller@wisconsin.gov>
Subject: [EXTERNAL] RE: 2021 Annual Water Quality Report

This email has been received from outside of DOI - Use caution before clicking on links, opening attachments, or responding.

Hello Cheryl and Darin,

Just a friendly reminder to provide any comments you may have regarding Xcel Energy's annual water quality report. If you have no comments, please reply as such so I may include your comments in my FERC submittal. I plan to file my report this week to meet my FERC deadline.

Matt

From: Miller, Matthew J
Sent: Friday, December 17, 2021 8:31 AM
To: Laatsch, Cheryl - DNR <Cheryl.Laatsch@wisconsin.gov>; Simpkins, Darin <darin_simpkins@fws.gov>
Cc: macaulay.haller@wisconsin.gov
Subject: 2021 Annual Water Quality Report

Hello Cheryl and Darin,

Attached is the 2021 annual water quality monitoring report for Big Falls and Thornapple flowages. Please provide any comments you may have by **January 20, 2022** so I may file my report with FERC. Let me know if you require a hard copy.

Matthew Miller

Xcel Energy

Hydro License Compliance Consultant

1414 W. Hamilton Ave., P.O. Box 8, Eau Claire, WI 54702

P: 715.737-1353 F: 715.737.1077

E: matthew.j.miller@xcelenergy.com

XCELENERGY.COM

Document Content(s)

Annual Water Quality Report Cover Letter.pdf.....1
Annual Water Quality Report.pdf.....2