Xcel Energy®

1414 West Hamilton Avenue
P.O. Box 8
Eau Claire, WI 54702-0008

January 20, 2016

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

Subject: **2014 Water Quality Monitoring Report – Articles 404 & 406**
Big Falls Hydro (P-2390-01) and Thornapple Hydro (P-2475)

Dear Secretary:

Enclosed is the 2015 Water Quality Monitoring Report for the Big Falls and Thornapple hydro projects. The report is filed pursuant to license articles 404 (Big Falls) and 406 (Thornapple). The results are summarized for the past five years and while there appears to be some variability in the parameters analyzed, for the most part, the results have been relatively consistent. Xcel Energy (licensee) 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 4, 2015. The USFWS did not respond. The WDNR had no comments on the report specifically; however, they did recommend that licensee download the data directly to their database to facilitate the annual review process.

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

Sincerely,

William Zawacki
Director, Hydro Plants

Enclosure: Water Quality Monitoring Report

c: Jeff Scheirer – WDNR (cover letter only – via e-mail)
Cheryl Laatsch – WDNR (cover letter only – via email)
Nick Utrup – USFWS (cover letter only – via e-mail)
Project Files

2015 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 2015

APPENDIX A

2015 Water Quality Lab Analysis For Big Falls and Thornapple Flowages

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: 05/08/15 Code: NNNN-S

NLS Project: 239519
NLS Customer: 96708
Phone: 715 737 1353

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

Project: **Big Falls - Thornapple**

Big Falls Flowage NLS ID: 857069
COC: 168028:1 Matrix: SW
Collected: 04/28/15 10:57 Received: 04/30/15

Parameter	Result	Units	Dilution	LOD	LOQ	Analyzed	Method	Lab
Chlorophyll, all species	see attached					05/06/15	10200-H	721026460
Lab filtration for Chlorophyll	yes					04/30/15	NA	721026460

Thornapple Flowage NLS ID: 857070
COC: 168028:2 Matrix: SW
Collected: 04/28/15 13:34 Received: 04/30/15

Parameter	Result	Units	Dilution	LOD	LOQ	Analyzed	Method	Lab
Chlorophyll, all species	see attached					05/06/15	10200-H	721026460
Lab filtration for Chlorophyll	yes					04/30/15	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.

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

Reviewed by:

Authorized by:
R. T. Krueger
President

Northern Lake Service, Inc.
Chlorophyll Results

Customer: Xcel Energy
Project: 239519
Big Falls - Thornapple

Sample	Description	CC a	Pheo a	TC a	TC b	TC c
857069	Big Falls Flowage	1.3	0.42	1.6	0.075	0.1
857070	Thornapple Flowage	1.7	0.77	2.3	0.078	0.27

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/cm_2 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.

Big Falls Hydro	Project:	Phosphorus	Sampled: 4/27/15 to 4/28/15
1400 Western Ave	Project Number:	[none]	Received: 4/30/15
Eau Claire, WI 54701	Project Manager:	Matt J Miller	Reported: 5/6/15 09:40

Wet Chemistry
Xcel Energy Minneapolis Testing Lab

Analyte	Batch Number	Date Prepared	Date Analyzed	Specific Method	(LOD)Limit of Detection	(LOQ)Limit of Quantitation	Result	Units	Analyst	Notes*
Big Falls Flowage Surface				**MAD0368-01**				**Water**		
Phosphate, Total as P										
	BAD0673	4/30/15	4/30/15	EPA 365.1	0.0049	0.0100	**0.0200**	mg/L	HRD	
Big Falls Flowage Bottom				**MAD0368-02**				**Water**		
Phosphate, Total as P										
	BAD0673	4/30/15	4/30/15	EPA 365.1	0.0049	0.0100	**0.0250**	mg/L	HRD	

Thornapple Hydro	Project:	Phosphorus	Sampled: 4/27/15 to 4/28/15
W 5506 Dam Road	Project Number:	[none]	Received: 4/30/15
Glen Flora, WI 54563	Project Manager:	Matt J Miller	Reported: 5/6/15 09:33

Wet Chemistry
Xcel Energy Minneapolis Testing Lab

Analyte	Batch Number	Date Prepared	Date Analyzed	Specific Method	(LOD)Limit of Detection	(LOQ)Limit of Quantitation	Result	Units	Analyst	Notes*
Thornapple Flowage Surface				**MAD0369-01**					**Water**	
Phosphate, Total as P										
	BAD0673	4/30/15	4/30/15	EPA 365.1	0.0049	0.0100	**0.0290**	mg/L	HRD	
Thornapple Flowage Bottom				**MAD0369-02**					**Water**	
Phosphate, Total as P										
	BAD0673	4/30/15	4/30/15	EPA 365.1	0.0049	0.0100	**0.0240**	mg/L	HRD	

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

NLS Project: 244374
NLS Customer: 96708
Phone: 715 737 1353

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

Project: Big Falls - Thornapple

Big Falls Flowage NLS ID: 872529
COC: 185683:1 Matrix: SW
Collected: 07/21/15 10:40 Received: 07/23/15

Parameter	Result	Units	Dilution	LOD	LOQ	Analyzed	Method	Lab
Chlorophyll, all species	see attached					07/29/15	10200-H	721026460
Lab filtration for Chlorophyll	yes					07/23/15	NA	721026460

Thornapple Flowage NLS ID: 872530
COC: 185683:2 Matrix: SW
Collected: 07/21/15 12:47 Received: 07/23/15

Parameter	Result	Units	Dilution	LOD	LOQ	Analyzed	Method	Lab
Chlorophyll, all species	see attached					07/29/15	10200-H	721026460
Lab filtration for Chlorophyll	yes					07/23/15	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.

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

Reviewed by:

Authorized by:
R. T. Krueger
President

Northern Lake Service, Inc.
Chlorophyll Results

Customer: Xcel Energy
Project: 244374
Big Falls - Thornapple

Sample	Description	CC a	Pheo a	TC a	TC b	TC c
872529	Big Falls Flowage	6.8	0.55	7.4	0.0*	0.57
872530	Thornapple Flowage	0.59	0.23	0.76	0.0*	0.0*

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/cm_2 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.

Big Falls Hydro	Project:	Phosphorus	Sampled: 7/21/15 to 7/22/15
1400 Western Ave	Project Number:	[none]	Received: 7/23/15
Eau Claire, WI 54701	Project Manager:	Matt J Miller	Reported: 7/30/15 06:42

Wet Chemistry
Xcel Energy Minneapolis Testing Lab

Analyte	Batch Number	Date Prepared	Date Analyzed	Specific Method	(LOD)Limit of Detection	(LOQ)Limit of Quantitation	Result	Units	Analyst	Notes*
Big Falls Flowage Surface				**MAG0267-01**			**Water**			
Phosphate, Total as P										
	BAG0593	7/27/15	7/29/15	EPA 365.1	0.0049	0.0100	**0.0390**	mg/L	HRD	
Big Falls Flowage Bottom				**MAG0267-02**			**Water**			
Phosphate, Total as P										
	BAG0593	7/27/15	7/29/15	EPA 365.1	0.0049	0.0100	**0.0510**	mg/L	HRD	

Thornapple Hydro	Project:	Phosphorus	Sampled: 7/21/15 to 7/22/15
W 5506 Dam Road	Project Number:	[none]	Received: 7/23/15
Glen Flora, WI 54563	Project Manager:	Matt J Miller	Reported: 7/30/15 06:51

Wet Chemistry
Xcel Energy Minneapolis Testing Lab

Analyte	Batch Number	Date Prepared	Date Analyzed	Specific Method	(LOD)Limit of Detection	(LOQ)Limit of Quantitation	Result	Units	Analyst	Notes*
Thornapple Flowage Surface				**MAG0268-01**			**Water**			
Phosphate, Total as P										
	BAG0593	7/27/15	7/29/15	EPA 365.1	0.0049	0.0100	**0.0310**	mg/L	HRD	
Thornapple Flowage Bottom				**MAG0268-02**			**Water**			
Phosphate, Total as P										
	BAG0593	7/27/15	7/29/15	EPA 365.1	0.0049	0.0100	**0.0330**	mg/L	HRD	

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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

NLS Project: 246622
NLS Customer: 96708
Phone: 715 737 1353

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

Project: Big Falls - Thornapple

Big Falls Flowage NLS ID: 879289
COC: 180979:1 Matrix: SW
Collected: 08/26/15 10:15 Received: 08/28/15

Parameter	Result	Units	Dilution	LOD	LOQ	Analyzed	Method	Lab
Chlorophyll, all species	See Attached					09/15/15	10200-H	721026460
Lab filtration for Chlorophyll	yes					08/28/15	NA	721026460

Thornapple Flowage NLS ID: 879290
COC: 180979:2 Matrix: SW
Collected: 08/26/15 12:07 Received: 08/28/15

Parameter	Result	Units	Dilution	LOD	LOQ	Analyzed	Method	Lab
Chlorophyll, all species	See Attached					09/15/15	10200-H	721026460
Lab filtration for Chlorophyll	yes					08/28/15	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.

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

Reviewed by:

Authorized by:
R. T. Krueger
President

Northern Lake Service, Inc.
Chlorophyll Results

Customer: Xcel Energy
Project: 246622
Big Falls - Thornapple

Sample	Description	CC a	Pheo a	TC a	TC b	TC c
879289	Big Falls Flowage	4.1	0.0*	4.2	0.46	0.7
879290	Thornapple Flowage	2.4	0.24	2.6	0.0*	0.38

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/cm_2 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.

Big Falls Hydro	Project:	Phosphorus	Sampled: 8/3/15 to 8/26/15
1400 Western Ave	Project Number:	[none]	Received: 8/28/15
Eau Claire, WI 54701	Project Manager:	Matt J Miller	Reported: 9/8/15 06:54

Wet Chemistry
Xcel Energy Minneapolis Testing Lab

Analyte	Batch Number	Date Prepared	Date Analyzed	Specific Method	(LOD)Limit of Detection	(LOQ)Limit of Quantitation	Result	Units	Analyst	Notes*
Big Falls Flowage Surface				**MAH0349-01**					**Water**	
Phosphate, Total as P										
	BAH0632	8/31/15	9/4/15	EPA 365.1	0.0049	0.0100	**0.0280**	mg/L	HRD	
Big Falls Flowage Bottom				**MAH0349-02**					**Water**	
Phosphate, Total as P										
	BAH0632	8/31/15	9/4/15	EPA 365.1	0.0049	0.0100	**0.0305**	mg/L	HRD	

Thornapple Hydro	Project:	Phosphorus	Sampled: 8/3/15 to 8/26/15
W 5506 Dam Road	Project Number:	[none]	Received: 8/28/15
Glen Flora, WI 54563	Project Manager:	Matt J Miller	Reported: 9/8/15 07:16

Wet Chemistry
Xcel Energy Minneapolis Testing Lab

Analyte	Batch Number	Date Prepared	Date Analyzed	Specific Method	(LOD)Limit of Detection	(LOQ)Limit of Quantitation	Result	Units	Analyst	Notes*
Thornapple Flowage Surface				**MAH0350-01**					**Water**	
Phosphate, Total as P										
	BAH0632	8/31/15	9/4/15	EPA 365.1	0.0049	0.0100	**0.0273**	mg/L	HRD	
Thornapple Flowage Bottom				**MAH0350-02**					**Water**	
Phosphate, Total as P										
	BAH0632	8/31/15	9/4/15	EPA 365.1	0.0049	0.0100	**0.0272**	mg/L	HRD	

APPENDIX B

Summary Of Total Phosphorous And Chlorophyll A Data For Big Falls And Thornapple Flowages 2011-2015

Summary of Water Quality Data for Big Falls and Thornapple Flowages (2010-2014)

	Big Falls Flowage			Thornapple Flowage		
Date	Surface Total Phosphorus (mg/L P)	Surface Chlorophyll-A (ug/L)	Bottom Total Phosphorus (mg/L P)	Surface Total Phosphorus (mg/L P)	Surface Chlorophyll-A (ug/L)	Bottom Total Phosphorus (mg/L P)
4/28/2010	0.025	4.2	0.048	0.029	7.2	0.016
7/27/2010	0.07	1.8	0.05	0.07	0.76	0.07
8/31/2010	0.05	3.8	0.06	0.01	0.69	0.06
4/29/2011*	NA	NA	NA	0.03	2.70	0.03
7/26/2011	0.04	7.3	0.06	0.05	5.40	0.04
8/24/2011	0.04	3.8	0.04	0.04	2.50	0.05
4/24/2012	0.03	6.9	0.04	0.03	2.30	0.03
7/23/2012	0.07	6.1	0.10	0.04	11.00	0.05
8/28/2012	0.02	3.3	0.04	0.03	8.60	0.03
5/29/2013	<0.05	2.6	0.06	0.07	1.3	0.07
7/30/2013	<0.05	3.1	<0.05	<0.05	1.3	0.05
8/27/2013	<0.05	5.0	0.06	<0.05	18.0	0.05
7/22/12014**	0.04	5.0	0.05	0.04	1.9	0.05
8/27/2014	0.03	3.6	0.10	0.04	14.0	<0.01
4/28/2015	0.02	1.3	0.03	0.03	1.7	0.02
7/21/2015	0.04	6.8	0.05	0.03	0.6	0.03
8/26/2015	0.03	4.1	0.03	0.03	2.4	0.03
Average (Ice-out sample)	0.03	3.75	0.04	0.04	3.04	0.03
Average (July sample)	0.05	5.02	0.06	0.05	3.49	0.05
Average (August sample)	0.03	3.93	0.06	0.03	5.37	0.04

* No spring sampling conducted at Big Falls as reservoir was drawndown for repairs to left embankment

** No spring sampling conducted due to high river flows

APPENDIX C

Summary Of Dissolved Oxygen And Temperature Data For Big Falls Flowage & Thornapple Flowage 2010-2014

Dissolved Oxygen and Temperature Profiles for the Big Falls Flowage in 2011.

Date:	4/29/2011
Secchi Disk (ft.):	
Depth of Bottom Sample (ft):	
Weather Conditions:	mostly sunny, light winds
Temperature (F):	

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface		

Not Sampled Due To Reservoir Drawdown

Date:	7/26/2011
Secchi Disk (ft.):	4.0
Depth of Bottom Sample (ft):	36
Weather Conditions:	mostly sunny, light winds
Temperature (F):	76

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	25.8	6.58
2.0	25.8	6.56
4.0	25.6	6.66
6.0	25.2	6.56
8.0	25.2	6.59
10.0	25.2	6.58
12.0	25.2	6.53
14.0	25.1	6.52
16.0	24.9	6.38
18.0	24.5	6.32
20.0	24.5	6.32
22.0	24.3	6.29
24.0	24.3	6.33
26.0	24.2	6.27
28.0	24.1	6.31
30.0	24.1	6.25
32.0	24.1	6.20
34.0	24.1	6.18
36.0	24.1	6.11
38.0	Bottom	Bottom

Date:	8/24/2011
Secchi Disk (ft.):	3.0
Depth of Bottom Sample:	36
Weather Conditions:	sunny, wind NW @ 10-15
Temperature (F):	72

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	22.3	7.51
2.0	22.3	7.52
4.0	22.3	7.53
6.0	22.2	7.54
8.0	22.1	7.60
10.0	22.0	7.59
12.0	21.9	7.46
14.0	21.8	7.45
16.0	21.7	7.52
18.0	21.6	7.49
20.0	21.6	7.55
22.0	21.6	7.52
24.0	21.5	7.55
26.0	21.5	7.53
28.0	21.5	7.56
30.0	21.5	7.58
32.0	21.5	7.57
34.0	21.5	7.56
36.0	21.5	7.52
38.0	Bottom	Bottom

Dissolved Oxygen and Temperature Profiles for the Big Falls Flowage in 2012.

Date:	4/24/2012
Secchi Disk (ft.):	4.0
Depth of Bottom Sample (ft):	32
Weather Conditions:	mostly sunny, light winds
Temperature (F):	58

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	11.9	10.90
2.0	11.7	10.94
4.0	11.2	10.91
6.0	11.2	10.91
8.0	11.1	10.88
10.0	11.1	10.87
12.0	11.1	10.85
14.0	11.0	10.83
16.0	11.0	10.81
18.0	11.0	10.81
20.0	11.0	10.77
22.0	11.0	10.73
24.0	11.0	10.72
26.0	11.0	10.72
28.0	11.0	10.72
30.0	11.0	10.72
32.0	11.0	10.71
34.0	*Low battery*	*Low battery*
36.0	*Low battery*	*Low battery*

Date:	7/23/2012
Secchi Disk (ft.):	4.0
Depth of Bottom Sample (ft):	34
Weather Conditions:	mostly sunny, NW wind @ 10
Temperature (F):	82

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	27.2	7.68
2.0	27.1	7.68
4.0	27.1	7.70
6.0	26.9	7.73
8.0	26.6	7.50
10.0	26.3	7.32
12.0	26.2	7.33
14.0	26.0	6.95
16.0	25.8	6.89
18.0	25.5	6.55
20.0	25.2	6.28
22.0	25.1	6.02
24.0	25.0	5.98
26.0	24.9	5.77
28.0	24.7	5.51
30.0	24.6	5.26
32.0	24.4	4.91
34.0	24.3	4.28
36.0	Bottom	Bottom

Date:	8/28/2012
Secchi Disk (ft.):	5.5
Depth of Bottom Sample:	34
Weather Conditions:	sunny, light winds
Temperature (F):	65

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	24.4	8.15
2.0	24.3	8.14
4.0	24.3	8.10
6.0	24.3	8.04
8.0	24.3	8.16
10.0	24.2	7.82
12.0	23.7	7.38
14.0	23.5	7.15
16.0	23.4	6.85
18.0	23.4	6.75
20.0	23.4	6.64
22.0	23.3	6.44
24.0	23.2	6.23
26.0	23.0	5.84
28.0	22.7	5.38
30.0	22.6	5.25
32.0	22.2	4.62
34.0	20.8	3.82
36.0	Bottom	Bottom

Dissolved Oxygen and Temperature Profiles for the Big Falls Flowage in 2013.

Date:	5/29/2013
Secchi Disk (ft.):	4.5
Depth of Bottom Sample (ft):	38
Weather Conditions:	mostly cloudy, light winds
Temperature (F):	59

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	15.3	9.22
2.0	15.3	9.17
4.0	15.2	9.13
6.0	15.2	9.13
8.0	15.2	9.10
10.0	15.2	9.10
12.0	15.2	9.07
14.0	15.2	9.07
16.0	15.2	9.07
18.0	15.2	9.07
20.0	15.2	9.06
22.0	15.2	9.06
24.0	15.2	9.05
26.0	15.2	9.05
28.0	15.2	9.04
30.0	15.2	9.04
32.0	15.2	9.04
34.0	15.2	9.03
36.0	15.2	9.01
38.0	Bottom	Bottom

Date:	7/30/2013
Secchi Disk (ft.):	4.0
Depth of Bottom Sample (ft):	36
Weather Conditions:	overcast, light winds
Temperature (F):	64

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	20.8	7.89
2.0	20.7	7.83
4.0	20.6	7.75
6.0	20.5	7.62
8.0	19.8	7.81
10.0	19.4	7.56
12.0	19.0	7.60
14.0	18.9	7.39
16.0	18.5	7.63
18.0	18.4	7.66
20.0	18.3	7.86
22.0	18.1	7.98
24.0	18.0	7.99
26.0	18.0	8.01
28.0	18.0	7.85
30.0	18.0	7.88
32.0	17.9	8.02
34.0	17.9	7.81
36.0	17.9	7.7
38.0	Bottom	Bottom

Date:	8/27/2013
Secchi Disk (ft.):	5.0
Depth of Bottom Sample:	38
Weather Conditions:	mostly cloudy, calm winds
Temperature (F):	65

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	26.0	7.35
2.0	26.0	7.31
4.0	25.9	7.27
6.0	25.9	7.23
8.0	25.9	7.22
10.0	25.8	7.25
12.0	25.7	7.22
14.0	25.7	7.26
16.0	25.7	7.30
18.0	25.4	7.10
20.0	25.2	7.00
22.0	24.8	6.94
24.0	24.7	6.77
26.0	24.6	6.68
28.0	24.5	6.54
30.0	24.4	6.29
32.0	23.9	5.69
34.0	23.8	5.40
36.0	23.3	4.0
38.0	Bottom	Bottom

Dissolved Oxygen and Temperature Profiles for the Big Falls Flowage in 2014.

Date: April 2014
Secchi Disk (ft.):
Depth of Bottom Sample (ft):
Weather Conditions:
Temperature (F):

Not Sampled Due To High River Flows

Date: 7/22/2014
Secchi Disk (ft.): 3.5
Depth of Bottom Sample (ft): 36
Weather Conditions: mostly cloudy, NW wind 10-15
Temperature (F): 75

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	24.9	7.75
2.0	24.8	7.74
4.0	24.7	7.71
6.0	24.7	7.69
8.0	24.7	7.68
10.0	24.7	7.68
12.0	24.6	7.65
14.0	24.6	7.65
16.0	24.6	7.64
18.0	24.5	7.60
20.0	24.4	7.62
22.0	24.3	7.61
24.0	24.0	7.31
26.0	23.7	7.22
28.0	23.5	7.19
30.0	23.5	7.17
32.0	23.4	7.04
34.0	23.1	6.93
36.0	22.9	6.73
38.0	Bottom	Bottom

Date: 8/27/2014
Secchi Disk (ft.): 5.0
Depth of Bottom Sample: 36
Weather Conditions: mostly sunny, light winds
Temperature (F): 68

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	24.1	7.43
2.0	24.1	7.41
4.0	24.1	7.43
6.0	24.0	7.36
8.0	24.0	7.32
10.0	23.9	7.13
12.0	23.8	7.15
14.0	23.8	7.15
16.0	23.8	7.17
18.0	23.8	7.16
20.0	23.8	7.15
22.0	23.7	6.91
24.0	23.6	6.80
26.0	23.5	6.59
28.0	23.3	6.38
30.0	23.0	6.13
32.0	22.9	6.00
34.0	22.9	5.90
36.0	21.7	4.97
38.0	Bottom	Bottom

Dissolved Oxygen and Temperature Profiles for the Big Falls Flowage in 2015.

Date:	4/28/2015
Secchi Disk (ft.):	4.0
Depth of Bottom Sample (ft):	34
Weather Conditions:	sunny, winds calm
Temperature (F):	57

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	13.4	10.75
2.0	12.0	10.83
4.0	11.9	10.81
6.0	11.7	10.77
8.0	11.6	10.75
10.0	11.6	10.72
12.0	11.6	10.71
14.0	11.5	10.69
16.0	11.5	10.69
18.0	11.4	10.66
20.0	11.3	10.64
22.0	11.2	10.60
24.0	11.1	10.57
26.0	11.1	10.57
28.0	11.0	10.59
30.0	11.0	10.56
32.0	10.8	10.45
34.0	10.7	10.4
36.0	Bottom	Bottom

Date:	7/21/2015
Secchi Disk (ft.):	4.0
Depth of Bottom Sample (ft):	34
Weather Conditions:	mostly sunny, NW winds @ 10
Temperature (F):	68

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	24.3	7.52
2.0	24.3	7.51
4.0	24.1	7.37
6.0	24.0	7.39
8.0	23.9	7.40
10.0	23.9	7.38
12.0	23.9	7.35
14.0	23.9	7.32
16.0	23.8	7.30
18.0	23.8	7.27
20.0	23.8	7.26
22.0	23.8	7.26
24.0	23.8	7.26
26.0	23.8	7.25
28.0	23.8	7.25
30.0	23.8	7.21
32.0	23.8	7.20
34.0	23.8	7.03
36.0	Bottom	Bottom

Date:	8/26/2015
Secchi Disk (ft.):	5.0
Depth of Bottom Sample:	36
Weather Conditions:	mostly sunny, NW winds @ 5
Temperature (F):	60

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	18.1	7.84
2.0	18.0	7.82
4.0	17.7	7.81
6.0	17.6	7.83
8.0	17.0	8.24
10.0	16.6	8.40
12.0	16.6	8.42
14.0	16.4	8.42
16.0	16.3	8.47
18.0	16.3	8.47
20.0	16.3	8.51
22.0	16.3	8.52
24.0	16.3	8.54
26.0	16.2	8.57
28.0	16.1	8.55
30.0	16.1	8.59
32.0	16.0	8.56
34.0	16.0	8.58
36.0	16.0	8.55
38.0	Bottom	Bottom

Dissolved Oxygen and Temperature Profiles for the Thornapple Flowage in 2010.

Date:	4/28/2010
Secchi Disk (ft.):	5.0
Depth of Bottom Sample (ft):	20
Weather Conditions:	p. cloudy, S winds 5-10
Temperature (F):	59

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	13.8	11.90
2.0	13.7	11.74
4.0	12.6	11.83
6.0	12.4	11.70
8.0	12.3	12.02
10.0	12.2	12.01
12.0	11.8	10.50
14.0	11.5	10.63
16.0	11.2	10.44
18.0	11.2	10.37
20.0	11.2	10.25

Date:	7/27/2010
Secchi Disk (ft.):	3
Depth of Bottom Sample (ft):	20
Weather Conditions:	p. cloudy, S wind @ 5
Temperature (F):	84

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	25.4	4.46
2.0	25.0	4.44
4.0	24.6	4.37
6.0	24.5	4.38
8.0	24.5	4.37
10.0	24.5	4.30
12.0	24.3	4.23
14.0	24.3	4.23
16.0	24.2	4.35
18.0	24.2	4.37
20.0	24.2	4.3
22.0	Bottom	Bottom

Date:	8/31/2010
Secchi Disk (ft.):	3
Depth of Bottom Sample (ft)	20
Weather Conditions:	cloudy, S wind @ 10
Temperature (F):	81

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	23.0	5.82
2.0	22.8	5.75
4.0	22.8	5.74
6.0	22.7	5.71
8.0	22.6	5.71
10.0	22.6	5.71
12.0	22.6	5.71
14.0	22.6	5.71
16.0	22.6	5.70
18.0	22.6	5.70
20.0	22.6	5.7
22.0	Bottom	Bottom

Dissolved Oxygen and Temperature Profiles for the Thornapple Flowage in 2011.

Date:	4/29/2011
Secchi Disk (ft.):	3.5
Depth of Bottom Sample (ft):	22
Weather Conditions:	sunny, wind S @ 5-10
Temperature (F):	45

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	6.9	12.5
2.0	6.8	12.4
4.0	6.8	12.4
6.0	6.8	12.4
8.0	6.8	12.4
10.0	6.8	12.4
12.0	6.8	12.4
14.0	6.8	12.3
16.0	6.8	12.3
18.0	6.8	12.3
20.0	6.8	12.3
22.0	6.8	12.3
24.0	Bottom	Bottom

Date:	7/26/2011
Secchi Disk (ft.):	4.5
Depth of Bottom Sample (ft):	20
Weather Conditions:	sunny, light winds
Temperature (F):	80

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	26.4	6.56
2.0	26.3	6.54
4.0	25.9	6.54
6.0	25.6	6.47
8.0	25.7	6.46
10.0	25.5	6.45
12.0	25.4	6.41
14.0	24.6	6.14
16.0	24.2	5.76
18.0	24.2	5.68
20.0	23.7	5.00
22.0	Bottom	Bottom

Date:	8/24/2011
Secchi Disk (ft.):	3
Depth of Bottom Sample (ft)	20
Weather Conditions:	sunny, NW wind 15-20
Temperature (F):	78

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	23.7	6.52
2.0	23.7	6.50
4.0	23.0	6.36
6.0	22.7	6.26
8.0	22.7	6.23
10.0	22.6	6.16
12.0	22.5	6.08
14.0	22.3	5.94
16.0	22.1	5.73
18.0	22.0	5.60
20.0	22.0	5.60
22.0	Bottom	Bottom

Dissolved Oxygen and Temperature Profiles for the Thornapple Flowage in 2012.

Date:	4/24/2012
Secchi Disk (ft.):	4.0
Depth of Bottom Sample (ft):	20
Weather Conditions:	sunny, light NW winds
Temperature (F):	67

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	15.4	10.99
2.0	13.2	11.22
4.0	12.8	11.25
6.0	12.4	11.27
8.0	12.1	11.24
10.0	11.9	11.10
12.0	11.9	11.06
14.0	11.7	11.04
16.0	11.6	10.97
18.0	11.6	10.95
20.0	11.6	10.92
22.0	Bottom	Bottom

Date:	7/23/2012
Secchi Disk (ft.):	3.5
Depth of Bottom Sample (ft):	18
Weather Conditions:	sunny, winds W @ 5-10
Temperature (F):	85

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	30.6	8.45
2.0	28.3	7.66
4.0	27.4	7.03
6.0	26.8	6.30
8.0	26.5	6.04
10.0	26.3	5.70
12.0	25.6	4.99
14.0	25.2	4.88
16.0	24.6	4.08
18.0	24.2	3.08
20.0	Bottom	Bottom

Date:	8/28/2012
Secchi Disk (ft.):	5.5
Depth of Bottom Sample (ft)	18
Weather Conditions:	overcast, calm
Temperature (F):	78

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	23.6	8.37
2.0	23.3	7.98
4.0	23.7	7.83
6.0	23.1	7.72
8.0	23.1	7.84
10.0	23.1	7.68
12.0	23.0	7.16
14.0	22.8	6.57
16.0	22.6	6.22
18.0	22.0	3.31
20.0	Bottom	Bottom

Dissolved Oxygen and Temperature Profiles for the Thornapple Flowage in 2013.

Date:	5/29/2013
Secchi Disk (ft.):	4.0
Depth of Bottom Sample (ft):	20
Weather Conditions:	mostly cloudy, light winds
Temperature (F):	62

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	15.7	8.95
2.0	15.2	8.95
4.0	15.2	8.96
6.0	15.2	8.94
8.0	15.2	8.94
10.0	15.2	8.95
12.0	15.2	8.94
14.0	15.2	8.94
16.0	15.2	8.93
18.0	15.2	8.92
20.0	15.2	8.92
22.0	Bottom	Bottom

Date:	7/30/2013
Secchi Disk (ft.):	5
Depth of Bottom Sample (ft):	19.5
Weather Conditions:	overcast, light winds
Temperature (F):	65

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	22.7	7.30
2.0	22.5	7.25
4.0	22.5	7.29
6.0	22.5	7.27
8.0	22.3	7.16
10.0	22.2	7.00
12.0	21.9	6.62
14.0	21.1	6.42
16.0	20.6	6.14
18.0	20.3	5.87
20.0	20.1	5.73
22.0	Bottom	Bottom

Date:	8/27/2013
Secchi Disk (ft.):	4.5
Depth of Bottom Sample (ft)	20
Weather Conditions:	partly sunny, light winds
Temperature (F):	88

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	26.2	8.32
2.0	26.0	8.34
4.0	25.1	7.36
6.0	24.8	7.23
8.0	24.7	7.08
10.0	24.7	6.94
12.0	24.5	6.68
14.0	24.3	6.69
16.0	23.9	6.59
18.0	23.7	6.23
20.0	23.7	6.18
22.0	Bottom	Bottom

Dissolved Oxygen and Temperature Profiles for the Thornapple Flowage in 2014.

Date:	April 2014	Date:	7/22/2014	Date:	8/27/2014
Secchi Disk (ft.):	4.0	Secchi Disk (ft.):	3.5	Secchi Disk (ft.):	5
Depth of Bottom Sample (ft):	20	Depth of Bottom Sample (ft):	20	Depth of Bottom Sample (ft)	20
Weather Conditions:	mostly cloudy, light winds	Weather Conditions:	mostly cloudy, sw wind @ 10	Weather Conditions:	mostly sunny
Temperature (F):	62	Temperature (F):	79	Temperature (F):	74

Not Sampled Due To High River Flows

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	25.4	6.90
2.0	25.1	6.86
4.0	24.8	6.84
6.0	24.7	6.80
8.0	24.1	6.72
10.0	24.0	6.69
12.0	24.0	6.67
14.0	24.0	6.65
16.0	23.9	6.63
18.0	23.9	6.60
20.0	23.9	6.59
22.0	Bottom	Bottom

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	23.9	7.81
2.0	23.1	7.83
4.0	22.8	7.41
6.0	22.8	7.42
8.0	22.7	7.41
10.0	22.3	7.07
12.0	22.2	6.90
14.0	22.2	6.77
16.0	22.1	6.67
18.0	21.8	6.58
20.0	21.8	6.59
22.0	Bottom	Bottom

Dissolved Oxygen and Temperature Profiles for the Thornapple Flowage in 2015.

Date:	4/28/2015	Date:	7/21/2015	Date:	8/26/2015
Secchi Disk (ft.):	4.0	Secchi Disk (ft.):	5.5	Secchi Disk (ft.):	6.0
Depth of Bottom Sample (ft):	18	Depth of Bottom Sample (ft):	20	Depth of Bottom Sample (ft)	18
Weather Conditions:	sunny, calm winds	Weather Conditions:	sunny, NW winds @ 10	Weather Conditions:	mostly sunny, NW winds @ 5
Temperature (F):	63	Temperature (F):	78	Temperature (F):	66

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	13.8	10.52
2.0	10.9	10.41
4.0	10.6	10.42
6.0	10.3	10.31
8.0	10.3	10.28
10.0	10.0	10.14
12.0	9.9	10.09
14.0	9.9	10.11
16.0	9.9	10.10
18.0	9.9	10.08
20.0	Bottom	Bottom

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	24.3	6.77
2.0	23.8	6.69
4.0	23.8	6.66
6.0	23.4	6.61
8.0	22.9	6.55
10.0	22.8	6.52
12.0	22.8	6.48
14.0	22.8	6.48
16.0	22.7	6.47
18.0	22.7	6.46
20.0	22.7	6.44
22.0	Bottom	Bottom

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	20.4	8.22
2.0	19.4	8.23
4.0	18.8	8.20
6.0	18.5	8.07
8.0	18.4	7.99
10.0	18.3	7.90
12.0	18.3	7.89
14.0	18.3	7.87
16.0	18.3	7.88
18.0	18.2	7.80
20.0	Bottom	Bottom

Appendix D

Agency Correspondence

1414 West Hamilton Avenue
P.O. Box 8
Eau Claire, WI 54702-0008

December 4, 2015

Cheryl Laatsch – Statewide FERC Coordinator
WI Dept. of Natural Resources
N7725 Hwy 28
Horicon, WI 53032

Nick Utrup
U.S. Fish and Wildlife Service
Wisconsin/Minnesota Ecological Services Field Office
4101 American Boulevard East
Bloomington, MN 55425

Subject: **2015 Water Quality Monitoring Report**
Big Falls (P-2390-01), Thornapple (P-2475) & Turtle-Flambeau (P-2390-02)

Dear Ms. Laatsch and Mr. Utrup:

Enclosed is the 2015 Water Quality Sampling Report for Big Falls and Thornapple flowages. The samples were taken in April, July and August from the deepest point of each reservoir immediately upstream of the boat restraining barrier. The report includes results for the past five years.

Annual water quality monitoring for the Turtle Flambeau Flowage is conducted by the Citizens Lake Monitoring Program and the results are published on the WDNR's website. The link is http://dnr.wi.gov/lakes/clmn/Stations.aspx?location=26. Should citizen monitoring be discontinued in the future, NSPW shall provide replacement services as stipulated in the 2008 Water Quality Certification for Big Falls Hydro.

Should you have any questions concerning this report, you may contact me at (715) 737-1353 or at matthew.j.miller@xcelenergy.com. Please provide any comments that you may have by **January 8, 2016**.

Sincerely,

Matthew J. Miller

Matthew J. Miller
Hydro License Compliance Consultant

Enclosure

c: Project Files