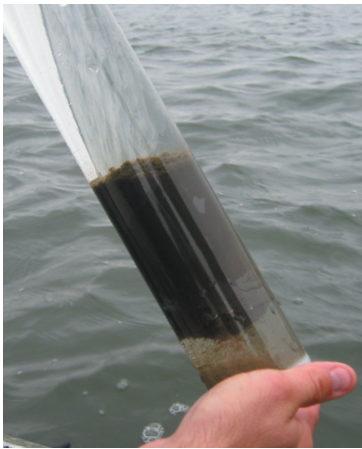




Emmons & Olivier Resources, Inc.
for the Mississippi Headwaters Board

Including: Clearwater, Beltrami, Cass, Hubbard,
Itasca, Aitkin, Crow Wing, and Morrison Counties

400-Mile Mississippi Headwaters Water Quality Analysis: 2003-2013 Reach Summary Sheets



Cover Images

Left Image: Water Quality Sampling

Right Image: EOR staff at the Mississippi Headwaters, Itasca State Park - MN

Document Component Specs

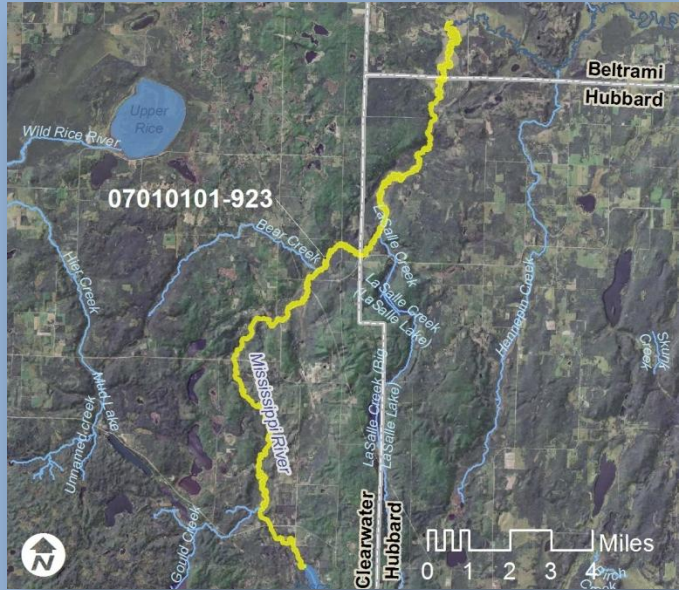
Text: Staples • multipurpose paper, 24 lb. text – 50% post-consumer fibers, FSC Certified.

Back Cover: Neenah Paper • Esse • Texture, Sapphire • 100 lb. cover • 30% post-consumer fibers, Green Seal® Certified

Wire Binding: Manufactured using recycled high carbon steel

07010101-923

Mississippi River – Lake Itasca to unnamed creek



- **Length:** 29.6 miles
- **Municipalities:** None
- **Tributaries:** Bear Cree, La Salle Creek

SUMMARY

- **Data gaps:** No flow data
- **Water quality:** TP exceeds standard
- **Biology:** Healthy fish and invertebrate communities
- **Concerns:**

WATER QUALITY + BIOLOGY

POLLUTANT	#	2003-12 Mean	Min.	Max.	Standard
Ammonia (mg/L)	92	0.06	0.05	0.26	0.04 ¹
Chloride (mg/L)	16	2.03	1.40	4.70	230
Dissolved Oxygen (mg/L)	95	8.52	0.86	14.38	0.5 ²
Nitrate-nitrite (mg/L)	92	0.05	0.05	0.11	10
pH	106	7.90	6.73	8.64	6.5 – 9.0
Phosphorus (µg/L)	57	0.06	0.03	0.15	50 ³
Sulfate (mg/L)	20	1.07	1.00	2.05	N/A
Total suspended solids (mg/L)	68	7.07	1.00	98.00	15 ⁴
<i>E. coli</i> (organisms/100 mL)	21	15.11	1.00	130.0	126 ⁵

¹ Unionized N, ² Daily min., ³ June 1-Sept 30, ⁴ Apr 1-Sept 30, ⁵ Geometric mean, Apr 1 -Oct 31

- Water quality data available from 2003-2010 at 5 stations
- TP exceeds water quality standard, but decreases from 2003 to 2010
- Other parameters meet water quality standards
- Healthy fish community with high IBI score. Yellow perch most common, with bluegill, northern pike, rock bass, and white sucker also present.
- Good invertebrate community with IBI score of 73 in 2011

FLOW + PHOSPHORUS LOAD

- No NPDES permitted point sources discharge directly to mainstem

07010101-923

Mississippi River – Lake Itasca to unnamed creek



- **Length:** 29.6 miles
- **Municipalities:** None
- **Tributaries:** Bear Cree, La Salle Creek

SUMMARY

- **Data gaps:** No flow data
- **Water quality:** TP exceeds standard
- **Biology:** Healthy fish and invertebrate communities
- **Concerns:**

WATER QUALITY + BIOLOGY

POLLUTANT	#	2003-12 Mean	Min.	Max.	Standard
Ammonia (mg/L)	92	0.06	0.05	0.26	0.04 ¹
Chloride (mg/L)	16	2.03	1.40	4.70	230
Dissolved Oxygen (mg/L)	95	8.52	0.86	14.38	0.5 ²
Nitrate-nitrite (mg/L)	92	0.05	0.05	0.11	10
pH	106	7.90	6.73	8.64	6.5 – 9.0
Phosphorus (µg/L)	57	0.06	0.03	0.15	50 ³
Sulfate (mg/L)	20	1.07	1.00	2.05	N/A
Total suspended solids (mg/L)	68	7.07	1.00	98.00	15 ⁴
<i>E. coli</i> (organisms/100 mL)	21	15.11	1.00	130.0	126 ⁵

¹ Unionized N, ² Daily min., ³ June 1-Sept 30, ⁴ Apr 1-Sept 30, ⁵ Geometric mean, Apr 1 -Oct 31

- Water quality data available from 2003-2010 at 5 stations
- TP exceeds water quality standard, but decreases from 2003 to 2010
- Other parameters meet water quality standards
- Healthy fish community with high IBI score. Yellow perch most common, with bluegill, northern pike, rock bass, and white sucker also present.
- Good invertebrate community with IBI score of 73 in 2011

FLOW + PHOSPHORUS LOAD

- No NPDES permitted point sources discharge directly to mainstem

07010101-923

Mississippi River – Lake Itasca to unnamed creek



- **Length:** 29.6 miles
- **Municipalities:** None
- **Tributaries:** Bear Cree, La Salle Creek

SUMMARY

- **Data gaps:** No flow data
- **Water quality:** TP exceeds standard
- **Biology:** Healthy fish and invertebrate communities
- **Concerns:**

WATER QUALITY + BIOLOGY

POLLUTANT	#	2003-12 Mean	Min.	Max.	Standard
Ammonia (mg/L)	92	0.06	0.05	0.26	0.04 ¹
Chloride (mg/L)	16	2.03	1.40	4.70	230
Dissolved Oxygen (mg/L)	95	8.52	0.86	14.38	0.5 ²
Nitrate-nitrite (mg/L)	92	0.05	0.05	0.11	10
pH	106	7.90	6.73	8.64	6.5 – 9.0
Phosphorus (µg/L)	57	0.06	0.03	0.15	50 ³
Sulfate (mg/L)	20	1.07	1.00	2.05	N/A
Total suspended solids (mg/L)	68	7.07	1.00	98.00	15 ⁴
<i>E. coli</i> (organisms/100 mL)	21	15.11	1.00	130.0	126 ⁵

¹ Unionized N, ² Daily min., ³ June 1-Sept 30, ⁴ Apr 1-Sept 30, ⁵ Geometric mean, Apr 1 -Oct 31

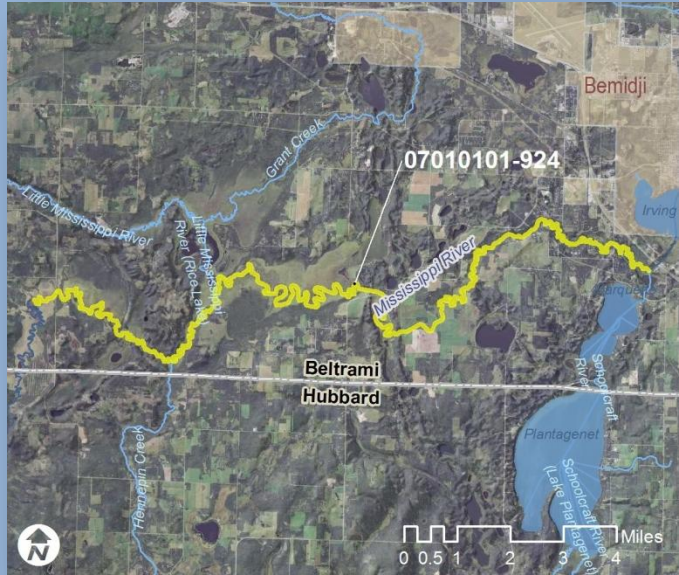
- Water quality data available from 2003-2010 at 5 stations
- TP exceeds water quality standard, but decreases from 2003 to 2010
- Other parameters meet water quality standards
- Healthy fish community with high IBI score. Yellow perch most common, with bluegill, northern pike, rock bass, and white sucker also present.
- Good invertebrate community with IBI score of 73 in 2011

FLOW + PHOSPHORUS LOAD

- No NPDES permitted point sources discharge directly to mainstem

07010101-924

Mississippi River – Unnamed creek to Schoolcraft River



- **Length:** 28.6 miles
- **Municipalities:** Bemidji
- **Tributaries:** Little Mississippi River, Grant Creek, Hennepin Creek

SUMMARY

- **Data gaps:** Only one year of data
- **Water quality:** Low DO in July and August
- **Biology:** Healthy fish community
- **Concerns:**

WATER QUALITY + BIOLOGY

POLLUTANT	#	2003-12 Mean	Min.	Max.	Standard
Ammonia (mg/L)	36	0.06	0.05	0.19	0.04 ¹
Chloride (mg/L)					230
Dissolved Oxygen (mg/L)	36	6.27	0.90	10.33	0.5 ²
Nitrate-nitrite (mg/L)	36	0.05	0.05	0.08	10
pH	36	7.67	6.80	8.36	6.5 – 9.0
Phosphorus (µg/L)	27	0.08	0.05	0.16	50 ³
Sulfate (mg/L)					N/A
Total suspended solids (mg/L)	30	3.71	1.00	9.60	15 ⁴
<i>E. coli</i> (organisms/100 mL)					126 ⁵

¹ Unionized N, ² Daily min., ³ June 1-Sept 30, ⁴ Apr 1-Sept 30, ⁵ Geometric mean, Apr 1 -Oct 31

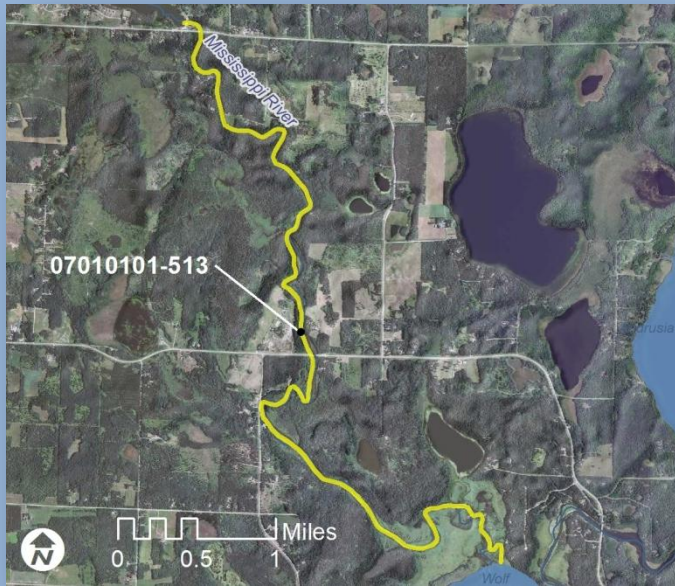
- Water quality data available from 2003 at 3 stations
- TP exceeds water quality standard
- Low dissolved oxygen in July and August (< 5 mg/L)
- Other parameters meet water quality standards
- Healthy fish community with high IBI score. Yellow perch most common, with bluegill, northern pike, rock bass, and white sucker also present.

FLOW + PHOSPHORUS LOAD

- No NPDES permitted point sources discharge directly to mainstem

07010101-513

Mississippi River – Stump Lake to Wolf Lake



- **Length:** 6.3 miles
- **Municipalities:** None
- **Tributaries:** None

SUMMARY

- **Data gaps:** No recent *E. coli* data
- **Water quality:** Good
- **Biology:** Healthy fish community
- **Concerns:**

WATER QUALITY + BIOLOGY

POLLUTANT	#	2003-12 Mean	Min.	Max.	Standard
Ammonia (mg/L)	30	0.05	0.05	0.05	0.04 ¹
Chloride (mg/L)	16	6.66	5.30	8.57	230
Dissolved Oxygen (mg/L)	35	10.74	6.79	15.07	0.5 ²
Nitrate-nitrite (mg/L)	30	0.07	0.05	0.30	10
pH	44	8.42	7.75	8.88	6.5 – 9.0
Phosphorus (µg/L)	12	0.03	0.02	0.05	50 ³
Sulfate (mg/L)	18	2.41	1.65	3.25	N/A
Total suspended solids (mg/L)	18	2.63	1.00	11.00	15 ⁴
<i>E. coli</i> (organisms/100 mL)	21	9.79	32.6	140.0	126 ⁵

¹ Unionized N, ² Daily min., ³ June 1-Sept 30, ⁴ Apr 1-Sept 30, ⁵ Geometric mean, Apr 1 -Oct 31

- Water quality data available from 2004-2010 at 1 station
- No *E. coli* data collected in most recent 5 years
- Parameters meet water quality standards
- Healthy fish community with high IBI score. Yellow perch most common, with bluegill, northern pike, rock bass, and white sucker also present.

FLOW + PHOSPHORUS LOAD

- Median flow = 228 cfs
(5th percentile = 97 cfs, 95th percentile = 635 cfs)
- TP flow-weighted mean concentration = 29 µg/L
- TP load = 17,020 pounds per year
- No NPDES permitted point sources discharge directly to mainstem



- **Length:** 11 miles
- **Municipalities:** None
- **Tributaries:** None

SUMMARY

- **Data gaps:** Only 2 years of available data
- **Water quality:** TP exceeded standard in 2005
- **Biology:** Healthy fish community
- **Concerns:**

WATER QUALITY + BIOLOGY

POLLUTANT	#	2003-12 Mean	Min.	Max.	Standard
Ammonia (mg/L)	34	0.04	0.01	0.25	0.04 ¹
Chloride (mg/L)	34	20.95	11.1	27.10	230
Dissolved Oxygen (mg/L)	34	8.53	3.76	12.78	0.5 ²
Nitrate-nitrite (mg/L)	34	0.08	0.02	0.46	10
pH	33	7.92	7.46	8.34	6.5 – 9.0
Phosphorus (µg/L)	18	0.07	0.02	0.15	50 ³
Sulfate (mg/L)					N/A
Total suspended solids (mg/L)	28	11.63	0.50	40.00	15 ⁴
<i>E. coli</i> (organisms/100 mL)					126 ⁵

¹ Unionized N, ² Daily min., ³ June 1-Sept 30, ⁴ Apr 1-Sept 30, ⁵ Geometric mean, Apr 1 -Oct 31

- Water quality data available from 2004-2005 at 1 station
- TP exceeded water quality standard in 2005
- Other parameters meet water quality standards
- Healthy fish community with high IBI score. Yellow perch most common, with bluegill, northern pike, rock bass, and white sucker also present.

FLOW + PHOSPHORUS LOAD

- No NPDES permitted point sources discharge directly to mainstem



- **Length:** 11 miles
- **Municipalities:** None
- **Tributaries:** None

SUMMARY

- **Data gaps:** Only 2 years of available data
- **Water quality:** TP exceeded standard in 2005
- **Biology:** Healthy fish community
- **Concerns:**

WATER QUALITY + BIOLOGY

POLLUTANT	#	2003-12 Mean	Min.	Max.	Standard
Ammonia (mg/L)	34	0.04	0.01	0.25	0.04 ¹
Chloride (mg/L)	34	20.95	11.1	27.10	230
Dissolved Oxygen (mg/L)	34	8.53	3.76	12.78	0.5 ²
Nitrate-nitrite (mg/L)	34	0.08	0.02	0.46	10
pH	33	7.92	7.46	8.34	6.5 – 9.0
Phosphorus (µg/L)	18	0.07	0.02	0.15	50 ³
Sulfate (mg/L)					N/A
Total suspended solids (mg/L)	28	11.63	0.50	40.00	15 ⁴
<i>E. coli</i> (organisms/100 mL)					126 ⁵

¹ Unionized N, ² Daily min., ³ June 1-Sept 30, ⁴ Apr 1-Sept 30, ⁵ Geometric mean, Apr 1 -Oct 31

- Water quality data available from 2004-2005 at 1 station
- TP exceeded water quality standard in 2005
- Other parameters meet water quality standards
- Healthy fish community with high IBI score. Yellow perch most common, with bluegill, northern pike, rock bass, and white sucker also present.

FLOW + PHOSPHORUS LOAD

- No NPDES permitted point sources discharge directly to mainstem



- **Length:** 11 miles
- **Municipalities:** None
- **Tributaries:** None

SUMMARY

- **Data gaps:** Only 2 years of available data
- **Water quality:** TP exceeded standard in 2005
- **Biology:** Healthy fish community
- **Concerns:**

WATER QUALITY + BIOLOGY

POLLUTANT	#	2003-12 Mean	Min.	Max.	Standard
Ammonia (mg/L)	34	0.04	0.01	0.25	0.04 ¹
Chloride (mg/L)	34	20.95	11.1	27.10	230
Dissolved Oxygen (mg/L)	34	8.53	3.76	12.78	0.5 ²
Nitrate-nitrite (mg/L)	34	0.08	0.02	0.46	10
pH	33	7.92	7.46	8.34	6.5 – 9.0
Phosphorus (µg/L)	18	0.07	0.02	0.15	50 ³
Sulfate (mg/L)					N/A
Total suspended solids (mg/L)	28	11.63	0.50	40.00	15 ⁴
<i>E. coli</i> (organisms/100 mL)					126 ⁵

¹ Unionized N, ² Daily min., ³ June 1-Sept 30, ⁴ Apr 1-Sept 30, ⁵ Geometric mean, Apr 1 -Oct 31

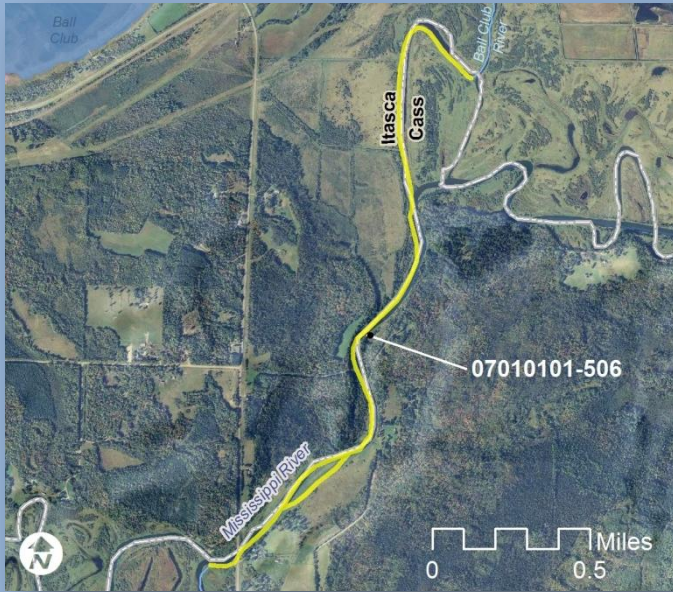
- Water quality data available from 2004-2005 at 1 station
- TP exceeded water quality standard in 2005
- Other parameters meet water quality standards
- Healthy fish community with high IBI score. Yellow perch most common, with bluegill, northern pike, rock bass, and white sucker also present.

FLOW + PHOSPHORUS LOAD

- No NPDES permitted point sources discharge directly to mainstem

07010101-506

Mississippi River – Leech Lake River to Ball Club River



- **Length:** 2.6 miles
- **Municipalities:** None
- **Tributaries:** Leech Lake River

SUMMARY

- **Data gaps:** Only 1 year of TSS data
- **Water quality:** Good
- **Biology:** Poor to good fish community
- **Concerns:**

WATER QUALITY + BIOLOGY

POLLUTANT	#	2003-12 Mean	Min.	Max.	Standard
Ammonia (mg/L)					0.04 ¹
Chloride (mg/L)					230
Dissolved Oxygen (mg/L)	95	9.23	2.94	18.35	0.5 ²
Nitrate-nitrite (mg/L)					10
pH	95	8.07	7.00	8.80	6.5 – 9.0
Phosphorus (µg/L)					50 ³
Sulfate (mg/L)					N/A
Total suspended solids (mg/L)	6	1.57	1.00	3.20	15 ⁴
<i>E. coli</i> (organisms/100 mL)					126 ⁵

¹ Unionized N, ² Daily min., ³ June 1-Sept 30, ⁴ Apr 1-Sept 30, ⁵ Geometric mean, Apr 1 -Oct 31

- Water quality data available from 2003-2008 at 1 station
- TSS only monitored in 2008
- Other parameters meet water quality standards
- Poor to good fish community. Yellow perch and black bullhead most common, with northern pike and rock bass also present.

FLOW + PHOSPHORUS LOAD

- Median flow = 817 cfs
(5th percentile = 313 cfs, 95th percentile = 1,890 cfs)
- No NPDES permitted point sources discharge directly to mainstem

07010101-502

Mississippi River – Deer River to Vermillion River



- **Length:** 10.7 miles
- **Municipalities:** None
- **Tributaries:** Deer River

SUMMARY

- **Data gaps:** No TP and nitrate data
- **Water quality:** Good
- **Biology:** Poor to good fish community
- **Concerns:**

WATER QUALITY + BIOLOGY

POLLUTANT	#	2003-12 Mean	Min.	Max.	Standard
Ammonia (mg/L)					0.04 ¹
Chloride (mg/L)					230
Dissolved Oxygen (mg/L)	93	8.31	2.87	13.35	0.5 ²
Nitrate-nitrite (mg/L)					10
pH	93	7.87	7.01	8.58	6.5 – 9.0
Phosphorus (µg/L)					50 ³
Sulfate (mg/L)					N/A
Total suspended solids (mg/L)	7	2.66	1.00	6.00	15 ⁴
<i>E. coli</i> (organisms/100 mL)					126 ⁵

¹ Unionized N, ² Daily min., ³ June 1-Sept 30, ⁴ Apr 1-Sept 30, ⁵ Geometric mean, Apr 1 -Oct 31

- Water quality data available from 2003-2008 at 1 station
- TSS only monitored in 2008
- Parameters meet water quality standards
- Poor to good fish community. Yellow perch and black bullhead most common, with northern pike and rock bass also present.

FLOW + PHOSPHORUS LOAD

- No NPDES permitted point sources discharge directly to mainstem

07010101-502

Mississippi River – Deer River to Vermillion River



- **Length:** 10.7 miles
- **Municipalities:** None
- **Tributaries:** Deer River

SUMMARY

- **Data gaps:** No TP and nitrate data
- **Water quality:** Good
- **Biology:** Poor to good fish community
- **Concerns:**

WATER QUALITY + BIOLOGY

POLLUTANT	#	2003-12 Mean	Min.	Max.	Standard
Ammonia (mg/L)					0.04 ¹
Chloride (mg/L)					230
Dissolved Oxygen (mg/L)	93	8.31	2.87	13.35	0.5 ²
Nitrate-nitrite (mg/L)					10
pH	93	7.87	7.01	8.58	6.5 – 9.0
Phosphorus (µg/L)					50 ³
Sulfate (mg/L)					N/A
Total suspended solids (mg/L)	7	2.66	1.00	6.00	15 ⁴
<i>E. coli</i> (organisms/100 mL)					126 ⁵

¹ Unionized N, ² Daily min., ³ June 1-Sept 30, ⁴ Apr 1-Sept 30, ⁵ Geometric mean, Apr 1 -Oct 31

- Water quality data available from 2003-2008 at 1 station
- TSS only monitored in 2008
- Parameters meet water quality standards
- Poor to good fish community. Yellow perch and black bullhead most common, with northern pike and rock bass also present.

FLOW + PHOSPHORUS LOAD

- No NPDES permitted point sources discharge directly to mainstem

07010101-501

Mississippi River – Vermillion River to Pokegama Lake



- **Length:** 8.1 miles
- **Municipalities:** Cohasset
- **Tributaries:** Vermillion River

SUMMARY

- **Data gaps:** None
- **Water quality:** Good
- **Biology:** Good fish community, Fair invertebrate community
- **Concerns:**

WATER QUALITY + BIOLOGY

POLLUTANT	#	2003-12 Mean	Min.	Max.	Standard
Ammonia (mg/L)	46	0.14	0.05	3.60	0.04 ¹
Chloride (mg/L)	33	3.40	2.66	4.70	230
Dissolved Oxygen (mg/L)	113	8.42	3.15	14.83	0.5 ²
Nitrate-nitrite (mg/L)	52	0.06	0.05	0.46	10
pH	127	7.85	6.61	8.76	6.5 – 9.0
Phosphorus (µg/L)	21	0.03	0.01	0.04	50 ³
Sulfate (mg/L)	35	2.27	1.09	4.79	N/A
Total suspended solids (mg/L)	40	3.48	1.00	8.40	15 ⁴
<i>E. coli</i> (organisms/100 mL)	23	5.66	9.71	42.0	126 ⁵

¹ Unionized N, ² Daily min., ³ June 1-Sept 30, ⁴ Apr 1-Sept 30, ⁵ Geometric mean, Apr 1 -Oct 31

- Water quality data available from 2003-2012 at 2 stations
- All parameters meet water quality standards
- Good fish community (IBI = 74). Black chin shiner and black nose shine most abundant, no invasive fish species present.
- Fair invertebrate community (IBI = 38) with fourteen invertebrate families identified

FLOW + PHOSPHORUS LOAD

- No NPDES permitted point sources discharge directly to mainstem

07010101-501

Mississippi River – Vermillion River to Pokegama Lake



- **Length:** 8.1 miles
- **Municipalities:** Cohasset
- **Tributaries:** Vermillion River

SUMMARY

- **Data gaps:** None
- **Water quality:** Good
- **Biology:** Good fish community, Fair invertebrate community
- **Concerns:**

WATER QUALITY + BIOLOGY

POLLUTANT	#	2003-12 Mean	Min.	Max.	Standard
Ammonia (mg/L)	46	0.14	0.05	3.60	0.04 ¹
Chloride (mg/L)	33	3.40	2.66	4.70	230
Dissolved Oxygen (mg/L)	113	8.42	3.15	14.83	0.5 ²
Nitrate-nitrite (mg/L)	52	0.06	0.05	0.46	10
pH	127	7.85	6.61	8.76	6.5 – 9.0
Phosphorus (µg/L)	21	0.03	0.01	0.04	50 ³
Sulfate (mg/L)	35	2.27	1.09	4.79	N/A
Total suspended solids (mg/L)	40	3.48	1.00	8.40	15 ⁴
<i>E. coli</i> (organisms/100 mL)	23	5.66	9.71	42.0	126 ⁵

¹ Unionized N, ² Daily min., ³ June 1-Sept 30, ⁴ Apr 1-Sept 30, ⁵ Geometric mean, Apr 1 -Oct 31

- Water quality data available from 2003-2012 at 2 stations
- All parameters meet water quality standards
- Good fish community (IBI = 74). Black chin shiner and black nose shine most abundant, no invasive fish species present.
- Fair invertebrate community (IBI = 38) with fourteen invertebrate families identified

FLOW + PHOSPHORUS LOAD

- No NPDES permitted point sources discharge directly to mainstem

07010101-648

Mississippi River – Blackwater Lake to Bass Brook



- **Length:** 1.25 miles
- **Municipalities:** Cohasset
- **Tributaries:** None

SUMMARY

- **Data gaps:** Only one sample for each parameter
- **Water quality:** TP and TSS potentially high
- **Biology:** Poor to good fish community
- **Concerns:** Point sources of TP

WATER QUALITY + BIOLOGY

POLLUTANT	#	2003-12 Mean	Min.	Max.	Standard
Ammonia (mg/L)	2	3.32	0.04	6.60	0.04 ¹
Chloride (mg/L)	2	3.71	3.57	3.85	230
Dissolved Oxygen (mg/L)	2	5.21	3.89	6.53	0.5 ²
Nitrate-nitrite (mg/L)	2	0.42	0.05	0.79	10
pH	5	7.44	6.60	8.04	6.5 – 9.0
Phosphorus (µg/L)	3	0.09	0.02	0.22	50 ³
Sulfate (mg/L)	2	6.98	3.65	10.30	N/A
Total suspended solids (mg/L)	1	35.00	35.0	35.00	15 ⁴
<i>E. coli</i> (organisms/100 mL)	1	260.0	260	260	126 ⁵

¹ Unionized N, ² Daily min., ³ June 1-Sept 30, ⁴ Apr 1-Sept 30, ⁵ Geometric mean, Apr 1 -Oct 31

- Water quality data available from 2009, 2011-2012 at 2 stations
- TP and TSS potentially exceeding water quality standards
- Other parameters meet water quality standards
- Poor to good fish community. Yellow perch and black bullhead most common, with northern pike and rock bass also present.

FLOW + PHOSPHORUS LOAD

- NPDES permitted point source: Minnesota Power-Boswell Energy Center



- **Length:** 2.8 miles
- **Municipalities:** Grand Rapids:
- **Tributaries:** None

SUMMARY

- **Data gaps:** Only one year of ammonia, chloride, *E. coli* and sulfate data
- **Water quality:** Good
- **Biology:** Poor to good fish community
- **Concerns:** Point sources of TP, Urban runoff

WATER QUALITY + BIOLOGY

POLLUTANT	#	2003-12 Mean	Min.	Max.	Standard
Ammonia (mg/L)	9	0.05	0.05	0.06	0.04 ¹
Chloride (mg/L)	10	4.62	3.06	14.20	230
Dissolved Oxygen (mg/L)	261	9.19	5.47	17.03	0.5 ²
Nitrate-nitrite (mg/L)	89	0.05	0.05	0.14	10
pH	268	7.95	7.30	8.36	6.5 – 9.0
Phosphorus (µg/L)	31	0.03	0.01	0.04	50 ³
Sulfate (mg/L)	10	5.83	3.37	10.60	N/A
Total suspended solids (mg/L)	72	2.82	1.00	10.00	15 ⁴
<i>E. coli</i> (organisms/100 mL)	1	9.00	9.00	9.00	126 ⁵

¹ Unionized N, ² Daily min., ³ June 1-Sept 30, ⁴ Apr 1-Sept 30, ⁵ Geometric mean, Apr 1 -Oct 31

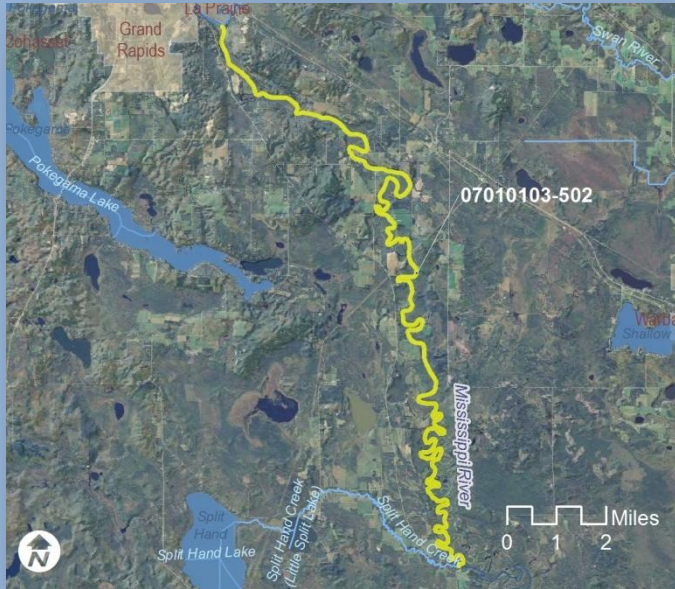
- Water quality data available from 2003-2012 at 2 stations
- Only one year of ammonia, chloride, *E. coli*, and sulfate data
- Parameters meet water quality standards
- Poor to good fish community. Yellow perch and black bullhead most common, with northern pike and rock bass also present.

FLOW + PHOSPHORUS LOAD

- Median flow = 1,024 cfs
(5th percentile = 344 cfs, 95th percentile = 2,172 cfs)
- TP flow-weighted mean concentration = 25-32 µg/L
- TP load = ~55,000 pounds per year
- NPDES permitted point source: Grand Rapids WWTP

07010103-502

Mississippi River – Prairie River to Split Hand Creek



- **Length:** 23.5 miles
- **Municipalities:** Grand Rapids
- **Tributaries:** Prairie River

SUMMARY

- **Data gaps:** None
- **Water quality:** Good
- **Biology:** Poor to good fish community
- **Concerns:**

WATER QUALITY + BIOLOGY

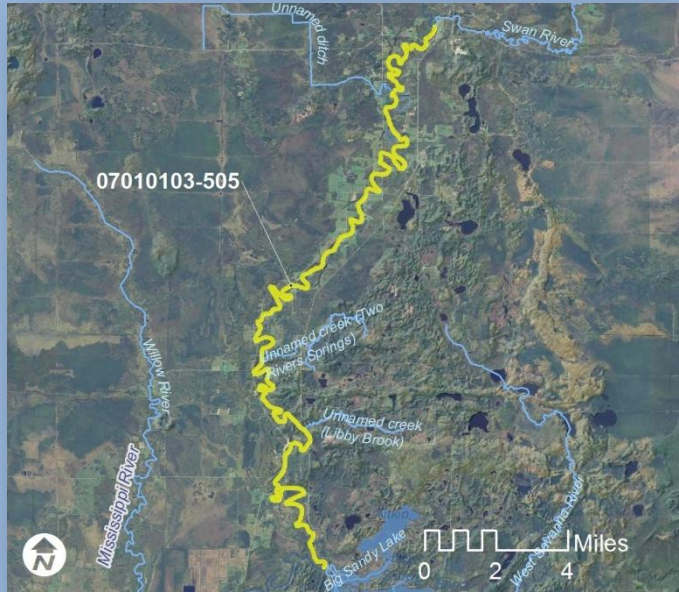
POLLUTANT	#	2003-12 Mean	Min.	Max.	Standard
Ammonia (mg/L)	60	0.06	0.05	0.43	0.04 ¹
Chloride (mg/L)	59	4.92	3.03	11.00	230
Dissolved Oxygen (mg/L)	183	8.86	4.30	16.19	0.5 ²
Nitrate-nitrite (mg/L)	89	0.10	0.05	3.70	10
pH	202	7.84	6.87	8.82	6.5 – 9.0
Phosphorus (µg/L)	32	0.03	0.03	0.04	50 ³
Sulfate (mg/L)	64	11.67	3.17	34.70	N/A
Total suspended solids (mg/L)	62	3.75	1.00	12.00	15 ⁴
<i>E. coli</i> (organisms/100 mL)	40	11.17	1.00	210.0	126 ⁵

¹ Unionized N, ² Daily min., ³ June 1-Sept 30, ⁴ Apr 1-Sept 30, ⁵ Geometric mean, Apr 1 -Oct 31

- Water quality data available from 2003-2011 at 1 station
- Sulfate concentration low and decreasing
- Parameters meet water quality standards
- Poor to good fish community. Yellow perch and black bullhead most common, with northern pike and rock bass also present.

FLOW + PHOSPHORUS LOAD

- No NPDES permitted point sources discharge directly to mainstem



- **Length:** 32.3 miles
- **Municipalities:** None
- **Tributaries:** Swan River, Two Rivers Spring, Libby Brook

SUMMARY

- **Data gaps:** Only 3 years of data, No TP or nitrate data
- **Water quality:** TSS exceeded standards in 2008
- **Biology:** Poor to good fish community
- **Concerns:**

WATER QUALITY + BIOLOGY

POLLUTANT	#	2003-12 Mean	Min.	Max.	Standard
Ammonia (mg/L)					0.04 ¹
Chloride (mg/L)					230
Dissolved Oxygen (mg/L)	113	8.77	6.29	14.01	0.5 ²
Nitrate-nitrite (mg/L)					10
pH	112	7.88	7.32	8.27	6.5 – 9.0
Phosphorus (µg/L)					50 ³
Sulfate (mg/L)					N/A
Total suspended solids (mg/L)	80	14.03	3.20	29.0	15 ⁴
<i>E. coli</i> (organisms/100 mL)					126 ⁵

¹ Unionized N, ² Daily min., ³ June 1-Sept 30, ⁴ Apr 1-Sept 30, ⁵ Geometric mean, Apr 1 -Oct 31

- Water quality data available from 2007-2009 at 2 stations
- Only dissolved oxygen, pH and TSS monitored
- TSS exceeds water quality standard in 2008
- Other parameters meet water quality standards
- Poor to good fish community. Shorthead and silver redhourse most common, with bluegill, northern pike, and rock bass also present.

FLOW + PHOSPHORUS LOAD

- No NPDES permitted point sources discharge directly to mainstem

07010103-501

Mississippi River – Sandy River to Willow River



- **Length:** 27.8 miles
- **Municipalities:** None
- **Tributaries:** Sandy River

SUMMARY

- **Data gaps:** No TP or nitrate data
- **Water quality:** TSS slightly exceeds standard
- **Biology:** Poor to good fish community
- **Concerns:** Point sources of TP

WATER QUALITY + BIOLOGY

POLLUTANT	#	2003-12 Mean	Min.	Max.	Standard
Ammonia (mg/L)					0.04 ¹
Chloride (mg/L)					230
Dissolved Oxygen (mg/L)	186	8.80	5.92	13.94	0.5 ²
Nitrate-nitrite (mg/L)					10
pH	188	7.96	7.07	14.20	6.5 – 9.0
Phosphorus (µg/L)					50 ³
Sulfate (mg/L)					N/A
Total suspended solids (mg/L)	78	15.04	4.00	37.00	15 ⁴
<i>E. coli</i> (organisms/100 mL)					126 ⁵

¹ Unionized N, ² Daily min., ³ June 1-Sept 30, ⁴ Apr 1-Sept 30, ⁵ Geometric mean, Apr 1 -Oct 31

- Water quality data available from 2003-2009 at 2 stations
- TSS slightly exceeds water quality standard, highest in 2009
- Other parameters meet water quality standards
- Poor to good fish community. Shorthead and silver redhourse most common, with bluegill, northern pike, and rock bass also present.

FLOW + PHOSPHORUS LOAD

- NPDES permitted point source: Palisade WWTP

07010104-503

Mississippi River – Rice River to Little Willow River



- **Length:** 16.4 miles
- **Municipalities:** Aitkin
- **Tributaries:** Rice River

SUMMARY

- **Data gaps:** None
- **Water quality:** TP and TSS exceeds standards
- **Biology:** Good fish community, Poor invertebrate community
- **Concerns:** Point sources of TP, Urban runoff

WATER QUALITY + BIOLOGY

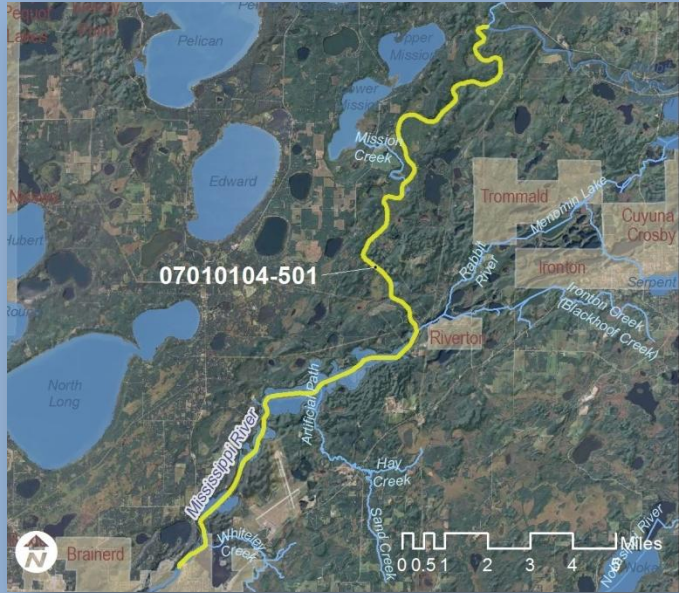
POLLUTANT	#	2003-12 Mean	Min.	Max.	Standard
Ammonia (mg/L)	77	0.06	0.05	0.30	0.04 ¹
Chloride (mg/L)	45	4.40	1.00	6.50	230
Dissolved Oxygen (mg/L)	276	8.96	2.54	15.50	0.5 ²
Nitrate-nitrite (mg/L)	185	0.15	0.05	3.90	10
pH	318	7.90	6.92	8.96	6.5 – 9.0
Phosphorus (µg/L)	75	0.05	0.02	0.10	50 ³
Sulfate (mg/L)	48	11.48	2.87	34.00	N/A
Total suspended solids (mg/L)	169	19.95	4.00	120.0	15 ⁴
<i>E. coli</i> (organisms/100 mL)	21	9.98	1.00	59.0	126 ⁵

¹ Unionized N, ² Daily min., ³ June 1-Sept 30, ⁴ Apr 1-Sept 30, ⁵ Geometric mean, Apr 1 -Oct 31

- Water quality data available from 2004-2012 at 1 station
- TP and TSS exceeds water quality standard
- Other parameters meet water quality standards
- Good fish community (IBI = 68). Spotfin shiner, shorthead and silver redhorse most common, with bluegill, northern pike, and rock bass also present. No invasive fish species observed.
- Poor invertebrate community (IBI = 31) with 15 families identified

FLOW + PHOSPHORUS LOAD

- Median flow = 1,805 cfs
(5th percentile = 637 cfs, 95th percentile = 6,436 cfs)
- TP flow-weighted mean concentration = 48-53 µg/L
- TP load = ~225,000 pounds per year
- NPDES permitted point source: Sampson Farms



- **Length:** 20.3 miles
- **Municipalities:** Brainerd
- **Tributaries:** Pine River, Rabbit River, Blackhoof Creek, Hay Creek, Sand Creek, Mission Creek

SUMMARY

- **Data gaps:** No *E. coli* or TSS data
- **Water quality:** TP increasing
- **Biology:** Good fish community, Common carp present
- **Concerns:** Point sources of TP

WATER QUALITY + BIOLOGY

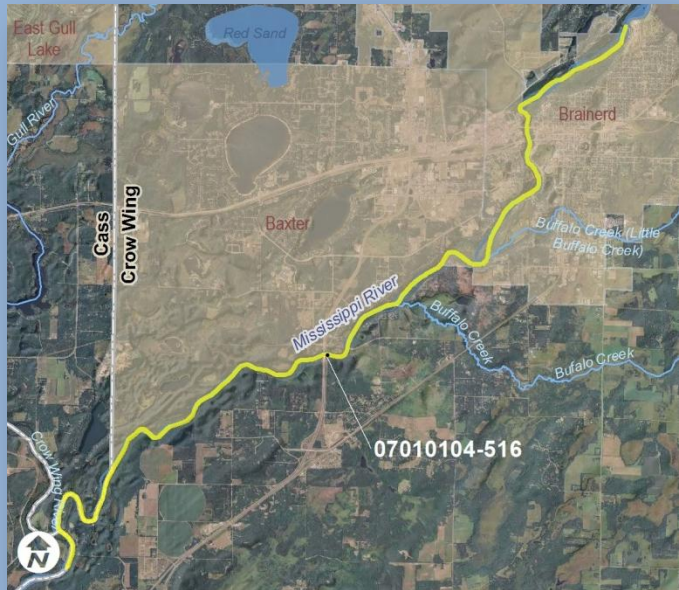
POLLUTANT	#	2003-12 Mean	Min.	Max.	Standard
Ammonia (mg/L)	1	0.05	0.05	0.05	0.04 ¹
Chloride (mg/L)	2	3.75	3.59	3.90	230
Dissolved Oxygen (mg/L)	51	9.00	4.80	14.00	0.5 ²
Nitrate-nitrite (mg/L)	14	0.36	0.05	0.40	10
pH	53	7.83	6.88	8.17	6.5 – 9.0
Phosphorus (µg/L)	7	0.06	0.03	0.08	50 ³
Sulfate (mg/L)	2	3.34	3.13	3.54	N/A
Total suspended solids (mg/L)					15 ⁴
<i>E. coli</i> (organisms/100 mL)					126 ⁵

¹ Unionized N, ² Daily min., ³ June 1-Sept 30, ⁴ Apr 1-Sept 30, ⁵ Geometric mean, Apr 1 -Oct 31

- Water quality data available from 2005-2007 and 2010-2012 at 6 stations
- TP exceeds water quality standard in 2012, and increases from 2010 to 2012
- No TSS or *E. coli* data
- Other parameters meet water quality standards
- Good fish community (IBI = 55-72)
- Common carp present near Brainerd Dam

FLOW + PHOSPHORUS LOAD

- NPDES permitted point sources: Aitkin WWTP and Wausau Paper Mills LLC



- **Length:** 13.5 miles
- **Municipalities:** Brainerd
- **Tributaries:** Little Buffalo Creek, Buffalo Creek

SUMMARY

- **Data gaps:** Only 3 years of available data
- **Water quality:** TP at standard
- **Biology:** Healthy fish community, Common carp near Brainerd Dam
- **Concerns:** Point sources of TP, Urban runoff

WATER QUALITY + BIOLOGY

POLLUTANT	#	2003-12 Mean	Min.	Max.	Standard
Ammonia (mg/L)	47	0.06	0.05	0.11	0.04 ¹
Chloride (mg/L)					230
Dissolved Oxygen (mg/L)	28	9.07	3.53	13.56	0.5 ²
Nitrate-nitrite (mg/L)	47	0.07	0.05	0.24	10
pH	54	7.91	7.20	8.31	6.5 – 9.0
Phosphorus (µg/L)	21	0.05	0.03	0.08	50 ³
Sulfate (mg/L)					N/A
Total suspended solids (mg/L)	40	11.89	1.60	34.00	15 ⁴
<i>E. coli</i> (organisms/100 mL)					126 ⁵

¹ Unionized N, ² Daily min., ³ June 1-Sept 30, ⁴ Apr 1-Sept 30, ⁵ Geometric mean, Apr 1 -Oct 31

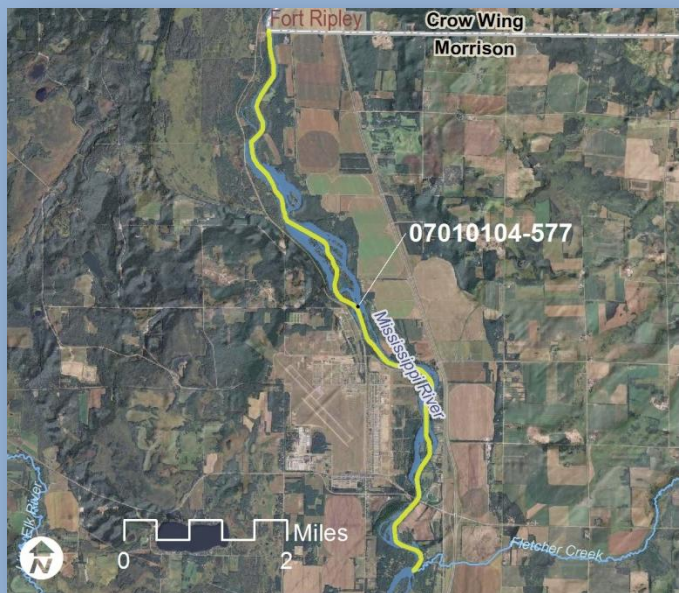
- Water quality data available from 2004-2006 at 1 station
- TP at water quality standard
- Other parameters meet water quality standards
- Good fish community (IBI = 55-72)
- Common carp present near Brainerd Dam

FLOW + PHOSPHORUS LOAD

- Median flow = 2,194 cfs
(5th percentile = 858 cfs, 95th percentile = 7,882 cfs)
- TP flow-weighted mean concentration = 54 µg/L
- TP load = ~315,000 pounds per year
- NPDES permitted point source: Brainerd WWTP

07010104-577

Mississippi River – County border to Fletcher Creek



- **Length:** 8.2 miles
- **Municipalities:** None
- **Tributaries:** None

SUMMARY

- **Data gaps:** None
- **Water quality:** TP exceeded standard in 2005 and 2010
- **Biology:** Fair to good fish community
- **Concerns:** Common carp

WATER QUALITY + BIOLOGY

POLLUTANT	#	2003-12 Mean	Min.	Max.	Standard
Ammonia (mg/L)	30	0.06	0.05	0.17	0.04 ¹
Chloride (mg/L)	17	9.00	6.07	14.80	230
Dissolved Oxygen (mg/L)	33	9.91	6.62	15.51	0.5 ²
Nitrate-nitrite (mg/L)	30	0.36	0.05	1.20	10
pH	44	8.40	7.69	9.04	6.5 – 9.0
Phosphorus (µg/L)	12	0.05	0.02	0.07	50 ³
Sulfate (mg/L)	18	9.50	3.87	16.90	N/A
Total suspended solids (mg/L)	18	7.99	1.00	32.00	15 ⁴
<i>E. coli</i> (organisms/100 mL)	21	6.76	1.00	40.0	126 ⁵

¹ Unionized N, ² Daily min., ³ June 1-Sept 30, ⁴ Apr 1-Sept 30, ⁵ Geometric mean, Apr 1 -Oct 31

- Water quality data available from 2004-2010 at 1 station
- TP exceeded water quality standard in 2005 and 2010
- Sulfate and TSS potentially decreasing
- Other parameters meet water quality standards
- Fair to good fish community. Hornyhead club most common, with bluegill, rock bass, smallmouth bass, and log perch also present.
- Common carp is present.

FLOW + PHOSPHORUS LOAD

- No NPDES permitted point sources discharge directly to mainstem

07010104-519

Mississippi River – Little Falls Dam to Swan River



- Length: 4.4 miles
- Municipalities: Little Falls
- Tributaries: None

SUMMARY

- Data gaps: No TP or TSS data
- Water quality: E. coli close to standard
- Biology: Fair to good fish community
- Concerns: Point sources of TP, Urban runoff

WATER QUALITY + BIOLOGY

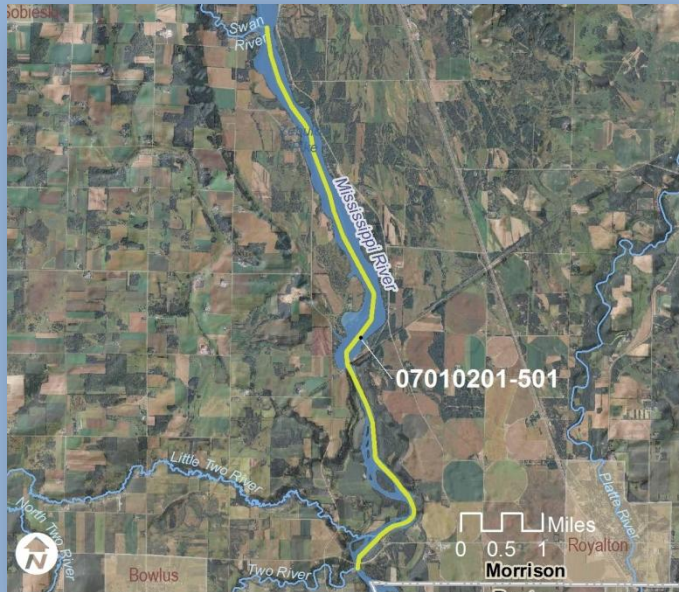
POLLUTANT	#	2003-12 Mean	Min.	Max.	Standard
Ammonia (mg/L)					0.04 ¹
Chloride (mg/L)					230
Dissolved Oxygen (mg/L)	19	7.66	4.73	10.78	0.5 ²
Nitrate-nitrite (mg/L)					10
pH	19	8.33	7.44	9.46	6.5 – 9.0
Phosphorus (µg/L)					50 ³
Sulfate (mg/L)					N/A
Total suspended solids (mg/L)					15 ⁴
<i>E. coli</i> (organisms/100 mL)	15	115.50	27.9	272.3	126 ⁵

¹ Unionized N, ² Daily min., ³ June 1-Sept 30, ⁴ Apr 1-Sept 30, ⁵ Geometric mean, Apr 1 -Oct 31

- Water quality data is only available for 2011 at 1 station
- TP and TSS were not collected
- Other parameters meet water quality standards
- Healthy fish community with high IBI score. Yellow perch most common, with bluegill, northern pike, rock bass, and white sucker also present.
- Good invertebrate community with high IBI score

FLOW + PHOSPHORUS LOAD

- No NPDES permitted TP discharges directly to mainstem



- Length: 7.6 miles
- Municipalities: Royalton
- Tributaries: Swan River, Little Two River

SUMMARY

- Data gaps: None
- Water Quality: TP exceeds standard
- Biology: Fair to good fish community
- Concerns: None identified

WATER QUALITY + BIOLOGY

POLLUTANT	#	2003-12 Mean	Min.	Max.	Standard
Ammonia (mg/L)	33	0.10	0.05	0.44	0.04 ¹
Chloride (mg/L)	40	7.99	4.60	13.00	230
Dissolved Oxygen (mg/L)	149	10.31	6.01	15.62	0.5 ²
Nitrate-nitrite (mg/L)	140	3.40	0.05	440.0	10
pH	155	8.03	2.76	8.90	6.5 – 9.0
Phosphorus (µg/L)	54	0.05	0.03	0.10	50 ³
Sulfate (mg/L)	44	10.27	3.32	31.70	N/A
Total suspended solids (mg/L)	97	6.68	1.00	30.00	15 ⁴
<i>E. coli</i> (organisms/100 mL)	55	12.12	1.00	345.0	126 ⁵

¹ Unionized N, ² Daily min., ³ June 1-Sept 30, ⁴ Apr 1-Sept 30, ⁵ Geometric mean, Apr 1 -Oct 31

- Water quality data available from 2003-2010 at 5 stations
- TP exceeds water quality standard, but decreases from 2003 to 2010
- Other parameters meet water quality standards
- Healthy fish community with high IBI score. Yellow perch most common, with bluegill, northern pike, rock bass, and white sucker also present.
- Good invertebrate community with IBI score of 73 in 2011

FLOW + PHOSPHORUS LOAD

- No NPDES permitted TP discharges directly to mainstem