

2012 Wild Rice Survey and Sulfate Monitoring

Mesabi Nugget Phase I Project

***Prepared for
Mesabi Nugget Delaware, LLC***

>February 2013



2012 Wild Rice Survey and Sulfate Monitoring

St. Louis River and Second Creek

Mesabi Nugget Phase I Project

***Prepared for
Mesabi Nugget Delaware, LLC***

January 2013



4700 West 77th Street
Minneapolis, MN 55435-4803
Phone: (952) 832-2600
Fax: (952) 832-2601



2012 Wild Rice Survey and Sulfate Monitoring

January 2013

Table of Contents

1.0 Introduction	1
2.0 Purpose	2
3.0 Methods	3
3.1 Wild Rice Survey Methods	3
3.2 Macrophyte Sampling Methods	3
3.3 Water Quality Monitoring Methods	4
4.0 Results	5
4.1 Wild Rice Survey Results	5
4.2 Other Macrophyte Results	6
4.3 Water Quality Monitoring Results	6
5.0 References	7

List of Tables

Table 1	Wild Rice Density Scale	3
Table 2	2012 Survey Results	5
Table 3	Maximum, Minimum and Average Sulfate Concentrations (mg/L) in 2012	6

List of Large Tables

Large Table 1	Overview of Macrophyte Monitoring Results for 2012 ⁽¹⁾	
Large Table 2	Water Quality Data Collected During the 2012 Wild Rice Survey	
Large Table 3	Maximum, Minimum and Average Bicarbonate, Chloride, and Cations Concentrations (mg/L) in 2012 ⁽¹⁾	

List of Figures

Figure 1	Wild Rice Field Survey of the Partridge River, Second Creek and St. Louis River ...	12
Figure 2	Wild Rice Field Survey Results for Second Creek	13
Figure 3	Wild Rice Field Survey Results for Partridge River	14
Figure 4	Wild Rice Field Survey Results for St. Louis River	15

List of Exhibits

Exhibit A	2012 Wild Rice Study Area Photographs	
-----------	---------------------------------------	--

1.0 Introduction

This report comprises the NPDES/SDS Permit No. MN0067687 (NPDES Permit) Chapter 5, 1.12 permit requirement to submit a progress report on the status of the Wild Rice Impact Study including a preliminary evaluation of the information and data collected to date.

In order to comply with the NPDES Permit Mesabi Nugget Delaware, LLC retained Barr Engineering Company (Barr) to monitor wild rice and water quality in surface waters in order to ultimately complete and submit the Wild Rice Impact Study Report. Wild rice studies have been conducted by Barr within the project area beginning 2009, and will continue to be completed per the future approved work plan. In compliance with the NPDES Permit, Chapter 5, 1.10, the Wild Rice Impact Study Work Plan is currently in progress.

The 2012 survey work included the St Louis River as required by the MPCA well in advance of the NPDES Permit re-issuance.

This report is being submitted on behalf of Mesabi Nugget Delaware, LLC; however some of the work was performed for Mesabi Mining, LLC.

2.0 Purpose

Wild rice waters are regulated under Minnesota Rules, part 7050.0224, subpart 2. Previous wild rice studies conducted by Barr on behalf of Mesabi Mining have identified those water bodies in the project area that contain wild rice. The purpose of this study is to provide information regarding wild rice stands, water quality within or proximate to those stands, and wild rice habitat, including description of other co-occurring macrophytes, in the identified water bodies for 2012. The water bodies surveyed in 2012 include the St. Louis River, the Partridge River, and Second Creek (study area). Figure 1 shows the portions of these water bodies surveyed for wild rice in 2012.

3.0 Methods

3.1 Wild Rice Survey Methods

The same methods described in Barr’s summary memo to Mesabi Mining, *2011 Wild Rice Field Survey of Select Areas on the St. Louis River* (Reference (1)) were followed in 2012. The methods are similar to those used by the 1854 Treaty Authority, “Wild Rice Monitoring and Abundance in the 1854 Ceded Territory (1998–2008)” and other vegetation plot data surveys designed to quantify *in situ* plant species (e.g., *A Handbook for Collecting Vegetation Plot Data in Minnesota: The Relevé Method* (Reference (2))). In summary, these methods include qualitative (shoreline surveys) and quantitative (grid sampling) wild rice stand density measurements and *in situ* and *ex situ* wild rice plant measurements and statistical analyses. Only qualitative surveys were completed, in 2012; wild rice was not observed at a high enough density at grid sampling locations to trigger quantitative sampling or *in situ* and *ex situ* wild rice plant measurements and statistical analyses.

A wild rice density rating system, 1 to 5, is used by the 1854 Treaty Authority. The rating system was applied to each observation of wild rice. A density rating was used to qualitatively assess the density of wild rice over a given area and indicates approximate percent cover of wild rice (Table 1).

Table 1 Wild Rice Density Scale

Wild Rice Density Rating	Description
1	<10% Wild Rice Cover
2	10–25% Wild Rice Cover
3	25–50% Wild Rice Cover
4	50–75% Wild Rice Cover
5	>75% Wild Rice Cover

3.2 Macrophyte Sampling Methods

As part of 2012 wild rice surveys, other aquatic macrophytes growing in or near the wild rice stands were identified. Macrophyte abundance was determined using similar qualitative density methods as for wild rice. Macrophyte surveys were conducted in conjunction with wild rice surveys because, identifying and describing the frequency and abundance of co-occurring macrophytes may be helpful in assessing a range of factors affecting wild rice growth and production. A subset of macrophyte

observations included collection of plant specimens to verify field identification. In areas where wild rice was not found, macrophyte occurrences were periodically recorded.

3.3 Water Quality Monitoring Methods

The same methods described in Barr's summary memo to Mesabi Mining, *2011 Wild Rice Field Survey of Select Areas on the St. Louis River* (Reference (1)) were followed in 2012, which are consistent with Barr's standard operating procedure (SOP), *Collection of Surface Water Samples* (Reference (3)). At the time of the wild rice surveys, water samples were collected at or near wild rice stands located in two water bodies (Second Creek and Partridge River). Upon collection, unfiltered samples were placed in a cooler with ice and submitted to Pace Analytical (Pace) for analysis.

Water samples were analyzed for concentrations of major cations (magnesium, calcium, potassium, and sodium) and anions (sulfate, bicarbonate, and chloride). The major cations were analyzed using EPA method 6010; sulfate and chloride were analyzed using EPA method 300.0; and bicarbonate was measured as bicarbonate alkalinity and reported as CaCO₃ using SM 2320B. The permit only requires reporting sulfate data, however this work was performed in advance of the NPDES Permit re-issuance.

4.0 Results

4.1 Wild Rice Survey Results

The locations of wild rice stands were identified and plant densities were measured during field surveys conducted on August 7th, 9th, and 30th 2012. Approximately 500 feet of Second Creek (including one 50-foot segment approximately 1/3 mile upstream of the Partridge River), four miles of the Partridge River, and 1.5 miles of the St. Louis River were surveyed (Figure 1). Results of the wild rice surveys are summarized in Table 2. Table 2 also includes a summary of sulfate concentrations found in water samples collected at or near the wild rice stands. Additional detail regarding water quality sampling is provided in the “Water Chemistry” section below. Figure 2 through Figure 4 show wild rice density results from field surveys. Photographs of select wild rice locations within the study area are included in Exhibit A.

Table 2 2012 Survey Results

Water Body	Reach		Wild Rice Monitoring Outcomes	Sulfate (mg/L)
	from	to	2012	Mean
Second Creek	~500 feet upstream of confluence with First Creek	~550 feet downstream of confluence with First Creek	No wild rice observed	Not sampled
	~500 feet upstream of confluence with Partridge River.	Confluence with Partridge River	Wild rice observed along entire stretch (density varying from 1-4)	1100
Partridge River	Just above confluence with Second Creek	Confluence with Second Creek	Wild rice observed along two stretches (density 1-2)	17.0
	Confluence with Second Creek	Hwy 110 bridge	Wild rice stand (density 4) immediately downstream of Second Creek, wild rice stand (density 3) immediately upstream of Hwy. 110 bridge.	56.4
	Hwy 110 bridge	Confluence with St. Louis River	Wild rice observed along 12 stretches, each with length ~200 ft. or less (density ranging from 1-2)	77.5
St. Louis River	Confluence with Partridge	~1/2 mile west of Co. Hwy 100	No wild rice observed	Not sampled

4.2 Other Macrophyte Results

Approximately 15 taxa of aquatic macrophytes were observed in waterbodies surveyed (Large Table 1). The greatest number of macrophyte species were recorded in the Partridge River. This results from the length of river surveyed and the number of wild rice occurrences, at which macrophytes were also documented.

Macrophyte abundance varied greatly among survey locations. At many wild rice stands, little or no submerged, floating, or emergent macrophytes were observed. The most common macrophytes found were white water-lily and arrowheads. At least two species of arrowhead were observed, broadleaf arrowhead and sessile-fruit arrowhead, although the lack of fertile plants at most locations prevented identification to species. Less common species observed multiple times included floating species such as yellow pond-lily and floating pondweed and emergent species such as common spike-rush, river horsetail, and northern manna grass.

4.3 Water Quality Monitoring Results

A total of five water samples were collected at two different water bodies near wild rice stands during the 2012 wild rice survey, including (Figure 3 and Figure 4). Water quality results are presented in Large Table 2. Sulfate concentration ranges by water body are presented in Table 3. Other water quality concentration ranges by water body are presented in Large Table 3.

Table 3 Maximum, Minimum and Average Sulfate Concentrations (mg/L) in 2012

Water Body	Sulfate		
	Max	Min	Avg
Partridge River	86	17	57
Second Creek	1100	1100	1100

Field duplicate measurements are not included in these calculations.

In 2012, a quality assurance and quality control (QA/QC) review was completed to assess the validity of the analytical surface water results. This review was performed in accordance with Barr's SOPs for routine data evaluation, which are based on *The National Functional Guidelines for Inorganic Data Review* (Reference (4)). Data evaluation included a review of technical holding times, preservation, blanks, laboratory control samples, matrix spike samples, duplicate samples, and data package completeness. All reported data have been determined to be acceptable and usable as presented in the data summary tables.

5.0 References

1. **Twin Metals Minnesota LLC.** 2010 Wild Rice Survey and Water Quality Monitoring. 2011.
2. **Minnesota Department of Natural Resources.** A Handbook for Collecting Vegetation Plot Data in Minnesota: The Relevé Method. 2007.
3. **Barr Engineering Company.** Standard Operating Procedure Collection of Surface Water Samples, Revision 5. April 2011.
4. **U.S. Environmental Protection Agency.** USEPA Contract Laboratory Program, National Functional Guidelines for Inorganic Superfund Data Review. *United States Environmental Protection Agency*. [Online] OSWER 9240.1-51. USEPA-540-R-10-011, January 2010.
<http://epa.gov/superfund/programs/clp/download/ism/ism1nfg.pdf>.

Large Tables

Large Table 1 Overview of Macrophyte Monitoring Results for 2012⁽¹⁾

Scientific Name ⁽²⁾	Common Name	Second Creek		Partridge River		St. Louis River	
		Wild Rice Present	Wild Rice Absent	Wild Rice Present	Wild Rice Absent	Wild Rice Present	Wild Rice Absent
		(n = 1)	(n = 1)	(n = 16)	(n = 3)	(n = 0)	(n = 2)
Carex cf. utriculata	Yellow lake sedge				1		
Eleocharis palustris	Common spike-rush			1	2		
Equisetum fluviatile	River horsetail			1	1		
Glyceria borealis	Northern manna grass			2	1		
Nuphar variegata	Yellow pond-lily			3	1		
Nymphaea odorata	White water-lily			13	1		
Phalaris arundinacea	Reed canarygrass						1
Polygonum amphibium	Water knotweed						1
Pontederia cordata	Pickeralweed						1
Potamogeton natans	Floating pondweed			2			
Sagittaria latifolia	Broadleaf arrowhead				1		
Sagittaria cf. rigida	Sessilefruit arrowhead			2			
Sagittaria spp.	Unidentified arrowhead species			15	2		1
Scirpus cyperinus	Woolgrass				1		
Typha spp.	Unidentified cattail species				1		

(1) Occurrences of individual species based on number of sample locations at which the species was observed. The number of sample points (n) is indicated for each water body, categorized as whether wild rice was present or not.

(2) When a plant could only be identified confidently to genus, it is designated "Genus spp." When a likely species identification could be made, but without complete confidence, it is indicated with "cf."

Large Table 2 Water Quality Data Collected During the 2012 Wild Rice Survey

Parameter Total or Dissolved				Alkalinity, bicarbonate, as CaCO ₃ NA	Chloride NA	Sulfate NA	Calcium Total	Magnesium Total	Potassium Total	Sodium Total
Water Body	Sample Name	Date	Sample Type	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
Partridge River	PM-MN-KMTM-01	8/7/2012	N	71.4	4.1	69.9	21.8	27.0	2.2	7.3
Partridge River	PM-MN-KSMB-5	8/9/2012	N	52.2	3.7	17.0	18.7	9.4	1.4	4.9
Partridge River	PM-MN-KSMB-6	8/9/2012	N	64.5	4.1	56.4	21.2	29.0	2.2	7.5
Partridge River	PM-MN-KSMB-7	8/9/2012	N	79.6	4.3	86.0	21.1	30.3	2.2	7.7
Second Creek	PM-KNCA-01	8/30/2012	N	485	8.8	1100	59.5	363	16.8	52.7

Large Table 3 Maximum, Minimum and Average Bicarbonate, Chloride, and Cations Concentrations (mg/L) in 2012⁽¹⁾

Water Body	Alkalinity, bicarbonate, as CaCO ₃ (mg/l)			Chloride (mg/l)			Calcium (mg/l)			Magnesium (mg/l)			Potassium (mg/l)			Sodium (mg/l)		
	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg
Partridge River ⁽²⁾	79.6	52.2	66.93	4.3	3.7	4.05	21.8	18.7	20.7	29	9.4	21.8	2.2	1.4	2	7.7	4.9	6.85
Second Creek	485	485	485	8.8	8.8	8.8	59.5	59.5	59.5	363	363	363	16.8	16.8	16.8	52.7	52.7	52.7

(1) Field duplicate measurements are not included in these calculations.

(2) Averages for Partridge River include sample locations both above and below Second Creek and sample values vary widely between samples collected above vs. below the confluence.

Figures



 River Segments Surveyed in 2012

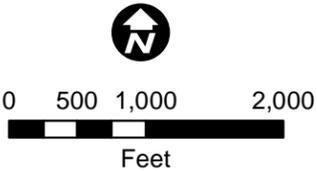


Figure 1
 WILD RICE FIELD SURVEY
 OF THE PARTRIDGE RIVER,
 SECOND CREEK AND
 ST. LOUIS RIVER
 2012
 Mesabi Mining, LLC
 Hoyt Lakes, Minnesota

Service Layer Credits: Source: Esri, i-cubed, USDA, USGS, AEX, GeoEye, Getmapping, Aerogrid, IGN, IGP, and the GIS User Community

Barr Footer: ArcGIS 10.1, 2013-01-09 11:03 File: I:\Client\Mesabi_Nugget\Out of Scope\Wild_Rice\Map\Report\Map2012_12_04\Figure 1 Wild Rice and Sulfate Sampling Locations 2012_rv.mxd User: KJM



● Water Quality Sample Location

Wild Rice Density in 2012

No Wild Rice Observed

1 <10%

3/4 25 - 75 %

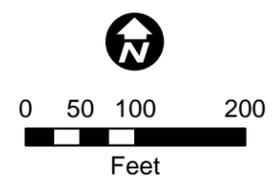


Figure 2
 WILD RICE FIELD SURVEY
 RESULTS FOR SECOND CREEK
 Mesabi Mining, LLC
 Hoyt Lakes, Minnesota

File: L:\Client\Mesabi_Mining\GIS\Map\Report\Map\2012_12_04\Figure 2 Wild Rice and Sulfate Sampling Locations Second Creek 2012.mxd User: KJM
 Service Layer Credits: Source: Esri, i-cubed, USDA, USGS, AEX, GeoEye, Getmapping, Aerogrid, IGN, IGP, and the GIS User Community

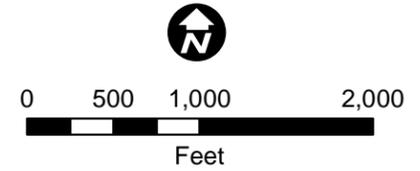
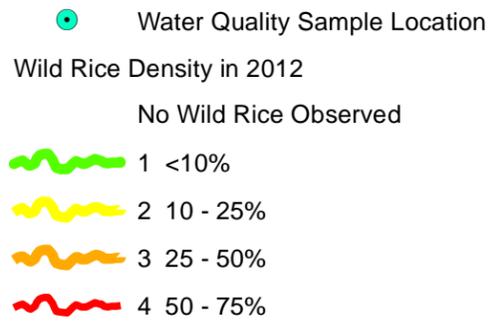
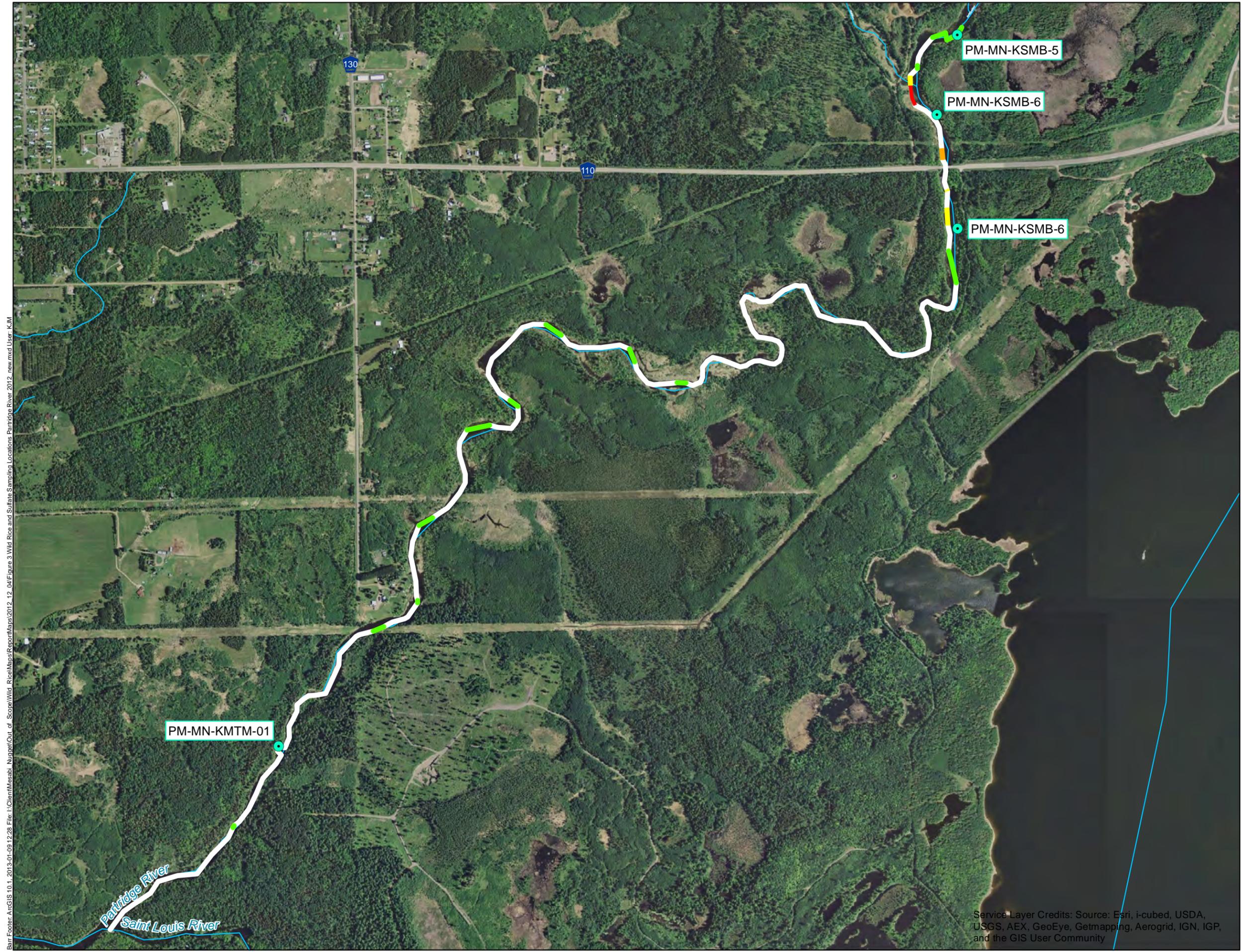


Figure 3
 WILD RICE FIELD SURVEY
 RESULTS FOR PARTRIDGE RIVER
 Mesabi Mining, LLC
 Hoyt Lakes, Minnesota

Barr Footer: ArcGIS 10.1, 2013-01-09 12:28 File: I:\Client\Mesabi_Mining\Reports\ReportMaps\2012_12_04\Figure 3 Wild Rice and Sulfate Sampling Locations Partridge River 2012_new.mxd User: KJM

Service Layer Credits: Source: Esri, i-cubed, USDA, USGS, AEX, GeoEye, Getmapping, Aerogrid, IGN, IGP, and the GIS User Community

Wild Rice Density in 2012
No Wild Rice Observed



Barr Footer: ArcGIS 10.1, 2013-01-09 12:30 File: L:\Client\Mesabi_Mining\Map\Report\Map\2012_12_04\Figure 4 Wild Rice and Sulfate Sampling Locations St. Louis River 2012.mxd User: KIM

Service Layer Credits: Source: Esri, i-cubed, USDA, USGS, AEX, GeoEye, Getmapping, Aerogrid, IGN, IGP, and the GIS User Community

Figure 4
WILD RICE FIELD SURVEY
RESULTS FOR ST. LOUIS RIVER
Mesabi Mining, LLC
Hoyt Lakes, Minnesota

Exhibit A

2012 Wild Rice Study Area Photographs

Photographs from 2012 Wild Rice Survey of Second Creek



Photo near culvert approximately 200 feet upstream of the confluence with Partridge River headed upstream (northwest)



Photo at Second Creek survey point approximately 500 feet upstream of the confluence with Partridge River

Photographs from 2012 Wild Rice Survey of Partridge River



Photo of wild rice on Partridge River looking west to Second Creek (culverts)



Photo on Partridge River just downstream of Second Creek, looking north with wild rice

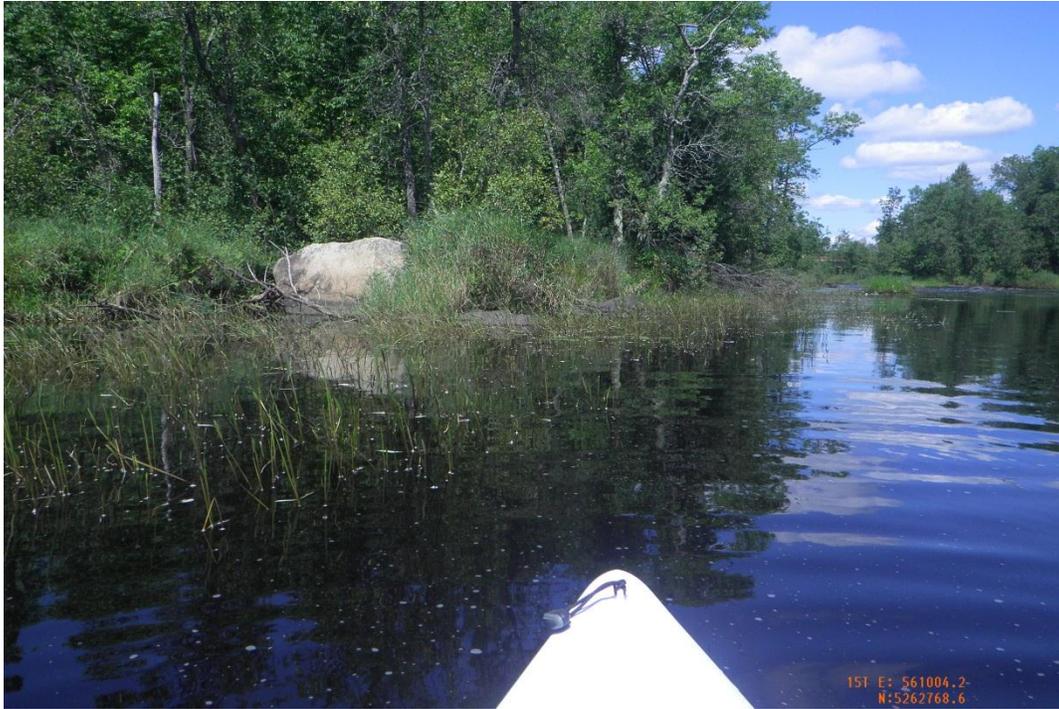


Photo on Partridge River facing north, with wild rice present; Hwy 110 bridge in background



Photo on Partridge River facing north, with sparse wild rice present among more dense arrowhead plants



Photo on Partridge River showing sparse wild rice, and lily pads

Photographs from 2012 Wild Rice Survey of St. Louis River



Three photo panorama of St. Louis River at confluence with Partridge River. From left to right: left bank, center of channel, right bank



Three photo panorama of St. Louis River just below confluence with Partridge River. From left to right: left bank, center of channel, right bank



Photo looking upstream at bouldery stretch of St Louis River approximately 130 meters upstream of County Road 100



Photo downstream of County Road 100 bridge, looking north