5.3.6 Aquatic Species

This section describes the environmental consequences of the Land Exchange alternatives on aquatic biota, using comparisons of the existing conditions presented in Sections 4.2.6 and 4.3.6 to conditions after the Land Exchange alternatives in terms of net increase or decrease in aquatic species resources for the federal and non-federal lands.

The Land Exchange Proposed Action would result in a net increase to the federal estate of surface waters (MIH 14), including ~~11~~99.1~~0~~ acres of lakes and ~~4.5~~3.8 miles of rivers. Additionally, it would result in a~~n~~ ~~increase~~ decrease to the federal estate of ~~0.4~~ 30.3 miles of first-order streams and 4.0 miles of second-order streams, and an increase to the federal estate in 8.~~2~~1 miles of third-order streams~~, and a decrease of 4.1 miles of second-order streams~~ The Land Exchange Proposed Action would result in an increase in watershed riparian connectivity and aquatic connectivity for the federal estate. Based on available data, the Land Exchange Proposed Action would potentially result in an increase of nine additional fish species to the federal estate, while the macroinvertebrate assemblage would be similar. The Land Exchange Proposed Action could result in an increase to the federal estate of six new potential SGCN species, based on eco-region data.

Land Exchange Alternative B would result in a net increase to the federal estate of surface waters (MIH 14), including ~~132~~120.7~~.6~~ acres of lakes and ~~3.1~~2.8 miles of rivers. Additionally, it would result in a decrease to the federal estate of 1.~~0~~ 3 miles of first-order streams and 4.~~1~~ 0 miles of second-order streams, and an increase to the federal estate of 8.~~2~~1 miles of third-order streams. Land Exchange Alternative B would result in an increase in watershed riparian connectivity and aquatic connectivity for the federal estate. Based on available data, Land Exchange Alternative B would potentially result in a decrease to the federal estate of four fish species, while the macroinvertebrate assemblage would likely be similar. Land Exchange Alternative B would result in no net change of SGCN species, based on eco-region data.

The Land Exchange No Action Alternative would not result in any increase or decrease of aquatic habitats or SGCN species to the federal estate.

5.3.6.1 Methodology and Evaluation Criteria

The criteria used to describe the direct and indirect effects of the Land Exchange alternatives focused on the ecological integrity of the aquatic systems present at the federal lands and non-federal lands where physical, chemical, and biological characteristics that are important to biotic quality were considered. The spatial and temporal area of analysis for aquatic resources included the federal and non-federal lands that are proposed for the exchange based on current conditions.

The methodology used for analysis of the Land Exchange alternatives included review and evaluation of available literature, aerial photography review, and GIS analysis of all surface waters and aquatic species habitat present within the Land Exchange areas. Both quantitative and qualitative analyses were used. The analysis of the aquatic resources affected by the Land Exchange alternatives was guided by evaluation criteria that were developed by the USFS and other Co-lead Agencies as follows:

- change in the amount of Superior National Forest MIHs (MIH 14 [aquatic habitat]) available for species on the federal and non-federal lands;

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- changes in the length of stream segments;
- changes in the area of lake or deepwater wetland;
- qualitative determination of community habitat and ecological value;
- qualitative assessment of the aquatic connectivity (network created by streams, rivers, and lakes as they flow into one another) and the potential for barriers to fish passage; and
- net change in aquatic species.

5.3.6.2 Land Exchange Proposed Action

5.3.6.2.1 Surface Water Features (MIH 14)

Comparing the footprints of the surface water features present within the federal and non-federal lands provides a direct assessment of the increase or decrease to the federal estate in aquatic environments that support aquatic biota and associated habitats. This comparison was made by analyzing the linear shoreline frontage and frontage index of the surface water features within the federal and non-federal lands, where the frontage index indicates the linear feet of lake and shoreline frontage per acre of land.

The Land Exchange Proposed Action would result in a net increase of surface water resources to the federal estate (Table 5.3.6-1). A net increase of ~~approximately 111~~ 99.1 acres of lake and ~~4.5~~3.8 miles of rivers would be added to the federal estate from the Land Exchange Proposed Action. For both lakes and streams, the frontage index would increase substantially by 34.0 shoreline/acre units as a result of the exchange.

Table 5.3.6-1 Federal and Non-federal Land Surface Water Comparisons

	Lake			Rivers/Creeks/Streams		
Parcel	**Acres**	**Frontage (ft)**	**Frontage Index (shoreline/acre)**	**Miles**	**Frontage (linear ft)[1]**	**Frontage Index (shoreline/acre)[2]**
Lands Conveyed						
Federal Lands	30.5	4,550.0	0.7	~~5.1~~5.3	~~53,856.0~~55,968.0	~~8.3~~8.6
Lands Acquired						
Tract 1	~~141.5~~ 129.6	~~17,100.0~~16,424.0	3.5	8.1~~2~~	~~73,392.0~~72,864.0	~~14.9~~15.3
Tract 2	0.0	0.0	0.0	0.0	0.0	0.0
Tract 3						
Wolf Lands 1	0.0	0.0	0.0	0.0	0.0	0.0
Wolf Lands 2	0.0	0.0	0.0	0.0	0.0	0.0
Wolf Lands 3	0.0	0.0	0.0	0.1~~3~~	1,056.0~~2,745.6~~	~~9.9~~3.9
Wolf Lands 4	0.0	0.0	0.0	0.9~~1.1~~	~~11,932.8~~9,504.0	~~29.5~~23.5
Tract 4	0.0	0.0	0.0	0.0	0.0	0.0
Tract 5	0.0	9~~0~~00.0	32.1	0.0	0.0	0.0
Total Non-federal lands	~~141.5~~ 129.6	~~18,000.0~~17,414.0	35.6	~~9.6~~9.1	~~88,070.4~~83,424.0	~~54.3~~42.6
Net Change						
Net Increase/-(Decrease)	~~111.0~~	~~13,450.0~~12,	34.9	~~4.5~~3.	27,456.0~~34,~~	~~46.0~~34.0

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		99.1	864.0	8	~~214.4~~

Note: Surface water shoreline distance calculated by GIS analysis.

[1] Includes shoreline distance on both sides of streams.
[2] Frontage Index calculated by dividing total acres of parcel by total shoreline within parcel.

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5.3.6.2.2 Differences of Strahler Stream Orders and Habitat

For the purposes of this SDEIS, the Strahler Order (USEPA 2011a) is used to describe the hierarchical ordering of streams, where a first-order stream describes a headwater type stream with no branching. Where two first-order streams meet, they become larger second-order streams and where two second-order streams meet, they become larger third-order streams, etc. A quantitative comparison of the Strahler Stream Order indicates the Land Exchange Proposed Action would result in a decrease of 0.3 miles of first-order headwater streams and 4.0 miles of second-order streams, and an increase in 8.1 miles of third-order streams ~~n increase of 0.4 miles of first-order headwater streams and 8.2 miles of third-order streams, and a decrease of 4.1 miles of second-order streams~~ to the federal estate (Table 5.3.6-2).

The net increase of third-order streams and decrease in second-order streams would likely add more habitat diversity to the Superior National Forest since, generally, stream habitat diversity increases with higher-order streams. No significant habitat ~~increases or decreases~~ changes would likely occur associated with the slight ~~changes~~ increases in first-order, headwater streams acquired as a result of the Land Exchange Proposed Action.

Table 5.3.6-2 Increase or Decrease of Stream Orders from the Land Exchange Proposed Action

	Stream Distance (miles)		
Parcel (Stream)	**1st ~~O~~order**	**2nd ~~order~~Order**	**3rd ~~order~~Order**
Lands Conveyed			
Federal Lands (Yelp Creek and Partridge River)	~~1.0~~1.3	~~4.1~~4.0	0.0
Lands Acquired			
Tract 1 – Hay Lake (Pike River)	0.0	0.0	8.1~~2~~
Tract 2 – Lake County	0.0	0.0	0.0
Tract 3			
Wolf Lands 1	0.0	0.0	0.0
Wolf Lands 2	0.0	0.0	0.0
Wolf Lands 3 (Coyote Creek)	0.1~~3~~	0.0	0.0
Wolf Lands 4 (Coyote Creek)	0.9~~1.1~~	0.0	0.0
Tract 4 – Hunting Club	0.0	0.0	0.0
Tract 5 – McFarland	0.0	0.0	0.0
Total Non-federal Lands	1.0~~4~~	0.0	8.1~~2~~
Net Increase~~/-~~(Decrease)	**(0.3)~~4~~**	**(4.0~~1~~)**	**8.1~~2~~**

Note: Surface water shoreline distance calculated by GIS analysis.

5.3.6.2.3 Watershed Level Riparian and Aquatic Connectivity

Riparian Connectivity

~~Intact~~ Intact riparian areas are an important factor contributing to diverse and productive aquatic ecosystems. ~~riparian areas are the foundation of diverse and productive aquatic ecosystems~~ and function to maintain available water quality and physical habitat. The streams present on the federal and non-federal lands (Partridge River, Pike River, and Coyote Creek) are each part of a ~~intricate~~ web of ~~perennial~~ streams, creeks, and rivers that makes up a larger watershed. The

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connections between these surface water features are affected by the vegetated, undisturbed riparian edges bordering these water bodies. A comparison of the watersheds using the RCI is presented in Table 5.3.6-3. The index was developed from GIS analysis of vegetative cover along riparian areas where agriculture and land development have affected natural riparian vegetative cover.

The Land Exchange Proposed Action would result in a slight increase in watershed riparian connectivity, which indicates that the streams on both the federal and non-federal lands are located within watersheds with existing high-quality riparian connectivity.

Table 5.3.6-3 Watershed Riparian Connectivity Index Comparison

Surface Water	Tract	Watershed	Percent Agriculture in Riparian Zone	Percent Development in Riparian Zone	RCI Score[1]
Lands Conveyed					
Partridge River/ Yelp Creek	Federal Lands	St. Louis	0	5	95
Lands Acquired					
Pike River	1 - Hay Lake	Vermilion	0	1	99
Coyote Creek	3 - Wolf Lands 3 and 4	Rainy River-Headwaters	0	0	100
Net Increase/ (Decrease)[2]			0	(4)	4.5

Adopted from MDNR 2012k.

[1] RCI score calculated with MDNR formula using Percent Agriculture and Percent Development in Riparian Zone; scale is from 0 to 100 where 100 indicates excellent riparian conductivity.

[2] Non-federal lands RCI score averaged to determine net increase/decrease.

Aquatic Connectivity

Structures within streams, such as dams, bridges, and culverts reduce the longitudinal and lateral connectivity of the watershed. These structures can degrade the aquatic habitat in the watershed by slowing stream flow, increasing sedimentation, incising stream channels, changing the depth, and disconnecting portions of streams from the floodplain. The ACI was developed from GIS analysis of number of structures per stream mile for each watershed, and the watershed ACI scores were used to provide a comparison of each watershed.

The Land Exchange Proposed Action would result in the Superior National Forest acquiring streams located in watersheds with better aquatic connectivity values (Table 5.3.6-4).

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Table 5.3.6-4 Watershed Aquatic Connectivity Index Comparison

Surface Water	Tract	Watershed	Aquatic: Bridges and Culverts (miles stream/# structures)	Aquatic: Dams (miles stream/# structures)	ACI Score[1]
Lands Conveyed					
Partridge River/ Yelp Creek	Federal Lands	St. Louis	15	6	11
Lands Acquired					
Pike River	1 - Hay Lake	Vermilion	41	11	26
Coyote Creek	3 - Wolf Lands 3 and 4	Rainy River-Headwaters	89	19	54
Net Increase /(Decrease)[2]			50	9	29

Adopted from ~~MDNR 2012b~~MDNR 2012l.

[1] ACI score calculated by dividing total miles of streams and ditches per watershed by total number of culverts, bridges, and dams; scale is from 0 to 100 where 100 indicates free flowing streams (no structures) and 0 indicates one structure for every 20 miles of flowing water.

[2] Non-federal lands averaged to determine net increase/decrease.

5.3.6.2.4 Aquatic Species

A complete quantitative comparison of the net increase or decrease of aquatic species cannot be made for the purposes of the Land Exchange Proposed Action due to the absence of complete baseline information. Only the federal lands had aquatic biota and habitat sampling sites within the parcel boundaries. However, a semi-quantitative comparison can be made for species located within the vicinity of the non-federal parcel boundaries since representative survey sites located in the vicinity of the parcels were likely similar to the existing aquatic habitats present at each parcel (see Section 4.2.6).

Fish Assemblages

Two survey sites were analyzed within the vicinity of the federal lands while four survey sites were analyzed among the non-federal lands (in the vicinity of Pike River and Coyote Creek; see Figure 5.3.6-1). The federal and non-federal lands had 11 species in common (Table 5.3.6-5). The Land Exchange Proposed Action would potentially result in an increase to the federal estate of ~~nine~~ 12 additional species, including ~~one~~ two pollution intolerant species and ~~one~~ two pollution tolerant species (Tables 5.3.6-5 and 5.3.6-7). There would be a decrease to the federal estate of one different pollution intolerant species and one different pollution tolerant species. Given the fact that representative survey sites were used for non-federal lands, it is possible that some species are more or less prevalent than is noted here.

The fish assemblages located at each survey site indicate that the Land Exchange Proposed Action would result in minimal change to the fish assemblages for the streams the Superior National Forest would acquire. Additionally, the dominant fish species present at each site (Table 5.3.6-6) indicate that the stream characteristics were consistent with slower moving, glide pool features with the exception of the segment on the Stony River where the MCAB_05RN024 survey site was located. This site exhibited dominant longnose dace populations which indicated riffle-run habitats were likely present as described in Section 4.2.6.

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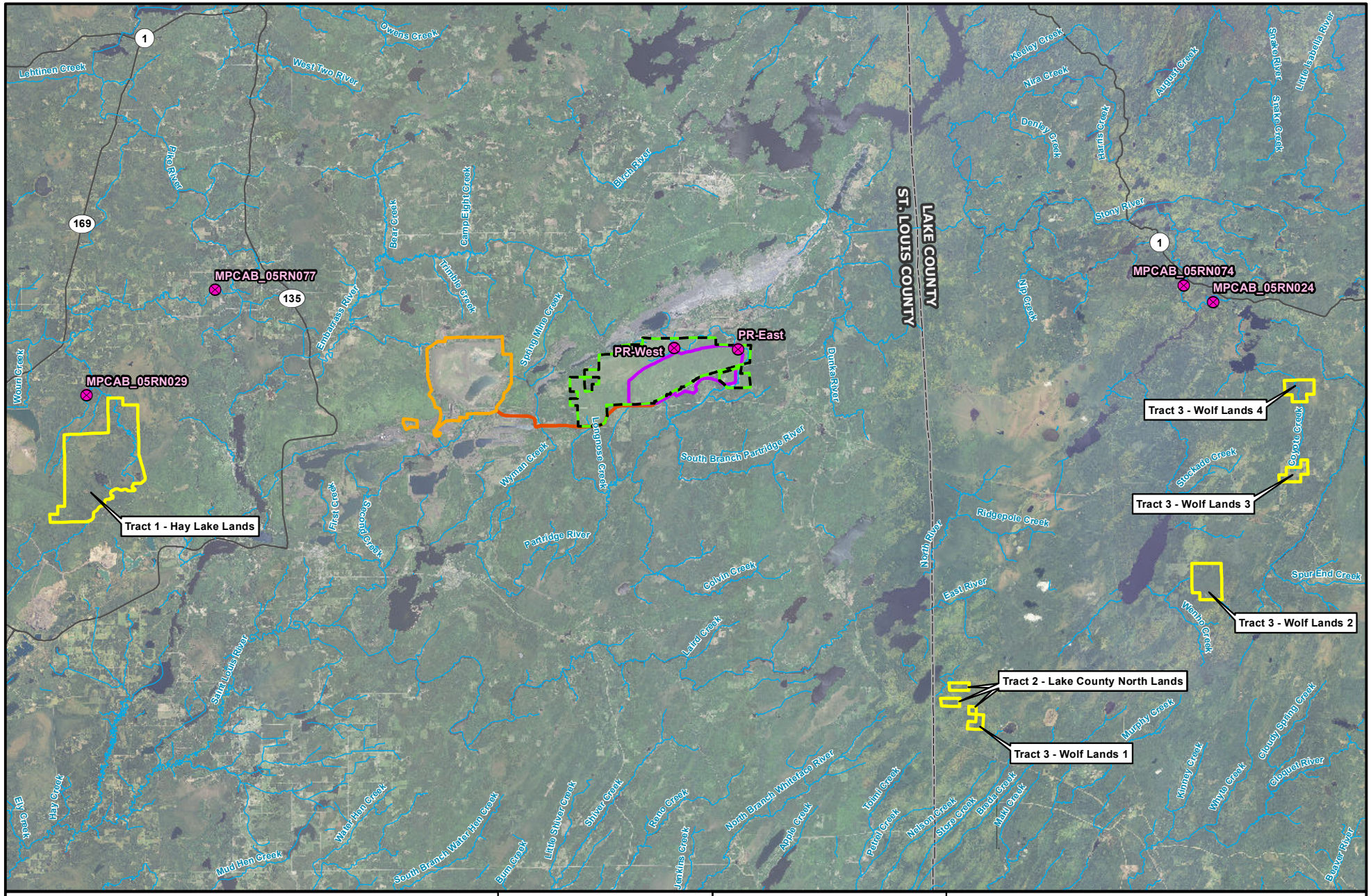

Study Site
Federal Lands
Non-federal Lands
Mine Site
Plant Site
Trasportation and Utility Corridor
Streams/Rivers
Existing Road

US Army Corps of Engineers
St. Paul District

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0 1.5 3 6 Miles

Figure 5.3.6-1
Federal and Non-federal Lands Aquatic Study Area
NorthMet Mining Project and Land Exchange PSDEIS
Minnesota

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August 2013

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147 ***Table 5.3.6-5 Increase or Decrease of Stream Fish Assemblage for the Land Exchange***
148 ***Proposed Action***

Species	Common Name	Tolerance Designation[1]	Federal Land Parcel	Non-federal Land Parcels
Catostomus commersonii	~~white~~ White sucker	~~tolerant~~Tolerant	X	X
Luxilus cornutus	~~common~~ Common shiner	~~intolerant~~~~Intolerant~~Intermediate	X	X
Notemigonus crysoleucas	~~golden~~ Golden shiner	Tolerant		X
Notropis heterolepis	~~blacknose~~ Blacknose shiner	Intolerant		X
Notropis hudsonius	~~spottail~~ Spottail shiner	I~~i~~ntermediate		X
Notropis volucellus	M~~mimic~~imic shiner	I~~i~~ntolerant		X
Etheostoma nigrum	Johnny darter	I~~i~~ntermediate	X	X
Perca flavescens	~~yellow~~ Yellow perch	Intermediate~~–~~		X
Sander vitreus	Walleye	~~–~~Intermediate		X
Percina caprodes	~~logperch~~Logperch	~~i~~Intermediate		X
Lota lota	~~burbot~~Burbot	~~–~~Intermediate	X	X
Ambloplites rupestris	~~rock~~ Rock bass	~~–~~Intermediate		X
Micropterus dolomieu	~~smallmouth~~ Smallmouth bass	~~–~~Intermediate		X
Esox lucius	~~northern~~ Northern pike	~~–~~Intermediate	X	X
Phoxinus eos	~~northern~~ Northern redbelly dace	~~tolerant~~Tolerant	X	
Culaea inconstans	~~brook~~ Brook stickleback	~~I~~~~intolerant~~Intermediate	X	X
Phoxinus neogaeus	~~finescale~~ Finescale dace	~~–~~Intermediate		X
Rhinichthys atratulus	~~blacknose~~ Blacknose dace	~~i~~Intolerant	X	
Rhinichthys cataractae	~~longnose~~ Longnose dace	I~~i~~ntolerant	X	X
Semotilus margarita	~~pearl~~ Pearl dace	~~–~~Intermediate	X	
Noturus gyrinus	~~tadpole~~ Tadpole madtom	~~i~~Intermediate	X	X
Umbra limi	~~central~~ Central mudminnow	T~~t~~olerant	X	X
Hybognathus hankinsoni	~~brassy~~ Brassy minnow	~~–~~Intermediate	X	
Pimephales promelas	~~fathead~~ Fathead minnow	T~~t~~olerant	X	X
Cottus bairdii	~~mottled~~ Mottled sculpin	~~I~~~~intermediate~~Intolerant	X	X
Semotilus atromaculatus	~~creek~~ Creek chub	T~~t~~olerant		X
Coregonus clupeaformis	~~lake~~ Lake whitefish	~~–~~Intermediate		X
Total Species			15	23
# Intolerant			~~4~~3	~~5~~4

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Species	Common Name	Tolerance Designation[1]	Federal Land Parcel	Non-federal Land Parcels
Species				
# Tolerant Species			4	5
Net Increase or Decrease Species			(8)	8
Net Increase or Decrease Intolerant Species			(1)	1
Net Increase or Decrease Tolerant Species			(1)	1

~~-- = no designation assigned~~

[1] Rapid Bioassessment Protocols for Use in Streams and Wadeable Rivers: Periphyton, Benthic Macroinvertebrates, and Fish - Second Edition EPA 841-B-99-002 (USEPA 2012b).

Table 5.3.6-6 Dominant Fish Species Present at Study Sites

Attributes	Federal ~~Parcel~~ Lands (within parcel)		Non-federal Land (study areas within vicinity of Tract 1)		Non-federal Land (study areas within vicinity of Tract 3- Wolf Lands 3 and 4)	
Study site	PR-west	PR-east	MPCAB-05RN029	MPCAB-05RN077	MPCAB-05RN024	MPCAB-05RN074
Dominant Species	Brook stickleback	Northern redbelly dace	White sucker	White sucker	Longnose dace	Blacknose shiner

Adopted from Barr 2011b and MPCA 2011c.

Table 5.3.6-7 Increase or Decrease of Stream Fish Assemblage for the Land Exchange Proposed Action

Combined Studies Within, or Within Vicinity of, Surface Water	Tract	Total Species (#)	Pollution Intolerant Species (#)	Pollution Tolerant Species (#)
Lands Conveyed				
Partridge River	Federal Lands	15	~~4~~3	4
Lands Acquired				
Pike River	Tract 1	~~14~~11	~~4~~0	4
Coyote Creek	Tract 3 - Wolf Lands 3 and 4	18	4	4
Total Non-Federal Lands		~~24~~21[1]~~32~~	~~4~~5	5[2]
Net Increase/-(Decrease)		12 species ~~9~~(4) other species~~17~~	1	1

Adopted from Section 4.~~2~~3.6.

[1] Species would overlap between Tract 1 and Tract 3; thus, 21 species are distinct number of species for combined non-federal lands.

[2] Does not equal sum of non-federal lands since some species overlap or vary between Tract 1 and Tract 3.

Benthic Macroinvertebrate Assemblages

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Macroinvertebrate baseline surveys completed within and in the vicinity of the federal lands ranked macroinvertebrate assemblages as fair within the second-order stretches of the Partridge River, as indicated by the HBI (Table 5.3.6-8). The first-, third-, and fourth-order segments of the streams within the vicinity of the non-federal lands indicated macroinvertebrate assemblages ranging from good to fair. A qualitative comparison using the attributes of HBI, stream order, total families (diversity), and percent pollution tolerant organisms indicate that the macroinvertebrate assemblages likely would remain the same under the Land Exchange Proposed Action. This qualitative comparison assumes the habitat and associated macroinvertebrate assemblages are similar in the stream segments within the non-federal lands boundaries including the third-order segment of the Pike River on Tract 1 and the first-order segments of Coyote Creek within Tract 3 (Figure 5.3.6-1).

Table 5.3.6-8 Stream Macroinvertebrate Assemblage Comparisons for the Land Exchange Proposed Action

Attributes	Federal Parcel (within parcel)		Non-federal Land (study areas within vicinity of Tract 1)		Non-federal Land (study areas within vicinity of Tract 3- Wolf Lands 3 and 4)	
Study site	PR-west	PR-east	MPCAB-05RN029	MPCAB-05RN077	MPCAB-05RN024	MPCAB-05RN074
Stream order	2	2	1	4	3	4
HBI score	6.4	6.0	5.7	5.1	5.9	5.2
HBI ranking	Fair	Fair	Fair	Good	Fair	Good
Total families	11	10	11	31	23	27
Percent pollution tolerant	8	18	3	5	10	26

Adopted from Barr 2011b and MPCA 2011c.

5.3.6.2.5 Aquatic Species of Greatest Conservation Need

The MDNR and USFS have developed the ECS for ecological mapping and landscape classification (MDNR 2011a), which defines uniform ecological features within a mapped area. The federal and non-federal lands are located in the Northern Superior Uplands Section of the Laurentian Mixed Forest Province. These lands are further divided into several subsections. The federal lands include the Laurentian and Nashwauk Uplands subsections while the non-federal lands include these two subsections and the Border Lakes subsection.

As discussed in Section 4.2.6.1.4, SGCN aquatic species are associated with these ecological subsections based on occurrence and habitat considerations. Using the approach of comparing SGCN species by subsection association only, the Land Exchange Proposed Action could result in an increase of six new potential SGCN species (Table 5.3.6-9). Of these, the spoonhead sculpin, lake chub, and longear sunfish have the highest potential to be found near the shoreline habitat of Tract 5 (within the Border Lakes subsection).

Regardless of the potential indicated by subsection association, no SGCN species were identified within the boundaries of the federal or non-federal lands during field surveys. While habitat is present in at least some locations within these boundaries for SGCN species, the surveys performed within the vicinity of the federal lands found no SGCN aquatic species, suggesting that SGCN species are likely not present on the federal lands. Conversely, occurrences of the creek heelsplitter, an SGCN species, have been documented within the vicinity of the non-

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federal lands on segments of the Pike River (downstream of Tract 1) and the Stony River (downstream of Tract 3) as discussed in Section 4.3.6.2. The predominant sand substrate documented in survey areas within the vicinity of these SGCN occurrence locations and the possibility that similar substrates exist within the boundaries of Tract 1 and Tract 3 indicate the creek heelsplitter may exist within the river segments of these non-federal lands. A qualitative review of these data indicates the Land Exchange Proposed Action may result in the added presence of the creek heelsplitter.

Table 5.3.6-9 Eco-region SGCN Species Comparisons for the Land Exchange

SGCN Species	Common Name	Federal Land (Laurentian and Nawshwauk Uplands)	Non-federal Lands (Laurentian Uplands, Nawshwauk Uplands, Border Lakes)
Fish			
Acipenser fulvescens	Llake sturgeon		X
Coregonus nipigon	Nnipigon cisco		X
Coregonus zenithicus	Sshortjaw cisco		X
Cottus ricei	Sspoonhead sculpin		X
Couesius plumbeus	Llake chub		X
Ichthyomyzon fossor	Bbrook lamprey	X	X
Lepomis megalotis	Llongear sunfish		X
Mussels			
Lasmigona compressa	Ccreek heelsplitter	X	X
Ligumia recta	Bblack sandshell	X	X
Total species		3	9

Adopted from Section 4.3.6.

5.3.6.3 Land Exchange Alternative B

5.3.6.3.1 Surface Water Features (MIH 14)

Land Exchange Alternative B would result in a net increase of lake and river surface water features to the federal estate (Table 5.3.6-10). A net increase of ~~approximately 13~~120.7~~3~~ acres of lake and ~~3.1~~2.8 miles of rivers would be added to the Superior National Forest under this alternative. The increase in lake and river frontage would provide a net increase to the federal estate of habitat for aquatic species (MIH 14). The frontage index would increase in the federal estate for both lakes and streams as a result of Land Exchange Alternative B.

Table 5.3.6-10 Frontage of Waterways for Land Exchange Alternative B

	Lake			Rivers/Creeks/Streams		
Parcel	**Acres**	**Frontage (ft)**	**Frontage Index (shoreline/acre)**	**Miles**	**Frontage (linear ft)[1]**	**Frontage Index (shoreline/acre)[2]**
Lands Conveyed						
Land Exchange Alternative B	8.9	1,200.0	0.3	~~5.1~~5.3	~~53,856.0~~55,968.0	~~11.3~~11.8
Lands Acquired						
Tract 1	1~~41~~29.~~56~~	~~17,100~~16,424.0	3.5	8.~~2~~1	~~73,392.~~72,864.0	~~14.9~~15.3
Net Change						

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Net Increase/-(Decrease)	~~132.6~~1 20.7	~~15,900.0~~1 5,224.0	3.2	~~3.1~~2.8	16,896~~19,5~~ ~~36.0~~.0	~~3.6~~3.5

Note: Surface water shoreline distance calculated by GIS analysis.

[1] Includes shoreline distance on both sides of streams.
[2] Frontage Index calculated by dividing total acres of parcel by total shoreline within parcel.

5.3.6.3.2 Differences of Strahler Stream Orders and Habitat

A quantitative comparison of the Strahler Stream Order indicates that Land Exchange Alternative B would result in a decrease of 1.~~0~~ 3 and 4.~~1~~ 0 miles of first- and second-order streams, respectively, and an increase of 8.~~2~~ 1 miles of third-order streams to the federal estate (Table 5.3.6-11).

As with the Land Exchange Proposed Action, the net increase of third-order streams and decrease in first- and second-order streams would likely add more habitat diversity to the Superior National Forest. The net decrease to the federal estate of first-order streams would slightly reduce the amount of available spawning habitat for some aquatic species as headwater streams provide specialized spawning habitat for some species.

Table 5.3.6-11 Increase or Decrease of Stream Orders from Land Exchange Alternative B

	Stream Distance (miles)		
Parcel (Stream)	**1st O~~o~~rder**	**2nd O~~o~~rder**	**3rd ~~order~~Order**
Lands Conveyed			
Federal Lands (Yelp Creek and Partridge River)	~~1.0~~1.3	~~4.1~~4.0	0.0
Lands Acquired			
Tract 1 – Hay Lake (Pike River)	0.0	0.0	8.1~~2~~
Net Increase/-(Decrease)	**(1.~~0~~3)**	**(4.~~1~~0)**	**8.1~~2~~**

Note: Surface water shoreline distance calculated by GIS analysis.

5.3.6.3.3 Watershed Level Riparian and Aquatic Connectivity

Riparian Connectivity

A comparison of the watersheds containing streams present on the federal ~~parcel~~ lands (Partridge River) and Tract 1 (Pike River) using the RCI is presented in Table 5.3.6-12. The index was developed from GIS analysis of vegetative cover along riparian areas where agriculture and land development have affected natural riparian vegetative cover.

Under Land Exchange Alternative B, there would be a slight increase to the federal estate in watershed riparian connectivity. The streams on both the federal lands and Tract 1 are located within watersheds with existing high quality riparian connectivity.

Table 5.3.6-12 Watershed Riparian Connectivity Index Comparison

Surface Water	Tract	Watershed	Percent Agriculture in Riparian Zone	Percent Development in Riparian Zone	RCI Score[1]
Lands Conveyed					
Partridge River/ Yelp	Federal Lands	St. Louis	0	5	95

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Creek					
Lands Acquired					
Pike River	1 - Hay Lake	Vermilion	0	1	99
Net Increase (Decrease)			0	(4)	4.0

Adopted from ~~MDNR 2012a~~MDNR 2012k.

[1] RCI score calculated with MDNR formula using *Percent Agriculture and Percent Development in Riparian Zone*; scale is from 0 to 100 where 100 indicates excellent riparian conductivity.

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Aquatic Connectivity

Land Exchange Alternative B would result in the Superior National Forest acquiring streams located in watersheds with significantly better aquatic connectivity values, indicating increased aquatic habitat.

Table 5.3.6-13 Watershed Aquatic Connectivity Index Comparison

Surface Water	Tract	Watershed	Aquatic: Bridges and Culverts (miles stream/# structures)	Aquatic: Dams (miles stream/# structures)	ACI Score[1]
Lands Conveyed					
Partridge River	~~Alternative B: Smaller~~ Federal ~~Parcel~~Lands	St. Louis	15	6	11
Lands Acquired					
Pike River	1 - Hay Lake	Vermilion	41	11	26
Net Increase (Decrease)			26	5	15

Adopted from ~~MDNR 2012b~~MDNR 2012l.

[1] ACI score calculated by dividing total miles of streams and ditches per watershed by total number of culverts, bridges, and dams; scale is from 0 to 100 where 100 indicates free flowing streams (no structures) and 0 indicates one structure for every 20 miles of flowing water.

5.3.6.3.4 Aquatic Species

As with the Land Exchange Proposed Action, a semi-quantitative comparison of the net increase or decrease to the federal estate of aquatic species was made for species located within the vicinity of the Tract 1 parcel boundaries since representative survey sites located in the vicinity of the parcel ~~were~~ are likely similar to the existing aquatic habitats present at the parcel (see Section 4.2.6).

Fish Assemblages

Two survey sites were analyzed within the vicinity of both the smaller federal parcel and within the vicinity of Tract 1. The smaller federal parcel and Tract 1 had six species in common. Land Exchange Alternative B would potentially result in a net decrease to the federal estate of four species, including two pollution-intolerant species (Table 5.3.6-14). Given the fact that only representative survey sites were used for Tract 1, it is possible that some species are more or less prevalent than is noted here. The attributes of the fish assemblages located at each survey site indicate that Land Exchange Alternative B would result in minimal change to the fish habitat for the portions of the river the Superior National Forest would acquire. The dominant fish species present at each site indicate that the stream characteristics were consistent with slower-moving, glide pool features.

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Table 5.3.6-14 Increase or Decrease of Stream Fish Assemblage for Land Exchange Alternative B

Combined Studies Within, or Within Vicinity of, Surface Water	Tract	Total Species (#)	Pollution Intolerant Species (#)	Pollution Tolerant Species (#)
Lands Conveyed				
Partridge River / Yelp Creek	~~Alternative B: Smaller Federal Parcel~~Federal Lands	15	4	4
Lands Acquired				
Pike River	Tract 1	11	2	4
Net Increase (Decrease)		(4)	(2)	0

Adopted from Section 4.2.6.

Benthic Macroinvertebrate Assemblages

Macroinvertebrate baseline surveys completed within, and in the vicinity of, the smaller federal parcel ranked macroinvertebrate assemblages as fair within the second-order stretches of the Partridge River, as indicated by the HBI pollution index (Table 5.3.6-15). The first- and fourth-order segments of the streams within the vicinity of Tract 1 indicated macroinvertebrate assemblages ranging from good to fair. A qualitative comparison using the attributes of HBI, stream order, total families (diversity), and percent pollution tolerant organisms indicate that the macroinvertebrate assemblages would likely be similar under Land Exchange Alternative B. This qualitative comparison assumes the habitat and associated macroinvertebrate assemblages are similar in the stream segments within the third-order segment of the Pike River on Tract 1.

Table 5.3.6-15 Stream Macroinvertebrate Assemblage Comparisons for Land Exchange Alternative B

Attributes	~~Alternative B: Smaller Federal Parcel (within parcel)~~Federal Lands		Non-federal Land (study areas within vicinity of Tract 1)	
Study site	PR-west	PR-east	MPCAB-05RN029	MPCAB-05RN077
Stream order	2	2	1	4
HBI score	6.4	6.0	5.7	5.1
HBI ranking	Fair	Fair	Fair	Good
Total families	11	10	11	31
Percent pollution tolerant	8	18	3	5

Adopted from Barr 2011b and MPCA 2011c.

5.3.6.3.5 Aquatic Species of Greatest Conservation Need

The smaller federal parcel includes the Laurentian and Nashwauk Uplands ecological subsections, while Tract 1 includes only the Nashwauk Uplands.

As discussed in Section 5.3.6.2.5, SGCN species are associated with these ecological subsections based on occurrence and habitat considerations. Using the approach of comparing SGCN species by subsection association only, Land Exchange Alternative B would likely result in no net change to the federal estate of SGCN species (Table 5.3.6-16).

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Regardless of the potential indicated by subsection association, no SGCN species were identified within the boundaries of the smaller federal parcel. Habitat is present in at least some locations within these boundaries for SGCN species. Although no surveys were completed within the boundaries of Tract 1, occurrences of the creek heelsplitter, an SGCN species, have been documented within the vicinity of Tract 1 on segments of the Pike River (downstream of Tract 1). The predominant sand substrate documented in survey areas within the vicinity of this SGCN occurrence location and the possibility that similar substrates exist within the boundaries of Tracts 1 indicate the creek heelsplitter may exist within the Pike River segments of Tract 1. A qualitative review of these data indicates that Land Exchange Alternative B may result in the added presence to the federal estate of the creek heelsplitter.

Table 5.3.6-16 Eco-region SGCN Species Comparisons for Land Exchange Alternative B

SGCN Species	Common Name	~~Alternative B: Smaller Federal Parcel~~ Federal Lands (Laurentian and Na~~w~~shwauk Uplands)	Tract 1 (Na~~w~~shwauk Uplands only)
Fish			
Ichthyomyzon fossor	B~~b~~rook lamprey	X	X
Mussels			
Lasmigona compressa	C~~c~~reek heelsplitter	X	X
Ligumia recta	B~~b~~lack sandshell	X	X
Total species		3	3

Adopted from Section 4.3.6.

5.3.6.4 Land Exchange No Action Alternative

Under the Land Exchange No Action Alternative, the Superior National Forest would have an ongoing responsibility for managing aquatic resources on the federal lands in accordance with the Forest Plan. The Land Exchange No Action Alternative would not change the USFS responsibility for managing aquatic resources and would result in no further effects on existing aquatic species or habitats.

Fish and other aquatic life on the federal lands would be exposed to the water quality, hydrologic, and physical habitat conditions that currently exist as a result of past mining activities. There would be no change from existing conditions, although it is expected that the water quality of the Embarrass River may improve as a result of corrective actions potentially required by the reissuance of existing NPDES/SDS permits in the NorthMet Project area. Future actions conducted under the Cliffs Erie Consent Decree may also change these conditions.

The non-federal lands would not go into USFS ownership, and land use would be determined by the private land owners. Effects to aquatic resources are difficult to predict given the uncertainty of future potential land use. Some lands may be developed, resulting in potential effects to aquatic species at the individual and local population levels, decreases in habitat, and adverse effects on habitat connectivity.

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