APPENDIX D
Cumulative Impact Analyses –

Approach, Air (D1), Health Risk (D2), Water Resources (D3), Wetlands (D4), Wildlife Habitat (D5), Rail Traffic (D6)

(Note: Color versions of figures in this Appendix are included in the file posted at the DOE NEPA website: http://www.eh.doe.gov/nepa/docs/deis/deis.html)

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D. APPROACH TO CUMULATIVE IMPACTS ANALYSIS

D.1 PURPOSE

The U.S. Department of Energy (DOE) and Minnesota Department of Commerce (MDOC) are preparing an Environmental Impact Statement (EIS) for the Mesaba Energy Project in the Iron Range of northeastern Minnesota as announced in a Notice of Intent published in the *Federal Register* on October 5, 2005. This paper specifically and exclusively provides an intended approach for addressing cumulative environmental impacts of the Mesaba Energy Project that will satisfy the Federal National Environmental Policy Act (NEPA) requirements and the Minnesota Rules promulgated in accordance with the Minnesota Power Plant Siting Act (Statutes 116C.51 through 116C.69).

D.2 BACKGROUND

D.2.1 Federal Requirements

The President's Council on Environmental Quality (CEQ) defined "cumulative impact" in regulations implementing the procedural provisions of NEPA as follows:

> *"Cumulative impact" is the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.* (40 CFR 1508.7)

In its implementing procedures for NEPA, DOE has stated its policy "…to follow the letter and spirit of NEPA; comply fully with the CEQ Regulations; and apply the NEPA review process early in the planning stages for DOE proposals" (10 CFR 1021.101). Therefore, DOE regulations require the consideration of cumulative impacts in published NEPA documents.

D.2.2 State Requirements

Minnesota Rules Chapter 4410, Parts 4410.0020 through 4410.6500 implement the environmental review procedures established by the Minnesota Environmental Policy Act (MEPA). Part 4410.1700, Subpart 7, Item B, specifically requires the responsible governmental unit (RGU) to consider the "cumulative potential effects of related or anticipated future projects." However, because it involves a large electric power generating plant (LEPGP), the Mesaba Energy Project is not subject to the requirements of Chapter 4410 (see Part 4400.1700, Subpart 12). Instead the project is subject to Minnesota Rules Chapter 4400, which does not require the consideration of cumulative impacts comparable to Part 4410.1700, Subpart 7. Therefore, no specific state requirement for consideration of cumulative impacts for the Mesaba Energy Project is indicated. However, MDOC may consider cumulative impacts in response to comments received during the state scoping process.

D.3 REASONABLY FORESEEABLE FUTURE ACTIONS

Based in part on the Scoping Environmental Assessment Worksheet (EAW) for the proposed Minnesota Steel Project near Nashwauk, Minnesota, which is subject to Minnesota Rules Part 4410.1700, Subpart 7, Item B (defined above), the following past and ongoing actions and potential projects represent "reasonably foreseeable future actions" in the vicinity of the preferred and alternative sites for the proposed Mesaba Energy Project.

D.3.1 Ongoing Actions

- National Pollutant Discharge Elimination System (NPDES) permitted discharges to the Swan River and Prairie River.
- NPDES permitted discharges to the St. Louis River watershed.
- Logging of state and county lands in the Arrowhead Region.
- Logging on private lands in the Arrowhead Region.
- Butler Taconite and predecessor natural ore operations.
- Keewatin Taconite Company and predecessor natural ore operations.
- Hibbing Taconite Company and predecessor natural ore operations.
- Cliffs-Erie and predecessor natural ore operations.
- Other taconite operations located in the Arrowhead Region.
- Minnesota Power plant operations in Itasca County (Clay Boswell), St. Louis County (Syl Laskin, M.L. Hibbard), and Lake County (Taconite Harbor).
- Public utility power plants in Hibbing and Virginia.
- UPM-Kummene Blandin Paper Mill in Grand Rapids and proposed expansion.
- Non-utility electric power plants in Arrowhead Region (Silver Bay, Alliant Energy, Lake Superior Paper).
- Planned or ongoing roadway improvements or substantial tracts of commercial/residential development that have been identified in any comprehensive planning documents, or that have been approved by the county or city.

D.3.2 Potential Future Emissions Sources

- Proposed Minnesota Steel Project – north of Nashwauk
- Proposed PolyMet Mining project – north of Hoyt Lakes
- Proposed Mesabi Nugget plant – north of Hoyt Lakes
- Proposed Laurentian Wood-Fired Generation Plants – near Hibbing and Virginia (The Laurentian Energy project is a semi-public partnership involving Hibbing Public Utilities and Virginia Public Utilities to provide renewable energy to Xcel Energy. Two wood-fired boilers for power generation, less than 25 MW each, would be built at each existing facility.)

D.4 POTENTIALLY AFFECTED RESOURCES

Although the lists of ongoing activities and potential future emissions sources in the regions of influence for the West and East Range Sites are substantial, various factors affect the potential for cumulative impacts on potential resources. For example, potential impacts on vegetation and archeological resources generally would be limited to the locations of anticipated land disturbance, which are specific to the individual projects. However, the impacts of air emissions may extend many miles beyond the individual project areas. Based on consideration of the regions of influence for impacts on environmental resources, the following resources have been identified that may be affected by cumulative impacts from the Mesaba Energy Project (including Phase II) in combination with other reasonably foreseeable actions in the Arrowhead Region. The potential cumulative impacts have been listed respectively for the preferred West Range Site and the alternative East Range Site.

D.4.1 West Range Site

- Air quality in Federally administered Class I areas (e.g., Boundary Waters Canoe Area Wilderness [BWCAW], Voyageurs National Park [VNP]) including "regional haze."
- Water quality in Federally administered Class I areas (e.g., BWCAW, VNP) due to deposition of pollutants and acidification.
- Deposition and bioaccumulation of mercury emissions in water resources/aquatic species.
- Effects of inhalation of air toxics emissions.
- Effects on water supplies, quantity, and quality in the Swan River watershed.
- Loss of wetlands in the Swan River watershed.
- Wildlife habitat loss, fragmentation, and obstruction of travel corridors in the Swan River watershed.
- Impacts of increased train traffic on regional communities between (and including) Grand Rapids and Hibbing along the US 169 corridor (noise, delays at grade crossings, obstruction of emergency vehicle access to service areas), taking into consideration the potential for disproportionate impacts on low-income populations (environmental justice).

D.4.2 East Range Site

- Air quality in Federally administered Class I areas (e.g., BWCAW, VNP) including "regional haze."
- Water quality in Federally administered Class I areas (e.g., BWCAW, VNP) due to deposition of pollutants and acidification.
- Deposition and bioaccumulation of mercury emissions in water resources/aquatic species.
- Effects of inhalation of air toxics emissions.
- Effects on water supplies, quantity, and quality in the Partridge River watershed.
- Loss of wetlands in the Partridge River watershed.
- Wildlife habitat loss, fragmentation, and obstruction of travel corridors in the Partridge River watershed.
- Impacts of increased train traffic and lengths on regional communities between (and including) Hoyt Lakes, Virginia, and Iron Junction (noise, delays at grade crossings, obstruction of emergency vehicle access to service areas), taking into consideration the potential for disproportionate impacts on low-income populations (environmental justice).

D.5 RESOURCES NOT LIKELY TO BE AFFECTED CUMULATIVELY (WITH BASIS)

Based on currently available information, there are some resources that are not expected to experience measurable cumulative impacts, although the EIS for the Mesaba Energy Project will address the specific impacts of the project on these resources in accordance with NEPA and Minnesota Rules Chapter 4400. Also, as additional information becomes available or as a result of public comments received, the need for a cumulative impact analysis for these resource areas will be reassessed. The resource areas and the basis for not including a cumulative impact analysis for these areas at this time are as follows:

- Demographics – The Mesaba Energy Project (including Phase II) is estimated to create approximately 182 permanent jobs by 2013, which, when added to other foreseeable actions in the region, would not affect population and housing substantially given that the population of Itasca County is expected to grow by 3,600 persons and St. Louis County is expected to grow by 5,400 (between 2000 and 2010).

- Community Services – As in the case of demographics, the project, when added to other foreseeable actions, is not expected to affect demands on local community services substantially, other than the impacts from the frequency and length of trains.
- Land Use – The Mesaba Energy Project and other foreseeable projects would have relatively small areas of influence in the context of land use, and the areas of influence would not be expected to overlap.
- Environmental Justice – As in the case of land use, areas of influence for environmental justice would not be expected to overlap for the respective projects.
- Traffic – As in the case of demographics and land use, the respective foreseeable projects would not contribute substantial amounts of new automobile traffic and would not utilize the same roadways and intersections concurrently.
- Geology and Soils – Potential adverse impacts on earth resources would be site-specific in context (small areas of influence) and not substantially cumulative provided that appropriate erosion and sedimentation controls are implemented in accordance with state and Federal regulations.
- Cultural Resources – As in the case of geology and soils, potential adverse impacts would be site-specific.
- Materials and Waste Management – The Mesaba Energy Project and other foreseeable projects would have relatively small areas of influence in the context of material and waste management, and the areas of influence would not be expected to overlap.
- Noise – An increase to noise levels will likely result from the increase in the number, frequency and length of trains, plant noise, and truck traffic. Cumulatively, noise levels would not affect the local areas where each project is located. Impacts from the Mesaba Energy Project and other foreseeable projects would affect relatively small areas of influence that would not be expected to overlap.
- Light and Glare – As in the case of land use, areas of influence for light and glare would not be expected to overlap for the respective projects.
- Safety and Health – There is a potential for cumulative impacts of mercury deposition and bioaccumulation to water resources and aquatic species. Otherwise, the foreseeable projects are not expected to contribute to substantial cumulative impacts on safety and health based on distance between potential radii of influence areas.
- Biological Resources – No known populations of endangered plant species have been identified that would be impacted by the Mesaba Energy Project.

D.6 RECOMMENDED CUMULATIVE ANALYSIS

D.6.1 Air Quality Impacts on Class I Areas

If not otherwise available in documents/reports previously generated by Excelsior, DOE and/or MDOC will request the following information from Excelsior as part of the Environmental Information Volume: air quality modeling to assess the cumulative impacts of continuous air emissions from Mesaba Energy Project emissions at the respective West and East Range Sites, taking into account projected emissions from the reasonably foreseeable projects listed in Section 3.2. The air quality model would provide an air quality analysis to determine the impacts on the national ambient air quality standards (NAAQS) and Prevention of Significant Impacts (PSD) increments associated with the construction and operation of the Mesaba Energy Project (including Phase II) combined with the proposed foreseeable projects. Excelsior would be required to obtain, from publicly available information, projected emissions from these foreseeable sources. These foreseeable sources are potentially new major sources of regulated pollutant emissions that would be required to provide the following information in order to comply with the PSD regulations:

- Background concentrations of each regulated pollutant using distant and regional sources in order to establish baseline concentrations.
- Variance in land use and topography in the proposed locations for the future projects in order to determine air dispersion of pollutants.
- Highest concentration for each pollutant under the facilities' various worst-case operating scenarios (e.g., startup, normal operations, flaring, etc.) in order to establish potential to emit.
- Identification of all best available control technologies (BACT) through a BACT analysis in order to establish mitigation measures.

For instances in which the data is not publicly available, Excelsior will provide an estimated representation of the emissions based on similar types of operations and activities. Adjustment of modeling parameters for other existing and foreseeable emission sources to account for reductions in emissions based on potential changes in regulatory controls on emissions would also be performed. Additionally, an impact analysis to assess the cumulative impact of air emissions on visibility caused by any increase in emissions from the Mesaba Energy Project combined with the reasonably foreseeable projects would be conducted, including the cumulative visibility effects on Federal Class I areas within 250 kilometers of the Mesaba Energy Project and the future projects. Overall, the cumulative impact analysis for air quality will take into consideration recommendations by the U.S. Department of Agriculture (USDA) Forest Service, Superior National Forest, as a cooperating agency for the EIS.

D.6.2 Water Quality Impacts on Class I Areas

If not otherwise available in documents/reports previously generated by Excelsior, DOE and/or MDOC will request from Excelsior, as part of the Environmental Information Volume, deposition modeling to predict the cumulative effects of deposition on water quality in Class I areas within 250 kilometers, taking into account the existing and reasonably foreseeable emission sources. Overall, the cumulative impact analysis for water quality will take into consideration recommendations by the USDA Forest Service, Superior National Forest, and the U.S. Army Corps of Engineers (USACE), as cooperating agencies for the EIS.

D.6.3 Mercury Deposition and Bioaccumulation

If not otherwise available in documents/reports previously generated by Excelsior, DOE and/or MDOC will request from Excelsior, as part of the Environmental Information Volume, deposition modeling to predict the cumulative effects from deposition of mercury on bioaccumulation in fish and qualitative impacts on eagles, taking into account the existing and reasonably foreseeable emission sources.

D.6.4 Air Toxics Inhalation Risk

If not otherwise available in documents/reports previously generated by Excelsior, DOE and/or MDOC will request from Excelsior, as part of the Environmental Information Volume, air emission risk assessment modeling to predict the cumulative effects of inhalation of air toxics emissions. Emissions generated by the Mesaba Energy Project (including Phase II) in combination with future projects may potentially contribute other hazardous air pollutants such as acetophenone, 2-chloroacetophenone, hexane, hydrogen fluoride, manganese, methyl methacrylate, methyl tert butyl ether, 5-methylchrysene, sulfuric acid, cadmium, indeno(1,2,3-cd)pyrene, arsenic, and acrolein. It is possible that the atmospheric load contributed by the Mesaba Energy Project may increase the load emitted by the other potential future emission sources listed in Section 3.2. However, based on the results of the current air emission modeling effort for the Mesaba Energy Project, the contribution is anticipated to be negligible.

D.6.5 Water Supply, Quantity, and Quality

If not otherwise available in documents/reports previously generated by Excelsior, DOE and/or MDOC will request from Excelsior, as part of the Environmental Information Volume, estimates of water withdrawals and effluent pollutant loadings, respectively in the Swan River and Partridge River watersheds, based on projections from water and sewer utilities and reasonably foreseeable projects identified in Section 3. These projections should then be added to the water withdrawals and discharges by Mesaba Energy Project (including Phase II) to predict the cumulative effects on water quantity and quality in the respective watersheds.

D.6.6 Loss of Wetlands

If not otherwise available in documents/reports previously generated by Excelsior, DOE and/or MDOC will request from Excelsior, as part of the Environmental Information Volume, estimates of wetland acreage that may be lost due to development of foreseeable projects identified in Section 3. Estimates of wetlands lost to development may be derived from available approved permits. In some cases the USACE lists permits that have been approved on its website and includes the acreages of wetlands impacted. In such situations, rough estimates of wetland acreage lost could be determined by coordinating with the regulatory agencies. The estimated acreage to be lost for development of foreseeable projects should then be added to the acreage expected to be lost for the respective Mesaba Energy Project (including Phase II) at preferred and alternative sites, and the cumulative acreage should be compared to the estimated total wetland acreage in respective watersheds, Swan River and Partridge River, for the West and East Range Sites. Consideration should be given to wetland acreage that would be replaced through mitigation, taking into account the comparative quality of wetlands lost/replaced and the effects of wetland fragmentation.

Overall, the cumulative impact analysis for wetlands will take into consideration recommendations by the USACE, St. Paul District, and the USDA Forest Service, Superior National Forest, as cooperating agencies for the EIS. When making recommendations about wetland impacts, a cooperating agency would be expected to provide appropriate data to support the suggested analysis, such as baseline acreage for past and present wetlands in the affected watersheds, descriptions of the functions and values of the wetlands to the respective watersheds, and the likelihood for wetland mitigation to be required within the watershed for ongoing and future projects.

D.6.7 Wildlife Habitat Loss, Fragmentation, and Obstruction of Movement

If not otherwise available in documents/reports previously generated by Excelsior, DOE and/or MDOC will request the following information from Excelsior as part of the Environmental Information Volume: estimates of wildlife habitat acreage that may be lost for development of foreseeable projects identified in Section 3. Overall, the cumulative impact analysis for wildlife habitat loss will take into consideration recommendations by the USDA Forest Service, Superior National Forest, as a cooperating agency for the EIS. When making recommendations about wildlife impacts, the cooperating agency would be expected to identify particular species of interest and provide estimates of habitat location (maps) and acreage in the Iron Range for use in the cumulative impact analyses. The cooperating agency would also be expected to provide estimates of locations (maps) and growth in acreage of non-native invasive and predator species in the Iron Range along with estimations of the types of human activities that have caused the influx and growth of these species.

The estimated acreage to be lost for development of foreseeable projects should be added to the acreage expected to be lost for the respective Mesaba Energy Project (including Phase II) preferred and alternative sites, and the cumulative acreage should be compared to the estimated total wildlife habitat acreage in respective watersheds for the West and East Range Sites based on general vegetated acreage and on specific estimates of habitat acreage for species of interest as provided by the cooperating agency. Consideration should be given to the cumulative effects on habitat fragmentation and the obstruction of wildlife travel corridors by combined project actions. Possible cumulative effects metrics could include increases in miles and density of roads (and trails) affecting habitat for lynx and wolf, and reductions in nest trees for eagles.

D.6.8 Impacts of Increased Frequency and Lengths of Trains

If not otherwise available in documents/reports previously generated by Excelsior, DOE and/or MDOC will request the following information from Excelsior as part of the Environmental Information Volume: estimates of rail traffic requirements, including frequencies and lengths of trains, to serve foreseeable projects identified in Section 3. The anticipated routes of trains should be projected and added to the rail traffic requirements and projected routes of trains for the Mesaba Energy Project (including Phase II) at respective West and East Range Sites. The results should be evaluated for cumulative impacts on communities along the respective rail routes between Grand Rapids and Hoyt Lakes, with particular consideration for at-grade crossings causing obstruction of emergency vehicle access to service areas, traffic delays, and increased noise. These cumulative impacts should be evaluated also for potential disproportionate effects on low-income populations in compliance with environmental justice requirements.

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APPENDIX D1
Air

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Cumulative Air Quality Impact Analysis for Class I Areas

Prepared by McVehil-Monnett Associates, Inc.
November 10, 2006

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CUMULATIVE AIR QUALITY IMPACT ANALYSES FOR CLASS I AREAS

1. Introduction

Air quality modeling was carried out to assess the cumulative impacts of existing and reasonably foreseeable future sources at Class I areas. The analyses addressed the Boundary Waters Canoe Area, Voyageurs National Park, and The Rainbow Lakes Wilderness Area. For each Class I area, model results were obtained to evaluate PSD increment consumption (for SO2, NO2, and PM10), total air quality impact and compliance with ambient air quality standards (for the same pollutants), deposition of sulfur and nitrogen compounds, and visibility impacts. A visibility assessment was not conducted for Rainbow Lakes Wilderness Area, since visibility is not considered a critical value for Rainbow Lakes.

Mercury emissions from major existing and proposed sources were included in modeling. Results for mercury consisted of predicted average concentrations of mercury in air at receptors in each Class I area. The mercury concentration results were obtained to provide a basis for estimation of potential mercury deposition in water bodies and to the land surface.

2. Modeling Methodology

All modeling utilized the CALPUFF model system, the EPA Guideline methodology for simulation of long-range transport and dispersion. The CALPUFF system includes CALMET for preparation of meteorological data, CALPUFF for calculation of pollutant concentrations, and CALPOST for processing of results to generate average concentrations, deposition rates, and visibility impacts. Options and input variables in the models were generally selected per standard guidance from the US EPA and Federal Land Managers (FLMs).

Meteorological data for the modeling represented calendar years 2002, 2003, and 2004. The basic meteorological data consisted of MM5 meteorological fields obtained from the Minnesota Pollution Control Agency (MPCA). These fields have been used by MPCA for their current regional haze and Best Available Retrofit Technology (BART) analyses. For use in the present cumulative modeling analysis, the MM5 data were augmented by regional meteorological observations from surface, upper air, and precipitation monitoring stations. The MM5 and supplemental meteorological data were processed with CALMET to produce complete meteorological input to CALPUFF for each of the three model years.

Receptors for modeling consisted of the high resolution receptor grids provided by the National Park Service for each of the three Class I areas. Model-predicted concentrations for each receptor included all modeled pollutants on an hourly basis.

Post-processing of CALPUFF results provided for each receptor:

- average concentrations for applicable time periods
  - SO2 - 3-hour, 24-hour, annual
  - NO2 - annual
  - PM10 - 24-hour and annual
- annual deposition of sulfur and nitrogen
- annual concentration of mercury
- light extinction and deciview change relative to natural background visibility

The post-processing programs summarize outputs in terms of highest and second-highest concentrations at any receptor in each Class I area, highest annual concentration in each area, and highest visibility impact for each day in each Class I area.

For visibility calculations "Method 6" of CALPOST was applied. This methodology is recommended by EPA for BART analyses and is being used by the State of Minnesota for regional haze modeling. The Method 6 calculation is an alternative to the Method 2 calculation presented in the Federal Land Managers Air Quality Workgroup (FLAG) report, and has recently been accepted by FLMs for alternative analyses. For Method 6 application in the present analyses, monthly average relative humidity values and annual average natural background concentrations were taken from EPA BART guidance for the applicable Class I areas.

Mercury emissions were modeled only for sources for which emissions data were available; these sources were electric generating plants and proposed new sources. Since the speciation of mercury is not defined for most sources, it was not possible to calculate deposition directly with the CALPUFF model. Mercury was modeled as a non-reactive pollutant with no deposition. Model results for mercury therefore represent a conservative estimate of maximum mercury concentration in the ambient air for all mercury species combined.

3.0 Pollutant Sources Modeled

Emissions data and source parameters for significant sources of SO_2, NO_x, and PM10 in northern Minnesota were assembled for the cumulative Class I modeling analyses. Data were provided by the MPCA, and other information was acquired from permit applications and regulatory submittals. Data on increment consuming sources were obtained from MPCA in 2005 for Mesaba permit application modeling; data on other sources were provided by MPCA in October 2006 in response to a specific request for cumulative Class I source information.

The modeled sources can be classified into the following groups.

(1) Existing sources that have not experienced significant permit or emissions changes since the applicable PSD baseline dates. These sources do not affect PSD increment consumption, and were assumed to continue operation in the future at their current emission rates.

(2) Existing sources that have submitted applications or received permits or permit modifications after the applicable baseline dates. For these sources, emission changes (increases or decreases) since the baseline date were modeled for the cumulative PSD increment analyses. The sources were also included in the future cumulative modeling analyses at their most recent emitting conditions.

(3) Proposed sources not yet in operation. Proposed sources were modeled, at their proposed permit limits, for both PSD increment and future total impact analyses.

(4) Existing sources that are expected to reduce emissions in the future as a result of pollution control projects required for compliance with CAIR, BART, CAMR or other regulations. The sources in this category are the Minnesota Power Boswell, Laskin, and Taconite Harbor generating stations. The planned emission reductions were taken into account for both PSD increment and future total impact modeling analyses.

The emissions data for the sources provided by the MPCA for increment analysis were based on MPCA's records of pollutant-specific baseline dates for northern Minnesota. For visibility and deposition analysis, all existing and proposed sources for which data could be acquired were included. Minor sources and those mining or other sources that emit pollutants at or near the ground were not included in the modeling inventories. Such emissions (mostly PM10) are deposited near the source, and are not expected to have significant impacts at Class I areas. Where reasonable, emissions from multiple stacks or emission points at a single facility were combined for modeling. The total emissions were represented as occurring from one or several stacks with stack parameters typical of the majority of emissions.

For most regional sources, emissions data were available only for SO2, NOx, and PM10. These were therefore the only pollutants modeled for those sources. Where SO4 and/or speciated particulate matter data were available, as for Mesaba One and Mesaba Two, the additional pollutant forms were modeled. Generally only maximum short-term potential emission rates were available. Where rates were given for several averaging times for a given source, the maximum (potential) 24-hour emissions were modeled. For Mesaba One and Mesaba Two, maximum proposed (permit limit) emission rates were modeled for each averaging time.

Table 1 shows all sources and total facility emission rates that were included in the cumulative PSD increment and total impact modeling. Blank spaces in the table indicate that data were not available for the specific pollutant and facility. The "Inc" column in Table 1 shows PSD increment consuming (positive) or expanding (negative) emissions. The "Total" column represents total reasonably foreseeable future emissions. Different emissions inventories were used for the increment modeling and for visibility/deposition modeling. The increment inventories used MPCA data on permitted PSD emissions changes after the pollutant-specific baseline dates. The visibility and deposition analyses included all existing sources for which data were available, proposed new sources, and planned emission reductions at Minnesota Power facilities.

It should be noted that essentially all emission rates in Table 1 represent potential or maximum allowable emissions. For most facilities, actual emissions on any given day are substantially less than maximum emissions allowed by permit. Thus, despite the existence of some missing data, the total emissions included in the modeling are almost certainly a very conservative estimate of actual or typical pollutant contributions to the atmosphere.

Table 1 indicates that total increment emissions are negative for SO_2 and PM10. This result, primarily due to planned emission reductions at Minnesota Power generating stations, means that available PSD increment will expand in the future at the Class I areas of interest, and that air quality can be expected to improve compared to baseline conditions. The planned addition of new sources, including Mesaba One and Mesaba Two, will contribute only a small quantity of SO_2 relative to the projected reduction in future regional emissions.

Table 2 shows a comparison of present emissions from modeled sources to projected future emissions. The totals at the bottom of Table 2 indicate that future emissions of all pollutants will be less than at present. Thus, despite the proposed addition of Mesaba One and Mesaba Two and other new facilities, future regional emissions will be substantially reduced, especially in the case of SO_2. The data in Table 2 reflect only planned emission cuts by Minnesota Power. It is likely that other emission reductions will occur at regional sources as a result of Minnesota BART and other regulatory programs; such reductions could not be quantified for this cumulative analysis.

4.0 Results and Discussion

4.1 Pollutant Concentrations in Class I Areas

Table 3 presents CALPUFF model results for Mesaba One and Mesaba Two alone, at both West Range and East Range sites. Highest predicted concentrations for any year are shown for each Class I area, pollutant, and averaging time. Impacts in the Boundary Waters Canoe Area are higher for the East Range site; at the other Class I areas, impacts are generally similar regardless of the Mesaba site.

Mesaba Project concentrations are "significant" under the PSD regulations for short-term SO_2 emissions at all Class I areas. They are marginally significant for 24-hour PM10 impacts at the Boundary Waters and Voyageurs NP. All annual average impacts are insignificant. Even in the cases of short-term SO_2 and PM10, where Mesaba impacts are significant, they are far below the allowable PSD increment.

Cumulative PSD increment model results are shown in Table 4. Cumulative increment consumption is well below PSD Class I increment limits for all pollutants and Class I areas. The effect of overall regional SO_2 emission reductions is shown for the annual SO_2 increment; negative increment consumption is indicated throughout each Class I area. The cumulative increment results demonstrate that there is little or no overall difference between Class I increment consumption for the West and East Range Mesaba sites.

Table 5 gives the results of total air quality impact modeling for all future regional emissions. Predicted total SO_2, NO_2, and PM10 impacts are far below the applicable state and federal ambient air quality standards. Though background concentrations from natural, distant, and minor sources are not included in the Table 5 results, it is clear that there will be no threat to ambient standards in any Class I area. Again, the difference between West and East Range sites is negligible.

It can be concluded from the results in Tables 3, 4, and 5 that the projected future regional emission scenario, including Mesaba One and Mesaba Two, will not pose a threat to Class I PSD increments or ambient air quality standards. Mesaba Project contributions to total cumulative impacts are small relative to total expected concentrations.

Table 1. Modeled Sources and Emission Rates (lb/day)

Source	SO_2		NO_x		PM10		Hg
	Inc.	Total	Inc.	Total	Inc.	Total	Total
Mesaba Project Phases I and II	11,294	11,294	15,916	15,916	2,417	2,417	.148
Polymet	522	522	1,354	1,354	6,592	6,592	.004
Mesabi Nugget	2,286	2,286	5,714	5,714	2,619	2,619	.206
Minnesota Steel	3,442	3,442	9,962	9,962	18,035	18,035	.222
Laurentian Energy – Hibbing	137	25,992	825	8,985	160	1,697	.040
Laurentian Energy – Virginia	137	16,438	825	6,097	160	3,192	.040
MN Power – Clay Boswell							
#1,2,3	-349,567	116,520	-40,681	13,560	-49,309	2,596	.030
#4	40,458	40,458	49,046	49,056	12,261	12,261	.053
MN Power – Laskin	0	64,763	-9,505	6,335	0	19,010	.055
MN Power – Tac Harbor	-27,200	14,646			0	10,726	.021
Potlatch – Grand Rapids	0	19	2,286	2,286	720	1077	
Blandin Paper – Grand Rapids	10,008	14,295	19	2,876	1,288	1,291	
US Steel – MN Tac			56,477	56,477			
Hibbing Taconite	18,536	18,536			345	345	
MN Power – Hibbard	10,002	10,002					
Boise Cascade	3,398	8,635	0	8,895	0	1,615	
Potlatch – Cloquet	-815	21,193					
Northshore Mining	-499	49,881	0	38,921	0	3,988	
Potlatch – Cook			1,499	3,415	1,066	1,066	
Ispat Inland Mining			0	43,201	0	20,324	
United Taconite					0	19,734	
Keewatin Taconite					0	69,068	
Total	-277,861	418,922	93,737	273,050	-3,646	197,653	0.820

Table 2. Comparison of Present and Future Emissions (lb/day).

Source	SO_2		NO_x		PM10		Hg	
	Present	Future	Present	Future	Present	Future	Present	Future
Mesaba Project Phases I and II	0	11,294	0	15,916	0	2,417	0	.148
Polymet	0	522	0	1,354	0	6,592	0	.004
Mesabi Nugget	0	2,286	0	5,714	0	2,619	0	.206
Minnesota Steel	0	3,442	0	9,962	0	18,035	0	.222
Laurentian Energy – Hibbing	25,785	25,992	8,160	8,985	1,537	1,697	.040	.040
Laurentian Energy – Virginia	16,301	16,438	5,272	6,097	3,055	3,192	.040	.040
MN Power – Clay Boswell								
#1,2,3	466,087	116,520	54,241	13,560	51,906	2,596	.311	.030
#4	40,458	40,458	49,056	49,056	12,261	12,261	.534	.053
MN Power – Laskin	64,763	64,763	15,840	6,335	19,010	19,010	.055	.055
MN Power – Tac Harbor	41,846	14,646			10,726	10,726	.214	.021
Potlatch – Grand Rapids	19	19	2,286	2,286	1,077	1,077		
Blandin Paper – Grand Rapids	14,295	14,295	2,876	2,876	1,291	1,291		
US Steel – MN Tac			56,477	56,477				
Hibbing Taconite	18,536	18,536			345	345		
MN Power – Hibbard	10,002	10,002						
Boise Cascade	8,635	8,635	8,895	8,895	1,615	1,615		
Potlatch – Cloquet	21,193	21,193						
Northshore Mining	49,881	49,881	38,921	38,921	3,988	3,988		
Potlatch – Cook			3,415	3,415	1,066	1,066		
Ispat Inland Mining			43,201	43,201	20,324	20,324		
United Taconite					19,734	19,734		
Keewatin Taconite					69,068	69,068		
Total	777,801	418,922	288,640	273,050	216,913	197,563	1.194	0.820

Table 3. Maximum Predicted Impact of Mesaba Project Phase I and II; Concentrations in µg/m^3.

Class I Area	Pollutant	Averaging Time	Mesaba Max West Range	Mesaba Max East Range	Significance Level	Allowable Increment	Minn/NAAQS
Boundary Waters Canoe Area	SO_2	3-hour	2.16	4.70	1.0	25.0	915
		24-hour	0.42	1.57	0.2	5.0	365
		annual	0.017	0.072	0.1	2.0	60
	NO_2	annual	0.024	0.125	0.1	2.5	100
	PM10	24-hour	0.28	0.55	0.3	8.0	150
		annual	0.014	0.040	0.2	4.0	50
Voyageurs National Park	SO_2	3-hour	1.74	2.15	1.0	25.0	915
		24-hour	0.43	0.59	0.2	5.0	365
		annual	0.018	0.018	0.1	2.0	60
	NO_2	annual	0.028	0.029	0.1	2.5	100
	PM10	24-hour	0.33	0.31	0.3	8.0	150
		annual	0.014	0.013	0.2	4.0	50
Rainbow Lakes Wilderness Area	SO_2	3-hour	0.64	1.02	1.0	25.0	1300
		24-hour	0.17	0.39	0.2	5.0	365
		annual	0.010	0.013	0.1	2.0	80
	NO_2	annual	0.012	0.018	0.1	2.5	100
	PM10	24-hour	0.14	0.29	0.3	8.0	150
		annual	0.010	0.012	0.2	4.0	50
Note: 3-hour and 24-hour average concentrations are “highest second-high” values; annual concentrations are highest values							

Table 4. Maximum Predicted PSD Increment Impact of Mesaba Project and all Existing and Foreseeable Future Sources; Concentrations in µg/m^3.

Class I Area	Pollutant	Averaging Time	Mesaba West Range	Mesaba East Range	Significance Level	Allowable Increment	Minn/NAAQS
Boundary Waters Canoe Area	SO_2	3-hour	8.31	6.83	1.0	25.0	915
		24-hour	1.48	1.80	0.2	5.0	365
		annual	-0.150	-0.124	0.1	2.0	60
	NO_2	annual	0.699	0.732	0.1	2.5	100
	PM10	24-hour	2.10	2.16	0.3	8.0	150
		annual	0.174	0.195	0.2	4.0	50
Voyageurs National Park	SO_2	3-hour	5.94	5.94	1.0	25.0	915
		24-hour	1.40	1.40	0.2	5.0	365
		annual	-0.123	-0.117	0.1	2.0	60
	NO_2	annual	0.341	0.347	0.1	2.5	100
	PM10	24-hour	1.13	1.09	0.3	8.0	150
		annual	0.060	0.062	0.2	4.0	50
Rainbow Lakes Wilderness Area	SO_2	3-hour	2.93	2.69	1.0	25.0	1300
		24-hour	0.79	0.71	0.2	5.0	365
		annual	-0.134	-0.131	0.1	2.0	80
	NO_2	annual	0.071	0.078	0.1	2.5	100
	PM10	24-hour	0.65	0.71	0.3	8.0	150
		annual	0.007	0.009	0.2	4.0	50
Note: 3-hour and 24-hour average concentrations are "highest second-high" values; annual concentrations are highest values							

Table 5. Maximum Predicted Total Impact of Mesaba Project and All Existing and Foreseeable Future Sources; Concentrations in μg/m^3

Class I Area	Pollutant	Averaging Time	Mesaba West Range	Mesaba East Range	Minn/NAAQS
Boundary Waters Canoe Area	SO_2	3-hour	35.97	37.87	915
		24-hour	11.89	12.95	365
		annual	1.646	1.704	60
	NO_2	annual	1.646	1.680	100
	PM10	24-hour	8.28	8.11	150
		annual	1.004	1.014	50
Voyageurs National Park	SO_2	3-hour	33.99	33.99	915
		24-hour	5.64	5.72	365
		annual	0.854	0.843	60
	NO_2	annual	0.753	0.758	100
	PM10	24-hour	5.62	5.46	150
		annual	0.493	0.494	50
Rainbow Lakes Wilderness Area	SO_2	3-hour	9.44	9.26	1300
		24-hour	4.72	4.60	365
		annual	0.732	0.733	80
	NO_2	annual	0.259	0.261	100
	PM10	24-hour	2.92	3.27	150
		annual	0.275	0.278	50
Note: 3-hour and 24-hour average concentrations are "highest second-high" values; annual concentrations are highest values					

4.2 Deposition of Sulfur and Nitrogen

The CALPUFF/CALPOST programs generate calculations of total annual sulfur and nitrogen deposition to the ground surface by summing contributions from all sulfur and nitrogen species (gaseous and particulate) at each Class I receptor. Results presented here are the highest annual deposition value for any receptor and any of the three years modeled, for each Class I area.

Table 6 shows deposition predictions for Mesaba One and Mesaba Two alone, and Table 7 shows maximum total cumulative deposition from all sources. The highest Mesaba deposition relative to total cumulative deposition ranges from 1.2 percent for West Range sulfur impacts in the Boundary Waters, to 9.6% for East Range nitrogen impacts in the Boundary Waters.

For National Park Service Class I areas (Voyageurs NP) no acceptable deposition values for impacts on soils or waters have been established. A “deposition analysis threshold” of 0.01 kg/ha-yr is given as a level below which no adverse impacts are expected. Model results in Tables 6 and 7 show deposition rates exceeding this significance threshold.

The US Forest Service has defined screening criteria for terrestrial and aquatic impacts of deposition. The “Green Line” criteria define levels “at which it was reasonably certain that no significant change would be observed in ecosystems that contain large numbers of sensitive components”. The USFS Green Line levels for the BWCA and Rainbow Lakes are shown in Table 8. Though no similar thresholds are available for Voyageurs NP, it is reasonable to assume that ranges of the same order as those for BWCA and RLWA are appropriate. Table 8 indicates that total sulfur and nitrogen deposition, including background, will be within the acceptable Green Line ranges. It should be noted that the background values shown probably include the current impacts of some of the modeled sources. Therefore the predicted future total deposition data in Table 8 are expected to be conservative.

4.3 Visibility Impacts

The CALPUFF model results for 24-hour average concentrations of particulate pollutants that affect light extinction and visibility were processed using CALPOST Method 6 to define maximum visibility impacts of Mesaba One and Mesaba Two and all regional sources. The results are presented as the number of days per year in each Class I area on which visibility impact (the change from natural or pristine background visibility) exceeds 0.5 deciview (dv), and the 98th percentile (8th highest per year) deciview change. A threshold of 0.5 dv is considered the level at which visibility change is potentially perceptible to a viewer, and is considered the lowest level at which a source is considered to contribute to visibility degradation.

Table 9 shows visibility modeling results for Mesaba One and Mesaba Two alone. For the West Range site, possible visibility impacts are indicated on 17 to 22 days per year in both BWCA and VNP. The 98th percentile (highest) impact is approximately 0.7 dv in both Class I areas. This deciview change corresponds to a potential visibility reduction from 187 km to 175 km in BWCA, and from 190 km to 176 km in VNP. For the East Range site, Mesaba impacts are higher at BWCA because of proximity to that Class I area, and lower at VNP. The 98th percentile visibility impacts represent a potential reduction in clear day visibility from 187 km to 157 km at BWCA, and from 190 km to 177 km at VNP.

The CALPUFF visibility calculations are quite conservative, and tend to indicate the greatest number and magnitude of potential impacts, rather than actual observable impacts. The calculations do not explicitly account for natural visibility degradation due to fog, clouds, or precipitation. Prior analyses have shown that a large fraction of the days on which visibility impacts are predicted for northern Minnesota are days of very low temperature, fog, and/or precipitation on which natural visibility is severely limited.

Results for the cumulative visibility modeling are presented in Table 10. It is clear that visibility issues are significant for the Boundary Waters and Voyageurs Class I areas. Table 9 suggests that possible impacts could occur on two-thirds of all days, and maximum impacts could potentially be as high as 8.7 dv in BWCA, and 8.6 dv in VNP. These correspond to potential visibility reductions from 190 km in pristine conditions to 80 km under worst-case conditions.

As noted above, the visibility calculations tend to overstate the potential for impairment. It should also be recognized that the cumulative modeling assumed maximum allowable pollutant emissions from all sources on every day of the year, a situation that is unrealistic. The visibility processing did not include use of the “ammonia limiting” calculation procedure due to time constraints. This calculation is appropriate where many sources contribute to visibility impacts, and available ammonia may limit the production of nitrate particles. Use of ammonia limiting was shown in a trial run to reduce predicted visibility impacts significantly. Thus, the results presented here should be considered as a worst-case scenario rather than an estimate of actual current or future visibility conditions.

The State of Minnesota is currently addressing visibility in BWCA and VNP under the Regional Haze Rule, and will require BART emission reductions from many sources in the state. Only potential actions at Minnesota Power facilities in northern Minnesota were considered in this analysis. It is expected that many other actions, both voluntary and in response to regulatory requirements, will be taken in the near future to reduce the potential for visibility degradation.

To assess the effectiveness of Minnesota Power’s planned emission controls at Boswell, Laskin, and Tac Harbor, an additional model run was conducted to define cumulative visibility impacts in the absence of those controls. Predicted 98th percentile impacts averaged 1.0 dv higher without the projected Minnesota power emission reductions. Thus, present emissions from those sources, which will be eliminated in the near future, account for approximately 10% of current visibility impacts in BWCA and VNP. The reduced visibility impacts resulting from Minnesota Power controls exceed projected impacts of Mesaba One and Mesaba Two by a significant amount (20 to 80%) for all cases except for East Range Mesaba impacts in BWCA. For that case, Minnesota Power reductions will offset approximately 50% of projected maximum Mesaba impacts.

4.4 Mercury Concentrations

Table 11 gives results of mercury concentration modeling. The concentrations shown, in $\mu g/m^3$, represent the 3-year average highest ambient mercury concentration at any point in each Class I area. There are no accepted standards for ambient mercury levels in air. The predicted values, which estimate maximum levels of combined mercury forms, may be used with assumptions on speciation and deposition velocity to derive conservative estimates of mercury deposition.

Table 6. Deposition Modeling Results (Maximum Annual Deposition) – Mesaba Alone

Class I Area	West Range Site		East Range Site	
	S (kg/ha-yr)	N (kg/ha-yr)	S (kg/ha-yr)	N (kg/ha-yr)
Boundary Waters Canoe Area	1.379 E-2	1.120 E-2	5.618 E-2	4.873 E-2
Voyageurs National Park	1.540 E-2	1.187 E-2	1.988 E-2	1.394 E-2
Rainbow Lakes Wilderness Area	6.826 E-3	5.687 E-3	9.204 E-3	8.176 E-3

Table 7. Deposition Modeling Results (Maximum Annual Deposition) – All Future Sources

Class I Area	West Range Site		East Range Site	
	S (kg/ha-yr)	N (kg/ha-yr)	S (kg/ha-yr)	N (kg/ha-yr)
Boundary Waters Canoe Area	1.146	0.501	1.194	0.508
Voyageurs National Park	0.628	0.267	0.622	0.267
Rainbow Lakes Wilderness Area	0.453	0.124	0.453	0.128

Table 8. Comparison of Projected S and N Deposition Rates to Green Line Criteria for Impacts to Terrestrial and Aquatic Ecosystems.

Class I Area	Parameter	Background [1] (kg/ha-yr)	Maximum Cumulative Impact (kg/ha-yr)	Total (kg/ha-yr)	Green Line [2] Value (kg/ha-yr)
BWC	Terrestrial				
	Total S Depo	2.85	1.194	4.04	5-7
	Total N Depo	4.75	.508	5.26	5-8
	Aquatic				
	Total S Depo	2.85	1.194	4.04	7.5-8
	S + 20% N	3.80	1.296	5.10	9-10
RLWA	Terrestrial				
	Total S Depo	2.98	.453	3.43	5-7
	Total N Depo	5.88	.128	6.01	5-8
	Aquatic				
	Total S Depo	2.98	.453	3.43	3.5-4.5
	S + 20% N	4.16	.479	4.64	4.5-5.5

[1] Background values from Mesabi Nugget Class I Air Modeling Report. Barr Engineering Company, May 2005.

(2) Green Line Values from Screening Procedure to Evaluate Effects of Air Pollution on Eastern Region Wilderness Cited as Class I Air Quality Areas. USFS. 1991.

Table 9. Results of CALPUFF Visibility Modeling for the Mesaba Plant Alone

	2002 (Num Values >.5 DV)	2003 (Num Values >.5 DV)	2004 (Num Values >.5 DV)	2002 8th Highest DV	2003 8th Highest DV	2004 8th Highest DV
East Range Site						
Boundary Waters	129	124	115	1.989	1.655	1.578
Voyageurs	14	13	14	0.699	0.652	0.633
West Range Site						
Boundary Waters	22	22	17	0.647	0.712	0.732
Voyageurs	18	19	20	0.729	0.694	0.708

Table 10. CALPUFF Cumulative Visibility Modeling

	2002 (Num Values >.5 DV)	2003 (Num Values >.5 DV)	2004 (Num Values >.5 DV)	2002 8th Highest DV	2003 8th Highest DV	2004 8th Highest DV
East Range Site						
Boundary Waters	238	244	245	8.734	8.407	7.481
Voyageurs	190	205	189	7.156	6.354	5.713
West Range Site						
Boundary Waters	231	242	244	8.600	8.420	7.635
Voyageurs	189	206	191	6.959	6.340	5.740

Table 11. Results of Mercury Modeling; Average Concentration (μg/m^3)

Class I Area	Mesaba Project Alone		Cumulative – All Sources	
	West Range	East Range	West Range	East Range
Boundary Waters Canoe Area	4.438 E-7	14.960 E-7	6.118 E-6	7.042 E-6
Voyageurs National Park	4.580 E-7	4.489 E-7	2.825 E-6	2.919 E-6
Rainbow Lakes Wilderness Area	2.294 E-7	3.295 E-7	1.492 E-6	1.595 E-6

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APPENDIX D2
Health Risk

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6.4 Cumulative Impacts – Air Toxics Inhalation Risk

Cumulative impacts resulting from inhalation of air toxics emissions from the Mesaba Energy Project, nearby existing facilities, and other potential future emission sources listed in Section 3.2 are evaluated at both the East Range and West Range locations. In addition to the Mesaba One and Mesaba Two, future emissions from the proposed Minnesota Steel Industries (MSI) plant near the West Range location are included in this evaluation. Emission sources considered at the East Range location include the exiting Laskin Energy Center (southwest of the IGCC Power Station footprint [hereafter, the "Footprint"]), the proposed Mesabi Nugget facility (northwest of the Footprint) and the proposed PolyMet Mining (PolyMet) project (north of the Footprint). It should be stressed that only the Laskin Energy Center (Laskin) is currently in operation, in fact permits have not been issued for the MSI or PolyMet facilities to date.

Two proposed wood-fired boilers at the Laurentian Wood-Fired Generation Plants located near Virginia, Minnesota and Hibbing, Minnesota are also listed in Section 3.2 as potential future emission sources. The Laurentian facility at Hibbing would be approximately 35 kilometers (km) from the proposed West Range Mesaba facility, and the Laurentian facility at Virginia would be approximately 40 km from the proposed East Range facility. Because of the relatively large distances from the Mesaba plant, the incremental risk which the Laurentian facilities would contribute due to inhalation of air toxics would not be significant and so are not evaluated further.

<u>Approach</u>

The method to determine potential cumulative impacts to receptors from inhaled (Mesaba One and Mesaba Two) emissions generated by Mesaba One and Mesaba Two and from other potential future emission sources uses a step-wise approach.

The first, more conservative step of the process determines the maximum cancer risk and non-cancer hazard index estimated for each facility. For the most part, this information is obtained from the most current Air Emission Risk Analysis (AERA) data submitted by each facility to the MPCA. For the Laskin facility, risk was estimated based on data obtained from the MPCA Annual Emission Inventory records. The maximum risks are evaluated for acute, sub-chronic, and chronic averaging periods (as available). As a worst-case scenario, it is assumed that the risks are additive and that receptors are exposed to inhaled pollutant concentrations that pose the maximum risks, without regard for the actual location of the risk determination.

The combined maximum cancer risks and maximum hazard indices from potential nearby facilities are compared to the thresholds of concern established by the Minnesota Department of Health (MDH). The threshold of concern for pollutants producing non-carcinogenic effects is 1 and the threshold of concern for pollutants producing carcinogenic effects is 1 in 100,000 or 1×10^{-5}.

If the combined cancer risks and hazard indices are below the MDH threshold values, then it is assumed that the cumulative worst-case risks are at acceptable levels and will not cause appreciable cumulative impacts.

If the combined risks or hazard indices are greater than the MDH threshold values, then the second, more refined, step in the process is conducted. Based on MPCA guidance, screening-level risk is assessed within a buffer zone of 3 km for facilities with stack heights less than 100 meter (m) and within a buffer zone of 10 km for facilities with stack heights greater than 100 m. In the second step, the calculated risks at receptor locations closest to the buffer zone portions common to each of the facilities (overlap areas) being assessed are added and compared to MDH threshold values. The facility buffer zones for the West Range can be seen on Figure 1 and for the East Range on Figure 2.

Because several of the facilities are not currently in operation, a third step of evaluation is conducted on the East Range to evaluate the cumulative effects of Mesaba One and Mesaba Two in combination with each of the Mesabi Nugget and PolyMet facilities separately. The purpose of this evaluation step is to evaluate the contribution of each facility in the event that either the Mesabi Nugget or PolyMet plants do not become operational.

Overview

Information regarding maximum inhalation cancer risks and hazard indices is obtained from the following sources:

- Mesaba Energy Project AERA, and related support files submitted to MPCA dated June 2006
- MSI Human Health Screening-Level Risk Assessment, dated May 2006
- PolyMet Mining, Inc. AERA, dated May 2005
- Mesabi Nugget, LLC, MPCA AERA Internal Form-03, dated April 7, 3005
- MPCA Annual Emissions Inventory record for year 2002, Laskin Energy Center

The MPCA AERA Internal Form-03 for Mesabi Nugget presented two sets of air toxics risk data. The “near field” data, representing the area at or between the Mesabi Nugget property boundary and the Cliffs Erie property boundary, is used for this evaluation. This data set contains the Mesabi Nugget maximum risk experienced by a receptor in the vicinity of Mesaba Energy and PolyMet.

In order to define the screening-level buffer zone areas in common to two or more facilities, SEH obtained stack height and location information for each facility. All facility stack heights, with the exception of MSI, are less than 100 m. At least one MSI stack height is listed at 100 m. Based on this information, or on files obtained from the facility or their consultant regarding buffer zone placement, SEH mapped the buffer zone boundaries. Mesaba One, Mesaba Two, Mesabi Nugget, Laskin, and PolyMet have buffer zones of 3 km. The MSI facility has a buffer zone of 10 km. Because the exact location of the PolyMet stacks are not known, the 3 km buffer zone for this facility is drawn from the approximate plant area boundary. The facility buffer zones for the West Range can be seen on Figure 1, Area A and for the East Range on Figure 2, Areas B and C.

As will be shown in subsequent sections, the maximum inhalation risks posed by two of the proposed facilities near the East Range Mesaba plant are at the MDH threshold values. Additional risk contributed by any other facility will cause the MDH threshold values to be exceeded. The contribution of the East Range Mesaba facility to inhalation risk is between 0.5 and 22 percent in all Step 2 and Step 3 evaluations.

It is also worthy to note that hazard indices and cancer risks are additive if a receptor experiences the emissions from all sources simultaneously. That is, emissions must coincide both spatially and temporally. It is highly unlikely that meteorological conditions would have maximum pollutant concentrations from two or more facilities located at the same time and at the same place. Meteorological conditions that would cause maximum concentrations from one facility at a specific receptor location would cause reduced concentrations at that same location from other facilities. In addition, as discussed below, while refined risk values are used for the Mesaba plant in Step 2 and Step 3 evaluations, maximum risk results must be used for both the Mesabi Nugget and PolyMet projects regardless of the geographical location of the overlap areas. Evaluation of cumulative impacts under these conditions results in greatly overestimated results.

West Range – Step 1 Results

The facilities on the West Range are Mesaba One, Mesaba Two, and MSI. The general area potentially impacted by both facilities can be seen on Figure 1, indicated by Area A. These results are summarized in Table 1.

Table 1
West Range Cumulative Risk – Step 1

Facility	Potential Inhalation Hazard Index/Averaging Period*			Potential Inhalation Cancer Risk*
	Acute (1-hour)	Sub-Chronic (1-month)	Chronic (annual)	
Mesaba	0.5	0.1	0.03	3×10^{-07}
MSI	0.7	Not conducted	0.2	6×10^{-07}
Potential Cumulative Impacts	1**	N/A	0.2	9×10^{-07}
MDH Threshold Values	1	1	1	1×10^{-05}
Cumulative Impact Decision	**Minimal Impacts**	**N/A**	**No Impacts**	**No Impacts**

*Hazard Index and Cancer Risks are reported to one significant figure only as stated in the U.S. EPA's Risk Assessment Guidance for Superfund (RAGS), Volume I – Human Health Evaluation Manual (Part A).

**The sum of the hazard indices is actually greater than one. However, because the hazard index is reported to one significant figure and that value is at the MDH threshold, the cumulative impacts decision is stated as minimal rather than exceeding the limit or having no impacts.

The combined acute hazard indices from both facilities result in a maximum acute cumulative hazard index of 1. A sub-chronic hazard index is not calculated for the MSI facility in the MSI Human Health Screening-Level Risk Assessment; therefore, a cumulative sub-chronic hazard index could not be evaluated. The maximum sub-chronic contribution from Mesaba One and Mesaba Two is 0.1, well below the threshold value of concern established by the MDH. The combined chronic hazard indices from both facilities result in a maximum cumulative hazard index of 0.2.

The combined cancer risks from both facilities results in a maximum cumulative cancer risk of 9×10^{-07}.

Based on the most current risk analyses performed for the Mesaba and MSI facilities, maximum acute and chronic hazard indices and cancer risk will not exceed MDH threshold values. A Step 2 evaluation is not required for these two facilities.

East Range – Step 1 Results

Four facilities are in relatively close proximity near the proposed East Range Mesaba site. Three of those facilities, Mesaba, Mesabi Nugget, and PolyMet are close enough geographically to result in the overlap of all three buffer zones. It is assumed that emissions from all three facilities could potentially impact a receptor in the overlap area. Likewise, the buffer zones for the Mesaba and Laskin facilities overlap. The Laskin buffer zone, however, does not overlap those of either Mesabi Nugget or PolyMet. The general area potentially impacted by Mesaba, Mesabi Nugget, and PolyMet can be seen on Figure 2, indicated by Area B. The general area potentially impacted by Mesaba and Laskin is indicated by Area C.

Mesaba One/Mesaba Two and Laskin Energy Center

Although the Laskin facility has been in operation for some time, an AERA is not available. SEH obtained the most recent air toxics data from the MPCA Annual Emissions Inventory database. The most recent data available was for 2002. Using the Laskin emission source information, SEH performed dispersion modeling of Laskin emissions at a 1 g/sec dispersion rate. Receptors having the maximum dispersion concentrations were identified. The 2002 annual pollutant emission rates and dispersion modeling factors were entered into the most recent version of the MPCA Risk Assessment Screening Spreadsheet (RASS) spreadsheet (dated August, 29, 2006). Inhalation cancer risk and non-cancer hazard indices were then generated by RASS. The Step 1 evaluation of the Mesaba and Laskin facilities is summarized in Table 2.

Table 2
East Range Mesaba/Laskin Cumulative Risk – Step 1

Facility	Potential Inhalation Hazard Index/Averaging Period*			Potential Inhalation Cancer Risk
	Acute (1-hour)	Sub-Chronic (1-month)	Chronic (annual)	
Mesaba	0.5	0.1	0.03	$3 X 10^{-07}$
Laskin Energy Center	0.2	0.01	0.04	$2 X 10^{-06}$
Potential Cumulative Impacts	0.7	0.1	0.07	$2 X 10^{-06}$
MDH Guideline Values	1	1	1	$1 X 10^{-05}$
Cumulative Impact Decision	**No Impacts**	**No Impacts**	**No Impacts**	**No Impacts**

*Hazard Index and Cancer Risks are reported to one significant figure only as stated in the U.S. EPA's Risk Assessment Guidance for Superfund (RAGS), Volume I – Human Health Evaluation Manual (Part A).

The combined acute hazard indices from the proposed Mesaba and Laskin facilities result in a maximum acute cumulative hazard index of 0.7. The combined sub-chronic hazard indices from the two facilities result in a maximum cumulative hazard index of 0.1. The combined chronic hazard indices from both facilities result in a maximum cumulative hazard index of 0.07.

The combined cancer risks from both facilities results in a maximum cumulative cancer risk of $2 X 10^{-06}$.

Based on the most current data and risk analyses performed for the Mesaba and Laskin facilities, maximum acute, sub-chronic and chronic hazard indices, and cancer risk will not exceed MDH threshold values. A Step 2 evaluation is not required for these two facilities.

Mesaba One/Mesaba Two, Mesabi Nugget, and PolyMet
Because the buffer zones of the Mesaba, Mesabi Nugget and PolyMet facilities overlap, a combined evaluation of all three facilities is conducted. The Step 1 evaluation of the Mesaba, Mesabi Nugget and PolyMet facilities is summarized in Table 3. The area potentially impacted by these facilities is shown on Figure 2 as Area B.

Table 3
East Range Mesaba/Mesabi Nugget/PolyMet
Cumulative Risk – Step 1

Facility	Potential Inhalation Hazard Index/Averaging Period*			Potential Inhalation Cancer Risk
	Acute (1-hour)	Sub-Chronic (1-month)	Chronic (annual)	
Mesaba	0.5	0.1	0.03	$3 X 10^{-07}$
Mesabi Nugget	1	0.04	0.9	$7 X 10^{-06}$
PolyMet	0.7	0.005	1	$1 X 10^{-05}$
Potential Cumulative Impacts	2	0.1	2	$2 X 10^{-05}$
MDH Guideline Values	1	1	1	$1 X 10^{-05}$
Cumulative Impact Decision	**Potential Impacts**	**No Impacts**	**Potential Impacts**	**Potential Impacts**

*Hazard Index and Cancer Risks are reported to one significant figure only as stated in the U.S. EPA's Risk Assessment Guidance for Superfund (RAGS), Volume I – Human Health Evaluation Manual (Part A).

The combined acute hazard indices from all three facilities result in a maximum cumulative hazard index of 2. The combined sub-chronic hazard indices from the three facilities result in a maximum cumulative hazard index of 0.1. The combined chronic hazard indices from all three facilities result in a maximum cumulative hazard index of 2.

The combined cancer risks from all three facilities result in a maximum cumulative cancer risk of $2 X 10^{-05}$.

Based on the most current risk analyses performed for the Mesaba, PolyMet, and Mesabi Nugget facilities, maximum acute and chronic hazard indices and cancer risk exceed the MDH threshold values. A Step 2 evaluation will be conducted for these averaging periods. The maximum sub-chronic hazard index does not exceed MDH threshold values and will not be carried forth into Step 2 of this evaluation.

East Range – Step 2 Results

In Step 2 of the cumulative impacts approach, cancer risk and hazard indices calculated at receptors in specific areas that will most likely be exposed to emissions from more than one facility (rather than maximum risk values used in Step 1) are evaluated.

According to information in the PolyMet and Mesabi Nugget AERAs, air emission risk analyses for both of these facilities are calculated using the MPCA RASS. In this method, a maximum total air concentration from all sources is entered for each pollutant. The RASS spreadsheet does not include the geographical location of the entered concentrations. Geographical refinement of risk using RASS requires entering the concentrations of pollutants at specific receptor locations, rather than the maximum values. Based on the information available to SEH from the MPCA to date, refinement of the maximum hazard index and cancer risk cannot be conducted for either the PolyMet facility or the Mesabi Nugget facility. Therefore, maximum hazard index/cancer risk values must be used for these two facilities in all evaluation steps.

The AERA for Mesaba One and Mesaba Two calculates health indices using the Q/CHI method (Q = emission rate; CHI = Critical Health Index) for acute and sub-chronic time periods. The Industrial Risk Assessment Program (IRAP) is used to calculate cancer risk and chronic hazard indices. IRAP incorporates algorithms in accordance with the U.S. EPA Human Health Risk Assessment Protocol (HHRAP). Both of these methods allow for the geographical examination of inhalation hazard index/cancer risk. In Step 2, hazard index/cancer risk calculated in or near the overlap of facility screening-level buffer zones are used for Mesaba One and Mesaba Two. The results from the East Range Step 2 evaluation are summarized in Table 4.

Table 4
East Range Mesaba/Mesabi Nugget/PolyMet
Cumulative Risk – Step 2

Facility	**Potential Inhalation Hazard Index/Averaging***		**Potential Inhalation Cancer Risk**
	Acute (1-hour)	**Chronic (annual)**	
Mesaba	0.2	0.01	1×10^{-07}
Mesabi Nugget	1	0.9	7×10^{-06}
PolyMet	0.7	1	1×10^{-05}
Potential Cumulative Impacts – all facilities	2	2	2×10^{-05}
MDH Guideline Values	1	1	1×10^{-05}
Cumulative Impact Decision – all facilities	**Potential Impacts**	**Potential Impacts**	**Potential Impacts**
Mesaba Contribution	**10%**	**0.5%**	**1%**

*Hazard Index and Cancer Risks are reported to one significant figure only as stated in the U.S. EPA's Risk Assessment Guidance for Superfund (RAGS), Volume I – Human Health Evaluation Manual (Part A).

The combined acute hazard indices from all three facilities result in a cumulative hazard index of 2. The combined chronic hazard indices from all three facilities result in a cumulative hazard index of 2. The combined cancer risks from all three facilities result in a cumulative cancer risk of 2×10^{-05}.

Based on the most current risk analyses, taking into account geographical location of risk for Mesaba One and Mesaba Two only, acute and chronic hazard indices and cancer risk exceed the MDH threshold values. The acute risk drivers in this scenario are the Mesabi

Nugget facility (HI = 1) and PolyMet facility (HI = 0.7.) The chronic non-cancer risk drivers are also the Mesabi Nugget facility (HI = 0.9) and PolyMet facility (HI = 1) The cancer risk driver is the PolyMet facility (1E-05.)

Because the inhalation risks posed by the risk drivers are at or near the MDH threshold values, additional risk from any facility will cause an exceedance of the threshold values. The contribution of Mesaba One and Mesaba Two to inhalation risk is 10 percent or less in all three cases.

The cumulative risks are relatively small, particularly considering the fact that no geographical refinement of the risks could be applied for two of the three facilities. In addition, cumulative impacts from all three facilities occur in a very limited area (Area B) Land use in this area is primarily mining. The conservative assumptions used to derive the maximum risks (i.e, those of a farmer or residential scenario) are not appropriate for a refined inhalation risk determination in this area (occupational scenario) and greatly overestimate cumulative impact.

East Range – Step 3 Results

Because the geographical buffer zone overlap of all three facilities on the East Range is so small and because none of the facilities being evaluated are operational at this time, it is prudent to evaluate the cumulative effects from each separate facility combined with Mesaba One and Mesaba Two. The results from the East Range Mesaba Project/Mesabi Nugget Step 3 evaluation are summarized in Table 5 and the results from the Mesaba Project/PolyMet Step 3 evaluation are summarized in Table 6.

Table 5
East Range Mesaba/Mesabi Nugget
Cumulative Risk – Step 3

Facility	Potential Inhalation Hazard Index/Averaging*		Potential Inhalation Cancer Risk
	Acute (1-hour)	Chronic (annual)	
Mesaba	0.2	0.01	1×10^{-07}
Mesabi Nugget	1	0.9	7×10^{-06}
Potential Cumulative Impacts – Mesaba/Mesabi Nugget	1**	0.9	7×10^{-06}
MDH Guideline Values	1	1	1×10^{-05}
Cumulative Impact Decision – all facilities	**Minimal Impacts**	**No Impacts**	**No Impacts**
Mesaba Contribution	**20%**	**1%**	**1%**

*Hazard Index and Cancer Risks are reported to one significant figure only as stated in the U.S. EPA's Risk Assessment Guidance for Superfund (RAGS), Volume I – Human Health Evaluation Manual (Part A).

**The sum of the hazard indices is actually greater than one. However, because the hazard index is reported to one significant figure and that value is at the MDH threshold, the cumulative impacts decision is stated as minimal rather than exceeding the limit or having no impacts.

The combined acute hazard indices from the Mesaba and Mesabi Nugget facilities result in an acute cumulative hazard index of 1. The combined chronic hazard indices from both facilities result in a cumulative hazard index of 0.9. The combined cancer risks from both facilities result in a cumulative cancer risk of 7 X 10^{-06}. The contribution of Mesaba One and Mesaba Two to the acute inhalation risk is 20 percent and 1 percent for both chronic non-cancer and cancer risk.

Table 6
East Range Mesaba/PolyMet
Cumulative Risk – Step 3

Facility	**Potential Inhalation Hazard Index/Averaging***		**Potential Inhalation Cancer Risk**
	Acute (1-hour)	**Chronic (annual)**	
Mesaba	0.2	0.01	1 X 10^{-07}
PolyMet	0.7	1	1 X 10^{-05}
Potential Cumulative Impacts – Mesaba/PolyMet	0.9	1**	1 X 10^{-05}**
MDH Guideline Values	1	1	1 X 10^{-05}
Cumulative Impact Decision – all facilities	**No Impacts**	**Minimal Impacts**	**Minimal Impacts**
Mesaba Contribution	**22%**	**1%**	**1%**

*Hazard Index and Cancer Risks are reported to one significant figure only as stated in the U.S. EPA's Risk Assessment Guidance for Superfund (RAGS), Volume I – Human Health Evaluation Manual (Part A).
**The sum of the hazard indices and cancer risks are actually greater than the MDH values. However, because hazard index and cancer risk are reported to one significant figure and that value is at the MDH threshold, the cumulative impacts decision is stated as minimal rather than exceeding the limit or having no impacts.

The combined acute hazard indices from the Mesaba and PolyMet facilities result in a cumulative hazard index of 0.9. The combined chronic hazard indices from both facilities result in a cumulative hazard index of 1. The combined cancer risks from both facilities result in a cumulative cancer risk of 1 X 10^{-05}. The contribution of Mesaba One and Mesaba Two to the acute inhalation risk is 22 percent and 1 percent for both chronic non-cancer and cancer risk.

Taking into account geographical location of risk for Mesaba One and Mesaba Two only, acute, sub-chronic, and chronic hazard indices and cancer risk will not exceed MDH threshold values for the Mesaba plant combined with either the Mesabi Nugget or PolyMet facilities.

Conclusions

Cumulative impacts due to inhalation of air toxics from reasonably foreseeable projects in the vicinity of Mesaba One/Mesaba Two have been examined using conservative assumptions and are found to be at or below levels of concern set by the Minnesota Department of Health.

Data Refinements

To the extent better data become available for Mesaba One/Mesaba Two, Laskin Energy Center, Mesabi Nugget, PolyMet Mining, and MSI projects, subsequent revisions of this Air Toxics Inhalation Risk analysis will be revisited to determine whether the above conclusions are maintained. In general, risks associated with such emissions are found to decrease as the analysis of air toxic impacts become more refined.

APPENDIX D3
Water Resources

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Cumulative Water Resources Effect Assessment

Prepared for Excelsior Energy

Mesaba Energy Project

SEH No. EXENR0502.03

November 2006

Prepared for Excelsior Energy
Cumulative Water Resources Effect Assessment
Mesaba Energy Project

SEH No. EXENR0502.03

Prepared for:
Excelsior Energy

November 2006

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West Range

I. Identification and description of affected watershed: Swan River.

The Swan River Watershed is located in Itasca and St. Louis Counties in Northern Minnesota and is part of the Upper Mississippi River Watershed Basin. Figure 1 shows the Swan River Watershed to a point immediately upstream of the confluence with Trout Creek, the location of Mesaba, and the location of the proposed Minnesota Steel Project.

Human influences related to logging, mining, ditch construction, agricultural activity, dam construction, flow diversion / withdrawal, development of transportation systems, and community development activities have impacted streams in the area, including the Swan River.

The contributing watershed area of the Swan River has been altered primarily through several past mining actions. The land use / cover type was modified significantly through the construction of mining related facilities and, in turn, this alteration has modified the quantity and timing of surficial runoff to the Swan River.

Impacts resulting from the Minnesota Steel Industries ("MSI") project are hydrologically upstream on the Swan River from the Mesaba Energy Project. The Swan River watershed study area was selected at a point sufficiently downstream of the Mesaba's impacts in order to encompass the cumulative impacts within the Swan River Watershed with respect to both the MSI project and Mesaba.

II. Identify existing usage and quality:

Existing Water Appropriation permits from surface waters in the Swan River watershed are shown in **Table 1**.

Table 1 - Existing Water Appropriation Permits for Surface Waters Near the West Range Site within the Swan River Watershed

		Permitted		Reported Pumping (Million Gallons)				
Permittee	**Resource**	**GPM**	**MG/Y**	**2000**	**2001**	**2002**	**2003**	**2004**
MDNR	Hill-Annex Tailing Basin	4500	500	ND	ND	ND	ND	70.3
MDNR	Hill-Annex Mine	7000	3416	ND	ND	621.1	1550.3	1374
Swan Lake Country Club	Oxhide Creek	540	10	4.6	8.5	9.2	8.4	5.8
City of Coleraine	Trout Lake	400	41	37	19.7	19.7	12.1	11.9

Currently, the Swan River is impaired for fecal coliform, dissolved oxygen, and mercury. **Table 18-2** from the **MSI Environmental Assessment Worksheet ("EAW")** includes existing water quality information.

III. Effects from new sources/appropriations

a. Quantity:

i. Mesaba:

The Swan River is affected to the degree that Mesaba One and Mesaba Two will pump water out of the Hill-Annex Mine Pit ("HAMP") complex to the CMP instead of the DNR's current practice of pumping water from the HAMP complex to Upper Panasa Lake, which discharges to Lower Panasa Lake and ultimately the Swan River. The DNR's current NPDES permit allows for annual transfers of water from the HAMP complex at an average pumping rate of 6,500 gpm. However, because of the costs associated with pumping such volumes, seasonal freeze-ups, and pump capacity, the HAMP complex is generally dewatered for 6 months per year at a rate of 6,200 gpm (which is the pump capacity). Therefore, such flows would represent the maximum loss of flow to the Swan River resulting from Mesaba's operations. This maximum would only occur during peak process water demand periods with both Mesaba Phase I and II in operation. Smaller quantities of water are likely to be diverted from the HAMP complex under Phase I if the Canisteo Pit yields more water than estimated and/or if above normal precipitation occurs. Excelsior's regulatory documents (the Joint Application, Environmental Supplement, NPDES Permit Application, and the Water Appropriation Permit Application contain detailed descriptions of Mesaba One and Mesaba Two water uses and the timing of their appropriation. As the Canisteo Pit has no discharge, water appropriated from it will not affect the Swan River or any other streams.

The 9 mile portion of the Swan River between the discharge of the Panasa Lakes and Holman Lake would experience loss of water from the Panasa Lakes discharge point and would not see an increase in flow until the Holman Lake discharge point.

Appropriations from the CMP will be partially offset by discharges of cooling tower blowdown from Mesaba into Holman Lake. Excelsior's NPDES permit application indicates that such discharges to Holman Lake would begin at 800 gpm and decrease to 400 gpm over 30 years. The remainder of cooling tower blowdown would be discharged to the CMP, which does not drain to the Swan River. The exact discharge to each water body will be determined as part of finalizing NPDES permit conditions. See **Table 2** below for a summary of total process water discharges.

Excelsior intends to work within guidelines published by the Minnesota Pollution Control Agency ("MPCA") to establish Total Maximum Daily Load limits to govern discharges of cooling tower blowdown to Holman Lake (*see* "TMDL Work Plan Guidance" issued by MPCA in January 2006 [http://www.pca.state.mn.us/publications/wq-iw1-01.pdf]). This intent will be discussed with the MPCA as part of finalizing NPDES permit conditions for Mesaba One and Mesaba Two. The TMDL process will play a critical role in minimizing cumulative impacts within watersheds affected by the Mesaba Energy Project.

Some withdrawals are possible for Phase I and II from the Lind Mine Pit and the Prairie River (into which the Lind drains). However, MSI will not reduce flows to that watershed and no other projects have been identified to have cumulative impacts to that river, so no further analysis of cumulative impacts on the Prairie River is necessary.

Table 2 – Estimated Process Water Discharge

	Cycles of Concentration	Peak Discharge (GPM)	Average Annual Discharge (GPM)
Phase I	5	1,300	550-900
Phase I and II	3	5,140	2,200-3,500

ii. Minnesota Steel Industries (MSI)

As shown in Table 3, the annual consumptive use of water from the MSI project is 4,063 gpm. This process water would come from surface water runoff to the mine pits and groundwater. The remaining process water would come from surface water sources that currently flow to the Swan River. The amount of process water from surface water runoff and groundwater has not been quantified, but is known to occur; therefore, the total amount of process water taken from the Swan River tributaries would be somewhat less than 4,063 gpm.

Table 3 – Water Consumption by MSI

Location	**Type of Consumption**	**Average annual consumption, gpm**
Crusher, pellet plant and concentrator	Evaporation from thickeners and induration of green balls	416
DRI Plant	Process water and cooling tower losses	1,171
Steel Mill	Cooling tower losses and direct evaporation from hot steel	1,176
Tailings Basin	Losses of water trapped with tailings (voids loss)	1,300
Stream Augmentation*	Replace flow diverted from receiving water bodies	To be determined during permitting *
Total Annual Consumptive Use		4,063*

Source: MSI Environmental Assessment Worksheet, Table 13-2. Note: For assessing cumulative water quantity impacts, stream augmentation is not considered consumptive use.

iii. Nashwauk WWTF

Sanitary wastewater flows to the Nashwauk WWTF from the MSI project could be as high as 21 gpm *(Question 18.b. – MSI EAW).* The effluent would be slightly less that the influent to the WWTF.

iv. Coleraine-Bovey-Taconite WWTF

Mesaba would connect to the wastewater treatment facility for disposal and treatment of domestic wastewater. The maximum estimated increase in 24 hr-averaged flow to the treatment facility during construction would be 31 gpm during construction and 5 gpm during the operational phase of Mesaba Phase I and II. The effluent from the WWTF would be slightly less than the influent.

Due to inflow and infiltration in the existing collection system, sewage bypasses and excess flows relative to the design limit of the treatment plant sometimes occur during times of heavy precipitation or thaw. Excelsior may seek to rehabilitate the collection system or enlarge the pumps to mitigate this situation.

v. Total: Compare to flow of Swan River.

From the above analysis, the maximum cumulative reduction in flow is approximately 10,300 gpm (9,500-9,900 gpm downstream of Holman Lake's outflow into the Swan River). For non-summer flows (without the loss of water pumped from the HAMP complex), the maximum cumulative reduction would be 4,000 gpm (3,200-3,600 gpm downstream of Holman Lake).

The historic mean flow of the Swan River is 29,000 gpm (USGS gage data for the period 1965-1990). However, significant mining has taken place within the watershed during the period of record, which could cause unnaturally high or low flows to be measured in the river during that time period and would be dependent on dewatering and stream augmentation practices during that period.

b. Quality:

Cooling tower blowdown released by the Mesaba One and Mesaba Two consists of water containing concentrations of minerals and other trace constituents concentrated through evaporation; the chemical species of biggest concern are limited to mercury, nutrients, hardness, and total dissolved solids (TDS).

All of Minnesota Steel's process water, including cooling water, will be treated with a zero liquid discharge (ZLD) system. Therefore, the only identifiable discharges associated with MSI are mine pit dewatering operations and periodic tailings basin discharges, and these discharges will not be concentrated through evaporation. As shown in Table 4, the quality of pit water is similar to that of the Swan River, with modestly higher conductivity (TDS) and hardness. All values are well below those of Mesaba's discharge, which in turn is within applicable discharge standards, so cumulative impacts on water quality from dewatering operations are negligible. Tailings basin discharges are likely to have higher TDS, but specific values were not provided in the EAW.

Table 4 – West Range Water Quality

	Swan River	Pit 1	Pit 5/F	Tailings Basin North	Mesaba discharge
Conductivity (uhmos/cm)	340	410	430	360	2,052 mg/L
Hardness (mg/L)	150	180	190	160	2,070
Phosphorous (mg/L)	<0.1	<0.1	<0.1	<0.1	0.5
Mercury (ug/L)	<0.2	<0.1	<0.1	<0.1	4.2 ng/L

Source: Average values from Table 18.2 of MSI's EAW and Table 1.8-21 from the Environmental Supplement to Mesaba's Joint Application Permit. MSI's Pits 1 and 5/F are adjacent and located approximately two miles northeast of the city of Calumet.

East Range

I. Identification and description of affected watershed: Partridge River.

The Partridge River Watershed is located in St. Louis County in Northern Minnesota. The Partridge River watershed is part of the St. Louis River and Lake Superior Watershed Basin. Figure 2 shows the Partridge River Watershed to a point approximately 5 miles downstream of the confluence with First Creek. The Mesaba Energy Project, Mesabi-Nugget, and PolyMet Projects are located within the watershed study area.

Human influences related to logging, mining, ditch construction, agricultural activity, dam construction, flow diversion / withdrawal, development of transportation systems, and community development activities have impacted streams in the area, including the Partridge River.

The contributing watershed area of the Partridge River has been primarily altered through several past mining actions. The land use / cover type was modified significantly through the construction of mining related facilities and, in turn, this alteration has modified the quantity and timing of surficial runoff to the stream.

Lake levels in Colby Lake are augmented with water from Whitewater Reservoir, which also has impacts on the natural flow regime within the Partridge River.

Impacts resulting from the PolyMet project are hydrologically upstream on the Partridge River from Mesaba. The Mesabi-Nugget project is relatively close to the Mesaba Energy Project and shares some of the same sub watersheds. The Partridge River watershed study area was selected at a point downstream of Mesaba's impacts in order to encompass the cumulative impacts within the Partridge River Watershed with respect to the Mesaba Energy Project, Mesabi-Nugget, and PolyMet.

NOTE: *The Mesaba East Range Site will have Zero Liquid Discharge (ZLD) and would not contribute to any cumulative impact on water quality in the Partridge River resulting from the discharge of wastewater from the project. There is no further discussion of water quality needed.*

II. Identify existing usage: EIS Table 2.5-4

Existing Water Appropriation permits for surface waters in the Partridge River Watershed are shown in **Table 5**.

Table 5 - Existing Water Appropriation Permits for Surface Waters Around East Range Site within the Partridge River Watershed[1]

		Permitted		Reported Pumping (Million Gallons)				
Permittee	**Resource**	**GPM**	**MG/Y**	**2000**	**2001**	**2002**	**2003**	**2004**
MP & Cliffs Erie LLC	Colby Lake	12000	6307	2945.7	69.2	ND	ND	ND
MP	Colby Lake	100500	50000	71.4	60.4	63.4	96.1	117.2

[1] Minnesota DNR. http://files.dnr.state.mn.us/waters/watermgmt_section/appropriations/idxloc.pdf

		Permitted		Reported Pumping (Million Gallons)				
Permittee	**Resource**	**GPM**	**MG/Y**	**2000**	**2001**	**2002**	**2003**	**2004**
MP	Colby Lake	100500	50000	23851.7	24061.7	24261.9	24132.9	22458.9
MP	Colby Lake	100500	50000	21734.0	24133.9	24185.4	24132.9	23541.8
MP	Colby Lake	10500	50000	51.1	4.0	3.4	0.0	21.1
MP	Colby Lake	10500	50000	4.3	41.6	28.8	0.1	0.4
MP	Colby Lake	100500	50000	17.3	0.1	ND	ND	ND
MP	Colby Lake	10500	50000	474.0	516.4	523.6	525.5	525.1
City of Hoyt Lakes	Colby Lake	1050	160	123.1	116.4	120.4	122.8	120.4
City of Hoyt Lakes	Partridge River		4	2.4	1.8	1.7	2.2	1.5
Cliffs Erie LLC		3600	1155	1055.4	ND	ND	ND	ND
Cliffs Erie LLC		3600	1155	ND	ND	ND	ND	ND
Cliffs Erie LLC		3600	1155	ND	ND	ND	ND	ND
Cliffs Erie LLC		1500	551	ND	ND	ND	ND	ND
Cliffs Erie LLC		20000	10512	ND	ND	ND	ND	ND
Cliffs Erie LLC		20000	10512	ND	ND	ND	ND	ND
Cliffs Erie LLC		20000	10512	1860.2	ND	ND	ND	ND
Cliffs Erie LLC		20000	10512	ND	ND	ND	ND	ND
City of Aurora		1020	160	73.7	74.7	81.8	106.5	93.4
Cliffs Erie LLC		5000	788	ND	ND	ND	ND	ND
Cliffs Erie LLC		12000	3049	316.9	ND	ND	ND	ND
Cliffs Erie LLC		12000	3049	ND	ND	ND	ND	ND
Cliffs Erie LLC		12000	3049	ND	ND	ND	ND	ND
Cliffs Erie LLC		3000	1050	ND	ND	ND	ND	ND
Cliffs Erie LLC		3000	1050	1807.2	ND	ND	ND	ND

III. Effects from new sources/appropriations

a. Quantity:

i. Mesaba:

Pits 3, 5N, and 5S discharge water to small streams, which flow to the Upper Partridge River, and the Stephens and Knox pits discharge water to small streams that flow to the Lower Partridge River. The Upper Partridge River is defined as the portion of the river upstream of Colby Lake and the Lower Partridge River is the stream reach downstream of the lake.

Pits 3, 5N, and 5S currently contribute an estimated mean flow to the Upper Partridge River of 500 gpm, which would potentially be eliminated if the water is used by Mesaba.

The Stephens and Knox pits contribute an estimated mean flow of 435 gpm to the Lower Partridge River, which would potentially be eliminated if the water is used by Mesaba.
The water sources that would be used for Mesaba are shown in **Table 6**.

Table 6 - Water Source Supply Capability

Water Source (Pits)	**Est. Range of Flow (gpm)**	**Currently Discharging (yes/no)**	**Assumed Sustainable Flow for Water Balance Modeling (gpm)**
2E	ND	N	112
2W	ND	N	898
2WX	ND	N	673
6	ND	N	1,795
Source: MDNR East Range Hydrology Report	Sub-Total		**3,478**
3	150–450	Y	300
5N	30–100	Y	60
5S	90–270	Y	140
9 / Donora	130–380	N	260
9S	90–270	N	180
Stephens	190–590	Y	390
Knox	20–70	Y	45
Source: Surface Water Modeling[1]	Sub-Total		**1,375**
Mesabi Nugget Discharge	1000	N	**1,000**
Source: MPCA NPDES Discharge Permit			

[1]Excelsior estimated the range of flow based only on the surface drainage area to the pit and average yearly rates of runoff. This represents a first order in approximation and the actual flow rates are likely much more dependent on groundwater components. The groundwater inflow/outflow component in this area can be highly variable as a result of fractures in the bedrock and/or highly pervious tailings dikes. Due to the complexity associated with the groundwater component, groundwater inflow/outflow has not been evaluated.

ii. PolyMet

PolyMet will not appropriate water directly from the Partridge River, but it may appropriate water from Colby Lake. Since PolyMet would not directly appropriate water from the Partridge River, there would be no direct impacts on stream flow in the river. PolyMet may have some indirect impacts on the stream flow in the Partridge River by cutting off a portion of the runoff to the river and dewatering of the mine pit which could cause a localized drop in the groundwater levels. This impact has not been quantified.

According to the MDNR, PolyMet may need to appropriate as much as 3000 gpm from Colby Lake, but this is a moving target at this time.

The PolyMet project would appropriate water from Colby Lake through an existing water appropriation permit held jointly by Cliffs-Erie and Minnesota Power.

PolyMet may be able to satisfy some or all of their make-up water need from Colby Lake, by amending and/or transferring part of the authority under this permit. A condition under this permit requires that the permit holder pump water from the Whitewater Reservoir into Colby Lake to offset their appropriation when the water level of Colby Lake is below a determined threshold. The control structure between the Whitewater Reservoir and Colby Lake was owned by Cliffs Erie, but is now owned by Minnesota Power. There is an agreement between Cliff's Erie and Minnesota Power whereby the conditions of the permit would be met. Any assignment of an appropriation permit from one party to another would require the consensus of all parties and the DNR's review and approval. The review would take into consideration effects on Colby Lake and Whitewater Reservoir water levels and outflow from Colby Lake.

PolyMet will reportedly employ a Zero Liquid Discharge system, so it would not contribute any new discharges of water to the system.

iii. Mesabi-Nugget

A water appropriation permit has been issued to Mesabi-Nugget. The permit from the MDNR allows Mesabi-Nugget to pump up to 5,000 gpm from Pit 1 and Pit 2WX would be used as a standby source with a permitted appropriation of 5,000 gpm. Pit 1 does not currently discharge to a surface water.

iv. Hoyt Lakes POTW

At this time, there are no reasonably foreseeable expansions to the Hoyt Lakes POTW. However, Mesaba would connect to the Hoyt Lake wastewater collection and treatment system. The current system discharges to Colby Lake, and additional effluent from the treatment facility would have negligible effects on the Partridge River flows.

The maximum estimated increase in flow to the treatment facility during construction would be 31 gpm during construction and 5 gpm during the operational phase of Mesaba Phase I and II. The effluent would be slightly less than the influent.

v. Total: Compare to low-flow of Partridge River.

Low, average, and high flow estimates for the Upper Partridge River are shown in Table 17-1 of the PolyMet EAW. Low flows are estimated to be in the range of 320-835gpm, average flow is estimated at 17,500gpm, and high flows are estimated at 156,000-161,000gpm. *The low flow* *estimated is the 7Q10 flow, which is a 7-day average low flow with a 10-year reoccurrence interval.* The total maximum flow that Mesaba could remove from the Upper Partridge River could be 500 gpm.

The total maximum flow that Mesaba could remove from the Lower Partridge River could be as much as 450 gpm. This is not cumulative with removals from the Upper Partridge River during low flow conditions, because the water level (and hence outflow) of Colby Lake, which separates the two rivers, is controlled according to existing permits. Currently, a number of different entities appropriate water from Colby Lake. Minnesota Power is required to augment lake levels in Colby Lake and a minimum allowable lake level has been established. When the lake level is at its minimum, flow out of the lake to Lower Partridge River is also at its minimum, which is approximately 13 cfs. This means that flows on the Lower Partridge River should never fall below 13 cfs or 5,835 gpm.

The maximum total estimated amount of water that PolyMet could appropriate from Partridge River (Colby Lake) would be determined by Minnesota Power and the MDNR. The Colby Lake water levels would still be expected to be augmented.

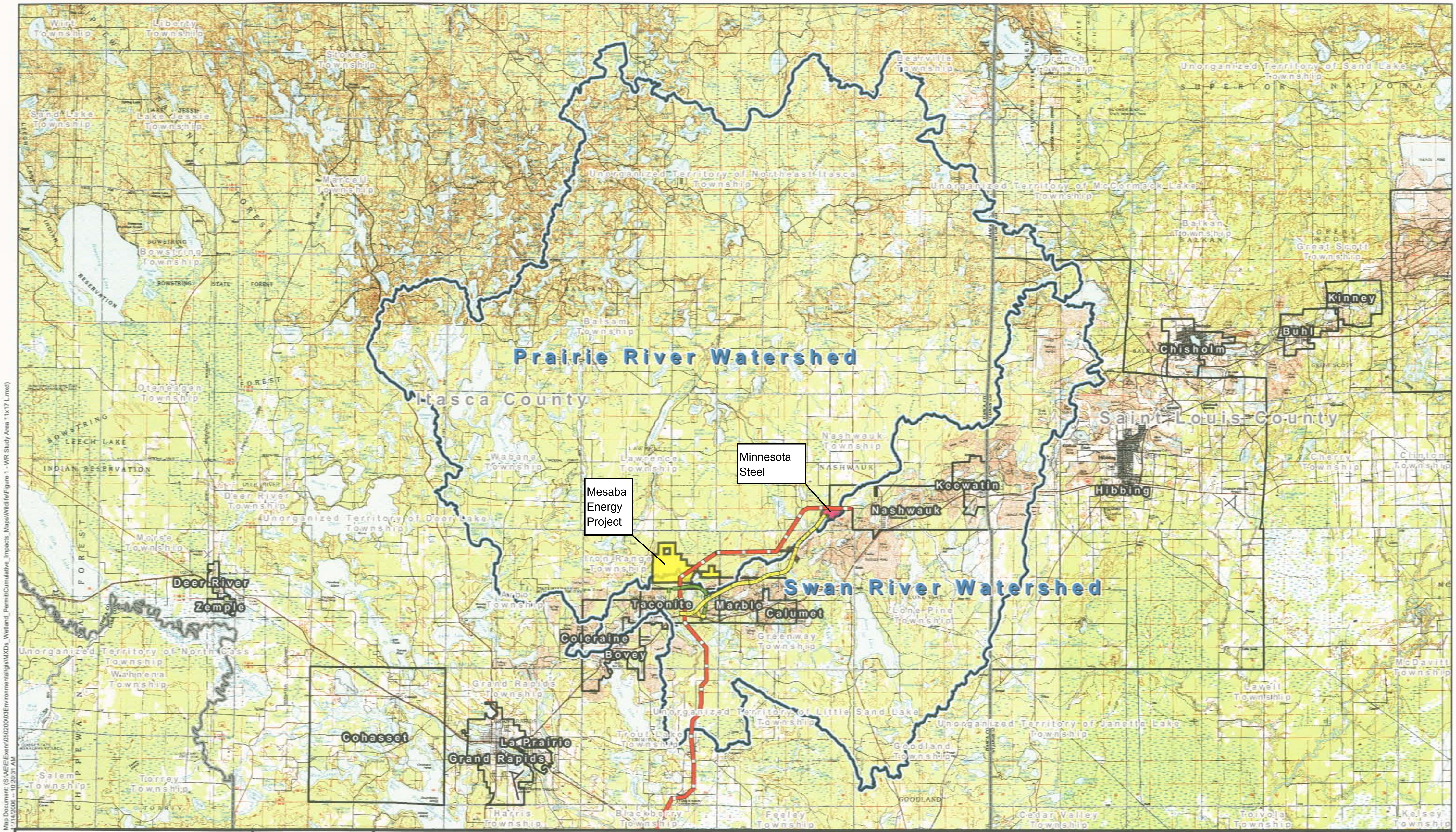
References

Minnesota Department of Natural Resources. "Water Appropriation Permit Index." 2001-2005. Available: http://files.dnr.state.mn.us/waters/watermgmt_section/appropriations/idxloc.pdf.

Attachments

Figure 1: Swan River Watershed
Figure 2: Partridge River Watershed

Table 1: Minnesota Steel Industries, Environmental Assessment Worksheet, Table 18-2
Table 2: Minnesota Steel Industries, Environmental Assessment Worksheet, Table 13-2
Table 3: PolyMet, Environmental Assessment Worksheet, Table 17-1



Excelsior Energy Inc.

Mesaba Energy Project

Energy, Innovation, and Economic Development for Minnesota

West Range

November 2006

Legend

Reasonable and Foreseeable Actions

- Swan River Watershed
- Prairie River Watershed
- Excelsior Energy West Range Site
- MN Steel DRI Plant Site
- Nashwauk Gas Pipeline
- Itasca County Road 7 Realignment
- Itasca County Rail Alignment
- Municipal Boundaries
- Civil Township Boundaries
- County Boundary

Source: USGS, USFWS, MNDNR, Mn/DOT, Excelsior Energy, MN Steel, City of Nashwauk and SEH.
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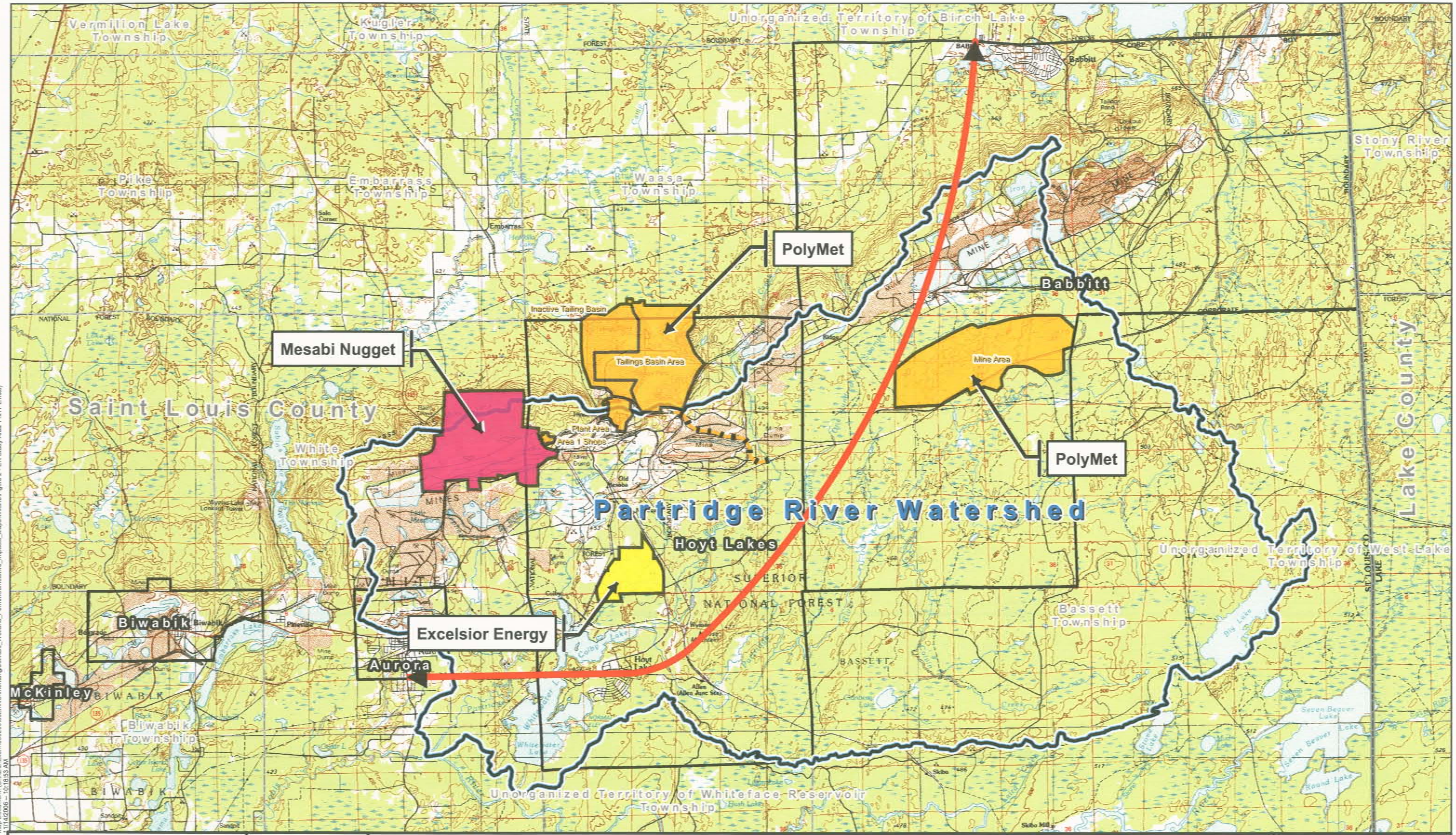
Figure 1

West Range Study Area

UTM, Zone 15, Meters NAD83

N W E S

0 5 Miles



Excelsior Energy Inc.

Mesaba Energy Project

Energy, Innovation, and Economic Development for Minnesota

East Range

November 2006

Legend

Reasonable and Foreseeable Actions

- Partridge River Watershed
- Excelsior Energy East Range Site
- Mesabi Nugget Plant Site
- PolyMet Sites
- PolyMet Rail Construction
- St. Louis County New Hoyt Lakes to Babbitt Connection
- Municipal Boundaries
- Civil Township Boundaries
- County Boundary

Source: USGS, USFWS, MNDNR, Mn/DOT, Excelsior Energy, and SEH.
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Figure 2

East Range Study Area

UTM, Zone 15, Meters
NAD83

0 — 2 Miles

Table 18-2. Baseline Water Quality Data
Collected by MIS.

				LPA	LPA	LPA	LPA	LPA	LS	LS	LS	LS	LS	OBCH	OBCH	OBCH	OBCH	OBCH	OBCH	OE	OE	OE	OE	OE
PARAMETER / ANALYTE	UNITS	MDL	METHOD	Larue Pit Access	Larue Pit Access	Larue Pit Access	Larue Pit Access	Larue Pit Access	Little Sucker	Little Sucker	Little Sucker	Little Sucker	Little Sucker	O'Brien Creek Head	O'Brien Creek Head	O'Brien Creek Head	O'Brien Creek Head	O'Brien Creek Head	O'Brien Creek Head	Oxhide Extension	Oxhide Extension	Oxhide Extension	Oxhide Extension	Oxhide Extension
SAMPLING ROUND				3	5	6	7	8	3	5	6	7	8	3	5	6	7	8	8	2	3	5	6	7
SAMPLED DATE				06/01/99	09/13/99	11/29/99	05/01/00	07/18/00	06/01/99	09/13/99	11/29/99	05/01/00	07/17/00	06/01/99	09/14/99	11/29/99	05/01/00	07/17/00	07/17/00	03/15/99	06/01/99	09/13/99	11/29/99	05/01/00
TIME (MILITARY)							930	915		1445		1005	1535		1530		1156		1447	1130				1127
EASTING (1927 State Plane Feet)				1986318	1986318	1986318	1986318	1986318	1963207	1963207	1963207	1963207	1963207	1985913	1985913	1985913	1985913		1985913	1971955	1971955	1971955	1971955	1971955
NORTHING (1927 State Plane Feet)				323566	323566	323566	323566	323566	320739	320739	320739	320739	320739	297552	297552	297552	297552		297552	304644	304644	304644	304644	304644
ELEVATION (feet, from 1997 mapping)				1413.1	1413.1	1413.1	1413.1	1413.1	1389.5	1389.5	1389.5	1389.5	1389.5	1343	1343	1343	1343		1343	1347.5	1347.5	1347.5	1347.5	1347.5
AIR TEMP	° F			47	56	24	55		48	56	26	55		51	59	24	59				51	56	24	58
WATER TEMP	° F			62	65	40		70	58	60	24		72	60	57	34			72		61	65	35	
Conductivity	uhmos/cm	1	EPA 120.1	282	299	324	351	349	261	239	327	224	223	315	308	293	319	315	280	434	440	384	390	449
Hardness, Total	mg/L	1	EPA 130.2	157	73.3	157	164	146	146	65.8	141	97	94	141	122	148	144	141	128	204	198	88.8	190	195
Color	PCU	5	EPA 110.2	5					50					30				30			10			
pH	SU	0.1	EPA 150.1	8.04	8.44	8.11	8.28	8.65	6.97	7.29	7.58	8.02	8.75	8.11	8.24	8.17	8.12	8.11	9.24	8.05	8.16	8.05	7.73	8.19
Alkalinity, Carb	mg/L	1	EPA 310.1	<1.0					<1.0					<1.0				<1.0		<1.0	<1.0			
Alkalinity, Total	mg/L	1	EPA 310.1	149	140				121	86				129	134			129		182	161	138		
Ammonia as N	mg/L	0.1	EPA 350.1	<0.10					<0.10					<0.10				<0.10		<0.10	0.12			
Kjeldahl Nitrogen, Total as N	mg/L	0.1	EPA 351.1	0.1	<0.1	0.4	0.66	0.36	2.7	0.4	1	1.01	1.18	0.4	0.3	0.7	1.2	0.4	0.76		0.2	<0.1	0.2	1.14
Nitrate+Nitrite as N	mg/L	0.1	EPA 353.2	<0.01					<0.01					<0.01				<0.01			<0.01			
Nitrate as N	mg/L	0.1	(NO3+N02)-NO2																	<0.10				
Nitrite as N	mg/L	0.01	EPA 354.1																	<0.01				
Nitrogren: N, Total	mg/L	0.2	TKN+NO2+NO2																					
Phosphorus, Total as P	mg/L	0.01	EPA 365.2	0.01	0.01	<0.1	<0.1	<0.01	0.06	0.03	<0.1	<0.1	0.01	0.02	0.03	<0.1	0.01	0.02	<0.01	<0.01	0.01	0.01	<0.1	0.01
Bromide	mg/L	0.1	EPA 320.1																					
Calcium	mg/L	1	EPA 200.7	31.7	29.3	34.2	35.2	32.4	32.5	26.3	33.6	24.8	22.7	30.3	26.8	33.7	33.1	30.3	26.4	39.6	39.3	35.5	42.1	43.4
Chloride	mg/L	0.5	EPA 325.3	1.7					1.5					5.2				5.2		7.1	5.8			
Fluoride	mg/L	0.1	EPA 340.1	0.44	0.24	0.012	<0.1	0.24	0.44	0.24	0.18	0.19	0.24	0.28	0.2	0.12	0.19	0.28	0.45		0.2	0.24	0.14	0.19
Iron	mg/L	0.03	EPA 236.1	0.06	0.05	0.04	<0.03	0.7	0.43	0.24	0.28	0.07	0.37	0.18	0.2	0.36	0.48	0.18	0.41	<0.03	0.03	6.59	0.2	0.23
Magnesium	mg/L	0.5	EPA 200.7	19.0	17	17.5	18.6	17	15.7	11.7	13.8	8.6	8.57	15.6	13.5	15.5	14.8	15.8	14	23.4	24.3	20.1	20.6	21.1
Manganese	mg/L	0.01	EPA 243.1	0.01	<0.01	0.04	<0.01	0.01	0.26	0.05	0.09	0.04	0.06	0.09	0.06	0.09	0.19	0.09	0.11	0.26	0.03	0.02	0.06	0.07
Potassium	mg/L	0.5	EPA 200.7	2.7	2.5				1.4	1.5				1.7	1.8			1.7		2.6	2.4	2.3		
Strontium	mg/L	4	EPA 200.7	73.2	68	75	78.4	72.3	79	70.1	78.7	57.4	53.8	75.7	73.1	80	79.2	75.7	66		115	98.1	113	119
Sulfide, Total	mg/L	2	EPA 376.1															<2						
Sulfite	mg/L	0.025	EPA 425.1	<2					<2					<2				<0.025			<2			
Sulfate	mg/L	1	EPA 375.4	8.92	<1	8.69	8.3	6.8	23.4	<1	32.8	16.6	11.7	8.92	4.19	10.7	8.3	8.92	6.3	45.6	36	17.1	43.2	26.7
Sodium	mg/L	0.5	EPA 200.7	4.1	3.8				4.6	3.2				5.9	5			5.9		8.1	7.7	6.6		
Aluminum	μg/L	10	EPA 202.2	0.05	34.6	18.5	22	42.8	0.02	26.4	<10	13.9	57.4	0.04	100	48.8	319	0.04	152		0.01	27.3	12.4	<10
Antimony	ug/L	3	EPA 204.2	<3.0					<3.0					<3.0				<3.0			<3.0			
Arsenic	μg/L	2	EPA 206.2	<2.0	<2	<2	<2	<2	<2.0	<2	<2	<2	<2	<2.0	<2	<2	<2	<2	<2		<2.0	<2	<2	<2
Barium	μg/L	10	EPA 200.7	0.01					0.03					0.02				0.02			0.02			
Berylllium	μg/L	0.2	EPA 210.2	<0.2					<0.2					<0.2				<0.2			<0.2			
Boron	μg/L	35	EPA 200.7	<35					44					41				41			52			
Cadmium	μg/L	0.2	EPA 213.2	<0.2					<0.2					<0.2				<0.2			<0.2			
Chromium	μg/L	4	EPA 218.2																					
Cobalt	μg/L	1	EPA 219.2	<1.0					<1.0					<1.0				<1.0			<1.0			
Copper	μg/L	1	EPA 220.2	<1.0					<1.0					<1.0				<1.0			<1.0			
Lead	μg/L	1	EPA 239.2	<1.0					<1.0					<1.0				<1.0			<1.0			
Lithium	μg/L	1	EPA 200.7	5.2					3.8					3.8				3.8			9.3			
Mercury--NTS	μg/L	0.2	EPA 245.1	<0.1					<0.1					<0.1				<0.1			<0.1			
Molybdenum	μg/L	5	EPA 246.2	<5.0	<5	<5	<5	<5	<5.0	<5	<5	<5	<5	<5.0	<5	<5	<5	<5	<5	<5.0	<5.0	<5	<5	<5
Nickel	μg/L	2	EPA 249.2	<2.0					<2.0					<2.0				<2.0			<2.0			
Selenium	μg/L	3	EPA 270.2	<3.0					<3.0					<3.0				<3.0			<3.0			
Silica	μg/L	1	EPA 200.7	5480	6220				1620	8410				1300	5170			1300		2380	5430	5690		
Silver	μg/L	1	EPA 200.7																					
Thallium	μg/L	4	EPA 279.2	<4.0	<4	<4	<2	<2	<4.0	<4	<4	<2	<2	<4.0	<4	<4	<2	<2	<2		<4.0	<4	<4	<2
Tin	μg/L	10	EPA 282.2	<10.0					<10.0					<10.0				<10.0			<10.0			
Titanium	μg/L	10	EPA 283.2	<10.0					<10					<10.0							<10.0			
Vanadium	μg/L	4	EPA 200.7	<4.0					<4.0					<4.0				<10			<4.0			
Zinc	μg/L	10	EPA 200.7	10					<10					<10.0				<0.06			12			
BOD	mg/L	1	Std Meth 5210	<2					<2					<2				<2			<2			
Chemical Oxygen Demand	mg/L	1	HACH 8000	5.6	<1	3.7	15	3.7	28.9	22.2	38.4	35.3	18.7	11.3	11.3	22.2	18.7	11.3	18.7		3.7	<1	7.5	18.7
Organic Carbon, Total	mg/L	1	EPA 415.1	3.0	2.9	2.2	5.2	2.3	11.4	14.6	11.7	11.2	8.2	8.5	7.2	7.2	8.2	8.5	6.6		3	3.4	2.5	4.5
Oil and Grease	mg/L	1	EPA 413.1	<0.5					<0.5					<0.5				<0.5		<0.5	<0.5			
Solids, Total Suspended	mg/L	1.0	EPA 160.2	4.0					4.0					3.0				3.0		<1.0	5.0			
Solids, Total Dissolved	mg/L	1	EPA 160.1	120	144	128	143	155	128	180	146	98	116.0	142.0	166	128	144	142	154	219	171.0	122	184	209
Corrosivity Index (Langlier)			Std Meth																	-0.13				
DRO-WATER	mg/L	0.1	WI Modified DRO	<0.10	<0.06	<01	<0.1	<0.1	<0.10	<0.06	<0.1	<0.1	<0.1	<0.10	<0.06	<0.1	<0.1	<0.1	<0.1			<0.06	<0.1	<0.1
GRO-WATER	mg/L	0.1	WI Modified GRO	<0.06	<0.10	<0.1	<0.06	<0.06	<0.06	<0.10	<0.1	<0.06	<0.06	<0.06	<0.10	<0.1	<0.06	<0.06	<0.06		<0.06	<0.10	<0.1	<0.06
Surfactants	mg/L	0.025	EPA 425.1	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	1	<0.025	<0.025	<0.025	<0.025
Fecal Coliform	colonies	1	Std Meth 9222																					
Residual Chlorine	mg/L		Std Meth 4500-Cl																					
Free Chlorine			HACH																	<0.2				
Chlorine (field)			HACH		0.03	0.07	0.07	0.01		0.04	0.04	0.09	0.14		0.04	0.02	0.08		0.07			0.03	0.09	0.1
Chlorine (field, second try)			HACH																					

Table 18-2. Baseline Water Quality Data
Collected by MIS.

			OE	P1	P1	P1	P1	P1	P1	P1	P1-5C	P5	P5	P5	P5-D	P5	P5-D	P5	P5-D	P5	P5-D	P5-D	SBL	SBL	SBL	SBL
PARAMETER / ANALYTE	UNITS	MDL	Oxhide Extension	Pit 1	Pit 1	Pit 1	Pit 1	Pit 1	Pit 1	Pit 1	Pit 1/5 Channel	Pit 5	Pit 5	Pit 5	Pit F	Pit 5	Pit F	Pit 5	Pit F	Pit 5	Pit F	Pit F	Snowball Lake	Snowball Lake	Snowball Lake	Snowball Lake
SAMPLING ROUND			8	1	3	5	6	7	8	8	2	1	3	5	5	6	6	7	7	8	8	8	3	5	6	7
SAMPLED DATE			07/17/00	03/05/97	06/02/99	09/14/99	11/30/99	05/01/00	07/17/00	07/17/00	03/15/99	03/05/97	06/02/99	09/14/99	09/14/99	11/30/99	11/30/99	05/01/00	05/01/00	07/17/00	07/17/00	07/17/00	06/01/99	09/13/99	11/29/99	05/01/00
TIME (MILITARY)			1400		1030	1430		1304		1305	1000		1000	1400	1400			1318	1322	1340		1335		1430		1116
EASTING (1927 State Plane Feet)			1971955		1971544	1971544	1971544	1971544		1971544			1970468	1970468	1970468	1970468	1970468	1970468	1970468	1970468		1970468	1966716	1966716	1966716	1966716
NORTHING (1927 State Plane Feet)			304644		313782	313782	313782	313782		313782			312869	312869	312869	312869	312869	312869	312869	312869		312869	303787	303787	303787	303787
ELEVATION (feet, from 1997 mapping)			1347.5	1360.1	1360.1	1360.1	1360.1	1360.1		1360.1		1354.5	1354.5	1354.5	1354.5	1354.5	1354.5	1354.5	1354.5	1354.5		1354.5	1357.1	1357.1	1357.1	1357.1
AIR TEMP	° F				58	58	42	59					58	61	59			58	58				51	56	24	55
WATER TEMP	° F		74		61	62	41			70			59	59	61	41	41			69		69	60	62	39	
Conductivity	uhmos/cm	1	419		408	371	381	431	440	428	415		424	381	385	437	418	448	450	453	424	415	285	240	260	269
Hardness, Total	mg/L	1	172		188	161	187	189	198	174	188		201	178	158	204	212	193	196	182	201	184	122	59.3	113	111
Color	PCU	5		<5	5				10			<5	5								5		20			
pH	SU	0.1	8.32	7.82	8.13	8.29	8.2	7.99	8.16	8.53	7.9	7.92	8.13	8.32	8.28	8.23	8.28	8.15	7.92	7.41	8.13	8.4	8.29	8.12	8.19	8.14
Alkalinity, Carb	mg/L	1			<1.0				<1.0		<1.0		<1.0								<1.0		<1.0			
Alkalinity, Total	mg/L	1			146	134			161		164		160	141	142						160		99.0	86		
Ammonia as N	mg/L	0.1		<0.10	0.11				0.12		<0.10	<0.10	0.11								0.11		<0.10			
Kjeldahl Nitrogen, Total as N	mg/L	0.1	0.34	<0.2	0.2	0.2	0.2	0.64	0.2	0.31		<0.2	0.1	<0.1	<0.1	0.2	0.2	0.7	0.47	0.32	0.1	0.27	0.4	0.3	0.5	1.38
Nitrate+Nitrite as N	mg/L	0.1			<0.01				<0.01				0.02								0.02		<0.01			
Nitrate as N	mg/L	0.1		<0.10							<0.10	<0.10														
Nitrite as N	mg/L	0.01									<0.01															
Nitrogren: N, Total	mg/L	0.2		<0.2								<0.2														
Phosphorus, Total as P	mg/L	0.01	<0.01	<0.01	0.01	<0.01	<0.1	<0.1	0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.1	<0.1	0.04	<0.1	<0.01	0.01	<0.01	0.02	0.01	<0.1	<0.1
Bromide	mg/L	0.1		<0.1								<0.1														
Calcium	mg/L	1	33.8		40.6	36.2	43.8	43.9	39.3	41	40.3		42.1	38.5	34	43.9	45.2	43.2	43.9	40.4	42.1	14.9	29.6	23.7	29	29
Chloride	mg/L	0.5			7.3				5.8		8.0		6.2								6.2		8.0			
Fluoride	mg/L	0.1	0.27	0.25	0.3	0.36	0.14	0.14	0.2	0.18		0.25	0.3	0.88	0.24	0.12	0.18	0.14	0.14	0.24	0.3	0.18	0.2	0.2	0.12	0.19
Iron	mg/L	0.03	0.17	0.07	<0.03	0.05	0.05	0.07	0.03	0.28	<0.03	0.26	<0.03	0.07	0.03	<0.03	<0.03	<0.03	<0.03	0.12	<0.03	0.18	0.07	0.11	0.07	0.08
Magnesium	mg/L	0.5	20.8	19.6	19.9	17.2	18.9	19.3	24.3	17.4	19.4	25.2	23.4	19.8	17.8	23	24.2	20.8	21	20	23.4	20	11.6	9.4	9.9	9.3
Manganese	mg/L	0.01	0.03	0.02	0.02	0.05	0.01	0.06	0.03	0.07	0.03	0.03	0.02	0.01	<0.01	0.02	0.01	0.02	0.02	0.02	0.02	0.04	0.09	0.06	0.06	0.08
Potassium	mg/L	0.5			2.3	2.2			2.4		2.5		2.5	2.4	2.1						2.5		1.4	1.2		
Strontium	mg/L	4	97.3		95.7	84.3	101	102	115	90.2			111	92.3	91.8	115	119	112	111	97.2	111	97.6	81.5	68.7	78.5	78.1
Sulfide, Total	mg/L	2		<0.5					<2			<0.5									<2					
Sulfite	mg/L	0.025		<2	<2				<0.025			<2	<2								<0.025		<2			
Sulfate	mg/L	1	33.6	36	31.5	39.1	36.9	38.6	36.0	31.5	46.0	42	34.2	41.9	40.6	38.8	39.2	37.8	32	32.7	34.2	33.3	20.0	<1	16.8	17.4
Sodium	mg/L	0.5			6.4	6			7.7		6.8		7.0	6.4	5.8						7.0		7.0	5.6		
Aluminum	µg/L	10	30.2	0.01	0.03	12.4	<10	26.7	0.01	18.9		<0.01	0.01	14.4	16.6	<10	<10	10.8	12.3	14.4	0.01	38	0.02	17.1	<10	19
Antimony	ug/L	3		<4	<3.0				<3.0			<4	<3.0								<3.0		<3.0			
Arsenic	µg/L	2	<2	<1.0	<2.0	<2	<2	<2	<2	<2		<1.0	<2.0	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2.0	<2	<2	<2
Barium	µg/L	10		0.01	0.01				0.02			0.02	0.01								0.01		0.03			
Berylllium	µg/L	0.2		<0.2	<0.2				<0.2			<0.2	<0.2								<.02		<0.2			
Boron	µg/L	35		45.6	<35				52			63	38								38		<35			
Cadmium	µg/L	0.2		<0.2	<0.2				<0.2			<0.2	<0.2								<0.2		<0.2			
Chromium	µg/L	4		<4.0								<4.0														
Cobalt	µg/L	1		<1.0	<1.0				<1.0			<1.0	<1.0								<1.0		<1.0			
Copper	µg/L	1		<1.0	<1.0				<1.0			<1.0	<1.0								<1.0		<1.0			
Lead	µg/L	1		<1.0	<1.0				<1.0			<1.0	<1.0								<1.0		<1.0			
Lithium	µg/L	1			9.8				9.3				10								10		4			
Mercury--NTS	µg/L	0.2		<0.2	<0.1				<0.1			<0.2	<0.1								<0.1		<0.1			
Molybdenum	µg/L	5	<5	<5.0	<5.0	<5	<5	<5	<5	<5	<5.0	<5.0	<5.0	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5.0	<5	<5	<5
Nickel	µg/L	2		<1.0	<2.0				<2.0			<1.0	<2.0								<2.0		<2.0			
Selenium	µg/L	3		<1.0	<3.0				<3.0			<1.0	<3.0								<3.0		<3.0			
Silica	µg/L	1			8990	7620			5430		2110		7870	6500	7080						7870		1220	2480		
Silver	µg/L	1		<1.0								<1.0														
Thallium	µg/L	4	<2	<4	<4.0	<4	<4	<2	<2	<2		<1.0	<4.0	<4	<4	<4	<4	<2	<2	<2	<2	<2	<4.0	<4	<4	<2
Tin	µg/L	10		<4.0	<10.0				<10.0			<4.0	<10.0										<10.0			
Titanium	µg/L	10		<5.0	<10.0							<5.0	<10.0										<10.0			
Vanadium	µg/L	4			<4.0				12				<4.0								<10.0		<4.0			
Zinc	µg/L	10		<10	12				<0.06			<10	12								<0.06		12			
BOD	mg/L	1		<1.0	<2				<2			<1.0	<2										<2			
Chemical Oxygen Demand	mg/L	1	53	<2.0	3.7	3.7	<1	7.5	3.7	44.4		<2.0	3.7	<1	3.7	<1	<1	<1	7.5	76.2	3.7	28.9	15.0	15	18.7	28.9
Organic Carbon, Total	mg/L	1	2.2	1.8	1.9	1.5	1.9	3.3	3.0	1.2		1.4	1.7	1.3	1.3	1.7	1.6	3	2.6	<1	1.7	<1	6.6	6.8	6.7	8.3
Oil and Grease	mg/L	1		<1.0	<0.5				<0.5		2.1	<1.0	<0.5								<0.5		<0.5			
Solids, Total Suspended	mg/L	1.0		<1.0	1.0				5.0		20.0	1.2	3.0								3.0		3.0			
Solids, Total Dissolved	mg/L	1	190		181.0	178	178	196	171	213	219		185.0	232	210	1?	182	200	213	203	185	133	127	102	120	126
Corrosivity Index (Langlier)											-0.32															
DRO-WATER	mg/L	0.1	<0.1		<0.10	<0.06	<0.1	<0.1	<0.1	<0.1			<0.10	<0.06	<0.06	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.10	<0.06	<0.1	<0.1
GRO-WATER	mg/L	0.1	<0.06		<0.06	<0.10	<0.06	<0.06	<0.06	<0.06			<0.06	<0.10	<0.10	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.10	<0.1	<0.06
Surfactants	mg/L	0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	2	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
Fecal Coliform	colonies	1		<1								<1														
Residual Chlorine	mg/L			<0.01								<0.01														
Free Chlorine																										
Chlorine (field)			0		0.06	0.07	0.05	0.08		0.05			0.03	0.03	0.03	0.06	0.06	0.08	0.07	0.06		0.06		0.12	0.06	0.11
Chlorine (field, second try)			0											0.13	0.13									0.2		

Table 18-2. Baseline Water Quality Data
Collected by MIS.

			SBL	SBL	SL1	SL1	SL1	SL1	SL2	SL2	SL3	SL3	SL3	SL6	SL6	SL6	TBN	TBN	TBN	TBN	TBN	TBN	UOD	UOD	UOD
PARAMETER / ANALYTE	UNITS	MDL	Snowball Lake	Snowball Lake	Swan 1	Swan 1	Swan 1	Swan 1	Swan 3	Swan 3	Swan 3B	Swan 3	Swan 6	Swan 6	Swan 6B	Swan 6	TBN (Tailings Basin North)	TBN (Tailings Basin North)	TBN (Tailings Basin North)	TBN (Tailings Basin North)	TBN (Tailings Basin North)	TBN (Tailings Basin North)	Upper Oxhide Diversion	Upper Oxhide Diversion	Upper Oxhide Diversion
SAMPLING ROUND			8	8	4	7	8	8	4	8	6	7	8	4	6	7	2	3	5	6	7	8	3	5	6
SAMPLED DATE			07/17/00	07/17/00	08/25/99	05/02/00	07/17/00	07/18/00	08/25/99	07/18/00	11/30/99	05/02/00	07/18/00	08/25/99	11/30/99	05/02/00	03/15/99	06/01/99	09/14/99	11/29/99	05/01/00	07/17/00	06/02/99	09/14/99	11/30/99
TIME (MILITARY)				1355		1000		1015		1000		1030	1025			1100	1100		1600		1422	1510	1100	1500	
EASTING (1927 State Plane Feet)				1966716	1979911	1979911		1979911	1978326	1978326	1978326	1978326	1977758	1977758	1977758	1977758	1990309	1990309	1990309	1990309	1990309	1990309	1977634	1977634	1977634
NORTHING (1927 State Plane Feet)				303787	293970	293970		293970	301561	301561	301561	301561	288741	288741	288741	288741	319809	319809	319809	319809	319809	319809	319515	319515	319515
ELEVATION (feet, from 1997 mapping)				1357.1	1335.5	1335.5		1335.5	1335.5	1335.5	1335.5	1335.5	1335.5	1335.5	1335.5	1335.5	1372.7	1372.7	1372.7	1372.7	1372.7	1372.7	1503	1503	1503
AIR TEMP	° F				82				78					82					59	26	58		58	62	35
WATER TEMP	° F			68	76			68	76	67	34		67	76	33			58	62	36		72	68	59	33
Conductivity	uhmos/cm	1	408	263	308	362	115	370	311	372	326	366	371	307	317	364	349	355	320	353	385	382	115	109	126
Hardness, Total	mg/L	1	183	110	135	159	48	146	140	154	167	159	152	135	150	160	162	165	143	170	166	174	48	42	54
Color	PCU	5	5		<20		40		<30					<20				20					40		
pH	SU	0.1	8.13	8.8	8.7	8.39	7.35	8.72	8.79	8.65	8.5	8.37	8.73	8.81	8.63	8.36	7.68	7.88	8.25	8.01	7.78	7.29	7.35	7.62	7.67
Alkalinity, Carb	mg/L	1	<1.0		7.5		<1.0		7.5					5			<1.0	<1.0					<1.0		
Alkalinity, Total	mg/L	1	146		125		40.0		123					135			148	148	134				40	42	
Ammonia as N	mg/L	0.1	0.11		<0.1		<0.10		<0.1					<0.1			<0.10	<0.10					<0.10		
Kjeldahl Nitrogen, Total as N	mg/L	0.1	0.2	0.64	0.7	0.98	1	0.55	0.6	0.47	1.3	0.96	0.58	0.6	0.5	0.89		0.3	0.5	0.8	1.39	0.49	1	0.7	0.6
Nitrate+Nitrite as N	mg/L	0.1	<0.01		<0.1		<0.01		<0.1					<0.1				<0.01					<0.01		
Nitrate as N	mg/L	0.1															<0.10								
Nitrite as N	mg/L	0.01															<0.01								
Nitrogren: N, Total	mg/L	0.2																							
Phosphorus, Total as P	mg/L	0.01	0.01	<0.01	<0.01	<0.1	0.03	<0.01	0.02	<0.01	0.1	<0.1	<0.01	0.02	<0.1	<0.1	<0.01	0.02	0.01	<0.1	0.02	<0.01	0.03	<0.01	<0.1
Bromide	mg/L	0.1																							
Calcium	mg/L	1	40.6	26	27.7	32.4	10.4	30	28	30.7	34.5	32.6	30	26.6	30.8	32.3	34.5	36.9	32.6	40.2	39.8	36.4	10.4	9.9	13.1
Chloride	mg/L	0.5	7.3		7.2		5.0		7.4					7.2			7.4	6.6					5		
Fluoride	mg/L	0.1	0.3	0.27	0.28	0.19	0.3	0.32	0.28	0.32	0.22	0.21	0.32	0.24	0.24	0.17		0.24	0.36	0.14	0.19	0.32	0.3	0.36	0.1
Iron	mg/L	0.03	<0.03	0.31	0.03	<0.03	0.9	0.29	0.04	0.25	1.13	<0.03	0.32	0.04	0.09	<0.03	0.04	0.12	0.06	0.34	0.11	0.09	0.9	1.62	2.64
Magnesium	mg/L	0.5	19.9	9.43	18.1	19	5.4	17.5	18.3	17.8	19.6	19	17.8	17.2	17.7	19.2	16.4	17.6	15	16.8	16.3	15.5	5.4	4.1	5.2
Manganese	mg/L	0.01	0.02	0.14	<0.01	0.03	0.29	0.02	<0.01	0.03	0.88	0.04	0.02	0.04	0.09	0.04	0.26	0.1	0.05	0.46	0.31	0.06	0.29	0.17	0.28
Potassium	mg/L	0.5	2.3		2.4		1.2		2.4					2.3			2.3	2.2	2				1.2	1.2	
Strontium	mg/L	4	95.7	69.6	78.3	83.8	39.8	74.5	77.8	78.1	87.2	83.8	78.5	77.5	79	83.8		89.2	77.8	94.1	92.4	84.7	39.8	36.1	41.2
Sulfide, Total	mg/L	2	<2				<2																		
Sulfite	mg/L	0.025	<0.025		<2		<0.025		<2					<2				<2					<2		
Sulfate	mg/L	1	31.5	14	24.3	21.4	<1.0	18.6	23.2	18.9	23	22.4	18	21.1	22.6	22.8	<1.0	13.7	<1	16.8	16.8	11	<1.0	2	9.76
Sodium	mg/L	0.5	6.4		7.3		3.6		7.3					7.2			7.1	7.1	6				3.6	3	
Aluminum	µg/L	10	0.03	94.4	10.1	<10	0.07	<10	13.1	<10	229	<10	18.3	12.2	<10	<10		0.03	21.4	55.1	12.9	12	0.07	52.4	99.2
Antimony	ug/L	3	<3.0		<3		<3.0		<3					<3				<3.0					<3.0		
Arsenic	µg/L	2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2		2	<2	<2	<2	<2	2.5	<2	<2
Barium	µg/L	10	0.01		19.8		0.01		20.1					19.7				0.03					0.01		
Beryllium	µg/L	0.2	<0.2		<0.2		<0.2		<0.2					<0.2				<0.2					<0.2		
Boron	µg/L	35	<35		<35		<35		<35					<35				39					<35		
Cadmium	µg/L	0.2	<0.2		<0.2		<0.2		<0.2					<0.2				<0.2					<0.2		
Chromium	µg/L	4																							
Cobalt	µg/L	1	<1.0		<1		<1.0		<1					<1				<1.0					<1.0		
Copper	µg/L	1	<1.0		1.1		<1.0		<1					1.5				<1.0					<1.0		
Lead	µg/L	1	<1.0		<1		<1.0		<1					<1				<1.0					<1.0		
Lithium	µg/L	1	9.8		5.3		2.1		5.3					5.1				4.9					2.1		
Mercury--NTS	µg/L	0.2	<0.1		<0.2		<0.1		<0.2					<0.2				<0.1					<0.1		
Molybdenum	µg/L	5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5.0	<5.0	<5	<5	<5	<5	<5.0	<5	<5
Nickel	µg/L	2	<2.0		<2		<2.0		<2					<2				<2.0					<2.0		
Selenium	µg/L	3	<3.0		<3		<3.0		<3					<3				<3.0					<3.0		
Silica	µg/L	1	8990		3.25		2540		3.2					3.45			2080	6070	7050				2540	6450	
Silver	µg/L	1																							
Thallium	µg/L	4	<2	<2	<4	<2	<2	<2	<4	<2	<4	<2	<2	<4	<4	<2		<4.0	<4	<4	<2	<2	<4.0	<4	<4
Tin	µg/L	10	<10.0		<10		<10.0		<10					<10				<10.0					<10.0		
Titanium	µg/L	10			<10				<10					<10				<10.0					<10.0		
Vanadium	µg/L	4	12		<4.0		12		<4.0					<4				<4.0					<4.0		
Zinc	µg/L	10	<0.06		10		<0.06		<10					<10				12					12		
BOD	mg/L	1	<2		2.4		<2		2.4					2.2				<2					<2		
Chemical Oxygen Demand	mg/L	1	3.7	7.5	25.6	25.6	3.7	68.8	32.1	7.5	25.6	22.2	18.7	28.9	15	22.2		11.3	11.3	22.2	30.5	22.2	3.7	18.7	25.6
Organic Carbon, Total	mg/L	1	1.9	5.8	7.9	8.6	12.7	5.2	8.2	5.2	8.8	8.5	5.2	7.5	7.9	8.5		14.5	6.7	7.9	7.2	4.6	12.7	10.2	11.8
Oil and Grease	mg/L	1	<0.5		6.2		<0.5		7.9					4.3			<0.5	<0.5					<0.5		
Solids, Total Suspended	mg/L	1.0	1.0		5.0		4.0		4.0					6.0			1.0	2.0					4.0		
Solids, Total Dissolved	mg/L	1	181	126	173	175	56.0	164	178	190.0	144	180	185	184	140	187	181	146.0	204	152	170	200	56.0	70	62
Corrosivity Index (Langlier)																	-0.67								
DRO-WATER	mg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		<0.10	<0.06	<0.1	<0.1	<0.1	<0.10	<0.06	<0.1
GRO-WATER	mg/L	0.1	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06		<0.06	<0.10	<0.1	<0.06	<0.06	<0.06	<0.10	<0.06
Surfactants	mg/L	0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	2	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
Fecal Coliform	colonies	1																							
Residual Chlorine	mg/L																								
Free Chlorine																	<0.2								
Chlorine (field)				0.12	0.13	0.08		0.11	0.04	0.01		0.06		0.06	0.08	0.09				0.06	0.08	0.11	0.07	0.21	0.05
Chlorine (field, second try)																									

Table 13-2. Water Consumption

Location	Type of consumption	Average annual consumption[1], gpm
Crusher, pellet plant and concentrator	Evaporation from thickeners and induration of green balls	416
DRI plant	Process water and cooling tower losses	1,171
Steel mill	Cooling tower losses and direct evaporation from hot steel	1,176
Tailings basin	Losses of water trapped with tailings (voids loss)	1,300
Stream Augmentation	Replace flow diverted from receiving water bodies[2]	To be determined during permitting.
Total consumptive use		4,063+

[1] Average annual figures account for annual shutdowns and downtime. They are slightly lower than the corresponding averages during operation.

[2]Not including possible augmentation of Little Sucker Lake, McCarthy Lake, or Snowball Lake.

Table 17-1 (of PolyMet EAW) – Calculated Low, High, and Average Flow Statistics for Ungauged Portions of the Partridge River

Location	Drainage Area (mi^2)	Low Flow – 7Q10 (cfs)		High Flow – Q2 (cfs)		Average Flow
		Brooks and White	Siegel and Ericson	Siegel and Ericson	This study	Siegel and Ericson
PU-1 without Pit B Area	10.8	0.23	0.05	90	57	6
PU-1 with Pit B Area	14.4	0.33	0.08	114	78	9
PU-2 without Pit B Area	20	0.49	0.13	149	111	13
PU-2 with Pit B Area	23.6	0.61	0.17	171	132	15
PU-3 without Pit B Area	54.4	1.71	0.65	340	325	37
PU-3 with Pit B Area	58	1.86	0.72	358	348	39

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APPENDIX D4
Wetlands

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Cumulative Wetland Effect Assessment

Prepared for Excelsior Energy

Mesaba Energy Project

SEH No. EXENR0502.03

November 13, 2006

(Revised – June 5, 2007)

Prepared for Excelsior Energy
Cumulative Wetland Effect Assessment
Mesaba Energy Project

SEH No. EXENR0502.03

Prepared for:
Excelsior Energy

November 13, 2006

(Revised – June 5, 2007)

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Table of Contents

Table of Contents (Continued)

List of Tables

List of Figures

Cumulative Wetland Effect Assessment

Prepared for Excelsior Energy

Mesaba Energy Project

Introduction

This assessment of cumulative impacts to wetlands has been prepared on behalf of Excelsior Energy for the proposed Mesaba Energy Project and to assist the federal and state agencies in the preparation of the environmental impact statement (EIS).

The Department of Energy (DOE) National Energy Technology Laboratory (NETL) is required by the National Environmental Policy Act (NEPA) of 1969, as amended (42 U.S.C. 4321, *et seq*.), the Council on Environmental Quality NEPA regulations (40 Code of Federal Regulations [C.F.R.] Parts 1500-1508), and the DOE NEPA regulations (10 C.F.R. Part 1021) to prepare an EIS as part of its participation in the Mesaba Energy Project.

Similarly, under the Power Plant Siting Act (PPSA) (Minnesota Statutes §§ 116C.51-.697) a site permit from the Public Utilities Commission (PUC) is required to build a large electric power generating plant (LEPGP), including preparation of a State EIS. The EIS requirements under NEPA and the PPSA are substantially similar, and DOE will prepare, in cooperation with the Minnesota Department of Commerce and the Minnesota Public Utilities Commission, a joint EIS that will fulfill the requirements of both state and federal law. The information contained in this report will be used in the preparation of that EIS.

The Minnesota Wetland Conservation Act and Section 404 of the Clean Water Act provide programs for evaluating the project-specific wetland impacts. The NEPA provides the context and carries the mandate to analyze the cumulative effects of federal actions (in this case, funding provided by the DOE). The Council on Environmental Quality (CEQ) regulations for implementing the NEPA defines cumulative effects as:

> The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such other actions (40 CFR § 1508.7).

The consideration of past, present and reasonable foreseeable future actions provide a context for assessing the cumulative impacts on the wetland resources.

Study Area

The PPSA and Applicable Rules requires definition of at least two potential sites for the proposed project, identification of which a preferred site, and justification for its preference. In compliance with these requirements, Excelsior Energy has identified two potential project sites, the West Range site and the East Range site.

The West Range site includes approximately 1,260 acres of undeveloped land within the city limits of Taconite, Minnesota in Iron Range Township as shown on **Figure 1**. The East Range site includes approximately 810 acres of undeveloped property located within the city limits of Hoyt Lakes, Minnesota as shown on **Figure 2**. The West Range site has been identified as the preferred location on which to construct the Mesaba Energy Project, however, final determination of the project site will be made by the Minnesota Department of Commerce and the Minnesota Public Utilities Commission under the PPSA requirements. The EIS includes a description of additional supporting project elements, including roadways, railroad, natural gas and electric transmission, required for operation of the proposed project at both alternative sites. This assessment includes evaluation of the potential wetland impacts from the preferred alternative project elements for each alternate site.

Because many of the primary functions performed by wetlands are related to the surrounding watershed, the study area for the cumulative effects assessment was defined according to the limits of the affected subwatersheds for each alternative site. The paragraphs below describe the study area for both the West Range and East Range sites. The characteristics of the study areas are described in the following sections.

West Range Site

The West Range site is located within subwatersheds on the boundary between the Swan River and Prairie River watersheds. The study area associated with the West Range site (See **Figure 3**) is defined as follows.

1) That part of the Swan River watershed upstream of the point where Holman Lake discharges to the Swan River. The Holman Lake discharge point represents the point on the Swan River affected by discharge and drainage from the West Range site.

2) That part of the Prairie River watershed upstream of Prairie Lake.

Swan River Watershed

The portion of the Swan River watershed considered within the study area covers approximately 114,266 acres extending from just northeast of the City of Grand Rapids to just northwest of the City of Hibbing (**Figure 3**) and then south and east. Seven small communities (Coleraine, Bovey, Taconite, Marble, Calumet, Nashwauk and Keewatin) are located along the Mesabi Iron Range that lies just south of the divide between the Swan River watershed and the adjacent Prairie River watershed to the north. These communities, along with the associated iron and ore mining that support them, represent the primary development in the study area.

Outside of the small urban areas and scattered farmsteads and rural residences, land uses in the watershed primarily consists of ore mine pits and spoil areas. The remainder of this portion of the study area is a mixture of deciduous and mixed forest and wetland. The MNDNR Census of the Land (1996) identifies the primary land cover in the watershed as gravel pits and open mines, deciduous and mixed wood forest and open water.

Prairie River Watershed

The portion of the Prairie River watershed considered in the study area covers approximately 285,890 acres along the same portion of the Mesabi Iron Range (**Figure 3**) but extending north and west. Because the existing communities lie primarily along the southern edge of the iron formation, there are no established communities within this area of the Prairie River watershed. Outside of widely scattered farmsteads and rural residences, land use in the watershed is primarily mixed wood and deciduous forest and wetland. The MNDNR Census of the Land (1996) identifies the primary land cover in the watershed as deciduous and mixed wood forest, regenerating forest, wetlands, and water.

East Range Site

The East Range site is located in a subwatershed of the Partridge River in St. Louis County, Minnesota. The study area of the East Range site (See **Figure 4**) is defined as point on the Partridge River approximately 5 miles downstream of the confluence with First Creek.

Partridge River Watershed

The portion of the Partridge River watershed considered in the study area covers approximately 88,692 acres extending from the City of Aurora northeast toward the City of Babbitt (**Figure 4**). Outside of the small urban areas of Aurora and Hoyt Lakes and widely scattered farmsteads and rural residences, land use in the watershed is primarily mining, mixed wood forest and wetland. The MNDNR Census of the Land (1996) identifies the primary land cover in the watershed as deciduous and mixed wood forest, regenerating forest, gravel pits and open mines, wetlands, and water.

Methodology

This analysis includes the evaluation of the incremental impact of the proposed project when added to other past, present, and reasonably foreseeable future actions. The proposed project will be evaluated along with reasonably foreseeable future actions within the study area to determine the potential for cumulative effects on wetland resources for each alternative site.

Previous Conditions (1980s)

The past condition of wetland resources in the project area is defined as the condition that existed at the time of the National Wetlands Inventory (NWI). The existing NWI data is used to represent the wetland area that existed at the time the aerial photography was flown.

Existing Conditions

Wetland areas estimated for the existing conditions were developed by compiling the following data.

1. The NWI was used to identify wetlands in most areas, particularly where additional detailed information was unavailable. However more accurate or more detailed data were used in place of NWI data where available, as described below.

2. Wetlands shown to be disturbed by mining and other development and industry were identified through interpretation of aerial photography. Where wetlands were shown to be filled or otherwise obliterated, they were removed from the "existing wetlands" data.

A "composite" wetlands layer was developed by deleting all of the NWI wetlands from the areas where additional data and/or photo interpretation show that wetlands have been impacted.

Foreseeable Future Conditions

Wetland areas estimated for future conditions were developed by defining reasonably foreseeable projects that are expected to be implemented in the future (± 20 years). In addition to identifying several project currently undergoing separate environmental assessment and permitting, potential future municipal and county highway departments projects were considered. The following table provides a summary of the projects considered reasonably foreseeable in each of the study areas. The potential effects of each project on existing wetland resources was estimated using the existing conditions wetland mapping described above and an assumed footprint of disturbance for each potential future project.

Table 1
Reasonably Foreseeable Future Actions

West Range Site Study Area	East Range Site Study Area
Minnesota Steel Industries	PolyMet Mining NorthMet Project
Nashwauk Gas Pipeline	Mesabi Nugget
Itasca County Highway 7 Realignment	St. Louis County – new roadway from Hoyt Lakes to Babbitt
Itasca County Railroad	

Cumulative Effects Assessment

The past condition of wetland resources in the project area is represented by the resources included on the NWI. Wetland area features used in this assessment were mapped as part of the NWI performed by the US Fish and Wildlife Service (USFWS) and made available in ARC/INFO format by the MNDNR GIS Data Deli. The wetland types described in this assessment utilize the Circular 39 Classification (Shaw and Fredine, 1956), a means of classifying the wetland basins of the U.S. It is composed of 20 types of which 8 are found in Minnesota. Three additional types were added into the GIS database to completely classify the Minnesota NWI wetlands into Circular 39 types. These additional classifications include Type 80

(Municipal and industrial activities, water regime), Type 90 (Riverine systems), and Type 98 (Uplands, i.e., the absence of wetland).

West Range Site

Past Conditions (1980s)

Swan River Watershed

The NWI data shows there are approximately 28,554 acres of wetland habitat in that portion of the Swan River watershed within the study area. At the time of the NWI, wetland habitat represented approximately 25% of the landscape within the study area. The majority of the wetland habitat was either shallow open water, shrub swamp or bog. **Table 2** below provides a summary of the wetlands by wetland type. For simplification, the Circular 39 classification is used.

Table 2
Past Conditions:
Wetlands Previously in the Swan River Study Area

Wetland Type	Description	Total Wetland Area (acres)	Percent of Wetland Area	Percent of Total Area
Type 1	Seasonally flooded basin or flat	3.95	0.01%	0.004%
Type 2	Wet meadow	855.60	3.00%	0.75%
Type 3	Shallow marsh	1,347.86	4.72%	1.18%
Type 4	Deep marsh	566.36	1.98%	0.50%
Type 5	Shallow open water	6,589.87	23.08%	5.77%
Type 6	Shrub swamp	6,009.28	21.05%	5.26%
Type 7	Wooded swamp	2,318.29	8.12%	2.03%
Type 8	Bog	6,320.11	22.13%	5.53%
Type 80	Municipal and industrial activities, water regime	4,501.66	15.77%	3.94%
Type 90	Riverine systems	40.75	0.14%	0.04%
Total		**28,553.73**		**24.99%**
Source: National Wetlands Inventory (NWI) from MNDNR GIS Data Deli.				

Prairie River Watershed

The NWI data shows there are approximately 100,363 acres of wetland habitat in that portion of the Swan River watershed within the study area. At the time of the NWI, wetland habitat represented approximately 35% of the landscape within the study area. As in the adjacent Swan River Watershed, the majority of the wetland habitat was either shallow open water, shrub swamp or bog. **Table 3** below provides a summary of the wetlands by wetland type.

Table 3
Past Conditions:
Wetlands Previously in the Prairie River Study Area

Wetland Type	Description	Total Wetland Area (acres)	Percent of Wetland Area	Percent of Total Area
Type 1	Seasonally flooded basin or flat	627.65	0.63%	0.22%
Type 2	Wet meadow	4,171.95	4.16%	1.46%
Type 3	Shallow marsh	2,260.88	2.25%	0.79%
Type 4	Deep marsh	485.25	0.48%	0.17%
Type 5	Shallow open water	23,686.65	23.60%	8.29%
Type 6	Shrub swamp	24,659.21	24.57%	8.63%
Type 7	Wooded swamp	9,233.76	9.20%	3.23%
Type 8	Bog	34,790.63	34.66%	12.17%
Type 80	Municipal and industrial activities, water regime	230.40	0.23%	0.08%
Type 90	Riverine systems	216.40	0.22%	0.08%
Total		**100,362.78**		**35.11%**
Source: National Wetlands Inventory (NWI) from MNDNR GIS Data Deli.				

Existing Conditions

The existing condition is represented by the “composite” wetlands layer developed from NWI data and aerial photo interpretation as described above. The following sections provide a summary of the existing wetland resources in each of the watershed study areas and a description of the wetland losses to the present.

<u>Swan River Watershed</u>

The existing conditions data shows there are approximately 25,058 acres of wetland habitat in that portion of the Swan River watershed within the study area. This represents a loss of approximately 3,496 acres or 12.24% of the past wetland habitat. The loss represents approximately 3% of the land cover in the study area. **Table 4** below provides a summary of the wetlands by wetland type.

Table 4
Existing Conditions:
Wetlands in the Swan River Study Area

Wetland Type	Previous Wetland Area from NWI (acres)	Wetlands Lost (acres)	Percent Lost	Remaining Area (acres)	Percent of Total Area
Type 1	3.95	0.00	0.0%	3.95	0.004%
Type 2	855.60	15.35	1.8%	840.85	0.74%
Type 3	1,347.86	168.64	12.5%	1,179.22	1.03%
Type 4	566.36	237.55	41.9%	328.81	0.29%
Type 5	6,589.87	1,105.79	16.8%	5,484.08	4.80%
Type 6	6,009.28	275.80	4.6%	5,733.49	5.02%
Type 7	2,318.29	138.85	6.0%	2,179.44	1.91%
Type 8	6,320.11	100.04	1.6%	6,220.07	5.44%
Type 80	4,501.66	1,454.08	32.3%	3,047.58	2.67%
Type 90	40.75	0.00	0.0%	40.75	0.04%
Totals	**28,553.73**	**3,496.1**	**12.24%**	**25,058.24**	**21.93%**
Source: National Wetlands Inventory (NWI) from MNDNR GIS Data Deli.					

The difference between past and present wetland areas is primarily due to the effects of ore mining and establishment of small urban communities. However, the effects of mining and the related human development in this area extends back to the early 1900s when iron mining and mining camps were established as the precursors of the development seen today. There was certainly additional pre-settlement wetland habitat affected by mining and other human disturbance that was removed prior to development of the NWI and therefore prior to the time considered in the scope of this assessment.

Prairie River Watershed

The existing conditions data shows there are approximately 100,264 acres of wetland habitat in that portion of the Swan River watershed within the study area. This represents a loss of approximately 99 acres of wetland or 0.10% of the past wetland habitat. The loss represents only 0.04% of the land cover in the study area. **Table 5** below provides a summary of the wetlands by wetland type. The lesser effect of mining and related human development on the northern side of the iron formation can be seen in the smaller change in wetland loss between the two watersheds.

Table 5
Existing Conditions:
Wetlands in the Prairie River Study Area

Wetland Type	Previous Wetland Area from NWI (acres)	Wetlands Lost (acres)	Percent Lost	Remaining Area (acres)	Percent of Total Area
Type 1	627.65	0.00	0.0%	627.65	0.22%
Type 2	4,171.95	0.86	0.0%	4,171.09	1.46%
Type 3	2,260.88	2.89	0.1%	2,257.99	0.79%
Type 4	485.25	10.97	2.3%	474.28	0.17%
Type 5	23,686.65	0.37	0.0%	23,686.28	8.29%
Type 6	24,659.21	1.01	0.0%	24,658.20	8.63%
Type 7	9,233.76	1.79	0.0%	9,231.97	3.23%
Type 8	34,790.63	2.20	0.0%	34,788.43	12.17%
Type 80	230.40	78.73	34.2%	151.67	0.05%
Type 90	216.40	0.00	0.0%	216.40	0.08%
Totals	**100,362.78**	**98.82**	0.10%	**100,263.96**	35.07%
Source: National Wetlands Inventory (NWI) from MNDNR GIS Data Deli.					

Mesaba Energy Project

The Mesaba Energy Project is to be constructed in two phases. Phase I will include construction of Mesaba One, the first IGCC unit, along with associated facilities including high voltage transmission line (HVTL), gas pipeline, roads, railroads, and utilities. Phase II will include construction of Mesaba Two, the second IGCC unit. The preferred alternatives for the supporting infrastructure are intended to support the operation of both IGCC units and are the alternatives for which wetland impacts are described below. **Table 6** below provides a summary of the wetland impacts from the Mesaba Energy Project on the West Range Site. The wetland impacts shown in **Table 6** are a summary of all wetland impacts, both within and outside of the study area defined for this assessment of cumulative effects. The wetland impacts within the study area are divided by subwatershed (Swan River and Prairie River) in the following sections.

Table 6
Summary of Wetland Impacts
Mesaba Energy Project – West Range Site

Project Element	Type 1	Type 2	Type 3	Type 4	Type 5	Type 6	Type 7	Type 8	Total
Wetland Filling									
IGCC Power Station, Phase I							17.33		17.33
IGCC Power Station, Phase II			0.12				1.99	11.52	13.63
Power Transmission (fill)		0.0006	0.0012			0.0013	0.0026	0.0045	0.01
Railroad			0.14			4.80	19.99	1.52	26.45
Plant Access Road (acres in ROW)						3.44	0.39	0.04	3.87
Subtotal Wetland Filling									**61.29**
Temporary Disturbance									
Gas Pipeline (acres in ROW)	0.12	1.28	1.14			3.98	6.94	4.01	17.47
Process Water – Lind Pit to Canisteo (acres in ROW)									0.00
Process Water – Canisteo to IGCC site (acres in ROW)						0.04	0.88	2.81	3.73
Process Water – Gross Marble to Canisteo (acres in ROW)				0.42	0.20	1.33	1.47	0.37	3.79
Process Water – Discharge to Holman Lake						0.32	0.88	2.78	4.07
Process Water – Discharge to Canisteo Pit						5.71	0.24	7.65	13.60
Potable Water and Sanitary Sewer						0.13	0.52	1.14	1.79
Subtotal Temporary Disturbance									**44.45**
Type Conversion									
Power Transmission						8.63	7.37	14.21	30.21
Gas Pipeline						3.98	6.94	4.01	14.93
Process Water – Canisteo to IGCC site						0.04	0.88	2.81	3.73
Process Water – Gross Marble to Canisteo						1.33	1.47	0.37	3.17
Process Water – Discharge to Holman Lake						0.32	0.88	2.78	3.98
Process Water – Discharge to Canisteo Pit						5.71	0.24	7.65	13.60
Potable Water and Sanitary Sewer						0.13	0.52	1.14	1.79
Subtotal Type Conversion									**71.41**
Note: In instances where NWI and other data identify wetland complexes of multiple types, the information above uses the most predominant wetland type.									

Swan River Watershed

Table 7 is a summary of wetland fill within the Swan River Watershed that would result from construction of the Mesaba Energy Project on the West Range Site. The table includes only those wetland impacts within the Swan River Watershed portion of the cumulative effects study area and only wetland fill impacts. The table excludes temporary wetland impacts or changes in wetland type as well as wetland impacts outside of the cumulative effects study area. The data show that construction of the proposed Mesaba Energy Project on the West Range Site would affect approximately 0.13% of the existing wetland area in the Swan River Watershed (within the study area).

Table 7
Summary of Mesaba Energy Project Wetland Impacts in Swan River Watershed

Wetland Types	Wetland Impact (acres)	Percent of Existing Wetland Area	Percent of Total Area
Type 1	0.00	0.000%	0.0000%
Type 2	0.31	0.037%	0.0003%
Type 3	4.11	0.349%	0.0036%
Type 4	0.42	0.128%	0.0004%
Type 5	0.20	0.004%	0.0002%
Type 6	21.21	0.370%	0.0186%
Type 7	4.25	0.195%	0.0037%
Type 8	2.27	0.037%	0.0020%
Total	**32.77**	**0.131%**	**0.0287%**
Note: In instances where NWI and other data identify wetland complexes of multiple types, the information above uses the most predominant wetland type.			

Prairie River Watershed

Table 8 is a summary of wetland fill within the Prairie River Watershed that would result from construction of the Mesaba Energy Project on the West Range Site. The table includes only those wetland impacts within the Prairie River Watershed portion of the cumulative effects study area and only wetland fill impacts. The table excludes temporary wetland impacts or changes in wetland type as well as wetland impacts outside of the cumulative effects study area. The data show that construction of the proposed Mesaba Energy Project on the West Range Site would affect approximately 0.02% of the existing wetland area in the Prairie River Watershed (within the study area).

Table 8
Summary of Mesaba Energy Project Wetland Impacts in Prairie River Watershed

Wetland Types	Wetland Impact (acres)	Percent of Existing Wetland Area	Percent of Total Area
Type 1	0.00	0.000%	0.0000%
Type 2	0.00	0.000%	0.0000%
Type 3	0.04	0.008%	0.00001%
Type 4	0.00	0.000%	0.0000%
Type 5	0.00	0.000%	0.0000%
Type 6	0.27	0.001%	0.0001%
Type 7	24.13	0.261%	0.0084%
Type 8	0.00	0.000%	0.0000%
Total	**24.44**	**0.024%**	**0.0085%**
Note: In instances where NWI and other data identify wetland complexes of multiple types, the information above uses the most predominant wetland type.			

Foreseeable Future Conditions

Reasonably foreseeable future projects in the West Range study area include:

- the proposed Minnesota Steel Industries steel plant northeast of the West Range Site,
- a proposed gas pipeline intended to serve Minnesota Steel and others to be constructed by the Nashwauk Public Utilities Commission,
- a new railroad to serve Minnesota Steel to be constructed by Itasca County,
- and a proposed realignment of County Road 7 also to be constructed by Itasca County.

See **Figure 3** for the location of these potential future projects in relation to the Mesaba Energy Project West Range Site and the cumulative effects study area. No other reasonably foreseeable future projects were identified after consideration of potential projects by the individual municipalities in the study area and the Itasca County Highway Department.

Minnesota Steel

Minnesota Steel Industries, LLC proposes to reactivate the former Butler Taconite mine and tailings basin near Nashwauk and add direct-reduced iron production and steel making and rolling equipment in an integrated facility to make steel directly from Minnesota taconite ore. The MNDNR is currently preparing an Environmental Impact Statement (EIS) for the proposed project.

The Draft Environmental Impact Statement (DEIS) published for the Minnesota Steel project states that an anticipated total of between 945 and 1,163 acres of wetlands and deepwater habitats will be impacted as a result of the project including: plant facilities, mining activities, tailings basin, tailings pipeline, rock and overburden stockpiling. Detailed wetland mitigation planning has begun and an overall mitigation plan is included as part of the DEIS.

Table 9 provides a summary of wetland impacts as reported in the DEIS. The division of impacts between the Swan River and Prairie River watersheds is not known. The Minnesota Steel site lies on or near the division between the two watersheds, similar to the Mesaba Energy Project West Range Site. However, most of the site is believed to be located in the Swan River Watershed.

Table 9
Minnesota Steel
Summary of Wetland Impacts

	Total wetland impacts with Stage I Tailings Basin (acres)	Total wetland impacts with Alternative Tailings Basin (acres)
Type 1	10.5	10.5
Type 2	107.7	71.0
Type 3	94.3	1.1
Type 4	66.1	59.7
Type 5	222.1	99.0
Type 6	231.8	207.8
Type 7	32.1	88.3
Type 8	1.2	9.0
Deepwater	398.2	398.2
Total	**1163.1**	**944.9**

Nashwauk Gas Pipeline

The Nashwauk Public Utilities Commission (NPUC) is planning to construct a natural gas pipeline to provide operating fuel to the Minnesota Steel Industries Nashwauk Taconite Reduction Plant described above. NPUC is proposing to install a 21.5 mile high-pressure natural gas pipeline extending from the existing Great Lakes Gas (GLG) 36-inch pipeline in Blackberry Township to the City of Nashwauk as shown on **Figure 3**.

Construction of the pipeline would result in temporary and some permanent impacts to wetland habitats, although the project has yet to reach a stage in planning where wetland impacts have been assessed. **Table 10** below provides a summary of the wetland habitat identified on the NWI within an assumed 70-foot right-of-way along the proposed alignment. Although the proposed pipeline alignment uses existing rights-of-way where possible, some new ROW will be established, resulting in conversion of wetland types from shrub and forested cover to emergent.

Table 10 Wetland Impacts from Nashwauk Gas Pipeline		
Wetland Type	**Swan River Watershed**	**Prairie River Watershed**
	Area in permanent ROW (acres)	
Type 2	0.31	0.00
Type 3	1.56	2.46
Type 4	0.00	0.36
Type 6	5.60	1.36
Type 7	2.07	5.92
Type 8	1.87	4.08
Totals	**11.41**	**14.18**

<u>Itasca County Railroad</u>

Itasca County is planning to construct a railroad spur to provide rail access to the Minnesota Steel Industries Nashwauk Taconite Reduction Plant described above. The rail spur is approximately eight miles in length extending from existing rail lines along Highway 169 in a northeasterly direction to the Minnesota Steel Industries site as shown on **Figure 3**. Construction of the railroad is expected to impact approximately 12 acres of wetland, all within the Swan River Watershed.

<u>Itasca County Road 7 Realignment</u>

Itasca County is also considering realignment of County Road 7 as shown on **Figure 3**. The new roadway would replace the existing County Road 7 which would become part of the entrance to the Mesaba Energy Project. This realignment would occur only if the Mesaba Energy Project was constructed at the West Range Site. If constructed the roadway would impact approximately 1.8 acres wetland area as shown in **Table 11**. All of the wetland impacts would be in the Swan River Watershed.

Table 11 Wetland Impacts from Itasca County Road 7 Realignment	
Wetland Type	**Wetland Impact (acres)**
Type 4	0.43
Type 6	0.42
Type 7	0.55
Type 8	0.40
Total	**1.80**

East Range Site

Previous Conditions (1980s)

The NWI data shows there are approximately 34,500 acres of wetland habitat in that portion of the Partridge River watershed within the study area. At the time of the NWI, wetland habitat represented nearly 39% of the landscape within the study area. The majority of the wetland habitat (over 60%) was bog. **Table 12** below provides a summary of the wetlands by wetland type.

Table 12
Past Conditions:
Wetlands Previously in the Partridge River Study Area

Wetland Type	Description	Total Wetland Area (acres)	Percent of Wetland Area	Percent of Total Area
Type 1	Seasonally flooded basin or flat	0.00	0.00%	0.00%
Type 2	Wet meadow	235.24	0.68%	0.27%
Type 3	Shallow marsh	552.30	1.60%	0.62%
Type 4	Deep marsh	308.05	0.89%	0.35%
Type 5	Shallow open water	2,847.50	8.25%	3.21%
Type 6	Shrub swamp	4,707.21	13.64%	5.31%
Type 7	Wooded swamp	4,864.80	14.10%	5.49%
Type 8	Bog	20,783.08	60.24%	23.43%
Type 90	Riverine systems	201.90	0.59%	0.23%
Totals		**34,500.08**		**38.90%**
Source: National Wetlands Inventory (NWI) from MNDNR GIS Data Deli.				

Existing Conditions

The existing conditions data shows there are approximately 33,212 acres of wetland habitat in that portion of the Partridge River watershed within the study area. This represents a loss of approximately 1,288 acres or 3.73% of the past wetland habitat. The loss represents less than 0.5% of the land cover in the study area. **Table 13** below provides a summary of the wetlands by wetland type.

Table 13
Existing Conditions:
Wetlands in the Partridge River Study Area

Wetland Type	Previous Wetland Area from NWI (acres)	Wetlands Lost (acres)	Percent Lost	Remaining Area (acres)	Percent of Total Area
Type 1	0.00	0.00	0.0%	0.00	0.00%
Type 2	235.24	10.36	4.4%	224.88	0.25%
Type 3	552.30	39.84	7.2%	512.46	0.58%
Type 4	308.05	169.08	54.9%	138.97	0.16%
Type 5	2,847.50	314.32	11.0%	2,533.19	2.86%
Type 6	4,707.21	176.07	3.7%	4,531.15	5.11%
Type 7	4,864.80	158.71	3.3%	4,706.10	5.31%
Type 8	20,783.08	420.08	2.0%	20,363.01	22.96%
Type 90	201.90	0.00	0.0%	201.90	0.23%
Totals	**34,500.08**	**1,288.46**	**3.73%**	**33,211.66**	**37.45%**
Source: National Wetlands Inventory (NWI) from MNDNR GIS Data Deli.					

As at the West Range Site, the difference between past and present wetland areas is primarily due to the effects of ore mining and establishment of small urban communities. However, the effects of mining and the related human development in this area extends back to the early 1900s when iron mining and mining camps were established as the precursors of the development seen today. There was certainly additional pre-settlement wetland habitat affected by mining and other human disturbance that was removed prior to development of the NWI and therefore prior to the time considered in the scope of this assessment.

Mesaba Energy Project

As described for the West Range Site, the Mesaba Energy Project is to be constructed in two phases. Phase I will include construction of Mesaba One, the first IGCC unit, along with associated facilities including high voltage transmission line (HVTL), gas pipeline, roads, railroads, and utilities. Phase II will include construction of Mesaba Two, the second IGCC unit. The preferred alternatives for the supporting infrastructure are intended to support the operation of both IGCC units and are the alternatives for which wetland impacts are described below. **Table 14** below provides a summary of the wetland impacts from the Mesaba Energy Project on the East Range Site. The wetland impacts shown in **Table 14** are a summary of all wetland impacts, both within and outside of the study area defined for this assessment of cumulative effects. The wetland impacts within the study area are described in **Table 15**.

Table 14
Summary of Wetland Impacts
Mesaba Energy Project – East Range Site

Project Element	Riv.	Type 2	Type 3	Type 4	Type 5	Type 6	Type 7	Type 8	Total
Wetland Filling									
IGCC Power Station, Phase I			6.38				5.53		11.91
IGCC Power Station, Phase II		0.003					3.70		3.70
Power Transmission (fill)	0.0006	0.0019			0.0006	0.0211	0.0030	0.0189	0.05
Railroad		0.06				0.85	9.77		10.68
Plant Access Road (acres in ROW)						0.47	2.76		3.23
Subtotal Wetland Filling									**29.57**
Temporary Disturbance									
Gas Pipeline (acres in ROW)	0.18	3.46			0.68	17.58	6.37	18.54	46.81
Process Water – intake (acres in ROW)				0.23	0.29	1.13			1.65
Potable Water and Sanitary Sewer					0.45				0.45
Subtotal Temporary Disturbance									**48.91**
Type Conversion									
Power Transmission						14.87	2.65	11.70	29.22
Gas Pipeline						17.58	6.37	18.54	42.49
Process Water – intake						1.13			1.13
Subtotal Type Conversion									**72.84**
Note: In instances where NWI and other data identify wetland complexes of multiple types, the information above uses the most predominant wetland type									

Table 15 is a summary of wetland fill within the Partridge River Watershed that would result from construction of the Mesaba Energy Project on the East Range Site. The table includes only those wetland impacts within the Partridge River Watershed portion of the cumulative effects study area and only wetland fill impacts. The table excludes temporary wetland impacts or changes in wetland type as well as wetland impacts outside of the cumulative effects study area. The data show that construction of the proposed Mesaba Energy Project on the East Range Site would affect 0.10% of the existing wetland area in the Partridge River Watershed (within the study area).

Table 15
Summary of Mesaba Energy Project Wetland Impacts
in Partridge River Watershed

Wetland Types	Wetland Impact (acres)	Percent of Existing Wetland Area	Percent of Total Area
Type 1	0.00	0.000%	0.0000%
Type 2	0.36	0.160%	0.0004%
Type 3	0.21	0.041%	0.0002%
Type 4	0.23	0.166%	0.0003%
Type 5	1.42	0.056%	0.0016%
Type 6	24.15	0.533%	0.0272%
Type 7	6.35	0.135%	0.0072%
Type 8	1.21	0.006%	0.0014%
Total	**33.93**	**0.102%**	**0.0383%**
Note: In instances where NWI and other data identify wetland complexes of multiple types, the information above uses the most predominant wetland type.			

Foreseeable Future Conditions

Reasonably foreseeable future projects in the East Range study area include:

- the mine portion of the PolyMet Mining project (excluding the processing facility),
- the Mesabi Nugget project, and
- the corridor for a new roadway between Hoyt Lakes and Babbitt as proposed by St. Louis County.

See **Figure 4** for the location of these potential future projects in relation to the Mesaba Energy Project East Range Site and the cumulative effects study area. No other reasonably foreseeable future projects were identified after consideration of potential projects by the individual municipalities in the study area and the St. Louis County Highway Department.

<u>PolyMet Mining, Inc. NorthMet Project</u>

PolyMet Mining Inc. proposes an open pit mine to extract copper, nickel, cobalt and precious metals by dissolution and precipitation from a low-grade mineral deposit. The project includes a new mine area and use of the currently inactive Cliffs Erie taconite processing facility. The MNDNR is currently preparing an Environmental Impact Statement (EIS) for the proposed project.

The Scoping Environmental Assessment Worksheet (SEAW) prepared for the PolyMet Mining project identifies a total of 1,257 acres of wetland that would be impacted by the proposed mining, construction of mine support facilities, rock and overburden stockpiling, and miscellaneous transportation and utility requirements during the life of the project. Preliminary evaluations indicate that approximately one-half of these wetlands are predominantly bog communities. Approximately one-fourth of the potential wetland impacts are predominantly shrub swamp communities. The remaining one-fourth of the potential wetland impacts includes a mix of wet/sedge meadows, shallow marshes, and lowland hardwood swamps.

Table 16 **PolyMet Mining Corp.** **Projected wetland impact summary by wetland type**		
Circular 39 Wetland Classification	**Number of Wetlands**	**Area (acres)**
Type 2	6	2.7
Type 2/3	8	24.5
Type 2/7	2	3.3
Type 3	4	32.5
Type 3/6	1	1.9
Type 3/7	1	2.5
Type 3/8	8	48.9
Type 6	12	100.8
Type 6/3	1	4.8
Type 6/7	7	161.5
Type 6/8	4	111.5
Type 7	15	82.5
Type 8	28	647.3
Type 8/7	1	32.0
Total	98	1,256.7

Mesabi Nugget

Mesabi Nugget, LLC (MNC) has proposed a new commercial iron production plant that would use a new process for producing high purity iron (97% metallic iron) directly from iron ore. The company has completed a small-scale pilot plant at Silver Bay and proposes a a large scale demonstration plant (LSDP) on the Ling-Temco-Vought (LTV) property near the City of Aurora (see **Figure 4**). It is not known how much wetland will be affected by the Mesabi Nugget project. It is believed that the project will utilize existing structures and infrastructure and will likely have little, if any, impact to wetlands. **Table 17** below provides a summary of the wetlands shown on the NWI within the project boundary and within the cumulative impacts study area.

Table 17
Mesabi Nugget
Wetlands within project site

Wetland Types	**Wetlands Identified within Project Area (acres)**
Type 4	2.56
Type 5	29.88
Type 6	27.42
Type 7	23.50
Type 8	2.07
Total	**85.43**
Note: In instances where NWI and other data identify wetland complexes of multiple types, the information above uses the most predominant wetland type.	

St. Louis County New Hoyt Lakes – Babbitt Connection

St. Louis County has proposed a new roadway segment, a new connection between Hoyt Lakes and Babbitt. This segment is part of a larger initiative to more efficiently link the Iron Range communities of Aurora, Hoyt Lakes, Babbitt, and Ely to enhance the potential for new industry and to help mitigate the existing economic situation in the area by developing a new tranportation corridor. To date, several alternative alignments have been identified and evaluation of those alternatives is proposed to begin in 2007. Therefore, no estimate of potential wetland impacts is available for this future project. However, it is expected that because of the extent of wetland habitat in the area, constrution of the project will result in some impact to wetlands.

Conclusions

Table 18 provides a summary of the past and present estimates of wetland habitat in the West Range study area and the area of wetland within the study area that would be filled by the proposed Mesaba Energy Project. It also includes a comparison of potential wetland impacts from other reasonably foreseeable future projects in the study area.

Table 18
Summary of Cumulative Wetland Impacts
West Range Site Study Area

	Swan River Watershed		Prairie River Watershed		Total	
	Wetland Area (acres)	Percent of Present Wetland Area	Wetland Area (acres)	Percent of Present Wetland Area	Wetland Area (acres)	Percent of Present Wetland Area
Past	28,554	---	100,363	---	128,917	---
Present	25,058	12.24% lost from past	100,264	0.10% lost from past	125,322	2.79% lost from past
Mesaba Energy Project	32.77	0.13%	24.44	0.02%	57.21	0.05%
Future Projects						
MSI	945 – 1,163*	3.77% - 4.64%*	0*	---	945 – 1,163	0.75% - 0.93%
Gas Pipeline	11.41	0.05%	14.18	0.02%	25.59	0.02%
Railroad	12	0.05%	0	---	12	0.01%
CR 7	1.8	0.007%	0	---	1.8	0.001%

* The vast majority of wetland impacts are known to fall within the Swan River watershed; however, a small portion of this impact may instead fall within the Prairie River watershed.

Mining and other development in the study area has impacted less than 3% of the wetlands identified on the NWI. Of those remaining, the Mesaba Energy Project would affect 0.05% of the wetlands in the study area. Most of the wetland impacts would occur in the Swan River Watershed.

Similarly, of the reasonably foreseeable future projects, most of the wetland impacts would occur in the Swan River Watershed (within the study area).

This is primarily because the existing mining and human development lies on and south of the iron formation and within the Swan River Watershed. There is little development, other than widely scattered rural residences in the Prairie River Watershed (within the study area).

Of the reasonably foreseeable future projects, the Minnesota Steel Industries project represents the greatest potential impact to wetlands in the study area and is of a magnitude 17 to 20 times greater than the Mesaba Energy Project.

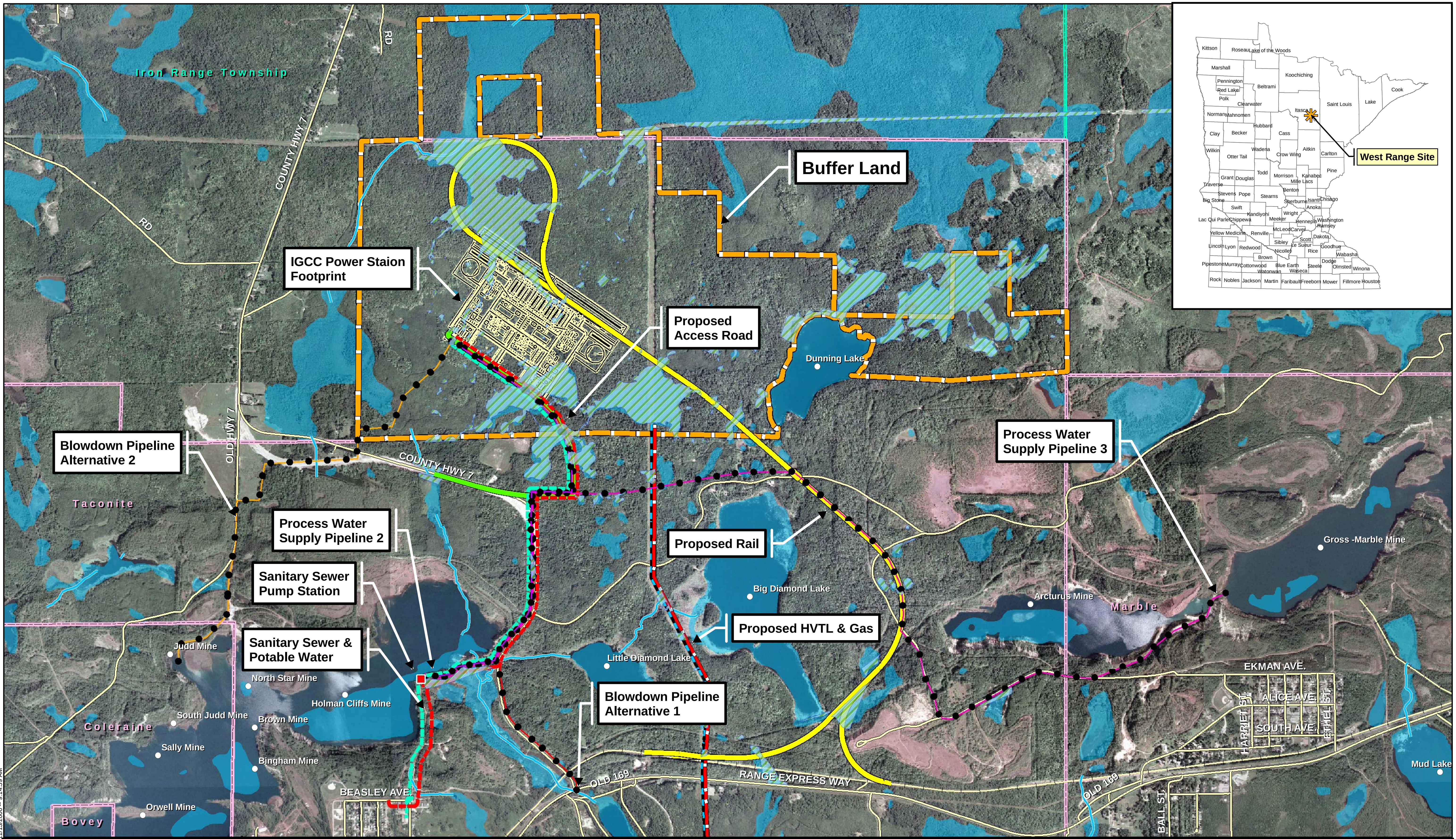
Table 19 provides a summary of the past and present estimates of wetland habitat in the East Range study area and the area of wetland within the study area that would be filled by the proposed Mesaba Energy Project. It also includes a comparison of potential wetland impacts from other reasonably foreseeable future projects in the study area.

Table 19
Summary of Cumulative Wetland Impacts
East Range Site Study Area

	Partridge River Watershed	
	Wetland Area (acres)	**Percent of Present Area**
Past	34,500	---
Present	33,212	3.73% lost from past
Mesaba Energy Project	33.93	0.10%
Future Projects		
PolyMet	1,256.7	3.78%
Mesabi Nugget	Unknown	---
St. Louis County New Hoyt Lakes – Babbitt Connection	Unknown	---

Mining and other development in the study area has impacted less than 4% of the wetlands identified on the NWI. Of those remaining, the Mesaba Energy Project would affect 0.10% of the wetlands in the study area. Of the reasonably foreseeable future projects, the PolyMet NorthMet project represents the greatest potential impact to wetlands in the study area and is of a magnitude nearly 40 times greater than the Mesaba Energy Project.

List of Figures



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Excelsior Energy Inc.

Mesaba Energy Project

Energy, Innovation, and Economic Development for Minnesota

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Phone 952.847.2360 Fax 952.847.2373

West Range

November 2006

Legend

- Plant Layout
- Footprint and Buffer Land
- Proposed Rail
- Proposed Access Road

Proposed Utilities

- Potable Water
- Gravity Sewer
- Sanitary Pump Station Alt 2
- Gas Pipeline
- HVTL
- Process Water Pipeline 1
- Process Water Pipeline 2
- Process Water Pipeline 3
- Blow Down Alt 1
- Blow Down Alt 2
- Geographic Names
- Municipal Boundaries
- Civil Township
- Existing Roads
- Existing Railroads
- Streams
- Surveyed Wetlands
- NWI

Source: USDA 2003 DOQQs, USFWS, Itasca County, MNDNR, Mn/DOT, USGS, Fluor, Excelsior Energy, and SEH.

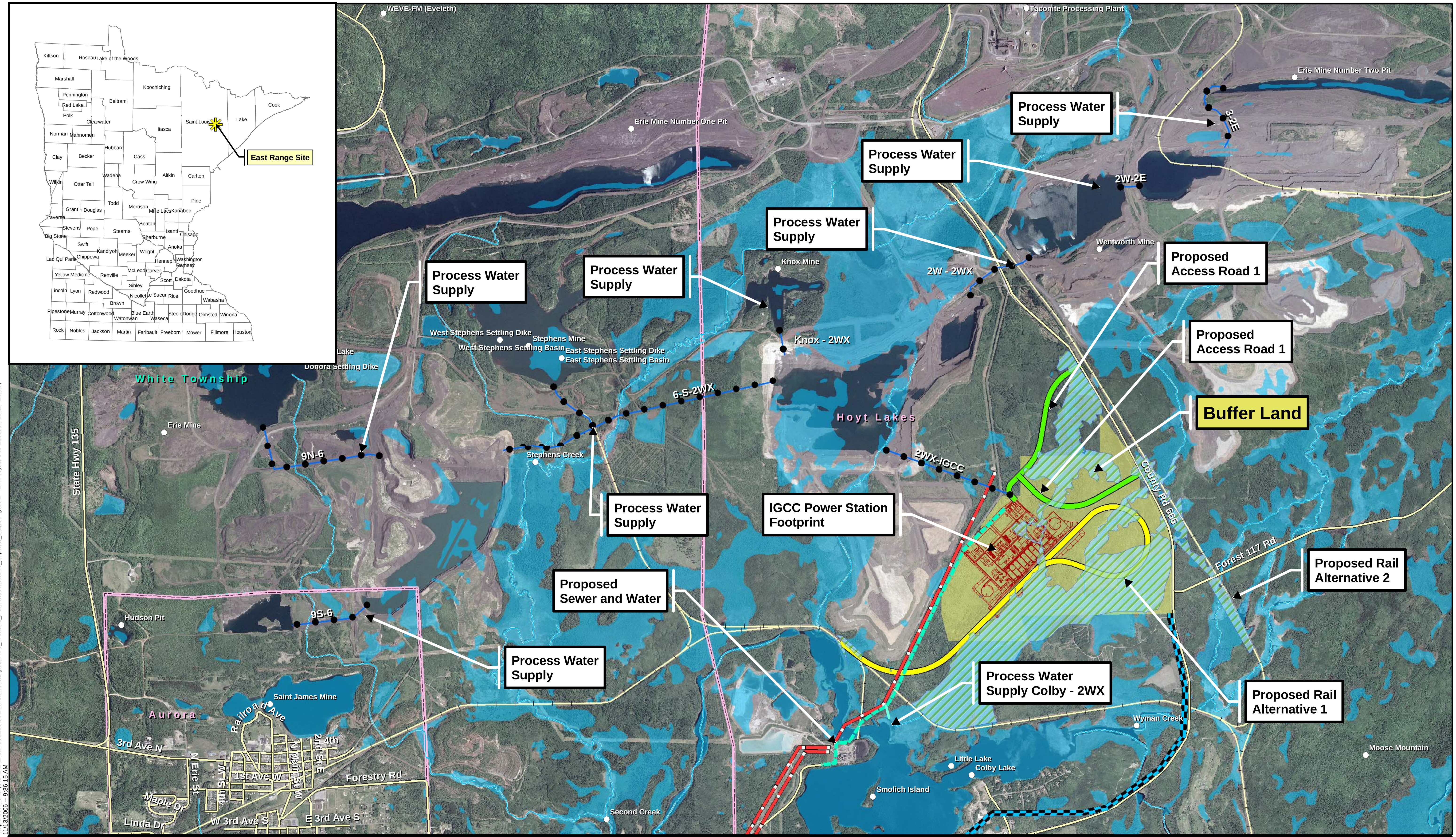
Figure 1

West Range Site Location

Itasca County - South Coordinate System

N E S W

0 2,000 Feet



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East Range

November 2006

Legend

- Footprint
- Buffer Land
- Proposed Access Roads
- Proposed Rail
- Gas Pipeline
- HVTL
- Proposed Sewer and Water
- Process Water Pipelines
- Geographic Names
- Municipal Boundaries
- Civil Township
- Existing Roads
- Existing Railroads
- Streams
- Surveyed Wetlands
- NWI

Source: USDA 2003 DOQQs, USFWS, MNDNR, Mn/DOT, USGS, Fluor, Excelsior Energy, and SEH.

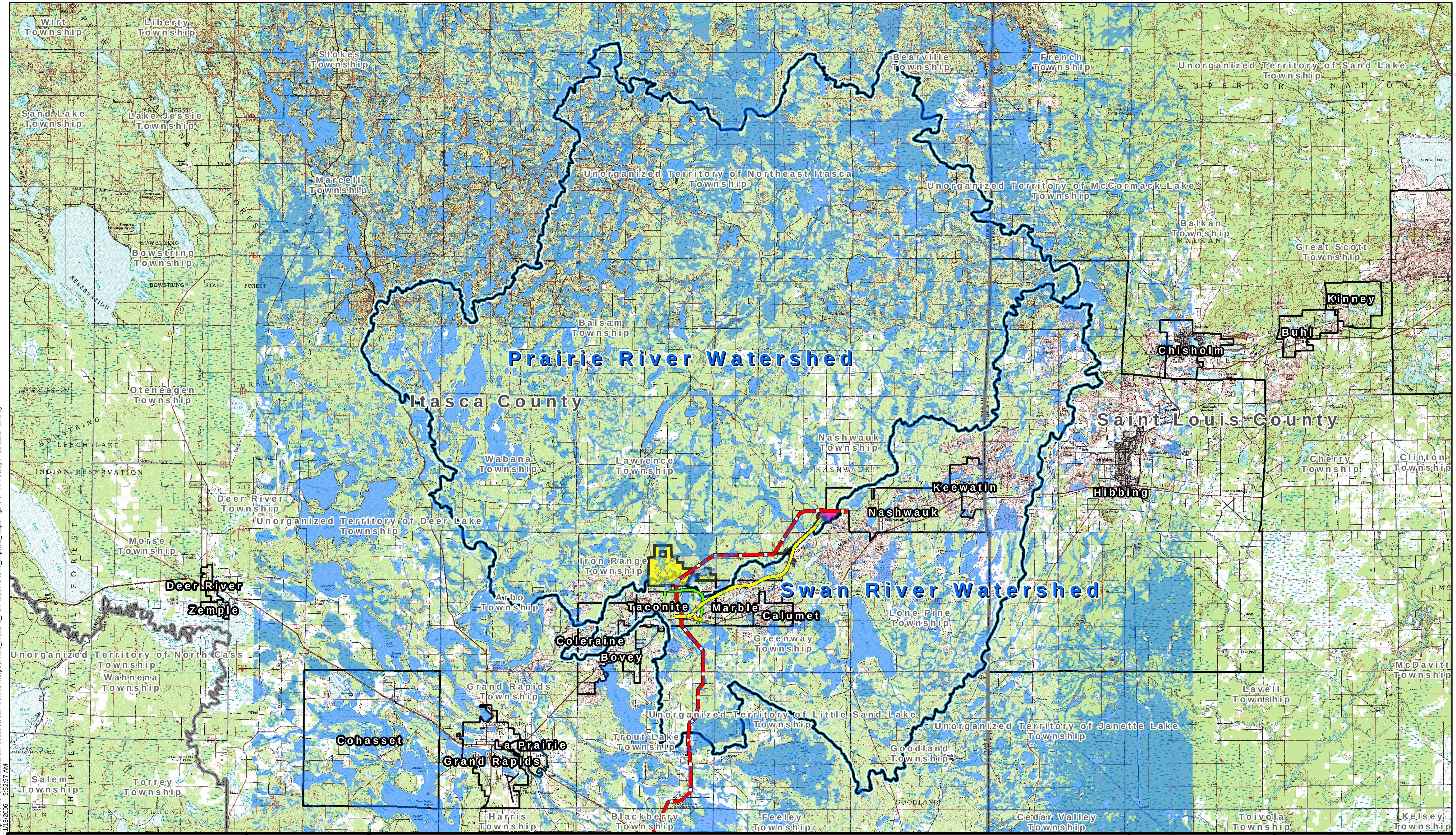
Figure 2

East Range Site Location

St. Louis County - Central Coordinate System

N W E S

0 3,000 Feet



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Excelsior Energy Inc.

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West Range

November 2006

Legend

- Swan River Watershed
- Prairie River Watershed
- NWI
- Surveyed Wetlands
- Excelsior Energy West Range Site
- MN Steel DRI Plant Site
- Nashwauk Gas Pipeline
- Itasca County Road 7 Realignment
- Itasca County Rail Alignment
- Municipal Boundaries
- Civil Township Boundaries
- County Boundary

Source: USGS, USFWS, MNDNR, Mn/DOT, Excelsior Energy, MN Steel, City of Nashwauk and SEH.
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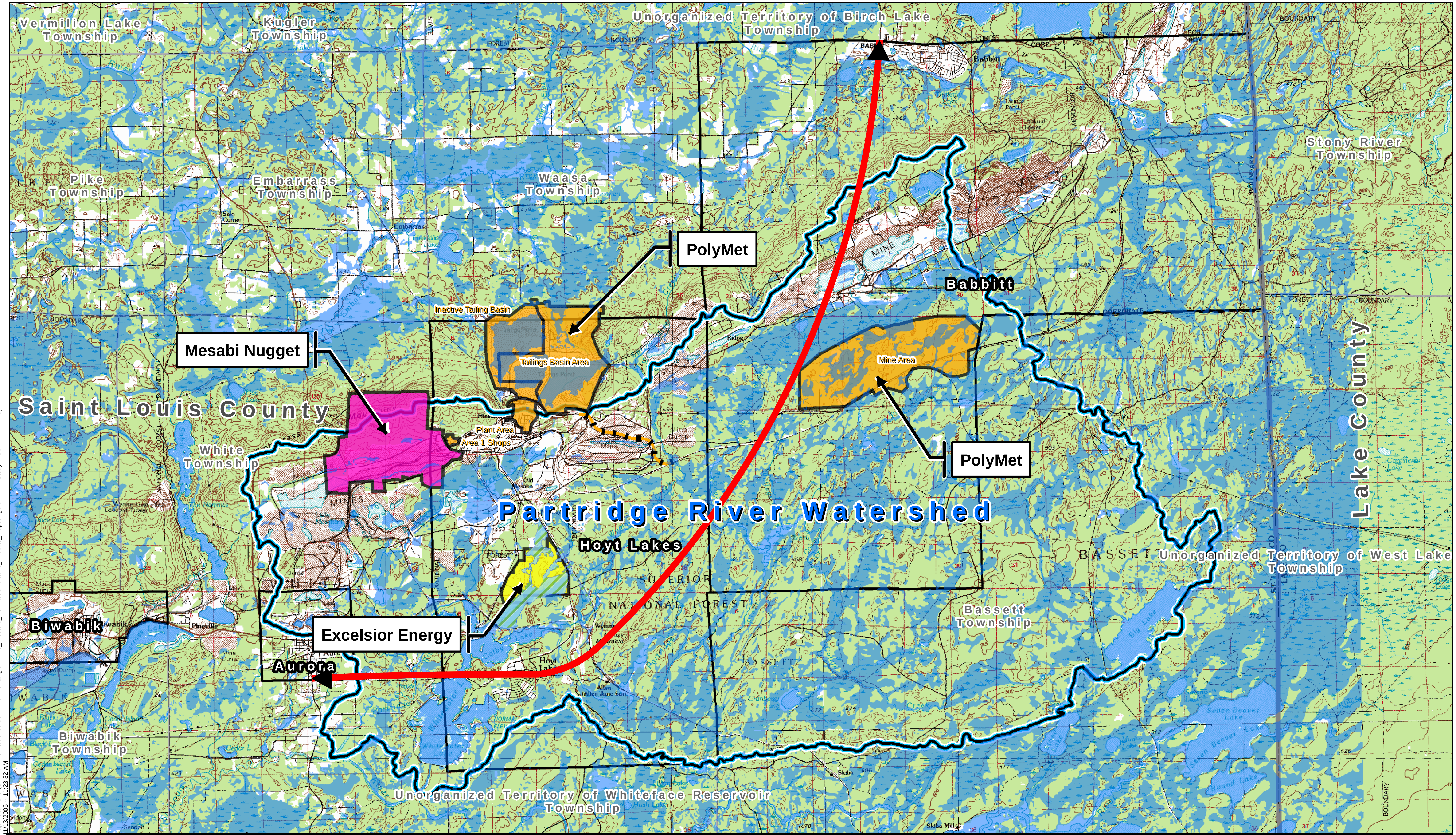
Figure 3

West Range Study Area

UTM, Zone 15, Meters
NAD83

N W E S

0 5 Miles



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Excelsior Energy Inc.	East Range	Legend	Figure 4	UTM, Zone 15, Meters NAD83
Mesaba Energy Project Energy, Innovation, and Economic Development for Minnesota 11100 Wayzata Boulevard Suite 305 Minnetonka, MN 55305 Phone 952.847.2360 Fax 952.847.2373	November 2006	Partridge River Watershed Surveyed Wetlands NWI Excelsior Energy East Range Site Mesabi Nugget Plant Site PolyMet Sites PolyMet Rail Construction St. Louis County New Hoyt Lakes to Babbitt Connection Municipal Boundaries Civil Township Boundaries County Boundary Source: USGS, USFWS, MNDNR, Mn/DOT, Excelsior Energy, and SEH. © 2006 SEH	East Range Study Area	N W E S 0 2 Miles

APPENDIX D5
Wildlife Habitat

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Cumulative Wildlife Effect Assessment

Prepared for Excelsior Energy

Mesaba Energy Project

SEH No. EXENR0502.03

November 2006

Prepared for Excelsior Energy
Cumulative Wildlife Effect Assessment
Mesaba Energy Project

SEH No. EXENR0502.03

Prepared for:
Excelsior Energy

November 2006

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Table of Contents

Table 1 –
Table 2 – Letter of Transmittal
Table 3 – Certification Page
Table 4 – Table of Contents

1.0 **Page**

Table of Contents (Continued)

List of Figures

Cumulative Wildlife Effect Assessment

- Prepared for Excelsior Energy
- Mesaba Energy Project

Introduction

This assessment of cumulative impacts to wildlife has been prepared on behalf of Excelsior Energy for the proposed Mesaba Energy Project and to assist the federal and state agencies in the preparation of the environmental impact statement (EIS).

The Department of Energy (DOE) National Energy Technology Laboratory (NETL) is required by the National Environmental Policy Act (NEPA) of 1969, as amended (42 U.S.C. 4321, *et seq*.), the Council on Environmental Quality NEPA regulations (40 Code of Federal Regulations [C.F.R.] Parts 1500-1508), and the DOE NEPA regulations (10 C.F.R. Part 1021) to prepare an EIS as part of its participation in the Mesaba Energy Project.

Similarly, under the Power Plant Siting Act (PPSA) (Minnesota Statutes §§ 116C.51-.697) a site permit from the Public Utilities Commission (PUC) is required to build a large electric power generating plant (LEPGP), including preparation of a State EIS. The EIS requirements under NEPA and the PPSA are substantially similar, and DOE will prepare, in cooperation with the Minnesota Department of Commerce and the Minnesota Public Utilities Commission, a joint EIS that will fulfill the requirements of both state and federal law. The information contained in this report will be used in the preparation of that EIS.

The NEPA provides the context and carries the mandate to analyze the cumulative effects of federal actions (in this case, funding provided by the DOE). The Council on Environmental Quality (CEQ) regulations for implementing the NEPA defines cumulative effects as:

> The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such other actions (40 CFR § 1508.7).

The consideration of past, present and reasonable foreseeable future actions provide a context for assessing the cumulative impacts on the wetland resources.

Study Area

The PPSA and Applicable Rules requires definition of at least two potential sites for the proposed project, identification of which a preferred site, and justification for its preference. In compliance with these requirements, Excelsior Energy has identified two potential project sites, the West Range site and the East Range site.

The West Range site includes approximately 1,260 acres of undeveloped land within the city limits of Taconite, Minnesota in Iron Range Township as shown on **Figure 1**. The East Range site includes approximately 810 acres of undeveloped property located within the city limits of Hoyt Lakes, Minnesota as shown on **Figure 2**. The West Range site has been identified as the preferred location on which to construct the Mesaba Energy Project, however, final determination of the project site will be made by the Minnesota Department of Commerce and the Minnesota Public Utilities Commission under the PPSA requirements. The EIS includes a description of additional supporting project elements, including roadways, railroad, natural gas and electric transmission, required for operation of the proposed project at both alternative sites. This assessment includes evaluation of the potential wildlife impacts from the preferred alternative project elements for each alternate site.

Because other cumulative effects studies performed on wetlands are related to the surrounding watershed, the study area for the cumulative effects assessment was defined according to the limits of the affected subwatersheds for each alternative site. This provides a convenient and meaningful study area boundary for assessing wildlife and habitat. Implications on wildlife and habitat at scales extending beyond the study areas are addressed as well. The paragraphs below describe the study area for both the West Range and East Range sites. The characteristics of the study areas are described in the following sections.

West Range Site

The West Range site is located within subwatersheds on the boundary between the Swan River and Prairie River watersheds. The study area associated with the West Range site (See **Figure 3**) is defined as follows.

1) That part of the Swan River watershed upstream of the point where Holman Lake discharges to the Swan River. The Holman Lake discharge point represents the point on the Swan River affected by discharge and drainage from the West Range site.

2) That part of the Prairie River watershed upstream of Prairie Lake.

Swan River Watershed

The portion of the Swan River watershed considered within the study area covers approximately 114,266 acres extending from just northeast of the City of Grand Rapids to just northwest of the City of Hibbing (**Figure 1**) and then south and east. Seven small communities (Coleraine, Bovey, Taconite, Marble, Calumet, Nashwauk and Keewatin) are located along the Mesabi Iron Range that lies just south of the divide between the Swan River watershed and the adjacent Prairie River watershed to the north. These communities, along with the associated iron and ore mining that support them, represent the primary development in the study area.

Outside of the small urban areas and scattered farmsteads and rural residences, land uses in the watershed primarily consists of ore mine pits and spoil areas. The remainder of this portion of the study area is a mixture of deciduous and mixed forest and wetland. The Minnesota Department of Natural Resources (MnDNR) Census of the Land (1996) identifies the primary land cover in the watershed as gravel pits and open mines, deciduous and mixed wood forest and open water.

Prairie River Watershed

The portion of the Prairie River watershed considered in the study area covers approximately 285,890 acres along the same portion of the Mesabi Iron Range (**Figure 3**) but extending north and west. Because the existing communities lie primarily along the southern edge of the iron formation, there are no established communities within this area of the Prairie River watershed. Outside of widely scattered farmsteads and rural residences, land use in the watershed is primarily mixed wood and deciduous forest and wetland. The MnDNR Census of the Land identifies the primary land cover in the watershed as deciduous and mixed wood forest, regenerating forest, wetlands, and water.

East Range Site

The East Range site is located in a subwatershed of the Partridge River in St. Louis County, Minnesota. The study area of the East Range site (See **Figure 4**) is defined as point on the Partridge River approximately 5 miles downstream of the confluence with First Creek.

Partridge River Watershed

The portion of the Partridge River watershed considered in the study area covers approximately 88,692 acres extending from the City of Aurora northeast toward the City of Babbitt (**Figure 4**). Outside of the small urban areas of Aurora and Hoyt Lakes and widely scattered farmsteads and rural residences, land use in the watershed is primarily mining, mixed wood forest and wetland. The MnDNR Census of the Land identifies the primary land cover in the watershed as deciduous and mixed wood forest, regenerating forest, gravel pits and open mines, wetlands, and water.

Methodology

This analysis includes the evaluation of the incremental impact of the proposed project when added to other past, present, and reasonably foreseeable future actions. The proposed project will be evaluated along with reasonably foreseeable future actions within the study area to determine the potential for cumulative effects on wildlife resources for each alternative site.

Both alternative site study areas for the cumulative effects analyses have been defined to create a scale of reference and a study area boundary that encompasses all the defined reasonable and foreseeable actions. But the cumulative effects implications defined in this assessment for wildlife resources extend beyond the study area. Biota interchange and movement, habitat continuity and ecological scales recognize no such boundaries. So this assessment on wildlife resources will address cumulative effects that may extend beyond the study areas as well as those within it. For example, effects at the regional scales of wildlife population should be addressed, besides those at smaller scales or microhabitats that are located entirely within the study area boundary. Ignoring the effects that occur out side of the study area, despite the obvious and direct link or correlation with variables and effects that occur within the boundary would result in an incomplete study on the cumulative effects on wildlife resources.

Two distinct wildlife habitat settings will be analyzed; terrestrial, and aerial habitats. Terrestrial wildlife habitat settings will utilize the GIS GAP land cover classification data, the MNDNR Ecological Land Classification program codes, the MNDNR's *Action Plan for Wildlife* (MNDNR, 2006) habitat type classifications, and the wildlife travel corridor data and criteria determined in a previous cumulative effects analysis on wildlife (MNDNR, 2006) conducted in the region. Terrestrial wildlife habitat analysis will utilize larger mammals as species to measure effects on due to their motility and ability to disperse over measurable distances. Smaller vertebrates will be addressed strictly from a habitat loss, fragmentation and population change perspective, verses addressing travel corridors and migration that would be expected for the larger fauna. Terrestrial habitat and species analyses will address the following:

1. Direct cumulative habitat loss and fragmentation resulting from development of the project alternatives and the other reasonable/foreseeable actions to all species of terrestrial vertebrates.

2. Both direct and indirect cumulative effects on faunal populations resulting from development of the project and the other reasonable and foreseeable actions.

3. Potential effects on habitat continuity blocks through habitat loss or conversion and fragmentation within the study area boundaries.

4. Cumulative effects on large mammal populations and motilities at local and regional scales that are anticipated under the project alternatives and the reasonable/foreseeable actions.

The above referenced GAP data, previous MNDNR study, and the MNDNR data and guidance documents will be utilized for the terrestrial habitat analyses.

Aerial wildlife habitat and species analyses will address the following:

1. The potential for bird strikes resulting from construction of the facility and the reasonable and foreseeable actions.

2. Potential effects on seasonal migration patterns and populations of migratory birds.

Terrestrial Wildlife and Habitats

The aerial habitat study will mostly rely on existing parametric data and previous studies. The assessment of terrestrial wildlife species and habitats will be accomplished by the following methods.

Previous Conditions (Pre-settlement, or prior to 1900)

The previous conditions will be based on the MNDNR presettlement vegetative cover mapped through the use of land survey data, known as the Marshner map (Marschner, 1974). The Marschner map vegetative communities represent wildlife habitats that were present prior to European settlement, including those preceding any mining, timber harvesting, or other developments. **Figures 3** and **4** show the Marschner codes for both study areas respectively and reflect a mosaic of terrestrial upland and wetland habitats common to the region. Similarly, the GAP data in **Figures 5** and **6** show the same mosaic of habitats, largely influenced by timber practices and to a lesser degree mining.

Existing Conditions

The Marshner map being used for the previous condition is based on data collected long before satellite and GIS technologies developed. Today's land cover databases are developed from aerial imagery and ground level data, all combined with advances in wildlife habitat and ecological classifications developed in recent years. The most comparable to Marschner and useful land cover data for this study is the GAP land cover system. The GAP provides multiple layers of land cover data and the level or layer that is most similar in scale to the Marschner classifications will be considered and utilized for most of this study. Some of the higher level GAP land uses will also be used, in particular for determining direct habitat losses or when an important habitat element needs to be addressed. GAP data are shown in **Figures 5** and **6** for the West and East Range Site study areas respectively.

The GAP data will reflect and show all of the new developments and effects of land usess that have occurred since the data was collected in the 1870s for the Marschner map. This includes mines, roads, cities and towns, and larger scale land conversions (e.g. agricultural).

The GAP data does not provide extensive details on timber harvest related land use changes are not. To adequately assess the existing condition as it applies to the results of timber harvesting and management, other resources will be reviewed and utilized when applicable. The Generic EIS on the on Timber Harvesting and Forest Management in Minnesota (MNDNR, 1992) will be reviewed to identify the existing condition as it relates to the effects of timber harvesting on wildlife. Given the dynamic nature of timber production tracts, where they are subjected to harvesting on a rotational scale, this EIS study may yield the highest level of details possible for describing the existing conditions. This study may also be useful for the assessment for the foreseeable future conditions described in the next section.

Since the region is vegetated with an intact mosaic of terrestrial upland and wetland habitats and lakes, all natural cover is considered wildlife habitat for the purposes of this study. Habitat is extensive and prevalent among the land uses in the region, with qualitative variation. The only areas completely devoid of any element of suitable habitat are full built out industrial sites, intense developments, and active mines are considered poor or non-exsitent wildlife habitats. With that in mind, this should even be qualified further with an example. Federally threatened peregrine falcons (*Falco peregrinus*) nest on the emission stacks of power generating plants located in Cohasset and St. Paul, Minnesota. Technically, emission stacks provide nesting habitat for peregrine falcons. At the same time, the facility structure and impact footprint of these facilities may not provide much else for wildlife habitat, but they are important structures for an important single species of wildlife.

Foreseeable Future Conditions

The reasonable and foreseeable actions defined below will be merged into the GAP data and maps assembled for the existing conditions for future conditions scenario. The following table provides a summary of the projects considered reasonably foreseeable in each of the study areas. The potential effects of each project on existing wildlife resources was estimated using the existing conditions mapping described above and an assumed footprint of disturbance for each potential future project.

Table 1
Reasonably Foreseeable Future Actions

West Range Site Study Area	East Range Site Study Area
Minnesota Steel Industries	PolyMet Mining NorthMet Project
Nashwauk Gas Pipeline	Mesabi Nugget
Itasca County Highway 7 Realignment	St. Louis County – new roadway from Hoyt Lakes to Babbitt
Itasca County Railroad	

Results - Cumulative Effects Assessment

Terrestrial Wildlife and Habitats

Ecological Setting, Wildlife Habitats, and Wildlife Ecology Implications

Study considerations include a determination and description of the ecological conditions in the region (both East and West Range Study Areas), the arrangement of wildlife habitats, and wildlife behavioral and ecological factors that all establish the base condition for analyzing and describing the cumulative effects that are anticipated through the analysis. The GAP data, literature, and best professional judgments used in the analysis are also utilized to assemble this baseline condition.

The ***ecological setting*** of Northeast Minnesota including the Mesabi iron range formation is highly influenced by human land uses and practices relating to natural resources, primarily timber related activities and iron ore mining. The region is relatively undeveloped with a low percentage of permanent land use conversions and natural vegetative cover and surface water resources predominate the landscape level ecological community compositions

Although the GAP data is not consistent or compatible with or as detailed as the MNDNR defined vegetative community codes in the Ecological Classification System program (ECS), correlations between the two are fairly obvious and straightforward.

The GAP data layers were the base data used for the analysis and the ECS is utilized when discussing habitats and ecological implications on specific wildlife species or smaller scales.

Wildlife Habitat character is similar both within the study area and throughout the region. Nearly all of the upland forest habitat is second growth and much of it is subjected to timber harvesting. Timber harvesting tracts are influenced by parcel boundaries and harvesting cycles resulting in a mosaic patchwork of tracts ranging from recently clear cut to older growth stands that will be subjected to harvesting again in the near term. Many tracts of timber have been harvested several iterations over the past 120 years or less. Timber harvesting and management heavily influence and define the upland forest habitats in the region. Ecologically, timber harvesting is a source of disturbance, perturbations, and ecological succession of these habitats.

In the ECS, the communities defined as Fire Dependent Forest/Woodland (FP code prefixes) and Mesic Hardwood Forest (MH code) comprise the forested upland habitats in the study area and region. These ECS codes correlate with the Upland codes in the GAP database. Many of these are influenced again by timber harvesting and management, often altering the character of these vegetative communities. Large expanses of upland habitat are characterized with compositions of early successsional tree species, primarily aspen and birch species (*Populus, betula*) that are harvested before the next successional sere develops. With the ECS based on presettlement vegetative communities, the effects of timber harvesting have resulted in an upland forest that often does not fit neatly into any particular ECS code. The pure monotypic stands of quaking aspen (*P. tremula*) so prevalent throughout the region are the main example, there is no comparable ECS code for this community since it was not present prior to settlement. Again, this is why the GAP data is used for most of the analysis, it most consistently represents the habitats present today.

Permanent ***habitat fragmentation*** is also limited in the region compared to areas further south in the state. Agricultural conversions are sparse, rural development is limited, and urbanization is restricted to existing towns and small cities, with relatively slower growth than other regions. Mines, all of which are concentrated on an axis along the Iron Range, represent a permanent conversion except on abandoned mine land where natural cover has reestablished. Linear facilities, including transmission lines, roads, and utility corridors are also a permanent habitat conversion and agent of habitat fragmentation. Timber harvesting is not considered a fragmentation agent since these vegetative communities become reforested after the disturbance.

Compared to other settings where habitat fragmentation has been studied, the region and study area does not have extensive habitat fragmentation or conversion. For example, the Amazon rain forest setting where many fragmentation studies have occurred is a large region never disturbed anthropogenically that is being fragmented by wide scale land clearing and permanent conversion. Or the studies in Southern Illinois on the effects of fragmentation Neotropical migrants located in a highly agricultural landscape setting. Extensive agriculture has fragmented the once contiguous Eastern deciduous forest community into isolated patches or fragments of forest with bird assemblages that demonstrate the effects of fragmentation (Donovan et. al., 1995). In comparison, northeast Minnesota has extensive forested habitats frequently disturbed by timber harvesting with a relatively low amount of habitat that has been permanently converted. Because of this, fragmentation will focus on the habitats that are permanently converted or lost as a result of the reasonable and foreseeable actions.

Specific wildlife behaviors and ecologies should be recognized prior to making any interpretations on wildlife. The MNDNR 2006 wildlife cumulative effects analysis focuses on "***wildlife travel corridors***" in the main part of their analysis. But this study failed to define the species and justifications for designating such corridors. In particular, defining the species that have behaviors or autecologies requiring the presence of travel corridors as a key habitat element was not established. Compared to other parts of the world, Minnesota does not have any large terrestrial fauna that migrate or are dependent on fixed discrete travel corridors. The exception is the semi-migratory deer herd in the Cascade River watershed along the Lake Superior shore of the state (MNDNR, 2006). Habitats in the region are diffusely distributed and widespread geographically, as are the wildlife species present in the region. Larger mammals are also diffusely distributed and move freely throughout these habitats in a pattern defined by their biology, not geography or for some other extrinsic reason. For the larger, motile mammals with the ability to travel widely, types of habitat and habitat needs define species use and movement in the region, not the presence or absence of barriers, travel corridors, or habitat fragmentation.

The wildlife travel corridors identified in the MNDNR 2006 cumulative effects wildlife analysis were overlaid on the GAP data. These were then redefined and analyzed as ***habitat continuity blocks***. Other areas in the GAP data that were similar as undisturbed polygons of habitat, were also defined as such for discussion in the analysis. This reclassification removes the travel corridor element and replaces with a more ecologically meaningful unit where contiguous and contiguous undisturbed blocks of habitat are defined as the currency. This assumes that these areas provide key linkages for genetic interchange, refugia, and habitat connectivity.

Many smaller species of fauna in the region do have fixed, discrete travel corridors. For example, many reptiles and amphibians make seasonal movements that are habitat based. Aquatic turtles that make annual overland movements to the same upland breeding habitat is a good example. Because these are so numerous and little known, these small travel corridors were not addressed in the analysis. Instead, these small corridors are assumed as habitat losses when they are directly affected by an action. This accounts for all of the effects on the habitat, including the travel corridors when present.

Lastly within this framework, is the subject of ***habitat loss or permanent conversion*** defined as just that; the direct loss or conversion of habitat that will result from the construction of development of infrastructure or permanent fixed facilities. The impact footprint of each reasonable and foreseeable action has been cumulatively analyzed to establish the anticipated amount of total habitat loss and conversion.

West Range Site

Previous Conditions

Terrestrial Wildlife and Habitat

In the previous conditions (presettlement) there are no anthropogenically driven habitat fragmentation vectors or sources of habitat loss/conversion. Timber harvesting disturbances and perturbations were not present, and no mining had occurred.

Existing Conditions

Terrestrial Wildlife and Habitat

In the existing condition, all of the mine land features on the USGS maps shown in the **Figures 1** and **2** are present, as are the cities, towns, rural development, and linear right of ways including highways and utilities. The study area and surrounding region has been subjected to extensive timber harvesting.

Foreseeable Future Conditions

Terrestrial Wildlife and Habitat

The proposed Minnesota Steel Industry (MSI) project, the Mesaba Energy Project, the Nashwauk Gas Pipeline, Itasca County Highway 7 Realignment, and the Itasca County Railroad projects all define the Foreseeable Future Condition for evaluating the cumulative effects on terrestrial wildlife and habitat in the West Range Study Area.

Terrestrial acreages that will be ***habitat losses/conversions*** include ***1,708 acres*** of upland and wetland habitats resulting from the **Mesaba Energy Project**, and ***379 acres*** from the **MSI project**. Acres of impact are not known from the linear project including the Nashwauk Gas Pipeline, Itasca County Highway 7 Realignment Project, and the Itasca County Railroad Project. **Cumulatively** these projects combine to impact ***2,987 acres*** of terrestrial upland and wetland habitat found within the study area. **Existing Condition** wildlife habitat totals within the West Range Site study area is ***400,423 acres***. In the **Foreseeable Future Condition**, there will be an estimated ***397,436 acres*** of wildlife habitat remaining after the cumulative impacts defined in this study. This represents habitat conversions or direct losses resulting from reasonable and foreseeable actions.

These facilities also represent the new wildlife habitat barriers and fragmentation agents. More specifically, the Mesaba Energy Project Site is located directly north of a habitat continuity block delineated in the MNDNR study known as Wildlife Travel Corridor #2 (see **Figure 3**). In comparison, the MSI site is located mostly on the north side of active mine lands and the edge of Wildlife Travel Corridor #3 eastward of the Mesaba Energy footprint. The West Range Site of the Mesaba Energy Project will create permanent habitat loss, fragment habitat, and disrupt habitat continuity along the north side of Wildlife Travel Corridor #2. The MSI Project site will create permanent habitat loss and fragment habitat, and be a wildlife aversion/avoidance element located along the east side of Wildlife Travel Corridor #3.

Results Summary – West Range Site Study Area

1. The most measurable cumulative effects on terrestrial wildlife and their habitats that result from the reasonable and foreseeable actions in the West Range Site study area are direct habitat loss/conversion (2,987 Acres total) resulting from construction of the defined reasonable and foreseeable projects in the study area. The area of direct habitat loss also represents the extent of habitat fragmentation. Within the West Range Site study area 397,436 acres of wildlife habitat will remain after the cumulative effect.

2. The proposed West Range Site Alternative of the Mesaba Energy facility will be located above the Wildlife Travel Corridor #2 block delineated in the MNDNR study, reclassified as habitat continuity blocks in this study. Since portions of the Mesaba Project site will be permanent habitat losses, this represents a potential barrier to animal movement, habitat connectivity, and at smaller scales, genetic interchange. The MSI site is located on the east side of Wildlife Travel Corridor #3, but does not form a geographic barrier for the corridor or affect habitat continuity to the extent that is potential for the Mesaba Project. None of the other reasonable and foreseeable projects are anticipated to create barriers to the habitats continuity blocks within the study area.

3. Within the West Range Site study area, there is 400,427 acres of wildlife habitat mostly comprised of timber harvesting tracts, wetlands, and other natural vegetative cover. Cumulative total habitat losses resulting from the reasonable and foreseeable actions are 2,987 acres total. 397,436 acres total of wildlife habitat will remain within the study area after the cumulative effect. Wildlife Travel Corridor #2, relabeled as a habitat continuity block will be potentially disrupted on the north side by the habitat losses associated with the Mesaba Project site. Two additional habitat continuity blocks (Wildlife Travel Corridors #3 and #4) are also located in the study area that will not be affected.

East Range Site

Previous Conditions

Terrestrial Wildlife and Habitat

In the previous conditions (presettlement) there were no anthropogenically driven habitat fragmentation vectors or sources of habitat loss/conversion. Timber harvesting disturbances and perturbations were not present, and no mining had occurred.

Existing Conditions

Terrestrial Wildlife and Habitat

In the existing condition, all of the mine lands shown on the USGS map in **Figure 2** are present, as are the cities, towns, rural development, and linear right of ways including highways and utilities. The Laskin Power Plant is also present. The study area and surrounding region has been subjected to extensive timber harvesting.

Foreseeable Future Conditions

Terrestrial Wildlife and Habitat

The existing conditions, the proposed PolyMet Mining NorthMet Project, Mesabi Nugget Mine project, St. Louis County Road Project, and the Mesaba Energy Project, Phase II define the Foreseeable Future Condition for evaluating the cumulative effects on terrestrial wildlife and habitat in the East Range Study Area.

Terrestrial acreages that will be ***habitat losses/conversion*** include ***807 acres*** of upland and wetland habitats resulting from the **Mesaba Energy Project**, ***6,431 acres*** resulting from the **PolyMet Mining NorthMet Project**, and ***2,820 acres*** from the **Mesabi Nugget Project**. Estimates for the St. Louis County Road Project were not available. **Cumulatively** this yields ***10,058 acres*** total of habitat conversions or direct losses resulting from reasonable and foreseeable actions within the ***103,644 acres*** of wildlife habitat within the study area under the **Existing Condition**. In the **Future Condition**, ***100,824 acres*** of terrestrial wildlife habitat will remain after the cumulative effect. These facilities and the new linear transportation corridor also represent the new wildlife habitat barriers and fragmentation agents.

All four of the new reasonable and foreseeable projects are set amongst habitats that have been highly fragmented and converted by mining. The Mesaba Energy Project is geographically located south of and between two habitat continuity blocks (Wildlife Travel Corridors #10 and 11 shown on **Figure 4**). The PolyMet Mine project is located within existing mine lands south and west of a habitat continuity block (Wildlife Travel Corridor #12 shown on **Figure 4**). Mesabi Nugget is located on the north side of a habitat continuity black (Wildlife Habitat Block #9, **Figure 4**) and is entirely within mine lands. Of these three projects, the Mesaba Energy Project East Range Site will affect the most wildlife habitat. Despite being on mine lands, the PolyMet Mining NorthMet Project will also result in wildlife habitat losses and conversions.

Results Summary – East Range Site Study Area

1. The most measurable cumulative effects on terrestrial wildlife and their habitats that result from the reasonable and foreseeable actions in the East Range Site study area are direct habitat loss/conversion (2,820 Acres total) resulting from construction of the Mesaba Energy Project, the PolyMet Mining NorthMet Expansion Project, the Mesabi Nugget Project, and the St. Louis County Road Project. The area of direct habitat loss also represents the extent of habitat fragmentation.

2. The proposed East Range Site Alternative of the Mesaba Energy facility nor any of the other reasonable and foreseeable actions will not affect any of the four habitat continuity blocks located within the study area.

3. Within the East Range Site study area, there is 103,644 acres of terrestrial wildlife habitat in the Existing Condition comprised of mostly timber harvesting tracts, wetlands, mine lands, and other natural vegetative cover. Cumulative total habitat losses resulting from the reasonable and foreseeable actions are 2,820 acres and 100,824 acres of wildlife habitat will remain in the Future Foreseeable Condition after the cumulative effect.

Summary Comparison West Range and East Range Study Areas

The following comparisons and conclusions on terrestrial wildlife and habitat are based on the findings above:

1. The West Range study area with 400,423 acres of terrestrial wildlife habitat and the East Range study area at 103,644 acres of terrestrial wildlife habitat are located within the same ecological province known as the Laurentian Mixed Forest. Both study areas are similar located in the same type of setting with similar land uses and wildlife habitats.

2. Both study areas have and will continue to be influenced by timber harvesting.

3. Wildlife habitat loss/conversion totals expected from the reasonable and foreseeable projects are expected to be 2,987 acres cumulatively within the West Range Site and 2,820 acres cumulatively within the East Range Site study areas respectively.

4. There are four habitat continuity blocks within the West Range Site and one block (Wildlife Travel Corridor #2 shown in **Figure 3**) will be potentially affected by the Mesaba Energy Project. There are four habitat continuity blocks in the East Range Study area (**Figure 4**) and none are anticipated to be affected by the reasonable and foreseeable projects.

5. Regionally, the cumulative effects within both study areas are such that no effects on terrestrial species of fauna are anticipated besides direct habitat loss. Cumulative effects on wildlife and habitats within both study areas are anticipated to have negligible effects for the following reasons:

    a. There are no large mammal mass migrations or migration routes within the region or study areas. No disruption of wildlife migration of movement is anticipated as a result of the reasonable and foreseeable actions.

    b. Besides permanent habitat loss and conversion, fauna in the immediate areas near the reasonable and foreseeable actions defined may engage in aversion or avoidance behaviors of these facilities, an effect of habitat loss. With the extensive acreage of habitat expected to remain after these actions, these effects are anticipated to be negligible.

    c. The Mesabi Energy Project West Range Site may be a potential barrier located on the north side of a habitat continuity block, representing the only such effect from a reasonable and foreseeable action. Three other habitat continuity blocks will remain undisturbed in the West Range study area and none of the four habitat continuity blocks will be disturbed in the East Range study area. Effects on habitat continuity blocks are anticipated to be negligible due to the extensive amount of wildlife habitats that will remain after the reasonable and foreseeable actions are expected to occur.

Aerial Habitat and Migratory Birds

West Range Site

Previous Conditions

Aerial Habitat Effects

In the previous conditions, there were no aerial habitat obstructions present that were potential bird collision sources within the Swan River and Prairie River Watersheds, hereafter referred as the study area.

Existing Conditions

Aerial Habitat Effects

In the existing condition, there are no comparable existing aerial habitat obstructions present within the study area. Comparable obstructions are defined as emission stack towers, tall buildings, or other facilities of similar size and magnitude. There are six (6) antenna towers within the study area that are considered a risk for bird collisions and will be included in the evaluation.

Foreseeable Future Conditions

Aerial Habitat Effects

The existing condition six (6) antenna towers, the proposed Minnesota Steel Industry (MSI) project, and the Mesaba Energy Project, Phase II define the Foreseeable Future Condition for evaluating the cumulative effects aerial habitat obstructions on bird flight and aerial habitat.

Literature and Data

A review of the biological sciences literature and data sources confirmed that the majority of the studies and empirical data on bird collisions on stationary structures focused on collisions with radio towers, transmission lines, and windows on buildings. Tower lighting and other light producing structures also generated several studies and data sources. A common thread among these studies is the wide ranging variability of the mortality rates from one site or structure to another. Furthermore, different structures present differing types of mortality. For example, both the poles or towers and the wires produce collision related mortalities on birds on transmission projects. A large body of the bird strike literature addresses bird collisions with moving vehicles, primarily airplanes.

From a bird population perspective, mortality rates in these studies and data sources may number in the thousands, a small percentage of the millions or tens of millions of birds that migrate and have travel flight routes through the study areas of these respective sources. Ecological hypotheses in the literature often focus on addressing acute effects including disproportionate mortalities among certain species, age classes, or temporal periods. Such testing may show that bird collisions can be significant at the species level or during some ecologically driven process.

Lastly, many of these studies, particular those dealing with animal vehicle and bird strikes on airplanes are prevalent in the literature. These studies are conducted from a human safety perspective. Biological effects, if a concern, may often be secondary issues or data in these studies. Some exceptions include studies involving endangered species (e.g. Key deer, bald eagles) or species under some level of threat.

Adequate field sampling and monitoring are required to determine the full cumulative effects of these projects and facilities on bird flight and aerial habitat. Since there is little to no monitoring data results for bird collisions on existing power plant facilities in the Region or beyond and wide variation in the mortality data, calculating a known numerical effect is not possible nor realistic. Instead, this study recognizes the potential for impacts through review and evaluation of these known literature and data sources, followed by projections of potential cumulative effects on bird flight and aerial habitat.

Results – West Range Site Study Area Cumulative Effects on Bird Flight and Aerial Habitat

Data collected on bird collisions with stationary structures show some expected trends (Johnson et al., 2002). Seasonally there are pulses and peaks of collision mortality during the spring and fall migrations. Temporally, collisions peak during night time hours and decline during the day. Ecologically there are differences as well. Migrant passerines often have the highest rates or mortality, a variable driven by a couple of factors including; Passerines include the majority of the bird species found and most migratory birds; passerines are numerically the most abundant bird biomass; and passerines migrate at varying elevations that put them at higher risk for collisions. Behaviorally, certain bird species may be more prone to collisions with structures due to an attractant, mainly lighting. Larger and slower flight birds (e.g. cranes, herons, large raptors) often collide with transmission wires and support wires, another example of a behaviorally driven conflict.

Migrating warbler species often represent the largest numbers of the total passerine mortality in some antenna tower studies (Johnson et. al., Kemper, 1996) . Many authors speculate on and some have investigated the primary causative factors that include behavioral and ecological reason why warblers account for this, and others attempt to demonstrate that the warbler (or similar species) mortality is simply due to their high abundances (Yanagawa, 1999). Behavioral factors are often the sources of collisions with airplanes, for example when gulls or raptors use thermals putting them in zones of conflict and creating species specific disproportionate mortalities in the data.

Several studies on bird collisions with stationary structures have estimated bird mortality rates and the total number of birds in a flight path for comparison. Veltri and Klem (2005) studied the causes of death of birds that collided with antenna towers and windows. They recorded 247 tower confirmed tower collisions during a fall migratory season. The Johnson et.al. studies on bird collisions with wind turbine towers in southwest Minnesota conducted from 1996 to 1999 documented only 55 collision fatalities during this time frame resulting from 354 individual wind towers. After correction factors were applied, they estimated that total annual mortality from the entire project was 72 birds per year for Phase 1 and 314 birds for Phase 2. The radar data showed that an estimated 3.5 million birds migrate over the project each year.

Numerous studies and data gathering efforts have been conducted in the wind turbine study area of southwest Minnesota on elucidating species specific mortality differences and species significant mortalities from collisions with the stationary towers, some with surprising results. Johnson et. al. conducted studies to determine if there was a potential for disproportionate mortality from tower collisions among the raptors that both nest within and migrate through the wind tower study area. They encountered little to no mortalities of raptors, and none for Swainson's hawks (*Buteo swainsoni*) an uncommon species of hawk in Minnesota. During these and other studies, some noticeably high mortalities were actually observed for a species of bat that migrates seasonally through the wind tower (Kolford, 2005) and bird mortalities were relatively low.

The wind tower study area in southwest Minnesota also sheds important insight into the potential importance of setting and topography. The wind tower setting is geologically and geographically similar to Mesabi Iron Range settings of both the West Range and East Range sites. The Iron Range is essentially comprised of a linear northeast/southwest trending ridge, many miles in length that crosses the north-south migration route on a right angle. The wind tower study area is located on the Coteau des Prairie and on the highest ridge of the Coteau that is known locally as Buffalo Ridge, trending for hundreds of miles on a northwest-southeast axis. Both the Iron Range and Buffalo Ridge are linear ridgelines that are as high as 2,100 feet above sea level and are some of the most prominent relief features in the state.

Studies on radio towers have yielded various results. A particular long term study of radio tower bird mortality in Wisconsin (Kemper, 1996) was conducted between 1957 through 1995 counted 121,560 birds comprising 123 species. During this 38 year period, it was estimated that 2 million birds were flying through the study area annually. Radio antenna tower design and lighting may be a source for the higher mortalities compared to the wind tower studies. Birds may be attracted to the warning light beacons on the towers and also colliding with the numerous guy wires and supporting structures in addition to the tower structure itself. Note that the numbers of dead birds are from a long term sample as well.

Besides these previous examples, other studies focus on the behavioral aspects and visual cues that result in bird collisions with structures. Behavioral aspects primarily focus on windows where birds will strike a window in reaction to a reflective image or perceptions that a there are no obstructions. Visual cues apply more often to power lines or other fine structures that need to be more visible to prevent collisions. Neither of these types of studies are relevant to this discussion.

Within the West Range Site study area, two proposed obstructions will be constructed under the future conditions, including the Mesaba Energy Project and the Minnesota Steel Industry facilities. Despite the absence of previous studies or numerical data on power plant towers effects on birds, some general conclusions can be made from the other studies and data.

1. Both structures will cause annual mortality of migrating birds as the results of collisions with the structures, and both are aerial habitat obstructions. Bird mortality will likely be seasonal, with the highest rates occurring during the spring and fall migration periods. The wind tower studies in southwest Minnesota suggest that mortalities may be numerically low or non-existent for some species despite both study areas being located in similar geological/geographical settings.

2. Due to the nature of radio towers and based on previous studies, it is expected the bird mortalities will be highest at the six (6) antenna towers and lowest at the MSI and Mesaba facilities located within the West Range study area.

3. Most species specific bird mortalities occur from conflicts with transportation modes and power transmission lines. Collisions with the antenna towers and facilities structures will likely not be species specific and will mostly be comprised of migrating passerines, possibly warblers, vireos, and other neotropical migrants.

4. The potential bird collision mortality rates at both structures could vary widely between sites, annually, or could be very low to non-existent. Long term monitoring will be necessary after construction of these facilities to determine the effects on birds and the significance of mortality.

5. Migratory birds that will fly over and through the study area will number in the millions annually. Even if bird collision mortality rates for cumulatively reach the thousands, additional studies are necessary to determine if and what level of mortality is considered significant. These include studies conducted and data gathered elsewhere. Mortality rates from other sources are far greater then those caused by collisions with stationary objects, and those in themselves are not considered significant (Janss, 1997) impacts on species populations in most cases.

6. Based on the findings summarized in 1 – 5, the following assessment statement is provided;

   Within the West Range Site study area, cumulative effects will occur on aerial habitat and bird migration as a result of the reasonable and foreseeable actions defined within the study area. Based on previous studies and existing data on the subject of bird collisions, the cumulative effect will be assumed to be bird mortality resulting from collisions with fixed stationary structures defined as the reasonable and foreseeable actions in the study area. Previous studies and data suggest that bird mortality rates that are the result of these collisions will be insignificant on bird populations within or migrating through the West Range Site study area, but future studies are needed to further support this finding. Future studies should *evaluate the cumulative effects on higher scales including regionally and globally, and measure against the cumulative effects of actions that extend beyond the West Range Site study area. It's anticipated that mortalities will be highest for neotropical migrants, mostly passerines and these should be the focus of future studies involving power generating facilities similar to the two proposed within the West Range Site study area.*

East Range Site

Previous Conditions

Aerial Habitat Effects

In the previous conditions, there were no aerial habitat obstructions present that were potential bird collision sources within the Partridge River Watershed hereafter referred as the study area.

Existing Conditions

Aerial Habitat Effects

In the existing condition, the Laskin Energy Center and the three (3) antenna towers within the study area are considered a risk for bird collisions and will be included in the evaluation.

Foreseeable Future Conditions

Aerial Habitat Effects

The three (3) existing condition antenna towers, Laskin Energy Center, the proposed Mesabi Nugget project, proposed PolyMet Mine Expansion project, and the Mesaba Energy Project, Phase II define the Foreseeable Future Condition for evaluating the cumulative effects aerial habitat obstructions on bird flight and aerial habitat in the East Range Site study area.

Literature and Data

A review of the biological sciences literature and data sources confirmed that the majority of the studies and empirical data on bird collisions on stationary structures focused on collisions with radio towers, transmission lines, and windows on buildings. Tower lighting and other light producing structures also generated several studies and data sources. A common thread among these studies is the wide ranging variability of the mortality rates from one site or structure to another. Furthermore, different structures present differing types of mortality. For example, both the poles or towers and the wires produce collision related mortalities on birds on transmission projects. A large body of the bird strike literature addresses bird collisions with moving vehicles, primarily airplanes.

From a bird population perspective, mortality rates in these studies and data sources may number in the thousands, a small percentage of the millions or tens of millions of birds that migrate and have travel flight routes through the study areas of these respective sources. Ecological hypotheses in the literature often focus on addressing acute effects including disproportionate mortalities among certain species, age classes, or temporal periods. Such testing may show that bird collisions can be significant at the species level or during some ecologically driven process.

Lastly, many of these studies, particular those dealing with animal vehicle and bird strikes on airplanes are prevalent in the literature. These studies are conducted from a human safety perspective. Biological effects, if a concern, may often be secondary issues or data in these studies. Some exceptions include studies involving endangered species (e.g. Key deer, bald eagles) or species under some level of threat.

Adequate field sampling and monitoring are required to determine the full cumulative effects of these projects and facilities on bird flight and aerial habitat. Since there is little to no monitoring data results for bird collisions on existing power plant facilities in the Region or beyond and wide variation in the mortality data, calculating a known numerical effect is not possible nor realistic. Instead, this study recognizes the potential for impacts through review and evaluation of these known literature and data sources, followed by projections of potential cumulative effects on bird flight and aerial habitat.

Results – East Range Site Study Area Cumulative Effects on Bird Flight and Aerial Habitat

Data collected on bird collisions with stationary structures show some expected trends (Johnson et al., 2002). Seasonally there are pulses and peaks of collision mortality during the spring and fall migrations. Temporally, collisions peak during night time hours and decline during the day. Ecologically there are differences as well. Migrant passerines often have the highest rates or mortality, a variable driven by a couple of factors including; Passerines include the majority of the bird species found and most migratory birds; passerines are numerically the most abundant bird biomass; and passerines migrate at varying elevations that put them at higher risk for collisions. Behaviorally, certain bird species may be more prone to collisions with structures due to an attractant, mainly lighting. Larger and slower flight birds (e.g. cranes, herons, large raptors) often collide with transmission wires and support wires, another example of a behaviorally driven conflict.

Migrating warbler species often represent the largest numbers of the total passerine mortality in some radio tower studies (Johnson et. al., Kemper, 1996). Many authors speculate on and some have investigated the primary causative factors that include behavioral and ecological reason why warblers account for this, and others attempt to demonstrate that the warbler mortality is simply due to their high abundances (Yanagawa, 1999). Behavioral factors are often the sources of collisions with airplanes, for example when gulls or raptors use thermals putting them in zones of conflict and creating species specific disproportionate mortalities in the data.

Several studies on bird collisions with stationary structures have estimated bird mortality rates and the total number of birds in a flight path for comparison. Veltri and Klem (2005) studied the causes of death of birds that collided with radio towers and windows. They recorded 247 tower confirmed tower collisions during a fall migratory season. Studies on bird collisions with wind turbine towers in southwest Minnesota (Johnson, et.al, 2002) were conducted from 1996 to 1999 documented only 55 collision fatalities during this time frame resulting from 354 individual wind towers. After correction factors were applied, they estimated that total annual mortality from the entire project was 72 birds per year for Phase 1 and 314 birds for Phase 2. The radar data showed that an estimated 3.5 million birds migrate over the project each year.

Numerous studies and data gathering efforts have been conducted in the wind turbine study area of southwest Minnesota on elucidating species specific mortality differences and species significant mortalities from collisions with the stationary towers, some with surprising results. Johnson et. al conducted studies to determine if there was a potential for disproportionate mortality from tower collisions among the raptors that both nest within and migrate through the wind tower study area. They encountered little to no mortalities of raptors, and none for Swainson's hawks (*Buteo swainsoni*) an uncommon species of hawk in Minnesota. During these and other studies, some noticeably high mortalities were actually observed for a species of bat that migrates seasonally through the wind tower and bird mortalities were relatively low.

The wind tower study area in southwest Minnesota also sheds important insight into the potential importance of setting and topography. The wind tower setting is geologically and geographically similar to Mesabi Iron Range settings of both the West Range and East Range sites. The Iron Range is essentially comprised of a linear northeast/southwest trending ridge, many miles in length that crosses the north-south migration route on a right angle. The wind tower study area is located on the Coteau des Prairie and on the highest ridge of the Coteau that is known locally as Buffalo Ridge, trending for hundreds of miles on a northwest-southeast axis. Both the Iron Range and Buffalo Ridge are linear ridgelines that are as high as 2,100 feet above sea level and are some of the most prominent relief features in the state.

Studies on radio towers have yielded various results. A particular long term study of radio tower bird mortality in Wisconsin (Kemper, 1996) was conducted between 1957 through 1995 counted 121,560 birds comprising 123 species. During this 38 year period, it was estimated that 2 million birds were flying through the study area annually. Radio tower design and lighting may be a source for the higher mortalities compared to the wind tower studies. Birds may be attracted to the warning light beacons on the towers and also colliding with the numerous guy wires and supporting structures in addition to the tower structure itself. Note that the numbers of dead birds are from a long term sample as well.

Besides these previous examples, other studies focus on the behavioral aspects and visual cues that results in bird collisions with structures. Behavioral aspects primarily focus on windows where birds will strike a window in reaction to a reflective image or perceptions that a there are no obstructions. Visual cues apply more often to power lines or other fine structures that need to be more visible to prevent collisions. Neither of these types of studies are relevant to this discussion.

Within the East Range Site study area, three new proposed obstructions will be constructed under the future conditions; the Mesaba Energy Project, PoyMet Mine facilities, and Mesabi nugget facilities. The existing Laskin Energy Center and proposed Mesabi Energy facilities are the most similar, and the PolyMet and Mesabi Nugget projects may not have significant or similar obstructions projected into the aerial flight paths of birds. Despite the absence of previous studies or numerical data on power plant towers effects on birds, some general conclusions can be made from the other studies and data.

1 At least two of the reasonable and foreseeable actions defined within the East Range study area will cause annual mortality of migrating birds as the results of collisions with the structures. The Laskin Power Plant and the Mesaba Energy project are the two actions that include or will include aerial habitat obstructions. Bird mortality will likely be seasonal, with the highest rates occurring during the spring and fall migration periods. The wind tower studies in southwest Minnesota suggest that mortalities may be numerically low or non-existent for some species despite both study areas being located in similar geological/geographical settings.

2 Due to the nature of radio towers and based on previous studies, it is expected the bird mortalities will be highest at the three (3) antenna towers and lowest at the Laskin and Mesaba facilities located within the East Range study area.

3 Most species specific bird mortalities occur from conflicts with transportation modes and power transmission lines. Collisions with the radio towers and facilities structures will likely not be species specific and will mostly be comprised of migrating passerines, possibly warblers, vireos, and other neotropical migrants.

4. The potential bird collision mortality rates at both the Laskin and Mesaba facilities could vary widely between sites, annually, or could be very low to non-existent. Long term monitoring will be necessary after construction of these and other facilities will be needed to determine the effects on birds and the significance of mortality.

5. Migratory birds that will fly over and through the study area will number in the millions annually. Even if bird collision mortality rates cumulatively reach the thousands, additional studies are necessary to determine if and what level of mortality is considered significant. These include studies conducted and data gathered elsewhere. Mortality rates from other sources are far greater then those caused by collisions with stationary objects, and those in themselves are not considered significant (Janss, 2000) impacts on species populations in most cases.

6. Based on the findings summarized in 1 – 5, the following assessment statement is provided;

> *Within the East Range Site study area, cumulative effects will occur on aerial habitat and bird migration as a result of the reasonable and foreseeable actions defined within the study area. Based on previous studies and existing data on the subject of bird collisions, the cumulative effect will be assumed to be bird mortality resulting from collisions with fixed stationary structures defined as the reasonable and foreseeable actions in the study area. Previous studies and data suggest that bird mortality rates that are the result*

of these collisions will be insignificant on bird populations within or migrating through the East Range Site study area, but future studies are needed to further support this finding. Future studies should evaluate the cumulative effects on higher scales including regionally and globally, and measure against the cumulative effects of actions that extend beyond the East Range Site study area. It's anticipated that mortalities will be highest for neotropical migrants, mostly passerines and these should be the focus of future studies involving power generating facilities similar to the two proposed within the East Range Site study area.

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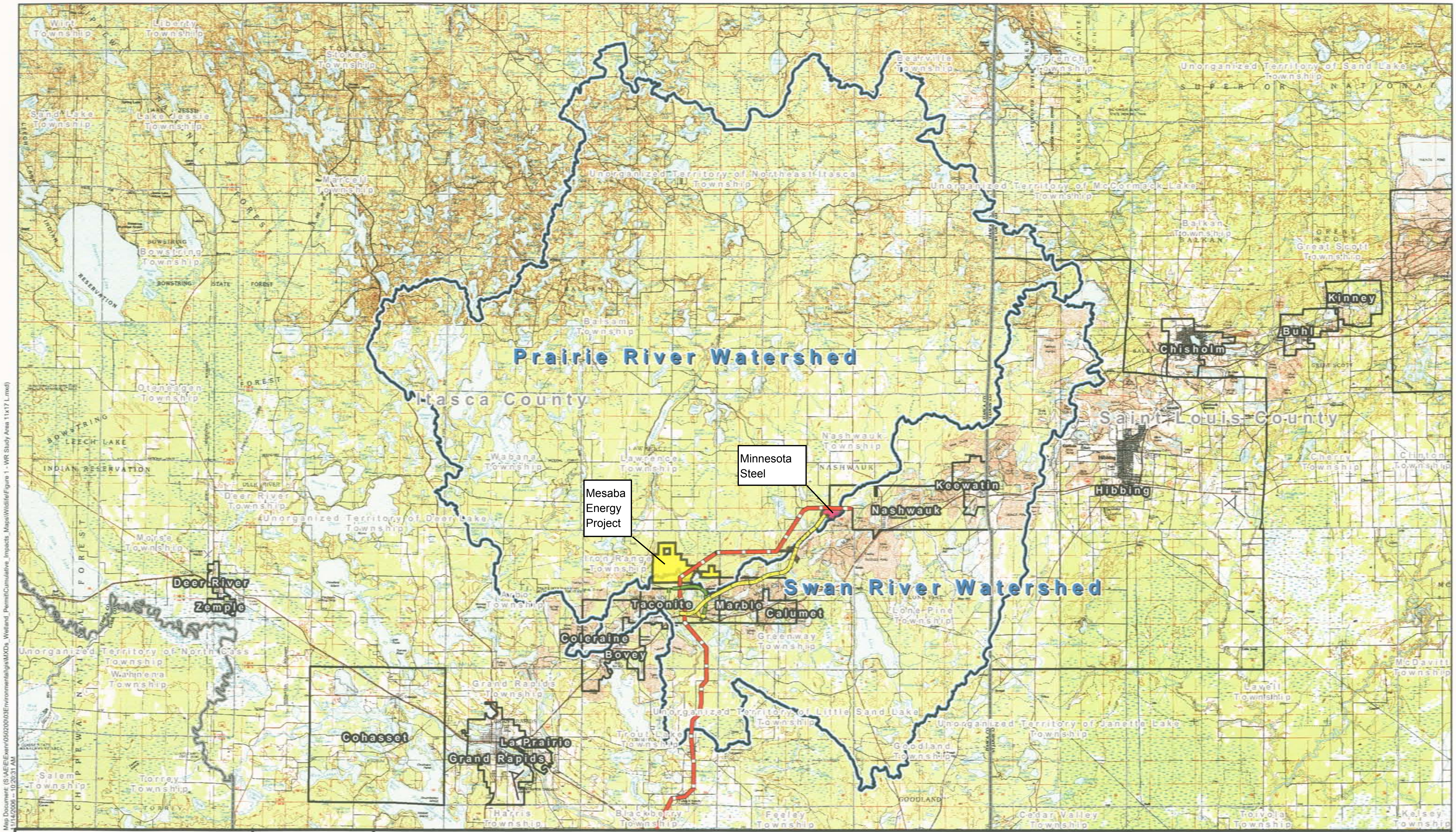
List of Figures



Excelsior Energy Inc.

Mesaba Energy Project

Energy, Innovation, and Economic Development for Minnesota

West Range

November 2006

Legend

- Swan River Watershed
- Prairie River Watershed

Reasonable and Foreseeable Actions

- Excelsior Energy West Range Site
- MN Steel DRI Plant Site
- Nashwauk Gas Pipeline
- Itasca County Road 7 Realignment
- Itasca County Rail Alignment
- Municipal Boundaries
- Civil Township Boundaries
- County Boundary

Source: USGS, USFWS, MNDNR, Mn/DOT, Excelsior Energy, MN Steel, City of Nashwauk and SEH.

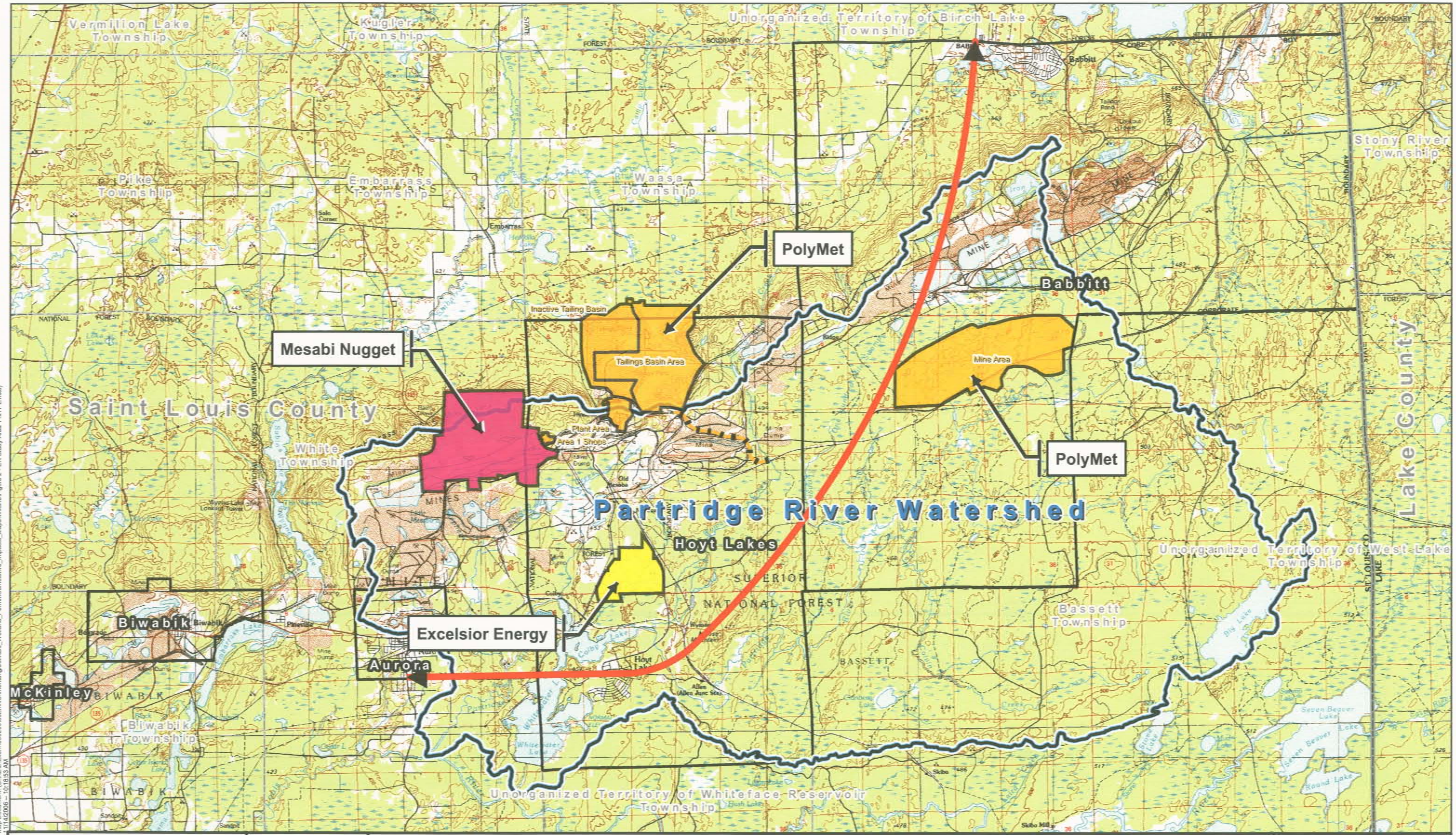
Figure 1

West Range Study Area

UTM, Zone 15, Meters
NAD83

N W E S

0 5 Miles



Excelsior Energy Inc. Mesaba Energy Project Energy, Innovation, and Economic Development for Minnesota	East Range November 2006	Legend	Figure 2 East Range Study Area

Legend — Reasonable and Foreseeable Actions

- Partridge River Watershed
- Excelsior Energy East Range Site
- Mesabi Nugget Plant Site
- PolyMet Sites
- PolyMet Rail Construction
- St. Louis County New Hoyt Lakes to Babbitt Connection
- Municipal Boundaries
- Civil Township Boundaries
- County Boundary

Source: USGS, USFWS, MNDNR, Mn/DOT, Excelsior Energy, and SEH.
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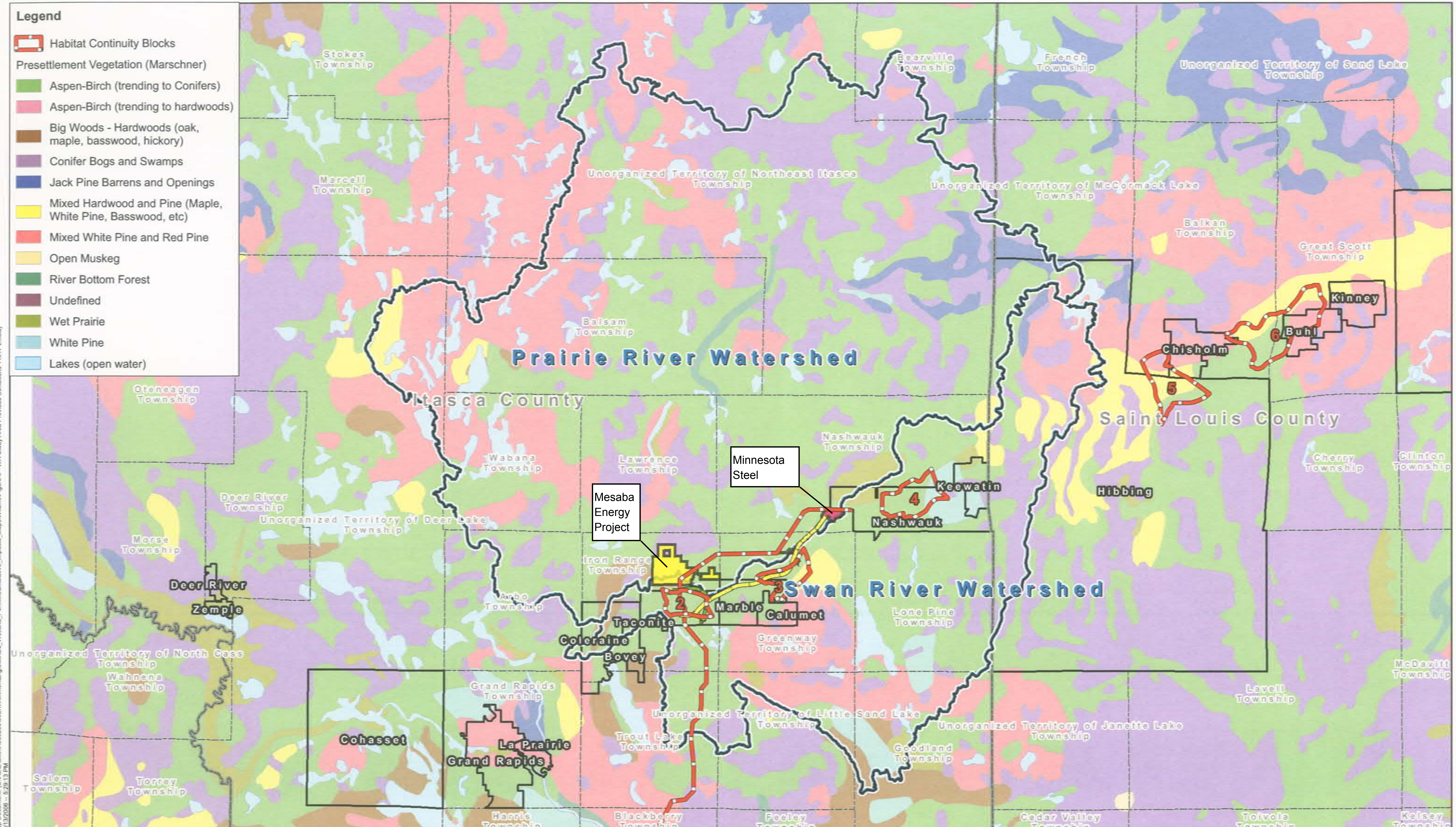
UTM, Zone 15, Meters NAD83

N E S W

0 2 Miles



Excelsior Energy Inc.

Mesaba Energy Project

Energy, Innovation, and Economic Development for Minnesota

West Range

November 2006

Legend

Reasonable and Foreseeable Actions

- Swan River Watershed
- Prairie River Watershed
- Excelsior Energy West Range Site
- MN Steel DRI Plant Site
- Nashwauk Gas Pipeline
- Itasca County Road 7 Realignment
- Itasca County Rail Alignment
- Municipal Boundaries
- Civil Township Boundaries
- County Boundary

Source: USGS, USFWS, MNDNR, Mn/DOT, Excelsior Energy, MN Steel, City of Nashwauk and SEH.
© 2006 SEH

Figure 3

West Range Study Area Previous Conditions

UTM, Zone 15, Meters
NAD83

N
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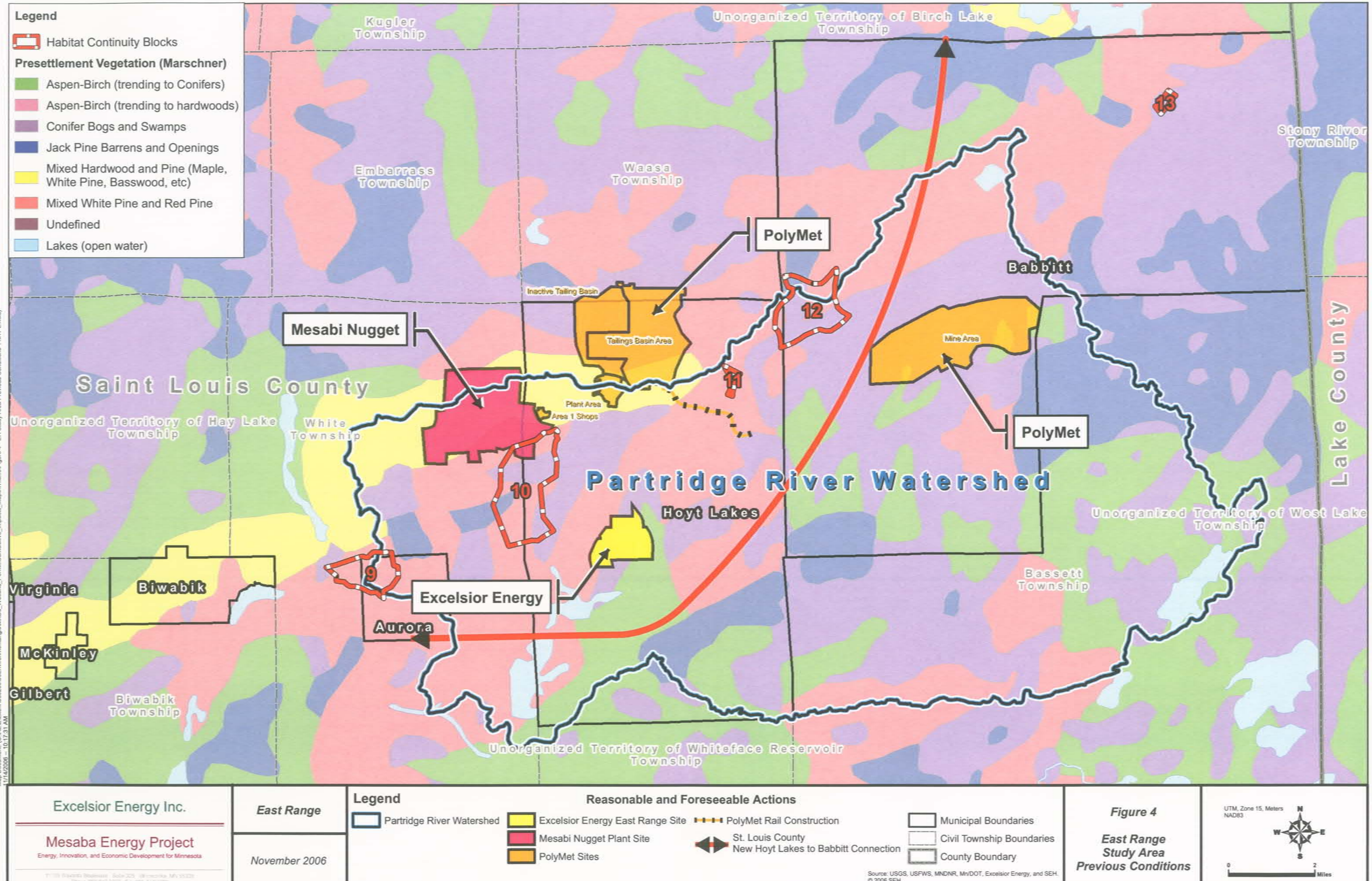
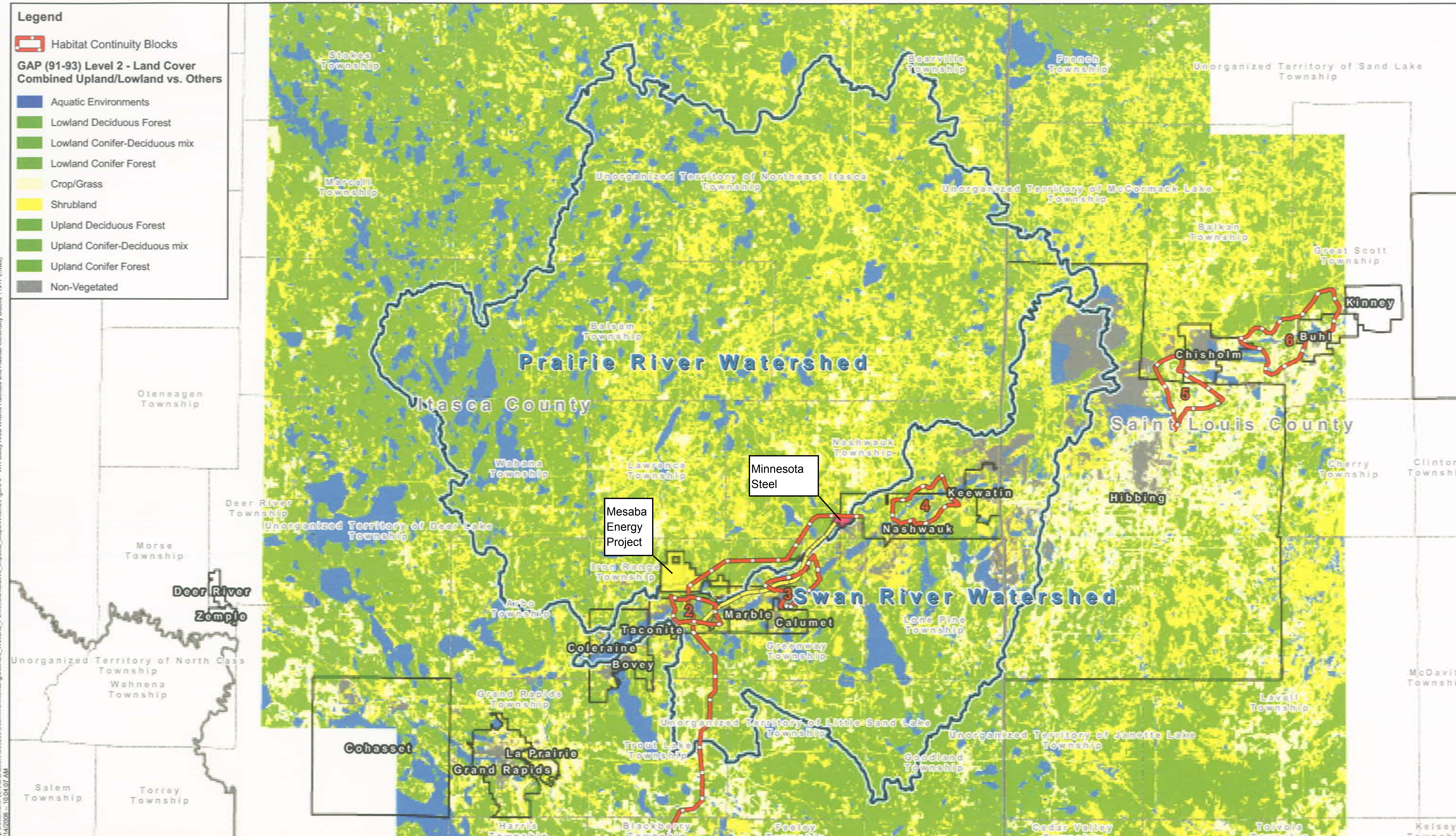
Miles



Legend
Habitat Continuity Blocks
Presettlement Vegetation (Marschner)
Aspen-Birch (trending to Conifers)
Aspen-Birch (trending to hardwoods)
Conifer Bogs and Swamps
Jack Pine Barrens and Openings
Mixed Hardwood and Pine (Maple, White Pine, Basswood, etc)
Mixed White Pine and Red Pine
Undefined
Lakes (open water)
Kugler Township
Unorganized Territory of Birch Lake Township
Embarrass Township
Waasa Township
Stony River Township
PolyMet
Babbitt
Inactive Tailing Basin
Tailings Basin Area
Mine Area
Mesabi Nugget
Saint Louis County
Lake County
Unorganized Territory of Hay Lake Township
White Township
Plant Area
Area 1 Shops
PolyMet
Partridge River Watershed
Hoyt Lakes
Unorganized Territory of West Lake Township
Bassett Township
Virginia
Biwabik
Excelsior Energy
Aurora
McKinley
Gilbert
Biwabik Township
Unorganized Territory of Whiteface Reservoir Township
9
10
11
12
13
Excelsior Energy Inc.
Mesaba Energy Project
Energy, Innovation, and Economic Development for Minnesota
East Range
November 2006
Legend
Reasonable and Foreseeable Actions
Partridge River Watershed
Excelsior Energy East Range Site
Mesabi Nugget Plant Site
PolyMet Sites
PolyMet Rail Construction
St. Louis County New Hoyt Lakes to Babbitt Connection
Municipal Boundaries
Civil Township Boundaries
County Boundary
Source: USGS, USFWS, MNDNR, Mn/DOT, Excelsior Energy, and SEH.
© 2006 SEH
Figure 4
East Range Study Area Previous Conditions
UTM, Zone 15, Meters NAD83
N
W
E
S
0
2
Miles



Map Document: (S:\AE\E\Exen\0502000\3Environmental\gis\MXDs_Wetland_Permit\Cumulative_Impacts_Maps\Wildlife\Figure 5 - WR Study Area Wildlife Habitats and Habitat Continuity Blocks 11x17 L.mxd) 11/14/2006 -- 10:04:07 AM

Excelsior Energy Inc.

Mesaba Energy Project

Energy, Innovation, and Economic Development for Minnesota

West Range

November 2006

Legend — **Reasonable and Foreseeable Actions**

- Swan River Watershed
- Prairie River Watershed
- Excelsior Energy West Range Site
- MN Steel DRI Plant Site
- Nashwauk Gas Pipeline
- Itasca County Road 7 Realignment
- Itasca County Rail Alignment
- Municipal Boundaries
- Civil Township Boundaries
- County Boundary

Source: USGS, USFWS, MNDNR, Mn/DOT, Excelsior Energy, MN Steel, City of Nashwauk and SEH.
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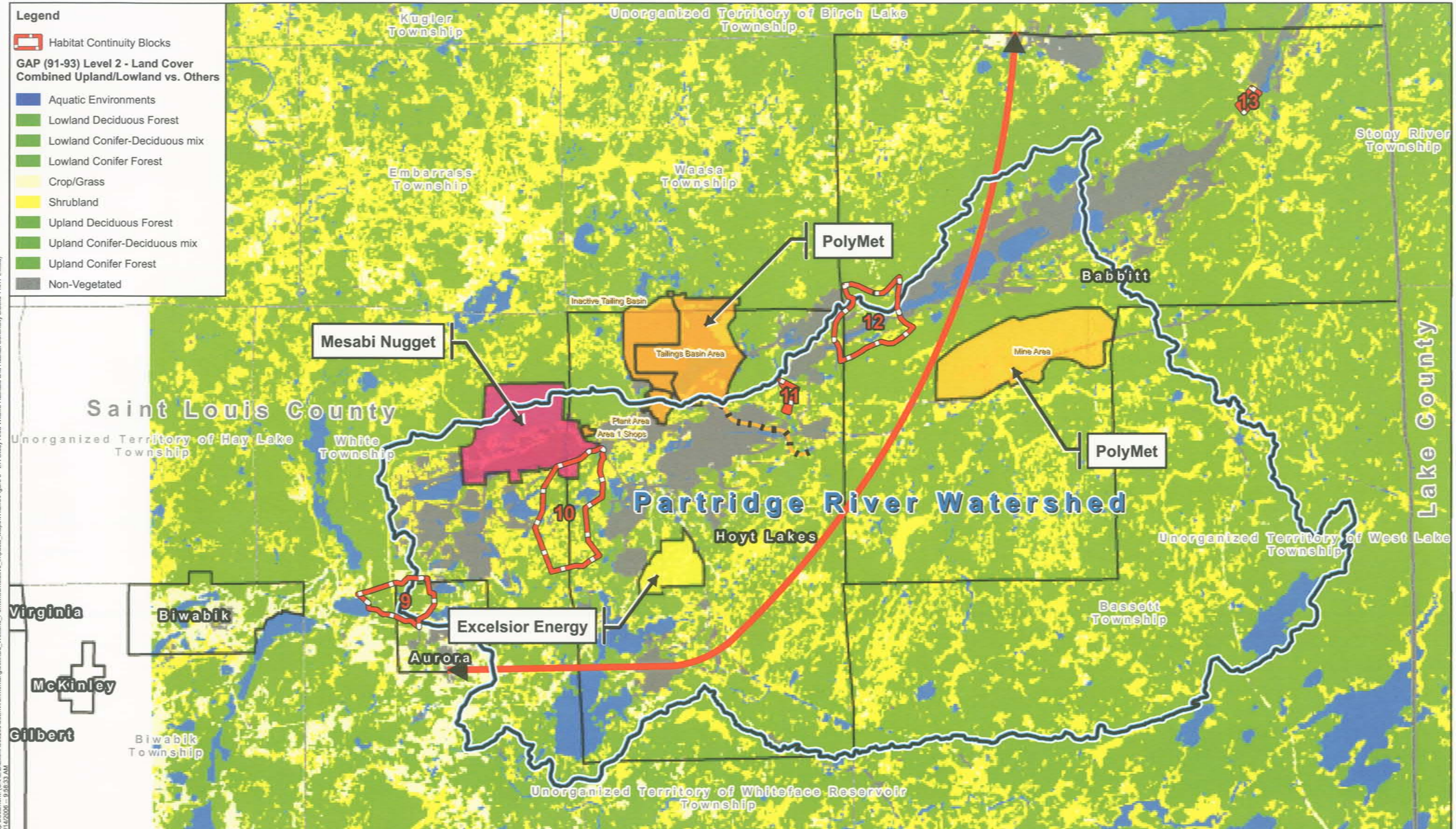
Figure 5

West Range Study Area and Wildlife Habitats and Habitat Continuity Blocks

UTM, Zone 15, Meters
NAD83

N W E S

0 5 Miles



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Energy, Innovation, and Economic Development for Minnesota

East Range

November 2006

Legend

Partridge River Watershed

Reasonable and Foreseeable Actions

Excelsior Energy East Range Site

Mesabi Nugget Plant Site

PolyMet Sites

PolyMet Rail Construction

St. Louis County New Hoyt Lakes to Babbitt Connection

Municipal Boundaries

Civil Township Boundaries

County Boundary

Source: USGS, USFWS, MNDNR, Mn/DOT, Excelsior Energy, and SEH.
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Figure 6

East Range Study Area and Wildlife Habitats and Habitat Continuity Blocks

UTM, Zone 15, Meters
NAD83

N W E S

0 2 Miles

APPENDIX D6
Rail Traffic

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East Range

Current traffic: **12 trains/day** on the DMIR line

Mesabi Nugget (Module 1):

Product hauled away on private line, do not consider for MEP cumulative impacts
400,000 tpy western coal, 150,000 tpy limestone on DMIR line
Assume 119 tons/car and 115 cars/train, train returns empty
Added traffic: 82 trains/yr → **2 trains/day** (maximum; same for 3 modules as 1)

PolyMet:

Two 30-car trains/wk for limestone → **2 trains/day** maximum

Mesaba One and Two would need a maximum of 4 trains/day (for all cases here, a round trip is considered 2 trains/day). The maximum cumulative train traffic on this line is 20 trains/day, and it is clear from the calculations above that this is a conservative estimate.

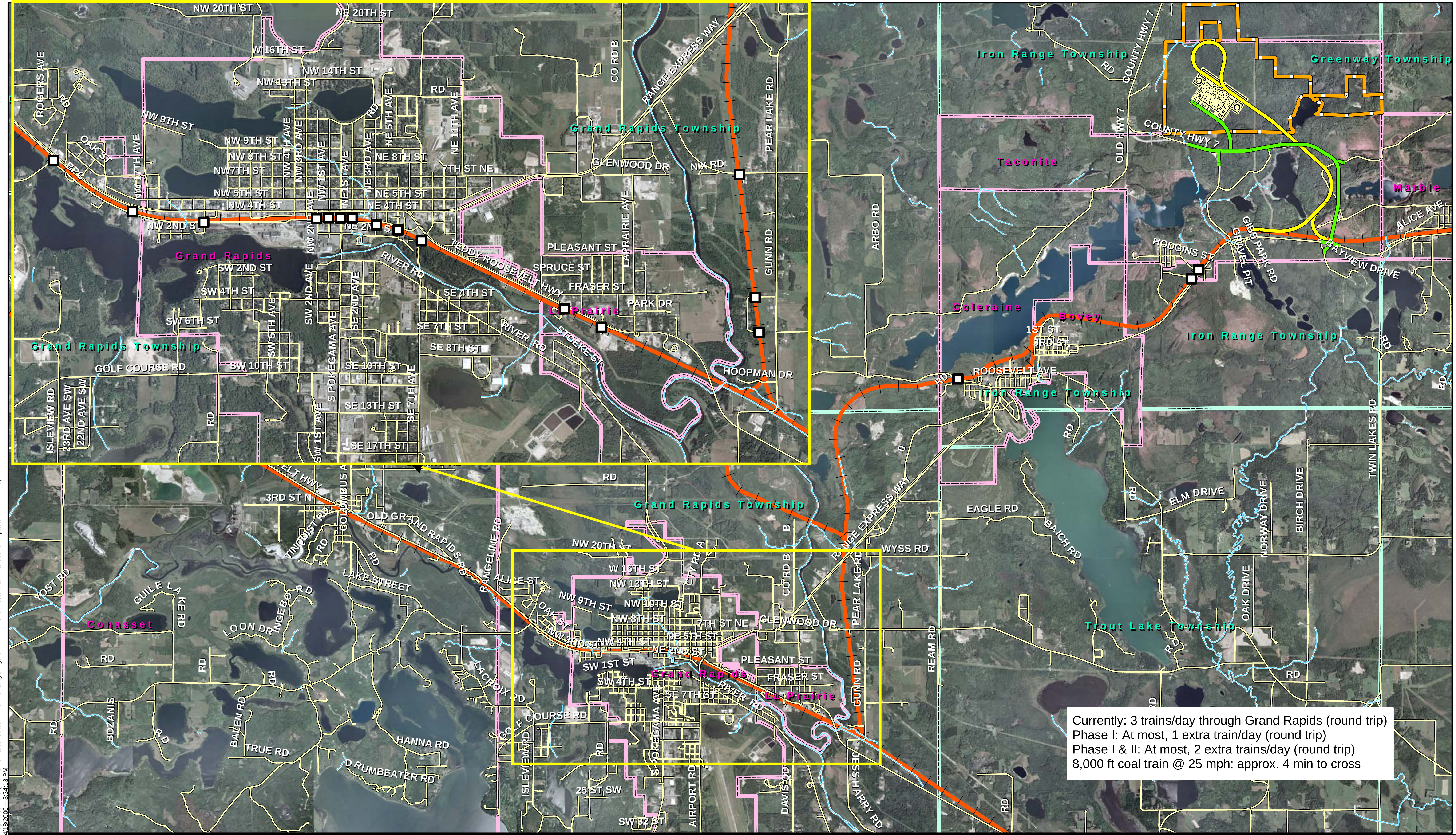
West Range

Rail traffic impacts in Grand Rapids have already been addressed in the permit applications, so I will focus on the segment of rail between Gunn, MN and the proposed site. It is currently inoperable due to rising water levels in the Canisteo Mine Pit, which have weakened the support along the section of track near Bovey, MN. Restoration of service to the line will require dropping of the water levels significantly, followed by reinforcement of the bank along which the rail travels. This has been anticipated, as the permit application describes lowering the water level before plant operation begins. Until this restoration occurs, train traffic from the west to the plant site must be routed south-east to Cloquet, then north and back west by Nashwauk to the plant site.

Current traffic: 0 trains/day now, 4 trains/day 90's-2001, much higher traffic in the 70's

MSI: The local train from Grand Rapids to Superior, WI would likely resume, with up to **4 trains/day**. This could accommodate MSI's needs of 70-90 cars per day (10 incoming, the balance outgoing).

Mesaba One and Two would need a maximum of 4 trains/day, so the maximum cumulative train traffic expected would be 8 trains/day on the segment identified above.



Currently: 3 trains/day through Grand Rapids (round trip)
Phase I: At most, 1 extra train/day (round trip)
Phase I & II: At most, 2 extra trains/day (round trip)
8,000 ft coal train @ 25 mph: approx. 4 min to cross

Map Document: (X:\AE\Exen\050200\03Environmental\gis\Figure 2.7-1 WR Site Wetland and Landcover Impacts 11x17 L.mxd) 4/18/2006 -- 3:34:13 PM

Excelsior Energy Inc.

Mesaba Energy Project

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Phone 952.847.2360 Fax 952.847.2373

West Range Site

July 2006

Legend

- Footprint and Buffer Land
- Plant Layout
- Proposed Roads
- Rail Alt 1-A
- Geographic Names
- Municipal Boundaries
- Civil Township
- Existing Roads
- Existing Railroads
- Streams
- Railroad Crossings (excludes bridges)

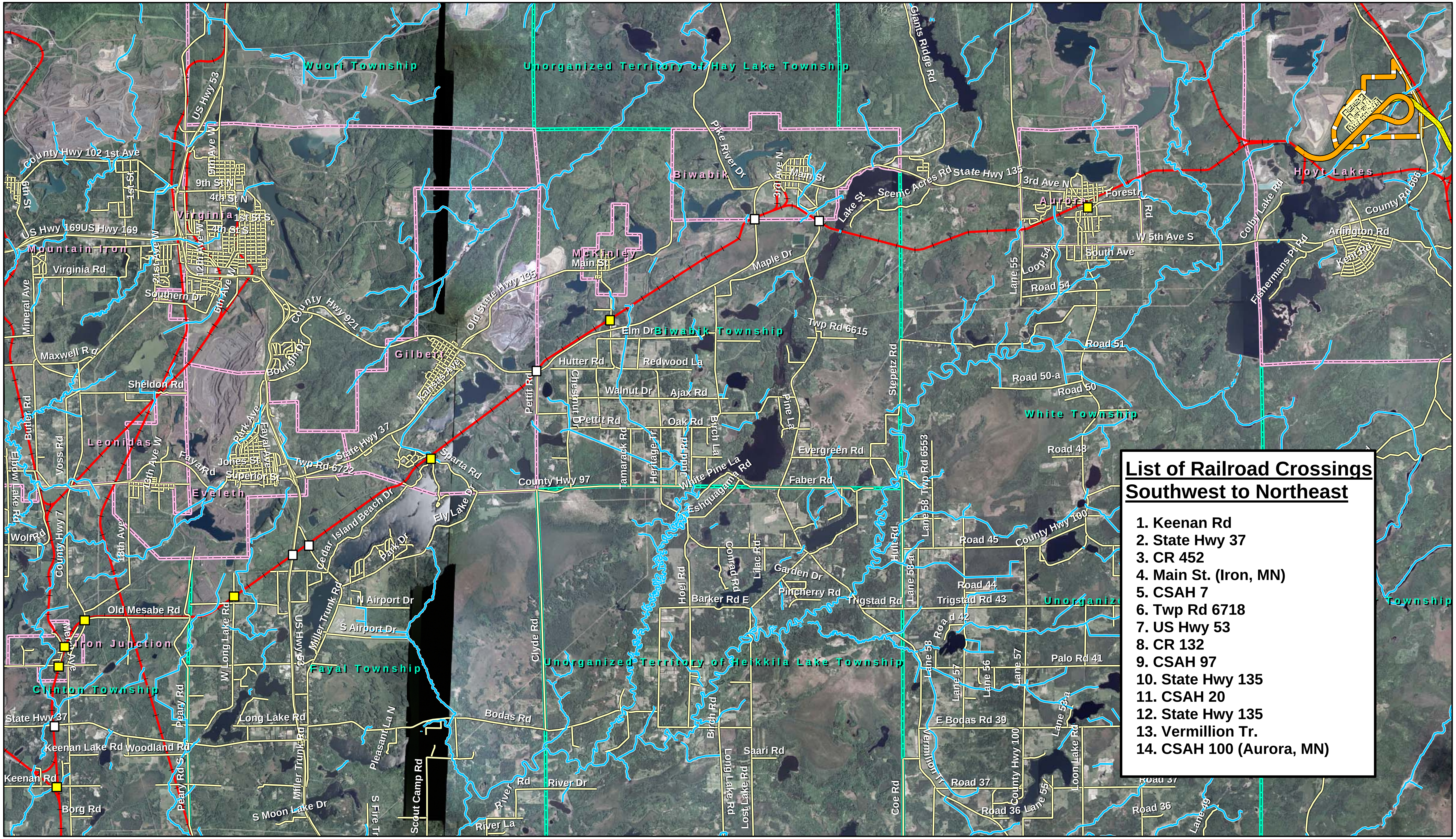
Source: Itasca County, MNDNR, Mn/DOT, USGS, Fluor, Excelsior Energy, and SEH.

Railroad Crossings

Itasca County - South Coordinate System

N E S W

0 2,000 Feet



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PHONE 952.847.2360 FAX 952.847.2373

East Range

September 2006

Legend

- Footprint and Buffer Land
- Plant Layout
- Municipal Boundaries
- Civil Township Boundaries
- Existing Roads
- Existing Railroads
- Streams

Rail Alternatives
- Proposed Rail Alt 1

Rail Alternatives
- Proposed Rail Alt 2

- Railroad crossing with bridge
- Railroad crossing at grade

Source: USDA 2003 DOQQs, MNDNR, Mn/DOT, USGS, Fluor, Excelsior Energy, and SEH.

East Range RR Crossings

St. Louis County - Central Coordinate System

N W E S

0 800 Feet