MESABA ENERGY PROJECT

ENVIRONMENTAL SUPPLEMENT:

SECTION TWO

Prepared by

EXCELSIOR ENERGY

June 16, 2006

BARR
Barr Engineering Co.
4700 West 77th Street
Minneapolis, MN 55435
(952) 832-2600

URS
URS Corporation
8181 East Tufts Avenue
Denver, Colorado 80237
(303) 694-2770

SEH
Short Elliott Hendrickson
3535 Vadnais Center Dr.
St. Paul, MN 55110
(800) 325-2055

FIGURES

2. Description of the Affected Environment

Section 2 describes the existing environmental setting in the vicinity of the West Range and East Range Sites. The section is divided into fourteen separate subsections and addresses topics that include the locations of the nearest residents and other "receptors" relative to Mesaba One and Mesaba Two and their Associated Facilities (2.1), current regional air quality (2.3), geology and soils, (2.4), the location, availability and quality of groundwater and surface water in nearby lakes and streams (2.5), wetlands, land use, ecology, endangered species, (2.7 and 2.8), historic and cultural resources (2.13) socioeconomics (2.14), and other topics.

2.1 Potentially Significant Receptors

Potentially significant receptors at the two sites include nearby residences and locations where people gather in groups or spend extended periods of time, including schools, daycare centers, recreation centers, playgrounds, nursing homes and hospitals. These "receptors" are those areas where people are most likely to be affected by construction and operation of Mesaba One and Mesaba Two. Aerial photography current as of 2003 was used to help identify significant receptors and their distances from the Phase I and II Developments.

2.1.1 West Range Site

Figure 2.1-1 shows receptors in the immediate vicinity of the IGCC Power Station Footprint and Buffer Land. The location of significant receptors nearby the Associated Facilities, the natural gas pipeline alternatives, and the HVTL routes proposed for the West Range Site is provided in Figure 1.5-25.

2.1.1.1 West Range IGCC Facility

No residences, schools, daycare centers, recreation centers, playgrounds, nursing homes or hospitals are located within 1 km of the proposed facility. The closest residence to the IGCC Power Station Footprint is shown in Figure 2.1-1 to be located southwest about 0.6 miles away. The closest residences to the northwest, west, and southeast, are located about 0.8 miles, 0.6 miles, and 0.7 miles away, respectively.

The residences most affected by construction and operation of the IGCC Power Station are located to the southeast on the north shore of Big Diamond Lake and the southeast shore of Dunning Lake. The residences on the lake shore are a mix of seasonal and year-round dwellings. These properties will be more exposed to construction and operations-related impacts than any other properties. It is to be noted that these dwellings are located in an area zoned "industrial." Figure 2.1-2 provides a close look at these properties relative to nearby infrastructure to be constructed. The proposed rail track and the proposed realignment of CR 7 will cut between the two lakes with the rail spur extending in a northwesterly direction and CR 7 extending directly to the west, just north of the existing "heavy haul" road now used for access by local residents. Construction of these two transportation elements will likely take place over a two-year period temporarily interrupting the residents' normal daily activities. Thereafter, increased levels of construction traffic will be ongoing over several years as construction of Mesaba One and Mesaba Two reach peak levels.

Figure 2.1-1 Significant Receptors in the Immediate Vicinity West of the West Range IGCC Power Station

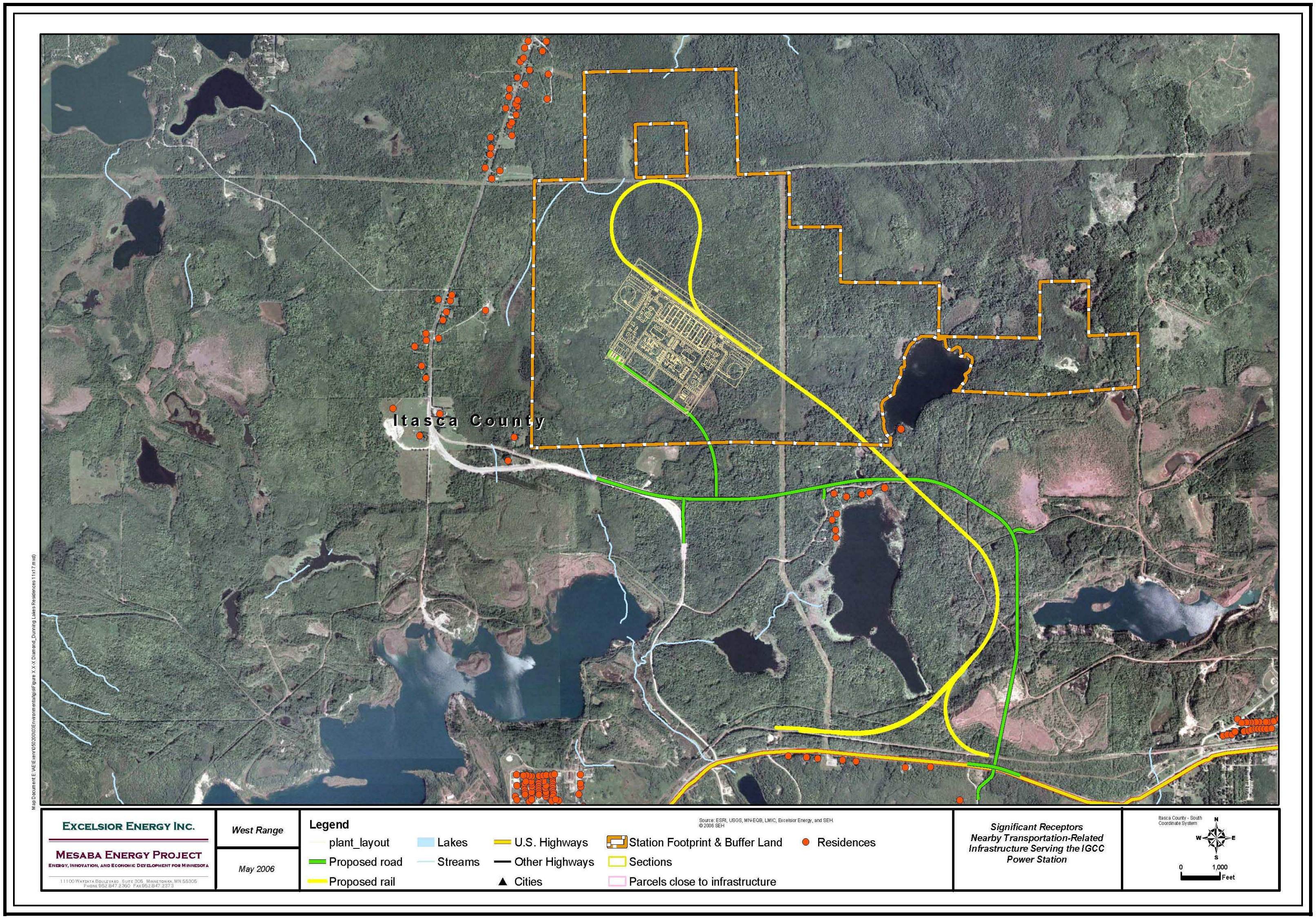
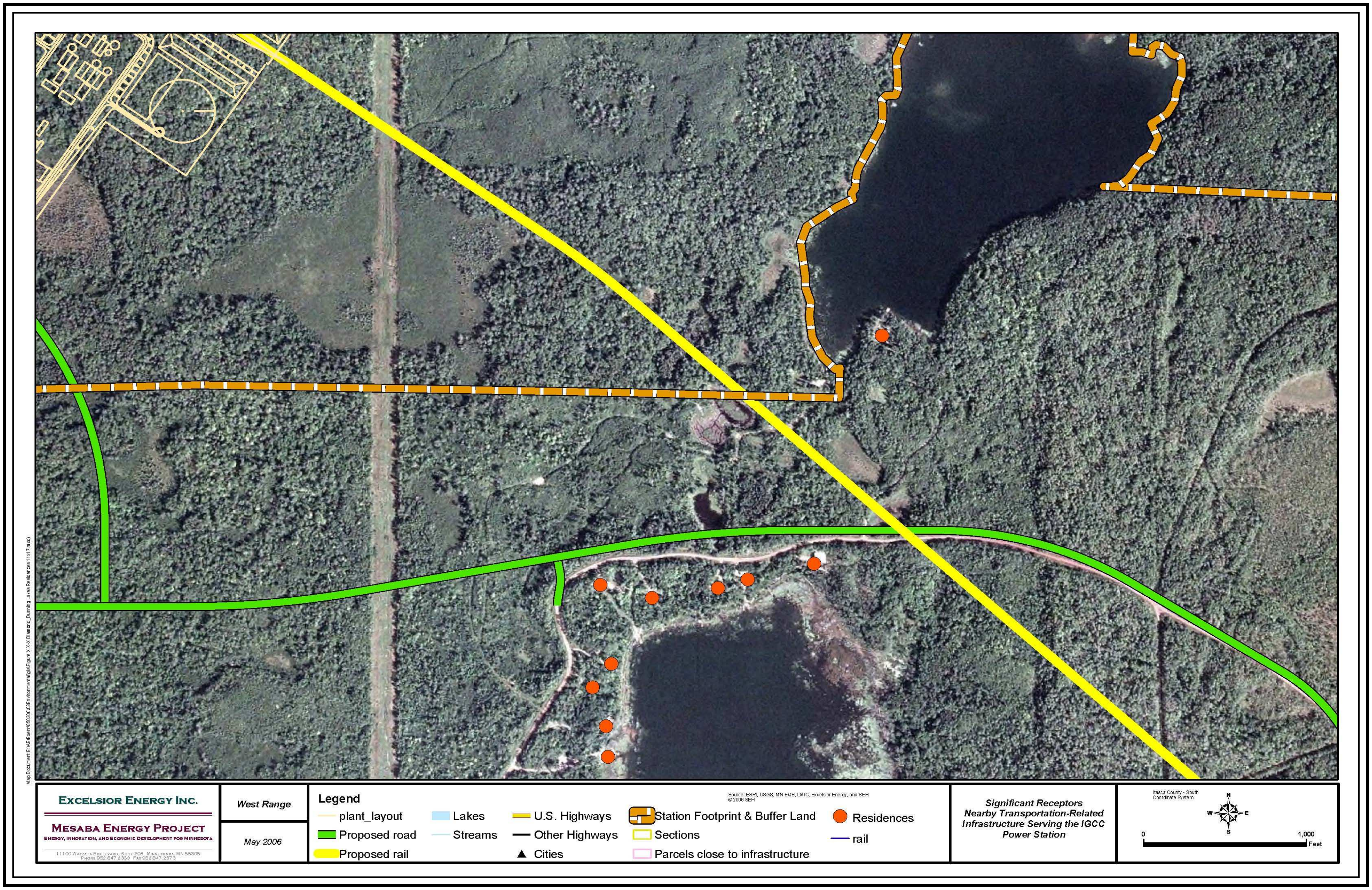


Figure 2.1-2 Significant Receptors in the Immediate Vicinity Southeast of the West Range IGCC Power Station



The closest resident on the shore of Big Diamond Lake is about 400 feet from the centerline of the rail track and the single resident on Dunning Lake is about 800 feet away. As shown in Figures 1.5-7 and 2.1-2, the closest resident on Big Diamond Lake to the rail alignment is also the closest to the potential realignment of CR 7. One other property owner on Big Diamond Lake will be located about the same distance from the centerline of the highway.

The City of Taconite has both single-family and multi-family residential houses located within 3 miles of the Power Station Footprint, most of which are occupied year-round. The closest residents of Taconite are located approximately 1.7 miles south-southeast of the IGCC Power Station Footprint.

An Air Emission Risk Assessment (AERA) was conducted to identify the air emission sources or groups of such sources, chemicals and associated pathways that may singly or collectively pose an unacceptable health risk to the public. The nearest receptors used in this study, and the results of the health risk assessment are discussed in Section 3.2.8.

2.1.1.2 Noise Receptors

Existing noise levels were monitored at six receptors located near the IGCC Power Station site, the railroad and roadways, or both. The monitoring data and noise analysis, including descriptions of the significant receptors are described in Section 2.11. Table 2.1-1 below identifies several of the noise monitoring locations. The table includes only current receptors, and excludes some other monitoring locations (e.g., the County Landfill or undeveloped property).

Table 2.1-1
Receptors near IGCC Power Station

Location	Approximate Distance from the nearest edge of IGCC Power Station Footprint
R2 Residence, on Big Diamond Lake	3,850' to the southeast
R3 Residence, 31950 Scenic Hwy 7	3,800' to the west
R4 Residence, 32423 Scenic Hwy 7	4,400' to the west
R5 Residence, on Dunning Lake	4,175' to the east
R6 Lutheran Church	18,000' to the southeast
R7 Catholic Church	10,700' to the NNW

2.1.1.3 HVTL Alternatives

The significant receptors along the HVTL alternatives were identified from aerial photography and those located within 0.5 miles of the centerline of each alignment were categorized as function of their distance. Table 2.1-2 provides a summary of that inventory. The location of significant receptors along all HVTL corridors considered for at the West Range Site is provided in Figure 1.5-25 and in the route maps presented in Sections 1.5.2.3 and 1.5.3.3.

Table 2.1-2
Receptors Located Along HVTL Routes

HVTL Route	Receptors	Distance from Centerline of Alignment (ft)					
		0–50	50–100	100–300	300–500	500–1,320	1,320–2,640
Preferred Route	66 residences	0	0	1	3	13	49
Alternative Route	62 residences	0	0	2	5	14	41
Plan B Alternate Route	214 residences	0	0	8	21	69	116

Only residential receptors are located within 0.5 miles of the centerline of each HVTL alignment. The receptors identified all appear to be located at a distance from the centerline that exceeds 100 feet. The HVTL alignment will be shifted to avoid residences located too close to the centerline.

2.1.1.4 Natural Gas Pipeline Alternatives

The locations of significant receptors within 0.5 miles of the centerline of the Proposed Natural Gas Pipeline Route were identified from aerial photography. Table 2.1-3 provides a summary of the significant receptor inventory for this route. The location of significant receptors along the pipeline routes is provided in Figure 1.5-25.

Table 2.1-3
Significant Receptors Located along the Proposed Natural Gas Pipeline Route

Pipeline Alternative	Significant Receptors	Distance from Centerline of Alignment (ft)					
		0–50	50–100	100–300	300–500	500–1,320	1,320–2,640
Natural Gas Pipeline Alternative 1	153 residences	0	0	3	14	61	75
	Trout Lake Cemetery					720 ft	
	Trout Lake Church				470 ft		
Natural Gas Pipeline Alternative 2	339 Residences	0	0	5	21	74	239
	Calvary Cemetery						2,370 ft
Natural Gas Pipeline Alternative 3	935	5	2	22	47	338	521
	Lakeview Cemetery					1,020 ft	
	Calvary Cemetery						2,430 ft

The location of the two Cemeteries is shown in Figure 1.5-25. All significant receptors located within 0.5 miles of the centerline of the Proposed Natural Gas Pipeline Route are located at a distance greater than 100 feet from its proposed centerline.

All of the 339 residences within 0.5 miles of Alternative 2 are greater than 100 feet away. The Calvary Cemetery, near the City of Taconite, is also more than 100 feet away from the Alternative 2 alignment. All but seven of the 935 residences within 0.5 miles of Alternative 3 are greater than 100 feet away from the Alternative 3 centerline. Table 2.1-4 provides the actual distance to the centerline of Alternative 3 for those potentially significant receptors within 100 feet of the alignment. As shown in Table 2.1-3, the Calvary Cemetery and Lakeview Cemetery (south of Coleraine) are both more than 1000 feet away from the centerline alignment of Alternative 3.

Table 2.1-4
Significant Receptors Located Within 100 feet of the Natural Gas Pipeline Routes Considered

Potentially Sensitive Receptor	Approximate Distance to Centerline of Gas Pipeline Alternatives		
	Gas Pipeline Alternative 1	Gas Pipeline Alternative 2	Gas Pipeline Alternative 3
Residence	No receptors found within 100 ft of the centerline	No receptors found within 100 ft of the centerline	0 ft
Residence			5 ft
Residence			27 ft
Residence			32 ft
Residence			47 ft
Residence			63 ft
Residence			86 ft

2.1.1.5 Process Water Supply Pipelines

The locations of significant receptors within 0.5 miles of each of the Process Water Supply Pipeline Segments were identified by aerial photography. Table 2.1-5 below provides a summary of the significant receptor inventory. The locations of residences near each Process Water Supply Pipeline is shown in Figure 1.5-25.

Table 2.1-5
Significant Receptors along the Process Water Supply Pipeline Corridors

Significant Receptors	Number	Distance from Centerline of Alignment (ft)					
		0–50	50–100	100–300	300–500	500–1,320	1,320–2,640
Segment 1 (LMP to CMP)	15	0	0	0	0	0	15
Segment 2 (CMP to West Range Site)	0	0	0	0	0	0	0
Segment 3 (HAMP Complex to CMP)	89	0	0	1	3	3	82

Only residential receptors are located within 0.5 miles of any of the Process Water Supply Pipeline segments, and only one is within 300 feet of the centerline of the alignment for Segment 3.

2.1.1.6 Process Water Blowdown Pipelines

Significant receptors within 0.5 miles of each of the Process Water Blowdown Pipelines were identified from aerial photography. Table 2.1-6 provides a summary of the significant receptor inventory.

Table 2.1-6
Significant Receptors along the Process Water Blowdown Pipelines

Process Water Blowdown Pipeline	Number	Distance from Centerline of Alignment (ft)					
		0–50	50–100	100–300	300–500	500–1,320	1,320–2,640
Pipeline 1	8	0	0	0	0	0	8
Pipeline 2	6	0	0	1	1	1	3

Only residential receptors are located within 0.5 miles either of the Process Water Blowdown Pipeline, and all are greater than 100 feet from the centerline of the alignments.

2.1.1.7 Potable Water and Sewer Pipelines

Significant receptors within 0.5 miles of each of the Potable Water and Sewer Pipeline alignments were identified from aerial photography. Table 2.1-7 provides a summary of the significant receptor inventory.

Table 2.1-7
Significant Receptors along the Potable Water and Sewer Pipeline Alignment

Potable Water and Sewer Pipelines	Number	Distance from Centerline of Alignment (ft)					
		0–50	50–100	100–300	300–500	500–1,320	1,320–2,640
Potable Water and Sewer Alignment	114	0	1	3	0	63	46

Only residential receptors are located within 0.5 miles of the potable water and sewer alignment, and all but one are greater than 100 feet away. The only exception is one residence located approximately 90 feet away.

2.1.1.8 Rail Lines

Significant receptors within 0.5 miles of each of the railroad alignment alternatives were identified from aerial photography. Table 2.1-8 provides a summary of the significant receptor inventory.

Table 2.1-8
Significant Receptors along the Alternative Railroad Alignments

Rail Line Alternative	Number	Distance from Centerline of Alignment (ft)					
		0–50	50–100	100–300	300–500	500–1,320	1,320–2,640
Rail Line Alternative 1A	16	0	0	0	0	10	6
Rail Line Alternative 1B	8	0	0	0	0	8	0

Only residential receptors are located within 0.5 miles of any of the railroad alternative alignments and none are within 500 feet of either centerline.

2.1.1.9 Roads

Significant receptors within 0.5 miles of each road alignment were identified from aerial photography. Table 2.1-9 provides a summary of the significant receptor inventory.

Table 2.1-9
Significant Receptors along Access Roads

Roads	Number	Distance from Centerline of Alignment (ft)					
		0–50	50–100	100–300	300–500	500–1,320	1,320–2,640
Access Roads 1 and 2	22	0	0	1	5	4	12

Only residential receptors are located within 0.5 miles of either road alignments and all but one are located at a distance greater than 300 feet away. One residence is located approximately 200 feet from the centerline of the proposed roadway alignment.

2.1.2 East Range Site

Figure 2.1-3 below shows receptors near the East Range IGCC Power Station Footprint and Buffer Land. Receptors nearby the Associated Facilities and the HVTL Natural Gas Pipeline Routes proposed are shown in Figure 1.5-50.

2.1.2.1 IGCC Power Station Footprint and Buffer Land

Figure 2.1-3 shows the nearest residences are located about one mile directly south of the IGCC Power Station Footprint, in the City of Hoyt Lakes. No significant receptors, such as schools, daycare centers, recreation centers, playgrounds, nursing homes or hospitals are located within this distance. The closest residence to the flare and CTG/HRSG stack emission points is located about 1.2 miles and 1.4 miles away, respectively. A noise analysis was performed to determine potential noise affects from construction and operation at the proposed plant site. Table 2.1-10 identifies several of the receptor locations included in the noise monitoring and subsequent impact analysis.

Figure 2.1-3 Residences and Other Receptors: East Range IGCC Power Station

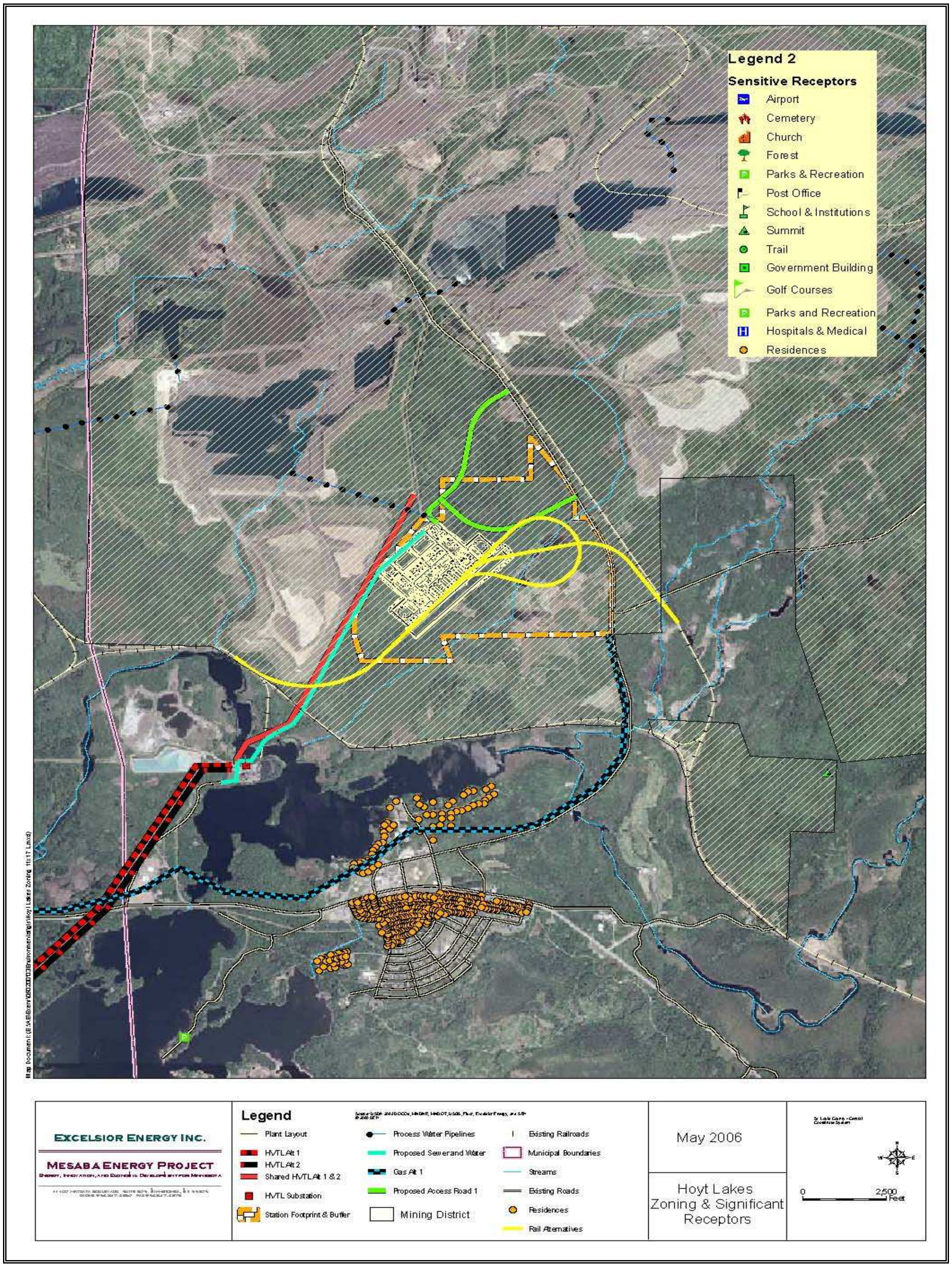


Table 2.1-10
Significant Receptors Near the IGCC Power Station Footprint and Buffer Land

Location	Approximate Distance From the Nearest Edge of Station Footprint (ft)
R2, Boat Landing and Park	7,700
R3, Residence (Colby Ridge)	6,800
R4, Residence, 321 Kent Street	10,600
R5, Faith Lutheran Church, Hoyt Lakes	8,400
R6, Queen of Peace Catholic church, Hoyt Lakes	8,700
R7, Trinity Methodist Church, Hoyt Lakes	8,800

Note: All points located south of IGCC Power Station Footprint.

The residences most likely to be affected by noise or other impacts during construction and operation of the IGCC Power Station are located on the south shore of the eastern arm of Colby Lake. Most of these residences will be somewhat insulated from construction traffic to and from the Station Footprint and Buffer Land. The details of the noise analysis, including descriptions of the significant receptors, are provided in Section 2.11.

An Air Emission Risk Assessment (AERA) was conducted to assess whether air emissions from the Project could pose an unacceptable health risk to nearby residents. The results of the risk assessment are discussed in Section 3.2-8.

2.1.2.2 East Range HVTL Alternative Routes

The significant receptors along the two existing HVTL routes proposed for use were identified from aerial photography. The location of significant receptors within 0.5 miles of the HVTL alternative alignments was determined. Table 2.1-11 provides a summary of the significant receptor inventory.

Table 2.1-11
Receptors along the HVTL Alternatives

HVTL Route	Significant Receptors	Approximate Distance from Centerline of Alignment (ft)					
		0–50	50–100	100–300	300–500	500–1,320	1,320–2,640
38L	271 residences	0	1	10	11	91	155
	Camp Olcott	0	0	0	0	1,160 ft	0
	Eveleth Scout Camp	0	0	0	0	0	1,600 ft
	Forbes Cemetery	0	0	0	0	0	2,400 ft
39L/37L	962 residences	0	2	14	33	317	593
	Fayal School	0	0	0	0	0	2,640 ft
	Lincoln School	0	0	0	0	0	2,000 ft
	Mamrelund Church	0	0	0	0	1,300 ft	0

Many residential receptors are located within 0.5 miles of each HVTL route. Most of the residences are greater than 100 feet away from the alignments, with only one within 100 feet of Alternative 1 (the distance being about 90 feet). Camp Olcott, Eveleth Scout Camp, and Forbes Cemetery are within 0.5 miles of Alternative 1, the specific distance for each being presented in Table 2.1-11. The two residential receptors identified as being within 100 feet of the centerline alignment of the 39L/37L route are located 50 feet and 100 feet away.

2.1.3 East Range Gas Pipeline

Significant receptors along the gas pipeline were identified from 2003 aerial photography and the location of such receptors within 0.5 miles of the gas pipeline alignment was determined. Table 2.1-12 below provides a summary of the significant receptor inventory.

Table 2.1-12
Significant Receptors along the East Range Natural Gas Pipeline Route

Significant Receptors	Distance from Centerline of Alignment (ft)					
	0–50	50–100	100–300	300–500	500–1,320	1,320–2,640
856 residences	2	5	39	41	199	570
Eveleth-Virginia Airport						1,852 ft
4H Camp						1,956 ft

Residential receptors are located within 0.5 miles of the gas pipeline alignment. All but seven of the 856 residences within 0.5 miles are greater than 100 feet away from the gas pipeline centerline. Table 2.1-13 identifies the actual separation of the residences within 100 feet of the alignment's centerline.

Table 2.1-13
Public Gathering Places in the Vicinity of the Natural Gas Pipeline and Significant Receptors within 100 feet of the Alignment's Centerline

Significant Receptor	Significant Receptors within 50 feet of Centerline	Significant Receptors 50 to 100 feet of Centerline
Residence	40 ft	
Residence	40 ft	
Residence		60 ft
Residence		70 ft
Residence		70 ft
Residence		80 ft
Residence		90 ft

2.1.3.1 Potable Water and Sewer Pipelines

The presence of significant receptors within 0.5 miles of each of the alternative Potable Water and Sewer Pipeline alignments was examined using aerial photography. No significant receptors were found within 0.5 miles of these alignments.

2.1.3.2 Process Water Supply Pipelines

The presence of significant receptors within 0.5 miles of each of the alternative Process Water Supply Pipeline alignments was examined using aerial photography. No significant receptors were found within 0.5 miles of these alignments.

2.1.3.3 Rail Lines

The presence of significant receptors within 0.5 miles of each of the alternative rail alignments was examined using aerial photography. No significant receptors were found within 0.5 miles of these alignments.

2.1.3.4 Roads

The presence of significant receptors within 0.5 miles of each of the alternative roadway alignments was examined using aerial photography. No significant receptors were found within 0.5 miles of these alignments.

2.2 Aesthetics

The proposed IGCC Power Station, its Associated Facilities, HVTLs and HVTL structures, natural gas pipeline ROWs, and other ROWs will be visible and will affect the aesthetic character of the existing environment. These visual impacts, along with other elements affecting the preexisting aesthetic character of the area are examined in Section 3.1.

2.3 Air Quality and Meteorology

The West Range and East Range sites are similar regarding air quality and meteorology The most significant difference is that the East Range Site is considerably closer to the nearest Class I area (the Boundary Waters Canoe Area) than the West Range Site.

2.3.1 Existing Air Quality Conditions

The state of Minnesota uses pollutant monitoring stations to determine the air quality of a particular region. Concentrations measured at the monitors are compared to primary and secondary ambient air quality standards. Primary standards protect public health. Secondary standards protect public welfare and property.

Itasca and St. Louis Counties have met and continue to meet State and National Ambient Air Quality Standards (NAAQS) for all criteria pollutants as shown in Table 2.3-1. Included in the table are the average concentrations over the past three years for each pollutant and averaging period.

Additional ambient monitors in the region not listed in Table 2.3-1 are located in Mille Lacs and Crow Wing Counties, and in Duluth.

2.3.2 Site Meteorology

Itasca (West Range) and St. Louis (East Range) counties in Minnesota have a continental-type climate and are subject to frequent outbreaks of continental polar air throughout the year, with occasional Arctic outbreaks during the cold season. Occasional periods of prolonged heat occur during summer, particularly in the southern portion when warm air pushes northward from the Gulf of Mexico and the southwestern United States. Pacific Ocean air masses that move across the Western United States produce comparatively mild and dry weather at all seasons.

Temperatures throughout the year are highly variable, with extremes ranging from 114°F to -60°F. Average temperatures range from 5.7°F in January to 67.4°F in July. From December through February, the maximum temperature is below 32°F an average of 24 days per month. During the summer, the maximum temperature exceeds 90°F an average of 5 to 6 days a year. The freeze-free (air temperatures greater than 32°F) growing season generally lasts only about 90 to 100 days.

Annual precipitation is nearly 26 inches per year. The number of days with precipitation per month varies from 7 (February) to 13 (June). The area receives an annual average of approximately 56 inches of snow annually. Snow cover of one inch or more occurs an average of 140 days per year.

Additional climate data are available through the High Plains Regional Climate Center (HPRCC, at www.hprcc.unl.edu/products/historical.htm), the Minnesota Climatology Working Group (climate.umn.edu/), or the National Climatic Data Center (NCDC, at www.ncdc.noaa.gov).

2.3.3 Attainment Status

The Clean Air Act requires the United States Environmental Protection Agency (USEPA) to establish National Ambient Air Quality Standards (NAAQS). Accordingly, EPA has developed primary and secondary ambient air quality standards. Primary standards are set to protect the public health, including the health of sensitive populations such as asthmatics, children and the elderly. Secondary standards are set to protect public welfare, including protection against decreased visibility, damage to animals, crops, vegetation, and buildings.

NAAQS have been set for six criteria pollutants: carbon monoxide, nitrogen dioxide, ozone, lead, particulate matter with an aerodynamic diameter of less than 10 microns (PM10), PM2.5, and sulfur dioxide. These standards and their averaging times are shown on Table 2.3-1. The State of Minnesota has also adopted ambient air quality standards for other pollutants: particulate matter, hydrogen sulfide, and sulfur dioxide (1-hour averaging period). These standards are also shown on Table 2.3-1.

The Minnesota Pollution Control Agency conducts ambient air quality monitoring throughout the state. Based on the monitored data, Itasca and St. Louis Counties are designated attainment or unclassified for each of the standards. Attainment means air quality in the county meets the standards. An “Unclassified” status means that no data exists that demonstrates non-compliance.

Table 2.3-1 National and Minnesota Ambient Air Quality Standards and Monitored Background Concentrations

Pollutant	Averaging Period	Standard Value		Standard Type	Monitored Background Concentration	Monitoring Station
Carbon Monoxide	8-Hour(1)	9 ppmv	10 mg/m^3	Primary	1.6 ppm	314 West Superior Street, Duluth
	1-Hour (1)	30 ppmv	35 mg/m^3	Primary	3.3 ppm	314 West Superior Street, Duluth
Nitrogen Dioxide	Annual Arithmetic Mean(2)	0.05 ppmv	100 ug/m^3	Primary and Secondary	0.004 ppm	Carlton County
Ozone	8-Hour (3)	0.08 ppmv	235 ug/m^3	Primary and Secondary	0.066 ppm	Voyageurs National Park
Lead	Quarterly (4)		1.5 ug/m^3	Primary and Secondary	0.01 ug/m^3	Virginia City Hall
Total Suspended Particulate (TSP)	Annual Geometric Mean(5)		75 ug/m^3	Primary	16 ug/m^3	Virginia City Hall
			60 ug/m^3	Secondary		
	24-Hour(1)		260 ug/m^3	Primary	35.7 ug/m^3	Virginia City Hall
			150 ug/m^3	Secondary		
PM_{10}	Annual Arithmetic Mean(2)		150 ug/m^3	Primary and Secondary	16 ug/m^3	Virginia City Hall
	24-Hour (1)		50 ug/m^3	Primary and Secondary	35.7 ug/m^3	Virginia City Hall
$PM_{2.5}$	Annual Arithmetic Mean(2)		15 ug/m^3	Primary and Secondary	6.1 ug/m^3	Virginia City Hall
	24-Hour (6)		65 ug/m^3	Primary and Secondary	19 ug/m^3	Virginia City Hall
Sulfur Dioxide (SO_2)	Annual Arithmetic Mean(2)	0.03 ppmv	80 ug/m^3	Primary	0.001 ppm	Rosemount, MN
		0.02 ppmv	60 ug/m^3	Secondary		
	24-Hour (1)	0.14 ppmv	365 ug/m^3	Primary and Secondary	0.005 ppm	Rosemount, MN
	3-Hour (1)	0.5 ppmv	1,300 ug/m^3	Primary	0.010 ppm	Rosemount, MN
	3-Hour (1)	0.35 ppmv	915 ug/m^3	Secondary		
	1-Hour (1)	0.5 ppmv	1,300 ug/m^3	Primary	0.019 ppm	Rosemount, MN
Hydrogen Sulfide (H_2S)	½-Hour(7)	0.05 ppmv	70 ug/m^3	Primary	NA	NA
	½-Hour(8)	0.03 ppmv	42 ug/m^3	Primary	NA	NA

(1) Maximum concentration not to be exceeded more than once per year.
(2) Maximum annual arithmetic mean.
(3) Daily maximum 8-hour average; the standard is attained when the average of the annual fourth-highest daily maximum 8-hour average ozone concentration is less than or equal to the standard.
(4) Maximum arithmetic mean averaged over a calendar quarter.
(5) Maximum annual geometric mean.
(6) The standard is attained when the 98th percentile 24-hour concentration is less than or equal to the standard.
(7) ½-Hour average not to be exceeded over 2 times per year.
(8) ½-Hour average not to be exceeded over 2 times in any 5 consecutive days.

2.3.4 Visibility

In 1999, the U.S. EPA established the Regional Haze Program to improve visibility and air quality in national parks and wildlife areas. As part of this program and the 1977 Clean Air Act amendments, a network of monitors was set up by the Interagency Monitoring of Protected Visual Environments (IMPROVE) program[1] to continuously record visibility and aerosol conditions for the protection of visibility in Class I areas. In northeastern Minnesota, monitors are located in the Boundary Waters Canoe Area Wilderness (BWCAW) near Ely and at Voyageurs National Park. Specifically, these monitors record concentrations of ammonium sulfate, ammonium nitrate, coarse particulate matter, and variables to determine extinction coefficients and deciviews to measure visibility. Detailed visibility data regarding these two Class I areas is available online at: http://vista.circa.colostate.edu/improve.

2.3.5 Class I Areas

The closest Class I areas to the proposed sites include two areas administered by the United States Forest Service: the Boundary Waters Canoe Area Wilderness (BWCAW) and Rainbow Lakes Wilderness Area (RBL, located in northwestern Wisconsin); and two national parks: Voyageurs National Park (VNP) and Isle Royale National Park (IRNP, located in Michigan). The West Range Site is 100 kilometers (km) from the BWCA, 190 km from the RBL, 120 km from VNP, and more than 300 km from IRNP. The East Range site is 40 km from the BWCA, 170 km from the RBL, 90 km from VNP, and more than 200 km from IRNP.

Class I areas are afforded special protection under the Clean Air Act. To protect the air quality within these areas, nearby projects must comply with more stringent allowable PSD increments and evaluate impacts of the project on air quality related values (AQRVs) such as visibility, flora/fauna, water quality, soils, odor and any other resources specified by the Federal Land Manager (FLM). The allowable Class I increments are shown in Table 2.3-2.

Table 2.3-2
Class I Increments

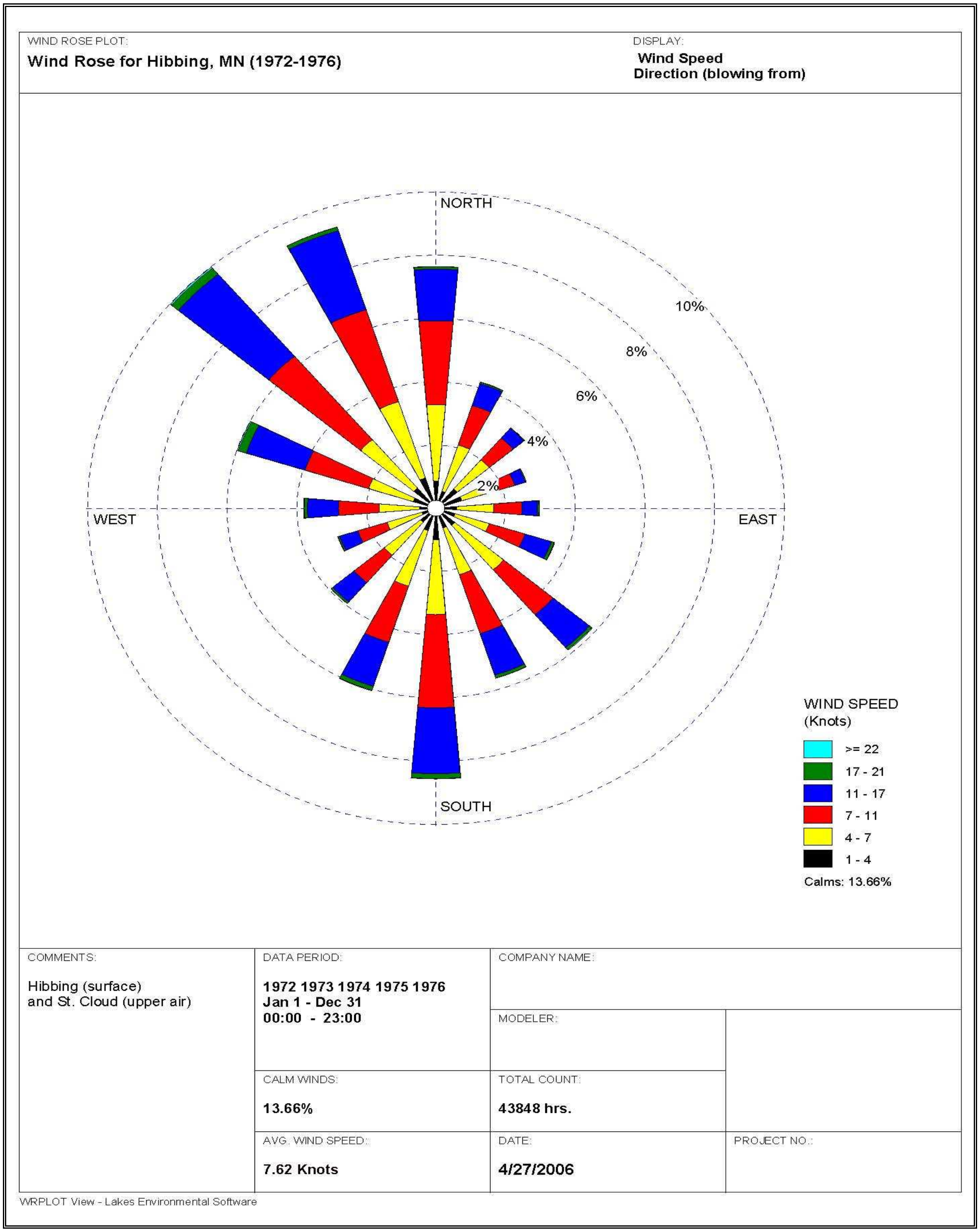
Pollutant, averaging period	Class I Increment, ug/m^3
SO_2, 3-Hour	25.0
SO_2, 24-Hour	5.0
SO_2, Annual	2.0
NOx, Annual	2.5
PM_{10}, 24-Hour	8.0
PM_{10}, Annual	4.0

1 IMPROVE is a cooperative measurement effort governed by a steering committee composed of representatives from Federal and regional-state organizations.

2.3.6 Wind Rose

Figure 2.3-1 is a wind rose based on five years of hourly meteorological data (1972–1976) from Hibbing, Minnesota (surface).

Figure 2.3-1 West Range Wind Rose Data, 1972-1976



Prevailing winds are from the northwest (approximately 10% of the observations) and the north-northwest (9% of the observations) at between 7 to 17 knots (8 to 20 miles per hour). Southerly winds occur in just over 8% of the observations.

2.3.7 Air Quality Monitoring

The state of Minnesota uses pollutant monitoring stations to determine the air quality of a particular region. Concentrations measured at the monitors are compared to the Federal and/or state ambient air quality standards. Monitoring results from regional monitoring instruments are shown in Table 2.3-1. Included in the table are the average concentrations over the past three years (2002–2005) for each pollutant and averaging period.

2.3.8 Fog

Due to the abundance of small lakes in the region, fog is likely to form on and around the lakes during clear, calm conditions in the evening and early morning. Persistent fogging at either location is unlikely.

2.3.9 Odors

There are no current odor problems near either of the proposed locations.

2.4 Geology and Soils

Both sites (West Range and East Range) are located within the Superior Upland Section of the Laurentian Upland of the Canadian Shield physiographic province (Leonards, 1962). The physical landscape of the region is typified by forests, lakes and bogs in glacial till over somewhat shallow bedrock. The landscape has been greatly affected by the glaciers that covered the land, the last of which left the area about 12,000 years ago. Physical relief is generally limited to a thousand feet or less in the project area. However, the maximum elevation range in the region is from elevation 600 feet above mean sea level (msl) at Lake Superior to elevation 2,301 feet above msl at Eagle Mountain, the highest point in Minnesota.

Wright has defined the physiography of Minnesota by subdividing the state into 27 distinct areas as shown on Figure 2.4-1 (Wright, 1972). Both sites are located in areas that generally consist of low glacial moraines and till plains. However, portions of the West Range site are located on topographically high areas of the Giants Range.

The landscape is dotted with 300-to-400-foot deep mine pits, large mine-pit overburden spoil piles and tailing basins, all associated with iron ore mining activity. The extent of mining disturbances in the vicinity of the West Range and East Ranges Sites shown in Figures 2.4-2 and 2.4-3 respectively.

2.4.1 Geology and Soils Overview

This subsection provides an overview of the complex soils and geology characterizing the regions within which the West Range and East Range Sites are located.

2.4.1.1 West Range Site

With respect to surficial geology, the Site straddles the boarder of Giants Range and the Chisholm-Embarrass physiographic area of Minnesota, as defined by Wright (Wright, 1972). The site is shown on Figure 2.4-1 in relation to the physiographic areas of Minnesota. The elevation atop the Giant’s Range Batholith is about elevation 1,430 ft msl to 1,470 feet above msl at the site. The Chisholm/Embarrass Till area exists north of the Giant’s Range. The Chisholm/Embarrass Till Area is an area of low glacial moraines and outwash plains that extends north and south of the Giants Range in the vicinity of the project site. The till is typically on the order of 25 feet thick or less in the immediate vicinity of the main plant site, but extends to greater depths in the general area north and south of the plant site. Bedrock outcrops also exist in the area. Much of the till has been stripped and removed along the iron range as part of mining operations. The elevation of the till plains to the north and south of the site are at about elevation 1,330 ft msl.

Figure 2.4-1 Physiographic Areas Of Minnesota

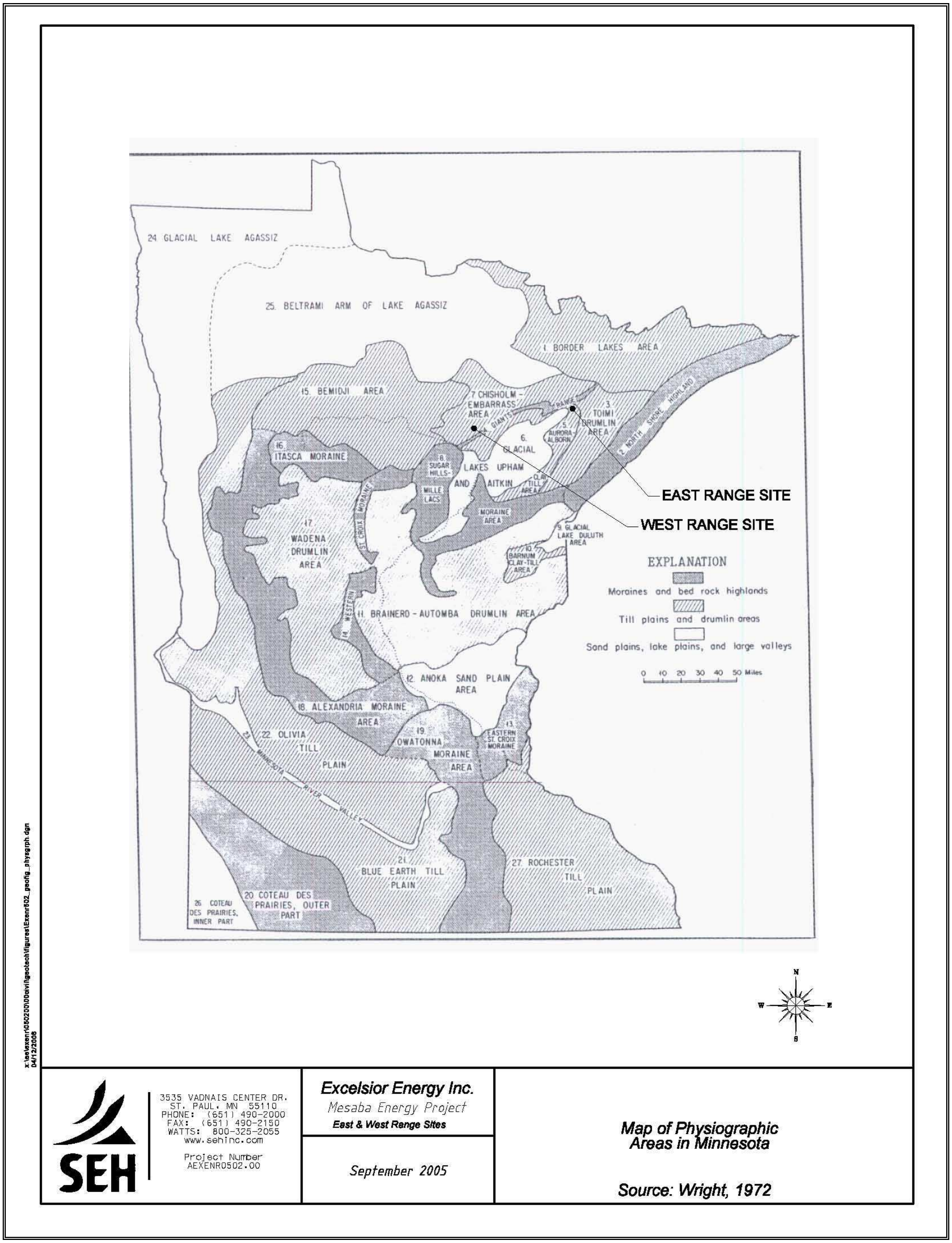


Figure 2.4-2 Mining Disturbances in the Vicinity of the West Range Site

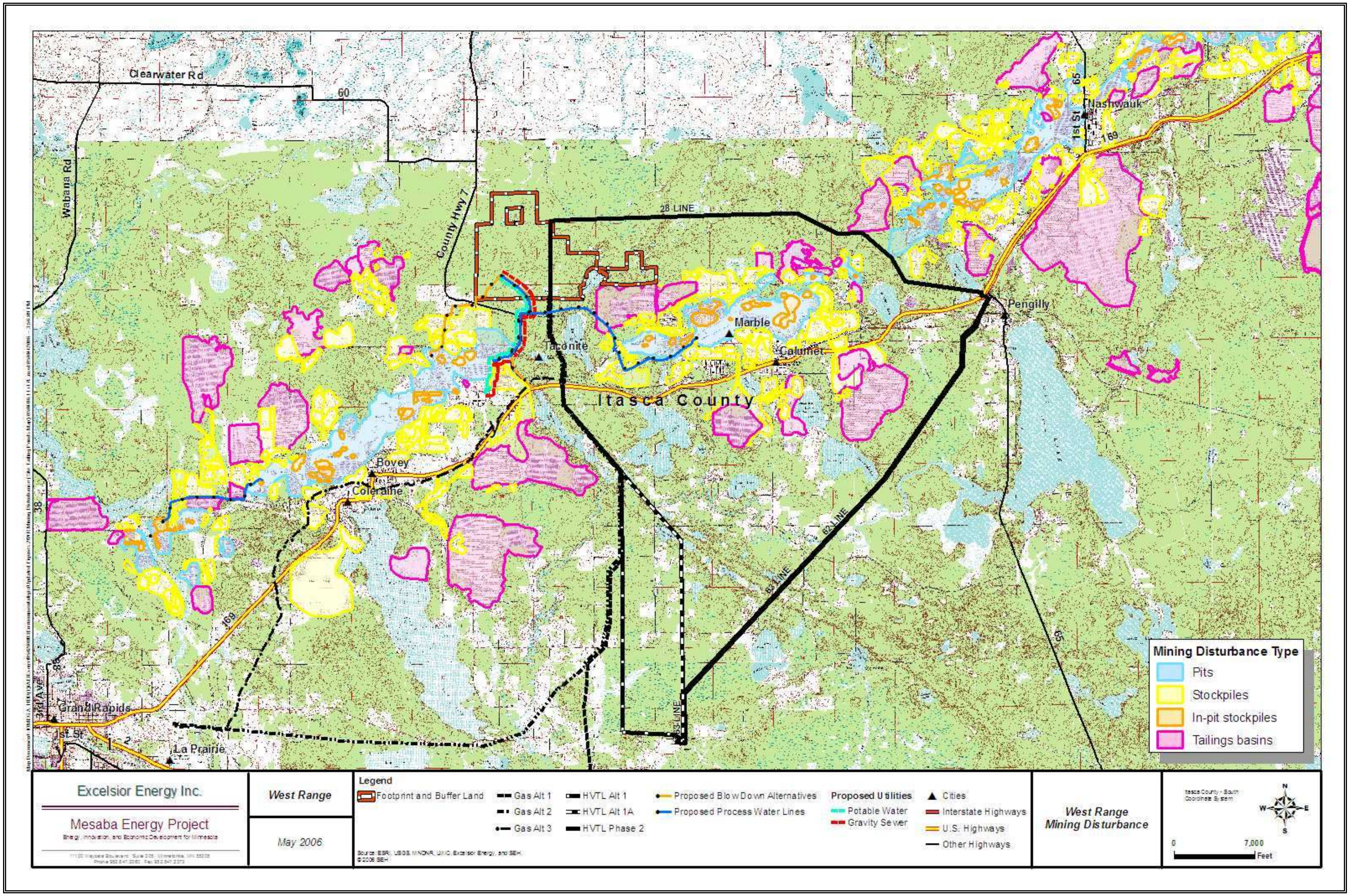
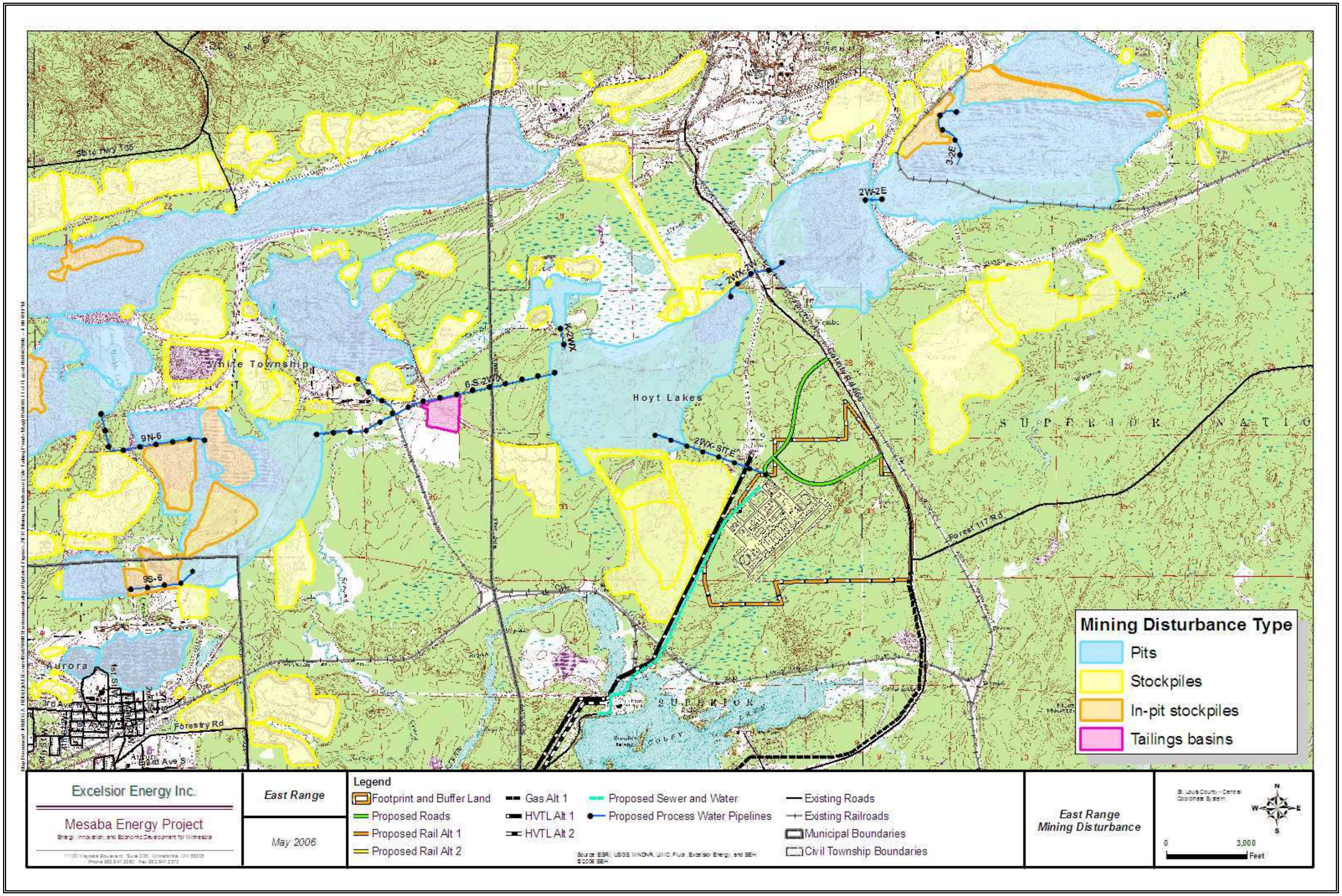


Figure 2.4-3 Historical Mining Disturbances in the Vicinity of the East Range Site



2.4.1.2 East Range Site

The East Range Site is located within the Aurora-Alborn Clay-Till area as shown in Figure 2.4-1 (Wright, 1972). The Aurora-Alborn Clay-Till Area is a fringe of reddish-brown clay till deposited by the St. Louis sublobe in its advance to the northeast and east. The glacial ice picked up sediments of an earlier Glacial Lake Upham and redeposited them at the ice lobe margin, generally as a veneer less than 25 feet thick (Wright and Watts, 1969). The Aurora-Alborn clay till buried the Toimi Drumlin field, and some of the buried landforms are visible beneath the clay till cover (Wright, 1972). The site generally slopes upward from 1,460 feet above msl in the south to 1,520 feet above msl in the north. A ridge trends northeast/southwest in the center of the site, and this ridge is as high as 1,540 feet above msl (USGS Topographic Quadrangle).

2.4.2 Previous Mining Activity

2.4.2.1 West Range Site

The plant site has not been disturbed by mining activity. However, extensive mining activity has taken place in the immediate vicinity of the site where numerous mine pits, tailings basins and spoil piles can be found. Disturbances from previous mining activities are shown in Figure 2.4-2.

2.4.2.2 East Range Site

The IGCC Power Station Footprint and Buffer Land have not been directly disturbed by mining activity as shown in Figure 2.4-3; however, numerous mining pits are located nearby. One is approximately one mile northwest of the Station Footprint and the other is approximately 1.5 miles due north and across CR 666. Mine stockpiles exist in two locations. One is on the immediate west of the utility easement that forms the west edge of the plant site (the stockpile is about 300 feet from the Station Footprint), and the other is northeast of the plant site, approximately one mile from CR 666.

2.4.3 Climate

In Itasca and St. Louis Counties, winters are very cold. Summers are short, but fairly warm. The short freeze-free time limits crops to forage, small grains and adapted vegetables. Snow covers the ground much of the time from late fall to early spring. The lowest recorded temperature in the area was in Embarrass (located near the East Range Site) in 1996 at -63 degrees Fahrenheit. Early freezes, prior to snow fall, send the frost depth to several feet. However, the frost depth recedes and seldom exceeds a few feet after the snow blanket is established. Frost depths are on the order of 6 feet or more in areas that are plowed or otherwise kept clear of snow.

2.4.4 Historical Land Use and Vegetation

2.4.4.1 West Range Site

The West Range site is located in Itasca County. About 71% of the acreage in Itasca County is forested and about 20% consists of organic soils (Nyberg, 1987). Approximately nine (9) percent of the County's surface area is water (lakes and streams). Mining, recreation enterprises and forestry contribute significantly to the economy of Itasca County. Before extensive settlement, vegetation in the area was predominantly conifer/hardwood forest (Wright, 1972). Early settlement began in the 1860's with people who came to harvest timber. Mining (iron ore) exploration began in the 1880's. Farming commenced in the late 1800s. By 1920, roughly ten percent of the land was in farming; however, both mining and farming activity have decreased in recent years (Nyberg, 1987.) The past and present mining activity in the area is depicted in Figure 2.4-2, which shows the locations and extent of mine pits, waste-rock dumps and tailing basins in the vicinity of the West Range Site.

2.4.4.2 East Range Site

The East Range Site has been disturbed through years of mining activity. Past and present mining activity in the former LTV Mining Company location is shown in Figure 2.4-3. This figure identifies the locations and extent of mine pits, waste-rock dumps and tailing basins. The large area highlighted in yellow and located immediately to the west of the IGCC Power Station Footprint and Buffer Land is an 80–100 foot mound of waste rock approximately 300 acres in size that has been planted with natural grasses.

According to the MDNR, the East Range Site is located in the Nashwauk Uplands subsection of the Laurentian Mixed Forest just south and east of the Mesabi Iron Range. Prior to settlement, the area was largely forested with white pine-red pine forest, aspen-birch forest, mixed hardwood-pine forest, and jack pine barrens in the uplands. Wetland vegetation included conifer bogs and swamps and open muskeg (MDNR, 2006). Quaking aspen is presently the dominant tree species and forest management is the most important land use. Forested public land is currently managed for wood products and recreation. According to the MDNR, 9.25% of the total area of the county is covered with water. Major industries include pulpwood production, tourism, and shipping/transportation. At one time, taconite mining was a major industry (St. Louis County, 2006); however, taconite mining has been in decline since the 1970's.

2.4.5 Surficial Geology

2.4.5.1 West Range Site

The soils characterizing the West Range Site consist of glacial till of the Nashwauk Moraine which coincides with the Chisholm-Embarrass till physiographic area. The Nashwauk Moraine was associated with the Rainey Lobe of Wisconsinan glaciation. South of the City of Taconite, along the existing gas pipeline and HVTLs, the surficial soil consists of till associated with the Culver and Sugar Hills moraines, which were a part of the Des Moines Lobe of Wisconsin glaciation. The extent of the different surficial materials in the entire Arrowhead Region is shown in the quaternary geology map in Figure 2.4-4.

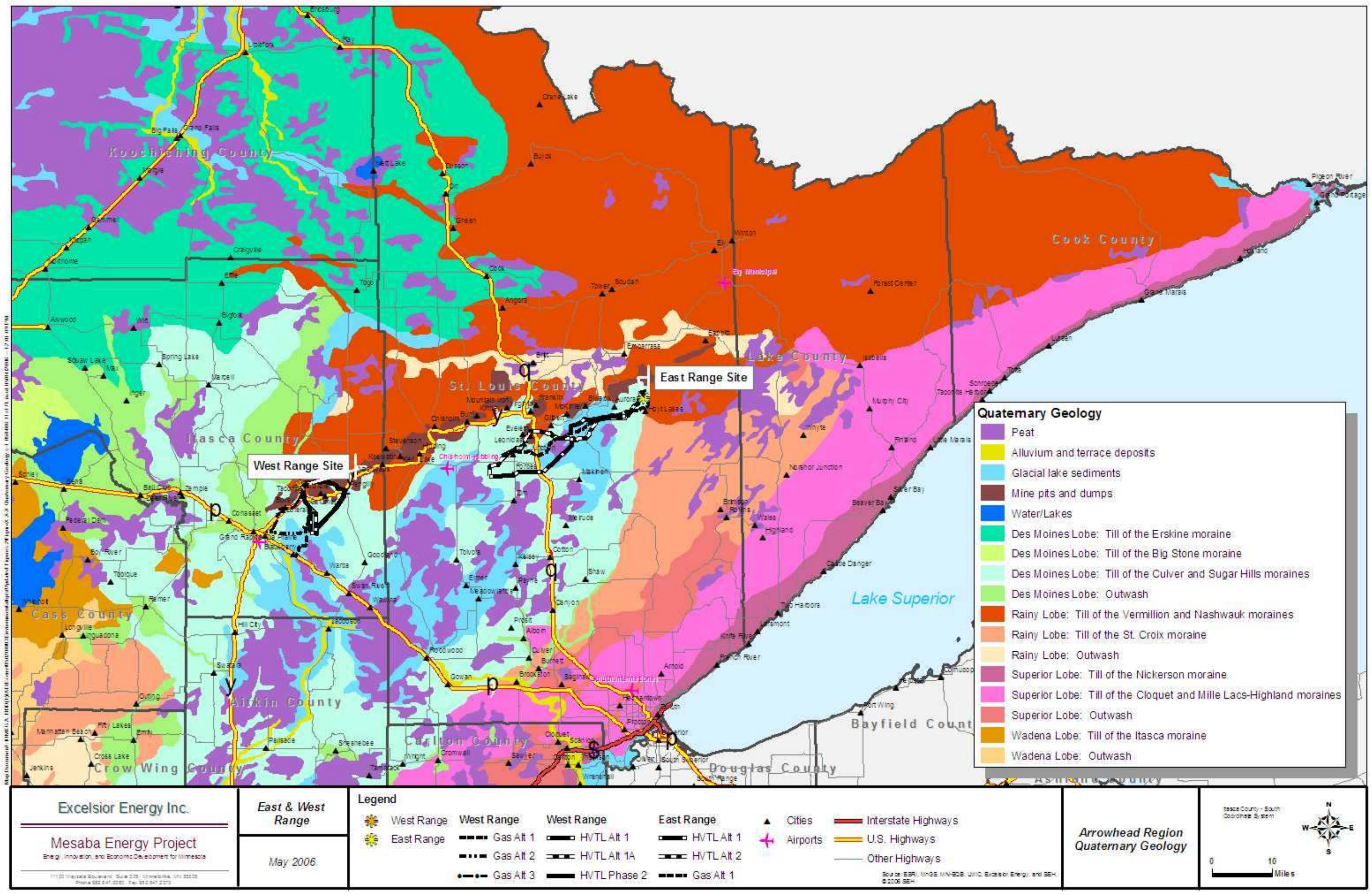
The glacial tills are typically sandy lean clays with gravel, cobbles and boulders. The amount of gravel, cobbles and boulders in the till at any particular location is highly variable. The tills can vary to clayey sands and silty sands. The tills typically overlie sand and gravel glacial outwash or alluvium, which overlies bedrock. The thickness of the overburden varies from a few feet to 100 feet.

The surface geology of the site consists of till, peat, and disturbed land in mined areas. Soils of the Nashwauk series cover the majority of the site. These soils consist of deep, well drained, slowly permeable soils on till plains and glacial moraines, formed in firm loamy glacial till.

The end moraine deposits form rolling and hilly topography including numerous lakes and potholes. Portions of the site are also Greenwood peat, Keewatin silt loam, or borosaprolites. The Greenwood peat consists of nearly level, very poorly drained, organic soils. The Keewatin silt loam is a nearly level, somewhat poorly drained soil on plane and slightly concave slopes on glacial moraines and till plains.

Sand and gravel aquifers occur beneath till and on the flanks of end moraines (USGS, 1968). Buried bedrock valleys in the region create variability in the thickness of quaternary deposits. North of Taconite, quaternary deposits range from approximately 10 to 40 feet thick, whereas in Coleraine and Bovey quaternary, deposits are approximately 130 feet thick (USDI, 1965).

Figure 2.4-4 Arrowhead Region Quaternary Geology



2.4.5.2 East Range Site

As shown in Figure 2.4-4, soils overlying the Virginia Formation include glacial till of the Culver Moraine of the Des Moines Lobe, which was part of the Wisconsinan glaciation. These soils are typically sandy lean clays with gravel, cobbles, and boulders. The amount of gravel, cobbles, and boulders in the till at any particular location is highly variable. The tills can vary to clayey sands and silty sands. The glacial till overlies the Virginia Formation bedrock. The thickness of the glacial till is 25 feet or less. The soil is reddish brown and clayey with sporadic clasts of shale. This glacial till is commonly non-calcareous (Hobbs and Goebel, 1982). The end moraine deposits form rolling and hilly topography including numerous lakes and potholes. Sand and gravel aquifers occur beneath till and in ice contact features on the flanks of end moraines (USGS, 1968).

At the extreme eastern reach of the East Range Site, the surface geology consists of ground moraine of the Vermillion Moraine Association of the Rainy Lobe. This glacial till is extremely stony and sandy and contains only trace amounts of clay. In this area, the till is thin and patchy over a hilly terrain of scoured bedrock (Hobbs and Goebel, 1982).

Buried bedrock valleys in the region create variability in the thickness of quaternary deposits. At the project site, quaternary deposits are typically less than 25 feet thick (Wright, 1972), whereas southwest of Aurora quaternary deposits are as much as 453 feet thick (MGS Publication M-158).

2.4.6 Soils

2.4.6.1 West Range

2.4.6.1.1 IGCC Power Station Footprint and Buffer Land

2.4.6.1.1A *Minnesota Geologic Survey*

The Quarternary geology map of Minnesota (Hobbs and Goebel, 1982) indicates that the West Range IGCC Power Station Footprint and Buffer Land is generally covered with ground moraine (glacial till) of the Nashwauk Moraine Association, which was deposited during the presence of the Rainey Lobe, late Wisconsinan stage of glaciations (see Figure 2.4-4). The till is brown to gray, non-calcareous drift; clasts are predominantly igneous and metamorphic rocks of the Canadian Shield. The till exists over Rainey lobe outwash deposits which are undivided as to association.

2.4.6.1.1B *Itasca County Soils Survey*

According to the Itasca County Soils Survey (Nyberg, 1982), surface soils at the West Range IGCC Power Station Footprint and Buffer Land are characterized by the Nashwauk-Keewatin Association and consist of nearly level to very steep, well drained and somewhat poorly drained loamy and silty soils that formed in glacial till on till plains, and moraines. Five soil series occur at the site, including Greenwood, Blackhoof, Keewatin, Nashwauk and Moose Lake, with Nashwauk being the most predominant. A map of the IGCC Power Station Footprint and Buffer

Land with site soils and proposed facilities is shown in Figure 2.4-5. The soil series are described below. A soils map for the IGCC Power Station Footprint and Buffer Land showing where soils are 3 feet or less above the groundwater table is provided in Figure 2.4-7

2.4.6.1.1B(1) ***Nashwauk (fine sandy loam) Series (622)***

This nearly level to rolling, well drained soil is on convex slopes on glacial moraine. A few stones and boulders are on the surface and in the soil. Included with this soil in mapping are small areas of the nearly level, somewhat poorly drained Keewatin soils and small areas of the very poorly drained Blackhoof soils. Permeability is low in the Nashwauk. The surface layer is very strongly acidic to slightly acidic and the underlying soil is strongly acidic to neutral. The organic matter content and natural fertility are low. The excessive acidity and low fertility can be overcome with lime and fertilizer. Erosion is problematic due to the low fertility and the extended time to build-up substantial vegetation. Building local roads on contour and establishing well suited vegetation on the road banks help control erosion. Frost action is problematic for road surfaces. The material is ill-suited for septic tank fields due to its low percolation rate. Enlarging the septic field helps alleviate the problem, but may not totally solve it.

2.4.6.1.1B(2) ***Keewatin (silt loam) Series (619)***

This nearly level somewhat poorly drained soil is on plain and slightly concave slopes on glacial moraine and till plains. Acidity, permeability and fertility are similar to Nashwauk soils. Ponding and frost action are problematic for roadways.

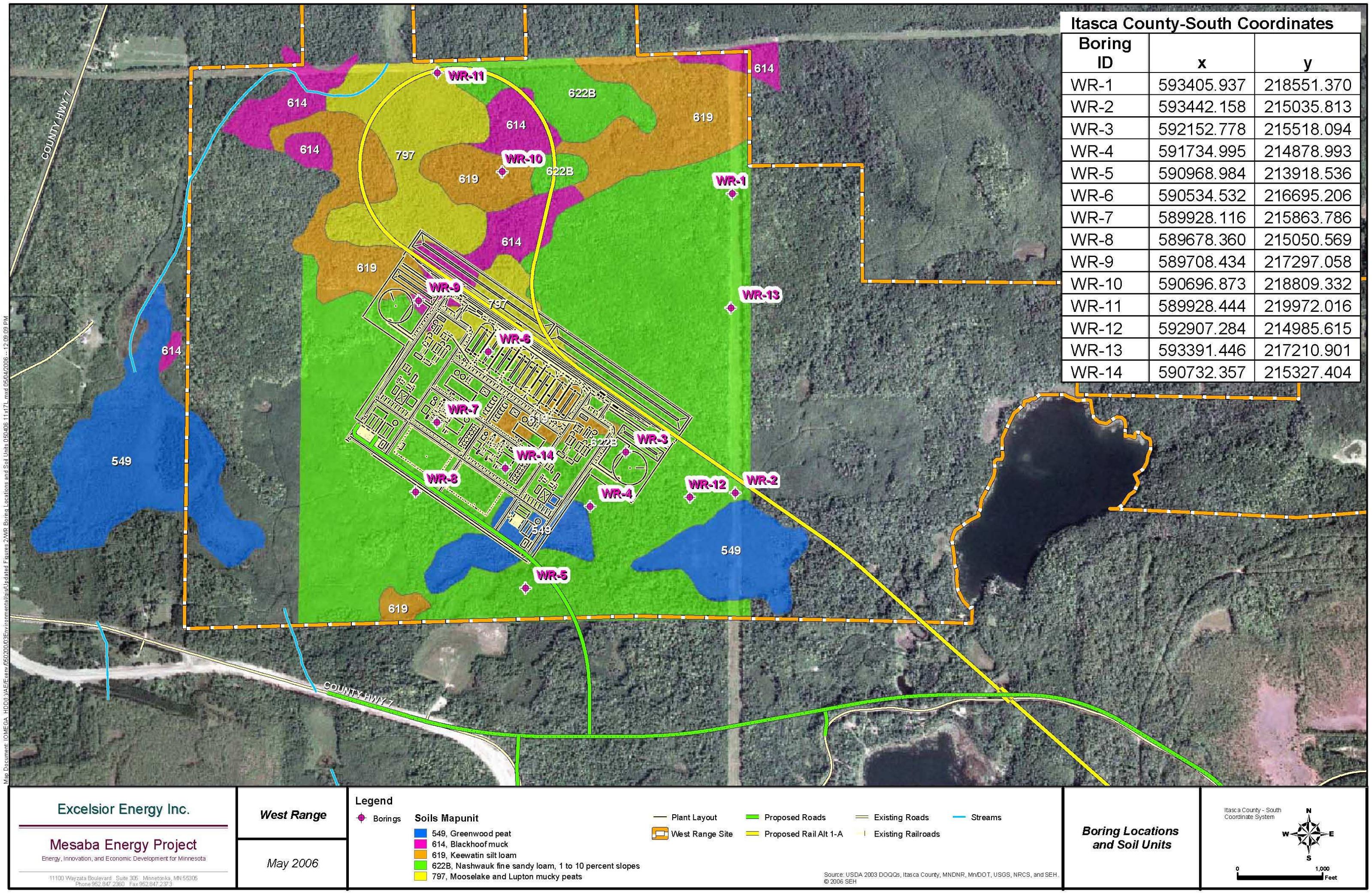
2.4.6.1.1B(3) ***Blackhoof (muck) Series (614)***

Blackhoof forms on concave and plain slopes on till plains and glacial moraines. Most Blackhoof areas are undrained. It is ponded in the spring and after heavy rains. The average high water is two feet above the surface to one foot below the surface. The peat is somewhat shallow, on the order of a foot or less. Underlying materials are silts and silty clays. The upper peat is highly acidic. The lower material is mildly alkaline. Ponding and frost action are problematic for roadways.

2.4.6.1.1B(4) ***Greenwood (Peat) Series (549)***

These soils consist of peat and are formed in depressions or on poorly drained flat ground (bogs in glacial moraine). The soils are encountered in wetland areas. The organic soil is extremely acidic throughout. Seasonal high water is one foot above to one foot bgs (“bgs”). Tamarack and Black Spruce are supported in some Greenwood bogs. Equipment access is a problem due to the material’s low strength. Because of low strength, road settlement is a problem.

Figure 2.4-5. West Range Soils and Boring Locations



2.4.6.1.1B(5) ***Moose Lake (mucky peat) Series (797)***

Moose Lake soils consist of peat and are formed in depressions or on poorly drained flat ground and consist of bogs on lake plains, outwash plains and glacial moraines. The soils are encountered in wetland areas where the seasonal high water is typically one foot above to 2 feet bgs. Reaction is strongly acidic to neutral. Moose Lake soils are characterized by low strength and compressibility and because of this, road settlement is a problem.

2.4.6.1.2 West Range HVTL Alternative Routes

2.4.6.1.2A ***Minnesota Geologic Survey***

The Quarternary geology map of Minnesota (Hobbs and Goebel, 1982) shown in Figure 2.4-4 indicates that the West Range HVTL corridors are generally covered with ground moraine (glacial till) of the Nashwauk Association, end moraine (glacial till) of the Sugar Hills Association, glacial outwash undivided as to moraine association, sand and gravel glacial lake sediment undivided as to moraine association, and peat. The till of the Nashwauk Association is brown to gray non-calcareous drift; clasts are predominately igneous and metamorphic rocks of the Canadian Shield. This till exists over Rainy Lobe outwash deposits which are undivided as to association. The Sugar Hills Moraine Association represents the northwestern part of the St. Louis sublobe. Reddish colored lake sediments are incorporated only locally.

2.4.6.1.2B ***Itasca County Soil Survey***

Soils along the West Range HVTL corridors are in the Greenwood-Mooselake-Lupton, Nashwauk-Keewatin, Warba-Nebish, Itasca-Goodland, Menhaga-Graycalm, Cutaway-Sandwick, Zimmerman-Cowhorn, Rosy-Spooner-Baudette, and Pengilly-Winterfield associations. Given the length of the proposed HVTL corridors, there is not one predominant soil type. For the purposes of this document, the soil series will be described according to parent material and anticipated construction issues associated with the series. The acidity/alkalinity is only mentioned for soil series where it is anticipated to affect the proposed construction.

2.4.6.1.2B(1) ***Recent Organic Deposits***

Organic deposits of recent vintage include the Loxley (Peat), Greenwood Peat, Mooselake and Lupton (Mucky Peats), Seelyville-Bowstring Association, and Borosaprists, Depressional series. These soils formed in nearly level bogs on lake plains, outwash plains, and glacial moraines. They are very poorly drained. The soil survey shows these peat soils extending to a depth of at least 6 feet, which is the maximum depth evaluated by the soil survey. The groundwater table is typically 2 feet below to 2 feet above the ground surface. These soils are highly acidic. As shown in Figure 2.4-6, there are numerous areas of compressible, highly organic soils at the West Range Site where the groundwater table is 3 feet or less below the surface. Ponding and caving of cutbanks severely impede shallow excavations in these soils. These soils are good for establishing wetland plants and poor for establishing other types of vegetation.

2.4.6.1.2B(2) ***Recent Organic Deposits and Alluvium***

Such deposits include the Cathro (Muck), Blackhoof (Muck), Tawas (Muck), and Sago and Roscommon series. These soils consist of 1 to 2 feet of hemic and sapric peat underlain by loam, loamy sand, coarse sand, loamy coarse sand, sand, and silt loam. The depth to the seasonal high groundwater table ranges from 2 feet above to 3 feet bgs. The peat in the upper portion of the soil profile is highly acidic. Figure 2.4-6 shows all soils where the ground water table is higher than 3 feet bgs. These areas include the recent organic deposits and alluvium, as well as other soils. These soils are poor for establishing grasses and legumes, wild herbaceous plants, hardwood trees, and coniferous plants. They are good for establishing wetland vegetation. These soils severely impede shallow excavations because of ponding, and cutbank caving.

2.4.6.1.2B(3) ***Lacustrine Deposits***

These deposits include the Spooner (Silt Loam), Cowhorn (Loamy Very Fine Sand), and Morph (Very Fine Sandy Loam) series. Such soils are poorly drained and occur on plane and slightly concave slopes on glacial lake plains and outwash plains. They consist of silt loam, clay loam, loam, loamy very fine sand, and very fine sand. The seasonal high groundwater table ranges from 1 to 3 feet bgs. These areas of high groundwater table are mapped in Figure 2.4-6, which shows all of the areas where the ground water table is 3 feet or less bgs. These soils severely impede shallow excavations because of wetness and caving cutbanks. These series are fair to good for establishing wetland plants. The Spooner and Morph series are fair for establishing grasses and legumes, hardwood trees, and coniferous plants and good for establishing wild herbaceous plants. The Cowhorn series is good for establishing grasses and legumes, hardwood trees, wild herbaceous plants, and coniferous plants.

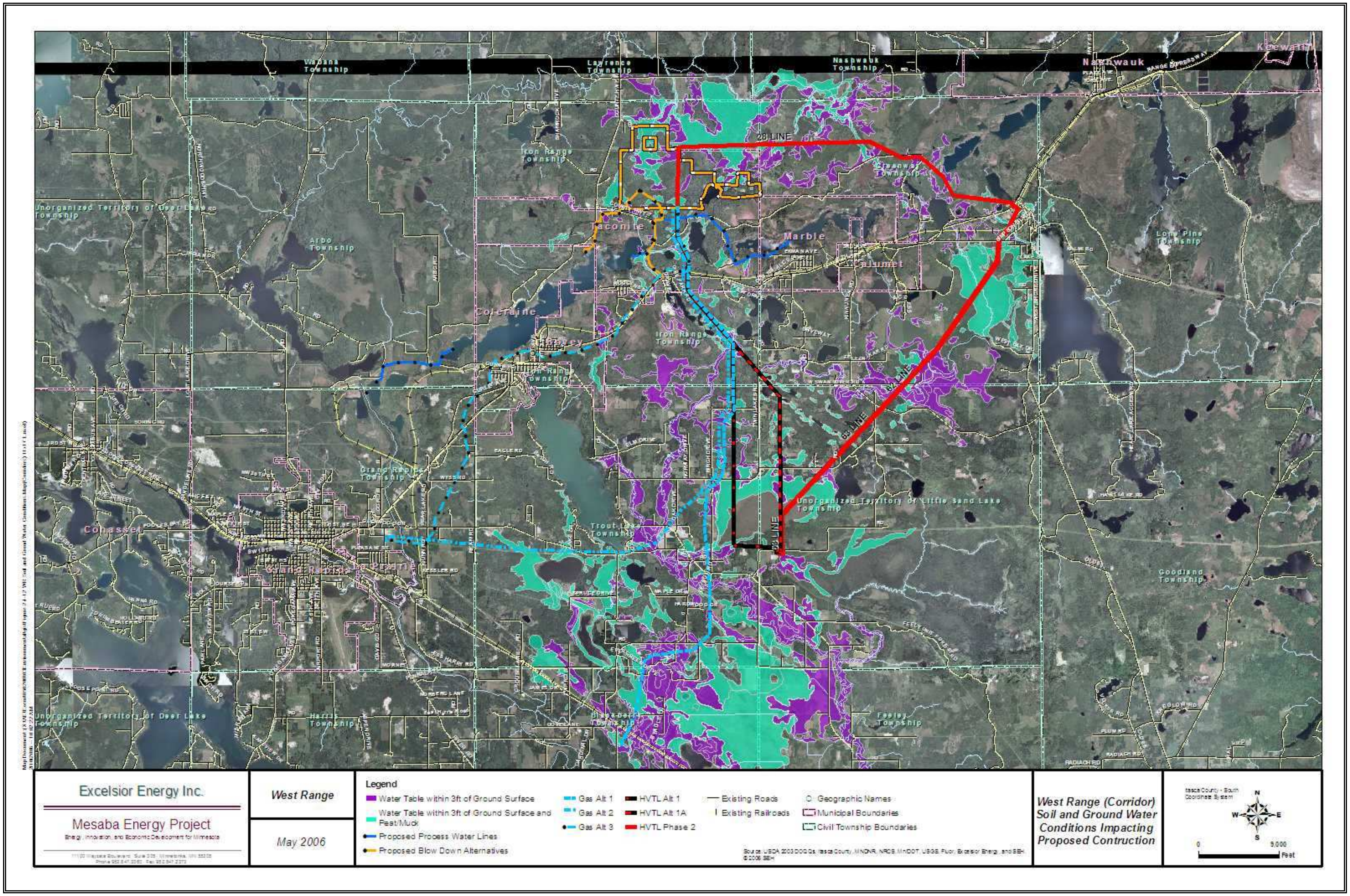
2.4.6.1.2B(4) ***Glacial Till***

This includes the Shooker, Warba, Stuntz, Itasca, Keewatin, Nashwauk, Sandwick, Talmoon, and Itasca-Goodland. The characteristics of these soils vary, so they are each described separately below. The first five soil series listed have a groundwater table 3 feet bgs or higher. The areas where these first fives shallow soil types are found is shown in Figure 2.4-6 along with the proposed HVTL alignment, since the shallow groundwater is expected to impact construction. The final four soil series listed have a deeper groundwater table.

2.4.6.1.2B(4)(a) ***Shooker (Very Fine Sandy Loam)***

This soil is poorly drained and occurs in plains and moraines. It includes very fine sandy loam, sandy clay loam, clay loam, and loam. The ground water table is 1 to 3 feet bgs. According to the Itasca County Soil Survey, wetness impedes shallow excavations. These soils are suitable for establishing grasses, legumes, wild herbaceous plants, coniferous plants, and wetland plants.

Figure 2.4-6 West Range Corridor Soil and Groundwater Conditions



2.4.6.1.2B(4)(b) ***Stuntz (Very Fine Sandy Loam)***

This soil is somewhat poorly drained and occurs in nearly level plains and moraines. Soil types include very fine sandy loam and clay loam. The ground water table ranges from 1.5 to 3 feet bgs. These soils are fair for establishing coniferous plants and wetland plants and good for establishing wild herbaceous plants, hardwood trees, and grasses and legumes. Wetness impedes shallow excavations.

2.4.6.1.2B(4)(c) ***Keewatin (Silt Loam)***

This soil is somewhat poorly drained and occurs on plane and slightly concave slopes on glacial moraines and till plains. Soil types include silt loam, fine sandy loam, sandy loam, and loam. The ground water table ranges from 0.5 to 1.5 feet bgs. These soils are good for establishing grasses and legumes, wild herbaceous plants, hardwood trees, and coniferous plants. They are fair for establishing wetland plants. Wetness impedes shallow excavations.

2.4.6.1.2B(4)(d) ***Sandwick (Loamy Fine Sand)***

This soil is somewhat poorly drained and occurs on nearly level glacial moraines and till plains. Soil types include loamy fine sand and loam. The groundwater table ranges from 1 to 2 feet bgs. This soil is fair for establishing grasses, legumes, and wetland plants and good for establishing wild herbaceous plants, hardwood trees, and coniferous plants. Wetness impedes shallow excavations, and cut banks tend to cave, according to the Itasca County Soil Survey.

2.4.6.1.2B(4)(e) ***Talmoon (Silt Loam)***

This soil is very poorly drained and occurs on nearly level concave slopes on glacial till plains. Soil types include silt loam, very fine sandy loam, sandy clay loam, and loam. The ground water table ranges from 1 foot above to 1.5 feet bgs. Talmoon soils are poor for establishing grasses and legumes, wild herbaceous plants, hardwood trees, and coniferous plants. They are good for establishing wetland plants. Ponding severely impedes shallow excavations.

2.4.6.1.2B(4)(f) ***Warba (Fine Sandy Loam)***

This soil is well drained and occurs in nearly level to rolling glacial moraines and till plains. Soil types include fine sandy loam, clay loam, and sandy clay loam. The ground water table is greater than 6 feet bgs. According to the Itasca County Soil Survey, restrictions on shallow excavations are "slight." These soils are fair for the establishing grasses, legumes, wild herbaceous plants, coniferous plants, and wetland plants.

2.4.6.1.2B(4)(g) ***Itasca (Silt Loam)***

This soil is well drained and occurs on nearly level to rolling plane and complex slopes on glacial till planes and moraines. Soil types include silt loam and fine sandy loam. The ground water table is more than 6 feet bgs. These soils are good for establishing grasses and legumes, wild herbaceous plants, hardwood trees, and coniferous plants. They are very poor for establishing wetland plants. The Itasca County Soil Survey describes the restrictions on shallow excavations to be "slight."

2.4.6.1.2B(4)(h) ***Nashwauk (Fine Sandy Loam)***

This soil is well drained and occurs on glacial moraines and along drainageways on till plains. Soil types include fine sandy loam, loam, and silt loam. The ground water table is greater than 6 feet bgs. These soils are good for establishing grasses and legumes where the slope is 10 percent or less and fair where the slope is greater than 10 percent. They are good for establishing wild herbaceous plants, hardwood trees, and coniferous plants and poor to very poor for establishing wetland plants. The Itasca County Soil Survey describes restrictions on shallow excavations to be moderate in the 1 to 10 percent slopes due to a hard layer and severe in the slopes steeper than 10 percent due to the slopes.

2.4.6.1.2B(4)(i) ***Itasca-Goodland (Silt Loams)***

This well drained soil occurs on hilly to steep (12 to 25 percent) concave and convex slopes on glacial moraines. Soil types include silt loam, fine sandy loam, loam, loamy coarse sand, and gravelly sand. The ground water table is greater than 6 feet bgs. According to the Itasca County Soil Survey, the steep slopes and caving of cutbanks severely impede shallow excavations. These soils are good for establishing grasses and legumes, wild herbaceous plants, hardwood trees, and coniferous plants. They are very poor for establishing wetland plants.

2.4.6.1.2B(5) ***Glacial Outwash***

This includes the Zimmerman (Loamy Fine Sand), Meehan (Loamy Sand), Cromwell (Fine Sandy Loam), Menahga (Loamy Sand), Goodland (Silt Loam), and Menahga and Graycalm series. These soils are well to excessively drained, except for the Goodland, which is poorly drained. These soils include loamy fine sand, fine sand, fine sandy loam, sandy loam, loamy sand, coarse sand, loamy coarse sand, sand, silt loam, and gravelly sand. The finer soils tend to be near the ground surface, with the soils becoming coarser with depth. The ground water table is greater than 6 feet bgs. These soils are very poor for establishing wetland vegetation. The Menahga and Zimmerman soils are poor for establishing grasses and legumes, hardwood trees, and coniferous plants and fair for establishing wild herbaceous plants. The Cromwell soils are fair for establishing grasses and legumes, wild herbaceous plants, hardwood trees, and coniferous plants. Goodland soils are good for establishing grasses and legumes, wild herbaceous plants, hardwood trees, and coniferous plants. Graycalm soils are good for establishing hardwood trees and coniferous plants, fair for establishing wild herbaceous plants, and poor for establishing grasses and legumes. According to the Itasca County Soil Survey, shallow excavations are severely impeded by cutbanks caving in all these soils.

2.4.6.1.3 West Range Gas Pipeline Alternatives Routes

2.4.6.1.3A ***Minnesota Geological Survey***

The quarternary geology map of Minnesota (Hobbs and Goebel, 1982) indicates that the West Range Gas Pipeline Alternative 1, 2, and 3 corridors are generally covered with ground moraine (glacial till) of the Nashwauk Association, end moraine (glacial till) of the Sugar Hills Association, glacial outwash undivided as to moraine association, sand and gravel glacial lake sediment undivided as to moraine association, and peat (see Figure 2.4-4). In addition, portions of Gas Pipeline Alternative 3 are covered by mine pits and dumps. The till of the Nashwauk

Association is brown to gray non-calcareous drift; clasts predominately igneous and metamorphic rocks of the Canadian Shield. This till exists over Rainy Lobe outwash deposits which are undivided as to association. The Sugar Hills Moraine Association represents the northwestern part of the St. Louis sublobe. Reddish colored lake sediments are incorporated only locally.

2.4.6.1.3B ***Itasca County Soil Survey***

Soils along the West Range Gas Pipeline Alternative 1, 2, and 3 corridors are in the Greenwood-Mooselake-Lupton, Nashwauk-Keewatin, Warba-Nebish, Itasca-Goodland, Menhaga-Graycalm, Cutaway-Sandwick, Zimmerman-Cowhorn, Rosy-Spooner-Baudette, and Pengilly-Winterfield associations. Given the length of the proposed gas pipeline corridors, there is not one predominant soil type. For the purposes of this document, the soil series will be described according to parent material and anticipated construction issues associated with the series. The acidity/alkalinity is only mentioned for soil series where it is anticipated to affect the proposed construction. Descriptions of the soils are included above. The areas where these soils are less than 3 feet above the groundwater table are shown for the entire West Range Site in Figure 2.4-6, including the areas crossed by transmission and pipeline routes. A similar, but close up version, of this map for the IGCC Power Station and Buffer Land is provided in Figure 2.4-7.

2.4.6.1.4 West Range Process Water Supply Pipeline

2.4.6.1.4A ***Segment 1—LMP to CMP***

2.4.6.1.4A(1) ***Minnesota Geologic Survey***

The quarternary geology map of Minnesota (Hobbs and Goebel, 1982) indicates that the Segment 1 Process Water Supply Pipeline corridor is covered with mine pits and dumps.

2.4.6.1.4A(2) ***Itasca County Soil Survey***

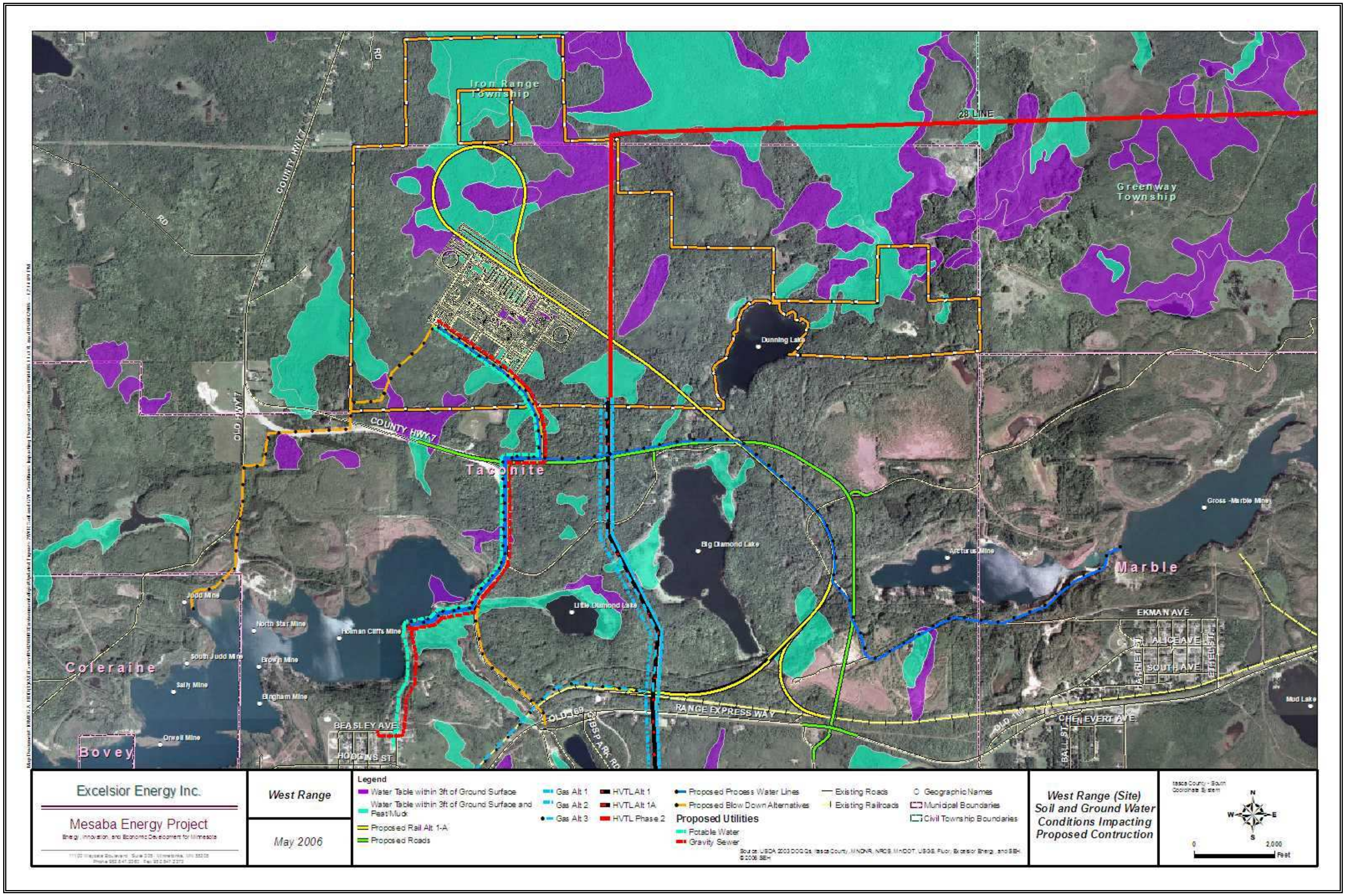
Soils along the Segment 1 Process Water Supply Pipeline consist of mine pits, Udorthents, nearly level to rolling, and Slickens. Slickens consist of mine tailings left over from the taconite concentration process. This material is in basins having containment dikes constructed from mine overburden. For the purposes of this document, the remaining soil series are described according to parent material and anticipated construction issues associated with the series. The acidity/alkalinity is only mentioned for soil series where it is anticipated to affect the proposed construction. Areas where the groundwater table is less than 3 feet below the soil surface are shown in Figure 2.4-7.

2.4.6.1.4B ***Segment 2—CMP to West Range Site***

2.4.6.1.4B(1) ***Minnesota Geologic Survey***

The quarternary geology map of Minnesota (Hobbs and Goebel, 1982) indicates that the West Range Process Water Supply Pipeline Alternative 2 corridor is generally covered with ground moraine (glacial till) of the Nashwauk Association, end moraine (glacial till) of the Sugar Hills Association, and peat. The till of the Nashwauk Association is brown to gray non-calcareous drift; clasts predominately igneous and metamorphic rocks of the Canadian Shield. This till exists over Rainy Lobe outwash deposits which are undivided as to association. The Sugar Hills Moraine Association represents the northwestern part of the St. Louis sublobe. Reddish colored lake sediments are incorporated only locally.

Figure 2.4-7 West Range Site Soil and Groundwater Conditions



2.4.6.1.4B(2) *Itasca County Soil Survey*

Soils along the West Range Process Water Supply Pipeline Alternative 2 corridor are in the Greenwood-Mooselake-Lupton and Nashwauk-Keewatin associations. The predominant soil type is glacial till. For the purposes of this document, the soil series are described according to parent material and anticipated construction issues associated with the series. The acidity/alkalinity is only mentioned for soil series where it is anticipated to affect the proposed construction. The soil types are described earlier for the HVTL routes, and are shown in Figure 2.4-4.

2.4.6.1.4C *Segment 3—HAMP Complex to CMP*

2.4.6.1.4C(1) *Minnesota Geologic Survey*

The quarternary geology map of Minnesota (Goebel and Hobbs, 1982) indicates that the West Range Process Water Supply Pipeline Segment 3 is generally covered with ground moraine (glacial till) of the Nashwauk Association, end moraine (glacial till) of the Sugar Hills Association, glacial outwash undivided as to moraine association, sand and gravel glacial lake sediment undivided as to moraine association, and peat. The till of the Nashwauk Association is brown to gray non-calcareous drift; clasts predominately igneous and metamorphic rocks of the Canadian Shield. This till exists over Rainy Lobe outwash deposits which are undivided as to association. The Sugar Hills Moraine Association represents the northwestern part of the St. Louis sublobe. Reddish colored lake sediments are incorporated only locally.

2.4.6.1.4C(2) *Itasca County Soil Survey*

Soils along the West Range Process Water Supply Pipeline Segment 3 corridor are in the Nashwauk-Keewatin association. The predominant soil type is glacial till. For the purposes of this document, the soil series will be described according to parent material and anticipated construction issues associated with the series. The acidity/alkalinity is only mentioned for soil series where it is anticipated to affect the proposed construction. Soil types are described earlier in this report and shown in Figure 2.4-4.

2.4.6.1.5 West Range Process Water Blowdown Pipeline Alternative 1

2.4.6.1.5A *Minnesota Geologic Survey*

The quarternary geology map of Minnesota (Hobbs and Goebel, 1982) indicates that West Range Process Water Blowdown Pipeline Alternative 1 corridor is generally covered with ground moraine (glacial till) of the Nashwauk Association, end moraine (glacial till) of the Sugar Hills Association, and peat. The till of the Nashwauk Association is brown to gray non-calcareous drift; clasts predominately igneous and metamorphic rocks of the Canadian Shield. This till exists over Rainy Lobe sand and gravel outwash deposits which are undivided as to association. The Sugar Hills Moraine Association represents the northwestern part of the St. Louis sublobe. Reddish colored lake sediments are incorporated only locally.

2.4.6.1.5B ***Itasca County Soil Survey***

Soils along the West Range Process Water Blowdown Pipeline 1 corridor are in the Greenwood-Mooselake-Lupton and Nashwauk-Keewatin associations. The predominant soil type is glacial till. For the purposes of this document, the soil series are described according to parent material and anticipated construction issues associated with the series. The acidity/alkalinity is only mentioned for soil series where it is anticipated to affect the proposed construction. Soil types are described earlier in Section 2.4.6.1.2 and generally shown in Figure 2.4-4. Areas where the soil surface is less than 3 feet above the groundwater table are shown in Figure 2.4-7.

2.4.6.1.6 West Range Process Water Blowdown Pipeline 2

2.4.6.1.6A ***Minnesota Geologic Survey***

The quarternary geology map of Minnesota (Hobbs and Goebel, 1982) indicates that the soils along the West Range Process Water Blowdown Pipeline 2 consist of mine pits and dumps and end moraine (glacial till) of the Sugar Hills Association. The Sugar Hills Moraine Association represents the northwestern part of the St. Louis sublobe. Reddish colored lake sediments are incorporated only locally.

2.4.6.1.6A(1) ***Itasca County Soil Survey***

Soils along the West Range Process Water Blowdown Pipeline 2 are in the Nashwauk-Keewatin and Udorthents Associations. For the purposes of this document, the soil series are described according to parent material and anticipated construction issues associated with the series. The acidity/alkalinity is only mentioned for soil series where it is anticipated to affect the proposed construction.

2.4.6.1.7 West Range Potable Water and Sewer Pipelines

2.4.6.1.7A ***Minnesota Geologic Survey***

Figure 2.4-4 indicates that West Range Potable Water and Sewer Pipeline corridors are generally covered with ground moraine (glacial till) of the Nashwauk Association, end moraine (glacial till) of the Sugar Hills Association, and peat. The till of the Nashwauk Association is brown to gray non-calcareous drift; clasts are predominately igneous and metamorphic rocks of the Canadian Shield. This till exists over Rainy Lobe sand and gravel outwash deposits which are undivided as to association. The Sugar Hills Moraine Association represents the northwestern part of the St. Louis sublobe. Reddish colored lake sediments are incorporated only locally.

2.4.6.1.7B ***Itasca County Soil Survey***

Soils along the West Range Potable Water and Sewer Pipeline corridors are in the Greenwood-Mooselake-Lupton and Nashwauk-Keewatin associations. The predominant soil type is glacial till. For the purposes of this document, the soil series are described according to parent material and anticipated construction issues associated with the series. The acidity/alkalinity is only mentioned for soil series where it is anticipated to affect the proposed construction. Soil types are shown in Figure 2.4-5.

2.4.6.1.8 West Range Rail Line Alternative 1A

2.4.6.1.8A *Minnesota Geologic Survey*

The quarternary geology map of Minnesota (Hobbs and Goebel, 1982) indicates that the West Range Rail Line Alternative 1A corridor is generally covered with ground moraine (glacial till) of the Nashwauk Association, end moraine (glacial till) of the Sugar Hills Association, glacial outwash undivided as to moraine association, sand and gravel glacial lake sediment undivided as to moraine association, and peat. The till of the Nashwauk Association is brown to gray non-calcareous drift; clasts are predominately igneous and metamorphic rocks of the Canadian Shield. This till exists over Rainy Lobe outwash deposits which are undivided as to association. The Sugar Hills Moraine Association represents the northwestern part of the St. Louis sublobe. Reddish colored lake sediments are incorporated only locally.

2.4.6.1.8B *Itasca County Soil Survey*

Soils along the West Range Rail Line Alternative 1A corridor are in the Nashwauk-Keewatin, association. The predominant soil type is glacial till. For the purposes of this document, the soil series are described according to parent material and anticipated construction issues associated with the series. The acidity/alkalinity is only mentioned for soil series where it is anticipated to affect the proposed construction. Soil types are described in Section 2.4.6.1.2 and shown in Figure 2.4-5.

2.4.6.1.9 West Range Rail Line Alternative 1B

2.4.6.1.9A *Minnesota Geologic Survey*

The quarternary geology map of Minnesota (Goebel and Hobbs, 1982) indicates that the West Range Rail Line Alternative 1B corridor is generally covered with ground moraine (glacial till) of the Nashwauk Association, end moraine (glacial till) of the Sugar Hills Association, sand and gravel glacial lake sediment undivided as to moraine association, and peat. The till of the Nashwauk Association is brown to gray non-calcareous drift; clasts predominately igneous and metamorphic rocks of the Canadian Shield. This till exists over Rainy Lobe outwash deposits which are undivided as to association. The Sugar Hills Moraine Association represents the northwestern part of the St. Louis sublobe. Reddish colored lake sediments are incorporated only locally.

2.4.6.1.9B *Itasca County Soil Survey*

Soils along the Rail Line Alternative 1B Corridor are in the Nashwauk-Keewatin association. Some mine dumps are indicated within the corridor. The predominant soil type is glacial till. For the purposes of this document, the soil series will be described according to parent material and anticipated construction issues associated with the series. The acidity/alkalinity is only mentioned for soil series where it is anticipated to affect the proposed construction.

2.4.6.1.10 West Range Rail Line Alternative 2

The geology and soil conditions for Alternative 2 were not evaluated because it would have required that a large portion of Big Diamond Lake be filled. This is discussed further in Section 1.12.3 of this report.

2.4.6.1.11 West Range Roads

2.4.6.1.11A *Minnesota Geologic Survey*

The quarternary geology map of Minnesota (Hobbs and Goebel 1982) indicates that the alignments are generally covered with ground moraine (glacial till) of the Nashwauk Association, end moraine (glacial till) of the Sugar Hills Association, glacial outwash undivided as to moraine association, sand and gravel glacial lake sediment undivided as to moraine association, and peat. The till of the Nashwauk Association is brown to gray non calcareous drift; clasts predominately igneous and metamorphic rocks of the Canadian Shield. This till exists over Rainy Lobe outwash deposits which are undivided as to association. The Sugar Hills Moraine Association represents the northwestern part of the St. Louis sublobe. Reddish colored lake sediments are incorporated only locally.

2.4.6.1.11B *Itasca County Soil Survey*

Soils along the Access Road 1 and Access Road 2 corridors are in the Nashwauk-Keewatin, association. The predominant soil type is glacial till. For the purposes of this document, the soil series are described according to parent material and anticipated construction issues associated with the series. The acidity/alkalinity is only mentioned for soil series where it is anticipated to affect the proposed construction. Soil types for the roadway sections within the Buffer Land are shown in Figure 2.4-5.

2.4.6.2 East Range

2.4.6.2.1 IGCC Power Station Footprint and Buffer Land

2.4.6.2.1A *Minnesota Geologic Survey*

The East Range IGCC Power Station Footprint and Buffer Land is located on the end moraine of the Culver Association of the Des Moines Lobe, which is shown below in Figure 2.4-8.

2.4.6.2.1B *St. Louis County Soil Survey*

This soil survey was being drafted as of the writing of this report and was not available in final format. However, information in the soil survey regarding the IGCC Power Station Footprint and Buffer Land confirms the presence of glacial till soils as described by the Minnesota Geologic Survey. Since this information was in draft form and not available in electronic format for creating figures/maps, discussion of the soil descriptions in this document have been left out of the soil conditions discussion for the rest of the East Range Site features.

2.4.6.2.2 East Range 38L/Route HVTL

The 38L Route extends southwesterly from the IGCC Power Station Footprint and Buffer Land. The route traverses till of the Culver and Sugar Hills moraines (Des Moines lobe sediments), glacial lake sediments and peat. The location of these soils along the alignment is shown generally above in Figure 2.4-4 on Arrowhead Quaternary Geology.

The glacial Des Moines lobe till sediments are derived from Manitoba and North Dakota. The sediments are typically reddish-brown stiff to hard silty clays with cobbles and boulders. They are commonly non-calcareous and contain sporadic clasts of limestone and shale. Discontinuous lenses and layers of silty sand can be encountered within the till.

The glacial lake sediments were typically deposited just prior to the close the last glacial episode and contain soft to medium stiff, stratified clay and silt deposits. Occasional cobbles and boulders (floats) are encountered within the deposits. The groundwater table is often rather high in these deposits.

The peat soils are Holocene in nature, deposited since the close of the last glacial period. The materials are very soft and highly compressible. The amount of organic material in any given peat deposit is a function of its depositional environment, age and degree of decomposition. The groundwater table is typically near the ground surface in these deposits.

2.4.6.2.3 East Range HVTL Alternative 2

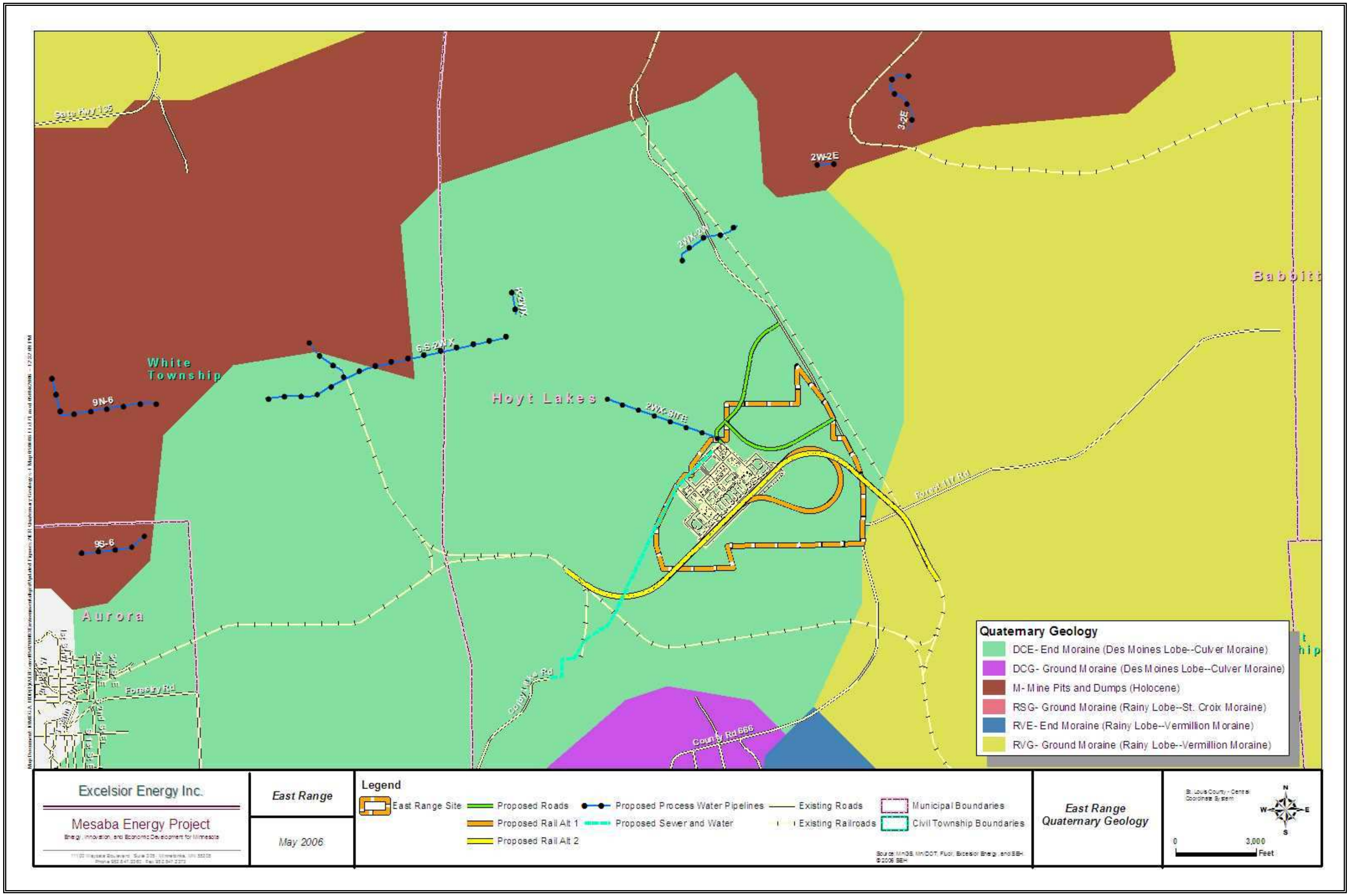
The 39L/37L HVTL Route extends southwesterly from the IGCC Power Station Footprint and Buffer Land. The route traverses glacial till of the Culver and Sugar Hills moraines (Des Moines lobe sediments), glacial till of the Vermillion and Nashwauk moraines (Rainy Lob sediments), mine pits and dumps, glacial lake sediments and peat. The location of these soils along the alignment is shown above in the Arrowhead Quartenary Geology Map in Figure 2.4-4.

The glacial Des Moines lobe till sediments are derived from Manitoba and North Dakota. The sediments are typically reddish-brown stiff to hard silty clays with cobbles and boulders. They are commonly non-calcareous and contain sporadic clasts of limestone and shale. Discontinuous lenses and layers of silty sand can also be encountered within the till.

The till of the Nashwauk moraine is brown to gray non-calcareous drift, with clasts of predominantly igneous and metamorphic rocks of the Canadian Shield. The till typically exists over Rainy lobe sand and gravel outwash deposits which are undivided as to Association. The consistency of the Nashwauk till is typically stiff to hard with cobbles and boulders present. The glacial lake sediments were typically deposited just prior to the close the last glacial episode and contain soft to medium stiff, stratified clay and silt deposits. Occasional cobbles and boulders (floats) are encountered within the deposits. The groundwater table is often rather high in these deposits.

The peat soils are Holocene in nature, deposited since the close of the last glacial period. The materials are very soft and highly compressible. The amount of organic material in any given peat deposit is a function of its depositional environment, age and degree of decomposition. The groundwater table is typically near the ground surface in these deposits.

Figure 2.4-8 East Range Site Quaternary Geology



Mine dumps contain overburden soil from iron mining operations, which typically consist of glacial till. They also contain fragments of rock and low-grade iron ore. The ore is typically 3 to 10 inches in diameter, but can range in size from pebbles to large boulders. The tops of the spoil piles are typically flat and the side slopes are steep. Some piles are as much as 200 feet high.

Mine pits are areas where the overburden soils and iron deposits have been removed. The depths of the pits often approach 400 feet. The pits have very steep side slopes (often 1:horizontal to 1:vertical). Some are currently being mined and some are abandoned. The abandoned pits contain water as deep as 350 feet or more. Partially submerged mine dumps of low-grade iron ore are located in some of the pits (Nyberg, 1987). Although this information has been taken from the Itasca County soil survey it is also applicable to this portion of St. Louis County due to the utilization of similar mining techniques.

2.4.6.2.4 East Range Natural Gas Pipeline Alternative 1

This alternative, HVTL 39L/37L, extends southerly from the east side of the plant footprint and buffer zone to Hoyt Lakes, then southwesterly. The route traverses glacial till of the Culver and Sugar Hills moraines (Des Moines lobe sediments), glacial till of the Vermillion and Nashwauk moraines (Rainy Lob sediments), glacial lake sediments and peat. The location of these soils along the alignment is shown in Figure 2.4-4.

The glacial Des Moines lobe till sediments are derived from Manitoba and North Dakota. The sediments are typically reddish-brown stiff to hard silty clays with cobbles and boulders. They are commonly non-calcareous and contain sporadic clasts of limestone and shale. Discontinuous lenses and layers of silty sand can also be encountered within the till.

The till of the Nashwauk moraine is brown to gray non-calcareous drift, with clasts predominantly igneous and metamorphic rocks of the Canadian Shield. The till typically exists over Rainy lobe sand and gravel outwash deposits which are undivided as to Association. The consistency of the Nashwauk till is typically stiff to hard with cobbles and boulders present.

The glacial lake sediments were typically deposited just prior to the close the last glacial episode and contain soft to medium stiff, stratified clay and silt deposits. Occasional cobbles and boulders (floats) are encountered within the deposits. The groundwater table is often rather high in these deposits.

The peat soils are Holocene in nature, deposited since the close of the last glacial period. The materials are very soft and highly compressible. The amount of organic material in any given peat deposit is a function of its depositional environment, age and degree of decomposition. The groundwater table is typically near the ground surface in these deposits.

2.4.6.2.5 East Range Process Water Supply Pipeline 9N-6

2.4.6.2.5A *Minnesota Geologic Survey*

The corridor for East Range Process Water Supply Pipeline 9N-6 is currently covered by mine pits and dumps. Figure 2.4-8 shows the quaternary geology at the Process Water Supply Pipeline 9S-6. Mine dumps contain overburden soil from iron mining operations, which typically consists of glacial till. They also contain fragments of rock and low-grade iron ore. The ore is mainly 3 to 10 inches in diameter, but can range from the size of pebbles to the size of boulders. The tops of piles are flat, and the sides are steep.

2.4.6.2.6 East Range Process Water Supply Pipeline 9S-6

The corridor for East Range Process Water Supply Pipeline 9S-6 is currently covered by mine pits and dumps. Figure 2.4-8 shows the quarternary geology characterizing Process Water Supply Pipeline 9S-6. Mine dumps contain overburden soil from iron mining operations, which typically consists of glacial till. They also contain fragments of rock and low-grade iron ore. The ore is mainly 3 to 10 inches in diameter, but can range from the size of pebbles to the size of boulders. The tops of piles are flat, and the sides are steep.

2.4.6.2.7 East Range Process Water Supply Pipeline 6-S-2WX

The corridor for East Range Process Water Supply Pipeline 6-S-2WX is currently covered by mine pits and dumps, and by the Culver Moraine of the Des Moines Lobe. Figure 2.4-8 shows the quarternary geology at the Process Water Supply Pipeline 6-S-2WX.

The Des Moines Lobe consists of gray calcareous drift, with shale and limestone clasts generally common. It is derived from Manitoba and eastern North Dakota. The combined content of silt and clay typically make up more than 50 percent of the till. The Culver Moraine Association represents the southwestern part of the St. Louis sublobe. It is generally reddish brown and clayey because it incorporated red sediment from earlier glacial lakes. Commonly, it is non-calcareous and contains sporadic clasts of limestone and shale.

2.4.6.2.8 East Range Process Water Supply Pipeline K-2WX

The corridor for East Range Process Water Supply Pipeline K-2WX is currently covered by the Culver Moraine of the Des Moines Lobe. Figure 2.4-8 shows the quarternary geology at the Process Water Supply Pipeline K-2WX.

The Des Moines Lobe consists of gray calcareous drift, with shale and limestone clasts generally common. It is derived from Manitoba and eastern North Dakota. The combined content of silt and clay typically make up more than 50 percent of the till. The Culver Moraine Association represents the southwestern part of the St. Louis sublobe. It is generally reddish brown and clayey because it incorporated red sediment from earlier glacial lakes. Commonly, it is non-calcareous and contains sporadic clasts of limestone and shale.

2.4.6.2.9 East Range Process Water Supply Pipeline 2WX-Site

The corridor for East Range Process Water Supply Pipeline 2WX-Site is currently covered by the Culver Moraine of the Des Moines Lobe. Figure 2.4-8 shows the quarternary geology at the Process Water Supply Pipeline 2WX-Site.

The Des Moines Lobe consists of gray calcareous drift, with shale and limestone clasts generally common. It is derived from Manitoba and eastern North Dakota. The combined content of silt and clay typically make up more than 50 percent of the till. The Culver Moraine Association represents the southwestern part of the St. Louis sublobe. It is generally reddish brown and clayey because it incorporated red sediment from earlier glacial lakes. Commonly, it is non-calcareous and contains sporadic clasts of limestone and shale.

2.4.6.2.10 East Range Process Water Supply Pipeline 2WX-2W

The corridor for East Range Process Water Supply Pipeline 2WX-2W is currently covered by the Culver Moraine of the Des Moines Lobe. Figure 2.4-8 shows the quarternary geology at the Process Water Supply Pipeline 2WX-2W.

The Des Moines Lobe consists of gray calcareous drift, with shale and limestone clasts generally common. It is derived from Manitoba and eastern North Dakota. The combined content of silt and clay typically make up more than 50 percent of the till. The Culver Moraine Association represents the southwestern part of the St. Louis sublobe. It is generally reddish brown and clayey because it incorporated red sediment from earlier glacial lakes. Commonly, it is non-calcareous and contains sporadic clasts of limestone and shale.

2.4.6.2.11 East Range Process Water Supply Pipeline 2W-2E

The corridor for East Range Process Water Supply Pipeline 2W-2E is currently covered by mine pits and dumps. Figure 2.4-8 shows the quaternary geology at the Process Water Supply Pipeline 2W-2E. Mine dumps contain overburden soil from iron mining operations, which typically consists of glacial till. They also contain fragments of rock and low-grade iron ore. The ore is mainly 3 to 10 inches in diameter, but can range from the size of pebbles to the size of boulders. The tops of piles are flat, and the sides are steep.

2.4.6.2.12 East Range Process Water Supply Pipeline 3-2E

The corridor for East Range Process Water Supply Pipeline 3-2E is currently covered by mine pits and dumps. Figure 2.4-8 shows the quaternary geology at the Process Water Supply Pipeline 3-2E. Mine dumps contain overburden soil from iron mining operations, which typically consists of glacial till. They also contain fragments of rock and low-grade iron ore. The ore is mainly 3 to 10 inches in diameter, but can range from the size of pebbles to the size of boulders. The tops of piles are flat, and the sides are steep.

2.4.6.2.13 East Range Potable Water and Sewer Pipelines

The soils within the East Range Potable Water and Sewer Pipeline corridors consist of the glacial till of the Culver Moraine Association of the Des Moines Lobe. These soils are described in Section 2.4.5.2.

2.4.6.2.14 East Range Rail Line Alternative

The soils within the East Range Rail Line Alternative 1 corridor consist of the glacial till of the Culver Moraine Association of the Des Moines Lobe. These soils are described in Section 2.4.5.2.

2.4.6.2.15 East Range Rail Line Alternative 2

From the west end of the East Range Rail Line Alternative 2 corridor to a point 200 feet east of the East Range IGCC Facility Site boundary, the soils underlying the rail corridor consist of the glacial till of the Culver Moraine Association of the Des Moines Lobe. From a point 200 feet east of the plant site boundary to the east end of the rail corridor, the underlying soils consist of the ground moraine of the Vermillion Association of the Rainy Lobe. These soils are described in Section 2.4.5.2.

2.4.6.2.16 East Range Roads

The soils underlying the Access Road 1 consist of the glacial till of the Culver Moraine Association of the Des Moines Lobe. These soils are described in Section 2.4.5.2

2.4.6.3 Prime and Statewide Important Farmland

The Federal Farmland Protection and Policy Act of 1981 and the Minnesota Agricultural Land Preservation and Conservation Policy Act (M.S. 17.80–17.84) have been enacted to ensure that impacts to agricultural lands and operations are integrated into the NEPA process, and the impacts upon agricultural land are minimized to a reasonable extent. Because the supply of high quality farmlands is limited, the U.S. Department of Agriculture (USDA) encourages management and wise use of our nation's prime farmland. The West and East Range Sites and surrounding utility and transportation corridors were evaluated to identify any soils classified by the Natural Resources Conservation Service (NRCS) as being Prime or Statewide Important Farmland.

Prime farmland, as defined by the USDA, is land that is best suited for food, feed, forage, fiber, and oilseed crops (USDA, 1987). It may exist as cultivated land, pasture, woodland, or other land that is not urban, built up land, or a water area. The soil qualities, growing season, and moisture supply are those needed for a well managed soil to produce a sustained high yield of crops in an economic manner. Prime farmland produces the highest yields with minimal inputs of energy and economic resources, and farming it results in the least damage to the environment. It has an adequate and dependable supply of moisture from precipitation or irrigation. The temperature, growing season, and acidity of the soil are all favorable. Prime farmland is not excessively erodible, is not saturated with water for long periods, and is not frequently flooded during the growing season. The slope ranges from 0 to 6 percent.

In some areas, land that does not meet prime farmland criteria is designated as "farmland of statewide importance." These lands do not meet the criteria for prime farmland; however, under favorable conditions the yield of food, feed, fiber, forage, and oilseed crops may be as high as the yield of prime farmland. The criteria for designating farmland of statewide importance are determined by appropriate state agencies (NRCS, 2006).

2.4.6.3.1 West Range Site Prime and Statewide Important Farmland

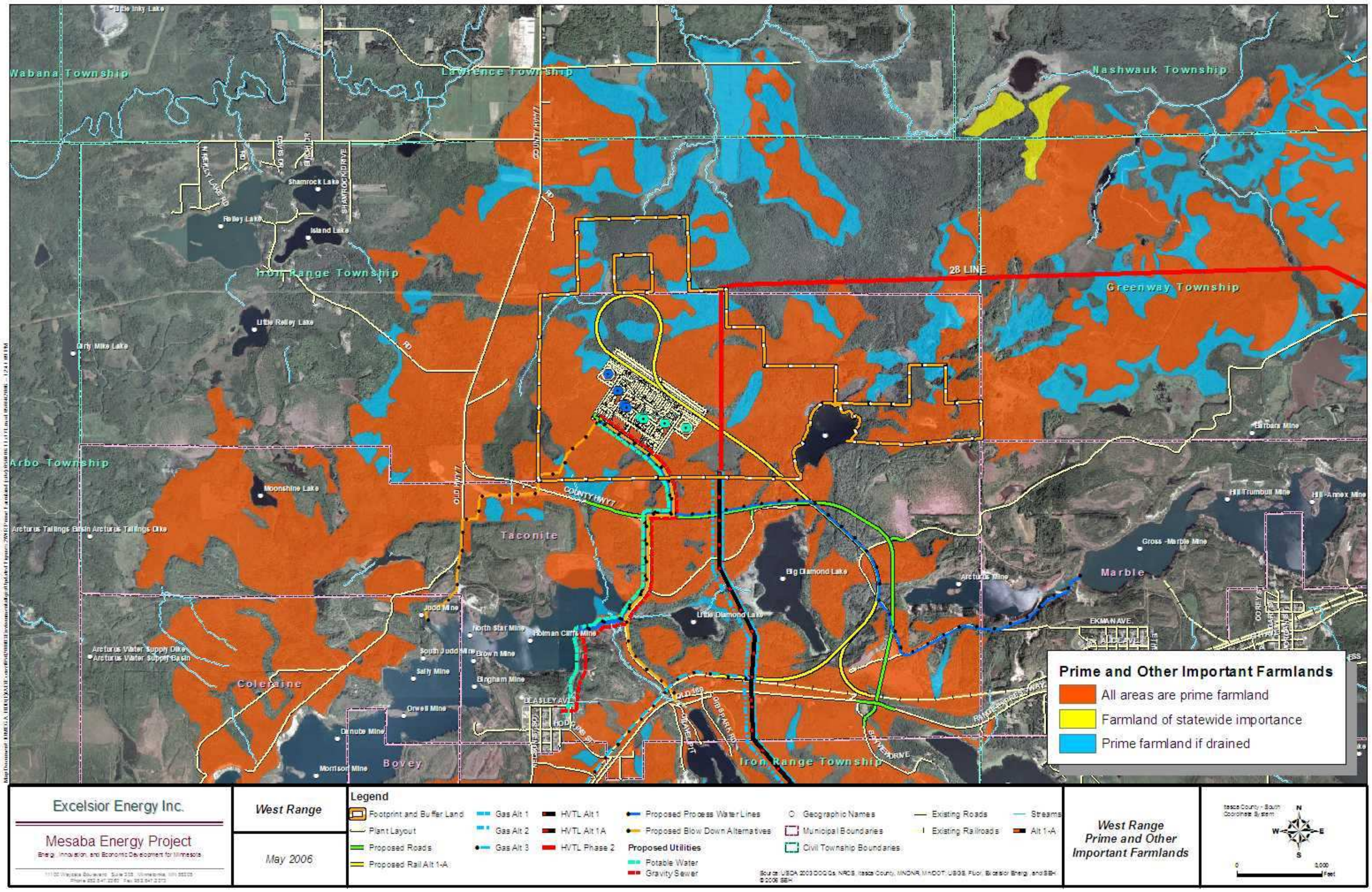
Soils within the West Range Site, HVTL routes, and natural gas pipeline routes that have been designated as prime or statewide important farmland in Itasca County, Minnesota are shown in Table 2.4-1. Some soils have a seasonally high water table, but qualify for prime farmland when drained. Soils fitting these characteristics are noted as prime farmland in Table 2.4-1. Figure 2.4-9 shows the soils on the West Range Site meeting the characteristics of prime farmland.

Table 2.4-1
Prime and Statewide Important Farmland within West Range Site and Utility and Transportation Corridors

Soil Map Unit	Soil Series[1]	Prime Farmland	Statewide Important
72	Shooker very fine sandy loam	Yes, if drained	No
147	Spooner silt loam	Yes, if drained	No
167B	Baudette silt loam, 0–5% slopes	Yes	No
240B	Warba fine sandy loam, 1–8% slopes	Yes	No
243	Stuntz very fine sandy loam	Yes, if drained	No
268B	Cromwell fine sandy loam, 1–10% slopes	No	Yes
617B	Goodland silt loam, 1–10% slopes	Yes	No
618B	Itasca silt loam, 1–10% slopes	Yes	No
619	Keewatin silt loam	Yes, if drained	No
620B	Cutaway loamy sand, 0–8% slopes	No	Yes
621	Morph very fine sandy loam	Yes, if drained	No
622B	Nashwauk fine sandy loam, 1–10% Slopes	Yes	No
628	Talmoon silt loam	Yes, if drained	No
870C	Itasca-Goodland silt loams, 2–12% slopes	No	Yes

[1] Soil Map Unit/Soil Series given are from the Soil Survey of Itasca County, Minnesota (USDA, 1987).

Figure 2.4-9 Prime Farmland in the Vicinity of the West Range Site



2.4.6.3.2 East Range Site Prime and Statewide Important Farmland

Soils within the East Range Site, HVTL routes, and natural gas pipeline routes that have been designated statewide important farmland in St. Louis County, Minnesota are presented in Table 2.4-2. The soil survey for St. Louis County, Minnesota is currently in progress and therefore preliminary data received from the NRCS Soil Survey office in Virginia, Minnesota were used to assess areas that could be designated as prime or statewide important farmland. Currently, St. Louis County's list of "Prime or Other Important Farmland" (USDA, 2006) has identified several soil series as "farmland of statewide importance," but no areas in the county have been designated as "prime farmland" to date. Because the soil survey data from St. Louis County are preliminary data, the maps used in this analysis as well as soil series names and descriptions are subject to change. Preliminary data were only available in select sections of the East Range Site. The entire East Range Site was evaluated qualitatively without calculation of detailed impacts. Select portions of the HVTL routes and natural gas pipeline corridors were also analyzed where data were available. Through the NEPA review process, the NRCS in St. Louis County, Minnesota will calculate impacts of farmlands of statewide importance with their available data.

Table 2.4-2
Prime and Statewide Important Farmland within East Range Site and Utility and Transportation Corridors[1]

Soil Map Unit[2]	Soil Series[2]	Statewide Important
F9B	Cloquet loam, 0–2 % slopes	Yes
F19A	Pequaywan loam, 0–3% slopes	Yes

2.4.7 Bedrock Stratigraphy

The following provides details of the general stratigraphy for both the West Range and East Range Sites and their associated corridors.

2.4.7.1 Archean Batholith

The bedrock geology of the West Range Site and surrounding area consists of Proterozoic rocks of the Mesabi Range. The upper most bedrock in the site is quartz-bearing granitic rock of the Giants Range Batholith. The composition of granitic rocks within the batholith ranges from tonalite to granite, which was emplaced in metavolcanic and metasedimentary host rocks during the Archean period (Sims and Viswanathan, 1972).

The bedrock geology to the north of the East Range Site and surrounding area consists of Proterozoic rocks of the Mesabi Range. North of the Biwabik Formation (discussed below) is the quartz-bearing granitic rock of the Giants Range Batholith. The composition of granitic rocks within the batholith ranges from tonalite to granite, which was emplaced in metavolcanic and metasedimentary host rocks during the Archean Period (Sims and Viswanathan, 1972).

2.4.7.2 Animike Group

2.4.7.2.1 Pokegama Quartzite

Overlying the Archean granites of the Giants Range is the Proterozoic Animike Group. The lowermost unit of the group is Pokegama Quartzite. The sedimentary unit was emplaced directly on the erosional surface of the underlying granitics during the extensional phase of the Penokean Orogeny and exists as the upper most bedrock in a narrow belt south of the West and East Range Sites. The Pokegama Quartzite consists of three members; a basal thin bedded to laminated shale; a middle shale and siltstone; and an upper quartz arenite (MGS, 2003). The thickness of the formation is variable, but can be up to 350 feet (Morey, 1972).

2.4.7.2.2 Biwabik Formation

Overlying the Pokegama Quartzite is the Biwabik Formation. The contact between the Pokegama Quartzite and Biwabik Formation represents a gradational change from clastic deposition to chemical precipitation (MGS, 2003). The Biwabik Formation is the upper most bedrock underlying the southern portion of the West Range Site and has been heavily mined in the area. The formation is a ferruginous chert, containing up to 30 percent iron. Two lithologies have been identified within the formation; a cherty, granular, and massive unit rich in quartz and iron oxide, and a slaty fine grained, finely laminated, unit of ironsilicates and ironcarbonates (MGS, 2003). The lithologies alternate within the formation expressed as a lower cherty, lower slaty, upper cherty, and upper slaty units. The basal portion of the formation consists of a stromatilitic red taconite (MGS, 2003). The thickness of the Biwabik Formation varies throughout the Mesabi Range from less than 200 to 750 feet (Morey, 1972). The Biwabik formation underlying Calumet is 692 feet thick. However, the thickness of the formation is often difficult to quantify due to the gradational nature of the upper and lower contacts (USDI, 1965). In some locations, the upper portion of the formation is interlayered with argillite of the overlying Virginia Formation.

2.4.7.2.3 Virginia Formation

The Virginia Formation overlies the Biwabik formation and consists of a lower argillaceous lithosome and an upper silty and sandy lithosome. The lower unit consists of intercalated argillite and carbonaceous argillite; the upper unit consists of siltstone and greywacke. The formation is up to 500 feet thick south of the West Range Site. The greywacke is the predominant bedrock at the East Range Site. Thick quaternary deposits overlie the Virginia Formation, causing the formation to be exposed only in mined areas (Lucente and Morey, 1983).

2.4.7.3 Upper Precambrian Intrusive Rocks

2.4.7.3.1 Duluth Complex

The Duluth Complex is found within the East Range Site and its associated corridors and lies to the east of the Virginia Formation. It consists mainly of troctolite and locally grades to gabbro, with numerous inclusions of hornfels and anorthositic rocks. It is locally intruded by titaniferous peridodite (MGS, 1970). The contacts and the internal layering of the Duluth Complex dip eastward or southward at low angles (Craddock, 1972, p. 288).

2.4.8 General Bedrock Geology

The predominate geo-physio-economic feature in the area is the Mesabi "Iron Range." The location of the Iron Range is shown in Figure 2.4-10, which shows the bedrock geology of the entire Arrowhead Region. The Mesabi Iron range is labeled "Iron Formation with a basal quartz arenite." The iron range, a narrow band of iron-rich strata, one-fourth to three miles wide, has had a major impact on the economy and settlement of the region for over 100 years. It extends for 120 miles along strike from eastern Cass County through Itasca County to Birch Lake near the eastern boundary of St. Louis County. Since iron ore was discovered in 1890, the Mesabi Range has supplied over 2.8 billion tons of iron ore. A generalized geologic cross section through the Iron Range area is shown in Figure 2.4-11 illustrating the location of both the West Range and East Range sites in relation to the iron range. The bedrock geology shown on the figure south of the Iron Range is more typical of the East Range site.

2.4.8.1 West Range Site

A generalized geologic cross section through the iron range area is shown in Figure 2.4-11. The location of the site is shown on the left side of the figure, illustrating its location atop the Giant's Range batholith. The Giants Range is a highland and archean granite flanking the Masabi (iron ore) Range on the north and rising 400 to 1,000 feet above the adjacent plains. (The Biwabik Iron formation is shown slightly to the right of the site on the figure). The Giants Range extends from Coleraine in Itasca County to Babbitt in St. Louis County, although from Coleraine to Hibbing its height is not as significant as in the eastern portion of its extent. At the project site the elevations at the top of Giants Range batholith are on the order of elevation 1,430 feet above msl to elevation 1,470 feet msl. At the eastern end of the Giants Range Batholith high points are on the order of elevation 1,850 feet above msl.

2.4.8.2 East Range Site

A generalized geologic cross section through the Iron Range area is shown in Figure 2.4-11. The location of the site is shown on the right side of the figure, illustrating its location southeast of the Giant's Range Batholith. According to Figure 2.4-10 "Arrowhead Region Bedrock Geology", the bedrock underlying most of the East Range Site is the Virginia Formation, which consists of interbedded argillite, argillaceous siltstone, and fine-grained feldspathic greywacke. This formation lies southeast of Giants Range (discussed in the West Range Site), with the Biwabik Iron Formation between the Giants Range and the Virginia Formation. The east edge of the project site is underlain by the Duluth Complex bedrock, which consists of troctolite and locally grades to gabbro, with numerous inclusions of hornfels and anorthositic rocks.

Figure 2.4-10 Arrowhead Region Bedrock Geology

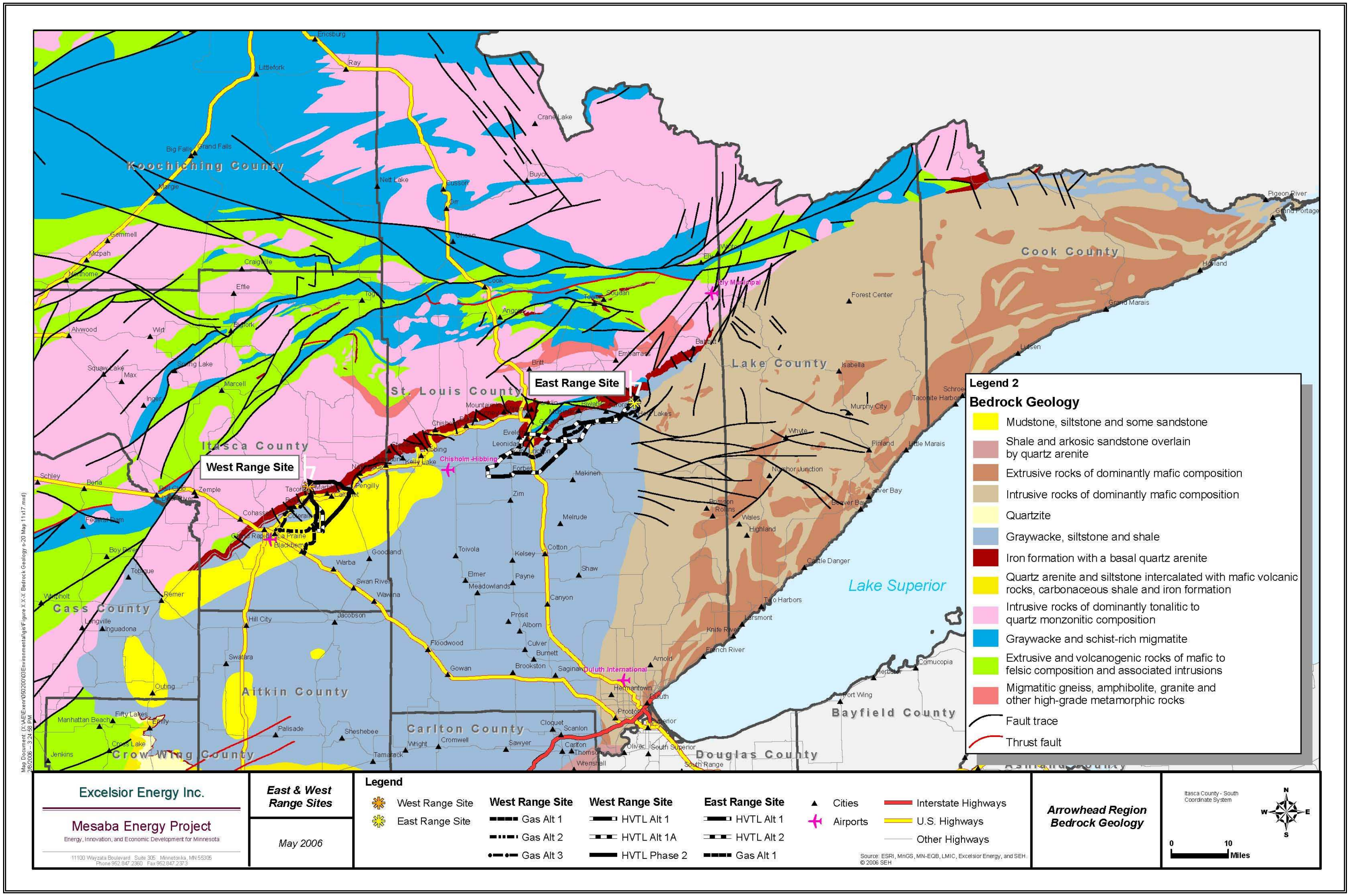
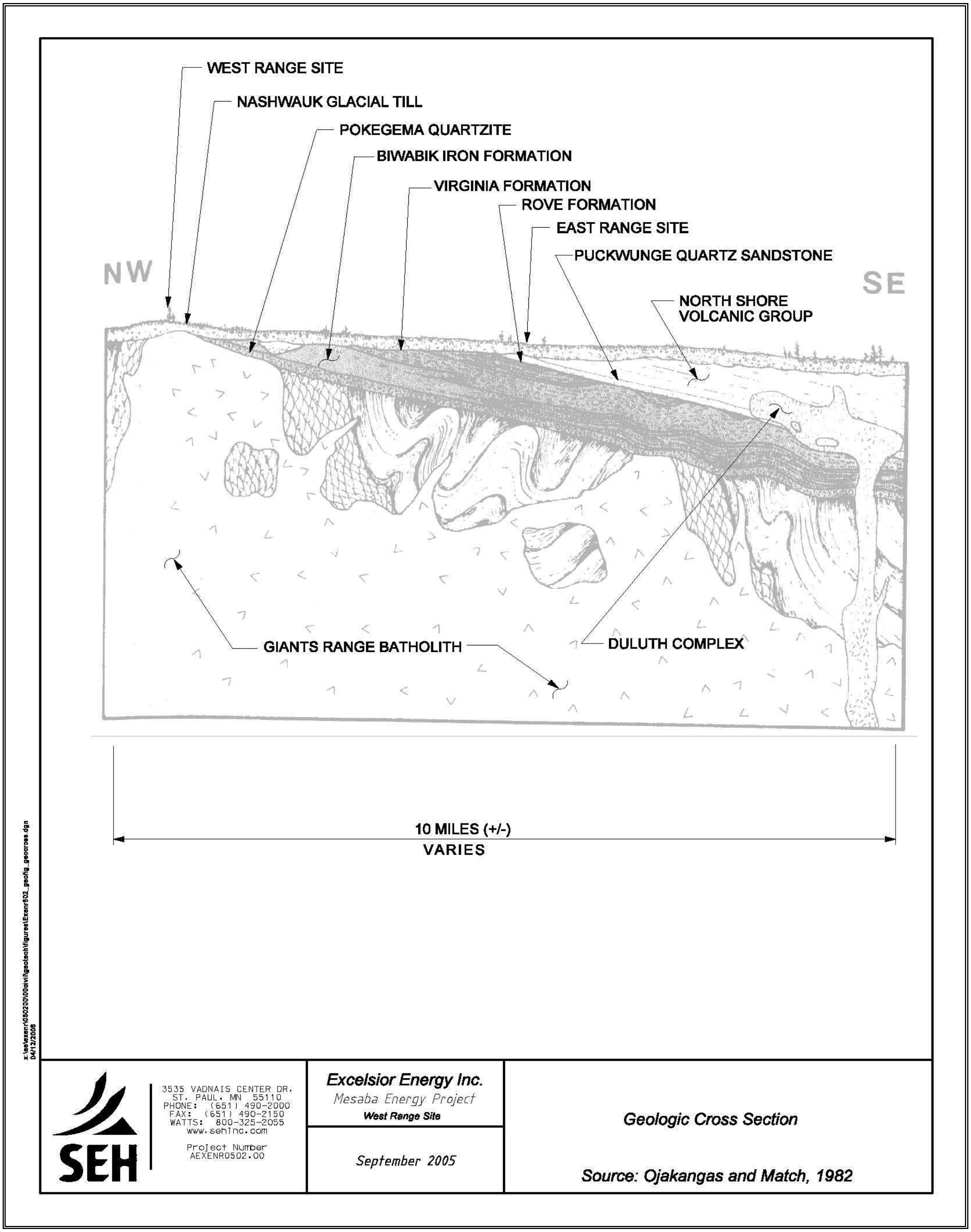


Figure 2.4-11. Geologic Cross Section of Site Area



2.4.9 Bedrock

2.4.9.1 West Range

2.4.9.1.1 IGCC Power Station Footprint and Buffer Land

Fourteen (14) soil borings were completed on the West Range IGCC Power Station Footprint to aid in definition of site bedrock. The borings are numbered WR-1 through WR-14. Boring locations at the West Range Site were provided above in Figure 2.4-5. Logs of the borings are presented in Appendix 3.

Boring depths were initially planned to extend to the top of bedrock, with four borings extending into bedrock with H-size rock cores. Due to the presence of large boulders in the soil column, it was necessary to core into bedrock at most locations to confirm the bedrock contact, rather than terminating the boring on a boulder.

Twelve (12) of the fourteen (14) soil borings encountered bedrock. With the exception of Boring WR-5, bedrock encountered in the nine borings consisted of Giant's Ridge Granite. The material color of the granite is generally pink to pink and gray, speckled with black, although some areas were greenish gray to white. Where unweathered, the material is hard. Discontinuities were rather frequent, 2 inches to 36 inches. Joint angles varied from near horizontal (0 to 5 degrees, to near vertical (85 to 90 degrees). Some joints were stained and others showed thin clay coatings.

At Boring WR-5, bedrock consisted of Pokegama siltstone. The siltstone particles appeared to be predominantly quartz, although no thin-sections were taken to confirm that observation. The material was dark gray and hard, with bedding at 0.5-inch to 2 inches. Coring in this material was extremely difficult due to its hardness, and the close spacing and frequency of the bedding planes.

The top of competent bedrock was encountered at elevations summarized in able 2.4-3. The top-of-bedrock elevations are highly variable. It should be noted that bedrock outcrops were observed along the north-south HVTL corridor along the eastern boundary of the West Range Site, while Boring WR-13, drilled about 100 feet west of the power line and at a slightly lower elevation, did not encounter bedrock until a depth of 31 feet.

Table 2.4-3
Top of Bedrock Elevation Summary

Boring No.	Ground Surface Elevation, ft	Bedrock Depth, ft	Top of Bedrock Elevation, ft
WR-1	1401.9	27.5	1374.4 (w)*
WR-2	1408.3	21	1387.3
WR-3	1451.1	7	1444.1
WR-4	1420.3	25	1395.3 (w)*
WR-5	1429.5	34.5	1395.0
WR-6	1409.8	12.0	1397.8
WR-7	1451.8	12.5	1434.8
WR-8	1451.7	>24.6	<1427.1
WR-9	1395.9	12.5	1383.4
WR-10	1357.6	32.5	1325.1 (w)*
WR-11	1341.0	>21.5	<1319.5
WR-12	1432.4	26.5	1405.9
WR-13	1458.0	31.5	1426.5
WR-14	1444.6	12.0	1432.6

* (w) weathered bedrock

Top of bedrock elevations generally drop off from northeast to southwest across the IGCC Power Station Footprint. However, there are anomalies and variations within the top of bedrock surface.

The locations of the boring profiles are shown in Figure 2.4-12. Subsurface profiles are provided in Figures 2.4-13 through 2.4-16. The top of bedrock elevations for the entire West Range Site are shown in Figure 2.4-17. Top to bedrock elevations for the area near the IGCC Power Station and Buffer Land are shown in Figure 2.4-18.

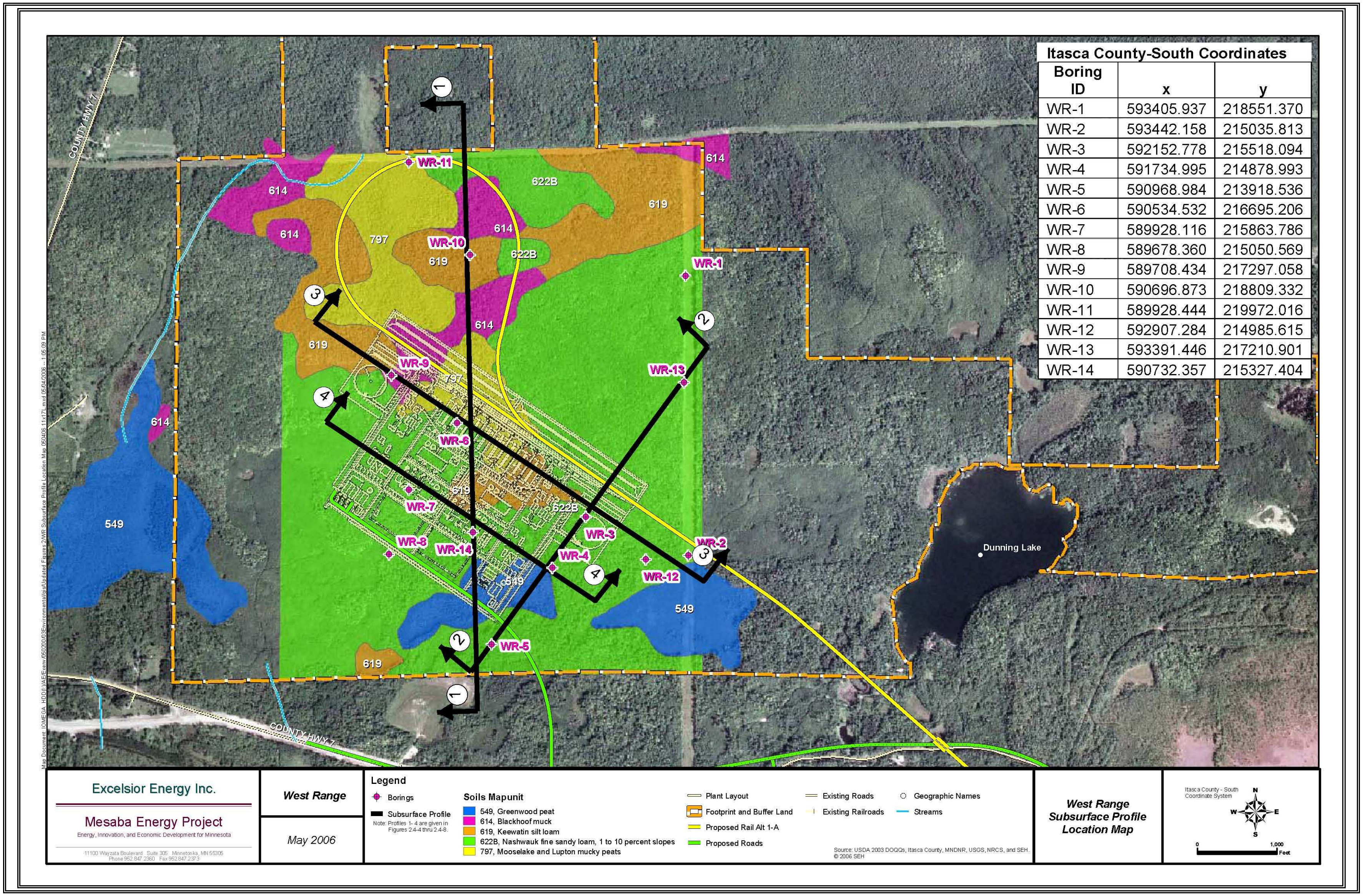
2.4.9.1.2 Preferred HVTL Route (WRA-1)

Bedrock along the Preferred HVTL Route consists of Giant's Range Granite, Pokegama Quartzite, and the Biwabik Formation. See Section 2.4.7.2 for a description of these formations. Bedrock is closest to the ground surface along the HVTL corridor from the project site south approximately one mile and in a separate location approximately one mile east of the city of Taconite. In all other areas, the bedrock is shown to be more than 50 feet bgs (Meyer, Jennings and Jirsa, 2004).

2.4.9.1.3 Alternative HVTL Route 1A (WRA-1A)

Bedrock along the West Range Alternative Route WRA-1A consists of Giant's Range Granite, Pokegama Quartzite, and the Biwabik Formation. See Section 2.4.7.2 for a description of these formations. Bedrock is closest to the ground surface along the HVTL corridor from the project site south approximately one mile and in a separate location approximately one mile east of the city of Taconite. This is shown in Figure 2.4-17. In all other areas, the bedrock is shown to be more than 50 feet bgs (Meyer, Jennings and Jirsa, 2004).

Figure 2.4-12 Soil Borings Useful in Determining Cut and Fill Required for Access Road 2



Boring ID	x	y
WR-1	593405.937	218551.370
WR-2	593442.158	215035.813
WR-3	592152.778	215518.094
WR-4	591734.995	214878.993
WR-5	590968.984	213918.536
WR-6	590534.532	216695.206
WR-7	589928.116	215863.786
WR-8	589678.360	215050.569
WR-9	589708.434	217297.058
WR-10	590696.873	218809.332
WR-11	589928.444	219972.016
WR-12	592907.284	214985.615
WR-13	593391.446	217210.901
WR-14	590732.357	215327.404

Figure 2.4-13 Subsurface Profile of Cross Section "1-1"

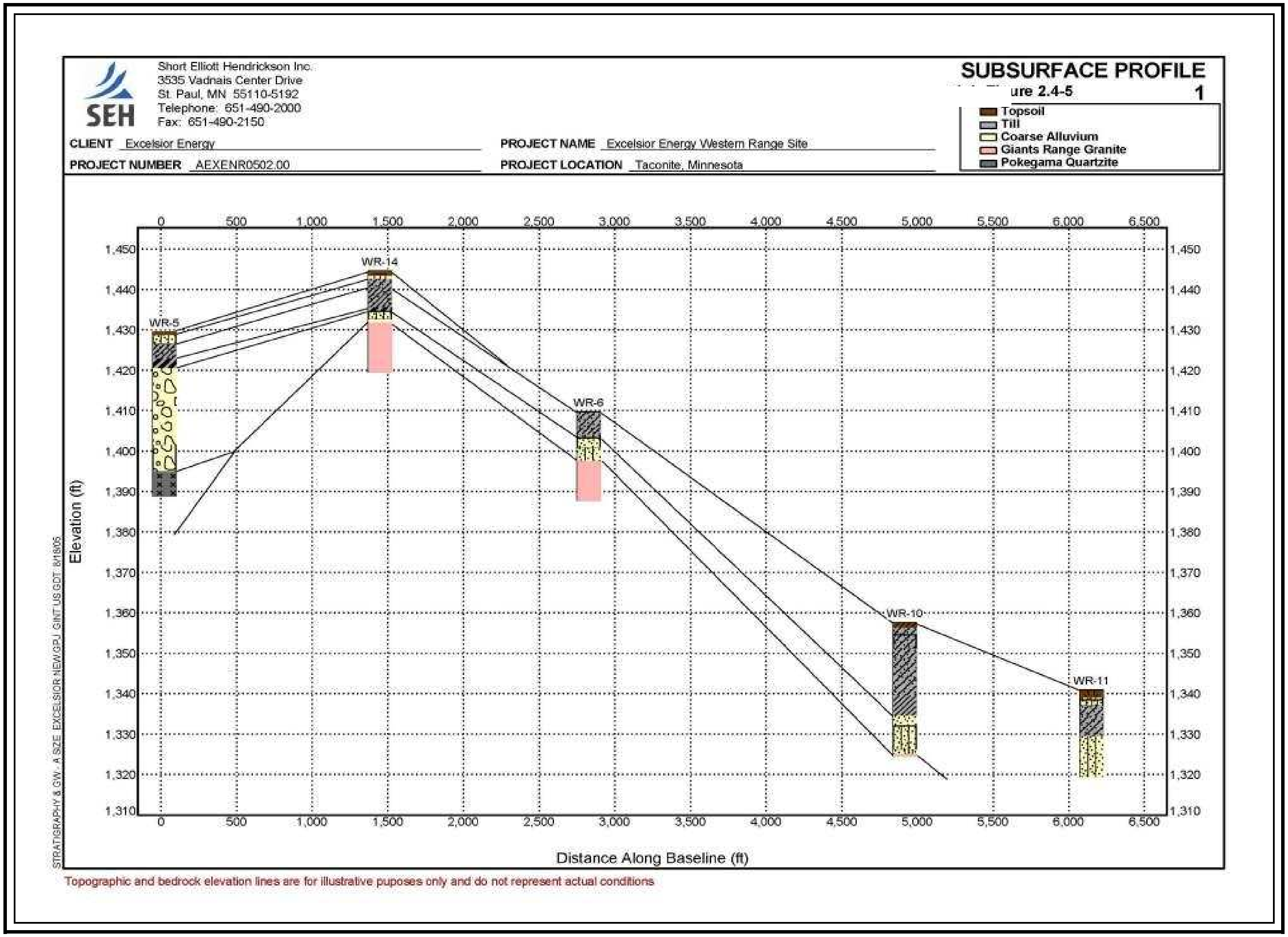


Figure 2.4-14 Subsurface Profile of Cross Section "2-2"

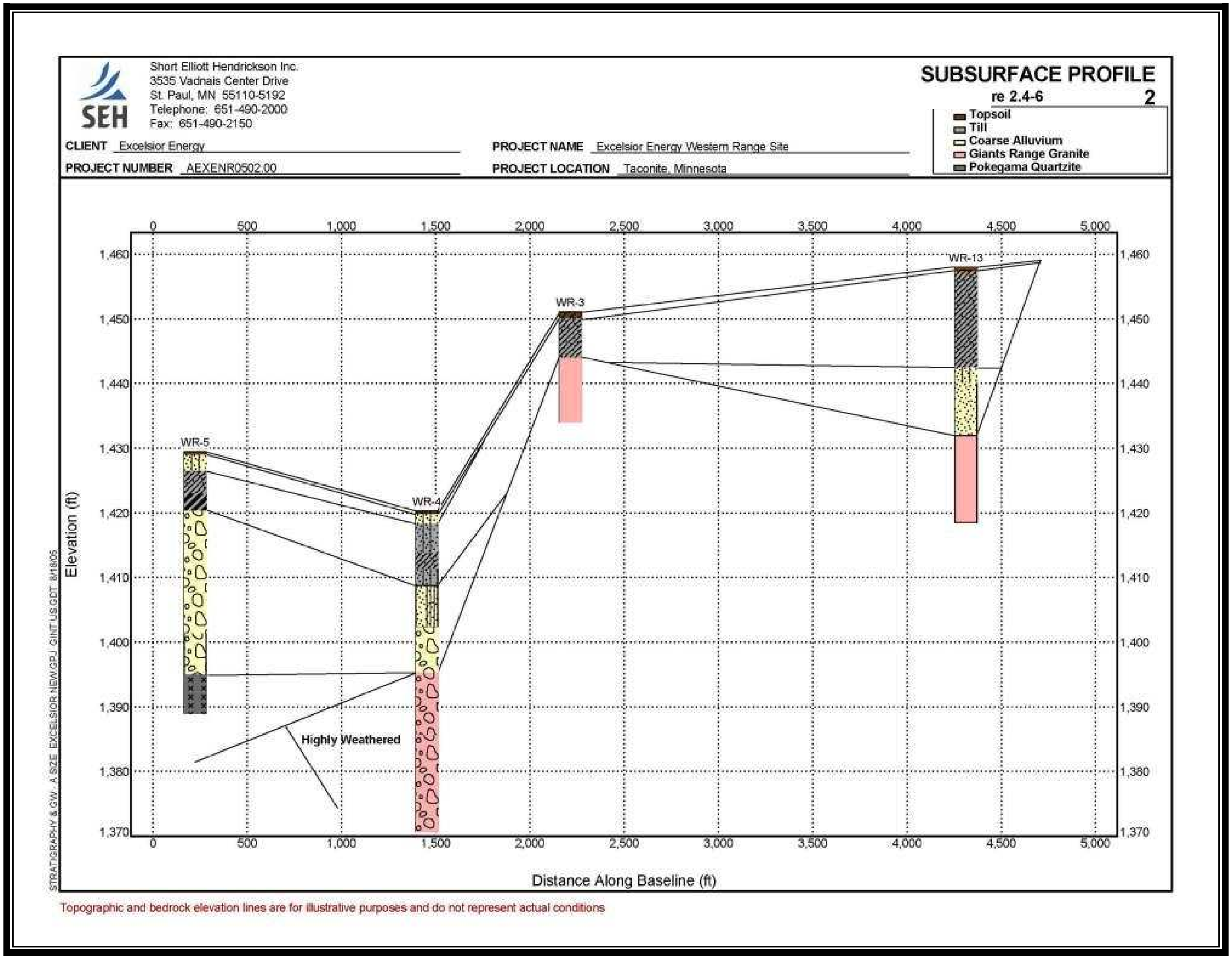


Figure 2.4-15 Subsurface Profile of Cross Section "3-3"

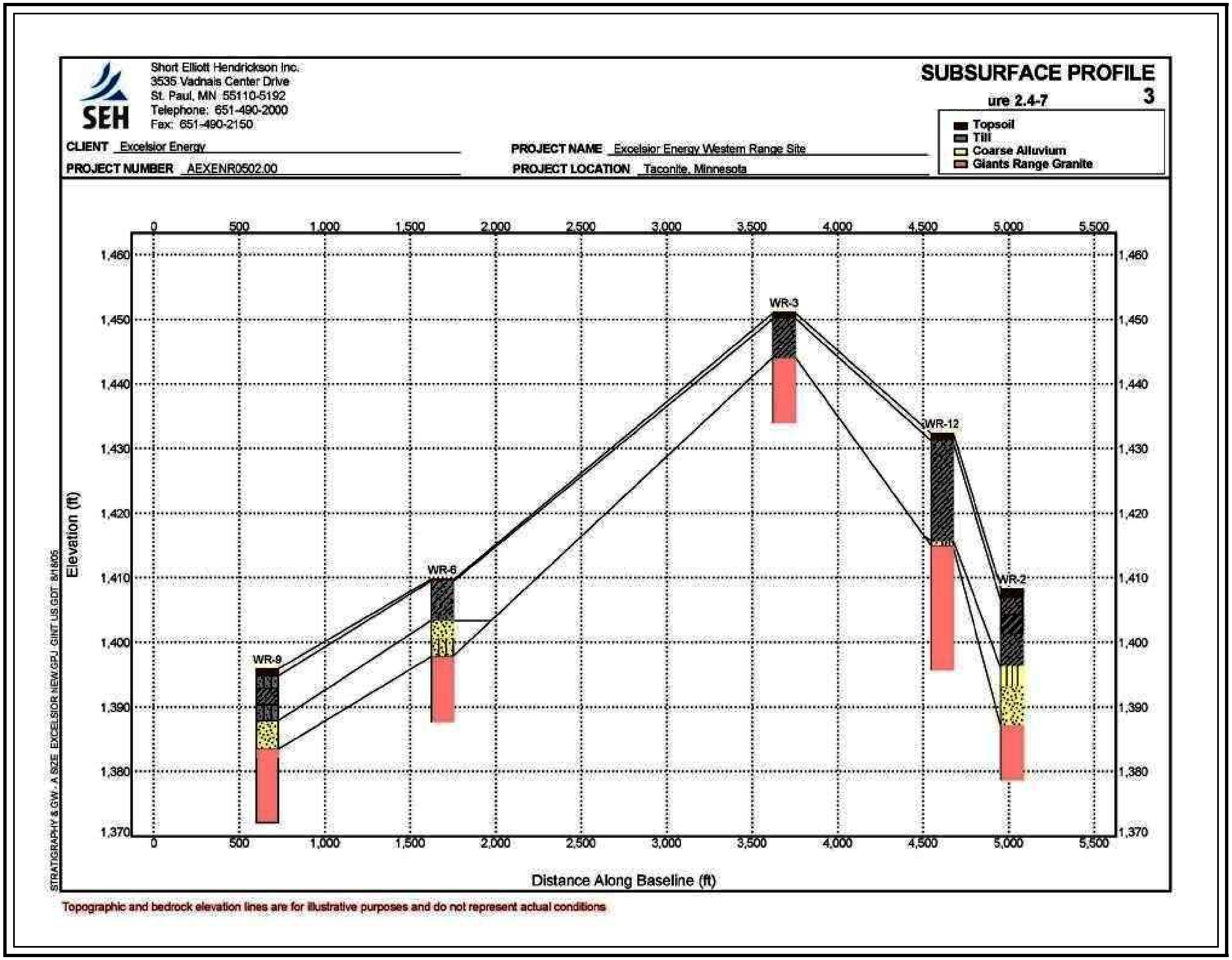


Figure 2.4-16 Subsurface Profile of Cross Section "4-4"

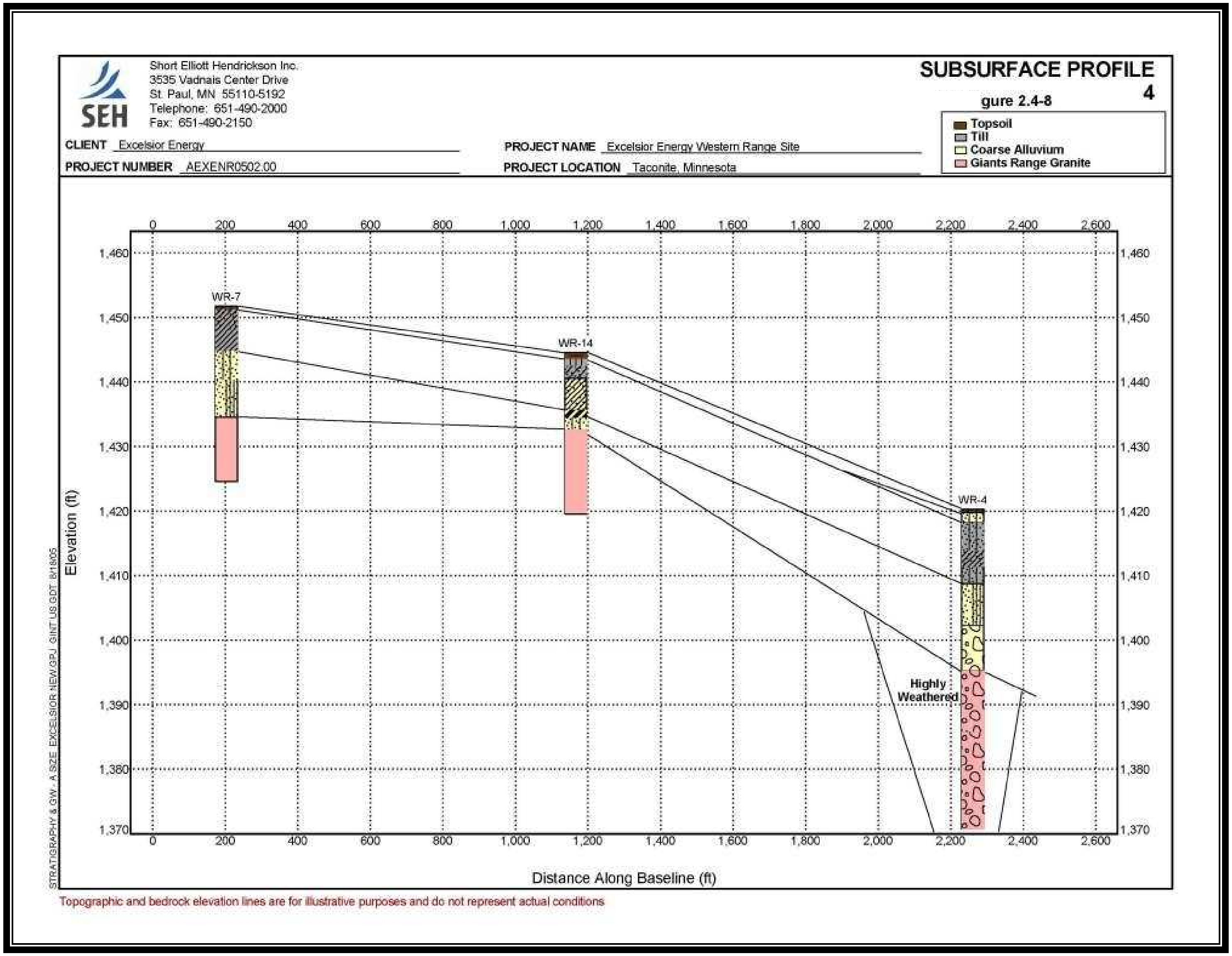


Figure 2.4-17 West Range Corridor Depth to Bedrock

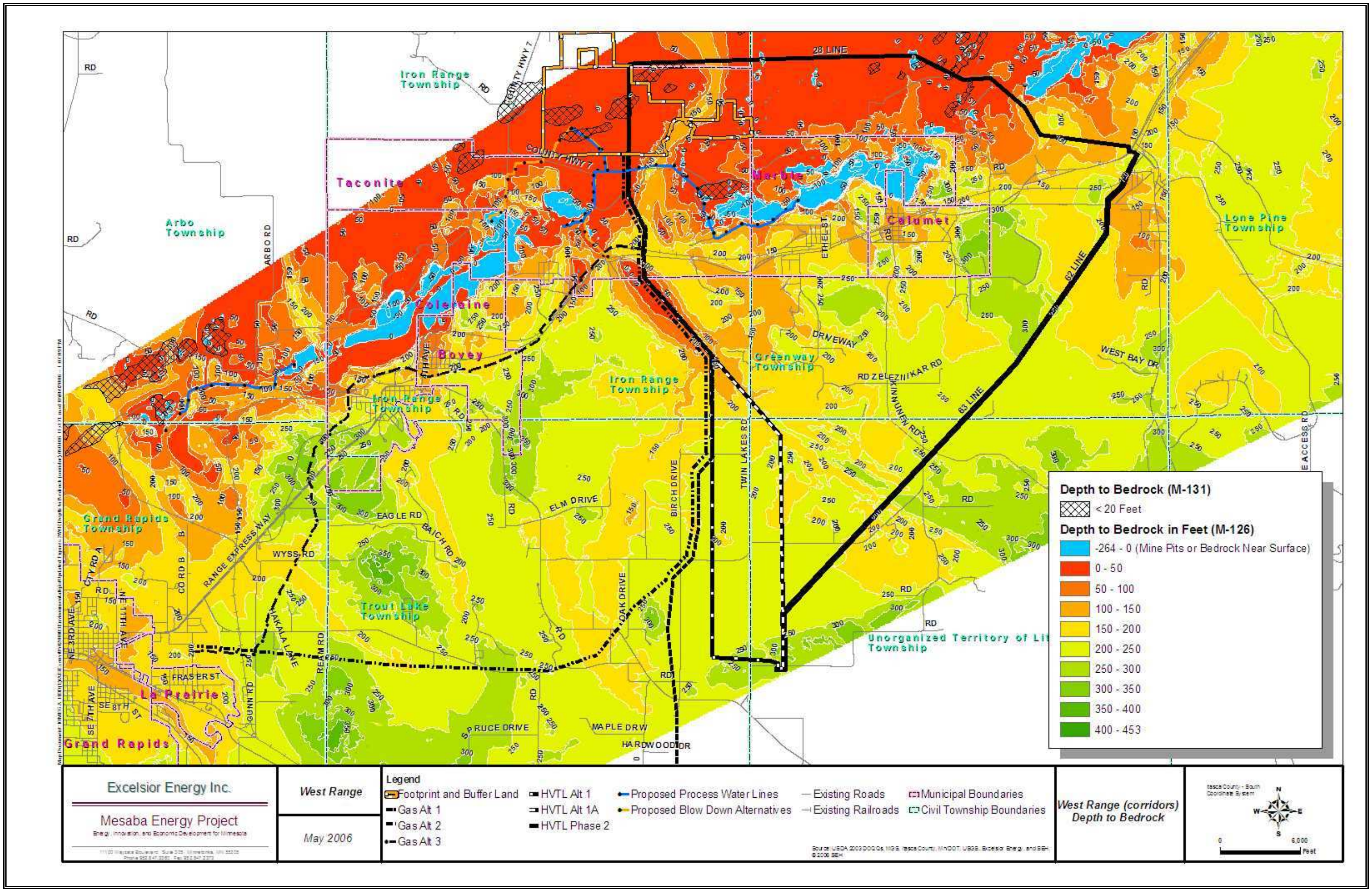
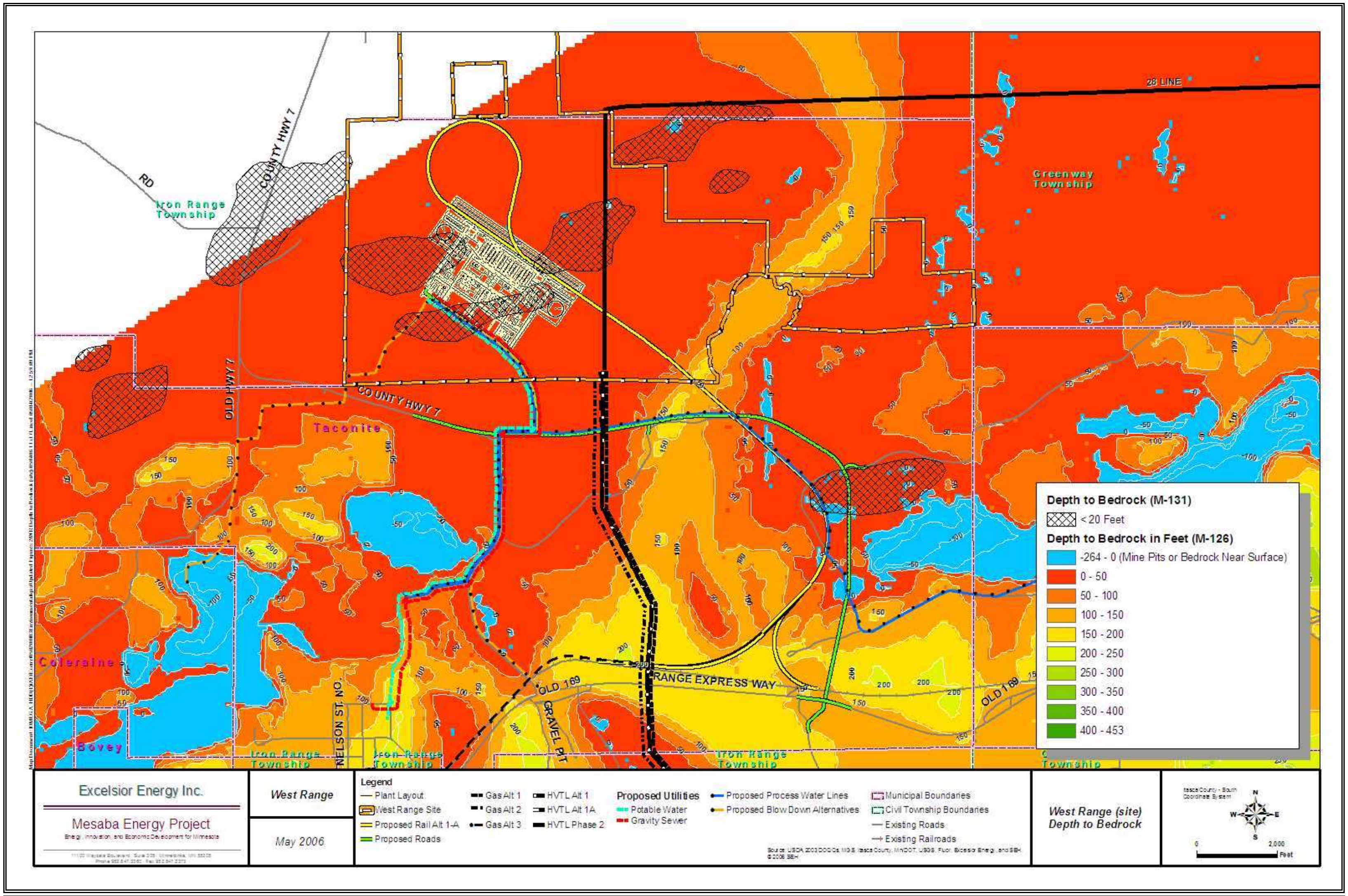


Figure 2.4-18 West Range Site Depth to Bedrock



2.4.9.1.4 Plan B Phase II Route (WRB-2A)

Bedrock along the West Range Plan B Phase 2 Route consists of Giant's Range Granite, Pokegama Quartzite, and the Biwabik Formation. Section 2.4.7.2 provides for a description of these formations. Bedrock is closest to the ground surface along the HVTL corridor from the plant site to approximately one mile west of Pengilly. Figure 2.4-17 shows isolated areas where the bedrock is less than 20 feet bgs, along with two possible bedrock outcrops. In all other areas, the bedrock is shown to be more than 50 feet bgs (Meyer, Jennings and Jirsa, 2004).

2.4.9.1.5 Natural Gas Pipeline Alternative 1

Bedrock along the West Range Natural Gas Pipeline Alternative 1 Route consists of Giant's Range Granite, Pokegama Quartzite, and the Biwabik Formation. See Section 2.4.7.2 for a description of these formations. The depth of the gas pipeline is expected to be 7 to 8 feet bgs. Bedrock is closest to the ground surface along the gas corridor from the IGCC Power Station Footprint south approximately one mile and in a separate location approximately one mile east of the city of Taconite. In these areas bedrock is less than 50 feet bgs, and in some areas bedrock is less than 20 feet bgs as shown in Figure 2.4-17. In all other areas, the bedrock is shown to be more than 50 feet bgs (Meyer, Jennings, and Jirsa, 2004).

2.4.9.1.6 Natural Gas Pipeline Alternative 2

Bedrock along the West Range Gas Pipeline Alternative 2 corridor consists of Giant's Range Granite, Pokegama Quartzite, and the Biwabik Formation. Section 2.4.7.2 provides a description of these formations. The depth of the gas pipeline is expected to be 7 to 8 feet bgs. Bedrock is closest to the ground surface along the gas corridor from the IGCC Power Station Footprint south approximately one mile and in a separate location approximately one mile east of the city of Taconite. In these areas bedrock is less than 50 feet bgs as shown in Figure 2.4-17. In all other areas, the bedrock is shown to be more than 50 feet bgs (Meyer, Jennings, and Jirsa, 2004).

2.4.9.1.7 Natural Gas Pipeline Alternative 3

Bedrock along the West Range Gas Pipeline Alternative 3 corridor consists of Giant's Range Granite, Pokegama Quartzite, the Virginia Formation, and the Biwabik Formation. Section 2.4.7.2 provides a description of these formations. The depth of the gas pipeline is expected to be 7 to 8 feet bgs. Bedrock is closest to the ground surface along the gas corridor from the plant site south approximately one mile and in a separate location immediately east of the city of Taconite. In these areas bedrock is less than 50 feet bgs. This is shown in Figure 2.4-17. In all other areas, the bedrock is shown to be more than 50 feet bgs (Meyer, Jennings, and Jirsa, 2004).

2.4.9.1.8 Process Water Supply Pipeline

2.4.9.1.8A *Segment 1—LMP to CMP*

Bedrock along the West Range Process Water Supply Pipeline Segment 1 alignment consists of the Biwabik Formation. See Section 2.4.7.2 for a description of this formation. Figure 2.4-18 shows the bedrock to be less than 50 feet bgs across a large distance of the pipe alignment, with the eastern 1,200 feet of the pipeline close to a bedrock outcrop/mine excavation (Meyer, Jennings and Jirsa, 2004). There are some isolated segments of the pipe alignment where the bedrock surface is 100 feet or more bgs.

2.4.9.1.8B ***Segment 2—CMP to West Range Site***

Bedrock along the West Range Process Water Supply Pipeline Segment 2 alignment consists of Giant's Range Granite, Pokegama Quartzite, and the Biwabik Formation. See Section 2.4.7.2 for a description of these formations. Bedrock is closest to the ground surface from the IGCC Power Station Footprint to 3,400 feet south of the proposed CR 7. Figure 2.4-18 shows the bedrock to be less than 50 feet bgs in this area (Meyer, Jennings and Jirsa, 2004). Bedrock is greater than 50 feet bgs in the remainder of the corridor.

2.4.9.1.8C ***Segment 3—HAMP Complex to CMP***

Bedrock along the West Range Process Water Supply Pipeline Segment 3 alignment consists of Giant's Range Granite, Pokegama Quartzite, and the Biwabik Formation. See Section 2.4.7.2 for a description of these formations. Bedrock is closest to the ground surface from the plant site to 3,400 feet south of the point where CR 7 and Access Road 1 intersect. Figure 2.4-18 shows the bedrock to be less than 50 feet bgs in this area (Meyer, Jennings, and Jirsa, 2004). Bedrock is greater than 50 feet bgs in the remainder of the corridor.

2.4.9.1.9 Process Water Blowdown Pipeline 1

Bedrock along the West Range Process Water Blowdown Pipeline 1 alignment consists of Pokegama Quartzite and the Biwabik Formation. See Section 2.4.7.2 for a description of these formations. Bedrock is less than 50 feet bgs throughout the pipeline alignment, and there is a bedrock outcrop 1,800 feet north of Highway 169. Figure 2.4-18 shows the depth to bedrock in this area (Meyer, Jennings, and Jirsa, 2004).

2.4.9.1.10 Process Water Blowdown Pipeline 2

Bedrock along the West Range Process Water Blowdown Pipeline 2 alignment consists of Pokegama Quartzite and the Biwabik Formation. See Section 2.4.7.2 for a description of these formations. Bedrock is less than 50 feet bgs throughout the pipeline alignment, as shown in Figure 2.4-18 (Meyer, Jennings, and Jirsa, 2004).

2.4.9.1.11 Potable Water and Sewer Pipelines

Bedrock along the West Range Potable Water and Sewer Pipeline alignment consists of Giant's Range Granite, Pokegama Quartzite, and the Biwabik Formation. See Section 2.4..7.2 for a description of these formations. Bedrock is closest to the ground surface from the plant site to 3,400 feet south of the Access Road 2. Figure 2.4-18 shows the bedrock to be less than 50 feet bgs in this area (Jennings, Jirsa, and Meyer, 2004). In other areas, the bedrock is greater than 50 feet bgs.

2.4.9.1.12 Rail Line Alternative 1A

Bedrock along West Range Rail Line Alternative 1A consists of Giant's Range Granite, Pokegama Quartzite, and the Biwabik Formation. Where the rail line exits the plant site, it crosses a bedrock valley 2000 feet wide where the bedrock surface ranges from 50 to 150 feet bgs. The east side of the bedrock valley is where the railroad crosses Access Road 2. From Access Road 2, south a distance of 2,200 feet, the bedrock is within 50 feet of the ground surface (Meyer, Jennings and Jirsa, 2004). In this area, there are 3 bedrock outcrops shown within the Alternative 1A railroad alignment. About 2,200 feet south of Access Road 2, the bedrock surface slopes downward to about 200 feet bgs. Figure 2.4.18 shows the bedrock topography along the rail line corridor.

2.4.9.1.13 Rail Line Alternative 1B

Bedrock along West Range Rail Line Alternative 1B consists of Giant's Range Granite, Pokegama Quartzite, and the Biwabik Formation. West of the plant, but within the IGCC Power Station Footprint, it crosses a bedrock valley 2,500 feet wide where the bedrock surface ranges from 50 to 150 feet bgs. The east side of the bedrock valley is where the railroad turns south around Dunning Lake. From Dunning Lake south a distance of 6,800 feet, the bedrock is within 50 feet of the ground surface (Meyer, Jennings and Jirsa, 2004). In this area, there are 2 bedrock outcrops shown within the Alternative 1B railroad alignment. About 6,800 feet south of Dunning Lake, the bedrock surface slopes downward to as much as 200 feet bgs. Figure 2.4.18 shows the bedrock topography along the rail line corridor.

2.4.9.1.14 Rail Line Alternative 2

The geology and soil conditions for West Range Rail Line Alternative 2 were not evaluated. This alternative is not feasible due to stringent design considerations that would require filling a large portion of Big Diamond Lake to maintain acceptable track curvatures. See Section 1.12.3 of this report.

2.4.9.1.15 West Range Roads

Bedrock along West Range Access Road 1 and Access Road 2 consist of Giant's Range Granite, Pokegama Quartzite, and the Biwabik Formation. From the west end of West Range Access Road 1 alignment to the east 6,000 feet, the bedrock surface is less than 50 feet below existing grade. From 6,000 feet to 8,500 feet east of the west end of the alignment, there is a bedrock valley where the surface of the bedrock is as much as 150 feet bgs. From 8,500 feet to 12,500 feet, the bedrock surface is less than 50 feet bgs, and the Access Road 1 alignment crosses 3 bedrock outcrops and a zone where bedrock is less than 20 feet deep. Figures 2.4-5 and 2.5-18 show that from 12,500 feet to the proposed Access Road 1/Highway 169 intersection, the bedrock surface is more than 50 feet bgs.

The bedrock surface is less than 50 feet bgs along the entire alignment of West Range Access Road 2. Figure 2.4.16 shows the bedrock surface contours in this area (Meyer, Jennings, and Jirsa, 2004).

2.4.9.2 East Range Bedrock Geology

2.4.9.2.1 IGCC Facility Site

The bedrock at the East Range IGCC Facility Site is the greywacke of the Virginia Formation as described in Section 2.4.7.2. The bedrock types are shown in Figure 2.4.19.

Figure 2.4-20 shows the depth to bedrock estimated for the IGCC Power Station Footprint and the corridors for road, rail, sanitary sewer, and potable water. Bedrock is exposed at the extreme southeast corner of the Station Footprint and is 1 to 50 feet bgs across the Footprint. However, there are two areas—one in the center and one in the southwest corner of the Station Footprint where the depth to bedrock is 50 to 100 feet bgs. Directly beneath the CTG/HRSG buildings, the bedrock surface slopes downward from northwest to southeast.

2.4.9.2.2 East Range 38L HVTL Route

As shown in Figure 2.4-21, bedrock along the East Range 38L HVTL Route, consists exclusively of the Virginia Formation, consisting of greywacke, siltstone and shale. More specifically, the formation consists of interbedded argillite, argillaceous siltstone, and fine-grained feldspathic greywacke.

The depth to bedrock is typically less than 50 feet in the vicinity of the IGCC Plant Footprint and Buffer Land and outward within about a mile of the footprint. Outside of that distance, the depth to bedrock gradually increases to 200 feet at Aurora, Minnesota. The 38L HVTL Route generally follows this bedrock valley to the southwest, where the depth to bedrock ranges between 50 and 200 feet bgs.

2.4.9.2.3 East Range HVTL 39L/37L HVTL Route

As shown in Figure 2.4-21, the bedrock along the 39L/37L HVTL Route consists almost exclusively of the Virginia Formation, consisting of greywacke, siltstone and shale. More specifically, that formation consists of interbedded argillite, argillaceous siltstone, and fine-grained feldspathic greywacke. Within about 2 miles either side of US 53, the alignment crosses the bottom of the Virginia Horn of the Mesabi Iron formation. This area has been partially mined and mine pits and mine dumps are noted to exist. The route would likely cross these types of features.

Figure 2.4-19 East Range Site Bedrock Geology

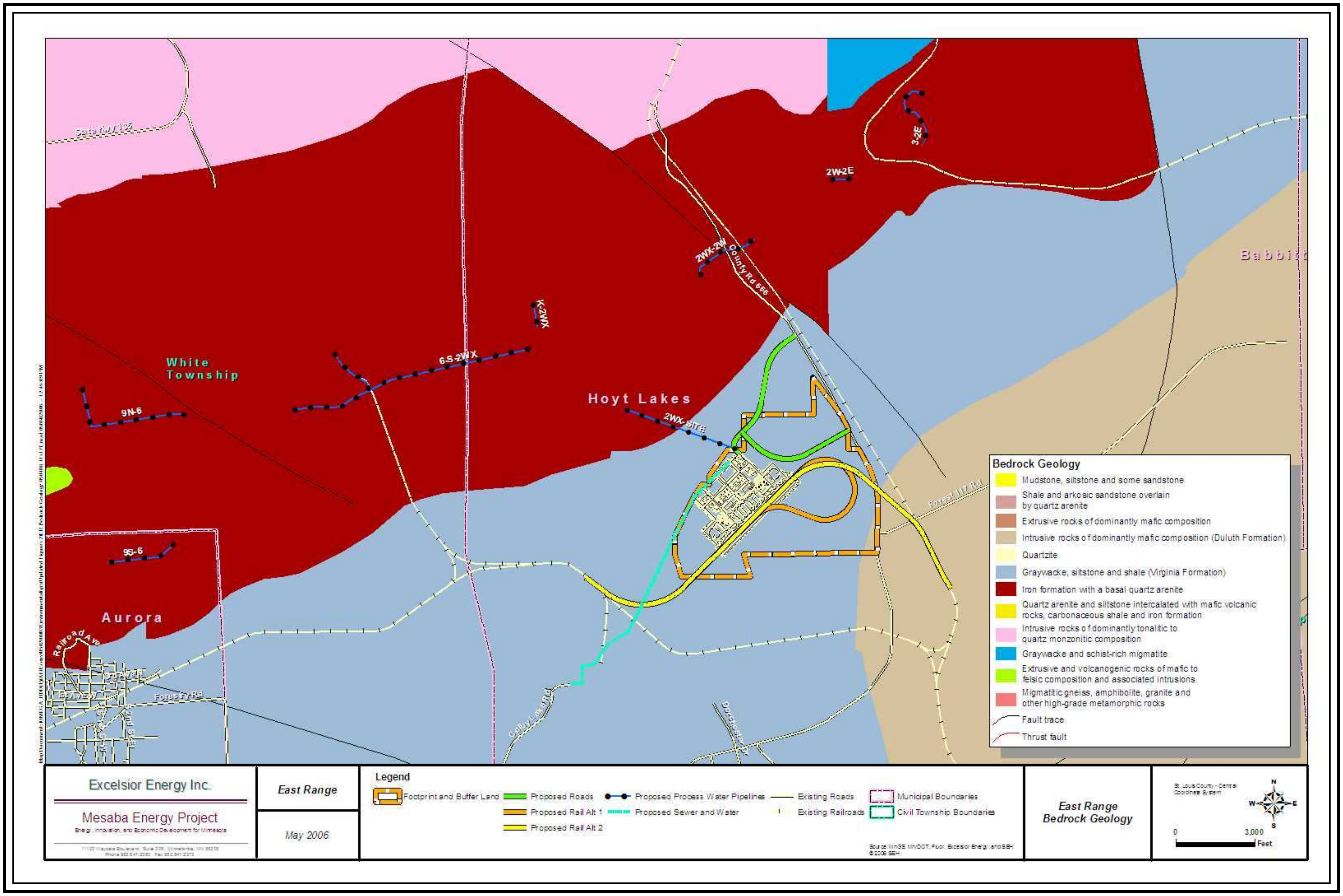


Figure 2.4-20 Depth to Bedrock At East Range IGCC Power Station Footprint and Buffer Land

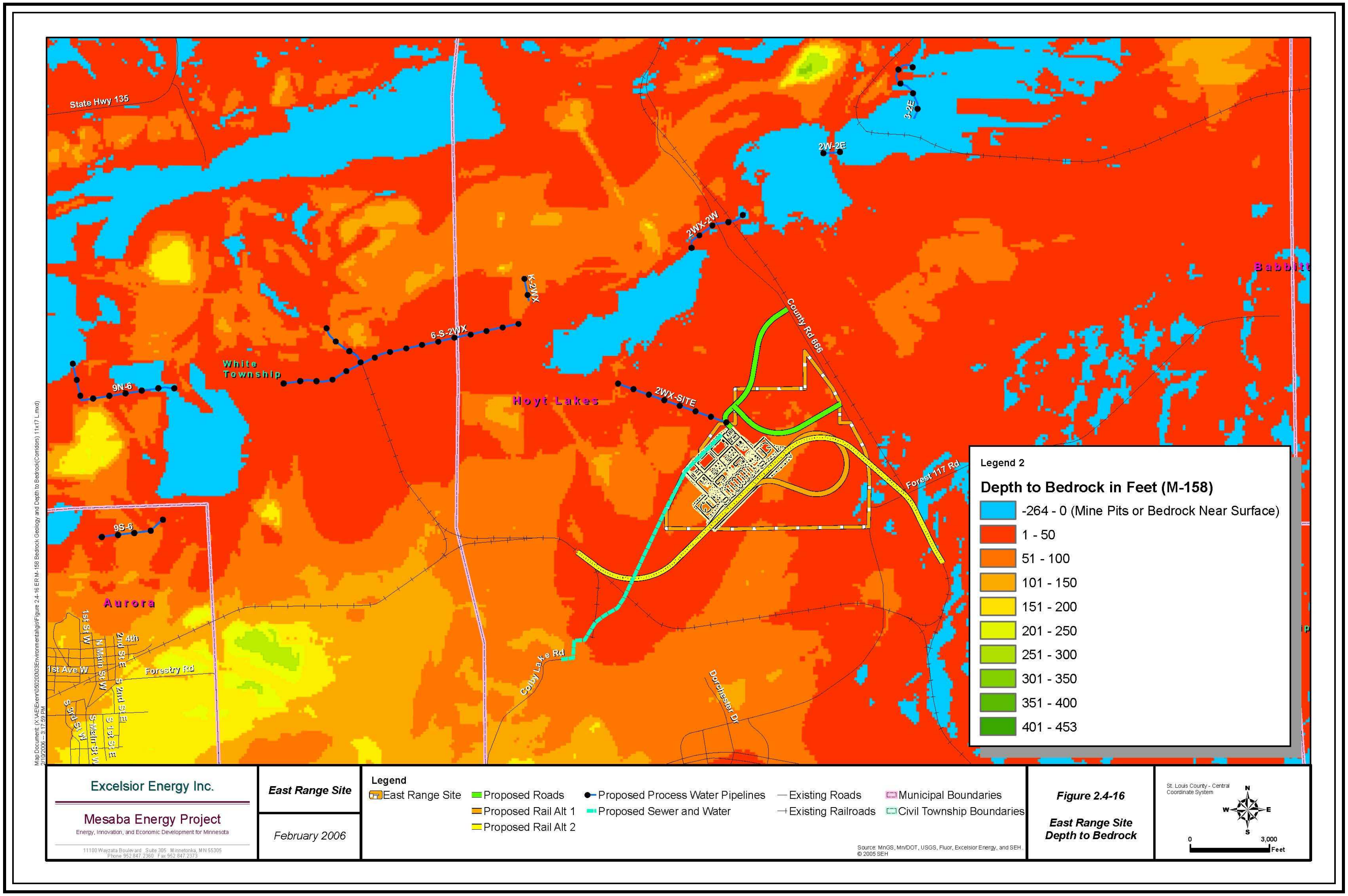
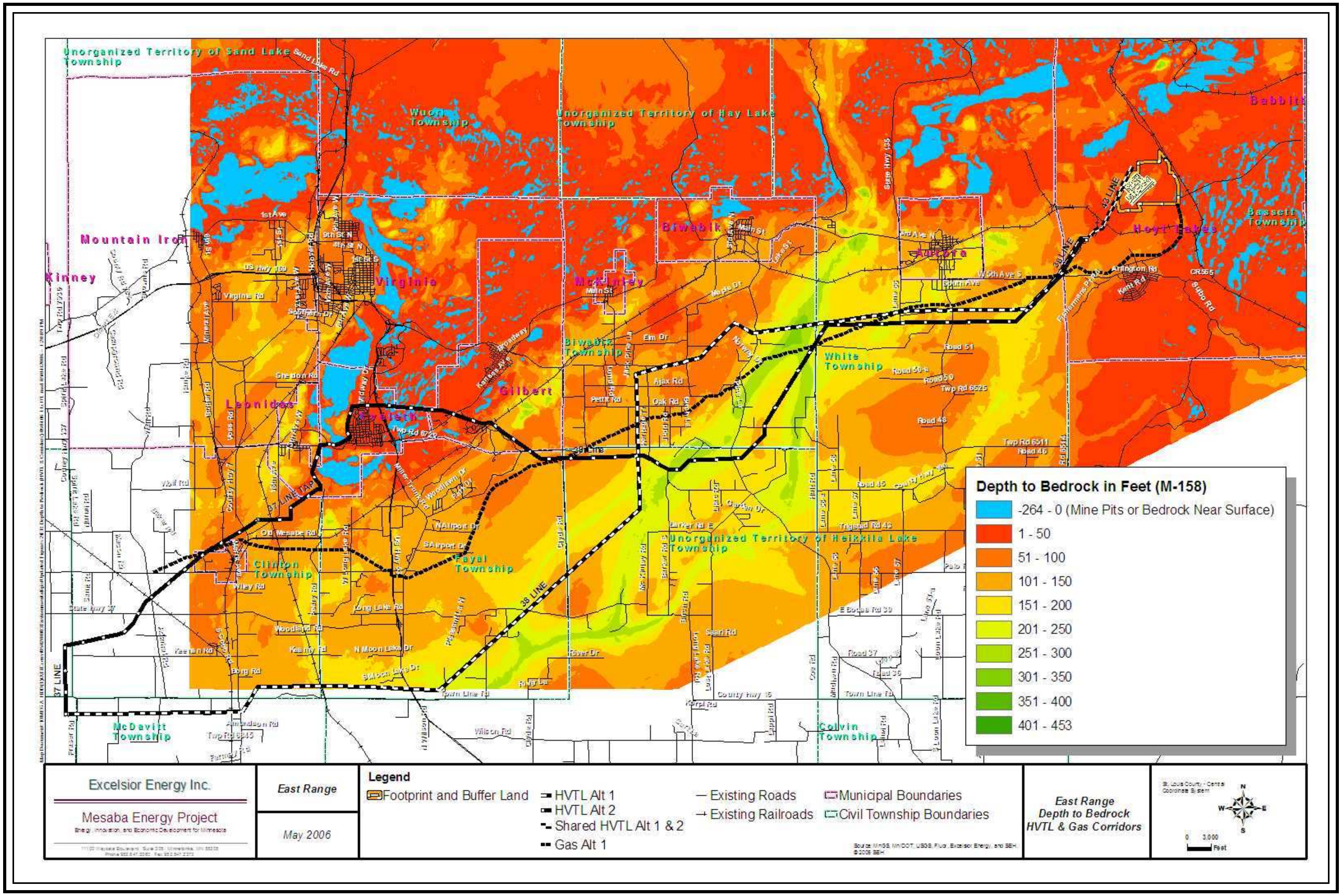


Figure 2.4-21 Depth to Bedrock At East Range IGCC Power Station Footprint and Buffer Land



The depth to bedrock is typically less than 50 feet in the vicinity of the IGCC Plant Station Footprint and Buffer Land and for one mile outside of the footprint. Outside that distance, the depth to bedrock gradually increases to 200 feet in a bedrock valley west of Aurora. Heading west from this valley, the depth to bedrock decreases gradually and is within 50 feet of the ground surface due south of Gilbert. From Gilbert to approximately one mile west of Eveleth, several areas of exposed bedrock are shown, and the bedrock is generally less than 50 feet bgs. The bedrock surface is more than 50 feet bgs from one mile west of Eveleth to the western limits of the bedrock contour map. The 39L/37L HVTL Route extends 3.5 miles west of the limits of the bedrock contour map.

2.4.9.2.4 East Range Gas Pipeline Alternative 1

As shown in Figure 2.4-19, the bedrock along the natural gas pipeline alignment consists almost exclusively of the Virginia Formation, consisting of greywacke, siltstone and shale. More specifically, this formation consists of interbedded argillite, argillaceous siltstone, and fine-grained feldspathic greywacke. Figure 2.4-19 shows that as the pipeline leaves the IGCC Power Station Footprint and Buffer Land on the east side of the plant and heads towards Hoyt Lakes, the bedrock along the alignment consists of intrusive rocks of the Duluth complex. Once the pipeline turns west at Hoyt Lakes, the bedrock along the alignment consists of the Virginia Formation.

The depth to bedrock is typically less than 50 feet in the vicinity of the IGCC Power Station Footprint and Buffer Land and outward for one mile. Outside that distance, the depth to bedrock gradually increases to 200 feet in a bedrock valley west of Aurora, Minnesota. The Gas Pipeline Alternative 1 corridor follows the west slope of this bedrock valley to the southwest, where the depth to bedrock ranges from 50 to 150 feet bgs. South of Eveleth, the corridor turns west, and the depth to bedrock ranges from 50 to 150 feet bgs. The western one mile of the gas pipeline corridor is beyond the western limit of the bedrock contour map.

2.4.9.2.5 East Range Process Water Supply Pipelines

2.4.9.2.5A *Process Water Supply Pipeline 9N-6*

Bedrock at the East Range Process Water Supply Pipeline 9N-6 consists of the Biwabik Formation described in Section 2.4.7.2. The bedrock types are shown in Figure 2.4.19. Figure 2.4.20 shows gradations of depth to the bedrock surface. Along the eastern 1200 feet of the pipeline and at the extreme west end of the pipeline, the bedrock surface is exposed at the ground surface. Along the remainder of the pipeline, the bedrock surface is expected to be less than 50 feet bgs.

2.4.9.2.5B *Process Water Supply Pipeline 9S-6*

Bedrock at the East Range Process Water Supply Pipeline 9S-6 consists of the Biwabik Formation described in Section 2.4.7. The bedrock types are shown in Figure 2.4.19. Figure 2.4.20 shows contours of depth to the bedrock surface. The bedrock surface ranges from 51 to 100 feet bgs along the middle 1,500 feet of the pipeline. Along the western 600 feet of the pipeline and at the extreme east end of the pipeline, the bedrock surface is expected to be less than 50 feet bgs.

2.4.9.2.5C ***East Range Process Water Supply Pipeline 6-S-2WX***

Bedrock at the East Range Process Water Supply Pipeline 6S-2WX consists of the Biwabik Formation described in Section 2.4.7. The bedrock types are shown in Figure 2.4.19. Figure 2.4.20 shows contours of depth to the bedrock surface. The bedrock surface is less than 50 feet bgs throughout the east-west oriented portion of the pipeline. Along the northern 900 feet of the north-south portion of the pipeline, the bedrock is 51 to 100 feet bgs. Along the remainder of the north-south pipeline, the bedrock surface is expected to be less than 50 feet bgs.

2.4.9.2.5D ***East Range Process Water Supply Pipeline K-2WX***

Bedrock at the East Range Process Water Supply Pipeline K-2WX consists of the Biwabik Formation described in Section 2.4.6. The bedrock types are shown in Figure 2.4-19. Figure 2.4-20 shows contours of depth to the bedrock surface. Along the entire pipeline corridor, the bedrock surface is 51 to 100 feet bgs.

2.4.9.2.5E ***East Range Process Water Supply Pipeline 2WX-Site***

Bedrock at the East Range Process Water Supply Pipeline 2WX-Site consists of the Biwabik Formation along the western one-half of the corridor and Virginia formation along the eastern one-half of the corridor. The bedrock types are described in detail in Section 2.4.7.2. The bedrock surface is expected to be less than 50 feet bgs throughout the entire pipeline corridor.

2.4.9.2.5F ***East Range Process Water Supply Pipeline 2WX-2W***

Bedrock at the East Range Process Water Supply Pipeline 2WX-2W consists of the Biwabik Formation described in Section 2.4.7.2. The bedrock is exposed at the ground surface at the east and west ends of the pipeline corridor. Along the remainder of the pipeline corridor, the bedrock surface is expected to be less than 50 feet bgs.

2.4.9.2.5G ***East Range Process Water Supply Pipeline 2W-2E***

Bedrock at the East Range Process Water Supply Pipeline 2W-2E consists of the Biwabik Formation described in Section 2.4.7.2. The bedrock geology is shown in Figure 2.4.19. Figure 2.4.20 shows contours of depth to the bedrock surface. The bedrock is exposed at the ground surface at the east and west ends of the pipeline corridor. Along the remainder of the pipeline corridor, the bedrock surface is expected to be less than 50 feet bgs.

2.4.9.2.5H ***East Range Process Water Supply Pipeline 3-2E***

Bedrock at the East Range Process Water Supply Pipeline 3-2E consists of the Biwabik Formation described in Section 2.4.7.2. The bedrock geology is shown in Figure 2.4.19. Figure 2.4.20 shows contours of depth to the bedrock surface. The bedrock is exposed at along the southern 1,800 feet of the pipeline corridor and at its northern end. Along the remainder of the pipeline corridor, the bedrock surface is expected to be less than 50 feet bgs.

2.4.9.2.6 East Range Potable Water and Sewer Pipelines

The proposed East Range Potable Water and Sewer Pipelines will use the same corridor, which exits the plant site on the west side and follows the existing utility corridor southwest across one set of railroad tracks to Colby Lake. They will be extended beneath Colby Lake to Colby Lake Drive, where they will connect to existing City of Hoyt Lakes water and sanitary mains. The bedrock along this entire corridor is the Virginia Formation graywacke, as shown in Figure 2.4.19.

Figure 2.4.20 shows that the bedrock surface is expected to be 1 to 50 feet bgs in all areas except along Colby Lake Drive, where the depth to bedrock is expected to be 51 to 100 feet.

2.4.9.2.7 East Range Rail Line Alternative 1

The bedrock along the East Range Rail Line Alternative 1 corridor is the Virginia Formation graywacke. This bedrock is described in Section 2.4.7.2. As shown in Figure 2.4.20, the bedrock surface is expected to be 1 to 50 feet bgs along the rail corridor to the IGCC Power Station. The exception is where the corridor extends along the southeast side of the Station. The bedrock surface there is expected to be 50 to 100 feet bgs.

2.4.9.2.8 East Range Rail Line Alternative 2

The bedrock along most of the East Range Rail Line Alternative 2 corridor is the Virginia Formation graywacke. However, where the corridor extends east beyond the east boundary of the plant site, the bedrock changes to the Duluth Complex. As shown in Figure 2.4.20, the bedrock from the west end of the rail corridor to the IGCC Power Station, the bedrock surface is 1 to 50 feet bgs. Where the corridor extends along the southeast side of the Station, the bedrock surface is 50 to 100 feet bgs. From the east corner of the Station to the east boundary of the plant site, the bedrock surface is 1 to 50 feet bgs. From the east boundary of the IGCC Power Station Footprint to the east end of the rail corridor, several bedrock outcrops exist, and the bedrock surface is generally shallow.

2.4.9.2.9 East Range Roads

The bedrock along the East Range Access Road 1 corridor is the Virginia Formation graywacke. This bedrock is described in Section 2.4.7.2. As shown in Figure 2.4.20, the bedrock surface is 1 to 50 feet bgs along this corridor. The exceptions are two isolated areas on the north side of the IGCC Power Station, where the bedrock surface is expected to be 51 to 100 feet bgs.

2.4.10 Geotechnical Investigations

Fourteen (14) soil borings were completed on the West Range Site to aid in definition of site soils and bedrock, to aid in assessment of the impact of the proposed construction on the site soils and bedrock, and to determine soil and rock engineering parameters for developing preliminary facility foundation and earthwork costs. The borings are numbered WR-1 through WR-14 and are shown in Figure 2.4-12. Logs of the borings are presented in Appendix 3. Soil classifications on the logs are in USCS format, ASTM D 2487.

Boring depths were initially planned to extend to the top of bedrock, with four borings extending into bedrock with H-size rock cores. Due to the presence of large boulders in the soil column, it was necessary to core into bedrock at most locations to confirm the bedrock contact, rather than terminating the boring on a boulder. There were exceptions, however. At location WR-8 the boring was terminated at 30 feet due to the presence of cobbles and boulders which resulted in extremely difficult drilling conditions below 25-foot penetration. At location WR-11, the boring was terminated in sand and gravel below the glacial till because the area in question will likely be filled for the proposed railroad grade and/or knowledge of the top of bedrock elevation was not considered critical knowledge as it relates to the proposed construction in that area. In locations WR-1A and WR-10, borings were terminated in highly weathered granite.

Subsurface conditions at the boring locations generally consist of topsoil, fine-grained glacial till and fine alluvial clay overlying sand and gravel alluvium, which overlies bedrock. The thickness of the combined topsoil, till and alluvial clay varied from 6.5 feet to 23 feet. The topsoil layer was on the order of 4 inches to 18 inches thick. The thickness of the sand and gravel alluvium varied from 2 feet to 25 feet, other than at Boring WR-3 where it was absent. Subsurface profiles are provided above in Figures 2.4-13 through 2.4-16. The location of these profiles is shown in Figure 2.4-12.

The till is typically a sandy lean clay or clayey sand. Fat clays and silty sands were also encountered within the till. The plasticity index (PI) of the till varied from 8 to 40 on tested samples. Liquid limits varied from 19 to 57 and the plastic limit varied from 11 to 19. The tills with PI's in the lower Range were classified as clayey sands. The fat clay layers were encountered at three locations and were generally thin, on the order a few feet thick. The silty sand layers within the till often contained cobbles and boulders.

The coarse alluvium varied from a clean sand to a sandy silt. Nineteen grain-size tests were completed on samples of the alluvium. The percentage of silt and clay fines within the sand varied from 4 percent to 27 percent, with a median value of 16 percent. Cobbles and boulders were generally present throughout the coarse alluvium. The high N-values of the split-spoon sampler (ASTM D 1586) do not necessarily reflect the density of the material, but most likely reflect the presence of the cobbles and boulders.

It should be noted that peat and muck are present at the surface at various locations throughout the West Range Site. See descriptions of the Greenwood, Blackhoof and Moose Lake deposits in the Section 2.4.6.1.1 narrative regarding the Itasca County Soils Survey. Soil borings were not drilled in the areas of peat and muck due to the inability of drilling equipment to access those locations without becoming immobilized.

Water levels observed in the soil borings are noted on the boring logs. In some instances it was necessary to switch from hollow-stem auger to rotary drilling with drilling fluid in order to advance the hole in dense sand and gravel or till with cobbles and boulders above the water table. In those borings, if water was not encountered prior to switching to rotary drilling, observation of the water level was not possible due to the presence of the drilling fluid.

At the location of Boring WR-8 an attempt was made to install a piezometer in an offset boring (Boring WR-8A). Boring WR-8A was advanced to a depth of 25.5 feet with a hollow-stem auger and was obstructed at that depth without encountering ground water. Both Borings WR-8 and WR-8A were obstructed at about 25-foot penetration. It is likely, although not confirmed, that bedrock exists at that depth.

Twelve (12) of the fourteen (14) soil borings encountered bedrock. With the exception of Boring WR-5, bedrock encountered in the nine borings consisted of Giant's Ridge Granite. The material color of the granite is generally pink to pink and gray, speckled with black, although some areas were greenish gray to white. Where unweathered, the material is hard. Discontinuities were rather frequent, 2 inches to 36 inches. Joint angles varied from near horizontal (0 to 5 degrees, to near vertical (85 to 90 degrees). Some joints were stained and others showed thin clay coatings.

At Boring WR-5, bedrock consisted of Pokegama siltstone. The siltstone particles appeared to be predominantly quartz, although no thin-sections were taken to confirm that observation. The material was dark gray and hard, with bedding at 0.5-inch to 2 inches. Coring in this material was extremely difficult due to its hardness, and the close spacing and frequency of the bedding planes.

The top of competent bedrock was encountered at elevations summarized in Table 2.4-4. The bedrock elevations were highly variable. It should be noted that bedrock outcrops were observed along the north-south HVTL corridor along the eastern boundary of the West Range Site, while Boring WR-13, drilled about 100 feet west of the HVTL and at a slightly lower elevation, did not encounter bedrock until a depth of 31 feet. Top of bedrock elevations generally drop off from northeast to southwest across the West Range Site. However, there are anomalies and variations within the top of bedrock surface.

Table 2.4-4
Top of Bedrock Elevation Summary

Boring No.	Ground Surface Elevation, ft	Bedrock Depth, ft	Top of Bedrock Elevation, ft
WR-1	1401.9	27.5	1374.4 (w)*
WR-2	1408.3	21	1387.3
WR-3	1451.1	7	1444.1
WR-4	1420.3	25	1395.3 (w)*
WR-5	1429.5	34.5	1395.0
WR-6	1409.8	12.0	1397.8
WR-7	1451.8	12.5	1434.8
WR-8	1451.7	>24.6	<1427.1
WR-9	1395.9	12.5	1383.4
WR-10	1357.6	32.5	1325.1 (w)*
WR-11	1341.0	>21.5	<1319.5
WR-12	1432.4	26.5	1405.9
WR-13	1458.0	31.5	1426.5
WR-14	1444.6	12.0	1432.6
* (w) weathered bedrock			

2.4.10.1.1 West Range Rail Alternative 1A

The West Range Rail Line Alternative 1A passes the existing north-south transmission line and enters the plant site in a 20 foot cut near Boring WR-2 (shown in Figure 2.4-12). The cut continues for about 2,900 feet to the vicinity of soil Boring WR-9 and is up to 60 feet deep in the vicinity of Boring WR3. The fill section that takes over at WR9 extends for about 7,000 feet and varies in depth from 0 to 50 feet. The 50-foot deep fill section is in the vicinity of Boring WR11 and is approximately 1,000 feet in length. Laboratory tests were completed to aid in determining engineering parameters for preliminary design and construction cost estimating. The laboratory test results are not discussed in detail in this document, but are provided for general information in Appendix 3. Laboratory tests completed as part of the West Range IGCC Facility Site and West Range Rail Line Alternative 1A are listed in Table 2.4-5, and included in the Appendix.

Table 2.4-5
Geotechnical Laboratory Test Assignments

Number of Tests	Description of Tests
26	Coarse partial grain-size analysis (ASTM C 136) (with plots of curves)
48	Water contents (ASTM D 2216)
10	Unit weight
1	Specific Gravity (ASTM D 654)
6	Grain-size analyses (sieve-hydro)(ASTM D 422)
11	Atterberg Limits (ASTM D 4318)
7	Permeability (in liners) (ASTM D 5856)
10	Electrical resistivity (ASTM G 57)
10	pH (ASTM G 51)
10	Sulphate (soil) (not complete)
10	Chloride (soil) (not complete)
5	Thermal Resistivity (ASTM D 5334)
6	Standard Proctor Tests (ASTM D 698)
2	R-value tests (not complete)
4	Unconfined compression tests (with curve) on undisturbed soil (ASTM D 2850)
4	Unconfined compression tests on remolded soil (ASTM D 2850)
5	Unconfined compression tests on rock
2	Consolidation tests with one rebound cycle (ASTM D 2435)
Test results are either included on the boring logs, or separately in Appendix 3.	

2.4.11 Seismology

The structural geology of the Mesabi Range consists of a gently dipping homocline that strikes east-northeast and dips 5 to 15 degrees southeast. More specifically, a drilling in Calumet indicates a dip angle of 10 degrees in the updip section and 12 degrees in the downdip section (USDI, 1965). The structural geology of the Mesabi Range is complicated; numerous tectonic events include faulting that was pre, post, or simultaneous with deposition of the Animike Group. Mapped structural features in the vicinity of the site include several northwest striking faults. A steeply dipping northeast trending fault is located at the eastern end of the Hill-Annex Mine Pit, but show minor movement. Other minor features present throughout the Mesabi Range include small folds and monoclines that create steep dips, steep joint and fracture sets, and secondary slumps, faults, and folds (MGS, 1972).

The primary structural feature in the general area is the Morris fault. This fault has been interpreted to be a late Archean suture and is part of the Great Lakes tectonic zone (GLTZ), which extends from central South Dakota to the north shore of Lake Huron in Ontario, Canada. The Morris fault separates a 2,650–2,750 million year-old greenstone-granite terrene to the northwest from a 2,600–3,600 million year old gneiss terrene to the southeast (Chandler, 1994). The Animike Basin extends northeasterly from the northeast end of the Morris fault. The Morris fault and the Animike Basin are separated by the Penokean fold and thrust belt in central Minnesota. Another structural feature includes the mid-continent rift system that extends through south-central Minnesota and up into Wisconsin south of Lake Superior.

The mechanism of seismicity in the central United States is poorly understood, but the prevalent model is reactivation of ancestral faults in the Precambrian basement by the modern stress field (Chandler, 1994). "Minnesota is one of the least seismically active states in the United States," (Mooney, 1979). However, this does not mean that Minnesota is earthquake free. In a 1994 update, Chandler cited 19 earthquakes that have occurred in Minnesota since 1860. The largest of the most recent quakes was the 4.6-4.8 magnitude quake, based on the Richter scale, which occurred near Morris, Minnesota on July 9, 1975. A similar magnitude quake (4.1) took place about 28 miles south of this location in Dumont of June 4, 1993. Both of these quakes occurred near the Morris fault within the GLTZ. However, there is no record of these quakes being felt in the vicinity of the West or East Range Sites. Harold Mooney, formerly of the University of Minnesota (Mooney, 1979, pg. 2), notes that it is more likely that the 7.8 magnitude New Madrid quake of 1812 would have been felt throughout Minnesota, but that due to a lack of population density no records of intensity exist for that quake in northern Minnesota. A list of historical seisimicity within the State, (Chandler, 1994), is provided in Table 2.4-6.

Table 2.4-6
Historical Seismicity of Minnesota

Epicenter (nearest town)	Mo/day/yr	Lat.	Long.	Felt area (km2)	Maximum intensity	Magnitude
1 Long Prairie	1860–1861	46.1	94.9	---	VI–VII	5.0
2 New Prague	12/16/1860	44.6	93.5	---	VI	4.7
3 St. Vincent	12/28/1880	49.0	97.2	---	II–IV	3.6
4 New Ulm	2/5–2/12/1881	44.3	94.5	v. local	VI	3.0–4.0
5 Red Lake	2/6/1917	47.9	95.0	---	V	3.8
6 Staples	9/3/1917	46.34	94.63	48000	VI–VII	4.3
7 Bowstring	12/23/1928	47.5	93.8	---	IV	3.8
8 Detroit Lakes	1/28/1939	46.9	96.0	8000	IV	3.9–3
9 Alexandria	2/15/1950	46.1	95.2	3000	V	3.6
10 Pipestone*	9/28/1964	44.0	96.4	---	---	3.4
11 Morris*	7/9/1975	45.50	96.10	82000	VI	4.8–4.6
12 Milaca*	3/5/1979	45.85	93.75	---	---	1.0

Epicenter (nearest town)	Mo/day/yr	Lat.	Long.	Felt area (km2)	Maximum intensity	Magnitude
13 Evergreen*	4/16/1979	46.78	95.55	---	---	3.1
14 Rush City*	5/14/1979	45.72	92.9	---	---	0.1
15 Nisswa*	7/26/1979	46.50	94.33	v. local	III	1.0
16 Cottage Grove	4/24/1981	44.84	92.93	v. local	III–IV	3.6
17 Walker	9/27/1982	47.10	97.6	v. local	II	2.0
18 Dumont*	6/4/1993	45.67	96.29	69500	V–VI	4.1
19 Granite Falls*	2/9/1994	44.86	95.56	11600	V	3.1

*Denotes earthquakes that were recorded instrumentally. All others and associated magnitudes based solely on intensity data from felt reports.

2.4.11.1 Fault Zones in Relation to Minnesota Earthquakes

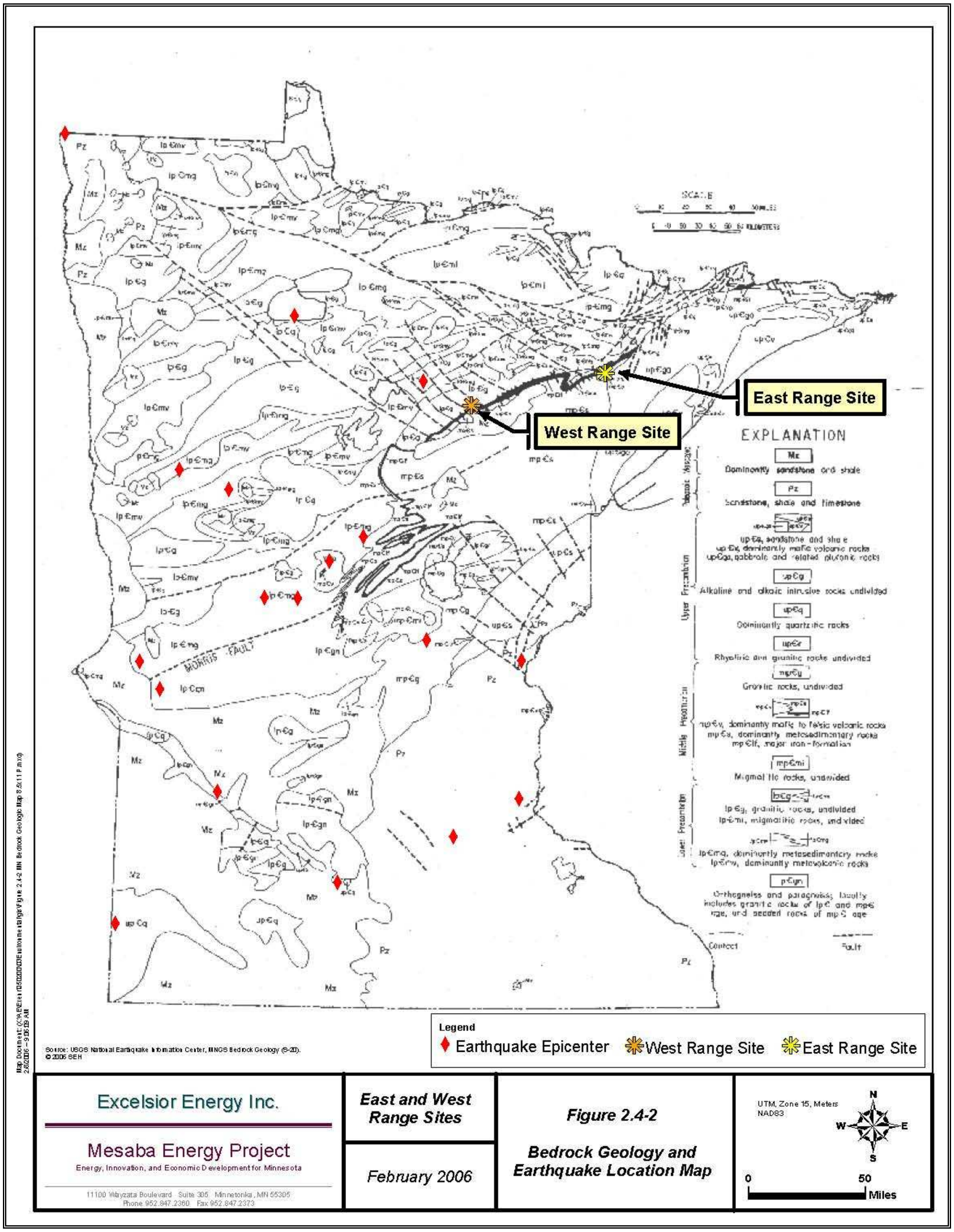
Sims attributed most of the seismic activity in Minnesota to the Great Lakes Seismic Zone, of which the Morris fault is the eastern anchor (Chandler and Morey, 1989). However, more recent geophysical studies in Minnesota have considerably improved our understanding of the GLTZ and adjacent structures. These recent studies have identified northwest-southeast trending substructures (subfaults) trending off of the GLTZ and the suggestion is that the earthquakes concentrated along the GLTZ are related to places where the northeast trending GLTZ is intersected by the northwest-southeast trending substructures (Chandler and Morey, 1989). The primary reason for this interpretation is that the epicenters for earthquakes in the vicinity of the GLTZ occur away from the immediate vicinity of the GLTZ along the northwest trending subfaults.

Figure 2.4-22 illustrates the epicenters and proposed LEPGP Sites in relation to faults and basement (Precambrian geology) rock types. The closest earthquake epicenter to the site is the Bowstring epicenter of 1928, a distance of about 25 miles. The magnitude of the Bowstring quake was estimated to be 3.8. (Magnitude 3 quake shocks are barely perceptible. Magnitude 5 shocks will be disturbing to nearby observers but will not do much damage.) Mooney (1979) reports that for this quake a small shock was reported in which a house seemed to sway in an east-west direction. From Figure 2.4-22 it appears that the Bowstring epicenter is located along one of the northwest trending fault lines emanating out from the iron range. Based on Figure 2.4-22, neither the West Range Site nor East Range Site appears to be located on one of the fault lines.

2.4.11.2 Earthquake Risk

Risk assessment relies largely on earthquake history. The lack of major earthquakes together with the infrequency of earthquakes in general, implies a low risk level for Minnesota (Mooney, 1979). Current knowledge indicates that, although weak to moderate earthquakes do occasionally occur in Minnesota, a severe quake is very unlikely (Chandler, 1994). The Uniform Building Code puts Minnesota in Seismic Risk Zone 1. The State Building Code has amended this to Seismic Risk Zone 0 (Mooney, 1979) and states that "any seismic earthquake provisions in this code are deleted and not required." "Algermissen and Perkins assigned damage probabilities for the United States in terms of severity of ground shaking and frequency of occurrence of damaging earthquakes. Minnesota lies outside the lowest contour interval, 0.04g, on their map of horizontal acceleration in rock with 90 percent probability of not being exceeded in 50 years", (Mooney, 1979).

Figure 2.4-22 Bedrock Geology and Earthquake Location Map



Mooney estimated average recurrence rates for Minnesota earthquakes as follows:

Magnitude 4	-	10 years
Magnitude 4.5	-	30 years
Magnitude 5	-	89 years
Magnitude 5.5	-	266 years

Based on the Minnesota Building Code, structures and infrastructure need not consider earthquake provisions as part of design. However, based on the location of the Bowstring event in 1928, it would be prudent to design foundations for sensitive and/or reciprocating equipment to accommodate a minor seismic event.

2.5 Water Resources and Water Quality

2.5.1 Surface Water

2.5.1.1 Drainage Areas, Water bodies, and Waterways

2.5.1.1.1 West Range Site

The West Range Site lies within the northernmost regions of the Upper Mississippi River Basin (UMRB) Watershed. The major surface waterbodies in the vicinity of the IGCC Power Station Footprint and Buffer Land are listed in Table 2.5-1. A map showing the location of these waters is provided below (Figure 2.5-1).

Table 2.5-1
Surface Waterbodies

Surface Water	Watershed	FEMA[1] Designated Floodplain	Public Water[2]	Special Water[3]	MPCA Designated Impaired Water[4]	Target TMDL Study[5]	Impairment
Big Diamond Lake	Swan River		X				
CMP	Swan River						
Dunning Lake	Swan River		X				
Greenway Mine Pit	Prairie River						
Hill-Annex Mine Pit	Swan River						
Holman Lake (Hill Lake)	Swan River		X				
Lind Mine Pit	Prairie River						
Little Diamond Lake	Swan River		X				

Surface Water	Watershed	FEMA[1] Designated Floodplain	Public Water[2]	Special Water[3]	MPCA Designated Impaired Water[4]	Target TMDL Study[5]	Impairment
Lower Panasa Lake	Swan River		X		X	NO	Mercury FCA[6]
Mississippi River		X	X	X	X	NO	Turbidity Low oxygen Mercury FCA[6]
Oxhide Creek	Swan River		X				
Oxhide Lake	Swan River		X		X	NO	Mercury FCA[6]
Prairie River	Mississippi River	X	X				
Snowball Creek	Swan River		X				
Swan River	Mississippi River	X	X		X	NO	Fecal coliform Low oxygen Mercury FCA[6]
Trout Creek	Swan River		X				
Trout Lake	Swan River		X	X	X	NO	Mercury FCA[6]
Twin Lakes	Swan River		X				
Upper Panasa Lake	Swan River		X		X	NO	Mercury FCA[6]
West Hill Mine Pit	Prairie River						

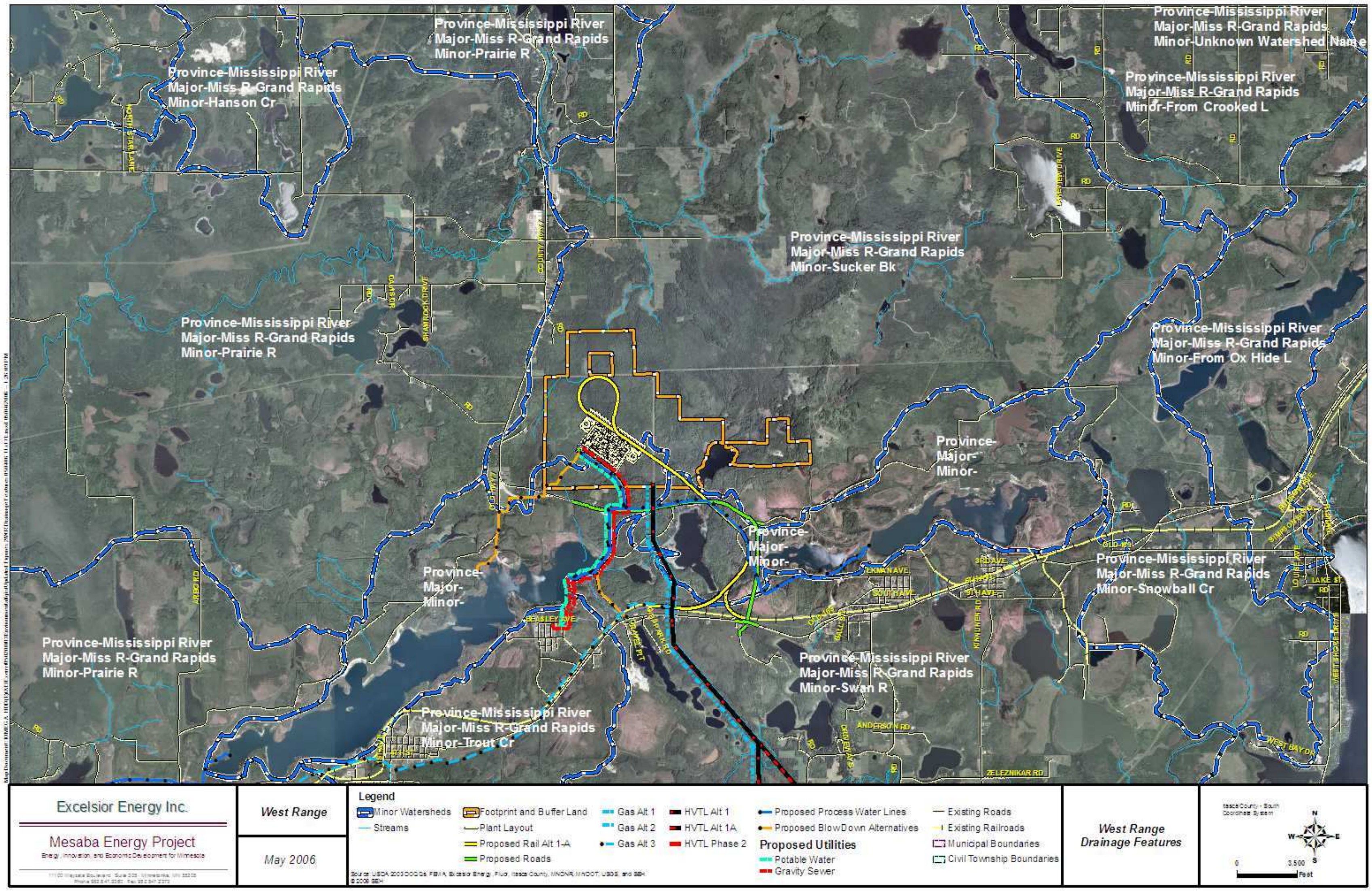
[1] Federal Emergency Management Agency
[2] MDNR Designated Public Water
[3] MPCA Designated Special Water
[4] From the 2004, EPA approved 303(d) list of impaired waters
[5] Total Maximum Daily Load
[6] Fish Consumption Advisory

The IGCC Power Station Footprint and Buffer Land consists of many small surface depressions, wetlands, and small streams. Runoff leaving these on-site features generally enters larger streams and wetland systems prior to entering the surface waters listed in Table 2.5-1.

The major drainage areas throughout the IGCC Power Station Footprint and Buffer Land have been delineated and are shown in Figure 2.5-1. The Prairie River Watershed includes the northern portions of the project site. The CMP Watershed is isolated from the other watersheds, since the CMP does not have an outlet. The remaining surface water bodies listed in Table 2.5-1 are all within the Swan River Watershed. The Prairie River and the Swan River both drain to the Mississippi River.

The land use and land cover within the watersheds are primarily made up of northern hardwoods, wetlands, surface water bodies, and mining features (see Figure 2.8-1). Impervious surfaces including highways and urban development make up a small percentage of the total land use. See section 2.8 for additional land use details.

Figure 2.5-1 West Range Major Drainage Areas



The soils in the watershed area are primarily Hydrologic Soil Group C. See Appendix 3 for soil borings and Figure 2.4-5 for the Itasca County Soil Survey designations. Hydrologic Soil Group C soils typically have low rates of infiltration and high rates of runoff (Minnesota Hydrology Guide, 1992).

However, since large portions of the watersheds are covered by trees, wetlands, and surface water bodies, there is a relatively large volume of available runoff storage, and runoff rates tend to be lower than expected in an area with Hydrologic Soil Group C soils.

2.5.1.1.1A ***Hill-Annex Mine Pit ("HAMP") Complex***

The HAMP Complex consists of the Arcturus, Gross-Marble, Hill-Trumbull, and Hill-Annex Mine Pits. The mine pit is located immediately north of the Cities of Marble and Calumet, and stretches over 3 miles from east to west.

Mining operations kept the HAMP Complex completely dewatered until 1979. Following 1979, some dewatering took place and some of the pits began to fill with water. By 1981, all mining operations had ceased (Barr, 1987). Hill-Annex was established as a state park in 1988 by the Minnesota Legislature and is controlled by the MDNR—Division of Parks and Recreation. The park currently offers tours of the mine pit features and facilities. Since the state park has limited funding, the dewatering pump cannot be operated more than 5.5 months a year, and as a result, the water level has risen above some of the mine features and facilities.

The Arcturus, Gross-Marble, and Hill-Trumbull/Hill-Annex mine pits were separated by large masses of rock during the mining operations. Following the cessation of mining, the water levels in the pits began to rise, and the GMMP became connected to the Hill-Trumbull/Hill-Annex when the water surface elevation reached approximately 1,215 feet msl. The water surface in the Arcturus is higher than that of the other pits, and has not become connected by water to the other pits. Water currently overflows out of the Arcturus into the GMMP. The stage in HAMP Complex was measured at 1,246.70 and Arcturus was measured at 1,268.51 on November 1, 2005 (SEH 2005).

The total contributing surficial drainage area to the HAMP Complex is approximately 2,938 acres. The watershed is 30% northern hardwoods, 36% pit, 31% mining features, and 3% natural water bodies.

Inflows into the HAMP Complex include surface and ground water components. Outflows from the system include evaporation, seepage (ground water outflow), and dewatering.

The water levels in the HAMP Complex fluctuate as a result of the seasonal variations in runoff and dewatering. The MDNR pumps an average of 6,200 gpm from the pit when the pump is in operation from the end of May until October.

Pumping records have been kept since 1973, and the MDNR Hill-Annex staff continues to report dewatering volumes on a monthly basis as shown in Table 2.5-2.

Bathymetric data was collected by the Proponent in the fall of 2005. A stage-storage relationship was developed for the Arcturus, Gross-Marble, and Hill-Trumbull/Hill-Annex mine pits from the bathymetric data. The bathymetric data for the Hill-Annex and Gross Marble Mine Pits are shown in Figure 2.5-2. The Arcturus bathymetric data are shown in Figure 2.5-3.

Stage data were collected by the MDNR from 1993 through 2002 for HAMP Complex. The stage data were not collected on a regular basis, and this data could not be used for a detailed yearly estimate of pit recharge. At present, the Proponent is measuring the stage at all of the pits within the HAMP Complex.

Actual recharge rates when the pits were dewatered from 1973–1979 were calculated based on pumping records. Recharge rates during this period range from 3,230 gpm to 4,030 gpm.

The stage-storage relationship, pumping records, and stage measurements, were used to calculate long-term average pit recharge rates. Given that the pits were completely dewatered on January 1, 1979 and that the Arcturus was completely full by 1999, an average recharge rate of 2,150 gpm was calculated using the stage-storage relationship, the stage measured on December 9, 1999, and pumping records.

A second long-term average recharge rate was calculated by adding the difference in volume in the pits between December 9, 1999 and November 1, 2005 and the volume of water pumped over this time period. The average recharge rate between the end of 1999 and 2005 was determined to be 1590 gpm.

There is less confidence in the long-term averages calculated because of potentially missing data and pumping records as well as highly variable groundwater head conditions.

2.5.1.1.1B ***CMP***

The CMP is made up of numerous abandoned mine pits. It is situated northeast of the City of Grand Rapids and immediately north of the Cities of Coleraine, Bovey, and Taconite. The entire mine pit complex is approximately 4.5 miles long and 0.5 miles wide. The pit has a maximum depth of approximately 300 feet and an approximate surface area of 1400 acres. The water surface elevation in the mine pit on November 1, 2005 was 1,308.75, which corresponds to a surface area of 1,393 acres and a water volume of 149,500 acre-ft.

Figure 2.5-2 Hill-Annex and Gross Marble Bathymetry

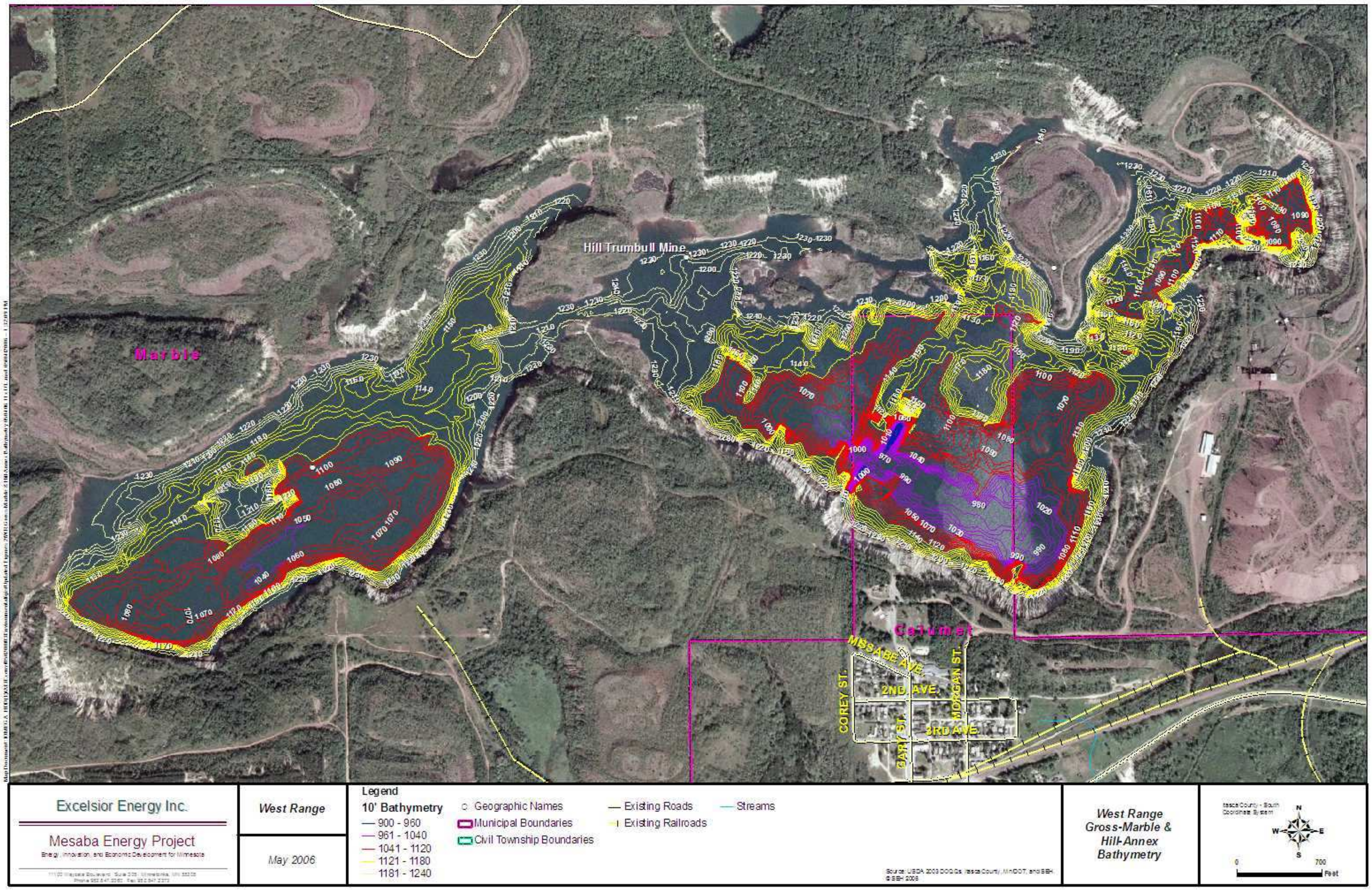
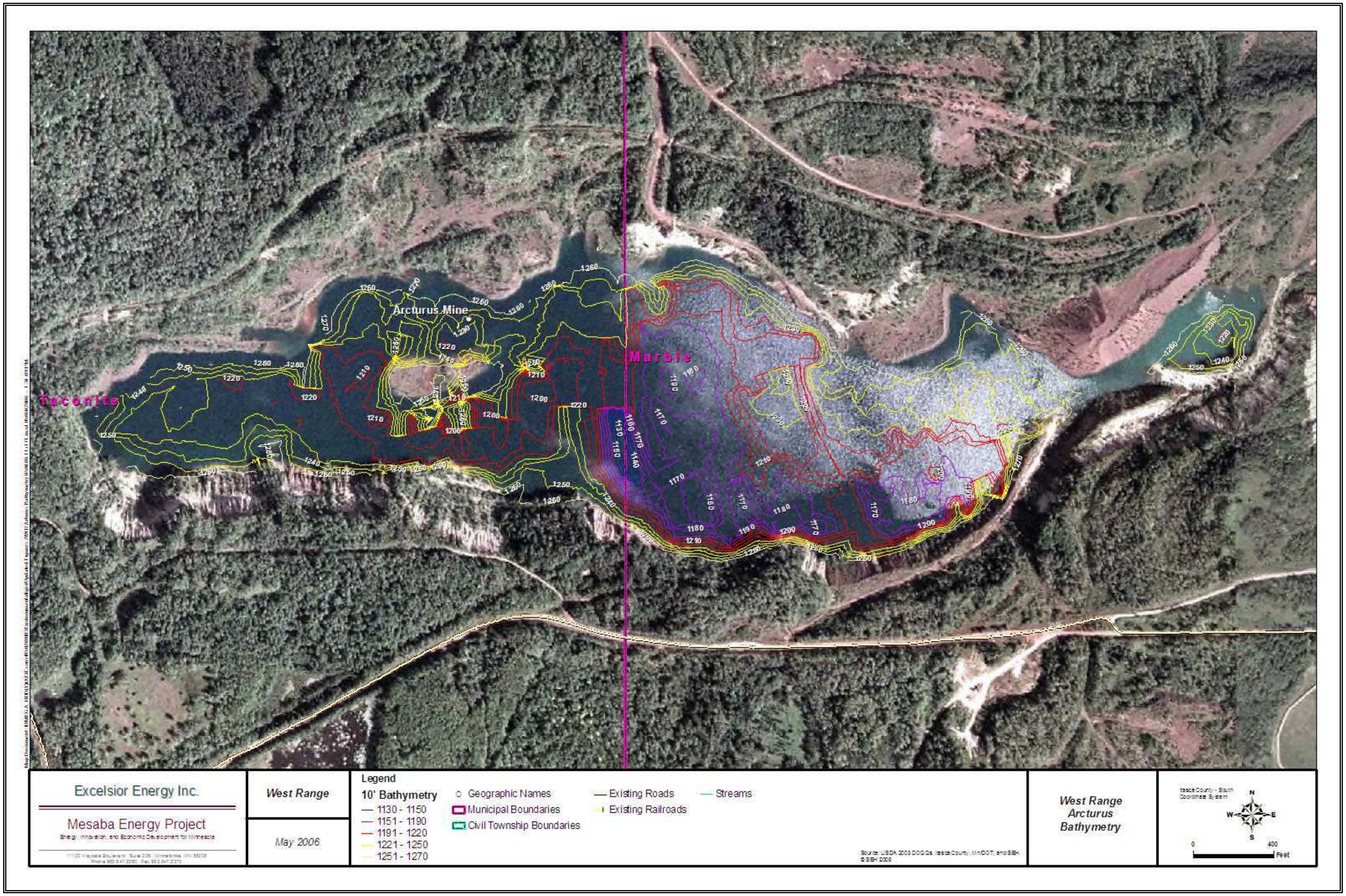


Figure 2.5-3 Arcturus Mine Pit Bathymetry



The total contributing surficial drainage area to the pit is approximately 4536 acres. The forest type on the Canisteo watershed is northern hardwoods comprised largely of aspen and occupies 50% of the total watershed. The pit itself occupies 29% of the watershed. Non-vegetated or grassy/bushy areas, including tailing basins and till stockpiles, are the third largest watershed component and cover 20% of the watershed. The smallest component of the watershed are the natural water bodies such as ponds and small lakes, 1% (MDNR, 2001).

The CMP does not have a surficial outlet at this time. Water input to the system includes surface water runoff and groundwater inflow. Water leaves the system through groundwater seepage and evaporation. However, the amount of surface and ground water that enters the mine pit is greater than the amount of water lost by seepage. As a result of this net inflow, the water surface elevation in the mine pit has continued to rise since the pumping of the pit for mining operations ceased in September of 1985.

The CMP has been modeled with the WATBUD model. The WATBUD model is a water balance model developed by the MDNR and is used to evaluate and predict water inflows and outflows to and from surface water bodies. The MDNR has monitored the water surface elevations in the mine pit and in monitoring wells since 1989, and has used this data to calibrate the WATBUD model. The model indicates that the CMP will overflow in the next 4.5 to 8.5 years.

Inflows into the CMP include surface water and ground water components. Outflows from the system include evaporation and seepage (ground water outflow). The estimated average input to the system is in the range of 2300–3500 gpm (MDNR, 2001). This range was determined with help from the WATBUD model and existing data, and was developed using the data collected up to 2001.

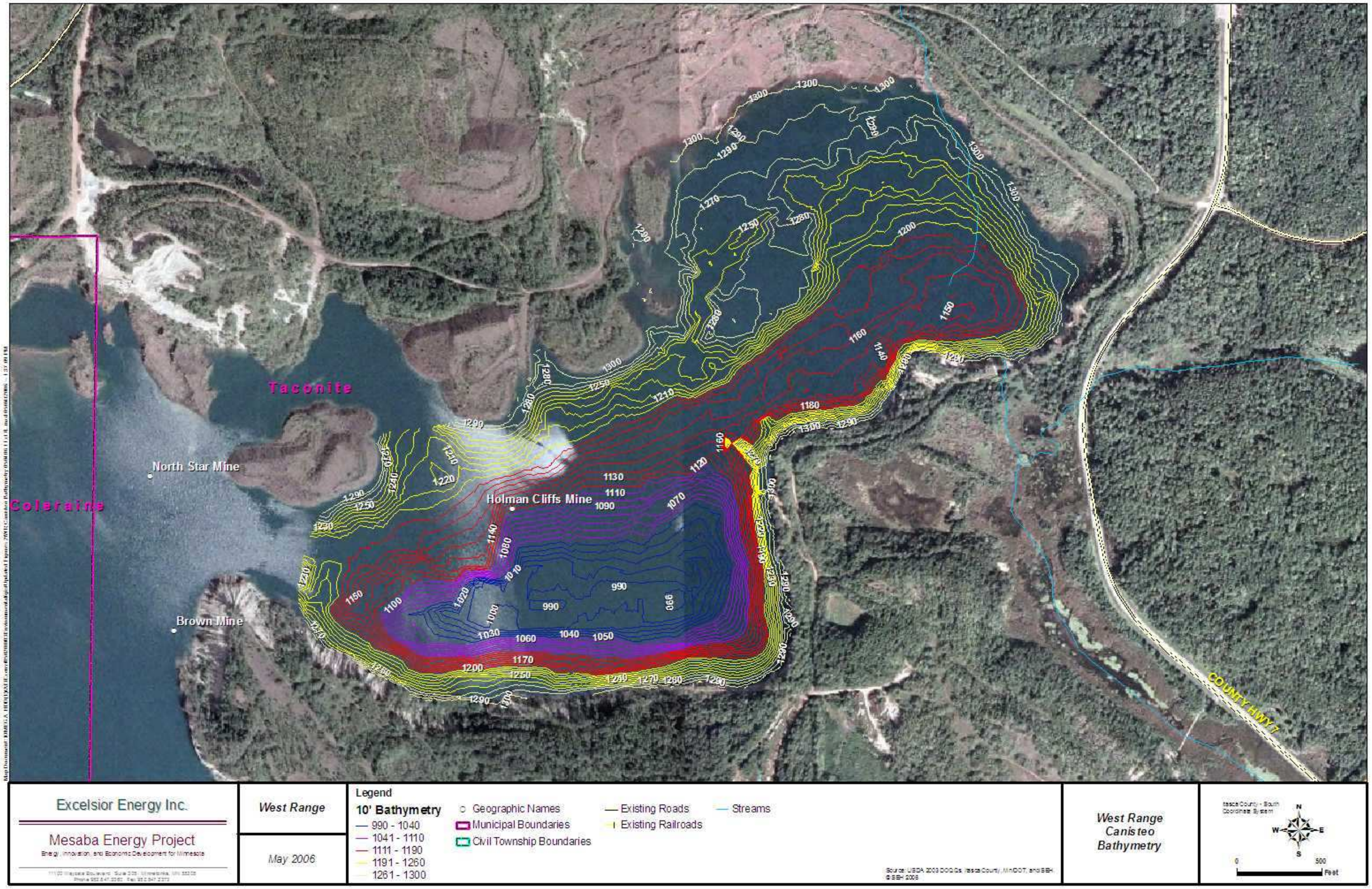
The WATBUD model has been updated by the MDNR with the data collected up to July, 2005. However, the MDNR has indicated that there is less confidence in the seepage (ground water outflow) estimates following the 2001 modeling effort, and therefore less confidence in the WATBUD model results from 2005.

Bathymetric data have been collected by the MDNR and were used to develop a stage-storage relationship for the pit. The MDNR has also collected stage (elevation) data since 1989. However, stage data were not collected on a daily basis until 1995. The bathymetric data for the CMP are shown in Figure 2.5-4.

Since there is less detailed stage data on the period from 1989 to 1995, a long-term average inflow was calculated. Based on the available stage data and the stage-storage relationship for the pit, an average recharge of 3,164 gpm was calculated over this period.

Daily stage data are available from the MDNR starting in 1995, but there are some data gaps. The MDNR continues to collect daily stage data. From 1995 to present, recharge rates range from 810 gpm to 4,190 gpm, with an average of 2,580 gpm.

Figure 2.5-4 CMP Bathymetry Data



Groundwater movements are extremely difficult to quantify. It appears that the amount of seepage out of the mine pit increases significantly when the water surface elevation is above the bedrock elevation (approximately 1,300 ft msl).

When the years in which the stage was above 1,300 (after year 2000) were eliminated, the recharge rates range from 1,820 gpm to 4,190 gpm, with an average of 2,980 gpm.

2.5.1.1.1C ***Prairie River***

The Prairie River lies within the UMRB and drains into the Mississippi River southeast of Grand Rapids and La Prairie. The U.S. Geological Survey maintains a river gauging station (gage number 05212700) several miles upstream of its confluence with the Mississippi River. Prairie Lake lies on the Prairie River between the gauging station and the Mississippi River. Lake levels are controlled at an existing hydropower dam, located approximately 5 miles upstream of its confluence with the Mississippi River.

According to USGS data, the Prairie River has a drainage area of 360 square miles at the gauging station. The drainage area consists primarily of northern hardwoods and surface water bodies (including wetlands).

Flow data have been collected at the gauging station from 1967 to 1983 and 2001 to present. Average monthly flow rates are in the 50–200 cfs range from August through March and in the 200–600 cfs range during the months of April, May, June, and July. See Figure 2.5-5.

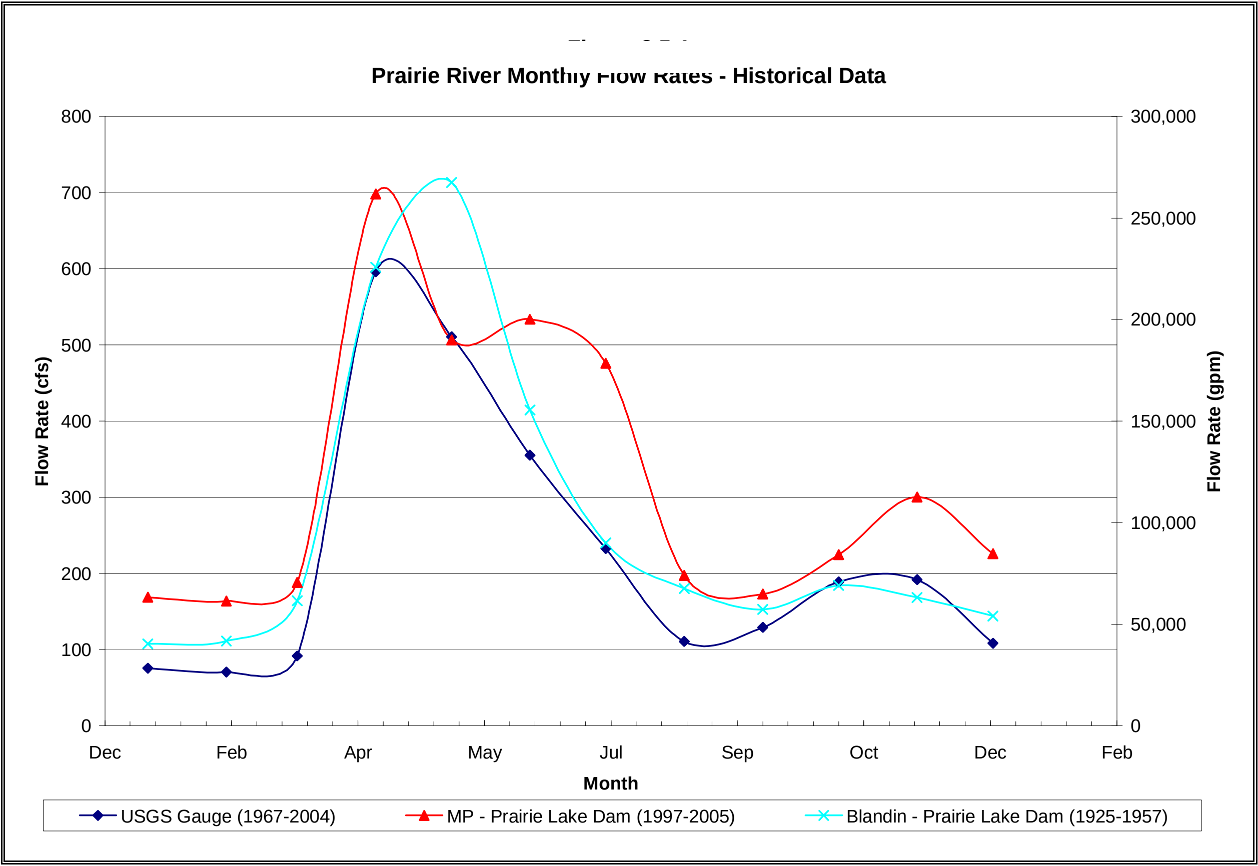
Gauge data have been collected off and on at the Prairie Lake Hydropower Dam. Flow data were collected from 1925 to 1957 on a monthly average basis while under the control and ownership of Blandin. MP assumed control and ownership of the facility and collected flow data from 1997 to 2005 on a daily basis.

The EPA Clean Water Act (CWA) rule 316(b) contains criteria regarding Cooling Water Intake Structures (CWIS). The rule specific to CWIS on fresh water rivers states that the maximum amount of water that can be taken is "5% of the mean annual flow or 25% of the 7Q10, whichever is the lesser."

Only the data collected by MP at the Prairie Lake Dam from 1998 to 2004 were used in the determination of the mean annual flow and the 7Q10. Since there was not a full year of record for 1997 and 2005, such data were not used. The Blandin data from 1925–1957 was recorded on a monthly average basis and also could not be used to determine the 7Q10.

The mean annual flow in the Prairie River is 319 cfs, and 5% of that flow is equal to 16 cfs. The 7Q10 in the Prairie River was determined to be 22 cfs, and 25% of that flow is equal to 5.5 cfs. Since 25% of the 7Q10 is the smaller amount, the maximum amount of water that can be appropriated from the Prairie River at one time is 5.5 cfs (2,468 gpm). Flow data are shown in Figure 2.5-5.

Figure 2.5-5 Historical Prairie River Monthly Flow Rates



2.5.1.1.1D ***Trout Lake***

Trout Lake does not currently receive any surface water from the CMP. Since the CMP water surface continues to rise, surface outlets for the CMP have been evaluated by the MDNR and Barr Engineering, and Trout Lake has been evaluated as a potential receiving water. The available studies (MDNR, 2001; Barr, 2004) identify a number of potentially negative and positive outcomes as a result of discharging to Trout Lake.

2.5.1.1.1E ***Upper Panasa Lake***

Upper Panasa Lake currently receives discharge water from the HAMP Complex dewatering operations. The amount of water that is discharged ultimately to Upper Panasa Lake from the HAMP Complex is shown in Table 2.5-2. The impacts on Upper Panasa Lake resulting from the discharge water from the Hill-Annex Mine Pit have not been studied.

2.5.1.1.1F ***Greenway Mine Pit***

There are very little data on the GMP. The pit has filled with water and has an outlet pipe that discharges to the Prairie River. The Proponent measured the pipe size, flow depth, and flow velocity at the pipe outlet (SEH, 2005) and determined the outflow from the Greenway Mine Pit was approximately 1 cfs (450 gpm) at that time.

Bathymetric data are not available for the Greenway Mine Pit.

2.5.1.1.1G ***West Hill Mine Pit***

There are very little data on the West Hill Pit. The pit has filled with water and has an outlet pipe that discharges to the Lind Pit. SEH personnel (November 2, 2005) measured the pipe size, flow depth, and flow velocity at the pipe outlet and determined the outflow from the West Hill Mine Pit was approximately 3.5 cfs (1,570 gpm) at that time.

Bathymetric data are not available for the West Hill Mine Pit.

2.5.1.1.1H ***Lind Mine Pit***

There are very little data on the LMP. The pit has filled with water and has an outlet pipe that discharges to the Prairie River. SEH personnel (November 2, 2005) measured the pipe size, flow depth, and flow velocity at the pipe outlet and determined the outflow from the LMP was approximately 4 cfs (1,800 gallons per minute) at that time. A majority of the outflow comes from the West Hill Mine Pit (3.5 gpm).

Bathymetric data for the LMP are shown in Figure 2.5-6.

2.5.1.1.2 East Range Site

The East Range Site lies within the northwest region of the Lake Superior Watershed. The major surface waterbodies in the vicinity of the project site are listed in Table 2.5-2 and are shown in Figure 1.12-72.

Figure 2.5-6 Lind Mine Pit Bathymetry

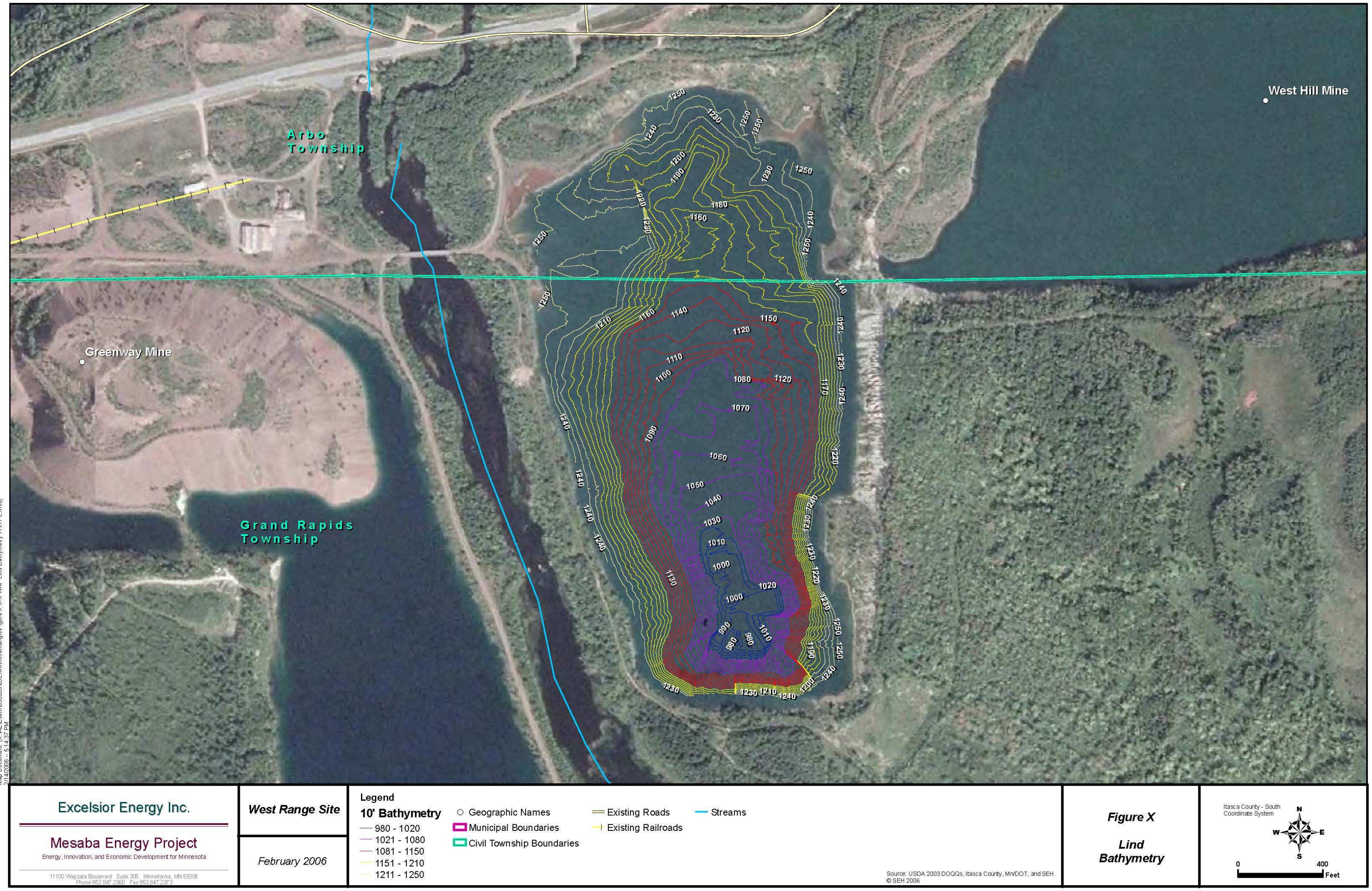


Table 2.5-2
Surface Water Bodies

Surface Water	Watershed	FEMA[1] Designated Floodplain	Public Water[2]	Special Water[3]	Impaired Water[4]	Target TMDL Study[5]	Impairment
St. Louis River	Lake Superior	X	X		X	2011	Mercury FCA[6]
Partridge River	St. Louis River	X	X				
2WX Pit	Partridge River						
2E Pit	Partridge River						
3 Pit	Partridge River						
Wyman Creek	Partridge River		X	X			
5S Pit	Wyman Creek						
6 Pit							
Colby Lake	Partridge River		X		X	2011	Mercury FCA[6]
Whitewater Reservoir	Partridge River	X	X		X	2011	Mercury FCA[6]
First Creek	Partridge River	X	X				
St. James Mine	First Creek			X			
9S Pit	First Creek						
Donora Mine / 9N	First Creek						
1W / 1 Pit	First Creek						
Little Mesaba Lake	First Creek						
Second Creek	First Creek	X	X				
Stephens Creek	Second Creek						
Stephens Mine	Second Creek						
Knox Mine	Second Creek						
2W Pit	Second Creek						

[1] Federal Emergency Management Agency
[2] MDNR Designated Public Water
[3] MPCA Designated Special Water
[4] MPCA Designated Impaired Water, 2006 EPA Draft 303(d) list of impaired waters
[5] Total Maximum Daily Load
[6] Fish Consumption Advisory

The site itself consists of many small surface depressions, wetlands, and small streams. Runoff leaving these on-site features generally enters larger streams and wetland systems prior to entering the surface waters listed in Table 2.5-2.

The major drainage areas throughout the project area are shown in Figure 2.5-7. All of the water bodies listed in Table 2.5-2 are within the St. Louis River watershed, which ultimately drains to Lake Superior.

Most surface water runoff eventually flows into Colby Lake or the Partridge River. Mining activities within this drainage area have significantly altered the regional hydrology. Changes to the hydrology within this watershed include removal of trees and soil, creation of mine pits and other depressions, and changes in topography and other features. The drainage area boundaries shown on Figure 2.5-7 were delineated from the USGS maps of the area. This map, and therefore the drainage area boundaries, does not represent the altered hydrology in this area that has taken place due to mining activities in recent years.

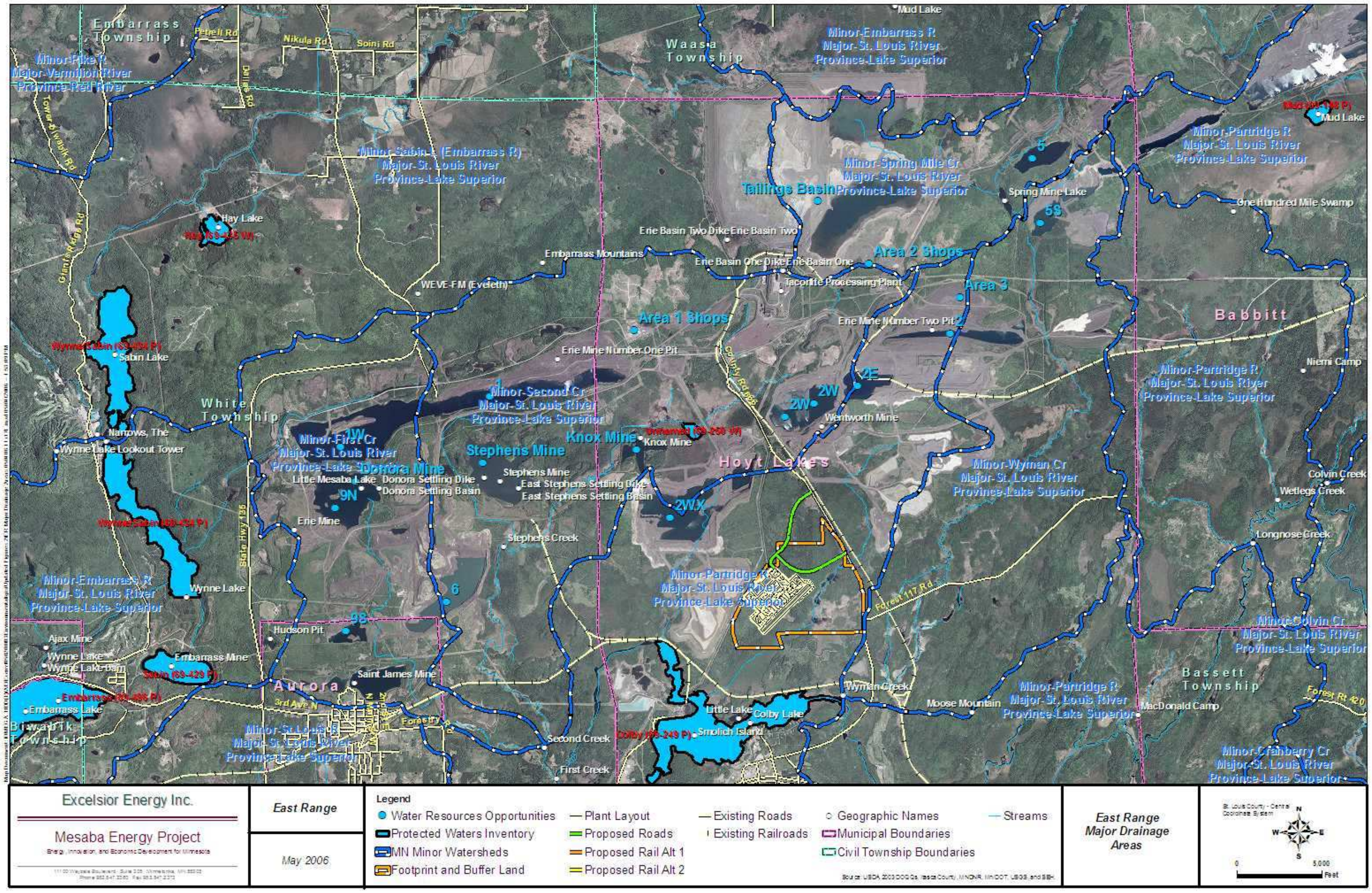
The land use and land cover within the watersheds are primarily made up of northern hardwoods, wetlands, surface water bodies, mine pits, and other mining features (see Figures 2.8-3 and 2.8-4). Impervious surfaces, including highways and urban development, make up a small percentage of the total land use. Additional land use information is provided in Section 2.8.

The soils in the watershed area consist mostly of Hydrologic Soil Group C and D. Hydrologic Soil Group C and D soils typically have relatively low rates of infiltration and high rates of runoff (Minnesota Hydrology Guide, 1992). See Section 2.4 for additional soil information.

There are several mine pits within the project area that are in various stages, from pre-mining activities to the cessation of mining. In locations where mining activities have ceased, the mine pits are filling with water. The MDNR completed a report titled the “East Range Hydrology Project” in 2004. The MDNR collected data and completed WATBUD models for pits 2E, 2W, 2WX, and 6, in order to predict when the pits would overflow and what the average and peak overflow rates would be. In addition, hydrologic changes to Colby Lake, Whitewater Reservoir, and St. James Pit were evaluated as part of the project. Pits 5N, 5S, 9N, and 9S have reached their static water levels and were not studied as part of the East Range Hydrology Project.

As a result of the development of the Alternative East Range Site and its supporting infrastructure, there will be impacts to several water bodies.

Figure 2.5-7 East Range Major Drainage Areas



2.5.1.2 Water Supply and Discharges

2.5.1.2.1 West Range Site

Existing MDNR water appropriation permits for surface waters in the vicinity of the West Range Site are shown in Table 2.5-3. Existing MDNR water appropriation permits for groundwater sources in this area are discussed in Section 2.5.2.3.

Table 2.5-3
Existing Water Appropriation Permits for Surface Waters Around West Range Site

		Permitted		Reported Pumping (Million Gallons)				
Permitee	**Resource**	**GPM**	**MG/Y**	**2000**	**2001**	**2002**	**2003**	**2004**
Jackson, Allen	Mississippi River	250	13			2.2		
Schwartz Redi Mix Inc.	West Hill-Annex Pit	900	39					21.6
MDNR	Hill-Annex Tailing Basin	4500	500					70.3
MDNR	Hill-Annex Mine	7000	3416			621.1	1550.3	1374
U of MN	Prairie River	500	7					
U of MN	Prairie River	1000	60	6.7	17	18.1	25.6	20.1
U of MN	Prairie River	1000	60	7.8		0.4	23.4	26.5
Blandin Paper Co.	Mississippi River	30000	7000	7985	7041	6350	6429	6088
Jackson, Allen	Mississippi River	265	4	2.8			2.5	
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

The HAMP Complex is currently dewatered from the end of May to October (5.5 months per year). The withdrawal is permitted under a MDNR Water Appropriation Permit and the discharge is permitted under a MPCA-NPDES/SDS Permit. These permits are currently held by the MDNR Parks and Recreation Division. An annual Water Use report is completed as required by the MDNR Water Appropriation Permit. Water quality sampling of Total Suspended Solids (TSS) and pH is completed and submitted to the MPCA along with water usage volumes on a monthly basis as stipulated in the NPDES/SDS Permit.

Water that is pumped from the HAMP Complex flows overland through a system of wetlands and small streams, ultimately discharging into Upper Panasa Lake.

The MPCA NPDES/SDS Permit stipulates that the TSS average should be no more than 30 mg/L with a 60 mg/L instantaneous maximum. The Discharge Monitoring Reports indicate that the TSS level is typically less than 1 mg/L. The permit also stipulates that the pH be in the range of 6 to 9, and the reports indicate that the discharge is consistently in this range.

The CMP does not currently have a surficial outlet. However, if the pit were allowed to naturally overflow, the water would flow into Trout Lake.

2.5.1.2.2 East Range Site

Existing MDNR water appropriation permits for East Range surface waters are shown in Table 2.5-4. Existing MDNR water appropriation permits for groundwater sources are discussed in Section 2.5.2.3.

Table 2.5-3
Existing Water Appropriation Permits for Surface Waters Around East Range Site
]

		Permitted		Reported Pumping (Million Gallons)				
Permitee	**Resource**	**GPM**	**MG/Y**	**2000**	**2001**	**2002**	**2003**	**2004**
MP & Cliffs Erie LLC	Colby Lake	12000	6307	2945.7	69.2			
MP	Colby Lake	100500	50000	71.4	60.4	63.4	96.1	117.2
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			
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				
Cliffs Erie LLC		3600	1155					
Cliffs Erie LLC		3600	1155					
Cliffs Erie LLC		1500	551					
Cliffs Erie LLC		20000	10512					
Cliffs Erie LLC		20000	10512					
Cliffs Erie LLC		20000	10512	1860.2				
Cliffs Erie LLC		20000	10512					
IRRRB	Embarrass Mine Pit	600	50		4.9	22.0	26.3	48.3
City of Aurora		1020	160	73.7	74.7	81.8	106.5	93.4
Cliffs Erie LLC		5000	788					

		Permitted		Reported Pumping (Million Gallons)				
Permitee	**Resource**	**GPM**	**MG/Y**	**2000**	**2001**	**2002**	**2003**	**2004**
Cliffs Erie LLC		12000	3049	316.9				
Cliffs Erie LLC		12000	3049					
Cliffs Erie LLC		12000	3049					
Cliffs Erie LLC		3000	1050					
Cliffs Erie LLC		3000	1050	1807.2				
IRRRB	Wynne Lake	1800	50	70.7	67.2	56.8	54.9	55.9
IRRRB	Wynne Lake	600	29	51.4	41.3	36.0	37.9	29.0
United Taconite LLC	St. Louis River	7000	4010	2835.6	3118.0	3811.7	2550.8	2400.0

2.5.1.3 Usage and Availability

2.5.1.3.1 West Range Site

Lakes within the project area are used for recreational purposes such as fishing, boating, and swimming. The CMP and the Greenway Mine Pit are also reported to host recreational uses.

The West Hill Mine Pit and the LMP do not have any known recreational uses.

The HAMP Complex is partially within the Hill-Annex Mine State Park. The current water level in the State Park allows the MDNR to give boat tours of the pit. Tours typically take place on Friday, Saturday, and Sunday between Memorial Day and Labor Day. However, there are now mine features and several historic structures below the current water surface elevation. According to the Hill-Annex State Park Draft Management Plan, there is a desire to dewater the pit to an elevation 100–150 feet below the current water surface elevation. This dewatering would uncover the historic structures and improve the interpretive quality of the site, as well as protect the historic structures on the pit rim. The dewatering of the pit to this level is currently cost prohibitive under the State Park’s annual budget.

Current water levels for the West Range Water Resources are provided in Table 1.12-16.

2.5.1.3.2 East Range Site

The current water surface elevation, water surface area and estimated water volume in the following mine pits are summarized in Table 2.5-5.

Table 2.5-5
Abandoned Mine Pit Water Sources

Water Source (Pits)	Bottom Elevation (ft)	Water Surface Elevation (ft) (11/2005)	Surface Area (acres) (11/2005)	Estimated Volume (acre-ft) (11/2005)
2E	1427	1492.2	84	1,700
2W	1282	1413	183	13,430
2WX	1331	1405.4	322	8,880
6	1276	1426.6	207	18,850
3	1522	1586.7		
5N				
5S				
9 / Donora	1493	1547.2		
9S	1396	1475.2		
Stephens	1377			
Knox	1362			
Reference Notes:	1	2	3	3

Notes:
1) Bottom elevations are based on blast maps and aerial contour mapping provided by Cliffs-Erie.
2) Water surface elevations are based on field surveys provided by Cliffs-Erie.
3) Surface area and estimated volumes were obtained from the MDNR March, 2004 East Range Hydrology Report.

Lakes in the vicinity of the East Range Site are used primarily for recreational purposes, such as fishing, boating, and swimming. Cooling water for the Laskin Power plant comes from Colby Lake, with water from Whitewater Reservoir used to augment water levels in Colby Lake.

The water availability for each water source was estimated using information supplied by the MDNR, previous engineering studies, and information supplied by local government units. The actual sustainable rates are dependent on several factors including: precipitation, evaporation, pit water level and hydrogeologic conditions. The estimated water source supply capabilities are presented in Table 2.5-6.

Table 2.5-6
Water Source Supply Capability

Water Source (Pits)	Est. Range of Flow (gpm)	Assumed Sustainable Flow for Water Balance Modeling (gpm)
2E		112
2W		898
2WX		673
6		1795
Source: MDNR East Range Hydrology Report	Sub-Total	**3478**
3	150–450	300
5N	30–100	60
5S	90–270	140
9 / Donora	130–380	260
9S	90–270	180
Stephens	190–590	390
Knox	20–70	45
Source: Surface Water Modeling [1]	Sub-Total	**1375**
Mesabi Nugget Discharge	1000	**1000**
Source: MPCA NPDES Discharge Permit		
PolyMet Dewatering Operations	2000–8000	**4000**
Source: NorthMet Mine EAW		
Total Resource		**9850**

[1]The Proponent 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.

2.5.1.4 Drainage Areas

See Section 2.5.1.1 for information regarding drainage areas.

2.5.2 Groundwater

2.5.2.1 Groundwater Quality and Quantity

2.5.2.1.1 West Range Site

The primary aquifer at the site is shallow Quaternary drift comprised of water-bearing sand and gravel deposits. Regionally, these aquifers occur beneath till and in ice contact features on the flanks of end moraines. End moraines are the ridge-like accumulation of till deposits marking a standstill position of a past or present glacier. Buried bedrock valleys in the region create variable thicknesses of Quaternary deposits. North of Taconite, Minnesota, Quaternary deposits range from approximately 10 to 40 feet thick, whereas, in the vicinity of the of the cities of Coleraine and Bovey (east of the site), Quaternary deposits are approximately 130 feet thick (USDI, 1965). Based on the results of geotechnical borings on the IGCC Power Station Footprint the unconsolidated deposits at the proposed facility consist of varying amounts of till and coarse alluvium, approximately 10 to 35 feet thick combined.

The IGCC Power Station Footprint and Buffer Land is located at a potentiometric high and groundwater recharge area for the shallow aquifer is due to the presence of the Giants Range Batholith (USGS, 1970). A groundwater divide (where the groundwater flow direction is north and south with surface water features primarily influencing the direction of shallow flow) is present in the vicinity of the West Range Site. On the IGCC Power Station Footprint itself where the facility will be located, the groundwater flow direction of the shallow aquifer appears to be north and northwestward based on groundwater elevation data collected from the on-site groundwater monitoring wells. Ultimately, groundwater in the shallow aquifer at the site discharges to tributaries and surface water bodies that, subsequently, discharge into the Prairie River.

Immediately south of the IGCC Power Station Footprint and Buffer Land, a bedrock aquifer exists underlying the Quaternary deposits (MGS, 1979). Bedrock in the area (Giants Range Batholith, Pokegama Quartzite, Biwabik Formation, and Virginia Formation) has very little primary porosity. However, secondary porosity in the form of fractures and leached zones has developed within Biwabik Formation allowing it to act as an aquifer (MGS, 1979). Regional groundwater flow within the Biwabik Formation is south from the Giants Range Batholith toward the Swan River—a regional groundwater discharge feature. The groundwater flow direction of this bedrock aquifer specifically on the IGCC Power Station Footprint and Buffer Land is interpreted to be south and southwest toward the CMP.

Mining activities in the area have influenced the natural groundwater system in the area (MDNR, 2002). Fractures and leached zones within the Biwabik Formation appear greatest near the mine pit complexes. The mine pits have been excavated below the water table and groundwater head of the Quaternary and bedrock aquifers. Local groundwater flow is influenced by the mine pits, directing flow towards the mine pit complexes (USDI 1965, MDNR 2002, USGS 1970). Since the cessation of mining activities, water levels in the mine pits have been increasing due to discharge of groundwater into the mined excavations.

Transmissivities and hydraulic conductivities of various shallow sand and gravel aquifers in the region have been estimated (MDNR, 2002). In studying the hydrogeology of the CMP area, the Minnesota Department of Natural Resources and U.S. Geological Survey installed 18 monitoring wells in the Quaternary drift aquifer(s) and performed pumping tests and hydraulic conductivity slug tests. The results of the testing are summarized in Table 2.5-7.

Table 2.5-7
Average Transmissivities and Hydraulic Conductivities for MDNR Monitoring Wells and Wells On-Site

Monitoring Well No.	*No. of pump test*	*No. of slug tests*	*Well depth (ft bgs)*	**Geology at Well Screen**	**Average Transmissivity (ft²/day)**		**Average Hydraulic Conductivity (ft/day)**		
					Theis	*Cooper-Jacob*	*Single-well pumping test recovery*[*1]	*Slug test, recovery following slug insertion*[*1]	*Slug test, recovery following slug removal*[*1]
1	6	3	50	Coarse sand and gravel, iron formation	98	107	58	52	51
2	0	0	69	Clay and coarse sand, iron formation	-	-	-	-	-
3	2	1	82	Large boulders, sand, and gravel	183	182	40	2.2	12
4	0	3	82	Coarse sand and gravel, iron formation	-	-	-	2.7	1.6
5	0	2	46	Coarse sand, gravel, boulders	-	-	-	0.01[*2]	-
6	0	0	20	Sand	-	-	-	-	-
7	0	0	20	Sand	-	-	-	-	-
8	1	1	30	Blue Clay	21	22	-	5	4.8
9	2	2	35	Gray Sand	8.6	8.5	-	2.5	1.6
10	4	1	85	Sandy Gravel	236	224	50	62	62
11	0	2	80	Gray sandy clay and rocks	-	-	-	0.06	0.08
12	4	2	50	Coarse sand and gravel	258	252	121	120	121
13	0	1	62	Sandy clay and boulders, slate	-	-	-	0.05	-
14	0	2	77	Fine to medium gray sandy clay, medium gray sand, boulders	-	-	-	0.23	0.23
15	0	0	28	Granite	-	-	-	-	-
16	0	1	70	Gray clay, fine to medium sand	-	-	-	0.23	-
17	1	0	80	Boulders, some iron formation	222	214	21	-	-
18	1	0	70	Coarse sand and gray clay	247	300	68	-	-
MW-1*	0	1	20	Silty sand and sandy lean clay	-	-	-	-	2.946
MW-2*	0	1	23	Gravel with silt and sand	-	-	-	-	32.51
MW-3*	0	1	20	Sand with silt and gravel	-	-	-	-	9.578
MW-4*	0	1	21.5	Silty sand with gravel	-	-	-	-	0.4924

[*1] Bouwer and Rice, 1976
[*2] Only partial recovery during slug test
* Groundwater monitoring wells on-site; all other wells installed by MN DNR around perimeter of CMP

Average calculated transmissivities for sand and gravel aquifers ranged from 98 to 300 ft^2/day. Average calculated hydraulic conductivities for the sand and gravel aquifers ranged from 2.2 to 68 ft/day (MDNR, 2002). Hydraulic conductivities for the four wells on the site ranged from 0.5 to 32.5 ft/day. Locally, well yields up to 1,000 gpm are obtainable for wells completed in the Quaternary drift deposits (USGS, 1968). The Biwabik Formation is a good source of groundwater for domestic use, and a fair source of supply for municipal and industrial use (USGS, 1970). However, local aquifers appear to have insufficient capacity to provide enough groundwater for the process water needs of the IGCC Power Station. A large number of wells would be required to pump enough water to meet the stations processing need. The exorbitant costs for constructing the number of wells necessary to produce a sufficient supply for cooling purposes, and the potential for groundwater interference issues, results in this alternative being deemed infeasible.

Although groundwater quantities and local aquifer capacities are limited, it is feasible that one or more wells could be utilized for providing a potable water supply for the IGCC Power Station. Indeed, several local public water supply wells are drilled into and utilize the Biwabik Formation.

Typically groundwater quality in the region has moderate dissolved solids content, is moderately siliceous, is very hard, and contains high levels of iron and manganese frequently above the maximum recommended limits of 0.3 mg/L for iron and 0.05 mg/L for manganese (USDI 1965, USGS 1970). Sand, ice-contact sand and gravel, and buried outwash aquifers have adequate yield (5 gpm or more) and suitable quality for domestic use (total dissolved solids less than 1000 mg/L) (USGS, 1970). Of these, only buried outwash aquifers have suitable yield (900 gpm or more) and quality (total dissolved solids less than 500 mg/L, iron content less than 0.3 mg/L, and hardness less than 180 mg/L) for municipal or industrial use (USGS, 1970).

2.5.2.1.2 East Range Site

The surface geology at the site consists of Quaternary outwash and brown silty till. The primary aquifer at the site is shallow outwash deposits comprised of fine to coarse grained sand and gravel. The static water level in wells near the proposed site is approximately 10 to 40 feet bgs.

Underlying the Quaternary deposits at the site is argillite and greywacke of the Virginia Formation. The formation ranges in total thickness from 0 to 2,000 feet. Although the formation typically has a low yield, fractures in the top of the unit may be used for domestic or stock wells. The Virginia Formation is typically used in conjuncture with iron formation aquifers that contain larger water supplies (USGS 1979). North of the site, the Biwabik formation is upper most bedrock where the Virginia Formation is not present. Secondary porosity in the form of fractures and leached zones has developed within Biwabik Formation allowing it to act as an aquifer (MGS 1979). The total thickness of the Biwabik formation in the area ranges from 0 to 800 feet. Regional groundwater flow within bedrock in the area is south, from a bedrock high created by the Giants Range Batholith. The Duluth Complex is the upper most bedrock west of the site. Gabbro of the Duluth Complex is massive with low porosity and permeability and therefore a poor source of water. However, where fractures create secondary porosity, the formation may be used for domestic or stock supply wells.

Typically groundwater quality in the region is of the calcium magnesium bicarbonate type (USGS 1979). In some areas water from the argillite, greywacke, and gabbro is sodium-softened. In other areas, water from these units is of sodium chloride type, deep wells may produce saline water. Water in the Biwabik formation is of good quality and suitable for use without softening or iron removal and is lower in total dissolved solids than other sources. Water from the Quaternary drift aquifer is also of the calcium magnesium bicarbonate type. Total dissolved solids from the Quaternary aquifer have been measured as high as 1,800 mg/L. Surface contamination has impacted the surface aquifer in some locations, and where this has occurred, high nitrogen concentrations are the most common contaminant. As well as bedrock aquifers, water produced from drift may have high iron content (USGS 1979).

2.5.2.2 Groundwater Depth and Recharge Sources

2.5.2.2.1 West Range Site

The potentiometric surface of the shallow Quaternary aquifer at the area is approximately 1350 to 1,400 ft msl (USGS, 1968), approximately 10 to 60 feet bgs. Static groundwater elevations of the shallow aquifer(s) have been recorded by the Minnesota Department of Natural Resources in a series of monitoring wells in the area of the CMP. Tables 2.5-8a and 2.5-8b presents data collected from these monitoring wells since 2001.

Table 2.5-8a
Static Groundwater Elevations

Groundwater Elevation (ft above mean sea level)								
	Well 1	**Well 2**	**Well 3**	**Well 4**	**Well 5**	**Well 6**	**Well 7**	**Well 8**
	Unique Well No.	Unique Well No.	Unique Well No.	Unique Well No.	Unique Well No.	Unique Well No.	Unique Well No.	Unique Well No.
DATE	**635984**	**635985**	**629802**	**629815**	**629803**	**552102**	**597369**	**629805**
01/04/01	1375.94	1381.90	1281.23	1294.00	1289.21	1322.78	1325.21	1294.65
02/12/01	1375.41	1381.82	1281.00	1293.93	1288.86	1321.39	1324.27	1294.56
03/05/01	1375.52	1381.75	1280.89	1293.90	1288.68	1320.71	1323.77	1294.64
04/04/01	1374.80	1381.67	1280.78	1294.18	1288.57	1320.49	1323.59	1295.35
05/07/01	1375.11	1381.68	1282.17	1295.83	1290.32	1326.18	1327.47	1296.05
06/19/01	1375.50	1381.91	1283.03	1297.38	1291.47	1326.49	1327.49	1295.97
07/19/01	1376.22	1382.16	1282.93	1297.50	1291.70	1324.05	1325.82	1294.92
10/17/01	1376.99	1382.35	1282.27	1296.97	1290.59	1320.59	1323.83	1295.14
11/16/01	1376.80	1382.34	1282.09	1296.60	1290.36	1321.03	1324.10	1294.99
01/31/02	1376.85	1382.38	1281.68	1295.98	1289.94	1321.34	1323.66	1294.42
04/19/02	1376.07	1382.16	1281.46	1296.48	1289.61			1295.35
06/05/02	1376.67	1381.88	1281.62	1297.49	1289.75	1321.79	1324.44	1294.95
08/02/02	1377.00	1381.83	1282.13	1298.49	1290.23	1322.44	1325.24	1295.30
09/12/02	1377.79	1381.96	1282.47	1298.84	1290.55	1322.78	1325.19	1295.14

Groundwater Elevation (ft above mean sea level)								
	Well 1	Well 2	Well 3	Well 4	Well 5	Well 6	Well 7	Well 8
	Unique Well No.	Unique Well No.	Unique Well No.	Unique Well No.	Unique Well No.	Unique Well No.	Unique Well No.	Unique Well No.
DATE	**635984**	**635985**	**629802**	**629815**	**629803**	**552102**	**597369**	**629805**
12/11/02	1377.94	1381.91	1282.18	1297.41	1290.07	1320.72	1323.52	1294.56
05/20/03	1376.49	1381.36	1281.77	1298.34	1289.68	1316.19	1321.49	1295.38
08/14/03	1376.98	1381.00	1282.10	1290.33	1289.85			1294.37
10/17/03	1376.39	1380.73	1281.52	1298.54	1289.57			1294.41
04/22/04	1374.53	1380.06	1281.39	1298.09	1289.36			1295.32
06/30/04	1375.49	1380.02	1281.80	1299.45	1289.71			1294.67
09/02/04	1375.95	1380.10	1282.28	1300.03	1289.95			1294.43
11/04/04	1376.42	1380.23	1282.82	1300.15	1290.48			1295.09
04/11/05	1376.29	1380.60	1282.96	1300.59	1290.61			1295.38

Table 2.5-8b
Static Groundwater Elevations

Groundwater Elevation (ft above mean sea level)										
	Well 9	Well 10	Well 11	Well 12	Well 13	Well 14	Well 15	Well 16	Well 17	Well 18
	Unique Well No.	Unique Well No.	Unique Well No.	Unique Well No.	Unique Well No.	Unique Well No.	Unique Well No.	Unique Well No.	Unique Well No.	Unique Well No.
DATE	**629811**	**629808**	**629809**	**629813**	**635982**	**629812**	**635983**	**650150**	**650149**	**650148**
01/04/01	1299.89	1300.41	1352.19	1301.45	1340.93	1362.32		1287.66	1290.46	1316.22
02/12/01	1299.74	1300.42	1351.45	1301.37	1340.36	1361.40		1287.34	1290.20	1315.81
03/05/01	1299.66	1300.37	1350.89	1301.40	1339.92	1360.91		1287.19	1290.12	1315.72
04/04/01	1300.62	1300.55	1350.62	1301.49	1339.74	1360.86		1287.05	1290.08	1315.83
05/07/01	1301.58	1301.32	1352.09	1303.11	1340.22	1362.10		1288.04	1291.08	1316.65
06/19/01	1301.49	1302.03	1353.12	1304.08	1340.61	1362.86		1289.39	1291.79	1317.29
07/19/01	1300.70	1302.61	1353.70	1303.70	1341.31	1363.25		1290.04	1291.92	1317.07
10/17/01	1300.82	1303.10	1353.66	1303.92	1342.13	1363.01		1289.24	1291.02	1317.19
11/16/01	1300.50	1303.18	1353.42	1303.93	1342.27	1362.86		1288.93	1290.85	1317.15
01/31/02	1299.85	1303.39	1352.57	1304.05	1342.12	1362.79		1288.47	1291.42	1316.90
04/19/02	1300.67	1303.58	1351.52	1304.60	1341.37	1362.02		1289.05	1290.12	1317.07
06/05/02	1300.21	1303.95	1351.40	1305.04	1341.17	1362.22		1288.18	1290.13	1317.23
08/02/02	1301.54	1304.40	1351.53	1305.85	1340.74	1362.22		1288.64	1290.69	1317.60
09/12/02	1301.57	1304.88	1351.93	1306.06	1341.32	1362.57		1288.94	1290.92	1317.76
12/11/02	1300.72	1305.07	1351.50		1348.88	1362.19		1288.61	1290.40	1317.48
05/20/03	1301.54	1305.07	1349.48		1339.87	1360.46		1288.07	1289.99	1317.33
08/14/03	1300.72	1305.43	1349.04	1306.56	1352.92	1346.97			1290.01	1317.51
10/17/03	1300.75	1305.32	1348.62		1352.34	1346.79		1288.22	1289.71	1317.11

Groundwater Elevation (ft above mean sea level)										
	Well 9	**Well 10**	**Well 11**	**Well 12**	**Well 13**	**Well 14**	**Well 15**	**Well 16**	**Well 17**	**Well 18**
	Unique Well No.	Unique Well No.	Unique Well No.	Unique Well No.	Unique Well No.	Unique Well No.	Unique Well No.	Unique Well No.	Unique Well No.	Unique Well No.
DATE	**629811**	**629808**	**629809**	**629813**	**635982**	**629812**	**635983**	**650150**	**650149**	**650148**
04/22/04	1301.72		1347.28	1307.10	1351.10	1345.63		1287.60	1289.93	1317.21
06/30/04	1301.32		1347.62	1307.41	1351.73	1345.69		1288.07	1290.16	1317.42
09/02/04	1301.94		1347.75	1307.39	1351.40	1345.93		1288.52	1290.18	1317.22
11/04/04	1301.98		1348.18	1307.81	1351.44	1346.19		1288.95	1290.54	1317.32
04/11/05	1302.58		1347.61	1308.73	1351.42	1346.49		1335.22	1290.59	1317.43

Groundwater flow is influenced by mine pits in the area (USDI, 1965); a potentiometric gradient exists between the surface water in mine pit lakes and groundwater in surrounding areas directing flow towards the mine pit complexes (USGS, 1970). During periods of mine operation, dewatering in the mine pits reduced the amount of lateral flow (north to south) through bedrock and Quaternary deposits, and decreased potential vertical recharge to the bedrock aquifer south of the mine pits (USDI, 1965).

Municipal wells for the cities of Bovey, Calumet, Coleraine, Marble, and Taconite are located south of the local mine pits (CMP and HAMP Complex). Tables 2.5-9 and 2.5-10 summarize the static water elevations and historic pumping in these wells.

Table 2.5-9
Static Groundwater Elevations Municipal Wells of Surrounding Communities

		Static Water Elevations (ft msl)														
		During Mining							**Post Mining**							
Unique No.	**Permitee**	***1918***	***1926***	***1936***	***1953***	***1955***	***1965***	***1976***	***1989***	***1991***	***1994***	***1999***	***2000***	***2001***	***2002***	***2003***
228842	Marble 1		1224*				1210				1243	1249	1254	1258	1257	1258
228846	Marble 2					1258*	1258		1240		1241	1247	1254	1255	1257	1257
228839	Calumet 2															
228838	Calumet 3															

110457	241430	228834	495997	241489
Coleraine 3	Coleraine 1	Bovey 1	Taconite 2	Taconite 1
	1283*			
				1273*
		1268*		
1267*				
			1289*	

** Minnesota County Well Index, Minnesota Department of Health*

Table 2.5-10
Pumping Groundwater Elevations City Municipal Wells

Date	water elevation	pumping rate	duration
	ft msl	gpm	hours
	Marble 1		
1926	1150	300	-
1955	1164	350	-
1977	1105	248	2
1994	1177	400	-
1999	1189	385	-
2000	1195	420	-
2001	1200	390	-
2002	1232	270	-
2003	1203	350	-
	Marble 2		
1955	1199	385	14
1965	1198	340	-
1977	1103	300	25
1989	1236	270	-
1994	1193	300	-
1999	1196	330	-
2000	1201	360	-

2001	1203	310	-
2002	1207	-	-
2003	1221	220	-
	Bovey 1		
1953	1256	650	10
	Coleraine 1		
1918	1258	500	-
	Coleraine 3		
1976	1243	1012	5
	Taconite 1		
1991	1112	218	12

Average annual recharge to groundwater is approximately 5.7 to 7.6 inches (MDNR 2002, USGS 1968). Groundwater recharge to the shallow sand and gravel aquifer(s) is derived from precipitation infiltration and interconnections with surface water bodies. Groundwater recharge to the underlying Biwabik Formation bedrock aquifer is largely by vertical infiltration through the Quaternary deposits where the formation is not overlain by other bedrock (USDI, 1965). Lateral groundwater recharge occurs as groundwater travels south from the Giants Range Batholith.

2.5.2.2.2 East Range Site

The potentiometric surface of the shallow Quaternary aquifer at the area is approximately 1440 to 1490 feet msl, approximately 10 to 40 feet bgs (USGS 1979). The static water level for the bedrock aquifer is approximately 10 to 40 feet bgs. Groundwater flow at and in the vicinity of the site is likely southwest towards Colby Lake.

2.5.2.3 Usage and Availability

2.5.2.3.1 West Range Site

Other than the four groundwater monitoring wells recently constructed, no wells are currently located on the property. However, numerous wells are located on surrounding properties. A well inventory of Sections 1, 2, 3, 4, 8, 10, 11, 12, 13, 14, 15, 21, 22, 23, 24, 33, 34, 35, 36 in Township 56 North, Range 24 West, was performed using the January 12, 2005 Minnesota Geological Survey-Minnesota Department of Health County Well Index.

Table 2.5-11 lists wells in surrounding areas, including the use, diameter of casing, aquifer and depth of completion. The list includes twenty-three (23) domestic wells, eleven (11) monitoring wells, three (3) "other use" wells, and two (2) public supply non-community transient wells. Domestic supply wells are concentrated along CR 7, Highway 169, and north of Big Diamond Lake. Domestic wells in the area utilize the Quaternary sand and or gravel aquifers.

Table 2.5-11
Well Inventory: West Range Site

T-R-S	Unique Well ID	Use	Name	Diameter Casing (ft)	Depth (ft)	Aquifer
56-24-1	NONE					
56-24-2	NONE					
56-24-3	528211	DO	Alfred Nelson	4	84	QBAA
	161975	DO	James Yoder	4	107	QBAA
56-24-4	263776	DO				
	452081	DO	Bill Hintz	4	103	QBA
	501234	DO	Allen Butterfiled	4	98	QBA
	629820	DO	Anna Butterfield	4	103	Sand and Clay
	671906	DO	Charles Grell	4	112	Sand, Rocks, and Clay
56-24-9	NONE					
56-24-10	NONE					
56-24-11	NONE					
56-24-12	NONE					
56-24-13	679331	DO	Roger Moll	4	56	Sand and Clay
56-24-14	529629	DO	Erl Orf	4	52	QFUB
	597510	DO	Kurt Christopherson	4	52	QABB
	619505	DO	Ben Castagneri	4	104	SAND
	666628	DO	Dave Hudek	4	67	Sand and Clay
	671947	DO	Tim Rudolph	4	102	SAND
	506871	MW	Itasca County	2	18	
	448201	MW	Iron Range Landfill			
	696689	MW			16	Sandy Clay and Gravel
56-24-15	435553	MW	Iron Range Landfill	4	19	
	435552	MW	Iron Range Landfill	4	25	
	435551	MW	Iron Range Landfill	4	12	
	506872	MW	Itasca County	2	18	
	696689	MW	Mw-5		16	Sand and Gravel
	448201	MW	Iron Range Landfill			
	506871	MW	Itasca County	2	18	
56-24-21	635983	OT	State Of Minnesota	4	18	Sand and Clay
56-24-22	650148	OT	Itasca County	4	50	Sand and Clay
	635982	OT	Village Of Taconite	4	52	Clay and Boulders
	629815	MW	DNR	6	84	IRON
56-24-23	452131	DO	Richard Kilmer	4	84	QBU
	452141	DO	Loren Durant	4	88	QBU
	498412	DO	Clara Rachunek	4	70	QBU
	543153	DO	Alman Smith	4	89	QBU
56-24-24	NONE					
57-24-33	693142	DO	Virginia Griffith		45	Sand, Rocks, and Clay
	543156	DO	Albert Oaks	4	61	SAND
57-24-34	260045	PN				
	629827	DO	Tod Plackner	4	110	Sand and Clay

T-R-S	Unique Well ID	Use	Name	Diameter Casing (ft)	Depth (ft)	Aquifer
	619524	DO	Gerry Gross	4	60	Sand
	515407	PN	Lawrence Township	4	139	Sand and Clay
	451966	DO	David Schwartz	4	113	Sand , Clay, and Gravel
	407224	DO	Bill Schwartz	4	98	Sand, Clay, and Gravel
57-24-35	NONE					
57-24-36	NONE					

Wells are also located adjacent to the CMP (Township 56 North, Range 24 West, Sections 16, 20, 21, 22, 27, 28, 29, 30, 31, 32, 33 and Township 56 North, Range 25 West and Sections 26 and 36) and the HAMP Complex (Township 56 Range 23 Sections 7, 8, 9, 10, 15, 16, 17, 18, 19, 20, 21, 22, and Township 56 North Range 24 West Section 54). Tables 2.5-12 and 2.5-13 summarize the construction information of these wells adjacent to these mine pits.

Table 2.5-12
Well Inventory: Canisteo Mine Complex

T-R-S	Unique Well ID	Use	Name	Diameter Casing (ft)	Depth (ft)	Aquifer
56-24-20	NONE					
56-24-21	635983	OT	State of MN	4	18	Sand and Clay
56-24-22	651148	OT	Itasca County	4	50	Sand and Clay
	635982	OT	Village of Taconite	4	52	Clay Gravel and Boulders
	629815	MW	DNR	6	84	Clay, Sand, and Iron
56-24-27	241489	PC	Taconite 1	18	293	Biwabik Formation
	495997	PC	Taconite 2	12	300	Biwabik Formation
	228837	MU	City of Taconite	12	80	
56-24-28	629813	MW	DNR	4	42	Sand
56-24-29	629809	MW	City of Bovey	4	68	Clay
56-24-30	635984	OT	Itasca Company	4	38	Sand and Clay
56-25-25	635985	OT	Itasca County	4	48	Sand and Clay
	629803	MW	Itasca County	6	46	Rocks and Sand
56-25-26	NONE					
56-25-36	496883	MW	Isd #317	3	3	
	643927	MW	Murphy Oil	2	4	Sand and Silt
	675989	MW	Murphy Oil	2	33	Silt and Clay
	675988	MW	Murphy Oil	2	3	Silt and Clay
	650150	OT	DNR, State of MN	4	55	Sand, Silt and Clay
	643928	MW	Murphy Oil	2	4	Sand and Silt
	511169	MW	Itasca Co Eng. Dept	2	3	
	511168	MW	Itasca Co Eng. Dept			
	511167	MW	Itasca Co Eng. Dept	2	3	

T-R-S	Unique Well ID	Use	Name	Diameter Casing (ft)	Depth (ft)	Aquifer
	496886	MW	Isd #317	2	3	
	496885	MW		2	3	
	496884	MW	Isd #317	2	3	
	643929	MW	Murphy Oil	2	4	Sand and Silt
56-24-16	637679	DO	Harlan & Chery Niles	4	50	Sand, Clay, and Gravel
56-24-31	629805	MW	City of Bovey	4	18	Sand and Clay
	603756	MW	Chuch Wentz	2	18	Sandy Clay
	603757	MW	US Steel	2	16	Sandy Clay
	619098	DO	Coleraine City Park	4	44	QBAA
	650149	OT	City of Coleraine	4	51	Gravel
	604055	PS	Mount Itasca Ski Area	6	132	Clay and Gravel
56-24-32	564507	DO	Joseph Dropp	4	87	Sand and Gravel
	228834	PS	Bovey 1	16		QBUA
	228835	IN	Oliver Iron Mining			
	228836	IN	Oliver Iron Mining			
	241430	PC	Coleraine 1	24	75	
	492431	MW	1st National Bank of Bovey	2	9	
	492433	MW	MW-3	2	7	
	228832	PC	Coleraine Old No. 3	24	100	QBAA
	110457	PC	Coleraine 3	16	100	QBAA
	564483	DO	Fred And M. Harris	4	66	QBAA
	629808	MW	City of Bovey	4	80	Sand
	629811	MW	Robert Berghammer	4	20	Sand
	629812	MW	DNR	4	69	Clay and Sand
	631886	DO	Brent and Doug Lane	4	92	Clay and Sand
	637548	DO	Randy Mattfield	4	105	Sand and Gravel
	652113	DO	Dave Schwarts	4	100	Sand and Rocks
	666643	DO	Robert Gernander	4	80	Sand
	671921	DO	Kenneth Wetzel	4	78	Sand and Rocks
	492432	MW	Mw-2	2	6	
56-24-33	NONE					

Table 2.5-13
Well Inventory Hill-Annex Mine Complex

T-R-S	Unique Well ID	Use	Name	Diameter Casing (ft)	Depth (ft)	Aquifer
56-23-7	NONE					
56-23-8	NONE					
56-23-9	122389	DO	Albert Ostlund	7	99	Sand and Hard Pan
56-23-10	NONE					

T-R-S	Unique Well ID	Use	Name	Diameter Casing (ft)	Depth (ft)	Aquifer
56-23-15	176790	DO	Duane Polzin	4	192	Clay and Slate
	576081	DO	Donna Barker	4	96	QBAA
	652124	DO	Frank Mollergren	4	60	Sand
	407394	DO	Steve Chupurdia	4	38	QBAA
	407393	DO	Michael Chupurdia	4	36	Sand
	407390	DO	Donna Barker	4	46	QBAA
	528223	DO	Don Vizenor	4	50	QBAA
56-23-16	228847	DW	Hill-Annex Mine	14	350	
56-23-17	NONE					
56-23-18	NONE					
56-23-19	111459	DO	Gary Jarva	4	80	QBAA
	228846	PC	Marble 2	20	503	Biwabik Formation
	228845	MU	Marble			
	228842	PC	Marble 1	12	300	Biwabik Formation
	647801	DO	Darus Pinke	4	142	
56-23-20	NONE					
56-23-21	643279	MW	Mw-6		13	Sand and Peat
	228831	PC	Calumet 1			
	228838	PC	Calumet 3	12	203	Biwabik and Virginia
	228839	PC	Calumet 2	8	155	Biwabik and Virginia
	228877	CO	Calumet	8	151	Sand , Gravel, Rock
	636589	MW	R.A. Sigfinius	2	7	Sand, Clay and Gravel
	686590	MW	R.A. Sigfinius	2	5	Silty Sand and Gravel
	636591	MW	R.A. Sigfinius	2	7	Silty Sand and Gravel
	636592	MW	R.A. Sigfinius	2	5	Silty Sand
	646879	MW	Brad Karjala	2	10	Silty Clay and Sand
56-23-22	NONE					
56-24-54	NONE					

Wells adjacent to the mine pits are used for:

- Community Supply (10)
- Dewatering (1)
- Domestic (19)
- Industrial (2)
- Monitoring (38)
- Municipal (2)
- Public Supply (2)
- Other (7).

Public water supply wells for the cities of Bovey, Calumet, Coleraine, Marble, and Taconite are constructed in Quaternary and Biwabik Formation aquifers. Table 2.5-14 summarizes DNR Appropriation Permits for these wells.

Table 2.5-14
DNR Appropriation Permits and Pumping Rates (Groundwater)

Unique No.	Permitee	Name	Aquifer	Permitted		Reported Pumping MG				
				GPM	*MG/Y*	*2000*	*2001*	*2002*	*2003*	*2004*
228842	City of Marble	Marble 1	Biwabik Formation	740	49.0	18.4	38.5	32.8	26.8	12.8
228846	City of Marble	Marble 2	Biwabik Formation	740	49.0	18.4	-	-	3.1	12.8
228839	City of Calumet	Calumet 2	Biwabik Formation	120	22.0	8.2	5.4	5.7	7.3	5.8
228838	City of Calumet	Calumet 3	Biwabik Formation	120	22.0	6.2	8	6	7.2	6.2
228837 (241489)	City of Taconite	Taconite 1	Biwabik Formation	125	20.0	5.6	5.6	6.5	6.6	7.9
495997	City of Taconite	Taconite 2	Biwabik Formation	125	20.0	5.7	6.9	6.6	6.6	7.3
228834	City of Bovey	Bovey 1	Quaternary Deposits	500	35.0	26.2	26.8	20.9	35.3	29.6
241430	City of Coleraine	Coleraine 1	Quaternary Deposits	550	80.0	-	54.2	67	60.8	52.2
110457	City of Coleraine	Coleraine 3	Quaternary Deposits	550	80.0	48.7	-	-	-	-

Wells for the cities of Bovey and Coleraine are completed in the same unit of ice stratified Quaternary drift (USDI, 1965). The wells receive limited amounts of recharge through infiltration and receive some recharge from Trout Lake (USDI, 1965). According to the County Well Index and DNR State Water Use Database System of Water Appropriations Permits, the City of Bovey has one (1) municipal well (Unique No. 228834). This well has a 16-inch diameter casing completed in sand and gravel Quaternary deposits. The static water elevation was 1,268 feet msl at the time of installation (1953). This groundwater level was recorded when the CMP was dewatered for mining activities. The City of Bovey is permitted to pump the well at a rate of 35.0 million gallons per year (MGY). The reported volume of groundwater pumped from this well in 2004 was 29.6 MGY.

The City of Coleraine has two wells (Coleraine 1 and 3: Unique Nos. 241430 and 110457, respectively). Coleraine 1 is completed at a depth of 75 feet within undivided Quaternary drift. Coleraine 1 had a static water level of 1,283 feet msl at the time of well installation (1918). Coleraine 3 is 100 feet deep. It is completed within sand, gravel, and boulder Quaternary deposits. Coleraine 3 had a static water level of 1267 feet msl at the time of well installation (1976). The City of Coleraine is permitted to pump 80 MGY from both wells. The reported pumped volume in 2004 was 52.2 MGY for Calumet 1; there was no reported pumping in 2004 for Coleraine 3.

The cities of Marble, Calumet, and Taconite each have two public water supply wells. These six wells draw water from the Biwabik Formation bedrock aquifer. Marble 1 (Unique No. 228842) is 300 feet deep. The static water level was 1224 feet msl at the time of well installation (1926).

Marble 2 (Unique No. 228846) had a static water level was 1258 feet msl at the time of installation (1955). The city of Marble is permitted to pump 49.0 MGY from both of the wells. The reported volume of groundwater pumped for both wells in 2004 was 12.8 MGY.

Calumet 2 (Unique No. 228839) was completed at a depth of 155 feet in the Virginia and Biwabik formations. The static water elevation was 1178 feet msl at the time of installation (1943). Calumet 3 (Unique No. 228838) is 203 feet deep. It is completed in the Virginia and Biwabik formations. The City of Calumet is permitted to pump 22.0 MGY from both wells. The reported volume of groundwater pumped in 2004 was 5.8 MGY for Calumet 2 and 6.2 MGY for Calumet 3.

The City of Taconite Well 1 (Unique No. 241489) is 384 feet deep and is completed in the Biwabik Formation bedrock aquifer. The approximate static groundwater elevation in the well at the time it was constructed (1936) was 1,273 feet msl. Taconite No. 2 (Unique No. 495997) is 394 feet deep and also utilizes the Biwabik Formation aquifer. Its static water elevation was 1290 feet msl at the time of installation (1991). The City of Taconite is permitted to pump 20 MGY from both wells. The reported volume of groundwater pumped in 2004 was 7.9 MGY for Taconite 1 and 7.3 MGY for Taconite 2.

The cities of Bovey, Calumet, Coleraine, Marble, and Taconite rely on groundwater resources for public water supplies. Each city has public water supply wells open to either the shallow sand and gravel aquifer (the cities of Bovey and Coleraine) or the Biwabik Formation bedrock aquifer (cities of Calumet, Coleraine, Marble, and Taconite). Due to the close proximity of these local public water supply wells to surface water bodies, a hydrologic connection may exist between the groundwater captured by the wells and local surface waters. Due to the relatively high tritium concentrations detected by the Minnesota Department of Health in the groundwater pumped from some of these public water supply wells, the source water aquifers (Quaternary sand and gravel deposits and the Biwabik Formation) appear to recharge quickly (i.e., 50 years or less) and are therefore more sensitive to land surface activities and more vulnerable to potential contamination.

2.5.2.3.2 East Range Site

No wells are currently located on the IGCC Power Station Footprint and Buffer Land. However, numerous wells are located on surrounding properties. A well inventory of Sections 27, 28, 29, 30, 31, 32, 33, and 34 in Township 59 North, Range 14 West and Sections 3, 4, 5, 6, in Township 58 North, Range 14 West was performed using the January 12, 2005 Minnesota Geological Survey-Minnesota Department of Health County Well Index. Table 15 lists wells in surrounding areas, including the use, diameter of casing, aquifer and depth of completion. The list includes eighteen (18) monitoring wells and one (1) domestic well. The monitoring wells are owned by St. Louis County and MP; the domestic well is also owned by MP. The wells range in depth from 14 to 90 feet and are completed in unconsolidated deposits.

Table 2.5-15
Well Inventory East Range Site

T-R-S	Unique Well ID	Use	Name	Diameter Casing (ft)	Depth (ft)	Aquifer
59-14-27	None					
59-14-28	None					
59-14-29	None					
59-14-30	None					
59-14-31	None					
59-14-32	None					
59-14-33	None					
59-14-34	None					
58-14-3	None					
58-14-4	486995	MW	St. Louis County	2	17	7
	486994	MW	St. Louis County	2	24	14
	486993	MW	St. Louis County	2	14	4
	486992	MW	St. Louis County	2	32	22
	486991	MW	St. Louis County	2	27	17
58-14-5	None					
58-14-6	110459	DO	MN Power and Light	16	65	60
	523736	MW	MN Power and Light	2	70	70
	523735	MW	MN Power and Light	2	30	22
	177973	MW	MN Power and Light	2	94	90
	177972	MW	MN Power and Light	-	47	-
	177970	MW	MN Power and Light	-	46	-
	177969	MW	MN Power and Light	2	30	22
	177979	MW	MN Power and Light	2	47	36
	177978	MW	MN Power and Light	2	63	42
	177977	MW	MN Power and Light	4	38	25
	177976	MW	MN Power and Light	2	39	29
	177975	MW	MN Power and Light	2	71	61
	177974	MW	MN Power and Light	2	52	33
	177980	MW	MN Power and Light	2	60	60

2.5.2.4 Permits

2.5.2.4.1 West Range Site

No groundwater use or withdrawal permits currently exist for the Mesaba One and Mesaba Two. As previously mentioned in Section 2.5.2.3, Minnesota Department of Natural Resources Water Appropriation Permits for groundwater withdrawal/use have been issued to local municipalities for public water supply systems (the cities of Bovey, Calumet, Coleraine, Marble, and Taconite). Regionally, groundwater appropriation permits have also been issued to mining companies for dewatering and farms for agricultural purposes and irrigation.

Four well permits were obtained from the Minnesota Department of Health (MDH) for constructing the four groundwater monitoring wells installed on the IGCC Power Station Footprint and Buffer Land in July 2005. These permits will be reissued annually by the MDH to the facility as long as the wells are still necessary and utilized.

Should groundwater be used for a potable water supply for the facility, a well permit from the Minnesota Department of Health will be required. If the amount of groundwater pumped from a well for potable water supplies exceeds 10,000 gallons per day or 1,000,000 gallons per year, a Water Appropriation Permit will be required from the MDNR.

During construction of Mesaba One and Mesaba Two, dewatering may be necessary that will temporarily lower the shallow water table aquifer in small localized areas. If the dewatering is expected to exceed 10,000 gallons per day or 1,000,000 gallons per year, a Water Appropriation Permit will be attained from the MDNR.

Any necessary discharges from the facility will be properly managed in accordance with the NPDES permits issued for plant, and applicable state and local regulations to prevent degradation of source water aquifers used for public water supplies.

2.5.2.4.2 East Range Site

No groundwater use or withdrawal permits currently exist for Mesaba One and Mesaba Two. Water appropriation permits have been issued by the MDNR to Cliffs Erie LLC for wells located within Township 59 North, Range 14 West, Section 29. Three permits were issued for pumping up to 10,512 millions of gallons per year to the corporation; however there is no reported pumping for the last four years. No unique well numbers are reported for the permits.

Available drawdown for the Quaternary drift aquifer is approximately 5 to 100 feet; the available drawdown for the bedrock aquifer is approximately 100 to 200 feet. Yields for wells completed in the Quaternary drift reach 10 gallons per minute for domestic wells and 1400 gallons per minute for public supply wells.

2.5.2.5 Groundwater Monitoring Wells

2.5.2.5.1 West Range Site

Four groundwater monitoring wells were installed within the West Range Buffer Land in July 2005. The construction details of these four wells are presented below in Table 2.5-16. Hydraulic conductivity slug tests were conducted on the four wells in August 2005, and these results are summarized above in Table 2.5-7.

Table 2.5-16. Well Details
Monitoring Wells Constructed On-Site, July 2005

Well	Unique No.	Total Depth (ft)	Top of Casing	Type of Casing	Type of Screen	Screened Interval (ft msl)
MW-1	717531	26	1404.95	Sch 40 PVC	10 slot	1392.0-1382.0
MW-2	717532	23	1452.00	Sch 40 PVC	10 slot	1436.1-1426.1
MW-3	717533	20	1434.89	Sch 40 PVC	10 slot	1422.2-1412.2
MW-4	717544	21.5	1343.15	Sch 40 PVC	10 slot	1336.3-1326.3

Static groundwater elevations recorded in the four monitoring wells constructed on-site were recorded in August 2005, Table 2.5-17. The static groundwater elevations for these wells range from 1,339 to 1,435 feet msl.

Table 2.5-17
Static Water Elevations Monitoring Wells Constructed On-Site

Well	Unique No.	Top of Casing	Elevation (ft msl) *8/3/2005*
MW-1	717531	1404.95	1396.41
MW-2	717532	1452.00	1435.00
MW-3	717533	1434.89	1417.71
MW-4	717544	1343.15	1338.76

2.5.2.5.2 East Range Site

No groundwater monitoring wells are installed at the East Range Site.

2.5.2.6 Existing Potable Water Treatment Systems

2.5.2.6.1 West Range Site

As discussed in Section 2.5.2.1, groundwater obtained from shallow sand and gravel aquifers and bedrock aquifers in the vicinity of the West Range Site can be high in iron and manganese, and classified as "hard" or "very hard." Many residences that have private domestic-supply wells or that are connected to public water supply systems use water softeners to lower the hardness. As required by the Minnesota Department of Health for public health reasons, the City of Taconite adds chlorine and fluoride to its groundwater-based public water supply system. No other treatment is applied to the groundwater used for Taconite's public water supply systems. Regionally, the City of Bovey sequesters the iron and manganese found in the groundwater obtained by its public water supply well prior to distributing it to city residents.

2.5.2.6.2 East Range Site

The City of Hoyt Lakes treats surface water for drinking water and has a wastewater collection system that conveys wastewater to the Hoyt Lakes WWTF. Potable water service and sanitary sewer collection systems would be extended from the City of Hoyt Lakes via existing utility systems to Mesaba One and Mesaba Two.

2.6 Floodplains

This floodplain analysis is based on Federal Emergency Management Agency (FEMA) Flood Insurance Study (FIS) and associated floodway maps. The MDNR is the administrator of the FEMA National Flood Insurance Program (NFIP) in Minnesota.

2.6.1 Description of Floodplains

2.6.1.1 West Range Site

The West Range Site includes infrastructure located in Bovey, Taconite, Coleraine, Marble and Calumet. In order to determine the degree to which Mesaba One and Mesaba Two will impact floodplains within each of the communities, the FEMA Flood Insurance Rate Maps (FIRM) were examined. Within each FIRM panel, FEMA has defined a flood hazard boundary in addition to the type of flood hazard. Flood hazards can be determined by approximate methods (Zone A) or by detailed studies (Zones AE, AO, AH, A1-30 and X).

2.6.1.2 East Range Site

The East Range Site is situated within St. Louis County in the City of Hoyt Lakes. Pipeline and transmission lines would cross the following cities and townships within St. Louis County: White Township, Biwabik Township, Unorganized Territory of Hay Lake, Wuori Township, City of Virginia, City of Mountain Iron, Unorganized Territory of Heikkila Lake Township, City of Gilbert, City of Eveleth, Fayal Township, City of Iron Junction, Clinton Township, Cherry Township, Lavell Township, McDavitt Township and City of Leonidas.

In order to determine the degree to which this project will impact the floodplains within each of the communities, the FEMA Flood Insurance Rate Maps (FIRM) were obtained and examined. Within each FIRM panel, FEMA will define a flood hazard boundary in addition to the type of flood hazard. Flood hazards can be determined by approximate methods (Zone A) or by detailed studies (Zones AE, AO, AH, A1-30 and X).

2.6.2 Federal Emergency Management Agency (FEMA) Maps

2.6.2.1 West Range Site

The City of Taconite (FEMA Community Number 270209) and Itasca County (FEMA Community Number FM270200, Panels 0675A, 0700A, and 0800A) are the only areas that have published FEMA FIRM panels. The Cities of Coleraine, Bovey, Marble, and Calumet are unmapped; therefore, FEMA does not have defined flood hazard zones within those communities.

2.6.2.2 East Range Site

Table 2.6-1 below lists the Communities and corresponding Flood Insurance Rate Map (FIRM) Panels at the East Range Site that will be impacted.

Table 2.6-1
Communities Impacted East Range

Community	FEMA Community Number	FIRM Panel
St. Louis County	27137	N/A
City of Biwabik	270418	No Map
City of Eveleth	270422	Refer to St. Louis County* 950
City of Hoyt Lakes	270575	No Map
City of Iron Junction	270580	0001
City of Mountain Iron	270424	0002
City of Virginia	270426	No Map
St. Louis County*	270416	825, 925, 950, 975, 1050

2.6.3 100-year and 500-year Floodplains

2.6.3.1 West Range Site

The 100-year floodplain is defined as the area in which there is at least a 1-percent annual chance of flooding, and the 500-year floodplain is defined as the 0.2-percent annual chance of flooding. As shown below in Figure 2.6-1, there is no FEMA-defined floodplain within the West Range IGCC Power Station Footprint and Buffer Land. The Itasca County FIRM maps indicate 100-year floodplains on portions of the Prairie River and Swan River in the vicinity of the West Range Site. See Figure 2.6-2.

2.6.3.2 East Range Site

The 100-year floodplain is defined as the 1-percent annual chance of flooding, and the 500-year floodplain is defined as the 0.2-percent annual chance of flooding. The FIRM maps listed in Table 2.6-1 for the area indicate 100-year floodplains on several rivers and lakes in the vicinity of the East Range Site.

The City of Hoyt Lakes does not have FEMA FIRM Panels, since there is no FEMA defined floodplain within the jurisdictional boundaries of that city (Figure 2.6-3). See Figure 2.6-4 for a floodplain map of the entire East Range Site region, including the pipeline and transmission line corridors.

Figure 2.6-1 FEMA Floodplains in the Vicinity of the West Range IGCC Power Station Footprint and Buffer Land

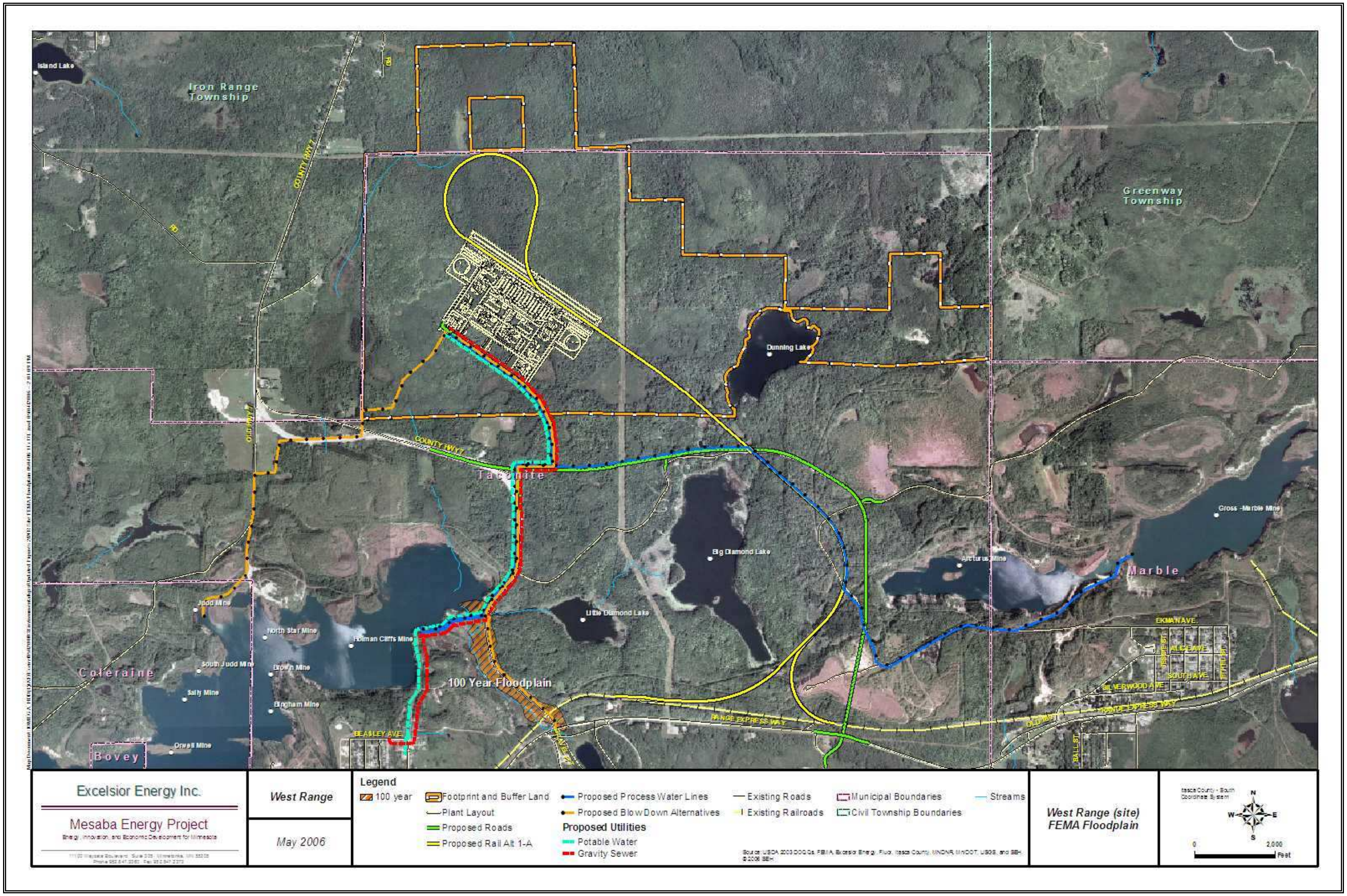


Figure 2.6-2 FEMA Floodplains the West Range Site Area.

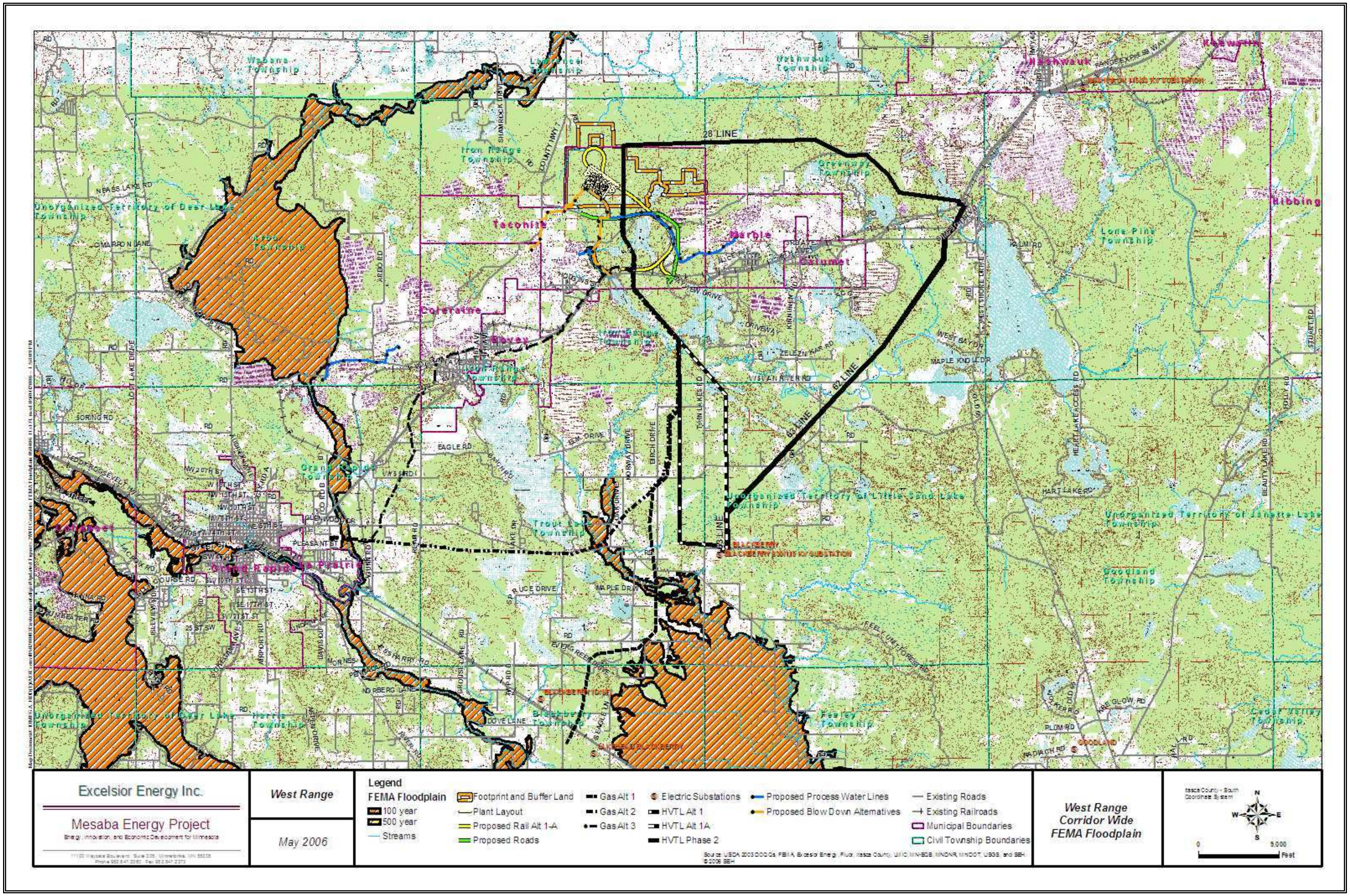


Figure 2.6-3 FEMA Floodplains near the East Range IGCC Power Station

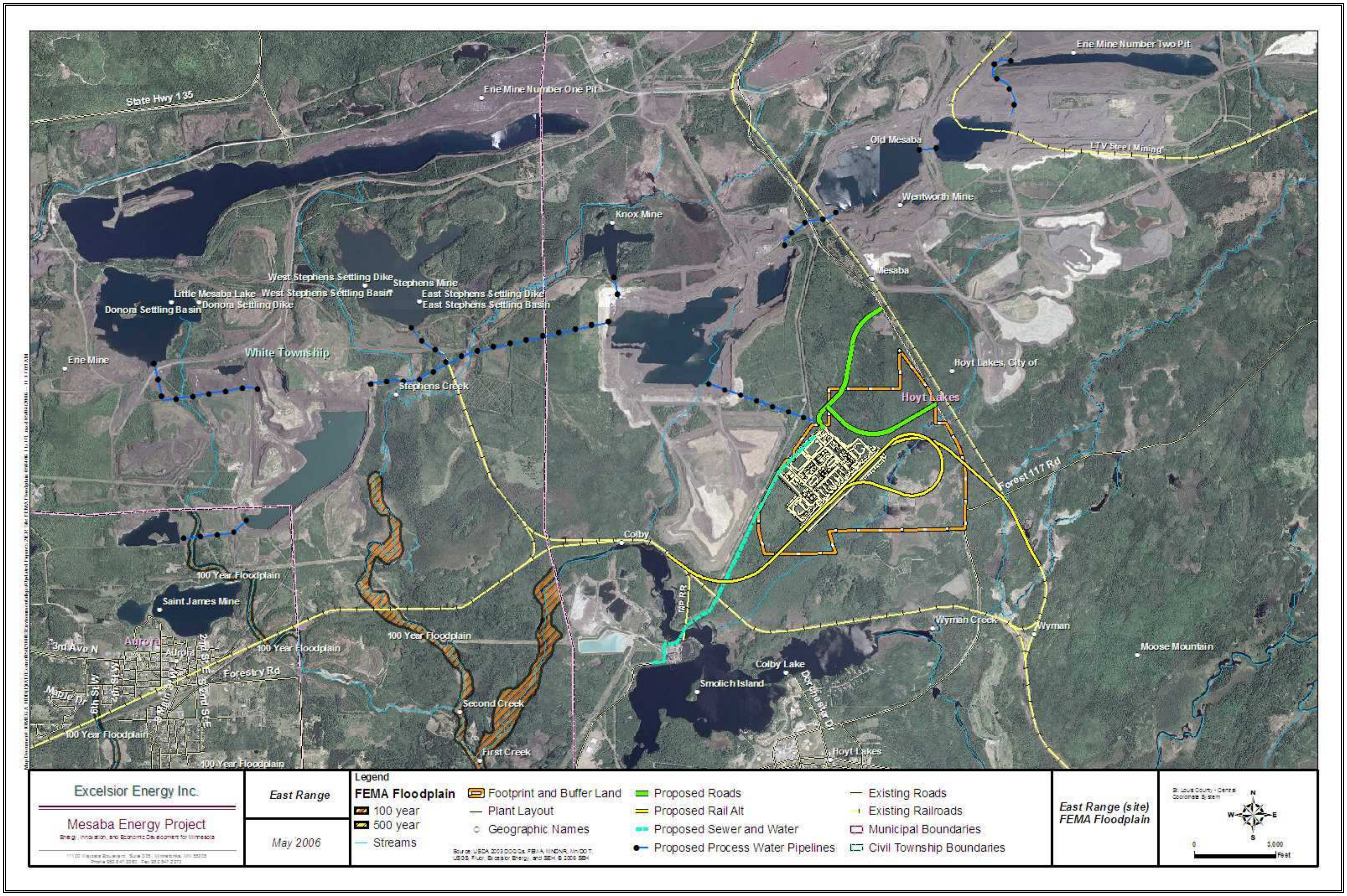
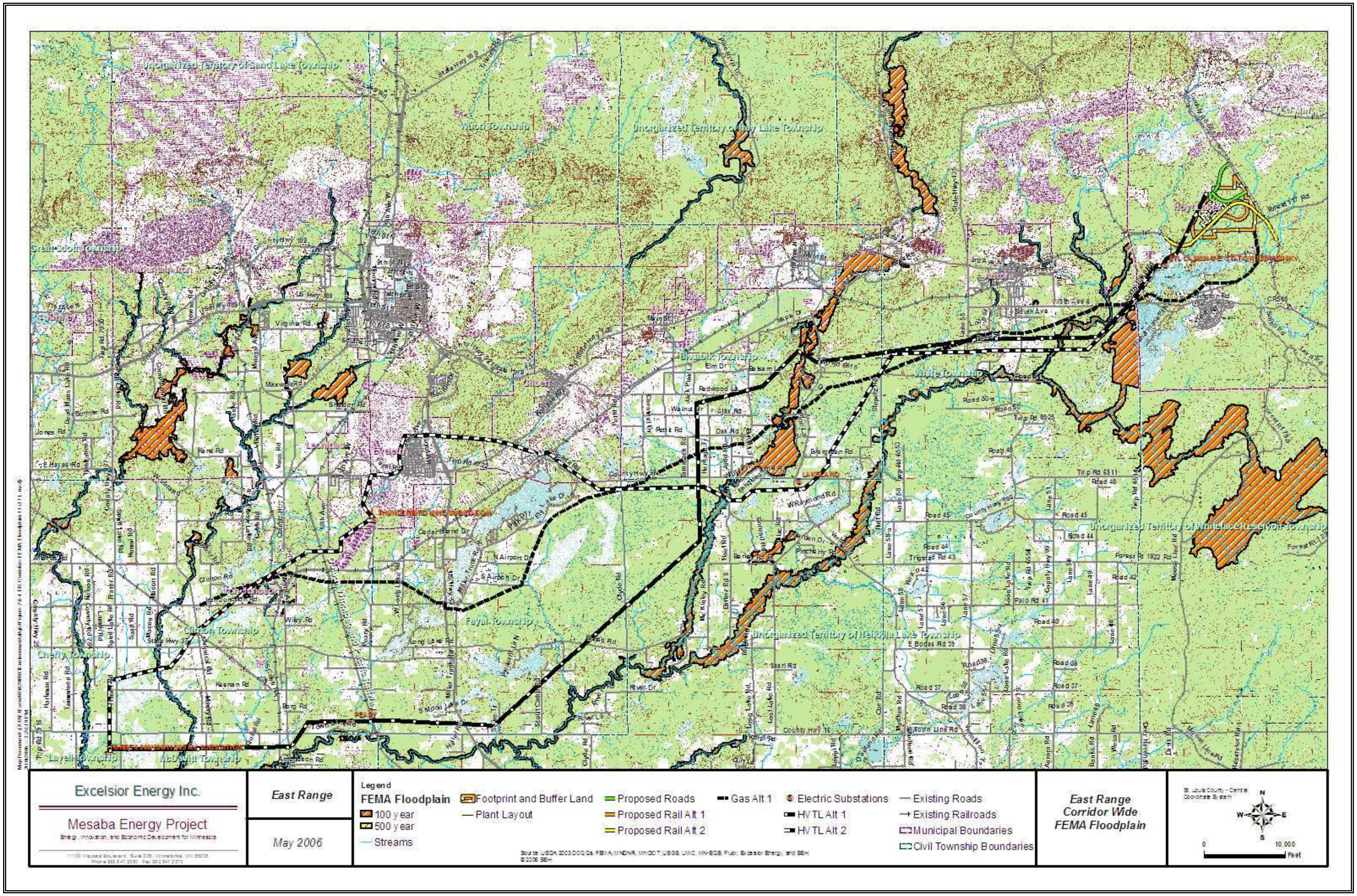


Figure 2.6-4 FEMA Floodplains in the East Range Site Area



2.7 Wetlands

Wetlands are defined by the U.S. Army Corps of Engineers (USACE) (*Federal Register*, 1982) and the U.S. Environmental Protection Agency (EPA) (*Federal Register,* 1980) as follows:

> Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas.

According to the USACE, one positive indicator (except in certain situations) from each of three elements must be present in order to make a positive wetland determination, which are as follows:

- Greater than 50 percent dominance of hydrophytic plant species;
- Presence of hydric soil; and
- The area is either permanently or periodically inundated, or soil is saturated to the surface during the growing season.

Wetlands in the project area are regulated by several agencies including the USACE and EPA at the federal level, and the Minnesota Board of Water and Soil Resources (BWSR) and the Minnesota Department of Natural Resources (MDNR) at the state level. At the federal level, Section 404 and Section 401 of the Clean Water Act provide regulation of wetlands that are hydrologically connected to U.S. Navigable Waters. The Minnesota Wetland Conservation Act (WCA) regulates wetlands at the state level (Minn. R. ch. 8420). Itasca County Soil and Water Conservation District has accepted responsibility for administering the WCA in the project area. Other state wetland regulations include designated Protected Waters and Protected Waters Wetlands regulated by the MDNR (Minn. R. 6115.0010–6115.0810). The Ordinary High Water Level (OHWL), as established by the MDNR, of Protected Waters Wetlands defines the upper extent of jurisdiction by the MDNR on these protected habitats.

In Minnesota and for the project, wetland impacts may require permits or approvals from as many as three agencies, the USACE (and the EPA through the USACE), the designated WCA Local Government Unit (LGU) under the oversight of BWSR, and the MDNR. In contrast, impacts to wetlands that are hydrologically isolated from U.S. Navigable Waters and are not MDNR Protected Waters Wetlands may only require WCA approval. However, formal jurisdiction of these wetlands is determined by each respective agency.

2.7.1 Wetland Identification and Mapping Process

Wetlands were identified, assessed, and where possible field delineated for the West Range Site, the East Range Site and the supporting rail, gas, utility and road corridors. Field investigations were not performed in areas where land access had not been granted. Wetland delineations will be conducted in these areas for the corridors and site following final route selection. In general, assessment of the wetlands was completed in three successive stages:

- Off-Site Assessment
- On-Site Screening
- Field Wetland Delineation

2.7.1.1 Off-Site Assessment

Off-site assessment was conducted first through remote sensing to identify potential wetland locations, wetland type and conditions, and to engage in preliminary planning and siting of facilities. Several resources were used in the off-site assessment including:

- USFWS National Wetlands Inventory ("NWI")
- U.S. Geological Survey ("USGS") topographic maps
- MDNR Protected Water Inventory ("PWI")
- Itasca County Soil Survey
- Farm Service Agency Aerial photographs (2003)
- Preliminary plans for the West Range and East Range sites
- Local land-use maps

Through this off-site assessment, the above-mentioned resources were used to create a preliminary map of potential wetland habitats, including National Wetland Inventory (NWI) boundaries, where available, overlaid on aerial photography using GIS. The preliminary map was then used for preliminary site planning and for on-site screening of wetland locations throughout the property.

The above-referenced off-site methods were also utilized to identify wetland locations, types and estimates of wetland impacts for the areas of the transportation and utility corridors that were not accessible during the 2005 field wetland delineations. Permission has not yet been obtained from the various landowners and easement holders where these corridors are proposed; therefore on-site field delineation of wetlands in these areas has not been completed at this time.

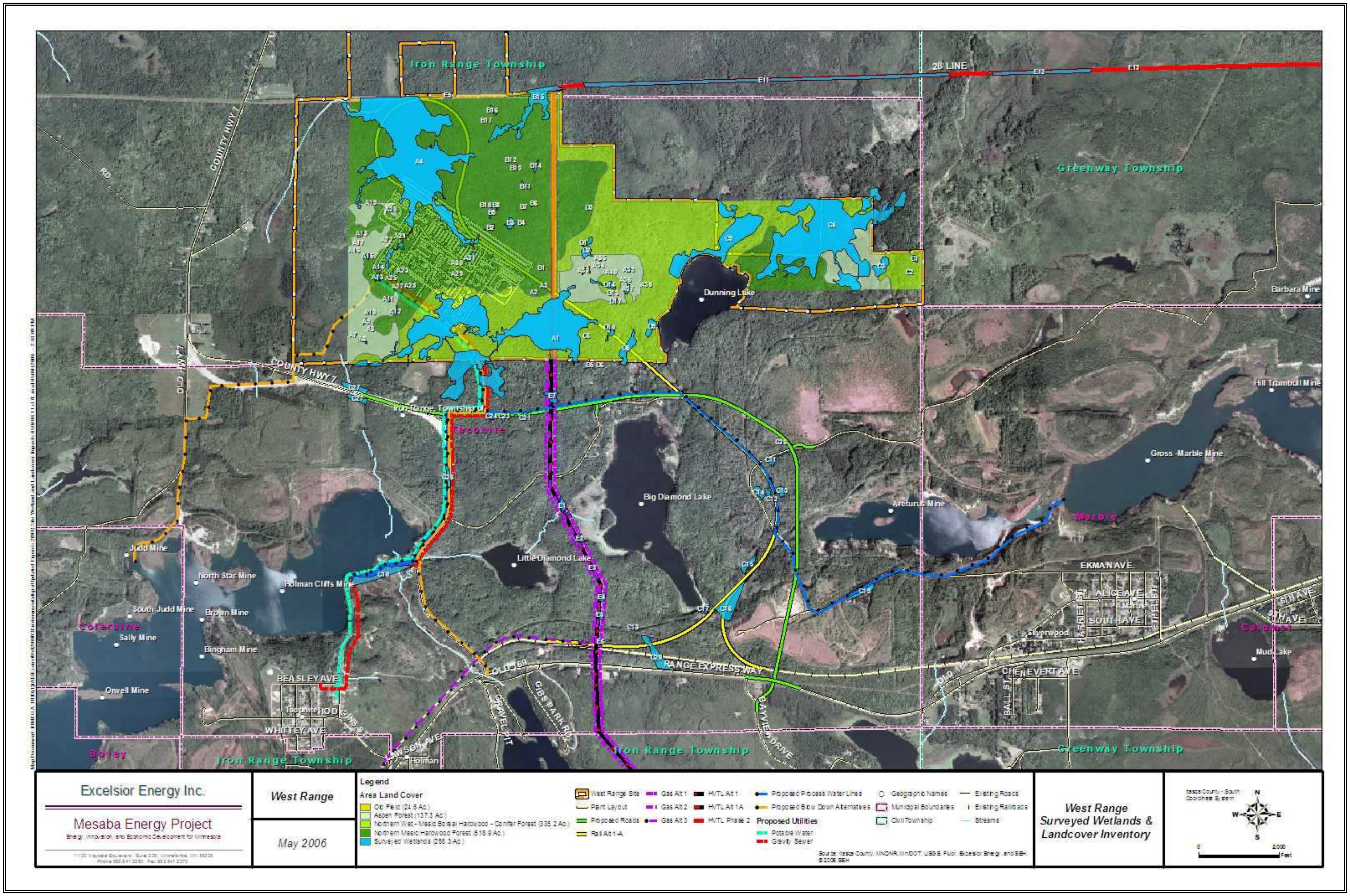
2.7.1.2 On-Site Screening

On-site screening consisted of field reconnaissance to verify the locations, scope, and scale of the wetlands identified in the off-site assessment. On-site screening also provided the ability to accurately scope and plan for follow-up field delineation of the wetlands. This process was critical given the size of the proposed facility sites and their respective corridors. On-site screening was conducted in late summer 2004 for the East Range site and in early June 2005 for the West Range site, prior to the field delineation of both areas. Adjustments to the wetland boundaries and locations determined in the off-site assessment were made through photo-interpretation on aerial photographs for both sites during the reconnaissance. The scope and planning for the field delineation were then developed.

2.7.1.3 Field Delineation

The entire East Range IGCC Power Station Footprint and Buffer Land was field delineated from October 18–21, 2004 and August 17–18, 2005. The majority of the West Range IGCC Power Station Footprint and Buffer Land was delineated in June, July, and August 2005. The areas where wetlands were delineated on the West Range Site, and the results are provided in Section 2.7.2.1 and Figure 2.7-1, below.

Figure 2.7-1. West Range Site Surveyed Wetlands and Land Cover Inventory



Wetlands were delineated in accordance with the *Corps of Engineers Wetlands Delineation Manual* (USACE, 1987), herein referred to as the "1987 Manual." The 1987 Manual requires that soil inundation or saturation occur within a major portion of the root zone (typically within 12 inches of the surface, and that all three wetland parameters (hydrology, soils, and vegetation, as discussed in Section 2.7 above) be present.

The Routine Onsite Determination Method (RODM) as defined in the 1987 Manual was applied for these field delineations. Field notes, RODM sample data, and photographs were taken at representative locations at or within each wetland. Collected data and information was transferred to RODM datasheets, which are included in Appendix 4. The boundary of each delineated wetland was marked with sequentially numbered "Wetland Boundary" flagging or pin flags. The boundary was then surveyed using a Trimble Pro XR or XRS Global Positioning System (GPS). The collected GPS data were processed and incorporated with project plans and GIS.

Each delineated wetland basin was assigned a unique identification number, photographed, and classified following the systems defined in *Classification of Deepwater Habitats of the United States* (Cowardin *et al.*, 1979) and USFWS Circular 39 publication *Wetlands of the United States* (Shaw and Fredine, 1956). The Cowardin *et al.* classification system is used by the USFWS NWI. Sample point data collected in the upland areas were defined with a "U" and sample point data collected in the wetland habitats were defined with a "W." These data and the wetland classification of each basin are included on the RODM.

Wetlands were field delineated by two-person teams of wetland scientists. Up to four teams were in the field at one time to delineate wetlands at the West Range Site. At the East Range Site field delineation was completed by one team of two wetland scientists. Access was on foot and/or by all terrain vehicles on both sites.

Plant taxonomy keys, field guides, and past regional botanical experience and knowledge were utilized to identify upland and wetland plants to the species level. Wetland plant species nomenclature and indicator status species was confirmed with the *National List of Plant Species that Occur in Wetlands, Region 3—North Central* (U.S. Department of Interior, 1988). The indicator status is included for each plant listed on the RODM datasheets with one of the following indicators:

- OBL—Obligate wetland plant species; occurs with an estimated 99% probability in wetlands.
- FACW—Facultative Wetland plant species; estimated 67–99% probability of occurrence in wetlands.
- FAC—Facultative plant species; equally likely to occur in wetlands and non-wetlands (uplands), 34–67% probability in wetlands.
- FACU—Facultative Upland plant species; 67–99% probability of occurrence in non-wetlands, 1–33% probability in wetlands.
- UPL—Obligate Upland plant species; not found in wetlands with a 99% probability.
- NI—No Indicator; insufficient information exists to determine indicator status.

Positive (+) and negative (-) signs are often addended to a plant species indicator to more specifically define frequency of occurrence. A positive sign indicates a frequency towards the higher end of the indicator category (e.g., FACW+ is more likely to occur in wetlands in 99% of the probability range). A negative sign indicates a frequency towards the lower end (e.g., FACW- is less likely to occur and trends towards the 67% probability of occurring in wetlands).

Soils were observed for hydric soil characteristics and recorded on the RODM datasheets. Soils were examined in soil pits excavated with a tile spade or in cores taken with a soil probe. Soil profiles were reviewed to a depth necessary to confirm hydric soil characteristics, up to a maximum depth of 24 inches. Soil color determinations were made using MUNSELL Soil Color Charts (Gretag Macbeth, 1994). Hydric soil indicators are noted on the RODM datasheets. Hydric soil indicators include observations of gleying, iron concentrations in a depleted soil matrix, presence of a histic epipedon, presence of histosols, depleted soil matrix (high value, low chroma MUNSELL colors), iron or manganese concretions, sulfidic odors, and other indicators of a reduction-oxidation environment due to prolonged duration of soil saturation/inundation.

Subsurface wetland hydrology indicators were examined using the soil cores and/or soil pits to confirm soil saturation and groundwater hydrology. Other primary indicators for wetland hydrology that were recorded in the RODM datasheets include direct observations of inundation, water marks, drift lines, sediment deposits, and drainage patterns. Secondary wetland hydrology indicators that were recorded include oxidized root channels, water stained leaves, the FAC-Neutral Test, multiple trunks on woody plants, tree buttressing, and topographic depressions. If no primary indicators are observed, then the 1987 Manual requires that at least two or more secondary wetland hydrology indicators be identified to confirm wetland hydrology.

The wetland boundary marked with flagging tape/pin flags and surveyed with GPS is considered the wetland edge and the highest extent of the wetland basin; areas above the edge fail to meet the required three wetland parameters while areas below the edge meet the wetland parameters required by the field delineation methodology.

Wetlands delineated at both the West and East Range Sites are discussed in detail in the following sections. Descriptions of typical wetland habitats encountered are described as they pertain to each of the respective sites.

2.7.2 Wetland Classifications

Wetlands are classified following the *Classification of Deepwater Habitats of the United States* (Cowardin *et al.*, 1979) and USFWS Circular 39 publication *Wetlands of the United States* (Shaw and Fredine, 1956). Both systems were used to classify the wetlands at the West and East Range Sites. There are eight recognized wetland types in Minnesota that are defined by Circular 39. The definitions of these eight wetland types are provided in Table 2.7-1 below and are discussed in more detail in the following sections.

Table 2.7-1.
Wetland Types and Definitions in Minnesota*

Wetland Type	Definition
Type 1 Seasonally flooded basin or flat	Soil is covered with water or is waterlogged during variable seasonal periods but usually is well-drained during much of the growing season. Vegetation varies greatly according to season and duration of flooding: from bottomland hardwoods (floodplain forests) to herbaceous plants.
Type 2 Wet meadow	Soil is usually without standing water during most of the growing season but is waterlogged within at least a few inches of surface. Meadows may fill shallow basins, sloughs, or farmland sags, or these meadows may border shallow marshes on the landward side. Vegetation includes grasses, sedges, rushes and various broad-leaved plants. Other wetland plant community types include low prairies, sedge meadows, and calcareous fens.
Type 3 Shallow marsh	Soil is usually waterlogged early during the growing season and may often be covered with as much as 6 inches or more of water. These marshes may nearly fill shallow lake basins or sloughs, or may border deep marshes on the landward side. These are common as seep areas on irrigated lands. Vegetation includes grass, bulrush, spikerush, and various other marsh plants such as cattail, arrowhead, pickerelweed, and smartweed.
Type 4 Deep marsh	Soil is usually covered with 6 inches to 3 feet or more of water during growing season. These deep marshes may completely fill shallow lake basins, potholes, limestone sinks and sloughs, or they may border open water in such depressions. Vegetation includes cattail, reed, bulrush, spikerush, and wild rice. In open areas, pondweed, naiad, coontail, water-milfoil, waterweed, duckweed, waterlily, or spatterdock may occur.
Type 5 Shallow open water	Shallow ponds and reservoirs are included in this type. Water is usually less than 10 feet deep and fringed by a border of emergent vegetation similar to areas of Type 4.
Type 6 Shrub swamp	Soil is usually waterlogged during growing season and is often covered with as much as 6 inches of water. These occur mostly along sluggish streams and occasionally on flood plains. Vegetation includes alder, willow, buttonbush, dogwood, and swamp-privet.
Type 7 Wooded swamp	Soil is waterlogged at least within a few inches of surface during growing season and is often covered with as much as 1 foot of water. These occur mostly along sluggish streams, on old riverine oxbows, on flat uplands, and in ancient lake basins. Forest vegetation includes tamarack, arborvitae, black spruce, balsam fir, red maple, and black ash. Deciduous swamps frequently support beds of duckweed and smartweed. Other wetland plant community types include lowland hardwood swamps and coniferous swamps.
Type 8 Bogs	Soil is usually waterlogged. These occur mostly in ancient lake basins, on flat uplands and along sluggish streams. Vegetation is woody or herbaceous or both, usually on a spongy covering of mosses. Typical plants are heath shrub, sphagnum moss, and sedge. In the North, leatherleaf, Labrador tea, cranberry, and cottongrass are often present. Scattered, often stunted, black spruce and tamarack may occur.
* Definitions based on USFWS Circular 39 *Wetlands of the United States* (Shaw & Fredine, 1956).	

Although the wetlands would be classified following the systems by Cowardin *et al.* (1979) and Shaw & Fredine (1956) for regulatory purposes, the MDNR classification system for vegetative communities in the northern floristic region of the state could also be used to characterize the vegetation components in the wetlands. The *Field Guide to the Native Plant Communities of Minnesota: The Laurentian Mixed Forest Province* (MDNR 2003) provides a dichotomous key of vegetative communities in the northern floristic region. This system was used to characterize the terrestrial (upland) communities, as described in Section 2.10, Ecological Resources. The following sections describe the wetland types encountered at the West and East Range sites by using the Cowardin *et al.* (1979) and Shaw & Fredine (1956) systems, followed by the MDNR vegetation classification system descriptions.

2.7.3 West Range Wetlands

2.7.3.1 Delineated Wetlands

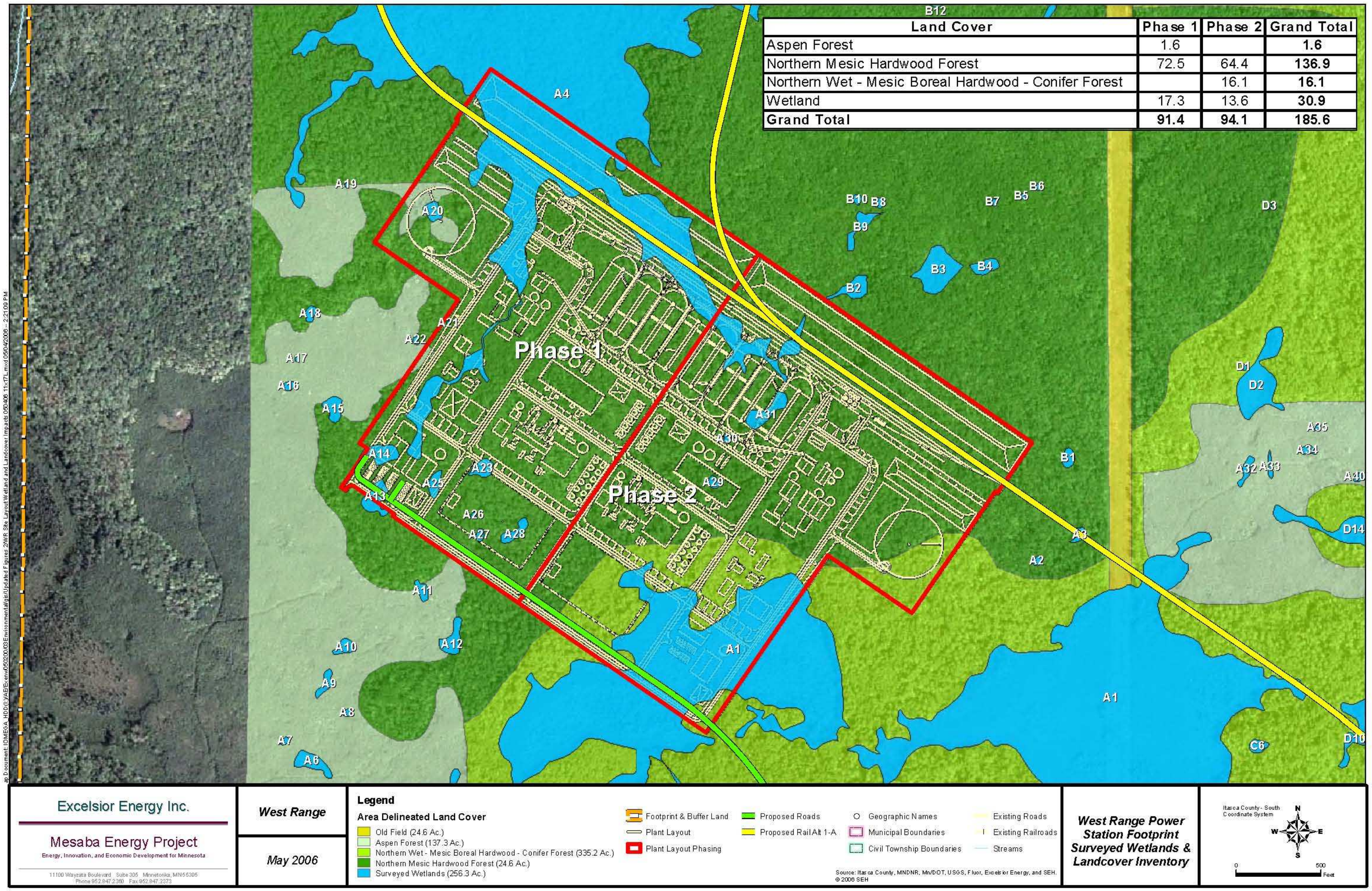
A total of 106 wetland basins were delineated for the West Range IGCC Power Station and its respective corridors where accessible during 2005. An additional 12 basins were identified through review of NWI maps, but were not accessible during the 2005 field surveys. The results of the field delineation describe the wetland habitats encountered, field conditions, routine on-site determination methodology (RODM) data gathered for each wetland, and the location of all wetlands. Table 2.7-2 provides a summary of wetlands delineated on the West Range Site and Table 2.7-3 provides a summary of these wetlands by Circular 39 type. Table 2.7-4 provides a summary of wetlands that were delineated within adjacent or proposed utility corridors, but outside the West Range Site facility boundary. Wetland impacts for the West Range Site and corridors are discussed under Environmental Consequences in Section 3.6 of this report.

The predominance of wetlands at the West Range Buffer Land and within the utility and transportation corridors includes Type 3 shallow marsh, Type 6 scrub-shrub swamp, and Type 7 forested swamp. Type 8 bog habitat was also observed in several large wetland complexes or in association with Dunning Lake. Type 4 deep marsh and Type 5 shallow open water were also encountered on-site, but with less frequency than Types 3, 6, and 7 wetlands. No Type 1 seasonally saturated basins were delineated within the West Range Site or its associated corridors during 2005.

2.7.3.1.1 West Range IGCC Power Station and Buffer Land

The delineated wetlands for the West Range IGCC Footprint and Buffer Land are shown in Figure 2.7-1. A more close up map of the wetland boundaries and other land cover types within the IGCC Power Station Footprint are shown in Figure 2.7-2. Finally, RODM datasheets for each delineated wetland are included in Appendix 4. Adjacent upland data for each delineated wetland is also found in the RODM data sheets. The terrestrial upland habitats and conditions are described in detail in Section 2.10 of this study report and are based on the *Field Guide to Native Plant Communities of Minnesota: The Laurentian Mixed Forest Province* (MDNR 2003), where these habitats have been assessed.

Figure 2.7-2. West Range IGCC Footprint Surveyed Wetlands and Land Cover Inventory



Land Cover	Phase 1	Phase 2	Grand Total
Aspen Forest	1.6		1.6
Northern Mesic Hardwood Forest	72.5	64.4	136.9
Northern Wet - Mesic Boreal Hardwood - Conifer Forest		16.1	16.1
Wetland	17.3	13.6	30.9
Grand Total	91.4	94.1	185.6

The following Table 2.7-2 also specifically identifies the wetlands within the West Range West Range IGCC Footprint and Buffer Land and provides the wetland classification for each.

Table 2.7-2
Summary of Wetlands within West Range IGCC Power Station Footprint and Buffer Land

Basin ID[1]	Total Approximate Area within Site (Acres)	Wetland Classification		Wetland Isolated[3]
		Cowardin	Circular 39	
A1	78.26	PEMB/PSS1B/PFO4	Type 3/6/8	No
A2	0.06	PFO1B	Type 7	Yes
A3	0.10	PFO1C	Type 7	Yes
A4	96.34	PFO1C/F	Type 7	No
A6	0.38	PEMC/PFO1C	Type 7	Yes
A7	0.04	PFO1C	Type 7	Yes
A8	0.04	PEMC	Type 3	Yes
A9	0.18	PFO1B	Type 7	Yes
A10	0.17	PEMC	Type 3	Yes
A11	0.13	PEMC	Type 3	Yes
A12	0.35	PSS1B	Type 6	Yes
A13	0.45	PFO1B	Type 7	Yes
A14	0.44	PFO1B	Type 7	Yes
A15	0.26	PEMC/PFO1C	Type 3/7	Yes
A16	0.07	PEMC	Type 3	Yes
A17	0.02	PEMC/PFO1C	Type 3/7	Yes
A18	0.11	PEMC/PFO1C	Type 3/7	Yes
A19	0.02	PEMC/PFO1C	Type 3/7	Yes
A20	0.19	PFO1C	Type 7	Yes
A21	0.01	PEMC/PFO1C	Type 3/7	Yes
A22	0.04	PEMC/PFO1C	Type 3/7	Yes
A23	0.24	PEMC/PFO1C	Type 3/7	Yes
A25	0.18	PFO1C	Type 7	Yes
A26	0.03	PFO1C	Type 7	Yes
A27	0.07	PFO1C	Type 7	Yes
A28	0.22	PEMC/PFO1C	Type 3/7	Yes
A29	0.08	PEMC/PFO1C	Type 3/7	Yes

Basin ID[1]	Total Approximate Area within Site (Acres)	Wetland Classification		Wetland Isolated[3]
		Cowardin	Circular 39	
A30	0.04	PEMC	Type 3	Yes
A31	0.48	PFO1C	Type 7	Yes
A32	0.14	PEMC	Type 3	Yes
A33	0.07	PEMC	Type 3	Yes
A34	0.08	PEMC	Type 3	Yes
A35	0.02	PEMC	Type 3	Yes
A36	0.04	PEMC	Type 3	Yes
A37	0.36	PEMC	Type 3	Yes
A38	0.07	PSS1C/PFO 1C	Type 6/7	Yes
A39	0.27	PEMC/PSS1 C	Type 3/6	Yes
A40	0.06	PEMC/PSS1 C	Type 3/6	Yes
B1	0.15	PFO1B	Type 7	Yes
B2	0.38	PFO1A	Type 7	Yes
B3	1.06	PFO1A	Type 7	Yes
B4	0.25	PFO1A	Type 7	Yes
B5	0.02	PFO1A	Type 7	Yes
B6	0.03	PFO1A	Type 7	Yes
B7	0.03	PFO1A	Type 7	Yes
B8	0.06	PFO1A	Type 7	Yes
B9	0.29	PFO1A	Type 7	Yes
B10	0.06	PFO1A	Type 7	Yes
B11	0.29	PFO1A	Type 7	Yes
B12	0.05	PFO1A	Type 7	Yes
B13	0.16	PFO1A	Type 7	Yes
B14	0.37	PFO1A	Type 7	Yes
B15	9.12	PEMB/PSS1 C/ PFO1A	Type 2/6/7	Yes
B16	0.27	PEMC	Type 3	Yes
B17	0.03	PEMB	Type 2	Yes
C1	0.31	PEMC	Type 3	No
C2	0.13	PEMA	Type 3	Yes
C3	2.47	PEM1H	Type 5	No
C4	45.95	PEM1H	Type 5/6/7	No
C6	0.16	PEMC	Type 3	No
C9	6.48	PSS1B/PFO 7B	Type 6/8	No
D1	0.02	PFO1C	Type 7	Yes
D2	1.64	PEMB	Type 3	Yes
D3	0.01	PEMC/PFO 1C	Type 3/7	Yes
D5	0.10	PEMC	Type 3	Yes

Basin ID[1]	Total Approximate Area within Site (Acres)	Wetland Classification		Wetland Isolated[3]
		Cowardin	Circular 39	
D6	0.09	PEMC/PFO 1C	Type 3/7	Yes
D8	2.61	PEMC/PFO 1C/ PFO4B	Type 3/7/8	Yes
D9	1.46	PEMH/PSS 1C	Type 4/6	No
D10	0.75	PEMC/PSS1 C	Type 3/6	Yes
D12	0.27	PEMC/PFO 1C	Type 3/7	Yes
D13	0.06	PEMC/PFO 1C	Type 3/7	Yes
D14	1.13	PSS1C/PFO 1C	Type 6/7	Yes
E9	0.19	PEMB	Type 3	Yes
NWI Basin[2]	0.56 (1 basin)	L1UBH	Type 5	No
NWI Basin[2]	21.47 (3 basins)	PSS/EM5B/ PSSB	Type 6	No
NWI Basin[2]	54.40 (6 basins)	PFO/SSB, PFO6/4B, PFO6/SSB, PFO6B	Type 7	No
NWI Basin[2]	4.36 (2 basins)	PFO4B, PFOB	Type 8	No
Total	**337.35 acres**			

[1] Some wetland ID numbers were combined when it was determined that wetlands were connected or part of a large single wetland complex (e.g., A5 is now combined with A4; C5 through C8 are now one wetland).

[2] NWI basins not delineated during the 2005 field season due to access limitations, but part of the West Range IGCC Power Station Footprint and Buffer Land.

[3] The designation of an isolated wetland was determined through field investigations and does not represent an agency determination.

As shown in the Table 2/7-2, approximately 337 acres of wetlands were identified either by field investigation or NWI map analysis within the West Range IGCC Power Station Footprint and Buffer Land. Table 2.7-3 summarizes this information by wetland type.

Table 2.7-3
Summary of Wetland Area by Circular 39 Type Within West Range Site Boundary

Circular 39	Total Basins	Total Acres
Type 2	1	0.03
Type 2/6/7	1	9.12
Type 3	17	3.96
Type 3/6	3	1.08
Type 3/6/8	1	78.26
Type 3/7	12	1.43
Type 3/7/8	1	2.61
Type 4/6	1	1.46
Type 5	2	3.03
Type 5/6/7	1	45.95
Type 6	4	21.82
Type 6/7	2	1.20
Type 6/8	1	6.48
Type 7	34	156.56
Type 8	2	4.36
Total	**83 basins**	**337.35 acres**

As shown above in Table 2.7-3, nearly half of the wetlands identified within the West Range Site are forested swamp (Type 7).

2.7.3.1.2 West Range Delineation outside Buffer Land

Table 2.7-4 identifies delineated wetlands outside the West Range IGCC Power Station Footprint and Buffer Land. These wetlands were delineated due to their immediate proximity to the proposed utility or transportation corridors where access was available.

Table 2.7-4
Summary of Delineated Wetlands within Adjacent Utility Corridors Outside of West Range Buffer Land[1]

Basin ID	Total Area within Site (Acres)	Wetland Classification		Wetland Isolated[2]
		Cowardin	Circular 39	
C10	4.89	PSS1A	Type 6	No
C11	0.88	PEM2H	Type 5	No
C12	0.67	PSS1C	Type 6	No
C13	0.90	PSS1C/PFO1C	Type 6/7	No
C14	1.02	PEM2H	Type 5	No
C15	1.36	PSS1C	Type 6	No

Basin ID	Total Area within Site (Acres)	Wetland Classification		Wetland Isolated[2]
		Cowardin	Circular 39	
C16	6.12	PEMC	Type 3	No
C17	0.54	LAB2	Type 5	No
C18	0.22	PSS1C	Type 6	No
C19	1.42	PEM2H	Type 5	No
C20	4.18	PEMC/PSS1C	Type 3/6	No
C21	0.69	PSS1C	Type 6	Yes
C22	0.09	PSS1C	Type 6	Yes
C23	0.62	PSS1C/PFO1C	Type 6/7	No
C24	0.48	PFO2B	Type 8	No
C26	0.12	PFO1C	Type 7	No
C27	1.28	PFO1C	Type 7	No
C28	1.77	PFO1C	Type 7	No
E1	1.37	PEMC	Type 3	No
E2	0.70	PEMB	Type 2	No
E3	0.08	PEMC	Type 3	No
E4	0.67	PEMC	Type 3	Yes
E5	0.65	PEMH	Type 8	No
E6	0.42	PEMC	Type 3	Yes
E7	1.44	PEMC	Type 3	Yes
E11	18.34	PEMC	Type 3	No
E12	5.65	PEMH	Type 8	No
E13	0.13	PEMC	Type 3	Yes
E14	0.49	PEMC/PEMG	Type 3/4	No
E15	0.14	PEMC	Type 3	No
E16	0.15	PEMC	Type 3	Yes
E17	0.76	PEMC	Type 3	No
E18	8.24	PEMC	Type 3	No
Total	**66.48 acres**			

[1] These basins are located outside of the West Range Site boundary, but were delineated due to their immediate proximity to proposed utility or transportation corridors adjacent to the facility site, and property access was available.
[2] The designation of an isolated wetland was determined through field investigations and does not represent an agency determination.

2.7.3.2 Typical West Range Wetland Types

The following paragraphs describe in more detail the typical characteristics of wetlands within the West Range Site. Although all of the utility and transportation corridors have not been fully evaluated for wetlands, the following wetland descriptions provide a summary of typical habitat that can be expected within the proposed utility and transportation corridors.

2.7.3.2.1 Type 2 Wet Meadow

The Type 2 wet meadow wetlands were primarily restricted to existing HVTL corridors and ROWs on acceptable portions of the West Range Site. These wetlands are a result of right-of-way construction and maintenance. The right-of-way was constructed through or across a wetland and continuous maintenance preserves the herbaceous wet meadow conditions. Canada blue-joint grass (*Calamagrostis canadensis*—OBL) is the dominant vegetative cover within the wet meadow habitats. Sedges (*Carex spp.*), woolgrass (*Scirpus cyperinus*—OBL), sensitive fern (*Onoclea sensibilis*—OBL), and goldenrods (*Solidago sp.*) are also common.

Type 2 wetlands typically had surface organic soils underlain by sandy clay loam, clay loam, sandy loam, and less frequently, loamy sands. Hydric soil indicators most frequently encountered in Type 2 wetlands include a histic epipedon, depleted matrices in subsurface mineral soils, gleying in subsurface soils, low chroma colors in mineral soils, and occasionally high organic content at the surface of sandy soils. The primary hydrology indicator in the Type 2 wet meadows were soils that were saturated to the surface.

The Type 2 wet meadows within the West Range Site and its accessible Associated Facilities corridors, and accessible HVTL corridors could be characterized by the MDNR vegetative classification system (2003) as *northern wet meadow/carr (sedge meadow, bluejoint subtype)* (MDNR code WMn82b1) wetlands. These are considered open wetlands dominated by dense cover of broad-leaved graminoids or tall shrubs. The northern wet meadow/carr wetlands are found on mineral or sapric peat soils in basins or along streams. The graminoid layer is typically vegetated by Canada bluejoint grass (*Calamagrostis canadensis*), lake sedge (*Carex lacustris*), tussock sedge (*C. stricta*), and beaked sedge (*C. stipata*). Forbs typically include marsh bellflower (*Campanula aparinoides*), tufted loosestrife (*Lysimachia thyrsiflora*), marsh skullcap (*Scutellaria galericulata*), great water dock (*Rumex orbiculatus*), species of willow-herb (*Epilobium spp.*), water hemlock (*Cicuta bulbifera*), water smartweed (*Polyganum amphibium*), and marsh cinquefoil (*Potentilla palustris*). Shrubs would be sparse or absent in this wet meadow community.

2.7.3.2.2 Type 3 Shallow Marsh

Type 3 shallow marsh wetlands were observed most frequently throughout the West Range Site, its accessible Associated Facilities corridors, and accessible HVTL corridors, and were most often associated with Type 6 and Type 7 wetlands forming a complex of wetland types. Type 3 wetlands were dominated by herbaceous species, such as sedges and/or grasses, and were either temporarily flooded (PEMA) basins or seasonally flooded (PEMC) marshes. The most commonly observed herbaceous vegetation throughout the site was Canada blue-joint (*Calamagrostis canadensis*—OBL). Several species of sedges observed include wiregrass sedge (*Carex lasiocarpa*—OBL), inflated sedge (*C. intumescens*—FACW), slender sedge (*C. tenera*—FAC+), pointed broom sedge (*C. scoparia*—FACW), Tuckerman's sedge (*C. tuckermanii*—OBL), and lake sedge (*C. lacustris*—OBL). Other dominant herbs include woolgrass (*Scirpus cyperinus*—OBL), broad-leaved cattail (*Typha latifolia*—OBL), sensitive fern (*Onoclea sensibilis*—OBL), fowl manna grass (*Glyceria striata*—OBL), marsh marigold (*Caltha palustris*—OBL), blue-flag iris (*Iris versicolor*—OBL), woodland horsetail (*Equisetum* *sylvaticum* - FACW), jewelweed, (*Impatiens capensis*—FACW), and bugleweed (*Lycopus americanus*—OBL).

Type 3 wetlands typically had surface organic soils underlain by sandy clay loam, clay loam, sandy loam, and less frequently, loamy sands. Hydric soil indicators most frequently encountered in Type 3 wetlands include a histic epipedon, depleted matrices in subsurface mineral soils, gleying in subsurface soils, low chroma colors in mineral soils, and occasionally high organic content at the surface of sandy soils. Most of the Type 3 wetlands hydrology were saturated at the surface or were inundated with up to six inches of water.

The Type 3 shallow marsh communities within the West Range Site, its accessible Associated Facilities corridors, and accessible HVTL corridors could be characterized by the MDNR vegetative classification system (2003) as *northern mixed cattail marsh [cattail-sedge marsh (northern)]* (MDNR code MRn83a) wetlands. These emergent marshes are typically dominated by cattails but with a significant component of graminoids including sedges, woolgrass, and Canada bluejoint grass. Floating-leaved aquatic and submergent aquatic species are sparse; however several species of duckweed (*Lemna spp.* and *Spirodela sp.*) and common bladderwort (*Utricularia vulgaris*) are common. Forb species mostly consist of greater than 50 percent cattails (*Typha spp.*), along with less frequent occurrence of marsh cinquefoil, tufted loosestrife, and willow-herb. Shrubs are absent or very sparse.

2.7.3.2.3 Type 4 Deep Marsh and Type 5 Shallow Open Water

Types 4 and 5 wetlands were less commonly observed, but were dispersed throughout the West Range Site, its accessible Associated Facilities corridors, and HVTL corridors. Most of these basins appeared to be formed through beaver activity. Other Type 4 and 5 wetlands were located along fringe areas of Dunning Lake. These habitats typically contained herbaceous and/or open water and ranged from semi-permanently flooded to permanently flooded. Type 4 and 5 Cowardin classification codes that were observed include L2EMF, L2EMH, and PEMB, PEMG, and PEMH.

Type 4 and 5 wetlands had dominant vegetation that includes broad-leaved cattail, Canada blue-joint, blue-flag iris, white water lily (*Nymphaea odorata*—OBL), and water hemlock (*Cicuta maculata*—OBL). For those Type 4 and 5 wetlands around Dunning Lake, vegetation included herbaceous and/or woody fringes surrounding the deeper open water habitat. Woody species observed with herbaceous vegetation in these areas typically included speckled alder (*Alnus rugosa*—OBL), black ash (*Fraxinus nigra*—OBL), and black spruce (*Picea mariana*—OBL).

The soils in Types 4 and 5 wetlands were typically deep, organic muck soils. Organic material was also observed overlain were sands, clays, and loams in areas flooded by beaver activity. Hydrology indicators included direct observations of six or more inches of standing water. Water marks and drift lines were also observed as primary hydrology indicators of inundated conditions.

The Type 4 deep marsh and Type 5 open water marsh communities within the West Range Site, its accessible Associated Facilities corridors, and accessible HVTL corridors could be characterized by the MDNR vegetative classification system (2003) as *northern mixed cattail* *marsh [cattail marsh (northern)]* (MDNR code MRn83b) wetlands. These emergent marshes are nearly dominated by pure stands of cattails (Type 4) or with cattail fringe areas (Type 5). Sedges and grasses are a minor component if present. Floating-leaved aquatic and submergent aquatic species are sparse; however, several species of duckweed (*Lemna spp.* and *Spirodela sp.*) and common bladderwort (*Utricularia vulgaris*) are common. Forb species mostly consist of greater than 50 percent cattails (*Typha spp.*), along with less frequent occurrence of marsh cinquefoil, tufted loosestrife, and willow-herb. Shrubs are absent or very sparse.

2.7.3.2.4 Type 6 Shrub Swamp

Type 6 wetlands are widespread throughout the study area. These wetlands range in size and hydrologic connectivity from small, isolated depressions to large swamps embedded within larger wetland complexes having multiple wetland types. Type 6 wetlands were often present with Type 3 shallow marsh habitats. Typically Type 6 wetlands were dominated with shrub canopies comprised of monocultures of speckled alder or mixtures of alder, young black ash, and the occasional willow species (*Salix spp.*). Sweet gale (*Myrica gale*—OBL) and red-osier dogwood (*Cornus sericea*—FACW) were also occasionally observed in the Type 6 wetland communities.

Type 6 wetland soils typically consisted of deep organic soil (histosols), or similar to Type 3 basins, soil with a histic epipedon over sandy or clayey soil. Deep, dark peat and mucks were most commonly observed within larger wetland complexes. Other hydric soil indicators observed commonly included depleted matrices in subsurface mineral soils, gleying in subsurface soils, low chroma colors in mineral soils, and occasionally high organic content at the surface of sandy soils. Type 6 wetlands typically had soils saturated to the surface and/or standing water.

The Type 6 scrub-shrub within the West Range Site, its accessible Associated Facilities corridors, and accessible HVTL corridors, could be characterized by the MDNR vegetative classification system (2003) as forested rich peatland *(northern alder swamp)* (MDNR code FPn73a) wetlands. These scrub-shrub wetlands resemble the northern wet meadow/carr (WMn82) graminoids and forbs, but have significant amounts of speckled alder (*Alnus rugosa*).

2.7.3.2.5 Type 7 Wooded Swamp

Type 7 wetlands are also common across the West Range Site, its accessible Associated Facilities corridors, and accessible HVTL corridors. These habitats are generally comprised of pure stands of black ash or with mixed stands of black ash, black spruce, balsam poplar (*Populus balsamifera*—FACW), balsam fir (*Abies balsamea*—FACW), and quaking aspen (*Populus tremuloides*—FAC). A shrub layer of speckled alder and young trees was observed occasionally. The herbaceous layer was typically dominated with species common to the Type 3 wetlands areas, such as Canada blue-joint, sedges, marsh marigold, and jewelweed.

The Type 7 wetlands on the West Range Site, its accessible Associated Facilities corridors, and accessible HVTL corridors, vary in size from small, isolated depressions to large complexes with multiple wetland types. These wetlands are classified as semi-permanently-flooded (PFO1F), seasonally flooded (PFO1C), or saturated (PFO1B) wetlands depending on their landscape position. Many of the small, isolated depressions are found in the heavy forested areas west of the existing utility ROW that bisects the site. These basins appear to be ephemeral with seasonal flooding in the spring or early summer; surface water evaporation follows in mid-summer leaving the basin saturated for much of the remaining growing season. In contrast, the large forested swamps are typically found in a complex of wetland types, including shallow marsh, scrub-shrub, and sometimes bog habitats. These large complexes provide much of the natural drainage through the site and are hydrologically connected to other upstream and downstream resources outside of the project area.

Soils in the Type 7 wetlands were similar to Type 6 wetland habitat with deep organic mucks forming a histic epipedon over sandy or clayey soils. In some of the large wetland complexes the soils consisted of deep peat and muck soils (histosols). The small, isolated basins typically had soils with dark surface horizon of muck or mineral soils over depleted subsurface clay loams. The Type 7 wetlands were typically saturated to the surface or were inundated with a few inches to several feet of standing water.

The Type 7 forested swamps within the West Range Site, its accessible Associated Facilities corridors, and accessible HVTL corridors, could be characterized by the MDNR vegetative classification system (2003) as *northern wet ash swamp* (MDNR code WFn55) or *northern very wet ash swamp* (MDNR code WFn64) wetlands. These wetlands may have pools of water that drain by late summer (WFn55) or are persistent throughout summer (WFn64). As described above, both of these conditions were observed throughout the forested swamps on-site, where smaller, isolated depressions tended to drain by mid-summer, but larger forested swamps were inundated throughout the season.

2.7.3.2.6 Type 8 Bogs

Type 8 bogs and fens are common to this region of Minnesota. There are several areas of Type 8 bog habitat throughout the West Range Site, its accessible Associated Facilities corridors, and accessible HVTL corridors. The majority of the bog habitat is dominated by conifers and would be classified as PFO4B.

The dominant vegetation associated with bog habitat included black spruce and tamarack (*Larix laracina*—OBL). In the understory or canopy openings, ericaceous shrubs and other heath vegetation were dominant. These species included, but were not limited to Labrador tea (*Ledum groenlandicum*—OBL), leatherleaf (*Chamaedaphne calyculata*—OBL), bog rosemary (*Andromeda glaucophylla*—OBL), small cranberry (*Vaccinium oxycoccus*—OBL), and bog laurel (*Kalmia polifoila*—OBL). Other shrub species observed included speckled alder and bog birch (*Betula pumila*—OBL). The herbaceous layer was often comprised of cotton grass (*Eriophorum sp.*—BL), woolgrass, wiregrass sedge, mud sedge (*Carex limosa*—OBL), three-seeded bog sedge (*C. trisperma*—OBL), northern pitcher plant (*Sarracenia purpurea*—OBL), northern manna grass (*Glyceria borealis*—OBL), horsetail, Canada blue-joint, and northern bog orchid (*Platanthera hyperborea*—FACW+) all growing in deep sphagnum moss (*Sphagnum sp.* —NI) peats. Sphagnum moss, Labrador tea, leatherleaf and small cranberry were often the most dominant species found in this diverse herbaceous layer.

In areas closest to the adjacent upland where groundwater influence would be higher, floating sphagnum mats were encountered and wetland vegetation trended toward more deciduous shrubs, sedges, and grasses. In the areas away from the wetland edge, the sphagnum soils were dense and with less influence from the shallow surficial groundwater, where vegetation trended toward ericaceous shrubs, cottongrass, and conifers. This difference in habitat conditions demonstrates the boundary between true bog habitat with little groundwater influence and fen habitat in the lagg area with groundwater influence from the surrounding upland.

The Type 8 bogs were comprised of deep peat soils (histosols) that were saturated to the surface with sphagnum moss. The peat soils varied in decomposition with rather undecomposed fibric peat (Oi) at the surface, to moderately decomposed hemic peat (Oe) from 1–2 feet below the surface, to well decomposed sapric peat (Oa) several feet below the surface.

The Type 8 bog habitats within the West Range Site could be characterized by the MDNR vegetative classification system (2003) as *northern rich tamarack swamp (western basin)* (MDNR code FPn82) and *black spruce bog* (MDNR code APn80a) of both the treed subtype (APn80a) and the semi-treed subtype (APn80ba).

The main area of *northern rich tamarack swamp* is within the large wetland complex along the southern boundary of the IGCC Power Station Footprint and Buffer Land (Wetland A1). *Northern rich tamarack swamp* is characterized by its presence on moderately deep to deep peat in basins on glacial till or outwash deposits. It is also found occasionally along margins of large peatlands on glacial lake plains or on floating mats along lake or river shores. These tamarack swamps on-site could be further characterized as rich tamarack— *(alder)* swamp (MDNR code FPn82a) where the habitat is dominated by tamarack, but often with black spruce. Speckled alder, bog birch, and bog willow (*Salix pedicillaris*) are common in the tall-shrub layer, and low, ericaceous shrubs usually have greater than 25 percent cover. The moss layer contributes to greater than 50 percent cover, has hummocks and often water-filled hollows throughout the wetland. Graminoids and forbs contribute about 25–50 percent coverage. The shrub layer is most frequently dominated by Labrador tea.

The *black spruce bog* habitats within the IGCC Power Station Footprint and Buffer Land were observed at the north end of Dunning Lake and within the large wetland complex (Wetland A1) near this area’s southern boundary. Black spruce bog is typically found on deep peat, and the canopy is often sparse, with stunted trees. The understory is dominated by ericaceous shrubs and fine-leaved graminoids on high hummocks of *Sphagnum* moss. The black spruce bog near Dunning Lake could be characterized as semi-treed (APn80a2), because the canopy is relative open (less than 50 percent cover) with water tables high enough to limit tree development. Three-seeded bog sedge (*Carex trisperma*) and cotton grass (*Eriophorum* sp.) were both commonly observed in this area. In contrast, the black spruce bog observed within the large wetland complex Wetland A1 could be characterized as treed (APn80a1). This area had a dense canopy of black spruce (greater than 50 percent coverage), creating habitat suitable for more shade-tolerant species. This habitat is best developed on upper portions raised bog crests, where drainage is more suitable for tree growth.

2.7.3.3 Wetlands Along Utility Water Crossings

Utility crossings over, under, or through water bodies listed as protected waters or wetlands on the MDNR PWI will require Licenses for Utility Crossings of Public Lands and Waters under Minnesota Statutes 84.415 and subsequent Minnesota Rules Chapter 6135. The MDNR Division of Land and Minerals is the administrative agency issuing 25 and 50-year licenses, which may be renewed at the end of the licensing period if both parties (i.e., the project applicant and the MDNR) wish to renew these licenses. The renewal fee and time period of the renewed license(s) are developed by the MDNR Commissioner when an applicant wishes to renew. Those protected water or wetlands that will be crossed by the HVTL, gas pipelines, and blowdown Process Water Supply Pipeline Alternative 1, which require a License for the crossings, are identified in the following subsections. For rivers or streams affected by the HVTL, gas pipelines, and blowdown Process Water Supply Pipeline Alternative 1, a discussion regarding cold and warm water habitats is provided in Section 2.10, Ecological Resources.

There are several streams and rivers, and one body of water that will be crossed for the various utility alternatives associated with the West Range Site. These water crossings are limited to the corridors associated with the HVTL, gas pipelines, and one water process line. There are no water crossings associated with siting, placement, or construction of the IGCC Facility, the railroad alternatives, sewer and water line, and roads. The following subsections describe the water crossings within the HVTL, gas pipelines, and water process lines.

2.7.3.3.1 West Range HVTL Alternative 1

There are a total of two river or stream crossings associated with HVTL Alternative 1. These crossings are over the Swan River (perennial) and a perennial stream between Big and Little Diamond Lakes. The perennial stream between Big and Little Diamond Lakes was the only water crossing along this alternative that was field surveyed during the 2005 field season due to access limitations. The Swan River is identified as a protected water by the MDNR PWI, and therefore would require a license to cross this waterbody for HVTL Alternative 1.

Wetland habitat associated with the water crossings for HVTL Alternative 1 is based on NWI classification and mapping. In areas where 2005 field surveys were conducted, the classification given is based on observations made during the field surveys. The wetland habitat for the Swan River crossing is mapped by NWI as Type 6 (PSS/EM5C) scrub-shrub habitat. The perennial stream between Big and Little Diamond Lake was mapped during the 2005 field surveys and included Type 3 (PEMC) shallow marsh habitat. Total length of water crossings for this alternative is estimated at 123 linear feet. The location and wetland types associated with the water crossings for HVTL Alternative 1 are summarized in the following table.

Table 2.7-5
Water Crossings for West Range HVTL Alternative 1

Stream Crossing Location	MDNR PWI	Milepost (mile + linear ft)	Length of Waterbody Crossing	Adjacent Wetland Types	
				Cowardin	Circular 39
Perennial stream between Big & Little Diamond Lakes (Basin E1)*	Yes	0+3980	3 linear ft	PEMC	Type 3
Swan River (perennial)	No	3+1630	120 linear ft	PSS/EM5C	Type 6
		Total	**123 linear ft**		
* = This information has been field verified.					

2.7.3.3.2 West Range HVTL Alternative 1A

There are a total of six river or stream crossings associated with HVTL Alternative 1A. Five of these crossings are over the Swan River (perennial) and one crossing is over a perennial stream between Big and Little Diamond Lakes. The perennial stream between Big and Little Diamond Lakes was the only water crossing in this alternative that was field surveyed during the 2005 field season due to access limitations. The Swan River is identified as a protected water by the MDNR PWI, and therefore would require a license to cross.

Wetland habitats associated with the water crossings for the Alternate Route WRA-1A are based on NWI classification and mapping. In areas where 2005 field surveys were conducted, the classification given is based on observations made during the field surveys. The wetland habitat for one of the Swan River crossings is mapped by NWI as Type 6 (PSS/EM5C) scrub-shrub habitat. The other Swan River crossings have no wetland habitats mapped by the NWI, and no classification is given for the streambed in these areas. The perennial stream between Big and Little Diamond Lake was mapped during the 2005 field surveys and included Type 3 (PEMC) shallow marsh habitat. Total length of water crossings for this alternative is estimated at 533 linear feet. The location and wetland types associated with the water crossings for HVTL Alternative 1A are summarized Table 2.7-6.

Table 2.7-6
Water Crossings for West Range Plan A Alternate Route WRA-1A

Stream Crossing Location	MDNR PWI	Milepost (mile + linear ft)	Length of Waterbody Crossing	Adjacent Wetland Types	
				Cowardin	Circular 39
Perennial stream between Big & Little Diamond Lakes (Basin E1)*	No	0+3980	3 linear ft	PEMC	Type 3
Swan River (perennial)	Yes	3+1700	60 linear ft	PSS/EM5C	Type 6

Stream Crossing Location	MDNR PWI	Milepost (mile + linear ft)	Length of Waterbody Crossing	Adjacent Wetland Types	
				Cowardin	Circular 39
Swan River (perennial)	Yes	3+2960	60 linear ft	No classification given by NWI	No classification given by NWI
Swan River (perennial)	Yes	3+3575	50 linear ft	No classification given by NWI	No classification given by NWI
Swan River (perennial)	Yes	3+4400	270 linear ft	No classification given by NWI	No classification given by NWI
Swan River (perennial)	Yes	4+360	90 linear ft	No classification given by NWI	No classification given by NWI
		Total	**533 linear ft**		

* = This information has been field verified.

2.7.3.3.3 West Range Plan B Phase II Alternate Route (WRB-2A)

There are a total of five water crossings associated with Alternate Route WRB-2A. Two crossings are over the Swan River (perennial) and one of its perennial tributaries. The other three crossings are associated with Snowball and Oxhide Creeks (both perennial), and Oxhide Lake. The Swan River and its tributary, Snowball Creek, and Oxhide Lake are identified as protected waters by the MDNR PWI, and therefore would require a license to cross. Lakes and wetlands designated as MDNR Protected Waters or Wetlands receive a unique identification number, but streams and rivers do not. In this case, the MDNR PWI identification number for Oxhide Lake is 106P.

Wetland habitats associated with the water crossings for Plan B Phase II Alternate Route WRB-2A are based on NWI classification and mapping. The wetland habitat for the Swan River crossing is mapped by NWI as Type 3 (PEM5C) shallow marsh habitat. The tributary of the Swan River tributary, which is the outlet of Lower Panasa Lake, and Oxhide Creek have no wetland habitats mapped by the NWI, and no classification is given for the streambed in this area. Snowball Creek is mapped by NWI as Type 2 (PEM5B) wet meadow habitat. Oxhide Lake is identified as Type 5 (L1UBH) deep water habitat and Type 6 (PSS1/EM5C) scrub-shrub habitat. Total length of water crossings for this alternative is estimated at 283 linear feet. The location and wetland types associated with the water crossings for Plan B Phase II Alternate Route WRB-2A are summarized in Table 2.7-7.

Table 2.7-7
Water Crossings for West Range HVTL Plan B Phase II Alternate Route WRB-2A

Stream Crossing Location	MDNR PWI	Milepost (mile + linear ft)	Length of Waterbody Crossing	Adjacent Wetland Types	
				Cowardin	Circular 39
Swan River (perennial)	Yes	14+0	190 linear ft	PEM5C	Type 3
Tributary of Swan River, outlet of Lower Panasa Lake (perennial)	Yes	12+4640	3 linear ft	No classification given by NWI	No classification given by NWI
Snowball Creek (perennial)	Yes	11	10 linear ft	PEM5B	Type 2
Oxhide Lake	Yes (PWI 106P)	8+2220	70 linear ft	L1UBH, PSS1/EM5C	Type 5, Type 6
Oxhide Creek (perennial)	Yes	9+2880	10 linear ft	No classification given by NWI	No classification given by NWI
		Total	**283 linear ft**		

2.7.3.3.4 Proposed West Range Natural Gas Pipeline Route

There are a total of four river or stream crossings associated with Proposed Natural Gas Pipeline Route. Two of these crossings are over the Swan River (perennial). The other crossings are over a tributary of the Swan River (perennial) and a perennial stream between Big and Little Diamond Lakes. The perennial stream between Big and Little Diamond Lakes was the only water crossing in this alternative that was field surveyed during the 2005 field season due to access limitations. The Swan River is the only waterbody identified as a protected water by the MDNR PWI, and therefore would require a license to cross this waterbody for Gas Pipeline 1.

Wetland habitats associated with the water crossings for the Proposed Natural Gas Pipeline Route are based on NWI classification and mapping. In areas where 2005 field surveys were conducted, the classification given is based on observations made during the field surveys. The wetland habitat for the two Swan River crossings is mapped by NWI as Type 1 (PFO1A) seasonally flooded and Type 6 (PSS/EM5C) scrub-shrub habitats. The wetland habitat at the tributary to the Swan River is mapped by NWI as Type 2 (PEM5Bd) wet meadow habitat. The perennial stream between Big and Little Diamond Lake was mapped during the 2005 field surveys and included Type 3 (PEMC) shallow marsh habitat. Total length of water crossings for this alternative is estimated at 133 linear feet. The location and wetland types associated with the water crossings for Gas Pipeline Alternative 1 are summarized in Table 2.7-8.

Table 2.7-8
Water Crossings for West Range Gas Pipeline Alternative 1

Stream Crossing Location	MDNR PWI	Milepost (mile + linear ft)	Length of Waterbody Crossing	Adjacent Wetland Types	
				Cowardin	Circular 39
Swan River (perennial)	Yes	4+2170	60 linear ft	PFO1A	Type 1
Tributary of Swan River (perennial)	No	5+1460	10 linear ft	PEM5Bd	Type 2
Swan River (perennial)	Yes	9+4560	60 linear ft	PSS/EM5C	Type 6
Perennial stream between Big & Little Diamond Lakes (Basin E1)*	No	12+2000	3 linear ft	PEMC	Type 3
		Total	**133 linear ft**		
* = This information has been field verified.					

2.7.3.3.5 West Range Natural Gas Pipeline Alternative 2

A total of four river or stream crossings are associated with the Natural Gas Pipeline Alternative 2 Route. Two of these crossings are over the Swan River (perennial). The other crossings are over the Prairie River (perennial) and a perennial stream between Big and Little Diamond Lakes. The perennial stream between Big and Little Diamond Lakes was the only water crossing in this alternative that was field surveyed during the 2005 field season due to access limitations. The Swan River and Prairie River are both identified as protected waters by the MDNR PWI, and therefore would require a license to cross these waterbodies for Gas Pipeline 2.

Wetland habitats associated with the water crossings for Gas Pipeline Alternative 2 are based on NWI classification and mapping. In areas where 2005 field surveys were conducted, the classification given is based on observations made during the field surveys. The wetland habitat for one crossing over the Swan River is mapped by NWI as Type 6 (PSS/EM5C) scrub-shrub habitat. The other Swan River crossing has no wetland habitats mapped by the NWI, and no classification is given for the streambed. The wetland habitat at the Prairie River is mapped by NWI as Type 6 (PSS/EM5C) scrub-shrub and riverine (R3UBH) habitat. The perennial stream between Big and Little Diamond Lake was mapped during the 2005 field surveys and included Type 3 (PEMC) shallow marsh habitat. Total length of water crossings for this alternative is estimated at 313 linear feet. The location and wetland types associated with the water crossings for Gas Pipeline Alternative 2 are summarized in Table 2.7-9.

Table 2.7-9
Water Crossings for West Range Natural Gas Pipeline Alternative 2 Route

Stream Crossing Location	MDNR PWI	Milepost (mile + linear ft)	Length of Waterbody Crossing	Adjacent Wetland Types	
				Cowardin	Circular 39
Prairie River (perennial)	Yes	0+1980	210 linear ft	R3UBH, PSS1/EM5C	Riverine, Type 6
Swan River (perennial)	Yes	5+4330	50 linear ft	No classification given by NWI	No classification given by NWI
Swan River (perennial)	Yes	10+4180	50 linear ft	PSS/EM5C	Type 6
Perennial stream between Big & Little Diamond Lakes (Basin E1)*	No	13+1690	3 linear ft	PEMC	Type 3
		Total	**313 linear ft**		
* = This information has been field verified.					

2.7.3.3.6 West Range Natural Gas Pipeline Alternative 3

There are a total of four river or stream crossings associated with the Natural Gas Pipeline Alternative 3 Route. These crossings are over the Prairie River and one of its tributaries, a perennial stream draining to Holman Lake, and a perennial stream between Big and Little Diamond Lakes. The perennial stream between Big and Little Diamond Lakes was the only water crossing in this alternative that was field surveyed during the 2005 field season due to access limitations. The Prairie River and the perennial stream that drains to Holman Lake are both identified as protected waters by the MDNR PWI, and therefore would require a license to cross these waterbodies for Gas Pipeline 3.

The wetland habitat associated with the water crossings for the Natural Gas Pipeline Alternative 3 Route is based on NWI classification and mapping. In areas where 2005 field surveys were conducted, the classification given is based on observations made during the field surveys. The wetland habitat adjacent to the Prairie River is mapped by NWI as Type 6 (PSS/EM5C) scrub-shrub and riverine (R3UBH) habitat. The tributary of Prairie River is mapped by NWI as Type 8 (PFOB) bog habitat. The perennial stream draining to Holman Lake is mapped by NWI as Type 3 (PEM/UBF) shallow marsh and Type 6 (PSS1/EMC) scrub-shrub habitat. The perennial stream between Big and Little Diamond Lake was mapped during the 2005 field surveys and included Type 3 (PEMC) shallow marsh habitat. Total length of water crossings for this alternative is estimated at 236 linear feet. The location and wetland types associated with the water crossings for Gas Pipeline Alternative 3 are summarized in Table 2.7-10.

Table 2.7-10
Water Crossings for West Range Natural Gas Pipeline Alternative 3 Route

Stream Crossing Location	MDNR PWI	Milepost (mile + linear ft)	Length of Waterbody Crossing	Adjacent Wetland Types	
				Cowardin	Circular 39
Prairie River (perennial)	Yes	0+2300	210 linear ft	R3UBH, PSS1/EM5C	Riverine, Type 6
Tributary of Prairie River (perennial)	No	2+880	20 linear ft	PFOB	Type 8
Perennial stream, drains to Holman Lake	Yes	9+3200	3 linear ft	PEM/UBF, PSS1/EM5C	Type 3, Type 6
Perennial stream between Big & Little Diamond Lakes (Basin E1)*	No	11	3 linear ft	PEMC	Type 3
		Total	**236 linear ft**		
* = This information has been field verified.					

2.7.3.3.7 West Range Process Water Supply Pipeline

The proposed process water supply pipelines do not cross any water bodies.

2.7.3.3.8 West Range Process Water Blowdown Pipeline 1 (IGCC Power Station Footprint to Holman Lake)

There are two stream crossings associated with the Blowdown Process Water Supply Pipeline 1. Both crossings are over perennial streams, one drains from Little Diamond Lake, and the other draining to Holman Lake. Neither stream was field surveyed during the 2005 field season due to access limitations. The NWI is the basis for evaluating wetlands associated with the stream crossings.

The perennial stream draining from Little Diamond Lake has no wetland habitats mapped by the NWI, and no classification is given for the streambed. The perennial stream draining to Holman Lake is mapped by NWI as Type 3 (PEM/UBF) shallow marsh and Type 6 (PSS1/EM5C) scrub-shrub habitat. Both crossings are approximately three feet in length. The location and wetland types associated with the stream crossings for Blowdown Water Process Line are summarized in Table 2.7-11.

Table 2.7-11
Water Crossings for West Range Blowdown Process Water Supply Pipeline 1

Stream Crossing Location	MDNR PWI	Milepost (mile + linear ft)	Length of Waterbody Crossing	Adjacent Wetland Types	
				Cowardin	**Circular 39**
Perennial stream from Little Diamond Lake	Yes	1+3990	3 linear ft	No classification given by NWI	No classification given by NWI
Perennial stream, drains to Holman Lake	Yes	2+2280	3 linear ft	PEM/UBF, PSS1/EM5C	Type 3, Type 6
		Total	**6 linear ft**		
* = This information has been field verified.					

2.7.3.3.9 West Range Blowdown Pipeline 2 (IGCC Power Station Footprint to CMP)

There are no water crossings associated with the Blowdown Pipeline Alternative 2.

2.7.4 East Range Wetlands

2.7.4.1 East Range Delineated Wetlands

A total of ten wetland basins were delineated for the East Range Site where accessible during October 2004 and August 2005. The results of the field delineation describe the wetland habitats encountered, field conditions, RODM data gathered for each wetland, and the location of all wetlands. Table 2.7-12 provides a summary of wetlands delineated for the East Range Site. Wetland impacts for the East Range Site and its Associated HVTL and Natural Gas Pipeline corridors are discussed under Environmental Consequences in Section 3.6.

2.7.4.1.1 IGCC Power Station Footprint and Buffer Land

The predominance of wetlands at the IGCC Power Station Footprint and Buffer Land includes Type 6 shrub swamps, Type 7 wooded swamps, and Type 8 bogs. Type 2 wet meadow habitat was also observed in several basins on the site. Type 3 shallow marshes and Type 4 deep marshes were less frequently encountered on-site, but observed where beaver activity has affected the wetland hydrology. No Type 1 seasonally saturated or Type 5 open water wetlands were delineated within the East Range Site or its associated utility and transportation corridors during 2004 or 2005.

The results of the wetland delineations within the IGCC Power Station Footprint and Buffer Lands are summarized in Table 2.7-12 and shown in Figure 2.7-3. (The upland terrestrial habitats and conditions are described in detail in Section 2.10).

Figure 2.7-3. Wetlands Within the East Range IGCC Power Station Footprint and Buffer Lands

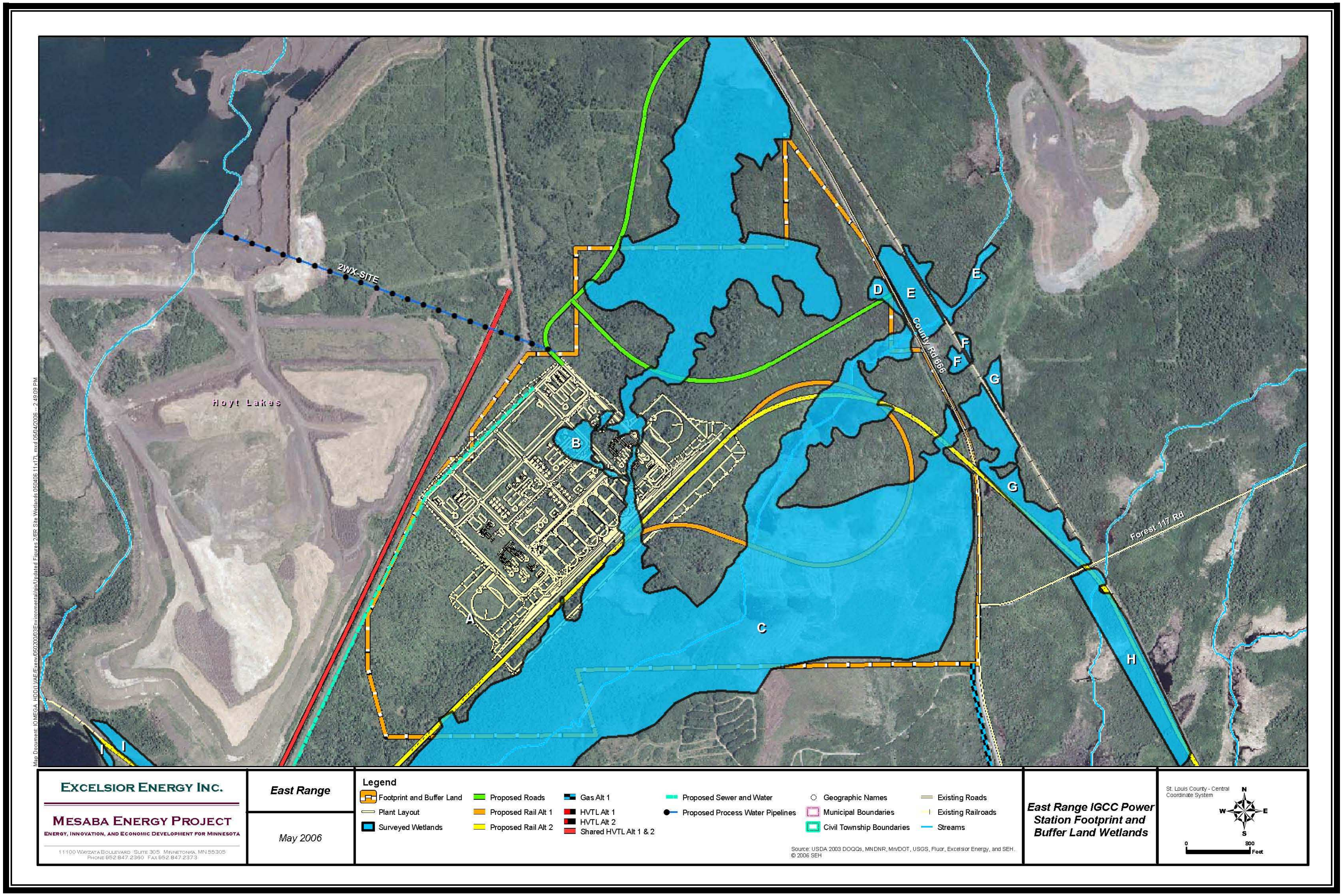


Table 2.7-12
East Range Wetland Characteristics

Basin ID	Approximate Total Wetland Area Delineated (Acres)[1]	Cowardin Classification	Circular 39 Classification
A	0.08	PEMC	Type 2
B	5.53	PFOC	Type 7
C	565.13	PEMC/PEMA/ PFOC/PSS1B/ PFO2B/PEMF/ PEMH	Type 2/Type 3/Type 4/ Type 6/Type 7/Type 8
D	2.03	PSS1B	Type 6
E	14.20	PSS1B	Type 6
F	2.11	PFOC/PFO2B	Type 7/Type 8
G	19.23	PFOC/PFO2B	Type 7/Type 8
H	18.79	PEMC/PFOC/PFO2B	Type 3/Type 7/Type 8
I	4.95	PSS1B	Type 6
J	0.07	PEMC	Type 2

[1] Total Wetland Area is an approximation based upon partially delineated wetland boundaries and the NWI. This acreage accounts for wetlands that were not delineated that extend beyond the established project limits.

2.7.4.2 Typical East Range Wetlands

The following paragraphs describe the typical characteristics of wetlands within the IGCC Power Station Footprint and Buffer Lands. Although not all of the utility and transportation corridors have been fully evaluated for wetlands, the following wetland descriptions provide a summary of typical habitat that can be applied to those wetlands with in the propose utility and transportation corridors.

2.7.4.2.1 Type 2 Wet Meadow

The Type 2 wet meadows primarily occurred as small isolated basins, although small amounts of Type 2 wetlands also existed in the fringe of the larger wetland complexes. Canada blue-joint grass (*Calamagrostis canadensis*—OBL) and woolgrass (*Scirpus cyperinus*—OBL) were the dominant vegetation in the wet meadow habitats. Red top (*Agrostis alba*—FACW), fowl manna grass (*Glyceria striata*—OBL), and several species of sedges (*Carex spp.*) were also common. Scattered black ash (*Fraxinus nigra*—FACW+) trees were also observed occasionally.

Type 2 wetland soils typically consisted of mineral surface horizons of sandy and loamy clays underlain by bedrock. Hydric soil indicators present included a depleted matrix in subsurface mineral soils, low chroma colors, and occasionally iron and manganese concretions. The primary hydrology indicators in the Type 2 wet meadows were that soils were saturated in the upper 12 inches.

The Type 2 wet meadows within the IGCC Power Station Footprint and Buffer Lands could be characterized by the MDNR vegetative classification system (2003) as *northern wet* *meadow/carr (sedge meadow, bluejoint subtype)* (MDNR code WMn82b1) wetlands. See Section 2.7.2.1 for a detailed description of this vegetative classification.

2.7.4.2.2 Type 3 Shallow Marsh

Type 3 shallow marshes occurred only in association with larger wetland complexes in the IGCC Power Station Footprint and Buffer Lands site. Type 3 wetlands were typically dominated by Canada blue-joint grass. Broad-leaf cattail (*Typha latifolia*—OBL), pickerelweed (*Pontederia cordata*—OBL), spotted joe-pye weed (*Eupatorium maculatum*—OBL), wire grass sedge (*Carex lasiocarpa*—OBL), and other species of sedges were also present.

Type 3 wetland soils typically consisted of black organic muck or peat (histosols) with a MUNSELL matrix color of 10YR2/1. In some areas where inundation from beaver activity is more recent, soils were a mix of silt and muck with a MUNSELL color of 2.5Y2.5/1. Hydrology throughout the Type 3 shallow marsh areas ranged from soils saturated to the surface to two feet of inundation in open water areas.

The Type 3 shallow marsh communities within the IGCC Power Station Footprint and Buffer Lands could be characterized by the MDNR vegetative classification system (2003) as *northern mixed cattail marsh [cattail-sedge marsh (northern)]* (MDNR code MRn83a) wetlands. See Section 2.7.2.1 for a detailed description of this vegetative classification.

2.7.4.2.3 Type 4 Deep Marsh

Type 4 deep marshes occurred in association with larger wetland complexes in the IGCC Power Station Footprint and Buffer Lands, specifically where hydrology has been altered by beaver activity. Type 4 deep marshes were dominated by broad-leaf cattail and pickerelweed in the fringe areas bordering open water.

Soils in Type 4 deep marshes were typically deep organic muck and peat (histosols). A mix of silts and muck soils were also observed in areas where recent beaver activity had occurred. Hydrology indicators observed included inundation with two to six feet of water, drift lines, and water marks.

The Type 4 deep marsh communities within the IGCC Power Station Footprint and Buffer Lands could be characterized by the MDNR vegetative classification system (2003) as *northern mixed cattail marsh [cattail marsh (northern)]* (MDNR code MRn83b) wetlands. See Section 2.7.2.1 for a detailed description of this vegetative classification.

2.7.4.2.4 Type 6 Shrub Swamp

Type 6 wetlands were common throughout the IGCC Power Station Footprint and Buffer Lands. Type 6 scrub-shrub swamps occurred both as single, isolated depressions as well as in association with larger wetland complexes. Type 6 wetland areas were commonly found between Type 3 shallow marshes and Type 7 wooded swamps and Type 8 bogs. Speckled alder (*Alnus rugosa*—OBL) typically dominated the scrub-shrub swamps while red-osier dogwood (*Cornus sericea*—FACW), black ash, and black spruce (*Picea mariana*—FACW) were also often observed in the shrub layer. Canada blue-joint grass and wire grass sedge dominated the herbaceous layer, while scattered broad-leaf cattail and red top were also observed.

Soils in the Type 6 scrub-shrub swamps typically consisted of a sandy clay surface horizon underlain by a clay horizon. Soils consisting of deep organic muck or peat (histosols) were observed in the large wetland complexes. One wetland had no soils; the substrate consisted of rock and gravel. Hydric soil indicators observed included a depleted matrix in subsurface mineral soils, iron and manganese concretions, and low chroma colors in mineral soils. Type 6 wetlands typically had soils that were saturated to the surface or inundated with up to six inches of water.

The Type 6 scrub-shrub within the IGCC Power Station Footprint and Buffer Lands could be characterized by the MDNR vegetative classification system (2003) as *forested rich peat land (northern alder swamp)* (MDNR code FPn73a) wetlands. See Section 2.7.2.1 for a detailed description of this vegetative classification.

2.7.4.2.5 Type 7 Wooded Swamps

Type 7 wooded wetlands were also common throughout the IGCC Power Station Footprint and Buffer Lands. These habitats were typically associated with Type 8 bogs. These wetlands were typically comprised of white cedar (*Thuja occidentalis*—FACW), black ash, or speckled alder with lesser amounts of black spruce, and tamarack (*Larix laricina*—FACW). Speckled alder, black spruce, tamarack, and quaking aspen (*Populus tremuloides*—FAC) were also found in the shrub layer. The herbaceous layer was mostly comprised of Canada blue-joint grass, wiregrass sedge, and sphagnum moss.

Soils in the Type 7 wooded swamps were typically comprised of deep organic black muck or peat (histosols). Less frequently, layers of relatively shallow peat were underlain by a thick layer of mineral muck. The soils in the Type 7 wetlands were saturated to the surface or inundated with two to three inches of standing water.

The Type 7 wooded swamps within the IGCC Power Station Footprint and Buffer Lands could be characterized by the MDNR vegetative classification system (2003) as *northern cedar swamp (white cedar swamp [northeast])* (MDNR code FPn63a) wetlands if the canopy was dominated by coniferous species such as white cedar and black spruce and if the soils consist of deep peat. The Type 7 wooded swamps could be classified as *northern wet cedar forest (lowland white cedar forest [northern])* (MDNR code WFn53b) wetlands if they are characterized by a codominance of black ash and white cedar in the canopy and their soils consist of a relatively shallow layer of peat over mineral soils.

2.7.4.2.6 Type 8 Bogs

Type 8 bogs were common throughout the IGCC Power Station Footprint and Buffer Lands. The majority of the bog habitat is dominated by conifers such as black spruce, white cedar, and tamarack. The bog understory was dominated by a thick sphagnum moss mat along with leatherleaf (*Chamaedaphne calyculata*—OBL).

Soils in the Type 8 bogs consisted of deep organic black peat soils (histosols). The peat soils varied in decomposition with rather undecomposed fibric peat (Oi) at the surface, to moderately decomposed hemic peat (Oe) from 1–2 feet below the surface, to well decomposed sapric peat (Oa) several feet below the surface. The soils in the Type 8 wetlands were saturated to the surface.

The Type 8 bog habitats within the IGCC Power Station Footprint and Buffer Lands could be characterized by the MDNR vegetative classification system (2003) as *northern rich tamarack swamp (western basin)(rich tamarack - [alder] swamp)* (MDNR code FPn82a). See Section 2.7.2.1 for a detailed description of this vegetative classification.

2.7.4.3 Wetlands Along East Range Utility Water Crossings

Construction of Associated Facilities corridors associated with the East Range Site and HVTL and Natural Gas Pipeline Routes will require crossing streams, rivers, and other bodies of water. These water crossings are limited to the routes associated with the HVTLs, Natural Gas Pipeline, and three water process lines, the potable water and sewer pipeline, and rail lines. There are no water crossings associated with siting, placement, or construction of the IGCC Power Station Footprint, Access Road 1, and Access Road 2. The following subsections describe the water crossings that will be encountered.

Utility crossings over, under, or through water bodies listed as protected waters or wetlands on the MDNR PWI will require Licenses for Utility Crossings of Public Lands and Waters under Minnesota Statutes 84.415 and subsequent Minnesota Rules Chapter 6135. The MDNR Division of Land and Minerals is the administrative agency issuing 25 and 50-year licenses, which may be renewed at the end of the licensing period if both parties (i.e., the project applicant and the MDNR) wish to renew these licenses. The renewal fee and time period of the renewed license(s) are developed by the MDNR Commissioner when an applicant wishes to renew. Those protected water or wetlands that will be crossed by the HVTL, gas pipeline, process water lines, potable water and sewer pipeline, and rail lines which require a license for the crossings, are identified in the following subsections. For rivers or streams affected by the HVTL, gas pipeline, process water lines, potable water and sewer pipeline, and rail lines, a discussion regarding cold and warm water habitats is provided in Section 2.10, Ecological Resources.

Maps showing the locations of each of the following water crossings by HVTL and natural gas pipeline routes are shown on the maps provided in Section 1.5.

2.7.4.3.1 East Range 38L HVTL Route

There are a total of 21 crossings of streams or other water bodies associated with 38L HVTL Route. These crossings were not field surveyed during the 2004 or 2005 field seasons due to access limitations. Therefore, the NWI was used as the basis for evaluating wetlands associated with water crossings. The longest crossing is over Colby Lake, with a linear crossing of approximately 540 linear feet.

The wetland habitat information associated with the water crossings for the 38L Route is based on the NWI classification and mapping. The locations and wetland types associated with each crossing are described in Table 2.7.13. The total length of water crossings for this Route is estimated at 1194 linear feet. Colby Lake, an unnamed pond, and nine other rivers and streams are identified as protected waters by the MDNR PWI, and therefore would require a license to be crossed.

Table 2.7-13
Water Crossings for East Range 38L HVTL Route

Stream Crossing Location	Milepost (mile + linear ft)	MDNR PWI	Length of Crossing (linear ft)	Adjacent Wetland Types	
				Cowardin	Circular 39
Colby Lake	1+4670	Yes 249 P	540	PUBH	5
Partridge River	5+1190	Yes	110	R3UBH	Riverine
Perennial Tributary to St. Louis River	6+3680	No	3	PSS1	6
Perennial Tributary to St. Louis River	6+4590	Yes	3	PSS1	6
Perennial Tributary to St. Louis River	8+1215	No	3	PSS1	6
Perennial Tributary to St. Louis River	8+2420	No	3	PEM	2
Unnamed Pond	9+0480	Yes 430 W	180	PUBH	5
Perennial Stream between North and South Cedar Island Lake	11+1780	Yes	60	n/a	n/a
Perennial Stream South of Forge Lake	13+1850	No	95	PSS/PEMC	6
Perennial Tributary to Esquagama Lake	15+0670	Yes	3	PSS/PEMC	6
Perennial Ditch to Esquagama Lake	15+3590	No	3	PSSB	6
Perennial Tributary to Embarrass River	16+3900	No	60	n/a	n/a
Intermittent Stream to Embarrass River	16+4900	No	3	PSSB	6
Ely Creek	22+0090	Yes	3	n/a	n/a

Stream Crossing Location	Milepost (mile + linear ft)	MDNR PWI	Length of Crossing (linear ft)	Adjacent Wetland Types	
				Cowardin	Circular 39
Perennial Stream south of Half Moon Lake	23+4750	No	3	n/a	n/a
Intermittent Stream north of Long Lake Creek	26+4020	No	3	PSS/PEM5C	6
Long Lake Creek	27+0360	Yes	3	n/a	n/a
Perennial Stream north of St. Louis River	29+3250	Yes	3	PSS/EM5C	6
Elbow Creek	30+1230	Yes	15	PSS1/EM5C	6
Perennial Stream north of Elbow Creek	30+4100	No	3	PSSB	6
Two River (in 3 places due to meander)	31+2840	Yes	95	n/a	n/a
Total			**1194 linear ft**		

2.7.4.3.2 East Range 39L/37L HVTL Route

There are a total of 20 crossings of streams or other water bodies associated with the 39L/37L HVTL Route. These crossings were not field surveyed during the 2004 or 2005 field seasons due to access limitations. Therefore, the NWI was used as the basis for evaluating wetlands associated with these water crossings. The largest water crossing is over Colby Lake, with a linear crossing of approximately 540 feet.

The wetland habitats associated with the water crossings for the 39L/37L HVTL Route are based on the NWI classification and mapping. The locations and wetland types associated with each crossing are described in Table 2.7-14. The total length of water crossings for this alternative is estimated at 1760 linear feet. Colby Lake, Deep Lake, and seven other rivers and streams are designated as protected waters by the MDNR PWI, and therefore would require a license to be crossed.

Table 2.7-14
Water Crossings for East Range HVTL Alternative 2

Stream Crossing Location	Milepost (mile + linear ft)	MDNR PWI	Length of Waterbody Crossing	Adjacent Wetland Types	
				Cowardin	Circular 39
Colby Lake	1+4760	Yes 249 P	540	PUBH	5
Partridge River	5+3020	Yes	250	n/a	n/a
Perennial Tributary to St. Louis River	7+1110	Yes	80	PSS1/EM5C	6
Perennial Tributary to St. Louis River	8+2300	Yes	3	n/a	n/a
Perennial Tributary to St. Louis River	8+2980	No	3	n/a	n/a
Perennial Drainage Ditch to wetland	12+1410	No	6	PSS/EM5B/ D	6
Embarrass River	15+1140	No	3	n/a	n/a
Embarrass River	15+1490	Yes	70	n/a	n/a
Deep Lake	19+2260	Yes 666 P	690	L1UBH	5
Perennial Stream west of Deep Lake (2 crossings in meander)	19+4840	No	6	n/a	n/a
Perennial Stream west of Deep Lake	20+1540	No	3	n/a	n/a
Unnamed Intermittent Stream	22+4080	Yes	3	n/a	n/a
Perennial Ditch to Mine Dump	25+0960	No	3	n/a	n/a
Perennial Stream to Mine Dump	25+1960	No	3	PSS1/EM5C	6
Elbow Creek	28+5130	Yes	15	PEM5B	2
Perennial Ditch to East Two River	30+2190	No	3	PFO4/SS3Bg	8

Stream Crossing Location	Milepost (mile + linear ft)	MDNR PWI	Length of Waterbody Crossing	Adjacent Wetland Types	
				Cowardin	Circular 39
Perennial Stream to East Two River	31+1910	No	3	PSSB	6
East Two River	32+0810	Yes	70	PSS1/EM5C	6
Unnamed Perennial Stream	33+0340	No	3	PFO4	7
Perennial Ditch to Two River	34+4960	No	3	n/a	n/a
Total			**1760 linear ft**		

2.7.4.3.3 Proposed East Range Natural Gas Pipeline Route

There are a total of 19 crossings of streams or other water bodies associated with the Proposed Natural Gas Pipeline Route. These crossings were not field surveyed during the 2004 or 2005 field seasons due to access limitations. Therefore, the NWI was used as the basis for evaluating wetlands associated with these water crossings. The largest water crossing is over Colby Lake, with a linear crossing of approximately 430 feet.

Wetland habitats associated with the water crossings for the Proposed Natural Gas Pipeline Route are based on the NWI classification and mapping. The locations and wetland types associated with each crossing are described in Table 2.7-15. The total length of water crossings for this alternative is estimated at 792 linear feet. Colby Lake and twelve rivers and streams are designated as protected waters by the MDNR PWI, and therefore would require a license to be crossed.

Table 2.7-15
Water Crossings for Proposed East Range Natural Gas Pipeline Route

Stream Crossing Location	Milepost (mile + linear ft)	MDNR PWI	Length of Waterbody Crossing	Adjacent Wetland Types	
				Cowardin	Circular 39
Elbow Creek	1+3580	Yes	20	PEM5B	2
Unnamed Perennial Stream	4+1010	No	3	PFO4B/PFO6	7/8
Perennial Stream from Mud to Horseshoe Lake	5+2840	Yes	3	PSSC/PFOB	6/8
Perennial Ditch from Airport to Ely Creek	8+0550	No	3	n/a	n/a
Perennial Ditch from Airport to Ely Creek	8+1030	No	3	n/a	n/a

Stream Crossing Location	Milepost (mile + linear ft)	MDNR PWI	Length of Waterbody Crossing	Adjacent Wetland Types	
				Cowardin	Circular 39
Ely Creek	9+3530	Yes	3	PSSB/PFO/ SS1C	6/7
Perennial Ditch from Leaf Lake	12+2370	No	3	PEM5B/PSSB /PFO4/SSB	2/7/8
Perennial Stream to Esquagama Lake	13+4720	Yes	15	PSS/EM5C	6
Perennial Stream to Esquagama Lake	14+1790	Yes	15	n/a	n/a
Perennial Ditch to Esquagama Lake	15+0710	No	3	PSS/EM5B	6
Perennial Stream from Fourth Lake to Esquagama Lake	15+3620	Yes	90	n/a	n/a
Perennial Stream to St. Louis River	19+3500	No	3	n/a	n/a
Perennial Stream to St. Louis River	19+4350	Yes	3	n/a	n/a
Perennial Stream to St. Louis River	21+1880	Yes	15	PSS1/EM5C	6
Perennial Stream to St. Louis River	21+3380	No	15	PSS1/EM5C	6
Partridge River	24+0960	Yes	100	PSS1B/PEM5 B	6
Colby Lake	25+1490	Yes	430	n/a	n/a
Partridge River	27+3230	Yes	50	PFO/SS1C	7
Wyman Creek	28+0950	Yes	15	n/a	n/a
		Total	**792 linear ft**		

2.7.4.3.4 East Range Process Water Supply Pipeline—Area 6 and Stephens Mine to Area 2WX

There are two crossings of streams or other water bodies associated with Process Water Supply Pipeline – Area 6 and Stephens Mine to Area 2WX. These crossings were not field surveyed during the 2004 or 2005 field seasons due to access limitations. Therefore, the NWI was used as the basis for evaluating wetlands associated with these water crossings. The largest water crossing is over Second Creek, with a linear crossing of approximately 30 feet.

Wetland habitats associated with the water crossings for the Process Water Supply Pipeline – Area 6 and Stephens Mine to Area 2WX are based on the NWI classification and mapping. The wetland types associated with each crossing are described below in Table 2.7-16. The total length of water crossings for this alternative is estimated at 33 linear feet. Both Stephens Creek and Second Creek are designated as protected water by the MDNR PWI, and therefore would require a license to be crossed.

Table 2.7-16
Water Crossings for East Range Process Water Supply Pipeline—Area 6 and Stephens Mine to Area 2WX

Stream Crossing Location	Milepost (mile + linear ft)	MDNR PWI	Length of Waterbody Crossing	Adjacent Wetland Types	
				Cowardin	Circular 39
Stephens Creek	n/a	Yes	3	PSSC	6
Second Creek	n/a	Yes	30	n/a	n/a
		Total	**33 linear ft**		

2.7.4.3.5 East Range Process Water Supply Pipeline—Area 9 South to Area 6

There is one crossing of a stream or other water body associated with Process Water Supply Pipeline – Area 9 South to Area 6 (Table 2.7-17). This crossing was not field surveyed during the 2004 or 2005 field seasons due to access limitations. Therefore the NWI was used as the basis for evaluating wetlands associated with this water crossing.

The NWI does not show any wetlands associated with Process Water Supply Pipeline – Area 9 South to Area 6 in the area of this crossing. Total length of water crossing for this pipeline is estimated at 3 linear feet. First Creek is designated as protected water by the MDNR PWI, and therefore would require a license to be crossed.

Table 2.7-17
Water Crossings for East Range Process Water Supply Pipeline—Area 9 South to Area 6

Stream Crossing Location	Milepost (mile + linear ft)	MDNR PWI	Length of Waterbody Crossing	Adjacent Wetland Types	
				Cowardin	Circular 39
First Creek	n/a	Yes	3	n/a	n/a
		Total	**3 linear ft**		

2.7.4.3.6 East Range Process Water Supply Pipeline—Area 9 North (Donora Mine) to Area 6

There is one crossing of a stream or other water body associated with Process Water Supply Pipeline – Area 9 North (Donora Mine) to Area 6 (Table 2.7-18). This crossing was not field surveyed during the 2004 or 2005 field seasons due to access limitations. Therefore the NWI was used as the basis for evaluating wetlands associated with the water crossing.

The NWI does not show any wetlands associated with Process Water Supply Pipeline – Area 9 North (Donora Mine) to Area 6 in the area of this crossing. The total length of water crossing for this pipeline is estimated at 3 linear feet. First Creek is designated as protected water by the MDNR PWI, and therefore would require a license to be crossed.

Table 2.7-18
Water Crossings for East Range Process Water Supply Pipeline—Area 9 North (Donora Mine) to Area 6

Stream Crossing Location	Milepost (mile + linear ft)	MDNR PWI	Length of Waterbody Crossing	Adjacent Wetland Types	
				Cowardin	Circular 39
First Creek	n/a	Yes	3	n/a	n/a
		Total	**3 linear ft**		

2.7.4.3.7 East Range Potable Water and Sewer Pipelines

There is one crossing of a stream or other water body associated with the Potable Water and Sewer Pipelines (Table 2.7-19). This crossing was not field surveyed during the 2004 or 2005 field seasons due to access limitations. Therefore the NWI was used as the basis for evaluating wetlands associated with this water crossing.

The NWI does not show any wetlands associated with the Potable Water and Sewer Pipelines in the area of this crossing. The total length of water crossing for these pipelines is estimated at 460 linear feet. Colby Lake is designated as protected water by the MDNR PWI, and therefore would require a license to be crossed.

Table 2.7-19
Water Crossings for East Range Potable Water and Sewer Pipelines

Stream Crossing Location	Milepost (mile + linear ft)	MDNR PWI	Length of Waterbody Crossing	Adjacent Wetland Types	
				Cowardin	Circular 39
Colby Lake	1+3720	Yes 249 P	460	n/a	n/a
		Total	**460 linear ft**		

2.7.4.3.8 East Range Rail Line Alternative 1

There are two crossings of streams or other water bodies associated with Rail Line Alternative 1. A tributary to Colby Lake is crossed twice by the center loop for the rail line. This area was field delineated during the 2004 and 2005 field seasons. The wetland types associated with each crossing are described below in Table 2.7.20.

Total length of water crossings for this alternative is estimated at 6 linear feet. This tributary is designated as protected water at both points of crossing by the MDNR PWI, and therefore would require a license to be crossed.

Table 2.7-20
Water Crossings for East Range Rail Line Alternative 1

Stream Crossing Location	Milepost (mile + linear ft)	MDNR PWI	Length of Waterbody Crossing	Adjacent Wetland Types	
				Cowardin	Circular 39
Tributary to Colby Lake (North Crossing)	n/a	Yes	3	PEMC/PEMA/ PFOC/PSS1B/ PFO2B/PEMF/ PEMH	Type 2/Type 3/Type 4/ Type 6/Type 7/Type 8
Tributary to Colby Lake (South Crossing)	n/a	Yes	3	PEMC/PEMA/ PFOC/PSS1B/ PFO2B/PEMF/ PEMH	Type 2/Type 3/Type 4/ Type 6/Type 7/Type 8
		Total	**6 linear ft**		

2.7.4.3.9 East Range Rail Line Alternative 2

There are two crossings of streams or other water bodies associated with Rail Line Alternative 2. These areas were field delineated during the 2004 and 2005 field seasons. The wetland types associated with each crossing are described below in Table 2.7-21.

Total length of water crossings for this alternative is estimated at 6 linear feet. Both Wyman Creek and the tributary to Colby Lake are designated as protected waters by the MDNR PWI, and therefore would require a license to be crossed.

Table 2.7-21
Water Crossings for East Range Rail Line Alternative 2

Stream Crossing Location	Milepost (mile + linear ft)	MDNR PWI	Length of Waterbody Crossing	Adjacent Wetland Types	
				Cowardin	Circular 39
Tributary to Colby Lake	n/a	Yes	3	PEMC/PEMA/ PFOC/PSS1B/ PFO2B/PEMF / PEMH	Type 2/Type 3/Type 4/ Type 6/Type 7/Type 8
Wyman Creek	n/a	Yes	3	PEMC/PFOC/ PFO2B	Type 3/Type 7/Type 8
			Total	**6 linear ft**	

2.8 Land use

2.8.1 Local and Regional Land Uses

The land cover on and adjacent to the project site and ROW corridors are forest lands consisting of coniferous forest, mixed wood forest and regeneration/young forests. This land is used primarily for forestry and mining purposes. There are also some areas that are open water/wetlands and scattered areas of grassland. Regionally, the same land cover and land uses are prevalent with the addition of open iron mines and rural residences as land uses. The residential neighborhoods in the City of Taconite are located more than 9,000 feet south of the West Range IGCC Power Station Footprint. The residential neighborhoods in the City of Hoyt Lakes are located about one mile south of the East Range IGCC Power Station Footprint. The City of Taconite features primarily residential and industrial/mining land uses, as does the City of Hoyt Lakes. Figures 1.5-22 and 1.5-47 show the current zoning designations for Itasca County (Taconite) and Hoyt Lakes, respectively. See Figures 2.8-1 (IGCC Power Station Footprint and Buffer Land) and Figure 2.8-2 (West Range Site Region) for maps showing existing land use/land cover. Figures 2.8-3 and 2.8-4 show the land use/cover for the East Range Site.

The source of the land use data used for this section is the 1996 Land Use/Land Cover Map completed by the Manitoba Remote Sensing Centre and obtained through the Minnesota Department of Natural Resources (DNR) Data Deli. After reviewing all available data it was determined that the 1996 Land Use/Land Cover map was the best source for studying land use. Local comprehensive plans were also reviewed but there was not sufficient information in those plans to discuss land use in detail.

The following are land use categories and definitions provided by the 1996 Land Use/Land Cover map:

Cultivated land—Includes those areas under intensive cropping or rotation, including fallow fields. Fields seeded to forage or cover crops are included. The fields exhibit linear or other patterns associated with current or recent tillage.

Deciduous forest—Includes areas with at least two-thirds or more of the total canopy cover composed of predominantly woody deciduous species. It may contain coniferous species but is dominated by deciduous species. It includes woodlots, shelter belts, and plantations.

Open water—Includes permanent water bodies such as lakes, rivers, reservoirs, stock ponds, ditches, and permanent and intermittently exposed palustrine open water areas where photo evidence indicates that the area is covered by water the majority of the time.

Grassland—Includes areas covered by grasslands and herbaceous plants and may contain up to one third shrubs and/or tree cover. Areas may be small to extensive and range from regular to irregular in shape. These areas are often found between agricultural land and more heavily wooded areas, along ROWs and drains. Some areas may be used as pastures and be mowed or grazed, and may range in appearance from very smooth to quite mottled. Included are fields which show evidence of past tillage but now appear to be abandoned and grown to native vegetation or planted to a cover crop.

Figure 2.8-1. West Range Land Use/Land Cover Within the Vicinity of the IGCC Power Station

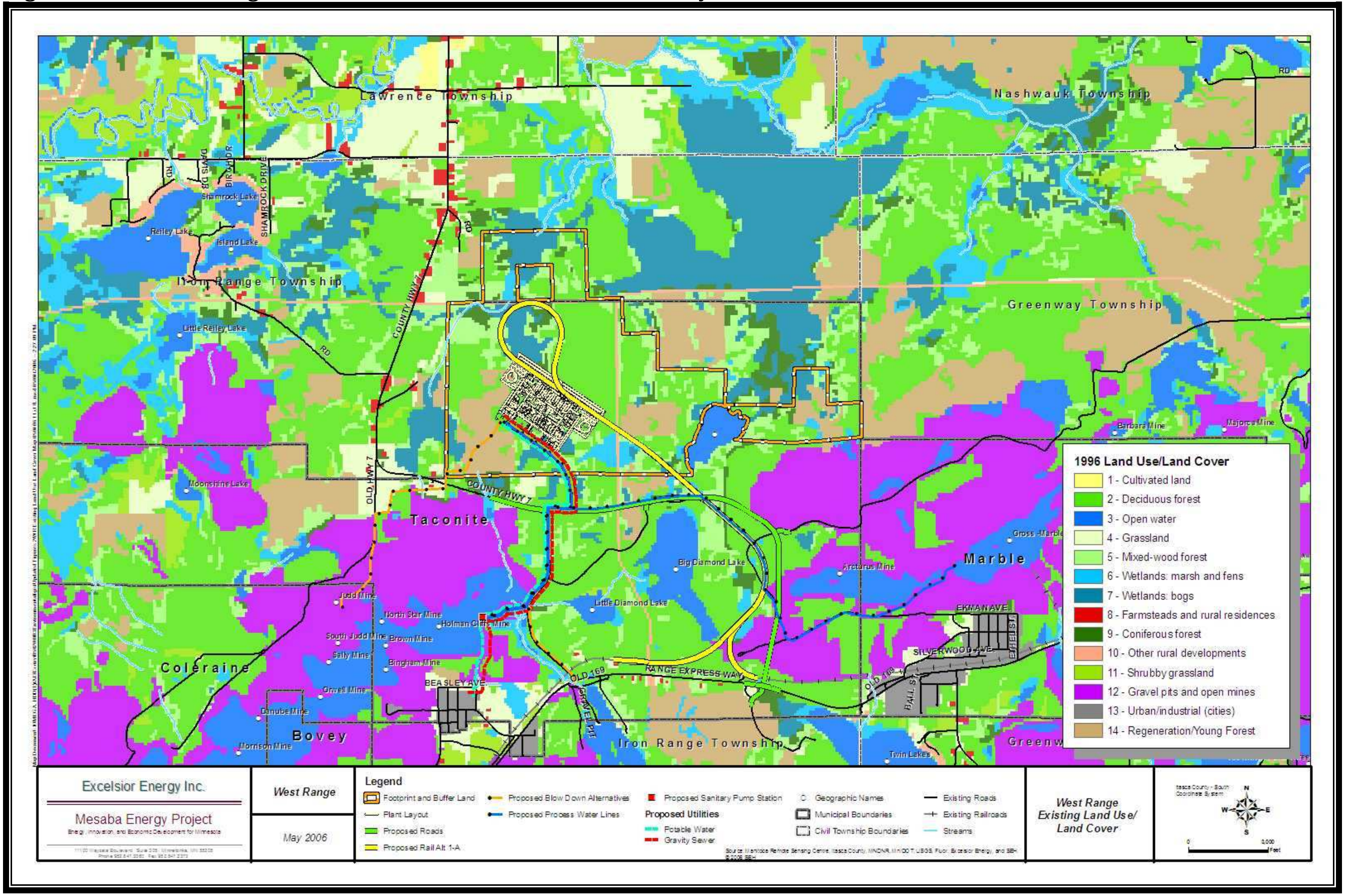
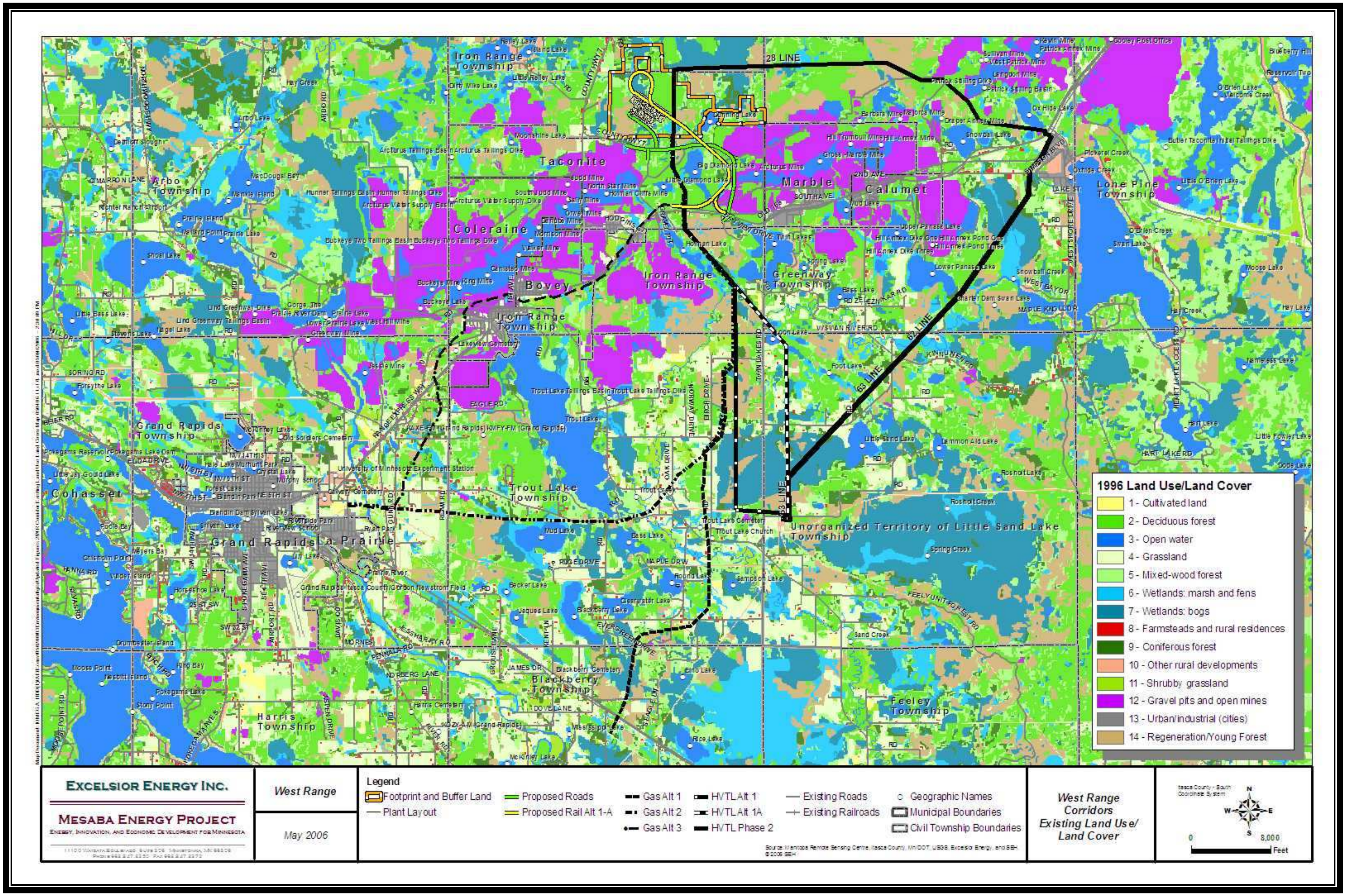


Figure 2.8-2. Land Use/Land Cover in the Vicinity of the West Range Site



Mixed-wood forest—Areas of forest where the canopy is composed of approximately equal amounts of deciduous and coniferous species.

Wetlands: marsh and fens—Grassy, wet areas with standing or slowly moving water. Vegetation consists of grass and sedge sods, and common hydrophytic vegetation such as cattail and rushes. Areas are often interspersed with channels or pools of open water.

Wetlands: bogs—Peat covered or peat filled depressions with a high water table. The bogs are covered with a carpet of sphagnum and ericaceous shrubs and may be treeless or tree covered with black spruce and/or tamarack.

Farmsteads and rural residences—Farmsteads include farmhouse and adjoining farmyard area. Includes machinery storage buildings, grain storage buildings, corrals, livestock holding and feeding areas directly associated with farmyard area.

Coniferous forest—Includes areas with at least two thirds or more of the total canopy composed of predominantly woody coniferous species. It may contain deciduous species but is dominated by coniferous species. It includes woodlots, shelter belts, and plantations.

Other rural developments—Includes commercial and industrial, cultural and recreational, and agricultural developments not associated with urban areas. Commercial/industrial developments include substations, communications facilities, power plants, private airstrips, landfills, storage maintenance yards, businesses, factories, lumber mills, and commercial livestock/poultry/grain operations. Recreational developments include built-up facilities and service areas associated with parks, rest areas, campgrounds, and golf courses. Cultural developments also include churches, cemeteries, community halls, and rural schools. Agricultural developments include agricultural facilities not directly associated with farmsteads including machine and grain storage areas, barns and corrals, and isolated buildings and farmsteads that no longer have apparent road access.

Shrubby grassland—This class includes a combination of grass, shrubs, and trees in which deciduous and/or coniferous treed cover comprises from one third to two thirds of the area, and/or the shrub cover comprises more than one third of the area. This complex is often found adjacent to grassland or forested areas, but may be found alone. These areas are often irregular in shape and vary greatly in size.

Gravel pits and open mines—Areas are stripped of top soil revealing exposed substrate such as sand/gravel. Included are gravel quarry operations, mine tailings, borrow pits, and rock quarries. Natural beaches/sand dunes are included.

Urban/industrial—The 1996 Land Use/Land Cover map simply provides the definition of urban/industrial land use as "cities."

Regeneration/Young Forest—Areas where commercial timber has been completely or partially removed by logging; management activities whose goal is to enhance timber productivity and/or wildlife habitat and to provide age class and species diversity; and catastrophic events, primarily fire and wind damage. These activities have taken place in the last 15 years. Almost all of these areas have been replanted or naturally regenerated into young trees.

Bare rock—Includes areas of rock outcrops that lack appreciable soil development or vegetation cover.

Roads, improved trails, rail lines—Roads and Improved Trails and Rail Lines Includes all highways, secondary gravel roads, and improved dirt trails, rail lines and utility easements.

2.8.2 West Range Existing Land Cover

2.8.2.1 West Range IGCC Power Station Footprint

The land use/land cover on the West Range IGCC Plant Site Footprint is primarily forest lands consisting of coniferous forest, mixed wood forest and regeneration/young forests. There are also some areas that are wetlands (See Figure 2.8-1). Table 2.8-1 below summarizes the existing land use/land cover on the site by acreage.

Table 2.8-1
West Range IGCC Power Station Footprint

Land Use/Land Cover	**Permanent Impacts (Acres)**
Coniferous forest	4.27
Deciduous forest	86.48
Grassland	0.00
Mixed wood forest	56.22
NWI Wetlands	0.00
Open water	0.00
Other Rural Development	0.00
Regeneration/Young Forests	3.12
Surveyed Wetlands	30.95
Wetlands—bogs	4.55
Wetlands—marsh and fends	0.00
Total	185.59

Based on the information from the table, approximately 150 acres or 81 percent of the site is some type of forested land. The remaining 35.5 acres or approximately 19 percent of the site location is wetlands.

2.8.2.2 West Range Plan A Preferred HVTL Route (WRA-1)

Land use within the West Range Preferred Route WRA-1 is predominately forested lands. See Figure 2.8-2. Table 2.8-2 below summarizes the existing land use/land cover along the HVTL in acres. The total length of the corridor is 8.66 miles.

Table 2.8-2
West Range Plan A Preferred HVTL Route (WRA-1)

Land Use/Land Cover	Acres
Coniferous forest	7.97
Deciduous forest	41.34
Grassland	2.75
Mixed wood forest	12.74
Open water	0.80
Other rural developments	8.72
Regeneration/Young Forests	26.37
Shrubby grassland	4.37
Wetlands—bogs	24.76
Wetlands—marsh and fens	4.30
Total	134.12

Based on the information from Table 2.8-2, approximately 88.42 acres or 66 percent of the Preferred Route (WRA-1) is some type of forest land. Wetlands comprise approximately 29 acres of the HVTL corridor.

2.8.2.3 West Range HVTL Plan A Alternate HVTL Route (WRA-1A)

Land use within the West Range Alternate Route WRA-1A is predominately forested. See Figure 2.8-2. Table 2.8-3 below summarizes the existing land use/land cover along Route WRA-1A. The total length of the corridor is 8.32 miles.

Table 2.8-3
West Range Plan A Alternate HVTL Route (WRA-1A)

Land Use/Land Cover	Permanent Impacts (Acres)
Coniferous forest	5.5
Deciduous forest	40.0
Grassland	12.2
Gravel Pits and open mines	1.1

Mixed wood forest	9.4
Open water	2.4
Other rural developments	5.6
Regeneration/Young Forests	15.4
Shrubby grassland	1.8
Wetlands—bogs	19.9
Wetlands—marsh and fens	7.2
Total	120.6

Based on the information from Table 2.8-3, approximately 82 acres, or 54 percent, of the Alternate HVTL Route WRA-1A corridor is forest land. Wetlands comprise approximately 36 acres or 24 percent of the corridor

2.8.2.4 West Range Plan B Phase II Alternate HVTL Route (WRB-2A)

Land use within the West Range Alternate HVTL Route WRB-2A corridor is predominately forested. See Figure 2.8-2 for a detailed map showing the existing land use/land cover in the area. Table 2.8-4 below summarizes the existing land use/land cover along the HVTL in acres. The total length of the corridor is 18.35 miles.

Table 2.8-4
West Range Plan

Land Use/Land Cover	Acres
Coniferous forest	9.38
Deciduous forest	68.03
Farmsteads and rural residences	0.05
Grassland	67.13
Gravel pits and open mines	1.52
Mixed wood forest	27.95
Open water	1.18
Other rural developments	173.75
Regeneration/Young Forests	22.71
Shrubby grassland	0.63
Urban/industrial (cities & towns)	4.97
Wetlands—bogs	40.42
Wetlands—marsh and fens	18.09
Total	435.81

Based on the information from Table 2.8-4, approximately 173.75 acres or about 40 percent of Route WRB-2A is considered other rural developments. Section 2.8.1 provides description of "other rural developments." Forest lands comprise approximately 128 acres or about 29 percent of the Phase 2 HVTL corridor.

2.8.2.5 West Range Proposed Natural Gas Pipeline Route

Land use within the West Range Proposed Natural Gas Pipeline Route corridor is predominately forested. See Figure 2.8-2 for a detailed map showing the existing land use/land cover in the area. Table 2.8-5 below summarizes the existing land use/land cover along the Proposed Natural Gas Pipeline Route in acres. The length of the corridor is 13.15 miles.

Table 2.8-5
West Range Proposed Natural Gas Pipeline Route

Land Use/Land Cover	Acres
Coniferous forest	11.51
Deciduous forest	31.19
Grassland	20.34
Mixed wood forest	25.84
Open water	0.59
Other rural developments	16.63
Regeneration/Young Forests	23.22
Shrubby grassland	10.55
Wetlands—bogs	14.64
Wetlands—marsh and fens	5.11
Total	159.62

Based on the information from Table 2.8-5 approximately 91 acres or 57 percent of the Proposed Natural Gas Pipeline Route is forest land. Grasslands comprise approximately 30 acres or 19 percent of the corridor.

2.8.2.6 West Range Natural Gas Pipeline Alternative 2 Route

Land use within the West Range Natural Gas Pipeline Alternative 2 Route is predominately forested and grasslands. See Figure 2.8-2 for a detailed map showing the existing land use/land cover in the area. Table 2.8-6 below summarizes the existing land use/land cover along the Route in acres. The length of the corridor is 14.08 miles.

Table 2.8-6
West Range Natural Gas Pipeline Alternative 2 Route

Land Use/Land Cover	Acres
Coniferous forest	7.60
Deciduous forest	17.25
Farmsteads and rural residences	0.21
Grassland	49.93
Mixed wood forest	13.70
Open water	0.69
Other rural developments	45.60
Regeneration/Young Forests	20.05
Shrubby grassland	5.16
Wetlands—bogs	6.75
Wetlands—marsh and fens	3.83
Total	170.77

Based on the information from Table 2.8-6, approximately 59 acres or 34 percent of the Route are forest lands. Approximately 55 acres or 32 percent of the Alternative 2 Route is grasslands. Approximately 46 acres or 27 percent is other rural developments. For a definition of "other rural developments," see Section 2.8-1.

2.8.2.7 West Range Natural Gas Pipeline Alternative 3 Route

Land use within the West Range Gas Pipeline Alternative 3 corridor is predominately forested and grasslands. See Figure 2.8-2 for a detailed map showing the existing land use/land cover in the area. Table 2.8-7 below summarizes the existing land use/land cover along the Route in acres. The length of the corridor is 11.73 miles.

Table 2.8-7
West Range Natural Gas Pipeline Alternative 3 Route

Land Use/Land Cover	Acres
Coniferous forest	6.72
Deciduous forest	26.40
Farmsteads and rural residences	2.57
Grassland	25.27
Gravel pits and open mines	20.23
Mixed wood forest	12.66
Open water	0.08
Other rural developments	21.87

Land Use/Land Cover	Acres
Regeneration/Young Forests	10.00
Shrubby grassland	7.12
Wetlands—bogs	1.06
Wetlands—marsh and fens	8.23
Total	142.21

Based on the information from Table 2.8-7, approximately 56 acres or 39 percent of the Natural Gas Pipeline Alternative 3 Route is forest land. About 32 acres or 23 percent of the Route is grasslands. Other rural development comprises almost 22 acres or 15 percent.

2.8.2.8 West Range Process Water Supply Pipeline

2.8.2.8.1 Segment 1 - LMP to CMP

Land use within the West Range Process Water Supply Pipeline Segment 1 corridor is predominately gravel pits and open mines. See Figure 2.8-2 for a detailed map showing the existing land use/land cover in the area. Table 2.8-8 below summarizes the existing land use/land cover along the Process Water Supply Pipeline segment in acres. The length of the corridor is 2.18 miles.

Table 2.8-8
West Range Process Water Supply Pipeline Segment 1

Land Use/Land Cover	Acres
Coniferous forest	2.60
Gravel pits and open mines	36.62
Open Water	0.74
Total	39.96

Based on information from Table 2.8-8 approximately 37 acres or 92 percent of the West Range Process Water Supply Pipeline Segment 1 is gravel pits and open mines.

2.8.2.8.2 Segment 2 - CMP to IGCC Power Station Footprint

Land use within the West Range Process Water Supply Pipeline Segment 2 corridor is predominately forest land. See Figure 2.8-2 for a detailed map showing the existing land use/land cover in the area. Table 2.8-9 below summarizes the land use/land cover along the Process Water Supply Pipeline segment in acres. The length of the corridor is 2.02 miles.

Table 2.8-9
West Range Process Water Supply Pipeline Segment 2

Land Use/Land Cover	Acres
Coniferous forest	0.13
Deciduous forest	18.51
Gravel pits and open mines	6.01
Mixed wood forest	7.52
Open water	0.03
Regeneration/Young Forests	0.29
Wetlands—bogs	4.23
Wetlands—marsh and fens	0.39
Total	37.11

Based on information from Table 2.8-9 approximately 26 acres or 71 percent of Process Water Supply Pipeline Segment 2 forest land.

2.8.2.8.3 Segment 3 - HAMP Complex to CMP

Land use within the West Range Process Water Supply Pipeline Segment 3 corridor is predominately forest land. See Figure 2.8-2 for a detailed map showing the existing land use/land cover in the area. Table 2.8-10 below summarizes the land use/land cover along the Process Water Supply Pipeline segment in acres. The length of the corridor is 4.83 miles.

Table 2.8-10
West Range Proposed Process Water Supply Pipeline Segment 3

Land Use/Land Cover	Acres
Coniferous forest	2.54
Deciduous forest	37.30
Gravel pits and open mines	32.47
Mixed wood forest	9.12
Open water	1.57
Other rural developments	0.34
Regeneration/Young Forests	2.26
Wetlands—bogs	0.13
Wetlands—marsh and fens	2.38
Total	88.12

Based on information from Table 2.8-10 approximately 51 acres or 58 percent of West Range Process Water Supply Pipeline Segment 3 is forest land. Approximately 32 acres or 37 percent is gravel pits and open mines.

2.8.2.9 West Range Blowdown Process Water Supply Pipeline 1

Land use within the West Range Blowdown Process Water Supply Pipeline 1 corridor is predominately forested. See Figure 2.8-2 for a detailed map showing the existing land use/land cover in the area. Table 2.8-11 below summarizes the land use/land cover along the Process Water Supply Pipeline in acres. The length of the corridor is 2.43 miles.

Table 2.8-11
West Range Blowdown Process Water Supply Pipeline 1

Land Use/Land Cover	Acres
Coniferous forest	0.38
Deciduous forest	27.04
Gravel pits and open mines	3.46
Mixed wood forest	9.63
Regeneration/Young Forests	0.18
Wetlands—bogs	3.80
Wetlands—marsh and fens	0.0005
Total	44.49

Based on information from Table 2.8-11 approximately 37 acres or 84 percent of the water pipeline blowdown is forested land.

2.8.2.10 West Range Blowdown Process Water Supply Pipeline 2

Land use within the West Range Blowdown Process Water Supply Pipeline 2 corridor is predominately gravel pits and open mines. See Figure 2.8-2 for a detailed map showing the existing land use/land cover in the area. Table 2.8-12 below summarizes the land use/land cover along the Process Water Blowdown Pipeline in acres. The length of the corridor is 2.16 miles.

Table 2.8-12
West Range Blowdown Process Water Supply Pipeline 2

Land Use/Land Cover	Acres
Coniferous forest	0.34
Deciduous forest	6.16
Gravel pits and open mines	14.95
Mixed wood forest	1.15
Regeneration/Young Forests	8.01
Wetlands—bogs	0.0

Farmsteads and rural residences	0.08
Grasslands	8.80
Total	39.49

Based on information from Table 2.8-12 approximately 15 acres or 38 percent of the West Range Blowdown Process Water Supply Pipeline 2 is gravel pits and open mines.

2.8.2.11 West Range Potable Water and Sewer Pipelines

The West Range Potable Water and Sewer Pipeline will be installed parallel to each other within the same corridor. Therefore, land use analysis included an assessment of these two pipelines and considered them as one impact. Existing land use/land cover within the Potable Water and Sewer Pipeline corridor are predominately forested. See Figure 2.8-2 for a detailed map showing the existing land use/land cover in the area. Table 2.8-13 below summarizes the land use/land cover along the pipelines in acres.

Table 2.8-13
West Range Potable Water and Sewer Pipeline

Land Use/Land Cover	Acres
Coniferous forest	0.10
Deciduous forest	13.49
Grassland	1.77
Gravel pits and open mines	9.62
Mixed wood forest	4.76
Regeneration/Young Forests	0.18
Urban/industrial (cities & towns)	0.48
Wetlands—bogs	2.81
Wetlands—marsh and fens	0.43
Total	33.65

Based on information from Table 2.8-13 almost 19 acres or 55 percent of the Potable Water and Sewer Pipeline corridor is forested land. Gravel pits and open mines comprise almost 10 acres or 29 percent of the corridor.

2.8.2.12 West Range Rail Line Alternative 1A

Land use within the West Range Rail Line Alternative 1A corridor is predominately forested. See Figure 2.8-2 for a detailed map showing the existing land use/land cover in the area. Table 2.8-14 below summarizes the land use/land cover along the rail line in acres.

Table 2.8-14
West Range Rail Line Alternative 1A

Land Use/Land Cover	Acres
Coniferous forest	5.10
Deciduous forest	69.12
Grassland	0.51
Gravel pits and open mines	4.12
Mixed wood forest	33.22
Open water	0.72
Other rural developments	3.61
Regeneration/Young Forests	0.64
Wetlands—bogs	15.77
Wetlands—marsh and fens	6.38
Total	139.19

Based on information from Table 2.8-14 approximately 108 acres or 78 percent of the rail line corridor is forested land. Wetlands comprise almost 16 percent.

2.8.2.13 West Range Rail Line Alternative 1B

Land use within the West Range Rail Line Alternative 1B corridor is predominately forested. See Figure 2.8-2 for a detailed map showing the existing land use/land cover in the area. Table 2.8-15 below summarizes the land use/land cover along the rail line in acres.

Table 2.8-15
West Range Rail Line Alternative 1B

Land Use/Land Cover	Acres
Coniferous forest	5.37
Deciduous forest	99.80
Gravel pits and open mines	28.66
Mixed wood forest	24.67
Other rural developments	1.45
Regeneration/Young Forests	1.94
Wetlands—bogs	11.50
Wetlands—marsh and fens	6.28
Total	179.67

Based on information from Table 2.8-15 almost 132 acres or 73 percent of the rail line corridor is forested land. Gravel pits and open mines comprise almost 29 acres or 16 percent. Wetlands are almost 18 acres or 10 percent of the corridor.

2.8.2.14 West Range Roads

There are two access roads leading to the IGCC Facility Site. Land use within Access Road 1 and Access Road 2 is predominately deciduous forests. See Figure 2.8-2 for a detailed map showing the existing land use/land cover in the area. Table 2.8-16 below summarizes the land use/land cover along proposed access roads in acres. The access roads total 5.03 miles in length.

Table 2.8-16
West Range Roads—Access Road 1

Land Use/Land Cover	**Acres**
Coniferous forest	6.25
Deciduous forest	48.50
Gravel Pits and open mines	23.26
Grassland	3.12
Mixed wood forest	8.94
Open water	0.75
Other rural developments	0.46
Regeneration/Young Forests	4.79
Wetlands—bogs	0.06
Wetlands—marsh and fens	2.73
Total	98.86

Based on the information from Table 2.8-16, approximately 68 acres or 69 percent of Access Road 1 is forest land of some type.

Existing land use for the Access Road 2 is shown 2.8-17 below.

Table 2.8-17
West Range Roads—Access Road 2

Land Use/Land Cover	**Acres**
Coniferous forest	0.41
Deciduous forest	11.19
Gravel Pits and open mines	0.00
Grassland	0.00
Mixed wood forest	6.42
Open water	0.00
Other rural developments	0.00

Regeneration/Young Forests	0.25
Wetlands—bogs	4.88
Wetlands—marsh and fens	0.00
Total	23.14

Based on the information from Table 2.8-17, approximately 18 acres or 79 percent of Access Road 2 is forest land of some type.

Existing land use for the Access Roads 1 and 2 Combined is shown 2.8-18 below.

Table 2.8-18
West Range Roads—Access Roads 1 and 2 Combined

Land Use/Land Cover	Acres
Coniferous forest	6.65
Deciduous forest	59.70
Gravel Pits and open mines	23.26
Grassland	3.12
Mixed wood forest	15.36
Open water	0.75
Other rural developments	0.46
Regeneration/Young Forests	5.04
Wetlands—bogs	4.94
Wetlands—marsh and fens	2.73
Total	122.01

Based on the information from Table 2.8-18, approximately 87 acres or 71 percent of the access roads are forest land of some type. Gravel pits and open mines comprise approximately 23 acres or 19 percent of the access road corridors.

2.8.3 East Range Existing Land Cover

2.8.3.1 IGCC Power Station Footprint

The land use/land cover on the East Range IGCC Power Station Footprint is primarily forest lands consisting of deciduous forest and mixed wood forest. See Figure 2.8-3, which is a detailed map showing existing land use/land cover on the IGCC Power Station Footprint and Buffer Land. Table 2.8-19 below summarizes the land use/land cover on the site by acreage.

Table 2.8-19
East Range IGCC Power Station Footprint

Land Use/Land Cover	Acres
Deciduous forest	22.35
Mixed wood forest	119.66
Other Rural Developments	1.24
Shrubby Grassland	8.18
Surveyed Wetlands	15.61
Total	167.04

Approximately 142 acres or 85 percent of the East Range Power Station Footprint is either deciduous forest or mixed wood forest.

2.8.3.2 East Range 38L HVTL Route

The land use/land cover within the entire East Range 38L HVTL Route is predominately characterized as "other rural development" (acknowledging that the entire route lies within the existing HVTL ROW). See Figure 2.8-4 for a detailed map showing existing land use/land cover for the entire East Range Site. Table 2.8-20 below summarizes the land use/land cover along the 38L HVTL Route corridor in acres.

Table 2.8-20
East Range 38L HVTL Route

Land Use/Land Cover	Acres
Coniferous forest	4.0
Deciduous forest	0
Mixed wood forest	50.3
Regeneration/Young Forest	12.1
Wetland—bogs	0
Wetland—marsh and fens	0
Grassland	10.4
Shrubby grassland	23.0
Gravel pits and open mines	4.7
Open water	0
NWI Wetlands	100.4
Other rural development	247.3
Farmsteads and rural residences	0.2
Total	452.3

Approximately 66.4 acres or 14 percent of the 38L HVTL Route is coniferous, deciduous, mixed wood, or regeneration/young forest land.

2.8.3.3 East Range 39L/37L HVTL Route

The land use/land cover within the entire East Range 39L/37L HVTL Route is predominately an existing HVTL corridor. See the detailed map in Figure 2.8-4 showing existing land use/land cover. Table 2.8-21 below summarizes the land use/land cover along the 39L/37L HVTL Route in acres.

Table 2.8-21
East Range 39L/37L HVTL Route

Land Use/Land Cover	**Acres**
Farms and residences	0.7
Coniferous forest	2.5
Deciduous forest	2.4
Mixed wood forest	44.5
Regeneration/Young Forest	15.5
Wetland—bog	0
Wetland—marsh and fens	0
Grassland	6.9
Shrubby grassland	20.8
Gravel pits and open mines	33.9
Open water	0.5
Other rural developments	242.8
NWI Wetlands	76.7
Total	447.2

Approximately 65 acres or 40 percent of 39L/37L HVTL Route is coniferous, deciduous, mixed wood, or regeneration/young forest land. Gravel pits and open mines account for almost 34. Other rural developments (reflecting the presence of an existing HVTL corridor) account for about 242 acres or over 50 percent of the proposed corridor.

Figure 2.8-3. East Range Existing Land Use/Land Cover IGCC Power Station Vicinity

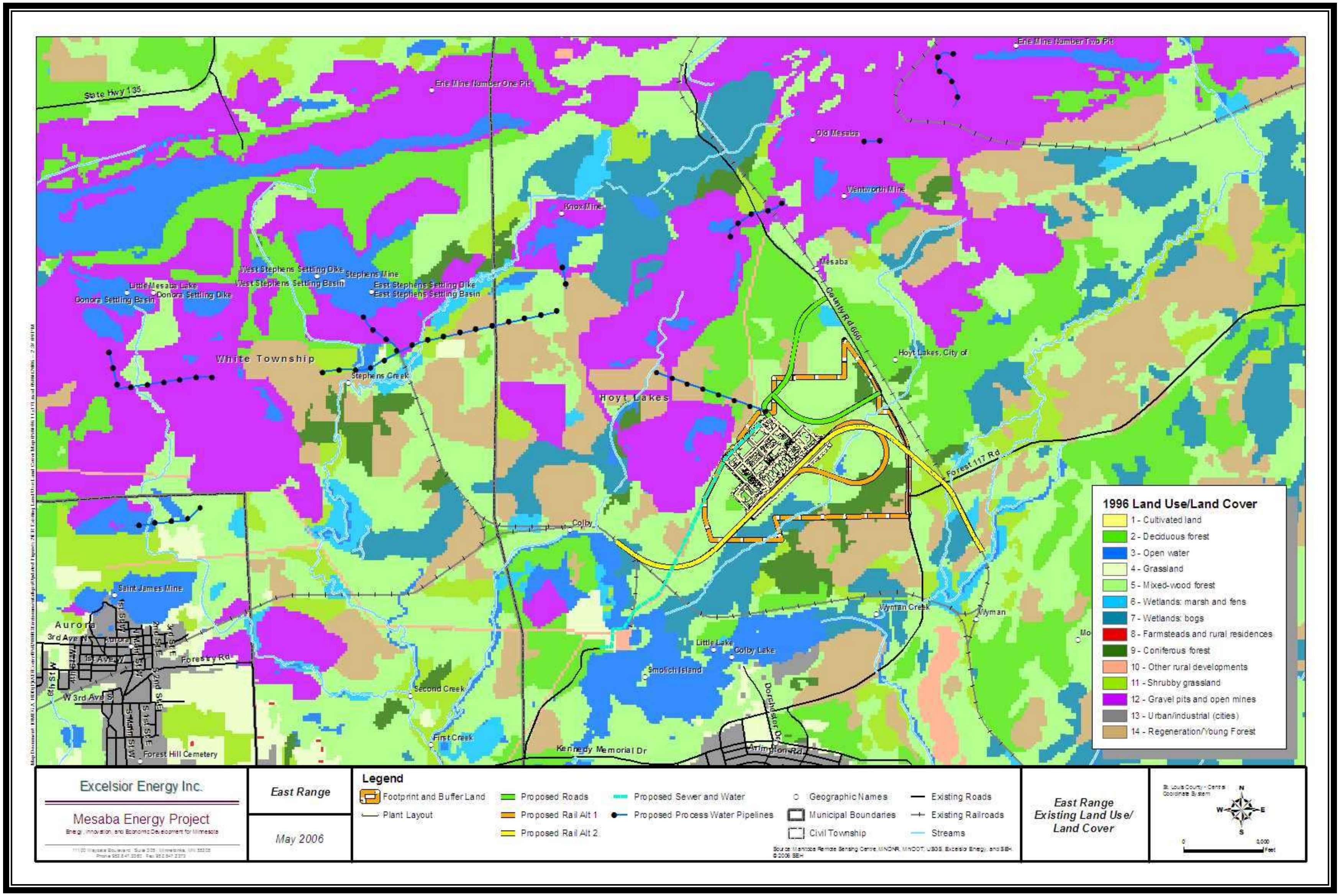
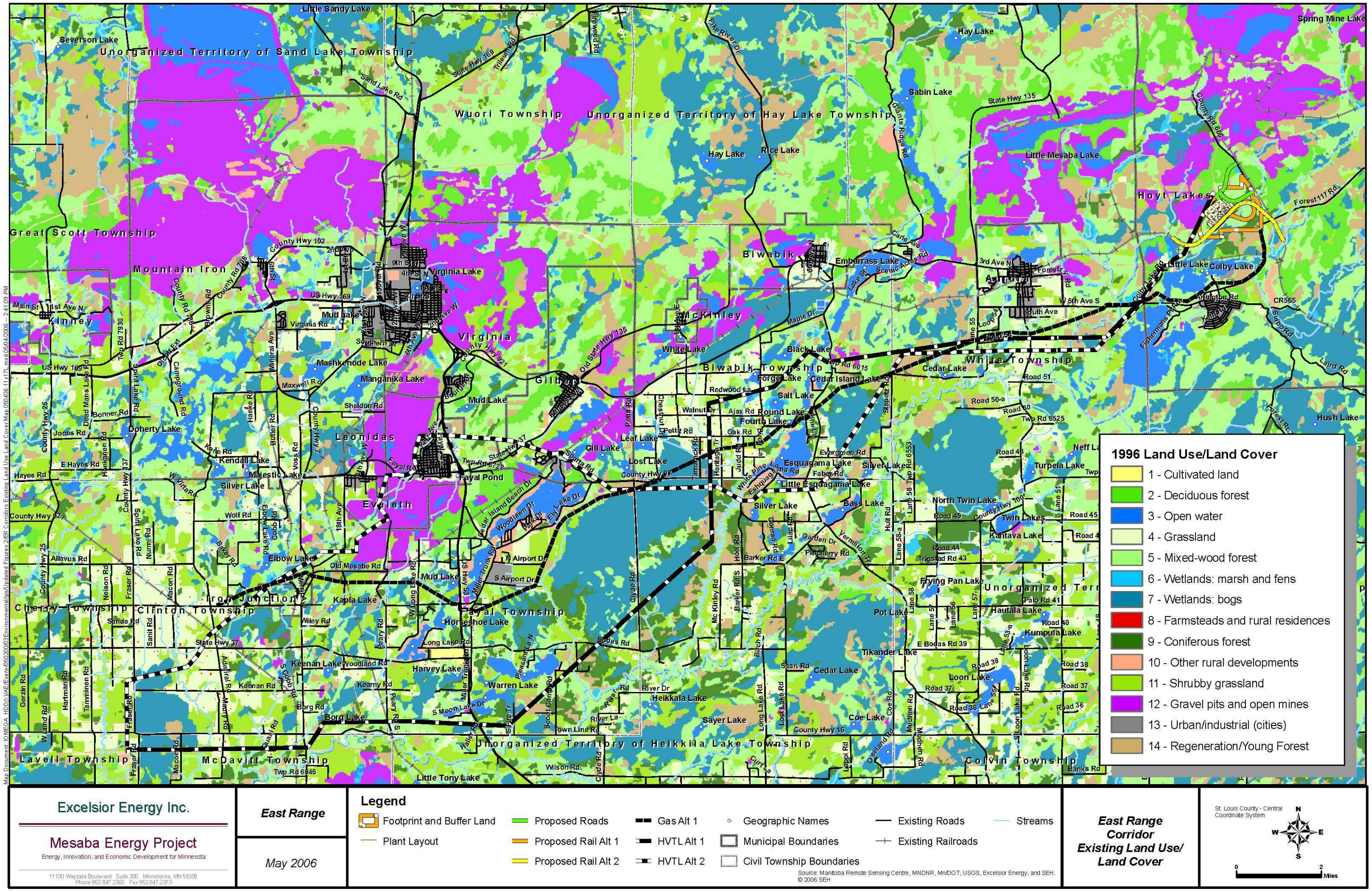


Figure 2.8-4. East Range Existing Land Use/Cover Pipeline and Transmission Corridors



2.8.3.4 East Range Natural Gas Pipeline Route

The land use/land cover along the East Range Natural Gas Pipeline Route is predominately forest land. See Figure 2.8-4 which shows a detailed map showing existing land use/land cover. Table 2.8-22 below summarizes the land use/land cover along the Natural Gas Pipeline Route in acres.

Table 2.8-22
East Range Natural Gas Pipeline Route

Land Use/Land Cover	**Acres**
Coniferous forest	7.56
Deciduous forest	5.00
Mixed wood forest	120.71
Regeneration/Young Forest	53.83
Wetland—bogs	28.16
Wetland—marsh and fens	1.19
Farmsteads and other rural residences	0.98
Grassland	46.12
Shrubby grassland	78.89
Gravel pits and open mines	0.24
Open water	1.69
Other rural development	4.80
Urban Industrial	0.53
Total	349.70

Approximately 187 acres or 54 percent of the gas pipeline is coniferous, deciduous, mixed wood, or regeneration/young forest land. Grassland of some type makes up about 125 acres or 36 percent of the corridor.

2.8.3.5 East Range Process Water Supply Pipelines

2.8.3.5.1 Process Water Supply Pipeline—Pipeline 2WX-SITE

The land use/land cover along the Process Water Supply Pipeline 2WX-SITE corridor is typically forest land. See Figure 2.8-4, above, shows a detailed map showing existing land use/land cover. Table 2.8-23 below summarizes the land use/land cover along the Process Water Supply Pipeline corridor in acres.

Table 2.8-23
East Range Process Water Supply Pipeline—Pipeline 2WX-Site

Land Use/Land Cover	**Acres**
Deciduous forest	3.41
Gravel pits and open mines	0.72
Mixed wood forest	1.85
Other rural developments	0.42
Regeneration/young forests	9.51
Total	15.91

Approximately 15 acres or 93 percent of the Process Water Supply Pipeline is forest land of some type. The total length of this corridor is 0.85 miles.

2.8.3.5.2 East Range Process Water Supply Pipeline - Pipeline 2WX- 2W

The land use/land cover along the East Range Process Water Supply Pipeline 2WX-2W corridor is typically gravel pits and open mines. See Figure 2.8-4 which shows a detailed map showing existing land use/land cover. Table 2.8-24 below summarizes the land use/land cover along the Process Water Supply Pipeline corridor in acres.

Table 2.8-24
East Range Process Water Supply Pipeline—Pipeline 2WX-2W

Land Use/Land Cover	**Acres**
Gravel pits and open mines	8.53
Mixed wood forest	0.10
Open water	0.31
Shrubby grassland	0.58
Wetland—marsh and fens	0.07
Total	9.59

Approximately 8.53 acres or about 89 percent of Process Water Supply Pipeline 2WX-2W is gravel pits and open mines. The length of this corridor is 0.5 miles.

2.8.3.5.3 East Range Process Water Supply Pipeline—Pipeline 2W-2E

The land use/land cover along the East Range Process Water Supply Pipeline 2W-2E corridor is exclusively gravel pits and open mines. See Figure 2.8-4 which shows a detailed map showing existing land use/land cover. Table 2.8-25 below summarizes the land use/land cover along the Process Water Supply Pipeline corridor in acres.

Table 2.8-25
East Range Process Water Supply Pipeline—Pipeline 2W-2E

Land Use/Land Cover	Acres
Gravel pits and open mines	2.90
Total	2.90

One-hundred percent of the Process Water Supply Pipeline 2W-2E corridor is gravel pits and open mines. The length of this corridor is 0.14 miles.

2.8.3.5.4 East Range Process Water Supply Pipeline - Pipeline 3 -2E

The land use/land cover along the East Range Process Water Supply Pipeline 3-2E corridor is gravel pits and open mines. See Figure 2.8-4 which shows a detailed map showing existing land use/land cover. Table 2.8-26 below summarizes the land use/land cover along the Process Water Supply Pipeline corridor in acres.

Table 2.8-26
East Range Process Water Supply Pipeline—Pipeline 3-2E

Land Use/Land Cover	Acres
Gravel pits and open mines	10.47
Total	10.47

One-hundred percent of the Process Water Supply Pipeline 3-2E corridor is gravel pits and open mines. The total length of this corridor is 0.55 miles.

2.8.3.5.5 East Range Process Water Supply Pipeline—Pipeline K-2WX

The land use/land cover along the East Range Process Water Supply Pipeline K-2WX corridor is typically forest land. See Figure 2.8-4 which shows a detailed map showing existing land use/land cover. Table 2.8-27 below summarizes the land use/land cover along the Process Water Supply Pipeline corridor in acres.

Table 2.8-27
East Range Process Water Supply Pipeline—Pipeline K- 2WX

Land Use/Land Cover	Acres
Gravel pits and open mines	0.97
Mixed wood forest	0.13
Open water	0.92
Regeneration/Young Forest	1.36
Total	3.38

Approximately 1.5 acres or 44 percent of the Process Water Supply Pipeline K- 2WX corridor is either regeneration/young forest or mixed wood forest. Approximately 29 percent of the corridor is gravel pits and open mines and about 27 percent is open water. The length of this corridor is 0.16 miles.

2.8.3.5.6 East Range Process Water Supply Pipeline—Pipeline 6-S-2WX

The land use/land cover along the East Range Process Water Supply Pipeline 6-S-2WX corridor is typically forest land. See Figure 2.8-4 which shows a detailed map showing existing land use/land cover. Table 2.8-28 below summarizes the land use/land cover along the Process Water Supply Pipeline corridor in acres.

Table 2.8-28
East Range Process Water Supply Pipeline—Pipeline 6-S-2WX

Land Use/Land Cover	Acres
Deciduous forest	1.76
Grassland	0.42
Gravel pits and open mines	8.42
Mixed wood forest	10.15
Open water	2.46
Regeneration/Young Forest	7.19
Shrubby grassland	8.57
Wetlands—marsh and fens	0.44
Total	39.41

Approximately 19 acres or 48 percent of the Process Water Supply Pipeline 6-S-2WX is some type of forest land. Grassland makes up almost 22 percent of the corridor and gravel pits and open mines makes up approximately 21 percent of the corridor. The total length of the corridor is 2.15 miles.

2.8.3.5.7 East Range Process Water Supply Pipeline—Pipeline 9S-6

The land use/land cover along the East Range Process Water Supply Pipeline 9S-6 corridor is typically forest land. See Figure 2.8-4 which shows a detailed map showing existing land use/land cover. Table 2.8-29 below summarizes the land use/land cover along the Process Water Supply Pipeline corridor in acres.

Table 2.8-29
East Range Process Water Supply Pipeline—Pipeline 9S-6

Land Use/Land Cover	Acres
Mixed wood forest	5.45
Open water	4.12
Total	9.57

Approximately 5.45 acres or 57 percent of the Pipeline 9S-6 is mixed wood forest. The remaining portion is open water. The total length of this corridor is 0.5 miles.

2.8.3.5.8 East Range Process Water Supply Pipeline—Pipeline 9N-6

The land use/land cover along the East Range Process Water Supply Pipeline 9N-6 corridor is typically gravel pits and open mines. See Figure 2.8-4 which shows a detailed map showing existing land use/land cover. Table 2.8-30 below summarizes the land use/land cover along the Process Water Supply Pipeline corridor in acres.

Table 2.8-30
East Range Process Water Supply Pipeline—Pipeline 9N-6

Land Use/Land Cover	Acres
Gravel pits and open mines	15.71
Mixed wood forest	1.99
Total	17.70

Approximately 89 percent of Process Water Supply Pipeline 9N-6 is gravel pits and open mines. The length of this corridor is 0.95 miles.

2.8.3.6 East Range Potable Water and Sewer Pipelines

The land use/land cover along the East Range Potable Water and Sewer Pipeline corridor is typically forest land. See Figure 2.8-4 which shows a detailed map showing existing land use/land cover. Table 2.8-31 below summarizes the land use/land cover along the Potable Water and Sewer Pipeline corridor in acres.

Table 2.8-31
East Range Potable Water and Sewer Pipeline

Land Use/Land Cover	Acres
Deciduous forest	0.62
Mixed wood forest	11.17
Grassland	1.84
Open water	1.76
Other rural developments	8.19
Regeneration/young forests	1.91
Total	25.49

Approximately 13 acres or 51 percent of the Potable Water and Sewer Pipeline is mixed wood forest and regeneration/young forests. Other rural developments comprise approximately 8 acres or 32 percent of the corridor. The total length of this corridor is 2.09 miles.

2.8.3.7 East Range Rail Line Alternative 1

The land use/land cover along the East Range Rail Line Alternative 1 corridor is typically forest land of some type. See Figure 2.8-4 which shows a detailed map showing existing land use/land cover. Table 2.8-32 below summarizes the land use/land cover along the rail line corridor in acres, and Table 2.8-33 summarizes existing land use within the center loop area of Rail Line Alternative 1.

Table 2.8-32
East Range Rail Line Alternative 1

Land Use/Land Cover	**Acres**
Mixed wood forest	37.24
Open water	0.09
Other rural developments	0.52
Shrubby grassland	20.65
Wetlands—bogs	1.14
Surveyed Wetlands	17.21
Total	76.83

Approximately 53 acres or 69 percent of the Rail Line Alternative 1 corridor is mixed wood forest and coniferous forest land. Shrubby grassland is almost 21 acres or 27 percent of the corridor. The total length of this corridor is 3.39 miles.

Table 2.8-33
East Range Rail Line Alternative 1—Center Loop

Land Use/Land Cover	**Acres**
Mixed wood forest	30.44
Open water	0.16
Shrubby grassland	25.23
Surveyed Wetlands	47.91
Total	103.73

Approximately 48 acres or 46 percent of center loop is surveyed wetlands. Mixed wood forest is about 30 acres or 29 percent of the corridor. Shrubby grassland is about 25 acres or 24 percent of the corridor. The total length of this corridor is 3.39 miles.

2.8.3.8 East Range Rail Line Alternative 2

The land use/land cover along the East Range Rail Line Alternative 2 corridor is typically forest land. See Figure 2.8-3 which shows a detailed map showing existing land use/land cover. Table 2.8-34 below summarizes the land use/land cover along the rail line corridor in acres.

Table 2.8-34
East Range Rail Line Alternative 2

Land Use/Land Cover	**Acres**
Mixed wood forest	35.18
Open water	0.09
Other rural developments	0.52
Regeneration/Young Forest	0.68
Shrubby grassland	17.84
Wetlands—bogs	1.14
Surveyed Wetlands	18.35
Total	73.79

Approximately 35 acres or 48 percent of the Rail Line Alternative 2 corridor is mixed wood forest land. Surveyed Wetlands make up about 18 acres or 25 percent of the corridor. Shrubby grassland makes up about 18 acres or 25 percent of the corridor. The total length of this corridor is 3.49 miles.

2.8.3.9 East Range Roads

The land use/land cover along the East Range Access Road 1 corridor is typically forest land. See Figure 2.8-4 which shows a detailed map showing existing land use/land cover. Table 2.8-35 below summarizes the land use/land cover along the Access Road 1 in acres.

Table 2.8-35
East Range Access Road 1

Land Use/Land Cover	**Acres**
Coniferous forest	2.38
Deciduous forest	7.97
Mixed wood forest	21.76
Regeneration/Young Forest	6.19
Shrubby grassland	3.12
Surveyed Wetlands	5.52
Total	46.95

Approximately 38 acres or 82 percent of the access road corridor is forest land of some type. Shrubby grassland makes up 3.12 acres or 7 percent of the corridor and surveyed wetlands makes up the remaining 5.52 acres or almost 12 acres of the corridor. The length of the Access Road 1 is 1.91 miles.

2.8.4 Publicly Owned Lands

2.8.4.1 West Range

Parcels of publicly owned land in the project vicinity of the West Range Site are shown in Figure 2.8-5. Table 2.8-36 identifies the acres of publicly owned land traversed by corridors associated with the West Range Power Station. No publicly owned lands are present within the IGCC Power Station Footprint and Buffer Lands boundary.

Table 2.8-36
Publicly Owned Lands in the Vicinity of the West Range Site

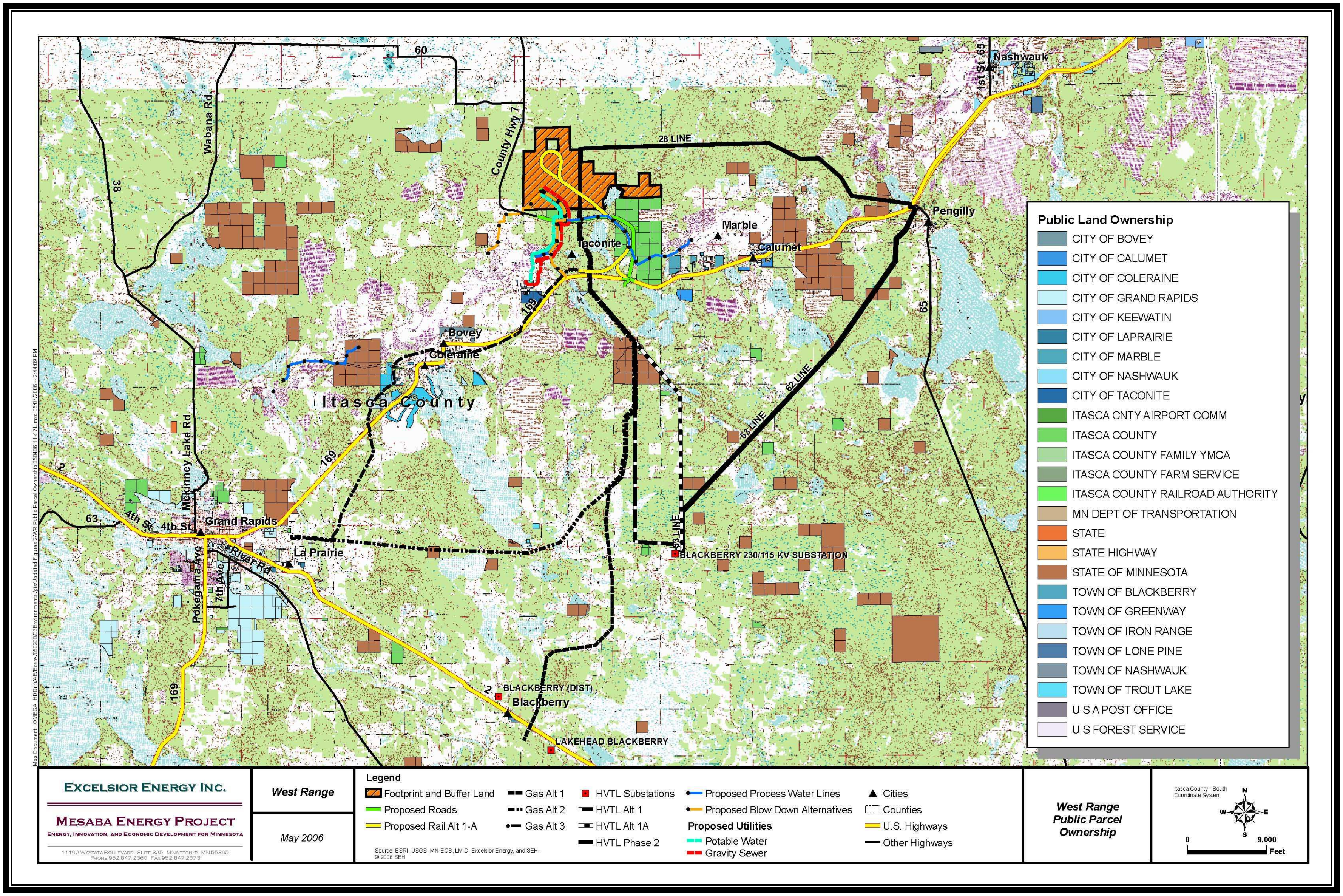
Public Entity	**Acres**
City of Bovey	0.73
City of Coleraine	4.41
City of Taconite	1.80
Itasca County	101.60
Itasca County Railroad Authority	0.0078
State of Minnesota	58.24
Town of Iron Range	2.28
Total	169.07

Based on information from Table 2.8-36 approximately 169 acres of publicly owned land are traversed by various corridors associated with the West Range IGCC Power Station. Sixty percent of the land traversed is owned by Itasca County and approximately 34 percent is owned by the State of Minnesota.

2.8.4.2 East Range

Publicly owned lands in the vicinity of the East Range Site were identified by consulting the St. Louis County Plat Book, the St. Louis County Land Department, and the City of Hoyt Lakes. Such lands include: Superior National Forest Land, MDNR Lands, and St. Louis County Tax Forfeit Lands.

Figure 2.8-5. Publicly Owned Lands West Range Site Area



2.8.5 Farmland

2.8.5.1 West Range Site and HVTL/Natural Gas Pipeline Routes

None of the land designated for the IGCC Power Station Footprint and Buffer Land is actively cultivated as farmland. Although trees are harvested within this area, the land that would be taken out of service in constructing the Power Station is not uniquely suited for such agricultural use. Several residents living off CR 7 pasture horses and raise hay to feed them.[2] At least one resident located about 8,500 feet north-northeast of the Power Station Footprint raises beef cattle and feeds them from crops grown on the property. No crops are currently known to be cultivated on properties across which the proposed access roads, railway, process water supply, or process water blowdown pipeline easements will be required. HVTL and natural gas pipeline ROWs will cross open lands that may be cultivated. However, these infrastructure developments will not irretrievably take land presently devoted to agricultural cropping out of service.

Aerial photography, current as of 2003, and the 1996 Land Use/Land Cover map provided in Figures 2.8-1 and 2.8-2 support the observations noted above by indicating the presence of numerous open areas and farmsteads to the southwest, west and northwest of the Power Station Footprint. The Land Cover map indicates the presence of cultivated lands about 11,000 feet to the north-northwest of the Footprint. In the case of the West Range Power Station, no linear infrastructure developments will directly impact the agricultural practices of any these residents. South of the plant along the HVTL and Proposed Natural Gas Pipeline Routes, the Land Cover map shows the presence of cultivated lands immediately north of the Plan A Alternate HVTL Route WRA-1A at a point where the route crosses Twin Lakes Road. Although Alternate HVTL Route WRA-1A crosses over more open land than the Preferred HVTL Route WRA-1, both alignments allow impacts on agricultural lands to be minimal. The Proposed Natural Gas Pipeline Route was also positioned in a manner to minimize such impacts.

Section 3.3.1.1.16A acknowledges the presence of prime farmland on and in the vicinity of the West Range Site and discusses its relevance as an LEPGP siting consideration in the instance of Mesaba One and Mesaba Two.

2.8.5.2 East Range Site and HVTL/Natural Gas Pipeline Routes

None of the land designated for the East Range IGCC Power Station Footprint and Buffer Land is actively cultivated as farmland. Further, no Hoyt Lakes residents are known to be involved in any animal husbandry activities within the City Limits[3]. Similar to the West Range IGCC Power Station Footprint and Buffer Land, trees are currently harvested from the land that will serve as the physical location for the East Range IGCC Power Station. The fact that this land is located on the fringe of the Superior National Forest (albeit within the City Limits of Hoyt Lakes) gives credence to the premise that it is not uniquely suited for growing trees.

With the exception of trees, no crops are currently known to be cultivated on properties across which access roads, railway, process water supply, potable water, or wastewater pipeline easements would be required. Land is known to be cultivated for crops south of Aurora[4] and

[2] Johnson, E., 2006. Personal communication with Iron Range Township Chairman, May 19, 2006.
[3] Bradford, R., 2006. Personal communication with Hoyt Lakes City Clerk, May 19, 2006
[4].Ibid, , May 19, 2006.

HVTL and natural gas pipeline infrastructure are proposed to traverse this area. However, ROWs for existing HVTLs (38L and 39L) and the natural gas pipeline (Northern's 10" branch line to Cliffs Erie) already exist and would be used for the GO HVTLs and natural gas pipeline routes to serve Mesaba One and Mesaba Two.

Aerial photography, current as of 2003, and the 1996 Land Use/Land Cover map provided in Figures 2.8-1 and 2.8-2 support the observations noted above and indicate the presence of numerous open areas and farmsteads in White and Biwabik Townships (south of Aurora and west of Esquagama Lake, respectively).

Section 3.3.2.2.17 addresses the current status of prime farmland determinations in the vicinity of the East Range Site and discusses their relevance as an LEPGP siting consideration in the instance of Mesaba One and Mesaba Two.

2.8.6 Industrial Areas

2.8.6.1 West Range Site and Associated Corridors

The Itasca County Zoning Map provided in Figure 1.5-22 shows that all of the land on which the IGCC Power Station Footprint and Buffer Land is located is zoned for industrial purposes. Industrial developments are known to be located nearby the West Range IGCC Power Station and its Associated Facilities and the proposed HVTL/Natural Gas Pipeline Routes. Such developments include among other things, the following:

- Solid waste landfill and transfer station contiguous with the southern boundary of the ICGG Power Station Buffer Land
- Mineral extraction operations located to the southwest of the Power Station Footprint and nearby Loon Lake (the Alternate HVTL Route WRA-1A would traverse this area)
- Mineral extraction operations on the west side of Holman Lake

Proposed industrial developments include the Minnesota Steel Industries plant that would be located about two to three miles east of the Power Station Footprint.

2.8.6.2 East Range Industrial Areas

The Hoyt Lakes Zoning Map provided in Figure 1.5-47 shows that the entire area surrounding the IGCC Power Station Footprint and Buffer Land is zoned as MD (for Mining District). This designation is described in Section 1.5.3.1. The entire land area north and west of the plant was part of a large mining complex now owned principally by CE and on which they are operating a mineral sales business (decorative and other specialty rock). Existing/planned industries and their orientation from the Power Station Footprint include the following:

- MP Syl Laskin Energy Center (a coal-fired, steam electric generating plant) located about 6,900 feet southwest
- Laskin Energy Park located about 11,500 feet southwest along the 38L and 39L GO HVTL routes

- Mesabi Nugget, a planned taconite processing industry permitted for development with operations located to the southwest of the Power Station Footprint and nearby Loon Lake (the Alternate HVTL Route WRA-1A would traverse this area)
- PolyMet Mining Corporation, a precious metals mining industry planned for development on the CE property at a location about 16,500 feet due north of the Power Station Footprint.

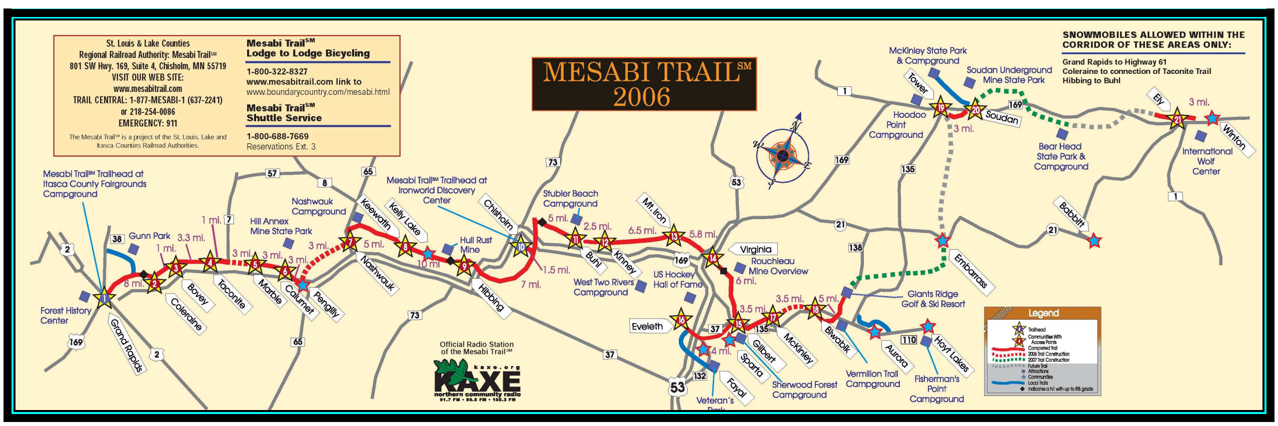
2.8.6.3 Recreational Areas

2.8.6.3.1 West Range

The Hill-Annex State Park is about 4.2 miles east of the City of Taconite. Gibbs Park is a day park that provides a fishing pier and swimming beach located on Holman Lake about 2.1 miles south-southwest of the Power Station Footprint. Numerous lakes in the area provide recreational opportunities for area residents. Activities such as swimming, boating, fishing, bird watching and other similar activities are prevalent.

The Mesabi Trail is a multiuse trail (bike, hiking, snowmobile, and wheelchair) that will ultimately connect Grand Rapids to Ely. A map of the trail is shown as Figure 2.8-6. One of the final segments of this trail will be constructed about 1.5 miles due south of the Power Station Footprint along an abandoned rail track. The Proponent will be required to coordinate its plans for constructing the rail spur to the Power Station Footprint with the plans for constructing this final trail segment.

Figure 2.8-6 Mesabi Trail Map



The forested areas in the project area also allow for recreational activities such as hiking, biking, hunting, bird-watching and other similar activities. Many of these activities take place on county-owned that is not specifically designated as a recreation area.

The Itasca County Comprehensive Land Use Plan was reviewed and the Plan mentions forest and recreational management zones in Itasca County, but does not provide the locations of these zones.

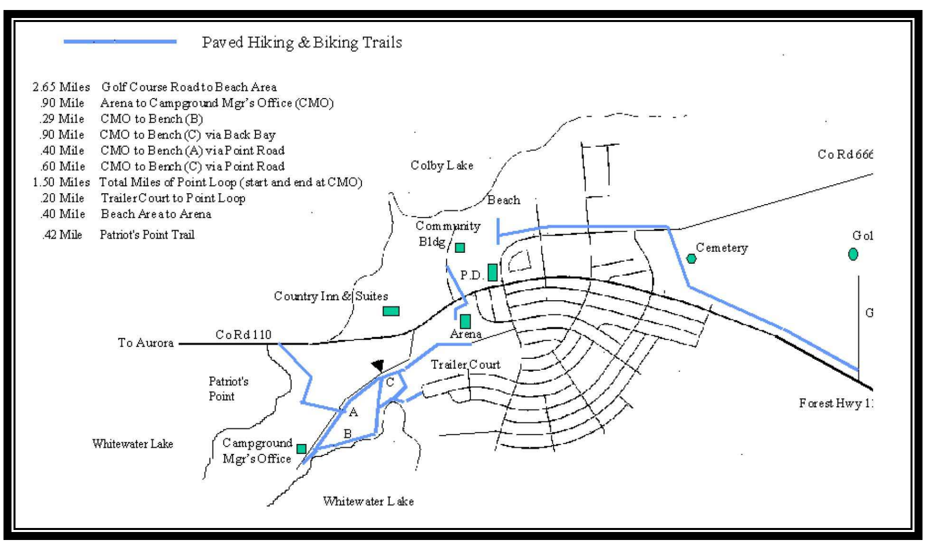
2.8.6.3.2 East Range Site

The East Range Site is located within the Superior National Forest. This area provides for recreational activities such as hiking, biking, hunting, bird-watching and other similar activities. Hoyt Lakes is on the Superior National Forest Scenic Byway shown in Figure 2.8-7.

Figure 2.8-7 Map of Superior National Forest Scenic Byway

In addition, area lakes provide numerous recreational opportunities for area residents. Hoyt Lakes offers numerous hiking and biking trails and a golf course as shown in Figure 2.8-7.

Figure 2.8-8 Nearby Recreational Activities in Hoyt Lakes



Many recreational activities take place on county-owned land that is not specifically referred to as designated recreational areas.

2.9 Materials and Waste Management

Sections 1.8.3 through 1.8.9 provide detailed information on solid and hazardous materials/wastes and their management. Material presented in these sections, unless otherwise noted, is applicable to both the West and East Range Sites.

2.10 Ecological Resources

The following sections describe the ecological conditions and biological communities that are present on the West and East Range Sites and their associated corridors. Section 2.10.1 describes the site conditions and occurrences of and habitats for flora and fauna associations and Section 2.10.2 describes the occurrences of and habitat for state and federally rare, special concern, threatened, or endangered species occurring on or near both sites.

2.10.1 Flora and Fauna

Biological communities and habitats for any occurrences of flora and fauna were assessed in conjunction with the field reconnaissance for wetland habitat. Review of MDNR Natural Heritage Information System (NHIS) data for known records of protected habitats or species within or near the project area provided information for potential target habitats to assess on-site.

2.10.1.1 West Range Site

For the West Range Site, habitats were first identified through off-site methods primarily through review of aerial and satellite imagery. This was followed by field reconnaissance completed by SEH Biologists during June 6–10, 2005. The terrestrial (upland) habitats described below are based on observations collected during the June 2005 field reconnaissance. Supplemental information describing terrestrial habitats was provided by SEH Wetland Scientists from their data and observations collected during June–August, 2005 during the wetland surveys. Observations of specific flora and fauna are also addressed below when it is vital information to include.

Biological communities could not be determined for the segments of the utility corridors that were not accessible during the 2005 field reconnaissance and survey of wetlands. Permission to access these existing or proposed corridors has not yet been obtained from the various landowners and/or easement holders. For the utility corridors, assessment of vegetation cover type was then completed through use of LandSat-Based Land Use-Land Cover data, which is raster-based land cover data derived from 30 meter resolution Thematic Mapper satellite imagery. Although the source imagery dates range from June 1995–June 1996, overall land use changes in this area of the state have not been dramatically changed. For these reasons, the dataset from 1995–1996 is considered appropriate for evaluation of biological communities. The corridors are described in detail in Section 1 of this report.

A general description of the physiography, biological communities, and faunal associations detail the affected environment for the general vicinity of the West Range Site and associated utility and transportation corridors. Additionally, a description of the vegetation cover types encountered within the utility and transportation alternatives based on LandSat imagery is provided in the following subsections. Section 3.9 describes in detail the specific environmental consequences of biological communities and faunal associations within the West Range Site boundary and IGCC facility, and utility and transportation corridors.

2.10.1.1.1 Physiography

The ecological communities of the West Range Site are influenced by topography and land uses. Timber harvesting is the primary land use that has impacted the site. Timber harvesting has influenced the composition and dynamics of the forest cover on the site. Both clear cutting and selective harvesting of timber are applied to defined tracts of land within the site resulting in a patchwork-like pattern of cleared recently cut areas and stands of forest cover of varying ages and compositions. Land uses are shown in Figures 2.8-1 and 2.8-2.

The geology is comprised of Pleistocene glacial till over Precambrian bedrock. The glacial till (surface geology) is ground moraine within the Nashwauk Moraine Association of the Rainy Lobe glacial advance. Deposits of peat and bedrock outcrops are embedded within the till. The site topography is varied with gently sloping hills located in the western half of the West Range Site and a more rugged series of north-south trending ridges located in the eastern half. Three small lakes are also present within the site boundary. Flat areas are peat deposits (wetlands) described in more detail in Section 2.7 on wetlands.

2.10.1.1.2 Flora—Vegetative Communities

The following descriptions of the vegetative communities found on the West Range Site are derived from the *Field Guide to the Native Plant Communities of Minnesota: The Laurentian Mixed Forest Province* (MDNR 2003), a vegetation classification system for north central and northeastern Minnesota. The following discussion describes terrestrial habitats present on the site. The wetland communities on the site are discussed in detail in Section 2.7. State and federally protected flora species addressed in Section 2.10.4.

The majority of the forested terrestrial (upland) habitats consist of northern mesic hardwood forest, and further classified as the plant community type red oak-sugar maple-basswood-(bluebead lily) forest (MDNR Code MHn35b). This hardwood forest is typical on well-drained to moderately well drained loamy soils, most often on stagnation moraines and till plains and less frequently on bedrock hills. The plant community association is dominated with sugar maple (*Acer saccharum*), basswood (*Tilia americana*), and northern red oak (*Quercus rubra*). The presence of paper birch (*Betula papyrifera*) and red maple (*Acer rubra*), and occasionally yellow birch (*Betula allegheniensis*) and quaking aspen (*Populus tremuloides*) indicate the plant community type MHn35b. Subcanopy species in the northern mesic hardwood forest commonly include sugar maple and ironwood (a.k.a. eastern hop hornbeam, *Ostrya virginiana*). Sugar maple is the dominant important species in the shrub layer, but other frequent shrub species include beaked hazel (*Corylus cornuta*), chokecherry (*Prunus virginiana*), pogoda dogwood (*Cornus alternifolia*), fly honeysuckle (*Lonicera canadensis*), and balsam fir (*Abies balsamea*). Common understory species include wild sarsaparilla (*Aralia nudicaulis*), large-leaved aster (*Aster macrophyllus*), mountain rice grass (*Oryzopsis asperifolia*), and rose twistedstalk (*Streptopus roseus*). Other common herbaceous species include Pennsylvania sedge (*Carex* *pennsylvanica*), sweet-scented bedstraw (*Galium triflorum*), large-flowered bellwort (*Uvularia grandiflora*), and bluebead lily (*Clintonia borealis*).

The northern mesic hardwood forest contained some of the more mature forest cover on the site. It was estimated that timber activities had not occurred within the 30–60 year span preceding the field reconnaissance visit. Sugar maple and yellow birch were the largest species observed, with many yellow birch averaging 8–12 inches in diameter at breast height (dbh) and sugar maple averaging 12–14 inch dbh. The subcanopy and shrub-layer were very sparsely vegetated with a few small maples, oaks, ironwood, hazel, honeysuckle, and serviceberry. Regeneneration of sugar maples is suppressed due to canopy cover with many maple seedlings in the forb layer. Understory forb species most commonly observed were bluebead lily, Pennsylvania sedge, and wild sarsaparilla, and large-leaved aster. In areas of blow downs or canopy openings, sugar maples have regenerated quickly through the available light creating dense stands of saplings. The soils in this natural community were typical Rainy Lobe tills, with stones and cobbles in sandy clay loam soils and boulders deposited intermittently on the forest floor.

The second most abundant upland plant community within the west range site is the northern wet-mesic boreal hardwood-conifer forest, and further classified as the aspen-birch-red maple forest (MDNR Code MHn44a). This hardwood forest is most commonly observed on level, clayey sites with high local water tables on glacial lake deposits, stagnation moraines, and till plains. The plant community association is variable, with canopy species generally dominated by quaking aspen, paper birch, and balsam fir. Other less frequent associates are red maple, white spruce (*Picea alba*), or black ash (*Fraxinus nigra*). These same canopy species are also important subcanopy species. The shrub layer has beaked hazel most prevalent, but other common species include chokecherry, juneberries (*Amelanchier spp*.), bush honeysuckle (*Diervilla lonicera*), and mountain maple (*Acer spicatum*). Common understory forbs include Canada mayflower (*Maianthemum canadensis*), wild sarsaparilla, sweet-scented bedstraw, dwarf raspberry (*Rubus pubescens*), and large-leaved aster (most frequent).

The northern wet-mesic boreal hardwood-conifer forest area within the West Range site had less mature forest stands than the northern mesic hardwood forest, and was mostly dominated by paper birch with less frequent amounts of balsam fir. Other species observed less frequently included white pine (occasional), American elm (*Ulmus americana*), sugar maple, and green ash (*Fraxinus pensylvanica*). Understory species consisted mostly of beaked hazel and less commonly serviceberries. Immature red maple, basswood, quaking aspen, and big-toothed aspen (*Populus grandidentata*) were also observed at the shrub and sub-canopy layer. Common understory forbs observed included, but were not limited to, large-leaved aster and bracken fern (*Pteridium aquilinum*), bluebead lily, species of clubmoss, Canada mayflower, and sweet coltsfoot (*Petasites frigidus*).

The remaining terrestrial forested areas within the West Range Site are second growth aspen forest, which are near even-age stands emerging after logging activities. This community has a tree canopy dominated with quaking aspen and balsam poplar (*Populus balsamifera*). Generally, these areas varied in age from 10–20 years and are defined by even aged canopy trees, many of which are relatively young with small stems. Herbaceous species consisted mainly of big-leaf aster, bracken fern, and goldenrods. The early successional aspen forest community is recognized in the MDNR's Mesic Hardwood Forest System as about 0–35 years in age, but does not receive a specific code in this system. For these reasons, these clear cut areas will be referred to as ***aspen forest*** throughout this analysis.

The linear maintained rights-of-way that transect the site are dominated with herbaceous vegetation and occasional shrubs. Wetlands within these linear features are described in Section 2.7. Uplands in the ROW are dominated with old field vegetation comprised of common Timothy (*Phleum pratense*), Canada blue-joint (*Calamagrostis canadensis*), goldenrods (*Solidago sp.*), smooth brome (*Bromus inermis*), reed canary grass (*Phalaris arundinacea*), big-leaf aster, bracken fern, wild sarsaparilla, and other pioneer vegetation typical of disturbed areas. Old field areas that are disturbed or maintained do not receive specific classification in the MDNR system for the Laurentian Mixed Forest Province. These old field areas are limited to the maintained utility rights-of-way.

There was no old growth or mature conifer forest observed during the field reconnaissance. White pines were observed infrequently and red pine (*Pinus resinosa*) was not observed at the site. All of these terrestrial communities on-site have been impacted by timber activities at some point in time. Some areas appear to have been logged for several consecutive decades. The eastern half of the site had areas of recent (2005) clear cutting of aspen stands. The western half of the site also had evidence of logging activities in the past 10–20 years, with dense quaking aspen regrowth. Beaver activity was also observed where the majority of the tree cover had been removed recently. Beaver activity was highest in the eastern half of the site.

2.10.1.1.3 LandSat Vegetative Cover Types

For utility and transportation corridors that were not investigated during the 2005 habitat assessments and wetlands surveys, use of the LandSat-Based Land Use-Land Cover (Raster) data provided vegetative coverage of these corridors. These data originated from the Manitoba Remote Sensing Centre, and are downloadable from the Minnesota Department of Natural Resources on-line Data Deli. A summary of each terrestrial vegetative land cover and within which utility and transportation corridors it is encountered is provided in the following table. Where the LandSat data provided wetland or aquatic vegetative land covers, these descriptions were not used. Rather, the National Wetlands Inventory and U.S. Fish and Wildlife Service Circular 39 classifications were used to characterize these wetland or aquatic habitats within the utility and transportation corridors that have not yet been field surveyed. The Project's potential impacts to wetlands and terrestrial vegetation are assessed in Sections 3.6 (Wetlands) and 3.9 (Ecological Resources), respectively.

Table 2.10-1
Terrestrial Land Cover Types from LandSat-Based Land Use-Land Cover[1] and in which Utility or Transportation Corridor it is Encountered

Land Cover	Definition
Coniferous forest	Includes areas with at least two thirds or more of the total canopy composed of predominantly woody coniferous species. It may contain deciduous species but is dominated by coniferous species. It includes woodlots, shelter belts, and plantations.
Deciduous forest	Includes areas with at least two-thirds or more of the total canopy cover composed of predominantly woody deciduous species. It may contain coniferous species but is dominated by deciduous species. It includes woodlots, shelter belts, and plantations.
Grassland	Includes areas covered by grasslands and herbaceous plants. May contain up to one third shrubs and/or tree cover. Areas may be small to extensive and range from regular to irregular in shape. These areas are often found between agricultural land and more heavily wooded areas, along ROWs and drains. Some areas may be used as pastures and be mowed or grazed, and may range in appearance from very smooth to quite mottled. Included are fields which show evidence of past tillage but now appear to be abandoned and grown to native vegetation or planted to a cover crop.
Mixed-wood forest	Areas of forest where the canopy is composed of approximately equal amounts of deciduous and coniferous species.
Regeneration/ Young Forest	Areas where commercial timber has been completely or partially removed by logging; management activities whose goal is to enhance timber productivity and/or wildlife habitat and to provide age class and species diversity; and catastrophic events, primarily fire and wind damage. These activities have taken place in the last 15 years. Almost all of these areas have been replanted or naturally regenerated into young trees.
Shrubby grassland	This class includes a combination of grass, shrubs, and trees in which deciduous and/or coniferous treed cover comprises from one third to two thirds of the area, and/or the shrub cover comprises more than one third of the area. This complex is often found adjacent to grassland or forested areas, but may be found alone. These areas are often irregular in shape and vary greatly in size.
[1] Source: Manitoba Remote Sensing Centre.	

Table 2.10-2
Terrestrial Land Cover Types Encountered in each Utility or Transportation Corridor

Utility or Transportation Corridor	Land Cover Types from LandSat-Based Land Use-Land Cover					
	Coniferous forest	Deciduous forest	Grassland	Mixed-wood forest	Regeneration/ Young Forest	Shrubby Grassland
HVTL Alternative 1	X	X	X	X	X	X
HVTL Alternative 1A	X	X	X	X	X	X
HVTL Phase 2	X	X	X	X	X	X
Gas Pipeline 1	X	X	X	X	X	X
Gas Pipeline 2	X	X	X	X	X	X
Gas Pipeline 3	X	X	X	X	X	X
Process Water Pipeline Segment 1 (LMP to CMP)		X				
Process Water Segment 2 (CMP to West Range Site)	X	X		X	X	
Process Water Segment 3 (HAMP Complex to CMP)	X	X		X	X	
Process Water Blowdown Pipeline Alternative 1	X	X		X	X	
Process Water Blowdown Pipeline Alternative 2	X	X	X	X	X	
Potable Water and Sewer Pipelines	X	X	X	X	X	
Rail Line Alternative 1A and Center Loop	X	X	X	X	X	
Rail Line Alternative 1B and Center Loop	X	X	X	X	X	
Roads	X	X	X	X	X	

2.10.1.1.4 Fauna

Fauna (animals) within the West Range Site include species that are typical to northern Minnesota. State and federally protected fauna are addressed in Section 2.10.2. The following discussion describes the wildlife habitats as related to the wetland and terrestrial vegetative communities described above, and faunal assemblages that are expected to occur within each community. Faunal habitats are represented by the terrestrial and wetland vegetative communities shown on Figures 2.8-1. Fauna that were observed during the field investigations are also addressed. Impacts to the faunal habitats are addressed in the Section 3.9.

The fauna utilizing habitats found within the northern mesic hardwood forest (red oak-sugar maple-basswood-(bluebead lily) forest) are common to second growth mixed forests, which is the most abundant habitat found on the West Range site. Avifauna (birds) diversity is highest within this community compared to other habitats. This includes nesting and foraging habitats for songbirds and raptors. The northern mesic hardwood forest also provides suitable habitats for reptiles, primarily nesting habitats for turtles when aquatic habitats are in close proximity, and for the two species of snake found in northern Minnesota.

The list of potential mammals that utilize this northern mesic hardwood forest includes predators and large ungulates such as moose and deer that are common to northern Minnesota. Many deer were observed within this forest type, and deer browse was commonly observed. Suitable forage for moose occurs in the northern mesic hardwood forest, and a moose skeleton was also observed on the site. Beaver also utilize this community for forage and beaver activity was prevalent, especially within the eastern half of the site. Interesting wildlife activity noted by SEH Biologists during the June 2005 field reconnaissance was observation of a grey wolf (*Canis lupus*—federally listed threatened) preying on a deer fawn.

The northern wet-mesic boreal hardwood-conifer forest is patchy and discontinuous on the West Range Site due to presence of other habitat types within, such as wetlands, and also by frequent disturbances from timber activities surrounding this forest community. The fauna found within this community are anticipated to be common to second growth forests and varying upland habitats found in northern Minnesota.

Faunal diversity within the aspen forest vegetative community is expected to be lower than the northern mesic hardwood forest due to the lack of habitat complexity and structure, and tree diversity. This may be especially applicable to the younger stands of aspen. In contrast, these aspen communities also provide habitat for species that may not be found in other habitats and/or have habitat preferences that are exclusive to aspen forests. The presence of the aspen communities within the project site likely increases the overall habitat complexity of the project site. Quaking aspens are often considered keystone species for which many other species are dependent on. Aspens are an important part of the north woods food web for many levels of fauna ranging from microscopic insects, to beaver and moose. Aspen stands are likely perpetuated through clear cutting activities as many stands of aspens are even aged and shaped like clear cut parcels (see Figures 2.8-1 and 2.8-2).

As a wildlife habitat, the northern wet-mesic boreal hardwood-conifer forest provides similar habitat components as the northern mesic hardwood forest community. The well defined shrub layer and older tree canopy increases the habitat structure and complexity of the site.

Wetland habitats for fauna are relatively diverse and common throughout the West Range Site. The Type 8 bog habitat is the most unique and is potential habitat for rare species of fauna, primarily birds, insects and small mammals. All other types of wetlands (Types 2–7) that are not hydrologically connected to lakes are the most important for amphibians. These wetlands provide optimum amphibian breeding habitats due to a lack of fish (predators) populations. Adult Anurans (frogs) were observed during the field reconnaissance and included American toad (*Bufo americanus*), gray treefrog (*Hyla versicolor*), Northern leopard frog (*Rana pipiens*), and wood frog (*Rana sylvatica*). Potential habitats were also observed for the spring peeper (*Psuedacris crucifer*), Western chorus frog (*Psuedacris triserata*), green frog (*Rana clamitans*), and mink frog (*Rana septentrionalis*), all species common to the area. The mink frog is common to lakes and lake fringe wetlands. These wetlands also provide potential habitat for the Eastern newt (*Notopthalmus viredescens*) and the blue-spotted salamander (*Ambystoma laterale*).

Types 6, 7, and 8 wetlands provide nesting and foraging habitat for songbirds and raptors. The Type 8 wetlands also provide habitat for insect fauna that are exclusive to bog habitats. Types 3, 4, and 5 marsh wetlands and the lake shore fringes provide foraging habitats for wading birds, rails, and waterfowl. No colonial waterbird nest colonies were observed and no islands for such colonies are present within the lakes of the West Range Site. Fish habitats are restricted to Dunning Lake along the site boundary.

No breeding concentrations of migratory birds were observed within the West Range Site. These include nesting swallow colonies, waterbird colonies, heron and egret nests, or other colonial nesting species. The entire site does contain breeding bird habitats as evidenced by the songbirds engaging in territorial behaviors and calls during the June and July 2005 field surveys. These were assumed to be from nesting birds. Raptor nesting was assumed to occur throughout the site as well. Two adult unidentifiable Accipiters (family name of forest dwelling hawks) and a barred owl (*Strix varia*) were observed. Of the three potential Accipiters found in this area, the Northern goshawk (*Accipiter gentiles*) is the only Accipiter considered rare and is a designated sensitive species in Minnesota by the U.S. Forest Service. Goshawk habitat was relatively absent from the site as this animal prefers old growth and undisturbed conifers. Ruffed grouse (*Bonasa umbellus*) were commonly observed especially in the second growth aspen forest, further indicating the widespread occurrence of timber activities on the site.

Habitat quality varies but overall habitat quality for the West Range Site would rank as medium on a scale from poor to high quality. Wetlands are the highest quality habitats on-site and the Type 8 wetlands would rank as high quality due to their uniqueness and lack of disturbance. Disturbance related to timber and clear-cutting is temporary due to forest regeneration. Disturbances also tend to generate more habitat variety compared to a large monotypic tract of land with an even aged forest. Habitat fragmentation and loss of habitat connectivity is most prevalent southwest of the site boundary due to the impacts of past mining. The existing roads and HVTLs in and around the project have also resulted in permanent conversions and represent a habitat fragmenting vector for some species. Land uses and habitats are similar in lands surrounding and extending outward from the West Range Site.

No designated federal Wildlife Refuges, Waterfowl Production Areas, or National Preserves are within or immediately adjacent to the West Range Site Boundary. No MDNR Wildlife Management Areas (WMAs), Wildlife Refuges, state Scientific and Natural Areas (SNA), designated Game Lakes, or Designated Trout Streams are within or immediately adjacent to the West Range Site or any of the associated utility or transportation corridors. There is a Designated Trout Stream located 2,500 feet east of HVTL Phase 2 (east of Pengilly) that drains into Swan Lake. This Designated Trout Stream is not directly connected to any wetland or water bodies within the West Range Site or its associated utility or transportation corridors.

Projects that receive any federal funds are subject to the Fish and Wildlife Coordination Act, requiring that federal agencies consider the project effects on fish and wildlife and their habitats. Fish and game species are protected through the hunting, fishing, and trapping regulations enforced by the MDNR and USFWS. Birds and their nests, including the songbirds and raptors found within the site, are protected under the federal Migratory Bird Treaty Act.

2.10.1.1.5 Crossings of Rivers, Streams, and Bodies of Water

There are several streams and rivers, and one body of water that will be crossed for the various utility alternatives associated with the West Range Site. These water crossings are limited to the corridors associated with the HVTL, gas pipelines, and one water process line. There are no water crossings associated with siting, placement, or construction of the IGCC Facility, the railroad alternatives, sewer and water line, and roads. The following discussion and tables provide information on the habitats and associated fisheries within these water bodies. Section 2.7 (Wetlands) provides details about the wetland habitat associated with the water crossings.

The water crossings identified under the various alternative alignments can generally be broken down into three basic categories: small ephemeral/perennial streams, rivers, and lakes. These three basic classifications all have somewhat unique fisheries components, and will be discussed in general terms. Specific information on fisheries resources in the project vicinity has been requested from the Minnesota Department of Natural Resources. These data are pending, but is expected to be limited to data on the Swan River, Prairie River, and some of the major lakes near the West Range Site. Fisheries data on most of the smaller waterways is not expected to be available. None of the water bodies proposed to be crossed are designated as trout streams, although it is possible that trout are occasionally present in some of the area waterways not designated. None of the waterways or water bodies that are proposed to be crossed are considered to be cold water due to the lack of naturally reproducing trout populations and significant groundwater source hydrology.

The small streams that are proposed to be crossed are typically less than three feet across, tend to be very shallow, have low discharge, are often vegetated with emergent marsh species, and tend to act as conveyance systems between the multiple wetlands and water bodies located in the project vicinity. These small waterways are also highly prone to hydrologic alteration due to the abundance of beaver and associated beaver dams. The fisheries habitat in these small streams is limited due to lack of space and cover, and occasional lack of water during dry periods. Beaver dams can also block fish passage, but can also create small ponds suitable for some species to thrive. These smaller streams can be important for allowing fish to move between more permanent suitable habitats, but are generally not primary fishery resources. If fish species are present in these small stream systems, they tend to be dominated by small non-game species such as Cyprinids (minnows, dace, creek chub) and Percids (darters).

The rivers, primarily the Swan River, Prairie River, and their tributaries, are more significant for fisheries than the smaller streams. Both of these river systems discharge into the Mississippi River and serve to connect many of the lakes including Trout Lake, Holman Lake, Twin Lake, and Swan Lake. Because of the interconnectedness of these rivers and lakes, the fish assemblages are likely to be similar in most of these rivers. While specific data have not been provided, it is likely that the rivers would support prime game fish species such as northern pike (*Esox lucius*), largemouth bass (*Micropterus salmoides*), panfish (*Lepomis* spp.), and possibly walleye (*Sander vitreus*). Nongame species likely include bowfin (*Amia calva*), many minnows and shiners (Cyprinidae), white sucker (*Catostomus commersoni*), redhorse (*Moxostoma* spp.), bullhead (*Ameiurus* spp.), and darters (Percidae).

The only lake that is proposed to be crossed is Ox Hide Lake, which would have approximately 70 feet of the lake crossed over by HVTL Phase 2. Because this is an overhead transmission line, there are no anticipated direct effects to the lake. The spacing of the transmission line supports should allow the entire lake to be spanned. Ox Hide Lake, like many of the lakes in the region, supports northern pike (*Esox lucius*), largemouth bass (*Micropterus salmoides*), panfish (*Lepomis* spp.), and yellow perch (*Perca flavescens*).

Construction methods of the water crossings will vary depending on what utility is crossing. The HVTL lines are suspended, and therefore should be able to avoid any direct impacts to the water resources. The gas pipelines are proposed to be directionally drilled under streams and would daylight approximately 100 feet from either side of each river or stream bank. The water process blowdown pipeline, however, is proposed to be buried through open-cut trenching, and therefore have the potential to directly impact the aquatic resources.

Construction methods have been evaluated to minimize impacts. The primary way to avoid impacts is to directionally drill under the aquatic resource. When feasible, which will be for short crossings with no bedrock, this method will be preferred. If directional drilling cannot be completed, an open cut will be used. This method can be timed to coincide with low water levels, and can be done using coffer dams, bypass flumes, diversionary channels, or other short-term methods of allowing work to be done in a dry channel. Guidance published by the U.S. Fish and Wildlife Service, U.S. Army Corps of Engineers, Federal Energy Regulatory Commission, and Minnesota Department of Natural Resources will be consulted and evaluated once final alignments have been determined. These sources will allow a minimally invasive construction method to be used depending on the type of crossing needed.

2.10.1.1.5A *West Range HVTL Alternative 1*

There are a total of two river or stream crossings associated with HVTL Alternative 1. These crossings are over the Swan River (perennial) and a perennial stream between Big and Little Diamond Lakes. The Swan River is identified as a protected water by the MDNR PWI. As the HVTL line is suspended, there are no direct impacts associated with these crossings. Further discussion of potential impacts to waterbodies is provided in Section 3.

Table 2.10-3
Water Crossings for West Range HVTL Alternative 1

Stream Crossing Location	MDNR PWI	Milepost (mile + linear ft)	Length of Waterbody Crossing
Perennial stream between Big & Little Diamond Lakes (Basin E1)	No	0+3980	3 linear ft
Swan River (perennial)	Yes	3+1630	120 linear ft

2.10.1.1.5B ***West Range HVTL Alternative 1A***

There are a total of six river or stream crossings associated with HVTL Alternative 1A. Five of these crossings are over the Swan River (perennial) and one crossing is over a perennial stream between Big and Little Diamond Lakes. The Swan River is identified as a protected water by the MDNR PWI. As the HVTL line is suspended, there are no direct impacts associated with these crossings. Further discussion of potential impacts to waterbodies is provided in Section 3.

Table 2.10-4
Water Crossings for West Range HVTL Alternative 1A

Stream Crossing Location	MDNR PWI	Milepost (mile + linear ft)	Length of Waterbody Crossing
Perennial stream between Big & Little Diamond Lakes (Basin E1)	No	0+3980	3 linear ft
Swan River (perennial)	Yes	3+1700	60 linear ft
Swan River (perennial)	Yes	3+2960	60 linear ft
Swan River (perennial)	Yes	3+3575	50 linear ft
Swan River (perennial)	Yes	3+4400	270 linear ft
Swan River (perennial)	Yes	4+360	90 linear ft

2.10.1.1.5C ***West Range HVTL Phase 2***

There are a total of five water crossings associated with HVTL Phase 2. Two crossings are over the Swan River (perennial) and one of its perennial tributaries. The other three crossings are associated with Snowball and Ox Hide Creeks (both perennial), and Ox Hide Lake. The Swan River and its tributary, Snowball Creek, and Ox Hide Lake are identified as protected waters by the MDNR PWI. Lakes and wetlands designated as MDNR Protected Waters or Wetlands receive a unique identification number, but streams and rivers do not. In this case, the MDNR PWI identification number for Ox Hide Lake is 106P. As the HVTL line is suspended, there are no direct impacts associated with these crossings. Further discussion of potential impacts to waterbodies is provided in Section 3.

Table 2.10-5
Water Crossings for West Range HVTL Phase 2

Stream Crossing Location	MDNR PWI	Milepost (mile + linear ft)	Length of Waterbody Crossing
Swan River (perennial)	Yes	14+0	190 linear ft
Tributary of Swan River, outlet of Lower Panasa Lake (perennial)	Yes	12+4640	3 linear ft
Snowball Creek (perennial)	Yes	11	10 linear ft
Ox Hide Lake	Yes (PWI 106P)	8+2220	70 linear ft
Ox Hide Creek (perennial)	Yes	9+2880	10 linear ft

2.10.1.1.5D ***West Range Gas Pipeline Alternative 1***

There are a total of four river or stream crossings associated with Gas Pipeline Alternative 1. Two of these crossings are over the Swan River (perennial). The other crossings are over a tributary of the Swan River (perennial) and a perennial stream between Big and Little Diamond Lakes. The channel between Big and Little Diamond Lakes is also within a wetland. The Swan River is the only water body identified as a protected water by the MDNR PWI.

The crossings of the Swan River and its tributary will require either directional drilling or open cutting to install the gas line. The perennial stream between Big and Little Diamond Lakes is small and best described as a flowing shallow marsh rather than a defined channel in the area where it will be crossed. The crossing location is also within a wetland, so directional drilling will be preferred but may not be feasible due to the total length of the stream and wetland that would need to be crossed. Further discussion of potential impacts to waterbodies is provided in Section 3.

Table 2.10-6
Water Crossings for West Range Gas Pipeline Alternative 1

Stream Crossing Location	MDNR PWI	Milepost (mile + linear ft)	Length of Waterbody Crossing
Swan River (perennial)	Yes	4+2170	60 linear ft
Tributary of Swan River (perennial)	No	5+1460	10 linear ft
Swan River (perennial)	Yes	9+4560	60 linear ft
Perennial stream between Big & Little Diamond Lakes (Basin E1)	No	12+2000	3 linear ft

2.10.1.1.5E ***West Range Gas Pipeline Alternative 2***

There are a total of four river or stream crossings associated with Gas Pipeline Alternative 2. Two of these crossings are over the Swan River (perennial). The other crossings are over the Prairie River (perennial) and a perennial stream between Big and Little Diamond Lakes. The channel between Big and Little Diamond Lakes is also within a wetland. The Swan River and Prairie River are both identified as protected waters by the MDNR PWI.

The crossings of the Swan River and its tributary, and the Prairie River will require either directional drilling or open cutting to install the gas line. The perennial stream between Big and Little Diamond Lakes is small and best described as a flowing shallow marsh rather than a defined channel in the area where it will be crossed. The crossing location is also within a wetland, so directional drilling will be preferred but may not be feasible due to the total length of the stream and wetland that would need to be crossed. Further discussion of potential impacts to waterbodies is provided in Section 3.

Table 2.10-7
Water Crossings for West Range Gas Pipeline Alternative 2

Stream Crossing Location	MDNR PWI	Milepost (mile + linear ft)	Length of Waterbody Crossing
Prairie River (perennial)	Yes	0+1980	210 linear ft
Swan River (perennial)	Yes	5+4330	50 linear ft
Swan River (perennial)	Yes	10+4180	50 linear ft
Perennial stream between Big & Little Diamond Lakes (Basin E1)	No	13+1690	3 linear ft

2.10.1.1.5F ***West Range Gas Pipeline Alternative 3***

There are a total of four river or stream crossings associated with Gas Pipeline Alternative 3. These crossings are over the Prairie River and one of its tributaries, a perennial stream draining to Holman Lake, which is also associated with a large wetland complex, and a perennial stream between Big and Little Diamond Lakes, which is also within a wetland. The Prairie River and the perennial stream that drains to Holman Lake are both identified as protected waters by the MDNR PWI.

The crossings of the Prairie River will require either directional drilling or open cutting to install the gas line. The perennial stream crossing of the channel draining into Holman Lake is part of a large wetland complex, and may not be able to be directionally drilled. The perennial stream between Big and Little Diamond Lakes is small and best described as a flowing shallow marsh rather than a defined channel in the area where it will be crossed. The crossing location is also within a wetland, so directional drilling will be preferred but may not be feasible due to the total length of the stream and wetland that would need to be crossed. Further discussion of potential impacts to waterbodies is provided in Section 3.

Table 2.10-8
Water Crossings for West Range Gas Pipeline Alternative 3

Stream Crossing Location	MDNR PWI	Milepost (mile + linear ft)	Length of Waterbody Crossing
Prairie River (perennial)	Yes	0+2300	210 linear ft
Tributary of Prairie River (perennial)	No	2+880	20 linear ft
Perennial stream, drains to Holman Lake	Yes	9+3200	3 linear ft
Perennial stream between Big & Little Diamond Lakes (Basin E1)	No	11	3 linear ft

2.10.1.1.5G ***West Range Blowdown Process Water Supply Pipeline Alternative 1 (West Range Site to Holman Lake)***

Alternative 1 for the Blowdown Process Water Supply Pipeline is the only water process pipeline that is associated with any water crossings. No other water process pipelines will cross water bodies and are therefore not discussed further in this section.

There are two stream crossings associated with the Blowdown Water Process Pipeline Alternative 1 (West Range Site to Holman Lake). Both crossings are over perennial streams; one drains from Little Diamond Lake, and the other drains to Holman Lake. Both of these streams are also within wetlands, and therefore the distance required to directionally drill and avoid impacts to aquatic resources is larger than indicated for the channel itself. Because of this increased distance, it is unknown if directional drilling is feasible, or if open cutting will be required. Further discussion of potential impacts to waterbodies is provided in Section 3.

Table 2.10-9
Water Crossings for West Range Blowdown Process Water Supply Pipeline Alternative 1

Stream Crossing Location	MDNR PWI	Milepost (mile + linear ft)	Length of Waterbody Crossing
Perennial stream from Little Diamond Lake	Yes	1+3990	3 linear ft
Perennial stream, drains to Holman Lake	Yes	2+2280	3 linear ft

2.10.1.2 East Range Site

For the East Range Site, habitats were first identified through off-site methods primarily through review of aerial and satellite imagery. The terrestrial (upland) habitats described below are based on observations collected by SEH Wetland Scientists from their data and observations collected during October 2004, and September through October 2005 during the wetland surveys. Observations of specific flora and fauna are also addressed below when it is vital information to include.

Biological communities could not be determined for the segments of the utility corridors that were not accessible during the 2005 field reconnaissance and survey of wetlands. Permission to access these existing or proposed corridors has not yet been obtained from the various landowners and/or easement holders. For the utility corridors, assessment of vegetation cover type was then completed through use of LandSat-Based Land Use-Land Cover data, which is raster-based land cover data derived from 30 meter resolution Thematic Mapper satellite imagery. Although the source imagery dates range from June 1995–June 1996, overall land use changes in this area of the state have not been dramatically changed. For these reasons, the dataset from 1995–1996 is considered appropriate for evaluation of biological communities.

A general description of the physiography, biological communities, and faunal associations detail the affected environment for the general vicinity of the East Range Site and associated utility and transportation corridors. Additionally, a description of the vegetation cover types encountered within the utility and transportation alternatives based on LandSat imagery is provided in the following subsections. Section 3.9 describes in detail the specific environmental consequences of biological communities and faunal associations within the East Range Site boundary and IGCC facility, and utility and transportation corridors.

2.10.1.2.1 Physiography

The ecological communities of the East Range Site are influenced by topography, faunal activities, and land uses. Timber harvesting is the primary land use that has impacted the site. A portion of the uplands within the East Range Site have been recently clear cut (within the previous five years). Timber harvesting has influenced the composition and dynamics of the forest cover on the site. Large areas are virtually devoid of tree cover due to recent clear cutting. Land uses for the East Range Site are shown in Figure 2.8.3 Land Use.

The geology is comprised of a thin mantle of Pleistocene glacial till over Precambrian bedrock amidst areas that are exposed bedrock. The glacial till (surface geology) is ground moraine within the Nashwauk Moraine Association of the Rainy Lobe glacial advance. Deposits of peat and bedrock outcrops are embedded within the till. The site topography is comprised of flat areas within the larger wetland basins and gently undulating hills elsewhere. The large ridges associated with the Iron Range occur approximately one mile to the north of the site. Large spoil and overburden piles surround the northern and western sides of the site. Flat areas are often peat deposits (wetlands), which are described in more detail in Section 2.7 on wetlands.

2.10.1.2.2 Flora—Vegetative Communities

The following descriptions of the vegetative communities found on the East Range Site are derived from the *Field Guide to the Native Plant Communities of Minnesota: The Laurentian Mixed Forest Province* (MDNR 2003), a vegetation classification system for north central and northeastern Minnesota. The following discussion describes terrestrial habitats present on the site. The wetland communities on the site are discussed in detail in Section 2.7. State and federally protected flora and fauna species are addressed in Section 2.10.4.

The forested terrestrial (upland) habitats found on the East Range Site consist of northern mesic mixed forest, further classified as the native plant community type aspen-birch forest (balsam fir subtype) (MDNR Code FDn43b1). This mixed forest is typically on loamy soils over bedrock in scoured bedrock uplands or on loamy, rocky, or sandy soils on glacial moraines, till plains, and outwash plains. This plant community association is dominated in the ground layer by wild sarsaparilla (*Aralia nudicaulis*), large-leaved aster (*Aster macrophylla*), bluebead lily (*Clintonia borealis*), and bunchberry (*Cornus canadensis*). The shrub layer consist of beaked hazel (*Corylus cornuta*), fly honeysuckle (*Lonicera canadensis*), and mountain maple (*Acer spicatum*). Presence of balsam fir in either the shrub layer or the subcanopy is an indicator of the northern mesic mixed forest. Canopy composition is mixed and includes include paper birch (*Betula papyrifera*), quaking aspen (*Populus tremuloides*), white pine (*Pinus strobus*), balsam fir (*Abies balsamea*), white spruce (*Picea glauca*), red pine (*Pinus resinosa*), and white cedar (*Thuja occidentalis*).

The northern mesic mixed forest habitat at the East Range Site contained a wide range of trees. From field observations, it was obvious that timber logging had occurred in many areas only a few years preceding the field reconnaissance. The entire site has undergone several iterations of clear cuts since settlement based upon tree age and community dominance. Quaking aspen stands were perpetuated through clear cutting activities, evidenced by the stands of evenly aged aspens observed on the site. The most mature trees in many areas were in an early to mid successional stage and age was less than 50 years. The landscape setting for this area is mostly scoured bedrock terrain. The soils in this natural community consisted of shallow parent material, mostly sands and loams, over bedrock.

2.10.1.2.3 LandSat Vegetative Cover Types

For utility and transportation corridors that were not investigated during the 2004 or 2005 habitat assessments and wetlands surveys, use of the LandSat-Based Land Use-Land Cover (Raster) data provided vegetative coverage of these corridors. These data originated from the Manitoba Remote Sensing Centre, and are downloadable from the Minnesota Department of Natural Resources on-line Data Deli. A summary of each terrestrial vegetative land cover encountered within utility and transportation corridors is provided in the following Table 2.10-10. Where the LandSat data provided wetland or aquatic vegetative land covers, these descriptions were not used. Rather, the National Wetlands Inventory and U.S. Fish and Wildlife Service Circular 39 classifications were used to characterize these wetland or aquatic habitats within the utility and transportation corridors that have not yet been field surveyed.

Table 2.10-10
Terrestrial Land Cover Types from LandSat-Based Land Use-Land Cover[1]

Land Cover	Definition
Deciduous forest	Includes areas with at least two-thirds or more of the total canopy cover composed of predominantly woody deciduous species. It may contain coniferous species but is dominated by deciduous species. It includes woodlots, shelter belts, and plantations.
Grassland	Includes areas covered by grasslands and herbaceous plants. May contain up to one third shrubs and/or tree cover. Areas may be small to extensive and range from regular to irregular in shape. These areas are often found between agricultural land and more heavily wooded areas, along ROWs and drains. Some areas may be used as pastures and be mowed or grazed, and may range in appearance from very smooth to quite mottled. Included are fields which show evidence of past tillage but now appear to be abandoned and grown to native vegetation or planted to a cover crop.
Mixed-wood forest	Areas of forest where the canopy is composed of approximately equal amounts of deciduous and coniferous species.
Coniferous forest	Includes areas with at least two thirds or more of the total canopy composed of predominantly woody coniferous species. It may contain deciduous species but is dominated by coniferous species. It includes woodlots, shelter belts, and plantations.
Shrubby grassland	This class includes a combination of grass, shrubs, and trees in which deciduous and/or coniferous treed cover comprises from one third to two thirds of the area, and/or the shrub cover comprises more than one third of the area. This complex is often found adjacent to grassland or forested areas, but may be found alone. These areas are often irregular in shape and vary greatly in size.
Regeneration/ Young Forest	Areas where commercial timber has been completely or partially removed by logging; management activities whose goal is to enhance timber productivity and/or wildlife habitat and to provide age class and species diversity; and catastrophic events, primarily fire and wind damage. These activities have taken place in the last 15 years. Almost all of these areas have been replanted or naturally regenerated into young trees.

[1] Source: Manitoba Remote Sensing Centre.

Utility or Transportation Corridor	Land Cover					
	Coniferous forest	Deciduous forest	Grassland	Mixed-wood forest	Regeneration/ Young Forest	Shrubby Grassland
IGCC Facility	X	X	X	X	X	X
HVTL Alternative 1	X	X	X	X	X	X
HVTL Alternative 2	X	X	X	X	X	X
Gas Pipeline	X	X	X	X	X	X
Process Water Supply Pipeline - Area 2WX to Site		X		X	X	
Process Water Supply Pipeline - Area 2WX to Area 2W				X		X
Process Water Supply Pipeline - Area 2W to Area 2E						
Process Water Supply Pipeline - Area 3 to Area 2E						
Process Water Supply Pipeline - Knox Mine to Area 2WX				X	X	
Process Water Supply Pipeline - Area 6 and Stephens Mine to Area 2WX		X	X	X	X	X
Process Water Supply Pipeline - Area 9 South to Area 6				X		
Process Water Supply Pipeline - Area 9 North (Donora Mine) to Area 6				X		
East Range Railroad Alternative 1	X			X		X
East Range Railroad Alternative 2				X	X	X
East Range Potable Water and Sewer		X	X	X	X	
East Range Roads	X	X		X	X	X

2.10.1.2.4 Fauna

Fauna (animals) within the East Range Site include species that are typical to northern Minnesota. State and federally protected fauna are addressed in Section 2.10.4. The following discussion describes the wildlife habitats as related to the wetland and terrestrial vegetative communities described above, and faunal assemblages that are expected to occur within each community. Faunal habitats are represented by the terrestrial and wetland vegetative communities shown on Figures 2.8-3 and 2.8-4. Fauna that were observed during the field investigations are also addressed. Impacts to the faunal habitats are addressed in the Section 3.9.

East Range site upland habitats have been greatly impacted by recent clearcutting. All of the uplands are classified as northern mesic mixed forest, aspen birch forest (balsam fir subtype) (MDNR Code FDn43B1). Most of the un-harvested stands of this habitat are located in the eastern third of the site. Clearcuts dominate elsewhere and wildlife habitat has been modified and qualitatively reduced in these areas. Avifauna (birds) diversity is highest within the un-harvested stands compared to the clearcut areas. This includes nesting and foraging habitats for songbirds and raptors. The same also applies to suitable habitats for reptiles, amphibians and mammals where clearcutting has diminished habitat quality and complexity for these faunal groups with representative species in the project area.

During the 2004 and 2005 habitat assessments and wetland surveys, no raptor nests were incidentally observed, however no formal surveys for such nests were conducted. An adult merlin (*Falco columbaris*) was observed in flight exhibiting territorial behaviors. A great horned owl (*Bubo virginianus*) was observed as well. Habitat for the red-shouldered hawk (*Buteo jamaicensis*) and northern goshawk (*Accipiter gentiles*) was lacking within the East Range site, attributable to timber activities and recent clearcutting. Probable habitats and improved habitat quality for these two rare species increase east and south of the project area, especially when entering the U.S. Forest Service property. No breeding concentrations of migratory birds were observed within the East Range Site. These include nesting swallow colonies, waterbird colonies, heron and egret nests, or other colonial nesting species.

The list of potential mammals that potentially utilize this site is comprehensive and includes predators, bears, and large ungulates such as moose and deer. A calf moose was observed during the wetland assessments in 2004 and moose signs were widespread throughout the East Range Site. Grey wolf (timber wolf) (*Canis lupus*—federally threatened) tracks and scat were also observed occasionally throughout the site. Grey wolf implications are addressed in the threatened and endangered species sections of this report in more detail. Deer were observed often, and a family of otters was observed on the eastern side of the project site. Beaver activity was widespread. Many of the wetlands within the project area contained beaver lodges, dams, and active evidence of foraging. Several beavers were observed as well. Habitat for fisher (*Martes pennanti*) and pine martin (*M. americana*) was confined to the forested wetlands where clearcutting has not occurred. Snowshoe hare habitat is also mostly confined to the forested wetlands for the same reason. This species is the primary prey item for the federally threatened Canada lynx (*Lynx canadensis*) that is discussed in more detail in the threatened and endangered species section of this report. Lastly, the American black bear (*Ursus americana*) is relatively common in the area and they are expected to potentially utilize all of the habitats in the area. Again, the clearcut areas provide the poorest quality habitat for this species and most other species of vertebrates in the area.

Wetland habitats for fauna are relatively diverse and common on the East Range Site. The Type 8 bog habitat is the most unique and is potential habitat for rare species of fauna, primarily birds and small mammals, but is not the most common or abundant wetland habitat within the East Range Site. All other types of wetlands (Types 2-7) on-site, but not connected to lakes are the most important for amphibians. These wetlands provide optimum amphibian breeding habitats that lack fish (predators) populations. Adult Anurans (frogs) were observed during the field reconnaissance and included American toad (*Bufo americanus*), gray treefrog (*Hyla versicolor*), northern leopard frog (*Rana pipiens*), and wood frog (*Rana sylvatica*). Potential habitats were also observed for the spring peeper (*Psuedacris crucifer*), western chorus frog (*Psuedacris triserata*), and green frog (*Rana clamitans*), all species common to the area. These wetlands also provide potential habitat for the eastern newt (*Notopthalmus viredescens*) and the blue-spotted salamander. Several of these species require upland habitats for some portion of their life histories. In some of these cases, clearcutting may have provided more or improved upland habitats for herpetofaunal species that require open upland habitats on sandy soils. For other herpetofaunal species, clearcutting may instead be a negative impact on upland habitat.

Types 6, 7, and 8 wetlands also provide nesting and foraging habitat for songbirds and raptors. Type 8 wetlands also provide habitat for insect fauna that are exclusive to bog habitats. Types 3 and 4 marsh wetlands provide foraging habitats for wading birds, rails, and waterfowl. No colonial waterbird nest colonies were observed on the East Range Site. Fish habitats are restricted to the creek and deeper wetlands that occur within the central portion of the site. Small fish (Notropids, darters) were observed in these open water habitats. Based on the field observations, small fish are most likely the only fish assemblages present. Lakes and larger waterbodies that might serve as sources of larger fish and game fish were absent within and immediately adjacent to the site. Furthermore, the extensive beaver dams and activity that is wide spread throughout the stream system could serve as formidable barriers for the movement of larger fish into the upstream portions of the system, in particular the spring spawning migrations of northern pike (*Esox lucius*).

Habitat quality varies but overall habitat quality for the East Range Site would rank as medium to medium-low on a scale from poor to high quality. Wetlands are the highest quality habitats on-site and the Type 8 wetlands would rank as high quality due to their uniqueness and lack of disturbance. Disturbed habitats from recent clearcutting are widespread, prevalent, and the primary reason for the diminished habitat quality.

Projects that receive any federal funds are subject to the Fish and Wildlife Coordination Act, requiring that federal agencies consider the project effects on fish and wildlife and their habitats. Fish and game species are protected through the hunting, fishing, and trapping regulations enforced by the MDNR and USFWS. Birds and their nests, including the songbirds and raptors found within the site, are protected under the federal Migratory Bird Treaty Act.

2.10.1.2.5 Crossings of Streams and Other Bodies of Water

There are several small streams and one lake that will be crossed for the various utility alternatives associated with the East Range Site. These water crossings are limited to the corridors associated with the HVTL, gas pipelines, water process line, processed sewer and water, and proposed rail alignments. There are no water crossings associated with siting, placement, or construction of the IGCC Facility or roads to access the facility. The following discussion and tables provide information on the habitats and associated fisheries within these water bodies. Section 2.7 (wetlands) provides details about the wetland habitat associated with the water crossings.

The water crossings identified under the various alternative alignments can generally be broken down into two categories: small perennial streams and Colby Lake. These two basic classifications all have somewhat unique fisheries components, and will be discussed in general terms. None of the water bodies proposed to be crossed are designated as trout streams or would be considered cold water streams, although it is possible that trout are occasionally present in some of the area waterways not designated.

The small streams that are proposed to be crossed are typically less than three feet across, tend to be very shallow, have low discharge, are often associated with wetland vegetation and tend to act as conveyance systems between the multiple wetlands and water bodies located in the project vicinity. These small waterways are also highly prone to hydrologic alteration due to the abundance of beaver and associated beaver dams. The fisheries habitat in these small streams is limited due to lack of space and cover, and occasional lack of water during dry periods. Beaver dams can block fish passage, but can also create small ponds suitable for some species to thrive. These smaller streams can be important for allowing fish to move between more permanent suitable habitat, but are generally not primary fishery resources. If fish species are present in these small stream systems, they tend to be dominated by small non-game species such as Cyprinids (minnows, dace, creek chub) and Percids (darters).

Colby Lake is a significant aquatic resource, and is proposed to be crossed for the HVTL alternatives and the processed water and sewer lines. This crossing is proposed at one of three narrowest portions of the lake and is proposed to tie into the Syl Laskin S.E. Station. Colby Lake is a 539-acre lake that has inlets from the Partridge River, Wyman Creek, and Whitewater Lake. There is a coal-fired electrical generating plant on Colby Lake with a fish screen in front of the cooling water intake. The power plant discharge goes into a long narrow arm of the lake that leads to the outlet, which is the Partridge River. A fish survey completed in 2000 identified Colby Lake as a below average lake for fish abundance compared to other lakes in the region. Fish populations in 2000 were dominated by bluegill sunfish (*Lepomis* spp.), followed by northern pike (*Esox lucius*), yellow perch (*Perca flavescens*), and white sucker (*Catostomus commersoni*). Other species were present in low numbers, but included walleye (*Sander vitreus*), black crappie (*Pomoxis nigromaculatus*), yellow bullhead (*Ameiurus natalis*), and rock bass (*Ambloplites rupestris*).

Construction methods of the water crossings will vary depending on what utility is crossing. The HVTL lines are suspended, and therefore should be able to avoid any direct impacts to the water resources. The gas, water, and sewer pipelines, however, are proposed to be buried, and therefore have the potential to directly impact the aquatic resources. Construction methods have been evaluated to minimize impacts. The primary way to avoid impacts is to directionally drill under the aquatic resource. When feasible, which will be for short crossings with no bedrock, this method will be preferred. If directional drilling cannot be completed, an open cut will be used. This method can be timed to coincide with low water levels, and can be done using coffer dams, bypass flumes, diversionary channels, or other short-term methods of allowing work to be done in a dry channel. Guidance published by the U.S. Fish and Wildlife Service, U.S. Army Corps of Engineers, Federal Energy Regulatory Commission, and Minnesota Department of Natural Resources will be consulted and evaluated once final alignments have been determined. These sources will allow a minimally invasive construction method to be used depending on the type of crossing needed.

2.10.1.2.5A ***HVTL Alternative 1***

There are 21 crossings of streams and other bodies of water associated with East Range HVTL Alternative 1. Colby Lake (249P) and an unnamed pond (430W) are lakes protected by the MDNR PWI. There are also nine rivers and streams that are protected by the MDNR PWI. As the HVTL line is suspended, there are no direct impacts associated with these crossings. However, the protected waters will require a License for Utility Crossings of Public Lands and Waters granted by the MDNR Division of Lands and Minerals. Table 2.10-11 below summarizes the stream crossings associated with this alternative. Potential impacts to these wetlands are discussed in Section 3.

Table 2.10-11
Water Crossings for East Range HVTL Alternative 1

Stream Crossing Location	Milepost (mile + linear ft)	MDNR PWI	Length of Crossing (linear ft)
Colby Lake	1+4670	Yes 249 P	540
Partridge River	5+1190	Yes	110
Perennial Tributary to St. Louis River	6+3680	No	3
Perennial Tributary to St. Louis River	6+4590	Yes	3
Perennial Tributary to St. Louis River	8+1215	No	3
Perennial Tributary to St. Louis River	8+2420	No	3
Unnamed Pond	9+0480	Yes 430 W	180
Perennial Stream between North and South Cedar Island Lake	11+1780	Yes	60
Perennial Stream South of Forge Lake	13+1850	No	95
Perennial Tributary to Esquagama Lake	15+0670	Yes	3
Perennial Ditch to Esquagama Lake	15+3590	No	3
Perennial Tributary to Embarrass River	16+3900	No	60
Intermittent Stream to Embarrass River	16+4900	No	3
Ely Creek	22+0090	Yes	3
Perennial Stream south of Half Moon Lake	23+4750	No	3
Intermittent Stream north of Long Lake Creek	26+4020	No	3
Long Lake Creek	27+0360	Yes	3
Perennial Stream north of St. Louis River	29+3250	Yes	3
Elbow Creek	30+1230	Yes	15
Perennial Stream north of Elbow	30+4100	No	3

Stream Crossing Location	Milepost (mile + linear ft)	MDNR PWI	Length of Crossing (linear ft)
Creek			
Two River (in 3 places due to meander)	31+2840	Yes	95
Total			**1194 linear ft**

2.10.1.2.5B *HVTL Alternative 2*

There are 20 crossings of streams and other bodies of water associated with East Range HVTL Alternative 2. Colby Lake (249P) and Deep Lake (666P) are lakes protected by the MDNR PWI. There are also seven rivers and streams that are protected by the MDNR PWI. As the HVTL line is suspended, there are no direct impacts associated with these crossings. However, the protected waters will require a License for Utility Crossings of Public Lands and Waters granted by the MDNR Division of Lands and Minerals. Table 2.10-12 below summarizes the stream crossings associated with this alternative. Potential impacts to these waterbodies are discussed in Section 3.

Table 2.10-12
Water Crossings for East Range HVTL Alternative 2

Stream Crossing Location	Milepost (mile + linear ft)	MDNR PWI	Length of Waterbody Crossing
Colby Lake	1+4760	Yes 249 P	540
Partridge River	5+3020	Yes	250
Perennial Tributary to St. Louis River	7+1110	Yes	80
Perennial Tributary to St. Louis River	8+2300	Yes	3
Perennial Tributary to St. Louis River	8+2980	No	3
Perennial Drainage Ditch to wetland	12+1410	No	6
Embarrass River	15+1140	No	3
Embarrass River	15+1490	Yes	70
Deep Lake	19+2260	Yes 666 P	690
Perennial Stream west of Deep Lake (2 crossings in meander)	19+4840	No	6
Perennial Stream west of Deep Lake	20+1540	No	3
Unnamed Intermittent Stream	22+4080	Yes	3
Perennial Ditch to Mine Dump	25+0960	No	3
Perennial Stream to Mine	25+1960	No	3

Stream Crossing Location	Milepost (mile + linear ft)	MDNR PWI	Length of Waterbody Crossing
Dump			
Elbow Creek	28+5130	Yes	15
Perennial Ditch to East Two River	30+2190	No	3
Perennial Stream to East Two River	31+1910	No	3
East Two River	32+0810	Yes	70
Unnamed Perennial Stream	33+0340	No	3
Perennial Ditch to Two River	34+4960	No	3
		Total	**1760 linear ft**

2.10.1.2.5C ***Gas Pipeline Alternative 1***

There are 19 crossings of streams and other bodies of water associated with East Range HVTL Alternative 1. Colby Lake (249P) is protected by the MDNR PWI. There are also 12 rivers and streams that are protected by the MDNR PWI. The crossings will require either directional drilling or an open cut trench to install the gas line. The crossing of protected waters will require a License for Utility Crossings of Public Lands and Waters granted by the MDNR Division of Lands and Minerals. Table 2.10-13 below summarizes the stream crossings associated with this alternative.

Table 2.10-13
Water Crossings for East Range Gas Pipeline Alternative 1

Stream Crossing Location	Milepost (mile + linear ft)	MDNR PWI	Length of Waterbody Crossing
Elbow Creek	1+3580	Yes	20
Unnamed Perennial Stream	4+1010	No	3
Perennial Stream from Mud to Horseshoe Lake	5+2840	Yes	3
Perennial Ditch from Airport to Ely Creek	8+0550	No	3
Perennial Ditch from Airport to Ely Creek	8+1030	No	3
Ely Creek	9+3530	Yes	3
Perennial Ditch from Leaf Lake	12+2370	No	3
Perennial Stream to Esquagama Lake	13+4720	Yes	15
Perennial Stream to Esquagama Lake	14+1790	Yes	15
Perennial Ditch to Esquagama Lake	15+0710	No	3
Perennial Stream from	15+3620	Yes	90

Stream Crossing Location	Milepost (mile + linear ft)	MDNR PWI	Length of Waterbody Crossing
Fourth Lake to Esquagama Lake			
Perennial Stream to St. Louis River	19+3500	No	3
Perennial Stream to St. Louis River	19+4350	Yes	3
Perennial Stream to St. Louis River	21+1880	Yes	15
Perennial Stream to St. Louis River	21+3380	No	15
Partridge River	24+0960	Yes	100
Colby Lake	25+1490	Yes	430
Partridge River	27+3230	Yes	50
Wyman Creek	28+0950	Yes	15
		Total	**792 linear ft**

2.10.1.2.5D ***Pipeline 6-S-2WX***

There are two crossings of streams and other bodies of water associated with East Range Process Water Supply Pipeline Area 6 and Stephens Mine to Area 2WX. Stephens Creek and Second Creek are both perennial streams protected by the MDNR PWI. The crossings will require an open cut trench to install the Process Water Supply Pipeline. The crossing of protected waters will require a License for Utility Crossings of Public Lands and Waters granted by the MDNR Division of Lands and Minerals. Table 2.10-14 below summarizes the stream crossings associated with this alternative. Potential impacts to these waterbodies are discussed in Section 3.

Table 2.10-14
Water Crossings for East Range Pipeline 6-S-2WX

Stream Crossing Location	Milepost (mile + linear ft)	MDNR PWI	Length of Waterbody Crossing
Stephens Creek	n/a	Yes	3
Second Creek	n/a	Yes	30
		Total	**33 linear ft**

2.10.1.2.5E ***Pipeline 9S-6***

There is one crossing of streams and other bodies of water associated with East Range Process Water Supply Pipeline Area 9 South to Area 6. First Creek is a perennial stream protected by the MDNR PWI. The crossings will require an open cut trench to install the Process Water Supply Pipeline. The crossing of protected waters will require a License for Utility Crossings of Public Lands and Waters granted by the MDNR Division of Lands and Minerals. Table 2.10-15 below summarizes the stream crossings associated with this alternative. Potential impacts to these waterbodies are discussed in Section 3.

Table 2.10-15
Water Crossings for East Range Pipeline 9S-6

Stream Crossing Location	Milepost (mile + linear ft)	MDNR PWI	Length of Waterbody Crossing
First Creek	n/a	Yes	3
		Total	**3 linear ft**

2.10.1.2.5F ***Pipeline 9N-6***

There is one crossing of streams and other bodies of water associated with East Range Process Water Supply Pipeline Area 9 North to Area 6. First Creek is a perennial stream protected by the MDNR PWI. The crossings will require an open cut trench to install the Process Water Supply Pipeline. The crossing of protected waters will require a License for Utility Crossings of Public Lands and Waters granted by the MDNR Division of Lands and Minerals. Table 2.10-16 below summarizes the stream crossings associated with this alternative. Potential impacts to these waterbodies are discussed in Section 3.

Table 2.10-16
Water Crossings for East Range Pipeline 9N-6

Stream Crossing Location	Milepost (mile + linear ft)	MDNR PWI	Length of Waterbody Crossing
First Creek	n/a	Yes	3
		Total	**3 linear ft**

2.10.1.2.5G ***Potable Water and Sewer Pipelines***

There is one crossing of streams and other bodies of water associated with East Range Potable Water and Sewer Pipelines. Colby Lake is protected by the MDNR PWI. The pipelines will either be installed via open cut trench method or by laying the pipes across the bottom of Colby Lake. The crossing of protected waters will require a License for Utility Crossings of Public Lands and Waters granted by the MDNR Division of Lands and Minerals. Table 2.10-17 below summarizes the stream crossings associated with this alternative. Potential impacts to these waterbodies are discussed in Section 3.

Table 2.10-17
Water Crossings for East Range Potable Water and Sewer Pipeline

Stream Crossing Location	Milepost (mile + linear ft)	MDNR PWI	Length of Waterbody Crossing
Colby Lake	1+3720	Yes 249 P	460
		Total	**460 linear ft**

2.10.1.2.5H ***Rail Line Alternative 1***

Railroad Alternative 1 will require two crossings of a small tributary to Colby Lake. Culverts under the newly constructed railbeds will continue the flow of water after construction. Impacts to the stream from the center loop will be reduced or negated upon final design when placement of storage areas within the center loop is determined. Both of these tributaries are protected by the MDNR PWI. The crossing of protected waters will require a License for Utility Crossings of Public Lands and Waters granted by the MDNR Division of Lands and Minerals. Table 2.10-18 below summarizes the stream crossings associated with this alternative. Potential impacts to these waterbodies are discussed in Section 3.

Table 2.10-18
Water Crossings for East Range Rail Line Alternative 1

Stream Crossing Location	Milepost (mile + linear ft)	MDNR PWI	Length of Waterbody Crossing
Tributary to Colby Lake (North Crossing)	n/a	Yes	3
Tributary to Colby Lake (South Crossing)	n/a	Yes	3
		Total	**6 linear ft**

2.10.1.2.5I ***Rail Line Alternative 2***

Railroad Alternative 2 will require crossings of 2 small streams that feed into Colby Lake. Culverts under the newly constructed railbeds will continue the flow of water after construction. Both the tributary to Colby Lake and Wyman Creek are protected by the MDNR PWI. The crossing of protected waters will require a License for Utility Crossings of Public Lands and Waters granted by the MDNR Division of Lands and Minerals. Table 2.10-19 below summarizes the stream crossings associated with this alternative. Potential impacts to these waterbodies are discussed in Section 3.

Table 2.10-19
Water Crossings for East Range Rail Line Alternative 2

Stream Crossing Location	Milepost (mile + linear ft)	MDNR PWI	Length of Waterbody Crossing
Tributary to Colby Lake	n/a	Yes	3
Wyman Creek	n/a	Yes	3
		Total	**6 linear ft**

2.10.2 Threatened, Endangered and Other Rare Species

2.10.2.1 West Range Site and Transportation/Utility Corridors

The following discussions regarding threatened, endangered, and other rare species are separated based on federal and state protection and regulatory authority. The entire West Range Site and associated utility and transportation corridors has potential habitat for three federally-listed species, as described in Section 2.10.4.1.1. Because the occurrences of state-listed species that may be affected within the West Range Site, including the IGCC Facility and utility and transportation corridors, is much a more comprehensive list, the affected environment for these project alternatives are assessed in more detail in Section 2.10.4.1.2.

2.10.2.1.1 Federal Protected Species

The federal Endangered Species Act is regulated by the USFWS and the West Range Site, including the entire IGCC facility and the associated utility and transportation corridors, are within USFWS Region 3. The Region 3 list of federally protected species describes Itasca County, Minnesota as occurring within the breeding range of bald eagle (*Haliaeetus leucocephalus*—federal status, de-listed threatened), within primary range of the grey wolf (*Canis lupus*—federal status, threatened); and within range of the Canada lynx (*Lynx canadensis*—federal status, threatened). There are no federally protected plant species identified by the USFWS within the West Range Site or any of the proposed utility or transportation corridors.

The USFWS will be contacted by the Department of Energy (DOE) to request Endangered Species Act Section 7 Formal Consultation for these species for the West Range Site. The USFWS Region 3 Endangered Species Biologist was contacted by SEH on October 18, 2005 (USFWS Record of Conversation, 2005). The USFWS indicated Formal Consultation would be initiated when the DOE request is submitted. The USFWS recommended that Formal Consultation be requested as soon as possible, so it can be coupled with combined Formal Consultation that the USFWS is providing for several other large projects proposed for the Iron Range region. The USFWS intends to provide Formal Consultation collectively and concurrently for all of these projects and they invited the Proponent to participate in this combined effort.

In particular, Section 7 Formal Consultation will need to occur for the Canada lynx and grey wolf. Currently, population studies are being conducted on these species in conjunction with the Formal Consultation that has been initiated by the other previously mentioned projects in the area. In the telephone conversation with the USFWS Endangered Species Biologist (October 10, 2005), the USFWS again invited the Proponent to participate in this comprehensive Formal Consultation process and expand these surveys to include the West Range Site and the alternative site which are all in close proximity to the other projects that are under current consultation. The projects that are currently partnering on this comprehensive Formal Consultation effort include the proposed PolyMet mine expansion, the Minnesota Steel Industry facility, and the ISPAT Mine Expansion.

SEH biologists observed a grey wolf preying on a fawn deer within the site boundary in July 2005. Wolf signs were observed several times within the site during the field wetland surveys as well.

According to the MDNR data (MDNR Online Data, 2005), there have been both “verified without evidence of breeding” and “unverified” sightings of Canada lynx within Itasca County through 2005. Potential Canada lynx habitat and prey items were observed on and around the

West Range Site during the field reconnaissance. The request for Formal Consultation under Section 7 of the Endangered Species Act will determine the need for additional studies and coordination for this species. The MDNR Natural Heritage and Information System (NHIS) database shows no bald eagle nesting areas within the West Range Site, nor within a 2-mile radius of the project boundary.

2.10.2.1.2 Minnesota Protected Species

The MDNR Natural Heritage Information System (NHIS) database contains documented occurrences of non-status (tracked), special concern, threatened, and endangered species; sensitive ecological and natural resources; and, results of the Minnesota County Biological Survey (MCBS). State-listed threatened or endangered species are protected under the Minnesota Endangered Species Statute (Minnesota Statutes, Section 84.0895). The MDNR was contacted to request a review of the NHIS for occurrences within the site boundaries and the Nashwauk, Taconite, and Bovey areas nearby the site. At the request of the MDNR, the specific locations of these occurrences are not provided in this report to protect the integrity of these rare or protected species.

Minnesota's Endangered Species Statute authorizes the MDNR to adopt rules designating species meeting the statutory definition of endangered, threatened, or species of special concern. Minnesota Rules, Chapter 6134 provide the resulting "List of Endangered, Threatened, and Special Concern Species." The Endangered Species Statute also authorizes the MDNR to adopt rules to regulate treatment of species designated as endangered and threatened, which are codified as Minnesota Rules, Parts 6212.1800–6212.2300. As such, species of special concern or non-status (tracked) species are not protected by Minnesota's Endangered Species Statute or the associated Rules. However, the full text of the Statutes and Rules must be considered when species designated as endangered, threatened, or species of special concern could be affected. This requires close project coordination with the MDNR, which may include permitting, if impacts or otherwise known potential effects could occur on a state-listed species.

The legal definition of species designated as endangered, threatened, or species of special concern is provided as follows:

- Endangered—the species is threatened with extinction throughout all or a significant portion of its range within Minnesota.
- Threatened—the species is likely to become endangered within the foreseeable future throughout all or a significant portion of its range within Minnesota.
- Species of Special Concern—if although the species is not endangered or threatened, is extremely uncommon in Minnesota, or has unique or highly specific habitat requirements and deserves careful monitoring of its status. Species on the periphery of their range that not listed as threatened may be included in the category along with those species that were once threatened or endangered but now have increasing or protected, stable populations.

A non-status (or tracked) species is one that has been identified by the MDNR as a rare species that has not received a legal status, but needs further monitoring to determine its status.

2.10.2.1.2A ***West Range IGCC Facility***

According to the MDNR NHIS, a total of 17 plant species occurrences have been recorded in the general vicinity of Nashwauk, Taconite, and Bovey areas. However, none of these 17 occurrences are recorded within the West Range Site boundaries. A list of the species that were identified by the MDNR NHIS is provided in the following table. Since the West Range Site may not have been surveyed by the MDNR, potential habitats for flora listed by NHIS were investigated during the June 2005 field reconnaissance and the June–August 2005 wetland surveys.

Table 2.10-20
MDNR NHIS Plant Species Occurrences in Vicinity of West Range Site

NHIS Occurrence Number	Scientific Name	Common Name	Protection Status	Associated Habitat Near Project Area
#28507, #28508	*Botrychium campestre*	Prairie moonwort	Special Concern	High iron content and gravel soils
#28509, #30927	*Botrychium matricariifolium*	Matricary grapefern	Non-status	Grassy opening, near mine area
#24083, #24098, #24107, #28518, #28536, #28639	*Botrychium simplex*	Least moonwort	Special Concern	Mine tailings basin, disturbed utility ROW
#24653, #28537	*Liparis lilifolia*	Lilia-leaved twayblade	Non-status	Tailings basin
#27799	*Myriophyllum tenellum*	Leafless water milfoil	Non-status	Lake shoreline
#24655, #28510	*Platanthera flava var. herbiola*	Tubercled rein-orchid	Endangered	Tailings basin
#30846	*Spiranthes casei*	Case's ladies'-tresses	Non-status	Tailings basin
#28514	*Torreyochloa pallida*	Torrey's manna grass	Special Concern	Shallow marsh in mixed hardwood forest

There are three records of moonworts (*Botrychium campestre*, *Botrychium matricariifolium*, and *Botrychium simplex*) listed in the MDNR NHIS database and within one mile of the project site. The three records of moonworts (*Botrychium spp.*) that are listed in the MDNR NHIS database are associated with within mine spoil areas or disturbed soils. *Botrychium campestre* and *B. simplex* are listed as special concern species; *B. matricariifolium* has no formal protection status in Minnesota, but has been identified as species that may be monitored due to its potential rarity or other factors that may affect this species or its habitat in the state.

SEH Biologists conducted preliminary investigations for potential habitats for *Botrychium spp.* during field investigations. No disturbed soil or mine spoil conditions are found within the West Range Site. However, habitat for these species or other *Botrychium spp.* may occur within the northern mesic hardwood forest. During the field reconnaissance in June 2005, a plants species that closely resembled *Botrychium minganense,* a state-listed special concern species, was observed in the northern mesic hardwood forest. Only one individual was observed, and no voucher specimens were collected. This area of forest may require a more thorough review for potential occurrences of state-listed *Botrychium spp.* There is potential that the MDNR could determine that a field review for state-listed species may be necessary. Early coordination with the MDNR will be undertaken, and if a detailed survey is needed, it will be initiated when the location for the project has been determined. Generally, detailed surveys for listed species should occur during the appropriate time of year when the species can be observed and documented when it is most identifiable. This would likely require surveys that occur over the course of a growing season for plants. For animals, surveys would be recommended during the optimal, prime activity, or detectable period specific to the subject species.

Most of the other plant species occurrences recorded by the MDNR NHIS are associated with mine spoil, tailings, or disturbed soil conditions. No mine areas are found within the West Range Site. If recruitment of these rare or otherwise protected species appears to be associated with mine spoil or disturbed soil conditions from mining activities, it is unlikely that the West Range Site provides this type of habitat. Further coordination with the MDNR regarding habitat conditions at the West Range Site will be completed to determine if protected or otherwise rare species require further review, which will be initiated when the preferred site location for the project is determined.

Two plant species records from the NHIS database that are of interest for the project area are *Myriophyllum tenellum* and *Torreyochloa pallida*. *Myriophyllum tenellum*, a non-status species is associated with aquatic environments along shorelines. Dunning Lake is probably the only habitat on-site that may provide potential for this species. *Torreyochloa pallida*, a species of special concern, is associated with shallow marsh habitats in mixed hardwood forests. This type of habitat is abundant throughout the West Range Site, although this species was not observed during the field reconnaissance for habitat or during the wetland surveys. Early coordination with the MDNR following site designation will be undertaken to determine if a detailed survey for listed species is needed. Generally, detailed surveys for listed species should occur during the appropriate time of year when the species can be observed and documented when it is most identifiable. This would likely require surveys that occur over the course of a growing season for these plants.

2.10.2.1.2B *West Range Utility and Transportation Corridors*

Since access was not available for nearly all the transportation and utility corridors during the 2005 field surveys, potential project implications on state-listed species could only be assessed through review of species locations within approximately one mile of the corridors. A summary of this review is provided in the following corridor sections. Federally listed species are addressed in Section 2.10.2.1.1.

Table 2.10-21 describes all of the NHIS occurrences that were documented in the vicinity of the utility corridors. No transportation corridors (i.e., rail or roads) have any NHIS occurrences within one-mile of these corridors. Since access in the field to the utility and transportation corridors was not available during the 2005 field season, some areas should be investigated for potential habitats for these species if the West Range Site is chosen as the preferred location, and when access is available. At the request of the MDNR, the element occurrence (EO) identification numbers for these known records of state-listed or otherwise rare natural features are not provided graphically to protect the integrity of the species, populations, or respective habitats. Rather, a general point location for the record is provided which only identifies an approximate area that a species or rare natural feature may be located within.

In addition, the NHIS occurrences provided in the original data request from MDNR, the MDNR provided a supplemental report completed by Critical Connections Ecological Services, Inc. completed in November 2005 that described six populations of previously undocumented occurrences of state-listed or tracked plant species (*Botrychium pallidum*, *B. campestre*, *B. simplex*, and *B. matricariifolium*). It is assumed that these occurrences have since been reported to managers of the MDNR NHIS and Division of Ecological Services and that future coordination with the MDNR regarding state-listed species will include data regarding these new occurrences.

According to the report completed by Critical Connections Ecological Services, Inc. (2005), the six populations of *Botrychium spp.* were observed "within mine tailings along the CMP to Prairie River outflow route." This outflow route appears to include the Lind Pit and West Hill Pit, which are located between the Prairie River and the west end of the CMP. The Lind Pit and CMP are both identified as a potential source for process water to serve the West Range IGCC facility. In addition, the CMP is identified as a source for discharge of process water from the West Range IGCC facility. The figures that accompany the report prepared by Critical Connections Ecological Services, Inc. (2005) identify these six populations of *Botrychium spp.* as actually occurring within the immediate vicinity of the Lind Pit and the West Hill Pit, which could be within the project area for West Range Process Water Supply Pipeline Segment 1 (LMP to CMP).

A summary of potential habitats for state-listed species (marked "yes" in Table 2.10-4, below) that could be within the project area for the West Range Site or its associated utility or transportation corridors may require further investigation if the West Range Site is chosen as the preferred location. It is likely that the MDNR has not yet conducted a thorough review of this area through the County Biological Survey program; therefore, there is potential to encounter other state or federally-listed species not previously identified in the MDNR NHIS database.

Table 2.10-21
MDNR NHIS Occurrences within One Mile of Utility Corridors

NHIS Occurrence Number	Common Name	Scientific name	State Protection Status[1]	Field Investigation for Potential Habitats Recommended (yes/no)
HVTL Alternatives 1 and 1A				
#28172, #29121, #24088	Tubercled-rein orchid	*Platanthera flava var. herbiola*	END	Yes. Occurs in fringe wetland habitats. Site records also within mine spoil areas.
#29124	Case's ladies'-tresses	*Spiranthes casei*	No Status	Yes. Occurs in fringe wetland habitats. Site records also within mine spoil areas.
#28638	Least moonwort	*Botrychium simplex*	SPC	No. Site record is within mine

NHIS Occurrence Number	Common Name	Scientific name	State Protection Status[1]	Field Investigation for Potential Habitats Recommended (yes/no)
				spoil areas, which will not be affected by HVTL.
#30922	Matricary grapefern	*Botrychium matricariifolium*	No status	No. Site record is within mine spoil areas, which will not be affected by HVTL.
#28637	Species of moonwort	*Botrychium michiganense*	No status	No. Site record is within mine spoil areas, which will not be affected by HVTL.
HVTL PHASE 2				
#28533	Least moonwort	*Botrychium simplex*	SPC	No. Site record is within mine spoil areas, which will not be affected by HVTL.
#28534	Pale moonwort	*Botrychium pallidum*	SPC	No. Site record is within mine spoil areas, which will not be affected by HVTL.
#28507	Prairie moonwort	*Botrychium campestre*	SPC	No. Site record is within mine spoil areas, which will not be affected by HVTL.
#28509	Matricary grapefern	*Botrychium matricariifolium*	SPC	No. Site record is within mine spoil areas, which will not be affected by HVTL.
#24655	Tubercled-rein orchid	*Platanthera flava var. herbiola*	END	Yes. Occurs in fringe wetland habitats. Site records also within mine spoil areas
#28537	Lilia-leaved twayblade	*Liparis lilifolia*	SPC	Yes. Occurs in fringe wetland habitats. Site records also within mine spoil areas.
#23754, #27894	Pale moonwort	*Botrychium pallidum*	END	No. Site record is within mine spoil areas, which will not be affected by HVTL.
#27895	Least moonwort	*Botrychium simplex*	SPC	No. Site record is within mine spoil areas, which will not be affected by HVTL.
#27896	Species of moonwort	*Botrychium michiganense*	No Status	No. Site record is within mine spoil areas, which will not be affected by HVTL.
#26408	Northern goshawk	*Accipiter gentiles*	No Status	Yes. Review habitats if new alignments are proposed within mature conifer forest habitat
#19111	Lapland buttercup	*Ranunculus laponnicus*	SPC	Yes. Species is found in wetland habitats.
West Range Gas Pipeline 1				
#27799	Leafless water milfoil	*Myriophyllum tenellum*	No Status	No. This species is found in lakes.
#12178	American bittern	*Botaurus lentiginosus*	No status	No. Secretive species with low population density.

NHIS Occurrence Number	Common Name	Scientific name	State Protection Status[1]	Field Investigation for Potential Habitats Recommended (yes/no)
				Nests are difficult to survey.
#28172, #29121, #24088	Tubercled-rein orchid	*Platanthera flava var. herbiola*	END	Yes. Occurs in fringe wetland habitats. Site records also within mine spoil areas.
#29124	Case's spiranthes	*Spiranthes casei*	No Status	Yes. Occurs in fringe wetland habitats. Site records also within mine spoil areas.
#28638	Least moonwort	*Botrychium simplex*	SPC	No. Site record is within mine spoil areas, which will not be affected by gas pipeline.
#30922	Matricary grapefern	*Botrychium matricariifolium*	No status	No. Site record is within mine spoil areas, which will not be affected by gas pipeline.
#28637	Species of moonwort	*Botrychium michiganense*	No status	No. Site record is within mine spoil areas, which will not be affected by gas pipeline.
West Range Gas Pipeline 2				
#28172, #29121, #24088	Tubercled-rein orchid	*Platanthera flava var. herbiola*	END	Yes. Occurs in fringe wetland habitats. Site records also within mine spoil areas.
West Range Process Water Supply Pipeline—Segment 1 (LMP to CMP)				
n/a [2]	Prairie moonwort	*Botrychium campestre*	SPC	Yes. Observed in mine tailings near Lind Pit and West Hill Pit.
n/a [2]	Matricary grapefern	*Botrychium matricariifolium*	No status	Yes. Observed in mine tailings near Lind Pit and West Hill Pit.
n/a [2]	Pale moonwort	*Botrychium pallidum*	END	Yes. Observed in mine tailings near Lind Pit and West Hill Pit.
n/a [2]	Least moonwort	*Botrychium simplex*	SPC	Yes. Observed in mine tailings near Lind Pit and West Hill Pit.
West Range Process Water Supply Pipeline—Segment 3 (HAMP Complex to CMP)				
#30926	St. Lawrence grapefern	*Botrychium rugulosum*	THR	Yes. Site record within mine tailings basin among aspen.

[1] END – Endangered
THR – Threatened
SPC – Species of Special Concern
No status – No state protection status, but species may be monitored due to other concerns

[2] No MDNR data available; new records provided by Critical Connections Ecological Services, Inc. (2005)

2.10.2.2 East Range Site

2.10.2.2.1 Federal Protected Species

The federal Endangered Species Act is regulated by the USFWS and the project area is within USFWS Region 3. The Region 3 list of federally protected species describes St. Louis County, Minnesota as occurring within the breeding range of bald eagle (*Haliaeetus leucocephalus*—federal status, de-listed threatened), within distributional range of the grey wolf (*Canis lupus*—federal status, threatened); within the breeding range of the peregrine falcon (*Falco peregrinus*—federal status, threatened); and within range of the Canada lynx (*Lynx canadensis*—federal status, threatened).

The USFWS will be contacted by the DOE to request Endangered Species Act Section 7 Formal Consultation for these species for the East Range Site. The USFWS Region 3 Endangered Species Biologist was contacted by SEH on October 18, 2005 (USFWS Record of Conversation, 2005). The USFWS indicated that they will request Formal Consultation to be initiated when the DOE request is submitted. The USFWS recommended that Formal Consultation be requested as soon as possible, so it can be coupled with combined Formal Consultation that the USFWS is providing for several other large projects proposed for the Iron Range region. The USFWS intends to provide Formal Consultation collectively and concurrently for all of these projects and they invited Excelsior Energy to participate in this combined effort.

In particular, Section 7 Formal Consultation will need to occur for the Canada lynx and grey wolf. Currently, population studies are being conducted on these species in conjunction with the Formal Consultation that has been initiated by other projects in the area. In the telephone conversation with the USFWS Endangered Species Biologist (October 10, 2005), the USFWS again invited the Proponent to participate in this comprehensive Formal Consultation process and expand these surveys to include the East Range Site and the alternative site which are all in close proximity to the other projects that are under current consultation. The projects that are currently partnering on this comprehensive Formal Consultation effort include the proposed PolyMet mine expansion, the Minnesota Steel Industry facility, and the ISPAT Mine Expansion.

Grey wolf signs, including tracks and scat, were observed at scattered locations within the East Range Site. Suitable snowshoe hare habitat (the primary prey item for Canada Lynx) is present, but is relatively poor or marginal due to the extensive and recent clearcutting. No bald eagle nests were observed within or immediately adjacent to the project site and the MDNR Natural Heritage Information System (NHIS) database shows no nesting areas within the East Range Site or within a 2-mile radius of the East Range Site project area. The NHIS does document five bald eagle nesting areas within a one-mile radius of the various proposed and existing utility and transportation corridors. There are no NHIS occurrences for the peregrine falcon within or adjacent to the East Range Site.

According to the MDNR data (MDNR Online Data, 2005), there have been "verified with evidence of breeding," "verified without evidence of breeding," and "unverified" sightings of Canada lynx within St. Louis County through 2005. The request for Formal Consultation under Section 7 of the Endangered Species Act will determine the need for additional studies and coordination for this species.

2.10.2.2.2 Minnesota Protected Species

State listed species of special concern, threatened, or endangered species are protected under the Minnesota Endangered Species Act. The MDNR Natural Heritage Information System (NHIS) database contains documented occurrences of these classified species, sensitive ecological and natural resources, and results of the Minnesota County Biological Survey (MCBS). The MDNR was contacted to request a review of the NHIS for occurrences within the site boundaries and the areas surrounding the various utility and transportation corridors. At the request of the MDNR, the specific locations of these occurrences are not provided in this report to protect the integrity of these rare or protected species. The following subsections describe the known occurrences of state-listed protected, rare, or otherwise unique natural features that are within the vicinity of the East Range Site facility and the associated transportation and utility corridors.

2.10.2.2.2A *East Range Site IGCC Facility*

According to the MDNR NHIS, there are no known occurrences of state-listed protected, rare, or otherwise unique natural features within the immediate vicinity of the East Range Site facility. The closest recorded occurrences of an NHIS feature are 2.5 miles or greater distance from the East Range Site facility. Although the MDNR NHIS is the most comprehensive database for known occurrences of rare natural features in the state, it does not preclude the discovery of undocumented occurrences within the East Range Site IGCC facility. Further coordination with the MDNR regarding habitat conditions at the East Range Site will be completed to determine if further review is required for protected or otherwise rare species.

2.10.2.2.2B *Transportation and Utility Corridors*

Since access was not available for nearly all the transportation and utility corridors during the 2004 and 2005 field surveys, potential project implications on state-listed species could only be assessed through review of species locations within approximately one mile of the corridors. A summary of this review is provided in the following corridor sections. Federally listed species are addressed in Section 2.10.2.1.1.

According to the MDNR NHIS, a total of nine listed species in 27 different occurrences have been recorded in the general vicinity of Aurora, Biwabik, Eveleth, and Virginia within one mile of a proposed transportation or utility corridor. Table 2.10-22 describes all of the occurrences that were documented by the MDNR NHIS in the vicinity of the corridors. Since access in the field to these corridors was not available, further coordination with the MDNR will be completed to determine if more detailed surveys are needed should the East Range Site be chosen as the site. At the request of the MDNR, these locations of occurrences are not provided graphically to protect these rare species.

Table 2.10-22
MDNR NHIS Plant Species Occurrences within One Mile of East Range Site Transportation or Utility Corridors

Scientific Name	Common Name	Protection Status	NHIS Records in Area	Associated Habitat Near Project Area
Flora				
Arethusa bulbosa	Dragon's mouth	Non-status	1	Creek shoreline
Caltha natans	Floating marsh-marigold	Endangered	1	Pond Outlet
Poa sylvenstris	Woodland bluegrass	Non-status	1	Mixed hardwood forest
Waldsteinia fragarioides	Barren strawberry	Special concern	3	Jack pine forest
Botrychium matricariifolium	Matricary grapefern	Non-status	1	Mine tailings
Botrychium simplex	Least moonwort	Special concern	2	Mine tailings
Fauna				
Clemmys insculpta	Wood Turtle	Threatened	13	Partridge and St. Louis Rivers
Haliaeetus leucocephalus	Bald Eagle	Special Concern	4	Various nesting areas, some in management areas
Ligumia recta	Black Sandshell Mussel	Special Concern	1	Lake shoreline

Habitats listed above as associated with a state listed species may require further investigation, which should be determined by the MDNR if the East Range Site is chosen as the preferred location. It is likely that the MDNR has not yet conducted thorough review of this area through the County Biological Survey program; therefore, there is potential to encounter other state or federally-listed species not previously identified in the MDNR NHIS database.

2.11 Noise

2.11.1 Sound and Noise Descriptions

Sound is described as varying pressures, from low to high, which are induced by disturbances in the air. These pressures present themselves in the form of periodic waveforms and are measured in cycles per second. When these varying pressures reach the human ear, they are converted by the eardrums and brain into sound. To describe how much pressure (loudness) these waves apply to the eardrum, SPL, or Sound Pressure Level, is utilized.

Sound is made up of many components. Among them are “pure tones” which represent one single waveform and is “broad band,” which includes many different waveforms arriving at the ear simultaneously. One might think of a pure tone as a single key depressed on a piano and broad band as many keys pressed simultaneously from low to high. The waveforms produced all have a different frequency of cycles per second.

The human ear is capable of hearing a wide range of frequencies, from low tones to high. Individual frequencies are expressed in Hertz (Hz), which takes the place of cycles per second. Sounds low in nature, such as an upright stringed bass, are expressed in low Hz. The accepted limit of human hearing in the low regions is 20Hz, or 20 cycles per second. Sounds higher up, such as a piccolo, are expressed in kilohertz, or thousands of cycles per second. The accepted high range of human hearing is 20kHz, or 20,000 cycles per second. Middle C on a piano for instance, has a frequency of 261.5 cycles per second, or 261.5Hz.

Sound, either low or high in nature, travels at a relative speed of 1130 feet per second. This varies slightly due to humidity and relative temperature. Ultimately, it is important to note that low sounds do not travel slower than high sounds.

Sound also has a loudness component (SPL). This is scientifically expressed as amplitude. In describing how humans hear variances in amplitude (or pressure), a measure known as a decibel (dB) is utilized. The decibel is a logarithmic/ratio description given to sound loudness as the human ear is quite sensitive to very quiet sounds and those very loud. It is appropriate to use logarithms due to this wide range of human hearing (the human ear can detect sounds a million times quieter than a jet aircraft during take-off). Thus the decibel is a logarithmic function used to accommodate a numbering scheme that encompasses a very large range of values.

Decibels, in their logarithmic function, can then be broken down accordingly:

- +/-1dB change in loudness= no noticeable change in loudness
- +/-3dB change in loudness= just perceptible threshold difference in loudness
- +/-6dB change in loudness= a clearly noticeable difference in loudness
- +/-10dB change in loudness= twice (or half) change in loudness
- +/-20dB change in loudness= a fourfold (4x) change in loudness

Humans also hear various frequencies (low and high tones) in a non-linear fashion. Human ears are most sensitive in the middle frequencies (those that encompass the range of human speech) than those sounds at the low and high range of tone. To associate the decibel with this non-linearity, there are various weighting schemes, but the one most commonly used to approximate human hearing is “A” weighting. Measuring sound with regard to how humans respond to it is described as XdBA.

The following Table 2.11-1 is a decibel scale, A-weighted, of common sound and noise sources:

Table 2.11-1
Sound Pressure Level (dBA)

140dBA	Jet Engine (at 25 meters)
130dBA	Jet Aircraft (at 100 meters)
120dBA	Rock and Roll Concert
110dBA	Pneumatic Chipper
100dBA	Jointer/Planer
90dBA	Chainsaw
80dBA	Heavy Truck Traffic
70dBA	Business Office
60dBA	Conversational Speech
50dBA	Library
40dBA	Bedroom
30dBA	Secluded Woods
20dBA	Whisper

2.11.2 Noise Loss Over Distance

Sound travel over distance is acted upon by many factors. Temperature, humidity, wind direction, barriers and absorbent materials such as soft ground and light snow are all factors in how sound will be perceived at various distances. In addition, there is significant loss of sound over distances due to the ever-expanding radius of the sound “sphere.” In a free field, one that is free from reflective materials and barriers, a single noise source will expand outward from its location in a spherical wave front spreading its energy over a continuously expanding sphere.

Since the area of this sphere is proportional to the square of its radius, the intensity of sound at any point along the sphere is inversely proportional to the square of the distance from the source to that point. This is known as the Inverse Square Law of sound radiation. The Inverse Square Law dictates that for every doubling of distance (in a free field), sound will lose energy at a rate of 6 dB.

Most noise sources, however, are not located within a free field and cannot be qualified as “true” spherical point sources. To the contrary, most noise sources are located near the ground giving them a description of being located within “half-space.” In these instances sound decays much less within close vicinity of the noise source. Relative to the size of the noise source, noise loses energy, due to the reflection from hard ground sources, at a rate closer to 3–4dB per doubling of the near field space. 6dB per doubling of distance (via the Inverse Square Law) will begin to come into effect at a distance relative to the size of the noise source.

Sound energy is also lost due to higher humidity. Energy is lost at higher humidity conditions due to the combined action of the viscosity and heat conduction of the air, and the behavioral state of the molecules therein. This is most common above 1000Hz due to the smaller wavelengths involved. This frequency dependent loss must be added to the over-all level loss (above 1kHz) due to divergence of the sound wave. This level change is commonly labeled as “excess attenuation” and is also a logarithmic function increasing with distance.

When humidity rises, there is an increase in the high frequency absorption of air. Thus, in the summer months, and assuming a higher relative humidity, less of the high frequency noise will be heard. As well, leaves and shrubs while in bloom during the summer months will further serve to attenuate propagated noise.

2.11.3 Minnesota Pollution Control Noise Guidelines

The Minnesota Pollution Control Agency (MPCA) has guidelines for both residential and industrial zones and acceptable SPL maximums.

These guidelines, measured in dBA, are stipulated in the form of L_{10} and L_{50}. Simply stated, L_{10} means that the measured SPL (in dBA) must not exceed a certain threshold more than 10% of the time (for a one hour survey), and L_{50} being a level that must not be exceeded more than 50% of the time (for a one hour survey). These thresholds are listed as SPL (dBA) maximums by the MPCA for Residential areas, as follows:

Table 2.11-2
7030.0050 Noise Area Classification (NAC)
Household Units including Farm Houses

	L_{50}	L_{10}
Daytime	60dBA	65dBA
Nighttime (10:00PM–7:00AM)	50dBA	55dBA

There are also MPCA standard testing procedures that must be followed in order to establish accuracy and consistency. These procedures include, but are not limited to:

- Measurement of noise conditions with a certified and calibrated Sound Level Meter per ANSI certification.
- Calibration of Sound Level Meter before and after measurement with approved and certified calibrator.
- Measurement readings not to be any less than for a one hour period.
- Measurements must be made away from reflective surfaces as to not influence readings (reflections can increase SPL readings).
- Measurement device must be, at a minimum, 3 feet from the ground.

- Measurements may not be made when environmental (wind, rain, etc.) conditions exist so that results are invalidated due to ambient environmental noise.

Additionally, there is no spectral component to these measurements. That is, although humans hear many varying tones, low to high, measurements are averaged broadband readings containing no frequency (tonal) descriptors.

2.11.4 Existing Noise Levels

2.11.4.1 West Range Site

Noise analysis was performed at 6 locations throughout the West Range site and within areas of common use by residences. These included three residential locations and three locations around the West Range site. All monitoring was completed using a Type II, ANSI approved noise level meter with calibration being performed before and after each monitoring cycle.

A windscreen was also used to counter any wind effects and no monitoring was performed during times when winds greater than 15mph were measured, or when precipitation was occurring. Monitoring at each location was performed for no less than one hour and during both times specified as “night” and “day” by MPCA classification.

The West Range Noise Reports are attached as Exhibit 5.

2.11.4.1.1 Receptor Location 1, County Landfill South of Proposed Plant

Receptor 1 was placed approximately 1,700 feet from the southern most corner of the West Range Site. This receptor was the closest measurement point towards the proposed facility but its proximity to CR 7 did account for a small amount of traffic noise especially during the daytime monitoring event.

The area where this receptor was located was within a reclaimed waste management site. Although no residences are within this area, monitoring at this location was performed in an attempt to collect readings as close to the proposed facility as possible. Monitoring events were recorded between the hours of 10:04PM and 11:04PM, June 7, 2005 and again between the hours of 9:15AM and 10:15AM, June 8, 2005.

Table 2.11-3
Monitoring results at Receptor 1, 1700 feet from IGCC Power Station Footprint

Reclaimed Landfill @ 1700’		
Receptor 1	L_{10}	L_{50}
Daytime (9:15AM–10:15AM)	53dBA	52dBA
Nighttime (10:04PM–11:04PM)	51dBA	49dBA

Ambient noise during the nighttime hours consisted mainly of insect noise, slight winds through the surrounding woods, and three cars passing along CR 7. Ambient noise recorded during the daytime event consisted mainly of slight winds through the surrounding woods, and car and truck passes along CR 7 (1–2 cars per minute, 7 heavy truck passes).

Both monitoring events fall within the MPCA guidelines for acceptable noise daytime and nighttime criteria.

2.11.4.1.2 Receptor Location 2, Residence North Big Diamond Lake

Receptor 2 was located approximately 3,900 feet south east from the proposed West Range Site along a cluster of residential and summer homes on the northern edge of Big Diamond Lake. These homes are situated along an undeveloped roadway with access off of CR 7. The roadway itself consists of dirt and red clay and is, at times, difficult to navigate without a 4-wheel drive vehicle.

Monitoring events at this location occurred in the nighttime hours between 11:15PM and 12:16AM, June 7 to the 8, 2005, and again during the daytime hours of 3:45PM and 4:45PM, June 8, 2005. Ambient noise during the nighttime event consisted of almost exclusively insect noise as winds were calm and there was no traffic along the adjacent roadway.

Daytime ambient noise consisted of slight winds through the surrounding woods, some slight traffic along the adjacent roadway (5 car passes, 3 medium truck passes) and insect noise. Results for both monitoring events are presented in Table 2.11-4.

Table 2.11-4
Monitoring results at Receptor 2, 3900 feet from IGCC Power Station Footprint

Residential @ 3900' South East		
Receptor 2	L_{10}	L_{50}
Daytime (3:45PM–4:45PM)	54dBA	53dBA
Nighttime (11:15PM–12:16AM)	50dBA	49dBA

Both monitoring events fall within the MPCA guidelines for acceptable noise for daytime and nighttime criteria.

2.11.4.1.3 Receptor Location 3, 31950 Scenic Hwy 7

Receptor 3 was located at 31950 Scenic CR 7 and was within the property of a medium sized residential home with a small hobby farm attached. The homeowners operate a small tourist horse riding business.

Monitoring events were logged between the hours of 1:03PM–2:04PM June 8, 2005, and again during 10:23PM and 11:23PM representing nighttime hours.

Traffic during the daytime monitoring event was consistent with car passes 2–3 times per minute, and cement trucks proceeding south and exiting Scenic CR 7 and proceeding south along Old CR 7. The cement trucks were an interesting anomaly as they were counted traveling both north and south (presumed laden and then empty) at a consistent rate of 2 passes every 2–3 minutes for a large part of the daytime monitoring event.

These cement trucks were also observed traveling at a relatively high rate of speed, which also heightened pavement noise. Results for both monitoring events are presented in Table 2.11-5.

Table 2.11-5
Monitoring results at Receptor 3, 3900 feet from IGCC Power Station Footprint

31950 Scenic Hwy 7 @ 3900' West		
Receptor 3	L_{10}	L_{50}
Daytime (1:03PM–2:04PM)	59dBA	55dBA
Nighttime (10:23PM–11:23PM)	58dBA	53dBA

2.11.4.1.4 Receptor Location 4, 32423 Scenic Hwy 7

Receptor 4 was located along Scenic CR 7, and approximately 4,400 feet from the northeastern corner of the West Range Site. Noise along Scenic CR 7 was the predominant noise source during times of monitoring. Monitoring was performed between the hours of 2:30PM and 3:30PM, and 11:45PM and 12:45AM June 9, 2005. Results for both monitoring events are presented here in Table 2.11-6.

Table 2.11-6
Monitoring results at Receptor 4, 3900 feet from IGCC Power Station Footprint

32423 Scenic Hwy 7 @ 4400 feet West		
Receptor 4	L_{10}	L_{50}
Daytime (2:30PM–3:30PM)	59dBA	52dBA
Nighttime (11:45PM–12:45AM)	56dBA	53dBA

2.11.4.1.5 Receptor Location 5, Dunning Lake

Receptor 5 was located along the southern end of North Dunning Lake and represented one residential location, and the location of future potential residential expansion.

No nighttime measurements were made (post 10PM) due to the remote nature of this location and a locked and gated roadway during the nighttime hours. Nighttime measurements were therefore correlated with the nearest other receptor (Receptor 2).

Monitoring was performed between the hours of 4:00PM and 5:00PM, June 9, 2005, and the events were within MPCA guidelines.

Table 2.11-7
Monitoring results at Receptor 5, 4100 feet from IGCC Power Station Footprint

Dunning Lake @ 4100' Southeast		
Receptor 5	L_{10}	L_{50}
Daytime (4:00PM–5:00PM)	51dBA	50dBA
Nighttime (correlated from R2)	50dBA	49dBA

2.11.4.1.6 Summary of Ambient Conditions and Expected Noise Levels

Tables 2.11-8 and 2.11-9 below, detail ambient noise conditions for the time frames measured in and around the West Range Site and for both daytime and nighttime conditions;

Table 2.11-8
Monitored levels at all Receptors, Daytime, dBA

Daytime Receptors	L_{10}	L_{50}	L_{10} **dB over State Compliance**	L_{50} **dB over State Compliance**
Receptor 1, 1700' West, Day (9:15AM–10:15AM)	53dBA	52dBA	0dB	0dB
Receptor 2, 3900' SE, Day (3:45PM–4:45PM)	54dBA	53dBA	0dB	0dB
Receptor 3, 3900' West, Day (1:03PM–2:04PM)	59dBA	55dBA	0dB	0dB
Receptor 4, 4400' West, Day (2:30PM–3:30PM)	59dBA	52dBA	0dB	0dB
Receptor 4, 4100' SE, Day (4:00PM–5:00PM)	51dBA	50dBA	0dB	0dB

Table 2.11-9
Monitored levels at all Receptors, Nighttime, dBA

Nighttime Receptors	L_{10}	L_{50}	L_{10} dB over State Compliance	L_{50} dB over State Compliance
Receptor 1, 1700’ West, Night (10:04PM–11:04PM)	51dBA	49dBA	0dB	0dB
Receptor 2, 3900’ SE, Night (11:15PM–12:16AM)	50dBA	49dBA	0dB	0dB
Receptor 3, 3900’ West, Night (10:23PM–11:23PM)	59dBA	55dBA	4dB	0dB
Receptor 4, 4400’ West, Night (11:45PM–12:45PM)	56dBA	53dBA	1dB	3dB
Receptor 5, 4100’ SE, Night (correlated)	50dBA	49dBA	0dB	0dB

All locations with the exception of receptors 3 and 4, and during the most critical nighttime hours, experience ambient noise conditions at or below state and federal standards during the monitoring event. Receptors 3 and 4, during nighttime conditions (10PM–7AM) experienced ambient noise levels above state standards, presumably due to their proximity to Scenic Hwy 7 (adjacent).

Ultimately, noise levels at all locations are typical for townships and locales of this size, and are below those of typical urban environments in close proximity to major transportation corridors.

2.11.4.2 East Range Site

Noise analysis was performed at 4 locations throughout the East Range Site and within areas of common use by residences. These included one residential location, and three locations around the East Range Site.

All monitoring was completed using a Type II, ANSI approved noise level meter with calibration being performed before and after each monitoring cycle. A windscreen was also used to counter any wind effects and no monitoring was performed during times when winds greater than 15mph were measured, or when precipitation was occurring. Monitoring at each location was performed for no less than one hour and during both times specified as “night” and “day” by MPCA classification. The East Range Noise study report is attached as Exhibit 5.

2.11.4.2.1 Receptor Location 1, Access Road Southwest of Plant

Receptor 1 was placed approximately 800 feet from the southwestern most corner of the IGCC Power Station Footprint. This receptor was the closest measurement point to the Phase I and Phase II Developments. The monitoring location is fairly remote, located on an old township highway (6401) with no throughway. Monitoring times were logged as between 10:12 PM–11:13 PM July 28, 2005 and then again from 8:23AM–9:23AM July 29, 2005.

Daytime monitoring conditions were calm with light cloud cover and variable winds. Any slight noise collected by the sound level meter during daytime hours were leaves rustling through the trees, and one small plane pass. The monitoring results are represented in Table 2.11-10.

Table 2.11-10
Monitoring results at Receptor 1, 800 feet southwest of IGCC Power Station Footprint

Township Highway 6401 @ 800 feet Southwest		
Receptor 1	L_{10}	L_{50}
Daytime (8:23AM–9:23AM)	50dBA	50dBA
Nighttime (10:12PM–11:13PM)	49dBA	49dBA

Ambient noise during the nighttime hours consisted mainly of insect noise and slight winds through the surrounding woods.

Both monitoring events fall within the MPCA guidelines for acceptable daytime and nighttime noise criteria.

2.11.4.2.2 Receptor Location 2, Boat Landing and Park

Receptor 2 was located approximately 7,800 feet southwest from the East Range IGCC facility site along a public boat landing and cit park. The sound level meter was placed near the water's edge and away from the comings and goings of users.

Monitoring events at this location occurred in the nighttime hours between 11:15PM and 12:16AM, July 28, 2005 to July 29, 2005, and again during the daytime hours of 9:50AM and 10:50AM, July 29, 2005. Ambient noise during the nighttime event consisted of insect noise and slight wind noise (leaves). There was no traffic in the park.

Daytime ambient noise consisted of slight winds through the surrounding woods, some slight boating traffic, and water noise. Results for both monitoring events are presented below in Table 2.11-11.

Table 2.11-11
Monitoring results at Receptor 2, 7,800 feet from plant

Boat Landing and Park @ 7,800 feet Southwest		
Receptor 2	L_{10}	L_{50}
Daytime (9:50AM–10:50AM)	52dBA	51dBA
Nighttime (11:30PM–12:30AM)	50dBA	49dBA

Both monitoring events fall within the MPCA guidelines for acceptable noise for daytime and nighttime criteria.

2.11.4.2.3 Receptor Location 3, Colby Ridge Developments, Pospeck Lane

Receptor 3 was within a newly developed area along the southern end of Colby Lake on Pospeck Lane, adjacent to the property of a medium sized residential lake home and 50 feet from the waters edge.

Monitoring events were logged between the hours of 12:40AM–1:40AM July 29, 2005, and again from 10:23AM and 11:23AM on July 29, 2005. Results for both monitoring events are presented below in Table 2.11-12.

Table 2.11-12
Monitoring results at Receptor 3, 8300 feet from IGCC Power Station Footprint

Colby Ridge Developments @ 8300' Southwest		
Receptor 3	L_{10}	L_{50}
Daytime (10:23AM–11:23AM)	53dBA	51dBA
Nighttime (12:40AM–1:40AM)	50dBA	49dBA

Both monitoring events fall within the MPCA guidelines for acceptable noise for daytime and nighttime criteria.

2.11.4.2.4 Receptor Location 4, 321 Kent Street

Receptor 4 was located within the southeastern neighborhoods of Hoyt Lakes, Minnesota and resided 10,500 feet directly south of the proposed facility.

Both daytime and nighttime monitoring sessions were quiet with an occasional car passing though the neighborhood. Additionally, during daytime monitoring, lawn mower noise was slightly evident in the distance. Results for both monitoring events are presented in Table 2.11-13 .

Table 2.11-13
Monitoring results at Receptor 4, 11,500 feet from IGCC Power Station Footprint

321 Kent St. @ 10,500 feet South		
Receptor 4	L_{10}	L_{50}
Daytime (12:30PM–1:30PM)	52dBA	50dBA
Nighttime (1:45AM–2:45AM)	49dBA	48dBA

Both monitoring events fall within the MPCA guidelines for acceptable noise for daytime and nighttime criteria.

2.11.4.2.5 Summary of Ambient Conditions and Expected Noise Levels

The tables below, detail ambient noise conditions for the time frames measured in and around the East Range Site and for both daytime and nighttime conditions.

Table 2.11-14
Monitored levels at all Receptors, Daytime, dBA

Daytime Receptors	L_{10}	L_{50}	L_{10} dB over State Compliance	L_{50} dB over State Compliance
Receptor 1, TH 6401 (8:23AM–9:23AM)	50dBA	50dBA	0dB	0dB
Receptor 2, Boat Landing (9:50AM–10:50AM)	52dBA	51dBA	0dB	0dB
Receptor 3, Colby Ridge (10:23AM–11:23AM)	53dBA	51dBA	0dB	0dB
Receptor 4, 321 Kent St. (12:30PM–1:30PM)	52dBA	50dBA	0dB	0dB

Table 2.11-15
Monitored levels at all Receptors, Nighttime, dBA

Nighttime Receptors	L_{10}	L_{50}	L_{10} dB over State Compliance	L_{50} dB over State Compliance
Receptor 1, TH 6401 (10:12AM–11:13PM)	49dBA	49dBA	0dB	0dB
Receptor 2, Boat Landing (11:30PM–12:30AM)	50dBA	49dBA	0dB	0dB
Receptor 3, Colby Ridge (12:40AM–1:40AM)	50dBA	49dBA	0dB	0dB
Receptor 4, 321 Kent St. (1:45AM–2:45AM)	49dBA	48dBA	0dB	0dB

Hoyt Lakes and the surrounding areas are, in general, very quiet places. During daytime hours there is little to no manufacturing noise other than from the Laskin power plant across Colby Lake, limited traffic that passes along Kennedy Memorial Drive proceeding through town, and very few school related noise sources such as busses and playgrounds.

Nighttime monitoring events were equally quiet with readings 1-2 decibels lower than daytime readings in most instances. One to two decibels is outside of the human ear's ability to perceive a level difference given similar conditions. This equates to similar conditions both night and day with a clinical difference attributed to the sensitivity of the Sound Level Meter. Essentially, Hoyt Lakes and the surrounding areas are equally quiet both during the MPCA daytime hours of 7:00 AM–10:00 PM, and during the nighttime hours of 10:00PM and 7:00AM. This can fluctuate slightly due to insect noise during evening events, and higher traffic and wind noise generated during the day.

All receptors, during times specified "nighttime" and "daytime" by the MPCA show no levels above state standards.

Three other significant receptors (churches) were located within the Hoyt Lakes city limits. These included:

- Faith Lutheran Church located at the northwest corner of Dorchester Dr. and Kennedy Memorial Dr. and 10,000 feet from the proposed plant site
- Queen of Peace Catholic Church at the northwest corner of Hampshire Rd. and Kennedy Memorial Dr. and 10,200 feet from the proposed plant site
- Trinity Methodist Church located at the northeast corner of Hampshire Rd. and Kennedy Memorial Dr. and 10,300 feet from the proposed plant site

These additional receptors were added to the overall analysis and labeled R5, R6, and R7 respectively (see Section 3.11).

2.12 Transportation and Traffic

2.12.1.1 West Range Site

2.12.1.1.1 Roads

The existing roadway system in the area of the West Range Site is shown above in Section 1 (see Figure 1.12-59). The West Range Site is bordered on the south by State Highway 169. Highway 169 is generally a four-lane east-west highway extending across the Iron Range from Grand Rapids to Virginia; however, it is a two-lane roadway in the site area. The Minnesota Department of Transportation (MnDOT) has developed preliminary plans to expand Highway 169 to four lanes in the site area, but these plans are unfunded to date and therefore not scheduled.

On the west, the site area is bordered by Itasca CR 7. CR 7 is a winding two-lane roadway stretching from Taconite to Bigfork. Itasca County has experienced maintenance problems with CR 7, including slope stability issues near the intersection of State Highway 169. CR 7 is a nine-ton roadway except during spring load restrictions when it is posted at seven-tons/axle.

Another existing road corridor in the project area is the Cross-Range Heavy Haul Road, a gravel road which has been in place for generations as a way to allow heavy or slow loads to be transported between mines across the Iron Range. In the West Range project area, the Cross-Range Heavy Haul Road also serves as access to a cluster of homes in the Big Diamond Lake/Dunning Lake area. The proposed access roadway (Access Road 1) that will serve the West Range Site will be a new two-lane roadway with shoulders, 17,000 feet in length, beginning at a new access point on State Highway 169, approximately 7,000 feet east of CR 7. Access Road 1 will cross underneath the adjacent rail line and proceed north, then curve west between Big Diamond and Dunning Lakes before terminating as it connects with CR 7, just southwest of the plant site. The section of existing CR 7 between the plant and State Highway 169 will remain in place as either a lower level County Road, or transferred back to the City of Taconite for use as a City Street. The plant would be served by a 4,900-foot paved driveway (Access Road 2), about 32 feet wide, connecting the plant with Access Road 1. The proposed roadway system is shown in Figures 1.5-1 and 1.5-7.

2.12.1.1.2 Traffic Volumes

State Highway 169 had 5,700 to 7,200 vehicles per day in this area in 2004. The most recent data for CR 7 showed 1,100 vehicles per day using the road in 2000. A traffic volume forecast was completed for the West Range site. This forecast shows existing traffic volumes, as well as forecast volumes during construction (2008) and 20 years after construction (2028). Details regarding roadway traffic volumes at the West Range Site are provided in Section 3.12, as part of the analysis of future forecast traffic volumes and level of service predicted after construction for Mesaba One and Mesaba Two.

2.12.1.1.3 Rail Line

The proposed West Range site is located approximately 1.5 miles north of the mainline tracks of the BNSF and CN allowing the competition referred to in Section 1.12.3.1 to occur. Maps of the BNSF and CN trackage in the region are provided in Figures 1.12-54 and 1.12-56.

The proposed railroad access will be from both the BNSF and CN Railroads. A detailed discussion of region wide railroad access issues is provided in Section 1.12.3.1.2 The Mesaba Project will construct about 8 miles of track, including the plant support tracks. Approximately 3 miles will be off-site lead track, with the remaining track being on the plant site. The majority of train traffic will be unit coal trains. Phase 1 and II Power Station would need slightly more than one loaded train per day. Other products would generate train traffic of 2 trips per week.

The existing railroad system in the area has historically handled between 4 and 10 trains per day when the taconite industry was operating at peak conditions. With the slump in taconite production, the track has seen infrequent use between Kewatin and Gunn.

2.12.1.2 East Range Site

2.12.1.2.1 Roads

The East Range Site is located about two miles north of Hoyt Lakes, Minnesota and is bordered on the south by Colby Lake, on the east by Saint Louis County Highway 666, and on the north and west by various mine pits and operations. County Highway 666 begins at its intersection with County Highway 110 that runs east/west through Hoyt Lakes. There are no other roadways in the area of the proposed site. The existing roadway system in the area of the East Range Site is shown above in Figure 1.12-61

The proposed access roadway that will serve the East Range Site will be a new two-lane loop-type roadway, about 10,000 feet in length, with two access points off of County Highway 666, just east of the plant (Access Road 1). Other roadway improvements that are proposed include a

2-inch mill and overlay of County Highway 666 from Hoyt Lakes to the plant site, and a full reconstruction of Hampshire Drive, a short connector between CR 110 and 666. The proposed roadway system is also shown in Figure 1.5-2.

In 2003, County Highway 110 had 2,950 vehicles per day west of CR 666 and 710 vehicles per day to the east. CR 666 averaged between 520 and 750 vehicles per day, with the higher traffic count on the stretch north of CSAH 110. Details regarding roadway traffic volumes at the East Range Site are provided in Section 3.12 as part of the analysis of future forecast traffic volumes and level of service predicted after construction for Mesaba One and Mesaba Two. This forecast shows existing traffic volumes, as well as forecast volumes during construction (2008) and 20 years after construction (2028).

2.12.1.2.2 Rail Line

The proposed railroad access will be from the CN Railroad. A detailed discussion comparing the alternative railroad routes and access issues is provided in Section 1.12.3.1.3. The Mesaba Project will require about 5 miles of track, with up to 2 miles of track off the plant site. The majority of the train traffic will be unit coal trains. Phase I and II Power Station would need 1 loaded train per day. Other products would generate train traffic of 2 trips per week.

The East Range site is located approximately one mile north and one mile west of two Canadian National Railroad (CN) tracks. The east-west track runs from Eveleth, Minnesota to Two Harbors. The north-south track connects with the east-west track southeast of the site and extends north to Embarrass, Minnesota. The north-south track connects with the east-west track at Wyman Junction (about 1.7 miles southeast of the Project Site) and extends northward to Embarrass. Coal would be delivered by other railroads to the CN at either Superior, Wisconsin or to a railroad yard south of Eveleth, Minnesota. The CN would deliver coal to the site from Superior or Eveleth. Figures 1.1-54 and 1.1-56 show the potential CN routes, with empty trains returning by the same route. The CN operates daily on the track servicing MP’s Syl Laskin Generating Station, the former Erie Mining Taconite Plant, and several proposed and existing industrial customers.

2.13 Historic and Cultural Resources

Section 106 of the National Historic Preservation Act requires consideration of the effects of an undertaking on historic, archaeological and cultural properties determined eligible for listing on the National Register of Historic Places (NRHP). Consultation between the federal agencies, the State Historic Preservation Office (SHPO) and federally-recognized tribes is required. A review of historic, archaeological and cultural resources was conducted of the proposed project to determine if these resources exist, or have the potential to exist, and if they may be impacted. The following sections describe the cultural, historical and archaeological resource studies performed for the Mesaba Energy Project and outlines additional studies that will be required.

2.13.1 Archaeological Resources

The following section identifies the preliminary studies performed for the Mesaba Energy Project including the West Range Site, East Range Site, and associated corridors.

2.13.1.1 West Range IGCC Site

During June and July 2005, a cultural resources assessment of the West Range Site and portions of associated corridors was conducted. The project area included within the study for the West Range site was approximately 1,344 acres (544 hectares), and for associated corridors was 4,970 acres (2,011 hectares), thus totaling 6,314 acres (2,555 hectares). A copy of this report is provided as Appendix 6.

Background research was first conducted using the SHPO site files for information on previously identified archaeological sites and cultural resource surveys within one mile (1.6 kilometer [km]) of the project area. An archaeological sensitivity model was developed to establish areas of archaeological sensitivity within the West Range Site and associated corridors. A 10-mile radius around the West Range Site was used to determine the type of cultural affiliations and locations of archaeological sites that could be encountered within the project area. Previously recorded sites located within the study area were grouped according to the model.

The model established a general set of criteria to determine archaeological sensitivity. These criteria were based upon previous work throughout Minnesota and conversations with the Minnesota State Historic Preservation Office. The criteria included undisturbed portions of the following areas:

- within 500 feet (150 m) of an existing or former water source (lake, pond, river, stream);
- elevated, comparatively well-drained areas within, or immediately adjacent to, a marsh or wetland of 10 acres (4.0 hectares) or greater in extent;
- topographically prominent areas that command a wide view of the surrounding landscape;
- areas adjacent to a known or suspected portage or transportation route;
- located within 300 feet. (100 m) of a previously reported site; and/or
- located within 300 feet. (100 m) of a former or existing historic structure or feature (such as a building foundation or cellar depression).

Areas of sensitivity were ranked in terms of the frequency in which previously recorded sites occurred. Areas were then categorized in terms of high, moderate and low potential for the location of archaeological sites.

On August 1–5, and August 8–12, 2005 The 106 Group conducted a limited archaeological survey covering 31 acres of the West Range Site. A report of this investigation is included as Appendix 6, *Archaeological Sampling of the Mesaba Energy Project, West Range Site, Itasca County, Minnesota*.

The sampling areas were selected by: i) having either high or moderate potential for producing archaeological resources; and ii) areas that could not be avoided by planned project developments. Approximately 6 acres identified as high potential areas by the sensitivity modeling and approximately 25 acres identified as moderate potential areas were assessed during the field investigation. The archaeological sampling was not intended to substitute for a formal Phase I archaeological evaluation. Rather it was used to further address the sensitivity model and testing strategy for archaeological resources within the entire West Range Site and associated corridors.

No archaeological resources were encountered in either the high or moderate potential areas identified. As a result of the negative findings of the sampling study, The 106 Group recommends that there be an adjustment to the testing strategy outlined above. The Minnesota SHPO and appropriate federal agencies and tribes will be consulted to address the proposed testing strategy area prior to any additional testing.

2.13.1.1.1 East Range IGCC Site

In September and October of 2004, The 106 Group conducted a Cultural Resources assessment and Phase I Survey for the East Range Site in areas determined to have a higher potential for containing archaeological sites. All work was conducted in accordance with the *SHPO Guidelines for Archaeological Projects in Minnesota* (Anfinson 2001) and *The Secretary of the Interior's Standards and Guidelines for Archeology and Historic Preservation* (48 Federal Register 44716-44740) (National Park Service 1983). A report was prepared summarizing the results of the investigation in November 2004 was updated in July 2005. A copy of this report is provided in Appendix 6. The survey area for the East Range Site located in Sections 32 and 33, T59N, R14W within St. Louis County, Minnesota, includes approximately 640 acres (259 hectares). The East Range Site is identified within the attached report as the "South Site."

The archaeological assessment for this project included background research, a visual reconnaissance, and assessment of archaeological potentials within the survey area. Background research was conducted using the Minnesota SHPO site files for information on previously identified archaeological sites and architectural history properties within one mile (1.6 km) of the survey area and on cultural resources surveys previously conducted within the survey area.

A database query was also submitted to SHPO staff to identify any previously identified properties within the survey area, including any that are listed or determined eligible for listing on the NRHP.

Archaeologists conducted a visual reconnaissance of the study area to identify locations with moderate to high archaeological potential.

Areas defined as having a relatively low potential for containing intact archaeological resources included inundated areas, former or existing wetland areas, poorly drained areas, and locations with a 20 percent or greater slope. Archaeologists also compared current field conditions with those from historical documents to assess the potential within the survey area for intact post-contact archaeological sites.

The Phase I archaeological survey included shovel testing of those areas identified during the assessment as having greater potential for containing intact archaeological deposits because surface visibility was less than 25 percent throughout the project area.

Areas identified within the East Range Site as having low precontact archaeological potential include:

- Twp Hwy 6401 (Colby Lake Road) ROW;
- CR 666 (Kensington Drive) right-of-way;
- the Two Harbors to Tower Junction segment of the DM&IR Railway right-of way;
- one overhead power line and a HVTL;
- low-lying wetlands; and
- the unnamed tributary of the Partridge River.

Areas of greater precontact archaeological potential include:

- topographically prominent areas in proximity to the tributary of the Partridge River; and
- topographically prominent areas in proximity to the larger wetlands.

Due to surface visibility being less than 25 percent throughout the survey area, shovel testing was necessary to examine those portions of the survey area identified during the assessment as having a greater potential to contain intact archaeological deposits. Shovel testing in those areas encountered no archaeological materials. Based on the low potential of much of the survey areas for intact archaeological resources, combined with the absence of archaeological material there, The 106 Group does not recommend additional archaeological work at the East Range Site.

A Phase I archaeological evaluation has not been conducted along the corridors associated with the East Range site. Reports outlining the results of future investigations will be submitted to the SHPO and approval will be received prior to commencement of construction activities.

2.13.2 Architectural History Assessment

A Phase I architectural history survey was conducted within the project boundaries to identify previous studies conducted in or near the project area, and to identify the expected resource types.

The recommended area of potential effect (APE) for the architectural history resources extends to 0.25 miles from the centerline of the proposed HVTL, rail and road corridors. The APE for underground utilities would be limited to the width of the corridor itself. The results of the air modeling may require an expansion of the APE. A detailed discussion of the APE is provided in Section 3.13.4.1.

2.13.2.1 West Range IGCC Site

Several NRHP-listed or eligible properties are located in the vicinity of the APE (not within the APE). Eleven architectural history properties within the recommended APE have been previously recorded in SHPO records. Two properties, the Great Northern Railway Nashwauk-Gunn Line, and the Duluth, Missabe & Northern Railway Alborn Branch have been determined eligible for listing on the NRHP. Two previously recorded properties no longer exist.

The 106 Group recommends a Phase I architectural history investigation for properties over 45 years of age within the recommended APE to determine their eligibility for listing on the NRHP. This phase would include the development of a historical context specific to the project area, and additional field work and historical research sufficient to develop a determination of potential eligibility. SHPO architecture-history inventory forms would be completed for each documented property. Because of the vastness of the potential cultural landscape associated with iron mining and the difficulty in perceiving the landscape patterns, additional research on the historical evolution of the landscape would be conducted through the review of historical maps, aerial photographs, and other archival documentation.

During the cultural resources assessment for the East Range Site, two architectural history resources were identified that are listed or may be eligible for inclusion into the NRHP. These include the Two Harbors to Tower Junction Segment of the DM&IR, and the NRHP-listed E. J. Longyear First Diamond Drill Site (Longyear Site, SL-HLC-001). Further evaluation of the Two Harbors to Tower Junction is needed to determine its eligibility for listing on the NRHP. A determination of effects of the proposed project on the Longyear Site and the potentially historic DM&IR line would be necessary prior to construction activities.

Detailed investigations were not performed for the East Range HVTL, natural gas pipeline, water pipeline, transportation corridors (rail line and roadways) and alternative routes. An architectural, archaeological, historical and cultural resource investigation will be conducted within the corridor selected for the project. These reports will be submitted to the SHPO prior to construction activities commencing. Consultation will occur among SHPO, the federal agencies and the federally recognized tribes to determine eligibility of historic, archaeological and cultural properties and to avoid any potential adverse effects.

2.13.3 Native American Tribal and Religious Practices

The cultural assessments of both the East and West Range Sites and associated corridors do not address traditional Native American Tribal and Religious Practices. As part of the cultural resources identification and evaluation process, The 106 Group will assist the federal agencies in addressing Native American tribal and religious practices. This will include inviting Native American tribes to consult on the Mesaba Energy Project and exploring whether there are traditional cultural properties within the project area. All federally-recognized tribes with historic or current affiliation to Minnesota and the project area have been invited to participate in the consultation process, and be a signatory to a Programmatic Agreement. Initial consultation letters were sent in September 2005 from the DOE to all federally recognized tribes who have expressed a cultural and historical interest in Minnesota.

2.13.3.1 Current Tribal Boundaries

The cultural assessments of both the East and West Range Sites and associated corridors do not address current tribal boundaries. As part of the cultural resources identification and evaluation process, The 106 Group will assist the federal agencies in identifying current tribal boundaries. This will include consulting with Native American tribes to determine whether there are culturally significant properties within the project area.

2.13.3.2 Current Religious Practices

The cultural assessments of both the East and West Range Sites and associated corridors do not address current religious practices. As part of the cultural resources identification and evaluation process, The 106 Group will assist the federal agencies in addressing Native American tribal and religious practices. This will include inviting Native American tribes to consult on Mesaba Energy Project and exploring whether there are traditional cultural religious practices within the project area.

2.14 Socioeconomics

In this section, background socioeconomic data is provided for (1) the Arrowhead Region in general, and (2) the municipalities nearest to the two project sites under consideration: Taconite (West Range Site) and Hoyt Lakes (East Range Site). The transmission line and natural gas pipeline routes under consideration are located within the Arrowhead Region near these two cities. Section 3 evaluates the project's potential social and economic impact on the region and local areas using these background data as a baseline.

This section deals with the following socioeconomic considerations:

- Section 2.14.1 Population
- Section 2.14.2 Demographics and Special Populations
- Section 2.14.3 Housing Availability
- Section 2.14.4 Employment
- Section 2.14.5 Unemployment
- Section 2.14.6 Income and Poverty Rates

2.14.1 Population

2.14.1.1 Regional Population Trends

To fully account for the broad industry linkages and impacts due to this project, the "Arrowhead Economic Development Region" was used as the regional study area. This region is defined by the Minnesota Department of Employment and Economic Development's (DEED), and consists of the following seven northeastern Minnesota counties:

- Aitkin
- Carlton
- Cook
- Itasca
- Koochiching
- Lake
- St. Louis

This region is also sometimes referred to as the Northeast Region or the Taconite Relief Area (although Duluth and some other areas in these counties are not included in the Taconite Relief

Area). The local study areas are defined as the City of Taconite (West Range Site) and the City of Hoyt Lakes (East Range Site).

After gaining population in the 1970's, the Arrowhead Region experienced a decade-long population decline beginning in about 1980, in part due to a downturn in both the national steel industry as well as the local taconite industry. Table 2.14-1, below, shows that the regional population declined about 8.5% between 1980 and 1990. St. Louis and Lake Counties, in the heart of the Iron Range, suffered the largest drop. Beginning in 1991, the population began to gradually increase. By 2000, the population had recovered to slightly less than what it was in 1970. In comparison, over the same thirty years, the population of the State of Minnesota increased by 29%, from about 3.8 million people to 4.9 million.

Table 2.14-1
Arrowhead Region Population Trends 1970–2000

Year	Population
1970	329,603
1980	343,344
1990	311,342
2000	322,073

Table 2.14-2 below, further breaks down regional population trends by county. The population of the 10 largest municipal districts is also provided below in Table 2.14-3. On a percentage basis, Cook County is the fastest growing in the region. Itasca County (West Range Site) has about the same population now that it did in 1980, and the population of St. Louis County (East Range Site) has dropped since 1980.

Table 2.14-2
Population Change Between Censuses by County for Arrowhead Region

County	1980	1990	2000	% Change 1980–2000	% Change 1990–2000
Aitkin	13,404	12,425	15,301	14.2	23.1
Carlton	29,936	29,259	31,671	5.8	8.2
Cook	4,092	3,868	5,168	26.3	33.6
Itasca	43,069	40,863	43,992	2.1	7.7
Koochiching	17,571	16,299	14,355	-18.3	-11.9
Lake	13,043	10,415	11,058	-15.2	6.2
St. Louis	222,229	198,213	200,528	-9.8	1.2
Region	343,344	311,342	322,073	-6.2	3.4

There are 278 cities and townships in the region. As shown in Table 2.14-3, almost one-quarter of the regional population lives in Duluth.

Table 2.14-3
10 Largest MCDs in Northeast Minnesota, 2002

City	2002 Population
Duluth	86044
Hibbing	16968
Cloquet	11378
Virginia	9108
Hermantown	8178
Grand Rapids	7829
International Falls	6554
Chisholm	4872
Thomson Township (Carlton County)	4361
Rice Lake Township (St. Louis Township)	4190

The Minnesota State Demography Office predicts that the Arrowhead Region will continue to gain in population over the next fifteen years, increasing by about another 18% by 2030. The Demography Office expects the population of St. Louis County to increase by about 9%, and that of Itasca County to increase by about 21% by 2030. During the summer, the regional population increases because of the large number of temporary residents and tourists that move into the area. These seasonal increases are not reflected in census data, but they should be taken into account when evaluating housing availability and transportation impacts of new projects.

2.14.1.2 Taconite and Hoyt Lakes Population Trends

The population trends for the Cities of Taconite (West Range Site) and Hoyt Lakes (East Range Site) are shown below in Table 2.14-4. These data show that the population of City of Taconite has remained about the same since 1980, while the population of Hoyt Lakes has declined by nearly 40% since 1980, from 3,186 to 1,961.

Table 2.14-4
Population Trends Since 1980 for Taconite (West Range) and Hoyt Lakes (East Range)

Municipality	1980	1990	2000	2004
Taconite	331	310	315	323
Hoyt Lakes	3,186	2,348	2,082	1,961

The area near both cities gets a large influx of temporary residents and visitors at lake cabins, resorts and campgrounds during the summer. These temporary residents are not counted in these population statistics, but they do impact the capacity of local government services to meet local needs.

2.14.2 Demographics and Special Populations

To help determine whether the project could disproportionately impact minority or low-income residents, demographic data were evaluated for the region and local site areas. Table 2.14-5 provides demographic data by race from the 2000 Census for the entire seven-county Arrowhead Region.

Table 2.14-5
2000 Census: Region 3 Arrowhead Population Profiles: Total and Minority Populations

Regional Population (2000) by Race	Number	Percentage
White	304,909	94.7
Black or African American	2,171	0.7
American Indian	8,342	2.6
Asian	1,657	0.5
Pacific Islander (Hawaiian)	82	0
Other	653	0.2
Two or more races	4,259	1.3
Total	322,073	100

Table 2.14-5 indicates that at almost 95% white (including white Hispanic/Latino), the population in the region is relatively homogenous, with few concentrations of minority or low-income areas. The largest minority concentrations in the region are in central Duluth and on tribal reservations relatively distant from either the West Range or East Range Site. The areas of concern in the region that have higher poverty and minority concentration (primarily American Indian) are shown in the environmental justice map provided as Figure 2.14-1. For reference, the State of Minnesota is 89.4% white.

2.14.2.1 West Range Site

The population of Taconite is over 97% white. Along the transmission routes discussed in Section 1, the population is similarly overwhelmingly white. As shown in Figure 2.14-1, there are no concentrations of minority or poor populations along the proposed transmission routes or likely alternatives.

2.14.2.2 East Range Site

The population of Hoyt Lakes is also over 95% white, with about 2.5% American Indian. Although the American Indian population is slightly higher near Taconite than near Hoyt Lakes, the Proponent is not aware of any minority populations that are disproportionately affected in the Hoyt Lakes area should the project be built at that location. As with the West Range Site, the population in the area through which the East Range Site transmission lines would cross has approximately the same racial make up as the City of Hoyt Lakes itself.

2.14.3 Housing Availability

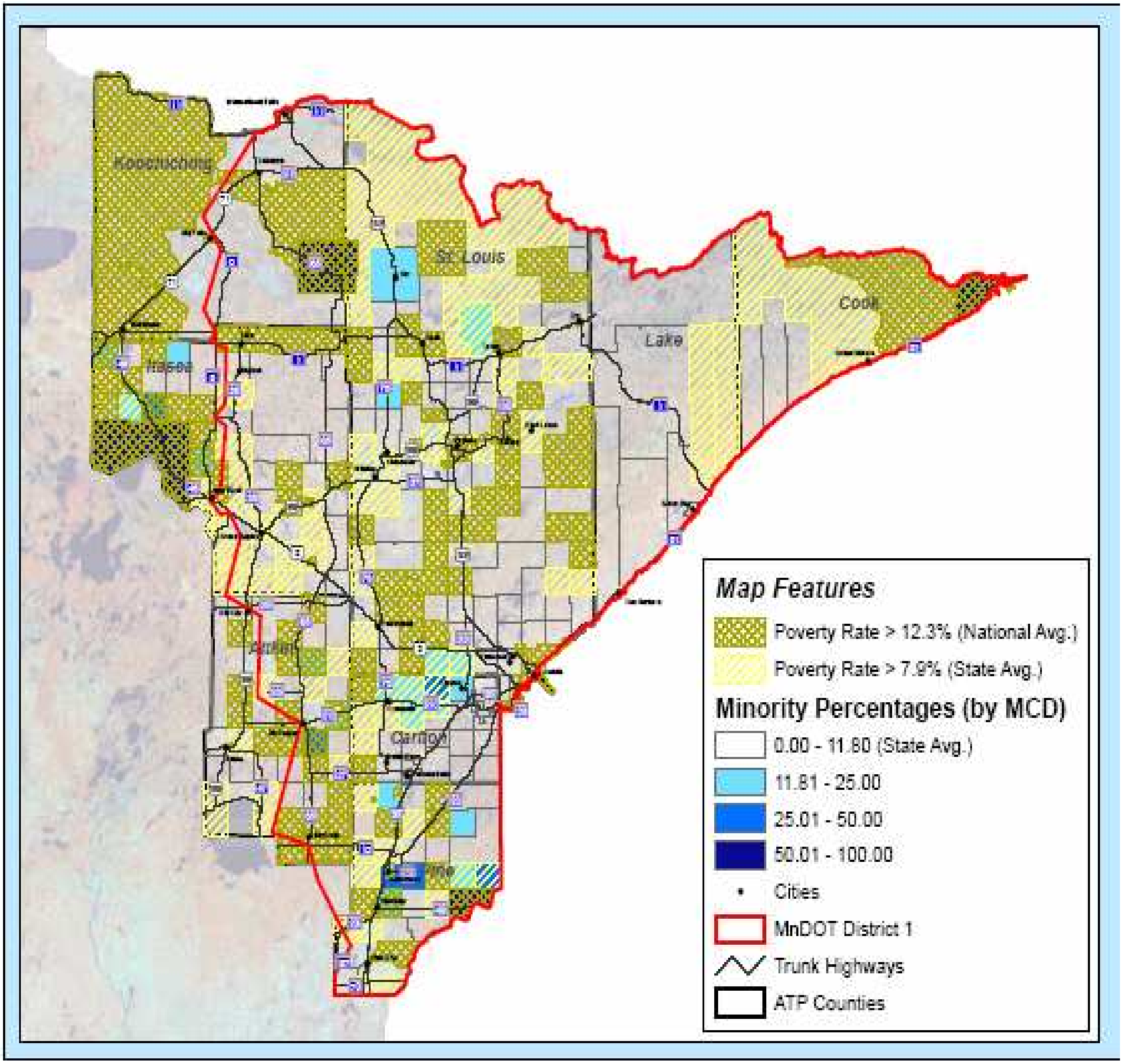
According to 2000 census data, there are a total of about 35,300 vacant housing units in the Arrowhead Region. Of these, over 27,600 (78%) are for seasonal, recreational, or occasional use. Therefore, approximately 7,700 year-round housing units are potentially available in the region for temporary or permanent housing during the project construction period and after. In Taconite, there are 150 existing housing units, of with 31 are rental units. In Hoyt Lakes, there are 995 housing units, of which 76 are rented. There are currently two new housing developments starting in the Hoyt Lakes area, one of which is the development of MP owned lots along nearby lakeshore areas.

2.14.4 Employment

Northeastern Minnesota has historically relied on the mining and forestry industries for well-paying jobs and economic base. Since 1970, job loss in these two industries, general population loss, and other changes have forced a diversification in employment. Between 2000 and 2003, jobs in mining declined by 36% (DEED, 2005). Although the mining and forestry industries have stabilized recently, both industries are now producing more output with fewer employees. These changes and the general economic crisis of the 1980's and earlier this decade have forced the region to adopt economic diversification as a long-term strategy.

DEED collects employment data for the state of Minnesota. The 2003 data show that, as in the rest of the country, employment in the service sector is an increasingly large percentage of total employment in the Arrowhead Region. Mining now accounts for only 3% of the employment in the region, but accounts for 5% of wages paid. This indicates that mining and manufacturing jobs, while no longer a large percentage of regional employment, pay significantly higher wages than most service jobs in the area.

Figure 2.14-1. Environmental Justice Demographics in Arrowhead Region

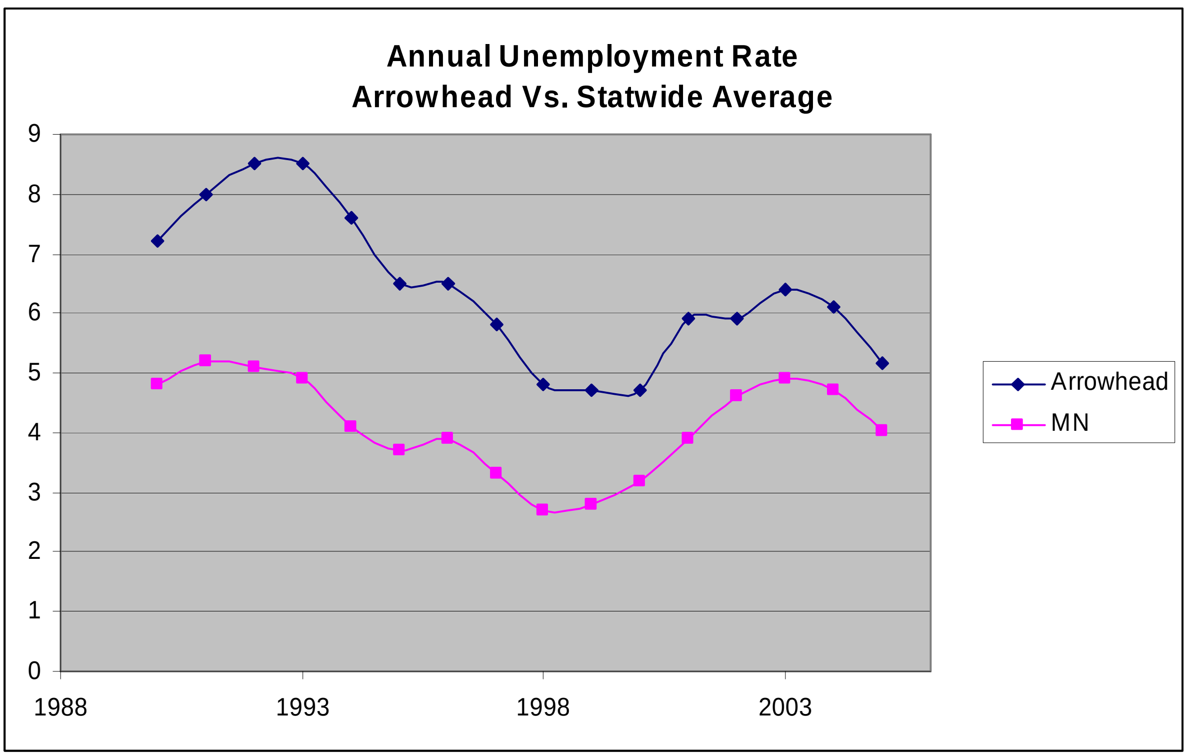


Mining and paper production are still the two highest output industries in the region on a dollar value basis (BBER, 2005). Although mining and forestry jobs account for only a small percentage of regional jobs, these industries still account for over 15% of the jobs in Taconite (West Range Site) and Hoyt Lakes (East Range Site), both of which are located in historic mining areas of the Iron Range.

2.14.5 Unemployment

Since both temporary construction and permanent employment for the project would be drawn from throughout the region, this section emphasizes regional unemployment rates. The average unemployment rate in the seven-county region averaged about 5.1% for 2005, but dropped to about 4.0% over the last four months of the year. Unemployment in the region has only gradually declined over the last several years due to a slow recovery from the 2001 recession. Since 1990, the regional unemployment rate has ranged from about 5% to over 8% annually. As shown in Figure 2.14-2, since 1980, the unemployment rate in the Arrowhead Region has been consistently about 2% higher than the state average, and about 1% higher than the state average for the last five years. Unemployment has also dropped statewide, and this continued economic expansion in other areas of the state will likely increase the employment disparity between the Arrowhead Region and other parts of the state.

Figure 2.14-2



As noted, unemployment is generally higher in most of the Arrowhead Region compared to other parts of Minnesota. The historically persistent higher unemployment rate in the Arrowhead Region suggests that the Northeast has and will continue to have a skilled labor force available for local employment in 2010 and beyond, unless demand in the taconite and other mining products continues to increase. Unemployment in St. Louis County (East Range Site) and Itasca County (West Range Site) is higher than the state as a whole. Other parts of the state, with lower unemployment, would potentially require more labor from outside the local area and the region than would occur in the Arrowhead Region. The historically higher unemployment in the Arrowhead Region may indicate that any new industrial capacity in the area is likely to not only attract new residents, but also provide long-term employment to currently unemployed skilled labor currently living in the area.

2.14.6 Income and Poverty Rates

While there are not significant concentrations of poverty in the Arrowhead Region, overall poverty rates are higher and income is lower in the region than in the state as a whole. While the overall poverty rate is higher than the state average, there do not appear to be any substantial concentrations of extreme poverty. The annual per capita household income in the Arrowhead Region in 2003 was about $26,770, with the corresponding figure for Minnesota was about 27% higher, at $34,030. Regarding poverty rates, according to 2000 Census information, about 11.9% of the population in the Arrowhead Region has an income below the poverty line compared to 8.3% who live below the poverty line statewide.

The median household income of Taconite is $30,250, with 17% below the poverty level. The median household income is higher and poverty rate is lower in Hoyt Lakes, where the median household income is $39,490 and 8.9% live below the poverty level.

2.15 Community Services

This section describes existing local government services for the Cities of Taconite (West Range Site) and Hoyt Lakes (East Range Site) that may be affected by the proposed project.

2.15.1 Fire and Emergency Medical

2.15.1.1 West Range Site: Taconite

The City of Taconite has an Emergency Medical Technician (EMT) staff of seven volunteers that handle emergency medical services for the area. Taconite currently has a total of 14 volunteer fire department personnel. Ambulance service may be from Nashwauk or Grand Rapids, depending on exact location of the 911 caller. The nearest hospitals are the Itasca Memorial Center in Grand Rapids (13 miles), Hibbing (30 miles), and Bigfork (29 miles.) Taconite also has a mutual aid agreement with nearby Cohasset and Grand Rapids. Itasca County provides additional emergency response as needed.

2.15.1.2 East Range Site: Hoyt Lakes

Hoyt Lakes operates a volunteer emergency response and fire department with 25 EMT and fire fighters, paid by service run. Hoyt Lakes operates this service cooperatively with the surrounding communities of Aurora, Biwabik and White Township, all of which contribute "cooperative" payments to cover administrative expenses, keep cost of service low and build up reserves for capital purchases. Hoyt Lakes also has mutual aid agreements with different combinations of these communities for police, fire and ambulance. The nearest hospitals are the White Community Hospital in Aurora (9 miles), Eveleth (27 miles), and Virginia (28 miles).

As Hoyt Lakes is within St. Louis County, the St. Louis County Sheriff is the appointed emergency management director for the county. St. Louis County assists its municipalities when emergency response exceeds local capabilities. Likewise, state government may supplement county resources as needed. The St. Louis County Sheriff’s Office Emergency Management Division coordinates emergency management plans and has jurisdiction throughout the county outside of cities who establish their own emergency management organizations.

In an extreme emergency or disaster situation within the county, the Chairman of the Board of Commissioners, the County Administrator, or the Sheriff activates the St. Louis County Emergency Operations Center (EOC). Response activities are coordinated through the EOC to assure effective response and recovery.

2.15.2 Police Protection

2.15.2.1 West Range Site: Taconite

Itasca County provides police protection to the City of Taconite and the surrounding area. The Itasca County Sheriff's Office has 64 employees working as Jailers, Dispatchers, Clerical and Road Deputies. Itasca County has employees that have specialized training to work in the following areas; D.A.R.E. (Drug Abuse Resistance Education), pre-employment background investigation, Boat and Water Safety, Snowmobile Safety, Drug Task Force, Emergency Response Team, Dive Team, and special enforcement projects.

The Sheriff's Office has divided the county into 5 patrol districts. Deputies live and work within their assigned patrol district. This concept of community policing was implemented by the County many years ago. The Itasca County Sheriff’s Posse and the Itasca County Dive Team support the Sheriff’s Office in their duties. These two groups are highly trained volunteers who contribute their time to search for lost persons, recover drowning victims and provide time to community service work.

2.15.2.2 East Range Site: Hoyt Lakes

Hoyt Lakes has a police department consisting of five full time and five part-time officers, with backup by St. Louis County Sheriff’s department. St. Louis County has 94 full time and 23 part time police on staff.

2.15.3 Utilities

2.15.3.1 Preferred Site (West Range)

The utilities in the rural areas are all on-site utilities including wells and septic systems. The City of Taconite uses wells to distribute water and has a wastewater collection system that conveys wastewater to the joint Coleraine-Bovey-Taconite WWTF located in Coleraine. The potable water service and sanitary sewer collection system will be extended from the city of

Taconite's existing utility systems to the IGCC facility site. The utility corridor will be approximately 12,400 feet in length and will affect about 17 acres.

There are also several private utilities that provide services to the area. Qwest provides local telephone service. Natural gas and electricity are also provided by various private companies

2.15.3.2 Alternative Site (East Range)

The utilities in the rural areas are all on-site utilities including wells and septic systems. The City of Hoyt Lakes treats surface water for drinking water and has a wastewater collection system that conveys wastewater to the Hoyt Lakes WWTF located in the city. The potable water service and sanitary sewer collection system will be extended from the Hoyt Lakes utility systems to the IGCC facility site. The utility corridor will be approximately 12,500 feet in length and will affect about 14 acres.