

## 5. DESCRIPTION OF THE PROPOSED PROJECT

### 5.1 Transmission Line

#### 5.1.1 Route Selection Process

The Project was reviewed during the electrical planning process by a team of right-of-way, environmental and engineering personnel. The team reviewed the general project area for significant routing/siting issues that may arise as well as any electric system performance issues associated with the various route alternatives. Route alternatives were identified using the process described below with one route selected for this Route Permit application in accordance with Minn. Rules 4400.2100.

#### Route Selection Criteria

The siting team analyzed the project area using various geographic data (e.g., aerial photos, topographical maps, etc.) and public input. Preliminary routes options were then identified based on opportunities to:

- share right-of-way with existing transmission lines by double circuiting where practical or paralleling an existing line;
- reduce impacts to reliability during construction (i.e., consider if existing lines can be taken out of service for construction);
- parallel roads to help decrease the amount of right-of-way required (the road that requires the least amount of clearing is normally chosen);
- parallel field lines, property lines or railroads, where access is adequate and the transmission line would cause minimal conflicts;
- minimize the length of the transmission line to reduce the impact area and costs for the proposed Project; and
- reduce the impact of double circuit construction on reliability of electric service to area and region.

The routes were further refined by avoiding, to the extent possible, areas where an HVTL could create significant impacts. These avoidance areas include:

- existing and planned high density residential areas;
- agricultural areas where center pivot irrigations systems are used;
- areas where clearances are limited because of trees or nearby structures; and
- environmentally sensitive sites, such as wetlands, archaeologically significant sites, areas with threatened, endangered and species of special concern, areas of significant biological or cultural significance, and state and federal lands.

A key to the route maps that show the Proposed Route developed for this permit application is provided in Figure 5-1. The Proposed Route is described below by segment and detailed route maps are provided for each segment.

## 5.2 Proposed Transmission Line Route

### 5.2.1 Transmission Segment 1 – Pequot Lakes Substation to Pine River Substation

The line will exit the Pequot Lakes Substation to the north and then will turn west and parallel existing MP 34.5 kV and GRE 69 kV lines for approximately 2300 feet. It will then turn northerly paralleling the MP 34.5 kV line for approximately 2200 feet to the intersection with an existing 230 kV line (identified as the 91 Line and owned by MP). It will then share right-of-way with the 91 Line to near the intersection with CSAH 1. At this point the line will proceed due north on the east side of CSAH 1 to the CWP Pine River Substation.

Total distance from the 91 Line's intersection with CSAH 1 to the Pine River Substation is about 2.8 miles.

Total distance of this line segment is about 9.2 miles (Figures 5-2 to 5-4).

Additional right-of-way will be required except for those segments adjacent to the 91 Line, where MP has a 215-foot easement that allows for the placement of a 115 kV line without the need for more right-of-way. Existing 91 Line easements will be reviewed and possibly amended.

### 5.2.2 Transmission Segment 2 – Pine River Substation to Badoura Substation

The proposed line would exit the Pine River Substation and head south as a double circuit with Segment 1 for approximately 0.5 miles. It will then turn west to the south side of CR 171 to its intersection with the 91 Line. This route will minimize the adverse reliability impacts associated with double circuit construction of two circuits serving the same purpose (see Section 7.1.1 Single Pole Steel Double Circuit).

The line would then be adjacent to the 91 Line on its east side and proceed north/northwesterly to its intersection with the DC line in Section 10 of Bull Moose Township (138 N-32 W) for a distance of 8.25 miles. The new line would then continue adjacent to the 91 Line from the DC line to its termination with the Badoura 115 kV Substation (approximately 8.5 miles) near TH 64.

Total distance of this line segment is about 20.2 miles (Figures 5-4 to 5-8).

Additional right-of-way would be required except for the 91 Line portion, where MP has a 215-foot easement that will accommodate the 115 kV line. Existing 91 Line easements will be reviewed and possibly amended.

Figure 5-1 Route Map Key

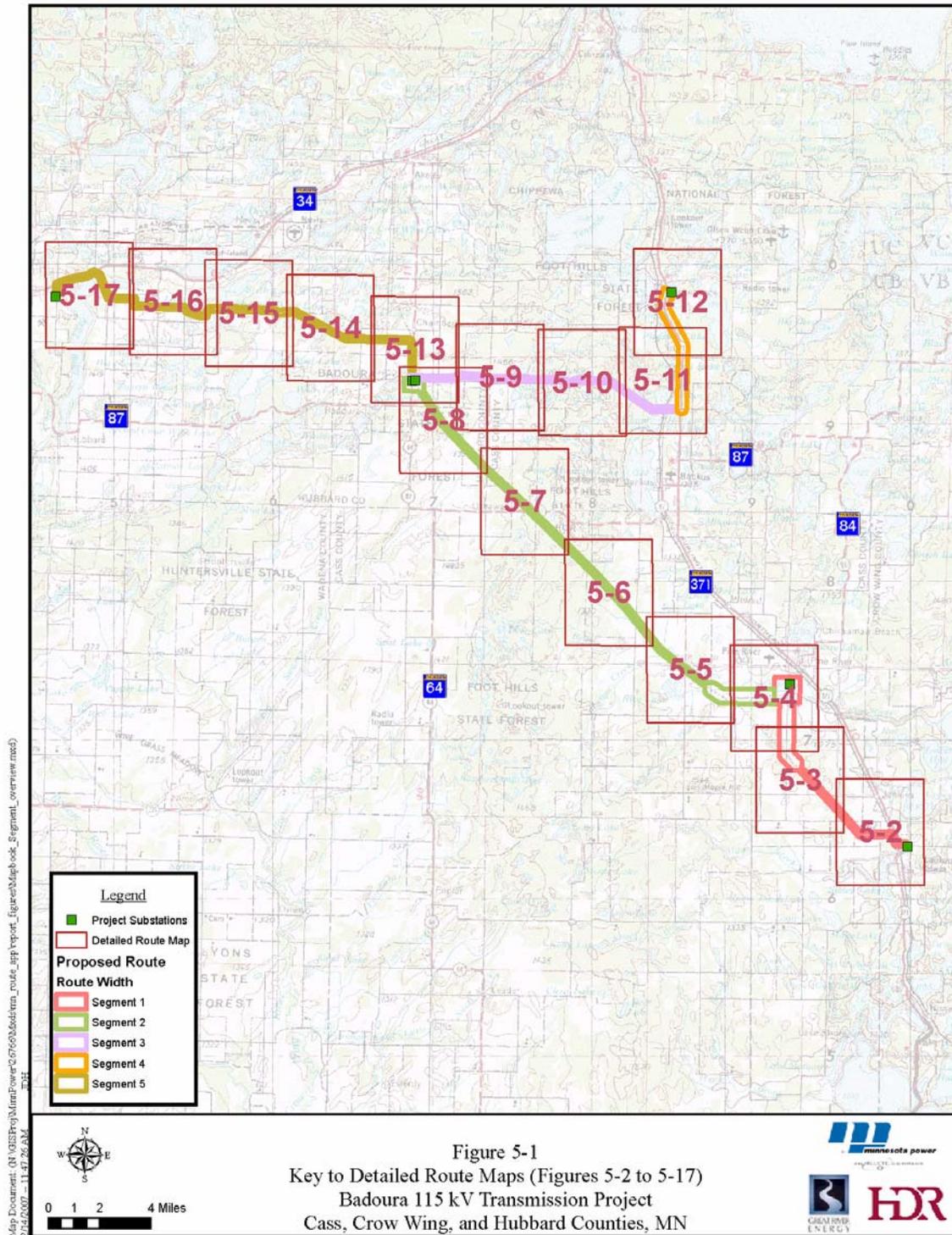
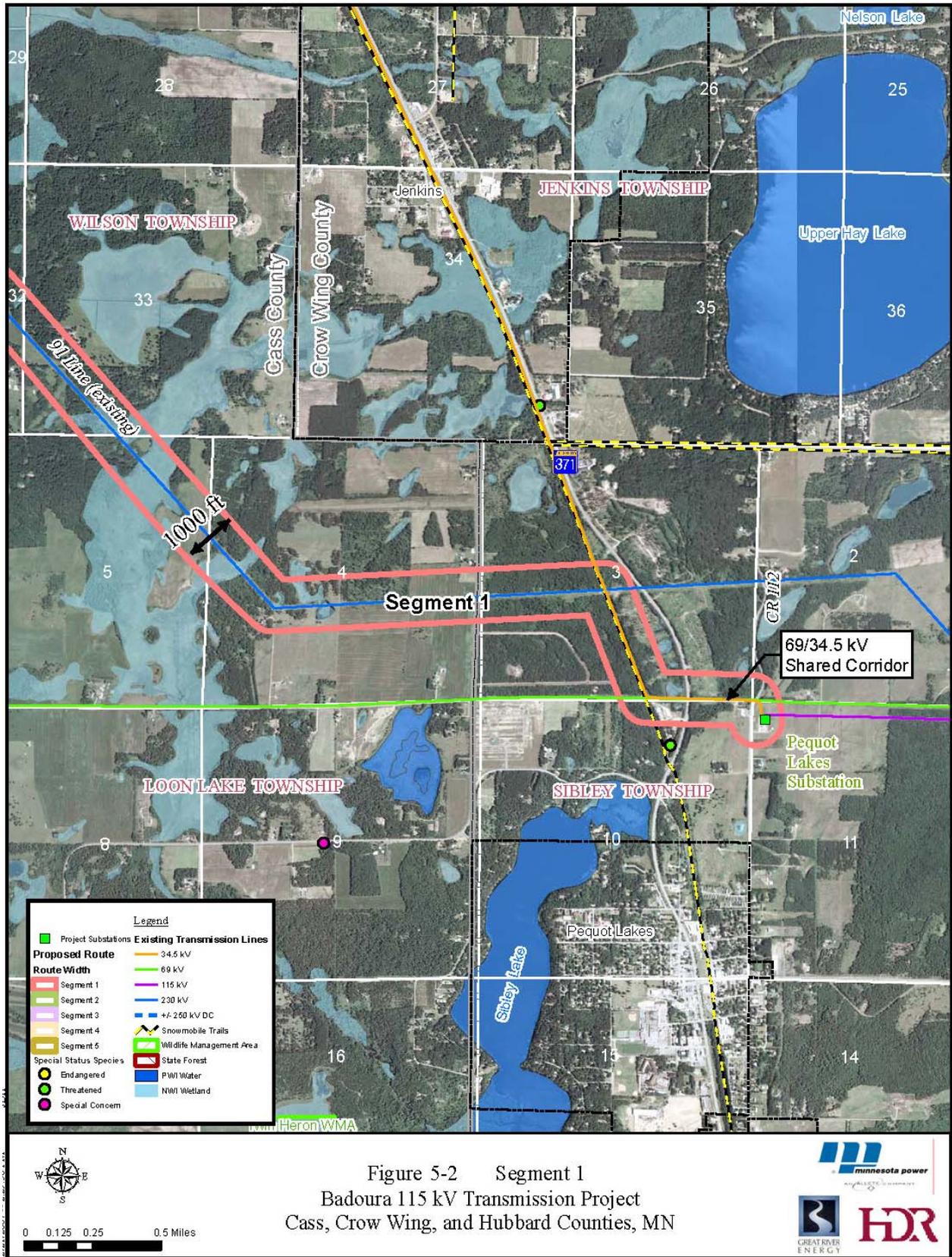
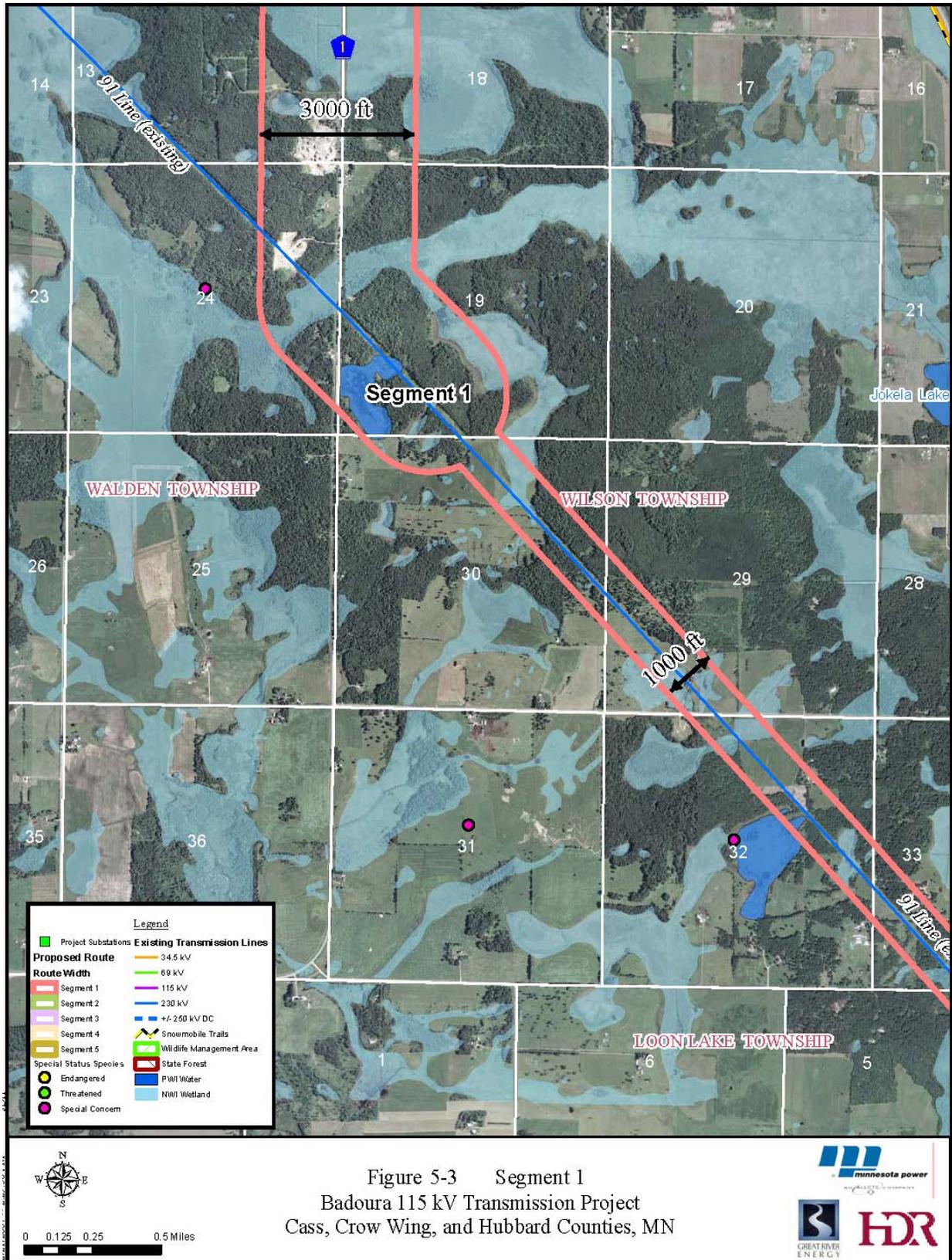
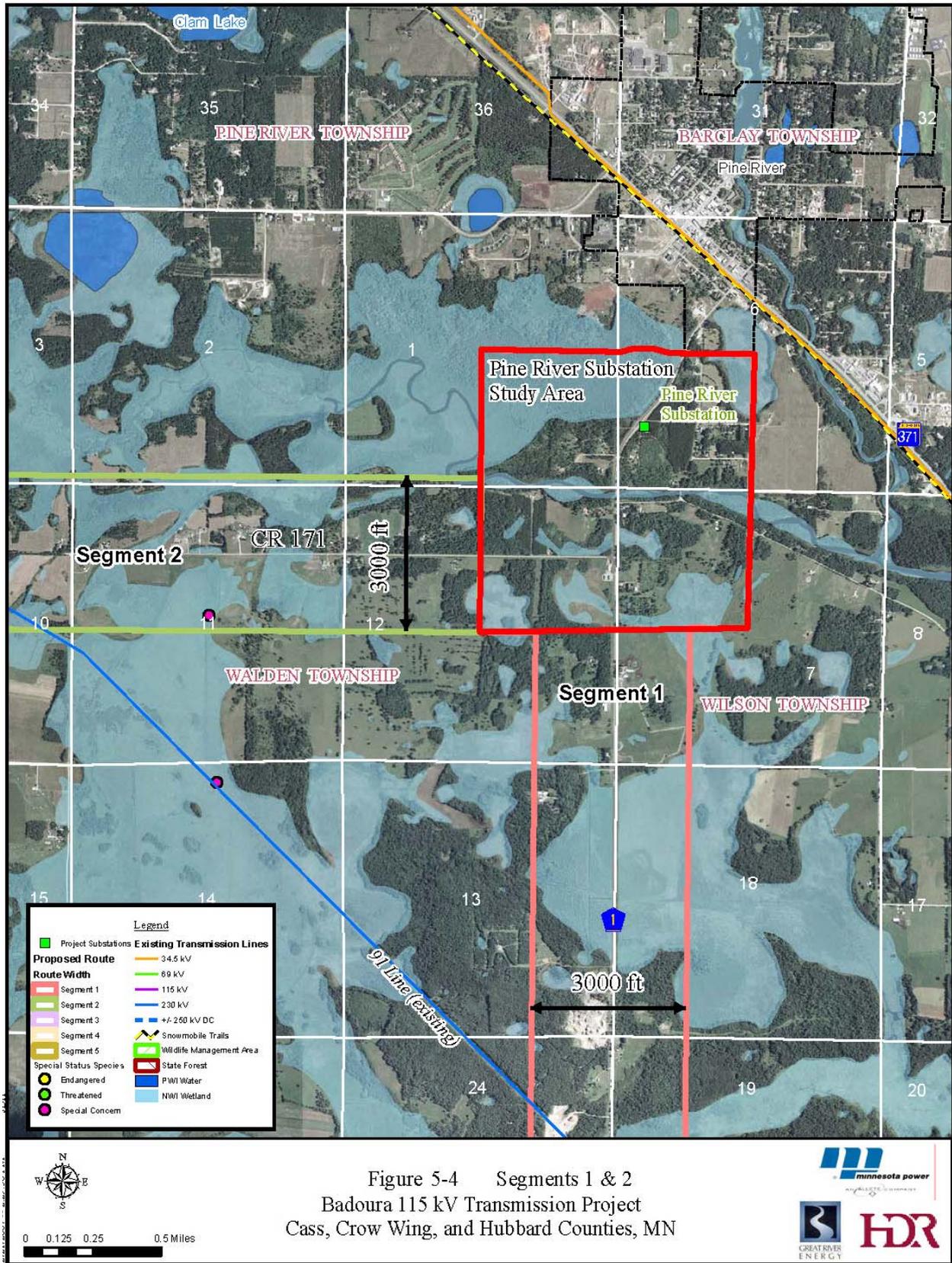


Figure 5-1  
Key to Detailed Route Maps (Figures 5-2 to 5-17)  
Badoura 115 kV Transmission Project  
Cass, Crow Wing, and Hubbard Counties, MN







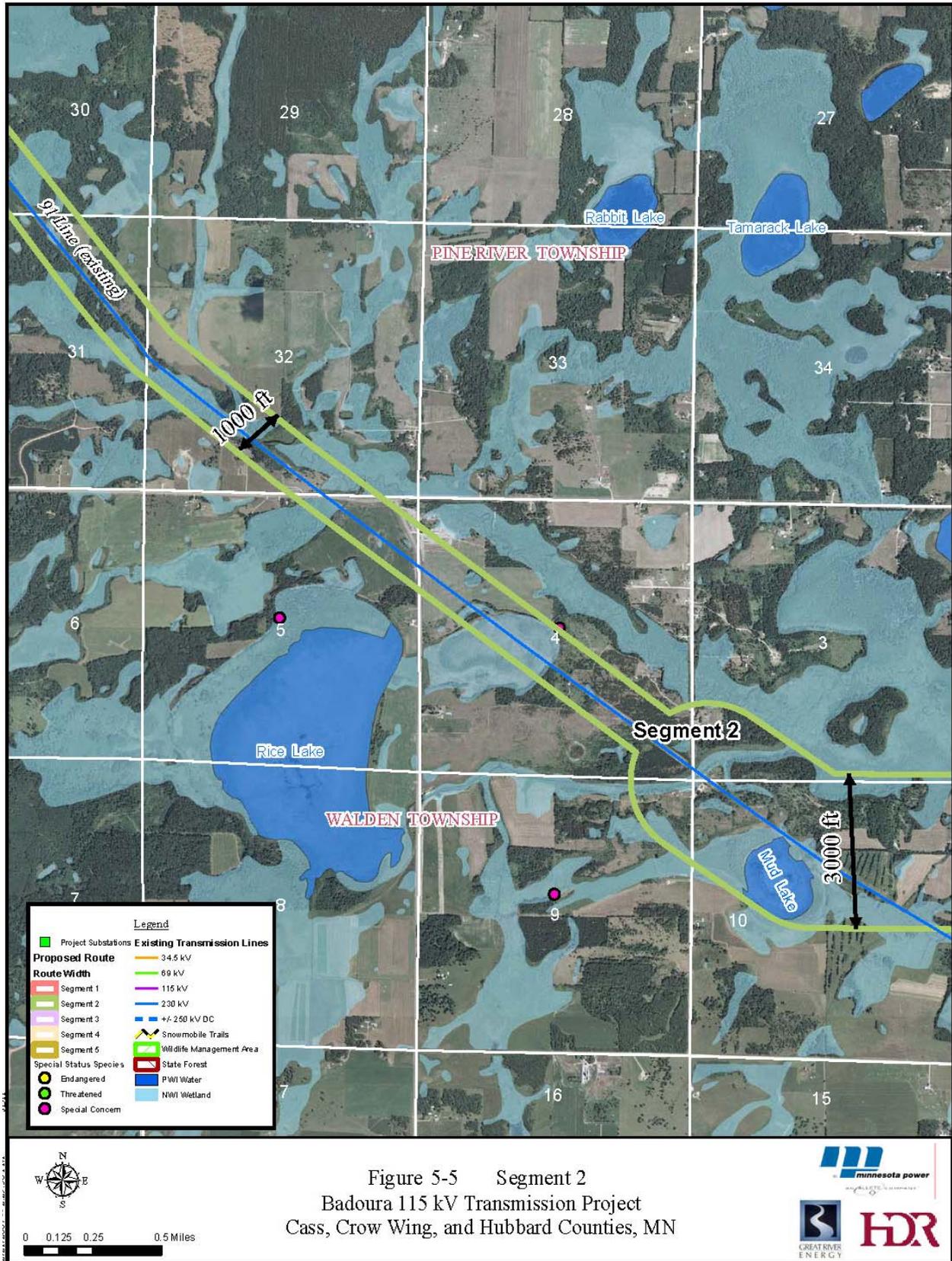
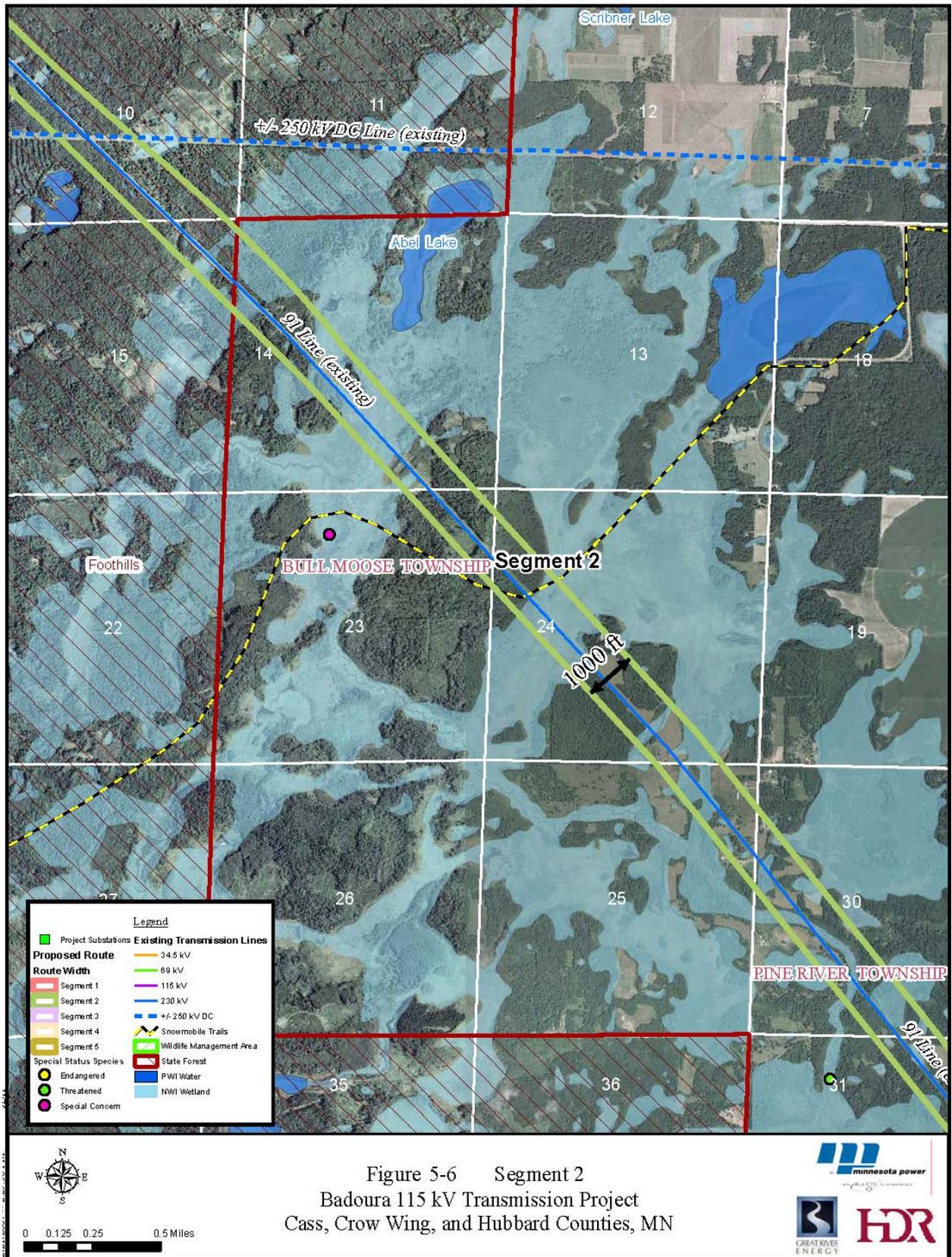
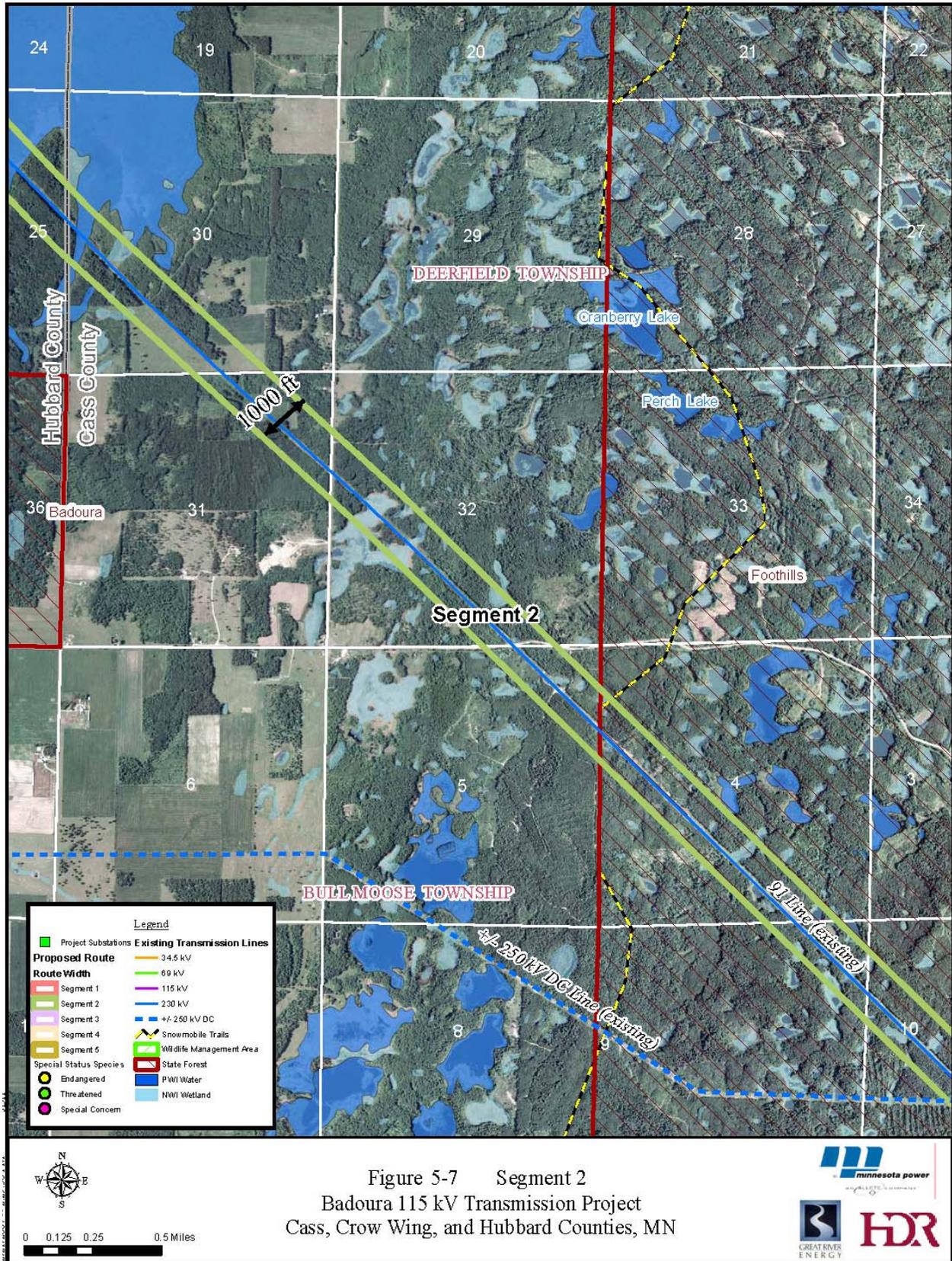
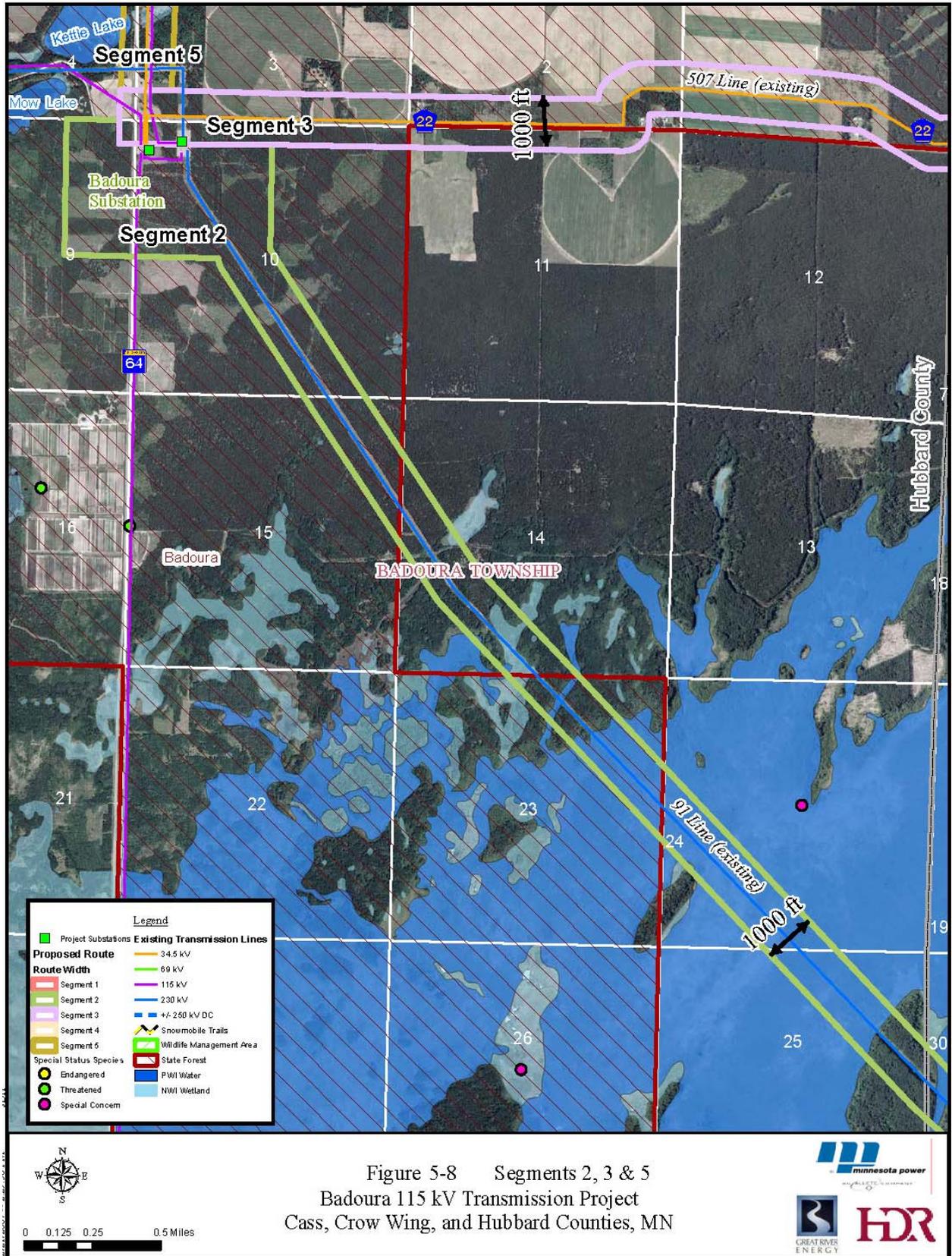


Figure 5-5 Segment 2  
 Badoura 115 kV Transmission Project  
 Cass, Crow Wing, and Hubbard Counties, MN









### 5.2.3 Transmission Segment 3 –Badoura Substation to TH 371 (507/516 Tie switch)

The new line will replace the 507 Line that starts at the Badoura 115 kV Substation east of TH 64 in Hubbard County and terminates at the 507/516 tie switch (Birch Lake Tap) east of TH 371 (two miles north of Backus). The 507 Line exits the Badoura 115 kV Substation and proceeds east along CSAH 22 for 3.75 miles, goes cross-country due east along the section line for four miles, turns southeasterly and proceeds diagonally (cross-country) for 1.5 miles, then turns east (cross-country) for one mile to TH 371.

Total distance of this line segment is about 11 miles (Figures 5-8 to 5-11).

New easements would have to be obtained. MP currently has centerline easements along this line segment.

### 5.2.4 Transmission Segment 4 – TH 371 (507/516 Tie switch) to Birch Lake Substation

The proposed line proceeds north from the Birch Lake 507/516 Tie switch paralleling TH 371 to a point south of Hackensack, where it turns northeast and goes cross-country to its termination with GRE's Birch Lake 69/34.5 kV Substation.

Total distance of this segment is approximately 5 miles (Figures 5-11 and 5-12).

New easements would have to be obtained. MP currently has relatively narrow (40-50 foot) easements for its 34.5 kV line (516 Line) along TH 371 in this segment.

### 5.2.5 Transmission Segment 5 – Badoura Substation to Long Lake Substation

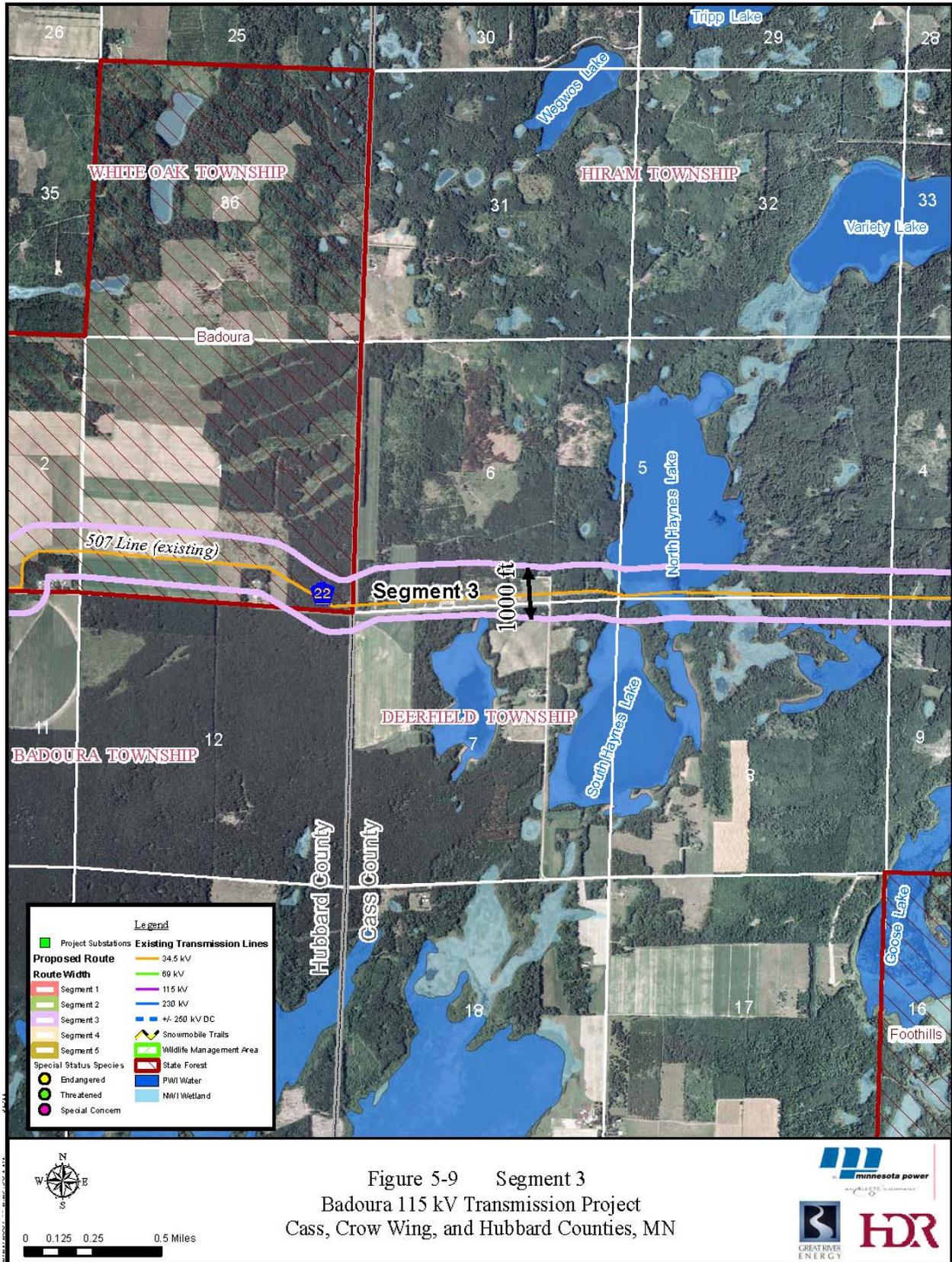
The new line will exit the Badoura 115 kV Substation and parallel TH 64 northerly for approximately 1.5 miles. It then crosses TH 64 and travels westerly cross-country for several miles before intersecting 174<sup>th</sup> Street. It parallels 174<sup>th</sup> Street on the north side until it turns southerly at Crown Point Road near Fifth Crow Wing Lake; here the line crosses the road and continues west cross-country for approximately three miles. The line then intersects with CSAH 11 and turns north paralleling CSAH 11 until it intersects 178<sup>th</sup> Street. The line turns west and parallels 178<sup>th</sup> Street on the north until it intersects CSAH 20 near Peysenske Lake, then follows CSAH 20 north until it intersects with TH 34. It then turns west and follows TH 34 around the north end of Long Lake until it intersects with 169<sup>th</sup> Avenue. The line turns south and follows 169<sup>th</sup> Avenue until it reaches the Long Lake Substation (just east of Park Rapids).

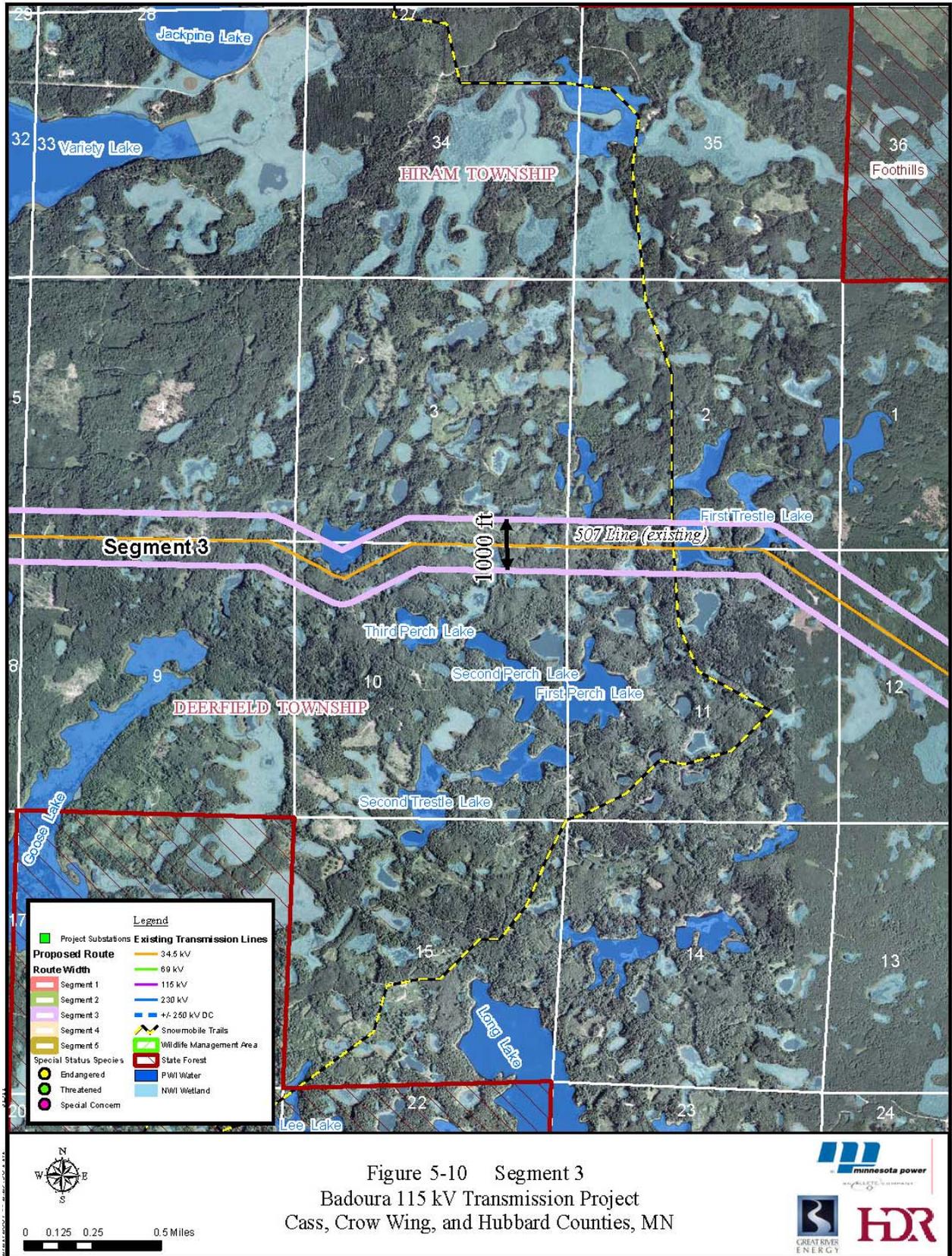
The new line in this segment will replace an existing MP 34.5 kV line except for an approximately two-mile section in the Park Rapids area (from the intersection of TH 34 and CSAH 20 to the Long Lake Substation).

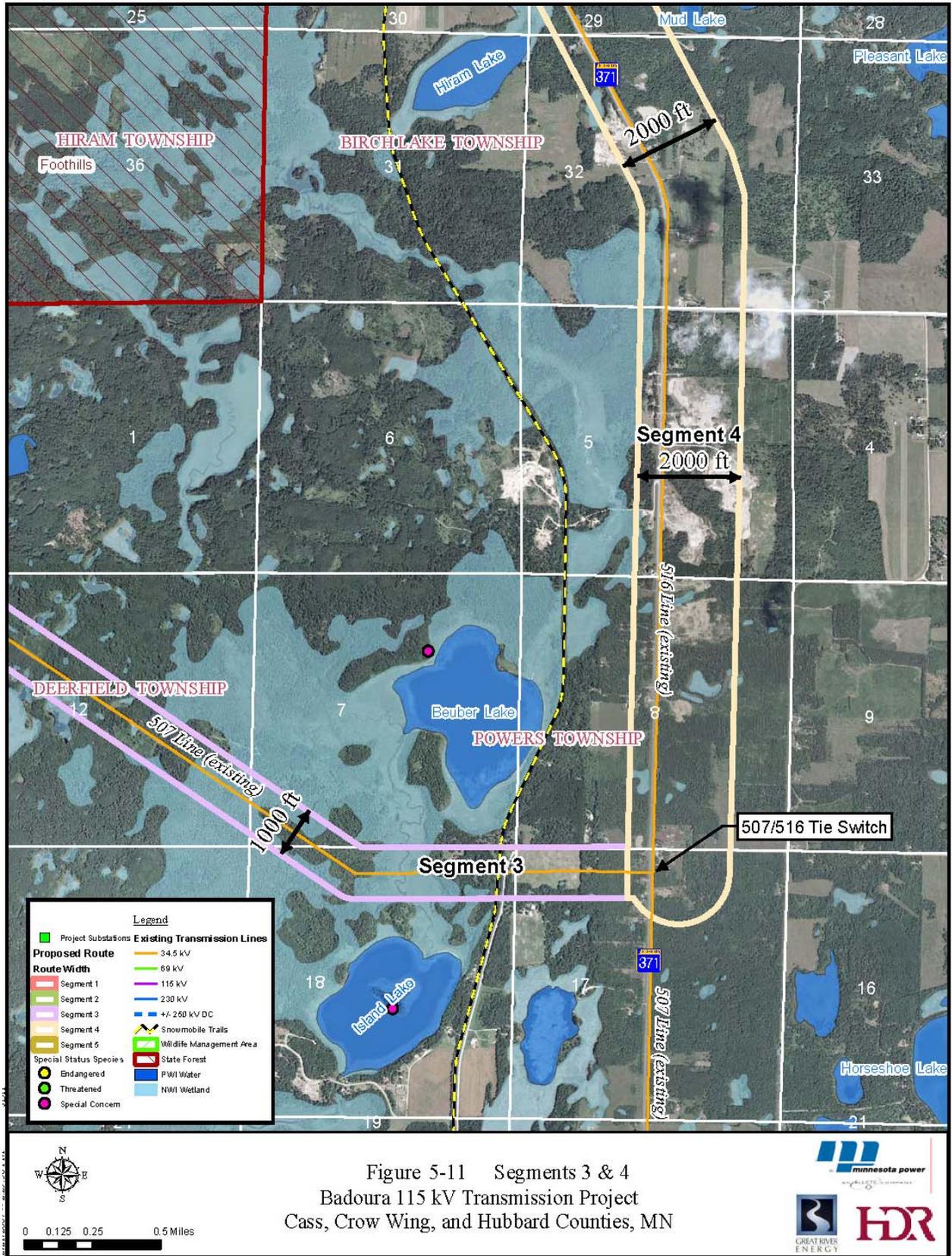
Total length of this line segment is 17.3 miles (Figures 5-13 to 5-17).

New easements would have to be obtained. MP currently has centerline easements along this line segment.

To alleviate the concern of landowners along CSAH 20, another option would be to cross the road to the west side of CSAH 20 near the lake and construct the line along the existing Itasca-Mantrap distribution line alignment. This route adjustment would reduce the amount of tree clearing and alleviate concerns about placing transmission poles in close proximity to Peysenske Lake. The existing distribution line could be underbuilt on the new structures and the existing MP 34.5 kV line on the east side of CSAH 20 (next to the lake) would be removed.







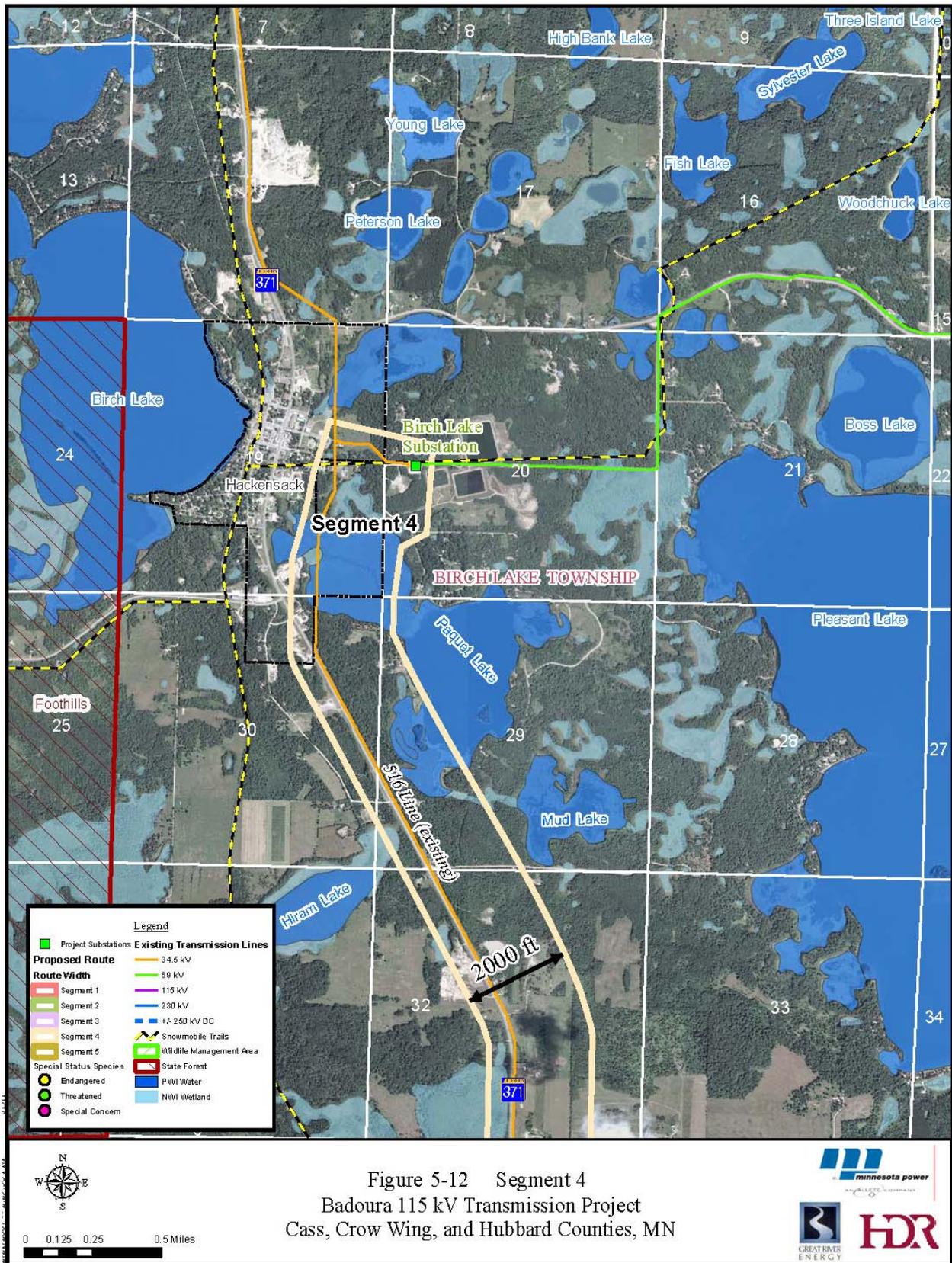
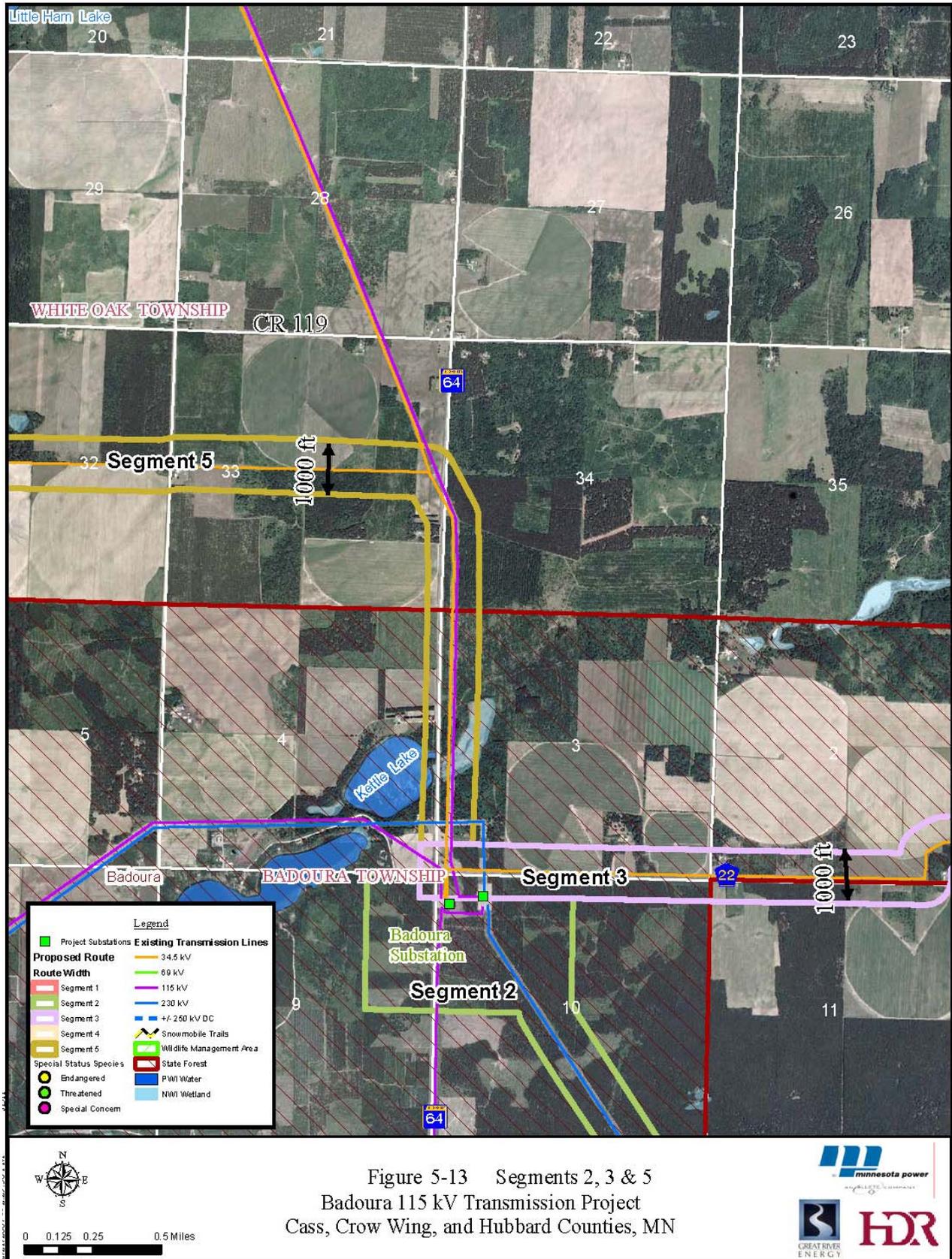
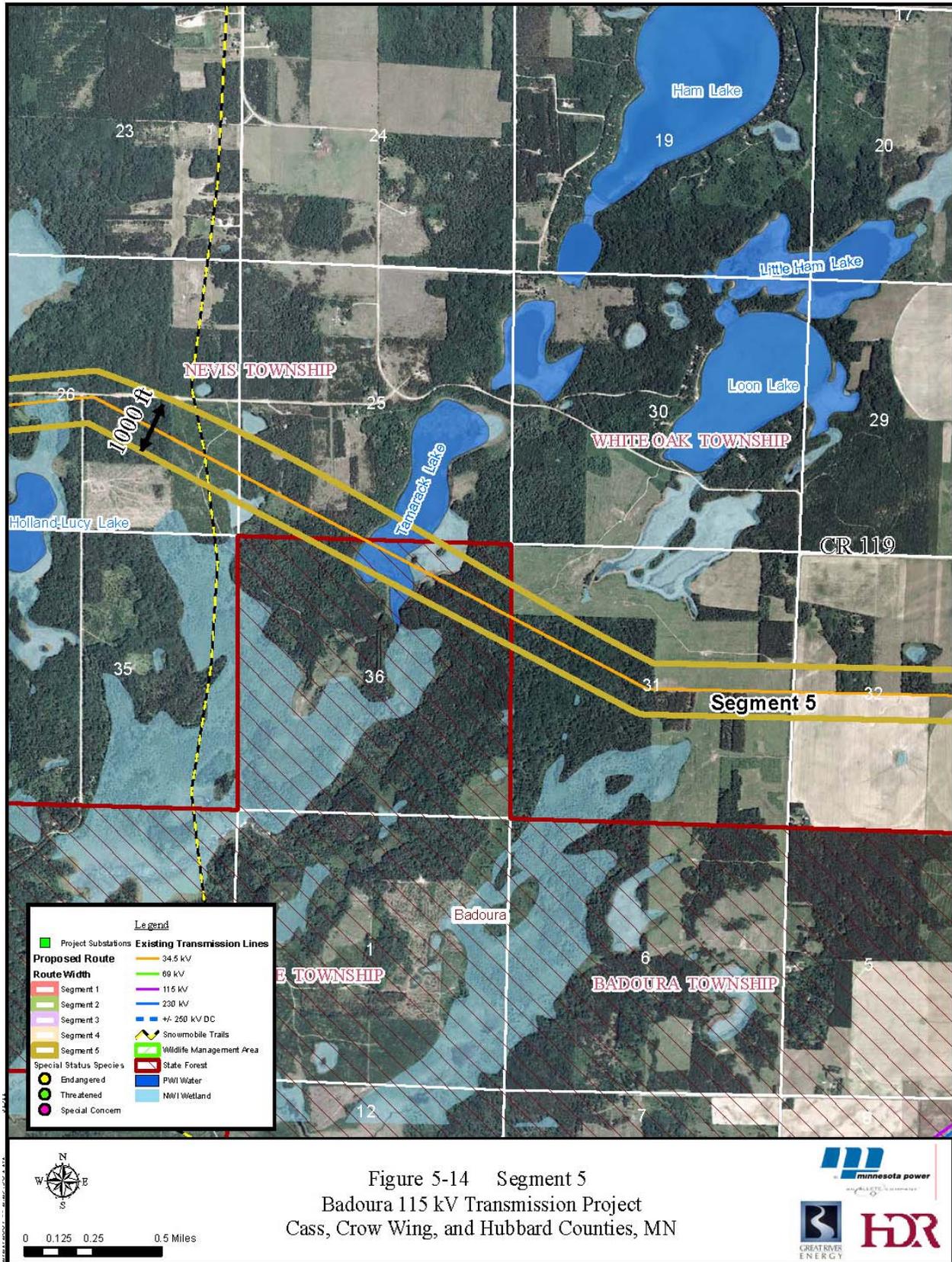
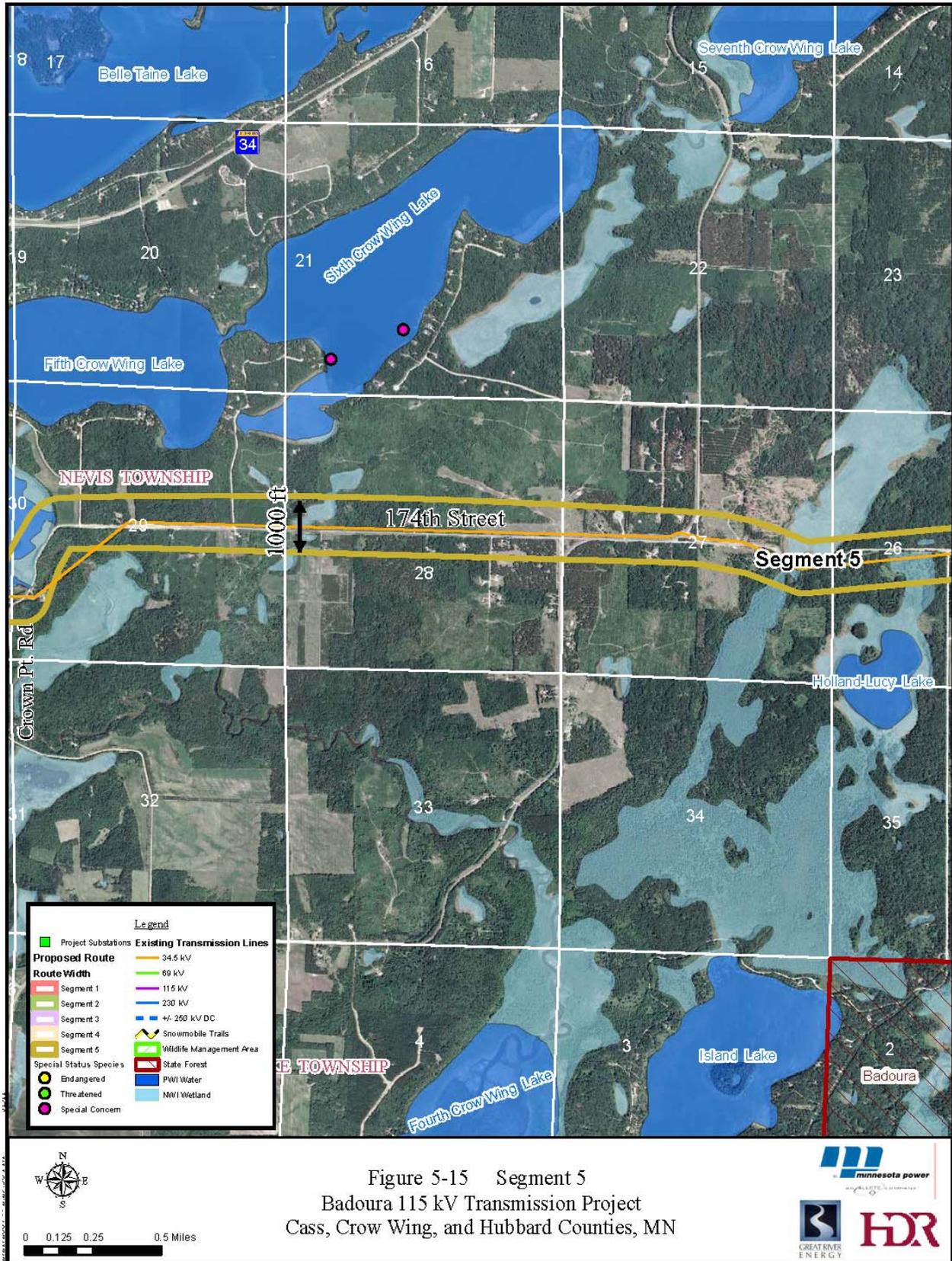


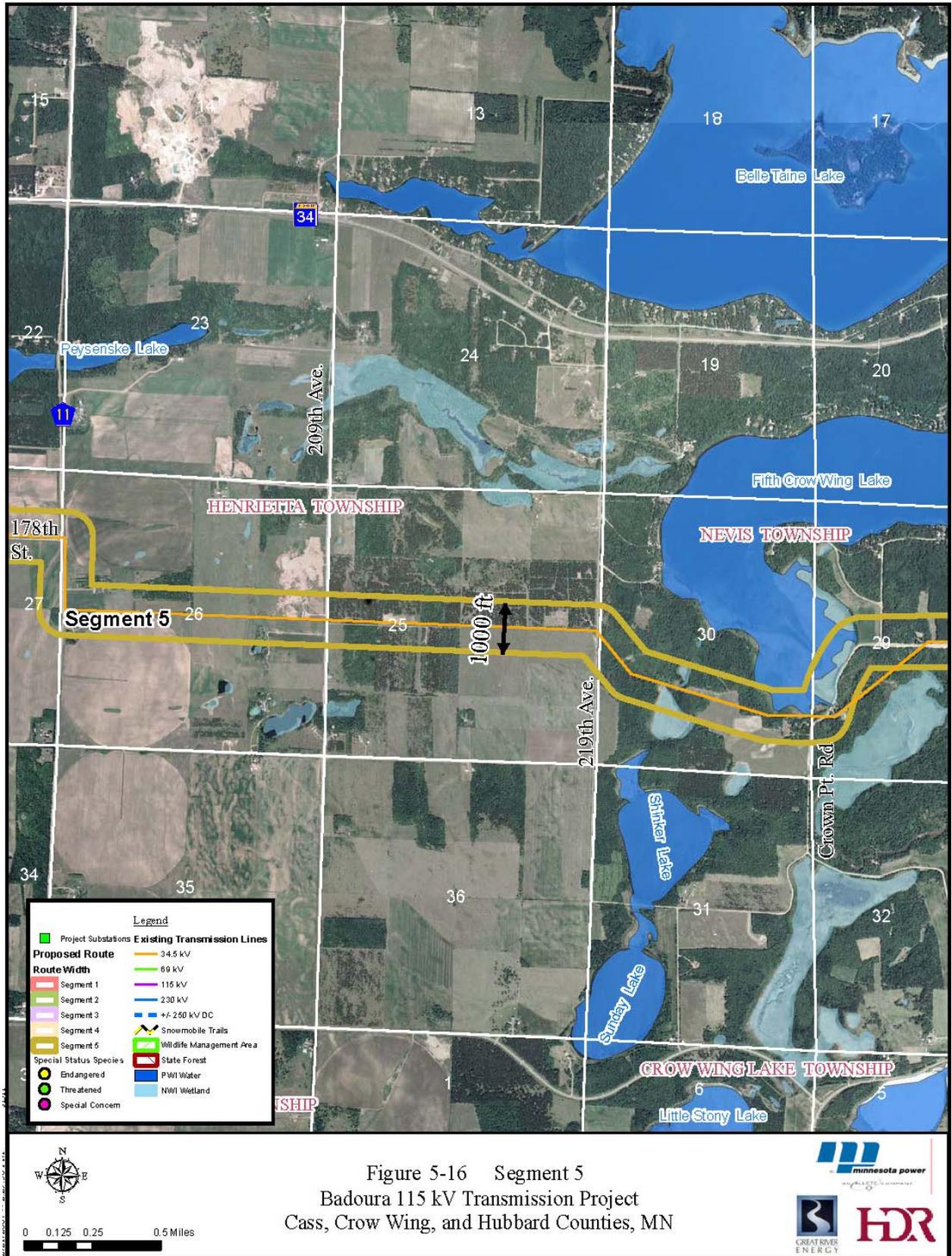
Figure 5-12 Segment 4  
 Badoura 115 kV Transmission Project  
 Cass, Crow Wing, and Hubbard Counties, MN

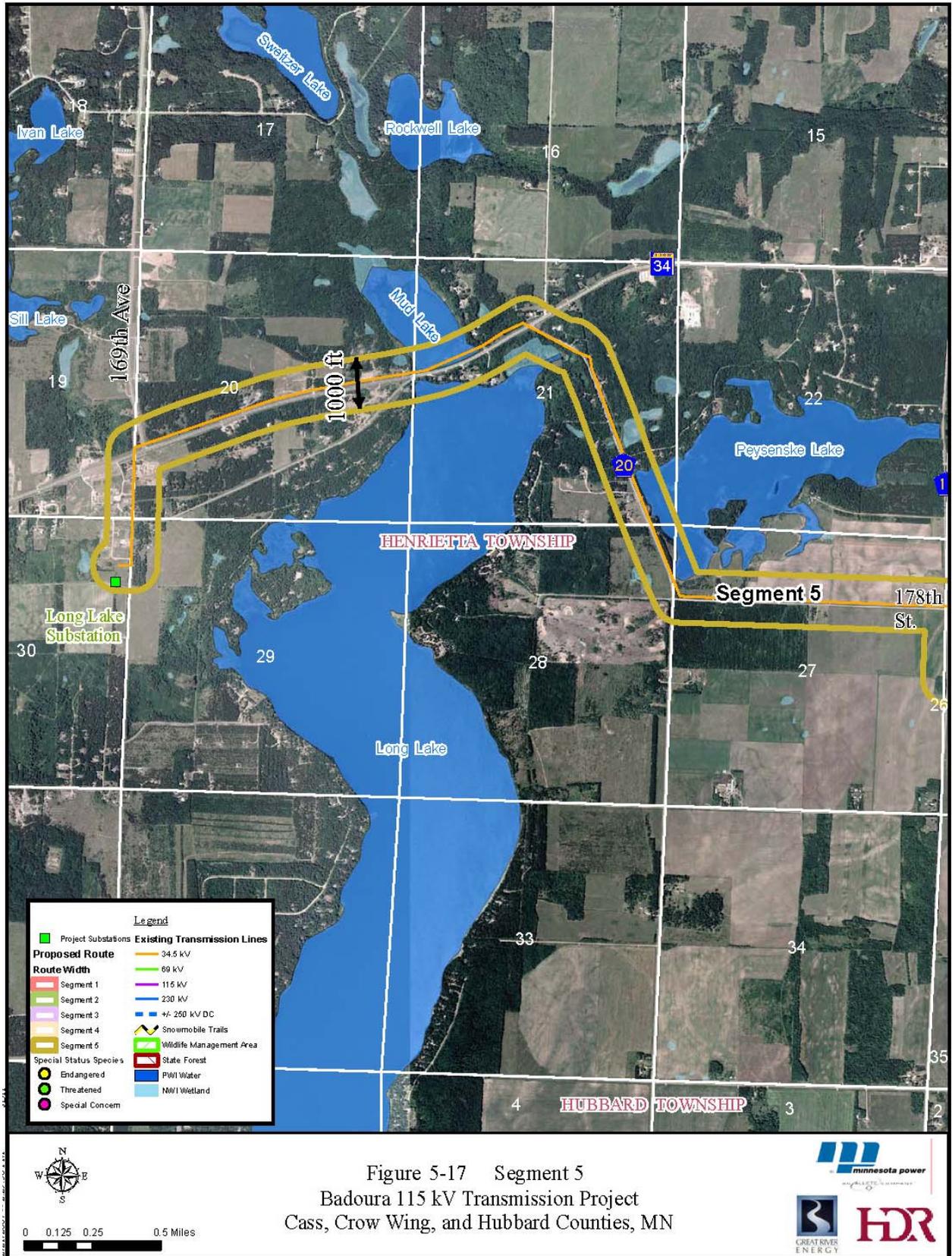












### 5.3 Substations

The new 115 kV transmission line would connect the Pequot Lakes Substation, located northeast of Pequot Lakes; the Pine River Substation, located southwest of Pine River; the Badoura Substation, located in Badoura Township, Hubbard County; the Birch Lake Substation located east of Hackensack; and the Long Lake Substation located east of Park Rapids. All these substations will be expanded as part of this Project. These expansions will include new 115 kV line exits at all the substations and transformer additions at Pine River, Birch Lake and Long Lake.

#### 5.3.1 Pine River Substation and Substation Siting Criteria

The existing CWP Pine River Substation is a small 34.5/12.5 kV distribution facility. As part of this Project, extensive 115 kV substation additions in the Pine River area will be required. If these additions are done at the existing Pine River Substation site, additional land will need to be purchased. The Applicants have been in contact with the owner of the land surrounding the existing Pine River Substation to determine if they would be willing to sell land for the substation expansion. Another option would be to relocate the Pine River 34.5 kV Substation facilities, and the Applicants have been in contact with nearby landowners concerning purchase of land for a new 115/34.5 kV Pine River Substation. The options currently under consideration for the Pine River Substation (expand at existing site or construct at new site) are shown on Figure 5-18.

#### Siting Criteria

The general substation siting criteria for the Pine River 115 kV Substation include:

- Locate near load-serving areas to minimize construction/length of 34.5 kV distribution lines and voltage drop between substation and loads. The sites under consideration are either located adjacent to the existing Pine River Distribution Substation or near the 34.5 kV lines that serve the area.
- Locate near existing high side (transmission) and low side (distribution) lines to reduce impacts associated with line construction. All sites being considered for the Pine River Substation are located adjacent to the proposed 115 kV transmission line corridors and adjacent to or near the 34.5 kV circuits. Expansion at the existing site would reduce construction necessary to connect the areas lower voltage system to the new 115 kV circuits. Construction at a new site near the existing distribution substation would reduce construction cost of the 115 kV lines because they would be slightly shorter; however, because there would be increased cost to connect the areas' lower voltage system to the new 115 kV circuits, overall Project costs would not be less.
- Avoid sensitive areas such as low areas, wetlands, waterways and wildlife areas. Locating facilities in these areas increases the likelihood of conflicts with environmental resources and poses problems both for construction and operation of a substation (i.e. poor soil conditions).The substation sites under consideration



DWN: .	APP: .
DATE: .	SCALE: .



**PINE RIVER SUBSTATION OPTIONS  
EXPAND AT EXISTING SITE OR  
CONSTRUCT AT NEW SITE**

REV. 0    DATE: .

**Figure 5-18**

FILE: .

. . .	. . .	. . .
-------	-------	-------

are not located in low areas, wetlands or wildlife areas, and are not adjacent to a waterway.

- Evaluate opportunities for screening the substation from points of view such as trails, roads and homes. The existing Pine River Substation site is located on CSAH 1. There is one home in close proximity (approximately 500 feet) that is screened from the site by existing vegetation that will not be removed. The Paul Bunyan Bike Trail is over 3,000 feet away from the existing Pine River Substation. The other possible substation sites are located on paved roads and homes are over 300 feet away, therefore they should not be impacted by the operation of the substation. Proper screening/landscaping will minimize the visual impacts from the roads and nearby homes.
- Locate near an access road(s) to minimize length of and make entrance to the substation convenient for security and outage purposes. The existing Pine River Substation is located on CSAH 1 and other sites under consideration are on paved roads.
- Locate away from residences. A primary impact associated with substations is noise. The existing Pine River Substation site is approximately 500 feet from the nearest residence. The alternative sites are over 300 feet from the nearest homes.
- Secure a suitably-sized parcel. A sufficiently-sized parcel to construct the substation, provide for future expansion (if necessary), provide for a buffer from residences, and allow access to a mobile substation should the need arise. Vacant land at site(s) under consideration is large enough to meet the Project's needs provided the landowners are willing to sell it. The Applicants have spoken with two landowners concerning purchase of land for the substation.
- Locate on marginally productive land to minimize impact to high-yield agricultural lands. The sites under consideration meet this requirement.

The new substation facilities in Pine River will include:

- Four 115 kV Circuit Breakers
- Two 34.5 kV Circuit Breakers
- One 115/34.5 kV, 33 megavolt ampere (MVA) (Top-Rated) Power Transformer
- One 115/12.5 kV, 10.5 MVA (Top-Rated) Power Transformer
- 34.5 kV and 115 kV Switches
- Control House
- Two or three 115 kV Dead End Structures (dependent on location)
- Bus work and fittings
- SCADA/Relay/Control Equipment

### Expansion at Existing Site

The Pine River Substation will employ a low-profile design and be situated within an approximately 8-acre parcel of land. An approximate 20 x 24-foot control house will be placed inside the fence near the terminus of the access road. The substation fence line would be approximately 260 x 240 feet. The access road will be aggregate surfaced with Class 5 material.

The proposed substation will use outdoor, 34.5 kV switchgear/circuit breakers and underground or aboveground 34.5 kV exits. The station will be designed to accommodate a future tie breaker position as well as a future 115/34.5 kV transformer. Initially, the proposed substation will include two 115 kV exits, 115 kV circuit breakers, disconnects, line protection, instrument transformers, outdoor switchgear, and two step down substation transformers (115 kV to 34.5 kV, and 115 kV to 12.5 kV). The 34.5 kV distribution lines will go southwest/south from the substation property to a connection with the MP 507 Line. The existing 34.5 kV feeder that serves the existing CWP Pine River Substation will be used as one of the ties to the 507 Line.

The CWP distribution network would be served by a new 115/12.5 kV, 10.5 MVA transformer and associated protection and controls. This transformer would replace CWP's existing 34.5 kV transformer and connect to the existing CWP Pine River 12.5 kV Substation distribution facilities.

At minimum, a 550 x 650 foot parcel of land would be needed to expand at the existing site. The expanded substation fence line dimensions would be approximately 260 x 240 feet. This size parcel is required to provide for routing of the two 115 kV circuits and two 34.5 kV circuits into the substation, an access road with turning radius large enough for movement of the transformers and other large equipment to the site, and to provide a buffer between the substation and adjacent property. The substation would be designed to provide space for connections to a mobile substation.

CWP will own the 115/12.5 kV transformer and 12.5 kV distribution. MP will own the 115 kV line exits, 115 kV bus, 34.5 kV bus, 34.5 kV line exits and associated 115 kV and 34.5 kV protection and controls. MP will either own the land its facilities are located on or have a permanent easement for its facilities to be located within the substation with CWP. MP will operate all the high voltage (115 kV) facilities. MP and CWP will own and operate their respective low voltage distribution facilities.

### Construction at New Site

If the Pine River 34.5 kV Substation is relocated, a low-profile design will be used and it would be situated on an approximately 8-acre parcel. The fenced area would be approximately 220 x 220 feet and an approximate 20 x 24-foot control house will be placed inside the fence near the terminus of the access road. The access road will be aggregate surfaced with Class 5 material. It will use outdoor, 34.5 kV switchgear/circuit breakers and underground or aboveground 34.5 kV exits. It will be designed to

accommodate a future tie breaker position as well as a future 115/34.5 kV transformer. MP would own all the facilities that are part of this substation.

Initially, the proposed substation will include at a minimum two 115 kV line exits, circuit breakers, disconnects, line protection, instrument transformers, outdoor switchgear, and a 115 kV to 34.5 kV step down substation transformer. The two 34.5 kV distribution lines will exit southwest/south from the substation property to interconnect with the existing MP 34.5 kV 507 Line.

The connections to CWP's 12.5 kV distribution system will likely consist of a short radial 115 kV line from the "new site" to the existing CWP Pine River Distribution Substation. The existing 34.5/12.5 kV transformer would be removed and replaced with a 115/12.5 kV 10 MVA transformer and associated protection. This would require either a third 115 kV line exit from the new substation or a short radial tap of the proposed 115 kV line. This would eliminate the need to move the existing 12.5 kV substation to the new site and no additional land would be required at the existing substation site; however, the fenced area would need to be expanded. GRE would acquire the easements for the radial 115 kV line in the same timeframe as acquiring the 115 kV lines into the new substation location. CWP would own all the substation facilities and GRE would own the radial line.

As shown in Figure 5-18, the potential new 115 kV substation site is located approximately 0.6 miles to the south of the existing Pine River Distribution Substation. There are additional sites being considered close to the site depicted in the figure and they would have the same substation layout.

#### Other alternatives for Pine River

A second alternative would be to abandon the existing CWP 12.5 kV Pine River Distribution Substation and construct new 12.5 kV distribution facilities at the new site if land cannot be obtained at the existing site. This would require construction of new 12.5 kV circuits and reconfiguration of the area's 12.5 kV distribution to connect it to the new substation. This alternative would be significantly more expensive; therefore it is not considered a reasonable alternative.

### 5.3.2 Substation Modifications

#### Pequot Lakes Substation

Upgrades to the Pequot Lakes Substation include a new 115 kV line exit and associated circuit breakers, protection and control facilities. The existing Pequot Lakes Substation is served by a radial 115 kV line from the MP Riverton Substation. Currently this line is protected by only one circuit breaker that is located at the Riverton Substation. With the addition of the Project's 115 kV line, the Pequot Lakes Substation will no longer be supplied radially. Because of this change, the protection on the existing 115 kV line from Riverton will be upgraded to enhance the reliability of the substation. The line protection improvements will include the addition of a 115 kV bus tie breaker, 115 kV line breakers

and associated control facilities. Although no additional land will be required, the fenced area will be increased by less than one acre.

#### Badoura Substation

Upgrades at the existing Badoura 115 kV Substation will include three new 115 kV line exits, associated bus work, circuit breakers and control facilities. In addition, existing line entrances will be reconfigured to improve area reliability and a 115 kV tie breaker will be added. Although no additional land will be required for the substation upgrades, the fenced area will be expanded by less than one acre. Although not part of this Project, the long-term plan is to remove all 34.5 kV facilities from the Badoura Substation.

#### Birch Lake Substation

Additions at the Birch Lake Substation include one 115 kV line exit, one 115/69 kV 60 MVA transformer and associated circuit breakers, protection and controls. A new 115 kV bus structure will be built to accommodate the new 115 kV line. The existing substation includes a 69 kV structure that is currently operated at 34.5 kV, which will be energized at 69 kV as part of the modifications needed to support the Project. This will require relocating the existing Birch Lake 69/34.5 kV transformer to another location within the substation. This transformer relocation will require that the existing 34.5 kV system be modified with the existing circuit breakers being potentially replaced with pad-mounted (ground level) breakers. Lastly, an existing capacitor that will no longer be needed after the Project is completed will be removed to free up space within the substation. The upgrade will not require additional land; however, the existing fenced area may be slightly expanded (by less than one acre) to provide room for the new 115 kV structure and transformer. Minimal site grading may occur due to variations in grade on the property.

#### Long Lake Substation

Additions at the Long Lake Substation include a 115 line exit and 115/34.5 kV 50 MVA transformer and associated protection and controls. When GRE constructed the Long Lake Substation, it was designed to accommodate a second 115 kV line exit and transformer. No additional land will be required and the fenced area may be minimally expanded.

The Itasca-Mantrap Park Rapids Distribution Substation (located approximately 0.25 miles to the north of the Long Lake Substation) will also be relocated to the Long Lake Substation. If the existing Badoura-Long Lake 34.5 kV line right-of-way is used for the proposed 115 kV transmission line, it would be impossible to serve the existing Park Rapids Substation from Akeley during a contingency. Moving the distribution substation into the Long Lake Substation eliminates this concern.

#### 5.4 Design Options to Accommodate Future Expansion

The 115 kV line proposed for this Project is being designed to upgrade the area's electric transmission and substation system to allow both utilities to maintain necessary voltage and reliability requirements in the Badoura project area. The proposed transmission line will provide the capacity required for serving the project area through 2025.

Design of the Badoura Project did consider impacts to future regional transmission system needs. For example, GRE's long-range plans include a 115 kV connection between the Birch Lake Substation and GRE's Hill City Substation with a future 230/115 kV substation located in the Hill City vicinity. To accommodate this future connection, higher capacity conductors (795 aluminum conductor steel supported (ACSS) rated at 316 MVA) will be used on the Birch Lake to Badoura 115 kV line. In addition, the route selected for the Project did consider the anticipated need for additional 115 kV distribution substation developments to serve the area's growing loads. For instance, the Applicants anticipate there will be a need for increased capacity between Akeley and Dorset in the future. The Proposed Route is located just to the south of this area and a short 115 kV radial tap line from the proposed 115 kV line could provide a new source to the area.

The planned substation upgrades are required to accommodate the proposed 115 kV line. The need for future substation capacity expansion to serve future development in the project area was fully considered in substation designs. For example, at some point in the future it is anticipated that the Birch Lake Substation will be a terminus for a 115 kV line to serve the growing electric load in the Walker area. The modifications at the Birch Lake Substation to support the Badoura Project will reflect this future need in the Walker area. In addition, the Pine River Substation was laid out to accommodate a second transformer when and if it is needed to maintain reliable electric service in the area.