

**INFORMATION RESPONSES
LOWER CHURCHILL PROJECT
CEAA REFERENCE NO.07-05-26178**

JOINT REVIEW PANEL

Volume 1-B
IR Numbers JRP.14 to JRP.18

July 3, 2009

INDEX

Volume 1-B IR Numbers JRP.14 to JRP.18

IR Number: JRP.14 (Landscape and Aesthetics)

Attachment A: Photo Study

Attachment B: Interconnecting Transmission Line Viewshed Analysis Map Atlas

IR Number: JRP.15 (Composite Mapping (Terrestrial Environment))

Attachment A: Primary Habitat for Individual Terrestrial Key Indicators for Churchill River Valley
Composite Mapping of Primary Habitat for Terrestrial Key Indicators for
Churchill River Valley
Primary Habitat for Individual Terrestrial Key Indicators for Interconnecting
Transmission Line
Composite Mapping of Primary Habitat for Terrestrial Key Indicators for
Interconnecting Transmission Line

IR Number: JRP.16 (Composite Mapping (Land and Resource Use))

Attachment A: Composite Land and Resource Use Maps

IR Number: JRP.17 (Summary Table of Environmental Effects)

IR Number: JRP.18 (Table of Concordance (EIS Guidelines and EIS))

Information Request Number: JRP.14
Landscape and Aesthetics

Requesting Organization – Joint Review Panel

Information Request No.: JRP.14

Subject - Landscape and Aesthetics

References:

EIS Guidelines, Section 4.4.4.4 (Description of the Existing Environment - Land and Resource Use)

Rationale:

The EIS Guidelines require the Proponent to describe the landscape, including the “aesthetic quality” of the Study Area (p. 28). The Proponent should also describe the effects of the entire Project on landscape and aesthetic quality.

Requesting Organization – Joint Review Panel**Information Request No.: JRP.14****Information Request:**

- a. In order for the Panel to assess the landscape and aesthetic quality of the Study Area, the Proponent is asked to submit a photo study of the Churchill River showing typical landscape features and stretches of the river that are representative of each type of habitat inventoried for the purpose of the environmental assessment.

Response:

A Photo Study of the Churchill River is attached (Attachment A) showing the following typical landscape features and stretches of the river:

- Churchill Falls Tailrace;
- Metchin River;
- Churchill River Ox-bow and Wolf Island;
- Cache River;
- Minipi River;
- Horseshoe Rapids;
- Gull Island;
- Lower Brook;
- Muskrat Falls; and
- Lower Churchill River at Happy Valley-Goose Bay.

Stretches of habitat inventoried for the purpose of environmental assessment, and included in the attached Photo Study, are:

- Riparian Habitats:
 - Riparian Thicket Ecotype
 - Riparian Meadow Ecotype
- Wetland Habitats:
 - Fen Ecotype
 - Low Shrub Bog Ecotype
 - Marsh Ecotype
- Dry Black Spruce/Lichen Habitats:
 - Black Spruce/Lichen Woodland Ecotype
 - Black Spruce on Outcropping Ecotype
- Wet Black Spruce/Moss Habitats:
 - Black Spruce/Sphagnum Forest Ecotype
 - Black Spruce/Feathermoss Ecotype

- White Spruce/Mixedwood Habitat:
 - Fir-White Spruce Woodland Ecotype
 - Spruce-Fir/Feathermoss Forest Ecotype
 - Mixedwood Forest Ecotype
- Hardwood Habitat
- Anthropogenic/Disturbed Habitat
- Gravel Bar Habitat
- Unvegetated Habitat
- Aquatic Habitat:
 - Fast Velocity Habitat
 - Profundal Habitat (Lake Winokapau)
 - Slow Velocity Habitat
 - Intermediate Habitat
 - Littoral Habitat

A locational map for each photo is provided at the end of the Photo Study for ease of reference.

Requesting Organization – Joint Review Panel

Information Request No.: JRP.14

Information Request:

- b. The Proponent is asked to describe the existing landscape and aesthetic quality of the proposed transmission line corridor between Muskrat Falls, Gull Island and Churchill Falls and to assess the effects of the proposed transmission lines the landscape and aesthetic quality.

Response:

The proposed transmission line corridor will extend from Churchill Falls in the west to Gull Island, and from Gull Island to Muskrat Falls in the east. It will be approximately 263 km long, and is adjacent to the existing TL240 transmission line corridor for 245 km. Both corridors roughly parallel the Trans Labrador Highway (TLH) – Phase 1. The existing corridor is 30 m wide with 24 m high wooden structures. The proposed corridor from Muskrat Falls to Gull Island (230 kV) will be 60 m wide, with 40 m high, double-circuit (two lines on one tower) lattice steel-type tower structures having a span of 380 m between towers. The proposed corridor from Gull Island to Churchill Falls (735 kV) will be 80 m wide, with 50 m high lattice steel-type towers having a span of 500 m between towers. Approximately 240 km of its length will be visible from the TLH. The primary ecotypes through which it will be located are Black Spruce-Lichen Woodland, Black Spruce-Feather Moss, Black Spruce on Outcropping, Wetland (Fen, Marsh, Low Shrub Bog) and Mixedwood Forest.

A viewshed analysis, illustrating areas of low (green) and high (red) visibility of the transmission line from the TLH, and computer-simulated viewscape models for six views of the proposed transmission line are provided in Attachment B. Examples of low and high degree of visibility are shown in Figures 1 and 2 respectively.



Figure 1 Example of Low Degree of Visibility (Shaded Green on Viewshed Maps in Attachment B)



Figure 2 Example of High Degree of Visibility (Shaded Red on Viewshed Maps in Attachment B)

The viewshed analysis maps presented in Attachment B were created using industry-standard methodologies and software (ESRI ArcGIS) to assess the visual impact of the interconnecting transmission line by identifying the locations where structure towers and/or transmission lines will be visible within the landscape. The output of the analysis is a raster grid in which the value assigned to each raster cell represents the number of times the proposed transmission line can be seen from that location. For example, cells that are in line of sight of a large proportion of the transmission line are shaded red and conversely, those cells coded green only have a small proportion of the transmission line visible. Viewshed maps were created using data and information specific to the Project. Information on the Project's transmission line structures and the line itself, data from the digital elevation model developed for the Project (topography), and information from the Ecological Land Classification (land cover with vegetation heights) were used to produce the viewshed analysis maps.

ATTACHMENT A

Photo Study

**INFORMATION RESPONSES
LOWER CHURCHILL PROJECT
CEAA REFERENCE NO.07-05-26178**

JOINT REVIEW PANEL

JRP.14

Landscape and Aesthetics

June 29, 2009

RESPONSE TO IR #14a – Photo Study

Note - Location of photos are shown on the map at the end of the Photo Study.

LANDSCAPE FEATURES ALONG THE LOWER CHURCHILL RIVER**Churchill Falls Tailrace**

Location: 63° 59.122'W, 53° 31.038'N

Mouth of Metchin River, showing delta

Location: 63° 22.125'W, 53° 18.656'N

RESPONSE TO IR #14a – Photo Study

Churchill River Ox-bow at Wolf Island (right)



Location: 63° 15.637'W, 53° 13.225'N

RESPONSE TO IR #14a – Photo Study

Mouth of Cache River, showing gravel bar



Location: 62° 13.016'W, 53° 4.611'N

RESPONSE TO IR #14a – Photo Study

Mouth of Minipi River



Location: 61° 37.3236'W, 52° 51.473'N

RESPONSE TO IR #14a – Photo Study

Horseshoe Rapids



Location: 61° 34.066'W, 53° 0.212'N

RESPONSE TO IR #14a – Photo Study

Gull Island



Location: 61° 22.457'W, 52° 57.865'N

RESPONSE TO IR #14a – Photo Study

Mouth of Lower Brook



Location: 60° 51.615'W, 53° 14.433'N

RESPONSE TO IR #14a – Photo Study

Muskrat Falls



Location: 60° 45.854'W, 53° 14.537'N

Happy Valley-Goose Bay and the lower Churchill River



RESPONSE TO IR #14a – Photo Study

PHOTOGRAPHS OF INVENTORIED HABITATS

Note – the locations of each habitat type and ecotype (habitat) in the lower Churchill River valley can be found in Appendix C of the Project Area Ecological Land Classification (ELC) component study.

Riparian Habitats:

Location: 60° 51.400'W, 53° 14.402'N



Location: 60° 37.515'W, 53° 14.935'N

Riparian Thicket Ecotype – found along the shores of large rivers in areas where sediments have been deposited at the confluence of the river and its tributaries, at bends in the river and on islands in the river. Tree cover is sparse and the vegetation is characterized by a dense, tall shrub thicket composed of speckled alder, willow, sweet bayberry, silky dogwood and red raspberry. It is usually found in drier areas than Riparian Meadow Ecotype.



Location: 60° 56.719'W, 53° 10.134'N



Location: 63° 20.724'W, 53° 18.581'N

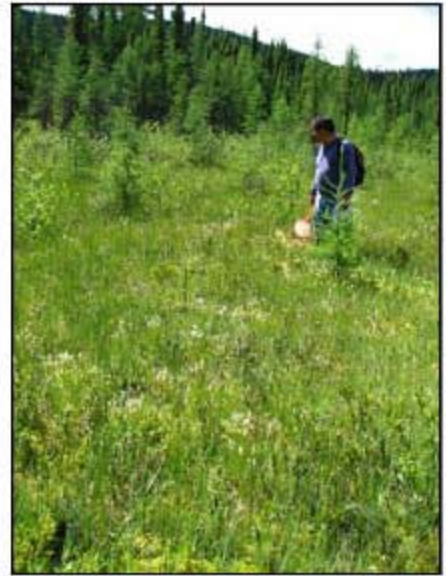
Riparian Meadow Ecotype – found mainly along the shores of large rivers with relatively large flood plains, similar to the Riparian Thicket Ecotype. Riparian Meadow has no tree cover. Vegetation consists of meadow species (blue-joint reedgrass, tall meadow-rue and dwarf red raspberry) interspersed with patches of shrubs.

RESPONSE TO IR #14a – Photo Study

Wetland Habitats:

Location: 60° 51.372'W, 53° 14.879'N

Fen Ecotype – located on organic substrates with poor to very poor drainage. Fens in the Lower Churchill River valley typically support a mixture of sphagnum mosses, sedges and grasses. The rooting zone of the fen is exposed to mineral rich groundwater which results in greater productivity than in bogs.



Location: 60° 51.327'W, 53° 14.879'N

Low Shrub Bog Ecotype – located on peat substrates with poor to very poor drainage. Bog is the most common type of wetland in the Lower Churchill River valley, and consists mainly of sphagnum moss and few-seeded sedge, and has sparse tree cover. A number of young bogs can be found near the mouth of the Churchill River, where old ox bows have filled in with peat.



Location: 61° 15.861'W, 53° 0.684'N

RESPONSE TO IR #14a – Photo Study



Location: 60° 55.807'W, 53° 10.438'N



Location: 61° 8.089'W, 53° 4.406'N

Marsh Ecotype – typically located near the mouth of the Churchill River, where the river cuts through marine sediments, along the shores of ox bow lakes, and at the confluences of the Churchill River and it's tributaries where substrates consist of mineral soil with little organic content. These areas are subject to seasonal flooding which discourages the growth of woody plants. Vegetation consists mainly of bulrushes, rushes, sedges and grasses with no tree cover. Vicinity

Dry Black Spruce/Lichen Habitat:

Location: 60° 51.372'W, 53° 14.879'N



Location: 60° 46.445'W, 53° 15.675'N

Black Spruce/Lichen Woodland Ecotype – widespread and abundant in the Lower Churchill River valley, encountered most frequently in upland areas. Characterized by patches of black spruce embedded in a carpet of *Cladonia* lichens. Substrates are typically deep with moderate drainage.

RESPONSE TO IR #14a – Photo Study



Location: 63° 58.300'W, 53° 29.550'N

Black Spruce on Outcropping Ecotype – located on the crests of hills and ridges where exposed bedrock is present, typically in upland areas. These sites are infertile, very dry and exposed to desiccating winds which also remove protective snow cover during winter. Tree cover consists of small patches of black spruce growing in sheltered microsites with ground vegetation largely composed of lichens.

Wet Black Spruce/Moss Habitat:



Location: 62° 30.129'W, 53° 14.680'N

Black Spruce/Sphagnum Forest Ecotype – an abundant ecotype in the Lower Churchill River valley, it is widely distributed in both upland and valley location. It is a transitional ecotype between coniferous forests and bogs or fens, often found around the margins of wetlands where drainage is poor. Tree cover consists of an open canopy of stunted black spruce with an understory of sphagnum moss punctuated by sedges, forbs and other mosses.

RESPONSE TO IR #14a – Photo Study



Location: 62° 21.704'W, 53° 5.801'N



Location: 62° 7.305'W, 52° 54.201'N

Black Spruce/Feathermoss Forest Ecotype – an abundant ecotype, found in both the Churchill River valley and the surrounding upland areas. These areas are generally nutrient-poor and well-drained, characterized by a moderately dense tree canopy of black spruce, moderately dense shrub layer, with a ground vegetation layer of red-stemmed feathermoss.

White Spruce/Mixedwood Habitat:

Location: 61° 16.891'W, 52° 59.126'N

Fir-White Spruce Woodland Ecotype – mainly restricted to the Churchill River valley and the valleys of its larger tributaries on level sites or on lower slopes with well-drained silty clay or sand substrates. The tree canopy is dense and consists of balsam fir, white spruce and heart-leaved paper birch. Ground cover consists of large patches of moss interspersed with patches of forest forbs.

RESPONSE TO IR #14a – Photo Study



Location: 60° 57.633'W, 53° 11.034'N



Location: 60° 34.808'W, 53° 15.308'N

Spruce-Fir Feathermoss Forest Ecotype - mainly found in the Churchill River valley and the valleys of its larger tributaries on both level sites and slopes (mid-slope). Substrates are well drained and moderately fertile. Tree cover is moderately dense and consists of black spruce and balsam fir. The ground layer is characterized by a well-developed moss carpet composed of red-stemmed feathermoss, knight's plume moss and stair-step moss.



Location: 61° 22.928'W, 53° 0.941'N

Mixedwood Forest Ecotype – located mainly along the Churchill River valley, but also found along the valleys of its tributaries, on both level sites and slopes where drainage is variable and substrates are moderately fertile.. It is characterized by a dense tree canopy consisting of heart-leaved paper birch, balsam fir, and black spruce. Shrub understory is well developed and consists of a mixture of tall shrubs and the ground layer is characterized by a patch cover of mosses intermixed with patches of forbs and pteridophytes.

RESPONSE TO IR #14a – Photo Study

Hardwood Habitat:

Location: 61° 22.086'W, 52° 58.323'N



Location: 61° 13.827'W, 53° 3.796'N

Hardwood Ecotype – located on both level areas and slopes within the Churchill River valley on low river terraces with rich soils. It is limited throughout the valley, but is particularly abundant in the hilly terrain north of Gull Island. Vegetation composition varies and is related to soil fertility and availability of water. Moist rich sites near the mouth of the Churchill River are dominated by balsam fir, while dry sites are dominated by quaking aspen. Areas outside of the Churchill River valley are usually dominated by paper birch. Ground cover consists mainly of forest forb species including dwarf dogwood, creeping snowberry, twinflower and northern starflower.

Anthropogenic/Disturbed Habitat:

Trans Labrador Highway and TL240 transmission line.



Gull Island, showing former construction site.

*RESPONSE TO IR #14a – Photo Study***Gravel Bar Habitat:**

Location: 61° 8.089'W, 53° 4.406'N

Unvegetated

Location: just upriver from Beaver Brook (~61° 57.109'W, 52° 53.769'N), facing west.

RESPONSE TO IR #14a – Photo Study

TYPICAL AQUATIC HABITATS

Typical Fast Velocity Habitat. Located just downriver of Horseshoe Rapids (~61° 34.065'W, 53° 0.121'N), facing east (i.e., downriver).



Typical Profundal Habitat, Lake Winokapau. Photo taken from Long Point (~62° 38.380'W, 53° 8.846'N), facing east (i.e., downriver).

RESPONSE TO IR #14a – Photo Study



Typical Slow Velocity Habitat. Located just upriver from Beaver Brook (~61° 57.109'W, 52° 53.769'N), facing south.

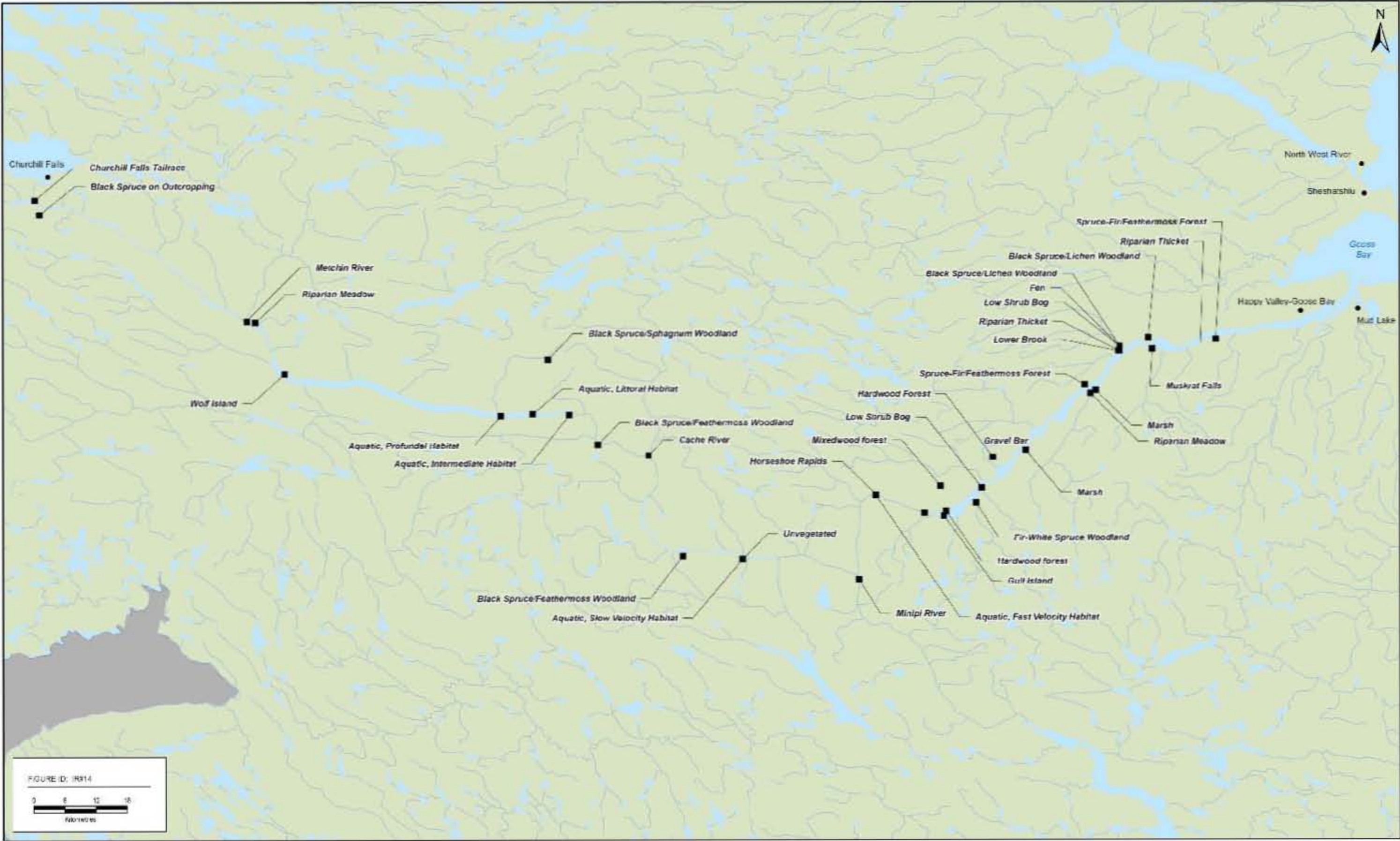


Typical Intermediate Habitat. Located just downriver from Lake Winokapau (~62° 26.587'W, 53° 8.908'N), facing south.

RESPONSE TO IR #14a – Photo Study

Typical Littoral Habitat, Lake Winokapau (~62° 32.851'W, 53° 9.053'N), facing north.

RESPONSE TO IR #14a – Photo Study



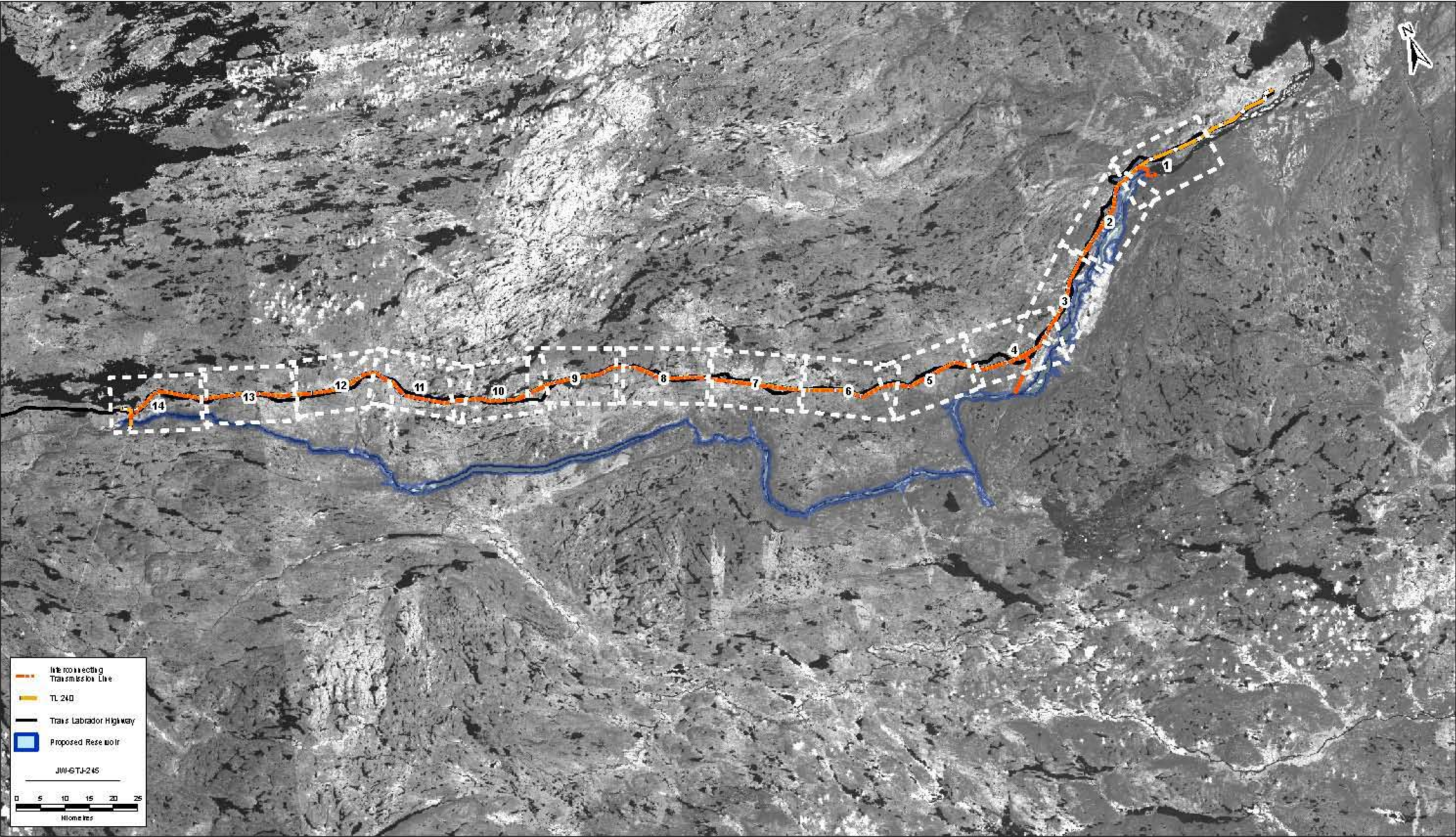
ATTACHMENT B
Interconnecting Transmission Line Viewshed
Analysis Map Atlas



INFORMATION RESPONSES
LOWER CHURCHILL PROJECT
CEAA REFERENCE NO.07-05-26178

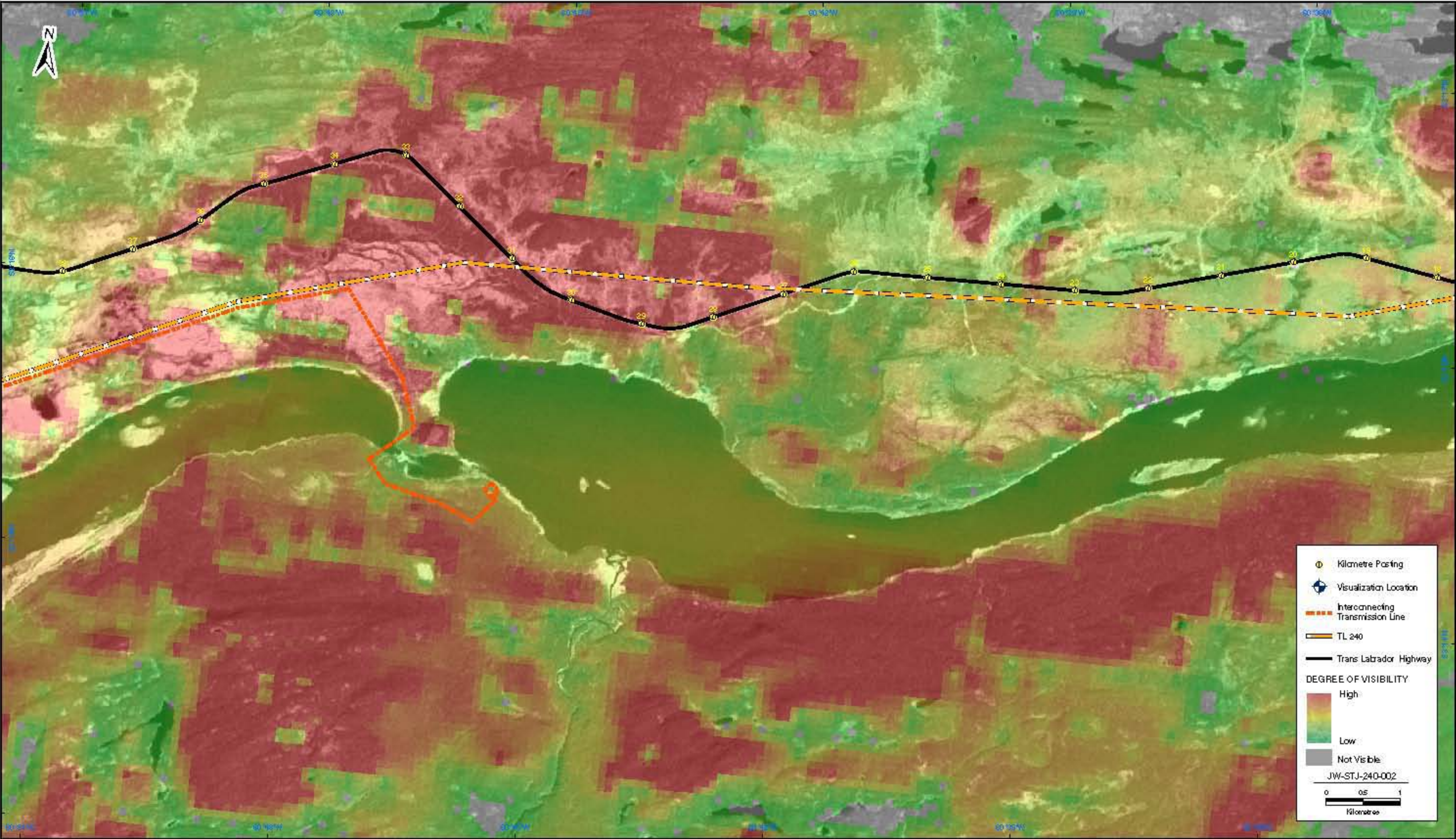
JOINT REVIEW PANEL

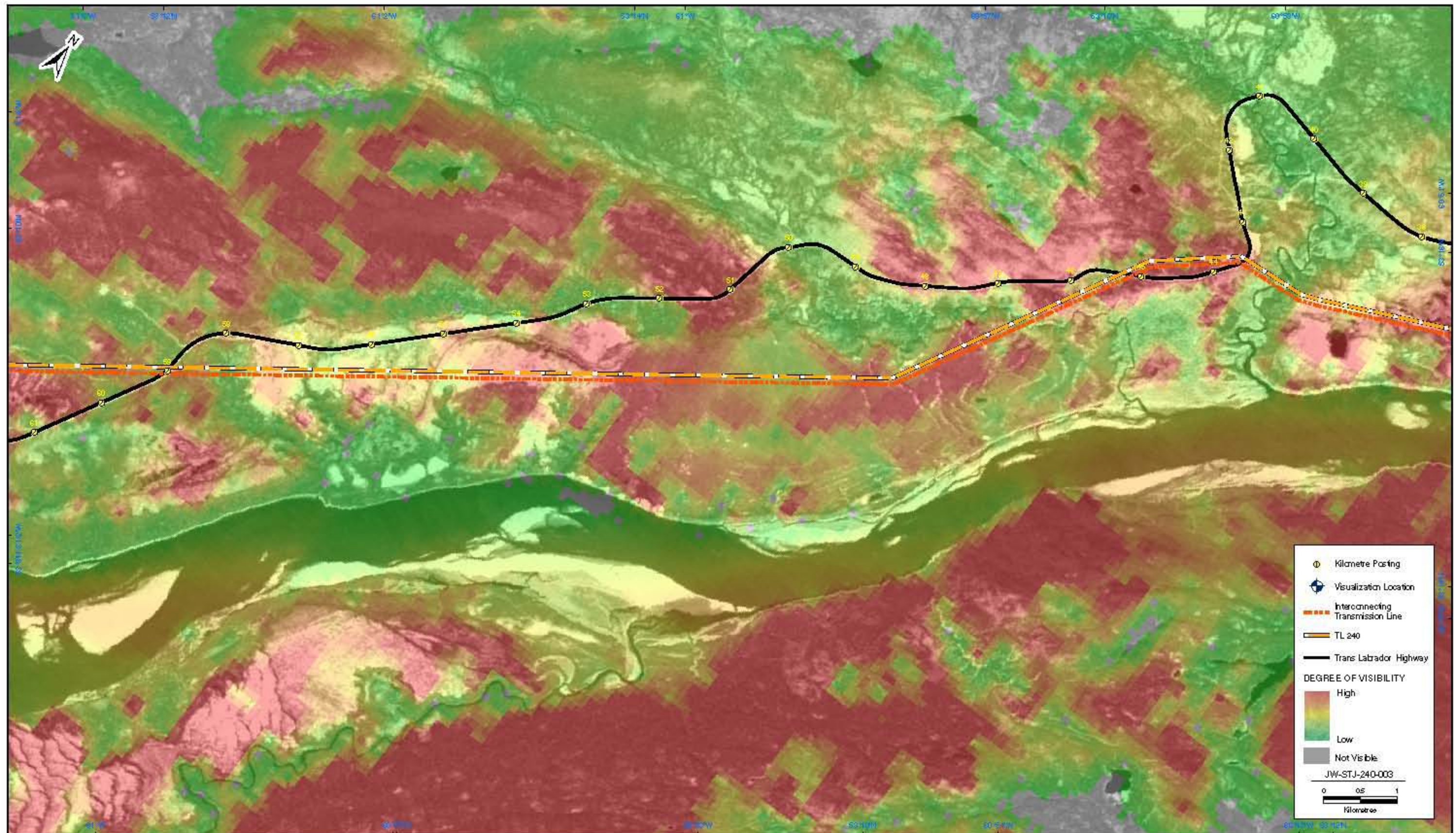
JRP.14
Landscape and Aesthetics

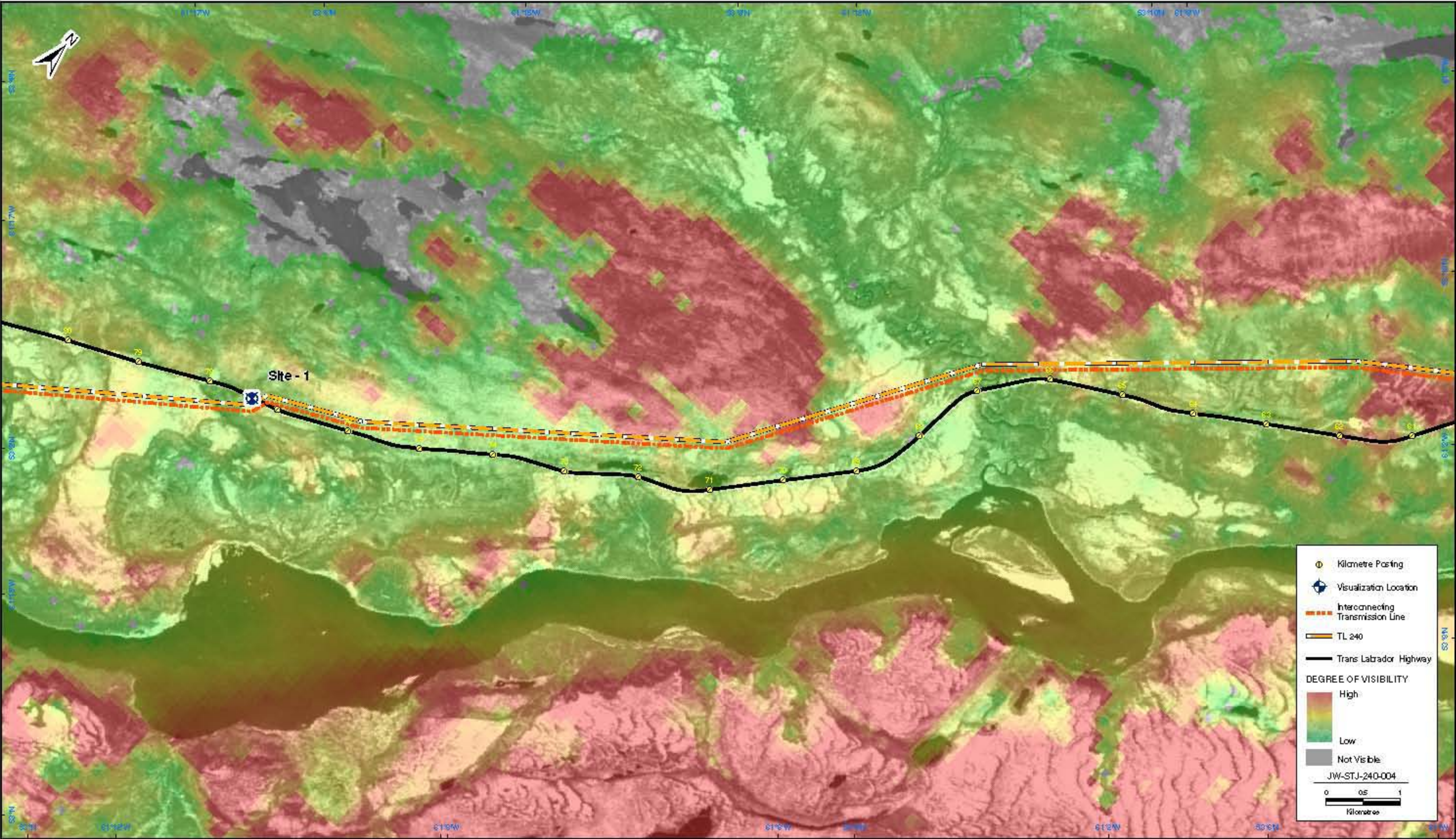
June 29, 2009

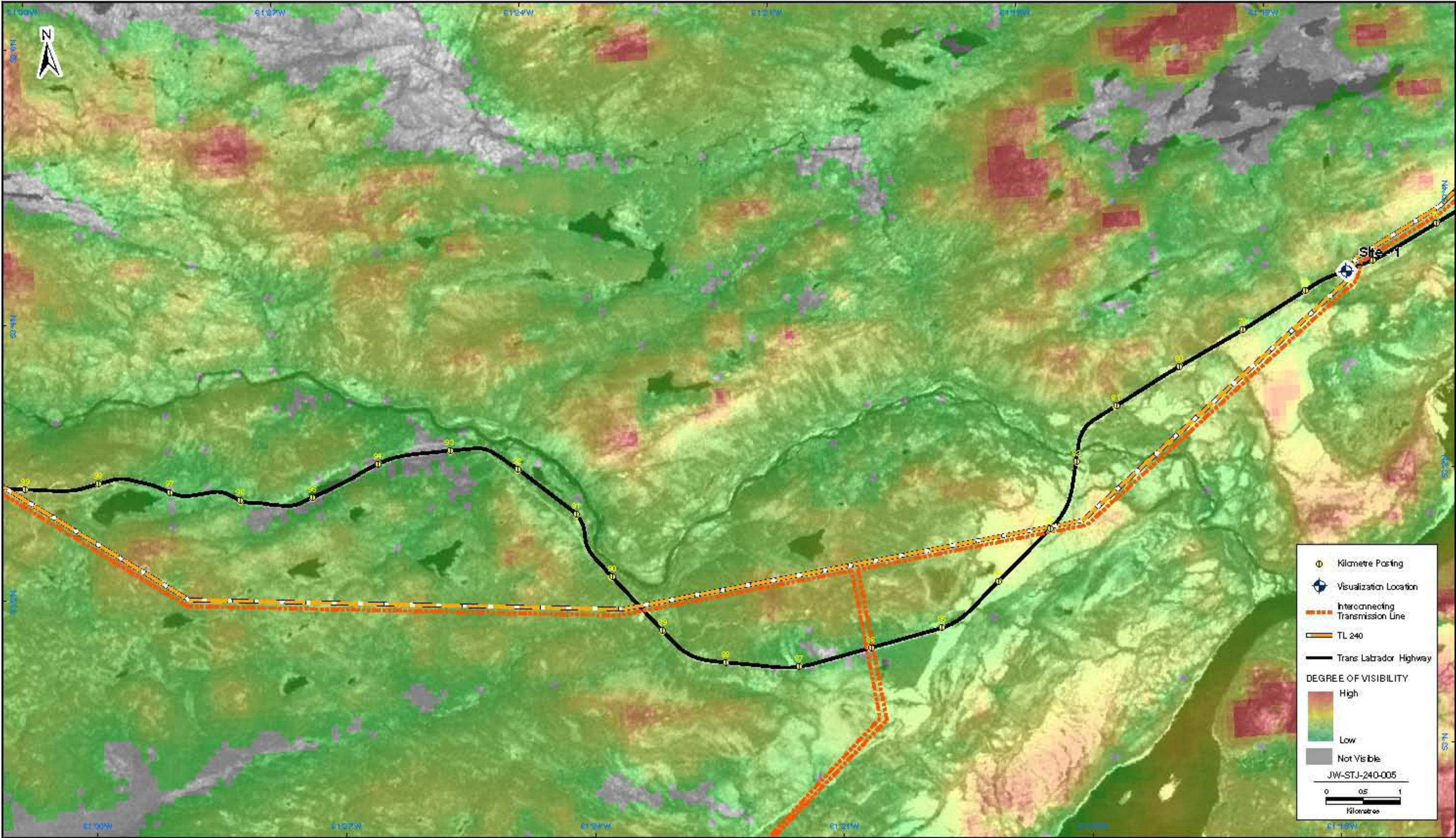


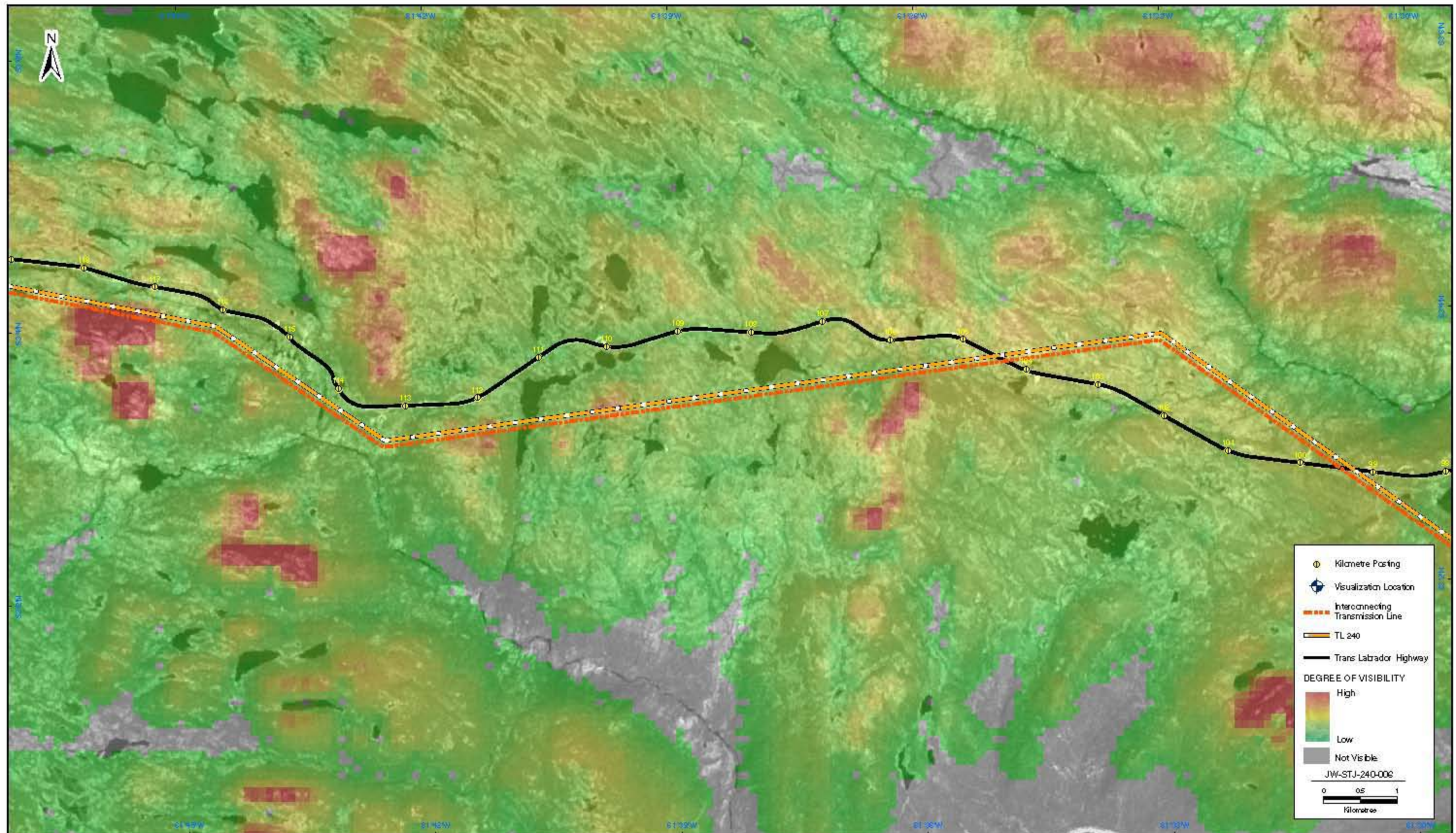
| | | |
|-------------------------------------------------------------------------------------|-----------------------------------------------------------|---------------------------------------------------------------------------------------|
|  | LOWER CHURCHILL HYDROELECTRIC GENERATION PROJECT | DATE: June 17, 2009 |
| FIGURE NO: Index | Interconnecting Transmission Line Viewshed Analysis Index |  |



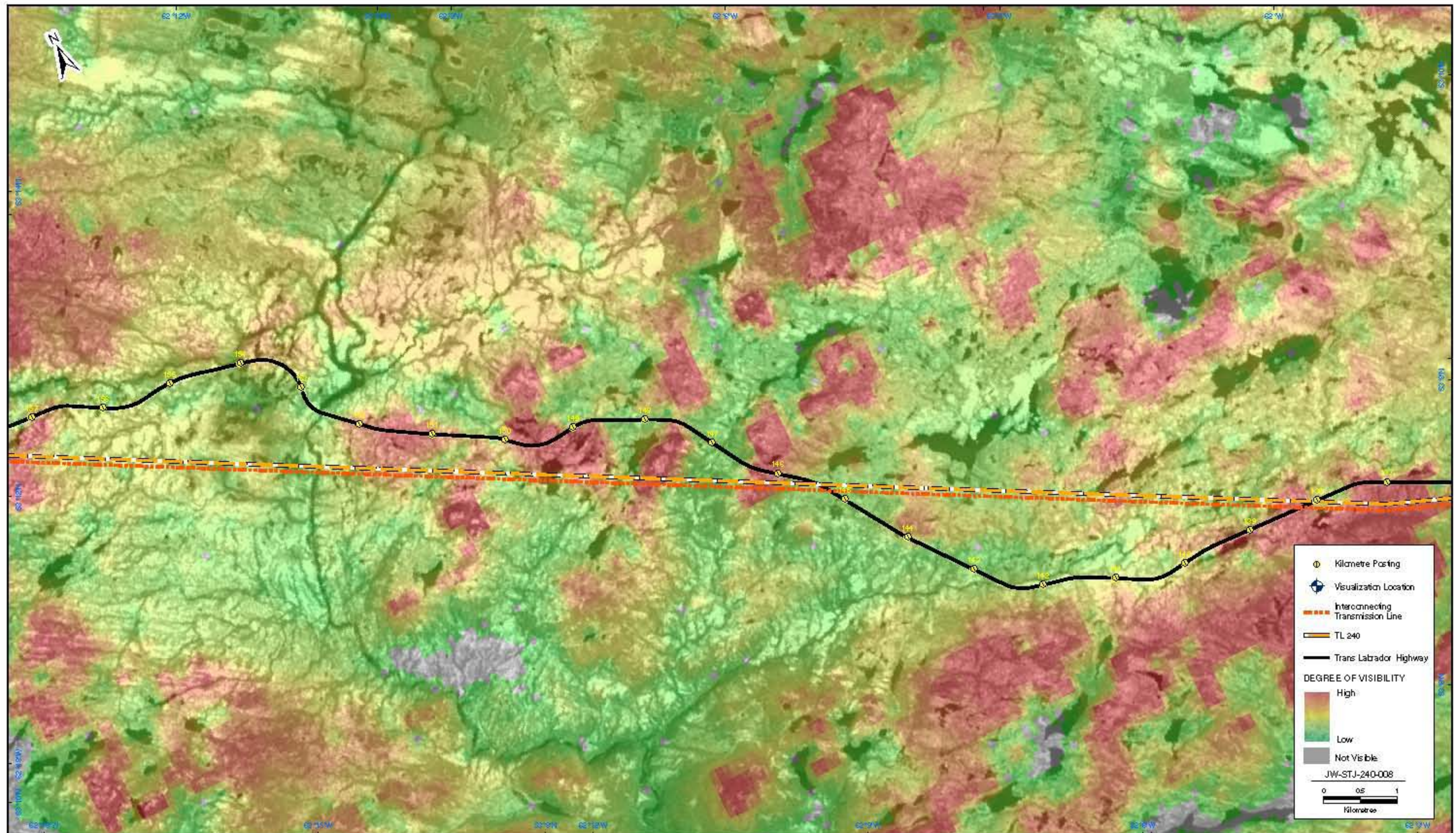


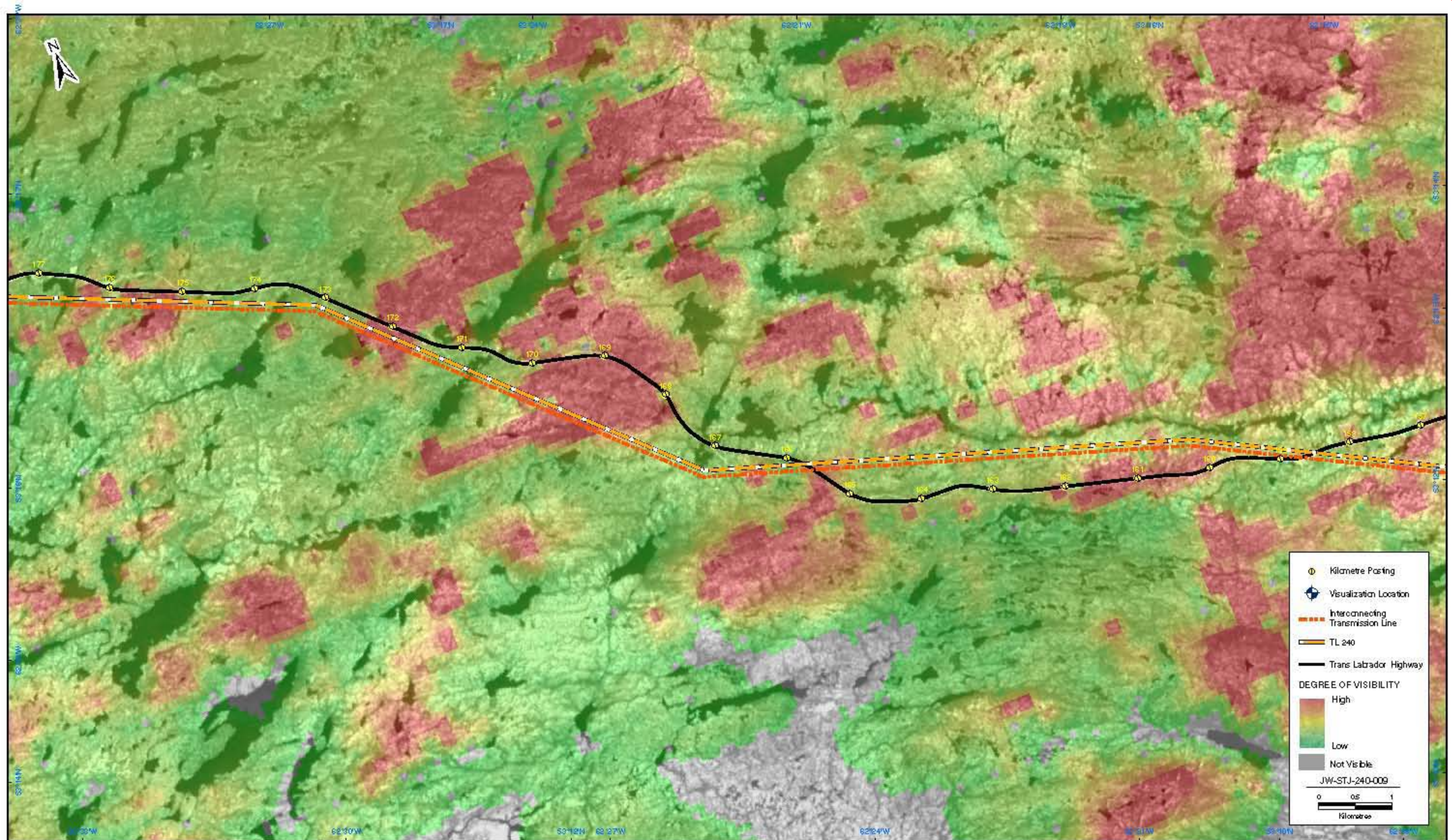












LOWER CHURCHILL HYDROELECTRIC GENERATION PROJECT

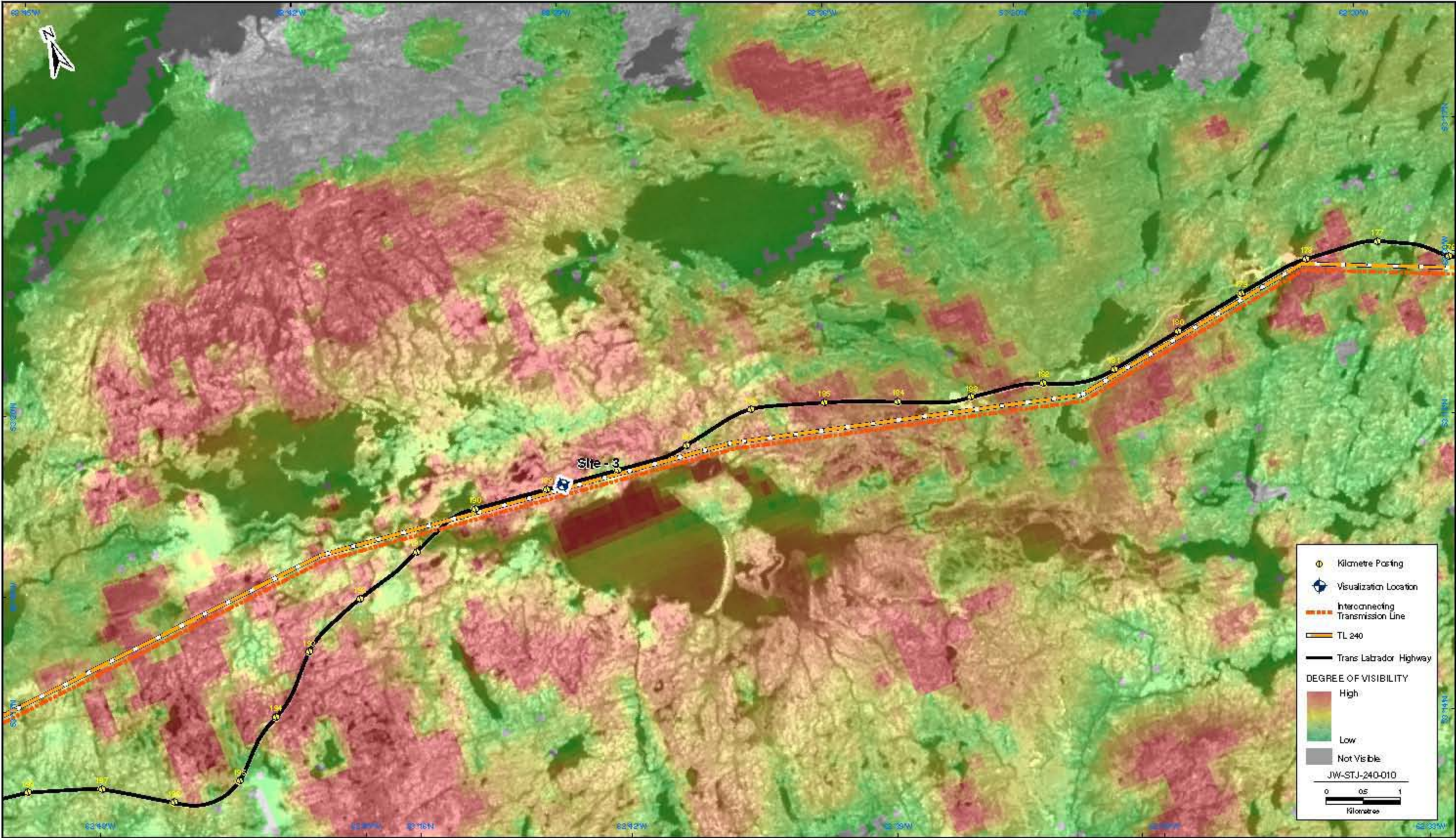
DATE
June 17, 2009

FIGURE NO.

8

Interconnecting Transmission Line Viewshed Analysis





LOWER CHURCHILL HYDROELECTRIC GENERATION PROJECT

DATE

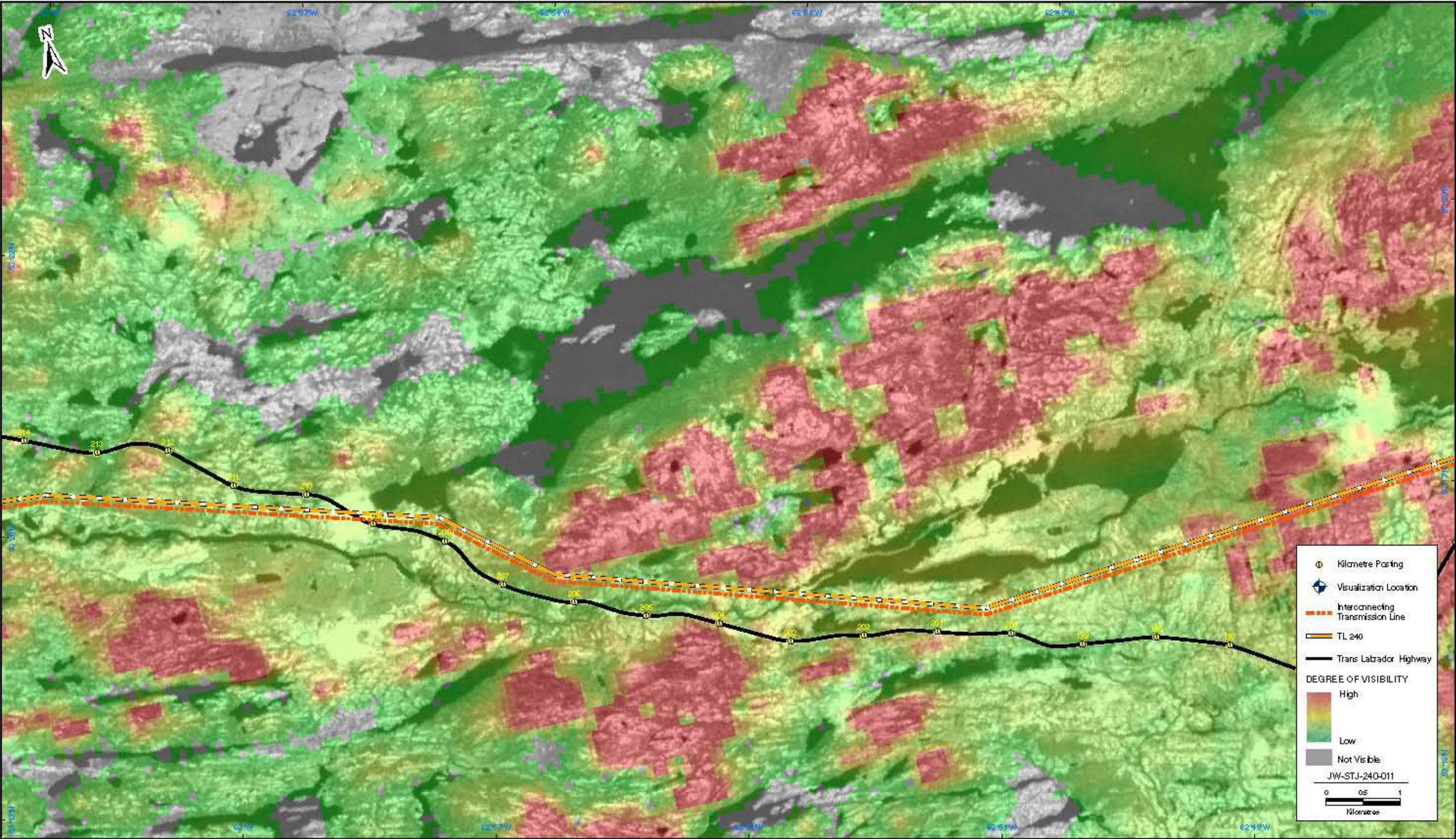
June 17, 2009

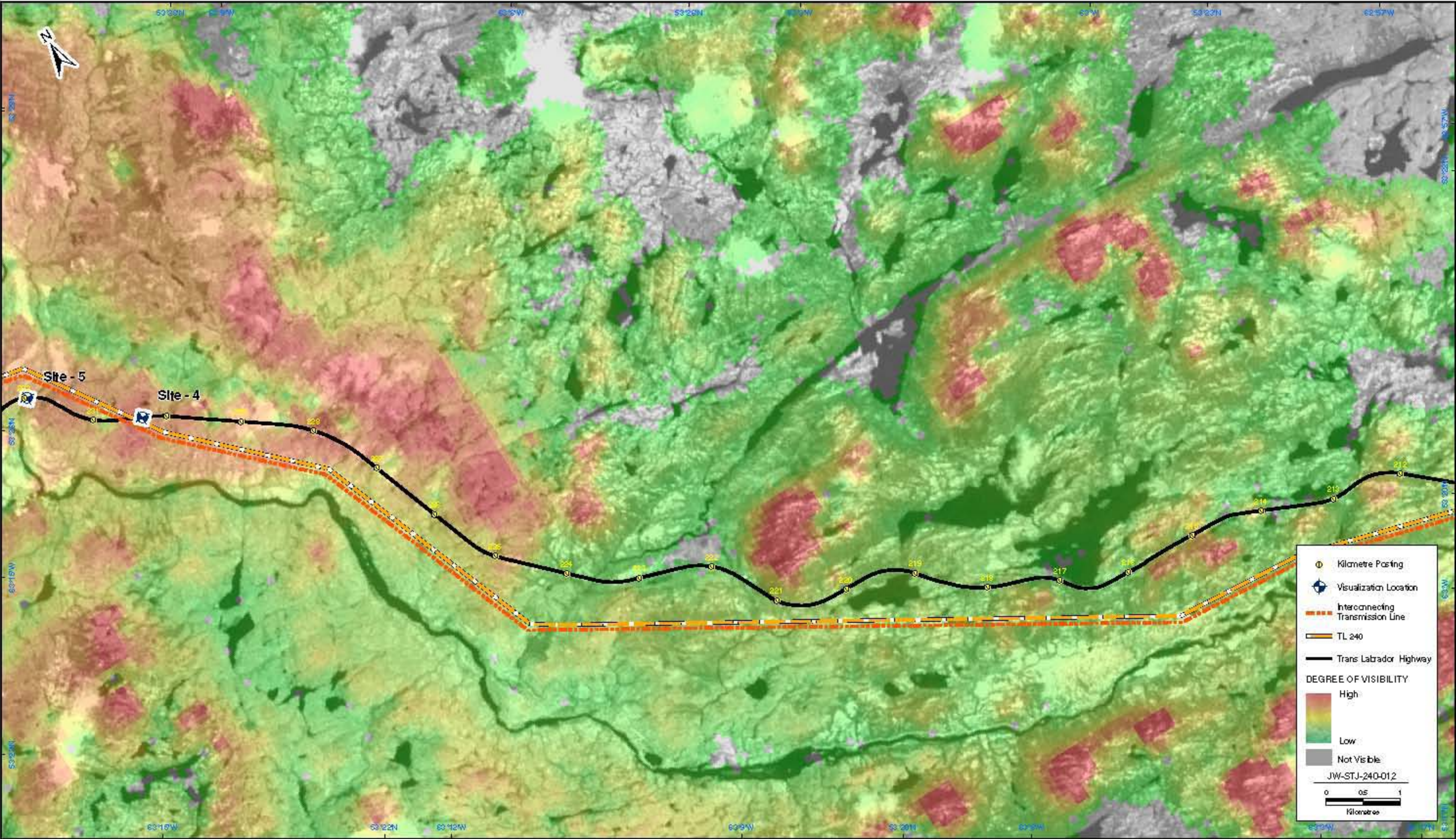
FIGURE NO.

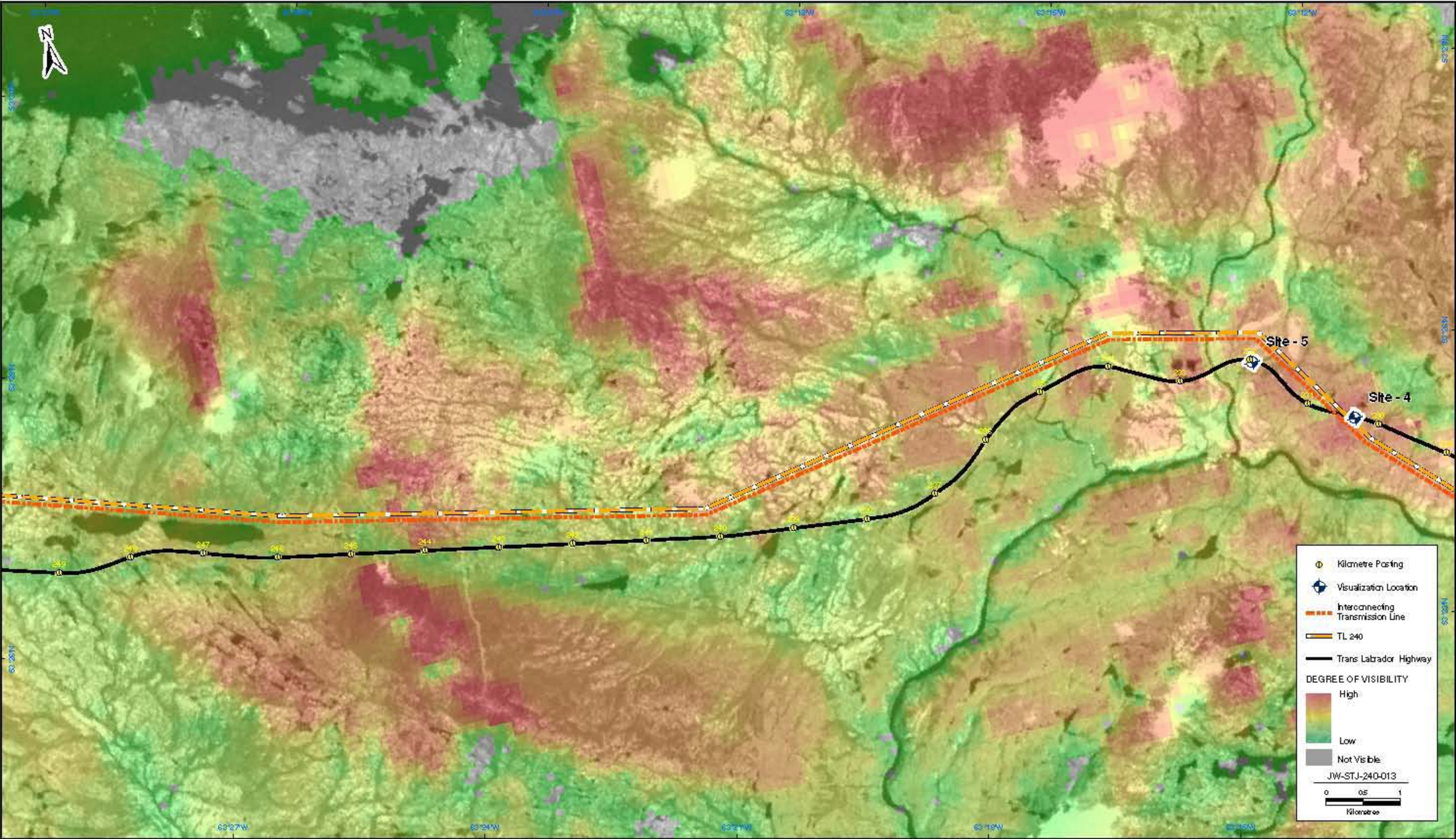
9

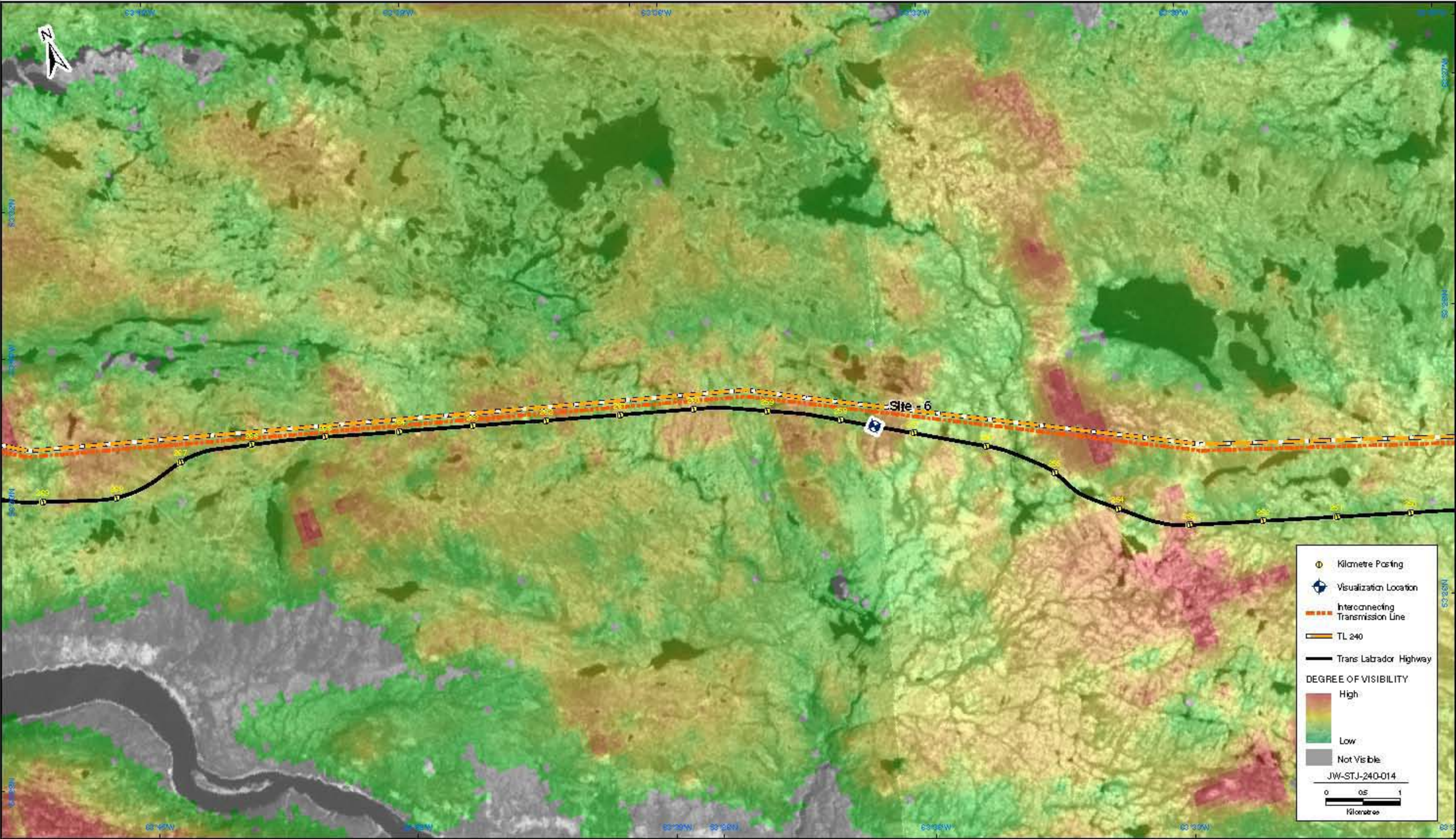
Interconnecting Transmission Line Viewshed Analysis





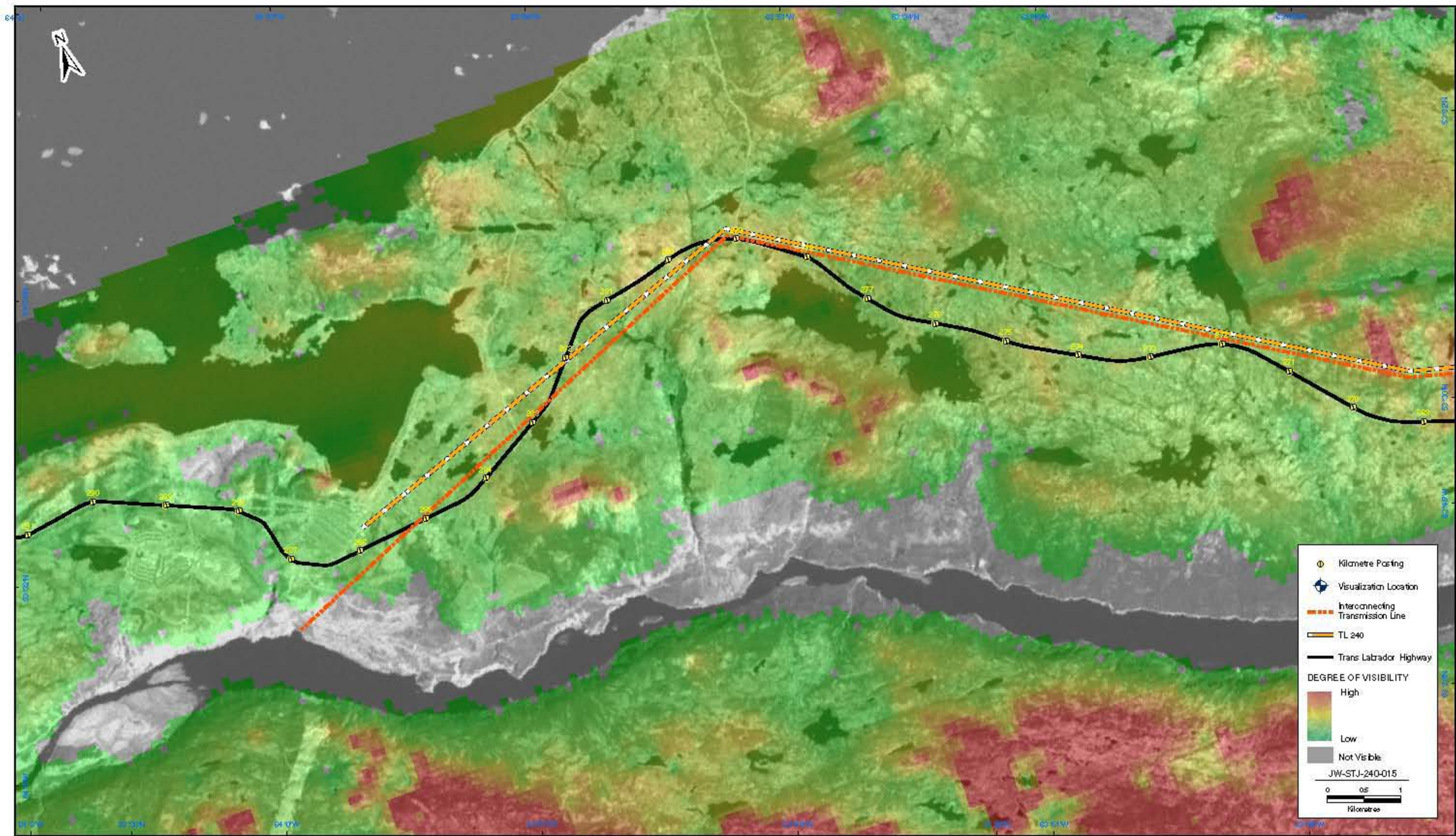








| | | |
|-------------------------------------------------------------------------------------|-----------------------------------------------------|---------------------------------------------------------------------------------------|
|  | LOWER CHURCHILL HYDROELECTRIC GENERATION PROJECT | DATE June 17, 2009 |
| FIGURE NO. 13 | Interconnecting Transmission Line Viewshed Analysis |  |



LOWER CHURCHILL HYDROELECTRIC GENERATION PROJECT

DATE
June 17, 2009

FIGURE NO.

14

Interconnecting Transmission Line Viewshed Analysis



Site # 1 Pre-Construction

Latitude: 53° 3.53' N
Longitude: 61° 14.27' W
Elevation: 110m
Datum: WGS 84



Site # 1 Post-Construction

Latitude: 53° 3.53' N
Longitude: 61° 14.27' W
Elevation: 110m
Datum: WGS 84

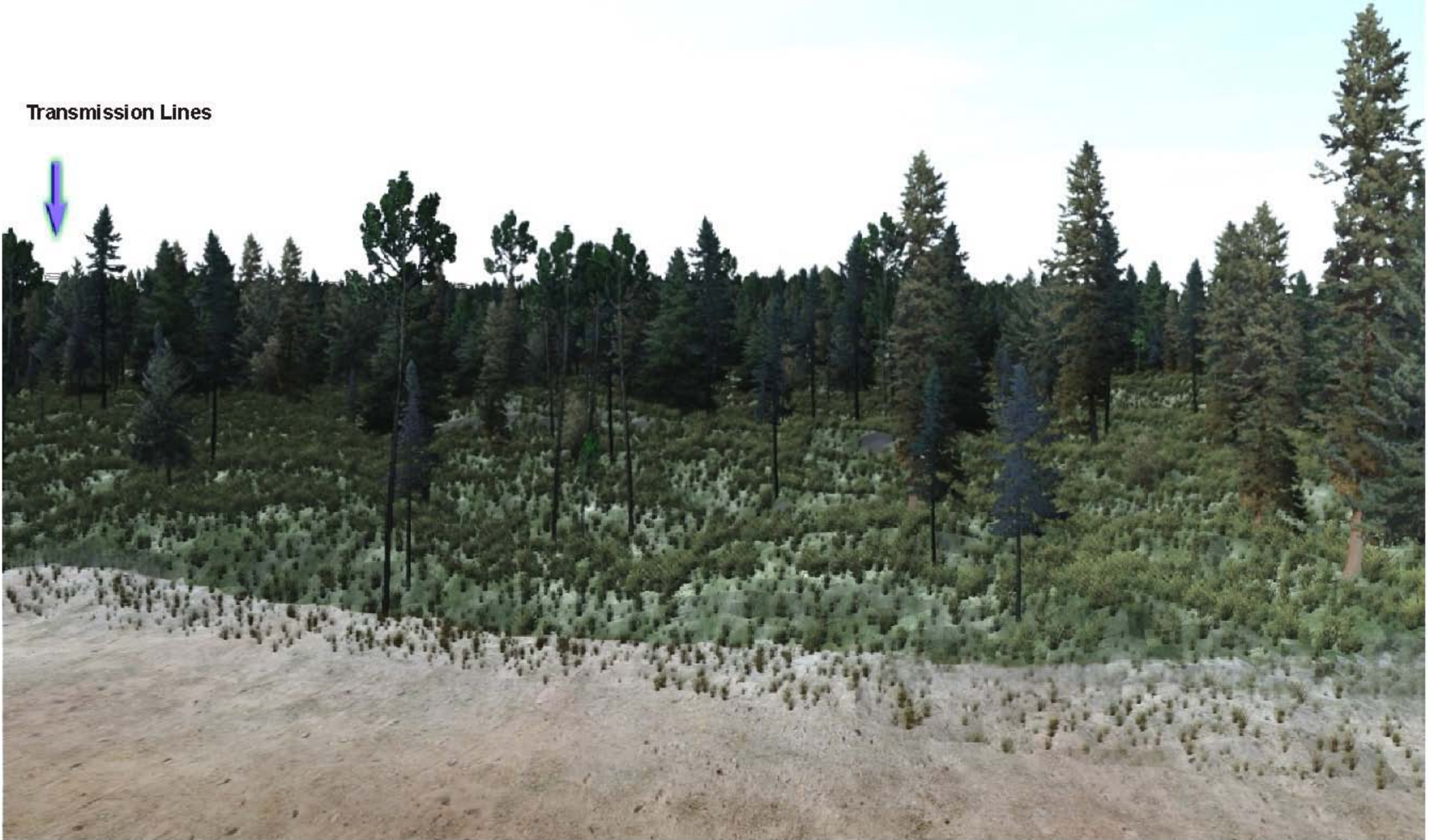


Site # 2 Pre-Construction

Latitude: 53° 6.97' N
Longitude: 61° 58.98' W
Elevation: 404m
Datum: WGS 84

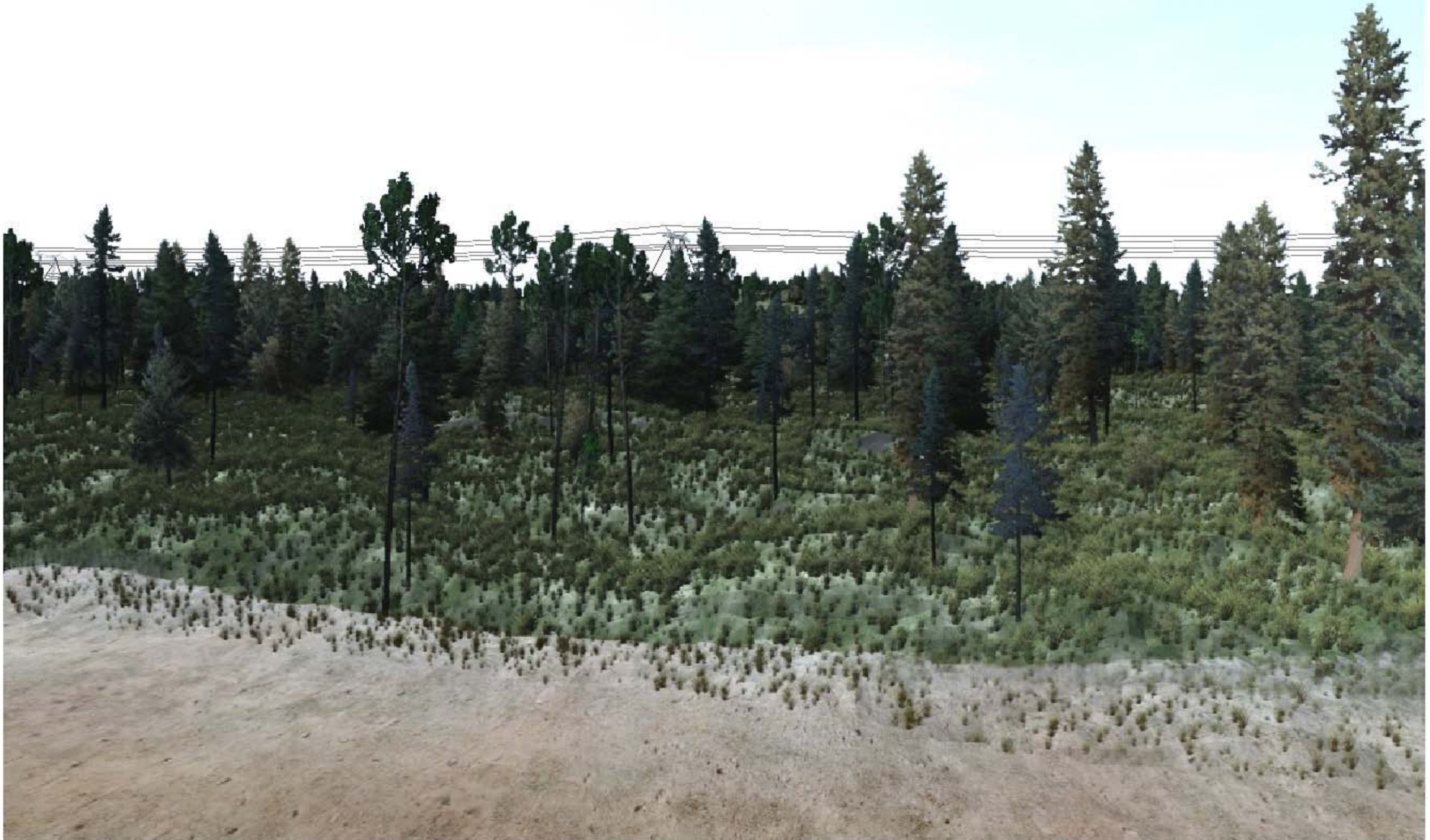


Transmission Lines



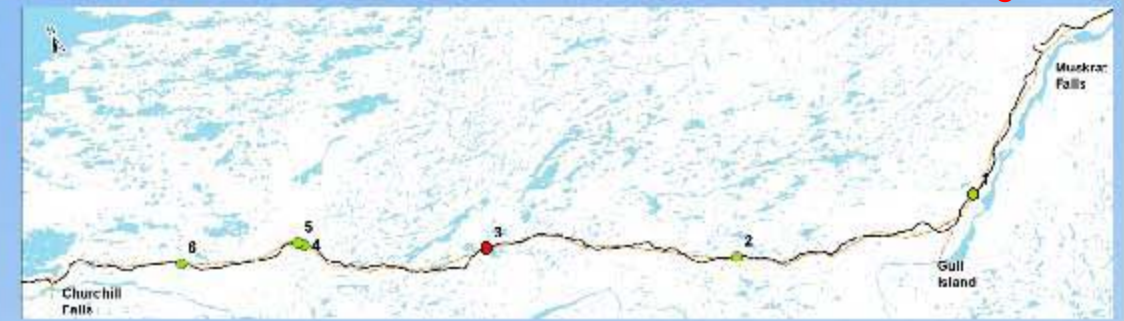
Site # 2 Post-Construction

Latitude: 53° 6.97' N
Longitude: 61° 58.98' W
Elevation: 404m
Datum: WGS 84



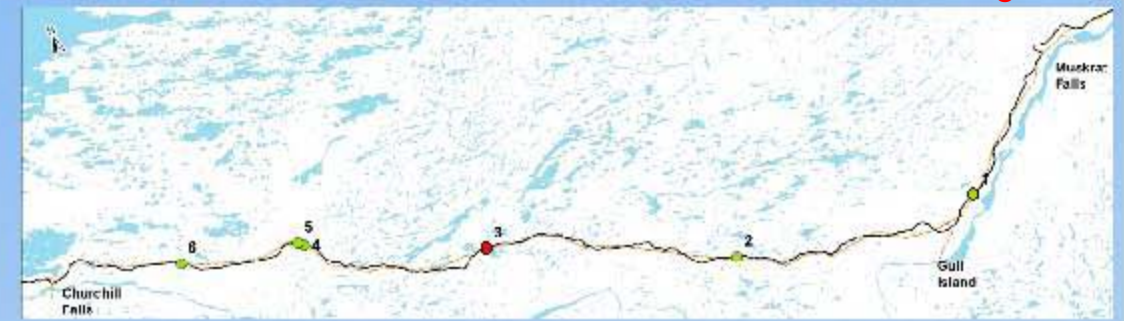
Site # 3 Pre-Construction

Latitude: 53° 17.99' N
Longitude: 62° 41.15' W
Elevation: 428m
Datum: WGS 84



Site # 3 Post-Construction

Latitude: 53° 17.99' N
Longitude: 62° 41.15' W
Elevation: 428m
Datum: WGS 84



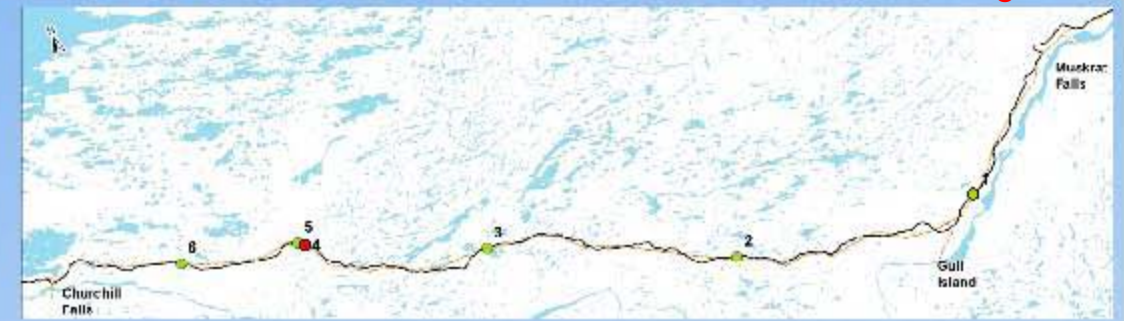
Site # 4 Pre-Construction

Latitude: 53° 25.54' N
Longitude: 63° 12.50' W
Elevation: 358m
Datum: WGS 84



Site # 4 Post-Construction

Latitude: 53° 25.54' N
Longitude: 63° 12.50' W
Elevation: 358m
Datum: WGS 84



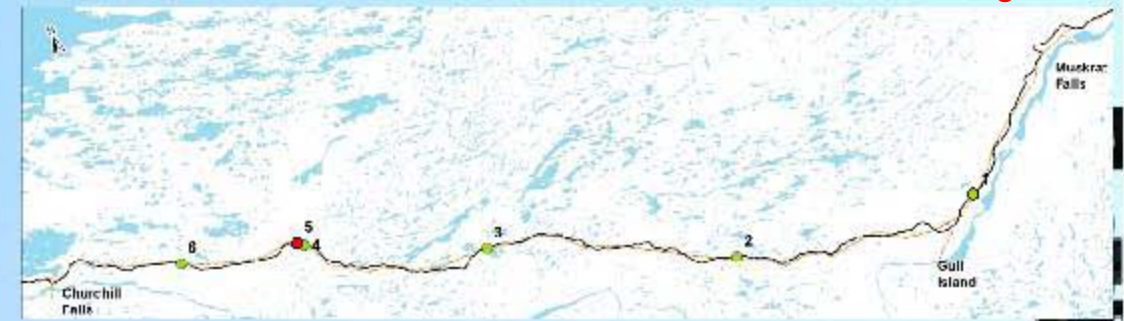
Site # 5 Pre-Construction

Latitude: 53° 26.11' N
Longitude: 63° 13.58' W
Elevation: 358m
Datum: WGS 84



Site # 5 Post-Construction

Latitude: 53° 26.11' N
Longitude: 63° 13.58' W
Elevation: 358m
Datum: WGS 84



Transmission Lines



Site # 6 Pre-Construction

Latitude: 53° 28.50' N
Longitude: 63° 35.11' W
Elevation: 422m
Datum: WGS 84



Transmission Lines



Site # 6 Post-Construction

Latitude: 53° 28.50' N
Longitude: 63° 35.11' W
Elevation: 422m
Datum: WGS 84

