

Using Mapping to Evaluate Impacts of Proposed Mine Projects on Natural Resources in Areas of Cultural Importance

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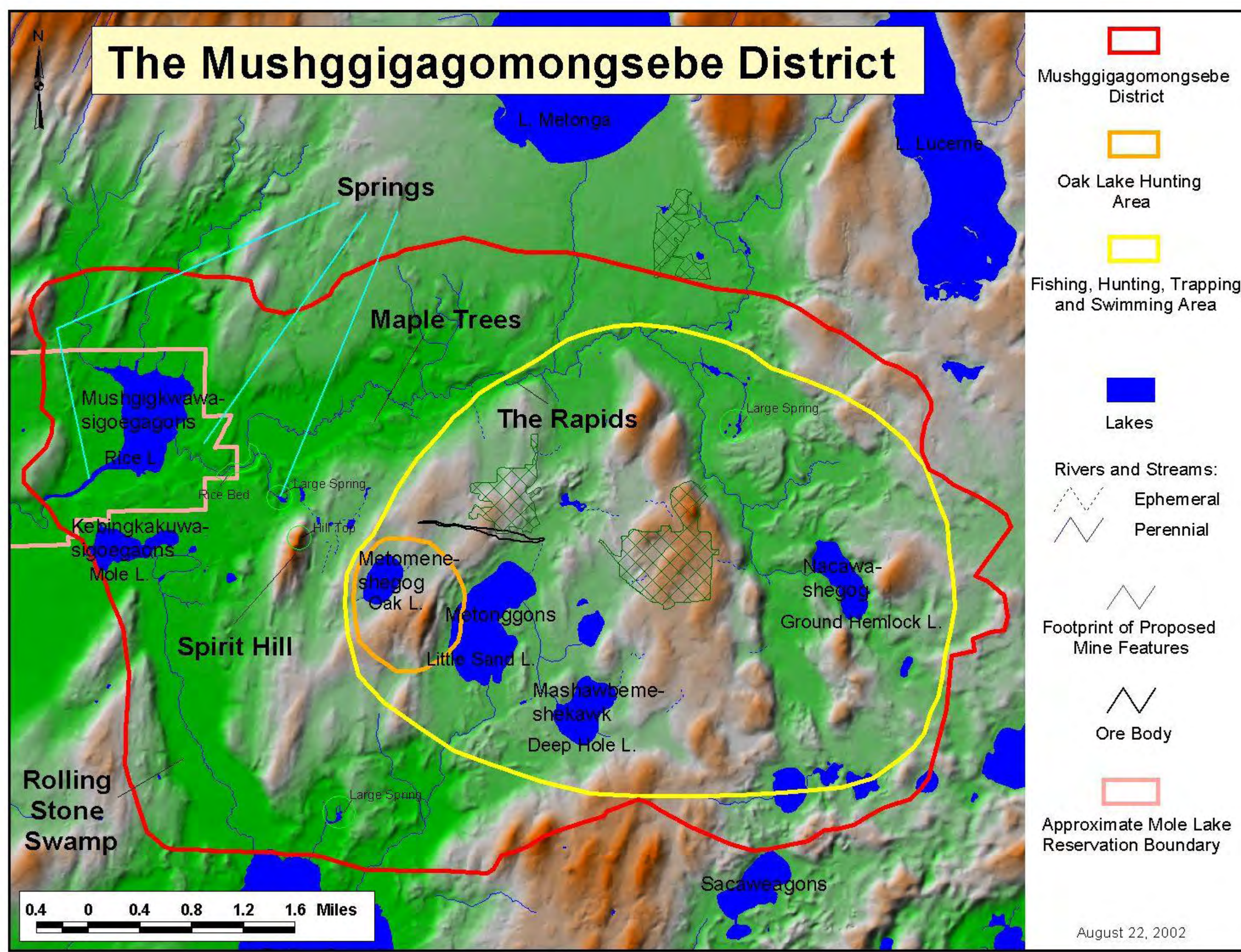


Figure 1: Map of the Mushggigagomongsebe district illustrating the information gathered by Nesper et al. ("The Mushggigagomongsebe District: A Traditional Cultural Landscape of the Sokaogon Ojibwe Community", 2002) on important cultural areas throughout the area of the proposed mine. Where possible, Ojibwe language place names have been used to better illustrate the strong cultural and historical links between the Sokaogon Chippewa and the district.

As part of the review of the proposed Crandon mine project, GLIFWC mapped the effects of various mine related disturbances on natural resources within the 18511 acre Mushggigagomongsebe traditional cultural property (TCP) of the Sokaogon Chippewa Community. The advantages of characterizing impacts using Geographic Information Systems (GIS) are twofold: First, GIS output includes numeric measurements (i.e. acres affected, number of springs affected, etc.) that provide a basis on which to describe cultural impacts. These numeric values can be effective in putting cultural impacts in a context that regulatory agencies are accustomed to dealing with. Second, GIS maps provide clear and dramatic pictures of the extent of the mine related impacts. All data generated in this analysis was submitted to the Army Corps of Engineers for use in their environmental impact statement for the Crandon project.

It is important to note that the methods that GLIFWC has used in characterizing impacts on features of cultural importance are only the first step of the process. The most critical aspect involves direct participation of the impacted local community. The numeric measurements obtained through GIS analysis and mapping must be used in well designed surveys of the affected community in order to determine the scope and severity of mine related impacts.

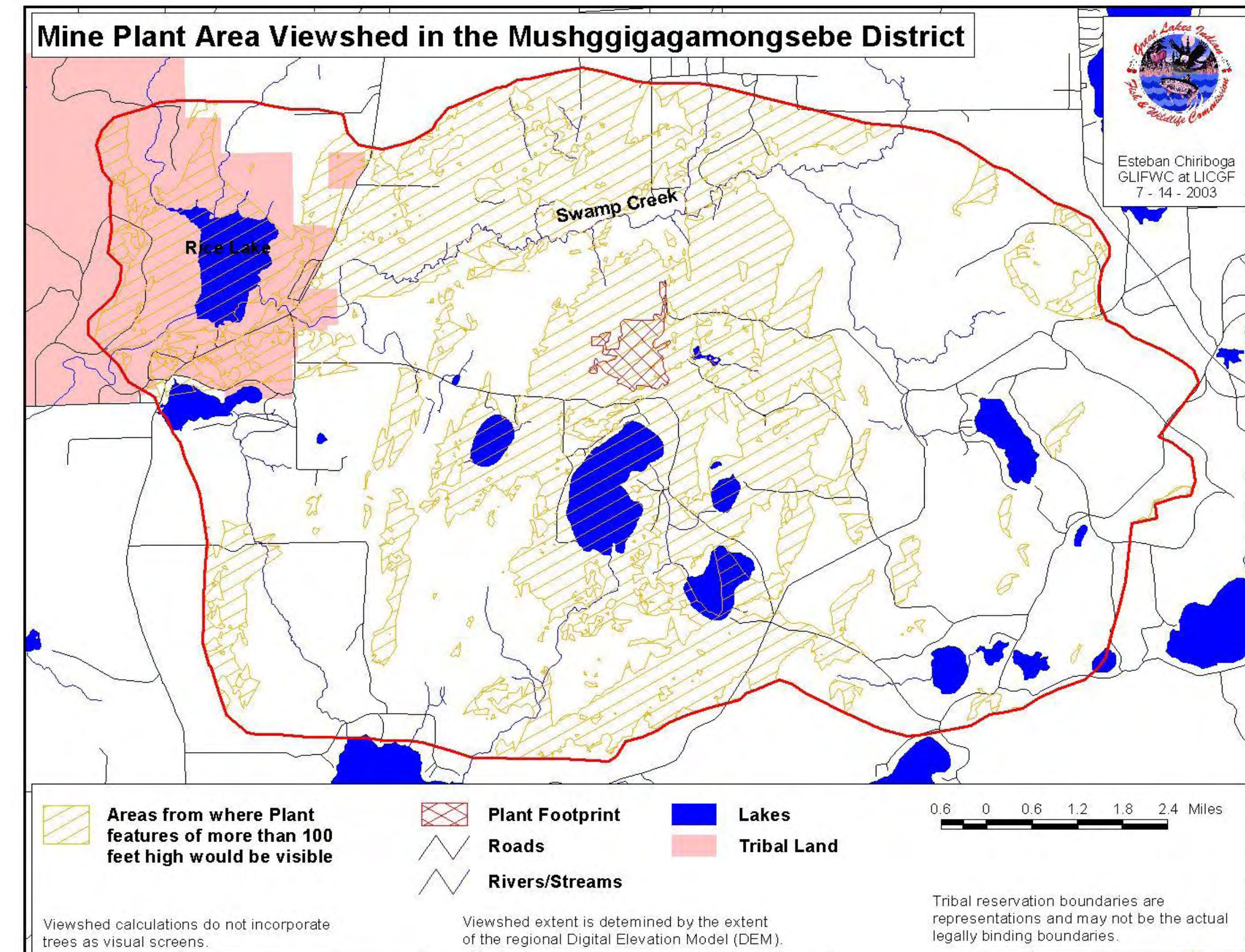


Figure 2: This map illustrates all areas in the TCP from where mine buildings of over 80 feet in height could be seen.

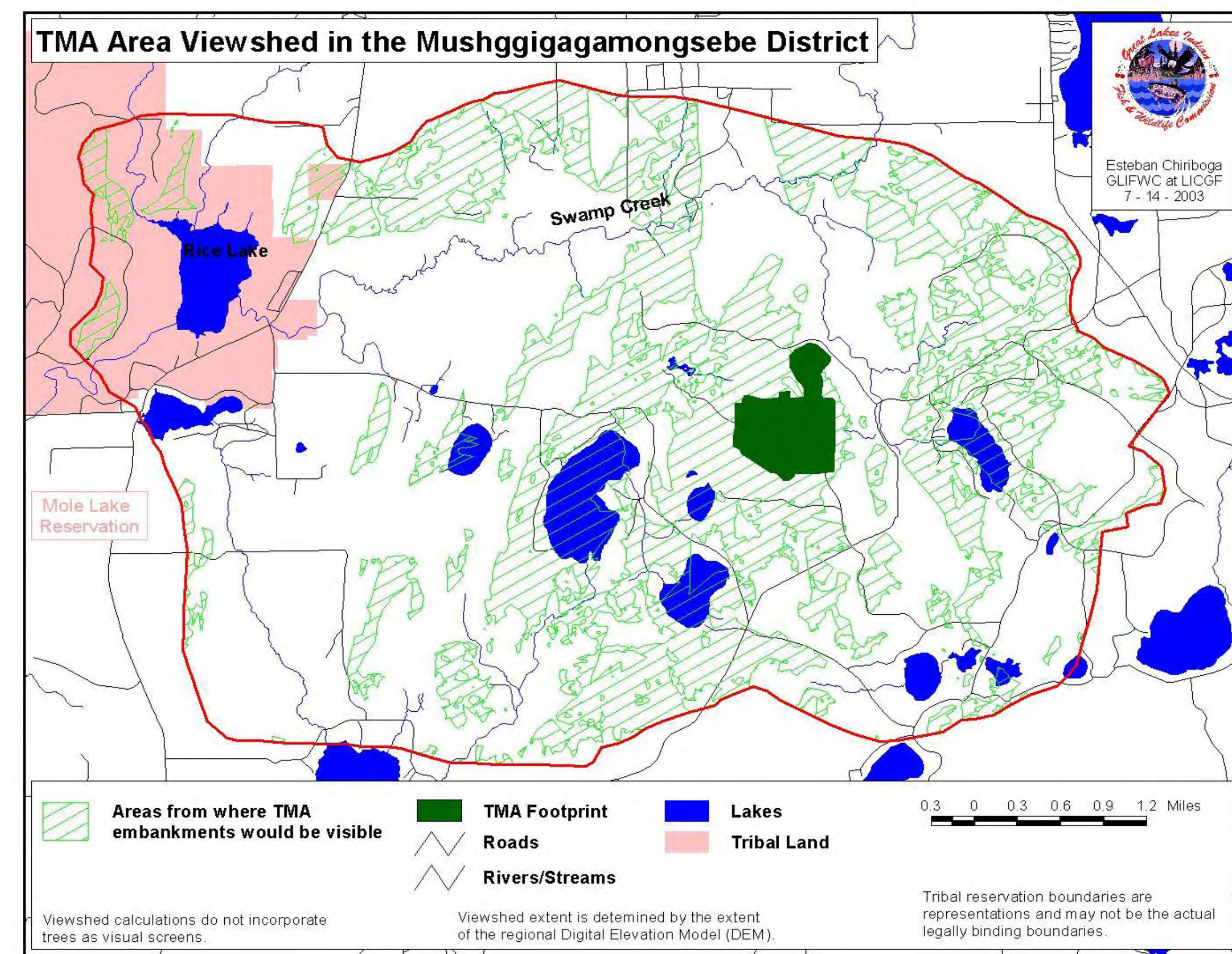


Figure 3: This map illustrates all areas in the TCP from where the tailings management area could be seen.

Visual Impacts

TCP area within the viewshed of plant features (>80 feet in height): 6882.60 acres
% of TCP area impacted: 37.18%

TCP area within the viewshed of the TMA: 7332.13 acres
% of TCP area impacted: 39.60%

Acres of impact does not include transportation corridors, pipeline corridors for natural gas and mitigation water, rail corridor, steam plumes from the main headframe and the east and west ventilation raises, diesel exhaust from mine heaters and vehicles, and night lighting of the project area.

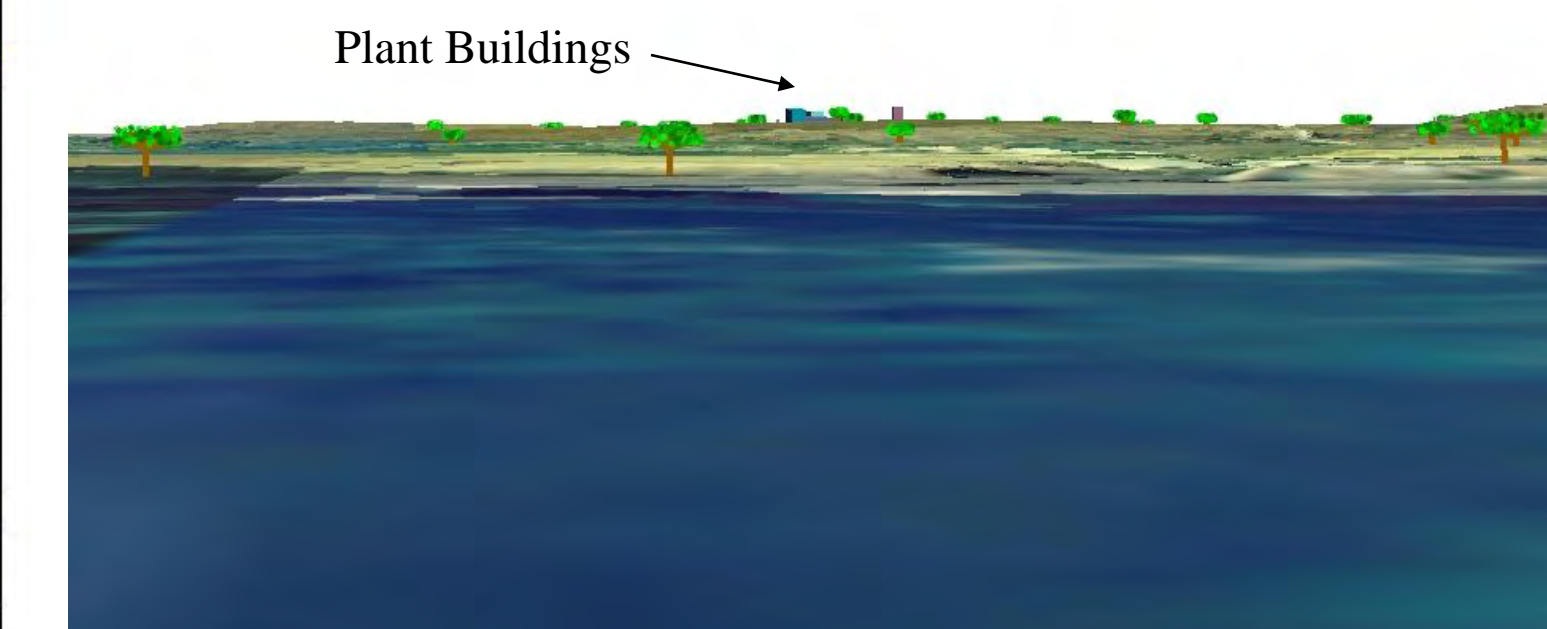


Figure 4: Visualization of mine buildings from Spirit Hill: a culturally important site.

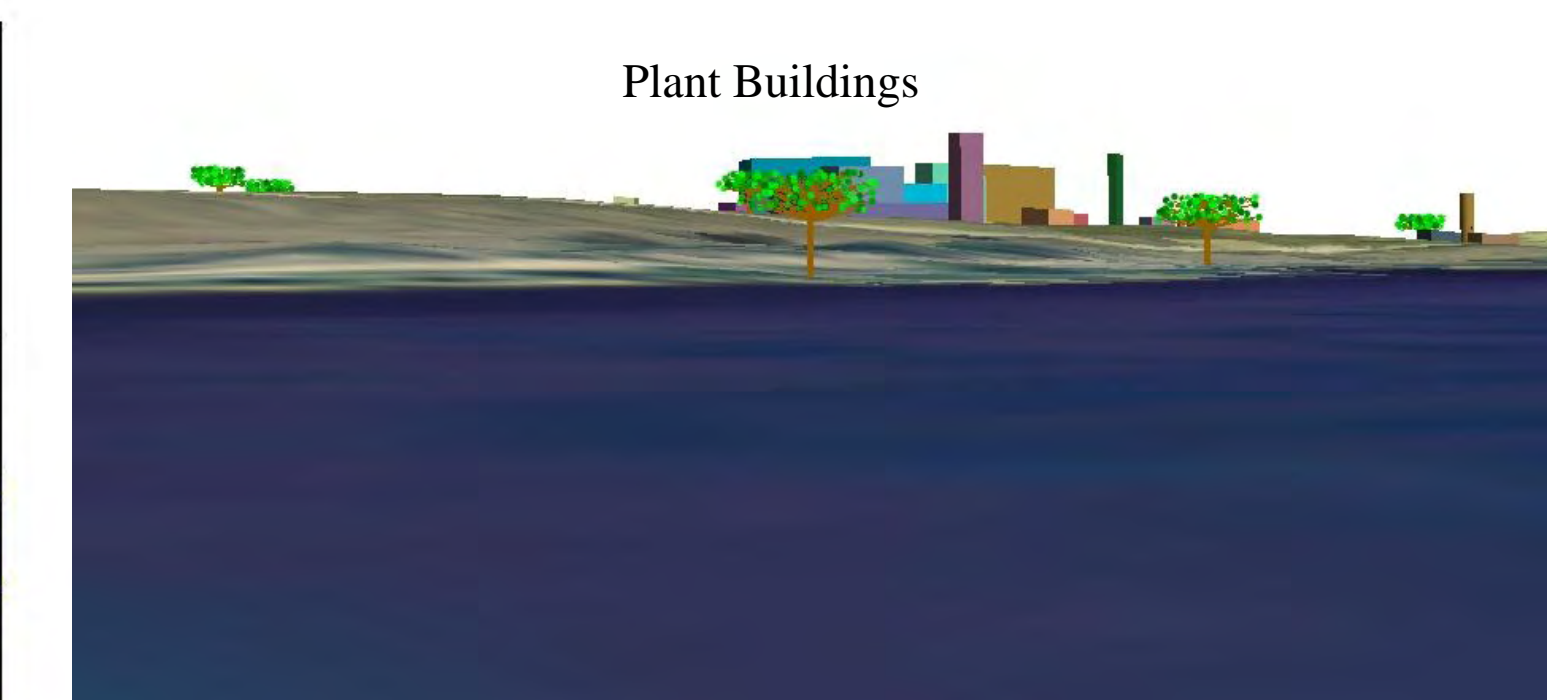


Figure 4: Visualization of mine buildings from Rice Lake: a culturally important site.

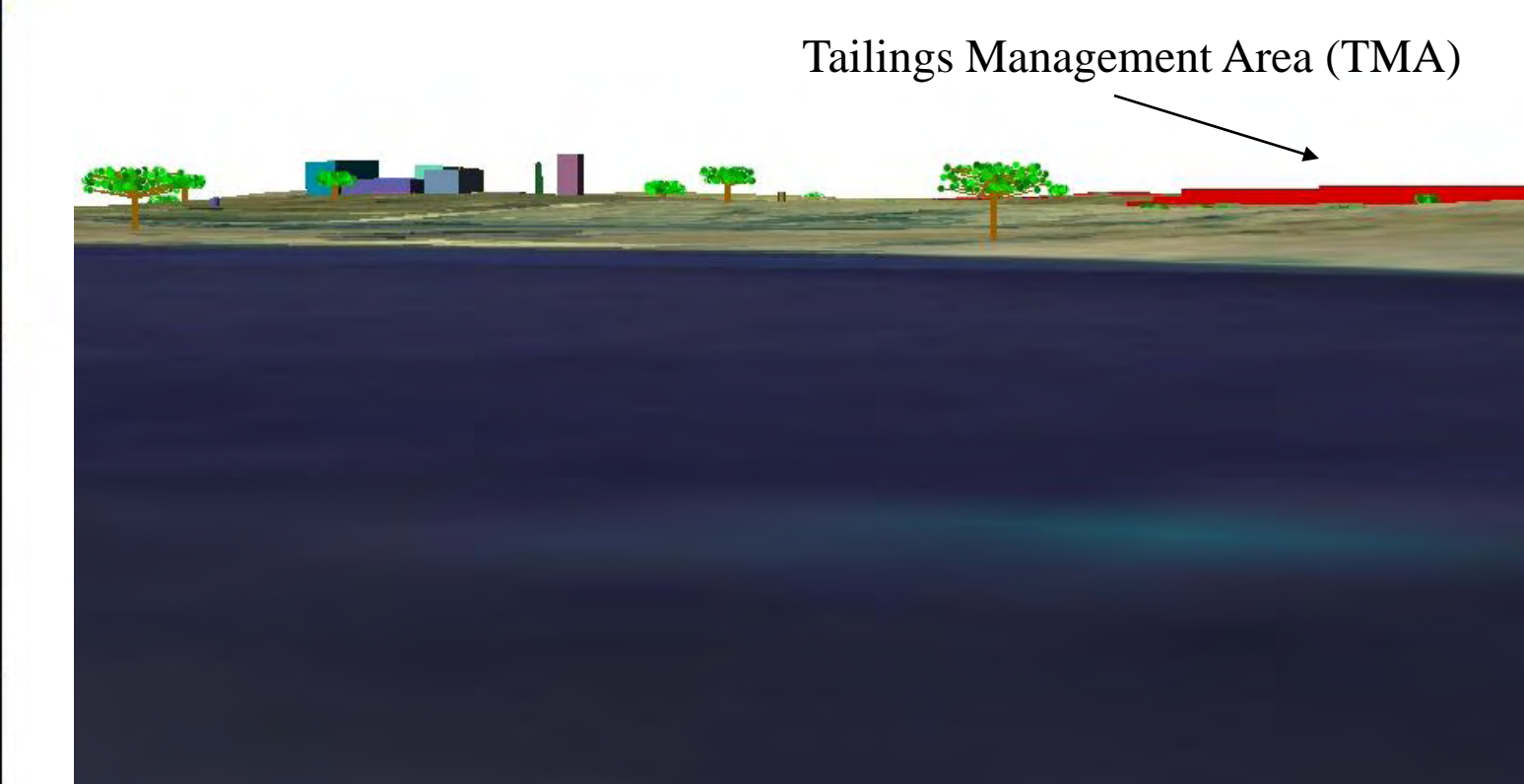


Figure 6: Visualization of mine buildings and TMA from Oak Lake.

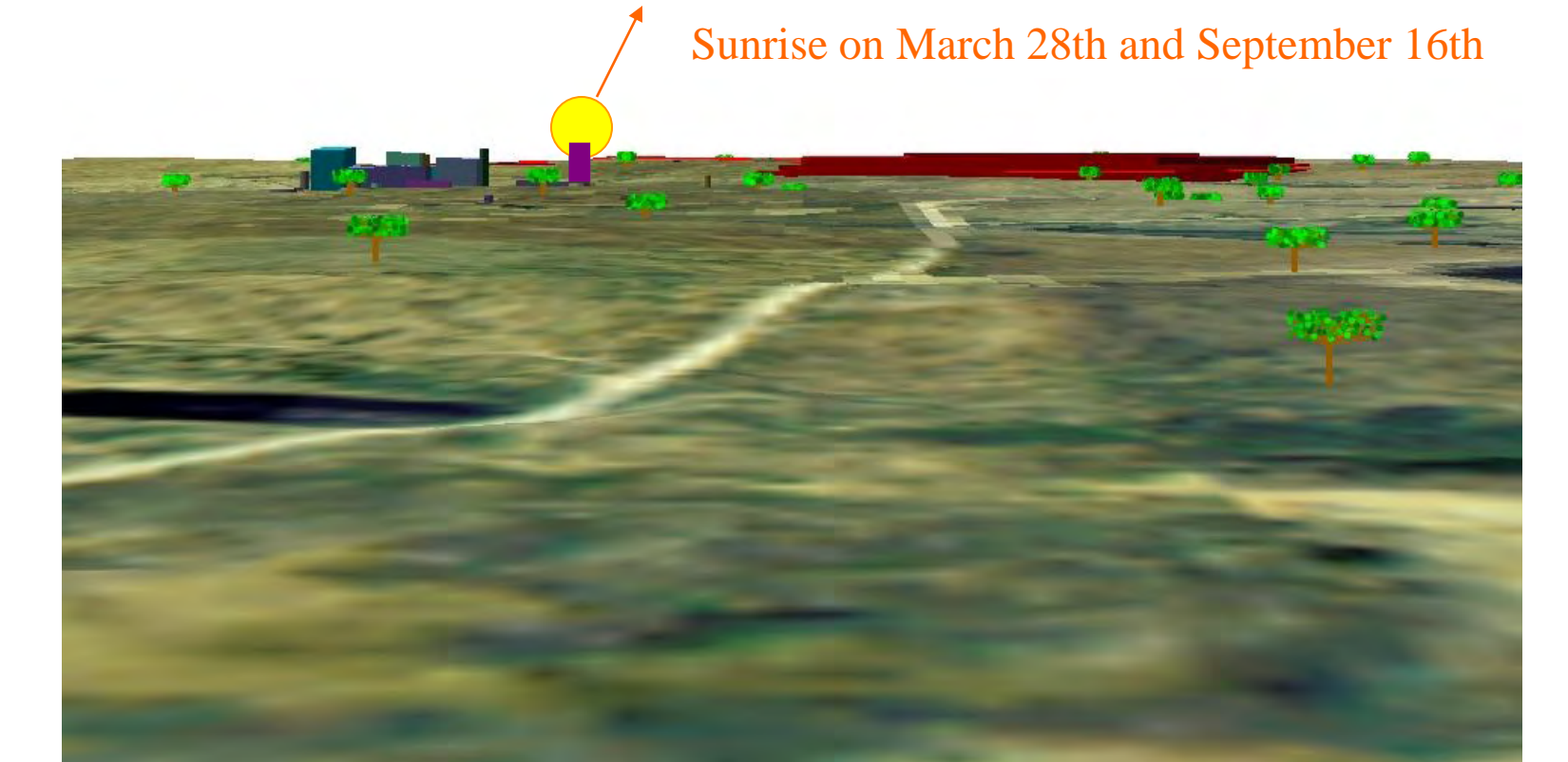


Figure 4: Visualization of mine buildings from Spirit Hill: a culturally important site.

Sunrise Ceremony impacts at Spirit Hill:

Plant buildings would be in the Spirit Hill – sunrise point line of sight from March 28th to April 4th and from September 8th to September 16th. The TMA would be in the Spirit Hill – sunrise point line of sight from March 4th to March 20th (vernal equinox) and from October 9th to September 24th (Autumnal equinox is September 23rd).

Parameters For Spirit Hill Solar Analysis

Latitude:	45 deg 30 min North
Longitude:	89 deg West
Winter Solstice:	December 22
Summer Solstice:	June 21
Vernal Equinox:	March 20
Autumnal Equinox:	September 23

Time Periods of Impact - Spring

Plant Buildings	Date	Time of Sunrise
Main Headframe	March 28	06:31
Loadout Building	April 4	06:44

TMA	Date	Time of Sunrise
South Corner	March 4	07:29
North Corner	March 20	06:59

Time Periods of Impact - Fall

Plant Buildings	Date	Time of Sunrise
Main Headframe	September 16	06:35
Loadout Building	September 8	06:25

TMA	Date	Time of Sunrise
South Corner	October 9	07:04
North Corner	September 24	06:45

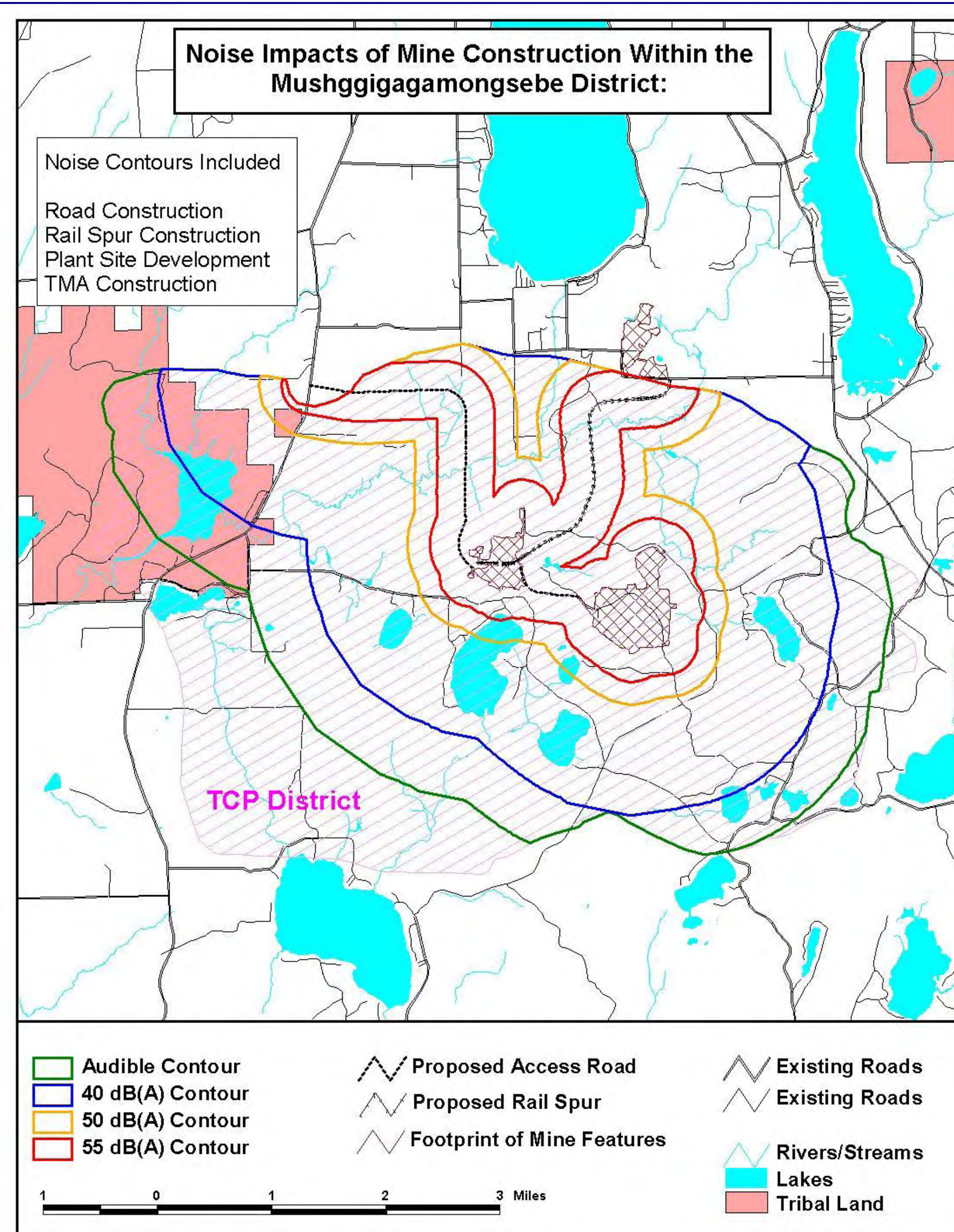


Figure 7: This map illustrates noise and vibration impacts of mine construction within the TCP.

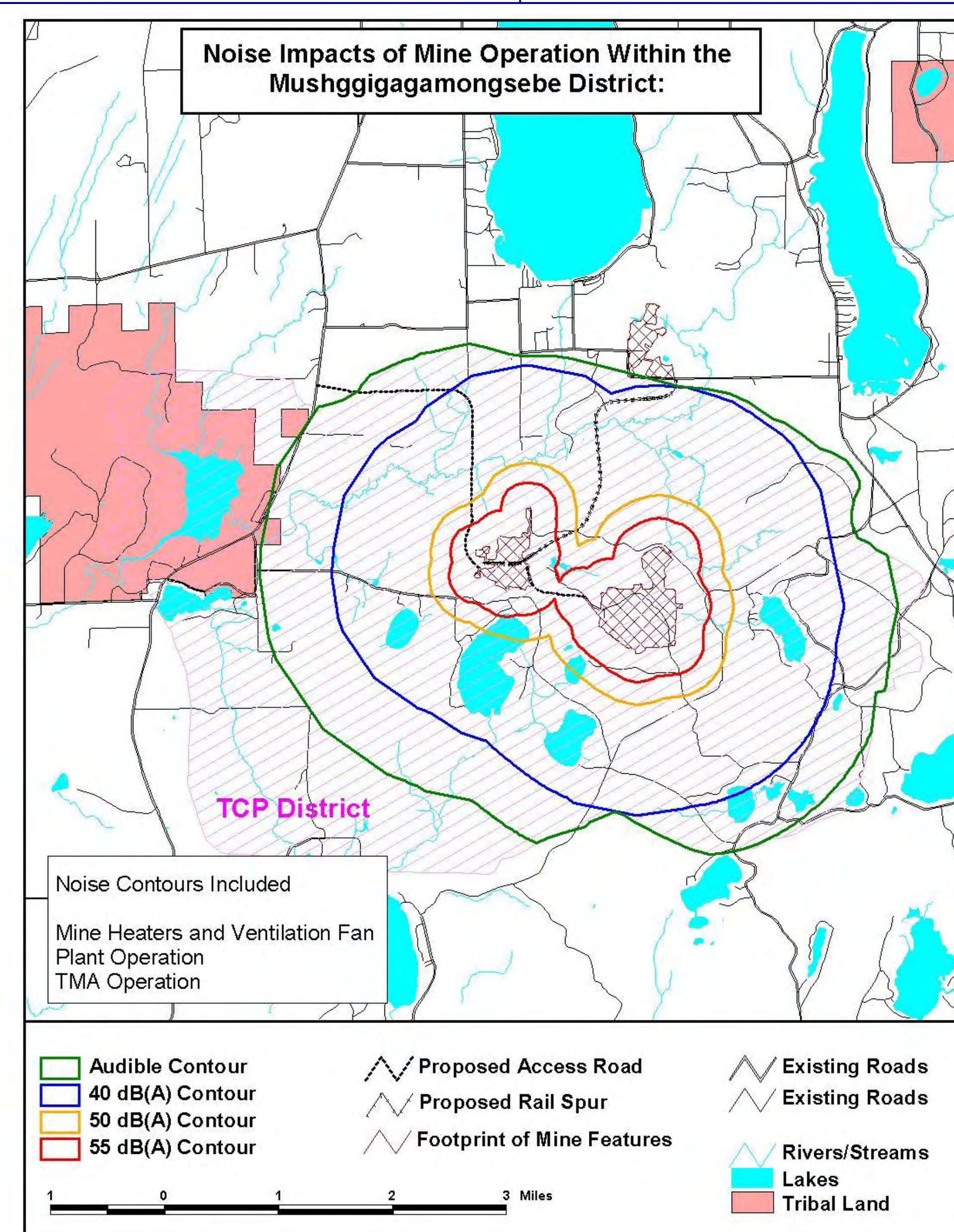


Figure 8: This map illustrates noise and vibration impacts of mine operation within the TCP.

Acoustic Impacts

All acreage calculations are based on information in the Corps draft Noise and Vibration Technical Memorandum for the Proposed Crandon Mine.

Operation Phase:

Area impacted at the 55 dB level: 1595.51 acres
% of TCP area impacted: 8.62%

Area impacted at the 50 dB level: 2680.49 acres
% of TCP area impacted: 14.48%

Area impacted at the 40 dB level: 9650.59 acres
% of TCP area impacted: 52.13%

Area impacted at the audible dB level: 15460 acres
% of TCP area impacted: 74.19%

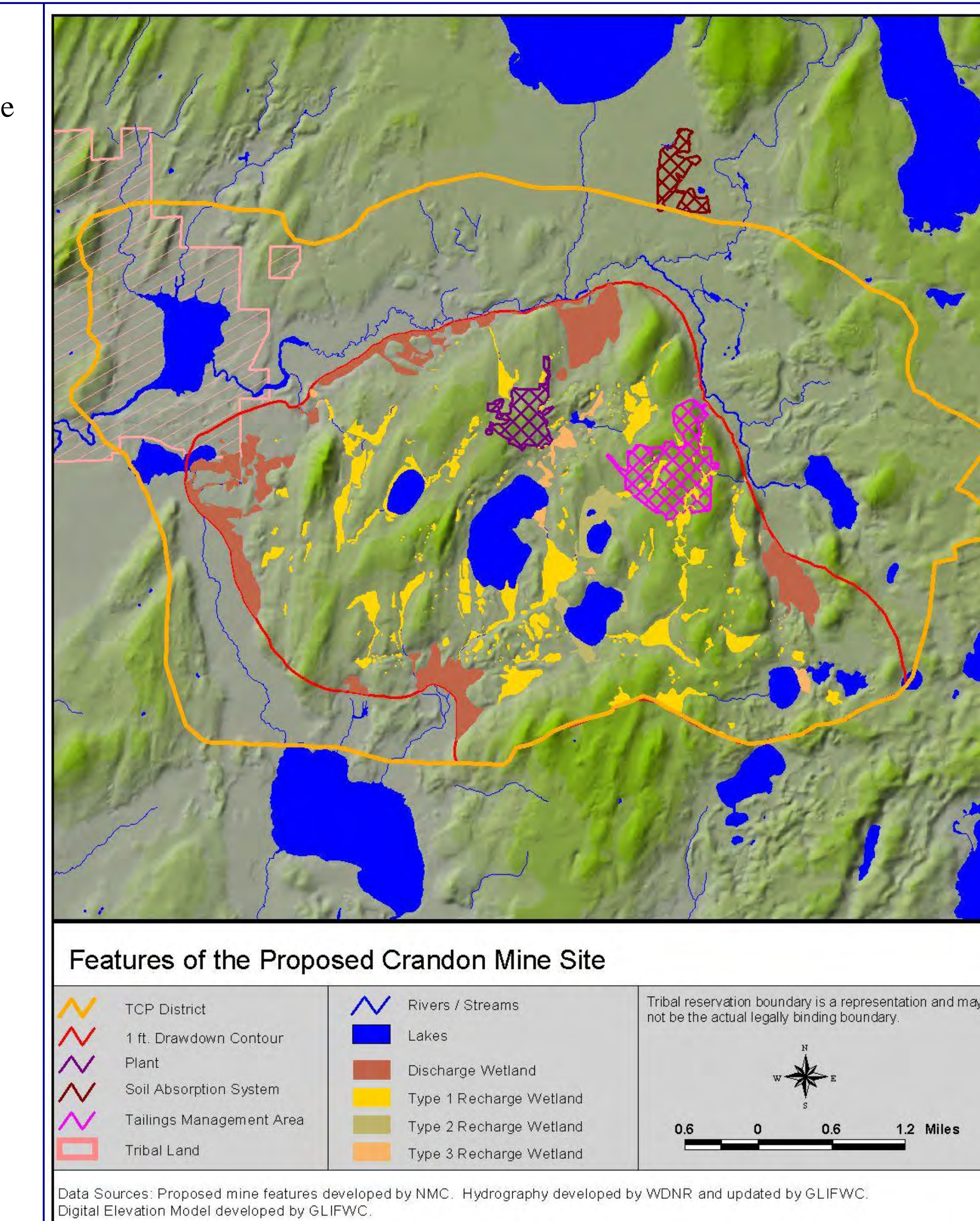
Construction Phase:

Area impacted at the 55 dB level: 3226.91 acres
% of TCP area impacted: 17.43%

Area impacted at the 50 dB level: 5017.64 acres
% of TCP area impacted: 27.11%

Area impacted at the 40 dB level: 11719.50 acres
% of TCP area impacted: 63.31%

Area impacted at the audible dB level: 15344 acres
% of TCP area impacted: 82.89%



Wetlands

There are 1545.43 acres of wetlands within the 1 foot groundwater drawdown contour. Mine related groundwater drawdown information is based on the WDNR/USGS groundwater model and a 1580 gallon per minute mine inflow rate.

TCP Wetland acreage within the 1 foot drawdown area: 1545.43 acres

% of 1 foot drawdown area that is wetland: 16.26%

Acres of Discharge wetland within the 1 foot drawdown area: 685.22 acres

% of TCP wetland area: 7.21%

Acres of Type 1 wetland within the 1 foot drawdown area: 703.28 acres

% of TCP wetland area: 7.40%

Acres of Type 2 wetland within the 1 foot drawdown area: 93.19 acres

% of TCP wetland area: 0.98%

Acres of Type 3 wetland within the 1 foot drawdown area: 63.74 acres

% of TCP wetland area: 0.67%

Figure 9: This map illustrates wetlands within the TCP that may be affected by mine related groundwater drawdown.