Metadata for the

# MnModel Phase 4

# MnModel Phase 4 Survey Implementation Model (SURVIMP4)

Developed by

# Minnesota Department of Transportation (MnDOT)

**These metadata were created using the [Minnesota Geographic Metadata Guidelines](#) .**

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**Section 1      Identification Information**

*Originator*     Minnesota Department of Transportation (MnDOT)

*Title*          MnModel Phase 4 Survey Implementation Model (2019)

*Abstract*       SURVIMP4 is an archaeological predictive model that predicts the locations of most types of prehistoric surface archaeological sites in Minnesota and also indicates the likelihood that environments have been adequately surveyed for sites.

*Purpose*        This predictive model was developed to assist MnDOT and agencies involved in cultural resource protection.   The use of predictive models is considered to be a good faith effort

in the implementation of Section 106 of the National Historic Preservation Act of 1966, as amended.

The site population used for modeling and model evaluation was last updated in 2018. Modeled sites include all surface prehistoric sites EXCEPT single artifacts and sites dependent on the locations of rock outcrops (rock art, rock shelters, quarries, etc.). 95 percent of the modeled sites fall into the high site potential areas.

Users must keep in mind that at five percent of modeled sites and an unknown percentage of historic sites, deeply buried sites, single artifacts, sites dependent on rock outcrops, and undiscovered sites will be found in the low and unknown site potential areas. Surveying only high site potential areas will minimize but not eliminate the chance of discovering sites during construction. Archaeologists must use professional judgement and supporting data to decide where else to survey.

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| *Time Period of Content Date* | 2018 (date of archaeological site database version used) |
| *Currentness Reference* | The model was developed from archaeological site data last updated in 2018 and survey data last updated in 2015. |
| *Progress* | Complete for Minnesota |
| *Maintenance and Update Frequency* | There are no plans for updating the model. However, it would be prudent to do so when a critical mass of new archaeological site data become available. |
| *Spatial Extent of Data* | Minnesota |
| *Bounding Coordinates* | -97.374<br>-89.259<br>49.463<br>43.310 |
| *Place Keywords* | Minnesota |
| *Theme Keywords* | MnModel, archaeological predictive model, archaeology, archaeological site distributions, archaeological surveys, Minnesota |
| *Theme Keyword Thesaurus* | None |

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| *Access Constraints* | Predictive models have the same access constraints as archaeological data. They may be made available only to professional archaeologists. |
| *Use Constraints* | The model is available to professional archaeologists via the [Office of the State Archaeologist (OSA) Portal](#). |
| *Contact Person Information* | OES GIS Support<br>Minnesota Department of Transportation (MnDOT)<br>MS 620<br>Transportation Building, 395 John Ireland Blvd.<br>St. Paul, MN 55155<br>E-mail: EnvironmentalDataManager.DOT@state.mn.us |
| *Browse Graphic File Name* | none available |
| *Browse Graphic File Description* | |
| *Associated Data Sets* | Archaeological databases (Office of the State Archaeologist and US Forest Service) |

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## Section 2    Data Quality Information - - - - - - [Go back to top](#)

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| *Attribute Accuracy* | For predictive models, accuracy is measured as the number of correct predictions (true positives plus true negatives) divided by the total sample. SURVIMP4 is a mosaic of twenty regional models. Accuracy of the site predictions is 0.99, and accuracy of the survey predictions is 0.93. |
| *Logical Consistency* | Data have been topologically structured and verified. |
| *Completeness* | Complete for Minnesota |
| *Horizontal Positional Accuracy* | Unknown. Input data source scales vary from 1:20,000 (gSSURGO) to 1:100,000 (DNR geomorphology) |
| *Vertical Positional Accuracy* | n/a |
| *Lineage* | Archaeological site and survey data were obtained from the Minnesota Office of the State Archaeologist, Minnesota State Historic Preservation Office, Chippewa National Forest, and Superior National Forest in 2015. Additional site data were acquired from OSA in 2018. These data were |

evaluated for suitability for modeling. Certain types of archaeological sites were excluded from the modeling database, including single artifacts, sites with only historic contexts, and sites dependent on rock outcrops (lithic workshops, quarries, rock art, rock shelters, etc.) for which we have no rock source data. Both sites and surveys were mapped as polygons.

To create the archaeological databases needed for statistical modeling, the site and survey polygons were converted to points. For sites, the points were the site centroids. Because surveys are much larger than sites, large survey polygons were first divided into sections no larger than 4,000,000 $m^2$. Sample points for surveys were the centroids of these sections.

Environmental variables were derived from terrain, soils, geomorphic, hydrographic, cost-path, and vegetation source data. Either mean or majority values of these variables were calculated for site and survey polygons and associated with the centroid points for those polygons.

The resulting databases (site or survey points with attached variable values) were modeled using a tree classification method (random forest) in R statistical software. The model predictions were converted to rasters in ArcGIS. The resultant floating point raster models were classified into high and low probability classes based on pre-determined decision rules. For the site models, the rule was that the threshold between high and low site potential had to capture 95% of the total site sample within the high probability cells (0.95 model sensitivity). This was accomplished while maintaining a very high (0.99) model specificity (portion of non-sites in the low probability area). For survey models, the decision rule was to maximize model specificity. The 'maximum accuracy' cutoff suggested by R produced models with an average specificity value of 0.99 while predicting 79% of surveyed points.

To create the Survey Implementation Model, the site models were combined with the survey models so that each cell can be identified as to its potential for site presence and the likelihood that places like it have been surveyed.

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| *Source Scale Denominator* | No better than 1:24,000 |

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### *Section 3* **Spatial Data Organization Information - - - - - - - [Go back to top](#)**

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| *Native Data Set Environment* | ArcMap 10.5.1 |
| *Geographic Reference for Tabular Data* | none |
| *Spatial Object Type* | Raster |
| *Vendor Specific Object Types* | ArcGIS GRID |
| *Tiling Scheme* | State |

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### *Section 4* **Spatial Reference Information - - - - - - [Go back to top](#)**

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| *Horizontal Coordinate Scheme* | UTM |
| *Ellipsoid* | GRS80 |
| *Horizontal Datum* | NAD83 |
| *Horizontal Units* | Meters |
| *Distance Resolution* | 30 m |
| *Cell Width* | 30 m |
| *Cell Height* | 30 m |
| *UTM Zone Number* | 15E |

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## Section 5    Entity and Attribute Information - - - - - - [Go back to top](#)

*Entity and Attribute Overview*

**Detailed Attribute Metadata Table**

*Entity and Attribute Detailed Citation*

Please consult the MnModel web site for further information about this model.

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## Section 6    Distribution Information - - - - - - [Go back to top](#)

*Publisher*

Minnesota Department of Transportation (MnDOT)

*Publication Date*

2019

*Contact Person Information*

OES GIS Support
Minnesota Department of Transportation (MnDOT)
MS 620
Transportation Building, 395 John Ireland Blvd.
St. Paul, MN 55155
E-mail: EnvironmentalDataManager.DOT@state.mn.us

*Distributor's Data Set Identifier*

SURVIMP4

*Distribution Liability*

to be determined by MnDOT

*Transfer Format Name*

ArcMap

*Transfer Format Version Number*

10.5.1

*Transfer Size*    59 MB (statewide raster)

*Ordering Instructions*

E-mail EnvironmentalDataManager.DOT@state.mn.us

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|---|---|
| *Online Linkage* | none available |

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## Section 7    Metadata Reference Information - - - - - - - **Go back to top**

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| *Metadata Date* | February 20, 2019 |
| *Contact Person Information* | OES GIS Support<br>Minnesota Department of Transportation (MnDOT)<br>MS 620<br>Transportation Building, 395 John Ireland Blvd.<br>St. Paul, MN 55155<br>E-mail: EnvironmentalDataManager.DOT@state.mn.us |
| *Metadata Standard Name* | Minnesota Geographic Metadata Guidelines |
| *Metadata Standard Version* | 1.1 |
| *Metadata Standard Online Linkage* | |

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**Detailed Attribute Metadata Table**

| Field Name | Type | Description | Valid Values |
|---|---|---|---|
| OBJECTID | Object ID | Unique record identifier | Any integer |
| VALUE | Long | Numeric code for vegetation type values | 1 = Unknown Site Potential/Poorly Surveyed<br>2 = Low Site Potential/Well Surveyed<br>3 = High Site Potential/Poorly Surveyed<br>6 = High Site Potential/Well Surveyed |
| COUNT | Double | Number of cells containing VALUE | |