User Guide
Piscataquog River Watershed Culvert Prioritization Model

Piscataquog River Watershed, New Hampshire
December 15, 2016

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User Guide
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Piscataquog River Watershed, New Hampshire
December 15, 2016

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1.0 INTRODUCTION

The Piscataquog River Watershed Culvert Prioritization Model is a spreadsheet and map screening tool for prioritizing the replacement of culverts based on the following data:

1. **GC** – How well a culvert matches the stream channel (i.e., geomorphic compatibility)
2. **STR** – Structural condition and approximate hydraulic capacity
3. **AOP** – Aquatic organism passage and habitat reconnection potential
4. **C** – How important the culvert is to the transportation network (i.e., criticality)

The model runs on the following existing data:

- **Data Level 1** – State and regional GIS data (e.g., road network lines, traffic count data, and proximity to public safety buildings)
- **Data Level 2** – Watershed and regional assessment data and GIS analysis (e.g., structure geomorphic assessment, approximate hydraulic capacity model, and amount of habitat reconnected if aquatic organism passage is restored)
- **Data Level 3** – Local data (e.g., poor condition culverts and highly critical culverts)

The model determines a risk (**R**) score based on the combination of GC, STR, and C. Structures are ranked by the risk score. For example, if GC, STR, and C are all scored as high, then R is high, and the priority level is 1 (highest).

The model is flexible and can still run properly if all culverts and future watersheds do not have field and local information (data level 3). The model will work with just level 1 (coarse) data. The model calculates a combined data level score based on data availability for each culvert. The data level score allows the user to know the scale and detail of the date used to score and prioritize each culvert. The data level score is used as a sub-rank where culverts with a given risk score are prioritized higher with a higher level of data.

The model is a Microsoft *Excel* spreadsheet called "Piscataquog Screen Development Final."

This user guide serves the following purposes.

- Defines the variables in each tab of the prioritization model spreadsheet
- Assists with interpretation of the model results
- Describes how to display the results
- Describes how to update data
- Describes how to add a new culvert
- Describes how to update the GIS results map

A project report that contains more details on the model development accompanies this document.

2.0 DATA DICTIONARY

Tab:	Town Results (Display)
Description:	Displays results of the prioritization model for the selected town. Results are sorted according to the current order in the "Watershed Results (Sort)" tab. Formatted for printing hard copy list on 11 x 17 inch paper.
Column Name	**Definition**
SADES_ID	Unique identifier developed by the New Hampshire Statewide Asset Data Exchange System to facilitate transportation asset data management. Used to link culvert data and screen results.
Town	Town the culvert is located in (see "Culvert Data" tab). Only user input on this tab is the Town dropdown menu in cell B1.
Road	Road the culvert carries (see "Culvert Data" tab).
Stream	Stream the culvert carries (see "Culvert Data" tab).
Owner	Owner of the culvert (NHDOT, municipal, or private) (see "Culvert Data" tab).
AOP	Qualitative AOP score, High, Moderate, or Low (see "AOP" tab).
GC	Qualitative GC score, High, Moderate, or Low (see "GC" tab).
STR	Qualitative STR score, High, Moderate, or Low (see "STR" tab).
C	Qualitative C score, High, Moderate, or Low (see "C" tab).
R	Qualitative R score, High, Moderate, or Low (see "R" tab).
Data Score	Qualitative Data score, High, Moderate, or Low (see "R" tab).
Risk Level	Risk level ranked 1 (highest risk) to 36 (lowest risk) as determined by the combination of screen results for the GC, STR, C variables and R score (see "R" tab).
Red Listed	Indicates if the culvert is a state "red listed bridge" (user input, see "Data Update" tab).
Town CIP	Indicates if the culvert is on the town capital improvements plan (user input, see "Data Update" tab).
10-year Road Plan	Indicates if the culvert is on the 10-year road plan (user input, see "Data Update" tab).
Structural Reinspection	Date of a culverts last structural reinspection (user input, see "Data Update" tab).
Replaced with	Indicates if the culvert was replaced with a bridge or new culvert (user input, see "Data Update" tab).
Replacement date	Date of a culverts replacement (user input, see "Data Update" tab).
Replacement cost	Cost of a culverts replacement (user input, see "Data Update" tab).
Local ID	Local identification code or number (user input, see "Data Update" tab).
Row Number	Hidden column. Used to display results.

Tab:	**Watershed Results (Sort)**
Description:	Displays results of the prioritization model for the entire watershed data set. Only user action on this tab is to sort results. Button in the top left corner will re-sort results by Risk Level and Data Level.
Column Name	**Definition**
SADES_ID	Unique identifier developed by the New Hampshire Statewide Asset Data Exchange System to facilitate transportation asset data management. Used to link culvert data and screen results.
Town	Town the culvert is located in (see "Culvert Data" tab).
Road	Road the culvert carries (see "Culvert Data" tab).
Stream	Stream the culvert carries (see "Culvert Data" tab).
Owner	Owner of the culvert (NHDOT, municipal, or private) (see "Culvert Data" tab).
Latitude	Latitude of the culvert in decimal degrees (NAD83) (see "Culvert Data" tab).
Longitude	Longitude of the culvert in decimal degrees (NAD83) (see "Culvert Data" tab).
AOP	Qualitative AOP score, High, Moderate, or Low (see "AOP" tab).
AOP_DataL	Indicates if AOP data for this culvert is level 1, level 2, or level 3 (see "AOP" tab).
GC	Qualitative GC score, High, Moderate, or Low (see "GC" tab).
GC_DataL	Indicates if GC data for this culvert is level 1, level 2, or level 3 (see "GC" tab).
STR	Qualitative STR score, High, Moderate, or Low (see "STR" tab).
STR_DataL	Indicates if STR data for this culvert is level 1, level 2, or level 3 (see "STR" tab).
C	Qualitative C score, High, Moderate, or Low (see "C" tab).
C_DataL	Indicates if C data for this culvert is level 1, level 2, or level 3 (see "C" tab).
R	Qualitative R score, High, Moderate, or Low (see "R" tab).
DATA_LEVEL	Combined data level. Used to assign data level score by summing the data levels of GC, STR, and C.
DL_SCORE	Qualitative Data score, High, Moderate, or Low (see "R" tab).
Risk Level	Risk level ranked 1 (highest risk) to 36 (lowest risk) as determined by the combination of screen results for the GC, STR, C variables and R score.
Red Listed	Indicates if the culvert is a state "red listed bridge" (user input, see "Data Update" tab).
Disruptive Detour	Indicates if a culverts closure would result in a disruptive detour (user input, see "Data Update" tab).
Town CIP	Indicates if the culvert is on the town capital improvements plan (user input, see "Data Update tab).

10-year Road Plan	Indicates if the culvert is on the 10-year road plan (user input, see "Data Update" tab).
Replaced With:	Date of a culverts last structural reinspection (user input, see "Data Update" tab).
Replacement Date	Indicates if the culvert was replaced with a bridge or new culvert (user input, see "Data Update" tab).
Replacement Cost	Date of a culverts replacement (user input, see "Data Update" tab).
Structural Reinspection	Cost of a culverts replacement (user input, see "Data Update" tab).
Initial Assessment	Date of initial culvert assessment (see "Culvert Data" tab).
Local ID	Local identification code or number (user input, see "Data Update" tab).
Row Number	Hidden column. Used to display results.

Tab:	**Data Update**
Description:	This tab allows the user to update data for culverts already included in the model. The model will automatically calculate and update results based on data input in this tab.
Column Name	**Definition**
Select Culvert by SADES ID	Unique identifier developed by the New Hampshire Statewide Asset Data Exchange System to facilitate transportation asset data management. Used to link culvert data and screen results. Select existing SADES ID in dropdown list.
Town	Town the culvert is located in (see "Culvert Data" tab).
Structure replaced with new culvert	Select "Bridge" or "Culvert" from drop down menu if a culvert is replaced.
Hydraulic Width	Input the hydraulic width of a new culvert in feet to update screen (user input).
Condition	Select updated condition rating from drop down menu for a reinspected culvert to update screen (user input).
AADT	Input updated Average Annual Daily Traffic in trips to update screen (user input).
Criticality	Select criticality rating from drop down menu to update screen (user input).
STR Data Updated	Hidden column. Indicates if STR data has been updated by user.
C Data Updated	Hidden column. Indicates if C data has been updated by user.
Date Replaced	Input date of a culvert replacement (user input).
Replacement Cost	Input cost of a culvert replacement (user input).

Structural Reinspection Date	Input date of a culvert structural reinspection (user input).
Town CIP	Select "Yes" or "No" from drop down menu to display in results summary tabs (user input).
10 Year Road Plan	Select "Yes" or "No" from drop down menu to display in results summary tabs (user input).
Red Listed	Select "Yes" or "No" from drop down menu to display in results summary tabs (user input).

Tab:	**GC**
Description:	Calculates score and data level for the geomorphic compatibility (GC) variable.
Column Name	**Definition**
SADES_ID	Unique identifier developed by the New Hampshire Statewide Asset Data Exchange System to facilitate transportation asset data management. Used to link culvert data and screen results.
% Bankfull Width	The percentage of the bankfull width of the stream spanned by the culvert (see "Culvert Data" tab).
LEVEL 1 SCREEN	Qualitative results of the level 1 screen, High, Moderate, or Low.
GeomorphCompat	Qualitative results of the Geomorphic Compatibility Screen (see "Culvert Data" tab).
LEVEL 2 SCREEN	Qualitative results of the level 2 screen, High, Moderate, or Low.
Screen Final	Qualitative Results of the highest data level screen available.
DATA LEVEL	Indicates the highest data level available for GC, no data (0), level 1, or level 2.

Tab:	**STR**
Description:	Calculates score and data level for the structural condition / approximate hydraulic capacity variable (STR).
Column Name	**Definition**
SADES_ID	Unique identifier developed by the New Hampshire Statewide Asset Data Exchange System to facilitate transportation asset data management. Used to link culvert data and screen results.
Condition	Structural condition of the culvert rated as either new, old, rusted, collapsing or eroding (see "Culvert Data" tab).
LEVEL 1 SCREEN	Qualitative results of the level 1 screen, High, Moderate, or Low.

Prec100yrc_PTF	Results of the approximate hydraulic capacity (AHC) analysis for the 100-year flood, rated as P (pass), T (transitional), or F (fail) (see "Hydraulic Data" tab).
Prec50yrco_PTF	Results of the approximate hydraulic capacity (AHC) analysis for the 50-year flood, rated as P (pass), T (transitional), or F (fail) (see "Hydraulic Data" tab).
Prec25yrco_PTF	Results of the approximate hydraulic capacity (AHC) analysis for the 25-year flood, rated as P (pass), T (transitional), or F (fail) (see "Hydraulic Data" tab).
Prec10yrco_PTF	Results of the approximate hydraulic capacity (AHC) analysis for the 10-year flood, rated as P (pass), T (transitional), or F (fail) (see "Hydraulic Data" tab).
Prec_2yr_PTF	Results of the approximate hydraulic capacity (AHC) analysis for the 2-year flood, rated as P (pass), T (transitional), or F (fail) (see "Hydraulic Data" tab).
100yrScore	Numerical score based on structural condition and AHC for the 100-year flood.
50yrScore	Numerical score based on structural condition and AHC for the 50-year flood.
25yrScore	Numerical score based on structural condition and AHC for the 25-year flood.
10yrScore	Numerical score based on structural condition and AHC for the 10-year flood.
2yrScore	Numerical score based on structural condition and AHC for the 2-year flood.
HYDRAULICS SCORE	Qualitative score based on combined numerical score for all AHC recurrence intervals.
LEVEL 2 SCREEN	Qualitative results of the level 2 screen, High, Moderate, or Low.
LOCAL INPUT	Local structural condition information from pilot towns.
LOCAL INPUT FROM DATA UPDATE	Local structural condition information input by user (see "Data Update" tab).
Red Listed	Indicates if the culvert is a state "red listed bridge" (see "Data Update" tab).
LEVEL 3 SCREEN	Qualitative results of the level 3 screen, High, Moderate, or Low.
DATA LEVEL	Indicates the highest data level available for GC, no data (0), level 1, or level 2.
SCREEN FINAL	Qualitative Results of the highest data level screen available.

Tab:	**AOP**
Description:	Calculates score and data level for the aquatic organism variable (AOP).
Column Name	**Definition**
SADES_ID	Unique identifier developed by the New Hampshire Statewide Asset Data Exchange System to facilitate transportation asset data management. Used to link culvert data and screen results.
AOP Compatibility Ranking	Qualitative results of the Aquatic Organism Passage Compatibility Screen (see "Culvert Data" tab).
LEVEL 1 SCREEN	Qualitative results of the level 1 screen, High, Moderate, or Low.
Upstream Functional Network	Length (miles) of potential upstream habitat gain if the culvert is replaced and becomes passable to aquatic organisms (see "BAT Data" tab).
Functional Network Score	Numerical score based on potential upstream habitat gain.
Level 2 Screen	Qualitative results of the level 2 screen, High, Moderate, or Low.
Habitat Priority Rank	Habitat priority rank for the Piscataquog River watershed provided by NH Fish and Game Department.
HABITAT SCREEN (Habitat Rank 1)	Level 3 screen results for culverts in habitat rank 1.
HABITAT SCREEN (Habitat Rank 2)	Level 3 screen results for culverts in habitat rank 2.
HABITAT SCREEN (Habitat Rank 3)	Level 3 screen results for culverts in habitat rank 3.
HABITAT SCREEN (Habitat Rank 4)	Level 3 screen results for culverts in habitat rank 4.
LEVEL 3 SCREEN	Qualitative results of the level 3 screen, High, Moderate, or Low.
DATA LEVEL	Indicates the highest data level available for GC, no data (0), level 1, or level 2.
SCREEN FINAL	Qualitative Results of the highest data level screen available.

Tab:	**C**
Description:	Calculates score and data level for the criticality variable (C).
Column Name	**Definition**
SADES_ID	Unique identifier developed by the New Hampshire Statewide Asset Data Exchange System to facilitate transportation asset data management. Used to link culvert data and screen results.
Highway Tier	NHDOT Highway Tier (See "GIS Data" tab).
FUNCT_SYST	NHDOT Functional System (See "GIS Data" tab).
LEVEL 1 SCREEN	Qualitative results of the level 1 screen, High, Moderate, or Low.
PublicSafetyHalfMile	Indicates if the culvert is within a half mile of a public safety structure (see "GIS Data" tab).
PublicSafetyHalfMileto1Mile	Indicates if the culvert is between a half mile and one mile from a public safety structure (see "GIS Data" tab).
LEVEL 1 SCREEN (PS1)	Qualitative results of the level 1 screen with proximity to public safety included, High, Moderate, or Low.
AADT	Average annual daily traffic in trips (see "GIS Data" tab).
AADT SCORE	Qualitative score based on AADT, High, Moderate or Low.
LEVEL 2 SCREEN	Qualitative results of the level 2 screen, High, Moderate, or Low.
LOCAL INPUT	Local criticality information from pilot towns.
LOCAL INPUT FROM DATA UPDATE	Local criticality information input by user (see "Data Update" tab).
LEVEL 3 SCREEN	Qualitative results of the level 3 screen, High, Moderate, or Low.
DATA LEVEL	Indicates the highest data level available for GC, no data (0), level 1, or level 2.
SCREEN FINAL	Qualitative Results of the highest data level screen available.
Disruptive Detour	Hidden column. Indicates if closing a culvert would results in a disruptive detour.

Tab:	**R**
Description:	Calculates score and data level for the risk variable (R).
Column Name	**Definition**
SADES_ID	Unique identifier developed by the New Hampshire Statewide Asset Data Exchange System to facilitate transportation asset data management. Used to link culvert data and screen results.
GC	Qualitative results of the highest data level screen available for the GC variable.
STR	Qualitative results of the highest data level screen available for the STR variable.

C	Qualitative results of the highest data level screen available for the C variable.
R (LOW)	Indicates if the culvert is R score is "Low".
R (MODERATE)	Indicates if the culvert is R score is "Moderate".
R (HIGH)	Indicates if the culvert is R score is "High".
R	Qualitative R score, High, Moderate, or Low.
Risk Level	Risk level ranked 1 (highest risk) to 36 (lowest risk) as determined by the combination of screen results for the GC, STR, C variables and R score.
GC DATA LEVEL	Indicates the highest data level available for GC, no data (0), level 1, or level 2 (see "GC" tab).
STR DATA LEVEL	Indicates the highest data level available for GC, no data (0), level 1, level 2 or level 3 (see "STR" tab).
C DATA LEVEL	Indicates the highest data level available for GC, no data (0), level 1, level 2 or level 3 (see "C" tab).
DATA LEVEL SUM	Combined data level. Used to assign data level score by summing the data levels of GC, STR, and C.
DATA LEVEL SCORE	Qualitative Data score, High, Moderate, or Low.

Tab:	**GIS Export Table**
Description:	Organizes results for export to a table used to generate GIS maps.
Column Name	**Definition**
SADES_ID	Unique identifier developed by the New Hampshire Statewide Asset Data Exchange System to facilitate transportation asset data management. Used to link culvert data and screen results.
Town	Town the culvert is located in (see "Culvert Data" tab).
Road	Road the culvert carries (see "Culvert Data" tab).
Stream	Stream the culvert carries (see "Culvert Data" tab).
Latitude	Latitude of the culvert in decimal degrees (NAD83) (see "Culvert Data" tab).
Longitude	Longitude of the culvert in decimal degrees (NAD83) (see "Culvert Data" tab).
AOP	Qualitative AOP score, High, Moderate, or Low (see "AOP" tab).
GC	Qualitative GC score, High, Moderate, or Low (see "GC" tab).
STR	Qualitative STR score, High, Moderate, or Low (see "STR" tab).
C	Qualitative C score, High, Moderate, or Low (see "C" tab).
R	Qualitative R score, High, Moderate, or Low (see "R" tab).
DL_SCORE	Qualitative Data score, High, Moderate, or Low (see "R" tab).

Tab:	**Results Stats**
Description:	Displays distribution data of GC, STR, C, AOP, and R screen result and data level in the Piscataquog River Watershed and for all of the towns used to develop local results for the final report. This tab also contains the distribution of the risk levels for each town. These data are used to create the plots in the "Pilot Plots" and "Town Plots" tabs.
Column Name	**Definition**
Score	Qualitative variable score of High, Moderate, or Low.
Totals	The number of times the adjacent score took place for the listed variable in the listed town or watershed.
Data Level	Qualitative data level score of High, Moderate, or Low.
Priority Level	The risk or priority level that range from 1 (highest risk/priority) to 36 (lowest risk/priority).

Tab:	**Pilot Plots**
Description:	Displays distribution plots of GC, STR, C, AOP, and R screen result and data level in the Piscataquog River Watershed and the three pilot towns used to develop the screen. The sheet is formatted for color printing on 11 x 17 inch paper.
Column Name	**Definition**
n/a	n/a

Tab:	**Pilot List**
Description:	Displays 50 highest priority culverts in the Piscataquog River Watershed, and the 15 highest priority culverts in each of the three pilot towns. The sheet is formatted for printing on 11 x 17 inch paper.
Column Name	**Definition**
SADES_ID	Unique identifier developed by the New Hampshire Statewide Asset Data Exchange System to facilitate transportation asset data management. Used to link culvert data and screen results.
Town	Town the culvert is located in (see "Culvert Data" tab).
Road	Road the culvert carries (see "Culvert Data" tab).
Stream	Stream the culvert carries (see "Culvert Data" tab).
Risk Level	Risk level ranked 1 (highest risk) to 36 (lowest risk) as determined by the combination of screen results for the GC, STR, C variables and R score.

Tab:	**Town Plots**
Description:	Displays distribution plots of R, priority, GC, STR, C, and AOP for each town in the watershed. The sheet is formatted for color printing on 11 x 17 inch paper.
Column Name	**Definition**
n/a	n/a

Tab:	**Culvert Data**
Description:	Data from by field assessments.
Column Name	**Definition**
SADES_ID	Unique identifier developed by the New Hampshire Statewide Asset Data Exchange System to facilitate transportation asset data management. Used to link culvert data and screen results.
TU_ID	Unique identifier used by Trout Unlimited culvert assessments.
CrossingCondition	Structural condition of the culvert. (Source: NHDES/TU)
GeomorphCompat	Results of the NH Geomorphic Compatibility Screen. (Source: NHDES/TU)
AOP Compatibility Ranking	Results of the NH Aquatic Organism Passage Compatibility Screen. (Source: NHDES/TU)
TOWN	Town the culvert is located in. (Source: NHDES/TU)
STREAMNAME	Stream the culvert carries. (Source: NHDES/TU)
LocalRoadName	Local name of the road the culvert carries. (Source: NHDES/TU)
DownstreamDimensionsWIDTH	Hydraulic width of the culvert at the downstream end. (Source: NHDES/TU)
Ave Bankfull Width	Average bankfull width calculated using measurements upstream and downstream of the culvert when available. (Source: NHDES/TU)
LONGITUDE	Longitude of the culvert in decimal degrees (NAD83). (Source: NHDES/TU)
LATITUDE	Latitude of the culvert in decimal degrees (NAD83). (Source: NHDES/TU)
Location	Additional location information for the culvert. (Source: NHDES/TU)
% of Ave BF Width	DownstreamDimensionsWIDTH / Ave Bankfull Width as a percentage. Calculate in workbook
Jurisdiction	Owner of the culvert (NHDOT, municipal, or private). (SOURCE: NHDES/TU)
AssessmentDate	Date of initial assessment for data collection. (Source: NHDES/TU)
Local ID	Unique identifier used by local municipalities (Source: Towns)

Tab:	**Updated Culvert Data**
Description:	Data input by user in "Data Update" tab.
Column Name	**Definition**
SADES ID	Unique identifier developed by the New Hampshire Statewide Asset Data Exchange System to facilitate transportation asset data management. Used to link culvert data and screen results.
New Culvert	Indicates if the culvert has been replaced with a new culvert (see "Data Update" tab).
Replaced with Bridge	Indicates if the culvert has been replaced with a bridge (see "Data Update" tab).
Width Input	Updated hydraulic width in feet (see "Data Update" tab).
Condition Input	Updated structural condition information as input by user (see "Data Update" tab).
AADT Input	Updated AADT in trips (see "Data Update" tab).
Criticality Input	Updated criticality rating as input by user (see "Data Update" tab).
Structural Reinspection	Date of most recent structural reinspection (see "Data Update" tab).
Updated % BFW	Updated percentage of the bankfull width of the stream spanned by the culvert, calculated from "Width Input" and "% of Ave BF Width" (see "Culvert Data" tab).
Updated Condition	Updated structural condition sorted from user input. Replaces "CrossingCondition" in screen (see "Culvert Data" tab).
Updated Local Input STR	Updated local structural condition information sorted from user input. Replaces "Local Input" in screen (see "STR" tab).
Updated Local Input C	Updated local criticality information sorted from user input. Replaces "Local Input" in screen (see "C" tab).
C Override	Overrides screen criticality results based on user input (see "C" tab).
Date Replaced	Date of culvert replacement (see "Data Update" tab).
STR Data Updated	Indicates if STR data has been updated by user (see "Data Update" tab).
C Data Updated	Indicates if C data has been updated by user (see "Data Update" tab).
Replacement Cost	Cost of culvert replacement (see "Data Update" tab).
Town CIP	Indicates if the culvert is on the town capital improvements plan (user input, see "Data Update" tab).
10 Year Road Plan	Indicates if the culvert is on the 10-year road plan (user input, see "Data Update" tab).
Red Listed	Indicates if the culvert is a state "red listed bridge" (see "Data Update" tab).

Tab:	Hydraulic Data
Description:	Data from 2014 Piscataquog River Watershed Stream Crossing Vulnerability Assessment Project prepared by TU and SNHPC.
Column Name	Definition
SADES ID	Unique identifier developed by the New Hampshire Statewide Asset Data Exchange System to facilitate transportation asset data management. Used to link culvert data and screen results. (Source: SNHPC/TU)
Prec100yrc	Results of the approximate hydraulic capacity (AHC) analysis for the 100-year flood, rated as 1 (pass), 2 (transitional), or 3 (fail). (Source: SNHPC/TU)
Prec50yrco	Results of the approximate hydraulic capacity (AHC) analysis for the 50-year flood, rated as 1 (pass), 2 (transitional), or 3 (fail). (Source: SNHPC/TU)
Prec25yrco	Results of the approximate hydraulic capacity (AHC) analysis for the 25-year flood, rated as 1 (pass), 2 (transitional), or 3 (fail). (Source: SNHPC/TU)
Prec10yrco	Results of the approximate hydraulic capacity (AHC) analysis for the 10-year flood, rated as 1 (pass), 2 (transitional), or 3 (fail). (Source: SNHPC/TU)
Prec_2yr	Results of the approximate hydraulic capacity (AHC) analysis for the 2-year flood, rated as 1 (pass), 2 (transitional), or 3 (fail). (Source: SNHPC/TU)
Prec100yrc_PTF	Results of the approximate hydraulic capacity (AHC) analysis for the 100-year flood, rated as P (pass), T (transitional), or F (fail). (Source: SNHPC/TU)
Prec50yrco_PTF	Results of the approximate hydraulic capacity (AHC) analysis for the 50-year flood, rated as P (pass), T (transitional), or F (fail). (Source: SNHPC/TU)
Prec25yrco_PTF	Results of the approximate hydraulic capacity (AHC) analysis for the 25-year flood, rated as P (pass), T (transitional), or F (fail). (Source: SNHPC/TU)
Prec10yrco_PTF	Results of the approximate hydraulic capacity (AHC) analysis for the 10-year flood, rated as P (pass), T (transitional), or F (fail). (Source: SNHPC/TU)
Prec_2yr_PTF	Results of the approximate hydraulic capacity (AHC) analysis for the 100-year flood, rated as P (pass), T (transitional), or F (fail). (Source: SNHPC/TU)
TU ID	Unique identifier used by Trout Unlimited culvert assessments.

Tab:	**GIS Data**
Description:	Data from GIS analysis.
Column Name	**Definition**
SADES ID	Unique identifier developed by the New Hampshire Statewide Asset Data Exchange System to facilitate transportation asset data management. Used to link culvert data and screen results.
TIER_DESCR	Descriptive title of NHDOT Highway Tier of road carried by culvert. (Source: NHDOT)
TIER	Numerical NHDOT Highway Tier of road carried by culvert. (Source: NHDOT)
HabScore	Habitat ranking of stream carried by the culvert. (Source: NHFG)
PublicSafetyHalf Mile	Indicates if the culvert is within a half mile of a public safety structure. (Source: NHDOT/MMI)
AADT	Average annual daily traffic of road carried by culvert in trips. (Source: NHDOT)
PublicSafetyHalf Mileto1Mile	Indicates if the culvert is between a half mile and one mile from a public safety structure. (Source: NHDOT/MMI)
FUNCT_SYST	NHDOT Functional System of road carried by culvert. (Source: NHDOT)
TU_ID	Unique identifier used by Trout Unlimited culvert assessments. (Source: NHDES/TU)

Tab:	**BAT Data**
Description:	Data from Barrier Analysis Tool (BAT).
Column Name	**Definition**
SADES ID	Unique identifier developed by the New Hampshire Statewide Asset Data Exchange System to facilitate transportation asset data management. Used to link culvert data and screen results.
FuncUS_miles	Length (miles) of potential upstream habitat gain if the culvert is passable to aquatic organisms. (Source: BAT analysis conducted by MMI)
TU ID	Unique identifier used by Trout Unlimited culvert assessments. (Source: NHDES/TU)

3.0 INTERPRETING RESULTS

Each assessed culvert is shown as a "pie icon" on a town or watershed map that summarizes the screen score (Figure 1). The outer ring of the icon displays the overall risk score. Red indicates a high risk, orange a moderate risk, and blue a low risk. The four inner quadrants display the individual variable scores, following the same color convention. A red, or high, score indicates a high priority for replacement while a blue, or low, score indicates a low priority. Each assessed culvert is also labelled with its SADES ID and Data Level Score. The SADES ID is the link between results on a map, results on a list, prioritization model data, and state infrastructure tracking.

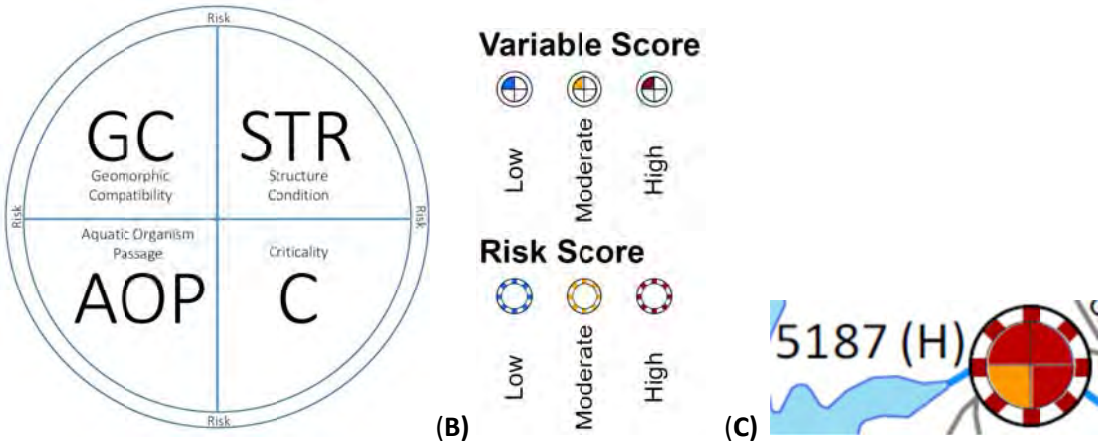

Figure 1: Definitions of the results icon (A), possible variable and risk scores (B), and a sample result icon showing a high-risk culvert where GC, STR, and C are all high while AOP is moderate (C).

As an example, a user identifies a culvert of interest on the map such as SADES IS 5187. The map tells the user the risk is high and that GC, STR, and C are high. AOP is moderate. The results can be considered reliable given that the data level is high. This culvert may be a candidate for replacement because it does not match the stream channel, has some structural problems, and is important to a properly functioning road network. Using the SADES ID, the user finds the culvert in either the "Town Results (Display)" or "Watershed Results (Sort)" tabs and sees that the risk level is the highest in the model (Level 1). Given that this is a screening tool, the user should visit the site with the screening data in hand to confirm the results. If the data are verified, design and implementation should follow. If the data are found to be out of date or incorrect, the data should be updated as outlined in Section 5.

Another potential use of this screening tool is if a user has funding for a culvert replacement as part of habitat restoration initiative. Having identified several culverts with poor (red) AOP scores but hoping to maximize the benefits of the project by replacing a high-risk culvert as well, there are several options for identifying potential culverts. The user can either select culverts visually based on information displayed on the town map or can sort results in the "Watershed Results (Sort)" tab by town, AOP, and R. This will list the results so that culverts located in the town of interest, with high AOP, and among those ranked high risk are shown at the top of the list. The model allows for quick sorting to identify projects with several co-benefits.

4.0 LISTING RESULTS

In addition to the map icons summarizing results, findings of the model can be summarized in lists for the entire watershed and by town. Summarized results for each town can be found in the "Town Results (Display)" tab. A town is selected from the drop down menu, and every assessed culvert in the database for that town will be listed and displayed as ordered in the "Watershed Results (Sort)" tab. Note that "Town Results (Display)" tab cannot be sorted directly.

The full watershed list is found in the "Watershed Results (Sort)" tab. This tab can be sorted by one or more variables (columns).

Calculations for each of the variables (GC, STR, C, and AOP) as well as risk and data level can be found in the relevant calculations tabs in the prioritization model. This information will not likely be accessed by the typical user.

5.0 UPDATING CULVERT DATA

If a culvert is replaced or reassessed, data may be updated using the "Data Update" tab. This information will then be included in future map and list updates. Select the structure by its SADES ID and input the updated data in the appropriate column. The screen will automatically replace the original data with the updated data. Users may indicate if a culvert is replaced with a new culvert or a new bridge. If a culvert is replaced with a bridge, it will no longer be screened.

Users may update the hydraulic width of a culvert, structural condition, and average annual daily traffic count. Structural condition can be scored in the following manner:

- New
- Rusted
- Collapsing
- Eroding
- Poor condition (locally identified)
- Known cause of flooding (locally identified)
- Frequently damaged (locally identified)
- Red listed (locally identified)

Criticality may be updated with the following options:

- Critical link
- Critical structure in floodprone area
- Near infrastructure
- High local traffic volume
- Neighborhood or town center
- Disruptive (long) detour
- High
- Moderate
- Low

Users may also add a replacement date, cost, and structural inspection date and/or indicate if the culvert is included in the town capital improvement plan or 10-year road plan or if it is a red-listed structure by the State of New Hampshire.

Once culvert data are updated, the list can be resorted in the "Watershed Results (Sort)" tab, and the new risk level will be reflected in a new priority list.

6.0 ADDING NEW CULVERTS

Culverts not included in the screen may be added once data become available. Up to 500 culverts can be included in the screen. In the "Culvert Data" tab, enter the new culverts SADES ID in the first column. The SADES ID allows the screen to compute and display results. The minimum data needed to screen a culvert is a SADES ID, structural condition (New, Old, Rusted, Collapsing, or Eroding), and criticality. To designate a criticality level to a newly added structure, use the "Data Update" tab.

7.0 UPDATING THE RESULTS MAPS

Results GIS maps (*ArcGIS* version 10.2) are updated using the following procedure using the provided GIS map.

1. Save the "GIS Export Table" tab in the screen as a Text (Tab Delimited) file.
2. In *ArcGIS*, "Join" the text table to the "ScreenResults" shapefile. Base the join on the SADES ID field for both the shapefile and text table. Choose the "Keep all records" option.
3. Once the text table is joined, use the Field Calculator to transfer the updated results from the text table to the shapefile. This step eliminates possible data errors associated with the join function during future map use.
4. Remove the join. Results will now be displayed based on the updated data.
5. Export the map to print and share the information. The map is formatted on 24x36-inch paper and needs to be printed in color.

The "pie icon" in the GIS map was created using a script in the "label expression" window. The labelling script that is contained in the GIS map templates follows.

```
Function FindLabel ( [GC] , [STR] , [AOP] , [C] )
Dim strInput

strInput=""

if  [GC] = "LOW" then
strInput =strInput & "<BOL>" & "<FNT name='ESRI IGL Font22'>" & "<CLR cyan='100' magenta='50'
yellow='0' black='0'>" &  "z"  & "</CLR>" & "</FNT>" & "</BOL>"
end if
if  [GC] = "MODERATE" then
strInput =strInput & "<BOL>" &  "<FNT name='ESRI IGL Font22'>" & "<CLR cyan='0' magenta='40'
yellow='100' black='0'>" &  "z"  & "</CLR>" & "</FNT>" & "</BOL>"
end if
if  [GC] = "HIGH" then
strInput =strInput & "<BOL>" &  "<FNT name='ESRI IGL Font22'>" & "<CLR cyan='25' magenta='100'
yellow='100' black='0'>" &  "z"  & "</CLR>" & "</FNT>" & "</BOL>"
end if
if  [STR]  = "LOW" then
strInput =strInput & "<BOL>" &  "<FNT name='ESRI IGL Font22'>" & "<CLR cyan='100' magenta='50'
yellow='0' black='0'>" &  "}"  & "</CLR>" & "</FNT>" & "</BOL>"
end if
if  [STR] = "MODERATE" then
strInput =strInput & "<BOL>" &  "<FNT name='ESRI IGL Font22'>" & "<CLR cyan='0' magenta='40'
yellow='100' black='0'>" &  "}"  & "</CLR>" & "</FNT>" & "</BOL>"
end if
if  [STR] = "HIGH" then
strInput =strInput & "<BOL>" &  "<FNT name='ESRI IGL Font22'>" & "<CLR cyan='25' magenta='100'
yellow='100' black='0'>" &  "}"  & "</CLR>" & "</FNT>" & "</BOL>"
end if
```

```
if  [AOP]  = "LOW" then
strInput =strInput & vbnewline & "<BOL>" &  "<FNT name='ESRI IGL Font22'>" & "<CLR cyan='100'
magenta='50' yellow='0' black='0'>" &  "{"  & "</CLR>" & "</FNT>" & "</BOL>"
end if
if  [AOP] = "MODERATE" then
strInput =strInput & vbnewline & "<BOL>" &  "<FNT name='ESRI IGL Font22'>" & "<CLR cyan='0'
magenta='40' yellow='100' black='0'>" &  "{"  & "</CLR>" & "</FNT>" & "</BOL>"
end if
if  [AOP] = "HIGH" then
strInput =strInput & vbnewline & "<BOL>" &  "<FNT name='ESRI IGL Font22'>" & "<CLR cyan='25'
magenta='100' yellow='100' black='0'>" &  "{"  & "</CLR>" & "</FNT>" & "</BOL>"
end if
if  [C]  = "LOW" then
strInput =strInput & "<BOL>" &   "<FNT name='ESRI IGL Font22'>" & "<CLR cyan='100' magenta='50'
yellow='0' black='0'>" &  "|"  & "</CLR>" & "</FNT>" & "</BOL>"
end if
if  [C] = "MODERATE" then
strInput =strInput & "<BOL>" &  "<FNT name='ESRI IGL Font22'>" & "<CLR cyan='0' magenta='40'
yellow='100' black='0'>" &  "|"  & "</CLR>" & "</FNT>" & "</BOL>"
end if
if  [C] = "HIGH" then
strInput =strInput & "<BOL>" &  "<FNT name='ESRI IGL Font22'>" & "<CLR cyan='25' magenta='100'
yellow='100' black='0'>" &  "|"  & "</CLR>" & "</FNT>" & "</BOL>"
end if

strInput =strInput & "<BOL>" &  "<FNT name='ESRI IGL Font22'>" & "<CLR cyan='0' magenta='0'
yellow='0' black='100'>" &  "]"  & "</CLR>" & "</FNT>" & "</BOL>"

FindLabel = strInput

End Function
```