

PNNL-21048



U.S. DEPARTMENT OF
ENERGY

PNNL River Habitat Model User Guide

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January 2012



Pacific Northwest
NATIONAL LABORATORY

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PACIFIC NORTHWEST NATIONAL LABORATORY
operated by
BATTELLE
for the
UNITED STATES DEPARTMENT OF ENERGY
under Contract DE-AC05-76RL01830

Printed in the United States of America

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(9/2003)

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Prepared for the U.S. Department of Energy
under Contract DE-AC05-76RL01830

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Executive Summary

This model was developed by Tim Hanrahan at Pacific Northwest National Laboratory (PNNL) to automate geoprocessing routines aimed at identifying suitable shallow water habitat (SWH) for Pallid Sturgeon in the Missouri River. The model uses the U.S. Fish and Wildlife Service definition of SWH, which is water depth less than 5.0 ft and water velocity less than 2.0 ft/sec.

The PNNL River Habitat Model was developed for use in ESRI ArcMap 9.3. It may not be compatible with previous versions of ArcMap. The ESRI "3D Analyst" & "Spatial Analyst" extensions must be installed and enabled on your machine.

For additional information please contact:

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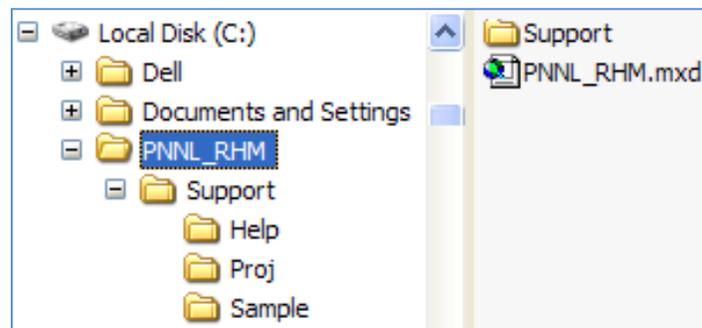
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1.0 Installation

An installation wizard is provided to help users install the model and supporting files.

Initial Installation:

1. Launch the Setup.exe program
2. Select an install location (we recommend "C:\" but a network location will also work)
3. Verify the installation by reviewing your install folder. It should contain an .mxd file and a Support directory



4. Open PNNL_RHM.mxd using ArcMap 9.3
5. Make sure 3D-Analyst and Spatial Analyst extensions are installed and enabled.
6. Click "Run Model" button in the PNNL menu to launch the model
7. Check "Load Default Settings" check box in lower right corner to execute the model using the sample data
8. The model should execute in about 30 seconds and pop-up an html report at the end in Internet Explorer

Installing Updates:

If updates are issued, the user should save the new .exe and .msi files and overwrite the previous versions. Double-click the new setup.exe file to launch the installation wizard.

During the initial installation, the installer creates a registry entry to keep track of the install location. As long as the user has not moved or deleted the install directory, the install wizard will use the registry key to automatically locate the install directory. The

installer will then prompt to user to repair or modify the application. Select repair to apply the updates.

If the installer cannot find the application directory, the installer will prompt the user to navigate to the directory location. In the event that the user has deleted the application directory, the installer will prompt the user to first use the Add/Remove Programs utility to uninstall the previous version prior to running the installer. This will clear the registry entry.

If model run directories are present when the software is uninstalled, the model runs will not be removed. If the application is re-installed to the default location where the previous model runs exist, the application directories will be added to the existing root directory leaving the model runs intact.

Important Notes:

The PNNL_RHM.mxd file may grow in size over time. To reduce the file size, perform a Save-As which will re-compress the .mxd file. Alternatively, start with a copy of the template, stored in the "Support" directory.

To improve performance we recommend changing your default ArcMap settings by unchecking "Make newly added layers visible by default" checkbox under "Tools >> Options >> General Tab".

When executed, the model will create a run folder in the same directory as the .mxd file. The run folder will contain all model inputs and outputs.

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2.0 Developer Notes

The model is implemented using ESRI VBA ArcObjects programming. The source code is contained within the PNNL_RHM.mxd file. This means the code travels along with the .mxd whether the file is physically moved, re-named, or saved as another file name.

We chose this implementation strategy because it avoids having the user register .dll's with Windows and ArcMap, which requires the user to have administrative privileges.

The source code has been locked to protect the user and the model. The developer password is available upon request by contacting PNNL.

3.0 Model Documentation

This section contains specific guidance for parameterizing and executing the model. For a detailed explanation of each model input, see the help topic entitled "User Interface".

Overall, the model is a simple geoprocessing tool that uses depth and velocity estimates from a hydraulic model to calculate suitable shallow water habitat (SWH). The habitat model uses the U.S. Fish and Wildlife Service definition of SWH, which is water depth less than 5.0 ft and water velocity less than 2.0 ft/sec. The SWH criteria for the model can be modified by revising the depth and velocity reclass files to assign any range of depth and velocity to be suitable SWH.

The primary inputs to the model are four ascii files containing the following information

- Velocity data (XYZ format)
- Velocity ReClass file (defines suitable velocity range)
- Depth data (XYZ format)
- Depth ReClass file (defines suitable depth range)

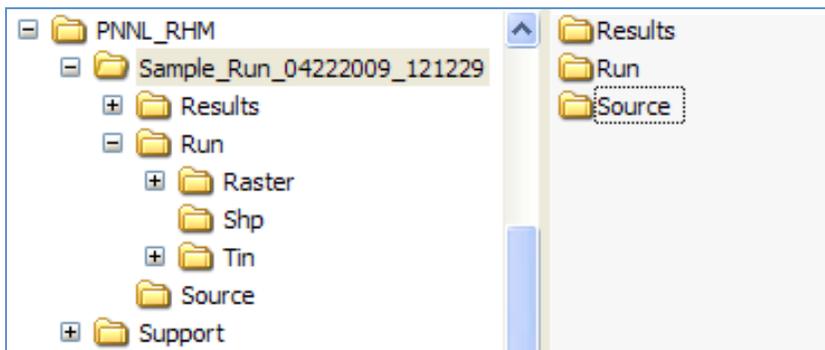
The model implements the following workflow using the specified input files

1. XYZ files are converted into shapefiles
2. Shapefiles are interpolated into TIN surfaces (as masspoints)
3. TIN surfaces are converted into rasters with evenly-spaced grid cells
4. Depth and velocity rasters are re-classified using ascii re-class files (non-classified values = NODATA)
5. Map Algebra (from .ini file) is used to calculate a raster representing suitable and non-suitable habitat

The model allows the user to parameterize each step of the process. For example, the user may set the maximum edge length and method used to delineate the TIN layers. Users may also select the re-sampling method and set the cell size of the raster outputs.

Each time the model is executed, a new directory is created that contains all of the model input and output files. In other words, the entire model run is preserved for the user. The figure below depicts a sample run directory. It contains three subfolders Source, Run, and Results. The original source files are copied into Source. All

intermediate GIS layers are created in the Run directory. And the final suitability raster and html report are stored in the Results folder.



The name of a run folder is the comprised of the model run name and a time stamp (e.g. [RunName]_mmddyyyy_hhmmss). Deleting a run directory does not affect the model.

4.0 User Interface

The following section summarizes the purpose of each control on the main form.

(1) Define Run Name

Name used to identify the model run (<= 25 characters). This name will be combined with the time stamp from the model run to create the output directory name.

(2) Projected Coordinate System

Users must define the coordinate system for the depth and velocity input files. Currently, only UTM zones based on the WGS_84 datum and a linear unit of US-foot are supported. Custom projection files are included with the install (C:\PNNL_RHM\Support\Proj). All geoprocessing outputs will be generated using the specified projected coordinate system.

(3) TIN Maximum Edge Length

This parameter must be a length from 1 to 500 feet. TIN triangles with at least one edge that exceeds the maximum edge length will be masked out as "NODATA" and will not be rendered or used in surface analysis. The purpose for this mask is to limit the subsequent analyses to data contained within the river channel. Set the maximum edge length to be slightly larger than the maximum distance between input points on the perimeter (i.e., the points from the hydraulic model computational grid provided in the depth and velocity XYZ ascii files used as input for the model run). A distance of 40 feet is recommended for the sample data.

(4) TIN Creation Method

This method will determine how the Maximum Edge Length is applied to delineate the TIN layers. A selection of "PERIMETER_ONLY" is recommended in order to retain the data within the river channel. ("ALL" is not supported by ArcObjects at this time.)

(5) Raster Output Data Type

This parameter requires a selection of "FLOAT" or "INT" and determines the data type for output raster layers. A setting of "FLOAT" is recommended.

(6) Raster Creation Method

This parameter requires a selection of "NATURAL_NEIGHBORS" or "LINEAR" and determines how the velocity and depth TIN layers will be interpolated to create raster layers. A selection of "NATURAL_NEIGHBORS" is recommended.

(7) Raster Cell Size

This parameter requires a length from 1 to 100 feet. Raster cell heights and widths will be equal. The cell size should be set according to the density and spatial distribution of the input points (i.e., the points from the hydraulic model computational grid provided in the depth and velocity XYZ ascii files used as input for the model run). Methods for determining the appropriate cell size can be found in the PNNL report accompanying this model. A cell size of 10 feet is recommended for the sample data.

(8) Map Algebra Formula

The syntax provided is used to calculate suitable habitat using the depth and velocity rasters calculated by the model. The formula is displayed primarily for reference.

(9) Select Velocity XYZ Data

Fully qualified path to comma-separated text file containing velocity XYZ data. File must contain a header row. Column1 = x-coordinates; Column2 = y-coordinates; Column3 = velocity values. The velocity units used in the source file must be the same as the units used in the velocity reclassification file.

Velocity values that are below or above the user-specified classification range are treated as NODATA cells. This includes negative values. A sample of this file is included with the install (C:\PNNL_RHM\Support\Sample\Velocity.csv).

(10) Select Depth XYZ Data

Fully qualified path to comma-separated text file containing depth XYZ data. File must contain a header row. Column1 = x-coordinates; Column2 = y-coordinates; Column3 = depth values. The

depth units used in the source file must be the same as the units used in the depth reclassification file.

Depth values that are below or above the user-specified classification ranges are treated as NODATA cells. This includes negative depth values (i.e., points outside the wetted channel). A sample of this file is included with the install (C:\PNNL_RHM\Support\Sample\Depth.csv).

(11) Select Velocity Re-class File

Fully qualified path to a text file containing valid syntax for reclassifying the Velocity raster layer. A sample file is included with the install (C:\PNNL_RHM\Support\Sample\velocity_reclass_file.txt). Suitable velocity values are classified as 0 (zero), and unsuitable velocity values are classified as 1 (one).

(12) Select Depth Re-class File

Fully qualified path to a text file containing valid syntax for reclassifying the Depth raster layer. A sample file is included with the install (C:\PNNL_RHM\Support\Sample\Depth_reclass_file.txt). Suitable depth values are classified as 0 (zero), and unsuitable depth values are classified as 1 (one).

(13) Help

Opens this help document.

(14) Run

This button will validate the inputs before executing the model.

(15) Cancel

This button will exit the Form.

(16) Load Default Settings

Loads the previously saved model settings from the PNNL_RHM.ini file (C:\PNNL_RHM\Support\PNNL_RHM.ini). The first time the model is run it will load the default INI settings using sample data.

(17) Save Settings as Defaults

This check box, if checked, will save current model settings to the PNNL_RHM.ini.

PNNL River Habitat Model ✕

Settings

Run Name (max 25) (1)

Define Coordinate System (2)

TIN Max Edge Length (1 - 500) feet (3)

TIN Creation Method (4)

Raster Output Data Type (5)

Raster Creation Method (6)

Raster Cell Size (1 - 100) feet (7)

Map Algebra Formula (8)



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Source Files

Select Velocity XYZ Data (9)

Select Depth XYZ Data (10)

Select Velocity Re-class File (11)

Select Depth Re-class File (12)

(13) (14) (15)

(16) Load Default Settings (17) Save Settings as Default



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