Wetlands and Riparian Data Verification Toolset

Installation Instructions and User Information

National Wetlands Inventory Program

**October 2022**

Contents

Introduction

The Wetlands and Riparian Data Verification Toolset was designed to automate the quality control functions necessary to ensure the accuracy of data submitted to the National Wetlands Data Layer. This comprehensive toolset has been designed to address geospatial errors, digital anomalies, and logic checks for all data types.

This most recent version of the toolset (October 2022) was created using Python 3.7.11 and has been provided in two versions, one that is compatible with ESRI's ArcDesktop and the other with ESRI's ArcGIS Pro (recommended for optimal performance). This customized toolset combines both wetland polygonal and linear, as well as riparian logic checks all one toolbox. This tool will only work on file geodatabases and replaces all previously released versions.

Folder Contents

The verification toolset and associated files are contained in a folder called 'NWI_QAQC_Tool_ArcPro' or 'NWI_QAQC_Tool_Desktop (Figure 1). This folder can be stored in any location on your machine and contains the following:

1. The NWI CONUS **NWI_CONUS_Schema.gdb** organizes feature classes in the format used by the verification tool and national wetlands database. Users can import their data into the respective feature classes to run the tool. *If you are mapping in areas outside of CONUS, please request the appropriate schema for your area via wetlands_team@fws.gov (ie, AK, HI, PRVI, PacTrust).*

2. The QAQC folder contains the **NWI_QAQC_Tool_Python.pyt** Arctoolbox that contains the scripts for polygonal and linear data types, as well as for riparian data. They are provided as combined tools that will run on all data inputs as well as individual tools that can be run as needed.

3. **Readme.txt** provides a general description of the contents and purpose of the folder.

4. The **Wetlands Data Verification Toolset Installation and User Information** document provides descriptions and procedures on the use of all verification tools.
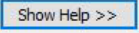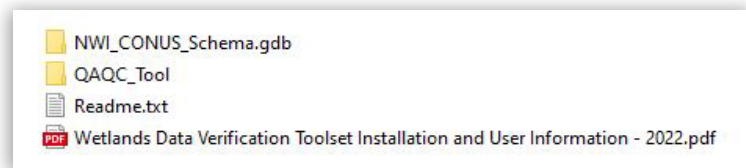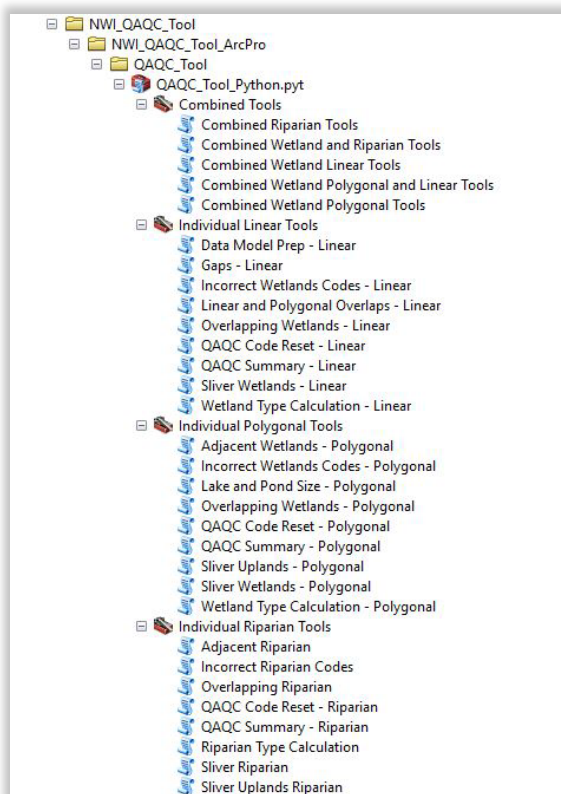

Figure 1. *NWI_QAQC_Tool folder and associated tools viewed in Arc Catalog (left). Contents of the NWI_QAQC_Tool folder including data schema, tools, readme.txt files and User Information documentation viewed in Windows Explorer. (above)*

Dataset Compatibility

This toolset was designed to work on file geodatabases containing the National Wetlands Database schema. Specifically, it requires the feature class CONUS_wet_poly in a CONUS_wetlands feature dataset, and CONUS_wet_projects in a CONUS_projects feature dataset (substitute AK, HI, PRVI or PacTrust for CONUS in other mapping areas). The CONUS_wet_projects feature class must contain a polygon that completely covers the area where wetland mapping was conducted. A blank geodatabase containing these schemas as well as those for line and riparian data are provided with the tool download. Use of this toolbox on other data formats or schemas will likely fail and is not recommended.

Running the models

To run any of the QAQC models:

1. Navigate in Catalog to the ⊞ 🗄 QAQC_Tool_Python.pyt toolbox located in the NWI_QAQC_Tool_Python folder.

2. Open the toolbox, then open either the combined toolset or any of the individual models. A window will appear similar to the one in, which will allow the user to select input data and provides a description of the tool on the right pane, if the [Show Help >>] button is selected (Figure 2).

3. Identify the mapping area (CONUS, AK, HI, PRVI, or PacTrust).

4. Click the browse button 🗁 next to the Geodatabase text box and browse to the wetlands file geodatabase on which to conduct verification and then press 'OK' (Figure 2).
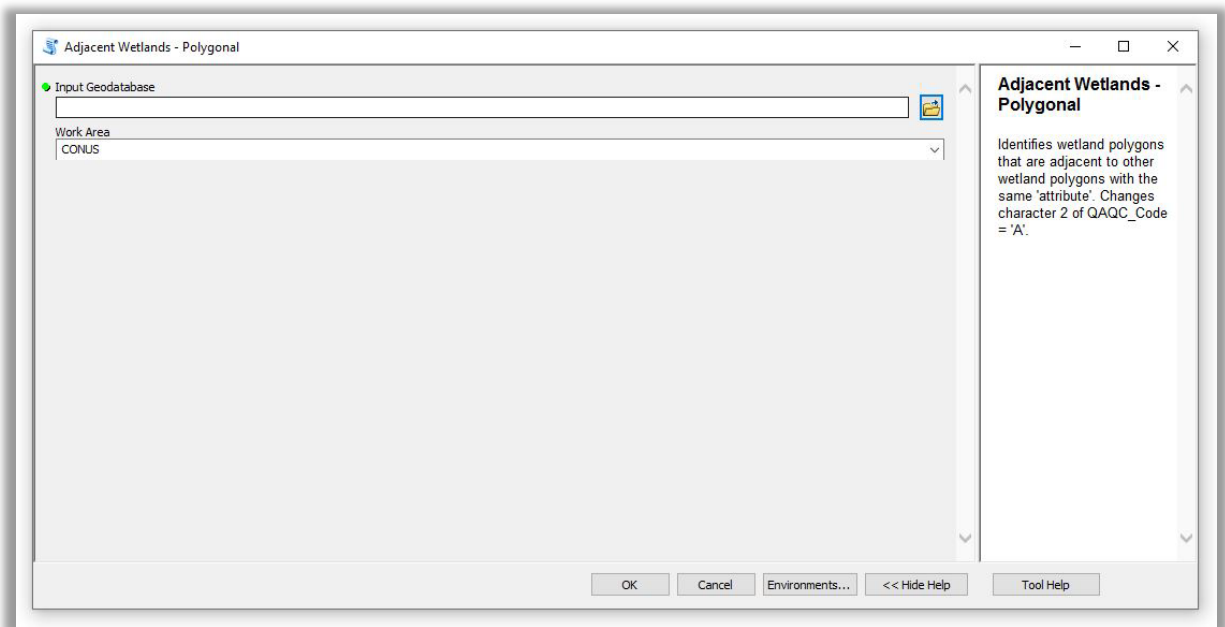
Figure 2. *Example of a model user interface. Verify the mapping area and browse to the file geodatabase on which to conduct verification. Clicking 'Tool Help' shows a description of the selected tool.*

Explanations of Verification Models

Combined QAQC Tools

Combined Tools

Combined tools have been provided to allow users to run all of the available tools for a given data type (i.e. wetland polygons, wetland lines, or riparian polygons) all at once, or in various combinations (i.e. wetlands polygons and riparian). Users can select which combination of tools to run depending on project needs (Figure 3).

Figure 3. *Combined Tool options available within the QAQC_Tool_Python toolbox.*

NOTE: Running the Combined Tools on projects that contain a high number of polygons or complex polygons may fail due to limitations in computer resources. It may be more efficient to run all the individual checks separately for these types of projects.

Additional Inputs

Verified By – Enter the individual or organization conducting the verification. This information will be output to the QAQC Summary table and QC History table (if option is selected).

Save History Table – This option will create a QAQC_History table and append subsequent iteration results of the QAQC_Summary table. Each group of errors appended from the QAQC_Summary table will be identified by a count iterator shown in the 'Run' field. The QAQC_History table will continue to grow with each iteration until it is manually deleted. This allows the user to track the progress of dataset edits between verification runs.

Individual Linear Tools

Data Model Prep - Linear

This model prepares the linear data to appropriately fit into the NWI linear data model. The tool dissolves and explodes linear features to ensure that they are single-part, and also splits lines at each intersection.

Gaps - Linear

This tool identifies gaps between features. An error code 'G', indicates there is a possible gap between it and another feature.

To correct this error, users should investigate the gap and snap to the adjacent feature if appropriate. If the gap was not created in error than justification should be added to the QAQC Table to acknowledge that the gap has been verified as correct.

Incorrect Wetland Codes - Linear

This model cross-references the list of valid wetland codes and identifies wetland lines with invalid codes, or null or blank values in the 'attribute' field. For identified code errors, this model changes the first character of the QAQC_CODE to 'C'.

To correct this error, users should change the attribute of the identified record to a valid wetland code.

Linear and Polygonal Overlaps

This tool identifies line features that overlap polygons. This tool has two error codes associated. An error code 'R', indicates the linear feature is connecting two riverine polygons and in the overwhelming majority of cases, should likely be a polygonal feature. An error code "W" indicates that the linear feature overlaps a polygonal feature that we don't allow linear features to overlap. These are all polygonal features in these classes: RB, UB, AB, RF, SB, RS, US.

To correct this error, users should edit or clip to remove the overlap, or justification would need to be added to the QAQC table where QC deemed the overlap acceptable.

Overlapping Wetlands - Linear

This tool indicates that a line feature overlaps with another line feature with a different attribute. An error code 'O" will be returned.

To correct this code, any overlaps should be removed from the dataset.

QAQC Code Reset

This model calculates the QAQC_CODE = 'NNNNNN'. This erases all recorded errors in the dataset and properly attributes the field for use by all other models. Users should run this tool to reset error codes after each round of edits.

Sliver Wetlands

This tool identifies linear features less than 2.5 meters in length. Genuine features flagged as linear slivers may be justified as correct in the comments field of the summary table associated with the toolset if deemed 'real.'

Wetland Type Calculation

This model populates the 'WETLAND_TYPE' field based on the wetland code in the 'attribute' field. The 'wetland_type' field provides a general description of the wetland and is used in the cartographic representation of the different wetland types on the Wetlands Mapper.

Individual Polygonal Tools

Adjacent Wetlands - Polygonal

This model identifies wetland polygons that are adjacent to other wetland polygons with the same 'attribute', or multipart features. For identified errors, this model changes the second character of the QAQC_CODE to 'A'.

To correct this error, users should join adjacent polygons sharing the same attribute, change one of the attributes, or explode the multipart feature.

Incorrect Wetland Codes - Polygonal

This model cross-references the list of valid wetland codes and identifies wetland polygons with invalid codes, or null or blank values in the 'attribute' field. For identified code errors, this model changes the first character of the QAQC_CODE to 'C'.

To correct this error, users should change the attribute of the identified record to a valid wetland code.

Lake and Pond Size - Polygonal

This model identifies lake polygons that are less than 20 acres in size and ponds that are greater or equal to 20 acres in size. For identified records, it changes the fifth character of the QAQC_CODE to 'L' for small lakes or 'P' for large ponds. Generally, 20 acres is the threshold between classification of a pond and lake, but certain small lakes may be justified based on water depth as outlined in the wetlands mapping standards. In those cases, comments should be added to the QAQC_Summary table for flagged wetland features. Otherwise, codes should be changed as appropriate.

Overlapping Wetlands - Polygonal

This model identifies overlapping wetland polygons and changes the sixth character of the QAQC_CODE to 'O'. The overlapping portions of these polygons are stored in the CONUS_wetlands feature dataset as a new feature class to assist in locating these features. Overlapping polygons should be edited so that polygons are not concurrent.

QAQC Code Reset - Polygonal

This model calculates the QAQC_CODE = 'NNNNNN'. This erases all recorded errors in the dataset and properly attributes the field for use by all other models. Users should run this tool to reset error codes after each round of edits.

Sliver Uplands - Polygonal

Identifies upland islands or gaps in wetlands that are less than 0.01 acres. Because this model identifies gaps and missing areas, it changes the fourth character of the QAQC_CODE to 'U', in wetland polygons **adjacent** to the upland sliver. In addition, this tool creates a new sliver upland feature class in 'CONUS_wetlands' to assist in locating these small geographic features. This tool requires that 'CONUS_wet_projects' has a feature(s) that defines the wetland mapping project and completely covers all features in the 'CONUS_wet_poly' feature class.

Like sliver wetlands, these upland polygons may be genuine upland features and can be justified as such in the comments field of the 'QAQC_Summary' table. Otherwise, these areas can be copied from the generated feature class and merged with the appropriate adjacent polygon.

This tool also identifies gaps between the wetland polygons and the project boundary. In some cases, these gaps are real, but in other cases the gaps are due to snapping errors in the mapping process. The tool changes the fourth character of the QAQC_CODE to 'G' and exports a feature class in 'CONUS_wetlands' named 'wetland_gap_check' to help identify the polygons that need to be inspected for potential extension to the project boundary.

NOTE: This tool is among the most computationally intensive and may fail on geographically large project areas with many polygons. One possible remedy of this failure is to split a portion of 'CONUS_wet_poly' polygons into a new geodatabase, run the tool on each geodatabase, and then merge the resulting outputs to a single feature class.

Sliver Wetlands - Polygonal

This model identifies wetland polygons less than 0.01 acres, which is smaller than the minimum mapping standard. For identified records, this model changes the third character of the QAQC_CODE to 'S'.

Genuine wetland features flagged as sliver wetlands can be justified as correct in the comments field of the QAQC_Summary table. Other features should be deleted or joined to adjacent polygons.

Wetland Type Calculation - Polygonal

This model populates the 'WETLAND_TYPE' field based on the wetland code in the 'attribute' field. The 'wetland_type' field provides a general description of the wetland and is used in the cartographic representation of the different wetland types on the Wetlands Mapper.

Individual Riparian Tools

Adjacent Riparian

This model identifies riparian polygons that are adjacent to other riparian polygons with the same attribute or multipart features. For identified errors, this model changes the second character of the QAQC_CODE to 'A.'

To correct this error, users should join adjacent polygons sharing the same attribute, change one of the attributes, or explode the multipart feature.

Incorrect Riparian Codes

This model cross-references the list of valid riparian codes and identifies riparian polygons with invalid codes, or null or blank values in the 'attribute' field.
For identified code errors, this model changes the first character of the QAQC_CODE to 'C'. To correct this error, u sers should change the attribute of the identified error to a valid riparian code.

To correct this error, users should edit or clip to remove the overlap, or justification would need to be added to the QAQC table where QC deemed the overlap acceptable.

Overlapping Riparian

This model identifies overlapping wetland polygons and changes the fifth character of the QAQC_CODE to 'O." The overlapping portions of these polygons are stored in the 'CONUS_riparian' feature dataset as a new feature class to assist in locating these features. Overlapping polygons should be edited so that polygons are not concurrent.

QAQC Code Reset - Riparian

This model calculates the QAQC_CODE = 'NNNNNN'. This erases all recorded errors in the dataset and properly attributes the field for use by all other models. Users should run this tool to reset error codes after each round of edits.

Riparian Type Calculation

This model populates the 'RIPARIAN_TYPE' field based on the wetland code in the 'attribute' field. The riparian _type' field provides a general description of the wetland and is used
in the cartographic representation of the different riparian types on the Wetlands Mapper.

Sliver Riparian

This model identifies riparian polygons less than 0.01 acres, which is smaller than the minimum mapping standard. For identified records, this model changes the third character of QAQC_CODE to 'S'. Genuine riparian features flagged as sliver riparian can be justified as correct in the comments field
of the QAQC_Summary table. Other features should be deleted or joined to adjacent polygons.

Sliver Uplands Riparian

This tool identified upland islands or gaps in riparian and wetland areas that are less than 0.01 acres. This tool requires input from the accompanying wetlands geodatabase, because sliver uplands may occur between shared edges of riparian and wetland polygons in the same project area. Because this model identifies gams and missing

areas, it changes the fourth character of QAQC_CODE to 'U' for riparian polygons that are adjacent to the upland sliver. In addition, it creates a new sliver upland feature class in 'CONUS_riparian' to assist in location these small geographic features. This tool requires that a project boundary in 'CONUS_wet_projects' and accurately represents the mapping areas of the 'CONUS_wet_poly' feature class.

NOTE: This tool is among the most computationally intensive, and therefore may fail on large datasets. One possible remedy is to split a portion of the 'CONUS_rip_poly' feature class into a new geodatabase, run the tools on each database, and then merge the resulting outputs.

_____

QAQC Summary – All Tools

This model summarizes the QAQC_CODE field into a 'QAQC_Summary' table in the wetlands file geodatabase. It also defines each error type and records the user conducting the data verification along with a date/time stamp. Records shown in the 'QAQC_Summary' represent polygon counts for each unique code combination. Comments can be added to the 'comments' field of the QAQC_Summary table to justify specific types of errors (Figure 4)

OBJECTID	FREQUENCY	QAQC_CODE	Error_Type	Verified_By	Verification_Date	Verification_Comments	RUN
1	2	CNNNNN	Bad Code	Name	12/10/2018 4:48:18 PM	\<Null\>	1
2	3	NANNNN	Adjacent Polys	Name	12/10/2018 4:48:18 PM	\<Null\>	1
3	1	NANNPN	Adjacent Polys, Large Pond	Name	12/10/2018 4:48:18 PM	\<Null\>	1
4	3	NANUNN	Adjacent Polys, Sliver Upland	Name	12/10/2018 4:48:18 PM	\<Null\>	1
5	2	NANUNO	Adjacent Polys, Sliver Upland, Overlapping Wetland	Name	12/10/2018 4:48:18 PM	\<Null\>	1
6	3	NASNNN	Adjacent Polys, Sliver Wetland	Name	12/10/2018 4:48:18 PM	\<Null\>	1
7	1	NASNPN	Adjacent Polys, Sliver Wetland, Large Pond	Name	12/10/2018 4:48:18 PM	\<Null\>	1
8	1	NNNNLN	Small Lake	Name	12/10/2018 4:48:18 PM	Valid based on depth info.	1
9	27	NNNNNN	Passed Verification	Name	12/10/2018 4:48:18 PM	\<Null\>	1
10	2	NNNNNO	Overlapping Wetland	Name	12/10/2018 4:48:18 PM	\<Null\>	1
11	4	NNNUNN	Sliver Upland	Name	12/10/2018 4:48:18 PM	\<Null\>	1
12	4	NNNUNO	Sliver Upland, Overlapping Wetland	Name	12/10/2018 4:48:18 PM	\<Null\>	1
13	4	NNSNNN	Sliver Wetland	Name	12/10/2018 4:48:18 PM	\<Null\>	1
14	3	NNSNNO	Sliver Wetland, Overlapping Wetland	Name	12/10/2018 4:48:18 PM	\<Null\>	1
15	1	NNSUNO	Sliver Wetland, Sliver Upland, Overlapping Wetland	Name	12/10/2018 4:48:18 PM	\<Null\>	1

Figure 4. *Due to the fact that many polygons within a wetlands dataset will be flagged with multiple errors, the QAQC_Summary table shows the frequency of each unique combination of errors, and provides a comments field for justification.*

Reviewing Verification Errors

1. To find specific instances of an error, in ArcMap or ArcGIS Pro, sort the 'CONUS_wet_poly' attribute table by QAQC_CODE. Then select a feature that contains a QAQC error code and zoom to it. (Figure 5).

OBJECTID *	ATTRIBUTE *	HGM_CODE	QAQC_CODE	WETLAND_TYPE	ACRES
4435	PEM1C	<Null>	NNSUNO	Freshwater Emergent Wetland	0.000733
4431	PSS1C	<Null>	NNSNNO	Freshwater Forested/Shrub Wetland	0.006964
4432	R2UBH	<Null>	NNSNNO	Riverine	0.00626
4427	PEM1A	<Null>	NNSNNN	Freshwater Emergent Wetland	0.000001

Figure 5. *The 'QAQC_CODE' field in the 'CONUS_wet_poly' attribute table can be used to sort and review error codes.*

2. The 'Select by Attribute' function, shown in Figure 6, can also be used to select all records of a defined QAQC_CODE error value. Example below:
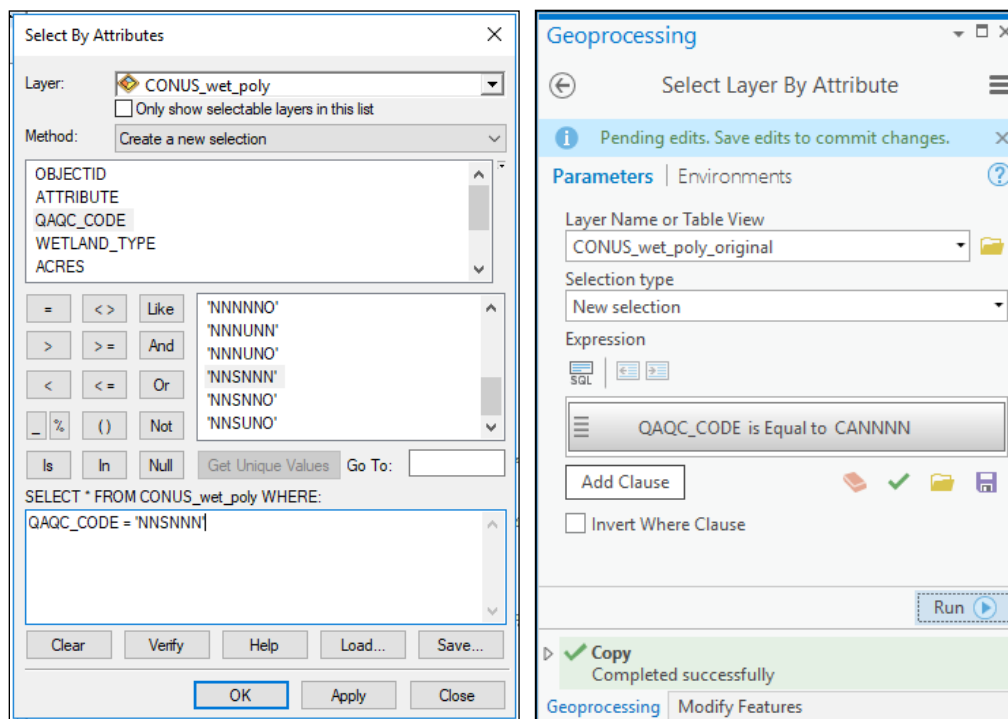
Figure 6. *'Select by Attributes', shown in ArcGIS 10.6 (left) and ArcGIS Pro (right) can help select and navigate to specific polygon errors.*

For further information, or assistance please contact: wetlands_team@fws.gov