

**NHD Update Project**  
Mapping and Editing Business Rules  
Idaho Dept. Water Resources

Last Update: **06/25/15**

---

**Table of Contents**

- I. Overview
- II. Reference Scales
- III. Minimum Mapping Unit
- IV. Aerial Basemap and Collateral Datasets for Editing Geometry
- V. Attribution Editing
- VI. Overview of Editing Tasks
- VII. Editing Methods
- VIII. QC/QA
- IX. Specific Decision-Making Rules
- X. Specialized Mapping Business Rules
- XI. Acknowledgements

**I. Overview:**

The objective of this project is to bring improvement to the high resolution National Hydrography Dataset (NHD) to (1) update the NHD dataset in Idaho, which in turn will (2) improve the corresponding hydrography features represented on the US Topo maps. The standards listed below are those that were applied during the active editing and updating of the NHD data by staff at the Idaho Department of Water Resources (IDWR). These rules were developed by integrating rules from previous hydro-mapping efforts as well as developing new rules and modifying existing rules as new topics and issues arose during editing.

**II. Reference Scales**

Reference scales will be used when assessing the NHD data and determining if updates are to occur while crosschecking the data with base aerial imagery for accuracy. Given that different areas of the subbasins to be updated often contain varying densities of features, different reference scales will be used based on an area's feature density to better facilitate decision making in editing. Given that the objective of this project is to update the NHD data for hydrologic analysis and display and the best available data for Idaho statewide is currently 1:24,000, the topographic map scale of 1:24,000 was considered in establishing reference and editing scales. If and where reference scales will be used will be documented in the Editing Methods and Specific Decision Making Rules sections.

**III. Minimum Mapping Units**

- a) A minimum mapping unit will ensure all data has been updated and edited at an established minimum scale. A scale of **1:12,000 – 1:10,000** will be used for any editing done to any NHD feature regardless of which reference scale was used. This scale range will also be referred to as the digitizing scale.
- b) Lake, Pond, Glacier, Ice and 2D Stream polygons must be  $\geq 2$  acres in size, or they should not be mapped
- c) 1D Stream arcs must be  $\geq 4$  meters in length.
- d) 2D Stream feature must be  $\geq 20$  meters in width, otherwise they should be represented as a line.
- e) Not all streams  $\geq 20$  meters in width must be mapped as a 2D stream polygon

**IV. Aerial Basemap and Collateral Datasets for Editing Geometry**

- a) 2013 NAIP Imagery  
The **2013 NAIP** imagery will be the **primary dataset** used to update the NHD data. This dataset will be accessed

through an online mapping service. This will be the primary source used to assess the NHD for updates. Additionally, this source will be used when digitizing new NHD geometry or reshaping/modifying/updating existing NHD geometry.

b) Supporting Secondary Collateral Datasets for Update Assessment

Additional collateral datasets will be used when the 2013 NAIP is not sufficient in determining appropriate editing actions. These sources will aid *decision making* in NHD updates. The following sources will be used and their order reflects priority of use from top to bottom (i.e. NAIP 2011 will take precedence over ESRI Aerial Basemap in decision making).

- i. **NAIP 2011 Imagery:** Accessed via online map service.
- ii. **Other NAIP Imagery:** Accessed via IDWR Data Server.
- iii. **ESRI Aerial Basemap:** Accessed via ESRI basemap service.

c) Secondary Digitizing/Editing Sources

In many cases, the edits based on the NAIP imagery is sent to local water managers for input and corrections to edits. The input provided by local water managers is considered authoritative.

Examples of local water managers include:

- 1) Watermasters
- 2) Canal or Irrigation District personnel

**V. Attribution Editing**

a) Common Attribute Edits

- i. GNIS Names
- ii. Flow Direction
- iii. FCode Modification

b) Editing Sources for Attribute information

In many cases, local water managers will provide input and corrections to NHD attributes. The input provided by local water managers is considered authoritative.

Examples of local water managers include:

- 1) Watermasters
- 2) Canal or Irrigation District personnel

**VI. Overview of Editing Tasks**

NHD editing will require editors to assess the NHD data for updates by cross checking it with the 2013 NAIP so that NHD features reflect the 2013 NAIP. Frequency and types of editing tasks will vary from area to area. Below are some common editing tasks expected to be carried out and rules associated with them:

a) *Feature Additions:*

When a feature on the base aerial is not represented in the NHD *and* is visible on the base aerial at the reference scale, it is to be added to the NHD data using the digitizing scale.

b) *Feature Updates:*

When a feature is present in the NHD data and in the base aerial, but its geometry, spatial location, and/or attributes do not reflect what is depicted on the base aerial *at the reference scale*, the feature will be updated to reflect the aerial. Updates may include:

- i) Modify feature
- ii) Modify attributes
- iii) Replace geometry
- iv) Reshape feature
- v) Split feature
- vi) Mask geometry

c) *Feature Deletions:*

Mapping and Editing Business Rules v. 1.1

When a feature in the NHD data is not present on the base aerial, the largest possible reference scale will be used to confirm absence of feature on the base aerial. Additional datasets will be used to assess absence of feature and the following will be considered:

- i) Piping or other modification of the feature making it difficult to see on the base aerial
- ii) Seasonality
- iii) Influence and presence of related features
- iv) Terrain
- v) Change in landscape/landuse
- vi) Other associated factors

If there is strong evidence, after review, to suggest the feature in the NHD is clearly an error, it will be deleted.

d) Attribute Modification

When a feature in the NHD data is identified as being incorrect from an authoritative source or other information, it will be modified.

- i) Addition of GNIS Names
  - Only names already in the GNIS database can be added.
- ii) Flow Direction - Flow direction for linear hydrography dataset features should be “with digitized” to ensure correct flow direction for network analysis.
- iii) FCode Modification - Please refer to the list of NHD FCodes as needed located here:  
[http://nhd.usgs.gov/userGuide/Robohelpfiles/NHD\\_User\\_Guide/Feature\\_Catalog/Hydrography\\_Dataset/Complete\\_FCode\\_List.htm](http://nhd.usgs.gov/userGuide/Robohelpfiles/NHD_User_Guide/Feature_Catalog/Hydrography_Dataset/Complete_FCode_List.htm)

e) NHD editing and update tools and procedures will be used as covered in the [USGS NHD Training Sessions](#) and the [NHD User Guide/Help Portal](#).

f) Editors are to refer to the “Editing Menu” section of the NHD Help Portal, which covers the required workflow for editing tasks and use of the NHD Update tools for those tasks. It is located under NHD Update Process>Editing Menu. The Help Portal can be accessed by following this link: [http://usgs-mrs.cr.usgs.gov/NHDHelp/WebHelp/nhd\\_help\\_portal.html](http://usgs-mrs.cr.usgs.gov/NHDHelp/WebHelp/nhd_help_portal.html)

f) Additionally, the USGS NHD Feature to Feature and NHD Feature Catalog Data Dictionaries will be used to conform to USGS/NHD standards when editing:

- i. Feature to Feature Rules Data Dictionary: [http://usgs-mrs.cr.usgs.gov/NHDHelp/FeatureRules/feature\\_rules.htm](http://usgs-mrs.cr.usgs.gov/NHDHelp/FeatureRules/feature_rules.htm)
- ii. NHD Feature Catalog:  
[http://nhd.usgs.gov/userGuide/Robohelpfiles/index.htm#NHD\\_User\\_Guide/Feature\\_Catalog/NHD\\_Feature\\_Catalog.htm](http://nhd.usgs.gov/userGuide/Robohelpfiles/index.htm#NHD_User_Guide/Feature_Catalog/NHD_Feature_Catalog.htm)

## VII. Editing Methods

a) Snapping and Vertices:

- 1) Snapping will always be set to vertices. Vertices will be added to features as needed to allow for snapping of other features and prevent snapping to edges.
- 2) Adjacent polygons with a shared edge should have coincident vertices (e.g. where lakes adjoin swamp/marsh)

b) Digitizing Direction for Flowlines:

Flowlines will always be digitized in an upstream direction. That is, the sketch will be in the opposite direction of the flow.

c) Feature Deletions:

Editors will be conservative in feature deletions. If there is any doubt the NHD feature may be a true feature and not a clear erroneous feature, it will be kept in the data.

d) Coordinate System:

The coordinate system used for edits shall be the native coordinate system of the NHD: Geographic NAD 83

e) Reach Codes: Make a best effort to preserve reachcodes, rather than delete and add new features or using replace.

f) Data at the International Boarder:

- i. Do not edit data that crosses an International Boarder.
  - If edits are required at an International Boarder, please contact the [USGS POC](#) for required documentation.

g) GNIS Names

- i. If you discover local names that need to be added, make note of them so we can begin the process of adding them to GNIS.
  - New GNIS Names will be noted by storing the entire geometry in a separate shapefile with the GNIS\_Name field populated with the new name. An additional attribute field should be added called Reference (text, 200) and should contain information on the source and/or reference for the new name.

h) Concurrent editing of 1D and 2D stream feature

- i. All 2D stream polygons must contain a corresponding 1D stream arc
- ii. When editing a 1D stream feature, the corresponding 2D feature should also be updated, ensuring consistency between 1D and 2D features.

i) Stream connectivity

- i. All 1D Stream segments within a given stream network must be connected – disconnected stream arcs are not allowed
- ii. Where 1D Stream segments flow sub-surface and there is no additional data to indicate actual location of sub-surface flow, the mapped stream segments should be approximated with straight lines and their FType attribute coded with one of the following values:
  - Pipe – man-made underground watercourse
  - Connector – common sub-surface flow
  - Underground Conduit – sub-surface flow through karst or subterranean caves
- iii. Where a 1D stream flows through a culvert, FTYPE shall remain stream/river

j) Segregating 2D hydrographic features

- i. All distinct 2D water bodies should be segregated at the point of junction with another water body.
  - Rivers & streams
    - Individual 2D linear features (rivers, streams and sloughs) should be segregated whether named or not. A feature may include sections of complex channels.
    - 2D features of the same feature type/classification may adjoin one another – e.g. the confluence or 2D tributaries should be segregated at the point of confluence
  - Sloughs, distributaries, side channels
    - Individual linear features which may be significant large channels connected at one or two points to other river or stream features, but are of sufficient size (width or length) to be best mapped as a unique feature
    - Individual features of sufficient human significance to be named
  - Islands
    - Mapping to a minimum size of 2 acres and/or a minimum length of 150 meters but does not preclude mapping smaller features.
- ii. Establishing appropriate closing lines
  - tributary junctions – straight line from headland to headland

- tributary junctions w intervening islands – straight line from mainland headland to island headlands or endpoints to mainland headland
  - river / bay junctions – straight line from headland to headland where a river abruptly enters a bay
  - river / estuary junctions – straight line from “headland to headland” across a river where the bank character changes widening from parallel river banks to an expanded estuary character
- iii. Abandoned channels
- Abandoned stream channels hydrologically segregated at both ends from the active stream channel should be removed from the river feature class. If these features are of sufficient size and still retain water, they should be added to the lake feature class.
  - Abandoned stream channels hydrologically segregated at only one end from the active stream channel should be considered sloughs and if sufficient size should be mapped as a separate slough as described above.

## VIII. QA/QC

Two types of QC processes will be run:

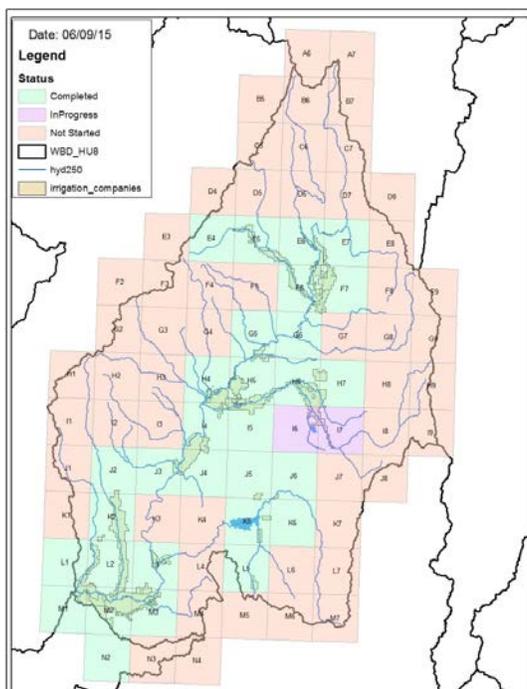
a) NHD QC Using NHD Tools (Initial, Intermediate, and Final)

The NHD Update workflow requires the execution of initial and final QC using the QC utility of the NHD tools. Initial QC will be run and required QC error fixes will be applied before NHD editing is initiated. Additional QC checks will be run as needed before final QC. Final QC will be run and associated QC error fixes will be applied before checking jobs back into the national dataset

b) Internal Editor QC

- a. Editors will track their progress through the subbasin with a grid system. Editors will track if they have completed the flowline, area, and waterbody edits through each grid. A grid where some edits have been performed will be marked as in progress. A grid will be considered “completed” when all flowline, area, and waterbody edits are completed in the entire grid.
- b. At a minimum of a bi-weekly basis, edits will be printed at a 1:24,000 scale for visual inspection by IDWR staff besides the primary editor of a subbasin. The tracking grid will be printed on each map. In addition, a grid status map will be printed. Questions and comments compiled during the first pass at editing will also be assessed in this step.

Example grid status map



In addition to QC, technical questions will be compiled throughout the project and present to project and USGS POCs. Responses will be implemented and if required, additional business rules will be created or exiting ones will be modified.

## IX. Specific Decision-Making Rules

### 1. Canal/Ditch Editing:

- a) Edits will be based on what is obvious and what can be determined with certainty and confidence based off the NHD Data in combination with the use of aerials/Bing/GoogleEarth/etc.
- b) If there are canal/ditch features that are “problematic” in terms of their accuracy when compared to the aerial, no assumptions will be made. If no decision can be reached with confidence after assessing the aerials and relevant collateral sources, no action will be taken.

Common examples where this occurs in Canal/Ditch features:

- i. Determining Connectivity: *Connectivity as present in the NHD will remain preserved unless aerials and supporting sources strongly suggest otherwise.*



- ii. Determining Flow Direction: *Flow direction as present in the NHD will remain preserved unless aerials, supporting sources, and surrounding flowlines strongly suggest otherwise.*

### iii. Addition/Deletion of Canal/Ditch Features:

*-Canal/Ditch features will be added into the NHD only when the base imagery and supporting imagery clearly depict a canal/ditch. If there is any question as to whether or not a feature depicted on the aerial photo and supporting sources is a canal/ditch, it will not be added.*

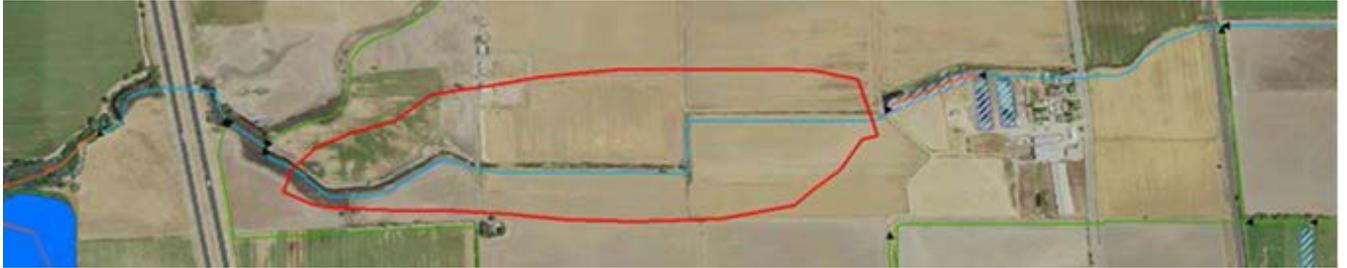
*-Canal/Ditches will be deleted from the NHD in high confidence cases where it is clear that the canal/ditch feature in the aerials and supporting sources does not exist.*

- c) Given the above, we expect the majority of edits done to Canal/Ditch features to be updates to geometry such as: shortening, lengthening, and reshaping lines.

### 2. Stream/River Flowline Features

#### a) Stream/Rivers That Transition into Canal/Ditch Features

Features like the one pictured below may end up feeding into a Canal/Ditch system. However, until the flowline breaks (confluence into the canal system), the flowline(s) will be considered Stream/River despite being engineered and straighten out.

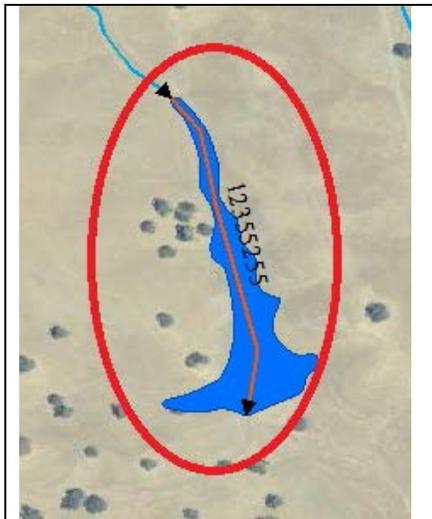


### 3. Washes and Braided Streams in Floodplains

- a) Update the NHDArea wash polygons so the shape of the polygons match the wash's outer boundary. This is accomplished by following the lighter color sediment associated with the wash as depicted in the 2014 aerial.
- b) In cases where there are complex braided stream in the flood plain:
  - i. Realign flowlines for braided channels that are more prominent.
  - ii. Keep a few of the intermediate braids.
  - iii. Delete any flowlines representing braids that are not depicted on the aerial or that represent very small/minor braids. These are very subject to seasonal changes and not worth editing or adding into the NHD.

### 4. Terminating Artificial Paths

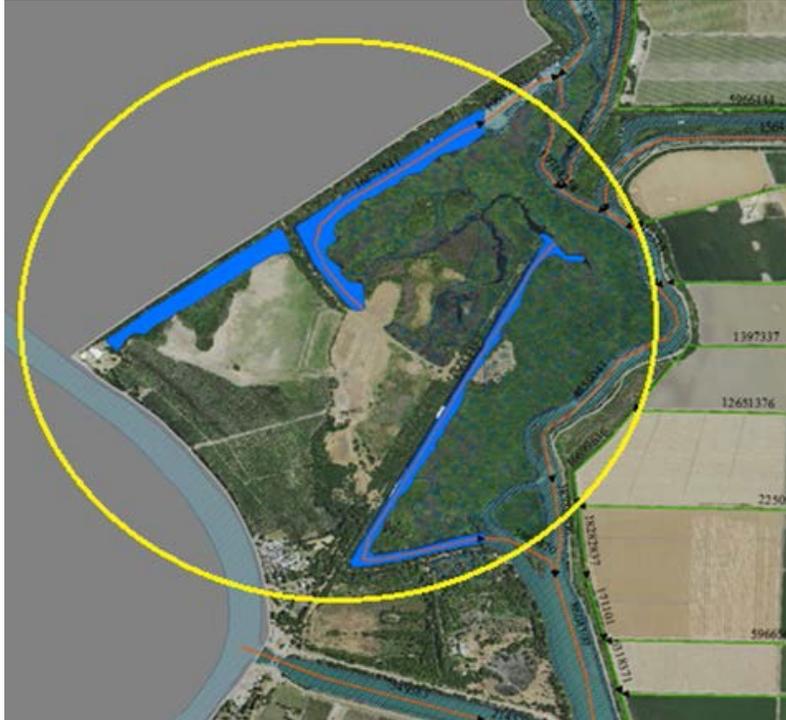
Example:



- a) If an NHDFlowline artificial path that has no downstream flowline is encountered:
  - i. Check to make sure the polygon has not outlet or if there needs to be some kind of downstream continuation in flow. Add a downstream flowline if needed.
  - ii. If there is no downstream flowline needed, the artificial path shall be maintained although it does not need to traverse the entire axis of the polygon.
  - iii. It is likely that the artificial path will show up later on as an isolated network feature in the NHD tool's QC.

### 5. Lake/Ponds VS 2D Stream/Rivers

- a) Currently existing lake/ponds that seem to have flow (are narrow, are in close proximity to other features that have flow, etc.) and or are adjacent to 2D stream/rivers will **not** have an FType attribution change unless clearly erroneous. Most will remain as-is and will not be converted into 2D Stream/Rivers.



6. Swamp/Marsh, Lake/Pond, and other Feature Editing in Agricultural Areas

- i. Swamp/Marsh features are not to be added in agricultural areas/parcels. Agricultural areas have a high human influence and often contain fields that are periodically inundated for agricultural use. Features in these area are often not natural and subject to frequent change controlled by humans and should therefore, not be mapped into the NHD.
  - a. There seems to be a couple areas where riparian-like vegetation can be found near larger rivers. These seem to be present in heavy agricultural areas. These features will generally not be added into the NHD as Swamp/Marsh features due to their presence inside agricultural areas.
- ii. Lake/pond features can be added when located in agricultural area, but only when the lake pond is clearly a depressional and more is a permanent and natural feature. Reservoirs can be considered when appropriate as well.
- iii. Swamp/Marsh and lake/pond features should be added when they are not located in agricultural areas.
- iv. Lake, Pond, Glacier, Ice and 2D Stream polygons must be  $\geq 2$  acres in size, or they should not be mapped

X. Specialized Mapping Business Rules

For agricultural areas that were once inundated, but are no longer receiving water:

- a) *Do not add swamp/marsh features*
- b) *Add canal/ditches that are easily identifiable and likely more permanent.*
- c) *Do not delete canal/ditches that currently exist in the NHD unless they clearly no*

*longer exist.*

- d) *Only add lake/pond features when there is an indication that there is some kind of natural, depressional feature and not just a human controlled/flooded agricultural area.*
- e) *Drainage ditches that solely channel flow off of agricultural fields and that do not contribute to the overall network connectivity will not be mapped.*

## **XI. Acknowledgements**

Thank you to:

Joel Osuna, Center for Geographical Studies, California State University, Northridge

Kacy Krieger, Alaska Natural Heritage Program, University of Alaska, Anchorage

Troy Blanford, Geographic Information, Montana State University Library

For providing examples and source documents of which much of this document was based.