Montana Hydrography Dataset
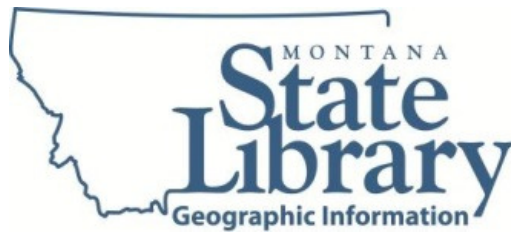
Stewardship and Edit Submission Guide

Montana State Library

Water Information System

November 2014, v1.3

Document version history

- v1.0 drafted by MSL and reviewed by Hydro Working Group
- v1.1 incorporated changes from Hydro WG and released September 2014 to public
- v1.2 modified to reflect release of the Montana Hydrography Edit Request Viewer, Oct. 2014
- v1.3 modified to reflect edit tracking ability using the online viewer, Nov. 2014

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Purpose of this document

The purpose of this document is to provide guidelines and a set of procedures for maintaining Montana's Hydrography Dataset. Hydrography stewardship is a collaborative effort led by the Montana State Library and guided by the Montana Hydrography Working Group, including representation from the United States Geological Society (USGS), Montana Department of Natural Resources and Conservation (DNRC), Montana Department of Environmental Quality (DEQ), and Montana Fish Wildlife and Parks (FWP). The Working Group recognizes the importance of a single, authoritative hydrography dataset that meets the needs of multiple state and local agencies, as well as contributes to the National Spatial Data Infrastructure and the National Map.

Bringing Montana's water-related data into a nationally consistent spatial framework

Accurate hydrography datasets, maps, and information facilitate water planning, water management, water development, environmental permitting, restoration, and protection of Montana's water resources. Understanding Montana's surface water systems, how they network together, and how they interact with other water-related features, or events, is fundamental to preserving the State's water quality and supply.

The National Hydrography Dataset (NHD) is a comprehensive digital spatial database, or Geographic Information System, representing the nation's water resources, including streams and rivers, lakes, ponds, reservoirs, springs, waterfalls, gages, water quality stations, dams, and wells, among others.

The NHD is a powerful backbone for water information because it orients features into a flow-directed network and provides an addressing system for water-related data, much like addresses on a street. Once addressed to, or connected to, the NHD network, water-related information from one organization can be discovered by and shared with other organizations and more easily incorporated into applications. The NHD provides mapping, data discovery, data sharing, and analysis and modeling capabilities within a nationally consistent framework.

Developed by the United States Geological Society (USGS), the NHD was originally created from a variety of sources, primarily USGS Digital Line Graphics (DLG) or 1:24K topographic maps. While the NHD is a respectable representation of nation-wide hydrographic features, the digital linework has become dated and regular updates are needed as newer data sources become available, such as high-resolution aerial imagery and LiDAR elevation data. In addition to spatially-accurate linework, the geodatabase model, components, and capabilities must satisfy Montana's needs and local uses. State, federal, local organizations and the general public all benefit from dedicated coordination between the USGS and the State of Montana to provide support, enhancement, and stewardship of the NHD.

Stewardship

In partnership with the USGS, the Montana State Library (MSL) is the steward of the Hydrography Dataset within Montana (Figure 1).   The USGS provides national level guidance, data storage, distribution, and NHD model development and support, while the State Library facilitates state and local level collaboration to incorporate edits into the NHD, advocate for its use, and assure the hydrography model satisfies state needs. Updates from local agencies and stakeholders are critical to improving the existing NHD and making it a useful and accurate representation of Montana's hydrography.

The Montana State Library's hydrography stewardship program strives to provide a high-level of support for the NHD, while fully taking advantage of the on-the-ground knowledge of local contributors, or substewards. The workload is a balancing act requiring national, state, and local substewards to take responsibility for the pieces of the hydrography dataset with which they are most familiar due to proximity (jurisdiction) or business needs.
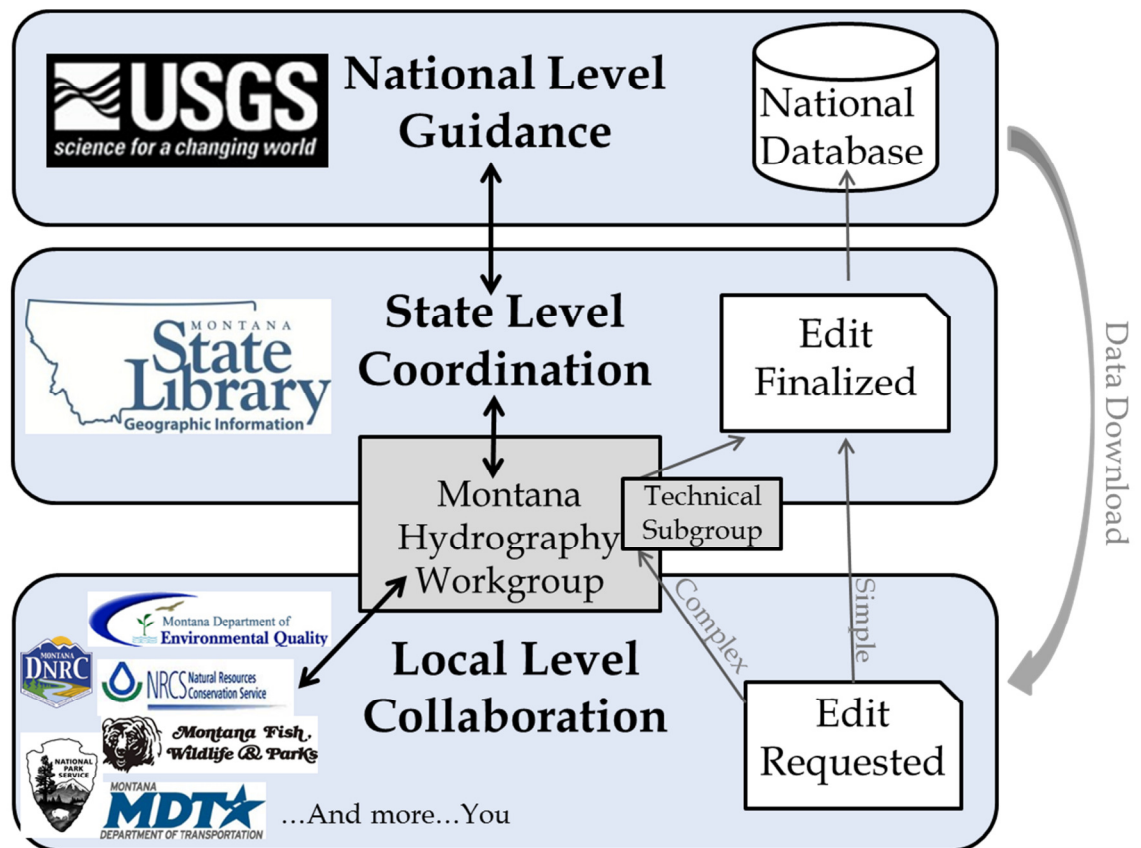

Figure 1. Montana's Hydrography Stewardship Program is a collaborative effort dependent upon national and state-level guidance and support and local-level revisions and updates.

Montana Hydrography Working Group

The Montana Hydrography Working Group is a primary sounding board for State water information needs. The Group meets quarterly to provide direction for the State's Water Information System (WIS) and hydrography framework, such as to discuss water data needs; to improve the hydrography dataset; to facilitate sharing opportunities; and to increase water-related data discovery. The Montana Hydrography Working Group is open to all who are interested—to join the group go to www.groups.google.com and search for "MAGIP Hydrography Workgroup".

Technical Subgroup

A subset of the Hydrography Working Group, the Technical Working Group, assists MSL in making decisions regarding complex NHD revision requests. This assures change requests made by one party that may impact others are brought to the attention of all before being implemented. Each core agency is represented on the technical workgroup and members are approved by the larger working group. Meetings are called on an ad hoc basis and decisions are made by consensus. In the event that a clear consensus is not achieved, the Principal Hydrography Dataset Steward may be called upon to make the decision.

Types of Revisions and Importance

The most common revisions made to the Hydrography Dataset follow:

- **Revisions to spatial location and geometry**. Because water is so dynamic, regular updates are needed to keep flowlines and other water features better aligned with the earth's surface. Recent aerial imagery, such as NAIP, and other high-resolution datasets, such as LiDAR, provides a readily available means for checking and revising the spatial location of water features. Accurate spatial representation of rivers and lakes enhances cartographic product and improves network navigation and modeling. Just like with any map, inaccurate representations decrease usefulness.

- **New features**. The NHD Model (see section, "NHD Documentation" pp. 14) provides for a variety of hydrologic feature types. In many cases the ability to store a hydrologic feature exists in the model, but a thorough, or recent, inventory of the features has not been completed. In general, the NHD depicts information portrayed on USGS 7.5 minute quad maps. Montana's Hydrography Dataset could be greatly enhanced by hydrologic data contributions from State and other local agencies. Examples include dams located on State-owned lands, glaciers and waterfalls in Glacier National Park,

small ponds near the Charles M. Russell National Wildlife Refuge, and diversion structures associated with water rights.

- **Name updates.** There are many unnamed rivers, streams, canals, and lakes in the Montana Hydrography Dataset. Names need to be added to better agree with State datasets, such as water rights, fisheries information, and water quality data. Currently, only names accepted by the U.S. Board on Geographic Names (BGN) and stored in the Geographic Names Information System (GNIS) can be included in the USGS NHD. If needed, the State Library may manage a separate database (related table) that associates additional or secondary (alias) names with the Hydrography Dataset. Names are an important revision that should be submitted to MSL and coordinated with the State GNIS Point of Contact.

- **Correct flow direction**. Streams are the fundamental core of the Hydrography Dataset, and correctly assigned direction of flow enables navigation of the stream network. While fairly straightforward to determine in areas of high relief, flatter areas and areas of complex channels require local-level contributions.

- **Feature Type (FType or FCode) revisions.** The NHD Model accommodates a variety of feature types (FType) and feature codes (Fcode). FTypes provide a general category for grouping water features, such as LakePond, StreamRiver, and SinkRise, while FCodes provide a more detailed description, such as intermittent stream, settling pond, and reservoir at normal pool. These are important attributes to submit to MSL because they are difficult to assign without on-the-ground knowledge.

Submitting Updates to the Montana Hydrography Dataset

Anyone can contribute to the hydrography dataset. Hydrography data stewardship is enriched by participation and contributions happening at multiple levels, including governmental agencies, local organizations, and individuals. No single agency can keep up with the dynamic, constantly changing nature of rivers and other hydrographic features. A collaborative approach to maintenance and upkeep is essential.

Potential contributors have differing skill levels, interests, and available staff and time resources; therefore, Montana's stewardship program has been setup to accommodate multiple options for submitting NHD updates. "Small orders" may require little more from the contributor than filling out a simple form and sending an email or submitting a revision online through the hydrography web application, while "large orders" may best be accomplished through USGS NHD Update Tool training and direct collaboration with MSL.

The primary contacts for NHD revisions and general assistance (pp. 10) are the Principal Montana Steward and the Montana Technical Point of Contact (referred to collectively in this document as the "Steward").   Three primary options are provided for submitting NHD revisions:

- **Option 1 Submit via web application or send email**. Submit a revision online using the *Montana Hydrography Edit Request Viewer:* *<http://mslapps.mt.gov/Geographic_Information/Applications/Hydrography/Default.aspx>* Instructions are provided on the webpage. Contributors may also fill out a form or send an email to the Steward with the information requested in the *Edit Submission Form* (pp. 11). The Steward will then add the request to the web application. Option 1 is ideal when only a handful of revisions need to be submitted. The contributor identifies what and where, and then the Steward takes 100% responsibility to complete the revisions.

- **Option 2 Use the NHD Update Tool**. Complete NHD Update Tool training provided by the USGS and coordinated with the Steward. The Steward will then checkout the area of interest (a 4th code/8-digit HUC), run QA/QC tools, and email/FTP the HUC to the contributor. The contributor will then complete updates using the NHD Update Tool and submit the job back to the Steward. The Steward will complete final QA/QC and submit the job to the USGS for acceptance into the national database. Besides alleviating the QC burden from the contributor (the most time consuming piece of the editing workflow), this process also promotes coordination. Because the Library is involved in the initial and final steps, they can coordinate with other agencies to make sure the revisions from one agency do not negatively impact another agency. This becomes especially important as more events are tied to the hydrography network.

- **Option 3 Send Own Data.** Send a geodatabase to the Steward (other formats may be accepted). The geodatabase should include the revisions and any sources used to vet them, such as aerial imagery or high-resolution elevation data (common public datasets need not be included). The Steward will then "import" or recreate the revisions using the NHD Update Tool. To facilitate the effort, data should include the information requested in the *Edit Submission Form* (pp. 11) to the extent possible, such as Ftype, Fcode, and direction of flow. Failure to provide essential information will lengthen the turnaround time for the revision; in general, the closer submitted datasets are to matching the NHD schema the more readily the data can be incorporated into the NHD.

Table 1 summarizes the options for submitting NHD revisions, including targeted skill-level, relative level-of-effort (contributor and steward), and approximate turnaround time.

Update Option	Intended for:	Targeted NHD/GIS Skill-level	Contributor Effort	Steward Effort	Min Turnaround Time (after contributor submission)
1. Submit via web app	A few to a handful of revisions	Low	10%	90%	Days
2. Use the NHD Update Tool	Mass revisions (impending)	High	70%	30%	Weeks
3. Send own data	Mass revisions (preexisting or resulting from other business needs)	Medium	30%	70%	Months

Tracking submitted revisions

Contributors can view ongoing NHD revisions and propose new revisions through the *Montana Hydrography Edit Request Viewer*: <http://mslapps.mt.gov/Geographic_Information/Applications/Hydrography/Default.aspx>. Users can view "Pending," "In Progress," and "Completed" requests and click on a feature to see a description of the revision. The web application allows users to track the status of their edits, edits submitted by their agency, and edits submitted by other users or agencies. Please visit the web application for additional information and help.

Contributors may also obtain a copy of the geodatabase from MSL to review edit requests in desktop GIS software.

Prioritizing edits

Because the editing checkout process occurs at the 8-digit HUC level and QC of the HUC is time-consuming, it is most efficient for the NHD Stewards to wait for multiple revision requests in a basin before checking out a particular basin and performing work. For this reason, edits will sometimes sit in the queue for an extended period of time, though most revisions are completed within a few months. Reasonable high priority requests may be filled in a few weeks or less. The Stewards will make every effort to assure an edit request does not sit in the queue for more than 6 months.

Conflicting edit requests

Occasionally, an edit submitted by one contributor may affect another organization. Agencies are responsible for identifying when a proposed revision may affect their business data. Concerned agencies should keep a watch on proposed revisions (see section, "Tracking Submitted Revisions," pp. 7). In the event of a conflict, the Montana Hydrography Technical Working Group will convene to discuss the proposed edit. The Group may accept the edit, reject the edit, or propose the edit in revised form. In the event that the Group cannot come to a consensus the revision will be rejected and additional information will be sought from the contributor.

In general, the Montana Hydrography Dataset should depict the physical surface hydrology of the State as accurately as possible; however, like any GIS dataset, the hydrography layer is a representation enabling spatial analysis and modeling. For modeling purposes, a feature's network location may sometimes be more important than its true, physical location. Business data needs may occasionally take precedence over spatial accuracy.

Where to get data and update frequency

Montana hydrography data can be obtained in multiple ways (e.g. staged statewide dataset, staged subbasin dataset, dynamic extract from the national database) and from multiple places (e.g. National Map Viewer, USGS NHD website, MSL Water Information System), each often providing a different version (date). This challenges the hydrography framework goal to serve a single, authoritative dataset used by multiple agencies. Therefore, the Stewards and the Hydrography Working Group recommend that Montana agencies and individuals obtain the hydrography dataset from the Montana State Library's MSDI Hydrography page but recognize some projects may require a more recent update. **Table 2** lists sources of the Hydrography Dataset and approximate update frequencies.

Table 2. Sources and update frequency of the Montana Hydrography Dataset

Source	Description	Data Type / location	Update Freq.
MSL	Statewide in MT State Plane Projection (subset by request)	File GDB 10.1 (other by request) / MSDI Hydrography http://geoinfo.montanastatelibrary.org/data/msdi/hydrography/	~ two months
MSL	Statewide z/m disabled in MT State Plane Projection (subset by request)	File GDB 10.1 (other by request) / ftp://ftp.geoinfo.msl.mt.gov/Data/Spatial/MSDI/Hydrography/	~ two months
USGS	Staged Statewide in GCS	File GDB 9.3.1 / http://nhd.usgs.gov/index.html	~ two months
USGS	Staged subregions (4-digit) in GCS	File GDB 9.3.1 / http://nhd.usgs.gov/index.html	~ two weeks
USGS	Dynamic Extract from National Map (HUC 8 or user defined map extent)	File or personal GDB or shape / http://viewer.nationalmap.gov/viewer/	~ one week
USGS	Cached Map Service	http://basemap.nationalmap.gov/arcgis/rest/services	~ 1 year (USGS future goal is 6 months)
USGS	Dynamic Map Service	http://services.nationalmap.gov/arcgis/rest/services	~ 3-6 months (USGS future goal is 1 month)

Montana Hydrography Dataset Contacts

Principal Data Steward

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Technical Point of Contact

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Montana State Library

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Phone: 406.444.0539

USGS Geospatial Liaison

Lance Clampitt

Email: lsclampitt@usgs.gov

Phone: 406.994.6919

USGS Point of Contact

Hank Nelson

Email:hpnelson@usgs.gov

Phone: 303.202.4448

Montana Hydrography Edit Submission Form

Montana State Library Water Information System

Use this form to submit revisions to the Montana Hydrography Dataset

Date:

Contact Information

Name _____

Organization _____

Phone _____

Email _____

Request

NHD Feature: ☐Flowline/line ☐Waterbody/area ☐Point ☐Event

Source(s) used to vet the edit: ☐Authority/expert ☐Imagery ☐LIDAR ☐Topo
Other:_____

Edit Type: ☐Name ☐Geometry ☐Attribute ☐Multiple

Location Description (e.g. Township, Range, Section; Lat/Long; or distance/direction from landmark):

Please provide a description of the edit. Include as much detail as possible, such as Ftype, Fcode, and direction of flow (e.g Stream/River: Intermittent: flows N towards the Beaverhead). For a list of Ftypes and Fcodes see:

http://nhd.usgs.gov/userGuide/Robohelpfiles/NHD_User_Guide/Feature_Catalog/Hydrography_Dataset/Complete_FCode_List.htm

Submit form to: MSL Water Information System, geoinfo@mt.gov

We will be in contact via email as we progress with these edits. Thank you for the submission!

Best Practices and Frequently Asked Questions

- **Please provide guidance on imagery as a data source for revising the NHD . . . Is NAIP adequate?**
    - *Yes, NAIP is a good source, and it does not have to be the most recent collection. Other imagery sources are sufficient as well. In fact, it is a good practice to use multiple years and dates of imagery, as hydrography may vary greatly from year-to-year. Attempting to capture "average" conditions is a practical approach. The key is to document what was used.*

- **I see tradeoffs in various sources, and I am inclined to use multiple datasets. How should I proceed?**
    - *The use of multiple sources is strongly encouraged. When discrepancies exist amongst good data sources, attempt to identify average conditions. Again, what source is used is less important than making sure whatever is chosen gets documented in the metadata.*

- **Does the Hydrography Dataset have a place for storing "local" or historically-accepted names?**
    - *Currently, names that differ from those maintained in the Geographic Names Information System (GNIS) are not included in the Hydrography Dataset; however, being able to capture local and historic names is a common interest of the State and other agencies. The Montana State Library anticipates needing to devise a cross-reference table for this. A user would then grab the primary names from the NHD and be able to relate to alternative hydro names from MSL.*

- **I'm ready to begin reviewing the Hydrography Dataset and submitting revisions. Where should I start?**
    - *Editing of the Montana Hydrography Dataset occurs on a 4th code (8-digit) HUC- by-HUC basis; therefore, it is most efficient to focus review and edit submissions by area (subbasin) as opposed to by type of edit. That said, any contributions are greatly appreciated, and your business needs should drive the workflow.*

        As a local contributor (substeward) you know the area best. The most important attributes to double-check and submit are FType, FCode, direction of flow, and GNIS Name/ID.

- **I am experienced with the ArcGIS Editor. Why should I use the NHD Update Tool?**
    - *The Hydrography Model depends on many relates between features and tables, such as feature level metadata, reach code maintenance, and source citations. An edit to one feature class likely impacts other feature classes and tables. The NHD Update Tool manages these properly for you; the ArcGIS Editor does not. The NHD Update Tool also knows the rules and topologies that must be followed.*

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Editors need to be aware of how features relate. One simple edit may necessitate several additional edits. For example, editing a waterbody geometry oftentimes requires that the flowline (artificial path) running through the lake gets updated, as well as any associated points.

- **At what scale should digitizing occur?**
    - *The digitization scale can vary but in general a good practice is 1:5000 or 1:8000. Be consistent in editing similar features and be sure to document the approximate scale in the metadata.*

- **I see some problems with the data across the border in Canada. Should I submit these?**
    - *At this time, Montana is not able to complete any edits in Canada. While border harmonization efforts are ongoing, Canada is responsible for their own hydrography data. Additionally, Montana does not edit features located across the state boundary.*

- **I know "events" are tied to the Hydrography Dataset by reachcodes and measures. How does editing flowlines impact reachcodes?**
    - *A best effort is made to preserve reachcodes by modifying the geometry of an existing reach whenever possible, rather than deleting and creating new ones. Regardless, sometimes new reachcodes are added or old ones are deleted. Some of these changes can be tracked in the ReachCrossReference and ReachCodeMaintenance tables.*

NHD Documentation

Extensive information on the NHD Data model is available through the USGS. Please visit the following URLs:

- **NHD Home**
  - http://nhd.usgs.gov/index.html

- **NHD Stewardship Home**
  - http://usgs-mrs.cr.usgs.gov/stewweb/index.html

- **NHD User Guide**
  - http://nhd.usgs.gov/userguide.html

- **NHD Feature Catalog**
  - http://nhd.usgs.gov/userguide.html?url=NHD_User_Guide/Feature_Catalog/NHD_Feature_Catalog.htm

- **NHD Model Schema Diagram**
  - http://nhd.usgs.gov/NHDv2.1_poster_3_23_2012.pdf