



**VGIS  
HANDBOOK**

**PART 2 - STANDARDS  
SECTION F**

**SURFACE WATERS  
STANDARD**

Vermont Geographic Information System

## **Standard History**

- February, 1993 - Final Draft released: Section F: Surface Water Data Standard
- June, 1995 – Draft released: Section K: Drainage Basins
- September 2008 – Section F: Surface Water Data Standard updated to officially adopt the NHD and the WBD standards and the NHD Stewardship Program as the Vermont standard.

## **Acknowledgments**

The Vermont Center for Geographic Information, Inc. (VCGI) would like to thank the people who assisted in developing and reviewing this standard. Special thanks to the Standard's primary author, Mike Brouillette (VCGI), and to all those whom contributed, particularly the VCGI Technical Advisory Committee (TAC), the Agency of Natural Resources, the Regional Planning Commissions and the Natural Resource Conservation Service for their revisions of the draft document to its current form. Further, we all owe thanks to the United States Geological Survey and the NHD and NHD Stewardship Programs, for without their support in the form of standards and an NHD Stewardship grant, our work could not have progressed to this point.

## **Statutory Authority**

Vermont Statutes: Title 10: Conservation & Development – Chapter 8: Geographic Information – 10 V.S.A. § 123. Powers and duties

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<p><b>I. INTRODUCTION</b></p>	<p>This major update of the standard follows a formalized agreement between the United States Geological Survey (USGS) and VCGI, with VCGI assuming the role of “State Steward” under the NHD Stewardship program. For complete details see the program homepage at: <a href="http://webhosts.cr.usgs.gov/steward/">http://webhosts.cr.usgs.gov/steward/</a>.</p> <p>The adoption of national “framework” standards as a basis for the Vermont state surface water and related standards will facilitate the usability of Vermont data in a regional and national context, while simultaneously reducing the duplication of creating a separate state standard and associated data related tools.</p> <p>This document is divided into the following sections:</p> <p><i>I. INTRODUCTION</i> Purpose Scope of Standard Background</p> <p><i>II. NHD STANDARD</i> Linear Referencing</p> <p><i>III. WATERSHED BOUNDARY DATASET STANDARD</i></p> <p><i>IV. MAINTENANCE</i> NHD Stewardship Maintenance Update Schedule Unique Version of the Current Data XY Units &amp; Coordinate System Technical References Review and Modification of this Standard Terminology</p>
<p><b>Purpose</b></p>	<p>To adopt nationally accepted “framework” data models, their standards and associated programs as the foundation for developing and maintaining surface water and hydrologic unit boundary data in Vermont. The following documents specify how features are defined and maintained:</p> <ol style="list-style-type: none"> <li>1) The National Hydrography Dataset (NHD) “<i>Standards for National Hydrography Dataset – High Resolution</i>”, draft 10/1999 (<a href="http://nhd.usgs.gov/techref.html">http://nhd.usgs.gov/techref.html</a>);</li> <li>2) The NHD Stewardship Program</li> </ol>

	<p>(<a href="http://webhosts.cr.usgs.gov/steward/">http://webhosts.cr.usgs.gov/steward/</a>); and</p> <p>3) The Watershed Boundary Dataset (WBD) "<i>Federal Standards For Delineation Of Hydrologic Unit Boundaries; Version 2.0 October 1, 2004</i>" – Available at the following website: (<a href="http://www.ncgc.nrcs.usda.gov/products/datasets/watershed/">http://www.ncgc.nrcs.usda.gov/products/datasets/watershed/</a>)</p> <p><b>NOTE:</b> The WBD and the Vermont Hydrography Dataset (VHD) are interrelated as the VHD is tiled at the WBD “subbasin” or 4<sup>th</sup> level “hydrologic unit boundary”.</p>
<p><b>Scope of Standard</b></p>	<p>This Standard applies to any organization involved in the development or maintenance of the NHD and WBD when receiving state or federal funding. Metadata must accompany all geospatial datasets developed with such funds.</p>
<p><b>Background</b></p>	<p>The historical surface water and drainage basin draft standards originally drafted in 1993 and 1995 are being replaced with the nationally accepted NHD and WBD standards, respectively. These standards are robust and time-tested data models supported by the FGDC, USGS, EPA and other federal agencies. The primary goal of these standards is to support the creation and maintenance of national “framework” datasets like the NHD and WBD. The broad based support for this standard will provide users with many benefits including; access to support, custom user interfaces and functionality that would be difficult, if not impossible, for organizations in the state to develop on their own.</p> <p>Prior to the “high” resolution (1:24,000) NHD and “local” resolution (1:5,000) NHD (herein referenced as the Vermont Hydrography Dataset or VHD), surface water data in the state was comprised of numerous data sets of varying extents, developed over a wide range of time, methodologies, and accuracies with data organized according to political boundaries. With the award of a USGS Innovative Partnership grant in late 2000, work began on creating the larger scale VHD in 2001 with initial state coverage completed in 2003. The master data model was migrated from the coverage based “NHDinARC” to its geodatabase counterpart “NHDinGEO” in 2006. Two attribute enrichment projects; the Value Added Attributes and Hydrographic Category (intermittent vs. perennial) were integrated in 2008.</p>

<p><b>II. NHD STANDARD</b></p>	<p>The NHD standard represents a shift from the previous, state based, draft VGIS Surface Waters Data Standard to a nationally supported and implemented standard. While this standard technically covers all implementations of the NHD data model, i.e., the “Local” (1:5,000), “High” (1:24,000) and “Medium (1:100,000) resolution datasets, it is unlikely resources will be applied to the “Medium” resolution (1:100,000) dataset due to its small scale and lack of detail.</p> <p>VHD represents the state’s implementation of this national standard at the “Local” resolution (1:5,000 scale).</p> <p>The standard has had numerous implementations, i.e., NHDinARC (coverage based), NHDinGEO (geodatabase) and NHDGEOinSHP (shapefile derivative of NHDinGEO).</p> <p>To date, the associated USGS metadata sections for attribute and domain descriptions resides in user guides and other documentation with only generalized information available in the metadata files. To remain consistent with other data in the VGIS these sections will be populated for NHD data downloaded from USGS, reprojected and posted to VGIS as a derivative product.</p> <p>The Tile Structure of the NHD is equal to the 4<sup>th</sup> level WBD, i.e., “subbasin”. There are 17 subbasins covering Vermont, but only 5 are completely within the state boundary. They are all listed below in the WBD section, with those internal to Vermont in bold.</p>
<p><b>ADDENDUM TO NHD STANDARD</b></p>	<p>In the future this section will detail any specifications or provisions required to accommodate Vermont Surface Water Data specifics that will build on, but not modify, the foundation of the national NHD or WBD Standards.</p> <p>The extensibility of these specifications or provisions for Vermont’s purposes is limited only by the requirement that they conform to the national models’ key concepts. For example, it is possible to add an attribute item to a data layer but not to replace an existing one.</p>

<p><b>Enriched NHD Attributes</b></p>	<p>As of August 2008, the VHD has officially been “enriched” with a number of attributes not populated in the original release of either High or Local resolution NHD in any state. The first is “Hydrographic Category”, i.e., “perennial” vs. “intermittent”, stored in the FCODE attribute, and the second is a set of 20 new attributes, referred to as the Value Added Attributes (VAA’s). The VAA’s are assigned to each drain feature in the stream network and are designed to enhance the capabilities of the NHD in three areas: 1) Navigation/Traversal; 2) Analysis; and 3) Display. For more information on VAA’s view the “NHDPlus” documentation at: <a href="http://www.horizon-systems.com/nhdplus/documentation.php">http://www.horizon-systems.com/nhdplus/documentation.php</a>.</p>
<p><b>Linear Referencing</b></p>	<p>Using linear referencing, the VHD provides a common framework for users to link, analyze and display numerous water-related data in concert.</p> <p>A Linear Reference System (LRS) provides users with the ability to associate point or linear "events", and their attributes, along a "linear feature" without segmenting or breaking the linear feature with pseudo nodes that would break the integrity of the NHD model. This allows users to associate information along a linear feature, such as a dam point on a stream, without having to actually update or modify the characteristics of the underlying features (split, unsplit, move, etc.).</p> <p>VCGI encourages users of the VHD to associate point and linear attribute data using event tables so that multiple sources of event data can be displayed and analyzed on the same reach to facilitate data sharing and improve analysis. In addition to “stock” functionality in GIS software for linear referencing, a number of useful utilities exist but due to their dynamic nature they are noted in both the VGIS VHD metadata or the VCGI surface water homepage: <a href="http://www.vcgi.org/sw">www.vcgi.org/sw</a>.</p>

<p><b>III. WATERSHED BOUNDARY DATASET STANDARD</b></p>	<p>The Watershed Boundary Dataset (WBD) is an interagency standard, i.e., EPA, USGS, NRCS, USDA, USFW etc., for “hydrologic unit boundaries” at the 4<sup>th</sup> (subbasin), 5<sup>th</sup> (watershed) and 6<sup>th</sup> (subwatershed) levels with a focus on remedying historical overlaps in both the USGS and NRCS hydrologic unit boundary standards. It is comprised of hydrologic unit boundary features that are hierarchical in nature and currently include six different levels, in the future, 7<sup>th</sup> and 8<sup>th</sup> level features will be added to the dataset:</p> <ul style="list-style-type: none"> <li>○ Region (1<sup>st</sup>);</li> <li>○ Subregion (2<sup>nd</sup>);</li> <li>○ Basin (3<sup>rd</sup>);</li> <li>○ Subbasin (4<sup>th</sup>);</li> <li>○ Watershed (5<sup>th</sup>); and</li> <li>○ Subwatershed (6<sup>th</sup>).</li> </ul> <p>Each level gets two digits in the hydrologic unit coding system, so that sub-basins, e.g., at the 4<sup>th</sup> nesting level, have 8-digit identification codes.</p> <p>The "FEDERAL STANDARDS FOR DELINEATION OF HYDROLOGIC UNIT BOUNDARIES" specifies how hydrologic unit boundaries are defined in the Watershed Boundary Dataset (WBD) <a href="http://www.ncgc.nrcs.usda.gov/products/datasets/watershed/">http://www.ncgc.nrcs.usda.gov/products/datasets/watershed/</a>.</p> <p>This standard, adopted by the Federal Geographic Data Committee, was (according to FGDC literature) created for the following reasons:</p> <ul style="list-style-type: none"> <li>✓ To guide development of a nationally consistent base-line drainage boundary framework known as the Watershed Boundary Dataset (WBD).</li> <li>✓ To resolve differences in the watershed (level 5, 10-digit) and subwatershed (level 6, 12-digit) hydrologic units between difference agencies.</li> </ul> <p>This federal standard established interagency standards and guidelines for creating, modifying and delineating hydrologic unit boundaries for a single nationally consistent and seamless dataset, i.e., the WBD.</p> <p>Watershed boundaries define the areal extent of surface water drainage</p>
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	<p>to a particular point in the landscape. The stated intent of establishing the WBD is to define a base-line drainage boundary framework that is predicated solely on science-based hydrologic principles, and independent of influence from artificial political boundaries or organizational bias.</p> <p>Since USGS 1:24k scale topographic quadrangles form the official base map for delineating WBD boundaries, discrepancies with the larger scale, 1:5k scale VHD are bound to exist. Discrepancies will be remediated, according to procedures outlined in the FGDC (WBD) standard, by the NRCS.</p> <p>At the end of this document is a map showing the location of the 17 Subbasins <b>contained within</b> or intersecting Vermont. These include:</p> <ul style="list-style-type: none"> <li>○ Black-Ottauquechee Rivers (01080106)</li> <li>○ Connecticut-Bellows Falls to Vernon Dam (01080107)</li> <li>○ Connecticut-Johns River to Waits River (01080103)</li> <li>○ Connecticut-Waits River to White River (01080104)</li> <li>○ Deerfield River (01080203)</li> <li>○ Hudson-Hoosic Rivers (02020003)</li> <li>○ Lake Champlain (02010008)</li> <li>○ Lake George (02010001)</li> <li>○ <b>Lamoille River (02010005)</b></li> <li>○ Middle Connecticut River (01080201)</li> <li>○ Mississquoi River (02010007)</li> <li>○ <b>Otter Creek (02010002)</b></li> <li>○ <b>Passumpsic River (01080102)</b></li> <li>○ St. Francois River (01110000)</li> <li>○ Upper Connecticut River (01080101)</li> <li>○ <b>White River (01080105)</b></li> <li>○ <b>Winooski River (02010003)</b></li> </ul>
<p><b>IV. MAINTENANCE</b></p>	
<p><b>NHD Stewardship Maintenance</b></p>	<p>Data maintenance and updates are supported through the NHD Stewardship program and individual “state stewards”. Under a Memorandum of Understanding (MOU) between the United States Geological Survey (USGS) and the Vermont Center for Geographic</p>

	<p>Information (VCGI), VCGI is the state NHD steward for Vermont. Adhering to the NHD standard provides a framework for maintenance and update, as well as, user access to seamless data at the regional and national levels. The MOU can be viewed at the following URL:</p> <p><a href="http://webhosts.cr.usgs.gov/steward/mou/VT_NHD_Stwrdsbp_agreement.doc">http://webhosts.cr.usgs.gov/steward/mou/VT_NHD_Stwrdsbp_agreement.doc</a></p> <p>Feedback from users and large stakeholders, primarily provided through a web based interface, the Surface Water Maintenance Tool (SWaMT) released in August 2008, will provide VCGI with information to perform maintenance on the “Local” resolution VHD and “High” resolution NHD for Vermont using the USGS “NHD Geo Edit” tool. The USGS role is to facilitate the larger process by providing overall management, coordination, customized tools, standards, program documentation, specialized training, quality assurance procedures and finally, data distribution. Edits made by state stewards are forwarded to and processed by the USGS, integrated into their central data archive and then made available to the public.</p> <p>Changes to the NHD are tracked “behind the scenes” via two tables, NHD.STATUS and NHD.DUU2FEA, that contain status information on the NHD feature and relationship updates. These tables are part of the NHD data model and will reside in the publicly available data.</p> <p>As the VHD is on the technical edge of both the VAA and “Hydrographic Category” enrichment efforts for Local Resolution data, there are no established maintenance methodologies to follow at this time. Once these, or supporting tools, are developed they will be integrated in the standard with a future revision.</p> <p>There is no national effort planned to generate VAA’s for the High Resolution (1:24,000) NHD at this time. Correspondingly, the source of “Hydrographic Category” for the High Resolution NHD is the 7.5’ hard copy topographic maps and USGS currently has no plans for maintenance on these features.</p>
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<p><b>WBD Maintenance</b></p>	<p>Currently, the WBD is maintained and distributed centrally through a national coordinator at the USDA Fort Worth National Cartographic and GIS Center and the Geodata Gateway, respectively:  <a href="http://datagateway.nrcs.usda.gov/NextPage.aspx">http://datagateway.nrcs.usda.gov/NextPage.aspx</a>.</p> <p>At the state level, the current process is a check-in/check-out system with Natural Resource Conservation Service (NRCS) employees coordinating local edits and forwarding to the federal coordinator for integration at the national level. State coordinators can be contacted by accessing the “National Technical and State Coordinators” section of the WBD homepage noted in the Purpose section above.</p> <p>All edits should be coordinated with the WBD state coordinator using the Geodatabase tools and guidelines noted below.  <a href="http://www.ncgc.nrcs.usda.gov/products/datasets/watershed/coordinators.html">http://www.ncgc.nrcs.usda.gov/products/datasets/watershed/coordinators.html</a></p> <p>The Natural Resource Conservation Service hosts the following Geodatabase tools to help edit/update the WBD on their <i>Watershed Boundary Dataset (WBD) Tools</i> web page:  <a href="http://www.ncgc.nrcs.usda.gov/products/datasets/watershed/tools.html">http://www.ncgc.nrcs.usda.gov/products/datasets/watershed/tools.html</a></p> <p>✓ <b>Geodatabase Tools</b>          These custom Watershed Tools from NRCS assist with Hydrologic Unit Delineation and Attribution in the Geodatabase format.</p> <ul style="list-style-type: none"> <li>○ WBD Introduction to Tools and Tutorial</li> <li>○ WBD Tools Tutorial</li> <li>○ WBD Tools for ArcGIS 9.x (Password required)</li> </ul> <p><b>NOTE:</b> In the future the two datasets may be integrated and managed in a singular data model. In that event, this standard will be updated.</p>
<p><b>Update Schedule</b></p>	<p>Updates to the NHD (“local” and “high” resolution) will be made on a bi-annual basis, or better, depending on the number of edits identified and submitted, as well as, available resources to underwrite the process.</p> <p>Updates to the WBD are managed by the national coordinator at the USDA Fort Worth National Cartographic and GIS Center and subject to their, currently undetermined, maintenance schedule.</p>

<p><b>Unique Version of the Current Data</b></p>	<p>The unique version, i.e., “the master”, for the NHD data, regardless of scale, is managed by USGS and resides in their NHD SDE database.</p> <p>The master WBD data resides in the USDA Geospatial Data Gateway and is maintained by the NRCS.</p> <p>Copies of these data will be periodically acquired, re-projected and posted to the VGIS Data Warehouse.</p>
<p><b>Quality Control Procedures</b></p>	<p>VCGI will utilize all quality control procedures outlined in the respective standards when updating features and their attributes.</p>
<p><b>XY Units &amp; Coordinate System</b></p>	<p>Master source data is stored in Geographic but VCGI reprojects XY coordinates values to the Vermont State Plane Coordinate System based on the North American Datum (NAD) of 1983. Coordinates are stored in meters. This is the standard map coordinate system used for storage of Vermont GIS (VGIS) data.</p>
<p><b>Technical References</b></p>	<p>The following websites include additional information:</p> <p><b><u>NHD</u></b></p> <ul style="list-style-type: none"> <li>• <b>NHD Standards</b> - <a href="http://nhd.usgs.gov/techref.html">http://nhd.usgs.gov/techref.html</a> <ul style="list-style-type: none"> <li>• Concepts and Contents</li> <li>• NHD Data Standards</li> <li>• NHDinGEO Schema</li> </ul> </li> <li>• <b>NHD Tools:</b> <a href="http://nhd.usgs.gov/tools.html">http://nhd.usgs.gov/tools.html</a></li> </ul> <p><b><u>NHD Stewardship</u></b></p> <ul style="list-style-type: none"> <li>• <b>Home page</b> - <a href="http://webhosts.cr.usgs.gov/steward/">http://webhosts.cr.usgs.gov/steward/</a></li> <li>• <b>Hydro Event Management (HEM) Tool</b> – Part of Data Management Tools (<a href="http://hydro.reo.gov/redesign.html">http://hydro.reo.gov/redesign.html</a>)</li> </ul> <p><b><u>WBD</u></b></p> <ul style="list-style-type: none"> <li>• <b>Main WBD website:</b> (<a href="http://www.ncgc.nrcs.usda.gov/products/datasets/watershed/">http://www.ncgc.nrcs.usda.gov/products/datasets/watershed/</a>)</li> <li>• <b>WBD Data Download website:</b> (<a href="http://datagateway.nrcs.usda.gov/">http://datagateway.nrcs.usda.gov/</a>)</li> </ul>

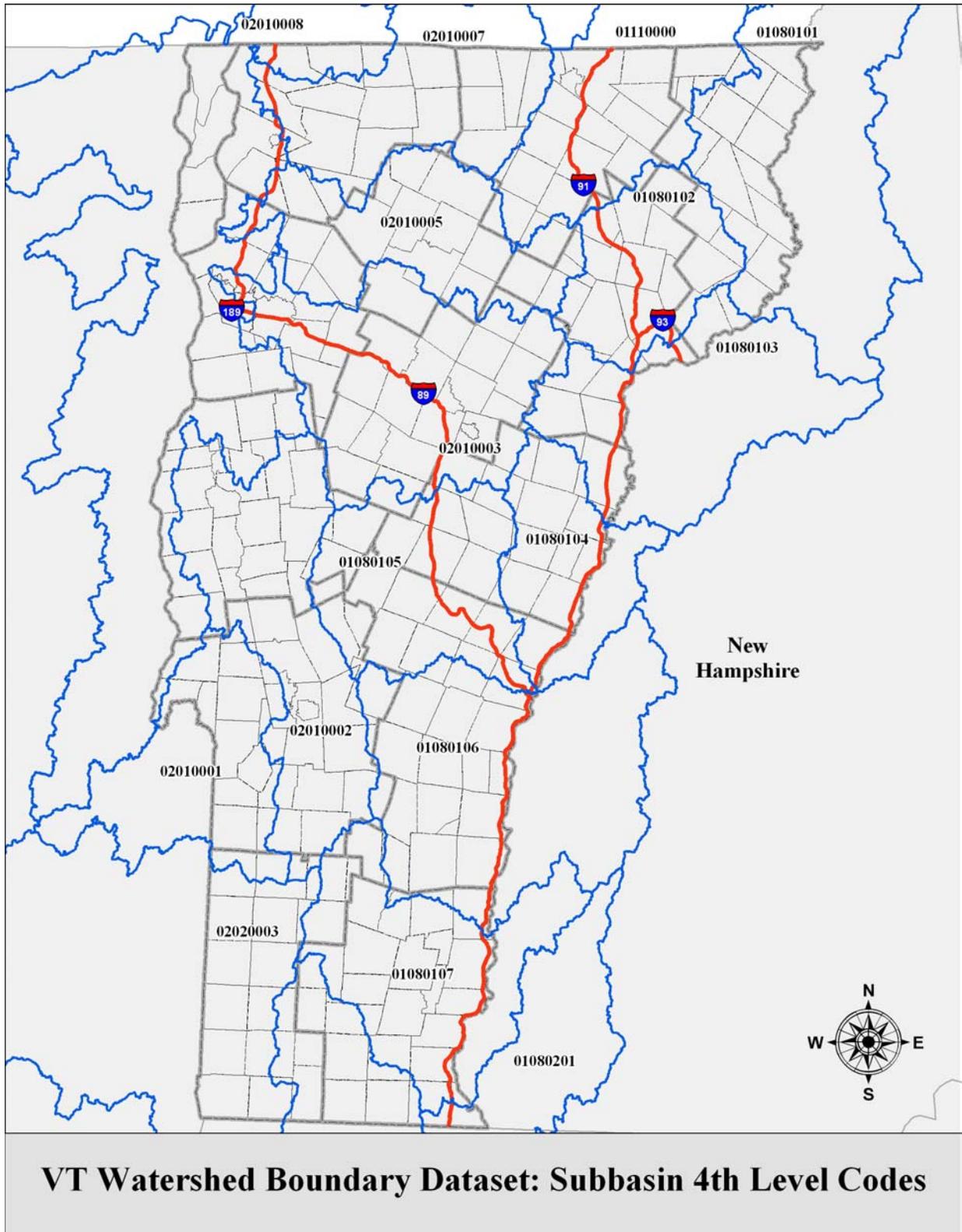
	<p><b>Other</b></p> <ul style="list-style-type: none"> <li>• <b>Water Resource Glossaries:</b> <a href="http://water.usgs.gov/glossaries.html">http://water.usgs.gov/glossaries.html</a></li> </ul>																		
<p><b>Review and Modification of this Standard</b></p>	<p>Proposed amendments to this document must be provided in writing to the VCGI TAC. This group will consider amendments to this Standard. The VGIS community will be provided with an opportunity to comment. Changes to the standard governing the NHD and WBD framework datasets are subject to certain limitations due to the fact that they are national standards.</p> <p>It is envisioned that additional criteria, identified by the Vermont user community, can be integrated to this new foundation in the future to address specific needs as they arise.</p>																		
<p><b>Terminology</b></p>	<p>The following terminology is used in this Standard:</p> <table border="1" data-bbox="605 999 1520 1730"> <tr> <td><i>Basin:</i></td> <td>The 3<sup>rd</sup> level (6-digit) of the hydrologic unit hierarchy. Basins are nested within or are sometimes</td> </tr> <tr> <td><i>Classic Watershed:</i></td> <td>A land and water area that has all the surface drainage within its boundary converging to a single point.</td> </tr> <tr> <td><i>Composite Hydrologic</i></td> <td>A land and water area that receives surface flow from an upstream watershed (s) and drains to one outlet.</td> </tr> <tr> <td><i>Contiguous Boundaries:</i></td> <td>Hydrologic unit boundaries shared in whole or in part by different hydrologic units.</td> </tr> <tr> <td><i>Digital Orthophoto</i></td> <td>Digital version of orthophotograph. In Vermont these are available from the Vermont Mapping Program.</td> </tr> <tr> <td><i>ESRI Shapefile:</i></td> <td>A specific GIS data layer format developed by Environmental Systems Research Institute (ESRI).</td> </tr> <tr> <td><i>Event Table:</i></td> <td>A tabular database containing information that can be associated with a linear reference system</td> </tr> <tr> <td><i>Feature:</i></td> <td>Representation of a real-world object (e.g.: “stream”, “bridge”, “building”, etc.)</td> </tr> <tr> <td><i>Framework:</i></td> <td>Baseline data layer incorporated into the National Spatial Data Infrastructure (NSDI)</td> </tr> </table>	<i>Basin:</i>	The 3 <sup>rd</sup> level (6-digit) of the hydrologic unit hierarchy. Basins are nested within or are sometimes	<i>Classic Watershed:</i>	A land and water area that has all the surface drainage within its boundary converging to a single point.	<i>Composite Hydrologic</i>	A land and water area that receives surface flow from an upstream watershed (s) and drains to one outlet.	<i>Contiguous Boundaries:</i>	Hydrologic unit boundaries shared in whole or in part by different hydrologic units.	<i>Digital Orthophoto</i>	Digital version of orthophotograph. In Vermont these are available from the Vermont Mapping Program.	<i>ESRI Shapefile:</i>	A specific GIS data layer format developed by Environmental Systems Research Institute (ESRI).	<i>Event Table:</i>	A tabular database containing information that can be associated with a linear reference system	<i>Feature:</i>	Representation of a real-world object (e.g.: “stream”, “bridge”, “building”, etc.)	<i>Framework:</i>	Baseline data layer incorporated into the National Spatial Data Infrastructure (NSDI)
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	<i>Framework:</i>	Baseline data layer incorporated into the National Spatial Data Infrastructure (NSDI)
	<i>Hydrography:</i>	The scientific description, study and analysis of the physical conditions, boundaries, measurement of flow, investigation and control of flow, and related characteristics of surface water such as rivers, lakes and oceans.
	<i>Hydrologic Unit (HU):</i>	"A hydrologic unit is a drainage area delineated to nest in a multi-level, hierarchical drainage system. Its boundaries are defined by hydrographic and topographic criteria that delineate an area of land upstream from a specific point on a river, stream or similar surface waters. A hydrologic unit can accept surface water directly from upstream drainage areas, and indirectly from associated surface areas such as remnant, non-contributing, and diversions to form a drainage area with single or multiple outlet points. Hydrologic units are only synonymous with classic watersheds when their boundaries include all the source area contributing surface water to a single defined outlet point." <sup>1</sup>
	<i>Hydrologic Unit Code (HUC):</i>	The numerical identifier of a specific hydrologic unit consisting of a 2-digit sequence for each specific level within the delineation hierarchy.
	<i>Hydrologic Unit Name:</i>	A name assigned to hydrologic units for better identifying and understanding the geographic location of the hydrologic unit. Hydrologic units are usually named after significant or prominent hydrographic features in an area, however hydrologic units may be named after non-hydrographic features if better understood by the users and public.
	<i>Lakes:</i>	A standing body of water with a predominantly natural shoreline surrounded by land.
	<i>Linear Referencing System:</i>	A Linear Reference System (LRS) provides users with the ability to associate point or linear "events", and their attributes, along a "linear feature" without segmenting or breaking the linear feature with pseudo nodes. This allows users to associate information along a linear feature, such as a dam point on a stream, without having to actually update or modify the characteristics of the features (split, unsplit, move, etc.).

<sup>1</sup> <http://www.ncgc.nrcs.usda.gov/products/datasets/watershed/index.html>

	<i>Non-contributing area:</i>	An area within a hydrologic unit that normally does not contribute directly to the surface runoff of the river or stream at the outlet of the hydrologic unit.
	<i>Ortho photograph:</i>	An orthophoto or orthophotograph is an aerial photograph that has been geometrically corrected ("orthorectified") such that the scale of the photograph is uniform, meaning that the photo can be considered equivalent to a map.
	<i>Region:</i>	Regions are the largest drainage basins, containing either the drainage area of a major river or the combined drainage areas of several rivers. Regions (2-digit) are the 1 <sup>st</sup> level in the hydrologic unit hierarchy.
	<i>Resolution:</i>	The degree to which features can be discerned, corresponding to the density of features. More streams and ponds can be discerned at a higher resolution. Generally, a larger scale map shows features at a higher resolution.
	<i>River:</i>	A body of flowing water.
	<i>Route section:</i>	A portion of a route defined by a "from" and "to" "measure".
	<i>Route:</i>	Multiple stream "segments" combined to define a single linear reference feature
	<i>Sub-basin:</i>	Subdivisions of basins. The sub-basin is the fourth level (8-digit) of the hydrologic unit hierarchy. Sub-basins were formerly named "cataloging unit". The average size is about 450,000 acres.
	<i>Sub-region:</i>	Subdivisions of regions. The sub-region is the 2 <sup>nd</sup> level (4-digit) of the hydrologic unit hierarchy.
	<i>Subwatershed:</i>	Subdivisions within watersheds. Subwatershed is the 6 <sup>th</sup> level (12-digit) in the hydrologic unit hierarchy. Subwatersheds generally range in size from 10,000 to 40,000 acres.
	<i>Surface waters:</i>	Includes rivers, streams, lakes, ponds, and wetlands.
	<i>Watershed:</i>	Subdivisions within a sub-basin. The 5 <sup>th</sup> level (10-digit) in the hydrologic unit hierarchy. Watersheds range in size from 40,000 to 250,000 acres.
	<i>Watershed Boundary Dataset:</i>	National implementation of the "Federal Standards for Delineation of Hydrologic Unit Boundaries" (geospatial database) containing the hydrologic unit boundaries for the 1 <sup>st</sup> through 6 <sup>th</sup> level units. Also includes the required attribute and metadata

		information.
	<i>Wetlands:</i>	Areas inundated with water for at least part of the growing season, but not considered rivers or lakes.



**VT Watershed Boundary Dataset: Subbasin 4th Level Codes**