Waterbody and Watershed Delineations

July 2019, ver. 1

FACT SHEET HISTORY	
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Unless stated otherwise, discard all previous versions of this Fact Sheet.

PURPOSE:

There are many ways to delineate and categorize waterbodies and their watersheds. DEQ's Integrated Report (IR) and stormwater permits use the 14-digit Waterbody Identification (WBID) system. The USGS's Hydrologic Unit Code (HUC) is used for watersheds and uses a different numbering system. This Fact Sheet provides an overview of the systems used to define the waterbodies and watersheds used in stormwater permits.

Waterbodies and Their Watersheds:

When complying with stormwater permits in Oklahoma, each permitted MS4 must address waterbodies and their watersheds. The *waterbody* is the stream, river, pond or lake into which rainfall runoff flows. The *watershed* of a given waterbody is the elevated land surrounding the waterbody over which runoff flows into the waterbody. Stormwater permits protect the water quality of waterbodies, but the sources of pollution are within the watersheds. Both are important: protection of a waterbody's water quality by controlling pollution sources within the waterbody's watershed.

Oklahoma agencies and water quality permits use formal designations (names and identification numbers) for waterbodies and their watersheds. Unfortunately, there are several types of identification systems and many versions of waterbody and watershed datasets now in use. This is due to many factors, including:

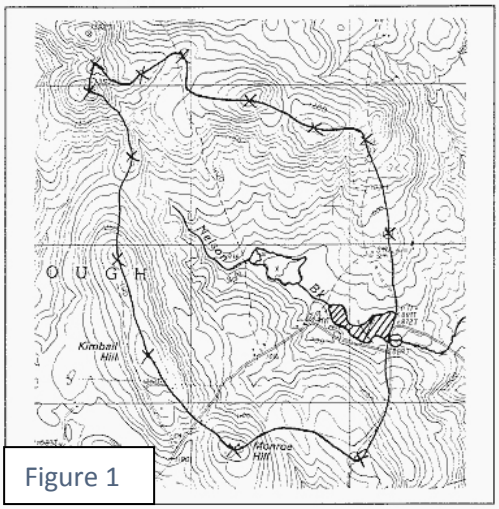


Figure 1

1. Watershed delineations have changed many times, with the original hand-drawn versions replaced by computer generated boundaries that are revised as new software and datasets became available (see Figure 1 copied from the NRCS website on how to delineate a watershed);
2. Because of the increased focus on nonpoint and stormwater sources of pollution within watersheds, agencies and permittees require delineations of ever-smaller watersheds to better define pollution sources and their impacts.
3. Single watersheds are often sub-divided into several smaller sub-watersheds, each with its own identification code and corresponding smaller waterbody to which the watershed's water flows;

4. Many stream channels with a single identification code may also be sub-divided into two or more smaller stream segments, each with its own waterbody code (WBID) and sub-watershed;
5. Waterbody features and watershed boundaries are subject to error corrections to match new information about water flows, when needed;
6. Often, digitizing of waterbodies and watershed boundaries are done locally without conforming to federal and state formats, and the files are often passed on to other users;
7. There are no procedures, agreements or regulatory requirements to replace older watershed boundaries or waterbody changes with the newer improved updates.
8. Consequently, several different types of watershed boundaries and waterbody features may be concurrently in use, often containing errors, and their differences can be problematic.

Because there may be several versions of watershed delineations and waterbody features concurrently in use, finding the most up to date version needed by stormwater permittees can be challenging.

Why Are Watersheds Important?

Rainfall runoff and illicit discharges within a watershed will flow into the "receiving waterbody", usually a stream channel. For municipal stormwater permittees, knowing where rainfall and illicit discharges will flow is essential for conducting field inspections and for interpreting data to characterize the extent of stormwater pollution. The locations of discharges within 303(d) and TMDL watersheds must also be known in order to effectively control sources of the 303(d) and TMDL "pollutants of concern". Stormwater permittees must use the correct 14-digit *Waterbody Identification (WBID)* number when reporting permit compliance for each waterbody and its watershed. An example of a 14-digit WBID number is: *OK121300010210_00*.

Watershed Sizes and Sub-Dividing:

The US Geological Survey (USGS) website describing the USGS Watershed Boundary Dataset provides an overview of the USGS *Hydrologic Unit Code (HUC)* levels (see Table 1 below). The largest sized delineations, which are multi-state, are Regions and Sub-Regions. For example, there are 22 HUC-2 Regions in the US, also referred to as Level 1. The USGS assigns each of the 22 Region's delineations a 2-digit HUC code, called a HUC-2.

Each of the 22 Regions is sub-divided into a total of 219 Sub-Regions in the US, with each Sub-Region boundary assigned a 4-digit HUC code. All of the USGS delineations are compiled and maintained in the *National Hydrography Dataset (NHD)*, with a web portal to the data at the USGS Data.gov website. Table 1 information is provided for reference only; Oklahoma does not use the terms "Levels", "Regions" and "Basins" as defined by the USGS in Table 1. However, DEQ uses the USGS HUC watershed delineations, but adds the associated WBID numbers used in Oklahoma.

Table 1: Breakdown of the USGS Watershed Boundary Dataset (WBD) *

Name	Level	Digit	Number of HUCs	Alias
2-Digit Hydrologic Unit	1	2	22	Region
4-Digit Hydrologic Unit	2	4	219	Sub-Region
6-Digit Hydrologic Unit	3	6	378	Basin
8-Digit Hydrologic Unit	4	8	2,283	Sub-Basin
10-Digit Hydrologic Unit	5	10	17,828	Watershed
12-Digit Hydrologic Unit	6	12	97,442	Sub-Watershed

** Data in Table 1 taken from the USGS Watershed Boundary Dataset website.*

This sub-diving process continues, with each sub-division having smaller watershed boundaries nested inside its larger "parent" watershed. At present, the USGS has sub-divided most of its HUC-10 watersheds into smaller HUC-12 watersheds. The following is an example of comparing the USGS' HUC-8 code with the 8-Digit Oklahoma WBID code for the same watershed boundary of *the Grand-Neosho River*:

USGS HUC-8 CODE: 11070103
WBID 8-DIGIT CODE: 12151003

Note that the USGS HUC code number is not numerically related to Oklahoma's WBID code. Fortunately, many data tables associated with GIS shapefiles of watersheds and waterbodies (e.g., a GIS shapefile's Attribute Table) often include HUC codes as well as WBID codes.

The colloquial terms watershed, sub-watershed, basin and sub-basin are often used interchangeably, despite the apparent formal definitions applied in Table 1 by the USGS. It can be said that, "one person's basin is another person's watershed, and still another's sub-watershed". It's more about context and local expression rather than any national definition. Generally, if you are referring to just a portion of a watershed, the term sub-watershed is clearly understood by everyone. Likewise, referring to a watershed as a basin is also clearly understood.

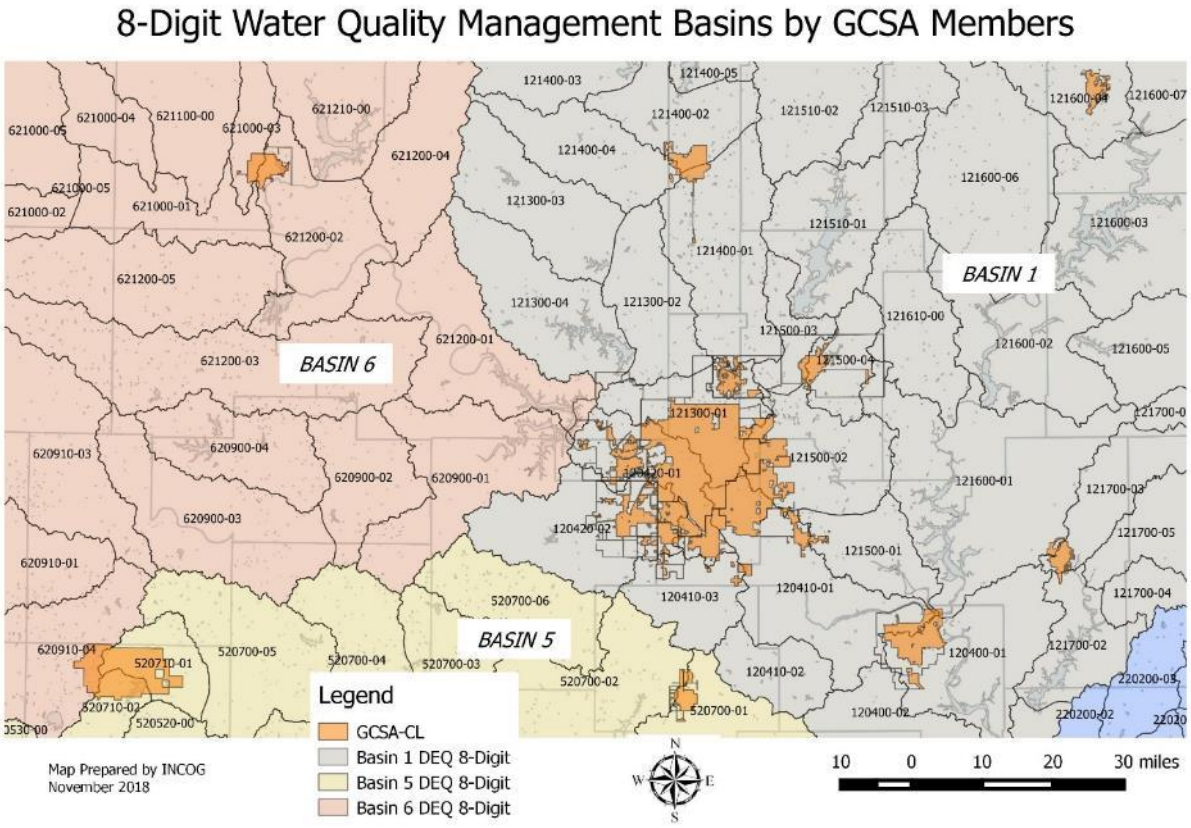
Waterbody and Watershed Identification Codes:

The USGS HUC system is used by many federal agencies nationwide, while the Oklahoma WBID system is used by Oklahoma's water quality agencies. DEQ's Appendix A of the 2016 Oklahoma Water Quality Integrated Report (IR) provides an excellent description of the WBID system used in the IR for all of Oklahoma. *The IR's Appendix A should be a must-read by all MS4 permittees*.

INCOG GIS LAYERS: INCOG has developed GIS shapefiles of Appendix A's seven statewide Water Quality Management Planning Basins as well as the HUC-8 sub-basins within each of the three Basins in which all GCSA Members are located (Basins 1, 5 and 6). INCOG also creates and updates as needed shapefiles and

GCSA maps of the HUC-8 and HUC-12 watersheds by its GCSA Members (see a map example in Figure 2 showing the Appendix A's 8-Digit WBID watersheds by GCSA Members).

Figure 2: 8-Digit Watersheds Within the Three Planning Basins by GCSA Members



With each biennial revision of DEQ's Integrated Report and 303(d) List of impaired waterbodies, INCOG updates its shapefiles for these waterbodies and produces updated maps for each GCSA Member. The present 2016 version of the 303(d) List is expected to be replaced later in 2019 with the finalized 2018 303(d) List. INCOG will assemble the newest shapefiles for the 2018 303(d) List and Completed TMDL list and assist its GCSA Members with preparing maps and obtaining map resources.

HUC NUMBERING SYSTEM: The USGS' HUC watershed numbering system isn't used in stormwater permits, only the Oklahoma WBID system for waterbodies is used. Yet when opening a GIS shapefile's Attribute Table of feature data, there are often a number of columns that contain many HUC-related codes along with the WBID number. For example, the Attribute Table may contain data columns for HUC-6, HUC-8, HUC-10 and/or HUC-12. However, the WBID number is of primary interest to MS4s.

DIFFERENT DELINEATIONS IN GIS: The watershed boundaries developed over the years using different delineation software and data sets are not seamlessly compatible with each other. For example, if a watershed boundary is overlain onto a different delineation of the same watershed, the boundaries appear similar but the boundary lines are not exact matches. This is due to the use of different software

and different surface elevation contour datasets. Non-aligned watershed polygons are a problem for those using GIS software when trying to perform geoprocessing of watersheds. It is very important to *check GIS shapefile compatibility and keep records of data sources, creation dates and updates*.

HUC AND WBID COMPATABILITY: Both the HUC and WBID code numbers are assigned to both the waterbody and to its watershed, but they use different numbering systems. You cannot derive a WBID code from a USGS HUC number, nor the reverse. HUCs remain important because GIS shapefiles of watershed boundaries are categorized by HUC size, for example, "HUC-8 watersheds", or "HUC-12 watersheds".

14-DIGIT WBID WATERBODY LAYERS: All Integrated Report (IR) waterbodies are listed by their 14-digit WBID code. This includes all listings of 303(d) and TMDL waterbodies. For IR waterbodies, DEQ has 14-digit WBID GIS layers for the streams, rivers and lakes in the IR. These are now viewable on the DEQ Data Viewer website and should soon be posted for download as shapefiles. *There are no delineations or shapefiles of 14-digit HUC watersheds that match up with these 14-digit WBID waterbodies*.

14-DIGIT WBID WATERSHED LAYERS: Unfortunately, Oklahoma does not have GIS shapefiles or delineations of "HUC-14" watersheds aligning with the IR's 14-digit WBID waterbodies. In addition, many TMDL watersheds are at least partially hand-drawn by the TMDL developers to create 14-digit TMDL watershed boundaries from larger watersheds. 14-digit delineations of 303(d) and TMDL watersheds within MS4s are not presently available as GIS layers. 14-digit watersheds for WBID waterbodies can be created using HUC-10 or HUC-12 watershed shapefiles, but geoprocessing of these is required to create 14-digit watersheds. INCOG will assist its GCSA Members with developing GIS map features upon request.

Watershed Information and Resources:

The best source of WBID data is found by using the DEQ Data Viewer interactive map, which also has a link for downloading GIS data. DEQ is also planning to post HUC-12 watersheds on the Data Viewer website to assist MS4s. INCOG also provides map-related data and information to its GCSA Members, including the latest versions of the 303(d) List and Completed TMDL List, Aquatic Resources of Concern (ARC) areas, waterbody and demographic GIS layers, and finished maps and data summaries as GCSA Technical Bulletins. INCOG has also begun a grant-supported project to compile a comprehensive summary with resource links on major water quality programs and projects that have been completed or are ongoing within the INCOG area. The results of this project will enable INCOG's GCSA Members to more easily locate water quality data and information relevant to their MS4.

INCOG NOTE: The information provided herein by INCOG does not necessarily reflect the views and positions of other persons or agencies. Please consult DEQ stormwater staff for information about stormwater permit requirements, implementation, assessments and enforcement. Also, contact INCOG for information about INCOG's Green Country Stormwater Alliance (GCSA) or this document.