



Stream Length Impaired by Metals other than Mercury

This EnviroAtlas national map displays the length in kilometers of streams, coasts, canals, and other linear hydrographic features from the 303(d) list of waters impaired by metals other than mercury within each 12-digit hydrologic unit (HUC). These are waters where high levels of metals have been found in the water, sediment, or fish. The most common metals in waterways are arsenic, cadmium, chromium, copper, lead, nickel, selenium, zinc, and mercury. Mercury is tracked separately and it is depicted in the layer Stream Length Impaired by Mercury.

Why are streams impaired by metals important?

Stream impairments can be due to a wide variety of causes, including chemical pollutants, physical conditions such as siltation, or biological contaminants such as bacteria. This map shows waters that are impaired by metals other than mercury. Metals impairments can have serious impacts on ecosystems, human health, and the economy.

Metals often enter streams through point source discharges or storm water runoff. Urban storm water contains many different metals from automobile tire, brake, and engine wear as well as fluid leakage.¹ Runoff from mines, waste sites like landfills, or soils that have been treated with pesticides, sludge, or fertilizers can contain metals. Metals can be released into the atmosphere, often from industrial sources. These pollutants can travel far from their sources before being deposited in the water or soil through atmospheric deposition. Metals can also enter the water through natural processes, such as the erosion of soils and rocks that contain metal; however, natural sources alone do not usually result in toxic levels.

Although some metals are necessary at trace amounts, all metals are toxic at high levels. Drinking water with high levels of certain metals can cause health problems, especially if it is consumed regularly over a long period of time. Depending on the metal, the risks can include circulatory system problems; skin, skeletal, liver or kidney damage; or increased cancer risks. Lead is especially dangerous to children, infants, and fetuses; it can cause learning disabilities, behavior problems, anemia, nervous system damage, and impaired hearing.²



Metals can harm aquatic animals. High exposures can kill them directly, while low exposures reduce populations by interfering with behavior or reproduction.³ For example, a study conducted in the Colorado Rocky Mountains found that mayflies, an important food source in mountain streams, were reduced by 75% in streams that were moderately polluted by heavy metals such as aluminum, cadmium, copper, lead, and zinc from mining.⁴ Metals can become concentrated in certain species in a process called biomagnification. When this happens, metals build up faster than they can be excreted by aquatic organisms and become concentrated in the fish that eat them; these metals become even more concentrated in predators near the top of the food web.⁵ People or animals that eat these fish can be exposed to high levels of metals, especially if they eat them regularly.

Section 303(d) of the Clean Water Act requires states to identify water bodies that do not support state designated clean water uses, such as fishing, irrigation, industrial uses, or drinking water supply, due to pollution or other impairments. The states must then establish [Total Maximum Daily Loads](#) (TMDLs), which cap the amount of each pollutant allowed in the water body based on its use. The TMDL sets a load limit in order for the water body to meet water quality standards and then divides the load into allowable contributions from [point](#) and [nonpoint](#) sources.

How can I use this information?

The map, Stream Length Impaired by Metals other than Mercury, provides information about the length of streams and other linear water features with metals impairments

within each 12-digit HUC. Information about the extent and causes of impairments could guide projects for improving water quality or inform decisions about how best to use water resources. Users can view this information along with supplemental layers, such as impervious surfaces and riparian buffers, to identify possible sources of impairments and remediation needs. It can be combined with layers on recreation or domestic water consumption to show how metal-related impairments relate to water use. This map can also be viewed in conjunction with the stream length layer to find out what percent of stream length in a HUC is impaired by metals. Because the total length of streams in a HUC can vary, supplementing information on impairments with information on stream length can give a clearer picture of the extent of impairments.

How was the data for this map created?

The May 1, 2015 303(d) Listed Impaired Waters National Hydrography Dataset (NHD) Indexed Dataset was obtained from the [EPA's WATERS Geospatial Data Downloads web page](#). This dataset includes features based on the [NHDPlus](#) flowlines and a table listing impaired waters. For this metric, the cause included is Metals (other than mercury). Stream features were split where they crossed 12-digit HUC boundaries. Then, the lengths of all waters impaired by metals other than mercury were summed for each 12-digit HUC. For detailed information about how the data were generated, see the [metadata](#).

What are the limitations of these data?

All national data layers, such as the 303(d) Listed Impaired Waters NHD Indexed Dataset, are by their nature inherently imperfect; they are an estimation of the truth based on the best available science. Calculations based on these data are therefore also estimations. The user needs to be aware that the mapped data should be used to inform further investigation. Periodic updates to EnviroAtlas will reflect improvements to nationally available data.

Selected Publications

1. Sansalone, J.J., S.G. Buchberger, and S.R. Al-Abed. 1996. [Fractionation of heavy metals in pavement runoff](#). *The Science of the Total Environment* 189/190: 371–378.
 2. Jarup, L. 2003. [Hazards of heavy metal contamination](#). *British Medical Bulletin* 68(1):167–182.
 3. Scott, G.R., and K.A. Sloman. 2004. [The effects of environmental pollutants on complex fish behaviour: Integrating behavioural and physiological indicators of toxicity](#). *Aquatic Toxicology* 68:369–392.
 4. Clements, W.H., D.M. Carlisle, J.M. Lazorchak, and P.C. Johnson. 2000. [Heavy metals structure benthic communities in Colorado mountain streams](#). *Ecological Applications* 10(2): 626–638.
 5. Croteau, M.-N., S. N. Luoma, and A. R. Stewart. 2005. [Trophic transfer of metals along freshwater food webs: Evidence of cadmium biomagnification in nature](#). *Limnology and Oceanography* 50:1511–1519.
- U.S. Environmental Protection Agency. 2017. [Introduction to the Clean Water Act](#). U.S. Environmental Protection Agency - Watershed Academy Web.
- United States Environmental Protection Agency. 2012. [Summaries of Water Pollution Reporting Categories](#). United States Environmental Protection Agency, Office of Water, Watershed Branch. Accessed May 2016.

This layer only represents waters on a state's approved 303(d) list rather than all impaired water bodies. The extent of monitoring and the methods used also vary from state to state. The dataset may include false positives resulting from data that is incorrect or inadequate for determining the exact location, or false negatives resulting from missing information. Because the total lengths of waters in a 12-digit HUC may vary, this information should be considered in conjunction with data on stream density and total lengths of streams and coastlines to better understand the extent of impairment in a 12-digit HUC. Accuracy information for the source data sets can be found on their respective web sites.

How can I access these data?

EnviroAtlas data can be viewed in the interactive map, accessed through web services, or downloaded. The dataset used to calculate the impairment counts, which provides greater detail on specific water bodies and the causes and sources of impairment, can be found on EPA's [WATERS Geospatial Data Downloads](#) website.

Where can I get more information?

There are numerous resources on water quality and impairment; a selection of these resources is listed below. The EPA Office of Water provides information on [Section 303\(d\)](#) of the Clean Water Act. For additional information on how the data were created, access the metadata for the data layer from the drop down menu on the interactive map table of contents and click again on metadata at the bottom of the metadata summary page for more details. To ask specific questions about this data layer, please contact the [EnviroAtlas Team](#).

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