

Missouri Department of Natural Resources
Total Maximum Daily Load Information Sheet

Shibboleth Creek

(Effective Oct. 30, 2009, name corrected in Missouri Water Quality Standards to “Shibboleth Branch.”)

Water Body Segment at a Glance:

County: Washington
Nearby Cities: Cadet and Shibboleth
Length of impaired segment: 3.0 miles
Length of impairment within segment: 0.5 miles
Pollutant: Inorganic Sediment
Source: Mill tailings (abandoned)
Water Body ID: 2120



Scheduled for TMDL Development: Approved by EPA 2010

Description of the Problem

Designated Beneficial uses of Shibboleth Branch

- Livestock and Wildlife Watering
- Protection of Warm-Water Aquatic Life
- Protection of Human Health (Fish Consumption)

Use that is impaired

- Protection of Warm-Water Aquatic Life

Standards that apply

Standards for inorganic sediment may be found in the general criteria section of the WQS, 10 CSR 20-7.031(3)(A), (C) and (G) where it states:

- (A) Waters shall be free from substances in sufficient amounts to cause the formation of putrescent, unsightly or harmful bottom deposits or prevent full maintenance of beneficial uses.
- (C) Waters shall be free from substances in sufficient amounts to cause unsightly color or turbidity, offensive odor or prevent full maintenance of beneficial uses.
- (G) Waters shall be free from physical, chemical or hydrologic changes that would impair the natural biological community.

And from 10 CSR 20-7.031(4)(H):

- (H) Solids. Water contaminants shall not cause or contribute to solids in excess of a level that will interfere with beneficial uses. The stream or lake bottom shall be free of materials which will adversely alter the composition of the benthos, interfere with

the spawning of fish or development of their eggs or adversely change the physical or chemical nature of the bottom.

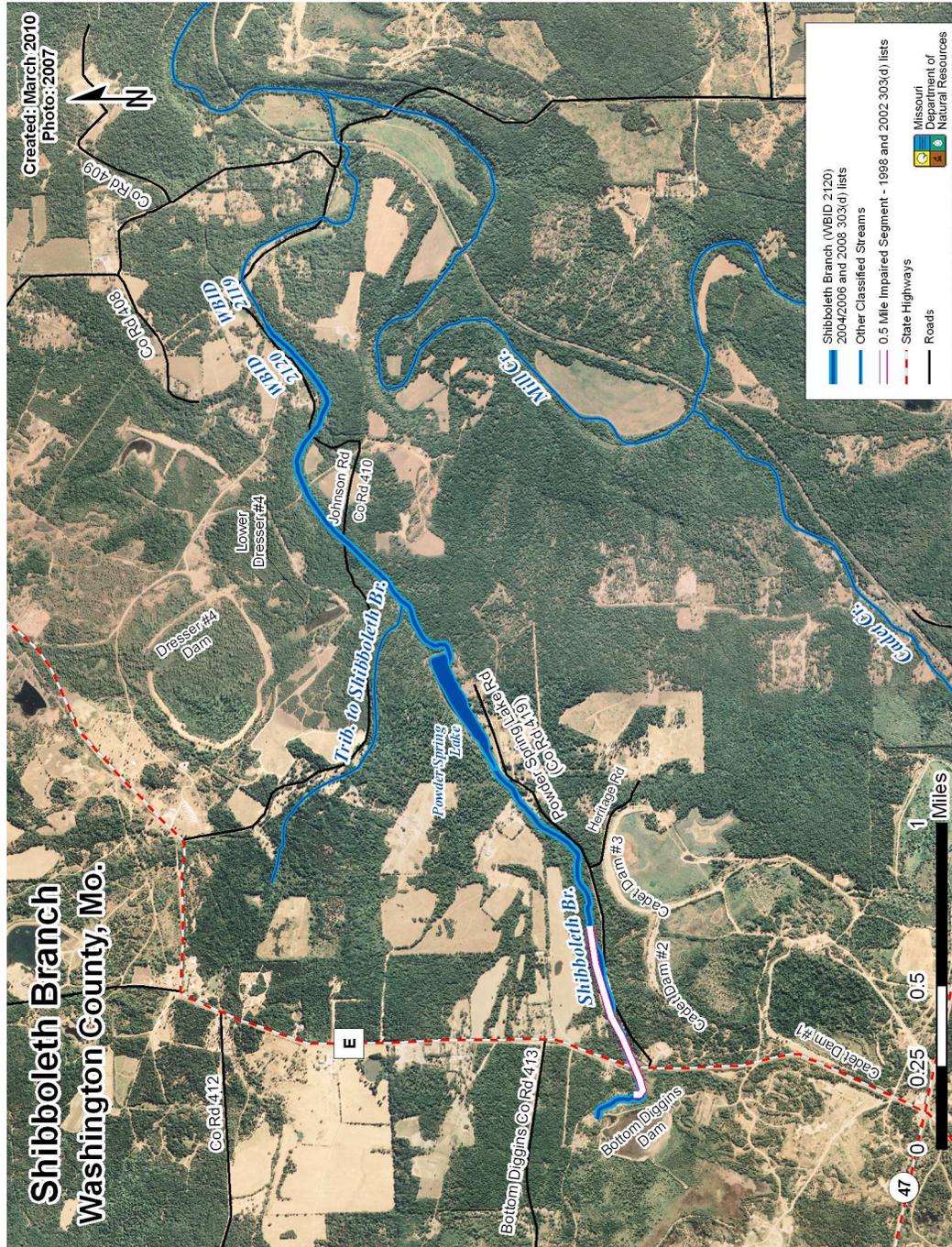
Background information and water quality

This Shibboleth Creek Total Maximum Daily Load (TMDL) for sediment is being established in accordance with Section 303(d) of the federal Clean Water Act. This water quality limited-segment in Washington County has historically been misnamed in Missouri's Water Quality Standards and 303(d) lists as Shibboleth "Creek." Effective Oct. 30, 2009, the name, as listed in 10 CSR 20-7.031, Table H, was changed to Shibboleth "Branch" in order to agree with the stream as identified in the U.S. Geological Survey's Geographic Name Information System. Future Missouri 303(d) lists will reflect this correction.

The upper half mile of Shibboleth "Creek" was included on the U.S. Environmental Protection Agency (EPA)-approved 1998 and 2002 303(d) lists for Missouri for sediment and nonvolatile suspended solids (NVSS), respectively. The change from sediment to NVSS was to specify that the problem was due to mineral solids (e.g., silt, sand and gravel) coming from eroding mine waste materials and stockpiles. On the 2004/2006 and 2008 303(d) lists, the pollutant, NVSS, was replaced with "inorganic sediment." Since NVSS and inorganic sediment have essentially the same meaning, the listing was changed to inorganic sediment to better characterize the impairment. These two terms are being used interchangeably, and the affect on the stream, and the data used to identify the listed impairment, did not changed. When these solids get into a stream, they settle onto the bottom and smother natural substrates (natural materials making up the streambed), aquatic invertebrate animals and fish eggs. Many aquatic creatures require silt-free gravel in order for their eggs to result in successful reproduction. In this situation, the inorganic sediment impairing Shibboleth Branch is thought to be a product of barite mining in the area.

Another modification from previous 303(d) listings is a change by the EPA to list the entire classified segment length of three miles as impaired instead of the previous listings of only the upper 0.5 mile. The formerly-listed half mile was upstream of Powder Spring Lake, but the entire 3-mile segment, as included in the 2004/2006 and 2008 303(d) lists, reaches approximately 1.25 miles downstream of Powder Spring Lake's dam (See map next page).

Barite, or barium sulfate, also known as "tuff," is a mineral used in well-drilling mud, chemical manufacture, fillers and extenders, face powders, chocolate coatings, glass making, golf and bowling ball cores, in paint and with X-rays. Barite is only sparingly soluble and being a compound formed by a metal and an anion (SO_4) of a strong acid (H_2SO_4), it has no effect on pH when it dissolves. The Washington County barite deposits are of the residual type (lumps of barite enclosed in clay). The barite-rich clays accumulated from the solution and weathering of impure carbonate rocks. Such residuum is typically stained red or brown by insoluble iron oxide. Potentially acid-producing sulfide minerals are not associated with these barite ores. Acid-producing hydrolysis of pyritic iron, with its production of orange or red flocculants, is probably not a factor here. Instead, the red color is due to fine red-stained clay (Brian Hicks, R.G., formerly with the department's Land Reclamation Program, e-mail communication, April 2, 2003).



Map of Impaired Segment of Shibolet Branch in Washington County, Missouri.

The first step in processing barite was to wash the mined material to separate the barite ore from the red clay and gravel found with it. Barite was hauled by trucks to barite "washers" where high pressure hoses and jigging tables were used to separate the barite from the red clays and any host rock. The used wash water (slurry) flowed into a pond where the red clays and rock settled out, and water from these ponds was pumped back to be used in the washers. When mining was active, water from a tailings pond was continually reused at the barite washer. Over time, large deposits of red clays and gravels developed behind these dams, often as a deep layer the consistency of thick pudding. If wash water went over the spillway before the suspended clay had time to settle out,

overflows could contain suspended clay material that would subsequently be deposited in the bottom of receiving streams.

Visual inspections of this stream, conducted for years before the first 303(d) listing in 1998, were made immediately downstream of an active barite settling pond (Bottom Diggins Dam) on upper Shibboleth Branch and showed an excessive amount of red clay fines being deposited in the stream. By the time the department conducted a qualitative examination of the aquatic invertebrate benthic community of this stream in October 2002, all mining in the area had ceased yet fine material continued to be deposited. The qualitative examination included a site just downstream from Highway E on upper Shibboleth Branch, two other streams with inactive barite tailings ponds (Pond Creek and Tributary to Mineral Fork), and a stream without a barite tailings pond (Rubeneau Creek), which was used as a control. The results of this survey are summarized in Table 1 below.

Summary of qualitative aquatic invertebrate sampling of four streams in eastern Washington County, Missouri, Oct. 2002.

<i>Stream</i>	<i>Total Number of Taxa</i>	<i>Total Number of EPT* Taxa</i>
Pond Creek – inactive tailings pond	23	7
Tributary to Mineral Fork – inactive tailings pond	20	6
Rubeneau Creek – control	16	6
Shibboleth Branch – inactive tailings pond	17	5

* EPT= Ephemeroptera, Plecoptera and Trichoptera (i.e., Mayflies, Stoneflies and Caddisflies)

Shibboleth Creek had the lowest number of EPT taxa and the next to lowest number of total taxa. For reference, using this evaluation methodology, a stream’s biological community is considered healthy if the number of EPT taxa in the stream is greater than those found in one quarter of the reference streams in its area (i.e., high quality streams in the ecological drainage unit, or EDU). (Note that Rubeneau Creek is not considered a “reference stream.”) In this case, the number of EPT taxa in the 25th percentile in the fall in reference streams in the area (in the Meramec basin) is eight. However, the reference streams are larger in size than the four streams noted above, and, all other things being equal, would be expected to have more taxa. Regardless, the relatively low number of taxa was cause enough to consider Shibboleth Branch impaired and it continued to be included on the 2002 303(d) List.

The Environmental Protection Agency (EPA) approved the Shibboleth Branch TMDL for inorganic sediment on Dec. 23, 2010.

For more information write or call:

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