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Summary of OUL Findings as Public Comment for the Section 404 Clean Water Act Permit Application by Missouri American Water Company for the Proposed Joplin Reservoir

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3/20/2025

A contract report for Glenn Brown, Diamond, Missouri.

Background

In February of 2019, the Missouri American Water Company (MAWC) prepared a document used as a Section 404 pre-application for a new water supply reservoir for Joplin to be constructed on Baynham Branch, a tributary to Shoal Creek near Diamond, Missouri. In 2020, the Ozark Underground Laboratory, Inc. (OUL) was retained by a landowner in the area of the planned Baynham Branch reservoir to conduct an independent and non-invasive evaluation of the MAWC proposal and of the proposed dam and reservoir. The OUL has summarized findings from those investigations in three reports, which have been shared widely with the public and MAWC. The reports are listed below:

1) *Evaluation of a Selected Site for a Proposed Joplin Water Supply Reservoir on Baynham Branch*. *Phase 1 Report*. December 29, 2020
2) *Evaluation of a Selected Site for a Proposed Joplin Water Supply Reservoir on Baynham Branch*. *Addendum 1 to December 29, 2020, Report*. April 2, 2021
3) *Evaluation of a Selected Site for a Proposed Joplin Water Supply Reservoir on Baynham Branch*. *Second Addendum to December 29, 2020, Report*. February 7, 2022.

On March 4th, 2025, the OUL was notified that pursuant to Section 404 of the Clean Water Act, MAWC had requested authorization for the placement of dredge and fill material in waters of the United States for the purpose of construction the proposed water supply reservoir. On behalf of our client and landowners in the affected area, this document is a summary of the OUL's evaluation of the proposed dam and reservoir for the purpose of providing public comment as part of the Section 404 permitting process.

The MAWC Section 404 public notice document provides the following basic information:

- **The impoundment would inundate approximately 828 acres at normal pool elevation. This is 372 acres less than the original pre-application document (69% of initial size).**
- **Normal pool elevation would be 1,040 feet above mean sea level. This is 11 feet lower than the original pre-application document.**
- **The reservoir would theoretically provide up to 20 million gallons of water per day (mgd). This is 10 mgd less than the original pre-application document.**
- **Water will be supplied to Joplin via a 10.2 mile, 35" pipeline running from the reservoir to Joplin's water supply intake on Shoal Creek. This is different from the pre-application document, where water was to be discharged back into Shoal Creek from the reservoir site for withdrawal at the existing intake on the creek.**
- **The watershed area for the proposed dam is 15.7 square miles. This has not changed.**

Below are updated calculations from the OUL's December 2020 Phase 1 report based on MAWC's changes to the proposed reservoir design provided in the 2025 Section 404 public notice documents.

- Mean annual runoff in this portion of Newton County is 11.5 inches (Schroeder, 1982). For a basin of 15.7 square miles, this is approximately 3,136 million gallons per year (8.59 mgd).
- The annual lake evaporation rate based on Class A pan evaporation data is 62 inches per year (Schroeder, 1982). A common coefficient for estimating lake evaporation from Class A pan data is 0.7; thus 62 inches/year x 0.7 = 43.4 inches per year. For an 828-acre lake this equals 976 million gallons a year of water loss to evaporation = 2.67 mgd.

- Total annual basin water yield with the reservoir (assuming no groundwater movement into or out of the basin) = 3,136 million gallons minus evaporation of 976 million gallons = 2,160 million gallons per year = 5.92 mgd
- If the reservoir is to provide 20 million gallons of water per day, this equals 7,300 million gallons per year. **70% of all water extracted from the reservoir (14.1 mgd) would need to be pumped into the reservoir from Shoal Creek. This presumes there would be no leakage out of the reservoir**

Based on the hydrological investigations conducted by the OUL, the following points highlight substantial shortcomings of the reservoir proposal, specifically, and overall project concept, generally.

- **MAWC's Section 404 permit public notice documents do not give any consideration to concerns about the karst geologic setting of the proposed site.**

    - Geologic literature published by the State of Missouri states that reservoirs in this portion of Missouri have tremendously high pollution and reservoir leakage hazards. MAWC ignored the issue of reservoir leakage in their Section 404 application document and made no estimate or allowance for the magnitude of reservoir leakage due to the nature of karst. Karst landscapes are formed by solutional processes in soluble rock, such as limestone, creating a terrain rich in caves, sinkholes, subterranean conduits, springs, and appreciable movement of water through the bedrock.

    - The planned dam is to be tied into Burlington-Keokuk Limestones. These geologic units are cavernous and are the host rocks for many caves in southwest Missouri and adjacent parts of Arkansas and Oklahoma where these units are included within the Boone Formation. Fantastic Caverns, a show cave at Springfield, is within the Burlington-Keokuk and passages are large enough that the cave is toured by trams drawn by jeeps. **The proposed dam is within a highly unfavorable geologic setting and substantial leakage must be anticipated through solutionally enlarged openings in the limestone.**

    - **The proposed dam on Baynham Branch is within a major losing stream segment.** A major losing stream segment is a highly undesirable location for an earth fill dam intended to impound water to a depth of about 80 feet near the dam site.

- **The proposed reservoir will experience substantial leakage that is not addressed in MAWC's Section 404 permit public notice documents.**

    - OUL identified three major losing stream segments within the planned reservoir area using fluorescent tracer dyes. All three losing stream segments yielded their respective tracer dye to the Lake Springs Complex. This spring complex is outside of the area that would be impounded by the planned reservoir. The planned dam location will not intercept water leaking out of the proposed reservoir area and into the Lake Springs Complex. **The dye tracing investigations demonstrated that the planned reservoir would experience major water leakage that will discharge outside of the impounded area.**

Figure 1. Location of proposed reservoir footprint, losing stream segments, and Lake Springs Complex.

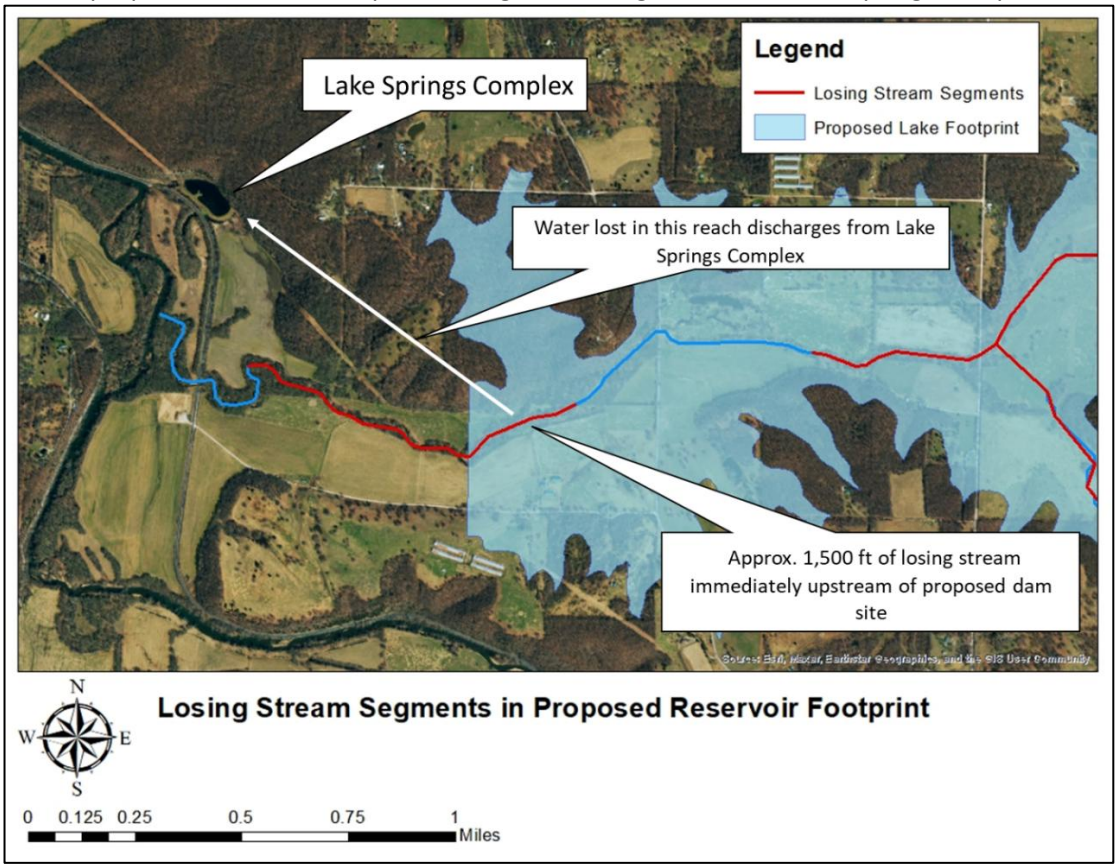
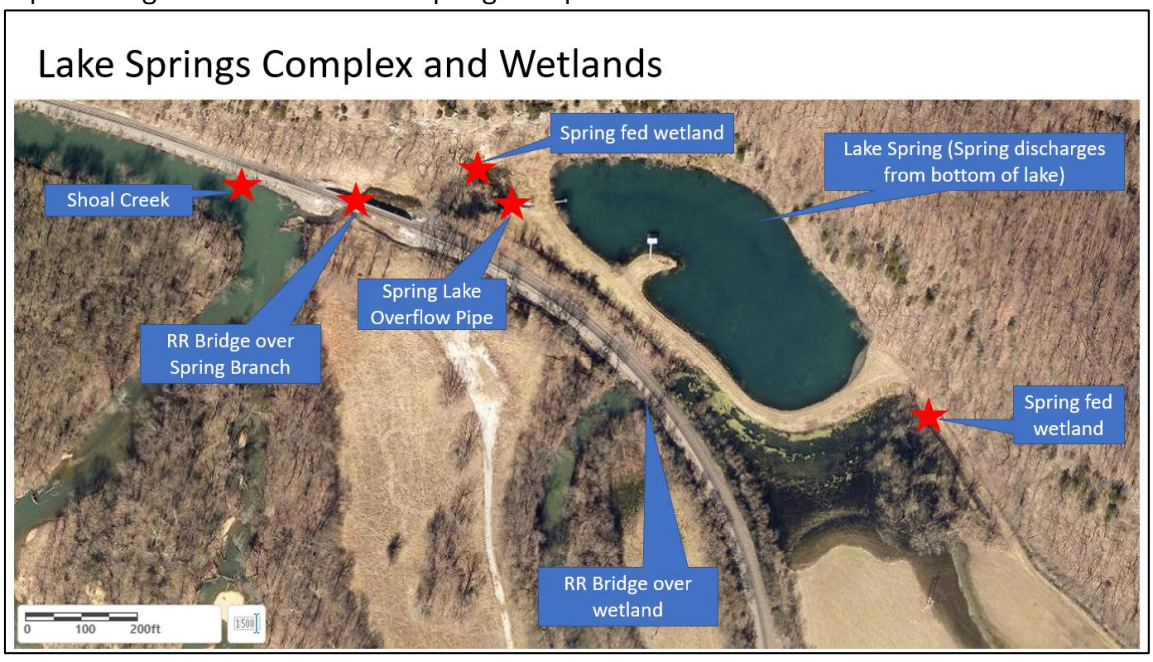


Figure 2. Map showing features of the Lake Spring Complex and associated wetland.



- An increase in head of 5 to 7 feet in the channel of Baynham Branch due to heavy precipitation was responsible for flow at the Lake Springs Complex increasing from 2.3 mgd on 3/13/2021 to 23.0 mgd on 3/15/2021. **If the dam impounded a minimum of 10 feet of water over all the leakage zones downstream of Lime Kiln Road (far less than the 80 feet of impounded water MAWC plans) leakage from the reservoir even at that minimal water depth would still greatly exceed the 20 mgd delivery rate to Joplin that MAWC plans.**

- Water level loggers at the Lake Springs Complex continuously recorded water level data over a 15-month period. **The mean daily discharge for the entire 15-month period was 6.6 million gallons per day (mgd); most, if not all, of this water came from Baynham Branch within the footprint of the proposed reservoir.** The highest mean daily discharge observed was 33.5 mgd. The highest instantaneous discharge observed at Lake Spring was 45.4 mgd on January 2, 2022. **If 80 feet of head existed over losing stream reaches in the Baynham Branch watershed that drain to the Lake Springs Complex, the leakage rates would far exceed any ability to fill the lake, much less deliver 20 mgd to Joplin for water supply.**

- **The proposed dam design will not prevent leakage.**

  - **Flow rate measurements made on November 5 and 19, 2020 show that water sinking in Baynham Branch between Lime Kiln Road and the railroad accounts for between 90 to 111% of the flow measured at the Lake Springs Complex. Almost all of the flow at the Lake Springs Complex was derived from water sinking in Baynham Branch upstream of the proposed dam site.** Water lost in the stream reaches upstream of the dam site cannot be captured by constructing a seepage barrier under the dam, since the water lost to the groundwater system follows a flow path outside of the Baynham Branch basin to the Lake Springs Complex.

Figure 3. Flow rate measurements made on November 5th, 2020, showing decreases in flow upstream of the dam site due to the presence of a losing stream segment.

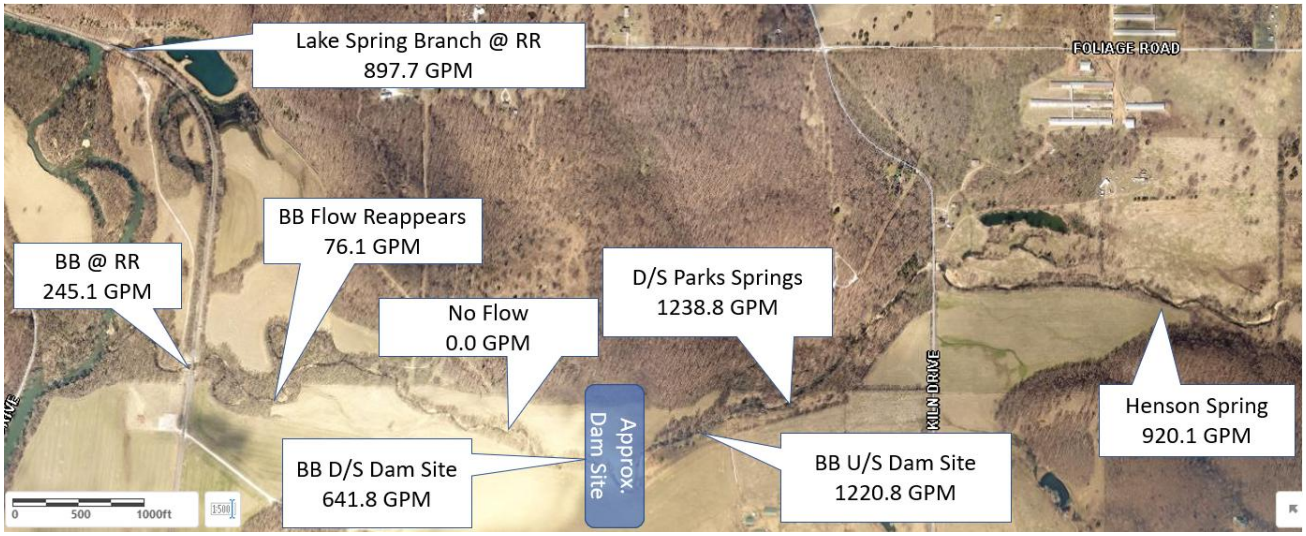


Figure 4. Block diagram of Baynham Branch between Lime Kiln Road and planned dam site under existing natural conditions. The west side of the block is through the dam centerline.

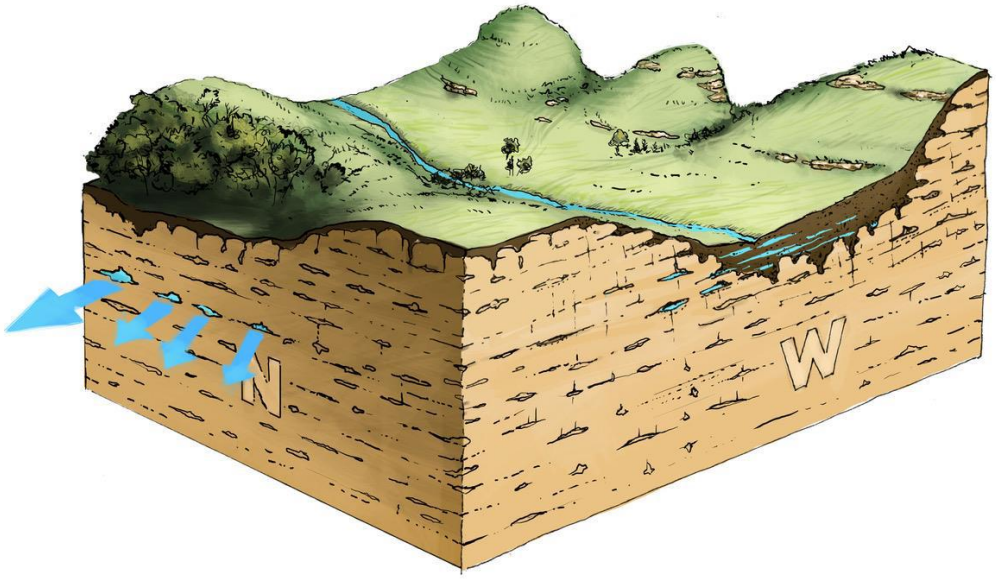
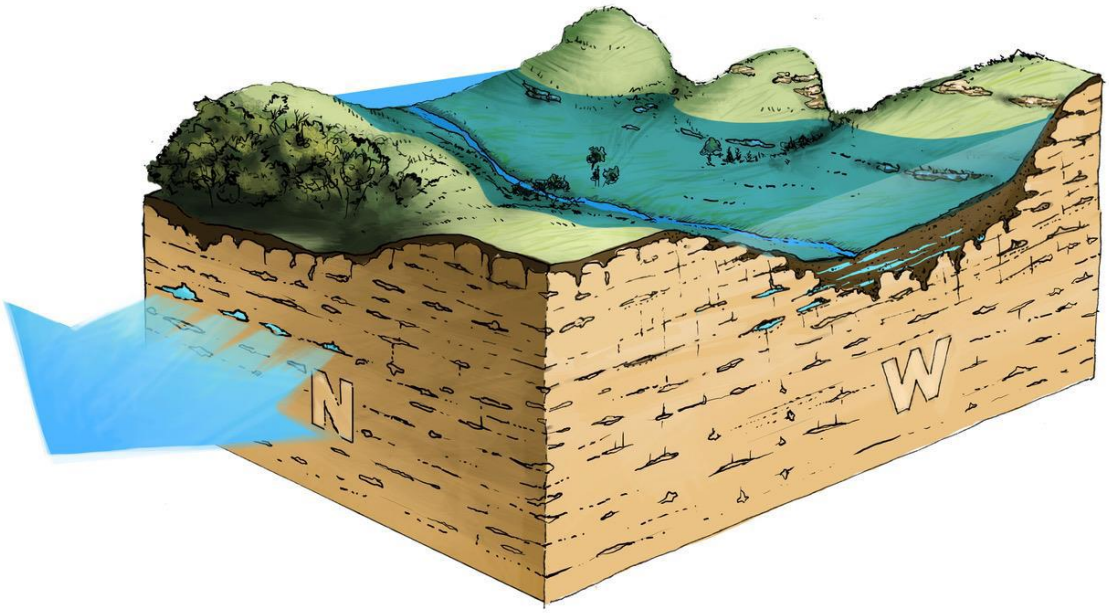


Figure 5. Block diagram of Baynham Branch between Lime Kiln Road and planned dam site under proposed reservoir conditions.



- **MAWC cannot obtain a Clean Water Act Section 401 permit for this project.**

  - The Clean Water Act Section 401 Certification Rule requires certification for any license or permit that authorizes an activity that may result in a discharge to waters of the state. The Missouri Department of Natural Resources Water Protection Program grants the Section 401 water quality certification in Missouri. The proposed project will require a Section 401 permit because discharge may occur from the reservoir to Baynham Branch and Shoal Creek via the spillway structure. Discharge via the spillway structure is assumed to only be required under high water conditions.

  - In addition to the spillway discharge to Baynham Branch downstream of the dam site, **the OUL has shown that reservoir leakage would discharge from the Lake Springs Complex, under all reservoir operation conditions. MAWC cannot obtain a permit for discharge from the spring complex for two reasons.** The first is that the Lake Spring Complex is not identified or recognized as a component of the proposed project in the permit application. The second is that if MAWC tried to get permitted discharges from the Lake Spring Complex, they would be admitting that substantial leakage would occur from the reservoir basin to the springs, showing their proposed project will not function as designed. **Under the U.S. Supreme Court decision *County of Maui, Hawaii v. the Hawaii Wildlife Fund et. al*, the leakage from the constructed reservoir, identified by the OUL using fluorescent tracer dyes, is the functional equivalent of direct discharge to surface water. Construction of the proposed reservoir would result in unpermitted discharges to Shoal Creek via leakage to the Lake Springs Complex.**

  - There are wetlands associated with the Lake Springs Complex that have not been considered in the MAWC Section 404 public notice documents. These wetlands will be affected by discharges resulting from leakage from the proposed reservoir. The current wetlands are fed by springs discharging water from the losing segments of Baynham Branch. **Theoretically, if MAWC can prevent leakage from the planned reservoir, they will be cutting off the water supply to the wetlands.** This will not occur however, since the reservoir will not hold water, but either way **MAWC has not done their due diligence in addressing wetland impacts near the Lake Springs Complex resulting from their proposed actions.**

  - Leaking water from the planned reservoir will discharge through the Lake Springs Complex and possibly other points tributary to Shoal Creek. It is likely that such discharging waters will not be in compliance with Missouri water quality standards. There are six mussel species of conservation concern in Shoal Creek , including the federally endangered Neosho Mucket. All species are likely to be significantly impacted by waters that do not meet Missouri water quality standards. Potential water quality concerns include hypoxic waters leaking from the bottom of the planned reservoir and sediment being flushed from flooded subterranean conduits or from the bottom of the reservoir.

  - In addition to potentially discharging waters that are not in compliance with Missouri water quality standards, increasing the flow within the spring branch tributary of Shoal Creek will lead to the incision of the stream channel and stream banks. As a result, significant sediment loads to Shoal Creek will be generated. This will potentially impact the six mussel species mentioned above as well as the existing water intake structure and water treatment plant. No mention of such adverse impacts of reservoir construction and operation have been mentioned in MAWC proposal.

- The reservoir, as planned, would create appreciably low dissolved oxygen concentrations in Ozark Cavefish habitats beneath the reservoir and beneath some adjacent lands. **This would represent a significant loss of Ozark Cavefish habitat and would more likely than not result in mortality of some Ozark Cavefish.**

- **The proposed reservoir will not provide the amount of water needed for Joplin and the surrounding area.**

  - Streamflow observations by the OUL under current flow conditions show that the proposed reservoir site has major leakage problems, yet MAWC has failed to report obvious and relevant field observations under appropriate flow conditions. Leakage rates will increase significantly if the losing stream reaches where leakage occurs are inundated by the proposed reservoir.

  - The MAWC proposal states that the reservoir would inundate approximately 34,728 linear feet of streams. **The proposal does NOT mention that approximately 55% (19,200 feet) of all the mainstem stream channels within the proposed reservoir are losing stream reaches, including the dam site.** The relevant definition of losing streams for reservoir evaluations is that of USEPA (1999) that defines a losing stream as: "a stream or reach of a stream in which water flows from the stream bed into the ground. In karst terranes, losing streams may slowly sink into fractures or completely disappear down a ponor." **With respect to reservoir leakage, the locations of surface stream segments that lose flow to groundwater are very important features if: 1) they are within proposed reservoir areas, and 2) if water entering groundwater through them discharges outside of the reservoir area. Both conditions are met for the losing stream segments identified by the OUL within the planned reservoir area.**

- **The proposed reservoir creates risk for the Canadian Pacific Kansas City (CPKC) railway located along Shoal Creek.**

  - The CPKC railway runs along Shoal Creek downstream of the proposed reservoir. A railroad bridge crosses Baynham Branch downstream of the proposed dam site. This bridge is designed for the current stream level, not for a possible flood event that could result from spillway discharge if a full reservoir experiences substantial flooding. This may or may not pose appreciable risk as the reservoir will not hold water.

  - A more significant risk associated with the construction of the reservoir are trestle bridges that cross the spring branch and spring fed wetlands that drain the Lake Springs Complex to Shoal Creek. **Adequate consideration has not been provided as to whether these trestle bridges and adjacent fill areas are able to withstand such increased flow conditions in the spring branch and wetlands that would result from reservoir leakage discharging at the Lake Springs Complex and the resultant erosion, incision, and soil saturation of the lands beneath the bridges.**

  - This rail line carries shipments of containers, coal, petroleum hydrocarbons, and other chemicals, and runs upstream of the current water intake for Joplin. Failure of either feature will significantly impact the water supply for Joplin, further stressing an already scarce resource.

- **The failure of the proposed reservoir to provide adequate water will cost rate payers in Joplin and the surrounding communities.**

  - Due to excessive leakage, the reservoir will not be able to supply adequate volumes of water to Joplin. The purpose/goal of this reservoir is to store water during periods of high flow and release water for Joplin during periods of low flow on Shoal Creek. Failure of the promised water supply will lead to a least two effects; 1) MAWC will try to salvage the constructed reservoir, further increasing the total cost of the proposed reservoir and extending the timeline in which Joplin continues to be without the necessary water supply required for growth, and 2) When attempts to salvage the reservoir are exhausted, a new water supply plan will need to be developed, built, and funded. The result of which will be that the rate payers will pay more than two times the proposed rate increases in order to secure additional water supply. MAWC has requested rate increases from the Missouri Public Services Commission over the past several years, including requests to increase rates by approximately 25.7% in 2022 and 34.4% in 2024.

  - This will require the development of another alternate water supply for Joplin. Moving ahead with the reservoir project will likely delay the planning and construction of an adequate alternate water supply for Joplin. If the reservoir is constructed, water users in the MAWC service area will need to pay for two water supplies, one of which will be of little if any value. There will also be critical time lost in addressing the water supply issues of the Joplin area.

  - As designed, the proposed reservoir places Joplin's existing water supply at more risk than it is likely to provide additional water. In an area where water supply does not meet the demands of future growth, implementing a 'solution' that has been shown to have a high risk of failure and places the existing water supply at risk has major implications on the future economic growth, environmental quality, and human health of Joplin and the surrounding areas.