UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 6
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DALLAS, TEXAS 75270

June 24, 2020

Bob Blanz, Associate Director
Office of Water Quality
Division of Environmental Quality
Arkansas Department of Energy and Environment
5301 Northshore Drive
Little Rock, AR 72118-5317

Dear Dr. Blanz:

I am writing in regard to the U.S. Environmental Protection Agency's (EPA's) recent action on revisions to Arkansas's (*Rule*) *Regulation No. 2: Regulation Establishing Water Quality Standards for Surface Waters of the State of Arkansas* by third-party rulemaking initiated by the City of Huntsville, AR. These amendments where approved by the Arkansas Pollution Control and Ecology Commission (Commission) on December 7, 2018. The revisions were submitted to the EPA for approval by letter dated December 7, 2018 by the Department, now Division of Environmental Quality (DEQ). Subsequent to EPA's May 22, 2020 action on the state's revised water quality standards (WQS), EPA discovered that the Commission had not approved revisions that we believed had been adopted, and as a result is amending its action.

In making our initial determination, EPA believed the Commission had approved revised mineral criteria for War Eagle Creek from its confluence with Holman Creek to its confluence with Clifty Creek. As a result, our May 22, 2020 approval included these proposed revisions. EPA has subsequently learned that these proposed modifications were not approved by the Commission and therefore never became Arkansas regulation. Under federal regulations at 40 C.F.R. §§ 131.5 and 131.21, EPA must review officially adopted revisions to state WQS. Because these proposed revisions specific to War Eagle Creek were not officially adopted by the Commission, these provisions are not approved by EPA and not effective for CWA purposes. See 40 CFR §131.21(c), which states that state WQS are not effective for CWA purposes unless and until approved by EPA. There are no other changes to our May 22, 2020 action.

We appreciate the collaborative effort by DEQ staff that has resulted in the amendment of our May 22, 2020 action. If you have any questions or concerns, please contact me at (214) 665-8138, or have your staff contact Russell Nelson at (214) 665-6646.

Sincerely,

Charles Maguire

Charles W. Maguire
Director
Water Division

cc: Joe Martin, Branch Manager, Water Quality Planning, DEQ
Mary Barnett, Ecologist Coordinator, Water Division, DEQ

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AMENDED TECHNICAL SUPPORT DOCUMENT:

EPA REVIEW OF SITE-SPECIFIC CRITERION REVISION TO *REGULATION 2: REGULATION ESTABLISHING WATER QUALITY STANDARDS FOR SURFACE WATERS OF THE STATE OF ARKANSAS*

Revision Adopted by the
Arkansas Pollution Control and Ecology Commission
Modifying Water Quality Standards for Chloride, Sulfates and Total Dissolved Solids for Town Branch and Holman Creek

U.S. EPA REGION 6
WATER DIVISION

June 2020

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I. Introduction

Regulatory Requirements and Purpose

As described in § 303(c) of the Clean Water Act (CWA) and in the standards regulation within the Code of Federal Regulations (CFR) at 40 CFR § 131.20, states and authorized tribes have primary responsibility for developing and adopting water quality standards to protect their waters. State and tribal water quality standards consist of three primary components: designated uses, criteria to support those uses, and an antidegradation policy. In addition, CWA § 303(c)(1) and 40 CFR § 131.20 require states to hold public hearings at least once every three years to review and, as appropriate, modify and adopt standards. As required by 40 CFR § 131.21, the Environmental Protection Agency (EPA) reviews new and revised surface water quality standards that have been adopted by states and authorized tribes. Authority to approve or disapprove new and/or revised standards submitted to EPA for review has been delegated to the Water Division Director in Region 6. Tribal or state water quality standards are not effective under the CWA until approved by EPA.

The purpose of this Technical Support Document (TSD) is to describe EPA's analysis of the site-specific revisions to *Regulation Establishing Water Quality Standards for Surface Waters of the State of Arkansas* adopted by the Arkansas Pollution Control and Ecology Commission (Commission) and documents supporting these revisions.

Summary of Revised Provisions

By letter dated December 7, 2018, the Arkansas Department of Environmental Quality (ADEQ) submitted water quality standards revisions adopted by the Commission via Minute Order No. 18-26 to EPA for review and approval. These amendments were developed subject to Regulation No. 2.306, which allows for the modifications of water quality criteria. These amendments are based on a 3rd-party rulemaking proposed by the City of Huntsville to establish site-specific chloride, sulfate and total dissolved solids (TDS) water quality criteria as described in Table 1 below and remove the designated drinking water supply use for Town Branch and Holman Creek.

Table 1. Revised Criteria

Town Branch from Point of Discharge of the Huntsville WWTP downstream to the confluence with Holman Creek			**Holman Creek downstream of the confluence with Town Branch**		
Revised Site-specific criteria			Revised Site-specific criteria		
Chloride (mg/L)	Sulfate (mg/L)	TDS (mg/L)	Chloride (mg/L)	Sulfate (mg/L)	TDS (mg/L)
223	51	779	180	48	621

EPA Action on the Revised Provisions

Based on the available information described in the following analysis, EPA has concluded that the revised site-specific criteria for Town Branch and Holman Creek are likely to adversely impact the aquatic community in these waters although overall the Ozark Highland fishery use is expected to remain attainable. Based on the weight of evidence, the revised site-specific criteria detailed below are approved pursuant to Sec. 303(c) of the CWA. Once approved by the EPA these criteria are in effect for all CWA purposes.

The EPA has also concluded that the state has adequately considered the use and value of the public water supply consistent with 40 CFR 131.10 from Town Branch and Holman Creek and approves removal of the DWS use.

II. Background

Timeline

In June 2013, the City of Huntsville initially petitioned APCEC seeking site-specific criteria modifications to Arkansas's water quality standards (Regulation 2) for chloride, sulfate and total dissolved solids (TDS) criteria for Town Branch from the discharge of the Huntsville Wastewater Treatment Plant (WWTP) to the confluence with Holman Creek, Holman Creek from the confluence with Town Branch to War Eagle Creek and War Eagle Creek from the confluence with Holman Creek to Clifty Creek. The Commission subsequently approved withdrawal of revised mineral criteria for Water Eagle Creek through an amended motion and minute order (18-26).

In August 2013, the Arkansas legislature issued Act 954 which changed regulation of minerals in Arkansas by removing the drinking water uses and associated drinking water minerals criteria (chloride, sulfate and TDS) from waters where the use was not an existing use. . In addition, the Act prohibited the use of Ecoregion Reference Stream Minerals criteria which were approved by EPA in 1991, placed restrictions on data use for assessment of water quality standards, and established default stream flow for water quality standards implementation. In effect, this legislation revised Arkansas's Regulation 2 although those revisions were not submitted to EPA for review as required by the Clean Water Act § 303(c) and 40 CFR 131. EPA has a nondiscretionary duty to review such revisions regardless of whether or not a state or authorized tribe formally submits the amendments to EPA. Prior to action under Clean Water Act § 303(c), EPA informed ADEQ that it was terminating EPA's waiver of review of any minor permit drafted or revised to comply with the requirements of Act 954 and would review in accordance with the provisions of 40 CFR § 123.24. In response to EPA's action the Arkansas legislature repealed Act 954 in October 2013.

Following the repeal of Act 954, the City of Huntsville revised its proposed revisions and reinitiated a third-party rulemaking to revise criteria for chloride, sulfate and total dissolved solids (TDS) and the removal of the Domestic Water Supply use for Town Branch, Holman and War Eagle Creeks. The APCEC approved the reinitiation through Minute Order 17-19 on August 25, 2017.

Watershed and Stream Descriptions and Conditions

The supporting *Study: Town Branch, Holman and War Eagle Creek* (2017) carried out by GBM^{C} & Associates provides a description of Town Branch and Holman Creek, specifying that they are a part of the larger War Eagle Creek Watershed within Segment 4K the White River Basin in northern Arkansas. War Eagle Creek is part of the Beaver Lake watershed. Beaver Lake is a major water supply reservoir for Northwest Arkansas. These waters are in the Ozark Highlands Ecoregion. A land use assessment was completed for the War Eagle Creek watershed using 2006 Land Use/Land Cover data (USGS 2006). The War Eagle Creek watershed is dominated by forest and pastureland uses. However, urban development is expanding in the watershed. The majority of the development is in the Town Branch sub-watershed, which contains most of the City of Huntsville. 28% of this subwatershed consists of urban development. The remainder of Huntsville and its surrounding suburban housing area is contained in the Holman Creek sub-watershed, which consists of 10% urban development.

Designated uses that currently apply to Town Branch are secondary contact recreation; domestic, industrial, and agricultural water supply; and seasonal Ozark Highlands fisheries use consistent with watersheds of less than 10 square miles. Holman Creek is currently designated for primary contact recreation, domestic, industrial, and agricultural water supply; and the Ozark Highlands fisheries use. Although the domestic water supply (DWS) use is a designated use in all waters in Arkansas unless specifically removed, it was not an existing use in any of these waters.

The City of Huntsville's wastewater treatment plant (WWTP) is currently authorized to discharge wastewater through NPDES Outfall 001 (NPDES No. AR0022004 which expired May 31, 2014) to Segment 959 of Town Branch then to Holman Creek, and then to War Eagle Creek. The facility design flow is 2.0 mgd. The facility discharges treated sanitary wastewater and industrial wastewater from a Butterball turkey processing facility. Approximately 80% of the flow from the WWTF originates from the turkey processing facility. The current effluent limitations do not contain discharge limitations for chloride and sulfate and only contain a report requirement for weekly composite TDS samples. Whole effluent toxicity (WET) test results are reported quarterly. Segment 959 of Town Branch is currently on Arkansas's 2016 and draft 2018 CWA §303(d) list for exceedences of TDS from industrial and municipal point sources. Both a tributary and Holman Creek are identified on the 2016 and the draft 2018 lists for not meeting the designated drinking water (DW) use due to exceedences of TDS and nitrate nitrogen (NO_3) from industrial and municipal point sources.

III. Water Quality and Biological Data Supporting the Revised Site-Specific Criteria

The focus of the supporting *Section 2.306 Site Specific Water Quality Study: Town Branch, Holman and War Eagle Creek* (GBMc, 2017) was an analysis of the discharge from the City of Huntsville WWTP outfall (Outfall 001), Town Branch, Holman Creek and War Eagle Creek. The *Study* relied on requirements in Regulation 2.306 and dated guidance on the development of site-specific water quality standards and minerals implementation (Arkansas CPP 2000). The *Study* itself consisted primarily of habitat characterization, spring and fall

macroinvertebrate collections, fall fish collection and twelve-monthly collections of water quality samples, and *in-situ* and flow measurements from July 2011 through June 2012. The document also includes discussions of current literature and outside studies that are discussed to support the revised site-specific criteria and drinking water use removal.

The stated objectives of this *Study* were to establish site-specific water quality criteria for chloride, TDS, and sulfate that reflect the current discharge concentrations of the City of Huntsville WWTP. The proposed criteria are intended to support the designated fishery use in Town Branch, Holman Creek and War Eagle Creek downstream of the discharge and the existing domestic water supply use of Beaver Lake, although as noted earlier, the Commission later withdrew the revised mineral criteria proposed for Water Eagle Creek. The *Study* included lines of evidence to support the revised criteria including whole effluent toxicity (WET) testing, Gas Research Institute-Salinity Toxicity Relationship (GRI-STR) toxicity modeling, an evaluation of the results of an experiment by Clements and Kotlik (2016), a comparison of macroinvertebrate communities upstream and downstream of the discharge and with other less impacted nearby sites, and a comparison of fish communities upstream and downstream of the discharge. Each of these lines of evidence is described and evaluated in turn below including the data presented for War Eagle Creek since it was included in the supporting study (GBMc, 2017).

Evaluation of WET Results

The *Study* also considered the results of whole effluent toxicity (WET) tests for the Huntsville WWTP from January 2009 – May 2012. The test organisms were limited to *Ceriodaphnia dubia* and *Pimephales promelas* consistent with current NPDES permit testing requirements. The data up until 2012 included 14 WET data points, 2 of which were failures with an unidentified toxicity source. The measured TDS concentrations in those failed tests were <1000 mg/L. All of the TDS results from the effluent are less than the approximate threshold of 2000 mg/L for chronic effects on *C. dubia*, the most sensitive of the two species to ion toxicity. The *Study* suggests that Huntsville does not have a WET issue based on the 2009 – 2012 failure rate. Since 2012, Huntsville has also had 4 test failures (1 for *P. promelas*, and 3 for *C. dubia*). However, given EPA's integrated approach to assessment of water quality (chemical specific, biological criteria, and WET) are independent of each other, a finding of impact on one does not override a finding of no impact based on another. Without a trigger for a Toxicity Reduction Evaluation (TRE) there has been no analysis of these ionic imbalance failures and there is no definitive information to conclude whether the toxicity is due to chloride, sulfate or TDS. If a TRE had been developed a GRI-STR model could have been run on actual ion levels from to support the revised criteria. The source of the toxicity remains unknown.

Evaluation of GRI-STR Model Results

The *Study* also describes the results of a Gas Research Institute-Salinity Toxicity Relationship (GRI-STR) model that was used to predict acute toxicity using the maximum for specific ions including chloride (Cl^-), sulfate (SO_4^{2-}), calcium (Ca^{2+}), magnesium (Mg^{2+}), potassium (K^+) and sodium (Na^+) as well as TDS and alkalinity from the Huntsville WWTP Outfall 001. The maximum value measured for each constituent was used in the GRI-STR model and was described as representative of the worst-case combination in the effluent, assuming organisms were exposed to 100% effluent using with *Daphnia magna, C. dubia* and *P. promelas*

test organisms. The survival rate for each organism was reported as greater than 95% after 48-hours of exposure to 100% effluent (**Table 2**). This survival rate is better than the percent minimum significant difference (%MSD) of 90% for sublethal endpoints from *Daphnia* and *C. dubia* for WET tests reported under NPDES permit requirements.

Table 2. Summary of results from GRI-STIR Model – current effluent.

Organism	**Percent Survival at 48-h**
Ceriodaphnia dubia	98.7
Daphnia (*pulex* or *magna* not defined)	96.8
Pimephales promelas	98.1

The GRI-STR model results indicate a high survival rate for with *Daphnia*, *C. dubia* and *P. promelas*, representing effects on test species based on the expected concentrations of individual ions measured over a one-year period. Although there appears to be some weight put on the outcome of this model, it is of limited value because it does not provide any information on the potential acute or chronic effects that complex ionic mixtures may have on the macroinvertebrate community including threatened and endangered unionid mussels in Town Branch and below its confluence with Holman Creek once the revised site-specific criteria are implemented.

Evaluation of Scientific Literature on Ion Toxicity

To support the GRI-STR modelling, the *Study* also referred to recent research on the effect of mineral toxicity by Clements and Kotalik (2016). The *Study* referred to the methodology used in the Clements and Kotalik paper, where 4 freshwater mesocosm experiments were carried out to quantify the effects of major ions on aquatic insect assemblages. These experiments used sixty-six taxa, using 8 dominant families/subfamilies (Baetidae, Ephemerellidae, Heptageniidae, Chloroperlidae, Capniidae, Brachycentridae, Orthocladiinae, Elmidae) which occurred in sufficient densities to develop specific conductance-response relationships for exposure to sodium bicarbonate ($NaHCO_3$), magnesium sulfate ($MgSO_4$), and sodium chloride (NaCl). The supporting *Study* refers to part of the discussion in Clements and Kotalik, noting that the effects of major ions were consistently more for NaHCO3 and $MgSO_4$ than NaCl in the mesocosm experiments.

Following the example in Clements and Kotalik, the supporting *Study* presented a comparison of upstream versus downstream abundance of the baetid, ephemerellid, and heptageniid mayflies in relation to the Huntsville outfall. These data are presented in **Table 3** below. As shown, there were no Heptageniidae downstream of the discharge in Town Branch

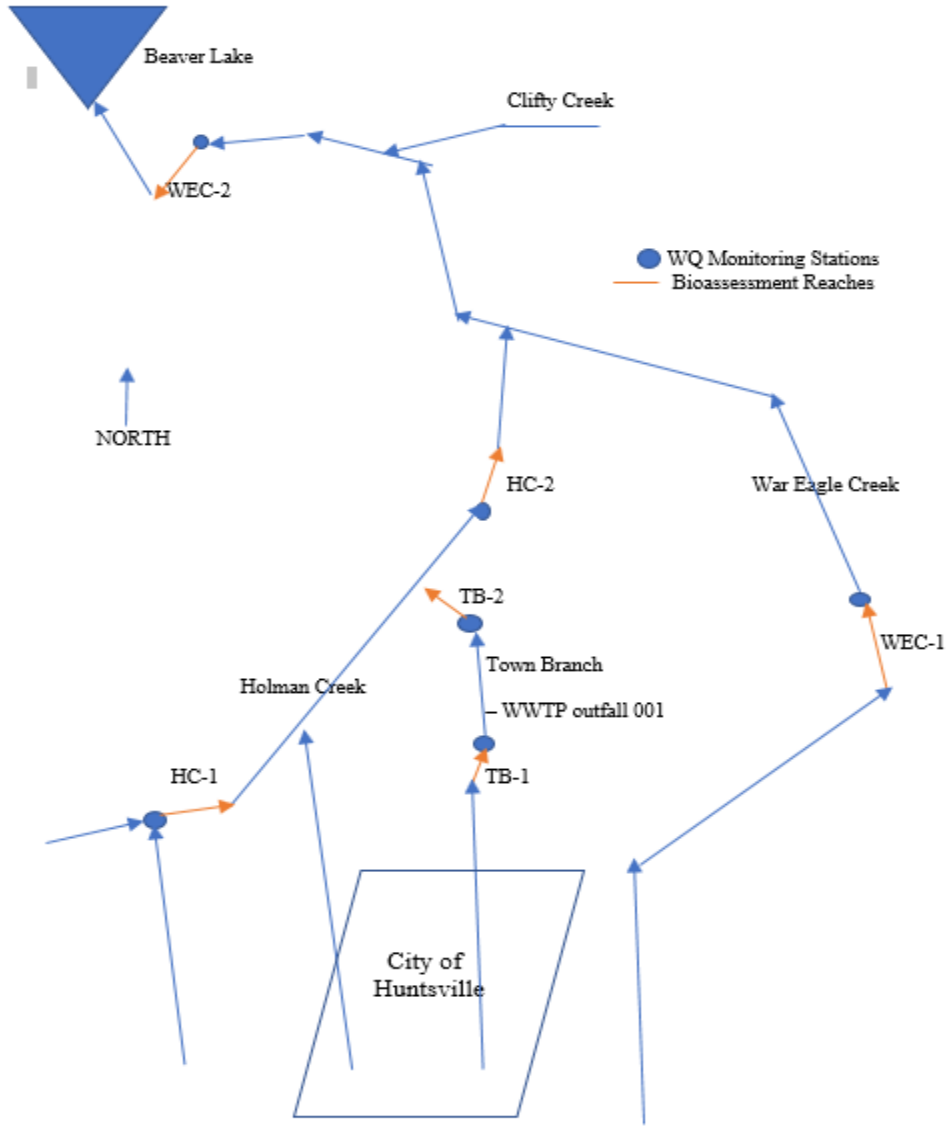
Table 3. Macroinvertebrate families – upstream/downstream comparison

Family	**TB-1**	**TB-2**	**HC-1**	**HC-2**	**WC-1**	**WC-2**
Heptageniidae	12	0	91	20	35	91
Baetidae	129	120	275	316	66	93
Ephemerellidae	0	0	0	0	0	0

(TB-2). In Holman Creek, the Heptageniidae were present in reasonable numbers downstream of the discharge (HC-2) but were more abundant upstream (HC-1). Heptageniidae were present in

greater numbers at the downstream monitoring site in War Eagle Creek (WC-2). Baetidae abundances were higher downstream of the outfall at Holman (HC-2) and War Eagle Creeks (WC-2) and slightly lower in Town Branch downstream of the discharge (TB-2). Ephemerellidae were not present in any of the stream reaches.

Figure 1. Monitoring stations and bioassessment reaches for Town Branch (TB), Holman Creek (HC) and War Eagle Creek (WEC)



The monitoring stations used were as follows:
1. TB-1, Town Branch Creek upstream of the Huntsville WWTF discharge.
2. TB-2, Town Branch Creek downstream from the Huntsville WWTF discharge.
3. HC-1, Holman Creek upstream of the confluence with Town Branch.
4. HC-2, Holman Creek downstream of the confluence with Town Branch.
5. WEC-1, War Eagle Creek upstream of the confluence with Holman Creek.
6. WEC-2, War Eagle Creek downstream from the confluence with Holman Creek

The intent in referring to the Clements and Kotalik paper appears to have been to support the contention that conductivity and TDS are directly related and that an evaluation of the three most sensitive macroinvertebrate families (Heptageniidae, Baetidae, and Ephemerellidae) supports the revised TDS criteria. Although conductivity and TDS are interrelated, the most significant finding in Clements and Kotalik was that natural benthic communities collected from a low-conductivity stream were highly sensitive to major ions. The Clements and Kotalik mesocosm experiments specifically looked at NaHCO3, $MgSO_4$, and NaCl, not overall TDS, which may include a number of additional ionic components.

The supporting *Study* oversimplifies the findings in the Clements and Kotalik paper regarding the sensitivity of mayflies that have been historically exposed to higher conductivity and by stating that in waters with lower background conductivity, macroinvertebrate abundance was not affected by NaCl until the specific conductance reached over 1,000 µS/cm. The Clements and Kotalik paper explained that the greater sensitivity of mayflies was partially explained by the strong effects on smaller, early mayfly instars which were the predominant life stage in one of the source waters for their late summer and autumn mesocosm experiments, as has also been reported for early instars having greater sensitivity to NaCl (Kefford et al. 2004, 2007). Natural differences in community composition between streams influenced responses to specific conductance – and by extension TDS. While benthic communities from the streams with moderate specific conductance were reported to be consistently more tolerant to NaCl than those from the low specific conductance streams, the context of these conditions matters. The paper also referred to Dunlop et al. (2008), who characterized spatial variation in salinity tolerance and concluded that species that evolved in conditions of greater natural salinity were more tolerant to salt. This paper also referenced Kefford et al. (2012), which examined global patterns of salinity tolerance and observed greater tolerance of macroinvertebrates that evolved in naturally arid regions. Since the revised Cl^-, SO_4^2 and TDS criteria do not represent the natural conditions of Town Branch, Holman Creek and War Eagle Creek, these papers suggest that the revised criteria may adversely impact the macroinvertebrate and likely the larger aquatic community.

Water Quality Characterization

The supporting field study included a physical habitat characterization, biological collections, twelve-monthly collections of water quality samples and flow measurements from July 2011 through June 2012. These collections occurred at monitoring stations and bioassessment reaches on Town Branch Creek, Holman Creek, and War Eagle Creek as described in **Figure 1** above.

In-situ measurements were taken during 12 separate sampling events at each of these stations consisting of pH, dissolved oxygen, temperature, and specific conductance. Samples for chloride and TDS were also collected during the 12 sampling events and sulfate, calcium, magnesium, potassium, sodium, and alkalinity were collected on four occasions. Samples for turbidity, chloride, sulfate, alkalinity, TDS, calcium, magnesium, potassium and sodium were collected for laboratory analysis.

The *Study* reports summary statistics for chloride and TDS samples from Huntsville WWTP Outfall 001 collections during the monthly field trips conducted from July 2011 – June 2012. Town Branch receives the Huntsville WWTP discharge and is heavily influenced - both chloride and TDS concentrations are considerably higher than at any of the other ambient monitoring sites. Concentrations decrease but remain high below the confluence of Town Branch and Holman Creek at HC-2. Further downstream, chloride and TDS concentrations continue to decrease in War Eagle Creek at WEC-2 and are only somewhat higher than at WEC-1, which is unaffected by the WWTP discharge. It is unclear why the average concentrations above Outfall 001 at TB-1 are higher than WEC-2 but is likely the result of dilution due to stormwater and other sources from the City of Huntsville itself.

Figure 2. Average chloride concentrations during from July 2011 – June 2012.

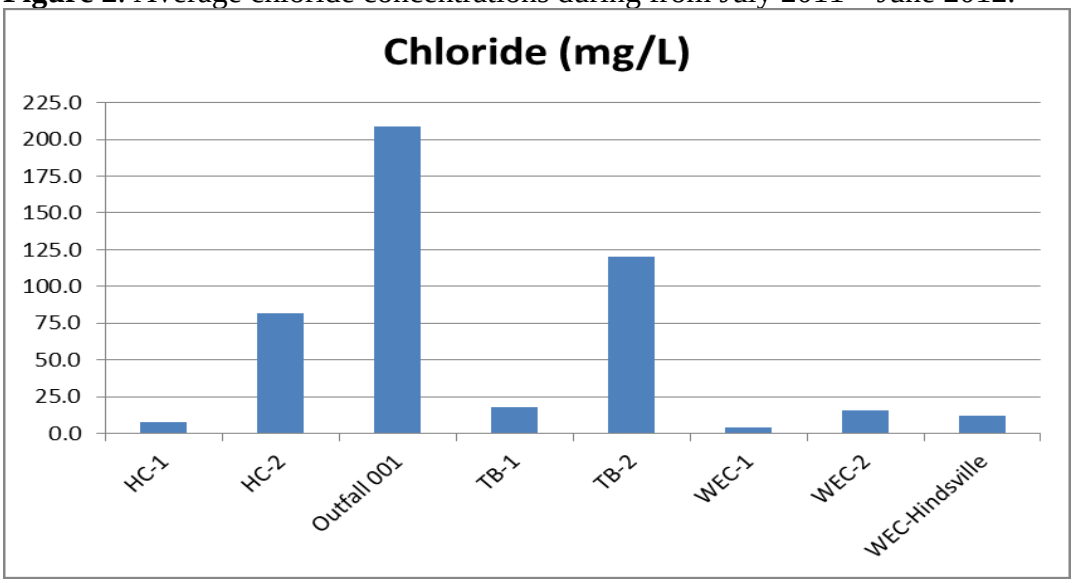
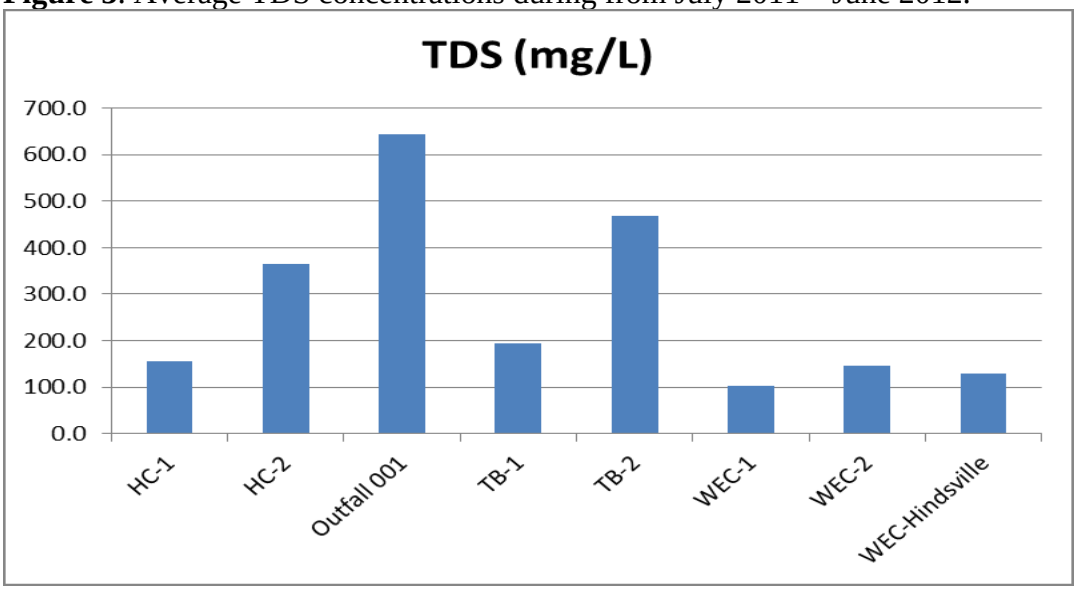


Figure 3. Average TDS concentrations during from July 2011 – June 2012.



The reported summary statistics for laboratory-analyzed parameters including sulfate, alkalinity (as $CaCo_3$), calcium, magnesium, and potassium generally showed similar trends to those shown above, with higher concentrations at the Huntsville WWTP Outfall 001. The increased ionic mineral concentrations for calcium, potassium and sodium are likely directly related to the high percentage of Huntsville's discharge that is comprised of process water from the Butterball processing plant. At Outfall 001, calcium, potassium and sodium where elevated with concentrations decreasing downstream of the discharge at TB-2 and HC-2. Although not affected by the Huntsville discharge, the average alkalinity concentrations seen at TB-1 were higher than any other site including the WWTP Outfall 001. The *Study* did not discuss the alkalinity data.

The *in-situ* parameters reported included temperature, dissolved oxygen (DO), specific conductivity (SC), pH, turbidity and flow. The majority of the summary statistics are relatively consistent across all sampling sites with the exception of specific conductance. Specific conductance was much higher at Outfall 001, decreasing downstream of the discharge at TB-2 and further at HC-2. The elevated specific conductance is consistent with the increased ionic minerals concentrations discussed earlier. The revised criteria will result in an increase in ionic mineral concentration and corresponding change in specific conductance, potentially amplifying the impact at Outfall 001 and/or extending that affect downstream.

Derivation of Revised Water Quality Criteria

The revised site-specific criteria adopted by the Commission were based on the 95th percentile of measured chloride, sulfate, and TDS data from the TB-2 and HC-2 sites (and WEC-2 site in the initial analysis). A comparison of the current Ozark Highland Ecoregion criteria that represent reference conditions to the revised site-specific criteria specific to Town Branch and Holman Creek are presented in **Table 4** below.

Table 4. Criteria comparison - Ecoregion reference to revised criteria.

Ozark Highlands Ecoregion	Statistic	Chloride (mg/L)	Sulfate (mg/L)	TDS (mg/L)
Ecoregional Criteria		13[1]	17[1]	240[1]
Town Branch	**95th %**	223	61	779
Holman Creek	**95th %**	180	48	621

[1] Existing Ozark Highland Ecoregion criterion

Although EPA has previously approved revised criteria derived using this approach, we have not and do not endorse or recommend a methodology using the 95th percentile of downstream mineral concentrations as a basis for developing site-specific criteria. In comments on prior 3rd party rulemakings, EPA has expressed concerns with this approach because the criteria are derived based on an analysis of mineral concentrations under current conditions, which includes mineral inputs from the existing effluent and other anthropogenic sources, in addition to natural mineral sources. This approach means that the resulting revised site-specific criteria are based on degraded conditions, particularly in smaller streams like Town Branch and in Holman Creek below its confluence with Town Branch, lessening as dilution increased

downstream to War Eagle Creek. Criteria based on these conditions do not consider the effect of the increased loads that will occur after the revised criteria are in place.

Basing site-specific criteria on what, in effect, are degraded instream conditions rather than least impacted reference stream conditions has the effect of ensuring that criteria are put in place that would allow the affected facilities to meet NPDES permits without implementing additional controls. In effect, these values lock in current ambient conditions as the applicable criteria rather than determining the appropriate concentrations of minerals that would protect the highest attainable aquatic life use based on a defensible scientific rationale. As discussed above, although the GRI-STR model results indicate a high survival rate, they represent effects based on the expected concentrations of individual ions that do not represent actual conditions. This model does not provide any information on the potential acute or chronic effects that actual complex mixtures of ions may have on the macroinvertebrate community. Field-based methodologies that assess aquatic communities across a gradient of minerals concentrations may be more appropriate than traditional toxicity testing for setting criteria. Criteria that are revised should not be adjusted to accommodate anthropogenic influences such as a discharge but should be based on least impacted reference conditions (USEPA, 1983 and 1989).

Habitat Characterization Analysis

The objectives of the habitat characterization portion of the study included an assessment of both the availability and quality of habitat for benthic macroinvertebrate and fish communities to determine whether the aquatic life designated use is currently attained or attainable. The habitat assessments were carried out in October 2011 and April 2012 at each bioassessment reach. The approximate locations of those reaches for Town Branch, Holman Creek and War Eagle Creek are shown in **Figure 1** above. The following discussion is limited to significant findings from each assessment.

In addition to direct habitat feature measurements, habitat potential was evaluated using procedures adapted from EPA's Rapid Bioassessment Protocols (Barbour et al. 1999). This approach was used to numerically score the measured characteristics of 10 habitat features. Based on the measured and estimated characteristics, overall habitat potential scores were calculated for each bioassessment reach. The habitat scores reported can be seen in **Table 5** below. Considering these scores, in most instances there is not a single parameter significantly affecting all sites, but scores are generally lower overall for several parameters including sediment deposition, flow and riparian area. The lower scores for these parameters suggest impacts from urbanization/land use and likely not directly attributable to the Huntsville discharge.

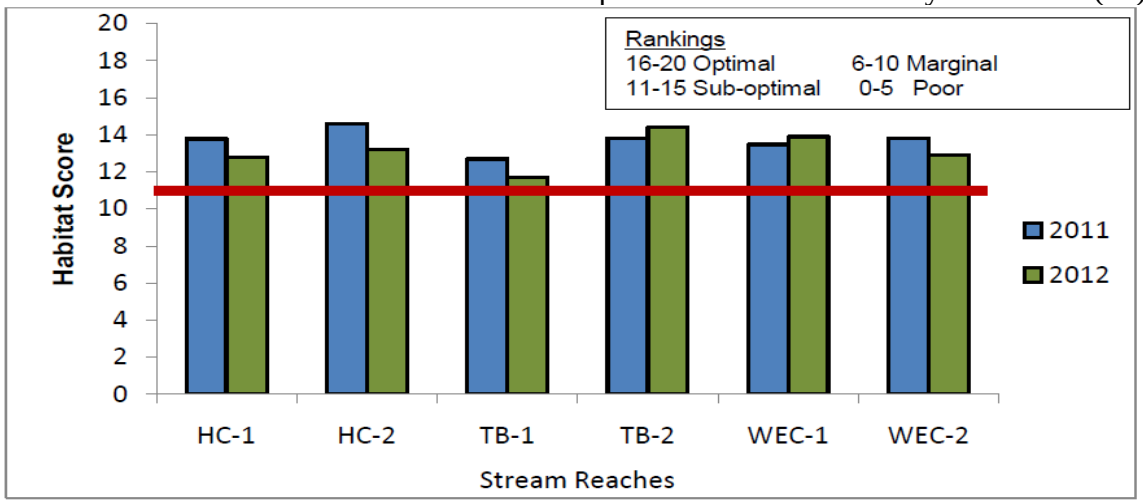
The *Study* contends that because scores were in the mid to high range of suboptimal in each bioassessment reach for both the fall 2011 and spring 2012 seasons indicates that these streams can support a diverse aquatic community (**Figure 4**). This contention depends on what represents a diverse aquatic community in these waters. Where physical habitat quality at an assessment site is similar to that of a reference, detected impacts can be used to attribute differences to specific stressors whether they are physical impairments or water quality factors. In this instance, the study design relies on a reach upstream of an effluent discharge and

downstream of that discharge. It is unlikely that this design provided minimally disturbed reference sites that could be used support the contention that the aquatic community at these sites could be considered diverse.

Table 5. Habitat potential summary scores - Town Branch, Holman Creek, and War Eagle Creek, October 2011.

Parameters	Reach					
	TB-1	TB-2	HC-1	HC-2	WEC-1	WEC-2
1. Epifaunal Substrate	12	16	16	16	16	12
2. Embeddedness	14	14	14	11	16	15
3. Velocity/Depth Regime	10	16	16	17	17	17
4. Channel Alteration	16	16	14	15	15	17
5. Sediment Deposition	13	12	15	12	12	5
6. Frequency of Riffles	16	19	14	17	17	16
7. Channel Flow Status	13	14	9	11	11	14
8. Bank Stability						
Left Bank	5	7	8	5	6	5
Right Bank	5	7	4	6	6	6
9. Vegetative Protection						
Left Bank	3	6	6	6	6	6
Right Bank	3	6	3	7	6	6
10. Riparian Vegetative Zone Width						
Left Bank	4	8	7	2	2	3
Right Bank	3	3	2	7	9	7
Score (Total)	117	144	128	132	139	129
Score Average	11.7	14.4	12.8	13.2	13.9	12.9
Ranking	S	S	S	S	S	S
Scores: 16-20 = optimal, 11-15 = sub-optimal, 6-10 = marginal, 0-5 = poor						

Figure 4. Summary of Habitat Quality Scores for fall 2011 and spring 2012 at all bioassessment sites with the minimum habitat score for sub-optimal habitat indicated by the red bar (11).



Benthic Macroinvertebrates

The ADEQ uses a Community Structure Index (CSI), which is a multimetric scoring system for macroinvertebrate assessment that incorporates an adaptation of EPA's Rapid Bioassessment Protocol (RBP) III as a biotic index relying on metrics such as dominant taxa in common, common taxa index, quantitative similarity index, taxa richness, indicator assemblage index, missing genera, and functional feeding group percentage similarity (Shackelford, 1988). The metrics included taxa richness, Hilsenhoff Biotic index, ratio of EPT (Ephemeroptera, Plecoptera, and Trichoptera) and Chironomid abundances, % contribution of dominant taxon, EPT index, and a community loss index. This multimetric system was used to determine impairment based on comparative changes in the macroinvertebrate community structure and function.

The *Study* reports that macroinvertebrate samples were taken in each of the paired bioassessment reaches for Town Branch (TB-1/TB-2), Holman Creek (HC-1/HC-2), and War Eagle Creek (WEC-1/WEC-2) during October 2011 and in April 2012. Samples were taken from multiple habitat types including root-wads, emergent vegetation, undercut banks and depositional areas that were combined for a community-level analysis. Macroinvertebrate samples of 100 organisms ± 10% collected at a riffle and in multiple habitats, respectively, were combined for a total of 200 ± 10% individuals. This approach may be based on ADEQ's methodology (Davidson and Clem, 2003). There is some concern regarding the use of an approach that is limited to a fixed sample size when deriving diversity indices. Using a larger sample size (300-500 ± 10%) or the total number of distinct taxa within a group will result in a more accurate diversity index.

Macroinvertebrate multimetric assessments were carried out in the paired bioassessment reaches at TB-1/TB-2, HC-1/HC-2, and WEC-1/WEC-2 during fall 2011. Downstream of the Huntsville WWTP outfall, TB-2 had the highest EPT % abundance of any site but had a reported EPT index of 2. An EPT index of 0-6 is considered indicative of poor water quality. TB-2 was described as slightly impaired based on ADEQ's multimetric assessment approach. The HC-2 site below the confluence with Town Branch had one of the lower EPT % abundances and had a reported EPT index of zero, indicative of poor water quality. This site was also reported as slightly impaired compared to the upstream site that was considered a reference. Further downstream WEC-2 had a high EPT % abundance and reported EPT index of 6. While still in the range of poor water quality this site was not reported as impaired. (**Table 6**).

The spring 2012 assessment indicates that downstream of the WWTP outfall there was a significant shift in scores. TB-2 had one of the lowest EPT % abundance of any site at 33.3% and a reported EPT index of zero, indicative of poor water quality. This site continued to be described as "slightly" impaired. The EPT % abundance at HC-2 below the confluence with Town Branch was similar to the fall 2011 score but a much higher EPT index score. This site was reported as unimpaired. Further downstream at WEC-2 the EPT % abundance fell significantly as did the reported EPT index, suggesting poorer water quality at this site although it was not reported as impaired. (**Table 7**).

In an effort to determine the reasons for the shift in EPT % abundance and the reported EPT indices, EPA considered the reported dominant taxa composition for both fall 2011 and spring 2012. In fall 2011, EPT taxa percentages ranged from 47.1-67.7%, with 6-13 different EPT taxa. Ephemeroptera dominated the TB-1, HC-1, HC-2 and WC-2 sites, Trichoptera dominated the TB-2 reach, and Diptera dominated the WEC-1. It was surprising that no Plecopterans were identified at any of the sites. (**Figure 5**). Although not identified to species level, collectors dominated the functional feeding group at all sites except the TB-2 reach, which was dominated by filterers.

Table 6. Summary macroinvertebrate multimetric assessment – October 2011

Parameter	TB-1	TB-2	HC-1	HC-2	WEC-1	WEC-2
Community Measures						
Total number of Taxa (Richness)	29	30	35	37	32	35
EPT Richness	8	6	13	9	9	10
EPT % Abundance	59.0	67.7	47.1	56.6	52.4	65.1
Shannon-Weiner Diversity Index	2.46	2.07	2.60	2.51	2.07	2.41
Percentage of Dominant Orders						
Gastropoda	0.3	1.0	0.6	10.5	1.8	5.9
Crustacea	0.3	0.2	7.0	0.4	0.6	0.3
Ephemeroptera	32.4	12.2	41.4	37.8	25.8	53.3
Odonata	3.8	3.5	1.3	3.6	1.2	1.3
Trichoptera	26.6	55.5	3.6	18.2	25.0	10.9
Coleoptera	8.9	4.0	12.4	18.0	3.5	6.9
Diptera	27.3	22.6	30.3	5.5	39.1	15.9
Functional Feeding Assemblage %						
Shredders	0.5	0.3	0.2	1.0	0.3	0.2
Scrapers	12.2	3.7	31.3	27.3	6.4	19.5
Filterers	28.1	56.5	4.3	20.0	27.7	16.4
Collectors	51.6	31.1	55.7	44.2	61.2	60.4
Predators	7.3	8.3	8.5	6.7	4.4	3.6
Biotic Index	6.47	6.25	5.81	6.25	7.18	6.78

In spring 2012, the EPT taxa abundance range declined to 32.8-55.5% with 6-14 different EPT taxa present. However, there was a distinct shift to more tolerant Diptera dominating all six sites. As seen in **Figure 6**, the communities in TB-1 and in TB-2 below the WWTP outfall were similar with collectors as the dominant functional feeding group at all the sites, ranging up to 71.9%.

A summary of the multimetric assessments in terms of impairment is shown in **Figure 7** below. The comparison of Town Branch was reported as “slightly” impaired for both the fall 2011 and spring 2012 assessments, although for different reasons as noted above. Holman Creek was reported as “slightly” impaired in the fall 2011, but unimpaired during spring 2012, although there was a significant shift in the macroinvertebrate community during that assessment. War Eagle Creek was reported as unimpaired for both the fall 2011 and spring 2012 assessments.

Table 7. Summary macroinvertebrate multimetric assessment – April 2012

Parameter	TB-1	TB-2	HC-1	HC-2	WEC-1	WEC-2
Total number of Taxa (Richness)	30	24	30	34	30	33
EPT Richness	4	3	14	6	6	6
EPT % Abundance	42.9	33.3	48.1	55.5	33.9	32.8
Shannon-Weiner Diversity Index	2.29	2.48	2.27	2.14	2.31	2.60
Percentage of Dominant Orders						
Annelia	0.9	10.1	0.7	1.0	1.1	1.8
Gastropoda	1.3	9.6	0.1	1.0	0.7	6.1
Ephemeroptera	17.9	10.8	37.2	27.2	21.6	23.2
Odonata	1.8	4.1	0.1	1.3	1.1	1.5
Plecoptera	0.1	0.0	5.6	1.1	2.9	3.1
Trichoptera	24.9	22.5	5.3	27.1	9.5	6.6
Coleoptera	3.4	1.8	4.4	3.3	2.4	3.7
Diptera	48.7	41.1	44.8	37.0	58.4	52.3
Functional Feeding Assemblage %						
Shredders	0.3	0.2	0.8	0.4	0.4	0.0
Scrapers	3.7	10.8	5.9	5.4	6.6	12.0
Filterers	31.6	26.4	12.2	35.8	17.6	17.7
Collectors	58.1	52.0	71.9	55.1	69.6	62.4
Predators	6.2	10.6	9.2	3.2	5.7	7.9
Biotic Index	6.86	7.29	6.34	6.60	6.91	6.89

Figure 5. Dominant taxa composition for each reach - Fall 2011.

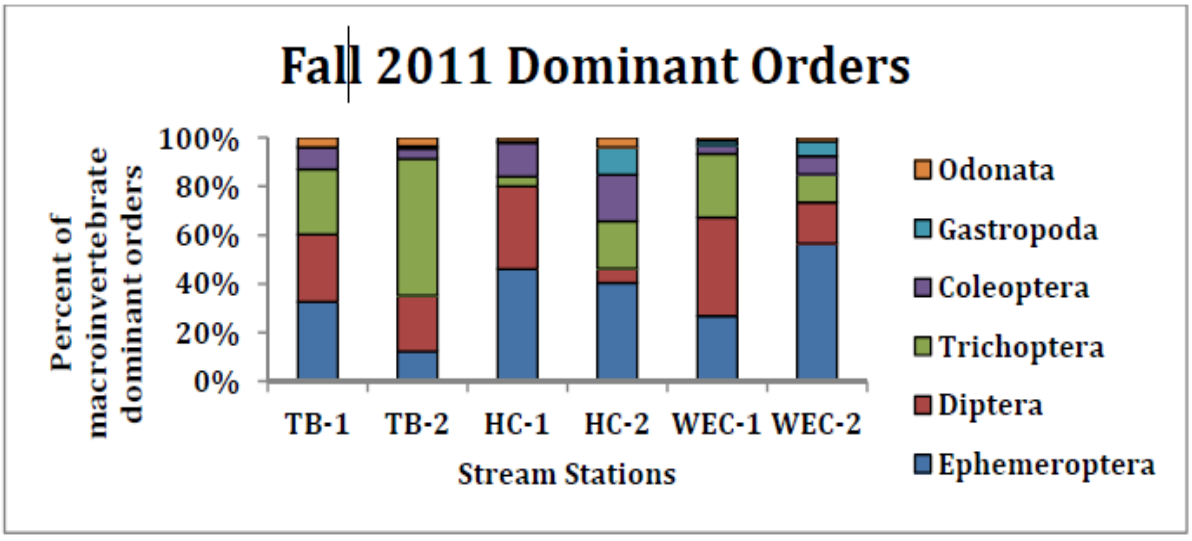
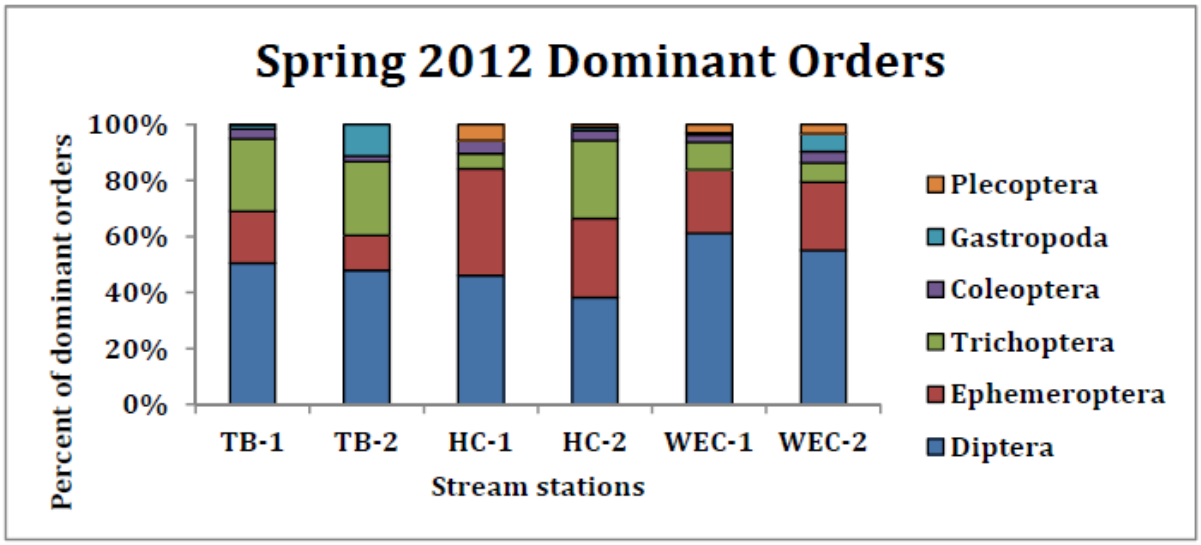
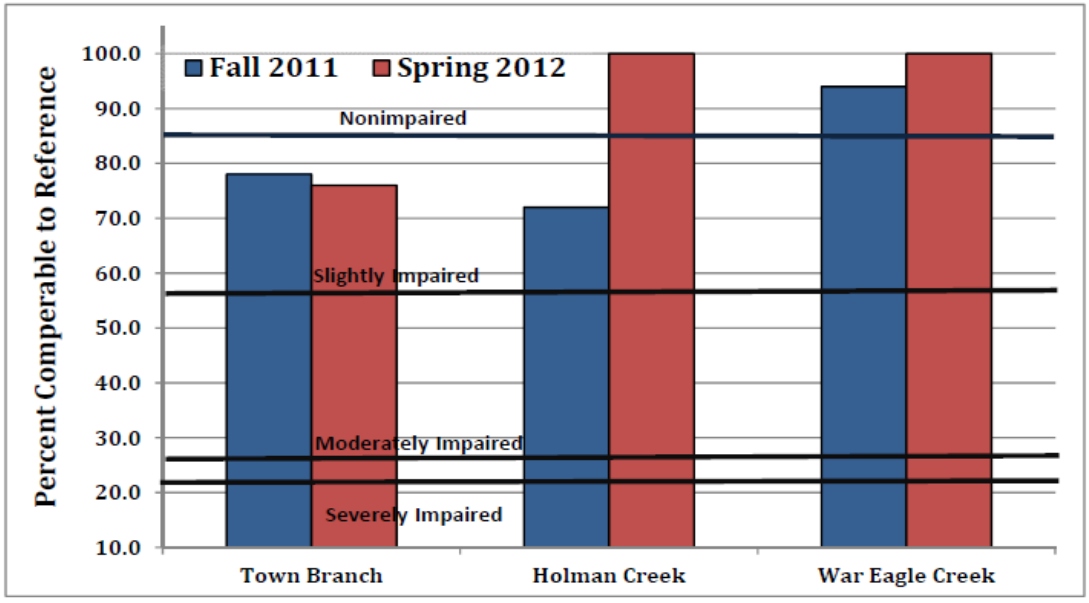


Figure 6. Dominant taxa composition for each reach – Spring 2012.



In drawing some conclusions from the macroinvertebrate assessment, one of the key metrics to consider is that each downstream bioassessment site had a relatively high percentage and number of different EPT taxa in both fall 2011 and spring 2012. The degree of impairment suggests that the Huntsville WWTP discharge does not appear to have a significant adverse effect on the macroinvertebrate community. However, this conclusion is based on data that was derived under current conditions and does not provide a clear indication of what the effect of increased mineral concentrations that would be if the revised criteria are put in place.

Figure 7. Comparison of upstream-downstream bioassessment reaches



Fish Community

Fish community analyses typically consider abundance, diversity, sensitivity and species present as indicators of both water quality and habitat quality. The following is a discussion of the results describing the fish community using the same paired bioassessment reaches used previously, Town Branch (TB-1/TB-2), Holman Creek (HC-1/HC-2), and War Eagle Creek (WEC-1/WEC-2) during the fall of 2011. Data were reported for each bioassessment site using several key community metrics including ADEQ's long-term ecoregion-based Community Similarity Index (CSI) to compare reference to downstream bioassessment sites. As with the macroinvertebrate assessment, the focus here is on the bioassessment sites at TB-1/TB-2 and HC-1/HC-2 given the location of the Huntsville WWTP outfall and potential downstream effects.

There was a total of 690 fish collected at TB-1, resulting in a high relative abundance score of 16 taxa. However, taxa richness was one of the lowest values of any site. This site was dominated by herbivorous Cyprinidae (70.7%) and insectivores (26.5%) (**Figures 8 and 9**). The community was dominated by pollution intermediate species at 50.0%, with pollution intolerant species at 45.2% and tolerant species at 4.8%. Table 5.18 provides fish community structure analysis that includes tolerance analysis for all stream reaches. At station TB-1, 49.9% of the total fish community was comprised of "Key and Indicator" species as defined by Regulation 2.302 for the Ozark Highlands Ecoregion. The overall community condition at TB-1 based on the CSI for Ozark Highland streams gave a total score of 29 which is indicative of a "generally similar" fish community when compared to similar reference sites (ADEQ, 1987).

Figure 8. Dominant family comparison – Fall 2011

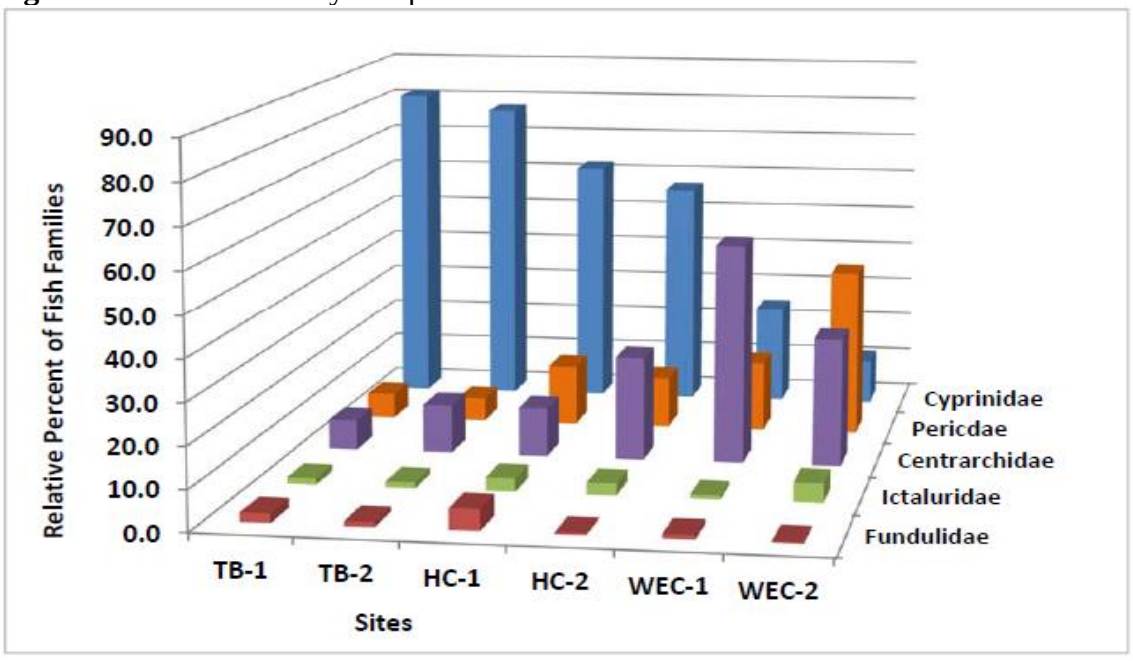
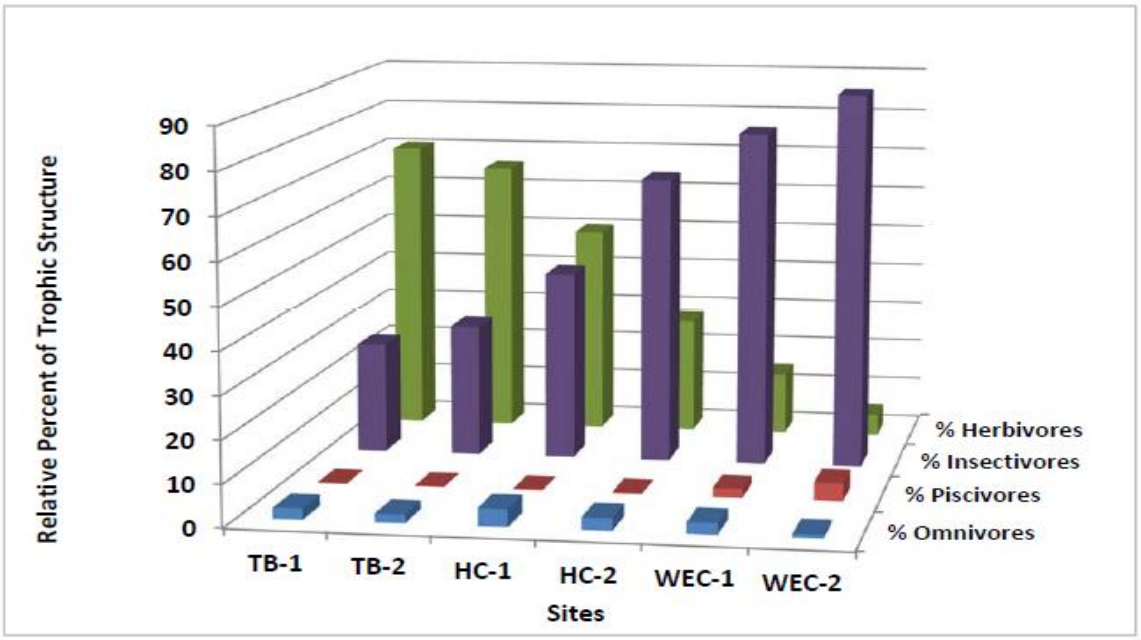
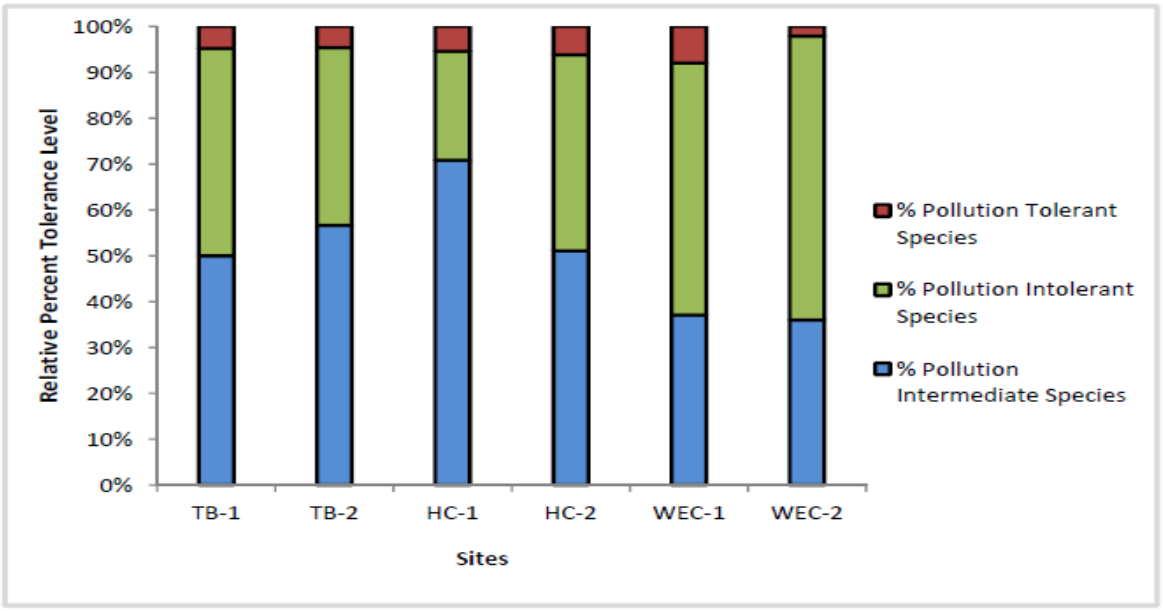


Figure 9. Trophic structure comparison – Fall 2011



In comparison, although fewer total fish (540) were collected at TB-2 the site had the same relative abundance as TB-1. This site was also dominated by the herbivorous Cyprinidae (66.1%) and insectivores (31.7%). **Figure 10** below shows that there was a shift at TB-2 in species tolerance with the community being dominated by intermediate species at 56.7%, followed by drop in intolerant species to 38.7% and similar percentages of pollution tolerant species at 4.6%. Key and Indicator species comprised 42.2% of the fish community at TB-2. The overall fish community condition at TB-2 yielded a CSI score of 31, which indicates it is generally similarity to ecoregion reference sites.

Figure 10. Composition of pollutant tolerant fish - Fall 2011.

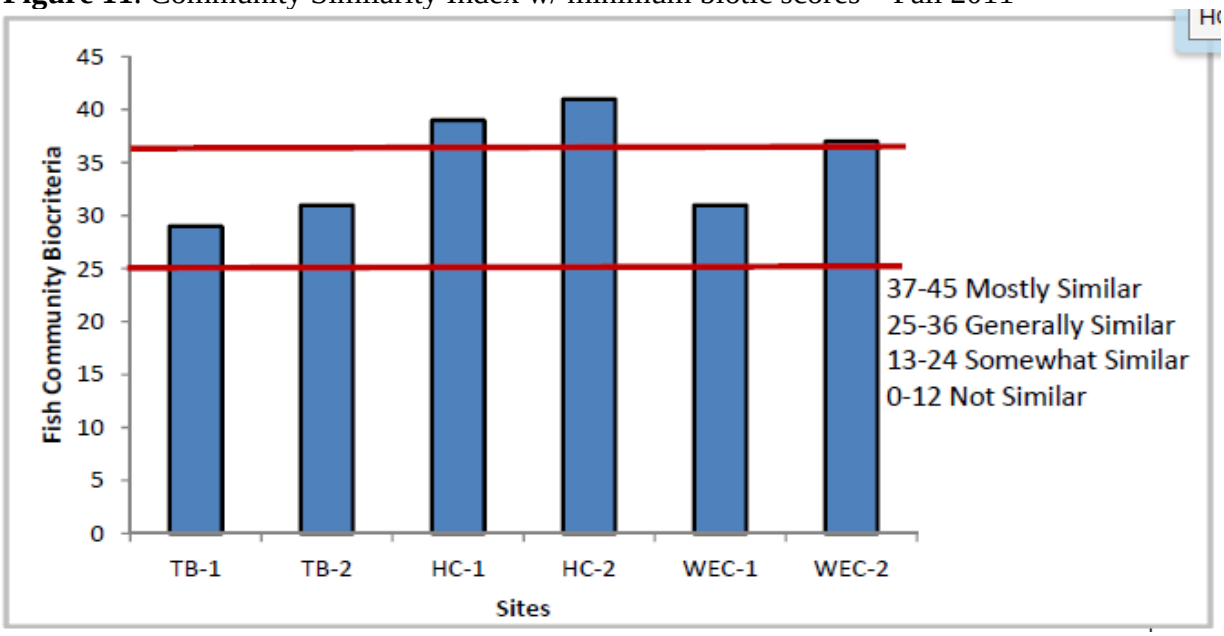


The total number of fish taken at HC-2 continued to decline to a total of 408 with a relative fish abundance of 13.4, the lowest of any site. However, HC-2 had a higher total richness score with a total of 19 taxa. The trophic structure was dominated by insectivorous Centrarchidae at 68.9% followed by herbivores at 27.9%. The community was dominated by intermediate tolerant species at 51.0%, followed by intolerant species at 42.6%, and pollution-tolerant species at 6.1%. "Key and Indicator" species made up 51.7% of the fish community at HC-2. As reported for the previous sites, the *Study* concluded that the CSI score of 41 indicates a generally similar community at station HC-2 compared to similar reference sites

The conclusions based on fish community assessment data indicate that the fish community at the downstream sites TB-2, HC-2 and WEC-2 were generally diverse and had similar taxa richness compared to the upstream sites. There is a clear shift in trophic structure, where Town Branch is dominated by herbivorous Cyprinidae and shifts to herbivorous Percidae in Holman Creek with War Eagle Creek being dominated by insectivorous Centrarchidae. This shift may reflect differences in habitat to a degree, but the dominance of herbivores in Town Branch (TB-2) and Holman Creek (HC-2) may well be driven by elevated nutrients from the Huntsville WWTP and possibly not significantly affected by mineral concentrations.

Regulation 2 relies on key and indicator species as well as CSI metrics for determining designated aquatic life use attainment. Regulation 2.302 identifies key and indicator species for the Ozark Highlands Ecoregion. The *Study* reported that there were at least 6 key and indicator species present at each of the paired sites and ranged from a low of 22.1% (WEC-1) to 49.9% (TB-1) of the total taxa at each assessment site. There were sensitive Percidae (darter) and Centrarchidae (sunfish) species reported at all sites, although TB-2 had only a single darter species. The assessments focused on the CSI as mentioned above for each site, which are characterized in the *Study* as showing that all of the assessment sites are generally similar to the state's Ecoregion Reference sites, and the downstream sites (TB-2, HC-2 and WEC-2) scored higher than paired upstream sites for each stream. (**Figure 11**).

Figure 11. Community Similarity Index w/ minimum biotic scores – Fall 2011



It is unclear what the number of key and indicator species or CSI scores mean in terms of aquatic life use attainment. In reference to key and indicator species, Regulation 2 refers to diverse fish communities characterized by a preponderance of sensitive species but does not establish a clear numeric threshold that can be used to evaluate the degree of aquatic life use attainability. Although ADEQ's CSI is designed to evaluate multiple components of the fish community and the values can be used to establish a pattern of little or no change over the study period, there is no clear way to determine the relevance of these values without an established numeric standard or threshold. To help translate this "similarity scale" into more applicable regulatory categories, EPA looked at ADEQ CSI scoring and categories from the previous Strawberry River Study (ADEQ, 2003) where use support designations were clearer. Using these interpretations, EPA concluded that scores less than 25 are indicative of impaired streams. Based on these scoring interpretations, the aquatic life use can be considered generally attained at TB-1, TB-2 and WEC-1, and fully attained at HC-1, HC-2 and WEC-2.

The data indicate that there is some notable variation to some impairment in both reference and assessment sites, particularly in Town Branch and Holman creek. In those downstream reaches below the Huntsville WWTP discharge there does not appear to be a significant adverse effect on the fish community. However, like the macroinvertebrate assessment, this conclusion is based on data that were derived under current conditions and does not provide a clear indication of whether those impacts are the result of current mineral concentration and/or nutrient loading from the WWTP outfall, nonpoint source/habitat impacts or a combination of these stressors. More importantly, this information does not provide any indication of what effect increased mineral concentrations would have on the fish community if the revised criteria for Town Branch and Holman Creek are put in place.

Conclusions Regarding the Water Quality and Biological Data to Support the Revised Criteria

The EPA's obligation is to ensure that all water quality criteria adopted by the state are based on a sound scientific rationale and are protective of the most sensitive use, in this instance, the Ozark Highland Ecoregion fishery use. Drawing conclusions based on the potential effect of the revised site-specific criteria based on the supporting data, like previous third-party rulemakings, continues to be challenging.

In summarizing the available habitat and biological data, the *Study* concludes that considering the habitat assessments, although the overall physical habitat scores were in the mid to high range of suboptimal, these streams appear to be able to support a "diverse aquatic community" under current conditions. Although the physical habitat may be minimally capable to support a diverse community, the water chemistry analyses, and biological assessments are critical in determining if the aquatic life use will continue to be attained.

Considering the macroinvertebrate community, there is some degree of impairment that can be attributed to the Huntsville WWTP discharge, but it is not clear that these impacts are the result of current mineral concentrations or if nutrient loading from the outfall, nonpoint source/habitat impacts, or a combination of these stressors are contributing to the adverse effects. Similarly, the fish community assessment indicated that there is some variation and impairment in both reference and assessment sites although there does not appear to be a significant adverse

effect from the discharge on the fish community. It is unclear what degree of impact and resulting shift in the community structure is attributable to current mineral concentrations or nutrient loading. It should be noted that although there is a significant loss of freshwater mussels in these and other waters in Arkansas, there was no evaluation of potential effects on juvenile freshwater species. What is significant is that these assessments are based on current conditions and do not provide a clear indication of what effect increased mineral concentrations resulting from the implementation of the revised site-specific criteria will have on either aquatic community.

In both the discussion of the macroinvertebrate analysis for the GTI-STR model, mineral concentrations and the WET testing as related to conductivity, the conclusions that it is unlikely that the mineral levels in Huntsville WWTP's effluent are having a negative impact on the macroinvertebrate community is difficult to support given that very small variations in ionic composition can result in subtle to significant differences in the structure and function of aquatic communities. It is difficult to conclude what effect other analytes like magnesium, potassium, alkalinity, pH, etc. may be having in Town Branch, Holman Creek and, to a lesser extent, in War Eagle Creek. The water quality modelling done in this study gives some inferences to what can be expected, but the reliance on current effluent and test species that may not be the most sensitive to minerals weaken the conclusions made, particularly since potential impacts on threatened and endangered species were not considered. The reference to sensitive species used in current research is inconclusive as the most sensitive species cited was not present in the affected waters. Thus, the 95th percentile methodology that has been used to derive the revised criteria makes it difficult to discern the effect of subtle changes in minerals concentrations based on ambient conditions.

The primary source of dissolved minerals discharged from the Huntsville WWTP is from the industrial discharge from the Butterball LLC turkey processing facility. The *Study* refers to models that project "dramatic" future growth and development in the watershed, particularly around Huntsville. The *Study* reported that in the next revision of Huntsville's NPDES permit the facility is expected to exceed its mineral limits, resulting in non-compliance for the City of Huntsville, presumably providing the impetus for this rulemaking. The *Study* notes that EPA has not established Best Available Technology (BAT) for removal of chloride, sulfate, or TDS from waste streams. The *Study's Alternative Analysis* does refer to a number of options, including treatment by the Butterball facility, noting that the cost with a process like reverse osmosis would be "burdensome." However, it does not provide a clear demonstration that such treatment is not feasible. Further, the *Alternative Analysis* does not indicate that the City of Huntsville performed an analysis based on EPA's *Interim Economic Guidance for Water Quality Standards* (1995) to determine the cost and potential impact of treatment upgrades.

IV. Supporting Data and Analysis for Removal of the Domestic Water Supply Use

The revised water quality standards include the removal of the Domestic Water Supply (DWS) use that is currently applicable to Town Branch and Holman Creek. The federal regulation at 40 CFR 131.10(k)(3) requires that in those instances where a state wishes to remove or revise a designated use that is a non-101(a)(2) use, that it submit documentation justifying how its consideration of the use and value of water for those uses appropriately supports the State's action.

The current supporting *Study* focuses on the physical characteristics limiting their ability to support the DWS use in both Town Branch and Holman Creek. These streams are also described as not containing adequate volumes of water to be utilized as drinking water supplies now or in the future. Given that these streams are both 3rd order streams and smaller within a watershed that is less than 30 square miles with intermittent flow with an 7Q10 of 0 cfs present a significant physical limitation to supporting the DWS use. This limitation was noted in the flow statistics presented in the *Study* and noted in Arkansas Department of Health (ADH) comments opposing the rulemaking. Neither Town Branch nor Holman Creek are currently being used as a drinking water source. This was supported by the comments provided by ADH opposing this rulemaking. Based on the information provided, EPA found that the state has adequately considered the use and value of Town Branch and Holman Creek as a public water supply consistent with 40 CFR 131.10 and approves removal of the DWS use from Town Branch and Holman Creek.

Although the physical characteristics of Town Branch and Holman Creek do limit their ability to support a DWS use, it is worth noting that in its discussion of the DWS use, the original supporting *Study* (2013) indicated that the concern was a combination of factors, the presumption of low flow combined with the application of the DWS criteria for chloride, sulfate, and TDS (250 mg/l, 250 mg/L and 500 mg/L). The 2013 *Study* noted that the application of the DWS criteria would result in more restrictive permit limits than the aquatic life use criteria since they would apply at the end of the pipe for the Tyson facility. Thus, the DWS use is being removed because it requires a criterion of 500 mg/L TDS, which precludes the revised TDS criteria for these waterbodies. This suggests that the possibility of more restrictive permit limits was a significant factor in removing the current DWS use.

V. Evaluation of Potential Impacts to Downstream Waters

EPA reviewed and considered all of the public comments ADEQ received on this rulemaking expressing concerns about impacts to downstream water quality from the revised criteria and removal of the DWS use. With the exception of comments by ADEQ, public comments on the Huntsville rulemaking were opposed to the DWS use removal and the revised criteria.

The commenters included the Beaver Water District (BWD) which initially commented on the then proposed amendments in 2013. The primary concerns expressed were that the revised criteria “represent over a six hundred percent increase in the WQC for chloride, a thirty percent increase in the WQC for sulfate, and a sixty percent increase in the WQC for TDS “ The BWD again commented in 2017, stating that the removal of the DWS use from segments of Town Branch and Holman Creek and increased mineral criteria in the War Eagle Creek watershed has the potential to adversely impact Beaver Lake water quality and can have a direct effect on its costs in providing drinking water that meets federal and state requirements. The BWD also noted the significant increase in chloride, sulfate and TDS criteria for Town Branch and Holman Creek compared to those values initially proposed in 2013. The BWD objected to the limited and dated data used as justification for the criteria revision, referring to data from 2011 – 2012 from the *Study* that was used to derive the revised chloride and TDS criteria, lacking other sources such as ADEQ and USGS data.

In 2017, the ADH reiterated its 2013 objection to the removal of the domestic water supply designation for both Town Branch and Holman Creek, noting that both are tributaries of War Eagle Creek in the Beaver Lake watershed, and Beaver Lake is a source of drinking water to over 400,000 people. The ADH expressed concern that the intake structures are vulnerable to mineral pollution, referencing events in Flint, MI, referring to the corrosive effects of dissolved chlorides when concentrations are below the secondary standards. ADH requested that supporting documents regarding Economic Impact/Environmental Benefit Analysis be revised to reflect the costs associated with treatment for any future degradation of the watersheds. The ADH also requested that all related documents mentioning ADH reflect its opposition to the proposed rulemaking and the removal of the domestic supply designation for Town Branch and Holman Creek.

Comments from the White River Waterkeeper also opposed the DWS use removal and raised specific concerns about the sufficiency of data to support the revised criteria. In addition, the Waterkeeper also commented regarding the derivation of the revised mineral criteria and the potential impact they may have on aquatic life uses, particularly the fish community.

To address concerns about potential impacts to downstream waters, the *Study* also included a United States Geological Survey (USGS) study of the Beaver Lake watershed (Green, 2013). The USGS report was available as part of the materials provided for public comment. The USGS study was developed to model the potential effect of increasing dissolved minerals on Beaver Lake given that the two primary drainages, the White River and War Eagle Creek, carry treated wastewater from the cities of Fayetteville and Huntsville to the lake. Water-quality samples were collected at the three main inflows to Beaver Lake: The White River near Fayetteville, Richland Creek at Goshen, and War Eagle Creek near Hindsville, looking at inflow concentrations of dissolved solids (DS), Cl^-, SO_4^2. The actual median concentrations of DS and Cl^- were higher at the War Eagle Creek site, but SO_4^2 concentrations were lower. As would be expected, concentrations declined at sampling sites further away from the inflow sites.

The analysis utilized the U.S. Army Corps of Engineers model CE-Qual-W2 calibrated to actual measured water quality values to help ensure that the model's predictions were consistent with real world water quality effects. Model fate and transport scenarios used increasing DS, Cl^-, SO_4^2 levels in factors of 1.2, 1.5, 2.0, 5.0 and 10.0 in Beaver Lake and tributaries. Concentrations of these pollutants at the level initially proposed for War Eagle Creek did not result in a significant difference in levels of these pollutants in Beaver Lake. The EPA also noted that the criteria revisions that would have applied to War Eagle Creek if they had been retained in the Commission's rulemaking would have represent only a 3% increase in TDS criteria and no change in sulfate criteria.

EPA relied primarily on the findings of the USGS report to conclude that downstream impacts to Beaver Lake from the revised criteria and removal of the DWS use would be negligible. While most commenters expressed concerns about impacts to downstream waters from the proposed WQS revisions, no commenters specifically contested the findings of the USGS model or provided data to contradict it. If any further increases to the site-specific criteria for any of these waterbodies are proposed in the future, the baseline established in the USGS

study or a baseline reflecting unimpacted or minimally impacted conditions should be used to evaluate potential impacts to downstream waters as opposed to setting the baseline equal to current conditions at the time of analysis. Use of an appropriate baseline reflecting unimpacted or minimally impacted conditions will reduce the risk of locking in incremental increases in criteria and pollutant loadings that could otherwise cumulatively result in gradual degradation of water quality in War Eagle Creek and Beaver Lake over time.

VI. Revised Provisions EPA is Approving

Based on the available information, EPA concludes that the revised site-specific criteria for Town Branch and Holman Creek are likely to adversely impact the aquatic community in these waters although overall the Ozark Highland fishery use is expected to remain attainable. Based on the weight of evidence, the revised site-specific criteria detailed below are approved pursuant to Sec. 303(c) of the CWA. Upon approval by EPA, these criteria are in effect for all CWA purposes (see **Table 1**).

The EPA has also concluded that the state has adequately considered the use and value of Town Branch and Holman Creek as a public water supply consistent with 40 CFR 131.10 and approves removal of the DWS use from Town Branch and Holman Creek.

VII. Additional Considerations

Antidegradation Requirements

Federal regulations require states to develop antidegradation implementation methods for the antidegradation policy that are, at a minimum, consistent with the state's policy and with 40 CFR 131.12(a). Neither Regulation 2 nor the state's Continuing Planning Process (CPP) document (2000) currently contain implementation methods for the state's antidegradation policy. It is EPA's understanding that ADEQ is working to develop implementation methods and will likely incorporate methods in the next iteration of its CPP. It is important to note that the state is required to provide an opportunity for public involvement during the development of, and during any subsequent revisions of, the state's implementation methods and that the final version of the implementation methods must be available to the public. See 40 CFR 130.5(b)(6) and 40 CFR 131.12(b). While not required for EPA's approval of the state's revised site-specific criteria for Town Branch, Holman Creek and War Eagle Creek, the development of these implementation methods is critical for the proper implementation of the site-specific criteria that the state has adopted.

Antidegradation is an integral part of a state's or tribe's water quality standards, as it provides important protections that are critical to the fulfillment of the CWA objective to restore and maintain the chemical, physical, and biological integrity of the Nation's waters. The federal regulations outline requirements for three tiers of antidegradation protection: protection for existing uses (Tier 1), protection for high quality waters, where the quality of the water exceeds levels necessary to support the protection and propagation of fish, shellfish, and wildlife and recreation in and on the water (Tier 2), and protection for outstanding national resource waters (Tier 3). Antidegradation is broadly applicable to all pollutant sources, all water bodies, and at all

times, but it is most commonly triggered through activities that could lower water quality and are regulated. No permit may be issued without an antidegradation review to a discharger to high-quality waters with effluent limits greater than actual current loadings, if such loadings will cause a lowering of water quality (USEPA, 1989). The antidegradation review will assure that the applicable level of protection is being provided to that water body.

Water quality data along with physical, chemical, and biological data from representative reference stream locations within the Town Branch and Holman Creek watersheds establish the baseline conditions for these waters and should be used for the purpose of an antidegradation review. Where water quality is better than the levels necessary to support the CWA Sec. 101(a)(2) uses, the state must conduct a Tier 2 antidegradation review, including an analysis of alternatives, to find that a lowering of high-water quality is "necessary to accommodate important economic or social development in the area in which the waters are located." The EPA anticipates that ADEQ will conduct a Tier 2 antidegradation review, as required by 40 CFR 131.12(a)(2)(i), to evaluate the use of assimilative capacity in allowing discharges of chloride, sulfate and TDS during the NPDES permitting process. The full requirements of a Tier 2 review can be found at 40 CFR 131.12(a)(2).

Assessment and 303(d) Listing

The *Study* refers to Arkansas's 2008 CWA Section 303(d) lists where Town Branch and Holman Creek were identified for exceedences of nitrate and TDS. Both Town Branch and Holman Creek were identified on the state's 2014 303(d) list for TDS. Town Branch is on the current 2016 303(d) list for exceedances of nitrate and on the draft 2018 303(d) list for TDS. Both creeks are identified as affected by industrial and municipal point sources for all listings.

Based on a comparison of the summary statistics reported in the *Study* for chloride, sulfate, and TDS data from TB-2, HC-2, and WEC-2 that were used as the basis for the revised site-specific criteria in comparison to the Ozark Highland Ecoregion criteria (see **Table 4** and **5**), it is unclear how Town Branch and Holman Creek were not listed for these minerals on the state's 2016 and draft 2018 lists. This apparent inconsistency may be related to the Commission's 2007 revisions to Regulation 2 which struck language that specified that minerals are not to exceed in more than "1 in 10 samples collected over a period of not less than 30 days or more than 360 days" and replaced that language with a 25 percent exceedance rate for site-specific minerals criteria. ADEQ subsequently modified its assessment methodology in 2016 to reflect the APCEC's 2007 amendments to Regulation 2. However, EPA had previously disapproved the removal of the 1 in 10 (10%) exceedance rate for minerals from Regulation 2 in its January 24, 2008 action (EPA, 2008). Because of EPA's action, the 10% exceedance rate for minerals criteria assessment remains effective for CWA purposes in lieu of a 25% exceedance rate regardless of the state's assessment methodology.

Endangered Species Act Consultation

EPA's approval of revised aquatic life water quality standards (WQS) is subject to the consultation requirement of Section 7(a)(2) of the Endangered Species Act (ESA). Under Section 7(a)(2) of the ESA, 16 U.S.C. §1536, EPA has the obligation to ensure that its approval of these

modifications to Arkansas's Regulation 2 will not jeopardize the continued existence of threatened and endangered species and their critical habitat in Arkansas. EPA initiated consultation with the USFWS-Conway Field Office regarding the effects of EPA approving a change to Arkansas's Regulation 2 for chloride, sulfate and TDS applicable to Town Branch, Holman Creek and War Eagle Creek on October 10, 2019 based on the original supporting *Study* by GBMc (2017).

EPA considered the available information in the literature and the technical comments from the Service, looking primarily at how increases in chloride, sulfate, and TDS (**Table 1**) would affect the listed species within the defined action area that encompasses portions of Town Branch, Holman Creek and War Eagle Creek. There are no nationally recommended water quality acute/chronic criteria for aquatic life for sulfate and TDS, however, the revised criteria for chloride that Arkansas has adopted is well within the federally recommended limits. The EPA has determined that the approval of site-specific mineral criteria adopted by the APC&EC for Town Branch from the point of discharge for the City of Huntsville WWTP to Town Branch downstream to its confluence with Holman Creek, Holman Creek to its confluence with War Eagle Creek to the War Eagle Creek confluence with Clifty Creek, may affect, but are not likely to adversely affect the Rabbitsfoot (*Quadrula cylindrica cylindrica*), Piping Plover (*Charadrius melodus*), Gray Bat (*Myotis grisescens*), Indiana Bat (*Myotis sodalis*), Ozark Big-eared Bat (*Corynorhinus townsendii ingens*), and Northern Long-eared Bat (*Myotis septentrionalis*). The EPA determined that the revised criteria will have no effect on Missouri Bladderpod (*Physaria filiformis*). The inclusion of War Eagle Creek in the consultation based on the supporting *Study* did not alter EPA's conclusions. The USFWS-Ecological Services Field Office concurred with EPA's determination on May 18, 2020.

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