Missouri Clean Water Commission
Department of Natural Resources
East Elm Street Conference Center
Bennett Springs/Roaring River Conference Rooms
1730 East Elm Street
Jefferson City, MO 65102

November 3, 2010

Finalization of 2010 303(d) List

Issue: Resolution of the 303(d) status of Cave Springs Branch and Wilsons Creek.

Background: At their September 8 meeting, the Commission approved the 2010 303(d) List proposed by the Department with the exception of two waters. The Commission requested a 30 day public notice to allow further comment on the proposed listing of Cave Springs Branch in McDonald County for nutrients, and requested further public comment on the source(s) of bacteria in Wilsons Creek in Greene County.

Comments Received During the Public Notice: The Department initiated a 30 day public notice to solicit comments on these two waters. The public notice ended October 28. The Department received two comments during this period. One comment came from Geosyntec Inc. on behalf of the City of Springfield and provided an analysis of bacteria levels in several streams in Southwest Missouri and a request that bacterial sources for Wilsons Creek be stated as "urban and rural nonpoint sources." The other comment letter was from Newman, Comley and Ruth, P.C. on behalf of Simmons Foods and provided information on water chemistry and biota in Cave Springs Branch. This letter requested removal of Cave Springs Branch from the 2010 Missouri 303(d) list.

Recommended Action: Based on the information provided in these two comment letters and on our separate review of data, the Department makes the following recommendations:

1. The source of bacteria in Wilsons Creek on the 2010 303(d) list should be listed as "urban and rural nonpoint sources", and
2. Cave Springs Branch should be removed from the 2010 303(d) list.

List of Attachments:

- Attachment One. Summary of nutrient levels in Cave Springs Branch (in Commission Packet)
- Attachment Two. Written public comments received during the public notice (to be provided in the Commission's blue folder)
- Attachment Three. A revised briefing document with the Department's recommended action (to be included provided in the Commission's blue folder)

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October 20, 2010

Mr. John Ford
Missouri Department of Natural Resources
Water Protection Program
Water Quality Monitoring and Assessment Section
P.O. Box 176
Jefferson City, MO 65102

Subject: Public Notice on 2010 303(d) List – Wilson Creek

Dear Mr. Ford:

On behalf of the City of Springfield (City), Geosyntec Consultants (Geosyntec) is providing comments on the proposed 2010 303(d) List for the public comment period ending October 28, 2010. The City strongly supports the Department's decision to modify the sources of bacteria in Wilson Creek from "Point/Urban Nonpoint Sources" to "Urban/Rural Nonpoint Sources". As discussed below, there is little to no evidence to suggest that the Springfield Southwest Wastewater Treatment Plant (SWWWTP) is contributing to the impairment and there are no other domestic waste point sources to Wilson Creek.

To demonstrate this point, we reviewed weekly fecal coliform data from the SWWWTP dating back to 2006 (i.e., the period following major wastewater treatment plant improvements). For purposes of comparison, the former bacteria criterion of 200 colonies/100 mL fecal coliform was assumed equivalent to the current *E. coli* criterion of 126 colonies/100 mL. For the period of analysis (i.e., 2006-2010), only 1.3% of fecal coliform measurements were above 200 fecal coliform colonies/100 mL. This is significantly less than the 10% threshold used for losing stream impairment decisions, which strongly suggests the SWWWTP is not the cause of impairment in Wilson Creek.

Furthermore, the City notes that the losing stream *E. coli* criterion (i.e., no more than 10% of *E. coli* samples may exceed 126 colonies/100 mL) is likely not met in Missouri streams with or without point sources. To illustrate this point, we reviewed *E. coli* data from USGS stations 07053810 (Bull Creek near Walnut Shade) and 07057500 (North Fork River near Tecumseh). Both these stations were used as reference streams for developing the Wilson and Pearson Creek TMDL targets. Samples collected from the Bull Creek and North Fork stations since 2003

exceeded the losing stream criterion of 126 colonies/100 mL 20.8% and 13.8% of the time, respectively (**Table 1**). This suggests the bacterial effluent quality from the SWWWTP (i.e., only 1.3% exceedance) far exceeds that than even the most pristine reference streams in southwest Missouri.

TABLE 1. Summary of *E. coli* Data from USGS Reference Stream Stations.

USGS Water Quality Station	Date Range	Count	Max *E. coli* (cfu/100 mL)	Count >126 cfu/100 mL
Bull Creek nr. Walnut Shade	10/11/06 – 9/3/2008	24	2,900	5 (20.8%)
North Fork River nr. Tecumseh	1/21/2003-7/27/2010	58	7,900	8 (13.8%)

In addition to analyzing reference stream data, we evaluated *E. coli* data compiled from 169 water quality stations throughout southwest Missouri, which include Beaver, Bull, Elk, James, Sac and Spring watersheds. Many of these stations we expect are in remote locations without urban impact. 75% of these stations have greater than 10% of their samples in excess of the losing stream criterion. On average, samples from these stations exceed the losing stream criterion 46% of the time. The Department identified 31% of Wilson Creek samples as exceeding the *E. coli* losing stream criterion.

In addition to the reasons stated above, there are other compelling arguments that Missouri's *E. coli* losing stream criterion is inappropriate. However, the point we are emphasizing here is that the SWWWTP is not the cause of impairment to Wilson Creek. The fact that most waters, including the most pristine, cannot meet this standard demonstrates this is not a point source issue. In fact, as noted above, the SWWWTP effluent only exceeds bacteria criteria 1.3% of the time compared to 31% of the time in Wilson Creek. We also note there is a large livestock population in the Wilson Creek watershed that likely contributes to the bacteria loading in Wilson Creek. Unlike effluent from the SWWTP, livestock waste is left untreated and it is not unreasonable to assume it finds its way into streams where animals tend to congregate.

We would like to thank the Department for this opportunity to provide comments on the draft 2010 303(d) List and again want to express our support for the removal of point sources as a cause of bacteria impairment to Wilson Creek. If you have any questions or comments, please feel free to contact me at (573) 443-4100.

Sincerely,

Tom Wallace
Senior Project Manager

cc: E. Malter, P.E., City of Springfield
Randy Lyman, City of Springfield
Todd Wagner, P.E., City of Springfield

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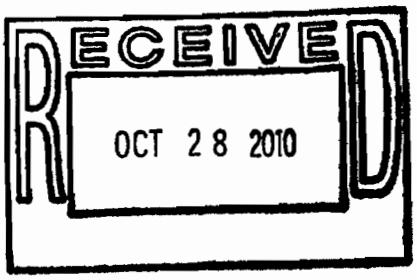
October 28, 2010



Mr. John Ford
Water Protection Program
Mo. Department of Natural Resources
P.O. Box 176
Jefferson City, MO 65102-0176

RE: 2010 303d List – Cave Springs Branch (WBID 3245U-01)

Dear Mr. Ford:

On September 28, 2010, the Missouri Department of Natural Resources published a public notice inviting comment as to whether Cave Springs Branch (WBID 3245U-01) should be removed from Missouri's 303d list of impaired waterbodies. Newman, Comley & Ruth, P.C. has been retained by Simmons Foods Inc. to offer comment on Simmons' behalf. Simmons suggests that Cave Springs Branch ("CSB") is no longer impaired and should be removed from the 303d list. This letter offers comment and a technical memorandum suggesting that CSB is no longer impaired and should be removed from Missouri's 303d list.

Simmons Foods operates a chicken processing and rendering plant near Southwest City, Missouri. The facility has a wastewater treatment plant that discharges to CSB pursuant to Missouri State Operating Permit MO-0036773. Simmons' plant employs approximately 1,400 employees who take pride in providing consumers with quality protein products while working to provide environmental protections.

In September1998, the Clean Water Commission first listed Cave Springs Branch on the 303(d) list. During the Commission meeting, no data was offered to support the listing. However, the Department later justified the listing based on anecdotal observations that the waterbody contained unsightly bottom deposits that violated the general water quality standards.

In 1998 and 1999, Simmons Foods made a commitment to research, design and construct new and additional, state-of-the art treatment facilities to improve the quality of water in CSB. Simmons is proud to say that it delivered on its commitment. For more than a decade Simmons Foods' wastewater treatment plant has produced a high-quality effluent that reduced ammonia and nutrient loadings to such an extent that it is now an industry leader in wastewater treatment. This letter will describe the vast improvement in water quality and how the aquatic life in CSB has prospered since the improvements were installed. This letter will also describe and conclude

that CSB is no longer impaired, and recommend the CWC vote to remove CSB from the 303d list at its meeting on November 3, 2010.

Effluent Monitoring Data Tells the Story

Prior to wastewater treatment improvements made in 1995/1996 and again in 1999, the Simmons Foods' wastewater treatment plant ("Simmons' plant") discharged effluent containing upwards of 50 mg/L ammonia, 20 mg/L total phosphorus (TP) and 158 mg/L nitrate/nitrite nitrogen. After the new treatment systems were placed online, ammonia, TP and nitrate/nitrite levels dropped precipitously. These improvements were made to meet the newly imposed nutrient limits for nitrates and phosphorous. Figure 1, below, demonstrates the dramatic reduction in total phosphorus in CSB at the state line. This reduction, in addition to changes in watershed land-use practices, led to healthier populations of macroinvertebrates and a reduction in filamentous algae growths in CSB.

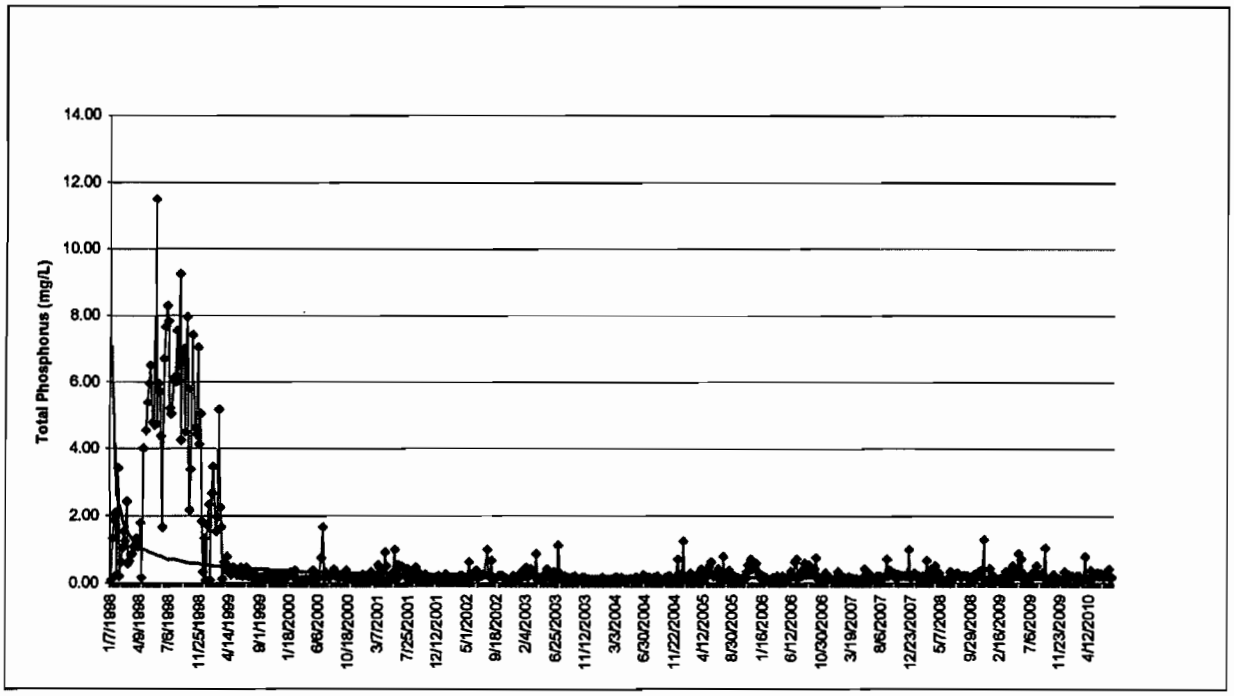


Figure 1. Total phosphorus data from Outfall 006 (Missouri/Oklahoma state line)

MDNR Data and Observations Recommend Delisting

In 2004, the Department published a document discussing Nutrient Trends in Cave Springs Branch. The document is enclosed as Attachment 1. In this document, the Department stated:

> There have been large reductions in the amount of nutrients discharged to Cave Spring Branch beginning in 1999. These reductions are due primarily to

> improvement in wastewater treatment at the Simmons poultry processing plant ... In August 2004, the Missouri DNR conducted a visual and benthic survey of Cave Spring Branch ... There is currently no evidence of exceedance of narrative water quality standards

The Department then made the "recommendation" to delist Cave Springs Branch from the 2004 303(d) list. Cave Springs Branch, however, was not delisted.

In 2005, EPA prepared a report discussing the status of numerous water bodies covered under the settlement agreement in American Canoe Assoc. Inc. et al. v. EPA et al., No. 98-1195-CV-W-SOW-ECF (W.D. Mo. 1998). Cave Springs Branch was included. The EPA reported that a TMDL had not yet been prepared for Cave Springs Branch because of the rationale provided by Missouri: "Will be recommended by staff to be delisted on the next 303(d) listing process (2007). Monitoring data indicated full attainment of beneficial uses." Again, Cave Springs Branch was not delisted.

In 2008, MDNR released another Nutrient Trends in Cave Springs Branch document and again stated, "There is currently no evidence of exceedance of narrative water quality standards." This document is also enclosed as Attachment 2. Cave Springs Branch was not delisted.

Based on MDNR's repeated assertion that Cave Springs Branch does not exceed water quality standards; therefore, Simmons Foods suggests that CSB is not impaired and asks that it be removed from the 303d list.

Macroinvertebrate Community

In the year 2000, Simmons Foods hired GBM^c & Associates to perform a macroinvertebrate survey in CSB. GBM^c & Associates is an environmental consulting firm with headquarters in Bryant, Arkansas. The 2000 macroinvertebrate and habitat survey detailed CSB's struggle with habitat impairment and the lingering effects of elevated ammonia and nutrient levels. Last month, Simmons Foods asked GBM^c & Associates to return to CSB to document the improvement in the aquatic community and habitat improvements along CSB. Enclosed with this letter is GBM^c & Associates' bioassessment report that describes its findings. The report is labeled Attachment 3.

The September 2010 macroinvertebrate survey showed a dramatic improvement in the community between 2000 and 2010. Habitat assessment was completed to evaluate the potential effect of habitat on the macroinvertebrate community, and to be used as a comparison with the habitat assessment conducted in 2000 that found habitat conditions degraded by heavy cattle use at the site (GBM^c & Associates, 2000). The community collected in 2010 shows vast improvement over that collected in 2000. Each community characteristic assessed in 2010 scored better, indicating improvement compared to the 2000 study. Most noteworthy is the shift from a community dominated by flatworms and dipterans in 2000 to one dominated by Ephemeroptera and Trichoptera in 2010. Overall, the community depicted by the 2010 CSB

collection appears typical for small Ozark Highland streams in the late summer/early fall seasonal period.

The Study indicated that the stream is dominated by Ephemeropterans and Trichoptera, a positive change from the 2000 Study which was dominated by Dipterans and Tubellarians. Additionally, the Study indicated that the representation of the more sensitive EPT Taxa increased from 0 to more than 60 percent of the collection. EPT richness improved exponentially, from 0 to 5. Overall, the Study also disclosed more species' diversity in the 2010 collection (2.33) than in the 2000 Study (1.85).

A Biotic Index, which is a measure of community tolerance to water quality and habitat degradation, was also calculated for collections from Cave Springs Branch. The Biotic Index calculated for the 2000 collection was 7.2/10.0 (with 0.0 being the least impacted). In 2010, however, the Biotic Index score had gone down (lower scores indicate higher quality water and habitat conditions) to 5.8. Based on a direct comparison from the 2000 Index score, this is a remarkable improvement. However, even objectively, scores below 6.0 are common in healthy Ozark highland streams. This indicates that the macroinvertebrate community has become composed of more intolerant (sensitive) species in the last 10 years, which is indicative of the steps Simmons has taken to improve its discharge and instream habitat through implementation of watershed management practices.

Dramatic Reduction in Filamentous Algae

The 1998 decision to list Cave Springs Branch may have relied in part on the results of a 1992 stream survey that noted heavy filamentous algae growth on rocks and substrate on the bottom of the stream. This filamentous algae growth was characterized as "objectionable bottom deposits," in Cave Springs Branch near the Simmons' facility. GBM^c & Associates' 2000 Bioassessment Study also noted heavy coverage of long-stranded filamentous algae. However, since 2000, growths of filamentous algae have all but disappeared.

In GBM^c & Associates' 2010 bioassessment study, almost no filamentous algae was observed. Instead, a small amount of filamentous algae was observed (approximately 5 percent of the channel bottom), and what was observed was short-stranded, not long-stranded, algae. Additionally, no objectionable bottom deposits, surface sheens, or unusual water or sediment odors were observed. Overall, there was a vast improvement in the presence of filamentous algae.[1]

Habitat Improvements

The 2000 Bioassessment Study also disclosed that the riparian area was littered with cow manure, heavily trampled, and unstable. However, these conditions were absent in the 2010 Bioassessment Study. The 2010 Study showed that habitat quality vastly improved, in part because the impacts of heavy cattle use were no longer present. It was observed that no grazing had been done in the immediate vicinity of the stream in several years, and that the banks were approximately 75 percent covered by vegetation. In 2006, between the two bioassessment studies, Simmons purchased the cattle farm adjacent to its facility (from upstream of the facility discharge point to approximately 1,300 feet upstream of the state line). Simmons then removed cattle from the CSB riparian area. The downstream owner also prevented cattle access to the stream in the portion of the stream from approximately 1,300 feet upstream of the state line to the state line. Additionally, Simmons planted approximately 3,500 trees in the riparian zone of Cave Springs Branch. Although not matured, the tree plantings will improve stream shading and lead to improved watershed conditions for years to come. Simmons believes the resulting improvement in habitat quality has significantly contributed to the improvements in the macroinvertebrate community in Cave Springs Branch. The cattle removal also resulted in significant reduction in the fecal coliform in Cave Springs Branch, shown in Figure 2, below, which is based on NPDES monitoring of Cave Springs Branch at the state line between 2001 and 2010.

[1] This is also consistent with a 2004 MDNR visual and benthic survey of Cave Springs Branch, which found "the aquatic invertebrate community and levels of algae in the stream appeared to be similar to other streams viewed in this area on the same date," and MDNR's response to Simmons' comments on the Cave Springs Branch TMDL, which stated, "Water quality has improved such that algae production in the stream has been reduced and objectionable bottom deposits have also been reduced or eliminated."

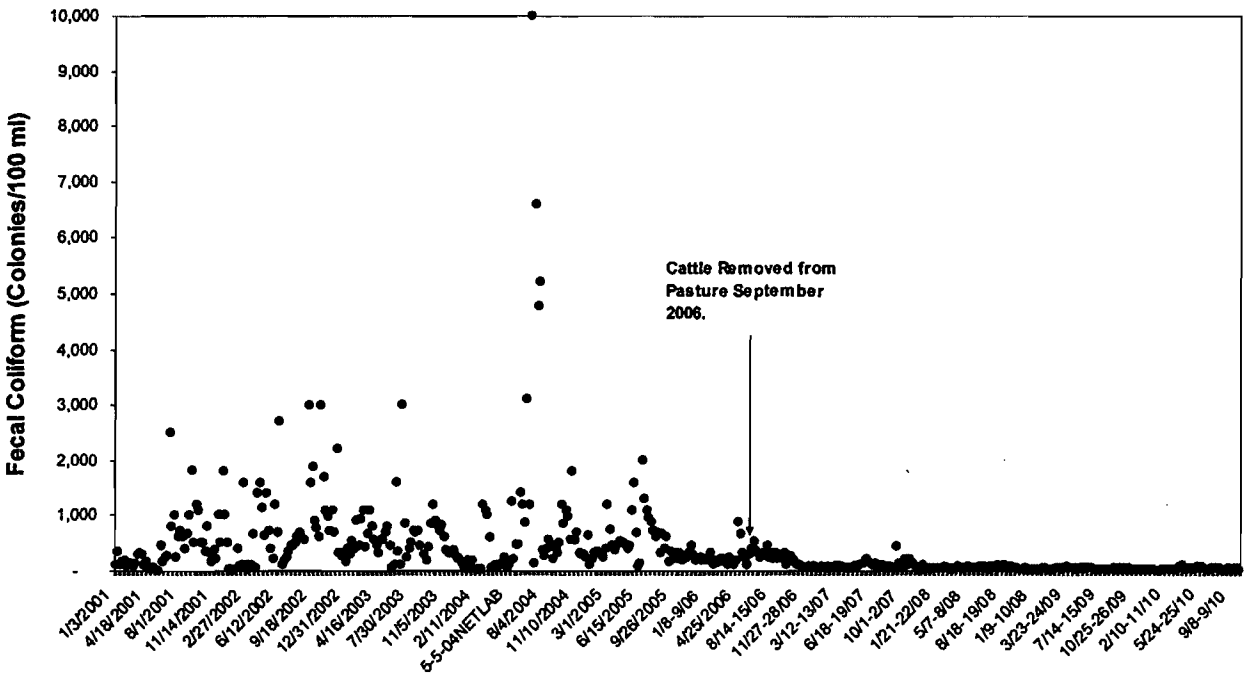


Figure2: Fecal coliform data from Outfall 006 (Missouri/Oklahoma state line)

Monitoring Data

Simmons Foods collects data from Cave Springs Branch at the state line (Outfall 006) as a condition of its MSOP. Review of that data (e.g. CBOD, TSS, ammonia, nitrate, total phosphorus) for the past 10 years indicates that little change in water quality, other than a decrease in fecal coliform since 2006, has occurred during the period from 2000-2010. The decrease in fecal coliform is demonstrated by Figure 2, above. Simmons' data is corroborated by MDNR data presented on the MDNR Web site. Figures 3-5, below, are based on MDNR's ammonia, nitrate/nitrite, and phosphorous data. These data show the dramatic reductions that occurred in the late 1990s, as well as the consistency of water quality for the part decade for the permit parameters depicted.

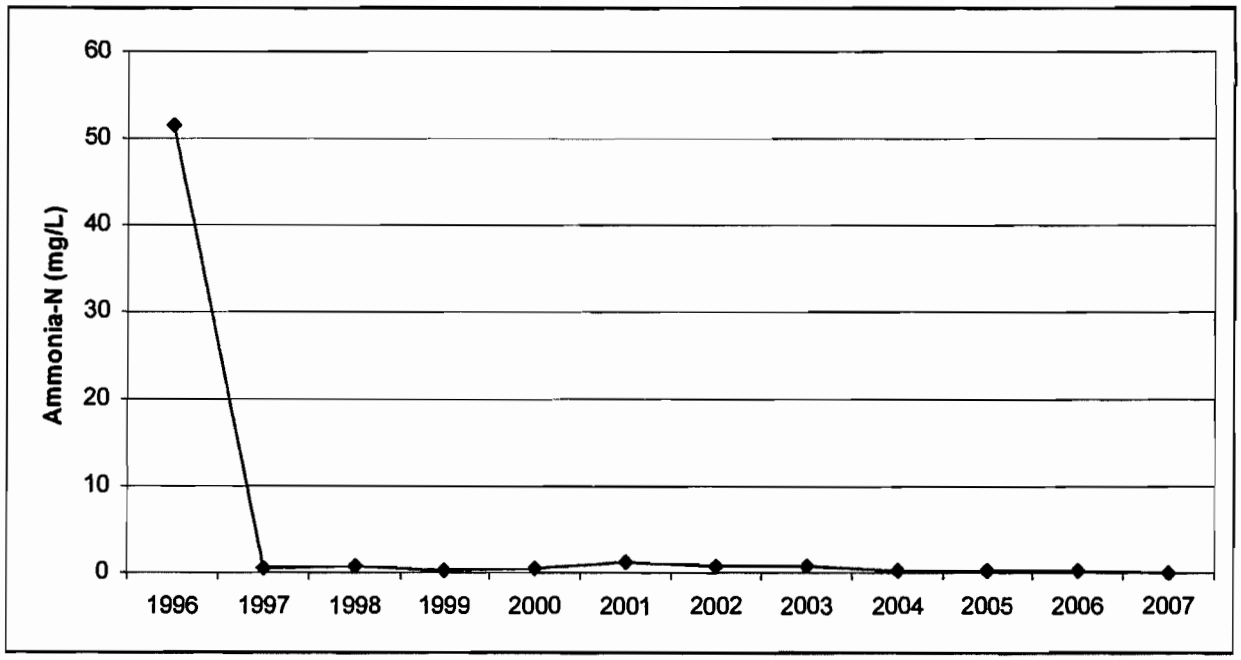


Figure 3: Ammonia data from 1996-2007

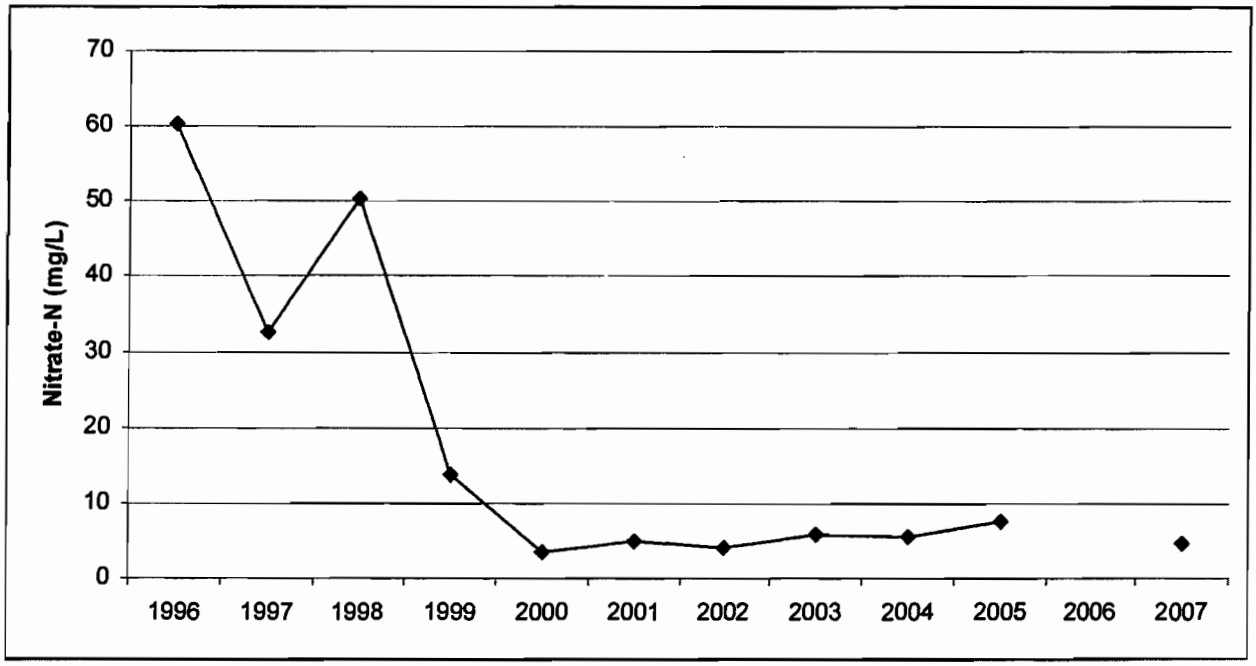


Figure 4: Nitrate/Nitrite data from 1998-2007

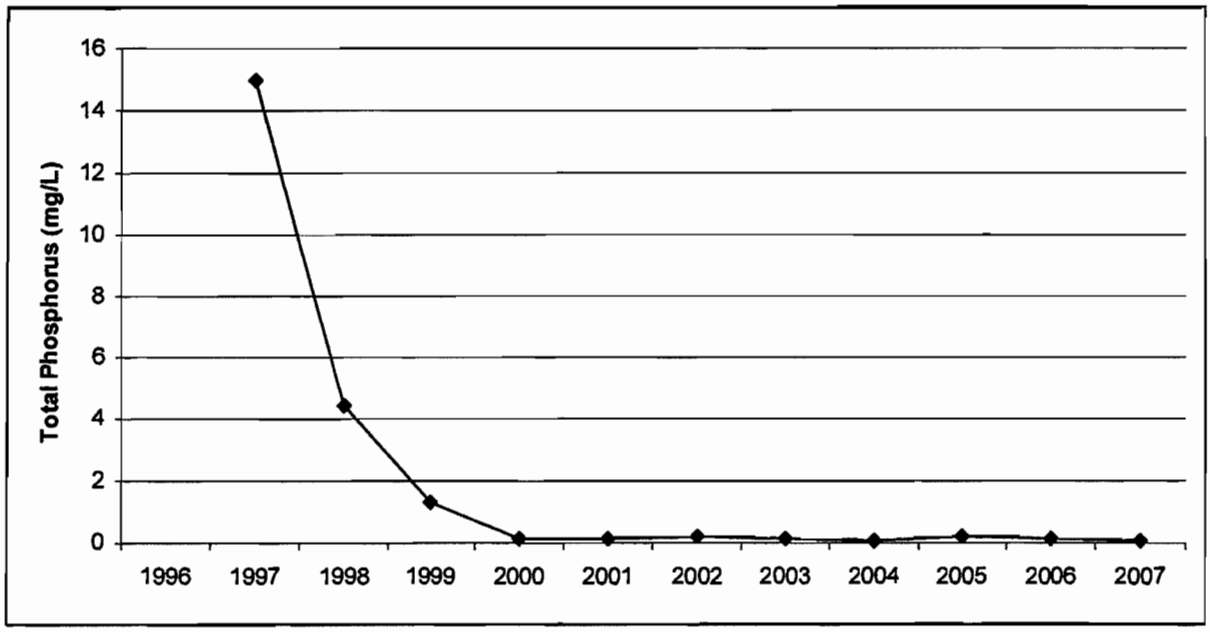


Figure 5: Total Phosphorous data from 1998-2007

Figures 3-5 reproduced from MDNR Web site at,
http://www.dnr.mo.gov/env/wpp/waterquality/303d

Conclusions – Cave Springs Brach is No Longer Impaired

In 1999, Simmons Foods began making vast improvements in its wastewater treatment capabilities. These improvements have lead to extremely low levels of nutrients in CSB. In addition, Simmons documented improvements in the riparian habitat along CSB. These improvements have manifested themselves in a healthy aquatic ecosystem. The macroinvertebrate community in CSB has not only recovered but flourished to the extent that macroinvertebrates in CSB are now comparable to other non-impaired Ozark streams. This conclusion is corroborated by the MDNR, which, twice in the last several years, has noted that CSB is no longer impaired. Based on the foregoing data, observations and MDNR recommendations Simmons Foods requests the CWC vote to remove CSB from the 2010 303d list of impaired waterbodies.

I always appreciate the opportunity to work with the Department, and particularly the opportunity to provide comments on this most important decision. Thank you for your time and consideration.

Sincerely,

NEWMAN, COMLEY & RUTH, P.C.

By: Brittany Barrientos for

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Enclosures
c: John Madras (w/encls.)
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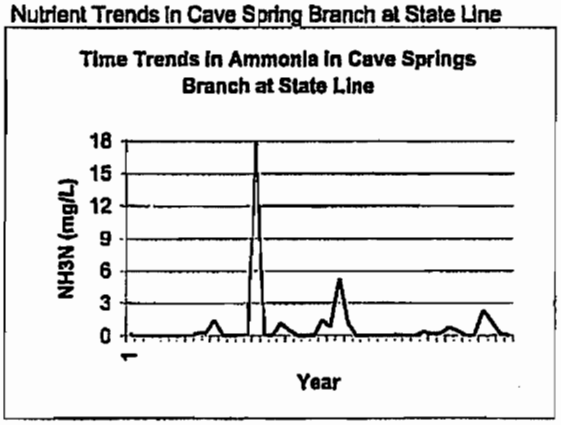
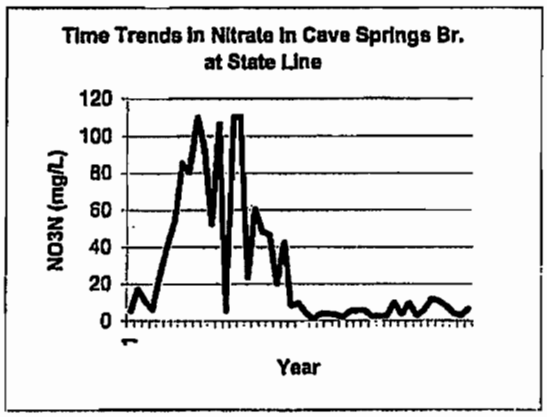
Simmons Foods, Inc. (w/encls.)

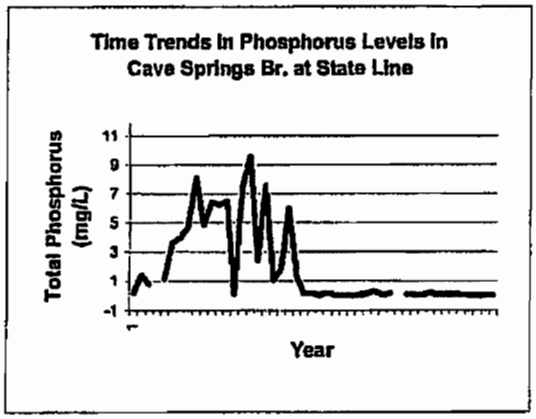
Missouri Department of Natural Resources
Water Protection Program
5737751-1300

Cave Spring Branch - WBID9002 (unclassified)

Nutrient Trends in Cave Spring Branch at State Line







There have been large reductions in the amount of nutrients discharged to Cave Spring Branch beginning in 1999. These reductions are due primarily to improvements in wastewater treatment at the Simmons poultry processing plant. Monitoring of fishes was done by Oklahoma DEQ in October, 1998. This study found a good diversity of fish species in the creek and concluded the stream had recovered from the acute pollution events that occurred in July 1997.

In August 2004, the Missouri DNR conducted a visual and benthic survey of Cave Spring Branch for the first four miles below the Simmons facility. The aquatic invertebrate community and levels of algae in the stream appeared to be similar to other streams viewed in this area on the same date.

There is currently no evidence of exceedence of narrative water quality standards. In addition, the Listing Methodology document does not include criteria for listing waters for protection of aquatic life.

Recommendation: delete this stream from the 2004 303(d) list.

Attachment 1

Missouri Department of Natural Resources
Water Protection Program
573/751-1300

Cave Springs Branch at State Line -WBID 9002 unclassified

Water Chemistry Data by Mo. DNR and Oklahoma DEQ

Org	Yr	Mo	Dy	NH3N	NO3N	TP	Org	Yr	Mo	Dy	NH3N	NO3N	TP
MDNR	1998	3	5		5.17	0.16	OKDEQ	1997	1		0.7	26.4	14.4
MDNR	1998	3	15	0.13	17.4	1.42	OKDEQ	1997	2		0.3	38.7	15.6
MDNR	1998	3	18	0.02499	10.8	0.82	OKDEQ	1998	1	28	0.93	30.39	2.71
MDNR	1998	3	26	0	5.87		OKDEQ	1998	2	4	0.4	7.36	0.13
MDNR	1998	4	6	0	25.1	1.16	OKDEQ	1998	2	11	0.86	29.49	2.88
MDNR	1998	4	14	0	40.3	3.63	OKDEQ	1998	2	18	1.11	39.38	4.69
MDNR	1998	4	30	0.04	53.8	3.96	OKDEQ	1998	2	22	2.15	44.32	6.12
MDNR	1998	5	19	0.02499	85.4	4.63	OKDEQ	1998	2	25	0.05	5.1	0.201
MDNR	1998	5	29	0.05	80.4	8.1	OKDEQ	1998	3	1	0.05	5.02	0.228
MDNR	1998	6	3	0.21	109.88	4.83	OKDEQ	1998	3	4	0.05	4.938	0.738
MDNR	1998	6	8	0.26	93.61	6.44	OKDEQ	1998	3	11	0.05	6.55	0.051
MDNR	1998	6	30	1.45	52.33	6.23	OKDEQ	1998	3	18	0.05	11.42	0.888
MDNR	1998	7	18	0.03	106.39	6.5	OKDEQ	1998	3	26	0.05	15.05	0.025
MDNR	1998	7	28	0.02499	5.35	0.09	OKDEQ	1998	4	1	0.07	17.5	1.51
MDNR	1998	8	27	0.11	110	7.56	OKDEQ	1998	4	7	0.12	22.06	1.156
MDNR	1998	9	10	0.13	110.43	9.61	OKDEQ	1998	4	15	0.05	45.56	4.223
MDNR	1998	10	8	18.2	23.43	2.37	OKDEQ	1998	4	22	0.05	61.57	6.178
MDNR	1998	10	20	0.12	60.7	7.62	OKDEQ	1998	4	29	0.18	52.5	4.986
MDNR	1998	12	9	0.02499	48.5	1.02	OKDEQ	1998	5	6	0.2	67.27	6.75
MDNR	1998	12	29	1.16	46.5	1.89	OKDEQ	1998	5	11	0.13	70.31	7.16
MDNR	1999	1	19	0.499	20	6	OKDEQ	1998	6	10	0.12	97.72	7.44
MDNR	1999	2	2	0.02499	42.6	1.38	OKDEQ	1998	7	15	0.28	93.41	10.66
MDNR	1999	6	3	0.0499	8.33	0.19	OKDEQ	1998	7	29	0.09	116	8.61
MDNR	1999	9	25	0.02499	9.66	0.2	OKDEQ	1998	8	6	0.16	65.48	4.72
MDNR	1999	12	29	1.44	4.56	0.06	OKDEQ	1998	8	19	0.1	92.99	9.424
MDNR	2000	2		0.83	1.14	0.21	OKDEQ	1998	9	16	0.16	59.33	6.271
MDNR	2000	2		5.26	3.8	0.06	OKDEQ	1998	9	30	0.24	92.98	19.61
MDNR	2000	3		1.15	3.96	0.05	OKDEQ	1998	10	14	0.33	37.08	3.303
MDNR	2000	3		0.0499	3.29	0.03	OKDEQ	1998	11	18	0.39	64.94	5.954
MDNR	2000	4	19	0.02499	2.05	0.06	OKDEQ	1998	12	9	0.12	55.94	1.507
MDNR	2000	6	29	0.05	5.29	0.15	OKDEQ	1998	12	16	0.45	68.79	5.621
MDNR	2000	7	13	0.02499	5.85	0.3	OKDEQ	1999	1	6	0.4	34.22	1.919
MDNR	2000	8	3	0.02499	5.77	0.06	OKDEQ	1999	1	20	0.65	49.02	4.469
MDNR	2000	8	14	0.06	2.4	0.18	OKDEQ	1999	2	3	0.05	47.67	2.817
MDNR	2000	8	31	0.02499	2.5		OKDEQ	1999	2	17	0.05	45.66	5.816
MDNR	2000	9	7	0.02499	2.97	0.1	OKDEQ	1999	3	10	0.1	13.54	1.106
MDNR	2000	9	19	0.4	9.93	0.12	OKDEQ	1999	3	24	0.16	5.74	1.194
MDNR	2001	6	14	0.13	3.89	0.05	OKDEQ	1999	4	4	0.05	9.47	0.253
MDNR	2002	8	4	0.23	9.57	0.22	OKDEQ	1999	4	5	0.07	7.65	2.157
MDNR	2003	1	6	0.76	2.82	0.11	OKDEQ	1999	4	21	0.05	9.47	0.25
MDNR	2003	6	17	0.44	5.97	0.12	OKDEQ	1999	5	5	0.05	3.69	0.46
MDNR	2003	7	31	0.01499	11.6	0.11	OKDEQ	1999	5	19	0.45	3.92	0.392
MDNR	2003	9	23	0.04	10.9	0.11	OKDEQ	1999	5	21	0.05	3.69	0.46
MDNR	2003	10	14	2.32	8.04	0.09	OKDEQ	1999	6	7	0.05	5.93	0.146
MDNR	2003	12	17	1.3	4.2	0.05	OKDEQ	1999	6	23	0.32	0.52	5.53
MDNR	2004	1	14	0.16	2.92	0.02	OKDEQ	1999	7	7	0.16	3.47	0.205
MDNR	2004	3	23	0.01499	6.61	0.02	OKDEQ	1999	8	4	0.14	2.62	0.162

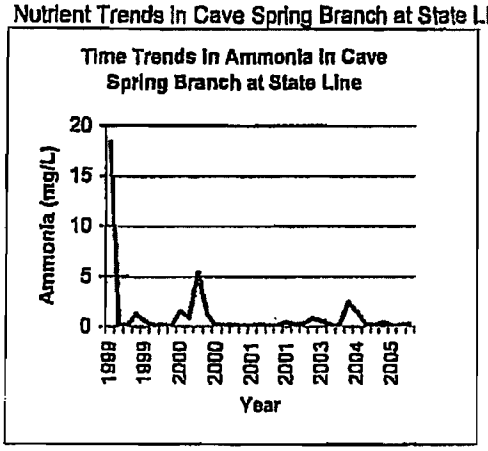
Missouri Department of Natural Resources
Water Protection Program
573/751-1300

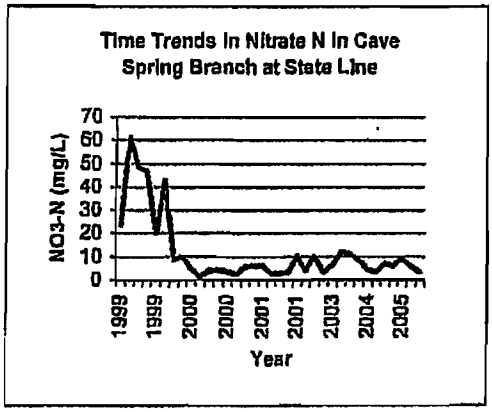
Org	Yr	Mo	Dy	NH3N	NO3N	TP
OKDEQ	1999	8	25	0.06	16.33	0.115
OKDEQ	1999	9	15	0.05	13.99	0.124
OKDEQ	1999	10	6	0.32	14.56	
OKDEQ	1999	10	20	0.16	12.38	0.17
OKDEQ	1999	11	3	0.45	0.82	0.041
OKDEQ	1999	11	17	0.1	1.03	0.202
OKDEQ	1999	12	1	0.36	6.27	0.134
OKDEQ	1999	12	15	0.35	3.97	0.13
OKDEQ	2000	1	12	0.05	3.36	0.196
OKDEQ	2000	2	9	1.22	1.69	0.171
OKDEQ	2000	3	22	0.19	4.72	0.064
OKDEQ	2000	5	3	0.16	3.77	0.148
OKDEQ	2000	5	31	0.05	1.38	0.131
OKDEQ	2000	6	28	0.13	3.77	0.242
OKDEQ	2000	7	26	0.07	2.89	0.104
OKDEQ	2000	8	23	0.14	4.05	0.167
OKDEQ	2000	9	20	1.24	2.23	0.192
OKDEQ	2000	10	18	0.23	1.01	0.118
OKDEQ	2000	11	15	0.28	3.45	0.068
OKDEQ	2001	1	3	4.9	2.99	0.15
OKDEQ	2001	1	24	3.8	11.54	0.046
OKDEQ	2001	2	7	3.64	9.87	0.084
OKDEQ	2001	3	21	2.74	7.89	0.049
OKDEQ	2001	4	18	0.25	2.47	0.057
OKDEQ	2001	5	23	0.15	6.1	0.05
OKDEQ	2001	6	13	0.15	1.96	0.056
OKDEQ	2001	7	18	0.51	2.28	0.094
OKDEQ	2001	8	22	0.13	8.17	0.105
OKDEQ	2001	9	19	0.15	3.86	0.123
OKDEQ	2001	10	13	0.25	2.36	0.079
OKDEQ	2001	12	5	0.33	1.44	0.301
OKDEQ	2001	12	19	0.1	4.41	0.409

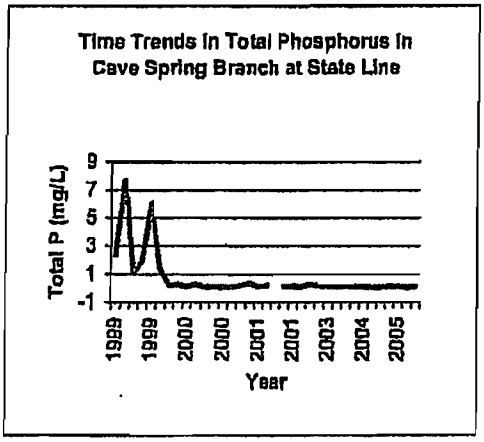
Note: The quality assurance program of Oklahoma DEQ has not yet been reviewed by Mo. DNR.

Missouri Department of Natural Resources
Cave Spring Branch - WBID 3245U001 (unclassified)
Water Chemistry Data by MoDNR and Oklahoma DEQ

Nutrient Trends in Cave Spring Branch at State Line. Assessment date July 25, 2006







There have been large reductions in the amount of nutrients discharged to Cave Spring Branch beginning in 1999. These reductions are due primarily to improvements in wastewater treatment at the Simmons poultry processing plant. Monitoring of fishes was done by Oklahoma DEQ in October, 1998. This study found a good diversity of fish species in the creek and concluded the stream had recovered from the acute pollution events that occurred in July 1997.

In August 2004, the Missouri Department of Natural Resources conducted a visual and benthic survey of Cave Spring Branch for the first four miles below the Simmons facility. The aquatic invertebrate community and levels of algae in the stream appeared to be similar to other streams viewed in this area on the same date.

There is currently no evidence of exceedence of narrative water quality standards.

GBMc

Simmons Foods, Inc.
Bioassessment of Reach CSB-1 on Cave Springs Branch

October 28, 2010

GBMc & Associates

Bioassessment of Reach CSB-1 on Cave Springs Branch

Prepared for:

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Prepared by:

GBM^c & Associates
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Bryant, AR 72022

October 28, 2008

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FIGURES

TABLE

ATTACHMENT

Bioassessment of Reach CSB-1 on Cave Springs Branch

Summary of Findings

Benthic macroinvertebrate sampling and habitat assessment were completed in Cave Springs Branch at CSB-1, upstream of the Missouri/Oklahoma state line on September 29, 2010. Collection and processing of macroinvertebrates were completed in a manner to replicate a previous assessment of the creek. Habitat assessment was completed to evaluate the potential effect of habitat on the macroinvertebrate community and as a comparison with the habitat assessment conducted in 2000 that found habitat conditions degraded by heavy cattle use at the site. The community collected in 2010 shows vast improvement over that collected in 2000. Each community characteristic assessed in 2010 scored better, indicating improvement, compared to that of 2000. Most noteworthy is the shift from a community dominated by flatworms and dipterans in 2000 to one dominated by Ephemeroptera and Trichoptera in 2010. Overall, the community depicted by the CSB-1 collection in 2010 appears typical for small Ozark Highland streams in the late summer/early fall seasonal period. The habitat was also found to have improved over time and no active use of stream or riparian zone by cattle was noted. Periphyton coverage was greatly reduced compared to 2000 (and almost no filamentous algae was observed), stream banks were better protected by vegetation, and the riparian areas showed no evidence of cattle impacts.

Macroinvertebrate Sampling and Analysis

Benthic macroinvertebrates inhabit the sediment or live on the bottom substrates of streams, rivers and lakes. The presence of these organisms and their diversity and tolerance to environmental perturbation at an expected level reflects the maintenance of a systems biological integrity. Monitoring these assemblages is useful in assessing the aquatic life status of the water body and detecting trends in ecological condition.

Benthic macroinvertebrate sampling was completed in Cave Springs Branch at CSB-1, upstream of the Missouri/Oklahoma state line on September 29, 2010. Cave Springs Branch was sampled as a riffle/pool predominant stream; and the samples were

collected in gravel and cobble riffles only. Collection and processing of macroinvertebrates were completed in a manner to replicate the work presented in the September 8, 2000 *Stream Assessment Report on Cave Springs Branch and Honey Creek* (GBM^c & Associates, 2000). Collection and sample processing was completed according to GBM^c SOP's and EPA protocols (Barbour, 1999) and are generally considered semi-quantitative.

Samples were condensed and processed in the field. Macroinvertebrate samples were processed according to GBM^c QAP protocol (GBM^c & Associates, 2008). The condensed sample was rinsed and a portion of it placed in a sorting tray. Organisms were picked randomly from the sample and preserved in 70% ethanol in small jars. One hundred organisms (+/- 10%) were picked from the sample in an effort to mimic observed abundance while still locating and removing a representative number of large or rare specimens. All organisms from the sample were identified to appropriate taxonomic levels (generally to genus). Identifications were completed using widely accepted taxonomic references including *An Introduction to the Aquatic Insects of North America* (Merritt and Cummins, 1996) and *Fresh Water Invertebrates of the United States* (Pennak, 1989). A series of biometrics were analyzed for each collection. The primary biometrics assessed were taxa richness (number of different taxa), EPT (Ephemeroptera, Plecoptera, and Trichoptera) richness, biotic index, Shannon-Weiner Diversity Index (base-e), percent EPT, and community ordinal and trophic composition structure. The biotic index was calculated following the formula developed by Hilsenhoff (EPA, 1989). Tolerance values used in the calculations were from a Missouri Department Natural Resources database (Sarver, 2001) which is based on tolerance values developed by Lenat, Hilsenhoff, Bode, and others, or from those provided in *Rapid Bioassessment Protocols for Use in Wadeable Streams and Rivers*, (EPA, 1999). A comprehensive listing of the macroinvertebrate taxa identified from the 2000 and 2010 samples are presented as an attachment to this letter. A summary of the biometric scores are presented in Table 1.

Table 1. Summary of macroinvertebrates metrics from collections at CSB-1.

Parameter	CSB-1 (2010)	CSB-1 (2000)
COMMUNITY MEASURES		
Total number of Taxa (Richness)	19	11
EPT Richness	5	0
EPT % Abundance	61.9	0.0
Diversity Indices (Shannon-Wiener)	2.33	1.85
Total % of 5 Dominant Taxa	83	87
PERCENTAGE OF THE 4 DOMINANT ORDINAL GROUPS		
Ephemeroptera	37	—
Trichoptera	25	—
Diptera	9	35
Crustacea	9	—
Turbellaria	—	34
Annelida	—	16
Megaloptera	—	10
FUNCTIONAL FEEDING ASSEMBLAGES %		
Shredders	0	0
Scrapers	4	2
Filterers	25	7
Collectors	59	55
Predators	13	36
Biometric Score*:	5.8	7.2

CSB-1 2010 Collection

The sample from Station CSB-1 collected in 2010 was dominated by Ephemeropterans (37%) and Trichopterans (25%). Taxa richness (total number of different taxa identified) and EPT richness (number of taxa representatives from the orders Ephemeroptera, Plecoptera and Trichoptera, which are generally considered to be more sensitive to water quality and habitat perturbation) were 19 and 5, respectively. The Biotic Index (a measure of macroinvertebrate tolerance to environmental perturbation) resulted in a value of 5.8 which portrays a somewhat intolerant community to water quality and habitat perturbation (value scored from 0-10, with 0 being the most intolerant). The lower the biotic index score the more indication that a community is healthy and experiencing no adverse impacts from water quality or habitat perturbation. Scores below 6 are common in healthy highland streams. A Shannon-Weiner Diversity Index (base-e) was calculated and resulted in a value of 2.33. The trophic structure of the community was dominated by collectors (55%) and filterers (25%) with

representatives present from each functional feeding group with the exception of shredders, which were absent.

CSB-1 2000 Collection

The CSB-1 sample collected in 2000 was dominated by Dipterans (35%) and Turbellarians (34%). Taxa richness and EPT richness were 11 and 0, respectively. The Biotic Index resulted in a value of 7.2 which portrays a community somewhat tolerant to water quality and habitat perturbation. A Shannon-Weiner Diversity Index (base-e) was calculated and resulted in a value of 1.85. The trophic structure of the community was dominated by collectors (55%) and predators (36%) with representatives present from each functional feeding group, including shredders which had 1% of the collection.

Comparison of 2010 and 2000 Collections

The community collected in 2010 shows vast improvement over that collected in 2000. Most noteworthy is the shift from a community dominated by the facultative flatworms and dipterans in 2000 to one dominated by the more desirable orders Ephemeroptera and Trichoptera in 2010 (Figure 1). The recent collection included 5 taxa representatives from the EPT that comprised 62% of the community while the 2000 collection had none (0) of these representatives. The biotic index decreased from 7.2 to 5.8 indicating an improved community that has become composed of more of intolerant (sensitive) taxa over the past 10 years. Additionally, taxa richness increased from 11 to 19, a positive increase of nearly 75% (Figure 2). A large increase in species diversity was observed in the 2010 collection as species diversity increased from 1.85 in 2000 to 2.33 in 2010. Overall the improved community depicted by the CSB-1 collection in 2010 appears typical for small Ozark Highland streams in the late summer/early fall seasonal period.

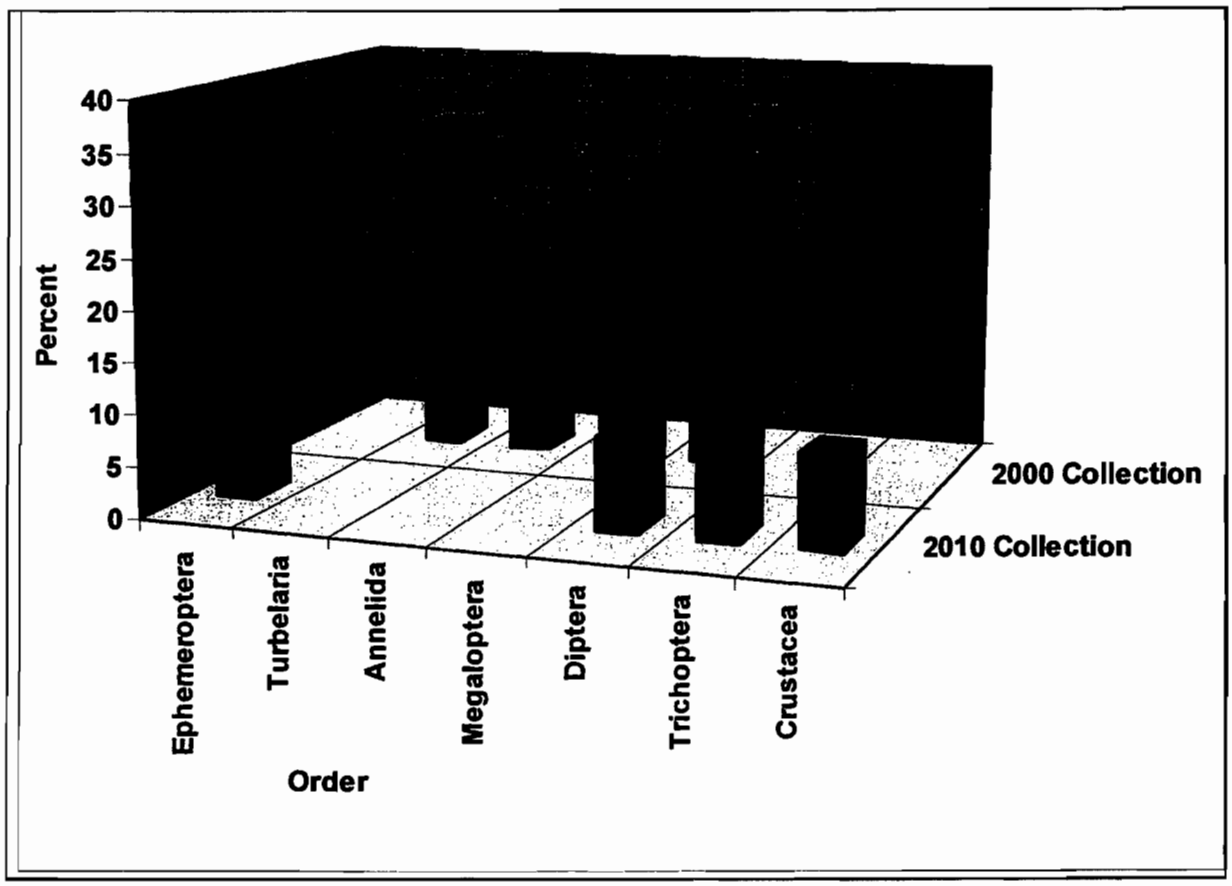

Figure 1. Comparison of dominant ordinal groups between collections.

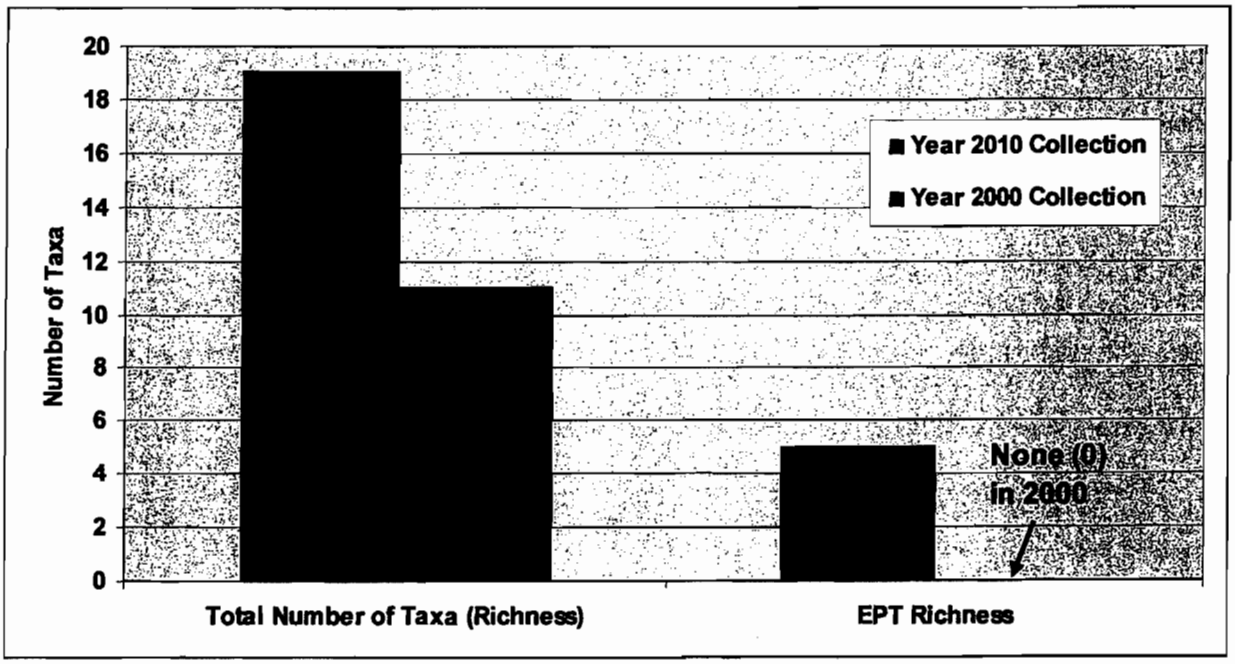

Figure 2. Depiction of richness data.

Stream Habitat Assessment

A semi-quantitative habitat assessment was completed on Cave Springs Branch in the CSB-1 reach. The assessment included visual and measured features of the stream reach as listed below.

1) Channel Morphology
   a) Reach Length Determination
   b) Riffle-Pool Sequence
   c) Depth and Width Regime

2) In-Stream Structure
   a) Epifaunal substrate
   b) Instream Habitat
   c) Substrate Characterization
   d) Embeddedness
   e) Sediment Deposition
   f) Aquatic Macrophytes and Periphyton coverage

3) Riparian Characteristics
   a) Canopy Cover
   b) Bank Stability and slope
   c) Vegetative Protection
   d) Riparian Vegetative Zone Width
   e) Land-use Stream Impacts

The stream can be described as a second order riffle-pool complex that is intermittent (bordering on ephemeral) in nature. The reach assessed contains water perennially due only to the presence of the Simmons Foods effluent discharge. The reach assessed is 38% riffle, 39% run and 23% shallow pool with a channel substrate of primarily cobble.

No objectionable bottom deposits (sludge, oils, foam, etc.), surface sheens or unusual water or sediment odors were noted. The heavy coverage of long strands of filamentous algae observed in 2000 was absent in 2010.

Emergent aquatic macrophytes were observed in the channel but coverage was minimal at only about 5% of the channel bottom. A submerged aquatic macrophyte believed to be a water moss (Fontinalis sp.) was fairly prominent on cobbles in the riffles and shallow runs but was often hard to distinguish from periphyton until observed from directly above. Its overall coverage is generally included in the periphyton estimates as it grows on the same rocky substrates along with the periphyton. Overall periphyton coverage on the channel bottom was about 68%. The majority of the periphyton was green algae and diatoms, with very little (less than 5%) filamentous algae observed. What filamentous algae were noted was short stranded (less than 2 inches in length).

The riparian area was dominated by immature forest on the right bank and grasses and wildflowers on the left bank. Riparian forest canopy shaded only 30% of the stream channel in the reach assessed, primarily due to the lack of mature trees on the left bank. Banks were about 75% covered by vegetation and no recent evidence was observed of cattle access to the stream or of grazing in the adjacent field. It appeared that there had been no grazing in the immediate vicinity of the stream in the past few years.

Habitat quality appears to have improved considerably since 2000. In the *Stream Assessment report on Cave Springs Branch and Honey Creek* (GBM^{c} & Associates, 2000) it was reported that "Cattle trails leading from the adjacent riparian zone directly to the stream caused the unstable and eroded areas of steam bank. Riparian cover was primarily grasses and the surrounding land use was pasture. Much of the riparian area close to the stream banks was littered with cow manure and was heavily trampled, suggesting high use of the area by cattle." The adverse impacts of heavy cattle use on habitat at CSB-1 upstream of the state line were not found in the 2010 assessment and the resulting habitat improvements undoubtedly contributed to improvements in the macroinvertebrate community.

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Attachment A

Macroinvertebrates collected in 2000 and 2010 from Cave Springs Branch

Taxa/Station I.D.	Biotic Index	Trophic Group	Cave Springs Branch CSB_1 (2000)	CSB_1 (2010)	
TURBELLARIA					
Planariidae	8	GC	34		
ANNELIDA					
Hirudinea	7.8	PR	16	3	
Oligochaeta	9.2	GC			
GASTROPODA					
Elimia	2.5	SC			
Glossosoma	---	SC			
Gyraulus	8	SC	2		
Hydrobidae	8	SC			
Lymnaeidae	---	SC			
Physella	9.1	SC		1	
Planorbidae	---	SC			
PELECYPODA					
Corbicula	6.3	FC			
Pelecypoda Sp1	---	FC			
Sphaeridae	7.7	FC			
CRUSTACEA					
Amphipoda	---	GC		9	
Cambaridae	---	GC	1	2	
Isopoda	7.7	GC			
Palaeomonetes	---	GC			
ARACHNOIDEA					
Acarina	---	PR			
EPHEMEROPTERA					
Baetis	6	GC		32	
Caenis	7.6	GC		11	
Callibaetis	9.3	GC			
Centroptilum	6.3	GC			
Choroterpes	2	GC			
Fallceon	6	GC			
Heptagenia	2.8	SC			
Isonychia	3.8	FC			
Paraleptophlebia	1.2	GC			
Ephemera	2.2	GC			
Ephemerella	1.7	GC			
Ephemeroptera Species1	---	GC			
Eurylophella	3	GC			
Stenacron	7.1	GC			
Stenonema	3.4	SC		1	
Tricorythodes	5.4	GC			
ODONATA					
Aechnidae	8	PR			
Aeshna	6.4	PR			
Argia	8.7	PR		3	
Arigomphus	6.4	PR			
Boyeria	6.3	PR			
Calopteryx	8.3	PR		3	
Celithemis	3.7	PR			
Cordulia	5	PR			
Corduligaster	6.1	PR			
Dromogomphus	6.3	PR			
Dythemis	3.7	PR			
Enallagma	9	PR			
Epithica (Epicordulia)	5.6	PR			
Erpetogomphus	5.5	PR			
Erythemis	7.7	PR			
Gomphus	6.2	PR		1	
Hagenius	4	PR	1		
Hesperagrion	---	PR			
Hetaerina	6.2	PR			
Ischnura	9.4	PR			
Ladona	---	PR			

Macroinvertebrates collected in 2000 and 2010 from Cave Springs Branch

Taxa/Station ID	Biotic Index	Trophic Group	Cave Springs Branch CSB-1 (2000)	CSB-1 (2010)	
Libellula	9.8	PR			
Macromia	6.7	PR			
Miathyria	—	PR			
Nasiaeschna (Aeschnidae)	8	PR			
Neurocordulia	4	PR			
Pachydiplax	9.6	PR			
Perithemis	10	PR			
Progomphus	8.7	PR			
Somatochlora	8.9	PR			
Stylogomphus	4.8	PR			
Stylurus	4	PR			
Sympetrum	7.3	PR			
Tramea	---	PR			
PLECOPTERA					
Acroneuria	1.4	PR			
Alocapnia	2.8	SH			
Attaneuria	2.75	PR			
Haploperla	1.3	PR			
Isoperla	2	PR			
Neoperla	1.6	PR			
Perlesta	0	PR			
Phasgonophora (Agnetina)	2	PR			
Zealeuctra	0	SH			
HEMIPTERA					
Belostoma	9.8	PR			
Corixidae	6	PR			
Halobates	—	PR			
Hydrometra	7.3	PR			
Mesovelia	6.4	PR			
Metrobates	6.4	PR			
Microvelia	6.4	PR	1		
Neoplea	5.5	PR			
Notonecta	5.5	PR			
Notonectidae	5.5	PR			
Ranatra	7.5	PR			
Rhagovelia	7.3	PR		1	
Rheumatobates	6.4	PR			
Steinovelia	—				
Trepobates	6.4	PR			
Trichochorixa	5.5	PR			
MEGALOPTERA					
Chauloides	4	PR			
Corydalus	5.6	PR	10	3	
Sialis	7.5	PR		1	
TRICHOPTERA					
Chematopsyche	6.6	FC		22	
Ceraclea	2.3	GC			
Chimarra	2.8	FC		7	
Glyphopsyche	—	SH			
Helicopsyche	0	SC			
Hydropsyche	4	FC			
Hydroptila	6.2	SC			
Mystacides	3.5	SH			
Nectopsyche	4.1	SH			
Oecetes	5.1	PR			
Potamyia	5	FC			
Polycentropus	3.5	PR			
Pycnopsyche	2.3	SH			
Trianodes	3.7	SH			
LEPIDOPTERA					
Petrophila	1.8	SC			
COLEOPTERA					
Agabus	5	PR			

Macroinvertebrates collected in 2000 and 2010 from Cave Springs Branch

Taxa/Station ID	Biotic Index	Trophic Group	Cave Springs Branch CSB-1 (2000)	CSB-1 (2010)	
Ancyronyx	6.9	GC			
Berosus	8.6	PR			
Coptotomus	9	PR			
Dineutus	5.5	PR			
Dryopidae	5.5	SC			
Dubiraphia	6.4	GC		1	
Dytiscidae	—	PR			
Enochrus	8.5	PR			
Graphoderus	3.7	PR			
Gyrinus	6.3	PR			
Haliplus	5	SH			
Helichus	5.4	SC			
Helophorus	7.9	SH			
Hydaticus	—	PR			
Hydrochus	4.6	SH			
Hydroporous	8.9	PR			
Hydrovatus	3.7	PR			
Laccobius	10	PR			
Oreodytes	4.6	PR			
Peltodytes	8.5	SH			
Psephenus	2.5	SC		1	
Scirtidae	—	SH			
Stenelmis larvae	5.4	SC		2	
Stenelmis adult	5.4	GC		3	
Thermonectus	3.7	PR			
Tropisternus	9.8	PR			
Uvarus	4.6	PR			
DIPTERA					
Alluaudamyia (Ceratopogonidae)	6	PR			
Athericidae	2.1	PR			
Bezzia	6	GC			
Chironomidae	8	GC	20	11	
Chironominae	8	GC			
Chironomini	8	GC			
Ortholadiinae	8	GC			
Tanypodinae	8	PR			
Tanytarsini	8	FC			
Culex	10	FC			
Culicidae	—	GC			
Dasyhelea	6	GC			
Diptera Sp.1	—	GC			
Hemerodromia	6	PR			
Hexatoma	4.7	PR			
Ormosia (Tipulidae)	4.6	GC			
Probezzia	6	PR	7		
Prosimulium	2.6	FC			
Serromyia	6	PR			
Silvius	—	PR			
Simulidae	6	FC	7		
Simulium	4.4	FC			
Sphaeromias	6	PR			
Tabanidae	—	PR	1		
Tipula	7.7	SH			
Tipulidae	3	SH			
Sum of Per Sample			100	100	
Total Abundance			100	100	
Shannon Richness			4	28	
Shannon-Wiener Diversity Index			1.09	2.76	