EXHIBIT F

SUMMARY RATIONALE, SPIKED TOXICITY TESTS, and BUCHANNAN *et al.* STUDY (2003)

Summary Rationale

- The Red River situation is unique for the following reasons:
  - It is a large river with historically high minerals levels in AR that are caused primarily by naturally occurring sources in upstream states (salt seeps in OK & TX);
  - Much of the segment of primary interest (the upper Red River segment in AR) has two totally different TDS criteria depending on which side of the state line you are on, 1100 mg/L TDS on the Texas side (south) and 850 mg/L on the Arkansas side (north);
  - The current AR criterion in the upper Red River segment in AR is based on a standards change in 1994 that would have selected a higher number if it had used the analysis and assessment methodology in place today;
  - The progression from high upstream criteria in OK and TX to low and lower criteria in AR segments, followed by much higher criteria in LA makes no sense and has no rational connection to the longstanding historical reality in the river;
  - There is no other situation like this in Arkansas.
- Spiked WET testing of the river water shows no acute or chronic toxicity due to dissolved minerals levels.
- Study supporting 1994 change would have resulted in numbers requested for Upper Red River segment in AR if current analysis and 303(d) assessment methodology had been used.
- Study supporting the pending site-specific minerals criteria rulemaking initiated by SWEPCO demonstrated sufficient lines of evidence that the Aquatic Life Designated Use is being attained within the studied reaches of the Little and Red Rivers[1], and that expected mineral concentrations from the SWEPCO outfall will not negatively impact existing uses.
- It is difficult to justify the time and expense of conducting a full biological study from scratch given the unique circumstances involved.
- Adoption of the change will follow all the applicable Arkansas procedural requirements for valid revision of the criteria in question.

[1] Red River from the mouth of the Little River to the Arkansas-Louisiana state line.

Table 1.

Reach	Proposed criteria		90th / 95th percentiles (monitoring station)	
	SO4 (mg/L)	TDS (mg/L)	SO4 (mg/L)	TDS (mg/L)
Red R from OK-AR state line to Domtar	250	940	224 / 243 (RED0025)	891 / 958 (RED0025)
Red R from Domtar to mouth of Little River	250	940	230 / 270 (07337000)	932 / 1044 (07337000)
Red R from mouth of Little River to AR-LA state line[2]	225	860 (see Note "C")	188 / 228 (RED0045)	778 / 860 (RED0045)

Notes:

A. Percentiles calculated using data going back as far as August 1990 (where available) and extending through October 2013.

B. Percentiles were calculated as 100% * (rank – 0.5) / n

C. Note the TDS value of 860 mg/L for the reach of the Red River from the Little River to the Arkansas/Louisiana state line is not proposed by ADEQ but rather by SWEPCO in a rulemaking that is currently underway.

[2] Domtar request assumes that SWEPCO study and 3rd Party Rulemaking will be approved by PC&E Commission and EPA.

ftn Associates Ltd.
water resources / environmental consultants

DOMTAR A.W. LLC
ESTIMATION OF TDS TOXICITY THRESHOLD IN THE RED RIVER

NOVEMBER 19, 2014

DOMTAR A.W. LLC
ESTIMATION OF TDS TOXICITY THRESHOLD IN THE RED RIVER

Prepared for

Domtar A.W. LLC
285 Highway 71 South
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Prepared by

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November 19, 2014

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1.0 INTRODUCTON

The objective of this testing was to estimate the toxic threshold for total dissolved solids (TDS), sulfate (SO_4^{-2}), and chloride (Cl^-) in the Red River. The approach was to evaluate chronic toxicity to *Ceriodaphnia dubia* per US Environmental Protection Agency (EPA) guidance (EPA 2002) in a series of increasing TDS concentrations in the river matrix to identify a threshold for chronic toxicity to *C. dubia.* This threshold sets an upper limit for site-specific mineral criteria because a discharge that is toxic due to mineral concentrations must be avoided.

2.0 METHODS

2.1 Ionic Makeup of the River Sample

The first step in developing this protocol was to identify the major ions contributing to TDS in the river sample. Results of the analysis of selected ions per methods given in Table 1 on a grab sample collected on November 7, 2012, from the Red River downstream of the mouth of the Little River are presented in Table 2. Calculated TDS (The sum of the measured ions with total alkalinity expressed as milligrams per liter of HCO_3^-) was 720 mg/L, which is 101% of the measured TDS. Part of the "excess" of measured ions might be due to analytical error, but is more likely due to the presence of colloidal forms of ions (e.g., Ca and Mg hydroxides, carbonates and sulfates), which are not present in the TDS measurement because the TDS analysis involves sample filtration. Nonetheless, the results show that the selected ions account for the majority of the ions present in the sample. The summary presented in Table 2 indicates that Na^+ and Ca^{+2} are the dominant cations both in terms of ionic strength (as indicated by the percent composition as mEq) and mass. Similarly Cl^- and SO_4^{-2} are the dominant anions.

Table 1. Analytical methods for ion analyses.

Ion	Analytical Method
Na^+	EPA 200.7
Ca^{++}	EPA 200.7
Mg^{++}	EPA 200.7
K^+	EPA 200.7
Cl^-	EPA 300.0
SO_4^{-2}	EPA 300.0
HCO_3^-	SM4500-CO_2D*
Total Alkalinity	SM2320B
TDS	SM2540C

*At pH = 7.7 su.

Table 2. Ionic makeup of sample collected November 7, 2012.

Ion	Concentration (mg/L)	Percent of Total					
		Mass		mMoles		mEq	
		Cations	Anions	Cations	Anions	Cations	Anions
Na^{+}	160	59.3		69.0		53.4	
K^{+}	7.7	2.9		2.0		1.5	
Ca^{2+}	78	28.9		19.3		29.9	
Mg^{2+}	24	8.9		9.8		15.2	
Cl^{-}	160		35.5		54.6%		44.9
SO_4^{-2}	170		37.7		21.4%		35.3
HCO_3^{-}	121		26.8		24.0%		19.8
Total Alkalinity	200						
Hardness	294						
Measured TDS	710						
Calculated TDS*	720						
pH	7.7						
Specific Conductance	1,214						

*Sum of measured ions.

Manipulating the anions using Ca^{+2} salts will, by necessity, concurrently raise hardness concentrations. Hardness is known to ameliorate the toxic effects of both Cl^{-} and SO_4^{-2} (Lasier and Hardin 2010, Soucek 2007, Soucek and Kennedy 2005, Soucek et al. 2011). Since Mg^{+2} accounts for 34% of the hardness, the spiking procedure included Mg as well as Ca salts such that the hardness of the spike mixture was comprised of approximately 66% Ca and 34% Mg. Accordingly, this evaluation focused on estimating the toxic threshold of TDS as Na^{+}, Ca^{+2}, Mg^{+2}, Cl^{-} and SO_4^{-2}.

The approach to conducting the threshold evaluation was to spike river sample approximately 4x (nominal) the existing concentrations of TDS, and then prepare a chronic test exposure series by serially diluting the spiked sample using unspiked river sample as diluent. In this way the Cl^{-}, SO_4^{-2}, Na^{+}, $Mg^{+2}$and Ca^{+2} concentrations were manipulated while keeping other aspects of the sample matrix (alkalinity, organic ligands, and clays) relatively unchanged.

2.2 Preparation of Test Exposures

A spreadsheet was developed to calculate ion concentrations resulting from various mixtures of inorganic salts. Using this program it was possible to identify a mixture of salts that very closely matched the ionic strength and makeup of the river sample based on the November 7, 2012 sample. This spreadsheet program was then used to develop the recipe for preparing a spiked river sample containing approximately 4x the TDS (as Cl^-, SO_4^{-2}, Na^+, Mg^{+2}, and Ca^{+2}) of the unspiked river sample. This spiked sample was then used to prepare test exposures of 4x, 3x, 2.25x, 1.69x 1.26x, and 1x (unspiked river sample) by serially diluting the 4x spiked sample with unspiked sample using a 0.75 dilution factor. This resulted in a test with 6 test exposures plus a laboratory control. This experimental design assumes that, in the normal variation of TDS in the river, (SO_4^{-2}, Cl^-, Na^+, Mg^{+2}, and Ca^{+2}) are all correlated and do not vary independently. The calculated amounts of reagent added to the river sample to produce the nominal 4x exposure are provided in Table 3.

Table 3. Summary of inorganic salt additions to result in a 4x concentration of the unspiked river sample, based on the sample collected on November 7, 2012.

Reagent	Milligrams per Liter of River Sample
NaCl	650
Na_2SO_4	639
$CaCl_2(2H_2O)$	38
$MgCl_2$	67
$MgSO_4(7H_20)$	525
$CaSO_4(2H_2O)$	189
CaO	240
KCl	45

The ion concentrations of the actual sample collected for testing differed from the concentrations of the sample collected on November 7, 2012. However, the most important feature of the test exposures is that they simulate an increase in SO_4^{-2}, Cl^-, Na^+, Mg^{+2}, and Ca^{+2} with constant alkalinity such that a toxic threshold can be evaluated. Therefore the salt additions given in Table 3 should be appropriate for a wide range of river conditions.

2.3 Data Analysis

Survival and reproduction data were statistically analyzed using appropriate parametric or non-parametric tests to calculate the no-observed-effect-concentration (NOEC), lowest-observed-effect-concentration (LOEC) and concentration that inhibits the endpoint by 25% (IC25) values per EPA (2002). For the purposes of this study the IC25 is the preferred endpoint to represent a toxic TDS threshold. If the data does not allow a valid IC25 calculation, the NOEC value will be used.

Analytically determined concentrations of selected analytes (SO_4^{-2}, Cl^-, hardness, alkalinity, and TDS) and test conductivity measurements in each exposure solution for each day's renewal were examined to verify correct preparation of test exposures, document changes (if any) in the ionic strength and makeup of the 4x mixture used to prepare daily exposure renewals and to provide concentrations for the calculation of test endpoints. The IC25, NOEC, and LOEC values were calculated for TDS, SO_4^-, and Cl^- using the average of the measured concentrations from each day's renewal. These endpoints provide an estimate of the toxic threshold for TDS, SO_4^-, and Cl^- in the Red River matrix.

The information and analysis presented above provides the overall approach and its justification for performing the spiked river sample test. The specific test protocol that the laboratory followed is presented in the following section.

2.4 Sampling and Testing Protocol

All sample spiking, analytical testing, and toxicity tests were conducted by Huther and Associates, Inc. (HA) (1156 N. Bonnie Brae, Benton, TX 76201), which is certified by the Arkansas Department of Environmental Quality (ADEQ) for the required analyses. As part of preliminary testing arrangements, HA reviewed this protocol and determined the volume of water needed for the testing. Testing and sampling dates were determined based on prior coordination between laboratory management and project managers.

2.5 Sample Collection

The river sample was collected at the Highway 41 bridge (volume determined based on coordination with HA) as a grab sample taken at a depth of 0.54 m from flowing water approximately at mid stream. Sampling did not take place while flows were influenced, e.g., during or immediately after a significant storm event.

Sampling was conducted by FTN personnel, who placed the sample on ice and shipped it to HA with appropriate chain-of-custody documentation via overnight carrier.

2.6 Toxicity Testing and Associated Measurements

Prior to testing, HA made routine preparations for conducting a three-brood survival and reproduction test using *C. dubia.*

Day 1: Sample Delivery and Spiked Sample Preparation

1. Sample was delivered to HA via overnight carrier.
2. Upon sample arrival and routine sample check-in procedures, HA spiked an appropriate volume of sample with reagent-grade salt according to Table 3.
3. A sufficient volume of spiked river sample was prepared on day one to meet the volume requirements for the entire test and analytical confirmatory testing of ion concentrations. Additional river sample was not provided during the test.
4. After preparation, the spiked sample was gently aerated for 24 hours at room temperature to allow the solution to reach full equilibrium.

Day 2: Test Setup

1. The toxicity test consisted of six test exposures plus a laboratory performance control. HA prepared four serial dilutions of the 4x spiked solution using a dilution factor of 0.75 using the unspiked river sample as diluent. The sixth exposure in the concentration series was the unspiked river sample. Reconstituted lab water (e.g., moderately hard reconstituted lab water) was used as a performance control for the test. Therefore, the entire test had seven exposures including the performance control.
2. HA collected an aliquot of the 4x and each of the serial dilutions, including the unspiked river sample, for the analysis of the parameters given in Table 4.

Table 4. Ion analyses required for each set of serial test dilutions prepared for each renewal.

Analyte	Analytical Method	Preservation	Holding Time
Hardness	EPA 200.7	Acidify to pH < 2 using HNO_3	6 months
Cl^-	EPA 300.0	None	28 days
SO_4^{-2}	EPA 300.0	4°C	28 days
Total Alkalinity	SM2320B	4°C	14 days
TDS	SM2540C	4°C	7 days

3. Appropriately preserved samples for the analysis of the parameters given in Table 4 were shipped to American Interplex Corporation Laboratories (AIC) (which is located at 8600 Kanis Road, Little Rock, AR 72204) for analysis within required holding times.
4. The following daily initial in situ test measurements were made on the test exposures:
    a. Conductivity in each exposure,
    b. DO and pH in at least three selected exposures, and
    c. Temperature per routine testing.
5. Daily final test measurements were made per normal routine test protocols.
6. Stored both the spiked and unspiked river sample under refrigeration per normal sample storage protocol.
7. Noted any changes in the spiked or unspiked samples during storage such as the formation of precipitates.

Day 3 through end of test: Test Maintenance

1. Using the unspiked river sample as diluents, prepared test exposures for daily renewal as described above. This included test measurements and collection of aliquots of each freshly prepared exposure (except the unspiked river sample and laboratory control) for analytical determination of the ions listed in Table 4.
2. The test ended when 60% of the performance control organisms had their third brood of neonates, per routine protocol.
3. Control performance (survival, average neonate production) conformed to normal NPDES biomonitoring. All applicable standards, practices, and guidelines for testing, sample handling, toxicity test performance, and organism culturing conformed to HA's in-house QA/QC protocols and practices.

3.0 RESULTS

Results of the analyses of selected ions in selected test exposures are presented in Table 5. Toxicity test results are presented in Table 6. Laboratory reports are provided in Appendices A and B. Average neonate production (and the percent coefficient of variation) and percent survival in the laboratory controls (Table 2) indicate satisfactory control performance per EPA (2002). Measurements of in situ test parameters (pH, dissolved oxygen; Table 7) indicated that test organism performance (survival and reproduction) was not affected by confounding factors. Measured mineral concentrations in all test exposures indicated correct preparation of test exposures. Neither survival nor reproduction showed a dose response. No test exposure resulted in a 25% reduction in reproduction relative to the unspiked control. Therefore, no IC25 calculation was possible. Based on these characteristics of test performance, the test results provide a valid estimate of the toxic threshold for dissolved minerals in the Red River.

Table 5. Measured concentrations of selected ions in test exposures.

% Spiked Mixture (Exposure)	Analyte	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Mean
Control (1x)	Total Alkalinity	120	NM	NM	NM	NM	NM	NM	120
	TDS	410	NM	NM	NM	NM	NM	NM	410
	Chloride	88	NM	NM	NM	NM	NM	NM	88
	Sulfate	75	NM	NM	NM	NM	NM	NM	75
	Hardness	200	NM	NM	NM	NM	NM	NM	200
32 (1.26x)	Total Alkalinity	380	150	120	160	190	210	110	189
	TDS	870	960	1,000	1,100	1,100	1,100	1,100	1,033
	Chloride	220	250	280	300	280	280	290	271
	Sulfate	290	290	320	340	310	320	320	313
	Hardness	650	470	410	430	470	470	350	464
42 (1.69x)	Total Alkalinity	180	120	110	130	160	150	100	136
	TDS	980	1,200	1,200	1,100	1,200	1,200	1,300	1,169
	Chloride	260	320	370	400	320	340	350	337
	Sulfate	360	380	400	470	370	400	410	399
	Hardness	420	480	430	420	490	460	400	443
56 (2.25x)	Total Alkalinity	170	110	100	130	150	150	100	130
	TDS	1,400	1,400	1,500	1,500	1,300	1,500	1,500	1,443
	Chloride	310	400	450	400	380	420	440	400
	Sulfate	440	470	480	470	450	500	500	473
	Hardness	440	550	550	510	530	550	470	514
75 (3x)	Total Alkalinity	100	92	90	120	150	150	96	114
	TDS	1,700	2,400	1,800	1,900	1,900	1,900	1,900	1,929
	Chloride	410	670	530	500	510	530	520	524
	Sulfate	630	800	650	600	620	650	630	654
	Hardness	470	680	630	600	630	620	590	603
100 (4x)	Total Alkalinity	75	110	89	120	150	120	130	113
	TDS	2,200	2,400	2,300	2,400	2,200	2,400	2,500	2,343
	Chloride	510	540	670	650	670	680	700	631
	Sulfate	810	630	810	780	800	820	850	786
	Hardness	540	780	770	760	780	730	750	730

All units are mg/L. Hardness and total alkalinity reported as mg/L as $CaCO_3$. NM=not measured.

Table 6. Summary of toxicity test results and endpoints.

% Spiked Mixture (Exposure)	% Survival (n = 10)		Mean Number of Neonates	% CV	Average Mineral Concentration (mg/L)		
	48 hrs	7 days			TDS	Chloride	Sulfate
Control (1x)	100	100	22.4	7.93	410	88	75
32 (1.26x)	100	100	23.3	8.35	1,033	271	313
42 (1.69)	100	100	23.4	9.91	1,169	337	399
56 (2.25x)	100	100	23.1	7.20	1,443	400	473
75 (3x)	100	100	22.5	4.80	1,929	524	654
100 (4x)	100	100	22.3	7.92	2,343	631	786
Laboratory Control	100	100	20.4	8.07	NM	NM	NM
Estimated Endpoint Values (mg/L)				IC25	>2,343	>631	>786
				NOEC	2,343	631	786

% CV = percent coefficient of variation.
NM = not measured.

Table 7. Summary of in situ test measurements.

% Spiked Mixture (Exposure)	pH (su)					
	Initial			Final		
	Minimum	Mean	Maximum	Minimum	Mean	Maximum
Control (1x)	7.61	7.91	8.22	8.00	8.21	8.40
32 (1.26x)	7.83	8.09	8.72	7.90	8.12	8.28
42 (1.69)	7.84	8.13	8.77	7.84	8.09	8.26
56 (2.25x)	7.84	8.15	8.92	7.83	8.06	8.24
75 (3x)	7.87	8.19	8.87	7.78	7.99	8.17
100 (4x)	7.91	8.24	8.99	7.66	7.93	8.11
Laboratory Control	8.15	8.33	8.44	8.20	8.30	8.42
% Spiked Mixture (Exposure)	**DO (mg/L)**					
	Initial			Final		
	Minimum	Mean	Maximum	Minimum	Mean	Maximum
Control (1x)	7.69	8.06	8.33	7.66	8.21	8.85
32 (1.26x)	7.58	7.96	8.35	7.58	8.13	8.76
42 (1.69)	7.58	7.94	8.39	7.50	8.06	8.67
56 (2.25x)	7.65	7.93	8.45	7.61	8.11	8.64
75 (3x)	7.84	8.00	8.46	7.54	8.12	8.66
100 (4x)	7.82	8.03	8.57	7.51	8.11	8.61
Laboratory Control	8.17	8.33	8.48	7.68	8.26	8.86

4.0 CONCLUSIONS

The 7-day *C. dubia* survival and reproduction test showed no statistically significant differences in survival or reproduction between the control and any of the concentrations. The estimated NOEC end points values (2,343 mg/L for TDS; 786 mg/L for sulfate; and 631 mg/L for chloride) indicate that toxicity due to minerals in the Red River would not be expected under normal conditions.

5.0 LITERATURE CITED

EPA. 2002. *Short-term methods for estimating the chronic toxicity of effluents and receiving waters to freshwater organisms, fourth edition* [EPA-821-R-02-013]. Washington, DC: Office of Water.

Lasier, P.J., and I.R. Hardin. 2010. Observed and predicted reproduction of *Ceriodaphnia dubia* exposed to chloride, sulfate, and bicarbonate. *Environ. Toxicol. Chem.* 29: 347-358.

Soucek, D.J. 2007. Comparison of hardness and chloride regulated acute effects of sodium sulfate on two freshwater crustaceans. *Environ. Toxicol. Chem.* 26: 773-253.

Soucek, D.J., and A.J. Kennedy. 2005. Effects of hardness, chloride, and acclimation on the acute toxicity of sulfate to freshwater invertebrates. *Environ. Toxicol. Chem.* 24:1204-1210.

Soucek, D.J., T.K. Linton, C.D. Tarr, A. Dickinson, N. Wickramanayake, C.G. Delos, and L.A. Cruz. 2011. Influence of water hardness and sulfate on the acute toxicity of chloride to sensitive freshwater invertebrates. *Environ. Toxicol. Chem.* 30: 930-938.

APPENDIX A

American Interplex Corporation Analytical Results

AMERICAN INTERPLEX CORPORATION
LABORATORIES

March 28, 2013
Control No. 165978

FTN Associates, Ltd.
ATTN: Mr. Pat Downey
3 Innwood Circle, Suite 220
Little Rock, AR 72211

This report contains the analytical results and supporting information for samples submitted on March 23, 2013. Attached please find a copy of the Chain of Custody and/or other documents received. Note that any remaining sample will be discarded two weeks from the original report date unless other arrangements are made.

This report is intended for the sole use of the client listed above. Assessment of the data requires access to the entire document.

This report has been reviewed by the Laboratory Director or a qualified designee.

John Overbey
Laboratory Director

This document has been distributed to the following:

PDF cc: FTN Associates, Ltd.
ATTN: Mr. Pat Downey
pjd@ftn-assoc.com

AMERICAN INTERPLEX CORPORATION
LABORATORIES

FTN Associates, Ltd.
3 Innwood Circle, Suite 220
Little Rock, AR 72211

SAMPLE INFORMATION

Project Description:
Six (6) water sample(s) received on March 23, 2013
Huther & Associates, Inc.
20791
RR Hwy 41-Day 1

Receipt Details:
A Chain of Custody was provided. The samples were delivered in one (1) ice chest.
Ice chest #1 was delivered with shipping documentation.

Each sample container was checked for proper labeling, including date and time sampled. Sample containers were reviewed for proper type, adequate volume, integrity, temperature, preservation, and holding times. Any exceptions are noted below:

Sample Identification:

Laboratory ID	Client Sample ID	Sampled Date/Time	Notes
165978-1	Cov 3/20/13 0900	20-Mar-2013 0900	
165978-2	32 3/20/13 0900	20-Mar-2013 0900	
165978-3	42 3/20/13 0900	20-Mar-2013 0900	
165978-4	56 3/20/13 0900	20-Mar-2013 0900	
165978-5	75 3/20/13 0900	20-Mar-2013 0900	
165978-6	100 3/20/13 0900	20-Mar-2013 0900	

Qualifiers:
D Result is from a secondary dilution factor

References:
"Methods for Chemical Analysis of Water and Wastes", EPA/600/4-79-020 (Mar 1983) with updates and supplements EPA/600/5-91-010 (Jun 1991), EPA/600/R-92-129 (Aug 1992) and EPA/600/R-93-100 (Aug 1993).
"Test Methods for Evaluating Solid Waste Physical/Chemical Methods (SW846)", Third Edition.
"Standard Methods for the Examination of Water and Wastewaters", 21st edition.
"American Society for Testing and Materials" (ASTM).
"Association of Analytical Chemists" (AOAC).

AMERICAN INTERPLEX CORPORATION
LABORATORIES

FTN Associates, Ltd.
3 Innwood Circle, Suite 220
Little Rock, AR 72211

ANALYTICAL RESULTS

AIC No. 165978-1
Sample Identification: Cov 3/20/13 0900

Analyte		Result	RL	Units	Qualifier
Alkalinity as CaCO3		**120**	1	**mg/l**	
SM 2320 B		Analyzed: 26-Mar-2013 0836 by 302		Batch: W43003	
Total Dissolved Solids		**410**	10	**mg/l**	
SM 2540 C	Prep: 26-Mar-2013 1417 by 285	Analyzed: 27-Mar-2013 1448 by 285		Batch: W43007	
Chloride		**88**	2	**mg/l**	D
EPA 300.0	Prep: 25-Mar-2013 1135 by 07	Analyzed: 25-Mar-2013 1336 by 07		Batch: S34268	Dil: 10
Sulfate		**75**	2	**mg/l**	D
EPA 300.0	Prep: 25-Mar-2013 1135 by 07	Analyzed: 25-Mar-2013 1336 by 07		Batch: S34268	Dil: 10
Hardness as CaCO3		**200**	1	**mg/l**	
SM 2340 B	Prep: 25-Mar-2013 1452 by 271	Analyzed: 25-Mar-2013 1937 by 305		Batch: S34271	

AIC No. 165978-2
Sample Identification: 32 3/20/13 0900

Analyte		Result	RL	Units	Qualifier
Alkalinity as CaCO3		**380**	1	**mg/l**	
SM 2320 B		Analyzed: 26-Mar-2013 0836 by 302		Batch: W43003	
Total Dissolved Solids		**870**	10	**mg/l**	
SM 2540 C	Prep: 26-Mar-2013 1417 by 285	Analyzed: 27-Mar-2013 1448 by 285		Batch: W43007	
Chloride		**220**	2	**mg/l**	D
EPA 300.0	Prep: 25-Mar-2013 1135 by 07	Analyzed: 25-Mar-2013 1425 by 07		Batch: S34268	Dil: 10
Sulfate		**290**	2	**mg/l**	D
EPA 300.0	Prep: 25-Mar-2013 1135 by 07	Analyzed: 25-Mar-2013 1425 by 07		Batch: S34268	Dil: 10
Hardness as CaCO3		**650**	1	**mg/l**	
SM 2340 B	Prep: 25-Mar-2013 1452 by 271	Analyzed: 27-Mar-2013 0900 by 305		Batch: S34271	

AIC No. 165978-3
Sample Identification: 42 3/20/13 0900

Analyte		Result	RL	Units	Qualifier
Alkalinity as CaCO3		**180**	1	**mg/l**	
SM 2320 B		Analyzed: 26-Mar-2013 0836 by 302		Batch: W43003	
Total Dissolved Solids		**980**	10	**mg/l**	
SM 2540 C	Prep: 26-Mar-2013 1417 by 285	Analyzed: 27-Mar-2013 1448 by 285		Batch: W43007	
Chloride		**260**	2	**mg/l**	D
EPA 300.0	Prep: 25-Mar-2013 1135 by 07	Analyzed: 25-Mar-2013 1451 by 07		Batch: S34268	Dil: 10
Sulfate		**360**	2	**mg/l**	D
EPA 300.0	Prep: 25-Mar-2013 1135 by 07	Analyzed: 25-Mar-2013 1451 by 07		Batch: S34268	Dil: 10
Hardness as CaCO3		**420**	1	**mg/l**	
SM 2340 B	Prep: 25-Mar-2013 1452 by 271	Analyzed: 26-Mar-2013 1438 by 305		Batch: S34271	

AMERICAN INTERPLEX CORPORATION
LABORATORIES

FTN Associates, Ltd.
3 Innwood Circle, Suite 220
Little Rock, AR 72211

ANALYTICAL RESULTS

AIC No. 165978-4
Sample Identification: 56 3/20/13 0900

Analyte		Result	RL	Units	Qualifier
Alkalinity as CaCO3		**170**	1	**mg/l**	
SM 2320 B		Analyzed: 26-Mar-2013 0836 by 302		Batch: W43003	
Total Dissolved Solids		**1400**	10	**mg/l**	
SM 2540 C	Prep: 26-Mar-2013 1417 by 285	Analyzed: 27-Mar-2013 1448 by 285		Batch: W43007	
Chloride		**310**	2	**mg/l**	D
EPA 300.0	Prep: 25-Mar-2013 1135 by 07	Analyzed: 25-Mar-2013 1517 by 07		Batch: S34268	Dil: 10
Sulfate		**440**	2	**mg/l**	D
EPA 300.0	Prep: 25-Mar-2013 1135 by 07	Analyzed: 25-Mar-2013 1517 by 07		Batch: S34268	Dil: 10
Hardness as CaCO3		**440**	1	**mg/l**	
SM 2340 B	Prep: 25-Mar-2013 1452 by 271	Analyzed: 26-Mar-2013 1442 by 305		Batch: S34271	

AIC No. 165978-5
Sample Identification: 75 3/20/13 0900

Analyte		Result	RL	Units	Qualifier
Alkalinity as CaCO3		**100**	1	**mg/l**	
SM 2320 B		Analyzed: 26-Mar-2013 0836 by 302		Batch: W43003	
Total Dissolved Solids		**1700**	10	**mg/l**	
SM 2540 C	Prep: 26-Mar-2013 1417 by 285	Analyzed: 27-Mar-2013 1448 by 285		Batch: W43007	
Chloride		**410**	20	**mg/l**	D
EPA 300.0	Prep: 25-Mar-2013 1135 by 07	Analyzed: 25-Mar-2013 1543 by 07		Batch: S34268	Dil: 100
Sulfate		**630**	20	**mg/l**	D
EPA 300.0	Prep: 25-Mar-2013 1135 by 07	Analyzed: 25-Mar-2013 1543 by 07		Batch: S34268	Dil: 100
Hardness as CaCO3		**470**	1	**mg/l**	
SM 2340 B	Prep: 25-Mar-2013 1452 by 271	Analyzed: 26-Mar-2013 1447 by 305		Batch: S34271	

AIC No. 165978-6
Sample Identification: 100 3/20/13 0900

Analyte		Result	RL	Units	Qualifier
Alkalinity as CaCO3		**75**	1	**mg/l**	
SM 2320 B		Analyzed: 26-Mar-2013 0836 by 302		Batch: W43003	
Total Dissolved Solids		**2200**	20	**mg/l**	
SM 2540 C	Prep: 26-Mar-2013 1417 by 285	Analyzed: 27-Mar-2013 1448 by 285		Batch: W43007	
Chloride		**510**	20	**mg/l**	D
EPA 300.0	Prep: 25-Mar-2013 1135 by 07	Analyzed: 25-Mar-2013 1608 by 07		Batch: S34268	Dil: 100
Sulfate		**810**	20	**mg/l**	D
EPA 300.0	Prep: 25-Mar-2013 1135 by 07	Analyzed: 25-Mar-2013 1608 by 07		Batch: S34268	Dil: 100
Hardness as CaCO3		**540**	1	**mg/l**	
SM 2340 B	Prep: 25-Mar-2013 1452 by 271	Analyzed: 26-Mar-2013 1451 by 305		Batch: S34271	

AMERICAN INTERPLEX CORPORATION
LABORATORIES

FTN Associates, Ltd.
3 Innwood Circle, Suite 220
Little Rock, AR 72211

DUPLICATE RESULTS

Analyte		AIC No.	Result	RPD	RPD Limit	Preparation Date	Analysis Date	Dil	Qual
Alkalinity as CaCO3		165978-1	120 mg/l				26Mar13 0836 by 302		
	Batch: W43003	Duplicate	120 mg/l	0.858	20.0		26Mar13 0836 by 302		
Total Dissolved Solids		165978-1	410 mg/l			26Mar13 1417 by 285	27Mar13 1448 by 285		
	Batch: W43007	Duplicate	420 mg/l	2.62	10.0	26Mar13 1417 by 285	27Mar13 1448 by 285		
Total Dissolved Solids		165978-2	870 mg/l			26Mar13 1417 by 285	27Mar13 1448 by 285		
	Batch: W43007	Duplicate	870 mg/l	0.920	10.0	26Mar13 1417 by 285	27Mar13 1448 by 285		

LABORATORY CONTROL SAMPLE RESULTS

Analyte	Spike Amount	%	Limits	RPD	Limit	Batch	Preparation Date	Analysis Date	Dil	Qual
Chloride	20 mg/l	97.9	90.0-110			S34268	25Mar13 1135 by 07	25Mar13 1219 by 07		
Sulfate	20 mg/l	98.7	90.0-110			S34268	25Mar13 1135 by 07	25Mar13 1219 by 07		

MATRIX SPIKE SAMPLE RESULTS

Analyte	Sample	Spike Amount	%	Limits	Batch	Preparation Date	Analysis Date	Dil	Qual
Chloride	165978-1	20 mg/l	92.0	80.0-120	S34268	25Mar13 1135 by 07	25Mar13 1245 by 07		
	165978-1	20 mg/l	93.8	80.0-120	S34268	25Mar13 1135 by 07	25Mar13 1311 by 07		
	Relative Percent Difference:		1.26	10.0	S34268				
Sulfate	165978-1	20 mg/l	94.7	80.0-120	S34268	25Mar13 1135 by 07	25Mar13 1245 by 07		
	165978-1	20 mg/l	97.2	80.0-120	S34268	25Mar13 1135 by 07	25Mar13 1311 by 07		
	Relative Percent Difference:		1.89	10.0	S34268				

LABORATORY BLANK RESULTS

Analyte	Result	RL	PQL	QC Sample	Preparation Date	Analysis Date	Qual
Alkalinity as CaCO3	< 1 mg/l	1	1	W43003-1		26Mar13 0836 by 302	
Total Dissolved Solids	< 10 mg/l	10	10	W43007-1	26Mar13 1417 by 285	27Mar13 1448 by 285	
Chloride	< 0.2 mg/l	0.2	0.2	S34268-1	25Mar13 1135 by 07	25Mar13 1153 by 07	
Sulfate	< 0.2 mg/l	0.2	0.2	S34268-1	25Mar13 1135 by 07	25Mar13 1153 by 07	

HUTHER & ASSOCIATES, INC.

1156 North Bonnie Brae
Denton, Texas 76201
Phone: (940) 387-1025 Fax: (940) 387-1036

165978

ANALYTICAL CHAIN-OF-CUSTODY

Company Name: HUTHER
Address:
Contact: BRUCE
Phone #: (940) 387-1025

Project #: 20791
P.O.#:
Project Name: NR HWY 41 - DAY 1

	Sample Description	Date	Time	Matrix	PARAMETERS FOR ANALYSIS: HARDNESS	Chloride Sulfate Alkalinity TDS	# Containers
1	COV	3/20/13	0900		X	X	2
2	32	"	0900		X	X	2
3	42	"	0900		X	X	2
4	56	"	"		X	X	2
5	75	"	"		X	X	2
6	100	"	"		X	X	2

RELINQUISHED BY: (Signature) Bruce Huther Date 3/22/13 1300 Time

RECEIVED BY: (Signature) Shawn Worm Date 3/23/13 Time: 0900

METHOD OF SHIPMENT: FED EX

ADDITIONAL COMMENTS: HARD: HNO_3

Copies Pat Dawney FTW

7993 4726 3538

2°C

AMERICAN INTERPLEX CORPORATION
LABORATORIES

FTN Associates, Ltd.
ATTN: Mr. Pat Downey
3 Innwood Circle, Suite 220
Little Rock, AR 72211

This report contains the analytical results and supporting information for samples submitted on March 23, 2013. Attached please find a copy of the Chain of Custody and/or other documents received. Note that any remaining sample will be discarded two weeks from the original report date unless other arrangements are made.

This report is intended for the sole use of the client listed above. Assessment of the data requires access to the entire document.

This report has been reviewed by the Laboratory Director or a qualified designee.

John Overbey
Laboratory Director

This document has been distributed to the following:

PDF cc: FTN Associates, Ltd.
ATTN: Mr. Pat Downey
pjd@ftn-assoc.com

AMERICAN INTERPLEX CORPORATION
LABORATORIES

FTN Associates, Ltd.
3 Innwood Circle, Suite 220
Little Rock, AR 72211

SAMPLE INFORMATION

Project Description:
Five (5) water sample(s) received on March 23, 2013
Huther & Associates, Inc.
20791
RR Hwy 41-Day 2

Receipt Details:
A Chain of Custody was provided. The samples were delivered in one (1) ice chest.
Ice chest #1 was delivered with shipping documentation.

Each sample container was checked for proper labeling, including date and time sampled. Sample containers were reviewed for proper type, adequate volume, integrity, temperature, preservation, and holding times. Any exceptions are noted below:

Sample Identification:

Laboratory ID	Client Sample ID	Sampled Date/Time	Notes
165979-1	32% 3/21/13 0900	21-Mar-2013 0900	
165979-2	42% 3/21/13 0900	21-Mar-2013 0900	
165979-3	56% 3/21/13 0900	21-Mar-2013 0900	
165979-4	75% 3/21/13 0900	21-Mar-2013 0900	
165979-5	100% 3/21/13 0900	21-Mar-2013 0900	

Qualifiers:
D Result is from a secondary dilution factor

Case Narrative:
165979-4 and 165979-5 are believed to be switched.

References:
"Methods for Chemical Analysis of Water and Wastes", EPA/600/4-79-020 (Mar 1983) with updates and supplements EPA/600/5-91-010 (Jun 1991), EPA/600/R-92-129 (Aug 1992) and EPA/600/R-93-100 (Aug 1993).
"Test Methods for Evaluating Solid Waste Physical/Chemical Methods (SW846)", Third Edition.
"Standard Methods for the Examination of Water and Wastewaters", 21st edition.
"American Society for Testing and Materials" (ASTM).
"Association of Analytical Chemists" (AOAC).

AMERICAN INTERPLEX CORPORATION
LABORATORIES

FTN Associates, Ltd.
3 Innwood Circle, Suite 220
Little Rock, AR 72211

ANALYTICAL RESULTS

AIC No. 165979-1
Sample Identification: 32% 3/21/13 0900

Analyte		Result	RL	Units	Qualifier
Alkalinity as CaCO3		**150**	1	**mg/l**	
SM 2320 B		Analyzed: 26-Mar-2013 0836 by 302		Batch: W43003	
Total Dissolved Solids		**960**	10	**mg/l**	
SM 2540 C	Prep: 26-Mar-2013 1417 by 285	Analyzed: 27-Mar-2013 1448 by 285		Batch: W43007	
Chloride		**250**	2	**mg/l**	D
EPA 300.0	Prep: 25-Mar-2013 1135 by 07	Analyzed: 25-Mar-2013 1752 by 07		Batch: S34268	Dil: 10
Sulfate		**290**	2	**mg/l**	D
EPA 300.0	Prep: 25-Mar-2013 1135 by 07	Analyzed: 25-Mar-2013 1752 by 07		Batch: S34268	Dil: 10
Hardness as CaCO3		**470**	1	**mg/l**	
SM 2340 B	Prep: 25-Mar-2013 1452 by 271	Analyzed: 26-Mar-2013 1456 by 305		Batch: S34271	

AIC No. 165979-2
Sample Identification: 42% 3/21/13 0900

Analyte		Result	RL	Units	Qualifier
Alkalinity as CaCO3		**120**	1	**mg/l**	
SM 2320 B		Analyzed: 26-Mar-2013 0836 by 302		Batch: W43003	
Total Dissolved Solids		**1200**	10	**mg/l**	
SM 2540 C	Prep: 26-Mar-2013 1417 by 285	Analyzed: 27-Mar-2013 1448 by 285		Batch: W43007	
Chloride		**320**	2	**mg/l**	D
EPA 300.0	Prep: 25-Mar-2013 1135 by 07	Analyzed: 25-Mar-2013 1818 by 07		Batch: S34268	Dil: 10
Sulfate		**380**	2	**mg/l**	D
EPA 300.0	Prep: 25-Mar-2013 1135 by 07	Analyzed: 25-Mar-2013 1818 by 07		Batch: S34268	Dil: 10
Hardness as CaCO3		**480**	1	**mg/l**	
SM 2340 B	Prep: 25-Mar-2013 1452 by 271	Analyzed: 26-Mar-2013 1500 by 305		Batch: S34271	

AIC No. 165979-3
Sample Identification: 56% 3/21/13 0900

Analyte		Result	RL	Units	Qualifier
Alkalinity as CaCO3		**110**	1	**mg/l**	
SM 2320 B		Analyzed: 26-Mar-2013 0836 by 302		Batch: W43003	
Total Dissolved Solids		**1400**	10	**mg/l**	
SM 2540 C	Prep: 26-Mar-2013 1417 by 285	Analyzed: 27-Mar-2013 1448 by 285		Batch: W43007	
Chloride		**400**	2	**mg/l**	D
EPA 300.0	Prep: 25-Mar-2013 1135 by 07	Analyzed: 25-Mar-2013 1843 by 07		Batch: S34268	Dil: 10
Sulfate		**470**	2	**mg/l**	D
EPA 300.0	Prep: 25-Mar-2013 1135 by 07	Analyzed: 25-Mar-2013 1843 by 07		Batch: S34268	Dil: 10
Hardness as CaCO3		**550**	1	**mg/l**	
SM 2340 B	Prep: 25-Mar-2013 1452 by 271	Analyzed: 26-Mar-2013 1523 by 305		Batch: S34271	

AMERICAN INTERPLEX CORPORATION
LABORATORIES

FTN Associates, Ltd.
3 Innwood Circle, Suite 220
Little Rock, AR 72211

ANALYTICAL RESULTS

AIC No. 165979-4
Sample Identification: 75% 3/21/13 0900

Analyte		Result	RL	Units	Qualifier
Alkalinity as CaCO3		**92**	1	**mg/l**	
SM 2320 B		Analyzed: 26-Mar-2013 0836 by 302		Batch: W43003	
Total Dissolved Solids		**2400**	20	**mg/l**	
SM 2540 C	Prep: 26-Mar-2013 1417 by 285	Analyzed: 27-Mar-2013 1448 by 285		Batch: W43007	
Chloride		**670**	20	**mg/l**	D
EPA 300.0	Prep: 25-Mar-2013 1135 by 07	Analyzed: 26-Mar-2013 1135 by 07		Batch: S34268	Dil: 100
Sulfate		**800**	20	**mg/l**	D
EPA 300.0	Prep: 25-Mar-2013 1135 by 07	Analyzed: 26-Mar-2013 1135 by 07		Batch: S34268	Dil: 100
Hardness as CaCO3		**680**	1	**mg/l**	
SM 2340 B	Prep: 25-Mar-2013 1452 by 271	Analyzed: 26-Mar-2013 1527 by 305		Batch: S34271	

AIC No. 165979-5
Sample Identification: 100% 3/21/13 0900

Analyte		Result	RL	Units	Qualifier
Alkalinity as CaCO3		**110**	1	**mg/l**	
SM 2320 B		Analyzed: 26-Mar-2013 0836 by 302		Batch: W43003	
Total Dissolved Solids		**2400**	20	**mg/l**	
SM 2540 C	Prep: 26-Mar-2013 1417 by 285	Analyzed: 27-Mar-2013 1448 by 285		Batch: W43007	
Chloride		**540**	20	**mg/l**	D
EPA 300.0	Prep: 25-Mar-2013 1135 by 07	Analyzed: 26-Mar-2013 1201 by 07		Batch: S34268	Dil: 100
Sulfate		**630**	20	**mg/l**	D
EPA 300.0	Prep: 25-Mar-2013 1135 by 07	Analyzed: 26-Mar-2013 1201 by 07		Batch: S34268	Dil: 100
Hardness as CaCO3		**780**	1	**mg/l**	
SM 2340 B	Prep: 25-Mar-2013 1452 by 271	Analyzed: 26-Mar-2013 1532 by 305		Batch: S34271	

AMERICAN INTERPLEX CORPORATION
LABORATORIES

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3 Innwood Circle, Suite 220
Little Rock, AR 72211

DUPLICATE RESULTS

Analyte		AIC No.	Result	RPD	RPD Limit	Preparation Date	Analysis Date	Dil	Qual
Alkalinity as CaCO3		165978-1	120 mg/l				26Mar13 0836 by 302		
	Batch: W43003	Duplicate	120 mg/l	0.858	20.0		26Mar13 0836 by 302		
Total Dissolved Solids		165978-1	410 mg/l			26Mar13 1417 by 285	27Mar13 1448 by 285		
	Batch: W43007	Duplicate	420 mg/l	2.62	10.0	26Mar13 1417 by 285	27Mar13 1448 by 285		
Total Dissolved Solids		165978-2	870 mg/l			26Mar13 1417 by 285	27Mar13 1448 by 285		
	Batch: W43007	Duplicate	870 mg/l	0.920	10.0	26Mar13 1417 by 285	27Mar13 1448 by 285		

LABORATORY CONTROL SAMPLE RESULTS

Analyte	Spike Amount	%	Limits	RPD	Limit	Batch	Preparation Date	Analysis Date	Dil	Qual
Chloride	20 mg/l	97.9	90.0-110			S34268	25Mar13 1135 by 07	25Mar13 1219 by 07		
Sulfate	20 mg/l	98.7	90.0-110			S34268	25Mar13 1135 by 07	25Mar13 1219 by 07		

MATRIX SPIKE SAMPLE RESULTS

Analyte	Sample	Spike Amount	%	Limits	Batch	Preparation Date	Analysis Date	Dil	Qual
Chloride	165978-1	20 mg/l	92.0	80.0-120	S34268	25Mar13 1135 by 07	25Mar13 1245 by 07		
	165978-1	20 mg/l	93.8	80.0-120	S34268	25Mar13 1135 by 07	25Mar13 1311 by 07		
	Relative Percent Difference:		1.26	10.0	S34268				
Sulfate	165978-1	20 mg/l	94.7	80.0-120	S34268	25Mar13 1135 by 07	25Mar13 1245 by 07		
	165978-1	20 mg/l	97.2	80.0-120	S34268	25Mar13 1135 by 07	25Mar13 1311 by 07		
	Relative Percent Difference:		1.89	10.0	S34268				

LABORATORY BLANK RESULTS

Analyte	Result	RL	PQL	QC Sample	Preparation Date	Analysis Date	Qual
Alkalinity as CaCO3	< 1 mg/l	1	1	W43003-1		26Mar13 0836 by 302	
Total Dissolved Solids	< 10 mg/l	10	10	W43007-1	26Mar13 1417 by 285	27Mar13 1448 by 285	
Chloride	< 0.2 mg/l	0.2	0.2	S34268-1	25Mar13 1135 by 07	25Mar13 1153 by 07	
Sulfate	< 0.2 mg/l	0.2	0.2	S34268-1	25Mar13 1135 by 07	25Mar13 1153 by 07	

165979

HUTHER & ASSOCIATES, INC.

1156 North Bonnie Brae
Denton, Texas 76201
Phone: (940) 387-1025 Fax: (940) 387-1036

ANALYTICAL CHAIN-OF-CUSTODY

Company Name: HUTHER
Address:
Contact: BRUCE
Phone #: (940) 387-1025

Project #:	P.O.#:	Project Name:
20791		RR HWY 41 - DAY 2

	Sample Description	Date	Time	Matrix	HARDNESS	Ca Iodide Sulfate Alkalinity TDS									# Containers
1	32%	3/21/13	0900	WATER	X	X									2
2	42%	"	"	"	X	✓									2
3	56%	"	"	"	X	✓									2
4	75%	"	"	"	X	X									2
5	100%	"	"	"	X	X									2

RELINQUISHED BY: (Signature) Bruce Huther Date 3/22/13 1300 Time

RECEIVED BY: (Signature) Shawn Worm Date 3/23/13 Time: 0900

METHOD OF SHIPMENT: FED EX

ADDITIONAL COMMENTS: Hard: HNO_3

Aspen Pat Dawsey, FTW

7993 4726 3530

AMERICAN INTERPLEX CORPORATION
LABORATORIES

FTN Associates, Ltd.
ATTN: Mr. Pat Downey
3 Innwood Circle, Suite 220
Little Rock, AR 72211

This report contains the analytical results and supporting information for samples submitted on March 23, 2013. Attached please find a copy of the Chain of Custody and/or other documents received. Note that any remaining sample will be discarded two weeks from the original report date unless other arrangements are made.

This report is intended for the sole use of the client listed above. Assessment of the data requires access to the entire document.

This report has been reviewed by the Laboratory Director or a qualified designee.

John Overbey
Laboratory Director

This document has been distributed to the following:

PDF cc: FTN Associates, Ltd.
ATTN: Mr. Pat Downey
pjd@ftn-assoc.com

AMERICAN INTERPLEX CORPORATION
LABORATORIES

FTN Associates, Ltd.
3 Innwood Circle, Suite 220
Little Rock, AR 72211

SAMPLE INFORMATION

Project Description:
Five (5) water sample(s) received on March 23, 2013
Huther
20791
RR Hwy 41
Day 3

Receipt Details:
A Chain of Custody was provided. The samples were delivered in one (1) ice chest.
Ice chest #1 was delivered with shipping documentation.

Each sample container was checked for proper labeling, including date and time sampled. Sample containers were reviewed for proper type, adequate volume, integrity, temperature, preservation, and holding times. Any exceptions are noted below:

Sample Identification:

Laboratory ID	Client Sample ID	Sampled Date/Time	Notes
165980-1	32% 3/22/13 0900	22-Mar-2013 0900	
165980-2	42% 3/22/13 0900	22-Mar-2013 0900	
165980-3	56% 3/22/13 0900	22-Mar-2013 0900	
165980-4	75% 3/22/13 0900	22-Mar-2013 0900	
165980-5	100% 3/22/13 0900	22-Mar-2013 0900	

Qualifiers:
D Result is from a secondary dilution factor

References:
"Methods for Chemical Analysis of Water and Wastes", EPA/600/4-79-020 (Mar 1983) with updates and supplements EPA/600/5-91-010 (Jun 1991), EPA/600/R-92-129 (Aug 1992) and EPA/600/R-93-100 (Aug 1993).
"Test Methods for Evaluating Solid Waste Physical/Chemical Methods (SW846)", Third Edition.
"Standard Methods for the Examination of Water and Wastewaters", 21st edition.
"American Society for Testing and Materials" (ASTM).
"Association of Analytical Chemists" (AOAC).

AMERICAN INTERPLEX CORPORATION
LABORATORIES

FTN Associates, Ltd.
3 Innwood Circle, Suite 220
Little Rock, AR 72211

ANALYTICAL RESULTS

AIC No. 165980-1
Sample Identification: 32% 3/22/13 0900

Analyte		Result	RL	Units	Qualifier
Alkalinity as CaCO3		**120**	1	**mg/l**	
SM 2320 B		Analyzed: 26-Mar-2013 0836 by 302		Batch: W43003	
Total Dissolved Solids		**1000**	10	**mg/l**	
SM 2540 C	Prep: 27-Mar-2013 1640 by 285	Analyzed: 28-Mar-2013 1155 by 285		Batch: W43026	
Chloride		**280**	2	**mg/l**	D
EPA 300.0	Prep: 25-Mar-2013 1135 by 07	Analyzed: 25-Mar-2013 2001 by 07		Batch: S34268	Dil: 10
Sulfate		**320**	2	**mg/l**	D
EPA 300.0	Prep: 25-Mar-2013 1135 by 07	Analyzed: 25-Mar-2013 2001 by 07		Batch: S34268	Dil: 10
Hardness as CaCO3		**410**	1	**mg/l**	
SM 2340 B	Prep: 25-Mar-2013 1452 by 271	Analyzed: 26-Mar-2013 1537 by 305		Batch: S34271	

AIC No. 165980-2
Sample Identification: 42% 3/22/13 0900

Analyte		Result	RL	Units	Qualifier
Alkalinity as CaCO3		**110**	1	**mg/l**	
SM 2320 B		Analyzed: 26-Mar-2013 0836 by 302		Batch: W43003	
Total Dissolved Solids		**1200**	10	**mg/l**	
SM 2540 C	Prep: 27-Mar-2013 1640 by 285	Analyzed: 28-Mar-2013 1155 by 285		Batch: W43026	
Chloride		**370**	2	**mg/l**	D
EPA 300.0	Prep: 25-Mar-2013 1135 by 07	Analyzed: 25-Mar-2013 2027 by 07		Batch: S34268	Dil: 10
Sulfate		**400**	2	**mg/l**	D
EPA 300.0	Prep: 25-Mar-2013 1135 by 07	Analyzed: 25-Mar-2013 2027 by 07		Batch: S34268	Dil: 10
Hardness as CaCO3		**430**	1	**mg/l**	
SM 2340 B	Prep: 25-Mar-2013 1452 by 271	Analyzed: 26-Mar-2013 1541 by 305		Batch: S34271	

AIC No. 165980-3
Sample Identification: 56% 3/22/13 0900

Analyte		Result	RL	Units	Qualifier
Alkalinity as CaCO3		**100**	1	**mg/l**	
SM 2320 B		Analyzed: 26-Mar-2013 0836 by 302		Batch: W43003	
Total Dissolved Solids		**1500**	10	**mg/l**	
SM 2540 C	Prep: 27-Mar-2013 1640 by 285	Analyzed: 28-Mar-2013 1155 by 285		Batch: W43026	
Chloride		**450**	2	**mg/l**	D
EPA 300.0	Prep: 25-Mar-2013 1135 by 07	Analyzed: 25-Mar-2013 2053 by 07		Batch: S34268	Dil: 10
Sulfate		**480**	20	**mg/l**	D
EPA 300.0	Prep: 25-Mar-2013 1135 by 07	Analyzed: 27-Mar-2013 0234 by 07		Batch: S34268	Dil: 100
Hardness as CaCO3		**550**	1	**mg/l**	
SM 2340 B	Prep: 25-Mar-2013 1452 by 271	Analyzed: 26-Mar-2013 1546 by 305		Batch: S34271	

AMERICAN INTERPLEX CORPORATION
LABORATORIES

FTN Associates, Ltd.
3 Innwood Circle, Suite 220
Little Rock, AR 72211

ANALYTICAL RESULTS

AIC No. 165980-4
Sample Identification: 75% 3/22/13 0900

Analyte		Result	RL	Units	Qualifier
Alkalinity as CaCO3		**90**	1	**mg/l**	
SM 2320 B		Analyzed: 26-Mar-2013 0836 by 302		Batch: W43003	
Total Dissolved Solids		**1800**	20	**mg/l**	
SM 2540 C	Prep: 27-Mar-2013 1640 by 285	Analyzed: 28-Mar-2013 1155 by 285		Batch: W43026	
Chloride		**530**	20	**mg/l**	D
EPA 300.0	Prep: 25-Mar-2013 1135 by 07	Analyzed: 25-Mar-2013 2118 by 07		Batch: S34268	Dil: 100
Sulfate		**650**	20	**mg/l**	D
EPA 300.0	Prep: 25-Mar-2013 1135 by 07	Analyzed: 25-Mar-2013 2118 by 07		Batch: S34268	Dil: 100
Hardness as CaCO3		**630**	1	**mg/l**	
SM 2340 B	Prep: 25-Mar-2013 1452 by 271	Analyzed: 26-Mar-2013 1550 by 305		Batch: S34271	

AIC No. 165980-5
Sample Identification: 100% 3/22/13 0900

Analyte		Result	RL	Units	Qualifier
Alkalinity as CaCO3		**89**	1	**mg/l**	
SM 2320 B		Analyzed: 26-Mar-2013 0836 by 302		Batch: W43003	
Total Dissolved Solids		**2300**	20	**mg/l**	
SM 2540 C	Prep: 27-Mar-2013 1640 by 285	Analyzed: 28-Mar-2013 1155 by 285		Batch: W43026	
Chloride		**670**	20	**mg/l**	D
EPA 300.0	Prep: 25-Mar-2013 1135 by 07	Analyzed: 25-Mar-2013 2144 by 07		Batch: S34268	Dil: 100
Sulfate		**810**	20	**mg/l**	D
EPA 300.0	Prep: 25-Mar-2013 1135 by 07	Analyzed: 25-Mar-2013 2144 by 07		Batch: S34268	Dil: 100
Hardness as CaCO3		**770**	1	**mg/l**	
SM 2340 B	Prep: 25-Mar-2013 1452 by 271	Analyzed: 26-Mar-2013 1554 by 305		Batch: S34271	

AMERICAN INTERPLEX CORPORATION
LABORATORIES

FTN Associates, Ltd.
3 Innwood Circle, Suite 220
Little Rock, AR 72211

DUPLICATE RESULTS

Analyte		AIC No.	Result	RPD	RPD Limit	Preparation Date	Analysis Date	Dil	Qual
Alkalinity as CaCO3		165978-1	120 mg/l				26Mar13 0836 by 302		
	Batch: W43003	Duplicate	120 mg/l	0.858	20.0		26Mar13 0836 by 302		
Total Dissolved Solids		166037-1	33 mg/l			27Mar13 1640 by 285	28Mar13 1155 by 285		
	Batch: W43026	Duplicate	30 mg/l	9.52	10.0	27Mar13 1641 by 285	28Mar13 1155 by 285		
Total Dissolved Solids		166037-2	35 mg/l			27Mar13 1640 by 285	28Mar13 1155 by 285		
	Batch: W43026	Duplicate	36 mg/l	2.82	10.0	27Mar13 1641 by 285	28Mar13 1155 by 285		

LABORATORY CONTROL SAMPLE RESULTS

Analyte	Spike Amount	%	Limits	RPD	Limit	Batch	Preparation Date	Analysis Date	Dil	Qual
Chloride	20 mg/l	97.9	90.0-110			S34268	25Mar13 1135 by 07	25Mar13 1219 by 07		
Sulfate	20 mg/l	98.7	90.0-110			S34268	25Mar13 1135 by 07	25Mar13 1219 by 07		

MATRIX SPIKE SAMPLE RESULTS

Analyte	Sample	Spike Amount	%	Limits	Batch	Preparation Date	Analysis Date	Dil	Qual
Chloride	165978-1	20 mg/l	92.0	80.0-120	S34268	25Mar13 1135 by 07	25Mar13 1245 by 07		
	165978-1	20 mg/l	93.8	80.0-120	S34268	25Mar13 1135 by 07	25Mar13 1311 by 07		
	Relative Percent Difference:		1.26	10.0	S34268				
Sulfate	165978-1	20 mg/l	94.7	80.0-120	S34268	25Mar13 1135 by 07	25Mar13 1245 by 07		
	165978-1	20 mg/l	97.2	80.0-120	S34268	25Mar13 1135 by 07	25Mar13 1311 by 07		
	Relative Percent Difference:		1.89	10.0	S34268				

LABORATORY BLANK RESULTS

Analyte	Result	RL	PQL	QC Sample	Preparation Date	Analysis Date	Qual
Alkalinity as CaCO3	< 1 mg/l	1	1	W43003-1		26Mar13 0836 by 302	
Total Dissolved Solids	< 10 mg/l	10	10	W43026-1	27Mar13 1641 by 285	28Mar13 1155 by 285	
Chloride	< 0.2 mg/l	0.2	0.2	S34268-1	25Mar13 1135 by 07	25Mar13 1153 by 07	
Sulfate	< 0.2 mg/l	0.2	0.2	S34268-1	25Mar13 1135 by 07	25Mar13 1153 by 07	

HUTHER & ASSOCIATES, INC.

1156 North Bonnie Brae
Denton, Texas 76201
Phone: (940) 387-1025 Fax: (940) 387-1036

165980

Company Name: HUTHER
Address:
Contact: BRUCE
Phone #: (940) 387-1025

Project #: 20791
P.O.#:
Project Name: RR HWY 4 - DAY 3

ANALYTICAL CHAIN-OF-CUSTODY

Sample Description	Date	Time	Matrix	HARDNESS	Chloride Sulfate Alkalinity TDS										# Containers
32%	3/22/13	0900	WATER	X	X										2
42%				X	X										2
56%				X	X										2
75%				X	X										2
100%				X	X										2

PARAMETERS FOR ANALYSIS

RELINQUISHED BY: (Signature) Bruce Huther Date 3/22/13 1300 Time

RECEIVED BY: (Signature) Shawn Worm Date 3/23/13 Time: 0900

METHOD OF SHIPMENT: FED EX

ADDITIONAL COMMENTS: Hard: HNO_3

Acct per Pat Dawney, FTN

7993 4726 3538

2°C

AMERICAN INTERPLEX CORPORATION
LABORATORIES

FTN Associates, Ltd.
ATTN: Mr. Pat Downey
3 Innwood Circle, Suite 220
Little Rock, AR 72211

This report contains the analytical results and supporting information for samples submitted on March 27, 2013. Attached please find a copy of the Chain of Custody and/or other documents received. Note that any remaining sample will be discarded two weeks from the original report date unless other arrangements are made.

This report is intended for the sole use of the client listed above. Assessment of the data requires access to the entire document.

This report has been reviewed by the Laboratory Director or a qualified designee.

John Overbey
Laboratory Director

This document has been distributed to the following:

PDF cc: FTN Associates, Ltd.
ATTN: Mr. Pat Downey
pjd@ftn-assoc.com

AMERICAN INTERPLEX CORPORATION
LABORATORIES

FTN Associates, Ltd.
3 Innwood Circle, Suite 220
Little Rock, AR 72211

SAMPLE INFORMATION

Project Description:
Five (5) water sample(s) received on March 27, 2013
Huther & Associates, Inc.
20791
RR Hwy 41-2Day 4

Receipt Details:
A Chain of Custody was provided. The samples were delivered in one (1) ice chest.
Ice chest #1 was delivered with shipping documentation.

Each sample container was checked for proper labeling, including date and time sampled. Sample containers were reviewed for proper type, adequate volume, integrity, temperature, preservation, and holding times. Any exceptions are noted below:

Sample Identification:

Laboratory ID	Client Sample ID	Sampled Date/Time	Notes
166020-1	32% 3/23/13 0900	23-Mar-2013 0900	
166020-2	42% 3/23/13 0900	23-Mar-2013 0900	
166020-3	56% 3/23/13 0900	23-Mar-2013 0900	
166020-4	75% 3/23/13 0900	23-Mar-2013 0900	
166020-5	100% 3/23/13 0900	23-Mar-2013 0900	

Qualifiers:
D Result is from a secondary dilution factor

References:
"Methods for Chemical Analysis of Water and Wastes", EPA/600/4-79-020 (Mar 1983) with updates and supplements EPA/600/5-91-010 (Jun 1991), EPA/600/R-92-129 (Aug 1992) and EPA/600/R-93-100 (Aug 1993).
"Test Methods for Evaluating Solid Waste Physical/Chemical Methods (SW846)", Third Edition.
"Standard Methods for the Examination of Water and Wastewaters", 21st edition.
"American Society for Testing and Materials" (ASTM).
"Association of Analytical Chemists" (AOAC).

AMERICAN INTERPLEX CORPORATION
LABORATORIES

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3 Innwood Circle, Suite 220
Little Rock, AR 72211

ANALYTICAL RESULTS

AIC No. 166020-1
Sample Identification: 32% 3/23/13 0900

Analyte		Result	RL	Units	Qualifier
Alkalinity as CaCO3		**160**	1	**mg/l**	
SM 2320 B		Analyzed: 27-Mar-2013 1307 by 302		Batch: W43020	
Total Dissolved Solids		**1100**	10	**mg/l**	
SM 2540 C	Prep: 28-Mar-2013 1629 by 285	Analyzed: 29-Mar-2013 1529 by 285		Batch: W43043	
Chloride		**300**	2	**mg/l**	D
EPA 300.0	Prep: 27-Mar-2013 1347 by 07	Analyzed: 27-Mar-2013 1808 by 07		Batch: S34290	Dil: 10
Sulfate		**340**	2	**mg/l**	D
EPA 300.0	Prep: 27-Mar-2013 1347 by 07	Analyzed: 27-Mar-2013 1808 by 07		Batch: S34290	Dil: 10
Hardness as CaCO3		**430**	5	**mg/l**	D
SM 2340 B	Prep: 27-Mar-2013 1138 by 271	Analyzed: 27-Mar-2013 1410 by 305		Batch: S34289	Dil: 5

AIC No. 166020-2
Sample Identification: 42% 3/23/13 0900

Analyte		Result	RL	Units	Qualifier
Alkalinity as CaCO3		**130**	1	**mg/l**	
SM 2320 B		Analyzed: 27-Mar-2013 1307 by 302		Batch: W43020	
Total Dissolved Solids		**1100**	10	**mg/l**	
SM 2540 C	Prep: 28-Mar-2013 1629 by 285	Analyzed: 29-Mar-2013 1529 by 285		Batch: W43043	
Chloride		**320**	2	**mg/l**	D
EPA 300.0	Prep: 27-Mar-2013 1347 by 07	Analyzed: 27-Mar-2013 1834 by 07		Batch: S34290	Dil: 10
Sulfate		**370**	2	**mg/l**	D
EPA 300.0	Prep: 27-Mar-2013 1347 by 07	Analyzed: 27-Mar-2013 1834 by 07		Batch: S34290	Dil: 10
Hardness as CaCO3		**420**	5	**mg/l**	D
SM 2340 B	Prep: 27-Mar-2013 1138 by 271	Analyzed: 27-Mar-2013 1414 by 305		Batch: S34289	Dil: 5

AIC No. 166020-3
Sample Identification: 56% 3/23/13 0900

Analyte		Result	RL	Units	Qualifier
Alkalinity as CaCO3		**130**	1	**mg/l**	
SM 2320 B		Analyzed: 27-Mar-2013 1307 by 302		Batch: W43020	
Total Dissolved Solids		**1500**	10	**mg/l**	
SM 2540 C	Prep: 28-Mar-2013 1629 by 285	Analyzed: 29-Mar-2013 1529 by 285		Batch: W43043	
Chloride		**400**	2	**mg/l**	D
EPA 300.0	Prep: 27-Mar-2013 1347 by 07	Analyzed: 27-Mar-2013 1900 by 07		Batch: S34290	Dil: 10
Sulfate		**470**	2	**mg/l**	D
EPA 300.0	Prep: 27-Mar-2013 1347 by 07	Analyzed: 27-Mar-2013 1900 by 07		Batch: S34290	Dil: 10
Hardness as CaCO3		**510**	5	**mg/l**	D
SM 2340 B	Prep: 27-Mar-2013 1138 by 271	Analyzed: 27-Mar-2013 1419 by 305		Batch: S34289	Dil: 5

AMERICAN INTERPLEX CORPORATION
LABORATORIES

FTN Associates, Ltd.
3 Innwood Circle, Suite 220
Little Rock, AR 72211

ANALYTICAL RESULTS

AIC No. 166020-4
Sample Identification: 75% 3/23/13 0900

Analyte		Result	RL	Units	Qualifier
Alkalinity as CaCO3		**120**	1	**mg/l**	
SM 2320 B		Analyzed: 27-Mar-2013 1307 by 302		Batch: W43020	
Total Dissolved Solids		**1900**	20	**mg/l**	
SM 2540 C	Prep: 28-Mar-2013 1629 by 285	Analyzed: 29-Mar-2013 1529 by 285		Batch: W43043	
Chloride		**500**	20	**mg/l**	D
EPA 300.0	Prep: 27-Mar-2013 1347 by 07	Analyzed: 27-Mar-2013 1926 by 07		Batch: S34290	Dil: 100
Sulfate		**600**	20	**mg/l**	D
EPA 300.0	Prep: 27-Mar-2013 1347 by 07	Analyzed: 27-Mar-2013 1926 by 07		Batch: S34290	Dil: 100
Hardness as CaCO3		**600**	5	**mg/l**	D
SM 2340 B	Prep: 27-Mar-2013 1138 by 271	Analyzed: 27-Mar-2013 1424 by 305		Batch: S34289	Dil: 5

AIC No. 166020-5
Sample Identification: 100% 3/23/13 0900

Analyte		Result	RL	Units	Qualifier
Alkalinity as CaCO3		**120**	1	**mg/l**	
SM 2320 B		Analyzed: 27-Mar-2013 1307 by 302		Batch: W43020	
Total Dissolved Solids		**2400**	20	**mg/l**	
SM 2540 C	Prep: 28-Mar-2013 1629 by 285	Analyzed: 29-Mar-2013 1529 by 285		Batch: W43043	
Chloride		**650**	20	**mg/l**	D
EPA 300.0	Prep: 27-Mar-2013 1347 by 07	Analyzed: 27-Mar-2013 1952 by 07		Batch: S34290	Dil: 100
Sulfate		**780**	20	**mg/l**	D
EPA 300.0	Prep: 27-Mar-2013 1347 by 07	Analyzed: 27-Mar-2013 1952 by 07		Batch: S34290	Dil: 100
Hardness as CaCO3		**760**	5	**mg/l**	D
SM 2340 B	Prep: 27-Mar-2013 1138 by 271	Analyzed: 27-Mar-2013 1429 by 305		Batch: S34289	Dil: 5

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Little Rock, AR 72211

DUPLICATE RESULTS

Analyte		AIC No.	Result	RPD	RPD Limit	Preparation Date	Analysis Date	Dil	Qual
Alkalinity as CaCO3		166020-1	160 mg/l				27Mar13 1307 by 302		
	Batch: W43020	Duplicate	160 mg/l	1.24	20.0		27Mar13 1307 by 302		
Total Dissolved Solids		166020-1	1100 mg/l			28Mar13 1629 by 285	29Mar13 1529 by 285		
	Batch: W43043	Duplicate	1100 mg/l	0.00	10.0	28Mar13 1629 by 285	29Mar13 1529 by 285		
Total Dissolved Solids		166020-2	1100 mg/l			28Mar13 1629 by 285	29Mar13 1529 by 285		
	Batch: W43043	Duplicate	1200 mg/l	8.41	10.0	28Mar13 1629 by 285	29Mar13 1529 by 285		

LABORATORY CONTROL SAMPLE RESULTS

Analyte	Spike Amount	%	Limits	RPD	Limit	Batch	Preparation Date	Analysis Date	Dil	Qual
Chloride	20 mg/l	95.9	90.0-110			S34290	27Mar13 1348 by 07	27Mar13 1433 by 07		
Sulfate	20 mg/l	97.2	90.0-110			S34290	27Mar13 1348 by 07	27Mar13 1433 by 07		

MATRIX SPIKE SAMPLE RESULTS

Analyte	Sample	Spike Amount	%	Limits	Batch	Preparation Date	Analysis Date	Dil	Qual
Chloride	166020-1	20 mg/l	92.8	80.0-120	S34290	27Mar13 1348 by 07	27Mar13 1651 by 07		
	166020-1	20 mg/l	98.6	80.0-120	S34290	27Mar13 1348 by 07	27Mar13 1717 by 07		
	Relative Percent Difference:		5.24	10.0	S34290				
Sulfate	166020-1	20 mg/l	94.7	80.0-120	S34290	27Mar13 1348 by 07	27Mar13 1651 by 07		
	166020-1	20 mg/l	96.1	80.0-120	S34290	27Mar13 1348 by 07	27Mar13 1717 by 07		
	Relative Percent Difference:		1.30	10.0	S34290				

LABORATORY BLANK RESULTS

Analyte	Result	RL	PQL	QC Sample	Preparation Date	Analysis Date	Qual
Alkalinity as CaCO3	< 1 mg/l	1	1	W43020-1		27Mar13 1307 by 302	
Total Dissolved Solids	< 10 mg/l	10	10	W43043-1	28Mar13 1629 by 285	29Mar13 1529 by 285	
Chloride	< 0.2 mg/l	0.2	0.2	S34290-1	27Mar13 1348 by 07	27Mar13 1407 by 07	
Sulfate	< 0.2 mg/l	0.2	0.2	S34290-1	27Mar13 1348 by 07	27Mar13 1407 by 07	

166020

HUTHER & ASSOCIATES, INC.

1156 North Bonnie Brae
Denton, Texas 76201
Phone: (940) 387-1025 Fax: (940) 387-1036

ANALYTICAL CHAIN-OF-CUSTODY

Company Name: HUTHER
Address:
Contact: BRUCE
Phone #: (940) 387-1025

Project #: 20791 | P.O.#: | Project Name: RR HWY 41 - PAY 4

PARAMETERS FOR ANALYSIS

	Sample Description	Date	Time	Matrix	HARDNESS	CHLORIDE SULFATE ALKALINITY TDS										# Containers
1	32%	3/23/13	0900		X	X										2
2	42%				X	X										2
3	56%				X	X										2
4	75%				X	X										2
5	100%				X	X										2

RELINQUISHED BY: (Signature) Bruce Huther Date 3/26/13 Time 1400

RECEIVED BY: (Signature) Inga Hampton Date 3-27-13 Time: 0900

METHOD OF SHIPMENT: FED EX

ADDITIONAL COMMENTS: Need: HNO_3

AC PICK UP AT DOWNEY FTH

Fed-X (2.1°C) 7993 4774 4157

AMERICAN INTERPLEX CORPORATION
LABORATORIES

FTN Associates, Ltd.
ATTN: Mr. Pat Downey
3 Innwood Circle, Suite 220
Little Rock, AR 72211

This report contains the analytical results and supporting information for samples submitted on March 27, 2013. Attached please find a copy of the Chain of Custody and/or other documents received. Note that any remaining sample will be discarded two weeks from the original report date unless other arrangements are made.

This report is intended for the sole use of the client listed above. Assessment of the data requires access to the entire document.

This report has been reviewed by the Laboratory Director or a qualified designee.

John Overbey
Laboratory Director

This document has been distributed to the following:

PDF cc: FTN Associates, Ltd.
ATTN: Mr. Pat Downey
pjd@ftn-assoc.com

AMERICAN INTERPLEX CORPORATION
LABORATORIES

FTN Associates, Ltd.
3 Innwood Circle, Suite 220
Little Rock, AR 72211

SAMPLE INFORMATION

Project Description:
Five (5) water sample(s) received on March 27, 2013
Huther & Associates, Inc.
20791
RR Hwy 41-Day 5

Receipt Details:
A Chain of Custody was provided. The samples were delivered in one (1) ice chest.
Ice chest #1 was delivered with shipping documentation.

Each sample container was checked for proper labeling, including date and time sampled. Sample containers were reviewed for proper type, adequate volume, integrity, temperature, preservation, and holding times. Any exceptions are noted below:

Sample Identification:

Laboratory ID	Client Sample ID	Sampled Date/Time	Notes
166021-1	32% 3/24/13 0900	24-Mar-2013 0900	
166021-2	42% 3/24/13 0900	24-Mar-2013 0900	
166021-3	56% 3/24/13 0900	24-Mar-2013 0900	
166021-4	75% 3/24/13 0900	24-Mar-2013 0900	
166021-5	100% 3/24/13 0900	24-Mar-2013 0900	

Qualifiers:
D Result is from a secondary dilution factor

References:
"Methods for Chemical Analysis of Water and Wastes", EPA/600/4-79-020 (Mar 1983) with updates and supplements EPA/600/5-91-010 (Jun 1991), EPA/600/R-92-129 (Aug 1992) and EPA/600/R-93-100 (Aug 1993).
"Test Methods for Evaluating Solid Waste Physical/Chemical Methods (SW846)", Third Edition.
"Standard Methods for the Examination of Water and Wastewaters", 21st edition.
"American Society for Testing and Materials" (ASTM).
"Association of Analytical Chemists" (AOAC).

AMERICAN INTERPLEX CORPORATION
LABORATORIES

FTN Associates, Ltd.
3 Innwood Circle, Suite 220
Little Rock, AR 72211

ANALYTICAL RESULTS

AIC No. 166021-1
Sample Identification: 32% 3/24/13 0900

Analyte		Result	RL	Units	Qualifier
Alkalinity as CaCO3		**190**	1	**mg/l**	
SM 2320 B		Analyzed: 27-Mar-2013 1307 by 302		Batch: W43020	
Total Dissolved Solids		**1100**	10	**mg/l**	
SM 2540 C	Prep: 28-Mar-2013 1629 by 285	Analyzed: 29-Mar-2013 1529 by 285		Batch: W43043	
Chloride		**280**	2	**mg/l**	D
EPA 300.0	Prep: 27-Mar-2013 1347 by 07	Analyzed: 27-Mar-2013 2135 by 07		Batch: S34290	Dil: 10
Sulfate		**310**	2	**mg/l**	D
EPA 300.0	Prep: 27-Mar-2013 1347 by 07	Analyzed: 27-Mar-2013 2135 by 07		Batch: S34290	Dil: 10
Hardness as CaCO3		**470**	5	**mg/l**	D
SM 2340 B	Prep: 27-Mar-2013 1138 by 271	Analyzed: 27-Mar-2013 1434 by 305		Batch: S34289	Dil: 5

AIC No. 166021-2
Sample Identification: 42% 3/24/13 0900

Analyte		Result	RL	Units	Qualifier
Alkalinity as CaCO3		**160**	1	**mg/l**	
SM 2320 B		Analyzed: 27-Mar-2013 1307 by 302		Batch: W43020	
Total Dissolved Solids		**1200**	10	**mg/l**	
SM 2540 C	Prep: 28-Mar-2013 1629 by 285	Analyzed: 29-Mar-2013 1529 by 285		Batch: W43043	
Chloride		**320**	2	**mg/l**	D
EPA 300.0	Prep: 27-Mar-2013 1347 by 07	Analyzed: 27-Mar-2013 2201 by 07		Batch: S34290	Dil: 10
Sulfate		**370**	2	**mg/l**	D
EPA 300.0	Prep: 27-Mar-2013 1347 by 07	Analyzed: 27-Mar-2013 2201 by 07		Batch: S34290	Dil: 10
Hardness as CaCO3		**490**	5	**mg/l**	D
SM 2340 B	Prep: 27-Mar-2013 1138 by 271	Analyzed: 27-Mar-2013 1457 by 305		Batch: S34289	Dil: 5

AIC No. 166021-3
Sample Identification: 56% 3/24/13 0900

Analyte		Result	RL	Units	Qualifier
Alkalinity as CaCO3		**150**	1	**mg/l**	
SM 2320 B		Analyzed: 27-Mar-2013 1307 by 302		Batch: W43020	
Total Dissolved Solids		**1300**	10	**mg/l**	
SM 2540 C	Prep: 28-Mar-2013 1629 by 285	Analyzed: 29-Mar-2013 1529 by 285		Batch: W43043	
Chloride		**380**	2	**mg/l**	D
EPA 300.0	Prep: 27-Mar-2013 1347 by 07	Analyzed: 27-Mar-2013 2227 by 07		Batch: S34290	Dil: 10
Sulfate		**450**	2	**mg/l**	D
EPA 300.0	Prep: 27-Mar-2013 1347 by 07	Analyzed: 27-Mar-2013 2227 by 07		Batch: S34290	Dil: 10
Hardness as CaCO3		**530**	5	**mg/l**	D
SM 2340 B	Prep: 27-Mar-2013 1138 by 271	Analyzed: 27-Mar-2013 1501 by 305		Batch: S34289	Dil: 5

AMERICAN INTERPLEX CORPORATION
LABORATORIES

FTN Associates, Ltd.
3 Innwood Circle, Suite 220
Little Rock, AR 72211

ANALYTICAL RESULTS

AIC No. 166021-4
Sample Identification: 75% 3/24/13 0900

Analyte		Result	RL	Units	Qualifier
Alkalinity as CaCO3 SM 2320 B		**150** Analyzed: 27-Mar-2013 1307 by 302	1	**mg/l** Batch: W43020	
Total Dissolved Solids SM 2540 C	Prep: 28-Mar-2013 1629 by 285	**1900** Analyzed: 29-Mar-2013 1529 by 285	20	**mg/l** Batch: W43043	
Chloride EPA 300.0	Prep: 27-Mar-2013 1347 by 07	**510** Analyzed: 27-Mar-2013 2252 by 07	20	**mg/l** Batch: S34290	D Dil: 100
Sulfate EPA 300.0	Prep: 27-Mar-2013 1347 by 07	**620** Analyzed: 27-Mar-2013 2252 by 07	20	**mg/l** Batch: S34290	D Dil: 100
Hardness as CaCO3 SM 2340 B	Prep: 27-Mar-2013 1138 by 271	**630** Analyzed: 27-Mar-2013 1506 by 305	5	**mg/l** Batch: S34289	D Dil: 5

AIC No. 166021-5
Sample Identification: 100% 3/24/13 0900

Analyte		Result	RL	Units	Qualifier
Alkalinity as CaCO3 SM 2320 B		**150** Analyzed: 27-Mar-2013 1307 by 302	1	**mg/l** Batch: W43020	
Total Dissolved Solids SM 2540 C	Prep: 28-Mar-2013 1629 by 285	**2200** Analyzed: 29-Mar-2013 1529 by 285	20	**mg/l** Batch: W43043	
Chloride EPA 300.0	Prep: 27-Mar-2013 1347 by 07	**670** Analyzed: 27-Mar-2013 2318 by 07	20	**mg/l** Batch: S34290	D Dil: 100
Sulfate EPA 300.0	Prep: 27-Mar-2013 1347 by 07	**800** Analyzed: 27-Mar-2013 2318 by 07	20	**mg/l** Batch: S34290	D Dil: 100
Hardness as CaCO3 SM 2340 B	Prep: 27-Mar-2013 1138 by 271	**780** Analyzed: 27-Mar-2013 1511 by 305	5	**mg/l** Batch: S34289	D Dil: 5

AMERICAN INTERPLEX CORPORATION
LABORATORIES

FTN Associates, Ltd.
3 Innwood Circle, Suite 220
Little Rock, AR 72211

DUPLICATE RESULTS

Analyte		AIC No.	Result	RPD	RPD Limit	Preparation Date	Analysis Date	Dil	Qual
Alkalinity as CaCO3		166020-1	160 mg/l				27Mar13 1307 by 302		
	Batch: W43020	Duplicate	160 mg/l	1.24	20.0		27Mar13 1307 by 302		
Total Dissolved Solids		166020-1	1100 mg/l			28Mar13 1629 by 285	29Mar13 1529 by 285		
	Batch: W43043	Duplicate	1100 mg/l	0.00	10.0	28Mar13 1629 by 285	29Mar13 1529 by 285		
Total Dissolved Solids		166020-2	1100 mg/l			28Mar13 1629 by 285	29Mar13 1529 by 285		
	Batch: W43043	Duplicate	1200 mg/l	8.41	10.0	28Mar13 1629 by 285	29Mar13 1529 by 285		

LABORATORY CONTROL SAMPLE RESULTS

Analyte	Spike Amount	%	Limits	RPD	Limit	Batch	Preparation Date	Analysis Date	Dil	Qual
Chloride	20 mg/l	95.9	90.0-110			S34290	27Mar13 1348 by 07	27Mar13 1433 by 07		
Sulfate	20 mg/l	97.2	90.0-110			S34290	27Mar13 1348 by 07	27Mar13 1433 by 07		

MATRIX SPIKE SAMPLE RESULTS

Analyte	Sample	Spike Amount	%	Limits	Batch	Preparation Date	Analysis Date	Dil	Qual
Chloride	166020-1	20 mg/l	92.8	80.0-120	S34290	27Mar13 1348 by 07	27Mar13 1651 by 07		
	166020-1	20 mg/l	98.6	80.0-120	S34290	27Mar13 1348 by 07	27Mar13 1717 by 07		
	Relative Percent Difference:		5.24	10.0	S34290				
Sulfate	166020-1	20 mg/l	94.7	80.0-120	S34290	27Mar13 1348 by 07	27Mar13 1651 by 07		
	166020-1	20 mg/l	96.1	80.0-120	S34290	27Mar13 1348 by 07	27Mar13 1717 by 07		
	Relative Percent Difference:		1.30	10.0	S34290				

LABORATORY BLANK RESULTS

Analyte	Result	RL	PQL	QC Sample	Preparation Date	Analysis Date	Qual
Alkalinity as CaCO3	< 1 mg/l	1	1	W43020-1		27Mar13 1307 by 302	
Total Dissolved Solids	< 10 mg/l	10	10	W43043-1	28Mar13 1629 by 285	29Mar13 1529 by 285	
Chloride	< 0.2 mg/l	0.2	0.2	S34290-1	27Mar13 1348 by 07	27Mar13 1407 by 07	
Sulfate	< 0.2 mg/l	0.2	0.2	S34290-1	27Mar13 1348 by 07	27Mar13 1407 by 07	

166021

HUTHER & ASSOCIATES, INC.

1156 North Bonnie Brae
Denton, Texas 76201
Phone: (940) 387-1025 Fax: (940) 387-1036

ANALYTICAL CHAIN-OF-CUSTODY

Company Name: HUTHER
Address:
Contact: BRUCE
Phone #: (940) 387-1025

Project #: 20791 | P.O.#: | Project Name: RR HWY 41 - DAY 5

	Sample Description	Date	Time	Matrix	PARAMETERS FOR ANALYSIS: HARDNESS	Chloride Sulfate Alkalinity TDS										# Containers
1	32%	3/24/13	0900		X	X										2
2	42%				X	X										2
3	56%				X	X										2
4	75%				X	X										2
5	100%				X	X										2

RELINQUISHED BY: (Signature) Bruce Huther Date 3/26/13 Time 1400

RECEIVED BY: (Signature) Logan Hopton Date 3-27-13 Time: 0900

METHOD OF SHIPMENT: FED EX

ADDITIONAL COMMENTS: Hard: HNO_3

AS PER PAT DAUNEY, FTN

Fed-X (2.1°C) 7993 4774 4157

AMERICAN INTERPLEX CORPORATION
LABORATORIES

FTN Associates, Ltd.
ATTN: Mr. Pat Downey
3 Innwood Circle, Suite 220
Little Rock, AR 72211

This report contains the analytical results and supporting information for samples submitted on March 27, 2013. Attached please find a copy of the Chain of Custody and/or other documents received. Note that any remaining sample will be discarded two weeks from the original report date unless other arrangements are made.

This report is intended for the sole use of the client listed above. Assessment of the data requires access to the entire document.

This report has been reviewed by the Laboratory Director or a qualified designee.

John Overbey
Laboratory Director

This document has been distributed to the following:

PDF cc: FTN Associates, Ltd.
ATTN: Mr. Pat Downey
pjd@ftn-assoc.com

AMERICAN INTERPLEX CORPORATION
LABORATORIES

FTN Associates, Ltd.
3 Innwood Circle, Suite 220
Little Rock, AR 72211

SAMPLE INFORMATION

Project Description:
Five (5) water sample(s) received on March 27, 2013
Huther & Associates, Inc.
20791
RR Hwy 41-Day 6

Receipt Details:
A Chain of Custody was provided. The samples were delivered in one (1) ice chest.
Ice chest #1 was delivered with shipping documentation.

Each sample container was checked for proper labeling, including date and time sampled. Sample containers were reviewed for proper type, adequate volume, integrity, temperature, preservation, and holding times. Any exceptions are noted below:

Sample Identification:

Laboratory ID	Client Sample ID	Sampled Date/Time	Notes
166023-1	32% 3/25/13 0900	25-Mar-2013 0900	
166023-2	42% 3/25/13 0900	25-Mar-2013 0900	
166023-3	56% 3/25/13 0900	25-Mar-2013 0900	
166023-4	75% 3/25/13 0900	25-Mar-2013 0900	
166023-5	100% 3/25/13 0900	25-Mar-2013 0900	

Qualifiers:
D Result is from a secondary dilution factor

References:
"Methods for Chemical Analysis of Water and Wastes", EPA/600/4-79-020 (Mar 1983) with updates and supplements EPA/600/5-91-010 (Jun 1991), EPA/600/R-92-129 (Aug 1992) and EPA/600/R-93-100 (Aug 1993).
"Test Methods for Evaluating Solid Waste Physical/Chemical Methods (SW846)", Third Edition.
"Standard Methods for the Examination of Water and Wastewaters", 21st edition.
"American Society for Testing and Materials" (ASTM).
"Association of Analytical Chemists" (AOAC).

AMERICAN INTERPLEX CORPORATION
LABORATORIES

FTN Associates, Ltd.
3 Innwood Circle, Suite 220
Little Rock, AR 72211

ANALYTICAL RESULTS

AIC No. 166023-1
Sample Identification: 32% 3/25/13 0900

Analyte		Result	RL	Units	Qualifier
Alkalinity as CaCO3 SM 2320 B		**210** Analyzed: 27-Mar-2013 1307 by 302	1	mg/l Batch: W43020	
Total Dissolved Solids SM 2540 C	Prep: 28-Mar-2013 1629 by 285	**1100** Analyzed: 29-Mar-2013 1529 by 285	10	mg/l Batch: W43043	
Chloride EPA 300.0	Prep: 27-Mar-2013 1347 by 07	**280** Analyzed: 27-Mar-2013 2344 by 07	2	mg/l Batch: S34290	D Dil: 10
Sulfate EPA 300.0	Prep: 27-Mar-2013 1347 by 07	**320** Analyzed: 27-Mar-2013 2344 by 07	2	mg/l Batch: S34290	D Dil: 10
Hardness as CaCO3 SM 2340 B	Prep: 27-Mar-2013 1138 by 271	**470** Analyzed: 27-Mar-2013 1516 by 305	5	mg/l Batch: S34289	D Dil: 5

AIC No. 166023-2
Sample Identification: 42% 3/25/13 0900

Analyte		Result	RL	Units	Qualifier
Alkalinity as CaCO3 SM 2320 B		**150** Analyzed: 27-Mar-2013 1307 by 302	1	mg/l Batch: W43020	
Total Dissolved Solids SM 2540 C	Prep: 28-Mar-2013 1629 by 285	**1200** Analyzed: 29-Mar-2013 1529 by 285	10	mg/l Batch: W43043	
Chloride EPA 300.0	Prep: 27-Mar-2013 1347 by 07	**340** Analyzed: 28-Mar-2013 0010 by 07	2	mg/l Batch: S34290	D Dil: 10
Sulfate EPA 300.0	Prep: 27-Mar-2013 1347 by 07	**400** Analyzed: 28-Mar-2013 0010 by 07	2	mg/l Batch: S34290	D Dil: 10
Hardness as CaCO3 SM 2340 B	Prep: 27-Mar-2013 1138 by 271	**460** Analyzed: 27-Mar-2013 1521 by 305	5	mg/l Batch: S34289	D Dil: 5

AIC No. 166023-3
Sample Identification: 56% 3/25/13 0900

Analyte		Result	RL	Units	Qualifier
Alkalinity as CaCO3 SM 2320 B		**150** Analyzed: 27-Mar-2013 1307 by 302	1	mg/l Batch: W43020	
Total Dissolved Solids SM 2540 C	Prep: 28-Mar-2013 1629 by 285	**1500** Analyzed: 29-Mar-2013 1529 by 285	10	mg/l Batch: W43043	
Chloride EPA 300.0	Prep: 27-Mar-2013 1347 by 07	**420** Analyzed: 28-Mar-2013 0036 by 07	2	mg/l Batch: S34290	D Dil: 10
Sulfate EPA 300.0	Prep: 27-Mar-2013 1347 by 07	**500** Analyzed: 28-Mar-2013 0036 by 07	2	mg/l Batch: S34290	D Dil: 10
Hardness as CaCO3 SM 2340 B	Prep: 27-Mar-2013 1138 by 271	**550** Analyzed: 27-Mar-2013 1526 by 305	5	mg/l Batch: S34289	D Dil: 5

AMERICAN INTERPLEX CORPORATION
LABORATORIES

FTN Associates, Ltd.
3 Innwood Circle, Suite 220
Little Rock, AR 72211

ANALYTICAL RESULTS

AIC No. 166023-4
Sample Identification: 75% 3/25/13 0900

Analyte		Result	RL	Units	Qualifier
Alkalinity as CaCO3		**150**	1	**mg/l**	
SM 2320 B		Analyzed: 27-Mar-2013 1307 by 302		Batch: W43020	
Total Dissolved Solids		**1900**	20	**mg/l**	
SM 2540 C	Prep: 28-Mar-2013 1629 by 285	Analyzed: 29-Mar-2013 1529 by 285		Batch: W43043	
Chloride		**530**	20	**mg/l**	D
EPA 300.0	Prep: 27-Mar-2013 1347 by 07	Analyzed: 28-Mar-2013 0102 by 07		Batch: S34290	Dil: 100
Sulfate		**650**	20	**mg/l**	D
EPA 300.0	Prep: 27-Mar-2013 1347 by 07	Analyzed: 28-Mar-2013 0102 by 07		Batch: S34290	Dil: 100
Hardness as CaCO3		**620**	5	**mg/l**	D
SM 2340 B	Prep: 27-Mar-2013 1138 by 271	Analyzed: 27-Mar-2013 1531 by 305		Batch: S34289	Dil: 5

AIC No. 166023-5
Sample Identification: 100% 3/25/13 0900

Analyte		Result	RL	Units	Qualifier
Alkalinity as CaCO3		**120**	1	**mg/l**	
SM 2320 B		Analyzed: 27-Mar-2013 1307 by 302		Batch: W43020	
Total Dissolved Solids		**2400**	20	**mg/l**	
SM 2540 C	Prep: 28-Mar-2013 1629 by 285	Analyzed: 29-Mar-2013 1529 by 285		Batch: W43043	
Chloride		**680**	20	**mg/l**	D
EPA 300.0	Prep: 27-Mar-2013 1347 by 07	Analyzed: 28-Mar-2013 0127 by 07		Batch: S34290	Dil: 100
Sulfate		**820**	20	**mg/l**	D
EPA 300.0	Prep: 27-Mar-2013 1347 by 07	Analyzed: 28-Mar-2013 0127 by 07		Batch: S34290	Dil: 100
Hardness as CaCO3		**730**	5	**mg/l**	D
SM 2340 B	Prep: 27-Mar-2013 1138 by 271	Analyzed: 27-Mar-2013 1535 by 305		Batch: S34289	Dil: 5

AMERICAN INTERPLEX CORPORATION
LABORATORIES

FTN Associates, Ltd.
3 Innwood Circle, Suite 220
Little Rock, AR 72211

DUPLICATE RESULTS

Analyte		AIC No.	Result	RPD	RPD Limit	Preparation Date	Analysis Date	Dil	Qual
Alkalinity as CaCO3		166020-1	160 mg/l				27Mar13 1307 by 302		
	Batch: W43020	Duplicate	160 mg/l	1.24	20.0		27Mar13 1307 by 302		
Total Dissolved Solids		166020-1	1100 mg/l			28Mar13 1629 by 285	29Mar13 1529 by 285		
	Batch: W43043	Duplicate	1100 mg/l	0.00	10.0	28Mar13 1629 by 285	29Mar13 1529 by 285		
Total Dissolved Solids		166020-2	1100 mg/l			28Mar13 1629 by 285	29Mar13 1529 by 285		
	Batch: W43043	Duplicate	1200 mg/l	8.41	10.0	28Mar13 1629 by 285	29Mar13 1529 by 285		

LABORATORY CONTROL SAMPLE RESULTS

Analyte	Spike Amount	%	Limits	RPD	Limit	Batch	Preparation Date	Analysis Date	Dil	Qual
Chloride	20 mg/l	95.9	90.0-110			S34290	27Mar13 1348 by 07	27Mar13 1433 by 07		
Sulfate	20 mg/l	97.2	90.0-110			S34290	27Mar13 1348 by 07	27Mar13 1433 by 07		

MATRIX SPIKE SAMPLE RESULTS

Analyte	Sample	Spike Amount	%	Limits	Batch	Preparation Date	Analysis Date	Dil	Qual
Chloride	166020-1	20 mg/l	92.8	80.0-120	S34290	27Mar13 1348 by 07	27Mar13 1651 by 07		
	166020-1	20 mg/l	98.6	80.0-120	S34290	27Mar13 1348 by 07	27Mar13 1717 by 07		
	Relative Percent Difference:		5.24	10.0	S34290				
Sulfate	166020-1	20 mg/l	94.7	80.0-120	S34290	27Mar13 1348 by 07	27Mar13 1651 by 07		
	166020-1	20 mg/l	96.1	80.0-120	S34290	27Mar13 1348 by 07	27Mar13 1717 by 07		
	Relative Percent Difference:		1.30	10.0	S34290				

LABORATORY BLANK RESULTS

Analyte	Result	RL	PQL	QC Sample	Preparation Date	Analysis Date	Qual
Alkalinity as CaCO3	< 1 mg/l	1	1	W43020-1		27Mar13 1307 by 302	
Total Dissolved Solids	< 10 mg/l	10	10	W43043-1	28Mar13 1629 by 285	29Mar13 1529 by 285	
Chloride	< 0.2 mg/l	0.2	0.2	S34290-1	27Mar13 1348 by 07	27Mar13 1407 by 07	
Sulfate	< 0.2 mg/l	0.2	0.2	S34290-1	27Mar13 1348 by 07	27Mar13 1407 by 07	

166023

HUTHER & ASSOCIATES, INC.

1156 North Bonnie Brae
Denton, Texas 76201
Phone: (940) 387-1025 Fax: (940) 387-1036

ANALYTICAL CHAIN-OF-CUSTODY

Company Name: HUTHER
Address:
Contact: BRUCE
Phone #: (940) 387-1025

Project #:	P.O.#:	Project Name:
20791		RR HWY 41 - DAY 6

PARAMETERS FOR ANALYSIS

	Sample Description	Date	Time	Matrix	HANDWELL	Chloride Sulfate Alkalinity TDS									# Containers
1	32%	3/25/13	0900		X	X									2
2	42%				X	X									2
3	56%				X	X									2
4	75%				X	X									2
5	100%				X	X									2

RELINQUISHED BY: (Signature) Bruce Huther Date 3/26/13 Time 1400

RECEIVED BY: (Signature) Eugene Hopton Date 3-27-13 Time: 0900

METHOD OF SHIPMENT: FED EX

ADDITIONAL COMMENTS: Hand: HNO_3

ALREA SAT DAWLEY FTW

Fed-X (2.1°C) 7993 4774 4157

AMERICAN INTERPLEX CORPORATION
LABORATORIES

FTN Associates, Ltd.
ATTN: Mr. Jim Malcolm
3 Innwood Circle, Suite 220
Little Rock, AR 72211

This report contains the analytical results and supporting information for samples submitted on March 27, 2013. Attached please find a copy of the Chain of Custody and/or other documents received. Note that any remaining sample will be discarded two weeks from the original report date unless other arrangements are made.

This report is intended for the sole use of the client listed above. Assessment of the data requires access to the entire document.

This report has been reviewed by the Laboratory Director or a qualified designee.

John Overbey
Laboratory Director

This document has been distributed to the following:

PDF cc: FTN Associates, Ltd.
ATTN: Mr. Pat Downey
pjd@ftn-assoc.com

AMERICAN INTERPLEX CORPORATION
LABORATORIES

FTN Associates, Ltd.
3 Innwood Circle, Suite 220
Little Rock, AR 72211

SAMPLE INFORMATION

Project Description:
Five (5) water sample(s) received on March 27, 2013
Huther & Associates, Inc.
20791
RR Hwy 41-Day 7

Receipt Details:
A Chain of Custody was provided. The samples were delivered in one (1) ice chest.
Ice chest #1 was delivered with shipping documentation.

Each sample container was checked for proper labeling, including date and time sampled. Sample containers were reviewed for proper type, adequate volume, integrity, temperature, preservation, and holding times. Any exceptions are noted below:

Sample Identification:

Laboratory ID	Client Sample ID	Sampled Date/Time	Notes
166025-1	32% 3/26/13 0900	26-Mar-2013 0900	
166025-2	42% 3/26/13 0900	26-Mar-2013 0900	
166025-3	56% 3/26/13 0900	26-Mar-2013 0900	
166025-4	75% 3/26/13 0900	26-Mar-2013 0900	
166025-5	100% 3/26/13 0900	26-Mar-2013 0900	

Qualifiers:
D Result is from a secondary dilution factor

References:
"Methods for Chemical Analysis of Water and Wastes", EPA/600/4-79-020 (Mar 1983) with updates and supplements EPA/600/5-91-010 (Jun 1991), EPA/600/R-92-129 (Aug 1992) and EPA/600/R-93-100 (Aug 1993).
"Test Methods for Evaluating Solid Waste Physical/Chemical Methods (SW846)", Third Edition.
"Standard Methods for the Examination of Water and Wastewaters", 21st edition.
"American Society for Testing and Materials" (ASTM).
"Association of Analytical Chemists" (AOAC).

AMERICAN INTERPLEX CORPORATION
LABORATORIES

FTN Associates, Ltd.
3 Innwood Circle, Suite 220
Little Rock, AR 72211

ANALYTICAL RESULTS

AIC No. 166025-1
Sample Identification: 32% 3/26/13 0900

Analyte		Result	RL	Units	Qualifier
Alkalinity as CaCO3		**110**	1	**mg/l**	
SM 2320 B		Analyzed: 28-Mar-2013 0820 by 302		Batch: W43027	
Total Dissolved Solids		**1100**	10	**mg/l**	
SM 2540 C	Prep: 29-Mar-2013 1637 by 285	Analyzed: 01-Apr-2013 1330 by 285		Batch: W43057	
Chloride		**290**	2	**mg/l**	D
EPA 300.0	Prep: 27-Mar-2013 1347 by 07	Analyzed: 28-Mar-2013 0311 by 07		Batch: S34290	Dil: 10
Sulfate		**320**	2	**mg/l**	D
EPA 300.0	Prep: 27-Mar-2013 1347 by 07	Analyzed: 28-Mar-2013 0311 by 07		Batch: S34290	Dil: 10
Hardness as CaCO3		**350**	5	**mg/l**	D
SM 2340 B	Prep: 27-Mar-2013 1138 by 271	Analyzed: 27-Mar-2013 1540 by 305		Batch: S34289	Dil: 5

AIC No. 166025-2
Sample Identification: 42% 3/26/13 0900

Analyte		Result	RL	Units	Qualifier
Alkalinity as CaCO3		**100**	1	**mg/l**	
SM 2320 B		Analyzed: 28-Mar-2013 0820 by 302		Batch: W43027	
Total Dissolved Solids		**1300**	10	**mg/l**	
SM 2540 C	Prep: 29-Mar-2013 1637 by 285	Analyzed: 01-Apr-2013 1330 by 285		Batch: W43057	
Chloride		**350**	2	**mg/l**	D
EPA 300.0	Prep: 27-Mar-2013 1347 by 07	Analyzed: 28-Mar-2013 0337 by 07		Batch: S34290	Dil: 10
Sulfate		**410**	2	**mg/l**	D
EPA 300.0	Prep: 27-Mar-2013 1347 by 07	Analyzed: 28-Mar-2013 0337 by 07		Batch: S34290	Dil: 10
Hardness as CaCO3		**400**	5	**mg/l**	D
SM 2340 B	Prep: 27-Mar-2013 1138 by 271	Analyzed: 27-Mar-2013 1603 by 305		Batch: S34289	Dil: 5

AIC No. 166025-3
Sample Identification: 56% 3/26/13 0900

Analyte		Result	RL	Units	Qualifier
Alkalinity as CaCO3		**100**	1	**mg/l**	
SM 2320 B		Analyzed: 28-Mar-2013 0820 by 302		Batch: W43027	
Total Dissolved Solids		**1500**	10	**mg/l**	
SM 2540 C	Prep: 29-Mar-2013 1637 by 285	Analyzed: 01-Apr-2013 1330 by 285		Batch: W43057	
Chloride		**440**	2	**mg/l**	D
EPA 300.0	Prep: 27-Mar-2013 1347 by 07	Analyzed: 28-Mar-2013 0402 by 07		Batch: S34290	Dil: 10
Sulfate		**500**	2	**mg/l**	D
EPA 300.0	Prep: 27-Mar-2013 1347 by 07	Analyzed: 28-Mar-2013 0402 by 07		Batch: S34290	Dil: 10
Hardness as CaCO3		**470**	5	**mg/l**	D
SM 2340 B	Prep: 27-Mar-2013 1138 by 271	Analyzed: 27-Mar-2013 1608 by 305		Batch: S34289	Dil: 5

AMERICAN INTERPLEX CORPORATION
LABORATORIES

FTN Associates, Ltd.
3 Innwood Circle, Suite 220
Little Rock, AR 72211

ANALYTICAL RESULTS

AIC No. 166025-4
Sample Identification: 75% 3/26/13 0900

Analyte		Result	RL	Units	Qualifier
Alkalinity as CaCO3		**96**	1	**mg/l**	
SM 2320 B		Analyzed: 28-Mar-2013 0820 by 302		Batch: W43027	
Total Dissolved Solids		**1900**	20	**mg/l**	
SM 2540 C	Prep: 29-Mar-2013 1637 by 285	Analyzed: 01-Apr-2013 1330 by 285		Batch: W43057	
Chloride		**520**	20	**mg/l**	D
EPA 300.0	Prep: 27-Mar-2013 1347 by 07	Analyzed: 28-Mar-2013 0428 by 07		Batch: S34290	Dil: 100
Sulfate		**630**	20	**mg/l**	D
EPA 300.0	Prep: 27-Mar-2013 1347 by 07	Analyzed: 28-Mar-2013 0428 by 07		Batch: S34290	Dil: 100
Hardness as CaCO3		**590**	5	**mg/l**	D
SM 2340 B	Prep: 27-Mar-2013 1138 by 271	Analyzed: 27-Mar-2013 1612 by 305		Batch: S34289	Dil: 5

AIC No. 166025-5
Sample Identification: 100% 3/26/13 0900

Analyte		Result	RL	Units	Qualifier
Alkalinity as CaCO3		**130**	1	**mg/l**	
SM 2320 B		Analyzed: 28-Mar-2013 0820 by 302		Batch: W43027	
Total Dissolved Solids		**2500**	20	**mg/l**	
SM 2540 C	Prep: 29-Mar-2013 1637 by 285	Analyzed: 01-Apr-2013 1330 by 285		Batch: W43057	
Chloride		**700**	20	**mg/l**	D
EPA 300.0	Prep: 27-Mar-2013 1347 by 07	Analyzed: 28-Mar-2013 0454 by 07		Batch: S34290	Dil: 100
Sulfate		**850**	20	**mg/l**	D
EPA 300.0	Prep: 27-Mar-2013 1347 by 07	Analyzed: 28-Mar-2013 0454 by 07		Batch: S34290	Dil: 100
Hardness as CaCO3		**750**	5	**mg/l**	D
SM 2340 B	Prep: 27-Mar-2013 1138 by 271	Analyzed: 27-Mar-2013 1617 by 305		Batch: S34289	Dil: 5

AMERICAN INTERPLEX CORPORATION
LABORATORIES

FTN Associates, Ltd.
3 Innwood Circle, Suite 220
Little Rock, AR 72211

DUPLICATE RESULTS

Analyte		AIC No.	Result	RPD	RPD Limit	Preparation Date	Analysis Date	Dil	Qual
Alkalinity as CaCO3		166025-1	110 mg/l				28Mar13 0820 by 302		
	Batch: W43027	Duplicate	110 mg/l	0.913	20.0		28Mar13 0820 by 302		
Total Dissolved Solids		166066-1	< 10 mg/l			29Mar13 1637 by 285	01Apr13 1330 by 285		
	Batch: W43057	Duplicate	< 10 mg/l	0.00	10.0	29Mar13 1637 by 285	01Apr13 1330 by 285		
Total Dissolved Solids		166074-1	59 mg/l			29Mar13 1637 by 285	01Apr13 1330 by 285		
	Batch: W43057	Duplicate	56 mg/l	5.22	10.0	29Mar13 1637 by 285	01Apr13 1330 by 285		

LABORATORY CONTROL SAMPLE RESULTS

Analyte	Spike Amount	%	Limits	RPD	Limit	Batch	Preparation Date	Analysis Date	Dil	Qual
Chloride	20 mg/l	95.9	90.0-110			S34290	27Mar13 1348 by 07	27Mar13 1433 by 07		
Sulfate	20 mg/l	97.2	90.0-110			S34290	27Mar13 1348 by 07	27Mar13 1433 by 07		

MATRIX SPIKE SAMPLE RESULTS

Analyte	Sample	Spike Amount	%	Limits	Batch	Preparation Date	Analysis Date	Dil	Qual
Chloride	166020-1	20 mg/l	92.8	80.0-120	S34290	27Mar13 1348 by 07	27Mar13 1651 by 07		
	166020-1	20 mg/l	98.6	80.0-120	S34290	27Mar13 1348 by 07	27Mar13 1717 by 07		
	Relative Percent Difference:		5.24	10.0	S34290				
Sulfate	166020-1	20 mg/l	94.7	80.0-120	S34290	27Mar13 1348 by 07	27Mar13 1651 by 07		
	166020-1	20 mg/l	96.1	80.0-120	S34290	27Mar13 1348 by 07	27Mar13 1717 by 07		
	Relative Percent Difference:		1.30	10.0	S34290				

LABORATORY BLANK RESULTS

Analyte	Result	RL	PQL	QC Sample	Preparation Date	Analysis Date	Qual
Alkalinity as CaCO3	< 1 mg/l	1	1	W43027-1		28Mar13 0820 by 302	
Total Dissolved Solids	< 10 mg/l	10	10	W43057-1	29Mar13 1637 by 285	01Apr13 1330 by 285	
Chloride	< 0.2 mg/l	0.2	0.2	S34290-1	27Mar13 1348 by 07	27Mar13 1407 by 07	
Sulfate	< 0.2 mg/l	0.2	0.2	S34290-1	27Mar13 1348 by 07	27Mar13 1407 by 07	

166025

HUTHER & ASSOCIATES, INC.

1156 North Bonnie Brae
Denton, Texas 76201
Phone: (940) 387-1025 Fax: (940) 387-1036

ANALYTICAL CHAIN-OF-CUSTODY

Company Name: HUTHER
Address:
Contact: BRUCE
Phone #: (940) 387-1025

Project #:	P.O.#:	Project Name:
20791		RR HWY 41 - DAY 7

	Sample Description	Date	Time	Matrix	PARAMETERS FOR ANALYSIS: Hardness	Chloride	Sulfate	Alkalinity	TDS	# Containers
1	32%	3/26/13	0900		X	X				2
2	42%				X	X				2
3	56%				X	X				2
4	75%				X	X				2
5	100%				X	X				2

RELINQUISHED BY: (Signature) Bruce Huther Date 3/26/13 Time 1400

RECEIVED BY: (Signature) Logan Hopkins Date 3-27-13 Time: 0900

METHOD OF SHIPMENT: FED EX

ADDITIONAL COMMENTS: Need: HNO_3

AS PER PAT DOWNEY, FTW

Fed-X (2.1°C) 7993 4774 4157

APPENDIX B

Huther & Associates, Inc. Chronic 7-day *Ceriodaphnia dubia* Report

RED RIVER TDS STUDY
Red River @ HWY 41

Chronic 7-day *Ceriodaphnia dubia* Report

March 20, 2013

Reviewed by: _____

Bruce Huther, Technical Director
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Denton, Texas 76201
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TOXICITY TEST REPORT - CHRONIC

Client ..... Red River TDS Study
Sample ..... Red River @ HWY 41

Laboratory I.D. 20837
Begin Date ..... March 20, 2013

Results: No statistically significant difference between the control and the TDS Red River sample in all concentrations tested for *Ceriodaphnia dubia* survival and reproduction.

SAMPLE COLLECTION

Approximately 100 liters of grab samples from the Red River at HWY 41 were delivered by Greyhound Package Express to Huther & Associates on March 14, 2013. Grab samples were collected by FTN personnel. One toxicity test was requested: a seven-day *Ceriodaphnia dubia* survival and reproduction test (EPA Method 1002.0). Test organisms, procedures and quality assurance requirements were in accordance with the EPA manual, *"Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms," Fourth Edition,* (EPA-821-R-02-013).

SAMPLE PREPARATION

Upon arrival at the laboratory, the river water sample was analyzed for total residual chlorine (Standard Methods, 22nd Edition, 4500-Cl D) and contained <0.01 mg/L. Additionally, water hardness, alkalinity, conductivity, pH, and dissolved oxygen data were measured and recorded.

The sample was split into two, 50-liter aliquots. One aliquot of river water was spiked to approximately 4X the existing concentration of TDS. The second aliquot was used as dilution water. Prior to use, the spiked aliquot was aerated for 24-hours. The following amounts of inorganic salts were added to the river water:

Summary of Inorganic Salts added to River Water

Salt	mg/L	g/L	g/50L
NaCl	650	0.650	32.50
Na_2SO_4	639	0.639	31.95
$CaCl_2 \cdot 2H_2O$	38	0.038	1.90
$MgCl_2$	67	0.067	3.35
$MgSO_4 \cdot 7H_2O$	525	0.525	26.25
$Ca_2SO_4 \cdot 2H_2O$	189	0.189	9.45
CaO	240	0.240	12.00
KCl	45	0.045	2.25

TEST SETUP
Ceriodaphnia dubia

The seven-day *Ceriodaphnia dubia* survival and reproduction test was initiated at 1655 hours, March 20, 2013. Five concentrations of the spiked sample were prepared (32%, 42%, 56%, 75%, and 100%) utilizing the un-spiked river water sample as the diluent. The test was conducted in 25 mL distilled water rinsed plastic beakers containing 15 mL of solution (one organism per beaker, ten beakers per concentration). *C. dubia* neonates were less than 24 hours old and within eight hours of the same age at test initiation. Neonates were placed in beakers following a randomized block test design. Fresh solutions were prepared and renewed daily. Daily feeding consisted of 0.5 mL *Selenastrum capricornutum* and cerophyll per test chamber. The test proceeded for seven days during which survival, reproduction and water quality data were collected daily.

A true control of ten replicate chambers containing one neonate each in Red River water collected at HWY 41 was conducted concurrently with the test. There was 100% survival in the true control. In addition, a performance control of ten replicate chambers containing one neonate each in synthetic laboratory water was conducted concurrently with the test. The purpose of the performance control was to assess the health of the test organisms and to identify river water toxicity. The performance control data was not used in the statistical analysis of the test data. There was 100% survival in the performance control. The test ended at 1655 hours, March 27, 2013.

SURVIVAL
Ceriodaphnia dubia

There was 100% survival to *C. dubia* in all of the concentrations tested. Therefore, statistical analyses were not required to determine a no effect concentration.

LOEC: Not Applicable
NOEC: 100% Spiked Red River sample

REPRODUCTION
Ceriodaphnia dubia

C. dubia reproduction data were normally distributed at the 0.01 alpha level (13.277) using Chi-Square test for normality. Reproduction data were homogeneous using Bartlett's test at the 0.01 alpha level (15.09) without data transformations. Therefore, a parametric test was performed on the homogeneous data. Dunnett's test on *C. dubia* reproduction data demonstrated that there were no statistically significant differences between the control and any of the concentrations.

LOEC: Not Applicable **PMSD: 8.3%**
NOEC: 100% Spiked Red River sample

SUMMARY

There were no statistically significant differences between the control and the spiked Red River sample for *C. dubia* survival and reproduction.

Huther and Associates

7-Day/3 Brood *Ceriodaphnia dubia* Survival and Reproduction Chronic Toxicity Test

CLIENT	Red River TDS Study	SAMPLE TYPE	Grab
TPDES #	Non-permitted	DATE COLLECTED	03/13/13
LAB ID #	20837	DATE RECEIVED	03/14/13
TEST TYPE	7 Day Chronic	BEGIN DATE/TIME	03/20/13 1655
TEST ORGANISM	*Ceriodaphnia dubia*	END DATE/TIME	03/27/13 1655
ORGANISM AGE	< 24 Hours	TEST TEMPERATURE (°C)	25 ± 1
ORGANISM SOURCE	In House	PHOTO PERIOD	16-hr. Light 8-hr. Dark
RECEIVING WATER	Not Applicable	LIGHT INTENSITY	50-100 ft. cndl.
DILUTION WATER	Red River @ HWY 41	TECHNICIAN	N. Lehr

SURVIVAL & REPRODUCTION SUMMARY

Performance Control

Date	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
	A	A	A	A	A	A	A	A	A	A
03/21/13	0	0	0	0	0	0	0	0	0	0
	A	A	A	A	A	A	A	A	A	A
03/22/13	0	0	0	0	0	0	0	0	0	0
	A	A	A	A	A	A	A	A	A	A
03/23/13	0	0	0	0	0	0	0	0	0	0
	A	A	A	A	A	A	A	2	A	A
03/24/13	0	0	0	0	0	0	0	2	0	0
	3	2	2	4	3	3	4	8	3	2
03/25/13	3	2	2	4	3	3	4	8	3	2
	8	7	6	8	7	8	7	A	6	6
03/26/13	9	9	8	10	10	9	11	8	9	8
	10	12	12	11	13	11	12	10	11	11
03/27/13	19	21	20	21	23	20	23	18	20	19

x # Young 20.4 C.V. 8.07%

x% Survival 100% C.V. 0.00%

True Control

Date	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
	A	A	A	A	A	A	A	A	A	A
03/21/13	0	0	0	0	0	0	0	0	0	0
	A	A	A	A	A	A	A	A	A	A
03/22/13	0	0	0	0	0	0	0	0	0	0
	A	A	A	A	A	A	A	A	A	A
03/23/13	0	0	0	0	0	0	0	0	0	0
	A	2	A	2	A	A	3	2	A	A
03/24/13	0	2	0	2	0	0	3	2	0	0
	3	A	2	6	4	2	7	A	2	4
03/25/13	3	2	2	8	4	2	10	2	2	4
	7	8	8	A	7	8	A	8	8	7
03/26/13	10	9	10	8	11	10	10	8	8	11
	13	13	12	13	14	14	13	11	14	13
03/27/13	23	21	22	21	25	24	23	19	22	24

x # Young 22.4 C.V 7.93%

x% Survival 100% C.V. 0.00%

32% spike @ HWY 41

Date	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
	A	A	A	A	A	A	A	A	A	A
03/21/13	0	0	0	0	0	0	0	0	0	0
	A	A	A	A	A	A	A	A	A	A
03/22/13	0	0	0	0	0	0	0	0	0	0
	A	A	A	A	A	A	A	A	A	A
03/23/13	0	0	0	0	0	0	0	0	0	0
	A	2	2	A	A	A	A	A	A	A
03/24/13	0	2	2	0	0	0	0	0	0	0
	3	A	6	4	3	2	2	4	3	4
03/25/13	3	2	8	4	3	2	2	4	3	4
	8	7	A	7	6	8	8	9	7	8
03/26/13	11	9	8	11	9	10	10	13	10	10
	14	13	14	12	13	14	12	15	13	12
03/27/13	25	22	22	23	22	24	22	26	23	22

x # Young 23 3 C.V. 6.35%

x% Survival 100% C.V. 0.00%

42% Spike @ HWY 41

Date	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
	A	A	A	A	A	A	A	A	A	A
03/21/13	0	0	0	0	0	0	0	0	0	0
	A	A	A	A	A	A	A	A	A	A
03/22/13	0	0	0	0	0	0	0	0	0	0
	A	A	A	A	A	A	A	A	A	A
03/23/13	0	0	0	0	0	0	0	0	0	0
	2	A	A	2	A	A	A	A	2	A
03/24/13	2	0	0	2	0	0	0	0	2	0
	A	5	3	A	2	4	4	3	A	2
03/25/13	2	5	3	2	2	4	4	3	2	2
	7	9	8	6	8	6	10	8	7	6
03/26/13	9	14	9	8	10	10	14	11	9	8
	13	13	14	12	14	13	12	14	15	12
03/27/13	22	27	23	20	24	23	28	25	24	20

x # Young 23.4 C.V 9.91%

x% Survival 100% C.V. 0.00%

where: A = Alive
5 = Alive, 5 young
D = Dead
D5 = 5 Young, Female died

ex 1: A alive today; 4 total young to date

ex 2: 5 alive, 5 young today; 12 total young to date

Huther and Associates

7-Day/3 Brood *Ceriodaphnia dubia* Survival and Reproduction Chronic Toxicity Test

Red River TDS Study | Lab ID# 20837 | Test Date: March 20, 2013

56% Spike @ HWY 41

Date	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
	A	A	A	A	A	A	A	A	A	A
03/21/13	0	0	0	0	0	0	0	0	0	0
	A	A	A	A	A	A	A	A	A	A
03/22/13	0	0	0	0	0	0	0	0	0	0
	A	A	A	A	A	A	A	A	A	A
03/23/13	0	0	0	0	0	0	0	0	0	0
	A	A	3	2	A	A	2	A	2	A
03/24/13	0	0	3	2	0	0	2	0	2	0
	3	2	A	A	2	4	A	4	A	3
03/25/13	3	2	3	2	2	4	2	4	2	3
	7	6	6	7	8	9	8	9	8	7
03/26/13	10	8	9	9	10	13	8	13	10	10
	12	13	13	12	14	13	15	12	14	13
03/27/13	22	21	22	21	24	26	23	25	24	23

x # Young 23.1 C.V. 7.20%

x% Survival 100% C.V. 0.00%

75% Spike@ HWY 41

Date	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
	A	A	A	A	A	A	A	A	A	A
03/21/13	0	0	0	0	0	0	0	0	0	0
	A	A	A	A	A	A	A	A	A	A
03/22/13	0	0	0	0	0	0	0	0	0	0
	A	A	A	A	A	A	A	A	A	A
03/23/13	0	0	0	0	0	0	0	0	0	0
	A	A	2	2	A	A	A	A	A	A
03/24/13	0	0	2	2	0	0	0	0	0	0
	2	3	A	A	4	3	2	4	3	2
03/25/13	2	3	2	2	4	3	2	4	3	2
	8	8	7	8	7	7	6	7	8	9
03/26/13	10	9	8	8	11	10	8	11	11	11
	14	13	12	13	12	12	14	12	13	12
03/27/13	24	22	21	21	23	22	22	23	24	23

x # Young 22.5 C.V. 4.80%

x% Survival 100% C.V. 0.00%

100% Spike @ HWY 41

Date	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
	A	A	A	A	A	A	A	A	A	A
03/21/13	0	0	0	0	0	0	0	0	0	0
	A	A	A	A	A	A	A	A	A	A
03/22/13	0	0	0	0	0	0	0	0	0	0
	A	A	A	A	A	A	A	A	A	A
03/23/13	0	0	0	0	0	0	0	0	0	0
	A	A	A	A	A	A	A	A	A	A
03/24/13	0	0	0	0	0	0	0	0	0	0
	2	3	2	3	2	2	2	3	3	4
03/25/13	2	3	2	3	2	2	2	3	3	4
	8	8	6	8	7	8	6	6	7	6
03/26/13	8	11	8	9	9	10	8	9	10	10
	12	14	12	13	14	13	12	15	13	13
03/27/13	20	25	20	22	23	23	20	24	23	23

x # Young 22.3 C.V. 7.82%

x% Survival 100% C.V. 0.00%

where: A = Alive

5 = Alive, 5 young

D = Dead

D5 = 5 Young, Female died

ex 1:

A	alive today
4	total young to date

ex 2:

5	alive, 5 young today
12	total young to date

Huther and Associates
7-Day/3 Brood *Ceriodaphnia dubia* Survival and Reproduction Chronic Toxicity Test

Red River TDS Study | Lab ID# 20837 | Test Date: March 20, 2013

WET CHEMISTRY MEASUREMENTS

Date	Time	Temp	Samp. No.	pH of Solution							Analyst
				PCON	TCON	32%	42%	56%	75%	100%	
03/20/13	Start	25.0	1	8.15	7.61	8.72	8.77	8.92	8.87	8.91	STC
03/21/13	24 Hr.	24.5	1	8.20	8.10	7.90	7.84	7.83	7.78	7.66	CTT
03/21/13	Renew	24.5	1	8.28	7.84	8.24	8.37	8.54	8.83	8.99	CTT
03/22/13	48 Hr.	24.9	1	8.26	8.17	8.10	8.07	8.03	7.95	7.88	TN
03/22/13	Renew	24.6	1	8.28	8.22	8.14	8.10	8.03	7.98	7.91	STC
03/23/13	72 Hr.	24.2	1	8.42	8.40	8.25	8.20	8.13	8.07	7.96	STC
03/23/13	Renew	24.6	1	8.28	7.89	7.91	7.94	7.90	7.88	7.91	STC
03/24/13	96 Hr.	24.1	1	8.30	8.23	8.16	8.14	8.12	8.00	7.99	STC
03/24/13	Renew	24.1	1	8.44	7.84	7.83	7.84	7.84	7.87	7.94	STC
03/25/13	120 Hr.	24.2	1	8.36	8.38	8.28	8.26	8.24	8.17	8.11	STC
03/25/13	Renew	24.2	1	8.44	8.02	7.97	8.00	7.98	8.01	8.08	STC
03/26/13	144 Hr.	24.0	1	8.29	8.00	8.10	8.07	8.04	7.97	7.93	STC
03/26/13	Renew	24.5	1	8.44	7.94	7.85	7.86	7.87	7.89	7.93	STC
03/27/13	168 Hr.	24.8	1	8.24	8.17	8.08	8.08	8.05	8.02	8.00	STC

Date	Time	Temp	Samp. No.	DO (mg/L) of Solution							Analyst
				PCON	TCON	32%	42%	56%	75%	100%	
03/20/13	Start	25.0	1	8.48	8.02	7.74	7.88	7.74	7.92	7.96	STC
03/21/13	24 Hr.	24.5	1	8.05	8.08	8.04	8.04	8.09	8.07	8.08	CTT
03/21/13	Renew	24.5	1	8.17	8.04	7.93	7.85	7.89	7.98	8.08	CTT
03/22/13	48 Hr.	24.9	1	8.16	7.99	7.81	7.69	7.61	7.54	7.51	TN
03/22/13	Renew	24.6	1	8.17	8.05	8.03	7.97	7.94	7.90	7.82	STC
03/23/13	72 Hr.	24.2	1	8.30	8.34	8.28	8.27	8.14	8.14	8.11	STC
03/23/13	Renew	24.6	1	8.17	8.32	8.23	8.04	7.92	7.84	7.82	STC
03/24/13	96 Hr.	24.1	1	7.68	7.66	7.58	7.50	8.16	8.23	8.23	STC
03/24/13	Renew	24.1	1	8.44	7.69	7.58	7.58	7.65	7.94	8.05	STC
03/25/13	120 Hr.	24.2	1	8.86	8.85	8.76	8.67	8.64	8.66	8.61	STC
03/25/13	Renew	24.2	1	8.44	8.33	8.35	8.39	8.45	8.46	8.57	STC
03/26/13	144 Hr.	24.0	1	8.42	8.31	8.27	8.12	7.97	8.14	8.20	STC
03/26/13	Renew	24.5	1	8.44	7.95	7.84	7.86	7.93	7.98	7.93	STC
03/27/13	168 Hr.	24.8	1	8.34	8.27	8.18	8.15	8.13	8.08	8.00	STC

Huther and Associates
7-Day/3 Brood *Ceriodaphnia dubia* Survival and Reproduction Chronic Toxicity Test

Red River TDS Study | Lab ID# 20837 | Test Date: March 20, 2013

DAILY CONDUCTIVITY MEASUREMENTS

		PCON	TCON	32%	42%	56%	75%	100%
Day 1	3/20/13	638	680	1592	1886	2232	2643	3266
Day 2	3/21/13	715	726	1398	1838	2274	2988	3732
Day 3	3/22/13	711	721	1401	1902	2281	3001	3742
Day 4	3/23/13	714	724	1411	1921	2299	3009	3739
Day 5	3/24/13	721	725	1421	1927	2297	3008	3741
Day 6	3/25/13	724	729	1424	1931	2301	3009	3752
Day 7	3/26/13	731	733	1439	1937	2304	3014	3769

INITIAL CHEMISTRY MEASUREMENTS @ 100% RED RIVER @ HWY 41 WATER (PRIOR TO INORGANIC SALT ADDITION)

Date	Samp. No.	pH	DO	Hardness mg/L CaCO3 [1]	Alkalinity mg/L CaCO3 [1]	Conduct. umhos/cm [1]	Resid.Cl2 mg/L [1]	Dechlor(mL) Na2S2O3 mg/L [1]	Analyst
3/20/13	1	8.91	7.96	160	132	680	<0.01	N/A	TN

INITIAL CHEMISTRY MEASUREMENTS @ RED RIVER @ HWY 41 WATER

Date	Samp. No.	pH	DO	Hardness mg/L CaCO3 [1]	Alkalinity mg/L CaCO3 [1]	Conduct. umhos/cm [1]	Resid.Cl2 mg/L [1]	Dechlor(mL) Na2S2O3 mg/L [1]	Analyst
3/20	RS1	8.91	7.96	160	132	680	<0.01	N/A	TN

[1] Measurements taken in 100% solution.

Huther and Associates, Inc.
Begin Date: March 27, 2013
Lab I.D.# 20837

CERIODAPHNIA DUBIA STATISTICAL ANALYSES
Reproduction

Summary Statistics on Transformed Data Table 1 of 2

Grp	Identification	N	Min	Max	Mean
1	Control	10	19.000	25.000	22.400
2	32% Red River	10	22.000	28.000	23.300
3	42% Red River	10	20.000	27.000	23.400
4	56% Red River	10	21.000	26.000	23.100
5	75% Red River	10	21.000	24.000	22.500
6	100% Red River	10	20.000	25.000	22.300

Summary Statistics on Transformed Data Table 2 of 2

Grp	Identification	Variance	Sd	Sem	C.V.%
1	Control	3.156	1.776	0.562	7.93
2	32% Red River	3.789	1.947	0.616	8.35
3	42% Red River	5.378	2.319	0.733	9.91
4	56% Red River	2.767	1.663	0.526	7.20
5	75% Red River	1.167	1.080	0.342	4.80
6	100% Red River	3.122	1.767	0.559	7.92

Chi-Square Test For Normality: Actual And Expected Frequencies

Interval	< -1.5	-1.5 to -0.5	-0.5 to 0.5	>0.5 to 1.5	>1.5
Expected	4.020	14.520	22.920	14.520	4.020
Observed	1	19	24	12	4

Calculated Chi-Square goodness of fit test statistic = 4.1394
Table Chi-Square value (alpha = 0.01) = 13.277

Data **Pass** normality test. Continue analysis.

Bartlett's Test For Homogeneity of Variance

Calculated B1 statistic = 4.83

Table Chi-square value = 15.09 (alpha = 0.01, DF = 5)
Table Chi-square value = 11.07 (alpha = 0.05, DF = 5)

Data **Pass** B1 homogeneity test at 0.01 level. Continue analysis.

ANOVA Table

SOURCE	DF	SS	MS	F
Between	5	11.933	2.387	0.739
Within (Error)	54	174.400	3.230	
Total	59	186.333		

Critical F value = 2.45 (0.05,5,40)
Since F < Critical F Fail to Reject Ho: All equal

Dunnett's Test - Table 1 of 2 Ho:Control<Treatment

Grp	Identification	Transformed Mean	Mean Calculated In Original Units	T Stat	Sig
1	Control	22.400	22.400		
2	32% Red River	23.300	23.300	-1.120	
3	42% Red River	23.400	23.400	-1.244	
4	56% Red River	23.100	23.100	-0.871	
5	75% Red River	22.500	22.500	-0.124	
6	100% Red River	22.300	22.300	0.124	

Dunnett table value = 2.31 (1 Tailed Value, P=0.05, DF=40,5)
No statistically significant difference

Dunnett's Test - Table 1 of 2 Ho:Control<Treatment

Grp	Identification	Num of Reps	Minimum Sig Diff (In Orig. Units)	% of Control	Difference from Control
1	Control	10			
2	32% Red River	10	1.857	8.3	-0.900
3	42% Red River	10	1.857	8.3	-1.000
4	56% Red River	10	1.857	8.3	-0.700
5	75% Red River	10	1.857	8.3	-0.100
6	100% Red River	10	1.857	8.3	0.100

APPENDIX A
RAW DATA

7-DAY *CERIODAPHNIA DUBIA* SURVIVAL & REPRODUCTION
DAILY RAW DATA TABLE
PAGE 1 OF 2

CLIENT NTTN Red River Study

OUTFALL

LAB ID # 20837

START DATE/TIME 3-20-13 NL 1655

END DATE/TIME 3-27-13 NL 1655

Pcon

Date	Rep1	Rep2	Rep3	Rep4	Rep5	Rep6	Rep7	Rep8	Rep9	Rep10	Analyst	Time
3/21	A	A	A	A	A	A	A	A	A	A	NL	1655
3/22	A	A	A	A	A	A	A	A	A	A	NL	1020
3/23	A	A	A	A	A	A	A	A	A	A	MH	1515
3/24	A	A	A	A	A	A	A	2	A	A	MH	1010
3/25	3	2	2	4	3	3	4	6	3	2	NL	1110
3/26	6	7	6	6	7	6	7	A	6	6	NL	1140
3/27	10	12	12	11	13	11	12	10	11	11	NL	1655
	19	21	20	21	23	20	23	18	20	19		

$\bar{x}$ # Young w/o Dead = 20.4 CV% = 8.07

$\bar{x}$ # Young w/Dead = CV% =

$\bar{x}$ % Survival = 100.0 CV% = 0.00

Tcon

Date	Rep1	Rep2	Rep3	Rep4	Rep5	Rep6	Rep7	Rep8	Rep9	Rep10	Analyst	Time
3/21	A	A	A	A	A	A	A	A	A	A	NL	1655
3/22	A	A	A	A	A	A	A	A	A	A	NL	1020
3/23	A	A	A	A	A	A	A	A	A	A	MH	1515
3/24	A	2	A	2	A	A	3	2	A	A	MH	1010
3/25	3	A	2	6	4	2	7	A	6 2	4	NL	1110
3/26	7	6	8	A	7	8	A	6	6	7	NL	1140
3/27	13	13	12	13	14	14	13	11	14	13	NL	1655
	23	21	22	21	25	24	23	19	22	24		

$\bar{x}$ # Young w/o Dead = 22.4 CV% = 7.93

$\bar{x}$ # Young w/Dead = CV% =

$\bar{x}$ % Survival = 100.0 CV% = 0.00

32

Date	Rep1	Rep2	Rep3	Rep4	Rep5	Rep6	Rep7	Rep8	Rep9	Rep10	Analyst	Time
3/21	A	A	A	A	A	A	A	A	A	A	NL	1655
3/22	A	A	A	A	A	A	A	A	A	A	NL	1020
3/23	A	A	A	A	A	A	A	A	A	A	MH	1515
3/24	A	2	2	A	A	A	A	A	A	A	MH	1010
3/25	3	A	6	4	3	2	2	4	3	4	NL	1110
3/26	8	7	A	7	6	8	8	9	7	6	NL	1140
3/27	14	13	14	12	13	14	12	15	13	12	NL	1655
	25	22	22	23	22	24	22	28	23	22		

$\bar{x}$ # Young w/o Dead = 23.3 CV% = 8.35

$\bar{x}$ # Young w/Dead = CV% =

$\bar{x}$ % Survival = 100.0 CV% = 0.00

42

Date	Rep1	Rep2	Rep3	Rep4	Rep5	Rep6	Rep7	Rep8	Rep9	Rep10	Analyst	Time
3/21	A	A	A	A	A	A	A	A	A	A	NL	1655
3/22	A	A	A	A	A	A	A	A	A	A	NL	1020
3/23	A	A	A	A	A	A	A	A	A	A	MH	1515
3/24	2	A	A	2	A	A	A	2	A		MH	1010
3/25	A	5	3	A	2	4	4	3	A	2	NL	1110
3/26	7	9	6	6	8	6	10	8	7	6	NL	1140
3/27	13	13	14	12	14	13	12	14	15	12	NL	1655
	22	27	23	20	24	23	26	23	24	20		

$\bar{x}$ # Young w/o Dead = 23.4 CV% = 9.91

$\bar{x}$ # Young w/Dead = CV% =

$\bar{x}$ % Survival = 100.0 CV% = 0.00

7-DAY *CERIODAPHNIA DUBIA* SURVIVAL & REPRODUCTION
DAILY RAW DATA TABLE
PAGE 2 OF 3

CLIENT NL EPA Red River Study

OUTFALL

LAB ID # 20837

START DATE/TIME 3-20-13 NL 1655

END DATE/TIME 3-27-13 NL 1655

56

Date	Rep1	Rep2	Rep3	Rep4	Rep5	Rep6	Rep7	Rep8	Rep9	Rep10	Analyst	Time
3/21	A	A	A	A	A	A	A	A	A	A	NL	1655
3/22	A	A	A	A	A	A	A	A	A	A	NL	1020
3/23	A	A	A	A	A	A	A	A	A	A	MH	1515
3/24	A	A	3	2	A	A	2	A	2	A	MH	1010
3/25	3	2	A	A	2	4	A	4	A	3	NL	1110
3/26	7	6	6	7	8	9	6	9	8	7	NL	1140
3/27	12	13	13	12	14	13	15	12	14	13	NL	1655
	22	21	22	21	24	26	23	25	24	23		

$\bar{x}$ # Young w/o Dead = 23.1 CV% = 7.20

$\bar{x}$ # Young w/Dead = CV% =

$\bar{x}$ % Survival = 100% CV% = 0.00

75

Date	Rep1	Rep2	Rep3	Rep4	Rep5	Rep6	Rep7	Rep8	Rep9	Rep10	Analyst	Time
3/21	A	A	A	A	A	A	A	A	A	A	NL	1655
3/22	A	A	A	A	A	A	A	A	A	A	NL	1020
3/23	A	A	A	A	A	A	A	A	A	A	MH	1515
3/24	A	A	2	2	A	A	A	A	A	A	MH	1010
3/25	2	3	A	A	4	3	2	4	3	2	NL	1110
3/26	8	6	7	6	7	7	6	7	8	9	NL	1140
3/27	14	13	12	13	12	12	14	12	13	12	NL	1655
	24	22	21	21	23	22	22	23	24	23		

$\bar{x}$ # Young w/o Dead = 22.5 CV% = 4.80

$\bar{x}$ # Young w/Dead = CV% =

$\bar{x}$ % Survival = 100% CV% = 0.00

100

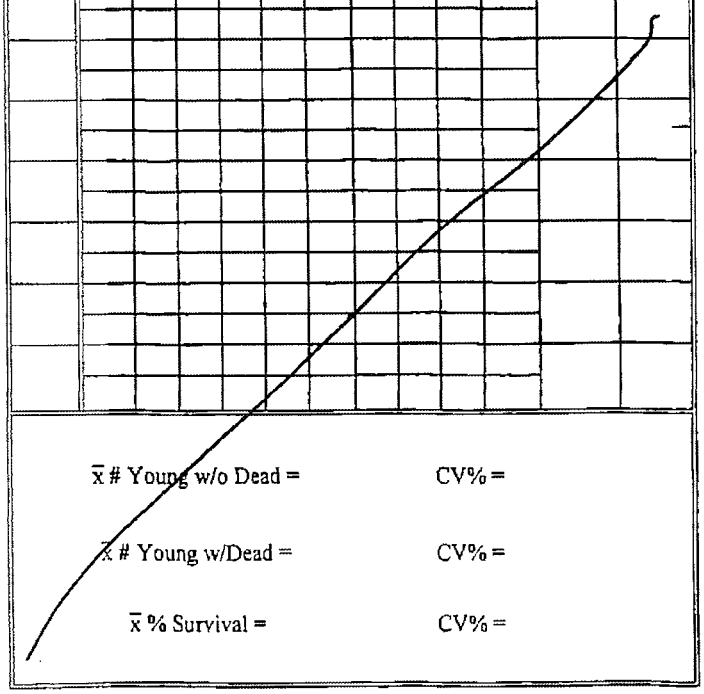
Date	Rep1	Rep2	Rep3	Rep4	Rep5	Rep6	Rep7	Rep8	Rep9	Rep10	Analyst	Time
3/21	A	A	A	A	A	A	A	A	A	A	NL	1655
3/22	A	A	A	A	A	A	A	A	A	A	NL	1020
3/23	A	A	A	A	A	A	A	A	A	A	MH	1515
3/24	A	A	A	A	A	A	A	A	A	A	MH	1010
3/25	2	3	2	3	2	2	2	3	3	4	NL	1110
3/26	6	8	6	6	7	8	6	6	7	6	NL	1140
3/27	12	14	12	13	14	13	12	15	13	13	NL	1655
	20	25	20	22	23	23	20	24	23	22		

$\bar{x}$ # Young w/o Dead = 22.3 CV% = 7.92

$\bar{x}$ # Young w/Dead = CV% =

$\bar{x}$ % Survival = 100% CV% = 0.00

Date	Rep1	Rep2	Rep3	Rep4	Rep5	Rep6	Rep7	Rep8	Rep9	Rep10	Analyst	Time



$\bar{x}$ # Young w/o Dead = CV% =

$\bar{x}$ # Young w/Dead = CV% =

$\bar{x}$ % Survival = CV% =

Huther and Associates, Inc.
environmental toxicologists and consultants

DAILY CONDUCTIVITY READING

CLIENT: Red River Effluent Study
PROJECT#: 20837
TEST DATE: March 20, 2013

		PCON	TCON	32%	42%	56%	75%	100%
Day 1	3/20/13	6.38	680	1592	1886	2232	2643	3266
Day 2	3/21/13	715	726	1398	1838	2274	2988	3732
Day 3	3/22/13	711	721	1401	1902	2281	3001	3742
Day 4	3/23/13	714	724	1411	1921	2299	3009	3739
Day 5	3/24/13	721	725	1421	1927	2297	3008	3741
Day 6	3/25/13	724	729	1424	1931	2301	3009	3752
Day 7	3/26/13	731	733	1439	1937	2304	3014	3769

1156 North Bonnie Brae St. Denton, TX 76201 Phone (940)387-1025 Fax (940)387-1036 E-mail huther@flash.net

APPENDIX B
REFERENCE TOXICANTS

Huther and Associates, Inc.
environmental toxicologists, biologists, consultants

CHRONIC REFERENCE TOXICANT TEST RESULTS

SPECIES:	*Ceriodaphnia dubia*
CHEMICAL:	Sodium Chloride
DURATION:	7-Days
TEST NUMBER:	3
TEST DATE/TIME:	03/04/13 - 03/11/13 1640 Hrs - 1640 Hrs
STATISTICAL METHOD:	Fishers, Dunnetts/Steels

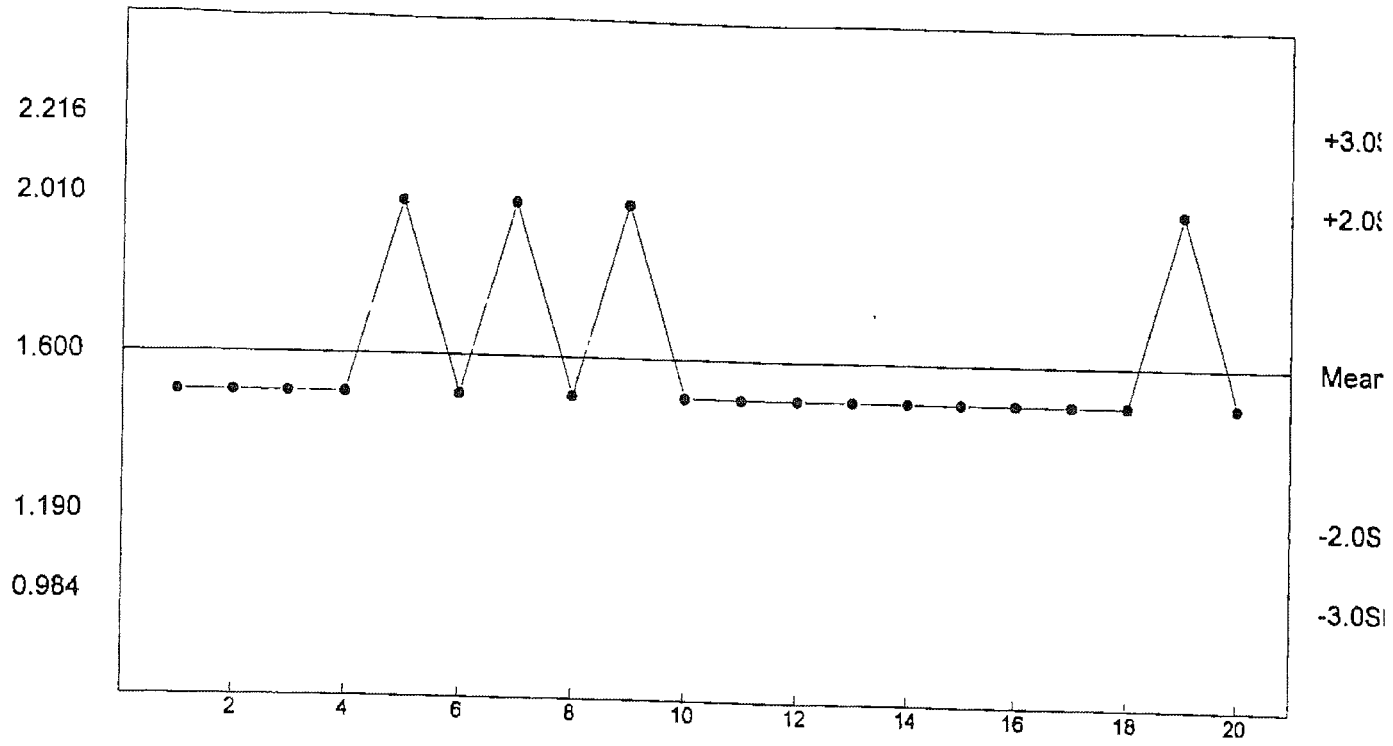
CONCENTRATION (g/L)	NUMBER EXPOSED	NUMBER DEAD
0.5	10	0
1.0	10	0
1.5	10	0
2.0	10	7
2.5	10	10
3.0	10	10
4.0	10	10

LOEC FOR SURVIVAL	NOEC FOR SURVIVAL	LOEC FOR REPRODUCTION	NOEC FOR REPRODUCTION
2.0 g/L	**1.5 g/L**	**1.5 g/L**	**1.0 g/L**

1156 Bonnie Brae Denton, Texas 76201 (940) 387-1025

Reference Tox Sodium Chloride g/L

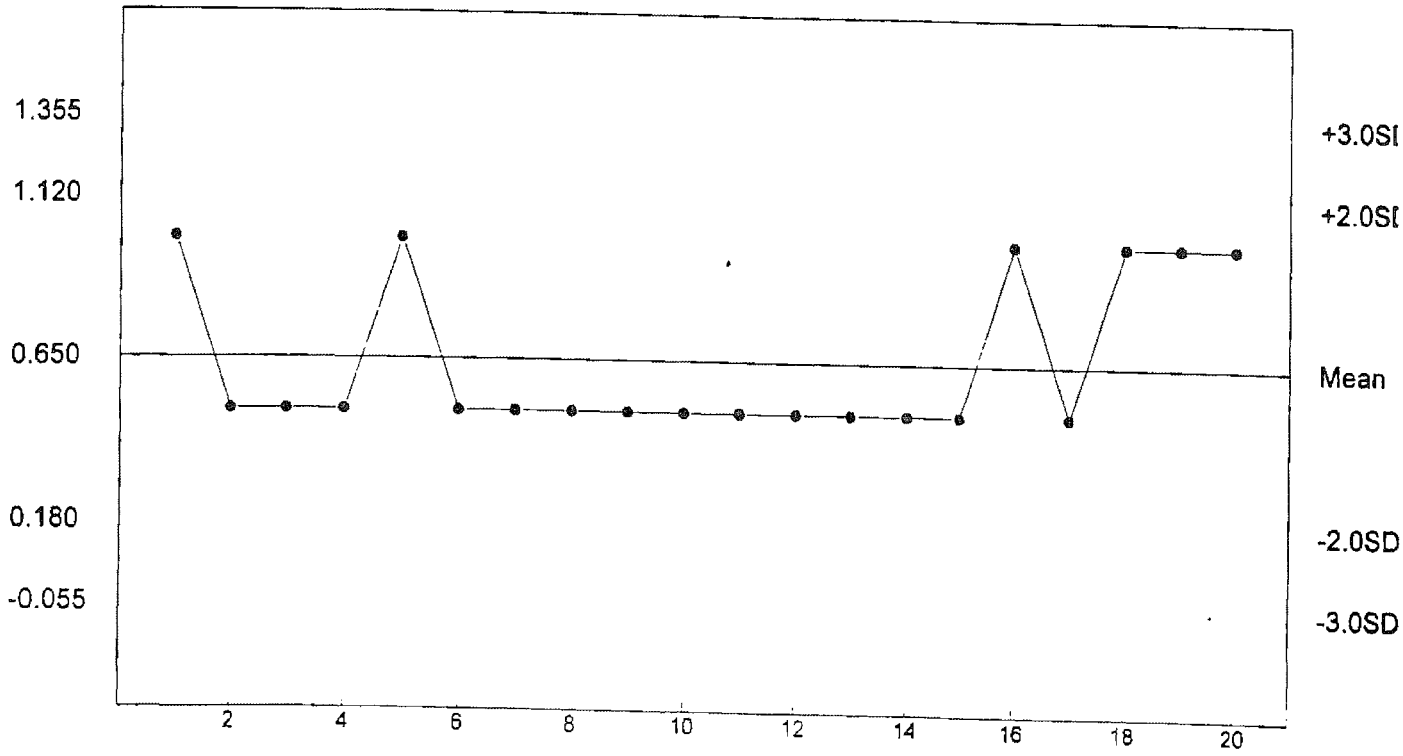
C. dubia Survival - NOEC



n= 20 Mean= 1.600 SD= 0.205 CV= 12.82% Min= 1.500 Max= 2.000

Reference Tox Sodium Cloride g/L

C. dubia Reproduction - NOEC



n= 20 Mean= 0.650 SD= 0.235 CV= 36.17% Min= 0.500 Max= 1.000

APPENDIX C
CHAIN OF CUSTODY SHEETS

HUTHER & ASSOCIATES
1156 NORTH BONNIE BRAE STREET
DENTON, TX 76201
(940) 387-1025 • FAX (940) 387-1036

CHAIN OF CUSTODY RECORD

PROJECT # 2079 | 20837 PT PROJECT NAME FTN River Sample PERMIT# N/A

ROGS10 0010-002

OUTFALL SAMPLES

24-Hr Flow Weighted Composite_____ Other_____

					METHODS OF COLLECTION AND COMPOSITE			
~~OUTFALL~~ NUMBER	PERSON TAKING SAMPLE	START DATE/TIME	END DATE/TIME	# OF PORTIONS COMPOSITED	AUTO COLL. AUTO COMP.	MANUAL COLL. MANUAL COMP.	AUTO COLL. MANUAL COMP.	# OF CONTAINERS TO BE SHIPPED
RED RIVER @ HWY 41	JMR/RPG	13 MAR 13 1050	13 MAR 13 1050	1		✓		1
RED RIVER @ HWY 41	JMR/RPG	13 MAR 13 1050	13 MAR 13 1050	1		✓		1

RECEIVING WATER SAMPLES

SAMPLE IDENTIFICATION (FOR REC'NG) H$_2$O GRABS, GIVE NAME OF STREAM AND LOCATION	PERSON TAKING SAMPLE	DATE	TIME	# OF CONTAINERS TO BE SHIPPED

TYPE OF TEST 7 day cerio

NAME OF RECEIVING WATER N/A

DILUTION WATER USED FOR THIS TEST N/A

RELINQUISHED BY: Jeremy Riggsby DATE: 13 MAR 13 TIME: 1200 RECEIVED BY AT THIS DATE/TIME _____

RELINQUISHED BY: _____ DATE: _____ TIME: _____ RECEIVED BY AT THIS DATE/TIME _____

RELINQUISHED BY: _____ DATE: _____ TIME: _____ RECEIVED BY AT THIS DATE/TIME _____

METHOD OF SHIPMENT: Greyhound X Pick Up _____ Client Delivered _____ Other _____

RECEIVED: Matt Horner DATE: 3-14-13 TIME: 1015 SAMPLE TEMP. @ RECEIPT. 0.4

1ST PAGE - LAB COPY 2ND PAGE - FACILITY COPY

HUTHER & ASSOCIATES
1156 NORTH BONNIE BRAE STREET
DENTON, TX 76201
(940) 387-1025 • FAX (940) 387-1036

CHAIN OF CUSTODY RECORD

20877PA

PROJECT # 20791 PROJECT NAME FTN River sample PERMIT# N/A

RC6510-0010-002

OUTFALL SAMPLES

24-Hr Flow Weighted Composite_____ Other_____

					METHODS OF COLLECTION AND COMPOSITE			
~~OUTFALL~~ NUMBER	PERSON TAKING SAMPLE	START DATE/TIME	END DATE/TIME	# OF PORTIONS COMPOSITED	AUTO COLL. AUTO COMP.	MANUAL COLL. MANUAL COMP.	AUTO COLL. MANUAL COMP.	# OF CONTAINERS TO BE SHIPPED
RED RIVER @ HWY 41	JMR/RPG	13MAR13 1050	13MAR13 1050	1		✓		1
RED RIVER @ HWY 41	JMR/RPG	13 MAR 13 1050	13 MAR 13 1050	1		✓		1

RECEIVING WATER SAMPLES

~~SAMPLE IDENTIFICATION (FOR REC'NG) H_2O GRABS, GIVE NAME OF STREAM AND~~ LOCATION	PERSON TAKING SAMPLE	DATE	TIME	# OF CONTAINERS TO BE SHIPPED

TYPE OF TEST 7 day ceriO

NAME OF RECEIVING WATER N/A

DILUTION WATER USED FOR THIS TEST N/A

RELINQUISHED BY: Jeremy Rigsby DATE: 13 MAR 13 TIME: 1200 RECEIVED BY AT THIS DATE/TIME _____

RELINQUISHED BY: _____ DATE: _____ TIME: _____ RECEIVED BY AT THIS DATE/TIME _____

RELINQUISHED BY: _____ DATE: _____ TIME: _____ RECEIVED BY AT THIS DATE/TIME _____

METHOD OF SHIPMENT: Greyhound X Pick Up _____ Client Delivered _____ Other _____

RECEIVED: Matt Bonner DATE: 3-14-13 TIME: 1015 SAMPLE TEMP. @ RECEIPT. 0.4

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HUTHER & ASSOCIATES
1156 NORTH BONNIE BRAE STREET
DENTON, TX 76201
(940) 387-1025 • FAX (940) 387-1036

CHAIN OF CUSTODY RECORD

PROJECT # 20791 2083717 PROJECT NAME FTN River sample PERMIT# N/A

R0610-0010-002

OUTFALL SAMPLES

24-Hr Flow Weighted Composite_____ Other_____

					METHODS OF COLLECTION AND COMPOSITE			
OUTFALL NUMBER	PERSON TAKING SAMPLE	START DATE/TIME	END DATE/TIME	# OF PORTIONS COMPOSITED	AUTO COLL. AUTO COMP.	MANUAL COLL. MANUAL COMP.	AUTO COLL. MANUAL COMP.	# OF CONTAINERS TO BE SHIPPED
RED RIVER @ Hwy 41	JMR/RPG	13 MAR 13 1050	13 MAR 13 1050	1		✓		1
RED RIVER @ Hwy 41	JMR/RPG	13 MAR 13 1050	13 MAR 13 1050	1		✓		1

RECEIVING WATER SAMPLES

SAMPLE IDENTIFICATION (FOR REC'NG) H_2O GRABS, GIVE NAME OF STREAM AND LOCATION	PERSON TAKING SAMPLE	DATE	TIME	# OF CONTAINERS TO BE SHIPPED

TYPE OF TEST 7 day cerio

NAME OF RECEIVING WATER N/A

DILUTION WATER USED FOR THIS TEST N/A

RELINQUISHED BY: Jeremy Rigsby DATE: 13 MAR 13 TIME: 1200 RECEIVED BY AT THIS DATE/TIME _____

RELINQUISHED BY: _____ DATE: _____ TIME: _____ RECEIVED BY AT THIS DATE/TIME _____

RELINQUISHED BY: _____ DATE: _____ TIME: _____ RECEIVED BY AT THIS DATE/TIME _____

METHOD OF SHIPMENT: Greyhound X Pick Up _____ Client Delivered _____ Other _____

RECEIVED: Matt Horner DATE: 3-14-13 TIME: 1015 SAMPLE TEMP. @ RECEIPT. 0.4

1ST PAGE - LAB COPY 2ND PAGE - FACILITY COPY

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DENTON, TX 76201
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CHAIN OF CUSTODY RECORD

PROJECT # 20791 20837 RA PROJECT NAME FTN River sample PERMIT# N/A

R06510-0010-002

OUTFALL SAMPLES

24-Hr Flow Weighted Composite_____ Other_____

					METHODS OF COLLECTION AND COMPOSITE			
~~OUTFALL~~ NUMBER	PERSON TAKING SAMPLE	START DATE/TIME	END DATE/TIME	# OF PORTIONS COMPOSITED	AUTO COLL. AUTO COMP.	MANUAL COLL. MANUAL COMP.	AUTO COLL. MANUAL COMP.	# OF CONTAINERS TO BE SHIPPED
RED RIVER @ HWY 41	JMR/RPG	13 MAR 13 1050	13 MAR 13 1050	1		✓		1
RED RIVER @ HWY 41	JMR/RPG	13 MAR 13 1050	13 MAR 13 1050	1		✓		1

RECEIVING WATER SAMPLES

~~SAMPLE IDENTIFICATION (FOR REC'NG H$_2$O GRABS, GIVE NAME OF STREAM AND LOCATION~~	PERSON TAKING SAMPLE	DATE	TIME	# OF CONTAINERS TO BE SHIPPED

TYPE OF TEST 7day chron

NAME OF RECEIVING WATER N/A

DILUTION WATER USED FOR THIS TEST N/A

RELINQUISHED BY: Jeremy Rigsby DATE: 13 MAR 13 TIME: 1200 RECEIVED BY AT THIS DATE/TIME _____

RELINQUISHED BY: _____ DATE: _____ TIME: _____ RECEIVED BY AT THIS DATE/TIME _____

RELINQUISHED BY: _____ DATE: _____ TIME: _____ RECEIVED BY AT THIS DATE/TIME _____

METHOD OF SHIPMENT: Greyhound X Pick Up _____ Client Delivered _____ Other _____

RECEIVED: Matt Horner DATE: 3-14-13 TIME: 1015 SAMPLE TEMP. @ RECEIPT. 0.4

1ST PAGE - LAB COPY 2ND PAGE - FACILITY COPY

Fishes of the Red River in Arkansas

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Drew Wilson and **L. G. Claybrook**
Arkansas Game and Fish Commission
2 Natural Resources Drive
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Pine Bluff, AR 71603

* Corresponding Author

Abstract

Fishes were collected from Red River mainstem habitats in Arkansas with seines, rotenone, hoop nets, gill nets, and trotlines from 1995 through 2001. Seventy-two species were identified distributed among 17 families, and 15 species were new records for the Red River in Arkansas. Eighty-three species are now historically known from the Arkansas segment of the Red River. Approximately 67% of the fishes known from the entire Red River have been found in the Arkansas segment, which is only 11% of the entire river length. Baseline data on the fish fauna of the Red River is critical for the analysis of potential effects to aquatic systems, and because of the potential for deleterious effects from alteration of aquatic habitats by a proposed project to extend the Red River Navigation System upstream from Shreveport, Louisiana to Index, Arkansas and by desalination projects upstream in Texas.

Introduction

The fish communities of large rivers are the least studied ichthyofaunas of all aquatic habitats in Arkansas. This study was the first comprehensive sampling to determine fish species distribution and abundance within the entire Arkansas segment of the Red River. An up-to-date survey of the fishes of the Red River in Arkansas is especially important because of the proposed construction of a navigation channel from Shreveport, Louisiana through the lower half of the Red River in Arkansas.

Description of the Red River and the Study Area in Arkansas.--The Red River originates in eastern New Mexico and flows easterly across the Texas panhandle, along the boundary between Texas and Oklahoma, through the southwestern corner of Arkansas, and across Louisiana to join the Atchafalaya River near Simmesport, Louisiana. The Red River formerly flowed directly into the Mississippi River, but the flood of 1927 and the subsequent construction of levees diverted the Red River southward into the Atchafalaya River (Douglas, 1974). Today, the Red River is accessible from the Mississippi River through its old channel because part of the Mississippi River flow is diverted through the old channel (11.3 km) into the Atchafalaya River, forming the first segment of the Red River Navigation System.

The Red River is 1,945 km long and drains an area of 179,308 km^2. The Arkansas segment of the river is 217 km long with a drainage area of 11,484 km^2. Compared to the other big rivers in Arkansas (e.g., the Arkansas and Mississippi Rivers), the Red River has been least altered by human activity. A number of anthropogenic alterations, however, have occurred in the Red River upstream and downstream from Arkansas. The upper Red River in Texas and Oklahoma contains salt concentrations approaching that of seawater with decreasing salinities occurring downstream (Matthews, 1998). The Echelle et al. (1972) fish surveys indicated that the species composition of the upper Red River reflected differences in the fish assemblages along the salinity gradient. Those assemblages are currently threatened to be influenced by a project underway to decrease the amount of salt in the Red River by building dams, brine reservoirs, pipelines and pumps on west Texas tributaries that feed the Red River. The natural flow regime has been changed by the construction of Denison Dam, which impounded Lake Texoma on the Red River in Oklahoma, by seven large impoundments in the Little River drainage in Arkansas and Oklahoma, and by several other small impoundments on Red River tributaries in Oklahoma. The lower portion of the Red River in Arkansas downstream from the U.S. Hwy 71 bridge has been modified by manmade levees and numerous areas of revetted banks and wing dikes. Upstream from U.S. Hwy 71 in Arkansas, however, few channel modification structures exist. Downstream from Arkansas, a series of locks and dams maintains a 2.7 m deep navigation channel from the Mississippi River through Old River and the Red River to Shreveport, Louisiana, a distance of approximately 377 km.

Chronological History of Red River Fish Sampling in Arkansas.--The earliest reported scientific collection of fishes from the Arkansas portion of the Red River was by Jordan and Gilbert (1886). During September 1884, David Starr Jordan assisted by Charles H. Gilbert, Joseph Swain, and Seth E. Meek collected fishes "with a fine-meshed seine of large size" from a number of streams in Arkansas, Indian Territory (Oklahoma), and Texas for the U. S. National Museum and the U.S. Fish Commission. The Red River at Fulton, Arkansas was one of their collecting sites. They judged the water to be at its lowest point and referred to the Red River at this site as "singularly barren of fish life"

although they collected 23 species. *Hybognathus nuchalis* was listed as "by far more numerous in individuals than any other species in the river." *Notropis atherinoides*, *Macrhybopsis hyostoma*, and *M. storeriana* were also reported to be rather common or abundant. All 23 species reported by Jordan and Gilbert (1886) were collected from the Red River in the 1990s.

The next reported collections of fishes from the Arkansas segment of the Red River were in 1938 and 1939 by John D. Black (1940), 54 years after Jordan's expedition. Black collected fishes at three mainstem sites and reported 34 currently recognized fish species from those localities, 18 of which had not been reported from the Red River mainstem by Jordan and Gilbert (1886). This increased the number of species known from the Red River in Arkansas to 41. Black's collections included the first known records of the Red River shiner, *Notropis bairdi*, from Arkansas (two adult specimens taken at Spring Bank Ferry, 8 km north of the Louisiana state line on 8 July 1939). Black also reported the only specimens of the plains minnow, *Hybognathus placitus*, ever taken from the Red River in Arkansas (three young and adult specimens collected at Spring Bank Ferry on 8 July 1939).

On 18 August 1940, Reeve M. Bailey and M. E. Davis collected 15 species of fishes from the Red River at Fulton. The results of this collection were not published, but the specimens were deposited in the University of Michigan Museum of Zoology. This collection added three species to the list of fishes known from the Red River in Arkansas, bringing the total known species to 44. The most noteworthy record from this sample was the second (and last known) report of *Notropis bairdi* from Arkansas (three

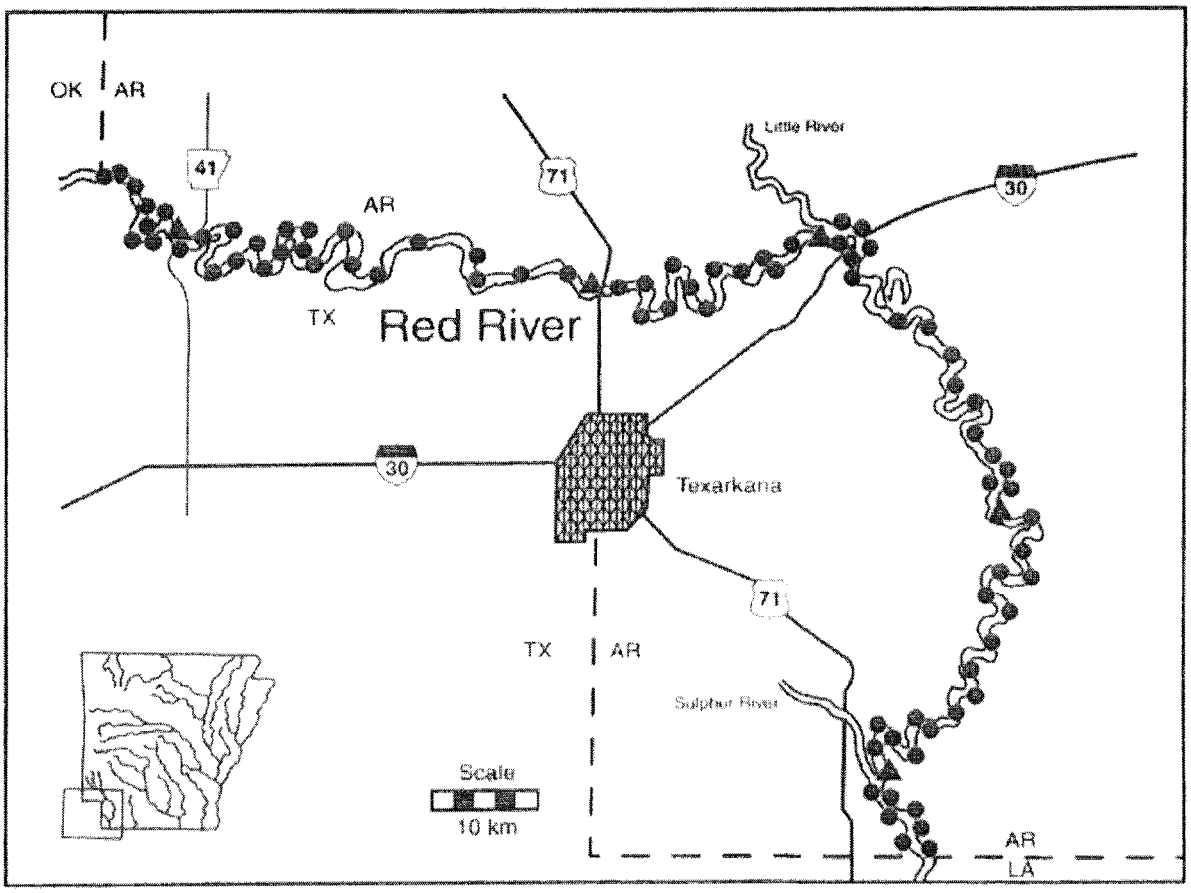

Fig. 1. Red River fish collecting sites in Arkansas, 1995-2001. Solid circles are localities sampled by seine and/or rotenone, solid triangles are localities sampled by hoop nets, gill nets, and/or trotlines. Collecting locales included the following counties in AR: Hempstead, Lafayette, Little River, and Miller.

Table 1. Fish species collected from the Red River in Arkansas, 1995-2001. Status of each species is designated as abundant (A), common (C), uncommon (U), or rare (R).

Species	Status	Collected upstream from Little R. mouth	Collected downstream from Little R. mouth
Scaphirhynchus platorynchus	C	X	X
Polyodon spathula	R		X
Atractosteus spatula	R	X	X
Lepisosteus oculatus	U	X	X
Lepisosteus osseus	A	X	X
Lepisosteus platostomus	U	X	X
Hiodon alosoides	R	X	
Alosa chrysochloris	U	X	X
Dorosoma cepedianum	C	X	X
Dorosoma petenense	A	X	X
*Ctenopharyngodon idella**	R		X
Cyprinella lutrensis	A	X	X
Cyprinella venusta	U	X	X
Cyprinus carpio	U	X	X
Hybognathus nuchalis	U	X	X
Macrhybopsis hyostoma	U	X	X
Macrhybopsis storeriana	A	X	X
Notemigonus crysoleucas	U	X	X
*Notropis amnis**	R		X
Notropis atherinoides	A	X	X
Notropis buchanani	U	X	X
Notropis potteri	A	X	X
Notropis shumardi	C	X	X
Opsopoeodus emiliae	U	X	X
*Phenacobius mirabilis**	R	X	
Pimephales vigilax	A	X	X
Carpiodes carpio	A	X	X
Cycleptus elongatus	A	X	X
Ictiobus bubalus	C	X	X
Ictiobus cyprinellus	U	X	X
*Ictiobus niger**	R	X	
Minytrema melanops	R		X
*Ameiurus natalis**	U	X	X
Ictalurus furcatus	A	X	X
Ictalurus punctatus	C	X	X
Noturus gyrinus	U	X	X
*Noturus nocturnus**	U	X	X
Pylodictis olivaris	C	X	X
Aphredoderus sayanus	U	X	X
*Fundulus blairae**	R		X
Fundulus chrysotus	R	X	X
Fundulus notatus	U	X	X
Fundulus olivaceus	R	X	
Gambusia affinis	C	X	X
*Labidesthes sicculus**	U	X	X
Menidia beryllina	A	X	X

Table 1. Continued

Morone chrysops	A	X	X
Morone mississippiensis	C	X	X
Morone saxatilis	C	X	X
Elassoma zonatum	U	X	X
Lepomis cyanellus	U	X	X
Lepomis gulosus	C	X	X
Lepomis humilis	C	X	X
Lepomis macrochirus	C	X	X
Lepomis megalotis	C	X	X
Lepomis microlophus	U	X	X
Lepomis miniatus	R	X	X
*Lepomis symmetricus**	U	X	X
*Micropterus punctulatus**	U	X	X
Micropterus salmoides	C	X	X
Pomoxis annularis	C	X	X
Pomoxis nigromaculatus	U	X	X
Ammocrypta clara	U	X	
*Etheostoma asprigene**	R	X	X
*Etheostoma chlorosomum**	U	X	X
*Etheostoma collettei**	R	X	
Etheostoma gracile	C	X	X
*Percina macrolepida**	U	X	X
*Percina maculata**	R	X	X
Percina sciera	U	X	
Percina shumardi	U	X	X
Aplodinotus grunniens	A	X	X

* A species first collected from the Arkansas segment of the Red River in this study.

specimens, UMMZ 170013).

Reeves (1953) provided records for the Alabama shad, *Alosa alabamae*, from the Little River of Oklahoma, a Red River tributary. *Alosa alabamae*, an anadromous species, had to ascend the Arkansas portion of the Red River to reach spawning habitat in the Little River of Oklahoma, increasing the known Red River fauna of Arkansas to 45 species.

Buchanan (1973) provided distribution maps showing all known species records and localities for the Red River in Arkansas. This was a summary of all known previous collections, but nine additional species were added to the list of fishes known from the Red River. These nine new species came from Arkansas Game & Fish Commission records of gill netting samples from the Red River in the 1960s and from seine collections at five localities by Buchanan in 1972, bringing the total known fish species in the Red River to 54.

The next, and until now most intensive, fish sampling on the Red River in Arkansas was a survey of the fishes from Index, Arkansas (U.S. Hwy. 71 bridge) to Shreveport, Louisiana by Kelly H. Oliver from December 1978 through July 1979 (Dorris et al., 1979). Oliver sampled 13 mainstem sites in the lower half of the Arkansas portion of the Red River and four mainstem sites in Louisiana. Each site was sampled from one to three times by gill nets, seines, and/or electrofishing; occasional creel censuses were made when local fishermen were encountered. Oliver's field notes and collection site species lists were lost, and it is not possible to precisely determine which fish species were found in the Arkansas portion of the Red River from the data presented in the report (Dorris et al., 1979). Eight species reported by Oliver from the Red River mainstem were possibly misidentified. No voucher specimens of the eight questionable species were available for examination, and those species were not considered as part of the documented Red River fauna. Because 57 of the 58 species reported from the mainstem of the Red River were found in the Arkansas segment of the river, we accept 10 of the species listed by Oliver as new Red River records for Arkansas, bringing the total known mainstem species to 64. All 10 of Oliver's new species records were subsequently confirmed from the Red River by other collectors.

From 1973 to 1987, Robison and Buchanan (1988) made 27 fish collections by seine in the Red River mainstem between the Oklahoma and Louisiana state lines. These collections added four additional species to the known Red River fish fauna of Arkansas, bringing the known species total to 68.

Table 2. Fish species historically known from the Red River in Arkansas but not collected in the 1995-2001 sampling.

Species	Collector and/or author first reporting species
Ichthyomyzon castaneus	Robison and Buchanan (1988)
Amia calva	Bailey, 1940 (Buchanan, 1973)
Anguilla rostrata	Buchanan (1973)
Alosa alabamae	Reeves (1953)
Campostoma anomalum	Oliver (Dorris et al., 1979)
Hybognathus placitus	Black (1940)
Luxilus chrysocephalus	Black (1940)
Notropis bairdi	Black (1940)
Pimephales promelas	Oliver (Dorris et al., 1979)
Ameiurus melas	Black (1940)
Mugil cephalus	Oliver (Dorris et al., 1979)

Methods

Main channel Red River habitats in four counties of Arkansas from the Oklahoma state line to the Louisiana state line were sampled by seines and rotenone from 1995 through 2001 and by gill nets, hoop nets, and trotlines in 1997 and 1998 (Fig. 1). Ninety-one seine and/or rotenone samples were taken in the following four mainstem habitats: main river channel in slow to swift current along point bars and islands, chutes, backwaters adjacent to main channel, and sandbar pools. Seine collections were made with 6 x 1.5 m and 9 x 1.5 m nylon seines of 3.2 mm mesh. Small-scale samples were made with rotenone in areas of little or no current. Sampling time by seine and rotenone averaged 1.0 hour per site and ranged from 0.5 to 2.0 hours. Specimens were preserved in 10% formalin and later transferred to 45% isopropanol. All preserved fishes were identified in the laboratory, and specimens were deposited in the Zoology Collection of the University of Arkansas – Fort Smith.

Five localities in the Arkansas segment of the Red River were sampled with gill nets and hoop nets between March and June 1997, and the three most downstream of those localities were sampled with gill nets and hoop nets between January and July 1998 (Fig. 1), for a total of eight site-samples during the two sampling periods. Each site included a river reach of approximately 8 km. Hoop nets 1.2 m in diameter with 3.8 cm bar mesh were used in deep water, and hoop nets 0.9 m in diameter with 3.8 cm bar mesh were used in shallow water. The hoop nets were checked twice daily, just after sunrise and just before sunset. Experimental gill nets consisting of three 30 m panels one each of 5.1, 7.6, and 10.2 cm monofilament webbing were checked at approximately two-hour intervals. At the two most downstream sampling localities, trotlines baited with golden shiners were used in 1997. A total of 378 hoop net nights, 24 gill net nights, and 8 trotline nights represented approximately 5000 hours of sampling at the five sites.

Present status in the Red River was assigned to each fish species collected in this study (Table 1) based on a combination of habitats sampled, sampling methods used, and number of individuals collected. Species collected mainly by seines and/or rotenone were assigned a status as follows: (1) Abundant – more than 700 specimens collected and the species taken in more than 60 samples, (2) Common – 100-700 specimens collected and taken in 25-59 samples, (3) Uncommon – 11-99 specimens collected and taken in 5-24 samples, and (4) Rare – 1-10 specimens collected and taken in 1-4 samples.

Species taken almost exclusively by hoop nets, gill nets, and trotlines were assigned a status as follows: (1) Abundant – more than 100 specimens collected and taken in seven or eight of the eight site-samples during 1997 and 1998, (2)

Common – 30-99 specimens collected and taken in five or six site-samples, (3) Uncommon – 5-15 specimens collected and taken in three or four site-samples, and (4) Rare – 1-4 specimens collected and taken in one or two site-samples.

Species meeting only one of the two criteria (number of specimens and number of sites) for a given rank in the above two ranking systems were assigned to the next lower ranked category. A few species, which were taken in a variety of habitats and by a variety of methods, were assigned a rank by using a combination of the two previously described ranking systems.

To compare fish species richness and distribution of the Arkansas segment of the Red River with the much longer Red River segments upstream and downstream from Arkansas, several data sources were consulted. Fish distribution records in the Red River upstream from Arkansas were obtained from Hargrave (2000), Miller and Robison (1973), Riggs and Bonn (1959), Sublette et al. (1990), the University of Oklahoma Museum of Natural History, and the Oklahoma Department of Environmental Quality records from Red River fish sampling stations. Fish distribution records in the Red River downstream from Arkansas came from Douglas (1974) and the University of Louisiana at Monroe and Tulane University fish collection databases. Fish species similarity of the Red River segments upstream and downstream from Arkansas was compared with the Arkansas segment by using the index of similarity (S) of Odum (1971), S=2C/A+B, where C is the number of fish species common to two segments being compared, A is the total number of species in one segment, and B is the total number of species in the other stream segment.

Results

Seventy-two fish species and one hybrid combination (38 specimens of *Morone chrysops* x *M. saxatilis*) were collected from the Red River mainstem in Arkansas (Table 1). Fifteen species were new records, bringing the total number of species historically known from the Red River in Arkansas to 83. Prior to this study, 68 fish species were historically reported from the Red River in Arkansas, and 11 of those species were not collected in our 1995-2001 sampling (Table 2). Fish sampling in the Arkansas segment of the Red River in 1999 and 2000 by the U.S. Army Corps of Engineers produced no additional new species records (pers. comm., J. Kilgore, U.S. Army Corps of Engineers Waterways Experiment Station, Vicksburg, MS).

The species collected in this study were distributed among 17 families. More than 84% of the specimens collected were in the minnow family, Cyprinidae. The four next most abundant families by number of specimens collected were Centrarchidae (5%), Clupeidae (3%), Catostomidae (1.7%), and Atherinopsidae (1.4%). The ten most abundant species in decreasing order of number of specimens collected were as follows: *Notropis atherinoides, N. potteri, Cyprinella lutrensis, Pimephales vigilax, N. shumardi, Lepomis humilis, Dorosoma petenense, Macrhybopsis storeriana, Menidia beryllina*, and *Carpiodes carpio*. Six species represented by only a single specimen each were as follows: *Polyodon spathula, Ctenopharyngodon idella, Phenacobius mirabilis, Ictiobus niger, Fundulus blairae*, and *F. olivaceus*.

In general, the 10 most abundant species were also the most widely distributed species in the study area based on the number of collections in which they were found. Only *N. shumardi* among the 10 most abundant species was not among the 10 most widely distributed species (falling to twelfth most widely distributed). The ten species appearing in the greatest number of collections in decreasing order were as follows: *C. lutrensis, P. vigilax, N. atherinoides, M. beryllina, D. petenense, M. storeriana, D. cepedianum, N. potteri, C. carpio*, and *L. humilis*.

Discussion

The Red River exhibits the well-documented pattern of increasing fish species richness from headwaters to downstream (Horwitz, 1978; Matthews, 1998), and the Arkansas segment of the Red River has high fish species richness. Approximately 124 fish species are historically known from the entire Red River. Eleven percent of the Red River mainstem length and 6.4% of the total Red River drainage area are in Arkansas, and 83 species are historically known from the Arkansas segment. This is approximately 67% of the entire Red River fish fauna, and 58% percent of the mainstem fish fauna was found in this study. Ninety fish species are known from the Red River upstream from Arkansas, and 106 species are known from the Red River downstream from Arkansas. Two species *Etheostoma collettei* and *Percina maculata* have been reported only from the Arkansas segment, 11 species from the Arkansas segment have not been reported upstream from Arkansas, and seven species found in Arkansas have not been reported from the Red River in Louisiana. In this study, the Arkansas segment of the Red River had 61% of the species known from the downstream segment and 68% of the species reported from the upstream reaches. Based on the similarity index (S) of Odum (1971), the fish species composition of the Arkansas segment of the Red River is slightly more similar to the river segment upstream from Arkansas (S=.83) than to the downstream segment (S=.80). Species historically known from the Arkansas segment comprise 80% and 72% of the species reported from the upstream and downstream segments, respectively.

One currently abundant species, *Notropis potteri*, occurs in the Arkansas portion of its range only in the main channel of the Red River. This species occurred throughout the

study reach and was the second most abundant species found with nearly 10,000 specimens collected. A single specimen of *Phenacobius mirabilis* was the first record of that species from the mainstem Red River in Arkansas and was only the second specimen of that species collected in Arkansas in the last 50 years. The bigscale logperch, *Percina macrolepida*, was first reported in Arkansas from the upper portion of the Red River (Buchanan et al., 1996) and was found throughout the Arkansas segment of the Red River in this study.

The blue sucker, *Cycleptus elongatus*, was the most abundant large species caught by hoop nets and was the third most common large species (after *Carpiodes carpio* and *Aplodinotus grunniens*) collected by all methods. The range of *C. elongatus* has drastically declined in recent decades, and it is currently more abundant in the Red River than in any other river in Arkansas. Two specimens of alligator gar, *Atractosteus spatula*, another declining big river fish were collected. Layher (1998) provided additional data on large species collected from the Red River by hoop nets, gill nets, and trotlines.

Eleven species previously reported from the Red River in Arkansas were not found in this study (Table 2). Two of those species, *Campostoma anomalum* and *Luxilus chrysocephalus*, probably are accidentals from tributaries. It is likely that additional Red River floodplain and tributary species could occasionally be taken in future main channel sampling.

Three of the historically reported species not found in our study have probably been extirpated from the Arkansas segment of the Red River. The Alabama shad, *Alosa alabamae*, was reported from the Little River, a Red River tributary in Oklahoma (Reeves, 1953; Miller and Robison, 1973). That anadromous species is no longer able to ascend the Little River to reach its former spawning areas in Oklahoma due to the 1963 construction of Millwood Dam on Little River in Arkansas. *Alosa alabamae* still successfully ascends the lower 55 km of the Red River Navigation System in Louisiana to enter and spawn in the Ouachita River in Arkansas (Buchanan et al., 1999). The plains minnow, *Hybognathus placitus*, and the Red River shiner, *Notropis bairdi*, have not been reported from the Arkansas segment of the Red River in more than 60 years. Both of those primarily Great Plains species are common today in the Red River upstream from Lake Texoma, and small populations of those species persisted into the mid 1990s in the Red River of Oklahoma downstream from Lake Texoma (pers. comm., J. Pigg, Oklahoma Department of Environmental Quality). It is possible that future fish sampling could produce sporadic records of *H. placitus* and *N. bairdi* in the Red River of Arkansas because both species were taken at an Oklahoma Department of Environmental Quality fish sampling site on the Red River near DeKalb, Texas, 18 km upstream from the Arkansas state line as recently as 1995. Unsuccessful attempts were made to collect both species in the Arkansas portion of the Red River near the Oklahoma state line in each year of this study.

Human alteration of the Red River has likely caused the extirpation of *A. alabamae*, *H. placitus*, and *N. bairdi* from the Arkansas segment of that river. Construction of the Red River Navigation System in Louisiana impedes or blocks access of *A. alabamae* to former upstream tributaries of the Red River in Arkansas and Oklahoma, and dams on Little River also block access to former spawning sites. The impoundment of Lake Texoma by Denison Dam on the Red River in Oklahoma in 1944 fragmented the ranges of *H. placitus* and *N. bairdi*, creating a more precarious situation for populations of those species downstream from Denison Dam. Great Plains streams typically experience environmental fluctuations that can lead to the extirpation of local populations of fish species (Luttrell et al., 1999). A species whose range has been fragmented by a dam has little possibility of repopulation if populations above or below the dam are lost. Winston et al. (1991) documented major changes in the fish community in the North Fork of the Red River in Oklahoma, including extirpation of four minnow species following construction of Altus Dam on that river. The small populations of *H. placitus* and *N. bairdi*, known from the Red River in Oklahoma below Denison Dam as recently as the 1990s, have little chance of repopulation from the larger populations of those species upstream from Lake Texoma if they are extirpated.

The mouth of the Little River, just west of Interstate Hwy 30, divides the Arkansas segment of the Red River into two nearly equal parts. The Red River upstream from the Little River mouth, especially upstream from the U.S. Hwy 71 bridge, has been altered very little by manmade structures, whereas the Red River downstream from the Little River mouth has numerous levees, wingdikes, and revetted banks. We found no substantial differences in fish species richness between the upstream (67 species) and downstream (65 species) segments in Arkansas. Seven species were found only in the upstream segment, and five species were found only in the downstream segment (Table 1). Some species found in both river segments in Arkansas were more abundant in one segment based on number of specimens taken and the number of samples in which they occurred. *Macrhybopsis hyostoma*, *Notropis buchanani*, *Labidesthes sicculus*, *Etheostoma asprigene*, and *E. chlorosomum* were more abundant in the upstream segment of the Red River in Arkansas, and *Lepisosteus oculatus*, *Cyprinella venusta*, and *Morone mississippiensis* were more abundant in the downstream segment.

The U.S. Army Corps of Engineers has proposed a project to extend the Red River Navigation System 217 km

upstream from Shreveport, Louisiana to Index, Arkansas near U.S. Highway 71. This project, currently estimated to cost one billion dollars, would require the construction of three to five locks and dams, over 100 dikes, extensive rock revetments, and other channel modification structures. It is not possible to precisely predict the effects of such a project on the fish community of the Red River; however, such a drastic modification of the environment would likely have major impacts on fish species richness, diversity, and distribution. Some species would increase in abundance, while others would decrease or even be extirpated from large sections of the river. This study of the fishes of the Arkansas segment of the Red River should provide a baseline for determining future changes in fish species distribution and abundance.

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