RESIDUAL ORGANOCHLORINE PESTICIDE CONTAMINATION IN FISH COLLECTED FROM THE TRINITY RIVER WITHIN THE PROPOSED CENTRAL CITY MULTI-PURPOSE PROJECTS AREA
TARRANT COUNTY, TEXAS
APRIL, 2004

Supplemental Report for:

Baseline Fisheries Survey for the Trinity River
within the Proposed Central City Multi-purpose Projects Area
Tarrant County, Texas
October, 2003

Residual Organochlorine Pesticide Contamination in Fish Collected from the Trinity River within the Proposed Central City Multi-purpose Projects Area, Tarrant County, Texas April, 2004

Introduction

For screening purposes, 13 fish and one freshwater mussel were collected from the five Trinity River sampling locations and retained for chemical analyses[1] (Figure 1 and Table 1). A whole body mussel sample and edible muscle tissues (skinless fillets) from each fish were collected by U.S. Fish and Wildlife personnel using a Rapala stainless steel fillet knife. This knife was decontaminated after each sample using Liqui-Nox detergent and de-ionized water. The samples were submitted to Talem Environmental Services, Inc. (610 South Jennings Avenue, Fort Worth, Texas 76104) for residual organochlorine pesticide analyses. Each sample was analyzed for 19 organochlorine contaminants [aldrin, alpha-hexachlorocyclohexane (αBHC), beta-hexachlorocyclohexane (βBHC), delta-hexachlorocyclohexane (δBHC), gamma-hexachlorocyclohexane (γBHC), technical chlordane, dichloro-diphenyl-dichloroethane

Table 1. Aquatic organisms collected from five Trinity River sampling sites, July, 2003, for chemical analyses (Note - g is grams; lb is pounds; mm is millimeters; and in is inches).

Site No.	Species	Weight (g)	Weight (lb)	Length (mm)	Length (in)
1	Largemouth Bass (*Micropterus salmoides*)	656	1.5	350	13.8
1	Channel Catfish (*Ictalurus punctatus*)	1687	3.7	540	21.3
1	Common Carp (*Cyprinus carpio*)	2825	6.2	585	23.0
2	Spotted Bass (*Micropterus punctulatus*)	199	0.4	240	9.4
2	Channel Catfish (*Ictalurus punctatus*)	1031	2.3	500	20.0
2	River Carpsucker (*Carpiodes carpio*)	694	1.5	380	15.0
3	Largemouth Bass (*Micropterus salmoides*)	336	0.7	300	11.0
3	Common Carp (*Cyprinus carpio*)	2117	4.7	525	20.7
3	Giant Floater Mussel (*Pyganodon grandis*)	425	0.9	160	6.3
4	Largemouth Bass (*Micropterus salmoides*)	625	1.4	360	14.2
4	Flathead Catfish (*Pylodictis olivaris*)	864	1.9	460	18.1
4	Common Carp (*Cyprinus carpio*)	1516	3.3	520	20.5
5	Largemouth Bass (*Micropterus salmoides*)	231	0.5	255	10.0
5	Common Carp (*Cyprinus carpio*)	1437	3.2	480	18.9

[1] It should be noted that these samples were collected in July, 2003, but not submitted for analyses until March, 2004. According to the USEPA Environmental Modeling and Assessment Program, samples may be retained up to one year before significant degradation of organochlorine contaminants would be expected to occur as long as the samples remain frozen at minus 20 degrees Celsius (Denoux, personal communication, 2004). After collection, each sample from the Trinity River was individually vacuum sealed in plastic bags using a Food Saver VacLoc Deluxe II Vacuum Sealer (Model No. 99-21-F-01-5226) and remained frozen until submitted for chemical analyses.

(DDD), dichloro-diphenyl-dichloroethylene (DDE), dichloro-diphenyl-trichloroethane (DDT), dieldrin, endosulfan I, endosulfan II, endosulfan sulfate, endrin, endrin aldehyde, heptachlor, heptachlor epoxide, methoxychlor, and toxaphene] in milligrams per kilogram (mg/kg) wet weight following U.S. Environmental Protection Agency Method 8081A.

Results

All of the fish collected contained detectable amounts of residual organochlorine pesticides (Table 2). The freshwater mussel sample collected from Site 3 did not contain organochlorine concentrations above the analytical detection limits (Table 2). Aldrin, αBHC, βBHC, δBHC, γBHC, endosulfan I, endosulfan II, endosulfan sulfate, endrin, endrin aldehyde, heptachlor, heptachlor epoxide, and methoxychlor were not detected above their respective analytical detection limits in any of the samples submitted (Table 2). Conversely, detectable amounts of technical chlordane, DDE, DDT, dieldrin, and toxaphene were measured in one or more of the fish tissue samples (Table 2).

[Technical Chlordane] Listed by the U.S. Environmental Protection Agency (USEPA) as a probable carcinogen, technical chlordane consists of the stereoisomers alpha and gamma or *cis* and *trans*-chlordane, heptachlor, *cis*- and *trans*-nonachlor, and the metabolites oxychlordane and heptachlor epoxide (ATSDR, 1994; USEPA, 2004). First developed in 1946, chlordane was used as a general pesticide until 1983 (LMF, 2002). Between 1983 and 1988, use of chlordane in the United States was restricted by the USEPA to subterranean termite control (ATSDR, 1994). All commercial use of chlordane as a pesticide was banned by the USEPA in the United States in 1988 (ATSDR, 1994). Once in the environment, chlordane binds tightly with soil and sediment particles and can remain in the soil for more than 20 years (LMF, 2002). It can bio-accumulate in the tissues of fish, birds, and mammals and can adversely affect the nervous, digestive, and hepatic systems in both humans and animals (ATSDR, 1994; LMF, 2002). In edible fish tissue, the USEPA considers a technical chlordane concentration of 0.0083 mg/kg wet weight as a conservative human-health screening value (Nowell and Resek, 1994). This concentration is based on a carcinogenicity risk level of 1×10^{-6} and negligible non-cancer health risks (Nowell and Resek, 1994). In contrast, both the U.S. Food and Drug Administration (USFDA) action level and the Texas Commission on Environmental Quality (TCEQ) screening value are reported at 0.3 mg/kg wet weight (USFDA, 2000; TCEQ, 2003). The USFDA action level is applicable for interstate commerce and represents a regulatory limit that when equaled or exceeded could result in legal action being taken by the USFDA to prevent the consumption of a given contaminant, while the TCEQ value is based on a carcinogenicity risk of 1×10^{-5} (USFDA, 2000; TCEQ, 2003).

Six of the 13 fish sampled (three common carp, one river carpsucker and two channel catfish), contained detectable amounts of technical chlordane (Table 2). These measured concentrations ranged from 0.084 mg/kg wet weight in the channel catfish collected from Site 2 to 0.61 mg/kg wet weight in the common carp collected from Site 1. All six of these fish contained chlordane levels that exceeded the cited USEPA criterion, while the river carpsucker from Site 2 and the common carp collected from Sites 1 and 4 contained chlordane concentrations that were greater than the cited USFDA action level and TCEQ screening value (Nowell and Resek, 1994; USFDA, 2000; TCEQ, 2003).

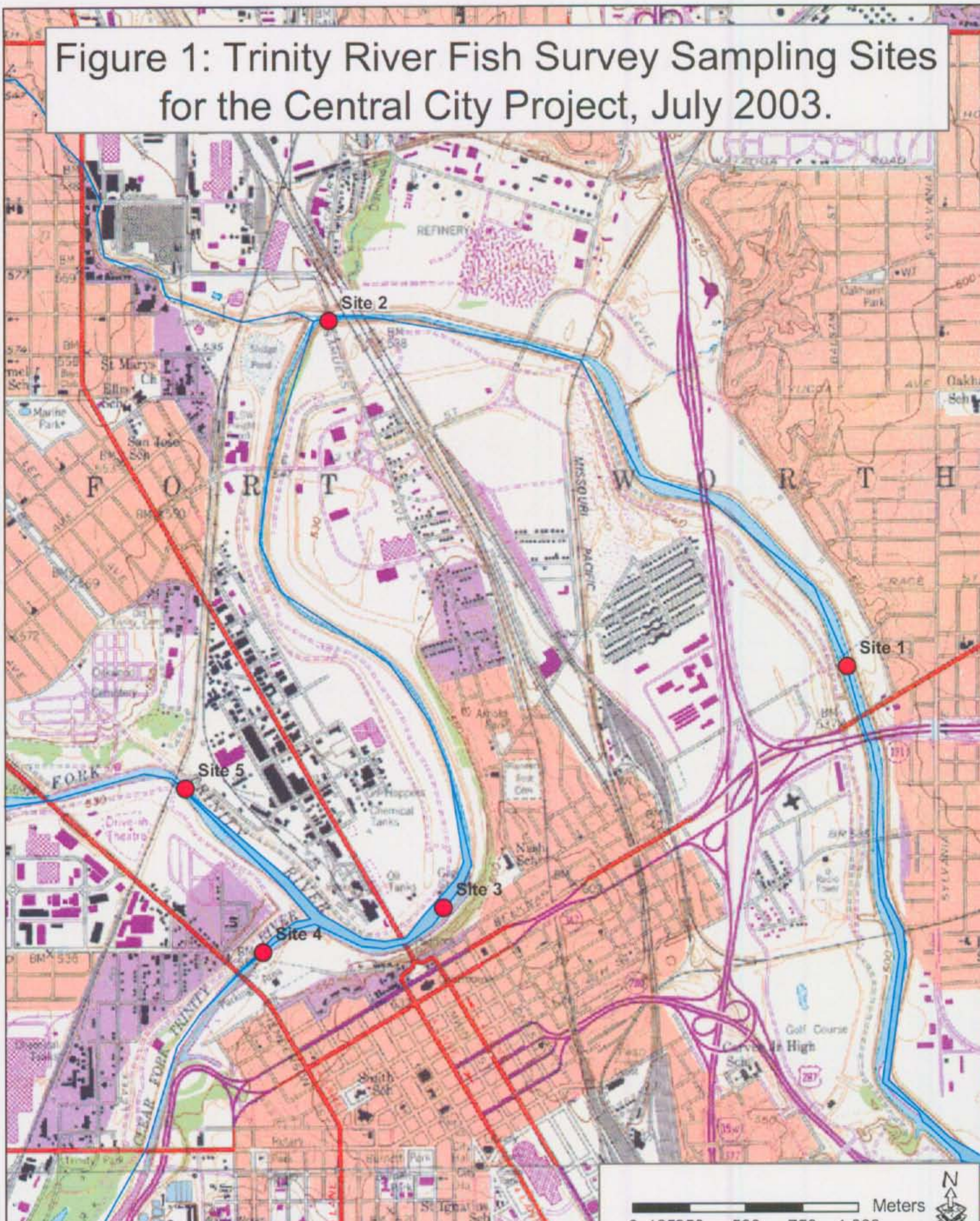

Figure 1: Trinity River Fish Survey Sampling Sites for the Central City Project, July 2003.

Table 2. Results of organochlorine pesticide analyses in mg/kg wet weight for fish skinless muscle tissue samples collected from five sites on the Trinity River, Tarrant County, Texas, July, 2003 (Note - mdl is the method detection limit; and bdl is below the analytical detection limit).								
Analyte	**Largemouth Bass Site 1**	**Channel Catfish Site 1**	**Common Carp Site 1**	**Spotted Bass Site 2**	**Channel Catfish Site 2**	**River Carpsucker Site 2**	**Largemouth Bass Site 3**	**Common Carp Site 3**
aldrin	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
mdl	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
αBHC	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
mdl	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
βBHC	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
mdl	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
δBHC	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
mdl	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
γBHC	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
mdl	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
chlordane	bdl	0.12	0.61	bdl	0.084	0.31	bdl	0.25
mdl	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
DDD	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
mdl	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
DDE	bdl	0.035	0.14	bdl	0.028	0.11	bdl	bdl
mdl	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
DDT	bdl	bdl	bdl	bdl	bdl	0.022	bdl	bdl
mdl	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
dieldrin	bdl	bdl	0.026	bdl	bdl	0.017	bdl	0.016
mdl	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
endosulfan I	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
mdl	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
endosulfan II	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
mdl	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
endosulfan sulfate	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
mdl	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
endrin	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
mdl	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
endrin aldehyde	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
mdl	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
heptachlor	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
mdl	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
heptachlor epoxide	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
mdl	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
methoxychlor	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
mdl	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
toxaphene	0.14	bdl	bdl	0.15	bdl	2.2	0.16	bdl
mdl	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05

Table 2 (concluded). Results of organochlorine pesticide analyses in mg/kg wet weight for fish skinless muscle tissue samples collected from five sites on the Trinity River, Tarrant County, Texas, July, 2003 (Note - mdl is the method detection limit; and bdl is below the analytical detection limit).						
Analyte	**Freshwater Mussel Site 3**	**Largemouth Bass Site 4**	**Channel Catfish Site 4**	**Common Carp Site 4**	**Largemouth Bass Site 5**	**Common Carp Site 5**
aldrin	bdl	bdl	bdl	bdl	bdl	bdl
mdl	0.01	0.01	0.01	0.01	0.01	0.01
αBHC	bdl	bdl	bdl	bdl	bdl	bdl
mdl	0.01	0.01	0.01	0.01	0.01	0.01
βBHC	bdl	bdl	bdl	bdl	bdl	bdl
mdl	0.01	0.01	0.01	0.01	0.01	0.01
δBHC	bdl	bdl	bdl	bdl	bdl	bdl
mdl	0.01	0.01	0.01	0.01	0.01	0.01
γBHC	bdl	bdl	bdl	bdl	bdl	bdl
mdl	0.01	0.01	0.01	0.01	0.01	0.01
chlordane	bdl	bdl	bdl	0.37	bdl	bdl
mdl	0.05	0.05	0.05	0.05	0.05	0.05
DDD	bdl	bdl	bdl	bdl	bdl	bdl
mdl	0.01	0.01	0.01	0.01	0.01	0.01
DDE	bdl	bdl	bdl	0.082	bdl	bdl
mdl	0.01	0.01	0.01	0.01	0.01	0.01
DDT	bdl	bdl	bdl	bdl	bdl	bdl
mdl	0.01	0.01	0.01	0.01	0.01	0.01
dieldrin	bdl	bdl	bdl	0.014	bdl	bdl
mdl	0.01	0.01	0.01	0.01	0.01	0.01
endosulfan I	bdl	bdl	bdl	bdl	bdl	bdl
mdl	0.01	0.01	0.01	0.01	0.01	0.01
endosulfan II	bdl	bdl	bdl	bdl	bdl	bdl
mdl	0.01	0.01	0.01	0.01	0.01	0.01
endosulfan sulfate	bdl	bdl	bdl	bdl	bdl	bdl
mdl	0.01	0.01	0.01	0.01	0.01	0.01
endrin	bdl	bdl	bdl	bdl	bdl	bdl
mdl	0.01	0.01	0.01	0.01	0.01	0.01
endrin aldehyde	bdl	bdl	bdl	bdl	bdl	bdl
mdl	0.01	0.01	0.01	0.01	0.01	0.01
heptachlor	bdl	bdl	bdl	bdl	bdl	bdl
mdl	0.01	0.01	0.01	0.01	0.01	0.01
heptachlor epoxide	bdl	bdl	bdl	bdl	bdl	bdl
mdl	0.01	0.01	0.01	0.01	0.01	0.01
methoxychlor	bdl	bdl	bdl	bdl	bdl	bdl
mdl	0.01	0.01	0.01	0.01	0.01	0.01
toxaphene	bdl	0.25	0.23	2.90	0.13	0.22
mdl	0.05	0.05	0.05	0.05	0.05	0.05

[Dichloro-diphenyl-trichloroethane (DDT) and metabolites] First developed in 1939, dichloro-diphenyl-trichloroethane (DDT) was used extensively throughout the world as an all purpose insecticide (ATSDR, 1995). Considered a probable human carcinogen by the USEPA, commercial production of DDT was banned in the United States in 1972 because of adverse affects to non-target wildlife species and the potential harm to human health (ATSDR, 1995; ATSDR, 2000). The metabolites dichloro-diphenyl-dichloroethane (DDD) and dichloro-diphenyl-dichloroethylene (DDE) are microbial degradation products formed by the dehydrohalogenation of DDT (ATSDR, 2000). In wildlife, DDT exposure has resulted in birds, alligators, and turtles producing eggs with shells too thin for offspring survival (Baskin, 2002). This compound exhibits very low solubility in aquatic environments and bio-accumulates in the fatty tissues of fish, birds, and other animals (Baskin, 2002). Chronic exposure has resulted in hepatic non-carcinogenic toxicological effects to exposed organisms (USEPA, 2004). In edible fish tissue, the USEPA recommends DDD, DDE, and DDT concentrations of 0.0449, 0.0316, and 0.0316 mg/kg wet weight, respectively, as conservative screening values (Nowell and Resek, 1994). These concentrations are based on carcinogenicity risk levels of 1×10^{-6} and negligible non-cancer health risks (Nowell and Resek, 1994). The USFDA action levels for DDT and its metabolites are 5 mg/kg wet weight, while the screening values reported by the TCEQ for DDD, DDE, and DDT are 9.606, 5.45, and 5.277 mg/kg wet weight, respectively (USFDA, 2000; TCEQ, 2003). The values reported by the TCEQ (2003) are based on a carcinogenicity risk level of 1×10^{-5}.

The metabolite DDE was measured above the analytical detection limit in five of the fish sampled (one river carpsucker, two common carp, and two channel catfish), while DDT was detected above the analytical detection limit in one sample (one river carpsucker from Site 2) (Table 2). As previously stated, the metabolite DDD was not measured above the analytical detection limits in any of the 13 fish collected. The measured DDE concentrations ranged from 0.028 mg/kg wet weight in the channel catfish collected from Site 2 to 0.14 mg/kg wet weight in the common carp collected from Site 1. The channel catfish collected from Site 1, the river carpsucker from Site 2, and the common carp collected from Sites 1 and 4 contained detectable amounts of DDE that exceeded the referenced USEPA criterion; however, none of the fish collected contained DDE levels that equaled or exceeded the cited USFDA or TCEQ screening values (Nowell and Resek, 1994; USFDA, 2000; TCEQ, 2003). The DDT level measured in the river carpsucker collected at Site 2 was less than all cited screening values (Nowell and Resek, 1994; USFDA, 2000; TCEQ, 2003).

[Dieldrin] Listed by the USEPA as a probable carcinogen, dieldrin is a synthetic cyclic hydrocarbon that exhibits high toxicity and is persistent in soils (Cornell, 1998). It is formed as a degradation product of the pesticide aldrin (Cornell, 1998; USEPA, 2004). From 1950 through 1970, dieldrin was used in the United States as a pesticide (ATSDR, 1993). In 1974, the USEPA banned all uses of dieldrin except for termite control (ATSDR, 1993). Once in the environment, dieldrin degrades very slowly and binds tightly to soil and sediment particles (ATSDR, 1993). Chronic exposure has resulted in hepatic non-carcinogenic toxicological affects to exposed organisms (USEPA, 2004). In edible fish tissue, the USEPA reports a dieldrin concentration of 0.0007 mg/kg wet weight as a conservative human-health screening value, whereas the USFDA action level is 0.3 mg/kg wet weight (Nowell and Resek, 1994; USFDA, 2000). The

USEPA concentration is based on a carcinogenicity risk level of 1 x 10^{-6} and negligible non-cancer health risks (Nowell and Resek, 1994). The dieldrin-fish tissue screening value recommended by the TCEQ (2003) for freshwater systems is 0.057 mg/kg wet weight. This value is based on a carcinogenicity risk level of 1 x 10^{-5} (TCEQ, 2003).

Dieldrin was detected above the analytical detection limits in four of the 13 fish collected from the Trinity River (one river carpsucker and three common carp) (Table 2). Detected concentrations in these four fish ranged from 0.014 mg/kg wet weight in the common carp collected from Site 4 to 0.026 mg/kg wet weight in the common carp from Site 1. All four of these fish contained dieldrin levels that exceeded the referenced USEPA criterion, however none of the fish sampled contained dieldrin concentrations the equaled or exceeded the cited USFDA action level or TCEQ screening value (Nowell and Resek, 1994; USFDA, 2000; TCEQ, 2003).

[Toxaphene] Listed by the USEPA as a persistent, bio-accumulative, and toxic chemical (PBT), and considered a probable human carcinogen, toxaphene is an organochlorine pesticide that is composed of over 670 polychlorinated bicyclic terpenes (ATSDR, 2004; USEPA, 2004). It was produced commercially in the United States from 1947 until banned in 1990 (ATSDR, 2004). Toxaphene was used primarily as an insecticide to control pests in cotton crops (ATSDR, 2004). When released into the environment, it readily adsorbs to soils and sediments (ATSDR, 2004; Spectrum, 2004). Reported half-lives in soil range up to 14 years (Spectrum, 2004). In aquatic systems, toxaphene does not readily hydrolyze, photolyze, nor biodegrade, and will bioaccumulate and bioconcentrate in aquatic organisms (Spectrum, 2004). Chronic exposure has resulted in neurotoxic and hepatotoxic non-carcinogenic affects to exposed organisms (USEPA, 2004). In edible fish tissue, the USEPA recommends a toxaphene concentration of 0.1 mg/kg wet weight as a conservative human-health screening value, while the USFDA action level is 5 mg/kg wet weight (Nowell and Resek, 1994). Th USEPA value is based on a carcinogenicity risk level of 1 x 10^{-5} and negligible non-cancer health risks (Nowell and Resek, 1994).

Nine of the 13 fish sampled (one spotted bass, four largemouth bass, one channel catfish, one river carpsucker, and two common carp) contained detectable amounts of toxaphene (Table 2). Detected concentrations ranged from 0.13 mg/kg wet weight in the largemouth bass from Site 5 to 2.9 mg/kg wet weight in the common carp collected from Site 4. All nine of these fish contained toxaphene levels that exceeded the cited USEPA criterion; however none of these fish contained toxaphene concentrations that equaled or exceeded the referenced USFDA action level (Nowell and Resek, 1994).

Conclusions

Detectable amounts of the organochlorine pesticides chlordane, DDE, DDT, dieldrin, and toxaphene were measured in one or more of the fish collected from the Trinity River sampling locations. Chlordane levels detected in benthic fish (common carp and a river carpsucker) collected from Sites 1, 2, and 4 exceeded all referenced human health screening values (Nowell and Resek, 1994; USFDA, 2000; TCEQ, 2003). This is not surprising, considering that as stated in the "Baseline Fisheries Survey for the Trinity River Within the Proposed Central City Multi-purpose Projects Area Tarrant County, Texas October, 2003," persons are prohibited from possessing any fish from this portion of the Trinity River due to elevated chlordane and other organochlorine contaminants. This baseline fisheries survey also noted that previous sampling conducted downstream of Site 1 indicated that sediments within the Trinity River contained elevated residual chlordane and other organochlorine contaminants. Fish inhabiting this segment of the Trinity River appear to be accumulating these contaminants from the sediments and sequestering them into their body tissues. This may be due to the consumption of contaminated sediments and/or the consumption of contaminated prey items.

No detectable organochlorine pesticide contaminants were measured in the freshwater mussel sample collected from Site 3. This may be due to mussels being filter feeders that absorb nutrients from the water column and the organochlorines detected in the fish samples typically adsorb to the sediments and do not readily remain suspended in the water column.

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Personal Communications

Denoux, G. 2004. Geochemical & Environmental Research Group, Texas A&M. (979) 862-2323.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
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WinSystems Center Building
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June 18, 2004

Colonel John R. Minahan
District Engineer
U.S. Army Corps of Engineers
(Attn: CESWF-EV-EE)
P.O. Box 17300
Fort Worth, Texas 76102-0300

Re: Central City Interim Feasibility Study for the Clear and West Forks of the Trinity River within the City of Fort Worth, Tarrant County, Texas.

Dear Colonel Minahan:

The U.S. Fish and Wildlife Service has prepared the enclosed planning aid report for the Central City Interim Feasibility Study, Fort Worth, Tarrant County, Texas. This project is the second of several feasibility studies to be conducted by your agency in Tarrant County as part of the comprehensive Clear and West Fork of the Trinity River Interim Feasibility Study. It was initiated at the request of the Tarrant Regional Water District where plans are being made to reduce flood damage, restore ecosystems, and provide additional and improved recreational opportunities within the Fort Worth Floodway along the Clear and West Forks of the Upper Trinity River and its tributaries. This action is being conducted under the authority contained in the United States Senate Committee on Environmental and Public Works resolution dated April 22, 1988.

The purpose of this report is to identify and describe existing fish and wildlife resources within the proposed project area and to recommend preliminary measures for wildlife habitat restoration during early project planning. This planning assistance is provided, pursuant to the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.) and is intended to assist in the preparation of your detailed project report (DPR). This information does not represent a final report of the Secretary of the Interior within the meaning of Section 2(b) of the Act because new information continues to develop with this project. A draft and final FWCA report will be required from the U.S. Fish and Wildlife Service when we have completed our review of the draft and final project plans. This report was prepared in accordance with the Scope of Work agreed to by our agencies, and it is being provided for equal consideration for fish and wildlife conservation in the planning of this project. Please provide comments on the enclosed report by July 16, 2004. A copy has been provided to the Texas Parks and Wildlife Department.

We greatly appreciate the opportunity to participate in the planning of this project. If you have any questions or comments concerning this report, please contact Carol S. Hale of my staff at (817) 277-1100 or at the address above.

Sincerely,

for Thomas J. Cloud, Jr.
Field Supervisor

Enclosure

cc: Executive Director, TPWD, Austin, Texas (Wildlife Division and Resource Protection Division)

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ecological Services
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February 1, 2005

Memorandum

To: Billy Colbert, Environmental Planner, U.S. Army Corps of Engineers, Fort Worth District

From: Carol S. Hale, Fish and Wildlife Biologist Carol Hale

Subject: Corrections for the HSI Averages contained in the December 2, 2004 memo regarding the Central City Project Extended Area Upstream

Thank you for informing me (via telephone) today of the errors regarding the average HSI values contained in Table 4 in my December 2, 2004 Central City Project Extended Area Upstream memorandum to you. The average HSI values per species in each habitat should reflect a value computed by use of the model after each parameter from all the sites in one habitat had been averaged. Instead, I had erroneously averaged the HSI value of each site listed in the Riparian Habitat column. The HSI values for the Upland sites are correct. The following are the correct average HSI values for each species in the Riparian Habitat in the extended area and the Average HSI value for that habitat.

	Average for Riparian Habitat
Barred owl	0.88
Raccoon	0.60
Carolina Chickadee	0.94
Fox Squirrel	0.38
Wood Duck	0.00
Red-tailed Hawk	0.40
Total Average Riparian HSI	0.53

The average HSI per species may be greater than any one site HSI, because the SI parameter reading for each site may have been less optimum due to being too "too much" or "not enough" of whatever it was measuring, but the average SI value for the parameter for all the sites combined may compute to the optimum HSI value.

Thank you for the opportunity to correct this error.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ecological Services
WinSystems Center Building
711 Stadium Drive, Suite 252
Arlington, Texas 76011

April 15, 2005

Mr. Bill Fickel
Attn: Billy Colbert, CESWF-PER-EE
United States Army Corps of Engineers
Fort Worth District
P.O.Box 17300
Fort Worth, Texas 76102-0300

RE: Transmittal of Report "Baseline Fisheries Survey of Lebow Creek within the Proposed Central City Multi-purpose Project Area, Tarrant County, Texas"

Dear Mr. Fickel:

Enclosed is a copy of the referenced report. This study was conducted as a supplement to the "Baseline Fisheries Survey for the Trinity River within the Proposed Central City Multi-purpose Projects Area, Tarrant County, Texas," report completed in October, 2003 and the "Baseline Fisheries Survey of Marine Creek within the Proposed Central City Multi-purpose Projects Area, Tarrant County, Texas," report completed in January, 2005. The results of the current survey characterized the fish community as exceptional in an area of Lebow Creek that would be impacted by stream modifications, development, and/or construction activities associated with the proposed project.

If you have any questions or comments concerning this study, please contact Craig Giggleman or Jacob Lewis of my staff at (817) 277-1100.

Sincerely,

Tom Cloud

Thomas J. Cloud, Jr.
Field Supervisor

Enclosure

BASELINE FISHERIES SURVEY OF LEBOW CREEK WITHIN THE PROPOSED CENTRAL CITY MULTI-PURPOSE PROJECT AREA TARRANT COUNTY, TEXAS

Introduction

A fisheries survey was conducted on Lebow Creek in Tarrant County, Texas, between the confluence with the West Fork of the Trinity River and Brennan Avenue in Fort Worth in April 2005, by the U.S. Fish and Wildlife Service (USFWS) and the U.S. Army Corps of Engineers (USACE). The purpose of this survey was to determine baseline fish-community structure within the area of Lebow Creek that could be potentially impacted by stream modifications, development, and/or construction activities associated with the Central City Multi-Purpose Projects.

Methods and Materials

On April 13, 2005, fish community structure was assessed at two sites on Lebow Creek in Tarrant County, Texas by USFWS/USACE personnel to determine baseline conditions (Table 1 and Figure 1). Site 1 was located in an area of the stream that would be directly impacted by activities associated with the proposed project. Site 2 was located approximately 300 meters (1,000 feet) upstream of the confluence with the West Fork. The drainage basin for both sites encompasses approximately 7 square kilometers (km^2) [3 square miles (mi^2)]. Flow measured upstream of both sampling sites at Brennan Avenue, equaled 0.04 cubic meters per second (1.43 cubic feet per second).

Table 1. Lebow Creek baseline fisheries survey sample sites, 2005.

Sample Site	General Description
Site 1	Lebow Creek, from the confluence with the West Fork of the Trinity River to a distance approximately 91 meters (300 feet) upstream of the confluence incorporating deep pool and shallow riffle-pool habitat. Stream width ranged from 12 meters (38 feet) at the confluence to 8 meters (25 feet) at the top of the sampling reach. Water depth averaged 0.7 feet (0. 2 meters). Substrate was dominated by silt and sand at the confluence and gravel, cobble and bedrock within the remainder of the reach.
Site 2	Lebow Creek, approximately 300 meters (1000 feet) upstream of confluence with the West Fork of the Trinity River, incorporating shallow riffle-pool sequences. Stream width ranged from 1 meter (3 feet) to 3 meters (10 feet). Water depth averaged 0.1 meters (0.4 feet). Large cobble to bedrock substrate.

Fish were collected from both sites using a Smith-Root Inc. back-pack electrofisher (Model LR-24; Serial No. C00100). Sampling consisted of electro-shocking for a period of 30 minutes at Site 1 and 17 minutes at Site 2. The habitat at Site 1 consisted of a deep pool at the confluence with the West Fork followed by a shallow riffle pool complex upstream of this area. The habitat at Site 2 consisted of a series of shallow riffle pool complexes. A 4 feet by 10 feet (1.2 by 3 meters) seine with ⅛ inch (0.32 centimeters) mesh was used for collection at the deep pool habitat at Site 1, but not at the remainder of the sites because the substrate at both sites was dominated by bedrock intermixed with large cobbles, broken concrete, root snags, fallen branches, and other obstacles which prevented the effective use of this sampling device. After collection, fish were identified to species using Robison and Buchanan (1988) and Miller and Robison (2004), counted, and any observed anomalies were recorded. All fish were then released back into the creek. The data resulting from this sampling were used to calculate aquatic life use values for each site and the overall area sampled employing the regional index of biotic integrity.

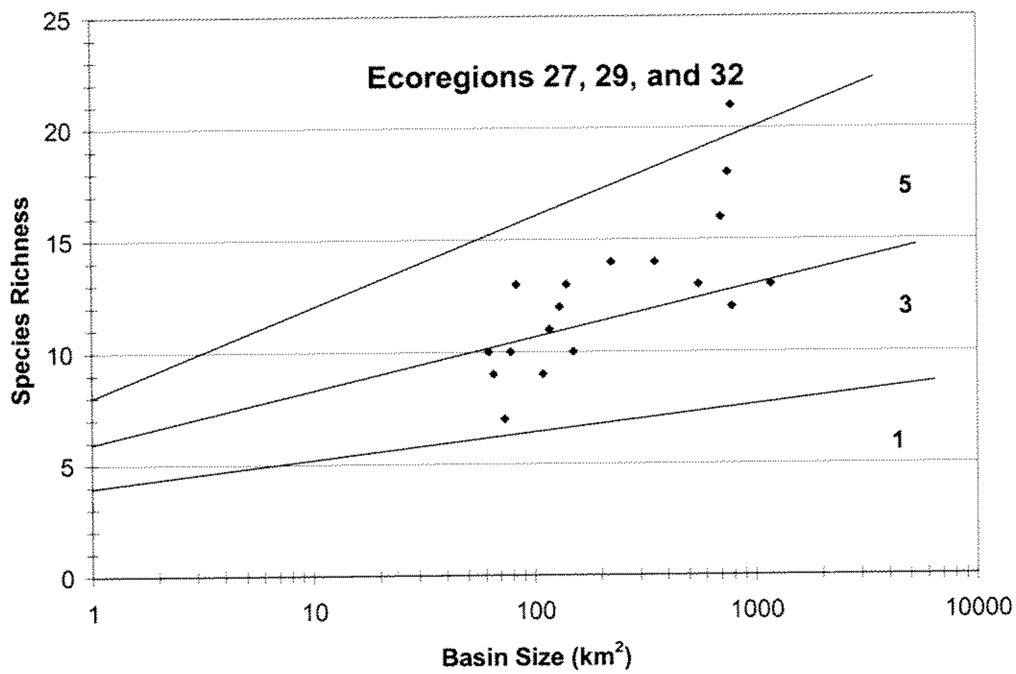
An index of biotic integrity (IBI) provides a means to assess aquatic life use within a given water body using multiple metrics. Accounting for the high variability in fish assemblages in aquatic systems between various ecological regions (eco-regions) in Texas, Linam *et al.* (2002) developed regionalized IBIs. Lebow Creek is located in the region designated by Linam *et al.* (2002) as the Subhumid Agricultural Plains which incorporates the variability of fish species inhabiting aquatic systems in Ecoregions 27 (Central Great Plains), 29 (Central Oklahoma/Texas Plains), and 32 (Texas Blackland Prairies). The regionalized IBI for this area consists of 11 metrics that define species richness, trophic composition, and abundance (Table 2 and Figure 2). Each one of these

Table 2. Regional index of biotic integrity scoring criteria for stream fish assemblages in the Subhumid Agricultural Plains (Ecoregions 27, 29, and 32) (Note - total score for aquatic life use subcategories: ≥49 = Exceptional; 41-48 = High; 35-40 = Intermediate; and <35 = Limited) (Linam *et al.*, 2002).

Metric	Scoring Criteria		
	5	3	1
1. Total number of fish species	★	★	★
2. Number of native cyprinid species	>3	2-3	<2
3. Number of benthic invertivore species	>1	1	0
4. Number of sunfish species	>3	2-3	<2
5. % of individuals as tolerant species (excluding western mosquitofish)	<26%	26-50%	>50%
6. % of individuals as omnivores	<9%	9-16%	>16%
7. % of individuals as invertivores	>65%	33-65%	<33%
8. % of individuals as piscivores	>9%	5-9%	<5%
9. (a) Number of individuals/seine haul	>87	36-87	<36
9. (b) Number of individuals/minute of electrofishing	>7.1	3.3-7.1	<3.3
10. % of individuals as non-native species	<1.4%	1.4-2.7%	>2.7%
11. % of individuals with disease or other anomaly	<0.6%	0.6-1%	>1%

★Refer to Figure 2 to obtain scoring criteria for Metric No.1.

Figure 2. Fish species richness versus drainage basin size for the Subhumid Agricultural Plains (Ecoregions 27, 29, and 32) (Linam *et al.*, 2002).



metrics is scored with values ranging from low (1) to high (5). In turn, aquatic life use values are determined by adding each metric score for a total score. These aquatic life use values can range from limited to exceptional.

Results

A total of 463 fish comprising 12 species from 6 families, were collected from Lebow Creek (Table 3). Three hundred nine individual fish were collected from Site 1, while 154 fish were taken from Site 2 (Table 3). Eleven species were collected at Site 1 and eight separate species were collected from Site 2 (Table 3). Blackstripe Topminnow (*Fundulus notatus*) represented 38% of the total number of fish collected from the two sites, followed by green sunfish (*Lepomis cyanellus*) (18%), bluegill (*Lepomis macrochirus*) (17%), western mosquitofish (*Gambusia affinis*) (17%), and longear sunfish (*Lepomis megalotis*) (5%) (Table 3). Fifty percent of the fish collected at Site 1 were sunfish, 25% were live-bearers, 19% were killifish, 3% were perch, and less then 2% were suckers and minnows. In contrast, 74% of the fish collected at Site 2 were killifish, 21% were sunfish, 3% were minnows, and less then 2% were perch and live-bearers. Furthermore, no suckers were observed at Site 2. In addition to fish, numerous dipteran (midges) larvae and crayfish were observed at both sites, while one red-eared slider (*Trachemys scripta elegans*) was observed upstream of Site 2 and a nutria (*Myocastor coypus*) was observed at Site 1.

Table 3. Fish collected by USFWS and USACE personnel from two sites on Lebow Creek, Tarrant County, Texas, April 13, 2005 (Note – nc is not collected).				
Family	**Species**	**Site 1**	**Site 2**	**Total**
Catostomidae (suckers)	*Minytrema melanops* - Spotted Sucker	2	nc	2
Centrarchidae (sunfish)	*Lepomis cyanellus* - Green Sunfish	69	13	82
	Lepomis gulosus – Warmouth	4	nc	4
	Lepomis macrochirus – Bluegill	72	5	77
	Lepomis megalotis - Longear Sunfish	9	14	23
	Micropterus punctulatus – Spotted Bass	2	nc	2
Cyprinidae (minnows)	*Campostoma anomalum* - Central Stoneroller	2	4	6
	Cyprinella lutrensis - Red Shiner	nc	1	1
	Cyprinella venusta – Blacktail Shiner	4	nc	4
Cyprinodontidae (killifish)	*Fundulus notatus* - Blackstripe Topminnow	60	114	174
Percidae (perch)	*Etheostoma spectabile* - Orangethroat Darter	9	1	10
Poeciliidae (live-bearers)	*Gambusia affinis* – Western Mosquitofish	76	2	78
Total		309	154	463

Table 4. Fish species and their associated tolerance levels and trophic guilds collected from two sites on Lebow Creek, Tarrant County, Texas, April 13, 2005 (Note - I = intermediate; N = intolerant; and T = tolerant) (Linam and Kleinsasser, 1998).			
Family	**Species**	**Tolerance Class**	**Trophic Guild**
Catostomidae	*Minytrema melanops* - Spotted Sucker	I	invertivore
Centrarchidae	*Lepomis cyanellus* - Green Sunfish	T	piscivore
	Lepomis gulosus – Warmouth	T	piscivore
	Lepomis macrochirus – Bluegill	T	invertivore
	Lepomis megalotis - Longear Sunfish	I	invertivore
	Micropterus punctulatus - Spotted Bass	I	piscivore
Cyprinidae	*Campostoma anomalum* - Central Stoneroller	I	herbivore
	Cyprinella lutrensis – Red Shiner	T	invertivore
	Cyprinella venusta – Blacktail Shiner	I	invertivore
Cyprinodontidae	*Fundulus notatus* - Blackstripe Topminnow	I	invertivore
Percidae	*Etheostoma spectabile* - Orangethroat Darter	I	invertivore
Poeciliidae	*Gambusia affinis* – Western Mosquitofish	T	invertivore

Designated tolerance levels and associated trophic guilds for the species collected from both sites were obtained from Linam and Kleinsasser (1998) and are presented in Table 4. Results of the regionalized IBI calculations for the two sites, as well as the overall study area, are included in Tables 5 through 7.

Table 5. Regional IBI Metric Calculations (IBI Score) for Site 1.			
1. Total # of fish species:	11(5)	7. % of individuals as invertivores:	75(5)
2. # of native cyprinid species:	2(3)	8. % of individuals as piscivores:	24(5)
3. # of benthic invertivore species:	1(3)	9a. # of individuals/seine haul:	na
4. # of sunfish species:	4(5)	9b. # of individuals/minute of electro-fishing:	10.2(5)
5. % of individuals as tolerant species:	47(3)	10. % of individuals as non-native species:	0(5)
6. % of individuals as omnivores:	0(5)	11. % of individuals with disease or other anomaly:	0(5)
IBI Total Score: 49 (Exceptional)			

Note: na - is not applicable because seines were not used for collecting at the site.

Table 6. Regional IBI Metric Calculations (IBI Score) for Site 2.			
1. Total # of fish species:	8(5)	7. % of individuals as invertivores:	89(5)
2. # of native cyprinid species:	2(3)	8. % of individuals as piscivores:	8.4(3)
3. # of benthic invertivore species:	1(3)	9a. # of individuals/seine haul:	na
4. # of sunfish species:	3(3)	9b. # of individuals/minute of electro-fishing:	10.2(5)
5. % of individuals as tolerant species:	12(5)	10. % of individuals as non-native species:	0(5)
6. % of individuals as omnivores:	0(5)	11. % of individuals with disease or other anomaly:	0(5)
IBI Total Score: 47 (High)			

Note: na - is not applicable because seines were not used for collecting at the site.

Table 7. Regional IBI Metric Calculations (IBI Score) for Overall Study Area.			
1. Total # of fish species:	12(5)	7. % of individuals as invertivores:	80(5)
2. # of native cyprinid species:	3(3)	8. % of individuals as piscivores:	19(5)
3. # of benthic invertivore species:	1(3)	9a. # of individuals/seine haul:	na
4. # of sunfish species:	4(5)	9b. # of individuals/minute of electro-fishing:	9.9(5)
5. % of individuals as tolerant species:	35(3)	10. % of individuals as non-native species:	0(5)
6. % of individuals as omnivores:	0(5)	11. % of individuals with disease or other anomaly:	0(5)
IBI Total Score: 49 (Exceptional)			

Note: na - is not applicable because seines were not used for collecting at either site.

Results of the regional IBI assessments demonstrated an exceptional aquatic life use value for the fish community sampled at Site 1 (score of 49) and a high aquatic life use value for the fish assemblage at Site 2 (score of 47). The fish community within the overall study area was characterized as exceptional (score of 49). No fish species considered by Linam and Kleinsasser (1998) to be omnivorous or non-native were collected at either site.

Conclusions

The fish community assessed at Lebow Creek in Tarrant County, Texas on April 13, 2005, within an area that would be impacted by activities associated with the proposed Central City Project demonstrated an exceptional aquatic life use value. This community would be completely displaced by activities associated with the proposed project. The deep pool and shallow riffle-pool habitats found in this area would be completely eliminated by fill operations associated with the proposed project. The fish assemblage evaluated upstream of this area was characterized as high. The shallow riffle-pool complexes within this portion of the stream would not be adversely impacted by the proposed project.

References

Linam, G.W. and L.J. Kleinsasser. 1998. Classification of Texas Freshwater Fishes into Trophic and Tolerance Groups (River Studies Report No. 14). Texas Parks and Wildlife Department. Austin, Texas.

Linam, G.W., L.J. Kleinsasser, and K.B. Mayes. 2002. Regionalization of the Index of Bitoic Integrity for Texas Streams (River Studies Report No. 17). Texas Parks and Wildlife Department. Austin, Texas.

Miller, R.J. and H.W. Robison. 2004. Fishes of Oklahoma. University of Oklahoma Press. Norman, Oklahoma. 450 pp.

Robison, H.W. and T.M. Buchanan. 1988. Fishes of Arkansas. University of Arkansas Press. Fayetteville, Arkansas. 536 pp.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ecological Services
WinSystems Center Building
711 Stadium Drive, Suite 252
Arlington, Texas 76011

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March 1, 2005

Mr. Bill Fickel
Attn: Billy Colbert, CESWF-PER-EE
United States Army Corps of Engineers
Fort Worth District
P. O. Box 17300
Fort Worth, Texas 76102-0300

Dear Mr. Fickel:

On February 23, 2005, the U.S. Fish and Wildlife Service (Service) received through the U.S. Army Corps of Engineers (Corps) a proposed conceptual plan to mitigate for the impoundment of the lower portion of Marine Creek resulting from the construction of the Samuels Avenue Dam associated with the proposed Central City Project (Technical Memorandum ECO-7). Based upon a detailed study of Marine Creek conducted in January 2005, it appears that the proposed Central City Project (i.e., construction of Samuels Avenue Dam) would impact approximately 1,875 feet of perennial riffle-pool complexes within Marine Creek by inundating the area with approximately 25 feet of water. The fish community within this area is currently characterized as high to exceptional. This rating can be attributed to the shallow riffle-pool complexes that currently exist within the stream.

To mitigate for the impacts to Marine Creek resulting from permanent inundation, two measures have been proposed:

1. The creation of riffle-pool habitat in an excavated channel associated with Lebow Creek. This creek is a tributary of the Trinity River. Its confluence is located approximately 500 feet downstream of the confluence of Marine Creek with the Trinity River. It is stated in the conceptual mitigation plan that riffle habitat can be accomplished by excavating to bedrock, without constructing specified riffle-pool structure in the excavated channel. In addition, a riparian area would also be established along the banks of the excavated channel by planting trees.

2. Introduction of an unspecified amount of water to a point in Lebow Creek downstream of Brennan Avenue that would be delivered by gravity flow through an underground pipeline from the new water surface elevation [525 feet above mean sea level (msl)] of the Trinity River resulting from construction of Samuels Avenue Dam.

We understand that the modifications proposed for Lebow Creek are to prevent permanent inundation of the creek channel to an elevation of 525 feet msl as would happen to Marine Creek resulting from the Samuels Avenue Dam construction project. These modifications would entail filling the lower reach of Lebow Creek (approximately 400 feet) with dirt and excavating a new channel that would run a distance of approximately 1,500 feet parallel to the Trinity River and discharge into the river downstream of the dam.

With this understanding, following are our concerns with the proposed mitigation plan:

- Baseline conditions for Lebow Creek are unknown and should be established. The composition of the fish community inhabiting the lower reach of Lebow Creek is unknown. The lower reach is composed of a series of riffle-pool complexes which would be lost due to the proposed fill operations. The fisheries within these complexes were not evaluated by the Service/Corps because Lebow Creek was not identified until recently as being subject to project modification.

- The area of the aquatic habitat encompassed by the proposed excavated channel of Lebow Creek appears inadequate to mitigate for the areas that would be impacted on Marine Creek (1,875 feet) and Lebow Creek (400 feet).

- It is stated in the conceptual plan, "Because the new channel will likely be excavated into rock, there will be no additional costs necessary to provide substrate for the new stream-riffle-pool habitat." The structure (riffles with plunge pools) within Marine Creek and Lebow Creek that will be inundated/filled by the proposed project will not be adequately mitigated for in the proposed excavated channel of Lebow Creek without specifically constructing riffle/pool habitat.

- Marine Creek is a perennial system, whereas Lebow Creek appears to be an intermittent stream. Since no specific quantity of water for diversion to Lebow Creek from the Trinity River has been identified, we cannot determine if there would be a sufficient amount of water capable to establish and maintain aquatic habitat necessary to support a fishery in Lebow Creek (including the excavated channel) equivalent to the high to exceptional fishery found in Marine Creek.

- The relief (i.e., slope) may not be sufficient in the proposed excavated channel of Lebow Creek to maintain wetted riffle pool sequences sufficient for the excavated stream to function as the more natural upstream portion of this lotic system.

- Other than the possibility of planting trees, the conceptual plan does not address bank stabilization in the proposed excavated channel. The area proposed for excavation is in close proximity to the Trinity River and may consist of unstable alluvial deposits that would require some type of stabilization effort to prevent excess sedimentation from occurring in the excavated channel.

- Acquisition of land to preserve and/or establish riparian habitat along the portion of Lebow Creek from Brennan Avenue and along the excavated channel diversion is not defined in the conceptual plan. There must be assurances that the riparian and stream features either existing or proposed as mitigation features will be maintained in perpetuity. We recommend acquisition of the creek channel and a narrow riparian corridor along the channel. Easements, if properly worded to safeguard future habitat conditions, may also be appropriate.

Until sufficient baseline information on Lebow Creek is identified, we cannot determine if the proposed stream mitigation plan is adequate to offset impacts to Marine Creek and the lower 400 feet of Lebow Creek. Therefore, we recommend that the Corps consider developing additional stream mitigation features possibly at other sites that would collectively mitigate for the potential impacts to Marine and Lebow Creeks associated with the proposed Central City Project. The Corps should consider the benefits of restoring stream habitat within Marine Creek above Main Street. This area has been modified in the past by stream channelization, however, there is the potential to restore habitat by adding shrubs and trees along the edges of the channel coupled with habitat modification features such as natural rock riffle construction and development of artificial undercut banks.

Thank you for the opportunity to comment on the proposed plan. Should you have any questions concerning this matter please do not hesitate in contacting Craig Giggleman of my staff at (817) 277-1100.

Sincerely,

Tom Cloud

Thomas J. Cloud, Jr.
Field Supervisor

Figure 1: Lebow Creek Sampling Sites.

0 250 500 Feet
0 50 100 Meters
Texas

U.S. Fish & Wildlife Service

Arlington, Texas, Ecological Services Field Office
Projection: UTM Zone 14N, NAD 1983, GRS 1980
Production Date: 04/14/2005

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United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ecological Services
WinSystems Center Building
711 Stadium Drive, Suite 252
Arlington, Texas 76011

January 24, 2005

Mr. Bill Fickel
Attn: Billy Colbert, CESWF-PER-EE
United States Army Corps of Engineers
Fort Worth District
P.O.Box 17300
Fort Worth, Texas 76102-0300

RE: Transmittal of Report "Baseline Fisheries Survey of Marine Creek within the Proposed Central City Multi-purpose Project Area, Tarrant County, Texas"

Dear Mr. Fickel:

Enclosed is a copy of the referenced report. This study was conducted as a supplement to the "Baseline Fisheries Survey for the Trinity River within the Proposed Central City Multi-purpose Projects Area, Tarrant County, Texas," report completed in October, 2003. The fish community was characterized as exceptional in an area of Marine Creek that could be impacted by stream modifications, development, and/or construction activities associated with the proposed project.

If you have any questions or comments concerning this study, please contact Craig Giggleman or Jacob Lewis of my staff at (817) 277-1100.

Sincerely,

Tom Cloud

Thomas J. Cloud, Jr.
Field Supervisor

Enclosure

BASELINE FISHERIES SURVEY OF MARINE CREEK WITHIN THE PROPOSED CENTRAL CITY MULTI-PURPOSE PROJECT AREA TARRANT COUNTY, TEXAS

Introduction

A fisheries survey was conducted on Marine Creek in Tarrant County, Texas, between the confluence with the West Fork of the Trinity River and North Main Street in Fort Worth in January 2005, by the U.S. Fish and Wildlife Service (USFWS) and the U.S. Army Corps of Engineers (USACE). The purpose of this survey was to determine baseline fish-community structure within the area of Marine Creek that could be potentially impacted by stream modifications, development, and/or construction activities associated with the Central City Multi-Purpose Projects.

Methods and Materials

On January 11, 2005, USFWS/USACE personnel conducted an assessment of Marine Creek from the confluence with the West Fork of the Trinity to North Main Street to ascertain the aquatic habitat types present within a section of the creek that could be impacted by stream modifications, development, and/or construction associated with the Central City Multi-Purpose Projects. From this assessment it was determined that approximately 360 linear meters (1,180 linear feet) of riffle habitat, 910 linear meters (2,985 linear feet) of pool habitat, and 50 linear meters (164 linear feet) of run habitat were within an area of the stream that could be impacted by the proposed project (Figure 1). On January 12, 2005, fish communities at two sites on Marine Creek were sampled by USFWS/USACE personnel (Table 1 and Figure 1). Both sites were located in areas

Table 1. Marine Creek baseline fisheries survey sample sites, 2005.

Sample Site	General Description
Site 1	Marine Creek, shallow riffle-pool complex from base of water fall to below the Southern Pacific Rail Road bridge, approximately 1000 feet (300 meters) upstream of the confluence with the West Fork of the Trinity River, Tarrant County, Texas. Stream width averaged 50 feet (15 meters). Water depth averaged 0.8 feet (0.2 meters). Gravel to cobble substrate.
Site 2	Marine Creek, riffle-pool complex at 23rd Street bridge, approximately 3000 feet (915 meters) upstream of the confluence with the West Fork of the Trinity River, Tarrant County, Texas. Stream width averaged 23 feet (7 meters). Water depth averaged 1.5 feet (0.5 meters). Large cobble to bedrock substrate.

that could be potentially impacted by activities associated with the proposed project. The drainage basin for these sites encompasses approximately 65 square kilometers (km^2) [25 square miles (mi^2)].

Fish were collected from both sites using a Smith-Root Inc. back-pack electrofisher (Model LR-24; Serial No. C00100). Sampling consisted of electro-shocking for a period of 55 minutes at Site 1 and 46 minutes at Site 2, incorporating riffle and pool habitats at both sites. Seines were not used for collection at either site because the substrate at both sites was dominated by bedrock intermixed with large cobbles, broken concrete, root snags, fallen branches, and other obstacles which prevented the effective use of these sampling devices. After collection, fish were identified to species using Robison and Buchanan (1988) and Miller and Robison (2004), counted, and any observed anomalies were recorded. All fish were then released back into the creek, with the exception of fish kept for voucher specimens. The data resulting from this sampling were used to calculate aquatic life use values for each site and the overall area sampled employing the regional index of biotic integrity.

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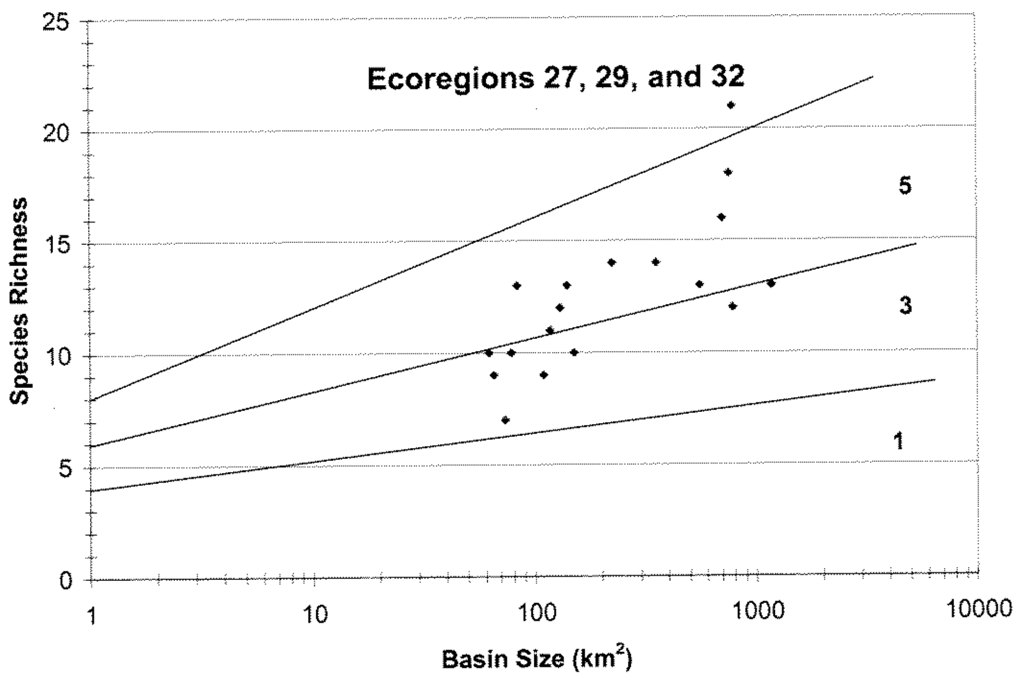
Table 2. Regional index of biotic integrity scoring criteria for stream fish assemblages in the Subhumid Agricultural Plains (Ecoregions 27, 29, and 32) (Note - total score for aquatic life use subcategories: ≥49 = Exceptional; 41-48 = High; 35-40 = Intermediate; and <35 = Limited) (Linam *et al.*, 2002).

Metric	Scoring Criteria		
	5	3	1
1. Total number of fish species	★	★	★
2. Number of native cyprinid species	>3	2-3	<2
3. Number of benthic invertivore species	>1	1	0
4. Number of sunfish species	>3	2-3	<2
5. % of individuals as tolerant species (excluding western mosquitofish)	<26%	26-50%	>50%
6. % of individuals as omnivores	<9%	9-16%	>16%
7. % of individuals as invertivores	>65%	33-65%	<33%
8. % of individuals as piscivores	>9%	5-9%	<5%
9. (a) Number of individuals/seine haul	>87	36-87	<36
9. (b) Number of individuals/minute of electrofishing	>7.1	3.3-7.1	<3.3
10. % of individuals as non-native species	<1.4%	1.4-2.7%	>2.7%
11. % of individuals with disease or other anomaly	<0.6%	0.6-1%	>1%

★Refer to Figure 2 to obtain scoring criteria for Metric No.1.

Figure 2. Fish species richness versus drainage basin size for the Subhumid Agricultural Plains (Ecoregions 27, 29, and 32) (Linam *et al.*, 2002).

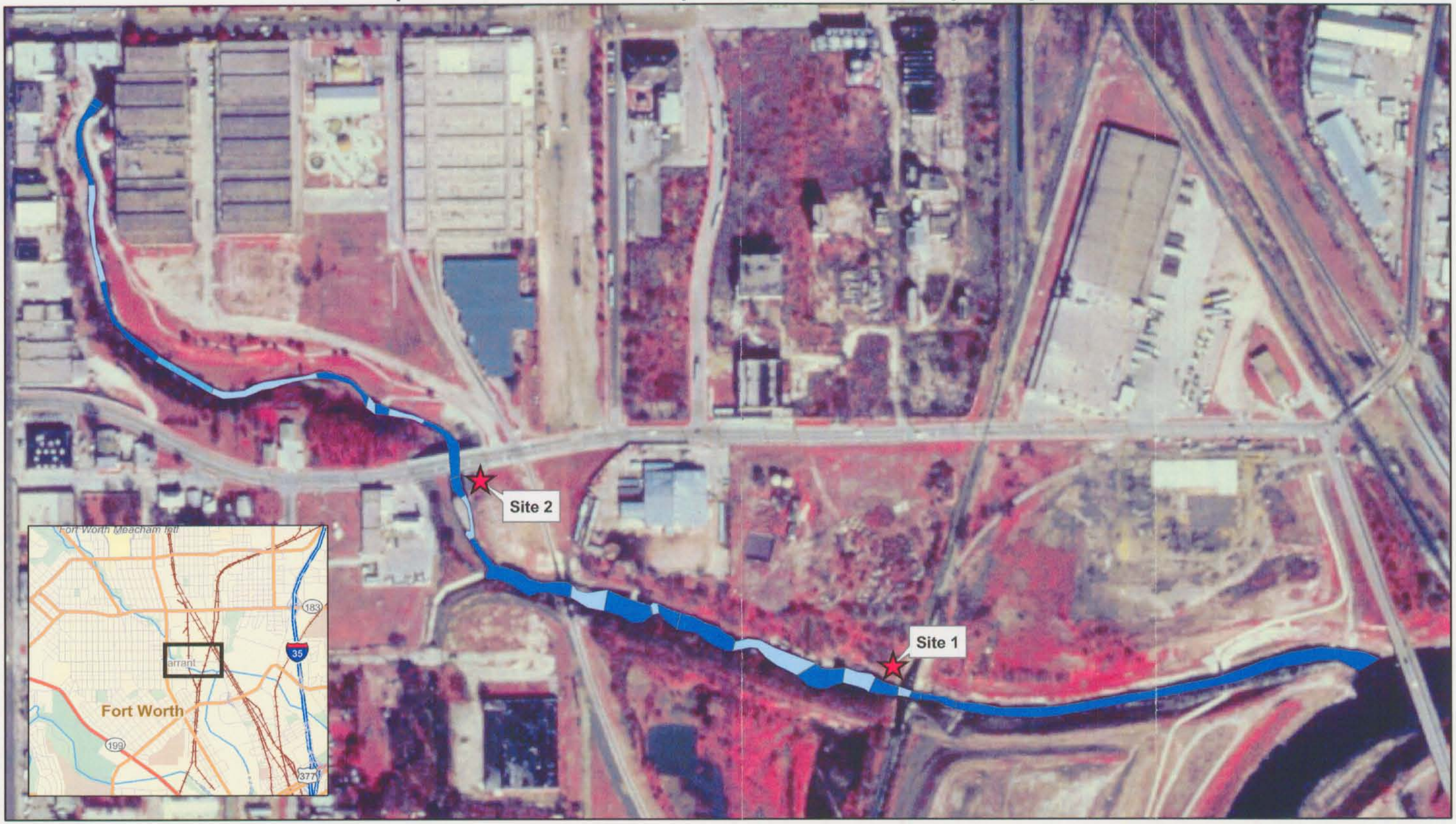


scored with values ranging from low (1) to high (5). In turn, aquatic life use values are determined by adding each metric score for a total score.

Results

A total of 1,234 fish, comprising 16 species from 6 families, were collected from Marine Creek (Table 3). Nine hundred forty-one individual fish were collected from Site 1, while 293 fish were taken from Site 2 (Table 3). Sixteen different species were collected at Site 1 and nine separate species were collected from Site 2 (Table 3). Bluegill (*Lepomis macrochirus*) represented 32% of the total number of fish collected from the two sites, followed by blacktail shiner (*Cyprinella venusta*) (27%), western mosquitofish (*Gambusia affinis*) (15%), green sunfish (*Lepomis cyanellus*) (8%), longear sunfish (*Lepomis megalotis*) (6%), and blackstripe topminnow (*Fundulus notatus*) (6%) (Table 3). Fifty percent of the fish collected at Site 1 were sunfish, 37% were minnows, 7% were killifish, 5% were perch, less then 2% were live-bearers, and less then 1% were suckers. In contrast, 59% of the fish collected at Site 2 were live-bearers, 36% were sunfish, 3% were killifish, and less then 2% were minnows. Furthermore, no suckers or perch were observed at Site 2. In addition to fish, numerous odonate (damselfly and dragonfly) larvae were observed at both sites. One crayfish and one razorback musk turtle (*Sternotherus carinatus*) were collected and released at Site 2. Several red-eared sliders (*Trachemys scripta elegans*) were observed in the vicinity of both sites.

Figure 1: Aquatic Habitat Types of Marine Creek within the Area of Potential Impacts from the Proposed Central City Project.



U.S. Fish & Wildlife Service

Arlington, Texas, Ecological Services Field Office
Projection: UTM Zone 14N, NAD 1983, GRS 1980
Production Date: 01/13/2005

Pool - Approximately 910 meters (2985 feet)

Run - Approximately 50 meters (164 feet)

Riffle - Approximately 360 meters (1180 feet)

0 250 500 Feet

0 50 100 Meters

Texas

Table 3. Fish collected by USFWS and USACE personnel from two sites on Marine Creek, Tarrant County, Texas, January 12, 2005.				
Family	**Species**	**Site 1**	**Site 2**	**Total**
Catostomidae (suckers)	*Minytrema melanops* - Spotted Sucker	1	0	1
Centrarchidae (sunfish)	*Lepomis cyanellus* - Green Sunfish	65	28	93
	Lepomis gulosus - Warmouth	4	2	6
	Lepomis humilis - Orangespotted Sunfish	4	1	5
	Lepomis macrochirus - Bluegill	333	57	390
	Lepomis megalotis - Longear Sunfish	57	18	75
	Micropterus salmoides - Largemouth Bass	11	0	11
Cyprinidae (minnows)	*Campostoma anomalum* - Central Stoneroller	2	2	4
	Cyprinella lutrensis - Red Shiner	14	0	14
	Cyprinella venusta – Blacktail Shiner	326	3	329
	Notemigonus crysoleucas - Golden Shiner	2	0	2
Cyprinodontidae (killifish)	*Fundulus notatus* - Blackstripe Topminnow	62	8	70
Percidae (perch)	*Etheostoma chlorosomum* - Bluntnose Darter	5	0	5
	Etheostoma spectabile - Orangethroat Darter	39	0	39
	Percina macrolepida - Big Scale Logperch	4	0	4
Poeciliidae (live-bearers)	*Gambusia affinis* – Western Mosquitofish	12	174	186
Total		941	293	1234

Table 4. Fish species and their associated tolerance levels and trophic guilds collected from two sites on Marine Creek, Tarrant County, Texas, January 12, 2005 (Note - I = intermediate; N = intolerant; and T = tolerant) (Linam and Kleinsasser, 1998).			
Family	**Species**	**Tolerance Class**	**Trophic Guild**
Catostomidae	*Minytrema melanops* - Spotted Sucker	I	invertivore
Centrarchidae	*Lepomis cyanellus* - Green Sunfish	T	piscivore
	Lepomis gulosus – Warmouth	T	piscivore
	Lepomis humilis - Orangespotted Sunfish	I	invertivore
	Lepomis macrochirus – Bluegill	T	invertivore
	Lepomis megalotis - Longear Sunfish	I	invertivore
	Micropterus salmoides - Largemouth Bass	I	piscivore
Cyprinidae	*Campostoma anomalum* - Central Stoneroller	I	herbivore
	Cyprinella lutrensis - Red Shiner	T	invertivore
	Cyprinella venusta – Blacktail Shiner	I	invertivore
	Notemigonus crysoleucas - Golden Shiner	T	invertivore
Cyprinodontidae	*Fundulus notatus* - Blackstripe Topminnow	I	invertivore
Percidae	*Etheostoma chlorosomum* - Bluntnose Darter	I	invertivore
	Etheostoma spectabile - Orangethroat Darter	I	invertivore
	Percina macrolepida - Big Scale Logperch	N	invertivore
Poeciliidae	*Gambusia affinis* – Western Mosquitofish	T	invertivore

Designated tolerance levels and associated trophic guilds for the species collected from both sites were obtained from Linam and Kleinsasser (1998) and are presented in Table 4. Results of the regionalized IBI calculations for the two sites, as well as the overall study area, are included in Tables 5 through 7.

Table 5. Regional IBI Metric Calculations (IBI Score) for Site 1.			
1. Total # of fish species:	16(5)	7. % of individuals as invertivores:	91(5)
2. # of native cyprinid species:	4(5)	8. % of individuals as piscivores:	8.5(3)
3. # of benthic invertivore species:	3(5)	9a. # of individuals/seine haul:	na
4. # of sunfish species:	5(5)	9b. # of individuals/minute of electro-fishing:	17.1(5)
5. % of individuals as tolerant species:	45(3)	10. % of individuals as non-native species:	0(5)
6. % of individuals as omnivores:	0(5)	11. % of individuals with disease or other anomaly:	0.2(5)
IBI Total Score: 51 (Exceptional)			

Note: na - is not applicable because seines were not used for collecting at the site.

Table 6. Regional IBI Metric Calculations (IBI Score) for Site 2.			
1. Total # of fish species:	9(3)	7. % of individuals as invertivores:	89(5)
2. # of native cyprinid species:	2(3)	8. % of individuals as piscivores:	10(5)
3. # of benthic invertivore species:	0(1)	9a. # of individuals/seine haul:	na
4. # of sunfish species:	5(5)	9b. # of individuals/minute of electro-fishing:	6.4(3)
5. % of individuals as tolerant species:	73(1)	10. % of individuals as non-native species:	0(5)
6. % of individuals as omnivores:	0(5)	11. % of individuals with disease or other anomaly:	0(5)
IBI Total Score: 41 (High)			

Note: na - is not applicable because seines were not used for collecting at the site.

Table 7. Regional IBI Metric Calculations (IBI Score) for Overall Study Area.			
1. Total # of fish species:	16(5)	7. % of individuals as invertivores:	91(5)
2. # of native cyprinid species:	4(5)	8. % of individuals as piscivores:	8.9(3)
3. # of benthic invertivore species:	3(5)	9a. # of individuals/seine haul:	na
4. # of sunfish species:	5(5)	9b. # of individuals/minute of electro-fishing:	12.3(5)
5. % of individuals as tolerant species:	48(3)	10. % of individuals as non-native species:	0(5)
6. % of individuals as omnivores:	0(5)	11. % of individuals with disease or other anomaly:	0(5)
IBI Total Score: 51 (Exceptional)			

Note: na - is not applicable because seines were not used for collecting at either site.

Results of the regional IBI assessments demonstrated an exceptional aquatic life use value for the fish community sampled at Site 1 (score of 51) and a high aquatic life use value for the fish assemblage at Site 2 (score of 41). The fish community within the overall study area was characterized as exceptional (score of 51). No fish species considered by Linam and Kleinsasser (1998) to be omnivorous were collected at either site.

Conclusions

The fish community assessed at Marine Creek on January 12, 2005, within an area that could be impacted by activities associated with the proposed Central City Project demonstrated an exceptional aquatic life use value. The sunfish and minnow species observed at both sites occupy a variety of aquatic habitats and were collected in large numbers from the West Fork of the Trinity River, downstream of the confluence with Marine Creek in 2003 (Hale and Giggleman, 2004). However, the perch species (darters) collected at Site 1 are typically only associated with shallow riffle-pool complexes and usually avoid deeper stream habitats (Robison and Buchanan, 1988). Consequently, the existing fish assemblage at this site could be significantly altered or completely displaced by activities associated with the proposed project.

References

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