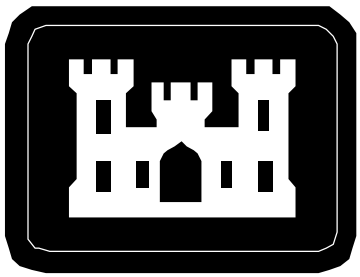
JEAN LAFITTE, FISHER SCHOOL BASIN, LOUISIANA

FEASIBILITY STUDY

WATER QUALITY



AUGUST 1997

JEAN LAFITTE, FISHER SCHOOL BASIN
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WATER QUALITY ASSESSMENT

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1.0 GENERAL. This section considers the applicable standards and criteria used to assess existing water quality in the area. It also describes existing water quality and identifies the potential water quality impacts associated with the alternatives proposed in the Jean Lafitte, Fisher School Basin Feasibility Study.

2.0 WATER QUALITY STANDARDS AND CRITERIA. The Louisiana Department of Environmental Quality (LDEQ) and the US Environmental Protection Agency (EPA) have established ambient water quality standards and criteria applicable to surface waters in the State of Louisiana. These standards and criteria are discussed in the following paragraphs.

2.1 Applicable Louisiana State Standards. The LDEQ has established general written water quality standards that are applicable to all waters of the State of Louisiana. The general written standards relate to the condition of the water as affected by waste discharges or human activity as opposed to purely natural phenomena, and are as follows. The standards were last revised in 1997.

2.1.1 LDEQ Descriptive Water Quality Standards.

(a) Aesthetics. The waters of the state shall be maintained in an aesthetically attractive condition and shall meet the generally accepted aesthetic qualifications. All waters shall be free from such concentrations of substances attributable to wastewater or other discharges sufficient to:

1. settle to form objectionable deposits;

2. float as debris, scum, oil, or other matter to form nuisances or to negatively impact the aesthetics;

3. result in objectionable color, odor, taste, or turbidity;

4. injure, be toxic, or produce demonstrated adverse physiological or behavioral responses in humans, animals, fish, shellfish, wildlife, or plants; or

5. produce undesirable or nuisance aquatic life.

(b) Color. Water color shall not be increased to the extent that it will interfere with present usage or projected future use of the state's waterbodies.

1. Waters shall be free from significant increases over natural background color levels.

2. A source of drinking water supply shall not exceed 75 color units on the platinum-cobalt scale.

3. No increases in true or apparent color shall reduce the level of light penetration below that required by desirable indigenous species of aquatic life.

(c) Floating, Suspended, and Settleable solids. There shall be no substances present in concentrations sufficient to produce distinctly visible solids or scum, nor shall there be any formation of long-term bottom deposits of slimes or sludge banks attributable to waste discharges from municipal, industrial, or other sources including agricultural practices, mining, dredging, and the exploration for and production of oil and natural gas. The administrative authority (LDEQ) may exempt certain short-term activities permitted under Sections 402 or 404 and certified under Section 401 of the Clean Water Act, such as maintenance dredging of navigable waterways or other short-term activities determined by the state as necessary to accommodate legitimate uses or emergencies or to protect the public health and welfare.

(d) Taste and Odor. Taste- and odor- producing substances in the waters of the state shall be limited to concentrations that will not interfere with the production of potable water by conventional water treatment methods or impart unpalatable flavor to food fish, shellfish, and wildlife, or result in offensive odors arising from the waters, or otherwise interfere with the designated water uses.

(e) Toxic Substances. No substances shall be present in the waters of the state or the sediments underlying said waters in quantities that alone or in combination will be toxic to human, plant, or animal life or significantly increase health risks due to exposure to the substances or consumption of contaminated fish or other aquatic life. The numerical criteria (LAC 33:IX.1113.C.6) specify allowable concentrations in water for several individual toxic substances to provide protection from the toxic-effects of these substances. Requirements for the protection from the toxic effects of other toxic substances not included in the numerical criteria and required under the general criteria are described in LAC 33:IX.1121.

(f) Oil and Grease. Free or floating oil or grease shall not be present in quantities large enough to interfere with the designated water uses, nor shall emulsified oils be present in quantities large enough to interfere with the designated uses.

(g) Foaming or Frothing Materials. Foaming and frothing materials of a persistent nature are not permitted.

(h) Nutrients. The naturally occurring range of nitrogen-phosphorous ratios shall be maintained. This range shall not apply to designated intermittent streams. To establish the appropriate range of ratios and compensate for natural seasonal fluctuations, the

administrative authority (LDEQ) will use site-specific studies to establish limits for nutrients. Nutrient concentrations that produce aquatic growth to the extent that it creates a public nuisance or interferes with designated water uses shall not be added to any surface waters.

(i) Turbidity.

1. Turbidity other than that of natural origin shall not cause substantial visual contrast with the natural appearance of the waters of the state or impair any designated water use. Turbidity shall not significantly exceed background; background is defined as the natural condition of the water. Determination of background will be on a case-by-case basis.

2. As a guideline, maximum turbidity levels, expressed as nephelometric turbidity units (NTU), are established and shall apply for the following named waterbodies and major aquatic habitat types of the state:

a. Red, Mermentau, Atchafalaya, Mississippi, and Vermilion Rivers and Bayou Teche -- 150 NTU;

b. estuarine lakes, bays, bayous, and canals -- 50 NTU;

c. Amite, Pearl, Ouachita, Sabine, Calcasieu, Tangipahoa, Tickfaw, and Tchefuncte Rivers -- 50 NTU;

d. freshwater lakes, reservoirs, and oxbows -- 25 NTU;

e. designated scenic streams and outstanding natural resource waters not specifically listed above -- 25 NTU; and

f. for other state waters not included above and in waterbody segments where natural background turbidity exceeds the values specified above, the turbidity in NTU caused by any discharges shall be restricted to the appropriate background value plus 10 percent. This shall not apply to designated intermittent streams.

3. The administrative authority (LDEQ) may exempt for short periods certain activities permitted under Sections 402 or 404 and certified under Section 401 of the Clean Water Act, such as maintenance dredging of navigable waterways or other short-term activities that the state determines are necessary to accommodate legitimate uses or emergencies or to protect the public health and welfare.

(j) Flow. The natural flow of state waters shall not be altered to such an extent that the basic character and water quality of the ecosystem are adversely affected except in situations where alterations are necessary to protect human life or property. If alterations to the natural flow are deemed necessary, all reasonable steps shall be taken to minimize the

adverse impacts of such alterations. Additionally, all reasonable steps shall be taken to mitigate the adverse impacts of unavoidable alterations.

(k) Radioactive Materials. Radioactive materials in the surface waters of the state designated for drinking water supply use shall not exceed levels established pursuant to the Federal Safe Drinking Water Act (P.L. 93-523 et Seq.).

(l) Biological and Aquatic Community Integrity. The biological and community structure and function in state waters shall be maintained, protected, and restored except where not attainable and feasible as defined in LAC 33:IX.1109.B.3. This is the ideal condition of the aquatic community inhabiting the unimpaired water bodies of a specified habitat and region as measured by community structure and function. The biological integrity will be guided by the fish and wildlife propagation use designated for that particular water body. Fish and wildlife propagation uses are defined in LAC 33.IX.1111.C. The condition of these aquatic communities shall be determined from the measures of physical, chemical, and biological characteristics of each surface water body type, according to its designated use (LAC 33:IX.1123). Reference site conditions will represent naturally attainable conditions. These sites should be the least impacted and most representative of water body types. Such reference sites or segments of water bodies shall be those observed to support the greatest variety and abundance of aquatic life in the region as is expected to be or has been recorded during past surveys in natural settings essentially undisturbed by human impacts, development, or discharges. This condition shall be determined by consistent sampling and reliable measures of selected, indicative communities of animals and/or invertebrates as established by the office and may be used in conjunction with acceptable chemical, physical, and microbial water quality measurements and records as deemed for this purpose.

(m) Other substances and Characteristics. General criteria on other substances and characteristics not specified in this section will be developed as needed.

2.1.2 Numerical Criteria. Numerical criteria identified in Table 1 apply to specified waterbodies, and to their tributaries, distributaries, and interconnected streams and waterbodies contained in the water management subsegment if they are not specifically named therein, unless unique chemical, physical, and/or biological conditions preclude the attainment of the criteria. In those cases, natural background levels of these conditions may be used to establish site-specific water quality criteria. Those waterbodies officially approved and designated by the state and EPA as intermittent streams, man-made waterbodies, or naturally dystrophic waters may be excluded from some or all numerical criteria as stated in LAC 33:IX.1109. Although naturally occurring variations in water quality may exceed criteria, water quality conditions attributed to human activities must not exceed criteria when flows are greater than or at critical conditions (as defined in LAC 33:IX.1115.C).

A list of surface waters in the study area for which numerical criteria are included in the published tables is shown in Table 1. Table 1 also includes designated use categories for the surface waters listed. Designated water uses for each stream are represented as follows:

A = Primary Contact Recreation
B = Secondary Contact Recreation
C = Propagation of Fish and Wildlife
D = Drinking Water Supply
E = Oyster Propagation
F = Agriculture
G = Outstanding Natural Resource Waters

(a) pH. The pH shall fall within the range of 6.0 to 9.0 standard units (su) unless natural conditions exceed this range or where otherwise specified in the tables. No discharge of wastes shall cause the pH of the water body to vary by more than one pH unit within the specified pH range for that subsegment where the discharge occurs.

(b) Chlorides, Sulfates, and Dissolved Solids. Numerical criteria for these parameters generally represent the arithmetic mean of existing data from the nearest sampling location plus three standard deviations. For estuarine and coastal marine waters subsegments that have no listed criteria (i.e. designated N/A), criteria will be established on a case-by-case basis using field determination of ambient conditions and the designated uses. For water bodies not specifically listed in the Numerical Criteria and Designated Table, increases over background levels of chlorides, sulfates, and total dissolved solids may be permitted. Such increases will be permitted at the discretion of the office (LDEQ) on a case-by-case basis and shall not cause in-stream concentrations to exceed 250, 250, and 500 mg/L for chlorides, sulfates, and total dissolved solids, respectively, except where a use attainability analysis indicates that higher levels will not affect the designated uses. In permitting such increases, the office (LDEQ) shall consider their potential effects of resident biota and downstream water bodies in addition to the background conditions. Under no circumstances shall an allowed increase over background conditions cause any numerical criteria to be exceeded in any listed water body or any other general or numerical criteria to be exceeded in either listed or unlisted water bodies.

(c) Dissolved Oxygen. The following dissolved oxygen (DO) values represent minimum criteria for the type of water specified. Naturally occurring variations below the criterion specified may occur for short periods. These variations reflect such natural phenomena as the reduction in photosynthesis activity and oxygen production by plants during hours of darkness. However, no waste discharge or human activity shall lower the DO concentration below the specified minimum. These DO criteria shall apply except in those water bodies which qualify for an excepted water use as specified in LAC 33.IX.1109.C or where exempted or excluded elsewhere in these standards. DO criteria for specific state water bodies are contained in LAC 33.IX.1123.

1. Fresh Water. For a diversified population of warmwater biota including sport fish, the DO concentration shall be at or above 5 mg/L.

2. Estuarine Waters. Dissolved oxygen concentrations in estuarine waters shall not be less than 4 mg/L at any time.

3. Coastal Marine Waters (Including Nearshore Gulf of Mexico). Dissolved oxygen concentrations in coastal waters shall not be less than 5 mg/L, except when the upwellings and other natural phenomena cause this value to be lower.

(d) Temperature.

1. The temperature criteria enumerated in Table 1, in most cases, represent maximum values obtained from existing data. In a few cases, however, a limited number of unusually high temperatures in the range of 35^{O} to 36^{O}C ($95\text{-}97^{O}$F) have been deleted because these values are believed to have been recorded during conditions of unseasonably high temperatures and/or unusually low flows or water levels and therefore, do not represent normal maximum temperatures.

2. The criterion consists of two parts, a temperature differential and a maximum temperature. The temperature differential represents the maximum permissible increase above ambient conditions after mixing. No additional process heat shall be added once the ambient temperature reaches the maximum temperature specified in the standards, except under natural conditions such as unusually hot, dry weather, as provided for in the following sections.

a. Fresh Water. The following temperature standards apply to freshwater:

i. maximum of 2.8^{o}C (5^{o}F) rise above ambient for streams and rivers.

ii. maximum of 1.7^{o}C (3^{o}F) rise above ambient for lakes and reservoirs.

iii. maximum temperature of 32.2^{o}C (90^{o}F), except where otherwise listed in the tables. Maximum temperature may be varied on a case-by-case basis to allow for the effects of natural conditions such as unusually hot and/or dry weather.

b. Estuarine and Coastal Waters. The following temperature standards apply to estuarine and coastal waters:

i. maximum of 2.2^{o}C (4^{o}F) rise above ambient from October through May.

ii. maximum 1.1^{o}C (2^{o}F) rise above ambient from June through September; and

iii. maximum temperature of 35°C (95°F), except when natural conditions elevate temperature above this level.

3. These temperature criteria shall not apply to privately-owned reservoirs or reservoirs constructed solely for industrial cooling purposes.

(e) Bacteria.

1. The applicability of bacterial criteria to a particular stream segment depends upon the use designation of that individual stream segment. Limitations are placed on either the most probable number (MPN) fecal or total coliform concentration, or on a combination of both in order to achieve the stream sanitary quality required for the most restrictive designated use classification.

2. Table 1 lists the applicable criteria for each individual Louisiana stream segment and designates one of the following four criteria as applicable according to present and/or anticipated water usage of the segment:

a. PRIMARY CONTACT RECREATION. Based on a minimum of not less than five samples taken over not more than a 30-day period, the fecal coliform content shall not exceed a log mean of 200/100 mL nor shall more than 10 percent of the total samples during any 30-day period or 25 percent of the total samples collected annually exceed 400/100 mL.

b. SECONDARY CONTACT RECREATION. Based on a minimum of not less than 5 samples taken over not more than a 30-day period, the fecal coliform content shall not exceed a log mean of 1,000/100 mL nor shall more than 10 percent of the total samples during any 30-day period or 25 percent of the total samples collected annually exceed 2,000/100 mL.

c. DRINKING WATER SUPPLY. The monthly arithmetic mean of total coliform most probable number (MPN) shall not exceed 10,000/100 mL, nor shall the monthly arithmetic mean of fecal coliforms exceed 2,000/100 mL.

d. OYSTER PROPAGATION. The fecal coliform median MPN shall not exceed 14 fecal coliforms per 100 mL, and not more than 10 percent of the samples shall exceed an MPN of 43/100 mL for a 5-tube decimal dilution test in those portions of the area most probably exposed to fecal contamination during the most unfavorable hydrographic and pollution conditions.

TABLE 1

1998 LDEQ NUMERICAL STANDARDS APPLICABLE TO
SURFACE WATERS IN THE STUDY AREA

	Water Uses[1]								CL	SO_4	DO	pH Range	Bacterial Standard	Temp-erature	TDS
Stream Description	A	B	C	D	E	F	G		mg/L	mg/L	mg/L	su	BAC[2]	^{O}C	mg/L
020601-Intracoastal Waterway-Bayou Villars to Mississippi River (Estuarine)	X	X	X						N/A	N/A	4.0	6.5-9.0	1	35	N/A
020802-Bayou Barataria/ Barataria Waterway to Bayou Rigolettes (Estuarine)	X	X	X						N/A	N/A	4.0	6.5-9.0	1	35	N/A

1 A - Primary Contact Recreation; B - Secondary Contact Recreation; C - Fish and Wildlife Propagation; D - Drinking Water Supply; E - Oyster Propagation; F - Agriculture; G - Outstanding Natural Resource

2 BAC - Bacterial standard (dependent upon water use designation)

(f) Toxic substances. Numerical criteria for specific toxic substances are listed in Table 2.

1. Numerical criteria for specific toxic substances are mostly derived from the following publications of the Environmental Protection Agency: Water Quality Criteria, 1972 (commonly referred to as the "Blue Book"); Quality Criteria for Water, 1976 (commonly referred to as the "Red Book"); Ambient Water Quality Criteria, 1980 (EPA 440/5-80); Ambient Water Quality Criteria, 1984 (EPA 440/5-84-85); and Quality Criteria for Water, 1986 - with updates (commonly referred to as the "Gold Book"). Natural background conditions, however, are also considered. These toxic substances are selected for criteria development because of their known or suspected occurrence in Louisiana waters and potential threat to attainment of designated water uses.

2. The criteria for protection of aquatic life are based on acute and chronic concentrations in fresh and marine waters as specified in the EPA criteria documents and are developed primarily for attainment of the fish and wildlife propagation use. Where a specific numerical criterion is not derived in EPA criteria documents, a criterion is developed by applying an appropriate application factor for acute and chronic effects to the lowest LC50 value for a representative Louisiana species.

3. Criteria for human health are derived using EPA guidelines, procedures, and equations for water bodies used as drinking water supplies and those not used as drinking water supplies. Criteria applied to water bodies designated as drinking water supplies are developed to protect that water supply for human consumption, including protection against taste and odor effects, to protect it for primary and secondary contact recreation, and to prevent contamination of fish and aquatic life consumed by humans. Criteria for water bodies not designated as drinking water supplies are developed to protect them for primary and secondary contact recreation and to prevent contamination of fish and aquatic life consumed by humans. In some cases, the maximum contaminant levels (MCLs) from the National Drinking Water Regulations, when more restrictive, are used as the criteria. For those toxic substances that are suspected or proven carcinogens, an incremental cancer risk

level of 10^{-6} (1 in 1,000,000) is used in deriving criteria, with the exception of 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD) and hexachlorocyclohexane (lindane, gamma BHC), in which case 10^{-5} (1 in 100,000) is used to derive the criteria.

4. Metals criteria are based on dissolved metal concentrations in ambient waters. Hardness values are averaged from two-year data compilations contained in the latest Louisiana Water Quality Data Summary or other comparable data compilations or reports.

5. For purposes of criteria assessment, the most stringent criteria for each toxic substance will apply. For determination of criteria attainment in ambient water where the criteria are below the detection limit, then no detectable concentrations will be allowed. However, for dilution calculations or water quality modeling used to develop total maximum daily load and wasteload allocations, the assigned criteria, even if below the detection limit, will be used.

TABLE 2
1997 LOUISIANA DEPARTMENT OF ENVIRONMENTAL QUALITY
NUMERICAL CRITERIA FOR SPECIFIC TOXIC SUBSTANCES
(In micrograms per liter (ug/L) or parts per billion, (ppb) unless designated otherwise)

	Aquatic Life Protection				Human Health Protection	
	Freshwater		Marine Water		Drinking Water Supply[1]	Non-Drinking Water Supply[2]
Toxic Substances	Acute	Chronic	Acute	Chronic		
Pesticides and PCBs						
Aldrin	3.00	-	1.300	-	0.04 ng/L	0.04 ng/L[3]
Chlordane	2.40	0.0043	0.090	0.0040	0.19 ng/L	0.19 ng/L
DDT	1.10	0.0010	0.130	0.0010	0.19 ng/L	0.19 ng/L
TDE (DDD)	0.03	0.0060	1.250	0.2500	0.27 ng/L	0.27 ng/L
DDE	52.5	10.5000	0.700	0.1400	0.19 ng/L	0.19 ng/L
Dieldrin	2.50	0.0019	0.710	0.0019	0.05 ng/L	0.05 ng/L
Endosulfan	0.22	0.0560	0.034	0.0087	0.47	0.64
Endrin	0.18	0.0023	0.037	0.0023	0.26	0.26
Heptachlor	0.52	0.0038	0.053	0.0036	0.07 ng/L	0.07 ng/L
Hexachlorocyclohexane (gamma BHC, Lindane)	5.30	0.21	0.160	-	0.11	0.20
Polychlorinated Biphenyls, Total (PCBs)	2.00	0.0140	10.000	0.0300	0.01 ng/L	0.01 ng/L
Toxaphene	0.73	0.0002	0.210	0.0002	0.24 ng/L	0.24 ng/L
2,4-Dichlorophenoxyacetic acid (2,4-D)	-	-	-	-	100.00	-
2-(2,4,5-Trichlorophenoxy) propionic acid (2,4,5-TP; Silvex)	-	-	-	-	10.00	-
Volatile Organic Chemicals						
Benzene	2,249	1,125	2,700	1,350	1.1	12.5
Carbon Tetrachloride (Tetrachloromethane)	2,730	1,365	15,000	7,500	0.22	1.2
Chloroform (Trichloromethane)	2,890	1,445	8,150	4,075	5.3	70

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Ethylbenzene	3,200	1,600	8,760	4,380	2.39 mg/L	8.1 mg/L[4]
1,2-Dichloroethane (EDC)	11,800	5,900	11,300	5,650	0.36	6.8
1,1,1-Trichloroethane	5,280	2,640	3,120	1,560	200.0	-
1,1,2-Trichloroethane	1,800	900	-	-	0.56	6.9
1,1,2,2-Tetrachloroethane	932	466	902	451	0.16	1.8
1,1-Dichloroethylene	1,160	580	22,400	11,200	0.05	0.58
Trichloroethylene	3,900	1,950	200	100	2.8	21
Tetrachloroethylene	1,290	645	1,020	510	0.65	2.5
Toluene	1,270	635	950	475	6.1 mg/L	46.2 mg/L
Vinyl Chloride (Chloroethylene)	-	-	-	-	1.9	35.8
Bromoform (Tribromomethane)	2,930	1,465	1,790	895	3.9	34.7
Bromodichloromethane	-	-	-	-	0.2	3.3
Acid - Extractable Organic Chemicals						
Methylene chloride (Dichloromethane)	19,300	9,650	25,600	12,800	4.4	87
Methyl chloride (Chloromethane)	55,000	27,500	27,000	13,500	-	-
Dibromochloromethane	-	-	-	-	0.39	5.08
1,3-Dichloropropene	606	303	79	39.5	9.86	162.79
2-Chlorophenol	258	129	-	-	0.10	126.4
3-Chlorophenol	-	-	-	-	0.10	-
4-Chlorophenol	383	192	535	268	0.10	-
2,3-Dichlorophenol	-	-	-	-	0.04	-
2,4-Dichlorophenol	202	101	-	-	0.30	232.6
2,5-Dichlorophenol	-	-	-	-	0.50	-
2,6-Dichlorophenol	-	-	-	-	0.20	-
3,4-Dichlorophenol	-	-	-	-	0.30	-
Phenol (Total)[5]	700	350	580	290	5.00	50.0
Base/Neutral Extractable Organic Chemicals						
Benzidine	250	125	-	-	0.08	0.17

TABLE 2
1997 LOUISIANA DEPARTMENT OF ENVIRONMENTAL QUALITY
NUMERICAL CRITERIA FOR SPECIFIC TOXIC SUBSTANCES
(In micrograms per liter (ug/L) or parts per billion, (ppb) unless designated otherwise)

					ng/L	ng/L
Hexachlorobenzene	-	-	-	-	0.25	0.25
					ng/L	ng/L
Hexachlorobutadiene[6]	5.1	1.02	1.6	0.32	0.09	0.11
			Other Organics			
2,3,7,8-Tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD)[9]	-	-	-	-	0.71 ppq[8]	0.72 ppq
			Metals and Inorganics			
Arsenic	360	190	69.00	36.00	50.0	-
Chromium III (Tri)[7]	980	120	515.00	103.00	50.0	-
	1,700	210				
	3,100	370				
Chromium VI (Hex)	16	11	1.10	50.0	50.0	-
			mg/L			
Zinc[7]	65	59	95.00	86.00	5.0 mg/L	-
	120	110				
	210	190				
Cadmium[7]	15.4	0.66	45.62	10.00	10.0	-
	33.7	1.13				
	73.6	2.0				
Copper[7]	9.9	7.1	4.37	4.37	1.0 mg/L	-
	19.2	12.8				
	36.9	23.1				
Lead[7]	34	1.3	220.0	8.50	50.0	-
	82	3.2				
	200	7.7				
Mercury	2.4	0.012[10]	2.10	0.025[10]	2.0	-
Nickel[7]	790	88	75.00	8.30	-	-
	1,400	160				
	2,500	280				

TABLE 2
1997 LOUISIANA DEPARTMENT OF ENVIRONMENTAL QUALITY
NUMERICAL CRITERIA FOR SPECIFIC TOXIC SUBSTANCES
(In micrograms per liter (ug/L) or parts per billion, (ppb) unless designated otherwise)

Cyanide	45.9	5.4	1.0	-	663.8	12,844

1 Applies to surface waterbodies designated as a Drinking Water Supply and also protects for primary and secondary contact recreation and fish consumption.
2 Applies to surface waterbodies not designated as a Drinking Water Supply and protects for primary and secondary contact recreation and fish consumption.
3 ng/L = nanograms per liter, parts per trillion
4 mg/L = milligrams per liter, parts per million
5 Total phenol as measured by the 4 – aminoantipyrine (4AAP) method
6 Includes Hexachloro-1,3-butadiene
7 Hardness-dependent criteria for fresh water based on the following natural logarithm formulas for acute and chronic protection (in descending order, numbers represent criteria in ug/L at hardness values of 50, 100, and 200 mg/L $CaCO_3$):

Chromium III: $acute = e^{(0.8190[\ln(hardness)] + 3.6880)}$
$chronic = e^{(0.8190[\ln(hardness)] + 1.5610)}$

Zinc: $acute = e^{(0.8473[\ln(hardness)] + 0.8604)}$
$chronic = e^{(0.8473[\ln(hardness)] + 0.7614)}$

Cadmium: $acute = e^{(1.1280[\ln(hardness)] - 1.6774)}$
$chronic = e^{(0.7852[\ln(hardness)] - 3.4900)}$

Copper: $acute = e^{(0.9422[\ln(hardness)] - 1.3844)}$
$chronic = e^{(0.8545[\ln(hardness)] - 1.3860)}$

Lead: $acute = e^{(1.2730[\ln(hardness)] - 1.4600)}$
$chronic = e^{(1.2730[\ln(hardness)] - 4.7050)}$

Nickel: $acute = e^{(0.8460[\ln(hardness)] + 3.3612)}$
$chronic = e^{(0.8460[\ln(hardness)] + 1.1645)}$

8 ppq = parts per quadrillion
9 Advances in scientific knowledge concerning the toxicity, cancer potency, metabolism, or exposure pathways of toxic pollutants that affect the assumptions on which existing criteria are based may necessitate a revision of dioxin numerical criteria at any time. Such revisions, however, will be accomplished only after proper consideration of designated water uses. Any proposed revision will be consistent with state and Federal regulations.
10 If the four-day average concentration for total mercury exceeds 0.012 ug/L in freshwater or 0.025 ug/L in saltwater more than once in a three-year period, the edible portion of aquatic species of concern must be analyzed to determine whether the concentration of methyl mercury exceeds the FDA action level (1.0 mg/kg). If the FDA action level is exceeded, the state must notify the appropriate EPA Regional Administrator, initiate a revision of its mercury criterion in its water quality standards so as to protect designated uses, and take other appropriate action such as issuance of a fish consumption advisory for the affected area.

2.2 General Description of Water Quality Parameters.

(a) Total Suspended Solids (TSS). Total suspended solids in waterbodies consist mainly of particulate material originating in other parts of the drainage area. Some of the more important sources of solids are eroded soil particles, particularly from construction sites or other unvegetated soil surfaces, but also to an important extent from grassed areas and agricultural areas; dirt and dust; fuel residue and other material including rubber, metal and synthetic substances associated with vehicular traffic; fallout from combustion of fossil fuels and other materials; solid waste and debris from poorly managed or exposed material storage sites, dumps and landfills; animal wastes; and leaves and other plant residue. Many pollutants become attached to the accumulating solid particles, and metals and organic compounds become physically or chemically adsorbed to clay particles. Excessive suspended solids levels in water generate unsightly turbidity plumes, and may interfere with the ability of sight-dependent fish and other organisms to obtain food, or may clog their breathing or feeding apparatus.

(b) Turbidity. Turbidity in water is caused by materials that inhibit light penetration, and reduce the clarity of, the water. It may be caused by microorganisms or various minerals, including plant detritus, silica, and sediment particles. The turbidity of a water sample is a measure of the reduction in intensity of visible light passing through the sample. Turbidity affects the aquatic system by limiting light transmission and the process of photosynthesis, which is vital to biological productivity. It is sometimes used as a broad indicator of suspended solids levels.

(c) pH. The pH level of a water body is a chemical measure of its tendency toward acidity or alkalinity. A pH value of 7.0 indicates neutrality. Most natural waters ore slightly basic, with pH values between 7.0 and 8.0. Technically, pH is the $1og_{10}$ of the reciprocal of the hydrogen ion concentration in water. Wide deviations of pH from the neutral or slightly basic range may signal the presence of important contaminants, particularly toxic substances. Industrial wastewater, for example, is often highly acidic.

(d) Biochemical Oxygen Demand (BOD). Biochemical oxygen demand is a useful indicator of biodegradable organic material, including natural materials such as simple sugars, fats and proteins, and more complex organic chemicals synthesized by man. For the most part, biodegradable materials are not toxic to aquatic organisms. Their primary importance from a water quality perspective is that their decaying process requires either dissolved or combined oxygen, and the oxygen supply of the receiving water body may become dangerously depleted. Since certain levels of dissolved oxygen are needed to sustain life and permit normal functioning of aquatic species and to prevent the existence of undesirable anaerobic conditions, excessive BOD levels in waterbodies may produce oxygen deficits, depending on the assimilative capacity of the receiving water and its rate of natural reaeration. The most common BOD measurement is an oxygen consumption test over a

five-day period. The ultimate BOD level may be estimated by extrapolation from test results over different time periods.

(e) Chemical Oxygen Demand (COD). Chemical oxygen demand is a general indicator of the amount of potentially biodegradable material in water. Various industrial chemicals and other organic chemicals that degrade slowly or only under highly oxidized conditions are better represented by COD than by BOD. The COD test does not distinguish between stable and unstable organic matter and is therefore not directly related to BOD values.

(f) Nutrients. Nutrients occur in nature in many forms. Nitrogen is an essential component of all proteins, chlorophyll and other important biological compounds. In organic matter, nitrogen decomposes from complex proteins through amino acids to ammonia, nitrites and nitrates, and is also synthesized from nitrates into plant and animal biomass (nitrogen fixation). The natural nitrogen cycle depends on microbiological activity for these processes. Nitrogen is present in waterbodies in many forms, including ammonia, organic nitrogen, nitrites and nitrates. Kjeldahl nitrogen refers to a laboratory process that is used to measure the ammonia content of a nitrogen sample.

(g) Nitrates. Nitrates are the end product of the aerobic stabilization of organic nitrogen, but they may also result from excessive fertilizer applications or from untreated domestic wastewater. Chemical fertilizer plants produce high nitrate levels in their wastewater. Despite their many sources, nitrates do not normally persist at high levels in natural waterbodies, but become converted to biomass by natural processes. When nitrate levels greatly exceed the biological requirements of a waterbody, eutrophication (over-enrichment) may occur, resulting in algal blooms or other undesirable conditions. Nitrites are seldom present in natural surface waters at significant levels except under polluted conditions and in the presence of ammonia.

(h) Phosphorus. Phosphorus occurs most commonly in nature as phosphates and orthophosphates and is a constituent of fertile soils, plants and animal tissue. It is an essential nutrient along with nitrogen for biological productivity and also undergoes cycles of decomposition and photosynthesis. It originates in domestic and industrial wastes, detergents and fertilizers. Phosphorus is often the critical parameter in the eutrophication of lakes and other waterbodies that act as nutrient sinks.

(i) Pathogentic Bacteria. Pathogenic bacteria in water may be harmful to humans, particularly if ingested while swimming. Organisms that are discharged from the intestinal tracts of humans or animals in fecal material may be pathogenic to humans or may alternatively serve as useful indicators of fecal pollution and the probable presence of pathogens. The most commonly employed pathogenic indicators are in the coliform group of bacteria, which consist predominantly of harmless organisms.

(j) Fecal Coliforms. Fecal coliforms are measured by federal and state regulatory agencies to monitor for the presence of human and/or animal fecal pollution in water. Total coliforms are also measured as a more general indicator of fecal pollution, but these

organisms may also originate in natural soils. None of the coliform group are ideal indicators of fecal pollution since they do not always exist in the same proportions to the pathogens. In order to be a reliable indicator of fecal pollution, an indicator should have a somewhat longer survival time in water than intestinal pathogens, but should nevertheless die off soon after the pathogens, so that their absence would assure the bacteriological safety of the water. The E. coli bacterial strain has been promoted as a superior indicator of fecal pollution, and has been adopted by EPA as the regulatory parameter for human health in bathing waters. E. coli is expected to eventually replace fecal coliform as the official State of Louisiana indicator organism for primary contact recreation.

(k) Metals. Many metals are known to be chronically or acutely toxic to various aquatic species above certain concentration levels in both saltwater and fresh water. The LDEQ currently has numerical criteria for fresh water aquatic life for the following eight metals: arsenic, chromium, zinc cadmium, copper, lead, mercury and nickel. The metals criteria are for the dissolved fraction of the metal in the water column and are typically hardness-dependent. Generally, as the hardness of a waterbody increases, the toxicity of the metals decrease. Thus, the maximum fresh water aquatic life criteria for metals increases as the hardness increases. These metals are discussed briefly in the following paragraphs.

1. Arsenic (As). Arsenic concentrations in natural waterbodies areas vary widely but are usually 5 ug/L or more. Arsenic is emitted to the environment by coal - fuel power plants.

2. Chromium (Cr). Chromium is more common than cadmium in natural estuaries, typically at about 0.5 ug/L. Chromium salts are used for electroplating and in cleaning agents, and are also present in paints, fungicides and wood preservatives.

3. Cadmium (Cd). Cadmium usually occurs at low levels in the natural estuarine environment, often below 0.01 ug/L, but waters affected by municipal and/or industrial development probably have much higher concentrations. Industrial sources include effluents from petrochemical plants, metallurgical processes and electroplating. It is extremely toxic to fish.

4. Copper (Cu). Copper is relatively plentiful in the natural environment, ranging from about 1 to 10 ug/L. Pertinent industrial sources of copper include petroleum refineries.

5. Lead (Pb). Lead occurs in most natural waterbodies at 1 ug/L or less. It is much more plentiful, however, in waters in and near inhabited areas. It is used in storage batteries and other metal products, but is no longer permitted in paint pigments and gasoline additives.

6. Mercury (Hg). Mercury background levels in natural waterbodies may range from 0.01 to 0.1 ug/L. It is used in the electrolytic preparation of chlorine and caustic soda, in mercury battery cells and thermometers, and in various other laboratory and industrial

applications. The chronic criterion was derived on the basis that all mercury discharged to the environment is methyl mercury, the form that evolves in sediment and in fish and the aquatic food chain. It is known, however, that almost all mercury discharged is mercury (II), a much less toxic form. The FDA action level for the concentration of methyl mercury in the edible portions of fish is considered to be a more relevant criterion for consumable species than the referenced chronic criterion.

2.3 EPA Water Quality Criteria. The EPA has established ambient water quality criteria applicable to surface waters in the study area. These criteria are shown in Tables 3, 4 and 5. The numerical criteria listed in Tables 3, 4 and 5 have been developed for various physical parameters, nutrients, metals, PCB's, and organic pesticides for uses of freshwater aquatic life, marine and estuarine aquatic life, and public water supply, respectively.

2.3.1 EPA Water Quality Tables.

TABLE 3

1986 EPA **FRESH WATER** AQUATIC LIFE CRITERIA
(All values in ug/L except where noted)

Parameter	Chronic (24-Hour Average)	Acute (Maximum at Any Time)	Chronic[1] (4-Day Average)	Acute[2] (1-Hour Average)
Aesthetic Qualities	(Narrative statement - SEE CRITERIA DOCUMENT[3])			
Aldrin[P]	-	3.0	-	-
Alkalinity	(20 mg/L MINIMUM)			
Ammonia	(Criteria are pH and temperature dependent-SEE CRITERIA DOCUMENT)			
Arsenic (III)[P]	-	-	190	360
Boron	(750 ug/L for long term irrigation on sensitive crops)			
Cadmium[4,P]	-	-	1.1/1.6/2.0	3.9/6.2/8.6
Chlordane[P]	0.0043	2.4	-	-
Chlorine	-	-	11	19
Chlorpyrifos	-	-	0.041	0.083
Chromium (VI)[P]	-	-	11	16
Chromium (III)[4]	-	-	210/289/370	1700/2420/3100
Color	(Narrative statement - SEE CRITERIA DOCUMENT)			
Copper[4,P]	-	-	12/17/21	18/26/34
Cyanide[P]	-	-	5.2	22
DDT[P]	0.0010	1.1	-	-
Demeton[P]	0.1	-	-	-
Dieldrin[P]	0.0019	2.5	-	-
Endosulfan[P]	0.056	0.22	-	-
Endrin[P]	0.0023	0.18	-	-
Gases, Total Dissolved	(Narrative statement - SEE CRITERIA DOCUMENT)			
Guthion	0.01	-	-	-
Heptachlor[P]	0.0038	0.52	-	-
Hexachlorocyclohexane (Lindane)[P]	0.080	2.0	-	-
Iron	1000	-	-	-
Lead[4,P]	-	-	3.2/5.3/7.7	82/137/200
Malathion	0.1	-	-	-
Mercury[P]	-	-	0.012	2.4
Methoxychlor	0.03	-	-	-
Mirex	0.001	-	-	-
Nickel[4,P]	-	-	160/222/280	1400/1999/2500
Oil and Grease	(Narrative statement - SEE CRITERIA DOCUMENT)			
Oxygen, Dissolved	(Warmwater and Coldwater Matrix - SEE CRITERIA DOCUMENT)			

TABLE 3

1986 EPA **FRESH WATER** AQUATIC LIFE CRITERIA
(All values in ug/L except where noted)

Parathion	-	-	0.013	0.065
Polychlorinated Biphenyls (PCB's)[P]	0.014	2.0	-	-
Pentachlorophenol (PCP)[5,P]	-	-	3.5/13/43	5.5/20/68
PH	(6.5 - 9.0 su)	-	-	-
Silver[4,P]	-	4.1/8.2/13	-	-
Solids (Suspended) and Turbidity	(Narrative statement - SEE CRITERIA DOCUMENT)			
Sulfide-Hydrogen Sulfide	2.0	-	-	-
Temperature	(Species dependent criteria - SEE CRITERIA DOCUMENT)			
Toxaphene[P]	-	-	0.0002	0.73
Zinc[P]	-	-	110/149/190	120/165/210

1 4-day average concentration not to be exceeded more than once every 3 years on the average.
2 1-hour average concentration not to be exceeded more than once every 3 years on the average.
3 *EPA Quality Criteria for Water 1986*, EPA 440/5-86-001, May 1, 1986.
4 Hardness dependent criteria. Values presented are for 100/150/200 mg/L as $CaCO_3$.
5 pH dependent criteria. Values presented are for 6.5/7.8/9.0 standard pH units.
P Priority Pollutant.

TABLE 4

1986 EPA **SALTWATER** AQUATIC LIFE CRITERIA
(All values in ug/L except where noted)

Parameter	Chronic (24-Hour Average)	Acute (Maximum at Any Time)	Chronic[1] (4-Day Average)	Acute[2] (1-Hour Average)
Aesthetic Qualities	(Narrative statement - SEE CRITERIA DOCUMENT[3])			
Aldrin[P]	-	1.3	-	-
Arsenic (III)[P]	-	-	36	69
Cadmium[P]	-	-	9.3	43
Chlordane[P]	0.004	0.09	-	-
Chlorine	-	-	7.5	13
Chlorpyrifos	-	-	0.0056	0.011
Chromium (VI)[P]	-	-	50	1100
Color	(Narrative statement - SEE CRITERIA DOCUMENT)			
Copper[P]	-	-	-	2.9
Cyanide[P]	-	-	-	1.0
DDT[P]	0.0010	0.13	-	-
Demeton[P]	0.1	-	-	-
Dieldrin[P]	0.0019	0.71	-	-
Endosulfan[P]	0.0087	0.034	-	-
Endrin[P]	0.0023	0.037	-	-
Gases, Total Dissolved	(Narrative statement - SEE CRITERIA DOCUMENT)			
Guthion	0.01	-	-	-
Heptachlor[P]	0.0036	0.053	-	-
Hexachlorocyclohexane (Lindane)[P]	-	0.16	-	-
Lead[P]	-	-	5.6	140
Malathion	0.1	-	-	-
Mercury[P]	-	-	0.025	2.1
Methoxychlor	0.03	-	-	-
Mirex	0.001	-	-	-
Nickel[P]	-	-	8.3	75
Oil and Grease	(Narrative statement - SEE CRITERIA DOCUMENT)			
Polychlorinated Biphenyls (PCB's)[P]	0.030	10	-	-
Pentachlorophenol (PCP)[3,P]	-	-	7.9	13
PH	(6.5 - 8.5 su)	-	-	-
Phosphorus (Elemental)	0.10	-	-	-
Selenite (inorganic)[P]	54	410	-	-
Silver[P]	-	2.3	-	-
Sulfide-Hydrogen Sulfide	2.0	-	-	-
Temperature	(Species dependent criteria - SEE CRITERIA DOCUMENT)			

TABLE 4

1986 EPA **SALTWATER** AQUATIC LIFE CRITERIA
(All values in ug/L except where noted)

Toxaphene[P]	-	-	0.0002	0.21
Zinc[P]	-	-	86	95

1 4-day average concentration not to be exceeded more than once every 3 years on the average.
2 1-hour average concentration not to be exceeded more than once every 3 years on the average.
3 *EPA Quality Criteria for Water 1986*, EPA 440/5-86-001, May 1, 1986.
P Priority Pollutant.

TABLE 5

1986 EPA **HUMAN HEALTH** CRITERIA
(Units per liter)

Parameter	Fish and Water Ingestion	Fish Consumption Only	Drinking Water M.C.L.[1]	Organo-leptic Criteria[2]
Acenapthene[P]	-	-	-	0.02 mg
Acrolein[P]	320 ug	780 ug	-	-
Acrylonitrile[P,C]	0.58/0.058/0.006 ug	6.5/0.65/0.065/ ug	-	-
Aesthetic Qualities	(Narrative Statement - SEE CRITERIA DOCUMENT[3)]			
Aldrin[P,C]	0.74/0.074/0.0074 ng	0.79/0.079/0.0079 ng	-	-
Antimony[P]	146 ug	45,000 ug	-	-
Arsenic[P,C]	22/2.2/0.22 ng	175/17.5/1.75 ng	0.05 mg	-
Asbestos[P,C]	300,000/30,000/3,000 Fibers	-	-	-
Bacteria	(For Primary Recreation And Shellfish Uses - SEE CRITERIA DOCUMENT)			
Barium	-	-	1.0 mg	-
Benzene[P,C]	6.6/0.66/0.066 ug	400/40.0/4.0 ug	-	-
Benzidine[P,C]	1.2/0.12/0.01 ng	5.3/0.53/0.05 ng	-	-
Beryllium[P,C]	68/6.8/0.68 ng	1170/117.0/11.71 ng	-	-
Cadmium	10 ug	-	0.010 mg	-
Carbon Tetrachloride[P,C]	4/0.40/0.04 ug	69.4/6.94/0.69 ug	-	-
Chlordane[P,C]	4.6/0.46/0.046 ng	4.8/0.48/0.048 ng	-	-
Chloroethyl Ether (BIS-2)[P,C]	0.3/0.03/0.003 ug	13.6/1.36/0.136 ug	-	-
Chloroform[P,C]	1.9/0.19/0.019 ug	157/15.7/1.57 ug	-	-
Chloroisopropyl Ether (Bis-2)[P]	34.7 ug	4.36 mg	-	-
Chloromethyl Ether (BIS)[C]	[37.6/3.76/0.376]x10^{-3} ug	[18.4/1.84/0.184]x10^{-3} ug	-	-
2-Chlorophenol[P]	-	-	-	0.1 ug
4 Chlorophenol	-	-	-	0.1 ug
Chlorophenoxy Herbicides(2,4,5,-TP) (Silvex)	10 ug	-	10 ug	-
Chlorophenoxy Herbicides(2,4-D)	100 ug	-	100 ug	-
Chloro-4 Methyl-3 Phenol	-	-	-	3000 ug
Chromium (VI)[P]	50 ug	-	0.05 mg	-
Chromium(III)	170 mg	3,433 mg	-	-
Color	(Narrative statement - SEE CRITERIA DOCUMENT)			
Copper[P]	-	-	-	1 mg
Cyanide[P]	200 ug	-	200 ug	-
DDT[P,C]	0.24/0.024/0.0024 ng	0.24/0.024/0.0024 ng	-	-
Dibutyl Phtalate[P]	34 mg	154 mg	-	-
Dichlorobenzenes[P]	400 ug	2.6 mg	-	-

TABLE 5

1986 EPA **HUMAN HEALTH** CRITERIA
(Units per liter)

Dichlorobenzidine[P,C]	0.103/0.010/0.001 ug	0.204/0.200/0.002 ug	-	-
1,2 Dichloroethane[P,C]	9.4/0.94/0.094 ug	2,430/243/24.3 ug	-	-
Dichloroethylenes[P,C]	0.33/0.033/0.003 ug	18.5/1.85/0.185 ug	-	-
2,4-Dichlorophenol	3.09 mg	-	-	0.3 ug
Dichloropropene[P]	87 ug	14.1 mg	-	-
Dieldrin[P,C]	0.71/0.071/0.0071 ng	0.76/0.076/0.0076 ng	-	-
Diethyl Phthalate[P]	350 mg	1.8 g	-	-
2,4-Dimethylphenol[P]	-	-	-	400 ug
Dimethyl Phthalate[P]	313 mg	2.9 g	-	-
2,4 Dinitrotoluene[C]	1.1/0.11/0.011 ug	91/9.1/0.91 ug	-	-
2,4 Dinitro-o-Cresol[P]	13.4 ug	765 ug	-	-
2,3,7,8-TCDD (Dioxin)[P,C]	[0.13/0.013/0.0013]x10^{-6} ug	[0.14/0.014/0.0014]x 10^{-6} ug	-	-
Diphenylhydrazine[P]	422/42/4 ng	5.6/0.56/0.056 ug	-	-
Di-2-EthylHexyl Phthalate[P]	15 mg	50 mg	-	-
Endosulfan[P]	74 ug	159 ug	-	-
Endrin[P]	1.0 ug	-	0.0002 mg	-
Ethylbenzene[P]	1.4 mg	3.28 mg	-	-
Fluorathene[P]	42 ug	54 ug	-	-
Halomethanes[P,C]	1.9/0.19/0.019 ug	157/15.7/1.57 ug	-	-
Heptachlor[P,C]	2.78/0.28/0.028 ng	2.85/0.29/0.029 ng	-	-
Hexachloroethane[C]	19/1.9/0.19 ug	87.4/8.74/0.87 ug	-	-
Hexachlorobenzene[P,C]	7.2/0.72/0.072 ng	7.4/0.74/0.074 ng	-	-
Hexachlorobutadiene[P,C]	4.47/0.45/0.045 ug	500/50/5 ug	-	-
Hexachlorocyclohexane-Alpha[P,C]	92/9.2/0.92 ng	310/31/3.1 ng	-	-
Hexachlorocyclohexane-Beta[P,C]	163/16.3/1.63 ng	547/54.7/5.47 ng	-	-
Hexachlorocyclohexane-Gama[P,C]	186/18.6/1.86 ng	625/62.5/6.25 ng	-	-
Hexachlorocyclohexane-Technical[P,C]	123/12.3/1.23 ng	414/41.4/4.14 ng	-	-
Hexachlorocyclopentadiene[P]	206 ug	-	-	1 ug
Iron	0.3 mg	-	0.3 mg	-
Isophorone[P]	5.2 mg	520 mg	-	-
Lead[P]	50 ug	-	0.05 mg	-
Manganese	50 ug	100 ug	50 ug	-
Mercury[P]	144 ng	146 ng	0.002 mg	-
Methoxychlor	100 ug	-	0.1 mg	-
Monochlorobenzene[P]	488 ug	-	-	20 ug
Nickel[P]	13.4 ug	100 ug	-	-
Nitrates	10 mg	-	10 mg	-
Nitrobenzene[P]	19.8 mg	-	-	30 ug
Nitrosodibutylamine N[P,C]	64/6.4/0.64 ng	5,868/587/58.7 ng	-	-
Nitrosodiethylamine N[P,C]	8/0.8/0.08 ng	12400/1,240/124 ng	-	-
Nitrosodimethylamine N[P,C]	14/1.4/0.14 ng	160000/16,000/1600 ng	-	-

TABLE 5

1986 EPA **HUMAN HEALTH** CRITERIA
(Units per liter)

Nitrosodiphenylamine N[P,C]	49000/4,900/490 ng	161000/16,100/1610 ng	-	-
Nitrosopyrrolidine N[P,C]	160/16/1.6 ng	919000/91,900/9190 ng	-	-
Oil and Grease	(Narrative Statement - SEE CRITERIA DOCUMENT)			
PCB's[P,C]	0.79/0.079/0.0079 ng	0.79/0.079/0.0079 ng	-	-
Pentachlorobenzene	74 ug	85 ug	-	-
Pentachlorophenol[P]	1.01 mg	-	-	-
Phenol[P]	3.5 mg	-	-	0.3 mg
Polynuclear Aromatic Hydrocarbons[P,C]	28/2.8/0.28 ng	311/31.1/3.11 ng	-	-
Selenium[P]	10 ug	-	0.01 mg	-
Silver[P]	50 ug	-	0.05 mg	-
Solids (Dissolved) And Salinity	-	-	250 mg	-
Tainting Substances	(Narrative Statement - SEE CRITERIA DOCUMENT)			
1,2,4,5 Tetrachlorobenzene[P]	38 ug	48 ug	-	-
1,1,2,2-tetrachloroethane[P,C]	1.7/0.17/0.017 ug	107/10.7/1.07 ug	-	-
Tetrachloroethylene[P,C]	8/0.8/0.08 ug	88.5/8.85/0.88 ug	-	-
Thalium[P]	13 ug	48 ug	-	-
Toluene[P]	14.3 mg	424 mg	-	-
Toxaphene[P,C]	7.1/0.71/0.07 ng	7.3/0.73/0.07 ng	0.005 mg	-
1,1,1-trichloroethane[P]	18.4 mg	1.03 g	-	-
1,1,2-trichloroethane[P,C]	6/0.6/0.06 ug	418/41.8/4.18 ug	-	-
Trichloroethylene[P,C]	27/2.7/0.27 ug	807/80.7/8.07 ug	-	-
2,4,5-trichlorophenol	2,600 ug	-	-	1 ug
2,4,6-trichlorophenol[P,C]	12/1.2/0.12 ug	36/3.6/0.36 ug	-	2 ug
Vinyl Chloride[P,C]	20/2/0.2 ug	5246/525/52.5 ug	-	-

1 M.C.L. is maximum contaminant level.

2 To control undesirable taste and order quality of ambient water. It should be recognized that organoleptic data have limitations as a basis for establishing water quality criteria, and have no demonstrated relationship to potential adverse human health effects.

3 *EPA Quality Criteria for Water 1986*, EPA 440/5-86-001, May 1, 1986.

P Priority Pollutant.

C Carcinogenic pollutant. For the maximum protection of human health from the potential carcinogenic effects resulting from exposure to these pollutants through ingestion of contaminated water and contaminated aquatic organisms, the ambient water concentrations should be zero based on the nonthreshold assumption for these chemicals. The levels presented are for $10^{-5}/10^{-6}/10^{-7}$ incremental increase of cancer risk over the lifetime.

2.3.2 Additional EPA Water Quality Criteria. Additional EPA water quality criteria are as follows:

(a) Aesthetic qualities. All waters free from substances attributable to wastewater or other discharges that:

1. settle to form objectionable deposits;

2. float as debris, scum, oil, or other matter to form nuisances;

3. produce objectionable color, odor, taste, or turbidity;

4. injure or are toxic or produce adverse physiological responses in humans, animals or plants; and

5. produce undesirable or nuisance aquatic life.

(b) Color. Waters shall be virtually free from substances producing objectionable color for aesthetic purposes; the source of supply should not exceed 75 color units on the platinum-cobalt scale for domestic water supplies, and increased color (in combination with turbidity) should not reduce the depth of the compensation point for photosynthetic activity by more than 10 percent from the seasonally established norm for aquatic life.

(c) Dissolved oxygen. Water should contain sufficient DO to maintain aerobic conditions in the water column and, except as affected by natural phenomena, at the sediment-water interface. Numerical criteria are available for varying aquatic life stages for coldwater and warmwater species.

(d) Fecal coliform bacteria.

1. Bathing waters. Based on a minimum of five samples equally spaced over a 30-day period, the geometric mean of the E. coli density should not exceed 126 per 100 mL for freshwater bathing. For the above sampling period, the geometric means of the enterococci density should not exceed 33 and 35 per 100 mL for freshwater and marine bathing, respectively. The annual primary contact recreation criteria of 400 colonies/100 mL is exceeded at many locations. In general, the areas with the lowest levels are in areas 2 and 3, and the areas with the highest levels are 4 and 6. Fecal coliform concentrations in Bayou Grand Caillou and Bayou Terrebonne (both are in area 4) appear to exceed the criteria for secondary contact recreation at least 25% of the time as well. In area 6, Bayou Choctaw exceeds the secondary contact criteria nearly 40 percent of the time, and Grand Bayou also experiences levels in excess of the secondary contact criteria on occasion. Samples from the Bayou Teche at Franklin station in area 3 exceed the secondary contact criteria over 40 percent of the time.

2. Shellfish harvesting waters. The median fecal coliform bacterial concentration should not exceed 14 MPN/100 mL for the taking of shellfish, with not more than 10 percent of samples exceeding 43 MPN/100 mL.

(e) Oil and grease. For domestic water supply: virtually free from oil and grease, particularly from the tastes and odors that emanate from petroleum products. For aquatic life: (1) levels of individual petrochemicals in the water column should not exceed 0.01 times the lowest continuous flow 96-hour LC_{50} to several important freshwater or marine species, each having a demonstrated high susceptibility to oils and petrochemicals; (2) levels of oils or petrochemicals in the sediment which cause deleterious effects to the biota should not be allowed; and (3) surface waters shall be virtually free from floating nonpetroleum oils of vegetable or animal origin, as well as petroleum derived oils.

(f) Settleable and suspended solids. Freshwater fish and aquatic life: settleable and suspended solids should not reduce the depth of the compensation point for photosynthetic activity by more than 10 percent from the seasonally established norm for aquatic life.

(g) Tainting substances. Materials should not be present in concentrations that individually or in combination produce undesirable flavors which are detectable by organoleptic tests performed on the edible portions of aquatic organisms.

The LDEQ general criteria state that "all waters of the state shall be capable of supporting desirable diversified species of fish, shellfish and wildlife." Therefore, EPA criteria for freshwater or marine aquatic life, Tables 3 and 4, respectively, are held to apply to all surface waters. Also, EPA criteria for the protection of human health apply to all surface waters.

3.0 EXISTING WATER QUALITY.

3.1 Water Use Designations. The Louisiana Department of Environmental Quality (LDEQ) has established seven water use designations for surface waters in the State. The seven designated water uses follow.

A = Primary Contact Recreation
B = Secondary Contact Recreation
C = Fish and Wildlife Propagation
D = Drinking Water Supply
E = Oyster Propagation
F = Agriculture
G = Outstanding Natural Resource Waters

Specifically, LDEQ has designated the waters of Jean Lafitte Fisher School Basin study area according to the following uses:

Primary Contact Recreation
Secondary Contact Recreation
Propagation of Fish and Wildlife
Drinking Water Supply
Oyster Propagation
Agriculture
Outstanding Natural Resource Waters

For the primary contact recreation designation, a waterbody should be suitable for activities such as swimming, water skiing, and skin diving. A waterbody designated for Secondary Contact Recreation should be suitable for activities such as boating, fishing, and limited contact incident to shoreline activities. The propagation of fish and wildlife designation means the waterbody should also be suitable for preservation and reproduction of aquatic biota such as indigenous species of fish, invertebrates, reptiles, amphibians, and other wildlife associated with the aquatic environment. Drinking water supply refers to the use of water for human consumption and general household use. Oyster propagation is the use of water to maintain biological systems that support economically important species of oysters, clams, mussels , or other mollusks so that their productivity is preserved and the health of human consumers of these species is protected. Agriculture involves the use of water for crop spraying, irrigation, livestock watering, poultry operations, and other farm purposes not related to human consumption. Outstanding natural resource waters are those waterbodies designated for preservation, protection, reclamation or enhancement of wilderness, aesthetic qualities, ecological regimes, such as those Designated under the Louisiana Natural and Scenic Rivers System or those designated by LDEQ as waters of ecological significance.

3.2 Water Use Support Classification. LDEQ classifies water use support based upon either an evaluation of land use, citizen complaints, etc., or upon actual monitored data. Only an evaluated assessment is available for the study area, and the results of this evaluated assessment are discussed below.

3.2.1 Evaluated Assessment. LDEQ has classified the waters of the Jean Lafitte, Fisher School Basin Study Area as either FULLY or PARTIALLY supporting their designated uses based upon an evaluated assessment as shown in Table 6.

TABLE 6

1996 LDEQ WATER USE SUPPORT CLASSIFICATION
EVALUATED ASSESSMENT

Waterbody Segment Code/ Description	Source [1]	Type	Size	Segment Class [2]	Overall Degree of Support [3]	Degree of Support [4]			Suspected Source(
						P C R	S C R	F W P	
1. 020601/ Intracoastal Waterway-Bayou Villars to Mississippi River (Estuarine)	NPS	R	15.0	EL	FULL	P	T	T	Minor industrial Point Sourc Plants (small flows); Inflow infiltration; Urban runoff/sto Spills; Contaminated Sedime
2. 020802/ Bayou Barataria/ Barataria Waterway to Bayou Rigolettes (Estuarine)	NPS	R	6.0	EL	FULL	P	P	F	Minor industrial point sourc plants (small flows) ; Petrole activities; Channelization; Sp Contaminated Sediments.

[1] Source may be Point Source (PS) or Non-Point Source (NPS)

[2] Segment Class may be Water Quality Limited (WQL) or Effluent Limited (EL)

[3] Overall Degree of Support may be FULL, PARTIAL, or NOT supporting designated uses. The overall degree of support of THREATENED has been eli

[4] Individual Degree of Support may be FULLY (F), THREATENED (T), PARTIALLY (P), or NOT supporting (N). The overall degree of use support is b 3 values assigned to the individual use support statements for primary contact recreation (PCR), secondary contact recreation (SCR) and fish and wildlife p corresponding numerical values for the individual use support statements are 4 for F, 3 for T, 2 for P, and 1 for N. Average support values from 2.5 to 4.0 support rating of FULLY supporting.

3.3 Existing Water Quality Data. No active water quality monitoring stations were identified in the study area. Prior to 1994, there were three stations located near the study area as part of Jefferson Parish's storm water drainage canal sampling program. These three stations were as follows.

Station 19 - Bayou Barataria @ Rosethorne Park
Station 20 - Bayou Barataria @ the small pumping station on LA Highway 45
Station 21 - Bayou Barataria just past Joe's Landing on LA Highway 301

The data for Stations 19, 20, and 21 are listed in Tables 7, 8, and 9, respectively. All of the pH values for each of the three stations are within the allowable range of 6.5 to 9.0 su. Fecal coliform levels at all three stations exceeded the state standard within the 3 year monitoring period. Fecal coliform levels at stations 19 and 21 exceeded the state acute criteria for primary contact recreation (400 per mL) 3 times in 16 samples, and exceeded the secondary contact recreation criteria (2000 per mL) once during the monitoring period. At station 20, the fecal coliform exceeded the primary contact recreation standard 8 times in 16 samples, and the secondary contact recreation standard on 3 occasions. On one occasion, the fecal coliform levels at Station 20 were 28,000 per 100 mL versus the primary contact recreation standard of 400 per 100 mL.

For all three stations, none of the cadmium, chromium, or arsenic concentrations exceed the LDEQ criteria for the estuarine aquatic life in 15 samples per station. Only one sample exceeded the LDEQ chronic lead criterion (8.5 mg/l) for estuarine aquatic life. This sample had a lead concentration of 11.76 ug/L and was collected at Station 19 in January 1993. No exceedances of the LDEQ acute criteria for lead were identified. None of the mercury concentrations at the three stations exceeded the LDEQ acute criteria for estuarine aquatic life. However, 10 of 15 mercury samples taken at station Stations 19, 10 of 15 samples taken at Station 20; and 12 of 15 samples taken at Station 20 exceeded the LDEQ chronic mercury criteria for estuarine aquatic life. At least 13, 9, and 4 of the 15 samples taken at stations 19, 20, and 21, respectively, exceeded both the LDEQ acute and chronic copper criteria (both 4.37 ug/L) for estuarine aquatic life. The mean copper concentrations for Stations 19 and 20 were above 4.37 ug/L whereas the mean copper concentration for Station 21 was below 4.37 ug/L.

3.4 Results of Water and Sediment Quality Testing. As part of this water quality assessment, water samples were taken at three sites. These sites were the forebay of the Gloria Drive pumping station, the tailbay of the Verret Street pumping station, and on the unprotected side of the existing levee near the Town Auditorium. Sediment samples were taken in the forebay of the Verret Street pumping station, just downstream of the Louisiana Highway 45 bridge. Both the water and the sediment samples were tested for priority pollutants.

The results of the water testing were compared to the water quality standards and criteria of the Louisiana Department of Environmental Quality. Very few contaminants were detected in any of the water samples. Trace amounts of D-BHC were detected at both the Gloria Street and the Verret Street pumping station sites. A trace amount of B-Endosulfan was detected at the site near the Town Auditorium. Arsenic was detected in very small quantities at all three sites tested, as was copper and nickel. Zinc was detected at the Town Auditorium site. None of these

parameters exceeded the state water quality criteria. No testing for fecal coliform was performed at these sites.

Since no sediment quality criteria have been established, the results of the sediment sample testing were compared to Sediment Quality Benchmarks (SQBs) compiled by the National Oceanic and Atmospheric Administration (NOAA) and by the State of Florida Department of Environmental Protection (FDEP). These benchmarks are shown in Table 10.

Table 7

Jean Lafitte, Fisher School Basin Sampling Data

Bayou Barataria at Rosethorne Park (Station 19)

Date	BOD (mg/L)	TSS (mg/L)	PH (s.u.)	Fecal Coliform #/100 mL	E. Coli #/100 mL	Fecal Strep #/100 mL	COD (mg/L)	Cd (ug/L)	Cr (ug/L)	Cu (ug/L)	Hg (ug/L)
2/90	2	97	7.53	800	470		27	0.10	1.38	3.60	0.20
3/90	2	47	7.74	1400	1600		36	0.41	1.00	6.12	0.26
4/90	2	52	7.97	300	200		44				
5/90	2	113	7.67	550	560		4	0.01	0.52	7.48	0.67
6/90	2	44	7.91	30	60		16	0.12	0.80	7.59	0.27
7/90	1	28	7.98	810	110		19	0.23	1.57	4.69	0.32
8/90	3	41	7.99	100		460		0.19	0.77	14.79	0.20
9/90	1	29	7.46	500		210	32	0.01	1.03	4.70	0.20
5/27/92	2	38	8.33	100		100	10	6.60	0.90	5.20	<0.20
7/22/92	1	36	7.86	50		100	22	<0.12	1.20	10.50	<0.10
9/23/92	1	29	7.46	500		210	32	<0.05	8.86	5.73	<0.15
11/4/92	4	64	7.97	800		3,300	20	<0.05	1.07	5.20	0.88
1/13/93	4	53	7.08	7800		5,600	26	<0.05	0.68	5.89	<0.15
7/21/93	2	25	7.64	100		100	26	<1.00	<10.00	<5.00	0.37
9/22/93	3	27	7.82	220		140	29	<1.00	<10.00	12.19	0.40
11/17/93	5	43	7.71	800		1,200	16	<0.05	2.76	13.00	<0.15
Mean	2	49	7.79	901	500	1,132	22	0.59	2.17	7.28	0.28
Log Mean				310							

Table 8
Jean Lafitte Fisher School Basin Sampling Data
on LA Highway 45 (Station 20)

Date	BOD (mg/L)	TSS (mg/L)	PH (s.u.)	Fecal Coliform #/100 mL	E. Coli #/100 mL	Fecal Strep #/100 mL	COD (mg/L)	Cd (ug/L)	Cr (ug/L)	Cu (ug/L)	Hg (ug/L)
2/15/90	2	78	7.49	730	800		200	0.10	2.57	11.26	0.20
3/15/90	1	63	7.60	5300	4400		36	0.27	1.00	7.10	0.27
4/26/90	1	59	7.98	150	180		108				
5/10/90	1	49	7.71	640	620		20	0.01	0.63	6.86	0.20
6/14/90	1	67	7.73	320	200		32	1.12	1.25	6.39	0.85
7/26/90	1	34	7.87	1400	970		33	0.01	1.48	3.92	0.20
8/23/90	1	28	7.85	350		290	51	0.15	0.37	4.68	0.20
9/19/90	1	31	7.57	190		70	20	0.01	0.13	1.10	0.20
5/27/92	1	44	7.93	100		400	16	0.31	1.20	4.70	<0.20
7/22/92	2	60	7.56	1800		2000	29	<0.12	1.10	2.80	<0.10
9/23/92	2	40	7.41	360		260	35	<0.05	2.04	7.16	<0.15
11/4/92	4	52	7.76	28000		21000	32	0.15	1.63	6.88	0.75
1/13/93	5	70	7.14	11000		8500	34	<0.05	1.63	3.63	<0.15
7/21/93	2	143	7.70	200		200	42	<1.00	<10.00	<5.00	0.31
9/22/93	3	65	7.61	200		300	39	1.17	<10.00	21.48	0.29
11/17/93	5	42	7.61	1800		3500	38	0.89	3.22	<0.51	<0.15
Mean	2	58	7.66	3284	1195	3652	48	0.32	1.88	6.05	0.26
Log Mean				772							

Table 9
Jean Lafitte Fisher School Basin Sampling Data
on Highway 301 (Station 21)

Date	BOD (mg/L)	TSS (mg/L)	PH (s.u.)	Fecal Coliform #/100 mL	E. Coli #/100 mL	Fecal Strep #/100 mL	COD (mg/L)	Cd (ug/L)	Cr (ug/L)	Cu (ug/L)	Hg (ug/L)
2/15/90	1	84	8.07	80	90		57	0.10	1.58	1.66	0.20
3/15/90	1	51	7.89	330	320		96	0.31	1.00	6.25	0.23
4/26/90	2	31	7.88	110	140		84				
5/10/90	1	28	7.82	220	120		28	0.90	0.36	5.71	0.20
6/14/90	1	13	7.57	250	100		44	0.01	0.65	7.99	0.41
7/26/90	2	15	8.01	120	20		55	0.01	1.79	7.31	0.20
8/2390	2	16	7.78	400		310	109	0.01	0.63	4.01	0.20
9/19/90	2	20	7.94	230		100	64	0.01	0.10	2.10	0.20
5/27/92	2	23	7.69	200		200	54	0.50	0.80	8.60	<0.20
7/22/92	1	11	7.58	100		100	40	<0.12	0.90	3.40	<0.10
9/23/92	2	31	7.49	250		390	39	<0.05	<0.45	3.00	0.25
11/4/92	4	29	7.77	560		1300	60	<0.05	1.00	2.86	0.72
1/13/93	5	47	7.41	3300		5400	34	<0.05	0.84	2.58	<0.15
7/21/93	2	29	7.63	100		500		<1.00	<10.00	<5.00	0.34
9/22/93	2	13	7.53	20		20	39	<1.00	<10.00	<5.00	0.43
11/17/93	4	30	7.80	660		720	64	0.32	3.23	<0.51	0.28
Mean	2	29	7.74	433	132	1,132	58	0.22	1.54	4.05	0.26
Log Mean				215							

TABLE 10
SEDIMENT QUALITY BENCHMARKS

	NOAA[a]		FDEP[b]	
CHEMICAL	ER-L	ER-M	TEL	PEL
Inorganics (mg/kg dry weight)				
Antimony	2	25		
Arsenic	8.2	70	7.24	41.6
Cadmium	1.2	9.6	0.68	4.21
Chromium	81	370	52.3	160
Copper	34	270	18.7	108
Lead	46.7	218	30.2	112
Mercury	0.15	0.71	0.13	0.7
Nickel	20.9	51.6	15.9	42.8
Silver	1.0	3.7	0.73	1.77
Zinc	150	410	124	271
Organics (ug/kg dry weight)				
Acenapthene	16	500	6.71	88.9
Acenaphthylene	44	640	5.87	128
Anthracene	85.3	1100	46.9	245
Benz(a)anthracene	261	1600	74.8	693
Benzo(a)pyrene	430	1600	88.8	763
Bis (2ethylhexyl)-phthalate			182	2647
Chlordane	0.5	6	2.26	4.79
Chrysene	384	2800	108	846
DDD,op'- + pp'-	2	20		
DDD,pp'-			1.19	4.77
DDE,pp'-	2.2	27	2.07	3.74
DDT,op'- + pp'-1	7			
DDT,pp'-			1.19	4.77
DDT,Total	1.58	46.1	3.89	51.7
Dibenzo(a,h)-anthracene	63.4	260	6.22	135
Dieldrin	0.02	8	0.72	4.3
Endrin	0.02	45		
Fluoranthene	600	5100	113	1494
Fluorene	19	540	21.2	144
Lindane			0.32	0.99
2-Methyl napthalene	70	670	20.2	201
Naphthalene	160	2100	34.6	391
PAH, Total LMW	552	3160	312	1442
PAH, Total HMW	1700	9600	655	6676
PAH, Total	4022	44792	1684	16770
PCB, Total	22.7	180	21.6	189
Phenanthrene	240	1500	86.7	544
Pyrene	665	2600	153	1398

[a]NOAA=National Oceanic and Atmospheric Administration; ER-L=effects range low; ER-M=effects range median.
[b]FDEP=Florida Department of Environmental Protection; TEL=threshold effects level; PEL=probable effects level.

These data, while not criteria or standards, provide a basis on which to evaluate relative sediment quality. The results of the sediment tests were compared to the ER-L and TEL benchmarks, for those parameters tested. The ER-L represents the lower 10^{th} percentile of chemical concentrations observed or predicted to be associated with biological effects. The TEL represents the upper limit of sediment contaminant concentration dominated by no effects data. Arsenic and mercury exceeded both the ER-L and the TEL benchmarks, while Copper and Nickel exceeded only the TEL benchmark

3.5 Existing Water Quality Summary. Various exceedances of LDEQ's water quality criteria were identified in this water quality assessment. The most persistent water quality problems in the study area appear to be fecal coliform which exceeded the primary contact recreation standard 50 percent of the time at Station 20. Mercury and Copper appear to be the other contaminants of concern in the study area. Mercury concentrations exceed both the chronic and acute water quality standard for mercury in at least 10, 10, and 12 of 15 samples each taken at stations 19, 20, and 21 respectively; and exceeded the TEL and ER-L for the sediment sample tested as part of this study. The copper concentrations at stations 19, 20, and 21 exceeded both the chronic and acute state water quality criteria for copper in 13, 9, and 4 of 15 samples each, and exceeded the TEL benchmark at the sample location.

4.0 PROJECTED WATER QUALITY.

4.1 Introduction. This section sets forth the projected impacts to water quality in the study area that might reasonably be expected to result from the implementation of the selected alternative. Impacts due to the no-action alternative or without project condition are also discussed. Data was obtained from , from results of testing area sediments and water, and from LDEQ publications. These sources were used to obtain information on the specific aspects of potential water quality impacts.

4.2 Future Without Project Conditions. For the without project condition, projected water quality for the study area is expected to remain similar to current conditions. The study area is protected by an existing non-Federal ring levee, and would continue to be pumped in the absence of a Federal project. Minor industrial point sources, package plants, petroleum activities, channelizations, spills, contaminated sediments, siltation, salinity, total dissolved solids, chlorides, and oil and grease are the major factors which currently affect water quality in the study area. These are expected to continue to be the major factors affecting water quality in the study area. Recent increased regulation and legislation as well as an increase in public awareness of environmental issues may result in slight reductions in the amount of pollutants released into the study area, which would result in slight improvements in its water quality.

4.3 Future With Project Conditions. The proposed ring levee around the town of Jean Lafitte is designed to reduce the frequency of flooding in the town of Jean Lafitte in lower Jefferson Parish along Bayou Barataria. The only alternative studied, other than the no-action alternative, is the ring levee alternative. The effects of the project can effectively be broken down into those due to

temporary construction activities, and those due the effects of removing the study area from the flood plain.

4.3.1 Effects of Construction. The effects of construction may include (but are not limited to) increased turbidity and sedimentation, increased temperature, increased oxygen demand, and decreased oxygen; and contamination from construction equipment and operations. The effects of construction are, by nature, temporary and cease with the end of the construction period.

Sediment runoff is a primary concern during construction activities. Site preparation activities and construction of temporary access roads result in denuded areas from which soil readily erodes. This erosion increases sedimentation and turbidity. The suspended sedimentary particles contribute dissolved minerals including sodium, potassium, calcium, magnesium, nitrates, and phosphates to the stream. These minerals act as nutrients in the water column, increasing plant growth. This, in turn, stimulates animal production and decomposition, increasing the oxygen demand. Simultaneously, the suspended particles decrease the light penetration and interfere with the photosynthetic production of oxygen. The particles also absorb solar energy from the sunlight and transform this energy into heat, elevating the temperature of the stream. Oxygen is less soluble in warm water than in cold water. The combination of these three effects results in an overall minor decrease in oxygen levels.

NPDES legislation requires a Pollution Prevention Plan (PPP) for each project in order to reduce contamination in the waterways due to the construction process. Often included in the PPP are temporary and permanent controls such as hay bales, silt fences, sedimentation ponds, vehicle washing racks, and seeding and mulching denuded areas. Even with these measures, however, some effects can be expected. The effects of construction, however, are generally temporary and subside when construction stops and denuded areas are restored.

4.3.2 Effects of Removing the Study Area from the Floodplain. Permanent changes due to construction of the proposed ring levee include: a slight increase in runoff due to compaction of the proposed levee, the contribution of herbicides and fertilizers due to maintenance of the proposed levee, and conversion of wetland habitat in those areas where there is no levee existing. Steps can be taken to minimize the amount of herbicides and fertilizers that enter the water column. These steps include using microfoil booms to apply herbicides, thus minimizing the amount of waste product.

No significant differences in organics, metals, nutrient, or pathogen levels are expected to result from this project. Induced development is not expected since the levee alignment primarily follows the limits of existing development. Since this system is already a pumped system, no significant effects are expected due to the addition of additional pumping capacity.

4.4 Summary of Overall Effects. The primary effects of this project are short term effects from construction that may include increased turbidity and sedimentation, and contamination from construction equipment and operations. The effects of construction are generally temporary and subside when construction ceases. Effects resulting from the removal of the protected area from the floodplain include an slight increase in runoff, and additional herbicides and fertilizers in the

water column due to maintenance of the levee. Water quality after completion of the project should be similar to the existing water quality.

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