RED RIVER ALLUVIAL AQUIFER SUMMARY

BASELINE MONITORING PROJECT, FY 2001

APPENDIX 3

OF THE

TRIENNIAL SUMMARY REPORT, 2003

FOR THE

ENVIRONMENTAL EVALUATION DIVISION

OF

LOUISIANA DEPARTMENT OF ENVIRONMENTAL QUALITY

PARTIAL FUNDING PROVIDED THROUGH 106 CWA

RED RIVER ALLUVIAL AQUIFER SUMMARY

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BACKGROUND

In order to better assess the water quality of a particular aquifer at a given point in time, an attempt was made during the project year to sample all Baseline Monitoring Project (Project or BMP) wells producing from a common aquifer in a narrow time frame. Also, to more conveniently and economically promulgate those data collected from a particular aquifer, a summary report on each aquifer sampled was prepared separately. Collectively, these aquifer summaries will make up part of the Project Triennial Summary Report.

Figure 3-1 shows the geographic locations of the Red River Alluvial aquifer and the associated Project wells, whereas Table 3-2 lists the wells in the aquifer along with their total depths and the use made of produced waters and date sampled.

In October of 2000 and April of 2001, five wells were sampled which produce from the Red River Alluvial aquifer. Two of the wells are classified as domestic, two are classified as irrigation wells, and one is an industrial well. The wells are located in four parishes from the central to the northwest part of the state.

Well data for registered water wells were obtained from the Louisiana Department of Transportation and Development's Water Well Registration Data file.

GEOLOGY

Red River alluvium consists of fining upward sequences of gravel, sand, silt, and clay. The aquifer is poorly to moderately well sorted, with fine-grained to medium-grained sand near the top, grading to coarse sand and gravel in the lower portions. It is confined by layers of silt and clay of varying thicknesses and extent.

HYDROGEOLOGY

The Red River Alluvial aquifer is hydraulically connected with the Red River and its major streams. Recharge is accomplished by direct infiltration of rainfall in the river valley, lateral and upward movement of water from adjacent and underlying aquifers, and overbank stream flooding. The amount of recharge from rainfall depends on the thickness and permeability of the silt and clay layers overlying it. Water levels fluctuate seasonally in response to precipitation trends and river stages. Water levels are generally within 30 to 40 feet of the land surface and movement is downgradient and toward rivers and streams. Natural discharge occurs by seepage of water into the Red River and its streams, but some water moves into the aquifer when stream stages are above aquifer water levels. The hydraulic conductivity varies between 10-530 feet/day.

The maximum depths of occurrence of freshwater in the Red River Alluvial range from 20 feet above sea level, to 160 feet below sea level. The range of thickness of the fresh water interval in the Red River Alluvial is 50 to 200 feet. The depths of the Red River Alluvial wells that were monitored in conjunction with the BMP range from 60 to 145 feet.

INTERPRETATION OF DATA

FIELD, WATER QUALITY, AND NUTRIENTS PARAMETERS

Table 3-3 lists the field parameters that are checked and the water quality and nutrients parameters that are sampled for at each well. It also shows the field results and the water quality and nutrients analytical results for each well. Table 3-5 provides an overview of field data, water quality data, and nutrients data for the Red River Alluvial aquifer, listing the minimum, maximum, and average results for these parameters.

Federal Primary Drinking Water Standards

Under the Federal Safe Drinking Water Act, EPA has established maximum contaminant levels (MCLs) for pollutants that may pose a health risk in public drinking water. An MCL is the highest level of a contaminant that EPA allows in public drinking water. MCLs ensure that drinking water does not pose either a short-term or long-term health risk. While not all wells sampled were public supply wells, this Office does use the MCLs as a benchmark for further evaluation.

A review of the analyses listed on Table 3-3 shows that no primary MCL was exceeded for field, water quality, or nutrients parameters.

Federal Secondary Drinking Water Standards

EPA has set secondary standards that are defined as non-enforceable taste, odor, or appearance guidelines.

Field and laboratory data contained in Table 3-3 show that the following secondary MCLs (SMCL)s were exceeded.

Chloride – SMCL = 250 ppm)

RR-WILSON – 664 ppm

Color – SMCL = 15 PCU

CD-376 – 55 PCU
CD-586 – 55 PCU, duplicate – 55 PCU
RR-WILSON – 22 PCU

Total Dissolved Solids (TDS) – SMCL = 500 ppm

CD-376 – 754 ppm
CD-586 – 924 ppm, duplicate – 916 ppm
NA-47 – 508 ppm
RR-WILSON – 1,506 ppm

Comparison To Historical Data

Table 3-7 lists the current field, water quality, and nutrients data averages alongside those parameters' data averages for the two previous sampling rotations (three and six years prior). A comparison of these averages show that other than an increase in the chloride concentration, the water quality characteristics of ground water produced from the Red River Alluvial aquifer has not changed significantly since the 1995 fiscal year (FY) sampling.

INORGANIC PARAMETERS

Table 3-4 shows the inorganic (total metals) parameters that are sampled for and the analytical results for those parameters for each well. Table 3-6 provides an overview of inorganic data for the Red River aquifer, listing the minimum, maximum, and average results for these parameters.

Federal Primary Drinking Water Standards

A review of the analyses listed on Table 3-4 shows that no primary MCL was exceeded for total metals.

Federal Secondary Drinking Water Standards

Laboratory data contained in Table 3-4 show that the following secondary MCL (SMCL) was exceeded.

Iron – SMCL = 300 ppb

CD-376 – 10,661 ppb
CD-586 – 5,871 ppb, duplicate – 5,716 ppb
RR-Wilson – 429 ppb

Comparison To Historical Data

Table 3-8 lists the current inorganic data averages alongside the inorganic data averages for the two previous sampling rotations (three and six years prior). A comparison of these averages shows that some of the inorganic characteristics have fluctuated over the six-year period.

VOLATILE ORGANIC COMPOUNDS

Table 3-9 shows the volatile organic compound (VOC) parameters that are sampled for. Due to the large number of analytes in this category, a total list of the analytical results for each analyte is not provided, however any detection of a VOC would be discussed in this section.

No VOC was detected during the FY 2001 sampling of the Red River Alluvial aquifer.

SEMIVOLATILE ORGANIC COMPOUNDS

Table 3-10 shows the semivolatile organic compound parameters that are sampled for. Due to the large number of analytes in this category, a total list of the analytical results for each analyte is not provided, however any detection of a semivolatile would be discussed in this section.

Laboratory data show that all the Red River Alluvial wells that were sampled during FY 2001 exhibited values for bis(2-ethylhexyl)phthalate (BEHP). All these values were below BEHP's MCL of 6 parts per billion (ppb). Additionally, all the field blanks and laboratory blanks also showed BEHP values. Therefore, it is this Office's opinion that the values exhibited for BEHP are due to laboratory or field contamination and are considered invalid.

Taking into consideration the invalid BEHP concentrations, no semivolatile organic compounds were detected during the FY 2001 sampling of the Red River Alluvial aquifer.

PESTICIDES AND PCBS

Table 3-11 shows the pesticide and PCB parameters that are sampled for. Due to the large number of analytes in this category, a total list of the analytical results for each analyte is not provided, however any detection of a pesticide or PCB would be discussed in this section.

No pesticide or PCB was detected during the 2001 sampling of the Red River Alluvial aquifer.

COMMON WATER CHARACTERISTICS

Table 3-1 below highlights some of the more common water characteristics that are considered when studying ground water quality. The minimum, maximum, and average values that were found during the current sampling of the Red River Alluvial aquifer for pH, TDS, hardness, chloride, iron, and nitrite-nitrate are listed in the table. Figures 3-2, 3-3, 3-4, and 3-5 respectively, represent the contoured data for pH, TDS, chloride, and iron. The data average for hardness shows that the ground water produced from this aquifer is very hard[1].

Table 3-1 Common Water Characteristics

Fiscal Year 2001

PARAMETER	MINIMUM	MAXIMUM	AVERAGE
pH (SU)	7.08	8.35	7.64
TDS (ppm)	396.0	1506.0	817.6
Hardness (ppm)	<5	653.0	353.7
Chloride (ppm)	6.1	664.0	163.4
Iron (ppb)	<20	10661.00	3396.20
Nitrite-Nitrate, as N (ppm)	<0.05	<0.05	<0.05

[1] Classification based on hardness scale from: *Peavy, H.S. et al. Environmental Engineering, 1985.*

SUMMARY AND RECOMMENDATIONS

In summary, the data show that the ground water produced from this aquifer is very hard, but is of good quality when considering short-term or long-term health risk guidelines. Laboratory data show that no project well that was sampled during the Fiscal Year 2001 monitoring of the Red River Alluvial aquifer exceeded a primary MCL. The data also show that this aquifer is of poor quality when considering taste, odor, or appearance guidelines. A comparison to historical BMP data shows an increase in the chloride concentration and some fluctuations with the inorganic data. But for the most part the characteristics of the ground water produced from the Red River Alluvial aquifer has not changed significantly since the FY 1995 sampling.

It is recommended that the Project wells assigned to the Red River Alluvial aquifer be re-sampled as planned in approximately three years. In addition, several wells should be added to those currently in place to increase the well density for this aquifer.

Table 3-2 List of Project Wells Sampled

PROJECT NUMBER	PARISH	WELL NUMBER	DATE SAMPLED	OWNER	DEPTH (FEET)	WELL USE
199115	CADDO	CD-376	10/31/2000	CERTAINTEED	80	INDUSTRIAL
199301	CADDO	CD-586	10/31/2000	PRIVATE OWNER	60	IRRIGATION
199502	NATCHITOCHES	NA-47	10/30/2000	PRIVATE OWNER	80	IRRIGATION
200023	RAPIDES	R-5756Z	10/30/2000	PRIVATE OWNER	145	DOMESTIC
200107	RED RIVER	RR-WILSON	04/19/2001	PRIVATE OWNER	100	DOMESTIC

Table 3-3 Summary of Field, Water Quality, and Nutrients Data

WELL NUMBER	COND. MMHOS/CM	PH SU	SAL. PPT	TEMP. OC	ALK. PPM	CL PPM	COLOR PCU	COND. UMHOS/CM	SO4 PPM	TDS PPM	TSS PPM	TURB. NTU	NH3 (AS N) PPM	HARD. PPM	NITRITE-NITRATE (AS N) PPM	TKN PPM	TOT. P PPM
CD-376	1.233	7.34	0.62	21.34	507.0	56.90	55.0	1233.0	82.30	754.0	33.3	100.0	0.97	615.0	0.03	1.22	0.85
CD-586	1.389	7.38	0.70	19.82	510.0	70.90	55.0	1405.0	167.00	924.0	11.5	60.0	0.37	645.0	0.03	0.37	0.79
CD-586*	1.389	7.38	0.70	19.82	510.0	72.40	55.0	1404.0	171.00	916.0	12.0	60.0	0.30	653.0	<0.02	0.37	0.47
NA-47	0.886	7.08	0.44	20.33	454.0	19.30	8.0	896.0	4.70	508.0	13.7	60.0	0.93	397.0	0.04	1.00	0.52
R-5756Z	0.644	8.35	0.31	20.88	337.0	6.10	10.0	663.0	1.90	396.0	<4.0	1.1	0.18	<5.0	<0.02	0.55	0.38
RR-WILSON	2.49	8.03	1.29	20.13	422.0	664.00	22.0	2794.0	<1.25	1506.0	<4.0	2.5	1.95	101.0	<0.05	2.11	<0.05

* Denotes duplicate sample.

Table 3-4 Summary of Inorganic Data

WELL NUMBER	ANTIMONY PPB	ARSENIC PPB	BARIUM PPB	BERYLLIUM PPB	CADMIUM PPB	CHROMIUM PPB	COPPER PPB	IRON PPB	LEAD PPB	MERCURY PPB	NICKEL PPB	SELENIUM PPB	SILVER PPB	THALLIUM PPB	ZINC PPB
CD-376	<5.0	<5.0	459.0	<1.0	1.8	<5.0	<5.0	10,661.0	<10.0	<0.05	<5.0	<5.0	1.7	<2.0	27.7
CD-586	<5.0	<5.0	187.0	<1.0	1.9	<5.0	5.2	5,871.0	<10.0	<0.05	<5.0	<5.0	1.8	<2.0	50.9
CD-586*	<5.0	<5.0	181.0	<1.0	<1.0	<5.0	<5.0	5,716.0	<10.0	<0.05	<5.0	<5.0	1.5	<2.0	37.0
NA-47	<5.0	<5.0	415.0	<1.0	<1.0	<5.0	<5.0	<20.0	<10.0	<0.05	<5.0	<5.0	<1.0	<2.0	14.0
R-5756Z	<5.0	<5.0	16.8	<1.0	<1.0	<5.0	<5.0	<20.0	<10.0	<0.05	<5.0	<5.0	<1.0	<2.0	111.0
RR-WILSON	<5.0	<5.0	15.6	<1.0	<1.0	<5.0	<5.0	429.0	<10.0	<0.05	<5.0	<5.0	<1.0	<5.0	<10.0

* Denotes duplicate sample.

Table 3-5 Field, Water Quality, and Nutrients Statistics

Fiscal Year 2001

PARAMETER	MINIMUM	MAXIMUM	AVERAGE
pH (SU)	7.08	8.35	7.64
Temperature ^{O}C	19.82	21.34	20.50
Sp. Conductivity (mmhos/cm) (Field)	0.644	2.490	1.328
Salinity (ppt)	0.31	1.29	0.67
TSS (ppm)	<4	33.3	12.5
TDS (ppm)	396.0	1506.0	817.6
Alkalinity (ppm)	337.0	510.0	446.0
Hardness (ppm)	<5	653.0	353.7
Turbidity (NTU)	1.10	100.00	44.72
Sp. Conductivity (umhos/cm) (Lab)	663.0	2794.0	1398.2
Color (PCU)	8.0	55.0	30.0
Chloride (ppm)	6.1	664.0	163.4
Sulfate (ppm)	<1.25	171.0	52.10
Nitrite-Nitrate, as N (ppm)	<0.05	<0.05	<0.05
Phosphorus (ppm)	<0.05	0.85	0.51
TKN (ppm)	0.37	2.11	1.05
Ammonia (ppm)	0.18	1.95	0.88

Table 3-6 Inorganic Statistics

Fiscal Year 2001

PARAMETER	MINIMUM	MAXIMUM	AVERAGE
Antimony (ppb)	<5	<5	<5
Arsenic (ppb)	<5	<5	<5
Barium (ppb)	15.60	459.00	218.68
Beryllium (ppb)	<1	<1	<1
Cadmium (ppb)	<1	1.9	1.04
Chromium (ppb)	<5	<5	<5
Copper (ppb)	<5	5.17	<5
Iron (ppb)	<20.00	10661.00	3396.20
Lead (ppb)	<10	<10	<10
Mercury (ppb)	<0.05	<0.05	<0.05
Nickel (ppb)	<5	<5	<5
Selenium (ppb)	<5	<5	<5
Silver (ppb)	<1	1.8	1.0
Thallium (ppb)	<2	<2	<2
Zinc (ppb)	<10	111.00	41.72

Table 3-7 Three-year Field, Water Quality, and Nutrients Statistics

PARAMETER	FY 1995 AVERAGE	FY 1998 AVERAGE	FY 2001 AVERAGE
pH (SU)	6.67	6.81	7.64
Temperature ^{O}C	21.00	19.88	20.50
Sp. Conductivity (mmhos/cm) (Field)	1.128	1.060	1.328
Salinity (ppt)	0.54	0.53	0.67
TSS (ppm)	18.8	13.6	12.5
TDS (ppm)	716.0	699.2	817.6
Alkalinity (ppm)	504.4	485.2	446.0
Hardness (ppm)	506.8	453.8	353.7
Turbidity (NTU)	56.00	54.42	44.72
Sp. Conductivity (umhos/cm) (Lab)	1099.8	1093.6	1398.2
Color (PCU)	24.6	5.0	30.0
Chloride (ppm)	45.3	42.8	163.4
Sulfate (ppm)	69.32	62.16	52.10
Nitrite-Nitrate, as N (ppm)	<0.05	0.11	<0.05
Phosphorus (ppm)	0.79	0.38	0.51
TKN (ppm)	4.96	0.95	1.05
Ammonia (ppm)	1.27	0.54	0.88

Table 3-8 Three-year Inorganic Statistics

PARAMETER	FY 1995 AVERAGE	FY 1998 AVERAGE	FY 2001 AVERAGE
Antimony (ppb)	<5	<5	<5
Arsenic (ppb)	5.00	<5	<5
Barium (ppb)	400.98	102.08	218.68
Beryllium (ppb)	<5	<5	<1
Cadmium (ppb)	<5	<5	1.04
Chromium (ppb)	12.38	<5	<5
Copper (ppb)	19.90	968.66	<5
Iron (ppb)	6122.40	3339.54	3396.20
Lead (ppb)	32.30	<10	<10
Mercury (ppb)	<0.05	<0.05	<0.05
Nickel (ppb)	10.36	1041.40	<5
Selenium (ppb)	<5	<5	<5
Silver (ppb)	<5	<5	1.0
Thallium (ppb)	<5	<5	<2
Zinc (ppb)	185.60	<10	41.72

Table 3-9 List of VOC Analytical Parameters

BASELINE MONITORING PROJECT

VOLATILE ORGANICS BY EPA METHOD 624

COMPOUND	PQL (ppb)
CHLOROMETHANE	2
VINYL CHLORIDE	2
BROMOMETHANE	2
CHLOROETHANE	2
TRICHLOROFLUOROMETHANE	5
1,1-DICHLOROETHENE	2
METHYLENE CHLORIDE	2
TRANS-1,2-DICHLOROETHENE	2
METHYL-t-BUTYL ETHER	2
1,1-DICHLOROETHANE	2
CHLOROFORM	2
1,1,1-TRICHLOROETHANE	2
CARBON TETRACHLORIDE	2
BENZENE	2
1,2-DICHLOROETHANE	2
TRICHLOROETHENE	2
1,2-DICHLOROPROPANE	2
BROMODICHLOROMETHANE	2
CIS-1,3-DICHLOROPROPENE	2
TOLUENE	2
TRANS-1,3-DICHLOROPROPENE	2
1,1,2-TRICHLOROETHANE	2
TETRACHLOROETHENE	2
DIBROMOCHLOROMETHANE	2
CHLOROBENZENE	2
ETHYLBENZENE	2
P&M XYLENE	4
O-XYLENE	2
STYRENE	2
BROMOFORM	2
1,1,2,2-TETRACHLOROETHANE	2
1,3-DICHLOROBENZENE	2
1,4-DICHLOROBENZENE	2
1,2-DICHLOROBENZENE	2

PQL = Practical Quantitation Limit
ppb = parts per billion

Table 3-10 List of Semi-volatile Analytical Parameters
BASELINE MONITORING PROJECT

SEMIVOLATILE ORGANICS BY EPA METHOD 625

COMPOUND	PQL (ppb)
N-Nitrosodimethylamine	2
Chlorobenzene	2
Phenol	2
Bis(2-chloroethyl)ether	2
2-Chlorophenol	2
1,3-Dichlorobenzene	2
1,4-Dichlorobenzene	2
1,2-Dichlorobenzene	2
Bis(2-chloroisopropyl)ether	6
N-Nitroso-di-n-propylamine	4
Hexachloroethane	2
Nitrobenzene	2
Isophorone	2
2,4-Dimethylphenol	4
2-Nitrophenol	6
1,3,5-Trichlorobenzene	2
Bis(2-chloroethoxy)methane	2
1,2,4-Trichlorobenzene	2
Naphthalene	2
2,4-Dichlorophenol	4
Hexachlorobutadiene	2
1,2,3-Trichlorobenzene	2
4-Chloro-3-methylphenol	4
Hexachlorocyclopentadiene	6
1,2,4,5-Tetrachlorobenzene	2
2,4,6-Trichlorophenol	6
1,2,3,4-Tetrachlorobenzene	2
2-Chloronaphthalene	2
Dimethylphthalate	2
2,6-Dinitrotoluene	4
Acenaphthylene	2
4-Nitrophenol	6
2,4-Dinitrophenol	20
Acenaphthene	2
Pentachlorobenzene	2
2,4-Dinitrotoluene	6
Diethylphthalate	2
4-Chlorophenyl phenyl ether	2
Fluorene	2

Table 3-10 (Cont'd)
Semivolatile Parameters

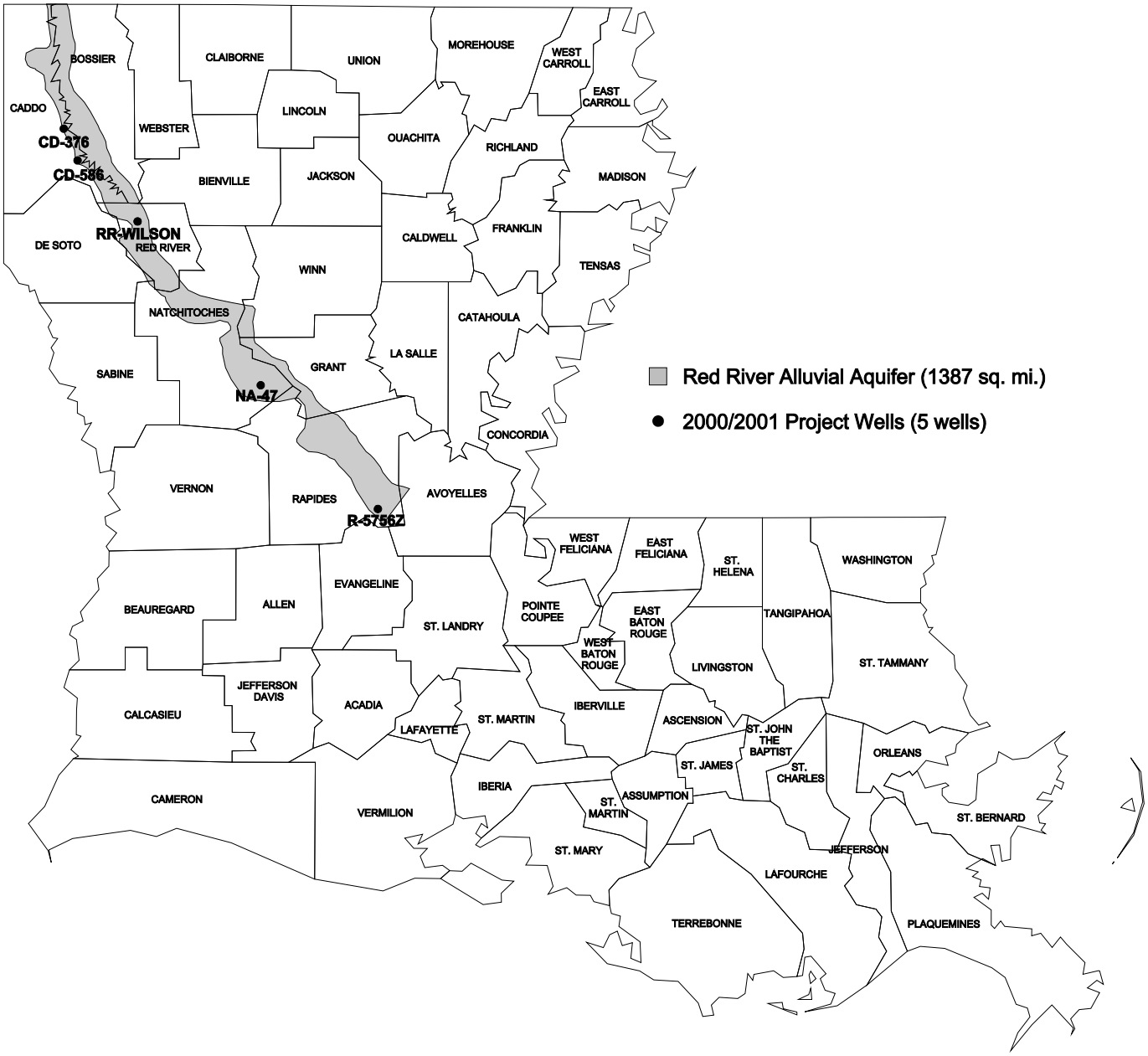
COMPOUND	PQL (ppb)
4,6-Dinitro-2-methylphenol	12
N-Nitrosodiphenylamine/Dipheny	2
4-Bromophenyl phenyl ether	2
Hexachlorobenzene	2
Pentachlorophenol	10
Phenathrene	2
Anthracene	2
Di-n-butylphthalate	2
Fluoranthene	2
Benzidine	20
Pyrene	2
Butylbenzylphthalate	2
Bis(2-ethylhexyl)phthalate	2
3,3'-Dichlorobenzidine	10
Benzo(a)anthracene	6
Chrysene	4
Di-n-octylphthalate	2
Benzo(b)fluoranthene	6
Benzo(k)fluoranthene	6
Benzo(a)Pyrene	6
Indeno(1,2,3-cd)pyrene	6
Dibenz(a,h)anthracene	6
Benzo(g,h,i)perylene	6

Table 3-11 List of Pesticide and PCB Analytical Parameters
BASELINE MONITORING PROJECT

SEMIVOLATILE ORGANICS BY EPA METHOD 625

COMPOUND	PQL (ppb)
Alpha BHC	2
Beta BHC	2
Gamma BHC	2
Delta BHC	2
Heptachlor	2
Aldrin	2
Heptachlor epoxide	2
Chlordane	2
Endosulfan I	2
4,4-DDE	2
Dieldrin	2
4,4-DDD	2
Endrin	2
Toxaphene	2
Endosulfan II	2
Endrin Aldehyde	2
4,4-DDT	2
Endosulfan Sulfate	2
Methoxychlor	2
Endrin Ketone	2
PCB 1221/ PCB 1232	10
PCB 1016/ PCB 1242	10
PCB 1254	10
PCB 1248	10
PCB 1260	10

BASELINE MONITORING PROJECT WELLS OF THE RED RIVER ALLUVIAL AQUIFER



Aquifer boundary digitized from Louisiana Hydrologic Map No. 2: Areal Extent of Freshwater in Major Aquifers of Louisiana, Smoot, 1986; USGS/LDOTD Report 86-4150.

08/30/2001

Figure 3-1 Location Plat, Red River Alluvial Aquifer

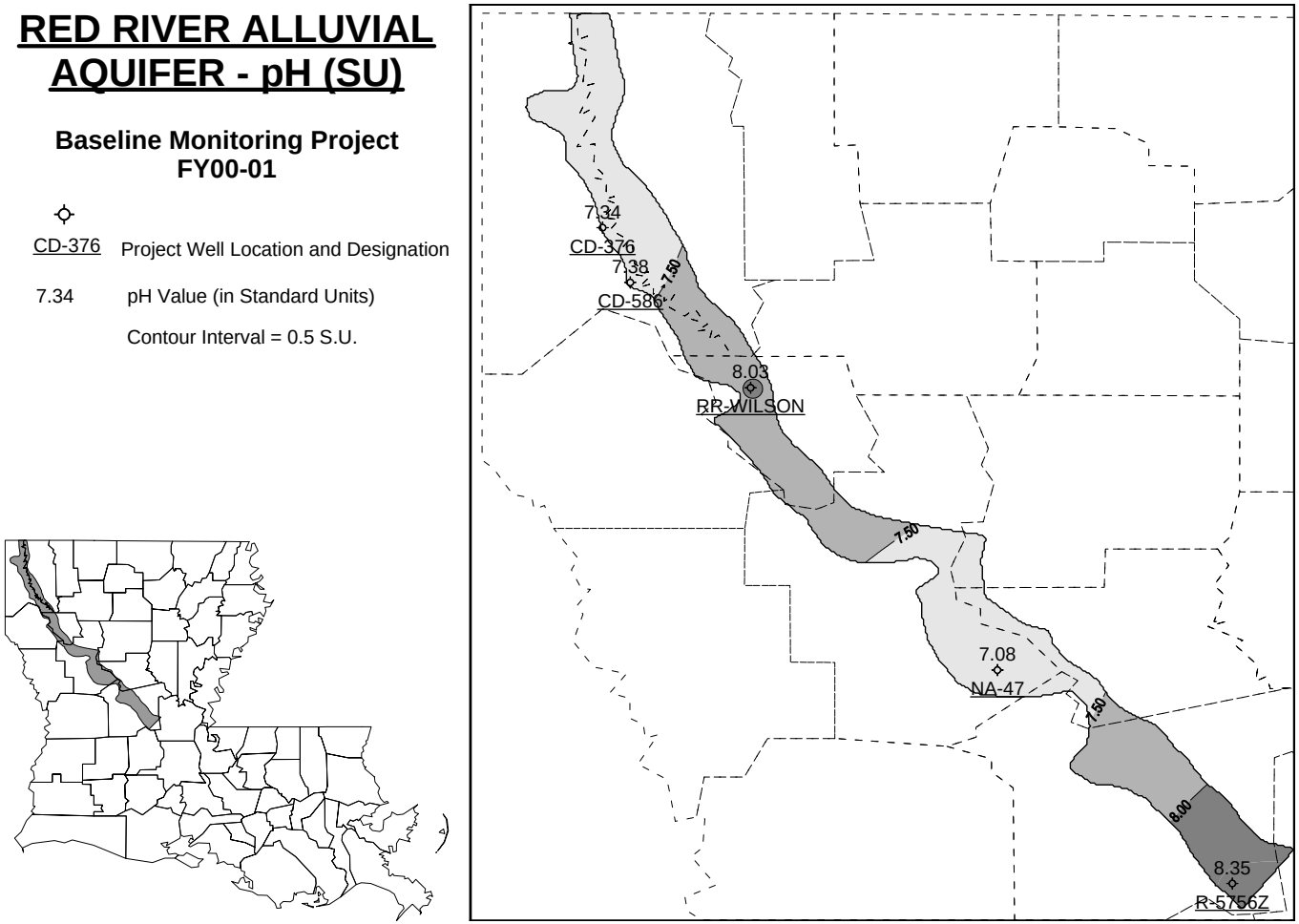


Figure 3-2 Map of pH Data

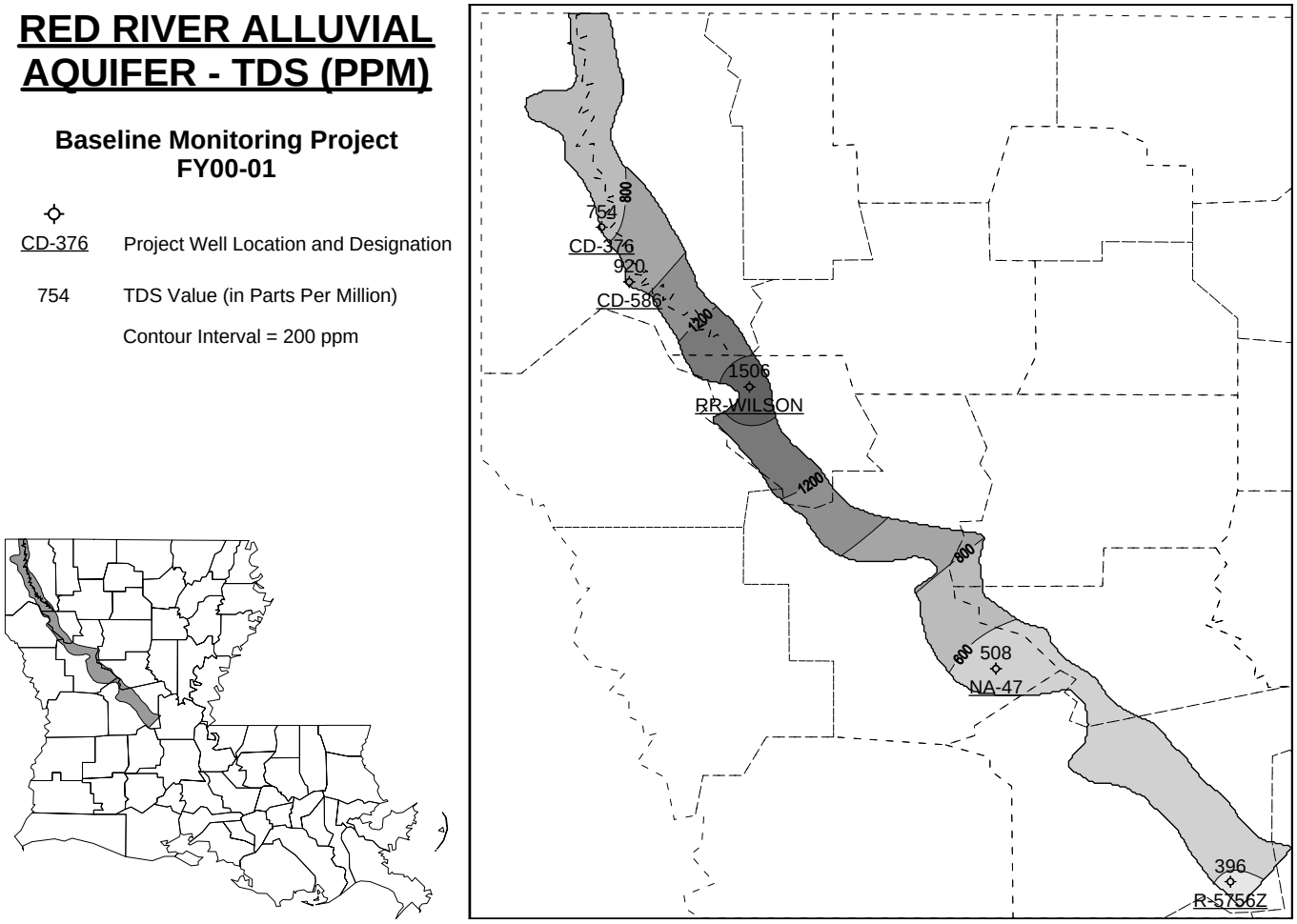


Figure 3-3 Map of TDS Data

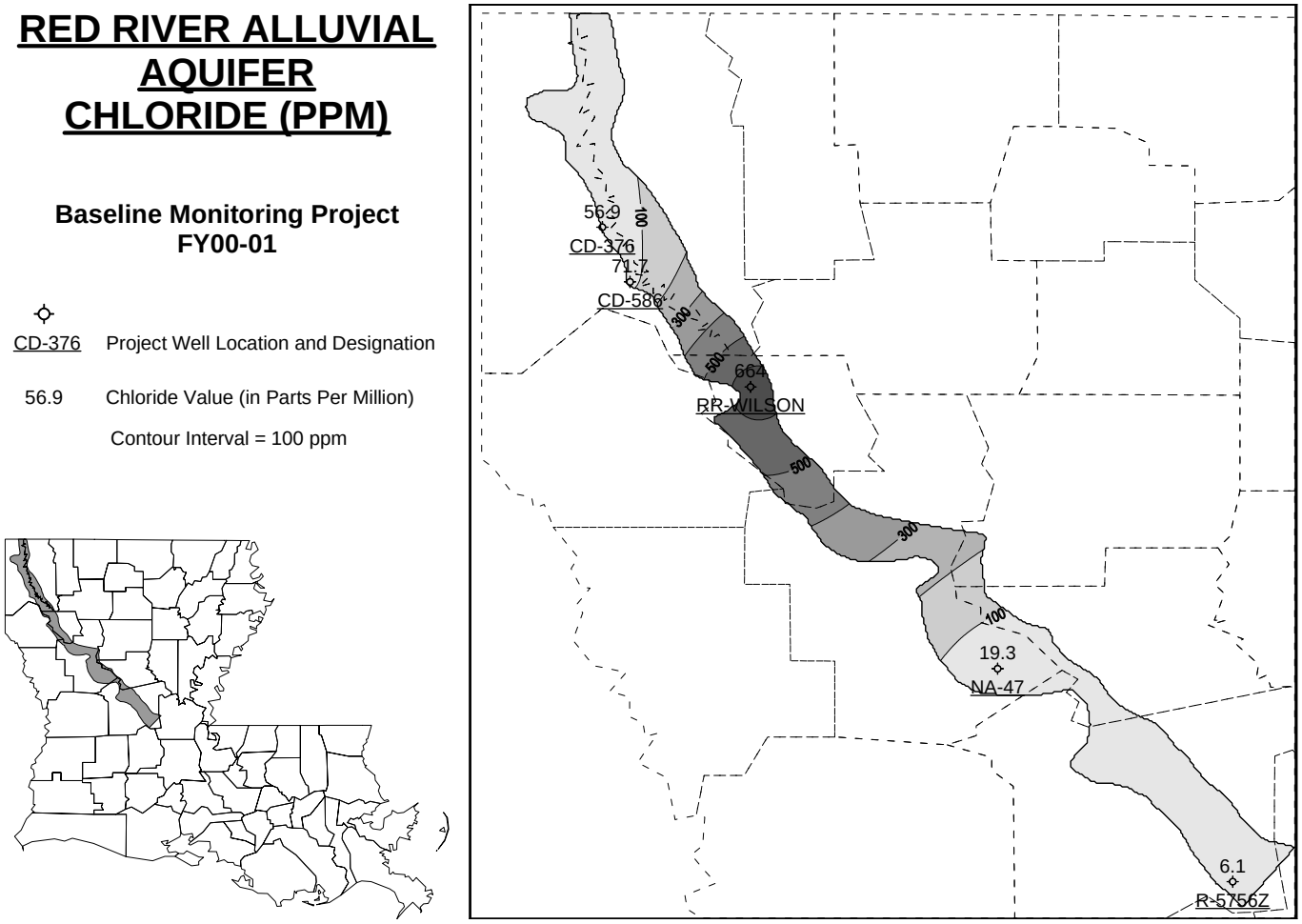


Figure 3-4 Map of Chloride Data

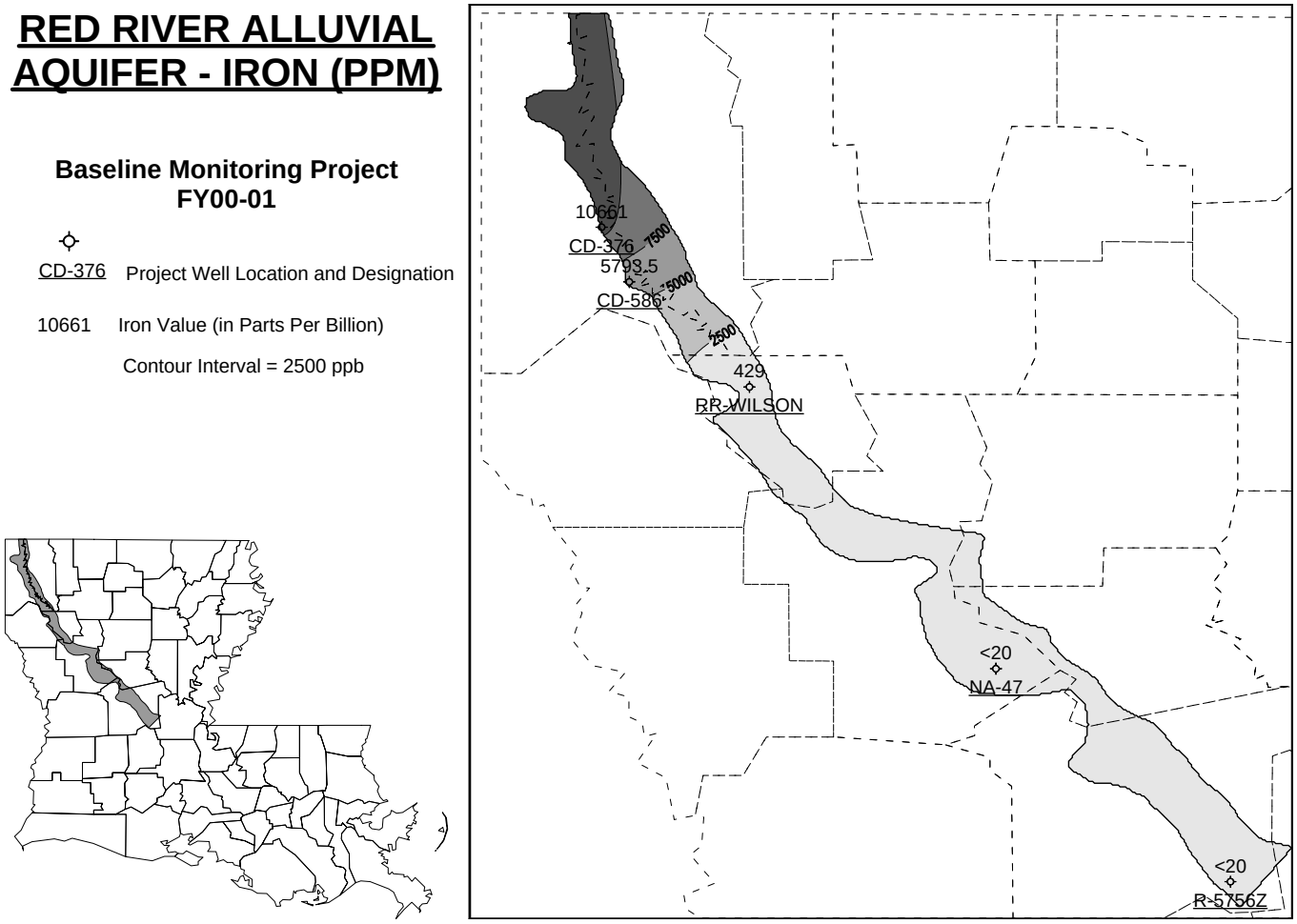


Figure 3-5 Map of Iron Data