CARNAHAN BAYOU AQUIFER SUMMARY

BASELINE MONITORING PROJECT, FY 2001

APPENDIX 7

OF THE

TRIENNIAL SUMMARY REPORT, 2003

FOR THE

ENVIRONMENTAL EVALUATION DIVISION

OF

LOUISIANA DEPARTMENT OF ENVIRONMENTAL QUALITY

PARTIAL FUNDING PROVIDED THROUGH 106 CWA

CARNAHAN BAYOU 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 project 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 the project Triennial Summary Report.

Figure 7-1 shows the geographic locations of the Carnahan Bayou aquifer and the associated project wells, whereas Table 7-2 lists the wells in the aquifer along with their total depths and the use made of produced waters and date sampled.

These data show that in May of 2001, nine wells were sampled which produce from the Carnahan Bayou aquifer. Five of the nine wells are classified as public supply, three are classified as domestic wells, and the one remaining well is classified as industrial. The wells are located in five parishes in the west-central area 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

The Carnahan Bayou member consists of sands, silts, and clays, with some gravel. The Carnahan Bayou member, along with the Williamson Creek and Dough Hills, is grouped into the Jasper aquifer. The aquifer unit consists of fine to coarse sand, which may grade laterally and vertically to silt and clay.

HYDROGEOLOGY

Recharge takes place primarily as a result of the direct infiltration of rainfall in interstream, upland outcrop areas, movement of water through overlying terrace deposits, and leakage from other aquifers. The hydraulic conductivity of the Carnahan Bayou varies between 20-260 feet/day.

The maximum depths of occurrence of freshwater in the Carnahan Bayou range from 250 feet above sea level, to 3,300 feet below sea level. The range of thickness of the fresh water interval in the Carnahan Bayou is 100 to 1,100 feet. The depths of the Carnahan Bayou wells that were monitored in conjunction with the BMP range from 66 to 2,036 feet.

INTERPRETATION OF DATA

FIELD, WATER QUALITY, AND NUTRIENTS PARAMETERS

Table 7-3 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 data results for each well. Table 7-5 provides an overview of field data, water quality data, and nutrients data for the Carnahan Bayou 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 in Table 7-3 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 7-3 show that the following secondary MCLs (SMCLs) were exceeded:

PH – SMCL = 6.5 – 8.5 SU
BE-405 – 8.55 SU
V-8102Z – 5.90

Total Dissolved Solids (TDS) – SMCL = 500
R-1210 – 742 ppm

Color – SMCL = 15 PCU
CO-71 – 25 PCU (duplicate sample of same well, color value = 5 PCU)

Comparison to Historical Data

Table 7-7 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 pH and TKN have increased, while all other parameters have decreased or remained fairly constant with minor fluctuations.

INORGANIC PARAMETERS

Table 7-4 shows the inorganic (total metals) parameters that are sampled for and the analytical results for those parameters for each well. Table 7-6 provides an overview of inorganic data for the Carnahan Bayou aquifer, listing the minimum, maximum, and average results for these parameters.

Federal Primary Drinking Water Standards

A review of the analyses listed in Table 7-4 show that no primary MCL was exceeded for total metals.

Federal Secondary Drinking Water Standards

Laboratory data contained in Table 7-4 show that the following secondary MCL (SMCL) was exceeded:

Iron – SMCL = 300 ppb
CO-71 – 4,051 ppb
CO-71 – 4,154 ppb (duplicate sample)

Comparison to Historical Data

Table 7-8 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 data shows that the average concentrations for barium, iron, and zinc have decreased over the last six years. The average concentration for copper (the only other compound detected in this group) has fluctuated, but has remained somewhat constant only for this same time period.

VOLATILE ORGANIC COMPOUNDS

Table 7-9 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 2001 sampling of the Carnahan Bayou aquifer.

SEMIVOLATILE ORGANIC COMPOUND

Table 7-10 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 compound would be discussed in this section.

Federal Primary Drinking Water Standards

Laboratory data show that there were no confirmed exceedances of a primary MCL for this category of compounds. However, phthalate compounds were reported in all nine wells sampled, in the field and lab blanks. Taking this into consideration, and based on information contained in the EPA guidance document "Guidance For Data Usability In Risk Assessment, EPA 1992", it is the opinion of this Office that the reported values for BEHP are due to laboratory contamination and are considered invalid.

Federal Secondary Drinking Water Standards

No semivolatile currently sampled have SMCLs established for them.

Detection of Semivolatiles with No Standards

There were detections of two semivolatiles that fit under this category. Fluoranthene and phenantherene were detected in well CO-71 at 3 ppb and 5 ppb respectively. However, a duplicate sample collected concurrently with the original sample, and re-samples collected at a later date reported no detections of these compounds. Therefore the original detections of these compounds are considered to be due to field or lab contamination and are invalid.

PESTICIDES AND PCBS

Table 7-11 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 Carnahan Bayou aquifer.

COMMON WATER CHARACTERISTICS

Table 7-1 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 Carnahan Bayou aquifer for pH, TDS, hardness, chloride, iron, and nitrite-nitrate are listed in the table. Figures 7-2 through 7-5 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 in the soft to moderately hard range[1].

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

Table 7-1 Common Water Characteristics
Fiscal Year 2001

PARAMETER	MINIMUM	MAXIMUM	AVERAGE
PH (SU)	5.90	8.55	7.66
TDS (ppm)	39.3	742	325.7
Hardness (ppm)	<5	270	48
Chloride (ppm)	4.5	211	33.9
Iron (ppb)	<20	4,051.0	531.5
Nitrite-Nitrate (ppm)	<0.05	0.14	<0.05

SUMMARY AND RECOMMENDATIONS

In summary, the data show that the ground water produced from this aquifer is in the soft to moderately hard range, and is of good quality when considering short or long-term health risk guidelines. Laboratory data show that no project well that was sampled during the Fiscal Year 2001 monitoring of the Carnahan Bayou aquifer exceeded a primary MCL. The data also show that this aquifer is of good quality when considering taste, odor, or appearance guidelines. A comparison to historical BMP data show that while there were some general fluctuations, the characteristics of the ground water produced from the Carnahan Bayou aquifer has not changed significantly since the FY 1995 sampling.

It is recommended that the Project wells assigned to the Carnahan Bayou aquifer be re-sampled as planned in approximately three years. Additionally, several wells should be added to the nine currently in place to increase the well density for this aquifer.

Table 7-2 List of Project Wells Sampled

PROJECT NUMBER	PARISH	WELL NUMBER	DATE SAMPLED	OWNER	DEPTH (FEET)	WELL USE
199118	BEAUREGARD	BE-405	05/07/2001	BOISE CASCADE	1016	INDUSTRIAL
199206	CONCORDIA	CO-71	05/08/2001	CONCORDIA W.W. DIST. NO.1	305	PUBLIC SUPPLY
199312	GRANT	G-5061Z	05/08/2001	PRIVATE OWNER	275	DOMESTIC
199514	RAPIDES	R-1001	05/07/2001	GARDENER WATER SYSTEM	1080	PUBLIC SUPPLY
198615	RAPIDES	R-1210	05/08/2001	CITY OF ALEXANDRIA	2036	PUBLIC SUPPLY
200109	RAPIDES	R-FAIRCLOT	05/08/2001	PRIVATE OWNER	270	DOMESTIC
198621	VERNON	V-496	05/07/2001	U.S. ARMY/FORT POLK	1415	PUBLIC SUPPLY
199515	VERNON	V-566	05/07/2001	ALCO-HUTTON VFD	143	PUBLIC SUPPLY
200108	VERNON	V-8102Z	05/07/2001	PRIVATE OWNER	66	DOMESTIC

Table 7-3 Summary Water Quality Parameters

WELL NUMBER	TEMP. °C	PH SU	SP. COND. MMHOS/CM	SAL. PPT	TSS PPM	TDS PPM	ALK. PPM	HARD. PPM	TURB. NTU	SP. COND. UMHOS/CM	COLOR PCU	CL PPM	SO_4 PPM	TOT. P PPM	TKN PPM	NH_3 (AS N) PPM	NITRITE-NITRATE (AS N) PPM
	FIELD PARAMETERS				*LABORATORY PARAMETERS*												
BE-405	26.90	8.55	0.377	0.18	<4.0	288.0	181.0	23.4	<1.0	380.0	<5.0	11.20	9.60	<0.05	0.27	0.19	<0.05
CO-71	20.28	7.25	0.712	0.35	10.8	474.0	360.0	270.0	45.0	711.0	25.0	10.00	23.00	0.77	0.93	0.72	<0.05
CO-71*	20.28	7.25	0.712	0.35	10.8	476.0	362.0	267.0	45.0	714.0	5.0	10.70	23.20	0.81	0.78	0.68	<0.05
G-5061Z	21.42	8.24	0.295	0.14	<4.0	225.0	148.0	5.0	1.7	294.0	<5.0	4.50	<1.25	0.25	0.38	0.31	<0.05
R-1001	27.65	8.26	0.434	0.21	<4.0	358.0	201.0	<5.0	<1.0	442.0	<5.0	10.00	14.40	0.36	0.71	0.30	<0.05
R-1210	36.06	8.22	1.229	0.60	<4.0	742.0	311.0	5.0	1.6	1201.0	<5.0	211.00	<1.25	0.60	0.58	0.45	<0.05
R-FAIRCLOT	20.85	8.11	0.313	0.15	<4.0	262.0	142.0	<5.0	1.5	317.0	5.0	10.40	8.00	0.53	0.32	0.21	<0.05
V-496	29.78	7.87	0.412	0.20	<4.0	326.0	177.0	95.0	<1.0	411.0	<5.0	24.70	7.40	0.05	0.64	0.49	<0.05
V-566	21.45	6.54	0.199	0.09	<4.0	217.0	53.8	26.2	<1.0	203.0	<5.0	18.40	13.50	0.60	0.31	0.16	<0.05
V-8102Z	20.31	5.90	0.027	0.01	<4.0	39.3	6.5	<5.0	<1.0	27.7	<5.0	5.00	<1.25	0.08	0.33	<0.10	0.14

* Denotes duplicate sample.

Table 7-4 Summary of Inorganic Data

WELL NUMBER	ARSENIC PPB	SILVER PPB	BARIUM PPB	BERYLLIUM PPB	CADMIUM PPB	CHROMIUM PPB	COPPER PPB	IRON PPB	MERCURY PPB	NICKEL PPB	ANTIMONY PPB	SELENIUM PPB	LEAD PPB	THALLIUM PPB	ZINC PPB
BE-405	<5.0	<1.0	44.5	<1.0	<1.0	<5.0	<5.0	<20.0	<0.05	<5.0	<5.0	<5.0	<10.0	<5.0	16.4
CO-71	<5.0	<1.0	473.0	<1.0	<1.0	<5.0	<5.0	4,051.0	<0.05	<5.0	<5.0	<5.0	<10.0	<5.0	<10.0
CO-71*	<5.0	<1.0	489.0	<1.0	<1.0	<5.0	<5.0	4,154.0	<0.05	<5.0	<5.0	<5.0	<10.0	<5.0	<10.0
G-5061Z	<5.0	<1.0	11.5	<1.0	<1.0	<5.0	<5.0	146.0	<0.05	<5.0	<5.0	<5.0	<10.0	<5.0	<10.0
R-1001	<5.0	<1.0	10.4	<1.0	<1.0	<5.0	<5.0	79.1	<0.05	<5.0	<5.0	<5.0	<10.0	<5.0	<10.0
R-1210	<5.0	<1.0	23.3	<1.0	<1.0	<5.0	5.9	40.6	<0.05	<5.0	<5.0	<5.0	<10.0	<5.0	<10.0
R-FAIRCLOT	<5.0	<1.0	5.7	<1.0	<1.0	<5.0	20.5	214.0	<0.05	<5.0	<5.0	<5.0	<10.0	<5.0	146.0
V-496	<5.0	<1.0	108.0	<1.0	<1.0	<5.0	<5.0	56.1	<0.05	<5.0	<5.0	<5.0	<10.0	<5.0	16.4
V-566	<5.0	<1.0	70.4	<1.0	<1.0	<5.0	<5.0	176.6	<0.05	<5.0	<5.0	<5.0	<10.0	<5.0	34.5
V-8102Z	<5.0	<1.0	24.9	<1.0	<1.0	<5.0	10.1	<20.0	<0.05	<5.0	<5.0	<5.0	<10.0	<5.0	<10.0

* Denotes duplicate sample.

Table 7-5 Water Quality Statistics

Fiscal Year 2001

PARAMETER	MINIMUM	MAXIMUM	AVERAGE
PH (SU)	5.90	8.55	7.66
Temperature ^{O}C	20.28	29.78	23.58
Sp. Conductivity (mmhos/cm) (Field)	0.027	0.712	0.346
Salinity (ppt)	0.01	0.35	0.17
TSS (ppm)	<4	10.8	<4
TDS (ppm)	39.3	742.0	325.7
Alkalinity (ppm)	6.5	360.0	175.6
Hardness (ppm)	<5	270.0	48.0
Turbidity (NTU)	<1	45.0	5.81
Sp. Conductivity (umhos/cm) (Lab)	27.7	1,201.0	443.0
Color (PCU)	<5	25.0	5.3
Chloride (ppm)	4.5	211.0	33.9
Sulfate (ppm)	<1.25	23.0	8.64
Nitrite-Nitrate, as N (ppm)	<0.05	0.14	<0.05
Phosphorus (ppm)	<0.05	0.77	0.36
TKN (ppm)	0.27	0.93	0.50
Ammonia (ppm)	<0.1	0.72	0.32

Table 7-6 Inorganic Statistics

Fiscal Year 2001

PARAMETER	MINIMUM	MAXIMUM	AVERAGE
Antimony (ppb)	<5	<5	<5
Arsenic (ppb)	<5	<5	<5
Barium (ppb)	<1	473.00	80.86
Beryllium (ppb)	<5	<5	<5
Cadmium (ppb)	<5	<5	<5
Chromium (ppb)	<5	<5	<5
Copper (ppb)	<5	20.50	5.72
Iron (ppb)	<20	4,051.00	531.49
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)	<5	<5	<5
Thallium (ppb)	<5	<5	<5
Zinc (ppb)	<10	146.00	26.48

Table 7-7 Three-year Water Quality Statistics

PARAMETER	FY 1995 AVERAGE	FY 1998 AVERAGE	FY 2001 AVERAGE
PH (SU)	6.90	7.11	7.66
Temperature ^{O}C	27.54	24.53	23.58
Sp. Conductivity (mmhos/cm) (Field)	0.468	0.389	0.346
Salinity (ppt)	0.21	0.19	0.17
TSS (ppm)	5.1	<4	<4
TDS (ppm)	326.9	246.7	325.7
Alkalinity (ppm)	202.7	186.3	175.6
Hardness (ppm)	62.7	70.1	48.0
Turbidity (NTU)	4.79	11.57	5.81
Sp. Conductivity (umhos/cm) (Lab)	492.3	405.5	443.0
Color (PCU)	16.4	9.2	5.3
Chloride (ppm)	41.5	13.0	33.9
Sulfate (ppm)	12.77	10.22	8.64
Nitrite-Nitrate, as N (ppm)	<0.05	0.11	<0.05
Phosphorus (ppm)	0.27	0.33	0.36
TKN (ppm)	0.29	0.65	0.50
Ammonia (ppm)	0.41	0.38	0.32

Table 7-8 Three-year Inorganic Statistics

PARAMETER	FY 1995 AVERAGE	FY 1998 AVERAGE	FY 2001 AVERAGE
Antimony (ppb)	<5	<5	<5
Arsenic (ppb)	<5	<5	<5
Barium (ppb)	110.90	197.07	80.86
Beryllium (ppb)	<5	<5	<5
Cadmium (ppb)	<5	<5	<5
Chromium (ppb)	<5	<5	<5
Copper (ppb)	5.47	7.47	5.72
Iron (ppb)	1,067.91	1,542.48	531.49
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)	<5	<5	<5
Thallium (ppb)	<5	<5	<5
Zinc (ppb)	560.57	607.83	26.48

Table 7-9 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	2
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 7-10 List of Semi-volatile Analytical Parameters

BASELINE MONITORING PROJECT

SEMIVOLATILE ORGANICS BY EPA METHOD 625

COMPOUND	PQL (ppb)
N-Nitrosodimethylamine	2
Anthracene	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	12
Acenaphthene	2
Pentachlorobenzene	2
2,4-Dinitrotoluene	6
Diethylphthalate	2
4-Chlorophenyl phenyl ether	2

Table 7-10 (Cont'd)
Semivolatile Parameters

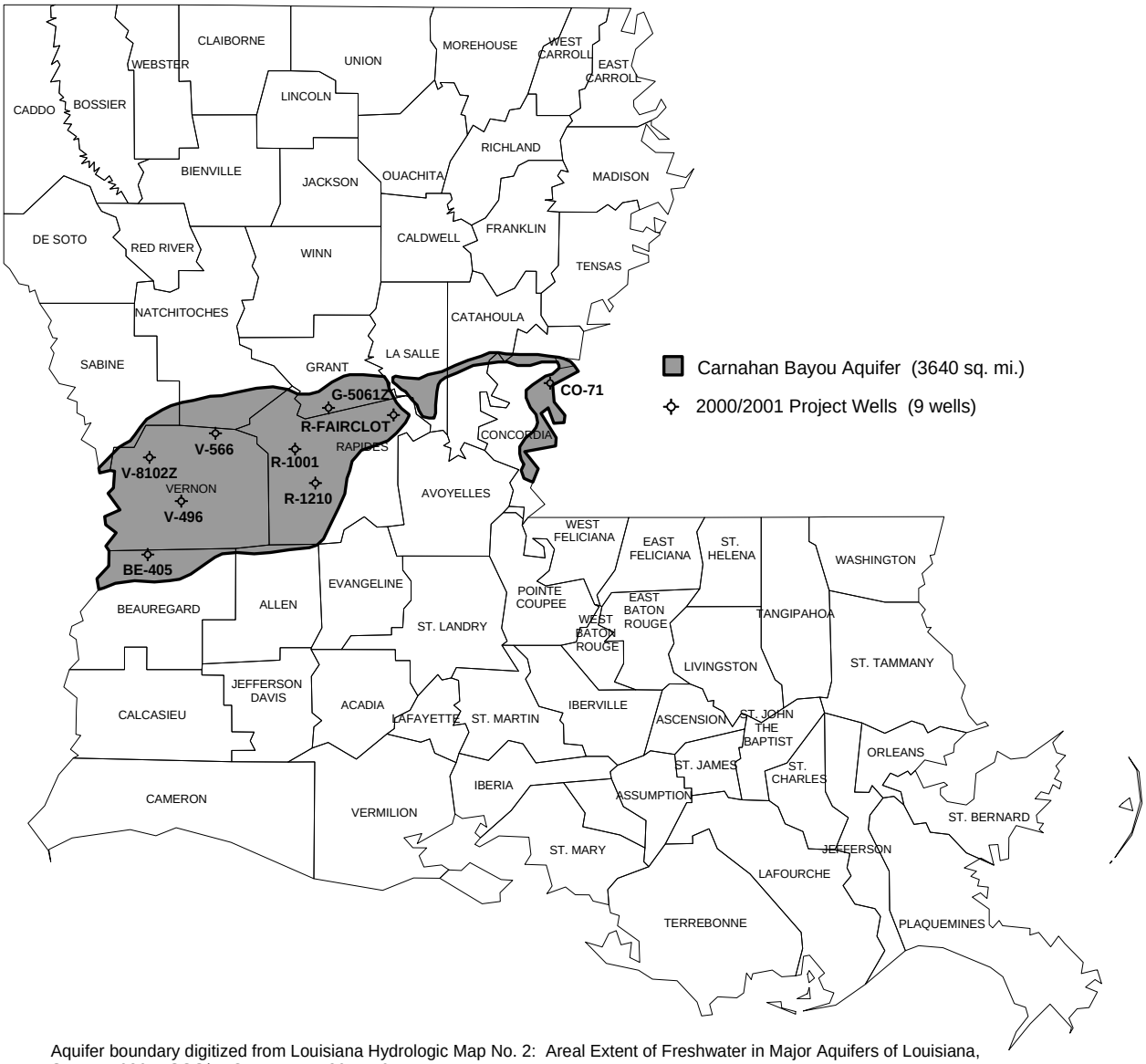
COMPOUND	PQL (ppb)
Fluorene	2
4,6-Dinitro-2-methylphenol	12
N-Nitrosodiphenylamine/Dipheny	2
4-Bromophenyl phenyl ether	2
Hexachlorobenzene	2
Pentachlorophenol	10
Phenathrene	2
Di-n-butylphthalate	2
Fluoranthene	2
Benzidine	20
Pyrene	2
Butylbenzylphthalate	2
Bis(2-ethylhexyl)phthalate	2
3,3'-Dichlorobenzidine	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 7-11 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 CARNAHAN BAYOU 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 7-1 Location Plat, Carnahan Bayou Aquifer

CARNAHAN BAYOU AQUIFER - pH (SU)

Baseline Monitoring Project, FY2000/2001

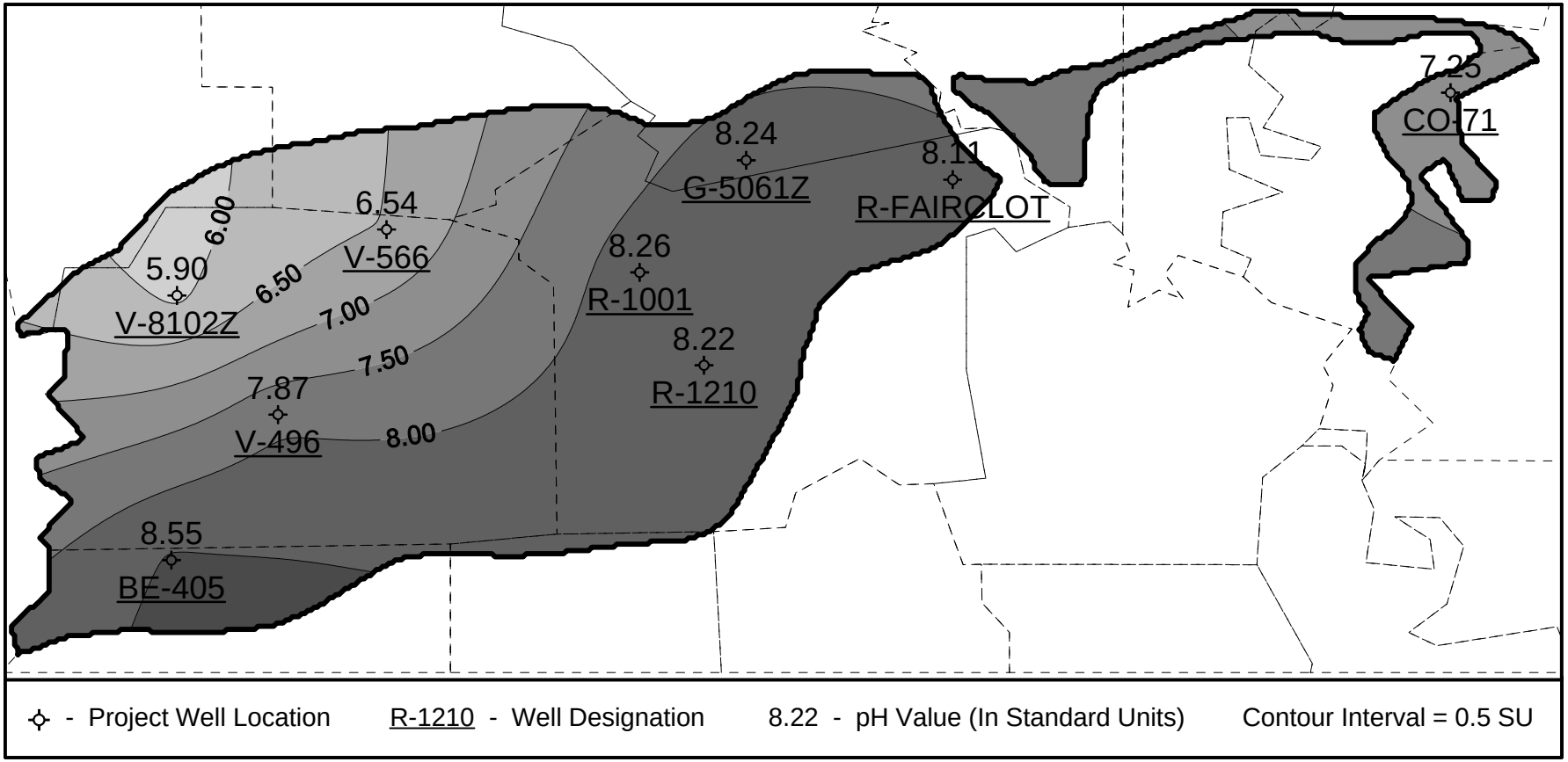


Figure 7-2 Map of pH Data

CARNAHAN BAYOU AQUIFER -TDS (PPM)

Baseline Monitoring Project, FY2000/2001

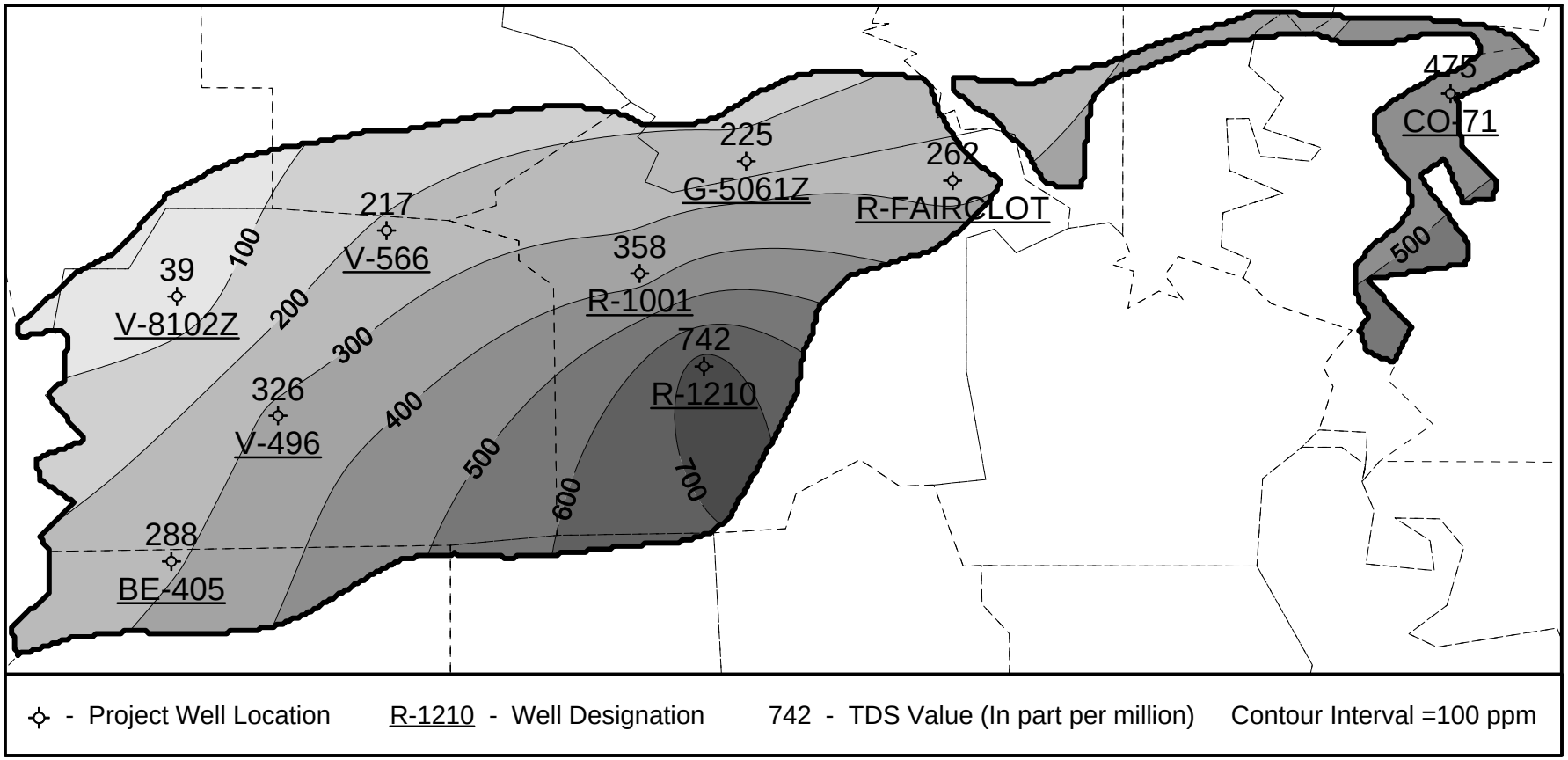


Figure 7-3 Map of TDS Data

CARNAHAN BAYOU AQUIFER -CHLORIDE (PPM)

Baseline Monitoring Project, FY2000/2001

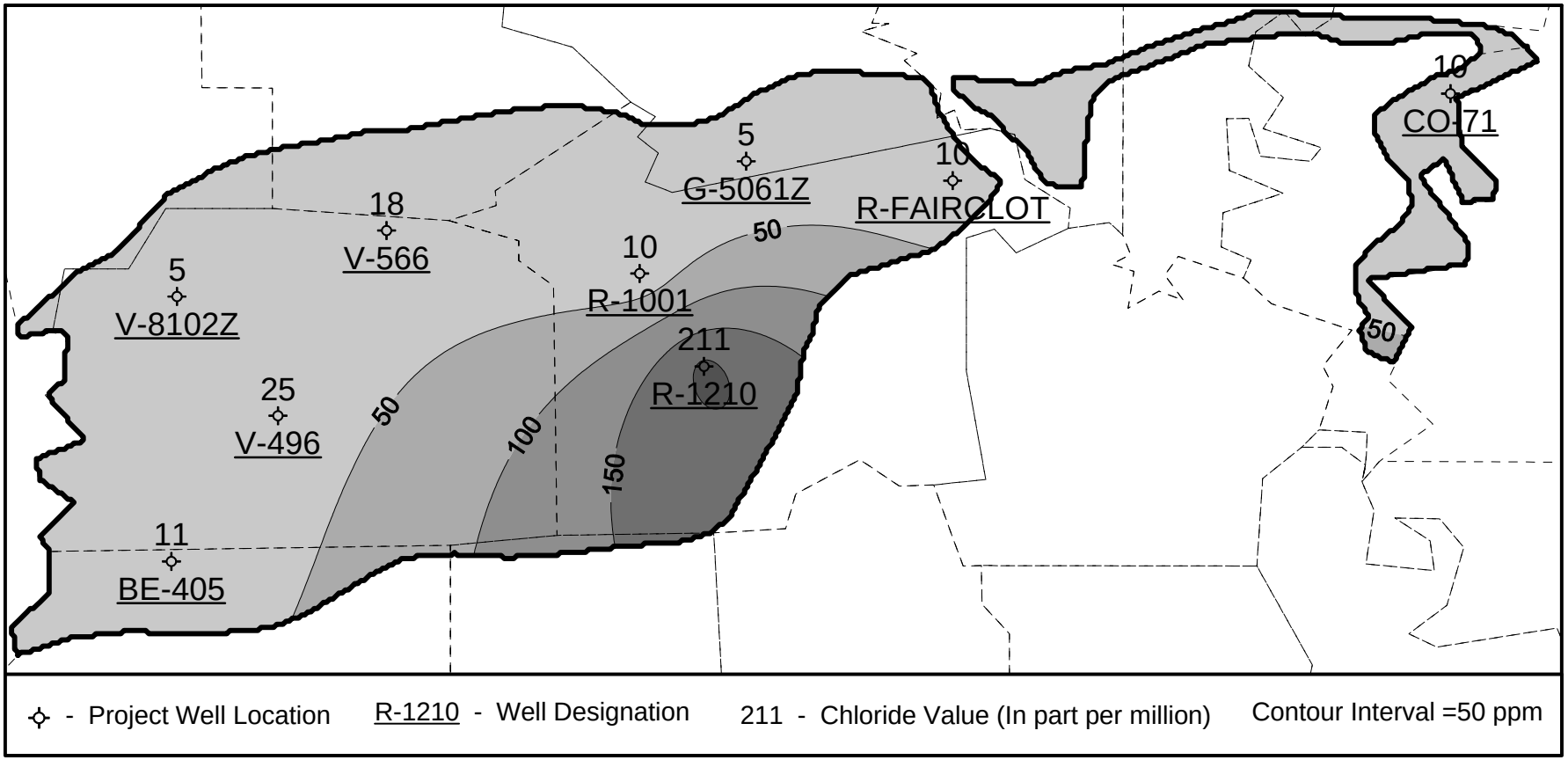


Figure 7-4 Map of Chloride Data

CARNAHAN BAYOU AQUIFER -IRON (PPB)

Baseline Monitoring Project, FY2000/2001

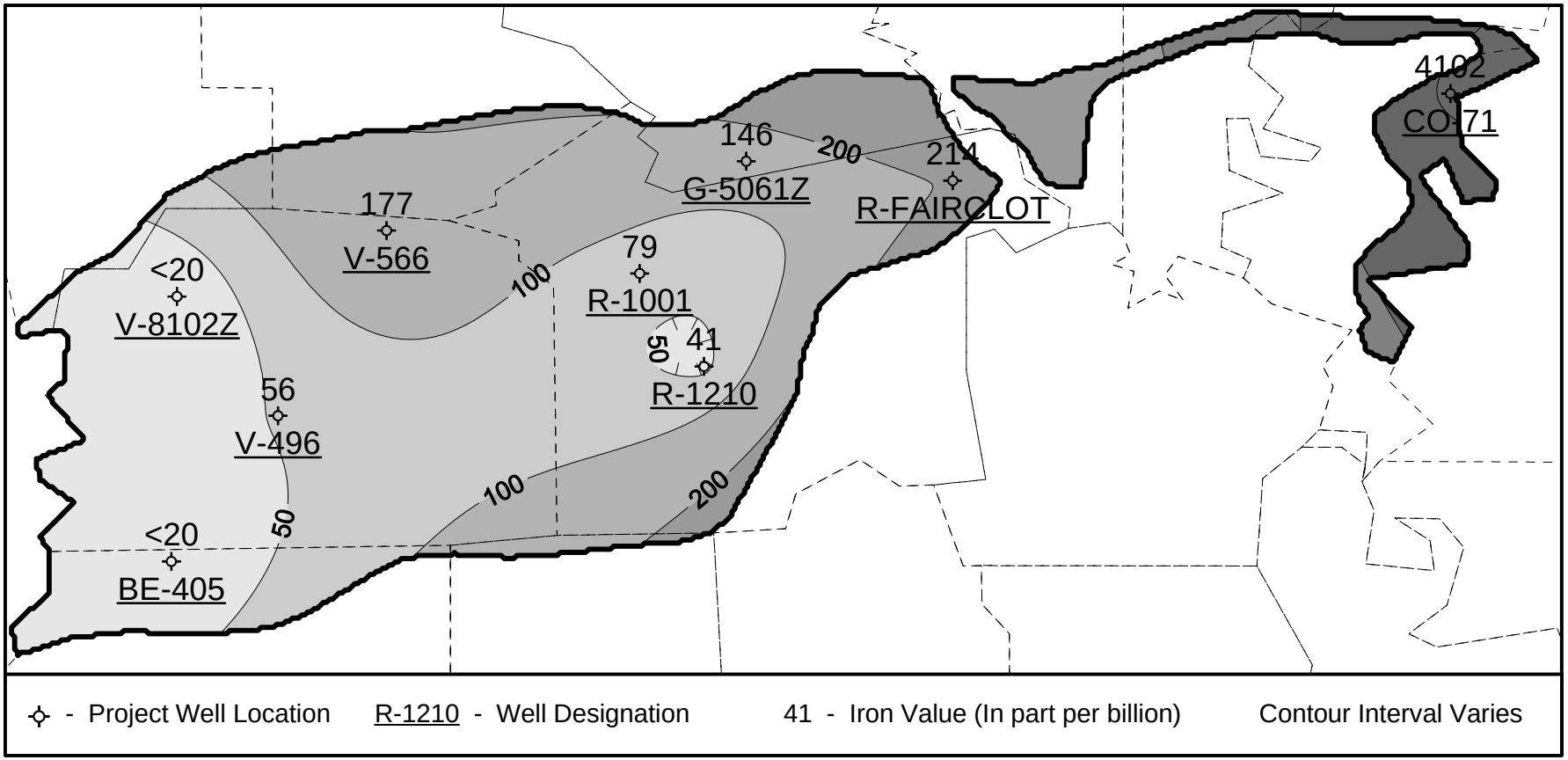


Figure 7-5 Map of Iron Data