CARRIZO-WILCOX AQUIFER SUMMARY, 2013

AQUIFER SAMPLING AND ASSESSMENT PROGRAM

APPENDIX 2 TO THE 2015 TRIENNIAL SUMMARY REPORT

PARTIAL FUNDING PROVIDED BY THE CWA

Contents

BACKGROUND

The Louisiana Department of Environmental Quality's (LDEQ) Aquifer Sampling and Assessment Program (ASSET) is an ambient monitoring program established to determine and monitor the quality of groundwater produced from Louisiana's major freshwater aquifers. The ASSET Program samples approximately 200 water wells located in 14 aquifers and aquifer systems across the state. The sampling process is designed so that all 14 aquifers and aquifer systems are monitored on a rotating basis, within a three-year period so that each well is monitored every three years.

In order to better assess the water quality of a particular aquifer, an attempt is made to sample all ASSET Program wells producing from it in a narrow time frame. To more conveniently and economically promulgate those data collected, a summary report on each aquifer is prepared separately. Collectively, these aquifer summaries make up, in part, the ASSET Program's Triennial Summary Report.

Analytical and field data contained in this summary were collected from wells producing from the Carrizo-Wilcox aquifer, during the 2013 state fiscal year (July 1, 2012 - June 30, 2013). This summary will become Appendix 2 of ASSET Program Triennial Summary Report for 2015.

These data show that from November 2006 through January 2013, 11 wells were sampled which produce from the Carrizo-Wilcox aquifer. Three of these 12 are classified as public supply, two are classified as industrial, two as irrigation, and four domestic. The wells are located in six parishes in the northwest area of the state.

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

Well data for registered water wells were obtained from the Louisiana Department of Natural Resources' water well registration data file.

GEOLOGY

The Carrizo-Wilcox aquifer system consists of the Carrizo Sand of the Eocene Claiborne group and the undifferentiated Wilcox group of Eocene and Paleocene age. The Wilcox deposits, outcropping in northwestern Louisiana, are the oldest deposits in the state containing fresh water. The Carrizo is discontinuous and consists of well-sorted, fine to medium grained, cross-bedded sands, with some silt and lignite. Well yields are restricted because the sand beds are typically thin, lenticular and fine textured. The system is confined downdip by the clays and silty clays of the overlying Cane River formation and the regionally confining clays of the underlying Midway group.

HYDROGEOLOGY

Primary recharge of the Carrizo-Wilcox aquifer occurs from direct infiltration of rainfall in interstream, upland outcrop-subcrop areas. Water also moves between overlying alluvial and terrace aquifers, the Sparta aquifer, and the Carrizo-Wilcox aquifer, according to hydraulic head differences. Water level fluctuations are mostly seasonal, and the hydraulic conductivity varies between 2 and 40 feet/day.

The maximum depths of occurrence of fresh water in the Carrizo-Wilcox range from 200 feet above sea level to 1,100 feet below sea level. The range of thickness of the fresh water interval in the Carrizo-Wilcox is 50 to 850 feet. The depths of the Carrizo-Wilcox wells that were monitored in conjunction with the ASSET Program range from 105 to 410 feet below land surface.

PROGRAM PARAMETERS

The field parameters checked at each ASSET well sampling site and the list of conventional parameters analyzed in the laboratory are shown in Table 2-2. The inorganic (total metals) parameters analyzed in the laboratory are listed in Table 2-3. These tables also show the field and analytical results determined for each analyte. For quality control, duplicate samples were taken for each parameter at wells CD-453 and CD-630.

In addition to the field, conventional and inorganic analytical parameters, the target analyte list includes three other categories of compounds: volatiles, semi-volatiles, and pesticides/PCBs. Due to the large number of analytes in these categories, tables were not prepared showing the analytical results for these compounds. A discussion of any detections from any of these three categories, if necessary, can be found in their respective sections. Tables 2-8, 2-9 and 2-10 list the target analytes for volatiles, semi-volatiles and pesticides/PCBs, respectively.

Tables 2-4 and 2-5 provide a statistical overview of field and conventional data, and inorganic data for the Carrizo-Wilcox aquifer, listing the minimum, maximum, and average results for these parameters collected in the FY 2013 sampling. Tables 2-6 and 2-7 compare these same parameter averages to historical ASSET-derived data for the Carrizo-Wilcox aquifer, from fiscal years 1995, 1998, 2001, 2004, 2007, and 2010.

The average values listed in the above referenced tables are determined using all valid, reported results, including those reported as non-detect, or less than the detection limit (< DL). Per Departmental policy concerning statistical analysis (including contouring purposes), one-half the DL is used in place of zero when non-detects are encountered. However, the minimum value is reported < DL, not one-half the DL. If all values for a particular analyte are reported as < DL, then the minimum, maximum, and average values are all reported as < DL.

Due to the variability in the laboratory's reporting detection limits caused by dilution factors, whenever an analyte in question is not detected, the standard reporting detection limit value for each analytical method is used as the DL when performing statistical calculations.

Figures 2-2, 2-3, 2-4, and 2-5 respectively, represent the contoured average values for pH, TDS, chloride and iron. Charts 2-1 through 2-16 represent the trend of the graphed parameter, based on the averaged value of that parameter for each three-year reporting period. Discussion of historical data and related trends is found in the **Water Quality Trends and Comparison to Historical ASSET Data** section.

INTERPRETATION OF DATA

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, the ASSET Program uses MCLs as a benchmark for further evaluation.

EPA has also set Secondary MCLs (SMCLs), which are defined as non-enforceable taste, odor, or appearance guidelines. Field and laboratory data contained in Tables 2-2 and 2-3 show that one or more SMCLs were exceeded in each of the 11 wells sampled in the Carrizo-Wilcox aquifer, with a total of 21 SMCLs being exceeded.

Field and Conventional Parameters

Table 2-2 shows the field and conventional parameters for which samples are collected at each well and the analytical results for those parameters. Table 2-4 provides an overview of this data for the Carrizo-Wilcox aquifer, listing the minimum, maximum, and average results for these parameters.

Federal Primary Drinking Water Standards: A review of the analysis listed in Table 2-2 shows that no MCL was exceeded for field, water quality, or nutrients parameters for this reporting period. Those ASSET wells reporting turbidity levels greater than 1.0 NTU do not exceed the MCL of 1.0, as this standard applies to public supply water wells that are under the direct influence of surface water. The Louisiana Department of Health has determined that no public water supply well in Louisiana was in this category.

Federal Secondary Drinking Water Standards: A review of the analysis listed in Table 2-2 shows that seven wells exceeded the SMCL for total dissolved solids, six wells exceeded the SMCL for pH, five wells exceeded the SMCL for color, two wells exceeded the SMCL for iron, and one well exceeded the SMCL for sulfate. Laboratory results override field results in exceedance determinations, therefore, only lab results are considered in determining the number of SMCL exceedances for TDS. Following is a list of SMCL parameter exceedances with well number and results:

pH (SMCL = 6.5 – 8.5 Standard Units):

BI-236 – 8.76 SU	DS-363 – 9.09 SU
DS-5297Z – 8.63 SU	DS-5996Z – 8.87 SU
RR-5070Z – 5.78	SA-522 – 8.61 SU

Total Dissolved Solids (TDS) (SMCL = 500 mg/L or 0.5 g/L):

LAB RESULTS (in mg/L)		FIELD MEASURES (in g/L)
BO-7274Z	860 mg/L	0.972 g/L
CD-453	657 mg/L, Duplicate – 643 mg/L	0.760 g/L (Original and Duplicate)
CD-639	1,140 mg/L	0.782 g/L
CD-642	680 mg/L	0.346 g/L
DS-363	683 mg/L	0.610 g/L
DS-5297Z	860 mg/L	1.003 g/L
DS-5996Z	557 mg/L	0.487 g/L

Color (SMCL = 15 color units (PCU)):

BI-236 – 69.9 PCU
CD-453 – 20.1 PCU, Duplicate 23.9 PCU
SA-522 – 60.0 PCU
BO-7247Z – 27.7 PCU
DS-363 – 16.2 PCU

Inorganic Parameters

Table 2-3 shows the inorganic (total metals) parameters for which samples are collected at each well and the analytical results for those parameters. Table 2-5 provides an overview of inorganic data for the Carrizo-Wilcox aquifer, listing the minimum, maximum, and average results for these parameters.

Federal Primary Drinking Water Standards: A review of the analyses listed on Table 2-3 shows that no MCL was exceeded for total metals.

Federal Secondary Drinking Water Standards: Laboratory data contained in Table 2-3 shows that 2 wells exceeded the SMCL for iron:

Iron (SMCL = 300 ug/L):

CD-630 – 791 µg/L, Duplicate – 778 µg/L
RR-5070Z – 956 µg/L

Volatile Organic Compounds

Table 2-8 shows the volatile organic compound (VOC) parameters for which samples are collected at each well. Due to the number of analytes in this category, analytical results are not tabulated; however, any detection of a VOC would be discussed in this section.

There were no confirmed detections of a VOC at or above its detection limit during the FY 2013 sampling of the Carrizo-Wilcox aquifer.

Semi-Volatile Organic Compounds

Table 2-9 shows the semi-volatile organic compound (SVOC) parameters for which samples are collected at each well. Due to the number of analytes in this category, analytical results are not tabulated; however, any detection of a SVOC would be discussed in this section.

There were no confirmed detections of a SVOC at or above its detection limit during the FY 2013 sampling of the Carrizo-Wilcox aquifer.

Pesticides and PCBs

Table 2-10 shows the pesticide and PCB parameters for which samples are collected at each well. Due to the number of analytes in this category, analytical results are not tabulated; however, any detection of a pesticide or PCB would be discussed in this section.

There were no confirmed detections of a pesticide or PCB at or above its detection limit during the FY 2013 sampling of the Carrizo-Wilcox aquifer.

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WATER QUALITY TRENDS AND COMPARISON TO HISTORICAL ASSET DATA

Analytical and field data show that the quality and characteristics of groundwater produced from the Carrizo-Wilcox aquifer exhibit some changes when comparing current data to that of the seven previous sampling rotations (three, six, nine, twelve, fifteen, and eighteen years prior). These comparisons can be found in Tables 2-6 and 2-7, and in Charts 2-1 to 2-16 of this summary. Over the eighteen-year period, 11 analytes have shown a general increase in their average concentrations. These analytes are: pH, specific conductance (field and lab), salinity, alkalinity, chloride, sulfate, TDS, ammonia, TKN, total phosphorous, and iron. For this same time period, five analytes have demonstrated a decrease in their average concentrations: temperature, color, hardness, nitrate-nitrite, and copper. The remaining analytes have shown no consistent change in their average concentrations for this time period.

The current number of wells with SMCL exceedances has remained the same while the current total number of SMCL exceedances have increased from the previous sampling event in FY 2010. Current sample results show that all 11 wells reported one or more SMCL exceedances with a total of 21 SMCL exceedances. The FY 2010 sampling of the Carrizo-Wilcox aquifer shows that 11 wells reported one or more SMCL exceedances with a total of 18 exceedances.

SUMMARY AND RECOMMENDATIONS

The data show that the groundwater produced from this aquifer is soft[1] and is of good quality when considering short-term or long-term health risk guidelines. Laboratory data show that no ASSET well that was sampled during the Fiscal Year 2013 monitoring of the Carrizo-Wilcox aquifer exceeded an MCL. The data also show that this aquifer is of good quality when considering taste, odor or appearance guidelines, with 21 SMCLs exceeded in all 11 wells monitored.

Comparison to ASSET derived historical data, current data show some change in the quality or characteristics of the Carrizo-Wilcox aquifer, with 11 parameters showing consistent increases

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

in average concentration, five parameters decreasing in average concentration, and the remaining parameters showing no consistent change over the previous 18 years.

It is recommended that the wells assigned to the Carrizo-Wilcox aquifer be resampled as planned, in approximately three years. In addition, several wells should be added to the 11 currently in place to increase the well density for this aquifer.

Table 2-1: List of Wells Sampled, Carrizo-Wilcox Aquifer–FY 2013

Well ID	Parish	Date	Owner	Depth (Feet)	Well Use
BI-236	Bienville	11/7/2012	Alberta Water System	410	Public Supply
BO-7274Z	Bossier	1/30/2013	Private Owner	290	Domestic
CD-453	Caddo	1/30/2013	City of Vivian	228	Public Supply
CD-630	Caddo	12/6/2012	Private Owner	240	Irrigation
CD-639	Caddo	12/6/2012	SI Precast	200	Industrial
CD-642	Caddo	12/6/2012	Louisiana Lift	210	Industrial
DS-363	De Soto	11/8/2012	City of Mansfield	280	Public Supply
DS-5297Z	De Soto	9/25/2012	Private Owner	170	Domestic
DS-5996Z	De Soto	11/8/2012	Private Owner	360	Domestic
RR-5070Z	Red River	9/24/2012	Private Owner	105	Domestic
SA-522	Sabine	9/25/2012	Private Owner	200	Irrigation

Table 2-2: Summary of Field and Conventional Data, Carrizo-Wilcox Aquifer–FY 2013

Well ID	Temp Deg. C	pH SU	Sp. Cond. mmhos/cm	Sal. ppt	TDS g/L	Alk mg/L	Cl mg/L	Color PCU	Sp. Cond. umhos/cm	SO4 mg/L	TDS mg/L	TSS mg/L	Turb. NTU	NH3 mg/L	Hard. mg/L	Nitrite-Nitrate (as N) mg/L	TKN mg/L	Tot. P mg/L
	LABORATORY DETECTION LIMITS →					1	2.5	1	10	0.25	10	4	0.3	0.05	5	0.01	0.1	0.05
	FIELD PARAMETERS					LABORATORY PARAMETERS												
BI-236	21.94	8.76	1.160	0.58	0.754	604	24.0	69.9	1,140	< DL	57	< DL	1.64	0.56	< DL	< DL	1.43	0.86
BO-7274Z	15.38	8.42	1.496	0.76	0.972	400	199.0	27.7	1,510	0.6	860	< DL	1.35	1.10	10	< DL	1.26	0.45
CD-453	17.90	8.39	1.169	0.58	0.760	300	175.0	20.1	1,240	18.8	657	< DL	2.30	1.13	< DL	< DL	2.23	0.36
CD-453*	17.90	8.39	1.169	0.58	0.760	276	180.0	23.9	1,220	19.6	643	< DL	2.25	1.18	16	< DL	2.18	0.40
CD-630	19.66	7.57	0.447	0.22	0.291	230	19.4	Not Analyzed	488	4.7	407	< DL	5.95	0.22	60	< DL	0.35	0.24
CD-630*	19.66	7.57	0.447	0.22	0.291	219	19.0		471	4.6	300	< DL	6.05	0.22	66	< DL	0.61	0.23
CD-639	19.01	8.20	1.204	0.60	0.782	387	192.0		1,180	< DL	1,140	< DL	4.98	1.06	< DL	< DL	1.08	0.21
CD-642	18.39	8.48	0.533	0.26	0.346	265	29.8		549	2.8	680	< DL	< DL	0.80	< DL	< DL	1.43	0.10
DS-363	18.62	9.09	0.939	0.46	0.610	380	79.8	16.2	962	< DL	683	< DL	0.70	0.79	< DL	< DL	1.11	0.26
DS-5297Z	18.86	8.63	1.542	0.78	1.003	311	112.0	8.0	1,460	273.0	860	9	1.46	3.12	< DL	0.11	3.33	0.07
DS-5996Z	18.79	8.87	0.749	0.37	0.487	290	24.1	8.6	732	27.1	557	< DL	0.51	1.00	< DL	0.06	1.27	0.20
RR-5070Z	20.49	5.78	0.484	0.23	0.315	20	131.0	8.0	477	< DL	243	306	3.77	0.23	44	0.28	1.12	< DL
SA-522	19.42	8.61	0.892	0.44	0.580	356	22.4	60.0	827	79.7	477	9	1.20	2.54	< DL	< DL	1.90	0.35

*Denotes Duplicate Sample

Shaded cells exceed EPA Secondary Standards

Table 2-3: Summary of Inorganic Data, Carrizo-Wilcox Aquifer–FY 2013

Well ID	Antimony ug/L	Arsenic ug/L	Barium ug/L	Beryllium ug/L	Cadmium ug/L	Chromium ug/L	Copper ug/L	Iron ug/L	Lead ug/L	Mercury ug/L	Nickel ug/L	Selenium ug/L	Silver ug/L	Thallium ug/L	Zinc ug/L
Laboratory Detection Limits †	5/25	4/20	5/25	2/10	2/10	2/10	2/10	100/ 500	1/5	0.0002	3/15	5/25	1/5	2/10	6/30
BI-236	< DL	< DL	< DL	< DL	< DL	< DL	< DL	< DL	< DL	< 0.0002	< DL	< DL	< DL	< DL	< DL
BO-7274Z	< DL	< DL	56.4	< DL	< DL	< DL	18.70	< DL	< DL	< 0.0002	< DL	< DL	< DL	< DL	< DL
CD-453	< DL	< DL	40.0	< DL	< DL	< DL	< DL	< DL	< DL	< 0.0002	< DL	< DL	< DL	< DL	< DL
CD-453*	< DL	< DL	38.9	< DL	< DL	< DL	< DL	< DL	< DL	< 0.0002	< DL	< DL	< DL	< DL	< DL
CD-630	< DL	< DL	181.0	< DL	< DL	< DL	< DL	791	< DL	< 0.0002	< DL	< DL	< DL	< DL	36.0
CD-630*	< DL	< DL	179.0	< DL	< DL	< DL	< DL	778	< DL	< 0.0002	< DL	< DL	< DL	< DL	36.4
CD-639	< DL	< DL	40.7	< DL	< DL	< DL	< DL	< DL	< DL	< 0.0002	< DL	< DL	< DL	< DL	< DL
CD-642	< DL	< DL	21.4	< DL	< DL	< DL	< DL	< DL	< DL	< 0.0002	< DL	< DL	< DL	< DL	< DL
DS-363	< DL	< DL	9.5	< DL	< DL	< DL	2.94	< DL	< DL	< 0.0002	< DL	< DL	< DL	< DL	< DL
DS-5297Z	< DL	< DL	37.3	< DL	< DL	< DL	< DL	< DL	< DL	< 0.0002	< DL	< DL	< DL	< DL	< DL
DS-5996Z	< DL	< DL	34.8	< DL	< DL	< DL	2.46	< DL	< DL	< 0.0002	< DL	< DL	< DL	< DL	< DL
RR-5070Z	< DL	< DL	180.0	< DL	< DL	5.26	11.10	956	3.22	< 0.0002	6.15	< DL	< DL	< DL	32.0
SA-522	< DL	< DL	23.2	< DL	< DL	< DL	2.08	225	< DL	< 0.0002	< DL	< DL	< DL	< DL	< DL

† Detection limits vary due to dilution factor. *Denotes Duplicate Sample. Shaded cells exceed EPA Secondary Standards.

Table 2-4: FY 2013 Field and Conventional Statistics, ASSET Wells

	PARAMETER	MINIMUM	MAXIMUM	AVERAGE
FIELD	Temperature (^{O}C)	15.38	21.94	18.92
	pH (SU)	5.78	9.09	8.25
	Specific Conductance (mmhos/cm)	0.447	1.542	0.965
	Salinity (ppt)	0.22	0.78	0.48
	TDS (g/L)	0.290	1.000	0.630
LABORATORY	Alkalinity (mg/L)	20	604	322
	Chloride (mg/L)	19.2	199.0	91.7
	Color (PCU)	8.0	69.9	27.3
	Specific Conductance (umhos/cm)	471	1,510	959
	Sulfate (mg/L)	< DL	273.0	40.9
	TDS (mg/L)	57	1,140	596
	TSS (mg/L)	< DL	306.0	30.9
	Turbidity (NTU)	< DL	6.05	2.19
	Ammonia, as N (mg/L)	0.22	3.12	1.14
	Hardness (mg/L)	< DL	66.0	12.5
	Nitrite - Nitrate, as N (mg/L)	< DL	0.28	0.05
	TKN (mg/L)	0.35	3.33	1.49
	Total Phosphorus (mg/L)	< DL	0.86	0.29

Table 2-5: FY 2013 Inorganic Statistics, ASSET Wells

PARAMETER	MINIMUM	MAXIMUM	AVERAGE
Antimony (ug/L)	< DL	< DL	< DL
Arsenic (ug/L)	< DL	< DL	< DL
Barium (ug/L)	< DL	181.0	56.9
Beryllium (ug/L)	< DL	< DL	< DL
Cadmium (ug/L)	< DL	< DL	< DL
Chromium (ug/L)	< DL	5.26	< DL
Copper (ug/L)	< DL	11.1	3.1
Iron (ug/L)	< DL	956	216
Lead (ug/L)	< DL	3.22	< DL
Mercury (ug/L)	< DL	< DL	< DL
Nickel (ug/L)	< DL	6.15	< DL
Selenium (ug/L)	< DL	< DL	< DL
Silver (ug/L)	< DL	< DL	< DL
Thallium (ug/L)	< DL	< DL	< DL
Zinc (ug/L)	< DL	36.4	7.4

Table 2-6: Triennial Field and Conventional Statistics, ASSET Wells

	PARAMETER	AVERAGE VALUES BY FISCAL YEAR						
		FY 1995	FY 1998	FY 2001	FY 2004	FY 2007	FY 2010	FY 2013
FIELD	Temperature (^{O}C)	21.44	21.30	21.98	21.39	21.83	20.29	18.92
	pH (SU)	7.53	7.65	7.87	7.75	8.31	8.17	8.25
	Specific Conductance (mmhos/cm)	0.676	0.732	0.808	0.800	0.740	0.816	0.965
	Salinity (Sal.) (ppt)	0.35	0.36	0.40	0.39	0.36	0.41	0.48
	TDS (Total dissolved solids) (g/L)	-	-	-	0.520	0.480	0.530	0.630
LABORATORY	Alkalinity (Alk.) (mg/L)	267.2	251.5	249.4	273.5	283.4	295.3	322
	Chloride (Cl) (mg/L)	59.2	71.6	69.7	66.5	66.4	77.21	91.7
	Color (PCU)	25.8	13.8	24.1	14.8	8.2	2.8	27.3
	Specific Conductance (umhos/cm)	726.4	772.4	748.1	799.5	739	799.3	959
	Sulfate (SO4) (mg/L)	30.1	30.5	28.7	26.6	13.1	28.9	40.9
	TDS (Total dissolved solids) (mg/L)	434.7	435.7	449.6	481.2	429.7	496.7	596
	TSS (Total suspended solids) (mg/L)	< DL	4.9	< DL	< DL	< DL	4.7	30.9
	Turbidity (Turb.) (NTU)	2.6	5.2	2.3	1.6	1.9	2.9	2.19
	Ammonia, as N (NH3) (mg/L)	0.42	0.64	0.64	0.81	0.63	< 1	1.14
	Hardness (mg/L)	52.4	42.2	31.3	41.0	33.5	13.5	12.5
	Nitrite - Nitrate , as N (mg/L)	0.08	0.07	0.07	0.07	0.10	0.05	0.05
	TKN (mg/L)	0.78	0.96	0.82	0.97	0.77	0.33	1.49
	Total Phosphorus (P) (mg/L)	0.29	0.24	0.26	0.33	0.26	0.36	0.29

Table 2-7: Triennial Inorganic Statistics, ASSET Wells

PARAMETER	AVERAGE VALUES BY FISCAL YEAR						
	FY 1995	FY 1998	FY 2001	FY 2004	FY 2007	FY 2010	FY 2013
Antimony (ug/L)	< DL	< DL	< DL	< DL	< DL	< DL	< DL
Arsenic (ug/L)	5.13	< DL	< DL	< DL	< DL	< DL	< DL
Barium (ug/L)	51.9	75	69.5	77.8	70.2	53.2	56.9
Beryllium (ug/L)	< DL	< DL	< DL	< DL	< DL	< DL	< DL
Cadmium (ug/L)	< DL	< DL	< DL	< DL	< DL	< DL	< DL
Chromium (ug/L)	< DL	< DL	< DL	< DL	< DL	< DL	< DL
Copper (ug/L)	31. 6	24.7	6.9	5.7	3.1	4.5	3.1
Iron (ug/L)	1,522	1,897	1,353	1,897	132	507	216
Lead (ug/L)	< DL	< DL	< DL	10.2	< DL	< DL	< DL
Mercury (ug/L)	< DL	< DL	< DL	< DL	< DL	< DL	< DL
Nickel (ug/L)	13.1	< DL	12.8	5.2	< DL	< DL	< DL
Selenium (ug/L)	< DL	< DL	< DL	< DL	< DL	< DL	< DL
Silver (ug/L)	< DL	1.1	15.8	< DL	< DL	< DL	< DL
Thallium (ug/L)	< DL	< DL	< DL	< DL	< DL	< DL	< DL
Zinc (ug/L)	33.5	164	60.4	135.4	21.9	39.4	7.4

Table 2-8: VOC Analytical Parameters

COMPOUND	METHOD	DETECTION LIMIT (ug/L)
ETHYL BENZENE	624	0.5
CIS-1,3-DICHLOROPROPENE	624	0.5
TRANS-1,3-DICHLOROPROPENE	624	0.5
1,4-DICHLOROBENZENE	624	0.5
1,2-DICHLOROETHANE	624	0.5
TOLUENE	624	0.5
CHLOROBENZENE	624	0.5
DIBROMOCHLOROMETHANE	624	0.5
TETRACHLOROETHYLENE (PCE)	624	0.5
TRANS-1,2-DICHLOROETHENE	624	0.5
TERT-BUTYL METHYL ETHER	624	0.5
1,3-DICHLOROBENZENE	624	0.5
CARBON TETRACHLORIDE	624	0.5
CHLOROFORM	624	0.5
BENZENE	624	0.5
1,1,1-TRICHLOROETHANE	624	0.5
BROMOMETHANE	624	0.5
CHLOROMETHANE	624	0.5
CHLOROETHANE	624	0.5
VINYL CHLORIDE	624	0.5
METHYLENE CHLORIDE	624	0.5
BROMOFORM	624	0.5
BROMODICHLOROMETHANE	624	0.5
1,1-DICHLOROETHANE	624	0.5
1,1-DICHLOROETHENE	624	0.5
TRICHLOROFLUOROMETHANE	624	0.5
1,2-DICHLOROPROPANE	624	0.5
1,1,2-TRICHLOROETHANE	624	0.5
TRICHLOROETHYLENE (TCE)	624	0.5
1,1,2,2-TETRACHLOROETHANE	624	0.5
1,2,3-TRICHLOROBENZENE	624	0.5
1,2-DICHLOROBENZENE	624	0.5
ETHYL BENZENE	624	0.5
CIS-1,3-DICHLOROPROPENE	624	0.5

Table 2-9: SVOC Analytical Parameters

COMPOUND	METHOD	DETECTION LIMIT (ug/L)
1,2,4-TRICHLOROBENZENE	625	5
2,4,6-TRICHLOROPHENOL	625	5
2,4-DICHLOROPHENOL	625	5
2,4-DIMETHYLPHENOL	625	5
2,4-DINITROPHENOL	625	20
2,4-DINITROTOLUENE	625	5
2,6-DINITROTOLUENE	625	5
2-CHLORONAPHTHALENE	625	5
2-CHLOROPHENOL	625	5
2-NITROPHENOL	625	10
3,3'-DICHLOROBENZIDINE	625	5
4,6-DINITRO-2-METHYLPHENOL	625	10
4-BROMOPHENYL PHENYL ETHER	625	5
4-CHLORO-3-METHYLPHENOL	625	5
4-CHLOROPHENYL PHENYL ETHER	625	5
4-NITROPHENOL	625	20
ACENAPHTHENE	625	5
ACENAPHTHYLENE	625	5
ANTHRACENE	625	5
BENZIDINE	625	20
BENZO(A)ANTHRACENE	625	5
BENZO(A)PYRENE	625	5
BENZO(B)FLUORANTHENE	625	5
BENZO(G,H,I)PERYLENE	625	5
BENZO(K)FLUORANTHENE	625	5
BENZYL BUTYL PHTHALATE	625	5
BIS(2-CHLOROETHOXY) METHANE	625	5
HEXACHLOROCYCLOPENTADIENE	625	5
HEXACHLOROETHANE	625	5
INDENO(1,2,3-C,D)PYRENE	625	5
ISOPHORONE	625	5
NAPHTHALENE	625	5
NITROBENZENE	625	5
N-NITROSODIMETHYLAMINE	625	5
N-NITROSODI-N-PROPYLAMINE	625	5
N-NITROSODIPHENYLAMINE	625	5

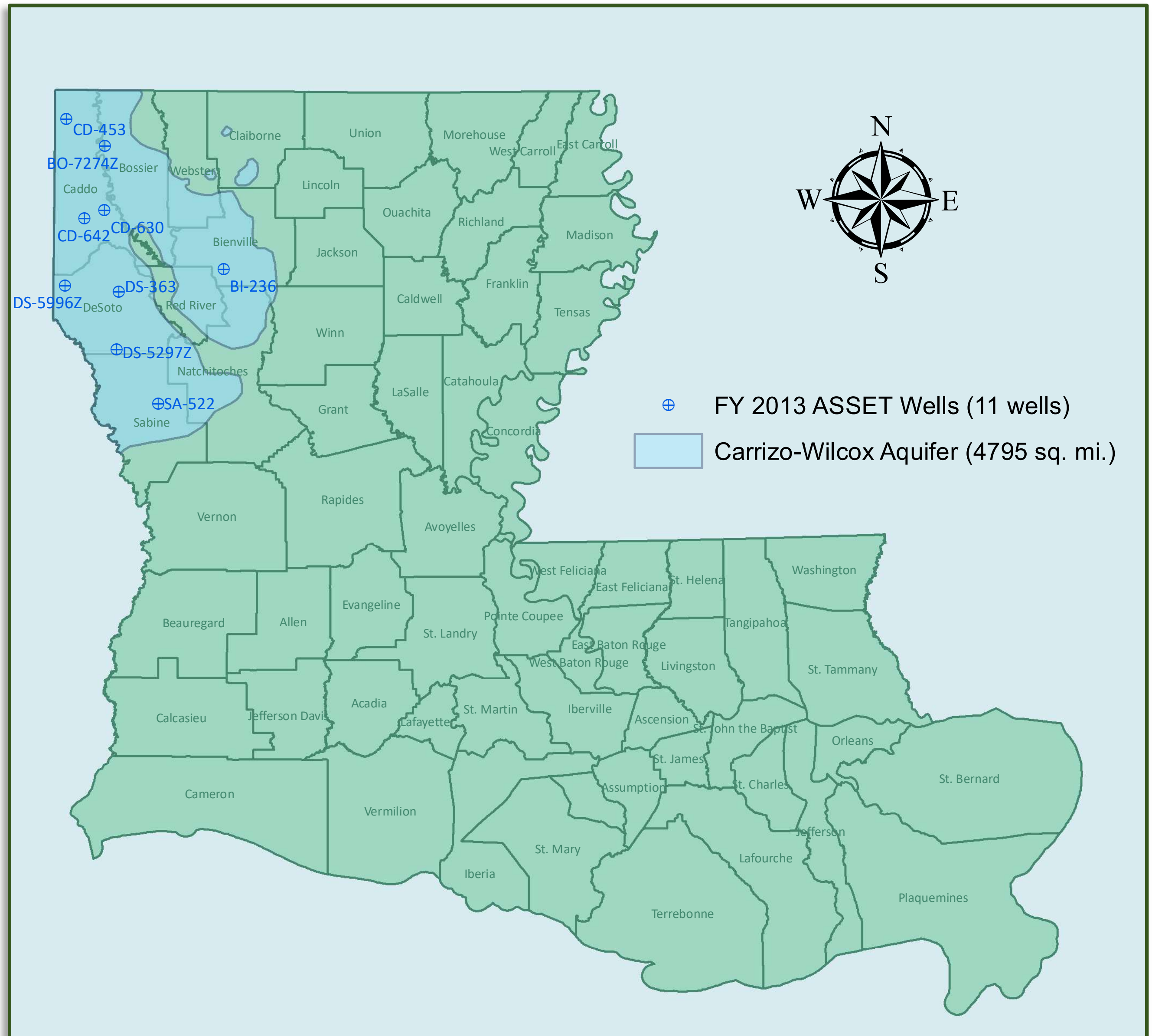
Table 2-9: SVOCs (Continued)

COMPOUND	METHOD	DETECTION LIMIT (ug/L)
PENTACHLOROBENZENE	625	5
PENTACHLOROPHENOL	625	10
PHENANTHRENE	625	5
PHENOL	625	5
PYRENE	625	5
TETRACHLOROBENZENE(S), TOTAL	625	10

Table 2-10: Pesticides and PCBs

COMPOUND	METHOD	DETECTION LIMITS (ug/L)
4,4'-DDD	8081	0.1
4,4'-DDE	8081	0.1
4,4'-DDT	8081	0.1
Aldrin	8081	0.05
Alpha-Chlordane	8081	0.05
alpha-BHC	8081	0.05
beta-BHC	8081	0.05
delta-BHC	8081	0.05
gamma-BHC	8081	0.05
Dieldrin	8081	0.1
Endosulfan I	8081	0.05
Endosulfan II	8081	0.1
Endosulfan Sulfate	8081	0.1
Endrin	8081	0.1
Endrin Aldehyde	8081	0.1
Endrin Ketone	8081	0.1
Heptachlor	8081	0.05
Heptachlor Epoxide	8081	0.05
Methoxychlor	8081	0.5
Toxaphene	8081	2
Gamma-Chlordane	8081	0.05
PCB-1016	8082	1
PCB-1221	8082	1
PCB-1232	8082	1
PCB-1242	8082	1
PCB-1248	8082	1
PCB-1254	8082	1
PCB-1260	8082	1

Figure 2-1: Location Plat, Carrizo-Wilcox 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.

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Figure 2-2: Map of pH Data

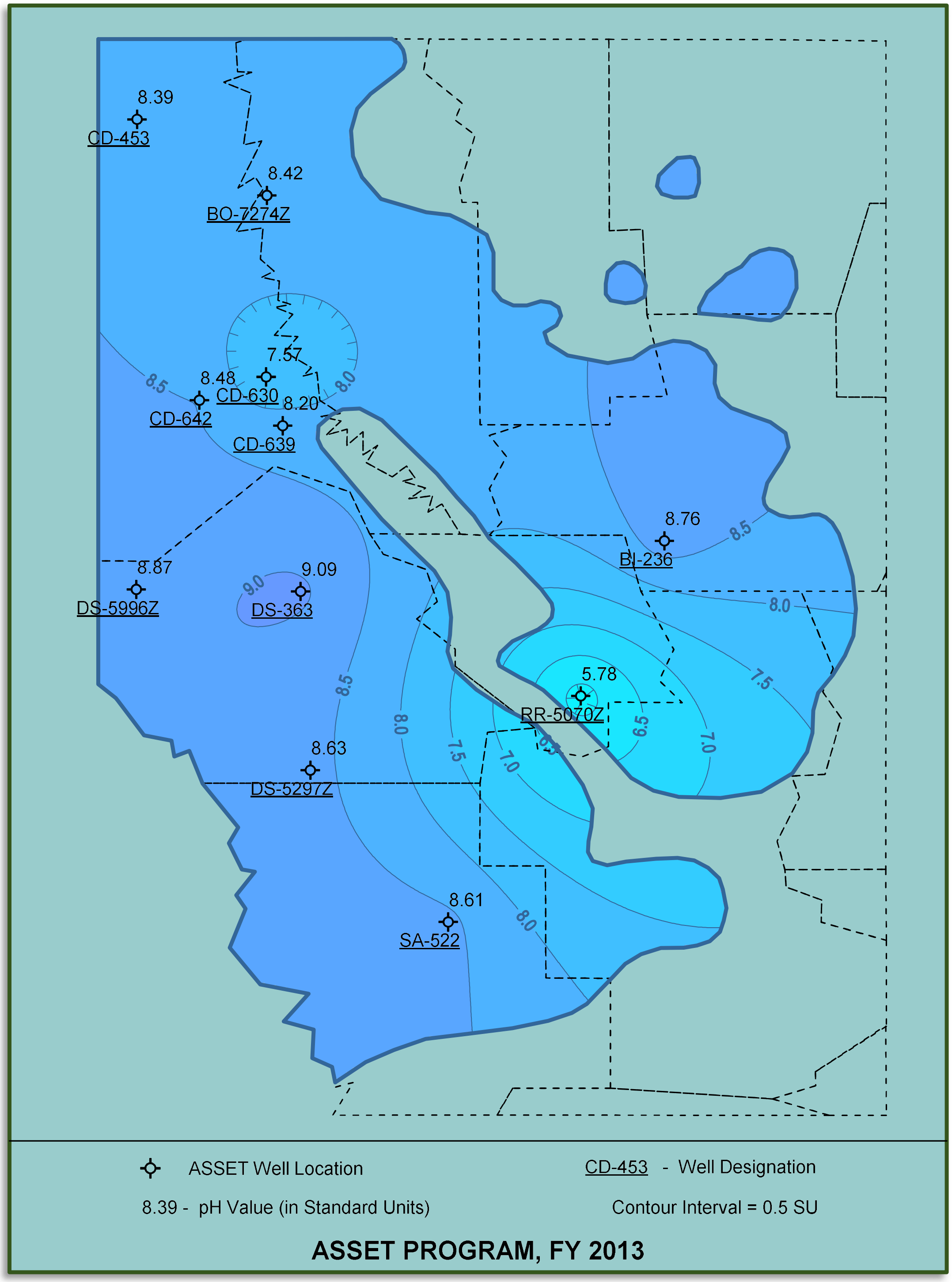

Figure 2-3: Map of TDS Lab Data

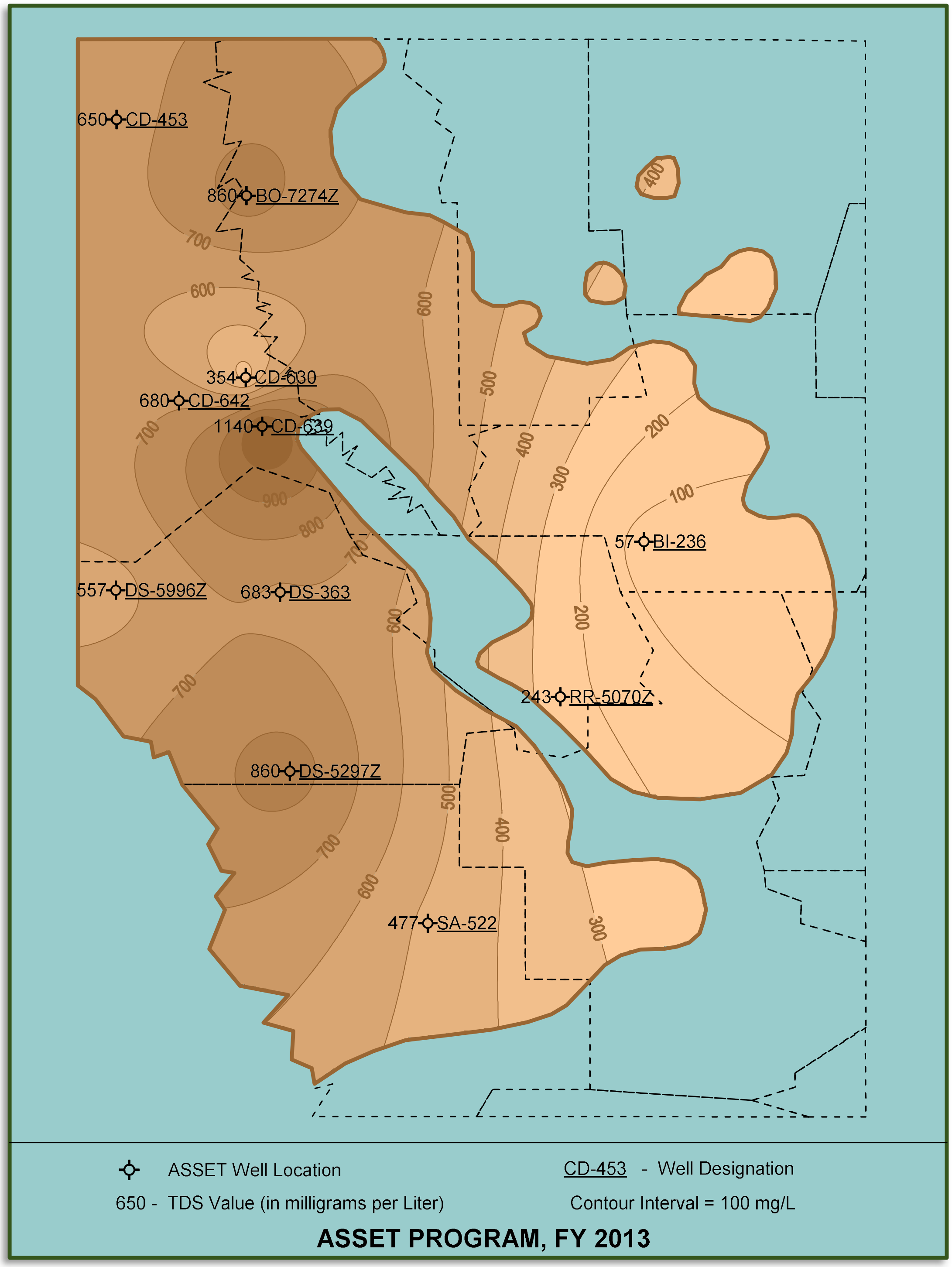

Figure 2-4: Map of Chloride Data

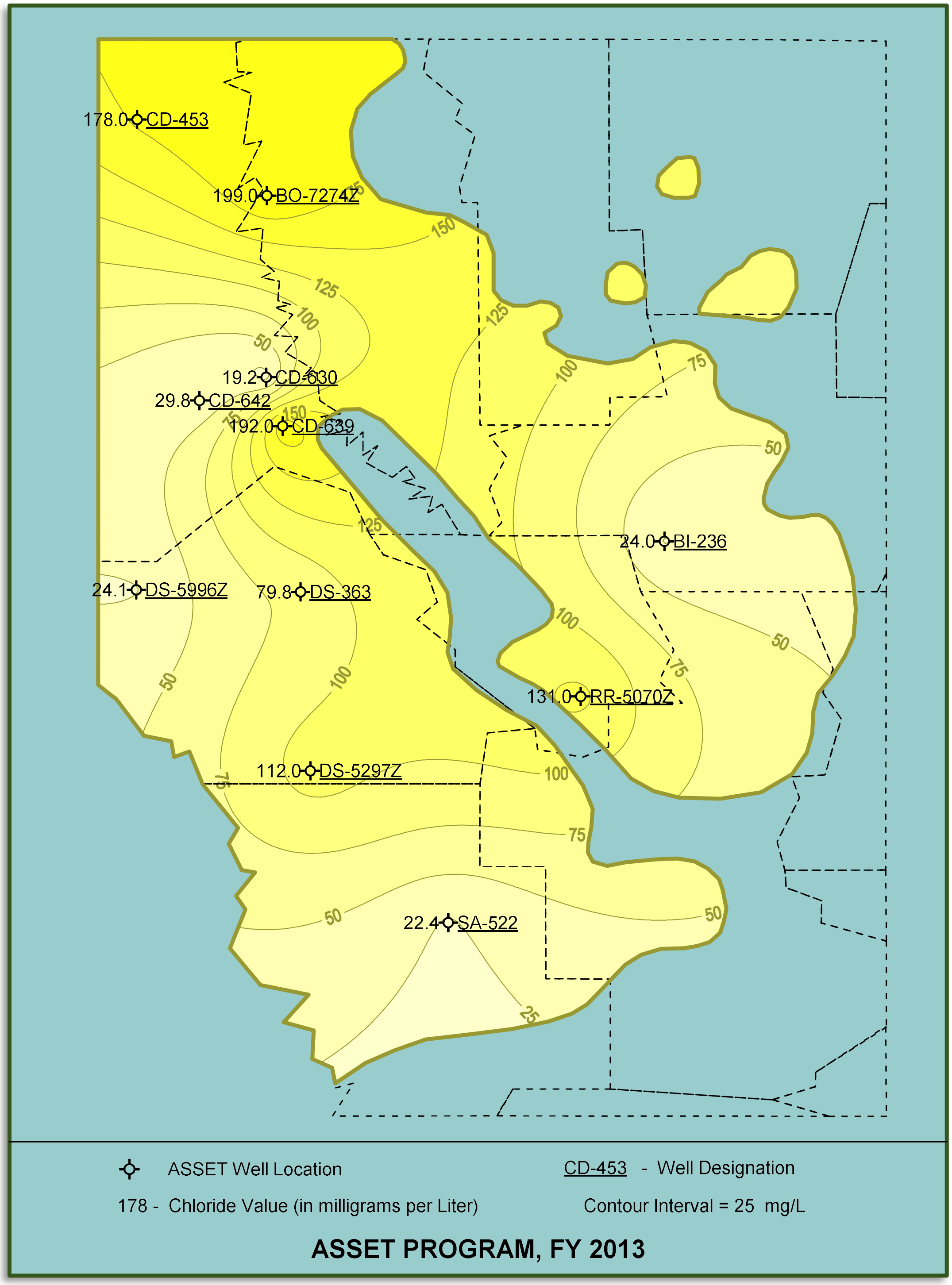

Figure 2-5: Map of Iron Data

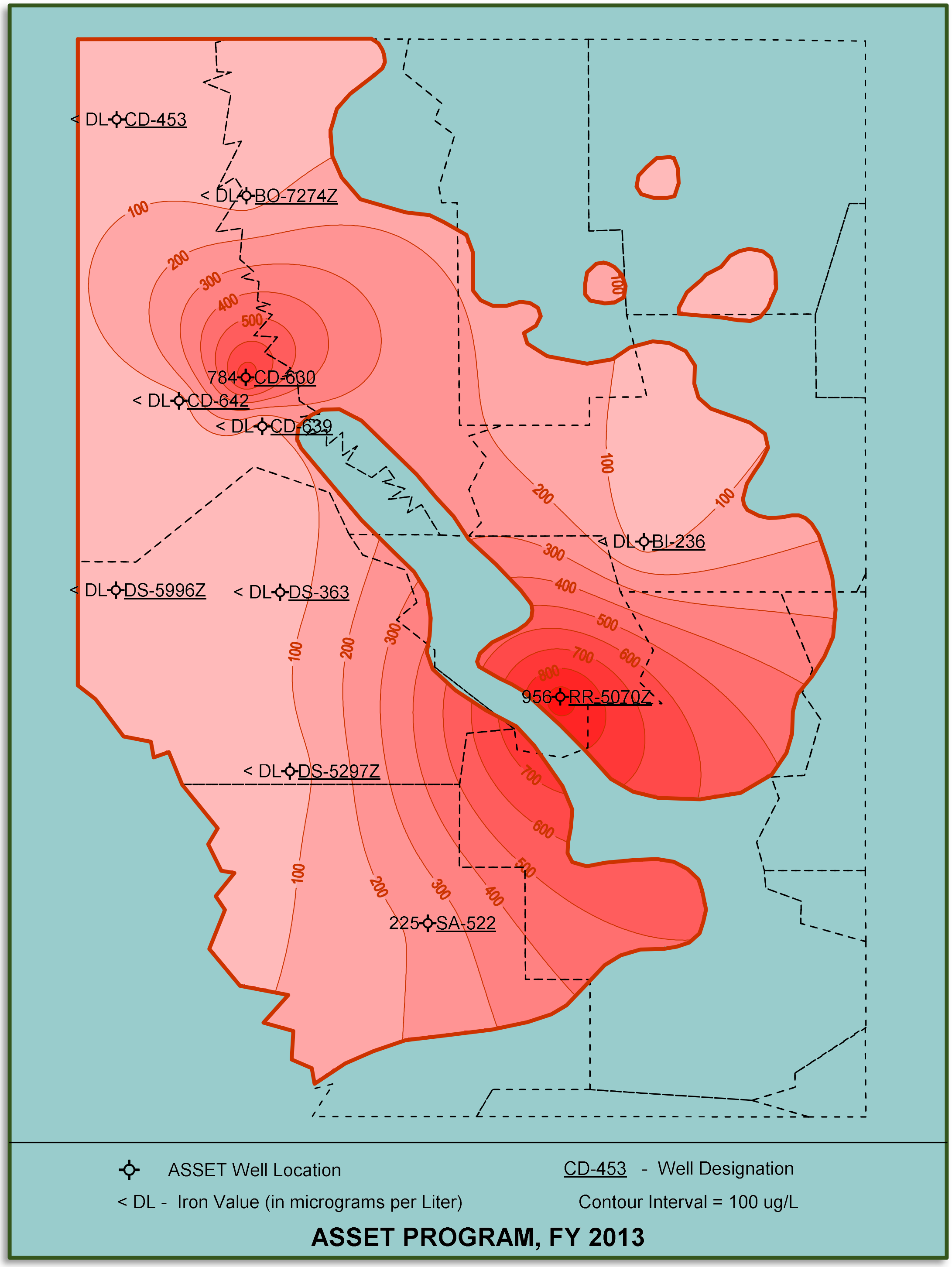

Chart 2-1: Temperature Trend

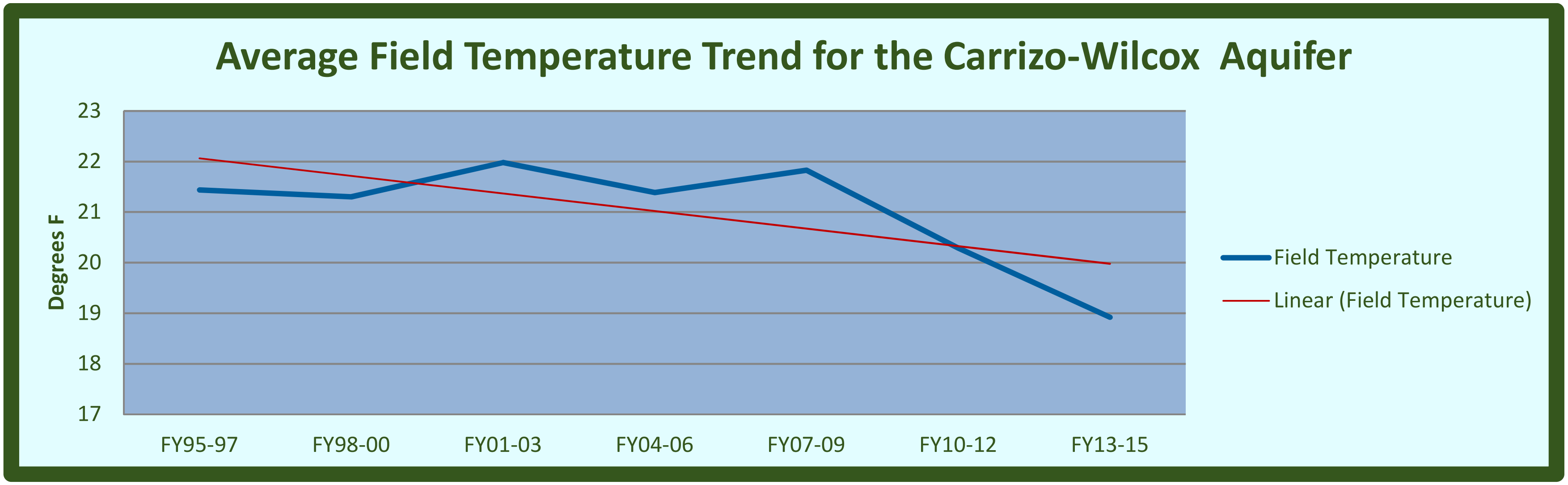

Chart 2-2: pH Trend

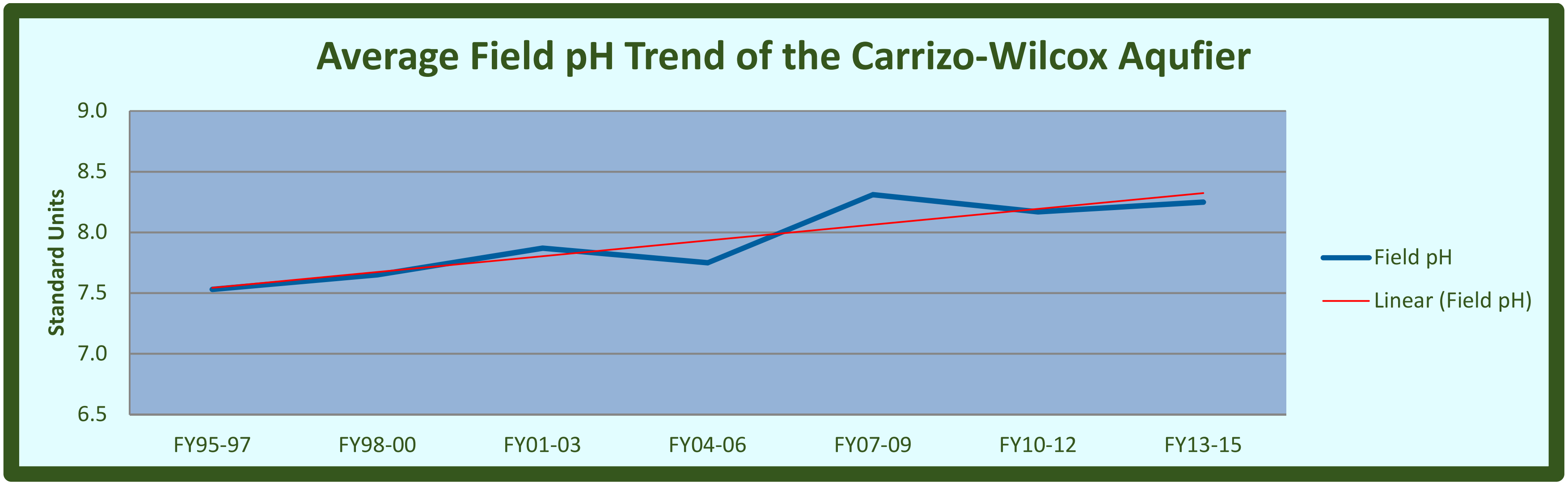

Chart 2-3: Field Specific Conductance Trend

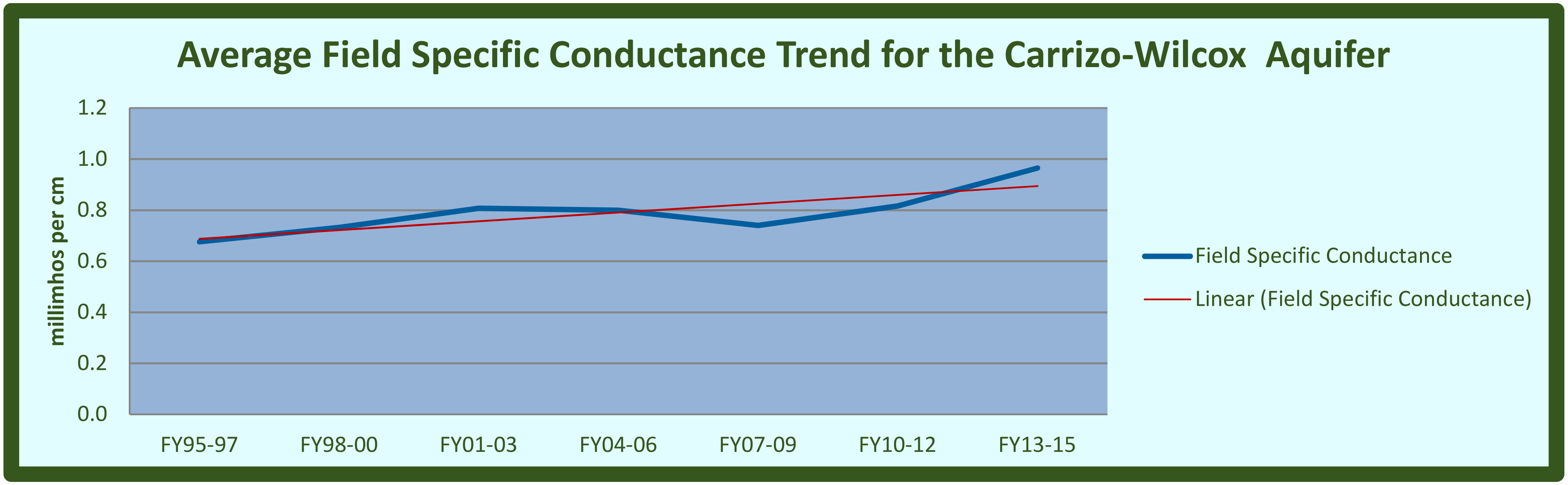

Chart 2-4: Lab Specific Conductance Trend

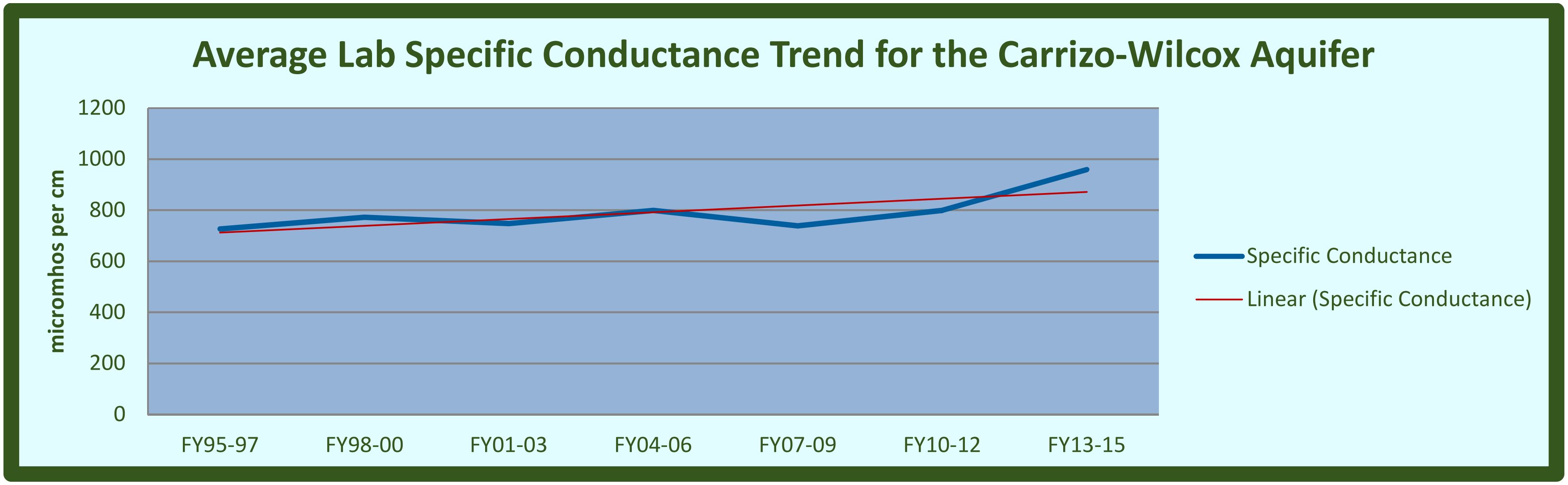

Chart 2-5: Field Salinity Trend

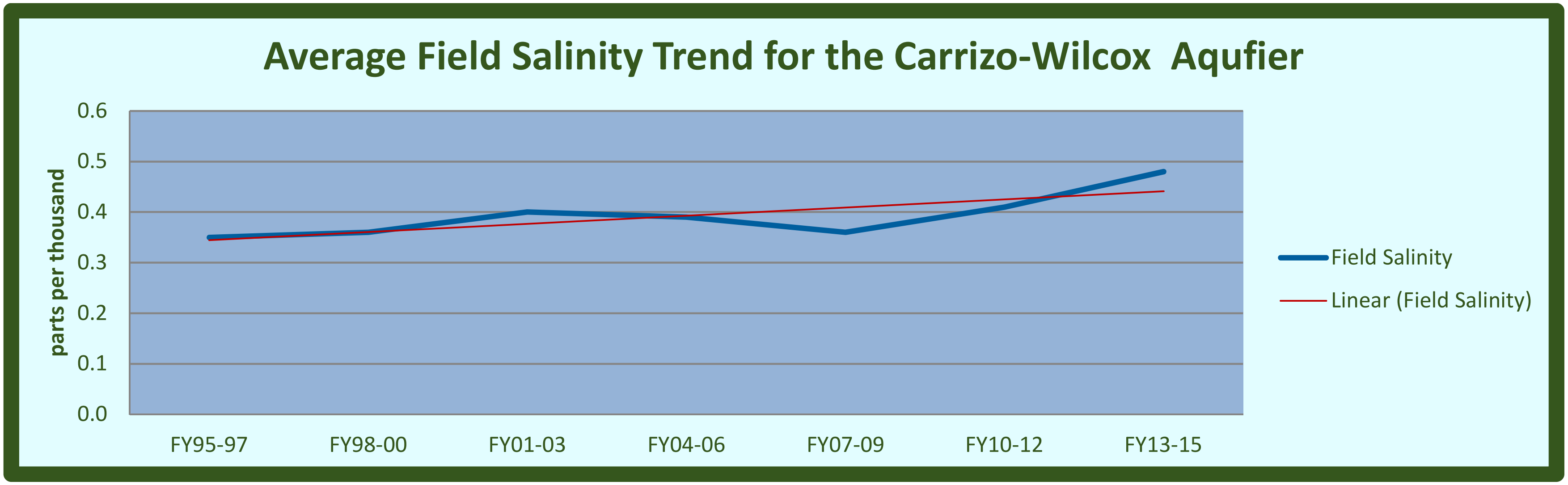

Chart 2-6: Chloride Trend

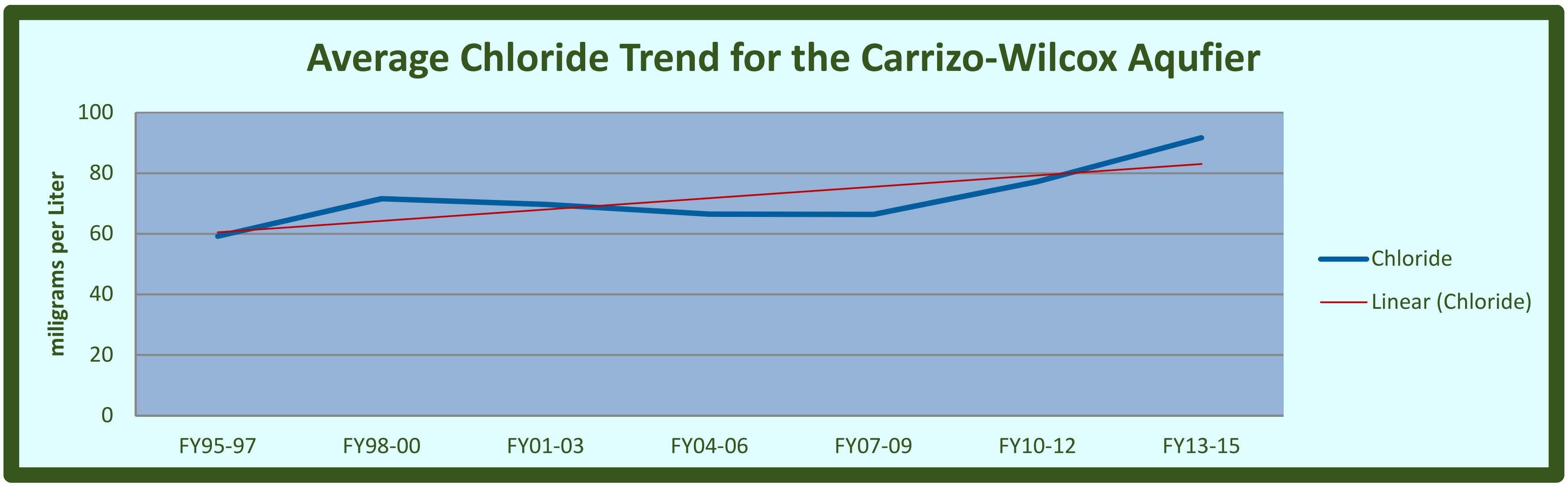

Chart 2-7: Alkalinity Trend

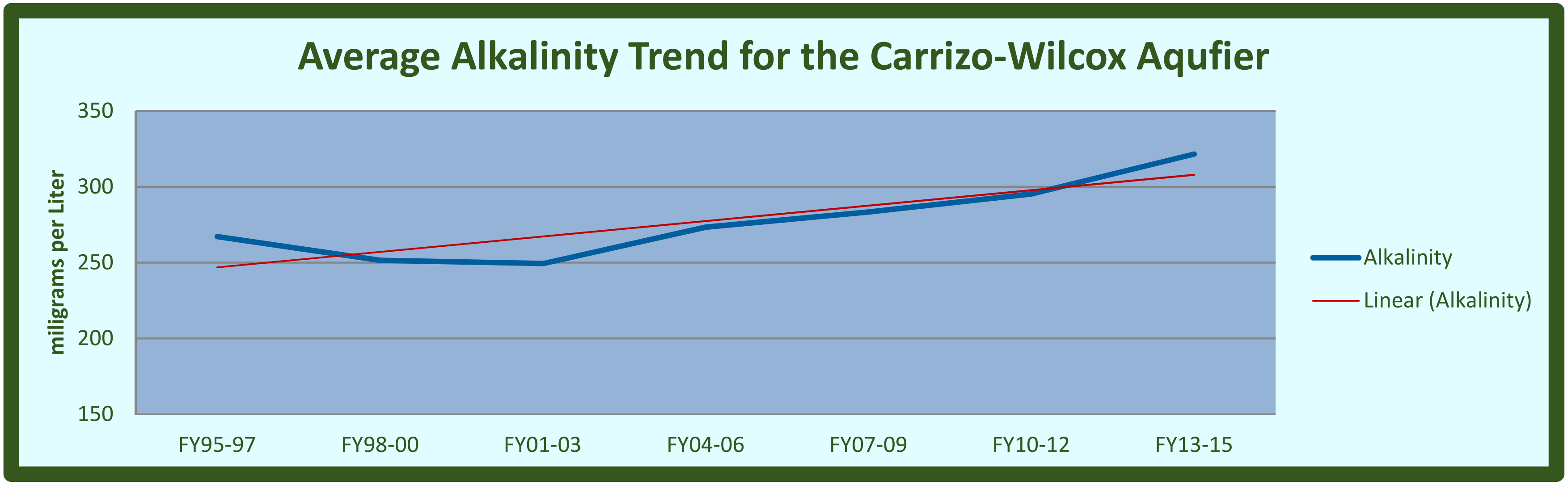

Chart 2-8: Color Trend

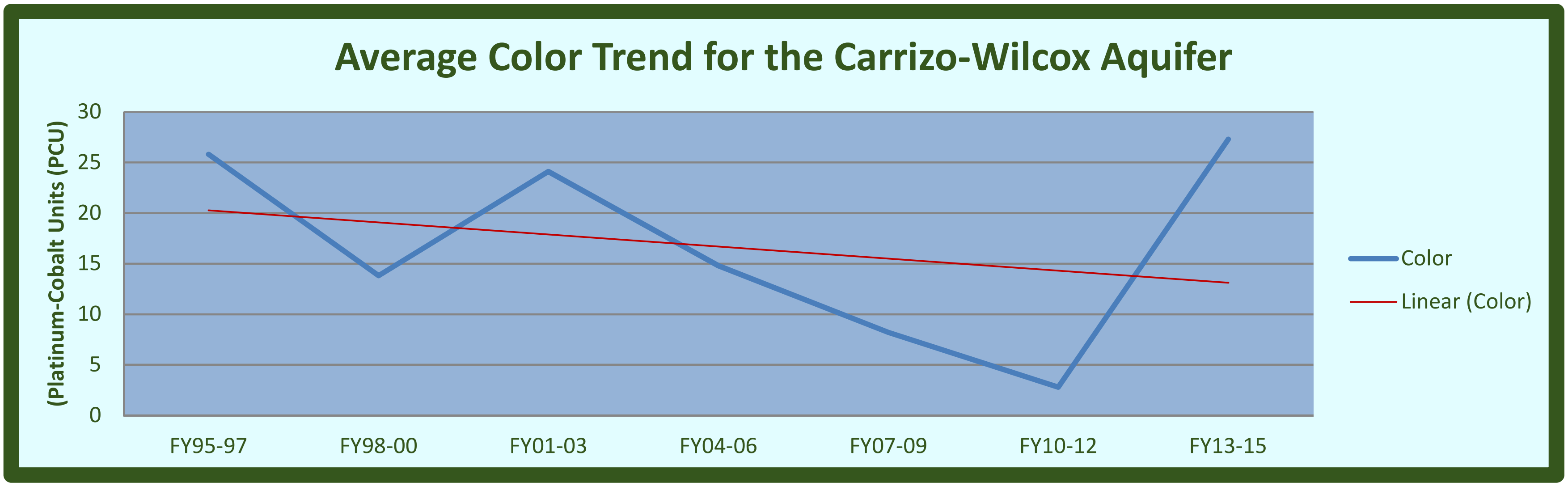

Chart 2-9: Sulfate (SO4) Trend

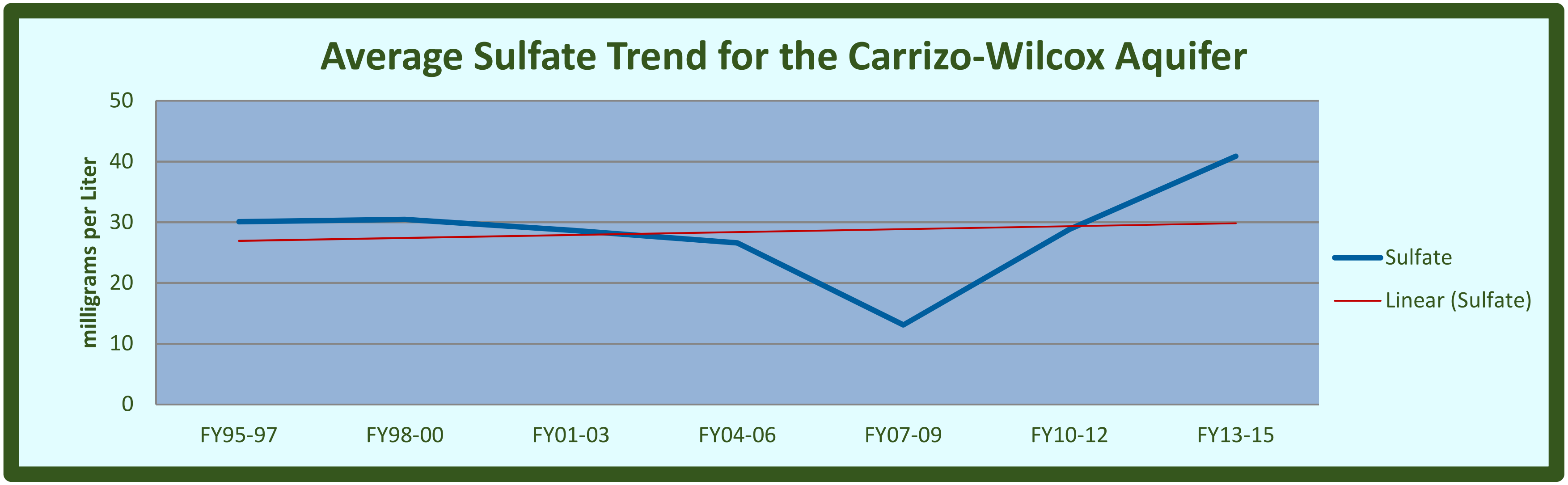

Chart 2-10: Total Dissolved Solids (TDS) Trend

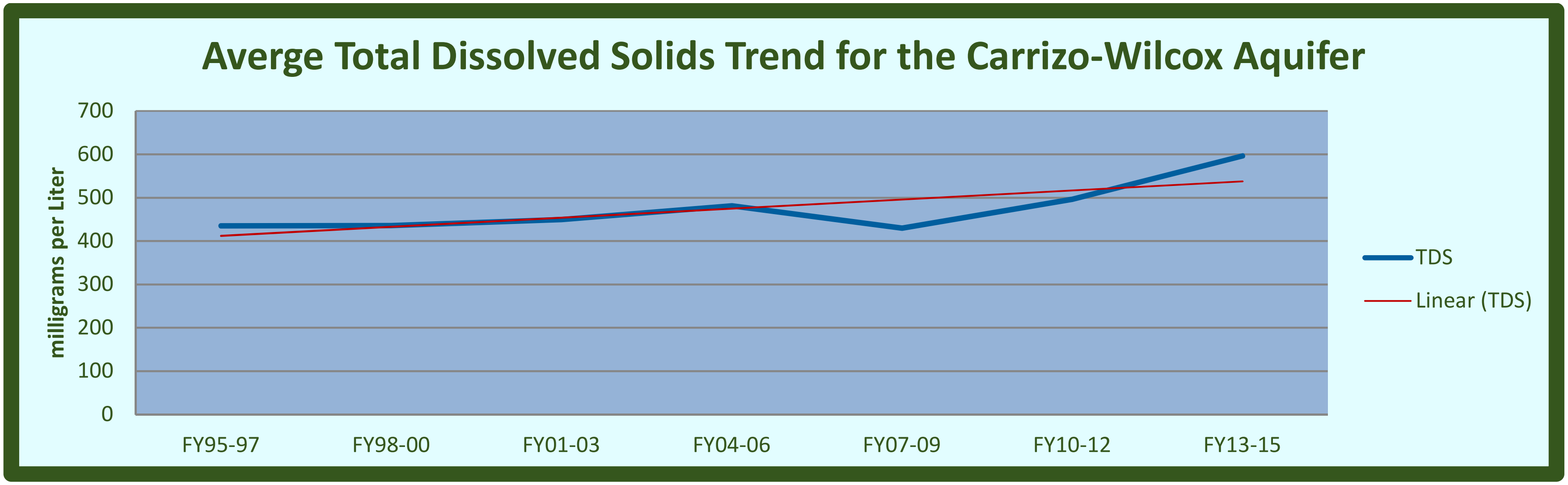

Chart 2-11: Hardness Trend

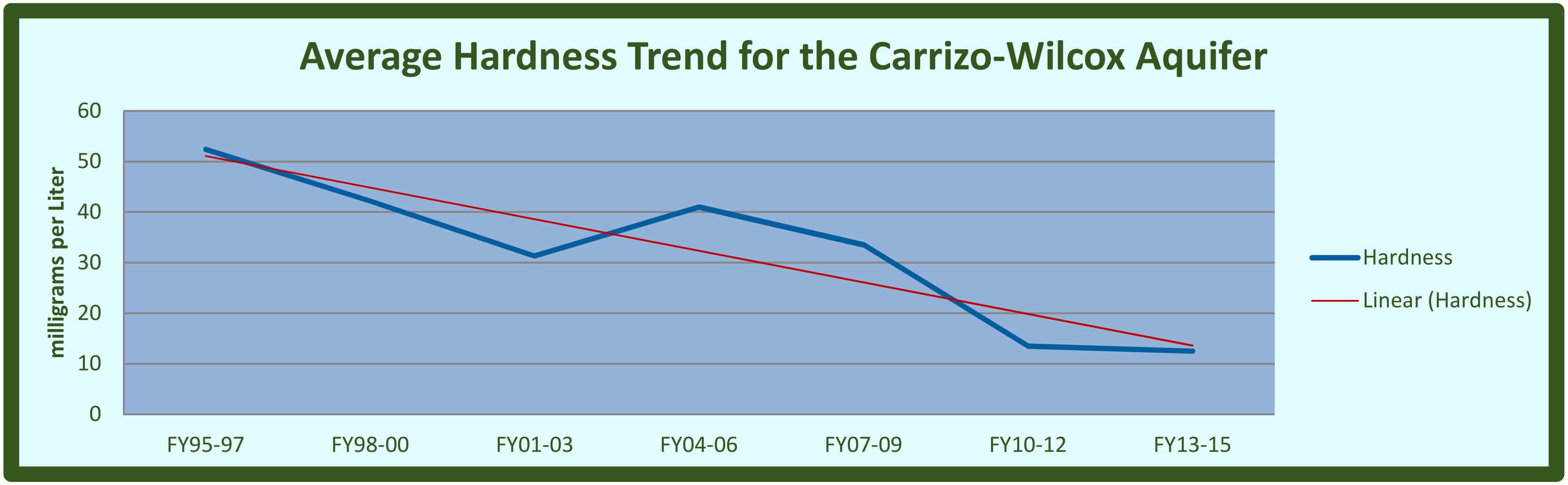

Chart 2-12: Ammonia (NH3) Trend

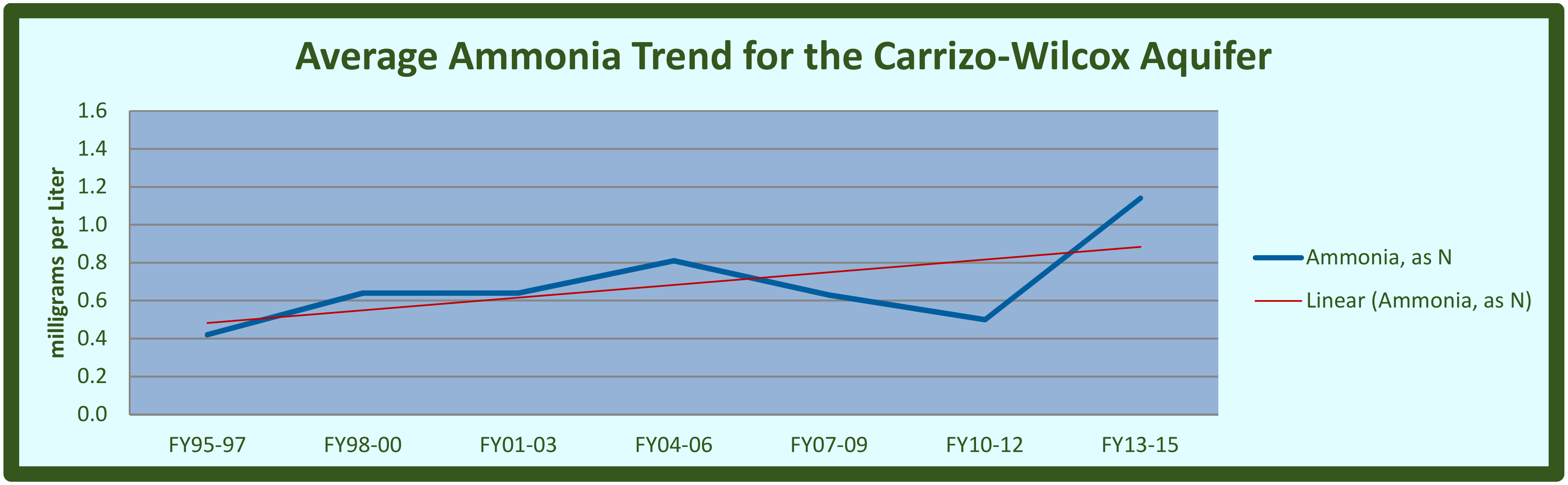

Chart 2-13: Nitrite – Nitrate Trend

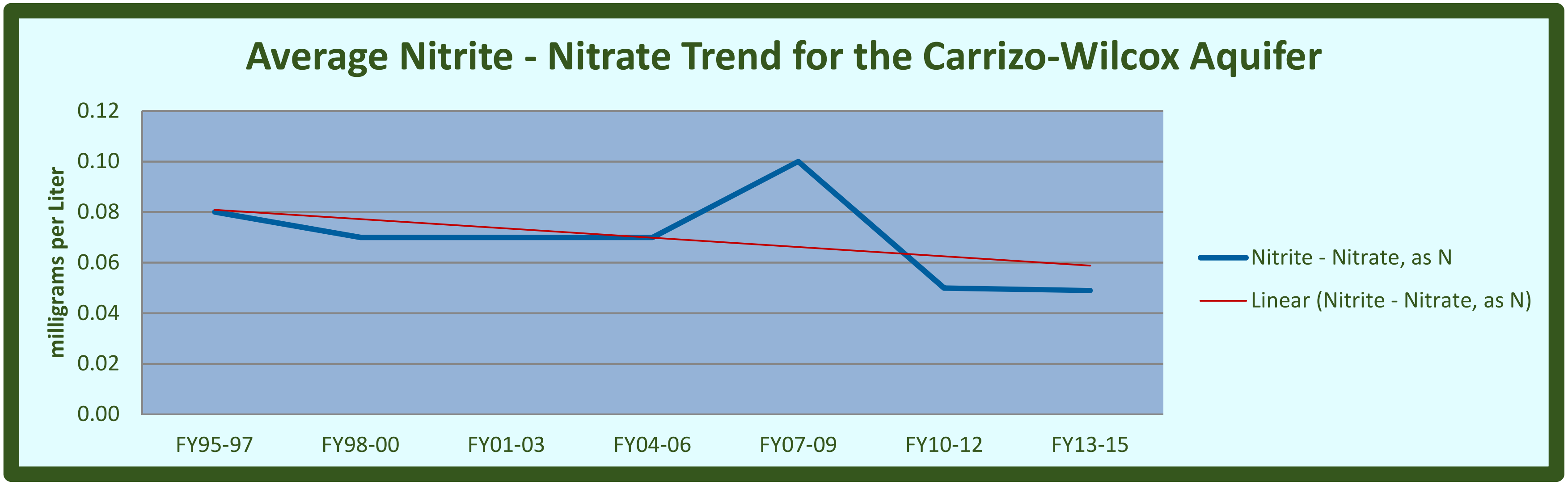

Chart 2-14: TKN Trend

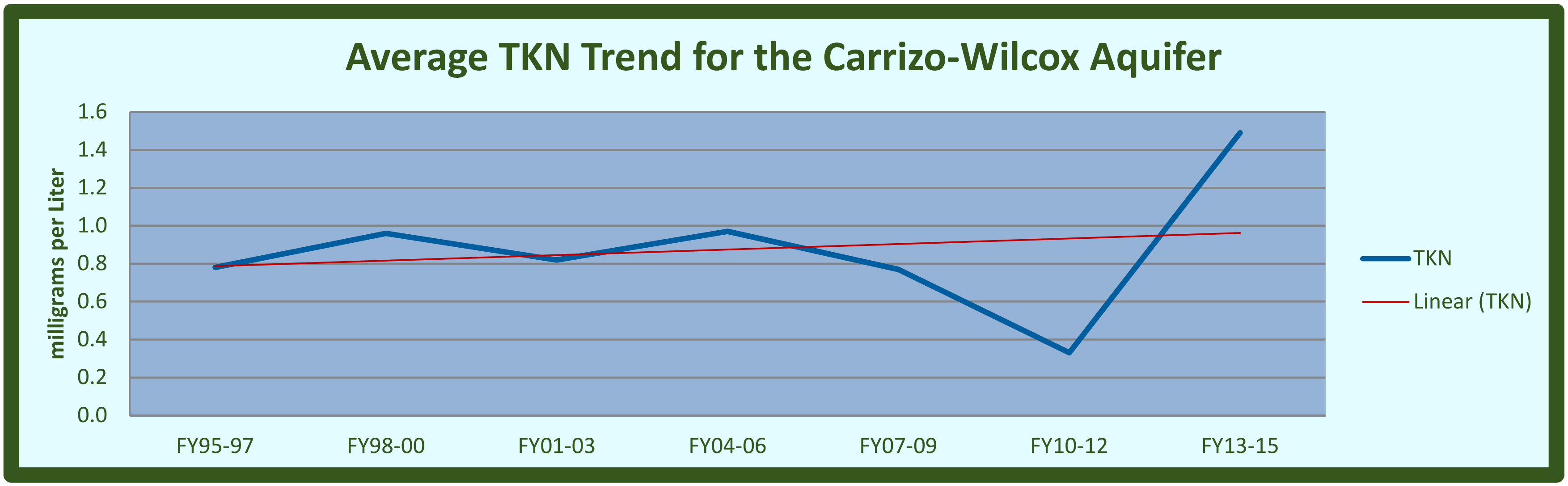

Chart 2-15: Total Phosphorus Trend

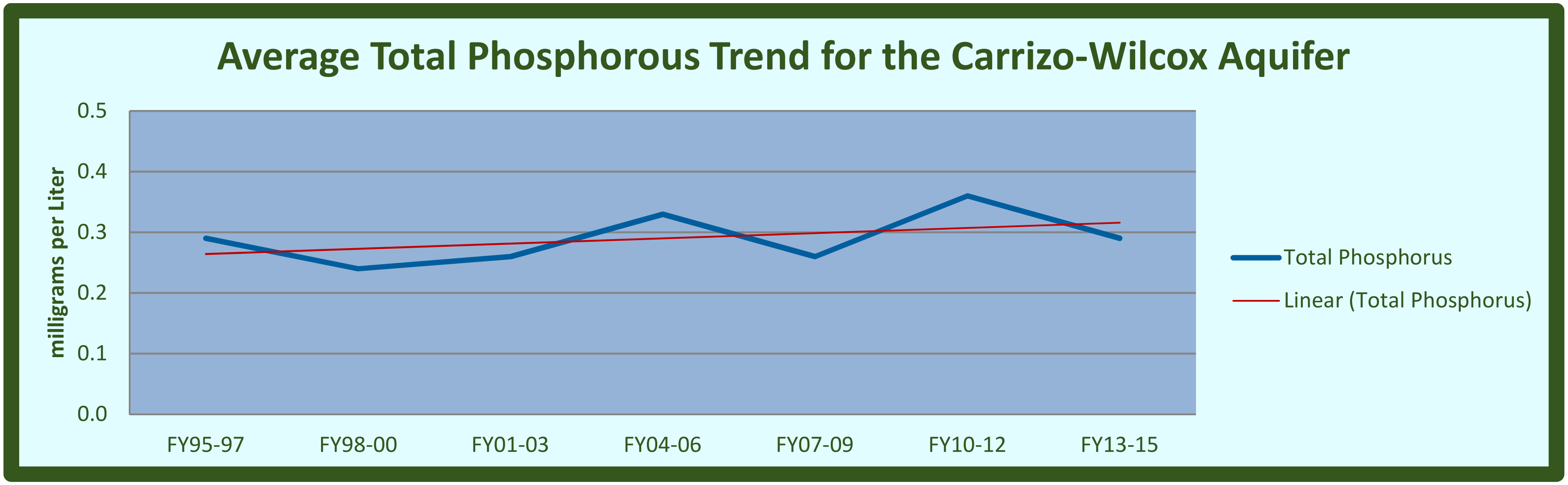

Chart 2-16: Iron Trend