CARRIZO-WILCOX AQUIFER SUMMARY, 2016

AQUIFER SAMPLING AND ASSESSMENT PROGRAM

DEQ
LOUISIANA

APPENDIX 2 TO THE 2018 TRIENNIAL SUMMARY REPORT

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Contents

BACKGROUND 4
GEOLOGY 4
HYDROGEOLOGY 5
PROGRAM PARAMETERS 5
INTERPRETATION OF DATA 6
Field and Conventional Parameters 6
Inorganic Parameters 7
Volatile Organic Compounds 7
Semi-Volatile Organic Compounds 7
Pesticides and PCBs 8
WATER QUALITY TRENDS AND COMPARISON TO HISTORICAL ASSET DATA 8
SUMMARY AND RECOMMENDATIONS 8
Table 2-1: List of Wells Sampled, Carrizo-Wilcox Aquifer–FY 2016 10
Table 2-2: Summary of Field and Conventional Data, Carrizo-Wilcox Aquifer–FY 2016 11
Table 2-3: Summary of Inorganic Data, Carrizo-Wilcox Aquifer–FY 2016 12
Table 2-4: FY 2016 Field and Conventional Statistics, ASSET Wells 13
Table 2-5: FY 2016 Inorganic Statistics, ASSET Wells 13
Table 2-6: Triennial Field and Conventional Statistics, ASSET Wells 14
Table 2-7: Triennial Inorganic Statistics, ASSET Wells 14
Table 2-8: Volatile Organic Compound List 15
Table 2-9: Semi-Volatile Organic Compound List 16
Table 2-10: Pesticide and PCB List 18
Figure 2-1: Location Plat, Carrizo-Wilcox Aquifer 19
Chart 2-1: Temperature Trend 20
Chart 2-2: pH Trend 20
Chart 2-3: Specific Conductance Trend 21
Chart 2-4: Field Salinity Trend 21
Chart 2-5: Chloride Trend 22
Chart 2-6: Total Dissolved Solids Trend 22
Chart 2-7: Alkalinity Trend 23
Chart 2-8: Hardness Trend 23

Chart 2-9: Sulfate Trend....24
Chart 2-10: Color Trend....24
Chart 2-11: Ammonia Trend....25
Chart 2-12: Nitrite - Nitrate Trend....25
Chart 2-13: Total Kjeldahl Nitrogen Trend....26
Chart 2-14: Total Phosphorus Trend....26
Chart 2-15: Barium Trend....27
Chart 2-16: Copper Trend....27
Chart 2-17: Iron Trend....28
Chart 2-18: Zinc Trend....28

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 across the state. The sampling process is designed so that all 14 aquifers 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 an 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 2016 state fiscal year (July 1, 2015 - June 30, 2016). This summary will become Appendix 2 of ASSET Program Triennial Summary Report for 2018.

These data show that from November 2015 through February 2016, nine wells were sampled which produce from the Carrizo-Wilcox aquifer. Three of these nine are classified as public supply, three are classified as domestic, two are classified as industrial, and one as irrigation. The wells are located in five 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 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-630 and DS-5996Z.

In addition to the field, conventional and inorganic analytical parameters, the target analyte list includes three other categories of compounds: volatile organic compounds, semi-volatile organic compounds, 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 2016 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, 2010 and 2013.

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, one-half the DL is used in place of zero when non-detects are encountered. However, the minimum value is reported as < 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.

Charts 2-1 through 2-20 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 eight of the nine wells sampled in the Carrizo-Wilcox aquifer, with a total of 13 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 four wells exceeded the SMCL for total dissolved solids, four wells exceeded the SMCL for pH, two wells exceeded the SMCL for color, 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	8.79 SU
DS-5297Z	8.63 SU
DS-5996Z	8.61 SU (Original and Duplicate)
RR-5070Z	5.77 SU

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

LAB RESULTS (in mg/L)		FIELD MEASURES (in g/L)
BI-236	765 mg/L	0.757 g/L
CD-453	665 mg/L	NOT RECORDED

CD-639	685 mg/L	NOT RECORDED
DS-5297Z	945 mg/L	1.011 g/L

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

BI-236	50 PCU
CD-453	20 PCU

Sulfate (SMCL = 250 mg/L):

DS-5297Z	314.0 mg/L

Inorganic Parameters

Table 2-3 shows the inorganic 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 inorganics.

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):

BO-274	2530 µg/L
CD-630	3890 µg/L (Duplicate 3820 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.

Analytical results for well CD-630, an irrigation well, reported a concentration of toluene at 0.67 µg/L, which is below the MCL of 1.0 µg/L for this compound.

There were no other confirmed detections of a VOC at or above its detection limit during the FY 2016 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 2016 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.

The pesticide beta-Endosulfan, which has no MCL established for it, was reported at its detection limit of 0.2 µg/L in domestic wells DS-5297Z and DS-5996Z.

There were no other confirmed detections of a pesticide or PCB at or above its detection limit during the FY 2016 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. These comparisons can be found in Tables 2-6 and 2-7, and in Charts 2-1 to 2-18 of this summary. Increasing or decreasing trend statements made here are based on an R-square value (slope) of 0.03 or greater. An R-square value of less than 0.03 is considered to have only a slight or no change.

Over the 21-year period, nine analytes have shown a general increase in their average concentrations. These analytes are: pH, specific conductance (field and lab), salinity, chloride, total dissolved solids (field and lab), alkalinity, sulfate, total phosphorus, and zinc. For this same time period, five analytes have demonstrated a decrease in their average concentrations: temperature, hardness, color, copper, and iron. All other analytes have demonstrated only slight change or have remained consistent for this time period.

The current number of wells with SMCL exceedances and the total number of exceedances have decreased from the previous sampling event in FY 2013. Current sample results show that eight wells reported one or more SMCL exceedance with a total of 13 SMCL exceedances. The FY 2013 sampling of the Carrizo-Wilcox aquifer shows that 11 wells reported one or more SMCL exceedance with a total of 21 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 2016 monitoring of the Carrizo-Wilcox aquifer exceeded an MCL. The data also show that this aquifer is of good quality when

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

considering taste, odor or appearance guidelines, with 13 SMCLs exceeded in eight of the nine wells monitored.

Comparison to ASSET derived historical data, current data show some change in the quality or characteristics of the Carrizo-Wilcox aquifer, with nine parameters showing consistent increases in average concentration, five parameters decreasing in average concentration, and the remaining parameters showing no consistent change.

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 nine currently in place to increase the well density for this aquifer.

Table 2-1: List of Wells Sampled, Carrizo-Wilcox Aquifer–FY 2016

Well ID	Parish	Date	Owner	Depth (Feet)	Well Use
BI-236	Bienville	2/18/2016	Alberta Water System	410	Public Supply
BO-274	Bossier	1/20/2016	Village Water System	395	Public Supply
CD-453	Caddo	1/20/2016	City of Vivian	228	Public Supply
CD-630	Caddo	1/19/2016	Private Owner	240	Irrigation
CD-639	Caddo	1/19/2016	SI Precast	200	Industrial
CD-642	Caddo	1/19/2016	Louisiana Lift	210	Industrial
DS-5297Z	De Soto	11/9/2015	Private Owner	170	Domestic
DS-5996Z	De Soto	11/9/2015	Private Owner	360	Domestic
RR-5070Z	Red River	2/16/2016	Private Owner	105	Domestic

Table 2-2: Summary of Field and Conventional Data, Carrizo-Wilcox Aquifer–FY 2016

Well ID	pH SU	Sal ppt	Sp Cond mmhos/cm	Temp Deg C	TDS g/L	Alk mg/L	Cl mg/L	Color PCU	Hard mg/L	Nitrite-Nitrate (as N) mg/L	NH3 mg/L	Tot P mg/L	Sp Cond µmhos/cm	SO4 mg/L	TDS mg/L	TKN mg/L	TSS mg/L	Turb NTU
	Laboratory Reporting Limits →					2	1	5	5	0.05	0.1	0.05	1	1	10	0.1	4	0.5
	Field Parameters					Laboratory Parameters												
BI-236	8.79	0.58	1.164	20.69	0.757	618	28.8	50	< DL	< DL	0.57	0.90	1250	< DL	765	0.88	< DL	2.20
BO-274	FIELD PARAMETERS NOT RECORDED					124	19.6	15	64	< DL	< DL	0.49	270	5.4	260	0.32	< DL	4.60
CD-453						303	160.0	20	30	< DL	0.65	0.40	1020	33.4	665	1.20	< DL	0.33
CD-630						191	19.6	10	14	< DL	< DL	0.16	406	3.1	330	0.40	7	49.40
CD-630*						202	18.5	10	150	< DL	< DL	0.17	409	3.7	320	0.35	8	44.20
CD-639						326	179.0	< DL	24	< DL	0.57	0.20	1090	< DL	685	1.10	10	6.50
CD-642						180	29.2	5	10	< DL	0.34	0.10	484	2.8	355	0.87	< DL	0.44
DS-5297Z	8.63	0.79	1.555	17.67	1.011	146	108.0	10	10	0.24	0.21	0.10	1410	314.0	945	1.60	< DL	0.62
DS-5996Z	8.61	0.37	0.758	18.69	0.493	371	22.5	15	10	0.11	0.84	0.23	703	27.9	475	1.10	< DL	0.68
DS-5996Z*	8.61	0.37	0.758	18.69	0.493	348	23.5	10	14	0.29	0.42	0.18	664	29.0	450	1.00	< DL	0.69
RR-5070Z	5.77	0.23	0.476	16.45	0.310	16	122.0	5	72	0.44	< DL	< DL	454	4.5	370	0.20	< DL	1.80

*Denotes Duplicate Sample   Shaded cells exceed EPA Secondary Standards

Table 2-3: Summary of Inorganic Data, Carrizo-Wilcox Aquifer–FY 2016

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 Reporting Limits	1	1	1	0.5	1	1	3	50	1	0.2	1	1	0.5	0.5	5
BI-236	< DL	< DL	11.0	< DL	< DL	< DL	< DL	< DL	< DL	< DL	< DL	< DL	< DL	< DL	< DL
BO-274	< DL	< DL	80.7	< DL	< DL	< DL	< DL	2530	< DL	< DL	< DL	< DL	< DL	< DL	9
CD-453	< DL	< DL	32.3	< DL	< DL	< DL	< DL	< DL	< DL	< DL	< DL	< DL	< DL	< DL	< DL
CD-630	< DL	< DL	182.0	< DL	< DL	< DL	< DL	3890	1.4	< DL	< DL	< DL	< DL	< DL	1850
CD-630*	< DL	< DL	179.0	< DL	< DL	< DL	< DL	3820	1.3	< DL	< DL	< DL	< DL	< DL	1840
CD-639	< DL	< DL	40.1	< DL	< DL	< DL	3.7	282	< DL	< DL	< DL	< DL	< DL	< DL	< DL
CD-642	< DL	< DL	21.1	< DL	< DL	< DL	< DL	< DL	< DL	< DL	< DL	< DL	< DL	< DL	6
DS-5297Z	< DL	< DL	43.9	< DL	< DL	< DL	< DL	< DL	< DL	< DL	< DL	< DL	< DL	< DL	< DL
DS-5996Z	< DL	< DL	36.2	< DL	< DL	< DL	< DL	< DL	< DL	< DL	< DL	< DL	< DL	< DL	< DL
DS-5996Z*	< DL	< DL	38.4	< DL	< DL	< DL	< DL	< DL	< DL	< DL	< DL	< DL	< DL	< DL	< DL
RR-5070Z	< DL	< DL	173.0	0.7	< DL	1.1	7.9	253	3.7	< DL	5.8	< DL	< DL	< DL	33

*Denotes Duplicate Sample. Shaded cells exceed EPA Secondary Standards.

Table 2-4: FY 2016 Field and Conventional Statistics, ASSET Wells

	PARAMETER	MINIMUM	MAXIMUM	AVERAGE
FIELD	pH (SU)	5.77	8.79	8.08
FIELD	Salinity (ppt)	0.23	0.79	0.47
FIELD	Specific Conductance (mmhos/cm)	0.476	1.555	0.942
FIELD	Temperature (^{O}C)	16.45	20.69	18.44
FIELD	Total Dissolved Solids (g/L)	0.310	1.011	0.613
LABORATORY	Alkalinity (mg/L)	16	618	257
LABORATORY	Chloride (mg/L)	18.5	179.0	66.4
LABORATORY	Color (PCU)	< DL	50	14
LABORATORY	Hardness (mg/L)	< DL	150	36
LABORATORY	Nitrite - Nitrate, as N (mg/L)	< DL	0.44	0.11
LABORATORY	Ammonia, as N (mg/L)	< DL	0.84	0.35
LABORATORY	Total Phosphorus (mg/L)	< DL	0.90	0.27
LABORATORY	Specific Conductance (µmhos/cm)	270	1410	742
LABORATORY	Sulfate (mg/L)	< DL	314.0	38.6
LABORATORY	Total Dissolved Solids (mg/L)	250	945	511
LABORATORY	Total Kjeldahl Nitrogen (mg/L)	0.20	1.60	0.82
LABORATORY	Total Suspended Solids (mg/L)	< DL	10	3.7
LABORATORY	Turbidity (NTU)	< DL	49.40	10.10

Table 2-5: FY 2016 Inorganic Statistics, ASSET Wells

PARAMETER	MINIMUM	MAXIMUM	AVERAGE
Antimony (µg/L)	< DL	< DL	< DL
Arsenic (µg/L)	< DL	< DL	< DL
Barium (µg/L)	11.0	182.0	76.2
Beryllium (µg/L)	< DL	0.7	< DL
Cadmium (µg/L)	< DL	< DL	< DL
Chromium (µg/L)	< DL	1.1	< DL
Copper (µg/L)	< DL	7.9	< DL
Iron (µg/L)	< DL	3890	993
Lead (µg/L)	< DL	3.7	1.0
Mercury (µg/L)	< DL	< DL	< DL
Nickel (µg/L)	< DL	5.8	< DL
Selenium (µg/L)	< DL	< DL	< DL
Silver (µg/L)	< DL	< DL	< DL
Thallium (µg/L)	< DL	< DL	< DL
Zinc (µg/L)	< DL	1850	341

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	FY 2016
FIELD	pH (SU)	7.53	7.65	7.87	7.75	8.31	8.17	8.25	8.08
	Salinity (ppt)	0.35	0.36	0.40	0.39	0.36	0.41	0.48	0.47
	Specific Conductance (mmhos/cm)	0.676	0.732	0.808	0.800	0.740	0.816	0.965	0.942
	Temperature (^{O}C)	21.44	21.30	21.98	21.39	21.83	20.29	18.92	18.44
	Total Dissolved Solids (g/L)	-	-	-	0.520	0.480	0.530	0.630	0.613
LABORATORY	Alkalinity (mg/L)	267.2	251.5	249.4	273.5	283.4	295.3	322.0	257
	Chloride (mg/L)	59.2	71.6	69.7	66.5	66.4	77.21	91.7	66.4
	Color (PCU)	26	14	24	15	8	3	27	14
	Hardness (mg/L)	52	42	31	41	34	14	12	36
	Nitrite - Nitrate, as N (mg/L)	0.08	0.07	0.07	0.07	0.10	0.05	0.05	0.11
	Ammonia, as N (mg/L)	0.42	0.64	0.64	0.81	0.63	< DL	1.14	0.35
	Total Phosphorus (mg/L)	0.29	0.24	0.26	0.33	0.26	0.36	0.29	0.27
	Specific Conductance (µmhos/cm)	726	772	748	800	739	800	959	742
	Sulfate (mg/L)	30.1	30.5	28.7	26.6	13.1	28.9	40.9	38.6
	Total Dissolved Solids (mg/L)	435	436	450	481	430	497	596	511
	Total Kjeldahl Nitrogen (mg/L)	0.78	0.96	0.82	0.97	0.77	0.33	1.49	0.82
	Total Suspended Solids (mg/L)	< DL	4.9	< DL	< DL	< DL	4.7	30.9	3.7
	Turbidity (NTU)	2.60	5.20	2.30	1.60	1.90	2.90	2.12	10.10

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	FY 2016
Antimony (µg/L)	< DL	< DL	< DL	< DL	< DL	< DL	< DL	< DL
Arsenic (µg/L)	5.13	< DL	< DL	< DL	< DL	< DL	< DL	< DL
Barium (µg/L)	51.9	75	69.5	77.8	70.2	53.2	56.9	76.2
Beryllium (µg/L)	< DL	< DL	< DL	< DL	< DL	< DL	< DL	< DL
Cadmium (µg/L)	< DL	< DL	< DL	< DL	< DL	< DL	< DL	< DL
Chromium (µg/L)	< DL	< DL	< DL	< DL	< DL	< DL	< DL	< DL
Copper (µg/L)	31. 6	24.7	6.9	5.7	3.1	4.5	3.1	< DL
Iron (µg/L)	1522	1897	1353	1897	132	507	216	993
Lead (µg/L)	< DL	< DL	< DL	10.2	< DL	< DL	< DL	1.0
Mercury (µg/L)	< DL	< DL	< DL	< DL	< DL	< DL	< DL	< DL
Nickel (µg/L)	13.1	< DL	12.8	5.2	< DL	< DL	< DL	< DL
Selenium (µg/L)	< DL	< DL	< DL	< DL	< DL	< DL	< DL	< DL
Silver (µg/L)	< DL	1.1	15.8	< DL	< DL	< DL	< DL	< DL
Thallium (µg/L)	< DL	< DL	< DL	< DL	< DL	< DL	< DL	< DL
Zinc (µg/L)	34	164	60	135	22	39	7	341

Table 2-8: Volatile Organic Compound List

VOC ANAYTICAL PARAMETERS	METHOD	REPORTING LIMIT (µg/L)
1,1,1-TRICHLOROETHANE	624	0.50
1,1,2,2-TETRACHLOROETHANE	624	0.50
1,1,2-TRICHLOROETHANE	624	0.50
1,1-DICHLOROETHANE	624	0.50
1,1-DICHLOROETHENE	624	0.50
1,2-DICHLOROBENZENE	624	0.50
1,2-DICHLOROETHANE	624	0.50
1,2-DICHLOROPROPANE	624	0.50
1,3-DICHLOROBENZENE	624	0.50
1,4-DICHLOROBENZENE	624	0.50
BENZENE	624	0.50
BROMODICHLOROMETHANE	624	0.50
BROMOFORM	624	0.50
BROMOMETHANE	624	1.0
CARBON TETRACHLORIDE	624	0.50
CHLOROBENZENE	624	0.50
CHLOROETHANE	624	0.50
CHLOROFORM	624	0.50
CHLOROMETHANE	624	1.0
CIS-1,3-DICHLOROPROPENE	624	1.0
DIBROMOCHLOROMETHANE	624	0.50
ETHYL BENZENE	624	0.50
METHYLENE CHLORIDE	624	1.0
O-XYLENE (1,2-DIMETHYLBENZENE)	624	0.50
STYRENE	624	0.50
TERT-BUTYL METHYL ETHER	624	0.50
TETRACHLOROETHYLENE (PCE)	624	0.50
TOLUENE	624	0.50
TRANS-1,2-DICHLOROETHENE	624	0.50
TRANS-1,3-DICHLOROPROPENE	624	0.50
TRICHLOROETHYLENE (TCE)	624	0.50
TRICHLOROFLUOROMETHANE (FREON-11)	624	0.50
VINYL CHLORIDE	624	0.50
XYLENES, M & P	624	1.0

Table 2-9: Semi-Volatile Organic Compound List

SVOC ANAYTICAL PARAMETERS	METHOD	REPORTING LIMIT (µg/L)
1,2,4-TRICHLOROBENZENE	625	5.0
2,4,6-TRICHLOROPHENOL	625	5.0
2,4-DICHLOROPHENOL	625	5.0
2,4-DIMETHYLPHENOL	625	5.0
2,4-DINITROPHENOL	625	20.0
2,4-DINITROTOLUENE	625	5.0
2,6-DINITROTOLUENE	625	5.0
2-CHLORONAPHTHALENE	625	5.0
2-CHLOROPHENOL	625	5.0
2-NITROPHENOL	625	5.0
3,3'-DICHLOROBENZIDINE	625	5.0
4,6-DINITRO-2-METHYLPHENOL	625	10.0
4-BROMOPHENYL PHENYL ETHER	625	5.0
4-CHLORO-3-METHYLPHENOL	625	5.0
4-CHLOROPHENYL PHENYL ETHER	625	5.0
4-NITROPHENOL	625	20.0
ACENAPHTHENE	625	0.20
ACENAPHTHYLENE	625	0.20
ANTHRACENE	625	0.20
BENZIDINE	625	20.0
BENZO(A)ANTHRACENE	625	0.20
BENZO(A)PYRENE	625	0.20
BENZO(B)FLUORANTHENE	625	0.20
BENZO(G,H,I)PERYLENE	625	0.20
BENZO(K)FLUORANTHENE	625	0.20
BENZYL BUTYL PHTHALATE	625	5.0
BIS(2-CHLOROETHOXY) METHANE	625	5.0
BIS(2-CHLOROETHYL) ETHER (2-CHLOROETHYL ETHER)	625	5.0
BIS(2-ETHYLHEXYL) PHTHALATE	625	5.0
CHRYSENE	625	0.20
DIBENZ(A,H)ANTHRACENE	625	0.20
DIETHYL PHTHALATE	625	5.0
DIMETHYL PHTHALATE	625	5.0
DI-N-BUTYL PHTHALATE	625	5.0
DI-N-OCTYLPHTHALATE	625	5.0
FLUORANTHENE	625	0.20
FLUORENE	625	0.20
HEXACHLOROBENZENE	625	5.0

SVOC ANAYTICAL PARAMETERS	METHOD	REPORTING LIMIT (µg/L)
HEXACHLOROBUTADIENE	625	5.0
HEXACHLOROCYCLOPENTADIENE	625	10.0
HEXACHLOROETHANE	625	5.0
INDENO(1,2,3-C,D)PYRENE	625	0.20
ISOPHORONE	625	5.0
NAPHTHALENE	625	0.20
NITROBENZENE	625	5.0
N-NITROSODIMETHYLAMINE	625	5.0
N-NITROSODI-N-PROPYLAMINE	625	5.0
N-NITROSODIPHENYLAMINE	625	5.0
PENTACHLOROPHENOL	625	5.00
PHENANTHRENE	625	0.20
PHENOL	625	5.0
PYRENE	625	0.20

Table 2-10: Pesticide and PCB List

Pest/PCB Analytical Parameters	METHOD	REPORTING LIMIT (µg/L)
ALDRIN	608	0.025
ALPHA BHC (ALPHA HEXACHLOROCYCLOHEXANE)	608	0.025
ALPHA ENDOSULFAN	608	0.025
ALPHA-CHLORDANE	608	0.025
BETA BHC (BETA HEXACHLOROCYCLOHEXANE)	608	0.025
BETA ENDOSULFAN	608	0.025
CHLORDANE	608	0.20
DELTA BHC (DELTA HEXACHLOROCYCLOHEXANE)	608	0.025
DIELDRIN	608	0.025
ENDOSULFAN SULFATE	608	0.025
ENDRIN	608	0.025
ENDRIN ALDEHYDE	608	0.025
ENDRIN KETONE	608	0.025
GAMMA-CHLORDANE	608	0.025
HEPTACHLOR	608	0.025
HEPTACHLOR EPOXIDE	608	0.025
METHOXYCHLOR	608	0.25
P,P'-DDD	608	0.025
P,P'-DDE	608	0.025
P,P'-DDT	608	0.025
PCB-1016 (AROCHLOR 1016)	608	0.80
PCB-1221 (AROCHLOR 1221)	608	0.80
PCB-1232 (AROCHLOR 1232)	608	0.80
PCB-1242 (AROCHLOR 1242)	608	0.80
PCB-1248 (AROCHLOR 1248)	608	0.80
PCB-1254 (AROCHLOR 1254)	608	0.80
PCB-1260 (AROCHLOR 1260)	608	0.80
TOXAPHENE	608	1.0

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

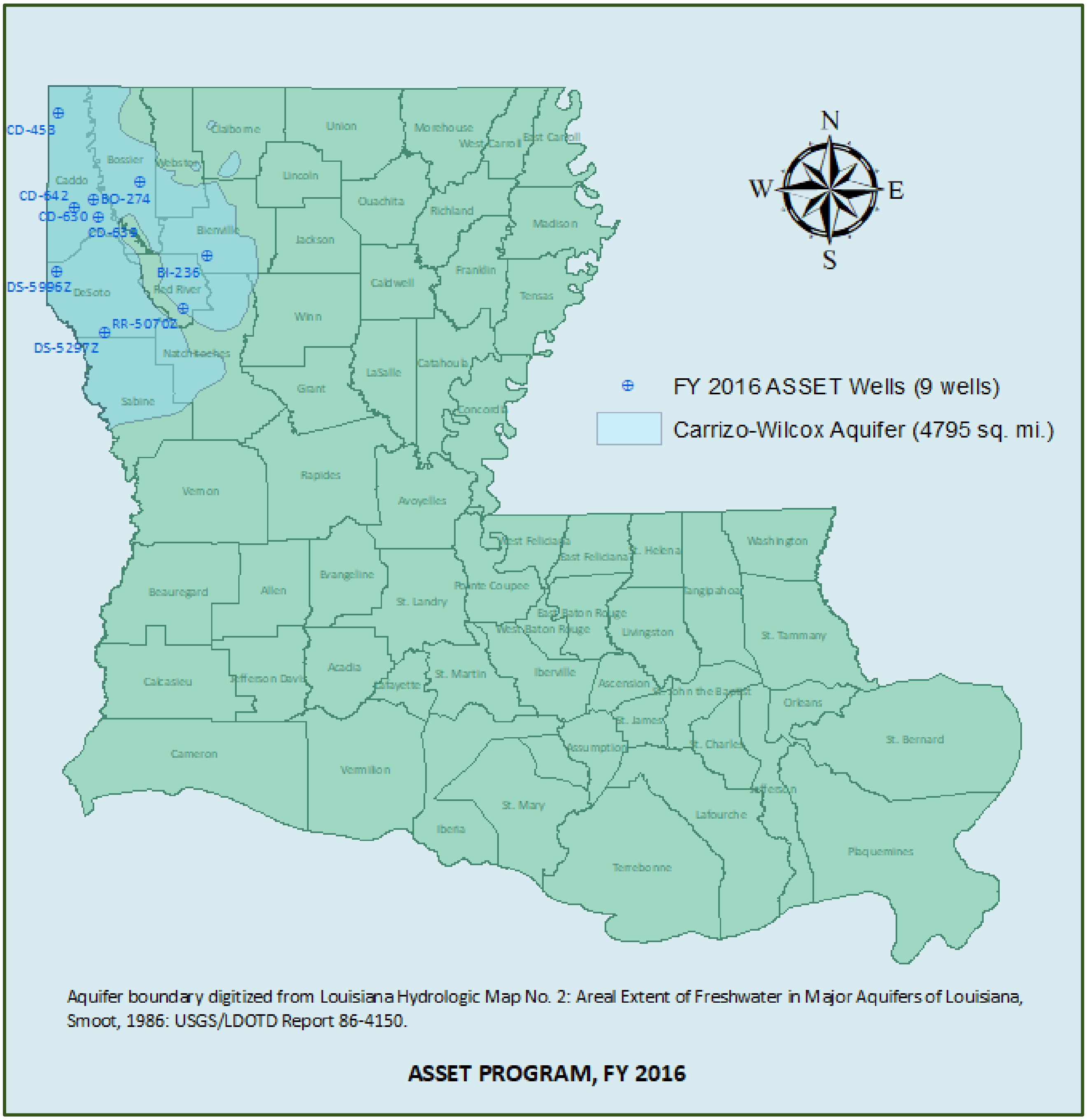

Chart 2-1: Temperature Trend

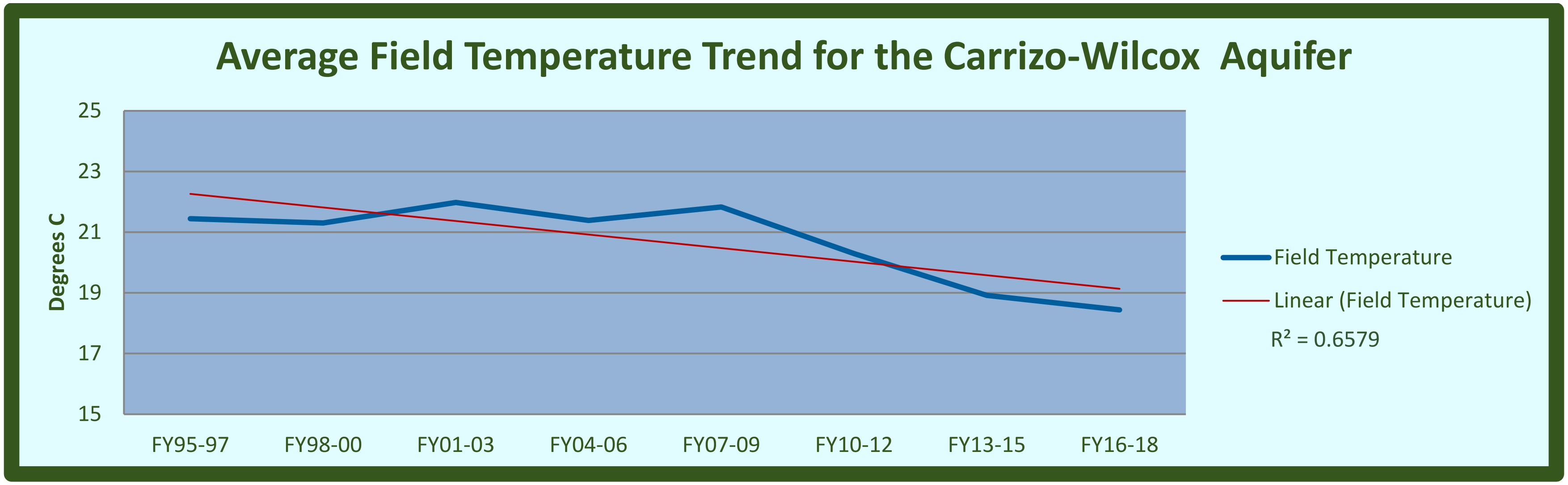

Chart 2-2: pH Trend

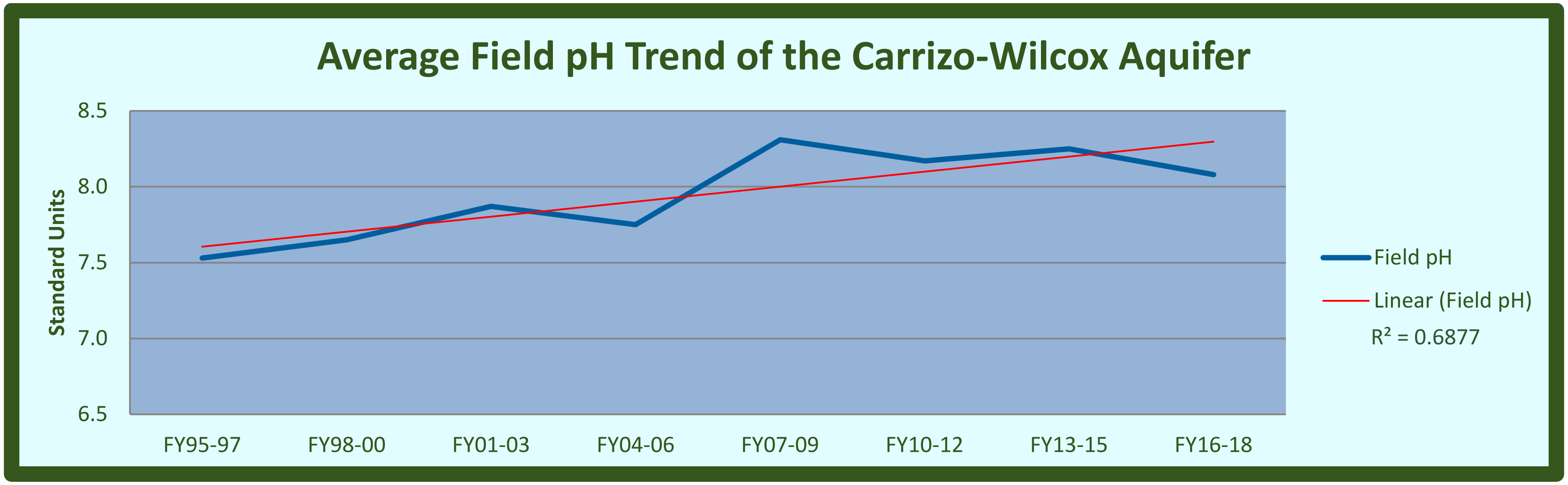

Chart 2-3: Specific Conductance Trend

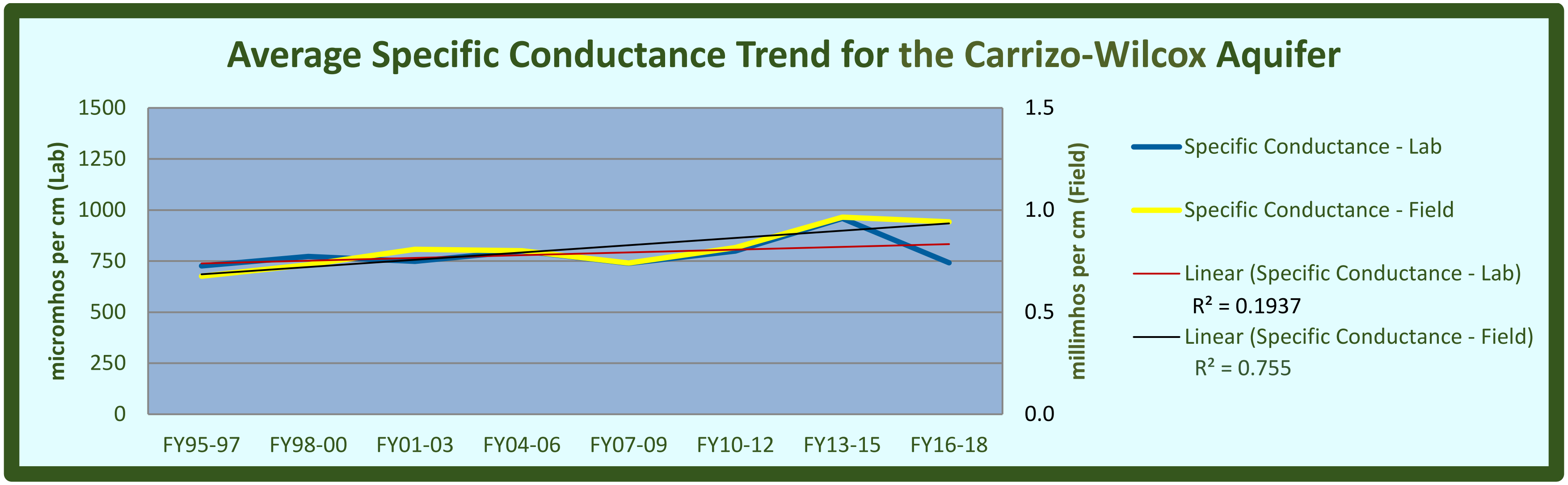

Chart 2-4: Field Salinity Trend

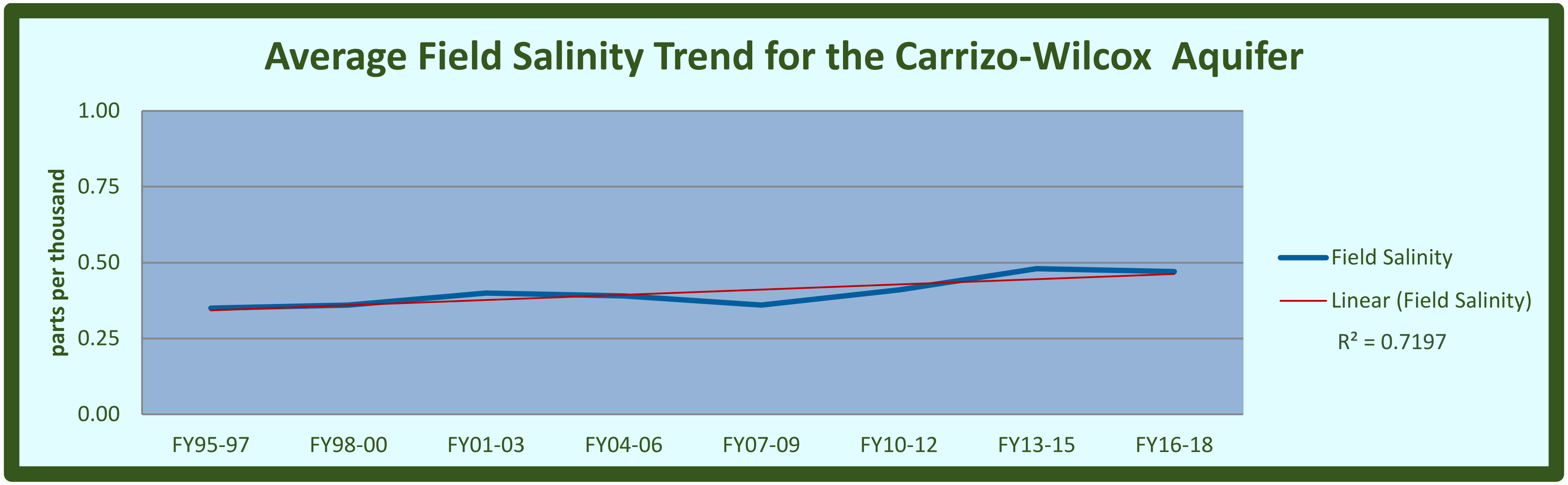

Chart 2-5: Chloride Trend

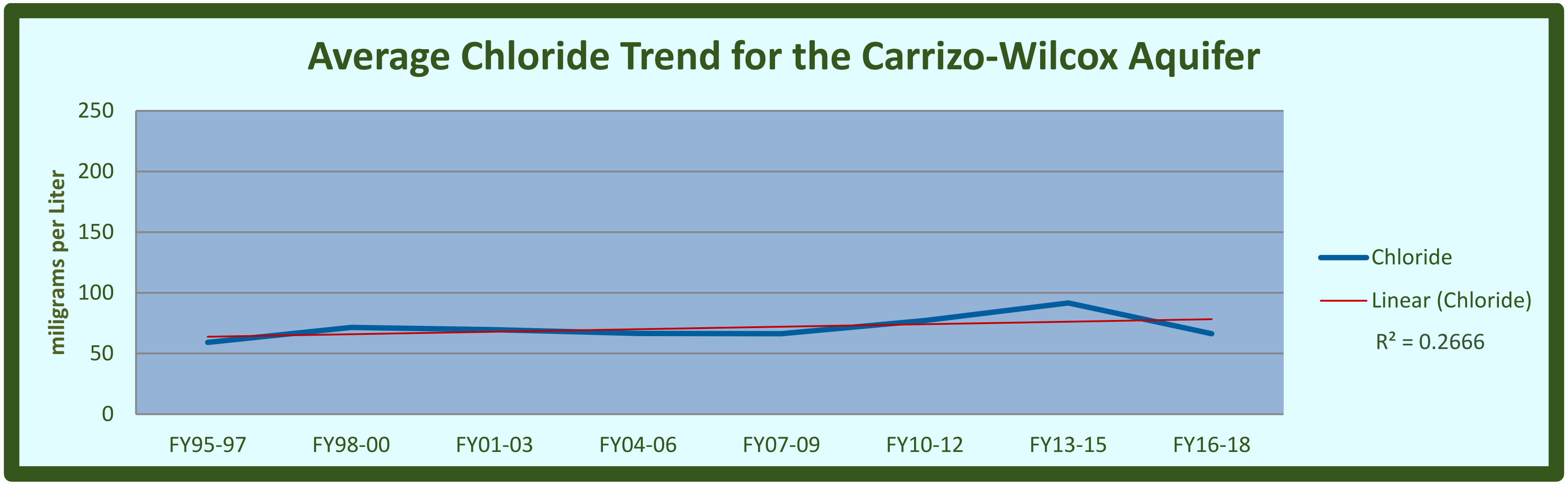

Chart 2-6: Total Dissolved Solids Trend

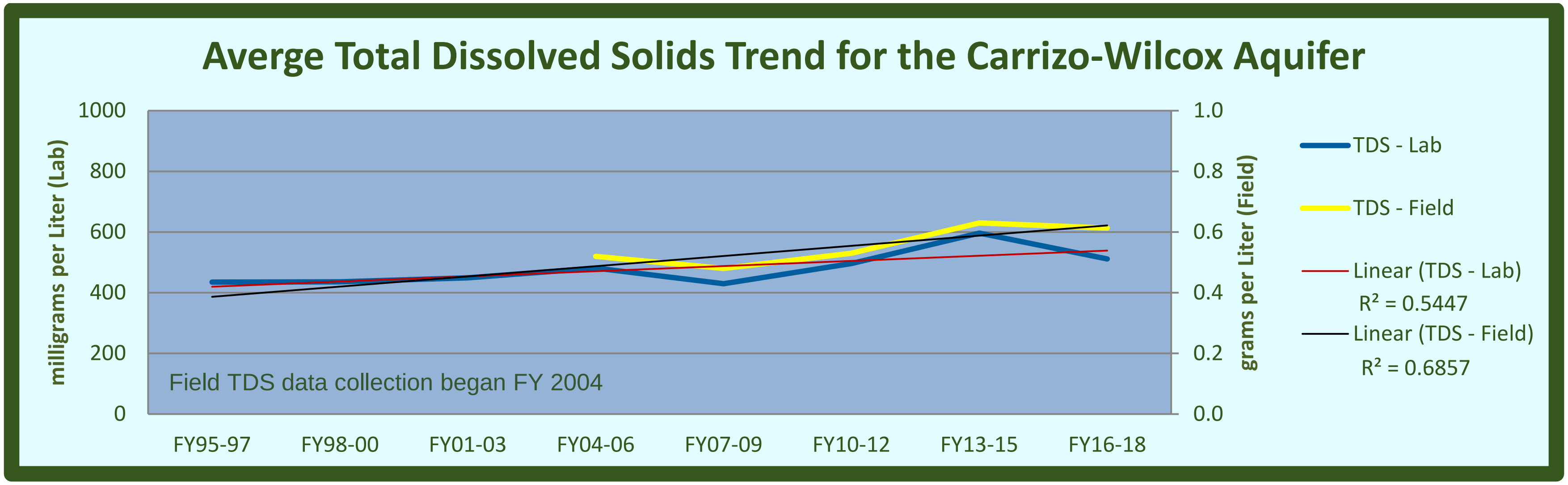

Chart 2-7: Alkalinity Trend

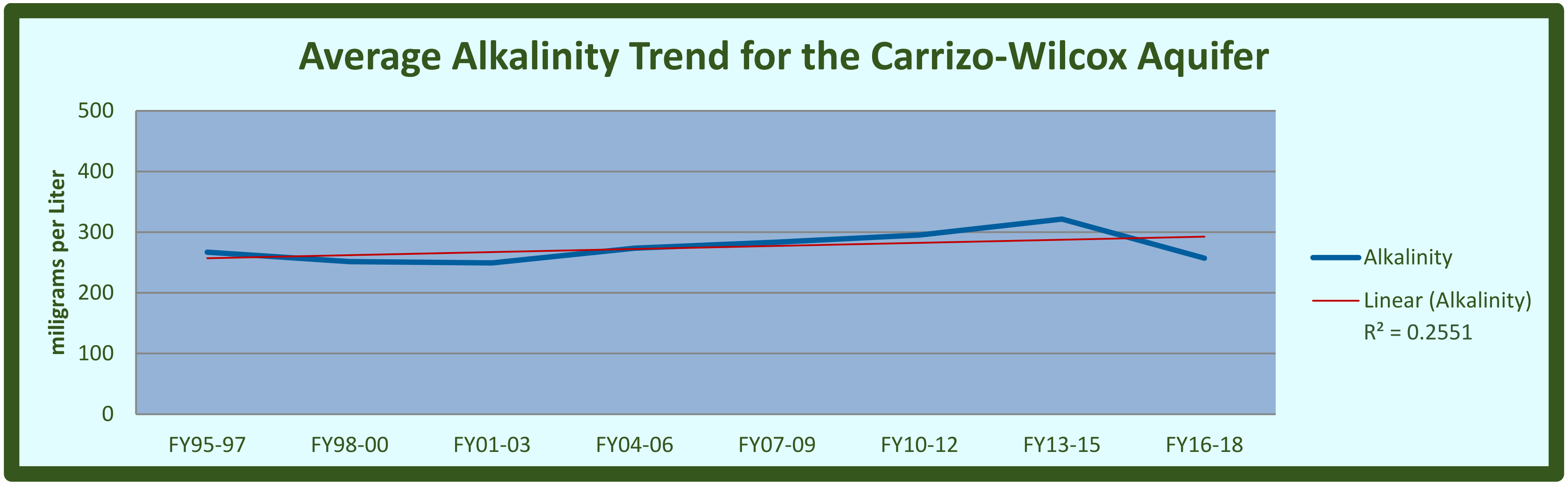

Chart 2-8: Hardness Trend

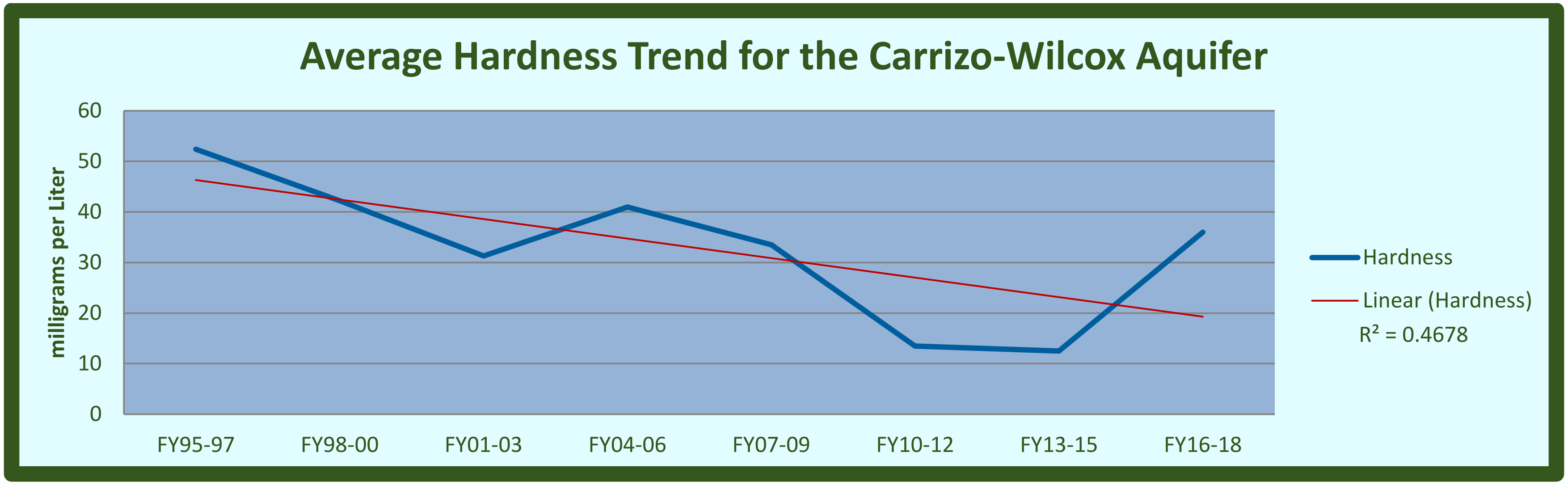

Chart 2-9: Sulfate Trend

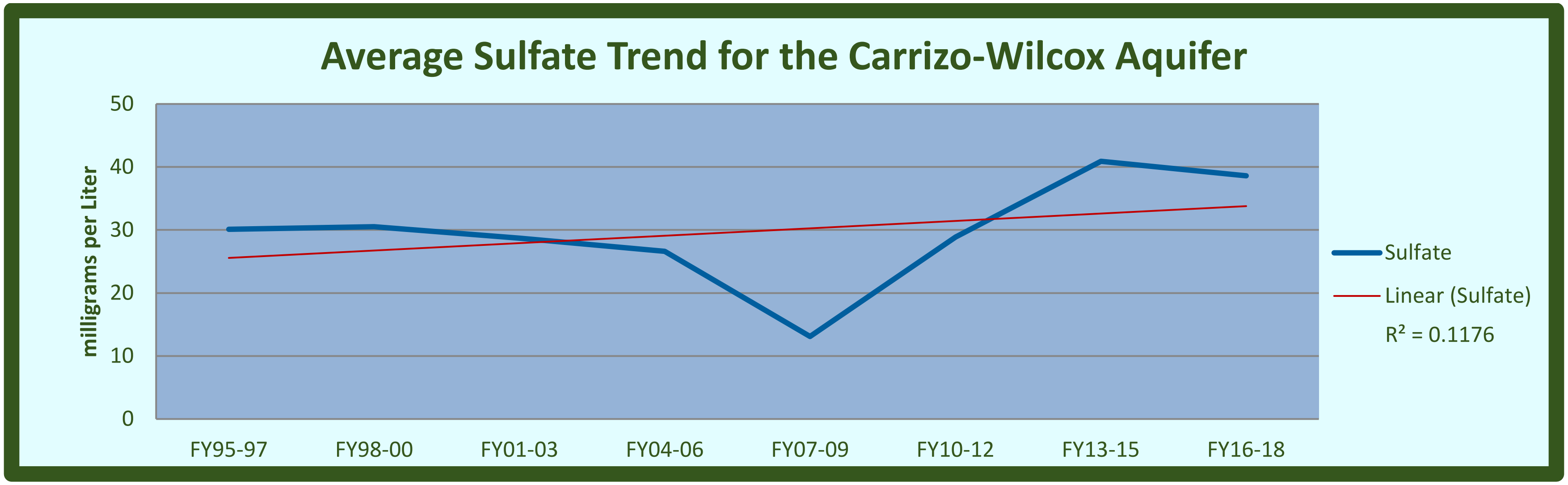

Chart 2-10: Color Trend

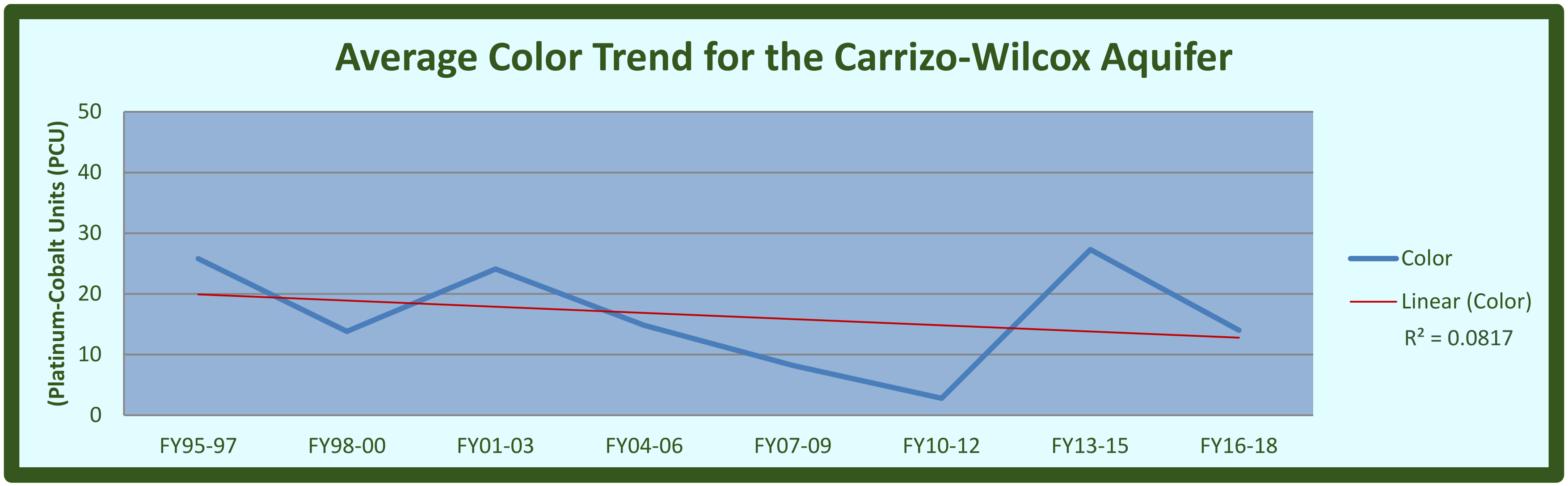

Chart 2-11: Ammonia Trend

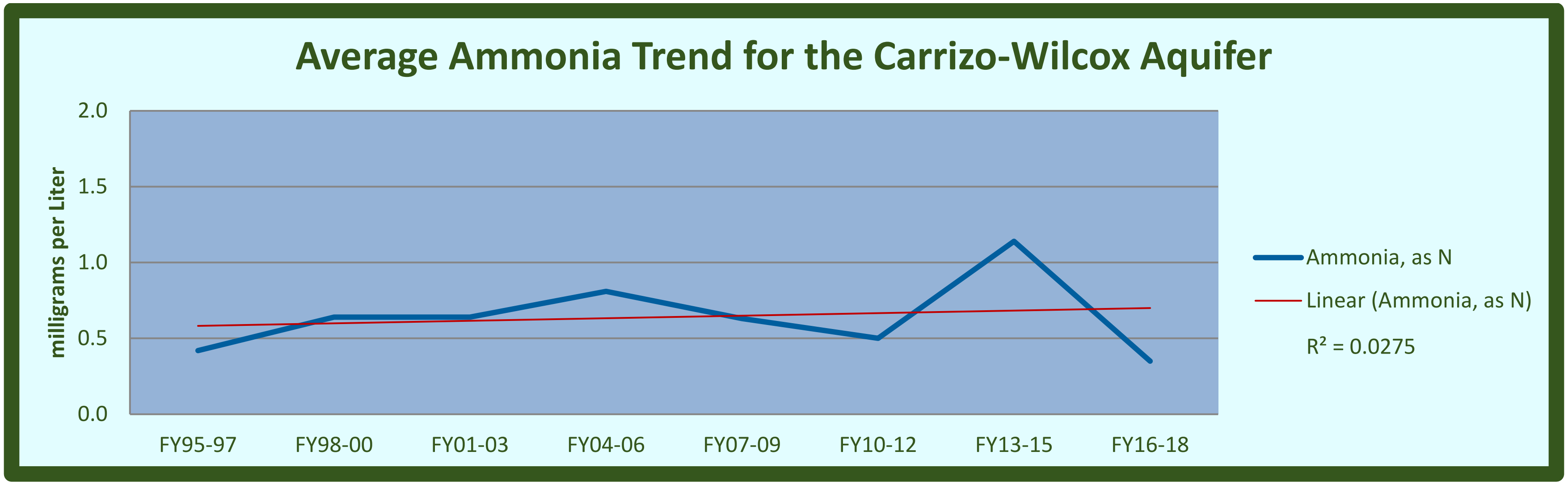

Chart 2-12: Nitrite - Nitrate Trend

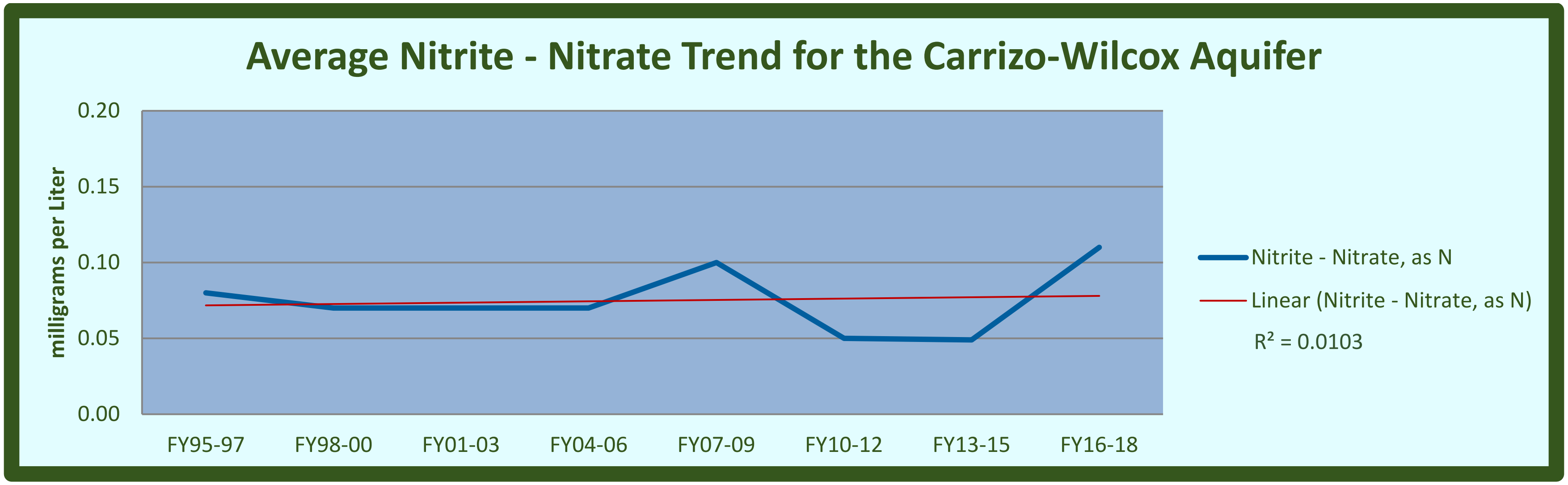

Chart 2-13: Total Kjeldahl Nitrogen Trend

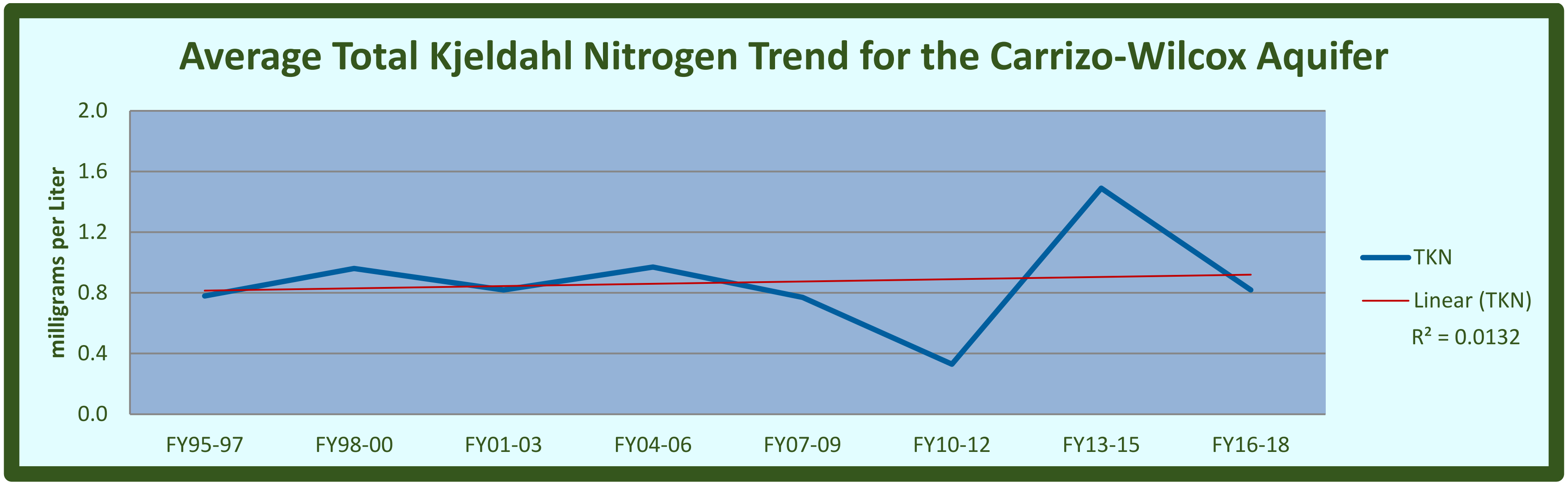

Chart 2-14: Total Phosphorus Trend

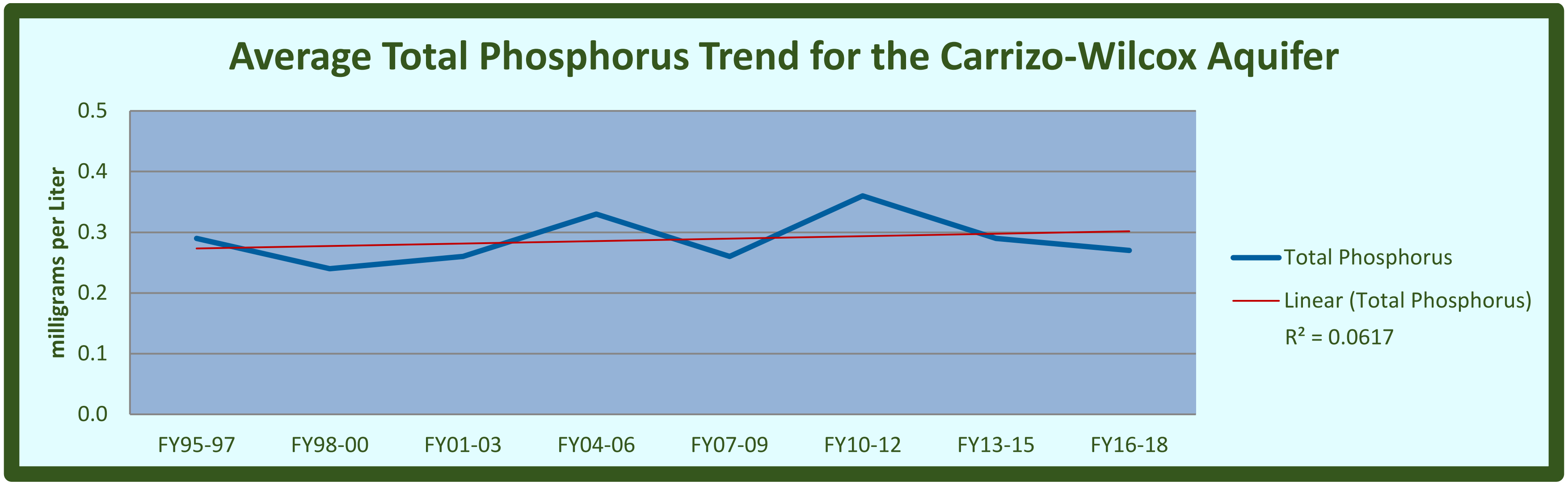

Chart 2-15: Barium Trend

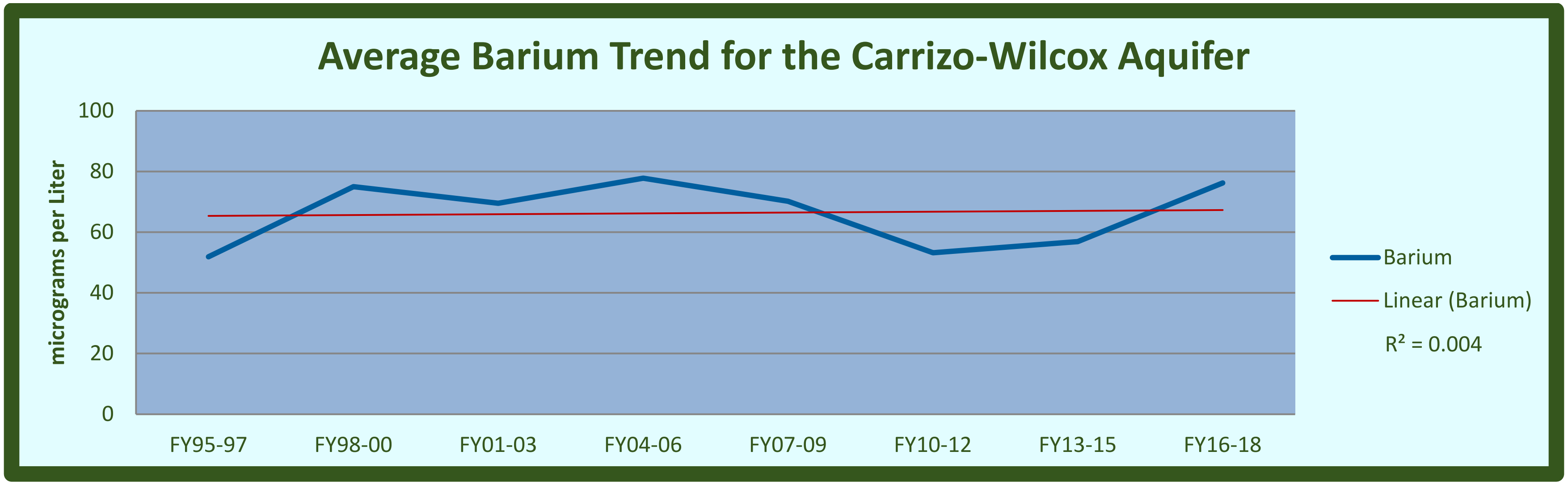

Chart 2-16: Copper Trend

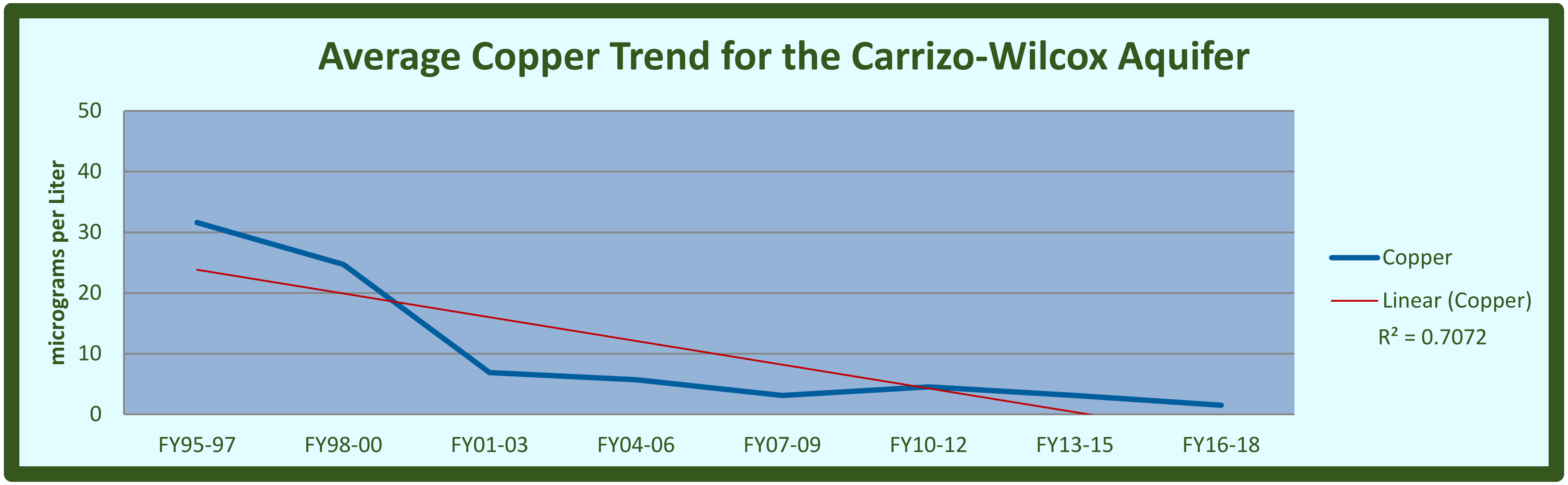

Chart 2-17: Iron Trend

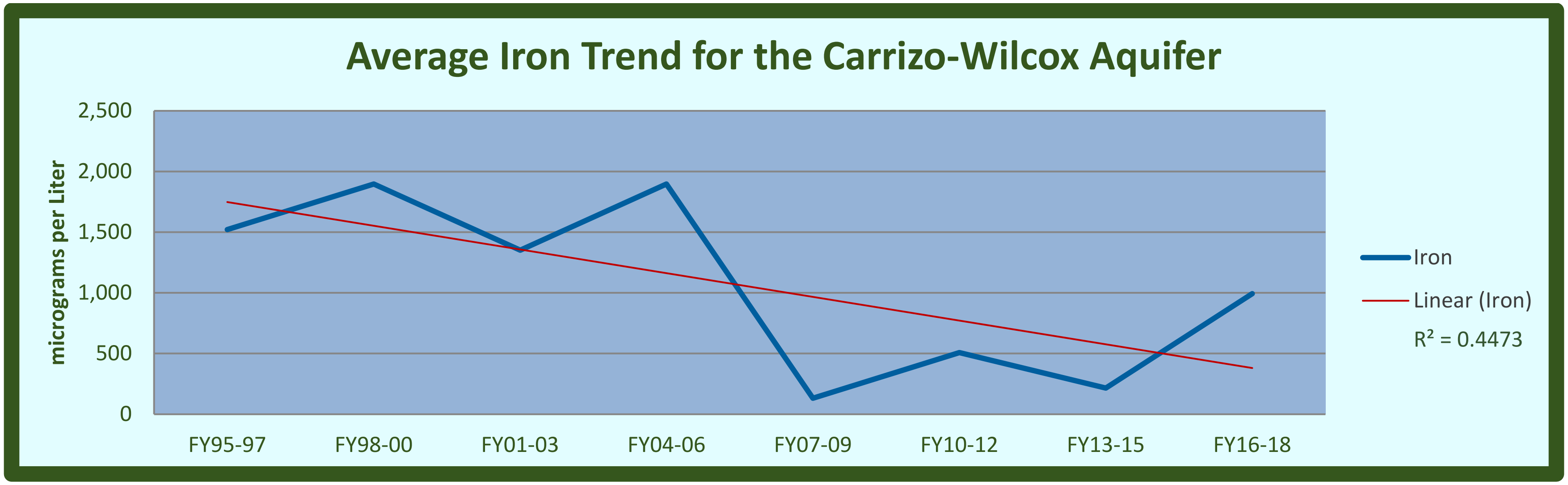

Chart 2-18: Zinc Trend