CARRIZO-WILCOX AQUIFER SUMMARY, 2020

AQUIFER SAMPLING AND ASSESSMENT PROGRAM

APPENDIX 2 TO THE 2021 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 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 2019 state fiscal year (July 1, 2018 - June 30, 2019) and the 2020 state fiscal year (July 1, 2019 – June 30, 2020). This summary will become Appendix 2 of ASSET Program Triennial Summary Report for 2021.

These data show that nine wells were sampled which produce from the Carrizo-Wilcox aquifer. Two of these nine are classified as public supply, four are classified as domestic, two are classified as industrial, and one is classified 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 395 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 well CD-639.

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 2019 - 2020 sampling. Tables 2-6 and 2-7 compare these same parameter averages to historical ASSET-derived data for the Carrizo-Wilcox aquifer, from previous fiscal years.

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). 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). The method used to generate the descriptive statistics varies, depending on the dataset and the proportion of values that are <DL. When estimating a dataset with more than 50 observations, the Maximum Likelihood Estimation (MLE) method is used. This is used to describe Upper and Lower confidence intervals or historical descriptive statistics. For datasets of less than 50 observations, the Kapan-Meier method is used. This is used to calculate descriptive statistics of

a single sampling round. If all values for a particular analyte are reported as < DL, then the minimum, maximum, and average values are all reported as < DL.

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 seven of the nine wells sampled in the Carrizo-Wilcox aquifer, with a total of 14 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):

CD-453	9.33 SU
DS-5297Z	8.61 SU
DS-5996Z	8.60 SU
RR-5070Z	5.23 SU
SA-5848Z	8.65 SU

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

LAB RESULTS (in mg/L)		FIELD MEASURES (in g/L)
CD-453	570 mg/L	0.555 g/L
DS-5297Z	930 mg/L	0.924 g/L
SA-5848Z	660 mg/L	0.702 g/L

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

CD-453	16 PCU
CD-630	18 PCU

Sulfate (SMCL = 250 mg/L):

DS-5297Z	255 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	2230 µg/L
CD-453	375 µg/L
CD-630	3510 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 2019 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 2019 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 2019 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 of 0.03 or greater and a p-value of 0.05.

Over the 24-year period, only Temperature shows a general increase in average concentration. For this same time period, Specific Conductance has decreased. 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 increased from the previous sampling event in FY 2016. Current sample results show that seven wells reported one or more SMCL exceedance with a total of 14 SMCL exceedances. The FY 2016 sampling of the Carrizo-Wilcox aquifer shows that 8 wells reported one or more SMCL exceedance with a total of 13 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 2019 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 14 SMCLs exceeded in seven of the nine wells monitored.

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.

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

Table 2-1: List of Wells Sampled, Carrizo-Wilcox Aquifer–FY 2019

ASSET ID	Well ID	Parish	Date	Owner	Depth (Feet)	Well Use
1952	BO-274	Bossier	3/20/2019	Village Water System	395	Public Supply
1704	CD-453	Caddo	3/21/2019	City of Vivian	228	Public Supply
1772	CD-630	Caddo	3/20/2019	Private Owner	240	Irrigation
1770	CD-639	Caddo	3/20/2019	SI Precast	200	Industrial
1769	CD-642	Caddo	3/20/2019	Louisiana Lift	210	Industrial
3973	DS-5297Z	De Soto	5/8/2019	Private Owner	170	Domestic
3421	DS-5996Z	De Soto	5/8/2019	Private Owner	360	Domestic
1802	RR-5070Z	Red River	7/1/2019	Private Owner	105	Domestic
4961	SA-5848Z	Sabine	10/24/2019	Private Owner	170	Domestic

Table 2-2: Summary of Field and Conventional Data, Carrizo-Wilcox Aquifer–FY 2019

Well ID	pH SU	Sal ppt	Sp Cond mmhos/cm	Temp Deg C	TDS mg/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												
BO-274	6.83	0.15	1.17	22.09	204.06	264	22	ND	66	ND	0.18	0.53	0.43	4.80	230	0.44	10	28.80
CD-453	9.33	0.42	0.85	15.83	555.00	1490	130	16	66	ND	1.20	0.56	1.17	35.10	570	1.60	ND	1.10
CD-630	7.30	0.24	0.45	22.68	318.79	127	22	18	140	ND	0.18	0.27	0.25	7.00	190	0.42	ND	3.10
CD-639	8.31	0.42	0.85	18.29	555.00	465	84	8	60	ND	0.80	0.15	0.79	8.50	485	1.20	ND	1.80
CD-639*	8.31	0.42	0.85	18.29	555.00	423	82	11	50	ND	0.73	0.16	0.78	16.60	430	1.10	ND	3.30
CD-642	8.44	0.31	0.52	21.62	418.75	275	62	12	12	0.05	ND	ND	0.57	3.00	355	0.95	5	0.29
DS-5297Z	8.61	0.71	1.55	20.20	923.86	285	114	7	38	0.12	1.70	ND	1.49	255	930	1.70	4	0.47
DS-5996Z	8.60	0.33	0.67	20.98	440.55	295	25	11	12	ND	1.20	ND	0.71	24.50	445	1.40	ND	0.87
RR-5070Z	5.23	0.20	0.42	19.94	276.71	23.2	118	ND	88	0.19	ND	ND	0.45	3.50	325	0.21	ND	0.96
SA-5848Z	8.65	0.54	1.08	20.67	702.59	373	44	ND	ND	ND	1.40	ND	1.13	139	660	0.85	ND	0.54

*Denotes Duplicate Sample

Shaded cells exceed EPA Secondary Standards

Table 2-3: Summary of Inorganic Data, Carrizo-Wilcox Aquifer–FY 2019

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**
BO-274	ND	ND	80.40	ND	ND	ND	ND	2230	ND	ND	ND	ND	ND	ND	12.90
CD-453	ND	ND	26.60	ND	ND	ND	ND	375	ND	ND	ND	ND	ND	ND	ND
CD-630	ND	ND	197.00	ND	ND	ND	13.00	3510	1.90	ND	2.00	ND	ND	ND	624.00
CD-639	ND	ND	104.00	ND	ND	ND	ND	227	ND	ND	1.20	ND	ND	ND	65.50
CD-639*	ND	ND	101.00	ND	ND	ND	ND	121	ND	ND	ND	ND	ND	ND	62.40
CD-642	ND	ND	22.40	ND	ND	ND	17.42	ND	1.30	ND	ND	ND	ND	ND	44.40
DS-5297Z	ND	ND	45.30	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	5.80
DS-5996Z	ND	ND	43.60	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
RR-5070Z	ND	ND	174.00	0.65	ND	ND	7.40	88.20	9.00	ND	6.10	ND	ND	ND	63.40
SA-5848Z	ND	ND	26.9	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	9.40

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

Table 2-4: FY 2019 Field and Conventional Statistics, ASSET Wells

	PARAMETER	MINIMUM	MAXIMUM	AVERAGE
FIELD	pH (SU)	6.13	9.33	8.07
FIELD	Salinity (ppt)	0.14	0.79	0.40
FIELD	Specific Conductance (µmhos/cm)	0.29	1.55	0.81
FIELD	Temperature (^{O}C)	15.83	20.43	17.68
FIELD	Total Dissolved Solids (g/L)	0.19	1.01	0.53
LABORATORY	Alkalinity (mg/L)	23.20	1490.00	420.62
LABORATORY	Chloride (mg/L)	21.60	130.00	65.09
LABORATORY	Color (PCU)	< DL	41.00	13.66
LABORATORY	Hardness (mg/L)	< DL	140.00	49.20
LABORATORY	Nitrite - Nitrate, as N (mg/L)	< DL	0.190	0.07
LABORATORY	Ammonia, as N (mg/L)	< DL	1.70	0.75
LABORATORY	Total Phosphorus (mg/L)	0.15	0.80	0.42
LABORATORY	Specific Conductance (mmhos/cm)	252.00	1490.00	822.00
LABORATORY	Sulfate (mg/L)	< DL	255.00	48.14
LABORATORY	Total Dissolved Solids (mg/L)	190.00	930.00	486.00
LABORATORY	Total Kjeldahl Nitrogen (mg/L)	0.21	1.70	0.95
LABORATORY	Total Suspended Solids (mg/L)	< DL	10.00	4.70
LABORATORY	Turbidity (NTU)	0.29	28.80	3.88

Table 2-5: FY 2019 Inorganic Statistics, ASSET Wells

PARAMETER	MINIMUM	MAXIMUM	AVERAGE
Antimony (µg/L)	< DL	< DL	< DL
Arsenic (µg/L)	< DL	< DL	< DL
Barium (µg/L)	11.20	197.00	73.14
Beryllium (µg/L)	< DL	0.65	< DL
Cadmium (µg/L)	< DL	< DL	< DL
Chromium (µg/L)	< DL	<DL	< DL
Copper (µg/L)	< DL	17.20	5.60
Iron (µg/L)	< DL	3510.00	668.02
Lead (µg/L)	< DL	9.00	1.92
Mercury (µg/L)	< DL	< DL	< DL
Nickel (µg/L)	< DL	6.10	1.63
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	FY 2019
FIELD	pH (SU)	7.53	7.65	7.87	7.75	8.31	8.17	8.08	8.08	8.07
	Salinity (ppt)	0.35	0.36	0.40	0.39	0.36	0.41	0.47	0.47	0.40
	Specific Conductance (mmhos/cm)	0.676	0.732	0.808	0.800	0.740	0.816	0.942	0.942	0.81
	Temperature (^{O}C)	21.44	21.30	21.98	21.39	21.83	20.29	18.44	18.44	17.68
	Total Dissolved Solids (g/L)	-	-	-	0.520	0.480	0.530	0.613	0.613	0.530
LABORATORY	Alkalinity (mg/L)	267.2	251.5	249.4	273.5	283.4	295.3	257	257	421
	Chloride (mg/L)	59.2	71.6	69.7	66.5	66.4	77.21	66.4	66.4	65.09
	Color (PCU)	26	14	24	15	8	3	14	14	13.66
	Hardness (mg/L)	52	42	31	41	34	14	36	36	49
	Nitrite - Nitrate, as N (mg/L)	0.08	0.07	0.07	0.07	0.10	0.05	0.11	0.11	0.07
	Ammonia, as N (mg/L)	0.42	0.64	0.64	0.81	0.63	< DL	0.35	0.35	0.75
	Total Phosphorus (mg/L)	0.29	0.24	0.26	0.33	0.26	0.36	0.27	0.27	0.42
	Specific Conductance (µmhos/cm)	726	772	748	800	739	800	742	742	822
	Sulfate (mg/L)	30.1	30.5	28.7	26.6	13.1	28.9	38.6	38.6	48.14
	Total Dissolved Solids (mg/L)	435	436	450	481	430	497	511	511	486
	Total Kjeldahl Nitrogen (mg/L)	0.78	0.96	0.82	0.97	0.77	0.33	0.82	0.82	0.95
	Total Suspended Solids (mg/L)	< DL	4.9	< DL	< DL	< DL	4.7	3.7	3.7	4.70
	Turbidity (NTU)	2.60	5.20	2.30	1.60	1.90	2.90	10.10	10.10	3.88

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	FY 2019
Antimony (µg/L)	< DL	< DL	< DL	< DL	< DL	< DL	< DL	< DL	< DL
Arsenic (µg/L)	5.13	< DL	< 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	73.14
Beryllium (µg/L)	< DL	< DL	< DL	< DL	< DL	< DL	< DL	< DL	< DL
Cadmium (µg/L)	< DL	< DL	< DL	< DL	< DL	< DL	< DL	< DL	< DL
Chromium (µg/L)	< DL	< 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	5.60
Iron (µg/L)	1522	1897	1353	1897	132	507	216	993	668
Lead (µg/L)	< DL	< DL	< DL	10.2	< DL	< DL	< DL	1.0	1.92
Mercury (µg/L)	< DL	< DL	< DL	< DL	< DL	< DL	< DL	< DL	< DL
Nickel (µg/L)	13.1	< DL	12.8	5.2	< DL	< DL	< DL	< DL	1.63
Selenium (µg/L)	< DL	< DL	< DL	< DL	< DL	< DL	< DL	< DL	< DL
Silver (µg/L)	< DL	1.1	15.8	< DL	< DL	< DL	< DL	< DL	< DL
Thallium (µg/L)	< DL	< DL	< DL	< DL	< DL	< DL	< DL	< DL	< DL
Zinc (µg/L)	34	164	60	135	22	39	7	341	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

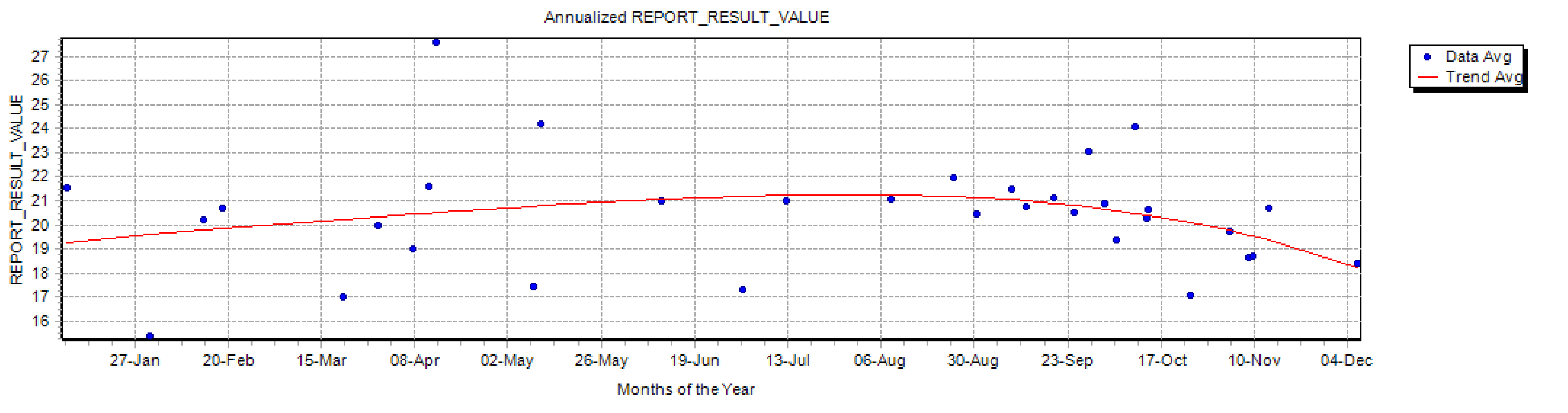
SVOC ANAYTICAL PARAMETERS	METHOD	REPORTING LIMIT (µg/L)
HEXACHLOROBUTADIENE	625	5.0
HEXACHLOROCYCLOPENTADIENE	625	10.0
HEXACHLOROETHANE	625	5.0
INDENO(1,2,3-C,D)PYRENE	625	0.20
ISOPHORONE	625	5.0
NAPHTHALENE	625	0.20
NITROBENZENE	625	5.0
N-NITROSODIMETHYLAMINE	625	5.0
N-NITROSODI-N-PROPYLAMINE	625	5.0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



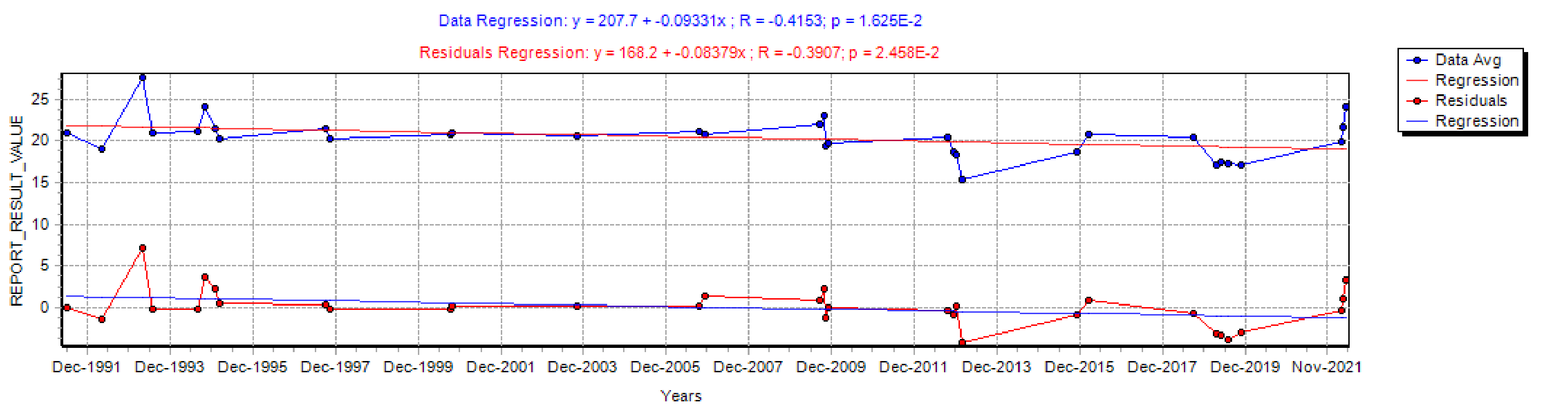
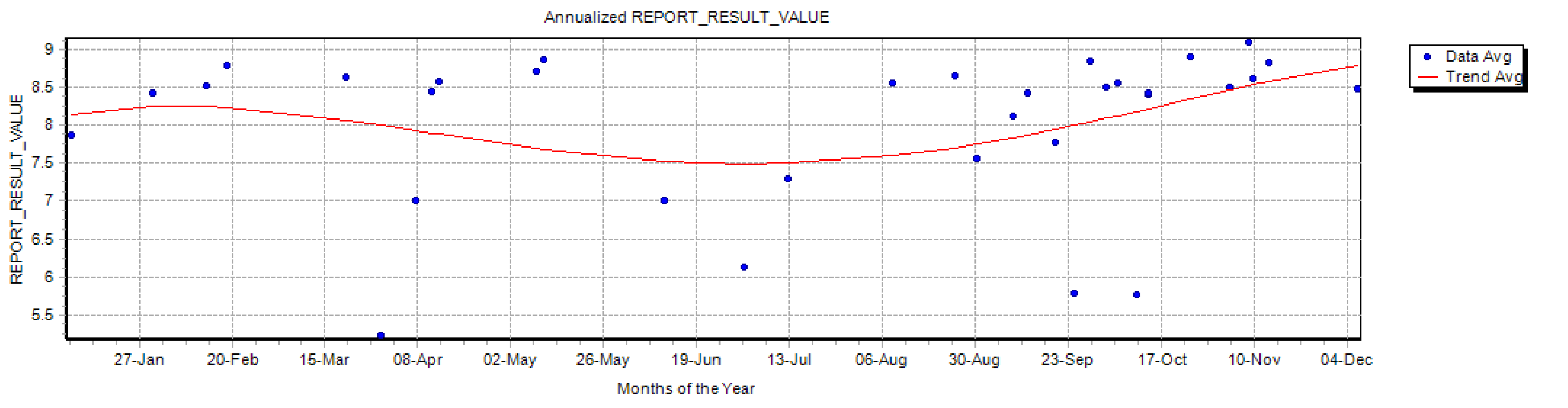


Chart 2-2: pH Trend



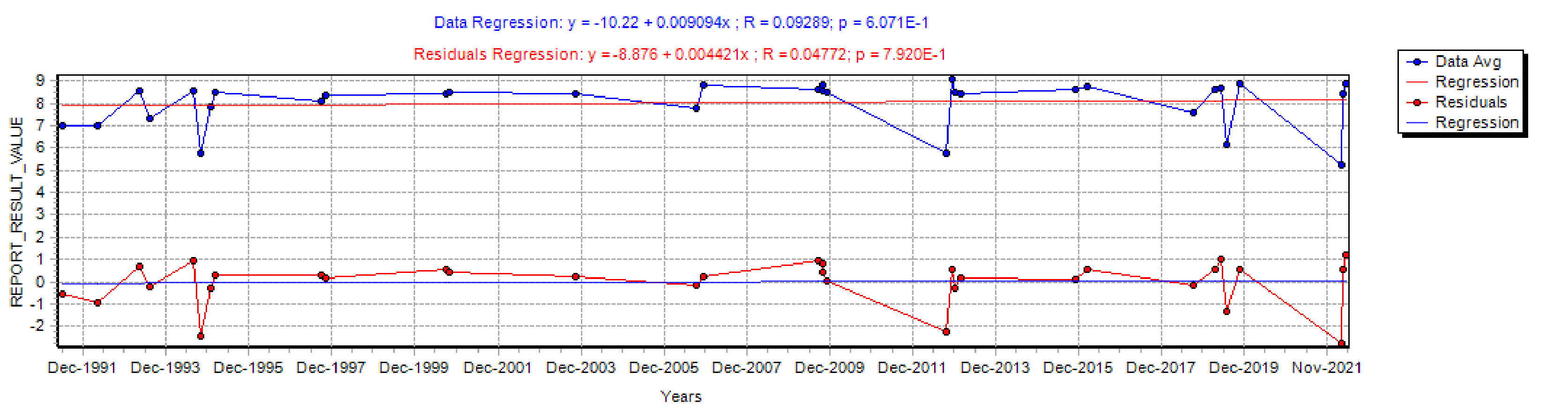
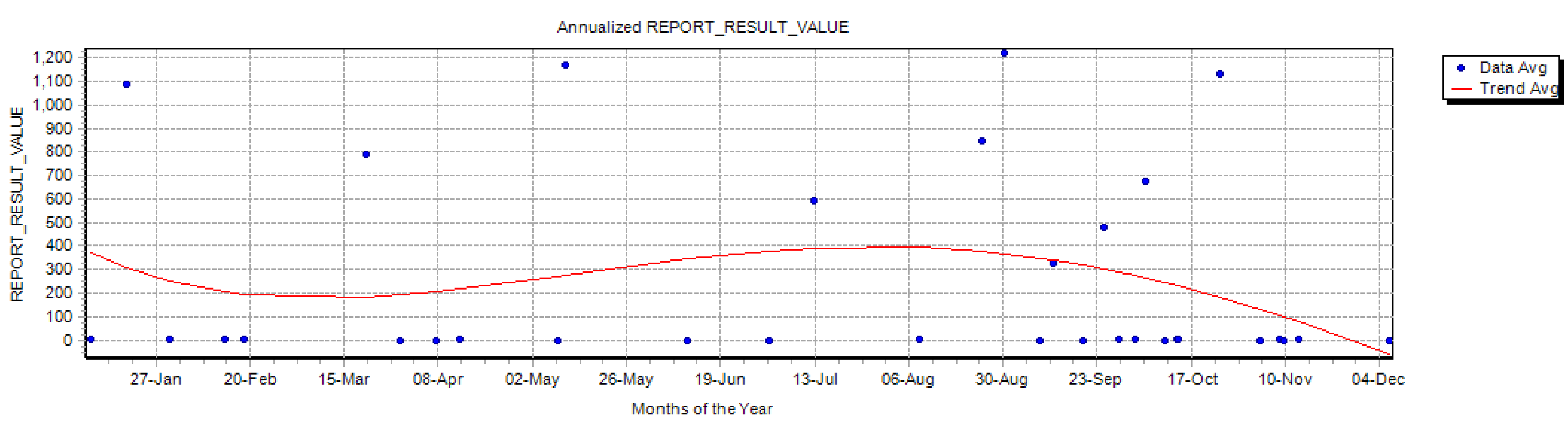


Chart 2-3: Specific Conductance Trend



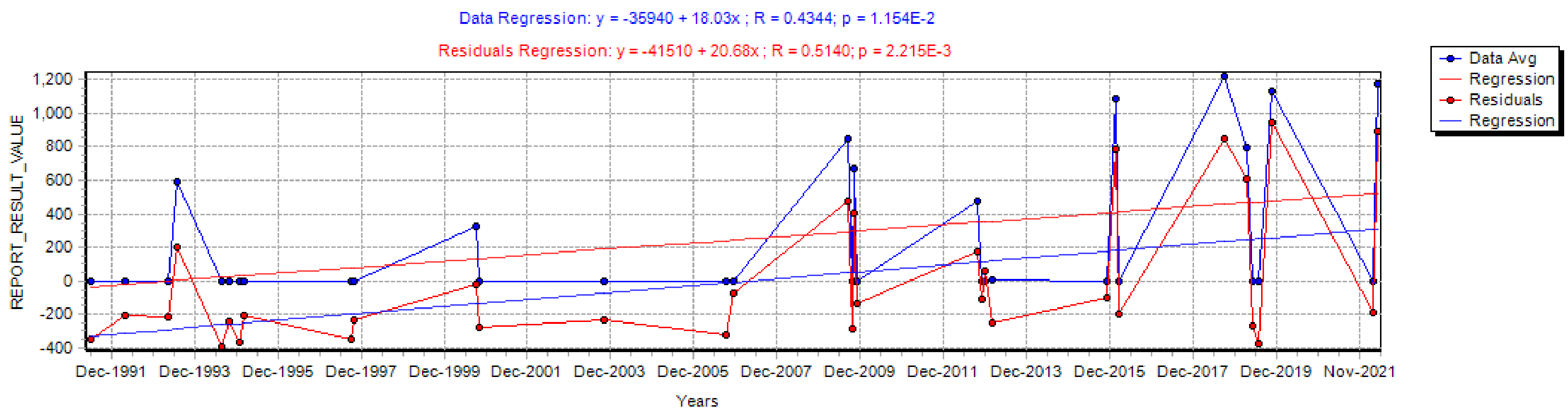
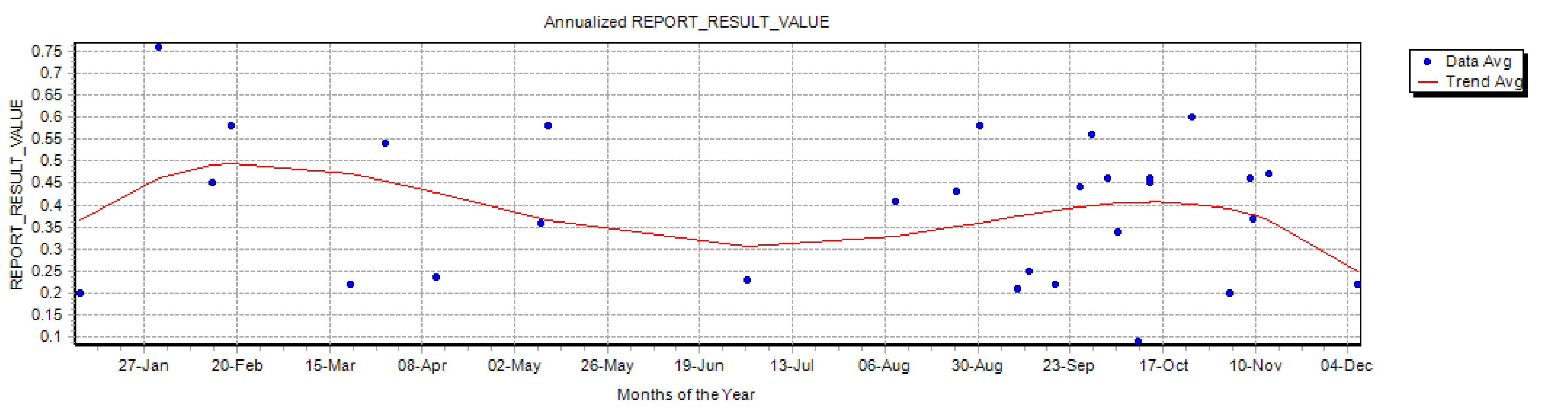


Chart 2-4: Field Salinity Trend



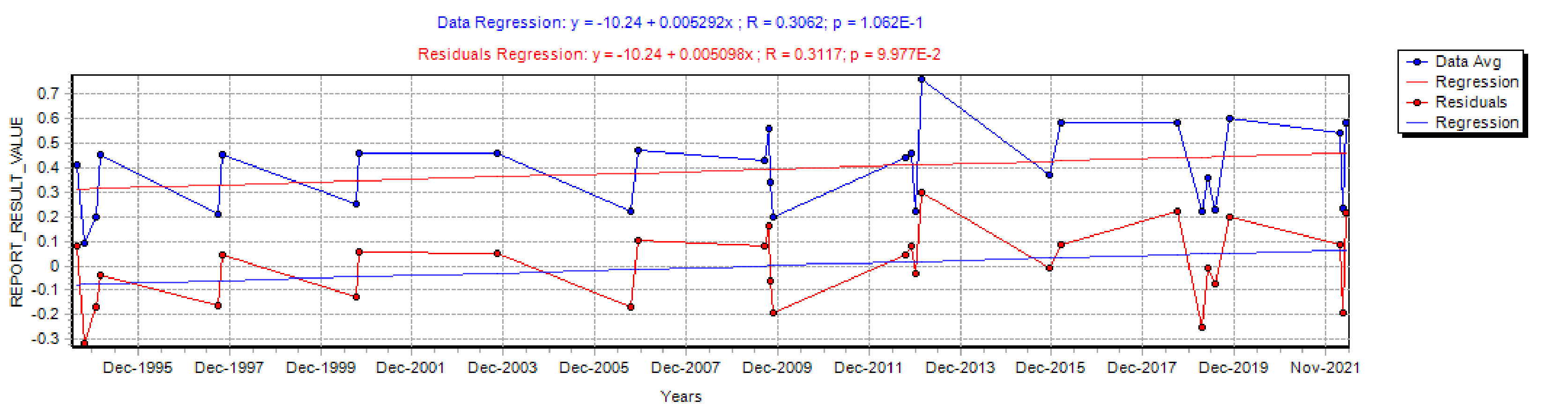
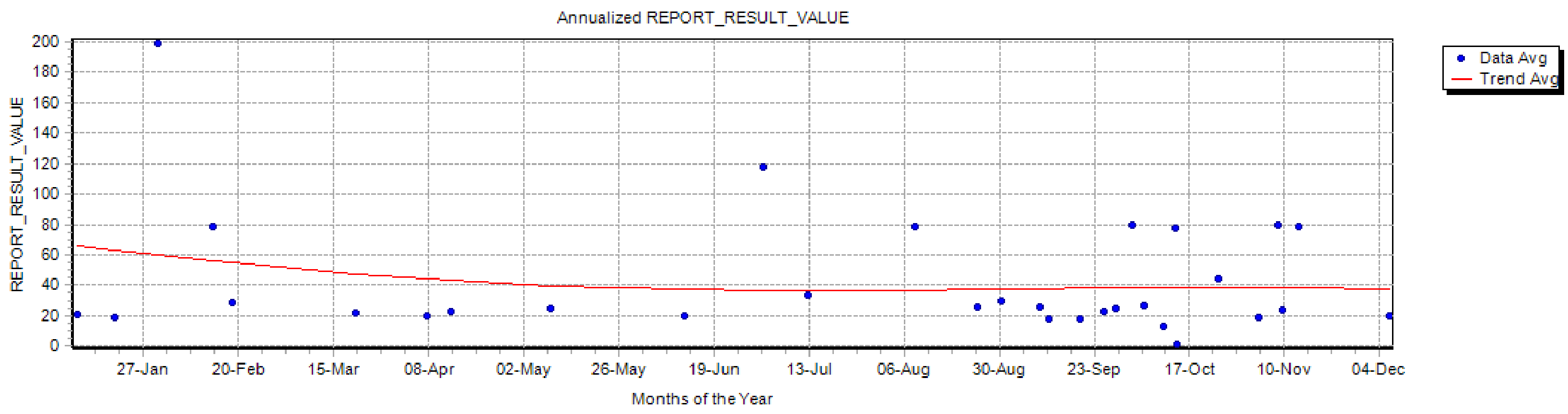


Chart 2-5: Chloride Trend



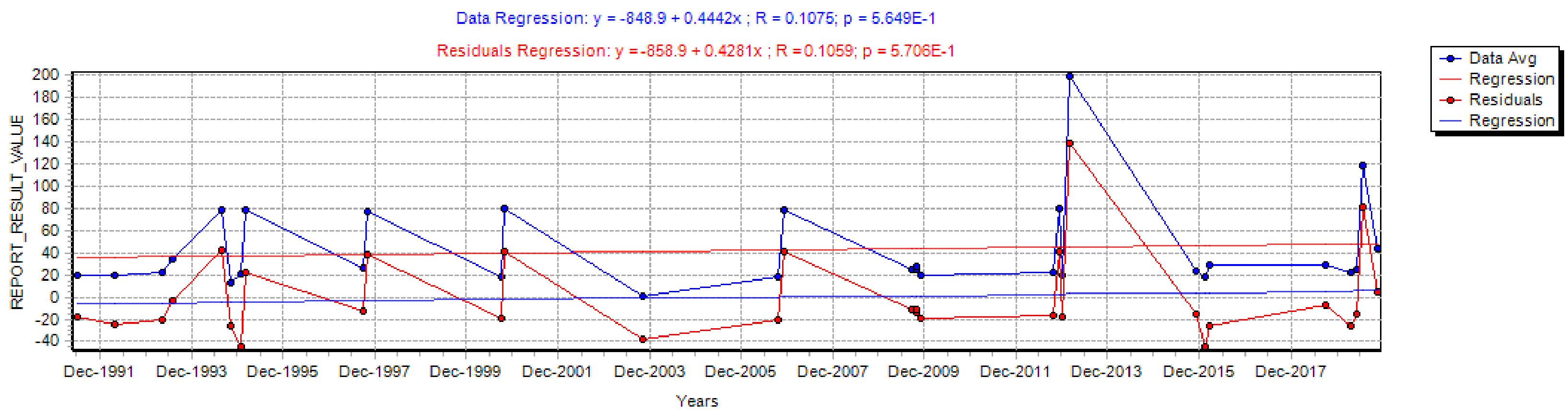
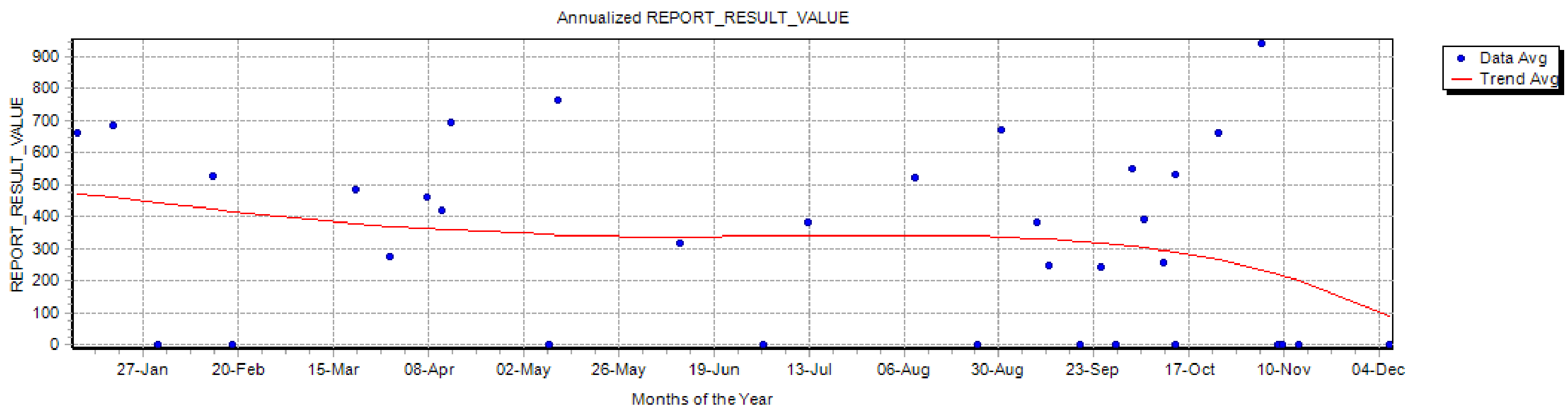


Chart 2-6: Total Dissolved Solids Trend



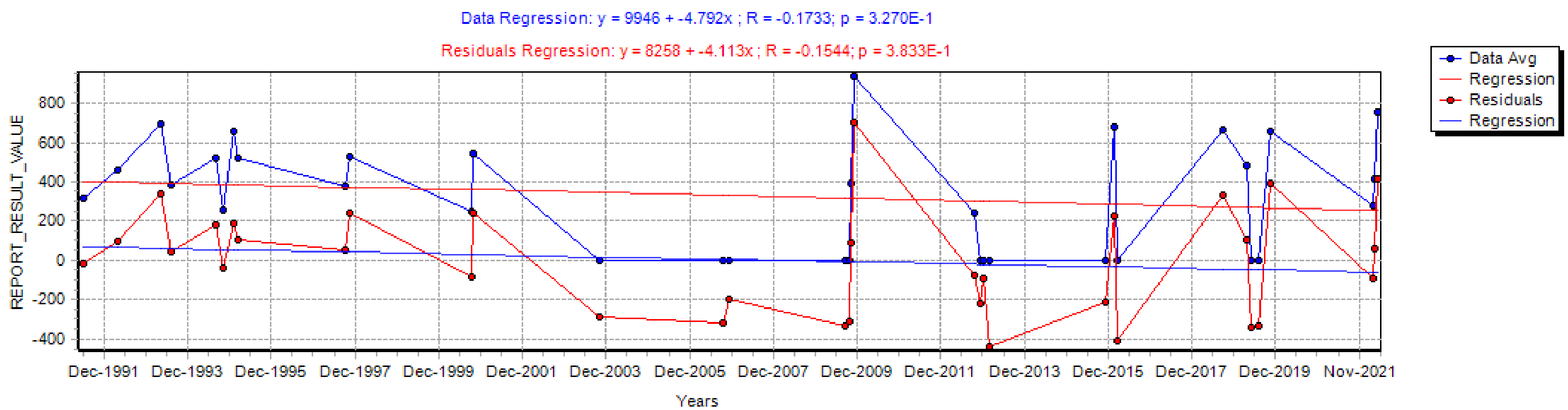
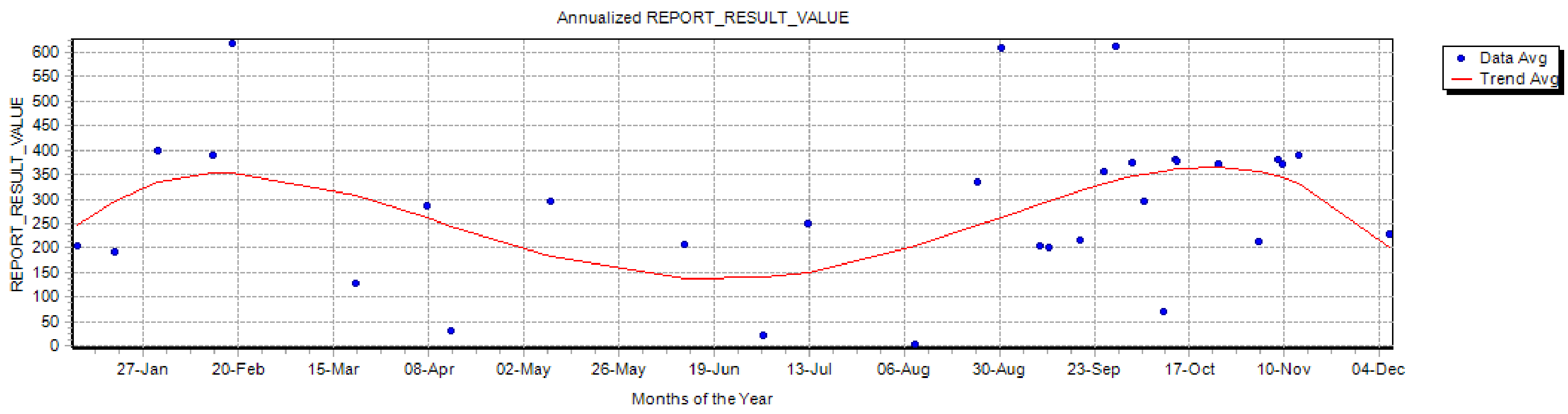


Chart 2-7: Alkalinity Trend



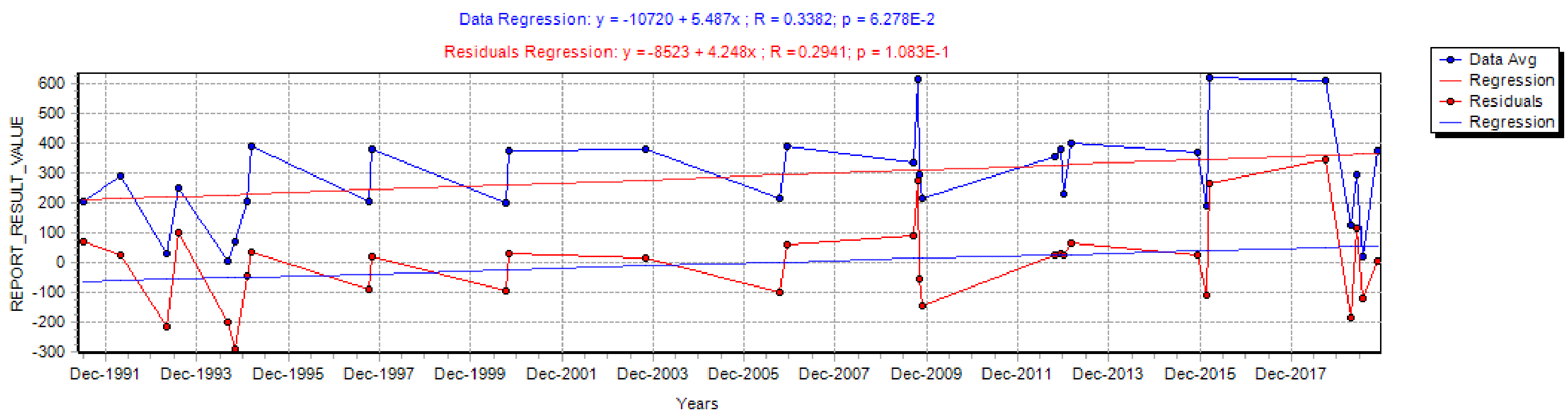
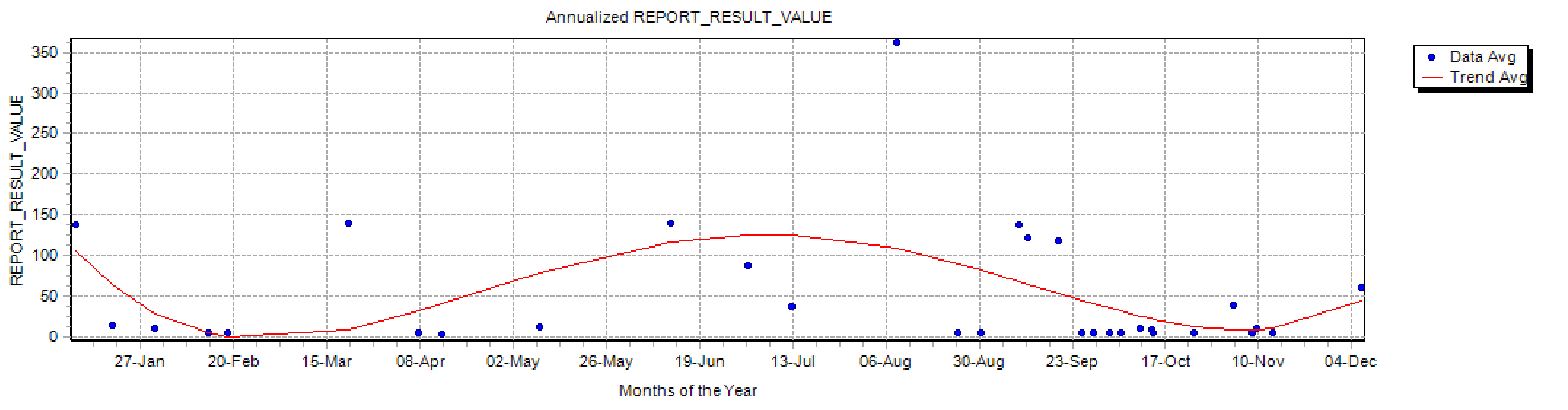


Chart 2-8: Hardness Trend



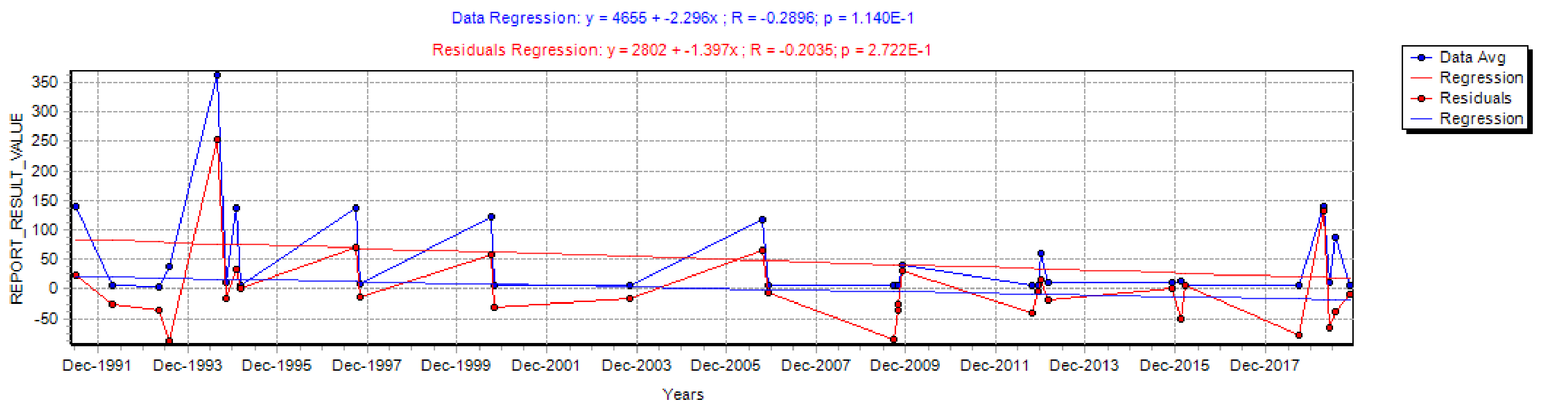


Chart 2-9: Sulfate Trend

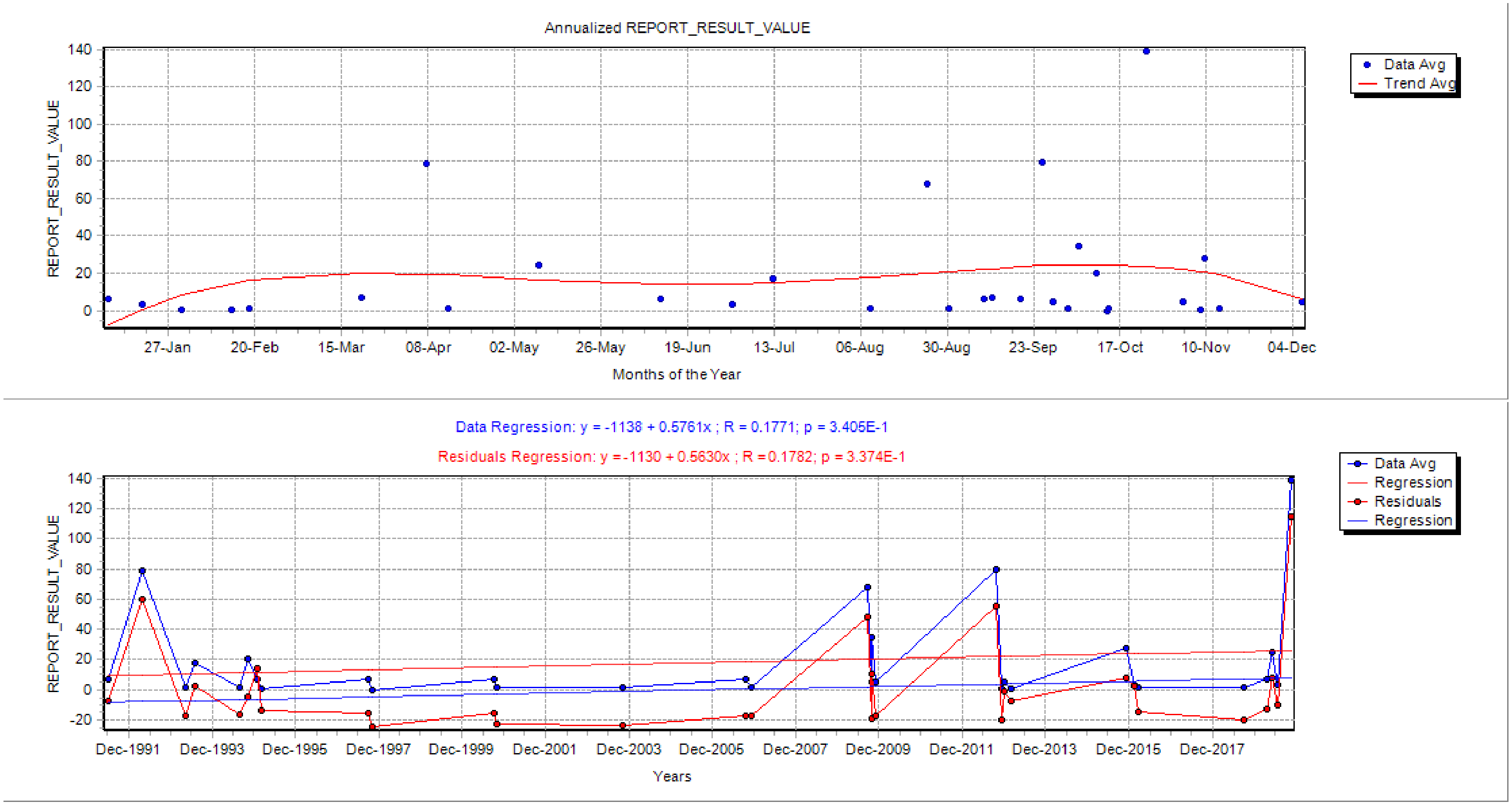
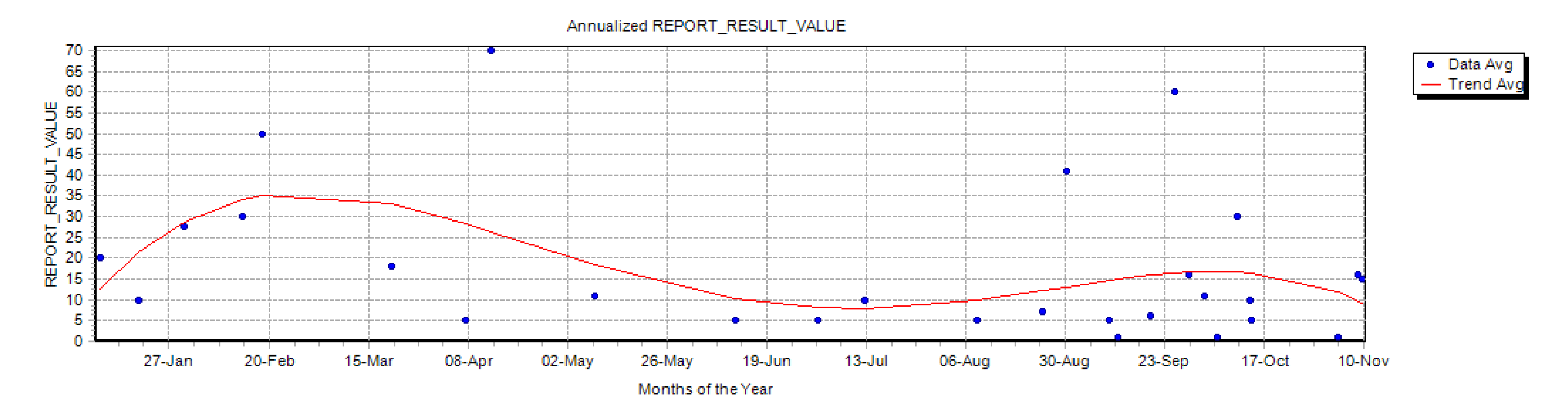


Chart 2-10: Color Trend



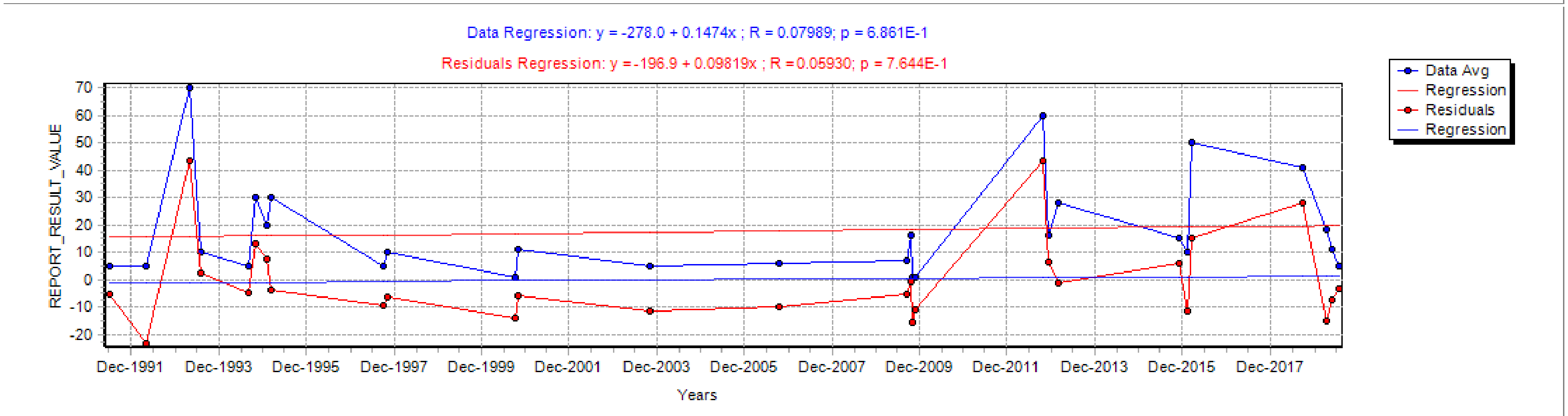
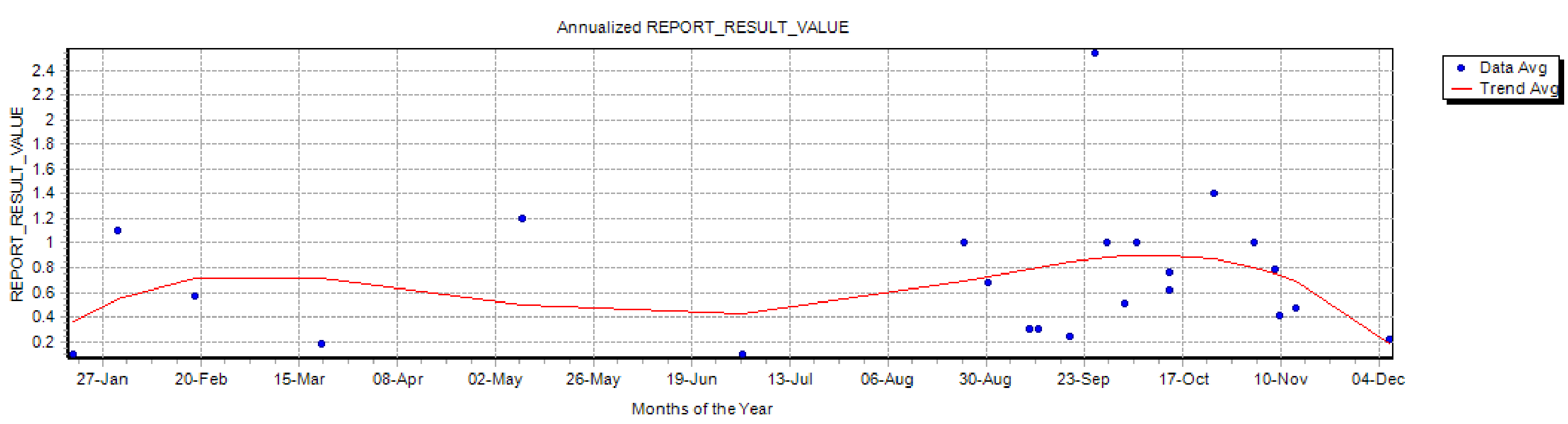


Chart 2-11: Ammonia Trend



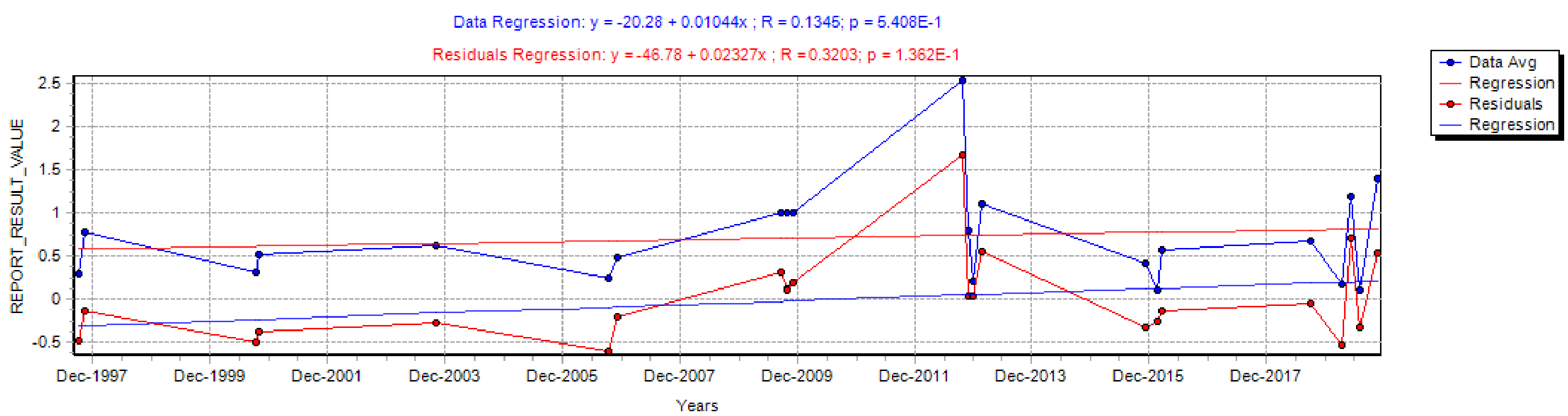
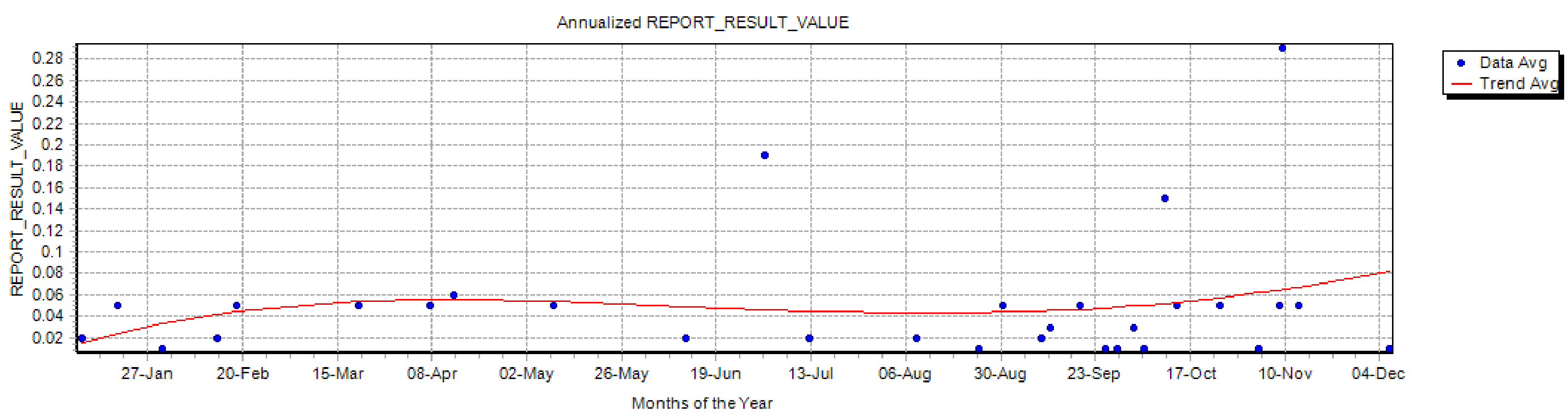


Chart 2-12: Nitrate - Nitrite Trend



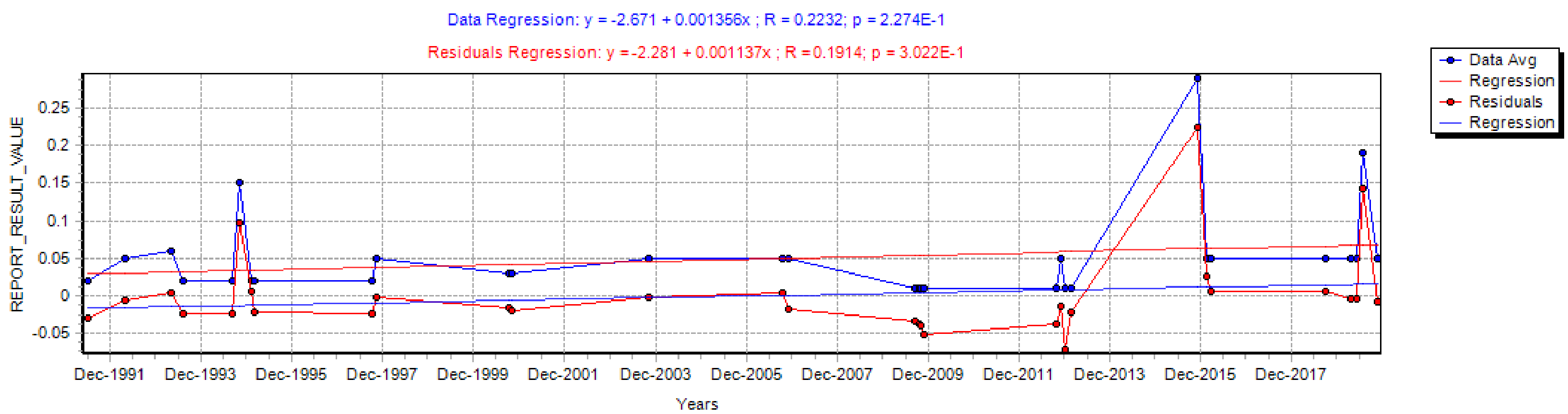
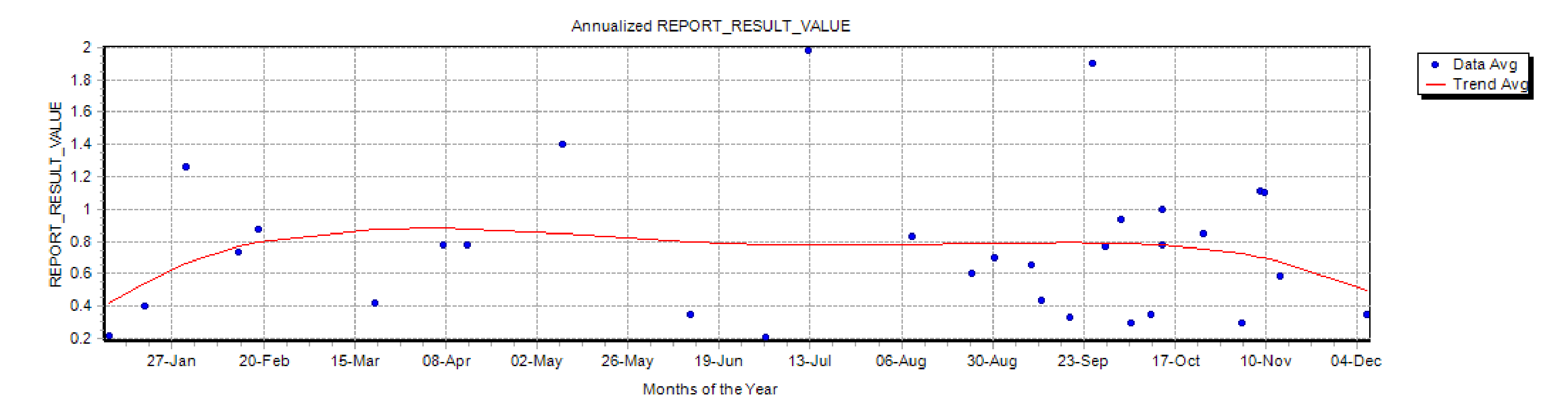


Chart 2-13: Total Kjeldahl Nitrogen Trend



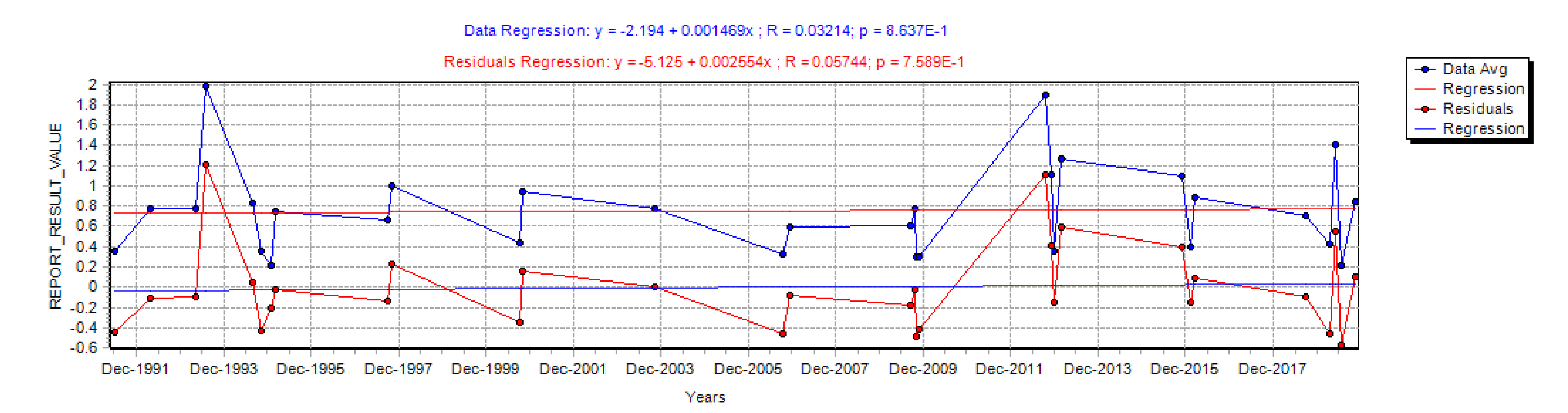
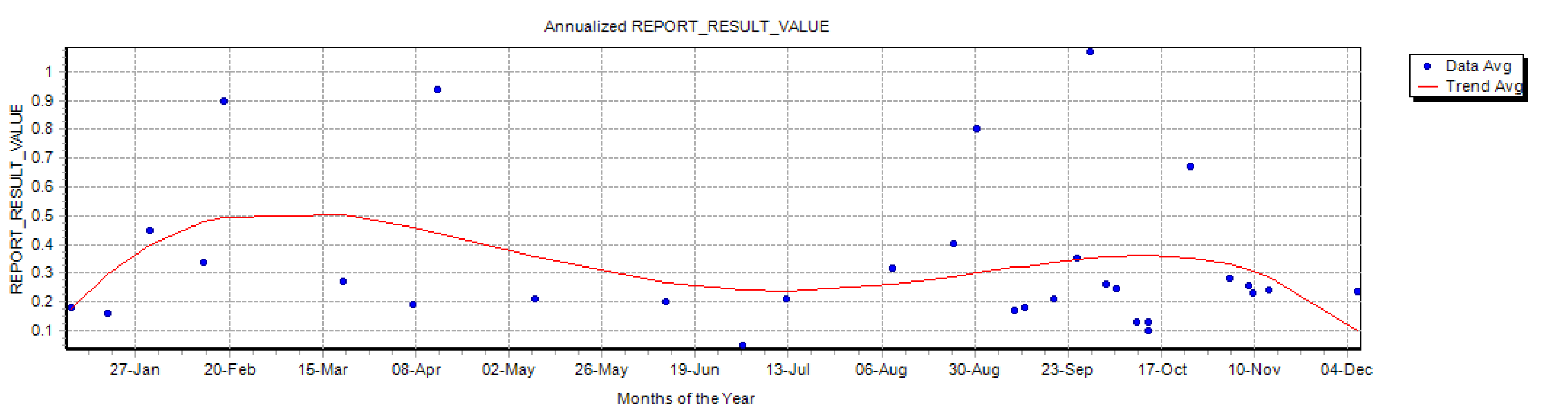


Chart 2-14: Total Phosphorus Trend



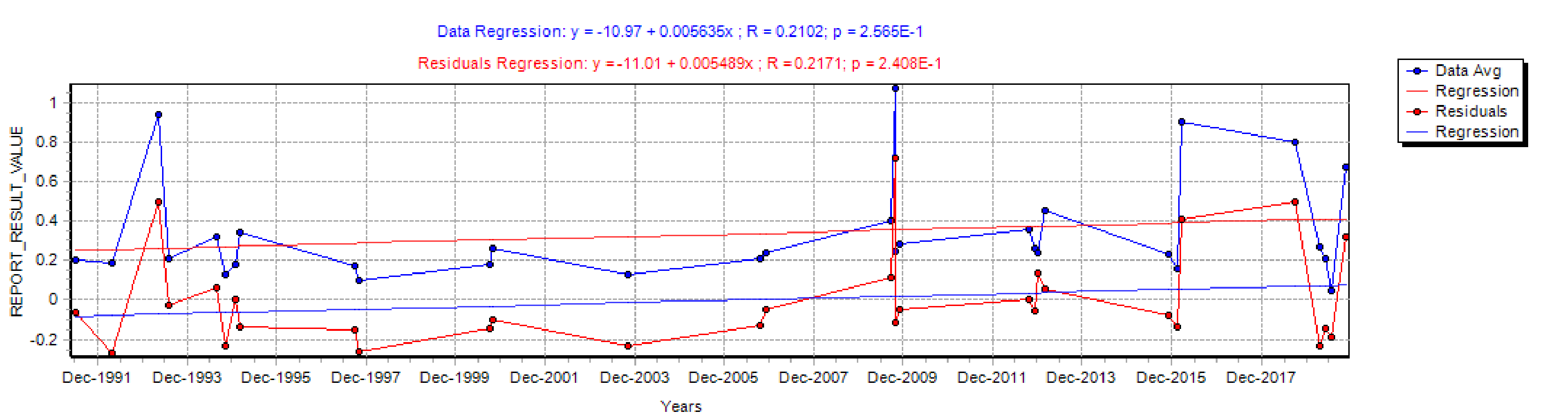
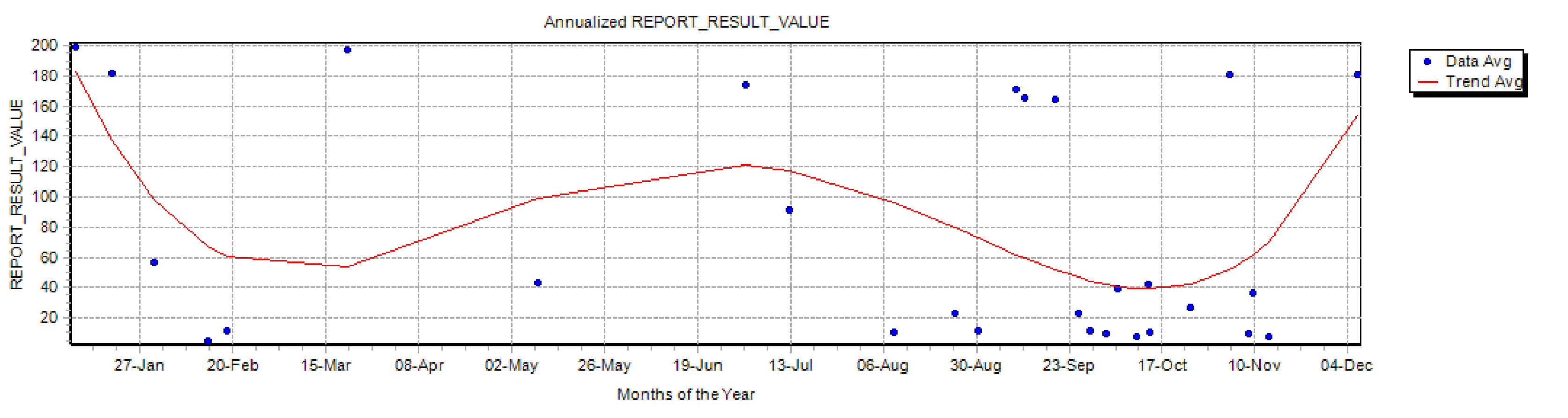


Chart 2-15: Barium Trend



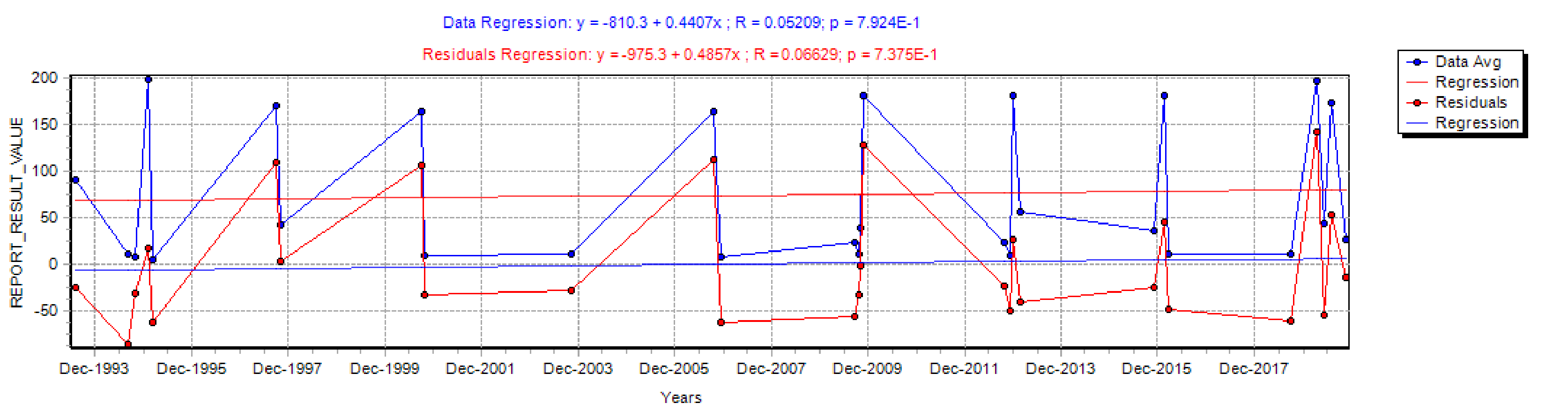
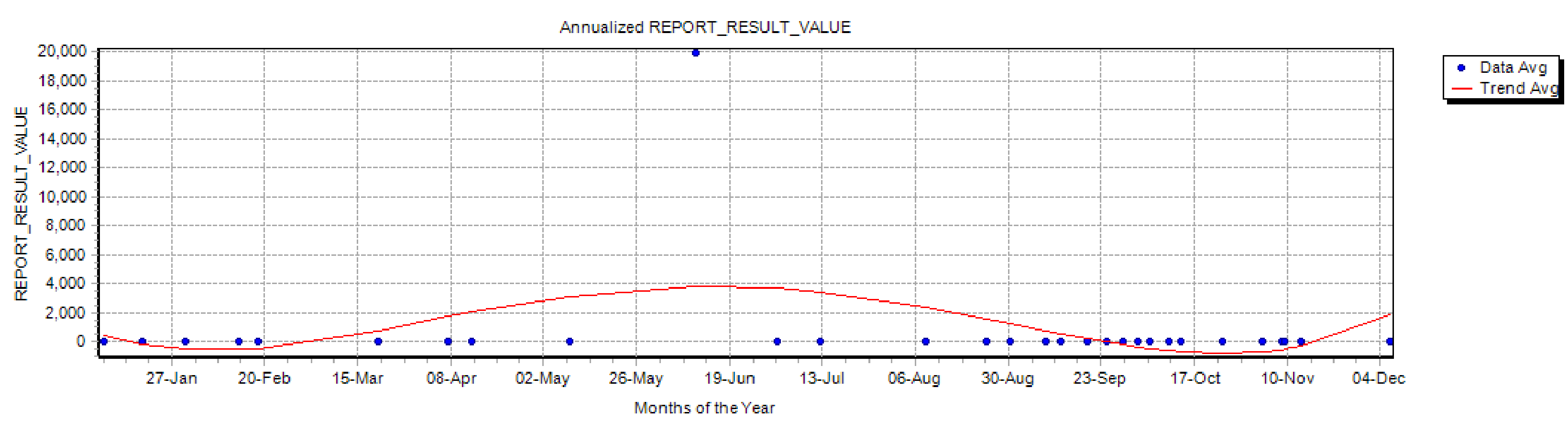


Chart 2-16: Copper Trend



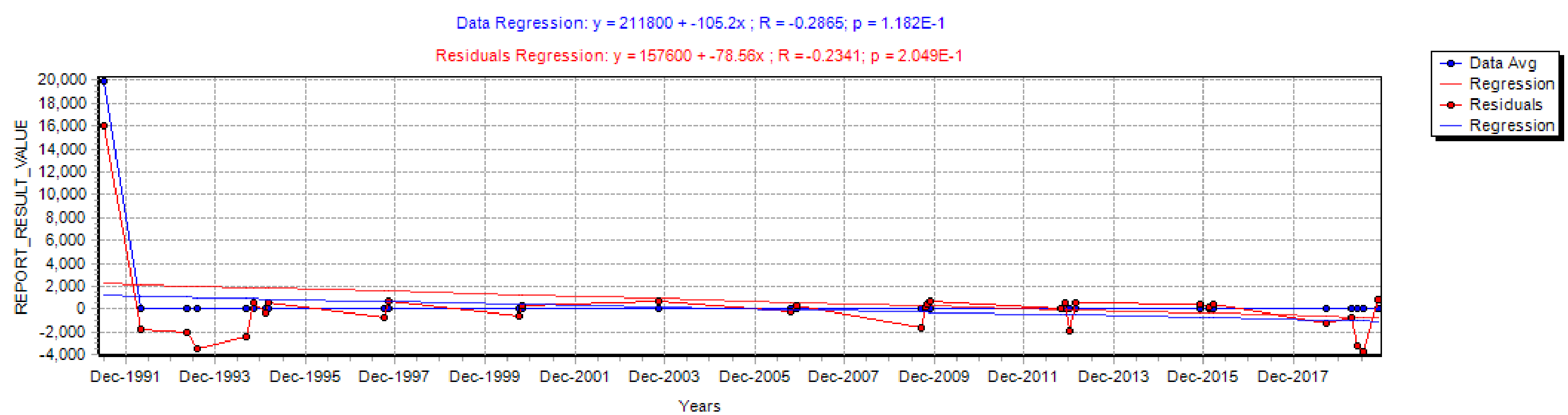
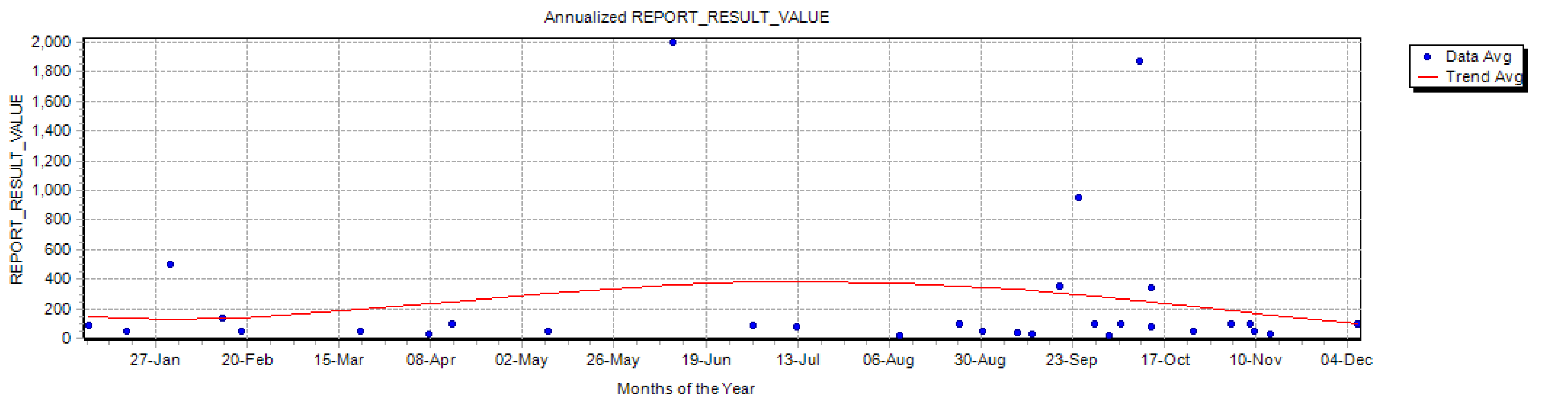


Chart 2-17: Iron Trend



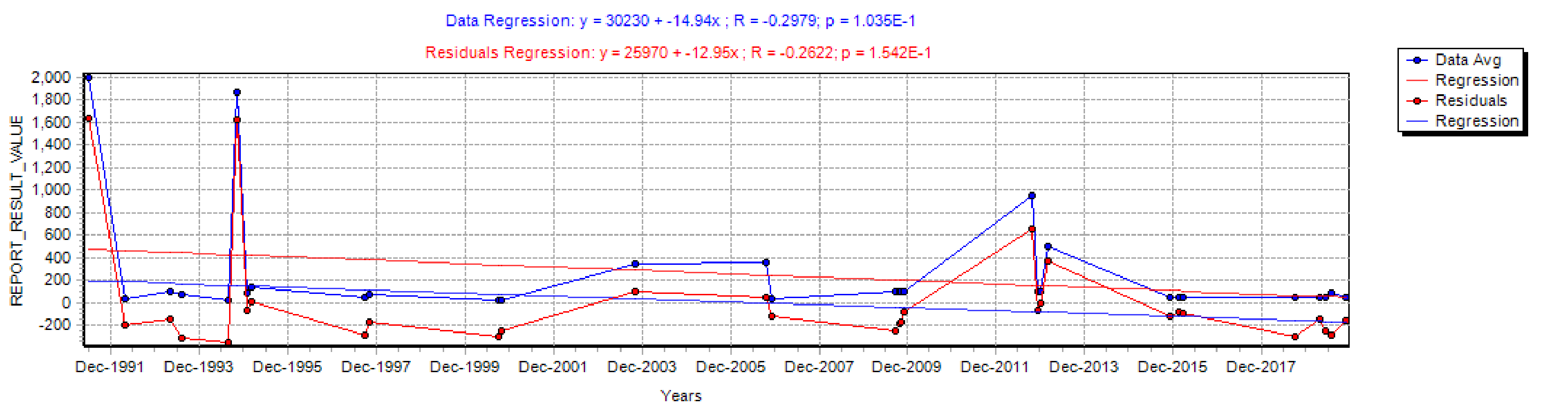


Chart 2-18: Zinc Trend