RED RIVER ALLUVIAL AQUIFER SUMMARY, 2019

AQUIFER SAMPLING AND ASSESSMENT PROGRAM

DEQ
LOUISIANA

APPENDIX 3 TO THE 2021 TRIENNIAL SUMMARY REPORT

PARTIAL FUNDING PROVIDED BY THE CWA

ASSET
AQUIFER SAMPLING AND ASSESSMENT PROGRAM

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 fourteen 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 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 Red River Alluvial aquifer, during the 2019 state fiscal year (July 1, 2018 - June 30, 2019). This summary will become Appendix 3 of ASSET Program Triennial Summary Report for 2021.

These data show that from November 2018 through February 2019, four wells were sampled which produce from the Red River Alluvial aquifer. Two are classified as irrigation and two are classified as domestic. The wells are in three parishes along the Red River in northwest Louisiana.

Figure 3-1 shows the geographic locations of the Red River Alluvial aquifer and the associated wells, whereas Table 3-1 lists the wells sampled 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 Resources' water well registration data file.

GEOLOGY

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

HYDROGEOLOGY

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

The maximum depths of occurrence of freshwater in the Red River Alluvial range from 20 feet above sea level, to 160 feet below sea level. The range of thickness of the freshwater interval in the Red River Alluvial is 50 to 200 feet. The depths of the Red River Alluvial wells that were monitored in conjunction with the ASSET Program range from 47 to 89 feet.

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 3-2. The inorganic parameters analyzed in the laboratory are listed in Table 3-3. These tables also show the field and analytical results determined for each analyte.

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 3-8, 3-9 and 3-10 list the target analytes for volatiles, semi-volatiles and pesticides/PCBs, respectively.

Tables 3-4 and 3-5 provide a statistical overview of field and conventional data, and inorganic data for the Red River Alluvial aquifer, listing the minimum, maximum, and average results for these parameters collected in the FY 2019 sampling. Tables 3-6 and 3-7 compare these same parameter averages to historical ASSET-derived data for the Red River Alluvial 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.

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 3-1 through 3-18 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 set Secondary MCLs (SMCLs), which are defined as non-enforceable taste, odor, or appearance guidelines. Field and laboratory data contained in Tables 3-2 and 3-3 show that one or more SMCLs were exceeded in all of the four wells sampled in the Red River Alluvial aquifer, with a total of seven SMCLs being exceeded.

Field and Conventional Parameters

Table 3-2 shows the field and conventional parameters for which samples are collected at each well and the analytical results for those parameters. Table 3-4 provides an overview of this data for the Red River Alluvial aquifer, listing the minimum, maximum, and average results for these parameters.

Federal Primary Drinking Water Standards: A review of the analysis listed in Table 3-2 shows that no MCL was exceeded for field or conventional 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 3-2 shows that three wells exceeded the SMCL for total dissolved solids. Laboratory results override field results in exceedance determinations, thus only lab results will be counted in determining SMCL exceedance numbers for TDS. Following is a list of SMCL parameter exceedances with well number and results:

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

	LAB RESULTS (in mg/L)	FIELD MEASURES (in g/L)
CD-11849Z	942 mg/L	0.725 g/L
NA-5404Z	624 mg/L	0.435 g/L
RR-345	680 mg/L	0.790 g/L

Inorganic Parameters

Table 3-3 shows the inorganic parameters for which samples are collected at each well and the analytical results for those parameters. Table 3-5 provides an overview of inorganic data for the Red River Alluvial aquifer, listing the minimum, maximum, and average results for these parameters.

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

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

Iron (SMCL = 300 µg/L):

CD-859	5510 µg/L
CD-11849Z	4030 µg/L
NA5404A	10800 µg/L
RR-345	13000 µg/L

Volatile Organic Compounds

Table 3-8 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 Red River Alluvial aquifer.

Semi-Volatile Organic Compounds

Table 3-9 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 an SVOC at or above its detection limit during the FY 2019 sampling of the Red River Alluvial aquifer.

Pesticides and PCBs

Table 3-10 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 Red River Alluvial aquifer.

WATER QUALITY TRENDS AND COMPARISON TO HISTORICAL ASSET DATA

Analytical and field data show that the quality and characteristics of groundwater produced from the Red River Alluvial aquifer exhibit some changes when comparing current data to that of the seven previous sampling rotations. These comparisons can be found in Tables 3-6 and 3-7, and in Charts 3-1 to 3-18 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, two analytes have shown a general increase in concentration. These analytes are barium and specific conductance. For this same time period, two analytes have demonstrated a decrease in concentrations: temperature and zinc. All other analytes have demonstrated only slight change or have remained consistent for this time period.

Current sample results show that all four wells reported one or more secondary exceedances with a total of seven SMCL exceedances. The FY 2016 sampling of the Red River Alluvial aquifer also shows that all four wells also reported one or more SMCL exceedances with a total of seven exceedances.

SUMMARY AND RECOMMENDATIONS

In summary, the data show that the groundwater produced from this aquifer is very hard[1] but is of good quality when considering short-term or long-term health risk guidelines. Laboratory data show that no program well that was sampled during the Fiscal Year 2019 monitoring of the Red River Alluvial aquifer exceeded a primary MCL. The data also show that this aquifer is of poor quality when considering taste, odor, or appearance guidelines, with at least one secondary MCL being exceeded in each of the wells monitored.

Comparison to historical ASSET-derived data shows some change in the quality or characteristics of the Red River Alluvial aquifer, with two parameters showing consistent increases in concentration and two parameters decreasing in concentration.

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

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

Table 3-1: List of Wells Sampled, Red River Alluvial Aquifer – FY 2019

Well ID	Parish	Date	Owner	Depth (Feet)	Well Use
CD-859	CADDO	03/20/2019	East Ridge Country Club	58	Irrigation
CD-11849Z	CADDO	03/21/2019	Private Owner	47	Domestic
NA-5404Z	NATCHITOCHES	10/24/2019	Seven C's Ranch	76	Domestic
RR-345	RED RIVER	07/02/2019	Bundrick Farms	89	Irrigation

Table 3-2: Summary of Field and Conventional Data, Red River Alluvial Aquifer – FY 2019

Well ID	pH SU	Sal ppt	Sp Cond mmhos/cm	TDS mg/L	TEMP Deg C	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	1	0.05	0.1	0.05	1	1	10	0.1	4	0.5
	Field Parameters					Laboratory Parameters												
CD-859	7.17	0.33	5.92	305.00	17.12	465	12.0	10	360	0.05	1.00	0.43	6.76	11.50	439	14.00	60	7.17
CD-11849Z	7.23	0.73	1.63	725.00	15.69	444	115.0	14	560	0.05	1.50	0.59	1.45	19	942	7.00	45	7.23
NA-5404Z	6.87	0.48	0.82	435.00	16.88	364	69.4	< DL	324	< DL	1.50	< DL	0.96	1.00	624	21.00	44	6.87
RR-345	7.14	0.61	0.21	790.00	17.03	377	63.30	< DL	480	< DL	1.40	< DL	1.06	62.60	680	86.00	189	7.14

Shaded cells exceed EPA Secondary Standards

Table 3-3: Summary of Inorganic Data, Red River Alluvial 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
CD-859	< DL	2.70	561.00	< DL	< DL	< DL	< DL	5510	< DL	< DL	< DL	< DL	< DL	< DL	< DL
CD-11849Z	< DL	8.70	162.00	< DL	< DL	< DL	< DL	4030	< DL	< DL	< DL	< DL	< DL	< DL	< DL
NA-5404Z	< DL	< DL	590.00	< DL	< DL	< DL	< DL	10800	< DL	< DL	< DL	< DL	< DL	< DL	5.10
RR-345	< DL	1.50	470.00	< DL	< DL	< DL	< DL	13000	< DL	< DL	< DL	< DL	< DL	< DL	< DL

Shaded cells exceed EPA Secondary Standards

Table 3-4: FY 2019 Field and Conventional Statistics, ASSET Wells

	PARAMETER	MINIMUM	MAXIMUM	AVERAGE
FIELD	pH (SU)	6.87	7.23	7.10
	Salinity (ppt)	0.33	0.73	0.54
	Specific Conductance (µmhos/cm)	676	1449	1075
	Temperature (^{O}C)	15.69	17.12	16.68
	Total Dissolved Solids (g/L)	0.44	0.94	0.70
LABORATORY	Alkalinity (mg/L)	364.00	465.00	412.50
	Chloride (mg/L)	12.00	115.00	64.93
	Color (PCU)	5.00	14.00	9.67
	Hardness (mg/L)	324.00	560.00	431.00
	Nitrite - Nitrate, as N (mg/L)	< DL	< DL	< DL
	Ammonia, as N (mg/L)	0.56	1.20	0.84
	Total Phosphorus (mg/L)	0.43	0.59	0.5
	Specific Conductance (µmhos/cm)	592	1630	1026
	Sulfate (mg/L)	< DL	198.00	68.28
	Total Dissolved Solids (mg/L)	435	725	536
	Total Kjeldahl Nitrogen (mg/L)	1.00	1.50	1.35
	Total Suspended Solids (mg/L)	7.00	86.00	32.00
	Turbidity (NTU)	44.30	189.00	84.90

Table 3-5: FY 2019 Inorganic Statistics, ASSET Wells

PARAMETER	MINIMUM	MAXIMUM	AVERAGE
Antimony (µg/L)	< DL	< DL	< DL
Arsenic (µg/L)	< DL	8.70	3.48
Barium (µg/L)	162.00	590.00	445.75
Beryllium (µg/L)	< DL	< DL	< DL
Cadmium (µg/L)	< DL	< DL	< DL
Chromium (µg/L)	< DL	< DL	< DL
Copper (µg/L)	< DL	< DL	< DL
Iron (µg/L)	4030	13000	8335
Lead (µg/L)	< DL	< DL	< DL
Mercury (µg/L)	< DL	< DL	< DL
Nickel (µg/L)	< DL	< DL	< DL
Selenium (µg/L)	< DL	< DL	< DL
Silver (µg/L)	< DL	< DL	< DL
Thallium (µg/L)	< DL	< DL	< DL
Zinc (µg/L)	< DL	< DL	< DL

Table 3-6: 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)	6.67	6.81	7.64	7.22	7.02	7.04	6.84	6.84	7.10
FIELD	Salinity (ppt)	0.54	0.53	0.67	0.47	0.46	0.51	0.50	0.50	0.54
FIELD	Specific Conductance (mmhos/cm)	1.128	1.060	1.328	0.940	0.930	1.034	1.013	1.013	1075
FIELD	Temperature (^{O}C)	21.00	19.88	20.50	20.55	20.23	19.96	17.32	17.32	16.68
FIELD	Total Dissolved Solids (g/L)	-	-	-	0.610	0.610	0.670	0.659	0.659	0.70
LABORATORY	Alkalinity (mg/L)	504.4	485.2	446.0	476.0	457.0	486	483	483	412.50
LABORATORY	Chloride (mg/L)	45.3	42.8	163.4	31.8	25.5	50.8	65.5	65.5	64.93
LABORATORY	Color (PCU)	25	5	30	22	-	1	11	11	9.67
LABORATORY	Hardness (mg/L)	507	454	354	454	462	401	430	430	431.00
LABORATORY	Nitrite - Nitrate, as N (mg/L)	< DL	0.11	< DL	< DL	< DL	0.33	< DL	< DL	< DL
LABORATORY	Ammonia, as N (mg/L)	1.27	0.54	0.88	0.86	0.77	< DL	0.86	0.86	0.84
LABORATORY	Total Phosphorus (mg/L)	0.79	0.38	0.51	0.61	0.59	0.72	0.730	0.730	0.5
LABORATORY	Specific Conductance (µmhos/cm)	1,100	1,094	1,398	953	892	950	934	934	1026
LABORATORY	Sulfate (mg/L)	69.3	62.2	52.1	29.9	18.3	14.2	51.0	51.0	68.28
LABORATORY	Total Dissolved Solids (mg/L)	716	699	818	594	517	607	633	633	536
LABORATORY	Total Kjeldahl Nitrogen (mg/L)	4.96	0.95	1.05	0.81	0.97	0.34	1.40	1.40	1.35
LABORATORY	Total Suspended Solids (mg/L)	19	14	12	17	16	18	20	20	32.00
LABORATORY	Turbidity (NTU)	56.0	54.4	44.7	68.3	73.6	75.7	126.4	126.4	84.90

Table 3-7: 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)	< DL	< DL	< DL	< DL	< DL	< DL	< DL	< DL	3.48
Barium (µg/L)	401	102	219	387	461	564	400	403	445.75
Beryllium (µg/L)	< DL	< DL	< DL	< DL	< DL	< DL	< DL	< DL	< DL
Cadmium (µg/L)	< DL	< DL	1.0	< DL	< DL	< DL	< DL	< DL	< DL
Chromium (µg/L)	12.4	< DL	< DL	< DL	< DL	< DL	< DL	1.1	< DL
Copper (µg/L)	19.9	968.7	< DL	10.3	< DL	< DL	< DL	7.4	< DL
Iron (µg/L)	6122	3340	3396	5977	7717	6281	5896	8950	8335
Lead (µg/L)	32.0	< DL	< DL	14.0	< DL	< DL	< DL	< DL	< DL
Mercury (µg/L)	< DL	< DL	< DL	< DL	< DL	< DL	< DL	< DL	< DL
Nickel (µg/L)	10.4	1,041.4	< DL	< DL	< DL	< DL	< DL	< DL	< DL
Selenium (µg/L)	< DL	< DL	< DL	< DL	< DL	< DL	< DL	< DL	< DL
Silver (µg/L)	< DL	< DL	1.1	< DL	< DL	< DL	< DL	< DL	< DL
Thallium (µg/L)	< DL	< DL	< DL	< DL	< DL	< DL	< DL	< DL	< DL
Zinc (µg/L)	185.6	<10.0	41.7	65.5	490.0	13.4	< DL	< DL	< DL

Table 3-8: VOC Analytical Parameters

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 3-9: SVOC Analytical Parameters

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 3-10: Pesticides and PCBs

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 3-1: Location Plat, Red River Alluvial Aquifer

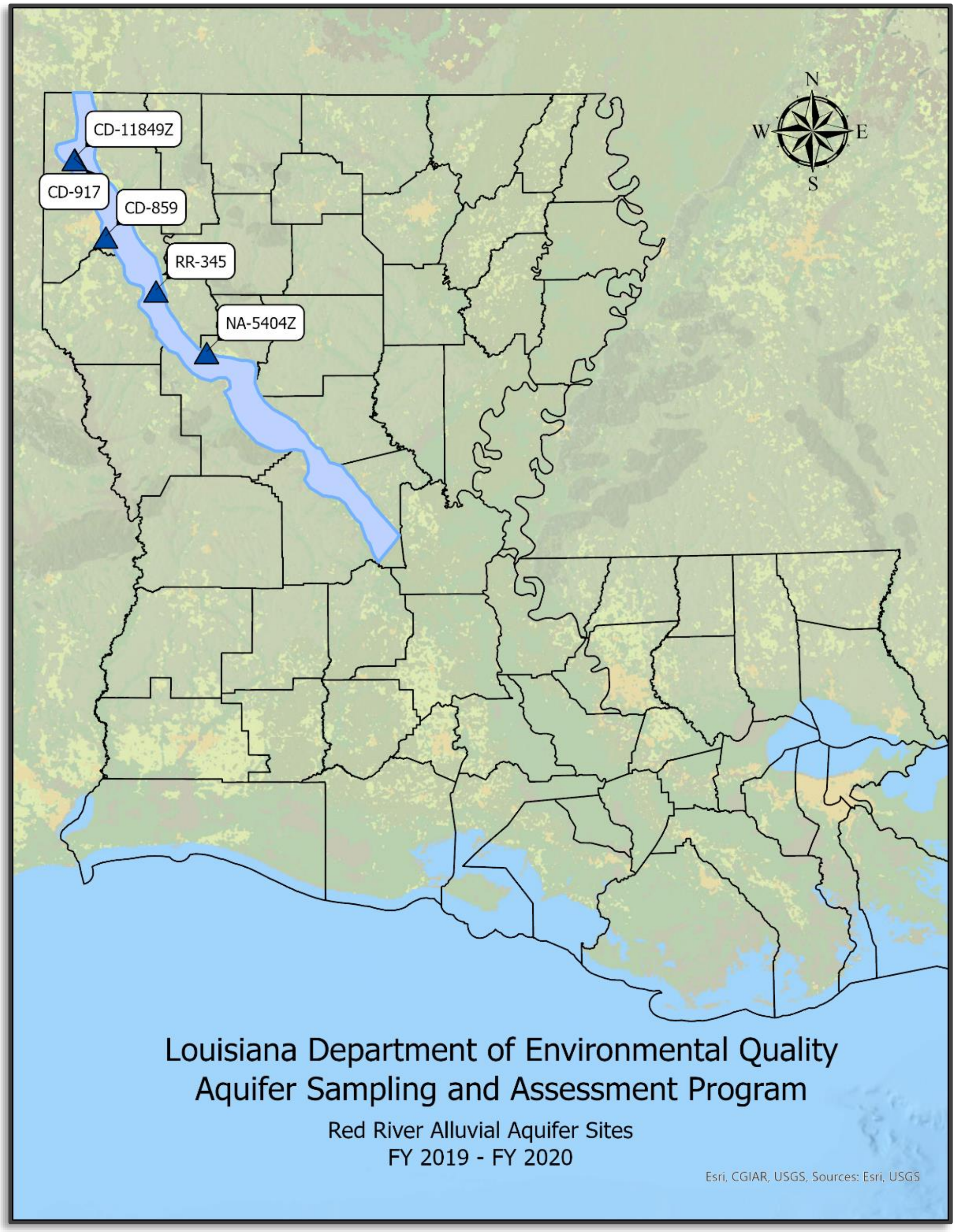
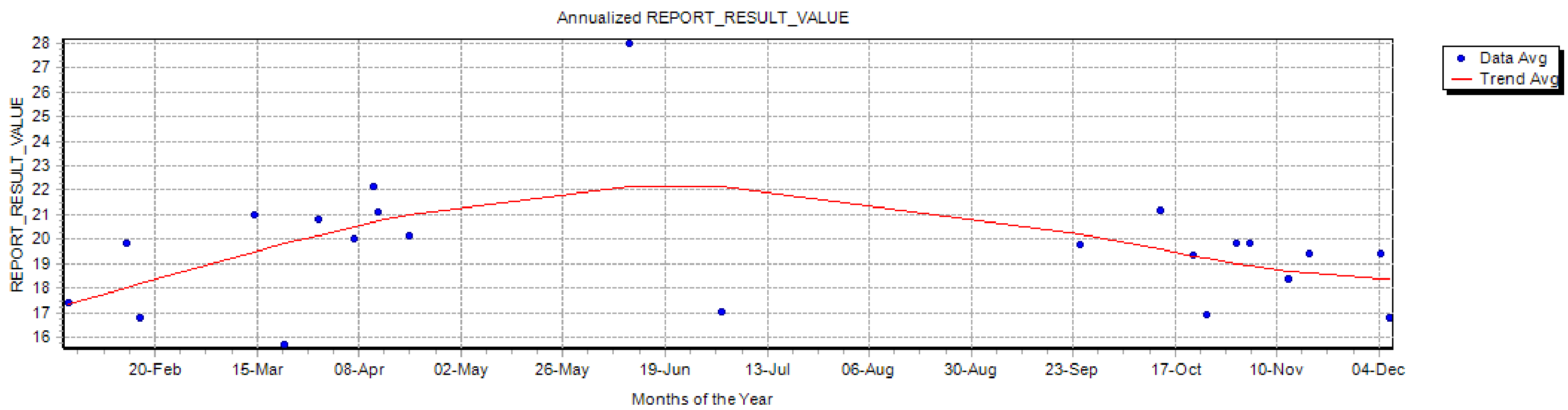


Chart 3-1: Temperature Trend



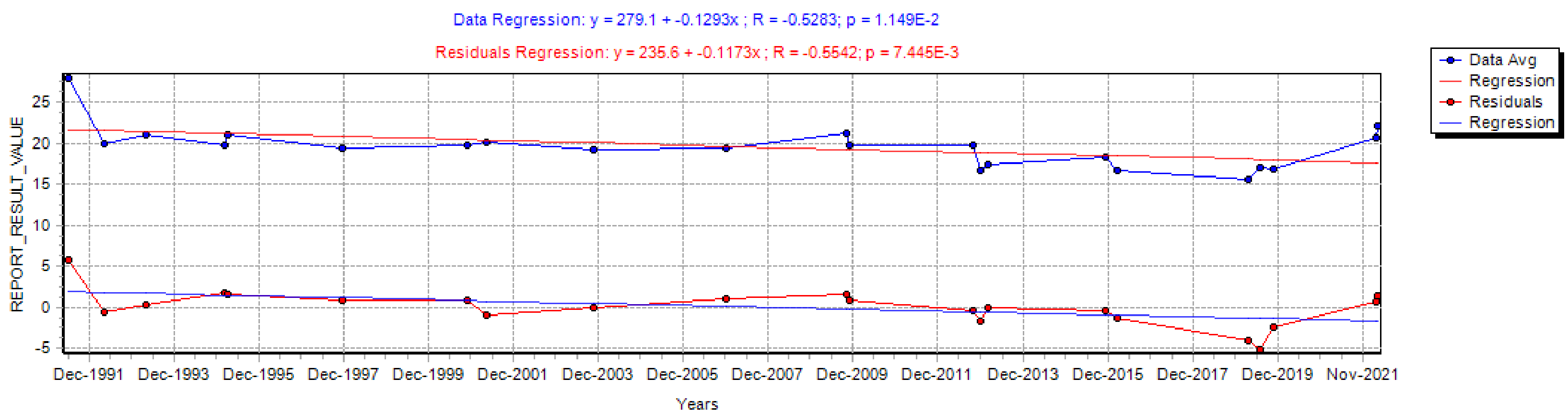
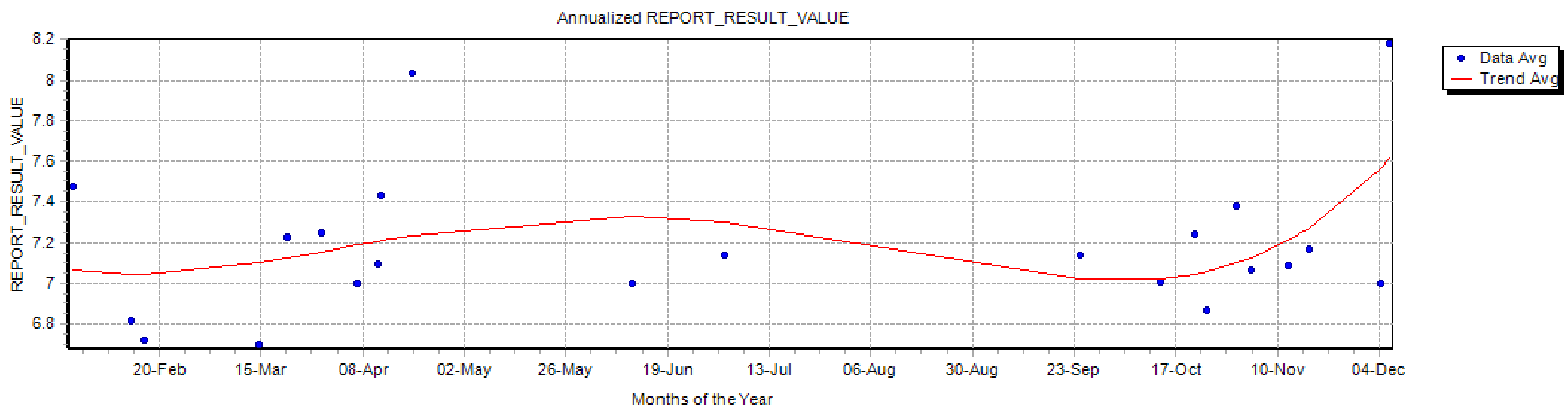


Chart 3-2: pH Trend



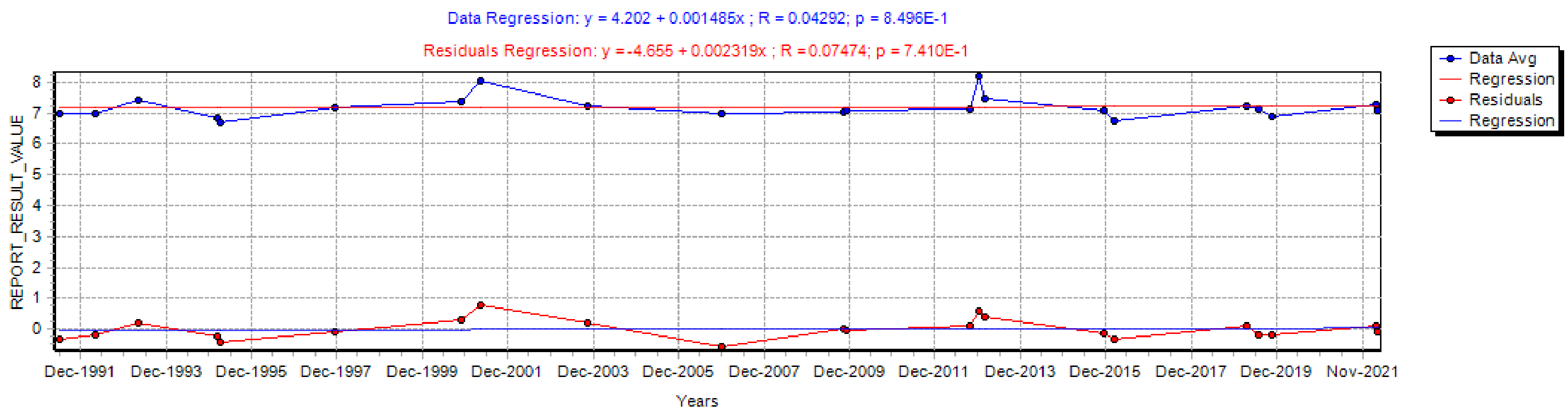
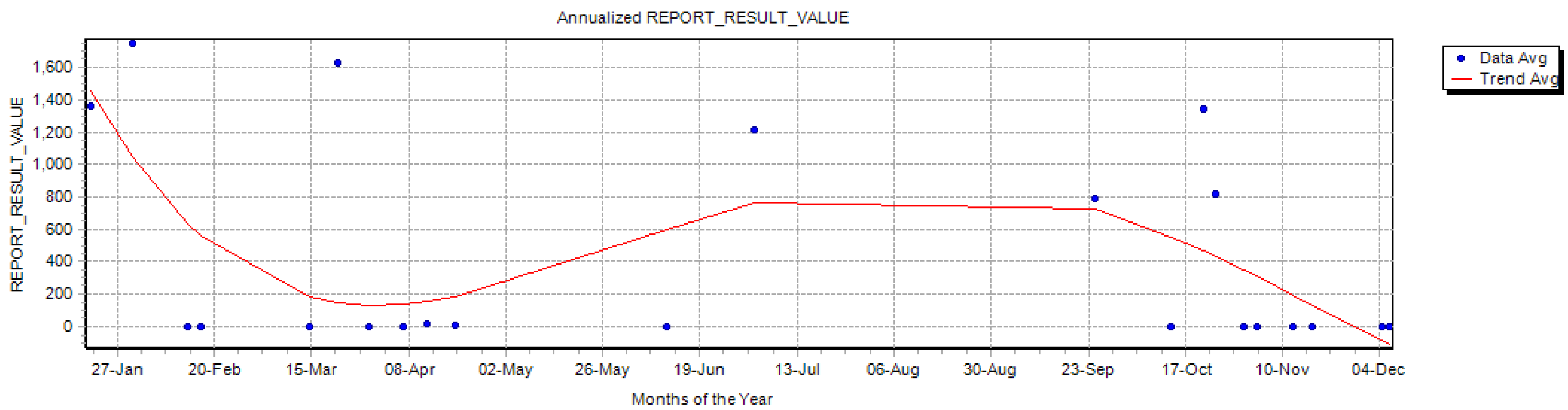


Chart 3-3: Specific Conductance Trend



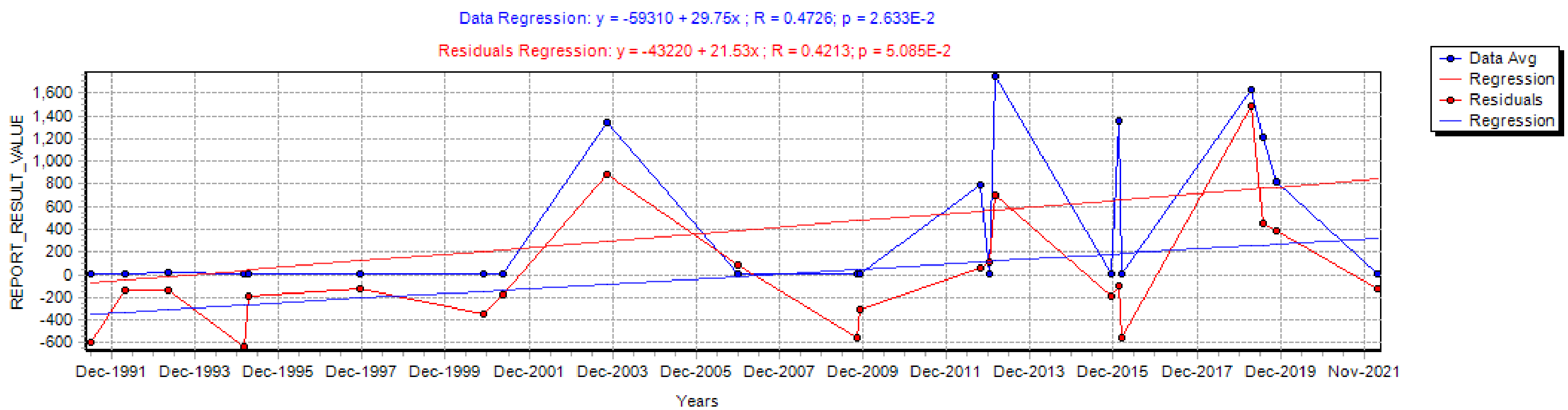
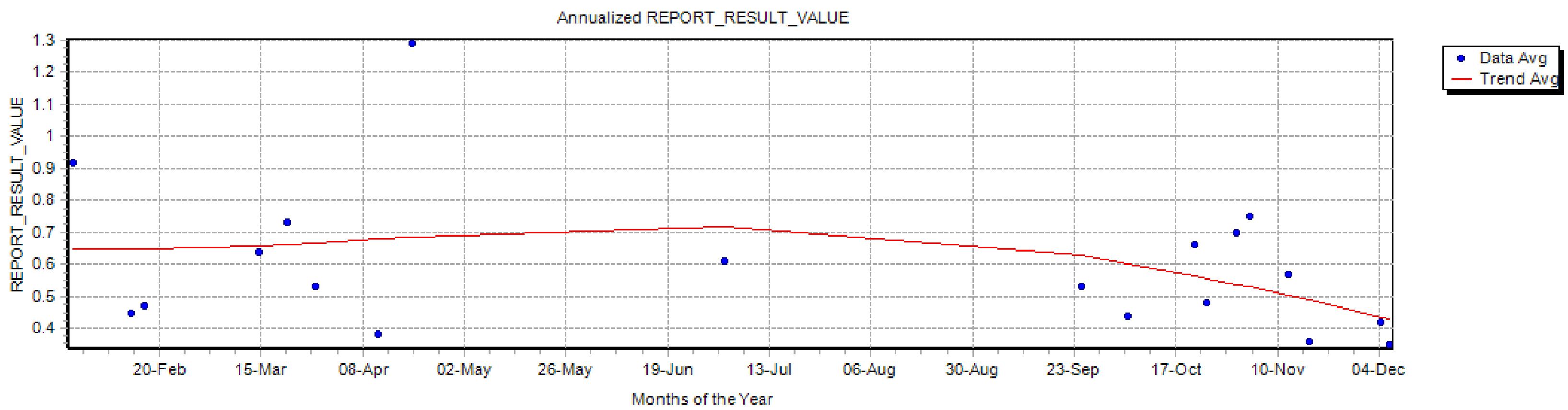


Chart 3-4: Field Salinity Trend



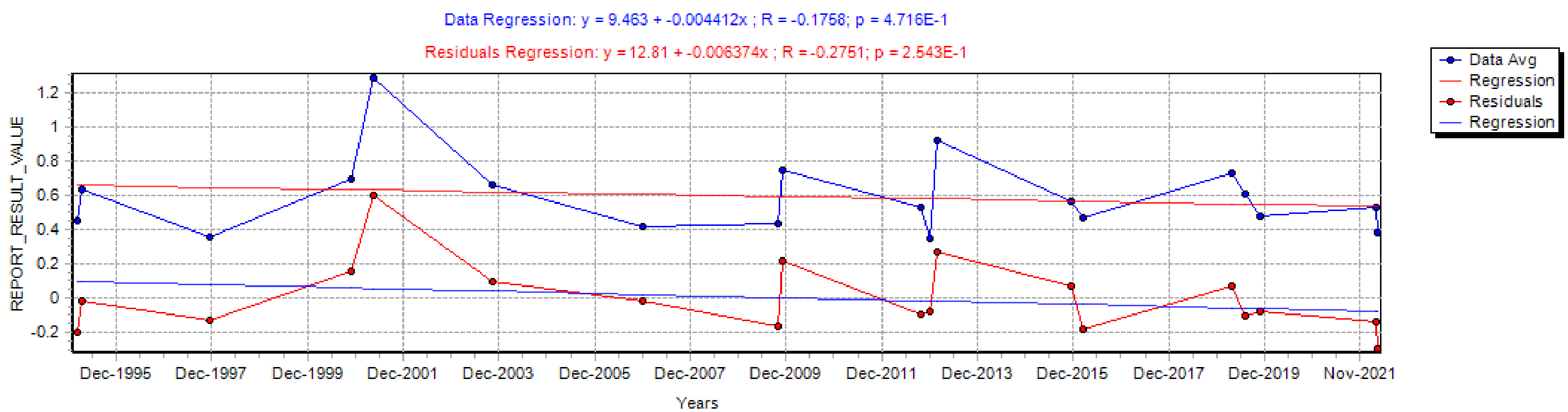
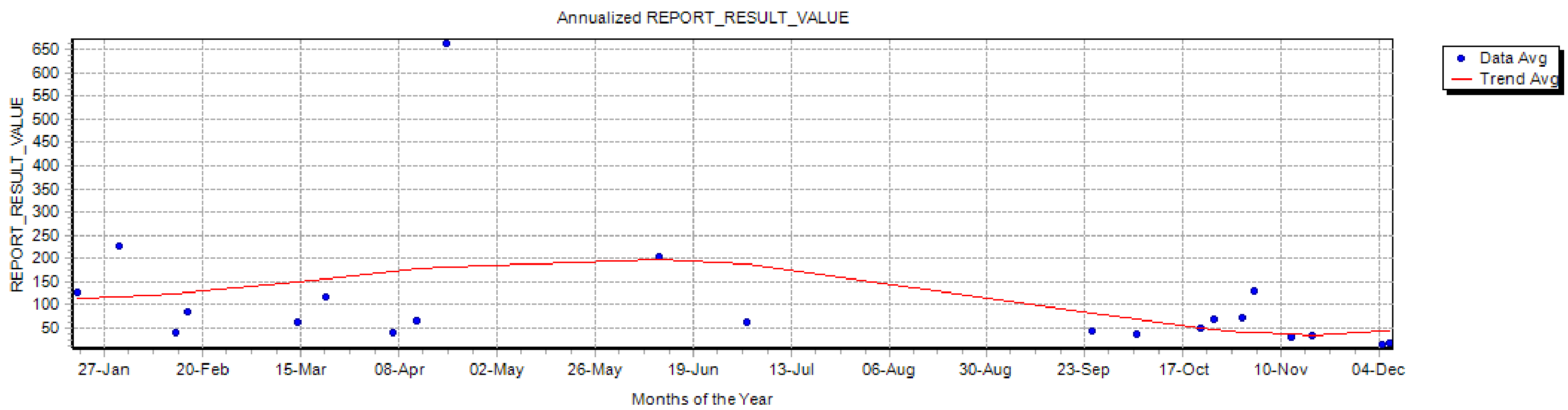


Chart 3-5: Chloride Trend



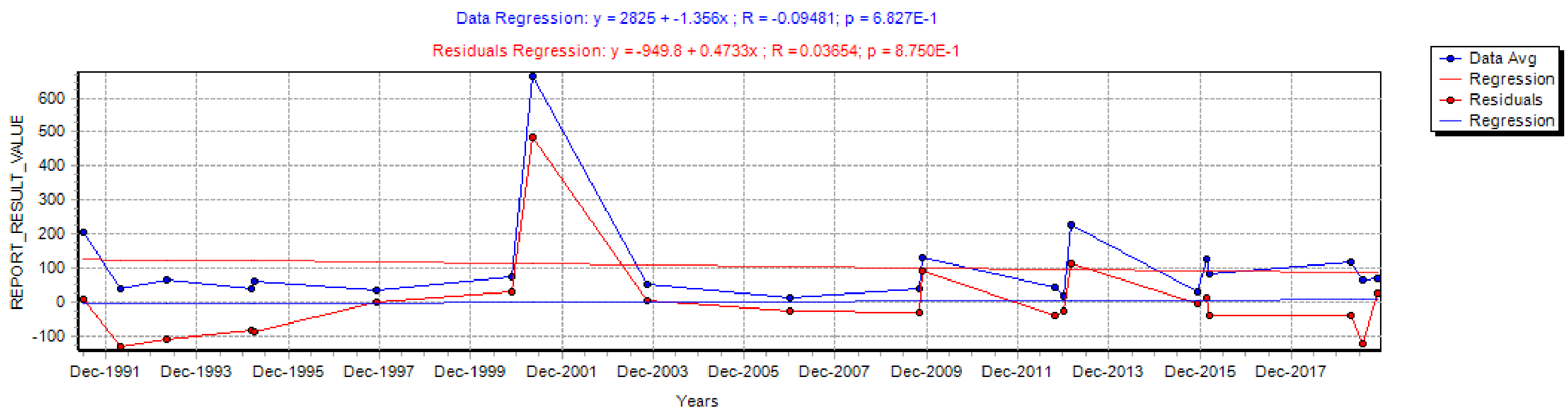
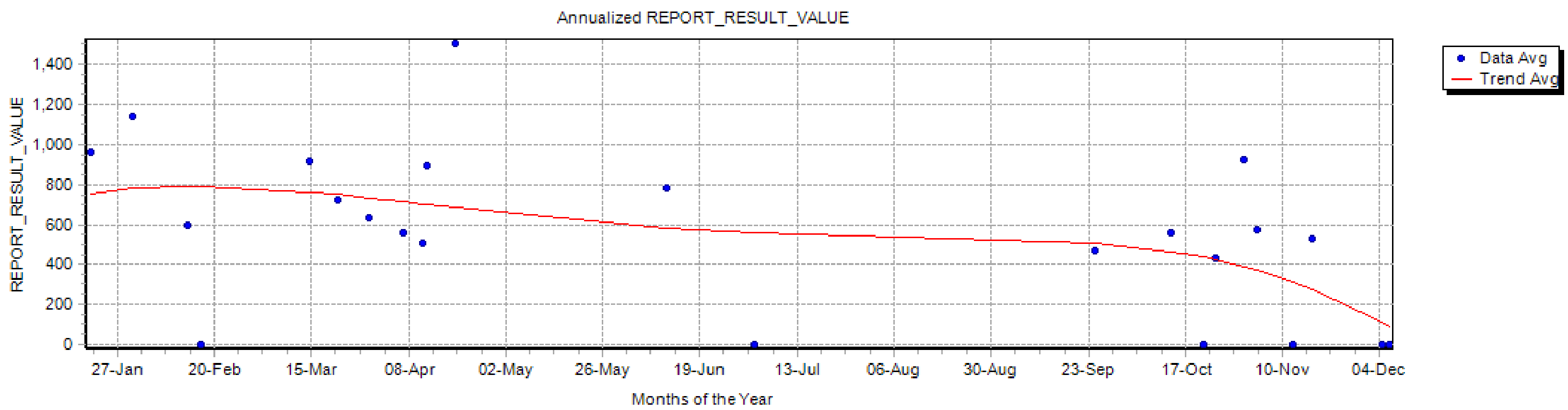


Chart 3-6: Total Dissolved Solids Trend



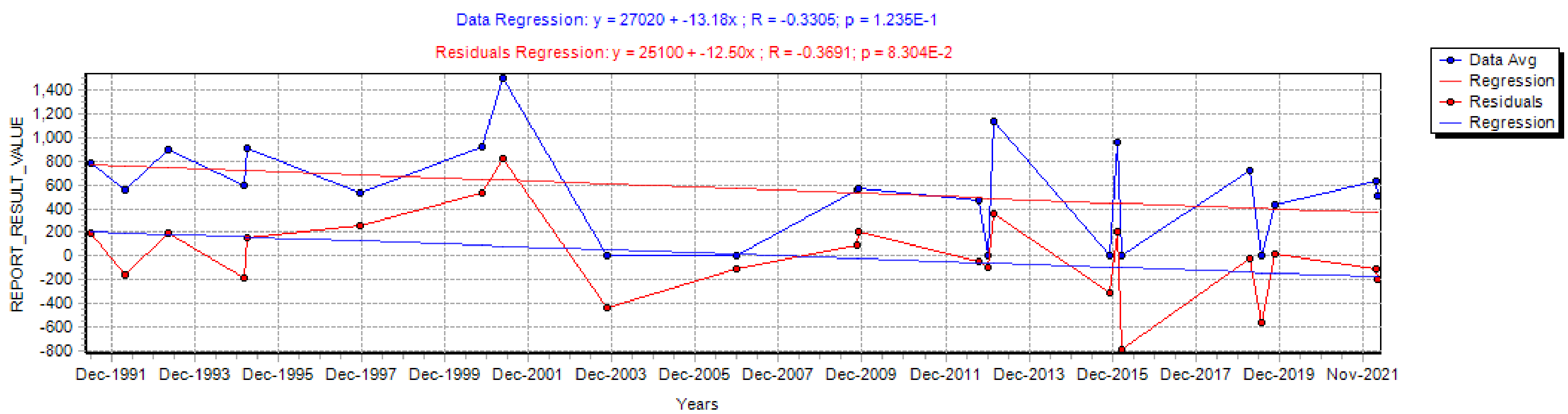
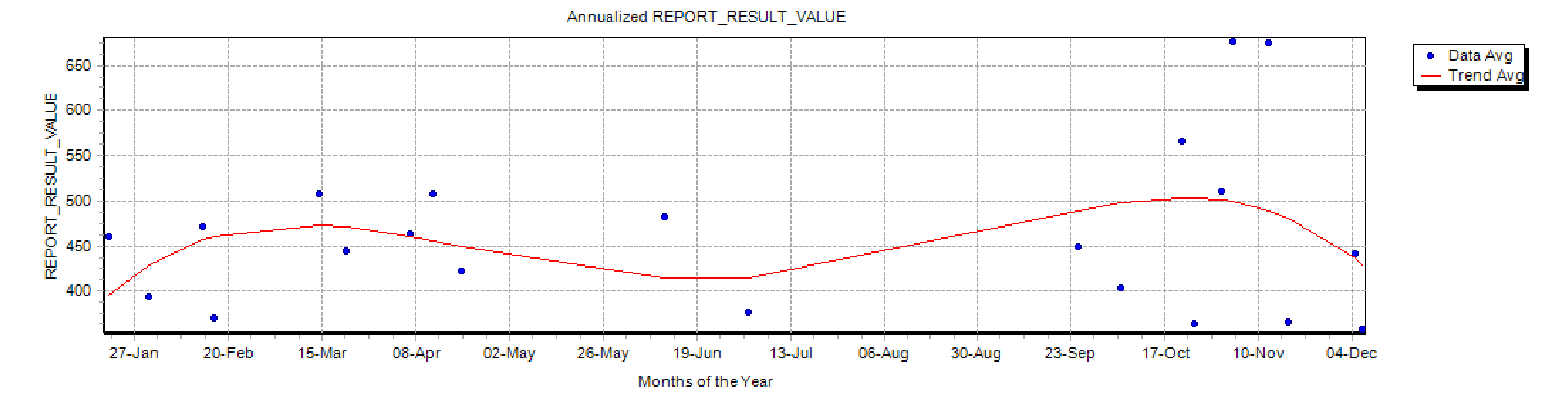


Chart 3-7: Alkalinity Trend



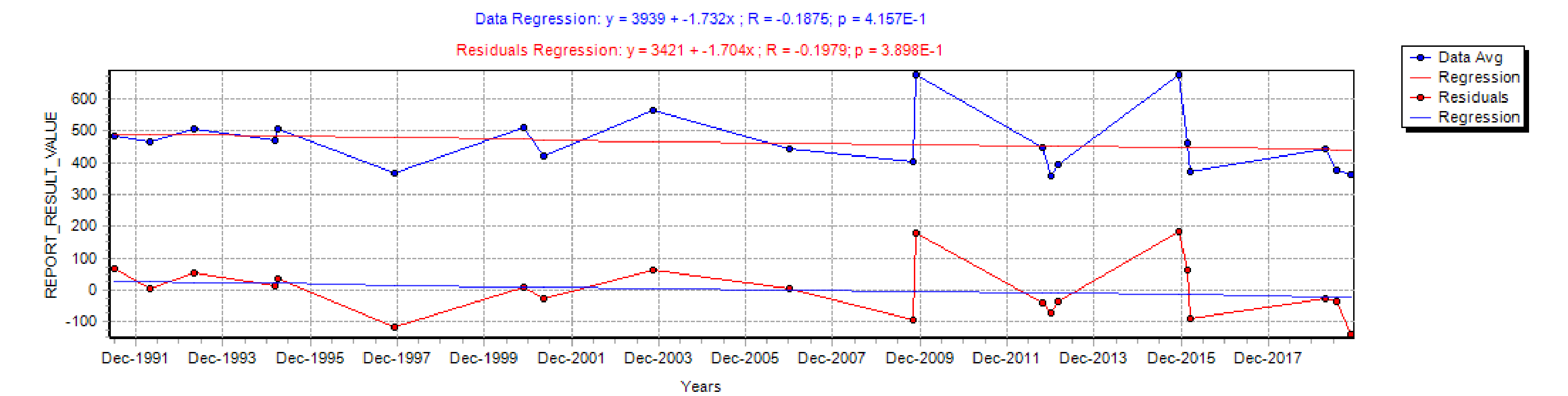
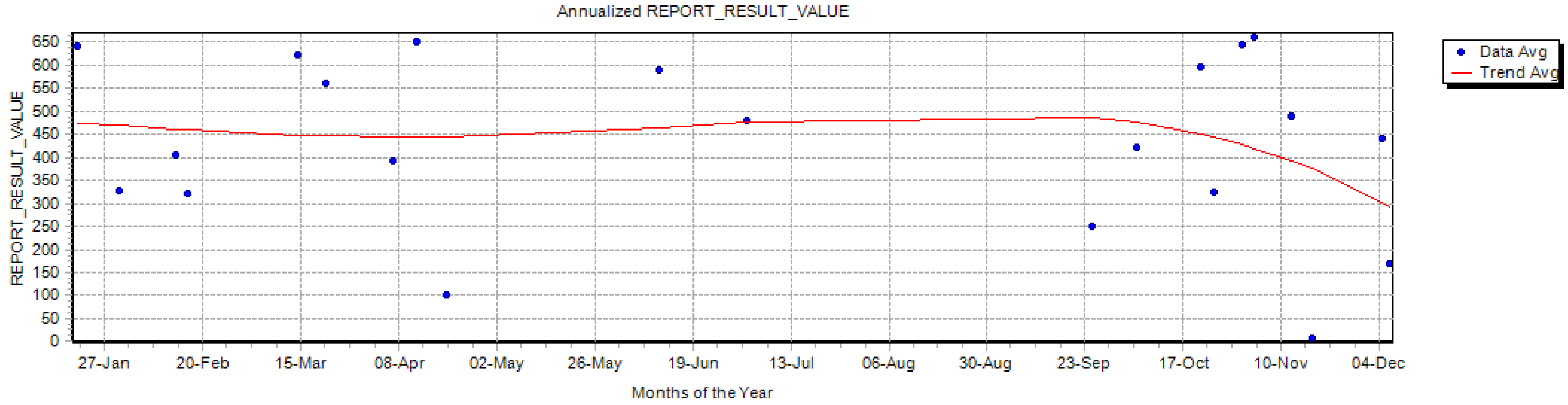


Chart 3-8: Hardness Trend



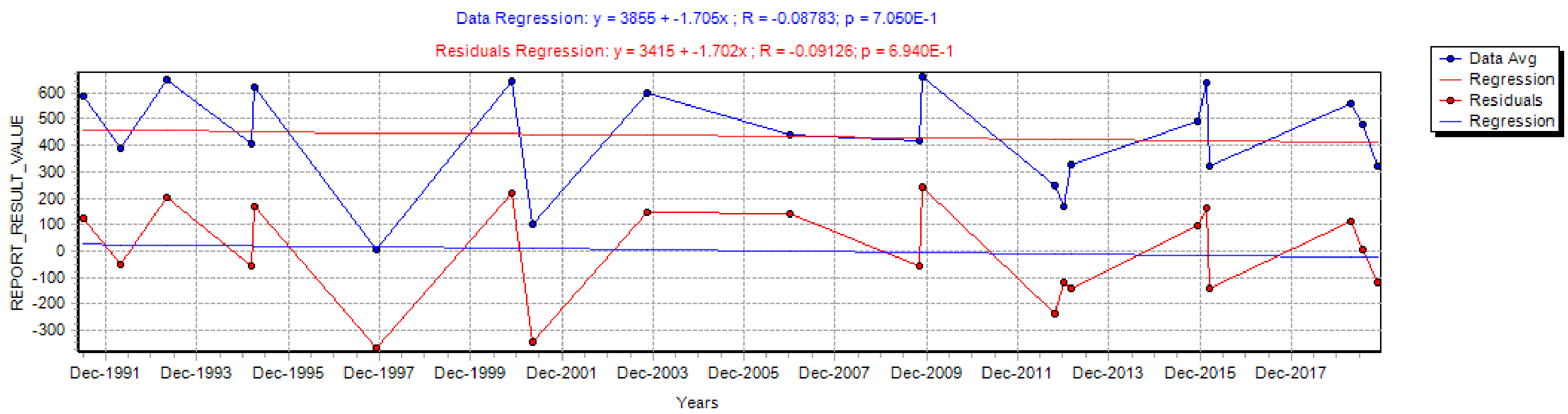
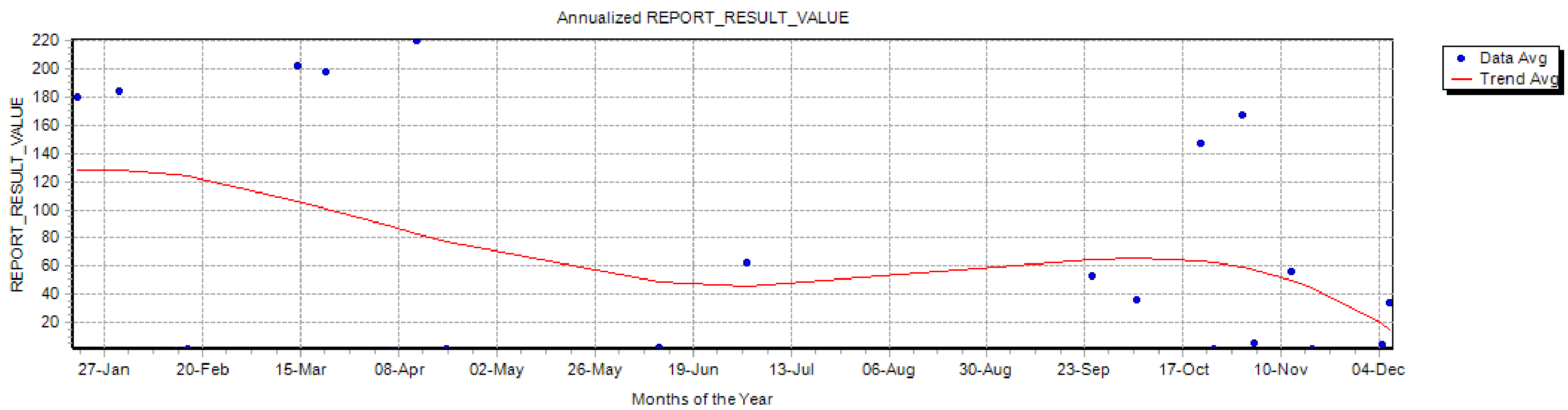


Chart 3-9: Sulfate Trend



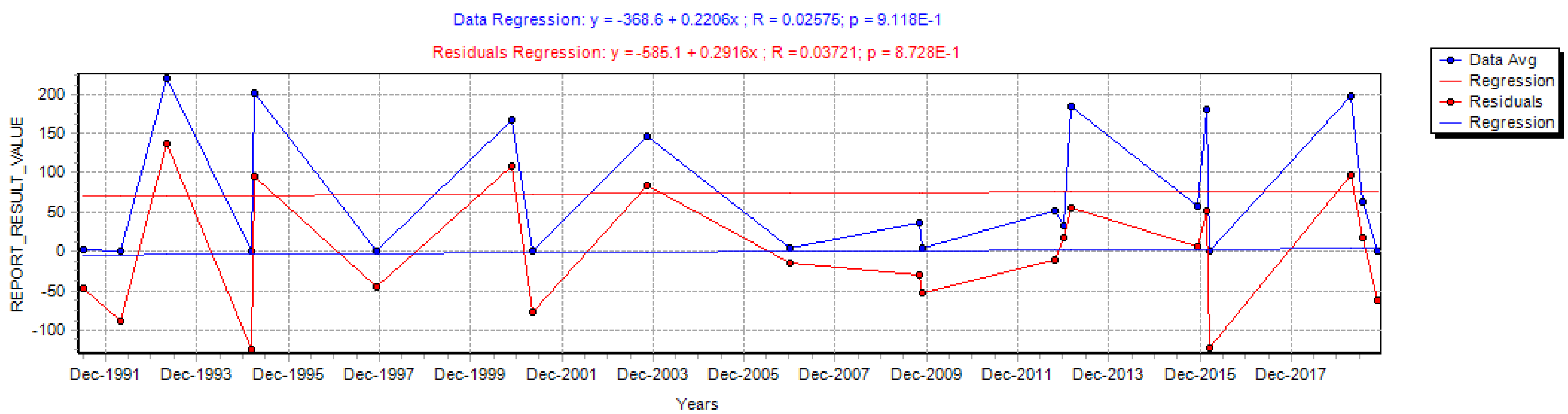
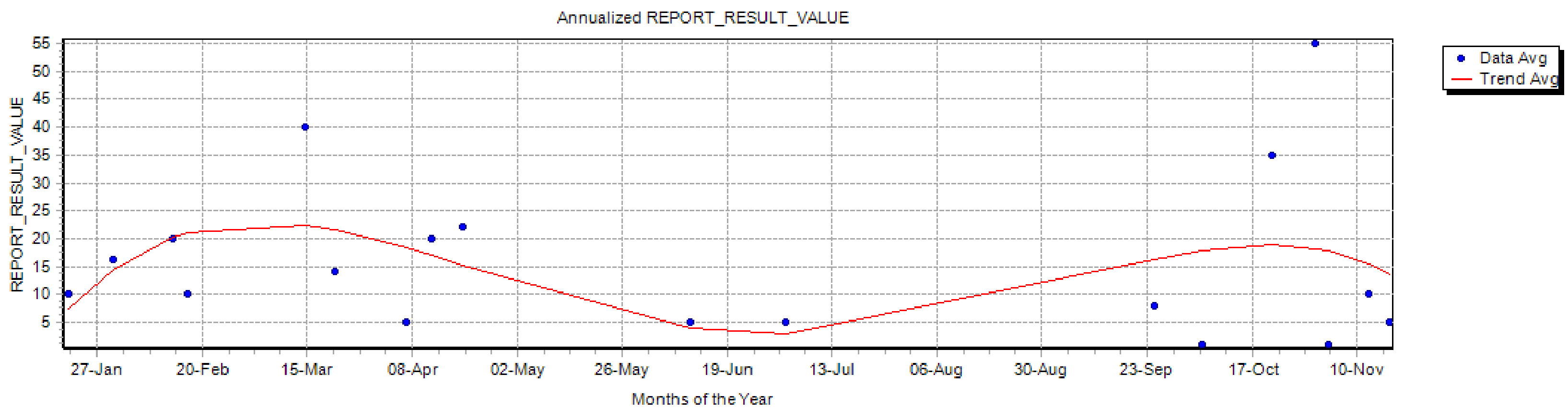


Chart 3-10: Color Trend



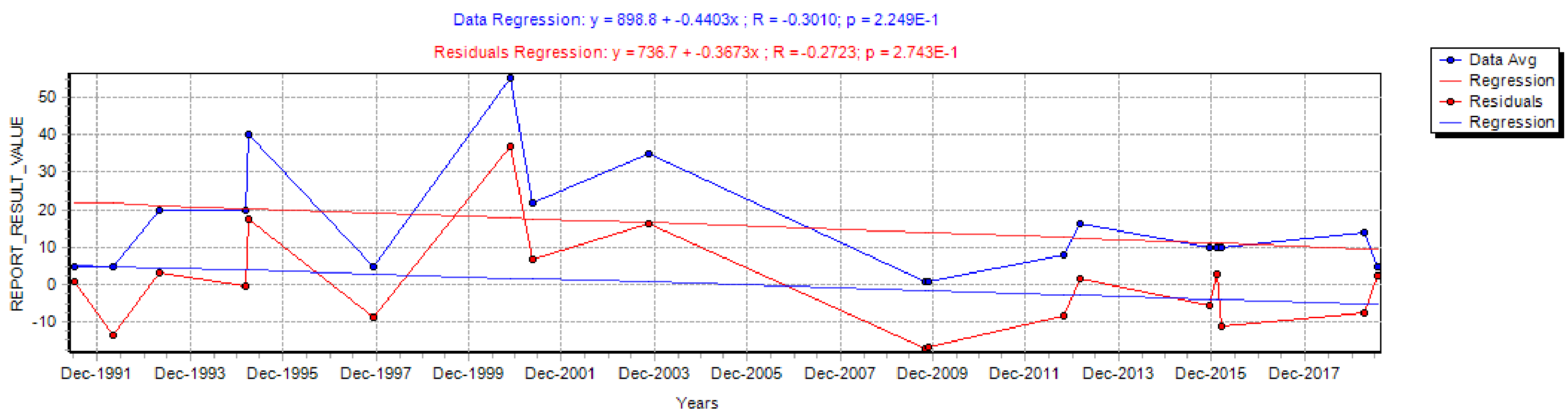
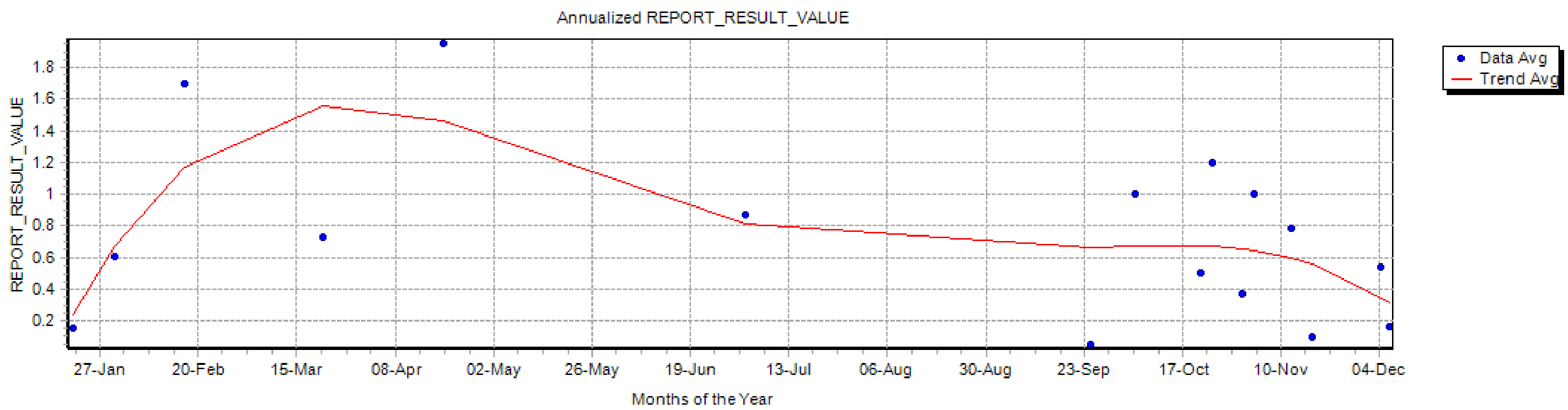


Chart 3-11: Ammonia Trend



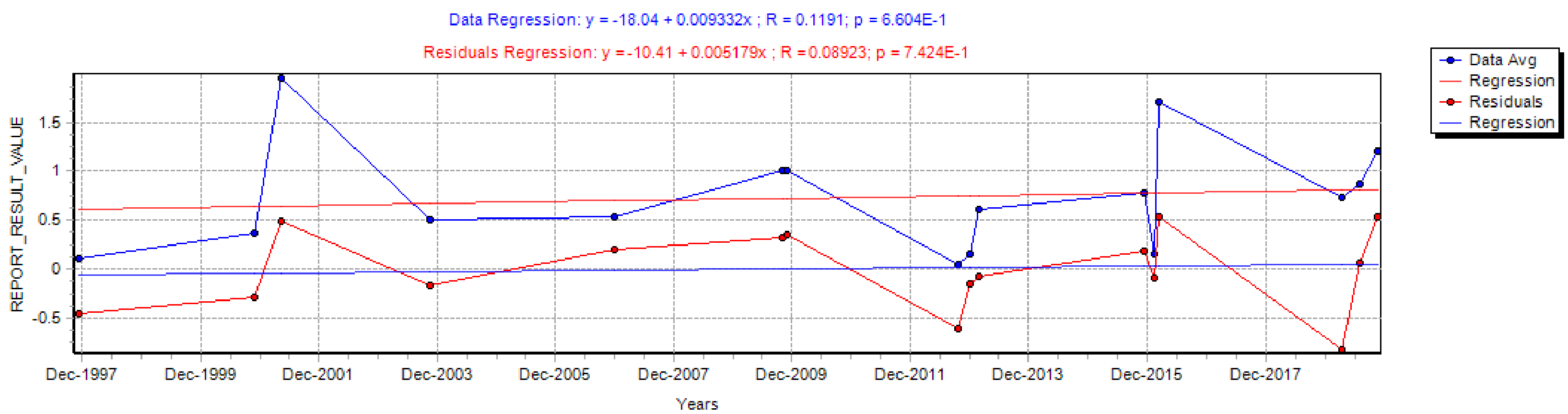
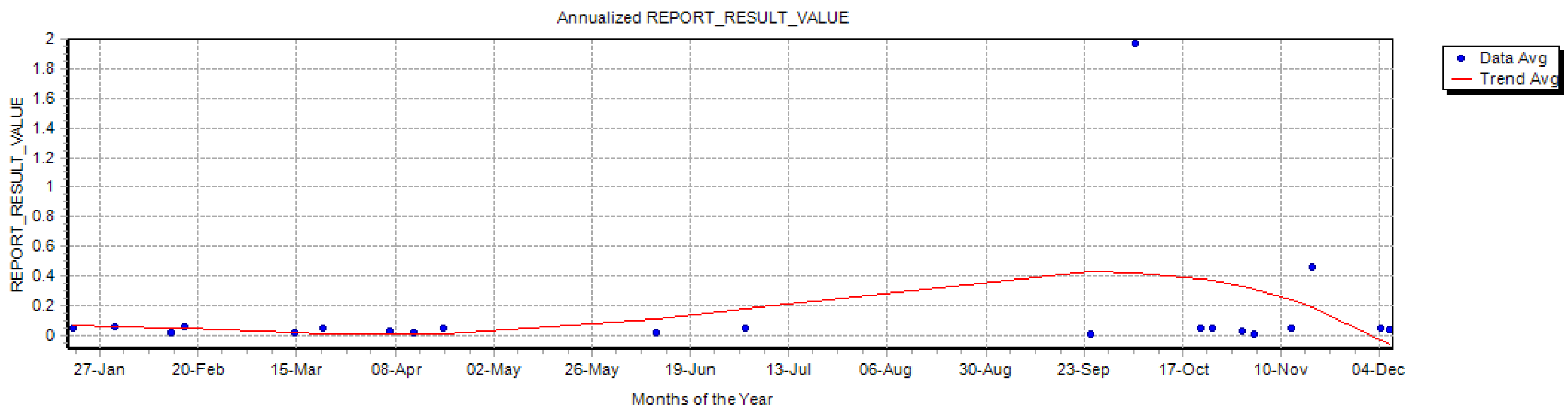


Chart 3-12: Nitrate - Nitrite Trend



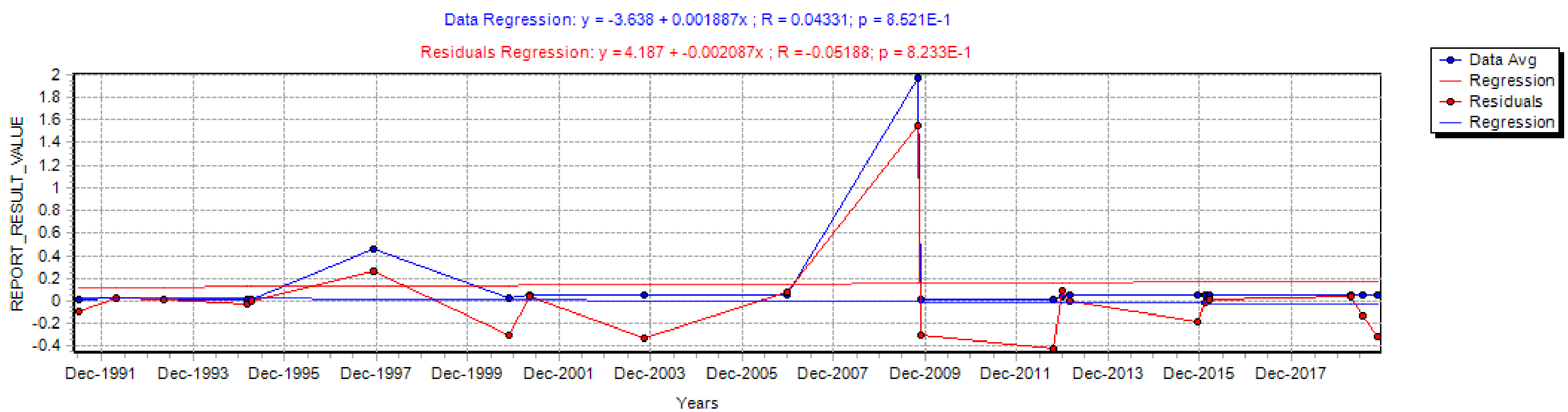
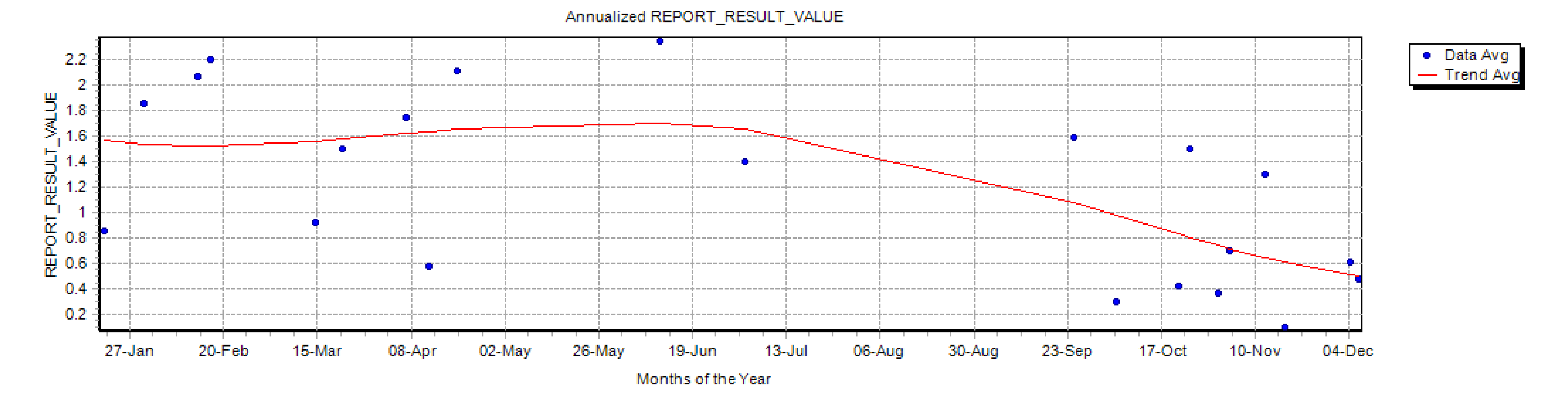


Chart 3-13: Total Kjeldahl Trend



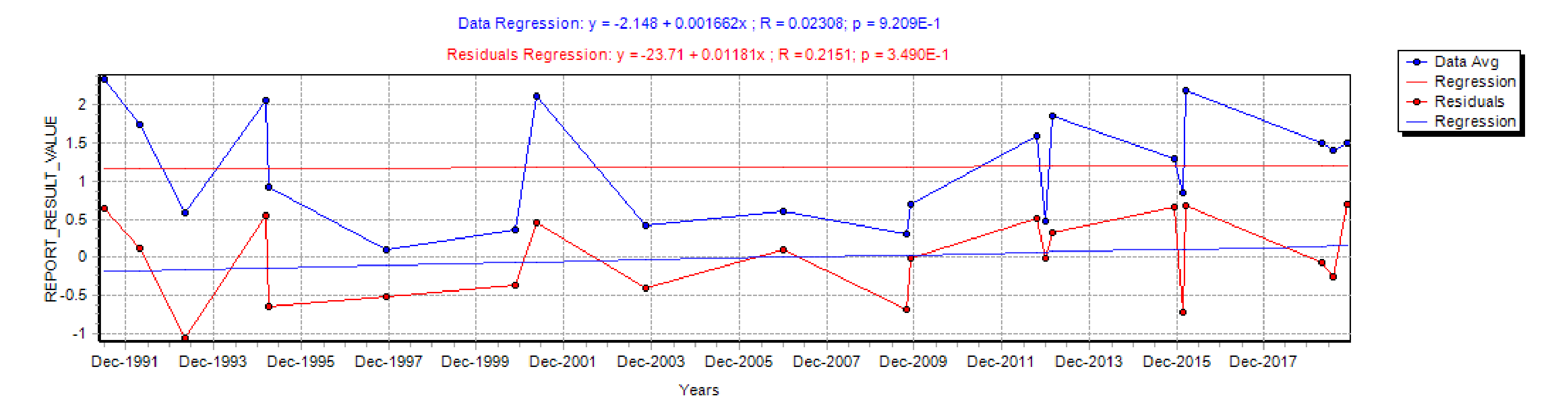
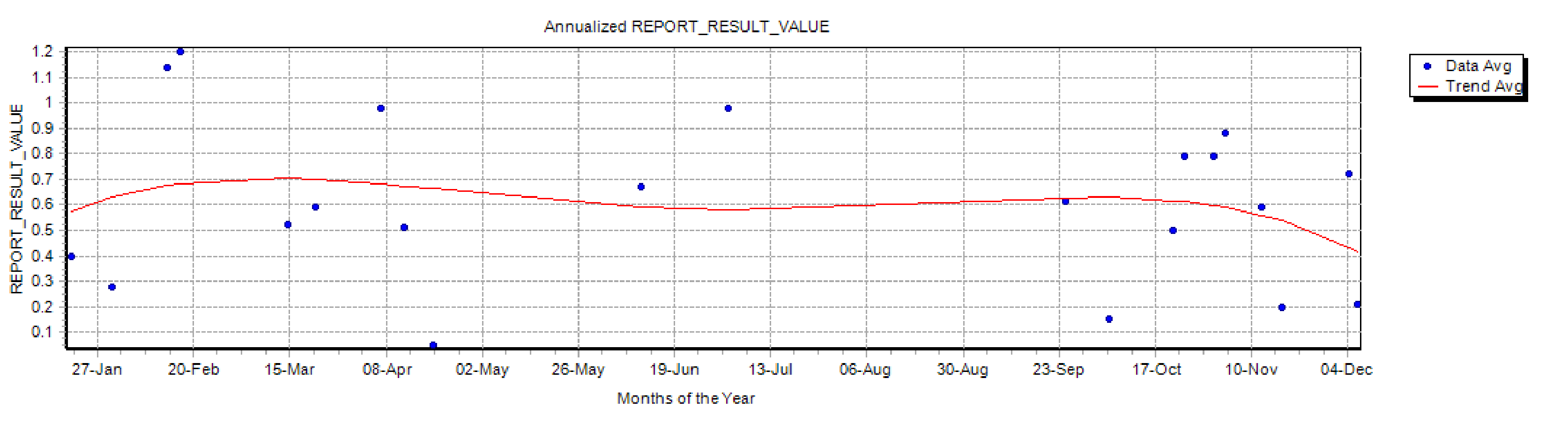


Chart 3-14: Total Phosphorus Trend



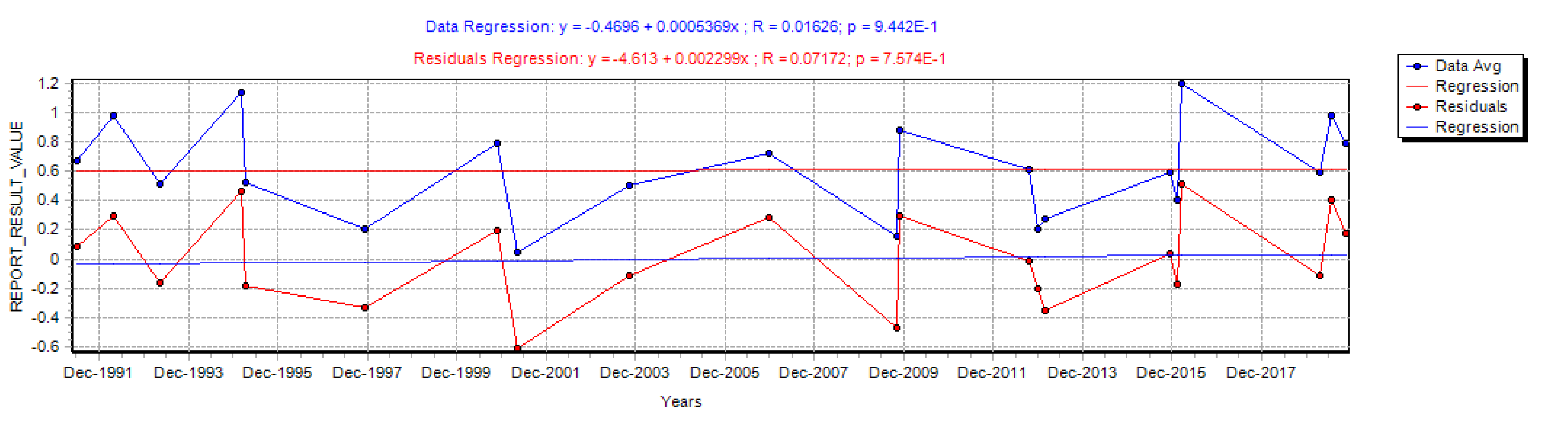
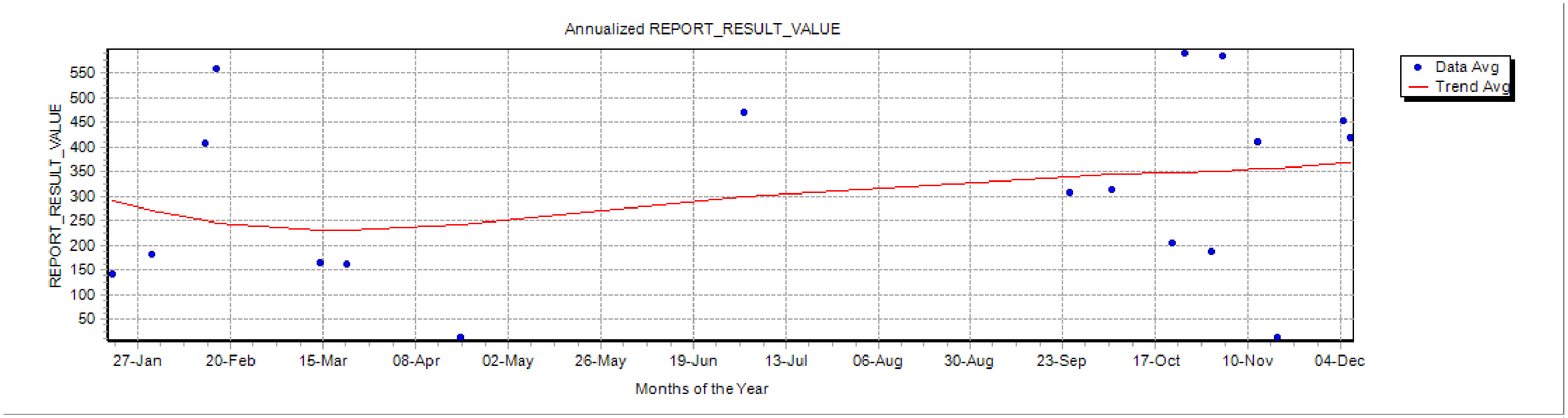


Chart 3-15: Barium Trend



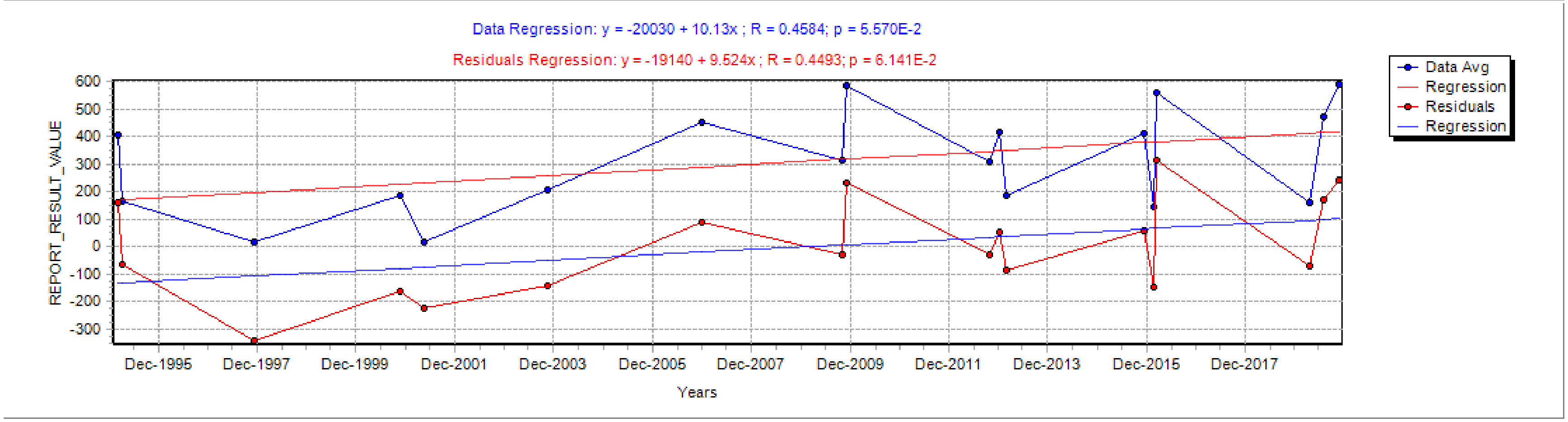


Chart 3-16: Copper Trend

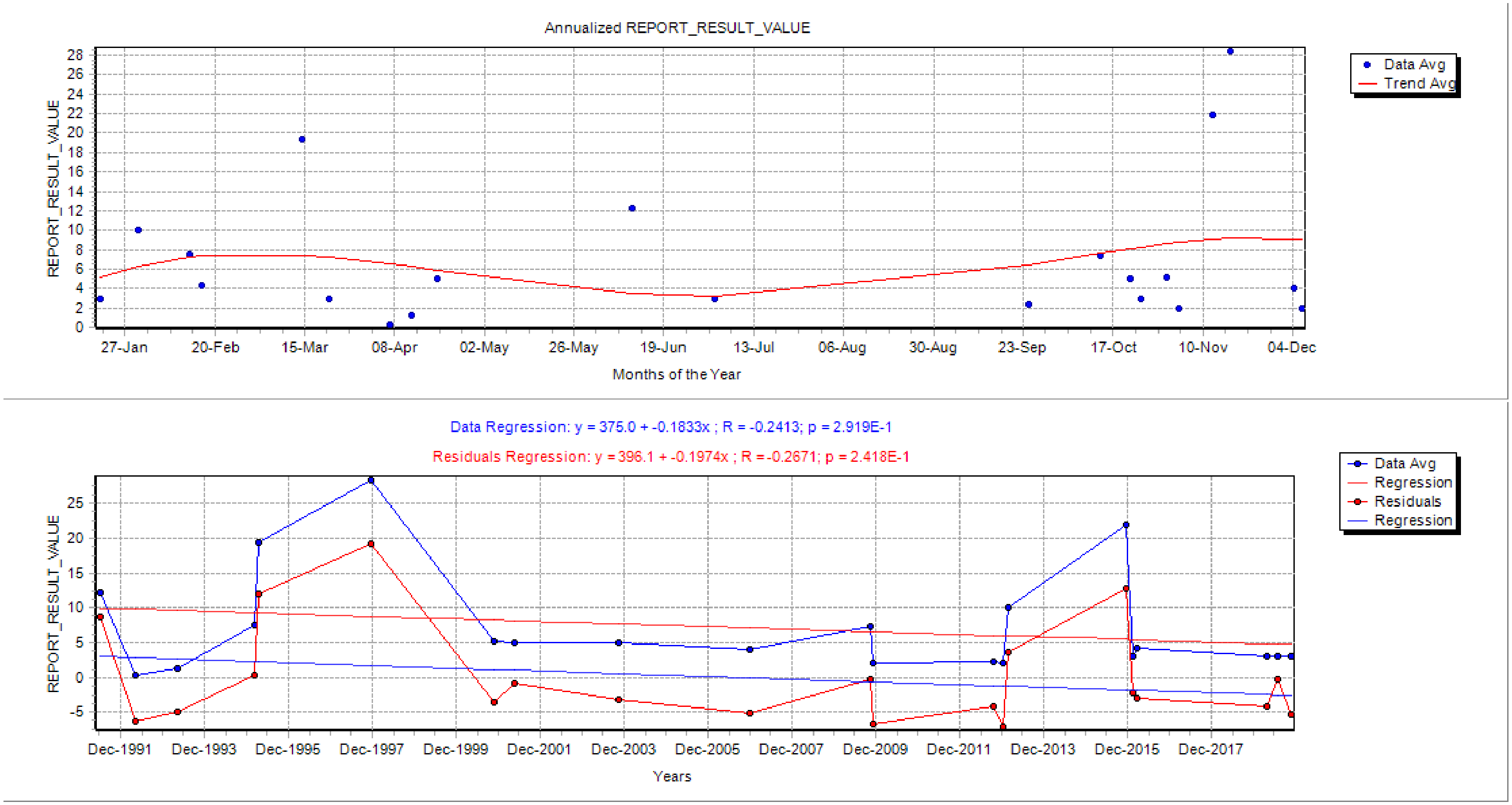
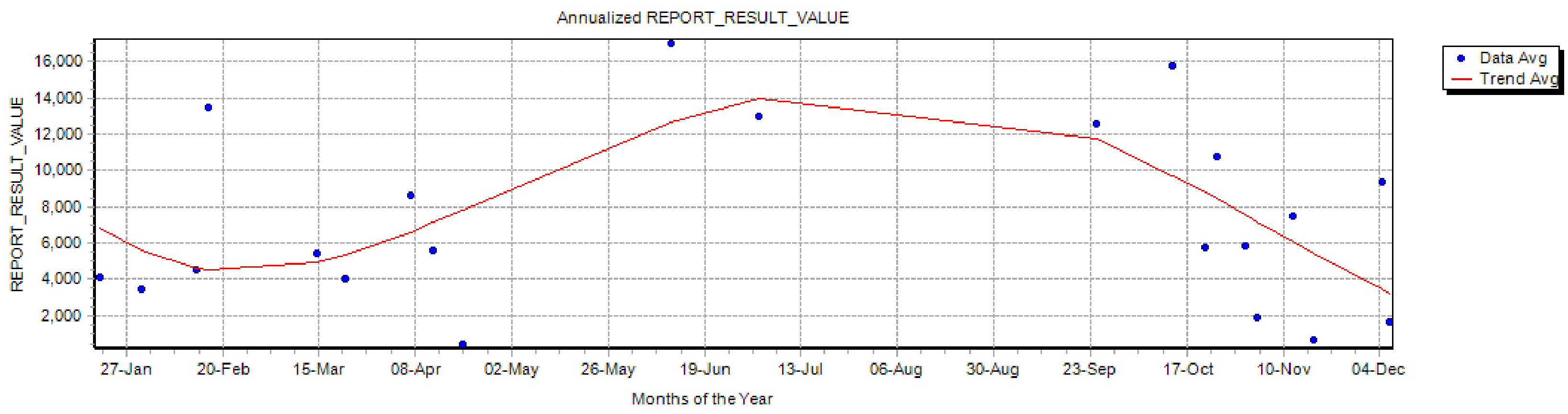


Chart 3-17: Iron Trend



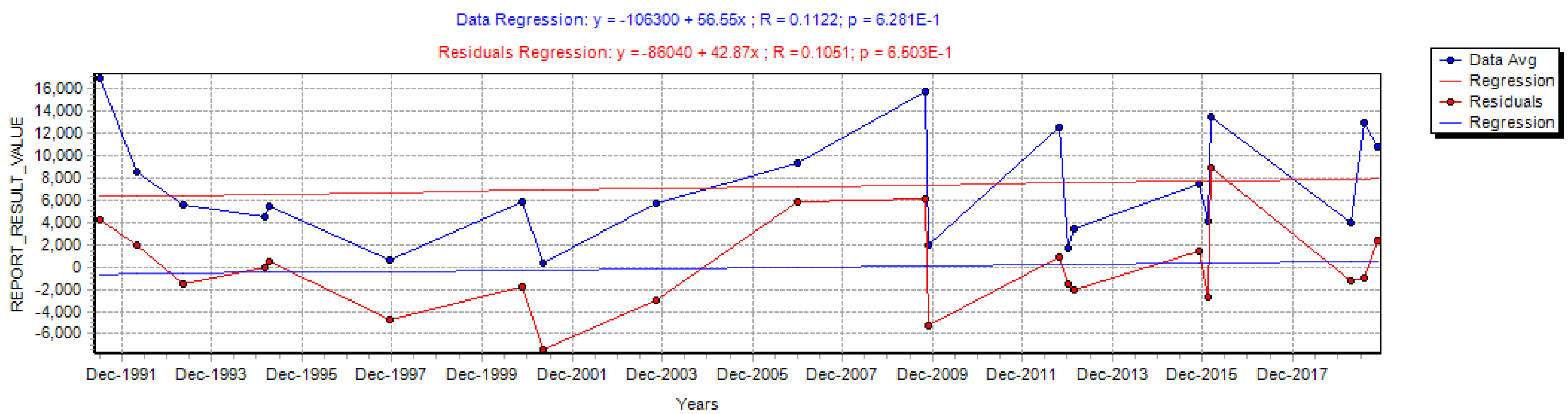


Chart 3-18: Zinc Trend