Appendix D: Physicals Trending Graphs
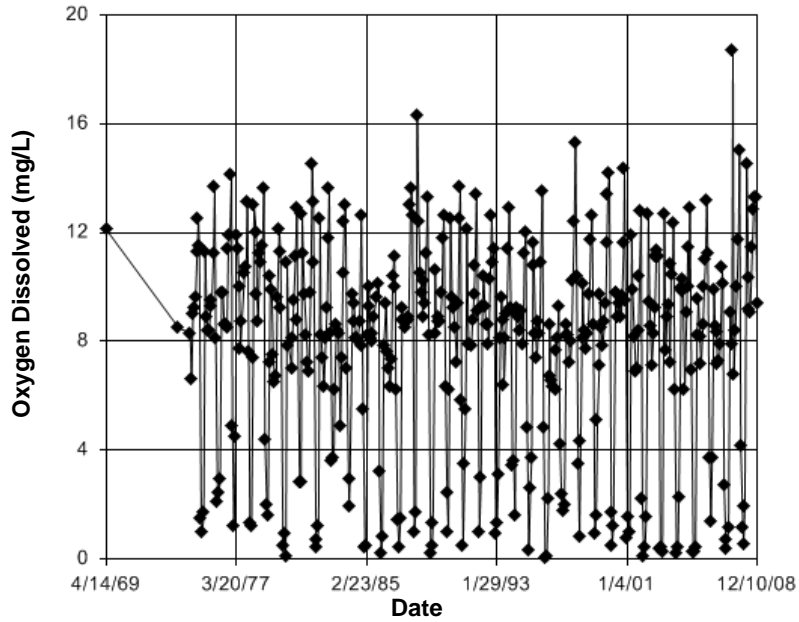
Time Series

Figure D1 Battle River: Oxygen Dissolved

Seasonality

For the data shown, the Kruskal-Wallis test indicates SEASONALITY at the 5% significance level. Because the calculated Kruskal-Wallis statistic is greater than the Chi-squared value, we conclude that at least one season has a significantly different median concentration of this constituent than any other season.
Calculated Kruskal-Wallis statistic = 10.68
Tabulated Chi-Squared value = 3.841 with 1 degrees of freedom at the 5% significance level.
There were 8 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 10.68
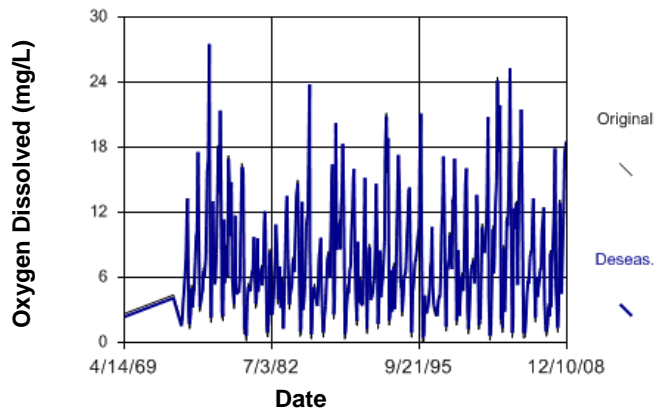Adjusted Kruskal-Wallis statistic (H') = 10.68

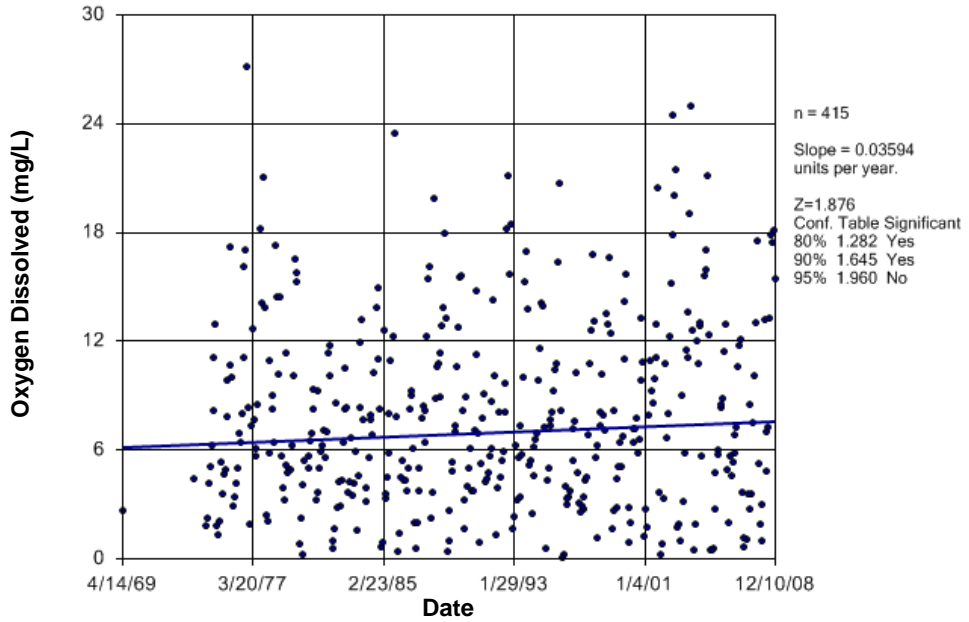**Figure D2 Battle River: Oxygen Dissolved**

Seasonal Kendall

n = 415

Slope = 0.03594
units per year.

Z=1.876
Conf. Table Significant
80% 1.282 Yes
90% 1.645 Yes
95% 1.960 No

Figure D3 Battle River: Oxygen Dissolved
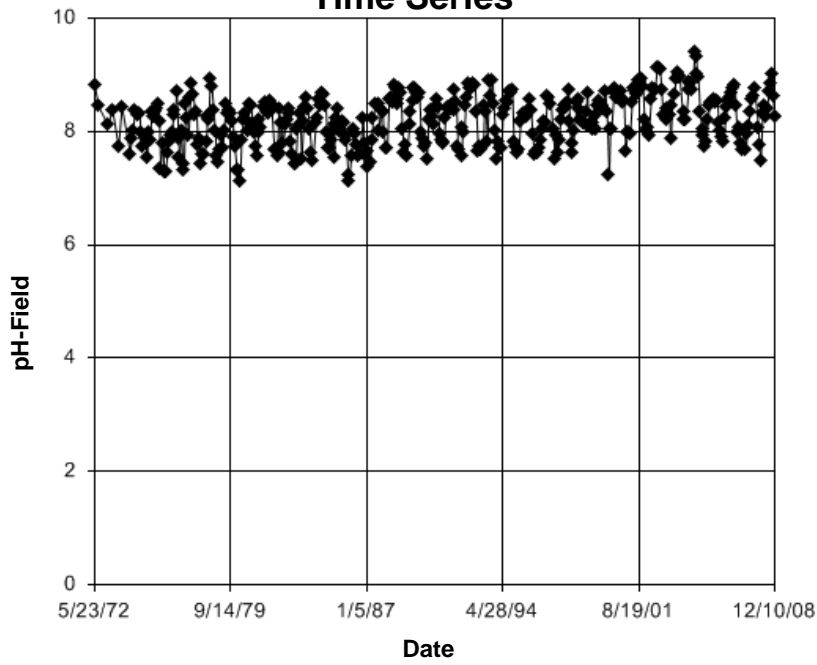
Time Series

Figure D4 Battle River: pH-Field

227

Seasonality

For the data shown, the Kruskal-Wallis test indicates SEASONALITY at the 5% significance level. Because the calculated Kruskal-Wallis statistic is greater than the Chi-squared value, we conclude that at least one season has a significantly different median concentration of this constituent than any other season.
Calculated Kruskal-Wallis statistic = 101.1
Tabulated Chi-Squared value = 3.841 with 1 degrees of freedom at the 5% significance level.
There were 44 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 101.1
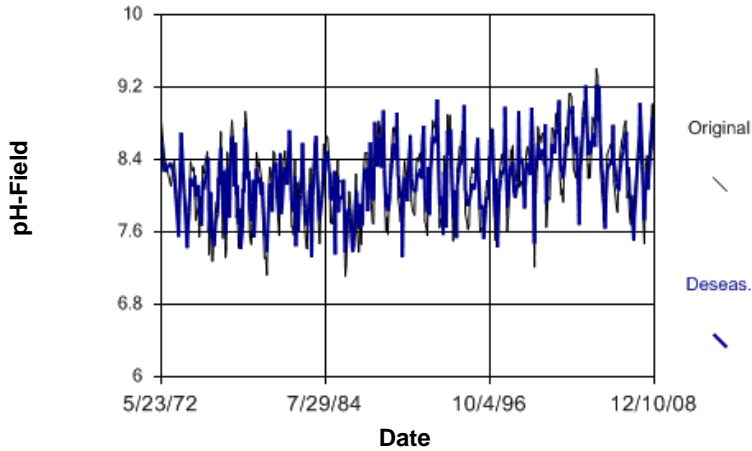Adjusted Kruskal-Wallis statistic (H') = 101.1
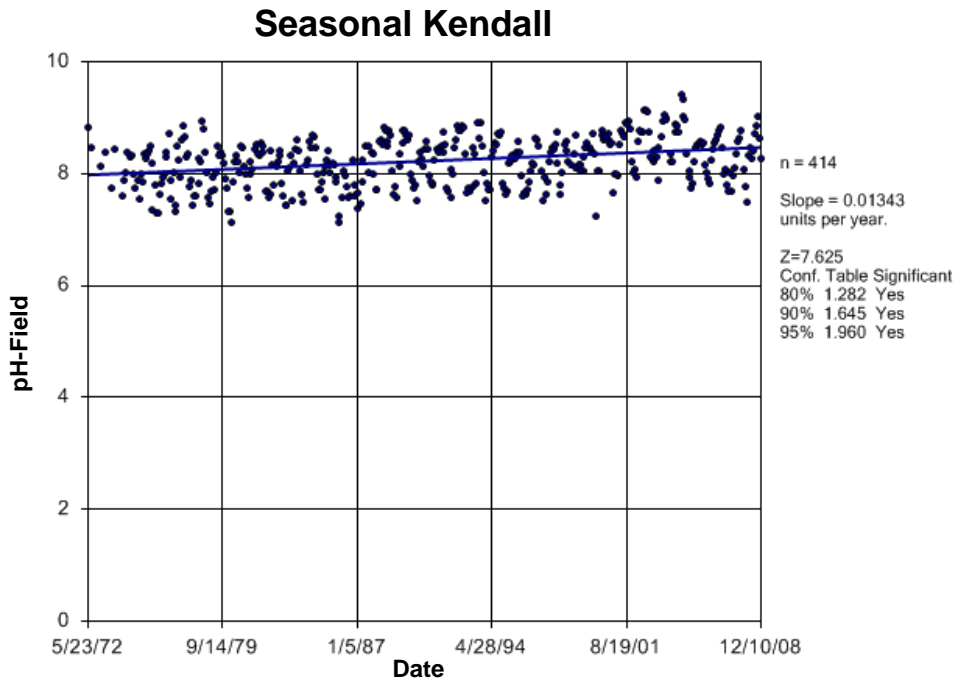

Figure D5 Battle River: pH-Field

Seasonal Kendall

Figure D6 Battle River: pH-Field
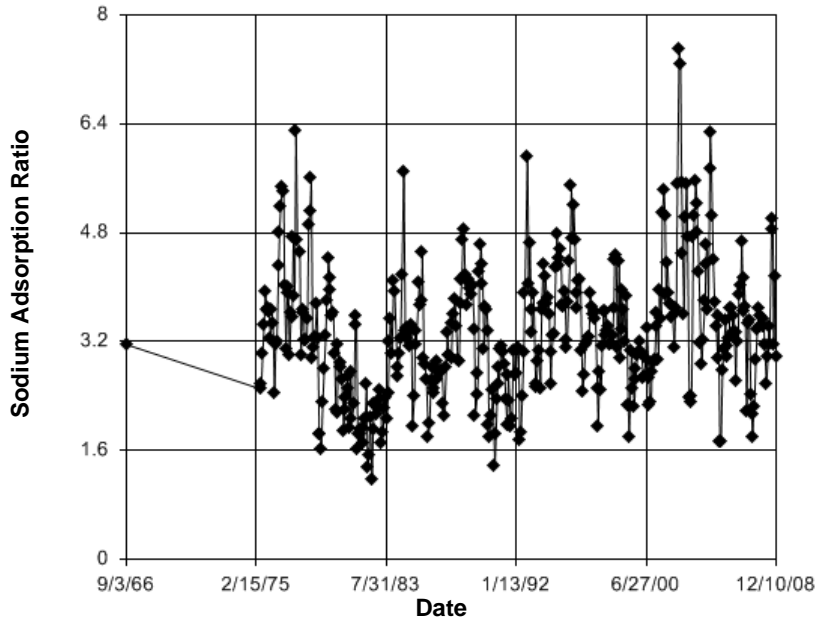
Time Series

Figure D7 Battle River: Sodium Adsorption Ratio

Seasonality

For the data shown, the Kruskal-Wallis test indicates SEASONALITY at the 5% significance level. Because the calculated Kruskal-Wallis statistic is greater than the Chi-squared value, we conclude that at least one season has a significantly different median concentration of this constituent than any other season.
Calculated Kruskal-Wallis statistic = 55.29
Tabulated Chi-Squared value = 3.841 with 1 degrees of freedom at the 5% significance level.
There were 30 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 55.29
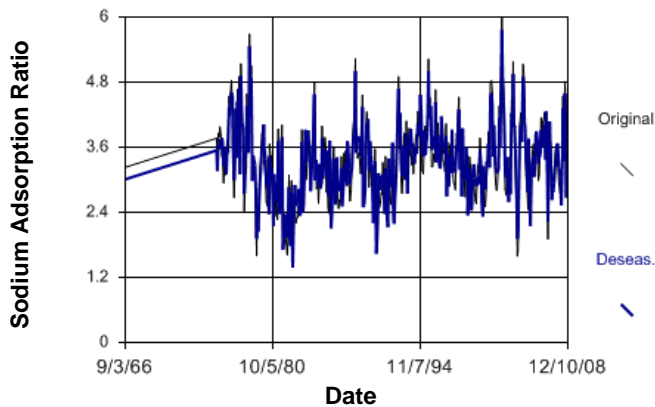Adjusted Kruskal-Wallis statistic (H') = 55.29
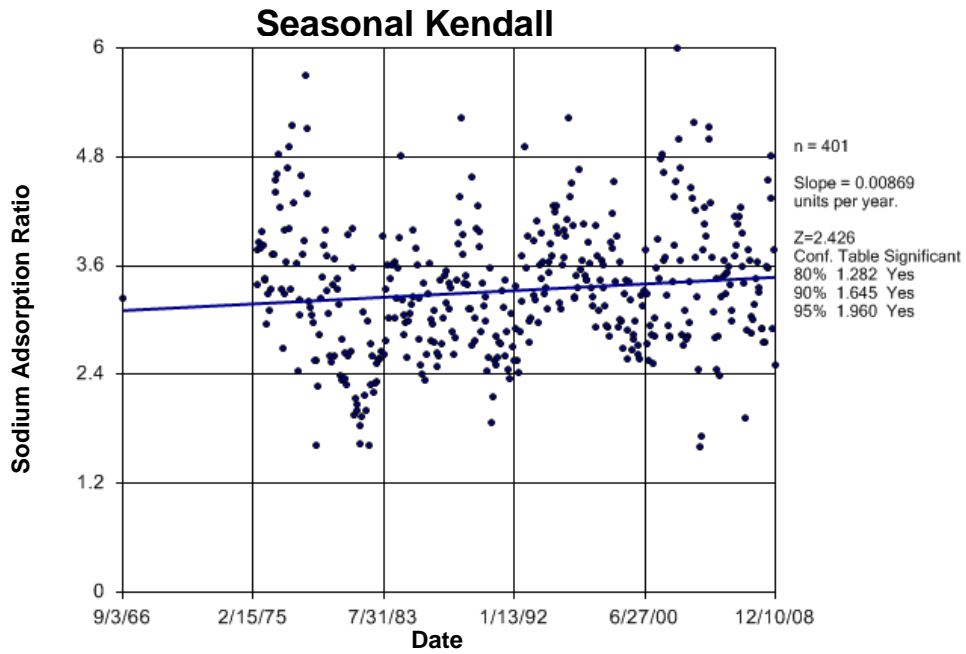

Figure D8 Battle River: Sodium Adsorption Ratio

Seasonal Kendall

n = 401

Slope = 0.00869
units per year.

Z=2.426
Conf. Table Significant
80% 1.282 Yes
90% 1.645 Yes
95% 1.960 Yes

Figure D9 Battle River: Sodium Adsorption Ratio

Time Series

Figure D10 Battle River: Total Suspended Solids

Seasonality

Figure D11 Battle River: Total Suspended Solids

Seasonal Kendall

n = 437

Slope = 0.3053 units per year.

Z=5.883
Conf. Table Significant
80% 1.282 Yes
90% 1.645 Yes
95% 1.960 Yes

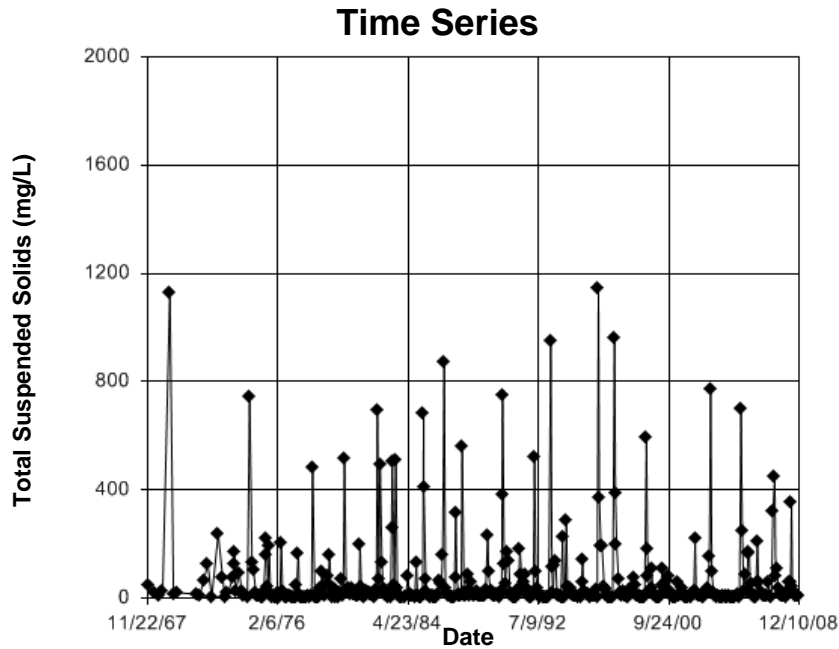**Figure D12 Battle River: Total Suspended Solids**

Time Series

Figure D13 Beaver River: Oxygen Dissolved

Seasonality

For the data shown, the Kruskal-Wallis test indicates SEASONALITY at the 5% significance level. Because the calculated Kruskal-Wallis statistic is greater than the Chi-squared value, we conclude that at least one season has a significantly different median concentration of this constituent than any other season.
Calculated Kruskal-Wallis statistic = 30.59
Tabulated Chi-Squared value = 3.841 with 1 degrees of freedom at the 5% significance level.
There were 4 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 30.59
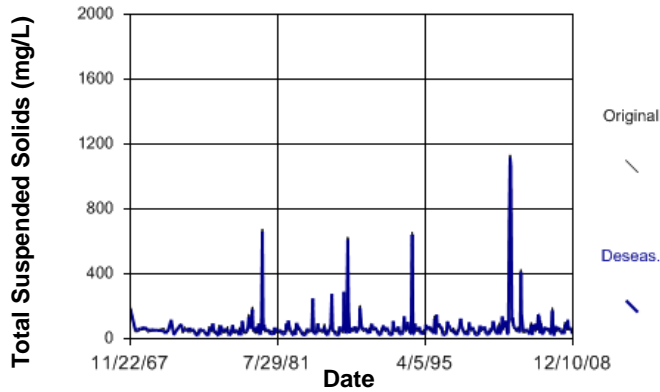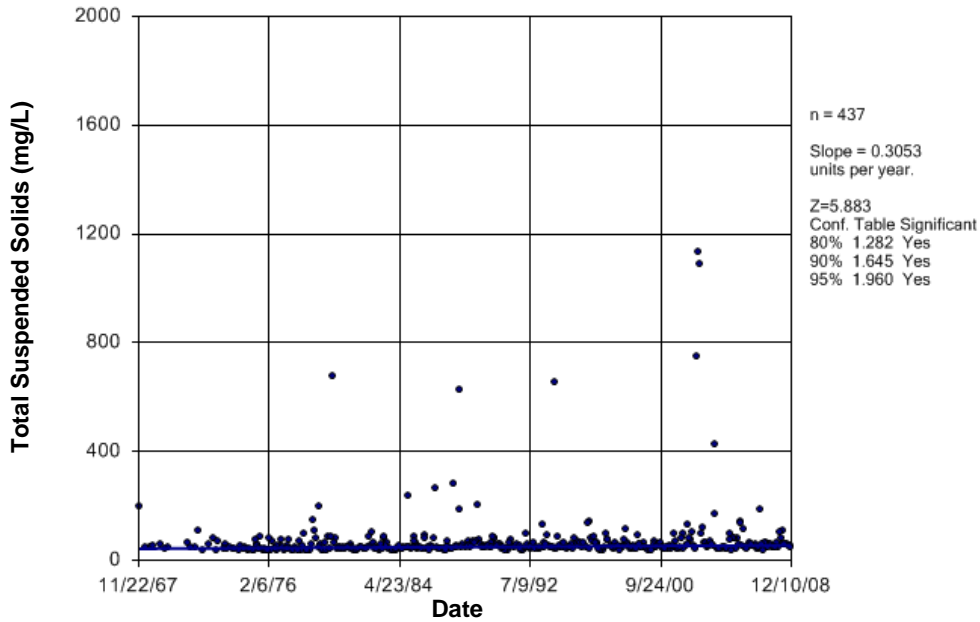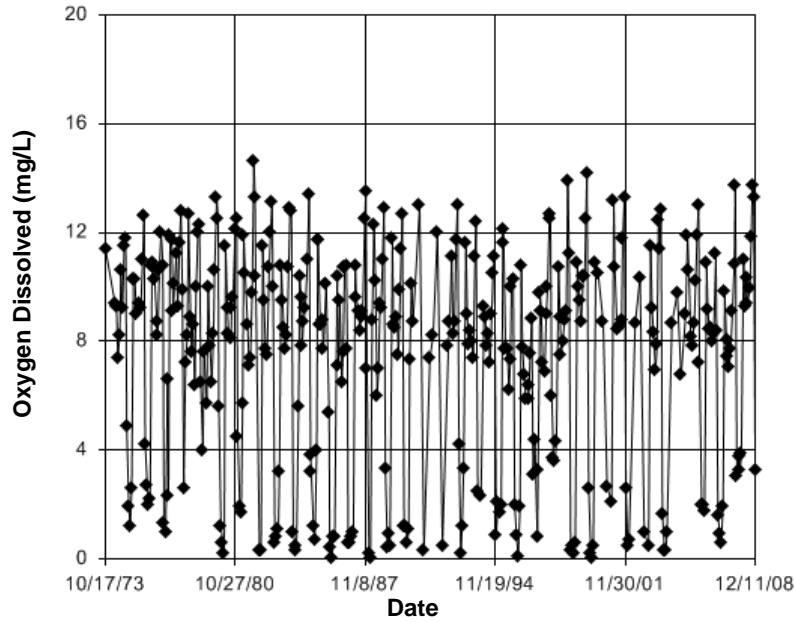Adjusted Kruskal-Wallis statistic (H') = 30.59

Figure D14 Beaver River: Oxygen Dissolved

Seasonal Kendall

n = 373

Slope = 0.03674
units per year.

Z=1.863
Conf. Table Significant
80% 1.282 Yes
90% 1.645 Yes
95% 1.960 No

Figure D15 Beaver River: Oxygen Dissolved

Time Series

Figure D16 Beaver River: pH-Field

Seasonality

For the data shown, the Kruskal-Wallis test indicates SEASONALITY at the 5% significance level. Because the calculated Kruskal-Wallis statistic is greater than the Chi-squared value, we conclude that at least one season has a significantly different median concentration of this constituent than any other season.
Calculated Kruskal-Wallis statistic = 92.1
Tabulated Chi-Squared value = 3.841 with 1 degrees of freedom at the 5% significance level.
There were 42 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 92.1
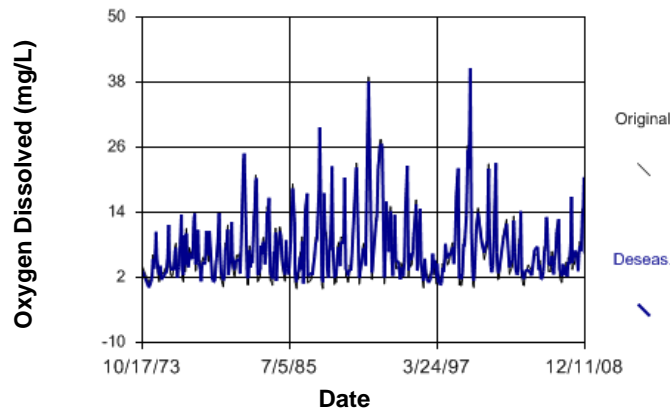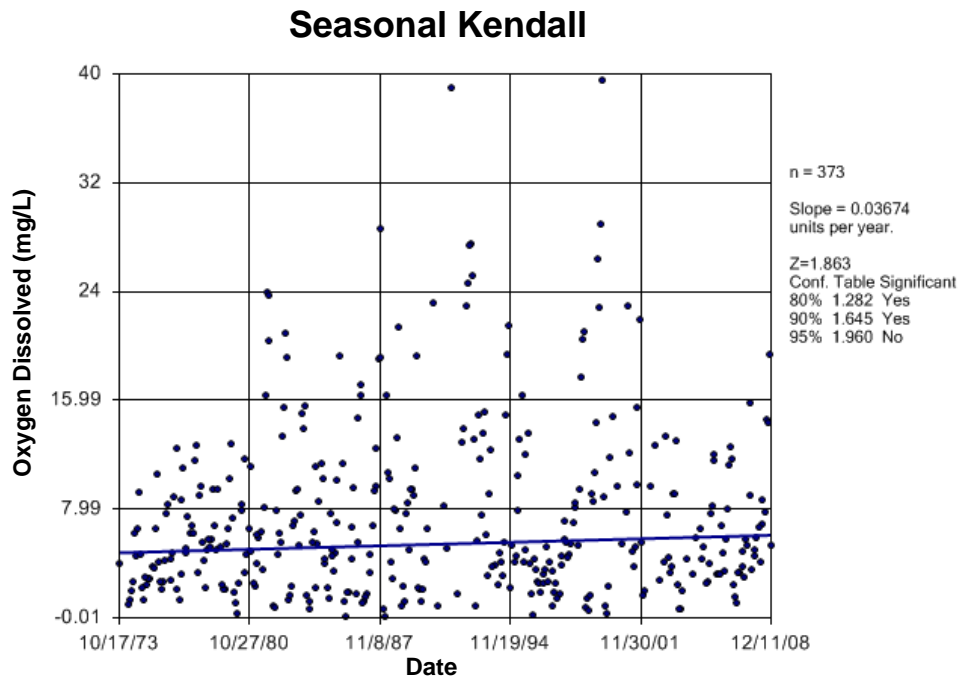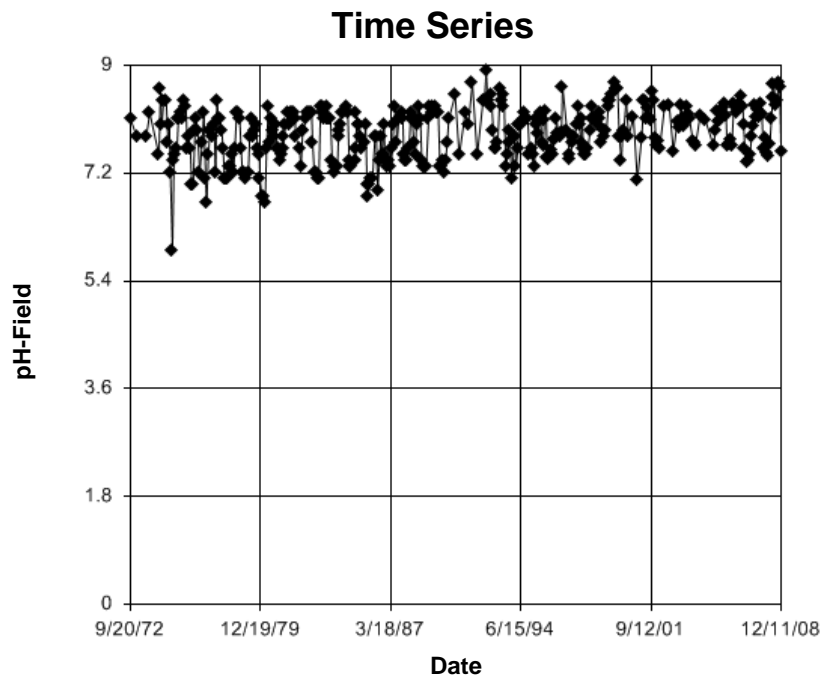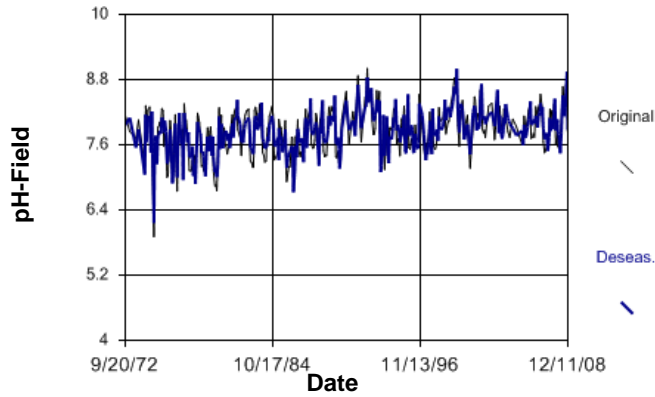Adjusted Kruskal-Wallis statistic (H') = 92.1

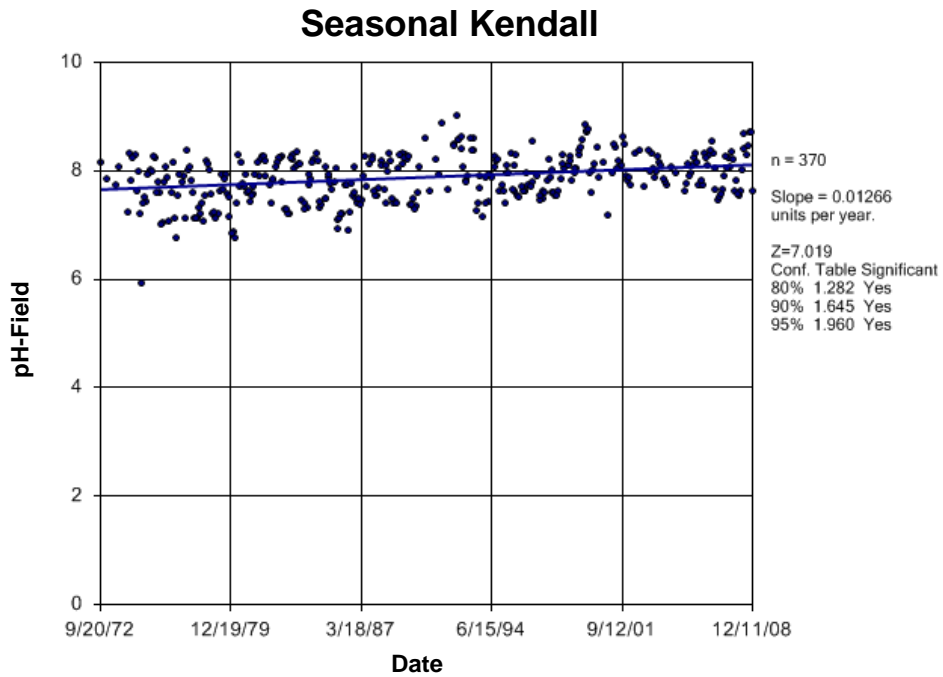

Figure D17 Beaver River: pH-Field

Seasonal Kendall

n = 370

Slope = 0.01266 units per year.

Z=7.019
Conf. Table Significant
80% 1.282 Yes
90% 1.645 Yes
95% 1.960 Yes

Figure D18 Beaver River: pH-Field
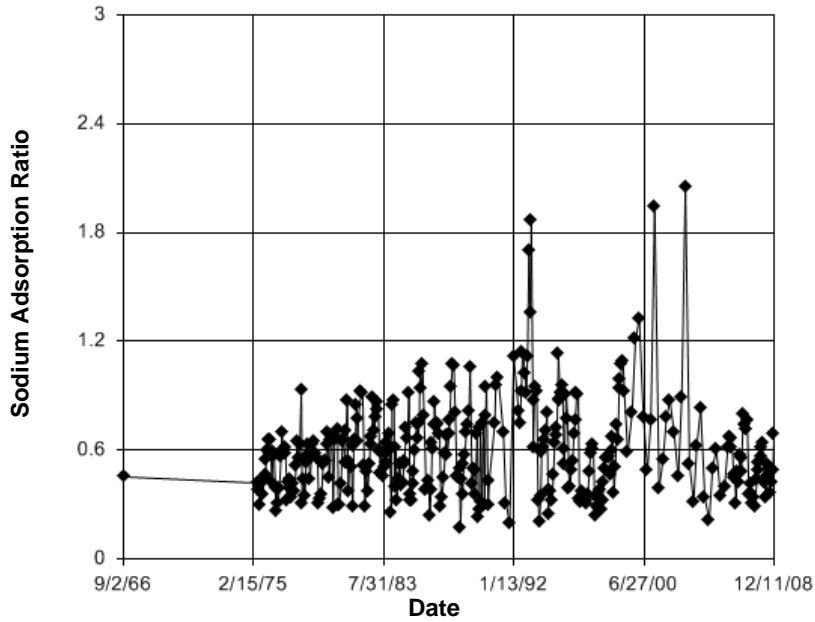
Time Series

Figure D19 Beaver River: Sodium Adsorption Ratio

Seasonality

For the data shown, the Kruskal-Wallis test indicates NO SEASONALITY at the 5% significance level. Because the calculated Kruskal-Wallis statistic is less than or equal to the Chi-squared value, we conclude that no season has a significantly different median concentration of this constituent than any other season.
Calculated Kruskal-Wallis statistic = 3.435
Tabulated Chi-Squared value = 3.841 with 1 degrees of freedom at the 5% significance level.
There were 18 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 3.435
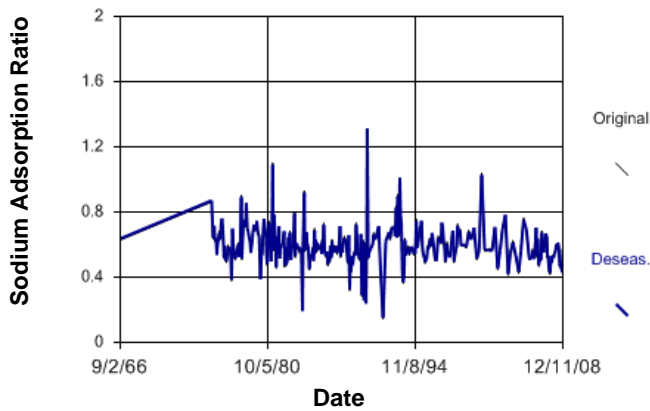Adjusted Kruskal-Wallis statistic (H') = 3.435

Figure D20 Beaver River: Sodium Adsorption Ratio

Sen's Slope Estimator

n = 335

Slope = -0.001625 units per year.

Mann-Kendall normal approx. = -3.26 critical = -1.96

Decreasing trend significant at 95% confidence level (α = 0.025 per tail).
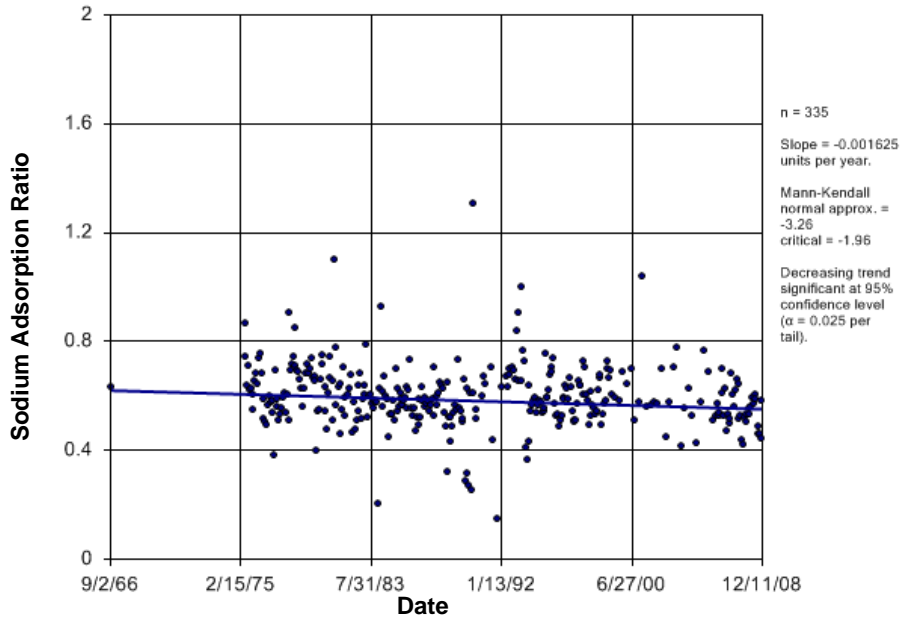
Figure D21 Beaver River: Sodium Adsorption Ratio
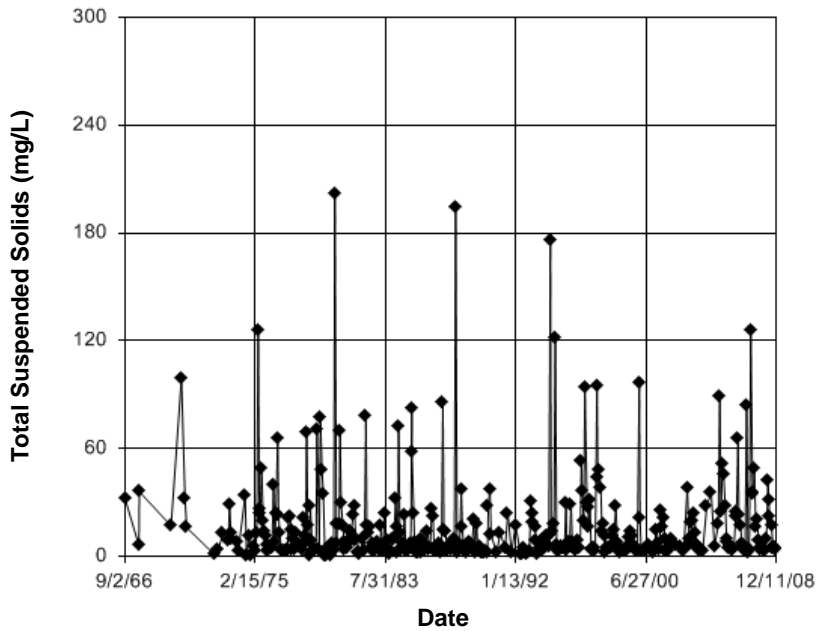
Time Series

Figure D22 Beaver River: Total Suspended Solids

236

Seasonality

For the data shown, the Kruskal-Wallis test indicates SEASONALITY at the 5% significance level. Because the calculated Kruskal-Wallis statistic is greater than the Chi-squared value, we conclude that at least one season has a significantly different median concentration of this constituent than any other season.
Calculated Kruskal-Wallis statistic = 6.254
Tabulated Chi-Squared value = 3.841 with 1 degrees of freedom at the 5% significance level.
There were 6 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 6.254
Adjusted Kruskal-Wallis statistic (H') = 6.254

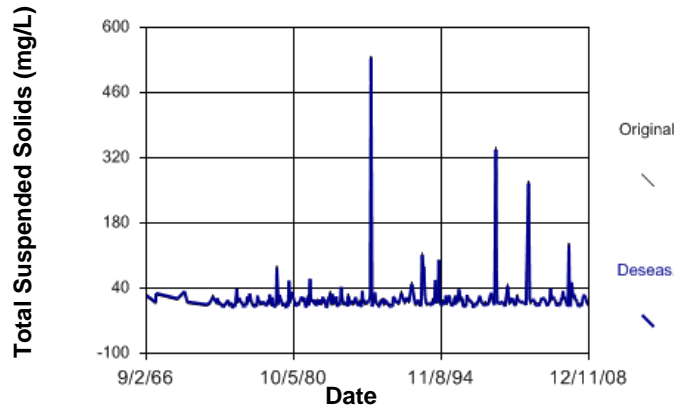**Figure D23 Beaver River: Total Suspended Solids**
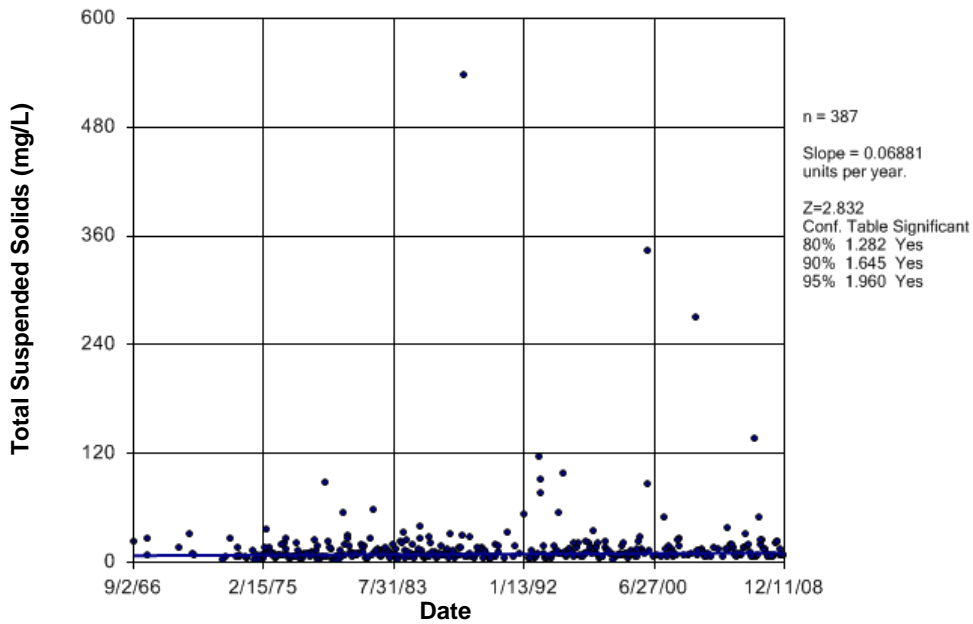
Seasonal Kendall

n = 387

Slope = 0.06881 units per year.

Z=2.832
Conf. Table Significant
80% 1.282 Yes
90% 1.645 Yes
95% 1.960 Yes

Figure D24 Beaver River: Total Suspended Solids
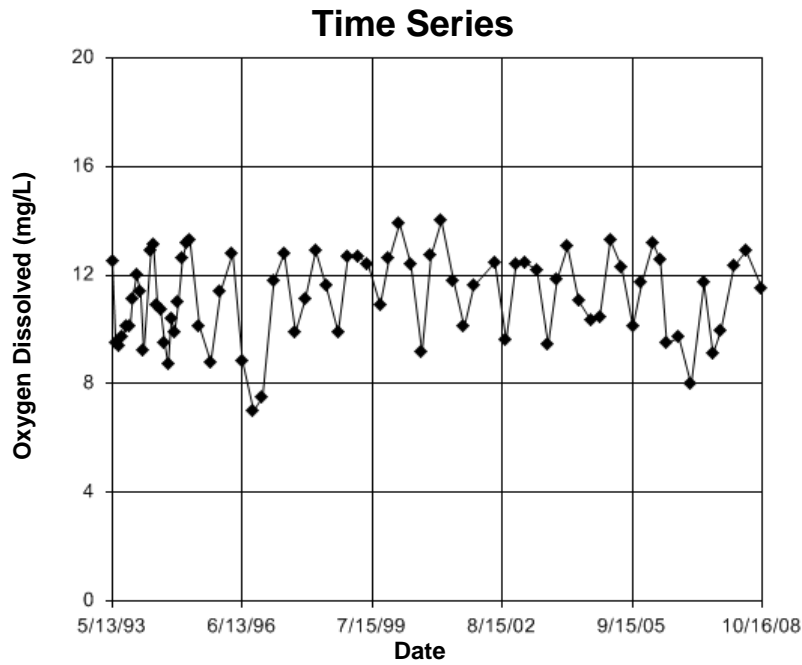
Time Series

Figure D25 Cold River: Oxygen Dissolved

Seasonality

For the data shown, the Kruskal-Wallis test indicates SEASONALITY at the 5% significance level. Because the calculated Kruskal-Wallis statistic is greater than the Chi-squared value, we conclude that at least one season has a significantly different median concentration of this constituent than any other season.
Calculated Kruskal-Wallis statistic = 10.43
Tabulated Chi-Squared value = 3.841 with 1 degrees of freedom at the 5% significance level.
There were 3 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 10.43
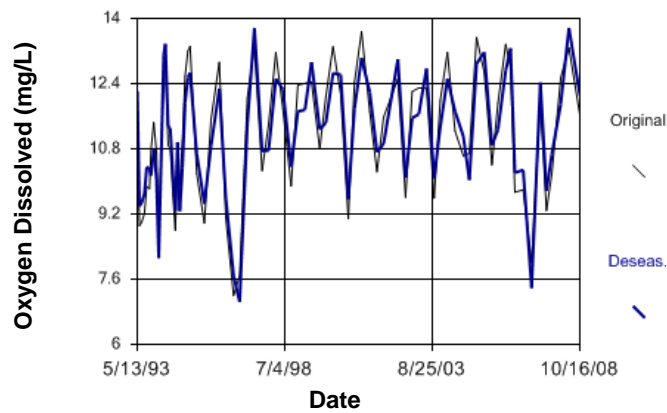Adjusted Kruskal-Wallis statistic (H') = 10.43

Figure D26 Cold River: Oxygen Dissolved

238

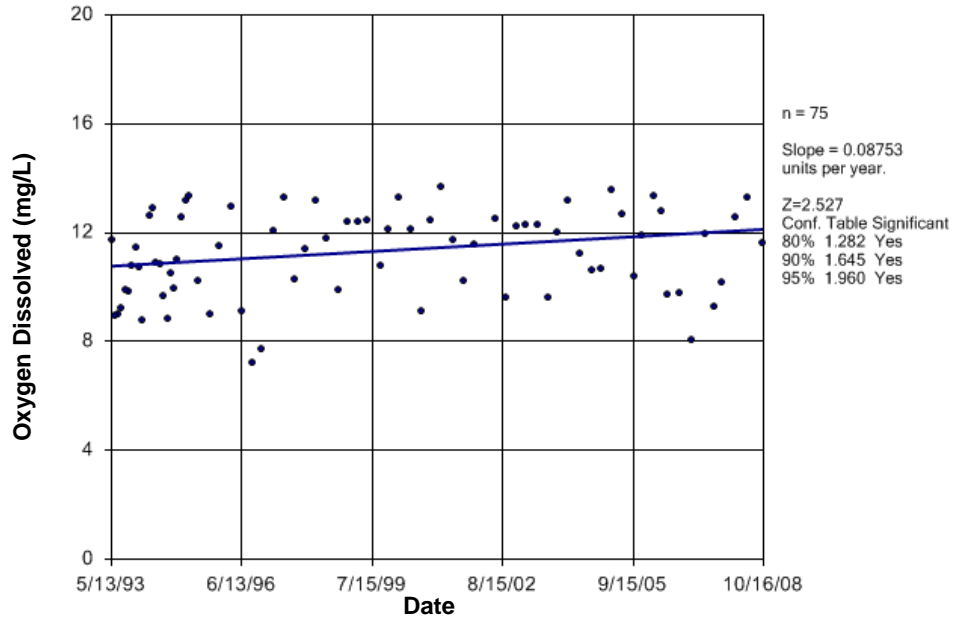## Seasonal Kendall

n = 75

Slope = 0.08753
units per year.

Z=2.527
Conf. Table Significant
80% 1.282 Yes
90% 1.645 Yes
95% 1.960 Yes

Figure D27 Cold River: Oxygen Dissolved
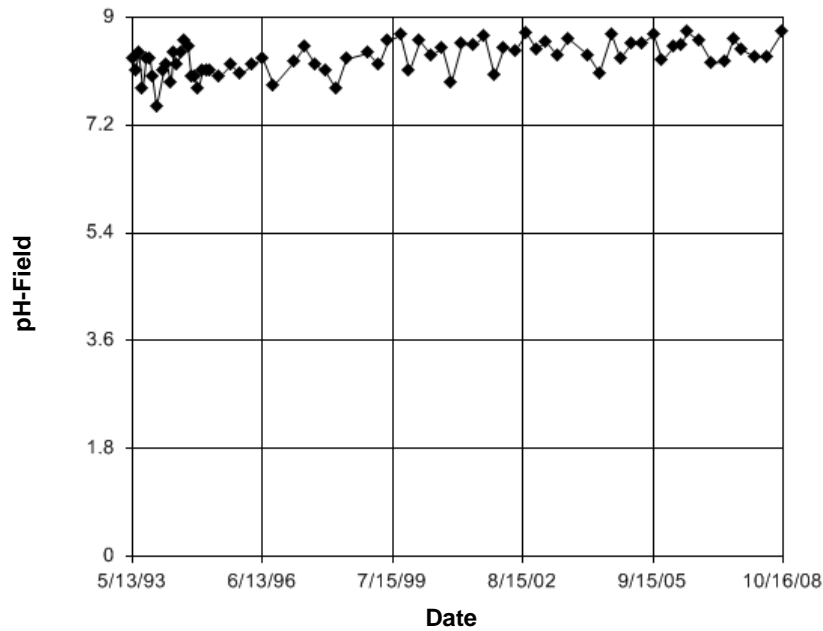
Time Series

Figure D28 Cold River: pH-Field

239

Seasonality

For the data shown, the Kruskal-Wallis test indicates SEASONALITY at the 5% significance level. Because the calculated Kruskal-Wallis statistic is greater than the Chi-squared value, we conclude that at least one season has a significantly different median concentration of this constituent than any other season.
Calculated Kruskal-Wallis statistic = 6.305
Tabulated Chi-Squared value = 3.841 with 1 degrees of freedom at the 5% significance level.
There were 1 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 6.305
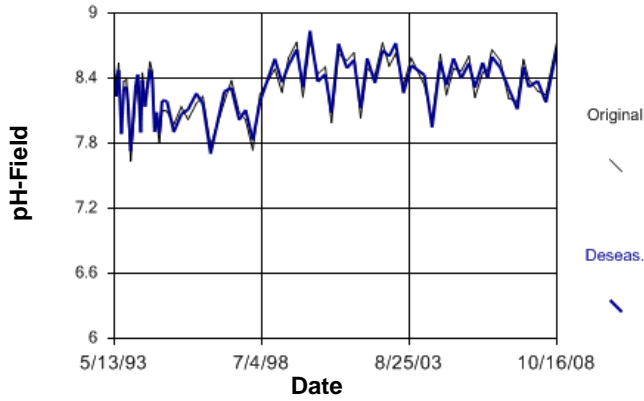Adjusted Kruskal-Wallis statistic (H') = 6.305
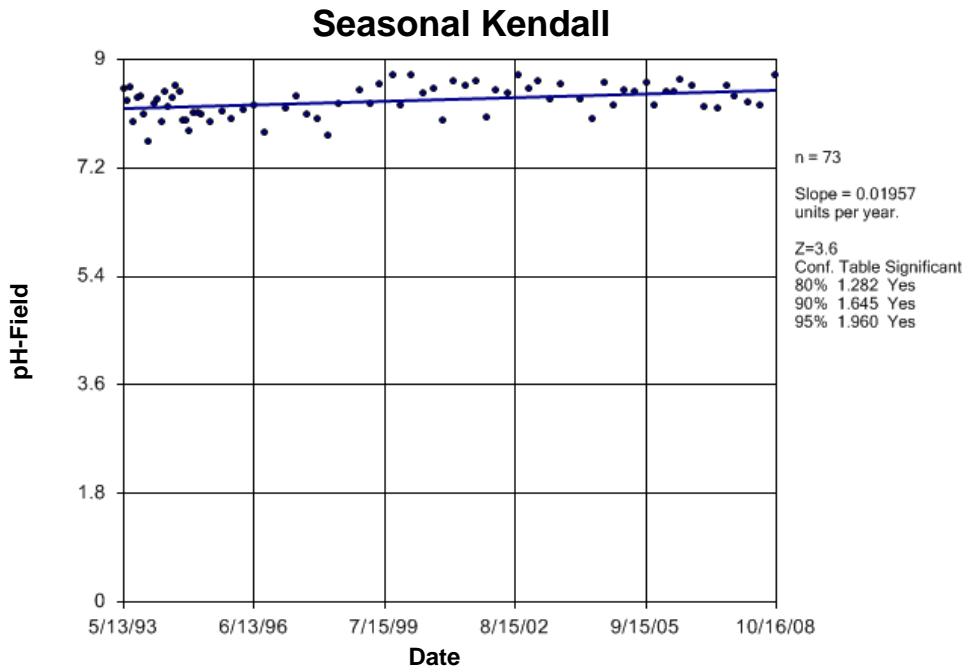

Figure D29 Cold River: pH-Field

Seasonal Kendall

n = 73

Slope = 0.01957
units per year.

Z=3.6
Conf. Table Significant
80% 1.282 Yes
90% 1.645 Yes
95% 1.960 Yes

Figure D30 Cold River: pH-Field
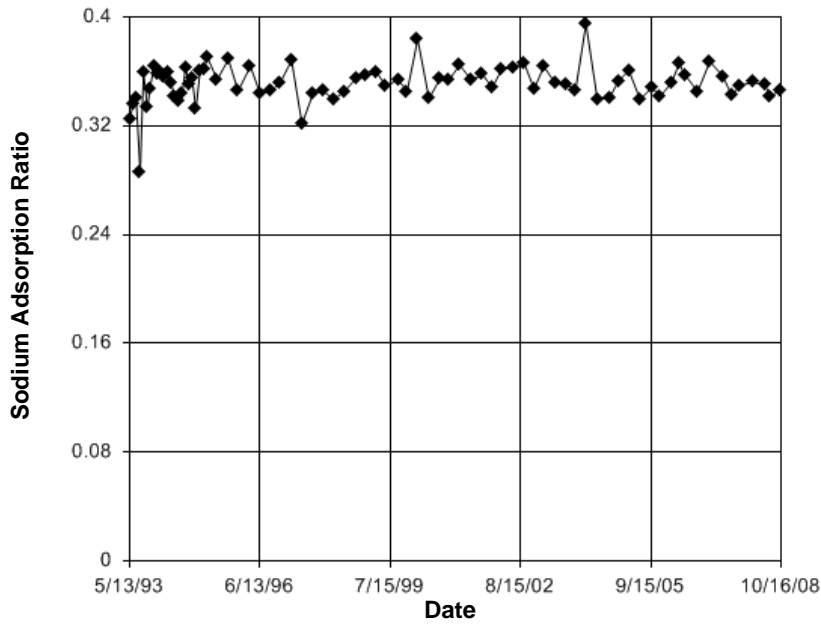
Time Series

Figure D31 Cold River: Sodium Adsorption Ratio

Seasonality

For the data shown, the Kruskal-Wallis test indicates SEASONALITY at the 5% significance level. Because the calculated Kruskal-Wallis statistic is greater than the Chi-squared value, we conclude that at least one season has a significantly different median concentration of this constituent than any other season.
Calculated Kruskal-Wallis statistic = 10.99
Tabulated Chi-Squared value = 3.841 with 1 degrees of freedom at the 5% significance level.
There were 8 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 10.99
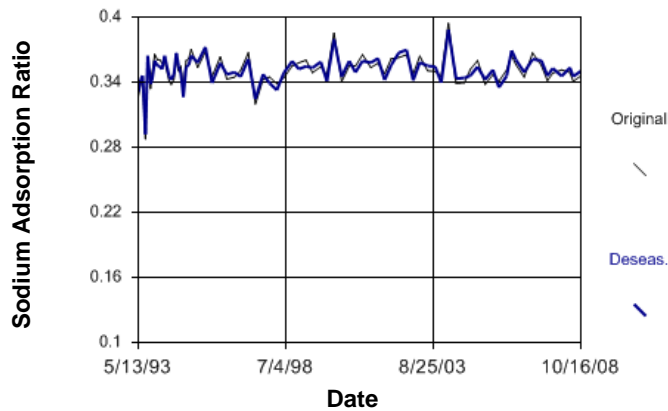Adjusted Kruskal-Wallis statistic (H') = 10.99

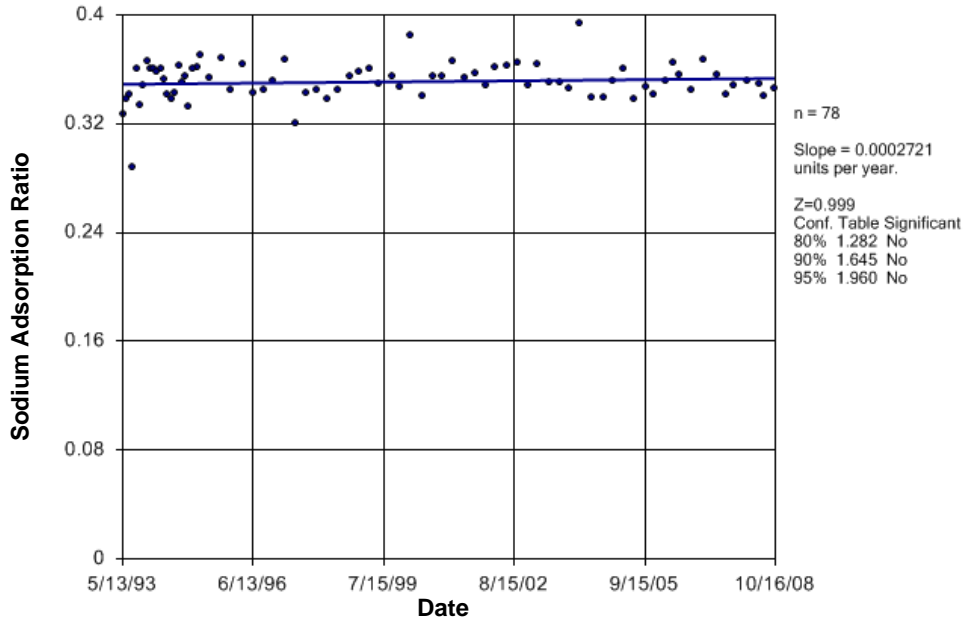**Figure D32 Cold River: Sodium Adsorption Ratio**

Seasonal Kendall

n = 78

Slope = 0.0002721
units per year.

Z=0.999
Conf. Table Significant
80%   1.282   No
90%   1.645   No
95%   1.960   No

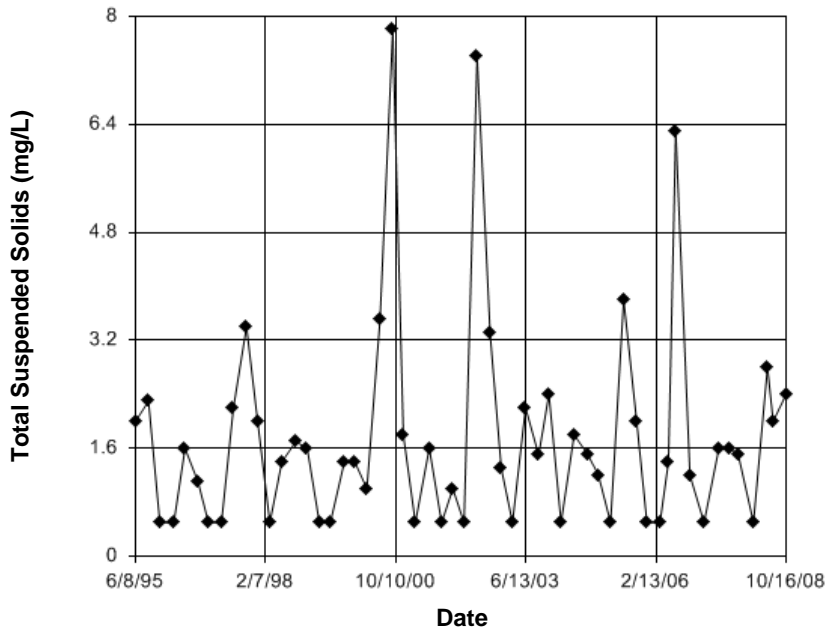**Figure D33 Cold River: Sodium Adsorption Ratio**

Time Series

Figure D34 Cold River: Total Suspended Solids

Seasonality

For the data shown, the Kruskal-Wallis test indicates SEASONALITY at the 5% significance level. Because the calculated Kruskal-Wallis statistic is greater than the Chi-squared value, we conclude that at least one season has a significantly different median concentration of this constituent than any other season.
Calculated Kruskal-Wallis statistic = 18
Tabulated Chi-Squared value = 3.841 with 1 degrees of freedom at the 5% significance level.
There were 1 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 18
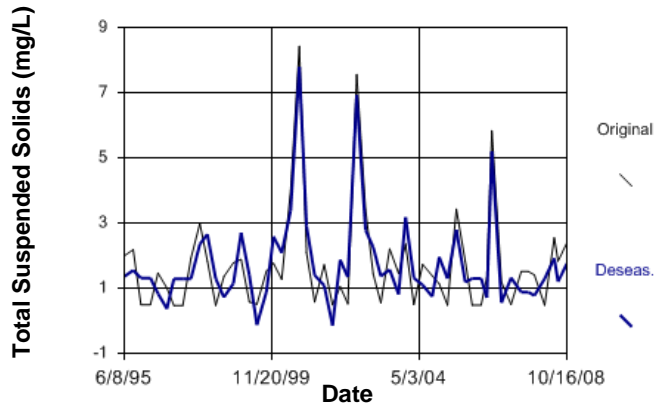Adjusted Kruskal-Wallis statistic (H') = 18

Figure D35 Cold River: Total Suspended Solids
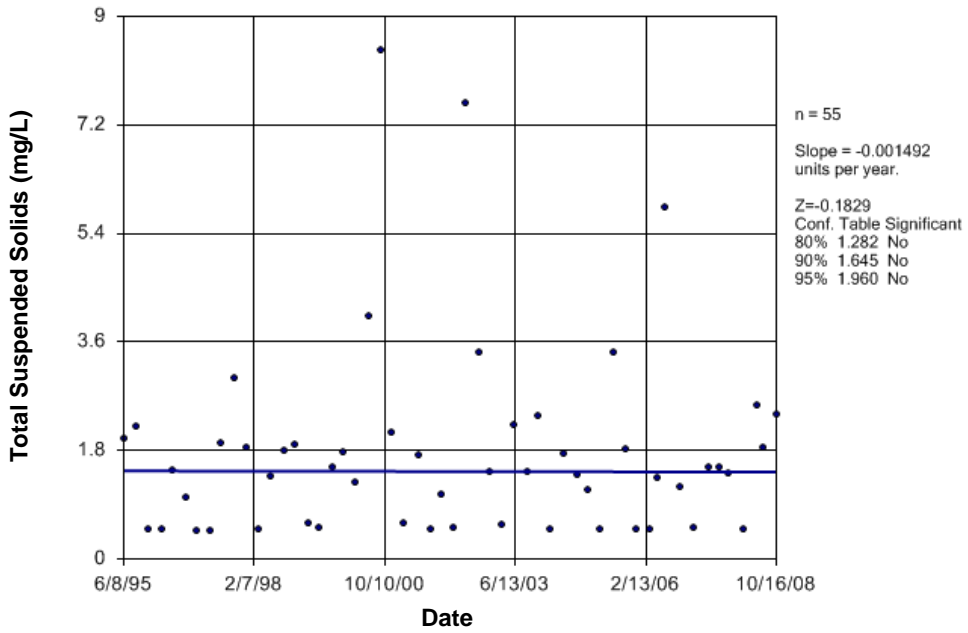
Seasonal Kendall

Figure D36 Cold River: Total Suspended Solids
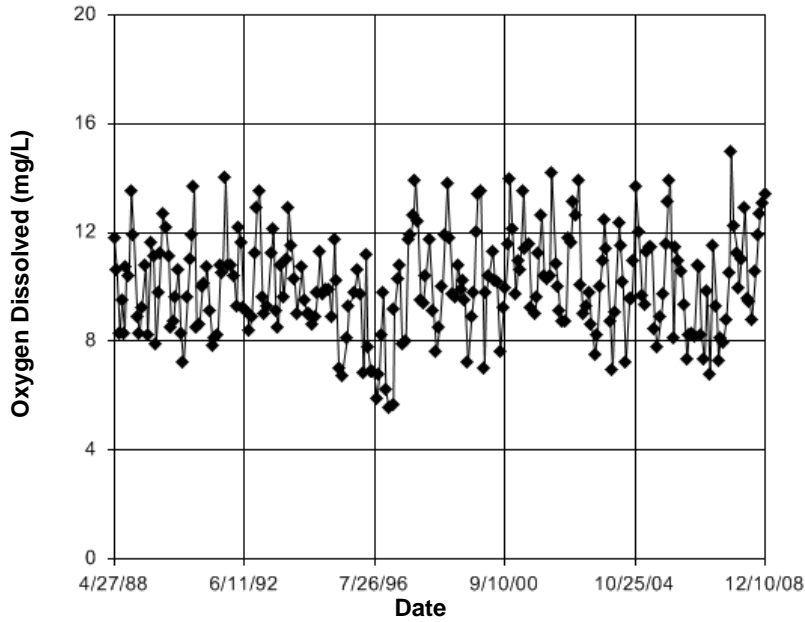
Time Series

Figure D37 North Saskatchewan River: Oxygen Dissolved

Seasonality

For the data shown, the Kruskal-Wallis test indicates NO SEASONALITY at the 5% significance level. Because the calculated Kruskal-Wallis statistic is less than or equal to the Chi-squared value, we conclude that no season has a significantly different median concentration of this constituent than any other season.
Calculated Kruskal-Wallis statistic = 0.6381
Tabulated Chi-Squared value = 3.841 with 1 degrees of freedom at the 5% significance level.
There were 17 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 0.638
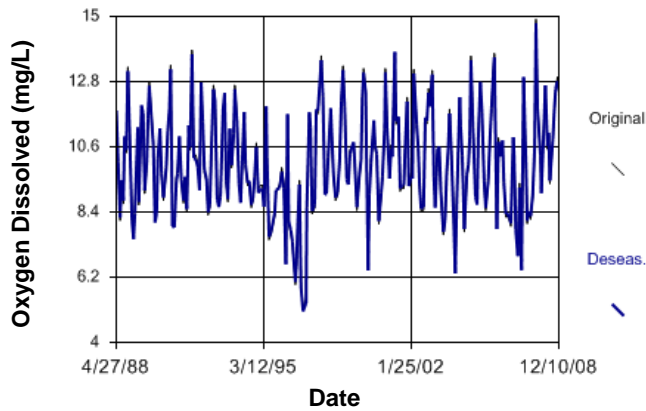Adjusted Kruskal-Wallis statistic (H') = 0.6381

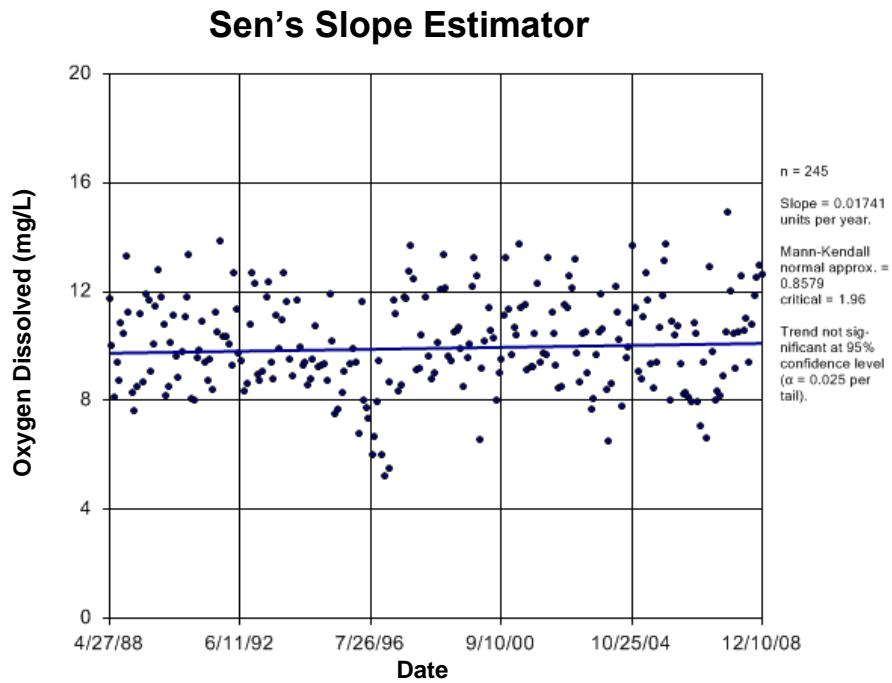**Figure D38 North Saskatchewan River: Oxygen Dissolved**

Sen's Slope Estimator

n = 245

Slope = 0.01741 units per year.

Mann-Kendall normal approx. = 0.8579 critical = 1.96

Trend not significant at 95% confidence level (α = 0.025 per tail).

Figure D39 North Saskatchewan River: Oxygen Dissolved
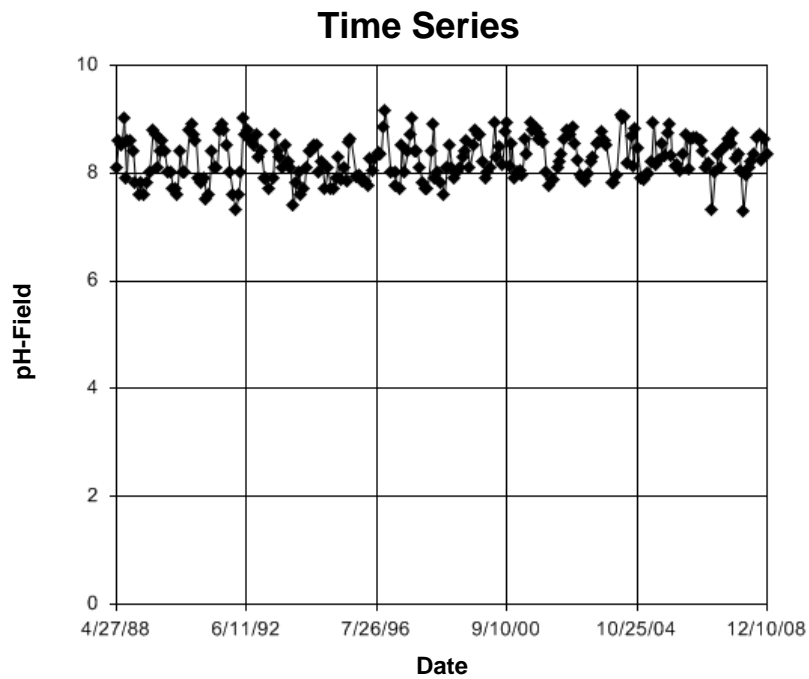
Time Series

Figure D40 North Saskatchewan River: pH-Field

245

Seasonality

For the data shown, the Kruskal-Wallis test indicates SEASONALITY at the 5% significance level. Because the calculated Kruskal-Wallis statistic is greater than the Chi-squared value, we conclude that at least one season has a significantly different median concentration of this constituent than any other season.
Calculated Kruskal-Wallis statistic = 47.02
Tabulated Chi-Squared value = 3.841 with 1 degrees of freedom at the 5% significance level.
There were 20 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 47.02
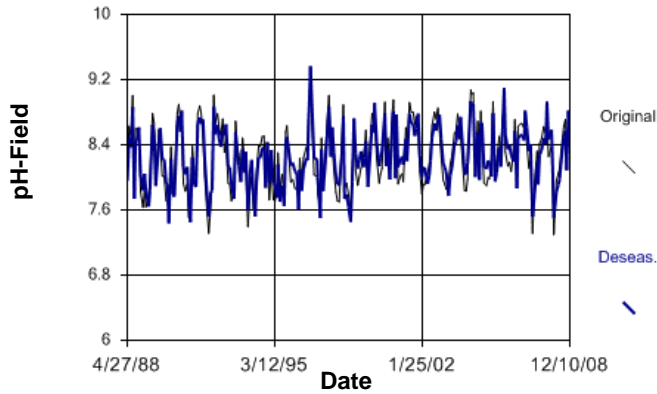Adjusted Kruskal-Wallis statistic (H') = 47.02

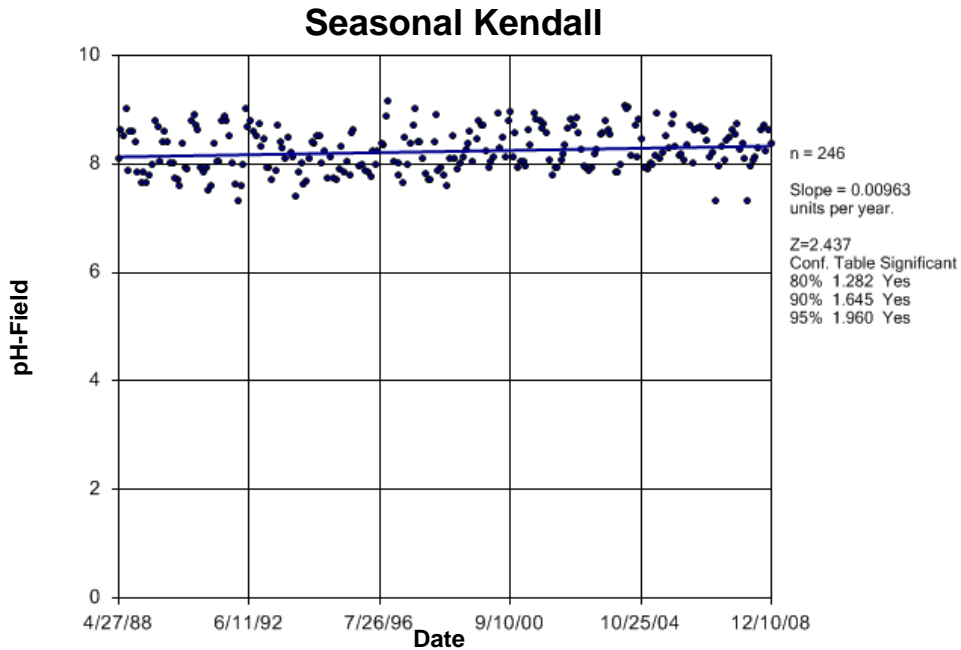**Figure D41 North Saskatchewan River: pH-Field**

Seasonal Kendall

n = 246

Slope = 0.00963
units per year.

Z=2.437
Conf. Table Significant
80% 1.282 Yes
90% 1.645 Yes
95% 1.960 Yes

Figure D42 North Saskatchewan River: pH-Field
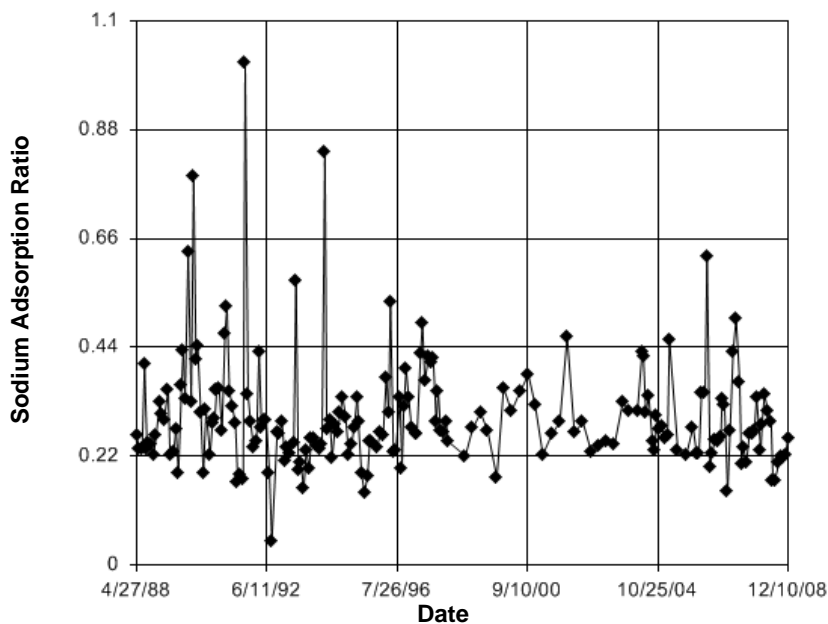
Time Series

Figure D43 North Saskatchewan River: Sodium Adsorption Ratio

Seasonality

For the data shown, the Kruskal-Wallis test indicates NO SEASONALITY at the 5% significance level. Because the calculated Kruskal-Wallis statistic is less than or equal to the Chi-squared value, we conclude that no season has a significantly different median concentration of this constituent than any other season.
Calculated Kruskal-Wallis statistic = 0.3306
Tabulated Chi-Squared value = 3.841 with 1 degrees of freedom at the 5% significance level.
There were 8 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 0.3306
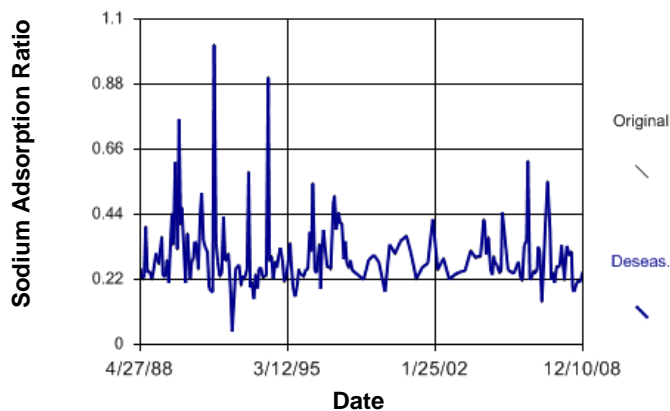Adjusted Kruskal-Wallis statistic (H') = 0.3306

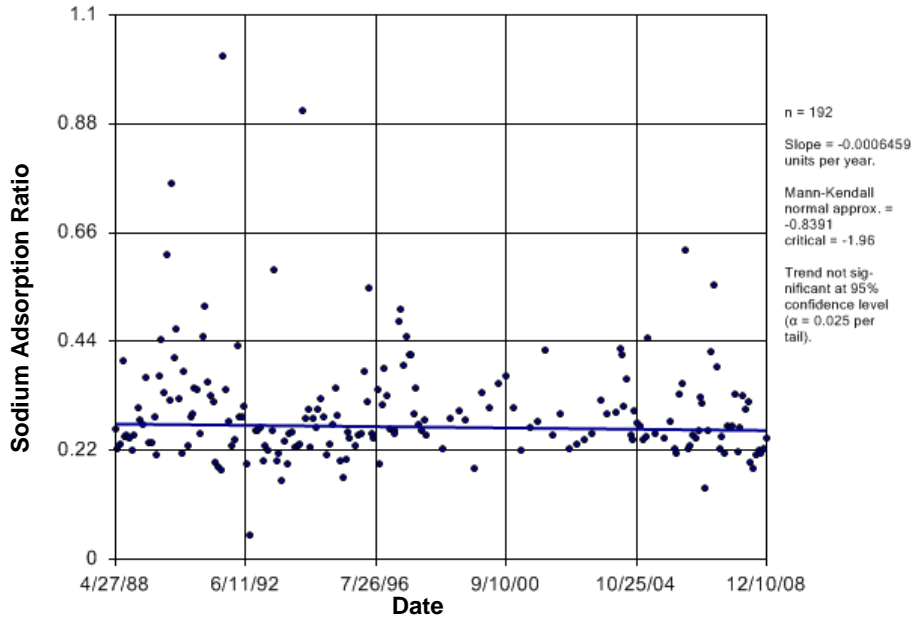**Figure D44 North Saskatchewan River: Sodium Adsorption Ratio**

Sen's Slope Estimator

n = 192

Slope = -0.0006459 units per year.

Mann-Kendall normal approx. = -0.8391 critical = -1.96

Trend not significant at 95% confidence level (α = 0.025 per tail).

Figure D45 North Saskatchewan River: Sodium Adsorption Ratio
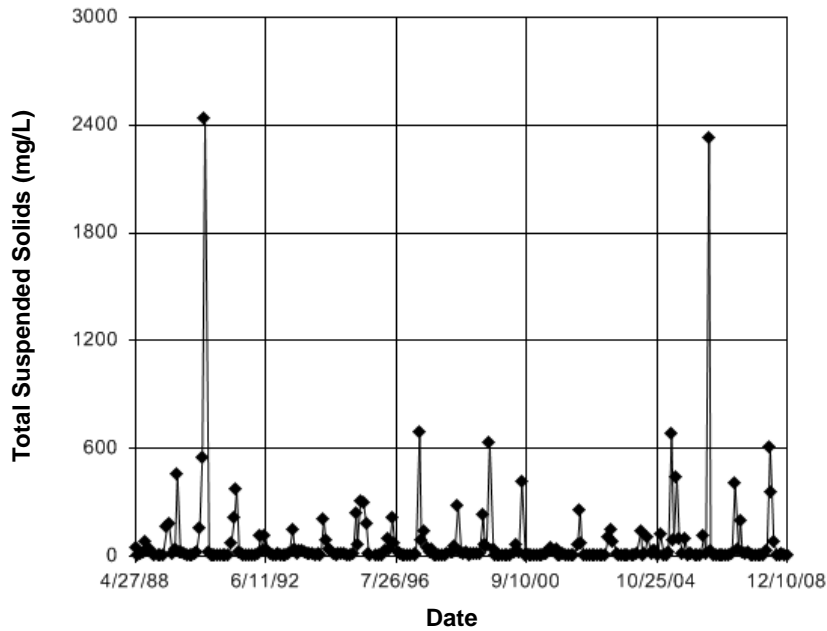
Time Series

Figure D46 North Saskatchewan River: Total Suspended Solids

Seasonality

For the data shown, the Kruskal-Wallis test indicates NO SEASONALITY at the 5% significance level. Because the calculated Kruskal-Wallis statistic is less than or equal to the Chi-squared value, we conclude that no season has a significantly different median concentration of this constituent than any other season.
Calculated Kruskal-Wallis statistic = 2.193
Tabulated Chi-Squared value = 3.841 with 1 degrees of freedom at the 5% significance level.
There were 9 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 2.193
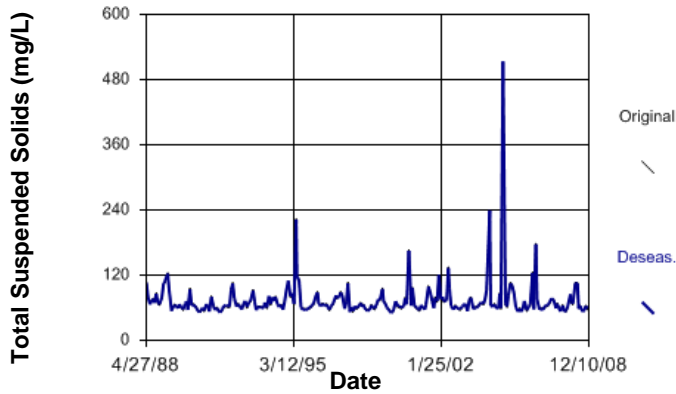Adjusted Kruskal-Wallis statistic (H') = 2.193

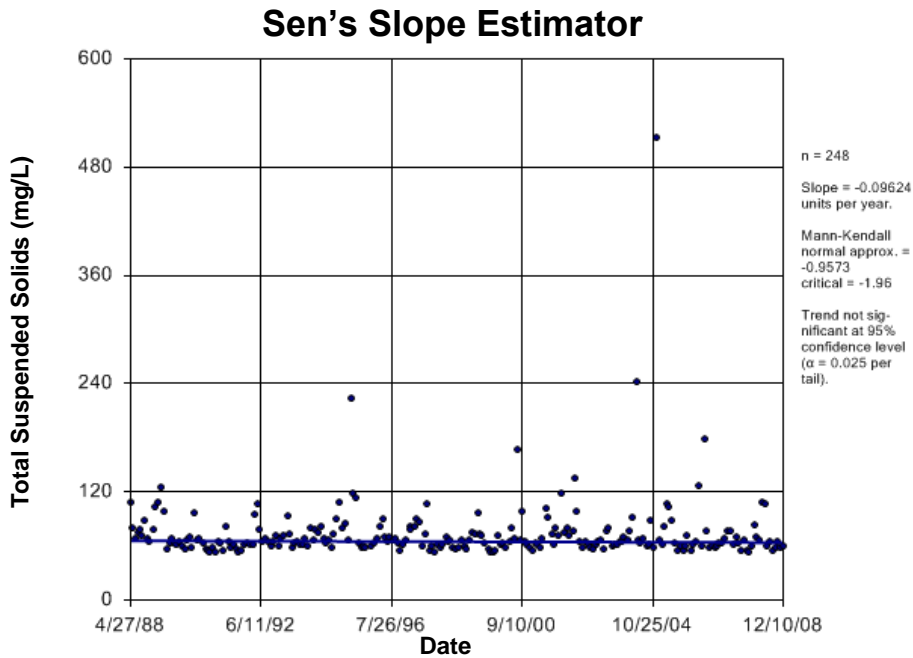**Figure D47 North Saskatchewan River: Total Suspended Solids**

Sen's Slope Estimator

n = 248

Slope = -0.09624 units per year.

Mann-Kendall normal approx. = -0.9573
critical = -1.96

Trend not sig-nificant at 95% confidence level (α = 0.025 per tail).

Figure D48 North Saskatchewan River: Total Suspended Solids
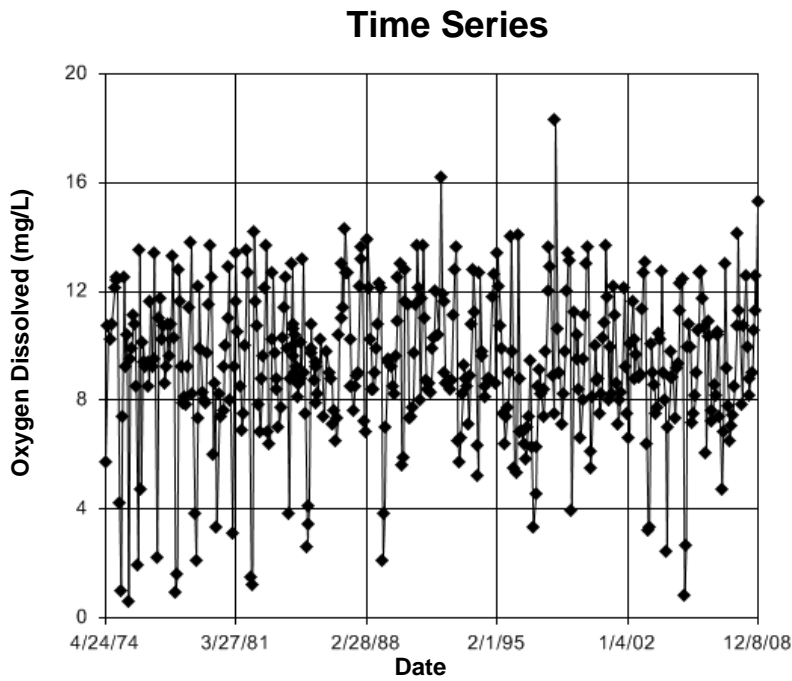
Time Series

Figure D49 Red Deer River (AB-SK): Oxygen Dissolved

Seasonality

For the data shown, the Kruskal-Wallis test indicates SEASONALITY at the 5% significance level. Because the calculated Kruskal-Wallis statistic is greater than the Chi-squared value, we conclude that at least one season has a significantly different median concentration of this constituent than any other season.
Calculated Kruskal-Wallis statistic = 15.95
Tabulated Chi-Squared value = 3.841 with 1 degrees of freedom at the 5% significance level.
There were 21 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 15.95
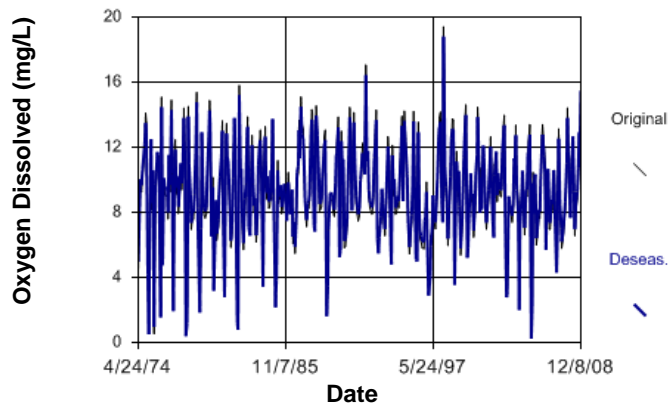Adjusted Kruskal-Wallis statistic (H') = 15.95

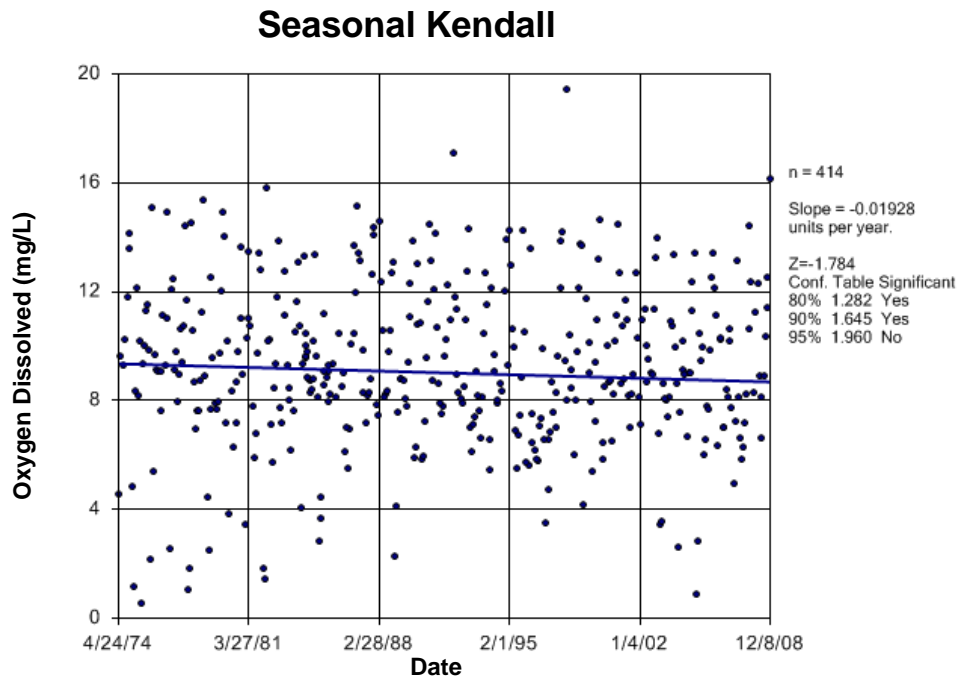**Figure D50 Red Deer River (AB-SK): Oxygen Dissolved**

Seasonal Kendall

n = 414

Slope = -0.01928
units per year.

Z=-1.784
Conf. Table Significant
80% 1.282 Yes
90% 1.645 Yes
95% 1.960 No

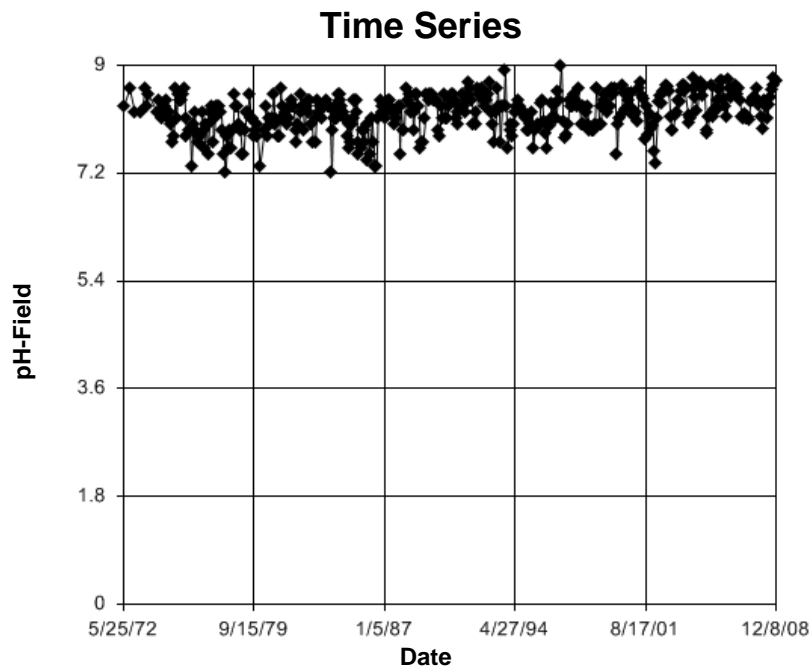**Figure D51 Red Deer River (AB-SK): Oxygen Dissolved**

Time Series

Figure D52 Red Deer River (AB-SK): pH-Field

Seasonality

For the data shown, the Kruskal-Wallis test indicates SEASONALITY at the 5% significance level. Because the calculated Kruskal-Wallis statistic is greater than the Chi-squared value, we conclude that at least one season has a significantly different median concentration of this constituent than any other season.
Calculated Kruskal-Wallis statistic = 14.86
Tabulated Chi-Squared value = 3.841 with 1 degrees of freedom at the 5% significance level.
There were 67 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 14.86
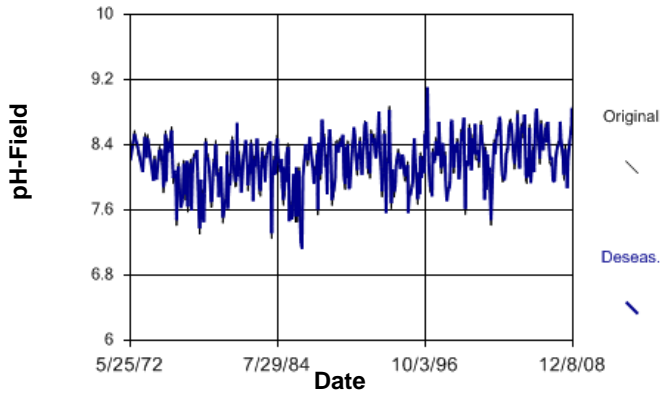Adjusted Kruskal-Wallis statistic (H') = 14.86

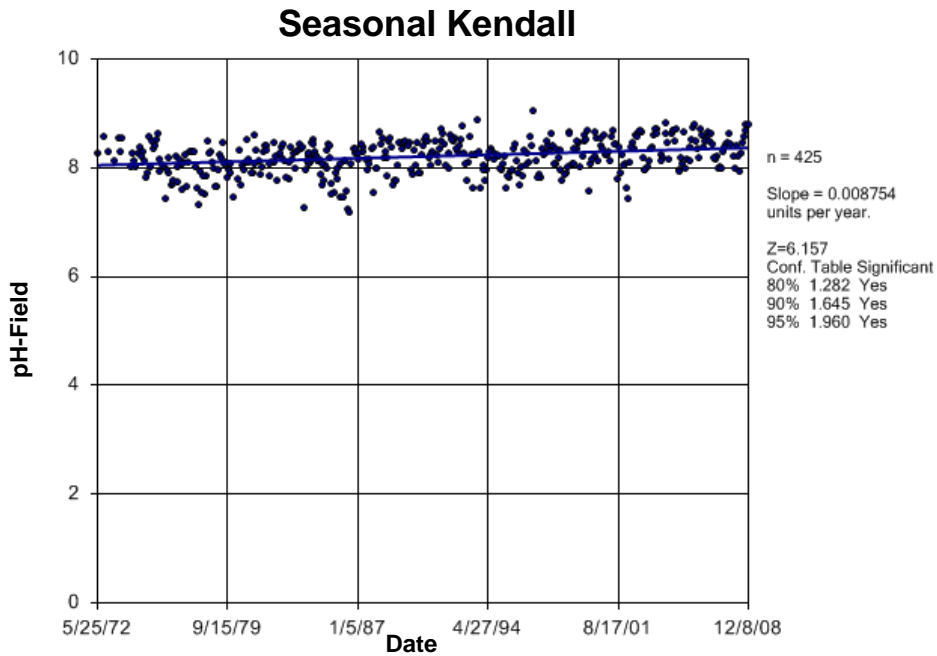**Figure D53 Red Deer River (AB-SK): pH-Field**

Seasonal Kendall

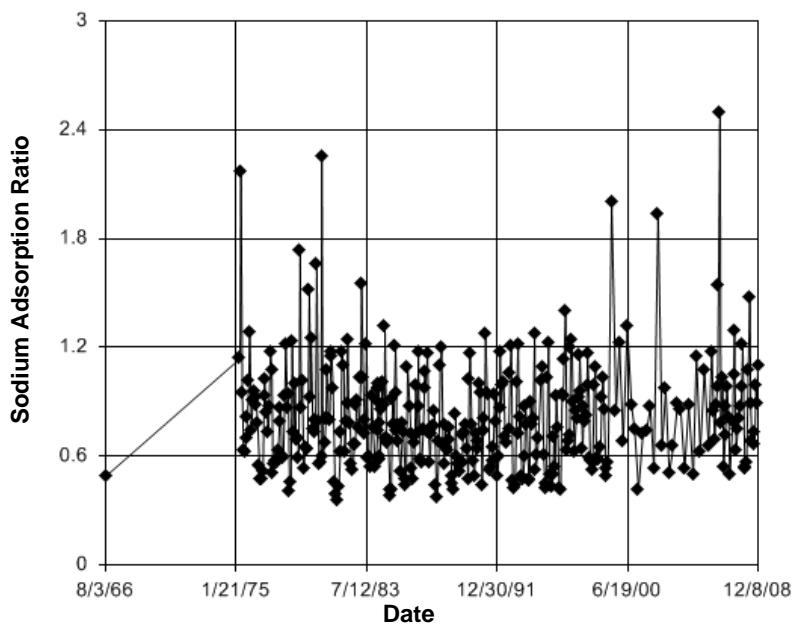**Figure D54 Red Deer River (AB-SK): pH-Field**

Time Series

Figure D55 Red Deer River (AB-SK): Sodium Adsorption Ratio

Seasonality

For the data shown, the Kruskal-Wallis test indicates NO SEASONALITY at the 5% significance level. Because the calculated Kruskal-Wallis statistic is less than or equal to the Chi-squared value, we conclude that no season has a significantly different median concentration of this constituent than any other season.
Calculated Kruskal-Wallis statistic = 0.06004
Tabulated Chi-Squared value = 3.841 with 1 degrees of freedom at the 5% significance level.
There were 17 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 0.06004
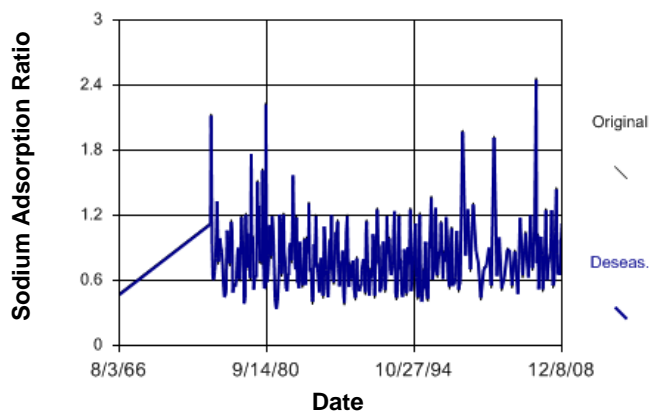Adjusted Kruskal-Wallis statistic (H') = 0.06004

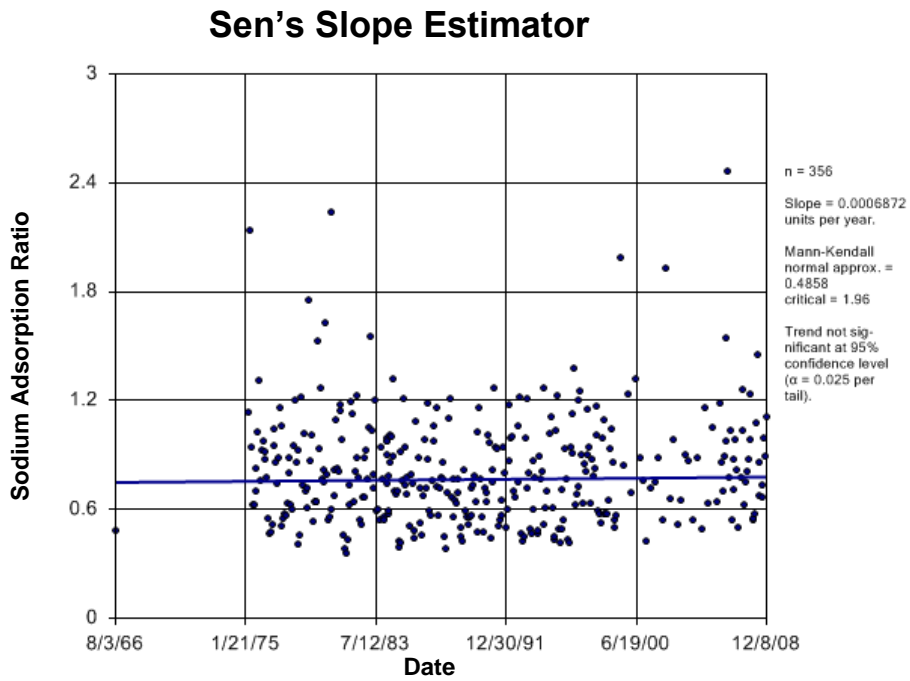**Figure D56 Red Deer River (AB-SK): Sodium Adsorption Ratio**

Sen's Slope Estimator

n = 356

Slope = 0.0006872 units per year.

Mann-Kendall normal approx. = 0.4858 critical = 1.96

Trend not sig-nificant at 95% confidence level (α = 0.025 per tail).

Figure D57 Red Deer River (AB-SK): Sodium Adsorption Ratio
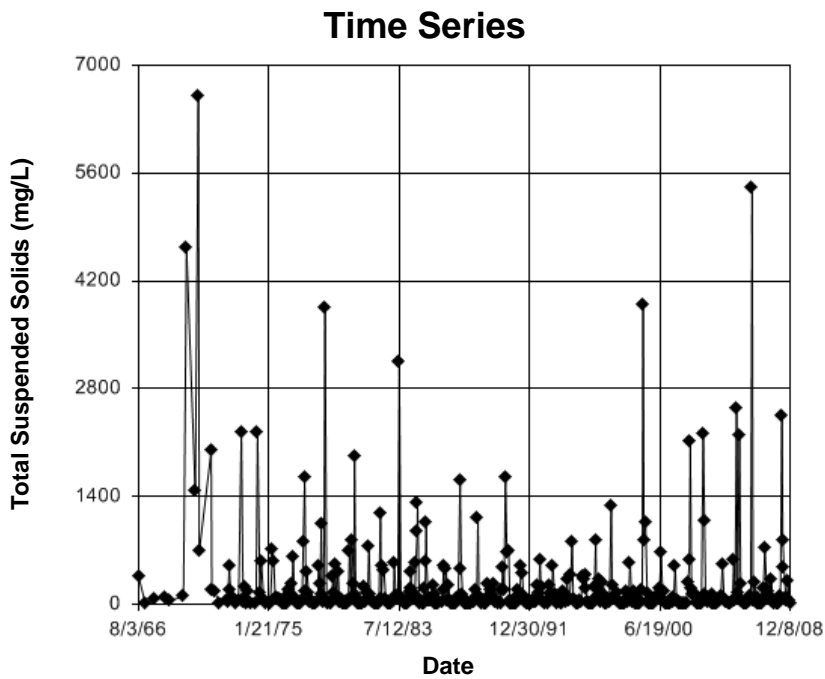
Time Series

Figure D58 Red Deer River (AB-SK): Total Suspended Solids

Seasonality

For the data shown, the Kruskal-Wallis test indicates SEASONALITY at the 5% significance level. Because the calculated Kruskal-Wallis statistic is greater than the Chi-squared value, we conclude that at least one season has a significantly different median concentration of this constituent than any other season.
Calculated Kruskal-Wallis statistic = 20.29
Tabulated Chi-Squared value = 3.841 with 1 degrees of freedom at the 5% significance level.
There were 51 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 20.29
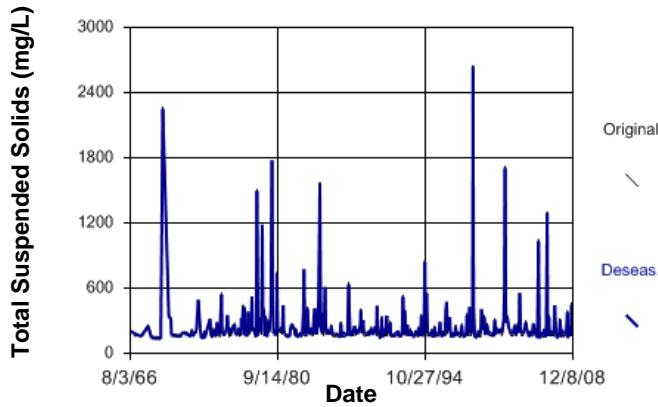Adjusted Kruskal-Wallis statistic (H') = 20.29

Figure D59 Red Deer River (AB-SK): Total Suspended Solids
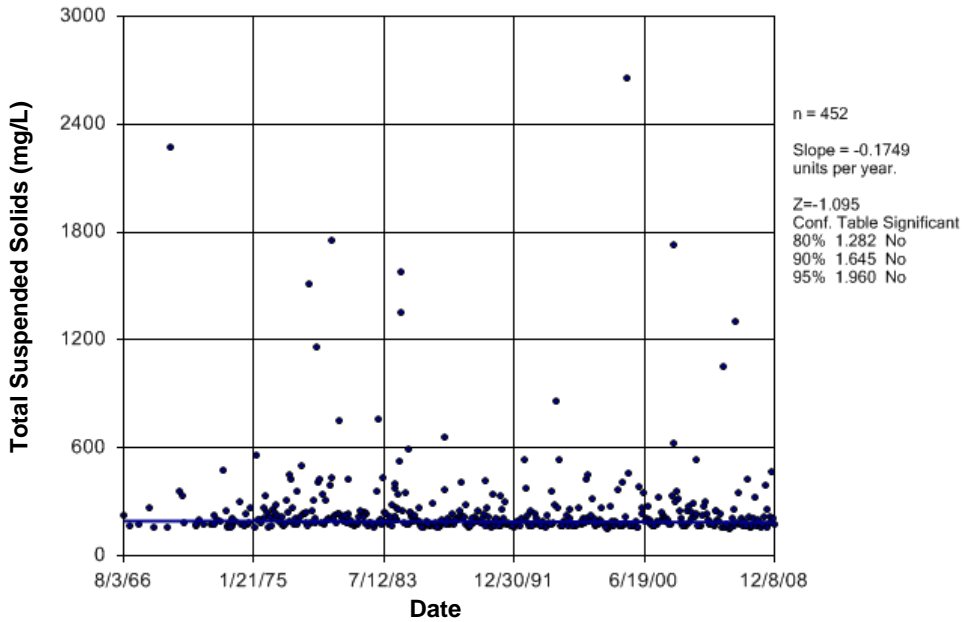
Seasonal Kendall

n = 452

Slope = -0.1749 units per year.

Z=-1.095
Conf. Table Significant
80% 1.282 No
90% 1.645 No
95% 1.960 No

Figure D60 Red Deer River (AB-SK): Total Suspended Solids
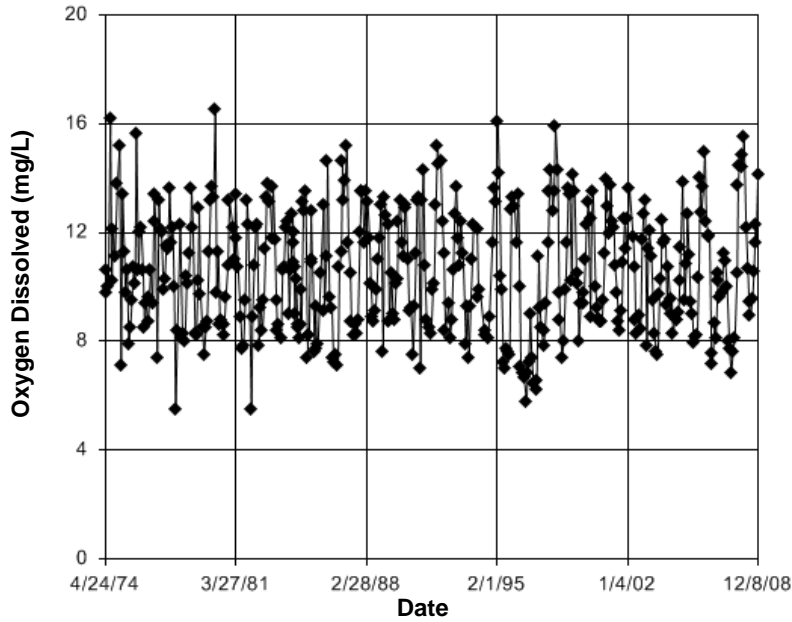
255

Time Series

Figure D61 South Saskatchewan River: Oxygen Dissolved

Seasonality

For the data shown, the Kruskal-Wallis test indicates SEASONALITY at the 5% significance level. Because the calculated Kruskal-Wallis statistic is greater than the Chi-squared value, we conclude that at least one season has a significantly different median concentration of this constituent than any other season.
Calculated Kruskal-Wallis statistic = 108.3
Tabulated Chi-Squared value = 3.841 with 1 degrees of freedom at the 5% significance level.
There were 46 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 108.3
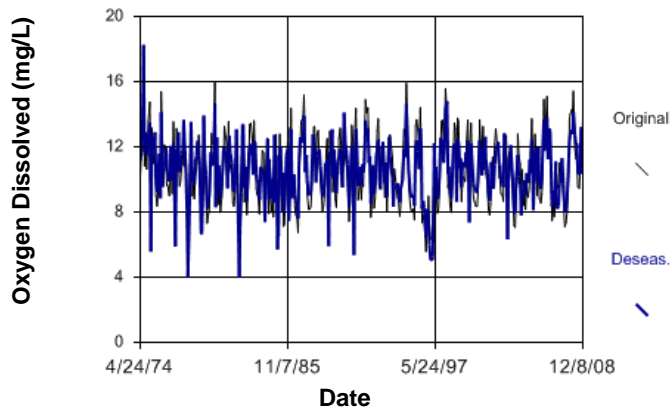Adjusted Kruskal-Wallis statistic (H') = 108.3

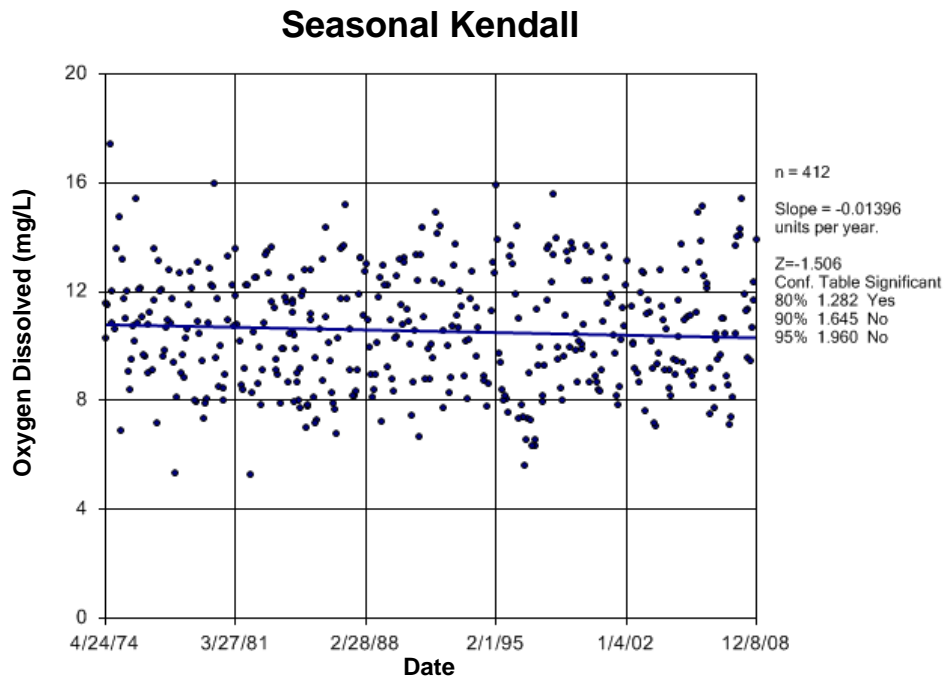**Figure D62 South Saskatchewan River: Oxygen Dissolved**

Seasonal Kendall

n = 412

Slope = -0.01396
units per year.

Z=-1.506
Conf. Table Significant
80% 1.282 Yes
90% 1.645 No
95% 1.960 No

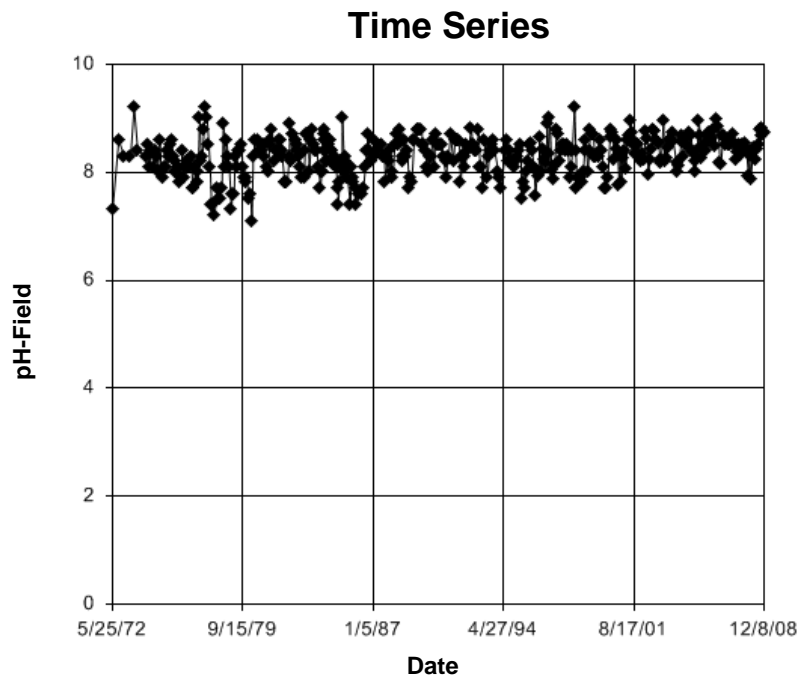**Figure D63 South Saskatchewan River: Oxygen Dissolved**

Time Series

Figure D64 South Saskatchewan River: pH-Field

Seasonality

For the data shown, the Kruskal-Wallis test indicates SEASONALITY at the 5% significance level. Because the calculated Kruskal-Wallis statistic is greater than the Chi-squared value, we conclude that at least one season has a significantly different median concentration of this constituent than any other season.
Calculated Kruskal-Wallis statistic = 62.63
Tabulated Chi-Squared value = 3.841 with 1 degrees of freedom at the 5% significance level.
There were 54 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 62.63
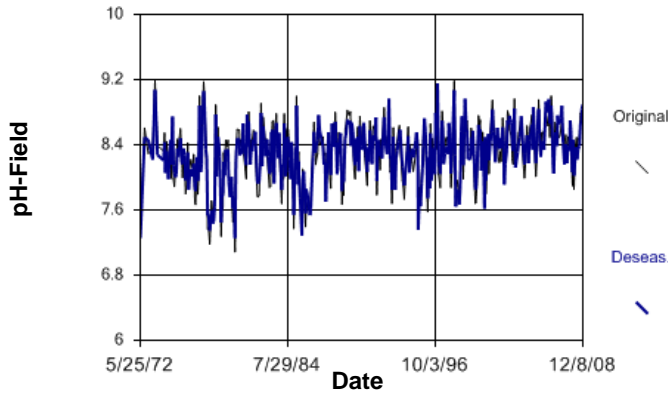Adjusted Kruskal-Wallis statistic (H') = 62.63

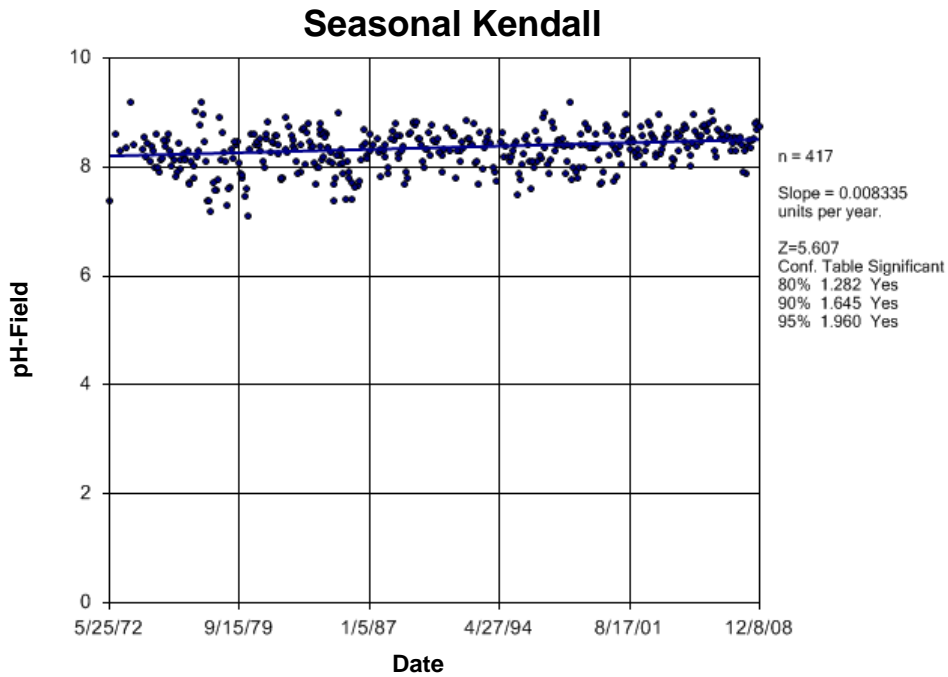**Figure D65 South Saskatchewan River: pH-Field**

Seasonal Kendall

n = 417

Slope = 0.008335 units per year.

Z=5.607
Conf. Table Significant
80% 1.282 Yes
90% 1.645 Yes
95% 1.960 Yes

Figure D66 South Saskatchewan River: pH-Field
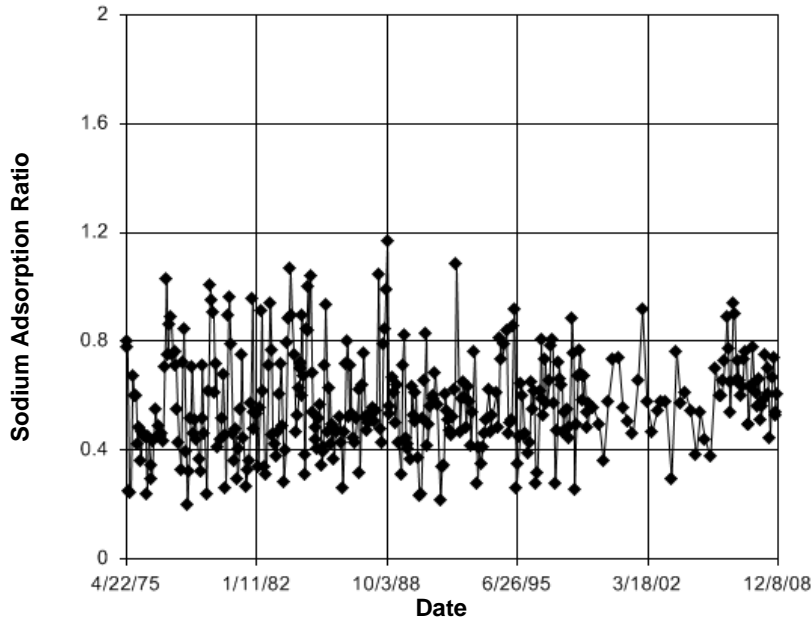
258

Time Series

Figure D67 South Saskatchewan River: Sodium Adsorption Ratio

Seasonality

For the data shown, the Kruskal-Wallis test indicates SEASONALITY at the 5% significance level. Because the calculated Kruskal-Wallis statistic is greater than the Chi-squared value, we conclude that at least one season has a significantly different median concentration of this constituent than any other season.
Calculated Kruskal-Wallis statistic = 44.75
Tabulated Chi-Squared value = 3.841 with 1 degrees of freedom at the 5% significance level.
There were 9 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 44.75
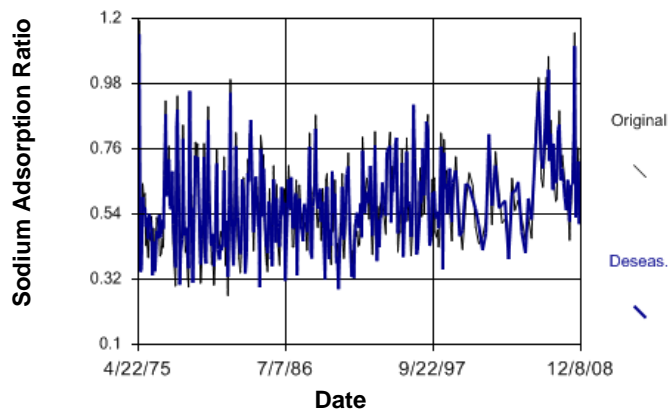Adjusted Kruskal-Wallis statistic (H') = 44.75

Figure D68 South Saskatchewan River: Sodium Adsorption Ratio
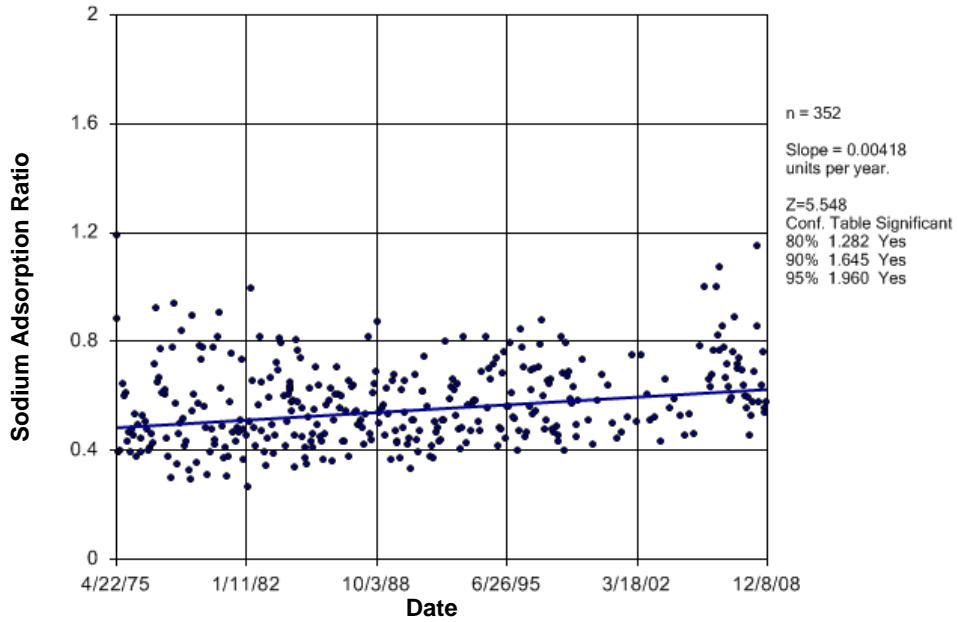
259

Seasonal Kendall

Figure D69 South Saskatchewan River: Sodium Adsorption Ratio
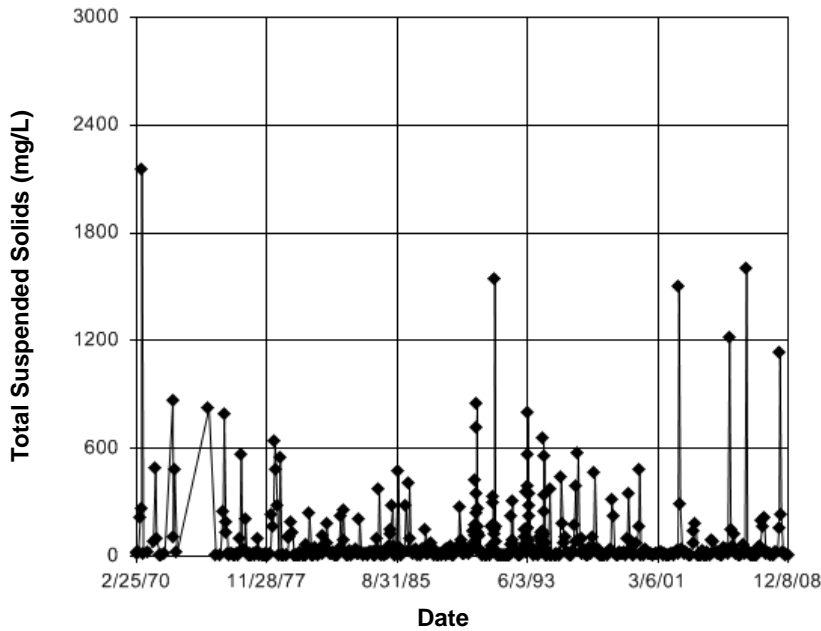
Time Series

Figure D70 South Saskatchewan River: Total Suspended Solids

Seasonality

For the data shown, the Kruskal-Wallis test indicates SEASONALITY at the 5% significance level. Because the calculated Kruskal-Wallis statistic is greater than the Chi-squared value, we conclude that at least one season has a significantly different median concentration of this constituent than any other season.
Calculated Kruskal-Wallis statistic = 49.56
Tabulated Chi-Squared value = 3.841 with 1 degrees of freedom at the 5% significance level.
There were 15 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 49.56
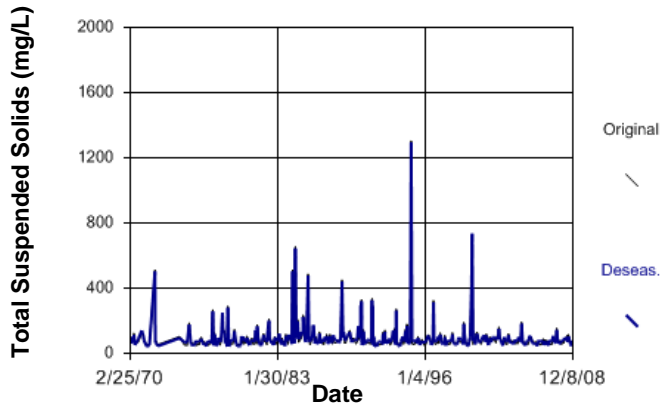Adjusted Kruskal-Wallis statistic (H') = 49.56

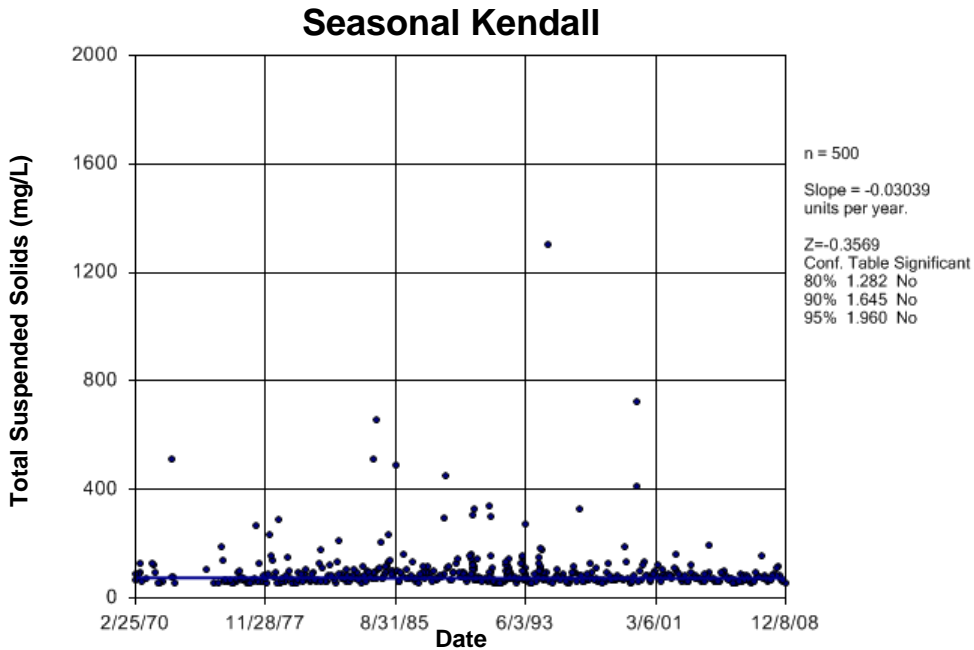**Figure D71 South Saskatchewan River: Total Suspended Solids**

Seasonal Kendall

n = 500

Slope = -0.03039 units per year.

Z=-0.3569
Conf. Table Significant
80% 1.282 No
90% 1.645 No
95% 1.960 No

Figure D72 South Saskatchewan River: Total Suspended Solids
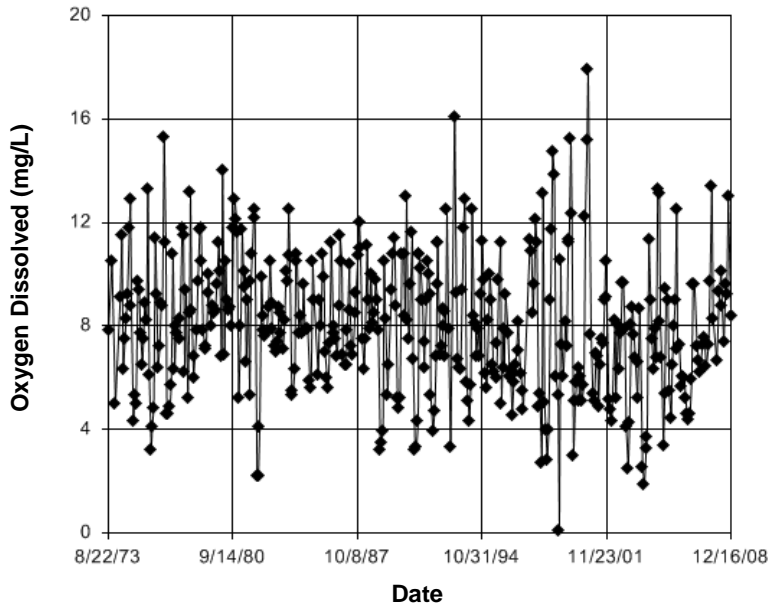
Time Series

Figure D73 Assiniboine River: Oxygen Dissolved

Seasonality

For the data shown, the Kruskal-Wallis test indicates SEASONALITY at the 5% significance level. Because the calculated Kruskal-Wallis statistic is greater than the Chi-squared value, we conclude that at least one season has a significantly different median concentration of this constituent than any other season.
Calculated Kruskal-Wallis statistic = 16.92
Tabulated Chi-Squared value = 3.841 with 1 degrees of freedom at the 5% significance level.
There were 19 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 16.92
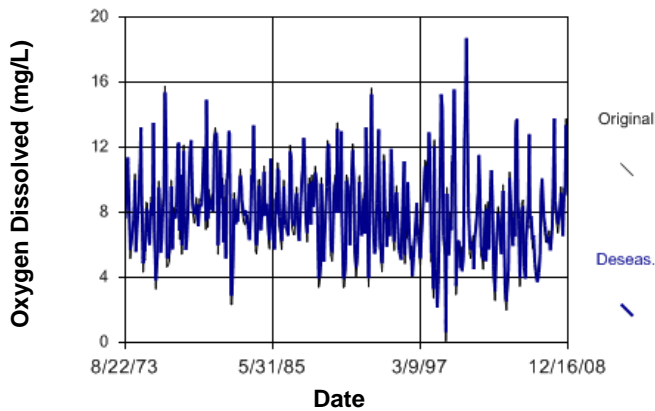Adjusted Kruskal-Wallis statistic (H') = 16.92

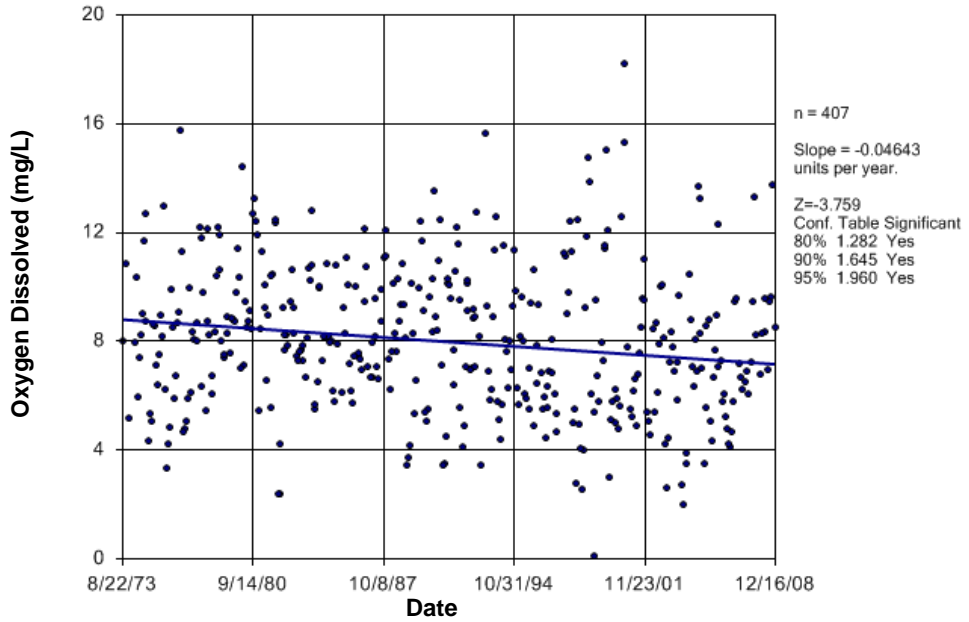**Figure D74 Assiniboine River: Oxygen Dissolved**

Seasonal Kendall

n = 407

Slope = -0.04643
units per year.

Z=-3.759
Conf. Table Significant
80% 1.282 Yes
90% 1.645 Yes
95% 1.960 Yes

Figure D75 Assiniboine River: Oxygen Dissolved
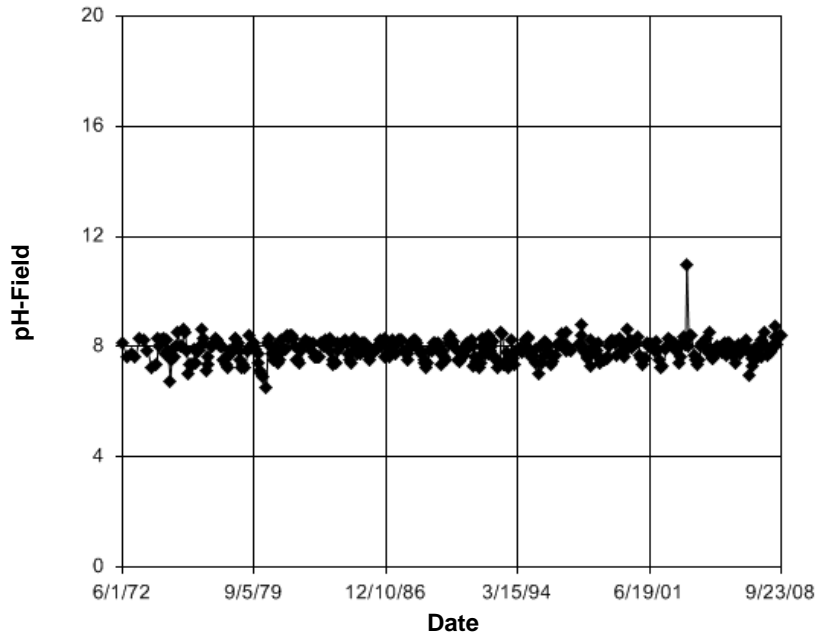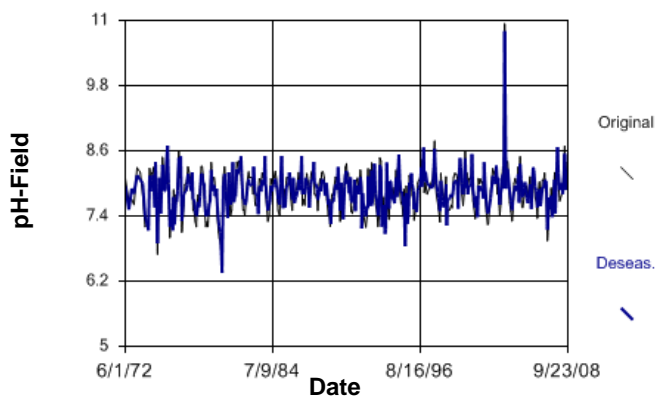
Time Series

Figure D76 Assiniboine River: pH-Field

263

Seasonality

For the data shown, the Kruskal-Wallis test indicates SEASONALITY at the 5% significance level. Because the calculated Kruskal-Wallis statistic is greater than the Chi-squared value, we conclude that at least one season has a significantly different median concentration of this constituent than any other season.
Calculated Kruskal-Wallis statistic = 97.26
Tabulated Chi-Squared value = 3.841 with 1 degrees of freedom at the 5% significance level.
There were 76 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 97.26
Adjusted Kruskal-Wallis statistic (H') = 97.26

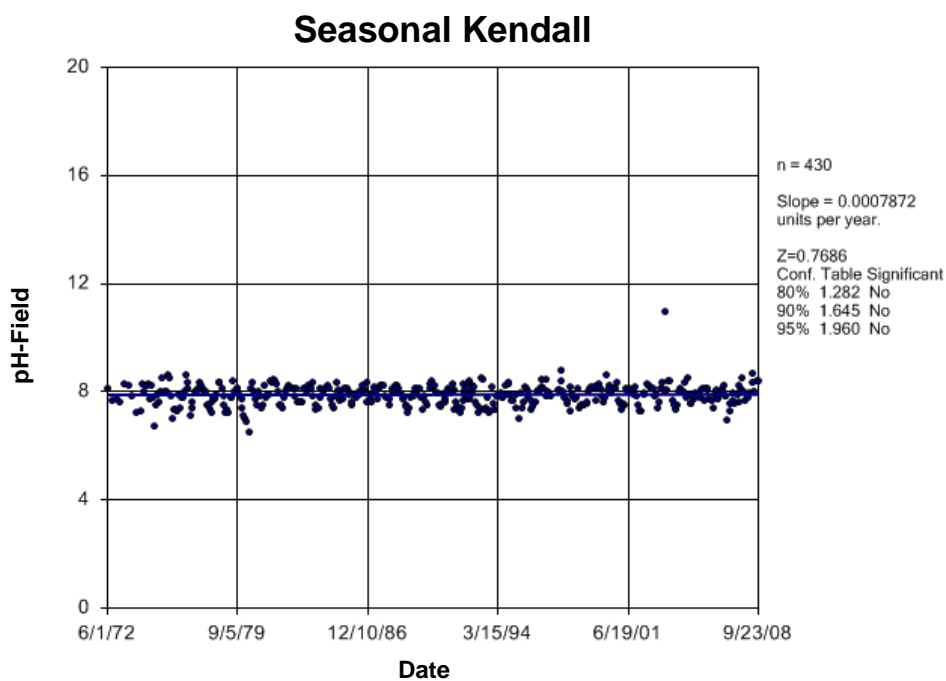**Figure D77 Assiniboine River: pH-Field**

Seasonal Kendall

Figure D78 Assiniboine River: pH-Field
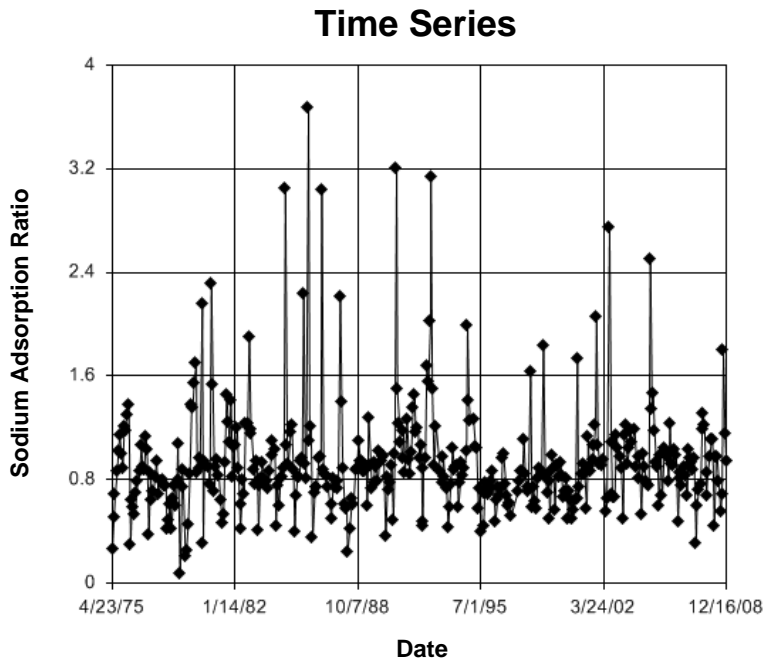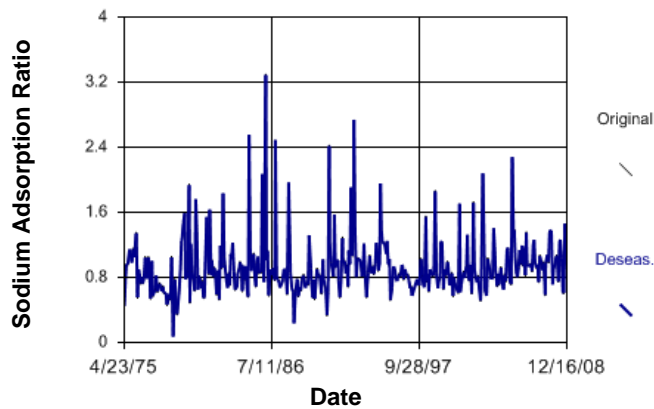
Time Series

Figure D79 Assiniboine River: Sodium Absorption Ratio

Seasonality

For the data shown, the Kruskal-Wallis test indicates SEASONALITY at the 5% significance level. Because the calculated Kruskal-Wallis statistic is greater than the Chi-squared value, we conclude that at least one season has a significantly different median concentration of this constituent than any other season.
Calculated Kruskal-Wallis statistic = 4.123
Tabulated Chi-Squared value = 3.841 with 1 degrees of freedom at the 5% significance level.
There were 13 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 4.123
Adjusted Kruskal-Wallis statistic (H') = 4.123

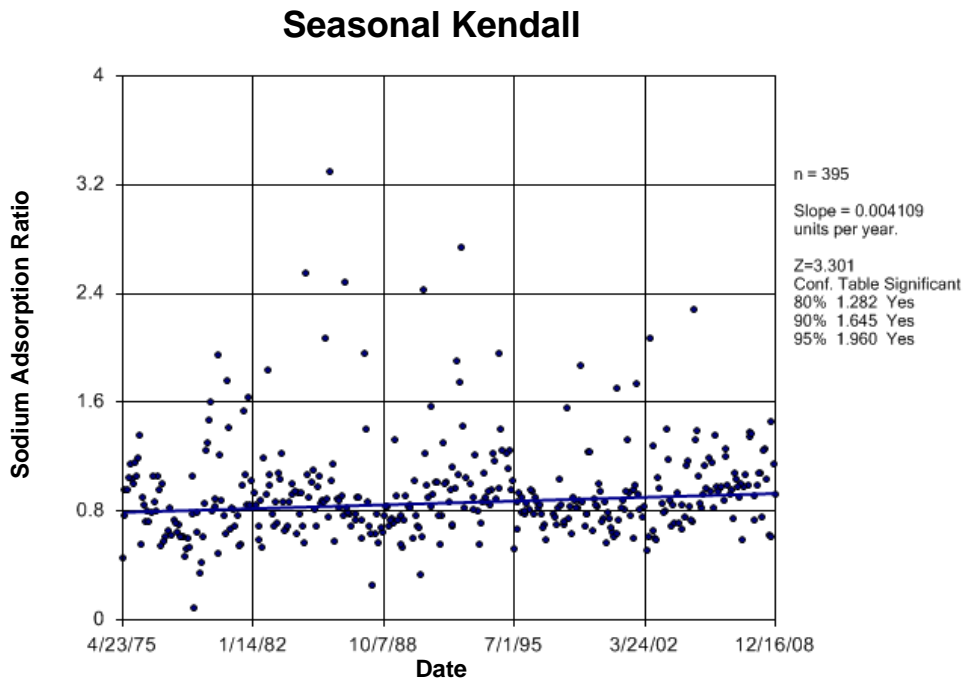**Figure D80 Assiniboine River: Sodium Adsorption Ratio**

Seasonal Kendall

n = 395

Slope = 0.004109
units per year.

Z=3.301
Conf. Table Significant
80% 1.282 Yes
90% 1.645 Yes
95% 1.960 Yes

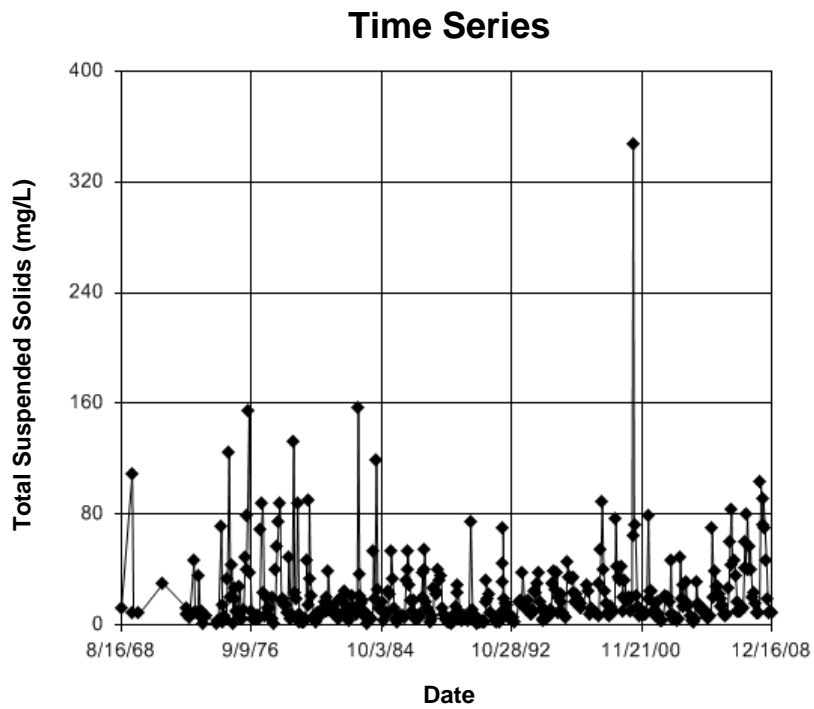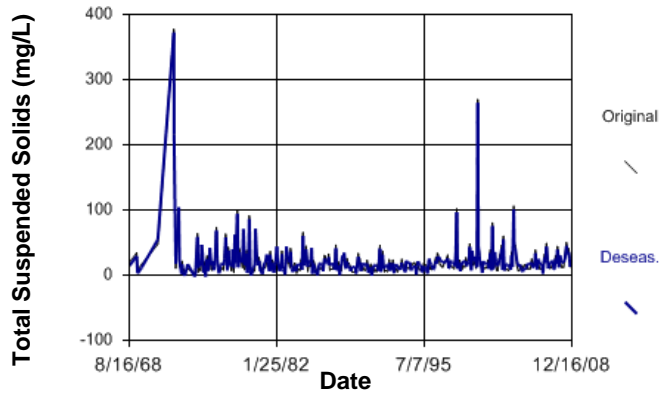**Figure D81 Assiniboine River: Sodium Adsorption Ratio**

Time Series

Figure D82 Assiniboine River: Total Suspended Solids

266

Seasonality

For the data shown, the Kruskal-Wallis test indicates SEASONALITY at the 5% significance level. Because the calculated Kruskal-Wallis statistic is greater than the Chi-squared value, we conclude that at least one season has a significantly different median concentration of this constituent than any other season.
Calculated Kruskal-Wallis statistic = 84.93
Tabulated Chi-Squared value = 3.841 with 1 degrees of freedom at the 5% significance level.
There were 24 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 84.93
Adjusted Kruskal-Wallis statistic (H') = 84.93

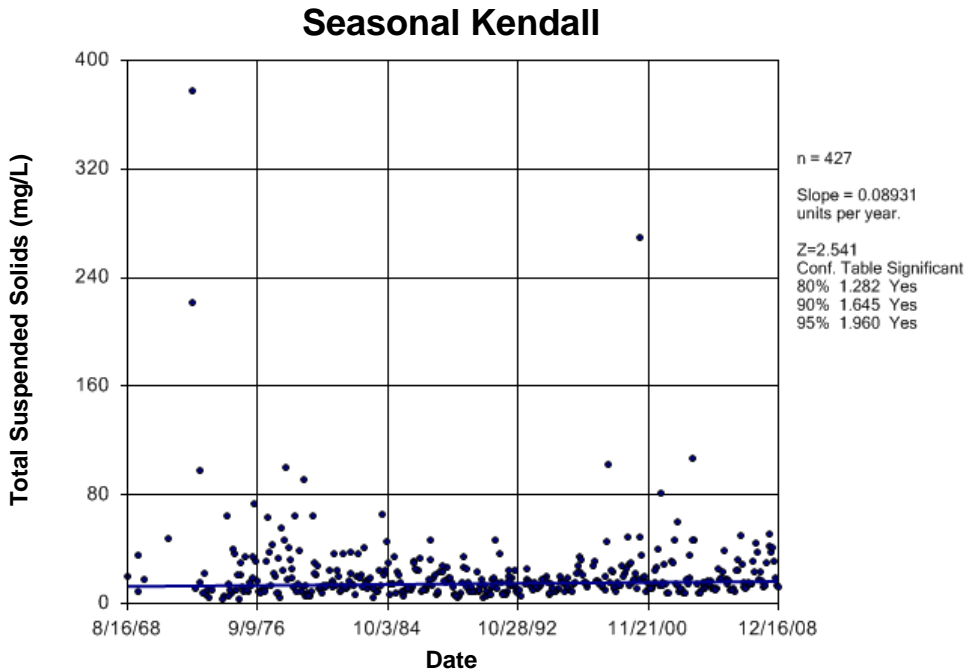**Figure D83 Assiniboine River: Total Suspended Solids**

Seasonal Kendall

n = 427

Slope = 0.08931 units per year.

Z=2.541
Conf. Table Significant
80% 1.282 Yes
90% 1.645 Yes
95% 1.960 Yes

Figure D84 Assiniboine River: Total Suspended Solids
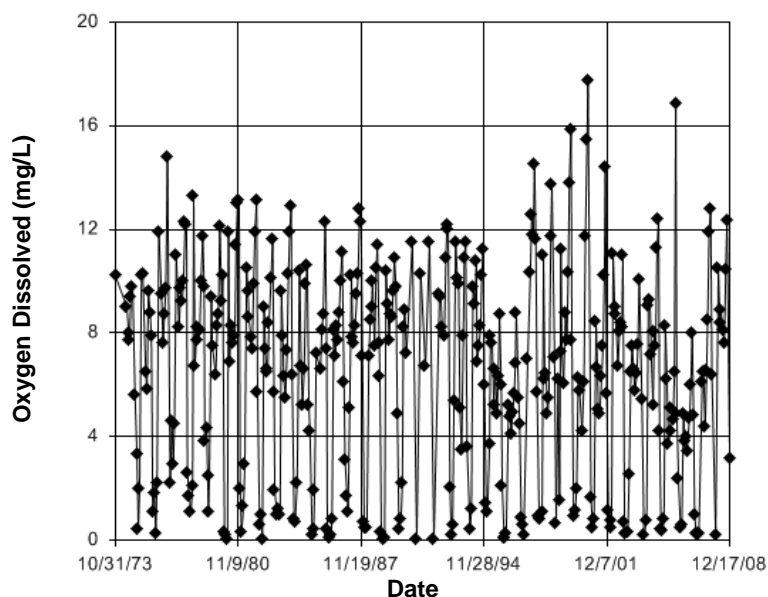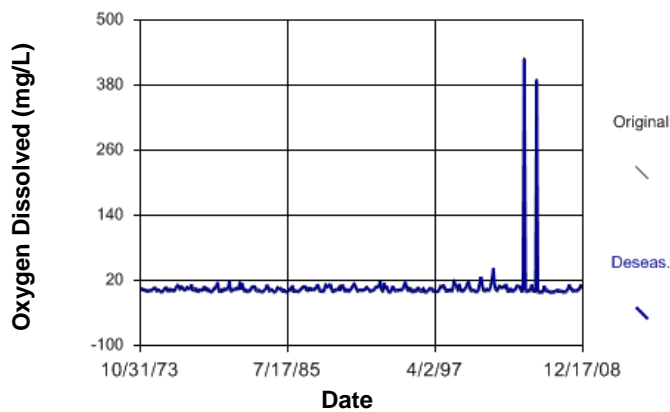
Time Series

Figure D85 Carrot River: Oxygen Dissolved

Seasonality

For the data shown, the Kruskal-Wallis test indicates SEASONALITY at the 5% significance level. Because the calculated Kruskal-Wallis statistic is greater than the Chi-squared value, we conclude that at least one season has a significantly different median concentration of this constituent than any other season.
Calculated Kruskal-Wallis statistic = 53.86
Tabulated Chi-Squared value = 3.841 with 1 degrees of freedom at the 5% significance level.
There were 6 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 53.86
Adjusted Kruskal-Wallis statistic (H') = 53.86
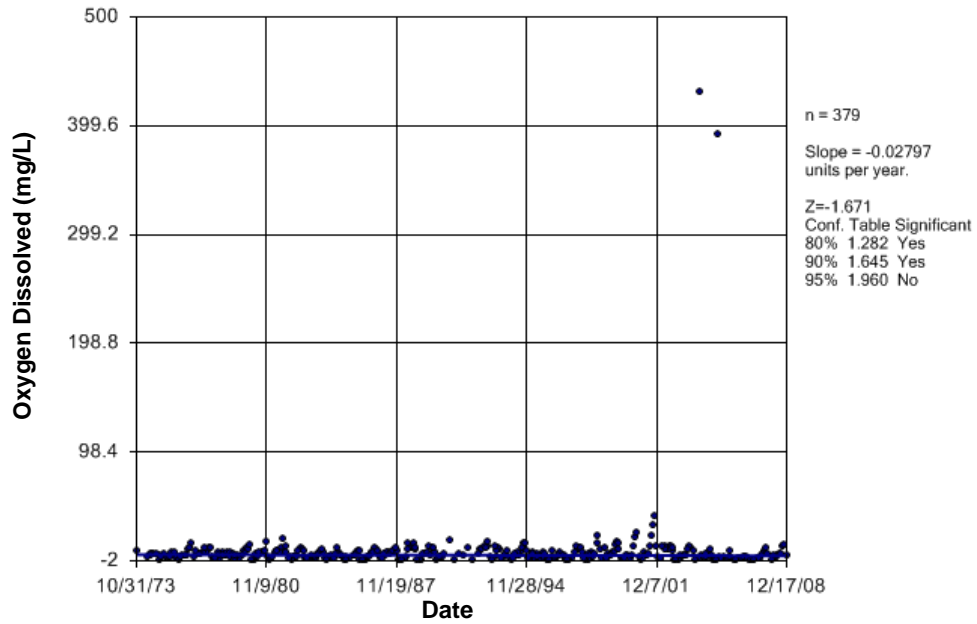

Figure D86 Carrot River: Oxygen Dissolved

268

Seasonal Kendall

n = 379

Slope = -0.02797
units per year.

Z=-1.671
Conf. Table Significant
80% 1.282 Yes
90% 1.645 Yes
95% 1.960 No

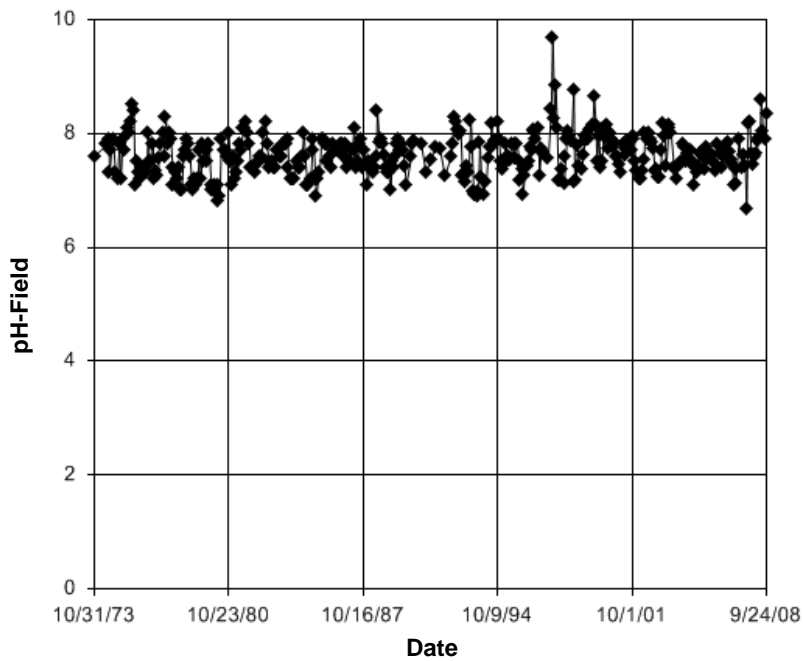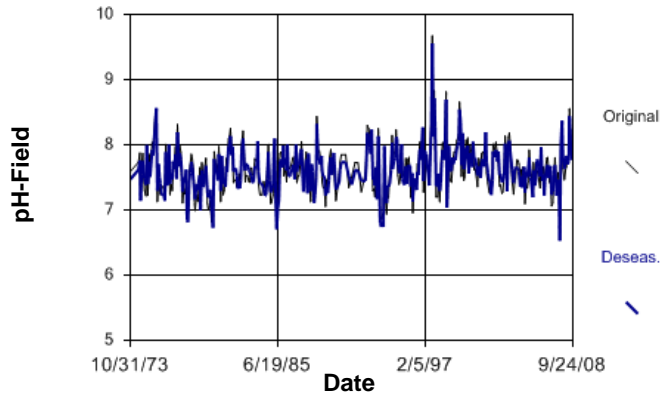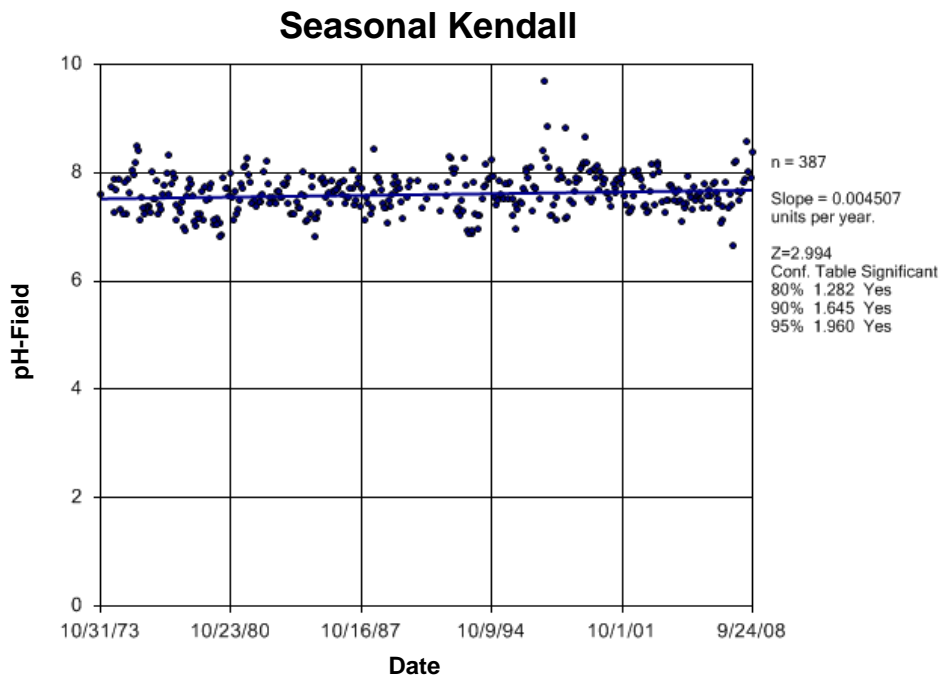**Figure D87 Carrot River: Oxygen Dissolved**

Time Series

Figure D88 Carrot River: pH-Field

269

Seasonality

For the data shown, the Kruskal-Wallis test indicates SEASONALITY at the 5% significance level. Because the calculated Kruskal-Wallis statistic is greater than the Chi-squared value, we conclude that at least one season has a significantly different median concentration of this constituent than any other season.
Calculated Kruskal-Wallis statistic = 76.02
Tabulated Chi-Squared value = 3.841 with 1 degrees of freedom at the 5% significance level.
There were 49 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 76.02
Adjusted Kruskal-Wallis statistic (H') = 76.02

Figure D89 Carrot River: pH-Field

Seasonal Kendall

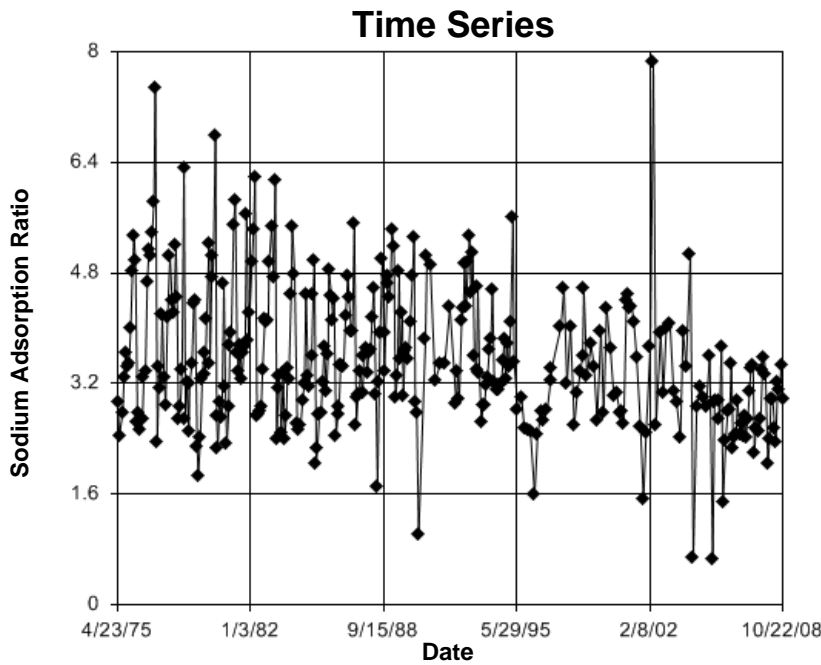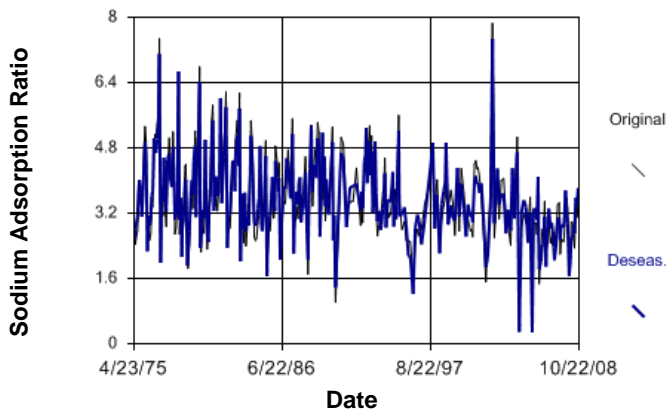**Figure D90 Carrot River: pH-Field**

Time Series

Figure D91 Carrot River: Sodium Absorption Ratio

Seasonality

For the data shown, the Kruskal-Wallis test indicates SEASONALITY at the 5% significance level. Because the calculated Kruskal-Wallis statistic is greater than the Chi-squared value, we conclude that at least one season has a significantly different median concentration of this constituent than any other season.
Calculated Kruskal-Wallis statistic = 43.87
Tabulated Chi-Squared value = 3.841 with 1 degrees of freedom at the 5% significance level.
There were 17 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 43.87
Adjusted Kruskal-Wallis statistic (H') = 43.87
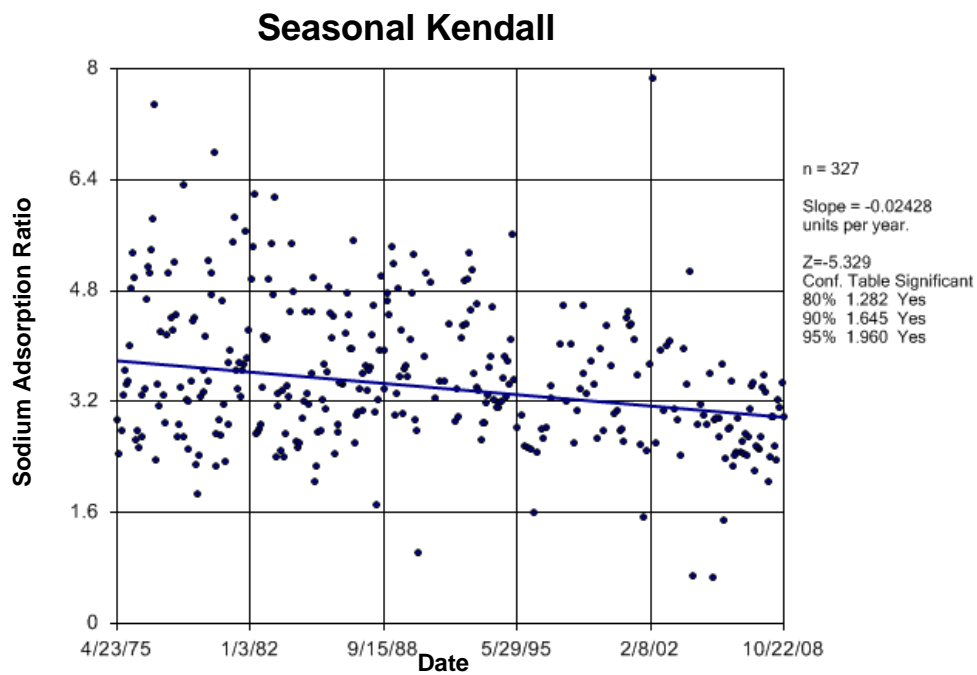

Figure D92 Carrot River: Sodium Adsorption Ratio

271

Seasonal Kendall

n = 327

Slope = -0.02428 units per year.

Z=-5.329
Conf. Table Significant
80% 1.282 Yes
90% 1.645 Yes
95% 1.960 Yes

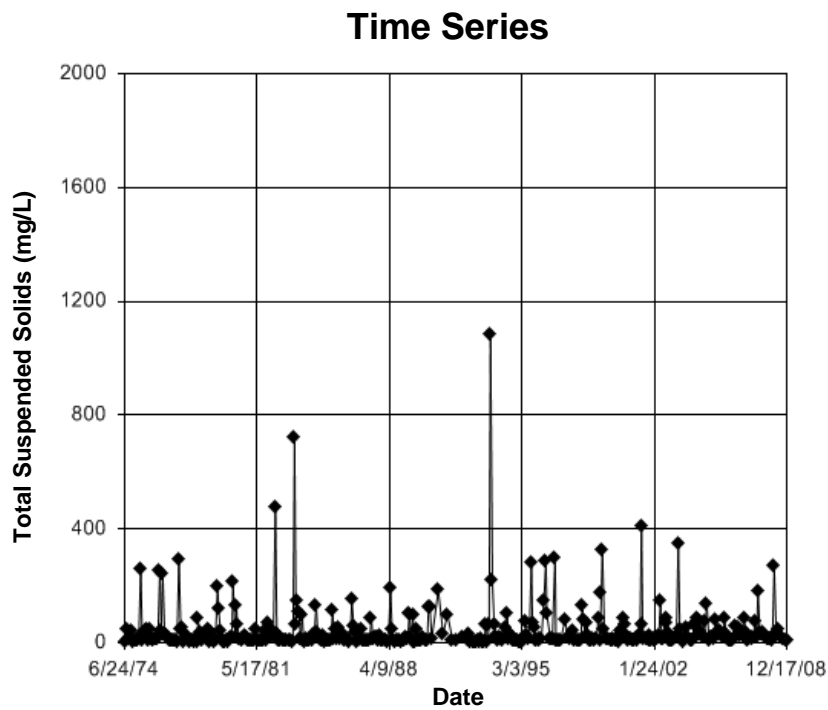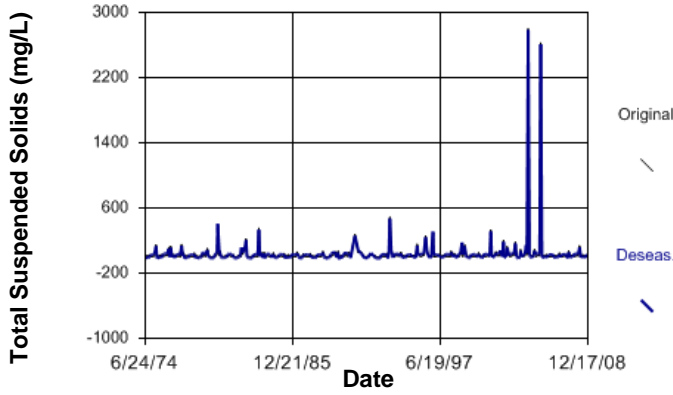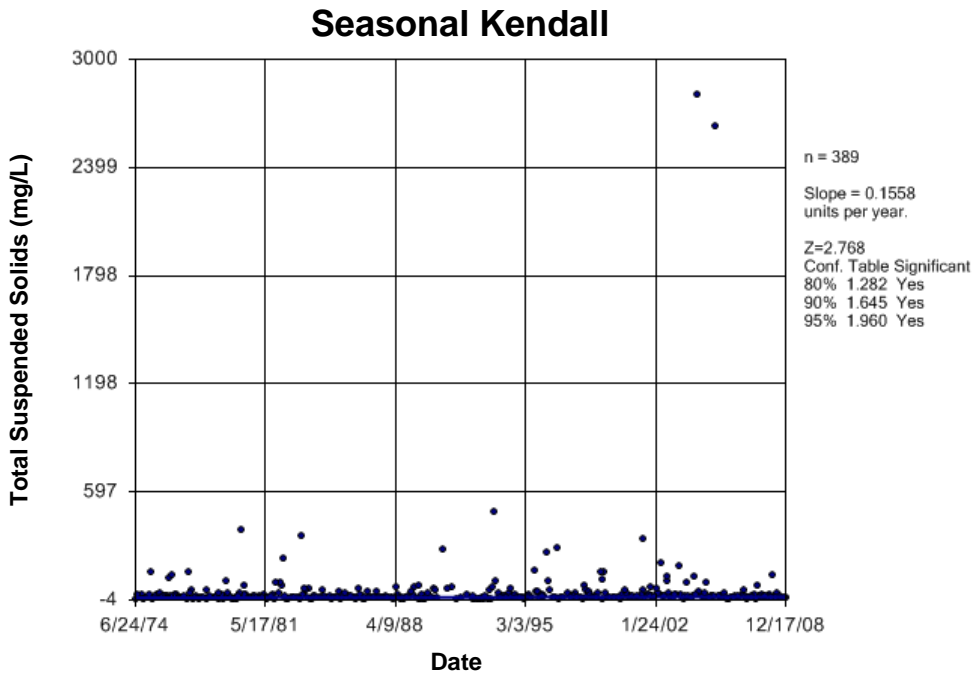**Figure D93 Carrot River: Sodium Adsorption Ratio**

Time Series

Figure D94 Carrot River: Total Suspended Solids

Seasonality

For the data shown, the Kruskal-Wallis test indicates SEASONALITY at the 5% significance level. Because the calculated Kruskal-Wallis statistic is greater than the Chi-squared value, we conclude that at least one season has a significantly different median concentration of this constituent than any other season.
Calculated Kruskal-Wallis statistic = 29.95
Tabulated Chi-Squared value = 3.841 with 1 degrees of freedom at the 5% significance level.
There were 5 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 29.95
Adjusted Kruskal-Wallis statistic (H') = 29.95

Figure D95 Carrot River: Total Suspended Solids

Seasonal Kendall

n = 389

Slope = 0.1558 units per year.

Z=2.768
Conf. Table Significant
80% 1.282 Yes
90% 1.645 Yes
95% 1.960 Yes

Figure D96 Carrot River: Total Suspended Solids
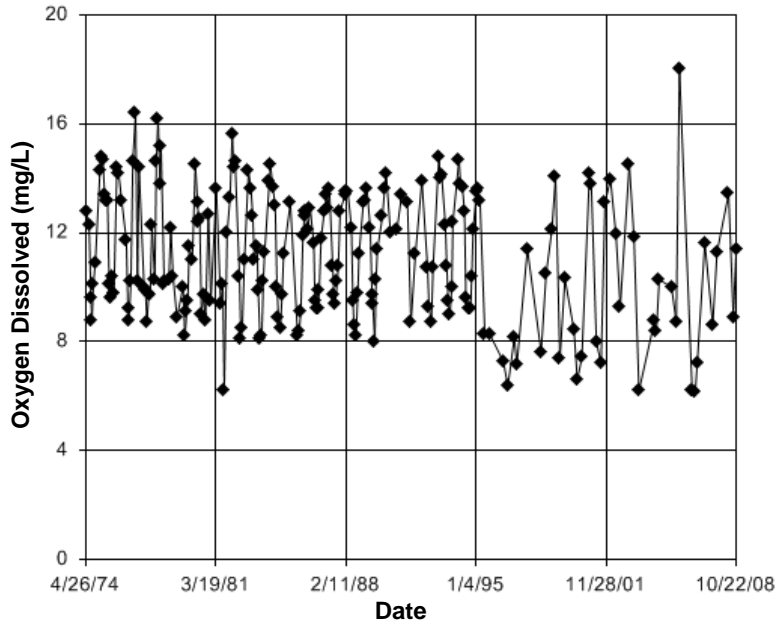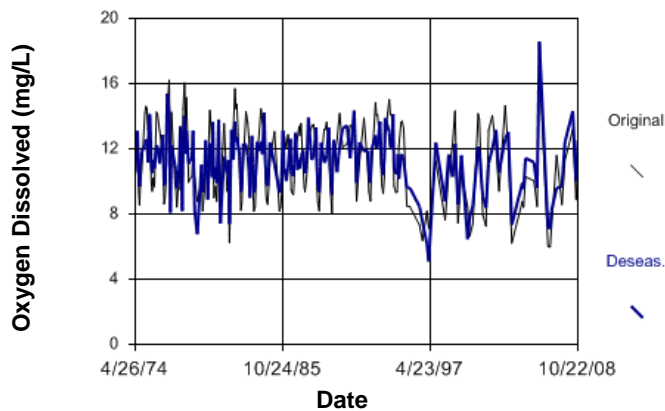
273

Time Series

Figure D97 Churchill River: Oxygen Dissolved

Seasonality

For the data shown, the Kruskal-Wallis test indicates SEASONALITY at the 5% significance level. Because the calculated Kruskal-Wallis statistic is greater than the Chi-squared value, we conclude that at least one season has a significantly different median concentration of this constituent than any other season.
Calculated Kruskal-Wallis statistic = 92.15
Tabulated Chi-Squared value = 3.841 with 1 degrees of freedom at the 5% significance level.
There were 11 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 92.15
Adjusted Kruskal-Wallis statistic (H') = 92.15

Figure D98 Churchill River: Oxygen Dissolved

Seasonal Kendall

n = 211

Slope = -0.02494
units per year.

Z=-1.812
Conf. Table Significant
80% 1.282 Yes
90% 1.645 Yes
95% 1.960 No
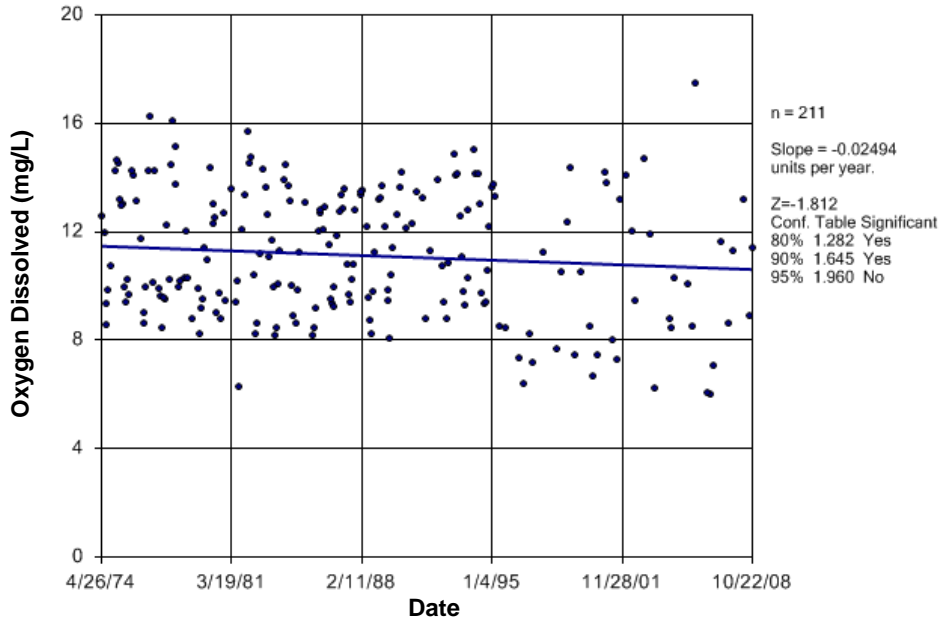
Figure D99 Churchill River: Oxygen Dissolved
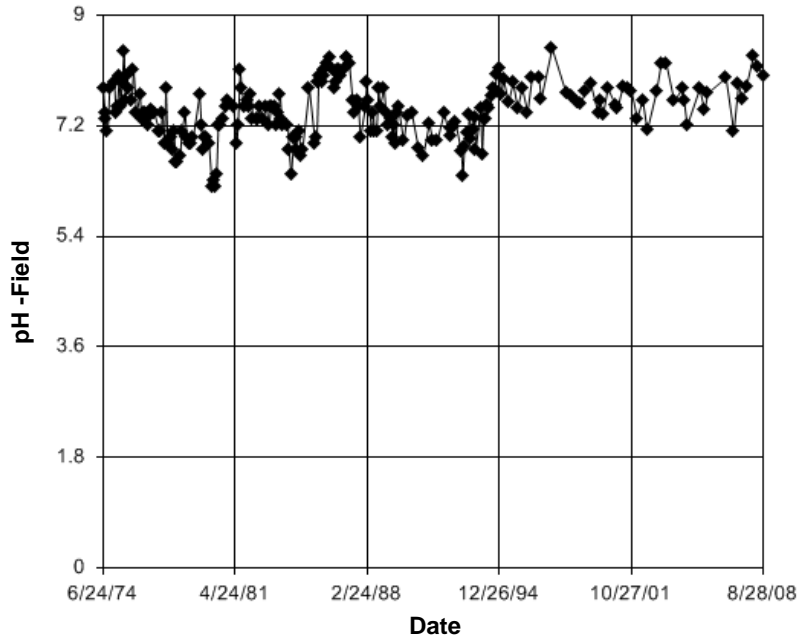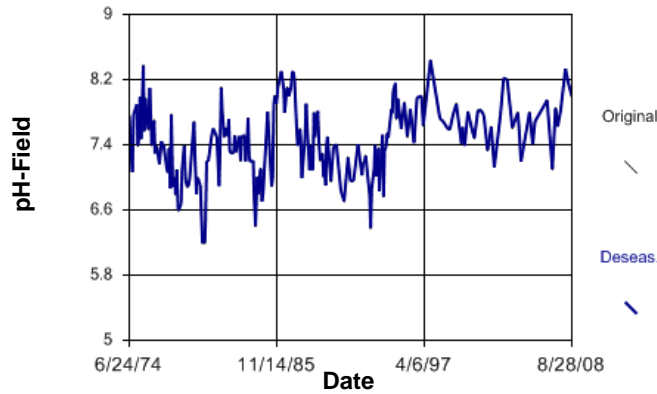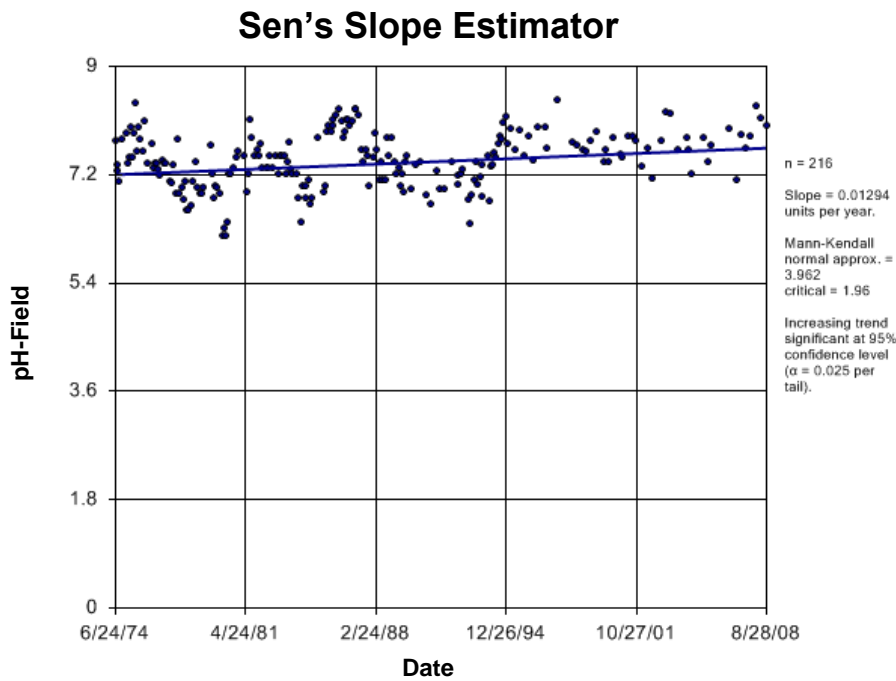
Time Series

Figure D100 Churchill River: pH-Field

Seasonality

For the data shown, the Kruskal-Wallis test indicates NO SEASONALITY at the 5% significance level. Because the calculated Kruskal-Wallis statistic is less than or equal to the Chi-squared value, we conclude that no season has a significantly different median concentration of this constituent than any other season.
Calculated Kruskal-Wallis statistic = 0.06344
Tabulated Chi-Squared value = 3.841 with 1 degrees of freedom at the 5% significance level.
There were 21 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 0.06344
Adjusted Kruskal-Wallis statistic (H') = 0.06344

Figure D101 Churchill River: pH-Field

Sen's Slope Estimator

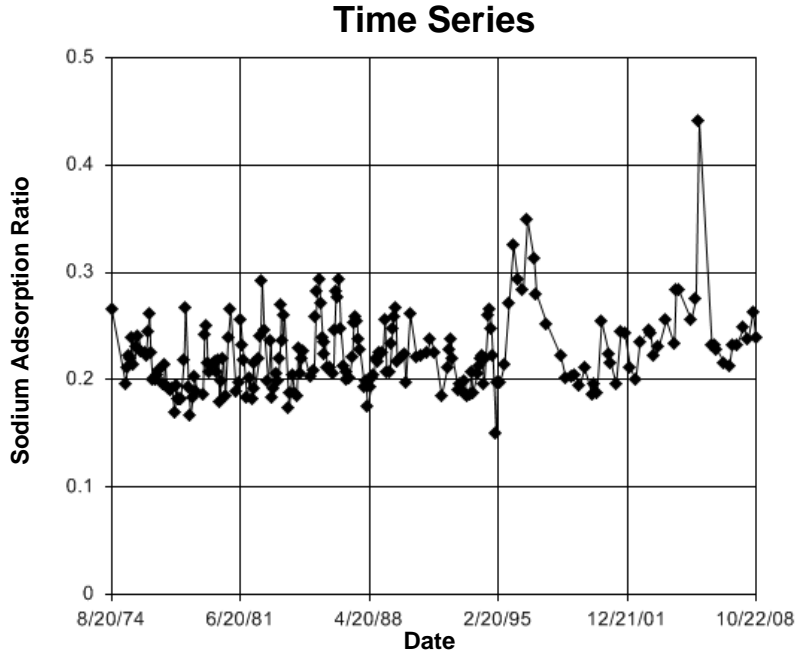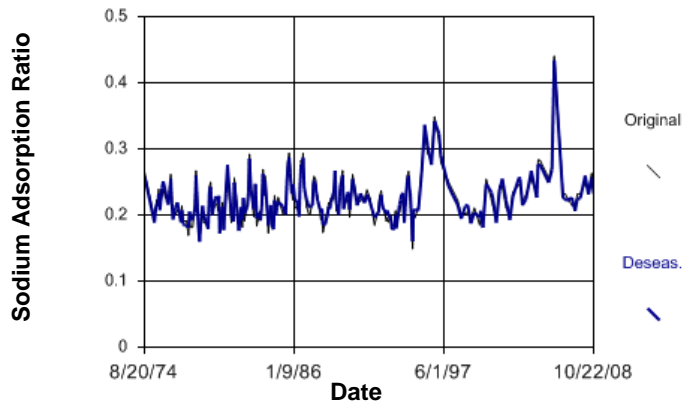**Figure D102 Churchill River: pH-Field**

Time Series

Figure D103 Churchill River: Sodium Absorption Ratio

Seasonality

For the data shown, the Kruskal-Wallis test indicates SEASONALITY at the 5% significance level. Because the calculated Kruskal-Wallis statistic is greater than the Chi-squared value, we conclude that at least one season has a significantly different median concentration of this constituent than any other season.
Calculated Kruskal-Wallis statistic = 17.97
Tabulated Chi-Squared value = 3.841 with 1 degrees of freedom at the 5% significance level.
There were 17 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 17.97
Adjusted Kruskal-Wallis statistic (H') = 17.97

Figure D104 Churchill River: Sodium Adsorption Ratio

277

Seasonal Kendall

n = 215

Slope = 0.0007124
units per year.

Z=3.242
Conf. Table Significant
80% 1.282 Yes
90% 1.645 Yes
95% 1.960 Yes
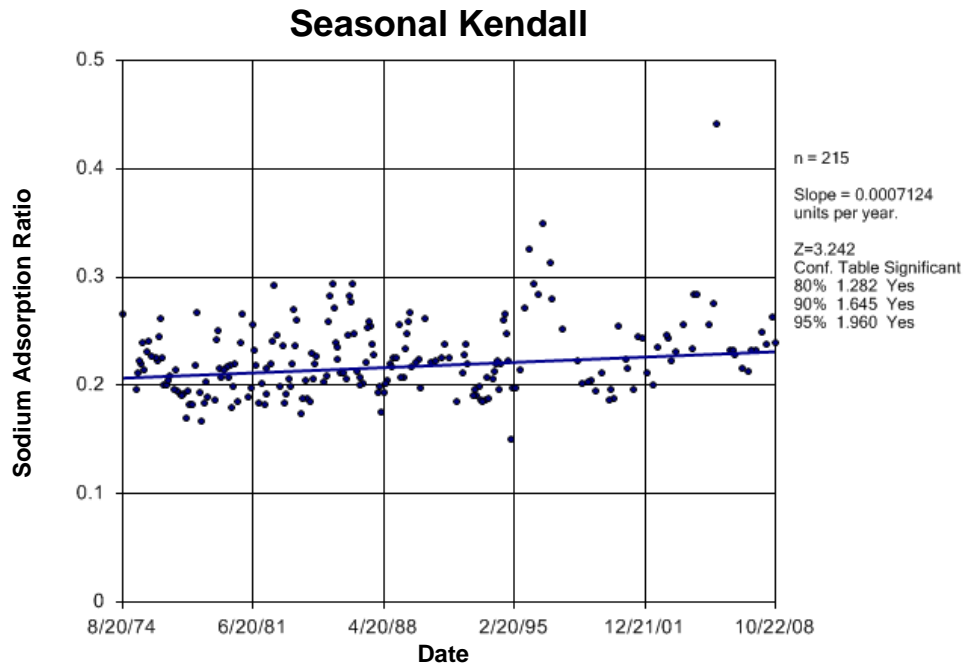
Figure D105 Churchill River: Sodium Adsorption Ratio
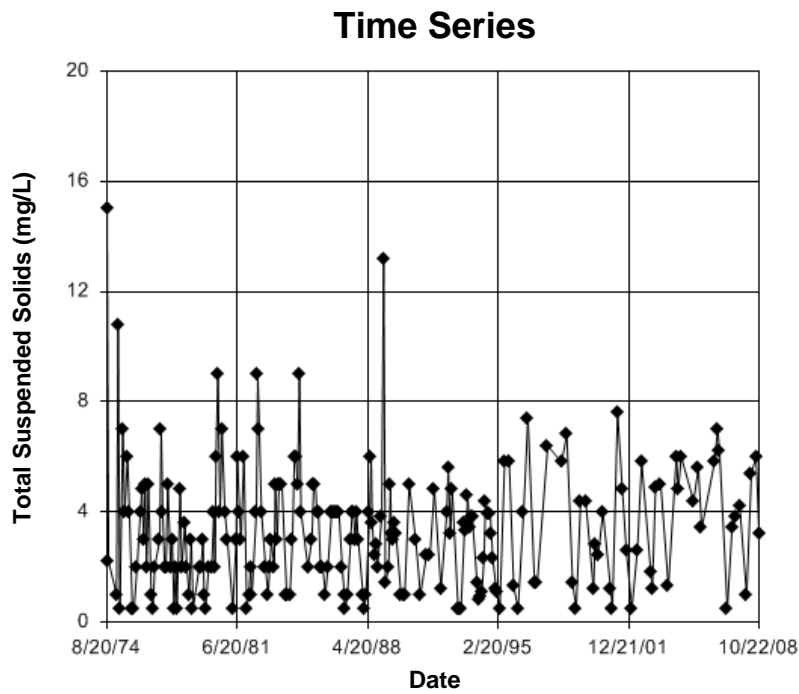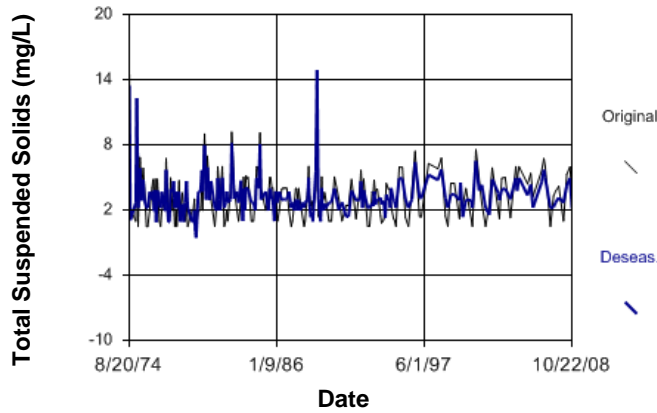
Time Series

Figure D106 Churchill River: Total Suspended Solids

278

Seasonality

For the data shown, the Kruskal-Wallis test indicates SEASONALITY at the 5% significance level. Because the calculated Kruskal-Wallis statistic is greater than the Chi-squared value, we conclude that at least one season has a significantly different median concentration of this constituent than any other season.
Calculated Kruskal-Wallis statistic = 115
Tabulated Chi-Squared value = 3.841 with 1 degrees of freedom at the 5% significance level.
There were 11 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 115
Adjusted Kruskal-Wallis statistic (H') = 115

Figure D107 Churchill River: Total Suspended Solids

Seasonal Kendall

n = 217

Slope = 0.00624 units per year.

Z=1.694
Conf. Table Significant
80% 1.282 Yes
90% 1.645 Yes
95% 1.960 No
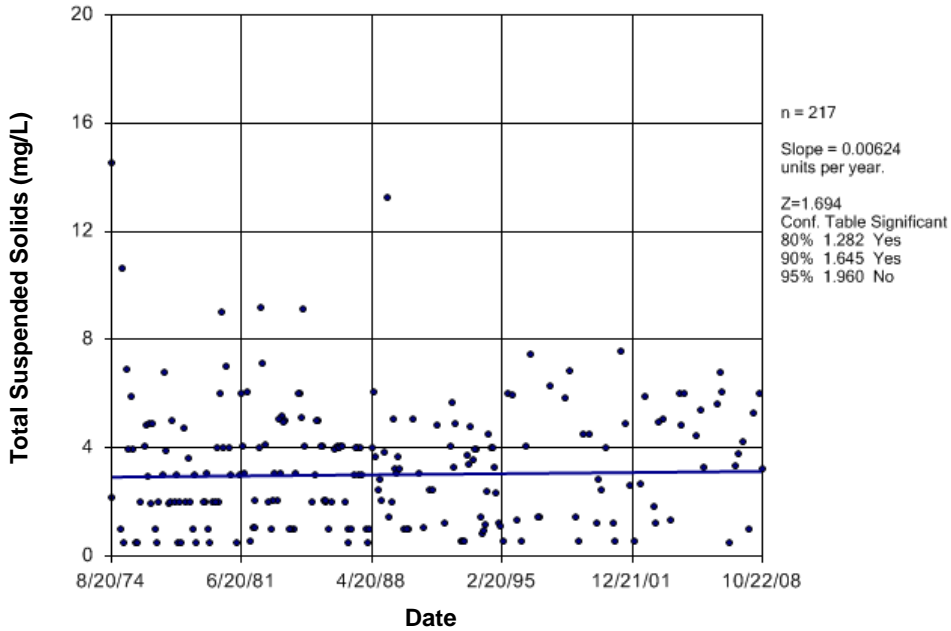
Figure D108 Churchill River: Total Suspended Solids
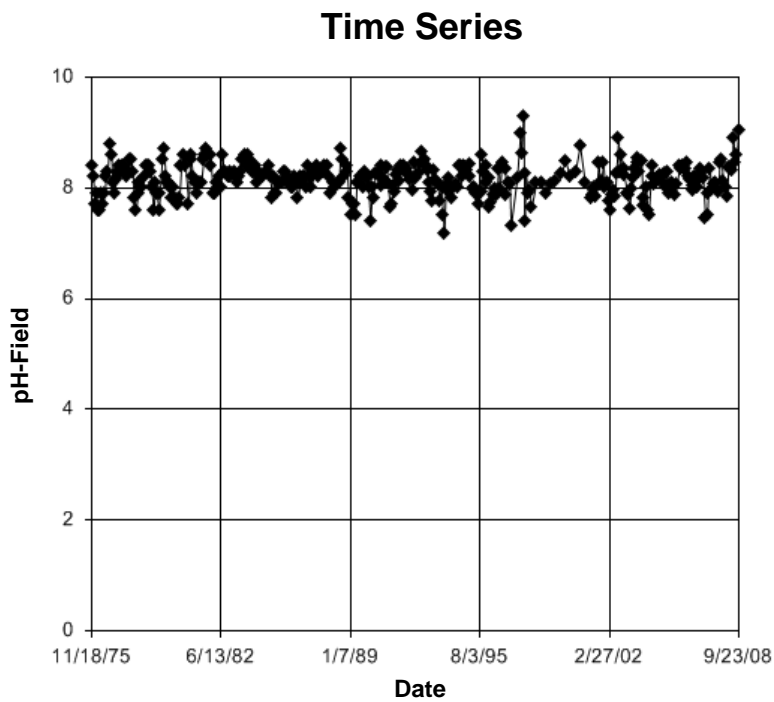
Time Series
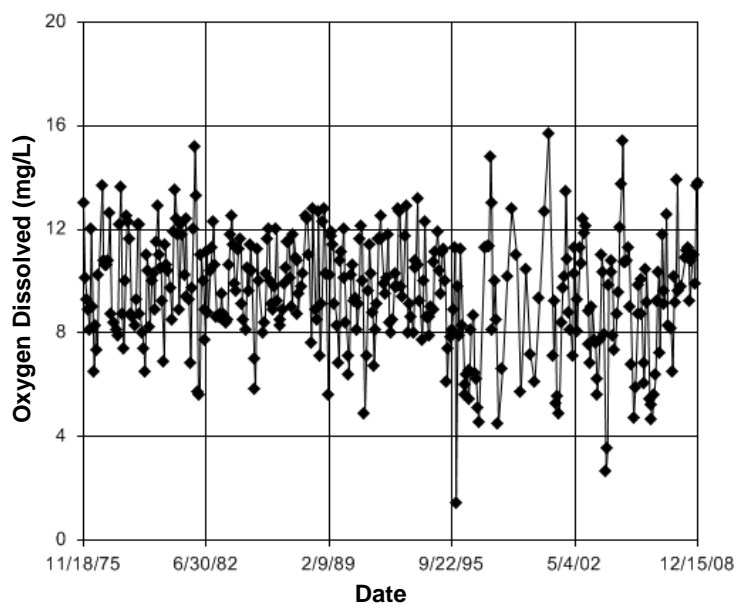
Figure D109 Qu'Appelle River: Oxygen Dissolved

Seasonality

For the data shown, the Kruskal-Wallis test indicates SEASONALITY at the 5% significance level. Because the calculated Kruskal-Wallis statistic is greater than the Chi-squared value, we conclude that at least one season has a significantly different median concentration of this constituent than any other season.
Calculated Kruskal-Wallis statistic = 6.723
Tabulated Chi-Squared value = 3.841 with 1 degrees of freedom at the 5% significance level.
There were 42 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 6.723
Adjusted Kruskal-Wallis statistic (H') = 6.723
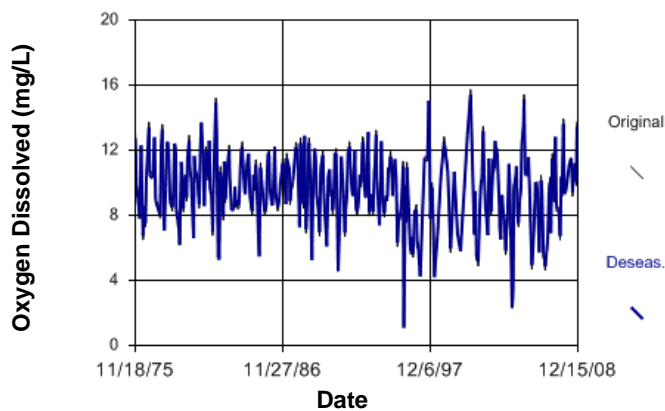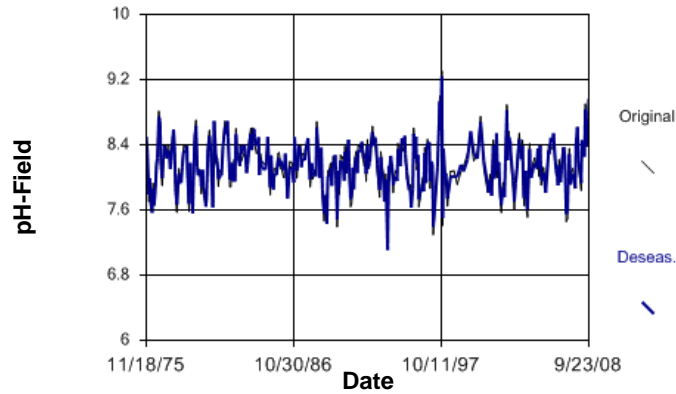

Figure D110 Qu'Appelle River: Oxygen Dissolved

Seasonal Kendall
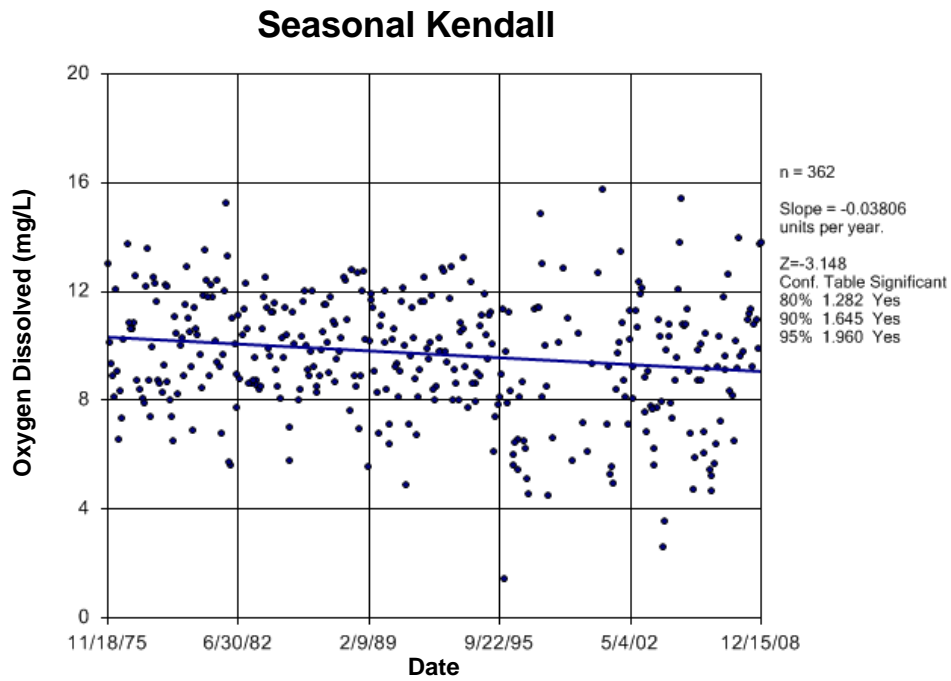
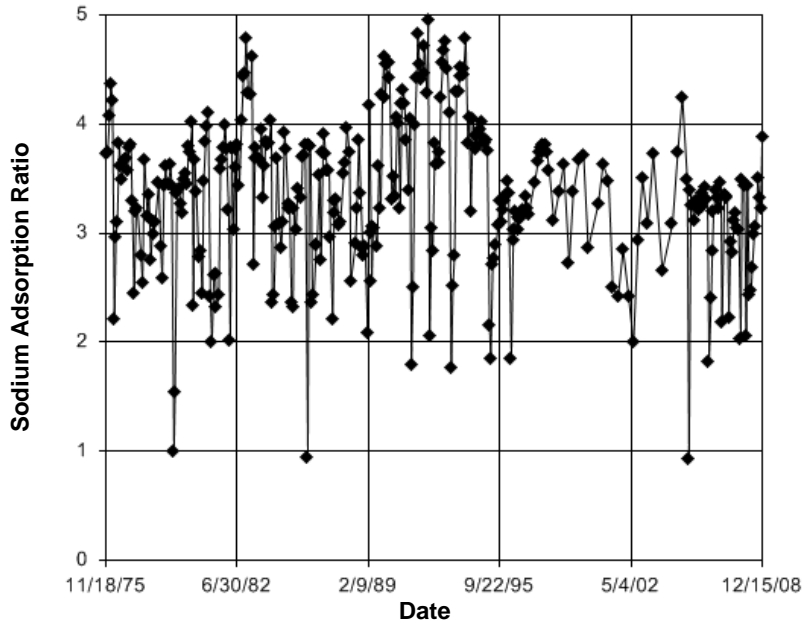**Figure D111 Qu'Appelle River: Oxygen Dissolved**

Time Series

Figure D112 Qu'Appelle River: pH-Field

Seasonality

For the data shown, the Kruskal-Wallis test indicates SEASONALITY at the 5% significance level. Because the calculated Kruskal-Wallis statistic is greater than the Chi-squared value, we conclude that at least one season has a significantly different median concentration of this constituent than any other season.
Calculated Kruskal-Wallis statistic = 21.61
Tabulated Chi-Squared value = 3.841 with 1 degrees of freedom at the 5% significance level.
There were 58 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 21.61
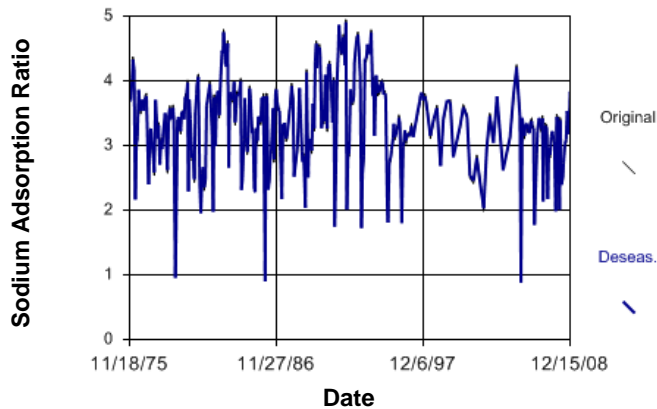Adjusted Kruskal-Wallis statistic (H') = 21.61

Figure D113 Qu'Appelle River: pH-Field

Seasonal Kendall
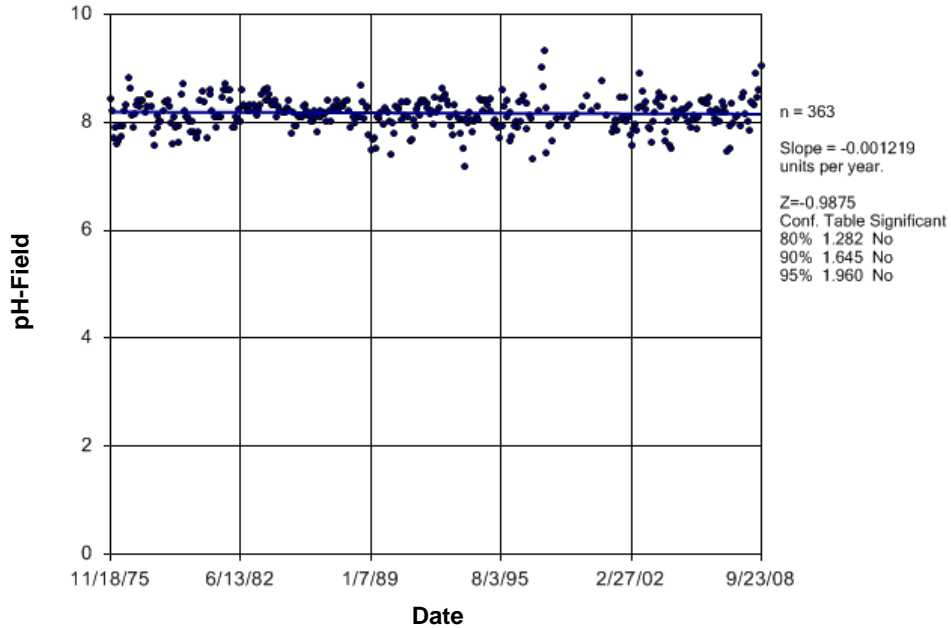
Figure D114 Qu'Appelle River: pH-Field

282

Time Series

Figure D115 Qu'Appelle River: Sodium Absorption Ratio

Seasonality

For the data shown, the Kruskal-Wallis test indicates SEASONALITY at the 5% significance level. Because the calculated Kruskal-Wallis statistic is greater than the Chi-squared value, we conclude that at least one season has a significantly different median concentration of this constituent than any other season.
Calculated Kruskal-Wallis statistic = 5.329
Tabulated Chi-Squared value = 3.841 with 1 degrees of freedom at the 5% significance level.
There were 18 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 5.329
Adjusted Kruskal-Wallis statistic (H') = 5.329

Figure D116 Qu'Appelle River: Sodium Adsorption Ratio

Seasonal Kendall

n = 329

Slope = -0.006846
units per year.

Z=-1.942
Conf. Table Significant
80% 1.282 Yes
90% 1.645 Yes
95% 1.960 No
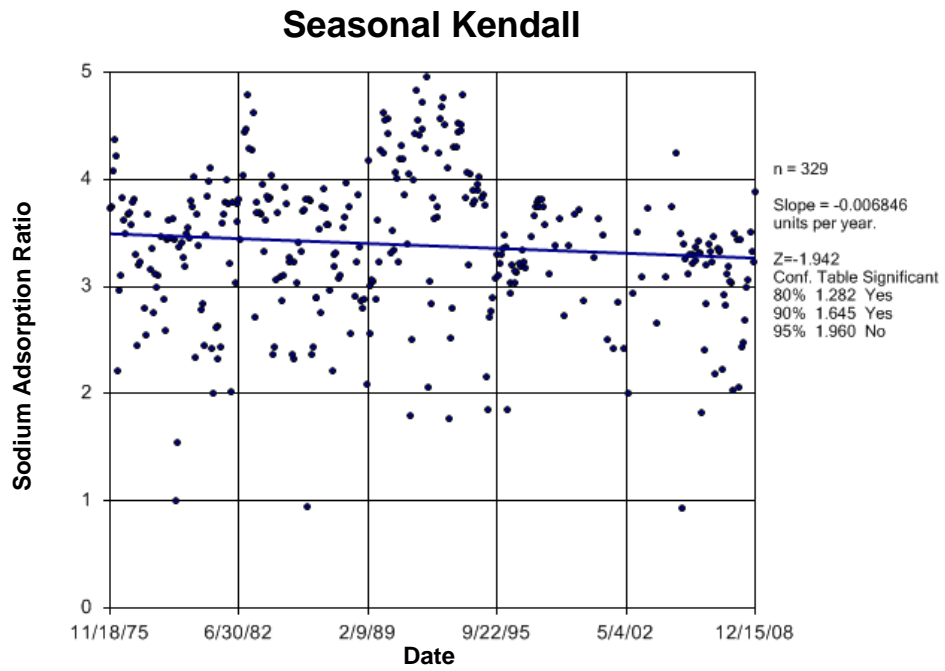
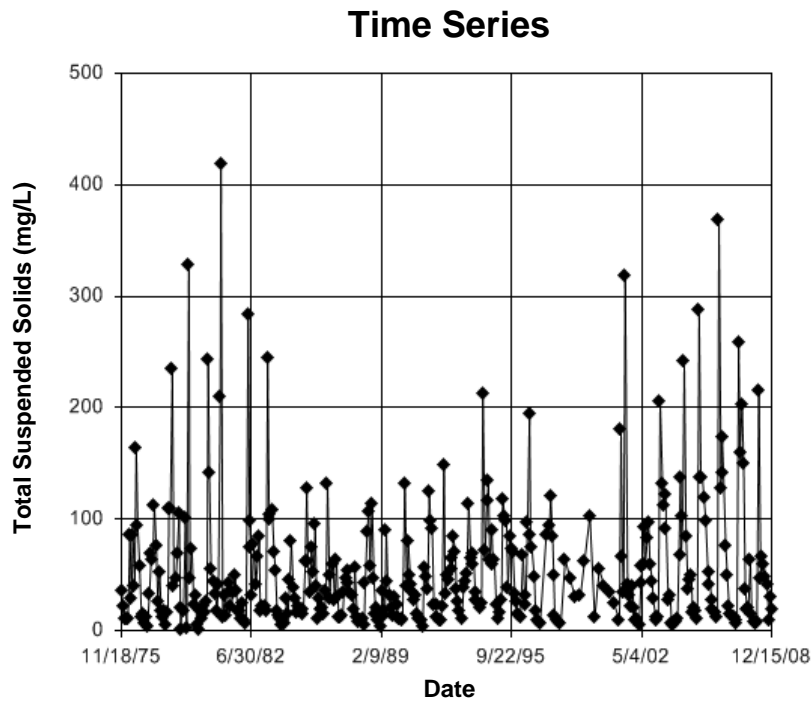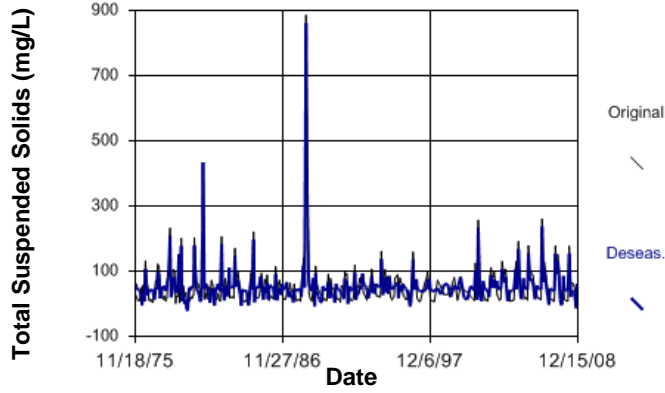**Figure D117 Qu'Appelle River: Sodium Adsorption Ratio**

Time Series

Figure D118 Qu'Appelle River: Total Suspended Solids

284

Seasonality

For the data shown, the Kruskal-Wallis test indicates SEASONALITY at the 5% significance level. Because the calculated Kruskal-Wallis statistic is greater than the Chi-squared value, we conclude that at least one season has a significantly different median concentration of this constituent than any other season.
Calculated Kruskal-Wallis statistic = 195
Tabulated Chi-Squared value = 3.841 with 1 degrees of freedom at the 5% significance level.
There were 10 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 195
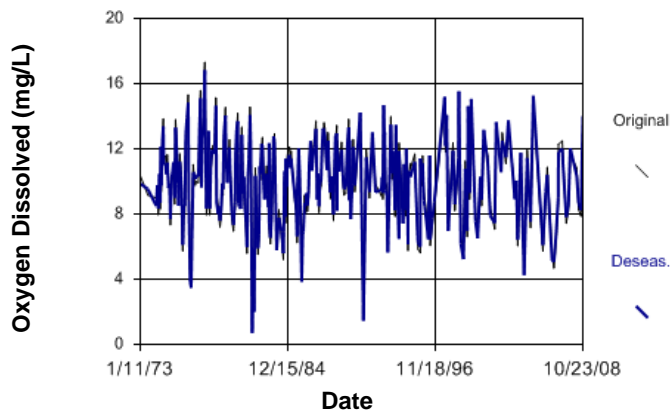Adjusted Kruskal-Wallis statistic (H') = 195

Figure D119 Qu'Appelle River: Total Suspended Solids

Seasonal Kendall

n = 371

Slope = 0.1194
units per year.

Z=1.302
Conf. Table Significant
80% 1.282 Yes
90% 1.645 No
95% 1.960 No
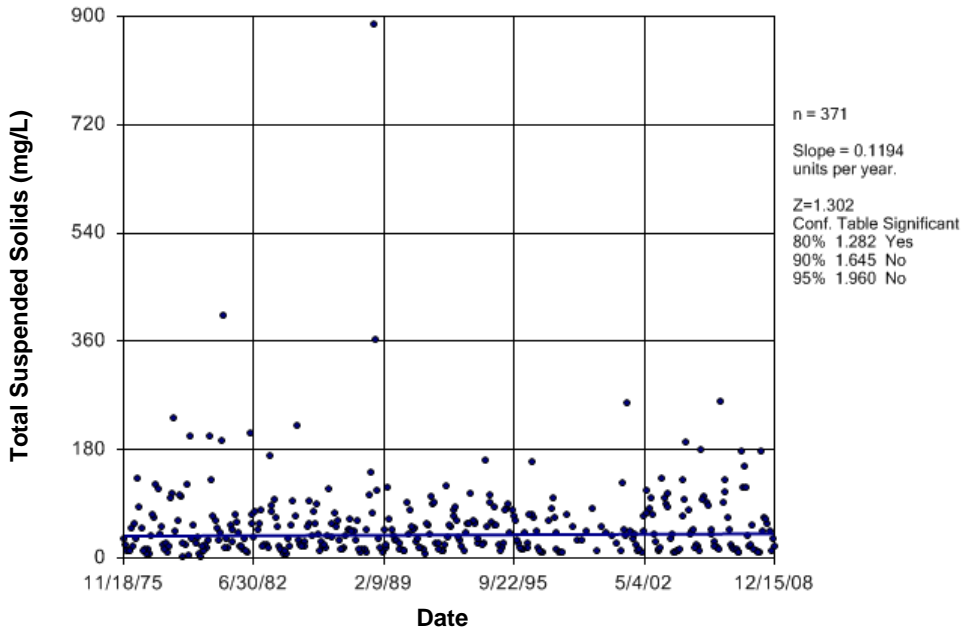
Figure D120 Qu'Appelle River: Total Suspended Solids
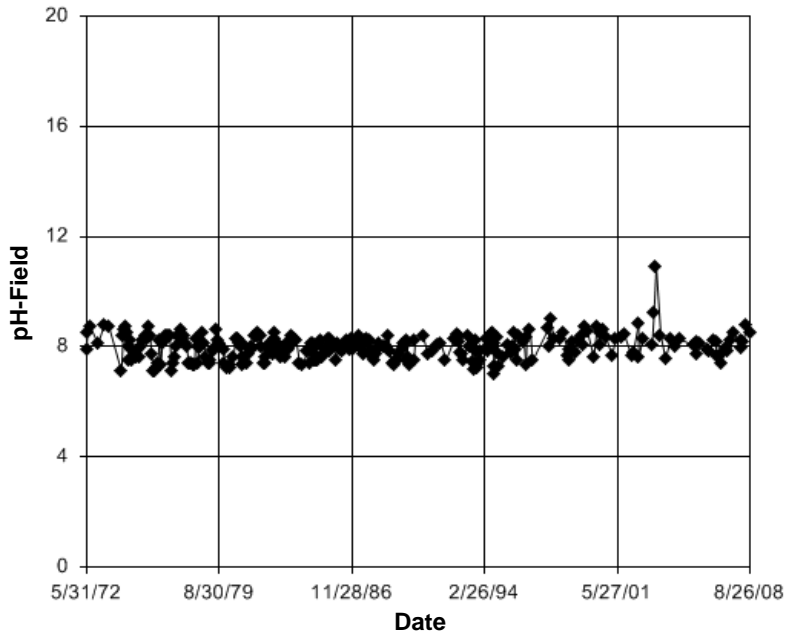
Time Series
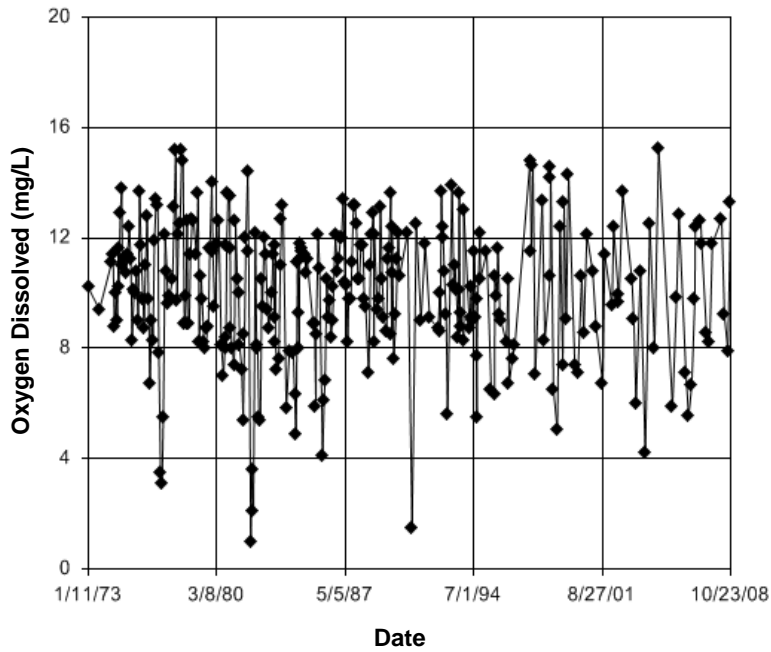
Figure D121 Red Deer River (MB-SK): Oxygen Dissolved

Seasonality

For the data shown, the Kruskal-Wallis test indicates SEASONALITY at the 5% significance level. Because the calculated Kruskal-Wallis statistic is greater than the Chi-squared value, we conclude that at least one season has a significantly different median concentration of this constituent than any other season.
Calculated Kruskal-Wallis statistic = 13.96
Tabulated Chi-Squared value = 3.841 with 1 degrees of freedom at the 5% significance level.
There were 26 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 13.96
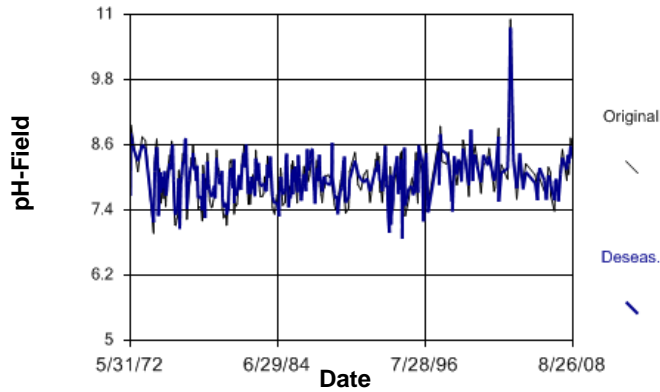Adjusted Kruskal-Wallis statistic (H') = 13.96
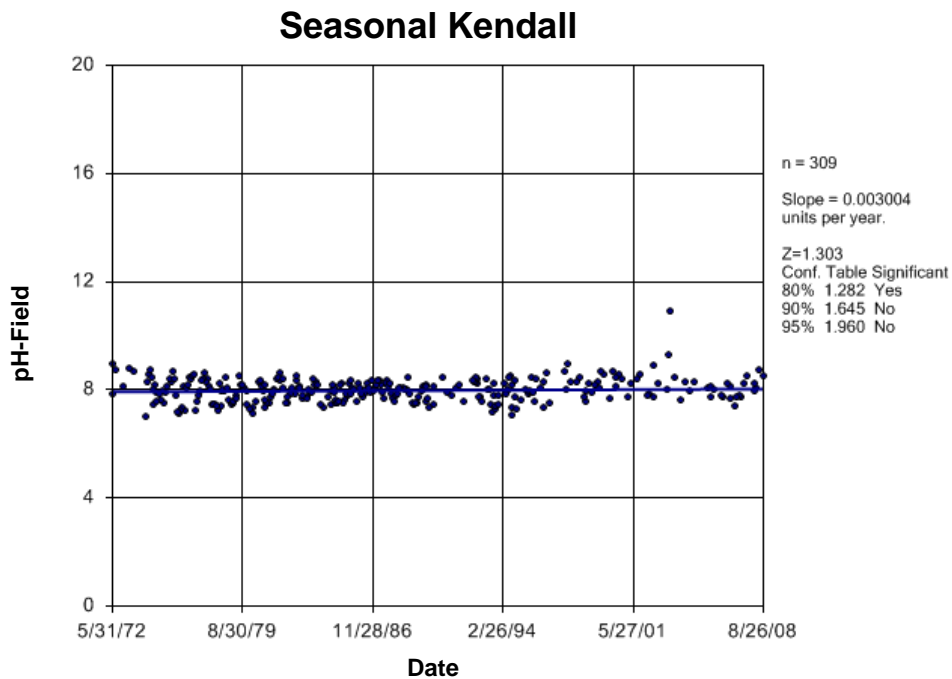

Figure D122 Red Deer River (SK-MB): Oxygen Dissolved

286

Seasonal Kendall

n = 298

Slope = -0.006108
units per year.

Z=-0.4082
Conf. Table Significant
80% 1.282 No
90% 1.645 No
95% 1.960 No
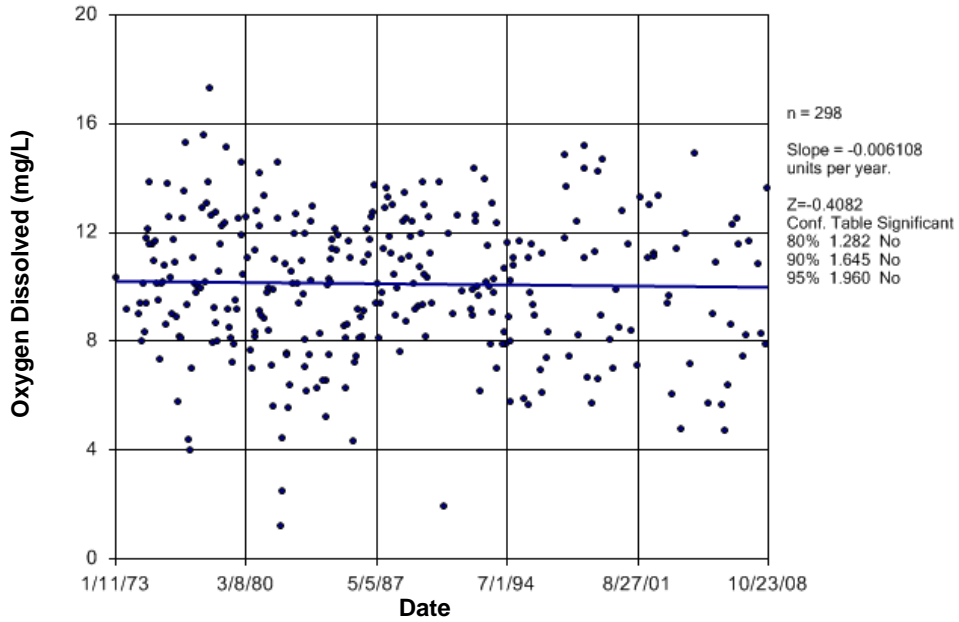
Figure D123 Red Deer River (SK-MB): Oxygen Dissolved

Time Series

Figure D124 Red Deer River (MB-SK): pH-Field

Seasonality

Figure D125 Red Deer River (SK-MB): pH-Field

Seasonal Kendall

n = 309

Slope = 0.003004
units per year.

Z=1.303
Conf. Table Significant
80% 1.282 Yes
90% 1.645 No
95% 1.960 No

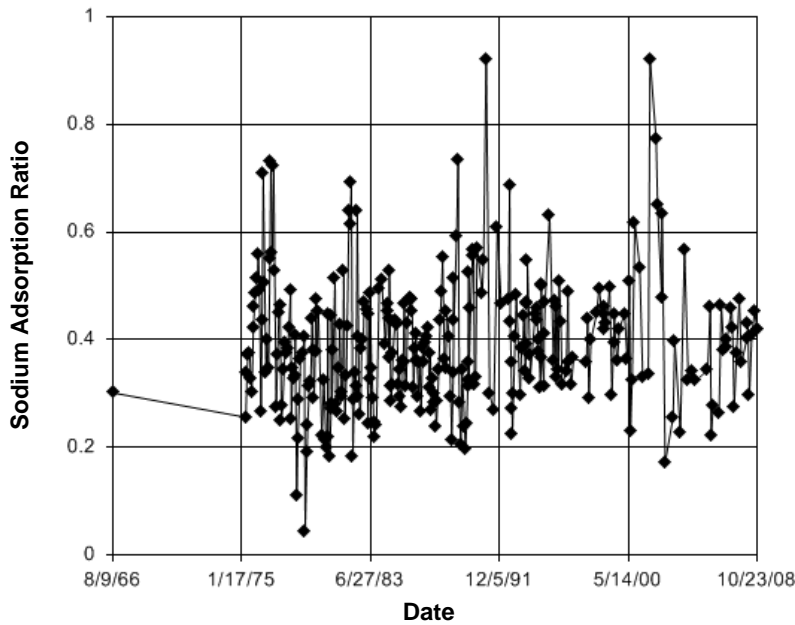**Figure D126 Red Deer River (SK-MB): pH-Field**

288

Time Series

Figure D127 Red Deer River (MB-SK): Sodium Absorption Ratio

Seasonality

For the data shown, the Kruskal-Wallis test indicates NO SEASONALITY at the 5% significance level. Because the calculated Kruskal-Wallis statistic is less than or equal to the Chi-squared value, we conclude that no season has a significantly different median concentration of this constituent than any other season.
Calculated Kruskal-Wallis statistic = 1.326
Tabulated Chi-Squared value = 3.841 with 1 degrees of freedom at the 5% significance level.
There were 11 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 1.326
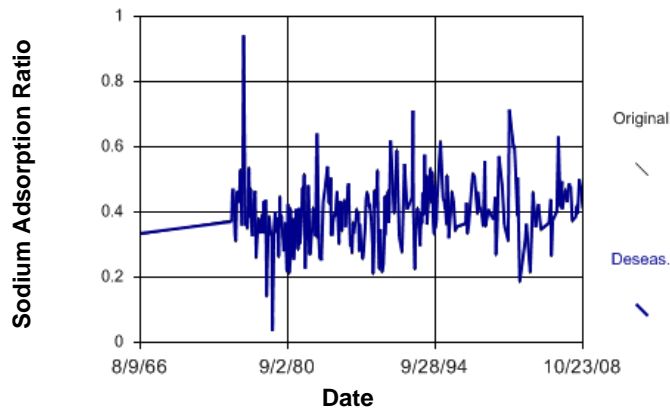Adjusted Kruskal-Wallis statistic (H') = 1.326

Figure D128 Red Deer River (SK-MB): Sodium Adsorption Ratio
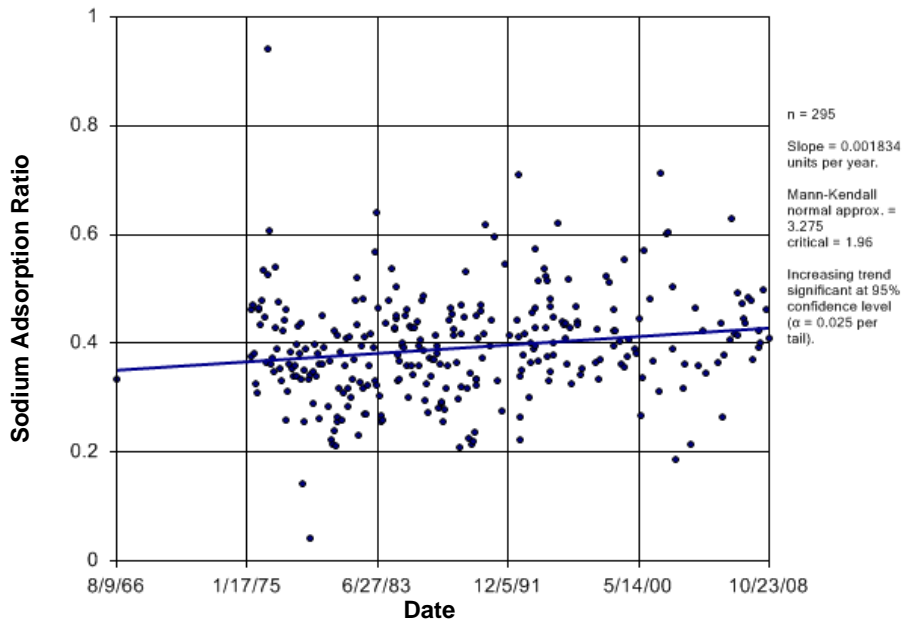
Sen's Slope Estimator

n = 295

Slope = 0.001834
units per year.

Mann-Kendall
normal approx. =
3.275
critical = 1.96

Increasing trend
significant at 95%
confidence level
(α = 0.025 per
tail).

Figure D129 Red Deer River (SK-MB): Sodium Adsorption Ratio
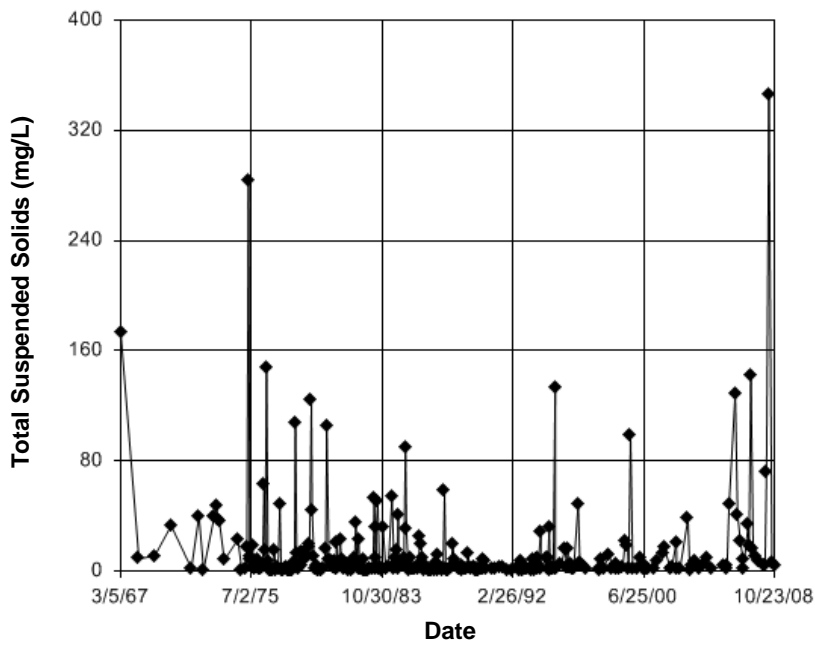
Time Series

Figure D130 Red Deer River (MB-SK): Total Suspended Solids

Seasonality

For the data shown, the Kruskal-Wallis test indicates SEASONALITY at the 5% significance level. Because the calculated Kruskal-Wallis statistic is greater than the Chi-squared value, we conclude that at least one season has a significantly different median concentration of this constituent than any other season.
Calculated Kruskal-Wallis statistic = 11.74
Tabulated Chi-Squared value = 3.841 with 1 degrees of freedom at the 5% significance level.
There were 2 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 11.74
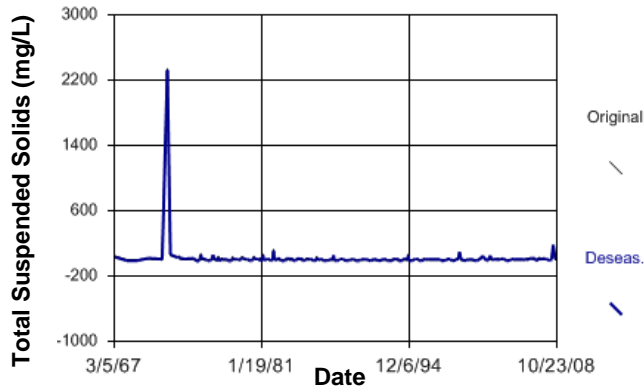Adjusted Kruskal-Wallis statistic (H') = 11.74

Figure D131 Red Deer River (SK-MB): Total Suspended Solids
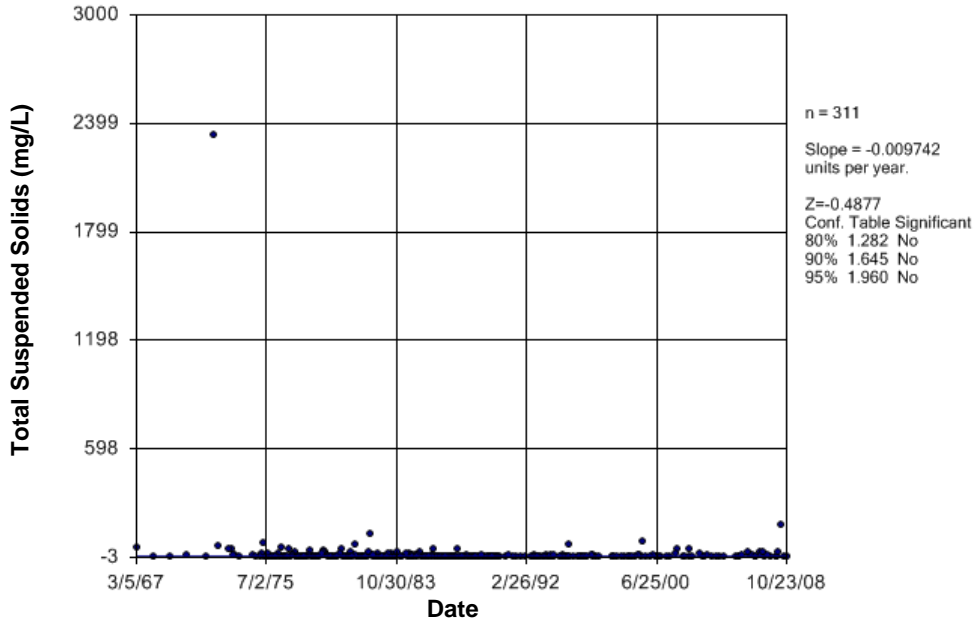
Seasonal Kendall

n = 311

Slope = -0.009742 units per year.

Z=-0.4877
Conf. Table Significant
80% 1.282 No
90% 1.645 No
95% 1.960 No

Figure D132 Red Deer River (SK-MB): Total Suspended Solids

Time Series
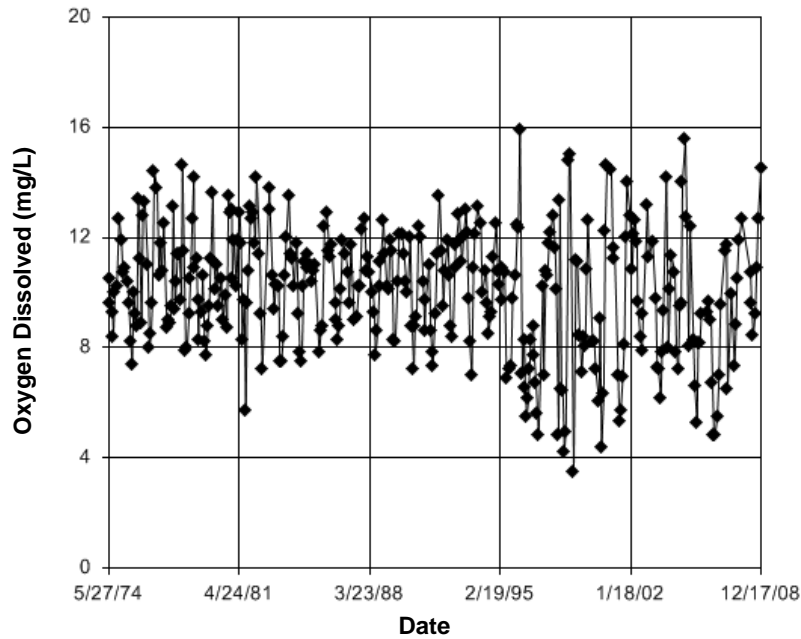
Figure D133 Saskatchewan River: Oxygen Dissolved

Seasonality

Figure D134 Saskatchewan River: Oxygen Dissolved

Seasonal Kendall

n = 346

Slope = -0.03791
units per year.

Z=-3.32
Conf. Table Significant
80% 1.282 Yes
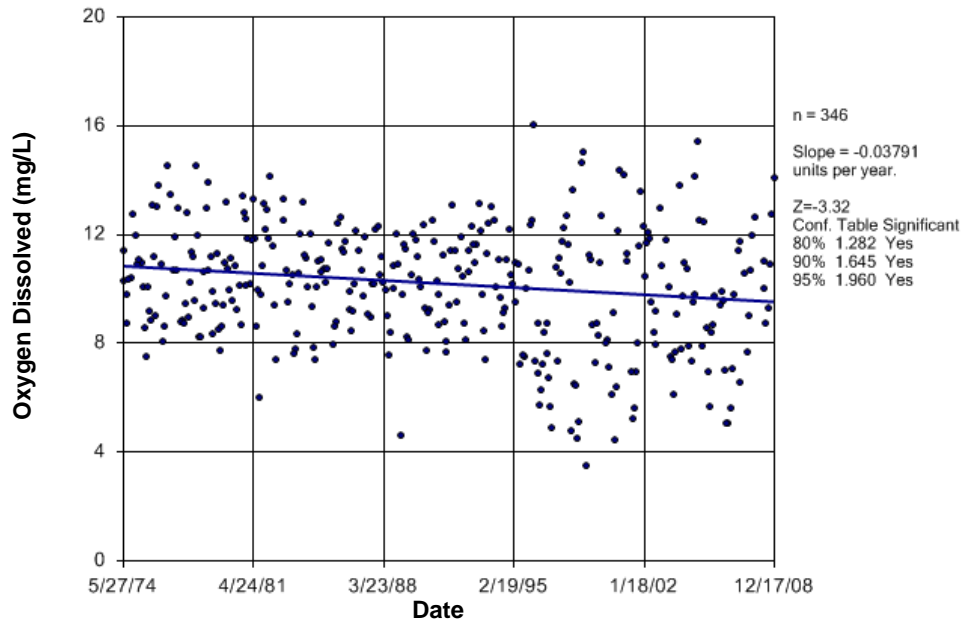90% 1.645 Yes
95% 1.960 Yes

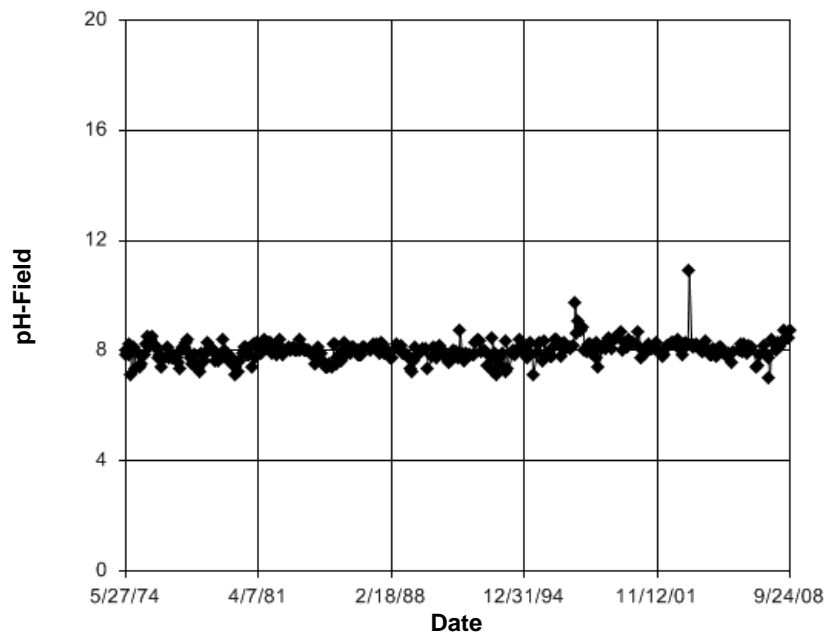**Figure D135 Saskatchewan River: Oxygen Dissolved**

Time Series

Figure D136 Saskatchewan River: pH-Field

293

Seasonality

For the data shown, the Kruskal-Wallis test indicates SEASONALITY at the 5% significance level. Because the calculated Kruskal-Wallis statistic is greater than the Chi-squared value, we conclude that at least one season has a significantly different median concentration of this constituent than any other season.
Calculated Kruskal-Wallis statistic = 13.83
Tabulated Chi-Squared value = 3.841 with 1 degrees of freedom at the 5% significance level.
There were 49 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 13.83
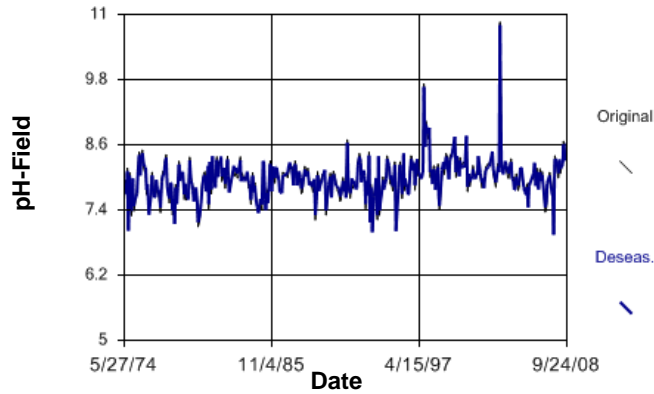Adjusted Kruskal-Wallis statistic (H') = 13.83

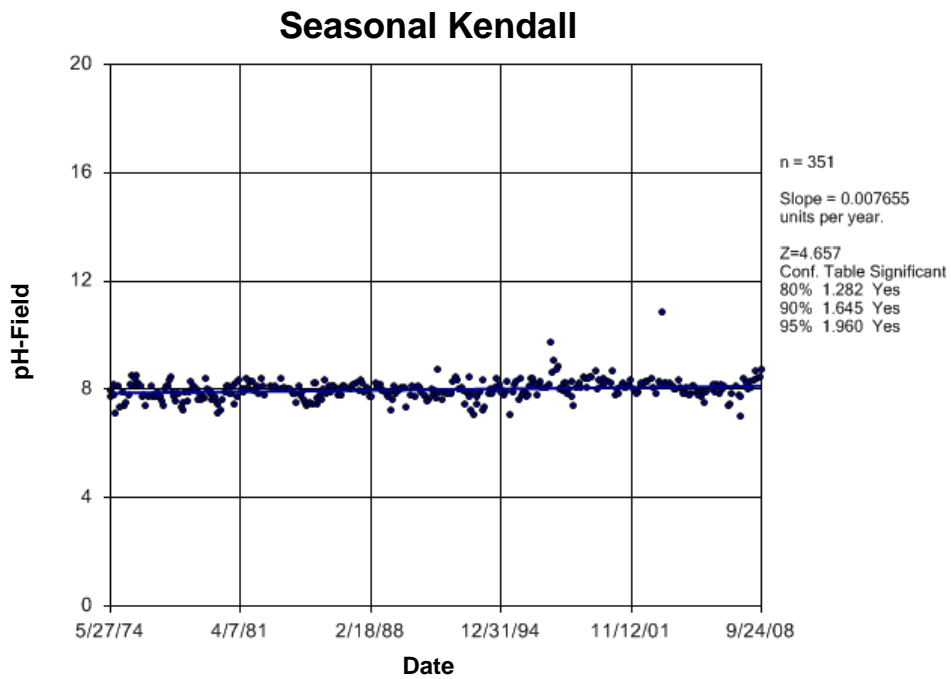**Figure D137 Saskatchewan River: pH-Field**

Seasonal Kendall

n = 351

Slope = 0.007655 units per year.

Z = 4.657
Conf. Table Significant
80% 1.282 Yes
90% 1.645 Yes
95% 1.960 Yes

Figure D138 Saskatchewan River: pH-Field
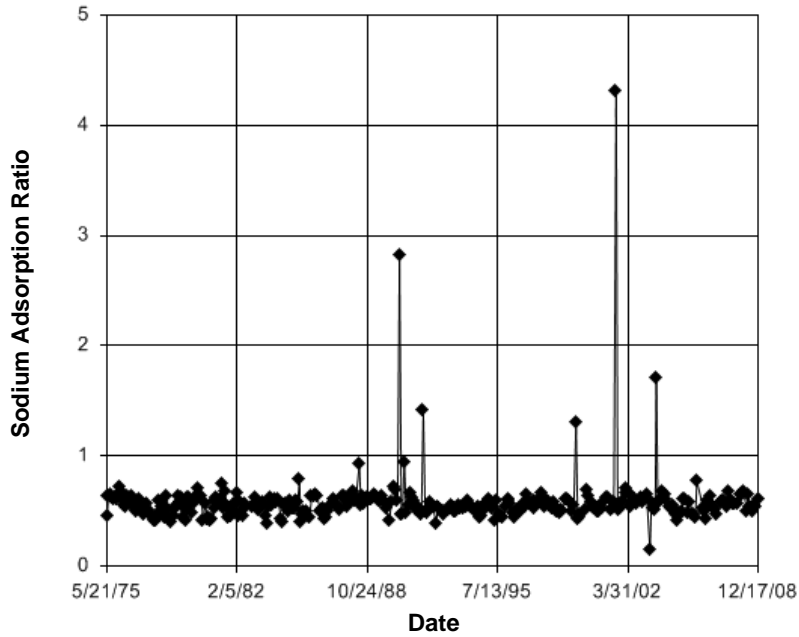
Time Series

Figure D139 Saskatchewan River: Sodium Absorption Ratio

Seasonality

For the data shown, the Kruskal-Wallis test indicates SEASONALITY at the 5% significance level. Because the calculated Kruskal-Wallis statistic is greater than the Chi-squared value, we conclude that at least one season has a significantly different median concentration of this constituent than any other season.
Calculated Kruskal-Wallis statistic = 39.17
Tabulated Chi-Squared value = 3.841 with 1 degrees of freedom at the 5% significance level.
There were 23 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 39.17
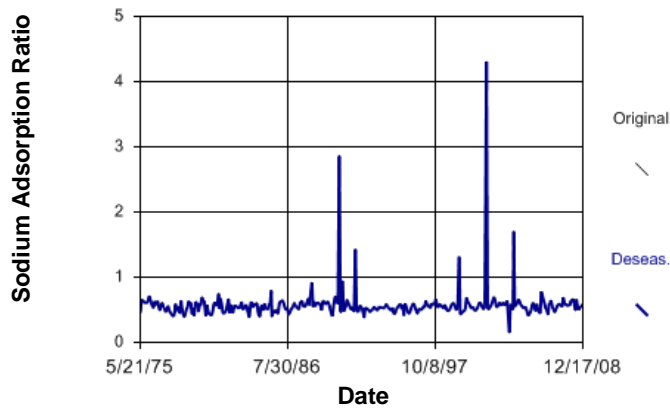Adjusted Kruskal-Wallis statistic (H') = 39.17

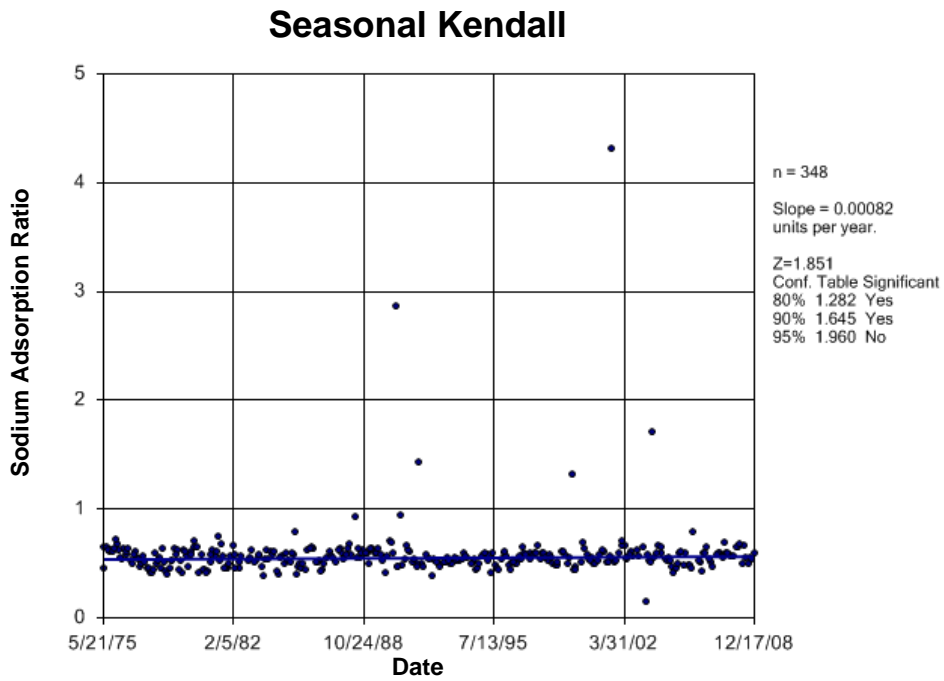**Figure D140 Saskatchewan River: Sodium Adsorption Ratio**

Seasonal Kendall

n = 348

Slope = 0.00082
units per year.

Z=1.851
Conf. Table Significant
80% 1.282 Yes
90% 1.645 Yes
95% 1.960 No

Figure D141 Saskatchewan River: Sodium Adsorption Ratio
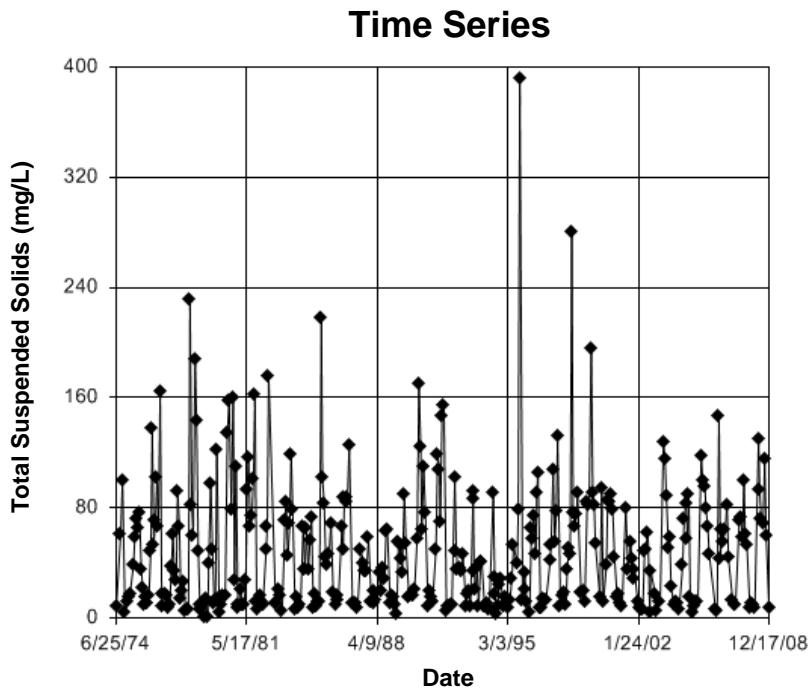
Time Series

Figure D142 Saskatchewan River: Total Suspended Solids

296

Seasonality

For the data shown, the Kruskal-Wallis test indicates SEASONALITY at the 5% significance level. Because the calculated Kruskal-Wallis statistic is greater than the Chi-squared value, we conclude that at least one season has a significantly different median concentration of this constituent than any other season.
Calculated Kruskal-Wallis statistic = 183.4
Tabulated Chi-Squared value = 3.841 with 1 degrees of freedom at the 5% significance level.
There were 3 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 183.4
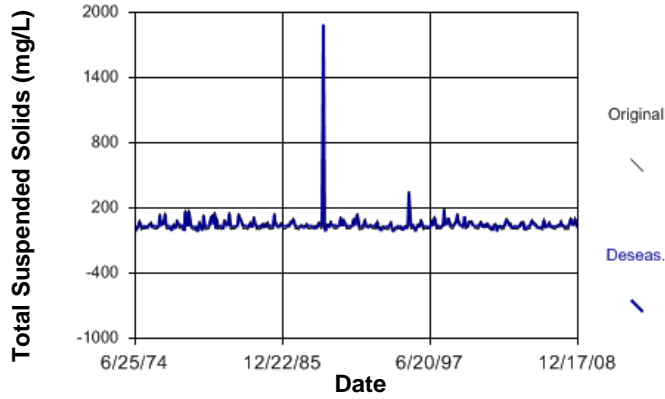Adjusted Kruskal-Wallis statistic (H') = 183.4

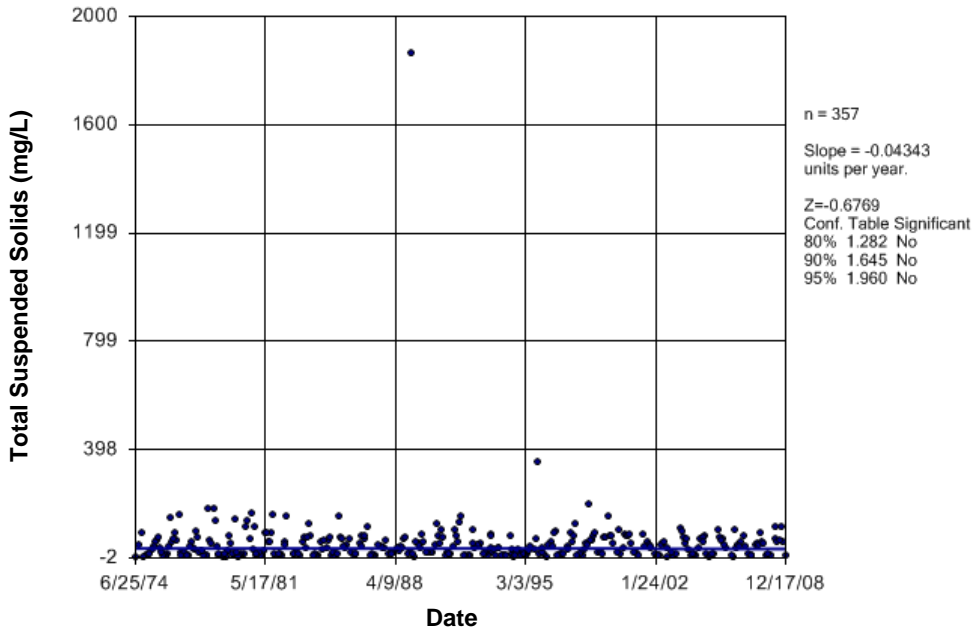**Figure D143 Saskatchewan River: Total Suspended Solids**

Seasonal Kendall

Figure D144 Saskatchewan River: Total Suspended Solids