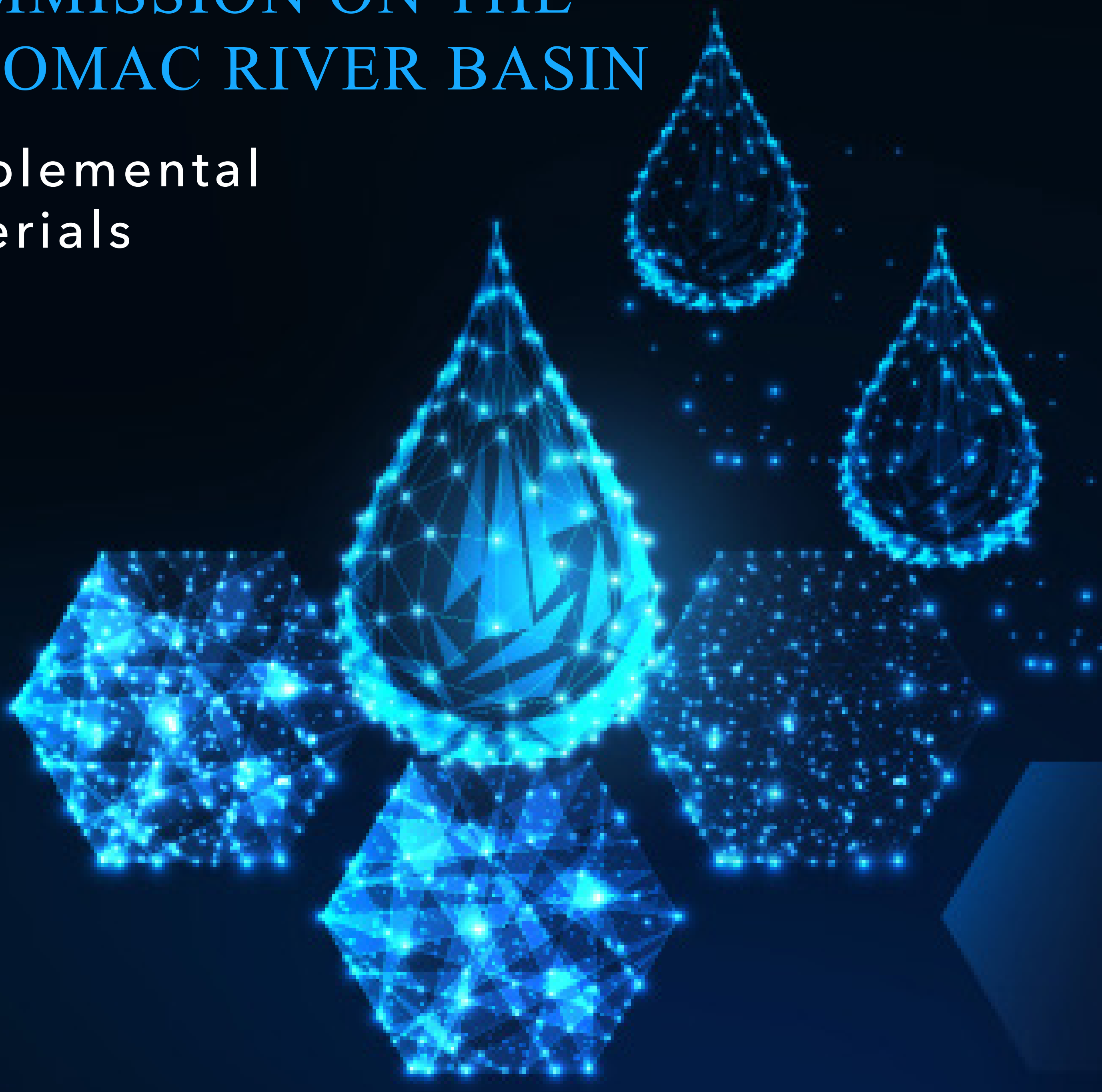
INTERSTATE COMMISSION ON THE POTOMAC RIVER BASIN

Supplemental Materials



Potomac River Water Quality at Great Falls: 1940 - 2019

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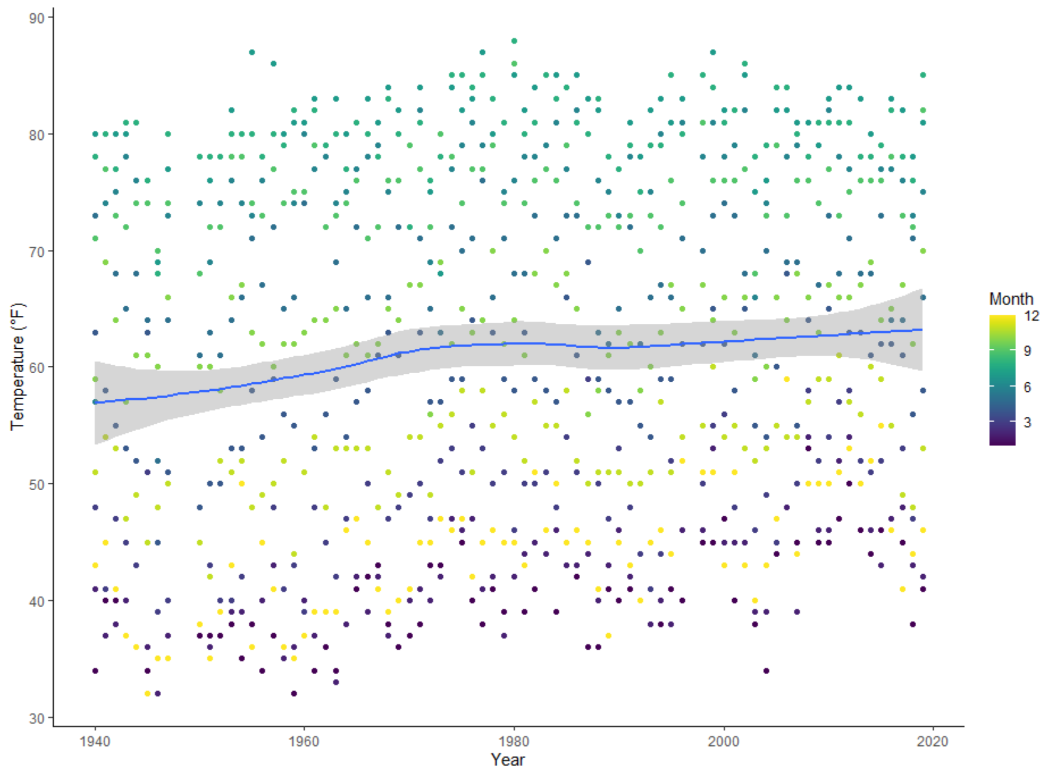
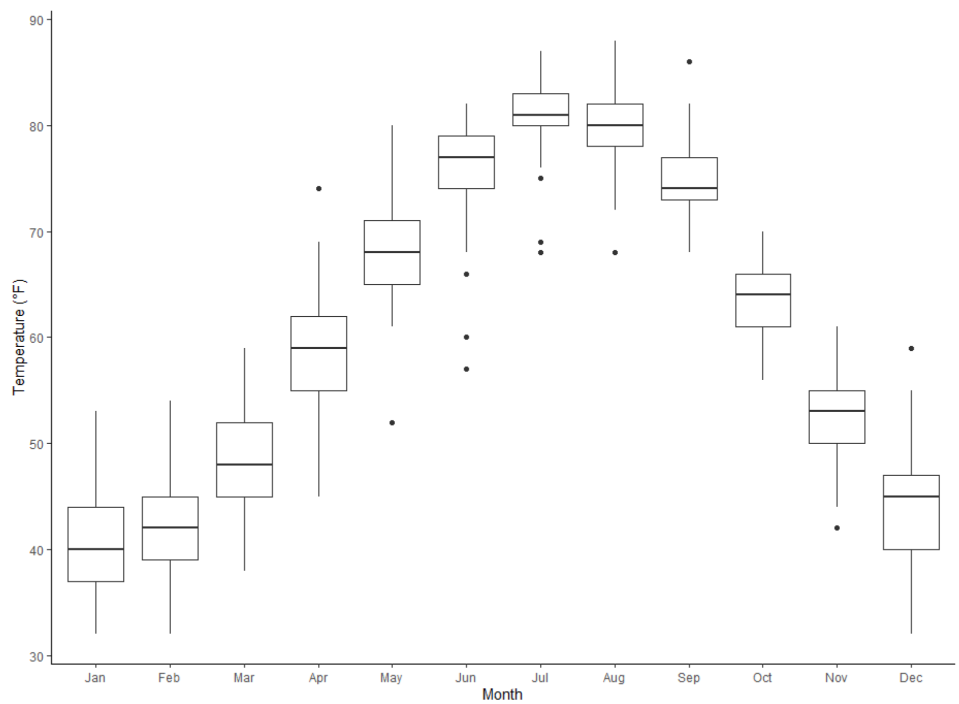
Temperature

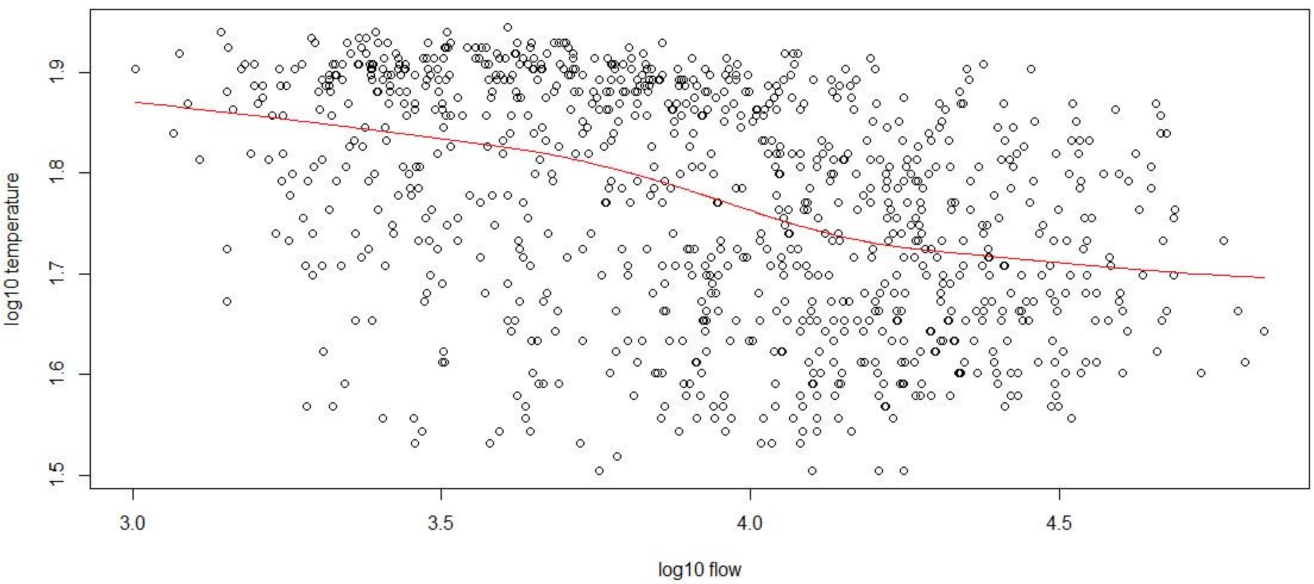
Scatterplot of Observed Data with LOWESS curve



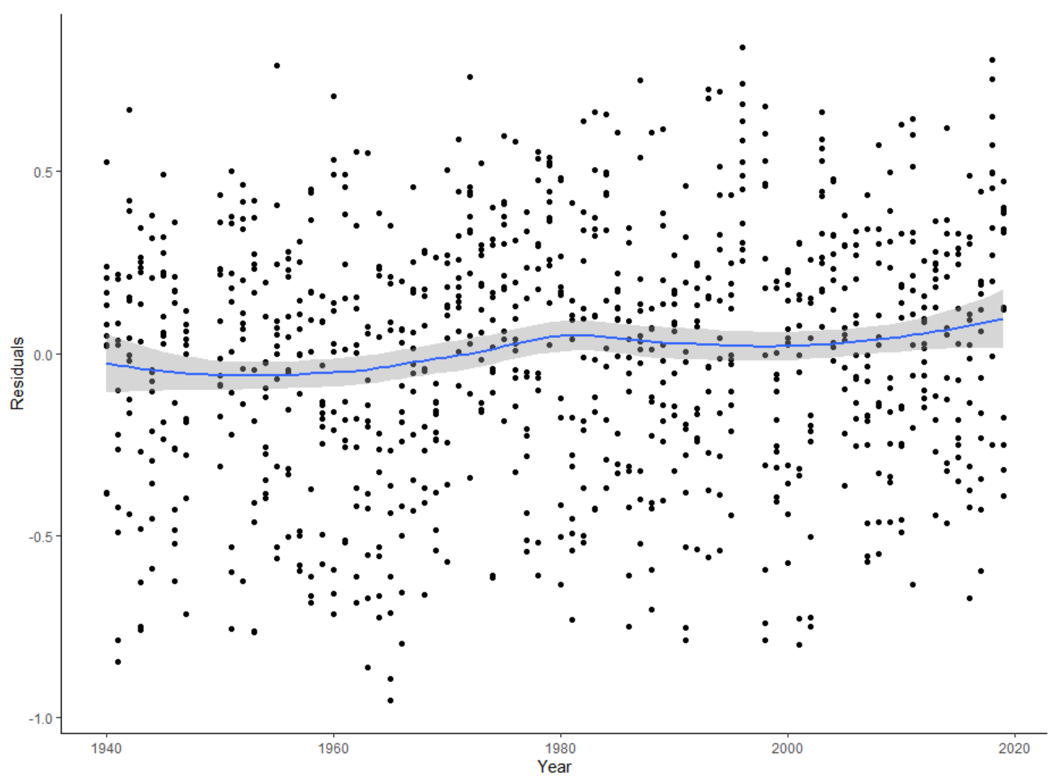
Monthly Boxplots



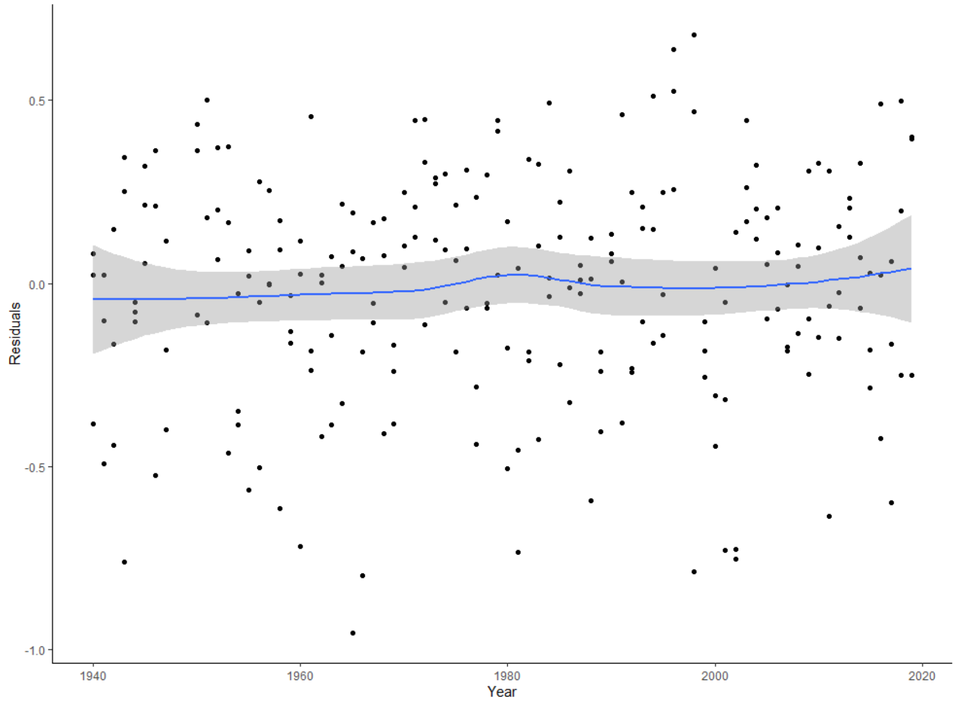
Log Monthly Temperature ~ Log Monthly Flow



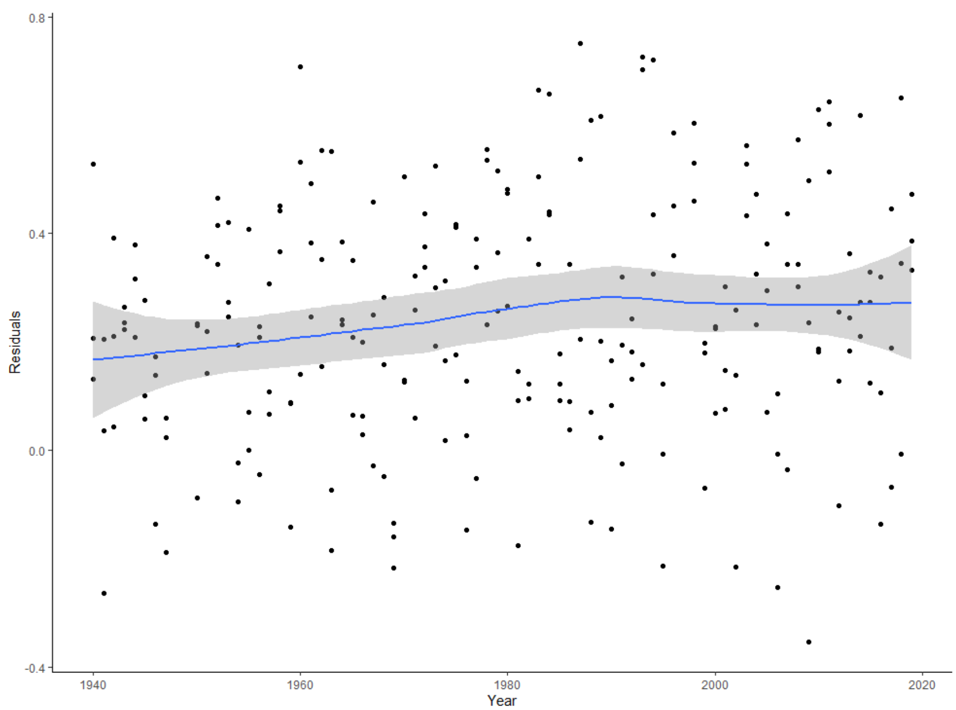
Residuals Scatterplot with LOWESS Curve



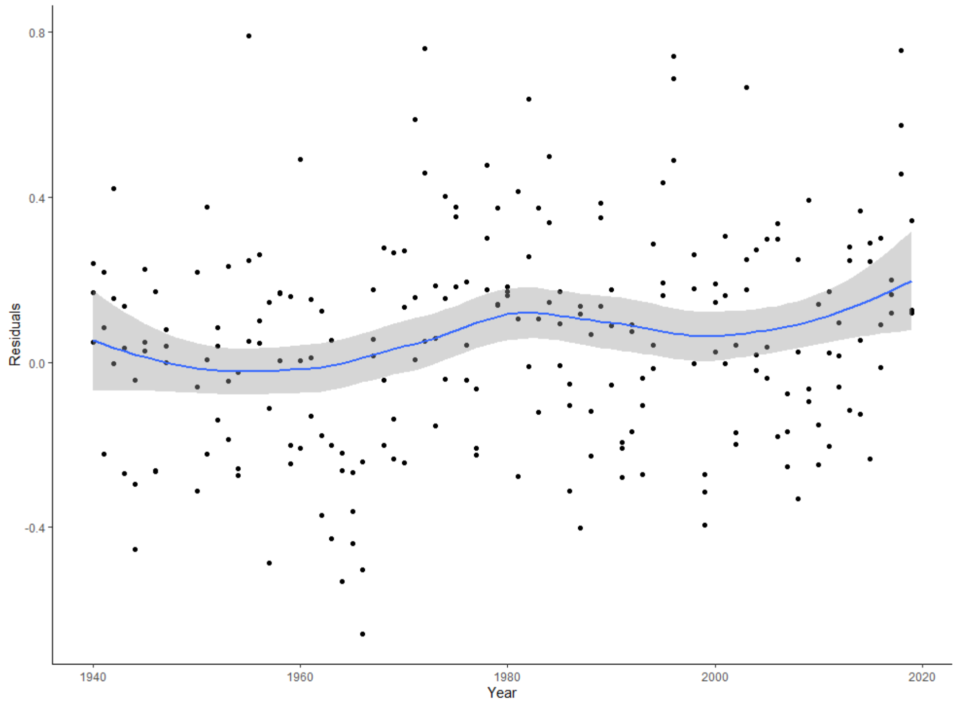
Residuals Scatterplot with LOWESS Curve – WINTER



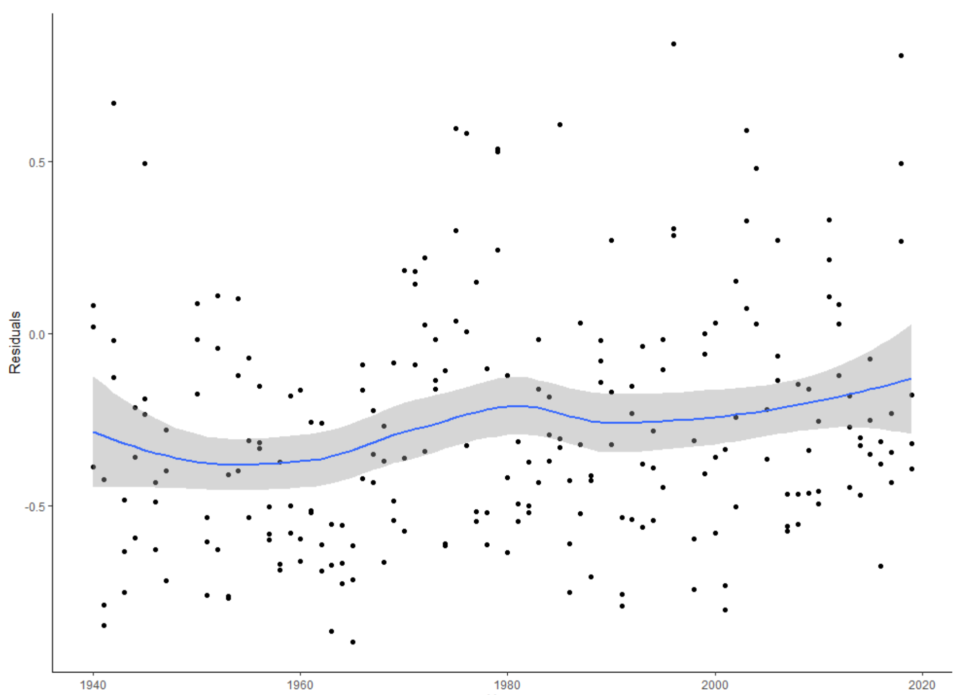
Residuals Scatterplot with LOWESS Curve – SPRING



Residuals Scatterplot with LOWESS Curve – SUMMER

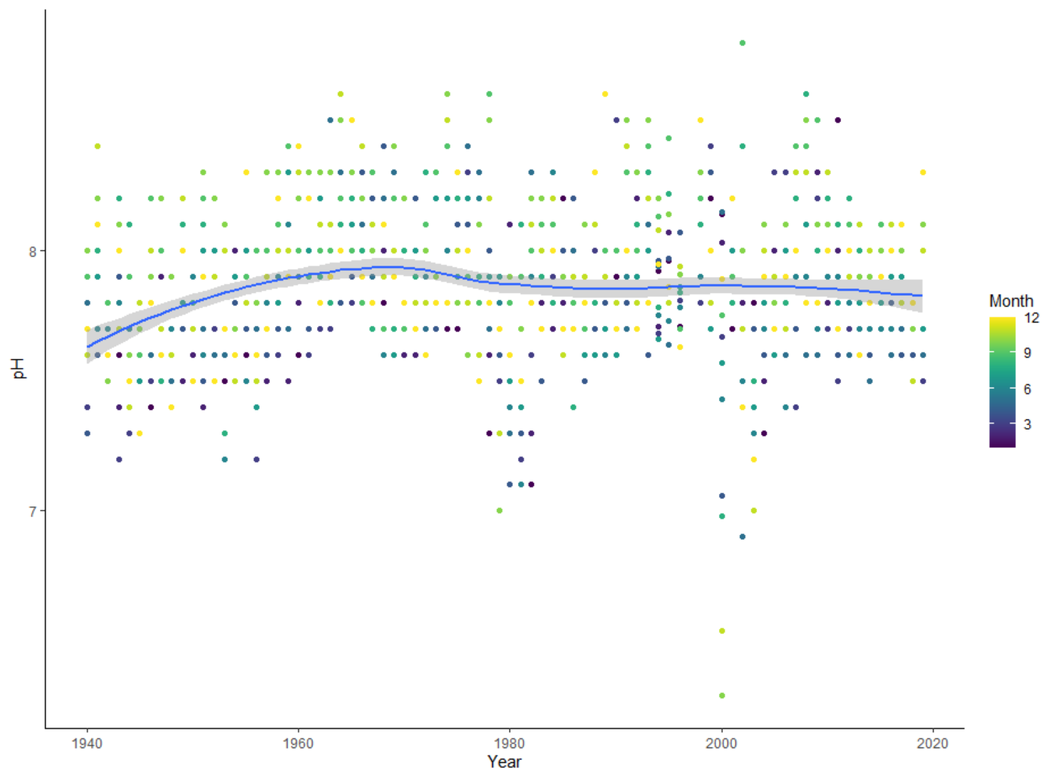


Residuals Scatterplot with LOWESS Curve - AUTUMN

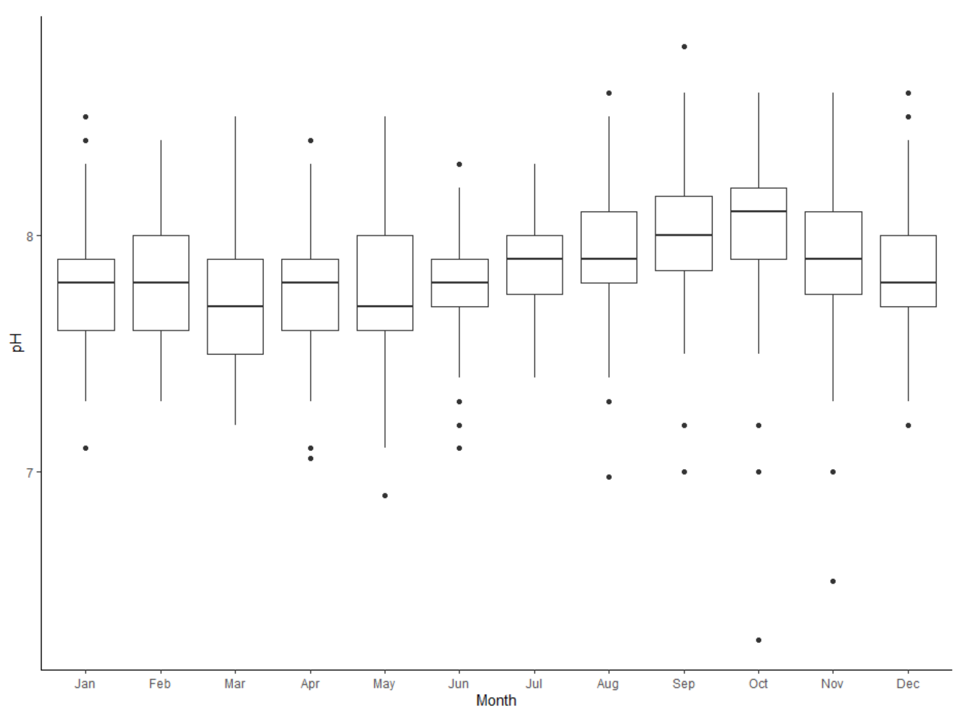


pH

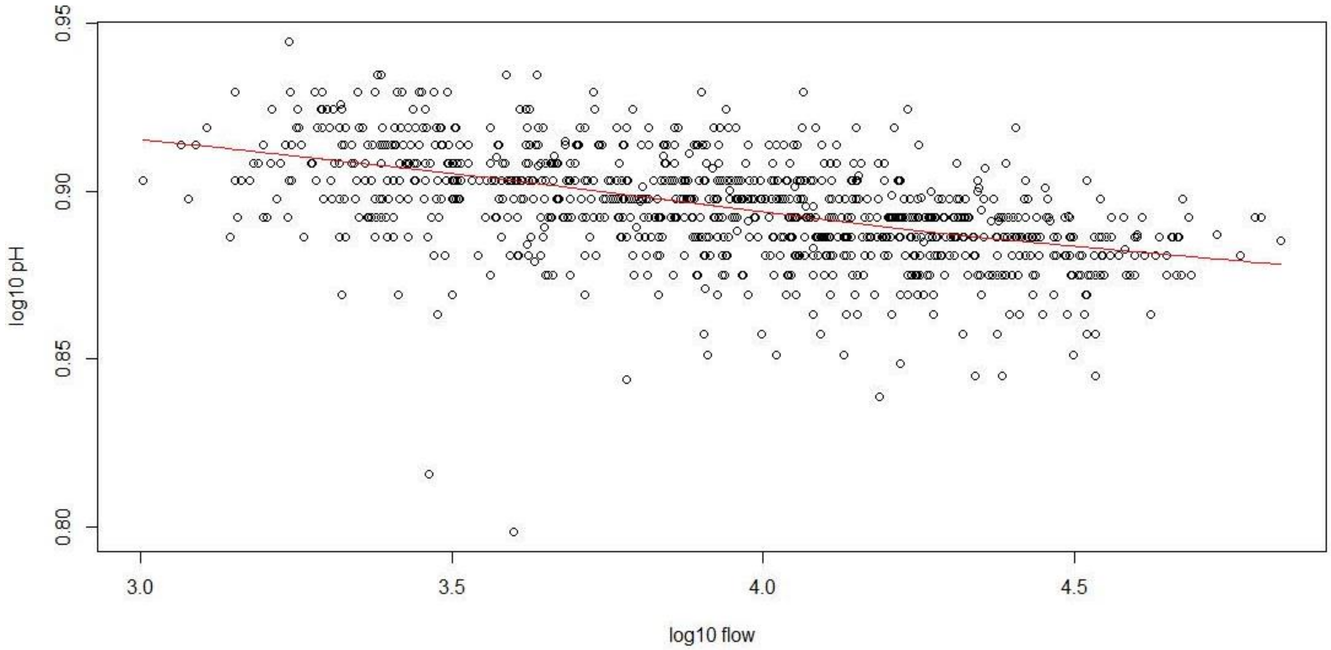
Scatterplot with LOWESS Curve



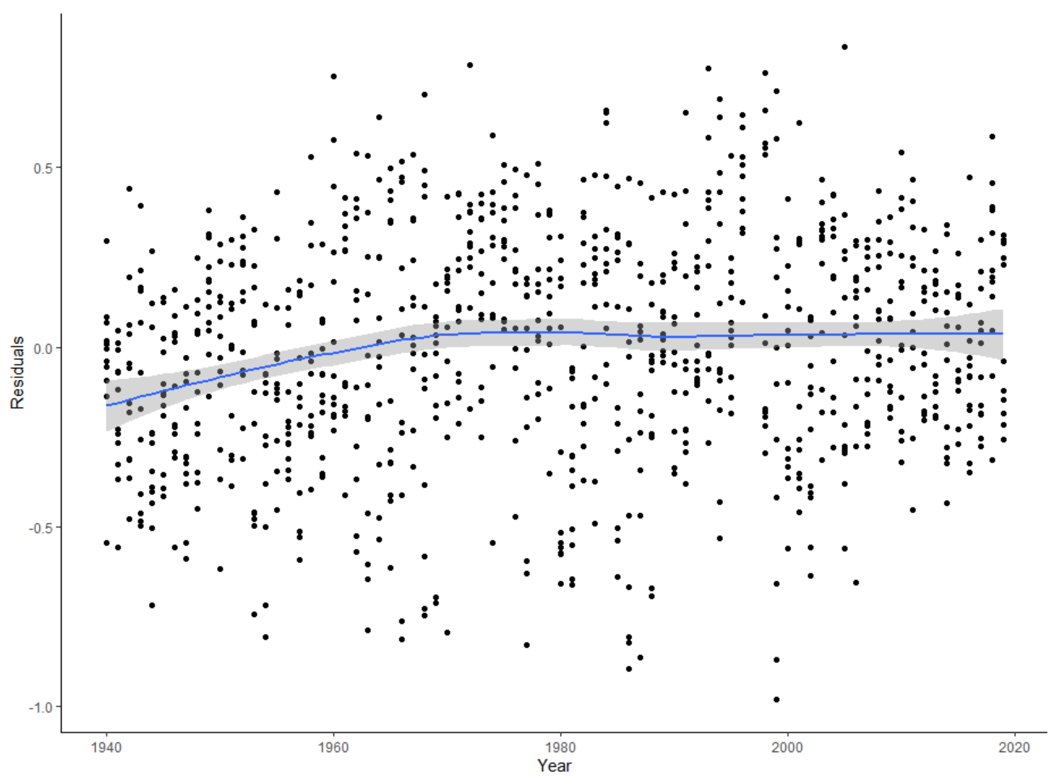
Monthly Boxplots



Log Monthly pH ~ Log Monthly Flow

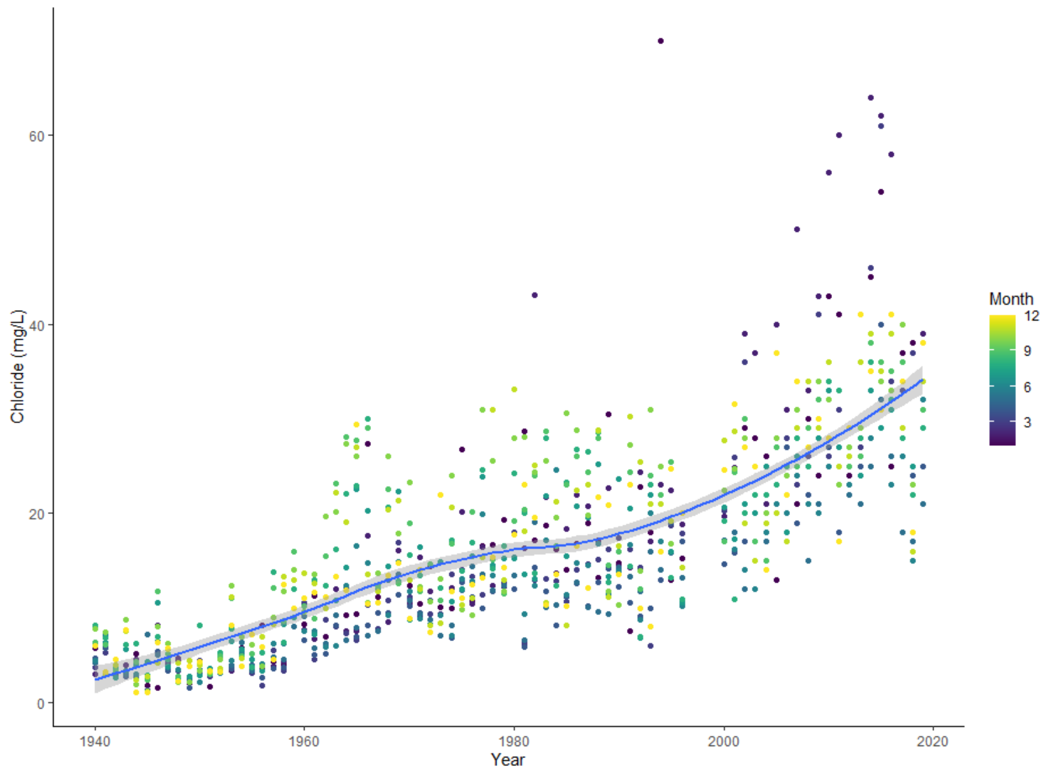


Residuals Scatterplot with LOWESS Curve

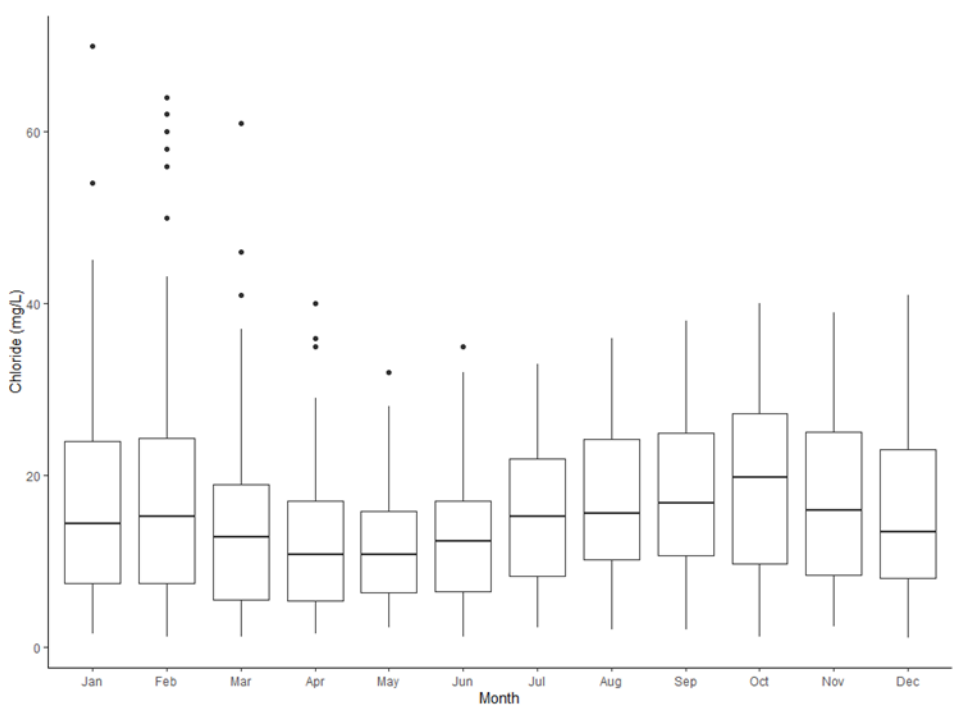


Chloride

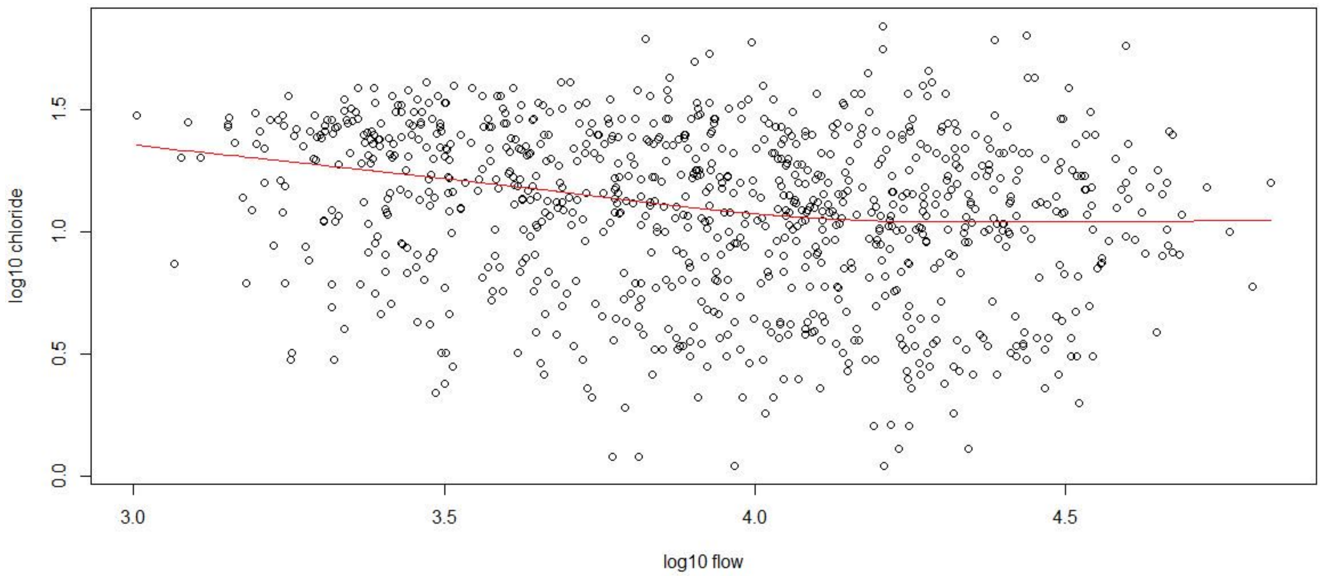
Scatterplot with LOWESS Curve



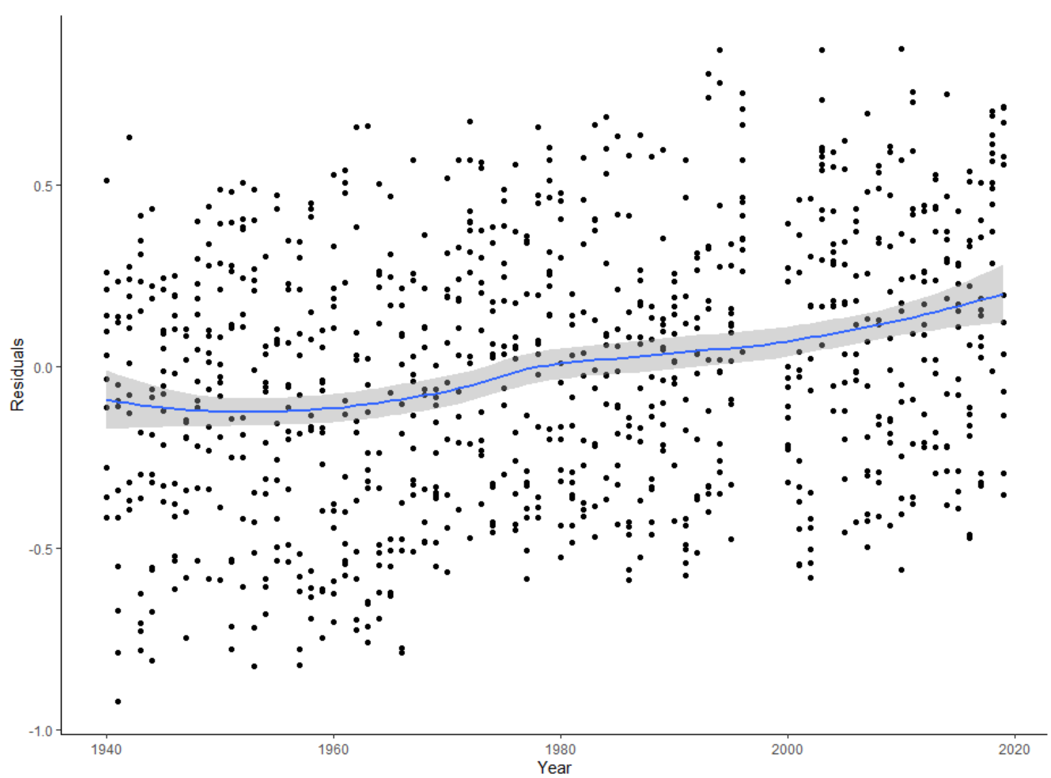
Monthly Boxplots



Log Monthly Chloride ~ Log Monthly Flow

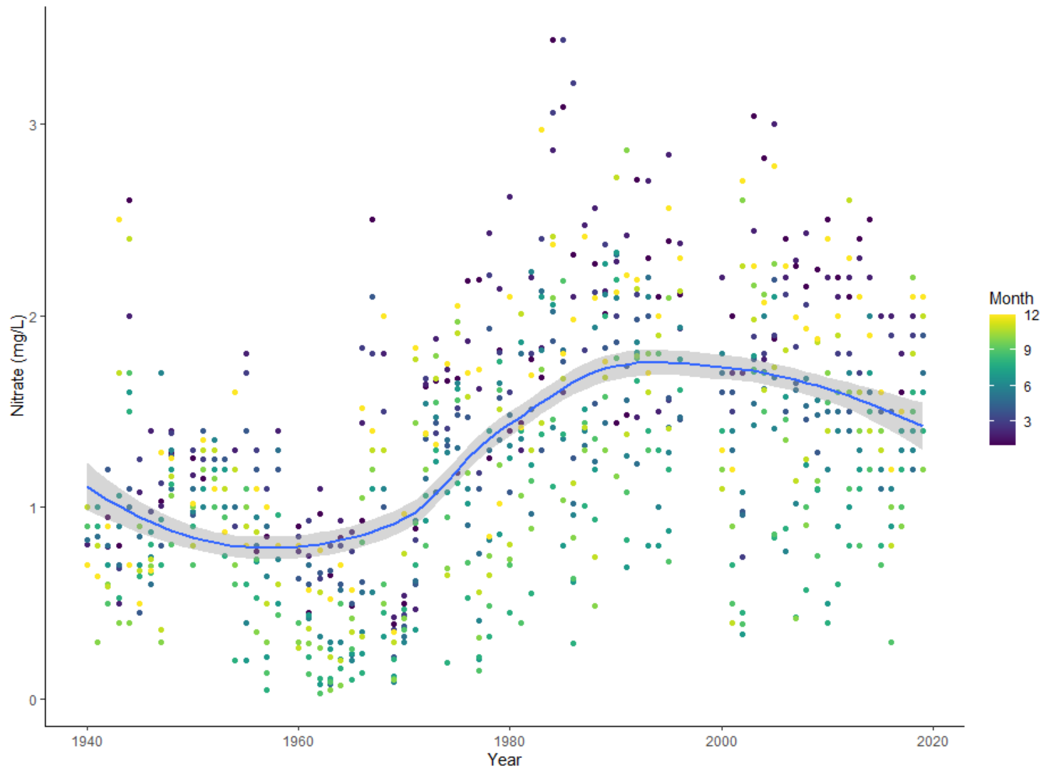


Residuals Scatterplot with LOWESS Curve

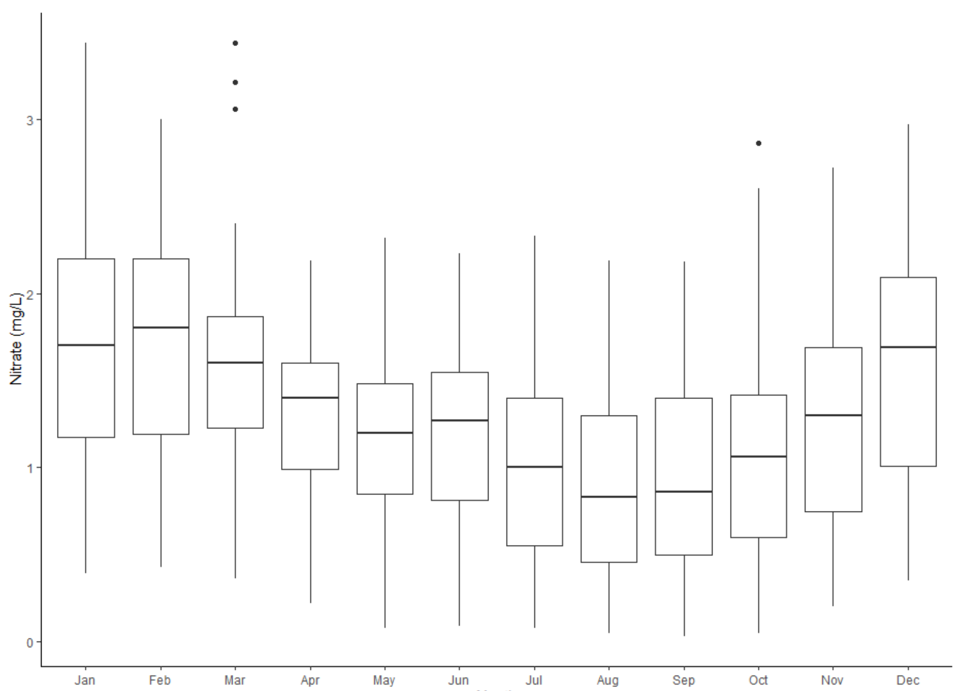


Nitrate

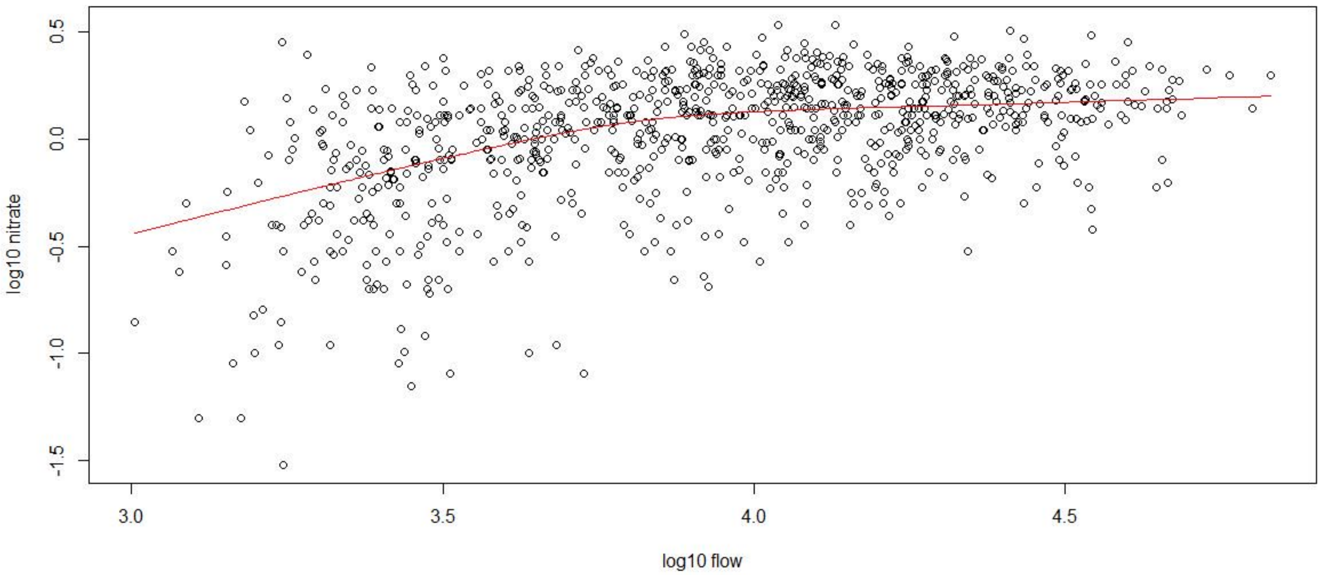
Scatterplot with LOWESS Curve



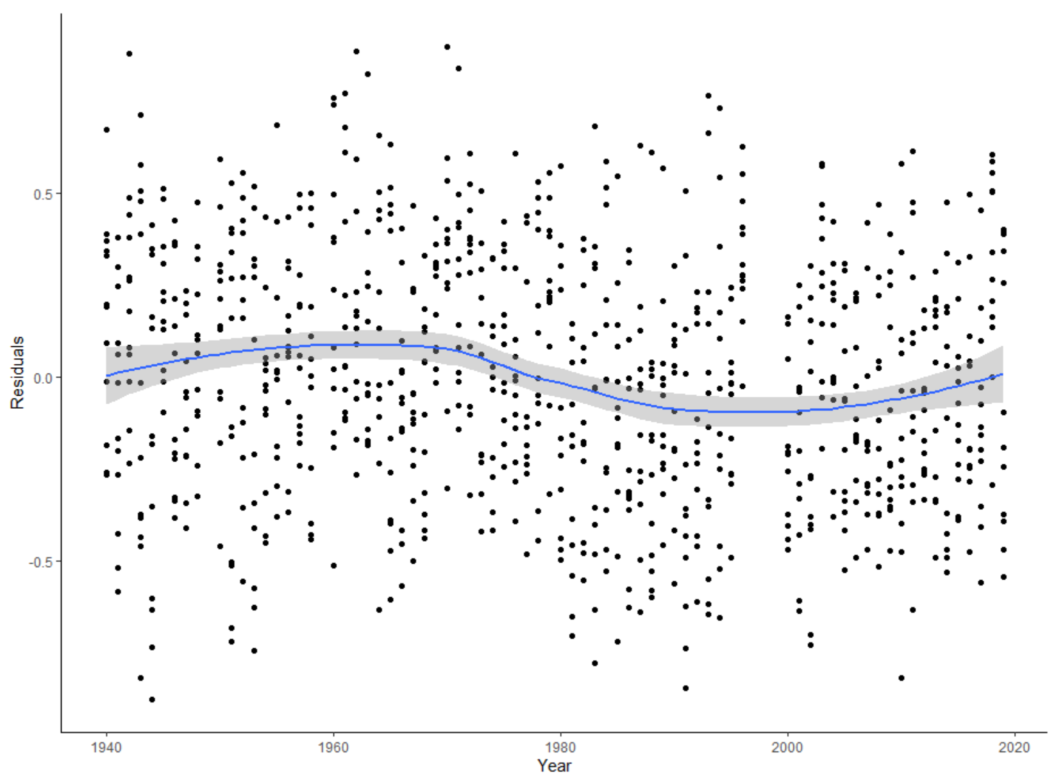
Monthly Boxplots



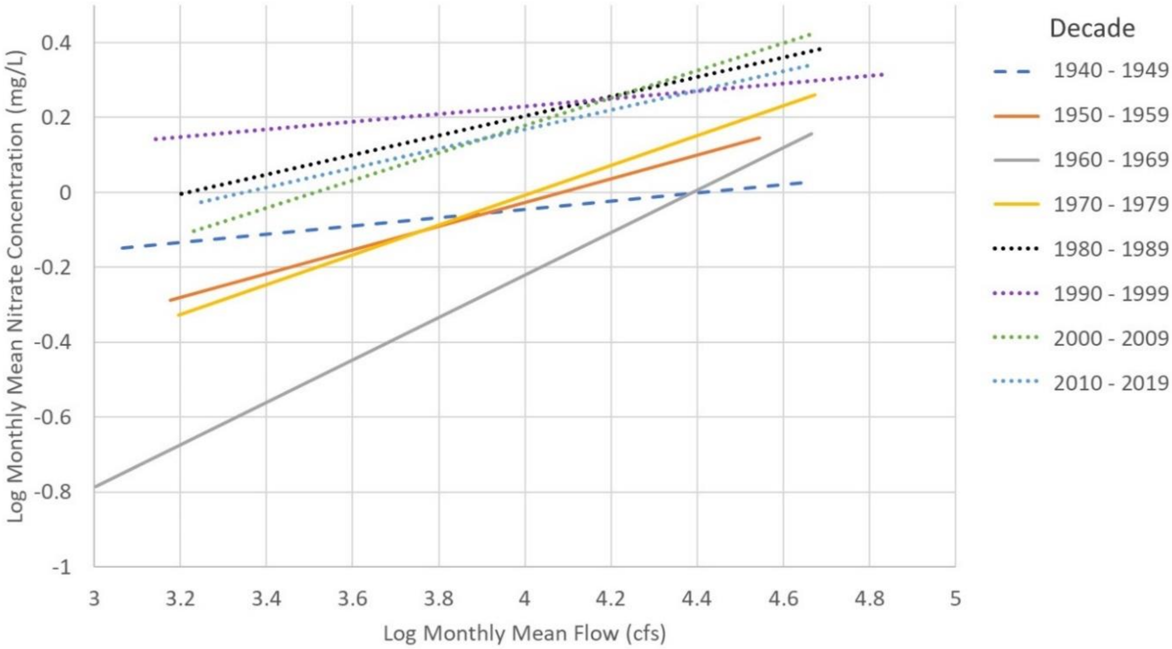
Log Monthly Nitrate ~ Log Monthly Flow



Residuals Scatterplot with LOWESS Curve



Decadal Changes in the Relationship between Log Nitrate and Log Flow

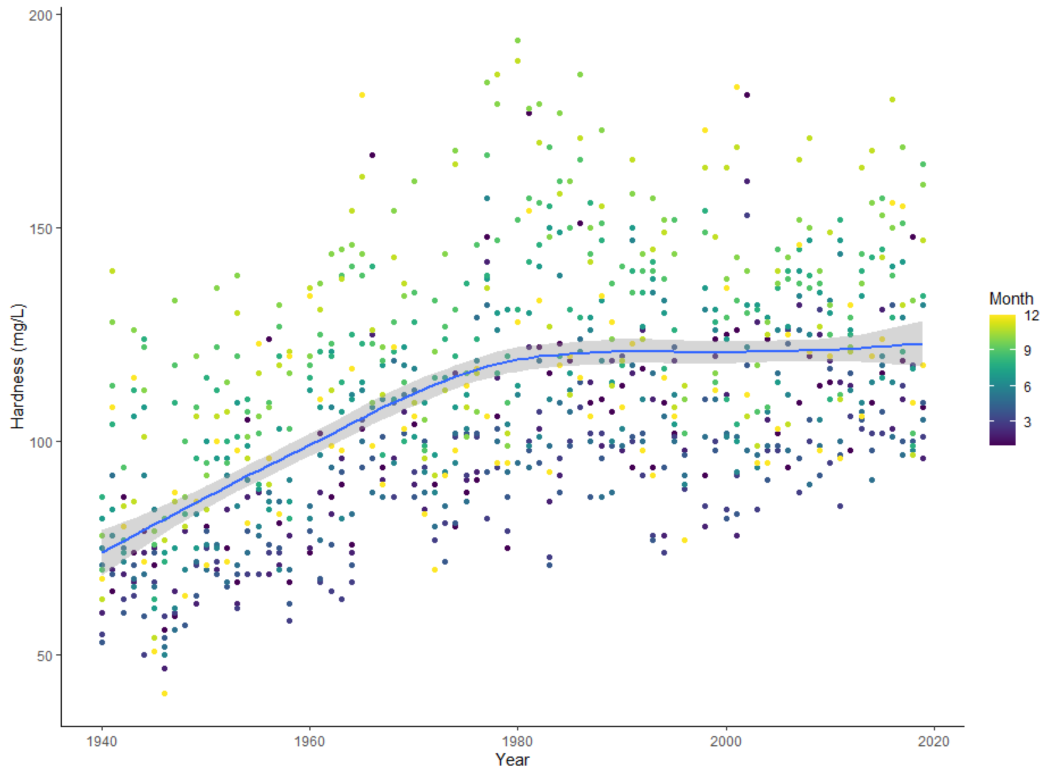


Linear regression lines for log monthly mean nitrate concentration (mg/L) versus log monthly mean flow (cfs), by decade.

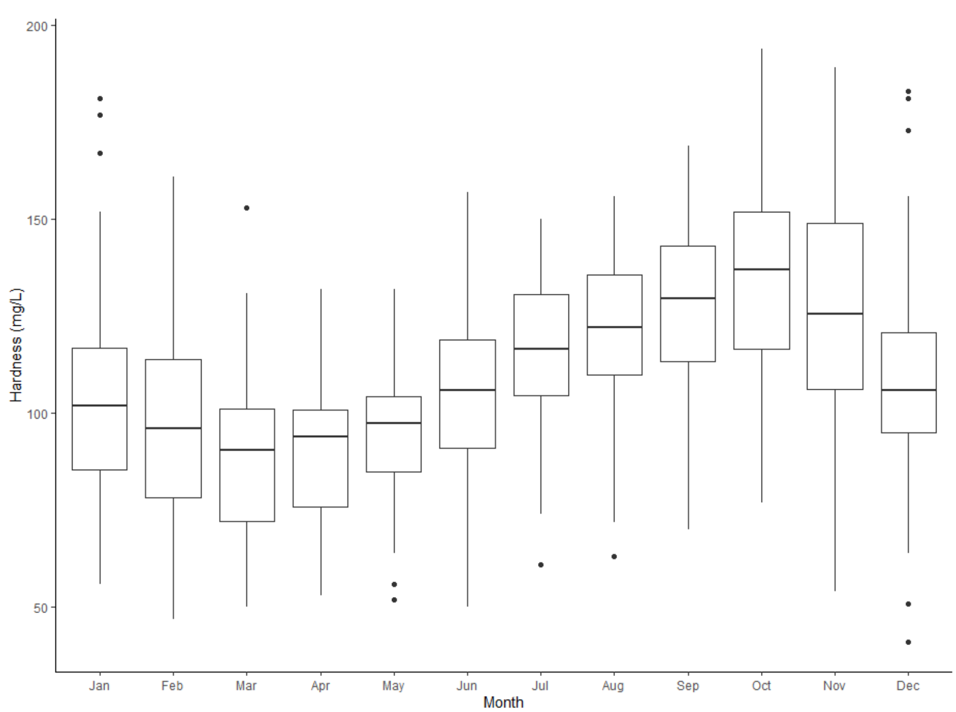
The slope of the earliest decade's regression (blue dashed line) was likely affected by the nitrate methods used at the time. Source materials suggest the methods could not accurately measure nitrate concentrations below 0.2 – 0.3 mg/L. The 1960 – 1969 decade was severely impacted by a prolonged, intermittent drought. When the ten months in that decade with the lowest flows are removed, the regression line (gray solid line) falls closer to and parallel to those for the preceding and following decade. Overall, regressions for the four earliest decades (1940 – 1979) are distinct from later decades (1980 – 2019). At least two explanations for this shift are possible but need further investigation. **1)** The various colorimetric methods used in the early years by the Aqueduct laboratory were not as sensitive as the ion chromatography method used after the mid-1980s (see report Methods). The mid-1980s timing of the method change corresponds to the shift in the nitrate-flow regression lines. If ion chromatography produces higher nitrate readings than the colorimetric methods, it would partly explain the shift. **2)** As populations grew rapidly in the mid-20th century and new economies began appearing (e.g. Jaworski et al. 2007), how and when nitrate entered the river were altered. Unmanaged animal waste enters the river chiefly during storm events while atmospheric deposition, wastewater discharges and septic leaks enter the river at more constant rates. Major sources of nitrogen in the 1980s were animal waste and atmospheric deposition (Jaworski et al. 1992). Both sources have since diminished. Biological removal of nitrogen recently implemented at wastewater treatment plants in the watershed is checking the increased nitrogen loads from a growing population. Complicating our understanding of nitrate pathways in the Potomac watershed, however, are the variable lag times in nitrate moving through groundwater to the river. Collectively, these factors could be expected to affect the nitrate-flow relationship and change it over time. A change in nitrogen *forms* has also been reported by Ator et al. (1998) in 1979 - 1996 Potomac River trends: ammonia plus organic nitrogen concentrations decreased while nitrate concentrations increased, resulting in apparently stable total nitrogen concentrations over most of the trend period.

Hardness

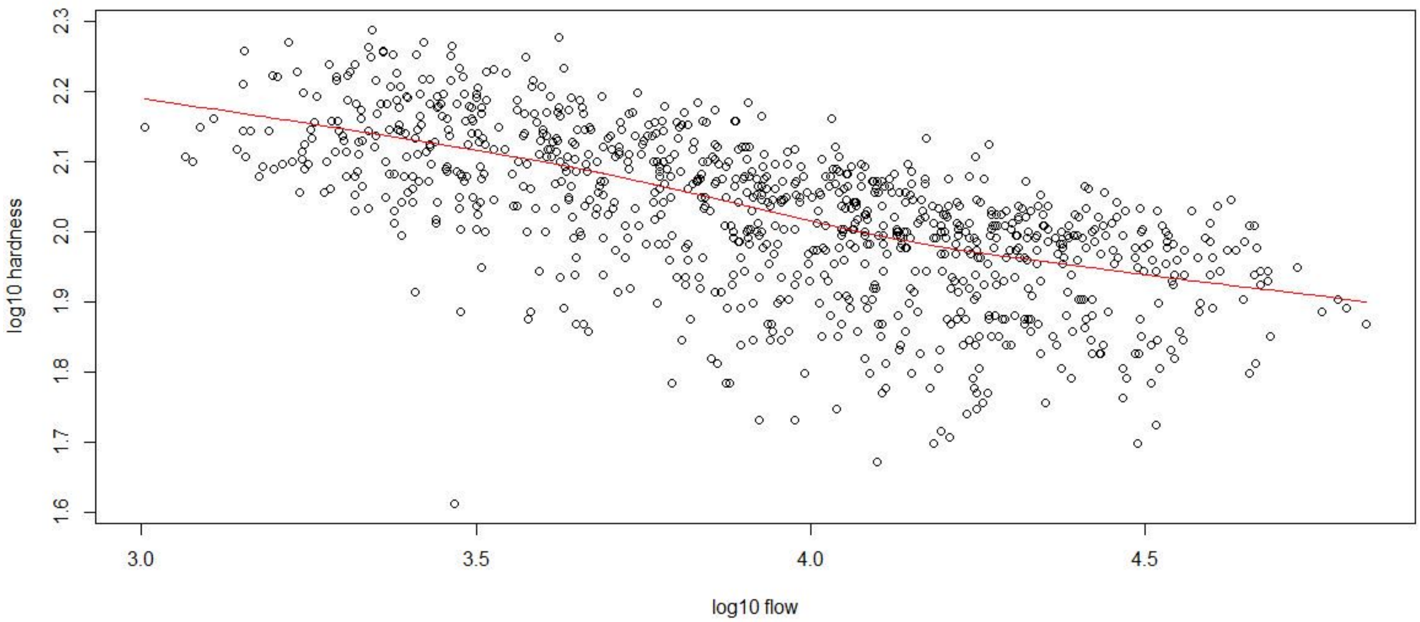
Scatterplot with LOWESS curve



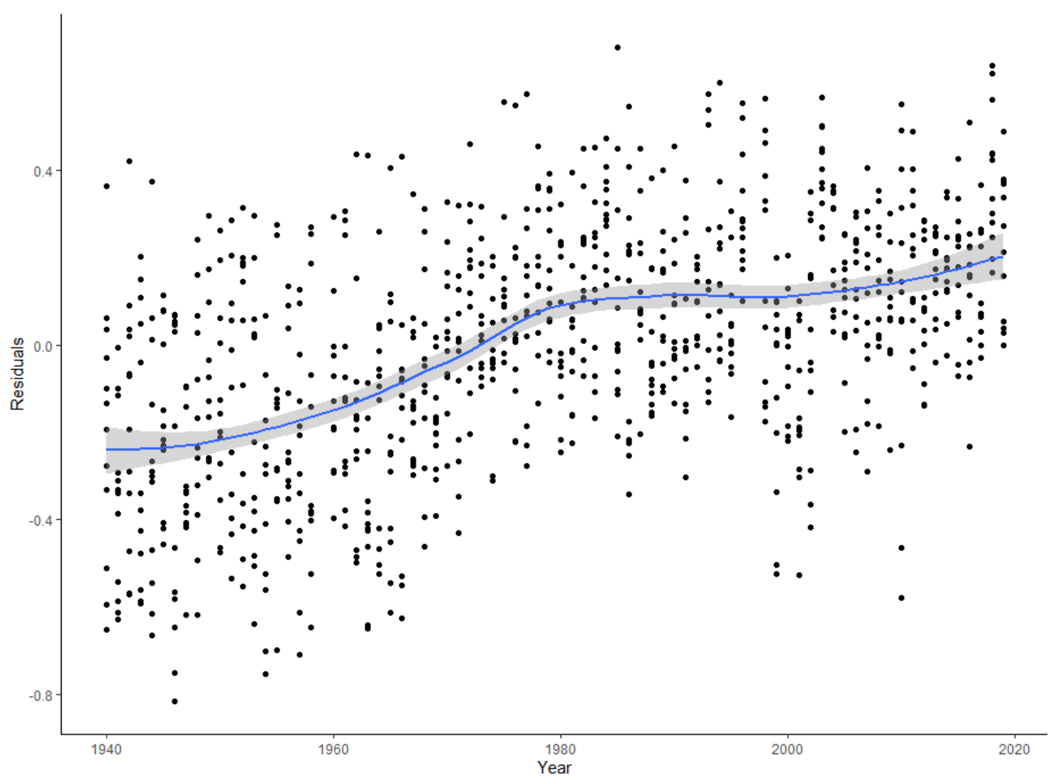
Monthly Boxplots



Log Monthly Hardness ~ Log Monthly Flow

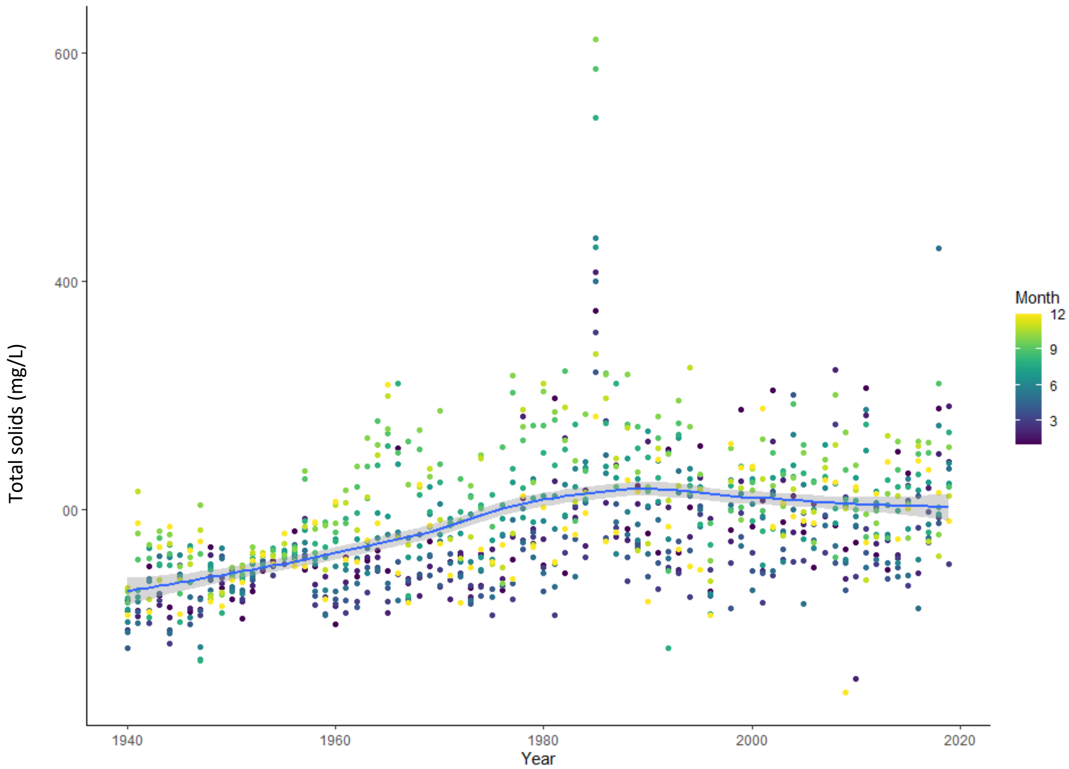


Residuals Scatterplot with LOWESS Curve

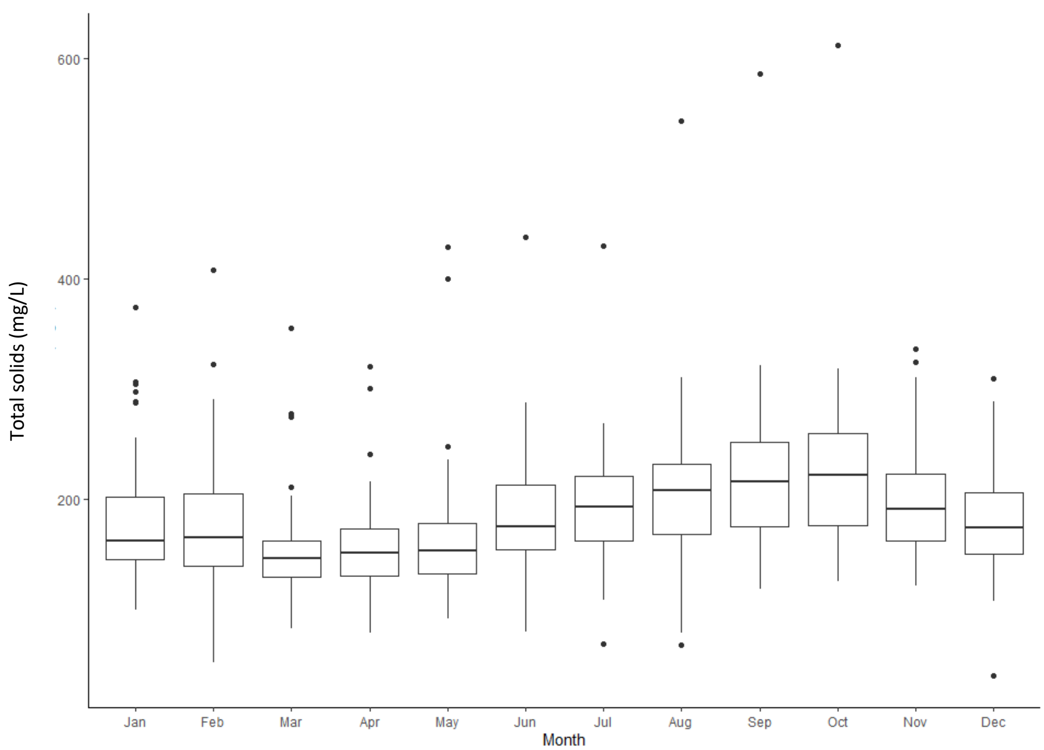


Total Solids

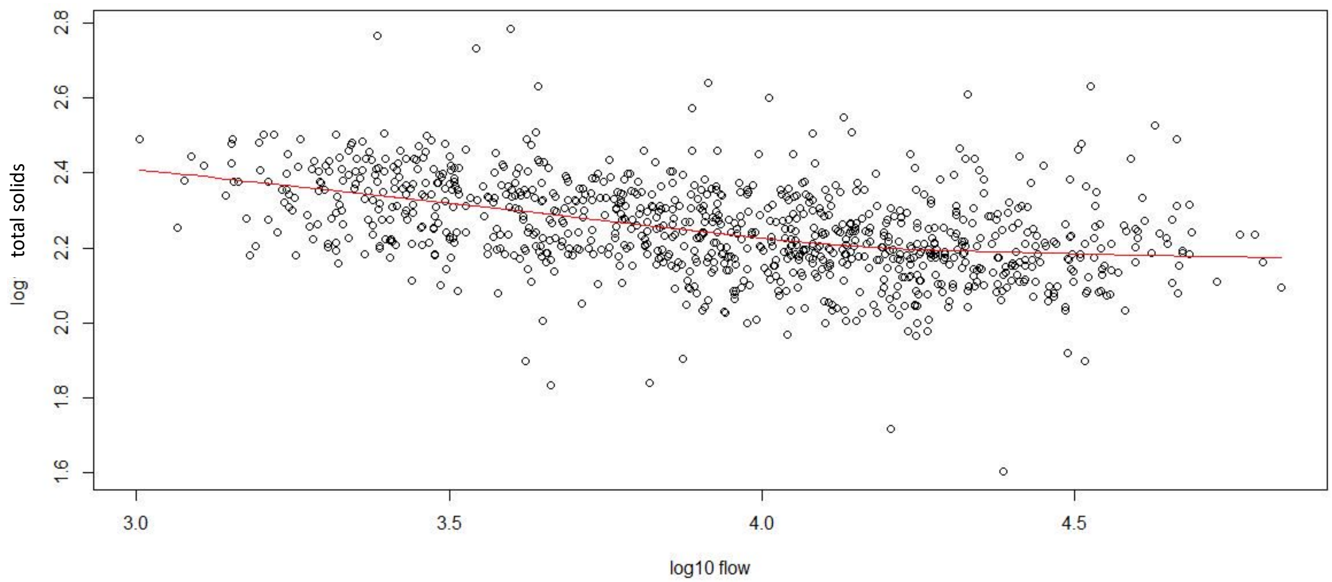
Scatterplot with LOWESS Curve



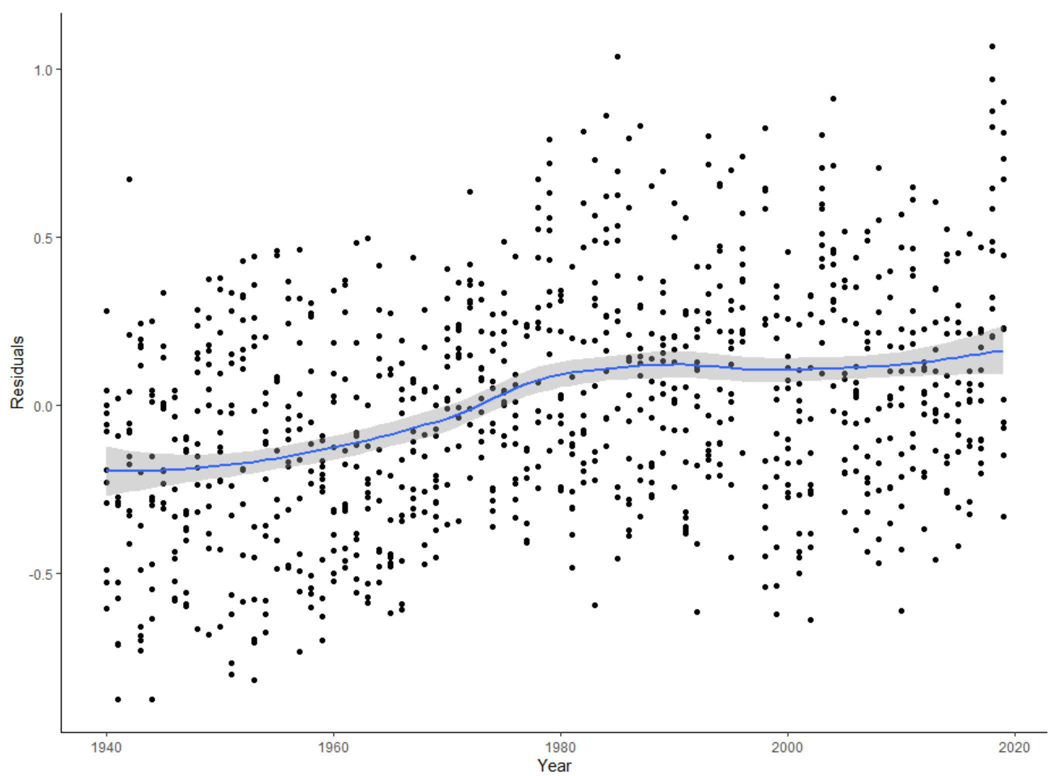
Monthly Boxplots



Log Total Solids ~ Log Monthly Flow

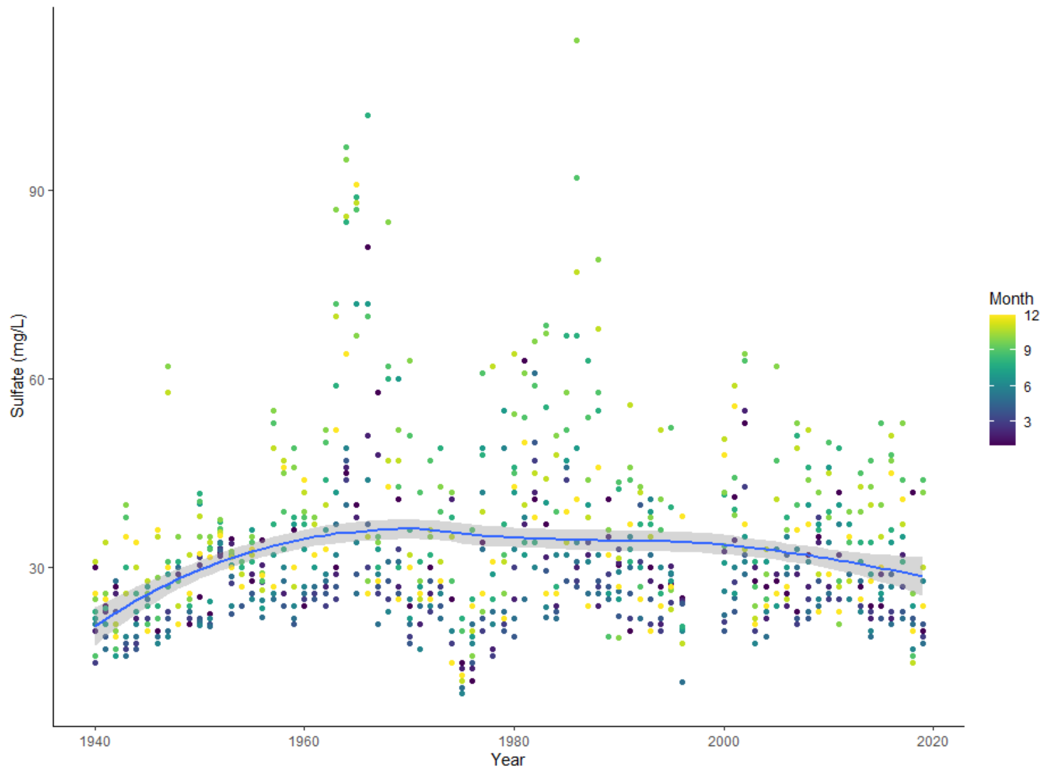


Residuals Scatterplot with LOWESS Curve

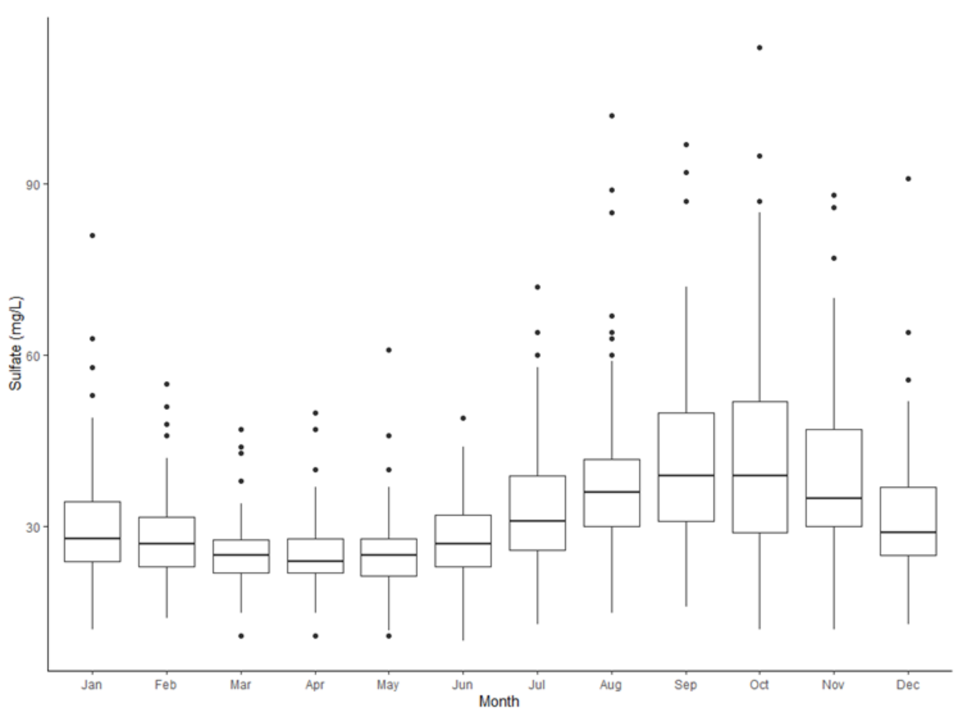


Sulfate

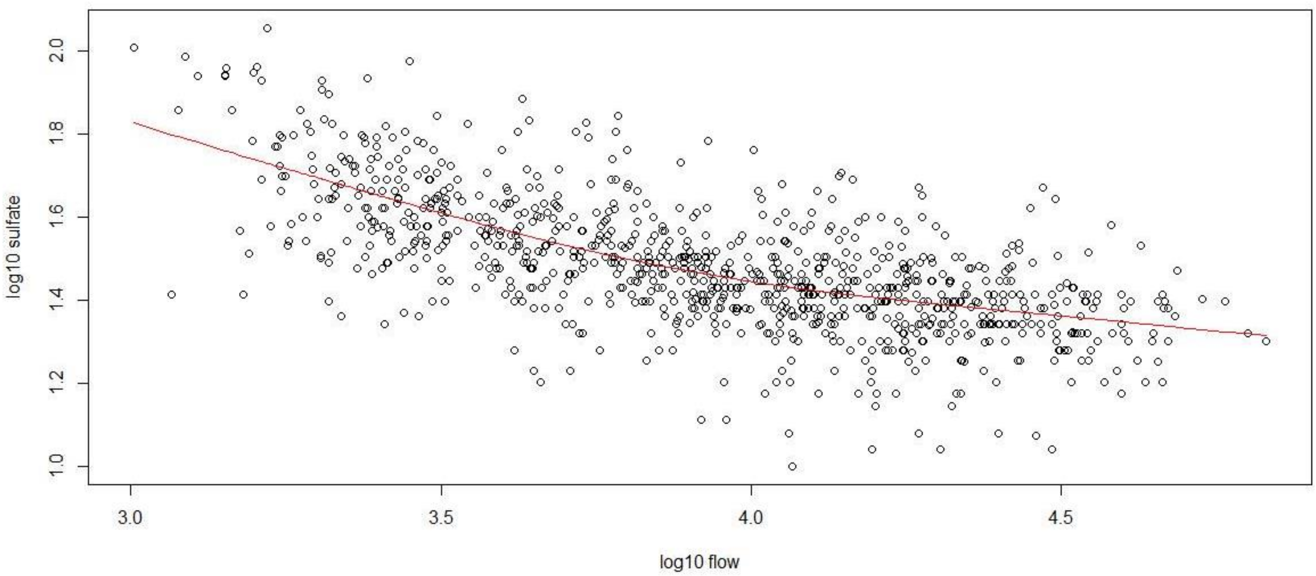
Scatterplot with LOWESS Curve



Monthly Boxplots



Log Monthly Sulfate ~ Log Monthly Flow



Residuals Scatterplot with LOWESS Curve