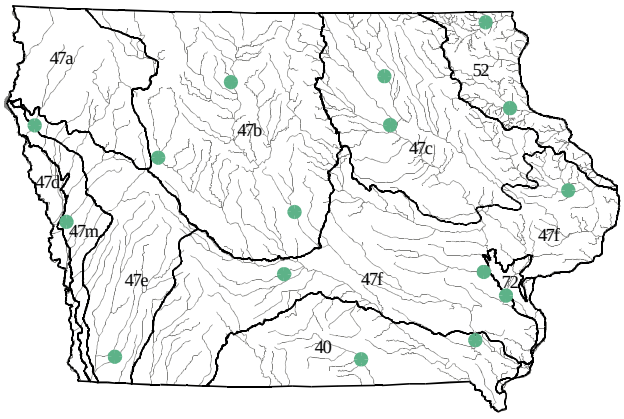
IOWA'S WATER
Ambient Monitoring Program

Rivers – Regional Patterns in Historic Data

The year 2000 marked a dramatic increase in the monitoring of surface-water quality in the State of Iowa. For the first time, the Governor and the Legislature appropriated state money to assess Iowa's streams and rivers. The new state program will greatly improve the understanding and knowledge of Iowa's water resources. Since the 1970s, federal dollars have supported a small, but important, surface water monitoring program. The early program began as a network of stations on rivers located upstream and downstream from Iowa's larger urban areas. In the mid-1980s, the Iowa Department of Natural Resources (IDNR) reviewed and revised its surface-water monitoring strategy. The revised monitoring program, implemented in October 1986, was designed to improve the monitoring of ambient (or background) conditions by avoiding direct urban influences. Sixteen sampling stations, located throughout Iowa and representing rivers of different sizes, were monitored monthly for nutrients and common water quality parameters such as dissolved oxygen, pH and turbidity. Additionally, bacteria was monitored during the spring and summer months.

In 1995, common herbicide ingredients were added to the monitoring on a quarterly basis. Along with the sixteen sites that formed the core of the monitoring program, the 1986 re-design added 44 stations that were monitored on a rotational basis. Eleven of the 44 sites were monitored four times a year for two successive years, before being

Long-term Monitoring Sites within Ecoregions



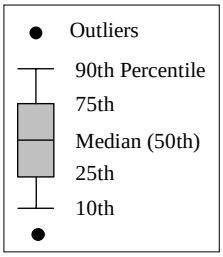
40	Central Irregular Plains
47a	Northwest Iowa Loess Prairies
47b	Des Moines Lobe
47c	Iowan Surface
47d	Missouri Alluvial Plain
47e	Loess Hills and Rolling Prairies
47f	Southern Iowa Rolling Loess Prairies
47m	Western Loess Hills
52	Paleozoic Plateau
72	Interior River Lowland

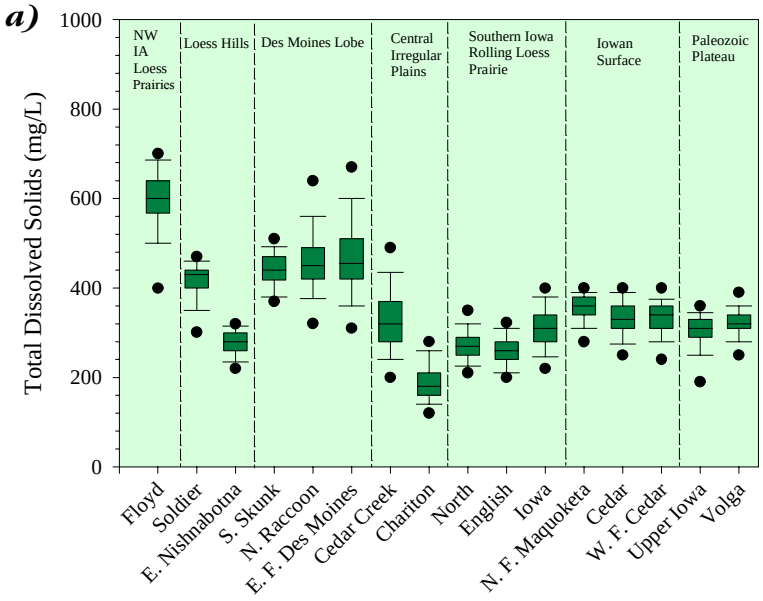
River Water Quality by Ecoregion

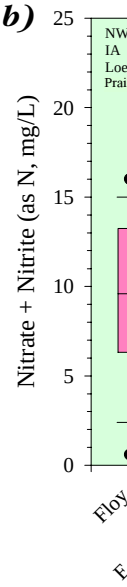
The boxplots represent monthly data collected from Oct 1986 through Oct 2000. The rivers are grouped by ecoregion. Sub-ecoregions 47e (Loess Hills) and 47m (Western Loess Hills) were combined in the plots.

a) *Total Dissolved Solids*
b) *Nitrate+Nitrite (as N)*
c) *Total Phosphorus*

Boxplot key



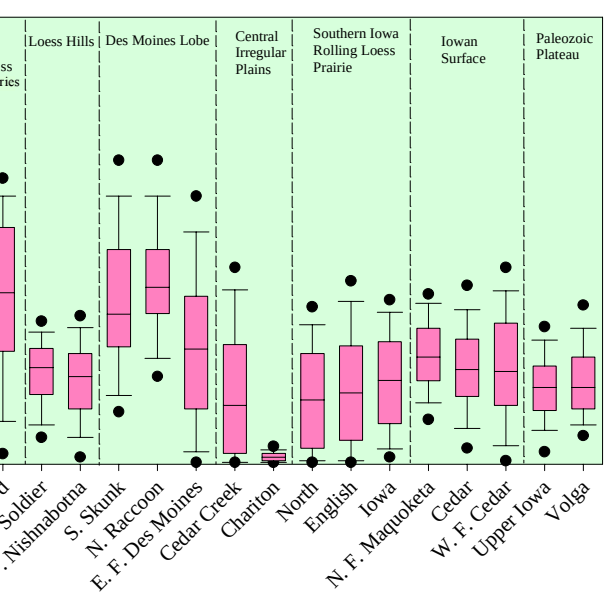


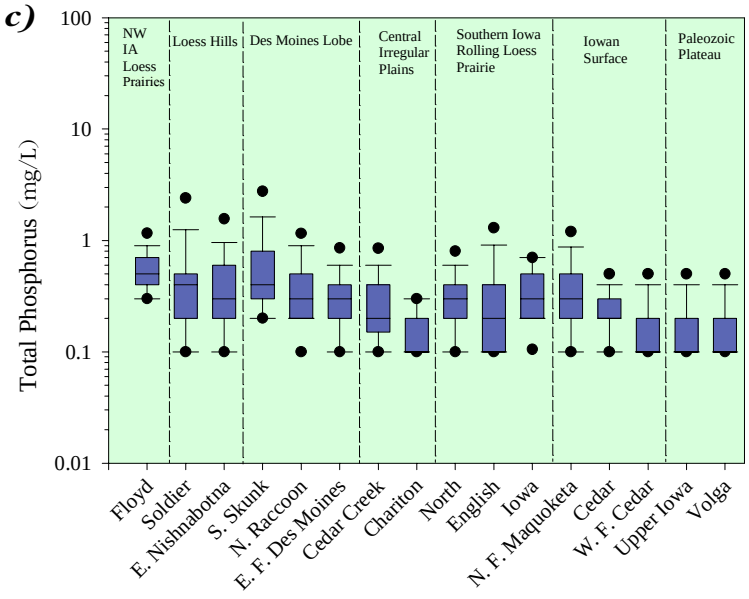


replaced by another 11 sites for the next two-year cycle. In this way, all forty-four rotational sites were monitored in an eight-year cycle.

The long-term monitoring sites provide a valuable, core dataset that allows researchers to track changes in Iowa's water quality over time as pollution control practices are implemented, farming practices evolve, and watersheds undergo urban or suburban development. The sixteen historical monitoring sites also offer the ability to compare different regions of the state for various water quality parameters. As anyone who has driven Iowa's highways knows, Iowa is not one uniform landscape. Iowa can be classified into four major ecoregions and further divided into sub-ecoregions. Ecoregion is a term used to characterize an area with similar soils, climate, and topography, which combine to result in related ecological patterns for plants and animals. Iowa's major ecoregions are the Central Irregular Plains (40) located in the southern part of the state, the Western Corn Belt Plains (47) located in the middle and western portion of the state, the Paleozoic Plateau (52) of extreme northeast Iowa, and the Interior River Lowland (72) adjacent to the Mississippi River. The influence of ecoregion characteristics on water quality can be observed with the long-term monitoring sites.

The figures above illustrate boxplots of three water quality compounds: total dissolved solids, nitrate+nitrite as nitrogen (nitrate-N) and total phosphorus. The boxplots are a visual summary of data. The "box" gives an indication of the data range by highlighting the 75th percentile (defined as the number where 75% of the values fall at or below) and





the 25th percentile with the median line through the center of the box (median is equivalent to the 50th percentile; 50% of the values are above this number, 50% are below this number). The boxplots show a dramatic difference in the three parameters among sub-ecoregions. The Northwest Iowa Loess Prairies (47a) and Des Moines Lobe (47b) have much higher levels of total dissolved solids than sub-ecoregions in the southern or eastern portion of the state (sub-ecoregions 40, 47f, 47c, 52). In part, the increased level of total dissolved solids may be related to drier climates in the western part of Iowa.

Nitrate-N levels also exhibit strong regional patterns. The Des Moines Lobe (47b) and Northwest Iowa Loess Prairies (47a) have median nitrate-N concentrations (as indicated by the "middle" line in the box) around 10 mg/L, whereas the other regions tend to have median nitrate-N concentrations half that value (5 mg/L). Nitrate-N levels in the Chariton River near Centerville Iowa in the Central Irregular Plains (40) are consistently lower than other streams in Iowa. The lower nitrate-N levels are most likely due to the presence of Rathbun Reservoir upstream from Centerville, which acts as a natural nitrate removal system.

Lastly, the sixteen long-term stations indicate that total phosphorus levels tend to be lower in the Paleozoic Plateau Ecoregion (52) of northeast Iowa with median concentrations at or below the method detection limit of 0.1 mg/L (method detection limit is the lowest concentration reliably measured by the laboratory instrument). The highest median levels of total phosphorus measured at the sixteen long-term stations were found in the

IDNR Historical Monitoring Parameter List

Field Tests
- Dissolved Oxygen
- Temperature
- pH
- Discharge
- Total Residual Chlorine

Common Constituents
- Specific Conductance
- Turbidity
- Total Dissolved Solids
- Total Suspended Solids
- Ammonia Nitrogen
- Nitrate + Nitrite Nitrogen
- Total Kjeldahl Nitrogen
- Total Phosphorus
- Dissolved Orthophosphorus
- Total Hardness as $CaCO_3$
- 5-day Carbonaceous BOD

Bacteria*
- Fecal Coliform Bacteria
- *E. coli* Bacteria
- Enterococci Bacteria

Common Herbicides#
- Acetochlor
- Alachlor
- Atrazine
- Butylate
- Cyanazine
- Deisopropyl atrazine
- Deethyl atrazine
- Metolachlor
- Metribuzin
- Trifluralin

Metals°
- Arsenic[f]
- Cadmium
- Chromium
- Copper
- Cyanide[f]
- Lead
- Mercury

* Analyzed April - October; Class A – primary contact waters only
\# Added in 1995; quarterly samples
° Collected annually all sites
[f] Collected monthly at Cedar River southeast of Charles City

Northwest Iowa Loess Prairies (47a) and the Loess Hills (47e, 47f). However, the monitoring protocol for the historical dataset avoided the collection of samples during periods of high runoff in order to ensure a consistent data record. Compounds such as phosphorus and pesticides that are found in much greater concentrations during heavy rainfall events will be under-represented in a sampling program designed to avoid these events. Therefore, the total phosphorus record is a good indication of long-term phosphorus levels when stream discharge is low, but may not be a good indication of overall concentrations when higher flows are considered. The new monitoring program will attempt to resolve this missing data record by including samples on a fixed, monthly schedule, and will begin to sample Iowa's streams during periods of high stream flow.

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