Louisiana Minerals Criteria

ACWA Conference

Albuquerque, NM

April 17, 2024

Background

- When referring to minerals criteria in this presentation, it is specifically for chloride, sulfate, and TDS.
- Louisiana has had numeric criteria for minerals since 1973.
- At the federal level, only chloride has a 304(a) criteria recommendation.
  - In 1988, EPA issued a national recommendation for chloride aquatic life criteria (ALC).
  - For sulfate, there is no national recommendation for ALC.
    - EPA's 1986 Gold Book recommends 250 mg/L for drinking water supplies.
  - TDS is not a pollutant and used as an indicator of dissolved inorganic (and organic) materials (i.e., < 0.45µm).

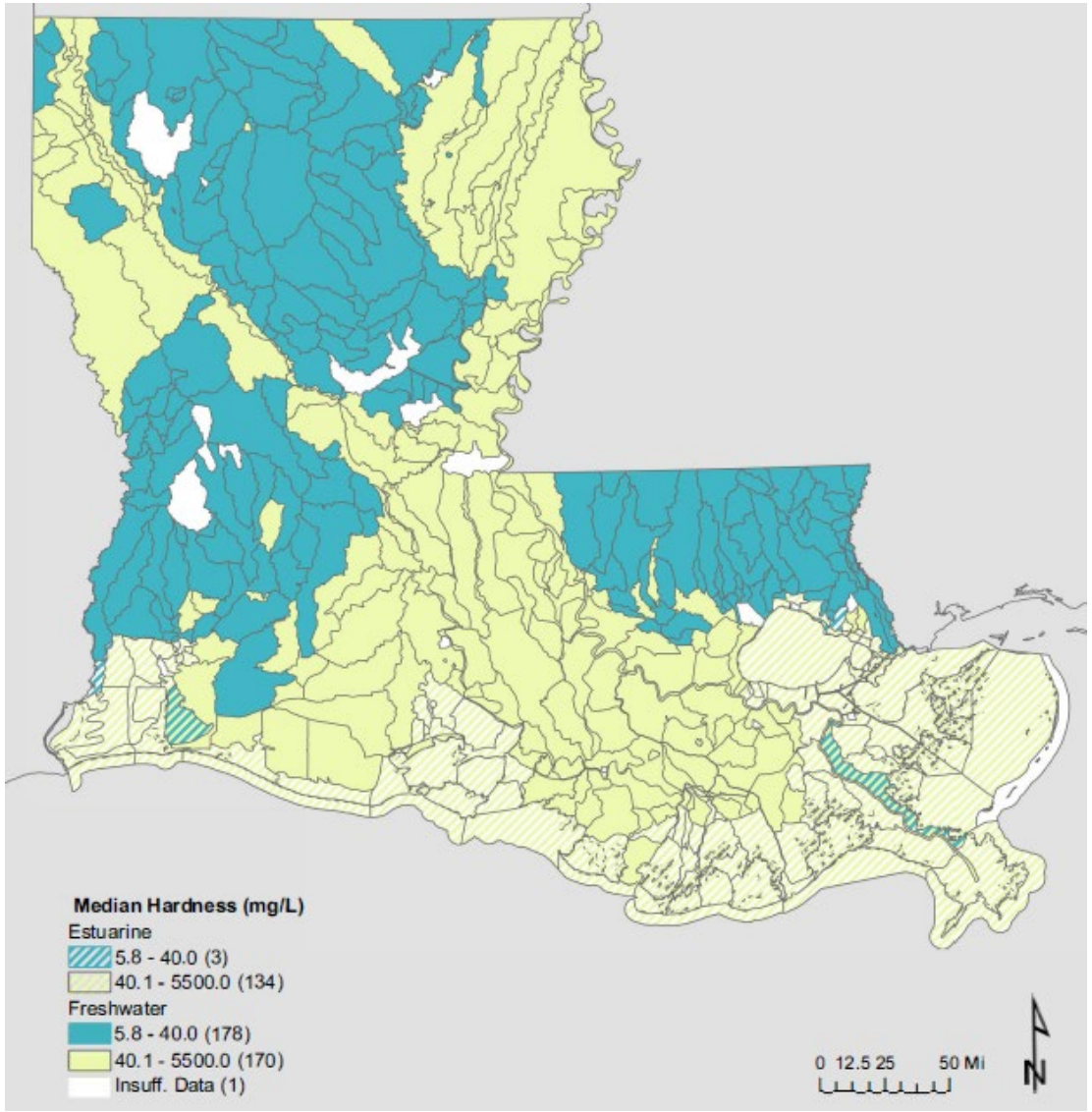
2016 Minerals Criteria Report

- In 2016, LDEQ completed a report evaluating minerals criteria and characterizing the dissolved ion components of surface waters.
- The report found that existing minerals criteria were statistically derived with a small dataset and methodology assuming data were normally distributed.
- Using a larger dataset and same methodology, only a 15% of recalculated criteria were within +/- 10% of existing criteria.
- Recommendation: reevaluate numeric minerals criteria using appropriate statistical methodology and consider biological and physical characteristics.

Subsequent Minerals Criteria Research

- A review of chloride and sulfate toxicity data found studies were conducted at hardness levels relatively high compared to those naturally occurring in Louisiana.
  - Many Louisiana waterbodies have a median hardness of 40 mg/L.
  - Illinois sulfate (2009) and Iowa chloride (2010) criteria were calibrated to 100 to 500 mg/L hardness; assumed toxicity less than 100 mg/L was equivalent.
- Research found that similar to dissolve metals (e.g., cadmium and lead having) having hardness-based toxicity, chloride and sulfate exhibit greater toxicity in soft water conditions.
- In order to properly evaluate minerals criteria for the entire state, toxicity data with hardness less than 100 mg/L would be necessary.

Louisiana Median Hardness Map



USGS Minerals Toxicity Study

- In 2016, a beneficial environmental project (BEP) was proposed to conduct toxicity studies of chloride and sulfate in a range of low-hardness waters to better understand the relationship between hardness and toxicity.
- With BEP funds, LDEQ contracted with USGS- Columbia Environmental Research Center (CERC) to conduct the toxicity study.
- LDEQ & CERC worked together to design toxicity studies compliant with EPA's 1985 ALC Guidelines.

Toxicity Study Design

- Six taxa* used in study include:
  - Warmwater fish: *Pimphales promelas*
  - Amphibian: *Hyla versicolor*
  - Daphnid: *Ceriodaphnia dubia*
  - Amphipod: *Hyalella Azteca*
  - Insect: *Chironomus dilutus*
  - Freshwater mussels: *Lampsilis siliquoidea* and *L. abrupta*
- All six taxa were tested in four hardness conditions (15, 30, 60, and 120 mg/L) to obtain acute toxicity values.
- Four taxa (*C. dubia*, *L. siliquoidea*, *H. azteca*, and *P. promelas*) were used for chronic tests in 40 mg/L hardness water.

*Adequate toxicity data was available for another insect and salmonids do not occur in Louisiana.

Toxicity Study Findings

- Similar sensitivity distributions resulted for both chloride and sulfate, with invertebrates ranking as most sensitive; the fish and amphibian were relatively tolerant.
- Pooled slopes for acute chloride and sulfate toxicity in relation to hardness were successfully obtained.
- Acute-chronic ratios were similar among the three invertebrates; the fish was much higher.

Next Steps

- Monitor EPA updates for chloride ALC and ionic strength criteria.
- Develop a QAPP to evaluate the revision chloride and sulfate criteria.
  - Multiple approaches are being considered.
- Evaluate the need of maintaining TDS criteria.
  - Will upcoming ionic strength criteria be better at indicating toxicity to aquatic life from dissolved ions than TDS?

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