Watershed Influences and In-Lake Processes—A Regional-Scale Approach to Monitoring a Water-Supply Reservoir, Lake Houston near Houston, Texas

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In Cooperation with the City of Houston

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Introduction

• Description of study area
• Watershed monitoring
• In-Lake monitoring
• Preliminary evaluation
Study Area

- Lake Houston is northeast of downtown Houston, Texas
- Reservoir with “small” contributing watershed
- A major source of water for Houston (pop. 4.5 million)
Study Area

- Drainage area 2,835 mi$^2$
- Land use is rural, transitional, and urban
- Western subbasin predominately urban
- Eastern subbasin predominately rural

Figures from Sneck-Fahrer and others, 2005, USGS SIR 2005-5241
Monitoring Sites
Watershed Monitoring

• Three sites selected above Lake Houston
  – 08068500 Spring Creek near Spring
    • Drainage area: 409 mi²
    • Streamflow data: 1939-present
    • Water-quality data: 1999-present
  – 08070200 E. Fork San Jacinto River near New Caney
    • Drainage area: 388 mi²
    • Streamflow data: 1984-present
    • Water-quality data: 1984-99; 2005-present
  – 08069000 Cypress Creek near Westfield
    • Drainage area: 285 mi²
    • Streamflow data: 1944-present
    • Water-quality data: 1959-64; 1977-78; 1983-2004; 2008
Watershed Monitoring
Watershed Monitoring

Spring Creek near Spring
Monitoring Sites
In-Lake Monitoring

- 2 sites in southwestern quadrant of lake
- 1 site about mid-lake
- Site configuration provides information upstream and downstream from areas of source-water withdrawal
In-Lake Monitoring

Lake Houston Near Mouth of Jack’s Ditch
In-Lake Monitoring

Auto-profile monitoring mechanism
Watershed Monitoring Approach

• Continuous water-quality monitoring
  – Turbidity, dissolved oxygen, water temperature, specific conductance, and pH

• Discrete sampling
  – Nutrients, sediment, and others
In-Lake Monitoring Approach

- Continuous water-quality monitoring
  - Turbidity, dissolved oxygen, water temperature, specific conductance, pH, chlorophyll, blue-green algae, PAR

- Discrete sampling
  - Nutrients, Geosmin, MIB, phytoplankton (species), and others
Time of Travel Estimation

Lake Houston at Mouth of Jack’s Ditch and inflow turbidity data
Time of Travel Estimation

Lake Houston at Mouth of Jack's Ditch and inflow turbidity data (zoom)
Time of Travel Estimation

Lake Houston at Mouth of Jack's Ditch and inflow specific conductance data
Time of Travel Estimation

Lake Houston at Mouth of Jack's Ditch and inflow specific conductance data (zoom)
Preliminary Results
In-Lake Processes

- Continuous vertical profile data
- Stratification
- Rapid mixing
Preliminary Results In-Lake Processes

Lake Houston at Mouth of Jack's Ditch dissolved oxygen data
Phytoplankton Analysis

- Graph a—Seasonal patterns in cyanobacterial biovolume were similar among sites, although peak biovolume was observed in mid-August at Site B and late-September at sites A and C.

- Graph b—Biovolume of potential taste-and-odor producers was significantly greater (ANOVA by site and date, p=.03; depths treated as replicates) at Site A than Site B during late September.
Conclusions

• Mobile, multidepth lake water quality monitoring gages are a viable method for collecting and transmitting data

• When combined with watershed water-quality information, the effects of watershed influences on water-quality in the lake can be evaluated at multiple scales
Conclusions (continued)

• Discrete sampling for ancillary constituents can be used to develop methods to estimate loads and frequency of occurrence

• Water-quality techniques developed through this project can be scaled and modified to fit most project needs
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