Evidence for Rapid Transport of Recharge from Onsite Sewage Treatment and Disposal Systems to Groundwater at Manatee Springs State Park.

By Eberhard Roeder\textsuperscript{1}, Harmon Harden\textsuperscript{2}, Jeff Chanton\textsuperscript{2}, Mark Hooks\textsuperscript{1}

\textsuperscript{1}FL Dept. of Health, Division of Environmental Health Bureau of Onsite Sewage Programs

\textsuperscript{2}Florida State University, Department of Oceanography
OSTDS Karst Study

• Hypotheses: Rapid flow of recharge into and through the groundwater and limited attenuation of any components of the recharge

• Test with wastewater effluent from two Onsite Sewage Treatment and Disposal Systems (OSTDS) as recharge

• Tracer Test (inject 50 gal in ~45 min into drainfield)
  – Fluorescein (soluble)
  – Sulfur Hexafluoride (SF6) (volatile)

• Groundwater quality monitoring
  – Nitrate (soluble, product of functioning drainfields)
  – Total Phosphorus
  – Fecal Coliform
Manatee Springs State Park

- Manatee Springs is remote, so OSTDS can be studied in relative isolation from other sources of nutrients
- Two OSTDS (septic tank and drainfield)
  - River front/shallow water table and
  - Upland/deep water table
Magnolia II: River Front Site

- Shallower water table (4-9 feet)
- Built into mound for flood protection
Tracers at Magnolia II

M-1: 75 feet from injection point
Fl arrival in 2.5 days

M-3: 135 feet from injection point
Fl arrival in 1.4 days
Nitrates at Magnolia II

- M1
- M2
- M3
- Catfish Hotel
- Sue Sink
- Spring

Date

01/01/03 04/02/03 07/02/03 10/01/03 12/31/03 03/31/04 06/30/04

mg/L NO₃-N
Hickory: Upland Site

- Deeper water table (12-15 ft)
- On top of Manatee Springs cave system
Tracers at Hickory

S-1: 35 feet from injection point
SF$_6$ arrival within one hour

S-3: 165 feet from injection point
SF$_6$ arrival within one hour

USGS Cedar Key
09/22-24/04
Hickory: Tracers in Surface Water

SF6 in surface water

Fluorescein in surface water

Below line is considered background fluorescence

USGS Cedar Key
09/22-24/04
Nitrates at Hickory

Date

mg/L NO₃-N

01/01/03 04/02/03 07/02/03 10/01/03 12/31/03 03/31/04 06/30/04

Bathhouse closed

- S1
- C5
- S3
- Catfish Hotel
- Sue Sink
- Spring

USGS Cedar Key
09/22-24/04
Results

• Transport velocities (based on tracer arrival times):
  – Magnolia II, from 5 to 100 feet per day
  – Hickory, from 1 to 280 ft/day

• More than one peak in many monitoring well concentration time series and persistently high tracer concentrations up to a year after begin of the tracer test indicate multiple porosities

• Elevated nutrients in wells surrounding the septic systems with nitrate concentrations as great as 20 to 60 mg/L

• High tracer concentrations correspond to high nutrient concentrations, wastewater is source of nutrients
Acknowledgements

• EPA-Gulf of Mexico Program and DOH-Bureau of Onsite Sewage Programs: funding
• FSU-Dept. of Oceanography: PI Dr. Jeff Chanton and Harmon Harden
• Manatee Springs State Park: Park Manager Sally Lieb
• Suwannee River Water Management District