# Ground Water and Surface Water Interactions in the Freshwater Wetlands of Taylor Slough


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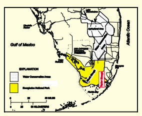
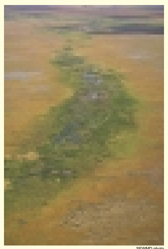
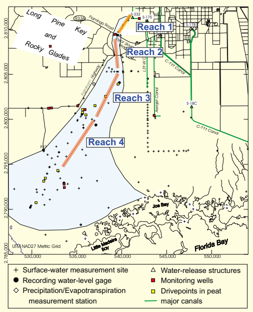
## Problem and Approach

- Area of Study






- Site Location Map




### • Site Description

Taylor Slough is one of two well-defined flow-ways for surface water in Everglades National Park. It is separated from Shark Slough by a series of low-lying coastal ridges referred to as Long Pine Key, and by an area of relatively high-elevation wetlands called the Rocky Glades. Historically, Taylor Slough received water from precipitation, surface overflow from Shark Slough, and possibly as ground-water discharge from the coastal ridge systems. Presently, Taylor Slough receives much of its water from the L31-W canal at the S332 pumping structure (at what is effectively the northern terminus of Taylor Slough), and from outflow at the southern end of the L31-W canal.

The organic wetland peat in Taylor Slough varies in depth (0.2 - 2 m) and in the content of calcitic mud. Under the peat is a highly permeable sand and limestone aquifer (Biscayne aquifer).

### • Problem

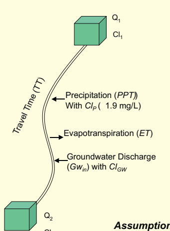
Determining wetland and groundwater interactions in Taylor Slough is important because the balance of freshwater flow in the lower part of the Slough is uncertain. Flows through Taylor Slough are relatively small in comparison with Shark Slough, but they are especially important to the ecology of estuarine mangrove embayments of northeastern Florida Bay. Improved estimates of wetland and ground-water interactions are also needed to better understand biogeochemical processes that affect water quality in lower Taylor Slough and in northeastern Florida Bay.

### • Research Approach

Two approaches were used to investigate wetland and ground-water interactions in Taylor Slough. One method was to compute ground-water discharge using chloride as an environmental tracer. Estimates of precipitation, evapotranspiration, and surface-flow velocity were needed in addition to chloride measurements in surface water and in ground water. We also estimated ground-water discharge by combining estimates of hydraulic conductivity in the peat (determined by the piezometer slug test method) with measurements of vertical hydraulic gradient. Vertical discharge from the peat was computed from those data using Darcy's law.

The research was conducted during seven primary measurement periods between September 1997 and September 1999. Our results are discussed with reference to four segments (referred to as reaches) that comprise Taylor Slough the freshwater portion of Taylor Slough.

### Analysis Equations




***Considering Precipitation and ET only***

$$Q_2^* \quad Q_1 \quad PPT \quad TT \quad ET \quad TT$$

$$Cl_2^* \quad \frac{Cl_1 \; Q_1 \quad (PPT \quad TT) \; Cl_P}{Q_2^*}$$

***Considering Precipitation, ET, and GW inflow***

$$Q_2^* \quad Q_1 \quad PPT \quad TT \quad ET \quad TT \quad GW_{in} \quad TT$$

$$Cl_2^* \quad \frac{Cl_1 \; Q_1 \quad PPT \quad Cl_P \quad GW_{in} \quad Cl_{GW} \quad TT}{Q_2^*}$$

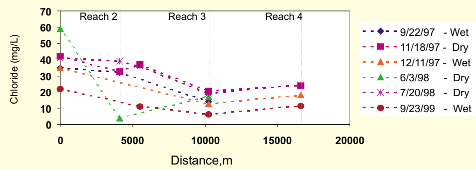
***Assumptions***:

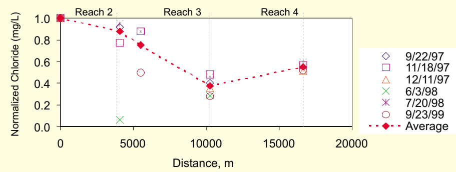
- Steady-state hydrologic condition
- Only inflow is groundwater discharge with substantially different chloride concentration

## Surface-Water Tracer of Groundwater Interactions

- Chloride Decreases Along Taylor Slough During Both Wet and Dry Periods

**Spatial Variation in Cl at Taylor Slough**

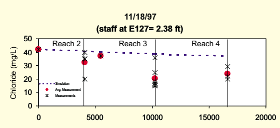


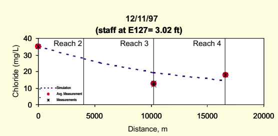



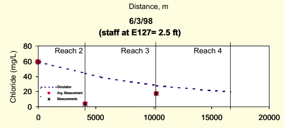

- Chloride Dilution is not Explained by Simulations that Only Account for Precipitation and Evapotranspiration

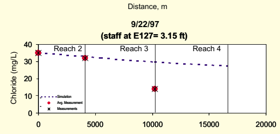
Dry Conditions

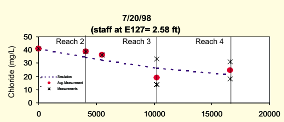
Wet Conditions

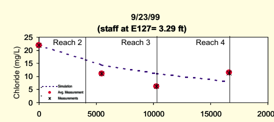


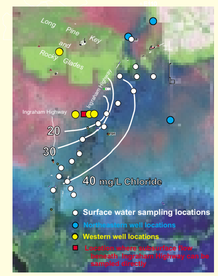



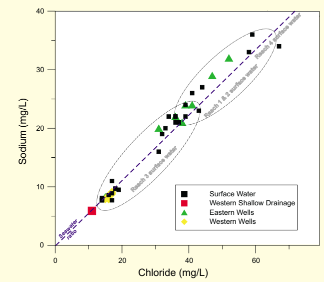



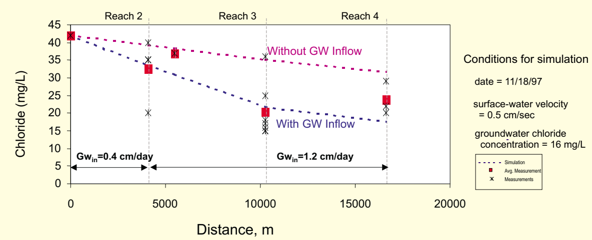

## Source and Quantity of Groundwater Discharge

- The Source of Low-chloride Water Entering Taylor Slough is Groundwater Discharge and Shallow Drainage from Long Pine Key and Rocky Glades.




- Groundwater Discharge can be Quantified by Simulating Chloride Transport




### Conclusion

- The source of discharging ground water is chemically dilute ground water and surface water that enter from the northwestern side of Taylor Slough. The ultimate source is recharge of precipitation on Long Pine Key and the Rocky Glades.
- During high-water, surface runoff from Long Pine Key that overflows Ingraham Highway to enter Taylor slough cannot be definitively separated from ground-water discharge, because both are relatively low in chloride concentration.
- Shallow ground-water discharge is highest in reach 3, on the order of 1.2 cm/day, which is a factor of three larger than average daily evapotranspiration. Discharge in reach 2 is lower. Discharge in reach 4 is uncertain, because chloride generally increases in this reach and because we have not yet been able to rule out input of salt to reach 4 by tidal mixing. Surface water recharges the aquifer in reach 1 when the S-332 pump is operational (evident from comparison of S-332 pumping data and flow data at Taylor Slough Bridge).
- Unfortunately, vertical discharge of deep ground water from directly beneath central Taylor Slough cannot be detected using chloride as a tracer. This is because of the similarity in chloride concentration between Taylor Slough surface water and ground water directly beneath the slough. For reaches 3 and 4, our preliminary estimate of ground-water discharge from directly beneath Taylor Slough (determined from measured vertical hydraulic gradients and hydraulic conductivity in peat) is 0.06 cm/day, which is only a minor component of the Taylor Slough water balance.