

Attachment 2B – Transect Locations



Figure 2B.1 - L7-L39 transects for sediment inventory study



Figure 2B.2 - L40 Transects for sediment inventory study

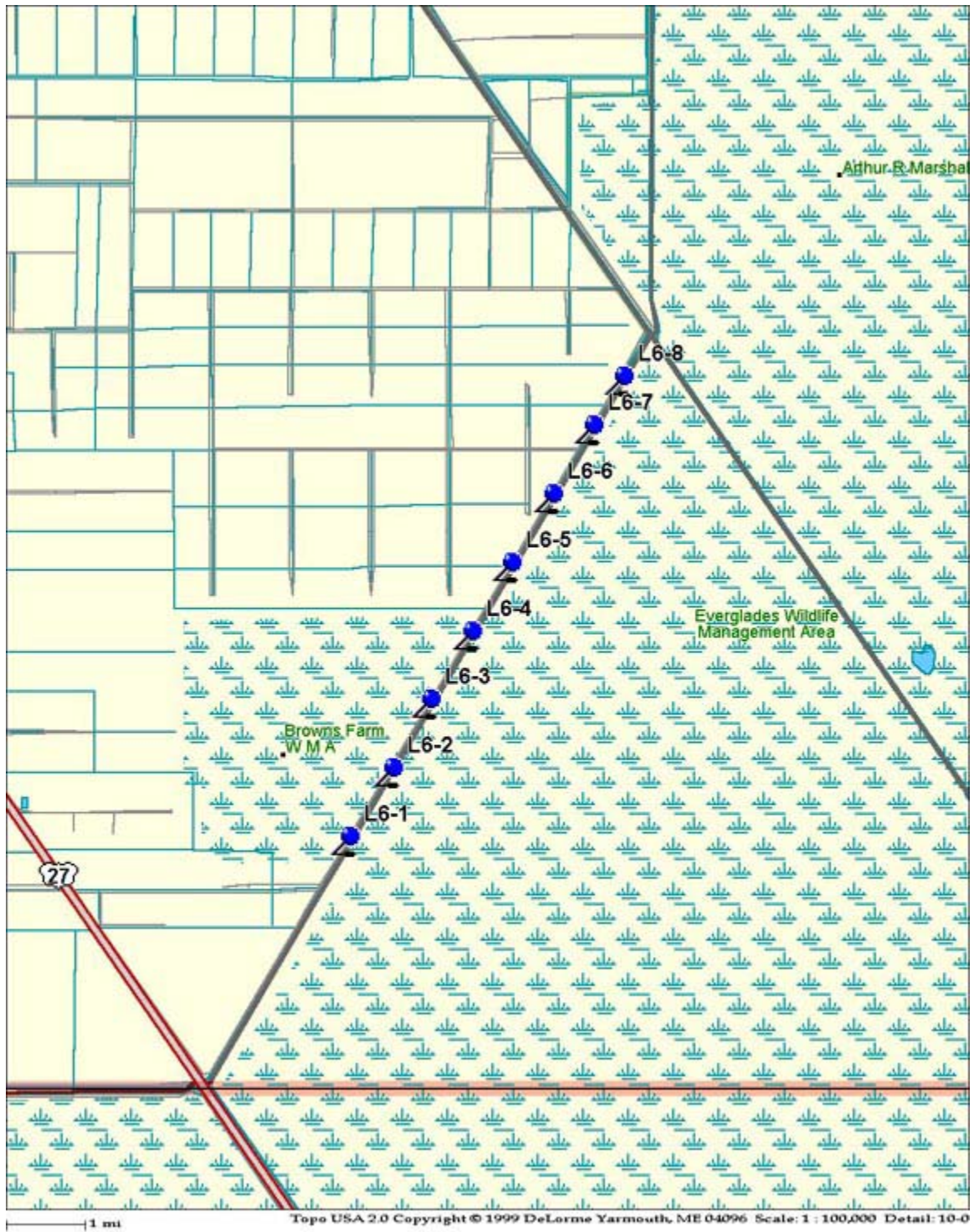


Figure 2 B.3 - L6 Transects for sediment inventory study

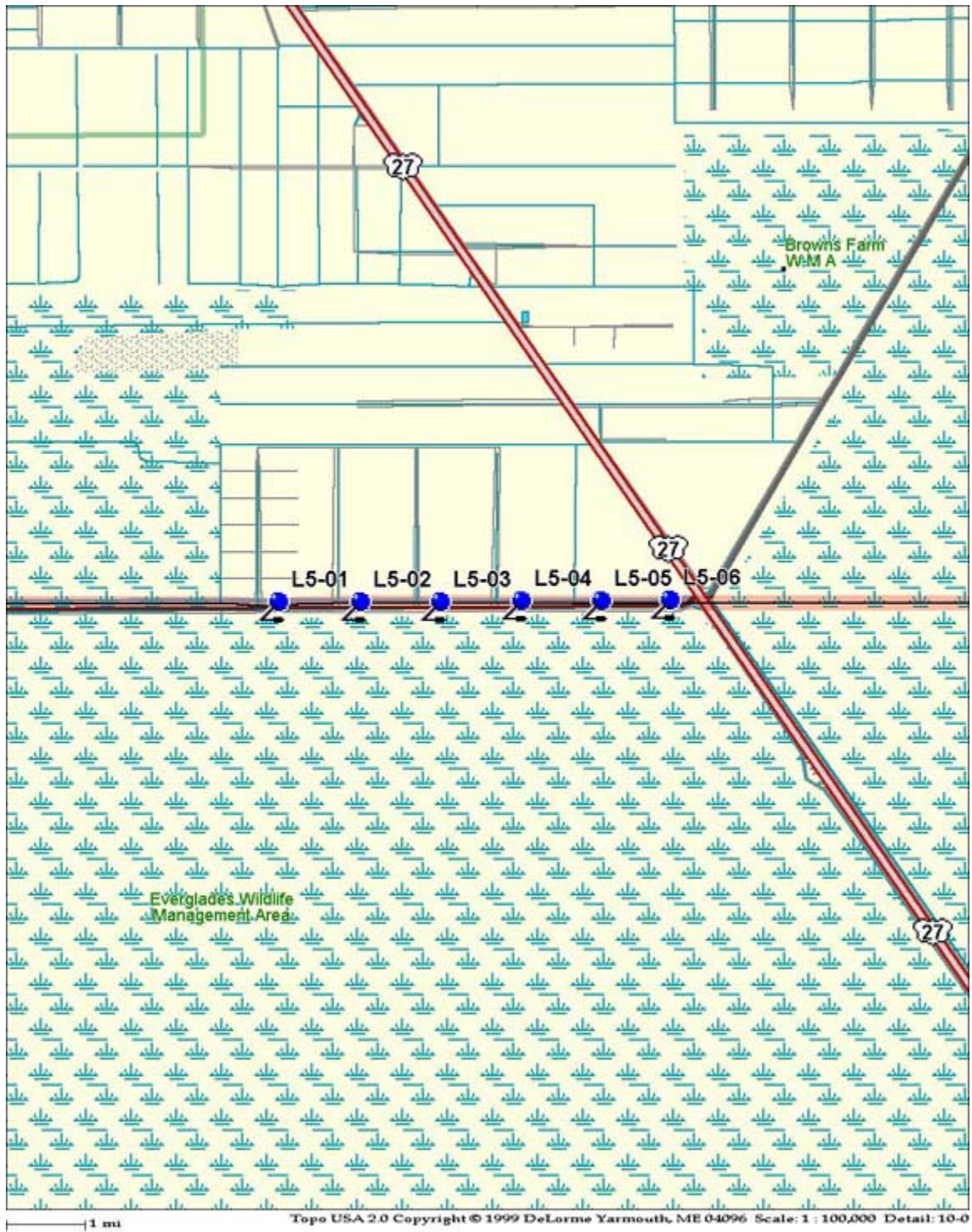


Figure 5B.4 - L5 Transects for sediment inventory study

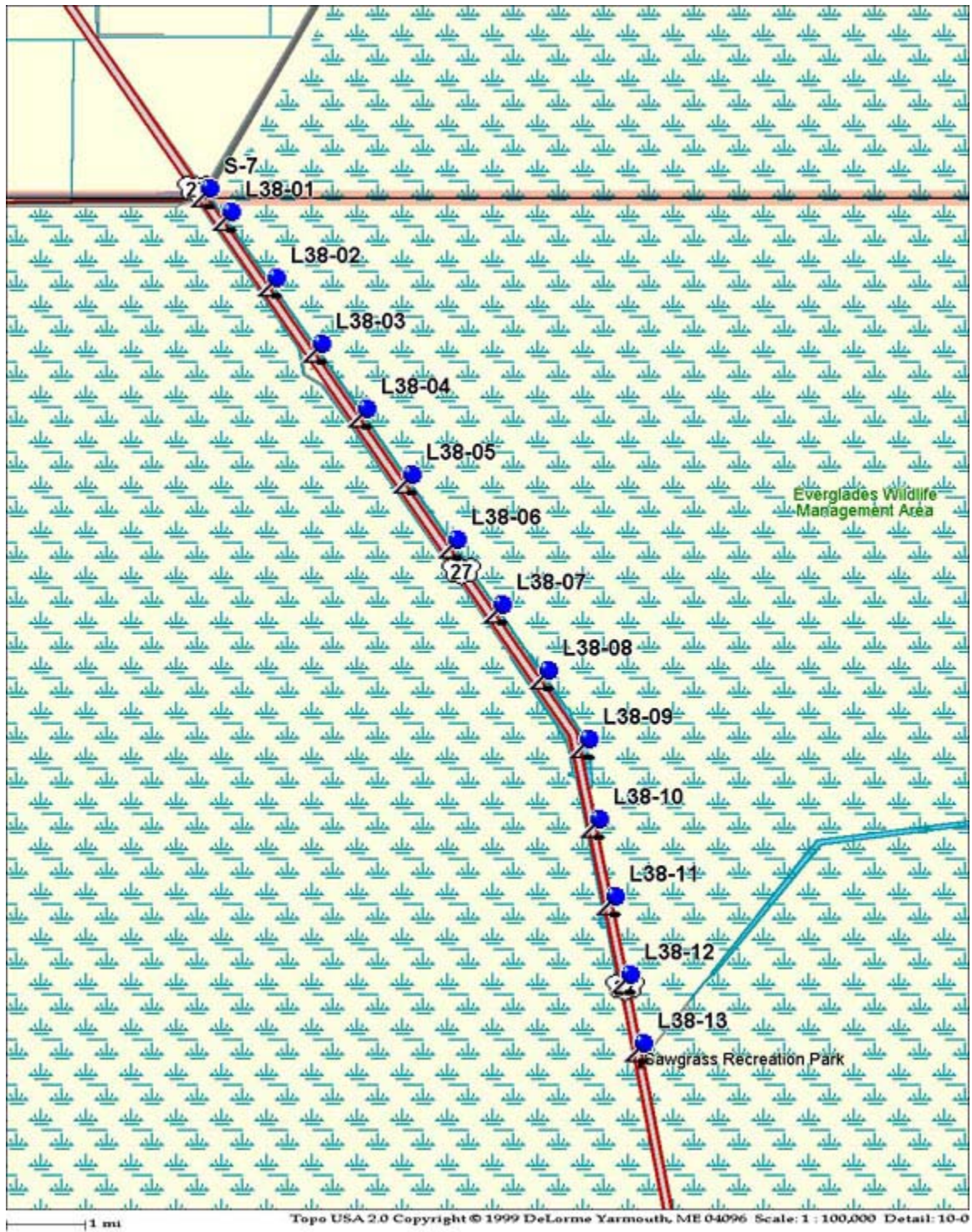


Figure 2B.5 - L38 Transects for sediment inventory study

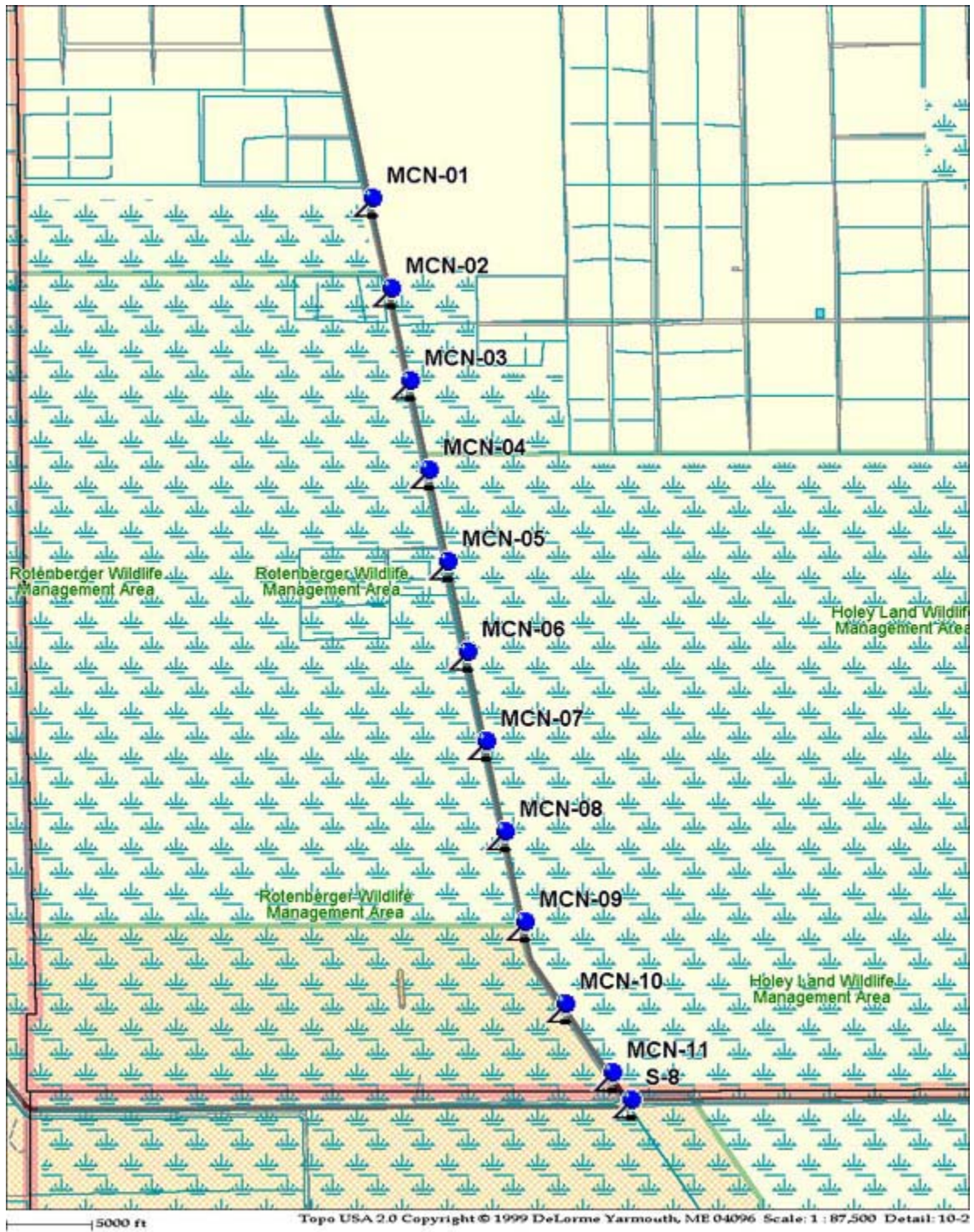


Figure 2B.6 - Miami Canal (North) Transects for sediment inventory study

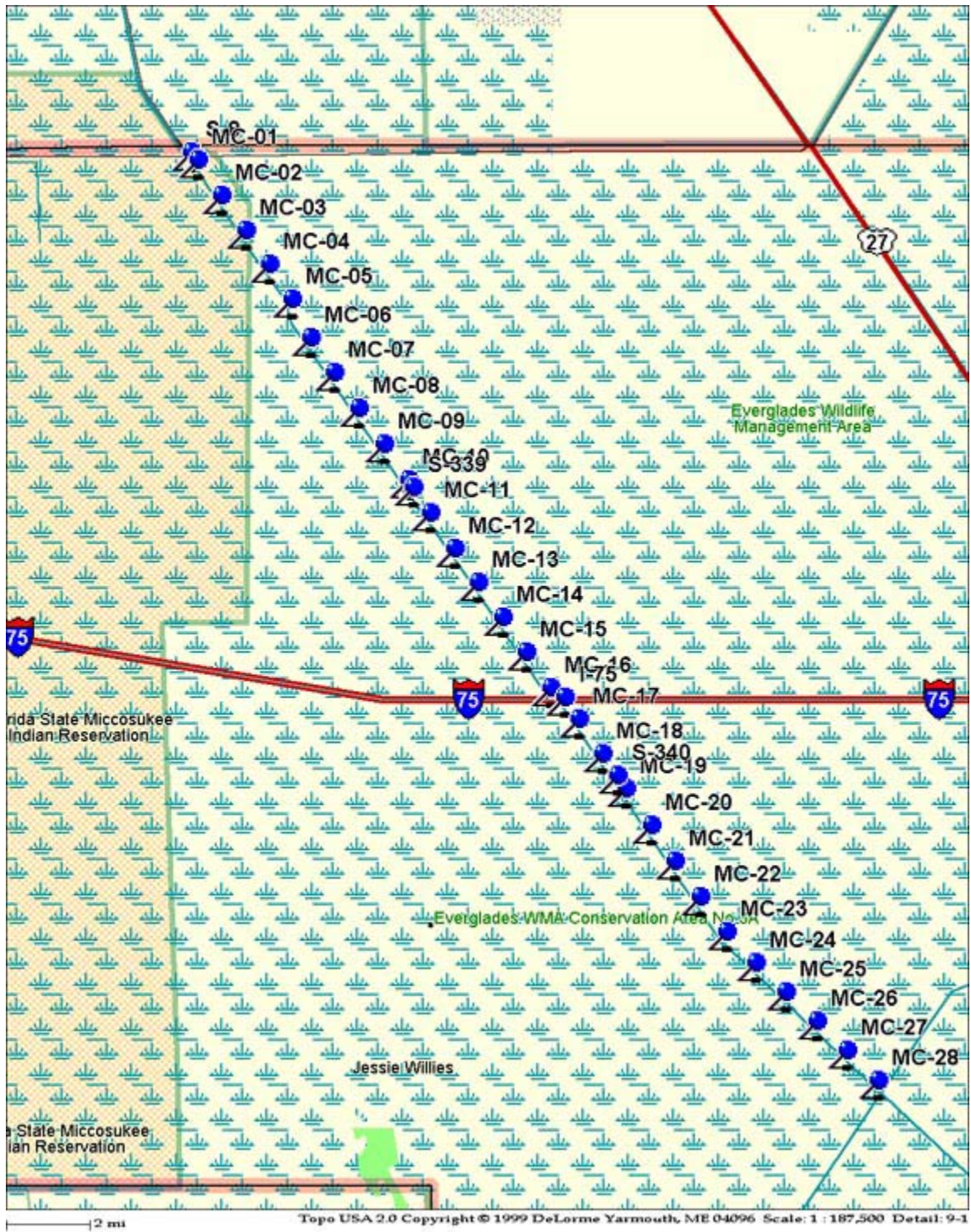


Figure 2B.7 - Miami Canal Transects for sediment inventory study



Figure 2B.8 - Release Study Core Sample Locations

Attachment 2C – Methods

WCA Canal Sediment Inventory and Sampling

Transect Locations

The selected reaches for this study provide approximately 122 miles of canal that will be used to transport clean water discharged from the proposed Storm Treatment Areas (STA). Transect locations at each study site were marked by GPS coordinates using a Trimble Unit. Transects at each study reach were marked at one mile increments down from the extreme upstream end of the reach. See attached maps for transect locations.

Sampling and Measurement Techniques

At each transect location, two steel rebar were installed at the edge of the water of each side of the canal. At the time of sediment sampling or measurement, a calibrated steel cable was attached to the anchor rebars. A boat, which served as the sampling and measurement platform, was anchored to the cable by clamps in a position directed into the canal flow. Distance from the reference anchor rebar was determined using the calibrated steel cable.

Sediment samples were taken using an Ogeechee sediment core sampler at the canal centerline and at locations 25% of the canal inward from each bank. Core tubes were carefully transported to the University of Florida Everglades Research and Education Center (UFEREC) for description, sectioning and analysis.

Sediment surface elevation and sediment depth at each transect were measured with a calibrated submersible footpad and a field penetrometer. The neutrally buoyant submersible footpad was lowered until it rested on the sediment surface to determine the depth of the sediment surface below the water surface. A calibrated hollow steel shaft was used as field penetrometer. The field penetrometer was pushed into the sediment manually. The depth of penetration of the shaft into the sediment was determined until there was no further penetration into the canal bottom. Pad-penetrometer readings were taken at 5 ft increments across all transects.

Sediment Analytical Methods

Sealed sediment cores samples were transported upright in their plastic core tubes to the UFEREC and store under refrigeration until their sectioning, which was usually done within 24 hours of sampling. Water was removed from the core tubes with a vacuum siphon and the cores were expunged vertically into a calibrated cylinder from their tubes using a piston. Samples were transferred from the calibrated cylinder to plastic bags and then refrigerated or frozen until analysis.

Three layer of sediment two cm thick were sectioned from each core and designated as the “A”, “B”, and “C” layers, in descending order, from the top of the core down. The sediment cores were sectioned into predetermined depth increments to a depth of 12 cm, however, when the physical appearance of the cores changed drastically below this depth, a fourth layer designated as “D” was taken. All sediment core samples were analyzed for the following parameter: Water Content, Dry solid Content, Volatile Solids and Ash Content, Phosphorus Content, Bulk Density, and Dry Solids Content. Detailed descriptions of the analytical techniques are contained in the Project Standard Operating Procedures WM754-7.0 “Physical Analysis of Sediment Samples” (ASTM, 1993; APHA, 1995) and M754-9.0 Analysis for Total Phosphorus in Sediment Samples (Alpkem, 1992; USEPA, 1984).

References

- Alpkem Corporation. 1992. Technical Information-Enviroflow 3500, Alpkem Corp. Publication, P/N000148-149, “Total Phosphorus.
- Annual Book of American Society for Testing Material (ASTM). 1993. “Specific Gravity”, V.04.08, Designation D854-92 [Modified], Philadelphia, PA..
- American Public Health Association (APHA). 1995. Standard Methods for the Examination of Water and Wastewater, Method 2540B, Method 2540C, 18th ed. Amer. Publ. Health Assoc., Washington D.C. 1540 pp.
- USEPA. 1984. Methods for Chemical Analysis of Water and Wastes, USEPA, Publication EPA-600/4-79-020, “Phosphorus, Total”, Method 365.4 (Colorimetric, Automated Block Digester, AAll).

Sediment Core Flux and Speciation Studies

Sediment and Intact Core Collection

Samples were collected at twenty pre-determined locations within the EAA-WCA canal system. See attached map for sample locations.

At each station, a clean, DDI rinsed 4-inch diameter polycarbonate tube was inserted into the sediment. The top was sealed and the entire core retrieved. All core samples were taken in triplicate. Samples to undergo sediment characterization were immediately extruded in the field into the 0-10 and 10-30 cm sediment intervals, sealed in plastic bags (Ziploc™) and placed in coolers on ice until return to the laboratory. Upon return to the Wetland Biogeochemistry Laboratory, soil/sediment samples were transferred to polyethylene containers and stored refrigerated at 4 degrees C until analysis. An additional set of triplicate intact cores was collected, transported upright and returned to the laboratory for use in the flux experiments.

Intact Sediment Core Nutrient Flux

The flux methodology utilized intact sediment cores incubated in the laboratory and monitored for changes in water column dissolved reactive P (DRP). Cores were incubated in the dark. The concentration gradient was used to estimate the flux of reduced substances from sediment to the overlying water column. Flux rates were then calculated using the Fickian diffusion equation for the given concentration gradient of each chemical species (Fisher and Reddy, 2001).

Triplicate cores from each station were returned to the University of Florida Wetland Biogeochemistry Laboratory. Water present in the cores from collection was siphoned off and replaced with filtered (0.45 micron filter) Everglade Nutrient Removal discharge water. Cores were outfitted with nalgene tubing equipped with a steel needle. The tubing was connected to an air pump and air was slowly bubbled into the water column to maintain aerobic conditions. Ten ml of floodwater was collected at times 0, 1, 2, 4, 7 days and then once a week over 2 months time. Water samples were passed through 0.45 micron membrane filters and analyzed for DRP. After 2 months, the overlying water column was siphoned off and replaced with filtered water. Water column sampling was repeated for additional 2-month cycles for a total of 6 cycles over one year.

Floodwater samples were frozen within 1 hour of collection and analyzed for DRP using a Technicon AutoAnalyzer (Technicon Instruments Corp., Tarrytown, NY), and USEPA Methods 350.1. The pH was measured at selected intervals with a Fisher Scientific Accumet model 1002 pH meter (Fisher Scientific, Pittsburgh, PA). Flux was calculated by calculation of the slope of the regression line through the data for DRP over time. (Fisher and Reddy, 2001).

Three triplicate, water only cores (no soil) were incubated in the dark and sampled over 30 days to determine the reactivity (microbial consumption) of re-flood water and P adsorption to the core tubing.

Sediment Characterization

Total weight was determined in order to calculate bulk density. A sub-sample was dried at 70C until constant weight, ground on a ball mill and run for total C, total N and total P. In addition, 1.0 N HCL extractable Ca, Mg, Al, Fe and P were determined on a separate extraction procedure on dried, ground samples. A moist sub-sample underwent an acid-base phosphorus fractionation scheme partitioning soil P into organic and inorganic pools (Ivanoff et al., 1998).

References

- Fisher, M.M. and K.R. Reddy. 2001. Phosphorus flux from wetland soils impacted by long-term nutrient loading. *J. Environ. Qual.* (in press).
- Ivanoff, D.B., K.R. Reddy and S. Robinson. 1998. Chemical fractionation of organic P in Histosols. *Soil Sci.* 163:36-45.
- US Environmental Protection Agency (USEPA) 1993. Methods for chemical analysis of water and wastes. *Environ. Monit. Support Lab.*, Cincinnati, OH.

Quality Control Summary for WCA Transport Study.

Water samples were analyzed for P using USEPA 365.4. Samples analyzed in the laboratory were subjected to accuracy, precision, and the method detection limit (MDL) data analysis. Additionally, 5% of the samples were spiked with a known amount of P to determine if there was matrix interference with the samples.

The accuracy of the results was determined by analyzing quality control samples of known concentrations that are from a different source than the calibration standards. For the WCA studies, a quality control sample of 0.10 mg/L P for total phosphorus and total dissolve phosphorus was analyzed with each batch of samples. The recovery ranged from 90 – 110%. Samples that fell outside these limits were reanalyzed following the standard operating procedure (SOP) for the analysis.

The precision of the analysis was monitored by analyzing 10% of the samples as duplicates. The relative percent recovery (RPD), of less than 10% RPD was used to determine the precision of the analysis. Duplicate samples showing P concentrations that with greater than 10% RPD were reanalyzed.

The method detection limit was determined as outlined in EPA 600/4-79-019 (March 1979). The detection limit was determined to be 0.01 mg/L P. Additionally, a laboratory blank sample was analyzed with each set of samples and the detection limit was calculated as three times the standard deviation of the blank samples. The MDL was determined to 0.009 mg/L P by this procedure. Approximately 5% of the samples were spiked with 0.10 mg/L P and the recovery calculated. Acceptable recoveries ranged from 85 – 115%.

References

US Environmental Protection Agency. 1979. Methods for Chemical Analysis of Water and Waste. EPA-600/4-79-020, National Environmental Research Center, Cincinnati, Ohio.

US Environmental Protection Agency. 1984. Definitions and procedure for the determination for method detection limits. Appendix B to 40 CFR 136 Rev. 1.11.

Everglades Research and Education Center Standard Operating Procedure for the Determination of Total Phosphorus, SOP #4, December 2002.