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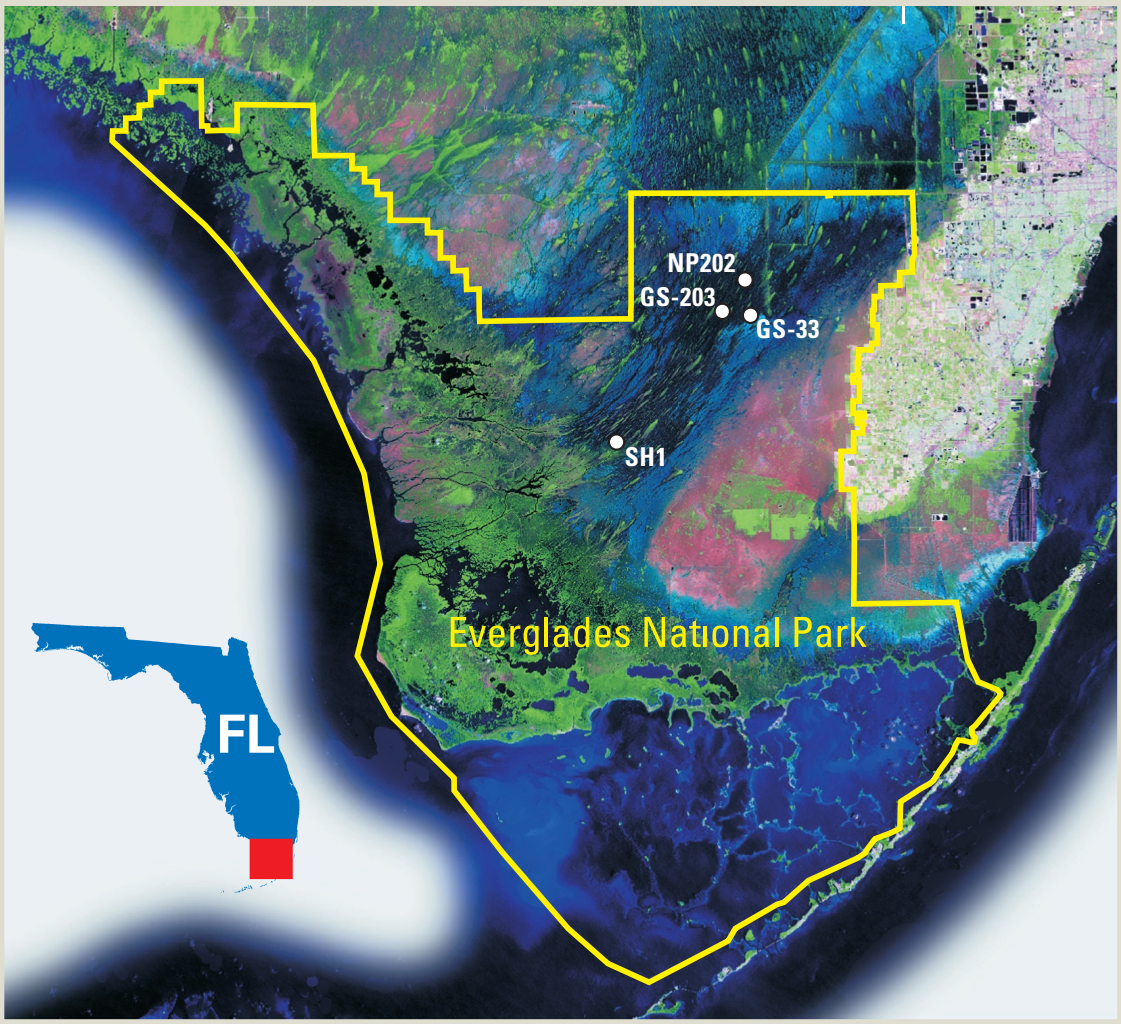
Flow Velocity, Water Temperature, and Conductivity in Shark River Slough, Everglades National Park, Florida: August 2001– June 2002



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U.S. Department of the Interior
U.S. Geological Survey

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By Ami L. Riscassi and Raymond W. Schaffranek

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U.S. Department of the Interior
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Divide	By	To obtain
	Length	
millimeter (mm)	25.4	inch (in)
centimeter (cm)	2.54	inch (in)
meter (m)	0.3048	foot (ft)
kilometer (km)	1.609	mile (mi)
	Velocity	
centimeter per second (cm/s)	30.48	foot per second (ft/s)

Temperature in degrees Celsius (°C) may be converted to degrees Fahrenheit (°F) as follows:

$$°F=(1.8\times°C)+32$$

Direction of flow is reported in degrees clockwise from magnetic north (°CW from MN).

Frequency of velocity measurements is reported in hertz (Hz).

Salinity is reported in parts per thousand (ppt).

Signal-to-Noise ratio is reported in decibels (dB).

Specific conductance is reported in microsiemens per centimeter (µS/cm).

Horizontal coordinates are referenced to North American Datum of 1983 (NAD83).

Flow Velocity, Water Temperature, and Conductivity in Shark River Slough, Everglades National Park, Florida: August 2001– June 2002

Ami L. Riscassi and Raymond W. Schaffranek

Abstract

The data-collection effort described in this report is in support of the U.S. Geological Survey (USGS) Place-Based Studies project investigating "Forcing Effects on Flow Structure in Vegetated Wetlands of the Everglades." Data collected at four locations in Shark River Slough, Everglades National Park, during the 2001–2002 wet season are documented in the report and methods used to process the data are described. Daily mean flow velocities, water temperatures, and specific conductance values are presented in the appendices of the report. The quality-checked and edited data have been compiled and stored on the USGS South Florida Information Access (SOFIA) website *http://sofia.usgs.gov.*

Photograph courtesy D. Briane Adams, retired USGS.

Introduction

A major thrust of the Everglades restoration effort, according to the Comprehensive Everglades Restoration Plan available on the website *http://www.evergladesplan.org*, is to restore the natural functioning of the ecosystem to pre-drainage conditions. This objective requires detailed knowledge of the hydrologic and hydraulic factors that affect the natural flow of water through the Everglades wetlands. The heterogeneous vegetation, small topographic gradient, microtopography, and ridge-and-slough structure of the landscape variously affect flows through the vast mosaic of sloughs, marshes, and wet prairies that make up the Everglades. The data collected in this project document the temporal and spatial variability of the extremely low velocity of shallow water in the heterogeneous wetlands and provide insight into the hydrologic and hydraulic processes that affect its flow through the low-gradient landscape.

Shark River Slough is the dominant path of surface-water flow in Everglades National Park (ENP) (fig. 1). It conveys freshwater inflows discharged through culverts and hydraulic control structures along Tamiami Trail to the coastal mangrove ecotone of the southwest Gulf Coast of Florida. Flow-velocity, water-temperature, and conductivity data collected in Shark River Slough during August 2001 through June 2002 (2001–2002 wet season) are presented in this report. These data supplement the data collected during the 1999–2000 and 2000–2001 wet seasons documented by Riscassi and Schaffranek (2002).

Description of Study Area and Monitoring Program

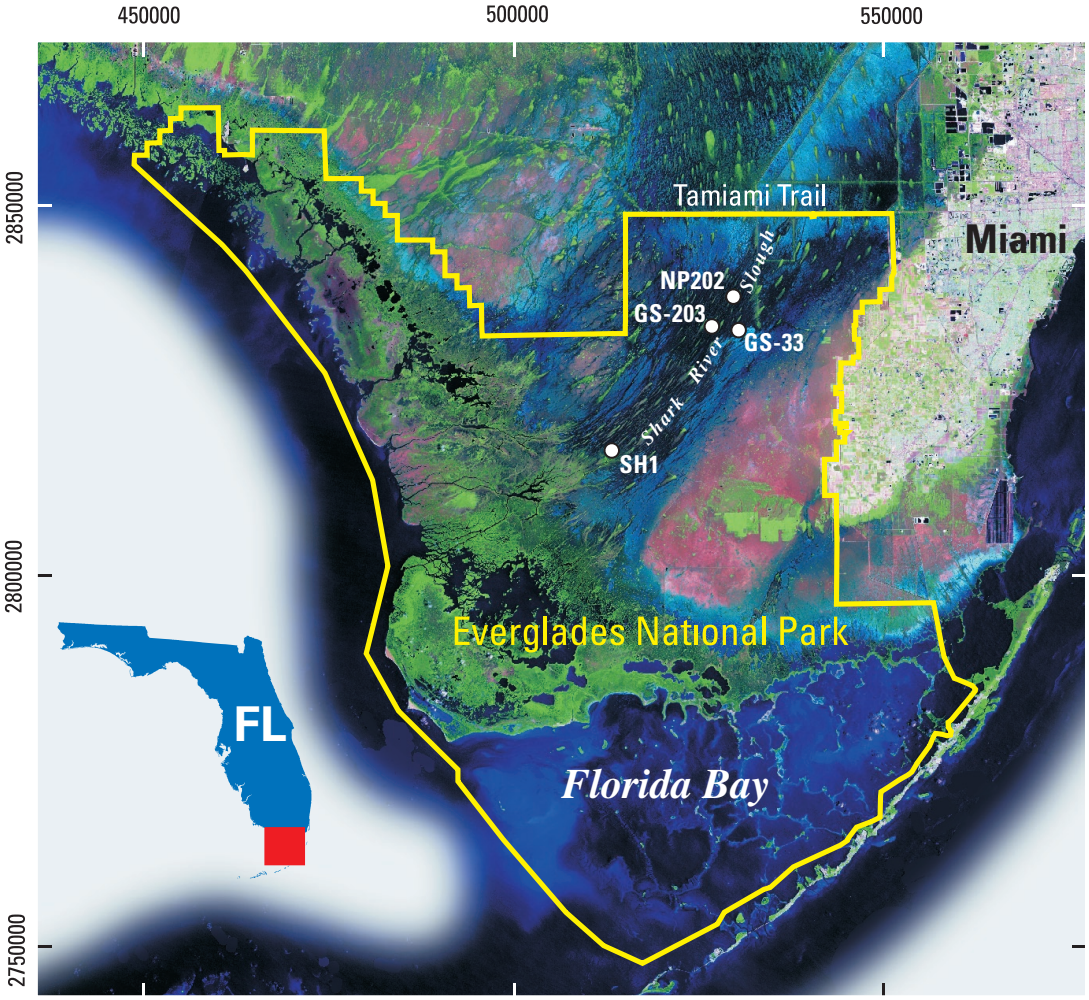
The freshwater wetlands of Shark River Slough are a mixture of tree islands, sawgrass marshes, wet prairies, and sloughs that variously affect the conveyance of water to the coastal mangrove ecotone. Flow velocities and (or) related hydrologic parameters were monitored at four sites (SH1, GS-203, GS-33, and NP202) in Shark River Slough with differing vegetative characteristics (fig. 1). At all four sites, temperatures were monitored in the plant litter, throughout the water column, on the water surface, and in the air above the water column using thermistors (thermally sensitive resistors). At three of the sites (SH1, GS-203, and GS-33), flow velocities were monitored bi-hourly at a fixed point in the water column using acoustic Doppler velocity (ADV) meters. At two of the three ADV monitoring sites (GS-203 and GS-33), conductivities and water temperatures were monitored bi-hourly at a fixed point in the water column using water-quality probes.

Purpose and Scope of Report

The data collected in the 2001–2002 wet season, as processed and presented in this report, are intended to supplement the data documented in Riscassi and Schaffranek (2002) for the 1999–2001 wet seasons. This report identifies the deployment specifications, describes the data-processing techniques, and presents the flow-velocity and related hydrologic data collected at four monitoring sites. Daily mean flow speeds and directions, specific conductance values, and water temperatures are listed in the report appendices. Quality-checked and edited data are available for downloading from the Data Exchange page of the USGS South Florida Information Access (SOFIA) website *http://sofia.usgs.gov*.

Acknowledgments

Gordon Anderson, USGS, provided ancillary stage data from the SH1 hydrologic monitoring station. Kevin Kotun, National Park Service (NPS)/ENP, provided ancillary stage data from the NP203 and P33 hydrologic monitoring stations. Edward German and Sandra Kinnaman, both of USGS, provided meteorological data from the P33 and SH1 evapotranspiration stations for flow analyses. Edward Simonds, USGS, provided logistical and technical support. Michael Duff, formerly of the USGS, developed the ADV filtering and plotting programs used to process, analyze, and display the flow-velocity data.



Base from U.S. Geological Survey South Florida satellite image map, 1993
Universal Transverse Metcator, NAD 83, Zone 17 Meters

Figure 1. Satellite image of south Florida showing locations of monitoring stations SH1, GS-203, GS-33, and NP202 in Everglades National Park, 1:500,000 scale.

Selection and Description of Flow-Monitoring Sites

Locations of the flow-velocity and water-temperature monitoring stations SH1, GS-203, GS-33, and NP202 are shown in figure 1. Thermistor strings were deployed at all four sites. ADV units were deployed at SH1, GS-203, and GS-33. The ADV units at GS-203 and GS-33 were equipped with integrated MicroCAT conductivity/temperature probes.

Sites SH1, GS-203, and GS-33 were established in differing vegetative communities as previously described in Riscassi and Schaffranek (2002). The ADV unit installed at GS-33 in August 2001 was intended to provide flow-velocity data to supplement water and air temperature profiling initiated at the site during the 2000–2001 wet season (Riscassi and Schaffranek, 2002). In August 2001, a thermistor string was deployed at the ENP NP202 hydrologic station (fig. 2) to monitor the temperature profile in an area of dense cattails. Site locations and instrumentation deployed at the sites during the 2001–2002 wet season are identified in table 1 for all four monitoring stations.

Methods

Methods developed to measure the flow velocity, temperature, and conductivity are identical to those defined in Riscassi and Schaffranek (2002). A brief description of the measurement techniques and a summary of the deployment techniques and critical parameter settings for the instrumentation are provided in this section of the report.

Figure 2. Thermistor string (attached to PVC pipe in center background indicated by arrow) deployed in a dense cattail area at NP202 in Shark River Slough, Everglades National Park, Florida.

Table 1. Site locations and instrumentation for flow-velocity and water-temperature monitoring stations, Shark River Slough, Everglades National Park, Florida

[UTM, Universal Transverse Mercator; NAD, North American Datum; m, meter; ADV, Acoustic Doppler Velocity]

Site Name	UTM Coordinates NAD 83, Zone 17		Location	Instrumentation
	East (m)	North (m)		
GS-203	526133	2833920	160 m from NP203 hydrologic station at 22.7 degrees west of south	ADV unit, MicroCAT meter, thermistor string, data logger, solar panel
GS-33	529637	2833457	440 m from P33 hydrologic station at 30.6 degrees west of north	ADV unit, MicroCAT meter, thermistor string, data logger, solar panel
SH1	515249	2817258	10 m southwest of SH1 hydrologic station	ADV unit, thermistor string, data logger, solar panel
NP202	529245	2838450	Co-located with NP202 hydrologic station	Thermistor string, data logger, solar panel

Measurement Techniques

Flow velocities were measured at a fixed point in the water column using SonTek/YSI 10 MHz ADVField units (Sontek, 2001). Conductivity and temperature data were measured near the top of the litter layer using MicroCAT model SBE 37-SI meters developed by Sea-Bird Electronics (Sea-Bird Electronics, 1999). Temperatures were measured at 5-, 15-, or 30-minute intervals in the plant litter, at 5- or 10-cm-depth increments throughout the water column, on the water surface, and in the air above the water column using glass-encapsulated thermistors manufactured by Yellow Springs Instruments (YSI) (Yellow Springs Instruments, 1998). Riscassi and Schaffranek (2002) present detailed descriptions of the instrumentation, including accuracy and resolution specifications.

Deployment Techniques and Parameter Settings

Deployment techniques and procedures used for the 2001–2002 wet season were the same as those documented in Riscassi and Schaffranek (2002) for the 1999–2001 wet seasons. ADV-deployment parameter settings at SH1, GS-203, and GS-33 are provided in table 2. MicroCAT meters were deployed 6 and 13 cm above the plant-litter layer near the ADV meters at GS-33 and GS-203, respectively. Thermistor positions, in relation to the top of the plant-litter layer, and temperature recording intervals at all four monitoring sites are listed in table 3. The ADV recording interval and sample volume location, relative to the top of the plant-litter layer, are provided in table 4 for each ADV deployment. Approximate water depths determined from water levels recorded at nearby hydrologic stations also are listed in table 4.

Table 2. Deployment parameter settings for SH1, GS-203, and GS-33 ADV units, Shark River Slough, Everglades National Park, Florida

[min, minute; Temp, temperature; ºC, degrees Celsius; ppt, parts per thousand; Vel, velocity; cm/s, centimeter per second; Coord, Coordinate; EDT, Eastern Daylight Time; EST, Eastern Standard Time; ENU, geodetic East North Up; XYZ, Cartesian coordinates].

Deployment Parameters					
Deployment period [1]	Recording interval (min)	Temp (°C)	Salinity (ppt)	Vel range (cm/s)	Coord system
SH1 2001–2002 wet season					
08/15/01 1500 – 10/10/01 1300 EDT	30	25	0.0	+/- 250	ENU
10/11/01 1130 – 11/06/01 1230 EDT	30	25	0.0	+/- 10	ENU
11/08/01 1000 – 01/23/02 1500 EST	30	25	0.0	+/- 10	ENU
01/24/02 1500 – 02/12/02 1230 EST	30	25	0.0	+/- 10	ENU
GS-203 2001–2002 wet season					
08/09/01 1330 – 08/15/01 1530 EDT	30	25	0.0	+/- 10	XYZ
08/16/01 1100 – 10/10/01 1400 EDT	30	25	0.0	+/- 10	XYZ
10/11/02 1030 – 11/06/01 1130 EDT	30	25	0.0	+/- 10	XYZ
11/08/01 0900 – 01/23/02 1600 EST	30	25	0.0	+/- 10	ENU
01/24/02 1505 – 02/12/02 1335[2] EST	30	25	0.0	+/- 10	ENU
GS-33 2001–2002 wet season					
08/09/01 1600 – 08/15/01 1530 EDT	30	30	0.0	+/- 250	XYZ
08/16/01 1000 – 10/10/01 1530 EDT	30	30	0.0	+/- 250	XYZ
10/11/01 1600 – 11/06/01 1000 EDT	30	25	0.0	+/- 10	ENU
11/08/01 0900 – 01/23/02 1630 EST	30	25	0.0	+/- 10	ENU
01/25/02 0915 – 02/12/02 1445[2] EST	30	25	0.0	+/- 10	ENU

[1] Excludes any invalid data segments at beginning and end of deployment record.

[2] Data collection inadvertently initiated at non-multiple time interval.

Table 3. Deployment specifications and parameter settings for SH1, GS-203, GS-33, and NP202 thermistor strings, Shark River Slough, Everglades National Park, Florida

[min, minute; cm, centimeter; EDT, Eastern Daylight Time; EST, Eastern Standard Time]

Deployment Period	Recording interval (min)	Thermistor height[1] (cm)
	SH1 2001–2002 wet season	
08/15/01 1350 – 10/11/01 1050 EDT	5	0, 10, 20, 30, 40, 50, 60, 70, 80, 90, 110
10/11/01 1055 – 11/06/01 1245 EST	5	0, 10, 20, 30, 40, 50, 60, 70, 80, 90, 110
11/06/01 1250 – 01/23/02 1155 EST	5	0, 10, 20, 30, 40, 50, 60, 70, 80, 90, 110
01/23/02 1200 – 02/12/02 1230 EST	5	0, 10, 20, 30, 40, 50, 60, 70, 80, 90, 110
02/12/02 1245 – 07/25/02 0830[2] EST	15	0, 10, 20, 30, 40, 50, 60, 70, 80, 90, 110
	GS-203 2001–2002 wet season	
08/08/01 1800 – 10/11/01 0930 EDT	30	0, 10, 20, 25, 30, 35, 40, 45, 55, 65, water surface
10/26/01 1810 – 11/06/01 1155 EST	5	0, 10, 20, 25, 30, 35, 40, 45, 55, 65, water surface
11/06/01 1200 – 01/23/02 1540 EST	5	0, 10, 20, 25, 30, 35, 40, 45, 55, 65, water surface
01/23/02 1545 – 02/12/02 1410 EST	5	0, 10, 20, 25, 30, 35, 40, 45, 55, 65, water surface
02/12/02 1415 – 06/27/02 0845[3] EST	15	0, 10, 20, 25, 30, 35, 40, 45, 55, 65, water surface
	GS-33 2001–2002 wet season	
08/08/01 1630 – 10/11/01 0830 EDT	30	0, 10, 20, 25, 30, 35, 40, 45, 55, 65, water surface [6]
10/11/01 0910 – 11/06/01 1030 EST	5	0, 10, 20, 25, 30, 35, 40, 45, 55, 65, water surface [6]
11/06/01 1035 – 01/06/02 0210 EST	5	0, 10, 20, 25, 30, 35, 40, 45, 55, 65, water surface [6]
01/23/02 1705 – 02/12/02 1515 EST	5	0, 10, 20, 25, 30, 35, 40, 45, 55, 65, water surface [6]
02/12/02 1530 – 06/27/02 1115[4] EST	15	0, 10, 20, 25, 30, 35, 40, 45, 55, 65, water surface [6]
	NP202 2001–2002 wet season	
08/10/01 1130 – 10/10/01 1440 EDT	5	0, 10, 20[7], 30, 40, 50, 60, 70, 80, 90, water surface
10/10/01 1445 – 11/06/01 1105 EDT	5	0, 10, 20[8], 30, 40, 50, 60, 70, 80, 90, water surface
11/06/01 1110 – 01/24/02 1620 EST	5	0, 10, 20, 30, 40, 50, 60, 70, 80, 90, water surface
01/24/02 1625 – 02/13/02 0835 EST	5	0, 10, 20, 30, 40, 50, 60, 70, 80, 90, water surface
02/13/02 0840 – 06/27/02 1245[5] EST	15	0, 10, 20, 30, 40, 50, 60, 70, 80, 90, water surface

[1] Measured from 1-2 cm below top of plant-litter layer.

[2] All thermistors out of water from approximately 04/04/02 – 06/02/02.

[3] All thermistors out of water from approximately 03/18/02 – 06/02/02.

[4] All thermistors out of water from approximately 03/18/02 – 06/02/02.

[5] All thermistors out of water from approximately 03/24/02 – 06/01/02.

[6] Floating water-surface thermistor hung on vegetation, therefore not measuring water temperature.

[7] No data recorded for thermistor 9/7/01 0835 – 10/10/01 1440 due to communications failure.

[8] No data recorded for thermistor 10/10/01 1130 – 10/29/01 0310 due to communications failure.

Table 4. ADV data-collection summaries for SH1, GS-203, and GS-33, Shark River Slough, Everglades National Park, Florida

[min, minute; cm, centimeter; avg, average; EDT, Eastern Daylight Time; EST, Eastern Standard Time]

Deployment period [1]	Recording interval (min)	Sample volume location above top of litter (cm)	Approximate water depth range (avg) (cm)
SH1 2001–2002 wet season			
08/15/01 1500 – 10/10/01 1300 EDT	30	22	37 – 68 (50)
10/11/01 1130 – 11/06/01 1230 EDT	30	22	56 – 65 (61)
11/08/01 1000 – 01/23/02 1500 EST	30	22	41 – 59 (50)
01/24/02 1500 – 02/12/02 1230 EST	30	22	31 – 40 (35)
GS-203 2001–2002 wet season			
08/09/01 1330 – 08/15/01 1530 EDT	30	15	27 – 29 (28)
08/16/01 1100 – 10/10/01 1400 EDT	30	27	27 – 56 (39)
10/11/02 1030 – 11/06/01 1130 EDT	30	27	50 – 61 (55)
11/08/01 0900 – 01/23/02 1600 EST	30	27	26 – 56 (46)
01/24/02 1505 – 02/12/02 1335 [2] EST	30	10	19 – 25 (22)
GS-33 2001–2002 wet season			
08/09/01 1600 – 08/15/01 1530 EDT	30	10	30 – 31 (30)
08/16/01 1000 – 10/10/01 1530 EDT	30	10	31 – 60 (42)
10/11/01 1600 – 11/06/01 1000 EDT	30	26	50 – 61 (54)
11/08/01 0900 – 01/23/02 1630 EST	30	26	30 – 56 (46)
01/25/02 0915 – 02/12/02 1445 [2] EST	30	13	24 – 29 (26)

[1] Excludes any invalid data segments at beginning and end of deployment record.

[2] Data collection inadvertently initiated at non-multiple time interval.

Processing Flow-Velocity, Conductivity, and Temperature Data

In post-processing the flow-velocity, conductivity, and temperature data, factors such as instrument accuracies and environmental difficulties associated with the wetland deployments were considered in the development of applicable processing techniques. The techniques and editing criteria used to quality check and verify the data are summarized in the following report sections.

ADV Flow Data

The techniques used to process ADV data collected during the 2001–2002 wet season are a continuation of methods developed and documented previously in Riscassi and Schaffranek (2002). A preliminary data-inspection process, a pre-editing data-conversion process, a quantitative data-editing process, and a qualitative inspection process were used to edit, verify, and otherwise process the recorded flow-velocity data. Specific deployment parameter settings used to collect the data and post-processing corrections applied to edit the data are provided in table 5.

Editing and filtering criteria used to process the ADV data for the 2001–2002 wet season include those suggested by the instrument manufacturer to detect suspect data attributed to poor signal quality (SonTek, 2001) and those developed during the processing and concurrent analysis of past ADV data (Ball and Schaffranek, 2000; Riscassi and Schaffranek, 2002). The equipment manufacturer suggests minimum signal-to-noise-ratio (SNR) and statistical-correlation values of 5 dB and 70 percent, respectively, as indicative of good acoustic signal quality (SonTek, 2001). SNR values are derived from acoustic signal strengths measured during the deployment and the ambient electron-

Table 5. Post-processing changes to ADV deployment parameter settings for SH1, GS-203, and GS-33, Shark River Slough, Everglades National Park, Florida

[ºC, degrees Celsius; ppt, part per thousand; EDT, Eastern Daylight Time; EST, Eastern Standard Time; ENU, geodetic East North Up; XYZ, Cartesian coordinates]

Deployment period[1]	Temperature		Salinity		Coordinate system	
	Old (°C)	New (°C)	Old (ppt)	New (ppt)	Old	New
SH1 2001–2002 wet season						
08/15/01 1500 – 10/10/01 1300 EDT	25	30	0.0	0.10	ENU	—
10/11/01 1130 – 11/06/01 1230 EDT	25	26	0.0	0.10	ENU	—
11/08/01 1000 – 01/23/02 1500 EST	25	23	0.0	0.10	ENU	—
01/24/02 1500 – 02/12/02 1230 EST	25	24	0.0	0.10	ENU	—
GS-203 2001–2002 wet season						
08/09/01 1330 – 08/15/01 1530 EDT	25	31	0.0	0.17	XYZ	ENU
08/16/01 1100 – 10/10/01 1400 EDT	25	30	0.0	0.17	XYZ	ENU
10/11/02 1030 – 11/06/01 1130 EDT	25	23	0.0	0.19	XYZ	ENU
11/08/01 0900 – 01/23/02 1600 EST	25	22	0.0	0.22	ENU	—
01/24/02 1505 – 02/12/02 1335[2] EST	25	23	0.0	0.26	ENU	—
GS-33 2001–2002 wet season						
08/09/01 1600 – 08/15/01 1530 EDT	30	31	0.0	0.22	XYZ	ENU
08/16/01 1000 – 10/10/01 1530 EDT	30	29	0.0	0.22	XYZ	ENU
10/11/01 1600 – 11/06/01 1000 EDT	25	25	0.0	0.22	ENU	—
11/08/01 0900 – 01/23/02 1630 EST	25	22	0.0	0.26	ENU	—
01/25/02 0915 – 02/12/02 1445[2] EST	25	22	0.0	0.26	ENU	—

[1] Excludes any invalid data segments at beginning and end of deployment record.

[2] Data collection inadvertently initiated at non-multiple time interval.

ics noise of the particular ADV meter used. SNR values are used to verify that particulate matter of appropriate size and concentration was present in the water column to produce a reflected acoustic signal that was sufficiently stronger than the ambient instrument noise. Particulate matter concentrations at the ADV measurement sites yielded average signal amplitudes of 84, 96, and 94 counts at GS-203, GS-33, and SH1, respectively, for all deployments. Ambient instrument noise levels of the ADV units deployed at GS-203, GS-33, and SH1 were 66, 72, and 84 counts, respectively. Thus, average SNR values were approximately 8 dB (range 5–20 dB) at GS-203, 10 dB (range 5–25 dB) at GS-33, and 5 dB (range 2–12 dB) at SH1 during all deployments. Although SNR values were computed for each burst for all ADV deployments, they were not used as a quantitative automated data-editing criterion. Instead, they were used in the qualitative editing processes as a means to evaluate the reliability of data that passed the quantitative filter criterion but were deemed potentially erroneous or suspect in comparison to other flow speeds and directions measured during the deployment period.

Data that passed the preliminary data inspection and validation process were first processed to correct for coordinate-system conversions and sound-speed re-calculations prior to quantitative automated data editing. The initial automated data-editing process consisted of the application of two filter criteria, one based on a minimal statistical correlation for each sample and the other on minimal number of valid samples per burst. A minimum correlation value of 70 percent was used as the statistical-filtering criterion. The number used for the minimum samples-per-burst criterion was determined by examination and assessment of plots of burst-averaged velocities generated using various values of 600, 500, 400, 300, 200, 100, and 1 (i.e., no minimum) in processing ADV data sets from the SH1, GS-203, and GS-33 sites. As was determined for the 1999–2001 data sets, the 100-minimum filter criterion appeared too inclusive of suspect data and the 300-minimum

criterion appeared overly exclusive of apparently valid data. Consequently, for the 10-Hz 1-minute burst sampling conducted at all three ADV sites, a criterion of 200 was determined to be the most appropriate minimum samples-per-burst filter and it was subsequently used to process all ADV data sets. Differences between daily mean horizontal flow velocities computed using the most liberal criterion, one minimum sample, and all others (100, 200, 300, 400, 500, and 600) were found to be small in sensitivity tests conducted with past data (Riscassi and Schaffranek, 2002) and data documented in this report. (For the November 2001 through January 2002 deployments at SH1, GS-203, and GS-33, average maximum mean-daily velocity differences using all seven samples-per-burst filters were calculated. Average maximum differences of 0.11, 0.03, and 0.009 cm/s were found with the largest maximum differences being 0.84, 0.42, and 0.10 cm/s, respectively.)

A secondary qualitative processing technique included the generation of plots of filtered data to detect any remaining anomalous horizontal flow speeds and directions. The qualitative inspection resulted in the removal of 5 percent of velocity bursts from all deployments at SH1 and 2 percent of velocity bursts from all GS-203 deployments, which included a 14-day period when water levels fell below the transducer of the ADV probe. For all valid deployments at GS-33, 19 percent of the velocity bursts were removed in the qualitative analyses, which included a 9-day period when water levels fell below the transducer of the ADV probe. Bursts that did not pass the qualitative inspection process were deleted and daily mean horizontal-flow speeds and directions were recalculated. The percentages of data that did not pass both the quantitative automated-filter and qualitative-analysis processes for each ADV deployment period are presented with daily mean flow summaries in appendix tables A, B, and C. The subsequent removal of individual velocity bursts by qualitative analysis did not significantly change the resultant daily mean velocity magnitudes or flow directions.

MicroCAT Conductivity and Temperature Data

Temperatures measured by the MicroCAT meter near the top of the plant-litter layer at GS-203 and GS-33 were compared to temperatures measured by the thermistor in the temperature string at approximately the same depth in the water column. Good agreement was found for all deployments. No anomalies were found in the MicroCAT temperature data; therefore, the data are made available on the SOFIA website as originally recorded. Daily mean temperatures, derived from data measured by the MicroCAT meters at GS-203 and GS-33, are reported in appendix tables B and C, respectively.

Conductivity data measured by the MicroCAT meter were compared to conductivity measurements taken with a hand-held portable YSI Model 30 meter during field visits. Good agreement was found between the YSI conductivity measurements and MicroCAT data at both GS-203 and GS-33 (figs. 3 and 4). No anomalies were found in MicroCAT conductivity data; therefore, the data are made available on the SOFIA website as originally recorded. Daily mean specific conductance values calculated from conductivities recorded at GS-203 and GS-33 are reported in appendix tables B and C, respectively. Conductivity data are recorded in siemens per meter and converted to specific conductance in microsiemens per centimeter (µS/cm) for reporting purposes as documented in Riscassi and Schaffranek (2002).

Thermistor String Temperature Profile Data

All temperature profile data from the thermistor strings were plotted and inspected for anomalies. Temperatures from the thermistor closest to the height of the MicroCAT probe above the litter layer also were compared to the MicroCAT recorded temperatures. No suspect data were found in the visual inspection or MicroCAT comparisons. Times when all thermistors were out of the water, thus measuring only air temperatures, are identified in table 3. Temperature profile data documented in this report are available on the SOFIA website.

Flow-Velocity, Conductivity, and Temperature Data Summary

The following report sections summarize the data collected at all four monitoring sites, SH1, GS203, GS33, and NP202, for all deployments during the 2001–2002 wet season. Daily mean flow velocities measured by ADV meters, MicroCAT measured temperatures, and specific conductances derived from MicroCAT measured conductivities are reported in Appendices A, B, and C.

Flow-Velocity Data

Valid flow-velocity data were not obtained from two ADV deployments at GS-33 during the 2001–2002 wet season. During the first two deployments at GS-33 (table 2), the velocity range setting for the ADV meter reverted to the instrument default of ±250 cm/s, instead of a more appropriate setting of ±10 cm/s, making the probe less sensitive to detecting very small velocities. As a consequence, no valid velocity data are available from these two deployments. For the initial deployment at SH1 the ADV meter also defaulted to a ±250 cm/s range setting, however, the recorded ADV data were not found to be appreciably noisy and were successfully qualitatively filtered to extract a valid set of flow velocities.

Vectors showing velocity magnitudes and flow directions in the horizontal plane, relative to magnetic north, measured during the 2001–2002 wet season at sites SH1, GS-203, and GS-33 are illustrated in figures 5, 6, and 7, respectively. Horizontal velocity magnitudes generally ranged from 0.4 to 2.5 cm/s at SH1 (fig. 5), from 0.4 to 1.8 cm/s at GS-203 (fig. 6), and from 0.02 to 1.5 cm/s at GS-33 (fig. 7). Horizontal flow

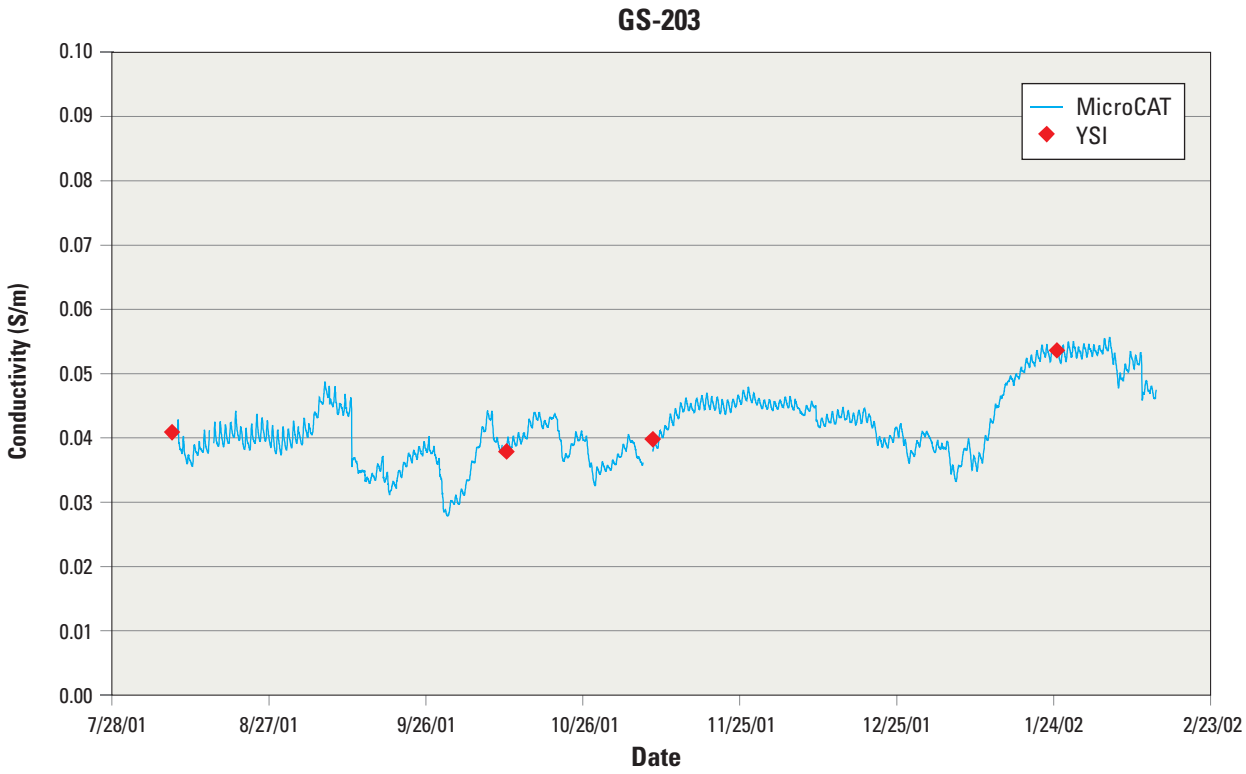


Figure 3. Conductivities measured continuously by MicroCAT probe and intermittently by hand-held YSI meter at GS-203 in Shark River Slough, Everglades National Park, Florida. (S/m = siemens per meter)

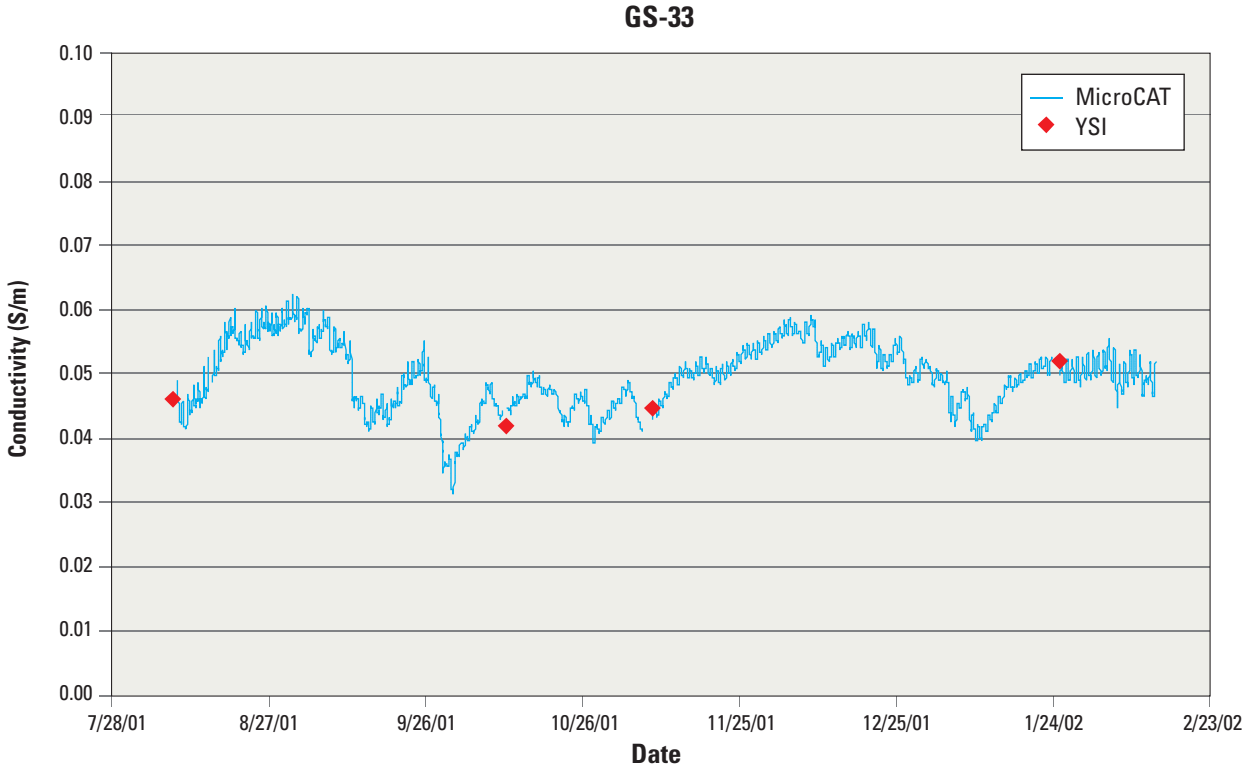


Figure 4. Conductivities measured continuously by MicroCAT probe and intermittently by hand-held YSI meter at GS-33 in Shark River Slough, Everglades National Park, Florida. (S/m = siemens per meter)

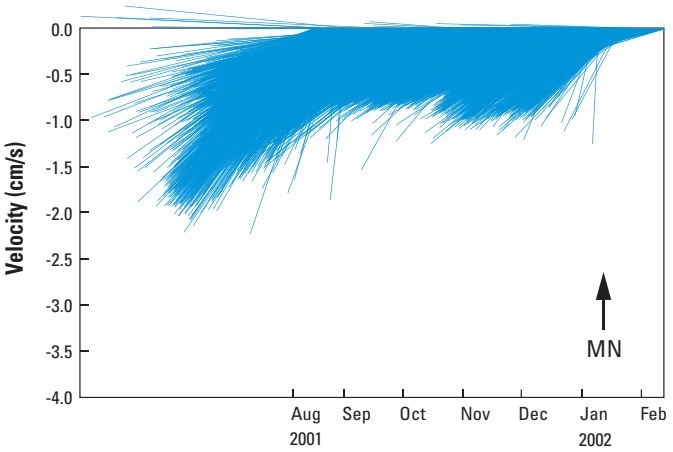


Figure 5. Burst-averaged flow velocities, shown as vectors relative to magnetic north, at SH1 in Shark River Slough, Everglades National Park, Florida, during the 2001–2002 wet season. (cm/s = centimeter per second; MN, magnetic north; negative velocity indicates south direction)

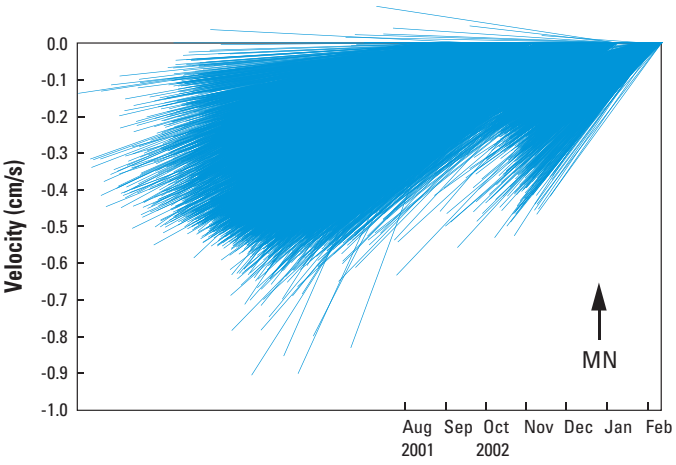


Figure 6. Burst-averaged flow velocities, shown as vectors relative to magnetic north, at GS-203 in Shark River Slough, Everglades National Park, Florida, during the 2001–2002 wet season. (cm/s = centimeter per second; MN, magnetic north; negative velocity indicates south direction)

directions at all locations generally ranged from 180 to 275 degrees, clockwise with respect to magnetic north (MN). (Declination corrections to Geodetic North are less than the +/- 2 degree accuracy of the ADV compass and, therefore, are not applied to the MN coordinates reported herein.) Horizontal flow directions averaged approximately 235 degrees at SH1, 251 degrees at GS-203, and 194 degrees at GS-33. Corresponding daily mean horizontal-flow velocities are reported in tabular form for SH1, GS-203, and GS-33 in Appendices A, B, and C, respectively.

Conductivity and Temperature Data

Specific conductance values, which were calculated from measured conductivities, ranged from approximately 281 to 568 µS/cm at GS-203 and from 315 to 594 µS/cm at GS-33. Water temperatures recorded by the MicroCAT meter near the top of the litter layer ranged from approximately 13 to 36 °C during all deployments at GS-203 and from 13 to 38 °C during all deployments at GS-33. During all deployments, temperatures fluctuated several degrees in a daily pattern. Daily mean water temperature and specific conductance values are reported in tabular form for GS-203 and GS-33 in Appendices B and C, respectively.

Temperature Profile Data

Water-column temperatures measured by the thermistor strings for all deployments at all sites ranged from approximately 11 to 38 °C in the 2001–2002 wet season. Daily vertical temperature gradients often approached 3 to 4 °C.

Data Availability

The quality-checked and edited flow-velocity, water-temperature, and specific-conductance data for the 2001–2002 wet season are available on the World Wide Web. Three-dimensional velocity component data (including associated statistical correlation and SNR values for each component), water-temperature, specific conductance, and water- and air-temperature profile data are available for downloading from the Data Exchange page of the USGS South Florida Information Access (SOFIA) website *http://sofia.usgs.gov*. Flow-velocity data also are available for downloading from the Data page of the Tides and Inflows in the Mangroves of the Everglades (TIME) website *http://time.er.usgs.gov*.

Summary

The data-collection effort described in this report is in support of the U.S. Geological Survey (USGS) Place-Based Studies project to investigate “Forcing Effects on Flow Structure in Vegetated Wetlands of the Everglades.” The acquisition, processing, and evaluation of flow-velocity, water-temperature, and conductivity data collected at four locations (sites SH1, GS-203, GS-33, and NP202) in Shark River Slough, Everglades National Park, Florida, during the 2001–2002 wet season are documented in this report. Temperatures were monitored at 5-, 15-, or 30-minute intervals throughout the water column at all four sites, 3-D component flow velocities were monitored bi-hourly at a fixed point in the water column at SH1, GS-203, and GS-33, and conductivities and temperatures were monitored bi-hourly near the

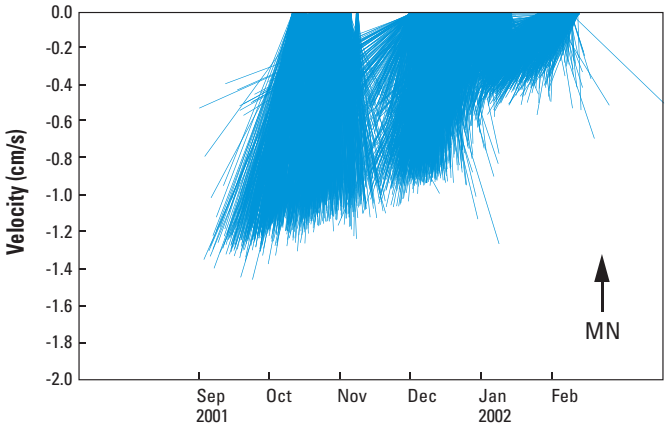


Figure 7. Burst-averaged flow velocities, shown as vectors relative to magnetic north, at GS-33 in Shark River Slough, Everglades National Park, Florida, during the 2001–2002 wet season. (cm/s = centimeter per second; MN, magnetic north; negative velocity indicates south direction)

top of the plant-litter layer at GS-203 and GS-33. Velocity vectors defining horizontal flow speeds and directions measured at sites SH1, GS-203, and GS-33 are illustrated in the report. Mean daily horizontal flow velocities, water temperatures, and specific conductance values are listed in tabular form in the report appendices. The quality-checked and edited data have been compiled and stored on the USGS South Florida Information Access (SOFIA) (*http://sofia.usgs.gov*) and the Tides and Inflows in the Mangroves of the Everglades (TIME) *(http://time.er.usgs.gov)* websites.

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Appendix A

Daily mean flow velocities and water depths at station SH1, Shark River Slough, Everglades National Park, Florida during the 2001–2002 wet season.

Table A - 1. Daily mean flow velocities and water depths at station SH1 during deployment period 08/15/01 1500–10/10/01 1300

[cm/s, centimeter per second; ° CW from MN, degrees clockwise from magnetic north]

Date	Flow velocity[1] (cm/s)	Flow direction[1] (° CW from MN)	Water depth (cm)
08/16/01	1.72	215	44
08/17/01	2.01	209	43
08/18/01	1.76	214	42
08/19/01	1.70	212	41
08/20/01	1.82	213	41
08/21/01	2.02	211	42
08/22/01	2.02	211	43
08/23/01	1.35	219	44
08/24/01	1.28	221	43
08/25/01	1.16	226	44
08/26/01	1.33	222	42
08/27/01	1.37	219	41
08/28/01	1.26	222	41
08/29/01	1.41	210	42
08/30/01	1.44	217	41
08/31/01	1.45	217	40
09/01/01	1.57	214	39
09/02/01	1.56	213	39
09/03/01	1.45	212	39
09/04/01	1.25	225	38
09/05/01	1.03	239	38
09/06/01	1.13	239	39
09/07/01	1.11	233	40
09/08/01	1.06	231	41
09/09/01	1.26	226	41
09/10/01	1.35	221	42
09/11/01	1.27	229	44
09/12/01	1.22	230	46
09/13/01	1.15	228	48
09/14/01	1.32	232	51
09/15/01	1.29	240	53

Continued

Table A - 1. Daily mean flow velocities and water depths at station SH1 during deployment period 08/15/01 1500–10/10/01 1300 — Continued

[cm/s, centimeter per second; ° CW from MN, degrees clockwise from magnetic north]

Date	Flow velocity[1] (cm/s)	Flow direction[1] (° CW from MN)	Water depth (cm)
09/16/01	1.38	244	54
09/17/01	1.51	235	54
09/18/01	1.44	235	55
09/19/01	1.44	237	55
09/20/01	1.43	236	55
09/21/01	1.42	238	56
09/22/01	1.42	236	56
09/23/01	1.40	237	56
09/24/01	1.42	238	57
09/25/01	1.33	236	57
09/26/01	1.35	236	57
09/27/01	1.27	241	57
09/28/01	1.20	230	57
09/29/01	1.42	242	66
09/30/01	1.41	245	69
10/01/01	1.32	250	69
10/02/01	1.34	249	68
10/03/01	1.43	247	68
10/04/01	1.37	246	67
10/05/01	1.28	243	66
10/06/01	1.30	241	65
10/07/01	1.28	241	65
10/08/01	1.31	239	64
10/09/01	*	*	63
* All bursts filtered out			
MINIMUM	1.03	209	38
MAXIMUM	2.02	250	69
AVERAGE	1.40	229	50
BURSTS FILTERED OUT (%)	5		

[1] Flow sample volume located 22 cm above top of litter.

Table A - 2. Daily mean flow velocities and water depths at station SH1 during deployment period 10/11/01 1130 – 11/06/01 1230

[cm/s, centimeter per second; º CW from MN, degrees clockwise from magnetic north]

Date	Flow velocity[1] (cm/s)	Flow direction[1] (° CW from MN)	Water depth (cm)
10/12/01	1.35	238	61
10/13/01	1.29	238	60
10/14/01	1.27	240	60
10/15/01	1.51	230	59
10/16/01	1.50	229	59
10/17/01	1.45	231	58
10/18/01	1.49	230	57
10/19/01	1.59	229	57
10/20/01	1.33	238	57
10/21/01	1.40	239	58
10/22/01	1.29	246	63
10/23/01	1.30	247	64
10/24/01	1.29	248	64
10/25/01	1.32	244	65
10/26/01	1.39	244	65
10/27/01	1.39	242	64
10/28/01	0.98	241	64
10/29/01	1.05	245	63
10/30/01	0.94	243	63
10/31/01	0.73	240	63
11/01/01	0.79	251	62
11/02/01	0.98	252	61
11/03/01	1.14	244	61
11/04/01	1.25	239	61
11/05/01	1.31	241	61
MINIMUM	0.73	229	57
MAXIMUM	1.59	252	65
AVERAGE	1.25	240	61
BURSTS FILTERED OUT (%)	5		

[1] Flow sample volume located 22 cm above top of litter.

Table A - 3. Daily mean flow velocities and water depths at station SH1 during deployment period 11/08/01 1000 – 01/23/02 1500

[cm/s, centimeter per second; ° CW from MN, degrees clockwise from magnetic north]

Date	Flow velocity[1] (cm/s)	Flow direction[1] (° CW from MN)	Water depth (cm)
11/09/01	1.43	237	58
11/10/01	1.34	236	58
11/11/01	1.40	238	57
11/12/01	1.38	238	56
11/13/01	1.34	237	56
11/14/01	1.30	236	55
11/15/01	1.30	235	54
11/16/01	1.30	236	54
11/17/01	1.28	235	53
11/18/01	1.20	232	53
11/19/01	1.20	231	52
11/20/01	1.19	232	52
11/21/01	1.17	235	52
11/22/01	1.14	233	51
11/23/01	1.19	236	51
11/24/01	1.18	236	50
11/25/01	1.13	234	50
11/26/01	1.20	237	49
11/27/01	1.23	239	48
11/28/01	1.23	239	48
11/29/01	1.29	238	48
11/30/01	1.27	237	47
12/01/01	1.22	235	47
12/02/01	1.28	236	47
12/03/01	1.24	233	47
12/04/01	1.22	233	46
12/05/01	1.23	234	46
12/06/01	1.26	234	46
12/07/01	1.25	235	46
12/08/01	1.22	234	46
12/09/01	1.41	236	48
12/10/01	1.61	241	54

Continued

Table A - 3. Daily mean flow velocities and water depths at station SH1 during deployment period 11/08/01 1000 – 01/23/02 1500 — Continued

[cm/s, centimeter per second; º CW from MN, degrees clockwise from magnetic north]

Date	Flow velocity[1] (cm/s)	Flow direction[1] (° CW from MN)	Water depth (cm)
12/11/01	1.50	240	54
12/12/01	1.42	239	54
12/13/01	1.39	237	54
12/14/01	1.31	241	54
12/15/01	1.19	246	53
12/16/01	1.23	245	52
12/17/01	1.28	239	51
12/18/01	1.23	237	51
12/19/01	1.22	236	50
12/20/01	1.14	234	52
12/21/01	1.14	234	53
12/22/01	1.08	232	52
12/23/01	1.13	228	52
12/24/01	1.11	230	51
12/25/01	1.25	226	51
12/26/01	0.97	229	51
12/27/01	1.21	223	50
12/28/01	1.24	220	50
12/29/01	1.16	221	49
12/30/01	1.02	224	49
12/31/01	1.09	228	49
01/01/02	0.96	229	49
01/02/02	0.94	242	51
01/03/02	0.91	239	54

Continued

Table A - 3. Daily mean flow velocities and water depths at station SH1 during deployment period 11/08/01 1000 – 01/23/02 1500 — Continued

[cm/s, centimeter per second; º CW from MN, degrees clockwise from magnetic north]

Date	Flow velocity[1] (cm/s)	Flow direction[1] (° CW from MN)	Water depth (cm)
01/04/02	1.28	247	53
01/05/02	1.00	246	52
01/06/02	0.80	246	51
01/07/02	0.77	233	51
01/08/02	0.84	228	50
01/09/02	0.81	234	49
01/10/02	0.88	235	49
01/11/02	0.82	238	48
01/12/02	0.80	242	47
01/13/02	0.85	232	47
01/14/02	0.83	229	46
01/15/02	0.85	240	46
01/16/02	0.82	236	45
01/17/02	1.00	234	45
01/18/02	1.14	230	44
01/19/02	1.32	237	43
01/20/02	1.18	221	43
01/21/02	1.25	224	42
01/22/02	1.25	226	42
MINIMUM	0.77	220	42
MAXIMUM	1.61	247	58
AVERAGE	1.16	235	50
BURSTS FILTERED OUT (%)	3		

[1] Flow sample volume located 22 cm above top of litter.

Table A - 4. Daily mean flow velocities and water depths at station SH1 during deployment period 01/24/02 1500 – 02/12/02 1230

[cm/s, centimeter per second; º CW from MN, degrees clockwise from magnetic north]

Date	Flow velocity[1] (cm/s)	Flow direction[1] (° CW from MN)	Water depth (cm)
01/25/02	1.10	248	40
01/26/02	1.04	251	39
01/27/02	1.03	245	39
01/28/02	1.03	247	38
01/29/02	0.93	245	37
01/30/02	1.01	244	37
01/31/02	1.14	249	36
02/01/02	1.34	250	36
02/02/02	1.23	244	35
02/03/02	1.36	251	35
02/04/02	1.48	256	34
02/05/02	1.45	255	34
02/06/02	1.18	260	33
02/07/02	*	*	32
02/08/02	1.42	255	32
02/09/02	1.56	261	32
02/10/02	1.54	264	33
02/11/02	1.41	261	33
* all bursts filtered out			
MINIMUM	0.93	244	32
MAXIMUM	1.56	264	40
AVERAGE	1.25	252	35
BURSTS FILTERED OUT (%)	13		

[1] Flow sample volume located 22 cm above top of litter.

Appendix B

Daily mean flow velocities, water-temperatures, specific conductances, and water depths at station GS-203, Shark River Slough, Everglades National Park, Florida during the 2001–2002 wet season.

Table B-1. Daily mean flow velocities, MicroCAT water temperatures and specific conductances, and water depths at station GS-203 during deployment period 08/09/01 1330 – 08/15/01 1530

[cm/s, centimeter per second; º CW from MN, degrees clockwise from magnetic north; º C, degrees Celsius; µS/cm, microsiemens per centimeter]

Date	Flow velocity[1] (cm/s)	Flow direction[1] (° CW from MN)	Temperature[2] (° C)	Specific conductance[2] (µS/cm)	Water depth (cm)
08/10/01	1.08	251	31.01	342	29
08/11/01	0.94	247	30.43	331	28
08/12/01	0.88	241	31.06	330	28
08/13/01	0.95	248	31.46	337	27
08/14/01	1.07	251	32.25	340	27
MINIMUM	0.88	241	30.43	330	27
MAXIMUM	1.08	251	32.25	342	29
AVERAGE	0.99	248	31.24	336	28
BURSTS FILTERED OUT (%)	0		0	0	

[1] Flow sample volume located 15 cm above top of litter.

[2] MicroCAT temperature and conductance measured 13 cm above top of litter.

Table B - 2. Daily mean flow velocities, MicroCAT water temperatures and specific conductances, and water depths at station GS-203 during deployment period 08/16/01 1100 – 10/10/01 1400

[cm/s, centimeter per second; º CW from MN, degrees clockwise from magnetic north; º C, degrees Celsius; µS/cm, microsiemens per centimeter]

Date	Flow velocity[1] (cm/s)	Flow direction[1] (° CW from MN)	Temperature[2] (° C)	Specific conductance[2] (µS/cm)	Water depth (cm)
08/17/01	1.02	251	32.84	347	28
08/18/01	0.97	251	32.94	346	27
08/19/01	0.95	249	32.73	351	27
08/20/01	0.94	248	32.25	362	27
08/21/01	0.97	248	30.36	366	28
08/22/01	0.97	248	29.55	361	29
08/23/01	0.95	247	30.58	358	29
08/24/01	1.02	251	31.75	360	29
08/25/01	1.17	256	32.32	358	29
08/26/01	1.01	253	32.62	354	29
08/27/01	0.93	252	32.13	349	29
08/28/01	0.88	249	31.83	343	29
08/29/01	0.88	248	32.00	344	29
08/30/01	0.87	247	32.02	347	29
08/31/01	0.87	248	32.15	351	29
09/01/01	0.85	246	31.61	355	29
09/02/01	0.90	248	31.45	360	30
09/03/01	0.88	250	30.93	367	30
09/04/01	0.88	250	30.41	380	31
09/05/01	0.81	249	30.91	399	31
09/06/01	0.83	250	30.88	418	31
09/07/01	0.91	253	29.63	424	32
09/08/01	0.95	255	29.07	425	33
09/09/01	0.91	255	28.55	416	34
09/10/01	0.95	256	28.38	417	34
09/11/01	0.94	256	28.44	405	37
09/12/01	1.12	262	27.57	347	44

Continued

Table B - 2. Daily mean flow velocities, MicroCAT water temperatures and specific conductances, and water depths at station GS-203 during deployment period 08/16/01 1100 – 10/10/01 1400 — Continued

[cm/s, centimeter per second; ° CW from MN, degrees clockwise from magnetic north; ° C, degrees Celsius; µS/cm, microsiemens per centimeter]

Date	Flow velocity[1] (cm/s)	Flow direction[1] (° CW from MN)	Temperature[2] (° C)	Specific conductance[2] (µS/cm)	Water depth (cm)
09/13/01	0.94	257	27.20	333	43
09/14/01	1.00	251	26.80	328	45
09/15/01	1.07	261	27.23	322	45
09/16/01	1.08	261	28.09	325	44
09/17/01	1.08	259	29.49	326	43
09/18/01	1.07	256	29.75	305	45
09/19/01	0.90	251	29.16	298	46
09/20/01	0.87	248	29.69	306	45
09/21/01	0.87	249	30.54	315	44
09/22/01	0.87	247	30.85	327	43
09/23/01	0.86	249	30.69	334	42
09/24/01	0.85	247	31.02	337	42
09/25/01	0.84	250	31.23	340	41
09/26/01	0.90	254	30.53	346	41
09/27/01	0.98	256	28.68	351	42
09/28/01	1.02	254	27.02	340	44
09/29/01	1.28	261	25.18	295	54
09/30/01	1.17	259	25.49	286	55
10/01/01	1.07	257	26.16	296	54
10/02/01	1.02	258	26.29	299	53
10/03/01	0.95	254	26.68	311	53
10/04/01	0.91	253	27.37	331	54
10/05/01	0.90	252	28.01	351	53
10/06/01	0.81	251	29.30	368	53
10/07/01	0.79	250	30.73	379	52
10/08/01	0.90	253	30.31	385	52
10/09/01	0.96	252	28.01	372	53
MINIMUM	0.79	246	25.18	286	27
MAXIMUM	1.28	262	32.94	425	55
AVERAGE	0.95	252	29.77	350	39
BURSTS FILTERED OUT (%)	0		0	0	

[1] Flow sample volume located 15 cm above top of litter.

[2] MicroCAT temperature and conductance measured 13 cm above top of litter.

Table B - 3. Daily mean flow velocities, MicroCAT water temperatures and specific conductances, and water depths at station GS-203 during deployment period 10/11/02 1030 – 11/06/01 1130

[cm/s, centimeter per second; º CW from MN, degrees clockwise from magnetic north; º C, degrees Celsius; µS/cm, microsiemens per centimeter]

Date	Flow velocity[1] (cm/s)	Flow direction[1] (° CW from MN)	Temperature[2] (° C)	Specific conductance[2] (µS/cm)	Water depth (cm)
10/12/01	1.22	248	27.23	374	51
10/13/01	1.19	246	27.07	381	51
10/14/01	1.17	246	27.05	384	51
10/15/01	1.18	247	27.78	390	50
10/16/01	1.16	245	28.67	399	50
10/17/01	1.26	247	28.12	408	50
10/18/01	1.28	248	25.97	413	50
10/19/01	1.27	248	26.08	415	51
10/20/01	1.28	248	26.37	421	52
10/21/01	1.35	247	25.80	400	56
10/22/01	1.43	250	26.19	361	61
10/23/01	1.34	249	27.55	360	60
10/24/01	1.29	248	28.77	369	60
10/25/01	1.29	247	29.45	368	59
10/26/01	1.43	251	28.81	367	59
10/27/01	1.51	252	23.76	367	58
10/28/01	1.46	251	20.26	375	57
10/29/01	1.37	249	21.12	382	56
10/30/01	1.33	250	21.53	380	56
10/31/01	1.31	249	22.40	376	56
11/01/01	1.29	250	23.47	378	55
11/02/01	1.26	250	24.36	384	55
11/03/01	1.26	249	25.26	389	55
11/04/01	1.25	249	24.48	397	55
11/05/01	1.50	253	22.51	391	57
MINIMUM	1.16	245	20.26	360	50
MAXIMUM	1.51	253	29.45	421	61
AVERAGE	1.31	249	25.60	385	55
BURSTS FILTERED OUT (%)	0		0	0	

[1] Flow sample volume located 27 cm above top of litter.

[2] MicroCAT temperature and conductance measured 13 cm above top of litter.

Table B - 4. Daily mean flow velocities, MicroCAT water temperatures and specific conductances, and water depths at station GS-203 during deployment period 11/08/01 0900 – 01/23/02 1600

[cm/s, centimeter per second; º CW from MN, degrees clockwise from magnetic north; º C, degrees Celsius; µS/cm, microsiemens per centimeter]

Date	Flow velocity[1] (cm/s)	Flow direction[1] (° CW from MN)	Temperature[2] (°C)	Specific conductance[2] (µS/cm)	Water depth (cm)
11/09/01	1.24	249	22.85	414	56
11/10/01	1.31	250	23.33	423	56
11/11/01	1.25	250	23.79	434	55
11/12/01	1.30	251	24.00	441	55
11/13/01	1.32	250	23.80	452	55
11/14/01	1.30	249	23.93	460	55
11/15/01	1.31	248	23.08	465	55
11/16/01	1.30	250	23.03	468	54
11/17/01	1.31	250	23.59	468	54
11/18/01	1.25	248	23.88	467	54
11/19/01	1.25	248	24.20	460	54
11/20/01	1.23	249	24.62	456	54
11/21/01	1.33	247	24.61	452	54
11/22/01	1.27	247	24.51	453	54
11/23/01	1.22	247	24.27	457	53
11/24/01	1.16	247	24.38	463	53
11/25/01	1.06	248	24.51	467	53
11/26/01	1.18	247	24.60	470	53
11/27/01	1.20	246	24.08	471	53
11/28/01	1.17	246	23.55	470	52
11/29/01	1.15	246	23.40	467	52
11/30/01	1.19	247	23.61	464	52
12/01/01	1.22	246	23.58	463	52
12/02/01	1.20	244	23.88	462	52
12/03/01	1.22	246	24.27	461	52
12/04/01	1.24	246	24.25	461	52
12/05/01	1.27	248	23.93	460	51
12/06/01	1.27	249	23.74	454	52
12/07/01	1.17	247	24.26	448	53
12/08/01	1.09	247	25.24	446	53
12/09/01	1.31	249	25.02	439	53
12/10/01	1.49	252	24.69	426	55
12/11/01	1.37	252	24.97	426	54
12/12/01	1.35	252	25.04	430	54
12/13/01	1.29	251	25.01	431	53
12/14/01	1.22	250	25.38	434	52
12/15/01	1.13	251	25.22	432	51
12/16/01	1.17	251	24.65	433	50
12/17/01	1.17	253	24.46	436	50
12/18/01	1.26	253	24.62	438	49
12/19/01	1.19	253	24.61	435	48

Continued

Table B - 4. Daily mean flow velocities, MicroCAT water temperatures and specific conductances, and water depths at station GS-203 during deployment period 11/08/01 0900 – 01/23/02 1600 — Continued

[cm/s, centimeter per second; º CW from MN, degrees clockwise from magnetic north; º C, degrees Celsius; µS/cm, microsiemens per centimeter]

Date	Flow velocity[1] (cm/s)	Flow direction[1] (° CW from MN)	Temperature[2] (°C)	Specific conductance[2] (µS/cm)	Water depth (cm)
12/20/01	1.29	254	23.37	435	47
12/21/01	1.37	255	20.93	432	46
12/22/01	1.31	255	20.25	434	45
12/23/01	1.31	256	20.50	433	44
12/24/01	1.28	257	21.56	435	43
12/25/01	1.31	257	22.29	436	42
12/26/01	1.28	256	20.37	435	42
12/27/01	1.30	258	17.44	438	41
12/28/01	1.32	259	18.30	440	43
12/29/01	1.29	258	19.80	442	44
12/30/01	1.30	258	20.94	442	44
12/31/01	1.22	259	20.26	437	44
01/01/02	1.21	261	19.65	431	44
01/02/02	1.26	259	19.76	430	44
01/03/02	1.23	259	19.89	431	44
01/04/02	0.93	258	15.77	436	44
01/05/02	0.98	258	14.13	439	44
01/06/02	0.97	261	16.43	442	44
01/07/02	0.93	255	18.13	449	44
01/08/02	1.14	252	15.56	450	44
01/09/02	*	*	14.45	459	44
01/10/02	*	*	14.85	473	44
01/11/02	*	*	16.93	486	40
01/12/02	*	*	18.52	497	32
01/13/02	*	*	19.67	508	31
01/14/02	*	*	20.77	517	31
01/15/02	*	*	22.11	520	30
01/16/02	*	*	21.72	526	30
01/17/02	*	*	22.32	528	29
01/18/02	*	*	23.08	531	29
01/19/02	*	*	23.56	534	28
01/20/02	*	*	23.63	537	28
01/21/02	*	*	24.18	540	27
01/22/02	*	*	24.40	541	27
* All bursts filtered out					
MINIMUM	0.93	244	14.13	414	27
MAXIMUM	1.49	261	25.38	541	56
AVERAGE	1.23	252	22.24	459	47
BURSTS FILTERED OUT (%)	22		0	0	

[1] Flow sample volume located 27 cm above top of litter.

[2] MicroCAT temperature and conductance measured 13 cm above top of litter.

Table B - 5. Daily mean flow velocities, MicroCAT water temperatures and specific conductances, and water depths at station GS-203 during deployment period 01/24/02 1505 – 02/12/02 1335

[cm/s, centimeter per second; ° CW from MN, degrees clockwise from magnetic north; ° C, degrees Celsius; µS/cm, microsiemens per centimeter]

Date	Flow velocity[1] (cm/s)	Flow direction[1] (° CW from MN)	Temperature[2] (°C)	Specific conductance[2] (µS/cm)	Water depth (cm)
01/25/02	0.59	248	23.48	545	25
01/26/02	0.59	248	23.86	546	25
01/27/02	0.60	249	24.19	546	24
01/28/02	0.57	251	23.85	547	24
01/29/02	0.62	252	23.63	549	23
01/30/02	0.66	252	24.01	547	23
01/31/02	0.69	252	23.91	548	22
02/01/02	0.66	251	23.82	548	22
02/02/02	0.68	250	24.25	550	22
02/03/02	0.66	251	24.89	545	22
02/04/02	0.62	246	23.02	546	21
02/05/02	0.62	242	19.90	549	21
02/06/02	0.62	242	20.29	554	20
02/07/02	0.63	240	21.45	556	20
02/08/02	0.64	244	21.55	557	19
02/09/02	0.64	241	21.68	550	19
02/10/02	0.66	244	22.60	502	22
02/11/02	0.66	246	22.55	499	22
MINIMUM	0.57	240	19.90	493	19
MAXIMUM	0.69	252	24.89	563	25
AVERAGE	0.63	247	22.94	536	22
BURSTS FILTERED OUT (%)	9		0	0	

[1] Flow sample volume located 10 cm above top of litter.

[2] MicroCAT temperature and conductance measured 13 cm above top of litter.

Appendix C

Daily mean flow velocities, water-temperatures, specific conductances, and water depths at station GS-33, Shark River Slough, Everglades National Park, Florida during the 2001–2002 wet season.

Table C - 1. Daily mean flow velocities, MicroCAT water temperatures and specific conductances, and water depths at station GS-33 during deployment period 08/09/01 1600 – 08/15/01 1530

[cm/s, centimeter per second; ° CW from MN, degrees clockwise from magnetic north; ° C, degrees Celsius; µS/cm, microsiemens per centimeter]

Date	Flow velocity[1] (cm/s)	Flow direction[1] (° CW from MN)	Temperature[2] (° C)	Specific conductance[2] (µS/cm)	Water depth (cm)
08/10/01	*	*	30.11	392	31
08/11/01	*	*	30.08	399	30
08/12/01	*	*	31.09	405	30
08/13/01	*	*	31.47	410	30
08/14/01	*	*	32.54	409	31
* Probe velocity range set to +-250, all bursts filtered out					
MINIMUM			30.08	392	30
MAXIMUM			32.54	410	31
AVERAGE			31.05	403	30
BURSTS FILTERED OUT (%)	100		0	0	

[1] Flow sample volume located 10 cm above top of litter.

[2] MicroCAT temperature and conductance measured 6 cm above top of litter.

Table C - 2. Daily mean flow velocities, MicroCAT water temperatures and specific conductances, and water depths at station GS-33 during deployment period 08/16/01 1000 – 10/10/01 1530

[cm/s, centimeter per second; º CW from MN, degrees clockwise from magnetic north; º C, degrees Celsius; µS/cm, microsiemens per centimeter]

Date	Flow velocity[1] (cm/s)	Flow direction[1] (° CW from MN)	Temperature[2] (° C)	Specific conductance[2] (µS/cm)	Water depth (cm)
08/17/01	*	*	32.09	459	31
08/18/01	*	*	32.54	476	31
08/19/01	*	*	32.58	492	31
08/20/01	*	*	31.55	505	31
08/21/01	*	*	29.71	505	31
08/22/01	*	*	29.06	506	32
08/23/01	*	*	30.12	505	33
08/24/01	*	*	31.78	505	33
08/25/01	*	*	32.32	502	34
08/26/01	*	*	32.34	508	33
08/27/01	*	*	32.04	506	33
08/28/01	*	*	31.61	509	33
08/29/01	*	*	31.58	513	33
08/30/01	*	*	32.22	516	33
08/31/01	*	*	32.31	519	33
09/01/01	*	*	31.32	522	33
09/02/01	*	*	31.23	517	34
09/03/01	*	*	30.13	521	34
09/04/01	*	*	30.05	498	36
09/05/01	*	*	30.47	504	35
09/06/01	*	*	30.07	525	35
09/07/01	*	*	28.68	523	37
09/08/01	*	*	28.50	511	38
09/09/01	*	*	28.22	513	38
09/10/01	*	*	28.08	512	39
09/11/01	*	*	28.67	490	41
09/12/01	*	*	27.71	436	47
09/13/01	*	*	27.55	435	46
09/14/01	*	*	26.97	420	48

Continued

Table C-2. Daily mean flow velocities, MicroCAT water temperatures and specific conductances, and water depths at station GS-33 during deployment period 08/16/01 1000 – 10/10/01 1530 — Continued

[cm/s, centimeter per second; º CW from MN, degrees clockwise from magnetic north; º C, degrees Celsius; µS/cm, microsiemens per centimeter]

Date	Flow velocity[1] (cm/s)	Flow direction[1] (° CW from MN)	Temperature[2] (° C)	Specific conductance[2] (µS/cm)	Water depth (cm)
09/15/01	*	*	27.65	408	49
09/16/01	*	*	28.37	411	48
09/17/01	*	*	29.30	416	47
09/18/01	*	*	29.21	402	48
09/19/01	*	*	28.93	410	48
09/20/01	*	*	29.54	420	48
09/21/01	*	*	30.19	428	47
09/22/01	*	*	30.54	443	46
09/23/01	*	*	30.17	452	45
09/24/01	*	*	30.30	458	45
09/25/01	*	*	30.78	459	44
09/26/01	*	*	29.99	451	45
09/27/01	*	*	28.39	438	46
09/28/01	*	*	26.74	430	48
09/29/01	*	*	25.00	373	57
09/30/01	*	*	25.28	353	59
10/01/01	*	*	26.24	330	57
10/02/01	*	*	26.46	372	56
10/03/01	*	*	26.69	382	55
10/04/01	*	*	27.40	388	54
10/05/01	*	*	27.86	397	53
10/06/01	*	*	29.18	408	53
10/07/01	*	*	30.65	421	52
10/08/01	*	*	30.11	429	51
10/09/01	*	*	28.05	427	52
* Probe velocity range set to +-250, all bursts filtered out					
MINIMUM			25.00	330	31
MAXIMUM			32.58	525	59
AVERAGE			29.53	458	42
BURSTS FILTERED OUT (%)	100		0	0	

[1] Flow sample volume located 10 cm above top of litter.

[2] MicroCAT temperature and conductance measured 6 cm above top of litter.

Table C-3. Daily mean flow velocities, MicroCAT water temperatures and specific conductances, and water depths at station GS-33 during deployment period 10/11/01 0900 – 11/06/01 1000

[cm/s, centimeter per second; º CW from MN, degrees clockwise from magnetic north; º C, degrees Celsius; µS/cm, microsiemens per centimeter]

Date	Flow velocity[1] (cm/s)	Flow direction[1] (° CW from MN)	Temperature[2] (° C)	Specific conductance[2] (µS/cm)	Water depth (cm)
10/12/01	1.16	187	27.31	430	51
10/13/01	1.19	187	27.05	439	51
10/14/01	1.19	187	26.97	447	50
10/15/01	1.15	185	27.81	451	50
10/16/01	1.13	186	28.64	457	50
10/17/01	1.11	185	28.04	461	50
10/18/01	1.12	188	26.15	465	50
10/19/01	1.17	190	26.09	464	51
10/20/01	1.14	189	26.23	461	52
10/21/01	1.13	184	25.81	447	55
10/22/01	1.13	182	26.18	418	60
10/23/01	1.09	184	27.51	412	60
10/24/01	1.01	182	28.67	425	59
10/25/01	1.04	183	29.30	426	59
10/26/01	1.04	183	28.66	431	59
10/27/01	0.99	182	24.16	438	58
10/28/01	1.01	184	20.82	444	57
10/29/01	1.00	183	21.26	454	56
10/30/01	1.00	184	21.70	462	56
10/31/01	1.03	183	22.58	467	55
11/01/01	1.01	181	23.57	467	55
11/02/01	1.04	183	24.51	472	55
11/03/01	1.03	182	25.35	475	54
11/04/01	1.08	181	24.45	475	54
11/05/01	0.97	180	22.54	459	56
MINIMUM	0.97	180	20.82	412	50
MAXIMUM	1.19	190	29.30	475	60
AVERAGE	1.08	184	25.65	450	54
BURSTS FILTERED OUT (%)	2		0	0	

[1] Flow sample volume located 26 cm above top of litter.

[2] MicroCAT temperature and conductance measured 6 cm above top of litter.

Table C - 4. Daily mean flow velocities, MicroCAT water temperatures and specific conductances, and water depths at station GS-33 during deployment period 11/08/01 0900 – 01/23/02 1630

[cm/s, centimeter per second; º CW from MN, degrees clockwise from magnetic north; º C, degrees Celsius; µS/cm, microsiemens per centimeter]

Date	Flow velocity[1] (cm/s)	Flow direction[1] (° CW from MN)	Temperature[2] (°C)	Specific conductance[2] (µS/cm)	Water depth (cm)
11/09/01	1.02	181	22.73	469	56
11/10/01	*	*	23.12	477	55
11/11/01	*	*	23.32	492	55
11/12/01	*	*	23.60	503	55
11/13/01	*	*	23.64	511	54
11/14/01	*	*	23.81	517	54
11/15/01	*	*	22.88	522	54
11/16/01	*	*	22.97	525	54
11/17/01	*	*	23.49	527	54
11/18/01	*	*	23.79	525	53
11/19/01	*	*	23.98	514	53
11/20/01	*	*	24.29	505	53
11/21/01	*	*	24.34	505	53
11/22/01	*	*	24.09	513	53
11/23/01	*	*	23.84	521	53
11/24/01	*	*	24.11	529	52
11/25/01	*	*	24.25	538	52
11/26/01	*	*	24.26	544	52
11/27/01	*	*	23.63	550	52
11/28/01	*	*	23.27	555	52
11/29/01	*	*	23.40	561	51
11/30/01	0.48	192	23.47	568	51
12/01/01	0.58	204	23.29	573	51
12/02/01	0.58	205	23.75	577	51
12/03/01	0.46	200	24.03	580	51
12/04/01	0.59	191	24.03	585	51
12/05/01	0.55	190	23.69	587	51

Continued

Table C - 4. Daily mean flow velocities, MicroCAT water temperatures and specific conductances, and water depths at station GS-33 during deployment period 11/08/01 0900 – 01/23/02 1630 — Continued

[cm/s, centimeter per second; º CW from MN, degrees clockwise from magnetic north; º C, degrees Celsius; µS/cm, microsiemens per centimeter]

Date	Flow velocity[1] (cm/s)	Flow direction1 (° CW from MN)	Temperature[2] (°C)	Specific conductance[2] (µS/cm)	Water depth (cm)
12/06/01	0.63	185	23.55	580	51
12/07/01	0.85	182	24.22	572	52
12/08/01	0.85	183	24.95	576	52
12/09/01	0.90	184	24.53	570	53
12/10/01	0.85	184	24.49	544	55
12/11/01	0.82	181	24.68	531	54
12/12/01	0.83	184	24.69	536	53
12/13/01	0.80	183	24.77	544	52
12/14/01	0.84	185	25.07	549	52
12/15/01	0.82	186	24.81	558	51
12/16/01	0.81	185	24.39	560	50
12/17/01	0.86	186	24.19	564	49
12/18/01	0.84	188	24.37	568	49
12/19/01	0.81	188	24.34	574	48
12/20/01	0.79	187	22.88	581	47
12/21/01	0.79	191	20.51	582	46
12/22/01	0.79	193	19.82	581	45
12/23/01	0.82	195	20.05	578	45
12/24/01	0.76	195	21.37	577	44
12/25/01	0.66	192	22.00	579	43
12/27/01	0.64	192	17.43	579	42
12/28/01	0.63	193	18.19	577	42
12/29/01	0.60	195	19.32	574	41
12/30/01	0.62	194	20.18	572	40
12/31/01	0.61	201	19.79	565	40
01/01/02	0.59	199	19.61	554	41
01/02/02	0.59	204	19.51	556	40

Continued

Table C - 4. Daily mean flow velocities, MicroCAT water temperatures and specific conductances, and water depths at station GS-33 during deployment period 11/08/01 0900 – 01/23/02 1630 — Continued

[cm/s, centimeter per second; º CW from MN, degrees clockwise from magnetic north; º C, degrees Celsius; µS/cm, microsiemens per centimeter]

Date	Flow velocity1 (cm/s)	Flow direction[1] (° CW from MN)	Temperature[2] (°C)	Specific conductance[2] (µS/cm)	Water depth (cm)
01/03/02	0.54	206	19.82	546	41
01/04/02	0.57	202	15.66	552	40
01/05/02	0.55	203	14.22	558	39
01/06/02	0.54	202	16.46	558	39
01/07/02	0.49	206	17.90	543	38
01/08/02	0.38	198	15.39	529	37
01/09/02	0.26	193	14.13	524	36
01/10/02	0.29	183	14.34	522	36
01/11/02	0.32	197	16.11	517	35
01/12/02	0.27	193	17.51	516	35
01/13/02	0.28	193	18.62	518	34
01/14/02	*	*	20.10	519	34
01/15/02	*	*	21.58	521	33
01/16/02	*	*	21.43	521	33
01/17/02	*	*	21.90	522	32
01/18/02	*	*	22.41	524	32
01/19/02	*	*	22.79	528	32
01/20/02	*	*	22.76	531	31
01/21/02	*	*	23.30	532	31
01/22/02	*	*	23.53	531	30
* All bursts filtered out					
MINIMUM	0.26	181	14.13	469	30
MAXIMUM	1.02	206	25.07	587	56
AVERAGE	0.65	192	21.90	545	46
BURSTS FILTERED OUT (%)	40		0	0	

[1] Flow sample volume located 26 cm above top of litter.

[2] MicroCAT temperature and conductance measured 6 cm above top of litter.

Table C - 5. Daily mean flow velocities, MicroCAT water temperatures and specific conductances, and water depths at station GS-33 during deployment period 01/25/02 0915 – 02/12/02 1445

[cm/s, centimeter per second; º CW from MN, degrees clockwise from magnetic north; º C, degrees Celsius; µS/cm, microsiemens per centimeter]

Date	Flow velocity[1] (cm/s)	Flow direction[1] (° CW from MN)	Temperature[2] (°C)	Specific conductance[2] (µS/cm)	Water depth (cm)
01/26/02	0.39	207	23.00	524	28
01/27/02	0.40	210	23.20	523	28
01/28/02	0.41	210	23.27	522	28
01/29/02	0.43	212	23.23	522	27
01/30/02	0.46	212	23.54	524	27
01/31/02	0.45	209	23.40	527	27
02/01/02	0.44	210	23.31	530	26
02/02/02	0.41	214	23.53	533	26
02/03/02	0.39	213	24.30	535	26
02/04/02	0.34	213	22.59	537	26
02/05/02	0.35	214	19.38	542	25
02/06/02	0.37	216	19.86	547	25
02/07/02	0.37	222	20.97	551	25
02/08/02	0.30	210	21.33	551	24
02/09/02	0.29	206	21.38	544	24
02/10/02	0.39	212	22.56	506	26
02/11/02	0.37	216	22.53	520	26
MINIMUM	0.29	206	19.38	506	24
MAXIMUM	0.46	222	24.30	551	28
AVERAGE	0.39	212	22.43	532	26
BURSTS FILTERED OUT (%)	0		0	0	

[1] Flow sample volume located 13 cm above top of litter.

[2] MicroCAT temperature and conductance measured 6 cm above top of litter.

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