Technical Publication

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Water Budget Analysis for Stormwater Treatment Area 1 West

(May 1, 2005 to April 30, 2006)

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by

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EXECUTIVE SUMMARY

Stormwater Treatment Area 1 West (STA-1W) is a constructed wetland that is part of the Everglades Construction Project mandated by Florida's Everglades Forever Act (Section 373.4592, Florida Statutes [F.S.]). STA-1W was built as an expansion of the Everglades Nutrient Removal (ENR) Project, a constructed wetland to demonstrate the effectiveness of phosphorus (P) removal from agricultural runoff/drainage. The ENR was operated for five years (1994 to 1999), and STA-1W started operation on July 1, 1999. STA-1W covers 2,700 hectares (ha) (6,670 acres [ac]) and is located in south Florida (26° 38' N, 80° 25' W) at the eastern edge of the Everglades Agricultural Area (EAA). The EAA with approximate area of 223,855 ha (552,922 ac) under agriculture (Redfield et al., 1999), is a highly productive irrigation drainage basin with a major production of sugarcane. Ecological changes in the Everglades have been partially attributed to an increase in P concentrations in the inflow waters. Local, state and federal initiatives have been taken to reduce P loads from agricultural runoff/drainage. Water from the agricultural area flows to the south and southeast through four primary canals: Miami, North New River, Hillsboro, and West Palm Beach. The West Palm Beach Canal, which carries runoff/drainage from the agricultural area and Lake Okeechobee releases, is the inflow source for STA-1W.

A minimum of 25 percent of the P load from the EAA is required to be removed at the basin level through the application of various agricultural Best Management Practices (BMPs) (Whalen and Whalen, 1994). Further removal of P is to be achieved through constructed wetland systems, known as Stormwater Treatment Areas (STAs), to an initial outflow total P concentration of 0.05 milligrams per liter (mg L^{-1}). STA-1W is one of the large-scale constructed wetlands that followed the successful operation of the ENR Project. This report presents the seventh annual water budget for STA-1W. Water budget analyses for five years of the ENR Project and six years of STA-1W were reported in the South Florida Water Management District's (SFWMD's) technical publications (Guardo et al., 1996; Abtew and Mullen, 1997; Abtew and Downey, 1998; Abtew et al., 2000; Abtew et al., 2001; Abtew et al., 2002; Abtew and Reardon, 2003; Abtew, 2004; and Abtew, 2005).

The total inflow into STA-1W through the inflow spillway for the study period was 17,600 hectare-meters (ha-m) (142,678 acre-feet [ac-ft]), and the total outflow through the outflow pumps was 17,009 ha-m (137,890 ac-ft). Estimated seepage inflow from the L-7 levee through the roadside culverts was 338 ha-m (2,739 ac-ft). The seepage recirculation pump had a total flow of 1,044 ha-m (8,465 ac-ft). The areal average rainfall for the study period was 111.4 centimeters (cm), or 43.8 inches (in), and the total areal average evapotranspiration (ET) was 131.4 cm (51.7 in). A comparison with the previous three years of water budget shows that the surface water inflow for this period was the largest, which indicates the highest hydraulic loading during this period. The sum of the errors and unknowns (remainders) was 1,395 (11,309 ac-ft) ha-m, which represents 6 percent of the total outflows into the system. Rainfall (15 percent) and ET (17 percent) contribute to the current mass balance.

The mean hydraulic loading rate for the study period, based on the daily average inflow, was 1.7 centimeters per day (cm d^{-1}) (0.7 inches per day [in d^{-1}]). The mean hydraulic retention time was 13.2 days and was computed as the ratio of the mean estimated volume of STA-1W and the average of inflow and outflow. The mean estimated volume was computed using the area-weighted (by cell) mean depth of 23 cm (8.9 in) and total area of 2,700 ha (6,670 ac).

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LIST OF ABBREVIATIONS AND ACRONYMS

ac	acre
ac-ft	acre-foot
BMP	Best Management Practice
cm	centimeter
cm d^{-1}	centimeter per day
cfs	cubic foot per second
EAA	Everglades Agricultural Area
ENR	Everglades Nutrient Removal
ET	evapotranspiration
ft	foot
ha	hectare
ha-m	hectare-meter
HW	headwater
in	inch
in d^{-1}	inch per day
m	meter
m^3s^{-1}	cubic meter per second
MAX	maximum
MIN	minimum
mm	millimeter
NGVD	National Geodetic Vertical Datum
P	phosphorus
Q	discharge
rpm	revolution per minute
SFWMD	South Florida Water Management District
STA	Stormwater Treatment Area
TW	tailwater
UVM	ultrasonic velocity meter
WCA	Water Conservation Area

CONVERSION FACTORS

Metric	English
mm	0.03937 in
cm	0.3937 in
m	3.2808 ft
ha	2.47 ac
m^3s^{-1}	35.33 cfs
ha-m	8.1068 ac-ft

ACKNOWLEDGEMENTS

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INTRODUCTION

Background

Stormwater Treatment Area 1 West (STA-1W) is a constructed wetland that is part of the Everglades Construction Project (ECP) mandated by Florida's Everglades Forever Act (EFA) (Section 373.4592, Florida Statutes [F.S.]). STA-1W was built as an expansion of the Everglades Nutrient Removal (ENR) Project, a constructed wetland to demonstrate the effectiveness of phosphorus (P) removal from agricultural runoff/drainage. The ENR operated for five years (1994 to 1999) and STA-1W started operation on July 1, 1999. STA-1W covers 2,700 hectares (ha) (6,670 acres [ac]) and is located in south Florida (26° 38' N, 80° 25' W) at the eastern edge of the Everglades Agricultural Area (EAA). The EAA is approximately a 223,855 ha (552,922 ac) (Redfield et al., 1999), highly productive irrigation drainage basin with a major production of sugarcane. Ecological changes in the Everglades have been partially attributed to an increase in P concentrations in the inflow waters. Local, state and federal initiatives have been taken to reduce P loads from agricultural runoff/drainage. Water from the agricultural area flows to the south and southeast through four primary canals: Miami, North New River, Hillsboro and West Palm Beach.

A minimum of 25 percent of the P load from the EAA is required to be removed at the basin level through the application of various agricultural Best Management Practices (BMPs) (Whalen and Whalen, 1994). Further removal of P is to be achieved through constructed wetland systems, known as Stormwater Treatment Areas (STAs), to an initial outflow total P concentration of 0.05 milligrams per liter (mg L^{-1}). STA-1W is one of the large-scale constructed wetlands that followed the successful operation of the ENR Project. This report presents the seventh annual water budget for STA-1W (May 1, 2005 to April 30, 2006). Water budget analyses for five years of the ENR Project and six years of STA-1W were reported in the South Florida Water Management District's (SFWMD's) technical publications (Guardo et al., 1996; Abtew and Mullen, 1997; Abtew and Downey, 1998; Abtew et al., 2000; Abtew et al., 2001; Abtew et al., 2002; Abtew and Reardon, 2003; Abtew, 2004; and Abtew, 2005).

Site Description

A survey of the ENR Project indicated that the area is primarily covered by Okeechobee muck soils where one to two meters of peat overlies several meters of carbonate rock (Jammal and Associates, Inc., 1991). The topography of STA-1W is relatively flat, with an average elevation of 3 meters (m) (10 feet [ft]) National Geodetic Vertical Datum (NGVD). To the east, the L-7 levee separates STA-1W from the Arthur R. Marshall Loxahatchee National Wildlife Refuge (Water Conservation Area 1 [WCA-1]). The seepage canal runs along the northern perimeter and the discharge canal on the west separates STA-1W from agricultural land. The narrow southern ENR levee separates STA-1W from the discharge area into WCA-1. STA-1W is currently a seven-cell STA which will be an eight-cell STA when the compartmentalization of Cell 1 into Cell 1A and Cell 1B is soon completed (Figure 2). The total area of STA-1W is 2,700 ha (6,670 ac). The area and average ground elevation for each cell are presented in Table 1.

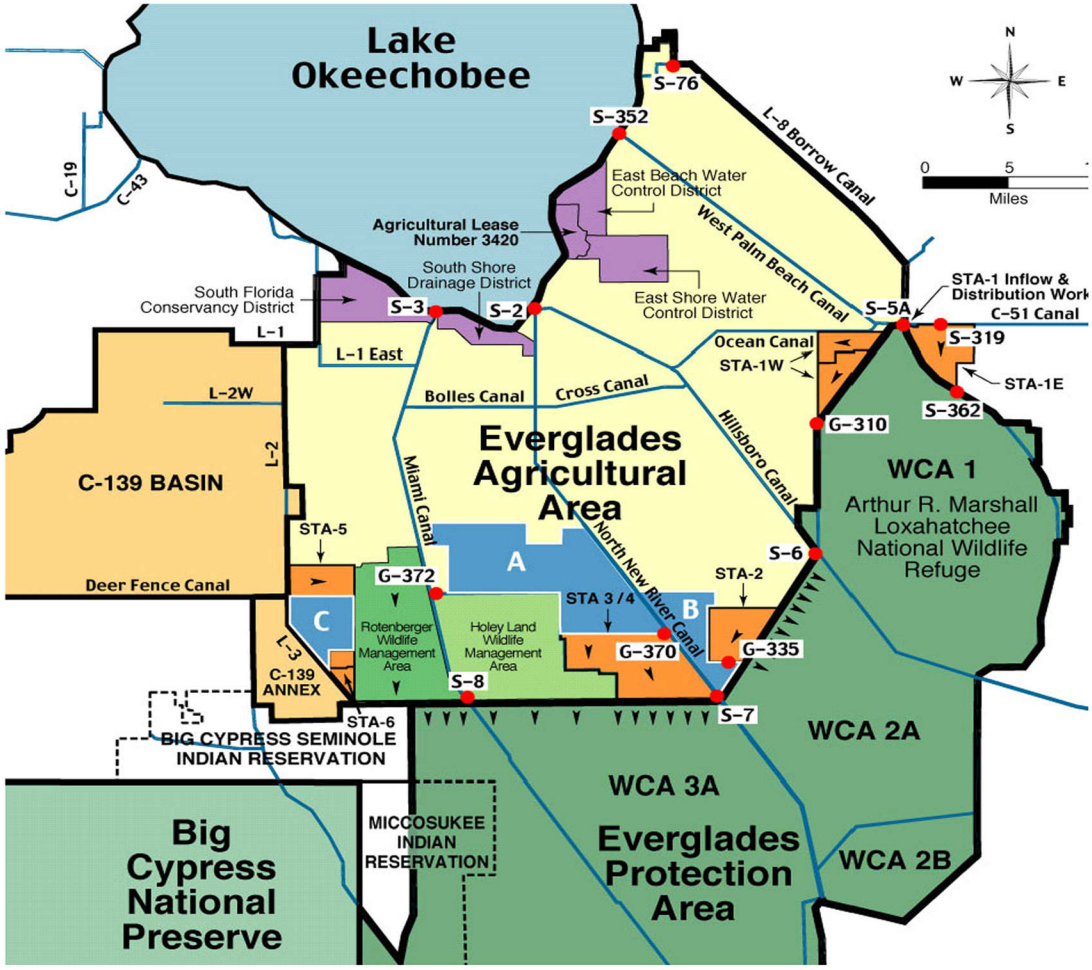

Figure 1. Location of Stormwater Treatment Area 1 West (STA-1W).

Table 1. Site characteristics of STA-1W.

Cell	Area		Average ground elevation	
	ha	ac	m NGVD	ft NGVD
Cell 1A	302	745	3.13	10.27
Cell 1B	302	745	3.13	10.27
Cell 2A	191	471	2.94	9.65
Cell 2B	190	470	2.94	9.65
Cell 3	415	1026	3.10	10.17
Cell 4	145	358	3.00	9.84
Cell 5A	228	562	2.90	9.51
Cell 5B	928	2293	2.90	9.51
Total	**2700**	**6670**		
Average			**3**	**10**

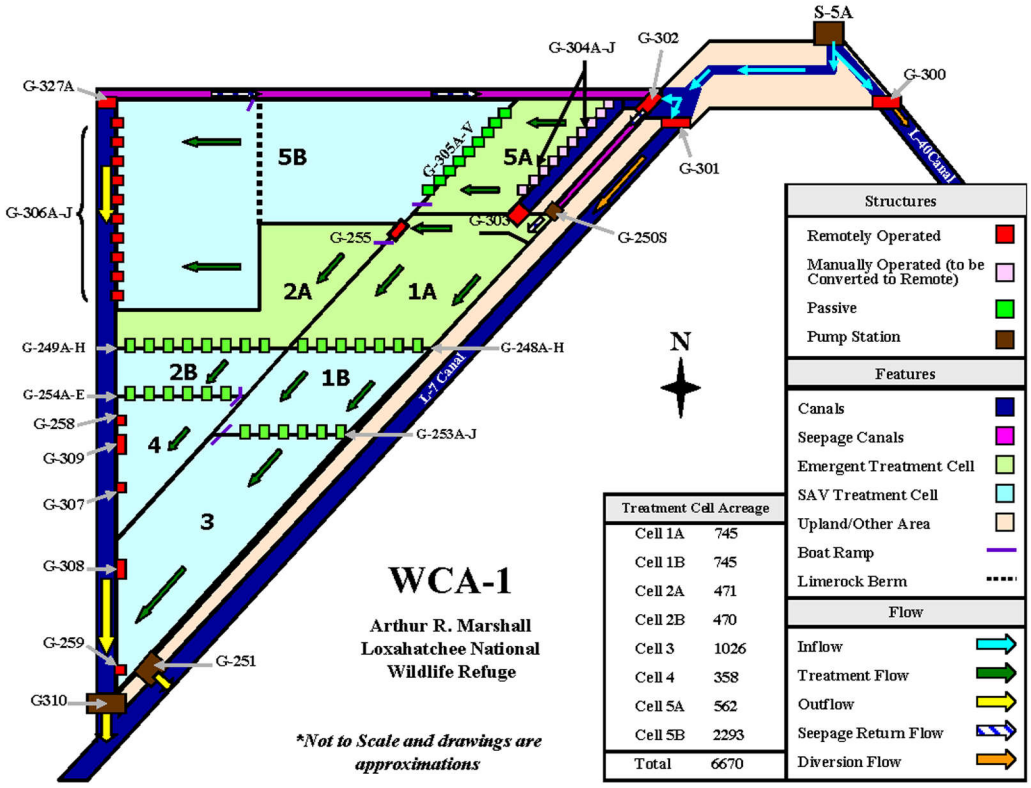

Figure 2. STA-1W with flow control structures.

Vegetation Cover

At STA-1W, vegetation cover generally varies from cell to cell and coverage changes with time. For the past year, vegetation coverage can be summarized as: Cell 1 was covered by some emergent vegetation with open water and submerged aquatic vegetation; Cell 2A had emergent vegetation and Cell 2B was open water; Cell 3 was covered with emergent vegetation with mostly cattails with some shrubs and open water and Cell 4 was an open water cell.

SYSTEM HYDRAULICS AND OPERATION

System Hydraulics

STA-1W Inflow and Distribution

Water from the West Palm Beach Canal (C-51) that previously was pumped into the Refuge (WCA-1) via the S5A pump station and flowed through the Refuge is presently diverted to STA-1W. A small portion of the area of WCA-1 near the S5A pump station is levied and forms the STA-1W Inflow and Distribution (STA-1 Inflow Basin or I&D) that serves as a storage area to divert water into STA-1W and into STA-1E. There are two former and four new water control structures in the STA-1 I & D. The S5A pump station delivers water from C-51 (West Palm Beach Canal); the S5AS spillway controls WCA-1 inflow and outflow at the junction of L-8 and C-51 (S-5A Complex). S-5A Complex has culvert structures S5AW, S5AE and spillway S5AS. The six structures in the I&D are S-5A Pump Station and spillways S-5AS, G300, G301, G302 and G311.

G300 is a two-bay, reinforced concrete, U-shaped spillway with vertical lift gates installed on the crest of ogee-shaped weirs. The purpose of this structure is to bypass flows from the STA-1 Inflow Basin area into the L-40 borrow canal that runs along the eastern edges of WCA-1. G301 is a three-bay, reinforced concrete, U-shaped spillway with vertical lift gates on weirs. The purpose of this structure is to bypass flow from the STA-1 Inflow Basin area into WCA-1 along the L-7 borrow canal on the western edge of WCA-1. G302 is a fixed-crest, concrete ogee spillway equipped with two vertical lift gates each of which are 6 m (20 ft) wide. The purpose of this structure is to supply inflow to STA-1W from the STA-1 Inflow Basin. G302 has a capacity of 92 cubic meters per second ($m^3 s^{-1}$) (3,250 cubic feet per second [cfs]). G311 is designed as a three-bay, reinforced concrete spillway with lift gates on weirs. The purpose of this structure is to supply water from the STA-1 Inflow Basin to STA-1E. It can also transfer water from STA-1E to STA-1W via the inflow basin, when needed.

STA-1W Inflow, Internal, and Discharge Structures

The supply canal to STA-1W is about 2.72 kilometers (km) (1.7 miles [mi]) long, extending between the inflow structure G302 and the flow-control structures G303 at the inflow to Cell 1A. The canal has a side slope of 2.5:1, with a bottom width of 18.3 m (60 ft) at elevation -1.52 m (-5 ft) NGVD. Expected velocities in the inflow canal vary between 0.232 m s^{-1} (0.76 ft s^{-1}) and 0.418 m s^{-1} (1.37 ft s^{-1}) (Hutcheon Engineers, 1996). G303 is a two-bay ogee spillway equipped with two lift gates with each 4.9 m (16 ft) wide and with a discharge capacity of 50.4 $m^3 s^{-1}$ (1780 cfs).

The perimeter and inter-cell levees facilitate vehicle transportation within the wetland. There are culverts situated below the levees for inflows, outflows, and inter-cell water delivery. Under each levee, the culverts are spread along the levee to facilitate distribution of flow over the downstream cell area. The evenness of flow distribution depends on the ground surface elevations and vegetation cover of the receiving cell.

Upstream of Cells 1 and 2, there was initially a buffer cell that received flow from G250S (seepage return pumps) and the inflow spillway G303. Also, there was a levee with 10 culverts (G252A-J) between the Buffer Cell and Cell 1. However, the transition to STA-1W involved degrading about 70 percent of the levee and removing all but three of the culverts (G252H, I, and J). The number of culverts between the Buffer Cell and Cell 2 originally was five (G255A through E), but the number was increased to seven (G255A-G) during the transition from ENR to STA-1W, which made a direct connection between Cell 1 and 2. During the 2005 STA enhancement project, G255 culverts were replaced with a structure with three box culverts with gates fitted for remote control. Currently, through the STA enhancement project Cell 2 is divided into two cells, 2A and 2B. Discharge from Cell 2A into Cell 2B is through new culverts G249A-H. When the planned splitting of Cell 1 into Cell 1A and 1B is completed, the adjoining structures will be culverts G248A-H. There were initially five G254 culverts between Cells 2 and 4 under the ENR Project, but they were increased to nine as part of STA-1W (G254A, A1, B, B1, C, C1, D, D1 and E). The levee between cells 1B and 3 has 10 culverts G253 (A through J), which did not change during the transition from ENR to STA-1W. Between Cells 3 and 4 there were five culverts (G256A through E), which were removed in the 2005 STA enhancement project and the levee section restored.

The inflow to Cell 5 occurs through 10 gated culverts, which are 29.3 m (96 ft) long (G304A through J). The combined capacity of the inflow culverts (G304A through J) is 41.6 $m^3 s^{-1}$ (1,470 cfs). The Florida Power and Light (FPL) levee runs across Cell 5 dividing the cell into two parts (5A and 5B). Twenty-two culverts (G305A through V) were constructed to deliver water from Cell 5A to the east to Cell 5B to the west. Each of the G305 culverts is 213 cm (84 inches) in diameter and 27.4 m (90 ft) long, with an invert

elevation of 1.07 m (3.5 ft) NGVD. Seepage and recirculated water from the discharge canal is pumped through G250S to Cell 1 through the former ENR Buffer Cell, which is now part of Cell 1. G250S has three pumps with a combined capacity of 5.66 $m^3 s^{-1}$ (200 cfs).

At the west end of Cell 3 there are two outflow structures releasing to the discharge canal, G308 and G259. Similarly, G258, G307 and G309 are the three outflow structures releasing to the discharge canal from Cell 4, located at the west end. G 307 is a 150 cfs new structure.

The outflow from Cell 5 to the discharge canal is through 10 corrugated metal pipe gated culverts (G306A-J), which are 183 cm (72 in) in diameter and 39.6 m (130 ft) long and have a combined discharge capacity of 41.6 $m^3 s^{-1}$ (1,470 cfs). G327A is a gated culvert which is 213 cm (84 in) in diameter, and 39.6 m (130 ft) long with 2.83 $m^3 s^{-1}$ (100 cfs) discharge capacity. G327C is a culvert 39.3 m (129 ft) long and has a discharge capacity of 2.83 $m^3 s^{-1}$ (100 cfs). It separates the discharge canal to the west from the seepage canal to the north. A new seepage pump station G327B, at the northwest corner of STA-1W, will serve to hydrate Cell 5B pumping in from the seepage canal.

The discharge from Cell 1B into Cell 3 flows through 10 culverts which are 183 cm (72 in) diameter and 17.7 m (58 ft) long (G253A through J). Discharge from Cell 2B into Cell 4 flows through nine culverts (G254A, A1, B, B1, C, C1, D, D1, and E) which are 183 cm (72 in) diameter and 16.5 m (54 ft) long. Discharge from Cell 3 is to the discharge canal through G308 and G259 and to WCA-1 through the G251 pump station. G308 is a gated weir with a discharge capacity of 15.85 $m^3 s^{-1}$ (560 cfs). G259 is a gated culvert which is 183 cm (72 in) in diameter and 23.9 m (78.5 ft) long. Discharge from Cell 4 into the discharge canal is through G309, G258 and G307. G309 is a gated weir with a discharge capacity of 15.85 $m^3 s^{-1}$ (560 cfs). G258 is a gated culvert which is 183 cm (72 in) in diameter and 23.5 m (77 ft) long. The STA-1W outflow structures are the G251 and G310 pump stations. G251 has six identical pumps with a combined capacity of 12.74 $m^3 s^{-1}$ (450 cfs). G310 is equipped with six pumps of three different capacities, with a total capacity of 86 $m^3 s^{-1}$ (3,040 cfs). G310 has two electric pumps with a combined discharge capacity of 5.66 $m^3 s^{-1}$ (200 cfs), two diesel pumps, with a combined discharge capacity of 26.6 $m^3 s^{-1}$ (940 cfs), and two diesel pumps with a combined discharge capacity of 53.8 $m^3 s^{-1}$ (1,900 cfs).

The discharge canal extends between G327A at the northwest corner and the G310 pump station at the southwestern corner. The discharge canal is about 9.12 km (5.7 mi) long with bottom width varying from 15.2 m (50 ft) at G327A to 24.4 m (80 ft) at G308 and to 30.5 m (100 ft) at G259, to account for changes in flow magnitude and ground elevation.

Operation

S5A diverts water from the West Palm Beach Canal into the STA-1 Inflow Basin also known as Inflow and Distribution (I&D) area. From the I&D area, water flows to STA-1W through spillway G302 or is diverted to WCA-1 through G300 and G301 when the need arises. G302 discharges into the supply canal and discharge into Cell 5A is made through 10 culverts (G304A-J). Water flows west from Cell 5A to Cell 5B through 22 culverts (G305A-V). Treated water is discharged from Cell 5 into the discharge canal through 10 gated culverts (G306A-J). Flows into cells 1, 2A, 2B, 3 and 4 are made through the gated weir structure G303. The old ENR seepage pumps (G250S) control stages in the seepage canal north of treatment Cell 5 and redirect flow to Cells 1, 2A, 2B, 3 and 4. Culverts, installed beneath G302, deliver seepage return inflow to the G250S pumps. Flow is primarily direct surface flow and partly through the remaining culverts G252 (H, I, and J) in the former ENR Buffer Cell. Cell 2A receives flow from Cell 1

through G255. Water flows from Cell 1 to Cell 2A through the G255 three gated culverts. Water flows from Cell 1 to Cell 3 through the G253 culverts (A through J). Water flows from Cell 2A to Cell 2B through culverts G248A-H. Water delivery between cells 2B and 4 occurs through nine culverts G254 (A, A1, B, B1, C, C1, D, D1, and E). At the west end of Cell 3 there are two outflow structures releasing to the discharge canal, G308 spillway and G259 culvert. Similarly, G309 spillway, G258 culvert and the new G307 structure are the three outflow structures releasing to the discharge canal from Cell 4, located at the west end. Outflow from STA-1W is through pump stations G251 lifting water from Cell 3 to WCA 1 and G310 lifting water from the discharge canal to WCA 1. The new seepage pump, G327B, pumps seepage into Cell 5 when needed.

HYDROLOGY AND HYDROLOGIC MONITORING

Rainfall

STA-1W has a six-gage rainfall monitoring network. The rainfall gauging stations along with their corresponding database keys and Theissen weights are presented in Table 2. The areal average rainfall on the project site was computed using a Theissen-weighted average of the six-gage network and stored in a preferred DBKEY KN809. Minimal data gaps at a station are estimated, while extended gaps result in areal rainfall computation using remaining stations with a new set of Theissen weights. The daily distribution of areal average rainfall for the study period is depicted in Figure 3. The monthly summary of areal average rainfall for STA-1W is shown in Table 3. The 12-month total areal average rainfall for STA-1W was 111.4 cm (43.8 in). The 12-year (May 1, 1994 to April 30, 2006) average areal rainfall for the previous ENR constructed wetland and the current STA-1W was 126 cm (49.6 inches).

Table 2. Rainfall stations in STA-1W, database retrieval keys and Theissen weights

Stations	DBKEY	Theissen Weights
ENR101	15851	0.087
ENR106	DU515	0.441
ENR203	15874	0.222
ENR301	15877	0.126
ENR308	15888	0.049
ENR401	15862	0.075

Evapotranspiration

The daily evapotranspiration (ET) was computed from high-resolution weather data using a radiation-based ET estimation model that was developed based on lysimeter studies in the ENR (Abtew, 1996a; 1996b). A complete weather station is located in Cell 3 (ENR 308). The daily distribution of ET for STA-1W for the study period is depicted in Figure 3. Monthly summary of ET for STA-1W is shown in Table 3. The 12-month total areal ET for STA-1W was 131.4 cm (51.7 in). The eleven-year (May 1, 1995 to April 30, 2006) average areal ET for the previous ENR and current STA-1W was 132.2 cm (52 in).

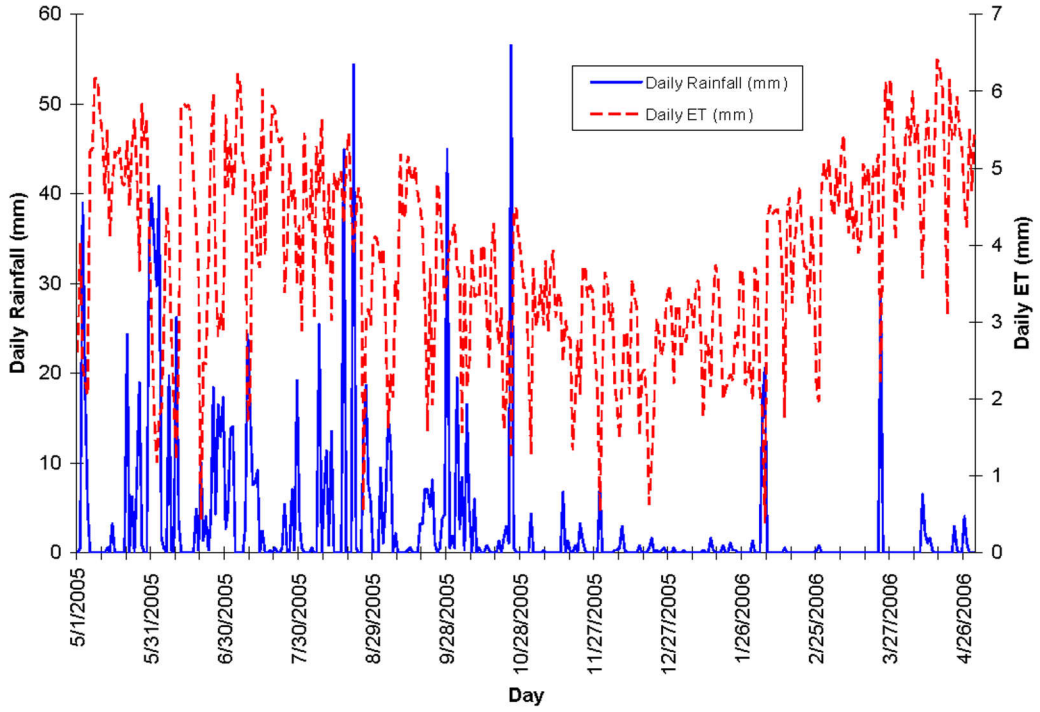

Figure 3. Daily distribution of areal average rainfall and evapotranspiration in STA-1W.

Table 3. STA-1W monthly flows, areal weighted rainfall and ET.

Year	Month	Inflow G302	Outflow G251+G310	Change in storage	Rainfall	ET	Seepage Pump	Seepage L-7 Culverts
		ha-m	ha-m	ha-m	cm	cm	ha-m	ha-m
2005	May	1018.947	631.362	412.172	18.65	13.63	112.576	7.802
2005	Jun	3512.863	3700.298	-60.093	23.86	10.03	270.146	12.161
2005	Jul	1609.775	1893.314	-506.977	13.11	13.43	96.77	7.226
2005	Aug	1242.146	1019.056	203.811	19.06	12.41	88.146	13.026
2005	Sep	1661.786	1282.08	89.268	12.91	10.57	102.826	29.754
2005	Oct	4081.336	4008.914	549.039	11.69	9.42	51.233	38.898
2005	Nov	1955.1	2235.677	-591.865	2.46	8.06	75.945	57.982
2005	Dec	35.427	30.084	-95.796	0.84	7.59	62.642	60.481
2006	Jan	0.034	29.542	-229.036	0.58	8.15	48.542	43.416
2006	Feb	1749.339	1792.686	-183.359	3.68	9.56	42.722	30.872
2006	Mar	379.702	378.281	-417.871	2.67	13.83	56.997	24.631
2006	Apr	353.292	7.9	-190.988	1.88	14.74	35.698	11.671

1 ha-m = 8.1068 ac-ft

Flows

Database keys for STA-1W flow structures and stage gages are listed in Table 4. The total inflow spillway discharge for the study period was 17,600 ha-m (142,678 ac-ft), and the total outflow through the outflow pump stations was 17,009 ha-m (137,890 ac-ft). In the past, inflows through G302 were underestimated. In July 2003, new flow data for the period of record were loaded into the database after

recalibration of the flow computation equations for G302 spillway. The daily discharge rates of the inflow spillway and outflow pumps are shown in Figure 4. The estimated seepage from L-7 levee flowing through the roadside culverts and the daily seepage recycling pumping is presented in Figure 5. The total seepage and recirculation pumping was 1,044 ha-m (8,465 ac-ft). The L-7 seepage through the roadside culverts was estimated using a regression equation developed from 42 data points. Guardo (1996) developed relationship between the seepage from L-7 through the roadside culverts, the stage rise in WCA-1 above 4.57 m (15 ft) NGVD, and the difference in stages between WCA-1 and the eastern cells of the ENR (Equation 1). The regression had a coefficient of determination (R^2) of 0.93 and a standard error of 0.30 $m^3 s^{-1}$. The total estimated seepage from L-7 through roadside culverts was 338 ha-m (2,739 ac-ft). The monthly flow data for the study period are presented in Table 3.

$$\mathbf{L7a = 0.217 * \Delta WCA^{1.311} * \Delta h^{2.025}} \qquad \mathbf{(1)}$$

Where L-7a is seepage in $m^3 s^{-1}$, ΔWCA is rise in stage in WCA-1 above 4.57 m (15 ft) NGVD and Δh is the difference in stage between WCA-1 and the eastern cells of STA-1W.

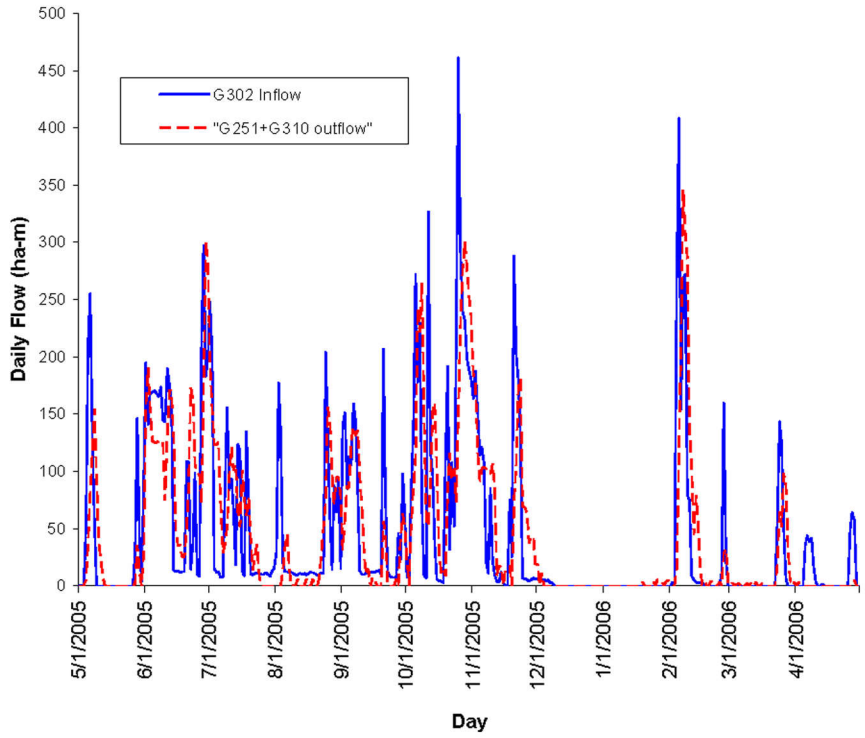

Figure 4. STA-1W daily inflows and outflows.

Water Levels

Daily water levels or water surface elevations (stages) in each cell of STA-1W are dependent upon rainfall, evapotranspiration, seepage and daily operational decisions. Water levels are regulated based on water depth, operational status of the S5A pump station, tests, maintenance and other operational decisions. The minimum, maximum and mean of the daily average stage observations for the study period are shown in Table 5. The mean observed stage in Cell 1 was 3.74 m (12.28 ft) NGVD. The mean stage in Cell 2 was 3.18 m (10.44 ft) and the mean stage in Cell 3 was 3.62 m (11.88 ft). The mean stage in Cell 4

was 3.15 m (10.34 ft) NGVD, and the mean stage in Cell 5 was 2.85 m (9.35 ft) NGVD. The average daily stages for Cell 5 were computed from the stage readings for G304 tailwater and G306 headwater. The average daily water level observations in Cell 1 and 3 of STA-1W and WCA-1 are shown in Figure 6. Water levels for cells 2 and 4 are shown in Figure 7 and the daily water levels for Cell 5 are shown in Figure 8. The mean water depths for Cells 1, 2, 3, 4 and 5 were 61 cm (24.1 in), 24 cm (9.5 in), 52 cm (20.5 in), 15 cm (6.0 in) and -5 cm (-1.9 in), respectively.

Table 4. Flow control structures, stage recorders and database retrieval keys used in the water budget analysis for STA-1W

Station	Description	Location	DBKEY	Remark
G302	Spillway	I & D Basin/Supply Canal	JW221	Inflow
G250S	Pump	Seepage Canal/Cell 1	JK278	seepage return/recirculation
G251	Pump	Cell 3/WCA-1	JW222	Outflow
G310	Pump	Discharge Canal/WCA-1	M2901	Outflow
ENR101	stage	Cell 1	15850	Center of cell
ENR203	stage	Cell 2	15873	Center of cell
ENR301	stage	Cell 3	15876	Center of cell
ENR401	stage	Cell 4	15727	Center of cell
G304E_H	stage	Supply Canal/Cell 5	OH559	Cell 5 stage close to WCA-1
G304E_H	stage	Supply Canal/Cell 5	OH560	Tailwater
G306A_H	stage	Cell 5/Discharge Canal	L9951	Headwater
G306J_H	stage	Cell 5/Discharge Canal	L9954	Headwater
G251_T	stage	G251 tail water	16219	WCA-1
g301_T	stage	I & D Basin/WCA-1	KS686	Tailwater

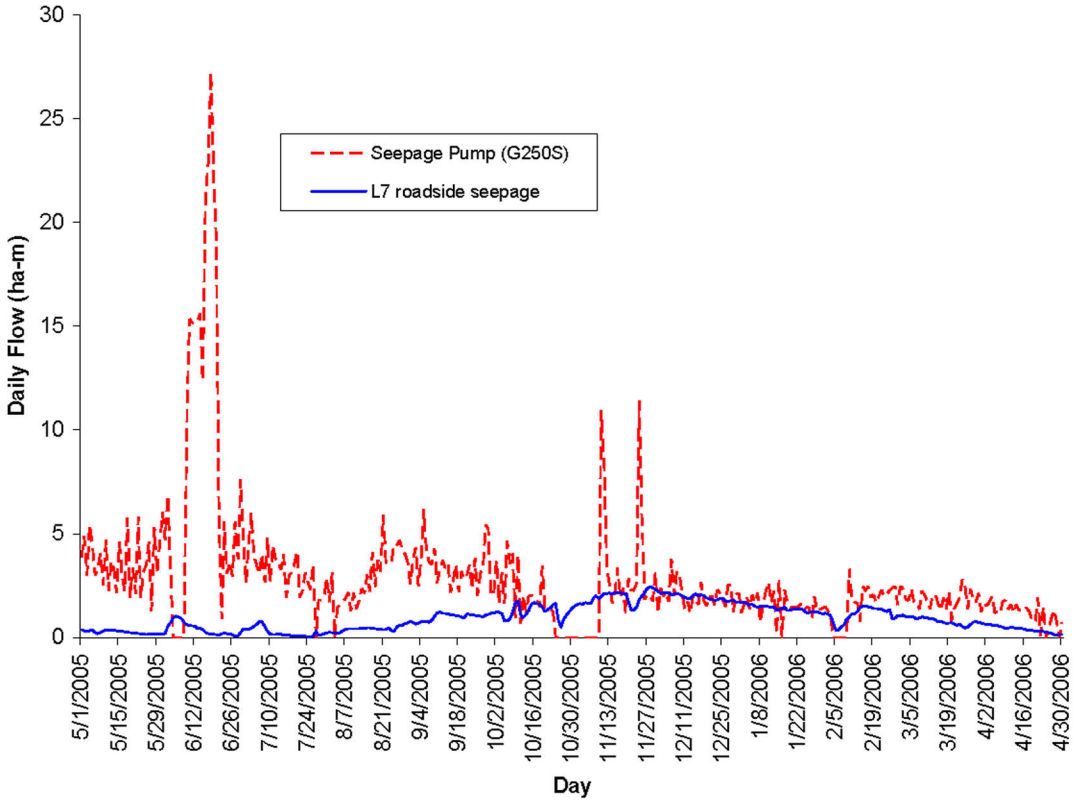

Figure 5. Daily pumping rates of the seepage recirculation pump and seepage flow through L-7 levee roadside seepage collection culverts in STA-1W.

Table 5. Observed water surface elevations (stages) and depths in STA-1W.

Cell	Water Surface Elevation						Depth	
	Min		Max		Mean		Mean	
	m	ft	m	ft	m	ft	cm	in
Cell 1	3.37	11.05	4.34	14.23	3.74	12.28	61	24.1
Cell 2	3.01	9.87	3.39	11.13	3.18	10.44	24	9.5
Cell 3	3.41	11.20	4.22	13.83	3.62	11.88	52	20.5
Cell 4	3.01	9.86	3.38	11.09	3.15	10.34	15	6.0
Cell 5	1.78	5.85	3.34	10.95	2.85	9.35	-5	-1.9

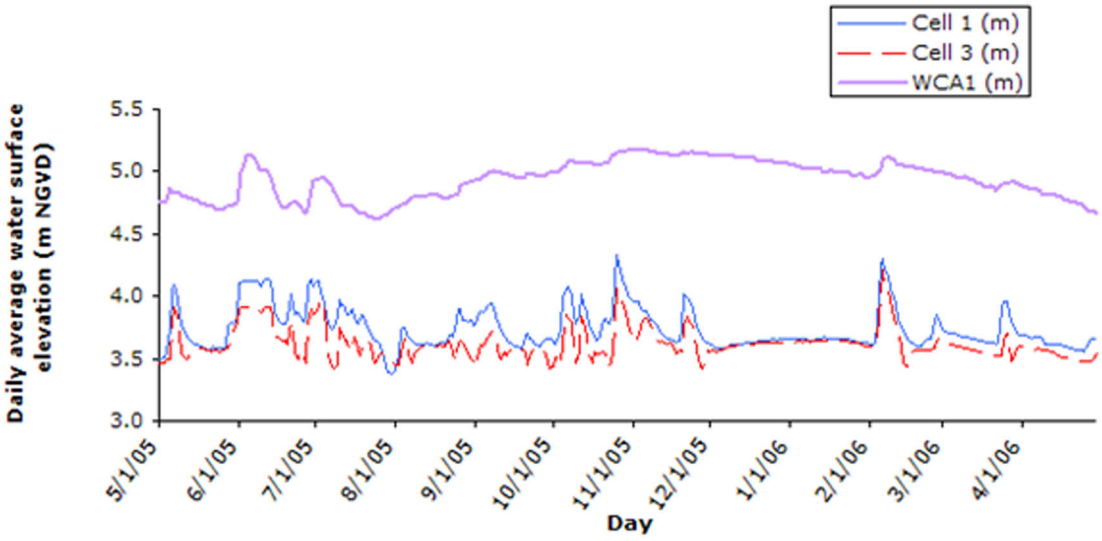

Figure 6. Daily mean water level in Cells 1 and 3 of STA-1W and Water Conservation Area 1.

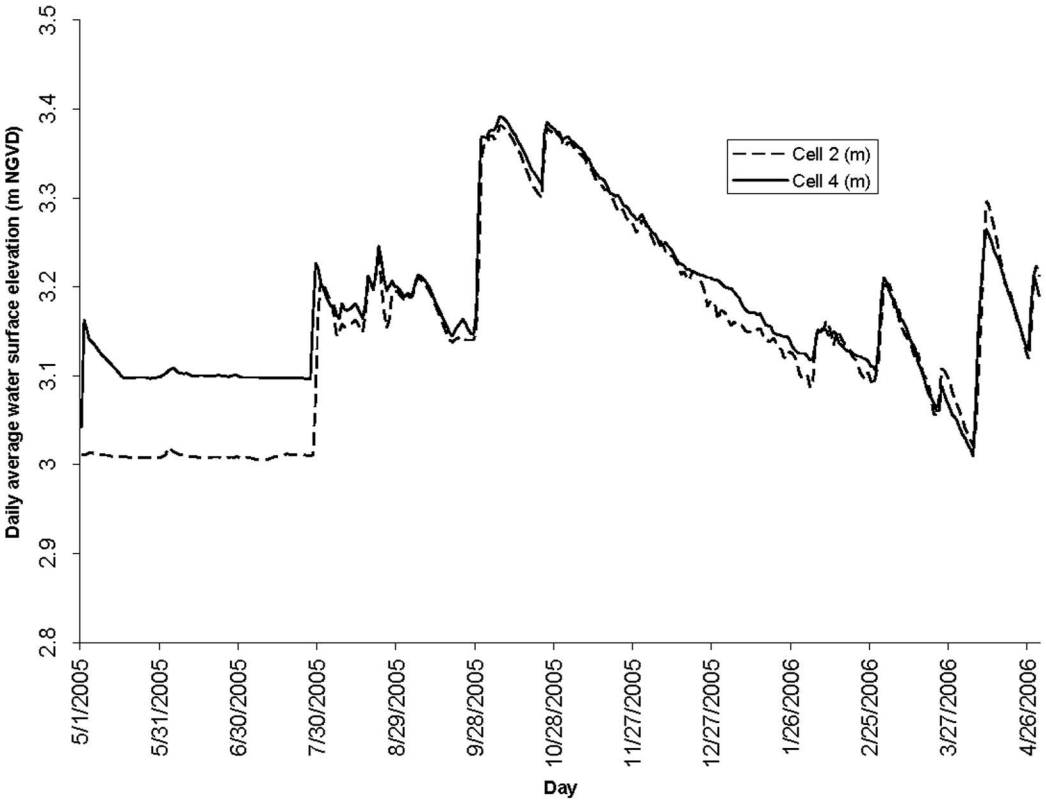

Figure 7. Daily mean water level in Cells 2 and 4 of STA-1W.

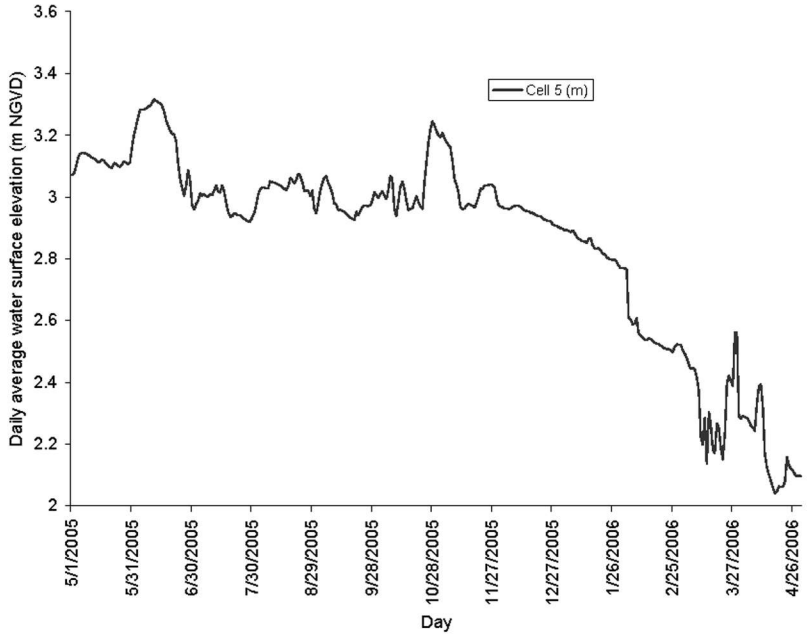

Figure 8. Daily mean water level in Cell 5 of STA-1W.

WATER BUDGET COMPUTATIONS

STA-1W Water Balance Model

A schematic hydrologic model for STA-1W is depicted in Figure 9. The inflow supplied through the G302 spillway accounts for about 83.7 percent of the inflow to the system. The known inflows to the system are G302 spillway inflows, rainfall and seepage through the roadside L-7 levee culverts (L-7a). Rainfall accounts for 14.7 percent, and seepage through the roadside culverts (L-7a) accounts for 1.6 percent. Outflow pumping (G251 and G310) accounts for 77 percent of the outflows, with evapotranspiration constituting 17 percent of the total outflows. The unknowns in the system are ungaged subsurface inflows, outflows and errors that account for 6 percent of the total inflows. The schematic model (Figure 9) and the following set of water balance equations represent the hydrologic system of STA-1W for water budget analysis purposes.

$$\mathbf{INFLOW - OUTFLOW = \Delta S + \varepsilon_T} \quad (2)$$

Where INFLOW is the amount of water that enters the system from external sources, and OUTFLOW is water that leaves the system boundary and is not recirculated. ΔS is the change in storage in the system during the time interval of interest. The sum of all errors is represented by ε_T. Because all inflows and outflows cannot be entirely quantified, the following equation is introduced to represent the remainders, errors and unknowns:

$$\mathbf{REMAINDERS = \varepsilon_T + UNKNOWNS} \quad (3)$$

Figure 9 shows the possible inflows and outflows to and from the STA-1W system. The seepage canal, which encompasses the northern side of STA-1W, is designed to capture seepage from STA-1W to the neighboring area and to recirculate discharge from the discharge canal when needed. Seepage through the former ENR supply canal is represented as SEEP1, and seepage in and out of the seepage canal to the north is represented as SEEP2. SEEP3 represents the two seepage possibilities into or out of the discharge canal to the west, regardless of the magnitude. SEEP4 represents the possible seepage loss or gain through the southern levee from WCA-1. The unmeasured inflow from WCA-1 into STA-1W from the east is represented by L-7b.

In computing the water balance for STA-1W, it is essential to identify quantifiable variables from unquantifiable variables, making reasonable assumptions to reduce the quantity of unknowns as much as possible. Since the purpose of the seepage canal is to recirculate seepage and recycle water, it is assumed that the seepage return pump flows are recirculation in the system. This assumption does not rule out the possibility of external seepage inflow being part of recirculation flow or seepage loss out of the seepage canal. The change in storage is represented as follows:

$$\mathbf{\Delta S = G302+R+L7a+L7b-G251-G310-ET+SEEP1+SEEP2+SEEP3+SEEP4+\varepsilon_T} \quad (4)$$

Where ΔS is change in storage in the system; G302 is inflow; R is rainfall; L-7a is seepage flow from WCA-1 through the roadside culverts; L-7b is unknown subsurface seepage flow from WCA-1 into STA-1W; ET is evapotranspiration losses. G310 and G251 represent outflow pumping; ε_T represents total error in inflow and outflow terms.

The daily change in storage for STA-1W was computed as the sum of storage changes in each of the five cells (cells 1, 2, 3, 4, and 5). The change in storage volume in each cell was computed based on the area of the cell and change in stage in the cell. The remainders in the computation of daily water balances are the sum of all errors and unknowns in the system. Daily remainders were computed for the one-year study period based on the following equation:

$$\text{REMAINDERS} = \Delta S - \text{INFLOWS} + \text{OUTFLOWS} \quad (5)$$

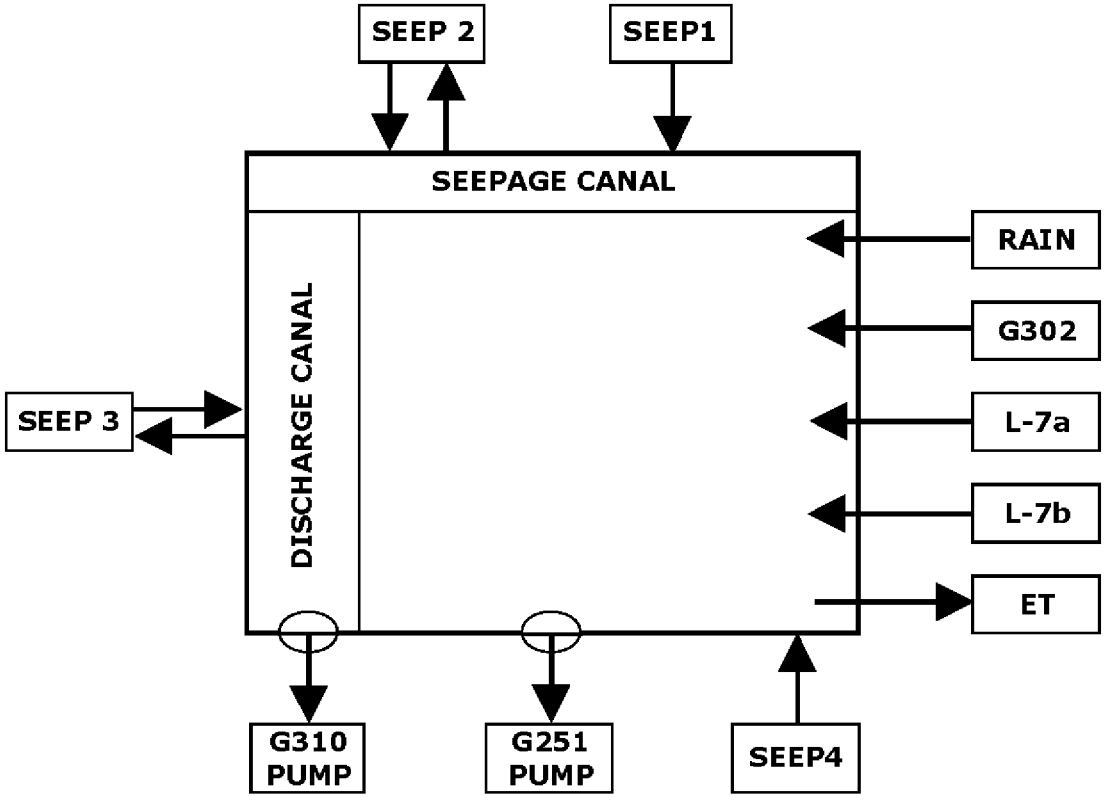

Figure 9. Schematic hydrologic model for STA 1-W.

Discussion

The total inflow through the inflow spillway was 17,600 ha-m (142,678 ac-ft) and total outflow through the outflow pumps was 17,009 ha-m (137,890 ac-ft). Seepage inflow from L-7 levee through the roadside culverts was a total of 338 ha-m (2,739 ac-ft). The seepage and recirculation pump had a total flow of 1,044 ha-m (8,465 ac-ft). Total average areal rainfall for the study period was 111.4 cm (43.8 inches) and the total average areal evapotranspiration was 131.4 cm (51.7 inches). For the study period, the mean daily remainders (errors and unknowns) was 3.82 ha-m d^{-1} (30.97 ac-ft d^{-1}), with total remainder being 1,395 ha-m (11,310 ac-ft). The standard deviation of the remainders is 63.2 ha-m d^{-1} (512.4 ac-ft d^{-1}), which signifies high variation. Figure 10 depicts the daily remainder distribution. The remainder is 6 percent of the total inflows. The known inflow from the system is higher than the known outflow and the remainder is accounted as outflow.

A summary of the one-year water budget is shown in Table 6. Details of the daily water balances terms and calculations results are shown in Appendix I. The mean hydraulic loading rate for the study period, based on the average inflow, was 1.7 centimeters per day (cm d^{-1}), or 0.7 inches per day (in d^{-1}). The mean retention time was computed as the ratio of the mean estimated water volume of STA-1W and the average daily flow rate, inflow and outflow. The estimated mean volume was computed from the area-weighted (by cell) mean depth of 23 cm (8.9 inches) and a total area of 2,772 ha (6670 ac). The estimated mean hydraulic retention time was 13.2 days.

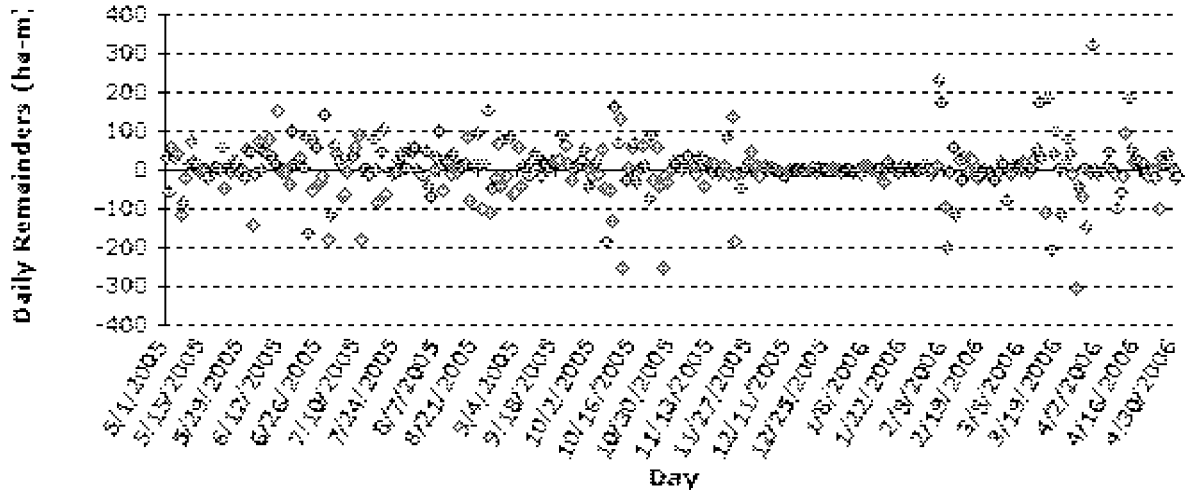

Figure 10. Distribution of daily remainders (errors and unknowns) from STA-1W water balance.

Table 6. Summary of water budget for STA-1W (May 1, 2005 to April 30, 2006)

Inflows	ha-m	Percent of total	Ouflows	ha-m	Percent of total
Spillway inflow	17,600	83.7	Outflow Pump	17,009	77
Rain	3,087	14.7	ET	3,642	17
L-7 Culverts (L7a)	338	1.6			
Remainders				1,395	6
Total	21,025	100	Total	22,046	100

Change in storage	-1,022
Seepage/recirculation seepage pump (ha-m)	1,044
Hydraulic loading rate (cm/d)	1.74
Average depth (cm)	23
Retention time (days)	13.2

1 ha-m = 8.1068 ac-ft

WATER BUDGET SUMMARY

This water budget study covers the seventh year of operation of STA-1W. The period of analysis was changed to May of previous year to April of current year in order to coincide with the reporting period for the South Florida Environmental Report. For the period of analysis, the total inflow through the spillway (G302) was 17,600 ha-m, or 142,678 ac-ft. The total outflow through the outflow pump stations (G251 and G310) was 17,009 ha-m (137,890 ac-ft). Seepage inflow from L-7 levee through the roadside culverts was 338 ha-m (2,739 ac-ft). The seepage and recirculation pump had a total flow of 1,044 ha-m (8,465 ac-ft). Total areal average rainfall for the study period was 111.4 cm (43.8 in), and the total areal average evapotranspiration was 131.4 cm (51.7 in). The sum of the errors and unknowns was 1,395 ha-m (11,310 ac-ft), which represents 6 percent of the total outflows from the system.

The mean hydraulic loading rate for the one-year period, based on the average flow, was 1.7 cm d^{-1} (0.7 in d^{-1}). The mean hydraulic retention time was computed as the ratio of the estimated mean volume of STA-1W and the average daily flow rate. The estimated mean volume was computed using the area-weighted (by cell) mean depth of 23 cm (8.9 inches) and a total area of 2,700 ha (6,670 ac). The estimated mean hydraulic retention time was 13.2 days and the change in storage was -1,022 ha-m (-8,283 ac-ft). A comparison with the previous four years of water budget shows that surface water inflow and outflow for this period was the smallest indicating lower hydraulic loading rate.

Inflow through the G302 spillway that was used for 2000, 2001 and 2002 water budgets for STA-1W was underestimated by the flow computation equations. In July 2003, after recalibration of the flow equations, new flow data for the G302 spillway, was loaded into the database for the period of record. Comparison of previous years' and current year water budgets are shown in Table 7. Inflows into STA-1W through the G302 spillway were updated based on the new dataset in DBHYDRO.

Table 7. Comparison of STA-1W water budget components to previous reporting years[#]

Year	(7/1/1999 -4/30/2000)*	(5/1/2000 - 4/30/2001)	(5/1/2001 - 4/30/2002)	(5/1/2002 - 4/30/2003)	(5/1/2003 - 4/30/2004)	(5/1/2004 - 4/30/2005)	(5/1/2005 - 4/30/2006)
Inflows (ha-m)							
Spillway inflow	14,296	11,573	34,398	73,006	36,104	42,075	17,600
Rain	2,623	2,467	3,704	2,901	2,337	2,949	3,087
L-7 Culverts (L7a)	541	288	440	393	429	305	338
Remainders				1,374	562	5,166	
Total	17,460	14,328	38,542	77,674	39,432	50,495	21,025
Outflows (ha-m)							
Outflow pump	13,379	11,166	33,012	73,518	36,710	47,326	17,009
ET	2,955	3,946	3,715	3,595	3,495	3,566	3,642
Remainders	1410	331	1,313				1,395
Total	17,744	15,443	38,040	77,113	40,205	50,893	22,046
Change in Storage (ha-m)	(284)	(1,113)	503	654	(785)	(397)	-1,022
Seepage/Recirculation Seepage Pump (ha-m)	5,475	3,386	1,449	1,431	1,294	1,863	1,044
Loading Rate (cm/d)	1.70	1.14	3.40	7.41	3.65	4.16	1.74
Average Depth (cm)	54.3	53.4	57.5	61.1	59.0	44.7	23
Retention Time (days)	38.7	46.3	16.8	8.2	16.0	10.1	13.2

1 ha-m = 8.1068 ac-ft

* 10-month period

water budget for previous years was recalculated to reflect the updated G302 spillway inflows in July 2003

REFERENCES

Abtew, W. 1996a. Evapotranspiration Measurements and Modeling for Three Wetland Systems in South Florida. Journal of American Water Resources Association, 32(3): 465-473.

Abtew, W. 1996b. Lysimeter Study of Evapotranspiration from a Wetland. C. R. Camp, E. J. Sadler and R. E. Yoder (eds.). In: Evapotranspiration and Irrigation Scheduling. Proceedings of the ASAE International Conference. November 3-6, 1996. San Antonio, TX.

Abtew, W. and V. Mullen. 1997. Water Budget Analysis for the Everglades Nutrient Removal Project (August 20, 1996 to August 19, 1997). Technical Memorandum WRE # 354. South Florida Water Management District. West Palm Beach, FL.

Abtew, W. and D. Downey, 1998. Water Budget Analysis for the Everglades Nutrient Removal Project (August 20, 1997 to August 19, 1998). Technical Memorandum WRE # 368. South Florida Water Management District. West Palm Beach, FL.

Abtew, W., J. Raymond and M. Imru. 2000. Water Budget Analysis for the Everglades Nutrient Removal Project and Stormwater Treatment Area 1 West (August 20, 1998 to June 30, 2000). Technical Publication EMA # 388. South Florida Water Management District. West Palm Beach, FL.

Abtew, W., J. Raymond and M. Imru. 2001. Water Budget Analysis for Stormwater Treatment Area 1 West (July 1, 2000 to June 30, 2001). Technical Publication EMA # 398. South Florida Water Management District. West Palm Beach, FL.

Abtew, W., M. Imru and J. Raymond. 2002. Water Budget Analysis for Stormwater Treatment Area 1 West (July 1, 2001 to June 30, 2002). Technical Publication EMA # 406. South Florida Water Management District. West Palm Beach, FL.

Abtew, W. and A. Reardon. 2003. Water Budget Analysis for Stormwater Treatment Area 1 West (May 1, 2002 to April 30, 2003). Technical Publication EMA # 411. South Florida Water Management District. West Palm Beach, FL.

Abtew, W. 2004. Water Budget Analysis for Stormwater Treatment Area 1 West (May 1, 2003 to April 30, 2004). Technical Publication ERA # 420. South Florida Water Management District. West Palm Beach, FL.

Abtew, W. 2005. Water Budget Analysis for Stormwater Treatment Area 1 West (May 1, 2004 to April 30, 2005). Technical Publication ERA # 434. South Florida Water Management District, West Palm Beach, FL.

Guardo, M., W. Abtew, L. Fink and A. Cadogan. 1996. Water Budget Analysis for the Everglades Nutrient Removal Project (August 19, 1994 to August 19, 1996). Technical Memorandum WRE # 347. South Florida Water Management District. West Palm Beach, FL.

Guardo, M. 1996. Hydrologic Balance of a Subtropical Wetland Constructed for Nutrient Removal. Presented at AWRA 32nd Annual Conference and Symposium on GIS and Water Resources. September 22-26, 1996.

Hutcheon Engineers. 1996. Everglades Construction Project Stormwater Treatment Area 1-W, Detailed Design Report, Report submitted to the South Florida Water Management District. West Palm Beach, FL.

Jammal and Associates, Inc. 1991. Geotechnical Services SFWMD Everglades Nutrient Removal Project. (draft) Report submitted to the South Florida Water Management District. West Palm Beach, FL.

Redfield, G., J. Van Arman, K. Rizzardi and M. Chimney. 1999. Chapter 1: Introduction to the Everglades Interim Report. Everglades Interim Report. South Florida Water Management District. West Palm Beach, FL.

Whalen, B. M. and P. J. Whalen. 1994. Nonpoint Source Regulatory Program for the Everglades Agricultural Area. ASAE Paper FL94-101.

APPENDIX I: WATER BALANCE TERMS WITH CALCULATED REMAINDERS

Date	Change in storage	Inflow surface water	Outflow surface water	Seepage pump	Seepage L-7 canal	Rain	ET	Remainders
	ha-m	ha-m	ha-m	ha-m	ha-m	ha-m	ha-m	ha-m
5/1/2005	-36.979	0	0	3.851	0.37	0	6.791	30.558
5/2/2005	50.223	0.695	0	4.878	0.312	1.408	10.478	-58.286
5/3/2005	36.026	0	0	2.996	0.308	101.387	6.32	59.349
5/4/2005	56.568	53.081	4.827	5.431	0.326	46.469	5.766	32.715
5/5/2005	138.374	210.147	35.024	4.487	0.373	11.969	5.35	43.741
5/6/2005	275.171	255.33	80.434	2.98	0.232	0	13.583	-113.626
5/7/2005	93.051	134.014	114.064	3.307	0.178	0	13.666	-86.589
5/8/2005	-88.63	58.896	154.231	4.056	0.243	0	16.05	-22.512
5/9/2005	-130.605	0.017	98.393	2.539	0.315	0	16.022	16.522
5/10/2005	-127.392	0	37.087	4.688	0.357	0	14.83	75.832
5/11/2005	-55.863	0	22.933	2.266	0.368	0	14.137	19.161
5/12/2005	-33.689	0	7.837	3.673	0.358	0	12.169	14.041
5/13/2005	-6.987	0	0	3.29	0.335	1.408	14.303	-5.573
5/14/2005	-12.478	0	0	2.159	0.323	0	10.727	2.074
5/15/2005	-4.29	0	0	4.604	0.292	8.449	12.446	0.585
5/16/2005	7.445	0	0.103	2.982	0.29	0	13.583	-20.841
5/17/2005	-14.238	0	0	2.23	0.277	0	13.361	1.154
5/18/2005	-16.708	0	0	5.758	0.247	0	13.721	3.234
5/19/2005	-16.007	0	0	1.915	0.231	0	12.529	3.709
5/20/2005	-13.731	0	0	3.342	0.218	0	12.446	1.503
5/21/2005	-6.607	0	0	2.12	0.197	63.367	13.943	56.228
5/22/2005	34.369	0	0	5.819	0.194	0	11.753	-45.928
5/23/2005	-5.418	0	0	1.908	0.183	16.194	13.777	8.018
5/24/2005	-9.867	0	0	3.147	0.158	0	14.664	-4.639
5/25/2005	-10.789	0	0	3.485	0.14	21.122	13.056	18.995
5/26/2005	17.542	0	0	4.594	0.162	49.286	9.536	22.37
5/27/2005	20.714	28.751	1.847	1.275	0.185	2.112	15.19	-6.703
5/28/2005	95.879	146.512	35.638	5.284	0.144	0	13.943	1.196
5/29/2005	39.091	42.266	11.507	3.077	0.149	0	14.719	-22.902
5/30/2005	31.241	3.619	0	4.413	0.165	90.826	10.894	52.475
5/31/2005	106.756	85.619	27.437	6.022	0.172	102.796	7.872	46.522
6/1/2005	263.9	195.198	156.849	4.68	0.192	90.122	4.657	-139.894
6/2/2005	36.135	141.205	190.882	6.841	0.525	77.449	3.049	-10.887
6/3/2005	41.489	167.901	156.188	3.189	0.716	106.316	4.546	72.71
6/4/2005	43.51	169.031	126.204	0	0.924	4.224	4.879	-0.414
6/5/2005	-5.686	170.382	125.365	0	1.036	1.408	7.872	45.275
6/6/2005	-8.619	168.317	125.382	0	0.99	0	11.698	40.846
6/7/2005	1.991	165.608	125.881	0	0.917	51.398	10.783	79.268
6/8/2005	10.947	173.638	126.662	0	0.729	0.704	7.401	30.061
6/9/2005	-4.425	144.298	126.476	9.913	0.612	0	5.073	17.786
6/10/2005	-18.42	142.991	74.743	15.348	0.581	68.296	3.16	152.385
6/11/2005	67.721	189.83	130.359	15.156	0.554	9.153	6.625	-5.168
6/12/2005	-8.807	176.019	171.062	15.179	0.543	0	15.135	-0.828
6/13/2005	-17.072	159.758	169.836	15.23	0.427	0	15.19	-7.769
6/14/2005	-96.157	13.601	130.1	15.598	0.438	0	15.079	-34.983
6/15/2005	-148.165	12.471	48.261	12.338	0.382	0	15.135	97.622
6/16/2005	-54.168	13.055	34.885	21.311	0.234	0	14.608	17.964
6/17/2005	-56.969	11.932	35.863	22.835	0.193	0	12.585	20.646

1 ha-m = 8.1068 ac-ft

Date	Change in storage	Inflow surface water	Outflow surface water	Seepage pump	Seepage L-7 canal	Rain	ET	Remainders
	ha-m	ha-m	ha-m	ha-m	ha-m	ha-m	ha-m	ha-m
6/18/2005	-40.548	12.182	25.083	27.234	0.145	12.673	11.088	29.377
6/19/2005	-26.017	12.392	25.59	22.232	0.143	0.704	9.536	4.13
6/20/2005	2.021	108.535	48.187	19.222	0.14	26.051	1.137	83.381
6/21/2005	181.274	108.451	85.475	5.885	0.12	3.52	6.431	-161.089
6/22/2005	-99.283	14.298	173.129	0.895	0.168	10.561	6.376	-55.195
6/23/2005	-206.682	38.22	162.552	5.599	0.221	0.704	9.84	73.435
6/24/2005	-71.711	98.185	106.734	3.076	0.175	9.857	13.472	59.722
6/25/2005	-25.139	10.433	97.931	3.643	0.172	47.877	15.551	-29.861
6/26/2005	-69.24	7.942	97.099	2.956	0.126	11.265	9.12	-17.646
6/27/2005	32.595	208.393	71.267	5.587	0.071	42.949	7.318	140.233
6/28/2005	335.139	297.026	168.238	3.785	0.06	33.796	8.122	-180.617
6/29/2005	34.315	183.256	301.377	7.619	0.23	45.061	7.512	-114.657
6/30/2005	-154.022	198.315	282.638	4.795	0.397	7.041	14.83	62.307
7/1/2005	12.094	247.846	196.089	2.578	0.375	11.969	12.391	39.616
7/2/2005	48.233	201.599	155.349	4.495	0.379	35.908	13.888	20.416
7/3/2005	-12.617	15.098	123.024	5.996	0.442	36.612	12.086	-70.341
7/4/2005	-62.14	11.773	123.332	3.998	0.532	0	13.305	-62.192
7/5/2005	-126.141	12.121	125.485	3.485	0.64	0	16.216	-2.799
7/6/2005	-113.253	7.382	72.042	3.041	0.763	0	15.745	33.611
7/7/2005	-68.184	7.413	28.318	4.003	0.746	0	13.278	34.747
7/8/2005	-9.171	89.02	36.26	2.67	0.513	7.041	13	56.485
7/9/2005	74.95	155.834	50.923	4.808	0.309	63.367	4.463	89.174
7/10/2005	198.33	84.053	97.128	2.662	0.154	40.133	5.294	-176.412
7/11/2005	-24.271	93.368	121.206	4.448	0.134	19.714	12.806	3.475
7/12/2005	-15.558	67.355	100.999	3.746	0.134	20.418	12.113	-9.647
7/13/2005	-61.458	18.167	106.169	3.63	0.158	23.939	9.951	-12.398
7/14/2005	-29.723	123.667	64.316	3.263	0.143	0	9.646	79.571
7/15/2005	58.019	117.323	51.862	4.018	0.117	6.337	15.689	-1.793
7/16/2005	-13.858	12.933	100.781	1.929	0.117	0	10.062	-83.935
7/17/2005	-125.303	8.798	75.206	3.002	0.114	0	13.222	45.787
7/18/2005	-42.155	134.623	61.602	3.137	0.065	0.704	12.945	103
7/19/2005	41.975	71.078	76.884	3.534	0.061	0	15.135	-62.855
7/20/2005	-37.542	10.22	41.05	4.149	0.098	1.408	14.969	-6.751
7/21/2005	-7.225	9.559	13.775	1.91	0.068	0	14.082	-11.005
7/22/2005	-26.958	10.959	27.232	2.23	0.048	0	13.888	-3.155
7/23/2005	-62.242	11.463	36.049	3.135	0.052	1.408	14.054	25.062
7/24/2005	-37.216	10.222	8.233	2.67	0.038	14.082	8.815	44.51
7/25/2005	-2.869	10.007	0	2.3	0.04	0.704	10.201	3.419
7/26/2005	-6.762	9.723	0	3.508	0.054	0	13.167	3.372
7/27/2005	-32.219	11.534	0	0	0.306	18.306	11.809	50.556
7/28/2005	-49.278	9.919	0	1.812	0.097	0.704	12.28	47.718
7/29/2005	-7.176	8.385	0	1.802	0.129	49.99	9.064	56.616
7/30/2005	10.773	12.777	0	1.939	0.174	9.153	11.088	0.243
7/31/2005	21.968	15.556	0	2.872	0.226	1.408	7.512	-12.29
8/1/2005	29.414	29.553	0	1.712	0.243	0	14.192	-13.81
8/2/2005	115.804	177.049	0	3.107	0.236	0	11.698	49.783
8/3/2005	165.371	136.478	0	0	0.207	0	11.254	-39.94
8/4/2005	63.519	20.043	12.248	1.434	0.193	1.408	12.973	-67.096
8/5/2005	-27.514	12.39	33.676	1.59	0.24	0	7.983	-1.515
8/6/2005	-76.591	12.16	45.227	1.79	0.316	0	13.749	30.091
8/7/2005	-48.27	11.962	16.062	1.851	0.399	66.183	12.141	98.611

1 ha-m = 8.1068 ac-ft

Date	Change in storage	Inflow surface water	Outflow surface water	Seepage pump	Seepage L-7 canal	Rain	ET	Remainders
	ha-m	ha-m	ha-m	ha-m	ha-m	ha-m	ha-m	ha-m
8/8/2005	51.647	11.668	0	2.163	0.42	0	14.691	-54.25
8/9/2005	-3.593	10.849	0.117	1.262	0.422	17.602	11.698	20.651
8/10/2005	6.606	9.429	0	2.13	0.419	29.571	9.785	23.028
8/11/2005	4.378	9.85	6.312	1.386	0.419	2.112	12.502	-10.811
8/12/2005	-3.048	10.968	0	1.775	0.424	35.204	7.872	41.772
8/13/2005	2.323	9.704	0	2.342	0.453	0	12.89	-5.056
8/14/2005	-12.036	10.966	0	2.127	0.455	0	12.197	11.26
8/15/2005	-18.135	9.589	5.549	3.03	0.462	0	12.612	10.025
8/16/2005	-16.977	10.819	0	2.221	0.461	0	12.89	15.367
8/17/2005	34.222	11.879	0	4.097	0.437	116.877	11.171	83.8
8/18/2005	69.45	11.536	5.649	2.448	0.42	0	13.305	-76.448
8/19/2005	-16.053	10.699	0	3.731	0.405	0	14.192	12.965
8/20/2005	-18.822	9.405	0	3.187	0.386	0	11.642	16.971
8/21/2005	42.045	9.814	6.339	5.925	0.368	141.52	10.09	93.228
8/22/2005	76.172	11.519	27.882	3.597	0.381	1.408	11.476	-102.222
8/23/2005	-68.117	10.934	50.497	3.578	0.452	0	12.335	16.671
8/24/2005	-30.378	204.102	72.989	3.598	0.336	0	11.781	150.046
8/25/2005	116.831	131.927	155.841	4.448	0.293	33.092	1.386	-108.746
8/26/2005	6.806	61.38	144.584	4.416	0.491	48.581	7.845	-48.783
8/27/2005	-48.303	14.066	96.947	4.685	0.581	19.714	8.26	-22.543
8/28/2005	-43.787	87.902	70.628	4.24	0.566	14.786	7.706	68.707
8/29/2005	0.017	64.235	95.039	4.049	0.668	0	10.589	-40.742
8/30/2005	-90.145	94.055	95.159	3.639	0.69	0	10.7	79.031
8/31/2005	-59.025	15.216	78.311	2.588	0.783	0	10.395	-13.682
9/1/2005	39.489	138.932	31.371	3.633	0.722	24.643	9.702	83.735
9/2/2005	150.876	151.019	58.25	4.337	0.641	2.816	10.312	-64.962
9/3/2005	61.807	84.939	87.092	2.476	0.688	14.786	7.789	-56.275
9/4/2005	7.222	112.978	85.869	3.736	0.748	39.428	4.213	55.85
9/5/2005	49.29	106.083	127.232	6.16	0.776	31.684	6.043	-44.022
9/6/2005	4.112	159.23	138.775	4.147	0.766	0	5.267	11.842
9/7/2005	10.696	144.337	130.758	3.648	0.738	5.633	9.231	0.023
9/8/2005	-42.641	85.668	136.035	3.512	0.819	0	8.538	-15.445
9/9/2005	-116.245	12.999	95.161	4.282	1.015	0	13.472	21.626
9/10/2005	-107.126	9.885	66.885	2.642	1.18	0	11.31	39.996
9/11/2005	-60.013	9.816	25.296	3.205	1.217	0	11.504	34.246
9/12/2005	4.12	11.69	9.586	3.703	1.157	0.704	13.416	-13.571
9/13/2005	-31.934	11.228	14.727	3.358	1.16	1.408	12.862	18.141
9/14/2005	-16.261	11.45	0	3.595	1.134	0	12.557	16.288
9/15/2005	-12.206	12.473	7.634	2.182	1.091	0	13.056	5.08
9/16/2005	-26.947	11.656	5.439	2.79	1.086	0	12.141	22.109
9/17/2005	-12.137	12.955	0	3.516	1.055	8.449	11.698	22.898
9/18/2005	-9.437	13.444	0	2.198	1.035	8.449	10.922	21.443
9/19/2005	-3.603	10.061	0	3.181	0.996	18.306	8.565	24.401
9/20/2005	75.745	206.94	56.741	2.814	0.921	18.306	4.13	89.551
9/21/2005	-27.752	72.769	43.277	2.976	1.128	13.378	9.619	62.131
9/22/2005	14.015	11.634	0	3.5	1.114	21.122	5.017	14.838
9/23/2005	29.44	8.187	0	2.324	1.082	2.816	7.567	-24.922
9/24/2005	-1.755	7.453	0	3.807	1.059	0	12.502	-2.235
9/25/2005	-11.82	7.083	0	2.034	1.038	1.408	11.947	9.402
9/26/2005	-12.336	7.861	5.5	3.047	1.03	9.857	10.312	15.272
9/27/2005	21.211	45.361	0	3.333	0.994	11.265	8.565	27.844
9/28/2005	34.778	23.28	42.019	5.437	1.088	116.877	9.342	55.106

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Date	Change in storage	Inflow surface water	Outflow surface water	Seepage pump	Seepage L-7 canal	Rain	ET	Remainders
	ha-m	ha-m	ha-m	ha-m	ha-m	ha-m	ha-m	ha-m
9/29/2005	71.849	97.882	62.652	5.212	1.11	1.408	10.617	-44.718
9/30/2005	6.831	62.493	51.781	2.041	1.166	4.929	10.755	-0.779
10/1/2005	-7.013	8.213	21.57	2.069	1.192	1.408	11.116	-14.86
10/2/2005	29.193	6.574	0	3.721	1.211	50.694	9.591	19.695
10/3/2005	37.178	81.641	53.293	1.64	1.217	7.041	9.397	-9.969
10/4/2005	17.264	134.286	84.912	3.113	1.145	21.826	4.075	51.006
10/5/2005	200.498	271.972	112.52	1.639	0.79	0.704	9.785	-49.337
10/6/2005	157.588	177.996	241.964	4.625	0.798	42.949	5.572	-183.381
10/7/2005	68.188	230.279	221.644	3.536	0.871	12.673	6.376	-52.385
10/8/2005	-72.922	67.355	264.65	4.062	1.207	0	10.312	-133.478
10/9/2005	-290.739	9.449	145.117	0.946	1.644	15.49	8.676	163.529
10/10/2005	-124.05	6.401	55.305	3.958	1.742	0	8.759	68.129
10/11/2005	134.945	326.736	52.303	0.658	1.098	1.408	8.649	133.345
10/12/2005	268.345	116.702	91.907	1.994	0.958	0	10.423	-253.015
10/13/2005	-38.755	96.264	152.274	1.217	1.121	0	10.256	-26.39
10/14/2005	-132.139	35.807	160.208	1.985	1.319	2.112	8.177	2.992
10/15/2005	-156.797	5.823	101.936	2.041	1.595	0.704	6.209	56.774
10/16/2005	-101.657	4.362	28.178	1.953	1.686	0	10.256	69.271
10/17/2005	13.381	4	10.778	1.811	1.622	0	11.143	-29.68
10/18/2005	-24.139	2.845	14.487	1.466	1.614	0	8.066	6.045
10/19/2005	36.438	109.861	8.847	3.428	1.456	3.52	7.041	62.511
10/20/2005	90.098	191.925	84.244	1.414	1.24	0	8.288	10.535
10/21/2005	-11.344	31.914	115.919	1.343	1.348	4.224	4.158	-71.247
10/22/2005	-72.531	107.747	94.429	1.347	1.416	7.745	5.239	89.771
10/23/2005	-29.77	51.808	102.626	1.267	1.564	2.816	7.845	-24.513
10/24/2005	225.341	209.668	73.033	0	1.632	147.153	3.16	56.919
10/25/2005	346.769	461.279	146.634	0	0.829	1.408	11.559	-41.446
10/26/2005	307.375	290.839	227.164	0	0.505	0	11.67	-254.865
10/27/2005	-28.278	240.139	276.068	0	0.894	0	10.617	-17.374
10/28/2005	-44.299	231.602	300.723	0	1.058	0	10.007	-33.771
10/29/2005	-85.636	198.942	278.784	0	1.239	0	8.981	-1.948
10/30/2005	-90.462	188.793	252.957	0	1.383	0	8.981	18.7
10/31/2005	-73.031	180.114	234.44	0	1.504	0	6.542	13.667
11/1/2005	-38.121	163.847	185.553	0	1.59	11.265	3.354	25.916
11/2/2005	-0.307	187.516	178.536	0	1.632	0	9.619	1.3
11/3/2005	2.865	153.111	118.468	0	1.596	0	7.623	25.751
11/4/2005	-22.645	114.162	91.486	0	1.668	0	8.122	38.867
11/5/2005	0.528	121.174	102.119	0	1.642	0	9.064	11.105
11/6/2005	-6.681	107.025	103.827	0	1.634	0.704	7.706	4.511
11/7/2005	-78.4	20.046	101.681	0	1.907	0	9.868	-11.196
11/8/2005	-124.855	11.179	98.051	0	2.011	0	7.484	32.51
11/9/2005	-52.324	84.748	97.759	0	1.867	0	9.619	31.561
11/10/2005	-53.737	21.122	106.744	10.932	1.982	0	10.229	-40.132
11/11/2005	-103.337	9.733	83.863	8.265	2.119	0	7.956	23.37
11/12/2005	-28.945	3.868	8.89	3.374	2.126	0	8.843	17.206
11/13/2005	-17.367	3.146	17.176	2.559	2.137	0	8.482	-3.008
11/14/2005	-7.975	12.172	17.478	1.654	2.076	17.602	6.459	15.888
11/15/2005	5.833	2.532	0	2.107	2.167	0	7.845	-8.979
11/16/2005	-11.748	0	14.559	3.343	2.182	3.52	7.346	-4.455

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	ha-m	ha-m	ha-m	ha-m	ha-m	ha-m	ha-m	ha-m
11/17/2005	-31.273	0	17.038	1.937	2.148	0	7.179	9.204
11/18/2005	-28.814	75.314	16.906	2.359	2.113	0	3.465	85.87
11/19/2005	32.92	25.365	0.181	1.176	2.12	2.112	5.045	-8.549
11/20/2005	70.432	288.373	74.072	2.832	1.737	0	7.179	138.427
11/21/2005	283.608	201.885	104.455	2.274	1.317	8.449	5.378	-181.79
11/22/2005	10.415	178.725	172.042	2.264	1.32	3.52	9.646	-8.538
11/23/2005	-11.841	129.906	181.331	2.577	1.442	0.704	9.702	-47.14
11/24/2005	-64.692	6.719	69.256	11.427	1.82	0	8.649	-4.674
11/25/2005	-72.411	5.867	68.138	6.055	1.983	0	9.037	3.086
11/26/2005	-86.121	5.713	63.482	1.846	2.151	0	8.87	21.633
11/27/2005	-83.099	3.599	37.587	2.068	2.363	0	6.653	44.821
11/28/2005	-48.316	5.312	42.678	1.99	2.441	0	5.544	7.847
11/29/2005	-26.542	6.797	43.29	1.758	2.391	20.418	1.414	11.444
11/30/2005	1.085	6.144	19.031	3.148	2.3	0	6.071	-17.743
12/1/2005	-23.274	5.865	18.795	1.183	2.243	0	9.48	3.107
12/2/2005	-11.62	5.016	0	2.382	2.123	0	9.12	9.639
12/3/2005	-13.526	3.883	11.289	1.999	2.143	0	7.845	0.418
12/4/2005	-4.521	5.667	0	2.172	2.174	0	8.454	3.908
12/5/2005	1.17	4.431	0	1.735	2.164	0.704	5.71	0.419
12/6/2005	3.609	5.099	0	3.781	2.051	0.704	4.934	-0.689
12/7/2005	6.745	2.809	0	1.994	2.081	1.408	3.853	-4.3
12/8/2005	16.845	2.633	0	3.191	2.129	7.745	5.766	-10.104
12/9/2005	9.117	0	0	2.98	2.067	0.704	7.484	-13.83
12/10/2005	0.505	0	0	2.06	1.983	0	7.373	-5.895
12/11/2005	-4.201	0	0	1.343	1.93	0	5.35	0.781
12/12/2005	-8.497	0.024	0	1.729	1.882	0	9.258	1.145
12/13/2005	-9.133	0	0	1.169	1.867	0	8.704	2.296
12/14/2005	-5.332	0	0	1.99	2.045	0	8.233	-0.856
12/15/2005	-0.056	0	0	1.715	2.096	2.112	3.936	0.328
12/16/2005	-3.407	0	0	1.608	2.01	0	6.043	-0.626
12/17/2005	0.139	0	0	2.648	2.053	0	6.209	-4.295
12/18/2005	-2.775	0	0	1.745	2.02	0	5.322	-0.527
12/19/2005	-1.76	0	0	1.525	1.902	1.408	1.635	3.435
12/20/2005	2.917	0	0	1.941	1.861	4.224	3.049	0.119
12/21/2005	2.59	0	0	1.998	1.816	0	4.962	-5.736
12/22/2005	-12.2	0	0	1.551	1.799	0.704	7.956	6.747
12/23/2005	-5.421	0	0	2.288	1.812	0	7.373	-0.14
12/24/2005	-3.825	0	0	2.154	1.887	0.704	6.653	-0.237
12/25/2005	-1.871	0	0	1.801	1.886	1.408	7.152	-1.987
12/26/2005	0.207	0	0	1.483	1.761	0	8.51	-6.956
12/27/2005	-12.846	0	0	2.512	1.736	0	9.037	5.545
12/28/2005	-4.969	0	0	2.516	1.772	0	8.454	-1.713
12/29/2005	-2.815	0	0	1.216	1.774	1.408	5.738	0.259
12/30/2005	-3.483	0	0	2.119	1.703	0	8.344	-3.158
12/31/2005	-4.108	0	0	2.114	1.711	0	8.371	-2.552
1/1/2006	-2.799	0	0	1.187	1.697	0	6.597	-2.101
1/2/2006	-5.906	0	0	1.565	1.716	0.704	7.567	0.759
1/3/2006	0.981	0	0	1.931	1.623	0	7.124	-6.482
1/4/2006	-3.782	0	0	1.387	1.567	0	8.593	-3.244
1/5/2006	-8.049	0	0	2.047	1.587	0	8.538	1.098
1/6/2006	4.434	0	0	1.673	1.498	0	7.595	-10.531
1/7/2006	-16.693	0	0	2.12	1.46	0	9.092	9.061

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	ha-m	ha-m	ha-m	ha-m	ha-m	ha-m	ha-m	ha-m
1/8/2006	-18.653	0	0	0.727	1.495	0	9.203	10.945
1/9/2006	-8.982	0	0	1.592	1.494	0	7.373	3.103
1/10/2006	-4.706	0	0	2.225	1.506	0.704	4.546	2.37
1/11/2006	-3.352	0	0	2.661	1.488	0	7.346	-2.506
1/12/2006	0.241	0	0	1.686	1.45	0	6.958	-5.749
1/13/2006	-5.587	0	0	2.241	1.484	4.224	5.627	5.668
1/14/2006	25.973	0	0	0.174	1.3	0.704	8.538	-32.507
1/15/2006	-13.147	0	0	2.765	1.326	0	9.73	4.743
1/16/2006	-28.22	0	0	0	1.411	0	9.231	20.4
1/17/2006	-13.046	0	0	2.291	1.477	0	7.512	7.011
1/18/2006	-0.866	0	0	1.726	1.296	2.112	5.184	-0.91
1/19/2006	-2.026	0	3.467	1.481	1.308	0	5.544	-5.677
1/20/2006	-11.114	0.034	0	1.439	1.367	0	5.766	6.749
1/21/2006	-14.2	0	0	1.486	1.359	2.816	6.043	12.332
1/22/2006	-1.888	0	0	1.484	1.348	0.704	5.821	-1.881
1/23/2006	-11.901	0	0	1.605	1.4	0.704	7.484	6.521
1/24/2006	-8.866	0	4.35	1.268	1.311	0	6.93	-1.103
1/25/2006	-7.178	0	0	1.426	1.194	0	9.591	-1.219
1/26/2006	-12.347	0	5.414	1.463	1.201	0	9.425	-1.291
1/27/2006	-9.15	0	3.719	0.905	1.23	0	5.683	0.978
1/28/2006	-15.14	0	4.269	1.981	1.245	0	6.071	6.045
1/29/2006	-19.186	0	0	1.28	1.247	0	6.431	14.002
1/30/2006	-11.653	0	3.447	1.329	1.192	3.52	5.128	7.79
1/31/2006	-2.228	0	4.876	1.397	1.139	0	9.646	-11.155
2/1/2006	-7.08	0	1.226	1.489	1.165	0	9.231	-2.212
2/2/2006	-9.626	3.117	0.11	1.295	1.145	0	5.433	8.345
2/3/2006	-190.723	0	0	0.989	1.057	44.357	4.823	231.314
2/4/2006	134.307	269.421	14.289	0	0.702	53.51	1.026	174.011
2/5/2006	380.666	408.392	112.665	0	0.357	0	11.254	-95.836
2/6/2006	130.622	153.913	214.439	0	0.349	0	11.753	-202.552
2/7/2006	-82.371	268.435	346.621	0	0.508	0	11.448	-6.755
2/8/2006	-107.756	271.723	310.055	0	0.61	0	11.559	58.475
2/9/2006	-99.675	79.578	284.972	0	0.861	0	11.615	-116.473
2/10/2006	-105.417	74.518	140.968	3.287	0.996	0	11.282	28.681
2/11/2006	-69.655	8.742	98.728	1.737	1.131	0	9.536	-28.736
2/12/2006	-75.011	5.128	44.845	1.707	1.125	1.408	4.601	33.226
2/13/2006	-78.844	3.401	78.908	1.641	1.26	0	11.393	-6.796
2/14/2006	-96.678	2.476	56.068	0.742	1.432	0	12.03	32.488
2/15/2006	-44.099	3.283	14.824	2.447	1.499	0	8.454	25.603
2/16/2006	-8.468	3.12	0	2.237	1.516	0	10.423	2.681
2/17/2006	7.43	0	3.208	2.46	1.468	0	11.337	-20.507
2/18/2006	-0.79	0	0	1.94	1.449	0	12.391	-10.152
2/19/2006	-8.926	0	0	2.066	1.39	0	11.088	-0.772
2/20/2006	-9.961	0	4.338	1.673	1.392	0	9.73	-2.715
2/21/2006	-5.21	0	0	1.975	1.376	0	9.646	-3.06
2/22/2006	6.723	0	0	2.269	1.352	0	8.094	-13.465
2/23/2006	15.054	0	0	1.99	1.28	0	11.448	-25.222
2/24/2006	-4.287	0	3.342	2.081	1.244	0	9.369	-7.18
2/25/2006	-11.433	11.504	0	2.271	1.349	0.704	5.35	19.64
2/26/2006	116.113	159.787	27.784	2.39	0.882	2.112	5.128	13.756
2/27/2006	57.063	22.801	32.196	2.459	0.94	0	12.28	-77.798

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Date	Change in storage	Inflow surface water	Outflow surface water	Seepage pump	Seepage L-7 canal	Rain	ET	Remainders
	ha-m	ha-m	ha-m	ha-m	ha-m	ha-m	ha-m	ha-m
2/28/2006	-15.327	0	3.1	1.577	1.037	0	13.167	0.097
3/1/2006	-2.961	0	0	2.457	1.034	0	12.64	-8.645
3/2/2006	-29.618	0	2.505	2.344	1.07	0	13.305	14.878
3/3/2006	-23.219	0	0	1.827	1.001	0	11.809	12.411
3/4/2006	-24.737	0	1.297	1.778	1.008	0	11.393	13.055
3/5/2006	-34.244	0	2.092	2.332	1.002	0	13	20.154
3/6/2006	-25.183	0	0	1.711	0.98	0	11.698	14.465
3/7/2006	-9.156	0	2.258	1.724	0.883	0	13.472	-5.691
3/8/2006	-17.997	0	0	1.362	0.932	0	14.137	4.792
3/9/2006	-37.816	0	2.131	2.229	0.991	0	11.67	25.006
3/10/2006	-62.387	0	0	2.015	0.962	0	10.838	52.511
3/11/2006	-188.069	0	2.985	1.712	0.933	0	12.529	173.488
3/12/2006	-43.444	0	0	1.385	0.89	0	10.617	33.717
3/13/2006	98.764	0	2.992	2.035	0.896	0	11.615	-112.475
3/14/2006	-191.238	0.093	0	2.06	0.826	0	10.145	182.012
3/15/2006	193.501	0.027	0	1.615	0.756	0	10.783	-203.501
3/16/2006	-58.83	0	2.523	1.307	0.788	0	13.167	43.928
3/17/2006	-110.648	0	0.675	1.889	0.715	0	12.391	98.297
3/18/2006	-19.649	0	0	1.366	0.678	0	13	7.327
3/19/2006	107.162	0	0	2.194	0.695	0	10.672	-117.139
3/20/2006	-25.839	0	0	0.835	0.702	0	13.111	13.43
3/21/2006	-92.255	0	0	1.381	0.652	0	12.751	80.156
3/22/2006	-55.414	0	0	1.624	0.585	0	13.472	42.527
3/23/2006	113.774	54.869	18.291	1.925	0.645	73.928	5.793	-8.416
3/24/2006	373.35	143.456	64.582	2.803	0.519	0	11.753	-305.71
3/25/2006	101.701	125.035	51.679	2.471	0.45	0	15.911	-43.806
3/26/2006	6.818	50.127	97.869	1.361	0.501	0	14.553	-68.612
3/27/2006	-104.195	6.095	87.833	2.335	0.623	0	16.022	7.058
3/28/2006	101.977	0	30.608	1.855	0.735	0	14.553	-146.403
3/29/2006	-10.342	0	5.062	1.694	0.756	0	10.561	-4.525
3/30/2006	-332.969	0	0	2.13	0.725	0	13.361	320.333
3/31/2006	-14.708	0	2.899	1.241	0.698	0	12.391	0.116
4/1/2006	0.82	0	0	1.662	0.654	0	11.615	-11.781
4/2/2006	-13.458	0	3.093	1.53	0.627	0	13.943	-2.951
4/3/2006	-12.613	0	0.149	1.688	0.635	0	14.83	-1.731
4/4/2006	-22.607	0	0	1.993	0.589	0	13.777	9.419
4/5/2006	-28.802	35.384	0	1.196	0.57	0	15.634	49.122
4/6/2006	28.657	43.739	0	1.242	0.568	0	13.888	1.762
4/7/2006	32.905	38.53	0	1.145	0.536	0	14.497	-8.336
4/8/2006	128.5	41.853	0	1.745	0.488	0	11.864	-98.023
4/9/2006	84.205	17.606	0	1.779	0.447	16.898	9.286	-58.54
4/10/2006	11.406	3.291	0	1.372	0.456	5.633	13.472	-15.498
4/11/2006	-104.371	0	0	1.59	0.479	2.816	15.079	92.587
4/12/2006	-191.534	0	0	1.191	0.472	4.224	12.862	183.368
4/13/2006	-63.788	1.617	0	1.564	0.442	0.704	12.391	54.16
4/14/2006	-36.98	0	0	1.299	0.438	0	14.137	23.281
4/15/2006	-37.238	0	0	1.481	0.435	0	16.687	20.986
4/16/2006	-38.747	0	0	1.499	0.398	0	16.465	22.68
4/17/2006	-32.495	0	0	1.377	0.356	0	15.745	17.106
4/18/2006	-5.678	0	0	1.201	0.322	0	13.056	-7.056
4/19/2006	8.556	0	0	0.803	0.339	0	8.039	-16.256
4/20/2006	-8.561	0	0	0.729	0.305	0	16.022	-7.156
4/21/2006	-12.446	0	0	1.904	0.311	0	13.943	-1.186

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	ha-m	ha-m	ha-m	ha-m	ha-m	ha-m	ha-m	ha-m
4/22/2006	13.472	0	0	0.067	0.318	7.745	14.082	-19.491
4/23/2006	88.162	0	0	1.487	0.28	0.704	15.44	-102.618
4/24/2006	-45.187	0	0	0	0.261	0	14.248	31.2
4/25/2006	-26.91	0	0	0.447	0.235	0	13.832	13.313
4/26/2006	5.803	49.611	0	0.912	0.196	10.561	11.892	42.673
4/27/2006	38.956	64.609	0	1.321	0.128	2.816	11.032	17.565
4/28/2006	36.089	57.052	4.658	0.748	0.119	0	14.331	2.093
4/29/2006	10.9	0	0	0	0.134	0	12.252	-23.018
4/30/2006	1.996	0	0	0.726	0.133	0	14.165	-16.028

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