Demonstration Wetlands Study in the City of Henderson Water Reclamation Facility Final Report

March 2007

SOUTHERN NEVADA WATER AUTHORITY

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1.0 INTRODUCTION

Wetlands are unique ecosystems that play an important role in improving water quality of natural waters, providing or restoring wildlife habitats for plants and animals, and minimizing erosion of sediments during flooding seasons (EPA 1993, 2000, Kadlec and Knight 1996, Moshiri 1993). To demonstrate the use of constructed wetlands for the integrated purposes of polishing municipal wastewater treatment plant effluent and creating wildlife habitat in the Las Vegas Valley, a demonstration wetland was built at the City of Henderson (COH) Water Reclamation Facility in 2001. The 5.75-acre wetland is a triangular-shaped pond with 14 loafing and emergent vegetation islands constructed with varying depths of water coverage. The islands inside the Demonstration Wetlands constitute about 50% of the surface area. Different native species of vegetation appropriate to the varying water depths were planted within the pond. Treated wastewater from the COH Water Reclamation Facility is pumped into the wetlands through the inlet on the western side; the outlet is located on the eastern side (Figure 1).

The project was conducted to demonstrate wetland concepts that the Las Vegas Wash Project Coordination Team (Project Team) believe can be readily adapted to the construction of sustainable, effective integrated treatment and habitat wetlands in the vicinity of the Las Vegas Wash. This pilot study also provides information on the effectiveness of water quality improvement as it moves through the wetlands and helps us identify vegetation compatible with ecological conditions prevalent in Southern Nevada. This report summarizes the water quality monitoring activities and results for the years 2004 through 2006 in the Demonstration Wetlands and shows the impacts of constructed wetlands on water quality.

2.0 STUDY METHODS

One of the treated wastewater ponds at the COH Water Reclamation Facility was converted into the Demonstration Wetlands (Appendix I). The average water depth in the wetlands ranged from 6-8 feet, depending on the availability of water from the upper pond during different seasons. To monitor and demonstrate water quality improvement by the wetland systems, the Project Team measured water quality parameters and collected water samples from the inlet, the outlet, and various locations in the wetlands during each sampling event. A small boat, powered with a 12-volt battery, was used for sample collection and measurements inside the wetlands (Appendix A).

2.1 Water Quality

2.1.1. Sampling Sites

Water samples were collected from five sampling sites, including the inlet (DWP-1), the outlet (DWP-4), and three sites inside the wetlands (DWP-2, DWP-3, and DWP-5; Figure 1; Table 1). Both the inlet and the outlet are PVC pipes with flow meters, accepting flow from the upper pond and draining into the lower pond, respectively. They were used to monitor water quality before and after the wetlands. Site DWP-2, located in the middle of the wetlands, was used to monitor water quality changes between the inlet and the outlet. Sites DWP-3 and DWP-5, located at the north corner and at the southeast corner of the wetlands, showed water quality with less mixing (stagnant) within the wetlands.

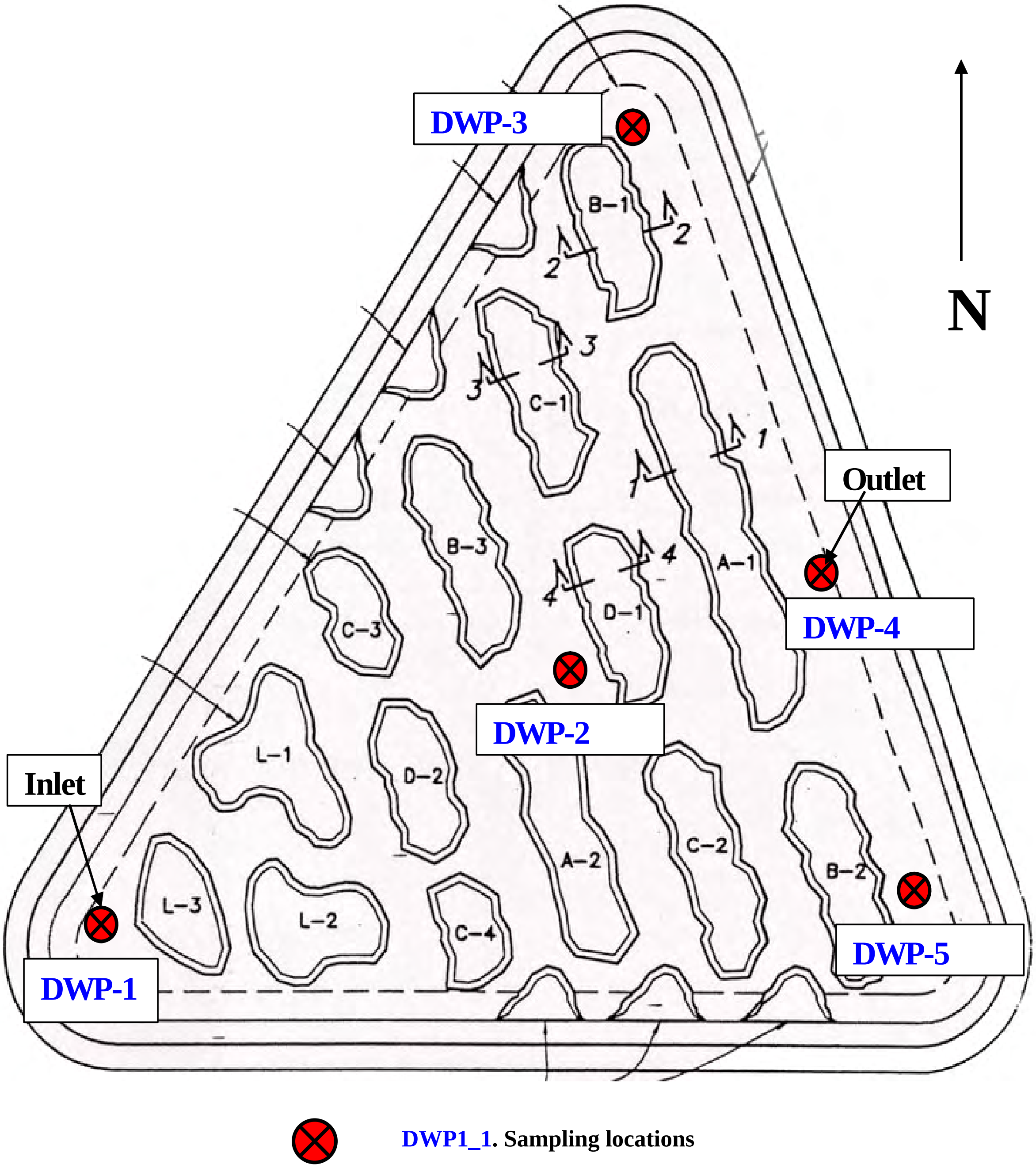

Figure 1: Sampling locations within the Demonstration Wetlands.

Location	Description	Name
Inlet	The inlet of the Demonstration Wetlands, located at the southwest corner of the wetlands	DWP-1
Middle Point	In the middle of the Demonstration Wetlands	DWP-2
North Corner	North corner of the Demonstration Wetlands, located near island B-1	DWP-3
Outlet	The outlet of the Demonstration Wetlands, located in the east side of the pond	DWP-4
Southeast Corner	Southeast corner of the Demonstration Wetlands, located near island B-2	DWP-5

Table 1: Sample locations and descriptions.

2.1.2 Sampling Methods

Samples were collected from five sites monthly. A Hydrolab, which measures water temperature, dissolved oxygen (DO) concentration, pH, and conductance, was used for field measurements at the inlet and the outlet and for collecting profile data within the water column at one foot intervals at each site during every sampling event.

During each sample event, only one set of samples was collected from both the inlet (DWP-1) and the outlet (DWP-4). Two sets of samples were collected from each of three sites inside the wetlands (DWP-2, DWP-3, and DWP-5), one set from one foot below the water surface, and another set from one foot above the bottom within the water column. A Van Dorn sampling device was used to collect samples from different water depths (Appendix A). In addition, one set of duplicate samples were also collected from the outlet (DWP-4Dup) each collection period for quality assurance and quality control.

Sample bottles without acid preservation were rinsed three times with sample water before sample collection. Each site was sampled with pre-labeled bottles prepared by different laboratories. For all sample bottles, site name, sampling location, analysis requested, and date and time of collection were labeled. After collection, bacteria samples were kept in a separate cooler of ice to prevent the contamination by the other samples. Other samples were maintained in another cooler of ice 4 °C. Samples were distributed immediately after sampling event to the designated laboratories and were accompanied by chain of custody record.

2.1.3 Analyses

In addition to field measurements (temperature, pH, DO, and conductance) at each site, water samples were collected monthly from all locations for major ion, heavy metal, nutrient, bacteria, selenium, and perchlorate analyses (Table 2). Individual water quality parameters were analyzed by four different laboratories: COH Water Quality, Southern Nevada Water System, Weck, and Montgomery Watson Harza.

Analytical Group	Description
Cations and Anions	Ca, Mg, K, Na, SO_4, Cl, HCO_3, F, Br, Hardness as $CaCO_3$, SiO_2, and TDS
Heavy Metals	20 metals or metalloids (Al, Sb, As, Ba, Be, Cd, Cr, Co, Cu, Fe, Pb, Mn, Hg, Mo, Ni, Se, Ag, Ti, V, and Zn)
Nutrients	Nitrate Nitrogen (NO_3-N) Nitrite Nitrogen (NO_2-N) Total Kjeldahl Nitrogen (TKN-N) Ammonia Nitrogen (NH_3-N) Total Phosphorus (TP-P) Ortho-Phosphate (OP-P)
Bacteria	Presence/absence and cell counts of both fecal coliforms, total coliform, and *E.coli*
Others	ClO_4, BOD_5, TSS

Table 2: Water quality parameters for monthly analyses.

2.2 Birds

Biologists conducted vehicular bird censuses of the pond on non-consecutive days surrounding water quality sampling events. The survey route consisted of a 0.8-km path around the pond, starting in the southeast corner and traveling north around the perimeter. Two people were required to conduct the surveys; one person identified and counted the birds and one person recorded the data. Binoculars and a spotting scope were used to aid identification. The observer identified all birds seen and/or heard to species, counted the number of individuals present and noted the habitat type being utilized. Four habitat types were identified for analyses: pond edge, loafing island, hummock, and open water. Surveys were conducted during the early morning hours (from sunrise to 10 a.m.) and averaged approximately one hour in duration. Species observations were tallied to generate a total of the number of birds of each species present in the specific habitat types. If a species was heard only, this was noted and another individual of the same species was recorded only if it was clearly a new bird. Birds flying over the pond were recorded; however, they were only included in the analyses if the species was aerially foraging in the pond and thus utilizing it as habitat.

2.3 Vegetation
Vegetation monitoring was conducted in November and December 2005. Three samples were collected per species identified on each hummock. Stem density for each species was obtained using 0.0625 m^2 quadrats. To determine stem density, all stems rooted in the quadrat were harvested and counted. Field staff noted whether each stem was live or dead to establish the average percentage of dead plant material per species. Ten live stems were randomly sub-sampled to determine average stem height and diameter. Stem length was measured from base to tip. Stem diameter was measured with a caliper at the thickest portion of the stem (near or at the base) and on the widest side and rounded to the nearest millimeter.

3.0 RESULTS

Water quality profile data from one foot intervals were collected from five sites (DWP-1, DWP-2, DWP-3, DWP-4, and DWP-5) each collection date (Appendix B). Additional water quality data were collected, including major ions, heavy metals, nutrients, bacteria, and others such as perchlorate, biological oxygen demand (BOD_5), and total suspended solids (TSS; Appendix C), and average concentrations of individual analyses at each site during the study period (August 2004 to December 2006) were summarized (Table 3).

3.1 Water Quality

3.1.1 Hydrolab Profiles
To study the water quality profile at each sample site and the water quality changes within the Demonstration Wetlands, two cross sections, A–A' and B–B' (Figure 2), were selected. The cross section from the inlet (A) to the outlet (A'), including Hydrolab data from DWP-1, DWP-2, and DWP-4, helped the Project Team evaluate and quantify the water quality change between the inflow and the outflow in the wetlands. However, water quality conditions inside the wetlands are also of great concern. The cross section from the north site (B) to the south site (B'), including Hydrolab data from DWP-3, DWP-4, and DWP-5, was selected to represent water quality in a relatively stagnant flow situation. This section was not intersected by the islands scattered in the wetlands. Water quality improvements within the Demonstration Wetlands, if any, will be more efficient along the A–A' section than along the B–B' section because the former represents the general flow path within the wetlands.

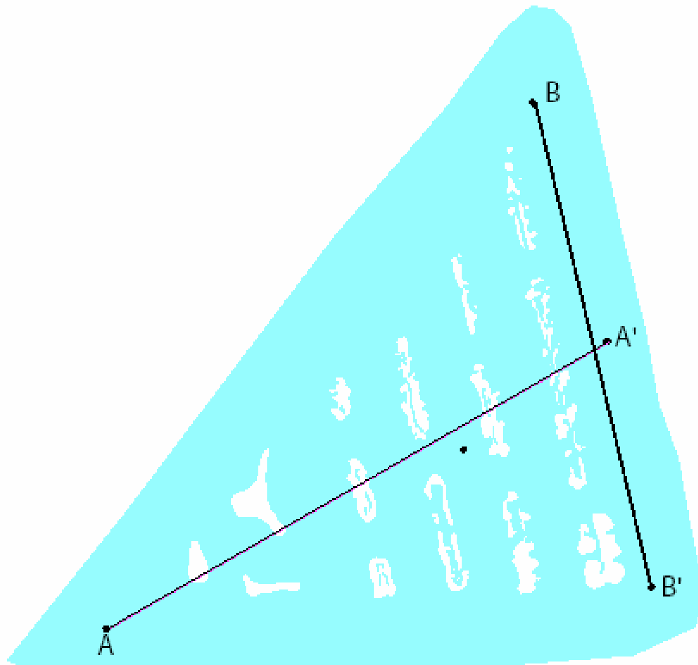

Figure 2: Cross sections selected for profile analysis of water quality.

Excel (Microsoft), Surfer (Golden Software), and LakeWatch (Lake Consulting Ltd.) were employed to process Hydrolab data and to develop graphics, including temperature, pH, specific conductance, and dissolved oxygen profiles for five locations (Figures 3–6). Graphics on the left of each figure represent profiles along the A–A' section (from the inlet to the outlet) and graphics on the right represent profiles along the B–B' section (from north to south). The x-axis is distance (in feet) from the the inlet (DWP-1) or the north corner of the wetlands; the y-axis is depth (in meters) from the surface. Profile data from four sample dates, including warm summer months (May, July, and August) and cold winter months (January or December), were selected to investigate impacts of seasonal changes on water quality in the wetlands.

3.1.1.1 Temperature

Temperature is a fundamental parameter for evaluating water quality. Temperature changes may explain the variation of other water quality parameters because of their relationships. The temperature within the Demonstration Wetlands (Figure 3; Appendix B) is determined by the season fluctuations and heat balance between the inlet and the outlet. Temperatures measured at different sites within the wetlands were very close for each sample date because the wetland area is fairly small in size (5.75-acres) and shallow (6.0~7.5 feet). In general, temperature was warm (20~29 ºC) during summer months and cold (6~13 ºC) during winter months, and a weak temperature stratification (warmer at the surface and colder at the bottom) occurred during summer. Temperature increased during warm seasons and decreased during cold seasons from the inlet to the outlet. At both north and southeast corners of the wetlands, temperature was warmer during summer and colder during winter. However, differences of temperatures, both vertically and horizontally, were generally <2 ºC for the same sample date due to the sufficient advection of heat within the wetlands. Note that temperature profiles (Figure 3) were generated based on the Hydrolab data along the A–A' section or the B–B' section with only three sample sites; therefore, the curves are less smooth and straight-lined with linear interpolation of three points.

3.1.1.2 pH

The pH value indicates acidity and alkalinity of water. Changes in pH result in variations of chemical speciation of nutrients such as nitrogen (N) and phosphorus (P), metals, and other elements as well as bicarbonate-carbonate-carbon dioxide equilibrium. The pH within the wetlands ranged from 6.8 to 9.4 with an average of 8.5 (Figure 4; Appendix B). In general, the pH in the outlet was closer to 7.0 of natural water, while pH in the inlet was slightly alkaline. Also, the pH of water in warm seasons was less alkaline than in cold seasons. The pH profiles along the two sections were quite similar, which implies the relative uniformity of pH within the wetlands.

3.1.1.3 Dissolved Oxygen

Dissolved oxygen (DO) is an important index of water quality essential for aquatic life. Highly contaminated water usually has low DO. Spatial and temporal changes of DO can provide information on wetlands (pond) water quality. Dissolved oxygen in the Demonstration Wetlands during warm seasons was generally lower than cold seasons (Figure 5; Appendix B). The fast growth and reproduction of aquatic plants and microorganisms consume a fair amount of DO in the wetlands. The saturation rates of DO in the wetlands were <50% during most of the sample period. Vertically, DO decreases as the water depth increases due to available atmospheric DO. Dissolved oxygen along the B–B' section was generally higher than the A–A' section.

3.1.1.4 Conductance

Conductance in the wetlands changed with different seasons, varying from 1800 µS/cm during cold seasons to 2650 µS/cm during warm seasons, with an average of approximately 2300 µS/cm during the sample period (Appendix B). Conductance increased along the A–A' section during warm seasons and was relatively homogenous during cold seasons. Compared with the A–A' section, conductance changes along the B–B' were less significant, except for a higher conductance at the north corner of the wetlands during August 2004 (Figure 6). However, conductance was relatively uniform at different water depths within the wetlands. Conductance increases during warmer seasons and from the inlet to the outlet due to higher ET rates.

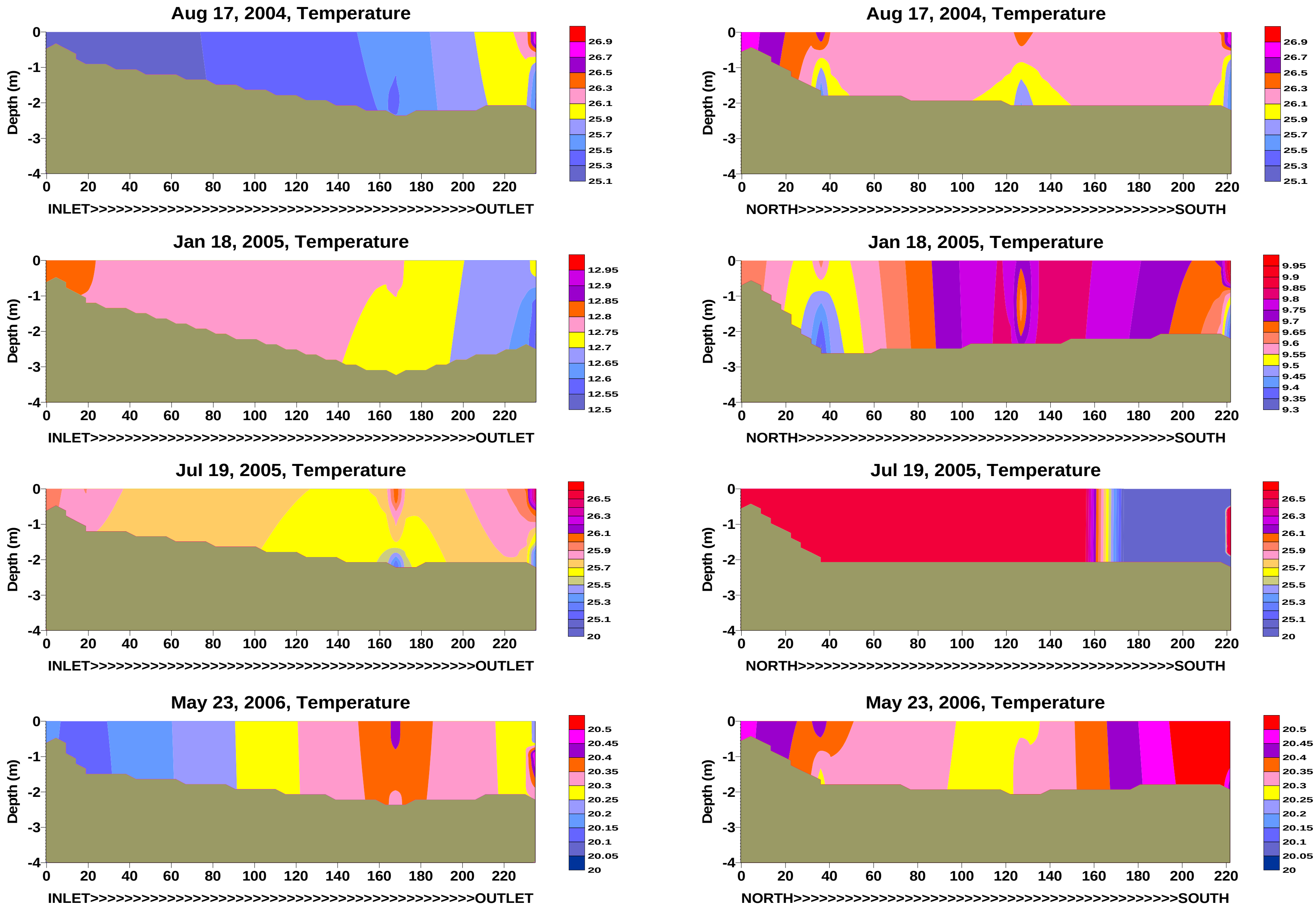

Figure 3: Temperature profiles along the A-A' (left) and B-B' (right) sections in the Demonstration Wetlands.

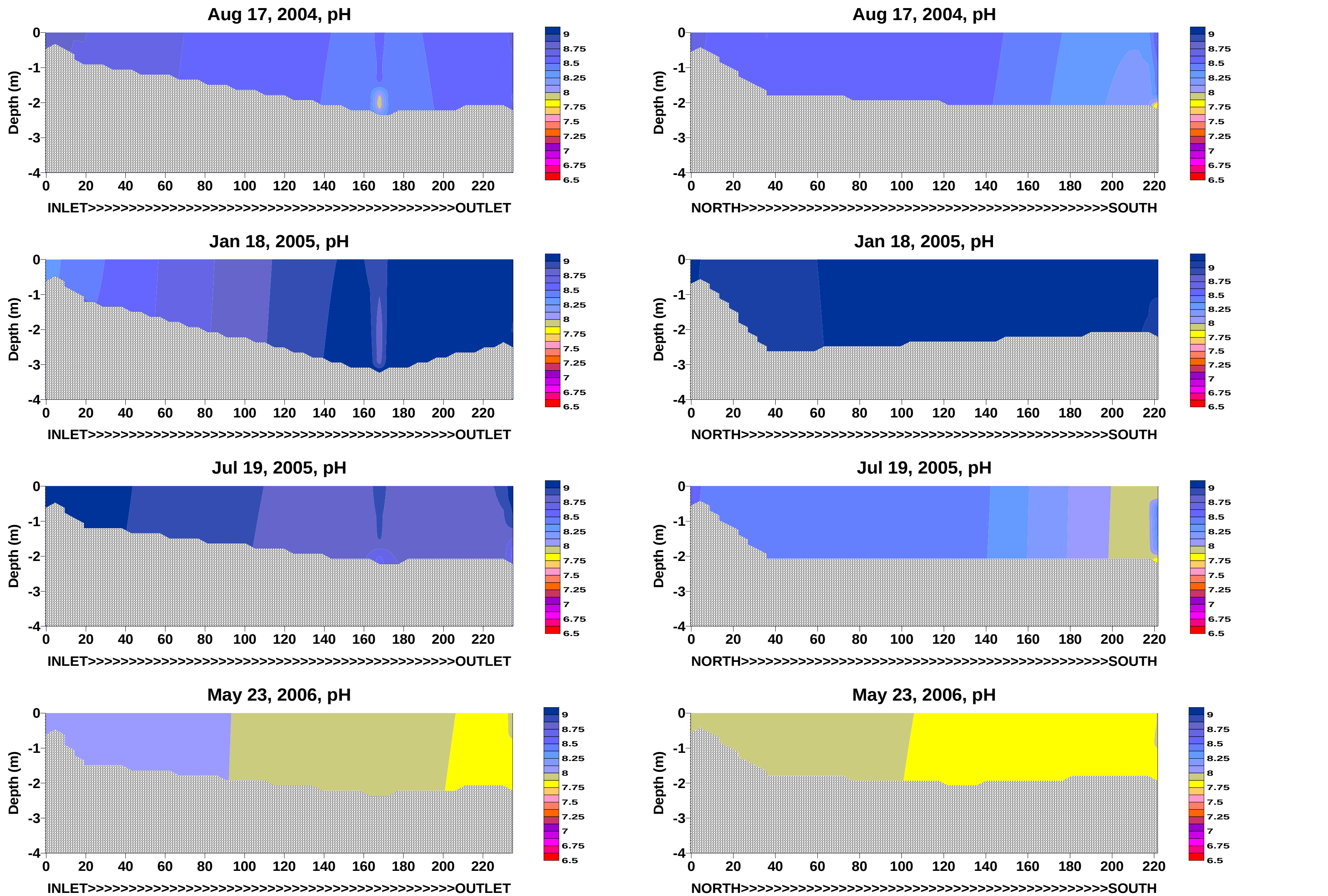

Figure 4: pH profiles along the A-A' (left) and B-B' (right) sections in the Demonstration Wetlands.

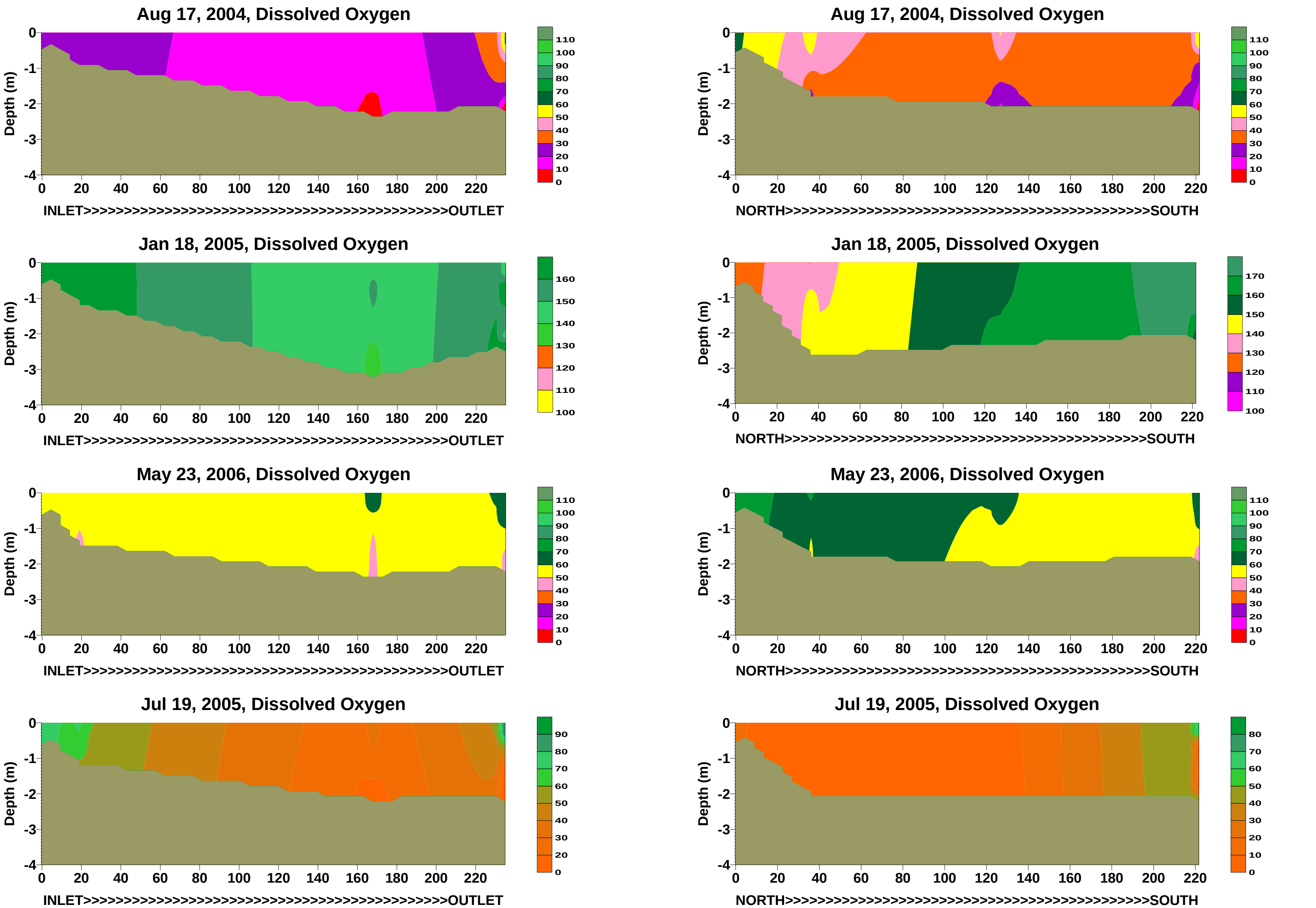

Figure 5: DO profiles along the A-A' (left) and B-B' (right) sections in the Demonstration Wetlands.

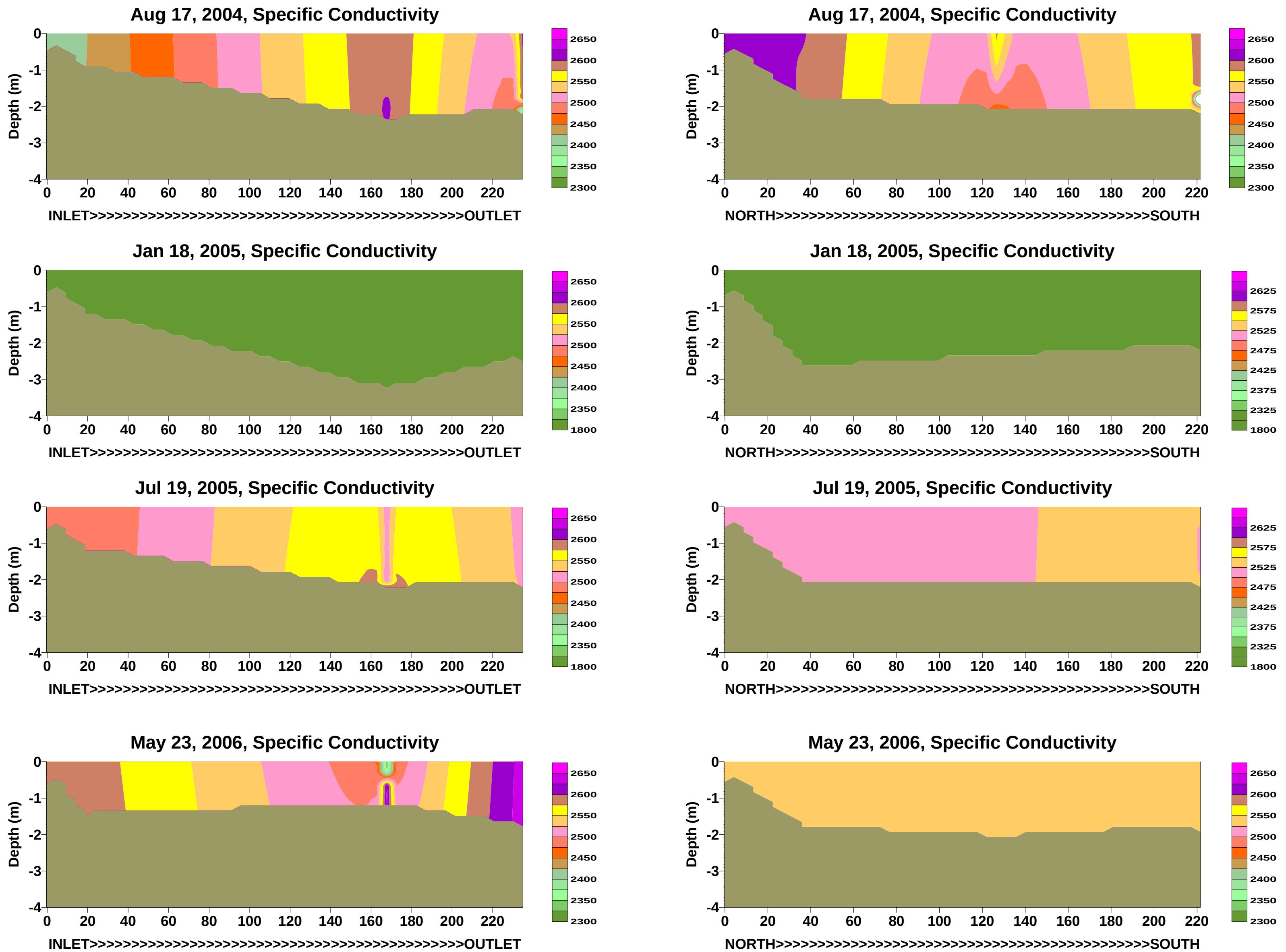

Figure 6: Conductance profiles along the A-A' (left) and B-B' (right) sections in the Demonstration Wetlands.

Analysis	Unit	DWP-1	DWP-2	DWP-3	DWP-4	DWP-5
Calcium	mg/L	99	103	105	105	105
Magnesium	mg/L	40	44	44	44	44
Potassium	mg/L	31	35	35	35	35
Sodium	mg/L	248	278	274	274	274
Sulfate	mg/L	428	472	479	471	482
Chloride	mg/L	301	331	335	337	338
Bicarbonate Alkalinity	mg/L	188	209	211	223	215
Fluoride	mg/L	0.61	0.67	0.67	0.90	0.66
Bromide	mg/L	0.21	0.24	0.23	0.24	0.24
Hardness as $CaCO_3$	mg/L	411	439	443	444	446
SiO_2	mg/L	3.48	4.98	5.18	5.58	5.46
TDS	mg/L	1383	1558	1550	1550	1567
TP	mg/L P	2.7	2.2	2.2	2.4	2.3
OP	mg/L P	1.3	1.4	1.4	1.7	1.5
NO_3	mg/L N	4.4	1.7	1.6	1.1	1.5
NO_2	mg/L N	0.5	0.2	0.2	0.2	0.2
NH_4	mg/L N	2.5	1.9	1.8	3.5	1.8
TKN	mg/L N	10.0	7.1	7.0	9.2	7.1
BOD_5	mg/L	36.4	19.1	18.4	22.7	18.1
TSS	mg/L	44.5	26.1	28.0	22.3	29.8
Perchlorate	µg/L	2.9	3.3	3.1	3.4	4.1
Aluminum	µg/L	47.06	37.97	38.92	32.22	46.00
Antimony	µg/L	0.59	0.57	0.57	0.56	0.58
Arsenic	µg/L	2.59	2.39	2.39	2.25	2.34
Barium	µg/L	80.72	80.81	80.78	81.06	80.47
Beryllium	µg/L	0.68	0.68	0.68	0.68	0.69
Cadmium	µg/L	0.35	0.35	0.35	0.35	0.38
Chromium	µg/L	0.86	0.76	0.76	0.77	0.77
Cobalt	µg/L	0.56	0.71	0.70	0.70	0.76
Copper	µg/L	12.09	8.41	7.42	7.01	8.99
Iron	µg/L	72.94	78.47	68.00	74.22	84.69
Lead	µg/L	0.79	0.78	0.78	0.76	0.81
Manganese	µg/L	19.24	46.86	47.47	57.22	49.28
Mercury	µg/L	0.35	0.50	0.41	0.35	0.39
Molybdenum	µg/L	10.39	10.25	10.18	9.50	10.12
Nickel	µg/L	6.29	6.69	6.33	6.41	6.42
Selenium	µg/L	2.41	2.21	2.16	2.07	2.22
Silver	µg/L	0.19	0.10	0.12	0.10	0.10
Thallium	µg/L	0.70	0.70	0.70	0.70	0.74
Vanadium	µg/L	1.35	1.38	1.40	1.24	1.41
Zinc	µg/L	46.89	40.69	40.54	39.62	40.96
E coli	#/100mL	2578	771	650	672	859
Fecal coliform	#/100mL	3898	957	1013	1167	993
Total coliform	#/100mL	14875	3424	2197	4008	3225

Table 3: Average concentrations of analyses from the Demonstration Wetlands (2004–2006).

3.1.2 Major Ion Chemistry

The inflows into the Demonstration Wetlands are treated wastewater from an upper pond at the COH Wastewater Treatment Facility. The chemical data of waters collected from the wetlands showed characteristics of typical wastewaters in the Las Vegas Valley (Table 3; Appendix C). Major cations are dominated by Ca, Mg, and Na; whereas major anions by SO_4, Cl, and HCO_3. Also, water types at five sample sites in the wetlands, based on major cations and anions and their relative percentages, were identical; they had overlapping Piper diagrams (Figure 7). However, concentrations of major cations, major anions and TDS increased by 5~20% from the inlet (DWP-1) to the outlet (DWP-4; Figure 8).

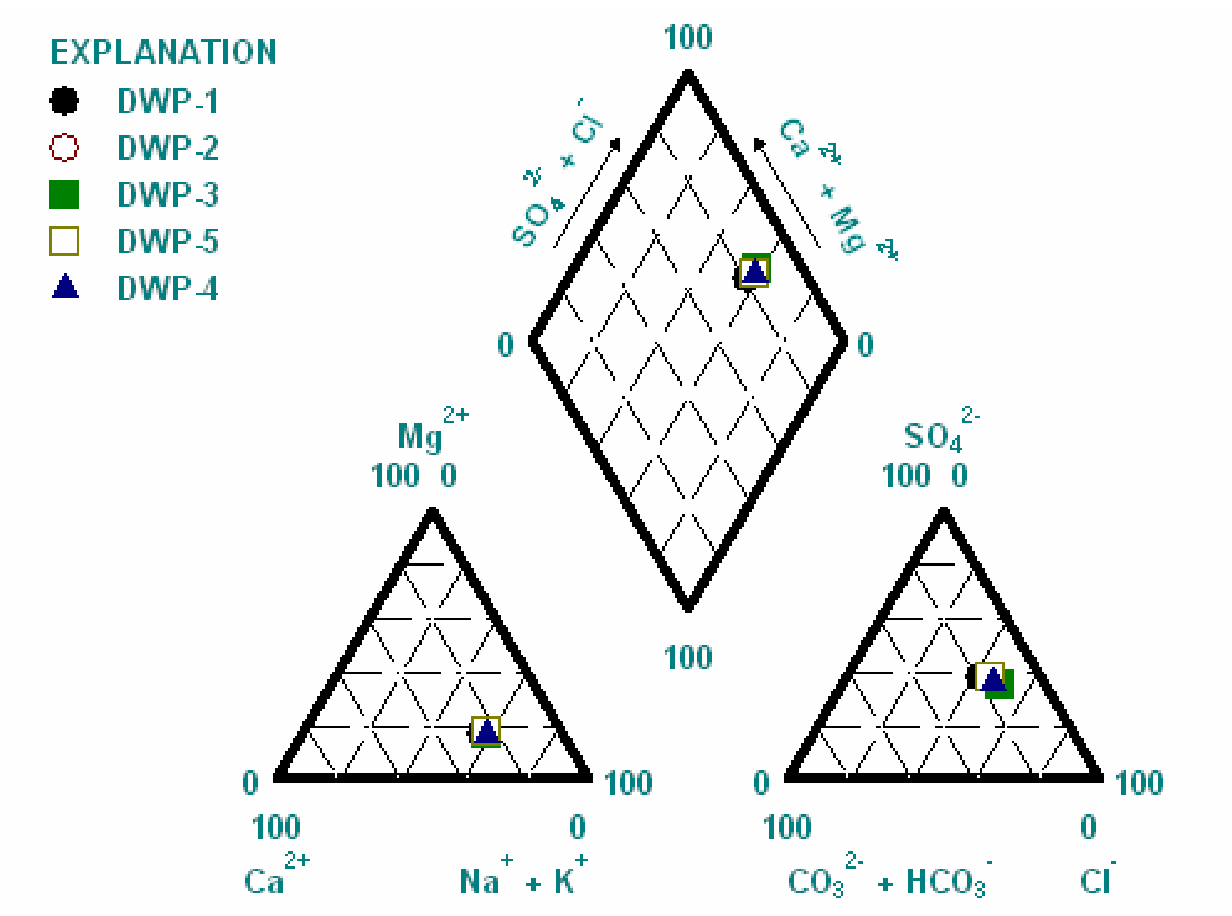

Figure 7: Piper diagrams of water samples from five sites in the Demonstration Wetlands.

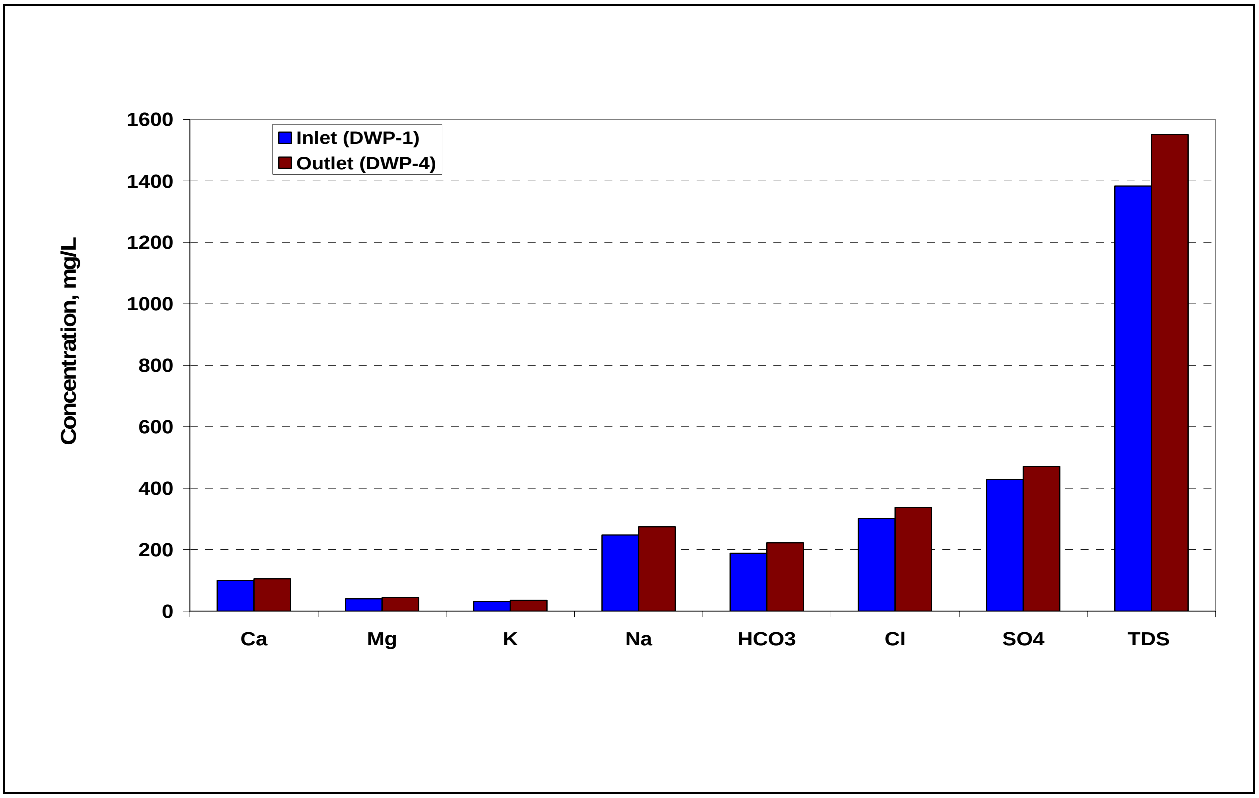

Figure 8: Average major ion concentrations from the inlet (DWP-1) and the outlet (DWP-4).

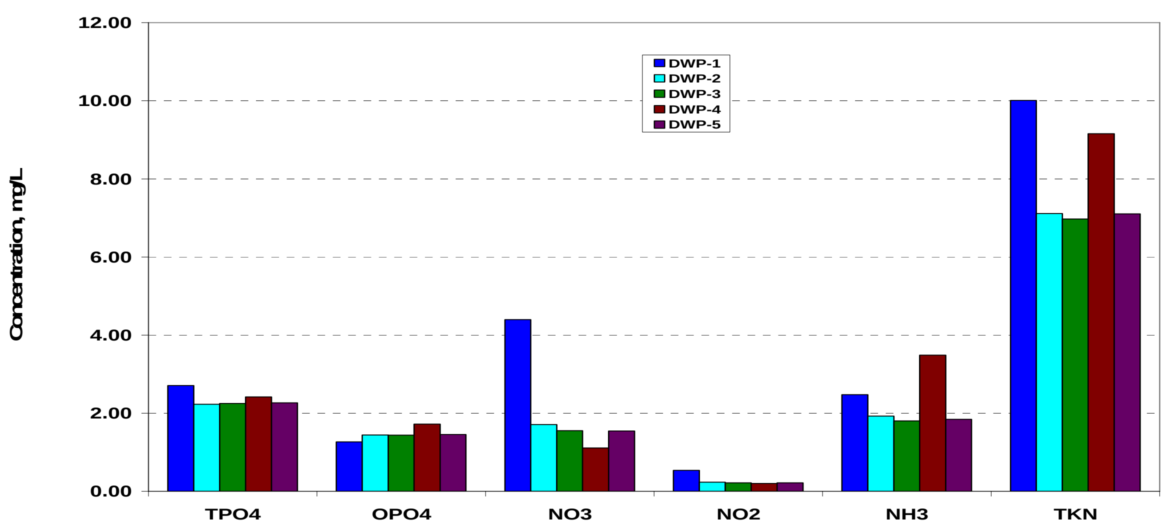

Figure 9: Nutrient (N, P) concentrations from five sites in the Demonstration Wetlands.

3.1.3 Nutrients

Average nutrient (N and P) concentrations during the sample period were calculated from the inlet to the outlet (Table 3). Average concentrations of total phosphorus (TP), NO_3, NO_2, and TKN decreased by 10.7%, 74.7%, 62.6%, and 8.5%, respectively; whereas concentrations of OP and NH_3 increased 35.8% and 40.9%, respectively (Table 3; Figure 9). However, all nutrients except OP decreased from the inlet to other sites (DWP-2, DWP-3, and DWP-5) inside the wetlands (Figure 9).

3.1.4 BOD_5

Biochemical oxygen demand (BOD) is a measure of the oxygen consumption of microorganisms in the oxidation of organic matter. This test normally runs for five days, and the result is recorded as BOD_5. The Demonstration Wetlands has played an efficient role in reducing BOD_5. The average concentration of BOD_5 was 36.4 mg/L in the inlet and 22.7 mg/L in the outlet (Table 3), a reduction of more than 37% from the inlet to the outlet. The BOD_5 reduction rates between the inlet and other locations in the wetlands were even higher (47.5 ~ 50.3%; Figure 10).

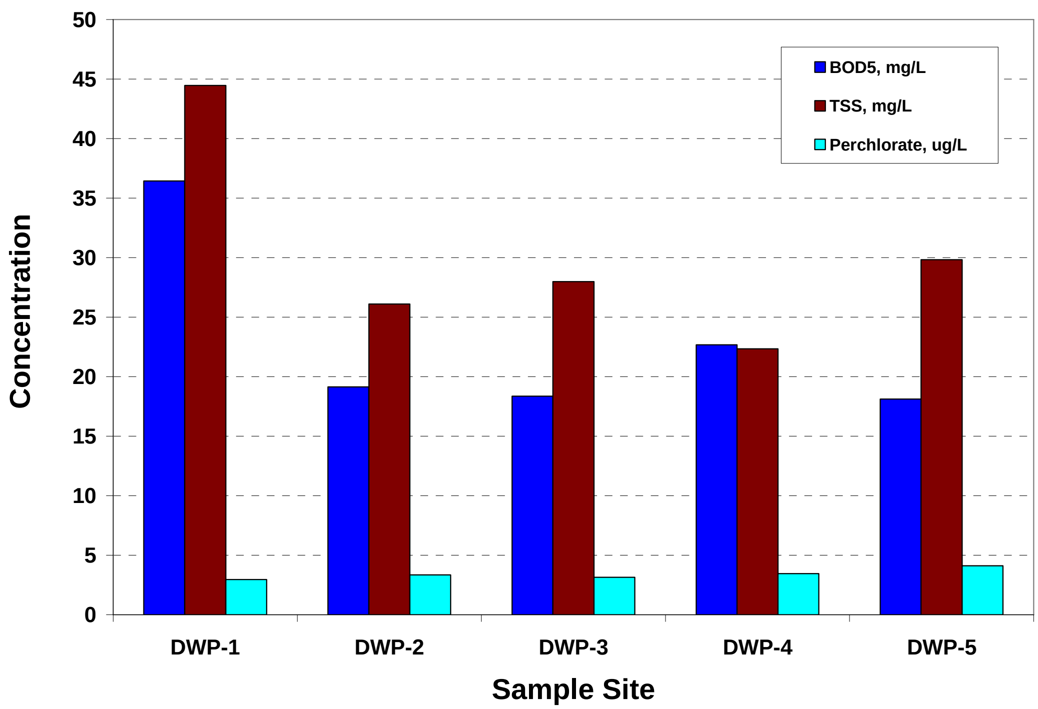

Figure 10: BOD_5, TSS, and perchlorate concentrations from five sites in the Demonstration Wetlands.

3.1.5 Total Suspended Solids

TSS are measured gravitationally after filtration and drying (APHA 1992). Wetland systems, including the Demonstration Wetlands, are consistently effective at reducing elevated concentrations of TSS. Average TSS concentrations were reduced nearly 50% from the inlet

(44.5 mg/L) to the outlet (22.3 mg/L). There were also dramatic decreases of TSS between the inlet and other locations (DWP-2, DWP-3, and DWP-5) inside the wetlands (Table 3; Figure 10).

3.1.6 Perchlorate

Perchlorate (ClO_4), a local contaminant from the Kerr-McGee industrial site located in the COH, has entered the groundwater system and eventually the water (both drinking water and wastewater) cycles in the Las Vegas Valley. The average perchlorate concentrations from five sample sites in the Demonstration Wetlands ranged from 2.9 µg/L to 4.1 µg/L (Table 3). Perchlorate increased approximately 17% from the inlet to the outlet (Figure 10). However, the relatively low perchlorate concentrations (generally <4.0 µg/L) in the wetlands indicate no additional perchlorate contributions coming from the shallow groundwater system.

3.1.7 Metals

The monthly metal data from five sites (eight locations) and a duplicate at the outlet (DWP-4) were recorded (Appendix C) and the average concentrations of these metals were calculated (Table 3), as well as the average concentrations of 20 common metals from the inlet and the outlet in the wetlands (Figures 11 and 12). The average concentrations of all analyzed metals were relatively low (<12 µg/L for trace metals and < 85 µg/L for Mn, Al, Fe, and Ba). More than half of these metals were reduced by the wetland ecosystems from the inlet to the outlet, including Ag, Al, As, Cr, Cu, Mo, Pb, Sb, Se, V, and Zn. The reduction rates of these metals ranged from 3.8% for Pb to 46% for Ag. Seven other metals, including Ba, Be, Cd, Fe, Hg, Ni, and Ti, had no changes in average concentrations or were slightly increased (<2%) from the inlet to the outlet. The wetland ecosystems may still play a positive role in reducing these seven metal concentrations when a high ET rate is considered for this free-open-water wetlands. However, the Co and Mn concentrations dramatically increased, 25% and 197%, respectively, from the inlet to the outlet. From the inlet (DWP-1) to other sample sites (DWP-2, DWP-3, and DWP-5) in the wetlands, these metals showed very similar reduction patterns. In summary, the average concentrations of most metals were reduced after the water flowed through the Demonstration Wetlands.

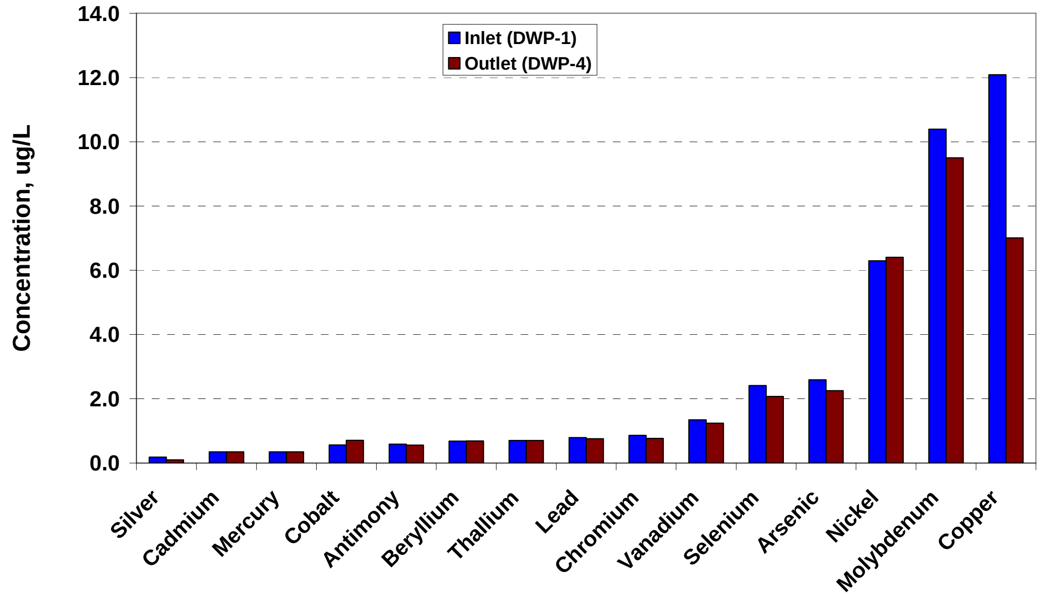

Figure 11: Trace metal concentrations from the inlet and the outlet in the Demonstration Wetlands.

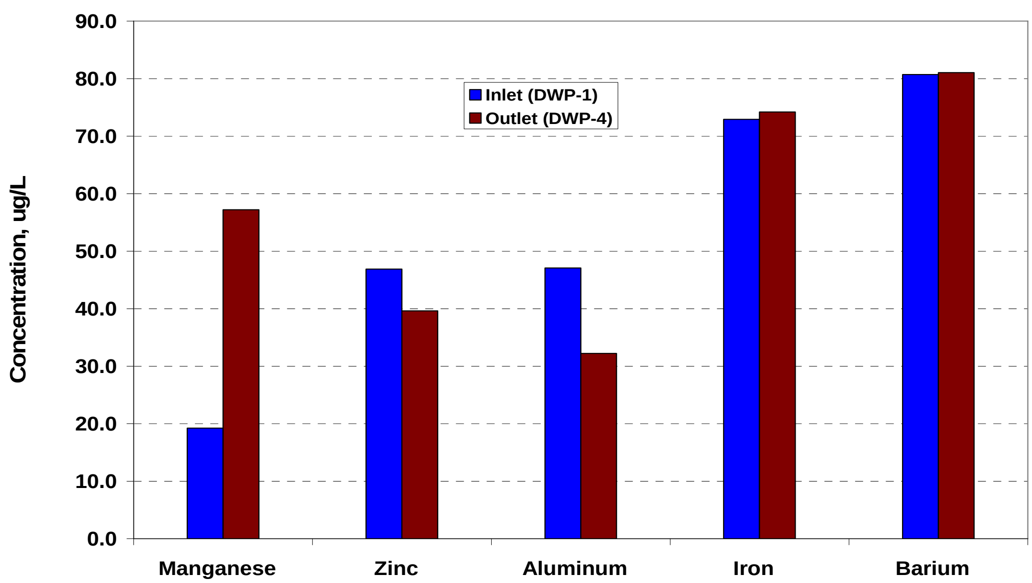

Figure 12: Other metal concentrations from the inlet and the outlet in the Demonstration Wetlands.

3.1.8 Bacteria

Three bacteriological parameters, including fecal coliforms, total coliform, and *E. coli*, were analyzed and average concentrations from all sample sites in the wetlands recorded (Table 3). The results were reported as average colony forming units (CFU) per 100 mL. Subsequently the average concentrations of these parameters were calculated. The concentrations of fecal coliforms, total coliform, and *E. coli*, were high at all sample sites. However, their concentrations, particularly total coliform concentration, were reduced >70% from the inlet to the outlet and to other sites of the wetlands (Figure 13).

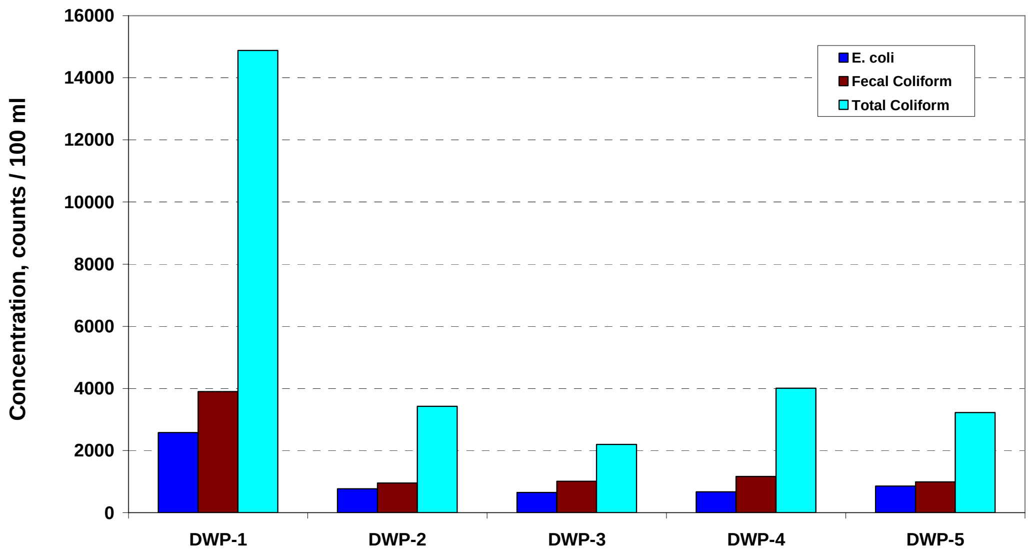

Figure 13: Bacteria concentrations from five sites in the Demonstration Wetlands.

3.2 Birds

Year 1

Thirty-three census visits were conducted from August 2004 through July 2005. A total of 10,519 individuals from 73 species and 25 families were detected. Five species accounted for 72.0% of the birds detected: northern shoveler, American coot, ruddy duck, great-tailed grackle and mallard. The 20 most abundant species accounted for 94.5% of the birds detected (Table 4).

Species richness varied significantly throughout the year, with the number of species detected per census visit ranging from 9 – 28 (Figure 14). Peak richness occurred in the fall and early winter months, while richness reached its lowest from May through June (9–11 species per visit). On average, 19.0 (±1.0) species were detected per visit. Abundances showed significant variation as well, with the lowest abundance (137 birds) detected during a single visit in August and the highest abundance detected during a single visit in February (718 birds; Figure 15). Total abundances of 300 or greater were recorded from late October through mid March, with total abundances greater than 415 detected from early November into mid February. The remainder of the year total abundances generally remained below 270 birds. On average, 318.8 (±25.7) individual birds were detected per visit.

Birds were most commonly detected in open water (39.6%), with the remaining individuals relatively evenly split between pond edge (17.7%), hummock (20.8%), and loafing island (21.9%) habitats.

Year 2

Twenty-six census visits were conducted from August 2005 through July 2006. A total of 10,074 individuals were detected over the course of the year, comprising 68 species from 23 families. The five most abundant species accounted for 70.4% of all birds detected. The four most abundant species remained the same as in Year 1, while common moorhen replaced mallard as the fifth most abundant species. The 20 most abundant species represented 93.2% of the total abundance detected during the year (Table 5).

Species	Total Individuals
Northern Shoveler	2703
American Coot	1808
Ruddy Duck	1802
Great-tailed Grackle	747
Mallard	511
Green-winged Teal	399
Ring-billed Gull	339
Eared Grebe	284
Common Moorhen	169
American Avocet	159
Red-winged Blackbird	132
Yellow-headed Blackbird	122
Black-necked Stilt	121
Gadwall	119
Bufflehead	93
Cinnamon Teal	91
Redhead	90
Yellow-rumped Warbler	90
Pied-billed Grebe	86
White-faced Ibis	76

Table 4: Twenty most abundant species detected August 2004 through July 2005.

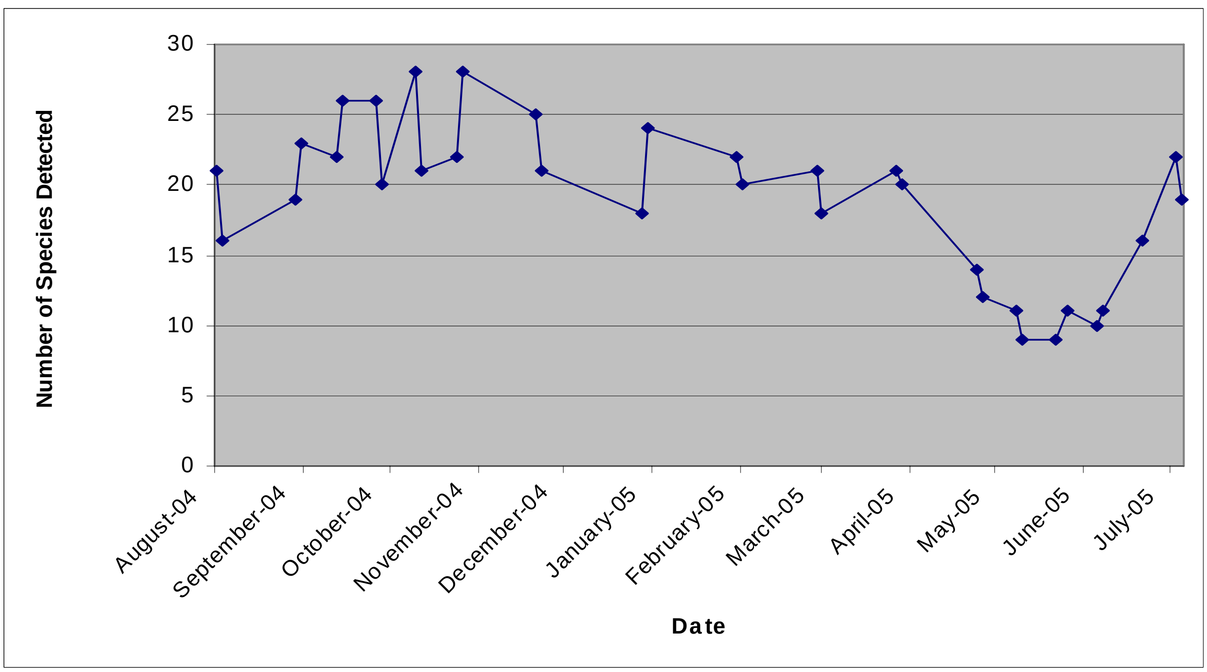

Figure 14: Species richness per census visit conducted August 2004 through July 2005.

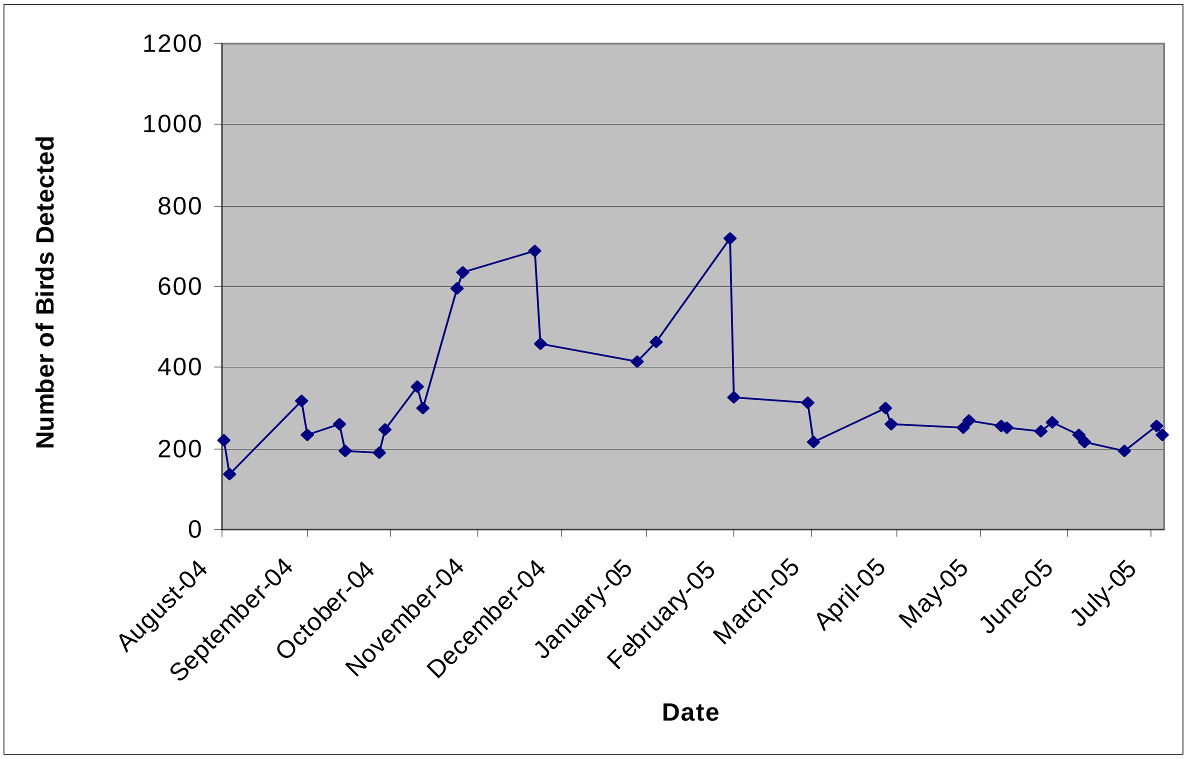

Figure 15: Total abundance detected per census visit conducted August 2004 through July 2005.

As in Year 1, both species richness and abundance varied throughout the year. Richness ranged from 13–29 species detected per visit (Figure 15). High species richness (exceeding 23 species per census) was recorded from late August through early February, only once declining to 19 in the roughly six month period. In fact, the number of species detected per visit only declined below 20 again beginning in April, and then comparatively low richness values (13 – 18) were detected through June. On average, 21.8 (±1.0) species were identified per census. Abundances fluctuated greatly, varying from 176–1,154 birds detected in a single census visit (Figure 17). The date of the lowest abundance corresponds to that of the lowest richness, and the highest total abundance of any census visit to date occurred on March 27, 2006. Highest sustained abundances per visit exceeded 600 birds from mid January through the end of March. Lowest sustained abundances (169–257) occurred from late April through mid June. Average abundance equaled 388.6 (±44.2) birds per visit.

Species	Total Individuals
Northern Shoveler	2841
American Coot	1679
Ruddy Duck	1137
Great-Tailed Grackle	998
Common Moorhen	441
Mallard	295
Red-Winged Blackbird	251
Ring-Billed Gull	195
Green-Winged Teal	191
Yellow-rumped Warbler	186
Black-Necked Stilt	163
Redhead	157
Ring-Necked Duck	157
Cinnamon Teal	137
American Avocet	112
Yellow-Headed Blackbird	114
Eared Grebe	87
Pied-Billed Grebe	86
Bufflehead	84
White-Faced Ibis	81

Table 5: Twenty most abundant species detected August 2005 through July 2006.

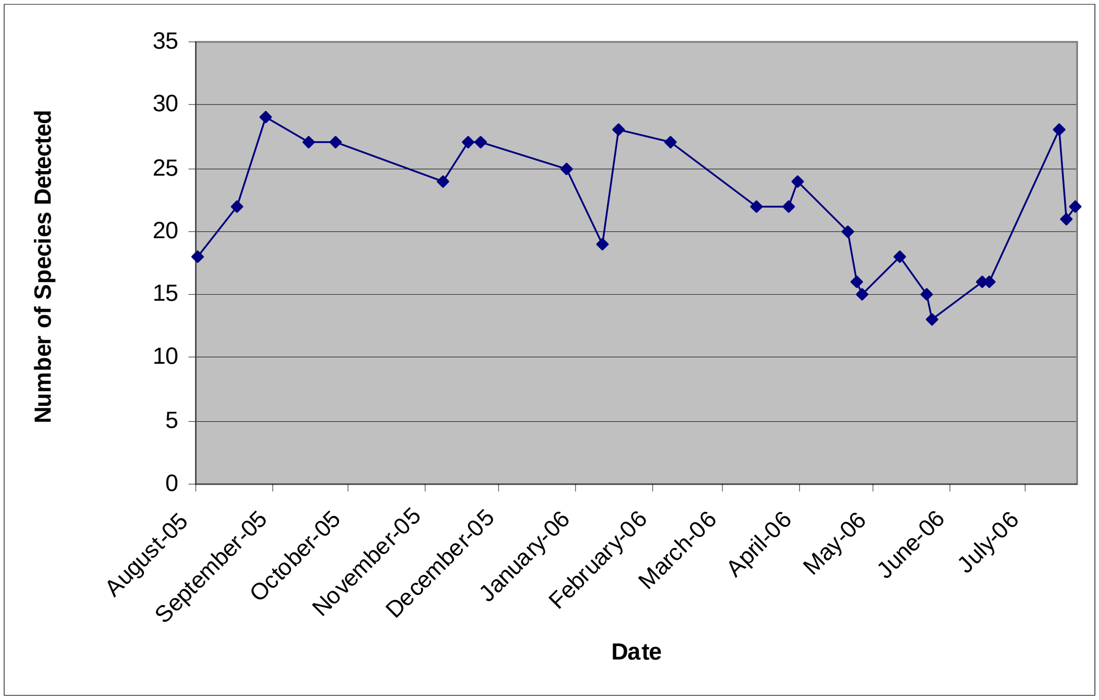

Figure 16: Species richness per census visit conducted August 2005 through July 2006.

Once again, birds were most commonly detected in open water (32.0%), with the remaining individuals fairly evenly distributed between pond edge (20.4%), hummock (23.0%), and loafing island (24.5%) habitats.

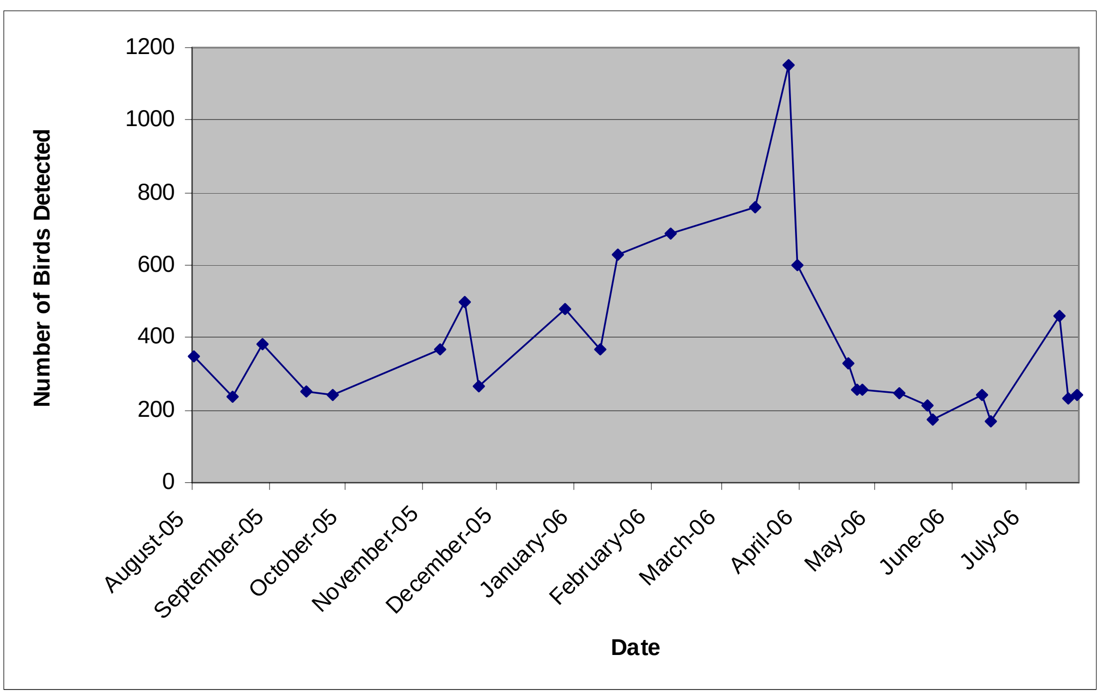

Figure 17: Total abundance detected per census visit conducted August 2005 through July 2006.

Year 3 - Partial

Seven census visits were conducted from August 2006 through December 2006. A total of 2,626 individuals were detected, representing 55 species from 21 families.

As only a limited number of census visits have been conducted, and they do not represent a full year's worth of data, only the total individuals detected and the number of species and families are included here. These data are included for completeness as the water quality data that forms the majority of this document include samples collected through 2006. A more thorough analysis of Year 3 bird data will be conducted after census visits have been completed through July 2007.

3.3 Vegetation

Three species were identified on the hummocks: California bulrush (*Schoenoplectus californicus*), tules also known as hardstem bulrush (*S. acutus*), and Olney bulrush (*S. americanus*). A minimum of two species were present on each hummock. California bulrush was present on 10 of the 11 hummocks as was tules, while Olney bulrush was present on eight. Olney bulrush was concentrated on the portions of the hummocks with shallower water depths (0-10cm), while California bulrush and tules were found from shallow to the deeper water zones (greater than 10cm).

Average stem density, height, diameter and percentage of dead stems varied among species (Table 6). California bulrush exhibited the smallest stem density (not unexpected given that it also had the thickest stems), greatest height and lowest percentage of dead stems. Conversely, Olney bulrush displayed the greatest stem density, with less than a 10mm average stem diameter, smallest height and a high percentage of dead stems.

Species	**Avg. Stem Density (#/0.0625 $m^{2)}$**	**Avg. Stem Height (m)**	**Avg. Stem Diameter (mm)**	**Avg. % Dead Stems**
California bulrush	52.2 (±6.8)	2.92 (±0.06)	22 (±0.5)	1.8 (±0.7)
Tules	75.9 (±6.2)	2.32 (±0.05)	14 (±0.3)	28.5 (±3.5)
Olney bulrush	225.8 (±32.8)	1.83 (±0.05)	9 (±0.2)	30.2 (±5.5)

Table 6: Average stem density, height, diameter, and percentage of dead stems for the three species occurring in the demonstration wetland.

4.0 DISCUSSION

4.1 Wetland Hydrology

The hydrologic conditions of a wetland determine its extent and species composition in natural wetlands (Mitsch and Gosselink 1993). They also influence the wetland soils, water quality, and the character of the biota (Kadlec and Knight 1996). The flows and storage volume determine the length of time that water spends (detention time) in the wetlands and, thus, physiochemical and biological interactions between waterborne substances and the wetland ecosystem.

Water enters the Demonstration Wetlands via inflows from an upper pond that stores treated (tertiary) wastewater. Runoff, groundwater discharge, and precipitation to the Demonstration Wetlands are minimal. The wetlands lose water via outflow into a lower pond, groundwater recharge, and ET (Figure 18). During summer months, wastewater from the COH wastewater treatment plant has been reused for irrigation and depletes the water flowing into and out of the wetlands. Therefore, the water level inside the wetlands has been low, and water stagnates in the wetlands during those periods. In addition, ET is high and precipitation is low during summer in Las Vegas. All these conditions greatly affect water quality, such as total dissolved solids (TDS), in the wetlands.

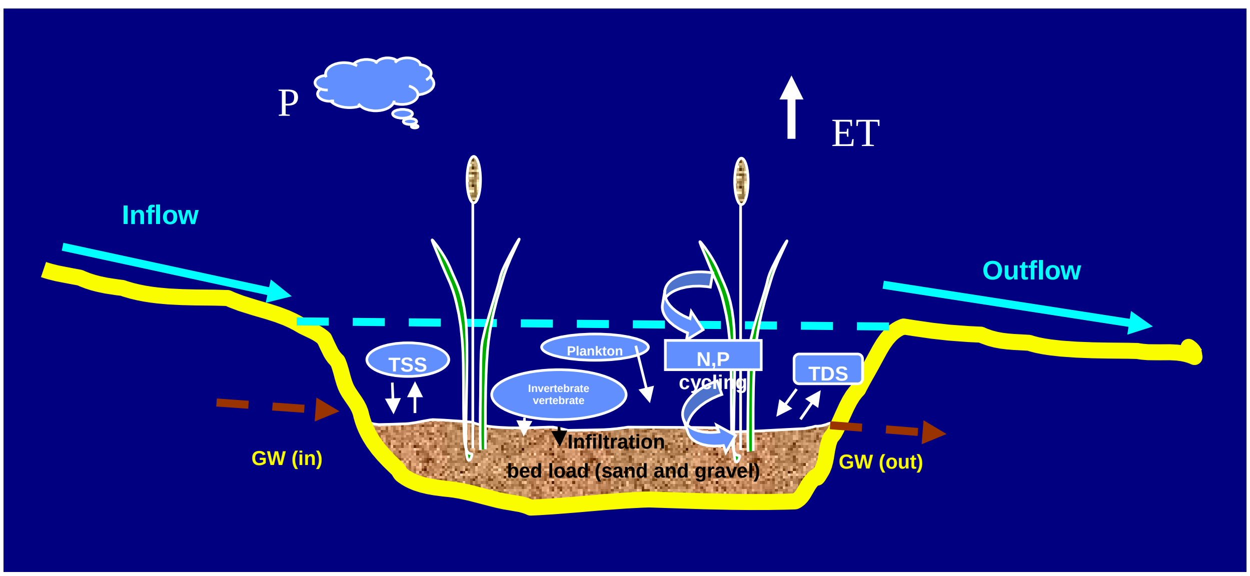

Figure 14: A conceptual model of water mass balance and the physiochemical and biological interactions in the Demonstration Wetlands.

The Demonstration Wetlands has a small storage volume. The 5.75-acre triangular pond contains three loafing islands and 11 submerged hummocks. These islands and hummocks occupy nearly 20% of the storage volume. The average water depth in the wetlands is between 6.0 and 7.0 feet. In addition, the slopes around the edges of the wetlands also decrease the storage volume of the wetlands. The estimated storage volume in the wetlands is about 24~28 acre-feet with different water depths. The inflow into the wetlands varies from season to season. Nominal detention time can be estimated by dividing the storage volume with inflow rate. The nominal detention time for the Demonstration Wetlands was estimated between 12-14 days assuming an inflow rate of 1.0cfs. This result was verified when the wetlands were first filled with water from the upper pond.

However, nominal detention time is not necessarily indicative of the actual detention time because it is based on the assumption that the entire volume of water in the wetlands is involved in the flow (Kadlec and Knight 1996). This assumption can be seriously in error because water into and out the specific wetlands follows a certain flow path without good mixing. Large zones of wetlands are not in the flow path. Therefore, the actual detention time for the Demonstration Wetlands could be much shorter than the nominal detention time (12~14 days). More studies (such as a dye study) are needed to determine the actual detention time and flow path in the wetlands.

4.2 Wetland Water Quality

Wetlands have been considered the "kidneys" of the global water cycle because they often help improve water quality for low-through water (Kadlec and Knight 1996). However, this concept does not suggest that wetlands can purify water under all circumstances. Water quality in wetlands is determined by wetland types, wetland hydrology (water mass balance), inflow water quality, plant and animal species, and physiochemical interactions.

4.2.1 Temperature, pH, and DO in the Wetlands

Temperatures are of interest for determining of the potential thermal condition of water leaving the wetlands. Many physiochemical and biochemical processes (Figure 18) are temperature sensitive. The Demonstration Wetlands, a shallow surface-flow wetland, mimics the air temperature variation (both daily and seasonal) and has a cooler water zone near the bottom during warm seasons.

The pH represents hydrogen ion concentrations in wetland waters and strongly affects wetland water chemistry and biology. Values in natural wetlands range from slightly basic to quite acidic (Mitsch and Gosselink 1993). Higher pH values (more basic) of water are strongly correlated with higher calcium content. Neutral wetland waters have Ca >20 mg/L (Kadlec and Knight 1996); however, the Demonstration Wetlands had pH values ranging from 7.3-9.4, which correspond with higher calcium concentrations (~100 mg/L; Table 3).

Like other treatment wetlands, the water column in the Demonstration Wetlands shows a vertical DO gradient, with high DO at the air-water interface and very low DO at the sediment-water interface. The concentration of DO in water varies with temperature, dissolved salts, and biological activity. Because of sufficient BOD loading to the Demonstration Wetlands, oxygen in the water is dramatically consumed, resulting in low DO concentrations, especially at the sediment-water interface. In addition, the decomposition of decaying vegetation and microorganisms requires more oxygen to process; therefore, low DO is not uncommon in treatment wetlands.

4.2.2 Total Dissolved Solids

The TDS (or conductance) concentrations in the Demonstration Wetlands are generally higher than wastewater effluents in the Las Vegas Valley. TDS also increases from the inlet to outlet and to other sites in the wetlands (Figure 8; Table 3), mainly due to high ET in the valley. This process was enhanced in the Demonstration Wetlands during summer months because inflow was insufficient to balance water storage. Secondarily, contacting with highly alkaline soils and groundwater contributions may play a role in increasing TDS in wetland water because the wetlands (pond) were not lined at the bottom. Finally, biological activity, such as fecal materials from birds and decomposition of decaying plants, could also add more TDS to the wetland water. In general, TDS concentrations are high in most wastewaters, and the individual components of these solids (major cations and anions) greatly exceed the biological requirements for growth of plants and microorganisms; wetlands have a negligible effect on this parameter (Kadlec and Knight 1996).

4.2.3 Nutrients

Nutrients, including nitrogen and phosphorus, are among the principal constituents of concern in wastewater and treatment wetlands. Their concentrations and ratios (N:P) are crucial to the growth of plants and microorganism in the wetland ecosystem.

Nitrogen can form compounds with varying stability that have oxidation states ranging from +5 to −3. These compounds include a variety of inorganic and organic nitrogen forms essential for biological life (Kadlec and Knight 1996). The most important inorganic and organic forms of nitrogen in the Demonstration Wetlands are ammonia (NH_4^+), nitrite (NO_2^-), nitrate (NO_3^-), and TKN (sum of organic and ammonia nitrogen). It is interesting that $NO_2^- + NO_3^-$ concentrations (<5.0 mg/L; Table 3) in the inflow to the wetlands were much lower than those in wastewater effluents ($NO_2^- + NO_3^- = 12$~14 mg/L) from the wastewater treatment plants in the Las Vegas Valley. Also, $NO_2^- + NO_3^-$ concentrations were greatly reduced (>60%) from the inlet to the outlet (Table 3). The NO_2^- and NO_3^- in water have probably been consumed by plants and microorganisms or released into air as gaseous forms of nitrogen (NH_3, N_2, and N_2O) due to volatilization and denitrification in the upper wastewater stabilization ponds and in the wetlands. Two other forms of nitrogen, ammonia and TKN, generally decreased as water flowed through the wetland system. However, ammonia concentrations at the outlet were higher than those in the inlet when the water level inside the wetlands were low (Figure 9; Table 3; Appendix C). The stagnant and organic-rich water enhances the ammonification (Reddy and Patrick 1984, Kadlec and Knight 1996), which increased NH_4^+ concentrations near the outlet. The principal components of the nitrogen cycle in wetlands (Figure 19) are also applicable to the Demonstration Wetlands.

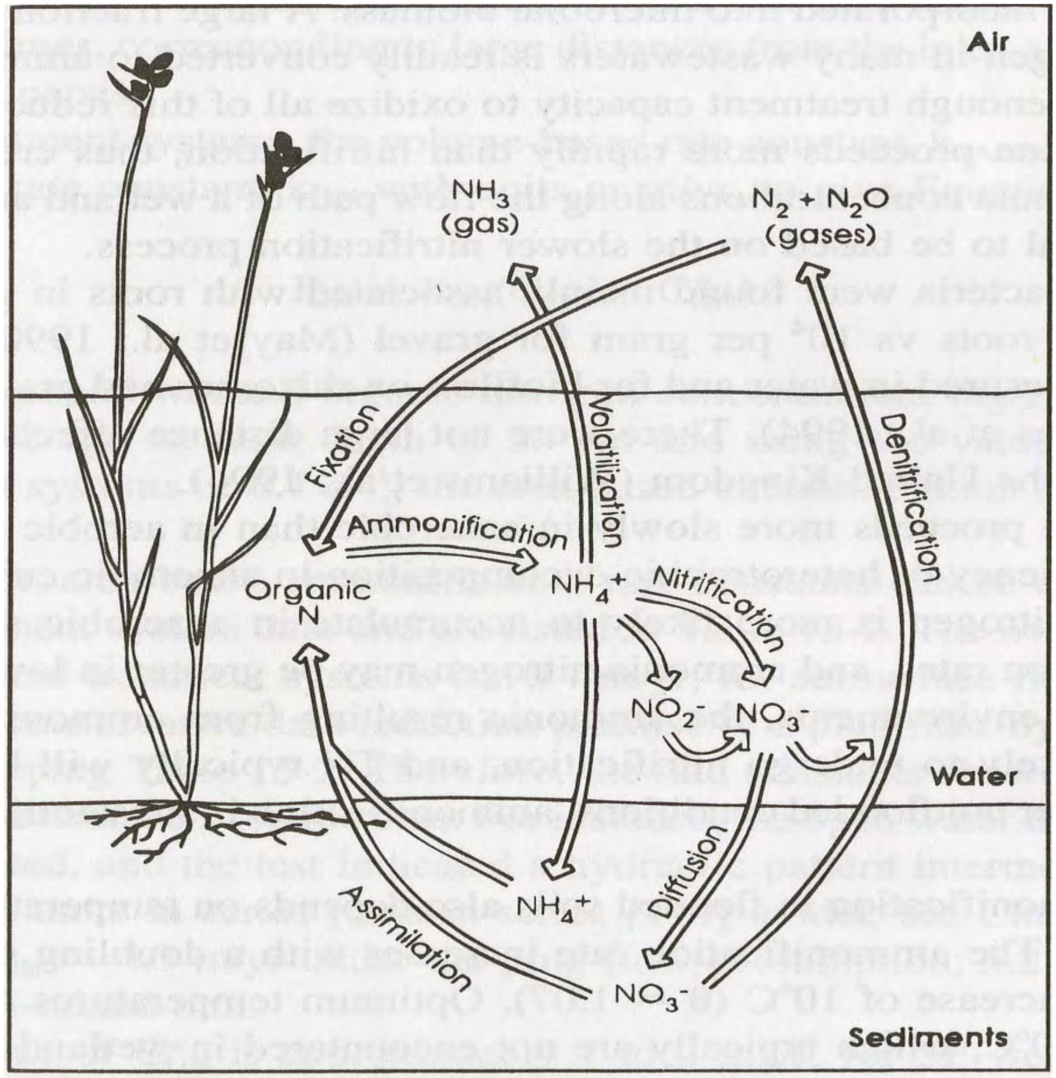

Figure 19: The principal components of the nitrogen cycle in wetlands (Kadlec and Knight 1996).

Phosphorus, a nutrient required for growth of plants and microbiota, is frequently a limiting factor for vegetative productivity. Thus, trace amount of phosphorus in receiving waters can have profound effects on the aquatic ecosystem. Phosphorus cycling and storage in wetlands involves complicate physiochemical and biological processes and several forms of phosphorus (Figure 20). Plant uptake of phosphorus is often compensated by the returning phosphorus to the wetland water through decomposition. Although harvesting biomass (wetland plants) is frequently considered a phosphorus removal option in wetlands, it has a limited impact because: (1) only a small amount (<2.5%) of the total phosphorus removal in surface-flow wetlands is achieved by harvesting (Herskowitz 1986); and (2) harvesting is labor intensive and costly. In addition, phosphorus removal through sorption processes on existing wetland soils has been exaggerated because wetland soils can quickly become saturated with any increase in phosphorus loading (Kadlec and Knight 1996). Overall, wetlands play a very limited role in removing phosphorus.

In contrast to nitrogen, phosphorus (both OP and TP) concentrations in the inflow to the Demonstration Wetlands were much higher than those in wastewater effluents from the Clark County and the City of Las Vegas wastewater treatment plants. Obviously, the wastewater stabilization ponds (the upper pond) have much lower phosphorus-removal efficiencies compared with other wastewater treatment technologies. The Demonstration Wetlands played a mixing role in the phosphorus cycle, decreasing TP and increasing OP from the inlet to the outlet (Table 3; Figure 9). First, both OP and TP concentrations were high in the wetlands, far higher than the biological needs for the growth of plants and microorganisms; therefore, the wetlands has a limited impact on phosphorus removal. Second, decomposition of decayed plants and microorganisms may cycle some phosphorus back to the wetland ecosystem. Finally, the Demonstration Wetlands, with three loafing islands and ideal wetland habitats, attracted thousands of birds. Fecal materials from these birds could potentially contribute a fair amount of phosphorus (Andersen et al. 2003) to the wetlands.

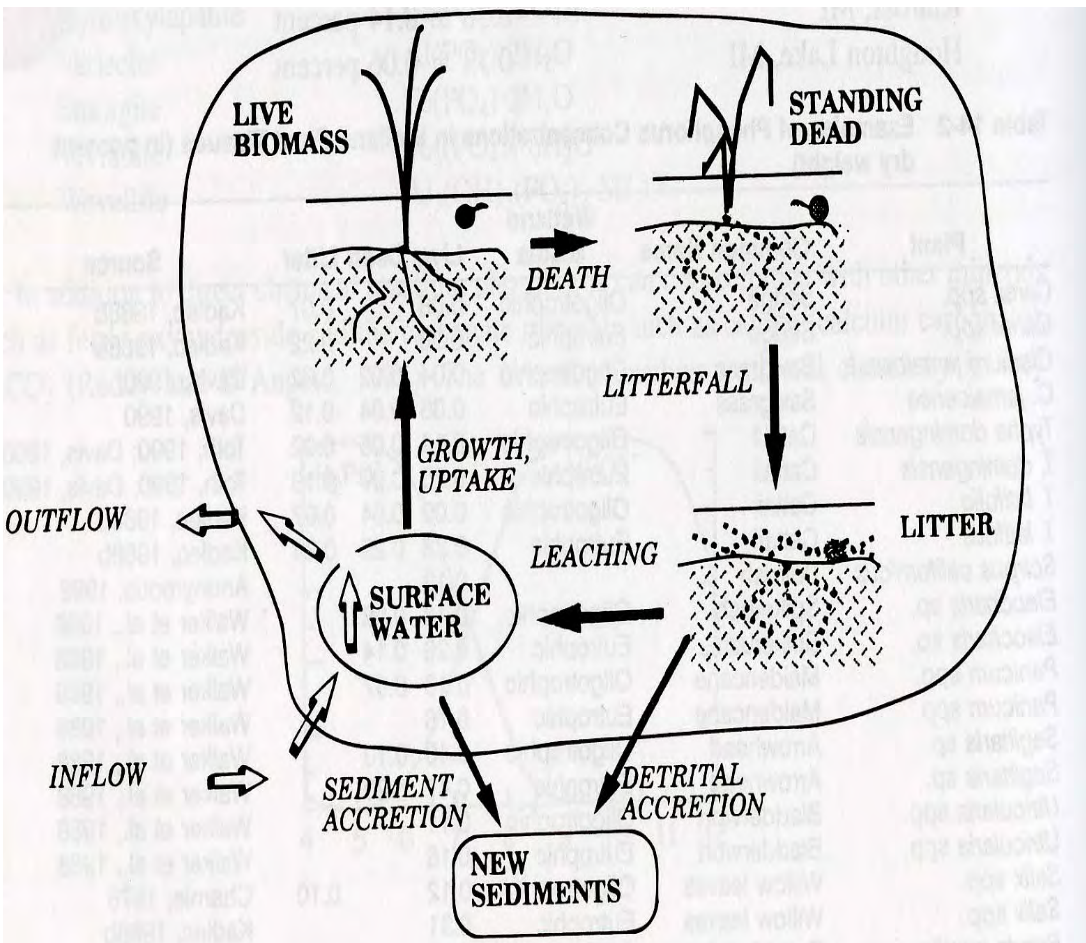

Figure 20: The principal components of the phosphorus cycle in wetlands (Kadlec and Knight 1996).

4.2.4 BOD_5

Wetlands effectively reduce BOD_5. Complex carbon conversion processes operate in wetlands, either consuming BOD_5 or producing it. For example, both anaerobic and aerobic processes consume carbon compounds, whereas litter and sediment decomposition produce soluble carbon compounds. With an average of 37~50% BOD_5 reduction from the inflow to the outflow, the Demonstration Wetlands apparently consumes more carbon compounds than it produces.

4.2.5 Total Suspended Solids

The effectiveness of TSS removal is controlled by settling and resuspension of particulates in wetland waters. The Demonstration Wetlands are a surface-flow pond with slow moving water, which permits enough time for physical settling of TSS. Nearly 50% of TSS was removed from water column within the Demonstration Wetlands. Conversely, resuspension of particulates also exists in the wetlands, especially during warm seasons. As more organic and inorganic particulates settled in the wetlands, a black, organic-rich mud layer has accumulated at the bottle of the wetlands. Dredging may be needed in the future to remove the accumulated deposits.

4.2.6 Metals

A number of metals are important micro-nutrients at trace concentrations. However, they could be toxic to sensitive organisms in waters or wastewaters when concentrations are higher than the maximum contamination level (MCL; Rudd 1987). Kadlec and Knight (1996) summarized published concentrations for a variety of trace metals in soils, surface water, and in biological tissues (plants, invertebrates, fish, and birds). Kaczynski (1985) specifically listed suggested discharge limits of selected metals for waterfowl wetlands. These studies provided a reference to determine metal concentration ranges typically associated with healthy and unhealthy aquatic and wetland environments. Compared with Kaczynski's (1985) action level concentrations, most metals in the Demonstration Wetlands, except for Al and Mn, have much lower concentrations.

Metal removal efficiencies are highly correlated with mass loading rates, influent concentrations, and characteristics of wetlands. Wetlands interact with trace metals in a number of pathways. Three major mechanisms were summarized by Kadlec and Knight (1996):

- Binding to soils, sediments, particulates, and soluble organics.
- Precipitation as insoluble salts, mainly sulfides and oxyhydroxides.
- Uptake by plants, including algae, and by bacteria.

Based on data from the Demonstration Wetlands, wetlands do seem to be effective at retaining significant loads of several trace metals (Table 3; Figures 11 and 12). However, the removal of trace metals will soon be weakened because the typical treatment wetlands contain more trace metals than plant growth requirements.

4.2.7 Bacteria

Indictor organisms such as fecal coliforms, *E. coli*, and total coliform were used to monitor the probable pathogenic activity of wastewater discharge to the Demonstration Wetlands. Pathogenic organisms are a normal component of domestic wastewater. Natural wastewater treatment technologies reduce pathogen population by increasing disinfection. Wetland treatment systems, which have long detention times (>10 days) and vegetation, provide more disinfection and appear to be more effective for pathogen removal. The high pathogen removal rates (>70%) in the Demonstration Wetlands support this conclusion.

However, wetlands used for wastewater treatment are likely to provide suitable breeding habitats for vectors such as mosquitoes (Tennessen 1993). The Demonstration Wetlands also have some public health concerns regarding vector controls. In addition, the current wetlands provide diverse habitats and attracts thousands of birds to the wetlands. They are an important source of both nutrients and pathogens.

4.3 Birds

The fluctuations in species richness and abundance detected over the reported period are expected in a bird community. Birds are highly mobile and several of the species detected in the Demonstration Wetlands are migratory and are only present during certain seasons. Species composition and the generally higher richness and sustained abundances through the winter months highlight the importance of the pond to overwintering birds, especially waterfowl. For example, the most abundant species each year has been the northern shoveler, a species of duck that overwinters in the pond and is only present from October through March. Conversely, the lower richness and abundances detected during the breeding months (April–June) show that the inhabitants of the pond are largely distilled down to those species that nest in the demonstration wetland. With the exception of the northern shoveler, four of the five most abundant species detected each year nest in the pond.

4.4 Vegetation

The three species of bulrush found in the demonstration wetland have proved to be the hardiest for our arid environment. California bulrush is the largest species in both the height of the stands and the thickness of the stems. Olney bulrush has the shortest, densest stands, not unexpected given the small diameter of the stems. Tules fall between these two extremes, with stands of moderate height, density and stem diameter. In general, California bulrush and tules provide a greater amount of cover on the pond, as a result of their presence on more hummocks and the large size of the stands themselves.

5.0 SUMMARY

The Demonstration Wetlands is a pilot study in the Las Vegas Valley. The purpose of the project is to study diverse ecosystems and water quality improvement mechanisms in wetlands. Water quality data, monitored since August 2004, indicate that the constructed wetlands played an effective role in improving water quality by reducing BOD_5, TSS, nitrogen and total phosphorus, most trace metals, and pathogens. However, the concentrations of major ions, TDS, OP, and several metals (Co and Mn) increased from the inflow to the outflow. The results from this study provided valuable information on water quality changes by constructed wetlands in the desert environment.

In general, wetland water quality is variable with time, space, and wetland type; therefore, great care must be exercised in interpretation of water quality data. The wetlands carry out microbial and algal reactions as well as complex interactions between wetland waters and biota and soils.

Vegetation, sediments, and soils in wetlands strongly determine many physical, chemical, and biological processes.

Water quality monitoring in the Demonstration Wetlands is currently on-going. Beginning 2007, the project was modified to better fit our needs based on the water quality data collected during 2004–2006. Wetland systems with balanced inflows and outflows provide more healthy ecosystems and better water quality improvements; therefore, one of challenges faced by the Project Team is providing enough inflows to the wetlands to keep the system refreshed. Another challenge is to collect reliable flow rate data from the inlet and the outlet, critical to estimate the detention time in the wetlands and to calculate mass loading rates of nutrients and other water quality parameters. The Project Team is working closely with the COH water reclamation facility staff to solve these problems.

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Appendix A

Photographs of the Demonstration Wetlands showing the wetland development and sample collection

The Demonstration Wetland at COH **before** filling with treated wastewater. Photo was taken on April 18, 2001.

The Demonstration Wetland at COH **after** filling with treated wastewater. Photo was taken on May 9, 2001.


The early stage of the Demonstration Wetland. Photo was taken on March 16, 2004.


The developing stage of the Demonstration Wetland. Photo was taken on September 28, 2004


April 27, 2004


April 27, 2004


Birds in the Demonstration Wetland. Photo was taken on February 6, 2004.


Birds in the Demonstration Wetland. Photo was taken on February 6, 2004.

Sample collection in the wetland (August 17, 2004).

Sample collection in the wetland (August 17, 2004).


Sample collection in the wetland (August 17, 2004).


Sample collection in the wetland (August 17, 2004).

Appendix B

Hydrolab profile data of five sites in the Demonstration Wetlands during 2004-2006

Hydrolab Profile Data at DWP-1

Date MMDDYY	Time HHMMSS	Temp °C	DO% Sat	pH Units	DO mg/l	SpCond µS/cm	Depth Feet
81704	73137	25.23	26.30	8.83	2.00	2422	1
81704	73313	25.22	25.30	8.81	1.92	2422	2
91404	71153	23.64	64.20	9.04	4.96	2358	1
91404	71320	23.68	64.90	9.03	5.03	2351	2
91404	71426	23.73	61.50	9.03	4.76	2352	3
91404	71511	23.78	57.10	9.06	4.42	2406	4
91404	71600	23.74	45.40	8.88	3.51	2408	5
92804	74359	21.58	12.90	8.18	1.05	2168	1
92804	74521	21.57	11.50	8.21	0.94	2169	2
92804	74649	21.51	8.60	8.27	0.70	2187	3
92804	74742	21.54	8.90	8.26	0.72	2181	4
92804	74918	21.59	11.20	8.22	0.91	2169	5
101204	73619	19.59	37.20	8.56	3.16	2125	1
101204	73702	19.57	34.90	8.69	2.96	2126	2
101204	73736	19.58	33.70	8.72	2.87	2128	3
101204	73813	19.58	34.90	8.73	2.96	2126	4
101204	73919	19.57	31.80	8.71	2.70	2130	5
102604	72103	15.27	37.20	7.87	3.42	2083	1
102604	72159	15.27	34.60	7.88	3.18	2084	2
102604	72226	15.28	34.00	7.88	3.12	2083	3
110904	70618	12.83	24.20	7.45	2.38	2005	1
110904	70742	12.82	19.80	7.45	1.95	2005	2
110904	70845	12.80	20.20	7.45	1.99	2008	3
110904	70957	12.80	17.80	7.45	1.75	2014	4
110904	71113	12.78	16.50	7.46	1.62	2016	5
110904	71247	12.76	15.00	7.46	1.49	2021	6
120704	71914	7.08	100.90	8.22	11.31	1923	1
120704	72127	7.07	97.80	8.32	10.96	1922	2
120704	72344	7.07	97.40	8.36	10.93	1923	3
120704	72550	7.08	93.20	8.37	10.45	1922	4
11805	90331	9.61	165.80	8.33	17.65	1842	1
11805	90347	9.44	169.50	8.45	18.11	1845	2
11805	90400	9.41	168.00	8.53	17.96	1847	3
11805	90413	9.40	164.50	8.58	17.59	1848	4
21505	75205	12.68	86.20	9.13	8.47	1827	1
21505	75245	12.68	88.90	9.18	8.73	1828	2
21505	75329	12.68	85.80	9.15	8.43	1825	3
21505	75406	12.68	86.80	9.16	8.52	1828	4
21505	75437	12.66	86.20	9.13	8.47	1831	5
31505	84350	15.29	35.50	8.73	3.31	1856	1
31505	84429	15.28	25.00	8.77	2.33	1856	2
31505	84526	15.26	21.10	8.77	1.97	1857	3
31505	84552	15.14	18.80	8.78	1.75	1855	4
31505	84607	15.14	18.00	8.78	1.68	1855	5

Hydrolab Profile Data at DWP-1

Date MMDDYY	Time HHMMSS	Temp ^0C	DO% Sat	pH Units	DO mg/l	SpCond µS/cm	Depth Feet
51005	84005	18.00	29.90	7.74	2.59	2441	1
51005	84132	17.99	25.90	7.61	2.24	2444	2
51005	84352	17.98	24.60	7.60	2.13	2449	3
51005	84519	17.98	19.40	7.58	1.66	2440	4
51005	84700	18.00	18.20	7.60	1.57	2441	5
52405	75249	25.13	18.90	7.63	1.42	2486	1
52405	75338	25.12	18.10	7.63	1.37	2486	2
52405	75415	25.12	17.90	7.63	1.35	2486	3
52405	75451	25.12	18.00	7.64	1.36	2485	4
52405	75519	25.11	17.20	7.64	1.30	2483	5
52405	75547	25.11	16.30	7.63	1.23	2485	6
60705	83733	19.81	49.50	7.71	4.13	2491	1
60705	83801	19.79	45.50	7.70	3.80	2505	2
60705	83822	19.78	43.40	7.70	3.62	2508	3
60705	83841	19.78	42.40	7.70	3.54	2511	4
60705	83904	19.78	42.10	7.70	3.52	2514	5
62105	80114	24.15	79.40	8.76	6.11	2387	1
62105	80140	24.14	79.60	8.77	6.13	2384	2
62105	80207	24.10	74.80	8.74	5.77	2393	3
62105	80223	23.67	39.10	8.50	3.04	2420	4
62105	80242	22.90	14.70	8.32	1.16	2444	5
62105	80257	22.79	9.20	8.31	0.73	2440	6
70505	83622	25.94	77.70	9.09	5.79	2413	1
70505	83801	26.03	87.80	9.12	6.51	2410	2
70505	83904	25.98	80.70	9.10	6.00	2412	2
70505	84001	25.91	65.90	9.08	4.90	2413	3
70505	84059	25.77	54.60	9.03	4.08	2416	4
70505	84158	25.68	40.90	9.00	3.06	2423	5
71905	73603	28.67	7.30	8.63	0.52	2479	1.1
71905	73706	28.67	6.70	8.62	0.48	2480	1.9
71905	73808	28.66	5.50	8.62	0.39	2481	3
71905	73911	28.63	6.70	8.61	0.48	2484	3.8
102505	73203	19.27		8.21		2330	1
102505	73414	19.28		8.22		2324	1.9
102505	73608	19.28		8.25		2334	2.9
102505	73811	19.25		8.29		2352	4
102505	74007	18.84		7.99		2419	5
102505	74017	18.79		7.97		2422	5
112205	71658	11.54	96.50	8.56	9.76	2277	1
112205	71740	11.56	111.20	8.59	11.25	2288	2
112205	71825	11.57	99.20	8.61	10.04	2285	3
112205	71854	11.56	107.30	8.62	10.86	2289	4
112205	71924	11.58	101.90	8.63	10.30	2286	5
112205	71942	11.57	100.70	8.63	10.18	2285	5.6
11706	75032	6.26		8.47		2161	1.2
11706	75118	6.26		8.45		2159	2.1

Hydrolab Profile Data at DWP-1

Date MMDDYY	Time HHMMSS	Temp ^0C	DO% Sat	pH Units	DO mg/l	SpCond µS/cm	Depth Feet
11706	75158	6.20		8.45		2161	3
11706	75234	6.17		8.42		2152	4
11706	75301	6.01		8.41		2156	4.3
32806	73803	14.50	83.80	9.29	7.85	2155	1
32806	73839	14.52	80.30	9.30	7.51	2156	2
32806	73934	14.45	73.50	9.27	6.90	2161	3
32806	74030	14.42	70.70	9.28	6.64	2156	4
32806	74125	14.40	58.60	9.26	5.50	2158	5
42506	73610	18.00	31.70	7.46	2.77	2346	0.9
42506	73846	17.96	23.50	7.45	2.05	2344	1.9
42506	73858	17.94	16.60	7.45	1.45	2344	3.2
42506	73917	17.89	11.10	7.45	0.97	2345	3.9
42506	73933	17.74	9.10	7.45	0.80	2342	5.1
52306	71805	20.16	56.50	8.11	4.73	2502	1
52306	71822	20.13	50.10	8.08	4.20	2498	2
52306	71841	20.11	47.80	8.06	4.01	2495	3
52306	71859	20.12	46.80	8.06	3.92	2495	4
52306	71926	20.10	46.80	8.08	3.93	2495	5
52306	72001	20.08	46.70	8.08	3.91	2489	6
62006	72007	24.00	11.40	8.45	0.88	2581	1
62006	72137	23.98	7.80	8.44	0.60	2585	2
62006	72252	23.97	5.70	8.43	0.44	2590	3
62006	72357	23.96	3.80	8.42	0.29	2590	4
62006	72459	23.94	3.20	8.41	0.24	2597	5
71806	73315	27.90	60.20	9.09	4.35	2349	1
71806	73326	27.91	60.00	9.09	4.34	2346	2
71806	73334	27.92	59.70	9.09	4.31	2345	3
71806	73343	27.91	59.40	9.09	4.29	2345	4
71806	73354	27.92	59.00	9.09	4.26	2349	5
71806	73401	27.92	58.50	9.07	4.23	2345	6
92606	81708	19.74		9.16		2533	0.5
92606	81747	19.76		9.16		2533	1.1
92606	81825	19.75		9.16		2533	2
92606	81859	19.74		9.15		2529	2.9
92606	81923	19.67		9.04		2534	4
92606	81952	19.24		8.68		2564	5
92606	82036	19.04		8.54		2571	6
112106	82525	12.08	141.90	8.98	14.03	2272	1
112106	82600	12.02	141.10	9.01	13.96	2289	2
112106	82619	11.99	139.30	9.04	13.79	2295	3
112106	82635	11.99	136.20	9.02	13.49	2300	4

Hydrolab Profile Data at DWP-2

Date MMDDYY	Time HHMMSS	Temp ^0C	DO% Sat	pH Units	DO mg/l	SpCond µS/cm	Depth Feet
81704	81029	25.56	19.80	8.53	1.50	2590	1
81704	81220	25.55	18.50	8.53	1.40	2590	2
81704	81437	25.51	15.10	8.52	1.15	2589	3
81704	81622	25.50	13.80	8.53	1.05	2588	4
81704	82013	25.46	7.60	7.90	0.57	2603	5
81704	82141	25.47	6.60	7.82	0.50	2613	6
81704	82652	25.50	1.60	8.39	0.11	2604	7
91404	72749	23.93	33.70	8.99	2.60	2450	1
91404	72829	23.99	39.60	9.02	3.05	2444	2
91404	72858	23.98	37.40	9.02	2.88	2444	3
91404	72935	23.99	39.40	9.02	3.04	2444	4
91404	73020	24.01	37.50	9.01	2.89	2443	5
91404	73105	23.96	27.60	8.93	2.13	2454	6
91404	75455	24.06	13.80	8.93	1.06	2497	7
92804	82710	21.58	8.40	8.39	0.68	2230	1
92804	82819	21.52	7.30	8.37	0.59	2221	2
92804	82915	21.50	5.60	8.37	0.45	2222	3
92804	83006	21.50	4.90	8.39	0.40	2225	4
92804	83059	21.45	3.90	8.46	0.32	2243	5
92804	83149	21.30	1.50	8.51	0.12	2252	6
92804	83229	20.39	1.00	8.54	0.08	2328	7
101204	92214	20.06	39.30	8.61	3.29	2141	1
101204	92329	19.89	30.10	8.69	2.54	2144	2
101204	92411	19.83	27.00	8.71	2.28	2142	3
101204	92520	19.80	25.70	8.72	2.17	2143	4
101204	92602	19.76	26.00	8.72	2.19	2140	5
101204	92654	19.73	24.80	8.73	2.10	2137	6
101204	92737	19.68	20.80	8.66	1.76	2130	7
102604	72955	15.57	31.10	7.88	2.84	2088	1
102604	73024	15.59	29.00	7.88	2.65	2088	2
102604	73213	15.59	27.00	7.88	2.47	2087	3
102604	73416	15.59	25.90	7.87	2.36	2087	4
102604	73608	15.59	24.80	7.87	2.27	2086	5
102604	73804	15.59	24.00	7.86	2.19	2087	6
102604	74046	15.59	23.20	7.86	2.12	2087	7
110904	71910	12.77	22.60	7.48	2.22	2032	1
110904	72024	12.77	19.90	7.49	1.95	2033	2
110904	72154	12.75	18.50	7.49	1.82	2031	3
110904	72316	12.75	18.60	7.49	1.83	2031	4
110904	72531	12.72	15.50	7.49	1.52	2031	5
110904	72735	12.72	14.70	7.49	1.45	2029	6
110904	72919	12.72	14.10	7.48	1.39	2031	7
120704	73427	6.98	97.40	8.47	10.94	1934	1
120704	73632	6.99	96.90	8.47	10.89	1940	2
120704	73839	6.97	101.90	8.48	11.46	1937	3
120704	74043	6.98	101.40	8.49	11.39	1938	4

Hydrolab Profile Data at DWP-2

Date MMDDYY	Time HHMMSS	Temp ^0C	DO% Sat	pH Units	DO mg/l	SpCond µS/cm	Depth Feet
120704	74322	6.94	102.80	8.48	11.56	1940	5
120704	74606	6.93	102.70	8.49	11.55	1938	6
120704	74826	6.89	100.70	8.49	11.35	1939	7
11805	90923	9.45	155.70	8.89	16.63	1850	1
11805	90933	9.41	151.60	8.86	16.21	1851	2
11805	90944	9.33	145.50	8.83	15.58	1854	3
11805	91004	9.31	142.90	8.81	15.32	1850	4
11805	91010	9.30	140.70	8.80	15.09	1853	5
11805	91016	9.29	138.40	8.80	14.84	1853	6
11805	91022	9.29	134.30	8.80	14.40	1854	7
11805	91029	9.35	130.90	8.81	14.02	1855	8
21505	80039	12.67	83.00	9.14	8.16	1829	1
21505	80131	12.66	78.20	9.12	7.69	1831	2
21505	80207	12.65	82.70	9.12	8.13	1831	3
21505	80425	12.64	79.90	9.11	7.85	1831	4
21505	80508	12.63	78.70	9.10	7.74	1831	5
21505	80550	12.61	75.60	9.10	7.42	1831	6
21505	80621	12.60	70.90	9.08	6.98	1832	7
31505	85350	15.36	25.40	8.68	2.36	1858	1
31505	85426	15.22	16.20	8.70	1.51	1857	2
31505	85446	15.15	13.60	8.72	1.27	1858	3
31505	85515	15.12	11.50	8.74	1.08	1853	4
31505	85530	15.07	11.10	8.75	1.04	1857	5
31505	85610	15.02	10.60	8.75	0.99	1856	6
31505	85628	14.93	9.60	8.73	0.90	1857	7
52405	80252	25.41	41.50	7.64	3.11	2495	1
52405	80350	25.34	39.70	7.63	2.98	2494	2
52405	80424	25.28	37.70	7.62	2.84	2493	3
52405	80505	25.19	35.80	7.61	2.70	2493	4
52405	80534	25.10	32.70	7.60	2.47	2494	5
52405	80616	24.80	27.30	7.60	2.07	2487	6
52405	80724	23.14	22.30	7.45	1.75	2492	7
60705	84600	20.07	61.00	7.78	5.06	2540	1
60705	84627	20.05	54.10	7.77	4.49	2537	2
60705	84640	20.02	52.40	7.76	4.35	2535	3
60705	84654	20.00	50.50	7.76	4.20	2538	4
60705	84720	19.99	47.30	7.74	3.93	2536	5
60705	84737	19.95	43.70	7.72	3.64	2535	6
60705	84756	19.87	39.00	7.68	3.23	2531	7
60705	84811	19.86	34.00	7.67	2.83	2531	8
62105	81357	24.69	90.20	8.81	6.88	2418	1
62105	81435	24.61	89.80	8.77	6.86	2418	2
62105	81633	24.34	58.10	8.69	4.46	2414	3
62105	81748	24.18	47.70	8.65	3.68	2415	4
62105	81831	23.99	46.40	8.64	3.58	2410	5
62105	81959	23.41	10.60	8.34	0.83	2443	6

Hydrolab Profile Data at DWP-2

Date MMDDYY	Time HHMMSS	Temp ^{0}C	DO% Sat	pH Units	DO mg/l	SpCond µS/cm	Depth Feet
62105	82047	22.85	4.10	8.29	0.32	2447	7
62105	82129	22.60	1.80	8.30	0.14	2446	8
70505	90320	25.94	32.00	8.95	2.38	2452	1
70505	90404	26.07	37.70	8.97	2.80	2446	2
70505	90501	25.91	31.40	8.94	2.33	2447	3
70505	90619	25.81	26.20	8.91	1.96	2440	4
70505	90704	25.79	28.40	8.92	2.12	2440	5
70505	90814	25.72	26.30	8.91	1.97	2440	6
70505	90913	25.51	5.00	8.75	0.37	2439	7
70505	91017	25.19	1.60	8.54	0.12	2451	8
71905	74614	29.17	8.50	8.58	0.60	2512	1
71905	74715	29.23	7.00	8.56	0.49	2514	2
71905	74818	29.21	6.50	8.57	0.46	2514	3
71905	74931	29.08	6.40	8.60	0.45	2508	4
71905	75116	29.14	4.10	8.57	0.29	2514	5
71905	75213	28.84	2.10	8.59	0.14	2498	6
71905	75312	28.74	1.50	8.51	0.10	2504	7
71905	75334	26.63	0.90	7.28	0.06	2657	8
102505	74819	19.44		8.27		2382	1
102505	75002	19.47		8.28		2380	2
102505	75018	19.46		8.28		2382	3
102505	75308	19.47		8.28		2382	4
102505	75550	19.34		8.24		2396	5
102505	75707	18.95		8.07		2431	6
102505	75901	18.55		7.74		2480	7
102505	75916	18.53		7.74		2482	8
112205	75310	11.78	97.40	8.69	9.16	2315	1
112205	75322	11.80	95.40	8.69	9.60	2314	2
112205	75404	11.80	97.90	8.68	9.85	2314	3
112205	75434	11.80	99.60	8.69	9.97	2314	4
112205	75457	11.80	95.90	8.69	9.65	2314	5
112205	75531	11.79	98.90	8.70	9.95	2314	6
112205	75558	11.77	98.80	8.70	9.95	2314	7
112205	75623	11.76	100.80	8.70	10.15	2313	8
11706	75903	6.70		8.22		2164	1
11706	75914	6.70		8.23		2164	2
11706	80035	6.70		8.25		2165	3
11706	80102	6.71		8.25		2164	4
11706	80142	6.71		8.29		2167	5
11706	80255	6.69		8.30		2166	6
11706	80320	6.68		8.30		2166	7
32806	74707	14.72	84.40	9.34	7.88	2157	1
32806	74745	14.72	82.10	9.35	7.66	2159	2
32806	74849	14.72	80.50	9.35	7.51	2157	3
32806	74913	14.68	79.90	9.33	7.46	2159	4
32806	74930	14.69	77.50	9.32	7.23	2159	5

Hydrolab Profile Data at DWP-2

Date MMDDYY	Time HHMMSS	Temp ^0C	DO% Sat	pH Units	DO mg/l	SpCond µS/cm	Depth Feet
42506	74411	18.19	31.70	7.45	2.76	2347	1
42506	74437	18.19	19.10	7.46	1.66	2344	2
42506	74638	18.18	8.40	7.45	0.73	2345	3
42506	74658	17.95	7.00	7.44	0.61	2339	4
42506	74743	17.34	4.20	7.43	0.37	2332	5
42506	74811	17.20	3.70	7.43	0.33	2329	6
42506	74840	16.95	3.30	7.43	0.30	2330	7
42506	74901	16.76	3.20	7.45	0.29	2332	8
52306	72757	20.42	14.80	7.93	5.68	2520	1
52306	72819	20.42	14.80	7.91	4.86	2521	2
52306	72846	20.39	14.30	7.90	4.34	2524	3
52306	72908	20.37	14.20	7.88	4.09	2523	4
52306	73020	20.33	13.80	7.88	3.92	2525	5
52306	73030	20.33	14.10	7.88	3.89	2529	6
52306	73047	20.33	16.50	7.88	3.85	2524	7
71806	73908	28.01	56.70	9.00	4.09	2396	1
71806	73921	28.03	41.90	8.99	3.02	2396	2
71806	73932	28.04	37.70	8.98	2.72	2395	3
71806	73938	28.04	36.50	8.98	2.63	2397	4
71806	73946	28.04	35.20	8.98	2.54	2395	5
71806	74000	28.04	34.10	8.99	2.46	2395	6
71806	74013	28.04	33.80	8.99	2.43	2395	7
71806	74025	28.04	33.40	8.98	2.41	2397	8
92606	82737	20.17		9.19		2566	1
92606	82938	20.12		9.15		2567	2
92606	83012	20.09		9.13		2568	3
92606	83039	19.70		8.97		2572	4
92606	83059	19.10		8.73		2580	5
92606	83136	18.97		8.50		2595	6
92606	83201	18.96		8.49		2592	7
92606	83231	18.99		8.38		2596	8
112106	85413	12.63	148.30	9.14	14.47	2333	1
112106	85442	12.26	135.10	9.11	13.29	2341	2
112106	85455	12.21	132.60	9.11	13.04	2342	3
112106	85510	12.19	130.20	9.11	12.83	2344	4
112106	85521	12.19	127.70	9.12	12.59	2343	5
112106	85535	12.19	126.80	9.13	12.50	2343	6
112106	85549	12.18	126.60	9.14	12.48	2344	7
112106	85614	12.24	108.50	8.96	10.69	2294	8

Hydrolab Profile Data at DWP-3

Date MMDDYY	Time HHMMSS	Temp ^0C	DO% Sat	pH Units	DO mg/l	SpCond µS/cm	Depth Feet
81704	100057	25.99	54.3	8.62	4.07	2594	1
81704	100218	26.02	51.5	8.62	3.87	2598	2
81704	100333	25.86	44.6	8.59	3.35	2597	3
81704	100452	25.63	34.3	8.54	2.59	2598	4
81704	100633	25.55	30.3	8.52	2.29	2598	5
81704	100646	25.51	21.8	8.46	1.65	2599	6
81704	100738	25.51	19.6	8.47	1.48	2600	7
91404	75512	24.03	13.4	8.93	1.03	2496	1
91404	75553	24.02	13.2	8.93	1.01	2495	2
91404	75635	24.04	13.5	8.94	1.04	2496	3
91404	75732	24.07	8.1	8.9	0.63	2495	4
91404	75833	24.07	3.5	8.8	0.27	2501	5
91404	75902	24.04	1.7	8.7	0.13	2501	6
91404	75932	24.01	1.3	8.3	0.1	2515	7
92804	90604	21.74	36.8	8.52	2.98	2249	1
92804	90754	21.64	15	8.5	1.21	2249	2
92804	90852	21.61	12.7	8.5	1.03	2248	3
92804	91011	21.57	10.1	8.5	0.82	2250	4
92804	91110	21.53	6.4	8.46	0.52	2256	5
92804	91228	20.87	1.9	8.51	0.16	2306	6
							7
101204	82357	19.69	51.5	8.5	4.34	2145	1
101204	82503	19.68	46.5	8.59	3.94	2145	2
101204	82605	19.66	40.1	8.64	3.4	2145	3
101204	82642	19.65	40.9	8.7	3.47	2150	4
101204	82730	19.63	42.4	8.74	3.6	2148	5
101204	82816	19.63	42.8	8.75	3.63	2150	6
101204	82942	19.58	32.3	8.7	2.74	2151	7
102604	82103	15.54	43.9	8	4.01	2088	1
102604	82302	15.55	40.9	8	3.73	2087	2
102604	82313	15.55	67.1	8	5.3	2088	3
102604	82500	15.54	40.9	8	3.74	2087	4
102604	82703	15.55	40.5	7.99	3.71	2086	5
102604	82900	15.55	39.4	7.99	3.6	2087	6
102604	83102	15.55	39	7.99	3.57	2088	7
102604	83300	15.55	37.8	8	3.45	2087	8
110904	80010	12.67	29.4	7.6	2.9	2036	1
110904	80126	12.66	25.9	7.59	2.56	2035	2
110904	80236	12.64	23.7	7.58	2.34	2034	3
110904	80406	12.57	22.3	7.58	2.21	2035	4
110904	80507	12.57	22.3	7.57	2.21	2035	5
110904	80621	12.56	20.9	7.58	2.07	2034	6
110904	80740	12.56	21.5	7.58	2.12	2037	7
120704	83112	6.77	109.5	8.58	12.37	1945	1
120704	83307	6.76	108.4	8.55	12.25	1950	2
120704	83507	6.75	105.4	8.56	11.92	1948	3
120704	83713	6.76	104.9	8.56	11.85	1950	4

Hydrolab Profile Data at DWP-3

Date MMDDYY	Time HHMMSS	Temp ^0C	DO% Sat	pH Units	DO mg/l	SpCond µS/cm	Depth Feet
120704	83906	6.76	106.3	8.56	12.01	1951	5
120704	84106	6.77	106.9	8.57	12.07	1948	6
120704	84228	6.77	103.2	8.56	11.65	1949	7
11805	93020	9.65	126	9.13	13.4	1842	1
11805	93031	9.53	140.6	8.98	14.99	1845	2
11805	93039	9.48	145.1	9.1	15.49	1846	3
11805	93051	9.43	147.5	9.1	15.76	1845	4
11805	93102	9.39	150	9.09	16.05	1848	5
11805	93108	9.38	150.2	9.08	16.07	1847	6
11805	93114	9.35	149.3	9.06	15.98	1847	7
11805	93123	9.34	148.9	9.06	15.95	1847	8
11805	93137	9.31	147.2	9.04	15.77	1849	9
21505	82600	12.53	95.7	9.18	9.44	1826	1
21505	82647	12.56	87.2	9.19	8.59	1824	2
21505	82739	12.53	88.1	9.18	8.68	1826	3
21505	82825	12.49	82.7	9.15	8.16	1826	4
21505	82904	12.48	82.3	9.15	8.13	1827	5
21505	82934	12.45	80.4	9.14	7.95	1825	6
31505	92046	15.66	26.4	8.7	2.44	1861	1
31505	92254	15.68	17.3	8.71	1.6	1863	2
31505	92320	15.32	14.4	8.69	1.34	1856	3
31505	92351	15.11	11.8	8.69	1.1	1855	4
31505	92408	15.06	9.6	8.69	0.89	1858	5
31505	92419	15.06	9	8.7	0.84	1861	6
51005	92558	18.12	49.8	7.7	4.31	2447	1
51005	92634	18.09	43.8	7.62	3.79	2446	2
51005	92709	18.08	41.3	7.68	3.57	2447	3
51005	92754	18.14	40.8	7.69	3.53	2446	4
51005	92843	18.15	39.6	7.68	3.42	2449	5
51005	92905	18.15	40.1	7.68	3.46	2447	6
51005	95139	18.38	53.6	7.67	4.61	2448	7
52405	83442	25.76	38.9	7.71	2.9	2504	1
52405	83525	25.74	40.4	7.7	3.01	2504	2
52405	83617	25.57	32.3	7.66	2.42	2502	3
52405	83655	25.51	27.8	7.64	2.09	2504	4
52405	83726	25.36	24.6	7.62	1.85	2502	5
52405	83751	25.37	22.2	7.62	1.67	2501	6
60705	91430	20.45	73.4	8.01	6.05	2550	1
60705	91454	20.41	66.7	7.91	5.5	2544	2
60705	91508	20.22	54.8	7.85	4.54	2546	3
60705	91519	20.21	50.1	7.86	4.15	2547	4
60705	91530	20.19	47.7	7.86	3.95	2546	5
60705	91544	20.19	46	7.86	3.81	2546	6
60705	91555	20.16	45	7.83	3.73	2544	7
60705	91605	20.06	41.2	7.79	3.42	2542	8
60705	91615	20.08	35.5	7.73	2.94	2431	9

Hydrolab Profile Data at DWP-3

Date MMDDYY	Time HHMMSS	Temp ^0C	DO% Sat	pH Units	DO mg/l	SpCond µS/cm	Depth Feet
62105	84445	24.92	107.3	8.82	8.15	2425	1
62105	84547	24.69	80.6	8.74	6.14	2430	2
62105	84646	24.54	68.1	8.67	5.21	2433	3
62105	84756	24.26	34.2	8.53	2.63	2432	4
62105	84921	23.96	10.6	8.38	0.82	2434	5
62105	85003	23.57	4	8.26	0.31	2450	6
62105	85023	23.27	2.3	8.26	0.18	2462	7
70505	93801	26.43	85.3	9.04	6.29	2447	1
70505	93905	26.07	47.2	8.95	3.5	2449	2
70505	94004	25.92	31.9	8.9	2.38	2452	3
70505	94108	25.86	23.7	8.86	1.77	2450	4
70505	94206	25.65	17.7	8.75	1.33	2455	5
70505	94300	25.39	12.1	8.65	0.91	2456	6
70505	94404	25.22	10.5	8.52	0.79	2466	7
71905	81912	29.28	10.7	8.51	0.75	2524	1
71905	82008	29.26	8.4	8.48	0.59	2525	1.9
71905	82106	29.13	5.1	8.47	0.36	2526	3
71905	82206	29.19	5.1	8.47	0.36	2524	4.1
71905	82306	28.95	1.4	8.45	0.1	2521	5.2
71905	82404	28.81	1	8.44	0.07	2522	6
71905	82508	28.75	0.9	8.33	0.06	2523	6.9
102505	82835	19.49	0	8.59	0	2399	1
102505	83104	19.48	0	8.55	0	2400	2
102505	83236	19.45	0	8.56	0	2401	3
102505	83357	19.42	0	8.56	0	2399	3.9
102505	83529	19.08	0	8.3	0	2436	5
102505	83658	18.77	0	7.91	0	2466	6
102505	83804	18.53	0	7.7	0	2494	7
112205	82807	11.81	131.3	8.86	13.21	2319	1.2
112205	82831	11.83	126.5	8.86	12.72	2319	1.8
112205	82859	11.83	162.9	8.86	16.38	2317	3
112205	82930	11.81	142.9	8.87	14.37	2319	4
112205	82955	11.8	143.7	8.85	14.45	2319	5
112205	83022	11.78	84.8	8.85	8.54	2320	6
112205	83047	11.77	115	8.85	11.57	2319	6.9
11706	83742	6.27		8.34		2167	0.9
11706	83854	6.26		8.36		2168	2
11706	83959	6.24		8.37		2168	2.9
11706	84036	6.2		8.38		2166	4
11706	84104	6.15		8.46		2168	5
11706	84122	6.11		8.41		2168	5.6
32806	80531	14.64	97.8	9.37	9.14	2160	0.9
32806	80640	14.65	93.3	9.37	8.65	2160	2
32806	80726	14.66	82.9	9.38	7.75	2160	3
32806	80754	14.65	81.9	9.38	7.65	2160	4.1

Hydrolab Profile Data at DWP-3

Date MMDDYY	Time HHMMSS	Temp ^0C	DO% Sat	pH Units	DO mg/l	SpCond µS/cm	Depth Feet
32806	80800	14.66	81.8	9.38	7.64	2161	4.1
42506	81336	18.18	51.8	7.53	4.51	2349	0.9
42506	81410	18.08	22.9	7.49	1.99	2351	1.9
42506	81454	18.06	13.5	7.47	1.18	2349	3
42506	81613	17.97	9.1	7.47	0.8	2342	4.1
42506	81639	17.4	7.3	7.46	0.65	2337	5
42506	81727	16.91	4	7.47	0.36	2333	6.1
52306	75920	20.47	73.4	7.99	6.11	2533	1
52306	75944	20.38	65.3	7.93	5.44	2532	2
52306	80002	20.32	61.9	7.9	5.16	2533	3
52306	80017	20.29	57.5	7.88	4.8	2533	4
52306	80032	20.28	55.8	7.9	4.66	2533	5
52306	80046	20.24	57.8	7.92	4.84	2534	6
62006	80842	24.48	31.6	8.54	2.42	2639	1
62006	81027	24.46	24.3	8.54	1.87	2641	2
62006	81142	24.45	24.5	8.54	1.88	2640	3
62006	81302	24.45	24.2	8.54	1.86	2641	4
71806	80112	27.97	27.1	8.91	1.95	2423	1
71806	80121	28	21.8	8.91	1.57	2423	2
71806	80132	27.99	20.7	8.9	1.49	2423	3
71806	80141	27.99	18.7	8.91	1.35	2423	4
71806	80151	27.99	17.4	8.9	1.25	2423	5
71806	80202	27.98	16.4	8.9	1.18	2426	6
71806	80217	27.93	16.8	8.82	1.21	2425	7
92606	85616	20.32		9.21		2583	1
92606	85646	20.27		9.19		2582	2
92606	85707	20.22		9.18		2584	3
92606	85732	19.65		8.99		2588	4
92606	85750	19.14		8.75		2596	6
92606	85825	18.99		8.48		2606	7.4
92606	85846	19		8.4		2607	7.5
112106	91857	12.46	146.7	9.14	14.37	2351	1
112106	91919	12.29	142.9	9.13	14.05	2353	2
112106	91932	12.23	137	9.14	13.49	2351	3
112106	91956	12.2	134	9.16	13.2	2354	4
112106	92010	12.18	134.1	9.18	13.24	2351	5
112106	92023	12.16	135.5	9.2	13.36	2350	6
112106	92042	12.16	138.2	9.22	13.63	2349	7
112106	92101	12.16	137.7	9.19	13.53	2336	8

Hydrolab Profile Data at DWP-4

Date MMDDYY	Time HHMMSS	Temp ^0C	DO% Sat	pH Units	DO mg/l	SpCond µS/cm	Depth Feet
81704	101234	26.83	65.30	8.67	4.83	2597	1
81704	101455	26.13	48.30	8.62	3.62	2600	2
81704	101636	25.82	37.50	8.58	2.82	2602	3
81704	101810	25.60	32.90	8.56	2.51	2602	4
81704	101941	25.53	26.70	8.53	2.02	2602	5
81704	102157	25.46	19.70	8.50	1.49	2601	6
92804	95328	21.86	25.90	8.56	2.09	2253	1
92804	95439	21.71	16.80	8.53	1.36	2255	2
92804	95602	21.62	11.30	8.51	0.91	2254	3
92804	95703	21.60	9.50	8.51	0.77	2253	4
92804	95824	21.69	10.60	8.53	0.86	2250	5
101204	83619	19.83	64.80	8.65	5.47	2144	1
101204	83731	19.81	57.00	8.75	4.81	2144	2
101204	83832	19.77	53.00	8.80	4.48	2147	3
101204	83924	19.75	55.20	8.84	4.67	2147	4
101204	84018	19.73	53.20	8.81	4.50	2146	5
101204	84056	19.70	54.90	8.85	4.64	2149	6
101204	84154	19.71	51.30	8.84	4.34	2149	7
102604	85907	15.50	47.60	8.01	4.36	2086	1
102604	90100	15.50	43.60	8.01	3.99	2086	2
102604	90254	15.50	43.50	8.00	4.02	2086	3
102604	90547	15.50	43.00	8.01	3.94	2086	4
102604	90647	15.50	42.00	7.98	3.84	2087	5
102604	90758	15.49	41.50	7.99	3.80	2087	6
110904	82907	12.75	30.60	7.62	3.01	2035	1
110904	83102	12.66	24.80	7.60	2.45	2036	2
110904	83216	12.64	23.90	7.59	2.36	2031	3
110904	83404	12.57	17.80	7.57	1.75	2035	4
110904	83530	12.57	16.60	7.57	1.64	2033	5
110904	83659	12.56	18.50	7.57	1.83	2033	6
110904	83800	12.54	17.10	7.57	1.69	2033	7
11805	95409	9.81	144.80	9.22	15.33	1840	1
11805	95422	9.52	167.80	9.15	17.90	1846	2
11805	95434	9.44	165.50	9.11	17.68	1850	3
11805	95446	9.42	160.50	9.09	17.16	1846	4
11805	95458	9.40	156.80	9.08	16.77	1848	5
11805	95512	9.34	151.00	8.99	16.13	1850	6
11805	95526	9.33	144.90	8.98	15.52	1849	7
11805	95838	9.97	177.90	9.25	18.77	1842	8
21505	84647	12.68	96.30	9.24	9.46	1824	1
21505	84737	12.53	88.90	9.19	8.77	1827	2
21505	84842	12.49	81.50	9.17	8.04	1827	3
21505	84940	12.48	77.10	9.16	7.61	1827	4
21505	85031	12.47	77.00	9.13	7.60	1826	5

Hydrolab Profile Data at DWP-4

Date MMDDYY	Time HHMMSS	Temp ^0C	DO% Sat	pH Units	DO mg/l	SpCond µS/cm	Depth Feet
21505	85243	12.45	78.50	9.16	7.75	1825	6
21505	85332	12.45	78.50	9.15	7.76	1829	7
31505	94455	15.22	33.70	8.70	3.15	1858	1
31505	94538	15.29	20.60	8.71	1.92	1858	2
31505	94557	15.19	17.20	8.71	1.61	1855	3
31505	94610	15.06	15.10	8.70	1.41	1858	4
31505	94639	14.95	11.70	8.71	1.10	1858	5
31505	94654	14.86	10.40	8.70	0.98	1861	6
31505	94704	14.86	9.50	8.70	0.90	1862	7
51005	95147	18.38	48.50	7.67	4.18	2447	1
51005	95217	18.29	40.50	7.66	3.49	2446	2
51005	95245	18.17	36.90	7.66	3.19	2441	3
51005	95322	18.01	36.40	7.67	3.16	2440	4
51005	95352	17.94	36.30	7.66	3.15	2441	5
51005	95417	17.87	36.50	7.66	3.17	2443	6
51005	95449	17.84	35.40	7.66	3.08	2443	7
51005	95519	17.83	34.40	7.66	2.98	2444	8
52405	85837	25.75	27.00	7.63	2.01	2499	1
52405	85925	25.61	23.60	7.60	1.77	2499	2
52405	90002	25.45	19.70	7.57	1.48	2499	3
52405	90047	25.39	18.20	7.56	1.37	2500	4
52405	90127	25.37	17.40	7.56	1.31	2500	5
52405	90239	23.91	3.60	7.47	0.28	2481	6
52405	90308	23.08	2.50	7.42	0.20	2491	7
52405	90410	25.37	58.60	7.87	4.39	2509	8
60705	93253	20.55	79.90	7.96	6.57	2545	1
60705	93304	20.44	76.00	7.92	6.26	2546	2
60705	93313	20.38	70.80	7.89	5.78	2547	3
60705	93328	20.33	62.20	7.86	5.14	2546	4
60705	93341	20.31	57.90	7.84	4.78	2546	5
60705	93354	20.24	52.60	7.78	4.35	2546	6
60705	93406	20.23	46.60	7.74	3.86	2545	7
62105	91008	25.50	148.00	8.96	11.15	2424	1
62105	91208	24.73	74.00	8.67	5.64	2432	2
62105	91303	24.59	63.50	8.60	4.85	2431	3
62105	91359	24.40	43.50	8.51	3.34	2431	4
62105	91532	23.88	11.90	8.30	0.92	2446	5
62105	91713	23.43	3.50	8.23	0.27	2449	6
62105	91806	22.91	1.80	8.22	0.14	2456	7
62105	91855	22.70	1.20	8.25	0.10	2461	8
70505	100330	26.52	91.90	9.12	6.77	2442	1
70505	100432	26.11	62.00	9.03	4.60	2447	2
70505	100535	25.93	41.30	9.00	3.08	2450	4
70505	100627	25.71	17.80	8.88	1.33	2452	5

Hydrolab Profile Data at DWP-4

Date MMDDYY	Time HHMMSS	Temp ^0C	DO% Sat	pH Units	DO mg/l	SpCond µS/cm	Depth Feet
70505	100728	25.58	5.50	8.74	0.42	2451	6
70505	100816	25.27	2.50	8.58	0.19	2460	7
70505	103855	26.85	55.30	8.88	4.05	2458	0
71905	84403	29.16	9.80	8.51	0.69	2520	1.1
71905	84508	29.04	4.00	8.49	0.28	2520	1.8
71905	84605	28.91	1.60	8.47	0.11	2521	3
71905	84707	28.94	1.60	8.48	0.11	2520	4
71905	84817	28.92	1.10	8.48	0.08	2520	5.1
71905	84906	28.87	1.00	8.47	0.07	2522	6.1
71905	84933	28.77	0.80	8.41	0.06	2524	6.7
102505	85739	19.60		8.43		2401	1
102505	85840	19.53		8.42		2402	2
102505	90003	19.50		8.41		2404	2.9
102505	90151	19.42		8.39		2411	4
102505	90311	18.99		8.14		2445	5
102505	90318	18.96		8.13		2446	5
102505	90442	18.60		7.58		2502	6
112205	83410	11.88	121.90	8.83	12.24	2321	1.1
112205	83431	11.88	122.70	8.82	12.32	2321	2
112205	83519	11.86	118.30	8.82	11.89	2321	3
112205	83551	11.87	32.30	8.83	15.59	2322	4
112205	83610	11.83	34.70	8.80	3.49	2316	5
112205	83636	11.83	128.70	8.81	12.93	2321	6
112205	83658	11.82	99.70	8.81	10.03	2323	7
11706	91326	6.48		8.35		2165	1
11706	91403	6.42		8.35		2161	2
11706	91440	6.41		8.34		2165	3
11706	91508	6.42		8.36		2166	4
11706	91540	6.37		8.37		2164	5
11706	91557	6.40		8.33		2160	5.7
32806	82155	14.71	91.40	9.35	8.53	2160	1.2
32806	82215	14.71	83.90	9.36	7.83	2161	2.1
32806	82253	14.70	79.30	9.37	7.40	2159	2.9
32806	82331	14.69	76.00	9.36	7.10	2163	4
32806	82423	14.62	67.70	9.33	6.31	2160	5.2
32806	82443	14.24	48.20	9.12	4.54	2165	6.1
32806	82507	14.11	24.50	9.08	2.32	2165	6.3
32806	83334	13.97	61.40	9.10	5.82	2174	0
32806	83348	13.97	61.30	9.09	5.81	2176	0
42506	84021	18.34	44.00	7.49	3.81	2352	1.1
42506	84038	18.19	25.90	7.48	2.25	2349	2
42506	84100	18.11	17.70	7.47	1.54	2348	2.9
42506	84241	18.01	8.30	7.46	0.72	2350	3.1
42506	84419	17.20	4.00	7.45	0.36	2345	5

Hydrolab Profile Data at DWP-4

Date MMDDYY	Time HHMMSS	Temp °C	DO% Sat	pH Units	DO mg/l	SpCond µS/cm	Depth Feet
42506	84709	16.97	1.90	7.45	0.17	2339	5.9
42506	84740	16.88	1.70	7.33	0.15	2330	6.7
52306	82138	20.66	76.50	7.90	6.34	2547	1
52306	82147	20.59	64.10	7.88	5.32	2545	2
52306	82159	20.49	62.10	7.86	5.16	2547	3
52306	82217	20.47	56.50	7.83	4.70	2544	4
52306	82242	20.42	51.00	7.79	4.25	2543	5
52306	82312	20.37	45.60	7.77	3.80	2545	6
52306	82335	20.31	44.80	7.81	3.74	2540	7
52306	82352	20.30	46.80	7.81	3.91	2537	7
62006	85248	24.61	43.40	8.55	3.32	2637	1
62006	85345	24.47	28.20	8.48	2.16	2633	2
62006	85501	24.41	20.70	8.46	1.59	2632	3
62006	85552	24.37	17.40	8.42	1.33	2636	4
62006	85658	24.35	10.50	8.40	0.80	2635	5
62006	85747	24.32	8.40	8.39	0.64	2635	6
62006	90546	24.52	28.20	8.35	2.16	2652	7
71806	82156	28.06	20.00	8.90	1.44	2426	1
71806	82207	28.05	19.80	8.89	1.42	2424	2
71806	82216	28.03	18.80	8.88	1.35	2424	3
71806	82224	28.01	17.30	8.88	1.25	2422	4
71806	82233	27.98	16.60	8.89	1.20	2423	5
71806	82243	27.96	17.00	8.89	1.23	2423	6
71806	82252	27.93	17.10	8.89	1.23	2422	7
92606	91537	20.35		9.23		2594	0.4
92606	91610	20.33		9.23		2593	1
92606	91633	20.31		9.23		2590	2
92606	91649	20.21		9.19		2594	3
92606	91713	19.73		9.02		2590	4
92606	91737	19.27		8.78		2605	5
92606	91754	19.10		8.55		2608	6
92606	91813	19.06		8.47		2610	7
92606	91832	19.09		8.38		2610	7.5
112106	92608	12.79	167.30	9.29	16.26	2362	1
112106	92627	12.45	164.20	9.26	16.08	2362	2
112106	92647	12.35	155.90	9.26	15.31	2368	3
112106	92701	12.32	153.20	9.26	15.05	2367	4
112106	92724	12.31	149.90	9.26	14.73	2368	5
112106	92740	12.29	147.80	9.26	14.53	2368	6
112106	92758	12.27	145.60	9.26	14.32	2368	7
112106	92807	12.28	144.90	9.25	14.25	2364	7

Hydrolab Profile Data at DWP-5

Date MMDDYY	Time HHMMSS	Temp ^0C	DO% Sat	pH Units	DO mg/l	SpCond µS/cm	Depth Feet
81704	102928	26.95	57.00	8.63	4.20	2588	1
81704	103100	25.85	39.90	8.56	3.00	2604	2
81704	103224	25.70	26.60	8.50	2.01	2597	3
81704	103345	25.60	22.20	8.47	1.67	2602	4
81704	103537	25.55	18.40	8.47	1.39	2598	5
81704	103659	25.53	12.00	8.41	0.91	2605	6
81704	103856	25.53	4.60	7.65	0.35	2580	7
91404	81107	23.96	39.30	8.98	3.03	2478	1
91404	81151	24.01	40.10	9.00	3.08	2476	2
91404	81245	24.00	36.40	8.99	2.79	2479	3
91404	81337	24.02	36.10	8.99	2.78	2477	4
91404	81430	24.01	36.60	8.99	2.82	2479	5
91404	81546	24.02	32.70	8.91	2.52	2479	6
92804	93830	21.85	13.90	8.46	1.12	2256	1
92804	93941	21.74	10.20	8.47	0.83	2257	2
92804	94126	21.69	8.80	8.47	0.71	2258	3
92804	94215	21.64	6.70	8.48	0.54	2259	4
92804	94301	21.61	5.30	8.48	0.43	2258	5
92804	94407	21.39	1.30	8.50	0.11	2271	6
92804	95142	21.86	19.50	8.54	1.57	2252	7
101204	90041	19.95	49.90	8.64	4.20	2145	1
101204	90126	19.84	41.90	8.73	3.54	2149	2
101204	90241	19.79	35.20	8.76	2.97	2151	3
101204	90326	19.78	40.90	8.80	3.45	2149	4
101204	90422	19.77	40.90	8.81	3.45	2148	5
101204	90525	19.76	41.10	8.82	3.49	2151	6
101204	90624	19.76	41.30	8.82	3.49	2153	7
102604	91408	15.38	39.00	7.96	3.58	2087	1
102604	91558	15.39	37.70	7.95	3.45	2086	2
102604	91755	15.40	38.10	7.95	3.50	2089	3
102604	91959	15.38	38.50	7.96	3.53	2086	4
102604	92159	15.40	38.50	7.96	3.53	2087	5
102604	92359	15.40	37.30	7.96	3.42	2087	6
110904	84322	12.79	34.00	7.64	3.33	2025	1
110904	84502	12.66	24.90	7.60	2.46	2026	2
110904	84610	12.61	23.10	7.60	2.28	2026	3
110904	84726	12.59	20.90	7.58	2.07	2026	4
110904	84850	12.56	18.70	7.60	1.86	2023	5
110904	85014	12.55	17.90	7.58	1.77	2025	6
110904	85125	12.54	15.80	7.58	1.56	2025	7
120704	92143	6.91	104.90	8.58	11.81	1943	1
120704	92259	6.88	103.50	8.57	11.66	1945	2
120704	92406	6.88	103.80	8.57	11.69	1945	3
120704	92506	6.88	103.40	8.58	11.65	1948	4
120704	92606	6.88	102.90	8.58	11.59	1946	5

Hydrolab Profile Data at DWP-5

Date MMDDYY	Time HHMMSS	Temp °C	DO% Sat	pH Units	DO mg/l	SpCond µS/cm	Depth Feet
11805	95853	9.93	192.50	9.23	20.34	1845	1
11805	95909	9.87	193.60	9.25	20.47	1841	2
11805	95918	9.58	194.00	9.17	20.63	1845	3
11805	95926	9.50	181.70	9.10	19.38	1846	4
11805	95939	9.44	167.30	9.07	17.88	1848	5
11805	95948	9.38	161.50	9.05	17.28	1849	6
11805	100001	9.35	154.90	9.03	16.59	1850	7
21505	85729	12.92	114.50	9.31	11.18	1822	1
21505	85817	12.75	113.50	9.27	11.14	1820	2
21505	85853	12.55	103.20	9.24	10.15	1823	3
21505	85959	12.51	96.50	9.21	9.51	1826	4
21505	90037	12.48	91.30	9.21	9.01	1823	5
21505	90134	12.41	84.40	9.18	8.34	1825	6
21505	90246	12.34	73.90	9.14	7.31	1827	7
31505	94951	15.68	42.10	8.67	3.89	1863	1
31505	95035	15.19	19.80	8.69	1.85	1857	2
31505	95052	15.07	16.40	8.69	1.54	1861	3
31505	95110	15.01	14.00	8.70	1.32	1860	4
31505	95128	14.98	12.60	8.69	1.19	1861	5
31505	95139	14.92	11.70	8.65	1.10	1855	6
31505	95150	14.90	10.50	8.69	0.99	1861	7
51005	100026	18.48	43.00	7.67	3.69	2453	1
51005	100109	18.16	34.70	7.66	3.00	2450	2
51005	100137	18.13	33.40	7.66	2.89	2451	3
51005	100211	18.09	31.80	7.66	2.75	2451	4
51005	100253	18.04	31.10	7.66	2.69	2449	5
51005	100324	18.02	30.40	7.65	2.64	2450	6
51005	100355	17.99	30.40	7.65	2.64	2452	7
52405	90750	25.69	28.50	7.64	2.13	2502	1
52405	90850	25.68	28.50	7.64	2.13	2500	2
52405	90950	25.61	24.50	7.62	1.83	2502	3
52405	91104	25.30	12.90	7.55	0.97	2493	4
52405	91214	24.99	6.40	7.53	0.48	2488	5
60705	93827	17.25	103.70	7.97	9.11	2461	1
60705	93851	20.55	81.30	7.94	6.68	2545	2
60705	93903	20.51	78.80	7.93	6.49	2548	3
60705	93919	20.50	75.10	7.93	6.19	2547	4
60705	93929	20.49	74.20	7.93	6.11	2548	5
60705	93940	20.48	72.20	7.92	5.94	2546	6
60705	93949	20.45	70.20	7.91	5.79	2546	7
60705	94001	20.42	66.90	7.88	5.51	2543	8
62105	92526	25.99	157.80	8.98	11.75	2439	1
62105	92702	24.97	110.80	8.82	8.40	2439	2
62105	92939	24.57	71.00	8.69	5.42	2444	3
62105	93102	24.34	48.30	8.58	3.71	2434	4
62105	93233	23.97	21.10	8.31	1.63	2438	5

Hydrolab Profile Data at DWP-5

Date MMDDYY	Time HHMMSS	Temp ^0C	DO% Sat	pH Units	DO mg/l	SpCond µS/cm	Depth Feet
62105	93326	23.44	7.60	8.22	0.57	2446	6
62105	93423	22.94	4.10	8.21	0.32	2460	7
62105	93521	22.74	2.30	8.20	0.18	2464	8
70505	101301	26.72	109.00	9.19	8.00	2434	1
70505	101356	26.11	66.40	9.04	4.90	2448	2
70505	101501	25.94	53.30	9.03	3.97	2449	3
70505	101559	25.85	39.50	8.99	2.94	2450	4
70505	101649	25.73	26.40	8.91	1.97	2456	5
70505	101743	25.44	5.00	8.67	0.37	2461	6
71905	85325	28.87	4.00	8.51	0.28	2520	1.2
71905	85424	28.86	2.10	8.50	0.15	2519	1.9
71905	85545	28.82	1.60	8.47	0.11	2519	2.9
71905	85658	28.73	1.10	8.45	0.08	2519	3.9
71905	85806	28.66	0.70	8.41	0.05	2520	4.9
71905	85858	28.32	0.60	8.29	0.04	2522	6.1
71905	85941	26.70	0.40	6.83	0.03	2613	7.3
102505	91011	19.63		8.42		2392	1
102505	91106	19.62		8.41		2392	2
102505	91113	19.60		8.40		2390	2.6
102505	91214	19.61		8.38		2393	3
102505	91312	19.49		8.40		2394	4
102505	91420	19.02		8.13		2432	5
102505	91530	18.63		7.58		2492	6.1
102505	91622	18.58		7.55		2504	7
112205	90456	12.07	124.90	8.84	12.49	2312	1
112205	90521	11.95	123.10	8.82	12.35	2318	2.1
112205	90552	11.91	130.50	8.80	13.10	2314	3.1
112205	90624	11.85	115.20	8.78	11.58	2315	4
112205	90718	11.81	201.80	8.76	20.29	2314	4.9
112205	90736	11.78	150.10	8.75	3.97	2315	6
112205	90758	11.78	106.80	8.67	10.88	2318	6.5
11706	92037	6.59		8.38		2165	1
11706	92103	6.52		8.38		2169	2
11706	92126	6.47		8.38		2166	3
11706	92159	6.45		8.39		2167	4
11706	92219	6.43		8.40		2165	5.1
11706	92236	6.44		8.41		2164	5.7
32806	82758	14.67	89.10	9.36	8.32	2161	1.1
32806	82821	14.59	75.00	9.32	7.02	2161	2
32806	82831	14.55	71.40	9.30	6.69	2163	3
32806	82846	14.51	61.40	9.26	5.75	2165	4
32806	82903	14.40	48.40	9.19	4.55	2166	4.9
32806	82919	14.34	40.40	9.14	3.80	2164	6
32806	82936	14.19	24.70	8.99	2.33	2172	5.2
42506	85040	18.38	37.60	7.47	3.26	2354	0.9

Hydrolab Profile Data at DWP-5

Date MMDDYY	Time HHMMSS	Temp ^{0}C	DO% Sat	pH Units	DO mg/l	SpCond µS/cm	Depth Feet
42506	85100	18.16	21.80	7.46	1.89	2352	2
42506	85124	18.12	14.90	7.46	1.29	2350	2.9
42506	85204	18.05	11.10	7.46	0.97	2350	3.9
42506	85225	17.40	8.20	7.45	0.72	2334	5
42506	85244	17.05	6.30	7.46	0.56	2331	6.1
52306	82637	20.74	66.50	7.88	5.51	2539	1
52306	82651	20.72	64.00	7.89	5.30	2541	2
52306	82717	20.77	63.10	7.90	5.22	2540	3
52306	82754	20.52	55.80	7.83	4.64	2538	4
52306	82821	20.47	48.70	7.79	4.06	2539	5
52306	82845	20.43	44.20	7.78	3.67	2539	6
62006	90630	24.68	47.80	8.57	3.67	2637	1
62006	90740	24.31	9.30	8.36	0.71	2636	2
62006	90817	24.38	10.30	8.38	0.79	2632	3
62006	90855	24.27	3.20	8.33	0.24	2634	4
62006	90918	24.25	2.00	8.32	0.15	2635	5
62006	90946	23.94	1.60	8.12	0.12	2628	6
62006	91011	24.21	1.50	8.32	0.11	2637	7
71806	82612	27.96	49.40	8.95	3.56	2419	1
71806	82622	27.97	47.70	8.94	3.44	2418	2
71806	82634	27.93	39.00	8.93	2.81	2415	3
71806	82646	27.91	32.50	8.91	2.34	2418	4
71806	82700	27.89	31.00	8.92	2.24	2416	5
71806	82711	27.88	30.70	8.92	2.22	2417	6
71806	82725	27.86	31.10	8.92	2.25	2417	7
92606	92341	20.34		9.17		2615	0.4
92606	92355	20.53		9.16		2595	1
92606	92414	20.32		9.17		2599	2
92606	92442	20.06		9.09		2601	3
92606	92506	19.56		8.90		2600	4
92606	92520	19.35		8.69		2604	4.9
92606	92538	19.16		8.49		2601	6
92606	92558	19.15		8.37		2606	6.7
112106	94202	12.68	145.80	9.33	14.20	2364	1
112106	94220	12.58	161.80	9.31	15.80	2362	2
112106	94232	12.52	162.90	9.30	15.93	2362	3
112106	94246	12.43	158.80	9.26	15.56	2361	4
112106	94258	12.33	151.70	9.26	14.90	2362	5
112106	94310	12.32	148.10	9.26	14.55	2362	6
112106	94322	12.28	144.30	9.23	14.19	2362	7

Appendix C

Water quality data collected from the Demonstration Wetlands during 2004-2006

Site Name	Sample Date	Calcium	Magnesium	Potassium	Sodium	Sulfate	Chloride	Bicarbonate Alkalinity	Fluoride	Bromide	Hardness as CaCO3	SiO2	TDS
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
DWP-1	12/7/2004	69	26	19	150	390	270		0.73	0.14	279		
	1/18/2005	94	34	25	210	400	260		0.4	0.18	370		
	2/15/2005	86	33	23	220	370	250		0.58	0.23	350		
	3/15/2005	79	33	25	170	380	260		0.45	0.085	330		
	5/10/2005	110	41	27	230	460	320				440		
	5/24/2005	100	36	26	220	460	320				400		
	6/7/2005	110	45	30	270	430	340				450		
	7/5/2005	100	45	30	270	420	340				440		
	10/25/2005	60	23	14	140	440	300				250		
	11/22/2005	100	36	27	210	450	300				400		
	1/17/2006	92	35	33	220	420	270				370		
	3/28/2006	100	40	45	290	450	290				420		
	4/25/2006	130	51	41	320	440	310	290	0.62	<0.50	535	7.9	1300
	5/23/2006	110	51	37	310	470	320	140	0.7	<0.50	485	4.7	1300
	6/20/2006	110	47	45	320	490	320	240	0.72	<0.50	468	2	1400
	7/18/2006	110	41	33	270	370	300	130	0.71	<0.50	443	0.54	1300
	9/26/2006	120	49	37	340	470	370	140	0.62	<0.50	501	0.66	1800
	11/21/2006	110	45	37	300	400	280	190	0.59	<0.50	460	5.1	1200
DWP-2A	12/7/2004	84	32	23	190	410	300		0.69	0.17	341		
	1/18/2005	110	35	26	230	400	280		0.53	0.25	410		
	2/15/2005	86	32	23	210	370	260		0.58	0.24	350		
	3/15/2005	88	32	24	160	380	260		0.58	<.05	350		
	5/10/2005	110	44	30	240	480	330				460		
	5/24/2005	110	39	27	230	500	340				430		
	6/7/2005	120	50	35	290	520	360				490		
	7/5/2005	27	60	40	340	490	390				310		
	10/25/2005	66	27	16	160	500	340				270		
	11/22/2005	120	47	34	260	490	330				500		
	1/17/2006	84	39	37	250	480	320				370		
	3/28/2006	93	44	49	320	500	330				420		
	4/25/2006	120	54	45	340	500	330	260	0.66	<0.50	522	10	1400
	5/23/2006	130	58	42	350	560	350	240	0.73	<0.50	563	5	1400
	6/20/2006	120	56	51	370	570	370	250	0.8	<0.50	530	5.3	1600
	7/18/2006	110	50	43	320	420	320	160	0.82	<0.50	480	0.43	1500
	9/26/2006	120	55	42	380	500	400	140	0.75	<0.50	526	3.1	1900
	11/21/2006	110	48	40	330	490	360	180	0.58	<0.50	472	5.1	1400
DWP-2B	12/7/2004	87	32	24	190	410	300		0.69	0.14	349		
	1/18/2005	99	33	25	220	400	280		0.52	0.21	380		
	2/15/2005	89	32	23	220	380	260		0.58	0.24	350		
	3/15/2005	82	29	22	150	380	260		0.57	<.05	320		
	5/10/2005	110	42	28	230	480	330				440		
	5/24/2005	110	39	27	230	490	340				430		
	6/7/2005	120	51	33	300	520	360				520		
	7/5/2005	120	56	42	370	490	380				540		
	10/25/2005	65	27	18	160	470	360				270		
	11/22/2005	130	47	25	270	490	330				510		
	1/17/2006	85	40	37	260	480	320				380		
	3/28/2006	94	44	49	310	340	210				410		
	4/25/2006	120	55	45	340	490	330	260	0.65	<0.50	526	11	1400
	5/23/2006	130	59	44	350	550	350	240	0.73	<0.50	567	5.1	1500
	6/20/2006	120	56	51	370	570	370	250	0.79	<0.50	530	5.3	1500
	7/18/2006	110	48	42	320	510	390	170	0.82	<0.50	472	0.4	1500
	9/26/2006	120	56	43	380	500	400	170	0.76	<0.50	530	3.1	1900
	11/21/2006	110	50	41	350	490	360	190	0.59	<0.50	480	5.9	1700

Site Name	Sample Date	Calcium	Magnesium	Potassium	Sodium	Sulfate	Chloride	Bicarbonate Alkalinity	Fluoride	Bromide	Hardness as CaCO3	SiO2	TDS
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
DWP-3A	12/7/2004	85	32	24	190	420	300		0.69	0.15	344		
	1/18/2005	94	32	24	210	420	290		0.54	0.21	370		
	2/15/2005	84	31	22	200	380	270		0.58	0.24	340		
	3/15/2005	86	31	24	160	380	260		0.57	<.05	340		
	5/10/2005	110	43	29	240	480	330				450		
	5/24/2005	100	38	26	220	500	350				420		
	6/7/2005	130	53	33	290	520	360				530		
	7/5/2005	120	55	39	320	490	390				520		
	10/25/2005	66	27	17	160	510	350				280		
	11/22/2005	120	43	32	250	490	330				460		
	1/17/2006	85	39	38	260	480	320				370		
	3/28/2006	96	46	50	330	370	230				430		
	4/25/2006	120	52	46	330	500	330	220	0.66	<0.50	514	9.8	1400
	5/23/2006	130	59	43	350	550	350	250	0.7	<0.50	567	5.1	1500
	6/20/2006	130	58	53	380	610	380	250	0.8	<0.50	563	5.4	1700
	7/18/2006	120	51	44	340	520	390	180	0.82	<0.50	510	0.45	1500
	9/26/2006	120	57	43	380	500	410	150	0.74	<0.50	534	4.9	1900
	11/21/2006	110	49	41	330	510	380	170	0.61	<0.50	476	5.7	1300
DWP-3B	12/7/2004	91	34	25	200	420	310		0.7	0.14	367		
	1/18/2005	84	33	25	200	400	290		0.46	0.22	350		
	2/15/2005	83	30	21	200	370	260		0.57	0.24	330		
	3/15/2005	87	32	24	160	380	260		0.57	<.05	350		
	5/10/2005	110	44	29	240	480	330				450		
	5/24/2005	100	39	27	230	500	350				420		
	6/7/2005	120	50	34	290	520	360				510		
	7/5/2005	110	60	39	340	490	380				530		
	10/25/2005	72	29	20	170	510	350				300		
	11/22/2005	94	35	27	210	490	330				380		
	1/17/2006	85	39	37	260	480	320				370		
	3/28/2006	94	45	45	320	390	250				420		
	4/25/2006	120	53	47	340	480	330	270	0.66	<0.50	518	10	1400
	5/23/2006	130	59	43	350	560	350	240	0.7	<0.50	567	5	1500
	6/20/2006	120	55	50	360	570	370	250	0.8	<0.50	526	5.4	1600
	7/18/2006	120	51	47	330	520	400	170	0.83	<0.50	510	0.39	1500
	9/26/2006	120	56	43	380	550	420	200	0.76	<0.50	530	5	2000
	11/21/2006	120	50	42	330	500	370	180	0.59	<0.50	505	5	1300
DWP-4	12/7/2004	89	32	23	190	390	310		3	0.16	354		
	1/18/2005	84	33	25	190	380	290		0.51	0.21	350		
	2/15/2005	82	31	22	190	380	270		0.57	0.24	330		
	3/15/2005	84	32	25	170	370	260		0.57	<.05	340		
	5/10/2005	110	42	28	230	480	330				440		
	5/24/2005	100	36	25	210	500	350				400		
	6/7/2005	120	48	30	270	510	360				490		
	7/5/2005	130	59	42	350	500	390				570		
	10/25/2005	60	25	17	150	510	350				250		
	11/22/2005	120	45	34	260	490	330				490		
	1/17/2006	86	39	37	260	390	330				380		
	3/28/2006	94	45	50	320	400	260				420		
	4/25/2006	140	62	54	430	500	350	270	0.64	<0.50	605	13	1400
	5/23/2006	130	58	42	340	550	350	250	0.69	<0.50	563	5.7	1500
	6/20/2006	130	57	54	380	570	370	250	0.8	<0.50	559	5.5	1600
	7/18/2006	110	50	43	330	520	390	170	0.82	<0.50	480	0.61	1500
	9/26/2006	120	54	42	370	500	420	200	0.88	<0.50	522	4.7	1800
	11/21/2006	120	50	43	330	500	380	180	0.61	<0.50	505	5	1300

Site Name	Sample Date	Calcium	Magnesium	Potassium	Sodium	Sulfate	Chloride	Bicarbonate Alkalinity	Fluoride	Bromide	Hardness as CaCO3	SiO2	TDS
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
DWP-4Dup	12/7/2004	85	31	23	190	390	310		2.9	0.2	340		
	1/18/2005	82	32	25	180	390	280		0.51	0.2	340		
	2/15/2005	80	30	21	200	370	260		0.57	0.24	320		
	3/15/2005	86	32	25	170	370	260		0.57	<.05	350		
	5/10/2005	110	43	29	230	480	330				460		
	5/24/2005	90	36	25	210	510	350				370		
	6/7/2005	130	51	34	290	520	360				530		
	7/5/2005	120	56	39	340	500	390				540		
	10/25/2005	64	26	17	150	510	350				270		
	11/22/2005	120	43	32	250	490	330				470		
	1/17/2006	82	40	38	260	390	330				370		
	3/28/2006	97	46	51	330	410	270				430		
	4/25/2006	120	55	46	340	490	320	280	0.65	<0.50	526	11	1500
	5/23/2006	130	58	43	340	560	350	250	0.69	<0.50	563	5.6	1500
	6/20/2006	130	57	53	380	570	370	250	0.8	<0.50	559	5.4	1600
	7/18/2006	110	50	44	330	520	400	170	0.83	<0.50	480	0.65	1500
	9/26/2006	120	54	42	370	550	420	200	0.7	<0.50	522	4.8	2000
	11/21/2006	120	50	42	330	480	370	200	0.6	<0.50	505	5	1400
DWP-5A	12/7/2004	89	33	25	190	430	310		0.69	0.2	358		
	1/18/2005	70	30	22	170	400	290		0.51	0.39	300		
	2/15/2005	84	31	22	210	380	270		0.57	0.24	340		
	3/15/2005	85	31	25	170	380	260		0.57	<.05	340		
	5/10/2005	110	43	29	240	480	330				460		
	5/24/2005	84	35	24	200	500	350				350		
	6/7/2005	130	52	35	290	520	360				530		
	7/5/2005	130	59	41	350	490	390				560		
	10/25/2005	61	26	17	150	510	350				260		
	11/22/2005	120	46	34	260	490	330				490		
	1/17/2006	84	39	37	250	490	330				370		
	3/28/2006	96	46	51	320	420	280				430		
	4/25/2006	140	59	52	390	520	340	270	0.64	<0.50	592	11	1400
	5/23/2006	130	59	43	350	580	360	240	0.68	<0.50	567	5.1	1500
	6/20/2006	130	58	53	370	560	370	250	0.78	<0.50	563	5.5	1600
	7/18/2006	110	49	46	330	520	390	160	0.82	<0.50	476	0.37	1500
	9/26/2006	120	55	43	380	550	420	150	0.7	<0.50	526	3.5	1900
	11/21/2006	120	49	41	310	500	380	220	0.6	<0.50	501	5.6	1500
DWP-5B	12/7/2004	87	33	24	190	430	310		0.7	0.12	353		
	1/18/2005	82	35	26	190	410	290		0.52	0.21	350		
	2/15/2005	88	32	23	210	370	260		0.57	0.24	350		
	3/15/2005	84	31	24	160	380	260		0.56	<.05	340		
	5/10/2005	110	44	29	240	480	330				460		
	5/24/2005	97	35	24	210	500	350				390		
	6/7/2005	120	50	33	290	520	360				520		
	7/5/2005	130	60	42	360	500	390				570		
	10/25/2005	61	25	16	150	510	350				260		
	11/22/2005	120	44	31	250	490	330				470		
	1/17/2006	82	40	38	260	490	330				370		
	3/28/2006	95	45	50	320	430	280				420		
	4/25/2006	130	53	45	350	490	330	270	0.64	<0.50	543	11	1400
	5/23/2006	130	59	43	350	560	360	240	0.67	<0.50	567	6.5	1500
	6/20/2006	130	58	53	380	570	370	250	0.78	<0.50	563	5.7	1600
	7/18/2006	110	50	44	330	460	350	160	0.82	<0.50	480	0.36	1600
	9/26/2006	120	55	43	380	550	420	190	0.73	<0.50	526	6.1	1900
	11/21/2006	120	50	42	320	500	380	180	0.62	<0.50	505	4.8	1400

Site Name	Sample Date	TP	OP	NO_3	NO_2	NH_4	TKN	BOD_5 mg/L	TSS	Perchlorate
		mg/L P	mg/L P	mg/L N	mg/L N	mg/L N	mg/L N	mg/L	mg/L	µg/L
DWP-1	8/17/2004	1.28	0.473	0.849	0.177			16.35	33	6.6
	9/14/2004	2.16	0.695	2.529	0.519			32.28	52	0.0
	9/28/2004	2.86	1.455	3.997	1.591			68.3	28	4.3
	10/12/2004	3.64	1.915	1.665	2.052			26.67	20	4.4
	10/26/2004	3.41	2.605	0.985	0.659			29.42	30	2.0
	11/9/2004	4.59	2.36	3.274	0.204			68.93	34	2.0
	12/7/2004	3.53	1.67	15.64	0.723	2.1	9.9	110.45	42	2.0
	1/18/2005	2.13	1.03	8.59	0.25	<0.03	6.4	29	30	<4
	2/15/2005	2.4	1.13	5.26	0.11	0.052	11	33	80	<4
	3/15/2005	1.59	<0.05	1.35	0.57	1.5	11	30	72	<4
	5/10/2005	4.14	2.05	0.26	0.3			44	30	<4
	5/24/2005	4.31	3.23	0.1	0.2	22	24	27	22	<4
	6/7/2005	3.16	2.44	6.46	0.93			62	25	6.0
	6/21/2005	1.02	0.18	6.42	0.34	0.067	3.3	16	31	6.0
	7/5/2005	1.35	0.43	3.49	0.49	0.2	3.3	<16	29	<4
	7/19/2005	2.44	0.79	1.67	1	0.33	8.2	61	73	<4
	10/25/2005	3.9	2.68	8.15	1.06	1.62	7.9	38	32	
	11/22/2005	3.23	1.34	8.2	0.42	0.08	9	50	64	
	1/17/2006	3.59	2.36	6.19	0.23	11	17	27	36	
	3/28/2006	3.26	0.17	11.5	0.65	0.15	12	40	83	
	4/25/2006	3.6	1.32	5.69	0.37	5	5	<14.1	39	
	5/23/2006	2.5	0.84	4.08	0.33	0.035	25	34	68	
	6/20/2006	2.59	0.6	1.24	0.29	0.17	13	31	99	
	7/18/2006	1.6	0.46	2.95	0.17	<0.03	3.3	9	38	
	9/26/2006	0.83	0.21	<0.05	<0.05	<0.03	4.6	20	32	
	11/21/2006	1.26	0.55	3.74	0.4	0.22	6.3	29	34	
DWP-2A	8/17/2004	0.99	0.577	0.034	0.031			<11	10.4	7.8
	9/14/2004	1.25	0.72	0.395	0.133			11.96	17.5	5.6
	9/28/2004	2.12	1.395	1.092	0.495			13.22	12	5.9
	10/12/2004	2.64	1.83	1.249	0.678			31.8	26	6.0
	10/26/2004	3.48	2.49	2.33	0.232			>51	26	2.0
	11/9/2004	3.56	2.515	4.577	0.105			23.12	17	2.0
	12/7/2004	2.95	2.11	8.21	0.138	0.18	7.4	47.22	32	2.0
	1/18/2005	2.46	1.54	5.08	0.12	<0.03	5.7	20	38	<4
	2/15/2005	2.17	1.84	2.78	0.1	0.15	7.8	17	48	<4
	3/15/2005	2	1.11	0.52	0.15	1.4	5.4	7	14	<4
	5/10/2005	3.86	3.08	0.39	0.23			<7.5	9	<4
	5/24/2005	3.8	3.28	0.56	0.39	17	17	7	11	<4
	6/7/2005	4.11	3.21	0.93	0.81			>34	22	<4
	6/21/2005	1.82	0.75	3.87	0.49	0.16	5	26	38	<4
	7/5/2005	1.12	0.35	0.18	0.11	0.25	4.5	18	34	<4
	7/19/2005	1.16	0.69	0.05	0.06	0.7	4.2	15	13	<4
	10/25/2005	2.46	1.89	1.32	0.41	1.68	6.2	13	10	
	11/22/2005	2.4	1.18	1.92	0.07	0.15	7	37	48	
	1/17/2006	1.06	0.29	2.33	0.23	2.7	6.1	12	18	
	3/28/2006	1.72	<0.05	3.65	0.55	0.32	9	23	48	
	4/25/2006	1.99	1.5	2	0.33	4.3	8.6	<5.64	12	
	5/23/2006	2.75	2.25	0.42	0.18	1.6	8	13	12	
	6/20/2006	2.06	1.15	0.05	<0.05	0.1	6.6	15	34	
	7/18/2006	1.4	0.61	0.47	0.09	0.31	3.8	9	27	
	9/26/2006	0.96	0.57	<0.05	<0.05	<0.03	3.8	10	22	
	11/21/2006	0.74	0.25	0.32	0.09	0.42	4.5	14	30	
DWP-2B	8/17/2004	0.98	0.593	0.03	0.03			<11	10.2	8.6
	9/14/2004	1.3	0.775	0.333	0.114			11.76	17	11.4
	9/28/2004	2.085	1.41	0.953	0.444			10.72	13	6.4
	10/12/2004	2.7	1.865	1.25	0.678			17.89	42	7.4
	10/26/2004	3.08	2.51	2.337	0.229			>52	24	2.0
	11/9/2004	3.53	2.5	4.572	0.105			>52	21	2.0
	12/7/2004	3.07	2.13	7.96	0.118	0.16	7.2	43.84	30	2.0
	1/18/2005	3.23	1.51	4.9	0.12	0.11	8.1	29	76	<4
	2/15/2005	2.21	1.84	2.71	0.1	0.18	8.2	21	52	<4
	3/15/2005	2.02	1.11	0.52	0.15	1.4	5.9	10	4	<4
	5/10/2005	3.75	3.08	0.41	0.24			<7.5	12	<4
	5/24/2005	3.93	3.42	0.52	0.38	18	19	7	6	<4
	6/7/2005	4.15	3.2	1.04	0.79			>34	23	<4
	6/21/2005	1.96	0.9	3.86	0.52	0.33	5.6	24	37	<4
	7/5/2005	1.19	0.41	0.63	0.12	0.94	5	16	28	<4
	7/19/2005	1.26	0.7	0.1	0.08	1.4	5	13	19	<4
	10/25/2005	2.5	1.89	0.73	0.3	4.85	9.2	15	8	
	11/22/2005	2.46	1.18	1.92	0.07	0.13	8.5	40	70	
	1/17/2006	1.43	0.29	2.32	0.23	2.7	8.2	17	56	
	3/28/2006	1.8	<0.05	3.81	0.55	0.33	9.9	25	49	
	4/25/2006	2	1.5	1.92	0.31	4.7	9.4	<5.64	6	
	5/23/2006	2.8	2.27	0.43	0.18	1.6	7.4	13	10	
	6/20/2006	2.07	1.18	0.05	<0.05	0.09	7	16	36	
	7/18/2006	1.4	0.61	0.46	0.09	0.3	3.7	10	25	
	9/26/2006	1.04	0.66	<0.05	<0.05	<0.03	3.1	10	20	
	11/21/2006	0.74	0.26	0.32	0.1	0.74	5.1	14	34	

Site Name	Sample Date	TP	OP	NO_3	NO_2	NH_4	TKN	BOD_5 mg/L	TSS	Perchlorate
		mg/L P	mg/L P	mg/L N	mg/L N	mg/L N	mg/L N	mg/L	mg/L	µg/L
DWP-3A	8/17/2004	1.01	0.562	0.045	0.032			<11	11.8	7.6
	9/14/2004	1.21	0.74	0.169	0.071			10.28	14.5	7.6
	9/28/2004	2.015	1.385	0.806	0.389			9.04	15	6.2
	10/12/2004	3.73	1.76	1.316	0.63			24.76	132	6.6
	10/26/2004	3.3	2.44	2.52	0.216			>52	29	2.0
	11/9/2004	3.46	2.465	4.438	0.097			>51	16	2.0
	12/7/2004	2.95	2.2	7.58	0.079	0.078	6.7	34.48	30	2.0
	1/18/2005	2.71	1.48	4.88	0.12	<0.03	6.5	22	50	<4
	2/15/2005	2.18	1.81	2.76	0.1	0.13	8.7	18	48	<4
	3/15/2005	2.01	1.15	0.51	0.14	1.4	5	10	8	<4
	5/10/2005	3.74	3.04	0.42	0.24			<7.5	8	<4
	5/24/2005	3.93	3.35	0.66	0.45	17	18	9	4	<4
	6/7/2005	4.15	3.2	0.85	0.81			>34	22	<4
	6/21/2005	1.9	0.66	3.54	0.46	0.09	5.9	31	43	<4
	7/5/2005	1.29	0.38	0.1	0.09	0.14	5.1	21	35	<4
	7/19/2005	1.19	0.77	<0.05	<0.05	0.88	4.6	11	11	<4
	10/25/2005	2.23	1.64	0.89	0.35	1.23	6.3	15	10	
	11/22/2005	2.59	1.02	1.5	0.05	0.06	6.1	32	56	
	1/17/2006	1.03	0.27	2.34	0.23	2.6	5.9	10	18	
	3/28/2006	1.77	<0.05	2.54	0.54	0.31	9.9	22	49	
	4/25/2006	2.02	1.51	1.91	0.33	4.4	8.9	<5.64	11	
	5/23/2006	2.81	2.28	0.37	0.19	1.6	7.4	13	9	
	6/20/2006	1.98	1.05	0.05	<0.05	0.085	7	16	55	
	7/18/2006	1.5	0.73	0.25	0.08	0.36	3.9	12	28	
	9/26/2006	1.01	0.6	<0.05	<0.05	<0.03	5.2	10	23	
	11/21/2006	0.68	0.25	0.19	0.08	0.68	5.5	13	34	
DWP-3B	8/17/2004	0.98	0.582	0.042	0.034			<11	9.6	7.3
	9/14/2004	1.32	0.775	0.242	0.1			10.33	16.5	7.2
	9/28/2004	2.32	1.42	0.788	0.389			6.78	12	4.7
	10/12/2004	2.9	1.78	1.242	0.601			16.15	56	2.5
	10/26/2004	3.28	2.425	2.536	0.218			>52	32	2.0
	11/9/2004	3.4	2.605	4.812	0.102			>41	19	2.0
	12/7/2004	3.05	2.25	7.43	0.075	0.074	6.8	36.67	36	2.0
	1/18/2005	2.55	1.49	4.86	0.12	<0.03	7.4	20	48	<4
	2/15/2005	2.15	1.81	2.73	0.1	0.14	8.2	19	46	<4
	3/15/2005	2	1.15	0.5	0.14	1.4	5.1	12	8	<4
	5/10/2005	3.72	3.04	0.42	0.24			8	17	<4
	5/24/2005	3.97	3.41	0.66	0.45	17	17	9	7	<4
	6/7/2005	4.28	3.13	0.88	0.83			>34	20	5.0
	6/21/2005	1.9	0.87	3.62	0.5	0.31	5.9	26	45	<4
	7/5/2005	1.43	0.66	0.07	<0.05	0.57	5.1	15	28	<4
	7/19/2005	1.29	0.8	<0.05	<0.05	0.97	4.8	9	21	<4
	10/25/2005	2.35	1.77	0.36	0.15	2.29	6.9	13	7	
	11/22/2005	2.44	1.04	1.5	<0.05	0.07	7.6	31	54	
	1/17/2006	1.03	0.27	2.33	0.23	2.7	6	9	16	
	3/28/2006	1.82	<0.05	2.38	0.54	0.32	9.4	23	54	
	4/25/2006	2.08	1.54	1.85	0.31	5.2	8.8	<5.64	9	
	5/23/2006	2.84	2.32	0.37	0.19	1.6	6.9	11	8	
	6/20/2006	2.11	1.08	0.05	<0.05	0.22	7	17	36	
	7/18/2006	1.48	0.75	0.25	0.07	0.35	3.8	10	27	
	9/26/2006	1.2	0.78	<0.05	<0.05	<0.03	3.3	11	23	
	11/21/2006	0.68	0.27	0.21	0.08	0.65	4.5	14	30	
DWP-4	8/17/2004	2.17	1.856	0.041	0			36.8	4.6	6.8
	9/14/2004	1.255	0.825	0.125	0.082			8.88	14	7.8
	9/28/2004	2.02	1.615	0.405	0.305			10.19	14	6.0
	10/12/2004	2.61	1.915	1.494	0.566			12.72	28	6.1
	10/26/2004	3.41	2.46	2.685	0.223			42.6	30	2.0
	11/9/2004	3.38	2.62	4.769	0.119			>40	20	2.0
	12/7/2004	4.8	4	1.89	0.048	14	39	71	14	2.0
	1/18/2005	3.1	2.7	0.63	<0.05	3.9	7.4	16	12	<4
	2/15/2005	2.23	1.91	2.69	0.1	0.37	9.4	21	54	<4
	3/15/2005	2.08	1.19	0.46	0.13	1.6	6.6	16	22	<4
	5/10/2005	3.87	3.02	0.49	0.24			14	18	<4
	5/24/2005	4.18	3.4	0.6	0.36	17	17	9	10	<4
	6/7/2005	4.14	3.1	0.93	0.78			>33	23	6.0
	6/21/2005	2.13	0.87	3.58	0.46	0.38	5.8	25	38	<4
	7/5/2005	1.28	0.62	0.12	0.08	0.59	4.7	17	24	<4
	7/19/2005	1.67	1.5	0.06	<0.05	3.3	5.8	20	12	<4
	10/25/2005	2.41	1.66	0.85	0.39	1.54	6.6	16	13	
	11/22/2005	2.47	1.15	1.52	0.05	0.22	7.5	27	46	
	1/17/2006	2.44	2.01	<0.05	<0.05	11	12	105	16	
	3/28/2006	1.78	<0.05	3.02	0.54	0.33	9.6	20	47	
	4/25/2006	2.14	1.66	1.58	0.28	4.8	11	<5.64	12	
	5/23/2006	2.84	2.38	0.35	0.18	2.6	7.1	9	8	
	6/20/2006	2.01	1.36	<0.05	<0.05	0.46	7.1	16	30	
	7/18/2006	1.48	0.78	0.19	0.08	0.46	4.1	11	24	
	9/26/2006	1.12	0.77	<0.05	<0.05	0.12	3.1	9	18	
	11/21/2006	0.7	0.27	0.17	0.08	0.8	4.6	14	32	

Site Name	Sample Date	TP	OP	NO_3	NO_2	NH_4	TKN	BOD_5 mg/L	TSS	Perchlorate
		mg/L P	mg/L P	mg/L N	mg/L N	mg/L N	mg/L N	mg/L	mg/L	µg/L
DWP-4 DUP	8/17/2004	1.29	0.847	0.02	0			<11	9.4	8.2
	9/14/2004	1.26	0.815	0.125	0.084			9.07	13.5	7.7
	9/28/2004	2.15	1.635	0.412	0.306			7.98	17	5.7
	10/12/2004	2.62	1.88	1.509	0.556			13.19	30	5.9
	10/26/2004	3.33	2.425	2.65	0.219			19.95	28	2.0
	11/9/2004	3.38	2.595	4.643	0.119			24.36	19	2.0
	12/7/2004	4.79	3.96	1.9	0.045	14	37	72.2	18	2.0
	1/18/2005	2.86	2.52	1.18	0.06	2.7	6.2	16	10	<4
	2/15/2005	2.24	1.87	2.66	0.09	0.35	7.9	21	54	<4
	3/15/2005	2.11	1.18	0.46	0.13	1.6	6.6	18	24	<4
	5/10/2005	3.86	2.98	0.5	0.25			16	24	<4
	5/24/2005	4.1	3.39	0.62	0.38	17	18	10	9	<4
	6/7/2005	4.17	3.1	0.9	0.78			>33	20	6.0
	6/21/2005	1.89	0.83	3.6	0.46	0.39	6.4	26	35	<4
	7/5/2005	1.21	0.61	0.12	0.09	0.57	4.5	16	27	<4
	7/19/2005	1.6	1.23	<0.05	<0.05	3.3	4.8	16	8	<4
	10/25/2005	2.41	1.72	0.85	0.39	1.52	6.7	16	13	
	11/22/2005	2.5	1.18	1.52	0.05	0.23	6.3	29	50	
	1/17/2006	2.47	2.04	<0.05	<0.05	11	12	104	10	
	3/28/2006	1.67	<0.05	3.1	0.54	0.33	9.6	21	46	
	4/25/2006	2.05	1.65	1.56	0.29	5.1	9.9	<8.46	12	
	5/23/2006	2.89	2.34	0.36	0.19	2	7.1	11	8	
	6/20/2006	1.98	1.36	0.05	<0.05	0.47	6.6	16	24	
	7/18/2006	1.45	0.77	0.19	0.08	0.47	3.8	10	24	
	9/26/2006	1.11	0.77	<0.05	<0.05	0.15	2.9	9	17	
	11/21/2006	0.65	0.27	0.16	0.08	0.94	5	12	28	
DWP-5A	8/17/2004	1.11	0.611	0.027	0.027			<11	13.8	7.9
	9/14/2004	1.22	0.705	0.233	0.087			11.62	18.5	14.5
	9/28/2004	2.08	1.43	0.795	0.388			8.59	21	7.4
	10/12/2004	3.04	1.825	1.295	0.623			21.45	70	6.0
	10/26/2004	3.33	2.425	2.449	0.218			>51	30	2.0
	11/9/2004	3.34	2.58	4.574	0.111			17.38	20	2.0
	12/7/2004	2.98	2.2	7.51	0.094	0.1	6.9	38.97	30	2.0
	1/18/2005	2.57	1.47	4.83	0.11	0.042	11	20	50	<4
	2/15/2005	1.85	1.81	2.77	0.1	0.11	4.7	14	24	
	3/15/2005	2.01	1.14	0.48	0.15	1.4	5.1	8	6	<4
	5/10/2005	3.7	3.12	0.42	0.24			<7.5	25	<4
	5/24/2005	3.97	3.39	0.66	0.42	17	17	6	6	<4
	6/7/2005	4.25	3.11	0.79	0.79			>34	24	7.0
	6/21/2005	1.82	0.6	3.58	0.47	0.075	6.7	28	42	<4
	7/5/2005	1.31	0.3	<0.05	<0.05	<0.03	5.1	26	43	<4
	7/19/2005	1.28	0.85	<0.05	0.05	1	4.5	12	12	<4
	10/25/2005	2.5	1.64	0.77	0.36	1.31	7.7	22	17	
	11/22/2005	2.72	1.11	1.62	0.07	0.09	7.6	36	62	
	1/17/2006	1.03	0.28	2.3	0.23	2.7	5.6	10	22	
	3/28/2006	1.8	<0.05	2.5	0.54	0.35	9.7	22	48	
	4/25/2006	1.98	1.51	1.92	0.34	4.4	10	6.52	12	
	5/23/2006	2.89	2.35	0.31	0.18	1.6	6.8	11	9	
	6/20/2006	2.13	1.25	<0.05	<0.05	0.11	6	17	41	
	7/18/2006	1.35	0.68	0.28	0.08	0.28	3.4	10	26	
	9/26/2006	1.05	0.68	<0.05	<0.05	<0.03	3	10	18	
	11/21/2006	0.73	0.2	<0.05	<0.05	1.2	11	16	42	
DWP-5B	8/17/2004	1.08	0.631	0.04	0.027			<11	11.6	7.7
	9/14/2004	1.17	0.73	0.184	0.071			11.33	15	11.2
	9/28/2004	1.505	1.43	0.772	0.372			7.5	19	5.9
	10/12/2004	2.9	1.755	1.217	0.567			18.82	56	5.8
	10/26/2004	3.37	2.43	2.439	0.218			>51	27	2.0
	11/9/2004	3.37	2.61	4.67	0.114			33.48	20	2.0
	12/7/2004	3.05	2.17	7.46	0.092	0.11	7.5	39.96	28	2.0
	1/18/2005	2.47	1.44	4.81	0.11	<0.03	7.2	17	36	<4
	2/15/2005	2.3	1.85	2.81	0.11	0.11	7	20	46	
	3/15/2005	2.05	1.15	0.48	0.15	1.4	5.4	7	8	<4
	5/10/2005	3.8	2.98	0.4	0.23			8	14	<4
	5/24/2005	4.01	3.39	0.61	0.38	17	17	7	4	<4
	6/7/2005	4.42	3.15	0.82	0.82			>33	24	8.0
	6/21/2005	1.93	0.85	3.66	0.5	0.28	5.4	23	37	4.0
	7/5/2005	1.46	0.61	0.1	<0.05	0.65	4.8	17	34	<4
	7/19/2005	1.83	0.92	<0.05	0.05	1.5	7.8	19	61	<4
	10/25/2005	2.48	1.82	0.55	0.23	2.84	6.2	17	13	
	11/22/2005	2.49	1.14	1.73	0.07	0.1	8.1	34	62	
	1/17/2006	1.03	0.27	2.29	0.23	2.7	5.7	12	14	
	3/28/2006	2.48	<0.05	2.5	0.58	0.41	9	29	105	
	4/25/2006	2.07	1.54	1.88	0.31	4.6	8.8	<5.64	15	
	5/23/2006	2.85	2.3	0.31	0.18	1.6	6.6	13	13	
	6/20/2006	2.19	1.36	<0.05	<0.05	0.21	5.5	15	43	
	7/18/2006	1.43	0.67	0.28	0.08	0.29	3.2	10	24	
	9/26/2006	1.17	0.91	<0.05	<0.05	0.06	2.9	9	17	
	11/21/2006	0.99	0.2	0.11	0.07	0.87	5.8	15	72	

Site Name	Sample Date	Aluminum (µg/L)	Antimony (µg/L)	Arsenic (µg/L)	Barium (µg/L)	Beryllium (µg/L)	Cadmium (µg/L)	Chromium (µg/L)	Cobalt (µg/L)	Copper (µg/L)	Iron (µg/L)	Lead (µg/L)	Manganese (µg/L)	Mercury (µg/L)	Molybdenum (µg/L)	Nickel (µg/L)	Selenium (µg/L)	Silver (µg/L)	Thallium (µg/L)	Vanadium (µg/L)	Zinc (µg/L)
DWP-1	12/7/2004	43	<1	<2	68	<2	<1	<2	NA	17	79	<2	24	<1	8	10	<5	<20	<2	<2	<100
	1/18/2005	77	<1	3.0	69	<2	<1	<2	NA	11	130	<2	26	<1	9	7	<5	<20	<2	2	<100
	2/15/2005	22	<1	3.0	35	<2	<1	<2	NA	11	<50	<2	16	<1	8	6	<5	<20	<2	2	<100
	3/15/2005	37	<1	2.0	69	<2	<1	<2	NA	9	240	<2	16	<1	6	5	<5	<20	<2	<2	<100
	5/10/2005	34	<1	2.0	100	<2	<1	<2	NA	18	51	<2	23	<1	5	6	<5	<20	<2	<2	<100
	5/24/2005	44	<1	<2	93	<2	<1	<2	NA	19	53	<2	26	<1	5	6	<5	<20	<2	<2	<100
	6/7/2005	23	<1	3.1	110	<2	<1	2.3	NA	19	85	<2	15	<1	11	6.8	<5	<20	<2	<2	<100
	7/5/2005	20	<1	3.6	82	<2	<1	<2	NA	16	<50	<2	8.4	<1	16	9.1	<5	<20	<2	2.2	<100
	10/25/2005	20	<1	<2	42	<2	<1	<2	NA	9.3	79	<2	11	<1	3.2	<5	<5	<20	<2	<2	<100
	11/22/2005	19	<1	2.5	75	<2	<1	<2	NA	17	54	<2	20	<1	11	5.8	<5	<20	<2	<2	<100
	1/17/2006	41	<1	2.8	65	<2	<1	<2	NA	14	<50	<2	16	<1	10	<5	<5	<20	<2	<2	<100
	3/28/2006	27	<1	2.9	79	<2	<1	<2	NA	12	<50	<2	13	<1	9.9	<5	<5	<20	<2	2.6	<100
	4/25/2006	130	0.9	2.8	170	<0.1	<0.1	0.6	0.7	12	150	0.75	41	<0.10	12	8.1	2.9	0.46	<0.20	<0.50	64
	5/23/2006	77	1.0	4.5	85	<0.1	<0.1	0.4	0.6	10	73	0.37	26	<0.10	17	7.9	2.4	<0.20	<0.20	3.1	45
	6/20/2006	70	1.0	3.7	69	<0.1	<0.1	0.4	0.7	9.1	79	0.37	23	<0.10	17	8.4	2.8	<0.20	<0.20	1	39
	7/18/2006	41	0.8	3.0	95	<0.1	<0.1	0.3	0.4	3.9	32	0.22	9.9	<0.10	11	5.7	2.3	<0.20	<0.20	0.72	40
	9/26/2006	73	<0.50	2.6	73	<0.1	<0.1	0.2	0.5	3.8	34	<0.20	14	<0.10	16	6.4	1.1	<0.20	<0.20	0.88	18
	11/21/2006	49	0.7	2.1	74	<0.1	<0.1	0.3	0.5	6.5	74	0.37	18	<0.10	12	7.6	1.9	0.25	<0.20	1.5	38
DWP-2A	12/7/2004	34	<1	<2	66	<2	<1	<2	NA	21	110	<2	46	<1	9	6	<5	<20	<2	<2	<100
	1/18/2005	38	<1	2.0	61	<2	<1	<2	NA	7	70	<2	42	<1	9	7	<5	<20	<2	3	<100
	2/15/2005	16	<1	3.0	43	<2	<1	<2	NA	11	350	<2	25	<1	9	6	<5	<20	<2	3	<100
	3/15/2005	28	<1	3.0	52	<2	<1	<2	NA	7	<50	<2	45	<1	8	6	<5	<20	<2	<2	<100
	5/10/2005	110	<1	2.0	100	<2	<1	<2	NA	14	200	<2	59	<1	6	6	<5	<20	<2	<2	<100
	5/24/2005	58	<1	<2	100	<2	<1	<2	NA	14	120	<2	45	<1	6	6	<5	<20	<2	<2	<100
	6/7/2005	15	<1	2.5	110	<2	<1	<2	NA	16	68	<2	56	<1	7.4	7.4	<5	<20	<2	<2	<100
	7/5/2005	36	<1	3.7	86	<2	<1	<2	NA	18	<50	<2	36	2	17	11	<5	<20	<2	2.5	<100
	10/25/2005	13	<1	<2	43	<2	<1	<2	NA	<5	68	<2	20	<1	3	<5	<5	<20	<2	<2	<100
	11/22/2005	25	<1	<2	92	<2	<1	<2	NA	13	60	<2	52	<1	7.9	6	<5	<20	<2	<2	<100
	1/17/2006	31	<1	2.2	63	<2	<1	<2	NA	7.7	<50	<2	25	<1	12	<5	<5	<20	<2	2.4	<100
	3/28/2006	18	<1	2.4	68	<2	<1	<2	NA	8.6	<50	<2	34	<1	11	<5	<5	<20	<2	3.1	<100
	4/25/2006	68	1.0	3.3	100	<0.1	<0.1	0.4	0.9	4.2	110	0.68	73	0.22	12	8.2	2.6	<0.20	<0.20	<0.50	38
	5/23/2006	61	0.8	3.4	110	<0.1	<0.1	0.3	0.9	3.2	140	0.53	80	0.35	13	9.1	1.6	<0.20	<0.20	1.9	27
	6/20/2006	35	0.9	3.6	84	<0.1	<0.1	0.3	0.8	3.5	71	0.28	78	1.1	16	9.2	1.8	<0.20	<0.20	<0.50	18
	7/18/2006	24	0.8	3.5	82	<0.1	<0.1	<0.20	0.6	2.1	21	<0.20	45	0.66	13	7.3	1.9	<0.20	<0.20	0.63	22
	9/26/2006	21	<0.50	2.6	110	<0.1	<0.1	0.2	0.5	4.8	22	<0.20	39	<0.10	14	5.2	0.86	<0.20	<0.20	<0.50	9.8
	11/21/2006	36	0.5	1.9	91	<0.1	<0.1	0.3	0.5	3	59	0.24	31	<0.10	13	7.9	0.97	<0.20	<0.20	1	16
DWP-2B	12/7/2004	36	<1	<2	66	<2	<1	<2	NA	9	120	<2	47	<1	9	15	<5	<20	<2	<2	<100
	1/18/2005	33	<1	2.0	47	<2	<1	<2	NA	7	80	<2	31	<1	9	6	<5	<20	<2	2	<100
	2/15/2005	15	<1	3.0	42	<2	<1	<2	NA	8	<50	<2	26	<1	9	6	<5	<20	<2	3	<100
	3/15/2005	26	<1	2.0	48	<2	<1	<2	NA	6	<50	<2	44	<1	7	5	<5	<20	<2	<2	<100
	5/10/2005	120	<1	2.0	98	<2	<1	<2	NA	13	190	<2	53	<1	6	6	<5	<20	<2	<2	<100
	5/24/2005	59	<1	<2	96	<2	<1	<2	NA	14	110	<2	50	<1	5	7	<5	<20	<2	<2	<100
	6/7/2005	15	<1	2.6	110	<2	<1	<2	NA	17	65	<2	57	<1	7.6	6.8	<5	<20	<2	<2	<100
	7/5/2005	39	<1	3.6	95	<2	<1	<2	NA	16	<50	<2	51	<1	16	9.6	<5	<20	<2	2.3	<100
	10/25/2005	13	<1	<2	46	<2	<1	<2	NA	<5	64	<2	40	<1	1.4	<5	<5	<20	<2	<2	<100
	11/22/2005	31	<1	<2	91	<2	<1	<2	NA	13	83	<2	55	<1	7.6	5.9	<5	<20	<2	<2	<100
	1/17/2006	27	<1	2.3	66	<2	<1	<2	NA	9.9	<50	<2	27	<1	12	<5	<5	<20	<2	2.5	<100
	3/28/2006	21	<1	2.3	67	<2	<1	<2	NA	9.3	<50	<2	33	<1	12	<5	<5	<20	<2	3	<100
	4/25/2006	80	1.0	2.9	100	<0.1	<0.1	0.4	0.9	4.2	120	0.63	74	0.1	12	10	2.4	<0.20	<0.20	<0.50	36
	5/23/2006	60	0.8	3.5	110	<0.1	<0.1	0.3	0.9	3.4	140	0.56	83	0.25	13	9.1	1.6	<0.20	<0.20	2.3	26
	6/20/2006	39	0.8	3.8	83	<0.1	<0.1	0.3	0.8	3	69	0.28	80	0.53	16	9.3	1.6	<0.20	<0.20	<0.50	18
	7/18/2006	21	0.9	3.9	82	<0.1	<0.1	<0.20	0.6	2.3	<20	<0.20	43	0.57	13	8.1	2.1	<0.20	<0.20	0.54	24
	9/26/2006	23	<0.50	2.8	110	<0.1	<0.1	0.2	0.5	1.4	20	<0.20	30	0.72	14	5.2	1.1	<0.20	<0.20	<0.50	11
	11/21/2006	42	0.6	2.2	91	<0.1	<0.1	0.3	0.5	3.2	60	0.33	32	<0.10	13	8.6	1.1	<0.20	<0.20	1.1	19

Site Name	Sample Date	Aluminum (µg/L)	Antimony (µg/L)	Arsenic (µg/L)	Barium (µg/L)	Beryllium (µg/L)	Cadmium (µg/L)	Chromium (µg/L)	Cobalt (µg/L)	Copper (µg/L)	Iron (µg/L)	Lead (µg/L)	Manganese (µg/L)	Mercury (µg/L)	Molybdenum (µg/L)	Nickel (µg/L)	Selenium (µg/L)	Silver (µg/L)	Thallium (µg/L)	Vanadium (µg/L)	Zinc (µg/L)
DWP-3A	12/7/2004	39	<1	<2	63	<2	<1	<2	NA	10	74	<2	46	<1	8	6	<5	<20	<2	<2	<100
	1/18/2005	32	<1	2.0	48	<2	<1	<2	NA	7	70	<2	34	<1	9	6	<5	<20	<2	2	<100
	2/15/2005	15	<1	3.0	40	<2	<1	<2	NA	6	56	<2	23	<1	8	6	<5	<20	<2	3	<100
	3/15/2005	25	<1	2.0	47	<2	<1	<2	NA	5	<50	<2	45	<1	7	5	<5	<20	<2	<2	<100
	5/10/2005	110	<1	2.0	100	<2	<1	<2	NA	13	190	<2	56	<1	6	6	<5	<20	<2	<2	<100
	5/24/2005	58	<1	<2	93	<2	<1	<2	NA	14	130	<2	47	<1	5	7	<5	<20	<2	<2	<100
	6/7/2005	14	<1	2.5	110	<2	<1	<2	NA	17	62	<2	56	<1	7.5	7	<5	<20	<2	<2	<100
	7/5/2005	36	<1	3.5	84	<2	<1	<2	NA	15	<50	<2	37	<1	16	8.4	<5	<20	<2	2.4	<100
	10/25/2005	14	<1	<2	45	<2	<1	<2	NA	<5	53	<2	17	<1	3.2	<5	<5	<20	<2	<2	<100
	11/22/2005	34	<1	<2	92	<2	<1	<2	NA	12	93	<2	54	<1	7.8	6.1	<5	<20	<2	<2	<100
	1/17/2006	30	<1	2.3	63	<2	<1	<2	NA	7.6	<50	<2	26	<1	12	<5	<5	<20	<2	2.5	<100
	3/28/2006	19	<1	2.5	72	<2	<1	<2	NA	9.1	<50	<2	33	<1	12	<5	<5	<20	<2	3.1	<100
	4/25/2006	67	1.0	3.1	96	<0.1	<0.1	0.4	0.9	3.8	100	0.59	68	0.28	12	7.6	2.4	<0.20	<0.20	<0.50	35
	5/23/2006	57	0.8	3.4	110	<0.1	<0.1	0.3	0.9	3	140	0.56	80	0.18	12	9.2	2	<0.20	<0.20	1.7	26
	6/20/2006	42	0.8	4.0	83	<0.1	<0.1	0.3	0.8	3.1	82	0.29	76	0.19	16	9.5	1.6	<0.20	<0.20	1.6	18
	7/18/2006	19	0.9	3.6	83	<0.1	<0.1	<0.20	0.6	2.2	<20	<0.20	51	0.72	14	8.2	1.9	<0.20	<0.20	0.52	21
	9/26/2006	14	<0.50	2.7	120	<0.1	<0.1	0.2	0.5	0.99	20	<0.20	49	<0.10	13	5.4	0.61	<0.20	<0.20	<0.50	8.3
	11/21/2006	40	0.6	2.1	91	<0.1	<0.1	0.3	0.6	2.6	67	0.3	31	<0.10	13	8.8	1.2	<0.20	<0.20	1	20
DWP-3B	12/7/2004	37	<1	<2	66	<2	<1	<2	NA	9	67	<2	49	<1	9	6	<5	<20	<2	<2	<100
	1/18/2005	32	<1	2.0	56	<2	<1	<2	NA	7	60	<2	37	<1	9	7	<5	<20	<2	2	<100
	2/15/2005	16	<1	3.0	40	<2	<1	<2	NA	6	<50	<2	23	<1	8	6	<5	<20	<2	3	<100
	3/15/2005	23	<1	2.0	51	<2	<1	<2	NA	5	<50	<2	46	<1	7	5	<5	<20	<2	<2	<100
	5/10/2005	110	<1	2.0	100	<2	<1	<2	NA	13	180	<2	58	<1	6	6	<5	<20	<2	<2	<100
	5/24/2005	61	<1	2.0	95	<2	<1	<2	NA	13	140	<2	48	<1	5	7	<5	<20	<2	<2	<100
	6/7/2005	15	<1	2.6	110	<2	<1	<2	NA	17	60	<2	63	<1	7.6	7.2	<5	<20	<2	<2	<100
	7/5/2005	38	<1	3.7	96	<2	<1	<2	NA	16	<50	<2	54	<1	17	8.6	<5	<20	<2	2.4	<100
	10/25/2005	19	<1	<2	50	<2	<1	<2	NA	<5	<50	<2	32	<1	2.8	<5	<5	<20	<2	<2	<100
	11/22/2005	32	<1	<2	87	<2	<1	<2	NA	12	76	<2	51	<1	7.4	5.9	<5	<20	<2	<2	<100
	1/17/2006	29	<1	<2	60	<2	<1	<2	NA	7.8	<50	<2	26	<1	13	<5	<5	39	<2	2.4	<100
	3/28/2006	18	<1	2.4	70	<2	<1	<2	NA	8.7	<50	<2	33	<1	12	<5	<5	<20	<2	3	<100
	4/25/2006	86	1.1	3.4	100	<0.1	<0.1	0.5	0.9	3.9	130	0.63	71	0.25	12	8	1.9	0.3	<0.20	<0.50	34
	5/23/2006	57	0.7	3.6	110	<0.1	<0.1	0.3	0.9	3	140	0.54	81	0.3	13	9	1.4	<0.20	<0.20	1.9	27
	6/20/2006	45	0.8	4.1	84	<0.1	<0.1	0.3	0.8	3	70	0.31	78	0.15	16	9.5	1.2	<0.20	<0.20	1.5	18
	7/18/2006	19	0.9	3.9	82	<0.1	<0.1	<0.20	0.6	2.3	<20	0.24	51	0.31	14	8.7	1.7	<0.20	<0.20	0.55	22
	9/26/2006	62	<0.50	2.6	120	<0.1	<0.1	0.3	0.5	1.7	56	<0.20	49	0.26	13	4.6	0.75	<0.20	<0.20	<0.50	15
	11/21/2006	37	0.5	2.0	91	<0.1	<0.1	0.2	0.5	2.5	62	0.23	30	<0.10	13	8	1.1	<0.20	<0.20	0.83	15
DWP-4	12/7/2004	29	<1	<2	77	<2	<1	<2	NA	10	140	<2	99	<1	5	6	<5	<20	<2	<2	<100
	1/18/2005	12	<1	<2	62	<2	<1	<2	NA	6	90	<2	60	<1	5	6	<5	<20	<2	<2	<100
	2/15/2005	16	<1	3.0	42	<2	<1	<2	NA	6	<50	<2	29	<1	9	6	<5	<20	<2	3	<100
	3/15/2005	25	<1	2.0	50	<2	<1	<2	NA	<5	<50	<2	50	<1	7	5	<5	<20	<2	<2	<100
	5/10/2005	120	<1	2.0	100	<2	<1	<2	NA	13	210	<2	57	<1	6	6	<5	<20	<2	<2	<100
	5/24/2005	56	<1	<2	91	<2	<1	<2	NA	13	110	<2	53	<1	5	8	<5	<20	<2	<2	<100
	6/7/2005	13	<1	2.5	100	<2	<1	<2	NA	15	73	<2	58	<1	7.2	6.6	<5	<20	<2	<2	<100
	7/5/2005	25	<1	4.0	94	<2	<1	<2	NA	17	<50	<2	43	<1	18	10	<5	<20	<2	2.6	<100
	10/25/2005	14	<1	<2	44	<2	<1	<2	NA	<5	<50	<2	18	<1	3.1	<5	<5	<20	<2	<2	<100
	11/22/2005	24	<1	<2	91	<2	<1	<2	NA	12	72	<2	54	<1	7.6	6	<5	<20	<2	<2	<100
	1/17/2006	17	<1	<2	67	<2	<1	<2	NA	6.3	140	<2	100	<1	7.5	<5	<5	<20	<2	<2	<100
	3/28/2006	16	<1	2.4	71	<2	<1	<2	NA	8.5	<50	<2	33	<1	12	<5	<5	<20	<2	3	<100
	4/25/2006	73	1.0	3.5	100	<0.1	<0.1	0.4	0.9	3.7	200	0.57	81	<0.10	11	8.1	1.4	<0.20	<0.20	<0.50	32
	5/23/2006	52	0.8	3.5	110	<0.1	<0.1	0.3	0.9	2.7	140	0.51	83	<0.10	13	9.4	1	<0.20	<0.20	2.2	23
	6/20/2006	20	0.8	3.7	81	<0.1	<0.1	0.2	0.8	2.5	48	<0.20	81	<0.10	16	9.6	1.3	<0.20	<0.20	0.65	15
	7/18/2006	22	0.9	3.4	83	<0.1	<0.1	<0.20	0.6	2.2	<20	<0.20	56	<0.10	13	8	1.8	<0.20	<0.20	0.68	20
	9/26/2006	12	<0.50	2.4	110	<0.1	<0.1	<0.20	0.5	0.97	20	<0.20	49	<0.10	12	5.4	0.69	<0.20	<0.20	<0.50	7.5
	11/21/2006	30	0.5	2.1	93	<0.1	<0.1	0.2	0.5	2	54	0.2	30	<0.10	13	8.4	1.2	<0.20	<0.20	1	14

Site Name	Sample Date	Aluminum (µg/L)	Antimony (µg/L)	Arsenic (µg/L)	Barium (µg/L)	Beryllium (µg/L)	Cadmium (µg/L)	Chromium (µg/L)	Cobalt (µg/L)	Copper (µg/L)	Iron (µg/L)	Lead (µg/L)	Manganese (µg/L)	Mercury (µg/L)	Molybdenum (µg/L)	Nickel (µg/L)	Selenium (µg/L)	Silver (µg/L)	Thallium (µg/L)	Vanadium (µg/L)	Zinc (µg/L)
DWP-4Dup	12/7/2004	18	<1	<2	77	<2	<1	<2	NA	9	140	<2	100	<1	5	6	<5	<20	<2	<2	<100
	1/18/2005	11	<1	<2	58	<2	<1	<2	NA	6	60	<2	56	<1	7	7	<5	<20	<2	<2	<100
	2/15/2005	17	<1	3.0	41	<2	<1	<2	NA	5	<50	<2	28	<1	8	6	<5	<20	<2	3	<100
	3/15/2005	26	<1	2.0	50	<2	<1	<2	NA	<5	<50	<2	50	<1	7	5	<5	<20	<2	<2	<100
	5/10/2005	120	<1	2.0	100	<2	<1	<2	NA	13	200	<2	58	<1	6	6	<5	<20	<2	<2	<100
	5/24/2005	61	<1	<2	87	<2	<1	<2	NA	14	110	<2	50	<1	5	6	<5	<20	<2	<2	<100
	6/7/2005	14	<1	2.5	100	<2	<1	<2	NA	16	66	<2	58	<1	7.4	6.7	<5	<20	<2	<2	<100
	7/5/2005	23	<1	3.7	86	<2	<1	<2	NA	16	<50	<2	40	<1	17	8.9	<5	<20	<2	2.3	<100
	10/25/2005	16	<1	<2	47	<2	<1	<2	NA	<5	<50	<2	18	<1	3	<5	<5	<20	<2	<2	<100
	11/22/2005	29	<1	<2	92	<2	<1	<2	NA	13	83	<2	54	<1	7.7	6.2	<5	<20	<2	<2	<100
	1/17/2006	18	<1	<2	66	<2	<1	<2	NA	6.1	<50	<2	97	<1	7.6	<5	<5	<20	<2	<2	<100
	3/28/2006	20	<1	2.5	74	<2	<1	2	NA	9	<50	<2	34	<1	12	<5	<5	<20	<2	3	<100
	4/25/2006	76	0.9	3.5	100	<0.1	<0.1	0.4	0.9	3.8	140	0.61	83	<0.10	12	8.5	1.3	<0.20	<0.20	<0.50	34
	5/23/2006	52	0.8	3.7	110	0.1	<0.1	0.3	0.9	2.9	150	0.59	82	<0.10	13	9.7	0.95	<0.20	<0.20	2	24
	6/20/2006	20	0.8	3.9	81	<0.1	<0.1	0.2	0.8	2.5	56	<0.20	83	<0.10	16	9.6	1.4	<0.20	<0.20	0.66	15
	7/18/2006	19	0.8	3.6	83	<0.1	<0.1	<0.20	0.6	2.1	<20	<0.20	55	<0.10	13	8.1	1.8	<0.20	<0.20	0.63	20
	9/26/2006	13	<0.50	2.3	110	<0.1	<0.1	<0.20	0.5	0.96	21	<0.20	50	<0.10	12	5.3	0.6	<0.20	<0.20	<0.50	7.9
	11/21/2006	31	<0.50	1.9	90	<0.1	<0.1	<0.20	0.5	2	54	0.21	30	<0.10	13	8.1	1.2	<0.20	<0.20	0.81	14
DWP-5A	12/7/2004	39	<1	<2	65	<2	<1	<2	NA	12	<50	<2	48	<1	9	6	<5	<20	<2	<2	<100
	1/18/2005	33	<1	2.0	50	<2	<1	<2	NA	6	70	<2	39	<1	8	6	<5	<20	<2	2	<100
	2/15/2005	20	<1	3.0	41	<2	<1	<2	NA	6	<50	<2	26	<1	8	6	<5	<20	<2	3	<100
	3/15/2005	24	<1	2.0	49	<2	<1	<2	NA	<5	<50	<2	45	<1	7	5	<5	<20	<2	<2	<100
	5/10/2005	110	<1	2.0	100	<2	<1	<2	NA	13	180	<2	56	<1	6	6	<5	<20	<2	<2	<100
	5/24/2005	59	<1	<2	72	<2	<1	<2	NA	13	100	<2	45	<1	5	6	<5	<20	<2	<2	<100
	6/7/2005	14	<1	2.6	110	<2	<1	<2	NA	16	75	<2	59	<1	7.4	6.7	<5	<20	<2	<2	<100
	7/5/2005	35	<1	3.9	88	<2	<1	<2	NA	16	<50	<2	36	<1	17	9.1	<5	<20	<2	2.7	<100
	10/25/2005	15	<1	<2	44	<2	<1	<2	NA	49	<50	<2	18	<1	2.7	<5	<5	<20	<2	<2	<100
	11/22/2005	17	<1	<2	93	<2	<1	<2	NA	12	66	<2	54	<1	7.9	6.3	<5	<20	<2	<2	<100
	1/17/2006	30	<1	<2	60	<2	<1	<2	NA	7.4	<50	<2	27	<1	13	<5	<5	<20	<2	2.4	<100
	3/28/2006	18	<1	2.4	67	<2	<1	<2	NA	9.7	150	<2	34	<1	11	<5	<5	<20	<2	3	<100
	4/25/2006	85	1.0	3.7	100	<0.1	<0.1	0.4	0.9	4	180	0.63	73	0.11	12	8.3	2.8	<0.20	<0.20	<0.50	36
	5/23/2006	53	0.7	3.5	110	<0.1	<0.1	0.4	0.9	2.9	140	0.54	83	0.4	12	9.5	1.7	<0.20	<0.20	1.9	25
	6/20/2006	41	0.8	4.0	83	<0.1	<0.1	0.3	0.8	3.1	69	0.3	84	0.3	16	9.8	1.4	<0.20	<0.20	1.1	19
	7/18/2006	19	0.9	3.6	83	<0.1	<0.1	<0.20	0.7	2.1	<20	<0.20	45	0.24	14	8.5	2	<0.20	<0.20	<0.50	20
	9/26/2006	49	0.6	2.9	120	0.3	1.1	0.4	0.9	8.1	55	0.84	52	<0.10	13	6.4	1.2	<0.20	1.6	0.55	22
	11/21/2006	54	0.6	1.9	92	<0.1	<0.1	0.3	0.5	5	110	0.45	42	<0.10	12	8.4	1.1	<0.20	<0.20	1.1	21
DWP-5B	12/7/2004	36	<1	<2	62	<2	<1	<2	NA	8	63	<2	45	<1	8	5	<5	<20	<2	<2	<100
	1/18/2005	31	<1	2.0	56	<2	<1	<2	NA	7	210	<2	43	<1	9	6	<5	<20	<2	3	<100
	2/15/2005	16	<1	3.0	37	<2	<1	<2	NA	5	90	<2	22	<1	8	6	<5	<20	<2	2	<100
	3/15/2005	28	<1	2.0	50	<2	<1	<2	NA	<5	<50	<2	47	<1	7	5	<5	<20	<2	<2	<100
	5/10/2005	160	<1	2.0	100	<2	<1	<2	NA	14	250	<2	61	<1	6	6	<5	<20	<2	<2	<100
	5/24/2005	59	<1	<2	89	<2	<1	<2	NA	13	110	<2	49	<1	5	7	<5	<20	<2	<2	<100
	6/7/2005	14	<1	2.5	110	<2	<1	<2	NA	16	<50	<2	58	<1	7.3	6.7	<5	<20	<2	<2	<100
	7/5/2005	49	<1	3.9	100	<2	<1	<2	NA	20	69	<2	53	<1	18	9.7	<5	<20	<2	2.5	<100
	10/25/2005	12	<1	<2	43	<2	<1	<2	NA	<5	<50	<2	28	<1	2.7	<5	<5	<20	<2	<2	<100
	11/22/2005	35	<1	<2	91	<2	<1	<2	NA	12	85	<2	53	<1	7.4	6.1	<5	<20	<2	<2	<100
	1/17/2006	22	<1	<2	61	<2	<1	<2	NA	8	<50	<2	32	<1	13	<5	<5	<20	<2	2.8	<100
	3/28/2006	19	<1	2.4	69	<2	<1	<2	NA	9.4	<50	<2	33	<1	12	<5	<5	<20	<2	3	<100
	4/25/2006	110	1.0	3.5	100	<0.1	<0.1	0.5	1.0	4.5	190	0.67	77	0.19	12	8.7	2.2	<0.20	<0.20	<0.50	37
	5/23/2006	240	0.8	3.7	120	<0.1	<0.1	0.5	1.0	4.6	340	0.93	88	0.14	12	9.8	2.1	<0.20	<0.20	2.3	31
	6/20/2006	44	0.8	4.0	85	<0.1	<0.1	0.2	0.8	3.2	79	0.3	87	0.17	16	9.9	1.7	<0.20	<0.20	1.3	18
	7/18/2006	20	0.8	3.6	84	<0.1	<0.1	<0.20	0.6	2.3	<20	<0.20	46	0.3	14	8.5	1.9	<0.20	<0.20	<0.50	21
	9/26/2006	17	<0.50	2.4	120	<0.1	<0.1	0.2	0.5	0.83	24	<0.20	58	<0.10	13	5.3	0.53	<0.20	<0.20	<0.50	7.7
	11/21/2006	29	0.5	1.8	93	<0.1	<0.1	0.2	0.5	3.1	49	<0.20	28	<0.10	13	8.3	1.2	<0.20	<0.20	0.95	17

Sample Date	DWP-1			DWP-2A			DWP-2B		
	Total coliform	Fecal coliform	*E. coli*	Total coliform	Fecal coliform	*E. coli*	Total coliform	Fecal coliform	*E. coli*
	#/100 mL	#/100 mL	#/100 mL	#/100 mL	#/100 mL	#/100 mL	#/100 mL	#/100 mL	#/100 mL
8/17/2004	2300	800	220	50	30	30	240	240	240
9/14/2004	1700	70	29	500	240	170	500	300	130
9/28/2004	16000	5000	2800	1600	500	300	600	300	170
10/12/2004	5000	1600	500	300	130	110	500	300	300
10/26/2004	>=160000	11000	11000	5000	3000	1100	3000	3000	3000
11/9/2004	130000	50000	22000	30000	5000	7000	50000	5000	5000
12/7/2004	3.0 x 10^4	2.4 x10^4	2.4 x 10^4	3000	2400	1300	8000	2200	2200
1/18/2005	240	240	240	300	170	170	900	900	900
2/15/2005	240	240	240	900	900	900	300	240	240
3/15/2005	170	50	50	1.1x10^4	700	500	1.1x10^4	1300	1300
5/10/2005	1700	500	300	800	800	800	500	500	300
5/24/2005	3000	70	70	2300	500	500	2400	900	900
6/7/2005	5000	30	17	2300	2300	1300	2300	1300	1300
6/21/2005	70	13	4	240	240	240	900	900	280
7/5/2005	17	13	8	2400	900	500	1600	500	300
7/19/2005	5000	1700	1700	9000	900	500	2400	1600	500
10/25/2005	NA	NA	NA	NA	NA	NA	NA	NA	NA
11/22/2005	2800	300	170	1300	1300	500	2800	2200	2200
1/17/2006	3000	300	300	800	500	220	500	500	220
3/28/2006	800	230	130	2200	300	300	800	800	800
4/25/2006	1100	500	500	170	50	50	500	500	90
5/23/2006	3000	700	108	1110	170	170	500	300	170
6/20/2006	300	30	30	500	110	17	500	220	170
7/18/2006	110	30	8	1700	700	70	197	197	108
9/26/2006	220	13	13	700	500	230	500	300	130
11/21/2006	110	23	23	800	500	300	800	500	300

Sample Date	DWP-3A			DWP-3B			DWP-4		
	Total coliform	Fecal coliform	*E. coli*	Total coliform	Fecal coliform	*E. coli*	Total coliform	Fecal coliform	*E. coli*
	#/100 mL	#/100 mL	#/100 mL	#/100 mL	#/100 mL	#/100 mL	#/100 mL	#/100 mL	#/100 mL
8/17/2004	90	13	8	140	40	60	50	30	30
9/14/2004	1100	300	300	1700	1100	1100	900	220	220
9/28/2004	900	170	80	110	70	30	300	300	110
10/12/2004	3000	280	80	500	210	210	900	110	60
10/26/2004	5000	500	500	3000	1600	1600	5000	1400	1700
11/9/2004	24000	13000	5000	22000	8000	2800	30000	13000	2500
12/7/2004	2800	2800	2800	8000	5000	3000	5000	5000	2200
1/18/2005	1300	500	300	500	500	500	300	300	170
2/15/2005	900	900	900	900	500	500	500	500	500
3/15/2005	2200	800	800	2800	170	170	3000	700	700
5/10/2005	300	300	300	300	300	300	500	500	500
5/24/2005	500	230	230	500	300	240	1600	1600	500
6/7/2005	800	800	800	1300	800	800	800	500	300
6/21/2005	800	800	800	500	500	500	500	220	170
7/5/2005	600	170	130	300	300	300	500	130	80
7/19/2005	2200	500	240	900	900	900	5000	5000	2200
10/25/2005	NA	NA	NA	NA	NA	NA	NA	NA	NA
11/22/2005	3000	1700	1700	2300	1300	800	8000	8000	2200
1/17/2006	2400	500	220	500	500	170	240	50	22
3/28/2006	2300	800	500	3000	500	300	1100	230	80
4/25/2006	50	23	13	130	13	13	300	80	80
5/23/2006	1300	170	220	800	800	800	350	800	280
6/20/2006	110	70	70	500	230	80	300	80	50
7/18/2006	500	500	350	800	170	70	500	230	230
9/26/2006	300	70	30	140	30	30	110	30	30
11/21/2006	500	130	80	1300	800	800	220	130	130

Sample Date	DWP-4 DUP			DWP-5A			DWP-5B		
	Total coliform	Fecal coliform	*E. coli*	Total coliform	Fecal coliform	*E. coli*	Total coliform	Fecal coliform	*E. coli*
	#/100 mL	#/100 mL	#/100 mL	#/100 mL	#/100 mL	#/100 mL	#/100 mL	#/100 mL	#/100 mL
8/17/2004	300	50	30	500	90	90	900	90	70
9/14/2004	500	170	300	1110	300	170	900	300	500
9/28/2004	1700	1600	220	500	300	240	900	110	70
10/12/2004	500	170	30	3000	220	170	900	240	130
10/26/2004	7000	1600	900	3000	1700	1700	7000	2400	2400
11/9/2004	90000	5000	8000	24000	5000	5000	24000	9000	9000
12/7/2004	8000	800	500	5000	5000	5000	1.1x10^3	800	800
1/18/2005	240	80	130	700	500	300	9000	1400	900
2/15/2005	500	500	500	1600	220	220	1600	1600	350
3/15/2005	5000	700	700	2.8x10^4	220	220	1.3x10^4	300	170
5/10/2005	1300	800	500	2300	1300	1300	1100	500	800
5/24/2005	3000	1300	1700	3000	1300	1300	500	500	300
6/7/2005	2400	1300	1300	1300	800	800	1110	500	500
6/21/2005	800	300	300	800	500	500	500	300	300
7/5/2005	1600	900	170	2400	110	110	1600	1600	300
7/19/2005	3000	1600	1600	3000	2400	2400	400	300	300
10/25/2005	NA	NA	NA	NA	NA	NA	NA	NA	NA
11/22/2005	3000	800	800	3000	3000	1700	1300	1300	1300
1/17/2006	240	22	17	900	170	170	700	300	300
3/28/2006	800	230	230	300	230	230	1300	1300	800
4/25/2006	130	50	50	300	230	230	230	50	50
5/23/2006	800	300	300	300	300	300	1700	170	170
6/20/2006	300	80	80	1300	230	230	500	300	300
7/18/2006	3000	700	140	800	800	170	2300	500	130
9/26/2006	220	70	21	500	230	130	500	300	33
11/21/2006	110	70	50	300	170	110	300	170	170