

Appendix C—Methods

Appendix C: Methods

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Precipitation

Historic and current precipitation data was accessed from: Utah State University Climate Center <http://climate.usurf.usu.edu/products/data.php>.

Hydrology

Staff Gauges

A total of nine staff gauges were installed in October 2009 - see Table 3.1 in the report and As-built sheets L-5.01 through L-5.05 in Appendix A for locations. Water levels were read on a monthly basis from September 2009 through May 2010, and then starting again in November 2010. In addition, observations were made recorded during the monthly readings.

Figure C-I Staff Gauge Monitoring Data Form

Date: _____			
Staff Gauge	Location	Water Depth (in feet)	Comments
SG 1	Entrance Marsh System; Pond 1; north end		
SG 2	Entrance Marsh System; Pond 7 (last pond); west end		
SG 3	Rice Paddy System; North Pond (NE of NE overlook berm); east end		
SG 4	Rice Paddy System; southeast quadrant (SE of willow island); north end of pond		
SG 5	Promontory Pond System; northwest lobe of North Pond; west end		
SG 6	Promontory Pond System; Outlet Pond (easternmost); south central portion by birdcage outlet		
SG 7	Linked Marsh System (NE 65th St), Pond 2 (middle pond) east end		
SG 8	Linked Marsh System (NE 65th St), Pond 3 (last pond) north-central portion, SE of birdcage		
SG 9	Soccer Fields System (Grove Marsh); Pond 1 (westernmost); west side		
Comments:			

Observed Standing Water

Due to the presence of a cemented layer within ten inches of the soil surface (on average) throughout the Phase 2 Mitigation Area, it was determined that piezometers could not be used to measure soil saturation. Instead, monthly observations and estimates of the extent of ponded water in each of the five hydrology systems were made by Parks staff (see Figure C-2 below). Observations were made from November 2009 through May 2010, and then starting again in November 2010.

Criteria for determining the extent of ponding are as follows:

- As long as water is entering from the USGS lab and there is flow out of the outlet structure in Outlet Prom Pond, 100% of potential capacity (maximum ponded area) is assumed for the Promontory Pond System (North, South, and Outlet Promontory Ponds).
- If the outflow from an area (pond, swale, rice paddy, etc.) is regulated by a structure, the pond will be considered to be at 100% of potential capacity when water is flowing over the limiting structure. Examples of limiting structures are: the outlet structure in Linked Marsh System Pond 3; the culverts under the trail at the southeast end of Entrance Marsh 1; weirs that are designed to flow from one pond to the next (e.g. the weirs between Entrance Marsh Ponds 2 through 6, and the Rice Paddies).
- For ponds that lack limiting structures (like Entrance Marsh System Pond 7 where water exits through a leaky berm), the highest level that water reaches will be marked with lath (or some other marker), and that level will be assumed to represent the maximum ponded area - other measurements will be calibrated accordingly.

Figure C-2 Extent of Ponding Data Form

Date: _____		
	Area with standing water: approximate fraction of maximum potential ponded area	Comments
Entrance Marsh System		
Pond 1		
Pond 2		
Pond 3		
Pond 4		
Pond 5		
Pond 6		
Pond 7 (last)		
Rice Paddy System		
North Pond		
Northeast quadrant		
West quadrant		
South quadrant		
Promontory Pond System		
South Pond		
North Pond		
Outlet Pond (last)		
Linked Marsh System (NE 65th St.)		
West swale (first)		
New Navy Pond		
First Pond (west of trail to boat launch parking lot)		
South swale		
Middle Pond (second pond)		
North swale		
Last Pond (last, outlet pond)		
Soccer Field System (Grove Marsh)		
Pond 1 (first, westernmost)		
Pond 2		
Pond 3		
Pond 4 (last, easternmost)		

Water Quality

Collection Procedure: Eight pre-labeled sample bottles were collected at each of the seven sampling sites (see Table C-1 below). Bottles were handled with latex gloves. Grab samples were collected and the bottles were immediately sealed and placed in iced coolers. Water temperature at the sampling site was measured. Sampling takes approximately 20 minutes per site. Coolers were then immediately delivered to lab for analysis.

Lab: Analytical Resources, Inc.

4611 South 134th Place, Suite 100
Tukwila, WA 98168
206-695-6200

Water Quality Sampling Sites: see Figure C-3 (next page), and As-built sheets L-5.01 through L-5.05 in Appendix A.

Table C-1 Water Quality Sampling Sites

Sample Site	Water Quality Sample #	Source or Outlet	Location/Phase 2 Hydrologic System
Prior to Entering Phase 2 Area	WQ-1	S	Stormwater catchment basin near along 62nd Ave NE, near the old Officers' Quarters, outside of Phase 2 Mitigation Area, upstream of the Entrance Marsh System.
OR Entrance Marsh 1	WQ-1A	S	Alternate sample site in 2010-2011 when WQ-1 is dry: at the structure that outlets to the head (north end) of Entrance Marsh 1. Not used during 2009-2010 sampling season.
Children's Hospital Parking Lot Swale	WQ-2	S	At the head (west end) of the swale adjacent to the north side of the Children's Hospital Auxiliary parking lot, before it enters the Promontory Pond System.
NE 65th Street Swale	WQ-3	S	At the head of the NE 65th Street swale, above where it outlets to the New Navy Pond of the Linked Marsh System.
Soccer Fields	WQ-4	S	Near the drainage outlets for synthetic turf Field 6 and the Junior League Parking Lot swale, at the southwest corner of Pond 1 in the Soccer Field System.
	WQ-4A	S	At the drainage outlet from synthetic turf Field 7, on the east side of the field, outside of the Phase 2 Mitigation Area.
Frog Pond	WQ-5	Control	Frog Pond, located outside of the Phase 2 Mitigation Area.
Final Outlet	WQ-6	O	Outlet Promontory Pond, at the final outlet to the existing stormpipe system.

Parameters Assayed: Water temperature was recorded when samples were collected. Samples were analyzed for the following:

- Polycyclic Aromatic Hydrocarbons (PAH) (19 different analytes)
- pH
- Total Suspended Solids
- Nitrate + Nitrites; Total Kjeldahl Nitrogen
- Total Phosphorus
- Dissolved Oxygen
- Fecal Coliform
- Heavy Metals (Arsenic, Copper, Lead, and Zinc)

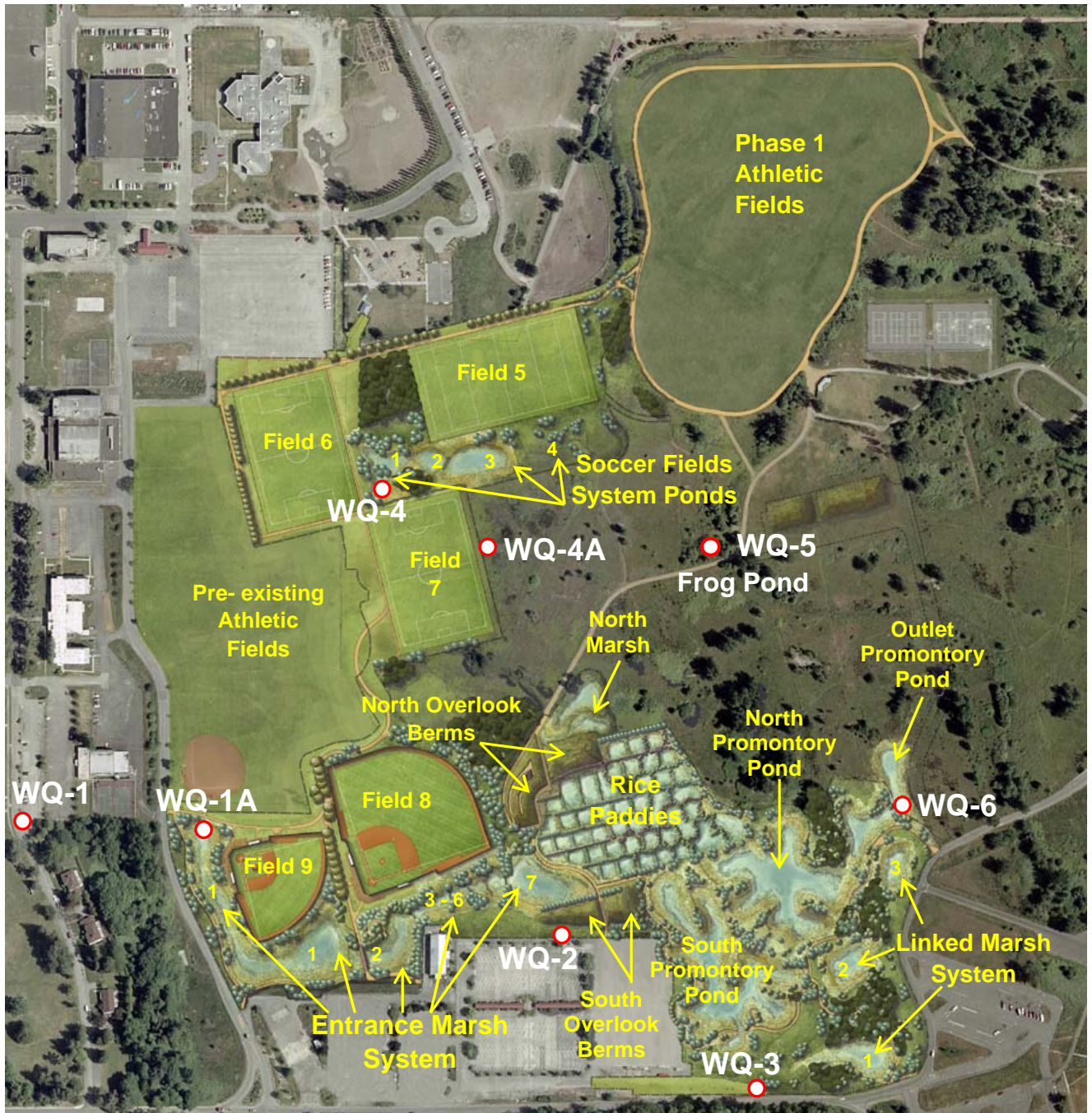


Figure C-3 Water Quality Sampling Locations

Vegetation

Permanent Monitoring Plots

A total of 68 permanent vegetation monitoring plots were established across the Phase 2 Mitigation Area in September and October 2009. The plots included: 3 aquatic bed plots; 30 emergent plots; 24 scrub-shrub plots; and 11 buffer plots (see Tables C-2 through C-6 below). See As-built Sheets L-5.01 through L-5.05 in Appendix A for plot locations. Monitoring plots were sampled by Seattle Parks Staff (Miriam Preus) and Otak staff (Suzanne Anderson and Brigid Stockton) on August 26, 27, and 31, and September 3, 2010.

The locations for the monitoring plots were chosen to be representative of the vegetative communities, as well as the hydrologic systems. In order to analyze whether the Performance Standards are achieved, to the extent possible, the plots were sized and located to include only one vegetative community. The aquatic bed plots are 15-foot diameter circles (177 square feet or 16.4 square meters), and metal fence posts were installed to mark the plot centers. Emergent plots are each one meter square, and 4-foot tall rebars were installed to mark the northeast corners of the plots. A PVC-pipe frame (each side is one meter long) is used for monitoring. The majority of the scrub-shrub and buffer plots are 10-foot by 20-foot rectangles (200 square feet or 18.6 square meters), and all four corners were marked with 2-foot tall rebars or fence posts. Scrub-shrub plots located on narrow berms were modified to fit the communities. Plots SS-8, SS-9, and SS-10 in the Rice Paddies are 5-foot by 20-foot rectangles (100 square feet or 9.3 square meters), and Plot SS-23 in the Soccer Fields System is a 5-foot by 35-foot rectangle (175 square feet or 16.3 square meters).

In each plot, presence and percent cover by installed plants, desirable native volunteers (both woody and herbaceous), and by non-native invasive plants (see Table C-7 below) was measured, and plant health was assessed. In addition, surviving installed trees and shrubs were flagged and counted in the scrub-shrub and buffer plots. The number of surviving plants was compared to the total number of installed woody plants from the Year 0/As-Built Monitoring Report to determine percent survival. See Appendix E for plot data and monitoring results.

Table C-2 Vegetation Monitoring Plots

System	Subsystem	Total Aquatic Bed Plots	Plot #'s	Total Emergent Plots	Plot #'s	Total Scrub-Shrub Plots	Plot #'s	Total Buffer Plots	Plot #'s
Entrance Marshes				6	EM 1-6	6	SS 1-6	2	B 1-2
Rice Paddies	North Marsh			2	EM 7-8	1	SS 7		
	Rice Paddies			6	EM 9-14	3	SS 8-10	1	B 3
Promontory Pond System	North and South Promontory Ponds	3	AB 1-3	4	EM 15-18	6	SS 11-16	4	B 4-7
	Outlet Promontory Pond			1	EM 19	1	SS 17	1	B 8
Linked Marsh System	new Navy Pond			1	EM 20				
	Linked Marshes			5	EM 21-25	3	SS 18-20	2	B 9-10
Soccer Fields Marshes				5	EM 26-30	4	SS 21-24	1	B 11
	Totals	3		30		24		11	

Table C-3 Aquatic Bed Monitoring Plots

System	Plot #	Habitat: Created or Enhanced Wetland	Plot Diameter in Feet	Location
Promontory Pond System	AB-1	Cr	15	North Prom Pond, S lobe, NE side of lobe, S of peninsula between S and E lobes, SE of EM-17
	AB-2	Cr	15	North Prom Pond, S lobe, W side of lobe, N of SS-15, opposite tip of peninsula between S and E lobes
	AB-3	Cr	15	South Prom Pond, S end of central peninsula between N & S Ponds, N (across water) of EM-16

Table C-4 Emergent Monitoring Plots

System	Plot #	Habitat: Created or Enhanced Wetland	Plot Dimensions	Location
Entrance Marshes	EM-1	En	1 meter ²	Entrance Marsh 1, N side of SW corner of pond, S of softball field SW corner
	EM-2	Cr	1 meter ²	Entrance Marsh 1, W side of pond, E of path, opposite softball field dugout
	EM-3	Cr	1 meter ²	Entrance Marsh 2, E side of pond, W of Bldg 308, middle of Bldg
	EM-4	Cr	1 meter ²	Entrance Marsh 3, S side of pond, NE of Bldg 308, E of SS-4
	EM-5	Cr	1 meter ²	Entrance Marsh 4, N side of pond, mid-way between weirs, E of B-2
	EM-6	Cr	1 meter ²	Entrance Marsh 7, W side of pond, just S of weir, N of SS-6, SW of SG-2
Rice Paddies	EM-7	Cr	1 meter ²	North Marsh, N of NE overlook berm, center bottom of pond
	EM-8	En	1 meter ²	North Marsh, N of NE overlook berm, N side of pond, NW of SG-3
	EM-9	En	1 meter ²	Rice Paddies, NE corner pondlet, W central side of pond, E of weir
	EM-10	Cr	1 meter ²	Rice Paddies, pondlet due E of existing willow island, SW side of pondlet
	EM-11	En	1 meter ²	Rice Paddies, pondlet adjacent to SE corner of NE overlook berm, west side of pondlet
	EM-12	Cr	1 meter ²	Rice Paddies, central SE pondlet with SG-4, pond bottom towards W side of pondlet, SW of SG-4
	EM-13	Cr	1 meter ²	Rice Paddies, SW corner pondlet, catty-corner to NW lobe of South Prom Pond, SW corner of pondlet
	EM-14	Cr	1 meter ²	Rice Paddies, furthest SE pondlet, N of NW lobe of North Prom Pond, NE side of pondlet mid-slope

Table C-4 Emergent Monitoring Plots Continued

System	Plot #	Habitat: Created or Enhanced Wetland	Plot Dimensions	Location
Promontory Pond System	EM-15	Cr	1 meter ²	South Prom Pond, NW lobe, north side of pond, E of standing snag
	EM-16	Cr	1 meter ²	South Prom Pond, SW lobe, south side of pond, N of path, E of SS-14
	EM-17	Cr	1 meter ²	North Prom Pond, S lobe, E side of pond near NW tip of peninsula, NW of educational sign
	EM-18	Cr	1 meter ²	North Prom Pond, W side of pond on tip of small peninsula between SW and NW lobes
	EM-19	En	1 meter ²	Prom Pond Outlet Pond, N side of pond, NW of birdcage outlet
Linked Marsh System (NE 65th Street)	EM-20	Cr	1 meter ²	Linked Marsh, W end, New Navy Pond, SW side of pond, just W of outlet
	EM-21	Cr	1 meter ²	Linked Marsh, W end, N side of West Swale, just E of outlet from Navy Pond
	EM-22	En	1 meter ²	Linked Marsh Pond 1, W of SE entry path bridge, N side of pond, towards W end where pond begins to widen out
	EM-23	Cr	1 meter ²	Linked Marsh, South Swale, E of entry path bridge, W side of swale, S half of swale, opposite green stormpipe outlet
	EM-24	Cr	1 meter ²	Linked Marsh Pond 2, E side of pond, just SE of W tip of peninsula, E of SG-7, W of PP-11
	EM-25	Cr	1 meter ²	Linked Marsh Pond 3, middle of S side of pond
Soccer Fields Marshes	EM-26	Cr	1 meter ²	Soccer Field Pond 1, N side of pond, opposite (N of) existing grove, E of SG-9
	EM-27	En	1 meter ²	Soccer Field Pond 2, N side of pond, E of existing grove
	EM-28	En	1 meter ²	Soccer Field Pond 3, towards middle of S side of pond
	EM-29	Cr	1 meter ²	Soccer Field Pond 4, N side of pond, S of drainage outlet from NE soccer field
	EM-30	Cr	1 meter ²	Soccer Fields Marsh Pond 4, SE side of pond, N of small secondary E-W berm by outlet

Table C-5 Scrub-Shrub Monitoring Plots

System	Plot #	Habitat: Created or Enhanced Wetland	Plot Dimensions in Feet	Location
Entrance Marshes	SS-1	En	10 X 12	Entrance Marsh 1, N side of SW corner of pond, SW of softball field SW corner, NW of EM-1
	SS-2	Cr	10 X 20	Entrance Marsh 1, S side of pond near SE corner, N of path
	SS-3	Cr	10 X 20	Entrance Marsh 2, E side of pond, W of Bldg 308, NE of EM-3
	SS-4	Cr	10 X 20	Entrance Marsh 3, S side of pond, N of Bldg 308, SW of EM-4
	SS-5	Cr	10 X 20	Entrance Marsh 6, N side of pond, middle between weirs
	SS-6	Cr	10 X 20	Entrance Marsh 7, W side of pond, S of weir and EM-6, SW of SG-2
Rice Paddies	SS-7	Cr	10 X 20	North Marsh, N of NE overlook berm, E side of pond, E of SG-3
	SS-8	Cr	5 X 20	Rice Paddies, pondlet NE of existing willow island, on E berm (N-S)
	SS-9	Cr	5 X 20	Rice Paddies, pondlet S/SE of existing willow island, on S berm (E-W)
	SS-10	En	5 X 20	Rice Paddies, pondlet W of existing willow island, on S end of W berm (N-S) by standing snag, S of SE corner of NE overlook berm
Promontory Pond System	SS-11	Cr	10 X 20	North Prom Pond, NW lobe, N side of pond, NE of SG 5, S of Rice Paddies
	SS-12	Cr	10 X 20	South Prom Pond, NW lobe, NE side of lobe, E of EM-15
	SS-13	Cr	10 X 20	Orphan Pond S of SW lobe of South Prom Pond, S side of pond, in middle
	SS-14	Cr	10 X 20	South Prom Pond, SW lobe on S side of pond, N of path, SW of EM-16
	SS-15	Cr	10 X 20	North Prom Pond, S lobe, SW side of pond, due W of educational sign
	SS-16	Cr	10 X 20	North Prom Pond, N lobe, NE side of pond, near NE corner of pond
	SS-17	Cr	10 X 20	Prom Pond Outlet Pond, NE lobe, W side of pond, near N end of pond
Linked Marsh System (NE 65th Street)	SS-18	Cr	10 X 20	Linked Marsh, W end, West Swale, N side of swale
	SS-19	Cr	10 X 20	Linked Marsh, N end, North Swale, W side of swale, S of Last Pond
	SS-20	Cr	10 X 20	Linked Marsh Pond 3, W side of pond, towards SW corner of pond
Soccer Fields Marshes	SS-21	En	10 X 20	Soccer Field Pond 3, N side of pond, @ NW corner, E of weir between Ponds 2 & 3
	SS-22	En	10 X 20	Soccer Field Pond 3, N side of pond, near NE corner, close to NE soccer field, S of 2nd light pole from SW corner
	SS-23	En	5 X 35	Soccer Field Pond 3, S side of pond, near SE corner, along top of berm starting @ SE corner extending W
	SS-24	Cr	10 X 20	Soccer Field Pond 4, E side of pond, on E-W mound SE of cottonwood stakes @ NE corner of pond

Table C-6 Buffer Monitoring Plots

System	Plot #	Habitat	Plot Dimensions in Feet	Location
Entrance Marshes	B-1	Upland	10 X 20	Entrance Marsh 1, SW corner of pond, west of path, opposite SW corner of softball field fence
	B-2	Upland	10 X 20	Entrance Marsh 3, N side of pond, N of Bldg 308, S of baseball field 1st base line
Rice Paddies	B-3	Upland	10 X 20	Rice Paddies, N edge of Phase 2 area, due N of existing willow island
Promontory Pond System	B-4	Upland	10 X 20	South Prom Pond, NE corner, N of NE lobe, immediately SE of SS-12, top of slope
	B-5	Upland	10 X 20	South Prom Pond, W side of pond near SW corner, east of path
	B-6	Upland	10 X 20	South Prom Pond, S side of pond near SW corner, SSW of pipe inlet, S side of path
	B-7	Upland	10 X 20	North Prom Pond just N of S lobe, on peninsula N of educational sign
	B-8	Upland	10 X 20	Outlet Pond, N end of N lobe, near NE end of Phase 2 area
Linked Marsh System (NE 65th Street)	B-9	Upland	12 X 23	Linked Marshes Pond 2, E side, E of Staff Gauge 7, on peninsula between swales
	B-10	Upland	10 X 20	Linked Marshes Pond 3, SW side, E of path, N of remaining young cottonwood grove
Soccer Fields Marshes	B-11	Upland	10 X 20	Soccer Field Pond 1, N side, N of cottonwood livestakes, on S side of berm with large planted trees

Non-native Invasive Species

As mentioned above, the presence and percent aerial cover by non-native invasive species was assessed in each plot. Species considered to be non-native invasive included the six species included in the Performance Standards, and 11 additional species that are either included in the King County and/or Washington State Noxious Weed lists, or are known to have particularly aggressive growth habits and a tendency to outcompete native species. See Table C-7 below.

Table C-7 Non-native Invasive Species Assessed in the Phase 2 Mitigation Areas

Non-native Invasive Species Listed in Performance Standards		Additional Non-native Invasive Species	
Scot's broom	<i>Cytisus scoparius</i>	Canada thistle	<i>Cirsium arvense</i>
reed canarygrass	<i>Phalaris arundinacea</i>	bull thistle	<i>Cirsium vulgare</i>
Japanese knotweed	<i>Polygonum cuspidatum, etc.</i>	wild clematis	<i>Clematis vitalba</i>
Lombardy poplar	<i>Populus nigra</i>	poison hemlock	<i>Conium maculata</i>
Himalayan blackberry	<i>Rubus armeniacus</i>	field bindweed	<i>Convolvulus arvensis</i>
evergreen blackberry	<i>Rubus laciniatus</i>	St. John's wort	<i>Hypericum perforatum</i>
		English holly	<i>Ilex aquifolium</i>
		ox-eye daisy	<i>Leucanthemum vulgare</i>
		bird's-foot trefoil	<i>Lotus corniculata</i>
		white sweet-clover	<i>Melilotus albus</i>
		black locust	<i>Robinia pseudoacacia</i>

Photopoints

A total of 18 permanent photopoints were established in 200 (PP-1 through PP-18). Four additional photopoints were established in 2010 (PP-9A, PP-9B, PP-16A, and PP-18A). Due to the large number of vegetation monitoring plots (68), rather than document each plot, photopoint locations were selected to provide panoramic overviews of the different hydrologic systems and vegetation communities to document overall changes during the course of the ten year monitoring period. The majority of the photopoints were located at/near easily identifiable geographic markers; because these locations are frequented by park users, they were not marked with fence posts. Photopoints located in areas where public access is discouraged were marked with fence posts. See As-built sheets L-5.01 through L-5.05 in Appendix A for photopoint locations, and see photos in Appendix D.

Table C-8 Photopoint Locations

System	Photo Point #	Location
Entrance Marshes	PP-1	Entrance Marsh 1, N end of pond
	PP-2	Entrance Marsh 1, E end of pond, from bridge between Entrance Marshes 1 and 2
	PP-3	Entrance Marsh 2, W end of pond, from bridge between Entrance Marshes 1 and 2
	PP-4	Entrance Marsh 7, E end of pond, and SW Rice Paddies from NE corner of the SW overlook berm
Rice Paddies	PP-5	SW Rice Paddies and NW lobe of South Prom Pond, from the NE corner of the SE overlook berm
	PP-6	W Rice Paddies and west end of Entrance Marsh system from the end of the path at the S end of the NW Habitat Overlook berm
	PP-7	North Marsh Pond and W Rice Paddies with the Existing Willow Island, from the E end of the NE Habitat Overlook berm
Promontory Pond System	PP-8	SW lobe of South Prom Pond, the Orphan Pond, and W portion of NE 65th Street swale from a small berm S of SW lobe
	PP-9	E lobe of North Prom Pond and the SW end of Outlet Prom Pond from SE end of weir between the two ponds
	PP-9A	SW end of Outlet Prom Pond from SE end of weir between Outlet Prom Pond and North Prom Pond
	PP-9B	SE end of Outlet Prom Pond from SE corner of pond, N of the NE entrance path
Linked Marsh System (NE 65th Street)	PP-10	N end of Linked Marsh Pond 3 and SE corner of Outlet Prom Pond, from woody debris S of the NE entrance path
	PP-11	E end of Linked Marsh Pond 2 from woody debris at the W end of E peninsula
	PP-12	S end of Linked Marsh South Swale from culvert under SE entrance path
	PP-13	W end of Linked Marsh Pond 1 from culvert under SE entrance path
	PP-14	Linked Marsh New Navy Pond and W end of Linked Marsh West Swale from W end of the swale
Soccer Fields Marshes	PP-15	Buffer on N side of Soccer Field System Pond 1 with remaining cottonwood grove, from small berm S of madrone grove
	PP-16	Soccer Field System Pond 2 from S end of the weir between Soccer Field System Ponds 2 and 3
	PP-16A	W end of Soccer Field Pond 3 from S end of the weir between Soccer Field System Ponds 2 and 3
	PP-17	E end of Soccer Field System Pond 3 from middle of the berm between Soccer Field Pond 3 and Soccer Field Marsh 4.
	PP-18	W end of Soccer Field System Marsh 4 from middle of the berm between Soccer Field Pond 3 and Marsh 4
	PP-18A	E portion of Soccer Field System Marsh 4 from S edge of Marsh 4

Patches of Non-native Invasive Species, Existing Tree Groves, and Informal Trails

Seattle Parks Staff, Miriam Preus, walked the Phase 2 mitigation area and identified and assessed patches of non-native invasive species, existing tree groves, and informal trails. She marked the locations on a site map, and recorded observations of conditions. She also listed maintenance actions that have been taken and that are scheduled to be taken in the coming year. See Appendix E for the map and Tables.

Macroinvertebrates

Year 1 data on benthic invertebrates were collected in June 2010 from 15 locations in the constructed wetlands and ponds in the Phase 2 Mitigation Area. Invertebrate collection involved sweep netting through the water column at each site, and additionally attaching Hester-Dendy (H-D) samplers to rebar posts inserted into the wetland substrate, or using other attachment points such as staff gages.

H-D samplers were all installed at a depth of approximately 1.5 feet below the water surface, in relatively close proximity to aquatic plants occurring at each site. Samplers were left for three weeks before they were collected.

Sweep sampling was conducted according to protocol derived from methodologies specifically created for depression wetland invertebrate sampling (Minnesota Pollution Control Agency. 1992. *Macroinvertebrate community sampling protocol for depression wetland monitoring sites*. Minnesota Pollution Control Agency, Biological Monitoring Program, St. Paul, MN). Two biologists using a heavy-handed D-frame aquatic dip net with a 500 micron mesh size. The two samples are taken in different areas within the same general location of the nearshore emergent vegetation zone and are not intended to be replicates, but rather are done to sample the wetland more widely. Each dip net sample consists of two dipnetting efforts composited into one sample. Each effort consists of sweeping the dip net strongly a few times (3 -5 depending on the density of the vegetation), reaching outward and pulling towards the body in a rapid motion. Each sweep should be through the water column and vegetation downwards to near the bottom.

Identification: Sweep net sampling and H-D sampling results were combined at each location for invertebrate totals. Insects from samples were identified to the taxonomic level of family, while other invertebrates were identified to higher taxonomic levels—generally to class or order. Invertebrates from samples were grouped into ordinal abundance categories of Abundant (50+ individuals in a sample), Numerous (20-49 individuals in a sample), Moderate (10-19 individuals in a sample), and Few (1-9 individuals in a sample). Sample sites are indicated in Table C-9 below.

Table C-9 Macroinvertebrate Monitoring Locations

Site	Location
Site 1	Outlet Pond from Promontory System
Site 2	Linked Marsh Pond #3
Site 3	Linked Marsh Pond #2
Sites 4 & 5	South Promontory Pond
Sites 6 & 7	North Promontory Pond
Site 8	Rice paddy #8
Site 9	Rice paddy #9
Site 10	Rice Paddy #10
Site 11	Rice Paddy #11
Sites 12 & 13	Frog Pond
Site 14	Soccer Pond #1
Site 15	Entrance Marsh #2

Amphibians

All amphibian monitoring was conducted on May 7, 2010 (Year 1).

Sweep Netting: The May sampling consisted of sweep netting within Frog Pond. Two biologists with sweep nets used a fixed effort sampling protocol, sampling within the pond for a total of 30 person-minutes.

Egg Mass Sampling: Egg mass sampling was conducted for the Phase 2 Mitigation constructed wetlands. Egg mass sampling involved visual surveys of vegetation along the shorelines of the constructed wetlands, with four surveyors participating in the process for a total of six hours effort (approximately 24 person-hours of visual surveying). The constructed wetlands were divided into four quadrants: northwest, southwest, northeast, and southeast sectors. Egg masses were qualitatively ranked into one of three categories: Type 1 (round eggs), Type 2 (tadpoles visible within eggs), and Type 3 (tadpoles hatched or very close to hatching).

Amphibian Calling: Sampling for amphibian calling consisted of aural surveys in various portions of the constructed wetlands, for five minute periods associated with each survey event.

Seattle Audubon Society Bird Counts

Bird counts were conducted at Magnuson Park by the Seattle Audubon Society as part of their Neighborhood Bird Project (NBP). The NBP is a monthly census that takes place in the morning of the second Saturday of each month. Observations are made throughout the entire Park, including the Phase 2 Mitigation Areas. There are a total of 27 point count stations at Magnuson Park: four are located in the Phase 2 Mitigation area; and five are located adjacent to or in the immediate vicinity of the Phase 2 Mitigation Areas (see Figure C-4 for survey station locations). See Appendix E for the compilation of bird count data that was collected from September 2009 through mid-November 2010.

NBP protocol is included in the following pages, and can be downloaded from:

<http://www.seattleaudubon.org/sas/WhatWeDo/Science/CitizenScience/NeighborhoodBirdProject.aspx>

NBP provides their census data at Magnuson Park with the following caveat:

The NPB counts at Magnuson do not represent a census, nor do they represent an estimate of population size / density (or anything proportional to population size / density). These data are collected similarly to the CBC and BBS, thus are prone to some of the same statistical problems and cannot be used to estimate a trend or change in population size over time."

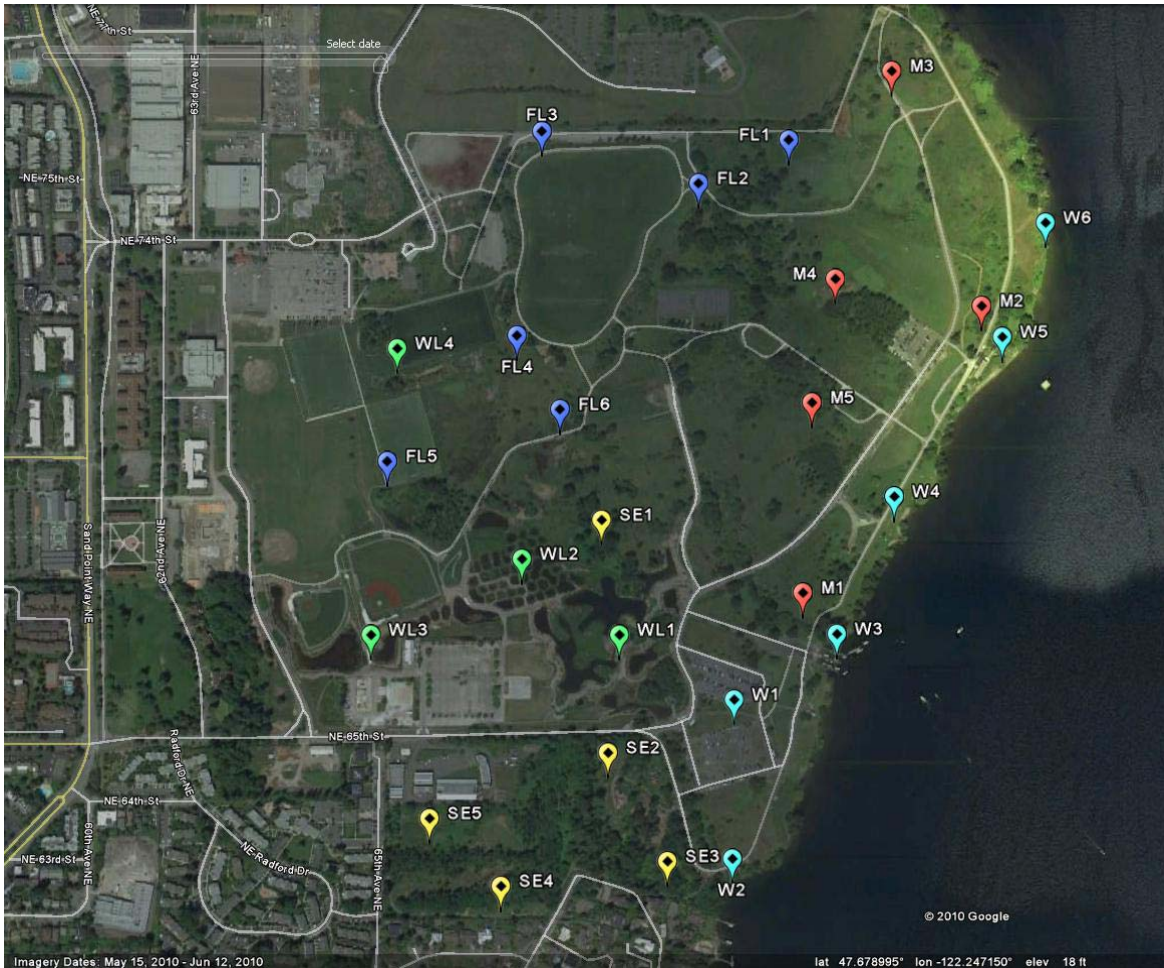


Figure C-4. 2010 Neighborhood Bird Project (NBP) Bird Survey Stations at Magnuson Park (Seattle Audubon Society).

FL=Fence Loop (dark blue), SE= South End (yellow), W= Water (light blue),
M=Main (red), WL= Wetland (green)

Neighborhood Bird Project

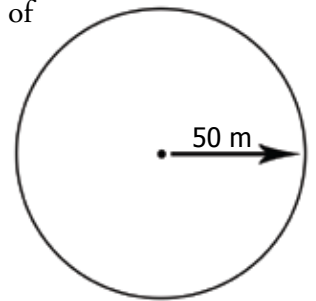


Point Count Protocol

TIMING Each site is required to be visited on the same weekend of each month; e.g. the second Saturday. The count start time remains constant either throughout the entire year, or with minor changes to accommodate shortened days in the winter.

LOCATION The site, a city park or greenspace, is divided into permanent loops, sufficient in number to cover the different habitats in a park, or the park in its entirety. Point count stations are located along the loops; stations are located at least 200 m apart and visited in approximately the same order each month. Each station receives a GPS location and habitat description, if possible.

PROTOCOL Once at the station, the team members stand quietly for one minute. At the end of the minute, the team counts every bird species seen, heard or flying over within a radius of 50 m in the next 5 minute period. Heard birds are defined as birds believed to be vocalizing within the 50 m circle. “Flying over” is distinguished from “seen” by whether or not the bird interacted with the habitat. For example, a robin flying from one tree to another or from the ground to a tree within the count circle is counted as “seen” whereas a merlin flying over the 50 m circle is counted as “flying over.” The recording area is construed as a cylinder above the observers, so that height is not a problem. The observers remain at the station, which is the center of the circle, for the 5 minutes. Ideally, stop watches are used to accurately time 5 minutes; start and stop times are announced to the participants. It is permitted after 4.5 minutes to “pish” in order to call up birds within the circle which may not yet have shown themselves. After the 5 minutes are up, it is permitted to investigate a previously heard bird if necessary to verify its identity. Note: For stops surveying waterfowl occupying a body of water, where it is impossible to stand in the middle of a circle, the same surface area over the body of the water is surveyed, i.e., a rectangle ~40 m wide by ~90 m out into the water, while standing on the shoreline at the midpoint of the 40 meter width.



RECORDING DATA The team leader records on a standardized form: park name, loop name, date, weather conditions, station or stop number, name of team leader and participants present; and for each station: time, and name and number of species seen, heard, or flying over that stop within the 5 minute period. Common bird names are written out in full or abbreviated using the AOU four-letter code.

REPORTING DATA Data sheets are placed in the NBP file at the SAS office as soon after each count as is reasonable. Birds seen between stations or before/after time at stations are not entered as data, but a list of total species can be preserved for each park for the interest of all participants.

CONSIDERATIONS

- If bad weather, e.g. snow, heavy rain or wind, makes the count inadmissible; attempts should be made to redo the count the following day.
- Please attempt to cover the loop in approximately the same amount of time each month.
- Avoid double-counting some of the larger birds, e.g., raptors, by having the team leaders within the park discuss amongst themselves afterwards which large birds were seen and when. It is therefore preferable for all the loops within one park to be accessed simultaneously.
- It is also preferable for park and loop leaders to be as constant as possible, to ensure consistency in data collection.

Dragonflies and Damselflies

Surveys for dragonflies and damselflies in the Phase 2 Mitigation Areas were conducted by Dennis Paulson, author of *Dragonflies and Damselflies of the West* (2009. Princeton University Press, Princeton, New Jersey. 535 pages), from May 8 through October 13, 2010 (and still ongoing). Dr. Paulson conducted surveys for 1-1/2 to 2 hours in the afternoon of days with conditions sufficient to promote substantial odonate activity (relatively sunny, with temperatures at or above 60° F). He sampled most of the Phase 2 wetlands, although he did not check all of the ponds during each visit. He always checked the Rice Paddies (primarily those along the trails); North Marsh; South Promontory Pond; and the Linked Marsh System. He rarely checked the North Promontory Pond and Outlet Promontory Pond, or the Rice Paddies that were most distant from the trail. Once he discovered (in midsummer) that the Entrance system was the best for odonates, he sampled that area fairly thoroughly each visit. He walked fairly rapidly around the majority of the shoreline of the surveyed ponds, and carefully scanned for adult odonates as well as for exuviae. He took photos at intervals, and managed to photograph all of the species there except for one very rare species seen only once. As soon as he returned home, he wrote up notes about what he saw, the relative abundance of species, where they were, and any behavior that he thought was of interest. Based on his 40+ years of experience in observing Washington Odonata, Dr. Paulson concludes that it is very unlikely that he missed any species that use the Phase 2 wetlands on a regular basis.

