Magnuson Park Phase 2 Development

Year 7 (2016) Monitoring Report
USACE Reference NWS-2006-52-NOW

Submitted to:

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Regulatory Branch
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Section 1—Project Overview

(1) **Permits:**

- U.S. Army Corps of Engineers File Number: NWS-2006-52-NOW, December 14, 2007.
- Washington State Department of Ecology Water Quality Certification Order #4208, April 6, 2007.
- City of Seattle Critical Areas Permit.

(2) **Monitoring:** Permit Conditions require ten years of monitoring. Year 7 hydrology monitoring was conducted by Otak, Inc. (Otak) staff members from October 2015 through June 2016. Amphibian, macroinvertebrate, and vegetation monitoring was conducted by Otak staff from March through August 2016. Wildlife surveys were conducted by various groups and individuals throughout 2016.

(3) **Project Purpose and Mitigation:** The purpose of the Magnuson Park Phase 2 Development was to: construct five athletic fields on the western portion of the project area (three soccer fields at the northwest portion, and a baseball field and a little league/softball field in the southwest portion); improve habitat functions by restoring and creating a variety of wetland habitat types and associated upland buffers; remove derelict structures and impervious areas; and create walking trails through a portion of the habitat zone. Development of the athletic fields, trails, and site grading for habitat work resulted in filling approximately six acres of wetlands. The wetland areas that were impacted were generally disturbed wet grasslands with some thickets of native [spirea (*Spiraea douglasii*)] and non-native [Himalayan blackberry (*Rubus armeniacus*) and English hawthorn (*Crataegus monogyna*)] shrubs. Compensation for wetland impacts included: enhancing upland habitats, rehabilitating approximately four acres of existing wetlands, and creating approximately ten acres of new wetlands.

(4) **Location:** The project and mitigation areas are located in the central portion of Magnuson Park, 7400 Sand Point Way NE, Seattle, WA 98115 (see Figures 1 and 2 in Section 4, and Appendix A).

(5) **Completion Date:** The majority of construction and plant installation was completed by February 2009; some additional seeding of wetlands areas was completed in September 2009.

(6) **Performance Standards Achievement:** As of December 2016, the majority of the Year 7 Performance Standards were being met. There has not been 100 percent removal of Himalayan blackberry, evergreen blackberry, or Scot's Broom.

(7) **Maintenance Activities:** On-going maintenance duties include: observing and reporting site conditions; determining maintenance activities that need to be undertaken; irrigating; weeding; replanting; and supervising volunteer work parties. During Year 7, weeding and control of invasive plants was undertaken within the wetland areas; overflow drains were cleared of vegetation and debris; and, pathways were pruned.

(8) **Recommended Actions:** Continue maintenance activities such as weeding, watering, and re-installing plants as necessary. Re-establish plot EM-18 that could not be surveyed in Year 7 due to the beaver den. Modify beaver dams and adjacent trails to restore design wetland mitigation habitat, reduce flooding, and improve probability of installed vegetation survival. Conduct Year 10

monitoring activities as required by the Monitoring Plan in 2019.

Permit Requirements for Monitoring

Permit Conditions require monitoring of the mitigation areas for ten years. *The Monitoring Plan for Wetland Compensatory Mitigation for Magnuson Park Phase 2 Development, Seattle, Washington* (Sheldon & Associates, 2006), contained in Appendix F of the *Final Wetland Compensation Plan for Magnuson Park Phase 2 Development, Seattle, Washington* (Otak, 2007), constitutes the approved monitoring plan for the project (referred to as the Monitoring Plan in this report) (http://www.seattle.gov/PARKS/ProParks/projects/Magnuson2007FinalCompensation.pdf). Performance Standards are specified in both the Monitoring Plan and the Compensation Plan, and are included in Appendix B of this report. Management of all landscape areas at Magnuson Park (including mitigation sites) is directed by the *Sand Point Magnuson Park Vegetation Management Plan* (Sheldon & Associates, Inc., 2001) (http://www.seattle.gov/PARKS/Magnuson/vmp.htm).

Performance Standards

Tables A through H from the Monitoring Plan are included in Appendix B. These Tables include the Performance Standards for the entire 10-year monitoring period, as well as monitoring activities, monitoring schedules, and adaptive management responses. Year 7 Performance Standards address hydrology, vegetation, non-native invasive species, macroinvertebrates, and amphibians. Table 2.1 below includes paraphrased Performance Standards for Year 7, and whether the Performance Standards were achieved in 2016. Table 2.1 is followed by a summarized evaluation of the Performance Standards. Detailed evaluations are included in Section 3, and data is included in Appendix E.

Table 2.1 Achievement of Year 7 Performance Standards

Monitoring Parameter	Year 5 Performance Standards	Achieved
Hydrology	In years of normal precipitation, for 5 consecutive months: • at least 12 inches of standing water for a minimum of 5 consecutive months in wetlands that are inundated by passive backwatering. • at least 16 inches of standing water for a minimum of 5 consecutive months in wetlands designed to be inundated due to grading. • soils will be saturated within 12 inches of the surface in all wetlands.	Yes
Vegetation: Emergent	• No single species will have more than 50 percent cover in the wetland. • By Year 3 (continue to observe in Year 5, 7, and 10), a minimum of 4 emergent species per community, including volunteers. • By Year 3 (continue to observe in Year 5, 7, and 10), there will be 45-60percent emergent aerial cover, including native volunteers.	Yes
Vegetation: Wetland Shrubs/Trees	• By Year 7, aerial cover for shrubs should be at least 70 percent. • By Year 3 (continue to observe in Year 5, 7, and 10), a minimum of 4 shrub species per community, including volunteers.[a] • Plants should be vigorous.	Yes
Vegetation: Buffer Shrubs/Trees	• By Year 7, aerial cover should be at least 70 percent. • By Year 3 (continue to observe in Years 5, 7, and 10), a minimum of 2 shrub and 2 tree species, excluding native volunteers.[b] • Plants should be vigorous.	Yes
Non-native Invasive Species	• Himalayan and evergreen blackberries (*Rubus armeniacus* and *R. laciniatus*): 100 percent removal by Year 3. • Scotch broom (*Cytisus scoparius*): 100 percent removal by Year 3. • Reed canarygrass (*Phalaris arundinacea*): Reduction in vigor and percent cover by Year 5.	No
Macro-invertebrates	Macroinvertebrate populations will fall within an appropriate reference range.	Yes
Amphibians	Amphibian populations in Frog Pond will not be negatively affected by the Phase 2 project.	Yes

a All installed species were evaluated as shrubs for Years 3, 5, and 7 based on stem diameters and heights.

b Planted and volunteer desirable shrub and tree species were not differentiated by shrub/tree type or individually counted during surveys in Year 7.

Summary Evaluation of Year 5 Performance Standards

- Hydrology: The hydrology Performance Standards were achieved for all staff gauge locations (see Section 3 for details, Appendix A for staff gauge locations, Appendix C for methods, and Appendix E for data).

- Water Quality: The water quality sampling requirement was waived for monitoring Years 3, 5, and 7 by the Army Corps of Engineers (see Section 3 and Appendix E for additional information). Water quality monitoring will take place in Year 10.
- Emergent Vegetation: Emergent vegetation is achieving the Year 7 Performance Standard as no single species has more than 50 percent cover in entire wetland. Furthermore, the vegetation continues to meet the Year 7 Performance Standard as there are more than 4 emergent species in the community and there is greater than 45-60percent emergent cover (see Section 3 for details, Appendix A for plot locations, Appendix C for methods, and Appendix E for data).
- Wetland Shrubs/Trees: Scrub-shrub communities are satisfying the Year 7 Performance Standards for aerial cover (>70 percent) and Year 7 diversity standards (see details in Section 3, Appendix A for plot locations, Appendix C for methods, and Appendix E for data).Einstein
- Buffer Shrubs/Trees: Most buffer communities are satisfying the Year 7 Percent Cover Performance Standard (see Section 3 for details, Appendix A for plot locations, Appendix C for methods, and Appendix E for data). As a whole, the buffer community in the mitigation site is achieving the Year 7 Percent Cover Performance Standard with greater than 70 percent aerial cover by native species.
- Non-native Invasive Species: The Mitigation Areas are not achieving the Year 7 Performance Standard as Himalayan and evergreen blackberries are still present in several monitoring plots and were not removed to 100 percent absence (see Section 3 for details, Appendix C for non-native species list, and Appendix E for data).
- Macroinvertebrates: The invertebrate community in the Phase 2 Mitigation Area increased in abundance of individuals and diversity of taxa in 2016 as compared to baseline levels of 2009; the created wetlands appear to show a pattern of typical wetland invertebrate community structure across the Mitigation Area site (see Section 3 for details; and data in Appendix E).
- Amphibians: Pacific chorus frogs have colonized and established breeding populations in the Phase 2 Mitigation Area (see Section 3 for details; and data in Appendix E). Larval population densities are greatest in the shallow ponds of the rice paddy wetlands, soccer ponds, and linked marsh system. Created wetland breeding and rearing habitat is providing numbers of egg masses and larvae during sampling events compared to pre-Phase 2 project conditions. Although population numbers are down in 2016 compared to previous years, this is likely associated with environmental and temporal variability (e.g. warm, dry spring) and population dynamics variability associated with Pacific chorus frog life history.

Monitoring Parameters

This section includes result summaries of the Year 7 monitoring parameters including: hydrology, vegetation, non-native invasive species, macroinvertebrates, and amphibians. In addition, Section 3 includes summaries of bird and wildlife observations, and dragonfly and damselfly information.

Monitoring Methods

Due to the large number of protocols, monitoring methods are included in Appendix C.

Results

Monitoring results are summarized below; data tables, graphs, and other information are located in Appendix E.

Hydrology

Flow Patterns: The Phase 2 Mitigation Area includes five inter-connected hydrologic systems: Entrance Marshes, Rice Paddies, Promontory Ponds, Linked Marshes, and the Soccer Field Ponds/Marshes – see Figure 2 in Section 4 for locations. Generally, water flows from west to east (or from northwest to southeast) through the Phase 2 systems into the pre-existing stormwater system which discharges to Lake Washington. Each hydrologic system has a series of depressions to create areas of seasonal inundation - many of the depressions have weirs that regulate inundation depth. The Entrance Marsh System seasonally receives water from wetland and stormwater systems to the west, as well as from adjacent seasonal surface runoff. Water infiltrates, evaporates, or exits the Entrance Marshes through a leaky berm into the Rice Paddies System. The Rice Paddies System also receives discharge from adjacent ball fields, and seasonal surface flow from the habitat area to the north. Water infiltrates, evaporates, or exits the Rice Paddies System into the Promontory Pond System through leaky berms. Water is continuously pumped into the Promontory Pond System from the adjacent USGS Labs, and there is some groundwater discharge into the system. Due to the water from the USGS Labs, the Promontory Pond System is inundated year-round. Water exits from the easternmost Promontory Outlet Pond into an outlet structure that constitutes the ultimate discharge location for the Phase 2 Mitigation Area into Lake Washington. The Linked Marsh System receives stormwater from the NE 65th Street swale, as well as seasonal surface runoff from adjacent areas, and some groundwater discharge into the deeper ponds. When levels are sufficiently high, water discharges through a structure from the Linked Marsh System into the Promontory Outlet Pond; otherwise, water in the Linked Marsh System either infiltrates, evaporates, or ponds. In the north portion of the Mitigation Area, the Soccer Field System receives discharge from the adjacent soccer fields, as well as seasonal runoff from adjacent areas. Water infiltrates, evaporates, or exits the Soccer Field System through leaky berms and an unrestricted opening at the southeast corner. As mentioned previously, there is seasonal surface flow from the Soccer Field System across the habitat area into the North Marsh/Rice Paddies System to the south.

The outlet points for both the Promontory Pond System and the Linked Marsh System were joined when the Promontory Outlet Pond and the Linked Marsh Outlet Pond were linked during the Magnuson Park Phase 3 project. The combined pond now flows into the Phase 3 System, and also outlets to the existing stormwater system that discharges to Lake Washington. Phase 3 construction began in 2011, and was completed and online in 2012.

Over the past four years beaver have inhabited the park and constructed dams in the Promontory Pond System, which substantially changed the hydrology on site, raising water levels and causing flooding in areas not previously subjected to inundation. Subsequently, alterations to herbaceous and scrub-shrub plant communities were noted in Year 5 and continued into Year 7. Due to concerns about flooding, trail use and maintenance, and plant mortality for wetland and buffer mitigation sites, a beaver deceiver (water control device) was installed in January 2015 as an adaptive management activity. However, water levels have continued to rise in the Promontory Pond System. Regular maintenance activities now include clearing mud and debris from the outlet (i.e., bird cage) in the Outlet Promontory Pond to prevent flooding adjacent trails and maintain wetland flow patterns. The beaver deceiver has provided some control of water levels in the system, but beaver activity has obviated much of its efficacy.

Precipitation: Precipitation is measured and recorded on a daily basis at the Sand Point NOAA Campus, which is adjacent to Magnuson Park. Monthly precipitation values for October 2015 through September 2016 (relative water year) were compared to 25-year averages (water years 1991-2016). See Figures E-1 and E-2 in Appendix E for details. October 2015 through March 2016 was wetter than the 25-year average, and April to September 2016 was slightly dryer than 25-year averages. Overall, precipitation amounts during the water year were close to 25-year averages except for December 2015 and January 2016—both months were wetter than the longer-term averages.

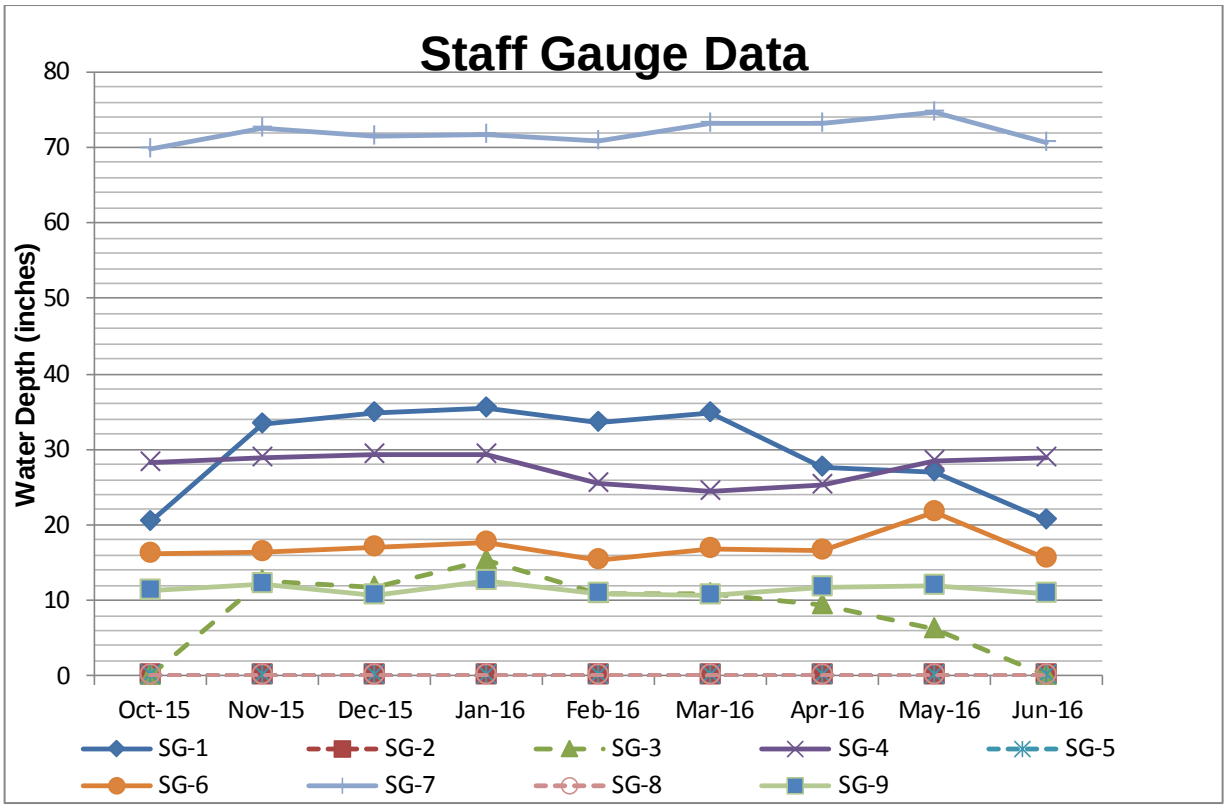
Staff Gauges: Nine staff gauges were located in the Phase 2 Mitigation Area after construction (see Table 3.1 below and As-built sheets in Appendix A for locations). Three of the staff gauges (SG-2, SG-5, and SG-8) were damaged or missing during the Year 7 monitoring year, and no data was recorded. Otak staff read the staff gauges on a monthly basis from October 2015 through June 2016, and results are summarized in Figure 3.1 below. The Promontory Pond System (SG-5 and SG-6) was inundated year-round. The other systems were designed to dry out during the summer, except for the deeper ponds in the Linked Marsh System (SG-7 and SG-8). The general pattern in the Phase 2 areas (with some variation) is for increasing water depths from summer low levels during the fall months, reaching maximum depths in the winter, and then a gradual dry-down over the summer. Due to a wet fall 2015/winter 2016, the water depths in the mitigation area reflect the precipitation patterns and reached maximum depths during the winter. Additionally, because of the beaver presence in the Promontory Pond System, water remained in portions of the system into and throughout the summer months; only a few wetland systems showed water level decreases in June 2016.

Staff gauge results indicate that the majority of the Phase 2 Mitigation Area is satisfying the Performance Standards for impounded water levels. As required, water was at least 16 inches deep for five consecutive months for the Promontory Pond System and deep ponds in the Linked Marsh System (SG-6 and SG-7). As required, water was at least 12 inches deep for five consecutive months for the Entrance Marsh and Rice Paddies Systems (SG-1 and SG-4). Water depths at SG-3 in the North Marsh Pond/Rice Paddy System and at SG-9 in the Soccer Field System (Pond 1) were at or above 12 inches for only two months (November 2015 and January 2016), with water depths measured at between 10 to 12 inches in the Soccer Field System for all of the other months. Water levels in the North Marsh Pond/Rice Paddy System were between 6 and approximately 11 inches from February to May 2016. While these two gauges did not quite satisfy the five month inundation requirement, due to the purpose of the system (passive backwatering), these systems were interpreted to have met the performance requirement and represent appropriate wetland hydrology conditions for the mitigation requirements. It should be noted that SG-9 was installed in a shallow portion of Pond 1, so its results may not be representative of the Soccer Field System–water depths in the Soccer Field System. Soccer Field Ponds 2 and 3 inundation depths were greater than 12 inches during parts of the monitoring year, and these water depths represent overflow from Pond 1.

Table 3.1 Staff Gauge Locations in the Phase 2 Mitigation Area

Hydrologic System	Staff Gauge #	Location
Entrance Marshes	SG-1	Entrance Marsh 1, north end of pond
	SG-2	Entrance Marsh 7, west end of pond
Rice Paddies	SG-3	North Marsh Pond, SE corner of pond
	SG-4	Rice Paddies, central SE pondlet, SE of Existing Willow Island, north end of pondlet
Promontory Pond System	SG-5	North Prom Pond, NW lobe, west side of pond
	SG-6	Outlet Prom Pond , north side of path, NW of birdcage inlet
Linked Marshes (NE 65th Street)	SG-7	Linked Marsh Pond 2, east end
	SG-8	Linked Marsh Pond 3, south of path, SE of birdcage inlet
Soccer Fields Marshes	SG-9	Soccer Field Pond 1, west side

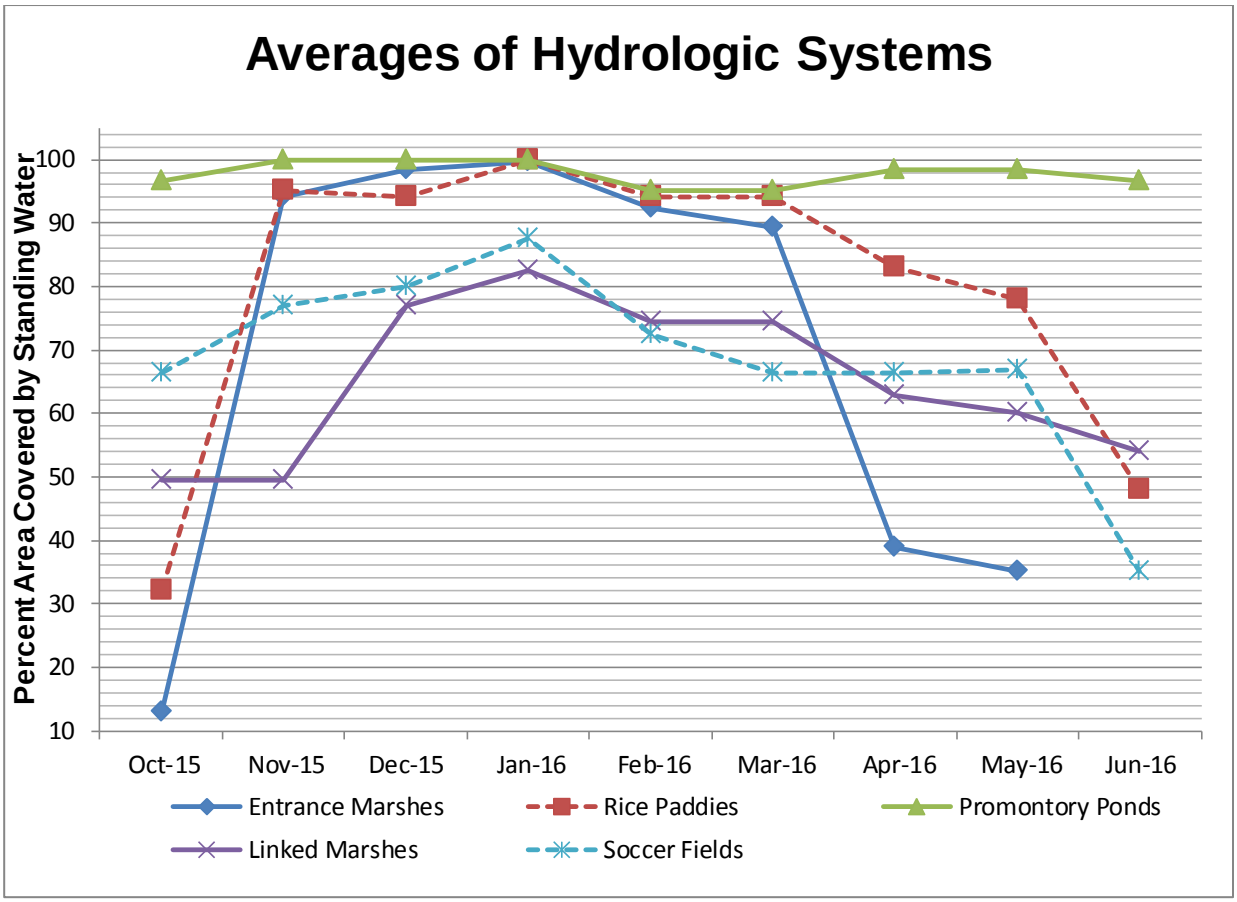
Figure 3.1 Year 7 Staff Gauge Data from the Phase 2 Mitigation Area



Note: No data was recorded for SG-2, SG-5, and SG-8 because staff gauges were damaged or missing.

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 Otak staff from October 2015 through June 2016. Sub-areas within the hydrologic systems (individual ponds, swales, rice paddies, etc.) were assumed to be at 100 percent capacity when water was flowing over the limiting structures (e.g., weirs and outlet structures). See Hydrology Monitoring Methods in Appendix C for additional monitoring criteria. Figure 3.2 below represents the averages of the individual sub-areas in the five hydrologic systems. See Figures E-3 through E-7 in Appendix E for the results of individual sub-areas.

Figure 3.2 Year 7 Average Percent of Hydrologic System Covered by Standing Water



As expected, due to consistent inflow and regulated outflow, the Promontory Pond System was at 100 percent capacity nearly the entire duration of the monitoring period. On average, the Entrance Marsh System reached 100 percent capacity during November 2015 and was at or near 100 percent capacity through March of 2016. The Rice Paddy System showed an increase in capacity from November 2015 to March 2016, where it approached 100 percent. The Soccer Field System and Linked Marsh System never achieved 100 percent capacity during the monitoring events, and was highest at 80-85 percent in January 2016 and then decreased to approximately 65 percent in May 2016. Except for the constant source Promontory Ponds, the general pattern was for water levels in the Systems to increase in fall/winter and decrease in the late spring/early summer. As noted above, hydrology performance standards for the monitored wetlands were met for the 2015-2016 water year.

Water Quality

Permit conditions required water quality monitoring during all years of monitoring. Years 1 and 2 of water quality monitoring resulted in all performance standards being met. In a Technical Memorandum prepared by Otak, dated November 2, 2011, Otak recommended that water quality

monitoring be discontinued due to the high cost of monitoring and the fact that performance standards had been met during the first two years of monitoring. A letter received from the Seattle District Army Corps of Engineers, dated November 15, 2011, concurred that water quality monitoring should be eliminated for the remaining years of monitoring, except for Year 10. Therefore, no water quality monitoring results are included in this Year 7 monitoring report.

Photopoints

Photographs were taken in August 2016 from the 22 photopoints that were previously established across the Phase 2 Mitigation Area. See Appendix D for the photos; and As-built sheets in Appendix A and Table C-8 in Appendix C for photopoint locations.

Vegetation

Initial Plant Installation: Plants were installed in the Phase 2 Mitigation Area from October 2008 through February 2009. Approximately 80 percent of the designated marsh/pond areas were seeded with a native wetland seed mix in November 2008, and seeding was completed in September 2009. Installed plants that died during summer 2009 were replaced/replanted by the contractor in November 2009 (after the monitoring plots were established).

Vegetation 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 include: 3 aquatic bed plots; 30 emergent plots; 24 scrub-shrub plots; and 11 buffer plots. Year 7 vegetation monitoring was conducted on July 27, and August 11, 18, and 19, 2016. During these surveys a total of 4 plots were not surveyed due to beaver activity in the Promontory Pond System, which caused inundation of plots (AB-1, AB-2, AB-3, EM-18). See As-built sheets L-5.01 through L-5.05 in Appendix A for plot locations; Appendix C for Methods; Tables C-2 through C-5 in Appendix C for plot sizes and locations; and Appendix E Tables E-4 through E-8 for plot data.

Vegetation Monitoring Results Summary: The Year 7 vegetation Performance Standards specify that no single emergent species will have more than 50 percent cover, a minimum of four species present, and 45-60 percent aerial cover. For the shrub/tree layer in the wetlands, there will be a minimum of four shrub species and shrubs/trees will provide greater than 70 percent cover. In the wetland buffers, there will be 70 percent cover by shrubs and trees with a minimum of two shrub/tree species. In all cases, plants will be vigorous. Overall, installed plants and desirable native volunteer species should continue to become more established and provide additional vegetative cover in the Phase 2 Mitigation Area. Of the 64 plots that were surveyed, the majority of emergent, scrub-shrub, and buffer communities are doing well. All 3 of the aquatic bed plots were inundated by deeper water in 2014 and 2016 due to beaver activity, and therefore no data was available for comparison. There was an increase in average percent cover in the emergent communities, and a decrease in average percent cover in the scrub-shrub and buffer communities over 2014 values. Due to beaver presence in the Phase 2 Mitigation area, the plant community composition and aerial cover suggest selective herbivory of vegetation for foraging and dam

construction from emergent and scrub-shrub communities (See summary Table 3.3 and discussions of individual vegetation communities below.) Average cover by non-native invasive species was not surveyed in the aquatic bed communities due to inundation. Average cover by non-native invasive species increased from 2014: average cover by non-native invasive species in the emergent community decreased by 2 percent, non-native cover in the scrub-shrub community decreased by 6 percent, and non-native cover in the buffer community increased by 3 percent when compared to Year 5. Average cover in the scrub-shrub and buffer communities by invasive species designated in the performance standards was 11 and 14 percent (respectively), which is 6-7 percent higher than the percent cover in Year 5. Average cover by invasive species in the performance standards species decreased by 1 percent in the emergent communities.

Table 3.3 Year 0 (2009) Through Year 7 (2016) Summary Vegetation Monitoring Data for Phase 2 Mitigation Area

Plot Community	Average % Cover by Desirable Species[a]						Average % Cover by Performance Standard Invasives[b]						Average % Cover by Invasives					
	Year 7 2016	Year 5 2014	Year 3 2012	Year 2 2011	Year 1 2010	Year 0 2009	Year 7 2016	Year 5 2014	Year 3 2012	Year 2 2011	Year 1 2010	Year 0 2009	Year 7 2016	Year 5 2014	Year 3 2012	Year 2 2011	Year 1 2010	Year 0 2009
Aquatic Bed	x	x	47%	78%	78%	15%	x	x	0%	0%	0%	0%	x	x	<5%	0%	0%	0%
Emergent^	68%	66%	73%	67%	62%	49%	1%	2%*	3%	0%	0%	0%	2%[c]	4%[c]	11%[c]	2%	3%	2%
Scrub-Shrub	79%	84%	68%	63%	48%	27%	11%	5%	6%	2%	1%	3%	12%	18%	15%[c]	17%[c]	19%[c]	19%[c]
Buffer	65%	67%	41%	41%	26%	16%	14%	7%	9%	4%	2%	2%	16%	13%	17%[c]	15%[c]	11%[c]	16%[c]

[a] Herbaceous Cover in AB and EM plots; Woody Cover in SS and Buffer Plots; includes cover by installed and desirable native volunteers

[b] Scot's broom, reed canarygrass, Japanese Knotweed, Lombardy poplar, and Himalayan and evergreen blackberries

[c] Predominately birdsfoot trefoil

x Aquatic Bed monitoring plots could not be located or surveyed due to beaver activity and flooding of the plot

^ One EM plot (EM18) could not be located or surveyed in 2016 due to beaver activity and flooding of the plot

* All invasives occurred within two plots

Aquatic Bed Plots: Aquatic bed (AB) communities and survey plots AB-1, AB-2, and AB-3 were inundated due to beaver presence in the Phase 2 Mitigation area and were unable to be surveyed.

Percent Cover and *Species Diversity*: N/A.

Non-native Invasive Species: N/A.

Emergent Plots: Due to beaver activity, 1 of the 30 plots in the Promontory Pond System emergent communities (EM-18) was inundated and therefore not surveyed. The remainder of the plots and communities surveyed were found to be vigorous.

Species Diversity: The most common emergent species (in terms of frequency of occurrence) was soft rush (*Juncus effusus*). Other common species included small-fruited bulrush (*Scirpus microcarpus*), tule (*Schoenoplectus sp.*), common spikerush (*Eleocharis palustris*), duckweed (*Lemna minor*), and cattail

(*Typha latifolia*). The emergent communities continue to satisfy the Year 7 Diversity Performance Standard for the establishment of four native species.

Percent Cover: Cover by desirable herbaceous species in the plots averaged 68 percent, a 2 percent increase over the Year 7 average (66 percent). Several plots were inundated and converting to aquatic bed habitats due to backwatering from the beaver dams (EM-12, EM-14, and EM-24). No single emergent species had more than 50 percent cover throughout the mitigation site, although soft rush (*Juncus effusus*) dominates much of the emergent community at a 40 percent average cover where present. The 2016 average value continues to satisfy the Year 7 Performance Standard for a minimum of 45 to 60 percent emergent cover.

Non-native Invasive Species: Non-native invasive species increased in the number of emergent plots from 5 in 2014 to 10 in 2016. The two invasive species were present in 10 plots: bird's-foot trefoil (*Lotus corniculatus*) (in 6 of 29 plots) and reed canarygrass (*Phalaris arundinacea*) (in 5 of 29 plots). Himalayan blackberry was eliminated from the one plot observed in 2012, and all emergent plots were free of blackberry in the 2014 and 2016 monitoring. Cover by invasives varied from 0 to 25 percent and averaged 5.6 to 7.0 percent on plots where they were present. In 2012 the Promontory Pond System has the greatest percent cover of bird's-foot trefoil, but with the plots in this system inundated, the percent cover of bird's-foot trefoil decreased to an average of 10 percent in 3 plots. Reed canarygrass was present in 5 plots in 2016 compared to three plots in 2012 and 2014. Species included on the Performance Standard list of non-native invasive species in the emergent wetlands comprise just 3.4 percent cover over all monitoring plots. For details, refer to Appendix E and the Non-native Invasive Species Section below.

Scrub-Shrub Plots: During the construction of Phase 3, Plot SS-19 was removed in order to construct a new trail. Plot SS-19 was reestablished during the 2012 monitoring fieldwork and now includes a portion of the trail through the plot, as well as newly-installed vegetation. Due to beaver presence in the Promontory Pond System, 4 scrub-shrub plots (SS-11, SS-13, SS-15 and SS-16) were inundated from backwatering and had increased cover by aquatic and herbaceous plants in 2016.

Species Diversity: The most common scrub-shrub species (in terms of frequency of occurrence and percent cover) were: black twinberry (*Lonicera involucrata*), Nootka rose (*Rosa nutkana*), clustered wild rose (*Rosa pisocarpa*), spirea (*Spiraea douglasii*), and willow (*Salix sp.*). Other common species included red-osier dogwood (*Cornus sericea*), red alder (*Alnus rubra*), black cottonwood (*Populus balsamifera ssp. Trichocarpa*), and Nootka rose (*Rosa nutkana*).The scrub-shrub communities continue to satisfy the Year 7 Diversity Performance Standard for the establishment of four native species.

Percent Cover: Cover by desirable woody species varied from 40 to 100 percent, and averaged 79 percent, a 5 percent decrease from the results in 2014. The herbaceous percent cover decreased by 6 percent from 2014, which is likely the result of increased canopy cover and shade. Four plots (SS-2, SS-5, SS-13, and SS-16) had under 50 percent cover by woody species, but had vigorous emergent communities due to changes in hydrology from the beaver activity. Average percent

cover meets the Year 7 Performance Standard of greater than 70 percent scrub-shrub overall cover.

Non-native Invasive Species: Cover by all non-native invasive species varied from 0 to 31 percent (species present in 21 of the 24 plots surveyed), and averaged 12 percent across all plots with non-native invasive species presence. Cover by Performance Standard invasive species varied from 0 to 30 percent across individual plots, and averaged 11 percent cover on all plots. Approximately half of invasive species cover is from Performance Standard species. A total of 6 invasive species were observed throughout the community, a decrease from 9 species in 2014. The most common of these 6 invasive species (both in terms of frequency of occurrence and percent cover) included bird's-foot trefoil, reed canarygrass, and Himalayan blackberry. Himalayan blackberry was observed in 12 plots at an average of 8.3 percent cover where present. Reed canarygrass was observed in 10 plots (12 plots in 2014) at an average of 8.9 percent cover (5.5 percent in 2014). For details, refer to Appendix E and the Non-native Invasive Species Section below.

Buffer Plots: In 2012, Buffer plot (B-8) had to be re-established due to construction that combined the Outlet Promontory Pond and Pond 3 of the Linked Marsh System. One corner of plot B-11 was reestablished during the 2012 monitoring fieldwork. In 2014, 2 of the 11 plots (B-2 and B-8) were not located due to missing markers so data was collected at only 9 of the 11 plots. In 2016, all 11 plots were surveyed.

Species Diversity: The most common shrub species in the buffer plots (in terms of frequency of occurrence and percent cover) was snowberry (*Symphoricarpos albus*), Nootka rose, willow, and spirea. The most common tree species were red alder and black cottonwood. The buffer communities continue to satisfy the Year 7 Diversity Performance Standard for the establishment of four installed shrub species and two installed tree species; however, during the survey for Year 7, species were not differentiated or counted separately as installed or volunteer species.

Percent Cover: Cover by desirable woody species varied from 0 to 100 percent, and averaged 65 percent, a percent decrease from 2014. The average value is below the Year 7 Performance Standard for 70 percent cover due to 2 of the 11 plots (B-4 and B-11) that had 2 and 8 percent cover by desirable woody species, respectively. These plots did have a dense herbaceous cover. However, plots B-4 and B-11 had zero percent cover by desirable woody species in 2014. The other systems have maintained or increased percent cover from 2012 to 2014. Excluding plots B-4 and B-11 results in an average cover of 78 percent by desirable woody species, which is more indicative of the overall site conditions. Average percent cover is therefore determined to meet the Year 7 performance standard for buffer areas.

Non-native Invasive Species: Cover by all non-native invasive species varied from 0 to 39 percent, and averaged 15.5 percent across all plots with non-native invasive species presence, which is an increase from 14 percent in 2014. The most common invasive species in the buffer plots (both in terms of frequency of occurrence and percent cover) were bird's-foot trefoil, thistles (*Cirsium sp.*), Himalayan blackberry, and reed canarygrass. Although Himalayan blackberry (included in the Performance Standard list) occurs relatively frequently (9 of the 11 plots), it represents a low

percent cover of just 9.7 percent. Average cover by performance standard invasive species was 13.7 percent on all plots containing Performance Standard invasive species. For details, refer to Appendix E and the Non-native Invasive Species Section below.

Non-native Invasive Species

Table 3.4 Year 7 (2016) Phase 2 Mitigation Area Non-native Invasive Species Presence

Non-native Invasive Species Listed in Performance Standards		2016		
		# Plots Present	% of Total Plots	Average % Cover Where Present
Cytisus scoparius	Scot's broom	0	0%	0%
Phalaris arundinacea	reed canarygrass	20	36%	7%
Polygonum cuspidatum, etc.	Japanese knotweed	0	0%	0%
Populus nigra	Lombardy poplar	0	0%	0%
Rubus armeniacus	Himalayan blackberry	21	38%	9%
Rubus laciniatus	evergreen blackberry	3	5%	5%

Table 3.4 above lists the six non-native invasive species specified for control by the Performance Standards. As of December 2016, neither Japanese knotweed (*Polygonum cuspidatum*, etc.), Lombardy poplar (*Populus nigra*), nor Scot's broom *(Cytisus scoparius*) was present in sampling plots in the Phase 2 Mitigation Area. Evergreen blackberry (*Rubus laciniatus*) (3 plots) was rare in the monitoring plots, and constituted only 5 percent cover on average when present. Reed canarygrass was observed in 20 of 64 plots, and averaged 7 percent cover when present due to relatively heavy infestations of a few plots—representing a decrease of 2 percent from 2014. Himalayan blackberries were present in 21 of the 64 plots, and due to weed control activities the average cover of blackberries remains relatively low (9 percent) where present. This is an increase from 2 percent average cover when present in 2014.

Due to the presence of Himalayan and evergreen blackberries in the mitigation area and an increase in cover of reed canarygrass, the non-native invasive species Performance Standard of 100% removal is still not being met for Year 7. Through ongoing and aggressive efforts, the site is on track to achieve this Performance Standard by Year 10 by reducing the vigor and stem density of these invasive species. However, achieving 100 percent removal of the six species as required by the Performance Standards may be unachievable, given the following factors: 1) non-native invasive species are omnipresent throughout Magnuson Park, 2) large infestations are located immediately adjacent to the Phase 2 Mitigation Area, and 3) seed dispersal either by wind or by birds provides a recurring vector for colonization by invasives. Maintenance by Park staff to control all non-native invasive species is and will remain an on-going effort in Magnuson Park (see the Maintenance Section below.)

Vegetation Maintenance Activities

During 2015/2016, vegetation maintenance activities in the Phase 2 Mitigation Area included weeding and control of invasive plants within the wetland areas; overflow drains were cleared of vegetation and debris; pathways were pruned; and due to beaver damming activities and subsequent ponding, several evergreen trees were moved out of submerged ponds and into upland areas. Maintenance activities were undertaken by Park staff and a wide variety of volunteers under the direction of Park staff.

One of the goals of the Phase 2 Mitigation Project is to engage the public in educational activities (see Photo 4 in Appendix D). Under the direction of Parks staff members, a wide diversity of volunteers from a variety of businesses, schools, government groups, and religious organizations, as well as private individuals, participated in planting and weeding activities.

Pre-Existing Patches of Non-native Invasive Species

Monitoring for patches of non-native invasive species was required in Years 1, 2, and 3. The performance criteria were met and no adaptive management or further monitoring was required. Therefore, no monitoring was conducted for this performance standard in Year 5 or in Year 7. Treatment of pre-existing and new non-native invasive species patches is included in the Parks maintenance program.

Pre-Existing Groves of Trees

Monitoring for existing tree groves was required in Years 1, 2, and 3. The performance criteria were met and no adaptive management or further monitoring was required. Therefore, no monitoring was conducted for this performance standard in Year 5 or Year 7.

Macroinvertebrates

Efforts were made to collect invertebrate samples using sweep nets during June 2016 at 12 sites in the Phase 2 Mitigation created wetland habitats, and at one site (Frog Pond) as an existing and established control wetland. For collections locations and methods see Appendix C; and for data obtained see Table E-15 in Appendix E. Due to the warm temperatures and relatively dry weather during the spring and early summer of 2016, some of the collection locations had dried up and invertebrates could not be collected from those sites—these locations included the southwest quadrant of the rice paddy ponds as well as Frog Pond.

The dominant invertebrate taxa collected from the sampled sites in 2014 as a whole were: water fleas (*Daphnia* cladocerans), scuds (amphipods), midges (chironomids), and freshwater snails (gastropods). Other taxa that displayed local abundances but showed patchy distribution across the sampling area in general included aquatic true bugs such as backswimmers (notonectid hemipterans); phantom midges (charoborid dipterans); mosquitoes (culicid dipterans); meniscus

midges (dixid dipterans); soldier flies (stratiomyid dipterans); and aquatic earthworms (annelid oligochaetes). Although these latter taxa showed relatively high densities locally, they were often absent or showed low sampling concentrations at other sites (Table E-15 in Appendix E).

Other invertebrates occurred at lower densities at individual sampling sites, but occurred broadly across many sampling sites. Such taxa included: the water scavenger and diving predaceous beetles (hydrophilid and dysticid coleopterans); water boatmen and velvet water bugs (corixid and hebrid hemipterans); small minnow mayflies (baetid ephemeropterans); and spreadwing and pond damselflies (lestid and coenogrionid odonates). A handful of terrestrial or semi-aquatic taxa were collected as well, including spiders (aranids), leafhoppers (cicadellid hemipterans), aphids (aphid hemipterans), parasitoid wasps (ichneumonid hymenopterans), and springtails (Collembola).

Previously in the 2010-2012 invertebrate sampling, Frog Pond (control wetland) and the North Promontory Pond (which has year-round deep water), showed relatively high taxomonic richness and diversity. In 2014, however, Frog Pond showed a relatively low taxonomic richness and diversity, consisting mostly of aquatic earthworms and scuds. Although the North Promontory Pond continued to show relatively high taxonomic richness and diversity, the rice paddies and entrance marsh habitats showed comparable values showed invertebrate communities of comparable richness and diversity, representing an increase in community complexity from the 2009-2011 sampling events and consistent with sampling conducted in 2012-2016.

Previously, Frog Pond represented a relatively established habitat compared to the constructed wetlands, and although Frog Pond is only seasonally inundated and dries up in the latter part of the summer, it represented habitat with ecological/taxonomic niches that are partitioned and a relatively diverse, established taxonomic assemblage. Due to the warm and dry weather prior to the 2016 invertebrate sampling, Frog Pond was no longer inundated and no invertebrate sampling could be conducted for that site. The same was true of the southwest quadrant of the rice paddy system. However, while fewer overall numbers of invertebrates were collected in 2016, a trend of increased invertebrate taxonomic richness, diversity, and composition of the invertebrate community in the created wetlands appears to hold true over the course of the 2010-2016 sampling period. Dominant taxa composition in the created wetlands consist primarily of scuds, water fles, midges, and freshwater snails. These dominant taxa collectively indicate an invertebrate assemblage that is tolerant of warm water, disturbance (e.g. seasonal fluctuations in hydrology), and high concentrations of fine sediment. Such a taxonomic distribution and associated habitat tolerances are not atypical of naturally occurring wetland conditions.

The North Promontory Pond also showed a relatively diverse taxonomic assemblage, with scuds and midges representing the largest proportions of the collected samples, but numerous other taxa less frequently represented; e.g. freshwater snails, dragonflies, mosquitoes, mayflies, etc. The rice paddy ponds were generally dominated by freshwater snails, with high local abundances of scuds, water fleas, midges and meniscus midges, and mosquitoes.

Similar to previous years' sampling events, the Entrance Marsh system (Ponds #1 and #2) showed the highest taxonomic richness and diversity during the 2016 sampling, continuing a trend observed in previous years' sampling. Dominant taxa for this pond included freshwater snails, water fleas, midges, and backswimmers. Phantom midges, damselflies, and diving beetles contributed to the overall taxonomic diversity in the Entrance Marsh complex, as well.

Generally, much of the created wetland habitat at Magnuson Park (rice paddies, linked marshes, etc.) appears to have been colonized by pioneer taxa that do well in disturbed environments and can rapidly colonize and reproduce within these contexts. Similar to the taxa found in Frog Pond during years when sampling has been possible, many of these organisms are tolerant of seasonal wetland conditions: fluctuating seasonal hydroperiod, warm water temperatures, and silty/fine sediment substrates. Many of these organisms tend to belong to pioneer taxa that can rapidly colonize and reproduce in newly available or recently disturbed habitat, may feed on a wide variety of different food items (trophic breadth), and may make use of seasonal wetland habitat in which surface water is absent during some portion of the summer months. Changes in wetland hydrology due to beaver activity, introduction of fish into portions of the wetland system (see section on dragonflies and damselflies, below), and successional changes in the vegetative community are likely to continue to influence the invertebrate community in the created wetlands.

Amphibians

Amphibian monitoring has been conducted in all years of monitoring at Magnuson Park, including 2016, and has consisted of larval sampling and egg mass sampling for the Phase 2 Mitigation wetlands. For locations and methods see Appendix C; and for data obtained see Table E-6 in Appendix E. Amphibian egg masses and larvae counts dropped considerably in 2016 relative to previous monitoring years. Sampling results from Frog Pond yielded a smaller number of Pacific chorus frog larvae (*Pseudacris regilla*, n=20) compared to 2014 (n=41) and previous years, but similar to the numbers seen in 2011 (n=59), 2012 (n=27), and 2013 (n=22). Changes in vegetation community have been observed from 2011-2016, with cattail (*Typha latifolia*) becoming more dominant and water levels appearing more shallow and drawing down earlier in the summer. These apparent changes in vegetative community structure and annual hydrologic conditions may be correlated with a decrease in breeding chorus frog activity: more cattail in Frog Pond implies fewer thin-stemmed vegetation to which female frogs can affix egg masses, and shallower water with an earlier seasonal draw-down implies a smaller window of developmental time for tadpoles to metamorphose into adults and leave the aquatic habitat.

The spring and summer of 2015 was exceptionally dry as well, which may have reduced the number of breeding frogs in 2016 across the whole wetland system. Based on anecdotal evidence, Park users also noted the reduction of the chorus frog population in 2016—particularly the frequency and magnitude of calling males during the mating season.

While the sampled density of larval frogs in Frog Pond was relatively low during the 2016 monitoring work—counts for both egg mass and larvae in 2016 were an order of magnitude below counts from pervious yeas—Pacific chorus frogs can demonstrate significant fluctuations in population densities from year to year, and some of the changes in the Magnuson Park wetlands may have implications for wetland-associated frog populations.

Pacific chorus frogs have successfully colonized the Phase 2 Mitigation wetlands and are utilizing the created wetland habitat for breeding, with relatively large numbers of larval frogs and egg masses collected in certain areas of the created wetland habitatover the course of monitoring. Data from the 2010-2016 sampling events indicate that the highest densities of both egg masses and larval frogs in the created wetlands occurred in the northeast and northwest quadrants of the rice paddies—possibly as a result of adult frogs colonizing this new breeding habitat from Frog Pond and/or the established wetland complex to the east. Data from 2016 showed relatively fewer numbers of egg masses and larval frogs in the southeast and southwest quadrants of the rice paddies as well, potentially the result of predatory species entering the rice paddy system from backwatering from North Promontory Pond due to the beaver dam and/or earlier drying out of the southwest rice paddy wetlands. Egg mass and larval densities were particularly high throughout the rice paddies during 2013 and 2014, including the typically less densely occupied southwest quadrant.

Other created wetland habitat sites—notably the linked marsh systems and to a lesser extent the soccer ponds—showed relatively high numbers of larvae or egg masses during the 2013-2014 sampling events as well along with much lower numbers during the 2016 sampling. The Linked Marsh 1 and 2 sites also showed moderately high densities of larvae and egg masses in 2013 and 2014, with higher densities observed in 2014. The lower sampling numbers in 2016 across the sample sites suggest that this decline may be less associated with specific location habitats and possibly more correlated with broader patterns in 2016 that would pertain to all of the sites…such as a very dry April and May in 2016. Additional factors, such as enough sufficient and appropriate shallow water breeding habitat with plant material for egg mass attachment, beaver-mediated inundation and changed in the vegetative community, presence of fish in the system (see dragonflies and damselfies section below), water depth variations during the breeding and rearing seasons, water quality, or other parameters that may show relatively high variability within breeding seasons and from year to year may also play roles in Pacific chorus frog population dynamics at Magnuson Park.

Although no egg masses or larvae have been observed to date, evidence of bullfrog (*Rana catesbiana*) adults has been noted in the Magnuson Park wetland system (calling adults) during 2012, 2013, and 2016 indicating that this invasive predatory species may be colonizing and/or attempting to breed in areas of the Magnuson created wetlands, and possibly representing a source of concern for native amphibian species.

Birds and Wildlife

Birds are the most frequently observed and reported animals at Magnuson Park. Numerous species (76 species counted between July and December 2016) of birds of prey, waterfowl, songbirds, and others have been observed in or near the Phase 2 Mitigation Area, including:

- Bald eagles, and Cooper's hawks;
- waterfowl species observed include: mallard, gadwall, widgeon, coot, Canada goose, scaup, goldeneye, bufflehead, northern shoveler, teals, various species of gull; and
- other bird species observed include: killdeer, American crow, American robin, European starling, cedar waxwing, bushtit, northern flicker, American goldfinch, Anna's hummingbird, and spotted towhee; along with various species of swallows, chickadees, sparrows, finches, wrens, and warblers.
- The most abundant species across the various sampling sites at Magnuson Park include black-capped chickadees, American robins, American crows, Bewick's wrens, mallards, and gulls (California, glaucous-winged, and mew gulls).
- The created wetlands appear to provide suitable habitat for passerine species based on observed use during the spring and summer, as well as suitable habitat for waterfowl species during the winter months.

See Appendix E for the results of bird surveys conducted by Seattle Audubon Society.

Observed signs of wildlife use of the Phase 2 Mitigation Areas include:

- coyote scat prevalent within the mitigation area;
- raccoon tracks;
- beaver;
- red-eared sliders and snapping turtles; and
- Pacific chorus frogs are prolific in the Phase 2 Mitigation Areas, especially in the Rice Paddies (see Amphibian Section above).

Dragonflies and Damselflies

Dennis Paulson, author of *Dragonflies and Damselflies of the West* (2009. Princeton University Press, Princeton, New Jersey. 535 pages), collected dragonfly and damselfly information in the Phase 2 Mitigation Area from May 8 through November 10, 2010; April 23 through October 13, 2011; June 11 through November 2, 2012; April 22 through November 11, 2013; April 13 through November 10, 2014; and May 8 through November 8, 2016 (and on-going). He has observed 26 species (15 Genera), some of which are rare in the Seattle area – see Table E-17 in Appendix E for details. Based on his 40-plus 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.

Dr. Paulson has noted changes in the Magnuson Phase 2 wetlands that pertain to dragonflies and damselflies as follows:

Fish (Oriental Weatherfish, *Misgurnus anguillicaudatus*) were first seen at easternmost Promontory Pond in 2015, then in Shore Lagoon in 2016. In addition, Shore Lagoon in 2016 hosted Prickly Sculpin (*Cottus asper*), Largemouth Bass (*Micropterus salmoides*), and Pumpkinseed (*Lepomis gibbosus*), the last incredibly abundant. At least Pumpkinseeds were seen in other ponds later in the summer of 2016. The presence of fish will play a part in reducing odonate abundance and diversity. The nymphs of many odonate species live out in the open and cannot thrive in the presence of fish.

Pied-billed Grebes began breeding in Shore Lagoon in 2016, possibly 2015; they preyed extensively on darner nymphs, especially before so many fish were available to them, and darner populations seemed reduced in 2016.

The presence of grebes and fish are expected to reduce odonate populations in the park, but the worst threat to those populations is the growing up of woody vegetation, which shades the ponds and thus reduces productivity as well as reducing the perches and oviposition substrates for adults that herbaceous vegetation provides along the shoreline.

Furthermore, the shallow ponds ("rice fields) that served as habitat for certain odonate species that breed in seasonal wetlands are filling in from natural succession and now drying up too rapidly to serve as habitat for them any more, so changes that are taking place are making the site less favorable for both permanent-pond and seasonal-pond species.

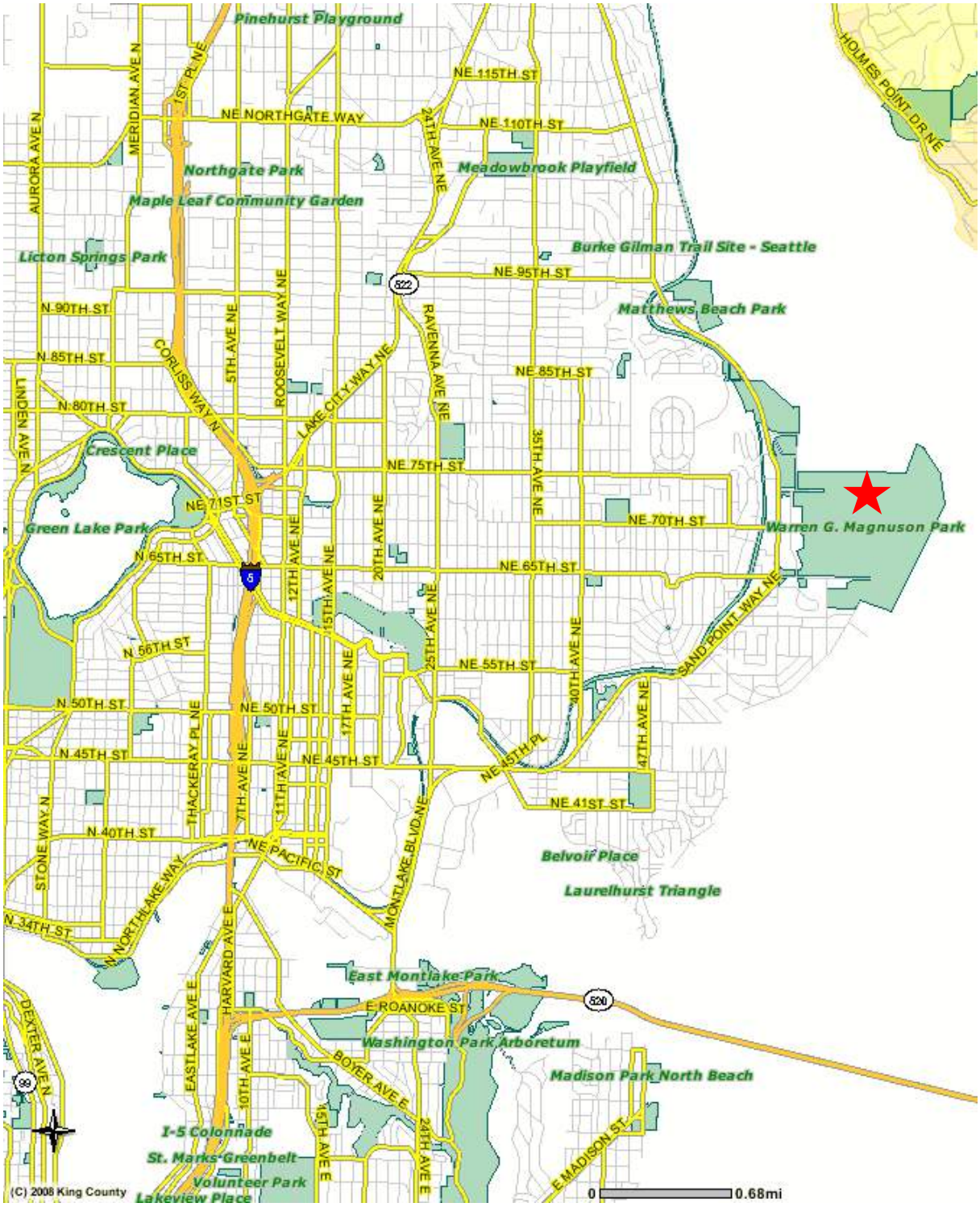


Figure 1. Magnuson Park Vicinity Map

Figure 2. Magnuson Park Phase 2 Development Site Map, January 2009
Note the five hydrologic systems: Entrance Marsh System, Rice Paddies System, Promontory Pond System, Linked Marsh System (NE 65th St.), and the Soccer Field System

Conclusions

The majority of the Year 7 Performance Standards were being achieved by the Phase 2 Mitigation Area; the only exception was that there has not been 100 percent removal of Himalayan and evergreen blackberries nor a reduction in vigor and percent cover of reed canary grass by Year 7. However, these species are being actively and aggressively controlled, and occur at low coverage percentages where they are present in the Phase 2 Mitigation Area. With increased efforts to control non-native invasive species, the Mitigation Area is on track to achieve Year 10 Performance Standards.

Beaver activity has resulted in the inundation of emergent and scrub-shrub mitigation wetlands on the site, as well as an increase in water depth in aquatic bed wetlands. During 2015, beaver deceivers were installed to lower water levels behind the beaver dam to preserve the appropriate vegetation in the mitigation wetland habitats and protect the trail system at Magnuson. The proposed adaptive management responses are designed to allow beaver presence and activity to continue at Magnuson while still maintaining the wetland mitigation design for the project, as well as allowing for continued use of the trail system by Park visitors.

Recommended Maintenance Actions for the Phase 2 Mitigation Area

- Continue to control non-native invasive species in all portions of the Phase 2 Mitigation Area, specifically reed canarygrass in plots EM-1, EM-2, EM-10, EM-23, EM-25, SS-5, SS-13, SS-16, B-9, and B-11, and Himalayan blackberry in plots SS-3, SS-4, SS-22, SS-23, SS-24, B-2, B-10, and B-11.
- As necessary, water Phase 2 Mitigation Areas during the dry months.
- Conduct maintenance and monitoring activities as required by the Monitoring Plan.
- Re-establish Aquatic Bed plots AB-1, AB-2, and AB-3 in aquatic bed communities not impacted by beaver pond inundation so that emergent wetland vegetation performance standards can continue to be evaluated in Year 10.
- Re-establish Emergent plot EM-18 in emergent communities not impacted by the beaver den so that emergent wetland vegetation performance standards can be evaluated in Year 10.
- Maintain or fix water level control devices (modified Clemson devices) through the existing beaver dams.
- Conduct maintenance activity on the trail and leaky berm facilities in the beaver dam vicinity in order to maintain designed wetland hydrology and flow patterns for the mitigation site.

Appendix A—Maps

NOTES:

1. TYPICAL SMALLER SIZES HAVE BEEN NOTED FOR THE MAJORITY OF PLANTS. WHERE SYMBOLS CONTAIN AN 'L', THE LARGER SIZE LISTED IN THE PLANT LIST IS TO BE USED.
2. SEE PLANT SCHEDULE FOR SIZES AND SPACING OF PLANTS UNLESS SPECIFICALLY NOTED ON PLANT NOTATION LEADERS.
3. SPACING OF PLANTS SHALL BE ⅔ OF SPECIFIED SPACING FROM TRAILS AND OTHER HARDSCAPE UNLESS NOTED OTHERWISE.
4. PLANTING LIMITS SHOWN ARE APPROXIMATE AND ARE SUBJECT TO FIELD ADJUSTMENT BY LANDSCAPE ARCHITECT.
5. PLANTING/SEEDING SHALL PROVIDE PLANT TO PLANT SPACING AS NOTED ON PLANS IN AND BETWEEN ALL PLANTING MASSES (VOIDS BETWEEN PLANT HATCHES ARE FOR ILLUSTRATIVE PURPOSES FOR PLAN CLARITY ONLY).
6. SEE SHEET L-5.06 FOR PROTOTYPICAL SCRUB-SHRUB, EMERGENT, & AQUATIC PLANTING.
7. SEE SHEET L-5.07 FOR PLANTING SCHEDULE & DETAILS.
8. OWNER TO PROVIDE UP TO 30 TREE ROOT WADS & UP TO 50 SALVAGED LOGS FOR FIELD PLACEMENT BY LANDSCAPE ARCHITECT IN WETLAND/HABITAT AREAS.
9. PRIOR TO COMPLETION OF THE PROJECT, NON-RIGID PLANT PROTECTION FENCING IS TO BE INSTALLED WHERE INDICATED.
10. ALL TREES TO BE PLANTED MIN. OF 8' FROM ALL PATHS & TRAILS

LEGEND	ON THIS SHEET:
SG=STAFF GAUGE	SG-9
PP=PHOTO POINT	PP-15 THRU PP-18
WS=WATER SAMPLING SITE	WS-4, WS-6

VEGETATION MONITORING PLOTS:	
B=BUFFER	B-11
EM=EMERGENT	EM-26 THRU EM-30
SS=SCRUB SHRUB	SS-21 THRU SS-24

MATCHLINE 'A' - THIS SHEET

MATCHLINE 'A' - THIS SHEET

WS-6

FIELD #5

FIELD #6

FIELD #7

PP-15

PP-16

PP-17

PP-18

SS-21

SS-22

SS-23

SS-24

EM-27

EM-28

EM-29

EM-30

B-11

EM-26

SG-9

WS-4

SOCCER FIELDS POND 1

SOCCER FIELDS POND 2

SOCCER FIELDS POND 3

GROVE MARSH

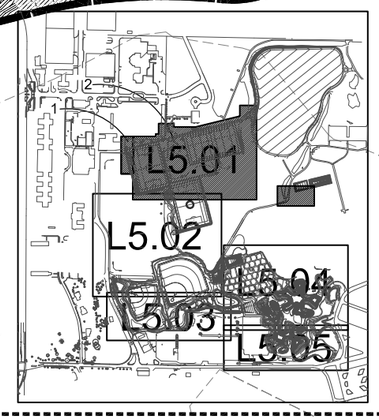
SOCCER FIELDS POND 4

APPROXIMATE LIMIT OF PHASE 2

SCALE: 1"=30'-0"

0' 15' 30' 60' 90'

MATCHLINE 'B' - SHEET L5.02



>>>>CAUTION<<<<
CALL BEFORE YOU DIG!

NOT LESS THAN TWO OR MORE THAN TEN BUSINESS DAYS PRIOR TO COMMENCING EXCAVATION OR DEMOLITION, SECURE THE SERVICES OF A COMMERCIAL UNDERGROUND UTILITIES LOCATOR SERVICE TO IDENTIFY BELOW-GROUND IMPROVEMENTS THAT MAY NOT BE INDICATED ON THE DRAWINGS. FOR IRRIGATION SYSTEMS, CALL SEATTLE PARKS PLUMBING SHOP (206 684 7070)

>>800 424 5555<<

PROJECT TEAM:

- The Berger Partnership - Landscape Architects (Prime Consultant)
- Sheldon & Associates - Wetlands Consultant (OTAK)
- D.A. Hogan & Associates - Athletic Fields Consultant
- Magnusson Klimencic Associates - Civil Engineers
- Sparling - Electrical Consultants

NO.	REVISION – AS BUILT	DATE
3		
2		
1		

REVIEWED: _____ PARK ENGINEER _____ DATE

All work done in accordance with the City of Seattle Standard Plans and Specifications in effect on the date shown above, and supplemented by Special Provisions.

SEATTLE PARKS AND RECREATION

MAGNUSON PARK PHASE II

AS BUILT

PLANTING PLAN

DESIGNED GM	DATE 12/15/2009
DRAWN RM	SHEET ____ OF ____
CHECKED JY	
ORDINANCE NO. See Cover sheet	L-5.01
CONTRACT NO. 1744	
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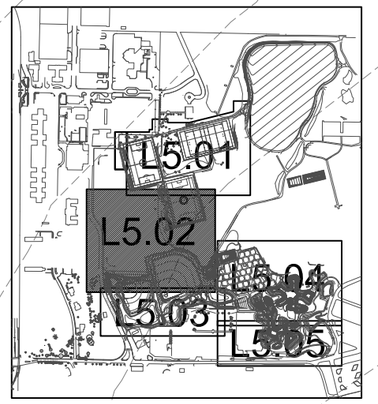

MATCHLINE 'B' - SHEET L5.01

FIELD #7

LIMIT OF ADD-ALTERNATE #2

MATCHLINE 'D' - SEE SHEET L5.04

LEGEND	ON THIS SHEET:
SG=STAFF GAUGE	SG-1
PP=PHOTO POINT	PP-1, PP-6

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SCALE: 1"=30'-0"

0' 15' 30' 60' 90'

EDUCATIONAL SIGN AND ACCESS POINT

PP-1

SG-1

WS-1

ENTRANCE MARSH 1

FIELD #8

PP-6

EDUCATIONAL SIGN

MATCHLINE 'C' - SHEET L5.03

>>>>CAUTION<<<<
CALL BEFORE YOU DIG!

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NO.	REVISION – AS BUILT	DATE
3		
2		
1		

REVIEWED: _____ _____
PARK ENGINEER DATE

All work done in accordance with the City of Seattle Standard Plans and Specifications in effect on the date shown above, and supplemented by Special Provisions.

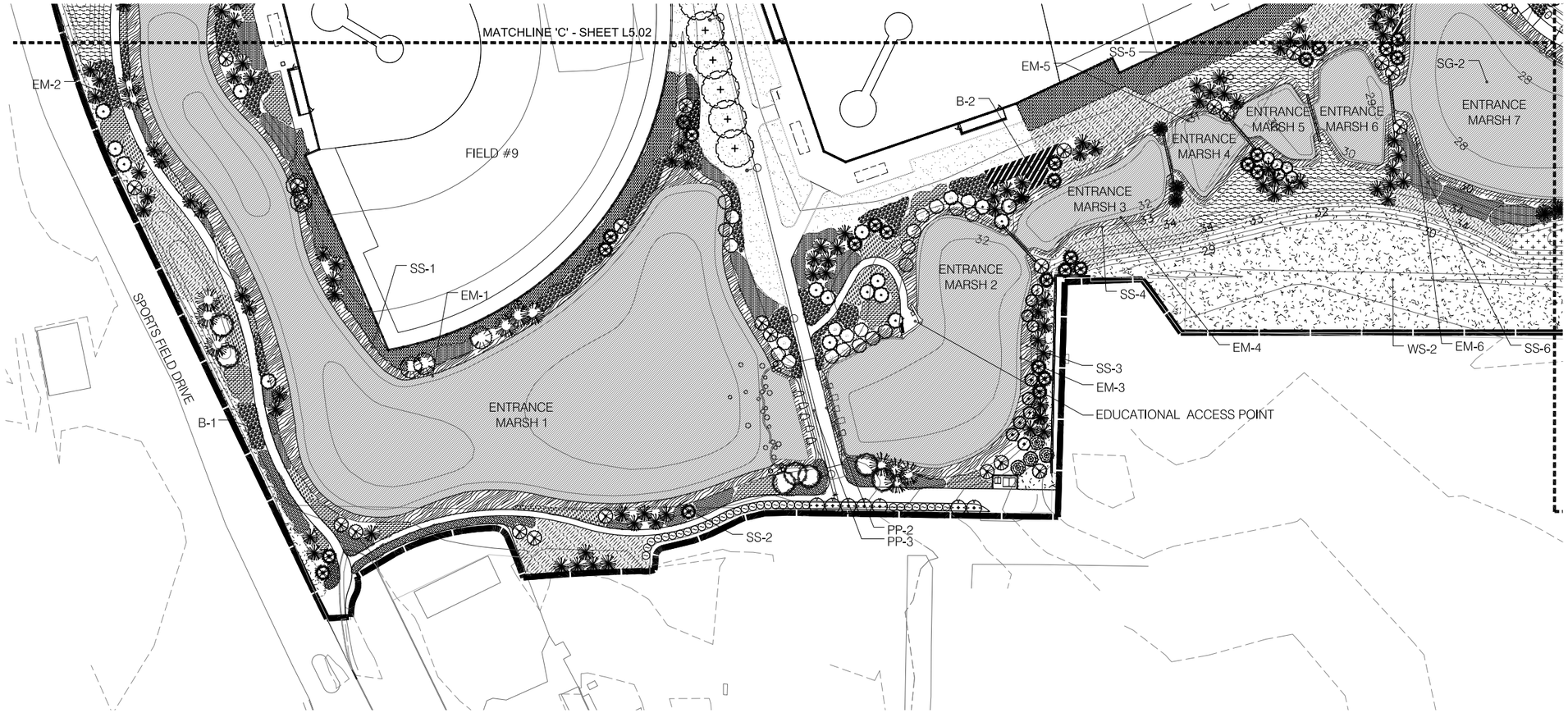
SEATTLE PARKS AND RECREATION

MAGNUSON PARK PHASE II

AS BUILT

PLANTING PLAN

DESIGNED GM	DATE 12/15/2009
DRAWN RM	SHEET ____ OF ____
CHECKED JY	
ORDINANCE NO. See Cover sheet	L-5.02
CONTRACT NO. 1744	
SCALE 1"=30'-0"	



LEGEND	ON THIS SHEET:
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PP=PHOTO POINT	PP-2, PP-3
WS=WATER SAMPLING SITE	WS-2

VEGETATION MONITORING PLOTS:	
B=BUFFER	B-1, B-2
EM=EMERGENT	EM-1 THRU EM-6
SS=SCRUB SHRUB	SS-1 THRU SS-6

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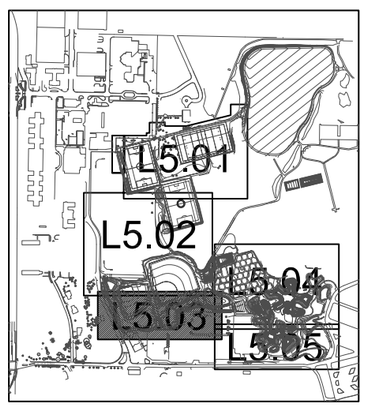
SCALE: 1"=30'-0"

0' 15' 30' 60' 90'



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>>800 424 5555<<

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NO.	REVISION – AS BUILT	DATE
3		
2		
1		

REVIEWED: _____ PARK ENGINEER _____ DATE

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SEATTLE PARKS AND RECREATION

MAGNUSON PARK
PHASE II

AS BUILT

PLANTING PLAN

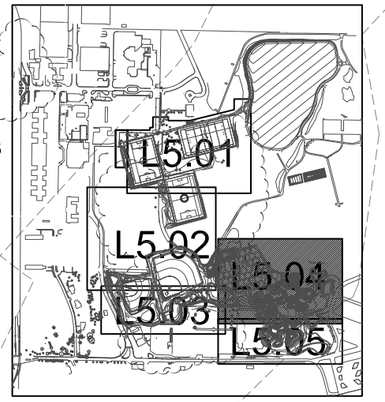
DESIGNED GM	DATE 12/15/2009
DRAWN RM	SHEET ____ OF ____
CHECKED JY	
ORDINANCE NO. See Cover sheet	L-5.03
CONTRACT NO. 1744	
SCALE 1"=30'-0"	

LEGEND
SG=STAFF GAUGE
PP=PHOTO POINT
WS=WATER SAMPLING SITE

ON THIS SHEET:
SG-3 THRU SG-8
PP-4,5,7,9,10,11
WS-5

VEGETATION MONITORING PLOTS:

B=BUFFER	B-3,4,7,8,9,10
EM=EMERGENT	EM-7 THRU EM-15, EM-17,18,19,24,25
SS=SCRUB SHRUB	SS-7 THRU SS-12, SS-15,16,17,19,20
AB=AQUATIC BED	AB-1, AB-2



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MATCHLINE 'D' - SEE SHEET L5.02

MATCHLINE 'E' - SEE SHEET L5.03

MATCHLINE 'F' - SEE SHEET L5.05

NORTH MARSH POND
EM-8
SS-7
SG-3
EM-7
B-3
HABITAT OVERLOOK BERM
PP-7
EXISTING WILLOW ISLAND
EM-9
NORTH EAST RICE PADDIES
SS-8
EM-10
EM-11
SS-10
SS-9
WEST RICE PADDIES
PP-4
EM-12
SOUTH EAST RICE PADDIES
EM-14
SS-11
EM-13
ENTRANCE MARSH 7
PP-4
PP-5
SS-12
EM-15
NW LOBE
SG-5
NW LOBE
NORTH PROMONTORY POND
EM-18
B-4
SOUTH PROMONTORY POND
SOUTH PROMONTORY POND
B-8
SS-17
NORTH LOBE
EM-19
SG-6
PROMONTORY MARSH OUTLET
STORMDRAIN MANHOLE WITH DEBRIS BARRIER
SS-16
NORTH LOBE
WS-5
PP-9
SG-8
LINKED MARSH POND 3
PP-10
SS-20
STORMDRAIN MANHOLE WITH DEBRIS BARRIER
EAST LOBE
B-7
EM-17
AB-2
SOUTH LOBE
AB-1
SS-15
EDUCATIONAL SIGN
EM-25
B-10
SS-19
LINKED MARSH NORTH SWALE
PP-11
B-9
SG-7
EM-24
LINKED MARSH POND 2
LINKED MARSH SOUTH SWALE

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NO.	REVISION – AS BUILT	DATE
3		
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1		

REVIEWED: PARK ENGINEER DATE

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SEATTLE PARKS AND RECREATION

WARREN G. MAGNUSON PARK

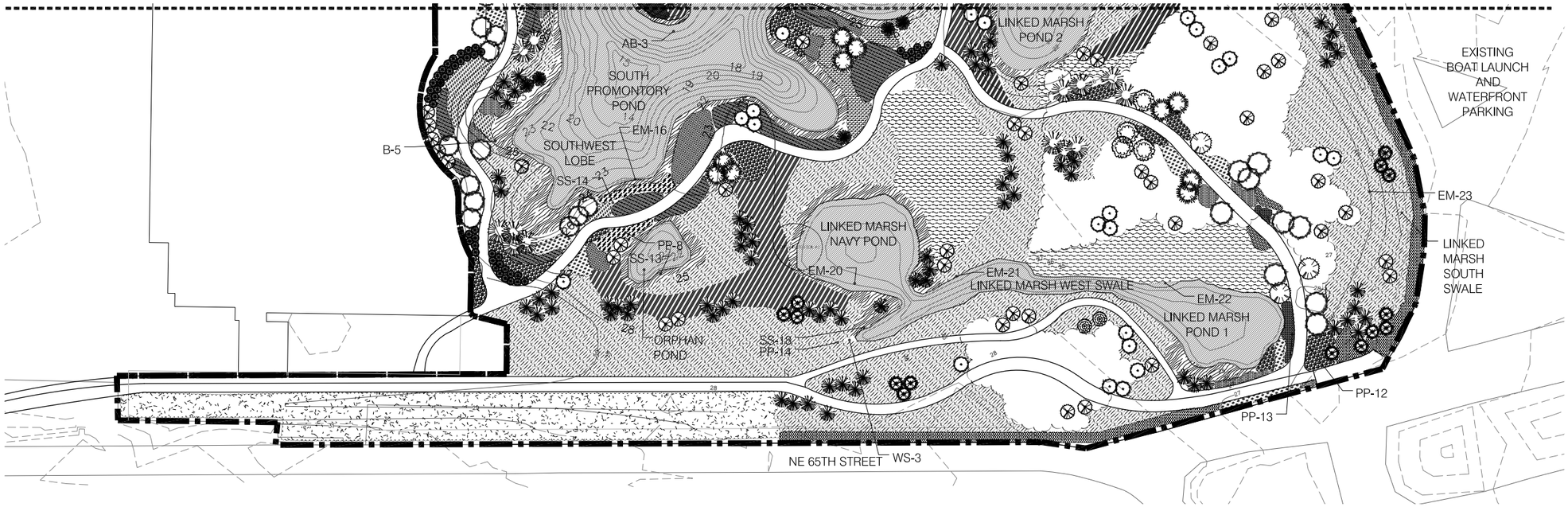
MAGNUSON PARK PHASE II

AS BUILT

PLANTING PLAN

DESIGNED GM	DATE 12/15/2009
DRAWN RM	
CHECKED JY	SHEET ____ OF ____
ORDINANCE NO. See Cover sheet	L-5.04
CONTRACT NO. 1744	
SCALE 1"=30'-0"	

MATCHLINE 'F' - SEE SHEET L5.04



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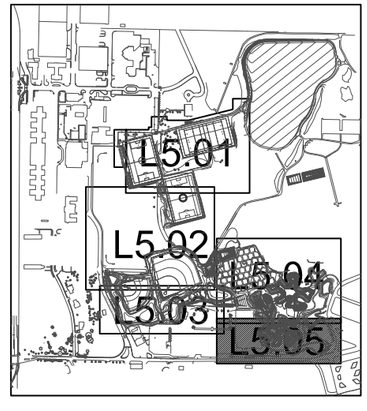
LEGEND	ON THIS SHEET:
SG=STAFF GAUGE	NONE
PP=PHOTO POINT	PP-8,12,13,14
WS=WATER SAMPLING SITE	WS-3

VEGETATION MONITORING PLOTS:	
B=BUFFER	B-5, B-6
EM=EMERGENT	EM-16,20,21,22,23
SS=SCRUB SHRUB	SS-13,14,18
AB=AQUATIC BED	AB-3

SCALE: 1"=30'-0"

0' 15' 30' 60' 90'



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NO.	REVISION – AS BUILT	DATE
3		
2		
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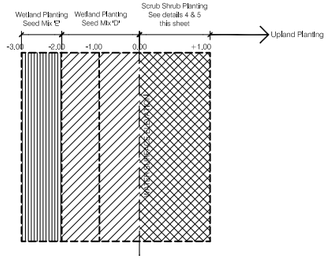
SEATTLE PARKS AND RECREATION

MAGNUSON PARK PHASE II

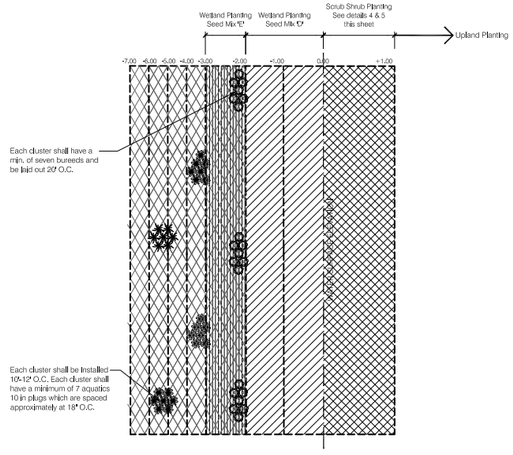
AS BUILT

PLANTING PLAN

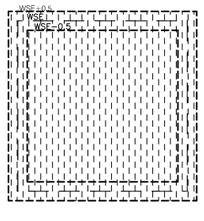
DESIGNED GM	DATE 12/15/2009
DRAWN RM	SHEET ____ OF ____
CHECKED JY	
ORDINANCE NO. See Cover sheet	L-5.05
CONTRACT NO. 1744	
SCALE 1"=30'-0"	



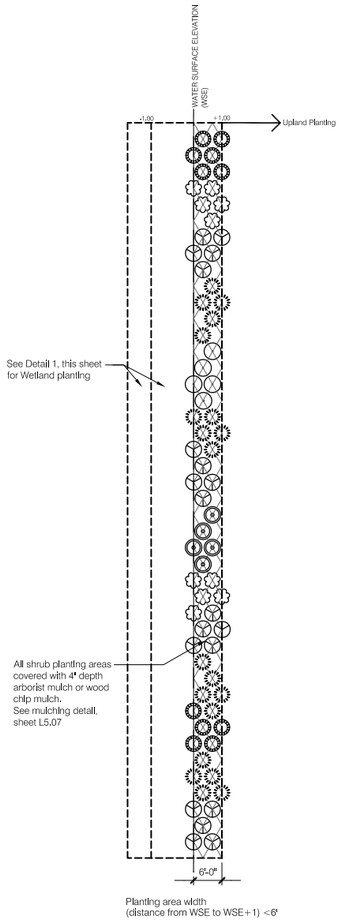
1 WETLAND PLANTING - EMERGENT SPECIES
SCALE: NTS



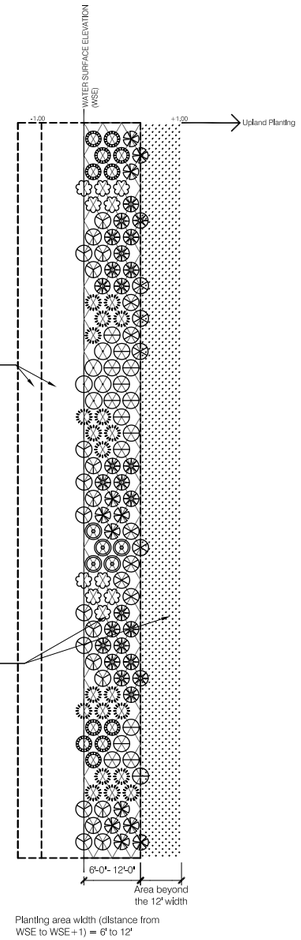
2 WETLAND PLANTING - AQUATIC SPECIES (PROMONTORY PONDS ONLY)
SCALE: NTS



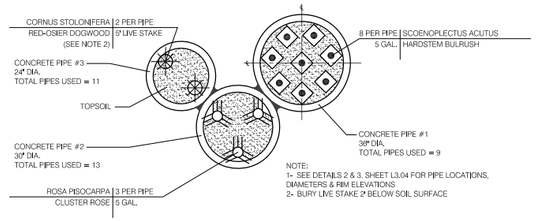
3 WETLAND PLANTING - MARSH PONDS
SCALE: NTS



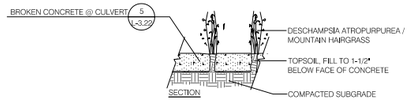
4 SCRUB SHRUB PROTOTYPICAL PLANTING - 6' WIDTH PLANTING BAND
SCALE: NTS



5 SCRUB SHRUB PROTOTYPICAL PLANTING - 12' WIDTH PLANTING BAND
SCALE: NTS



6 CONCRETE PIPE PLANTING
SCALE: 1/2"= 1'-0"



7 BROKEN CONCRETE @ CULVERT PLANTING
SCALE: 1/2"= 1'-0"

PLANT MATERIAL SCHEDULE FOR DETAILS 1, 2, & 3, THIS SHEET

TREES	COMMON NAME/ SCIENTIFIC NAME	SIZE	SPACING
	Western Red Cedar/Thuja plicata	2 Gallon	10' O.C.
	Sitka spruce/Picea sitchensis	2 Gallon	10' O.C.
SHRUBS	**COMMON NAME/ SCIENTIFIC NAME**	**SIZE**	**SPACING**
Scrub Shrub Planting	See scrub shrub prototypical planting diagram, this sheet		
EMERGENTS	**COMMON NAME/ SCIENTIFIC NAME**	**SIZE**	**SPACING**
WETLAND PLANTING SEED MIX *2 ** Emergent Mix-Upper	See specifications Section 02933.		Seeding (recommended) or 10 in² Plug at 18" O.C. See notes
WETLAND PLANTING SEED MIX *3 *** Emergent Mix-Lower	See specifications Section 02933.		Seeding (recommended) or 10 in² Plug at 18" O.C. See notes
WETLAND PLANTING SEED MIX *1 *** Emergent Mix-Marsh Pond	See specifications Section 02933.		Seeding (recommended) or 10 in² Plug at 18" O.C. See notes
AQUATICS	**COMMON NAME/ SCIENTIFIC NAME**	**SIZE**	**SPACING**
	Floating-leaved pondweed/ Potamogeton natans	10 in² Plug	18" O.C.
	Large-leaf pondweed/ Potamogeton amplifolius	10 in² Plug	18" O.C.
	Narrow-leaf Bureed/ Sparganium angustifolium	10 in² Plug	18" O.C.

* Live stakes may be used at the ratio of 3:1 (3 live stakes = 1 Gallon Plant)
** shall be seeded if the following condition allows (see notes 2 & 3)

Notes:
1. The verification of all plant quantities is the responsibility of the bidder/contractor

2. Seeding is recommended for the sections of the emergent zones which will not have standing water for a sufficient period of time during the growing season to allow the seeds to germinate and become established. The establishment period should be approximately 3 months, during which time the seeded emergent area must have sufficient hydrology to support seedling growth. 10 in plugs shall be planted at 18" O.C. In the emergent zones where hydroperiod will not allow seeding, and as a contingency measure if performance standards are not met by the seeded plants.

3. % of emegent mix is by aerial cover. Seed mix proportions shall be calculated based on seed weight. Minimum seed germination rate shall be 90%.

PLANT MATERIAL SCHEDULE FOR DETAILS 4 & 5 THIS SHEET

SHRUBS	COMMON NAME/ SCIENTIFIC NAME	SIZE	SPACING
	Hooker willow/Salix hookeriana	1 Gallon	4' O.C.
	Pacific willow/Salix lucida	1 Gallon	4' O.C.
	Sitka willow/Salix sitchensis	1 Gallon	4' O.C.
	Spirea/Spiraea douglasii	1 Gallon	4' O.C.
	Salmonberry/Rubus spectabilis	1 Gallon	4' O.C.
	Red-osier dogwood/Cornus sericea	1 Gallon	4' O.C.
	Swamp rose/Rosa pisocarpa	1 Gallon	4' O.C.
	Black hawthorn/Crataegus douglasii	1 Gallon	4' O.C.
	Black twinberry/Lonicera involucrata	1 Gallon	4' O.C.
	Western crabapple/Malus fusca	1 Gallon	4' O.C.
	Spirea (20%)/Spiraea douglasii	1 Gallon	3' O.C.
	Nootka rose (40%)/Rosa nutkana	1 Gallon	3' O.C.
	Snowberry (40%)/Symphoricarpos albus	1 Gallon	3' O.C.

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NO.	REVISION – AS BUILT	DATE
3		
2		
1		

REVIEWED: _____ _____
PARK ENGINEER DATE

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SEATTLE PARKS AND RECREATION

MAGNUSON PARK PHASE II

AS BUILT

PROTOTYPICAL PLANTING

DESIGNED GM
DRAWN RM
CHECKED JY
DATE 12/15/2009
SHEET ____ OF ____
ORDINANCE NO. See Cover sheet
CONTRACT NO. 1744
SCALE

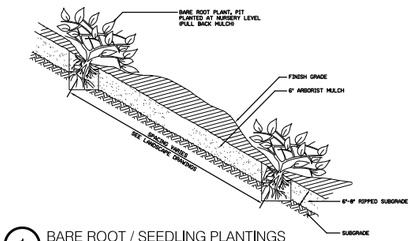
L-5.06

PLANT SCHEDULE

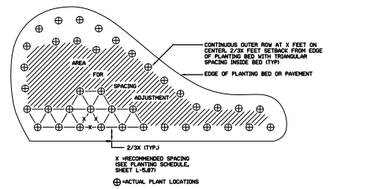
SCIENTIFIC NAME	COMMON NAME	PLANT FORM	SPACING	SQUARE FT.	QUANTITY
TREES					
ABIES GRANDIS	GRAND FIR	2 Yrs. (18"-36")	PER PLAN		155
ABIES GRANDIS	GRAND FIR	6'-8'	PER PLAN		16
ACER MACROPHYLLUM	BIGLEAF MAPLE	SEED	LBS/ACRE	29,838	SEED AT A RATE OF 10 LBS/ACRE
ALNUS RUBRA	RED ALDER	SEED	LBS/ACRE	127,936	SEED AT A RATE OF 4 LBS/ACRE
ALNUS RUBRA	RED ALDER	2 Yrs. (3'-4')	PER PLAN		101
ARBUTUS MENZIESII	PACIFIC MADRONE	5 GAL.	PER PLAN		5
LIRIODENDRON TULIPIFERA	TULIP TREE	2.5" Cal.	PER PLAN		29
NYSSA SYLVATICA	BLACK TUPELO	2.5" Cal.	PER PLAN		41
PICEA SITCHENSIS	SITKA SPRUCE	Transplants (12"-18")	PER PLAN		113
PINUS CONTORTA VAR. CONTORTA	SHORE PINE	Transplants (12"-18")	PER PLAN		131
PINUS CONTORTA VAR. CONTORTA	SHORE PINE	4'-6'	PER PLAN		18
POPULUS BALSAMIFERA	BLACK COTTONWOOD	Live Stake	5' o.c.	32,619	1,504
POPULUS TREMULOIDES	QUAKING ASPEN	2 Yr. Seedling (3'-4')	PER PLAN		26
PSEUDOTSUGA MENZIESII	DOUGLAS FIR	2 Yrs. (12"-18")	PER PLAN		429
PSEUDOTSUGA MENZIESII	DOUGLAS FIR	6'-8'	PER PLAN		61
RHAMNUS PURSHIANA	CASCARA	2 Yr. Seedling (18"-36")	PER PLAN		6
THUJA PLICATA	WESTERN RED CEDAR	Transplants (12"-18")	PER PLAN		95
THUJA PLICATA	WESTERN RED CEDAR	6'-8'	PER PLAN		53
THUJA PLICATA 'EMERALD CONE'	DWARF RED CEDAR	4'-6'	PER PLAN		7
TSUGA HETEROPHYLLA	WESTERN HEMLOCK	Transplants (12"-18")	PER PLAN		31
TSUGA HETEROPHYLLA	WESTERN HEMLOCK	6'-8'	PER PLAN		5
SHRUBS					
ACER CIRCINATUM	VINE MAPLE	Seedling (18"-36")	8' o.c.		26
AMELANCHIER ALNIFOLIA	WESTERN SERVICEBERRY	Seedling (6"-12")	4' o.c.	565	
GARRYA ELLIPTICA	SILKTASSEL	Seedling (18"-36")	4' o.c.		35
HOLODISCUS DISCOLOR	OCEAN SPRAY	Seedling (18"-36")	4' o.c.	6,391	
LONICERA INVOLUCRATA	BLACK TWINBERRY	Seedling (18"-36")	4' o.c.	711	
MAHONIA AQUIFOLIUM	TALL OREGON GRAPE	Seedling (18"-36")	4' o.c.	12,501	
MAHONIA AQUIFOLIUM	TALL OREGON GRAPE	Seedling (18"-36")	4' o.c.		30
PHILADELPHUS LEWISII	MOCK ORANGE	Seedling (18"-36")	4' o.c.	2,015	
PHYSOCARPUS CAPITATUS	PACIFIC NINEBARK	Seedling (18"-36")	4' o.c.		121
RIBES BRACTEOSUM	STINK CURRANT	Seedling (18"-36")	4' o.c.	2,789	
ROSA GYMNOCARPA	BALD-HIP ROSE	Seedling (18"-36")	4' o.c.	2,904	
ROSA NUTKANA	NOOTKA ROSE	Seedling (18"-36")	5' o.c.	1,623	
ROSA NUTKANA	NOOTKA ROSE	Seedling (18"-36")	5' o.c.		312
RUBUS SPECTABILIS	SALMONBERRY	Seedling (18"-36")	4' o.c.	7,769	
RUBUS PARVIFLORUS	THIMBLEBERRY	Seedling (18"-36")	4' o.c.	470	
SALIX PURPUREA 'NANA'	DWARF ARCTIC BLUE WILLOW	Seedling (18"-36")	5' o.c.		117
SALIX SITCHENSIS	SITKA WILLOW	Seedling (18"-36")	4' o.c.	3,044	
SALIX SITCHENSIS	SITKA WILLOW	Seedling (18"-36")	4' o.c.		88
SPIRAEA DOUGLASII	WESTERN SPIRAEA	Seedling (18"-36")	4' o.c.		336
SYMPHORICARPOS ALBUS	SNOWBERRY	Seedling (18"-36")	4' o.c.	10,289	
CONCRETE PLANTER					
CORNUS STOLONIFERA	RED-OSIER DOGWOOD	5' LIVE STAKE	2 per pipe		22
ROSA PISOCARPA	CLUSTER ROSE	5 GAL.	3 per pipe		39
SCOENOPLECTUS ACUTUS	HARDSTEM BULRUSH	5 GAL.	8 per pipe		72
BROKEN CONCRETE @ CULVERT					
DESCHAMPSIA CESPITOSA	PACIFIC HAIRGRASS	PLUGS	12" o.c.	350	
SCRUB SHRUB				126,727	
TYPICAL PLANTING - SEE PROTOTYPICAL LAYOUT, SHEET L-5.06					
MARSH POND WEIR MIX				4,059	
ROSA PISOCARPA	CLUSTER ROSE			1/3	
CORNUS STOLONIFERA	REDTWIG DOGWOOD			1/3	
LONICERA INVOLUCRATA	BLACK TWINBERRY			1/3	
SEED MIXES					
SEED MIX 'A' (LAWN)				76,743	
SEED MIX 'B'				113,621	
SEED MIX 'C'				35,274	
SEED MIX 'D' & 'E' (EMERGENT & AQUATIC)				321,828	
SEED MIX 'F' (MARSH PONDS)				102,348	
SEED MIX 'G' (BERM - SIDES)				34,755	
SEED MIX 'H' (BERM - TOP)				4,175	

NOTE:
PLANT SCHEDULE 'SQUARE FOOTAGE" AND "QUANTITY" INFORMATION PROVIDED FOR REFERENCE. CALCULATE ALL PLANT QUANTITIES & AREAS PRIOR TO BID SUBMITTAL.

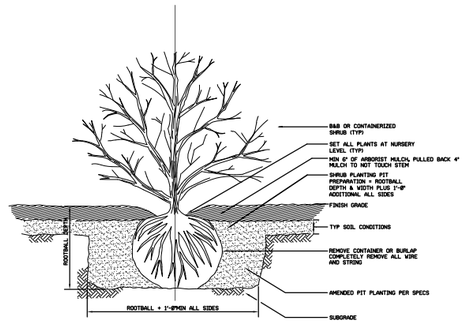
NOTE: SEE SHEET L5.06 FOR PROTOTYPICAL PLANTING FOR ALL HABITAT & WETLAND AREAS



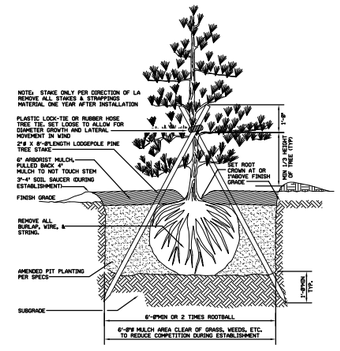
1 BARE ROOT / SEEDLING PLANTINGS
SCALE: NTS



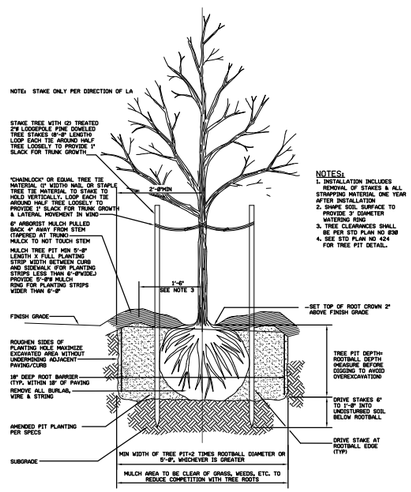
2 PLANTING PATTERN (FOR ON-CENTER SPACING)
SCALE: NTS



3 SHRUB PLANTING
SCALE: NTS



4 CONFIFEROUS TREE PLANTING
SCALE: NTS



5 DECIDUOUS TREE PLANTING
SCALE: NTS

>>>>CAUTION<<<<
CALL BEFORE YOU DIG!

NOT LESS THAN TWO OR MORE THAN TEN BUSINESS DAYS PRIOR TO COMMENCING EXCAVATION OR DEMOLITION, SECURE THE SERVICES OF A COMMERCIAL UNDERGROUND UTILITIES LOCATOR SERVICE TO IDENTIFY BELOW-GROUND IMPROVEMENTS THAT MAY NOT BE INDICATED ON THE DRAWINGS. FOR IRRIGATION SYSTEMS, CALL SEATTLE PARKS PLUMBING SHOP (206 684 7070)

>>800 424 5555<<

PROJECT TEAM:

- The Berger Partnership - Landscape Architects (Prime Consultant)
- Sheldon & Associates - Wetlands Consultant (OTAK)
- D.A. Hogan & Associates - Athletic Fields Consultant
- Magnusson Klemencic Associates - Civil Engineers
- Sparling - Electrical Consultants

NO.	REVISION – AS BUILT	DATE
3		
2		
1	ADD PLANTING NOTE	

REVIEWED: _____ PARK ENGINEER _____ DATE

All work done in accordance with the City of Seattle Standard Plans and Specifications in effect on the date shown above, and supplemented by Special Provisions.

SEATTLE PARKS AND RECREATION

WARREN G. MAGNUSON PARK

MAGNUSON PARK PHASE II

AS BUILT

PLANTING SCHEDULE & DETAILS

DESIGNED GM | DATE 12/15/2009
DRAWN RM | SHEET ____ OF ____
CHECKED JY

ORDINANCE NO. See Cover sheet
CONTRACT NO. 1744
SCALE

L-5.07

Appendix B: Performance Standards

Table A—Hydrology Performance Standards				
Habitat Area	**Performance Standards**	**Monitoring Activity**	**Monitoring Schedule**	**Adaptive Management Responses**
Enhanced Wetlands designed to have inundation and saturation from passive backwatering	• Create a minimum of 12 inches of inundation for a minimum of 5 consecutive months/year in years of normal precipitation levels.	Measure Staff Gauges	Once/month December 1 – June 1; Years 1, 2, 3, 5, 7, 10.	• Increase depths of inundation by raising outlets. • Diminish permeability of leaky berms or other non-fixed outlets.
	• Create saturated soils within 12 inches of the surface for a minimum of 5 consecutive months/year in years of normal precipitation levels.	Original (2006): Measure Piezometers. Modified (2009): Estimate extents of ponded water in created wetlands.		
Enhanced Wetlands designed to have inundation and saturation by grading	• Create impounded water levels of a minimum of 16 inches for a minimum of 5 consecutive months/year in years of normal precipitation levels.	Measure Staff Gauges		• Deepen the excavation to increase depths of inundation. • Restrict size of outlets to increase volume of retention and prolong inundation.
	• Create saturated soils within 12 inches of the surface for a minimum of 5 consecutive months/year in years of normal precipitation levels.	Original (2006): Measure Piezometers. Modified (2009): Estimate extents of ponded water in created wetlands.		
Created Wetlands designed to have inundation and saturation	• Create impounded water levels of a minimum of 16 inches for a minimum of 5 consecutive months/year in years of normal precipitation levels.	Measure Staff Gauges		• Deepen the excavation to increase depths of inundation. • Restrict size of outlets to increase volume of retention.
	• Create saturated soils within 12 inches of the surface for a minimum of 5 consecutive months/year in years of normal precipitation levels.	Original (2006): Measure Piezometers. Modified (2009): Estimate extents of ponded water in created wetlands.		• Add organic soil to facilitate capillary action. • Modify wetland outlet to prolong adjacent inundation.

Table B—Water Quality Performance Standards				
Habitat Area	**Performance Standards**	**Monitoring Activity**	**Monitoring Schedule**	**Adaptive Management Responses**
Enhanced Wetlands designed to have inundation and saturation from passive backwatering	• Provide appropriate pre-treatment for portions of the existing untreated stormwater currently being discharged to Lake Washington • Pre-treat stormwater, and then run it through over 2,000 linear feet of created and enhanced wetland habitats prior to discharging to an existing storm-drain pipe leading to Lake Washington	• Grab samples at appropriate water discharge sites • Grab samples at appropriate sites in the enhanced wetlands	Original (2006): Once/month for November 1 – May 31; Years 1, 2, 3, 5, 7, 10. Modified (2011): Once/month for Years 1, 2, and 10	According to 2005 Seattle Parks and Recreation BMP's for Turf Management, fertilizer, herbicides and pesticides are not likely to be a component of water discharged from natural grass playing fields. • If used, alter fertilization and herbicide application on natural turf fields. • Extend time period that water is retained within wetlands. • Alter hydrological regimen for recharging wetlands.
Enhanced Wetlands designed to have inundation and saturation by grading		• Grab samples at appropriate water discharge sites • Grab samples at appropriate sites in the enhanced wetlands		
Created Wetlands designed to have inundation and saturation		• Grab samples at appropriate water discharge sites • Grab samples at appropriate sites in the created wetlands		

Table C—Vegetative Performance Standards				
Habitat Area	**Performance Standards**		**Monitoring Activity**	**Adaptive Management Responses**
WETLANDS Created and Enhanced.	EMERGENTS	• No one species will constitute more than 50% presence in the wetland. • By Year 3, a minimum of 4 species per community will be present which can include appropriate native spp. • By Year 3, there will be 45-60% emergent aerial cover, including desirable native spp.	In 1 meter plots measure: • % aerial cover by species Years 1, 2, 3, 5, 7, 10 In whole wetland measure: • species composition and note spp. with ≥ 50 % aerial cover Years 1, 2, 3, 5, 7, 10	• Determine causes of species failure. • Install plug, seed, live stake, bare-root or potted material (as appropriate) of additional plants. May substitute other hydrologically appropriate species. • Increase management of invasives or competitive species. • Provide temporary irrigation during establishment period. • Provide herbivory protection. Possibilities include: netting for emergents; and rodent collars or fencing for trees and shrubs.
	SHRUBS: live stakes	• At a minimum % aerial cover will be: 25% by year 3, 50% by year 5, and >70% by year 7. • Plants should be vigorous beginning in Year 1.	In 5 meter plots measure: • % survival Years 1 & 2 (except for live-stakes); • % aerial cover and vigor by species Years 3, 5, 7, 10	
	SHRUBS: live stakes planted @ shading density	• At a minimum % aerial cover will be: >50% by year 3 and >70% by year 5.		
	SHRUBS: potted or bareroot	• A minimum of 80% survival of installed plants for Years 1 and 2. • % aerial cover should be at least: 25% by year 3, 50% by year 5, and >70% by year 7. • By Year 3, planting clusters will have a minimum of 4 shrub spp including desirable native spp. • Plants should be vigorous.		
	SHRUBS: potted or bareroot planted @ shading density	• A minimum of 80% survival of installed plants for Years 1 and 2. • At a minimum % aerial cover will be: >50% by year 3 and >70% by year 5 • Richness parameter is absent as function is to provide vigorous competitive growth for canopy closure goal		

Table C—Vegetative Performance Standards				
Habitat Area	**Performance Standards**		**Monitoring Activity**	**Adaptive Management Responses**
WETLANDS: Created and Enhanced.	TREES: live stakes TREES: live stakes @ shading density	• At a minimum % aerial cover will be: 25% by year 3, 50% by year 5, and >70% by year 7. • Plants should be vigorous.	In 10 meter plots measure: • % survival Years 1 & 2, except live-stakes; • % aerial cover and vigor by species Years 3, 5, 7, 10	• Determine causes of species failure. • Install plug, seed, live stake, bare-root or potted material (as appropriate) of additional plants. May substitute other hydrologically appropriate species. • Increase management of invasives or competitive species. • Provide temporary irrigation during establishment period. • Provide herbivory protection. Possibilities include rodent collars or fencing for trees and shrubs. • In upland areas, add or increase mulch depth for trees and shrubs.
	TREES: potted or bareroot TREES: pot or bareroot planted @ shading density	• At least 80% survival of installed plants for Years 1&2. • % aerial cover should be: 20-30% by year 3, 50-60% by year 5, and >70% by year 7. • By Year 3, planting clusters will have a minimum of 2 tree spp., not including desirable native spp. • Plants should be vigorous.		
UPLANDS: Buffers (Created and Enhanced Wetlands); Created Forest Areas	SHRUBS: potted or bareroot	• At least 80% survival of installed plants for Years 1&2. • % aerial cover should be at least: 25% by year 3, 50% by year 5, and >70% by year 7. • By Year 3, planting clusters will have a minimum of 2 tree spp. not including desirable native spp. • Plants should be vigorous.	In 5 meter plots measure: • % survival Years 1 & 2; • % aerial cover and vigor by species Years 3, 5, 7, 10	
	TREES: potted or bareroot	• At least 80% survival of installed plants for Years 1&2. • % aerial cover should be: 20-30% by year 3, 50-60% by year 5, and >70% by year 7. • By Year 3, planting clusters will have a minimum of 2 tree spp. not including desirable native spp. • Plants should be vigorous.	In 10 meter plots measure: • % survival Years 1 & 2; • % aerial cover and vigor by species Years 3, 5, 7, 10	
CONIFER Under-planting of Existing Forest Areas	TREES: potted or bareroot installed by the end of Year 4.	• Survival of 80% of installed plants by 3 years post-installation. • Plants should be vigorous.	In 10 meter plots measure: • % survival Years 1, 2 and 3 post-installation; • vigor by species Years 3, 5, 7, 10	
Monitoring Schedule for all Habitat Areas: Once/year by August 1 in Years 1, 2, 3, 5, 7, and 10 Document with photographs from permanent photo points during all monitoring events				

Table D—Non-native Invasive Species Performance Standards			
Performance Standards	**Monitoring Activity**	**Monitoring Schedule**	**Adaptive Management Responses**
Removal and effective control of non-native invasive species to the following Performance Standards: • Lombardy poplar (*Populus nigra*): 100% removal by end of Year 2 in the Phase 2 project area. • Himalayan and evergreen blackberries (*Rubus armeniacus* and *R. laciniatus*): 100% removal by Year 3 in the Phase 2 project area. • Scotch broom (*Cytisus scoparius*): 100% removal by Year 3 in the Phase 2 project area. • Japanese knotweed and hybrids (*Polygonum cuspidatum, P. bohemicum, P. sachalinense*): 100% removal by Year 3 in the Phase 2 project area. • Reed canary-grass (*Phalaris arundinacea*): installation of native species at high densities (over-planting) in the planting areas of the Phase 2 project area with RCG by Year 2. Reduction in vigor and stem density of RCG in areas of over-planting by Year 5.	The entire Phase 2 project area will be monitored for all managed non-native invasive species: • Patches will be identified and located in as-builts or at Year 1 monitoring. • Monitoring plots will focus on the existing or former invasive patches. Plots will include the entire patch. Patches will be monitored to watch for re-sprouting or recolonization of managed species. • Document with photographs from permanent photo points.	For all managed invasives: • Twice/year Years 1, 2, and 3. Early growing season (prior to June 30) and late growing season (by August 30) to ensure that rapid maintenance actions can be undertaken to remove/control invasives. • Years 5, 7, 10 (spring/summer) monitoring may be reduced to once/year depending upon presence of invasives.	• Increased monitoring frequency to allow faster maintenance action response time. • Re-grubbing of roots, re-application of sheet mulch, and/or re-application of wood chips. • Increased frequency of stem injection of Japanese knotweed • Active mowing between clumps/rows of woody plants to reduce above-ground stock of reed canary grass.
Performance Standards Apply to the Entire Phase 2 Project Area.			

Table E—Existing Groves and Informal Trails Performance Standards				
Monitoring Parameter	**Performance Standards**	**Monitoring Activity**	**Monitoring Schedule**	**Adaptive Management Responses**
Existing Stands and Groves of Trees	• Maintain the extent and improve the species composition of existing groves of trees and saplings within the Phase 2 Project Area that are designated for monitoring by under-planting with late seral stage conifer saplings.	• Document locations, approximate boundaries, general conditions and composition of existing groves of trees and saplings within the Project Area that are designated for monitoring.	• Groves will be identified and located in as-builts drawings or at Year 1 monitoring.	• Groves will be augmented or replanted if they are damaged during site construction.
		• Document with photographs from permanent photo points. • Document the sizes, species composition, and general conditions of the groves.	• Once/year coincides with annual vegetation monitoring for Years 1, 2, and 3.	
Informal Trails	• Block access, eliminate, and post informational signage on all informal trails through the habitat area that are noted for removal, by end of Year 2 of construction.	• Confirm condition of barriers, informational signage, and trail conditions.	• Once/year coincides with annual vegetation monitoring for Years 1, 2, 3, 5, 7, 10.	• Reinstall effective barriers; • Post additional signage • Deconstruct trails through ripping of soils and replanting with un-inviting plant (e.g. wild rose).
Performance Standards Apply to the Entire Phase 2 Project Area				

Table F—Wildlife Use and Condition of Habitat Structures Performance Standards			
Performance Standards	**Monitoring Activity**	**Monitoring Schedule**	**Adaptive Management Responses**
• At the completion of installation, there will be an average of 4 –6 habitat structures per acre in habitat areas of the Phase 2 project area. • Habitat structures may include brush piles, LWD, and/or rock piles. • Brush piles should be a minimum of approximately 5x5 feet wide and 3-4 feet high at installation. • LWD will be no less than 8" diameter at the smallest end, and no less than 3 feet long. • Rock piles will be no smaller than 3x3 feet wide and average of 2 feet high. Rocks should be an average of 4-6 inches minimum in 'diameter' with the intent to form a pile with substantial spacing between/underneath rocks for refuge.	• Document the location and approximate dimensions of brush piles, LWD, and rock piles in the As-builts. Note presence, dimensions, locations, and provide photo-documentation in the baseline/as-built report..	• Identify and locate Habitat Structures in As-Built drawings.	• Augment brush piles with additions if they become too compressed or diminished over time. • Add additional pieces of LWD if ones are too decomposed or use indicates need for more; • Replenish rock piles or remove invasives (blackberry) which may establish in them.
	• Note evidence of use (trails in/out, scat, droppings, grazing, observed perching activity, etc.) of habitat structures. • Observe and document with photographs, the dimensions and conditions of habitat structures.	• Once/year coincides with annual vegetation monitoring for Years 1, 2, 3, 5, 7, 10.	
Performance Standards Apply to the Entire Phase 2 Project Area.			

Table G—Birds, Amphibians, and Aquatic Macroinvertebrates Performance Standards				
Animal/Habitat Area	**Performance Standards**	**Monitoring Activity**	**Monitoring Schedule**	**Adaptive Management Responses**
BIRDS All habitats associated with Phase 2 of the project	• No specific performance standard in place for birds	• Christmas bird count (Audubon Society)	• Once/year for bird counts.	• N/A
		• Monthly bird species tallies (Audubon Society)	• Once/month for species richness Years 1, 2, 3, 5, 7, 10.	
AMPHIBIANS All Monitored Wetland Areas in Phase 2 project area AND Frog Pond.	• Original (2006): Amphibian populations in Frog Pond, adjacent to Phase 2, will not show declines.	• Frog-Watch qualitative data from volunteers during breeding season (as opportunities arise)	• Once/week from January through July, every year.	• Inoculation of larval amphibians into appropriate habitat. • Establishment of appropriate aquatic plant community to facilitate amphibian survival and reproduction. • Monitoring of created wetland habitat to determine if breeding and rearing habitat is sufficient to offset any decline in Frog Pond larval population numbers
		• Egg mass counts during breeding season	• Original (2006): Once/month from January through May, every year. Modified (2009): Annual egg mass survey in March of Years 1-10	
		• Adult/larval counts	• Original (2006): Once/month from March through July, every year. Modified (2009): Annual larval survey in May of Years 1-10	
MACROINVERTEBRATES All Monitored Wetland Areas in Phase 2 project area.	• Macroinvertebrates: Index of Biological Integrity falls within an appropriate reference range.	• Dip net sweeps	• Original (2006): Once/month from March through September, every year. Modified (2009): Once/year in June of Years 1-10	• Establishment of appropriate aquatic community to facilitate macroinvertebrate survival and reproduction.
		• Dendy plate larval collections	• Original: Once/year, during a three week period in June. Modified (2011): Dendy sampling discontinuued	

Table H—Special One-Time Monitoring Events Performance Standards				
Monitoring Parameter	**Performance Standards**	**Monitoring Activity**	**Monitoring Schedule**	**Adaptive Management Responses**
Site Grading	• Maintain generalized pattern of water movement across the site in pre-existing conditions.	• Examination of as-builts to confirm that site grading reflects approved designs. • Document construction modifications with change-order approvals from design ecologist and agency staff.	Completion of grading of Phase 2 project area.	• Modify grades and elevations as necessary to achieve appropriate water movement and control erosion. • Document construction modifications with change-order approvals from design ecologist and agency staff.
Removal of Impervious Surfaces	• Remove 12 acres of existing impervious surfaces from the Phase 2 project area and dispose of the material appropriately off-site.	• Document removal of materials in As-Builts and include photographs in annual monitoring report.	At end of demolition stage of construction.	• If not possible to complete all at once, remove materials in stages and document % removal to agencies.
Construction of the New Trail for access that also maintains habitat exclusions	• Trail is completed that allows adequate pedestrian movement. • New trail eliminates informal portions of existing trails and maintains portions of the habitat zones as 'trail-free'.	• Document trail completion in As-Builts. • Document with photographs of site conditions and include in annual monitoring report.	At completion of construction activities.	• If necessary, construct New Trail in phases, and remove old trails in phases.
Construction of Educational Access Sites on the New Trail	• Appropriate active education access sites and nodes are located on the Trail such that students can access water and various habitat types in a manner that does not cause damage to habitat functions or water quality.	• Document in As-Builts • Document with photographs of site conditions and include in first monitoring report following completion of construction activities.	At completion of construction activities.	• If necessary, construct active education access sites on the New Trail in phases.
Construction of ADA Access on the New Trail	• The portions of trail designed to meet state and federal ADA standards are located to access water and habitats appropriately.	• Document in As-Builts • Document with photographs of site conditions and include in annual monitoring report.	At completion of construction activities.	• If necessary, phase construction of access sites which meet ADA standards on the New Trail.
Events are expected to occur once at the completion of construction.				

Appendix C: Methods

Contents:

Precipitation

Historic and current precipitation data was accessed from: the National Climatic Data Center http://www.ncdc.noaa.gov/oa/ncdc.html

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 November 2013 through June 2014. In addition, observations were made recorded during the monthly readings (see Figure C-1 below).

Figure C-1 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 hydrologic systems were made by Parks staff (see Figure C-2 below). Observations were made from November 2013 through June 2014.

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 slow 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

Permit conditions require water quality monitoring during all years of monitoring. Years 1 and 2 of water quality monitoring resulted in all performance standards being met. In a Technical Memorandum prepared by Otak, and dated November 2, 2011, Otak recommended that water quality monitoring be discontinued due to the high cost of monitoring and the performance standards having been met. A letter received from the Seattle District Army Corps of Engineers, dated November 15, 2011, concurred that water quality monitoring be eliminated for the remaining years of monitoring, except for Year 10. Therefore, no water quality monitoring results are included in this Year 5 monitoring report.

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 (AB); 30 emergent plots (EM); 24 scrub-shrub plots (SS); and 11 buffer plots (B)(see Tables C-1 through C-5 below). See As-built Sheets L-5.01 through L-5.05 in Appendix A for plot locations. Monitoring plots were sampled by Otak staff (Jessica Redman and Tom Early) and Seattle Parks Staff (Miriam Preus) on August 4, 5, and 11, 2014.

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 AB 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. EM plots are each one meter square, and 4-foot tall rebars were installed to mark the northeast corners of the plots. A one square meter PVC-pipe frame (each side is one meter long) is used for monitoring. The majority of the SS and B 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. SS 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). At least one marker of some plots had to be relocated in 2011 due to vandalism that occurred since last year's vegetation monitoring. Those plots included: EM3, EM24, SS1, SS2, SS17, SS20, B1, B4, B8, B9, and B10.

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-6 below) was measured, and plant health was assessed. See Appendix E for plot data and monitoring results.

Table C-1 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 Field Marshes				5	EM 26-30	4	SS 21-24	1	B 11
	Totals	**3**		**30**		**24**		**11**	

Table C-2 Aquatic Bed Monitoring Plots

Hydrologic 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-3 Emergent Monitoring Plots

Hydrologic 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-3 Emergent Monitoring Plots Continued

Hydrologic 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 Field 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 Marsh 4, N side of pond, S of drainage outlet from NE soccer field
	EM-30	Cr	1 meter^2	Soccer Field Marsh 4, SE side of pond, N of small secondary E-W berm by outlet

Table C-4 Scrub-Shrub Monitoring Plots

Hydrologic 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 Field 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 Marsh 4, E side of pond, on E-W mound SE of cottonwood stakes @ NE corner of pond

Table C-5 Buffer Monitoring Plots

Hydrologic 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 Field 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-6 below.

Table C-6 Non-native Invasive Species Assessed in the Phase 2 Mitigation Areas

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

Photopoints

A total of 18 permanent photopoints were established in 2009 (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 are located in areas that are frequented by park users, so these photopoints were established at/near easily identifiable geographic markers, and were not were not marked with fence posts. Photopoints located in areas were public access is discouraged were marked with fence posts. See Table C-7 for a description of the photopoint locations and As-built sheets L-5.01 through L-5.05 in Appendix A for maps. Also, see photos in Appendix D.

Table C-7 Photopoint Locations

Hydrologic 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 Field 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 and Existing Tree Groves

Monitoring for patches of non-native invasive species and existing tree groves was required in Years 1, 2, and 3. The performance criteria were met and no adaptive management or further monitoring was required. Therefore, no monitoring was conducted for this performance standard in Year 5.

Macroinvertebrates

Year 5 data on benthic invertebrates were collected on June 18, 2014 from 14 locations in the constructed wetlands and ponds in the Phase 2 Mitigation Area – see Table C-8 below for locations. Invertebrate collection involved sweep netting through the water column at each site.

Sweep sampling was conducted according to protocol derived from methodologies specifically created for depressional wetland invertebrate sampling (Minnesota Pollution Control Agency. 1992. *Macroinvertebrate community sampling protocol for depressional wetland monitoring sites*. Minnesota Pollution Control Agency, Biological Monitoring Program, St. Paul, MN). One Otak biologist and one Seattle Parks staff member used a heavy-handled D-frame aquatic dip net with a 500 micron mesh size. The two samples were collected in different locations within the same general area of the nearshore emergent vegetation zone; these sweeps are not intended to be replicates, but rather were done to sample the wetland more widely. Each dip net sample consisted 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 moved through the water column and vegetation downwards to near the bottom.

Identification: Insects from the sweep net samples from June 18, 2014 were identified to the taxonomic level of family, while other invertebrates were identified to higher taxonomic levels—generally to class, order/suborder, or family level if feasible. Invertebrates from samples were grouped into ordinal abundance categories of Abundant (50 plus individuals in a sample), Numerous (20 to 49 individuals in a sample), Moderate (10 to 19 individuals in a sample), and Few (1 to 9 individuals in a sample).

Table C-8 Macroinvertebrate Sampling Locations

Site	Location/Hydrologic System
12	Frog Pond (control)
13	Entrance Marsh #2
3	Rice paddy Northwest Quadrant
1	Rice paddy Southwest Quadrant
7	Rice Paddy Northeast Quadrant
5	Rice Paddy Southeast Quadrant
2 & 4	South Promontory Pond
6 & 8	North Promontory Pond
10	Outlet Pond from Promontory System (now combined with Linked Marsh #3, conducted monitoring in 2 locations)
9	Linked Marsh Pond #2
11	Linked Marsh Pond #3
14	Soccer Pond #1

Amphibians

Year 5 amphibian monitoring was conducted on March 27, 2013 and March 30, 2014 (egg mass survey); May 10, 2013 and May 6, 2014 (larvae sweep netting).

Sweep Netting: Two Otak biologists sampled representative pond areas with sweep nets (see Table C-9 below). The sampling effort per pond area depended on size and vegetation density, and varied between a total of 10 and 30 person-minutes, for a total of 2 hours and 50 minutes of active survey time. Larvae collected in nets were qualitatively ranked into one of 5 categories: State 1 (0-1 cm); Stage 2 (1-2 cm); Stage 3 (2-4 cm); Stage 4 (4-8 cm); Stage 5 (8+ cm).

Egg Mass Sampling: Egg mass sampling was conducted for the Phase 2 Mitigation constructed wetlands at 12 locations (see Table C-9 below). Egg mass sampling involved visual surveys of vegetation along the shorelines of the constructed wetlands, with four surveyors participating in the process. Egg masses were qualitatively ranked into one of three categories: Stage 1 (round eggs), Stage 2 (tadpoles visible within eggs), and Stage 3 (tadpoles hatched or very close to hatching).

Table C-9 Amphibian Monitoring Locations

Site	Location/Hydrologic System
1	Frog Pond (Control)
2	Rice Paddies— NW Quadrant
3	Rice Paddies— SW Quadrant
4	Rice Paddies— SE Quadrant
5	Rice Paddies— NE Quadrant
6	Linked Marsh 1
7	Linked Marsh 2
8	Entrance Marsh 1
9	Entrance Marsh 2
10	North and South Promontory Ponds
11	Promontory Outlet Pond (now combined with Linked Marsh 3)
12	Soccer Field Ponds

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 January through December 2014.

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 Magnusson 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."*

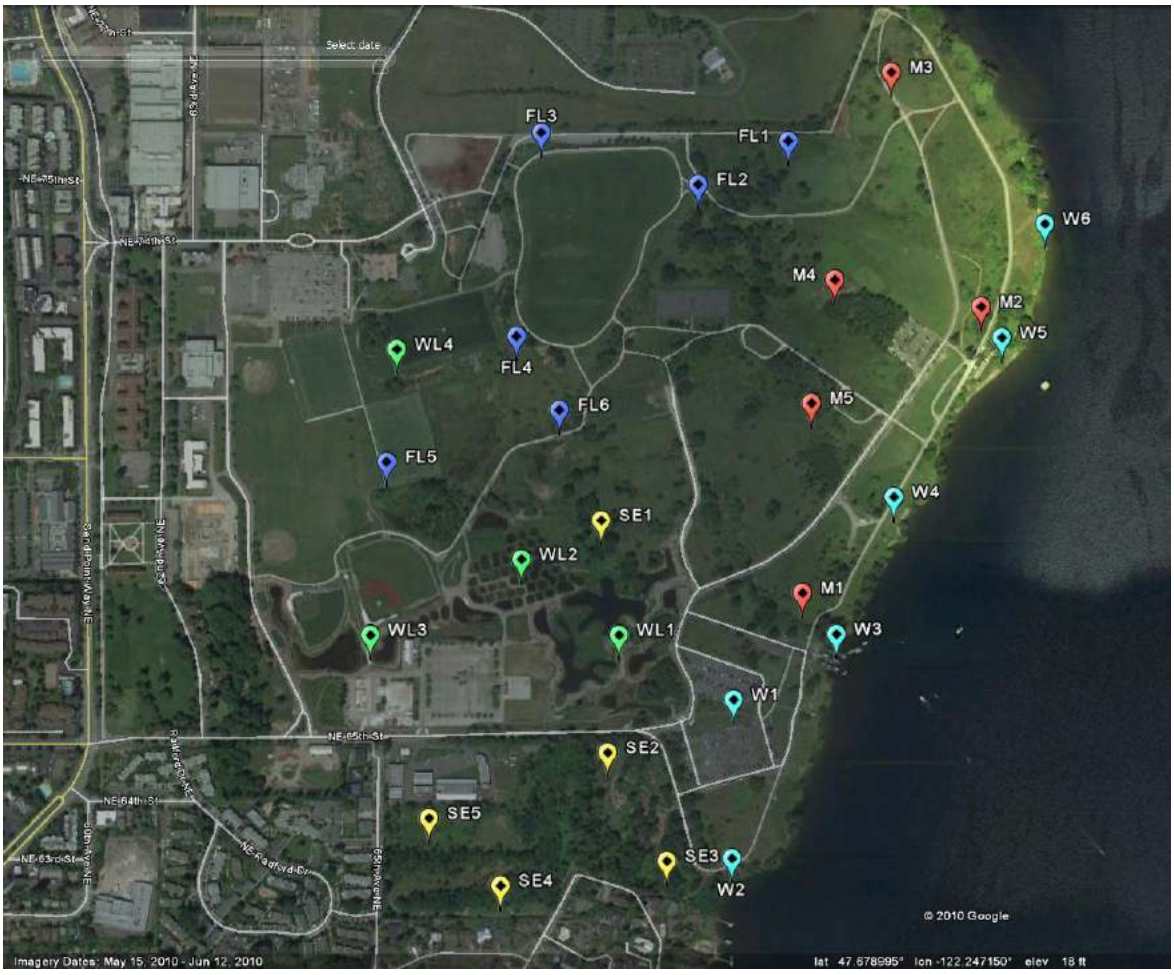


Figure C-4. Neighborhood Bird Project (NBP) Bird Survey Stations at Magnuson Park (Seattle Audubon Society).

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

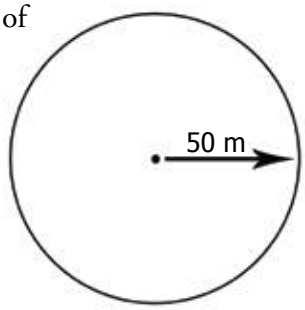
Neighborhood Bird Project

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.

Seattle Audubon Society
for birds and nature
8050 35th Avenue NE
Seattle WA 98115

Park:_____ **Loop:**_____

Leader: _____

Date: ____ /____ /____

Start time: _____ End time: _____

Neighborhood Bird Project

Station 1 Start time: _____ Weather: _____

species	*seen*	*heard*	*fly*	*nest*

After time but at Station 1: _____

Between Stations 1 and 2: _____

_____

_____

Station 2 Start time: _____ Weather: _____

species	*seen*	*heard*	*fly*	*nest*

After time but at Station 2: _____

Between Stations 2 and 3: _____

_____

_____

Station 3 Start time: _____ Weather: _____

species	*seen*	*heard*	*fly*	*nest*

After time but at Station 3: _____

Between Stations 3 and 4: _____

_____

_____

Station 4 Start time: _____ Weather: _____

species	*seen*	*heard*	*fly*	*nest*

After time but at Station 4: _____

Between Stations 4 and 5: _____

_____

_____

Return to: Seattle Audubon
8050 35th Ave NE
Seattle, WA 98115
ATTN: Neighborhood Bird Project

Neighborhood Bird Project

Station 5 Start time: _____ Weather: _____

species	*seen*	*heard*	*fly*	*nest*

After time but at Station 5: _____
Between Stations 5 and 6: _____
_____
_____

Station 6 Start time: _____ Weather: _____

species	*seen*	*heard*	*fly*	*nest*

After time but at Station 6: _____
Between Stations 6 and 7: _____
_____
_____

Station 7 Start time: _____ Weather: _____

species	*seen*	*heard*	*fly*	*nest*

After time but at Station 7: _____
Between Stations 7 and 8: _____
_____
_____

Station 8 Start time: _____ Weather: _____

species	*seen*	*heard*	*fly*	*nest*

After time but at Station 8: _____

NOTES:

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 8 May through 10 November 2010, 23 April through 13 October 2011, 11 June through 2 November 2012, 22 April through 11 November 2013, and 13 April through 10 November 2014. Dr. Paulson conducted surveys for 1 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. During the first three years, 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. Having previously determined that the Entrance system was the best for odonates, he sampled that area fairly thoroughly each visit in those years. During the last two years, the newest ponds by Lake Washington proved to be more productive and interesting, and he concentrated his surveys more at those ponds, visiting the Entrance ponds only every second or third trip (they have deteriorated in their value to Odonata as they are filling in and drying). 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. 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-plus 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.

Photo 1. 2002 Aerial Photo of the Phase 2 Development Area of Magnuson Park Before Construction.

Photo 2. Fall 2009 Aerial Photo of Magnuson Park After Construction.

Photo 3. Fall 2009 Aerial Photo of the Southern Portion of the Phase 2 Development Area After Construction, including: Athletic Fields 7, 8, and 9; new trail system; Entrance Marsh System; North Marsh and the Rice Paddies System; Promontory Pond System; and the Linked Marsh System with the new Navy Pond (see Figure 1 that follows for Hydrologic System names).

Figure 1. Magnuson Park Phase 2 Site Map, January 2009

Note the five hydrologic systems referenced in the Photopoint captions: Entrance Marsh System, Rice Paddies System, Promontory Pond System, Linked Marsh System (NE 65th St.), and the Soccer Field System. The Outlet Promontory Pond has since been expanded to include the northernmost Linked Marsh pond.

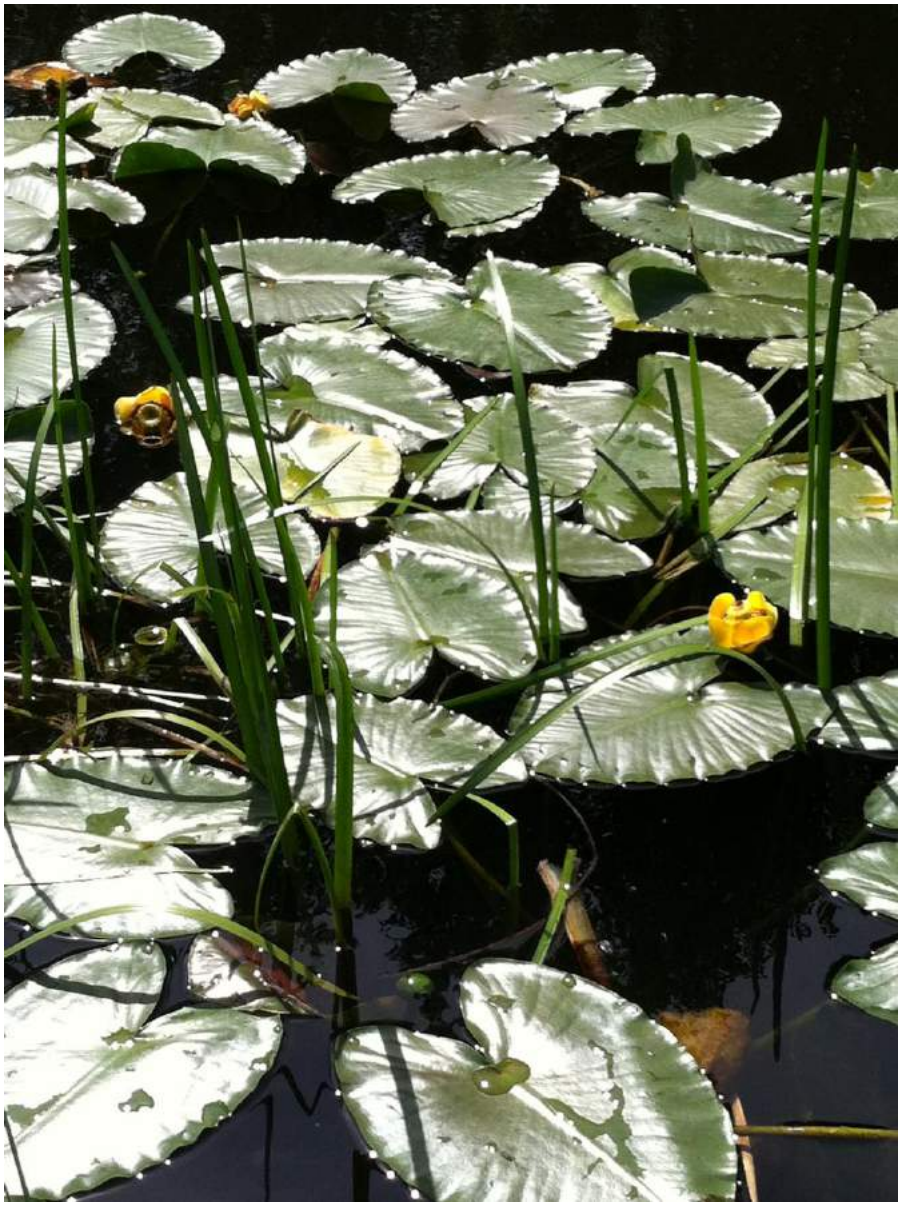


Photo 4. Yellow pond lily in Linked Marsh System.

Photo 5. Beaver lodge in North Promontory Pond.

Photo 6. Pacific Chorus Frog in the Soccer Field System.

Photo 7. Amphibian larvae sampling (Pacific Chorus Frogs).

Photo 8. Inundated vegetation on site, beaver-mediated.

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Photopoint 1. Looking south at the north end of Entrance Marsh 1 with the softball field (Field #9) to the southeast (left background); photo taken from the inlet structure on August 12, 2016.

Photopoint 2. Looking west at the east end of Entrance Marsh 1, with the softball field (Field #9) to the north (right background); photo taken from the bridge between Entrance Marshes 1 and 2 on August 12, 2016.

Photopoint 3. Looking east at the west end of Entrance Marsh 2 (foreground) and Building 308 (in the distance), with the baseball field (Field #8) to the north (left background); photo taken from the bridge between Entrance Marshes 1 and 2 on July 28, 2016.

Photopoint 4. Looking northwest at the east end of Entrance Marsh 7 (center left); photo taken from the southwest overlook berm on August 12, 2016.

Photopoint 5. Looking northeast at the southern portion of the rice paddies (left) and the northwest lobe of the South Promontory Pond (right); photo taken from the northeast corner of the southeast overlook berm on August 12, 2016.

Photopoint 6. Looking east at the western portion of the Rice Paddies (left) and the Entrance Marsh system (right); photo taken from the end of the path at the south end of the northwest Habitat Overlook berm on August 12, 2016.

Photopoint 7. Looking northeast at the North Marsh Pond (left) with the Existing Willow Island (right); photo taken from the east end of the northeast Habitat Overlook berm on August 12, 2016.

Photopoint 8. Looking north east at the southwest lobe of the South Promontory Pond (left) from the bench; photo taken on August 12, 2016.

Photopoint 9. Looking south at the east lobe of North Promontory Pond; photo taken from the weir (now beaver dam) between North Promontory Pond and Promontory Outlet Pond on August 22, 2016.

Photopoint 9A. Looking northeast at the southwest end of Promontory Outlet Pond; photo taken from the southeast end of the weir (now beaver dam) between Promontory Outlet Pond and North Promontory Pond on August 22, 2016.

Photopoint 9B. Looking northwest at the southwest end of Promontory Outlet Pond; photo taken from the southeast corner of the Promontory Outlet Pond, north of the northeast entrance path on August 22, 2016.

Photopoint 10. Looking east at the north end of Linked Marsh Pond 3 (now joined with Promontory Outlet Pond); photo taken from near the roadway at the east end of the trail on August 22, 2016.

Photopoint 11. Looking southwest at the east end of Linked Marsh Pond 2; photo taken from the west end of the east peninsula on August 22, 2016.

Photopoint 12. Looking east at the south end of Linked Marsh South Swale with the boat launch parking area in the background (left); photo taken from on top of the culvert under the southeast entrance path on August 12, 2016.

Photopoint 13. Looking west at the east end of Linked Marsh Pond 1 (center); photo taken from on top of the culvert under the southeast entrance path on August 12, 2016.

Photopoint 14. Looking northeast at west end of Linked Marsh West Swale; photo taken from the west end of the swale on August 22, 2016.

Photopoint 15. Looking south at the buffer on the north side of Soccer Field System Pond 1; photo taken from the small berm south of the madrone grove on July 23, 2016.

Photopoint 16. Looking west at Soccer Field System Pond 2; photo taken from the weir between Soccer Field System Ponds 2 and 3 on July 28, 2016.

Photopoint 16A. Looking northeast at the west end of Soccer Field System Pond 3 (in the foreground); photo taken from the weir between Soccer Field System Ponds 2 and 3 on July 28, 2016.

Photopoint 17. Looking west at the east end of Soccer Field Pond 3 (in the foreground); photo taken from the berm between Soccer Field Pond 3 and Soccer Field Pond 4 on July 28, 2016.

Photopoint 18. Looking northeast at the western portion of Soccer Field Marsh 4; photo taken from the berm between Soccer Field Pond 3 and Marsh 4 on July 28, 2016.

Photopoint 18A. Looking north and east at the eastern portion of Soccer Field Pond 4; photo taken from the south edge of Pond 4 on July 28, 2016.

Appendix E: Data

Contents:

Precipitation

Figure E-1. Histogram showing monthly precipitation at Sand Point in 2015-2016 water year (blue bars) and average monthly values for the preceding 25-year time period (red hollow bars).

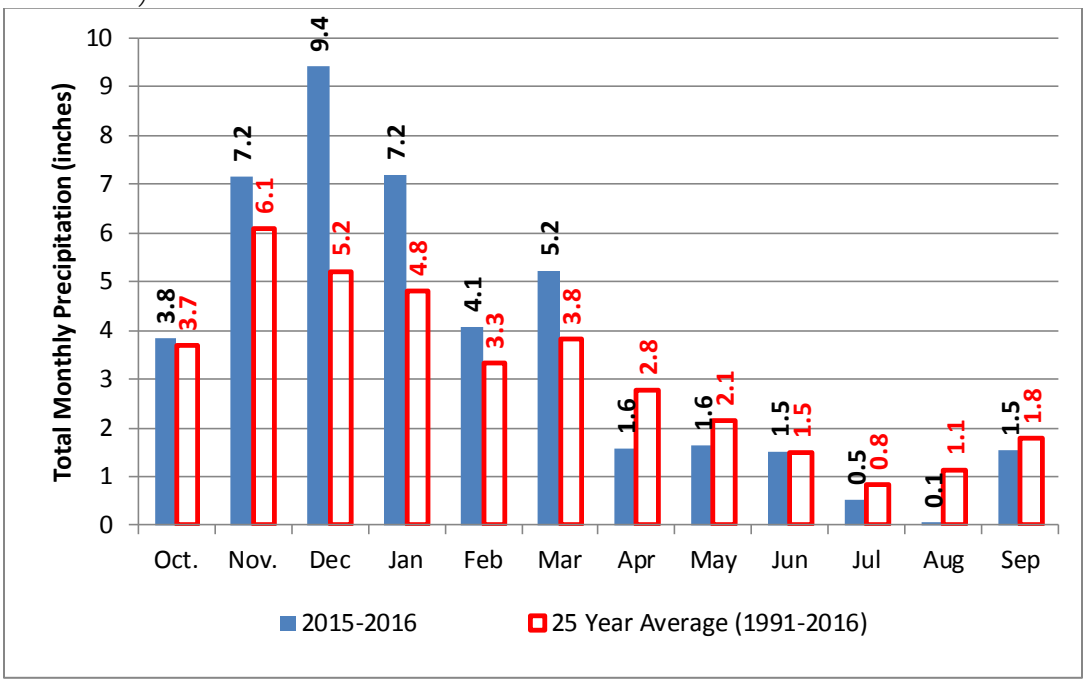
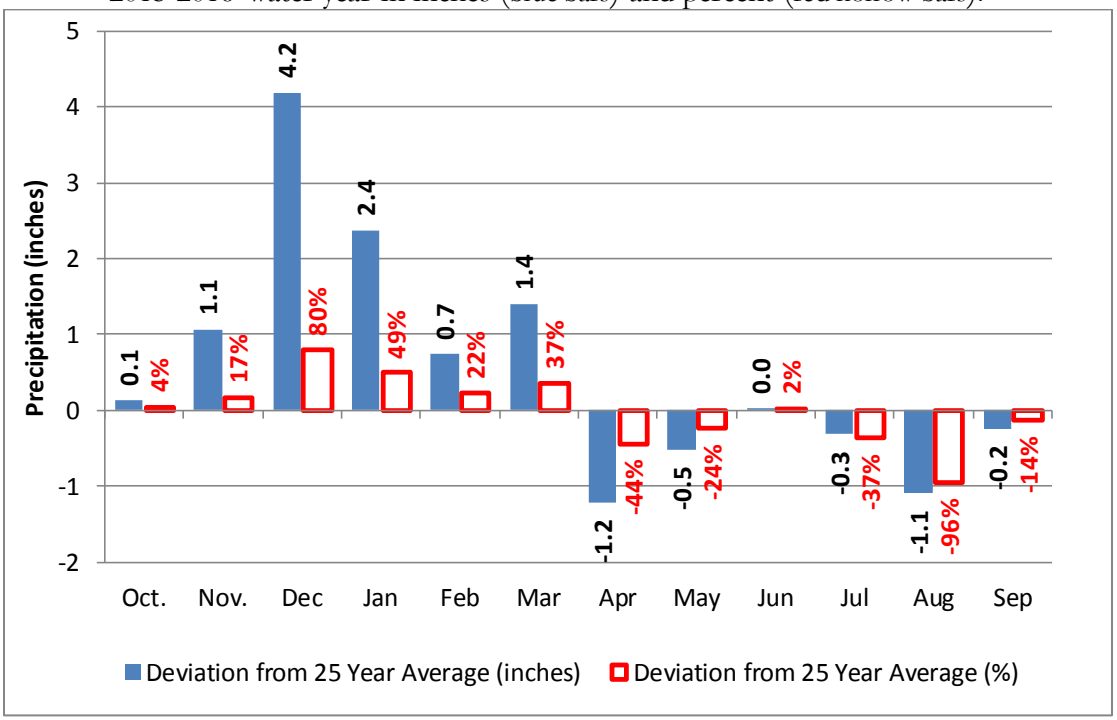


Figure E-2. Histogram showing deviation from 25-year average monthly precipitation values for 2015-2016 water year in inches (blue bars) and percent (red hollow bars).

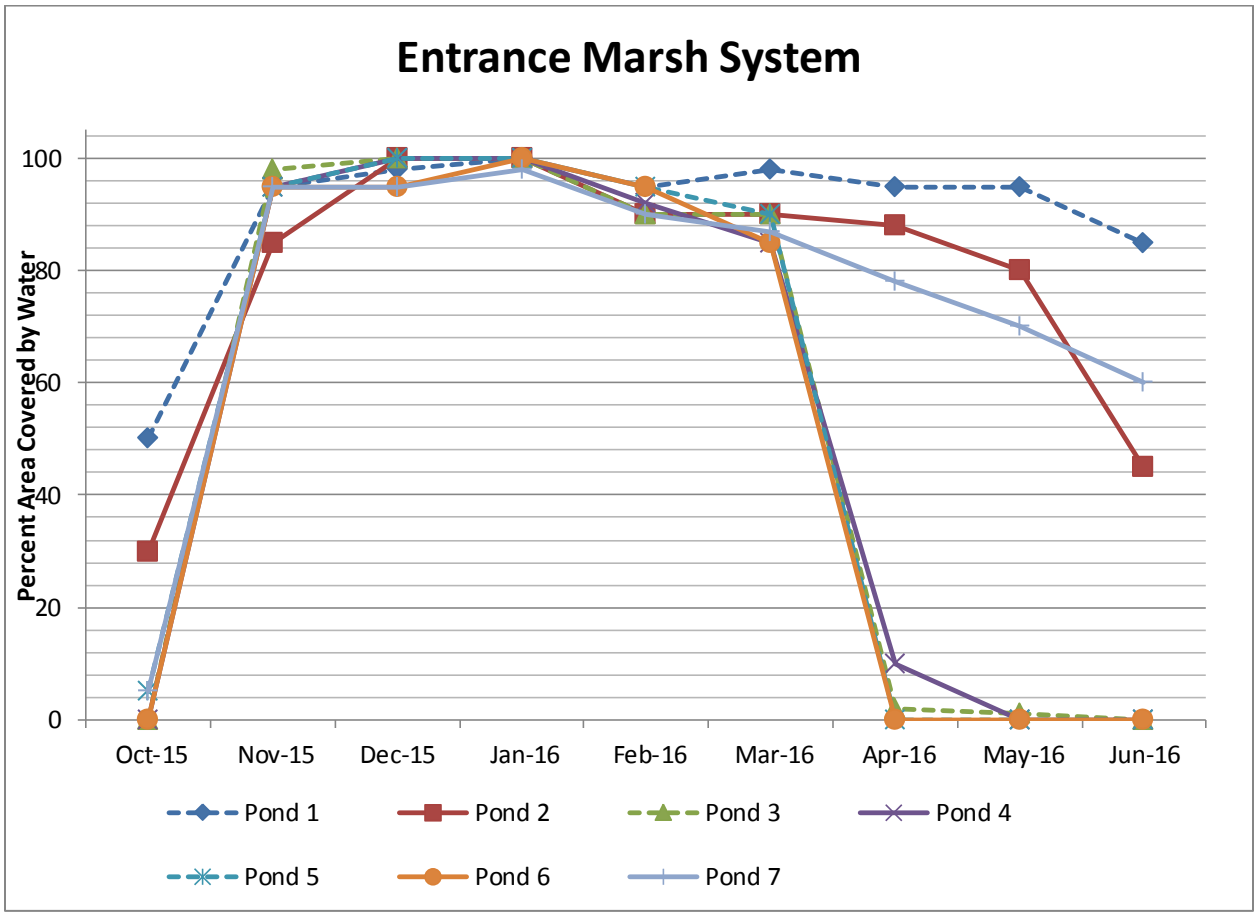


Hydrology

Observed Standing Water Results

Observed Standing Water Results of Individual Ponds Grouped by Hydrologic System

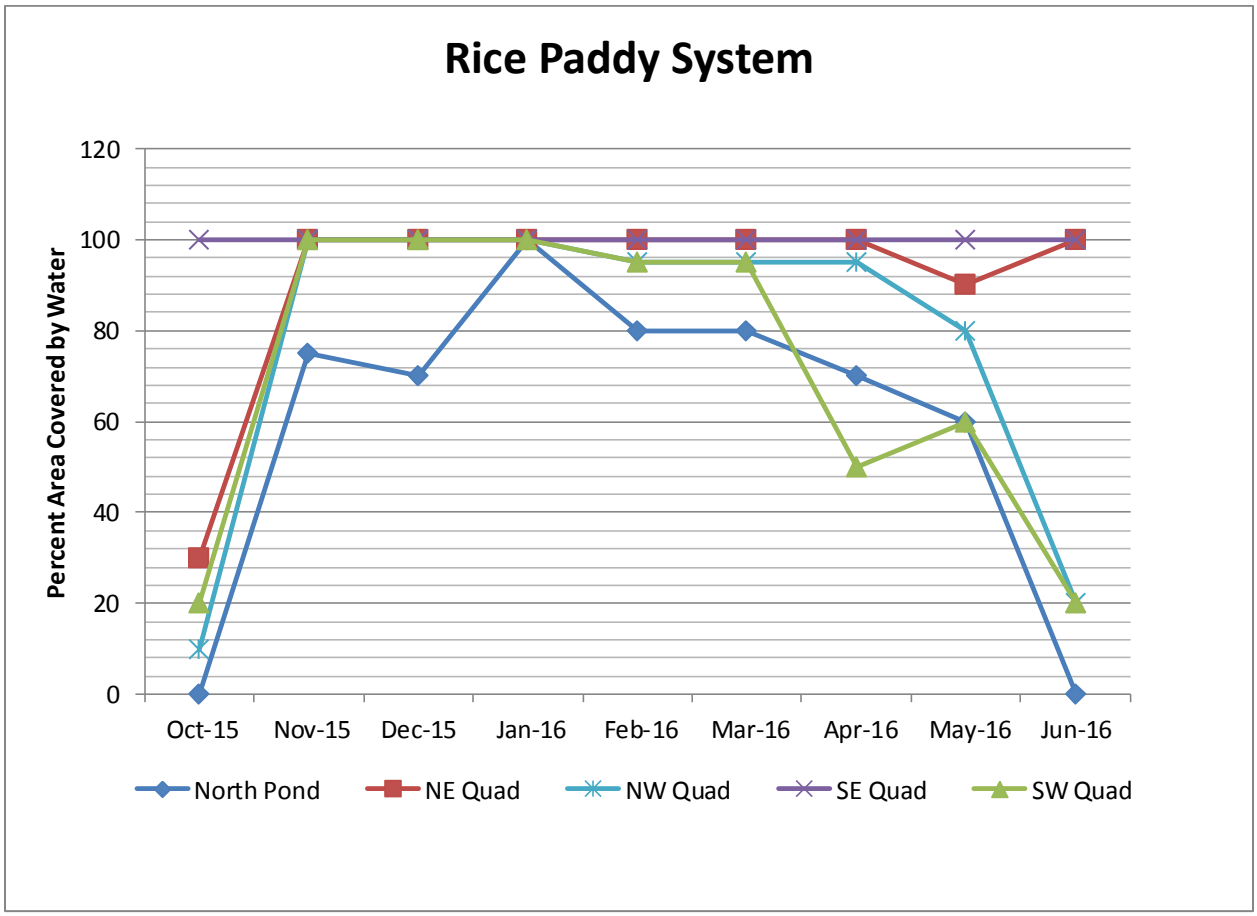
Figure E-3. Change in percent area covered with standing water at ponds in the Entrance Marsh System during the monitoring period (October 2015 through June 2016).



See **Figure E-8** below for Pond Locations in the **Entrance Marsh System**

Hydrology: Observed Standing Water Results (continued)

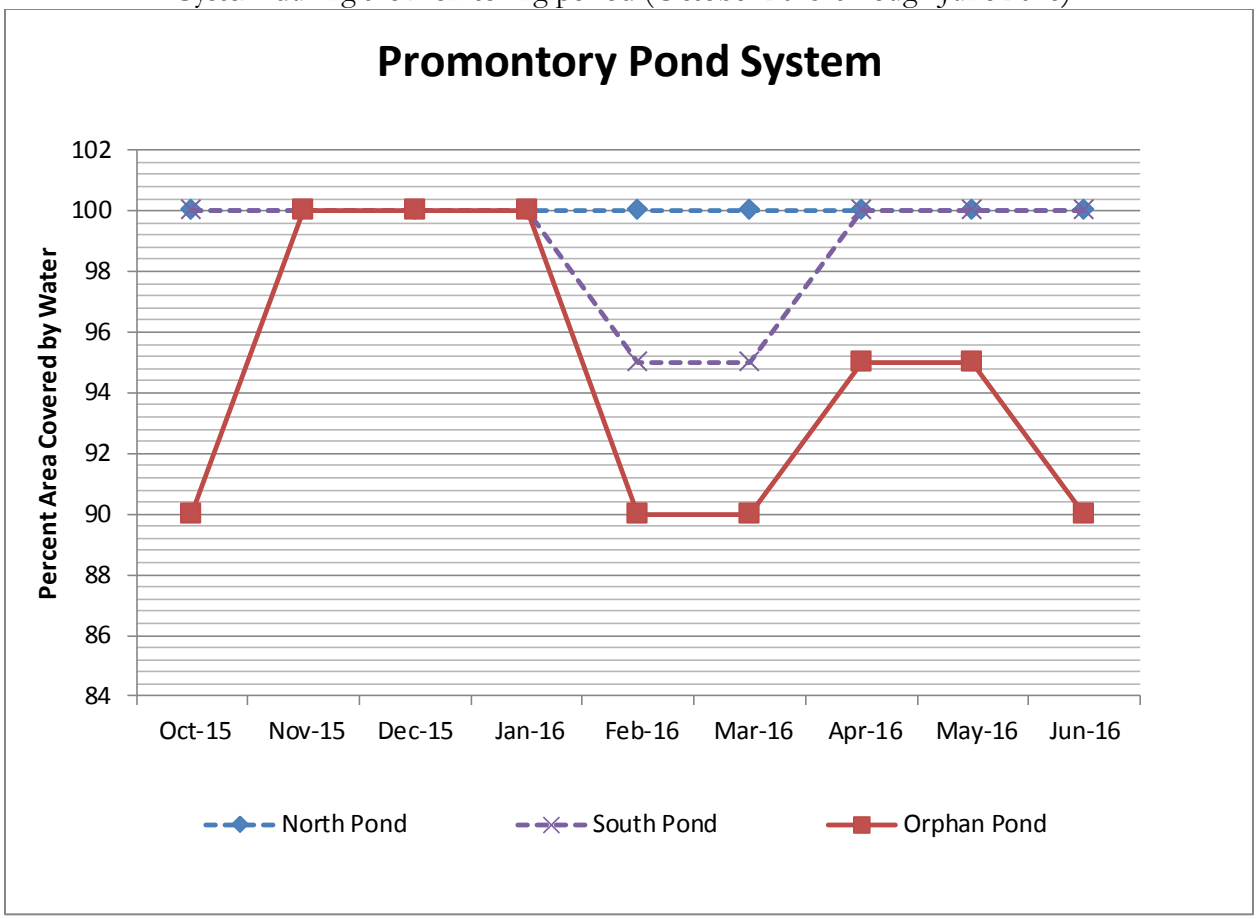
Figure E-4. Change in percent area covered with standing water at ponds in the Rice Paddy System during the monitoring period (October 2015 through June 2016).



See **Figure E-8** below for Quadrant Locations in the **Rice Paddy System**

Hydrology: Observed Standing Water Results (continued)

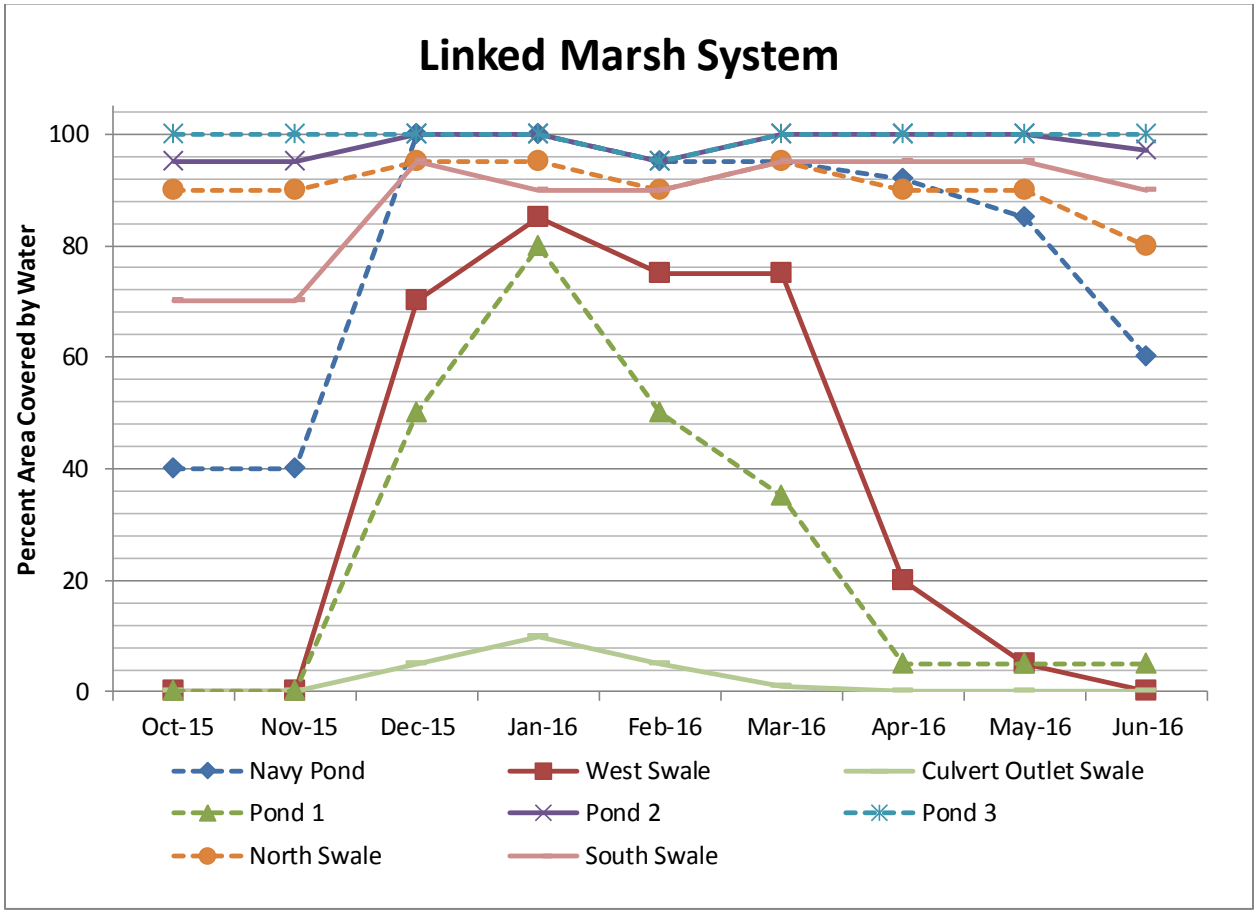
Figure E-5. Change in percent area covered with standing water at ponds in the Promontory Pond System during the monitoring period (October 2015 through June 2016).



See **Figure E-8** below for Pond Locations in the **Promontory Pond System**

Hydrology: Observed Standing Water Results (continued)

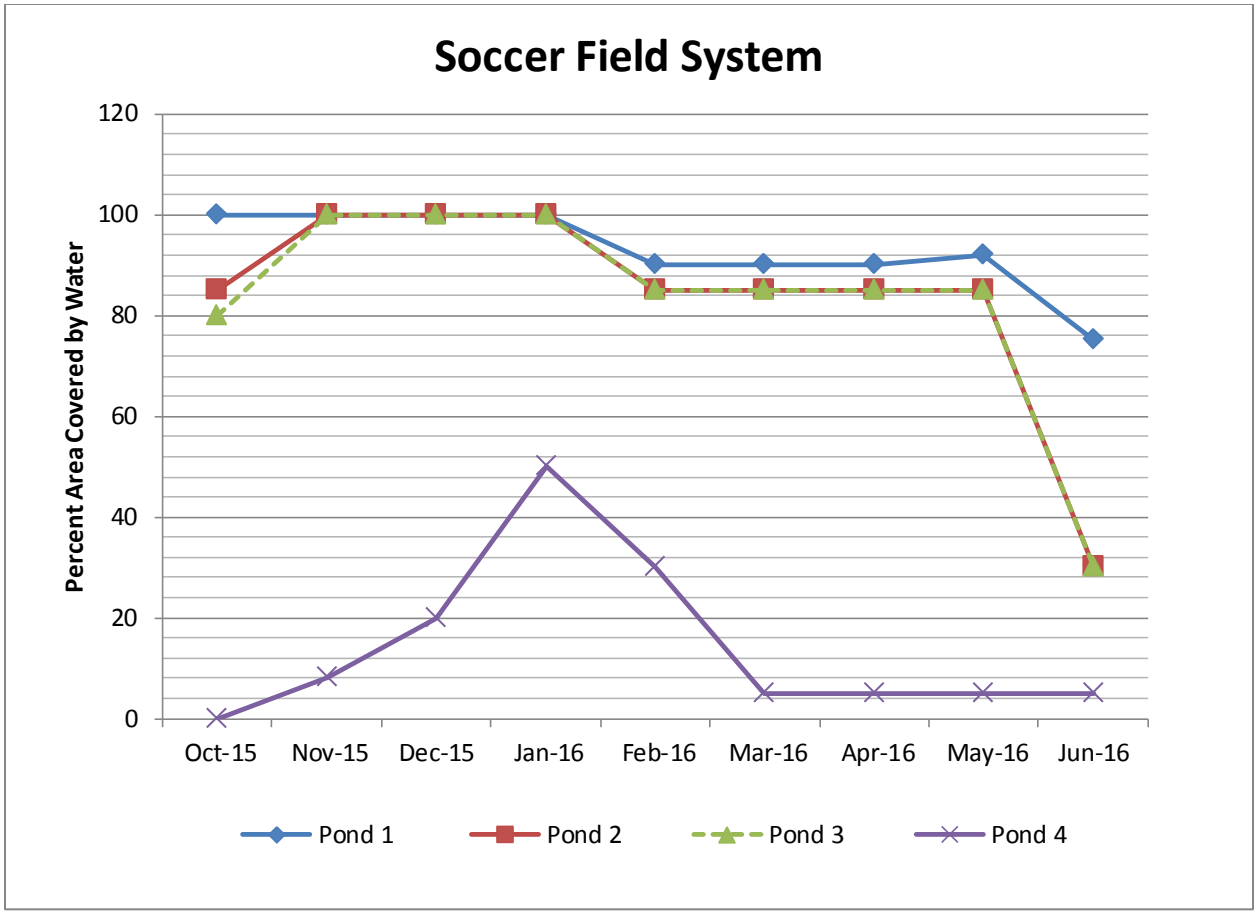
Figure E-6. Change in percent area covered with standing water at ponds in the Linked Marsh System during the monitoring period (October 2015 through June 2016).



See **Figure E-8** below for Swale and Pond Locations in the **Linked Marsh System**.

Hydrology: Observed Standing Water Results (continued)

Figure E-7. Change in percent area covered with standing water at ponds in the Soccer Field System during the monitoring period (October 2015 through June 2016).



See **Figure E-8** below for Swale and Pond Locations in the **Soccer Field System**.

Figure E-8. Hydrologic systems located within the mitigation area.

Water Quality

Permit conditions require water quality monitoring during all years of monitoring. Years 1 and 2 of water quality monitoring resulted in all performance standards being met. In a Technical Memorandum prepared by Otak, and dated November 2, 2011, Otak recommended that water quality monitoring be discontinued due to the high cost of monitoring and the performance standards having been met. A letter received from the Seattle District Army Corps of Engineers, dated November 15, 2011, concurred that water quality monitoring be eliminated for the remaining years of monitoring, except for Year 10. Therefore, no water quality monitoring results are included in this Year 7 monitoring report.

Vegetation: Monitoring Plot Data

Table E-1. Aquatic Bed Plots

2014 Aquatic Bed Plots **% Aerial Cover**		**AB1**	**AB2**	**AB3**	# Plots where species is present	% Plots where species is present	Average % cover in Plots where present
Alisma plantago-aquatica	water-plantain				0	0%	0.0
Elodea canadensis	common waterweed				0	0%	0.0
Glyceria occidentalis	Western mannagrass				0	0%	0.0
Lemna minor	common duckweed				0	0%	0.0
Naja sp.	water-nymph				0	0%	0.0
Schoenoplectus tabernaemontani	softstem bulrush				0	0%	0.0
Sparganium angustifolium	narrow-leaf burreed				0	0%	0.0
Veronica americana	American brooklime				0	0%	0.0
Algae	filamentous green algae				0	0%	0.0
Overall % Cover					0	0%	**0.0**

Note: Plots could not be surveyed due to inundation and backwatering from beaver dams.

Vegetation: Monitoring Plot Data (continued)

Table E-2. Emergent Plots

2016 Emergent Plots		Entrance Marsh System						Rice Paddies North Marsh		Rice Paddies						Promontory Pond System North and South Ponds				Prom Pond Outlet	Linked Marshes Navy Pond	Linked Marsh System					Socccer Field System					# Plots where species is present	% Plots where species is present	Sum of %'s	Average % cover of Plots where present
% Aerial Cover		EM1	EM2	EM3	EM4	EM5	EM6	EM7	EM8	EM9	EM10	EM11	EM12	EM13	EM14	EM15	EM16	EM17	EM18	EM19	EM20	EM21	EM22	EM23	EM24	EM25	EM26	EM27	EM28	EM29	EM30				
% Cover																																			
sorted by # plots																																			
Agrostis sp.	bentgrass				5																						1	1		1		4	13%	8	2.0
Algae	filamentous green algae																15	30											4			3	10%	49	16.3
Alisma plantago-aquatica	water-plantain																															1	3%	0	0.0
Carex obnupta	Slough sedge															10				20												2	7%	30	15.0
Caltha palustris	Marsh marigold															30																1	3%	30	30.0
Deschampsia cespitosa	tufted hairgrass																															1	3%	0	0.0
Eleocharis palustris	creeping spikerush			20				25		15		50		95							30	25										8	27%	260	32.5
Epilobium ciliatum	willow-herb													1								3		3				1	1	10	5	7	23%	24	3.4
Juncus acuminatus	tapertip rush			15																												1	3%	15	15.0
Juncus articulatus	jointed rush											2																				1	3%	2	2.0
Juncus effusus	soft rush	35	60	30	20	50	15			5	10					15								50	5		55	90	94		45	15	50%	579	38.6
Lemna minor	duckweed																25															1	3%	25	25.0
Lycopus americanus	Bugleweed																			40												1	3%	40	40.0
Poa palustris	Fowl bluegrass			10	15																											2	7%	25	12.5
Rumex crispus	curly dock																															2	7%	0	0.0
Scirpus cyperinus	woolly sedge																				30	45			8							5	17%	83	16.6
Scirpus microcarpus	small-fruited bulrush											5																				2	7%	5	2.5
Scirpus tabernaemontani	softstem bulrush			5			5	35	65					1							20		95									7	23%	226	32.3
Typha latifolia	cattail										35	15								39				5						70	35	7	23%	199	28.4
	other					1																			25								3	10%	26	8.7
	grass sp.																											1			20	2	7%	21	10.5
Elodea, Nitella, Chara	Aquatics												100		100	40	5								1	100						6	20%	346	57.7
	Total Emergent % Cover	**35**	**60**	**80**	**40**	**51**	**20**	**60**	**65**	**20**	**45**	**72**	**100**	**97**	**100**	**95**	**45**	**30**		**99**	**80**	**73**	**95**	**30**	**39**	**100**	**56**	**93**	**99**	**81**	**100**	**29**		**1960**	67.6
Shrubs/Saplings																																			
sorted by # plots																																			
Salix sp.	willow						50		35	80												20		5	40		50				80	6	20%	360	60.0
Spiraea douglasii	Spirea	5			5																											2	7%	10	5.0
Populus balsamifera	Cottonwood				45																											1	3%	45	45.0
Rosa pisocarpa	Peafruit rose					15																										1	3%	15	15.0
Rosa nutkana	Nootka rose						50																									1	3%	50	50.0
Invasives																																			
sorted by # plots																																			
Lotus corniculata	bird's-foot trefoil													3						1	2			10			25		1			6	20%	42	7.0
Phalaris arundinacea	reed canarygrass	5	7								10												3	3								5	17%	28	5.6
	Total Invasive Cover	**5**	**7**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**10**	**0**	**0**	**3**	**0**					**1**	**2**	**0**	**3**	**13**	**0**		**25**	**0**	**1**	**0**	**0**	**10**	**33%**	**70**	7.0

Vegetation: Monitoring Plot Data (continued)

Table E-3. Scrub-Shrub Plots

2016 Scrub-Shrub Plots		Entrance Marsh System						Rice Paddies North Marsh	Rice Paddies			Promontory Pond System North and South Ponds						Prom Pond Outlet	Linked Marsh System			Soccer Field System				# Plots where species is present	% Plots where species is present	Average % cover of Plots where present
		SS1	SS2	SS3	SS4	SS5	SS6	SS7	SS8	SS9	SS10	SS11	SS12	SS13	SS14	SS15	SS16	SS17	SS18	SS19	SS20	SS21	SS22	SS23	SS24			
% Aerial Cover																												
Installed Shrubs																												
Abies grandis	grand fir						5											1		3						3	13%	3.0
Cornus sericea	red-osier dogwood			8			15				40														30	4	17%	23.3
Crataegus douglasii	black hawthorn					40		15										1	20					5		5	21%	16.2
Lonicera involucrata	black twinberry		8	5						8	35										40		10	5		7	29%	15.9
Malus fusca	western crabapple																	10		5						2	8%	7.5
Physocarpus capitatus	pacific ninebark									90	15													10		3	13%	38.3
Rosa nutkana	Nootka rose						5	70	40			7	35				15		34	25					20	9	38%	27.9
Rosa pisocarpa	clustered wild rose	40			1		15			2	5							10					10			7	29%	11.9
Rubus spectabilis	salmonberry						5								4				1		10					4	17%	5.0
Salix sp.	willow	15	7	55	70	5	20	10	10			30		10	75	50	30	78		20	5	75	15	10	20	20	83%	30.5
Spiraea douglasii	Douglas spirea	40	10						50			40	25						7		10	20	10	15	10	11	46%	21.5
Symphoricarpos albus	snowberry												15						3	2			25	1	5	6	25%	8.5
Woody Volunteers/Seeded																												
Acer macrophyllum	bigleaf maple	5																								1	4%	5.0
Alnus rubra	red alder				5		30												35		10					4	17%	20.0
Corylus cornuta	hazelnut																						10			1	4%	10.0
Populus balsamifera ssp. trichocarpa	black cottonwood (seedlings)		15	5				5					1							45				40		6	25%	18.5
Prunus sp.	cherry															10										1	4%	10.0
Total Woody Cover including Volunteers		**100**	**40**	**73**	**76**	**45**	**95**	**100**	**100**	**100**	**95**	**77**	**76**	**10**	**79**	**60**	**45**	**100**	**100**	**100**	**75**	**95**	**80**	**86**	**85**	**24**		**78.8**
Herbaceous Volunteers																												
Carex sp.	sedge			1	1							2			2			10	15	3						7	29%	4.9
Daucus carota	Queen Anne's lace																							1		1	4%	1.0
Elocharis palustris	Spikerush																											
Epilobium ciliatum	willow-herb				1										3	2										3	13%	2.0
Equisetum sp.	horsetail				5										5						3					3	13%	4.3
Juncus effusus	soft rush		10									3	10				3					1			1	6	25%	4.7
Lactuca serriola	prickly lettuce			1	10																					2	8%	5.5
Lemna minor	duckweed													40	25	3	3									4	17%	17.8
Plantago sp.	plantain		10																							1	4%	10.0
Ranunculus repens	creeping buttercup														4											1	4%	4.0
Schoenoplectus sp.	tule		25																							1	4%	25.0
Scirpus cyperinus	woolly sedge												3	5	5											3	13%	4.3
Scirpus microcarpus	small-fruited bulrush					3				3																2	8%	3.0
	grass sp.		30	20	10	61	15			15	5	3	3		8			20		15		1				13	54%	15.8
	other			5	1							12				4	10							1	1			
	aquatic bed species											37				7	56											
Total Herbaceous Cover		**0**	**75**	**27**	**28**	**64**	**15**	**0**	**0**	**18**	**5**	**57**	**16**	**45**	**52**	**16**	**72**	**30**	**15**	**18**	**3**	**2**	**0**	**2**	**2**	**24**		**23.4**
Invasives																												
Cirsium sp.	thistle			1		3				1																3	13%	1.7
Hedera helix	English ivy																								1	1	4%	1.0
Lotus corniculata	bird's-foot trefoil			10								5	15			4					2					5	21%	7.2
Phalaris arundinacea	reed canarygrass		5		5	10	1					5	5	30	6		15			7						10	42%	8.9
Rubus armeniacus	Himalayan blackberry			15	15	7		1	1	1	3		7									5	20	15	10	12	50%	8.3
Rubus laciniatus	evergreen blackberry			5		10																				2	8%	7.5
Total Invasive Cover		**0**	**5**	**31**	**20**	**30**	**1**	**1**	**1**	**2**	**3**	**10**	**27**	**30**	**6**	**4**	**15**	**0**	**0**	**7**	**2**	**5**	**20**	**15**	**10**	**21**		**11.7**

Vegetation: Monitoring Plot Data (continued)

Table E-4. Buffer Plots

2016 Buffer Plots		Entrance Marsh System		Rice Paddies	Promontory Pond System North and South Ponds				Outlet Prom Pond	Linked Marsh System		Soccer Field System	# Plots where species is present	% Plots where species is present	TotalSum of percents	Average % cover of Plots where present
		B1	B2*	B3	B4	B5	B6	B7	B8*	B9	B10	B11				
% Aerial Cover																
Installed Shrubs																
Crataegus douglasii	Douglas' hawthorn							1					1	9%	1	1.0
Mahonia aquifolium	tall Oregon grape	10											1	9%	10	10.0
Malus fusca	Western crabapple		10							5			2	18%	15	7.5
Rosa nutkana	Nootka rose			35			5			90			3	27%	130	43.3
Salix sp.	willow		15			5		20	15		5	8	6	55%	68	11.3
Spiraea douglasii	Douglas spirea			60			5	7		2			4	36%	74	18.5
Symphoricarpos albus	snowberry	5		5					19	3			4	36%	32	8.0
Installed Trees																
Picea sitchensis	Sitka spruce							5					1	9%	5	5.0
Pseudotsuga menziesii	Douglas fir							2			3		2	18%	5	2.5
Thuja plicata	Western red cedar	5											1	9%	5	5.0
Woody Volunteers/Seeded																
Alnus rubra	red alder					85	80				65		3	27%	230	76.7
Populus balsamifera ssp. trichocarpa	black cottonwood (seedlings)	25	35		2	5	5		45				6	55%	117	19.5
Acer macrophyllum	bigleaf maple							7					1	9%	7	7.0
Oemleria cerasiformis	osoberry		5										1	9%	5	5.0
Betula papyrifera	paper birch		7										1	9%	7	7.0
Total Woody Cover	**Including Volunteers**	**45**	**72**	**100**	**2**	**95**	**95**	**42**	**79**	**100**	**73**	**8**	**11**		**711**	**64.6**
Herbaceous Volunteers																
Daucus carota	Queen Anne's lace		7		2			3					3	27%	12	4.0
Epilobium ciliatum	willow-herb										3		1	9%	3	3.0
Equisetum arvense	field horsetail					15		1					2	18%	16	8.0
Juncus effusus	soft rush	10			5	1		1				1	5	45%	18	3.6
Lactuca serriola	prickly lettuce		5						1		2		3	27%	8	2.7
Plantago sp.	plantain				5								1	9%	5	5.0
Poacea	grasses	45	20		50			60		8	60		6	55%	243	40.5
Ranunculus repens	creeping buttercup	5				2					2	45	4	36%	54	13.5
Rumex sp.	dock				1			1					2	18%	2	1.0
	other	6				2	3	4	3				5	45%	18	3.6
Total Herbaceous Cover	**Including Volunteers**	**66**	**32**	**0**	**63**	**20**	**3**	**70**	**4**	**8**	**67**	**46**	**11**	**100%**	**379**	**34.5**
Invasives																
Cirsium sp.	thistle				2			7	1			3	4	36%	13	3.3
Hedera helix	English iwy		10			1							2	18%	11	5.5
Lotus corniculata	bird's-foot trefoil				25						2	1	3	27%	28	9.3
Phalaris arundinacea	reed canarygrass		3		7	3		5				15	5	45%	33	6.6
Rubus armeniacus	Himalayan blackberry	5	15	1		5		5	18		10	20	8	73%	79	9.9
Rubus laciniatus	evergreen blackberry							3					1	9%	3	3.0
	Total Invasive Cover	**5**	**28**	**1**	**34**	**9**	**0**	**20**	**23**	**0**	**12**	**39**	**11**		**171**	15.5

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Patches of Non-native Invasive Species and Existing Tree Groves

Monitoring for patches of existing tree groves was required in Years 1, 2, and 3. The performance criteria were met and no adaptive management or further monitoring was required. Therefore, no monitoring was conducted for this performance standard in Year 5 or Year 7.

Monitoring pre-existing patches of non-native invasive plant species was completed on October 9, 2015, in addition to the vegetation sampling completed in summer 2016. See monitoring plot data in Tables E-1, E-2, E-3, and E-4.

Macroinvertebrate Data

Invertebrates Recovered Abundance Key:

Abundant: 50 or more individuals
Numerous: 20 to 39 individuals
Moderate: 10 to 19 individuals
Few (X): Fewer than 10 (number of individuals)

*Terrestrial or semi-aquatic taxa

^Sample site dry; no invertebrates collected

Table E-5. Macroinvertebrate Results from June 18, 2014 Sampling Event

Macroinvertebrate Data			
Table E-15. Macroinvertebrates			
Invertebrates Collected from Magnuson Phase 2 Wetlands			
Date: 6/18/14			
Site #	**Location/ Hydrologic System**	**Invertebrates Recovered**	**Abundance**
13	**Entrance Marsh Complex Ponds 1 & 2**	Amphipoda, *Gammarus/Crangonyx*	Moderate
		Caecidotea, Isopod	Few (3)
		Chaobonidae	Moderate
		Coleoptera, Hydrophilidae (adult)	Few (1)
		Coleoptera, Hydrophilidae (larvae)	Few (1)
		Collembola*	Few (1)
		Copepod	Moderate
		Daphnia	Numerous
		Diptera, Ceratopogonidae	Few (1)
		Diptera, Chironomidae	Numerous
		Diptera, Culicidea	Few (5)
		Diptera, Dixidae	Few (4)
		Ephemoroptera, Leptophlebiidae	Few (1)
		Gastropoda, Lymnaeidae	Moderate
		Gastropoda, Physidae	Numerous
		Gastropoda, Planorbidae	Few (1)
		Hemiptera, Aphididae*	Few (1)
		Hemiptera, Cicadellidae*	Few (1)
		Hemiptera, Hebridae	Few (1)
		Hemiptera, Notonectidae	Moderate
		Hirundinea, Erpodbdellidae	Few (2)
		Odonata, Nymph	Few (1)
		Odonata, Lestidae	Few (7)
		Ostracod	Few (4)

Table E-5 – continued. Macroinvertebrate Results from June 18, 2014 Sampling Event

Site #	Location/ Hydrologic System	Invertebrates Recovered	Abundance
7	Rice Paddy Northeast Quadrant	Amphipoda, *Gammarus/Crangonyx*	Few (7)
		Coletoptera, Distiscidae (adult)	Few (2)
		Coleoptera, Elmidae (adult)	Few (1)
		Copepod	Few (2)
		Daphnia	Numerous
		Diptera, Ceratopogonidae	Few (2)
		Diptera, Charoboridae	Few (9)
		Diptera, Culicidae	Few (3)
		Diptera, Dixidae	Few (3)
		Gastropoda, Lymnaeidae	Moderate
		Gastropoda, Physidae	Moderate
		Gastropoda, Planorbidae	Few (4)
		Hemiptera, Hebridae	Few (5)
		Hemiptera, Notonectidae	Few (1)
		Hirundinea	Few (1)
		Isopoda, Caecidotea	Few (2)
		Odonata, Coenagrionidae	Few (1)
5	Rice Paddy Southwest Quadrant	Aranae (spider)*	None^
		Amphipoda, *Gammarus/Crangonyx*	None^
		Coleoptera, Dystichidae	None^
		Collembola*	None^
		Coleoptera, Hydrophilidae	None^
		Diptera, Ceratopogonidae	None^
		Diptera, Chironomidae	None^
		Diptera, Dixidae	None^
		Ephemeroptera, Baetidae	None^
		Gastropoda, Lymnaeidae	None^
		Gastropoda, Physidae	None^
		Hemiptera, Aphididae*	None^
		Hemiptera, Corixidae	None^
		Hemiptera, Notonectidae	None^
		Isopoda, Caecidotea	None^
		Odonata, Coenagrionidae	None^

Table E-5 – continued. Macroinvertebrate Results from June 18, 2014 Sampling Event

Site #	Location/ Hydrologic System	Invertebrates Recovered	Abundance
3	Rice Paddy Northwest Quadrant	Amphipoda, *Gammarus/Crangonyx*	Moderate
		Coleoptera, Hydrophilidae	Few (1)
		Copepod	Moderate
		Daphnia	Moderate
		Diptera, Chaoboridae	Ferw (5)
		Diptera, Chironomidae	Few (5)
		Diptera, Culicidae	Ferw (3)
		Diptera, Dixidae	Few (7)
		Diptera, Empididae (larva)	Few (1)
		Ephemeroptera, Baetidae	Few (2)
		Gastropoda, Lymnaeidae	Moderate
		Gastropoda, Physidae	Moderate
		Gastropoda, Planorbidae	Few (5)
		Hemiptera, Aphididae*	Few (3)
		Hemiptera, Corixidae	Few (2)
		Hemiptera, Delphacidae	Few (2)
		Hemiptera, Hebridae	Few (5)
		Oligochaeta, Nereidae (prob.)	Few (1)
1	Rice Paddy Southeast Quadrant	Amphipoda, *Gammarus/Crangonyx*	Moderate
		Coleoptera, Dysticidae	Moderate
		Coleoptera, Hydrophilidae	Few (6)
		Collembola*	Few (3)
		Daphnia	Numerous
		Diptera, Ceratopogonidae	Few (1)
		Diptera, Charoboridae	Few (4)
		Diptera, Chironomidae	Numerous
		Diptera, Culicidae	Numerous
		Diptera, Dixidae	Numerous
		Diptera, Empididae	Few (1)
		Gastropoda, Lymnaeidae	Numerous
		Hemiptera, Aphididae*	Few (2)
		Hemiptera, Cicadellidae*	Few (1)
		Hemiptera, Miridae*	Few (1)
		Hemiptera, Notonectidae	Few (2)
		Odonata, Coenagrionidae	Few (2)
		Odonata, Lestidae	Few (4)
		Ostracod	Moderate

Table E-5 – continued. Macroinvertebrate Results from June 18, 2014 Sampling Event

Site #	Location/ Hydrologic System	Invertebrates Recovered	Abundance
6 & 8	North Promontory Pond	Amphipoda, *Gammarus/Crangonyx*	Moderate
		Coleoptera, Hydrophilidae	Few (1)
		Copepod	Few (2)
		Daphnia	Few (3)
		Diptera, Ceratopogonidae	Moderate
		Diptera, Chaoboridae	Few (5)
		Diptera, Chironomidae	Numerous
		Diptera, Cucilidae	Few (4)
		Diptera, Empididae	Few (1)
		Ephemeroptera, Baetidae	Few (1)
		Ephemeroptera, (pupae)	Few (2)
		Gastropoda, Lymnaeidae	Few (1)
		Gastropoda, Physidae	Few (3)
		Gastropoda, Planorbidae	Few (2)
		Hemiptera, Notonectidae	Few (6)
		Odonata, Aeshnidae	Few (2)
		Odonata, Coenagrionidae	Few (1)
2 & 4	South Promontory Pond	Amphipoda, *Gammarus/Crangonyx*	Moderate
		Coleoptera, Hydrophilidae	Few (1)
		Diptera, Chironomidae (adult)	Few (2)
		Diptera, Chironomidae	Abundanct
		Ephemeroptera, Baetidae	Few (1)
		Odonata, Coenagrionidae	Few (6)
		Odonata, Lestidae	Few (2)

Table E-5 – continued. Macroinvertebrate Results from June 18, 2014 Sampling Event

Site #	Location/ Hydrologic System	Invertebrates Recovered	Abundance
10	Outlet Pond from Promontory System	Amphipoda, *Gammarus/Crangonyx*	Moderate
		Collembola*	Few (1)
		Copepod	Few (6)
		Daphnia	Few (8)
		Diptera, Ceratopogonidae	Few (2)
		Diptera, Chironomidae	Few (7)
		Ephemeroptera, (pupae)	Few (1)
		Gastropoda, Lymnaeidae	Moderate
		Gastropoda, Physidae	Moderate
		Hemiptera, Cercopidae*	Few (1)
		Hemiptera, Cicadellidae*	Few (2)
		Hemiptera, Corixidae	Few (1)
		Hemiptera, Notonectidae	Few (9)
		Odonata, Lestidae	Few (1)
9	Linked Marsh Pond #2	Amphipoda, *Gammarus/Crangonyx*	Few (4)
		Copepod	Moderate
		Daphnia	Abundant
		Diptera, Ceratopogonidae	Few (2)
		Diptera, Charoboridae	Moderate
		Diptera, Chironomidae	Moderate
		Ephemeroptera, Baetidae	Few (1)
		Gastropoda, Lymnaeidae	Few (3)
		Hemiptera, Miridae*	Few (1)
		Odonata, Coenagrionidae	Few (2)

Site #	Location/ Hydrologic System	Invertebrates Recovered	Abundance
14	Soccer Pond #1	Amphipoda, *Gammarus/Crangonyx*	Few (8)
		Aranae (spider)*	Few (1)
		Caecidotea, Isopod	Few (3)
		Coleoptera, Dysticidae	Few (1)
		Coleoptera, Hydrophilidae (adult)	Few (2)
		Coleoptera, Hydrophilidae (larvae)	Few (5)
		Collembola*	Few (2)
		Diptera, Chironomidae	Few (4)
		Diptera, Empididae (adult)	Few (2)
		Diptera, Phoridae (adult)	Few (1)
		Diptera, Stratiomyidae	Few (8)
		Diptera, Tipulidae (adult)	Few (1)
		Gastropoda, Lymnaeidae	Numerous
		Gastropoda, Physidae	Moderate
		Gastropoda, Planorbidae	Few (1)
		Hemiptera, Hebridae	Few (4)
		Hydracarina	Few (1)
		Hymenoptera, Scelionidae*	Few (1)
		Odonata, Zygoptera (pupa)	Few (2)
12	Frog Pond (Control)	Aranae (spider)*	None^
		Amphipoda, *Gammarus/Crangonyx*	None^
		Diptera, Charoboridae	None^
		Diptera, Chironomidae	None^
		Diptera, Tipulidae	None^
		Gastropoda, Lymnaeidae	None^
		Hemiptera, Corixidae	None^
		Hemiptera, Hebridae	None^
		Hemiptera, Miridae*	None^
		Hemiptera, Notonectidae	None^
		Isopoda, Caecidotea	None^
		Odonata, Aeshnidae	None^
		Oligochaeta, Nereidae (prob.)	None^

Amphibian Data

Amphibian monitoring at Magnuson was conducted on March 27, 2013, March 30, 2014, and March 16, 2016 (egg mass survey); and, May 10, 2013, May 5, 2014, and May 4, 2016 (larvae sampling). Year 7 monitoring for amphibian was conducted in 2016.

Qualitative Egg Mass Categories:

- Stage 1 (round eggs)
- Stage 2 (tadpoles visible within eggs)
- Stage 3 (tadpoles hatched or very close to hatching)

Qualitative Larvae Categories:

- Stage 1 (0-1 cm)
- Stage 2 (1-2 cm)
- Stage 3 (2-4 cm)
- Stage 4 (4-8 cm)

Table E-6. Amphibian Presence on March 27 and May 10, 2013; March 30 and May 5, 2014; and March 16 and May 4, 2016.

Hydrology System	Site	Stage	Egg Masses			Larvae			Notes
			3/27/13	3/30/14	3/16/16	5/10/13	5/5/14	5/4/16	
Frog Pond		1	1	14	13	21	16	7	
		2	0	18	5	1	21	5	
		3	1	0	0	0	4	8	
Rice Paddies	NW Quad	1	28	24	12	155	13	5	
		2	46	93	4	53	7	8	
		3	13	7	0	0	10	20	
	NE Quad	1	49	34	3	76	56	6	
		2	54	42	1	55	32	13	
		3	0	1	1	0	54	16	
	SW Quad	1	32	18	10	258	6	0	
		2	10	55	1	51	10	1	
		3	0	0	0	0	18	5	
	SE Quad	1	53	59	1	135	3	0	
		2	43	199	12	38	11	0	
		3	5	4	0	0	2	0	
Linked Marsh	Pond 1	1	19	32	38	64	80	5	2013 egg mass and larvae surveys combined all ponds
		2	76	210	13	11	117	10	
		3	9	0	1	3	52	2	
	Pond 2	1	-	11	2	-	138	0	
		2	-	36	0	-	52	0	
		3	-	0	0	-	5	0	
	Pond 3	1	-	2	0	-	11	0	
		2	-	5	0	-	2	0	
		3	-	0	0	-	0	0	
Entrance Marsh	Pond 1	1	5	22	8	48	10	-	• 2013 egg mass surveys combined both ponds • No surface water in Pond 1 in 2016
		2	21	49	0	0	6	-	
		3	3	0	0	0	1	-	
	Pond 2	1	-	5	0	18	49	3	
		2	-	15	0	0	4	4	
		3	-	0	0	0	2	1	
Promontory Ponds	North	1	0	0	0	1	5	0	• 2013 egg mass surveys combined both ponds • Bull frogs heard in summer 2016
		2	0	0	2	0	5	0	
		3	0	0	0	0	0	0	
	South	1	-	0	0	3	0	0	
		2	-	0	0	2	3	0	
		3	-	0	0	0	0	0	
Soccer Field	Pond 1	1	39	7	1	30	30	8	• 2013 egg mass surveys combined both ponds • No surface water in Pond 2 in 2016
		2	30	6	0	7	33	6	
		3	2	1	0	0	23	2	
	Pond 2	1	-	7	1	14	28	-	
		2	-	22	3	0	13	-	
		3	-	0	0	0	18	-	
TOTALS		1	226	235	89	823	445	34	
		2	280	750	41	218	316	47	
		3	72	20	2	36	219	54	
		All	**578**	**1,005**	**132**	**1,077**	**980**	**135**	

Seattle Audubon Society Bird Counts

The following information was provided by the Seattle Audubon Society Neighborhood Bird Project (NBP) at Magnuson Park with the following caveat:

> *The NBP counts at Magnusson 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 Christmas Bird Count (CBC) and Breeding Bird Survey (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."*

Census information was collected across the entire Park, including the Phase 2 Mitigation Areas. The Seattle Audubon Society was able to provide bird count data from Year 7 for July 2017 through December 2017; that data is included in the following pages. A total of 76 avian species were documented at Magnuson Park in 2016.

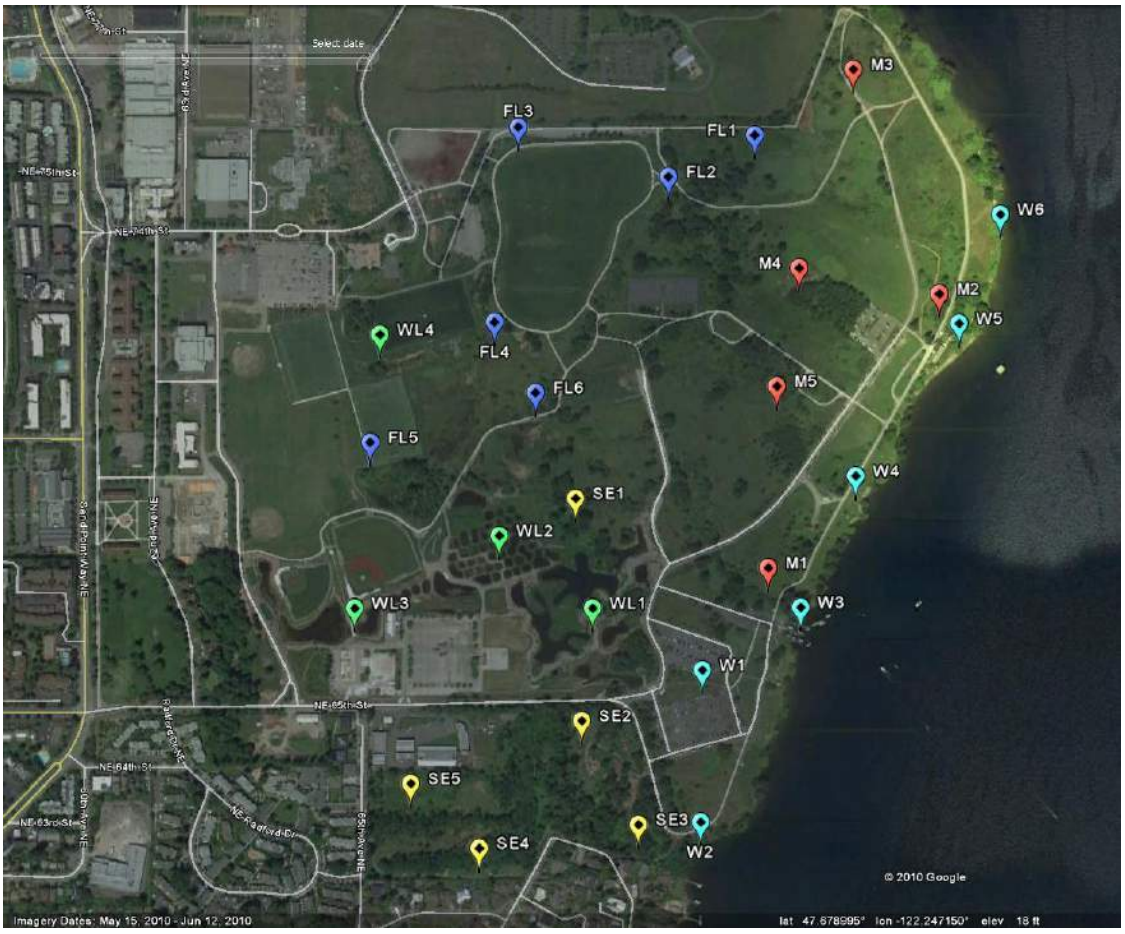

Figure E-9. 2014 Neighborhood Bird Project (NBP) Bird Survey Stations at Magnuson Park (Seattle Audubon Society).

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

Table E-7. Neighborhood Bird Project Bird Survey Data—2017:

Species	Seen	Heard	Fly	Nest
Accipter spp	1			
American Coot	3			
American Crow	93		23	
American Goldfinch	61	17	7	
American Robin	149	11	32	
American Wigeon	5		2	
Anna's Hummingbird	45	8	2	
Bald Eagle			1	
Band-tailed Pigeon	2			
Barn Swallow	5		24	
Belted Kingfisher		2		
Bewick's Wren	121	39		
Black-capped Chickadee	106	42		
Brown-headed Cowbird	1	2		
Bufflehead	67			
Bushtit	87	6		
California Gull	94		6	
Canada Goose	36	1	6	
Cedar Waxwing	32	2	40	
Chestnu-backed Chickadee		1		
Cliff Swallow			36	
Common Bushtit				
Common Goldeneye	20		5	
Common Merganser	1		1	
Common Yellowthroat	2	8		
Cooper's Hawk	4		1	
Dark-eyed Junco	26	6		
Double-crested Cormorant	2			
Downy Woodpecker	9	5		
Eurasian Wigeon	1			
European Starling	23	3	4	
Fox Sparrow		4		
Gadwall	22		1	
Glaucous-winged Gull	21		7	
Golden-crowned Kinglet	5	8		
Golden-crowned Sparrow	9	2		
Great Blue Heron	3			
Greater Scaup	1			
Green-winged Teal	17			
Gull spp	44		81	
Herring Gull				

Table E-7. Neighborhood Bird Project Bird Survey Data—2017:

Species	Seen	Heard	Fly	Nest
House Finch	79	19	16	
Killdeer	7	1		
Lesser Scaup	28			
Lincoln Sparrow	3			
Long-billed Dowitcher	2			
Mallard	137	1	21	
Marsh Wren	3	5		1
Mew Gull	58		34	
Northern Flicker	13	7	4	
Northern Shoveler	4			
Orange-crowned Warbler				
Osprey			9	
Pied-billed Grebe	63			
Pileated Woodpecker				
Purple Martin			1	
Red-breasted Nuthatch	1	1		
Red-tailed Hawk	4			
Red-winged Blackbird	34	4	1	
Ring-billed Gull	42		13	
Ring-necked Duck				
Rock Dove (Pigeon)				
Ruby-crowned Kinglet	12	2		
Rufous Hummingbird	1			
Savannah Sparrow	8	4		
Song Sparrow	42	47		
Spotted Sandpiper				
Spotted Towhee	30	53	1	
Steller's Jay	2	1		
Swallow spp			7	
Swan sp.				
Tree Swallow			23	
Varied Thrush		1		
Vaux's Swift			7	
Violet-green Swallow	4		33	
Virginia Rail	6			
Warbling Vireo	1			
Western Grebe	3			
White-crowned Sparrow	17	2		
Willow Flycatcher	4			
Wilson's Warbler				
Winter Wren		6		

Table E-7. Neighborhood Bird Project Bird Survey Data—2017:

Species	Seen	Heard	Fly	Nest
Wood Duck	1			
Yellow Warbler				
Yellow-rumped Warbler	9	2		

Dragonfly and Damselfly Data

Dennis Paulson, author of *Dragonflies and Damselflies of the West* (2009. Princeton University Press, Princeton, New Jersey. 535 pages), collected dragonfly and damselfly information in the Phase 2 Mitigation Area from May 8 through November 10, 2010; April 23 through October 13, 2011; June 11 through November 2, 2012; April 22 through November 11, 2013; April 13 through November 10, 2014; and May 8 through November 8, 2016 (and on-going). He has observed 26 species (15 Genera), some of which are rare in the Seattle area – see Table E-17 in Appendix E for details. Based on his 40-plus 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. As noted in the body of this report, the introduction of fish species, changes in wetland hydrology, and changes in the vegetative community and structure may reduce the abundance and/or diversity of the odonate species assemblage in the Park.

Table E-8. Dragonflies and Damselflies in the Phase 2 Mitigation Area

Latin Name	Common Name	Relative Abundance
Archilestes californicus	California Spreadwing	common
Lestes congener	Spotted Spreadwing	common
Enallagma carunculatum	Tule Bluet	abundant
Ischnura cervula	Pacific Forktail	common
Ischnura perparva	Western Forktail	uncommon
Aeshna palmata	Paddle-tailed Darner	common
Aeshna umbrosa	Shadow Darner	uncommon
Anax junius	Common Green Darner	common
Rhionaeschna californica	California Darner	fairly common
Rhionaeschna multicolor	Blue-eyed Darner	abundant
Erythemis collocata	Western Pondhawk	common
Leucorrhinia intacta	Dot-tailed Whiteface	rare
Libellula forensis	Eight-spotted Skimmer	common
Libellula luctuosa	Widow Skimmer	rare
Libellula quadrimaculata	Four-spotted Skimmer	rare
Pachydiplax longipennis	Blue Dasher	common
Pantala hymenaea	Spot-winged Glider	rare
Plathemis lydia	Common Whitetail	common
Sympetrum corruptum	Variegated Meadowhawk	uncommon
Sympetrum costiferum	Saffron-winged Meadowhawk	rare
Sympetrum danae	Black Meadowhawk	rare
Sympetrum illotum	Cardinal Meadowhawk	common
Sympetrum internum	Cherry-faced Meadowhawk	rare
Sympetrum pallipes	Striped Meadowhawk	common

Latin Name	Common Name	Relative Abundance
Sympetrum vicinum	Autumn Meadowhawk	rare
Tramea lacerata	Black Saddlebags	uncommon

Notes: D. Paulson:

Archilestes californicus, California Spreadwing – C, first detected 2011, now common everywhere but perhaps most in jeopardy from the introduction of fish; 25 Jun-10 Nov
Lestes congener, Spotted Spreadwing – C, 30 May-27 Oct
Enallagma carunculatum, Tule Bluet – A, 20 Apr-10 Nov
Ischnura cervula, Pacific Forktail – C, 30 Mar-22 Oct
Ischnura perparva, Western Forktail – U, 20 Apr-11 Sep; first detected 2011, has slowly increased since then
Aeshna palmata, Paddle-tailed Darner – C, 14 Jul-10 Nov
Aeshna umbrosa, Shadow Darner – U, 11 Aug-11 Nov; a bit more common in recent than in previous years, always much less common than *palmata*
Anax junius, Common Green Darner – C, 26 Apr-16 Oct
Rhionaeschna californica, California Darner – FC, 18 Apr-14 Jul
Rhionaeschna multicolor, Blue-eyed Darner – A, 11 May-10 Nov
Erythemis collocata, Western Pondhawk – increased over time, now C, 17 May-10 Sep
**Leucorrhinia intacta*, Dot-tailed Whiteface – one record by Nathan Goldberg, 9 Aug 2012
Libellula forensis, Eight-spotted Skimmer – C, 2 May-6 Oct
**Libellula luctuosa*, Widow Skimmer – one record by Bob Vandenbosch, 8 Sep 2012
**Libellula quadrimaculata*, Four-spotted Skimmer - one record by Kevin Aanerud, 14 July 2016
Pachydiplax longipennis, Blue Dasher – 2 older records, 10 Sep 2011 & 29 July 2012, then became established at easternmost pond in 2013; now C, 11 Jun-28 Sep
**Pantala hymenaea*, Spot-winged Glider - two records, 14 Jul 2010 and 29-31 Jul 2012
Plathemis lydia, Common Whitetail – C, 20 May-30 Sep, may be declining
Sympetrum corruptum, Variegated Meadowhawk – originally C but declined considerably in last year, 20 Apr-20 Oct
Sympetrum costiferum, Saffron-winged Meadowhawk – C to FC, 11 Jul-10 Nov; less common after 2011, not seen 2015-2016
**Sympetrum danae*, Black Meadowhawk - one record, 30 Sep 2016
Sympetrum illotum, Cardinal Meadowhawk – C. 18 Apr-10 Nov, less common from 2014 on than in earlier years
**Sympetrum internum*, Cherry-faced Meadowhawk – one record by Kevin Aanerud, 12 Sep 2014
Sympetrum pallipes, Striped Meadowhawk – C, 11 Jun-29 Oct; scarcely any in 2015 but good population found in 2016
Sympetrum vicinum, Autumn Meadowhawk – FC to U, 23 Sep-10 Nov; not seen 2012, single male photographed by Bob Vandenbosch 2013, single male 2014, at least 2 in 2016
Tramea lacerata, Black Saddlebags – U, 6 Jul-23 Sep

A abundant, C common, FC fairly common, U uncommon, * not considered part of the resident fauna

Dennis Paulson, dennispaulson@comcast.net. 6 January 2017.