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WETLAND MITIGATION REPORT

LARCHMONT WETLAND RESERVE (PIERCE COUNTY PERMIT # 742848)
PCILF WETLAND MITIGATION RECEIVING SITE

December 2015

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This Report Prepared by:

Ann Boeholt, Wetland Biologist, PWS

Pierce County Public Works and Utilities, Division of Surface Water Management

Executive Summary

The Larchmont Wetland Reserve is a proposed Pierce County In-Lieu Fee (PCILF) Program mitigation receiving site that was constructed in advance of certification of the PCILF Program Instrument (Instrument). It was constructed in order to pre-capitalize PCILF program credits. Wetlands were re-established and rehabilitated prior to any sale of credits.

Pierce County's pre-capitalization model deviates from the normal In-Lieu Fee (ILF) model. Typically, mitigation receiving sites are added to an ILF program *after* adoption of an Instrument. Site selection is then, normally, guided by a Compensation Planning Framework. Once selected, new mitigation sites are added to the Instrument through a minor Instrument amendment.

Selection and implementation of the Larchmont Wetland Reserve did not follow that path. A portion of property rights acquisitions as well as design and construction of the Larchmont Wetland Reserve were funded with a pre-capitalization grant from the Washington State Department of Ecology. The intent of that grant was to 1) develop a Pierce County In-Lieu Fee Program and 2) pre-capitalize credits within that program by constructing an initial mitigation receiving site. While ILF programs require the construction of compensatory mitigation sites within three growing seasons of debit projects, the construction of the Larchmont Wetland Reserve in advance of adoption of the Instrument, and well in advance of debit projects, reduces temporal losses of wetland functions that are otherwise inherent with ILF programs.

The Ecology grant required construction of the Larchmont Wetland Reserve by June 30, 2014. Construction occurred in the summer of 2013 (See Appendix E—As-Built Report, Construction Plans, and Photo Documentation of Construction). Construction involved grading and excavating a portion of the site, installing a water level control weir, re-routing water from drainage ditches, and replanting with native vegetation. Hand removal of invasive plants, replanting, and seeding efforts continued into June 2015. Invasive plant removal and replanting will continue for several years to come, as Pierce County aims to meet performance measures related to invasive plant cover.

This Wetland Mitigation Report describes the actions taken at this wetland reserve site, the lifts in functions expected from these actions, the number of PCILF credits expected from this ecological lift, performance standards to be attained, and the accompanying credit release schedule.

A requirement of credit release is to record a Conservation Easement for the site. That has been done. The Pierce Conservation District will serve as the long term conservation steward. The Conservation Easement is attached (Appendix F).

Finally, the Long Term Management Plan describes actions expected to maintain the long term conservation values at this site. The draft Long Term Management Plan is also attached (Appendix G).

1. Goals and Objectives

1.1. Project Location

The Larchmont Wetland Reserve lies in the unincorporated Pierce County area known as Midland, between 91st Street East and 96th Street East (to the north and south) and 9th Avenue Court East and McKinley Avenue East (to the east and west). It comprises most of the block between these streets and totals 16.875 acres. The site is adjacent to the City of Tacoma's Larchmont Community and within the city's Urban Growth Area. Pierce County Surface Water Management, a division of the Pierce County Public Works Department, purchased these parcels between the years 2005 and 2011 for the purpose of providing advance wetland mitigation.

The site is within the Chambers-Clover Creek watershed (WRIA 12). The wetland at this site serves as a headwater area to the North Fork of Clover Creek. The upper reach of the fifth west tributary of the North Fork of Clover Creek flows within a ditch network through the site. The historic landform of the site was that of a pothole, with no clearly defined surface drainage.

1.2. Project Goals

The goals of the Larchmont Wetland Reserve Project are to improve overall wetland functions within this block of parcels, thereby earning advance wetland mitigation credits to be used within Pierce County's In Lieu Fee Program.

Although pre-existing wetlands on the site rated moderately-high in terms of the functions they provided, this site had been disturbed over the years and was found likely to benefit from wetland rehabilitation and enhancement measures. Disturbances included:

- Drainage efforts in the 1920's confined this tributary of the North Fork to deep, straight ditches that were regularly maintained by the local Drainage District. Ditch maintenance involved dredging accumulated sediment from within the ditches and side-casting that material beside the ditch (Drainage District #19 Commissioner, Scott McElhiney, personal communication). These drainage efforts effectively drained portions of the site and caused the top portion of the peat deposit to decompose. This, in turn, marginalized the habitat by rendering it more conducive for the encroachment of invasive plants that reduced native plant diversity within the wetland.

- Untreated runoff from roadside ditches discharged to the site, comprising the majority of the flow within these internal ditches.

- Dumping within portions of the wetland had occurred for decades. During project construction, it was discovered that a wetland area in the north end of the site had served as an undisclosed landfill. During site excavation nearly 80 cubic yards of garbage were removed. This material consisted of asphalt and concrete (which were recycled),

roofing material, old tires, batteries, yard waste, kitchen appliances, household items, gardening tools, and metal conduit (taken to an authorized landfill).

- Leaking underground storage tanks or accumulations of garbage impacted soils on the property. About 120 cubic yards of contaminated soil was removed from two locations within the wetland and taken to the dump. This material had been in direct contact with surface water for an untold number of years.

- Peat harvest, land clearing, and ATV riding had all disturbed soils, vegetation communities, and habitat. A previously disturbed portion of the wetland, in the southeast corner of the project site, was a monoculture of reed canarygrass prior to our wetland rehabilitation efforts.

- Homeless encampments--common in urban settings such as this--often lead to surface disposal of human waste, drug paraphernalia, and drug producing materials. One abandoned homeless encampment at the south end of the site was littered with batteries and used hypodermic needles. Clean up of this encampment required the services of a hazardous waste removal company. Fencing and site monitoring will reduce the likelihood of future homeless encampments.

The Wetland Mitigation project was implemented with the goals of lifting the water quality improvement function of the wetland, improving stormwater attenuation and treatment, and improving the potential of the wetland to provide habitat for native animals and plants. We also restored to wetland condition small areas within the site that had previously been filled or otherwise disturbed. The wetland will remain classified as a depressional outflow wetland.

The Midland area has seasonally shallow groundwater and poorly drained soils due to its location on a glacial till plain. It has been subject to extensive local flooding. Restoration of the natural surface water-attenuation function of this wetland, by decommissioning ditches and allowing the wetland to detain stormwater, will address local concerns about flooding and maintain base flows within this tributary of the North Fork of Clover Creek.

The Larchmont Wetland Reserve is 2,800 feet north of, and along the same tributary as, the existing South Midland Wetland Reserve—another proposed PCILF mitigation receiving site that was constructed by Pierce County Surface Water Management in 2007 and 2008. The preservation and rehabilitation of the Larchmont site helps to preserve habitat connectivity along this reach of Clover Creek, within an area that is increasingly urban.

1.3. Project Objectives

Specific, measurable objectives of the project are to:

1. Increase the area of seasonal ponding to at least 25% of the wetland area on the project site. Areas of seasonal ponding are those that pond consecutively for at least two months during a normal rainfall year, but that dry out sometime during the year.

A seasonal pond, 4.02 acres in size (169,985 square feet), was created by excavating a portion of the existing wetland. This area is expected to pond for at least two months--throughout the winter months--but dries out in the summer. We excavated to a depth of 384.5 ft. in the low flow channel and to 385 ft. at the bottom edge of the pond slope, tapping into seasonally high groundwater (which is generally at or above 386 ft. from November until the end of May and below 383 ft. in the summer months of normal rainfall years--Figure 1).

2. Rehabilitate 12.2 acres of existing wetland.

   3.58 acres of *existing* wetland was excavated to become the seasonal pond (along with the re-established wetland area). All remaining existing wetland areas were enhanced with selective hand removal of invasive vegetation and native vegetation re-establishment. The addition of a greater area of seasonal ponding lifts the functions of the wetland system as a whole.

3. Re-establish 1.16 acres of wetland in the northern portion of the project site.

4. Comply with minimum technical requirements and recommendations for stormwater discharges to wetlands, per the Pierce County 2008 Stormwater Management and Site Development Manual (Pierce County 2008).

   These minimum technical requirements, as discussed in the attached hydrology report (Appendix D), are:

   - Mean Annual Water Level Fluctuation (WLF) and mean monthly WLF for every month of the year does not exceed 20 centimeters (8 inches).
   - The duration of stage excursions greater than 15 cm (6 inches) above pre-development stage does not exceed 72 hours per excursion.
   - The frequency of stage excursions of 15 centimeters (6 inches) above or below predevelopment stage does not exceed an annual average of six.
   - The magnitude of stage excursions above or below the predevelopment stage should not exceed 3 inches for more than 24 hours in any 30-day period between 1 February and 31 May of any year (in order to minimize disruption of amphibian breeding).

   Additionally, because of the surrounding built environment, it is critical that the water surface elevation for the 100 year event not exceed 386.5', which is approximately the existing surface water elevation in the study area.

5. Add at least ¼ acre of permanently or seasonally ponded wetland that is vegetated with thin-stemmed persistent vegetation and is suitable for native amphibian egg-laying.

6. Reduce the prevalence of invasive plants to less than 25% within every plant stratum throughout the site.

7. Increase the species richness of native wetland plants throughout the site.

8. Permanently protect the wetland with fencing, a conservation easement, and a long term maintenance and management plan.

1.4. Design Summary

The project is to re-establish 1.16 acres of wetland and rehabilitate the remaining 12.2 acres of wetland on the site. Wetland rehabilitation and re-establishment involved several main actions:

1. Excavate a Seasonal Pond, with a Meandering Low-Flow Channel.

   The seasonal pond was designed to provide suitable habitat for aquatic macro-invertebrates, breeding native amphibians, and resident fishes. The low flow channel will support resident fishes in the dry season until they can navigate their way out of the desiccating pond or until fall rains continue. The entire pond bottom was planted with native wetland shrubs and emergent plants and seeded with a specially designed wetland seed mix.

2. Decommission the Network of Drainage Ditches.

   The ditches internal to the site will cease to be maintained as ditches. They were not filled, so will remain full of water during high water times and will remain wetlands; however, flow into the site is now routed away from the ditches and into the seasonal pond. Over time the internal ditches will fill with vegetation. Minor maintenance of the ditch entering the site from the north (along 91st St. E) will be necessary to ensure that flooding does not back up and flood surrounding infrastructure along or north of 91st St. E. This maintenance is addressed in the Long Term Management Plan (Appendix G) and will consist of hand removal of organic and inorganic debris, and accumulations of silt that may block the drainage way.

3. Improve the Quality of Incoming Stormwater.

   Stormwater entering the wetland site will be filtered by vegetated swales that are outside of the wetland edge. These swales were planted with emergent plants that will provide filtration. This is an improvement over pre-existing conditions, since stormwater from roadside ditches previously flowed directly into the site, or directly into the N. Fork Clover Creek tributary, with no level of treatment.

4. Rehabilitate Existing Wetlands.

   Excavation of the seasonal pond and the associated decommissioning of the drainage ditches will re-set the hydrology of a significant portion of the site, maintaining the peat profile. Excavation was followed by installing habitat features (snags, downed logs, and boulder/brush piles). The selective removal of invasive plants and re-planting with a diversity of native emergent and woody plants appropriate for this location further enhance the habitat potential of the existing wetlands. Finally, the removal of impacted soils and trash improve the quality of the groundwater filtering through this site, and the quality of the habitat.

5. Re-Establish 1.16 Acres of Wetland.

   Non wetland area was excavated in the NE quarter of the site, re-establishing 1.16 acres of wetland. During the course of excavation, undocumented household waste and other garbage was unburied and removed from the site.

6. Install a Water Level Control Weir

   A control structure (weir) was placed upstream of 96th Street East. Two existing culverts carry flow under the road and previously served as the outlet control from the wetland. These culverts remain in place but by installing the weir the water level control was moved into the site, thereby providing the desired area of seasonal ponding, regardless of what may occur to the road culverts in the future. The control structure has horizontal control walls and a fixed 12-inch tall weir plate set level with the invert of these existing culverts (385 ft.). [1]

Construction was completed between August and October, 2013. Plants were installed in the fall of 2013. Seeding was accomplished in the fall of 2013 and spring of 2014—after water levels within the pond had substantially diminished. A one year plant establishment contract resulted in planting replacement plants in the fall of 2014. Additionally, from the fall of 2013 to the spring of 2015, the Washington Conservation Corps invested 135 days (over 6,000 man-hours) hand-removing invasive plants and planting additional native trees and shrubs. The site will be monitored for a period of ten years, beginning in 2015 (Appendix K), to ensure that performance standards are being met.

[1] Only 6 inches of the horizontal weir plate extends above the invert of the weir structure. Six inches of the plate are necessary to secure it to the concrete weir. So, a 12-inch weir plate only retains 6 inches of water and the optional 18-inch weir plate would retain water to a depth of 12 inches above the invert of the weir.

2. Mitigation Site Selection

2.1. Initially Selected as Pilot Site by Puget Sound Partnership

The Larchmont Wetland Reserve site was initially selected as a Pierce County In-Lieu Fee site when, in 2010, the Puget Sound Partnership (PSP) initiated the development of a Puget Sound In-Lieu Fee Program as part of their Puget Sound Action Agenda. The 2010 Washington State Legislature allocated approximately $4 million in grant funds to develop an ILF program and to construct pilot ILF mitigation projects prior to the collection of mitigation fees. This "pre-capitalization" money was intended to help ensure no net loss of ecological function as PSP's ILF program was being established. The grant dollars were to be managed by the Washington Department of Ecology.

In April 2010 the PSP requested information about projects suitable for its Pilot ILF Mitigation Program. Four projects were proposed within Pierce County. These projects were reviewed and scored by a Site Selection Review Team, whose members comprised representatives from PSP, the Department of Ecology (Ecology), the Corps of Engineers, the Environmental Protection Agency, and Cascade Land Conservancy (now Forterra). Scoring was based on how well projects met ecological criteria, in addition to how they demonstrated consistency with feasibility conditions. Based on a recommendation from the Site Selection Review Team, PSP and Ecology selected the Larchmont Wetland Reserve as the Pierce County Pilot Site.

The Larchmont site is approximately 0.5 mile upstream of the South Midland Wetland Reserve (SMWR)—another proposed Pierce County In-Lieu Fee site. The Site Selection Review Team thought that rehabilitation of the Larchmont Wetland Reserve site, in combination with the already constructed SMWR site, would provide a system-wide approach to improving water quality, reducing downstream flooding, and augmenting habitat in the urban Clover Creek watershed.

Although PSP relinquished sponsorship of the ILF Program in Pierce County to Pierce County Surface Water Management (PCSWM), the state grant remained committed to pre-capitalizing the Pierce County ILF Program. Ecology administered the grant to PCSWM to design and construct the Larchmont Wetland Reserve *as a component* of the Pierce County ILF program. These grant funds obligate PCSWM to continue with the development of this restoration site and to rely on that prior site selection effort.

2.2. Puget Sound Watershed Characterization Applied

Even though the Larchmont Wetland Reserve was selected as an In-Lieu Fee site prior to PCSWM's development of a compensation planning framework, its selection is supported by the Puget Sound Watershed Characterization Project (Washington State Department of Ecology, 2014). The Puget Sound Watershed Characterization Project provides a watershed approach to prioritizing areas for restoration. The prioritization is based on models that rank

how important an area is for providing watershed processes and how much those processes have been altered or degraded. High importance and low degradation indicate an area that should be prioritized for preservation, while high importance and high degradation reveal areas that would be good targets for restoration efforts. Low importance and high degradation suggest that development might be prioritized for that area.

Within the Chambers-Clover Watershed, the sub-drainage analysis unit that includes the upper North Fork Clover Creek and encompasses both the Larchmont Wetland Reserve and the SMWR is prioritized for *restoration* (Figure 3). This sub-drainage area ranks moderately-high for importance of overall water flow processes and very important for surface water storage. Water flow processes and surface water storage in this area have a high level of degradation. Because of the high importance and high degradation of surface water storage processes, the upper North Fork Clover Creek sub-drainage area is ranked a high priority for restoration of those processes.

Observations and data reported in area basin plans, watershed plans, and local community plans corroborate the watershed characterization models. The Larchmont Wetland Reserve and SMWR are within the unincorporated Pierce County community of Midland. This area is underlain by shallow groundwater and poorly drained soils. The drainage system of the North Fork Clover Creek sub-basin was historically an area of large interconnected wetlands. The area has been extensively altered over the years by ditching, channelization, extensive wetland fill and drainage in order to dry out land for farming and more recently for urban development. In recent years, the Midland area has experienced extensive flooding, as reported through citizen complaints and as documented in the Clover Creek Basin Plan. Partly in response to these concerns, the 2005 Clover Creek Basin Plan (Pierce County Public Works and Utilities 2002) identified the need for a future detention pond in the North Fork system. At the time that basin plan was developed, a detention pond was given a priority rating of high. This potential pond received a moderately high rating for flood reduction and natural resource protection and a very high rating for water quality improvement. The South Midland Wetland Reserve was, in part, designed to provide the flood reduction and water quality improvement functions that a conventional detention pond would have provided. The Larchmont Wetland Reserve further contributed to these functions.

2.3. Site Selection Using a Watershed Approach

The Larchmont Wetland Reserve meets the watershed scale criteria for site potential and sustainability established in the guidance document, *Selecting Wetland Mitigation Sites Using a Watershed Approach* (Hruby et al. 2009). On a site-scale, the design of Larchmont Wetland Reserve addresses site constraints to improve hydrologic, water quality, and habitat functions (Appendix C).

2.4. Adherence to Other Planning Documents and Planning Efforts

The Larchmont and South Midland Wetland Reserves both lie within an area mapped by Pierce County as "open space corridor" (Figure 4). This designation encourages the conservation of fish and wildlife habitat and recognizes that these areas serve as buffer between the drainage system and urban growth in the surrounding area.

Rehabilitation and re-establishment of wetlands on this site will increase water quality as well as surface water (flood) storage capacity within this sub-basin. These are both significant, high priority functions. Restoring these functions is consistent with the Clover Creek Basin Plan and with Parkland-Spanaway-Midland Communities Plan recommendations.

3. Site Protection

The federal rule (33 CFR 332.7) requires permanent site protection to ensure mitigation-receiving sites continue to provide ecological functions in perpetuity. Pierce County proposes to secure the permanent protection of the Larchmont Wetland Reserve in the following ways:

1. Pierce County Surface Water Management (PCSWM) owns the Larchmont Wetland Reserve and will monitor the site for attainment of performance measures for the next ten years. PCSWM will continue to provide the long-term maintenance and management of the site after the establishment phase has been successfully completed.

2. The entire reserve site has been fenced with a wildlife friendly fence intended to inhibit human intrusion. The fence is welded-wire field fence, installed with the largest cells installed toward the bottom of the fence. As the ground occasionally dips, the bottom of the fence will remain straight, allowing for gaps under the fence that allow for ingress and egress of mammals and other small animals.

3. PCSWM has placed a Conversation Easement on the Larchmont Wetland Reserve site (Appendix F). The overall intent of that Conservation Easement is to permanently preserve the Conservation Values of the site.

4. PCSWM named the Pierce Conservation District (PCD), a publicly supported subdivision of the State of Washington, as the third party Conservation Easement Holder. PCSWM and PCD signed a Memorandum of Agreement clarifying PCD's rights and responsibilities as the easement holder, the timeline for the agreement, and how PCD is to be compensated for their efforts to oversee the site. The PCD's work will be paid from the WRIA 12 Individual Mitigation Projects Account through the establishment phase of the project and thereafter from the WRIA 12 Long Term Management Account.

5. PCD will conduct a baseline conditions report of the Larchmont Wetland Reserve and will then monitor the site annually to ensure that the Conservation Values are being preserved. They have the authority to direct PCSWM (as the property owner) to take certain maintenance actions as may be necessary to protect the long term conservation values of the site. If PCSWM fails to respond to their directives in a satisfactory manner, PCD has the authority to elevate the matter to the Corps and Ecology or to the Courts.

4. Baseline Site Conditions

Baseline conditions of the Larchmont Wetland Reserve were assessed and documented in the *Larchmont Wetland Reserve, Final Wetland Delineation and Assessment Report* (Pierce County Public Works and Utilities 2011; Appendix A) and in the *Cultural Resources Survey Report*, *Larchmont Wetland Reserve Project* (Elder et al. 2011; Appendix B).

4.1. Historic and Current Land Uses

The Larchmont Wetland Reserve is on the very edge of the City of Tacoma and within the City's Comprehensive Urban Growth Area (Figure 5). This is in an area zoned for single family development and the land use designation is moderate density single family development. With the exception of six parcels, the entire block of parcels between 9th Ave. Ct. E. and McKinley Avenue East and between 91st St. East and 96th St. East comprises the Larchmont Wetland Reserve. At the north end of the block, adjacent to McKinley Ave E, there are three duplexes within the City of Tacoma. South of these duplexes, and also along McKinley are two single family residences and a third lot that is used for a private vegetable garden. The only other developed property within this block of parcels is along the south margin of the property (on 96th) and it contains a duplex. Across the streets that border the Larchmont Wetland Reserve, all of the parcels, with one exception, are developed as single family residences. The one adjacent parcel that remains undeveloped contains a wetland and is in conservation status.

The majority of the Larchmont Wetland Reserve was previously undeveloped. Two of the parcels that comprise the Larchmont Wetland Reserve had homes on them when the sites were acquired by PCSWM in 2011. Those homes were demolished and all appurtenances (Sewer tie-ins, power boxes, water meters, etc.) were removed as part of mitigation site construction. Demolition included asbestos abatement. The only other human uses of the site were the occasional homeless encampments and dumping of garbage.

4.2. Historic and Cultural Resources

The Larchmont Wetland Reserve is within an area historically associated with the Puyallup Tribe, however there is no recorded ethnographic place name located in the vicinity of the Larchmont Wetland Reserve (Elder et. al. 2011).

The buried terrestrial surface at this location was identified as having a high potential to contain archaeological deposits in primary depositional context because it represented a habitable surface adjacent to a water supply. Clovis-style artifacts, dating from between 13,300 and 12,800 years ago, have been found within Pierce County, on Anderson Island and near Waughop Lake and so might have been expected to be found at this project site.

The shallow lacustrine sediments were identified as having a low potential to contain archaeological deposits in primary depositional context because they would have been formed in a permanently or regularly inundated environment, which is not conducive to human habitation.

Archaeological investigations identified no archaeological deposits and no historic properties on the site (Appendix B- Cultural Resources Survey Report).

4.3 Pre-Existing Wetlands

Prior to implementation of this project, most of the Larchmont Wetland Reserve site was wetland, labeled Wetland A. Wetland A was 12.2 acres onsite and was classified as a Category II, depressional wetland (Appendix A). This is a headwater wetland serving Clover Creek.

Forest and shrub wetland habitats dominated this wetland (see Figure 6 of the Wetland Delineation and Assessment Report—Appendix A). Three distinct Cowardin vegetation classes were present. The northern and southwestern portions of the wetland contained a forested community dominated by red alder, black cottonwood, Oregon ash, Sitka willow, and Pacific willow. The understory was composed mainly of salmonberry, red-osier dogwood, and willow saplings. Dense patches of Himalayan blackberry were found throughout these areas of Palustrine Forested Wetland. Approximately one acre of the forested wetland had multiple strata but the majority of the forested wetland areas had a simple structure with little understory. The wetland interior contained a scrub-shrub community dominated by thick patches of Sitka willow, Pacific willow, European hawthorn, clustered rose, spirea, and Himalayan blackberry, with small patches of red elderberry, sword fern, and Indian plum growing on hummocks within the wetland. The southeastern portion of the wetland contained an emergent community dominated by reed canarygrass, bentgrass, and soft rush.

The majority of the site is mapped as Dupont muck. This is an organic soil that formed from decaying plant remains and diatomaceous earth in narrow depressions or basins on uplands of the glacial till plan. Soils investigations during the design process revealed muck or desiccated peat to a depth of 18 inches, with several feet of reddish-brown fibrous peat below that-to depths of 5.5 feet below ground surface (Appendix I-Soil Logs). A thin clay lens and a sand layer below the peat hold surface and shallow ground waters within this glacially formed depression.

4.4 Other Aquatic Resources

The Pierce County GIS Stream Inventory (Figure 3 of Appendix A) maps a stream on the Larchmont site. This is the stream that is conveyed by the main ditch through the site (see

section 4.5) and to the North Fork of Clover Creek. This is considered a tributary to the North Fork of Clover Creek. It is known as the "5th West Tributary of the North Fork of Clover Creek". This creek contains resident fish (three-spined stickleback), but has no current use by "critical fish" species, as identified in Pierce County Code 18E.40.020: it is typed as an N-2 Stream.

4.5 Water Regime of the Project Site

Historically, the North Fork Clover Creek sub-basin, was an area of large interconnected wetland potholes. There was no direct surface water drainage away from the North Fork plateau. The sub-basin was extensively altered by ditching and channelization dating back to the early 1900's, and by extensive wetland fill.

The water source to the Larchmont Wetland Reserve is rainfall, discharge from roadside ditches, and a seasonally high groundwater table. Groundwater levels were tracked for one full year during project design (Figure 1). The data was used to verify that we would obtain the desired hydrology by excavating to a low flow notch depth of 384.5 ft. The location of the groundwater monitoring wells were mapped and are shown in Figure 2. The hydrology of this wetland was interrupted by the (circa 1920) construction of a network of drainage ditches that cut through the site. Now, a main ditch enters the site from 91st St. East. This ditch runs north-south one third of the way down the property. The ditch jogs east-west, horizontal with 93rd St. E, and then south again to the twin culverts under 96th St. East. An arm of this east-west ditch extended east to 9th Ave. Ct. E. A secondary ditch runs north from the vicinity of the duplex along 96th St. E. and joins the main ditch in line with 93rd St. E. These ditches provided localized drainage of surface and subsurface interflow from the site and into the North Fork of Clover Creek[2]. Nearly the entire site is within the 100 year floodplain of the creek.

Prior to construction, basins 1, 2, and 4 (Figure 8) discharged stormwater to the site. Basin 4 is the Larchmont wetland itself, plus the developed parcels around the perimeter of the Larchmont Wetland Reserve. Basin 1 enters the wetland from the north and is a 31.93 acre contributing basin. Basin 2, east of the Larchmont site, contributes stormwater from 15.15 acres. None of this stormwater received any level of treatment or detainment prior to project implementation.

Prior to construction, less than one acre of the site (0.88 acres) ponded on a seasonal basis, providing native amphibian breeding habitat (Figure 9). This was essentially the area within the

[2] The ditches remain post construction. It was not necessary to fill them to achieve the restoration goals for the site. They remain as aquatic habitat and wetland. They do, however, carry less water overall. Rather than filling in the ditches to de-commission them, water was directed away from them with the construction of the seasonal pond.

drainage ditches. This area of seasonal ponding significantly expanded with implementation of the mitigation design.

4.6 Wildlife Corridor and Habitat Connections

The wetland rating for Wetland A illustrates that there are at least three other wetlands within ½ mile of the Larchmont Wetland Reserve, but the connections between them are disturbed. Figure 10 illustrates zones 150 ft. and 1 km surrounding Wetland A. More than 10% of the land use within 150 ft. of the wetland is clearly in agriculture, pasture, residential, urban, or commercial (it is mostly residential). Within 1 km of the wetland, 6.6% of the area comprises immediately adjacent "accessible habitat" and between 10 and 50% of the area comprises "undisturbed habitat".

4.7 Assessment of Baseline Functions

Water quality functions, water quantity functions, and wildlife habitat functions all scored moderate prior to mitigation implementation (Appendix A and Appendix J). The wetland and drainage ditches provided riparian and aquatic habitat functions, and snags and downed wood provided additional habitat structures.

Aerial photographs through time show wetland disturbance within the southeast corner of the site, dating back to the 1940s, when it appeared that peat was mined from the site, likely for war-time fuel (a circumstance corroborated by longtime residents). This was also the area dominated by reed canarygrass prior to mitigation implementation. Prior to the rehabilitation efforts described in this report, much of the site was partially overgrown with Himalayan blackberry, and was providing only moderate levels of native plant diversity, plant structure, and habitat: the wetland habitat rating was 21 out of a possible score of 36 (See Appendix A). The northeast corner of the site had been disturbed with considerable fill (trash and construction debris) prior to the year 1990 (as determined by viewing Google Earth history photos and verified with mechanically excavated test pits). The very northeast and southeast corners of the property recently contained single family homes. These homes and their appurtenances were demolished and removed in 2011 as part of this project

This tributary of the North Fork of Clover Creek provides seasonal flow. Portions of the ditch become dry during the summer drought season--supporting only limited aquatic life. Electro-fish surveying during project design yielded three-spined stickleback, but no other fishes. Amphibians, leeches, and other aquatic macro-invertebrates were also present.

4.8 Buffers

Prior to implementation of the mitigation design, non-wetland buffer area between the wetland and the road or other adjacent land uses totaled 4.46 acres, averaging about 47 ft. wide, although in many areas wetland extended to the edge of the property boundary and in other areas the buffer was as great as 385 ft. (Figures 6 and 7). As discussed in the Wetland Delineation and Assessment Report (Appendix A), these buffer areas are typically mapped as

having Dupont Muck—a hydric soil—although the Northern and Northeast corner of the property are exceptions: there, the soil map unit is Kapowsin gravelly loam, 0-6% slopes (non-hydric) (See Figure 2 of Appendix A).

These non-wetland communities support a native, mixed conifer and deciduous forest, with red alder, black cottonwood, and Douglas fir as the dominant tree species and understory species that included salal, snowberry, salmonberry, Oregon grape, sword fern, and Himalayan blackberry. Several of the cottonwoods appeared to be quite large-- at least one with a diameter at breast height (dbh) greater than 36 inches. The estimated age of that particular tree (from a tree core) is only 65 years, however. A grove of quaking aspen occupies a portion of this forest within the NW corner of the site.

5. Credit Determination and Credit Release Schedule

It is proposed that the construction of the Larchmont Wetland Reserve will generate 72.67 mitigation credits by lifting water quality, water quantity, and wetland habitat site potential.

The Department of Ecology's Credit/Debit Assessment Tool (Hruby, 2012), referred to herein as the "credit/debit tool", was used to determine the number of wetland mitigation credits expected to be earned from the recent mitigation construction efforts at the Larchmont Wetland Reserve. The tool illustrates that construction efforts are expected to generate 20.39 water quality credits, 9.28 hydrologic credits, and 18.07 habitat credits (for a total of 47.74 credits) once all performance standards are met (Appendix J). A discussion of that functional lift is presented below.

According to the IRT, the *area* of buffer (even if it is wetland), cannot be included in the multiplication of wetland area by function scores in the Credit Worksheet. However, the IRT did agree that to the extent that the overall function scores are lifted by features (such as numbers of plant species, hydroperiod regimes, and other wetland features) in this area (even though it is within "the buffer"), it *would* contribute to the overall water quality, hydrology, and habitat scores, and so contributes to the overall credit score in that manner. Buffers averaged 47 feet prior to our construction efforts. IRT agency representatives agreed that we could reduce buffers to 50 feet in the NE corner of the property. For the exclusive purpose of determining the area of the wetland that should and should not be included as a multiplier in the Credit Worksheet, Pierce County proposes a 50 ft. average buffer around the perimeter of the property. Wetland area (created or pre-existing that falls inside this 50 ft. buffer) totals 483,749 Sq. Ft (11.11 acres). Of that, 1.16 acres was new wetland (i.e. restored wetland). The rest (9.95 acres) is the pre-existing wetland that was rehabilitated. Again, more than that was rehabilitated, but since 2.25 acres of pre-existing wetlands comprise part of this 50 ft. buffer zone, that acreage is not counted in the credit worksheet calculations.

Site rehabilitation included actions that will further lift ecological function in ways that are not accounted for by the credit/debit tool. As discussed in the PCILF Instrument, the Sponsor may request additional credits when additional actions will in fact result in an increased lift of

functions. It is proposed that additional actions will earn another 12.65 water quality credits, 2.78 hydrology credits, and 9.95 habitat credits, for a total of 24.93 additional credits, and for a grand total of 72.67 potential credits. The discussion of this proposal for additional credits follows as well.

5.1 Improvement of Water Quality Functions

The project will improve opportunities to purify surface water by creating a seasonal pond that will comprise over 30% of the wetlands on the site. Previously, about 7% of the wetland (0.88 acres) held standing water on a seasonal basis (for at least 2 months of the year but dried out for a portion of the year) (Figure 9). By increasing the percentage of the wetlands that will pond on a seasonal basis to more than 25%, the score for Water Quality Site Potential elevates by 2 points—enough to raise it from "Medium" to "High" performance of function.

The area of seasonal ponding is now 4.02 acres. This area now ponds continuously from about mid-November to mid-February but dries out in the summer months. This provides retention time and opportunity for sediment and other soil-bound pollutants to settle out of the water column. But more importantly, areas that are seasonally ponded (and anoxic) but that dry out for a portion of the year (becoming oxygenated) allow the complete process of nitrification/denitrification to occur. In aerobic soils, Nitrogen, in the form of ammonium ion, transforms to nitrite, then to nitrate (nitrification). When the soil becomes anaerobic again, nitrate is then transformed to atmospheric nitrogen gas (denitrification), thereby returning this element to the air and purifying the surface and groundwater.

PCSWM proposes that additional actions that were not accounted for in the credit/debit tool have further lifted the water quality function of this wetland and that additional credits should be given to account for this lift. Specifically, vegetated treatment swales treat incoming stormwater that previously had no treatment whatsoever and the removal of garbage and contaminated soils from within the wetland unit improved the quality of surface and groundwater in the wetland.

Additional 2.7 Water Quality Credits Requested Because of Water Quality Treatment From Vegetated Swales

Prior to construction, stormwater entering the wetland from roadside ditches received no pre-treatment. The project reconfigured the inlet channels that directed water into the wetland from basins 1 and 2 (Figure 8). These inlet channels are now broad, vegetated swales seeded with emergent plants known for their ability to trap and sequester sediment and other water borne pollutants. Basin 3 did not previously drain into the wetland but now does so-- through the wide South Inlet Swale. These vegetated channels will provide a degree of stormwater treatment that was not previously afforded. The vegetated swales will be maintained by mowing and removal of accumulated debris. They may develop into wetlands but they were constructed in non-wetland areas and are not considered part of the 13.16 acres of wetlands (11.11 acres that are not included as part of the wetland buffer) within the Larchmont Wetland Reserve.

The prominent South Swale (Photo 27 of Appendix E) will treat stormwater from Basin 3 which drains 127.53 acres (Figure 8). This stormwater previously circumvented the Larchmont site, in a perimeter ditch; it flowed directly into the Clover Creek system with no level of treatment. With this project, this stormwater now flows through this wide (40-50 feet wide) vegetated swale, 280 ft. in length. The construction of this South Inlet Swale was possible because Pierce County acquired the non-wetland lot at the corner of 96th St. E. and 9th Ave Ct E and demolished the home that previously existed there. This was a substantial expense and was undertaken largely to provide these improvements to water quality function. This, however, is one activity not captured by the credit/debit tool. As a rule, the credit/debit tool does not give credit for installation of stormwater or water quality technologies, or Best Management Practices (BMPs) even though some such technologies can result in a measurable and significant improvement to water quality.

In addition to improving the level of treatment of stormwater that *previously* entered the Larchmont Wetland system, the inlet swales picked up stormwater that previously *skirted* the wetland and are treating it. Stormwater modeling and site design were considered together such that the wetland stormwater discharge guidelines will be honored. Wetlands are valued in part for their ability to purify and attenuate surface water on a watershed scale. Prior to implementation of rehabilitation and restoration actions the Larchmont wetlands were not doing that as well as they could have and certainly not at all for those waters that circumvented the site. Treating stormwater inputs and picking up additional, stormwater restores these historic landscape processes and lifts the site potential, landscape potential, and value of the water quality benefits of this wetland.

PCSWM requests credit for the water quality benefits these vegetated swales provide even though the credit/debit tool does not account for this enhanced functional lift. Our logic for the number of credits this water quality benefit is worth, follows:

1. The post- construction credit/debit rating of water quality site potential, landscape potential, and value are all expected to be “high”.
2. A rating can be no higher than “high”.
3. We cannot suggest that this additional lift would increase the water quality scores from a “medium” to “high” since our other construction efforts already provided that lift in Water Quality Site Potential.
4. So, to translate this additional functional lift into additional credits, PCSWM proposes to multiply the area of the vegetated swales (0.3 acres) by the increase in water quality score for wetland creation/restoration areas (9) *for the purpose of calculating the water quality functional lift only. (The area within the vegetated swales will not be considered additional wetland creation area for other function scores).*
5. This results in an additional 2.7 water quality credits.

Additional 12.2 Water Quality Credits Requested Because of Removal of Garbage and Impacted Soil

Rehabilitation actions will also improve the quality of *groundwater* moving through the Larchmont Wetland. But, the credit/debit tool does not address groundwater.

During site excavation we discovered buried garbage and contaminated soil that were in contact with shallow groundwater and surface water and that had been so for decades. The credit/debit tool addresses other "sources of pollutants coming into the wetland" as part of the score for water quality landscape potential (Question D2.4 on the Credit/Debit rating form—Appendix J). However, the tool does not address restoration efforts *on-site* that remove additional *on-site* sources of contamination that may otherwise have the effect of reducing the site potential and value of the water quality potential. The water quality of the site further benefits from the removal of this material and so it makes sense that these actions would be reflected in additional water quality credits.

Nearly 6 dump truck loads (over 35 tons) of buried garbage was discovered and removed from the wetland. Asphalt, concrete, roofing material, old tires, batteries, yard waste, kitchen appliances, household items, gardening tools, foam blocks, car and motorcycle frames, and metal conduit were unburied and removed from the site. This material was either recycled or taken to an authorized landfill.

120 cubic yards of soil having a petroleum-like odor were removed from other locations within the site, tested, and disposed at an authorized landfill. Analytical samples confirmed the presence of Barium, Chromium, and Pentachlorophenol (PCP) within measurable limits (Appendix H—Soil Characterization Sampling). The Acetone, Barium, and Chromium were discounted as they could be explained by Laboratory Drift or by Puget Sound area background metal levels. The PCP cannot, however, be so discounted.

Pentachlorophenol (PCP) is an organochlorine compound used as a pesticide and a disinfectant. It was manufactured in the United States from the 1930s, primarily as a wood preservative, until it was banned in 1987. EPA reports that nearly 6,000 pounds of PCP were released to land within Washington State between 1987 and 1993. PCP has been detected in surface waters and sediments, rainwater, drinking water, aquatic organisms, soil, and food, as well as in human milk, fish adipose tissue, and urine. PCP is generally used for its properties as a biocidal agent, so there is considerable concern about adverse ecosystem effects in areas of PCP contamination. Long term exposure to drinking water contaminated with PCP can lead to problems with liver or kidneys and may increase the risk of getting cancer.

The soil samples with detectable levels of PCP had one-tenth the concentration of PCP that would have required cleanup, according to the State's Model Toxics Control Act (MTCA). Cleanup was not required. And yet, given that groundwater at this site is so shallow, we were concerned that impacted soils had the potential to compromise the quality of the surface and groundwater at this site (and of the habitat it supports). Also because the site is retaining more runoff on-site and because the subgrade has been loosened, there is more surface to

groundwater interaction than previously. To prevent future leaching of contaminants into the wetland rehabilitation area Pierce County had the affected soil removed from the site and disposed at an authorized facility (Appendix H—Waste Disposal Authorization Application).

The removal of this garbage and contaminated soil benefits the surface water quality, groundwater quality, and habitat of all areas that previously had a groundwater connection to it. This includes the entire 13.16 acres of wetland on the site, as well as the receiving Clover Creek drainage. This represents a significant improvement in water quality, as well as habitat function; improvements which were not captured in the credit/debit tool. Not only is the site potential for these ecological services lifted, but the *value* of the site's potential to provide these services is significantly improved because this garbage and contaminated soil are no longer present. The question is, how many credits are earned by this lift in site potential and value?

Prior to our restoration efforts, water quality and habitat site potential scored "medium" and our restoration efforts are expected to lift these scores from "medium" to "high". The presence of garbage and impacted soil did not result in a reduced initial score for water quality site potential or value: those features are lacking from the credit/debit tool. The presence of such other sources of pollutants *coming into* the wetland would be cause to elevate the l*andscape potential* score (Question 2.0 of the Credit/Debit tool), but the presence or removal of these other sources of pollutants *when they occur onsite* is not figured into this question about landscape position and surrounding disturbances.

Though not reflected in the credit/debit score, this contaminated material likely counteracted (at least in part) the water quality benefits the wetland had been providing. If we presume that the garbage and contaminated soil, had they been included in the credit/debit scoring, resulted in an initial water quality site potential score of "low", not "medium", then the removal of the garbage and contaminated soil, alone, could have improved water quality site potential, potentially lifting the score from "low" to "medium". Then, our additional restoration efforts would have further lifted that score from "medium" to "high". In this case, the water quality lift would exactly double within the restoration/enhancement areas, yielding another 9.95 water quality points.

A Total of 12.65 Additional Water Quality Credits Are Requested

PCSWM proposes that the addition of vegetated treatment swales to provide treatment of incoming stormwater and the removal of garbage and impacted soils from within the wetland unit result in an additional 12.65 acre-credits of water quality function (2.7 credits from the additional stormwater treatment provided by the vegetated swales plus 9.95 credits from the removal of garbage and impacted soils).

5.2 Improvement of Hydrologic Functions

Restoration of 1.16 acres of wetland is expected to yield 9.28 Hydrologic credits (1.16 acres times the score of 8 for hydrologic function, times 1—the risk factor for "advance mitigation").

According to the credit/debit tool, the hydrologic score for the *existing* wetland is not being elevated so would not result in any additional hydrologic credits. Site design had to account for surrounding infrastructure and needed to adhere to stormwater guidelines so opportunities to retain water to a greater depth were limited. And yet, stormwater *is* being detained: pre-construction modeling indicated that hydrologic functions will be improved (Appendix D—Hydrology Report) with implementation of this design, so PCSWM is requesting additional credits for this improvement in function.

Additional 2.78 Hydrology Credits Requested Because of Increase in Stormwater Attenuation

The site plans include an outlet control structure to meter flows out of the site. This control structure is a weir with horizontal and vertical controls and is immediately upstream of the pre-existing outlet control (still-existing twin culverts under 96th St. E.) The weir is not providing *new* outlet control; it is just moving the control onto the site so that the hydrology of the site will not be affected by any future maintenance or replacement of those twin culverts. The purpose of the weir is to restrict wetland outflow in order to control the duration of ponding within the wetland, while preventing flooding of the public roadway and surrounding properties. The outlet control structure has been set at 385 ft. (NAVD 88), which is the invert elevation of the twin culverts.

The slopes of the seasonal pond were graded at a 10:1 slope from a top elevation of 387 ft. to a bottom elevation of 385.5'. The majority of the pond was then gently graded from 385.5' to a low flow notch elevation of 384.5'. This low flow notch is 6 inches below the invert of the 12-inch weir plate at the outlet, creating a refuge for aquatic organisms during low flow conditions.

Application of the Credit/Debit tool indicates that there will be no improvement in hydrologic functions, and yet modeling shows that the proposed design will increase live storage enough to reduce the discharge flow rate of the 100 year storm by 34% and the 2-year discharge flow rate by 25%, while still meeting all of the threshold limits for discharges of stormwater to wetlands (Appendix D—Hydrology Report). Meeting those threshold limits means that even though floodwater will be retained onsite, the wetland will not pond higher than, nor will the duration of ponding exceed, the height and duration of ponding determined to be impactful to native plants and native wildlife. The Credit/Debit tool is a rapid assessment tool and by its nature is unable to show quantitative improvement of wetland hydrology functions. However, in its post-construction condition, the Larchmont wetland will clearly provide improved hydrologic functions. This is significant when considering the wetland's position in an urban basin with downstream aquatic resources (including salmonids) that are impacted by stormwater flows, and in a basin identified as being a high priority for surface water storage processes.

Prior to implementing the mitigation design, the site potential for hydrologic function at the Larchmont Wetland Reserve was "medium". The site potential is expected to remain "medium" even after rehabilitation measures, since actions PCSWM took to improve water storage

processes are not reflected in the robust credit/debit tool. However, had restoration measures raised the hydrology site potential from “medium” to “high”, this *would* have resulted in an additional 11.11 credits of hydrologic function (9.95 credits for wetland restoration/enhancement areas and 1.16 credits for creation/rehabilitation areas). Some fraction of this number of credits should be given as recognition for a 25% decrease in stormwater flow from the wetland. PCSWM proposes to receive 25% of the credits that would be have resulted from outright lifting the hydrologic site potential (according to the tool) to high-- so 25% of 11.11 credits, or 2.78 additional hydrologic credits.

5.3 Improvement of Habitat Functions

The habitat function of the Larchmont Wetland Reserve will be lifted (from medium to high) through several actions. This will result in 18.07 habitat credits. Additionally, several collective actions that are not accounted for in the credit/debit tool will further improve the ability of the site to provide undisturbed habitat for a variety of non-human species. Because of those actions, PCSWM is requesting an additional 9.95 habitat credits.

Less than ten percent (0.88 acres) of the wetland ponded on a seasonal basis prior to construction (Figure 9). Those areas that ponded were part of the seasonally flowing stream (AKA the ditch network). Implementation of the restoration design increased the area of seasonal ponding beyond the ditch/stream, to a total area of 4.02 acres. This action earns water quality credits, as discussed above (section 5.1), but will also earn habitat credits--by increasing the number of water regimes within the wetland.

Many aquatic species have their life cycles keyed to different water regimes, so increasing areas within the wetland that have different water regimes increases the potential of the wetland to provide suitable habitat for a broader suite of organisms, incrementally lifting habitat function and earning habitat credits. Prior to construction, three water regimes were present (Occasionally Flooded or Inundated, Saturated Only, and Seasonally Flowing Stream). Seasonally ponded areas were presented as well, but all seasonally ponded areas were within the seasonally flowing stream/ditch and so the seasonally ponded areas and seasonally flowing stream/ditch together counted as only one water regime. But by extending the seasonally ponded area well beyond the seasonally flowing stream, the number of water regimes represented onsite increased to four. This is reflected in the credit/debit score and is a part of why the habitat score increased from medium to high.

The habitat score is also affected by several actions that increase ‘special habitat features’ within the wetland:

- Areas vegetated with thin-stemmed emergent plants suitable as egg-laying structures for pond breeding amphibians have increased. One objective of the planting plan was to facilitate the development of a diverse wetland emergent plant community that will provide several acres of thin-stemmed persistent emergent

plants and woody branches to improve breeding success of pond breeding amphibians.

- Invasive plants were selectively removed from throughout the wetland and replaced with native trees and shrubs. Ongoing maintenance will control the reinvasion of undesirable plant species.

- The seasonal pond includes several snags and brush/boulder piles and is replete with micro-topographic variability, further enhancing habitat for wetland dependent organisms. Three wood-duck nesting boxes were strategically installed in trees near the emergent/open water areas of the wetland. Nest boxes are not individually tallied in the credit/debit tool but can be considered part of the variety of snags/snag habitat provided from project implementation.

Prior to construction, the Larchmont Wetland unit received three points for special habitat features. After construction and attainment of performance standards, the wetland unit will receive six of six possible points for special habitat features.

Additional 9.95 Credits Requested for Actions not Reflected in the Credit/Debit Scoring

Project implementation included additional actions which improve the site potential and value of wetland habitat but which are not reflected in the credit/debit scoring. These include:

Site Protection Measures.
Restoration actions included fully fencing the site. A welded wire fence, designed in consideration of the needs of wildlife for ingress/egress will now deter human intrusion but allow wildlife (large and small) to migrate in and through the site. The urban location of this wetland (just blocks from Pacific Avenue), and its character of being densely vegetated, have made this wetland attractive as a homeless encampment as well as a place to deposit debris. PCSWM removed two homeless encampments prior to project implementation and numerous additional isolated piles of debris that had been dumped on the site. Fencing the site to preclude future homeless encampments and dumping will improve the function of the habitat for non-human wetland dependent organisms. While this action is a necessary part of site protection, it is not reflected in the lift of habitat function.

Trash Removal
The removal of buried garbage and impacted soil will enhance habitat for soil dwelling organisms as well as for any organism that uses habitat affected by groundwater (i.e. any organism, plant or animal, within the wetland).

To determine the value (scoring) of these additional habitat improvements, if we were to consider that the presence of buried garbage, impacted soil, new garbage dumps and homeless encampments act as a reducer, such that no action could lift habitat site potential above, say, “medium” when these conditions persist, then removing these conditions would logically

equate to the number of credits that could be earned by lifting this function from “low” to “medium” or “medium” to “high”. In this case, that equates to an additional 9.95 habitat credits (the number of habitat credits earned within the wetland restoration/enhancement area). Note: the area of created wetland is not considered in this equation, because it should be assumed that a wetland will not be created in a garbage dump or pocket of contaminated soil or where the wetland will be continuously impacted by human intrusion.

5.4 Wetland Functional Lift and Overall Credit Determination

As discussed above, the overall lift in functions from implementation of the Mitigation Plan for the Larchmont Wetland Reserve will yield 72.67 universal credits of mitigation (once all performance standards are met). 47.74 credits are shown to be generated by a comparison of the before condition and after-condition assessments of functions per the Department of Ecology’s Credit/Debit Assessment Tool (Hruby, 2012). An additional 24.93 universal credits would be generated from restoration actions that the credit/debit tool did not capture.

5.5 Proposed Credit Release

Appendix L of the PCILF Instrument states that a credit release schedule will be individually negotiated with and approved by the Corps and Ecology, in consultation with the IRT, for each mitigation receiving site. Credit releases are to correspond with the achievement of specific performance standards. The Instrument included an example of project milestones and performance standards that could be used to meter credit releases.

The proposed credit release schedule for Larchmont Wetland Reserve credits is illustrated in Table 1. This credit release schedule is based on the assumption that a total of 72.67 universal credits, as proposed above, will be released once all performance standards are met.

Table 1. Larchmont Wetland Reserve Proposed Credit Release Schedule

Proposed Project Milestone	Portion of Credit Released	Credits Released at Milestone	Total Credits Released
Site acquisition by Sponsor, recording of Conservation Easement, and mitigation-receiving site plan approved by IRT.	12.5%	9.08	9.08
Installation and approval of as-built plan and report. Performance standards 3a1, 3a2 achieved.	12.5%	9.08	18.16
Staff/flow gauges installed.	12.5%	9.08	27.24
Year 2 and 3 performance standards, including hydrologic and water quality improvement, achieved: performance standards 1b1, 2a1, 2a2, 2b1, 3a3, 3c1, 3d1, 3d2, 4a1, 4a2 achieved.	12.5%	9.10	36.34
Year 5: Performance standards 1a1, 1a2, 1a3, and 2b1 (where conditions must be monitored for 5 out of 10 years), 3a4, 3d3 achieved.	12.5%	9.08	45.42
Year 7 performance standards achieved: 3a5, 3a6, 3a7, 3b1, and 4b1. Wetland areas delineated.	25%	18.17	63.59
Year 10: Hydrologic (2a1, 2a2, and 2b1) and water quality performance standards (1a2 and 1a3) are still met. Credit/debit tool applied to assess wetland condition. IRT signs off on achievement of all performance standards. Steps taken to transition site into long-term stewardship (including transfer of remaining implementation and contingency funds to Long Term Maintenance account).	12.5%	9.08	72.67

6. Mitigation Work Plan

The Larchmont Wetland Reserve project involves wetland rehabilitation and re-establishment (See Construction Plans appended to Appendix E—As-Built Report). A portion of the existing wetland was excavated in order to create a seasonal pond and to interrupt the drainage previously afforded by the drainage ditches: the ditches were not filled in order to decommission them; rather, water was directed away from them. These ditches will remain wetland but will no longer convey the flow of water through the site and will no longer serve to drain the area.

The seasonal pond was constructed with a meandering low-flow channel. It was designed such that stormwater entering the site must flow around landscape features, thereby extending its residence time. The seasonal pond and all other areas disturbed during construction were seeded with one of several native emergent seed mixes and planted with native shrubs and trees. A control structure, consisting of a concrete weir and weir plate was installed at the downstream end of the site, just upstream of the existing outlet control. The weir plate is adjustable but the intent is for it to be adjusted only once and then kept in a fixed position. It has not been adjusted even once since installation in late summer, 2013. Vegetated swales provide filtration of previously untreated stormwater from roadside ditches flowing into the site. Additional habitat improvements include the selective removal of invasive vegetation within the existing wetland and buffers, installation of boulder and brush piles, snags, and downed logs, the excavation of new wetland areas from non-wetlands at the north end of the project site, and the removal of buried and surface trash and impacted (contaminated) soils.

The purpose of this project was to improve wetland functions and construction imposed only minor and short term adverse impacts to wetlands. The plans included removing 15,323 cubic yards of native soils, placing fill within up to 758 square feet of an existing ditch system, installing an outlet control structure, and filling 200 square feet of existing wetland to establish an access in order to maintain this outlet control weir.

Construction of the project was initiated in late summer, 2013. Plants were installed in early winter, 2013. Emergent seeding was completed in 2014. Selective removal of invasive plants, hand removal of garbage found throughout the site on and lightly embedded into the soil surface, and additional planting continued into June 2015.

Site construction is further discussed in the As-Built report, included as Appendix E to this Mitigation Report. Specific construction elements are discussed below.

6.1 Channel Modification

The pre-existing drainage ditches are approximately 5 feet deep. The water level is controlled at 385 ft. (NAVD 88)--which is the invert elevation of the culverts under 96th St. E. Years of dredging have resulted in deeper pockets within the ditch that hold water and continue to drain surrounding areas even below elevation 385 ft. Soils investigation during the site design revealed that throughout the site, peat has become desiccated to varying depths ranging from

1 to 2.3 ft. below ground surface. In these areas, the top surface of the peat horizon has decomposed to muck. To arrest the disruption caused by the ditches, maintenance dredging will be discontinued within the Larchmont Wetland Reserve. This includes 898 linear feet of the main ditch and 812 linear feet of the secondary ditch. These ditch sections will be allowed to fill in with silt, vegetation, and organic matter over time.

To continue to manage stormwater and flooding, ditch maintenance could not be discontinued without providing a place for the water to go. Accordingly, construction included the excavation of a seasonal pond within a portion of the existing wetland. A new, north inlet channel was added to direct stormwater into the seasonal pond from 91st St. E.

The outlet of the existing ditch system was re-graded during construction to ensure positive flow through the site (See sheet 8 of 17 of the construction plans, Appendix E). Long term maintenance of these ditch sections is discussed in our Long Term Management Plan (Appendix G). These ditch sections will be allowed to fill in with wetland vegetation and silt, but will be regularly inspected and any blocking material (organic and inorganic debris, silt) removed only as necessary—by hand, or with small equipment-- to maintain flow and prevent flooding of surrounding infrastructure. As stated in the Long Term Management Plan, any maintenance activity that may affect the site hydrology, such as dredging or ill-timed beaver dam removal, could adversely affect the amount of mitigation credits that could be released from the site and so will be closely coordinated with the IRT.

Salvaged organic soils were placed within a 48’ section of the east-west ditch. This was necessary to direct flow from the north inlet channel to the seasonal pond. However, this ditch section will remain wetland. The fill brought the bottom elevation of the ditch to 386.5’ (the upper elevation of seasonally ponded areas) and the slopes will grade up to 387.5’ (level to existing ground, which is wetland).

All excavation was accomplished during the driest part of the 2013 construction year, which was the period August through September. Work was accomplished in the dry, with an excavator.

6.2 Fence

The perimeter of the site was fenced to limit human intrusion. This was necessary due to the urban location of this wetland. This wetland site has already been inhabited by homeless individuals on multiple occasions and in once instance, a neighbor was encroaching onto the property with a trailer and living on this County property. This wetland will continue to be an attraction to people, for activities that are not necessarily compatible with the goals of improving wildlife habitat potential of the site or of maintaining the site’s conservation values. For these reasons, it is necessary to fence the property. The perimeter fence uses a wildlife friendly design. It consists of 4’ welded wire fabric (“field fence”), placed with the larger openings closest to the ground. This fence design does not prohibit the ingress and egress of small mammals and other animals. Also, the fence has been installed such that it does not

closely hug the ground—thereby providing spaces under the fence for larger mammals to access. The top of the fence has a single wire.

6.3 Weir

An outlet control weir was placed 40 ft. upstream of the existing culverts at 96th St. E. Although the existing culverts previously provided outlet control, the outlet control weir is one of the most important design items of this project. Its purpose is to restrict wetland outflow and allow two months or more of ponding within the seasonal pond area while preventing flooding of the public roadway and private residences which surround the site. Moving the control upstream in this manner will allow future culvert replacement under 96th St. E., should that become necessary, without compromising the desired hydrology of the Larchmont Wetland Reserve. The control structure is provisioned with adjustable horizontal gates that are held in place by set screws and a removable and replaceable steel bottom plate. The bottom plate has been set at 385 ft. (which is the same as the invert elevations of the existing culverts--that is, that was the pre-existing outflow control elevation). This plate can be replaced with a taller plate if necessary, but that is not the intent. Since construction, the weir plate has not been adjusted and it is not expected to need adjustment. The desired hydrology appears to have been achieved by the initial setting of the weir plate at 385 ft. Future plate adjustments will only be made to accommodate significant hydrologic changes within the drainage basin, and only then after consulting with all appropriate environmental resource agencies.

The control weir was constructed from reinforced concrete cement, poured in place. Its footing measures 24 ft. by 10 ft. and it was poured 3 ft. below finish grade. The size of the control structure was based on shear strength and bearing capacities of the soil. Construction involved excavation and temporary stockpiling of native soils, dewatering, and spill prevention and containment.

A maintenance access was installed to allow access to the weir. This is comprised of quarry spalls and hog fuel and encroached into 200 square feet of the delineated wetland (8 CY of fill).

6.4 Land Clearing

Less than 6 acres of the 16.85 acre site was cleared and grubbed during construction-- after the clearing limits were delineated with high visibility construction fencing. The remainder of the site was undisturbed. Grubbed out plant material that was a mixture of native and non-native shrubs was hauled off site to a composting facility. Native trees, shrubs, and branches that could be easily separated from non-native plant material were retained on site and tossed about as woody material to provide habitat and structure.

The reed canarygrass patch in the SE quadrant of the property was grubbed to a depth of 18 inches, to ensure that rhizomes are removed.

6.5 Stormwater Facility

Prior to construction, stormwater from roadside ditches entered the wetland at the north end of the project site, providing surface hydrology to support the flow in the tributary ditches.

Stormwater from contributing basin #3 (127.53 acres) circumvented the site in roadside ditches and flowed directly into the N. Fork of Clover Creek. A vegetated swale was constructed at the SE corner of the property (in a non-wetland portion of the site). This swale now picks up water from contributing basin #3, provides treatment, and releases it into the seasonal pond. The vegetated swale is 45 ft. wide by 160 ft. long. It was seeded with grasses and emergent plants known to be effective in trapping water borne pollutants from the surface water and that are generally recommended for planting within biofiltration swales (*Festuca arundinacea* or *Festuca elatior*, *Agrostis palustris*, and *Agrostis alba* or *Agrostis gigantea*). This swale will be maintained as a stormwater facility and not as part of the wetland. Its maintenance is addressed in the long term maintenance and management plan and will, essentially, involve grade contouring to keep the soil flat and level, with no channelizing or rilling; mowing vegetation as necessary in order to retain dense emergent vegetation; and removal of accumulated sediment and garbage.

6.6 Pond Excavation

Implementation included the creation of a seasonal pond covering 4.02 acres. The area excavated for the seasonal pond is mapped as Dupont muck and the soil appeared to meet the description of the peat soil inclusion recognized as present within the Dupont muck soil mapping unit. Fibrous peat was been found to depths of up to eight feet within the area to be excavated. Soil boring revealed that below the peat lies a thin layer of clay, followed by a thick deposit of fine sand (Appendix I). The clay layer appears to form the impermeable barrier which has led to the formation and persistence of this depressional wetland. The depth to this clay barrier was studied to establish the configuration and depth of the seasonal pond. Pond excavation was designed and carefully inspected such that this clay barrier was never perforated. Portions of the site known to have thinner peat deposits were over-excavated (but not into the clay barrier) and then brought to finish grade with salvaged peat from portions of the site having deeper deposits of peat (see sheets 9 and 10 of the construction plans, Appendix E).

Altogether, 23,325 cubic yards of soil was excavated—much of it for this over-excavation. The over-excavation material was stockpiled and returned to the wetland as salvaged marsh surface in areas where buried organic soil was lacking—at the north end of the construction area, and where it was necessary to grub out 18” of reed canarygrass rhizomes--in the south end of the construction area. By over excavating in these areas (Soil Preparation Area 1—see sheets 9 and 10 of the construction plans—Appendix E) and placing salvaged organic soil from other portions of the site (Soil Preparation Area 2), the amount of organic soil removed from the site was minimized and all portions of the seasonal pond were provided a healthy surface layer of organic soil: all constructed areas had a minimum of 12 inches of peat at project completion.

In the end, only 15,325 CY of soil and fill material was actually removed from the site. All earthwork was accomplished with low ground pressure equipment which minimized compaction and disruption of the remaining soil profile.

Additional Excavation Features

The pre-existing ground surface in the area of the pond excavation was, generally, at elevation 387 ft. (but as high as 391 ft. in the very northeast corner of this site). The sides of the pond now slope, at 10:1, from the pre-existing elevation to a pond bottom elevation of 385.5 ft. This further notches down to a low-flow channel with a bottom elevation of 384.5 ft.

As illustrated in the construction plans, an island and a higher berm were retained within the south end of the excavated pond. This lengthens the residence time of water entering the site from the southeast corner.

A portion of the pond excavation—in the northeast quadrant of the property—involved excavation of fill material. Construction debris (concrete chunks and roofing material) defined the wetland edge in this portion of the site. Excavation included removal of this material (and more, as discussed in Sections 5.1 and 5.3) and the re-establishment of wetlands in this area.

The as-built plans (plan sheets 3 and 4 of Appendix E) note the general location of septic tanks in the vicinity of the NE and SE corners of the property, along with the note "septic tanks were not located". As-built reports and health letters indicated that septic systems were possibly used at one time at each of the two homes (the Schmidt and Lindley acquisitions) that Pierce County demolished in those corners of the project site. At the time of purchase, the two homes were hooked up to sewer (Pierce County obtained permits to cap the sewer lines as part of the demolition process). Since these properties were on sewer at the time Pierce County purchased them, it was assumed that the septic tanks had been decommissioned. In the case of Schmidt (917 96th), Pierce County was able to locate the septic tank decommission report which stated that the tank was pumped dry, filled with pea gravel (standard decommissioning practice), and left in place. Pierce County was not able to find such a report for Lindley. Pierce County included septic tank removal in the construction contract, in the event they were found during the course of excavation. They were never found.

Soil Stabilization and Planting

Upon achieving finish grade, the soil was stabilized with a 50% cover of weed-free Woodstraw®, seeded with specially designed wetland emergent seed mixes, and finally planted with native wetland emergent and woody plant species.

The seasonal pond area is represented by two vegetation zones: Seasonally Ponded Area 1 (expected to pond deeper and longer), and Seasonally Ponded Area 2. Each area was planted with emergent vegetation and, in the case of Seasonally Ponded Area 2, also with shrubs. Each area was also seeded with a specially designed native emergent seed mix:

> Seasonally Ponded Area 1 was planted with gallon-sized containers of and *Alisma plantago-aquatica* (European water plantain)*, and Sparganium emersum* (European bur-reed) and seeded with *Carex aquatilis*, *Carex cusickii*, *Carex vesicaria*, *Eleocharis palustris*, *Glyceria occidentalis*, and *Juncus balticus*.

Seasonally Ponded Area 2 was planted with the emergents *Potentilla palustris* (marsh cinquefoil) and *Lysichiton americanum* (skunk cabbage) and shrubs *Salix sitchensis* (Sitka willow)*, Spiraea douglasii (*Spirea or Hardhack*)*, *Alnus sinuata* (Sitka alder), *Lonicera involucrata* (Black twinberry), and *Rubus spectabilis* (salmonberry). The emergent seed mix is composed of equal parts (by seed number) *Scirpus microcarpus* (small-fruited bulrush), *Carex obnupta* (slough sedge), *Carex aquatilis* (water sedge), and *Glyceria occidentalis* (Northwestern mannagrass).

These plant templates were based on Washington DNR accounts (Kunze 1994) of native plant assemblages within different natural occurring landforms, categorized by geographic area, soil type, and hydrologic regime. Consideration was also given to existing native plants present on site and in reference sites in this vicinity.

6.7 Wetland Re-Establishment

1.16 acres of wetland area was re-established in the northeast quadrant of the property. This is now part of the seasonally ponded wetland area. Side slopes are 10:1 from the pond bottom to the edge of the occasionally ponded wetland and 4:1 to pre-existing grade. The wetland creation area received the same treatment of Woodstraw, emergent seed mix, and native wetland plantings described above for the area of pond excavation.

The addition of this wetland area results in a total of 13.16 acres of wetland within the 16.85 acre site. This includes about 2.25 acres of wetland within the 50 ft. minimum regulatory buffer but does not include the area of the vegetate swales, which, technically, are also wetland.

6.8 Native Plant Community Restoration

Project objectives include adding an area (of at least ¼ acre) of thin-stemmed emergent vegetation that will support breeding native amphibians, maintaining invasive plant cover to less than 25% in every plant stratum within the wetland, and maintaining high richness of native plant species.

Upon completion of earthwork, all disturbed soil was stabilized with weed-free Woodstraw and a mix of native wetland emergent seeds. Seed mixes were designed for the different wetland hydroperiods we aim to achieve. These seed mixes are shown for the different areas on sheet 12 of the construction plans and include the following species: *Carex aquatilis, Carex cusickii, Carex vesicaria, Eleocharis palustris, Glyceria occidentalis, Juncus balticus, Scirpus microcarpus, Carex obnupta, Glyceria elata, and Festuca rubra.* All constructed wetland areas were planted, in late fall, 2013. The planting plan was designed from a review of reference sites, and the ecological plant community descriptions provided by the Washington Department of Natural Resources (Kunze 1994) and it included *Potentilla palustris, Sparganium emersum, Alisma plantago- aquatica, Salix sitchensis, Spiraea douglasii, Alnus sinuata, Lysichiton americanum, Rhamnus purshiana, Physocarpus capitatus, Lonicera involucrata, Rubus spectabilis, Cornus sericea, Crataegus suksdorfii, Pyrus fusca, Rosa pisocarpa, and Thuja plicata.* All disturbed non-wetland areas were also seeded with a specially designed grass mix and planted. The non-

wetland plant template was comprised of *Oemleria cerasiformis, Rubus spectabilis, Tsuga heterophylla, Alnus rubra, and Rosa pisocarpa.*

A large part of plant community restoration will be the control of invasive plants. Portions of the site were heavily dominated by patches of aggressive invasive plants including Himalayan blackberry (*Rubus armeniacus*), Japanese knotweed (*Polygonum cuspidatum*), and reed canarygrass (*Phalaris arundinacea*). The initial construction contract included the use of herbicide spray to knock down these plants. Grubbing helped to manage the reed canarygrass and blackberry (but will be of little help against the knotweed). The planting of native woody species will help to outcompete or shade out these aggressive plants, over time. The long term maintenance and operations plan addresses the future management of these aggressive invasive plant species.

It can be expected that there will be continued hand-maintenance as well as follow-up use of glyphosate, imazapyr, or another herbicide approved for use in aquatic habitats.

6.9 Wetland Buffers

As noted above, the wetland buffer width prior to rehabilitation and restoration efforts was already compromised since wetlands extended to the property boundaries and to the roads encircling the site in many locations. Historically, some of those roads were most likely placed on top of wetlands. There was no opportunity to increase wetland buffers. Filling wetlands to create non-wetland buffers was not a good option.

Within Pierce County, buffers for Category 1 wetlands with a high level of function for habitat (which is what the wetlands at the Larchmont Wetland Reserve are expected to become), and that are surrounded by high intensity land uses, would be 300 ft. During an on-site meeting with the IRT on June 14, 2012, it was agreed that in this situation (given that there was no opportunity to increase wetland buffers) average buffers could be minimal. Pierce County Planning and Land Services later followed with an e-mail, stating that a wetland variance would not be necessary if the wetland buffer ends up being less than the standard per Title 18E of Pierce County Code (Scott Sisson, PALS Biologist, in e-mail, dated June 21, 2012). All IRT members were in agreement that we should remove the fill pad left from the demolished home in the NE corner of the Larchmont parcel and that modified buffers of 50 ft. in that area would be acceptable (Linda Storm, EPA, comments on the Larchmont Wetland Reserve Wetland Mitigation Design Report, May 1, 2012 Draft).

The 50 ft. minimal buffer was extended to other areas of the site where construction was planned. The regulatory buffer for Larchmont is, therefore, a *minimum* width of 50 ft., with a few exceptions. Those exceptions are at the locations of the graveled accesses and the vegetated swales (See Section 7.1). Three maintenance access locations, at the northeast, southeast, and southwest corners of the parcel, encroach into what would otherwise be wetland buffer (Figures 5 and 6). The combined area comprising the graveled accesses is 10,624 sq. ft. (0.24 acres). This reduces the buffer since those areas are not vegetated and will

occasionally be accessed by maintenance vehicles. Additionally, the north, south, and east swales comprise part of the area that would otherwise serve as buffer (Figures 5 and 6). As mentioned elsewhere, while technically wetland, these areas are not considered part of the wetland that was re-established and rehabilitated. The swales are likely to need maintenance from time to time so they don't serve all of the functions of an undisturbed buffer either. The combined area of the swales is 10,484 sq. ft. (0.24 acres). This also comes out of the area that would otherwise have been considered wetland buffer.

As before, the buffer extends to as great at 385 ft. in places (Figure 11). The overall average buffer width (when wetland areas within 50 ft. of the property boundary are considered as part of this regulatory buffer but when the graveled accesses and the vegetated swales are excluded) is approximately 56 ft. and the area within the buffer (which includes 2.25 acres of wetland) is 230,218 sq. ft. (5.29 acres). Aside from construction of the graveled accesses and the vegetated swales, all earthwork associated with wetland rehabilitation and restoration was conducted 50 feet or more from the property boundary in order to leave the minimal 50 ft. buffer area untouched (except by invasive plant removal and native plant installation). In areas of the site where wetlands previously extended to the property boundary, they still extend to the property boundary.

7. Maintenance Plan

Maintenance requirements for the Larchmont Wetland Reserve can be separated into near term and long term maintenance and management actions. Near term requirements are those necessary to meet the performance standards in order to ensure project success and full release of anticipated In-Lieu Fee Credits. Performance monitoring will reveal the need for adaptive management and contingency measures in order to ensure that performance standards will be attained. Those near term requirements are addressed in the Contingency/Adaptive Management section of this report.

The Larchmont Wetland Reserve sits upon a block of twelve parcels totaling 16.875 acres. All parcels are in public ownership (PCSWM). The site will be perpetually maintained as a wetland and natural, open space area. A Maintenance Plan has been prepared, according to PCSWM standard practices (Appendix G). Excerpted sections of the Maintenance Plan are captured in the discussion below.

For the first ten years after construction, for the period known as the Establishment Phase, the site will be monitored to ensure project performance objectives are being attained. PCSWM staff will monitor site conditions both formally and informally. Informal monitoring will be conducted by PCSWM Staff that are in the area, performing drive by investigations or responding to citizen calls. PCSWM will also undertake or contract performance monitoring of the site.

Additionally, the Pierce Conservation District (PCD) will serve as third party overseer and holder of the Conservation Easement for the Larchmont Wetland Reserve and they will be provided the financial resources (from PCSWM) to provide annual oversight of the project site. They are responsible for reporting actions necessary to maintain the site's conservation values. Following the Establishment Phase, the site will continue to be monitored by the PCD to ensure that the conservation values of the property are preserved in perpetuity.

In response to these monitoring efforts, PCSWM will take whatever actions are necessary to repair the site from damage and to prevent other encroachments. If PCSWM fails to implement required maintenance, PCD has the authority to enforce conditions set forth in the conservation easement. This is discussed in appendix Q of the PCILF Program Instrument and in the Interagency Memorandum of Agreement between PCSWM and the PCD. Coordination between the PCD, the IRT (Internal Review Team –group of external stakeholders responsible for overseeing the ILF Program), and the PCSWM maintenance group will be the responsibility of the PCILF Project Manager.

Maintenance actions may include:

- Removing invasive plants and replacing native plants.
- Repairing fencing and gates.
- Maintaining accesses.
- Removing garbage.

Despite the involvement of the PCD as conservation easement holder, it remains incumbent upon PCSWM to provide the level of monitoring and maintenance they would normally afford a PCSWM-owned parcel. For instance PCSWM must prevent and remove hazardous conditions when discovered; they must monitor the site for the presence of noxious weeds, and take action when necessary, etc. The focus will be to proactively maintain the site and not rely upon PCD reports to remedy deficiencies. By conducting regular monitoring and implementing corrective measures as needed, PCSWM will protect their reputation with the IRT and public at large.

7.1 Project Elements Where Future Maintenance Anticipated

Certain areas within the project site will be maintained as described below. These include: three inlet drainage swales, perimeter fence and gates, concrete weir control structure, three gravel access ingress/egress areas. Vegetation maintenance in the pre-existing drainage swales is also permitted. However, in the event dredging work becomes necessary, this work will require a hydraulic project approval and other applicable aquatic permits. Any regular maintenance activities within Road Right of Way are also exempt and permissible under permit requirements provided wetland hydrology is not impacted. See as-constructed plans and M&O maintenance overview plan sheet (Appendix G) for locations of regular maintenance areas.

- **Gravel Access Ingress/Egress Areas**: Three gravel access areas were installed to provide access and staging areas.
- **Perimeter Fence and Gates:** Approximately 4,350 lf of wire fence type 1 modified and (6) double wire gates were installed to provide access to the project site.
- **Three Inlet Drainage Swales**: Inlet swales were not technically designed to be biofiltration swales, and therefore no particular maintenance standards apply. However, it is the intent that they provide a pre-treatment water quality benefit through a healthy stand of grass. It is recommended swales be inspected annually and any rilling be repaired, any invasive weeds be removed, and any mowing or re-seeding be done as necessary. See record drawings for swale seed mix. Swale maintenance will be limited to inlet swale bottoms only. The side slopes have been planted and plantings will remain intact.
- **Concrete Control Structure with Adjustable Steel Weir Plates:** Weir was installed at SW corner of site to control flow rates and adjust wetland hydrology if necessary. The as-constructed flow line elevation of the steel plate was set to 385' – equal to the elevation of the twin 36" culverts crossing 96th Street. Overflow elevation of the control structure is 386.5'. An additional 18" high weir plate for vertical elevation control was purchased as part of the project. The plate is currently being stored at Pierce County SWM Quarry, in the event it becomes needed in the future. A staff engineer as well as a wetland biologist familiar with the In-Lieu-Fee Program should be consulted prior to adjustment of the control structure weir plate elevation.
- **Drainage Culverts:** Roadside ditch culverts were installed around the perimeter of project site to facilitate ingress/egress locations. All culverts were installed within Road Right of Way and shall be maintained by P.C. Road Operations per their standards. Road Operations will be provided with a copy of As-Constructed Plans and copy of this manual. Additionally, a request for GIS updates has been submitted.
- **Wetlands & Planting Areas:** As discussed above maintenance in these areas is intended to be limited to invasive weed removal, plant replacement, and garbage removal. Garbage removal may include removal of homeless encampments. PCD will assist with identification of maintenance needs in these areas during their annual inspection.
- **Beaver Colonies:** Beavers are part of the native wildlife this site was designed to support and since beaver activities create important habitat forming and restructuring processes, efforts should be made to first allow beaver to remain onsite. However, in the event beavers are observed to be in the process of building dams that could negatively affect drainage ways, the following actions shall be taken in order of preference:
    1. Notch (lower) dam in 8" to 12" increments until threats of flooding are removed.
    2. Remove dam.

3. Install beaver deceiver.
4. Remove beaver colony.

- **On Site Drainage Ways:** A Memorandum of Understanding dated March 9, 2007 details an agreement between Drainage District #19 and PCSWM. The agreement states the Drainage District will not conduct drainage maintenance on the properties that comprise The Larchmont Wetland Reserve and that PCSWM assumes full responsibility of the site. This agreement was revisited in 2015 and determined to still be in force, as originally written.

  The site was designed to ensure no change in upstream or downstream hydrology. However, circumstances difficult to control may jeopardize this design. These circumstances may include beaver colonization and accumulations of woody debris, emergent vegetation, or silt. If any of these are observed to be a problem, removal must be coordinated with a wetland biologist familiar with the PCILF Program. This work will also require a Hydraulic Project Approval (HPA) and other aquatic permits, and be carefully timed as to not disturb sensitive aquatic resources, including native pond breeding amphibians. Any maintenance activity that may affect the site hydrology, such as dredging or ill-timed beaver dam removal, could adversely affect the amount of mitigation credits that could be released from the site.

- **Flow Meter and Staff Gauge:** Discharge from the site will be monitored with a continuous monitoring flow meter for a period up to ten years. Hydroperiod limits and excursions will also be measured with continuous monitoring staff gauges. The flow meter will be located within the outlet channel near the control structure. The two staff gauges will be located in the Northeast and Southeast ends of the site respectively. Installation and monitoring of the monitoring equipment will be coordinated by the wetland biologist familiar with the PCILF Program. Maintenance is expected to be minimal, but may include removal of trapped debris. Approximate locations are shown on M&O Overview Plan Sheet (Appendix G).

7.2 Alteration of Drainage System

A pre-existing type 2 catch basin on the north side of the project site was modified to prevent flow to the west. The invert elevation of the west pipe was low enough to allow water to flow west toward the City of Tacoma's system during high flow events. The pipe was plugged with a cement concrete plug. This forced all flow south into the Larchmont wetland site along its original drainage course. This work is documented on the As-Constructed Plans.

Prior to Construction, Drainage District #19 was responsible for maintaining the north/south swale that bisected the site. The project redirected this flow into the wetlands. As discussed above, a memorandum of understanding was drafted alleviating the Drainage District from future maintenance responsibilities within the boundaries of the Larchmont Wetland Reserve and placing the responsibility for maintaining the drainage course with Pierce County Surface Water Management.

7.3 Access and Easements

No property easements were acquired for this project. All project infrastructure was installed either within Pierce County Road Right of Way, or on PCSWM property.

A Conservation Easement has been established for this site and recorded with the Pierce County Auditor. The easement names PCD as the holder of the conservation easement and third party steward, as described above.

Access to storm water infrastructure and wetlands shall be from the road right of way. Access locations are clearly shown on the As-Constructed plans and M&O Overview Plan Sheet.

8. Performance Standards

The project purpose is to rehabilitate and re-establish wetlands in order to earn advance wetland mitigation credits for use in the Pierce County In-Lieu Fee program.

The performance standards are the measures to be used to determine whether, in fact, functional lift has been achieved. Any failure to meet performance standards is addressed within the Adaptive Management/Contingency Plan (Chapter 11).

Goal 1: Improve water purification function of the wetland.

Objective 1a:
Create a seasonally ponded wetland with a surface area of at least 3.5 acres.

Seasonally ponded wetlands that pond continuously for at least 2 months during the year but dry out sometime during the year allow a balance between oxic and anoxic conditions that is most conducive to nitrogen transformation and removal. A seasonally ponded wetland area of 3.34 acres would represent 25% of the wetlands on the project site—a significant threshold according to the credit/debit tool. The area of seasonally ponding, as designed, will exceed that; it is expected to be 4.02 acres. However, we've established 3.5 acres as the performance standard.

- Performance Standard 1a1--Marks of ponding around the perimeter of the seasonal pond define an area measuring at least 3.5 acres, as determined by staking and survey for at least five of the years during the ten year monitoring period.

- Performance Standard 1a2—Continuous monitoring staff gauges verify that this ponding persists for at least 2 months for at least five of the years during the ten year monitoring period.

- Performance Standard 1a3--At least 3.5 acres of the seasonal pond lacks surface ponding for some period of time for at least five of the years during the ten year monitoring period.

Objective 1b:
Key parameters of water quality improve as water flows through the site.

- Performance Standard 1b1—fecal coliform bacteria counts from water samples taken downstream of the outlet control structure are less than counts from water samples taken at the inlet swales, a minimum of two times during each of years 2 and 3 after construction.

Goal 2: Improve stormwater attenuation

Objective 2a:
Comply with minimum technical requirements and recommendations for stormwater discharges to wetlands.

Minimum Requirement #8 (Section 2.4.8) of the Pierce County Stormwater Management and Site Development Manual (Pierce County SWM 2008) and the accompanying Guide Sheets (Guide Sheets 1B and 2B of Appendix 1-C of that volume) address when it is acceptable to discharge stormwater into existing wetlands. The Larchmont Wetland Reserve project is not development, in the usual sense. The project involved moving earth, manipulating the surface contours of the wetland, and intentionally altering the wetland's hydrology. Portions of the wetland will pond more water than with pre-existing conditions and the network of ditches which currently have the effect of partially draining the site are being decommissioned. In addition, stormwater is being routed into the wetland from contributing basin 3, whereas that water was previously routed away from the wetland, within a roadside ditch.

The hydroperiod limits mentioned in Guide Sheet 2B were developed from research that looked at the adverse effects to wetlands from stormwater discharges. Wetlands with highly fluctuating hydroperiods (whether due to increased watershed development, re-contouring of the ground surface, alteration of the outfall, or natural conditions) have reduced plant species diversity. The hydroperiod limits mentioned in this Guide Sheet apply to the Larchmont project even though this project will not result in a change of developed area. We do not want to decrease the plant species diversity of the Larchmont Wetland Reserve in our efforts to achieve functional lift. Therefore, the project was designed such that it would adhere to those minimum technical requirements and hydroperiod limits within Guide Sheet 2B.

- Performance Standard 2a1—beginning with the second monitoring year (2016) and through the monitoring period (to year 10) mean annual and mean monthly water level fluctuations in the seasonally ponded wetland, as measured by a staff gauge outfitted with a continuous monitoring probe, do not exceed 15 cm.

- Performance Standard 2a2— Beginning with the second monitoring year (2016) and through the monitoring period (to year 10) ponding excursions greater than 8 cm along the slope of the seasonal pond (above elevation 385.5') will persist for no more than 24 hours total within any 30 day period between February 1 and May 31, as measured by a continuous monitoring gauge.

Objective 2b:
The project will decrease the rate of surface water release from the site by at least 25% (Table 1). This will alleviate downstream flooding.

- Performance Standard 2b1—flow from the site, as measured by a continuous velocity gauge at the outlet beginning with the second monitoring year (2016), shall be no greater than the modeled post-development rate for each recurrence interval shown in Table 1.

Table 1. Larchmont Wetland Reserve Pre- versus Post-Development Runoff Rates for each recurrence interval as determined through Gringorten Plotting.

Recurrence Interval	Predevelopment Runoff (cfs)	Post-development Runoff (cfs)
2-year	14.931	11.244
5-year	21.050	15.674
10-year	27.074	20.392
25-year	31.408	23.789
50-year	41.863	30.145
100-year	47.421	31.366
200-year	49.200	34.447

Goal 3: Improve the potential for the wetland to provide habitat for native animals and plants.

Objective 3a:
Increase plant diversity and provide multiple vegetation layers and communities in the wetland and buffer.

- Performance Standard 3a1—as built planting plans confirm that three different wetland plant communities and one non-wetland plant community were installed.
- Performance Standard 3a2 - 100 percent survival of installed emergent, shrub, and tree vegetation one year following installation.
- Performance Standard 3a3 - 20 percent aerial cover provided by native emergent, shrub, or tree vegetation within constructed portions of the site by Year 2.
- Performance Standard 3a4 - 30 percent aerial cover of native emergent, shrub, or tree vegetation within constructed portions of the site by Year 4.
- Performance Standard 3a5 - 50 percent aerial cover of native emergent, shrub, or tree vegetation within constructed portions of the site by Year 7.
- Performance Standard 3a6 – At the end of the seventh year after construction, a minimum of nineteen species of native shrubs, trees, or emergent plants are present within the wetland and each of these species cover an area of at least ten square feet. Plant species may be distributed in small patches that collectively add up to ten square feet or more.
- Performance Standard 3a7—three to five strata of vegetation each provide 20% or more cover within all forested wetland areas of the site by year 7.

Objective 3b:
Reduce the prevalence of invasive plants to less than 25% within every plant stratum within the wetland.

- Performance Standard 3b1 - aggressive invasive plant species (including reed canarygrass) cover less than 25 percent cover within all wetland areas within seven years of construction.

Objective 3c:
Increase portions of the wetland that are seasonally ponded to at least 10% of the wetland area (or 1.3 acres).

- Performance Standard 3c1—at least 1.3 acres of the pond bottom meets the criteria for “seasonally ponded wetland”, as determined by a comparison of staff gauge readings, as

built grading plans, and direct site observations by the second year after construction or the first normal rainfall year thereafter.

Objective 3d:
Increase amphibian habitat in the wetland.

- Performance Standard 3d1 – A minimum of two thin-stemmed emergent species will dominate at least ¼ acre of the seasonally ponded wetland by the third year after construction.

- Performance Standard 3d2- An amphibian egg mass survey will be conducted in early spring of the 2nd year after construction to document the occurrence of amphibian breeding.

- Performance Standard 3d3 - An amphibian egg mass survey will be conducted in early spring of the 4th year after construction to document the occurrence of, and trend regarding, amphibian breeding.

Goal 4: Re-establish 1.16 acres of additional wetland.

Objective 4a:
Re-establish wetlands in the north end of the site.

- Performance Standard 4a1—areas planned as "wetland re-establishment" in the north portion of the site are dominated with hydrophytic plant species the second summer following site planting.

- Performance Standard 4a2—areas planned as "wetland re-establishment" in the north portion of the site meet at least one of the primary hydrology indicators or two of the secondary hydrology indicators, as described in the Western Mountains, Valleys, and Coasts supplement to the Corps of Engineers' 1987 Wetland Delineation Manual, sometime within the second year following construction.

Objective 4b:
Re-established wetland areas total at least 1.16 acres.

The existing wetlands within the limits of construction totalled 3.58 acres prior to construction. It is expected that 4.74 acres within the area of pond construction will be wetland once this project is complete. This will result in an increase of 1.16 acres.

- Performance Standard 4b1—At least 4.74 acres within the limits of construction meet criteria for wetland vegetation and wetland hydrology and show evidence of the presence or development of hydric soils 7 years after construction. All areas meeting wetland criteria will be flagged and surveyed for an accurate measure of the amount of wetlands rehabilitated and re-established.

9. Monitoring Plan

The main objective for mitigation monitoring is to document the level of success in meeting the performance standards and to identify the need for corrective actions. Monitoring for attainment of performance standards will be conducted six times: at the first, second, third, fourth, seventh, and tenth years after construction.

Monitoring will begin the first full growing season after construction is complete and the plants have been installed. Containerized plants and plugs and wetland emergent seeds were installed in the fall, following summer (2013) construction. Replacement plantings were installed in the fall of 2014. Additionally, more plantings were installed after the WCC cleared invasive plants from portions of the site. All planting was completed in early spring 2015. The as-built report was completed June 2015 and that is when construction officially completed. The first full growing season after completion of construction has therefore been determined to be 2015.

Amphibian breeding season is generally January through June; therefore, monitoring for amphibian performance standards must be coordinated during the breeding season. Amphibian breeding monitoring will be done the second and fourth years after construction (spring of 2016 and 2018).

Monitoring for attainment of wetland hydrology will be provided for ten years. Other characteristics of the wetland will be monitored for a period of seven years. It is expected that the type of wetland targeted can be achieved or can be determined to be on a successful trajectory within seven years of construction.

A qualified biologist will conduct the monitoring. The following information will be recorded during each of the monitoring site visits:

- General plant health assessment and plant aerial coverage from established sampling points;
- Documentation of the presence of undesirable plants (weedy and/or non-native species) with estimated percent cover;
- Photo documentation of site conditions from established photo points;
- Signs or observations of wildlife/animal use of the area, in addition to amphibian egg mass surveys;
- Signs of red-legged and Pacific tree frog competitors (i.e., bullfrogs).

Additionally, any impacts to the wetland or wetland buffer from human use (e.g., dumping of debris or vandalism) will be monitored. Results of the monitoring events will be discussed in monitoring reports, which will be due by December of years 1, 2, 3, 5, 7, and 10 after construction.

9.1 Variables to be Monitored and Specific Monitoring Methods

Goal 1: Water Purification

The increase in the wetland's ability to purify surface waters will, for the most part, be assumed if a sufficient area of seasonally ponded wetland is provided. Monitoring by continuous water level reporting will determine the presence of ponding. Ponding depth will be correlated with design elevations and site inspections during wet periods to verify that a minimum of 4.02 acres of wetland ponds seasonally.

As one indicator of water quality, fecal coliform bacteria will be sampled according to standard methods at a location to be determined at the upstream end of the project site and at the outlet from the site.

Goal 2: Stormwater Attenuation

An increase in the wetland's ability to attenuate stormwater will be assumed if the post-development flow rate of water leaving the wetland is less than the modeled predevelopment discharge flow rates of the different flood events (recurrence intervals). Discharge will be monitored by installing a continuous monitoring flow meter for a period not to exceed ten years. Flow data will be downloaded semi-monthly.

Several performance measures are designed to ensure that the wetland, during the course of collecting and metering the discharge of stormwater, is not adversely affected by increased hydroperiod dynamics. Hydroperiod limits and excursions will be measured with continuous monitoring staff gauges.

Goal 3: Habitat Potential

Numerous specific objectives and performance standards are related to the goal of improving habitat. Habitat for a diversity animals and animal niches is partly dependent upon plant species diversity, diversity of plant assemblages, edge habitat, and the presence of multiple vegetation layers. Plant community assessment therefore provides a suitable metric for wildlife habitat potential and in most cases circumvents the need to directly measure wildlife use.

Performance Standard 3a2 (100% survival of all plantings after one year) was determined by direct observation of each plant.

Performance Standards 3a3, 3a4, 3a5, 3a6, 3a7, and 3b1 relate to plant cover and plant species richness. Percent aerial cover within each planted community will be evaluated at years 1, 2, 4, and 7. Sample plots will be randomly selected within each plant community. The plots will not be repeated between years; rather, plot locations will be re-selected each monitoring year. The number of sample plots within each plant community will be the minimum number required to evaluate whether the site is developing into the desired wetland types, taking into account the homogeneity of the communities and proportion of the site occupied by each.

Plant cover within plots will be determined independently for emergent plants, shrubs, and trees. Species and cover of herbaceous vegetation will be assessed within a 5-ft. radius plot. Species, cover, and number of stems of shrub vegetation will be assessed within a 15-ft. radius plot. Species, cover, and number of stems of trees will be assessed within a 30-ft. radius plot.

Goal 4: Wetland Re-establishment

Monitoring will include the use of wetland delineation methods (per the Corps of Engineer's 2010 Western Mountains, Valley's, and Coasts Supplement) to verify that the area intended to become wetland indeed has become wetland. As illustrated with the performance standards, the wetland re-establishment areas in the northern portion of the site will be carefully analyzed 7 years after construction to verify that wetland vegetation and hydrology are present and that hydric soil indicators are forming within the surface soil horizons.

Seven years after construction, all areas meeting wetland criteria within this wetland re-establishment area will be flagged and then surveyed for an accurate measure of the amount of wetlands re-established.

9.2 Reporting

Monitoring reports will be prepared by a qualified biologist. The reports will compare the performance standards to field observations and will recommend species replacements or other adaptive management/maintenance activities, as may be necessary. Reports will present data collected during the monitoring site visit and document successes in meeting specific performance standards. Photographs will be included to illustrate and document site conditions. Reports will be submitted by the end of December of years 1, 2, 3, 5, 7, and 10 after construction.

10. Long Term Site Management

Long Term Maintenance and Management Actions are those that are required in perpetuity. As the land owner, PCSWM has developed and agrees to comply with the Larchmont Maintenance Plan—Appendix G). The Pierce Conservation District (PCD) has been designated the third party Conservation Steward: their role will be to monitor and enforce (if necessary) Pierce County's long term maintenance actions.

Activities that could require intervention/long term maintenance from Pierce County include control of noxious weeds, removal of homeless camps, clean-up of hazardous waste deposited on the property, maintenance of the vegetated swales, investigation and enforcement of illicit discharges to surface water, removal of beaver dams if they threaten surrounding properties or infrastructure (e.g. roads) with flooding, repairing fencing, and similar activities.

If Pierce County fails to fully comply with this plan, the responsibility and authority to enforce the provisions of this plan resides with the Conservation Easement holder, as described in the Conservation Easement (Appendix F).

Funding for Long Term Site Management will come from the WRIA 12 Service Area Long Term Management account. This account will receive 5% of all credit fees from sales of PCILF credits within WRIA 12 (where credit fees comprise 75% of the overall mitigation fee and the land fee comprises the remaining 25%). An analysis of the numbers and costs of long term management tasks was conducted to determine the percent allocation into this fund. It is believed that the Long Term Management account will earn sufficient interest that long term management activities can be funded exclusively with the interest from that account and that monies in the account will be non-wasting—thereby ensuring a continuous source of funds for future long term management actions.

11. Adaptive Management Plan/Contingency Plan

Post-construction maintenance, including plant replacement and competition control, will be completed to maintain conditions conducive to the development of the wetland and buffer communities and attainment of performance standards.

11.1 Plant Replacement

The landscaping contract included a one-year plant establishment period; the contractor was responsible for ensuring plant survival for the first year after planting. Warranty inspections for contract compliance evaluated plant establishment, growth and survival over the entire project area during the warranty period. In September 2014, a count was taken of all living and dead planted material. All dead, dying, or missing plant material was replaced.

Performance monitoring may determine the need for additional plant replacement or substitution. PCSWM will install additional plants, as necessary.

11.2 Competition Control

Competition with unplanted vegetation for water and nutrients can stunt the development of plants and plant communities. To minimize competition, plants were mulched with a ring of wood chip mulch or coir weed mats. Weed control will be regularly performed by skilled labor (through a contract with the Washington Conservation Corps). Weed control will be done by hand, weed whacker, and with occasional use of herbicides through spraying or injecting.

The need for weed control will be evaluated during each monitoring visit. Control actions will be recommended when reed canary grass, purple loosestrife, Japanese knotweed, non-native blackberries, European hawthorn, yellow iris or other invasive, non-native species threaten the establishment of planted vegetation or exceed the cover performance standard (Performance

Standard 3b1). Recommended control actions will be described in an integrated pest management plan, which will be part of the Larchmont Maintenance Plan.

11.3 Hydroperiod Limits

If it is found that the hydroperiod limits, as defined in Guide sheet 2B of Appendix 1-C of the Pierce County Stormwater Management and Site Development Manual, are exceeded, the biologist will determine whether such exceedances appear to correlate with a decline in plant species richness or in other adverse effects to the wetland. It may be that any exceedances are minor enough or that the plant communities within this wetland are tolerant enough that corrections to the wetland's hydrology are not necessary; or, it may be that a one-time modification to the weir control plate will be needed. The outlet control structure has been designed to allow maximum flexibility, such that it may be adjusted according to unanticipated site conditions. PCSWM has the ability to replace the twelve-inch weir plate with an eighteen-inch weir plate to achieve a greater depth of seasonal ponding, or the outlet control rate can be adjusted with the horizontal weir plates if necessary.

11.4 Contingency Plan

Natural and human-related events could have detrimental effects on the success of the restoration areas. Post-construction monitoring may show that contingency measures are required for the project to meet its performance standards for hydrologic conditions, vegetation cover, and plant survival. Should monitoring indicate the restoration is failing to meet its performance standards, alternative plans meeting regulatory agency requirements will be developed, constructed, and monitored to ensure that performance standards will be met by the end of the Establishment phase. Replacement of dead or dying planted herbs, shrubs, and trees will occur as part of the maintenance program described above.

Agencies with jurisdiction over this project will determine whether performance standards have been achieved by the end of the Establishment Phase. Any finding that a standard has not been met will require implementation of corrective measures or adjustments to the amount of In-Lieu Fee credits that are available. PCSWM will be responsible for preparing an analysis of the cause of failure, proposing corrective actions, and presenting a schedule for implementing the actions for agency approval. Minor corrective measures completed as part of routine maintenance will be identified in the monitoring reports.

12. Financial Assurances

PCSWM proposes the Larchmont Wetland Reserve as an ILF mitigation-receiving site. The federal rule requires PCSWM, as the ILF program sponsor, to provide financial assurances "sufficient to ensure a high level of confidence that the compensatory mitigation project will be successfully completed, in accordance with its performance standards." [33 CFR 332.4(c)(13)].

When an applicant buys mitigation credits from the ILF program to meet a mitigation need for unavoidable, permitted impacts, full responsibility for fulfilling the mitigation obligation is transferred from the applicant to PCSWM. Pierce County recognizes and fully accepts responsibility for meeting these mitigation obligations. To ensure adequate funding to meet mitigation obligations associated with any given unavoidable, permitted impact, there are several safeguards "built in" to the ILF program to ensure PCSWM has adequate funds, including:

- Credit prices are based on actual project costs and adhere to full-cost accounting requirements in the federal rule (33 CFR 332.8(o)(5).

- A percentage of each credit fee will be allocated to a Contingency Account for the service area in which the impact project occurs and a percentage allocated to the Long Term Maintenance Account. Fixed percentages of the fees obtained from the sale of credits from the Larchmont Wetland Reserve will be allocated to the Contingency and Long Term Maintenance Accounts for the Chambers/Clover Creek watershed (WRIA 12).

- Interest earned by moneys held in the ILF program accounts will accrue within the ILF fund to the Contingency Accounts and Long Term Management Accounts for each Service Area.

- In the event that funds allocated to the PCILF accounts are insufficient to cover the costs associated with ILF mitigation projects, including the Larchmont Wetland Reserve, Pierce County SWM shall include in its budget request to Pierce County Council appropriations sufficient to cover the balance of the Sponsor's obligations to provide mitigation. This is so stated within the Basic Agreement for the Pierce County In-Lieu Fee Program Instrument.

In addition to the programmatic financial assurance listed above, the Larchmont Wetland Reserve comes with project specific financial assurances. That is, the investment of state funds pre-capitalized the Pierce County ILF Program and funded the construction of the Larchmont Wetland Reserve. This mitigation receiving site will provide improved wetland functions before any applicants purchase ILF credits. Thus, by the time an applicant purchases ILF credits from this site, the mitigation obligations undertaken by Pierce County will already be partially or wholly fulfilled. Pierce County will assure the successful attainment of performance standards for Larchmont Wetland Reserve through implementation of maintenance activities during the performance period and adherence to the Adaptive Management/Contingency Plan.

References Cited

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Hruby, T. 2012. *Calculating Credits and Debits for Compensatory Mitigation in Wetlands of Western Washington*, Final Report, March 2012. Washington State Department of Ecology publication #10-06-11.

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Figures

LARCHMONT WETLAND
GROUNDWATER LEVELS
OCTOBER 2010 - NOVEMBER 2011
FIGURE 1

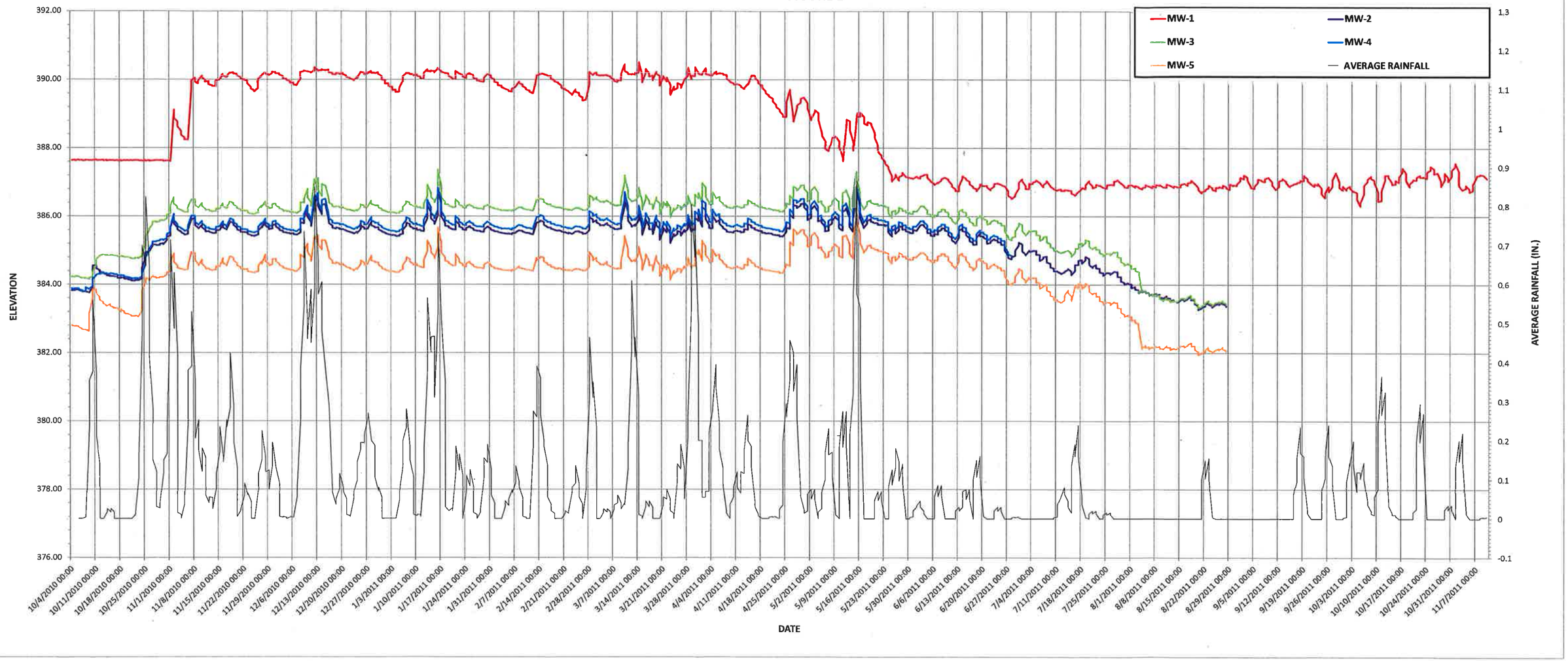


FIGURE 2

Larchmount Property: Monitoring Wells and Gauging Site

FIGURE 2

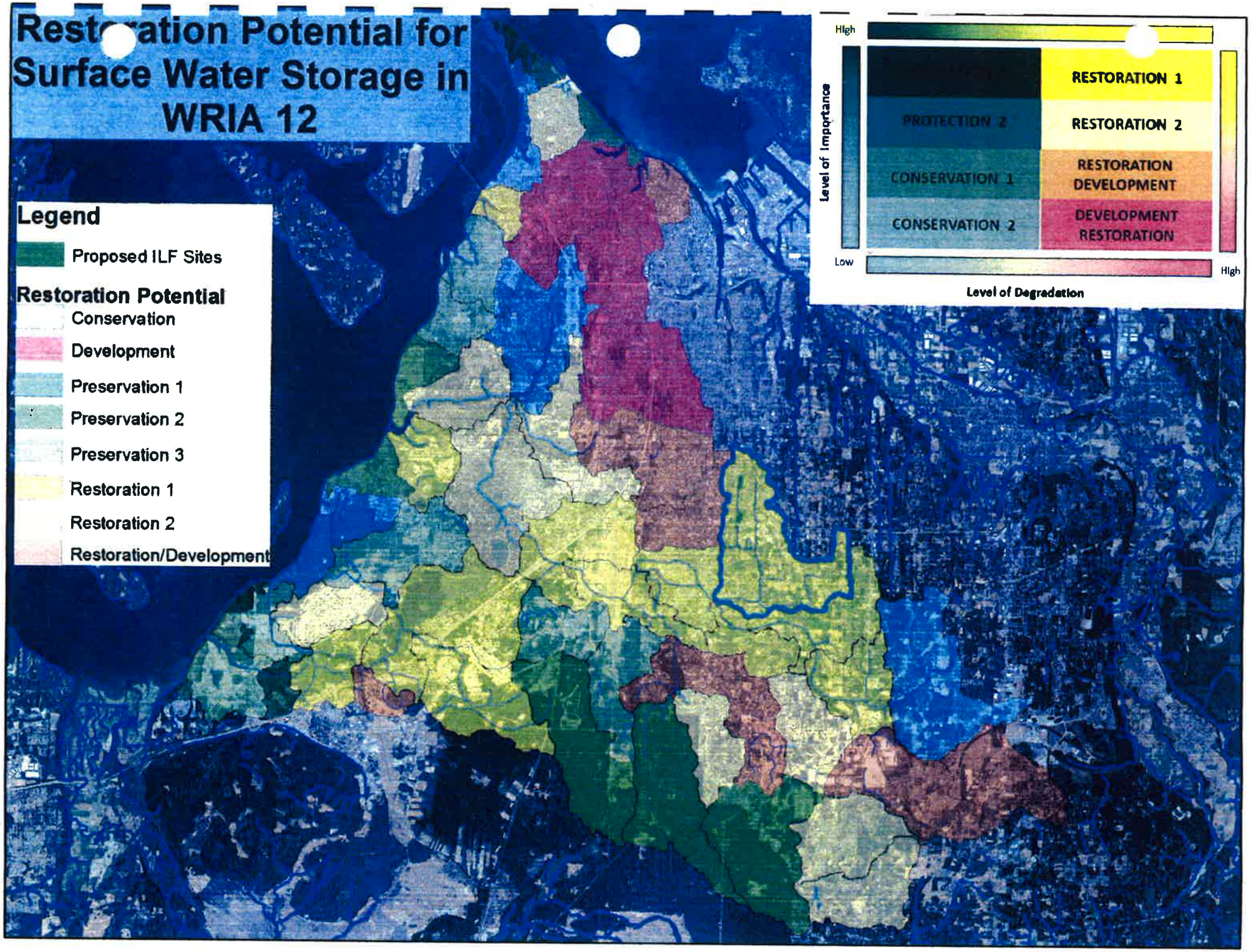
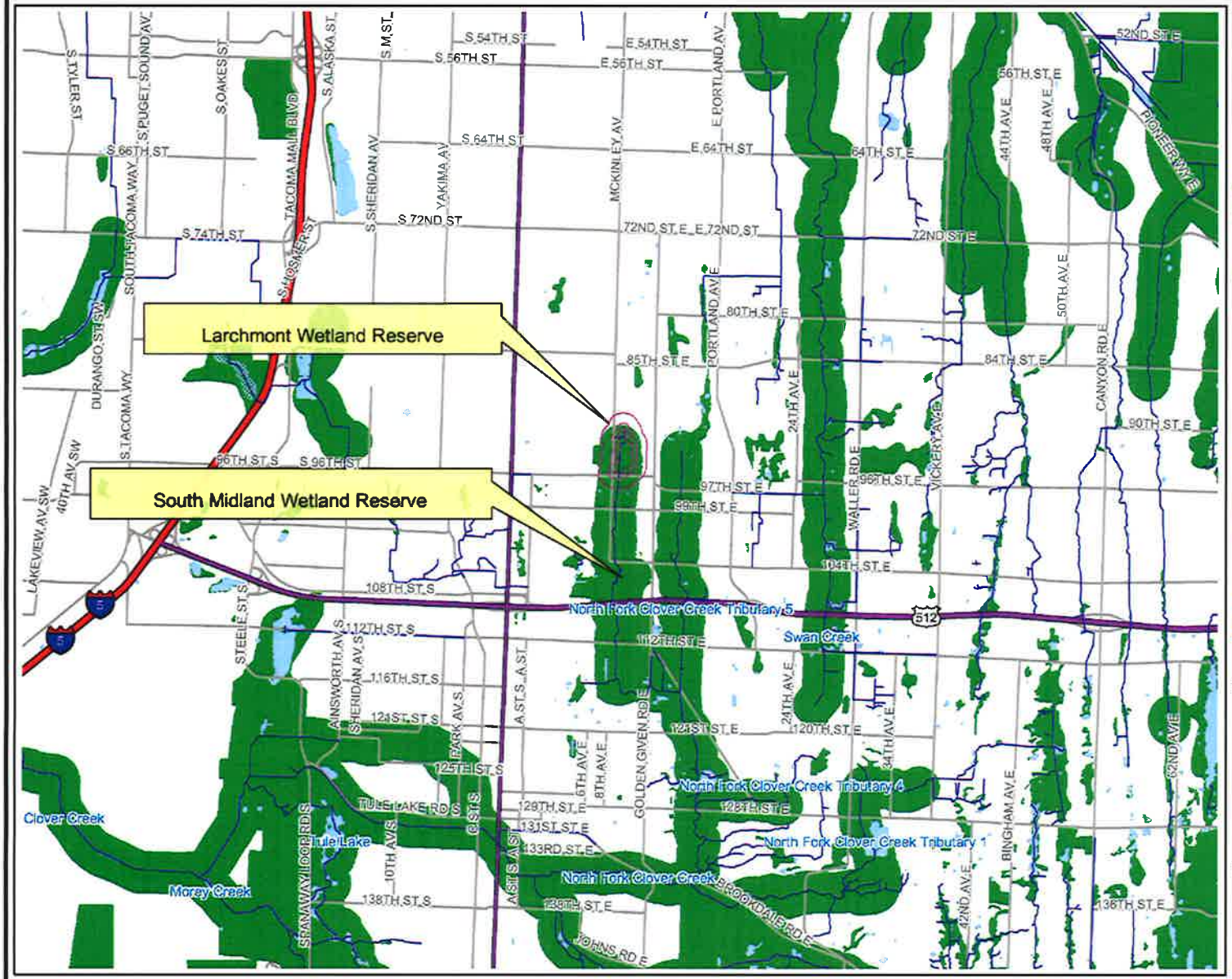

Restoration Potential for Surface Water Storage in WRIA 12
Legend
Proposed ILF Sites
Restoration Potential
Conservation
Development
Preservation 1
Preservation 2
Preservation 3
Restoration 1
Restoration 2
Restoration/Development
High
Level of Importance
Low
RESTORATION 1
PROTECTION 2
RESTORATION 2
CONSERVATION 1
RESTORATION DEVELOPMENT
CONSERVATION 2
DEVELOPMENT RESTORATION
High
Level of Degradation

FIGURE 3

Map of Pierce County Open Space Corridors

North Fork Clover Creek

Figure 4



Map Legend

- Larchmont with 150 ft and 1 km buffers
- Hydro - Centerlines
- Roads
- Interstate
- Limited Access State Routes
- Other State Routes
- Ramps
- Major Arterial
- Collector
- Hydro - Surface Boundaries
- Water body
- Island
- Swamp
- Open Space Corridors
- Biodiversity Network
- Connector
- Gig Harbor #3

0 2500 5000 ft.

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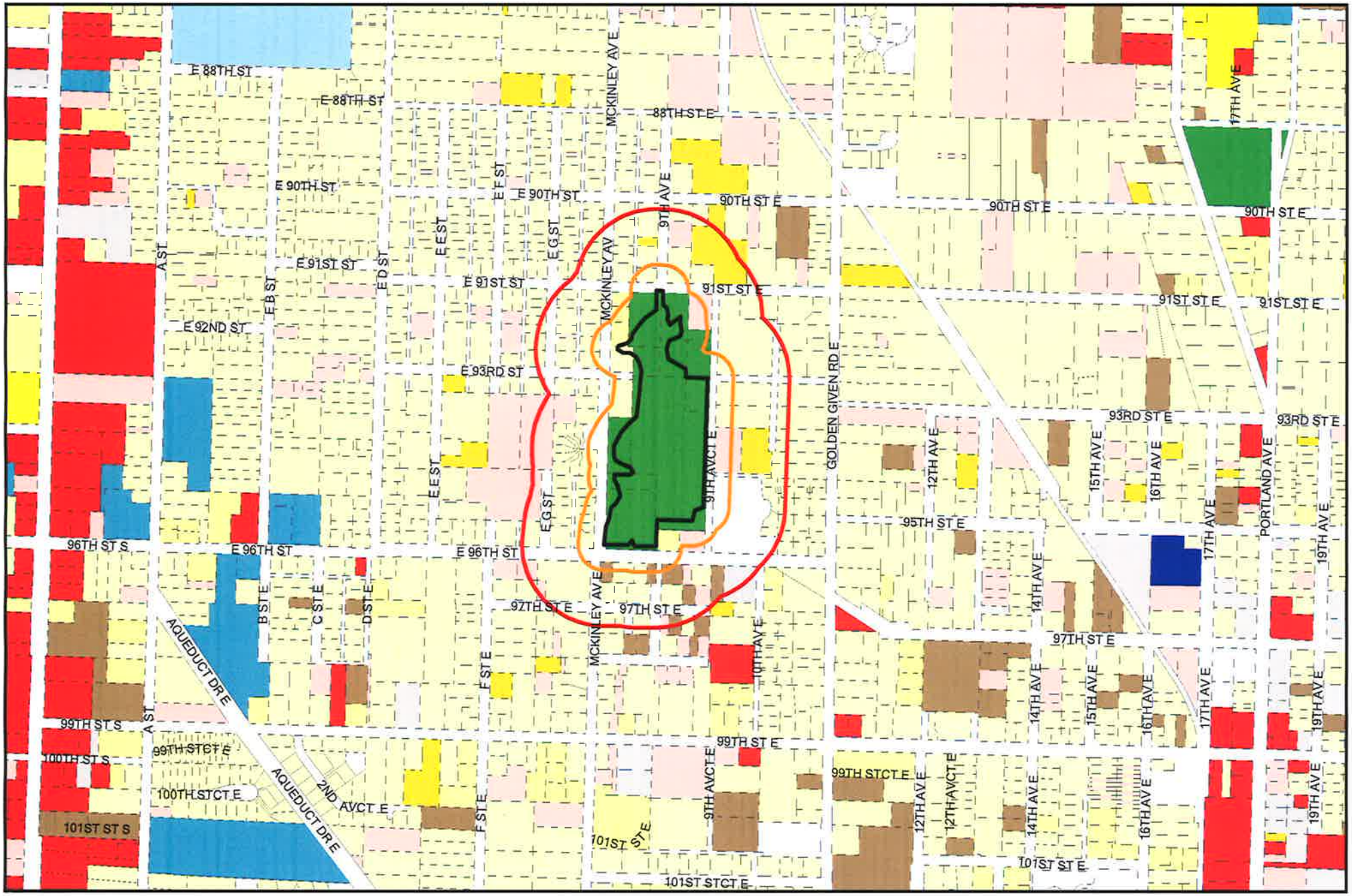
Pierce County
Geographic Information Services



Wetland Buffer
- 150ft
- 1km
- Wetland

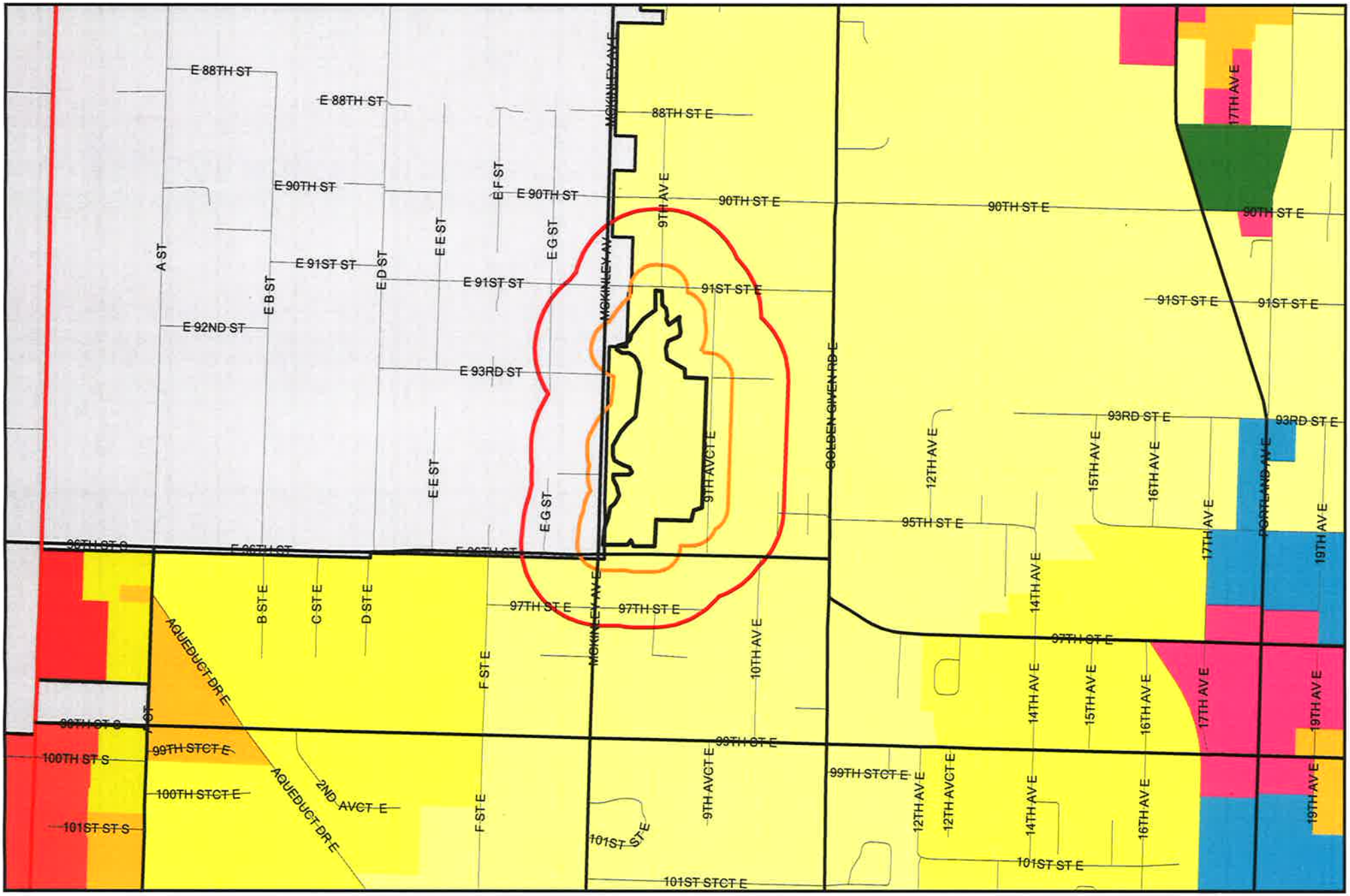
Land Use - Existing
- Single-Family Residential
- Multi-Family Residential
- Group Quarters/Other
- Mobile Homes
- Residential Outbuildings
- Commercial/Service
- Education
- Quasi-Public Facilities
- Public Facilities
- Industrial
- Open Space/Recreation
- Vacant
- Unknown

Figure 5A
Larchmont Wetland Reserve
Existing Land Use

November 2015

0 235 470 940 Feet

Pierce County
Public Works and Utilities
Surface Water Management



Wetland Buffer Zoning

- 150ft
- 1km
- Wetland

- Community Employment (CE)
- Neighborhood Centers (NC)
- Mixed Use Districts (MUD)
- Commercial Mixed Use Districts (CMUD)
- Residential/Office-Civic (ROC)
- Moderate-High Density Residential (MHR)
- Moderate Density Single-Family (MSF)
- Single-Family (SF)
- Park and Recreation (PR)
- Municipal Area

Figure 5B
Larchmont Wetland Reserve
Existing Zoning

November 2015

0 235 470 940 Feet

N

Pierce County
Public Works and Utilities
Surface Water Management

FIGURE 6

SEC. 34, T. 20 N., R. 03 E., W.M.

NOTE:
PROPERTY LINES OF THE ADJACENT PARCELS SHOWN ON THESE PLANS ARE LOCATED BY INTERPRETATION OF DEEDS AND OTHER INFORMATION FOUND IN THE PUBLIC RECORD AND SHOULD NOT BE CONSTRUED AS AN ACTUAL SURVEY.

CALL 2 WORKING DAYS BEFORE YOU DIG
1-800-424-5555
UTILITIES UNDERGROUND LOCATION CENTER

MCKINLEY AVE E

FOUND BRASSIE SECTION CORNER
N: 675614.09 E: 1162869.69
ELEV. = 388.78

FOUND BRASSIE
N: 676698.14 E: 1162698.82
ELEV. = 390.61

GENERAL NOTE:
SEE GENERAL GRADING NOTES ON SHEET 6.

0320343028
LAWRENCE
EARL R & KATHLEEN A
9001 MCKINLEY AVE E

0320343024
LAWRENCE
EARL R JR
9307 MCKINLEY AVE E

0320343159
PHILLIPS
MICHAEL B
9155 MCKINLEY AVE E

N

40 0 40 80
SCALE IN FEET

END POND OUTLET CHANNEL ALIGNMENT
N:675661.29 E:1162870.29

REGRADE EXISTING DITCH
SEE "TYPICAL INLET/OUTLET CHANNEL SECTION" SHEET 8

EXISTING DITCH TO REMAIN

PERMANENT ACCESS
SEE SHEET 8

POND OUTLET CHANNEL CENTERLINE

BEGIN POND OUTLET CHANNEL ALIGNMENT
N:675970.65 E:1163008.93

0320343122
PIERCE COUNTY

FILL EXISTING DITCH TO 384.5

FILL EXISTING DITCH SEE "TYPICAL FILLED DITCH SECTION" SHEET 8

NORTH INLET CENTERLINE

END NORTH INLET ALIGNMENT
N:676613.95 E: 1163126.83

MATCH LINE - SEE SHEET 6

96TH ST E

0320343146
MCDONALD
JUDY
901 96TH ST E

FILL EXISTING DITCH TO 386.5 AND ARMOR WITH QUARRY SPALLS

SOUTH SWALE CENTERLINE

ISLAND

LOW FLOW CHANNEL CENTERLINE

384.5

385.5

END SOUTH SWALE ALIGNMENT
N:675832.72 E:1163213.11

PERMANENT ACCESS
SEE SHEET 8

9TH AVE CT E

BEGIN SOUTHEAST DITCH ALIGNMENT
N:676265.40 E: 1163305.97

END SOUTHEAST DITCH ALIGNMENT
N:676678.64 E:1163256.99

BEGIN SOUTH SWALE ALIGNMENT
N:675658.57 E:1163868.41

REGRADE EXISTING DITCH, SEE REGRADED DITCH SECTION SHEET 8

END NORTHEAST DITCH ALIGNMENT
N:676677.25 E:1163313.45

LEGEND

- TEMPORARY CONSTRUCTION EASEMENT
- EXISTING WETLANDS
- BOTTOM OF SEASONAL POND, SWALE OR INLET/OUTLET CHANNEL
- FILL EXISTING DITCH
- REGRADE EXISTING DITCH
- QUARRY SPALLS
- HMA FOR APPROACH

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Xrefs: (DIESEL evaluation folder)

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DRAWN BY: E. GRIMM	DATE SURVEYED: NOV. 2010
DESIGNED BY: E. GRIMM	BOOK NO. –
CHECKED BY: A. ZEHNI, P.E.	DATE PLOTTED: SEE SIDE STAMP

NO.	DATE	REVISION	BY	APPROVED

Pierce County
DEPARTMENT OF PUBLIC WORKS AND UTILITIES
SURFACE WATER MANAGEMENT
TACOMA MALL PLAZA BUILDING
2702 SOUTH 42nd STREET, SUITE 201
TACOMA, WA 98409-7322

APPROVED BY: _____
HAROLD SMELT, P.E. SURFACE WATER MANAGEMENT MANAGER

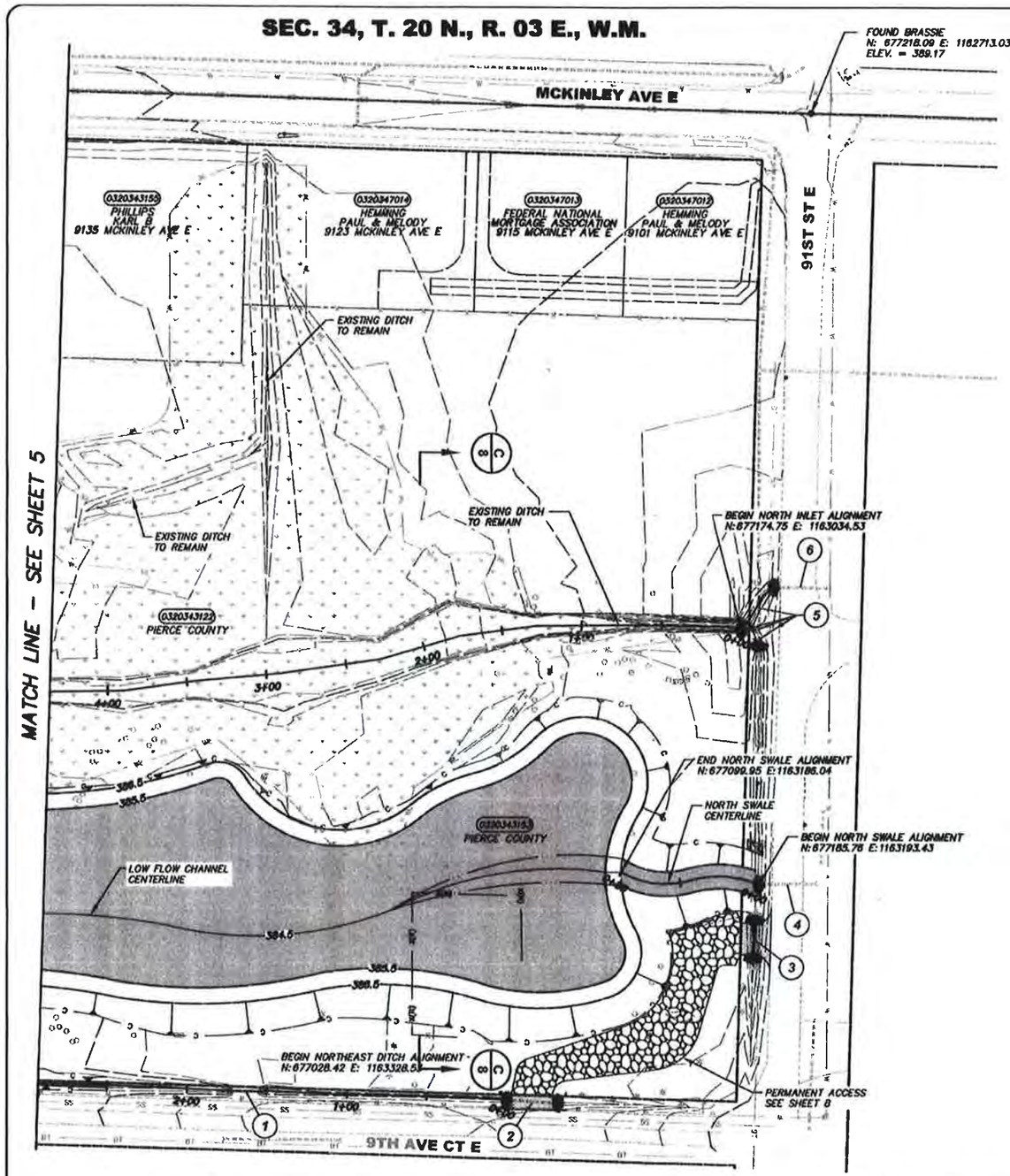
DANIEL F. HUNGER — STATE OF WASHINGTON — 33740 — REGISTERED PROFESSIONAL ENGINEER

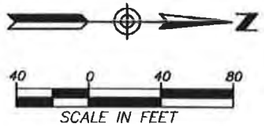
LARCHMONT WETLAND RESERVE

GRADING PLAN

C.I.P. # D200-006

SHEET 5 OF 17





LEGEND

- TEMPORARY CONSTRUCTION EASEMENT
- EXISTING WETLANDS
- BOTTOM OF SEASONAL POND, SWALE OR INLET/OUTLET CHANNEL
- FILL EXISTING DITCH
- REGRADE EXISTING DITCH
- QUARRY SPALLS
- HMA FOR APPROACH

SPECIAL HYDRAULIC FLUID REQUIREMENTS EXIST FOR ALL HEAVY EQUIPMENT MOBILIZED ONSITE
SEE SPECIAL PROVISION:
"LEGAL RELATIONS AND RESPONSIBILITIES TO THE PUBLIC"

CALL 2 WORKING DAYS BEFORE YOU DIG
1-800-424-5555
UTILITIES UNDERGROUND LOCATION CENTER

NOTE:
PROPERTY LINES OF THE ADJACENT PARCELS SHOWN ON THESE PLANS ARE LOCATED BY INTERPRETATION OF DEEDS AND OTHER INFORMATION FOUND IN THE PUBLIC RECORD AND SHOULD NOT BE CONSTRUED AS AN ACTUAL SURVEY.

GENERAL GRADING NOTES:

1. AN AUTOCAD FILE WILL BE PROVIDED TO THE CONTRACTOR UPON REQUEST FOR STAKING ALIGNMENTS, DAYLIGHT CATCHES (CUT AND FILL), COORDINATE POINTS, AND ALL GRADING.
2. CONSTRUCTION ACTIVITIES SHALL BE DONE IN SUCH A MANNER SO AS TO MINIMIZE COMPACTION. ALL COMPACTED AREAS, INCLUDING BUT NOT LIMITED TO TEMPORARY ACCESS ROADS AND COMPACTED TOPSOIL TYPE B AREAS, SHALL BE SCARIFIED (DE-COMPACTED), AT THE CONTRACTORS EXPENSE, TO A MIN. DEPTH OF 12-INCHES PRIOR TO HAND SEEDING AND PLANTING OR AS DIRECTED BY THE ENGINEER.
3. SEE SOIL PREPARATION PLAN SHEETS 9 AND 10 FOR ADDITIONAL INFORMATION.
4. SEE PLANTING PLAN SHEETS 11 AND 12 FOR ADDITIONAL INFORMATION.
5. SEE SHEET 8 FOR TYPICAL SECTIONS AND ADDITIONAL INFORMATION.
6. SEE SHEET 10 FOR SUBGRADE ELEVATION INFORMATION.
7. THE CONTRACTOR SHALL ROUTE THE SURFACE WATER AND GROUND WATER FLOW AROUND THE EXCAVATED (SITE EXCAVATION) AREAS AS NECESSARY OR AS DIRECTED BY THE ENGINEER. SEE SPECIAL PROVISION: "DEWATERING AND BYPASS SYSTEM".
8. TREES WITHIN AND NEAR CLEARING AND GRUBBING LIMITS THAT SHALL REMAIN WILL BE FLAGGED BY THE ENGINEER. CARE SHALL BE TAKEN WHEN CLEARING AND GRUBBING AROUND TREES THAT SHALL REMAIN AS NOT TO DAMAGE THEIR BARK AND/OR ROOTS. SEE SPECIAL PROVISION: "CLEARING, GRUBBING, AND ROADSIDE CLEANUP". ANY SALVAGEABLE MATERIAL FROM THE CLEARING AND GRUBBING LIMITS FOR HABITAT FEATURES MUST MEET SPECIFICATIONS, SEE SPECIAL PROVISION: "HABITAT IMPROVEMENTS".

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DRAWN BY: E. GRIMM	DATE SURVEYED: NOV. 2010
DESIGNED BY: E. GRIMM	BOOK NO. -
CHECKED BY: A. ZEHNI, P.E.	DATE PLOTTED: SEE SIDE STAMP

NO.	DATE	REVISION	BY	APPROVED

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APPROVED BY: _____
HAROLD SMELT, P.E. SURFACE WATER MANAGEMENT MANAGER

DANIS P. HINCKLEY STATE OF WASHINGTON 33750 REGISTERED PROFESSIONAL ENGINEER

LARCHMONT WETLAND RESERVE

GRADING PLAN

C.I.P. # D200-006

SHEET 6 OF 17

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Larchmont Drainage Area Map

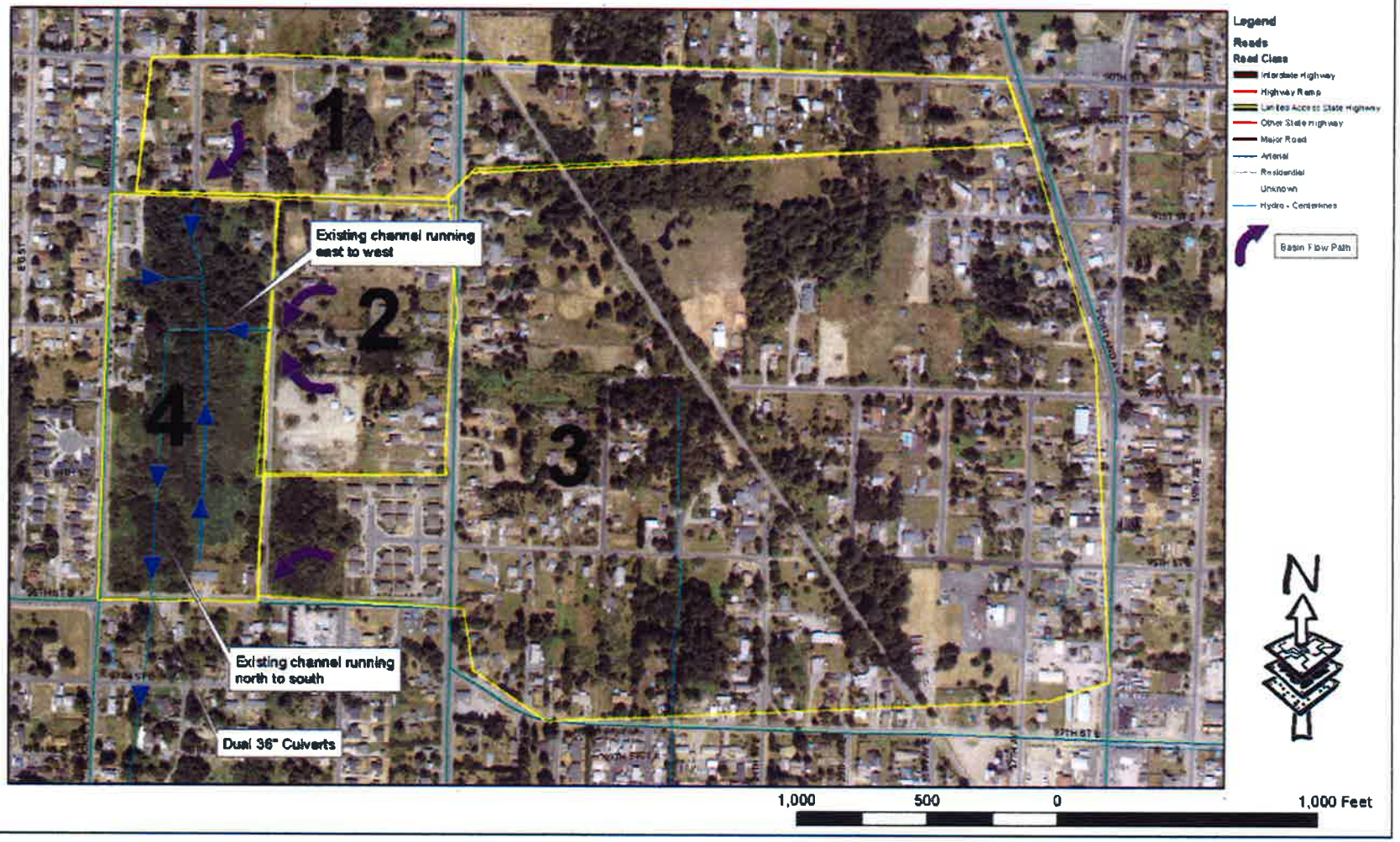
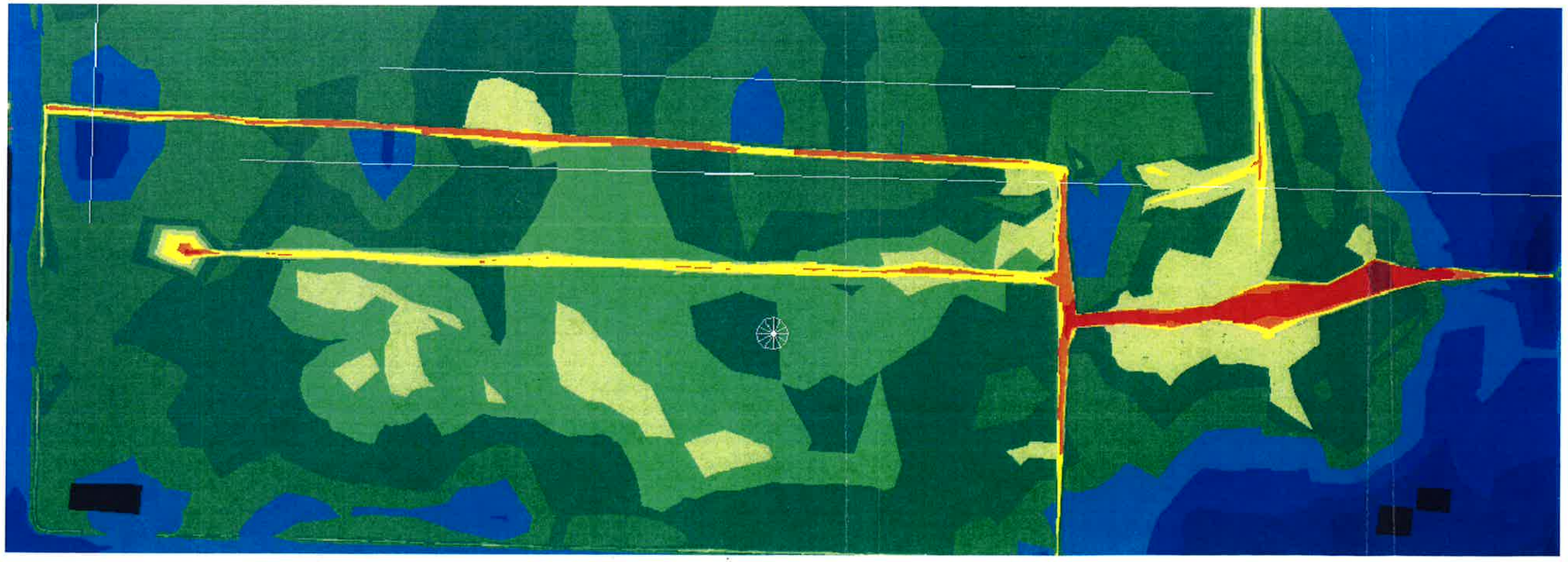


FIGURE 8 **Map of Contributing Basins**

FIGURE 9 –SEASONAL PONDING AREAS, EXISTING

Minimum Elevation	Maximum Elevation	Color Scheme
382.80'	383.00'	
383.00'	384.00'	
384.00'	385.00'	
385.00'	386.00'	
386.00'	386.50'	
386.50'	387.00'	
387.00'	388.00'	
388.00'	389.00'	
389.00'	390.00'	
390.00'	391.00'	
391.00'	392.00'	
392.00'	393.00'	
393.00'	395.25'	

Modeling, ground water observation well measurements, and direct observations during rainy season site visits altogether illustrate that areas of seasonal ponding (pond for more than two months, but dries out sometime during the year) are those areas below 386 ft. (.88 acres). Similarly, areas of occasional ponding are those areas between 386 and 386.5 ft (1.1 acres).



Larchmont Wetland Reserve Landscape Potential

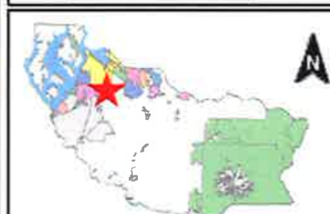
Undisturbed plus Moderate and Low Intensity Land Uses

FIGURE 10

Map Legend

- Wetland A
- Highlighted Tax Parcels
- Roads
  - Interstate
  - Limited Access State Routes
  - Other State Routes
  - Ramps
  - Major Arterial
  - Collector
  - Local Access
  - Unknown
- County - 2011 - Ortho

0 200 400 ft.



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Pierce County
Geographic Information Services

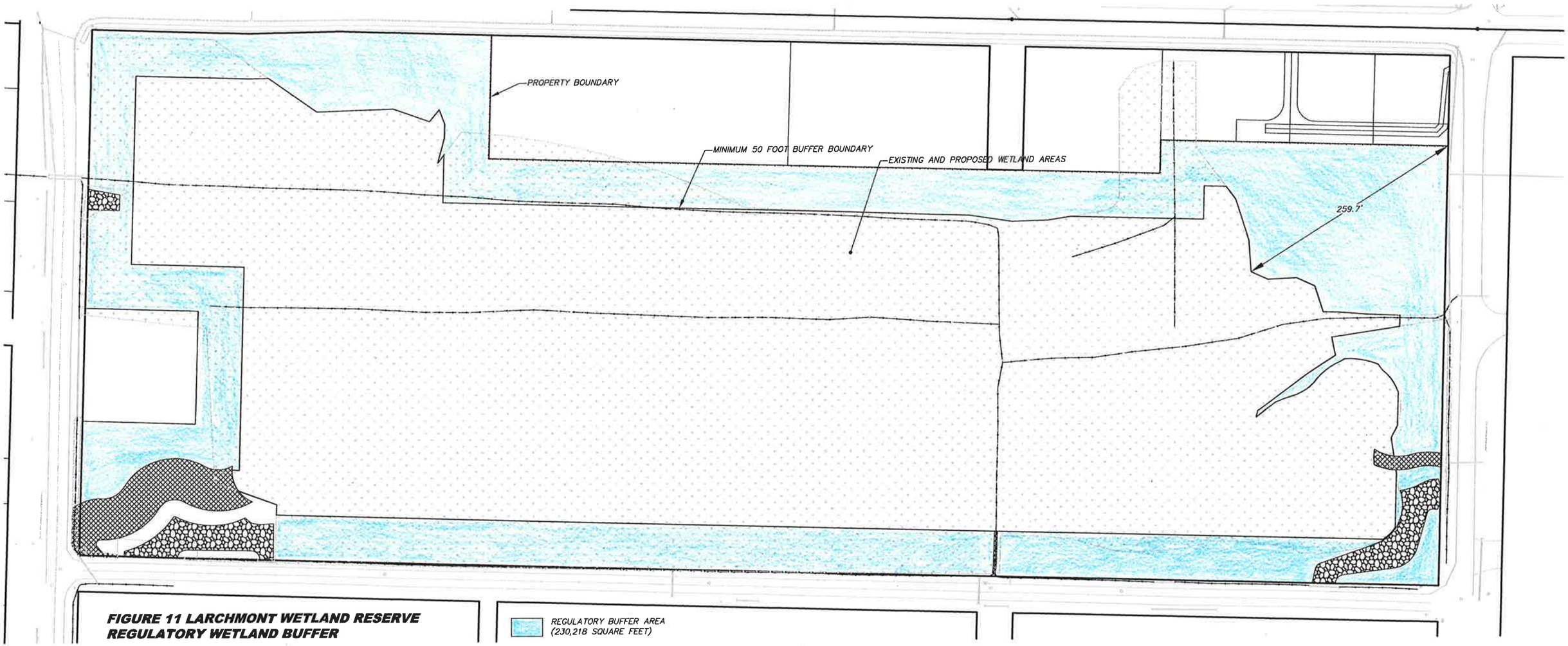

FIGURE 11 LARCHMONT WETLAND RESERVE
REGULATORY WETLAND BUFFER