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CITY OF MERCER ISLAND  
DEVELOPMENT SERVICES

## Mercer Island Treehouse

Mercer Island, Washington

### Level 1 Downstream Analysis

Issue Date:  
June 23, 2015

Prepared For:  
MI Treehouse, LLC

H. FLOOR  
E.V. 137.0  
RESIDENTIAL  
BUILDING  
ROOF  
E.V. = 58.7  
FINISH FLOOR  
E.V. = 37.0

RESIDENTIAL  
BUILDING

FINISH FLOOR  
E.V. 36.6

# Mercer Island Treehouse

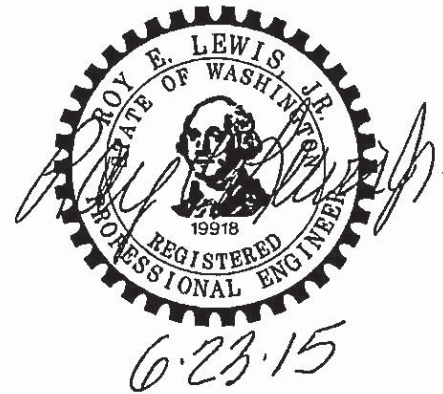
## LEVEL 1 DOWNSTREAM ANALYSIS

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JUL 02 2015  
CITY OF MERCER ISLAND  
DEVELOPMENT SERVICES

City of Mercer Island, Washington

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## Supplemental Information

### Appendix A

Mercer Island Stormwater Conveyance Inventory Exhibit with Project Tributary Area  
Downstream Flowpath and Glenhome Pond Photos  
King County iMap Exhibit Showing Contours  
Mercer Island Landslide Hazard Assessment Map  
Mercer Island Erosion Hazard Assessment Map  
Mercer Island Seismic Hazard Assessment Map

### Appendix B

Drainage Complaints Map  
Mercer Island Drainage Complaint Log  
Schedule B Culvert As-Built by City of Mercer Island, dated July 30, 2012

### Appendix C

Conceptual Site Plan prepared by CHS Engineer, LLC. Dated 11-14

*5637 Mercer Way – Revised Critical Areas Report* by Sewall Wetland Consulting, Inc., dated March 5, 2015

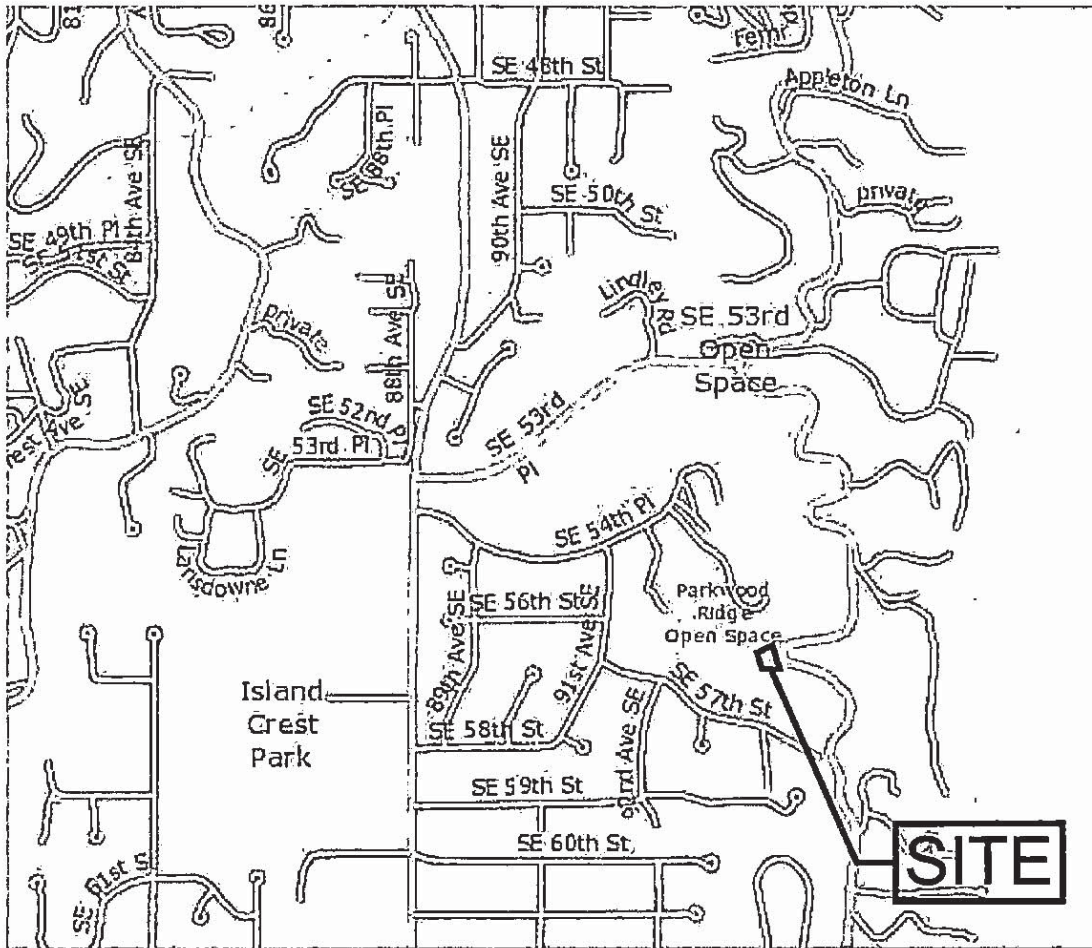
*Geotechnical Engineering Study Proposed Residence* by GEO Group Northwest, Inc., dated March 12, 2015

*Parkwood Trail and Subbasin 45B Watercourse Stabilization Project (WD 526C)*

WWHM Modeling Output for Conceptual Detention Sizing

# 1 PROJECT OVERVIEW

The Mercer Island Treehouse project proposes to construct a single family residence on a 37,554 square foot lot. The project is located at 5367 East Mercer Way in Mercer Island Washington.



VICINITY MAP

(by King County iMap)

The lot is currently undeveloped and completely forested except for a concrete driveway and a short quarry spall access road. TRIAD staff made a visit to the site on June 19, 2015 to investigate the site's existing condition and downstream flow path. The information gained from the site visit supplements information acquired from the City of Mercer Island website

and GIS system, the King County website and site specific studies conducted by others. A wetland investigation was conducted by Sewall Wetland Consulting, Inc. and is summarized in their report titled *5637 Mercer Way – Revised Critical Areas Report* dated March 5, 2015. A geotechnical analysis of the site was conducted by GEO Group Northwest, Inc. The findings of this analysis are summarized in their report titled *Geotechnical Engineering Study Proposed Residence* dated March 12, 2015.

This report intends to summarize the information gathered to describe the onsite and downstream drainage conditions for the Mercer Island Treehouse project and will satisfy the Level 1 Downstream Analysis requirements as described in the 2009 King County Surface Water Design Manual (KCSWDM). This report will also provide design recommendations for the proposed development meant to mitigate for the observed onsite and downstream drainage issues.

### **1.1 Existing Site Conditions**

The proposed development will occur on a 37,554 square foot lot which is currently undeveloped. In the existing condition the site is densely vegetated with a mature understory of bushes and ferns. There are several large evergreen and deciduous trees on the site. The lot has been previously platted and is a part of the Greg Newitt Short Plat. There is an existing single family residence on the parcel directly to the south of the site. This house (5645 East mercer Way) is accessed by a shared concrete paved driveway that crosses the project's parcel. There is a short length of rip-rapped covered ground, similar to a construction entrance that extends into the site approximately 10 feet. The majority of the site is covered by steep slopes ranging from 10-40%. An area of level (<10% slopes) ground can be found near the existing shared driveway.

### **1.2 Developed Condition**

This description of proposed development is based on a conceptual site plan prepared by CHS Engineer, LLC. dated 11-14. This plan is attached to Appendix C of this report for reference. The proposed development includes a single family residence with a raised deck with an

approximate footprint of 2,800 square feet. A concrete driveway that connects to existing shared driveway is also proposed. In total the proposed development will add approximately 4,200 square feet of new impervious surfaces. There is minimal landscaping proposed around the new residence with most of the site proposed to be left in the pre-project, forested condition. Several rockeries or retaining walls will be required to achieve the desired final grades. Grading will be primarily cut with little imported fill anticipated.

## **2 Downstream Analysis**

### **2.1 Task 1, Study Area Definition and Maps**

This site drains to Lake Washington. The study area for this project includes the entire upstream and downstream tributary basin. The ultimate outfall for the site's tributary basin at Lake Washington has an approximate tributary area of 10.8 acres.

The Mercer Island GIS system provides a schematic description of the stormwater conveyance system downstream of the project. A printout of the Mercer Island stormwater conveyance inventory relating to this project is attached to Appendix A. This map has been annotated to show approximate upstream and downstream tributary areas.

### **2.2 Task 2, Resource Review**

The following recourses were reviewed for assisting with the offsite analysis:

#### **2.2.1 Geotechnical Engineering Study**

A geotechnical analysis of the site was performed by GEO Group Northwest, Inc. and is summarized in their report titled *Geotechnical Engineering Study Proposed Residenc*, dated March 12, 2015. The geotechnical investigation included two boring investigations along with laboratory testing on soil samples taken from these borings and engineering design recommendations for the proposed residential construction. The boring logs found that the site is primarily underlain by outwash soils to a depth of 14-17 feet with denser till deposits below the outwash layer. Groundwater was observed near the surface of the borings and saturated soils were documented to depths of 20 feet. Groundwater seepage was noted at the base of the onsite steep slope areas. The report noted that the upper layers of outwash are susceptible to liquefaction. The report concluded that construction of a foundation on piles was feasible and that grading should be kept to a minimum to avoid impacting steep slopes.



### 2.2.2 Wetland Report

A wetland investigation of the site was conducted by Sewall Wetland Consulting, Inc. (Sewall) and is summarized in their report titled *5637 Mercer Way – Revised Critical Areas Report* dated March 5, 2015. This report identified an onsite wetlands and an onsite stream: ‘Wetland A’ which is a Category III wetland occurs over the north portion of the site. Wetland A was delineated by Sewall in 2004 and has a 50-foot buffer. This study also identified an onsite stream (referred to as Stream A) as listed by the City of Mercer Island to be a Type 2 watercourse and noted that it was a non-fish bearing stream with a 50-foot buffer. Proposed development would occur within the buffers of Wetland A and Stream A.

### 2.2.3 City of Mercer Island GIS Maps:

Online maps available from the City of Mercer Island website were analyzed, these maps are attached to the Appendix A.

**Seismic Hazard Assessment Map:** This map shows the site to be within a known or suspected seismic hazard area. A point indicating a “Miscellaneous Ground Effect of the 2001 Nisqually Earthquake” is shown near East Mercer Way to the north of the site.

**Erosion Hazard Assessment Map:** The project parcel is shown to be in a known or suspect Erosion hazard area, this map also shows the site in an area of high infiltration potential.

**Landslide Hazards Assessment Map:** The project parcel is shown to be in a known or suspect Landslide hazard area and also in a “Landslide and Mass Wasting Deposits; subaerial and subaqueous” area.

A “Geologic contact of coarse-grained deposits over fine-grained deposits where slopes  $\geq$  15%” delineation line runs to the east of the site through the downstream ravine to the east of the site. The site is also shown to be within an “Area where water less than 10 feet below ground surface based on limited data set”.

This map shows one identified landslide location in the stream channel uphill of the site and five identified landslide locations downstream of the site.

Two “Areas of Rapid Stream Incision(vi)” points are located upstream of the site; one of these points appears to be identifying the onsite stream channel, the other point identifies a stream channel in the Parkwood open space, which is tributary to the onsite stream channel (Stream A). Another point is located in the Stream A channel downstream of the site, in the ravine to the east of East Mercer Way. This map also identifies a scarp directly uphill of the site and along the ravine downstream of the site, east of East Mercer Way.

**Geologic Map of Mercer Island:** This map shows the general soil classifications for Mercer Island. Data regarding on-site soils should be superseded by the geotechnical investigation of the site performed by GEO Group Northwest, Inc. This map shows the downstream soils to be various types of Pre-Olympia type outwash deposits, transitioning to Lake Deposits near the shore of Lake Washington.

#### **King County iMap**

The King County iMap system includes contours and elevation data. These contours were analyzed in combination with schematic storm drainage infrastructure information obtained from the City of Mercer Island to determine the general upstream and downstream tributary basin as well as the approximate slopes of the watershed, where more specific elevation information was not available. A King County iMap Exhibit Showing Contours for the site is attached to Appendix.

#### **2.2.4 Drainage Complaints**

A public records request was submitted to the City of Mercer Island on June 11, 2015 requesting a record of drainage complaints for the area surrounding the site. The public records request yielded 35 records which included drainage complaints and maintenance logs. These records were filed by street address. There were records for 8 separate addresses in the vicinity

of the site. These addresses are shown on the attached Drainage Complaints Exhibit. A summary of the drainage records are given below:

**Drainage Complaint #1 (5/12/1998)**

This complaint reported flooding of a yard during heavy rain. This complaint is outside of the project's tributary area and appears to be unrelated to the proposed development.

**Drainage Complaint #2 (10/6/1998)**

This complaint was a maintenance request by a resident for a roadside drainage. Maintenance was performed – debris were cleared, and this complaint was closed. This complaint appears to be outside of the project's tributary area and unrelated to the proposed development.

**Drainage Complaint #3 5632 E Mercer Way (10/5/2009 - 3/31/2015)**

This address is directly downstream of the project site along the stream which collects runoff from the project site. The address has 13 complaints on record.

Five of these complaints, between October 2009 and April 2014 are reports of a catch basin being clogged. Although not explicitly stated, the catch basin is likely the outlet of the small sediment pond (the Glenhome Pond) that collects Stream A, before the stream is conveyed to the Lake. On April 22, 2014 it appears that this catch basin was enlarged and its outlet pipe upsized from a 6" PVC to a 12" ductile iron pipe to mitigate for clogging issues.

The other complaints were related to the removal of silt and sediment from the pond. Silt removal occurred 4 times between March 2014 and March 2015. The maintenance crew reported that an estimated 20 cubic yards of sediment was removed on March 31, 2015.

**Drainage Complaint #4 5642 E Mercer Way (10/15/1998 – 11/16/2010)**

This address had 6 records between October 1998 and November 2006. All of the records were maintenance logs on the Glenhome Pond. Maintenance included the removal of sediment and debris from the Glenhome Pond.

**Drainage Complaint #5 5646 E Mercer Way (3/24/1997)**

This complaint reported land movement along the south side of East Mercer Way. This would correspond to the hillside to the north of the project site. Although the complaint reported that the slope had dropped 8-10 inches and looked to be endangering East Mercer Way, the staff report noted “There’s a little sluffing, nothing to worry about.” No other actions were required/taken besides the inspection of the site by city staff.

**Drainage Complaint #6 and 7: 5655 & 5565 E Mercer Way (9/2004 – 7/2014)**

These drainage complaints detail the maintenance of a sediment pond near these two addresses. Sediment from this pond was removed 7 times in this time period. One of the records from September of 2007 indicate that the pond was removed, however there are subsequent records of pond maintenance. A maintenance note from July of 2014 indicates that this pond is upstream of the Glenhome neighborhood, but it is unclear if flows from this pond eventually reach the Glenhome Pond.

**Drainage Complaint #8: 9208 SE 57<sup>th</sup> Place (6/5/2012)**

This complaint reported a failing catch basin that was scheduled to be replaced in 2012. This drainage complaint appears to be out of the Project’s tributary basin and unrelated to the proposed development.

**2.3 Task 3, Field Inspection**

Staff from Triad preformed a field visit on June 15, 2015 to inspect the site as well as the relevant drainage features upstream and downstream of the site. The weather was sunny during the site visit with sparse rainfall in the week leading up to the visit. A small amount of runoff was observed in the onsite stream and drainage systems during the site visit. The field inspection began with a visual inspection of the site noting topographical features and likely drainage paths. The site visits, along with the aforementioned resources were used to perform the following analysis of the project’s drainage basin.

See the downstream drainage maps located in Appendix A for maps of the downstream study area.

### **2.3.1 Onsite Basins**

The project site is located within a ravine and receives stormwater flows from upstream areas. To determine the extent of the project's tributary basin, a topographical map obtained from the King County iMap program was analyzed, along with drainage infrastructure information obtained from the City of Mercer Island GIS database. The upstream edge of the project's tributary basin is well defined as a ridge that runs along Parkwood Ridge Road to the north of the site, 91<sup>st</sup> Avenue SE to the west of the site and SE 57<sup>th</sup> Street to the south of the site. In addition to this area, portions of SE 56<sup>th</sup> Street and SE 54<sup>th</sup> Street and adjacent lots drain to catch basins that discharge into the Parkwood Ridge Open Space. The upstream tributary basin is shown on the Upstream Drainage exhibit attached to the end of this section.

It was found that approximately 8.0 acres are tributary to the site. The majority of the upstream tributary area consists of undeveloped, forested hillside. Roadways and about 15 lots developed with single family residences are also upstream of the site. The upstream tributary area drains to a natural watercourse which runs through the project parcel. This watercourse was referred to as 'Stream A' in the Sewall Wetland Report.

Stream A is a natural stream which runs west to east across the northern portion of the project site. The main stream channels varies in width, depth and slope but, based on visual inspection and analysis of a site topographical survey, appears to be 10 feet wide and 5 feet deep in the portions that crosses the project site. The channel has steep side slopes, in the order of 1:1 in some portions. The stream channel is vegetated by a mature understory of ferns, and shrubs and several large evergreen and deciduous trees. The stream channel has an approximate slope of 10% in the portion that crosses the site.

A planset entitled *Parkwood Trail and Subbasin 45B Watercourse Stabilization Project (WD 526C)* was obtained from the City of Mercer Island. A bid set of these plans are attached to Appendix C of this report. City staff have indicated that the project has been completed. The plans show stream channel stabilization measures to be installed within Stream A beginning at East Mercer way and continuing 400 feet upstream. The improvements include the installation of logs and natural debris, minor grading, the installation of a rockery and replanting of the stream channel side slopes. A sewer line was also installed within the stream channel, upstream of the project site. These improvements cover the portions of Stream A that pass through the project's parcel, as well as a portion of the channel upstream of the site.

During the site visit, the vegetation in the stream channel appeared to be well established. Many of the installed logs and the rockery were overgrown, indicating that the plantings conducted during the project had become established. The stream channel near the site displayed minimal visual signs of erosion. A pedestrian trail which runs parallel to the stream channel to the north of the project parcel appeared to be in good shape and showed no sign of sluffing towards the stream. The improvements to the stream channel appear to have been successful in limiting the erosion problems within the improved section of Stream A. It is likely that the noted erosion problems come from the unimproved sections of Stream A, downstream of the site.

Stream A appears to have formed a fork and a side channel that runs through the site parallel to the main channel. The side channel is shallower and weakly defined as compared to the main channel. The side channel forks to the south of the main channel and then rejoins the main channel as both channels combine within a closed depression at the edge of East Mercer Way.

A Type-2 catch basin with a beehive overflow grate collects Stream A within this depression and conveys the stream under East Mercer Way via a 16-inch HPDE pipe. This system discharges to the continuing stream channel to the east of East Mercer Way. An As-built drawing obtained from the City of Mercer Island titled *Schedule 'B' Culvert dated July 30, 2102* shows this system and is attached to Appendix B.

### 2.3.2 Downstream Basin

Flows leave the project site via the catch basin and culvert described above. Flows are discharged from this pipe into a natural stream channel which flows down a steep ravine. This stream channel and ravine are both densely vegetated by low lying plants as well as large trees. At this point the stream is flowing on private property (Parcel # 1924059343). The stream channel flattens and transitions from a densely vegetated natural channel to a landscaped, straight and flat, maintained channel section approximately 500 feet east of East Mercer Way. The channel at this point is approximately 10 feet wide and 4 feet deep with side slopes of approximately 2:1. The channel sides are covered with landscaping bark and has been sparsely planted with ornamental plants. Photos of this channel and of the Glenhome Pond, taken from Google Streetview, are attached to Appendix A.

This channel section flows between two residences until it terminates in a manmade closed depression. This closed depression, referred to as the 'Glenhome Pond', is a circular pond, approximately 20 feet in diameter and approximately 4 feet deep. This pond is located to the west of a concrete paved private shared driveway and can be accessed for maintenance by a short length of gravel access road. The Glenhome Pond is drained via a catch basin with a beehive overflow grate located within the west edge of the pond. Flows from the Glenhome Pond leave through this catch basin and are piped under two residential driveways before emerging as a drainage ditch that outfalls to Lake Washington.

## **2.4 Task 4, Drainage System and Problem Description**

The site is within an area where seismic, landslide and erosion hazard area have been documented. There are steep slopes upstream and downstream of the sites which, in combination with the surficial outwash-type soils have contributed to erosion problems downstream of the project. The Glenhome Pond, which receives all runoff flows from the project site and upstream areas, has a history of filling with sediment and requires frequent maintenance. This sediment collection within the Glenhome Pond indicates that sediment from the upstream ravine is being eroded and transported downstream. This erosion may lead to Stream A incising a deeper ravine possibly causing settlement and slope stability issues.

The documented drainage complaints for the Glenhome Pond deal mainly with erosion and maintenance issues; no flooding problems were reported for the Glenhome Pond or for any of the downstream conveyance systems. This suggests that the downstream conveyance systems are adequately sized. The scale of the proposed project's improvements is not anticipated to impact the capacity of these systems.

## **2.5 Task 5, Mitigation of Existing and Potential Problems**

Although this project proposes a minimal area of new impervious surfaces, providing flow control should reduce the impact to the downstream watercourse. Preliminary detention modeling performed by the Western Washington Hydraulic Model Version 3 (WWHM) was performed based on a proposed impervious footprint of 5,000 square foot. The model showed that a live storage volume of approximately 1,300 cubic feet would be required to provide standard flow control (matching developed discharge durations to predeveloped durations for the range of predeveloped discharge rates from 50% of the 2-year peak flow up to the full 50-year peak flow). The WWHM model outputs are attached to Appendix C.