FINAL STORM DRAINAGE REPORT

5637 E Mercer Way
MERCER ISLAND, WASHINGTON

FOR

Bill Summers
5637 E Mercer Way
Mercer Island, WA 98040

09/22/2022

Project Manager:	**Michael A. Moody, P.E., LEED AP**
Prepared by	**Basel Draw, EIT**
Date:	**March 2021**
Approved by	**Michael A. Moody, P.E., LEED AP**
Core No.:	**18039**
Revised:	**September 2022**
Revised By:	**Brackon Rawlinson, EIT**

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1.0 PROJECT OVERVIEW

The 5637 E Mercer Way property includes one lot on Mercer Island, WA. See Figure 1. 1 Vicinity Map on the following page. The lot, which is currently entirely undeveloped, and a single-family residence will be constructed on the lot as well as a driveway which will connect to the adjacent access drive to the south. The parcel is in the SE ¼ of Section 19, Township 24, Range 5 East, W.M. The King County tax parcel ID numbers for the project parcel is provided below in Table 1. 1.

Table 1. 1 Parcel Areas

King County Parcel ID & Area
(1) Parcel A: 192405-9312 (0.86 Acres)

The parcel is bordered by E Mercer Way to the east by large single-family, hillside lots to the west and south, and a designated Open Space to the north. The existing, on-site area contains heavy vegetation, trees, a wetland, and a stream. The existing site topography slopes from 10% to approximately 80% on the far west end of the property. This project is permitted under reasonable use, and permanent onsite measure, as well as construction BMPs will be employed to mitigate impacts to the wetland, stream, or downstream drainage. Increased runoff will be addressed with a detention pipe at the downslope section of the driveway, per Mercer Island design requirements (see Appendix).

The project is designed using the guidelines and requirements established in the following reference: 2014 Department of Ecology Stormwater Management Manual for the Puget Sound Basin requirements for surface water runoff management and the City of Mercer Island Construction Stormwater Codes.

The King County Parcel and Districts Reports are included in the Appendix.

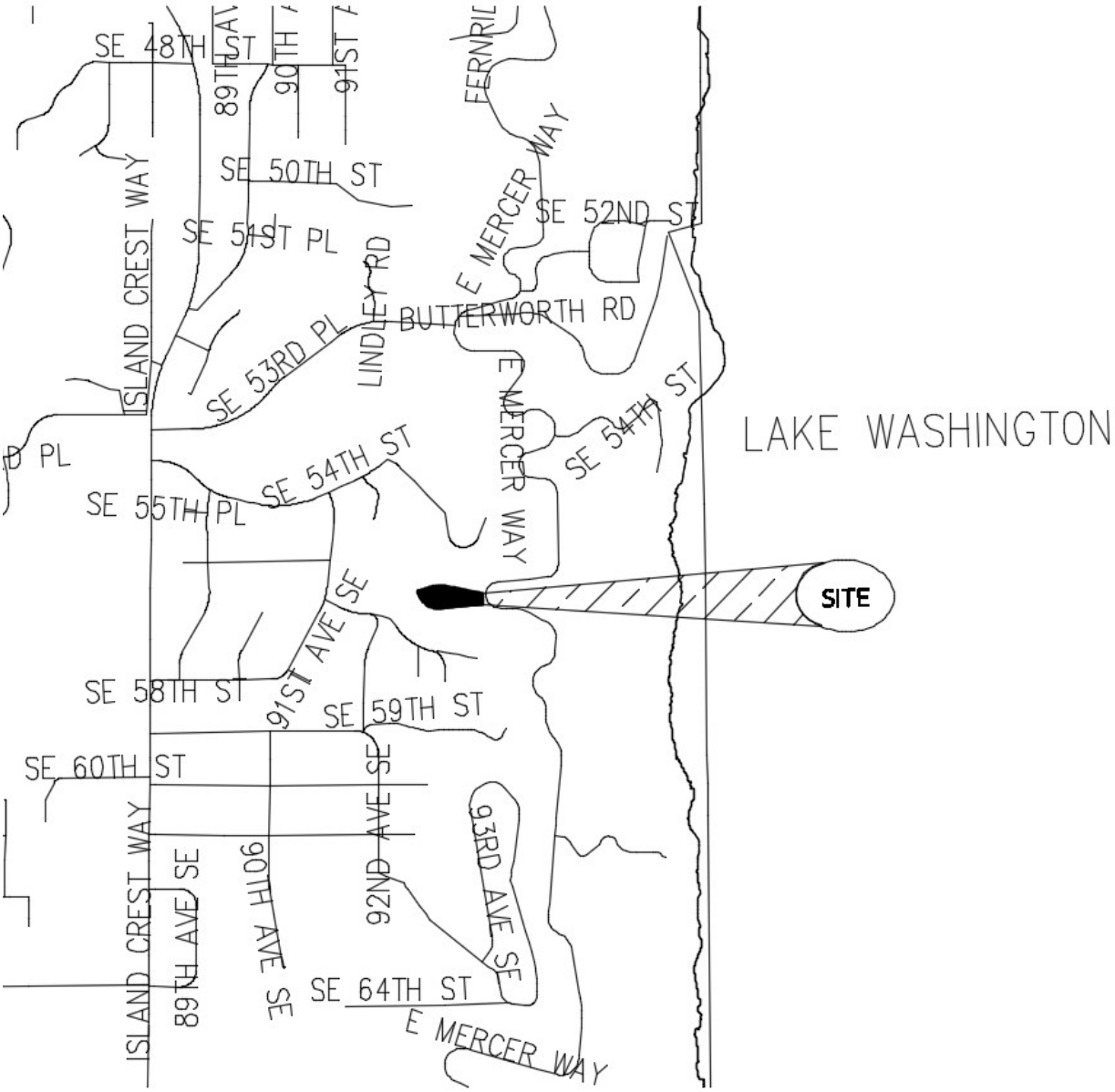


Figure 1. 1 Vicinity Map

2.0 CONDITIONS AND REQUIREMENTS SUMMARY

The site is covered with steep slopes and a wetland/creek designation that crosses the site, making typical construction almost impossible; therefore, construction of the proposed property will be completed under a "reasonable use" permit in the state of Washington.

The proposed project is classified as a development which includes less than 5,000 square feet of new plus replaced impervious surfaces and disturbs less than an acre but does result in a net increase of more than 2,000 sq-ft of impervious surface. Therefore, only Minimum Requirements 1 through 5 will be addressed per the City of Mercer Island Stormwater Management Standards and the 2014 DOE Stormwater Management Manual for Western Washington (SWMMWW). Applicable minimum requirements, and how the project addresses each, are listed below.

2.1 Minimum Requirements

2.1.1 Minimum Requirement #1: Preparation of Stormwater Site Plans

See Site & Stormwater Plan under separate cover.

2.1.2 Minimum Requirement #2: Construction Stormwater Pollution Prevention (SWPP/TESC)

Due to the sensitive nature of the site and the need for the "reasonable use" permit, the final SWPP will include an elevated degree of TESC BMPs and construction will occur over a reduced area (0.33 acres). A final SWPP report will be included in final submittal.

2.1.3 Minimum Requirements #3: Source Control of Pollutants

The SWMMWW requires that available and reasonable source control measures be adopted on all sites. Source control measures cannot be implemented due to severe site constraints, such as severe slopes and wetland protection. Adding Source Controls would require additional impact to the site.

2.1.4 Minimum Requirement #4: Preservation of Natural Drainage Systems and Outfalls

Natural drainage patterns shall be maintained, and discharges from the project site will occur at the natural location to the east. The manner by which runoff is discharged from the project site must not cause a significant adverse impact to downstream receiving waters and down gradient properties, per SWMMWW Vol 1: 2.5.3. See Section 3 of this report for the downstream analysis and discussion of the natural discharge location.

2.1.5 Minimum Requirement #5: On-Site Stormwater Management

Projects are required to implement On-site Stormwater Management BMPs to infiltrate, disperse, and retain stormwater runoff onsite to the maximum extent feasible without causing

groundwater contamination, flooding, or erosion impacts. Per Mercer Island Standards and Volume I of the 2014 SWMMWW, this project shall be required to meet the minimum standards for sites under 5,000 ft^2 but over 2,000 ft^2 of new impervious area. This requirement includes the implementation of LID standards as well as the establishment of a minimum soil depth.

Due to the severe slopes and sensitive wetland/stream concerns on the north end of the site, any LID BMP implementation would be both infeasible and result in an overall increase in impact to the site. Alternatively, the SWMMWW allows for the implementation of BMPs found in an approved list to be used in place of LID measures. This project is susceptible to List #1 Per list #1 the following BMPs were considered for the site:

Lawn and Landscaped Areas

- Post Construction Soil Quality and Depth in accordance with BMP T5.13 in Chapter 5 of Volume V (2014 SWMMWW).
    - Response: Amended soils will be applied to approximately 1,456 SF of disturbed pervious areas within the clearing limits of the project in accordance with BMP T5.13 of the 2014 SWMMWW.

Roofs

- Full Dispersion in accordance with BMP T5.30 in Chapter 5 of Volume V of the DOE Manual, or Downspout Full Infiltration Systems in accordance with BMP T5.10A in Section 3.1.1 in Chapter 3 of Volume III (2014 SWMMWW).
    - Response: Per page 941 of the 2014 SWMMWW, the flowpath must be located between the dispersion device and any downstream drainage feature such as a pipe, ditch, stream, river, pond, lake, or wetland. Due to onsite streams and wetlands, the required 100-foot flowpath cannot be attained. Thus, full dispersion systems are infeasible for the project.
- Bioretention BMPs that have a minimum horizontally projected surface area below the overflow which is at least 5% of the total surface area draining to it.
    - Response: Per the bioretention infeasibility criteria on page 966 of the 2014 SWMMWW, bioretention cannot be placed on slopes greater than 8%. Due to the surrounding site constraints, a bioretention facility cannot be reasonably placed on slopes less than 8%. Thus, bioretention is infeasible.

- Downspout Dispersion Systems in accordance with BMP T5.10B in Section 3.1.2 in Chapter 3 of Volume III (2014 SWMMWW).

    - Response: Due to onsite slopes which are greater than 15%, the required vegetated flowpath of at least 50 feet in length cannot be maintained between the outlet of the trench and any slope steeper than 15%. Additionally, the 5-foot setback between any edge of the trench and any structure or property line will cause further impacts to the surrounding critical areas; thus, full dispersion is considered infeasible.

- Perforated Stub-out Connections in accordance with BMP T5.10C: Perforated Stub-out Connections in Section 3.1.3 in Chapter 3 of Volume III (2014 SWMMWW).

    - Response: Due to onsite slopes greater than 20%, erosion hazard areas, and geotechnical recommendations, Perforated Stub-out Connections are not proposed for the project.

Other Hard Surfaces

- Full Dispersion in accordance with BMP T5.30 in Chapter 5 Volume V (2014 SWMMWW).

    - Response: Due to onsite slopes which are greater than 15%, the required vegetated flowpath of at least 50 feet in length cannot be maintained between the outlet of the trench and any slope steeper than 15%. Additionally, the 5-foot setback between any edge of the trench and any structure or property line will cause further impacts to the surrounding critical areas; thus, full dispersion is considered infeasible.

- Permeable pavement in accordance with BMP T5.15 in Chapter 5 of Volume V of the DOE Manual, or Rain Gardens in accordance with Chapter 7 of Volume V of the DOE Manual. The rain garden or bioretention facility must have a minimum horizontally projected surface area below the overflow which is at least 5% of the total surface area draining to it.

    - Response: Per the infeasibility criteria on page 923 of the 2014 SWMMWW, permeable pavement cannot be located within an area designated as an erosion hazard, or landslide hazard.

- Bioretention BMPs that have a minimum horizontally projected surface area below the overflow which is at least 5% of the total surface area draining to it.

    - Response: Per the bioretention infeasibility criteria on page 966 of the 2014 SWMMWW, bioretention cannot be placed on slopes greater than 8%. Due to the surrounding site constraints, a bioretention facility cannot be reasonably placed on slopes less than 8%. Thus, bioretention is infeasible.

- Sheet Flow Dispersion in accordance with BMP T5.12, or Concentrated Flow Dispersion in accordance with BMP T5.11 in Chapter 5 of Volume V (2014 SWMMWW).

    - Response: Due to existing site grades, runoff from the walkway cannot be routed over any infiltration facilities or over the necessary length for a dispersion facility without potentially compromising site stability. Therefore, no dispersion BMPs will be employed onsite.

Due to the severe slopes throughout the site, wetland buffers, limited space for dispersion, and geotechnical recommendations, our engineering judgement suggest none of these list items be implemented.

City of Mercer Island Code 15.09, however, includes an additional alternative method to completing Minimum Requirement #5. This requires supplemental detention onsite when no LID options are considered viable, or a fee in lieu for cases where any detention would also be infeasible. The supplemental detention is not related to Minimum Requirement #7 or flow control standards, but rather a final, required design consideration to meet Minimum Requirement #5. The supplement detention is feasible, and therefore, the site design was adjusted to add the detention to meet this minimum requirement (for design details see Section 4.2 of this report).

3.0 OFFSITE ANALYSIS

Downstream Investigation
Date of Field Inspection: April 20, 2018

Weather Conditions: 62 degrees Fahrenheit and mostly sunny. No rain in the past 12 hours.

Existing Conditions
The site maintains a consistent and steep slope, descending east, northeast towards E Mercer Way. The slope varies from 10% to 80% across the lot. Much of the site is saturated wetland or buffer for the stream that runs through the north end of the property. The site is currently undeveloped and remains largely forested with a Type 2 catch basin at the confluence of the E Mercer Way Swale system, the stream, and drainage from the neighboring lot to the south. The Parkwood Ridge Open Space public trail runs along the north end of the property and an access drive bends through the southeast edge of the lot.

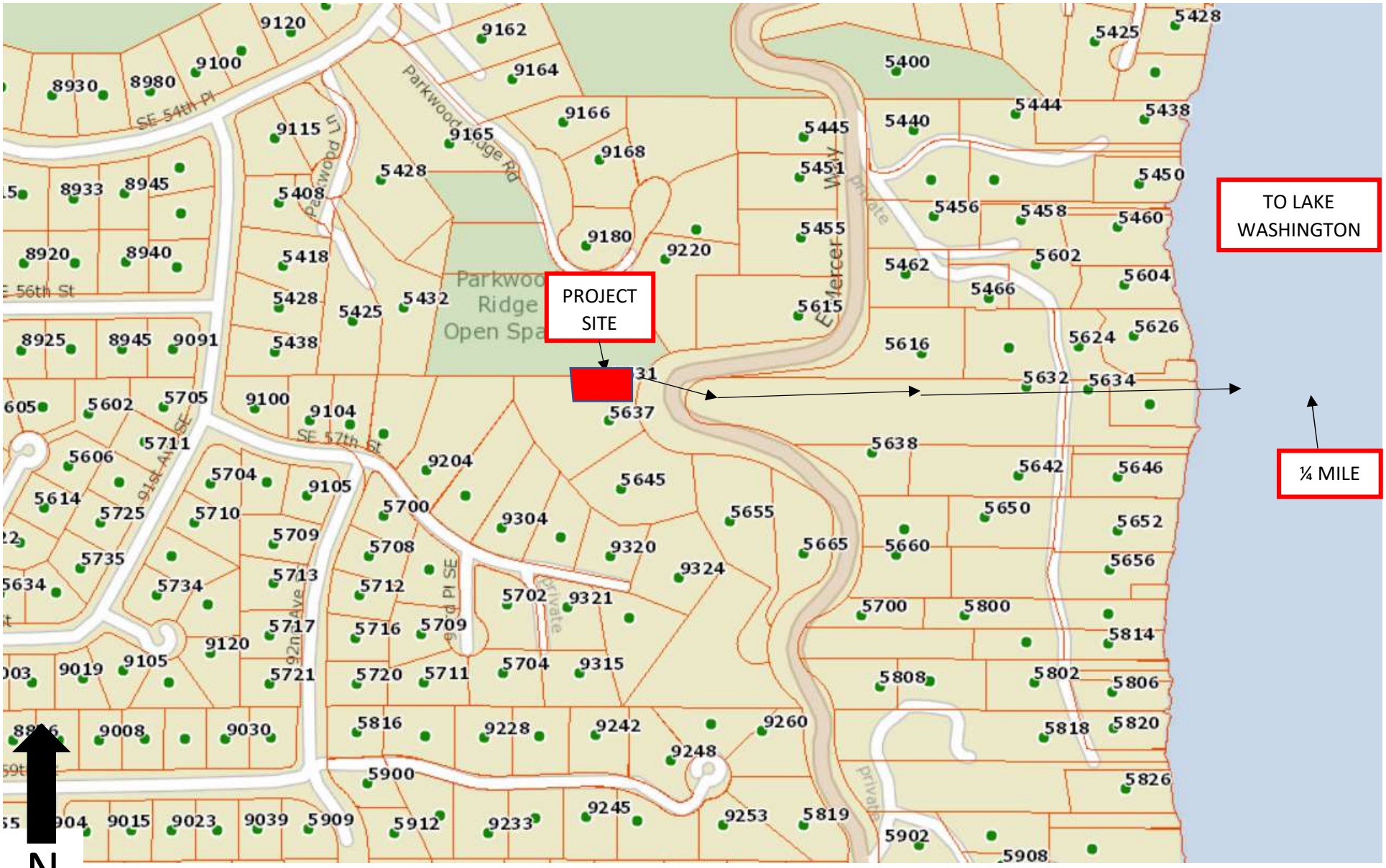
Upstream Drainage
The neighboring/uphill plats to the west and north of the site (including the Parkwood Ridge Open Space) have the flows from their respective steep slopes channeled via a mixed conveyance system, comprised of both ditches and PVC conveyance pipes, which runs through the open space or sheet flows into the stream on the north end of the property. Most of these flows enter the stream prior to reaching the property site, though a negligible portion sheet flows through the northwestern tip of the property. Uphill plats to the south and southwest contribute flows from the undeveloped sections of their respective lots which lie on steep slopes and constitute roughly 20% of their total lot areas.

Downstream Drainage
On-site flows drain east, northeast to the overflow catch basin at a local confluence ditch in the Right-of-Way of E Mercer Way. Flows enter the catch basin and are routed east under E Mercer Way by an 18" PVC pipe that outlets into a natural creek bed to the east of the street. The creek bed slopes precipitously down towards the water, before reaching a detention pond at 5646 E Mercer Way. The sediment pond also functions as a natural flow control measure and flows from this pond proceed underground due east, and through an orifice structure located in a catch basin on the east side of Glenhome Drive. From here flows are routed in an 18" PVC pipe into Lake Washington. The ¼ mile downstream analysis occurs 280 feet into Lake Washington. No observable siltation or other environmental concerns appear to exist in the vicinity of that 280-foot extension into the lake.

Additional Notes

Complaints relevant to the project site were reviewed prior to the inspection. All major complaints near the site are either not applicable to the project or have been resolved. One exception is a complaint regarding catch basin clogging due to debris. This can be resolved with standard catch basin maintenance. All catch basins and inlets included metal grating; however, some of the grating appeared covered or otherwise blocked, again resolved through standard catch basin maintenance. Any area-drain or catch basin installations on-site will be designed to minimize clutter or clogging from debris, and construction BMPs will be applied to avoid debris entering the downstream storm system.

FIGURE 3-1: Downstream Drainage Map



N.T.S.

4.0 FLOW CONTROL AND WATER QUALITY DESIGN

4.1. Basin Modeling

The drainage analysis for detention sizing was modeled using the City of Mercer Island Detention Requirement Sheet. The sheet contains a table for pre-sized detention vaults for projects which cannot meet LID standards and are under 9,500 ft^2 of impervious surface (see appendix for additional details).

4.1.1 Existing Conditions

The site consists of one parcel for a total of 0.86 acres. The project parcel is currently undeveloped. The project proposes to construct a single-family home on the property with a walkway and a driveway to provide access. Much of the parcel is encumbered with steep slopes and an active wetland stream traversing the site. These conditions cause the developable area to be reduced to 0.33 acres of land. The disturbance limits for the project are approximately 5,834 SF (0.134 ac).

4.1.2 Existing Soils

The onsite soil type is mapped by NRCS as Alderwood gravelly, sandy loam. Based on the King County Soil types the soil is considered hydraulic soil group C. The NRCS Site Soils Map and King County Soil Types Table are included in the Appendix.

4.1.3 Existing Site Summary

The pre-developed conditions were modeled in MGSFlood as Second Growth-Forested area with hydrologic soil group C.

SW 1/4, SE 1/4, SEC. 19, TWP. 24 N., RGE. 5 E., W.M.

M.I. TREEHOUSE LLC
5631 E MERCER WAY
TPN 1924059312

TOE OF STEEP SLOPE
STEEP SLOPE BUFFER
TREE DRIPLINE (TYP)
LIMITS OF CATEGORY III SLOPE WETLAND PER CRITICAL AREA ENHANCEMENT PLAN BY SEWALL WETLAND CONSULTING DATED 10-21-2015
5'± WIDE GRAVEL FOOT TRAIL CROSSES PROP LINE
PARKWOOD RIDGE OPEN SPACE
5'± WIDE GRAVEL FOOT TRAIL
STORMWATER/UTILITY & PEDESTRIAN TRAIL EASEMENT REC. NO. 20070425001878
4" CLF ENDS
℄ CREEK
STREAM B (PER SEWALL WETLAND CONSULTING, INC. SURVEYED AUGUST 31, 2020)
APPROXIMATE ACCESS EASEMENT PER SP REC. NO. 7703310851
MERCER FIRS VOL 79, PG 70
ROCKERY CROSSES ℄
CONC DRIVE ACCESS
GABION REST WALL
12"CPEP IE 159.49=
18"IP IE=154.03
SDMH
RIM EL=158
18"IP(W)E=
12"IP(E)E=1
AREA DRAIN W/ 1" SQ GRATE W/ 4" CPEP N & S, CONNECTIONS UNKNOWN N'LY & S'LY
RIM EL=180.45
FOUND REBAR W/ 1" ORANGE CAP STAMPED "HGG 38984" ON ℄
LOT B SP NO. MI-77-1-10
STEEP SLOPE PER MERCER ISLAND CRITERIA
SCALE: 1" = 10'
0 5 10 20

NO.	REASONS	DATE

09-14-2022

CORE DESIGN
ENGINEERING • PLANNING • SURVEYING
14711 NE 29th Place Suite 101
Bellevue, Washington 98007
425.885.7877 Fax 425.885.7963

EXISTING CONDITIONS
5637 MERCER WAY
MI TREEHOUSE, LLC
11030 SE 30TH ST.
BELLEVUE, WA 98004

DATE	SEPTEMBER 2022
DESIGNED	NICHOLAS JOHNSON
DRAWN	NICHOLAS JOHNSON
APPROVED	MICHAEL A MOODY
	MICHAEL A MOODY, PROJECT MANAGER

SHEET	OF
1	1

PROJECT NUMBER 18039

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4.1.4 Developed Conditions

The developed condition proposes the construction of a single-family residence and an access easement. Refer to Table 4.1 and 4.2 below for a breakdown of the actual developed areas. The disturbed area for the project is approximately 5,834 sf (0.134 ac). An existing drive borders the west property line and has been modeled using the proposed impervious area. Refer to the developed conditions exhibit on the following page for an area breakdown.

Table 4.1 Developed Site Disturbed Area Breakdown

Total Area (sf)	***5,834***
Roofs (with eaves)	2,184
Driveway/Roadway	2,162
Walkway/Patio	135
Impervious Subtotal	***4,481***
Lawn/Landscaping	1,353
Pervious Subtotal	***1,353***

Table 4.2 Developed Area Summary

DEVELOPED CONDITIONS	Total Area = 0.134 acres
GROUND COVER	AREA (acres)
Grass/Lawn	0.031
Impervious	0.103

N88°34'08"W 258.39

M.I. TREEHOUSE LLC
5631 E MERCER WAY
TPN 1924059312

STEEP SLOPE BUFFER (TYP)

TOE OF STEEP SLOPE

LIMITS OF CATEGORY III SLOPE WETLAND PER CRITICAL AREA ENHANCEMENT PLAN BY SEWALL WETLAND CONSULTING DATED 10-21-2015

STREAM B
(PER SEWALL WETLAND CONSULTING, INC. SURVEYED AUGUST 31, 2020)

PARKWOOD RIDGE OPEN SPACE

5'± WIDE GRAVEL FOOT TRAIL

STORMWATER/UTILITY & PEDESTRIAN TRAIL EASEMENT REC. NO. 20010425001878

4" CPEP ENDS

℄ CREEK

12"CPEP IE 159.49

18"IP IE=154.03

SDMH
RIM EL=158.61
18"P(W)IE=154.71
12"P(E)IE=154.51

SSMH
RIM
6"PV
8"PV
8"PV

CB
RIM
8"CP

EXISTING GRADE CONTOUR (TYP)

PROPOSED FINISHED GRADE CONTOUR (TYP)

R=101.02 Δ=29°09'06" L=49.57

BUILDING
GARAGE EL:184.0
MAIN FLOOR: 194.83

SSMH #8030
RIM EL=160.33
8"PVC(NW)IE=15
8"PVC(SE)IE=15

ROCKERY CROSSES

AREA DRAIN W/ 1' SQ GRATE W/ 4" CPEP N & S, CONNECTIONS UNKNOWN N'LY & S'LY
RIM EL=180.45

FOUND REBAR W/ 1" ORANGE CAP STAMPED "HGG 35984" ON ℄

ONSITE AREA
IMPERVIOUS AREA = 0.103 AC
PERVIOUS AREA = 0.031 AC
TOTAL AREA = 0.134 AC

CLEARING LIMITS (TYP)

N57°55'41"E 183.21

N40°14'06"W 101.00

LOT B
SP NO. MI-77-1-10

SCALE: 1" = 10'
0 5 10 20

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Bellevue, Washington 98007
425.885.7877 Fax 425.885.7963
ENGINEERING · PLANNING · SURVEYING

NO.	REVISIONS	DATE

09-14-2022

DEVELOPED CONDITIONS
5637 MERCER WAY
MI TREEHOUSE, LLC
11030 SE 30TH ST.
BELLEVUE, WA 98004

DATE	SEPTEMBER 2022
DESIGNED	NICHOLAS JOHNSON
DRAWN	NICHOLAS JOHNSON
APPROVED	MICHAEL A MOODY
	MICHAEL A MOODY, PROJECT MANAGER

SHEET	OF
1	1

PROJECT NUMBER
18039

4.1.5 WWHM Modeling Results

The existing condition area was assumed to be fully forest in Group C soils. The developed condition area is represented in Tables 4.1 and 4.2. Both conditions were input into WWHM and a model using 15-minute timesteps was executed. The project causes a 0.09 cfs change to the 100-year peak flow which is less than the maximum 0.15 cfs change. Refer to the WWHM Flow Frequency Analysis on the following page. The full WWHM Report Printout has been included in the Appendix of this report.

Flow Frequency			
Flow(cfs)		Predeveloped	Mitigated
2 Year	=	0.0040	0.0479
5 Year	=	0.0065	0.0616
10 Year	=	0.0082	0.0713
25 Year	=	0.0101	0.0842
50 Year	=	0.0115	0.0943
100 Year	=	0.0127	0.1048

4.2. Flow Control BMPs

Per the City of Mercer Island regulation, the project follows the Mercer Island City Code in addendum to the 2014 DOE Manual. As such, the Minimum Requirements 1 through 5 determine whether or not various stormwater BMP measures are required and to what degree. The Mercer Way Project includes less than 5,000 ft^2 of replaced/new impervious surfaces and therefore is not subject to standard Flow Control BMPs. LID BMPs are typically used to meet minimum requirement 5; however, all LID options are not feasible onsite due to the severe nature of the site constraints. The City of Mercer Island then requires supplemental detention in place of any LID requirements and has provided a pre-sized detention tank table for sites, such as this one, which do not have available LID options (see Appendix for sizing table).

This site will employ a detention pipe, designed using the City of Mercer Island Table 1 to meet Minimum Requirement 5 in accordance with Mercer Island City Code. The 5637 E Mercer Way project site will add approximately 4,481 SF of impervious area, and the site is covered in primarily Class C soils (see Appendix for the NRCS Soils Map of the area). A 5-foot (60 inch) diameter Contech Aluminized Type II CMP pipe (or approved equivalent) was selected to minimize trenching impact for utility placement. The dimensions of the pipe are therefore as follows:

- 60” diameter
- 31’ in length

Orifice placement and sizing is governed by the City of Mercer Island Table 1 and is as follows:

- First orifice Diameter 0.5”
- Second Orifice Diameter 1.3”
- Separation between first and second orifices, 3.5’

The detention pipe will be subject to HS-20/HS-25 loading. The Contech CMP pipe has been designed to have a thickness of 16 gauge (0.064 inch). Per Contech’s CMP Detention Design Guide, a 0.064 inch thick, 60-inch pipe has a minimum cover of 12 inches.

Additional details and placement information can be found on the Stormwater Site Plans. Specifications for the Contech Aluminized Type II CMP pipe have been provided on the following pages.

SECTION (_____)

Aluminized Type II (ALT2) Corrugated Metal Pipe (CMP) with Void Saver™
Underground Detention

1.0 GENERAL

1.1 This item shall govern the furnishing and installation of Underground Detention Systems for all types, sizes and designations as shown on the plans that utilize Void Saver technology.

1.2 Contractor shall furnish all labor, materials, equipment and incidentals necessary to install the CMP System, appurtenances and incidentals in accordance with the Drawings and as specified herein.

1.3 When an underground storage design requires water storage within the stone voids, it is recommended that the stone storage be utilized only during larger storm events to prevent long term capacity loss. The majority of storm events should be stored within the pipe. Fully perforated pipe, open bottomed chambers, and plastic crate systems shall not be accepted as alternatives.

1.4 Geotextiles shall not be used as filtration method to protect the stone voids as they are subject to clogging and decreased long term effectiveness. Stone Void contamination can compromise large portions of allocated overall storage within the underground detention system leading to long term flooding risk.

1.5 Applicable provisions of any Division shall govern work in this section.

1.6 American Association of State Highway and Transportation Officials (AASHTO)

1.6.1 AASTHO Design Section 12 – Soil-Corrugated Metal Structure Interaction Systems

1.6.2 AASHTO Construction Section 26 – Metal Culverts

1.6.3 AASHTO M36 – Standard Specification for Corrugated Steel Pipe, Metallic-Coated for Sewers and Drains

1.6.4 AASHTO M274 – Standard Specification for Steel Sheet, Aluminum-Coated (Type 2), for Corrugated Steel Pipe

1.7 American Society for Testing and Materials (ASTM)

1.7.1 ASTM A760: Standard Specification for Corrugated Steel Pipe, Metallic-Coated for Sewers and Drains

1.7.2 ASTM A929: Standard Specification for Steel Sheet, Metallic-Coated by the Hot-Dip Process for Corrugated Steel Pipe

1.7.3 ASTM A798: Standard Practice for Installing Factory-Made Corrugated Steel Pipe for Sewers and Other Applications

1.7.4 ASTM A998: Standard Practice for Structural Design of Reinforcements for fittings in Factory-Made Corrugated Steel Pipe for Sewers and Other Applications

1.8 Site layout drawings, product specifications, materials, corrugation, gage, hydraulic storage data and supported calculations of proposed alternatives shall be submitted to the EOR for review a minimum of 10 working days prior to bid date.

1.9 Shop drawings shall be annotated to indicate all materials to be furnished and installed under this section, and all applicable standards for materials, required tests of materials and design assumptions for structural analysis:

1.9.1 Before installation of the CMP System, Contractor shall obtain the written approval of the EOR for the stormwater system and the installation drawings.

2.0 MATERIALS

2.1 Aluminized Type II material shall conform to the applicable requirements of AASHTO M274 or ASTM A929. CMP shall be manufactured in accordance with the applicable requirements of AASHTO M36 or ASTM A760.

2.2 The pipe sizes, gauges and corrugations shall be as shown on the project plans. Joint performance requirements are published in Division II, Section 26.4.2, of the current edition of the AASHTO Bridge Construction Specifications.

2.3 Soil tight, gravity flow, non-pressure, drainage pipe joints shall conform to AASHTO M36 and ASTM A760. Minimum joint spacing shall be 10 ft.

2.4 Overlapping of adjacent pipes are not permitted and appropriate banding must be utilized in order to properly secure individual pipes in place.

2.5 Integral End Sections: Each barrel of the CMP System shall either be connected to a fitting composing a manifold for hydraulic distribution or have an integrated bulkhead to resist loading at the end/start of the barrel, end cap sections shall not be permitted.

2.6 Material selected shall be flame resistant and capable of retaining 80% of strength when subjected to a temperature of 400 degrees Fahrenheit for one hour.

2.7 All fittings shall be manufactured prior to arriving on the jobsite to ensure structural integrity. Fitting reinforcement shall be in accordance with ASTM A998 and reinforcing details. Bulkhead design and fabrication does not vary with differing coatings on the steel components.

2.8 The manufacturer of the CMP System shall be one that has regularly been engaged in the engineering design and production of these systems for at least fifteen (15) years and which

has a history of successful production, acceptable to the EOR. In accordance with the Drawings, the CMP System shall be supplied by:

Contech Engineered Solutions
9025 Centre Pointe Drive
West Chester, OH, 45069
Tel: 1 800 338 1122

2.9 Sampling, testing, and inspection of metal sheets and coils used for manufacturing the CMP System shall be in accordance with to the above applicable referenced specifications. All fabrication of the product shall occur within the United States.

3.0 PERFORMANCE

3.1 The CMP System proposal shall be sized in accordance to the design provided and approved by the Engineer of Record (EOR). Any Contractor deviating from the design shown on the plans, to include: material, footprint, etc., shall provide to the EOR a summary report on stage-storage curves, design calculations, HydroCAD modeling and engineering drawings.

3.2 The CMP System shall comprise of manhole access with minimum dimensions of 24 inches diameter to provide adequate inspection and maintenance without restrictions and obstructions to entry into interior of the CMP System. Manholes shall be provided to allow full entry into and visual inspection of the complete CMP System, at a minimum as to allow full maintenance of the CMP System. Cleanouts or inspection ports are not acceptable access points for maintenance and inspection nor are any other alternatives which do not allow for full entry into the system.

3.3 CMP spacing, gage (thickness) and stone base thickness can be altered with consultation from Contech Engineered Solutions, LLC.

3.4 The CMP System shall be designed for a minimum HS-20/HS-25 final live loading conditions. The CMP System shall meet HS-20/HS-25 loading requirements with a minimum of 12-inches of cover to bottom of flexible pavement for pipe spans less than or equal to 96 inches and 18 inches of cover to bottom of flexible pavement for pipe spans greater than 96 inches.

3.5 The CMP System shall be designed so as the hydraulic grade line will increase evenly throughout whereas transverse movement from one storage compartment to another shall not be permitted. All storage compartments shall be connected via manifold (or connecting pipe) versus by transporting stormwater through stone.

3.6 The CMP System shall be designed to prevent stone void contamination by means to only utilize the stone storage during infrequent events using an overflow vent with the bulkhead at a designed elevation. Water should return to the CMP System from the stone during infrequent events by one-way check valves to allow stormwater to exit the system at the required flow.

4.0 EXECUTION

4.1 The CMP System installation shall be in accordance with AASHTO Standard Specifications for Highways Bridges, Section 26, Division II or ASTM A798 and in conformance with the project plans and specifications.

4.2 The CMP System shall be installed in accordance with the manufacturer's recommendations and related sections of the contract documents. Handling & assembly shall be in accordance with National Corrugated Steel Pipe Association's (NCSPA) recommendations.

4.3 For temporary construction vehicle loads, an extra amount of compacted cover may be required over the top of the pipe. The Height-of-Cover shall meet the minimum requirements shown in the table below. The use of heavy construction equipment necessitates greater protection for the pipe than finished grade cover minimums for normal highway traffic.

Minimum Cover (ft) Requirements

Pipe Span	Axle Loads (kips)			
(inches)	18 - 50	50 - 75	75 - 110	110 - 150
12 - 42	2.0	2.5	3.0	3.0
48 - 72	3.0	3.0	3.5	4.0
78 - 120	3.0	3.5	4.0	4.0
126 - 144	3.5	4.0	4.5	4.5

4.4 Minimum cover may vary, depending on local conditions. The contractor must provide the additional cover required to avoid damage to the pipe. Minimum cover is measured from the top of the pipe to the top of the maintained construction roadway surface.

4.5 Refer to the Contech's Corrugated Metal Pipe Detention Design Guide for additional guidance regarding installation, inspection and maintenance.

4.6 The contractor shall follow Occupational Safety and Health Association (OSHA) guidelines for safe practices in executing the installation process in accordance with the manufacturer/supplier installation recommendations.

4.7 Backfill material shall be placed in 8 inch loose lifts and compacted to 90% AASHTO T99 standard proctor density.

4.8 Supplier will conduct an on-site preconstruction meeting with the contractor prior to the scheduled delivery date of the CMP System.

SECTION (_____)

Aluminized Type II (ALT2) Corrugated Metal Pipe (CMP)
Underground Detention and Infiltration Standard Specification

1.0 GENERAL

1.1 This item shall govern the furnishing and installation of Underground Detention and Infiltration Systems for all types, sizes and designations as shown on the plans.

1.2 Contractor shall furnish all labor, materials, equipment and incidentals necessary to install the CMP System, appurtenances and incidentals in accordance with the Drawings and as specified herein.

1.3 A stormwater treatment device upstream of the CMP System is recommended as the appropriate means of pretreating for the purpose of extending the maintenance interval on the CMP System and reducing the life cycle cost. Both engineered solutions shall be provided by a single supplier/manufacturer. Filtration by wrapping a system with geotextile is not an acceptable means of pretreatment.

1.4 Applicable provisions of any Division shall govern work in this section.

1.5 American Association of State Highway and Transportation Officials (AASHTO)

1.5.1 AASTHO Design Section 12 – Soil-Corrugated Metal Structure Interaction Systems

1.5.2 AASHTO Construction Section 26 – Metal Culverts

1.5.3 AASHTO M36 – Standard Specification for Corrugated Steel Pipe, Metallic-Coated for Sewers and Drains

1.5.4 AASHTO M274 – Standard Specification for Steel Sheet, Aluminum-Coated (Type 2), for Corrugated Steel Pipe

1.6 American Society for Testing and Materials (ASTM)

1.6.1 ASTM A760: Standard Specification for Corrugated Steel Pipe, Metallic-Coated for Sewers and Drains

1.6.2 ASTM A929: Standard Specification for Steel Sheet, Metallic-Coated by the Hot-Dip Process for Corrugated Steel Pipe

1.6.3 ASTM A798: Standard Practice for Installing Factory-Made Corrugated Steel Pipe for Sewers and Other Applications

1.6.4 ASTM A998: Standard Practice for Structural Design of Reinforcements for fittings in Factory-Made Corrugated Steel Pipe for Sewers and Other Applications

1.7 Site layout drawings, product specifications, materials, corrugation, gage, hydraulic storage data and supported calculations of proposed alternatives shall be submitted to the EOR for review at a minimum of 10 working days prior to bid closing.

1.8 Shop drawings shall be annotated to indicate all materials to be furnished and installed under this section, and all applicable standards for materials, required tests of materials and design assumptions for structural analysis:

1.8.1 Before installation of the CMP System, Contractor shall obtain the written approval of the EOR for the stormwater system and the installation drawings.

1.9 All proposed alternatives to the CMP System shall conform to applicable above referenced AASHTO and ASTM specifications. NCSPA provides design service life guidance for certain products up to 100 years in recommended environments.

2.0 MATERIALS

2.1 Aluminized Type II material shall conform to the applicable requirements of AASHTO M274 or ASTM A929. CMP shall be manufactured in accordance with the applicable requirements of AASHTO M36 or ASTM A760.

2.2 The pipe sizes, gauges and corrugations shall be as shown on the project plans. Joint performance requirements are published in Division II, Section 26.4.2, of the current edition of the AASHTO Bridge Construction Specifications.

2.3 Soil tight, gravity flow, non-pressure, drainage pipe joints shall conform to AASHTO M36 and ASTM A760. Minimum joint spacing shall be 10 ft.

2.4 Overlapping of adjacent pipes are not permitted and appropriate banding must be utilized in order to properly secure individual pipes in place.

2.5 Integral End Sections: Each barrel of the CMP System shall either be connected to a fitting composing a manifold for hydraulic distribution or have an integrated bulkhead to resist loading at the end/start of the barrel, end cap sections shall not be permitted.

2.6 Material selected shall be flame resistant and capable of retaining 80% of strength when subjected to a temperature of 400 degrees Fahrenheit for one hour.

2.7 All fittings shall be manufactured prior to arriving on the jobsite to ensure structural integrity. Fitting reinforcement shall be in accordance with ASTM A998 and reinforcing details. Bulkhead design and fabrication does not vary with differing coatings on the steel components.

2.8 The manufacturer of the CMP System shall be one that has regularly been engaged in the engineering design and production of these systems for at least fifteen (15) years and which has a history of successful production, acceptable to the EOR. In accordance with the Drawings, the CMP System shall be supplied by:

Contech Engineered Solutions
9025 Centre Pointe Drive
West Chester, OH, 45069
Tel: 1 800 338 1122

2.9 Sampling, testing, and inspection of metal sheets and coils used for manufacturing the CMP System shall be in accordance with to the above applicable referenced specifications. All fabrication of the product shall occur within the United States.

3.0 PERFORMANCE

3.1 The CMP System proposal shall be sized in accordance to the design provided and approved by the Engineer of Record (EOR). Any Contractor deviating from the design shown on the plans, to include: material, footprint, etc., shall provide to the EOR a summary report on stage-storage curves, design calculations, HydroCAD modeling and engineering drawings.

3.2 The CMP System shall comprise of manhole access with minimum dimensions of 24 inches diameter to provide adequate inspection and maintenance without restrictions and obstructions to entry into interior of the CMP System. Manholes shall be provided to allow full entry into and visual inspection of the complete CMP System, at a minimum as to allow full maintenance of the CMP System. Cleanouts or inspection ports are not acceptable access points for maintenance and inspection nor are any other alternatives which do not allow for full entry into the system.

3.3 CMP spacing, gage (thickness) and stone base thickness can be altered with consultation from Contech Engineered Solutions, LLC.

3.4 The CMP System shall be designed for a minimum HS-20/HS-25 final live loading conditions. The CMP System shall meet HS-20/HS-25 loading requirements with a minimum of 12-inches of cover to bottom of flexible pavement for pipe spans less than or equal to 96 inches and 18 inches of cover to bottom of flexible pavement for pipe spans greater than 96 inches.

3.5 The CMP System shall be designed so as the hydraulic grade line will increase evenly throughout whereas transverse movement from one storage compartment to another shall not be permitted. All storage compartments shall be connected via manifold (or connecting pipe) versus by transporting stormwater through stone.

3.6 A stormwater pretreatment device is recommended upstream of the CMP system as follows:

3.6.1 Infiltration: Where feasible, the selected stormwater treatment device upstream of an infiltration system shall be a filter system and have General Use Level Designation (GULD) for Basic Treatment by the Washington State Department of Ecology or demonstrate equivalent performance in independently verified field testing following a peer reviewed testing protocol, and must be sized consistent with the system producing those results.

3.6.2 Detention: Where feasible, the selected Stormwater treatment device upstream of a detention system shall be a separator system and have GULD for Pretreatment by the WADOE or demonstrate equivalent performance in independently verified field testing following a peer reviewed testing protocol, and must be sized consistent with the system producing those results.

3.6.3 Selected pretreatment stormwater device shall incorporate a physical barrier capable of capturing and retaining trash and debris (i.e.: floatable and neutrally buoyant materials) for all flows up to the treatment capacity of the device.

3.6.4 The application of wrapping a system with geotextile of any branding or material type, that allows the passage of stormwater, shall not be regarded as an acceptable treatment or pretreatment device.

3.6.5 The manufacturer of the selected Stormwater treatment device shall have been regularly engaged in the engineering design and production of systems for the physical treatment of Stormwater runoff for 15 years.

3.6.6 In order to not restrict the Owner's ability to maintain the stormwater pretreatment device, the minimum dimension providing access from the ground surface to the sump chamber shall be 20 inches in diameter.

4.0 EXECUTION

4.1 The CMP System installation shall be in accordance with AASHTO Standard Specifications for Highways Bridges, Section 26, Division II or ASTM A798 and in conformance with the project plans and specifications.

4.2 The CMP System shall be installed in accordance with the manufacturer's recommendations and related sections of the contract documents. Handling & assembly shall be in accordance with National Corrugated Steel Pipe Association's (NCSPA) recommendations.

4.3 For temporary construction vehicle loads, an extra amount of compacted cover may be required over the top of the pipe. The Height-of-Cover shall meet the minimum requirements shown in the table below. The use of heavy construction equipment necessitates greater protection for the pipe than finished grade cover minimums for normal highway traffic.

Minimum Cover (ft) Requirements

Pipe Span (inches)	Axle Loads (kips)			
	18 - 50	50 - 75	75 - 110	110 - 150
12 - 42	2.0	2.5	3.0	3.0
48 - 72	3.0	3.0	3.5	4.0
78 - 120	3.0	3.5	4.0	4.0
126 - 144	3.5	4.0	4.5	4.5

4.4 Minimum cover may vary, depending on local conditions. The contractor must provide the additional cover required to avoid damage to the pipe. Minimum cover is measured from the top of the pipe to the top of the maintained construction roadway surface.

4.5 Refer to the Contech's Corrugated Metal Pipe Detention Design Guide for additional guidance regarding installation, inspection and maintenance.

4.6 The contractor shall follow Occupational Safety and Health Association (OSHA) guidelines for safe practices in executing the installation process in accordance with the manufacturer/supplier installation recommendations.

4.7 Backfill material shall be placed in 8 inch loose lifts and compacted to 90% AASHTO T99 standard proctor density.

4.8 Supplier will conduct an on-site preconstruction meeting with the contractor prior to the scheduled delivery date of the CMP System.

4.3 Stream and Wetland Hydrologic Evaluation

The project discharges to an existing water course which flows into wetland areas downstream. A condition of approval for the project is for a hydrologist to analyze the impact, if any, of the discharge from the project site and recommend necessary mitigation if deemed appropriate. Core Design, Inc. has conducted a hydrologic evaluation and analyzed the impacts, if any, to the system.

The pre-project conditions were evaluated via the most recent aerial imagery and topographical survey data of the area to determine the landcover types which are used to model the existing conditions in WWHM2012. Refer to Table 4.3 below for a summary of the pre-project conditions areas. The post-project condition areas used for the model match those of Table 4.2 in this report.

Table 4.3 Pre-project Condition Landcover Areas

PRE-PROJECT CONDITIONS	Total Area = 0.134 acres
GROUND COVER	AREA (acres)
Till-Forest	0.064
Wetland	0.056
Impervious	0.014

The values in Table 4.3 were input into WWHM as the Pre-developed “Pre-project” condition and values in Table 4.2 as the Developed “Post-project” condition. The Predeveloped “Pre-project” conditions were connected to Point of Compliance (POC) 1 in the model. The Developed “Post-project” conditions include the prescriptively sized tank the associated tributary area. The surface and interflow flows of the area tributary to the tank were routed to the tank and the groundwater was connected to POC 1.

The model results show an increase at the 2-year, 10-year, and 100-year peak flow of 0.0061 cfs, 0.0081 cfs, and 0.0130 cfs, respectively. Refer to the flow frequency analysis provided by WWHM on the following page. Refer to the Appendix of this report for the full WWHM analysis report.

Flow Frequency		
Flow(cfs)	Predeveloped	Mitigated
2 Year =	0.0108	0.0169
5 Year =	0.0157	0.0228
10 Year =	0.0192	0.0273
25 Year =	0.0240	0.0337
50 Year =	0.0278	0.0390
100 Year =	0.0318	0.0448

It is Core Design's professional opinion the discharge from the project site causes negligible increases at all storm events through the 100-year with no adverse impacts expected. Additionally, the discharge is to the same stream system which flows through the project site.

5.0 FINANCIAL LIABILITY

A site improvement Bond Quantities Worksheet will be provided prior to permit approval.

6.0 APPENDIX

King County Parcel Report

DOE Flow Minimum Requirement Flow Charts

NRCS Soil Survey Map

Technical Memo

Mercer Island Detention Requirement Guidelines

WWHM Model Reports

Department of Assessments

500 Fourth Avenue, Suite ADM-AS-0708, Seattle, WA 98104

Office Hours: Mon - Fri 8:30 a.m. to 4:30 p.m.

TEL: 206-296-7300
FAX: 206-296-5107
TTY: 206-296-7888

Send us mail

New Search | Property Tax Bill | Map This Property | Glossary of Terms | Area Report | Property Detail

PARCEL

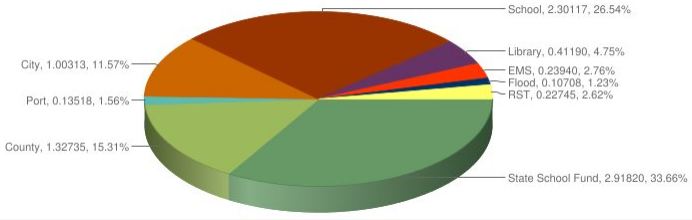
Parcel Number	192405-9312
Name	MI TREEHOUSE LLC
Site Address	
Legal	LOT A MERCER IS SP 77-1-10 REC AF #7703310851 SD SP DAF POR OF NE 1/4 OF SW 1/4 AND OF GL 3 LY BTWN LNS PLW & DIST 1700 FT & 2350 FT N OF SLY LN OF SEC & LY WLY OF E MERCER WAY BLVD LESS POR PLATTED EL DORADO ESTATES ALSO LESS POR PLATTED MERCER FIRS

BUILDING 1

Year Built	
Total Square Footage	
Number Of Bedrooms	
Number Of Baths	
Grade	
Condition	
Lot Size	37554
Views	No
Waterfront	

TOTAL LEVY RATE DISTRIBUTION

Tax Year: 2018 **Levy Code:** 1031 **Total Levy Rate:** $8.67086 **Total Senior Rate:** $5.28238



46.37% Voter Approved

Click here to see levy distribution comparison by year.

TAX ROLL HISTORY

Valued Year	Tax Year	Appraised Land Value ($)	Appraised Imps Value ($)	Appraised Total ($)	Taxable Land Value ($)	Taxable Imps Value ($)	Taxable Total ($)
2017	2018	35,000	0	35,000	35,000	0	35,000
2016	2017	32,094	0	32,094	32,094	0	32,094
2015	2016	32,094	0	32,094	32,094	0	32,094
2014	2015	32,094	0	32,094	32,094	0	32,094
2013	2014	190,000	0	190,000	190,000	0	190,000
2012	2013	176,000	0	176,000	176,000	0	176,000
2011	2012	186,000	0	186,000	186,000	0	186,000
2010	2011	195,000	0	195,000	195,000	0	195,000
2009	2010	201,000	0	201,000	201,000	0	201,000
2008	2009	250,000	0	250,000	250,000	0	250,000
2007	2008	250,000	0	250,000	250,000	0	250,000
2006	2007	359,000	0	359,000	359,000	0	359,000
2005	2006	359,000	0	359,000	359,000	0	359,000
2004	2005	330,000	0	330,000	330,000	0	330,000
2003	2004	330,000	0	330,000	330,000	0	330,000
2002	2003	330,000	0	330,000	330,000	0	330,000
2001	2002	210,000	0	210,000	210,000	0	210,000
2000	2001	183,000	0	183,000	183,000	0	183,000
1999	2000	147,000	0	147,000	147,000	0	147,000
1998	1999	140,000	0	140,000	140,000	0	140,000
1997	1998	0	0	0	87,000	0	87,000

Reference Links:

- King County Taxing Districts Codes and Levies (.PDF)
- King County Tax Links
- Property Tax Advisor
- Washington State Department of Revenue (External link)
- Washington State Board of Tax Appeals (External link)
- Board of Appeals/Equalization
- Districts Report
- iMap
- Recorder's Office

Scanned images of surveys and other map documents

1996	1997	0	0	0	80,000	0	80,000
1994	1995	0	0	0	80,000	0	80,000
1992	1993	0	0	0	63,700	0	63,700
1990	1991	0	0	0	65,000	0	65,000
1988	1989	0	0	0	40,500	0	40,500
1986	1987	0	0	0	54,000	0	54,000
1984	1985	0	0	0	46,000	0	46,000
1982	1983	0	0	0	46,000	0	46,000

Updated: March 17, 2016

Information for... **Do more online**
Get help

Figure I-2.4.1 Flow Chart for Determining Requirements for New Development

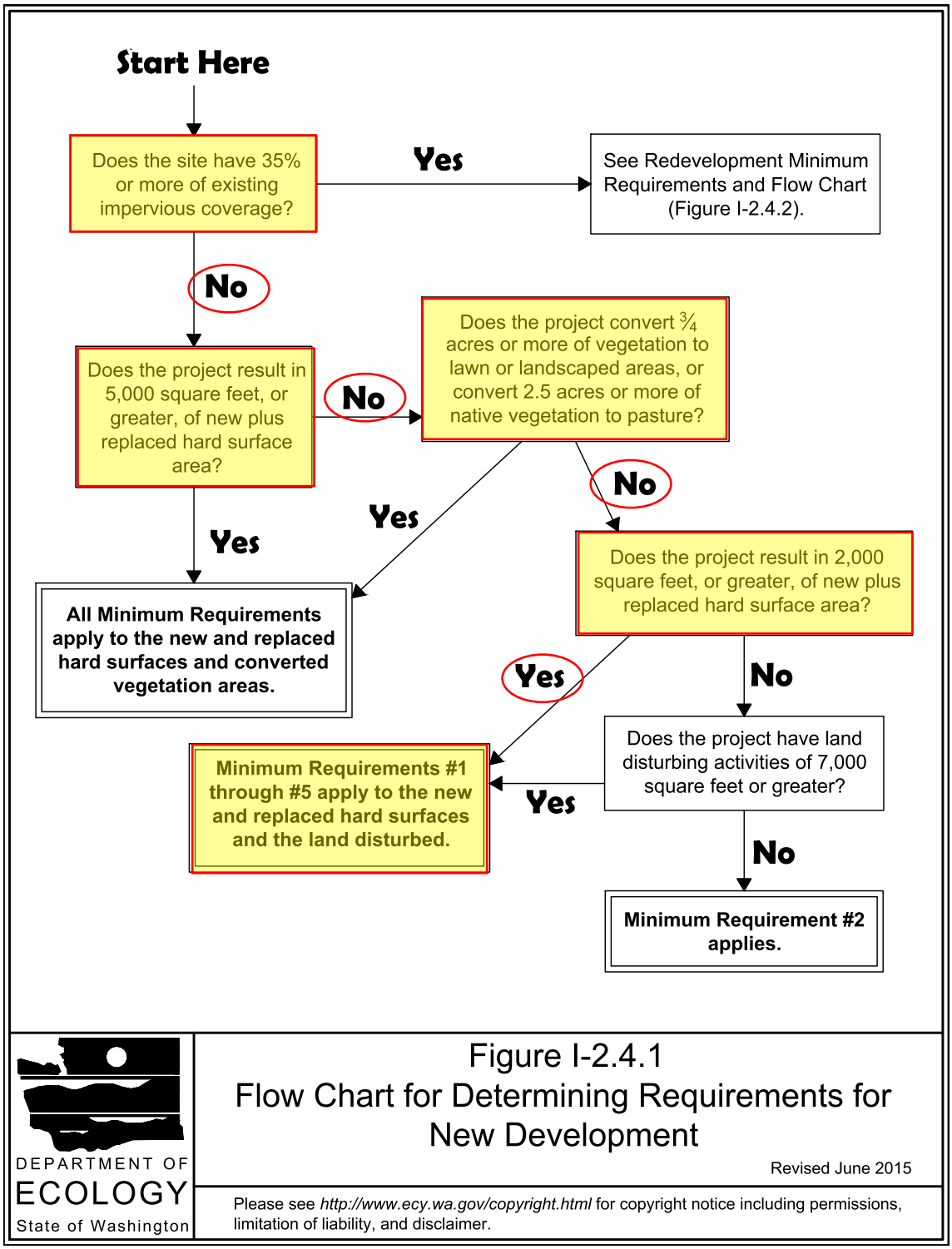
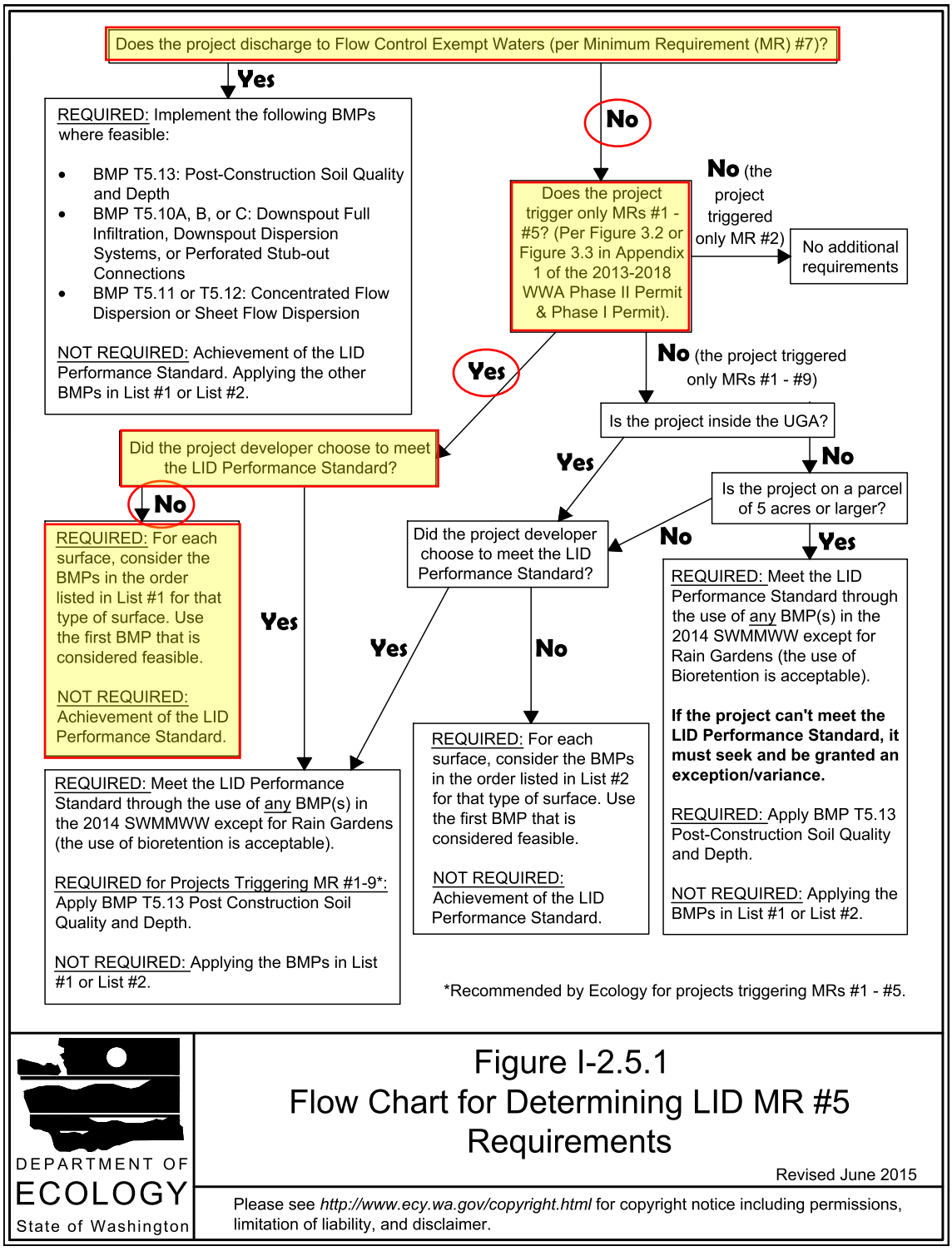


Figure I-2.5.1 Flow Chart for Determining LID MR #5 Requirements



Map Scale: 1:729 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 10 20 40 60

Feet
0 35 70 140 210

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 10N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: King County Area, Washington
Survey Area Data: Version 13, Sep 7, 2017

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Aug 31, 2013—Oct 6, 2013

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
AgC	Alderwood gravelly sandy loam, 8 to 15 percent slopes	1.4	99.6%
KpD	Kitsap silt loam, 15 to 30 percent slopes	0.0	0.4%
Totals for Area of Interest		**1.4**	**100.0%**

• 14711 NE 29Th Place, Suite 101
• Bellevue, Washington 98007
• Ph 425.885.7877
• www.coredesigninc.com

TECHNICAL MEMORANDUM

To: Evan Maxim
Planning Manager
City of Mercer Island

From: Michael A. Moody, P.E., LEED-AP
Project Engineer

Date: March 23, 2018

Re: RUE CAO 15-001 (MI Treehouse Project) Supplemental Evaluation

---

The purpose of this memorandum is to provide additional documentation and evaluation for the above referenced project as requested in your email dated February 2, 2018 and a letter from the City Attorney (Kari L. Sand) dated December 26, 2017 (both provided as attachments for reference).

More specifically this memo intends to provide the City with our Civil Engineering opinion and/or technical responses to Items A, B and E in the City's December 26, 2017 letter so that processing of the Reasonable Use Exemption permit may continue.

Item A: Geotechnical / Civil (drainage) Engineering:

Our additional analysis of the existing condition for the Type 2 Watercourse located on-site and conveying water downstream of the project site discovered that the system currently experiences siltation throughout the year.

The proposed project will likely adversely impact siltation in the watercourse during construction without temporary erosion and sediment control measures beyond those required at minimum. The project will therefore apply additional BMPs to reduce impacts during construction including:

- Restricted construction dates (dry season construction only)
- Additional filter fabric fence (double layer)
- Restricted clearing limit footprint (clear only what is necessary for the home and driveway as discussed in the *Revised Critical Areas Report* provided under separate cover)
- Restricted construction entrance disturbance (no excavation at existing driveway, add quarry spalls per typical, maintain daily)

The proposed project is unlikely to impact siltation or flooding in the watercourse in the permanent condition. Refer to the *Revised Critical Areas Report* for more information and detail regarding permanent impacts and proposed mitigation.

The proposed project will apply and comply with the Washington State Department of Ecology's 2014 Stormwater Management Manual for Western Washington (2014 DOE) per City of Mercer Island Stormwater Code.

In addition to the 2014 DOE Manual, the project proposes to apply downstream analysis standards and recommendations in the 2016 King County Surface Water Design Manual considered equivalent to the 2014 DOE Manual.

Item B: Wetland / watercourse impacts:

A *Revised Critical Areas Report* has been prepared and is included under separate cover (by Sewall Wetland Consulting Inc). Also included under separate cover (by Healey-Jorgensen Architects) is a *Site Plan Wetland* that shows the optimized site shifted to minimize critical area and critical area buffer impacts.

It is our professional opinion that together these supplemental documents address Item B from the City's December 2017 comment letter. Temporary and permanent critical area impacts are well documented in the revised report and clearly shown on the updated site plan. These documents also provide both narrative and graphical representation of reductions to critical area impacts as a result of the revised site plan.

Item E: Technical corrections:

A *Revised Critical Areas Report* has been prepared and is included under separate cover (by Sewall Wetland Consulting Inc). Also included under separate cover (by Healey-Jorgensen Architects) is a *Site Plan Wetland* that shows the optimized site shifted to minimize critical area and critical area buffer impacts.

It is our professional opinion that together these supplemental documents address Item E from the City's December 2017 comment letter. Temporary and permanent critical area impacts are well documented in the revised report and clearly shown on the updated site plan.

CITY OF MERCER ISLAND

DEVELOPMENT SERVICES GROUP
9611 SE 36TH STREET | MERCER ISLAND, WA 98040
PHONE: 206.275.7605 | www.mercergov.org
Inspection Requests: Online: www.MyBuildingPermits.com VM: 206.275.7730

ON-SITE DETENTION DESIGN REQUIREMENTS

General Requirements

This guidance applies only to projects that meet the thresholds specified below in "Is On-site Detention Required for My Project?" if all of the on-site stormwater BMPs included on List #1 and List #2 are determined to be infeasible for roofs and/or other hard surfaces.

Is On-site Detention Required For My Project?

YES, if my project:

1) Results in 2,000 square feet, or greater, of new plus replaced hard surface area, or
2) Has a land disturbing activity or 7,000 square feet or greater, or
3) Results in a ***net increase*** of impervious surface of 500 square feet or greater.

AND

1) All of the on-site stormwater BMPs included on List #1 and List #2 are determined to be infeasible for roofs and/or other hard surfaces, and
2) Drainage from the site will be discharged to a storm and surface water system that includes a watercourse or there is a capacity constraint in the system.

NO, if my project:

1) Results in less than 2,000 square feet of new plus replaced hard surface area, and
2) Has a land disturbing activity less than 7,000 square feet, and
3) Results in a **net increase of less than 500 square feet** of impervious surface area.
4) The project discharges ***directly*** to Lake Washington, or findings from a ¼-mile downstream analysis confirm that the downstream system is free of capacity constraints.

Designing Your On-Site Detention System

All on-site detention system designs must be prepared by a professional engineer registered in the State of Washington. The Standard On-site Detention System worksheet (Attachment 1) must be submitted on 18" x 24" (minimum) size sheets.

Construction that results in 500 to 9,500 square feet of new plus replaced impervious surfaces: Size system according to Table 1. The configuration of the on-site detention system shall be as shown on Attachment 1 (Standard On-Site Detention Systems Worksheet) or as specifically designed by the engineer for the site.

Note:

- The applicant may pay a fee-in-lieu-of constructing an on-site detention system when allowed by the City Engineer. The fee will not be an option when in the opinion of the City Engineer, undetained runoff from the development may adversely exacerbate an existing problem (MICC 15.11) or if flow control is required by Minimum Requirement #7.
- **Construction that results in more than 9,500 square feet of new plus replaced impervious surfaces and/or exceeds a 100-year flow frequency of 0.15 cubic feet per second (for moderate and steep sloped sites greater than a 5% slope):** Size system according to Minimum Requirement #7 (Flow Control) in the Stormwater Management Manual for Western Washington (Ecology 2014).

Table 1

ON-SITE DETENTION DESIGN FOR PROJECTS BETWEEN 500 SF AND 9,500 SF NEW PLUS REPLACED IMPERVIOUS SURFACE AREA

New and Replaced Impervious Surface Area (sf)	Detention Pipe Diameter (in)	Detention Pipe Length (ft)		Lowest Orifice Diameter (in)[3]		Distance from Outlet Invert to Second Orifice (ft)		Second Orifice Diameter (in)	
		B soils	C soils	B soils	C soils	B soils	C soils	B soils	C soils
500 to 1,000 sf	36"	30	22	0.5	0.5	2.2	2.0	0.5	0.8
	48"	18	11	0.5	0.5	3.3	3.2	0.9	0.8
	60"	11	7	0.5	0.5	4.2	3.4	0.5	0.6
1,001 to 2,000 sf	36"	66	43	0.5	0.5	2.2	2.3	0.9	1.4
	48"	34	23	0.5	0.5	3.2	3.3	0.9	1.2
	60"	22	14	0.5	0.5	4.3	3.6	0.9	0.9
2,001 to 3,000 sf	36"	90	66	0.5	0.5	2.2	2.4	0.9	1.9
	48"	48	36	0.5	0.5	3.1	2.8	0.9	1.5
	60"	30	20	0.5	0.5	4.2	3.7	0.9	1.1
3,001 to 4,000 sf	36"	120	78	0.5	0.5	2.4	2.2	1.4	1.6
	48"	62	42	0.5	0.5	2.8	2.9	0.8	1.3
	60"	42	26	0.5	0.5	3.8	3.9	0.9	1.3
4,001 to 5,000 sf	36"	134	91	0.5	0.5	2.8	2.2	1.7	1.5
	48"	73	49	0.5	0.5	3.6	2.9	1.6	1.5
	60"	46	31	0.5	0.5	4.6	3.5	1.6	1.3
5,001 to 6,000 sf	36"	162	109	0.5	0.5	2.7	2.2	1.8	1.6
	48"	90	59	0.5	0.5	3.5	2.9	1.7	1.5
	60"	54	37	0.5	0.5	4.6	3.6	1.6	1.4
6,001 to 7,000 sf	36"	192	128	0.5	0.5	2.7	2.2	1.9	1.8
	48"	102	68	0.5	0.5	3.7	2.9	1.9	1.6
	60"	64	43	0.5	0.5	4.6	3.6	1.8	1.5
7,001 to 8,000 sf	36"	216	146	0.5	0.5	2.8	2.2	2.0	1.9
	48"	119	79	0.5	0.5	3.8	2.9	2.2	1.7
	60"	73	49	0.5	0.5	4.5	3.6	2.0	1.6
8,001 to 8,500 sf[1]	36"	228	155	0.5	0.5	2.8	2.2	2.1	1.9
	48"	124	84	0.5	0.5	3.7	2.9	1.9	1.8
	60"	77	53	0.5	0.5	4.6	3.6	2.0	1.6
8,501 to 9,000 sf	36"	NA [1]	164	0.5	0.5	NA [1]	2.2	NA [1]	1.9
	48"	NA [1]	89	0.5	0.5	NA [1]	2.9	NA [1]	1.9
	60"	NA [1]	55	0.5	0.5	NA [1]	3.6	NA [1]	1.7
9,001 to 9,500 sf[2]	36"	NA [1]	174	0.5	0.5	NA [1]	2.2	NA [1]	2.1
	48"	NA [1]	94	0.5	0.5	NA [1]	2.9	NA [1]	2.0
	60"	NA [1]	58	0.5	0.5	NA [1]	3.7	NA [1]	1.7

Notes:

▪ Minimum Requirement #7 (Flow Control) is required when the 100-year flow frequency causes a 0.15 cubic feet per second increase (when modeled in WWHM with a 15-minute timestep). Breakpoints shown in this table are based on a flat slope (0-5%). The 100-year flow frequency will need to be evaluated on a site-specific basis for projects on moderate (5-15%) or steep (> 15%) slopes.

▪ Soil type to be determined by geotechnical analysis or soil map.

▪ Sizing includes a Volume Correction Factor of 120%.

▪ Upper bound contributing area used for sizing.

[1] On Type B soils, new plus replaced impervious surface areas exceeding 8,500 sf trigger Minimum Requirement #7 (Flow Control)

[2] On Type C soils, new plus replaced impervious surface areas exceeding 9,500 sf trigger Minimum Requirement #7 (Flow Control)

[3] Minimum orifice diameter = 0.5 inches

in = inch

ft = feet

sf = square feet

Basis of Sizing Assumptions:

Sized per MR#5 in the Stormwater Management Manual for Puget Sound Basin (1992 Ecology Manual)

SBUH, Type 1A, 24-hour hydrograph

2-year, 24-hour storm = 2 in; 10-year, 24-hour storm = 3 in; 100-year, 24-hour storm = 4 in

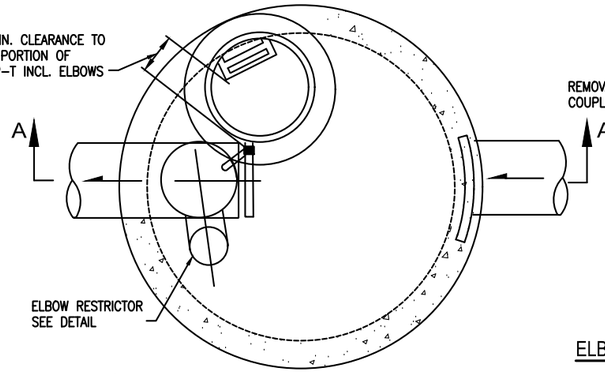
Predeveloped = second growth forest (CN = 72 for Type B soils, CN = 81 for Type C soils)

Developed = impervious (CN = 98)

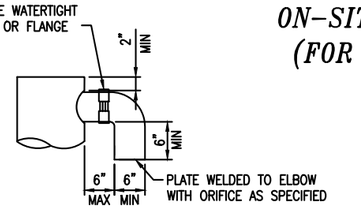
0.5 foot of sediment storage in detention pipe

Overland slope = 5%

ATTACHMENT 1
CITY OF MERCER ISLAND
ON-SITE DETENTION SYSTEM WORKSHEET
(FOR NEW PLUS REPLACED IMPERVIOUS AREA OF 9,500 SF OR LESS)

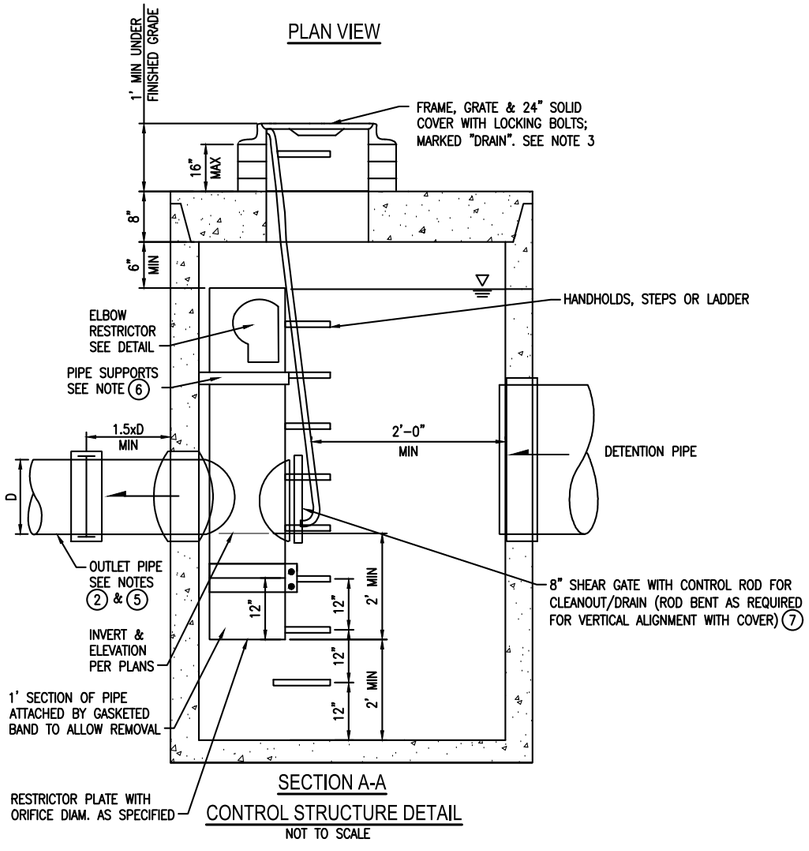


PLAN VIEW



ELBOW RESTRICTOR DETAIL

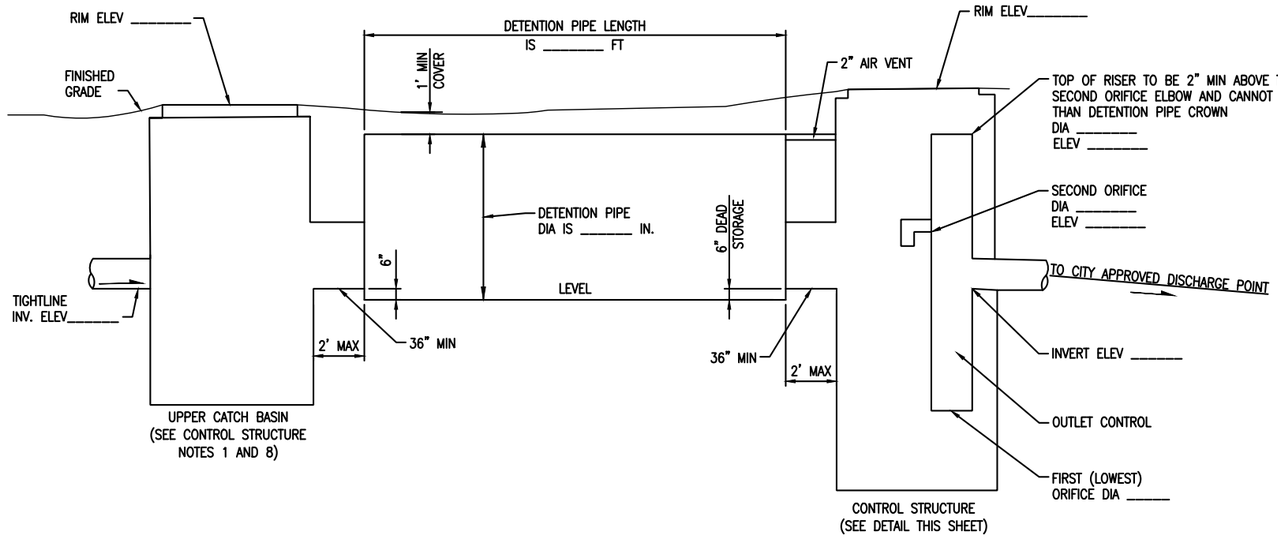
OWNER: _____	ADDRESS: _____	PREPARED BY: _____
PERMIT #: _____	_____	PHONE: _____
		DATE: _____
NEW PLUS REPLACED IMPERVIOUS SURFACE AREA (SF): _____	DETENTION PIPE DIA (INCH): _____	DETENTION PIPE LENGTH (FT): _____
SOIL TYPE: _____	PIPE MATERIAL: _____	



SECTION A-A

CONTROL STRUCTURE DETAIL

NOT TO SCALE



ON-SITE DETENTION SYSTEM

NOT TO SCALE (ENGINEER TO FILL IN BLANKS)

CONTROL STRUCTURE NOTES:

(1) USE A MINIMUM OF A 54 IN. DIAM. TYPE 2 CATCH BASIN. THE ACTUAL SIZE IS DEPENDENT ON CONNECTING PIPE MATERIAL AND DIAMETER.

(2) OUTLET PIPE: MIN. 6 INCH.

(3) METAL PARTS: CORROSION RESISTANT. NON-GALVANIZED PARTS PREFERRED. GALVANIZED PIPE PARTS TO HAVE ASPHALT TREATMENT 1.

(4) FRAME AND LADDER OR STEPS OFFSET SO:

A. CLEANOUT GATE IS VISIBLE FROM TOP;
B. CLIMB-DOWN SPACE IS CLEAR OF RISER AND CLEANOUT GATE;
C. FRAME IS CLEAR OF CURB.

(5) IF METAL OUTLET PIPE CONNECTS TO CEMENT CONCRETE PIPE, OUTLET PIPE TO HAVE SMOOTH O.D. EQUAL TO CONCRETE PIPE I.D. LESS 1/4 IN.

(6) PROVIDE AT LEAST ONE 3 X 0.090 GAUGE SUPPORT BRACKET ANCHORED TO CONCRETE WALL WITH 5/8 IN. STANLESS STEEL EXPANSION BOLTS OR EMBEDDED SUPPORTS 2 IN. INTO CATCH BASIN WALL (MAXIMUM 3'-0" VERTICAL SPACING).

(7) THE SHEAR GATE SHALL BE MADE OF ALUMINUM ALLOY IN ACCORDANCE WITH ASTM B 26M AND ASTM B 275, DESIGNATION ZG32A; OR CAST IRON IN ACCORDANCE WITH ASTM A 48, CLASS 30B.
THE LIFT HANDLE SHALL BE MADE OF A SIMILAR METAL TO THE GATE (TO PREVENT GALVANIC CORROSION), IT MAY BE OF SOLID ROD OR HOLLOW TUBING, WITH ADJUSTABLE HOOK AS REQUIRED.
A NEOPRENE RUBBER GASKET IS REQUIRED BETWEEN THE RISER MOUNTING FLANGE AND THE GATE FLANGE.
INSTALL THE GATE SO THAT THE LEVEL-LINE MARK IS LEVEL WHEN THE GATE IS CLOSED.
THE MATING SURFACES OF THE LID AND THE BODY SHALL BE MACHINED FOR PROPER FIT.
ALL SHEAR GATE BOLTS SHALL BE STAINLESS STEEL.

(8) THE UPPER CATCH BASIN IS REQUIRED IF THE LENGTH OF THE DETENTION PIPE IS GREATER THAN 50 FT.

ON-SITE DETENTION SYSTEM NOTES:

1. CALL DEVELOPMENT SERVICES (206-275-7605) 24 HOURS IN ADVANCE FOR A DETENTION SYSTEM INSPECTION BEFORE BACKFILLING AND FOR FINAL INSPECTIONS.
2. RESPONSIBILITY FOR OPERATION AND MAINTANANCE OF DRAINAGE SYSTEMS ON PRIVATE PROPERTY IS RESPONSIBILITY OF THE PROPERTY OWNER. MATERIAL ACCUMULATED IN THE STORAGE PIPE MUST BE REMOVED FROM CATCH BASINS TO ALLOW PROPER OPERATION. THE OUTLET CONTROL ORIFICE MUST BE KEPT OPEN AT ALL TIMES.
3. PIPE MATERIAL, JOINT, AND PROTECTIVE TREATMENT SHALL BE IN ACCORDANCE WITH SECTION 7.04 AND 9.05 OF THE WSDOT STANDARD SPECIFICATION FOR ROAD, BRIDGE, AND MUNICIPAL CONSTRUCTION, LATEST VERSION. SUCH MATERIALS INCLUDE THE FOLLOWING, LINED CORRUGATED POLYETHYLENE PIPE (LCPE), ALUMINIZED TYPE 2 CORRUGATED STEEL PIPE AND PIPE ARCH (MEETS AASHTO DESIGNATIONS M274 AND M36), CORRUGATED OR SPIRAL RIB ALUMINUM PIPE, OR REINFORCED CONCRETE PIPE. CORRUGATED STEEL PIPE IS NOT ALLOWED.
4. FOOTING DRAINS SHALL NOT BE CONNECTED TO THE DETENTION SYSTEM.

WWHM2012

PROJECT REPORT

General Model Information

Project Name:	18039 No Detention
Site Name:	MI Treehouse
Site Address:	5637 E Mercer Way
City:	Mercer Island
Report Date:	9/14/2022
Gage:	Seatac
Data Start:	1948/10/01
Data End:	2009/09/30
Timestep:	15 Minute
Precip Scale:	1.000
Version Date:	2021/08/18
Version:	4.2.18

POC Thresholds

Low Flow Threshold for POC1:	50 Percent of the 2 Year
High Flow Threshold for POC1:	50 Year

Landuse Basin Data

Predeveloped Land Use

Basin 1

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Forest, Mod	0.134
Pervious Total	0.134
Impervious Land Use	acre
Impervious Total	0
Basin Total	0.134

Element Flows To:

Surface	Interflow	Groundwater

Mitigated Land Use

Basin 1

Bypass:	No
GroundWater:	No

Pervious Land Use	acre
C, Lawn, Mod	0.031
Pervious Total	0.031

Impervious Land Use	acre
ROADS MOD	0.103
Impervious Total	0.103
Basin Total	0.134

Element Flows To:

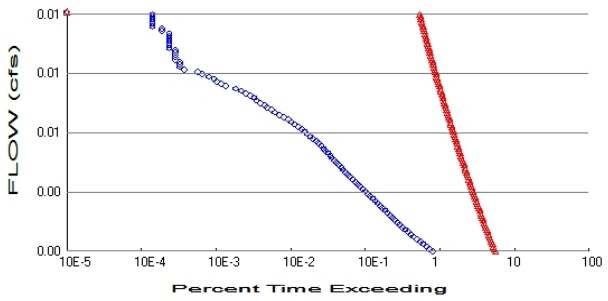
Surface	Interflow	Groundwater

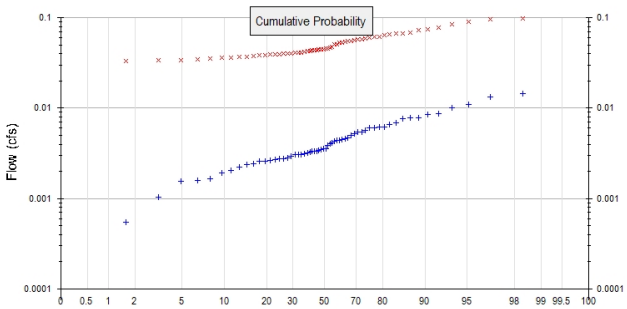
Routing Elements
Predeveloped Routing

Mitigated Routing

Analysis Results

POC 1





\+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 0.134
Total Impervious Area: 0

Mitigated Landuse Totals for POC #1
Total Pervious Area: 0.031
Total Impervious Area: 0.103

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	0.00399
5 year	0.006538
10 year	0.008176
25 year	0.010125
50 year	0.011475
100 year	0.012735

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	0.047902
5 year	0.061639
10 year	0.071302
25 year	0.084185
50 year	0.094287
100 year	0.104835

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	Predeveloped	Mitigated
1949	0.005	0.064
1950	0.005	0.061
1951	0.009	0.038
1952	0.003	0.031
1953	0.002	0.036
1954	0.003	0.039
1955	0.005	0.046
1956	0.004	0.041
1957	0.004	0.046
1958	0.004	0.039

1959	0.003	0.041
1960	0.006	0.043
1961	0.003	0.040
1962	0.002	0.034
1963	0.003	0.042
1964	0.004	0.040
1965	0.003	0.048
1966	0.003	0.034
1967	0.006	0.058
1968	0.003	0.074
1969	0.003	0.044
1970	0.003	0.044
1971	0.003	0.054
1972	0.007	0.055
1973	0.003	0.033
1974	0.003	0.051
1975	0.005	0.050
1976	0.003	0.041
1977	0.000	0.040
1978	0.003	0.056
1979	0.002	0.068
1980	0.008	0.078
1981	0.002	0.046
1982	0.005	0.067
1983	0.004	0.053
1984	0.003	0.035
1985	0.002	0.045
1986	0.007	0.039
1987	0.006	0.060
1988	0.002	0.039
1989	0.002	0.062
1990	0.014	0.085
1991	0.008	0.073
1992	0.003	0.036
1993	0.003	0.043
1994	0.001	0.037
1995	0.004	0.041
1996	0.010	0.056
1997	0.008	0.044
1998	0.002	0.044
1999	0.009	0.099
2000	0.003	0.045
2001	0.001	0.054
2002	0.004	0.058
2003	0.005	0.059
2004	0.006	0.096
2005	0.004	0.037
2006	0.005	0.035
2007	0.011	0.091
2008	0.013	0.067
2009	0.006	0.065

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	0.0144	0.0993
2	0.0133	0.0956
3	0.0109	0.0905

4	0.0101	0.0852
5	0.0087	0.0775
6	0.0086	0.0738
7	0.0078	0.0725
8	0.0078	0.0683
9	0.0077	0.0674
10	0.0068	0.0672
11	0.0066	0.0651
12	0.0062	0.0636
13	0.0061	0.0618
14	0.0060	0.0613
15	0.0060	0.0602
16	0.0056	0.0590
17	0.0055	0.0581
18	0.0054	0.0576
19	0.0053	0.0565
20	0.0051	0.0557
21	0.0047	0.0549
22	0.0046	0.0537
23	0.0045	0.0536
24	0.0044	0.0534
25	0.0044	0.0508
26	0.0043	0.0504
27	0.0042	0.0479
28	0.0040	0.0464
29	0.0039	0.0459
30	0.0035	0.0457
31	0.0035	0.0450
32	0.0034	0.0449
33	0.0034	0.0444
34	0.0034	0.0441
35	0.0034	0.0440
36	0.0033	0.0436
37	0.0033	0.0429
38	0.0032	0.0426
39	0.0031	0.0420
40	0.0031	0.0415
41	0.0030	0.0414
42	0.0030	0.0412
43	0.0029	0.0405
44	0.0028	0.0403
45	0.0027	0.0400
46	0.0027	0.0398
47	0.0027	0.0395
48	0.0027	0.0391
49	0.0026	0.0387
50	0.0026	0.0386
51	0.0024	0.0376
52	0.0024	0.0373
53	0.0022	0.0369
54	0.0021	0.0362
55	0.0019	0.0359
56	0.0017	0.0353
57	0.0016	0.0350
58	0.0015	0.0340
59	0.0010	0.0337
60	0.0005	0.0332
61	0.0005	0.0308

Duration Flows

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0020	17075	118451	693	Fail
0.0021	15492	114815	741	Fail
0.0022	14072	111329	791	Fail
0.0023	12797	107971	843	Fail
0.0024	11563	104869	906	Fail
0.0025	10523	101832	967	Fail
0.0026	9565	98902	1033	Fail
0.0027	8750	96164	1099	Fail
0.0028	8031	93448	1163	Fail
0.0029	7347	90945	1237	Fail
0.0030	6733	88443	1313	Fail
0.0030	6190	85983	1389	Fail
0.0031	5724	83630	1461	Fail
0.0032	5309	81299	1531	Fail
0.0033	4924	79117	1606	Fail
0.0034	4569	77128	1688	Fail
0.0035	4235	75139	1774	Fail
0.0036	3951	73257	1854	Fail
0.0037	3645	71353	1957	Fail
0.0038	3388	69514	2051	Fail
0.0039	3133	67674	2160	Fail
0.0040	2915	65920	2261	Fail
0.0041	2706	64209	2372	Fail
0.0042	2490	62498	2509	Fail
0.0043	2314	60915	2632	Fail
0.0044	2136	59375	2779	Fail
0.0045	1972	57899	2936	Fail
0.0046	1824	56445	3094	Fail
0.0047	1702	55055	3234	Fail
0.0048	1577	53686	3404	Fail
0.0049	1443	52317	3625	Fail
0.0050	1325	51034	3851	Fail
0.0051	1232	49772	4039	Fail
0.0052	1147	48531	4231	Fail
0.0053	1085	47398	4368	Fail
0.0053	1020	46221	4531	Fail
0.0054	946	45109	4768	Fail
0.0055	885	44018	4973	Fail
0.0056	824	42949	5212	Fail
0.0057	760	41922	5516	Fail
0.0058	724	40938	5654	Fail
0.0059	674	39933	5924	Fail
0.0060	623	39013	6262	Fail
0.0061	589	38093	6467	Fail
0.0062	549	37217	6779	Fail
0.0063	506	36318	7177	Fail
0.0064	469	35484	7565	Fail
0.0065	427	34671	8119	Fail
0.0066	388	33858	8726	Fail
0.0067	356	33067	9288	Fail
0.0068	328	32318	9853	Fail
0.0069	297	31548	10622	Fail
0.0070	270	30843	11423	Fail
0.0071	241	30115	12495	Fail

0.0072	218	29431	13500	Fail
0.0073	197	28768	14603	Fail
0.0074	173	28105	16245	Fail
0.0075	152	27463	18067	Fail
0.0075	130	26886	20681	Fail
0.0076	119	26287	22089	Fail
0.0077	104	25709	24720	Fail
0.0078	95	25132	26454	Fail
0.0079	83	24576	29609	Fail
0.0080	74	24041	32487	Fail
0.0081	69	23549	34128	Fail
0.0082	61	23079	37834	Fail
0.0083	53	22608	42656	Fail
0.0084	46	22116	48078	Fail
0.0085	39	21645	55500	Fail
0.0086	29	21181	73037	Fail
0.0087	25	20683	82732	Fail
0.0088	22	20259	92086	Fail
0.0089	20	19823	99115	Fail
0.0090	17	19380	114000	Fail
0.0091	14	18987	135621	Fail
0.0092	12	18604	155033	Fail
0.0093	8	18223	227787	Fail
0.0094	7	17838	254828	Fail
0.0095	7	17440	249142	Fail
0.0096	7	17120	244571	Fail
0.0097	6	16769	279483	Fail
0.0098	6	16437	273950	Fail
0.0098	6	16080	268000	Fail
0.0099	6	15744	262400	Fail
0.0100	6	15451	257516	Fail
0.0101	5	15145	302900	Fail
0.0102	5	14848	296960	Fail
0.0103	5	14596	291920	Fail
0.0104	5	14292	285840	Fail
0.0105	5	14020	280400	Fail
0.0106	5	13751	275020	Fail
0.0107	5	13479	269580	Fail
0.0108	4	13214	330350	Fail
0.0109	4	12949	323725	Fail
0.0110	3	12716	423866	Fail
0.0111	3	12444	414800	Fail
0.0112	3	12189	406300	Fail
0.0113	3	11935	397833	Fail
0.0114	3	11719	390633	Fail
0.0115	3	11445	381500	Fail

The development has an increase in flow durations from 1/2 Predeveloped 2 year flow to the 2 year flow or more than a 10% increase from the 2 year to the 50 year flow.
The development has an increase in flow durations for more than 50% of the flows for the range of the duration analysis.

Water Quality

Water Quality BMP Flow and Volume for POC #1

On-line facility volume:	0 acre-feet
On-line facility target flow:	0 cfs.
Adjusted for 15 min:	0 cfs.
Off-line facility target flow:	0 cfs.
Adjusted for 15 min:	0 cfs.

LID Report

LID Technique	Used for Treatment ?	Total Volume Needs Treatment (ac-ft)	Volume Through Facility (ac-ft)	Infiltration Volume (ac-ft)	Cumulative Volume Infiltration Credit	Percent Volume Infiltrated	Water Quality	Percent Water Quality Treated	Comment
Total Volume Infiltrated		0.00	0.00	0.00		0.00	0.00	0%	No Treat. Credit
Compliance with LID Standard 8% of 2-yr to 50% of 2-yr									Duration Analysis Result = Failed

Model Default Modifications

Total of 0 changes have been made.

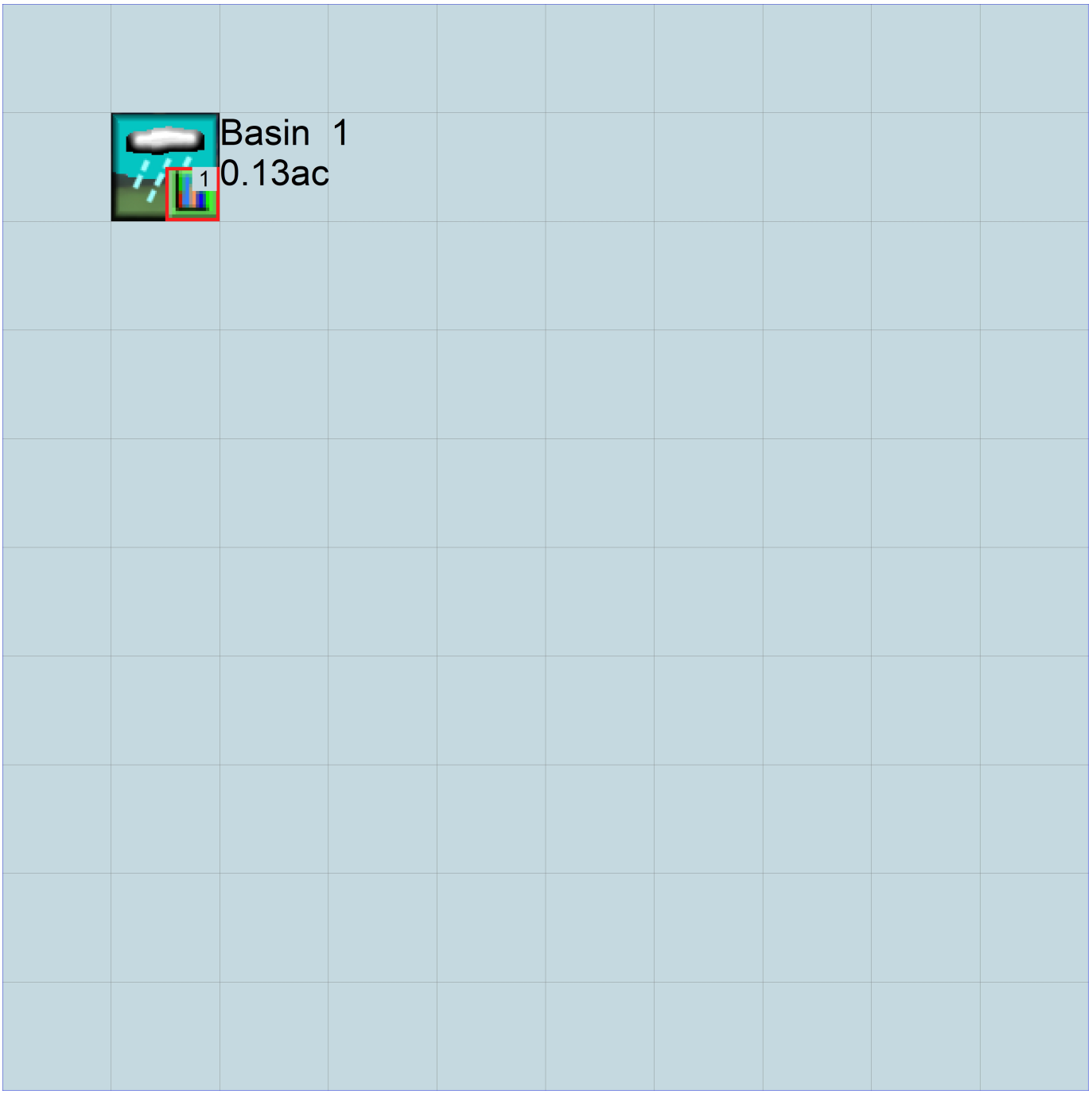
PERLND Changes

No PERLND changes have been made.

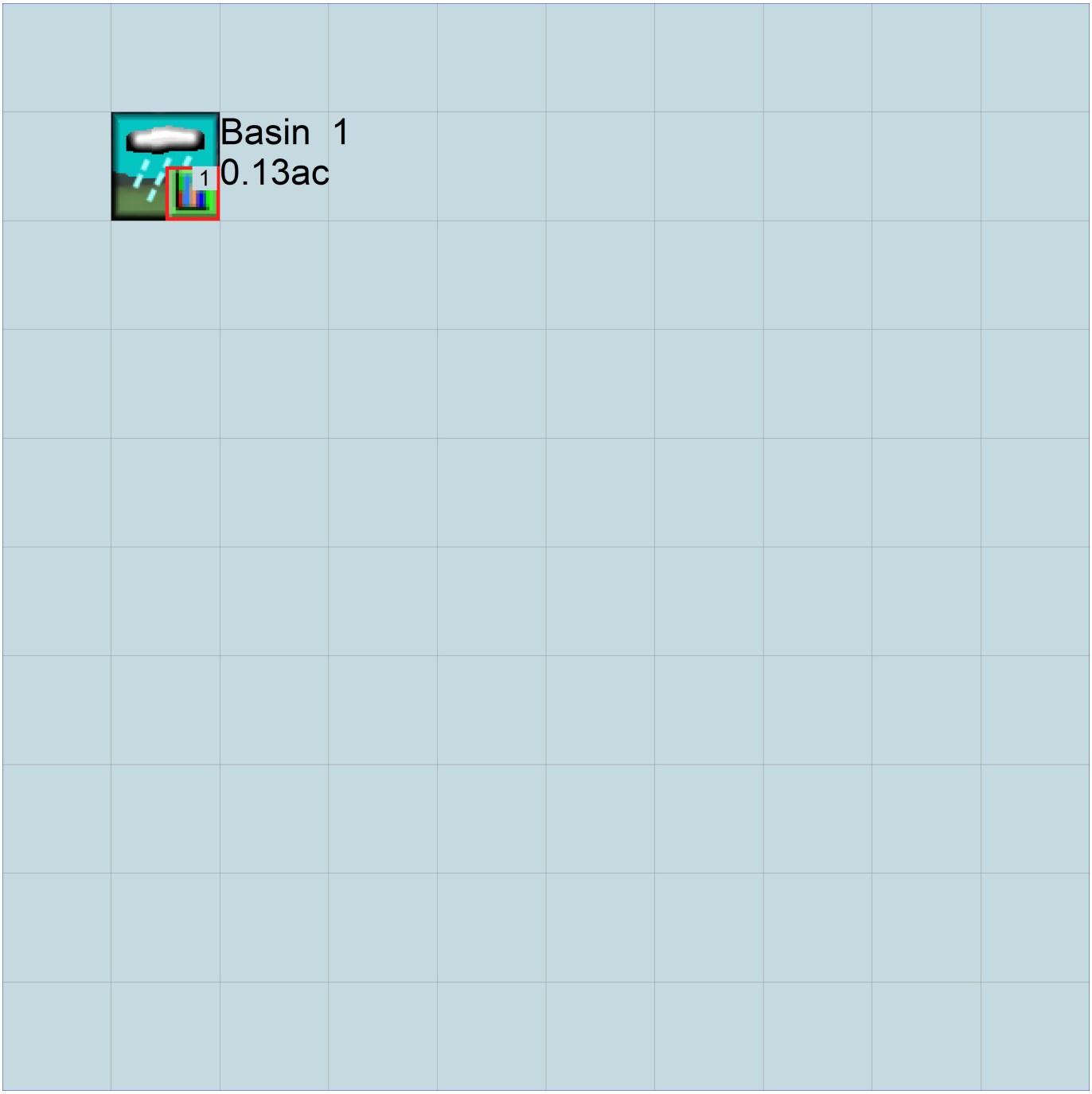
IMPLND Changes

No IMPLND changes have been made.

Appendix
Predeveloped Schematic



Mitigated Schematic



Predeveloped UCI File

```
RUN

GLOBAL
  WWHM4 model simulation
  START       1948 10 01        END    2009 09 30
  RUN INTERP OUTPUT LEVEL    3    0
  RESUME     0 RUN     1                   UNIT SYSTEM     1
END GLOBAL

FILES
<File>  <Un#>   <-----------File Name------------------------------>***
<-ID->                                                              ***
WDM         26   18039 No Detention.wdm
MESSU       25   Pre18039 No Detention.MES
            27   Pre18039 No Detention.L61
            28   Pre18039 No Detention.L62
            30   POC18039 No Detention1.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      PERLND      11
      COPY       501
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title---------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Basin  1                   MAX                    1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  501         1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
  END OPCODE
  PARM
    #    #         K ***
  END PARM
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name------->NBLKS   Unit-systems   Printer ***
    # -  #                         User  t-series Engl Metr ***
                                      in  out           ***
   11     C, Forest, Mod          1    1    1    1   27    0
  END GEN-INFO
  *** Section PWATER***

  ACTIVITY
    <PLS > ************ Active Sections ******************************
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
   11         0    0    1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags **************************** PIVL  PYR
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC  *********
   11         0    0    4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO
```

```
  PWAT-PARM1
    <PLS >  PWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE INFC  HWT ***
   11         0    0    0    0    0    0    0    0    0    0    0
  END PWAT-PARM1

  PWAT-PARM2
    <PLS >      PWATER input info: Part 2         ***
    # -  # ***FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY     AGWRC
   11              0       4.5      0.08       400       0.1       0.5     0.996
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
   11             0         0         2         2         0         0         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                              ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
   11           0.2       0.5      0.35         6       0.5       0.7
  END PWAT-PARM4

  PWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
               ran from 1990 to end of 1992 (pat 1-11-95) RUN 21 ***
    # -  # ***  CEPS      SURS       UZS      IFWS       LZS      AGWS      GWVS
   11             0         0         0         0       2.5         1         0
  END PWAT-STATE1

END PERLND

IMPLND
  GEN-INFO
    <PLS ><-------Name------->   Unit-systems   Printer ***
    # -  #                     User  t-series Engl Metr ***
                                     in  out           ***
  END GEN-INFO
  *** Section IWATER***

  ACTIVITY
    <PLS > ************ Active Sections ******************************
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL   ***
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    *********
  END PRINT-INFO

  IWAT-PARM1
    <PLS >  IWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP  VRS  VNN RTLI     ***
  END IWAT-PARM1

  IWAT-PARM2
    <PLS >      IWATER input info: Part 2         ***
    # -  # ***  LSUR     SLSUR      NSUR     RETSC
  END IWAT-PARM2

  IWAT-PARM3
    <PLS >      IWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
  END IWAT-STATE1
```

```
END IMPLND

SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK   ***
<Name>   #                  <-factor->     <Name>   #   Tbl#   ***
Basin  1***
PERLND  11                       0.134     COPY   501     12
PERLND  11                       0.134     COPY   501     13

******Routing******
END SCHEMATIC

NETWORK
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
COPY   501 OUTPUT MEAN   1 1   48.4        DISPLY   1     INPUT  TIMSER 1



<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
END NETWORK

RCHRES
  GEN-INFO
    RCHRES       Name        Nexits   Unit Systems   Printer                 ***
    # -  #<------------------><---> User T-series  Engl Metr LKFG            ***
                                          in  out                            ***
  END GEN-INFO
  *** Section RCHRES***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG ***
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ****************** PIVL  PYR
    # -  # HYDR ADCA CONS HEAT  SED  GQL OXRX NUTR PLNK PHCB PIVL  PYR  *********
  END PRINT-INFO

  HYDR-PARM1
    RCHRES  Flags for each HYDR Section                                      ***
    # -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for each
            FG FG FG FG  possible  exit  *** possible  exit      possible  exit
             *  *  *  *    *  *  *  *  *       *  *  *  *  *         ***
  END HYDR-PARM1

  HYDR-PARM2
    # -  #    FTABNO       LEN     DELTH     STCOR        KS      DB50       ***
  <------><--------><--------><--------><--------><--------><-------->       ***
  END HYDR-PARM2
  HYDR-INIT
    RCHRES  Initial conditions for each HYDR section                         ***
    # -  # ***   VOL     Initial  value  of COLIND     Initial  value  of OUTDGT
          *** ac-ft     for each possible exit       for each possible exit
  <------><-------->     <---><---><---><---><---> *** <---><---><---><---><--->
  END HYDR-INIT
END RCHRES

SPEC-ACTIONS
END SPEC-ACTIONS
FTABLES
END FTABLES

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #  ***
WDM      2 PREC     ENGL    1              PERLND   1 999 EXTNL  PREC
WDM      2 PREC     ENGL    1              IMPLND   1 999 EXTNL  PREC
```

```
WDM      1 EVAP     ENGL    0.76           PERLND   1 999 EXTNL  PETINP
WDM      1 EVAP     ENGL    0.76           IMPLND   1 999 EXTNL  PETINP

END EXT SOURCES

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Tgap Amd ***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>    tem strg strg***
COPY   501 OUTPUT MEAN   1 1     48.4      WDM    501 FLOW     ENGL      REPL
END EXT TARGETS

MASS-LINK
<Volume>   <-Grp> <-Member-><--Mult-->     <Target>       <-Grp> <-Member->***
<Name>            <Name> # #<-factor->     <Name>                <Name> # #***
  MASS-LINK       12
PERLND     PWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   12

  MASS-LINK       13
PERLND     PWATER IFWO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   13


END MASS-LINK

END RUN
```

Mitigated UCI File

```
RUN

GLOBAL
  WWHM4 model simulation
  START       1948 10 01        END    2009 09 30
  RUN INTERP OUTPUT LEVEL    3    0
  RESUME     0 RUN     1                    UNIT SYSTEM     1
END GLOBAL

FILES
<File>  <Un#>   <-----------File Name------------------------------>***
<-ID->                                                              ***
WDM         26   18039 No Detention.wdm
MESSU       25   Mit18039 No Detention.MES
            27   Mit18039 No Detention.L61
            28   Mit18039 No Detention.L62
            30   POC18039 No Detention1.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      PERLND      17
      IMPLND       2
      COPY       501
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Basin  1                   MAX                     1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  501         1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
  END OPCODE
  PARM
    #    #         K ***
  END PARM
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name------->NBLKS   Unit-systems   Printer ***
    # -  #                          User  t-series Engl Metr ***
                                        in  out           ***
   17     C, Lawn, Mod            1    1    1    1   27    0
  END GEN-INFO
  *** Section PWATER***

  ACTIVITY
    <PLS > ************ Active Sections ****************************
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
   17         0    0    1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags **************************** PIVL  PYR
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC  *********
   17         0    0    4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO
```

```
  PWAT-PARM1
    <PLS >  PWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE INFC  HWT ***
   17         0    0    0    0    0    0    0    0    0    0
  END PWAT-PARM1

  PWAT-PARM2
    <PLS >      PWATER input info: Part 2         ***
    # -  # ***FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY     AGWRC
   17             0       4.5      0.03       400       0.1       0.5     0.996
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
   17              0         0         2         2         0         0         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                              ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
   17            0.1      0.25      0.25         6       0.5      0.25
  END PWAT-PARM4

  PWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
               ran from 1990 to end of 1992 (pat 1-11-95) RUN 21 ***
    # -  # ***  CEPS      SURS       UZS      IFWS       LZS      AGWS      GWVS
   17             0         0         0         0       2.5         1         0
  END PWAT-STATE1

END PERLND

IMPLND
  GEN-INFO
    <PLS ><-------Name------->   Unit-systems   Printer ***
    # -  #                     User  t-series Engl Metr ***
                                     in  out           ***
    2      ROADS/MOD              1    1    1   27    0
  END GEN-INFO
  *** Section IWATER***

  ACTIVITY
    <PLS > ************* Active Sections ******************************
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL   ***
    2         0    0    1    0    0    0
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    *********
    2         0    0    4    0    0    0    1    9
  END PRINT-INFO

  IWAT-PARM1
    <PLS >  IWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP  VRS  VNN RTLI     ***
    2         0    0    0    0    0
  END IWAT-PARM1

  IWAT-PARM2
    <PLS >      IWATER input info: Part 2         ***
    # -  # ***  LSUR     SLSUR      NSUR     RETSC
    2            400      0.05       0.1      0.08
  END IWAT-PARM2

  IWAT-PARM3
    <PLS >      IWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN
    2              0         0
```

```
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
    2              0         0
  END IWAT-STATE1

END IMPLND

SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK   ***
<Name>   #                  <-factor->     <Name>   #   Tbl#   ***
Basin  1***
PERLND  17                       0.031     COPY   501     12
PERLND  17                       0.031     COPY   501     13
IMPLND   2                       0.103     COPY   501     15

******Routing******
END SCHEMATIC

NETWORK
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
COPY   501 OUTPUT MEAN   1 1   48.4        DISPLY   1     INPUT  TIMSER 1



<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
END NETWORK

RCHRES
  GEN-INFO
    RCHRES       Name        Nexits   Unit Systems   Printer                 ***
    # -  #<------------------><---> User T-series  Engl Metr LKFG            ***
                                           in  out                           ***
  END GEN-INFO
  *** Section RCHRES***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG ***
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ****************** PIVL  PYR
    # -  # HYDR ADCA CONS HEAT  SED  GQL OXRX NUTR PLNK PHCB PIVL  PYR  *********
  END PRINT-INFO

  HYDR-PARM1
    RCHRES  Flags for each HYDR Section                                      ***
    # -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for each
            FG FG FG FG  possible  exit  *** possible  exit      possible  exit
             *  *  *  *    *  *  *  *  *       *  *  *  *  *          ***
  END HYDR-PARM1

  HYDR-PARM2
    # -  #    FTABNO       LEN     DELTH     STCOR        KS      DB50       ***
  <------><--------><--------><--------><--------><--------><-------->       ***
  END HYDR-PARM2
  HYDR-INIT
    RCHRES  Initial conditions for each HYDR section                         ***
    # -  # ***   VOL     Initial  value  of COLIND     Initial  value  of OUTDGT
          *** ac-ft     for each possible exit       for each possible exit
  <------><-------->     <---><---><---><---><---> *** <---><---><---><---><--->
  END HYDR-INIT
END RCHRES

SPEC-ACTIONS
```

```
END SPEC-ACTIONS
FTABLES
END FTABLES

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #  ***
WDM      2 PREC     ENGL    1              PERLND   1 999 EXTNL  PREC
WDM      2 PREC     ENGL    1              IMPLND   1 999 EXTNL  PREC
WDM      1 EVAP     ENGL    0.76           PERLND   1 999 EXTNL  PETINP
WDM      1 EVAP     ENGL    0.76           IMPLND   1 999 EXTNL  PETINP

END EXT SOURCES

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Tgap Amd ***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>    tem strg strg***
COPY     1 OUTPUT MEAN   1 1     48.4      WDM    701 FLOW     ENGL      REPL
COPY   501 OUTPUT MEAN   1 1     48.4      WDM    801 FLOW     ENGL      REPL
END EXT TARGETS

MASS-LINK
<Volume>   <-Grp> <-Member-><--Mult-->     <Target>       <-Grp> <-Member->***
<Name>            <Name> # #<-factor->     <Name>                <Name> # #***
  MASS-LINK       12
PERLND     PWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   12

  MASS-LINK       13
PERLND     PWATER IFWO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   13

  MASS-LINK       15
IMPLND     IWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   15


END MASS-LINK

END RUN
```

Predeveloped HSPF Message File

Mitigated HSPF Message File

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WWHM2012

PROJECT REPORT

General Model Information

Project Name:	18039 Wetland Hydrologic Analysis
Site Name:	MI Treehouse
Site Address:	5637 E Mercer Way
City:	Mercer Island
Report Date:	9/22/2022
Gage:	Seatac
Data Start:	1948/10/01
Data End:	2009/09/30
Timestep:	15 Minute
Precip Scale:	1.000
Version Date:	2021/08/18
Version:	4.2.18

POC Thresholds

Low Flow Threshold for POC1:	50 Percent of the 2 Year
High Flow Threshold for POC1:	50 Year

Landuse Basin Data
Predeveloped Land Use

Pre-project Area

Bypass:	No
GroundWater:	No

Pervious Land Use	acre
C, Forest, Mod	0.064
SAT, Forest, Mod	0.056
Pervious Total	0.12

Impervious Land Use	acre
ROADS MOD	0.014
Impervious Total	0.014
Basin Total	0.134

Element Flows To:

Surface	Interflow	Groundwater

Mitigated Land Use

Post-project Area Trib to Tank

Bypass:	Yes
GroundWater:	No
Pervious Land Use	acre
Pervious Total	0
Impervious Land Use	acre
ROADS MOD	0.089
Impervious Total	0.089
Basin Total	0.089

Element Flows To:

Surface	Interflow	Groundwater
Tank 1	Tank 1	

Post-project Area not Trib to Tank

Bypass:	Yes
GroundWater:	No

Pervious Land Use	acre
C, Lawn, Mod	0.031
Pervious Total	0.031

Impervious Land Use	acre
ROADS MOD	0.014
Impervious Total	0.014
Basin Total	0.045

Element Flows To:

Surface	Interflow	Groundwater

Routing Elements
Predeveloped Routing

Mitigated Routing

Tank 1

Dimensions
Depth: 5 ft.
Tank Type: Circular
Diameter: 5 ft.
Length: 31 ft.
Discharge Structure
Riser Height: 4 ft.
Riser Diameter: 12 in.
Orifice 1 Diameter: 0.5 in. Elevation:0 ft.
Orifice 2 Diameter: 1.3 in. Elevation:3.5 ft.
Element Flows To:
Outlet 1 Outlet 2

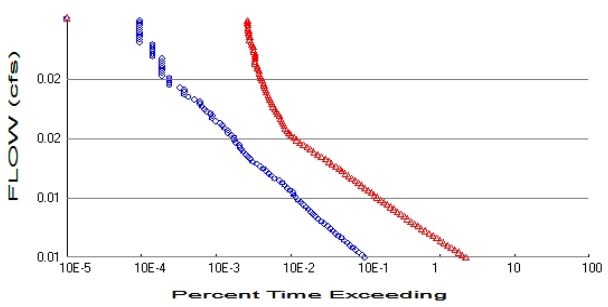
Tank Hydraulic Table

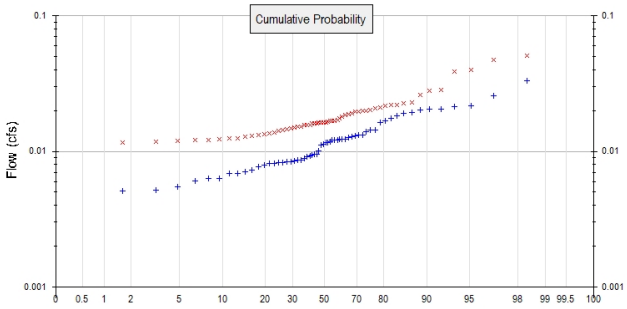
Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.000000	0.000000	0.000	0.000
0.0556	0.000746	0.000028	0.001	0.000
0.1111	0.001049	0.000078	0.002	0.000
0.1667	0.001277	0.000143	0.002	0.000
0.2222	0.001467	0.000219	0.003	0.000
0.2778	0.001630	0.000305	0.003	0.000
0.3333	0.001775	0.000400	0.003	0.000
0.3889	0.001906	0.000502	0.004	0.000
0.4444	0.002025	0.000612	0.004	0.000
0.5000	0.002135	0.000727	0.004	0.000
0.5556	0.002237	0.000849	0.005	0.000
0.6111	0.002331	0.000976	0.005	0.000
0.6667	0.002419	0.001108	0.005	0.000
0.7222	0.002502	0.001244	0.005	0.000
0.7778	0.002579	0.001385	0.006	0.000
0.8333	0.002652	0.001531	0.006	0.000
0.8889	0.002721	0.001680	0.006	0.000
0.9444	0.002786	0.001833	0.006	0.000
1.0000	0.002847	0.001990	0.006	0.000
1.0556	0.002904	0.002149	0.007	0.000
1.1111	0.002959	0.002312	0.007	0.000
1.1667	0.003010	0.002478	0.007	0.000
1.2222	0.003058	0.002647	0.007	0.000
1.2778	0.003104	0.002818	0.007	0.000
1.3333	0.003147	0.002991	0.007	0.000
1.3889	0.003188	0.003167	0.008	0.000
1.4444	0.003226	0.003346	0.008	0.000
1.5000	0.003261	0.003526	0.008	0.000
1.5556	0.003295	0.003708	0.008	0.000
1.6111	0.003326	0.003892	0.008	0.000
1.6667	0.003355	0.004077	0.008	0.000
1.7222	0.003382	0.004264	0.008	0.000
1.7778	0.003407	0.004453	0.009	0.000
1.8333	0.003429	0.004643	0.009	0.000
1.8889	0.003450	0.004834	0.009	0.000
1.9444	0.003469	0.005026	0.009	0.000
2.0000	0.003486	0.005220	0.009	0.000

2.0556	0.003502	0.005414	0.009	0.000
2.1111	0.003515	0.005609	0.009	0.000
2.1667	0.003527	0.005804	0.010	0.000
2.2222	0.003536	0.006000	0.010	0.000
2.2778	0.003544	0.006197	0.010	0.000
2.3333	0.003550	0.006394	0.010	0.000
2.3889	0.003555	0.006591	0.010	0.000
2.4444	0.003557	0.006789	0.010	0.000
2.5000	0.003558	0.006987	0.010	0.000
2.5556	0.003557	0.007184	0.010	0.000
2.6111	0.003555	0.007382	0.011	0.000
2.6667	0.003550	0.007579	0.011	0.000
2.7222	0.003544	0.007776	0.011	0.000
2.7778	0.003536	0.007973	0.011	0.000
2.8333	0.003527	0.008169	0.011	0.000
2.8889	0.003515	0.008365	0.011	0.000
2.9444	0.003502	0.008560	0.011	0.000
3.0000	0.003486	0.008754	0.011	0.000
3.0556	0.003469	0.008947	0.011	0.000
3.1111	0.003450	0.009139	0.012	0.000
3.1667	0.003429	0.009331	0.012	0.000
3.2222	0.003407	0.009520	0.012	0.000
3.2778	0.003382	0.009709	0.012	0.000
3.3333	0.003355	0.009896	0.012	0.000
3.3889	0.003326	0.010082	0.012	0.000
3.4444	0.003295	0.010266	0.012	0.000
3.5000	0.003261	0.010448	0.012	0.000
3.5556	0.003226	0.010628	0.023	0.000
3.6111	0.003188	0.010806	0.028	0.000
3.6667	0.003147	0.010982	0.031	0.000
3.7222	0.003104	0.011156	0.034	0.000
3.7778	0.003058	0.011327	0.037	0.000
3.8333	0.003010	0.011495	0.039	0.000
3.8889	0.002959	0.011661	0.042	0.000
3.9444	0.002904	0.011824	0.044	0.000
4.0000	0.002847	0.011984	0.046	0.000
4.0556	0.002786	0.012140	0.186	0.000
4.1111	0.002721	0.012293	0.439	0.000
4.1667	0.002652	0.012443	0.754	0.000
4.2222	0.002579	0.012588	1.098	0.000
4.2778	0.002502	0.012729	1.438	0.000
4.3333	0.002419	0.012866	1.739	0.000
4.3889	0.002331	0.012998	1.978	0.000
4.4444	0.002237	0.013125	2.147	0.000
4.5000	0.002135	0.013246	2.263	0.000
4.5556	0.002025	0.013362	2.409	0.000
4.6111	0.001906	0.013471	2.525	0.000
4.6667	0.001775	0.013573	2.635	0.000
4.7222	0.001630	0.013668	2.742	0.000
4.7778	0.001467	0.013754	2.844	0.000
4.8333	0.001277	0.013831	2.943	0.000
4.8889	0.001049	0.013895	3.038	0.000
4.9444	0.000746	0.013946	3.131	0.000
5.0000	0.000000	0.013973	3.221	0.000
5.0556	0.000000	0.000000	3.308	0.000

Analysis Results

POC 1





\+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 0.12
Total Impervious Area: 0.014

Mitigated Landuse Totals for POC #1
Total Pervious Area: 0.031
Total Impervious Area: 0.103

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	0.010781
5 year	0.015659
10 year	0.019191
25 year	0.023991
50 year	0.02781
100 year	0.031837

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	0.016881
5 year	0.022799
10 year	0.0273
25 year	0.033688
50 year	0.038985
100 year	0.044768

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	Predeveloped	Mitigated
1949	0.013	0.021
1950	0.020	0.021
1951	0.019	0.017
1952	0.008	0.012
1953	0.005	0.013
1954	0.012	0.014
1955	0.014	0.016
1956	0.013	0.015
1957	0.009	0.019
1958	0.008	0.013

1959	0.008	0.013
1960	0.014	0.020
1961	0.013	0.015
1962	0.005	0.012
1963	0.009	0.014
1964	0.012	0.013
1965	0.017	0.017
1966	0.007	0.013
1967	0.021	0.022
1968	0.010	0.020
1969	0.012	0.016
1970	0.008	0.016
1971	0.009	0.017
1972	0.019	0.020
1973	0.009	0.012
1974	0.008	0.016
1975	0.012	0.020
1976	0.012	0.015
1977	0.007	0.012
1978	0.008	0.016
1979	0.009	0.016
1980	0.013	0.023
1981	0.007	0.017
1982	0.013	0.026
1983	0.008	0.017
1984	0.011	0.013
1985	0.006	0.016
1986	0.008	0.019
1987	0.011	0.018
1988	0.005	0.012
1989	0.008	0.014
1990	0.021	0.039
1991	0.022	0.028
1992	0.006	0.015
1993	0.006	0.012
1994	0.005	0.010
1995	0.010	0.014
1996	0.021	0.022
1997	0.016	0.022
1998	0.010	0.016
1999	0.018	0.028
2000	0.012	0.016
2001	0.007	0.015
2002	0.009	0.023
2003	0.012	0.017
2004	0.012	0.051
2005	0.012	0.018
2006	0.014	0.016
2007	0.033	0.040
2008	0.026	0.047
2009	0.018	0.020

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	0.0333	0.0507
2	0.0257	0.0472
3	0.0215	0.0401

4	0.0215	0.0387
5	0.0205	0.0284
6	0.0205	0.0279
7	0.0203	0.0260
8	0.0193	0.0231
9	0.0190	0.0227
10	0.0183	0.0221
11	0.0176	0.0221
12	0.0167	0.0218
13	0.0164	0.0212
14	0.0144	0.0207
15	0.0144	0.0201
16	0.0141	0.0200
17	0.0133	0.0200
18	0.0133	0.0196
19	0.0131	0.0196
20	0.0127	0.0190
21	0.0127	0.0189
22	0.0124	0.0185
23	0.0123	0.0181
24	0.0123	0.0175
25	0.0122	0.0171
26	0.0121	0.0168
27	0.0121	0.0168
28	0.0118	0.0167
29	0.0116	0.0166
30	0.0116	0.0164
31	0.0113	0.0164
32	0.0112	0.0163
33	0.0101	0.0163
34	0.0096	0.0162
35	0.0095	0.0161
36	0.0094	0.0160
37	0.0092	0.0158
38	0.0092	0.0157
39	0.0089	0.0157
40	0.0086	0.0153
41	0.0086	0.0152
42	0.0084	0.0150
43	0.0084	0.0148
44	0.0084	0.0145
45	0.0082	0.0144
46	0.0082	0.0142
47	0.0081	0.0138
48	0.0081	0.0137
49	0.0080	0.0134
50	0.0076	0.0132
51	0.0072	0.0131
52	0.0071	0.0129
53	0.0069	0.0125
54	0.0068	0.0125
55	0.0063	0.0124
56	0.0063	0.0122
57	0.0061	0.0121
58	0.0055	0.0120
59	0.0051	0.0118
60	0.0051	0.0116
61	0.0045	0.0104

Duration Flows

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0054	2088	47141	2257	Fail
0.0056	1918	42264	2203	Fail
0.0058	1741	37837	2173	Fail
0.0061	1594	33880	2125	Fail
0.0063	1445	30244	2093	Fail
0.0065	1318	26993	2048	Fail
0.0067	1224	24084	1967	Fail
0.0070	1126	21517	1910	Fail
0.0072	1018	19179	1883	Fail
0.0074	927	17098	1844	Fail
0.0077	845	15267	1806	Fail
0.0079	790	13503	1709	Fail
0.0081	725	12033	1659	Fail
0.0083	659	10799	1638	Fail
0.0086	602	9689	1609	Fail
0.0088	547	8712	1592	Fail
0.0090	495	7835	1582	Fail
0.0092	458	7063	1542	Fail
0.0095	424	6370	1502	Fail
0.0097	398	5717	1436	Fail
0.0099	372	5118	1375	Fail
0.0101	342	4631	1354	Fail
0.0104	308	4190	1360	Fail
0.0106	292	3771	1291	Fail
0.0108	266	3422	1286	Fail
0.0111	248	3104	1251	Fail
0.0113	235	2819	1199	Fail
0.0115	230	2560	1113	Fail
0.0117	209	2319	1109	Fail
0.0120	192	2080	1083	Fail
0.0122	178	1894	1064	Fail
0.0124	165	1719	1041	Fail
0.0126	149	1561	1047	Fail
0.0129	129	1403	1087	Fail
0.0131	119	1278	1073	Fail
0.0133	109	1155	1059	Fail
0.0135	99	1032	1042	Fail
0.0138	91	953	1047	Fail
0.0140	83	861	1037	Fail
0.0142	75	758	1010	Fail
0.0144	65	690	1061	Fail
0.0147	61	622	1019	Fail
0.0149	57	547	959	Fail
0.0151	54	492	911	Fail
0.0154	50	435	870	Fail
0.0156	46	388	843	Fail
0.0158	44	354	804	Fail
0.0160	43	317	737	Fail
0.0163	39	282	723	Fail
0.0165	38	258	678	Fail
0.0167	37	238	643	Fail
0.0169	34	215	632	Fail
0.0172	31	202	651	Fail
0.0174	31	191	616	Fail

0.0176	28	183	653	Fail
0.0178	26	174	669	Fail
0.0181	24	167	695	Fail
0.0183	21	163	776	Fail
0.0185	19	157	826	Fail
0.0188	19	149	784	Fail
0.0190	18	143	794	Fail
0.0192	16	137	856	Fail
0.0194	15	131	873	Fail
0.0197	14	124	885	Fail
0.0199	13	120	923	Fail
0.0201	13	117	900	Fail
0.0203	11	112	1018	Fail
0.0206	9	110	1222	Fail
0.0208	8	106	1325	Fail
0.0210	8	100	1250	Fail
0.0212	8	99	1237	Fail
0.0215	7	96	1371	Fail
0.0217	5	94	1879	Fail
0.0219	5	92	1840	Fail
0.0221	5	88	1760	Fail
0.0224	5	84	1679	Fail
0.0226	4	83	2075	Fail
0.0228	4	80	2000	Fail
0.0231	4	80	2000	Fail
0.0233	4	77	1925	Fail
0.0235	4	76	1900	Fail
0.0237	4	72	1800	Fail
0.0240	4	71	1775	Fail
0.0242	4	71	1775	Fail
0.0244	3	71	2366	Fail
0.0246	3	71	2366	Fail
0.0249	3	69	2300	Fail
0.0251	3	68	2266	Fail
0.0253	3	67	2233	Fail
0.0255	3	64	2133	Fail
0.0258	2	63	3150	Fail
0.0260	2	60	3000	Fail
0.0262	2	60	3000	Fail
0.0265	2	59	2950	Fail
0.0267	2	58	2900	Fail
0.0269	2	58	2900	Fail
0.0271	2	57	2850	Fail
0.0274	2	57	2850	Fail
0.0276	2	56	2800	Fail
0.0278	2	56	2800	Fail

The development has an increase in flow durations from 1/2 Predeveloped 2 year flow to the 2 year flow or more than a 10% increase from the 2 year to the 50 year flow.
The development has an increase in flow durations for more than 50% of the flows for the range of the duration analysis.

Water Quality

Water Quality BMP Flow and Volume for POC #1

On-line facility volume:	0 acre-feet
On-line facility target flow:	0 cfs.
Adjusted for 15 min:	0 cfs.
Off-line facility target flow:	0 cfs.
Adjusted for 15 min:	0 cfs.

LID Report

LID Technique	Used for Treatment ?	Total Volume Needs Treatment (ac-ft)	Volume Through Facility (ac-ft)	Infiltration Volume (ac-ft)	Cumulative Volume Infiltration Credit	Percent Volume Infiltrated	Water Quality	Percent Water Quality Treated	Comment
Tank 1 POC	☐	12.93			☐	0.00			
Total Volume Infiltrated		12.93	0.00	0.00		0.00	0.00	0%	No Treat. Credit
Compliance with LID Standard 8% of 2-yr to 50% of 2-yr									Duration Analysis Result = Failed

Model Default Modifications

Total of 0 changes have been made.

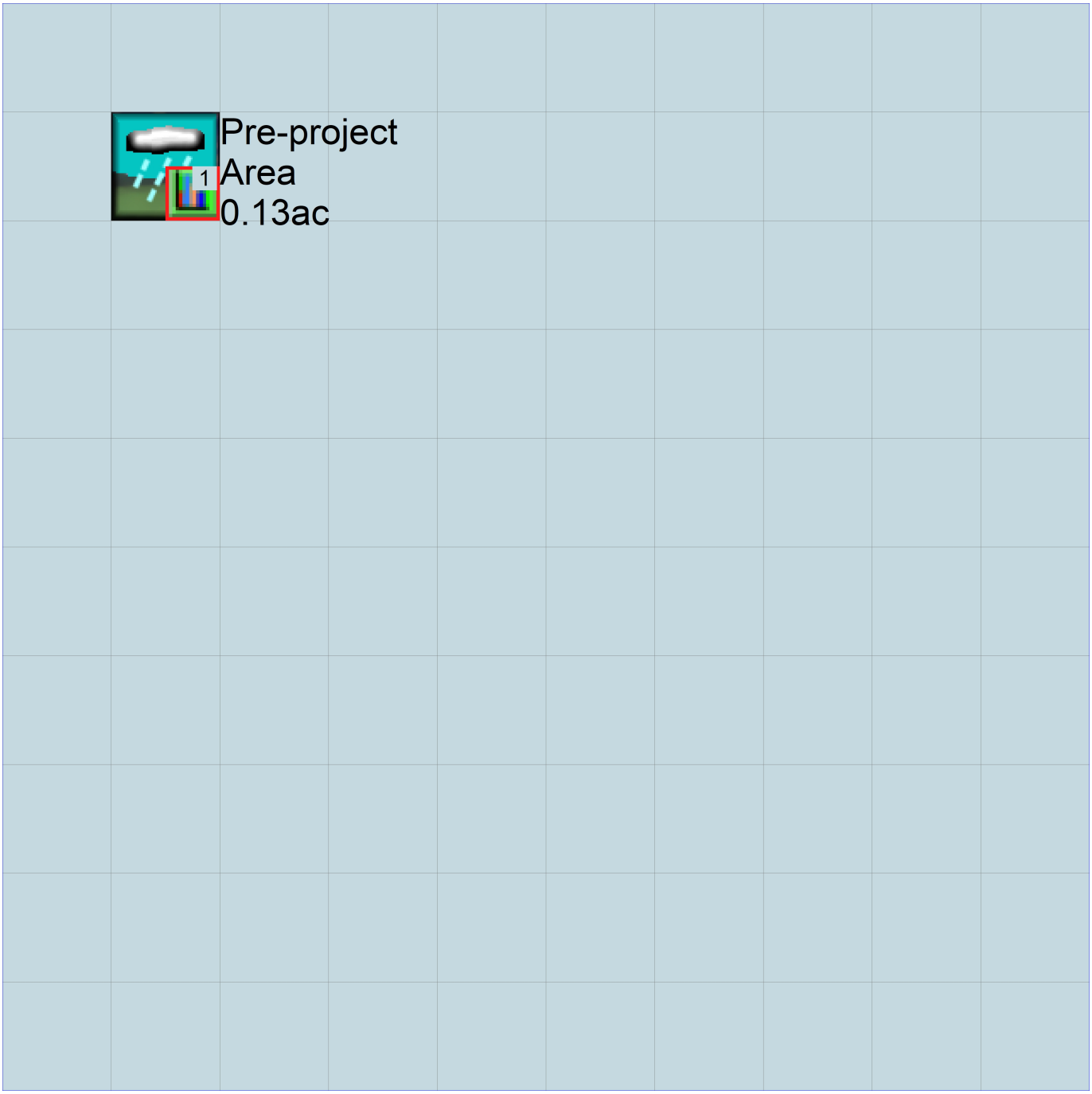
PERLND Changes

No PERLND changes have been made.

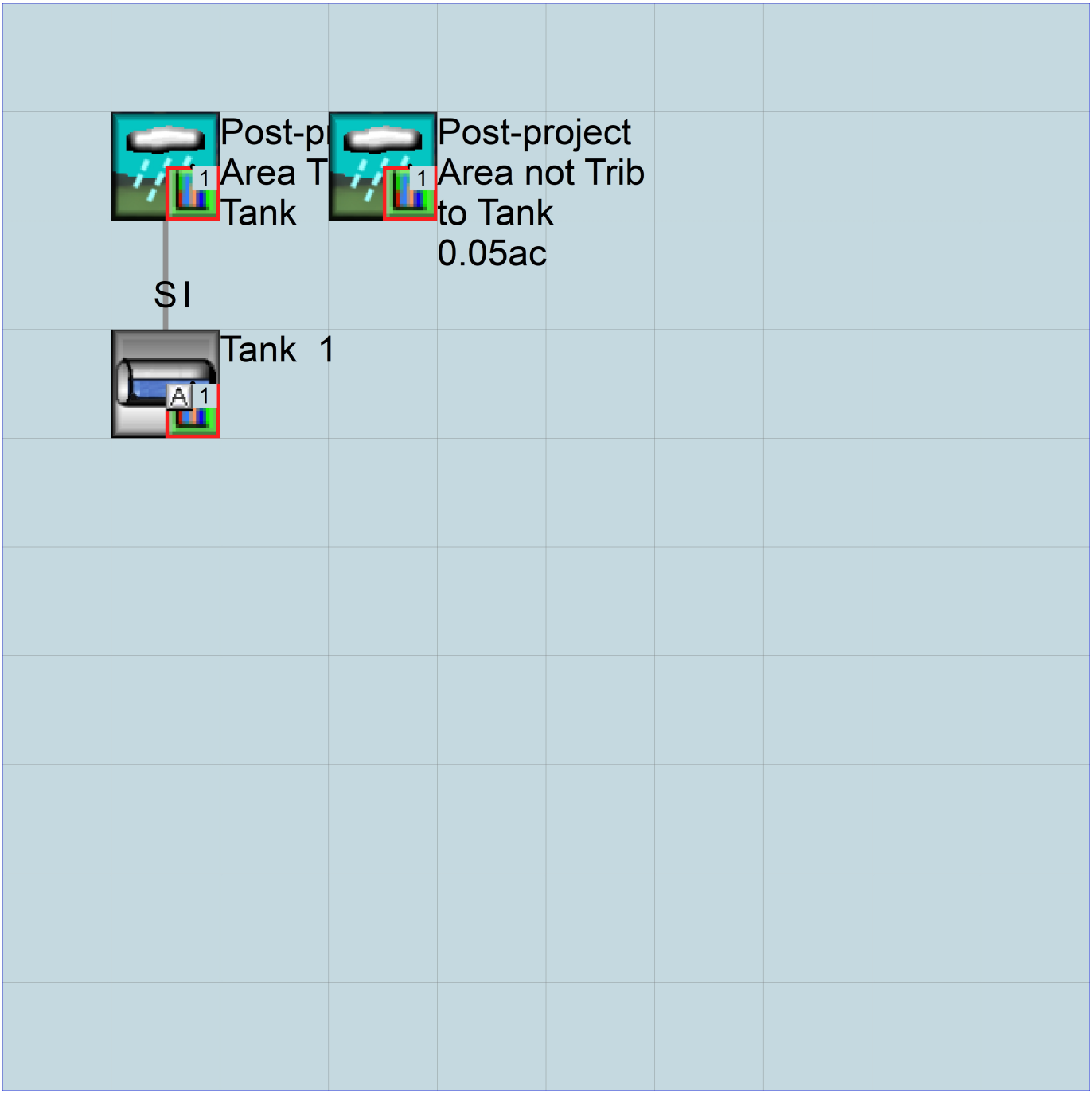
IMPLND Changes

No IMPLND changes have been made.

Appendix
Predeveloped Schematic



Mitigated Schematic



Predeveloped UCI File

```
RUN

GLOBAL
  WWHM4 model simulation
  START       1948 10 01        END    2009 09 30
  RUN INTERP OUTPUT LEVEL    3    0
  RESUME     0 RUN     1                   UNIT SYSTEM     1
END GLOBAL

FILES
<File>  <Un#>   <-----------File Name------------------------------>***
<-ID->                                                              ***
WDM         26   18039 Wetland Hydrologic Analysis.wdm
MESSU       25   Pre18039 Wetland Hydrologic Analysis.MES
            27   Pre18039 Wetland Hydrologic Analysis.L61
            28   Pre18039 Wetland Hydrologic Analysis.L62
            30   POC18039 Wetland Hydrologic Analysis1.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      PERLND      11
      PERLND      20
      IMPLND       2
      COPY       501
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Pre-project Area            MAX                   1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  501         1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
  END OPCODE
  PARM
    #    #         K ***
  END PARM
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name------->NBLKS   Unit-systems   Printer ***
    # -  #                          User  t-series Engl Metr ***
                                        in  out           ***
   11     C, Forest, Mod          1    1    1    1   27    0
   20     SAT, Forest, Mod        1    1    1    1   27    0
  END GEN-INFO
  *** Section PWATER***

  ACTIVITY
    <PLS > ************ Active Sections ****************************
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
   11         0    0    1    0    0    0    0    0    0    0    0    0
   20         0    0    1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags **************************** PIVL  PYR
```

```
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC  *********
   11         0    0    4    0    0    0    0    0    0    0    0    0    1    9
   20         0    0    4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO

  PWAT-PARM1
    <PLS >  PWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE INFC  HWT ***
   11         0    0    0    0    0    0    0    0    0    0    0
   20         0    0    0    0    0    0    0    0    0    0    0
  END PWAT-PARM1

  PWAT-PARM2
    <PLS >      PWATER input info: Part 2         ***
    # -  # ***FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY     AGWRC
   11              0       4.5      0.08       400       0.1       0.5     0.996
   20              0         4         2       100      0.01       0.5     0.996
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
   11              0         0         2         2         0         0         0
   20              0         0        10         2         0         0       0.7
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                              ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
   11            0.2       0.5      0.35         6       0.5       0.7
   20            0.2         3       0.5         1       0.7       0.8
  END PWAT-PARM4

  PWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
               ran from 1990 to end of 1992 (pat 1-11-95) RUN 21 ***
    # -  # ***  CEPS      SURS       UZS      IFWS       LZS      AGWS      GWVS
   11              0         0         0         0       2.5         1         0
   20              0         0         0         0       4.2         1         0
  END PWAT-STATE1

END PERLND

IMPLND
  GEN-INFO
    <PLS ><-------Name------->   Unit-systems   Printer ***
    # -  #                     User  t-series Engl Metr ***
                                     in  out           ***
    2      ROADS/MOD              1    1    1   27    0
  END GEN-INFO
  *** Section IWATER***

  ACTIVITY
    <PLS > ************ Active Sections ****************************
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL   ***
    2         0    0    1    0    0    0
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    *********
    2         0    0    4    0    0    0    1    9
  END PRINT-INFO

  IWAT-PARM1
    <PLS >  IWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP  VRS  VNN RTLI     ***
    2         0    0    0    0    0
  END IWAT-PARM1

  IWAT-PARM2
```

```
    <PLS >      IWATER input info: Part 2         ***
    # -  # ***  LSUR     SLSUR      NSUR     RETSC
    2            400      0.05       0.1      0.08
  END IWAT-PARM2

  IWAT-PARM3
    <PLS >      IWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN
    2              0         0
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
    2              0         0
  END IWAT-STATE1

END IMPLND

SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK   ***
<Name>   #                  <-factor->     <Name>   #   Tbl#   ***
Pre-project Area***
PERLND  11                       0.064     COPY   501     12
PERLND  11                       0.064     COPY   501     13
PERLND  20                       0.056     COPY   501     12
PERLND  20                       0.056     COPY   501     13
IMPLND   2                       0.014     COPY   501     15

******Routing******
END SCHEMATIC

NETWORK
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
COPY   501 OUTPUT MEAN   1 1   48.4        DISPLY   1     INPUT  TIMSER 1



<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
END NETWORK

RCHRES
  GEN-INFO
    RCHRES       Name        Nexits   Unit Systems   Printer                ***
    # -  #<------------------><---> User T-series  Engl Metr LKFG           ***
                                      in  out                               ***
  END GEN-INFO
  *** Section RCHRES***

  ACTIVITY
    <PLS > ************ Active Sections ****************************
    # -  # HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG ***
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ****************** PIVL  PYR
    # -  # HYDR ADCA CONS HEAT  SED  GQL OXRX NUTR PLNK PHCB PIVL  PYR  *********
  END PRINT-INFO

  HYDR-PARM1
    RCHRES  Flags for each HYDR Section                                 ***
    # -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for each
            FG FG FG FG  possible  exit  *** possible  exit      possible  exit
             *  *  *  *    *  *  *  *  *       *  *  *  *  *         ***
  END HYDR-PARM1

  HYDR-PARM2
    # -  #    FTABNO       LEN     DELTH     STCOR        KS      DB50       ***
```

```
  <------><--------><--------><--------><--------><--------><-------->       ***
  END HYDR-PARM2
  HYDR-INIT
    RCHRES  Initial conditions for each HYDR section                         ***
    # -  # ***   VOL     Initial  value  of COLIND     Initial  value  of OUTDGT
          *** ac-ft     for each possible exit        for each possible exit
  <------><-------->     <---><---><---><---><---> *** <---><---><---><---><--->
  END HYDR-INIT
END RCHRES

SPEC-ACTIONS
END SPEC-ACTIONS
FTABLES
END FTABLES

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #  ***
WDM      2 PREC     ENGL    1              PERLND   1 999 EXTNL  PREC
WDM      2 PREC     ENGL    1              IMPLND   1 999 EXTNL  PREC
WDM      1 EVAP     ENGL    0.76           PERLND   1 999 EXTNL  PETINP
WDM      1 EVAP     ENGL    0.76           IMPLND   1 999 EXTNL  PETINP

END EXT SOURCES

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Tgap Amd ***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>    tem strg strg***
COPY   501 OUTPUT MEAN   1 1     48.4      WDM    501 FLOW     ENGL      REPL
END EXT TARGETS

MASS-LINK
<Volume>   <-Grp> <-Member-><--Mult-->     <Target>       <-Grp> <-Member->***
<Name>            <Name> # #<-factor->     <Name>                <Name> # #***
  MASS-LINK       12
PERLND     PWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   12

  MASS-LINK       13
PERLND     PWATER IFWO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   13

  MASS-LINK       15
IMPLND     IWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   15


END MASS-LINK

END RUN
```

Mitigated UCI File

```
RUN

GLOBAL
  WWHM4 model simulation
  START       1948 10 01        END    2009 09 30
  RUN INTERP OUTPUT LEVEL    3    0
  RESUME     0 RUN     1                    UNIT SYSTEM     1
END GLOBAL

FILES
<File>  <Un#>   <-----------File Name------------------------------>***
<-ID->                                                              ***
WDM         26   18039 Wetland Hydrologic Analysis.wdm
MESSU       25   Mit18039 Wetland Hydrologic Analysis.MES
            27   Mit18039 Wetland Hydrologic Analysis.L61
            28   Mit18039 Wetland Hydrologic Analysis.L62
            30   POC18039 Wetland Hydrologic Analysis1.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      IMPLND       2
      PERLND      17
      RCHRES       1
      COPY         1
      COPY       501
      COPY       601
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Tank  1                    MAX                    1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  501         1    1
  601         1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
  END OPCODE
  PARM
    #    #         K ***
  END PARM
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name------->NBLKS   Unit-systems   Printer ***
    # -  #                          User  t-series Engl Metr ***
                                          in  out           ***
   17     C, Lawn, Mod            1    1    1    1   27    0
  END GEN-INFO
  *** Section PWATER***

  ACTIVITY
    <PLS > ************ Active Sections ******************************
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
   17         0    0    1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
```

```
    <PLS > ***************** Print-flags ***************************** PIVL  PYR
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC  *********
   17         0    0    4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO

  PWAT-PARM1
    <PLS >  PWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE INFC  HWT ***
   17         0    0    0    0    0    0    0    0    0    0    0
  END PWAT-PARM1

  PWAT-PARM2
    <PLS >      PWATER input info: Part 2         ***
    # -  # ***FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY     AGWRC
   17              0       4.5      0.03       400       0.1       0.5     0.996
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
   17               0         0         2         2         0         0         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                              ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
   17            0.1      0.25      0.25         6       0.5      0.25
  END PWAT-PARM4

  PWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
             ran from 1990 to end of 1992 (pat 1-11-95) RUN 21 ***
    # -  # ***  CEPS      SURS       UZS      IFWS       LZS      AGWS      GWVS
   17              0         0         0         0       2.5         1         0
  END PWAT-STATE1

END PERLND

IMPLND
  GEN-INFO
    <PLS ><-------Name------->   Unit-systems   Printer ***
    # -  #                     User  t-series Engl Metr ***
                                     in  out           ***
    2      ROADS/MOD              1    1    1   27    0
  END GEN-INFO
  *** Section IWATER***

  ACTIVITY
    <PLS > ************* Active Sections ******************************
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL   ***
    2         0    0    1    0    0    0
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    *********
    2         0    0    4    0    0    0    1    9
  END PRINT-INFO

  IWAT-PARM1
    <PLS >  IWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP  VRS  VNN RTLI     ***
    2         0    0    0    0    0
  END IWAT-PARM1

  IWAT-PARM2
    <PLS >      IWATER input info: Part 2         ***
    # -  # ***  LSUR     SLSUR      NSUR     RETSC
    2            400      0.05       0.1      0.08
  END IWAT-PARM2
```

```
  IWAT-PARM3
    <PLS >      IWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN
    2             0         0
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
    2             0         0
  END IWAT-STATE1

END IMPLND

SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK   ***
<Name>   #                  <-factor->     <Name>   #   Tbl#   ***
Post-project Area Trib to Tank***
IMPLND   2                       0.089     RCHRES   1      5
Post-project Area Trib to Tank***
Post-project Area not Trib to Tank***
PERLND  17                       0.031     COPY   501     12
PERLND  17                       0.031     COPY   601     12
PERLND  17                       0.031     COPY   501     13
PERLND  17                       0.031     COPY   601     13
PERLND  17                       0.031     COPY   501     14
PERLND  17                       0.031     COPY   601     14
IMPLND   2                       0.014     COPY   501     15
IMPLND   2                       0.014     COPY   601     15

******Routing******
IMPLND   2                       0.089     COPY     1     15
RCHRES   1                           1     COPY   501     16
END SCHEMATIC

NETWORK
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
COPY   501 OUTPUT MEAN   1 1   48.4        DISPLY   1     INPUT  TIMSER 1



<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
END NETWORK

RCHRES
  GEN-INFO
    RCHRES       Name        Nexits   Unit Systems   Printer                ***
    # -  #<----------------><---> User T-series  Engl Metr LKFG             ***
                                        in  out                             ***
    1     Tank  1                1    1    1    1   28    0    1
  END GEN-INFO
  *** Section RCHRES***

  ACTIVITY
    <PLS > ************ Active Sections ****************************
    # -  # HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG ***
    1         1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ****************** PIVL  PYR
    # -  # HYDR ADCA CONS HEAT  SED  GQL OXRX NUTR PLNK PHCB PIVL  PYR  *********
    1         4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO

  HYDR-PARM1
    RCHRES  Flags for each HYDR Section                                  ***
    # -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for each
```

```
            FG FG FG FG  possible  exit  *** possible  exit      possible  exit
             *  *  *  *    *  *  *  *  *       *  *  *  *  *         ***
    1        0  1  0  0    4  0  0  0  0       0  0  0  0  0       2  2  2  2  2
  END HYDR-PARM1

  HYDR-PARM2
    # -  #    FTABNO       LEN     DELTH     STCOR        KS      DB50       ***
  <------><--------><--------><--------><--------><--------><-------->       ***
    1               1      0.01       0.0       0.0       0.5       0.0
  END HYDR-PARM2
  HYDR-INIT
    RCHRES  Initial conditions for each HYDR section                         ***
    # -  # ***   VOL     Initial  value  of COLIND     Initial  value  of OUTDGT
          *** ac-ft     for each possible exit        for each possible exit
  <------><-------->     <---><---><---><---><---> *** <---><---><---><---><--->
    1           0         4.0  0.0  0.0  0.0  0.0       0.0  0.0  0.0  0.0  0.0
  END HYDR-INIT
END RCHRES

SPEC-ACTIONS
END SPEC-ACTIONS
FTABLES
  FTABLE      1
   91    4
     Depth      Area    Volume  Outflow1 Velocity  Travel Time***
      (ft)   (acres) (acre-ft)   (cfs)   (ft/sec)    (Minutes)***
  0.000000  0.000000  0.000000  0.000000
  0.055556  0.000746  0.000028  0.001599
  0.111111  0.001049  0.000078  0.002261
  0.166667  0.001277  0.000143  0.002770
  0.222222  0.001467  0.000219  0.003198
  0.277778  0.001630  0.000305  0.003576
  0.333333  0.001775  0.000400  0.003917
  0.388889  0.001906  0.000502  0.004231
  0.444444  0.002025  0.000612  0.004523
  0.500000  0.002135  0.000727  0.004797
  0.555556  0.002237  0.000849  0.005057
  0.611111  0.002331  0.000976  0.005303
  0.666667  0.002419  0.001108  0.005539
  0.722222  0.002502  0.001244  0.005765
  0.777778  0.002579  0.001385  0.005983
  0.833333  0.002652  0.001531  0.006193
  0.888889  0.002721  0.001680  0.006396
  0.944444  0.002786  0.001833  0.006593
  1.000000  0.002847  0.001990  0.006784
  1.055556  0.002904  0.002149  0.006970
  1.111111  0.002959  0.002312  0.007151
  1.166667  0.003010  0.002478  0.007328
  1.222222  0.003058  0.002647  0.007500
  1.277778  0.003104  0.002818  0.007669
  1.333333  0.003147  0.002991  0.007834
  1.388889  0.003188  0.003167  0.007995
  1.444444  0.003226  0.003346  0.008154
  1.500000  0.003261  0.003526  0.008309
  1.555556  0.003295  0.003708  0.008461
  1.611111  0.003326  0.003892  0.008611
  1.666667  0.003355  0.004077  0.008758
  1.722222  0.003382  0.004264  0.008903
  1.777778  0.003407  0.004453  0.009046
  1.833333  0.003429  0.004643  0.009186
  1.888889  0.003450  0.004834  0.009324
  1.944444  0.003469  0.005026  0.009460
  2.000000  0.003486  0.005220  0.009594
  2.055556  0.003502  0.005414  0.009727
  2.111111  0.003515  0.005609  0.009857
  2.166667  0.003527  0.005804  0.009986
  2.222222  0.003536  0.006000  0.010113
  2.277778  0.003544  0.006197  0.010239
  2.333333  0.003550  0.006394  0.010363
  2.388889  0.003555  0.006591  0.010486
```

```
  2.444444  0.003557  0.006789  0.010607
  2.500000  0.003558  0.006987  0.010727
  2.555556  0.003557  0.007184  0.010845
  2.611111  0.003555  0.007382  0.010963
  2.666667  0.003550  0.007579  0.011079
  2.722222  0.003544  0.007776  0.011193
  2.777778  0.003536  0.007973  0.011307
  2.833333  0.003527  0.008169  0.011420
  2.888889  0.003515  0.008365  0.011531
  2.944444  0.003502  0.008560  0.011641
  3.000000  0.003486  0.008754  0.011751
  3.055556  0.003469  0.008947  0.011859
  3.111111  0.003450  0.009139  0.011966
  3.166667  0.003429  0.009331  0.012073
  3.222222  0.003407  0.009520  0.012178
  3.277778  0.003382  0.009709  0.012283
  3.333333  0.003355  0.009896  0.012386
  3.388889  0.003326  0.010082  0.012489
  3.444444  0.003295  0.010266  0.012591
  3.500000  0.003261  0.010448  0.012692
  3.555556  0.003226  0.010628  0.023602
  3.611111  0.003188  0.010806  0.028179
  3.666667  0.003147  0.010982  0.031714
  3.722222  0.003104  0.011156  0.034708
  3.777778  0.003058  0.011327  0.037357
  3.833333  0.003010  0.011495  0.039761
  3.888889  0.002959  0.011661  0.041978
  3.944444  0.002904  0.011824  0.044048
  4.000000  0.002847  0.011984  0.045997
  4.055556  0.002786  0.012140  0.186574
  4.111111  0.002721  0.012293  0.439446
  4.166667  0.002652  0.012443  0.754726
  4.222222  0.002579  0.012588  1.098945
  4.277778  0.002502  0.012729  1.438029
  4.333333  0.002419  0.012866  1.739456
  4.388889  0.002331  0.012998  1.978556
  4.444444  0.002237  0.013125  2.147105
  4.500000  0.002135  0.013246  2.263588
  4.555556  0.002025  0.013362  2.409194
  4.611111  0.001906  0.013471  2.525089
  4.666667  0.001775  0.013573  2.635853
  4.722222  0.001630  0.013668  2.742115
  4.777778  0.001467  0.013754  2.844383
  4.833333  0.001277  0.013831  2.943077
  4.888889  0.001049  0.013895  3.038548
  4.944444  0.000746  0.013946  3.131094
  5.000000  0.001000  0.013973  3.220968
  END FTABLE  1
END FTABLES

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #  ***
WDM      2 PREC     ENGL    1              PERLND   1 999 EXTNL  PREC
WDM      2 PREC     ENGL    1              IMPLND   1 999 EXTNL  PREC
WDM      1 EVAP     ENGL    0.76           PERLND   1 999 EXTNL  PETINP
WDM      1 EVAP     ENGL    0.76           IMPLND   1 999 EXTNL  PETINP

END EXT SOURCES

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Tgap Amd ***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>    tem strg strg***
COPY     1 OUTPUT MEAN   1 1     48.4      WDM    701 FLOW     ENGL      REPL
COPY   501 OUTPUT MEAN   1 1     48.4      WDM    801 FLOW     ENGL      REPL
COPY   601 OUTPUT MEAN   1 1     48.4      WDM    901 FLOW     ENGL      REPL
RCHRES   1 HYDR   RO     1 1        1      WDM   1004 FLOW     ENGL      REPL
RCHRES   1 HYDR   STAGE  1 1        1      WDM   1005 STAG     ENGL      REPL
END EXT TARGETS
```

```
MASS-LINK
<Volume>   <-Grp> <-Member-><--Mult-->     <Target>       <-Grp> <-Member->***
<Name>             <Name> # #<-factor->     <Name>                <Name> # #***
  MASS-LINK         5
IMPLND     IWATER SURO       0.083333      RCHRES         INFLOW IVOL
  END MASS-LINK     5

  MASS-LINK        12
PERLND     PWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK    12

  MASS-LINK        13
PERLND     PWATER IFWO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK    13

  MASS-LINK        14
PERLND     PWATER AGWO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK    14

  MASS-LINK        15
IMPLND     IWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK    15

  MASS-LINK        16
RCHRES     ROFLOW                          COPY           INPUT  MEAN
  END MASS-LINK    16


END MASS-LINK

END RUN
```

Predeveloped HSPF Message File

Mitigated HSPF Message File

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