Clean Water Services Design and Construction Standards Update:  
Base Strategy and Methodology to Address Hydromodification Impacts 

1.0 INTRODUCTION

The proposed hydromodification base strategy (Base Strategy) builds on existing Clean Water Services Design and Construction Standards (D&C Standards) to address the management of stormwater runoff volume from development. The Base Strategy includes a methodology for evaluating potential impacts from runoff with respect to the risk of stream channel alteration (erosion), and a stormwater management selection approach based on those risks. This methodology relies on getting information from a Hydromodification Planning Tool map (Map). A link to a draft version of the Map is included in this document.

This document describes:

- The methodology for determining three key components for decision-making on a given project: Hydromodification Protection Level, Development Class, and Project Size Category.
- Proposed stormwater management approaches (Hydromodification Approaches) including: Enhanced LIDA, detention, and fee-in-lieu.
- A Hydromodification Approach selection methodology that is based on project specific components.

New terms will be described throughout this document, and definitions can also be found in Section 4.0. Additionally, an example project, including step-by-step screenshots, is included at the end of this document to illustrate the evaluation and decision-making process.

The District is also actively developing more detailed strategies for specific sub-basins similar to the strategies presently available for the North Bethany development subarea north of Beaverton and the River Terrace neighborhood in Tigard. More information about sub-basin specific strategies will be made available as those plans are developed.

2.0 APPROACH SELECTION METHODOLOGY

The stormwater management approach selection methodology is based on three key components: Hydromodification Protection Level, Development Class, and Project Size Category. Below is a description of each component and a step-by-step methodology for determining each for a given project, and the corresponding proposed Hydromodification Approach.

1) Hydromodification Protection Level. Where does this project discharge? Stream characteristics such as size and slope can affect the sensitivity to changes in runoff from development.

   STEP 1A: Locate the project on the Map, available here.

   STEP 1B: Determine a preliminary Point of Discharge.
   a. If the runoff does not discharge directly to an onsite Sensitive Area, evaluate the existing or proposed storm drainage pipes or ditches, and identify the outfall from the engineered or existing conveyance system to a Sensitive Area. If the Sensitive Area is a wetland or pond, continue to a stream. This is the Point of Discharge.
   b. If a Point of Discharge has not been identified and there is no existing stormwater infrastructure in the area, preliminary engineering may be required to determine stormwater routing and an appropriate Point of Discharge.
   c. Individual projects may drain in more than one direction and have multiple Points of Discharge. For example, project sites may drain to different streams or to different segments of the same stream. Each Point of Discharge should be identified.

   STEP 1C: Determine Receiving Reach.
a. Determine the Stream Order on the Map at the Point(s) of Discharge
b. Determine the Receiving Reach by beginning at the Point of Discharge and ending at a distance downstream based on Stream Order. The Receiving Reach length corresponding to each Stream Order is indicated in Table 1 below. If the Receiving Reach extends from a lower Stream Order to a higher Stream Order, the length of the Receiving Reach should be proportional to the percentage of the Receiving Reach in each category.

**Table 1. Length of Receiving Reach as a function of Stream Order**

<table>
<thead>
<tr>
<th>Stream Order</th>
<th>Receiving Reach length (ft.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>350</td>
</tr>
<tr>
<td>2</td>
<td>400</td>
</tr>
<tr>
<td>3</td>
<td>500</td>
</tr>
<tr>
<td>4</td>
<td>750</td>
</tr>
<tr>
<td>5</td>
<td>1250</td>
</tr>
<tr>
<td>6</td>
<td>1700</td>
</tr>
<tr>
<td>7</td>
<td>2300</td>
</tr>
</tbody>
</table>

**STEP 1D:** Determine the Hydromodification Protection Level for the project based on the highest Hydromodification Protection Level in the Receiving Reach.

2) Development Class. Where is the project located in relation to the Urban Growth Boundary? Project location within a watershed context is a major determinant of the Base Strategy, because changes in runoff with new development can be substantially larger in Expansion Areas than Developed Areas.

**STEP 2A:** Using the Map legend, determine whether the Point(s) of Discharge is in an Expansion Area or a Developed Area.

3) Project Size Category. How large is the project? The Base Strategy uses four project size categories as a factor to identify the appropriate Hydromodification Approaches and tools.

**STEP 3A:** Calculate the proposed new and modified impervious surface area, consistent with the D&C Standards Sections 4.05.5, except that development types described in Section 4.05.5.c will be evaluated with actual modified impervious surface area, rather than using an area multiplied by three.

**STEP 3B:** Determine the Project Size Category, using the calculation from Step 3A:
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- **Very Small** sized projects range from 1,000 to less than 8,000 square feet of new and modified impervious surface;
- **Small** sized projects range from 8,000 to less than 20,000 square feet of new and modified impervious surface;
- **Medium** sized projects range from 20,000 to 50,000 square feet of new and modified impervious surface;
- **Large** sized projects are larger than 50,000 square feet of new and modified impervious surface.

4) Using the Hydromodification Protection Level, Development Class, and Project Size Category from the steps above, determine the corresponding Hydromodification Approaches from Table 2 below.

### Table 2. Hydromodification Approaches for the Base Strategy by Development Class, Hydromodification Protection Level, and Project Size Category. Note: bold indicates preferred approach for selection prioritization.

<table>
<thead>
<tr>
<th>Development Class/ Hydromodification Protection Level</th>
<th>Very Small Project Size 1,000 – 8,000 sq. ft.</th>
<th>Small Project Size 8,000 – 20,000 sq. ft.</th>
<th>Medium Project Size 20,000 – 50,000 sq. ft.</th>
<th>Large Project Size &gt; 50,000 sq. ft.</th>
</tr>
</thead>
<tbody>
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<td>Expansion/ High</td>
<td>Peak Matched Detention</td>
<td>Flow Duration Curve Matched Detention</td>
<td></td>
<td>Flow Duration Curve Matched Detention</td>
</tr>
<tr>
<td></td>
<td>Enhanced LIDA</td>
<td>Fee-In-Lieu*</td>
<td>Flow Duration Curve Matched Detention</td>
<td>Fee-In-Lieu*</td>
</tr>
<tr>
<td>Expansion/ Moderate &amp; Expansion/ Low</td>
<td>Enhanced LIDA</td>
<td>Peak Matched Detention</td>
<td>Flow Duration Curve Matched Detention</td>
<td>Flow Duration Curve Matched Detention</td>
</tr>
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<td>Fee-In-Lieu*</td>
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<tr>
<td>Developed/ High</td>
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* indicates option if project is anticipated to have small impacts within watershed context.
3.0 APPROACHES & TOOLS

Three categories of Hydromodification Approaches are identified in Table 2 and may be used under the Base Strategy: Enhanced Low Impact Development Approaches (Enhanced LIDA), detention, and fee-in-lieu. The application of each of these approaches, and allowance for alternate approaches, is described below.

1) Enhanced LIDA options are identified in Table 3 below, and may be used as the sole strategy to manage runoff from Very Small and Small projects, as well as some Medium category projects. Enhanced LIDA may also be used to manage a portion of runoff from any project.
   a. Enhanced LIDA that promote infiltration are preferred over those that have liners and engineered drainage structures, if appropriate for site conditions (e.g., geotechnical, flooding).
   b. Enhanced LIDA must meet existing standards for all design attributes other than sizing (see D&C Standards 4.07).

STEP 1A. To determine whether infiltration-based LIDA is appropriate, characterize subsurface drainage conditions within the project area. Sources for this information include the Natural Resource Conservation Service Web Soil Survey and the Oregon Water Resource Department Well Report Query Tool.

STEP 1B: Select all LIDA to be used within the project to address water quality and hydromodification using the crediting methods outlined in Table 3 and D&C Standards 4.05 and 4.06.
## Table 3. Enhanced Low Impact Development Approaches

<table>
<thead>
<tr>
<th>Enhanced LIDA Type</th>
<th>LIDA</th>
<th>Water Quality</th>
<th>Hydro-modification</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tree retention</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>Reduce impervious area per eligible stormwater tree by: Retained evergreen: 20% of canopy area (100 sq. ft. minimum) Retained deciduous: 10% of canopy area (50 sq. ft. minimum) New evergreen: 50 sq. ft. New deciduous: 20 sq. ft.</td>
</tr>
<tr>
<td>Structural soils</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>Direct reduction of impervious area.</td>
</tr>
<tr>
<td>Post-construction soil quality and depth (soil “rebuild”)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>Direct reduction of impervious area for area of “rebuilt” or protected soil. Can be credited for infiltration-based water quality treatment if suitable measures are in place to protect pre-project infiltration function of soil, runoff from point locations (e.g., downspouts) is distributed, and area is revegetated.</td>
</tr>
<tr>
<td>Porous pavement</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>Direct reduction of impervious area based on area of porous pavement (&lt;6% slope); no run-on allowed</td>
</tr>
<tr>
<td>Sheetflow dispersion</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>Direct reduction of impervious area, subject to mechanism for flow spreading, adequate area for dispersion and post-construction soil infiltration characteristics.</td>
</tr>
<tr>
<td>Rainwater harvesting</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>Offset annual runoff volume requiring additional management; may be used for credit if more than 15,000 gallons of storage is provided. Assume no discharge November 1 – March 31.</td>
</tr>
<tr>
<td>Site design</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>Direct reduction of impervious area</td>
</tr>
<tr>
<td>Green roof</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>Direct reduction of impervious area based on vegetated area of green roof</td>
</tr>
<tr>
<td>Oversized vegetated water quality facilities</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>Facility must be sized to 12% of total impervious area. Credit against this sizing may be allowed for infiltration on the basis of site-specific infiltration testing at the base of the facility and suitable measures are in place to protect pre-project infiltration function. Total contributing area (pervious and impervious) must be less than 15,000 sq. ft. See D&amp;C Standards 4.05.6b for additional requirements.</td>
</tr>
</tbody>
</table>
2) Detention is the approach for managing runoff from Medium and Large projects. Detention sizing is based on matching post-development runoff to pre-development runoff for the site using one of two methods: Flow Duration Curve-Matched Detention or Peak-Matched Detention. Projects may also be eligible for fee-in-lieu of detention as described in Section 3, below.

**STEP 2A:** Determine post-development runoff volumes at each Point of Discharge, reduce runoff volumes with Enhanced LIDA crediting as described in Table 3.

**STEP 2B:** Determine detention sizing methodology based on Hydromodification Protection Level, Development Class, and Project Size Category (Table 2).

   a. Peak-Matched Detention: follow Hydraulic Design Criteria in D&C Standards Section 4.03.4.
   b. Flow Duration Curve-Matched Detention. Use the CWS interface to HSPF ([draft version to be available online soon](#)) or similar program to build a project scale dynamically routed rainfall runoff model with rainfall, soils, slopes and land use conditions particular to the Tualatin River watershed. Match flow duration curves between pre-development and post-project conditions for runoff events between 50% of the 2-year flow event and the 10-year flow event. If detention is also required as a result of a downstream conveyance deficiency (described in D&C Standards 2.04.2.m.3), the detention sizing volumes must address both requirements.

3) The Fee-In-Lieu eligibility criteria are dependent on Project Size, Development Class, and Protection Level as shown in Table 2. Fee-In-Lieu rates will be published in the District’s Rates and Charges, updated annually.

4) Alternative runoff volume control approaches that can be demonstrated, to the satisfaction of the District, to address the effects of hydromodification, will be considered on a case-by-case basis, as authorized by D&C Standards Section 1.06.

### 4.0 DEFINITIONS

**Development Class**

One of the project conditions determining the Hydromodification Approach under the Base Strategy, based on the land use at the Point of Discharge. There are two Development Classes: Developed Area and Expansion Area.

**Developed Area**

Areas within the urban growth boundary prior to 2011, for which a sub-basin strategy does not yet exist. Sub-basin specific strategies, such as those that have been developed for the North Bethany subarea River Terrace, should be used in-lieu of the Base Strategy.

**Enhanced LIDA**

Enhanced Low Impact Development Approaches (Enhanced LIDA) are site layout and land management strategies and structural facilities which, when sized appropriately, reduce or slow post-development runoff sufficiently offset the effects of hydromodification. Enhanced LIDA may also provide water quality treatment.
Expansion Area

All areas added to the urban growth boundary starting in 2011, and all Urban Reserves in Washington County.

Hydromodification Approach

An engineered or natural feature designed or protected to provide stormwater management and offset impacts to natural resources from runoff from impervious surfaces. Hydromodification Approaches in the Base Strategy include Enhanced LIDA, detention facilities, and fee-in-lieu. Sub-basin specific Hydromodification Approaches also include stream and floodplain enhancement techniques.

Hydromodification Protection Level

One of the project conditions determining the Hydromodification Approach under the Base Strategy, based on the likely risk of physical or biological degradation of the stream corridor. There are three Hydromodification Protection Levels: High, Moderate, and Low.

Point of Discharge

Location where runoff discharges to a Sensitive Area. This may be direct discharge to an onsite Sensitive Area, or discharge to an offsite Sensitive Area through conveyances systems, such as pipes and roadside ditches. If the Sensitive Area is a wetland or pond, follow the flowpath to a stream to find the Point of Discharge.

Project Size Category

One of the project conditions determining the Hydromodification Approach under the Base Strategy, based on amount of impervious surface within the project site. There are four Project Size Categories: Very Small, Small, Medium, and Large.

Receiving Reach

Used to determine Hydromodification Protection Level for a project, the reach of Sensitive Area beginning at a Point of Discharge and ending at a point downstream. The length is based on Stream Order and the distance is measured along the flow centerline.

Sensitive Area

Definition can be found in D&C Standards Section 1.03.56

Stream Order

Stream Order is a measure of the relative size of streams. The smallest tributaries are referred to as first-order streams, while larger streams and rivers correspond to larger stream orders. The Tualatin River has a Stream Order of 8.
Example Project

Development – 5 lot subdivision

Location: TLNO 1N1290000400 (near intersection of NW West Union Rd. and NW Bethany Blvd.)

Impervious Area: 17,691 SF (includes public streets and 2,640 square feet of impervious surface per lot)

Section 2.1, STEP 1A: Locate the project on the Map.
STEP 1B: Determine Point of Discharge.

Follow flowpath from project site through existing or proposed stormwater conveyance to the receiving Sensitive Area (if wetland or pond, continue to stream). This is the Point of Discharge. (For simplicity, the flowpath is shown as a blue arrow).

Note from the stream at the Point of Discharge is a fourth order stream.

STEP 1C: Determine Receiving Reach.

a. Determine Stream Order for the Point(s) of Discharge

Point of Discharge is a 4th order stream (see legend in figure above).
b. Determine the Receiving Reach by beginning at the Point of Discharge and ending at a distance downstream based on Stream Order. The Stream Order is identified on the Map and the Receiving Reach length corresponding to each Stream Order is indicated in Table 1. If the Receiving Reach extends from a lower Stream Order to a higher Stream Order, the length of the Receiving Reach should be proportional to the percentage of the Receiving Reach in each category.

From Table 1, the receiving reach extends 750 feet from the Point of Discharge. Use the Measure Tool on the map to find the downstream extent of the Receiving Reach. The solid blue line shows trace of measurement.

STEP 1D: Determine the Hydromodification Protection Level for the project, based on the highest Hydromodification Protection level in the Receiving Reach.

Hydromodification Protection Levels

The Hydromodification Protection Level mapped along the Receiving Reach includes portions that are High and Low. The Hydromodification Protection Level for the project is the highest for the reach, which is **High** (see Figure above)
STEP 2: Determine the Development Class.

The Point of Discharge is located in an area that is not mapped as an Expansion Area. This means that the project site is located within the "Developed Area". (The Figure below shows a nearby Expansion Areas for contrast.)

STEP 2A: Calculate proposed new and modified impervious surface.

For this example, Impervious Surface = 17,691 square feet
(This is dependent on the development plan, and not found on the Map.)

STEP 3A: Determine the Project Size Category.

- **Very Small** sized projects range from 1,000 to less than 8,000 square feet of new and modified impervious surface;
- **Small** sized projects range from 8,000 to less than 20,000 square feet of new and modified impervious surface;
- **Medium** sized projects range from 20,000 to 50,000 square feet of new and modified impervious surface;
- **Large** sized projects are larger than 50,000 square feet of new and modified impervious surface.

Based on the calculated impervious surface in Step 2A, the Project Size Category is “Small.”
STEP 4: Determine the corresponding Hydromodification Approaches from Table 2.

*Project Size = Small*
*Development Class = Developed Area*
*Hydromodification Protection Level = High*

Table 2. Hydromodification Approaches for the Base Strategy by Development Class, Hydromodification Protection Level, and Project Size Category. Note: bold indicates preferred approach for selection prioritization.

<table>
<thead>
<tr>
<th>Development Classes/Protection Levels</th>
<th>Very Small Project 1,000 - &lt;8,000 sq. ft.</th>
<th>Small Project 8,000-20,000 sq. ft.</th>
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<td></td>
<td>Fee-in-Lieu</td>
<td>Fee-in-Lieu*</td>
<td>Fee-in-Lieu*</td>
</tr>
<tr>
<td>Expansion/Low</td>
<td>Enhanced LIDA</td>
<td>Peak Matched Detention</td>
<td>Flow Duration Curve Matched Detention</td>
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<td>Fee-in-Lieu</td>
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* indicates option if project is anticipated to have small impacts within watershed context.

Preferred Approach = Enhanced LIDA (see Table above)