LOW IMPACT DEVELOPMENT (LID) STANDARD PROPOSAL

1. Goal

- Improve Chapter 500 standards through incorporation of LID strategies for effective mitigation of stormwater impact on:
    - Unimpaired waters threatened by land development,
    - Impaired waters.

- Prioritize nature-based and stressor-specific Stormwater Control Measure (SCM) selection for effective stormwater management.

2. Scope

The proposal is primarily related to the current "General Standards" and "Phosphorus Standard", Chapter 500(4)(C) and 4(D), respectively. The proposed standard will primarily control the impact of small and frequent storms at the following levels:

- Groundwater recharge,
- Water quality,
- Channel protection.

The proposed standard is expected to provide partial overbank flood protection. Overbank and extreme flood protection is beyond the scope of this proposal and will be addressed in a separate proposal.

3. Background & Justification

Current Chapter 500 regulations already have several LID elements: vegetated stormwater buffers (Chapter 500 Appendix F) and other structural LID measures (e.g., Grassed Underdrained Soil Filter: Stormwater BMP Manual Chapter 7.1). There is a *popular* provision under the General Standards (Chapter 500 Section 4(C)(2)(d)) that incentivizes "redevelopment" projects to reduce impervious cover and/or replace the high pollutant exporting surfaces with relatively lower pollutant exporting surfaces. The redevelopment projects that use this provision can be considered LID compared to new development projects. There is another provision under the General Standards (Chapter 500 Section 4(C)(2)(iii)) that offers relatively less incentive in terms of treatment requirement reduction (i.e., maximum 5% point) for projects proposed in parcels where the developable area to proposed development ratio is relatively high. Applicants infrequently opt for using this provision since the incentive is weak.

There are opportunities for improvement in Chapter 500 to further LID in Maine. The following opportunities for improvement have been identified using the existing LID definition in Chapter 500 and LID objectives defined within:

- "Replace or Replicate Predevelopment Hydrology": Current practice has a technology-based approach providing water quality and channel protection level of control using a set of Chapter 500 compliant stormwater measures. This practice has its appeal since it can be easily and consistently implemented throughout the state. On the other hand, the current practice (i.e.,

General Standards) does not require the applicants to consider the predevelopment hydrology of their project sites.

- "Disconnect Impervious Surfaces": Applicants usually disconnect impervious surfaces using vegetated stormwater buffers (Chapter 500 Appendix F). It is also a common practice to disconnect rooftops via dripline filter measure (Stormwater BMP Manual Section 7.5). The degree of impervious surface disconnection usually decreases as a function of the project size. For instance, Site Law projects often collect and convey stormwater to structural measures which result in relatively less impervious surface disconnection. Please also see the discussion below in "*Stormwater Control Measure Selection*".

- *Stormwater Control Measure Selection:* Project designers usually have the option of selecting any Chapter 500 compliant SCM to comply with the General standards. Although there are merits of the current practice, its disadvantages must be also considered in the LID context: impervious area disconnection, nature based SCMs conducive to groundwater recharge (infiltration) and evapotranspiration are not prioritized. Lack of structured guidance for SCM selection results in missed LID opportunities. Any new LID standard will require a clear distinction between LID and non-LID SCMs and guidelines on SCM selection.

4. LID Standard Components

The LID standard proposal includes the following components that are new:

a. Groundwater Recharge Volume

Land development disrupts pre-development hydrology by altering groundwater recharge, interflow, and baseflow mainly through the creation of new impervious cover. As highlighted above, replacing or replicating pre-development hydrology is one of the key LID goals. Considering this LID goal, several states (e.g., CT, MA, NH, NJ) require groundwater recharge level of control in their stormwater regulations whereas Maine currently does not require groundwater recharge. A recently completed comprehensive study demonstrated positive results of groundwater recharge at both watershed- and site-scale (EPA, 2022). The Department proposes to incorporate groundwater recharge level of control into Chapter 500 for select watersheds.

b. Sensitive and Threatened Watersheds

Land development is geographically concentrated in the State as demonstrated by a recent GIS project that analyzed impervious cover change in Maine within the past two decades (DEP, 2024). In developing watersheds, cumulative stormwater impact can be significant enough to impair water quality. The Department proposes to identify the watersheds that are sensitive to and threatened by development and implement a stormwater management strategy to preserve their water quality. This proactive strategy aims to avoid potential loss of ecosystem services and goods and restoration costs due to future water quality impairment. The Department proposes to incorporate a new list of "Sensitive and Threatened Watersheds" into Chapter 502 pursuant to Subsection 4 of the Stormwater Management Law.

c. Watershed Stressor-Guided Stormwater Control Measure Selection

Current General Standards are based on the premise that all approved SCMs are equivalent in terms of water quality treatment if they are sized and designed per Chapter 500 and the Stormwater BMP Manual. Therefore, a site development can be designed to have a structural stormwater system with little to no consideration of LID principles and/or the stressors identified for its watershed.

The Department proposes a guided approach for SCM selection to ensure that nature-based, LID SCMs are properly evaluated and exhausted before non-LID SCMs are used for site development. The guided approach also requires selection of the SCMs which are more effective at targeting the stressors identified for the watersheds. The Department proposes to specify the target pollutant and its minimum removal level for all projects that will be required to provide water quality level of control. This approach will enable Maine to leverage the stormwater treatment tools primarily developed by EPA and used in New England (e.g., SCM performance curves) (VHB, 2022).

d. Core Low Impact Development Standards

Translating LID strategies listed in Chapter 500(4)(C)(4) and covered in the Stormwater BMP Manual (see Vol. III Chapter 10) into practicable stormwater management standards is a challenging task. The Department has come up with “core” LID standards which are clear, specific, and measurable. The core LID standards will apply to all Chapter 500 projects that are required to provide water quality level of control.

A flowchart for the proposed LID standard is provided in **Figure 1**.

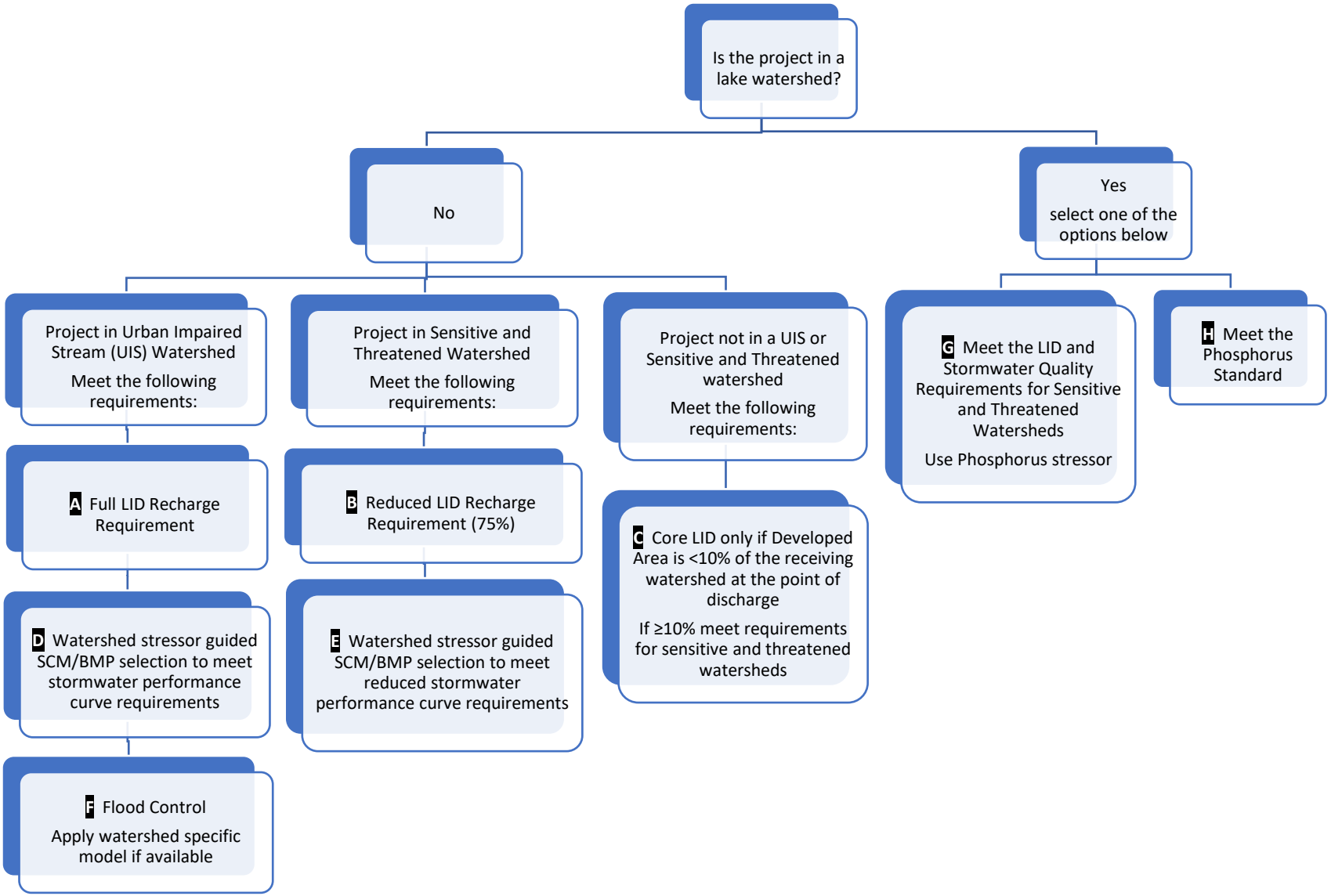

Figure 1. LID standard implementation flowchart.

Groundwater Recharge Requirement

Projects that are in the following watersheds will be required to retain and infiltrate stormwater:

- Urban Impaired Stream watersheds,
- Sensitive and Threatened watersheds.

Furthermore, projects that will develop 10 or more percent of a watershed will be required to retain and infiltrate stormwater (**Figure 1**).

Projects will meet the groundwater recharge requirements given in **Table 1** which is a revised version of the table provided in the "Watershed Protection Standard" memo of the Taunton Watershed project (EPA, 2022). Please note that the values given in **Table 1** indicate the cumulative runoff depth that must be infiltrated; they will not be directly used to size the SCMs.

Table 1. New Development: Groundwater Recharge Requirements.

Runoff depth (inches) from project impervious area that must be infiltrated		
Hydrologic Soil Group	Predevelopment condition replaced by impervious area	
	Meadow/Field	Forest*
A	0.69	0.79
B	0.56	0.66
C	0.41	0.52
D	0.28	0.38
*: The Department increased the values in this column by 0.1 inch to recognize the forest's surface storage potential and to disincentivize the development of forested areas.		

Detailed explanations of the boxes in **Figure 1** are provided below:

Box A The following requirement applies to all projects in the watershed of an Urban Impaired Stream (UIS) listed in Ch. 502 that will create 20,000 sq feet or more of new impervious area.

Box B The following requirement applies to all projects in the sensitive and threatened watersheds that will create one acre or more new impervious area: 75% of the figures given in **Table 1**. It would also apply to projects in Box **C** if the project's developed area was greater than 10% of the receiving watershed area at the point of discharge to the receiving water.

Core LID Requirements

Core LID standards will apply to the projects that are required to obtain a full Stormwater Law or SLODA permit[1]: all projects shown in **Figure 1**. Please note that these standards are provided as mostly elective guidelines in the current Chapter 500 and their implementation has been limited so far:

[1] The intent is to apply the core LID standards to the projects that create impervious and/or developed area and trigger the water quality level of control. Water quality treatment thresholds in current Chapter 500: ≥ 20,000 sf impervious area or ≥ 5 ac developed area for the projects in Chapter 502 watersheds. ≥ One ac impervious area or ≥ 5 ac developed area for the projects in the watersheds not listed in Chapter 502.

a. Protect natural drainageways: This standard is aimed to protect all major natural drainageways including the ones are not jurisdictional under the Natural Resources Protection Act (NRPA). Major natural drainageways are defined as the natural drainageways that (a) originate from upgradient areas and enter project site, or (b) leave project site.

> "Drainageway" Definition in Current Chapter 500:
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> *"Drainageway" means a natural or man-made channel or course to or from which surface discharge of water may occur. Drainageways include, but are not limited to streams (whether intermittent or perennial), swales, ditches, pipes, culverts, and wetlands with localized discharge of water.*

i. New Development Projects:
Major natural drainageways must be protected by undisturbed riparian buffers and maintaining their contributing drainage areas. Importance of preserving riparian buffers was demonstrated by a study of the Department that analyzed the effect of urbanization on Maine's streams (Danielson et al., 2016).

Minimum undisturbed buffer requirement will be 100 ft if the drainageway is in the jurisdiction of NRPA. It will be 50 ft for the nonjurisdictional drainageways.

A project will be considered to meet this standard unless one or more of the following conditions apply:

- Twenty-five percent or more of the contributing drainage area will change as a result of the project,
- Twenty-five percent or more of the riparian buffer area will be developed,
- Twenty-five percent or more of the drainageway length will be altered through filling.

ii. Redevelopment Projects:
If the proposed redevelopment includes a major natural drainageway altered by the existing development, the applicant must restore the altered drainageway to its pre-development condition to the extent practicable.

b. LID envelope: This standard only applies to new development projects. The proposed development footprint must be within the LID envelope to the extent practicable.

LID envelope is the area within a project site that is not within the following:

- 100 ft setback from downgradient protected natural resources and major natural drainageways,
- 50 ft setback from downgradient abutting parcel,

LID envelope also excludes the following areas:

- Hydrologic Soil Group A and B soils,
- Areas with sustained slope greater than 25%,
- Protected natural resources.

A project will be considered to meet the standard if no more than 25% of the non-linear developed area is outside the LID envelope.

c. Vegetated open-channel conveyance: Vegetated open-channels must be used for stormwater conveyance. Exceptions apply to the projects that are in the watersheds where there is a stressor of concern that may justify the use of a closed-channel system (e.g., chloride, temperature).

i. New Development Projects:

- No more than 25% of the impervious area can be served by closed-channel conveyance.

ii. Redevelopment Projects:

- If existing development has closed-channel conveyance, the proposed impervious area served by closed-channel conveyance cannot be more than 50% of the existing impervious area or 25% of the proposed impervious area, whichever is higher.

If the above requirements (*i* and *ii*) cannot be met, the applicant must demonstrate that the proposed closed-channel system is unavoidable and use vegetated open-channel conveyance to the extent practicable.

d. Utilize low-maintenance and native vegetation: Maine native or climate-resilient Northeastern native plants must be used in landscaped areas and vegetated stormwater treatment measures.

If a project cannot meet the requirements in a and/or b above, then:

- An alternatives analysis must be provided to justify that the proposed site design is the least impactful practicable alternative, and
- The project will meet the standards applicable to the projects in the sensitive and threatened watersheds (Box B and E in **Figure 1**).

Quality Treatment Requirements

The proposal intends to provide effective guidance to the regulated community by

- Clearly identifying the target stormwater pollutant,
- Providing a stressor-specific pathway to select SCMs.

The Department envisions two major pathways to be used for stressor-guided SCM selection to provide water quality level of control:

a. Conventional Pollutants: This pathway is for the pollutants that can be effectively treated by the common SCMs through physicochemical and biological operations and processes (e.g., solids, nutrients, metals, pathogens). A key LID component, stormwater retention (infiltration and evapotranspiration of stormwater), effectively mitigates these conventional pollutants.

b. Challenging Pollutants: This pathway is for the atypical stormwater pollutants which are recalcitrant, hard to treat by the common SCMs. For instance, chloride that is deliberately added on pavement for winter maintenance is a challenging pollutant which cannot be treated effectively by common SCMs and cause long-term interflow, baseflow, and groundwater contamination in the watersheds. Effective mitigation of the challenging pollutants can require a combination of stormwater source control, non-LID and/or innovative SCMs.

Performance Curve Requirement: Projects required to meet this requirement must incorporate SCMs designed in accordance with the performance curves to provide the required removal level for the pollutant of concern. There is significant amount of ongoing work in New England region to develop and update performance curves for SCMs (e.g., New England Stormwater Retrofit Manual). Therefore, existing performance curves and/or methods used to develop the performance curves can be utilized for the state's Chapter 500 program. Pollutant export coefficients will need to be assigned for commonly encountered types of developed areas. It must be noted that pollutant export coefficients are currently used to comply with the existing Phosphorus standard, Chapter 500(4)(D).

Required level of pollutant removal, the pollutant of concern for various watershed designations are given in **Table 2**.

Table 2. Pollutants of Concern, Required Level of Pollutant Removal for Various Watershed Designations.

Box	Watershed Type	Required Level of Pollutant Removal	Pollutant of Concern
D	Urban Impaired Stream	70%	Stream – Phosphorus Coastal - Nitrogen
E & **C in part**	Sensitive or Threatened & Some Large Projects in Box **C**	60%	
G	Any Lake Watershed that is not required to and chooses not to meet the Phosphorus Standard	60%	Phosphorus

Applicability: The Performance Curve Requirement must be applied to:

- Projects in the watershed of an urban impaired stream that result in 20,000 sq ft or more of impervious area,
- Projects in a "Sensitive or Threatened" watershed that result in one acre or more impervious area,
- Projects in the watershed of a "Lake Most at Risk from New Development" that are not required to and choose not to meet the Phosphorus Standard that disturb one acre or more and create 20,000 sq ft or more of new impervious area,
- Projects in the watershed of any lake other lake that are not required to or choose not to meet the Phosphorus Standard that disturb more than one acre and create more than one acre of new impervious area.

Flood Control Requirements – Box F

Flood control via peak flow attenuation (see current Flooding Standard in Chapter 500(4)(F)) can be ineffective in the highly developed Urban Impaired Stream (UIS) watersheds. An alternative approach to conventional peak flow attenuation/peak matching can be warranted for the projects in the UIS watersheds: Require a compensation fee in lieu of SCMs providing on-site detention.

The compensation fee can be used for upgrading the stream infrastructure in ways that (a) increase its capacity to handle current and expected future flow regimes to mitigate the risk of significant flooding, and (b) improve the resilience of stream channel morphology and habitat.

Potential revision of the Flooding standard will be discussed in detail in "Flood Control" proposal.

5. References

1. Danielson, T. J., Tsomides, L., Suitor, D., DiFranco, J.L., and B. Connors. 2016. Effects of Urbanization on Aquatic Life of Maine Streams. https://www.maine.gov/dep/water/monitoring/biomonitoring/materials/dep-effects-of-urbanization-on-streams.pdf

2. DEP. 2024. Maine Impervious Surface Change Tool. bit.ly/MaineISTool

3. EPA. 2022. Holistic Watershed Management for Existing and Future Land Use Development Activities: Opportunities for Action for Local Decision Makers: Modeling and Development of Flow Duration Curves (FDC 1 and 2 Projects). https://www.epa.gov/snep/holistic-watershed-management-existing-and-future-land-use-development-activities#pptsc

4. Maine Stormwater Management Law. https://www.mainelegislature.org/legis/statutes/38/title38sec420-D.html

5. Stormwater Management Rules (Chapter 500). https://www.maine.gov/sos/cec/rules/06/096/096c500.docx

6. VHB. 2022. New England Stormwater Retrofit Manual. https://snepnetwork.org/wp-content/uploads/2022/07/SNEP_Stormwater-Retrofit-Manual_July-2022-508c.pdf

7. DEP. 2016. Maine Stormwater BMP Manual. https://www.maine.gov/dep/land/stormwater/stormwaterbmps/index.html

8. Maine Natural Resources Protection Act. https://www.mainelegislature.org/legis/statutes/38/title38sec480-A.html