Proposed Requirements and Timelines to Update Development Codes to Incorporate LID

August 2010

LID development principles – Refers to LID measures authorized through a variety of local development codes beyond the stormwater code. Examples include provisions for:

- clustering and impervious surface limits (zoning and subdivision code),
- narrower roads (road standards),
- native vegetation retention (clearing and grading and subdivision code),
- reduced lot setbacks (zoning and utilities code).

Proposed Approach:

1. Permits would use the PCHB language and performance standard to frame the requirements. Jurisdictions would have flexibility in the specifics of code revisions.[i]
2. Deadlines for implementation would align with Growth Management Act (GMA) update deadlines.[ii]

The local program would require non-structural preventative actions and source reduction approaches, including low impact development techniques, to minimize the creation of impervious surfaces, and measures to minimize the disturbance of soils and vegetation where feasible and to facilitate meeting the performance standard.

Phase I and Phase II jurisdictions in King, Pierce, Snohomish, Clark, Kitsap, Thurston, Whatcom, and Clallam Counties[iii]

a. Proposed deadline to adopt LID site and subdivision performance standard, checklists, and technical practices is no later than December 1, 2014.
b. Proposed deadline to review and, as necessary to incorporate LID principles[iv], revise ordinances and other enforceable documents that apply to site and subdivision development, such as codes applying to zoning, subdivision, road and parking standards, landscaping, clearing and grading, and utilities is no later than December 1, 2014.

Phase II jurisdictions in Island, Skagit, Lewis, Cowlitz, and Grays Harbor Counties

a. Proposed deadline to adopt LID site and subdivision performance standard, checklists, and technical practices is no later than December 1, 2015

b. Proposed deadline to review and, as necessary to incorporate LID principles, revise ordinances and other enforceable documents that apply to site and subdivision development, such as codes applying to zoning, subdivisions, road and parking standards, landscaping, clearing and grading, and utilities is no later than December 1, 2015.[v]

END NOTES

[i] Ecology proposes to use the performance standard to drive the use of LID techniques and development principles. Most projects meeting the threshold would need to use development principles such as narrower roads, clustering, or retention of native vegetation to meet the performance standard. Ecology's proposed approach is consistent with past practice of setting a hydrologic performance standard and providing a menu of BMPs and practices to achieve that performance standard. This allows developers flexibility in applying LID techniques and development principles to specific sites and project designs. It also provides each local government the flexibility to determine which development principles work best in its jurisdiction.

[ii] The 2010 Washington State Legislature delayed the GMA deadlines to update comprehensive plans and development codes to changes in the GMA by three years from previous deadlines. By proposing to align the deadline for LID development code updates with the new GMA update deadlines, Ecology intends to provide efficiencies for concurrent review, amendment, and public process. Ecology also proposes the deadlines in response to input from advisory committee members that local governments prefer to amend the stormwater codes at the same time as other development codes. This is in part for efficiency, but additionally because developments will need to use the LID development principles to meet the performance standard.

[iii] Because the GMA update deadlines apply to the counties and all the cities within those counties, aligning the LID deadline means that some of the Phase II cities and counties have the same deadline as the Phase I permittees. New permittees under the 2012 permit would not be subject to this deadline.

[iv] Ecology proposes to require review and revision of codes "as necessary" rather than identifying and requiring amendment of specific development codes. That level of specificity is not possible because local government codes vary widely in organization, terminology, and approach. In addition, many local governments already have adopted some LID development principles, and permit language requiring an amendment to those codes is unnecessary and could raise concerns about compliance.

[v] Aberdeen is the only Phase II with a proposed LID deadline that does not align with the GMA update deadline. The city is in a non-GMA county and has a deadline to update critical areas and resource lands ordinances no later than December 1, 2017. Because this date is after the end of the next permit term, we are proposing a deadline of December 1, 2015 to adopt LID site and subdivision standards and development principles.

Proposed Requirements for Basin-Scale Approach

August 12, 2010

Proposed Approach: When permittees take land use actions to significantly increase the Urban Growth Area (UGA) or to significantly increase densities, the permit would require the local government to conduct an analysis of impacts to water quality and hydrology and a description of the public interest rationale for the action. The outcome of the analysis would be sub-basin targets established to prevent or mitigate impacts of the action, and a description of the measures the local government will take to achieve those targets. [i] The analysis would be subject to a public review process.

A. Actions that would trigger an analysis under this proposed approach
   1. Significant expansion of UGA
      a. Proposed definition of "significant" as 80 acres or ≥5% of area of the existing UGA, whichever is smaller[ii]. The requirement would apply to cumulative increases in area.
      b. Ecology would encourage permittees to conduct an analysis beyond the immediate incremental increase in the UGA to address a longer-term expansion area. This could be done at a 7-year Growth Management Act (GMA) update, a 10-year UGA review[iii], or at any annual Comprehensive Plan amendment.[iv]
   2. Significant increase in density
      a. Proposed definition of "significant" as any increase in density for an area of 80 acres or, for cities, ≥5% of the area of the incorporated city, whichever is smaller. The requirement would apply to cumulative areas of increases in density.
      b. If there is a density range (e.g., 4-8 du/acre), the analysis would address the higher density.
B. Water quality impact and mitigation analysis
   Ecology recognizes that urbanization of relatively undeveloped areas and significant increases in density will impact water quality and hydrology. Current GMA and State Environmental Policy Act (SEPA) laws require a review of these impacts and measures to prevent or mitigate for those impacts. The analysis could be incorporated into those processes or as a separate public process.[v]

   1. The proposal would require an analysis that includes[vi] the following:

a. An assessment of the predicted water quality impacts from the proposed UGA expansion and/or increase in density (done with models at the sub-basin or basin scale).
b. Pollution prevention measures and other mitigation alternatives. The analysis would establish mitigation targets to track for the sub-basin. For example, targets in some sub-basins could include setting limits on the maximum impervious area and minimum area to be retained as native vegetation.
c. The public interest benefits of the action, including social, environmental, and economic benefits. The public interest intersection with GMA is as follows:
    - **UGA Expansion:** It is in the public interest under GMA goals to concentrate growth in UGAs and to provide sufficient land to accommodate growth.
    - **Increase Density Inside UGAs:** It is in the public interest as a GMA goal to have higher density in UGAs.
    - **Increase Density Outside UGAs:** It would be more difficult to justify these actions as consistent with GMA goals, however stormwater impacts at rural densities (1 dwelling unit/5 acres) are much easier to mitigate.[vii]

2. Compliance with the permit would be achieved by conducting the analysis and including it in the public process either as part of SEPA or under the public process for the GMA action.
3. At a minimum, the analysis would:
    a. be conducted at the appropriate sub-basin or basin scale to address upstream and downstream impacts to hydrology and water quality,
    b. include a statement of benefits and costs of the social, economic, and environmental effects associated with the action, including impacts to hydrology and water quality,
    c. identify the best combination of measures to prevent or minimize the impacts to hydrology and water quality,
    d. set targets to track such as for sub-basin impervious surface limits and native vegetation retention[viii]. The targets and measures to achieve them would be the primary outcome of the analysis.
4. The action could not allow a violation of water quality standards.

Implementation and Timing

1. For fully-planning GMA jurisdictions, Ecology proposes to require this analysis for a significant UGA expansion or density increase after 6 months from the effective date of the permit.

2. For non-fully planning GMA jurisdictions (applies only to the City of Aberdeen) Ecology proposes to require this analysis for a significant expansion of boundaries of the incorporated city or density increase after 6 months from the effective date of the permit.

END NOTES

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[i] Ecology proposes to apply the requirement for basin (or sub-basin) analysis based on specific actions or triggers, rather than imposing a general basin planning requirement. This approach addresses future changes in land cover, hydrology, and water quality resulting from increased urbanization.

[ii] Ecology proposes definitions of "significant" and requests advisory committee input on these thresholds.

[iii] The GMA requires cities and counties to provide sufficient land capacity for the 20-year projected growth. (RCW 36.70A.115) Fully-planning local governments must conduct a review of the UGA and densities at least every 10 years (RCW 36.70A.130(3)(a).

[iv] Ecology intends to provide local government permittees with some flexibility in the timing for such an analysis, especially since the trigger actions can occur with any comprehensive plan amendment. Ecology also encourages local governments to use either the GMA public process and/or the SEPA process, but does not specify a public process mechanism.

[v] A consideration of the impact of such actions to water quality and beneficial uses is already required under GMA and SEPA:

a. The State Environmental Policy Act (SEPA) RCW 43.71C.020:

(1) The legislature, recognizing that a human being depends on biological and physical surroundings for food, shelter, and other needs, and for cultural enrichment as well; and recognizing further the profound impact of a human being's activity on the interrelations of all components of the natural environment, particularly the profound influences of population growth, high-density urbanization, industrial expansion, resource utilization and exploitation, and new and expanding technological advances and recognizing further the critical importance of restoring and maintaining environmental quality to the overall welfare and development of human beings, declares that it is the continuing policy of the state of Washington, in cooperation with federal and local governments, and other concerned public and private organizations, to use all practicable means and measures, including financial and technical assistance, in a manner calculated to: (a) Foster and promote the general welfare; (b) create and maintain conditions under which human beings and nature can exist in productive harmony; and (c) fulfill the social, economic, and other requirements of present and future generations of Washington citizens.

(2) In order to carry out the policy set forth in this chapter, it is the continuing responsibility of the state of Washington and all agencies of the state to use all practicable means, consistent with other essential considerations of state policy, to improve and coordinate plans, functions, programs, and resources to the end that the state and its citizens may:

(a) Fulfill the responsibilities of each generation as trustee of the environment for succeeding generations;

(b) Assure for all people of Washington safe, healthful, productive, and aesthetically and culturally pleasing surroundings;

(c) Attain the widest range of beneficial uses of the environment without degradation, risk to health or safety, or other undesirable and unintended consequences;

(d) Preserve important historic, cultural, and natural aspects of our national heritage;

(e) Maintain, wherever possible, an environment which supports diversity and variety of individual choice;

(f) Achieve a balance between population and resource use which will permit high standards of living and a wide sharing of life's amenities; and

(g) Enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources.

(3) The legislature recognizes that each person has a fundamental and inalienable right to a healthful environment and that each person has a responsibility to contribute to the preservation and enhancement of the environment.

b. The GMA (RCW 36.70A.070(1) in the land use element:

"Where applicable, the land use element shall review drainage, flooding, and storm water run-off in the area and nearby jurisdictions and provide guidance for corrective actions to mitigate or cleanse those discharges that pollute waters of the state, including Puget Sound or waters entering Puget Sound."

[vi] Ecology plans to provide guidance for this analysis when it issues the draft permits.

[vii] This requirement would also apply to other rural lands such as Limited Areas of More Intense Rural Development (LAMIRD). The authority for counties to designate LAMIRDs is found in the GMA under RCW 36.70A.070(5)(d). They are unincorporated rural areas of more intensive rural development that existed prior to July 1, 1990.

[viii] Ecology recognizes that local governments may set targets other than maximum percent of sub-basin impervious area or minimum percent of vegetated area for some sub-basins. The specific targets would depend on the existing level of development or other factors. For example, in some sub-basins a mitigation target could be a structural retrofit project, or reducing densities in another part of the sub-basin. In other sub-basins a county could propose to expand a UGA in one area and propose to mitigate the action by reducing the UGA in another area.

Ecology Proposal for LID Site and Subdivision Technical Requirements

August 12, 2010

Ecology's presents proposed LID technical requirements for site and subdivision scale development and redevelopment as outlined below:

A. Table of LID Requirements—refer to End Notes for annotated comments on the rationale for the requirements.

B. LID Requirements Table—Clarifications
   Explanation of mandatory checklists
   LID Performance Standard
   Full Dispersion Option
   Treatment Credits

C. LID Requirements in Specific Areas
   Flow Control Exempt Areas
   Projects on Outwash Soils
   Projects in Highly Urbanized Basins

D. Technical Considerations
   Identification of Permeable Pavement Infeasibility
   Procedures for Identifying Saturated Hydraulic Conductivity

Attachment #1 – Feasibility Review Criteria

Attachment #2 – Results of Updated Modeling Summary

LID Curves

Low Impact Development Minimum Requirements for New Development and Redevelopment

A. Table of LID Requirements

Type of Development	Saturated Hydraulic Conductivity[i] > 0.15 inch/hour	Saturated Hydraulic Conductivity ≤ 0.15 inch/hour
New Development—Inside UGA[ii] Based on project size[iii]:		
<2,000 sq ft hard surface; < 7,000 sq ft disturbed area	No LID requirements.	No LID requirements.
>2,000 sq ft hard surface or > 7,000 sq ft disturbed area	M.R. #5-Onsite SW BMP's expanded to include infiltration below pavement unless engineering infeasibility.	M.R. #5-Onsite SW BMP's expanded to include infiltration below pavement unless engineering infeasibility. .
>10,000 sq ft hard surface, or >3/4 acre disturbed but < 5 acres disturbed	Performance Standard[iv] or Mandatory list #1[v] (applicant option). Engineering & competing needs feasibility review.[vi] Cost analysis[vii] for commercial green roofs.	Performance Standard or Mandatory list #2[viii] (applicant option). Engineering & competing needs feasibility review. Cost analysis for commercial green roofs.
>5 acres disturbed, or part of a larger common plan of development or sale exceeding 5 acres	Performance Standard with Engineering & competing needs feasibility review. Cost analysis for commercial green roofs.	Performance Standard or Mandatory list #2 (applicant option). Engineering and competing needs feasibility review. Cost analysis for commercial green roofs.
New Development—Outside Current UGA/CUA		
Parcels below 5 acres	See above.	See above.
≥ 5 acres and any project on parcels 5 acres or larger	Performance standard.	Performance standard.
Redevelopment—Outside UGA/CUA		
Parcels below 5 acres	See above for new hard surfaces. If value of improvements > 50% of existing, apply LID to replaced hard surfaces too.	See above for new hard surfaces. If value of improvements > 50% of existing, apply LID to replaced hard surfaces too.
≥5 acres and any project on parcels 5 acres or larger	Performance standard for new hard surfaces. Cost feasibility analysis only for green roofs. If > 50% value, Performance Standard for replaced hard surfaces.	Performance standard for new hard surfaces. Cost feasibility analysis only for green roofs. If > 50% value, Performance Standard for replaced hard surfaces.

Type of Development	LID Requirement
Redevelopment—Inside UGA Based on project size:	
<2,000 sq ft new hard surface; < 7,000 sq ft disturbed area	No LID requirements.
>2,000 sq ft new hard surface; > 7,000 sq ft disturbed area	M.R. #5-Onsite SW BMP's expanded to include infiltration below pavement unless engineering infeasibility.
>10,000 sq ft new hard surface; >3/4 acre conversion. See below for replaced hard surfaces	Mandatory list #2 or Performance Standard (applicant option), with Engineering & Competing needs feasibility review for these new surfaces. Cost feasibility review only for green roofs.
>5 acre project site or part of a larger common plan of development or sale exceeding 5 acres. See below for replaced hard surfaces	Mandatory list # 1* or Performance Standard (applicant option), with Engineering & Competing needs feasibility review. Cost feasibility review only for green roofs.
Replaced hard surfaces: Where the 50% area or value thresholds are exceeded	The applicable mandatory list* or Performance Standard (applicant option) with Engineering & Competing needs feasibility review.

*Use mandatory list #2 if saturated hydraulic conductivity is < 0.15 in/hr

B. LID REQUIREMENTS TABLE - CLARIFICATIONS

1. *Mandatory List #1: Items below are mandatory unless otherwise noted*
    a. On-site SW Management BMP's of M.R. #5
    b. Use site- appropriate development principles to retain native vegetation and minimize impervious surfaces to the extent feasible as required by local code.
    c. Infiltration below pavement (permeable pavement or impermeable pavement with collection and redistribution below) for new and replaced (if 50% cost or space threshold exceeded)hard surfaces, e.g., public and private walks, driveways, patios, sports courts, roads, parking lots
    d. Rain Gardens meeting a minimum size designation and through which all runoff and overflow from permeable pavement storage basins must pass. Rain gardens should comprise at least 7.5% of residential developments and 4% of commercial developments.
    e. For commercial buildings (not single family residences), green roofs or an impervious roof with runoff routed below the parking lot (cost analysis to claim unreasonableness of green roof if parking lot option not used)

2. *Mandatory List #2 : Items in list are mandatory unless otherwise noted*

   Same as list #1 without rain gardens

3. *LID Performance Standard*

The proposed LID Performance Standard requires meeting ***historic*** flow durations from 8% of the 2-year flow through 50% of the 2-year flow. In basins designated by Ecology as "highly urbanized" (> 40% TIA as of 1985), the LID Performance Standard requires meeting ***existing*** flow durations from 8% of 2-year flow through 50% of the 2-year flow. Project sites which must meet minimum requirement #7 – flow control, and the LID performance standard must meet flow durations between 8% of the 2-year flow through the full 50-year flow.

4. *Full Dispersion Option*

Projects meeting full dispersion (65/10/0) allowed in all development situations. Full dispersion meets treatment, flow control (stream protection), and LID performance standards.

5. *Treatment credits*

An additional benefit of LID techniques is that they provide water quality treatment. Projects can claim to partially or wholly meet their water quality treatment obligations through LID techniques. The water quality requirement would be to treat 91% of the total runoff file water volumes that either enter or bypass LID techniques that provide the adequate level of treatment. Cumulative water volumes that have passed through bioretention soils or through native soils (that meet the soil quality criteria) beneath pavements can be tracked by approved continuous runoff models. Those volumes can be subtracted from the 91% target. Projects not fully meeting the 91% target through approved LID techniques must locate approved, engineered treatment systems sized to effectively treat sufficient additional runoff to raise the treated runoff volume to at least 91%.

C. LID REQUIREMENTS IN SPECIFIC AREAS

6. *Flow Control Exempt Areas*

At project sites which drain to surface waters not significantly impacted by hydrologic changes caused by development (see Appendix I-E, Flow Control Exempt Surface Waters in the Western Washington storm water manual), the LID requirement is modified. LID techniques and principles have pollution control benefits as well as hydrologic benefits. Therefore, the requirement for LID techniques can be restricted to those surfaces that are pollution-generating.

- Projects are relieved from meeting the flow control standard (matching flow durations from 50% of the 2-year through the 50-year flows).

- Projects may choose to meet the LID performance standard (match durations from 8% of 2-year through 50% of 2-year flow), or apply the LID techniques from the applicable mandatory list only to pollution-generating surfaces.
- In these areas, lists #1 and #2 do not require rain gardens serving non-PGIS or non-PGPS, nor infiltration below non-PGIS (sidewalks, patios). Also, for commercial sites, roof runoff control via infiltration below permeable pavement or application of green roof technology is not required unless the roof is classified as a Pollution-Generating Impervious Surface (roofs are classified as PGIS if they are metal or vent a significant amount of pollutants).

7. Projects on Outwash Soils

At project sites on soils with higher infiltration rates characteristic of outwash soils, the performance standard may be achieved with the use of a centralized retention (a.k.a. infiltration) basin. The minimum requirements for treatment, including pre-treatment prior to infiltration, must also be achieved.

8. Projects in Highly Urbanized Basins

Ecology has allowed a reduced stream protection standard in highly urbanized basins (defined as basins with 40% or more total impervious area as of 1985, as further identified on maps released by Ecology). That standard is to match durations produced by the existing land cover of the project site. If Ecology retains that standard, it follows that the LID standard should also be based on matching durations to the existing land cover. The same rationale for the stream standard applies to the LID standard. Until such time as a basin-specific strategy for improving hydrology and habitat conditions is developed, it is difficult to justify matching flow durations to an historic land cover condition.

D. TECHNICAL CONSIDERATIONS

9. Identification of Permeable Pavement Infeasibility

Ecology would appreciate additional input to establish instances where permeable pavements, or impermeable pavements with re-distribution of runoff below the pavement, should be considered not feasible

Possible Example: Roads with AADTs above 10,000 and any collector/distributor or arterial

10. Updated Guidance on Procedures for Identifying Saturated Hydraulic Conductivity:

This performance standard approach requires assessment of project site saturated hydraulic conductivity rates. Revised guidance re how to establish short-term and long-term rates and averaging rates across a site would be needed.

END NOTES

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[i] The primary intent and benefit of LID is to retain and infiltrate storm water on the project site. Where the underlying soil has extremely low infiltration capability, there is minimal ability to infiltrate deeply. In those instances, it would be very difficult to impossible for a project to meet the performance standard as measured by the accepted runoff models. The project would have to export water from the site through rainwater harvesting, internal use, and discharge to a sanitary sewer, which would have to discharge through a municipal sewage treatment plant out of the basin. Ecology has decided that rainwater harvesting is not an LID technique that is ready for common use throughout western Washington.
Ecology has revised the high density residential and commercial projects examples presented earlier to the committee and varied the assumed site infiltration rates to determine a minimal infiltration rate at which it could expect compliance with the performance standard (See Attachment #2). The examples assumed extensive use of permeable pavement and rain gardens, and detention facilities to meet both the proposed LID standard and the stream protection standard. Further description of the assumptions is available in the January 25th meeting materials posted at the LID Technical Committee website. Based upon those examples, Ecology has decided to place the minimal infiltration rate for the performance standard at 0.15 inches per hour. Compliance with both performance standards is considered reasonably achievable with the assumed LID techniques and a detention facility which is not any larger than if LID techniques were not used.

[ii] Areas outside the UGA generally have much less land disturbance and corresponding higher quality aquatic habitat and resources. We want to preserve that high quality. Because most parcels are multiple acres, there are more storm water management options for keeping runoff on-site and meeting the hydrologic performance standard.
Inside the UGA, there can be more confounding factors that make keeping runoff on-site more difficult and application of some LID techniques impractical or unwise. So, while we would prefer all sites to meet the performance standard, it may not be feasible in some cases. Therefore it is appropriate to identify instances that warrant relief from the standard. But even in these instances, some LID techniques and principles are appropriate and implementable and should be used.

[iii] Ecology has long-standing guidance and permit requirements for triggering storm water requirements based upon project size. To reduce regulatory confusion, Ecology considers it appropriate to use those same size thresholds to apply project-level LID requirements.

The lowest level of triggers, 2,000 sq. ft. of impervious area and 7,000 sq. ft. of disturbed area are used to apply Minimum Requirement #5, On-site Stormwater Management BMP's. These are BMP's that are considered appropriate for a single family home or a small commercial project. They generally do not require the services of a professional engineer. The existing M.R. #5 requires implementation of a soil quality and depth standard, and roof and driveway dispersion or infiltration depending upon project soil type. To these requirements, we propose to add use of permeable pavements. A drawback with this approach is that professional services may have to be employed to justify not using permeable pavement. e.g., confirmation of a seasonal high groundwater table.
At 10,000 sq. ft. of impervious area, or conversion of ¾ acres of native vegetation to lawn/landscape, or conversion of 2.5 acres of native vegetation to pasture, the stream and wetland hydrologic performance standards apply. Since the primary need for the LID requirement is to reduce hydrologic disruption caused by projects, Ecology decided to use these same project sizes to trigger the performance standard and the mandatory lists of LID techniques. Compliance with the performance standard requires the services of a professional engineer.
Also, the larger the project, the less potential for surrounding development to restrict LID options, and more options are available to the developer (e.g., location of developed and undeveloped areas, location and options for LID techniques.). Therefore, for sites that have sufficient locations to infiltrate storm water at or above 0.15 in./hr, Ecology has chosen 5 acres as a project size which should be expected to meet the performance standard without the option of simply using the mandatory list option.

[iv] Ecology has indicated that its bottom line interests lie in preserving and to the extent possible restoring high quality aquatic natural resources. So, Ecology prefers having an aspect to the LID requirement that focuses on the achievement of a hydrologic performance standard that would significantly reduce alterations in the natural hydrology and thus impacts on the beneficial uses dependent on that hydrology. Ecology already has a stream erosion protection standard that controls the duration of flows in the range of ½ the 2-year flow to the 50-year flow. But that standard is only intended to prevent accelerated stream channel erosion. It controls flows that are exceeded 1% of the time or less in a natural land cover situation. It does not guard against other significant alterations in the natural hydrology that impact the beneficial uses. Those alterations commonly occur with land development in most watersheds in western Washington.
The proposed LID standard extends the lower limit of the range of flows whose duration must be matched to 8% of the 2-year flow. That flow rate is associated with flows that are exceeded approximately 10% of the time and less. Extending the duration standard to the 10% level will also have the effect of reducing the magnitude of deviations in the flows that are exceeded greater than 10% of the time as compared to deviations from historical flows by projects that only have to match durations to the flows occurring at 1% frequency and lower. Ecology cannot quantify the relative benefits to the beneficial uses of this more stringent standard. It can say that more closely matching the natural hydrology will reduce the impact of land development on the physical aspects of surface water habitat, and will reduce pollutant loading to surface waters through trapping of pollutants in the soils.
The 10% exceedance level was selected because matching flows up to that level is readily achievable with LID techniques that Ecology considers to be AKART. However, the proposal allows the developer to choose a different combination of LID techniques than those in the "mandatory list" as long as the performance standard is achieved.

[v] State water pollution control laws require the use of all known available and reasonable treatment (AKART) to control and prevent pollution must be implemented regardless of the quality of the receiving waters. The federal

Clean Water Act has a similar technology-based requirement. The Pollution Control Hearings Board has indicated that some amount of LID should be considered AKART.
Ecology considers the LID techniques and principles in the Mandatory Lists as AKART unless there are engineering/site or competing need constraints. Ecology has concluded that a reasonable application of those techniques can result in achieving the proposed performance standard at even high density project sites. If one or more LID techniques cannot be applied at a site, the performance standard does not have to be achieved, but the use of all the remaining LID techniques on the applicable "mandatory list" is required.

[vi] Ecology and the advisory committees generally agreed that there are instances where an LID technique is either infeasible or not advisable for public health and safety reasons. Ecology has drafted a list of engineering/site constraints for each of the three LID techniques – rain gardens, permeable pavements, and green roofs - that play prominent roles in this proposal. (See Attachment #1.) The lists are primarily drawn from LID advisory committees' input; a matrix developed by the local American Public Works Association storm water managers group; and AHBL Consultants on behalf of the Puget Sound Partnership.
Ecology also proposes to identify a "Competing Needs" list that could be used to disqualify use of LID techniques on a project level. The committees discussed situations where LID techniques or principles could conflict with other requirements, local codes, local vision, values or preferences. Ecology can agree to relief from a requirement where it conflicts directly with another state or federal mandate. Ecology cannot agree to granting relief from local preferences, values, or vision on a general basis. Ecology may be able to concur with a municipal decision to grant relief on a case-by-case basis using the variance/exception provisions.

[vii] Based on their extensive use in Europe and expanding use on commercial buildings in the United States, Ecology considers green roofs a proven and accepted LID technology. However, in many instances, a building can more effectively reduce its surface runoff by routing impervious roof runoff to its pervious parking area. If a project chooses the latter, no cost analysis is necessary. If a project chooses to not route its runoff to its parking area - or cannot send it there because of a site limitation reason - and also to not employ a green roof, then a cost analysis is called for. Though green roofs can have a lower lifetime cost, their initial construction cost is higher. However, Ecology does not have the benefit of substantial local experience with green roofs to propose a generic cost basis for deciding when a green roof is cost reasonable or not. By requiring projects to submit a comparison of the cost of green roof installation over a standard roof, it may be possible to eventually establish a basis.
Green roofs have not been introduced into mainstream residential development sector nearly as extensively. Therefore, Ecology has not assumed that they are an accepted residential LID technology, and has not yet added green roofs to the "Mandatory Lists."

[viii] Ecology has not included rain gardens in mandatory list #2 to reduce the potential for extended periods of standing water in late spring. During the height of the mosquito breeding season, the presence of shallow water for 4 to 7 days will enable mosquito development. A rain garden with a 12-inch water depth and a 0.1 inch per hour infiltration rate will have standing water for 120 hours (5 days).

Attachment #1
Feasibility Review Criteria

I. Site/Engineering Constraints

A. Bioretention/Rain Gardens

Land is within area designated as a Landslide Hazard Area.

Site cannot be reasonably designed to locate bioretention facilities on slopes less than 15%.

Bioretention would be located within 50 feet from the top of slopes that are > 20%.

Geotechnical evaluation recommends infiltration not be used anywhere within the project area due to plausible concerns about erosion, or slope failure.

Within 100 feet of a known contaminated site or abandoned landfill.

Within 100 feet of a drinking water well, a spring used for drinking water supply, or an onsite sewage disposal drainfield.

Within 10 feet of an underground storage tank.

Within local setbacks from structures.

Where the drainage area is less than 5,000 sq. ft. of pollution-generating impervious surface, or less than 10,000 sq. ft. of impervious surface; or less than ¾ acres of lawn & landscape, the minimum vertical separation of 1 foot to the seasonal high water table, bedrock, or other impervious layer is not achieved.

Where the drainage area is more than any of the above amounts, and cannot reasonably be broken down into amounts smaller than those designated above, the minimum vertical separation of 3 feet to seasonal high water table, bedrock, or other impervious layer is not achieved.

Test pits determined the native soil infiltration rate to be less than 0.15 inches per hour.

Bioretention facilities not compatible with surrounding drainage system.

B. Permeable Pavements

Land is within area designated as a Landslide Hazard Area

Geotechnical evaluation recommends infiltration not be used anywhere within the project area due to plausible concerns about erosion, or slope failure

Within 100 feet of a known contaminated site or abandoned landfill

Within 100 feet of a drinking water well, a spring used for drinking water supply, or an onsite sewage disposal drainfield.

Site cannot reasonably be designed to have pavement surface at less than 5 percent slope. Portions of pavements that must be laid at greater than 5 percent slope must prevent drainage from upgradient base courses into its base course.

Native soils below the road do not meet the soil suitability criteria for providing treatment. Note: a six-inch layer of media meeting the soil suitability criteria or the sand filter specification can be placed within the subgrade to meet the treatment requirement.

Site design cannot avoid putting pavement in areas likely to have long-term excessive sediment deposition after construction (e.g., construction and landscaping material yards)

Sites down slope of steep, erosion prone areas that are likely to deliver sediment

Sites where the risk of concentrated pollutant spills is more likely such as gas stations, truck stops, and industrial chemical storage sites

Sites where seasonal high groundwater creates prolonged saturated conditions at the ground surface, within the wearing course, or within one foot of the bottom of the base course.

Sites that receive regular, heavy applications of sand to maintain traction during winter

Site design cannot avoid a contributing tributary impervious area that is more than 3 times larger than the permeable facility

Infiltrating and ponded water below new permeable pavement area will compromise adjacent impervious pavements.

C. Green Roofs

Roof design has a slope greater than 20%.

Building cannot technically be designed to accommodate structural load of a green roof.

II. Competing Needs

A. The LID requirement is superseded by other federal and state requirements.

B. The LID requirement is not superseded by:

- local community values and vision,
- Growth Management Act requirements (GMA requirements are compatible with LID).

Attachment #2
Results of Revised Computer Modeling of 10 Units/Acre & Commercial Development

Development layouts and most assumptions used in examples by SvR were retained.

The assumptions changed by Ecology were:

In the 10 DU/acre example:

Eliminated the small, private bioretention facilities on individual lots. Area converted to lawn/landscape. Larger bioretention along the road retained.

Used Run B which assumes the public road is permeable.

In the Commercial example:

Ran two scenarios: green roof; impermeable roof to infiltration below parking lot.

Green roofs represented in the model as ½ impervious/ ½ grass rather than as all grass.

Used Run A which assumes the public road and the truck delivery access are impervious.

In both examples:

Long-term infiltration below permeable pavements used a correction factor that cut the initial infiltration in half. For example, @ initial of 0.25 in/hr, the long-term rate = 0.125 in/hr.

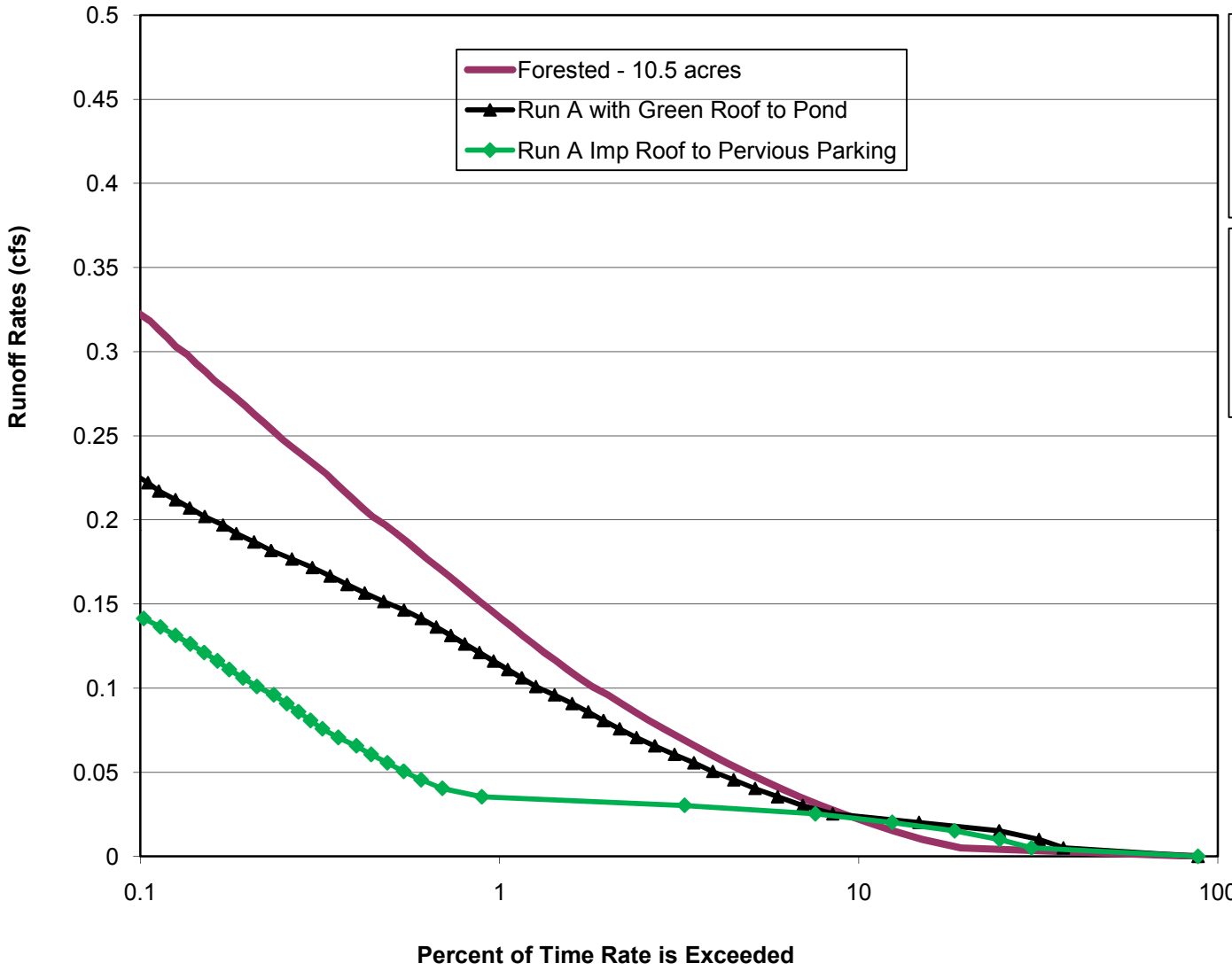
Additional runs assuming 0.15 in/hr and 0.1 in/hr initial infiltration rates.

Summary of Results

"Yes" means the standard was met. "No" means it was not met.

Development Type & Infiltration Rate	Flow Duration Standard	Volume Standard
10 DU/ac @ 0.1 in/hr	No	No
Commercial @ 0.1 in/hr & Green Roof	No	No
Commercial @ 0.1 in/hr & Roof to Parking Lot	Yes	No
10 DU/ac @ 0.15 in/hr	Yes	No
Commercial @ 0.15 in/hr Green Roof	Yes	No
Commercial @ 0.15 in/hr & Roof to Parking Lot	Yes	Yes
10 DU/ac @ 0.25 in/hr	Yes	Yes
Commercial @ 0.25 in/hr	Yes	Yes

Scenario 5 / Commercial *
Infiltration Rate = 0.15 in/hr



Runoff Volumes:

10 ac Drainage+0.5 ac Pond
10.5 ac Forested = 301 ac-ft
Green Roof = 359 ac-ft
Imp Roof to Parking = 222 ac-ft

Pond Area:

8% of 2 yr to 50 yr
Green Roof = 0.9 ac
Imp Roof to Parking = 0.68 ac

**** Changes from SVR Jan 2010 are***:

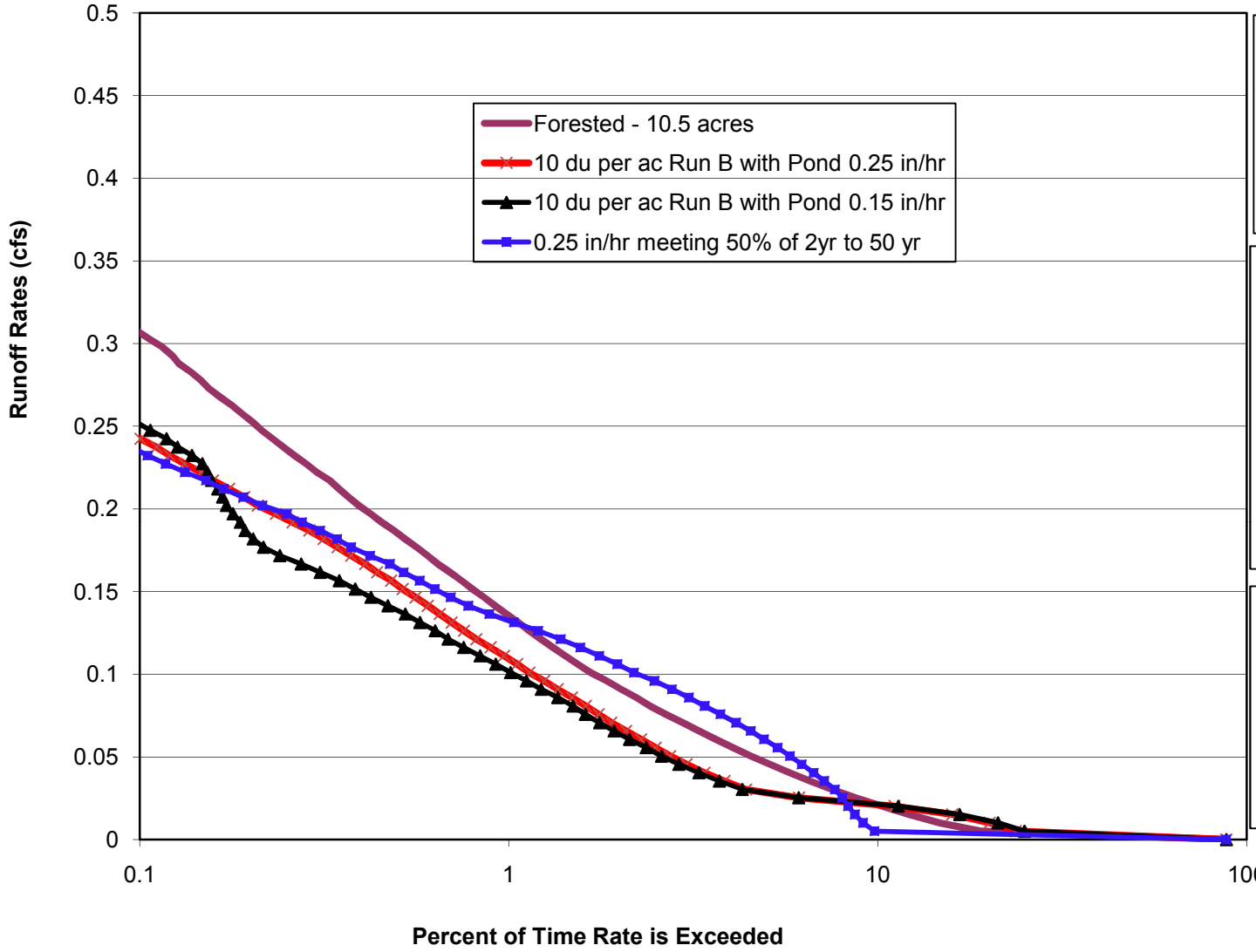
Green Roof Modeled as half Lawn half Impervious

Coventional/Imp Roof to Parking

Perm Pave Infiltration Reduction Factor = 0.5

Delivery+Public Rds are Impervious to Public Bio-Retention.

0.25 in/hr, 0.15 in/hr, & 0.1 in/hr Infiltration Rates Scenario 4 *



Runoff Volumes:

SVR area adds to 10 ac
10 ac Forested = 287 ac-ft
0.25 in/hr = 250 ac-ft
0.15 in/hr = 363 ac-ft
0.10 in/hr = 439 ac-ft

Pond Area:

8% of 2 yr to 50 yr
For 0.25 in/hr = 0.54 ac
For 0.15 in/hr = 0.65 ac
For 0.10 in/hr *Infeasible*

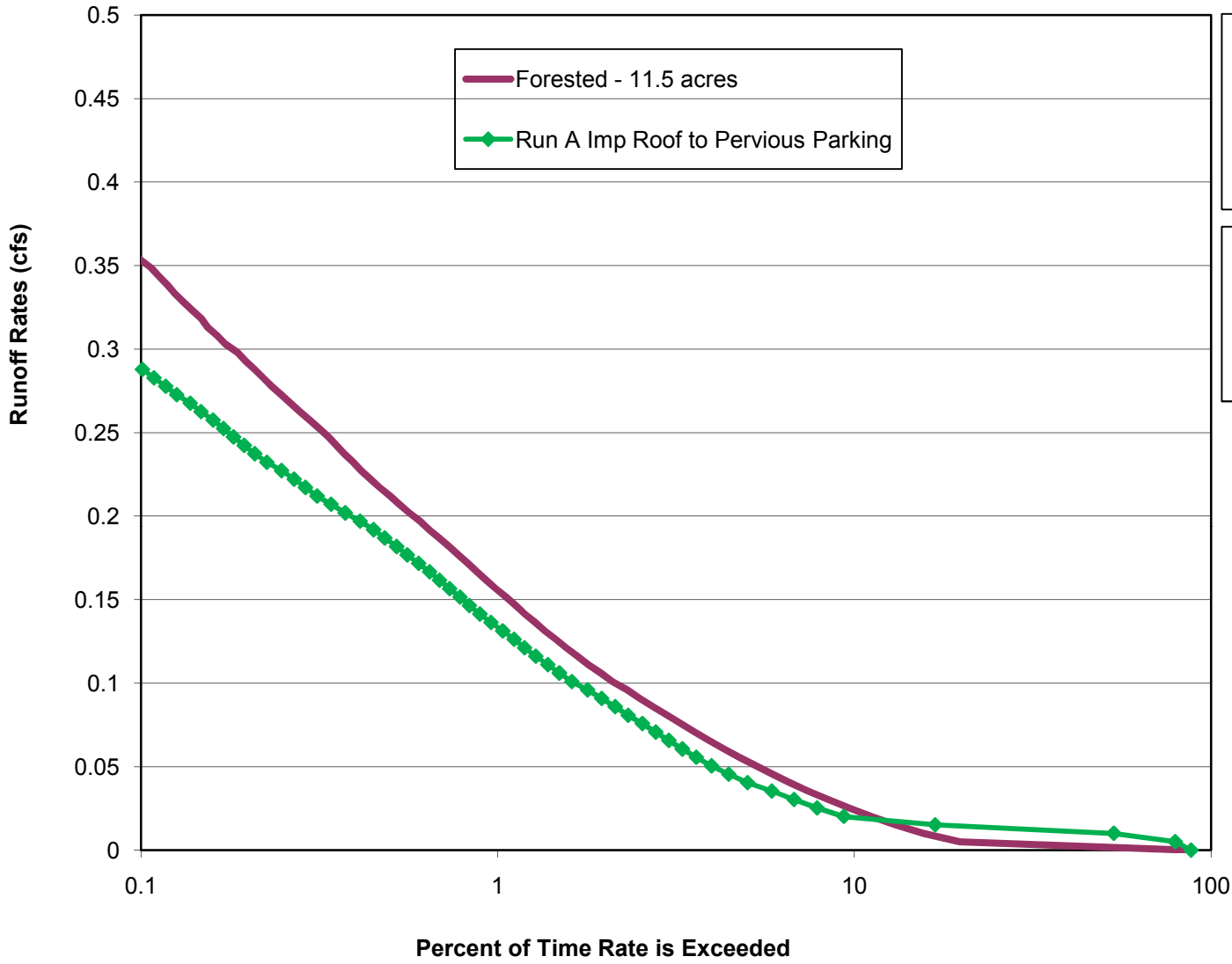
50% of 2 yr to 50 yr
For 0.25 in/hr = 0.43 ac
Without LID = 0.84 ac

**** Changes from SVR Jan 2010 are:***

Perm Pave Infil tration Reduction Factor = 0.5

No Private Bio-Retention.

Infiltration Rate = 0.1 in/hr Scenario 5 / Commercial *



Runoff Volumes:

10 ac Drainage+1.5 ac Pond
11.5 ac Forested = 330 ac-ft
Imp Roof to Parking = 336 ac-ft
Green Roof = 431 ac-ft

Pond Area:

8% of 2 yr to 50 yr
Imp Roof to Parking = 1.18 ac
Green Roof = *Infeasible*

**** Changes from SVR Jan 2010 are***:

Green Roof Modeled as half Lawn half Impervious

Coventional/Imp Roof to Parking

Perm Pave Infiltration Reduction Factor = 0.5

Delivery+Public Rds are Impervious to Public Bio-Retention.