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Low impact site design

Practices that protect and preserve natural resources

GREEN
from the Ground Up

This fact sheet is one of a series on nature-friendly development practices created by Metro through its Nature in Neighborhoods initiative.

Nature-friendly development practices minimize the impact of development on natural resources and can help developers save money and add value to their properties.

Nature in Neighborhoods is Metro's long-term effort to protect and restore fish and wildlife habitat throughout the urban area and ensure that every citizen in the region has access to nature.

Low impact site design uses planning techniques that are intended to conserve the natural systems and hydrologic functions of a site. Successful site planning and design concepts integrate these key concepts:

- preserve natural areas and minimize land disturbance
- protect and incorporate natural systems (wetlands, stream/wildlife corridors, mature forests, native vegetation) into site plans
- design new landscape elements to mimic natural systems
- use creative lot layouts and roadway configurations to preserve natural features
- minimize effective impervious surface area
- retain on-site native soil and vegetation, allowing them to soak up stormwater
- minimize soil compaction
- orient lots and buildings to maximize on-lot infiltration or open conveyance through swales or rain gardens to downstream stormwater facilities
- locate lots adjacent to or with views of natural areas to improve aesthetics and privacy
- design swales and rain gardens as visual features
- retain buffers along streams and rivers.

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Benefits/added value
Communities designed to maximize open space and preserve mature vegetation generally have been found to be highly marketable and command higher lot prices. Cost savings and other benefits include:

- reduced wetland impacts and associated impact or mitigation fees
- reduced land clearing and grading costs
- reduced stormwater management, site infrastructure and associated maintenance costs
- integration of the built environment with the natural environment, creating a strong sense of place
- balanced growth with environmental protection
- preservation of habitat for wildlife and native plants, improved air and water quality
- protection of regional water quality by reducing sediment, nutrient and toxic loads in water bodies
- preserving the features that make our region unique, desirable and beautiful for future generations.

Achieving low impact site design

Step one: site inventory and assessment

The first step is to inventory and assess natural features on the site, including topography, soils, vegetation and water features. Identify how stormwater moves through the site prior to development as well as significant vegetation that could be retained. Also assess adjacent off-site conditions to identify valuable wildlife corridors to preserve.

Step two: preliminary site plan

Use the findings of step one to establish limits of disturbance to impact only the areas required for roads, utilities, building pads, landscape areas and the smallest additional area needed to maneuver equipment. Map natural resource protection areas. Walk the property with the owner, engineers, landscape architects and others directing the project's design to identify problems, concerns and priorities that need to be considered when developing the site plan. Set project goals and objectives with the entire team.

Step three: low impact site planning, design and layout

Working collaboratively with the entire design team and using the results of steps one and two will produce the best design. In addition, techniques to achieve low impact site design include:

- configuring roads and lots to minimize grading
- minimizing individual lot size so that housing is clustered and open space preserved
- minimizing setbacks or using zero lot-line setbacks to increase side yard areas
- using small building footprints and narrow streets for highly compact development (homes may be close to the road with short driveways)
- amending native disturbed soils with organic matter to regain stormwater storage capacity
- detaining and infiltrating stormwater with many small, decentralized stormwater facilities
- setting valuable natural resource areas aside permanently through voluntary land preservation easements with clear management guidelines
- avoiding soil compaction in and around stormwater facilities by heavy machinery and temporary storage of materials.

Drawings courtesy of AHBL Engineering and Puget Sound Action Team

Techniques to minimize site disturbance

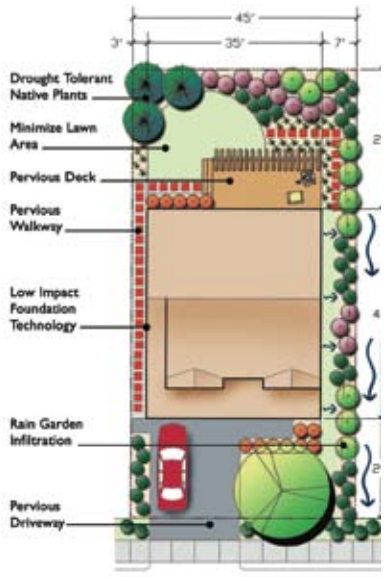
One of the most significant challenges within the development process is protecting native soil and vegetation so that hydrologic function is retained during the clearing and grading phase. The activities and equipment used to clear or grade most sites tend to expose and compact underlying subsoil, producing a site with significantly different hydrologic characteristics. In addition, the increase of soil erosion that results from clearing, grading and other construction activities can significantly affect downstream water bodies. Minimizing site disturbance is the most cost efficient and effective method for controlling erosion and sedimentation.

Design sites efficiently to retain natural topographic features that slow and store runoff and use minimum-excavation foundations. Other examples of effective site design are efficient roadway layouts and cluster design. During construction, it is recommended that access to the construction area is limited to one route if feasible and is located where future roads and utilities will be placed.

Coordinate construction activities to sequence construction during the dry season and minimize exposed soils at any one time. Concluding heavy construction activity by late fall will also allow planting to occur when conditions are most favorable for establishing vegetation. Site disturbance can also be minimized by designing construction phases and staging areas to reduce equipment activity and potential damage to soil and vegetation. Every construction project should follow established erosion and sediment control principles regarding sequencing, fencing protected areas, stockpiling topsoil for re-use and making inspections. Timing may also be important to avoid impacts to ground-nesting birds. Check with your local Oregon Department of Fish and Wildlife representative.

Train personnel to ensure that operators are trained in erosion and sediment control and that they understand limits around protected areas as well as overall disturbance limits. It is worth the time to walk the property with equipment operators regularly and to explain the use and management of areas designated for protection as well as the signs that identify those limits.

Use equipment that has the least ground pressure to accomplish tasks. In areas with relatively soft, deep soils limit the use of vehicles with tracks or tires with axle loads exceeding 10 tons per axle because they can compact soils as deep as three feet. A majority of the total soil compaction (70 to 90 percent) can occur in the first pass with such equipment. For smaller projects, many activities can be completed with mini-track loaders (e.g., Bobcats) that are more precise, require less area to operate, exert less contact pressure than equipment with deep lugged tires and have lower total axle weight.



Drawing courtesy of AHBL Engineering and Puget Sound Action Team.

Many low impact practices can be used on a single lot.

Note: Check local codes to determine which practices are recommended for your jurisdiction.

Appropriate site conditions

One of the best attributes of low impact site design principles and techniques is that they are extremely flexible. They can be incorporated into any site; the unique characteristics of a site will dictate what practices are best suited to a particular project. These practices work in highly constrained urban areas as well as on sites with larger lots and valuable natural resources.

Metro

Clean air and clean water do not stop at city limits or county lines. Neither does the need for jobs, a thriving economy and good transportation choices for people and businesses in our region. Voters have asked Metro to help with the challenges that cross those lines and affect the 25 cities and three counties in the Portland metropolitan area.

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For more information on nature-friendly development practices or Metro's Nature in Neighborhoods initiative, visit **www.oregonmetro.gov/nature**, send e-mail to nature@oregonmetro.gov or call 503-797-1555.

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Partners in the use of low impact development practices:

Home Builders Association of Metro Portland, Building Green Council

Earth Advantage Inc.

Energy Trust of Oregon

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Villebois neighborhood


Costa Pacific Communities

Villebois is a 500-acre master-planned community currently under construction in Wilsonville, Oregon. This mixed-use, transit-oriented neighborhood incorporates a number of nature-friendly development practices including rehabilitation of wetlands, redirection of storm water flows to the natural drainage pattern and preservation of 160 acres of parks and open space. In addition, Villebois hosts an innovative rainwater management program that uses a variety of low impact development techniques including swales, stormwater planters, porous pavers and a green roof that will mitigate the majority of rainfall runoff occurring at Villebois. Costa Pacific Communities, the project's developer and master-planner, is currently in the process of establishing Villebois as a pilot project for LEED Neighborhood Development.

Comparing costs of low impact site design to conventional development techniques

- Case studies and pilot projects have shown that low impact site design practices often cost less than conventional approaches through reduced infrastructure and site preparation work (e.g., less clearing, grading, fewer pipes, ponds, inlets, curbs and paving). These infrastructure reduction savings may outweigh any cost increases, such as an increase of onsite landscaping material or design costs.
- Integrating many of these low impact practices add to the aesthetics of the development, therefore adding marketing value.
- Infrastructure reduction savings may enable builders to add value-enhancing features to the property and to be more flexible and competitive in pricing their product. Low impact developments may command a higher price or allow faster sales because of customer demand for "green" products.

Maintenance considerations

Ongoing inspections from the beginning to the end of the project are needed to be sure that site planning and development proceed as intended and with minimal impacts. Once established, common open space and protected natural resource areas must be managed by a responsible party able to maintain the areas in a natural state in perpetuity. In most communities, the authority for managing open space falls to a homeowner, homeowners association, neighborhood, or community association. Maintenance for developments with low impact site design generally consists of landscape maintenance that would be required in any development, along with a periodic clearing of inlets that may be present within the landscape areas that function as stormwater features.

Once established, many low impact site design features are self-perpetuating, easily repairable, or are left as natural areas. Minimal maintenance is required, although it may be useful to develop a habitat plan for natural areas that may require periodic management actions.

References

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Builder's Guide to Low Impact Development. Available ***http://www.lowimpactdevelopment.org/lid%20 articles/Builder_LID.pdf*** and *Introduction to Low Impact Development (LID): Frequently Asked Questions*. Available ***http://www.lid-stormwater.net/intro/background.htm.*** Prince George's County, Maryland; NAHB Research Center Toolbase Services; and U.S. EPA document partners.