UF UNIVERSITY of FLORIDA
IFAS Extension

Low Impact Site Preparation

Definition:

Low impact site preparation is a suite of practices that seek to preserve the site's natural hydrological and biological characteristics.

Benefits

- Lower irrigation and fertilizer requirements
- Reduction in runoff volume
- Preserving quality of stormwater
- Enhanced biodiversity

Objectives:

The overall goal is to conserve natural areas, minimize development impacts and maintain site runoff rate and volume so that post-development conditions match pre-development conditions to the greatest extent possible. Therefore, low impact site preparation focuses on four main objectives. First, existing rainfall interception should be retained and new interception should be promoted. Second, infiltration capacity should be preserved, which requires minimized compaction and impervious surface area. Third, existing depressional storage should be retained, and new depressional storage should be created in conjunction with infiltration. Finally, stormwater treatment by soils and vegetation should be promoted through maximization of contact area and time.

Overview:

Conventional development processes often drastically alter natural landscapes and their capacity to treat and infiltrate stormwater. Removing trees or replacing large ones with smaller ones, leveling and grading topography, disturbing soil profiles and compacting soils all are common land development activities that significantly affect the functioning of important natural hydrological services in the landscape. Low impact site preparation requires comprehensive development planning, ranging from thoughtful site layout to strict land clearing practices on the ground.

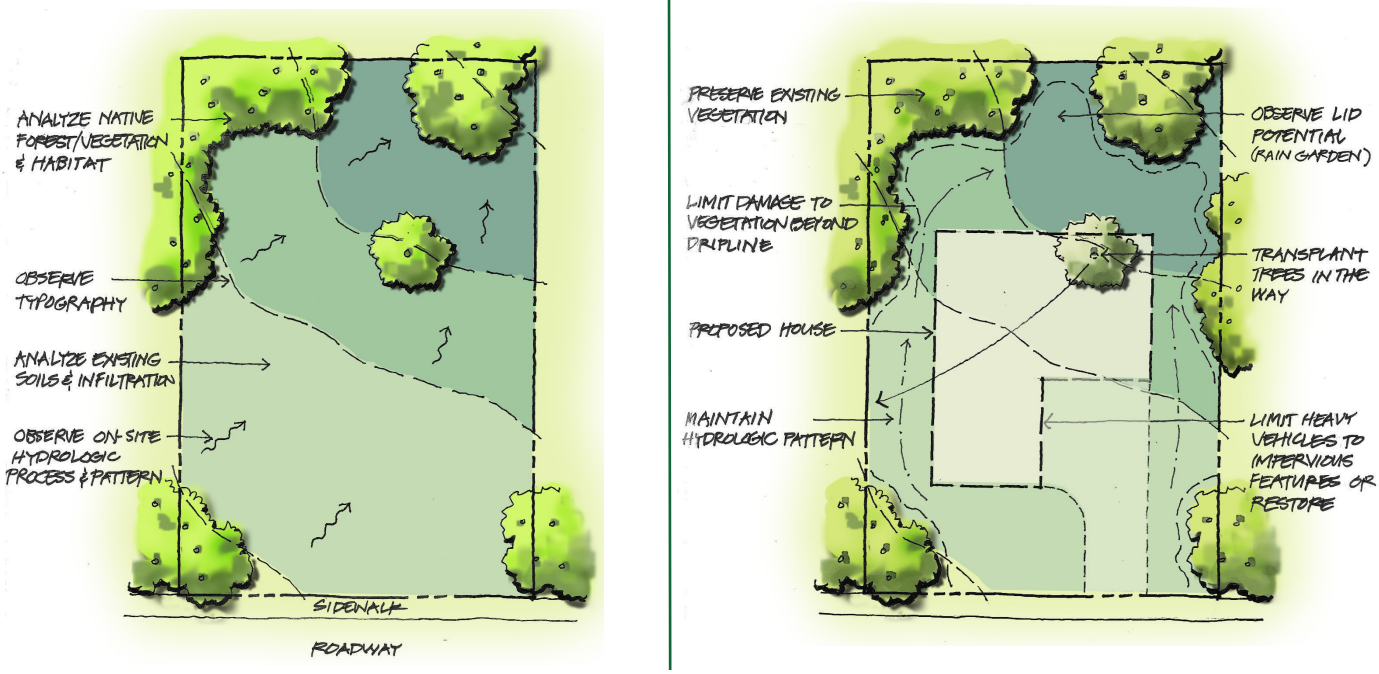

Diagram of site considerations before and after placement of house on site. Integrity of drainage pattern and canopy cover are maintained and soils are evaluated for placement of on-site LID practices such as a rain garden, permeable surfaces or exfiltration system.

These principles require non-conventional land development practices such as minimized clearing, minimized grading, preservation of high infiltration soils, and limited lot-level disturbance. Practices should be integrated into a holistic process that begins with definition of the development envelope and protected areas. Ultimately, it is ideal to reduce the total area that is cleared and graded and the number and size of structure footprints on the site. This process begins with identifying, mapping, and avoiding wetlands and floodplains and using stem wall or pier construction. Implementing these practices as an alternative to site grading and slab on grade construction complements floodplain avoidance and reduces the amount of excavation and fill required during site preparation and construction.

Specific LID site preparation practices include:

- Minimal paving and compaction of permeable soils (including limiting movement of construction equipment to specific areas)
- Reduced size of construction easements and material storage areas
- Stockpiles sited within the development envelope during the construction phase of a project
- Siting the building layout and clearing and grading to avoid removal of existing trees
- Marking off tree protection areas to prevent compaction and mounding around roots during construction
- Disconnected impervious areas to increase opportunities for infiltration and reduce stormwater runoff flows
- Maintenance of existing topography and associated drainage divides to encourage dispersed flow paths
- Using hydrology/drainage as a design element
- Saving topsoil for reapplication before landscape planting, and applying soil amendments before planting

Applications

- New construction
- Residential communities
- Commercial

Water Protection Benefits:

Water conservation implications –Minimal site disturbance that retains existing vegetation and soil characteristics can result in lower irrigation requirements. Retention of existing trees leads to higher moisture levels throughout the landscape and less need for irrigation.

Stormwater implications – Preserving and promoting interception, infiltration, depressional storage, and on-site treatment are essential elements to reducing the runoff quantity and preserving the quality of stormwater.

Quantity

Minimal impervious area, retention of infiltration capacities, preservation of depressional storage and other benefits from LID site preparation greatly increase the ability of the landscape to manage stormwater at the source. This reduces dependence on the conventional stormwater system, and if done correctly, LID site preparation can reduce piping size and length as well as the land area allocated to conventional stormwater ponds.

Quality

By reducing and treating stormwater at the source, there is significant improvement of water quality percolating into the aquifer or running into downstream water bodies. Retained vegetation preserves natural interception processes and helps cleanse water. In addition, soil compaction can make establishing new landscapes very difficult and can substantially decrease infiltration rates (up to 99% in one north central Florida study). Removing or burying topsoil can have similar impacts on infiltration and provides poor soil quality for establishment of new landscape plant material. By maintaining native, uncompacted soils, plant stress is lower and less fertilizer is likely to be applied or run off, resulting in greater source control.

Design Keys

- **Preservation of:**
- **Interception**
- **Infiltration**
- **Depressional storage**
- **Soil and vegetation treatment**

Design Considerations:

Pre-development site preparation options are determined largely by existing site constraints. LID site preparation practices are designed to preserve existing natural features. A site with streams, floodplains, wetlands, or steep slopes will require very careful land development planning. Because there can be no single strategy of low impact site preparation, it is important to focus on preservation of four key features: interception; infiltration; depressional storage; and soil and vegetation treatment.

Operations and Maintenance:

By applying the concept of low impact site preparation, long term maintenance costs of stormwater infrastructure and landscaping can be significantly reduced. For example, grading and applying disturbed fill soil to a site often results in poor establishment and quality of installed plants, requiring replacement and resulting in perpetual maintenance problems. By preserving native soils and minimizing compaction, plant stress is reduced and the need for added water, fertilizer and pesticides can be significantly reduced. Similarly, creating protection zones around existing trees during construction can reduce or eliminate the incidence of damage to tree roots that often results in tree death later on. Implementing invasive exotic control when needed will provide biodiversity benefits.

Credits in Green Building Certification Programs:

- FGBC Home Standard (S-2 maximize tree survivability; S-3 minimize soil compaction; S-4 25% of site protected from mechanical soils compaction via barrier; saving and reusing topsoil)
- Florida Water StarSM (preservation of existing vegetation)
- LEED for Homes (SS 1.2 minimize disturbed area of site)
- LEED for Neighborhood Development Pilot (GCT Prerequisite 1: Construction Activity Pollution Prevention; GCT Credit 6: Minimize Site Disturbance Through Site Design; GCT Credit 7: Minimize Site Disturbance During Construction)
- NAHB Model Green Home Building Guidelines (1.3.4 Minimize soil disturbance and erosion; 1.3.5 Manage storm water using low-impact development when possible; 1.4 Minimize environmental intrusion during onsite construction)

Relative Costs:

Costs for LID site preparation practices are typically lower than those for conventional practices. In an example from the Madera subdivision in Gainesville, FL, grading and clearing costs were $1,612 for a LID lot, compared to $2,016 for a similar-sized conventionally-cleared lot. Labor is spent on more careful clearing of smaller areas instead of rapid clearing of large areas. These two strategies tend to balance out, resulting in similar clearing costs. Less cleared area, however, can result in lower overall costs.

References and Resources:

EPA Stormwater BMP Fact Sheet: Preserving Natural Vegetation http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=browse&Rbutton=detail&bmp=34

Gregory, J.H., M.D. Dukes,P.H. Jones, and G.L. Miller. 2006. Effect of urban soil compaction on infiltration rate. *Journal of Soil and Water Conservation* 61(3):117-124.

Low Impact Development (LID) Practices for Storm Water Management (Toolbase Services): http://toolbase.org/Techinventory/TechDetails.aspx?ContentDetailID=909&BucketID=6&CategoryID=11

Credits

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