Low Impact Development: From Concept to Design

Presented by:
Williamsburg Environmental Group, Inc.

W. Douglas Beisch Jr., P.E. (VA)
Senior Water Resource Engineer

What is LID?

- An Approach to Site Design and Stormwater Management that seeks to mimic the pre-development runoff characteristics on a development site:
  - Site-specific techniques
  - Alternative to conventional stormwater treatment

Goal of LID

- Ultimate goal is to provide better overall stormwater control and management utilizing distributed small-scale stormwater practices to mimic natural hydrology
**Why LID?**

- Replicate pre-development conditions (flow rates, volume, and timing)
- Better protection of aquatic resources
- Avoid and Minimize impacts
  - Direct
  - Indirect

**LID Techniques**

- Referred to as Integrated Management Practices (IMPs):
  - Preserve natural cover on site
  - Minimize or disconnect impervious cover
  - Enhance infiltration
  - Maintain natural drainage-ways
- Integrated into Site Design

**Driving Forces Behind LID**

- Rezonings/SUPs (requests by boards and commissions)
- Special Environmental Concerns
- Corps of Engineers
- Department of Environmental Quality
- Local Code Requirements/Planning Objectives

**Sources for Design Documentation**

- Stormwater Handbooks
- PG County LID Handbook
- Local or Regional Guidance
- Adaptations of Hydrologic Methods

…….Very little consistency
Initial Project Evaluation

- Why LID?
- Where LID?
- How much LID?

Multi-Level Planning

- Feasibility
- Concept (Guideline)
- Preliminary
- Detailed

Cross-Disciplinary

- Engineers
- Hydrologists
- Landscape Architects
- Soil Scientists/Geotechnical
- Elected Representatives
- Infrastructure Managers
- Maintenance Personnel
- Land Planners
- Transportation Officials
- Utilities (wet and dry)
- Contractors
- Developers
- Code Compliance Officials
- Builders

Feasibility

- Soils Evaluation
- Identify Acceptable Practices – Land Use Compatibility
- Evaluate Local Codes and Standards
- Evaluate Cost Tolerance
- Set Achievable Targets
Feasibility – Soils

- Permeability
- Slope
- Depth to Bedrock/GW Table
- Grading (cut/fill) – Automated using 3-dimensional CAD software

- Overall composite done in spatial analysis tool (CAD Map or ArcGIS)

Suitability Screening: New Development

Feasibility - Land Planning Compatibility

- Screen Practices versus Land Use Type
- Structural and Non-structural
- Opportunities in Landscape (template)
- Develop Standard Treatment Approaches

STREETS
Feasibility - Local Codes and Standards

- On-lot Practices?
- Local SWM Codes
- Transportation
- Utilities
- Standards and Specifications
- Maintenance

Feasibility - Costs

- Initial cost projections
- Alternatives versus costs
- Cost offsets/recoveries
- Practices versus costs

Benefits and Cost Recoveries/Incentives

- Potential Cost Reductions
  - Usable site area/yield/density
  - Reduction of impacts and associated mitigation
  - Elimination of curb and gutter/storm drain
  - Reduction of clearing/grading/infrastructure
  - Time-savings for Permits and Approvals…

- Other Benefits
  - Aesthetic Appeal – Community Character
  - Enhanced Environmental Protection
  - Reduced consequences of failure?
  - Maintenance – Who Knows
Feasibility – Setting Targets

- Resource Based
- Sub-watershed-based
- Realistic targets:
  - Demonstration Only (Token LID)
  - Water Quality
  - Supplemental Quantity control
  - Full volume replication
  - Large storm control

Feasibility - Achievable Targets

- Selected Conceptual alternatives
- Goals for:
  - Volume Capture
  - % land area treated
- Types of practices envisioned
- Ability to meet objectives

Conceptual Planning

- Development of Design Guidelines:
  - Types of Practices
  - Typical Implementations
  - Evaluating Performance
  - Standards to Use

Concept - Practice Types

- Illustrative Detail
- Structural and Non-structural
- Sources for Practice Specifications
- Crediting value
- ID design coordination issues (standards and specifications)
- Locate in Typical Development Scenarios
Illustrate the Proposal

Concept - Typical Implementations

- Template-based layout
- Address various land types
- Address various runoff types
- ID Design Coordination issues (layout and grading)

Conceptual Application

Concept - Evaluating Performance

- Accounting method
- Worksheets for compliance
- Identify Areas of Flexibility
Concept - Standards to Use

- Master Planned or Municipally Planned
- Clear direction to design community
- Easy to read and understand
- Backed up by commitment to further development

Preliminary Community Design
(Design Development)

- Practice Locations
- Practice Sizes
- System Layout
- Initial Modeling

DD - Practice Sizing

- Determine capture volume required
- Use distributed network where feasible
- Use offsets for fingerprinting
DD - Practice Locations

- Locate practices in plan view
- Use non-structural first
- Use offline second
- Use inline third/last

DD - System Layout

- Schematic Design of drainage infrastructure
- Resolve initial plan and profile conflicts
- Address design coordination issues

DD - Initial Modeling

- Model system
- Lumped or Aggregated
- Detailed Routing
- Determine supplement required
- Size and schematically design
Design and Plans Preparation (CDs)

- Grading and drainage
- Landscaping and stabilization
- Standards and Specifications
- Constructability
- Requirements for Inspections and Maintenance

CDs - Grading and Drainage

- Clear and concise
- Use tables and typical details where feasible
- Design and size overflows and spillways
- Anticipate field problems
- Landscape setting
CDs - Landscaping and Stabilization

- Aesthetic criteria
- Plant materials
- Stabilization of inlets/outlets/sides
- Landscape detail elements
- Mix the palette up

CDs - Landscape Design

CDs - Standards and Specifications

- Construction Details
- Notes and Specifications
- Quality Control Requirements

CDs - Constructability

- Clear directions
- Construction sequencing
- Construction timing
- Protection of work
- Online vs. offline
- Clarify responsibilities
Constructability

CDs - Inspections and Maintenance

- Maintenance Requirements
- Inspection Requirements
- Easements or covenants
- “Users Manual”
- Describe system characteristics

Questions??