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Creative Storm Water Design

When Doing the Right Thing Means Breakin' the Rules

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Presenters

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- Managing Principal, Environmental Planning & Design, LLC
- Registered Landscape Architect
- Certified Planner
- 20+ Years of Community Planning and Landscape Architecture Experience

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- Registered Professional Engineer
- 25+ Years of Municipal Engineering

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Today's Agenda

1. Why Has Storm Water Design Become a Difficult Land Development Issue?
2. Is Storm Water Design Different on Some Sites
3. What Do the PA DEP and County Conservation District Officials Expect from Property Owners and Developers?
4. What Are Some Creative Storm Water Design Solutions?
5. Additional Panelist Thoughts and Perspectives
6. Questions and Answers

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Learning Outcomes

1. Typical Best Management Practices For Storm Water Design

2. How Constraints Common to Non-Greenfield Sites Affect Storm Water Design Solutions

3. What Are Some Creative Storm Water Design Solutions?

4. What Questions/Information Should Planners Ask/Require from Applicants When Dealing With Non-Greenfield Development Sites

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Special Focus of Today's Discussion

How to best handle storm water on non-greenfield sites for:

- Rural – reclaimed sites such as a strip mine; and
- Urban – sites previously used for industrial purposes.

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Background Context

- A New "Best Management Practices" (BMP) Guidance Manual was introduced by PA DEP in December 2006
- New regulations required designers to address both water quality and water quantity
- Water quality must address Total Suspended Solids (TSS), Total Phosphates (TP) and Nitrates (NO_3)
- Water quantity must be addressed by infiltration (where possible), detention or re-use

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Background Context

- Post Construction Storm Water Management (PCSM) BMPs are required to be designed for the 2-year/24 hour peak storm event
- Water Quantity
  - BMPs for water quantity may not increase the runoff volume for all storm events equal to or less than the 2-year storm
  - Existing (pre-development) non-forested pervious areas must be considered meadow in good condition
  - 20% of existing impervious areas shall be considered meadow in good condition for purposes of modeling existing conditions for re-development

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Background Context

- Water Quality
  - BMPs for total water must, at a minimum, remove the following pollutants
    - 85% reduction in post-construction pollutant load of Total Suspended Solids
    - 85% reduction in post-construction pollutant load of Total Suspended Solids
    - 50% reduction in post-construction pollutant load of nitrates
  - These reductions must be based on the proposed post-construction land use

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Additional Considerations

- Problematic sites for infiltration:
  - Sites discharging Acid Mine Drainage (AMD)
  - Sites with karst topography
  - Brownfield sites
  - Sites containing contaminated soils
  - Sites in a wellhead protection area
  - Groundwater aquifer distribution

- Infiltration alternatives
  - Wet ponds
  - Pond linings to prevent infiltration into problem soils
  - Oversized storm sewer pipes
  - Infiltration through clean media

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Storm Water Management Challenges

Problems unique to non-greenfield developments that create storm water challenges to meeting the typical BMP's

- Quality of backfill/ overburden
- Infiltration characteristics
- Contamination or mineral content
- Coal deposits
- Shafts, tunnels, high walls

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Additional Storm Water Management Challenges

- Abandoned water impoundments and/ or equipment/ infrastructure
- Lack of quality existing vegetation
- Act 2 status (cannot infiltrate)
- Implementation costs

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Examples of Storm Water Management Challenges

Groundwater Seepage

Rock Fractures

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Examples of Storm Water Management Challenges

Sinkholes

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Problems Associated to Poor BMP Implementation

Common problems found with poorly implemented BMP's

- Abandoned mine drainage – orange, white, etc…
- Poor infiltration rates – standing water in detention basins
- Excessive infiltration rates – appears on-site where not planned/accommodated
- Loss of vegetation

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Problems Associated to Poor BMP Implementation

Curb cuts on low side of bio-filtration area

Poor endwall construction

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Types of Mitigation Needed to Correct Poor BMP Implementation

Examples of mitigation solutions necessitated because of poorly implemented BMP's

- Treatment – limestone filter, vegetative restoration, etc…
- Additional soil supplements
- Additional volume (evaporation)
- Introduction of structural BMP's – cisterns, infiltration galleries, Stormceptors®

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Examples of Mitigation Solutions/ Measures

Post Construction Storm Water Management Basin

Detention Pond Reconstruction

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Examples of Mitigation Solutions/ Measures

Bio-Filtration Area

Rain Gardens

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Alternative Approach to Implementing BMP's

- Backfill/overburden – geo-tech analysis to identify pyritic content and excessive overburden depths
- Infiltration characteristics – increase the number of infiltration tests
- Contamination or mineral content – geo-tech analysis to determine inert or non-pyritic
- Coal deposits, tailings – geo-tech analysis to determine whether coal remains in the area of a storm water pond or infiltration zone
- Shafts, tunnels, high walls – geo-tech review of site history/activity to determine any required mitigation

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Additional Alternative Approaches

- Slurry ponds and washing plants – completely avoided; must be permanently maintained as a green space
- Abandoned water impoundments – environmental assessment of each impoundment to determine ecological vitality
- Abandoned equipment/ infrastructure – visual assessment and mitigation
- Act 2 status – cannot legally infiltrate; need to be creative in how you balance structural and non-structural BMP's

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What Planners Should Ask Applicants For When Dealing with Challenging Sites

Challenging sites often demand additional studies, reports, analysis and explanations. Examples include:

- List of issues and how they are being dealt with
- Early stage concept sketches
- Multi-tiered geo-technical analysis
  - Stage 1 – initial determination for conceptual design (a few within the proposed BMP location)
  - Stage 2 – needed final site design and final BMP locations for permitting (many within the vicinity [50'] of a proposed BMP)
  - Stage 3 – needed for individual lots/buildings
- Infiltration tests

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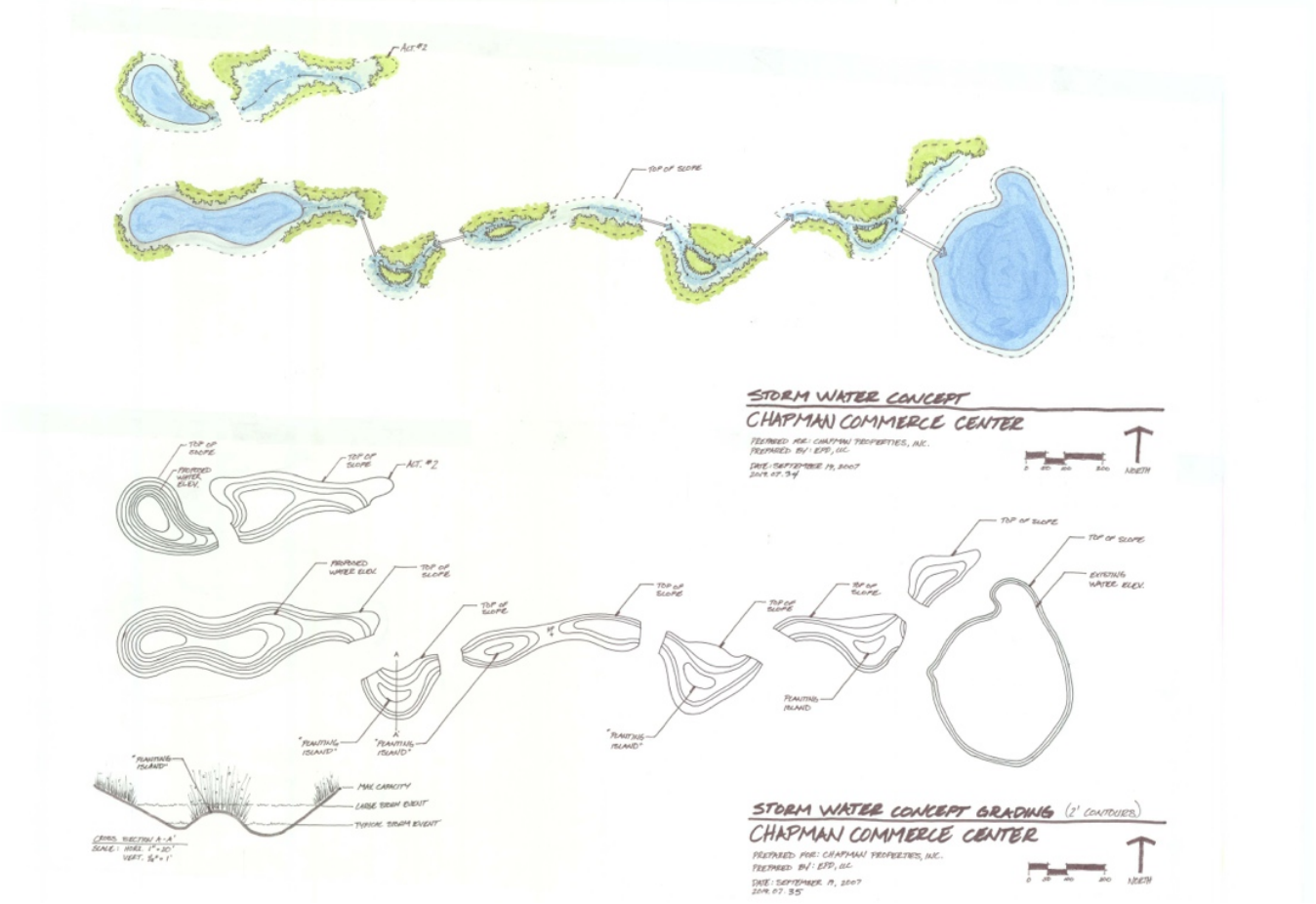
Examples of Early Stage Concept Sketches



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Areas Where to "Break the Rules"

Specific storm water requirements/provisions where creative interpretation could be beneficial:

1. Allow a property owner/developer to utilize the BMP vegetation requirements to satisfy a portion of the bufferyard landscaping requirements;
2. Re-purpose on-site impoundments into storm water facilities
3. Grass lined swales and vegetation
4. Harvested storm water for irrigation and temperature mitigation
5. Combining BMP's in the urban areas

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Examples of Creative Storm Water Design

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"Lessons Learned"

- Use conservative infiltration rates
- Incorporate existing natural features into PCSM design (i.e. vegetated filter strips, riparian buffers, minimized disturbed areas)
- Utilize proper vegetation and plantings for the type of PCSM BMP that is proposed (i.e. tolerant to inundation, salt tolerant, etc.)
- Place infiltration-related BMPs in suitable soils and above the seasonal high water table
- Implement a long term Operations and Maintenance Plan to keep BMPs functioning properly
- BMP construction should be monitored

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