LID CALCULATIONS IN COASTAL NORTH CAROLINA

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SUSTAINABLE DEVELOPMENT SUMMIT

MARCH 2009

LID SITE EVALUATIONS

The Coastal North Carolina Process

- Lockwood Folly (River) Roundtable
  - Reverse deterioration of water quality in watershed
  - Formulated 8 key strategies to address WQ issues
- 2006 – NOAA Grant Funding to develop LID ordinances
  - North Carolina Coastal Federation
    - Brunswick County
    - New Hanover County
    - City of Wilmington
- 2007 – Formation of Technical Advisory Committees
  - Partnership with Larry Coffman
  - Government, Public, and Private sector representation

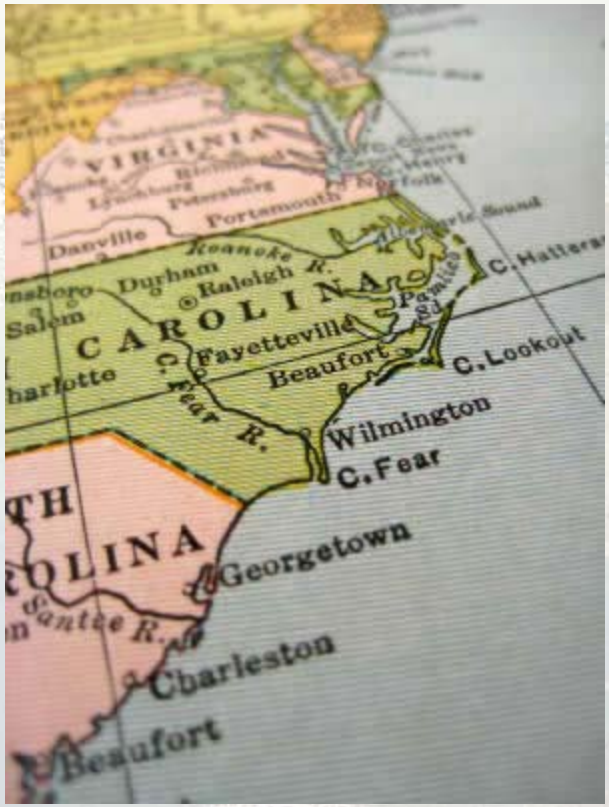
LID SITE EVALUATIONS

Challenges of a Multi Faceted Region

- Three jurisdictions each have unique goals and visions

- Brunswick County
  - Largely undeveloped
  - Watershed management planning
  - Tailored to new development

- New Hanover County & City of Wilmington
  - Urbanized, and getting denser
  - Focus on retrofit opportunities and redevelopment



LID SITE EVALUATIONS

Benefits of LID

- Natural Benefits
  - Flood control
  - Habitat protection
- Development Benefits
  - Aesthetic enhancement
  - Infrastructure reduction
  - Efficient land use
  - Reduced water use
  - Cost savings
- Incentives
  - Limitless

LID SITE EVALUATIONS

Potential Incentives – just a start….

- Property Tax Credits
- Density Bonuses
- Permit Streamlining
- Permit Fees
- Parking Requirements
- Jurisdiction Assistance
- Town Maintenance
- Dedicated Review Teams
- Public Recognition
- Reduced Permitting Requirements

LID SITE EVALUATIONS

LID Permitting Obstacles

- Easy to write “Low Impact Development” into regulations
- Implementation may vary from current process
- Current practices tailored to conventional plans
- Dependant on nature of stormwater regulations
  - Peak Flow (Flood Control)
  - Volume
- Hard to define LID in context of site plans

LID SITE EVALUATIONS

Working Within the Permit Process

- Site Planning
  - Natural Resources
  - Development types - zoning
- Calculations
  - Stormwater requirements
  - Stormwater plan

- Analysis
  - Quantifying LID
- Calculation Results
  - Does the site meet stormwater regulations?
  - Does the site meet LID criteria?
  - Which incentives are available?

LID SITE EVALUATIONS

Building Blocks for A Successful Permit Program

- Performance Standards
  - Design Standards
  - LID Criteria
  - Calculations
- Construction
  - Design Standards
  - Inspections
- Maintenance
  - Qualified Professionals
  - Educated Owners

IMPLEMENTATION

LID SITE EVALUATIONS

North Carolina Stormwater Regulations

- Specific regulations for 20 coastal counties
- Permit review conducted by NC Division of Water Quality
- Volume based – 1.5” Rainfall or 1-Year storm
- Focus on water quality – no flood control component
- Target nutrients – vary by river basin
  - Total Suspended Solids
  - Nitrogen
  - Phosphorous
  - Fecal Coliform
  - Temperature
- State BMP Design Manual
- Standard forms and applications

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LID SITE EVALUATIONS

Required Calculations - Typical Permits

- Simple Method
- Treatment Volume Required / Provided per BMP
- Seasonal High Water Table & Infiltration Rate
- Total Impervious Area / BMP Drainage Area
- Drawdown Time

LID SITE EVALUATIONS

LID Calculations – SCS Method

- Reflects soil conditions on site
- Can be used for volume and peak runoff computations
- Disconnected impervious area / non structural devices
- Well established, widely used
- **Because NC Division of Water Quality said it's allowed!**

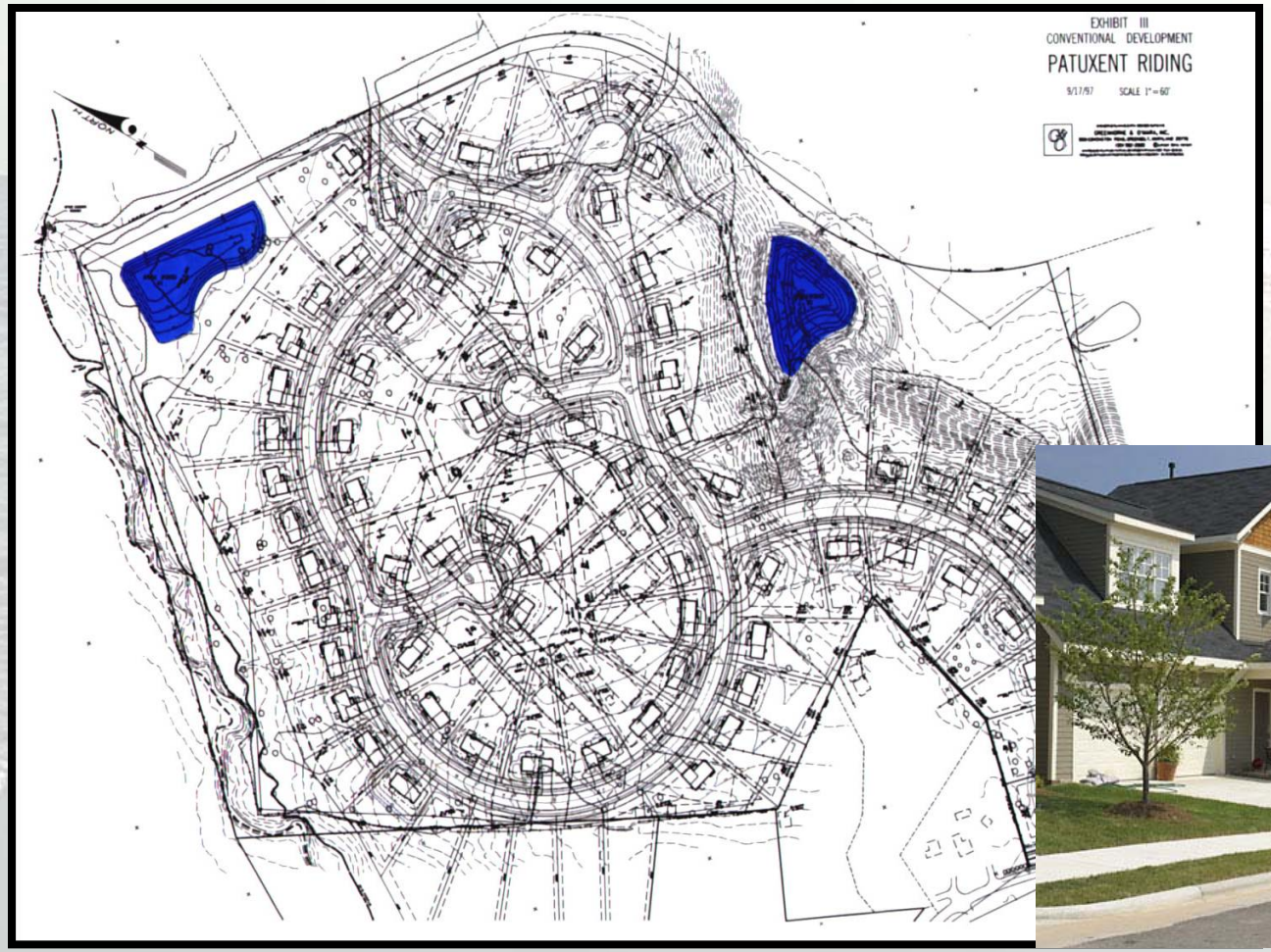
"The SCS method (SCS, 1985; NRCS 1986) is an alternative method for calculating the volume of stormwater runoff that is generated from a given amount of rainfall. **It may only be used when the site design is a Low Impact Development (LID)."**

Page 3-4 NC Stormwater BMP Manual, NCDWQ

- **Missing Link - No definition of LID provided!!**

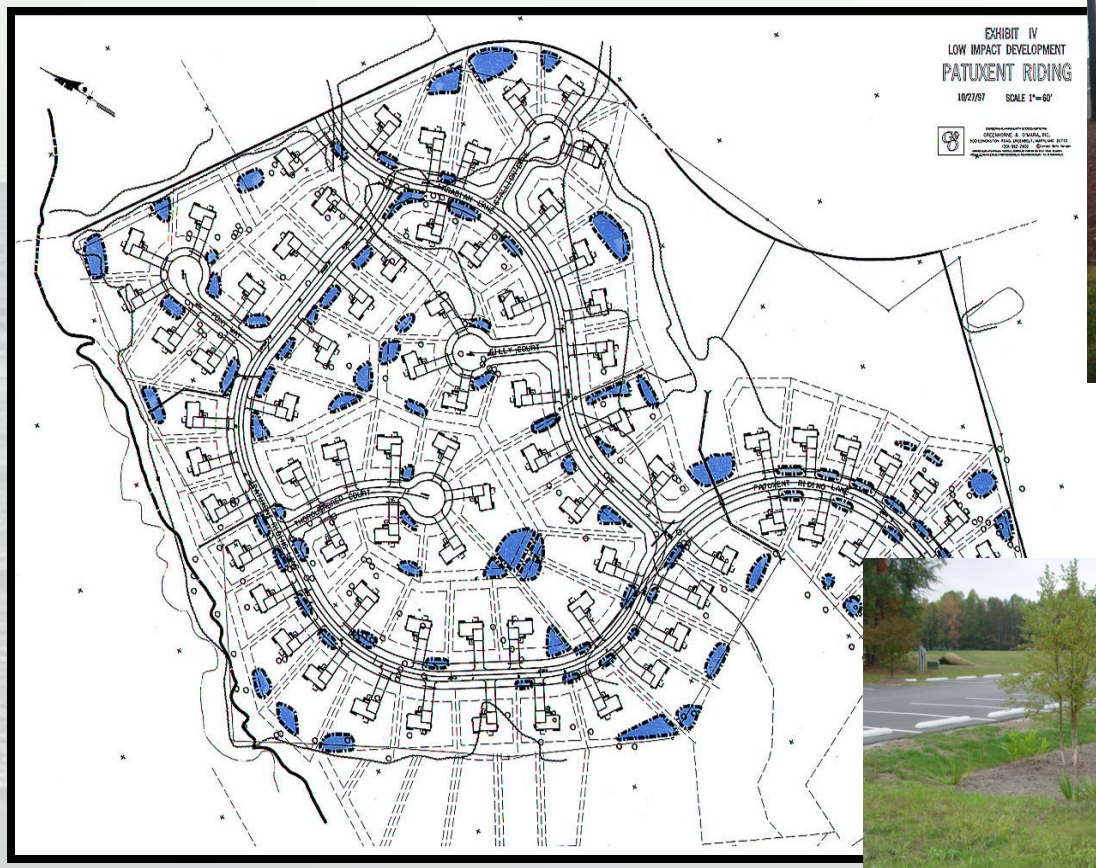
LID SITE EVALUATIONS

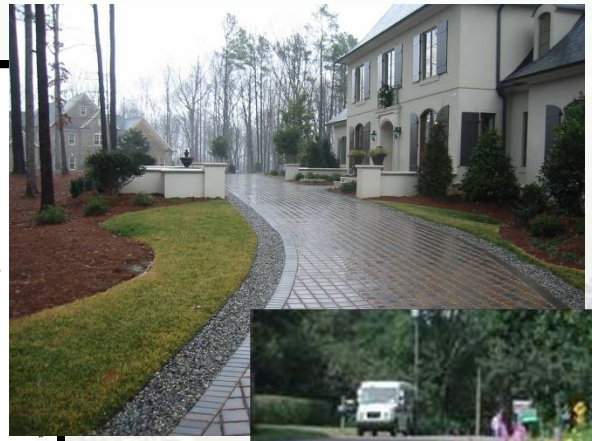
Conventional Development Plan



LID SITE EVALUATIONS

LID Plan



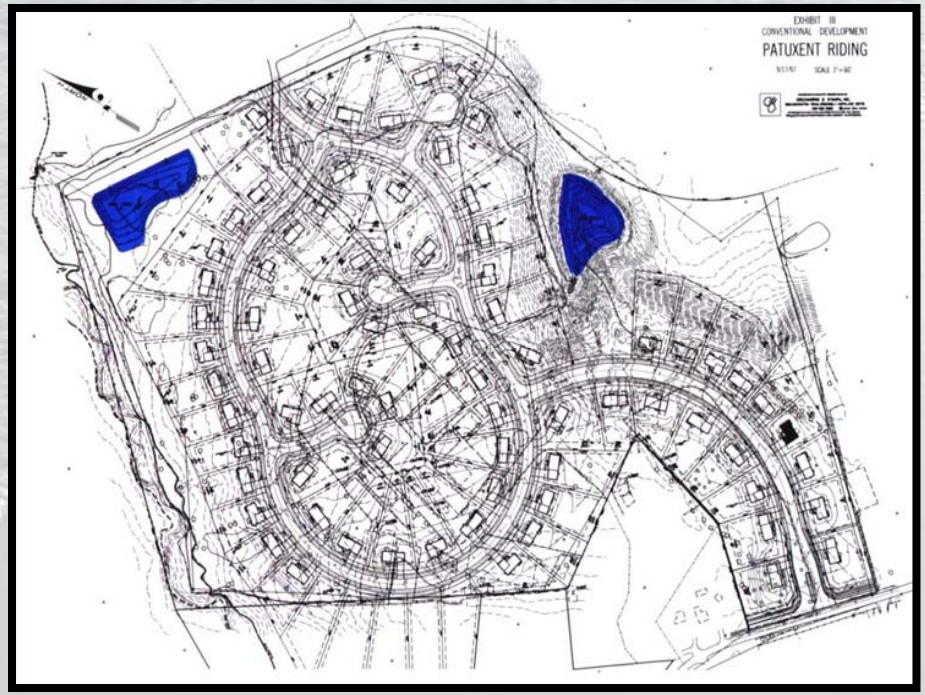


LID SITE EVALUATIONS

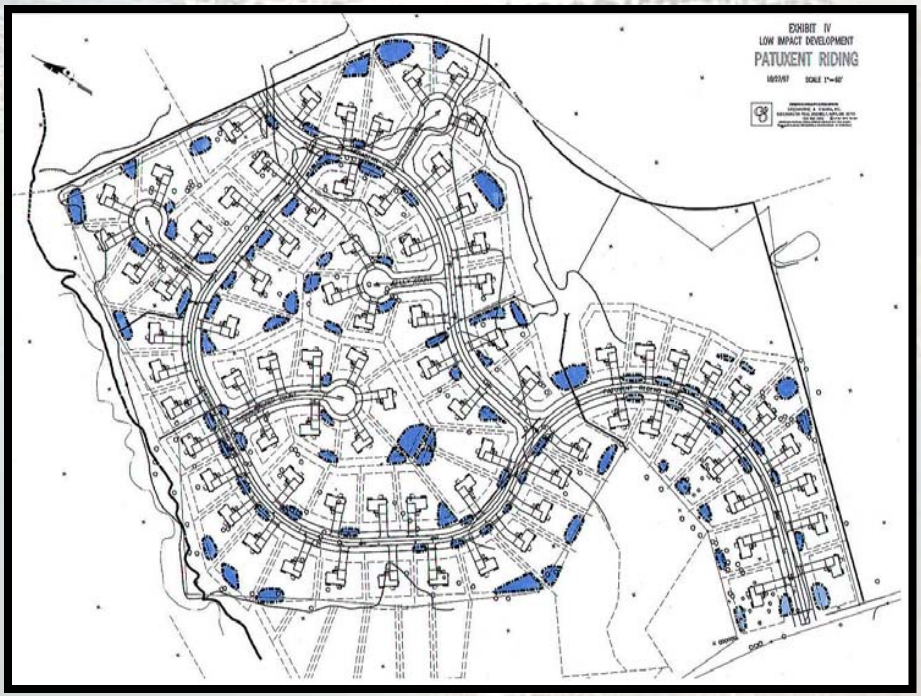
When is a Site LID?

Hybrid Developments

Conventional Development



LID Development



LID SITE EVALUATIONS

Identifying Exemplary Sites – Evaluating Hybrid Sites

- SLIDE Ranking system in comment phase
- 4 categories / 19 individual metrics
- Categories follow typical submittal process
- All categories have direct relationship with stormwater
- Accompanied by spreadsheet for all calculations

LID SITE EVALUATIONS

SLIDE Metrics

- Narrative
  - Design Philosophy
  - Natural Resource Inventory
  - Soil / Water Table Mapping
  - Project Team
    - Sustainable Experience
  - Alternative Analysis
  - Impact Avoidance and Minimization

LID SITE EVALUATIONS

SLIDE Metrics

- Natural Resources
  - Wetland & Surface Waters Protected
  - Stream Length Protected
  - Floodprone Area Protected
    - % of total area / length protected
  - Project Location
    - Based on downstream stream classification

LID SITE EVALUATIONS

SLIDE Metrics

- Construction and Grading
  - Redevelopment Preferred
    - Existing Impervious Area Credited
  - Steep Slopes Protected
  - Buffers Protected
  - Land Disturbance Minimized
    - % of total area protected
  - Trees Protected
    - Function of total significant DBH preserved
  - Watershed Boundaries Maintained
    - % of land area which changes basins

LID SITE EVALUATIONS

SLIDE Metrics

- Natural Systems
  - Non Structural BMPs
    - Volume reduction
  - Time of Concentration
    - Maintain predevelopment flow paths
  - Vegetated Conveyances
    - % of site which is not served by pipe network
  - Disconnected Impervious Area
    - % of total impervious that is disconnected
  - Natural Vegetation
    - Transplated vegetation from other areas of site

LID SITE EVALUATIONS

SLIDE Metrics

- Stormwater Management Plan
  - Structural BMPs
    - Volume reduction
  - Decentralized Stormwater Management
    - Treatment provided within 150’ of runoff source
  - Infiltration Systems
    - % of volume reduced through structural infiltration
  - Nutrient Removal
    - TSS, Nitrogen, Phosphorous

LID SITE EVALUATIONS

Integration

Calculation Method

NC Coastal Stormwater Rules

Ranking

LID SITE EVALUATIONS

LID-EZ Features

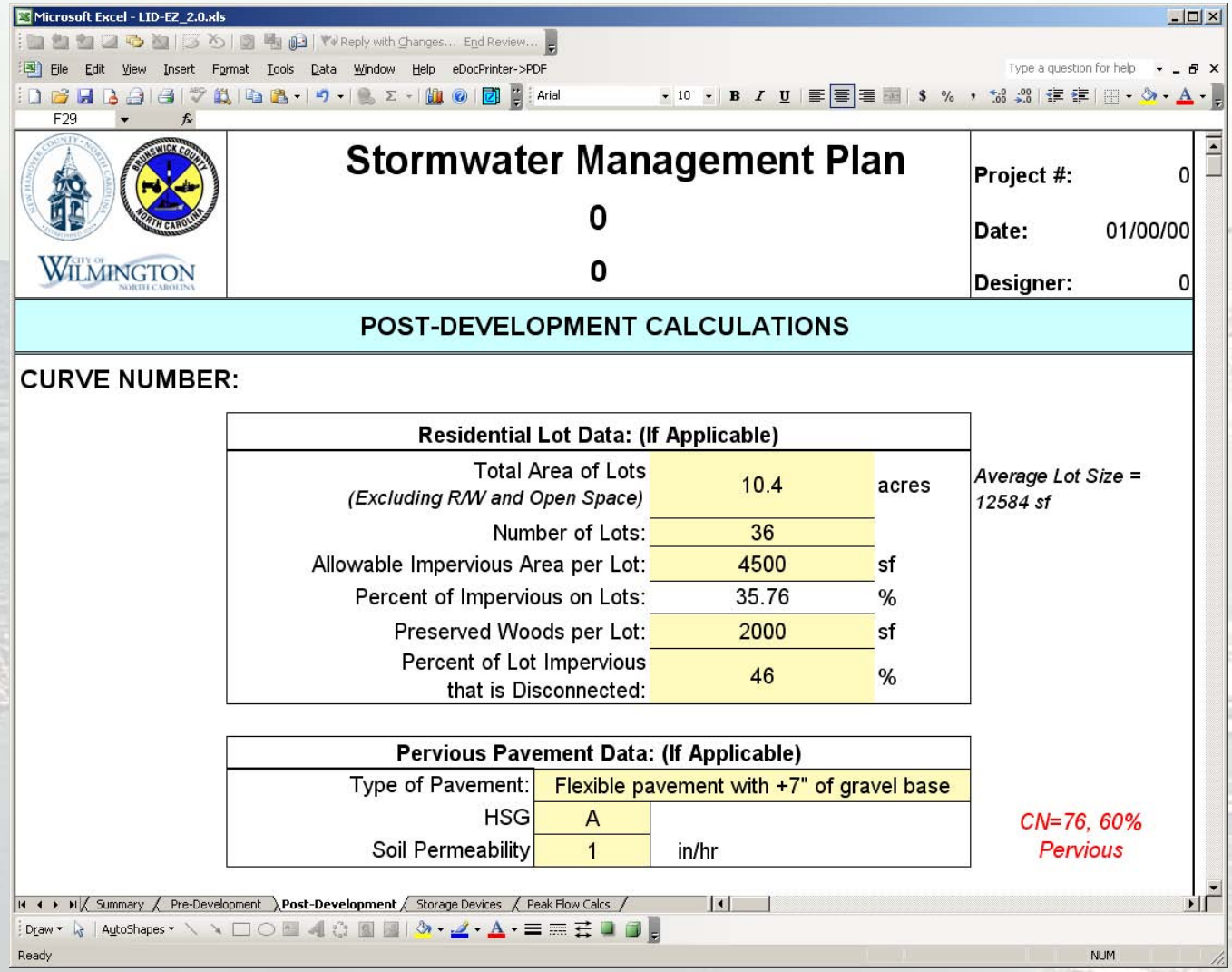
- Excel based spreadsheet
- Customized error messages and data verification for NC permits
- Thresholds developed by regulators through stakeholder process

- Site Scale
  - Predevelopment CN
  - Post Development CN

- Land Use
- Soil Type
- Site Composition

- Discrete CN Method
- Disconnected / Connected Impervious Area

LID SITE EVALUATIONS



Microsoft Excel - LID-EZ_2.0.xls

Stormwater Management Plan

0

0

Project #:	0
Date:	01/00/00
Designer:	0

POST-DEVELOPMENT CALCULATIONS

CURVE NUMBER:

Residential Lot Data: (If Applicable)		
Total Area of Lots *(Excluding R/W and Open Space)*	10.4	acres
Number of Lots:	36	
Allowable Impervious Area per Lot:	4500	sf
Percent of Impervious on Lots:	35.76	%
Preserved Woods per Lot:	2000	sf
Percent of Lot Impervious that is Disconnected:	46	%

Average Lot Size = 12584 sf

Pervious Pavement Data: (If Applicable)		
Type of Pavement:	Flexible pavement with +7" of gravel base	
HSG	A	
Soil Permeability	1	in/hr

CN=76, 60% Pervious

Summary | Pre-Development | Post-Development | Storage Devices | Peak Flow Calcs

Ready

LID SITE EVALUATIONS

Microsoft Excel - LID-EZ_2.0.xls

F39 ='Pre-Development'!F28

HSG	Land-use	CN	Area (acres)	%
A	Lots (Excluding R/W and Open Space)	59	10.4	55.91%
A	Pervious Pavement	76	2	10.75%
A	Impervious (Connected)	98	2.2	11.83%
A	Open Space (Managed Open Space)	39	4	21.51%
		0		0.00%
		0		0.00%
		0		0.00%
		0		0.00%
		0		0.00%
		0		0.00%
		0		0.00%
		0		0.00%
		0		0.00%
		0		0.00%
	Sub-Total:		18.6	100.00%

Lakes & Non-Coastal Wetlands :	0	acres
Coastal Wetlands:	0	acres
Total Area:	**18.6**	**acres**

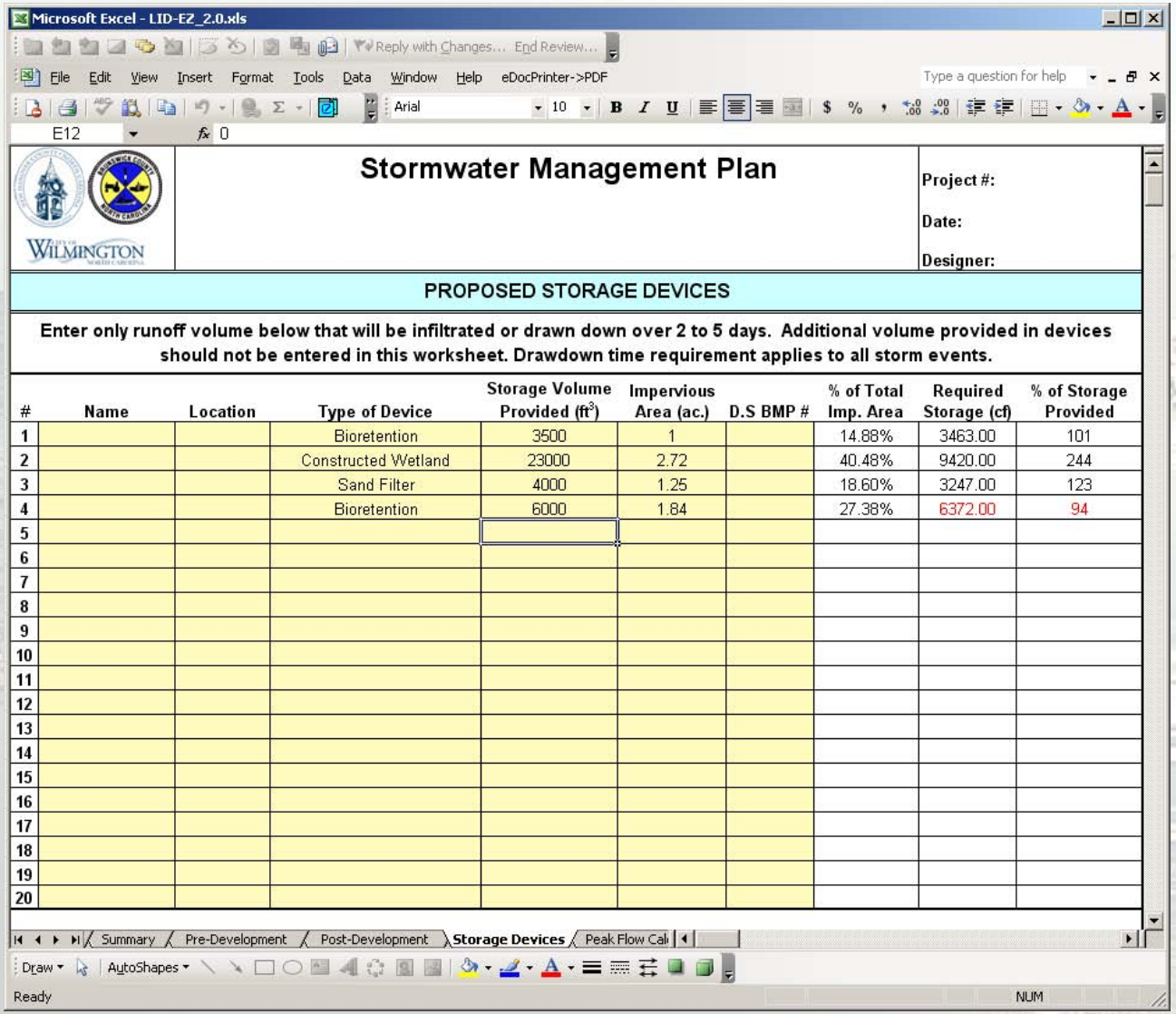
Post-Development CN = 58

Runoff Volume for First Flush:	6.41	acre-inches	23273	cf
Runoff Volume for 1-yr Storm:	9.93	acre-inches	36061	cf

Summary | Pre-Development | Post-Development | Storage Devices | Peak Flow Calcs

Ready

LID SITE EVALUATIONS



Microsoft Excel - LID-EZ_2.0.xls

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E12

Stormwater Management Plan

Project #:

Date:

Designer:

PROPOSED STORAGE DEVICES

Enter only runoff volume below that will be infiltrated or drawn down over 2 to 5 days. Additional volume provided in devices should not be entered in this worksheet. Drawdown time requirement applies to all storm events.

#	Name	Location	Type of Device	Storage Volume Provided (ft^3)	Impervious Area (ac.)	D.S BMP #	% of Total Imp. Area	Required Storage (cf)	% of Storage Provided
1			Bioretention	3500	1		14.88%	3463.00	101
2			Constructed Wetland	23000	2.72		40.48%	9420.00	244
3			Sand Filter	4000	1.25		18.60%	3247.00	123
4			Bioretention	6000	1.84		27.38%	6372.00	94
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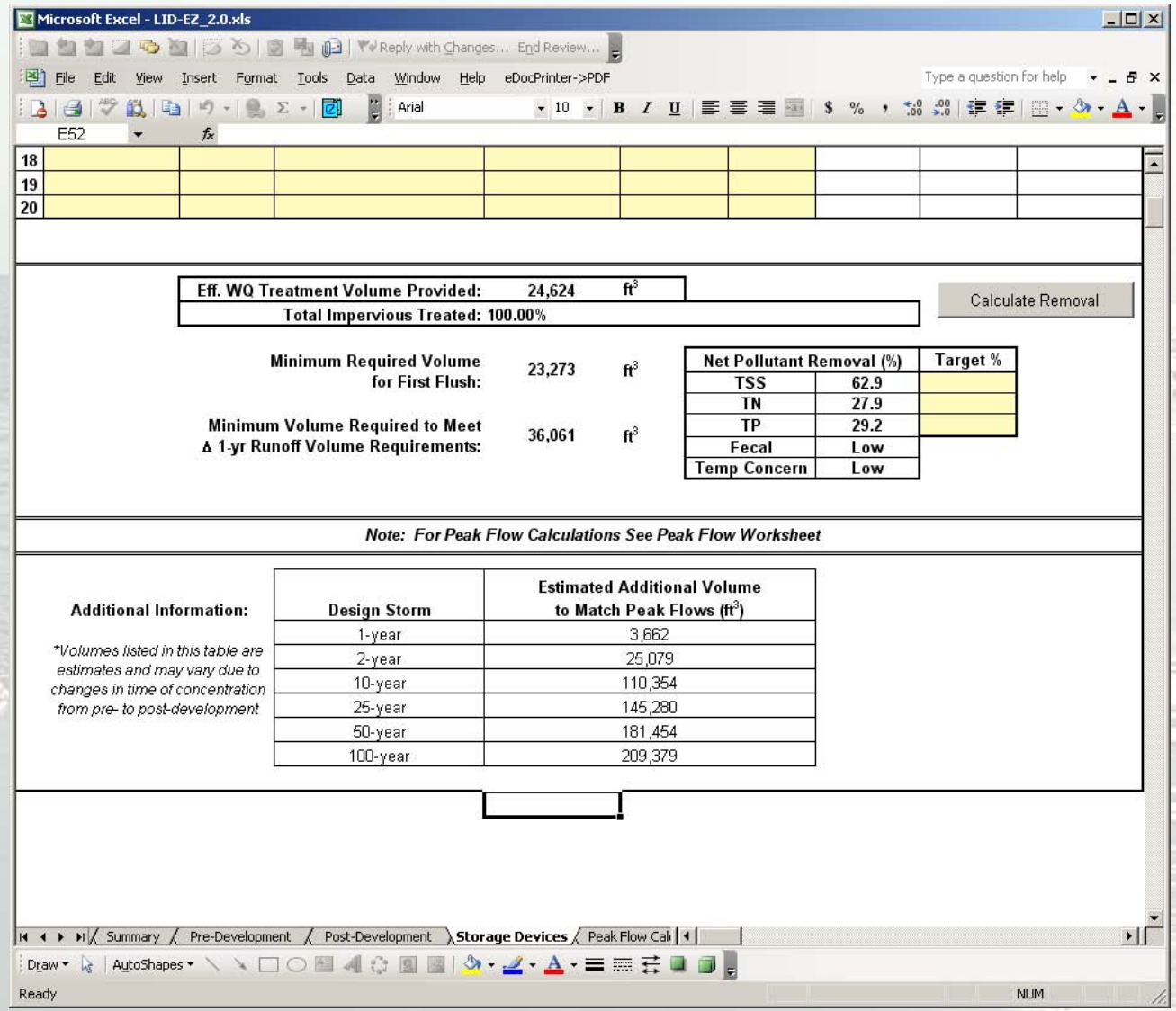
Summary | Pre-Development | Post-Development | Storage Devices | Peak Flow Cal

Draw AutoShapes

Ready NUM

LID SITE EVALUATIONS



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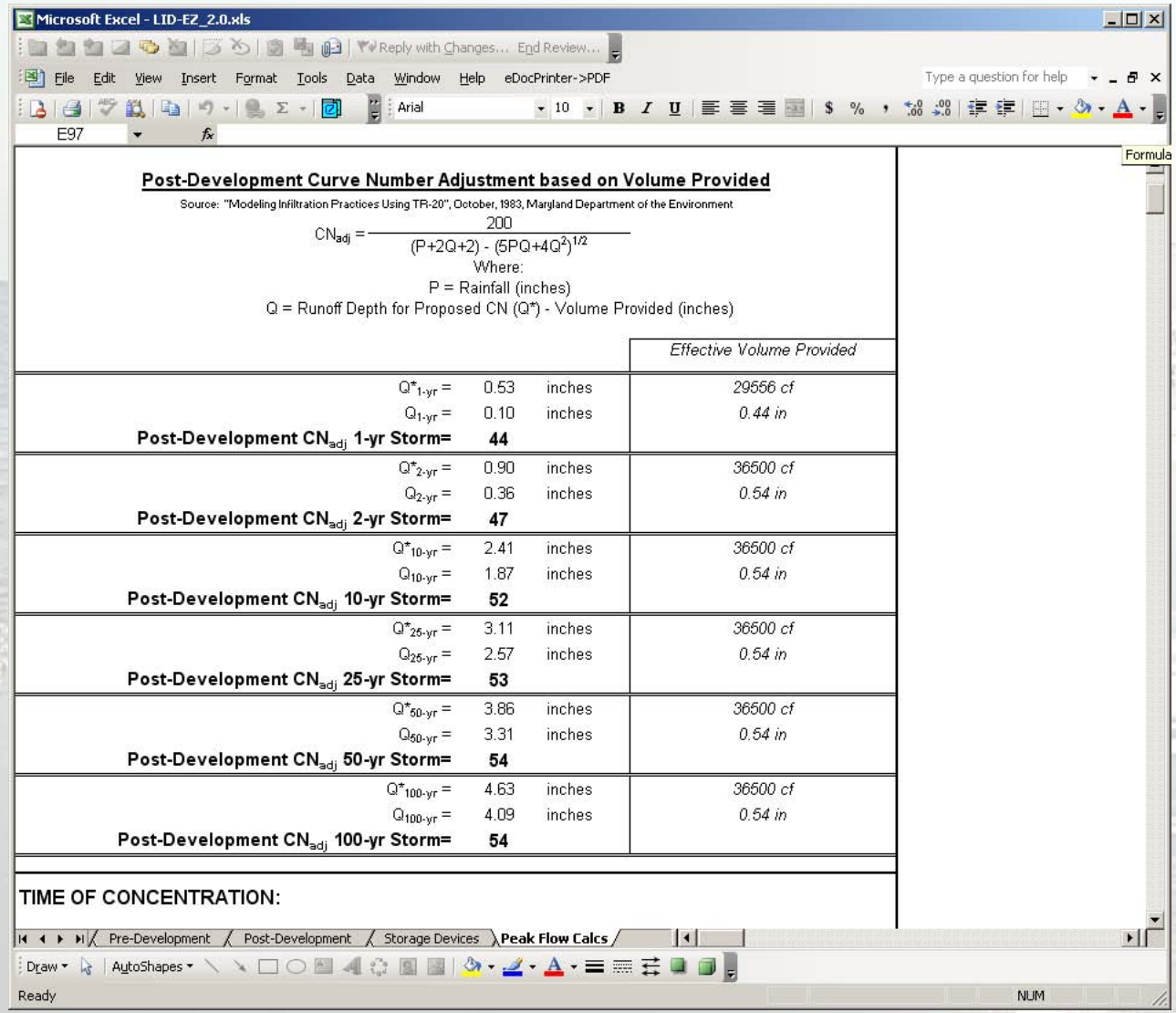

LID SITE EVALUATIONS

Lessons Learned

- Involve regulators early
- Work within current framework if possible
- Comprehensive stakeholder group
- Implementation

Next Steps…

- Refining Ranking System – Establishing Benchmarks
- Development of LID Specific Permit Process
- Construction Methodology
- Widespread Acceptance – Changing Philosophies

LID SITE EVALUATIONS

Questions?