City of Columbia BMP Manual

Applying Better Site Crediting
& BMP Sizing

March 20, 2013

Goal: cost effectively reduce the impact of urban development

- Less pollution from human activity
- Less pollution from site developments
- Treat the remaining pollution

Public Education
Better Site Design
Structural Controls

How to integrate this into the normal approach?

1. Match developer business practices.
2. Apply early - influence the process.
3. Streamline for the developer and local reviewer.

Project Idea
Find Site
Feasibility Study
Site Analysis
Concept Plan
SW Mgmt Plan
Construction
Final Inspections

Lets follow a typical project

Palmetto Alley Strip Mall

Prior to Unified Design Approach

- Have a concept in mind
- Look at site
  - ✓setting, shape, etc.
- Assess constraints and requirements
- "go" or "no go" ?

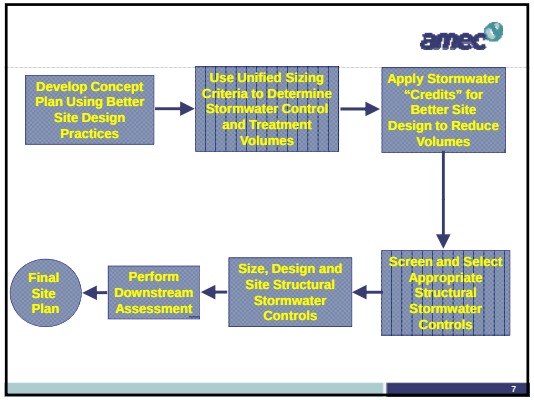
Project Idea
Find Site
Feasibility Study

Goal: understand site constraints & potential, don't invest too much time and money.

Fitting in the Unified Approach

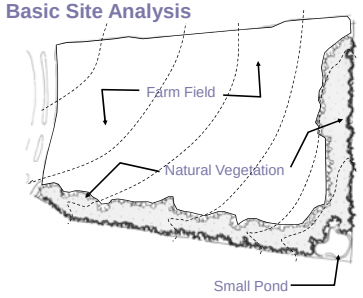
- Early input and clear requirements
- Cost savings innovations
- Reward better site design practices
- Make room for integrated BMPs

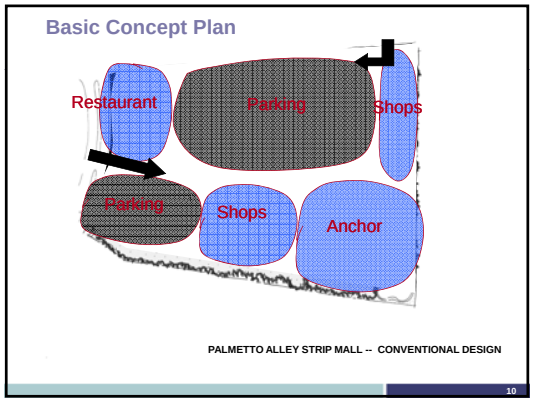
Project Idea
Find Site
Feasibility Study
Site Analysis
Concept Plan
SW Mgmt Plan

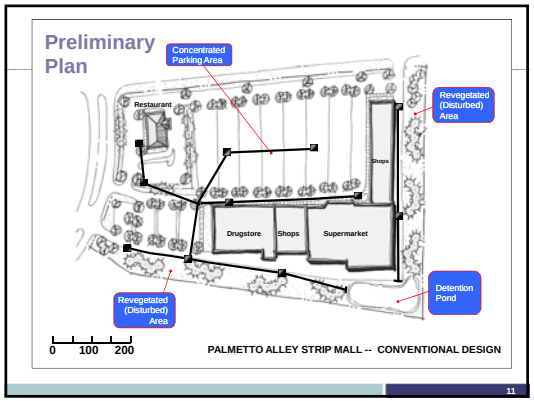


Palmetto Alley Strip Mall

Conventional Design



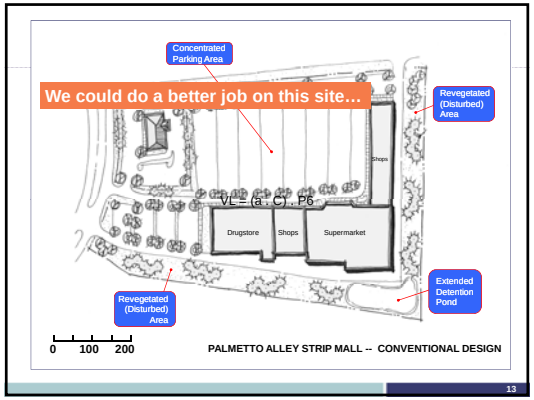




Peachtree Strip Mall

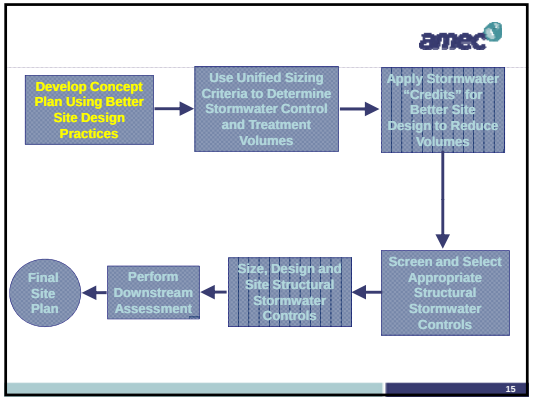
Conventional Design

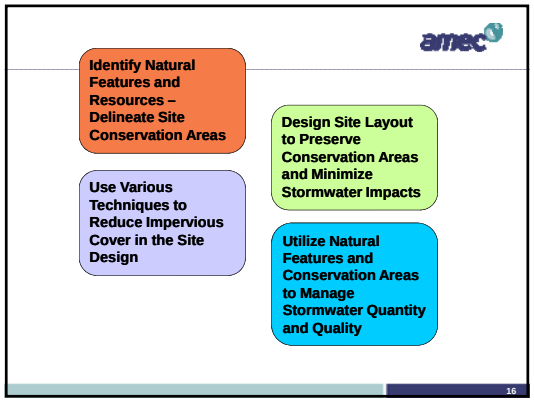
- Area = 18 ac, 84% impervious
- WQ_v = (0.009*84+.05)*1.2/12*18
  = 1.45 ac-ft
- Cp_v = 1.78 ac-ft
- Q_{p25} = 4.68 ac-ft

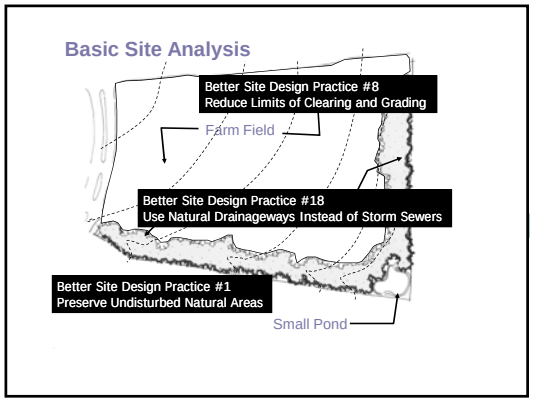


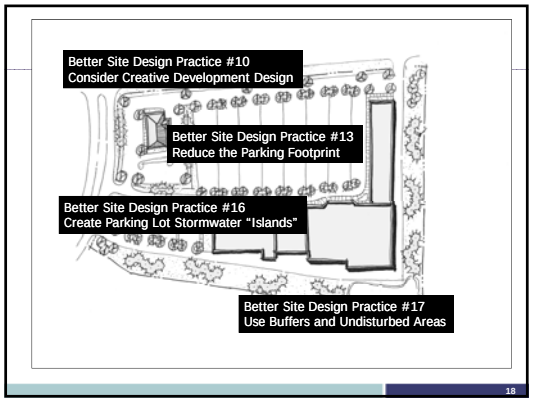
Palmetto "Glen"

Using Stormwater Better Site Design Techniques

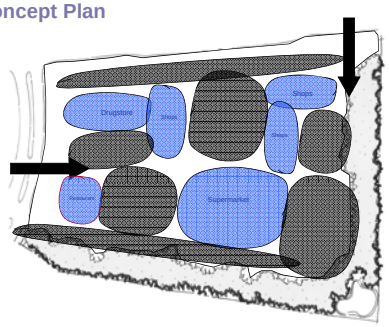






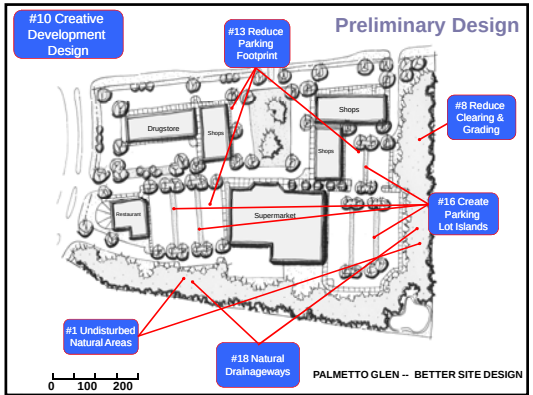


Concept Plan

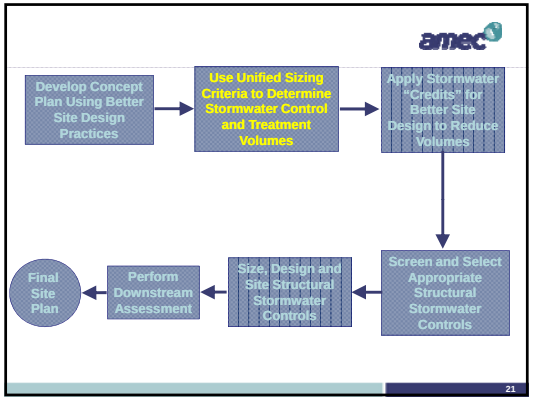


PALMETTO GLEN -- BETTER SITE DESIGN

Preliminary Design



PALMETTO GLEN -- BETTER SITE DESIGN



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Site Details

If site taken as one unit:

- 18 ac total area
- 10 ac impervious (56%)
- WQ
  = (0.009*56+0.05)*1.2*18/12
  = 0.997 ac-ft
- Was 1.45 ac-ft
  - ✓ 31% savings just using Better Site Design
- Cp_v = 1.20 ac-ft
  (32% reduction)
- Q_{p25} = 2.77 ac-ft
  (41% reduction)

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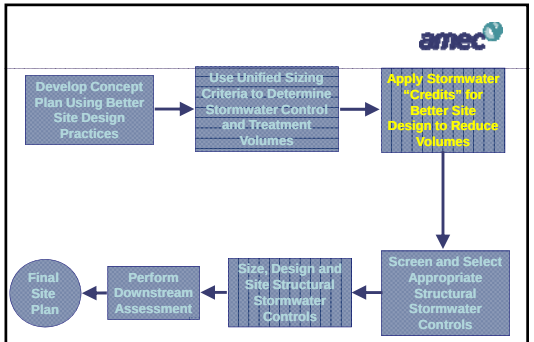

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Credit investigation:

Practice	Description
Natural area conservation	Undisturbed natural areas are conserved on a site, thereby retaining their pre-development hydrologic and water quality characteristics.
Stream buffers	Stormwater runoff is treated by directing sheet flow runoff through a naturally vegetated or forested buffer as overland flow.
Use of vegetated channels	Vegetated channels are used to provide stormwater treatment.
Overland flow filtration/infiltration zones	Overland flow filtration/infiltration zones are incorporated into the site design to receive runoff from rooftops and other small impervious areas.

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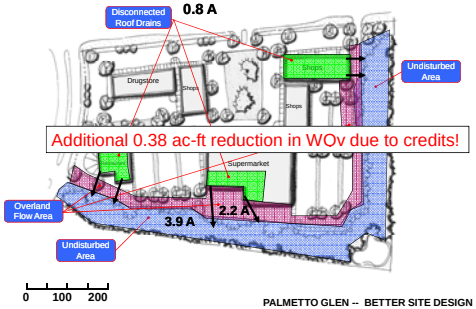
Same number of parking spaces but with slightly narrower widths



PALMETTO GLEN -- BETTER SITE DESIGN

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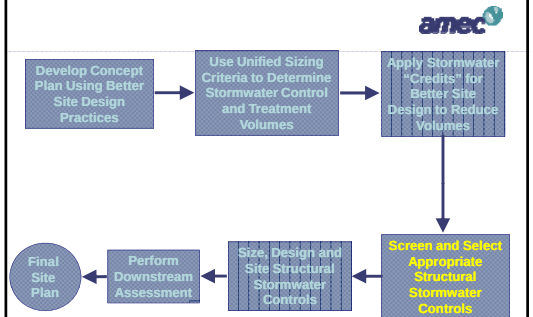

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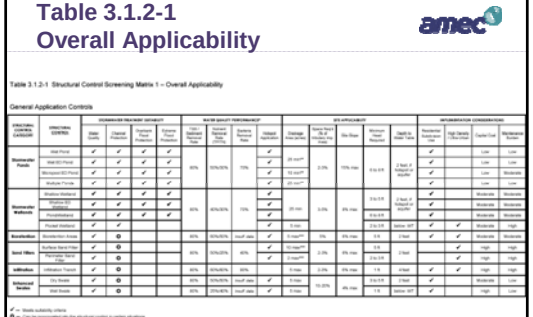
Table 3.1.2-1
Overall Applicability



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STRUCTURAL CONTROL CATEGORY	STRUCTURAL CONTROL	STORMWATER TREATMENT SUITABILITY				WATER QUALITY PERFORMANCE*			
		Water Quality	Channel Protection	Overbank Flood Protection	Extreme Flood Protection	TSS / Sediment Removal Rate	Nutrient Removal Rate (TP/TN)	Bacteria Removal Rate	Hotspot Application
Stormwater Ponds	Wet Pond	✓	✓	✓	✓	80%	50%/30%	70%	✓
	Wet ED Pond	✓	✓	✓	✓				✓
	Micropool ED Pond	✓	✓	✓	✓				✓
	Multiple Ponds	✓	✓	✓	✓				✓
Stormwater Wetlands	Shallow Wetland	✓	✓	✓	✓	80%	40%/30%	70%	✓
	Shallow ED Wetland	✓	✓	✓	✓				✓
	Pond/Wetland	✓	✓	✓	✓				✓
	Pocket Wetland	✓	✓						✓
Bioretention	Bioretention Areas	✓	○			80%	60%/50%	Insuff. data	✓
Sand Filters	Surface Sand Filter	✓	○			80%	50%/25%	40%	✓
	Perimeter Sand Filter	✓	○						✓
Infiltration	Infiltration Trench	✓	○			80%	60%/60%	90%	
Enhanced Swales	Dry Swale	✓	○			80%	50%/50%	Insuff. data	✓
	Wet Swale	✓	○			80%	25%/40%	Insuff. data	✓

Screening:

- Vegetated channel treatment?
  - ✓ But we wanted to have a conservation area
- Wet pond for the whole site?
  - ✓ But we had a concern for vector problems
- Bioretention chosen
  - ✓ More costly, uses parking lot, treats Cp_v

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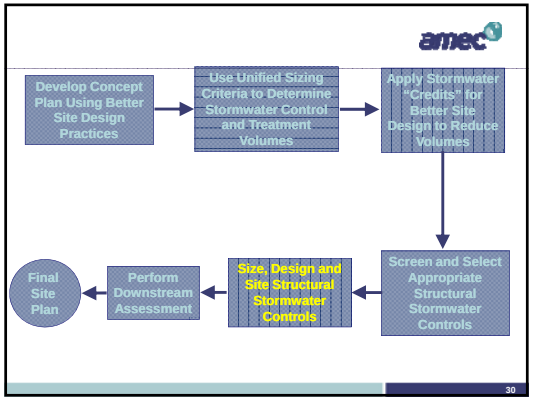

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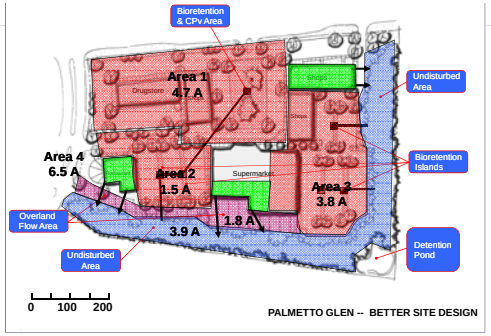
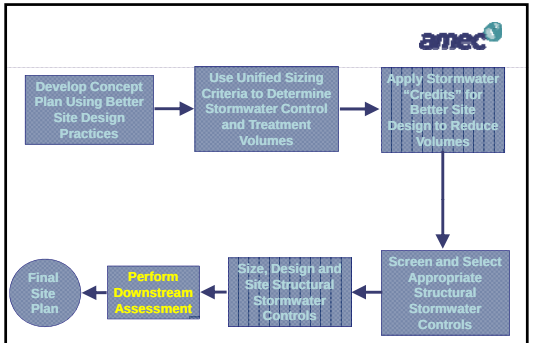
Same number of parking spaces but with slightly narrower widths



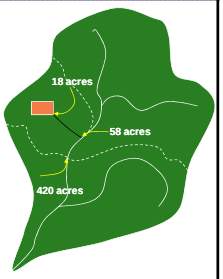
Comparison

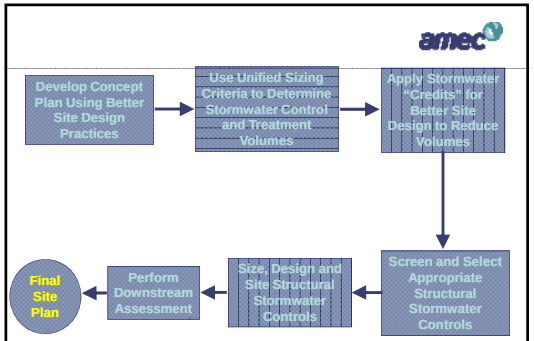
Original Plan	Better Site Design & Credits
18 Acres	18 Acres
84% impervious	57% impervious
-0- acres preserved	3.9 acres preserved
60% TSS removal	80% TSS removal
WQv = 1.45 ac-ft	WQv = 0.61 ac-ft



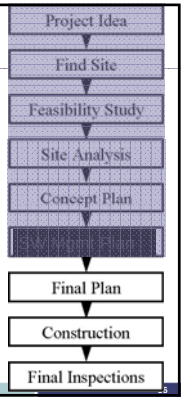
Downstream assessment:

- 18 ac at site outlet
- 58 ac at junction with main stem
  - ✓Slight increase in peak flow; increase in Q_{p25} from 2.77 to 2.95 ac-ft
  - ✓Alternates: flow easement or channel improvement.
- 420 ac is next check point - no further increase





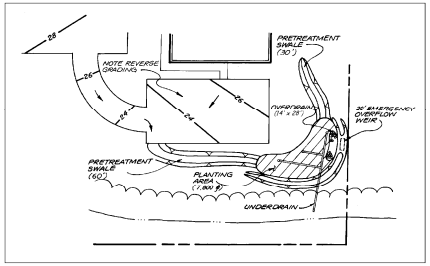
Moving on to the final design:



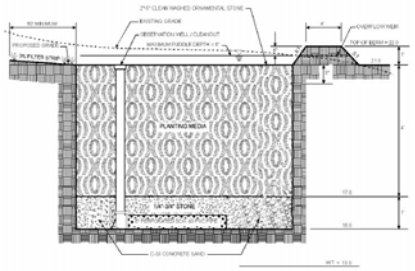
A Look Ahead…

Design details to be shown in future presentations

Bioretention



Bioretention



Bioretention & Darcy's Formula

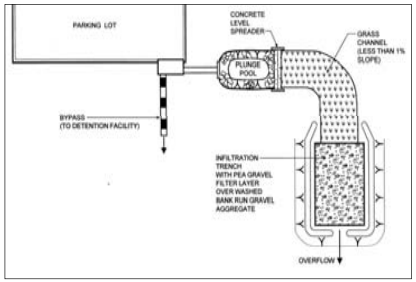
$A_f = (WQv)\,(d_f) / [\,(k)\,(h_f + d_f)\,(t_f)]$

where:

A_f = surface area of ponding area (ft^2)
WQ_v = water quality volume (or total volume to be captured)
d_f = filter bed depth (4 feet minimum)
k = coefficient of permeability of filter media (ft/day)
(use 0.5 ft/day for silt-loam)
h_f = average height of water above filter bed (ft)
(3 inches, which is half of the 6-inch ponding depth)
t_f = design filter bed drain time (days)
(2.0 days or 48 hours is recommended maximum)

And it looks like this…

Infiltration Trench



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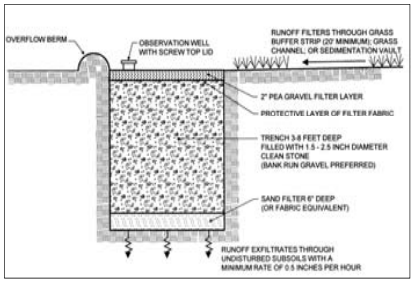

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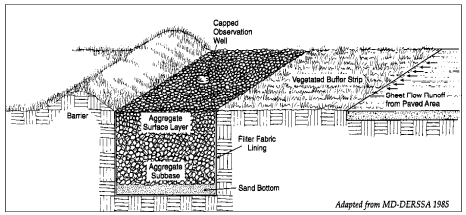

Infiltration Trench Volume

$A = WQ_v/(nd+kT/12)$
$= WQ_v/(0.32d+k/6)$

- n=0.32
- d=depth in feet
- k=percolation rate (in/hr)
- T = fill time = 2 hrs.

And it looks like this…

…NOT this.

Questions?