Sustainable Infrastructure

September 19, 2013

Jonathan Ford, PE
Morris Beacon Design
Providence, RI

Conventional Stormwater Management

(peak rate mitigation banished to the backyard!)

Low Impact Development (LID)!!

- Reduce impervious cover
- Prevent impact to natural drainage systems
- Manage water as close to the source as possible
- Preserve natural areas, native vegetation, reduce impact on watershed
- Protect natural drainage pathways
- Utilize less complex, non-structural BMPs
- Create a multi-functional landscape

- RI Design and Installation Standards Manual, 2010

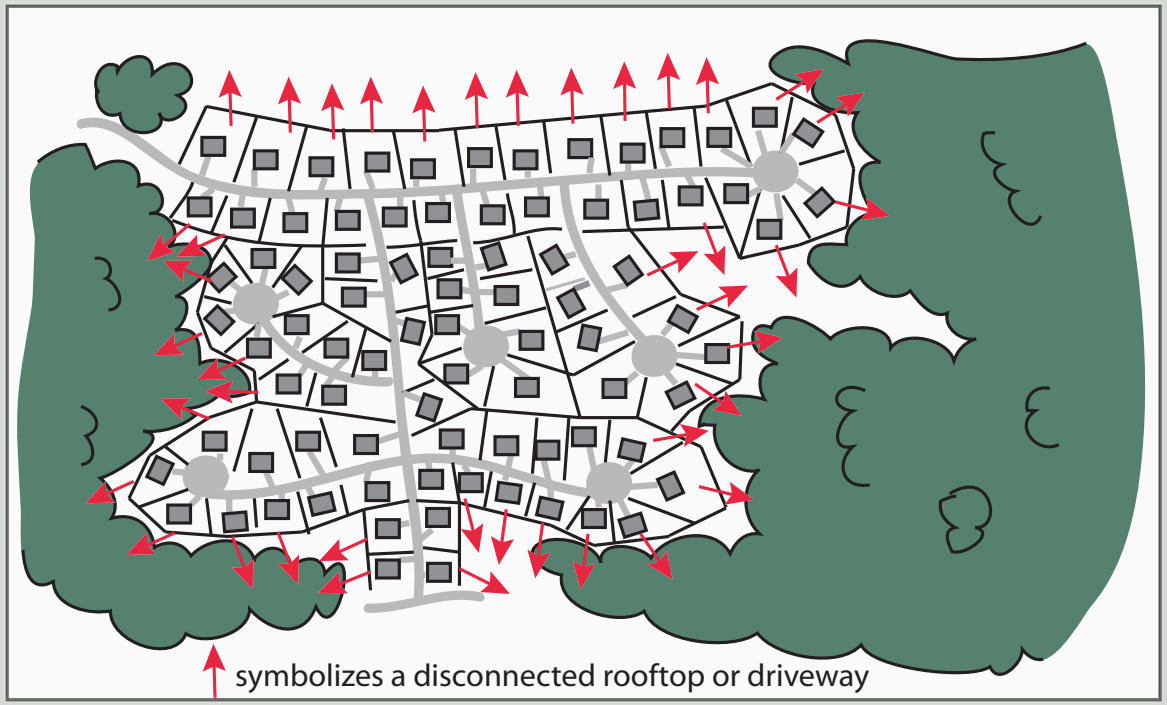
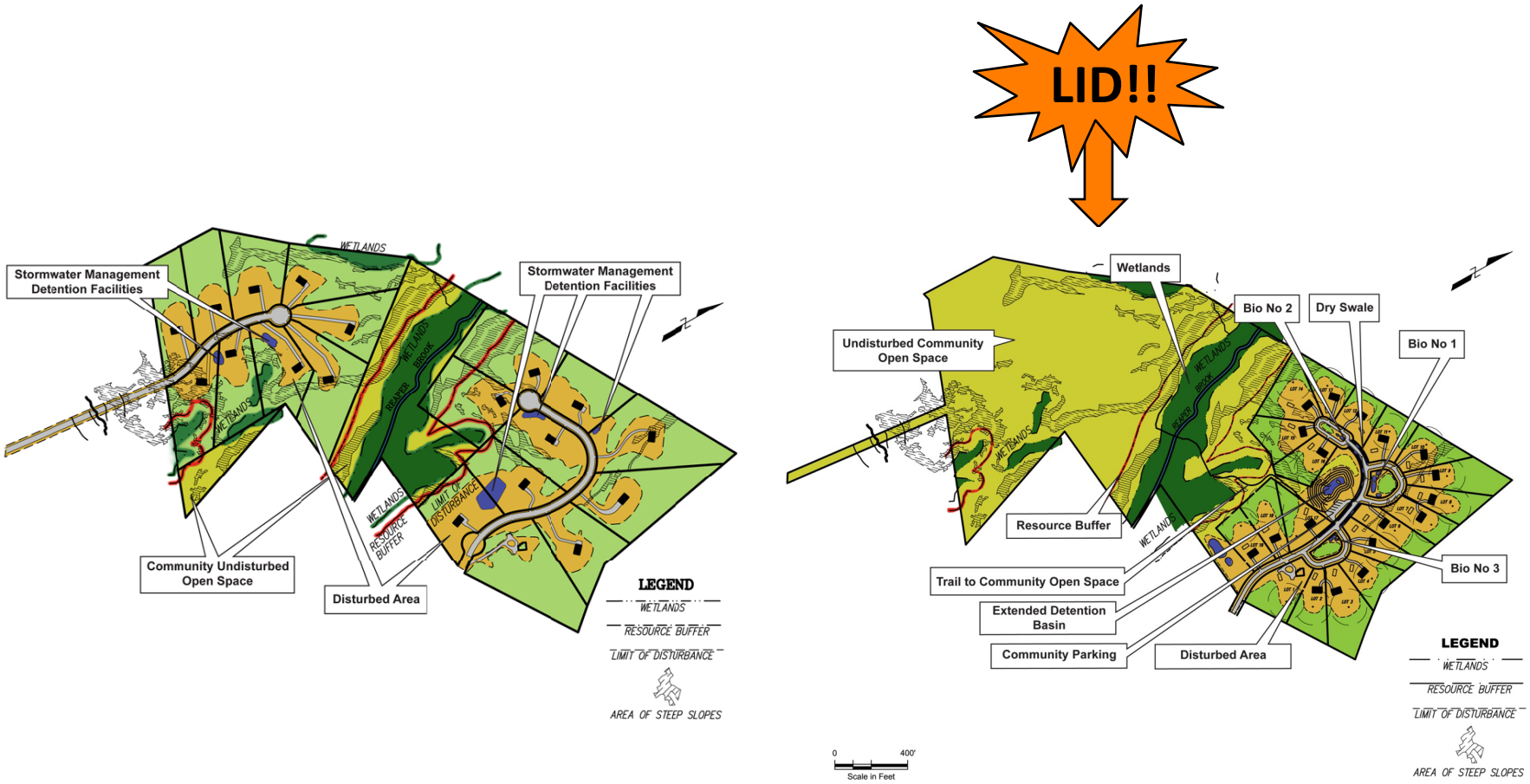
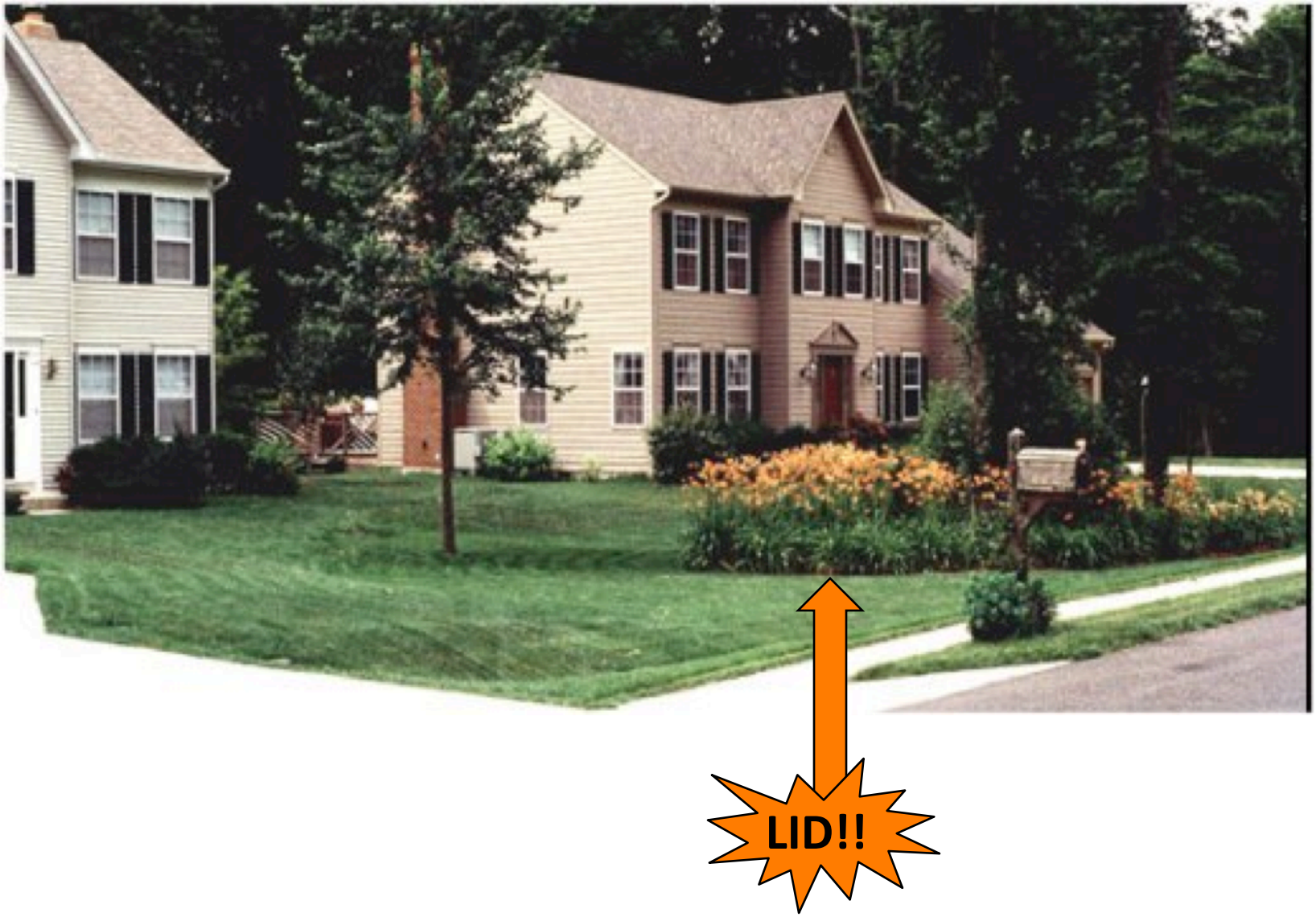


Figure 6-5. The amount of runoff and associated pollutants from a project can be reduced by disconnecting impervious surfaces through the disconnection methods described in Section 6-2.



Rhode Island Stormwater Design and Installation Standards Manual, 2010


LID!!

Claytor, from Rhode Island Stormwater Design and Installation Standards Manual, 2010


Governor Bradford
RESTAURANT
FOOD · DRINK
ENTERTAINMENT
Budweiser
Old Colony TAP
POT
AIR CONDITIONED


CONGRESS ST
CHURCH ST
ONE WAY
GOOD KIDS
BAKERY & CAFE


She's back!
Les Miserables
GET BLOWN AWAY
CHEW


Heineken
ARGENT
Twizzlers
ONE WAY

EPA Business Case for Smart Growth

Placemaking
Market acceptance & premiums
Demographics
Supply & demand
Marketing

Now how do we build it?

image credit: Chuck Bohl

Material adapted from "Comparative Infrastructure & Material Analysis" under UPA Contract EP-W-05-25 and appears in the working publication "Smart Growth: The Business Opportunity for Developers and Production Builders" under the same contract.

Original scenarios by Dover Kohl & Partners.

Smart Growth & Conventional Suburban Development

An infrastructure case study completed for the EPA

MORRIS BEACON design

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CIVIL ENGINEERING. PLANNING. URBAN DESIGN.
implementing community vision

by Jonathan Ford, PE

January 13, 2010

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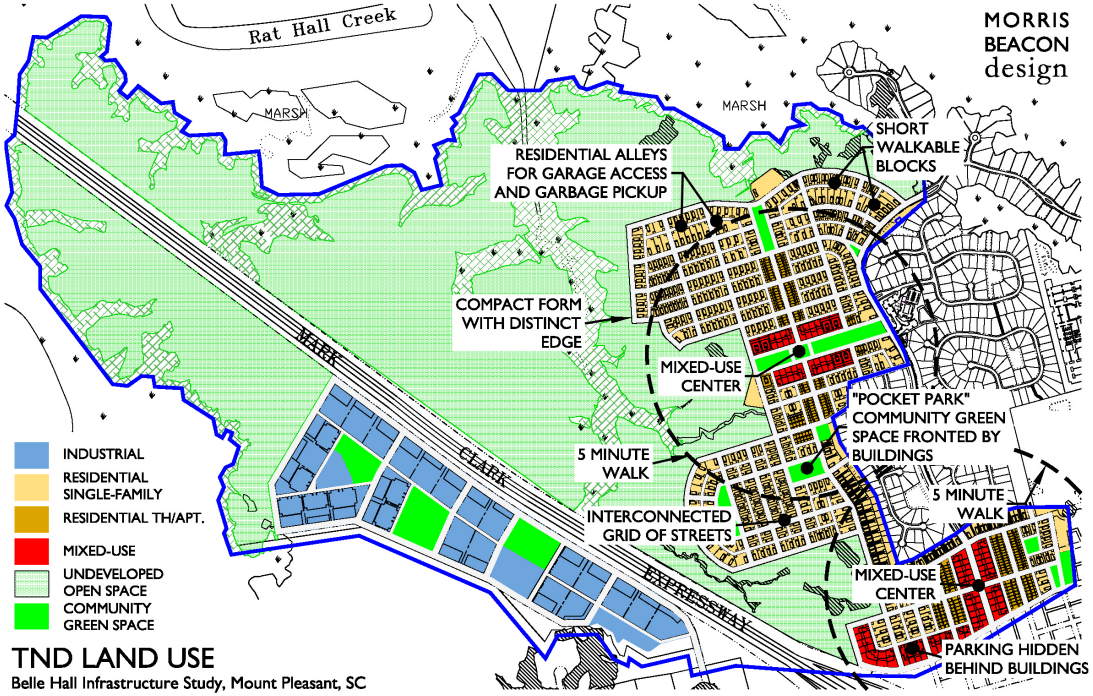
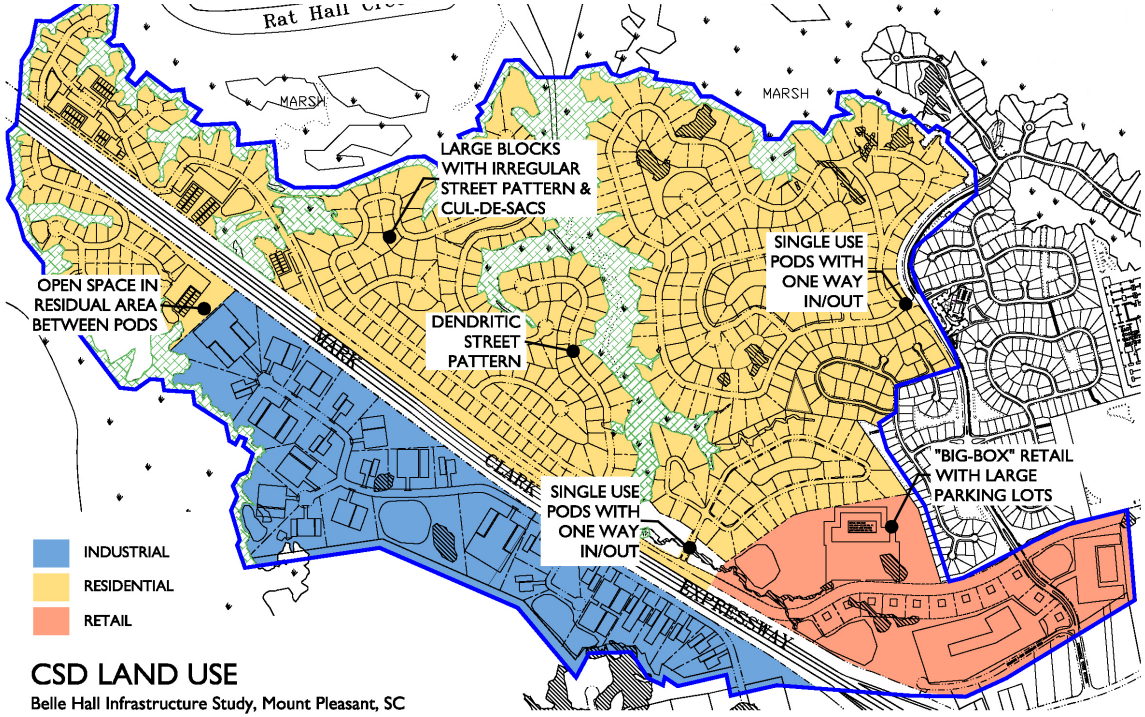
Comparative infrastructure analysis





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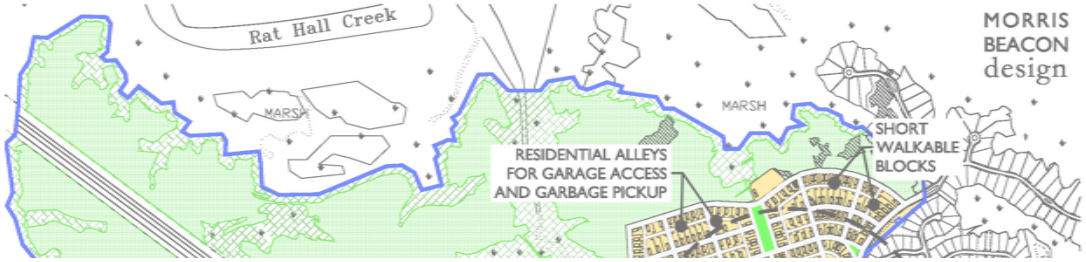
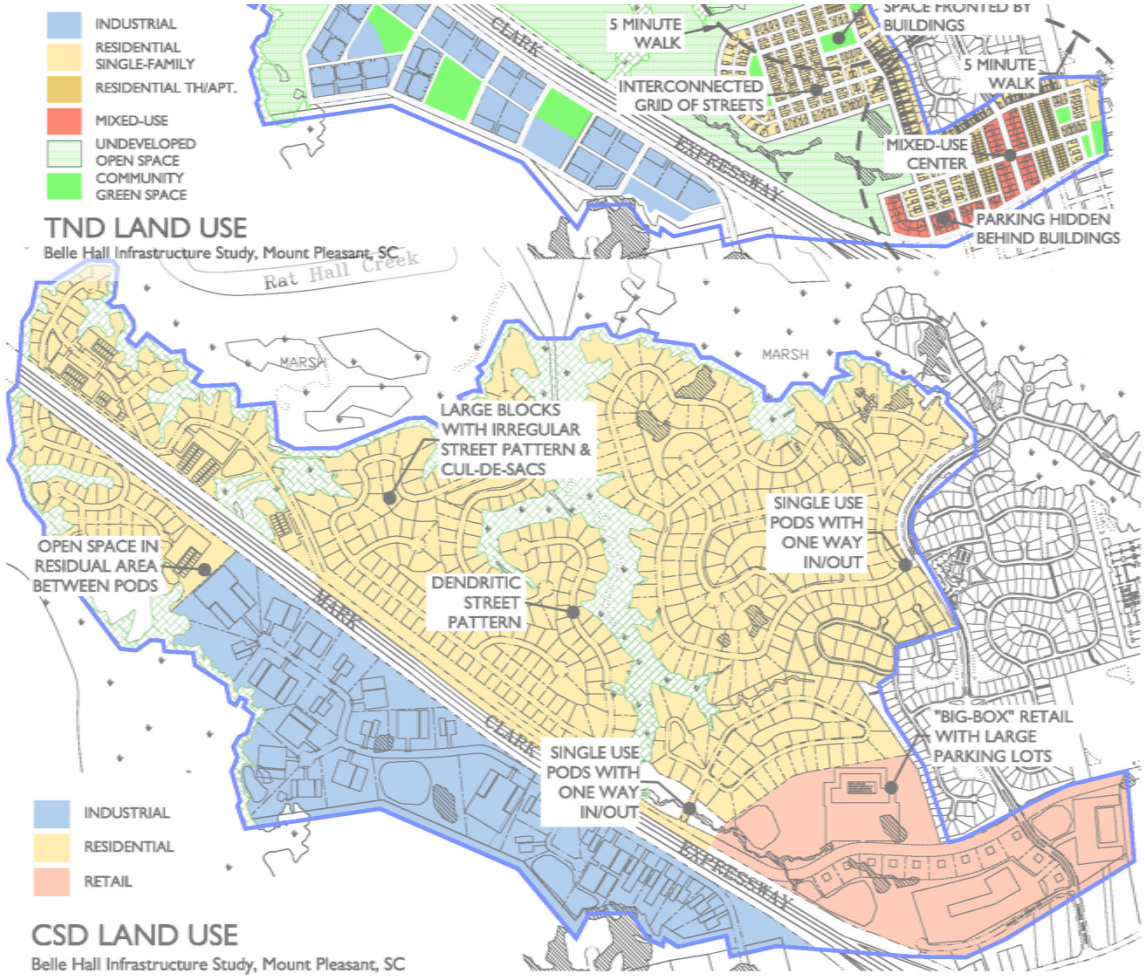
Comparative infrastructure analysis



Which costs more?



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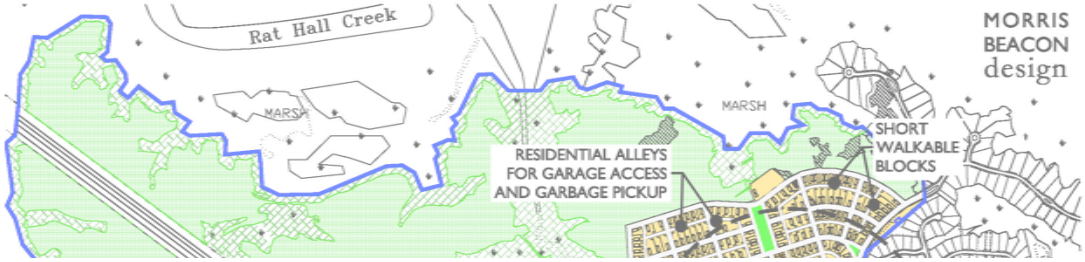
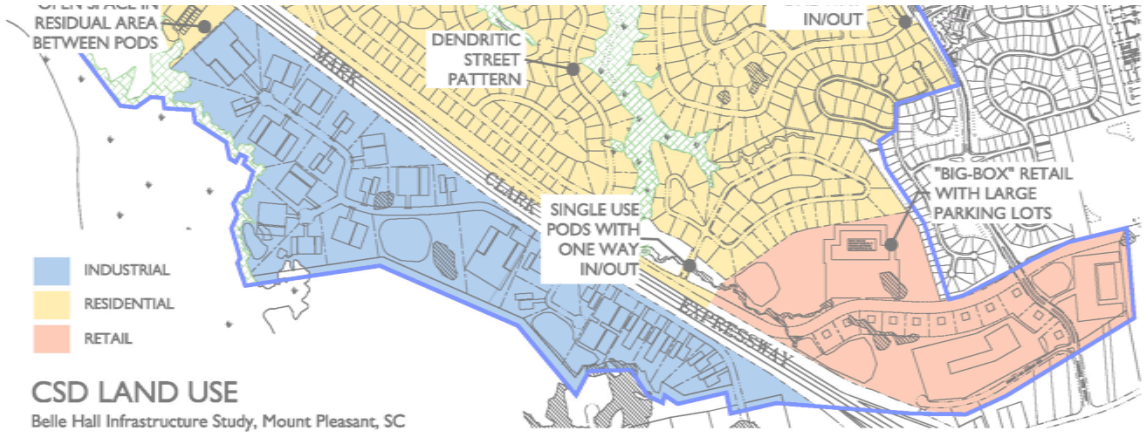


Which costs more?

It depends, but costs are measurable



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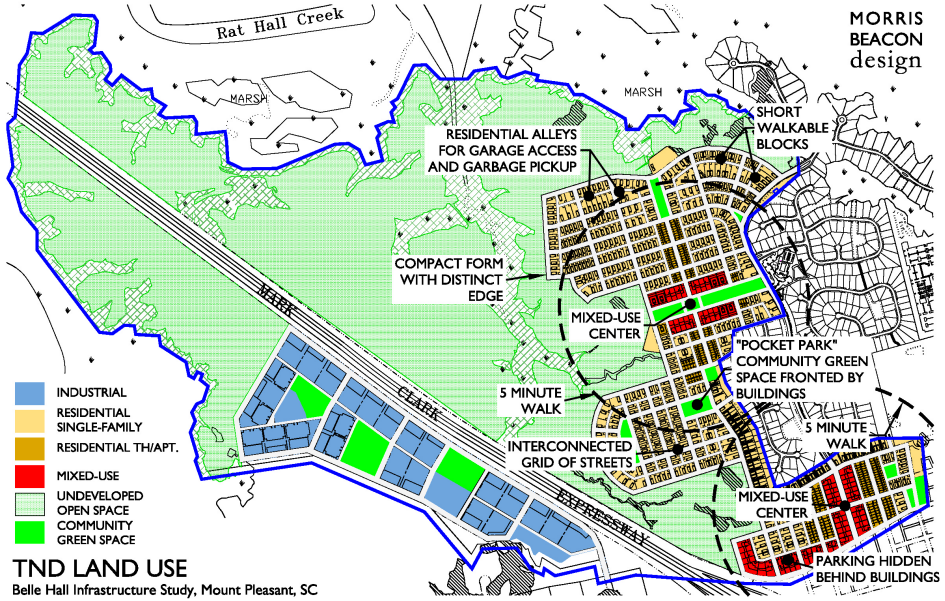
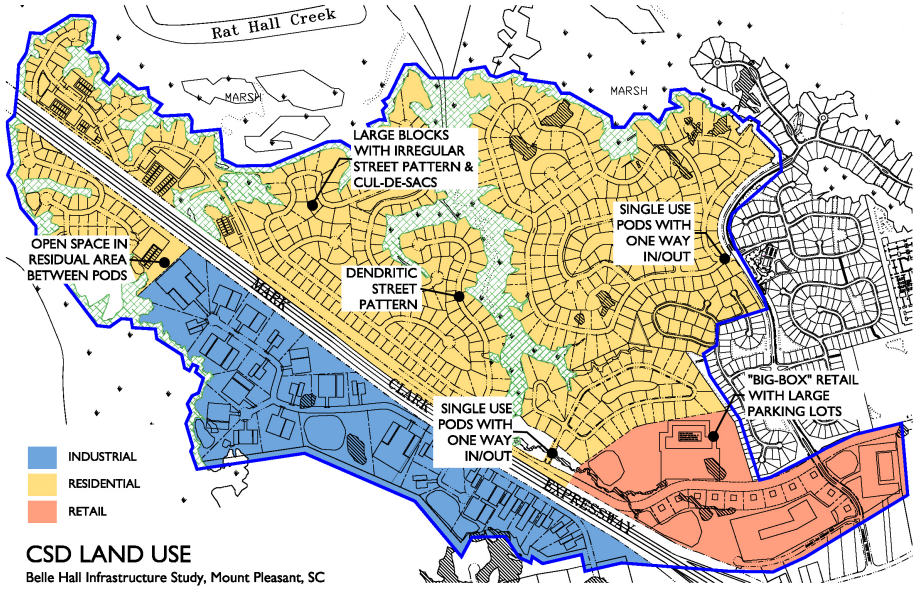


TND LAND USE
Belle Hall Infrastructure Study, Mount Pleasant, SC



CSD LAND USE
Belle Hall Infrastructure Study, Mount Pleasant, SC

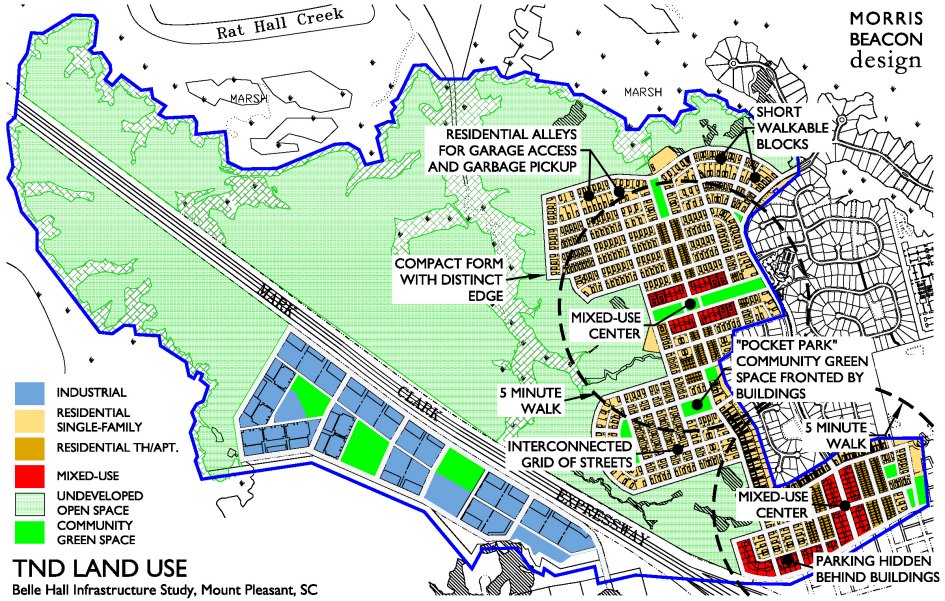
TND A
253 developed acres
800 residential units
Net density per res. acre = 4.6

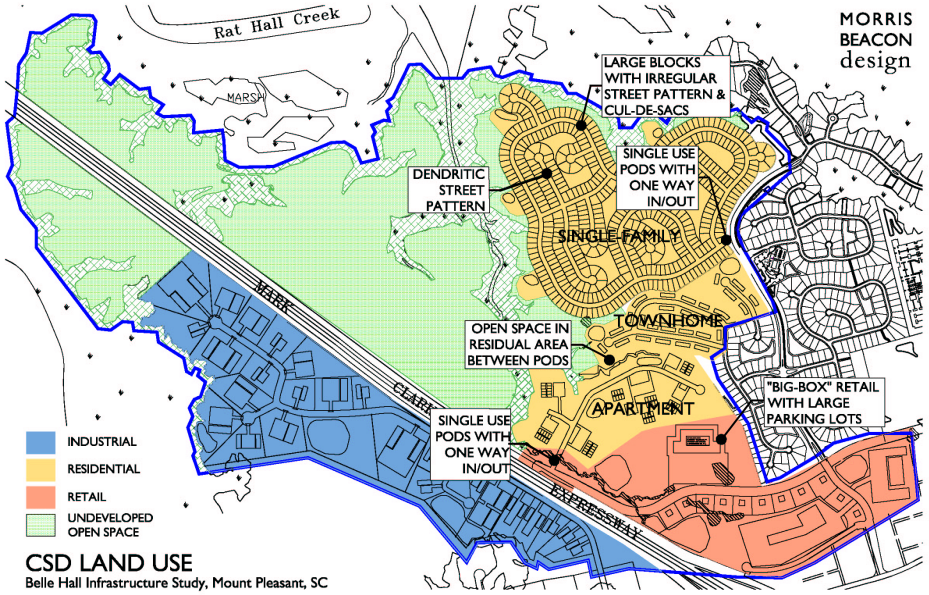
CSD B
601 developed acres
800 residential units
Net density per res. acre = 2.1

Material adapted from "Comparative Infrastructure & Material Analysis" under UPA Contract EP-W-05-25 and appears in the working publication "Smart Growth: The Business Opportunity for Developers and Production Builders" under the same contract.

Original scenarios by Dover Kohl & Partners.

draft - do not cite or publish





<u>TND A</u>
253 developed acres
800 residential units
Net density per res. acre = 4.6

<u>CSD C (smaller lot)</u>
384 developed acres
800 residential units
Net density per res. acre = 4.6

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Original scenarios by Dover Kohl & Partners.

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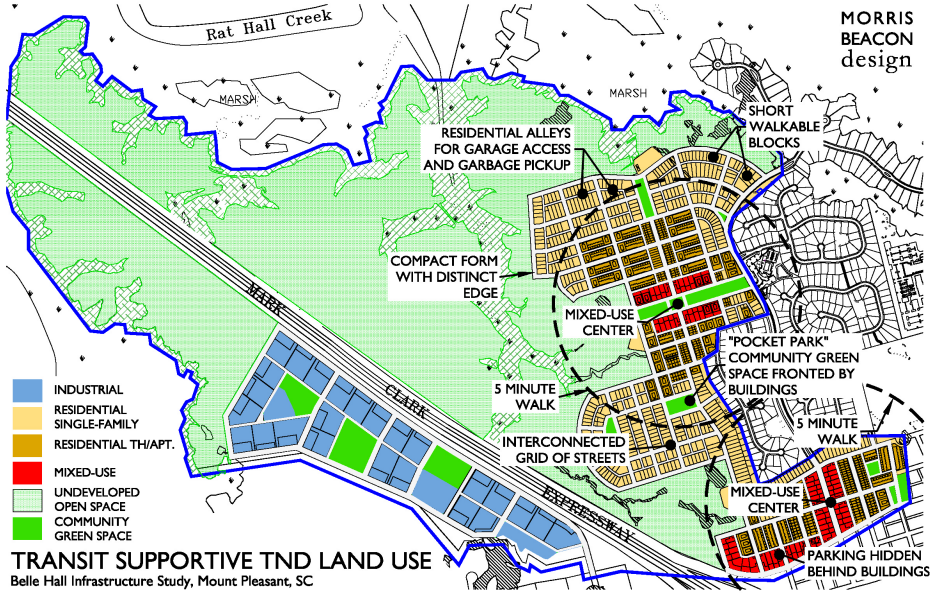

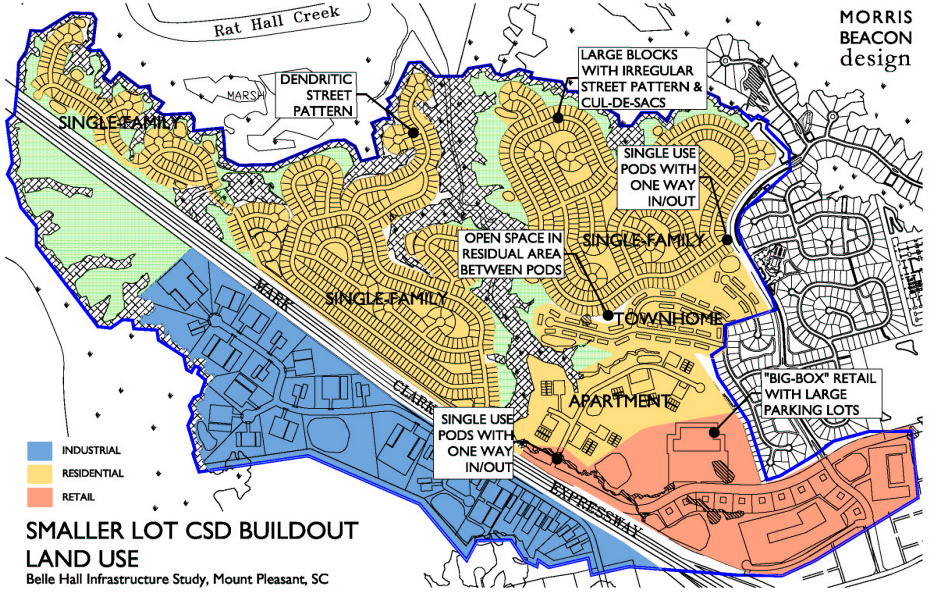

<u>TND D (transit supportive)</u>
253 developed acres
1410 residential units
Net density (per res. acre) = 8.0

<u>CSD E (smaller lot)</u>
601 developed acres
1410 residential units
Net density (per res. acre) = 4.5

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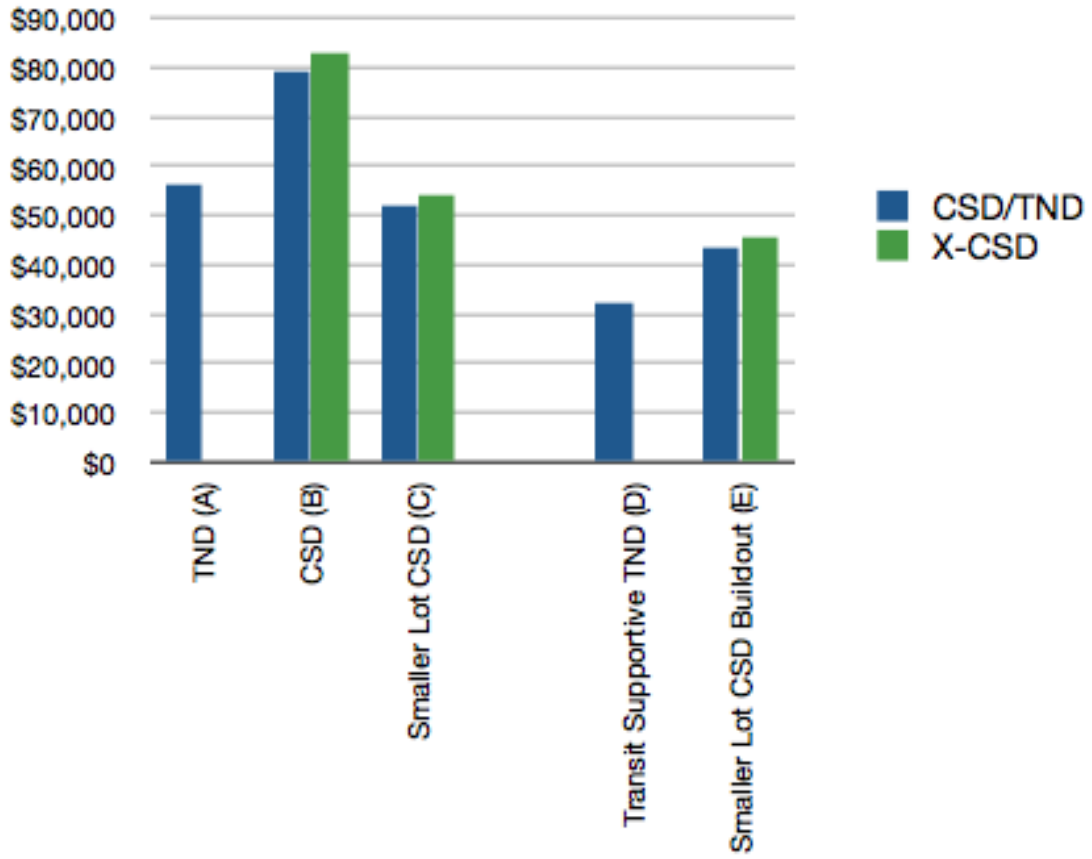
Original scenarios by Dover Kohl & Partners.

draft - do not cite or publish

Belle Hall: Infrastructure Cost per Residential Unit



TOTAL COST:	**$45,287,144**	**$63,057,778**	**$41,609,239**	**$45,769,366**	**$61,317,693**
Cost/residential unit	**$56,538**	**$79,318**	**$52,339**	**$32,507**	**$43,519**
Residential units used in calculation	**801**	**795**	**795**	**1,408**	**1,409**
Percent Change	**--**	**40.3%**	**-7.4%**	**--**	**33.9%**

Material adapted from "Comparative Infrastructure & Material Analysis" under UPA Contract EP-W-05-25 and appears in the working publication "Smart Growth: The Business Opportunity for Developers and Production Builders" under the same contract.

Original scenarios by Dover Kohl & Partners.

Conclusions

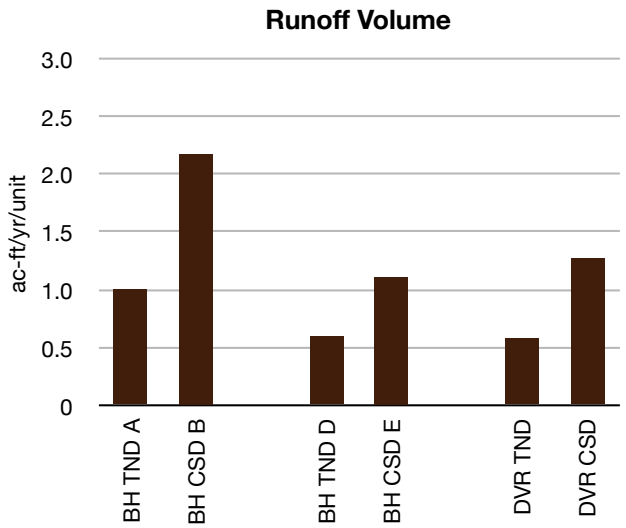
•It's measurable! Measuring infrastructure components of a Smart Growth project is no different than measuring the same in a conventional suburban project

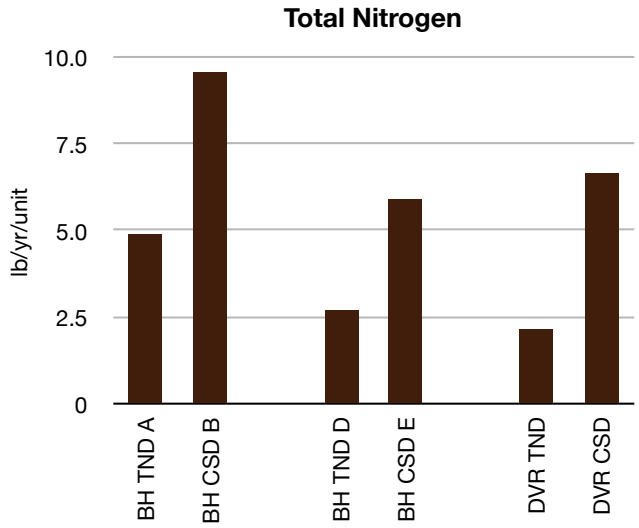
•Both TND and CSD needs roads, utilities, parking, curb…it's the arrangement of these that can lead to cost efficiencies

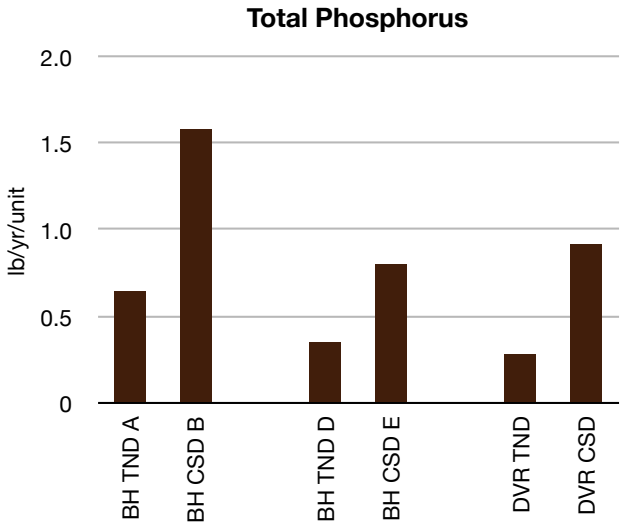
•Density, compactness, connectivity, and a mix of uses all tend to make Smart Growth more efficient

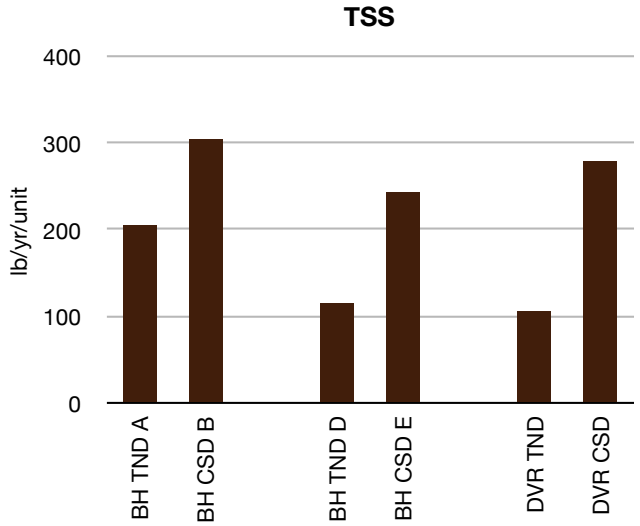
•Infrastructure requirements in Smart Growth communities allow for strategic phasing that can reduce risk and allow incremental changes in product type

Beyond LID: not all impervious area is equal









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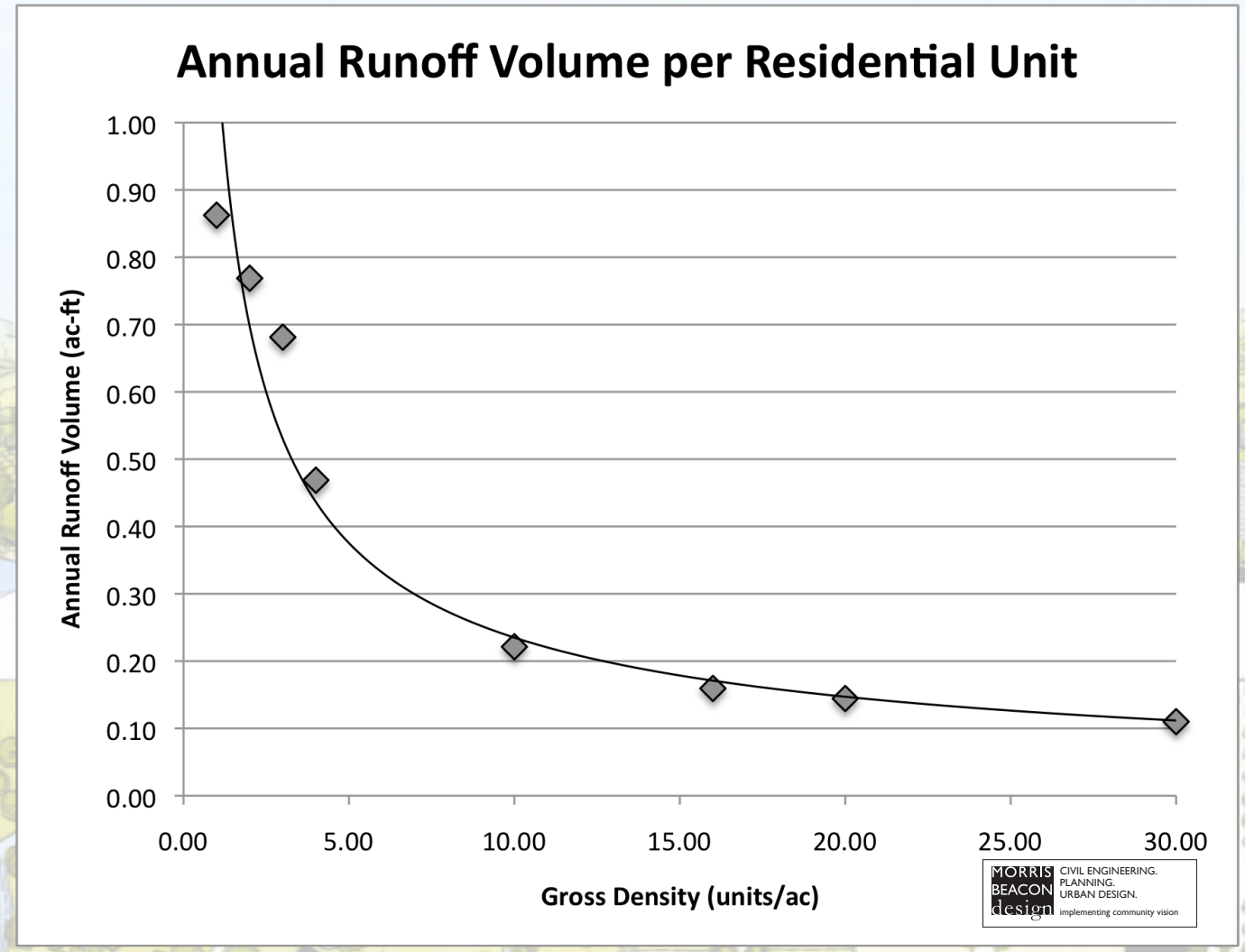
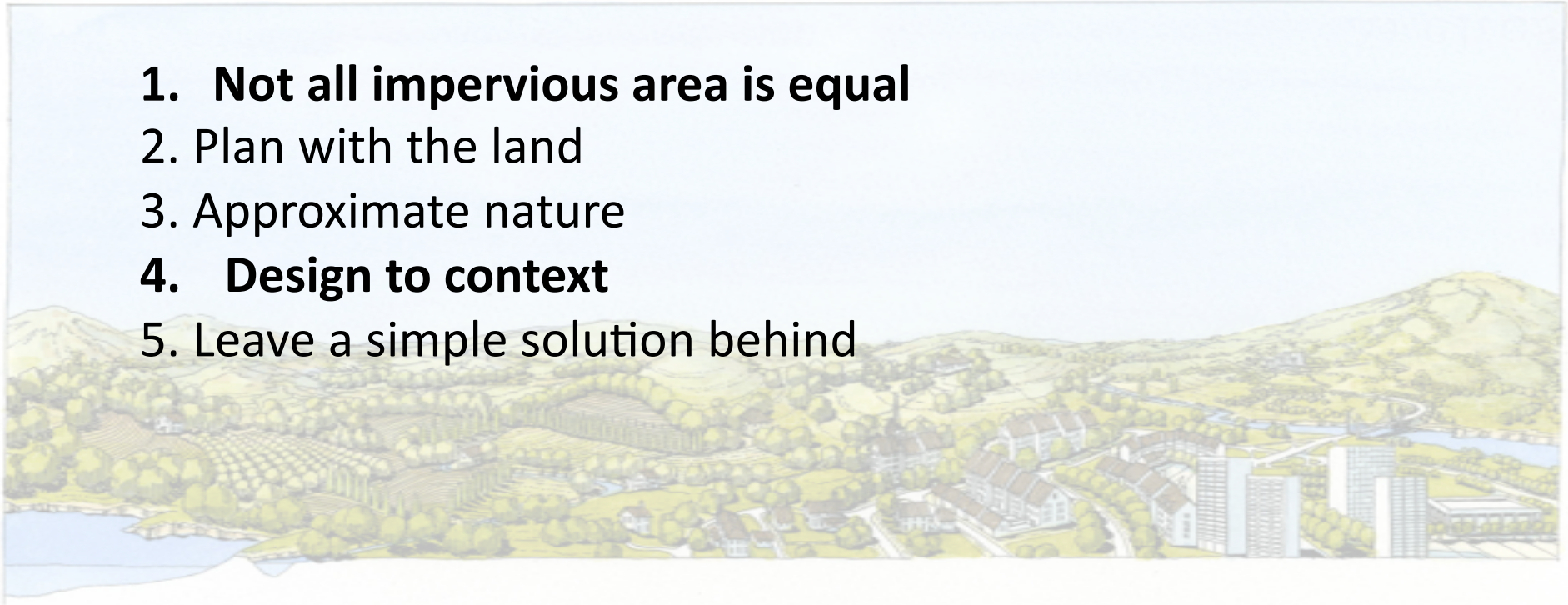
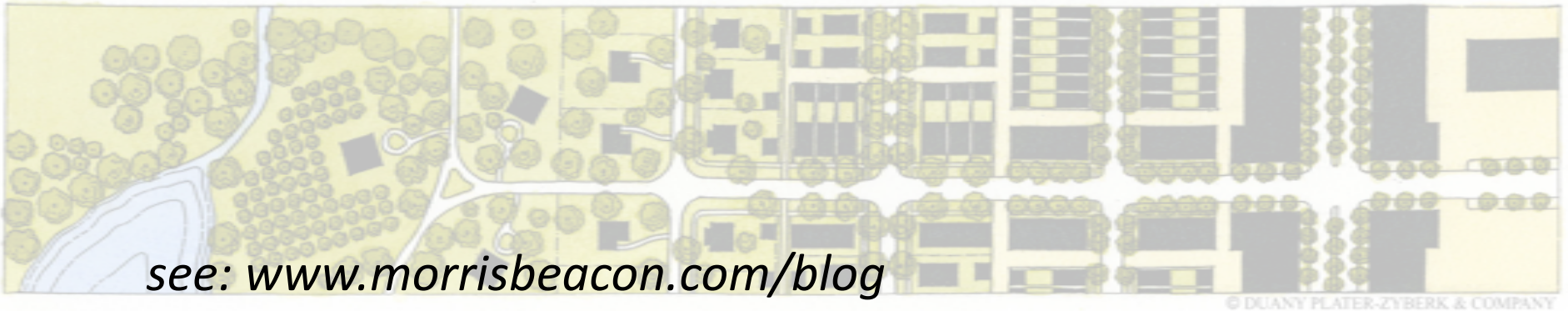
Beyond LID: not all impervious area is equal



LID 2.0

1. **Not all impervious area is equal**
2. Plan with the land
3. Approximate nature
4. **Design to context**
5. Leave a simple solution behind

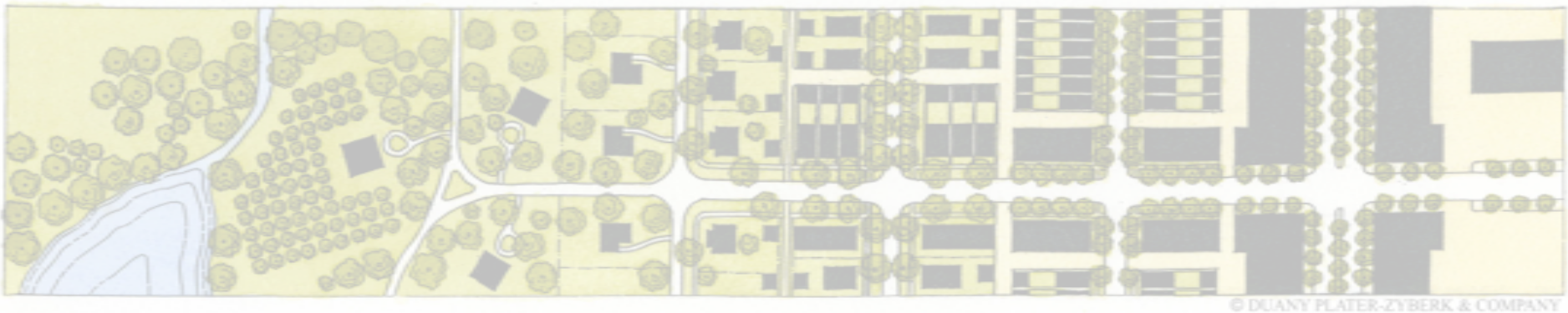




see: www.morrisbeacon.com/blog

LID 2.0 & Simsbury: Focus Areas

1. Design to Context – Form-Based Zoning
2. Incentives for Projects Located in Compact, Walkable Areas
3. Design Checklist
4. Planning & Site Design Guidelines
5. Operation & Maintenance – *Lovable* Infrastructure



Simsbury Center Code Simsbury Connecticut

ADOPTED: APRIL 04, 2011 | EFFECTIVE: APRIL 15, 2011

Zoning code by Code Studio.

Zoning code by Code Studio.

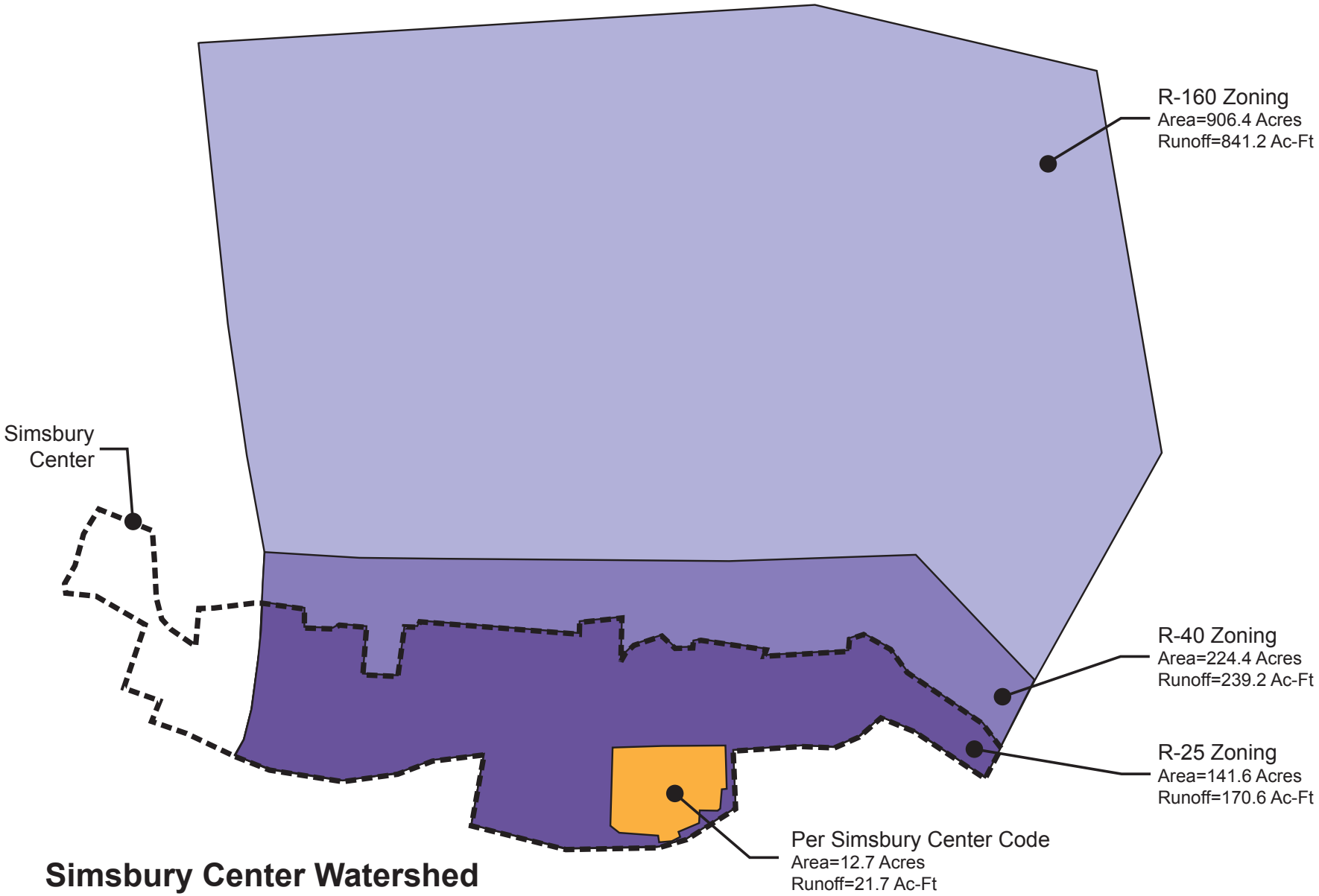
Zoning code by Code Studio.

Zoning code by Code Studio.

SEC. 2.3 SUMMARY OF FRONTAGE REQUIREMENTS

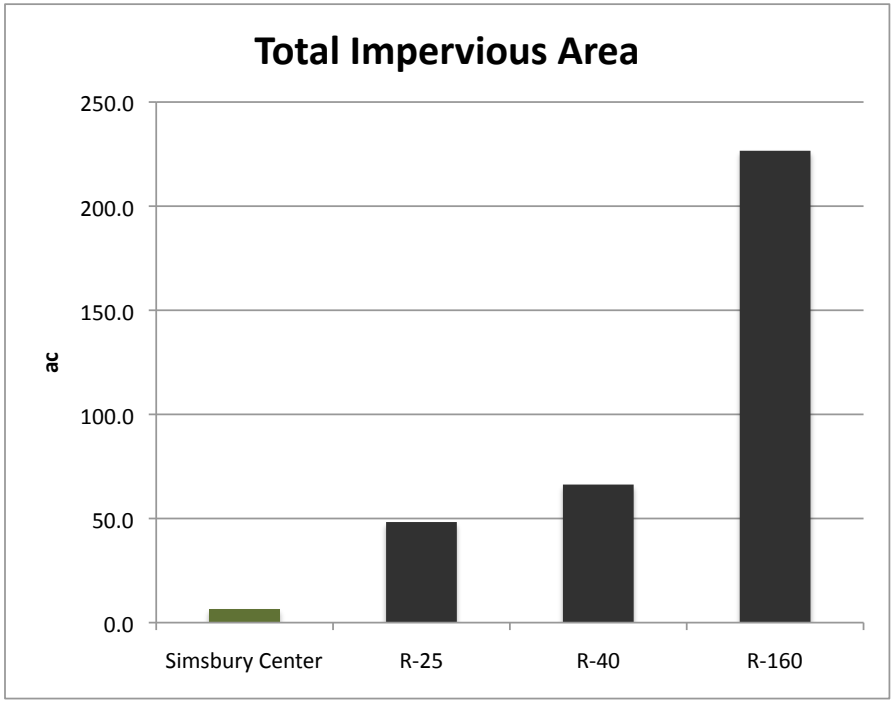
2.3.1 Lot	SC-1	SC-2	SC-3	SC-4	SC-5	CIV	OS
Lot Standards							
Ⓐ Area (min)	5,000 sf	3,000 sf	5,000 sf	1,500 sf	1,500 sf	n/a	n/a
Ⓑ Width (min)	50'	30'	50'	20'	20'	n/a	n/a
Building Setbacks							
Ⓒ Street setback line (min)	Varies (see regulating plan)	Varies (see regulating plan)	Varies (see regulating plan)	Varies (see regulating plan)	Varies (see regulating plan)	Varies (see regulating plan)	10’
Ⓓ Setback, protected district (min)	20'	10’	10’	10’	10’	10’	10’
Ⓓ Setback, unprotected district (min)	0’ or 5’	0’ or 5’	0’ or 5’	0’ or 5’	0’ or 5’	0’ or 5’	10’

2.3.2 Placement							
Build-to							
Ⓔ Street setback area (min/max)	0’ / 15’	0’ / 5’	0’ / 8’	0’ / 12’	0’ / 12’	n/a	n/a
Ⓕ Building width in setback area (min % of lot width)	50%	90%	70%	70%	70%	n/a	n/a
Parking Location							
Ⓖ Parking setback line (min)	Varies (see regulating plan)	Varies (see regulating plan)	Varies (see regulating plan)	Varies (see regulating plan)	Varies (see regulating plan)	Varies (see regulating plan)	not allowed
Setback, protected district (min)	10'	10’	10’	10’	10’	10’	not allowed
Setback, unprotected district (min)	0' or 5'	0’ or 5’	0’ or 5’	0’ or 5’	0’ or 5’	0’ or 5’	not allowed
Open Space							
Ⓗ % of open area on the lot (min)	15%	15%	15%	15%	15%	30%	98%



Simsbury Center Watershed

Simscroft Farms Test Site Buildout Comparison


Total Impervious Area
250.0
200.0
150.0
100.0
50.0
0.0
ac
Simsbury Center
R-25
R-40
R-160

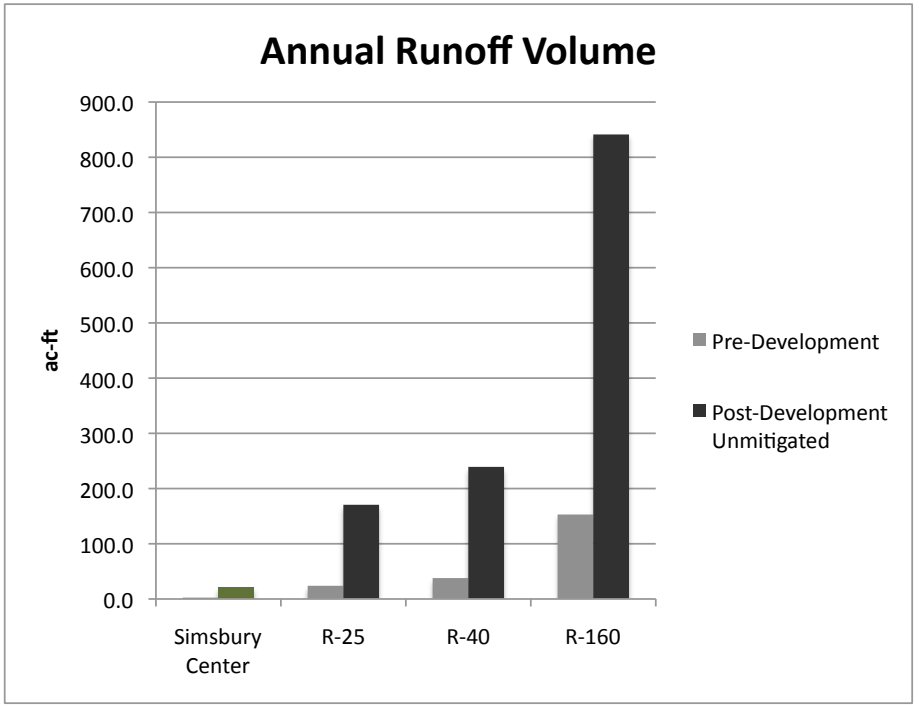
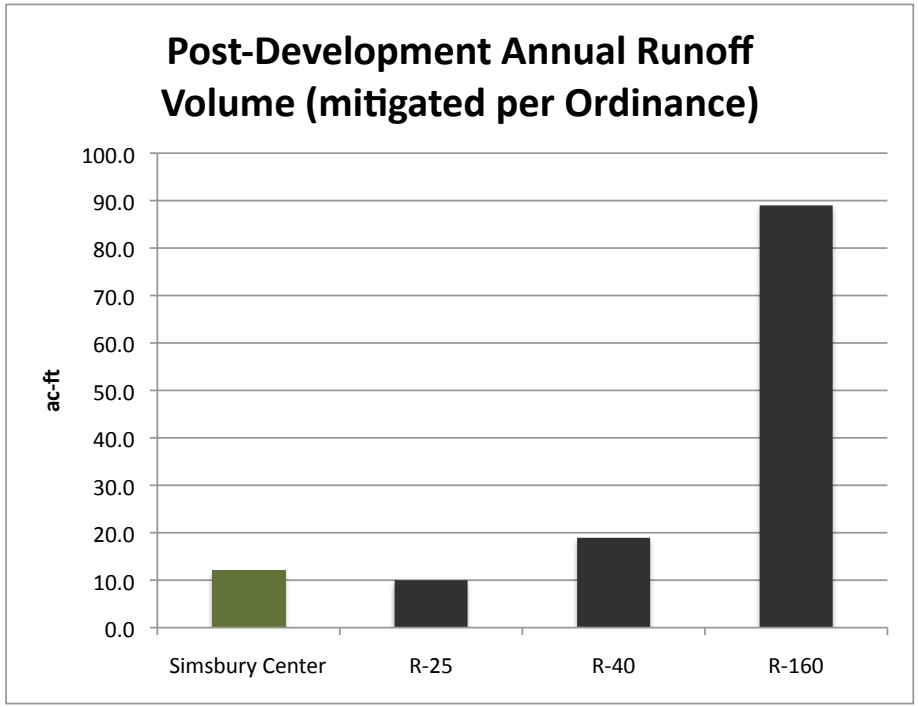
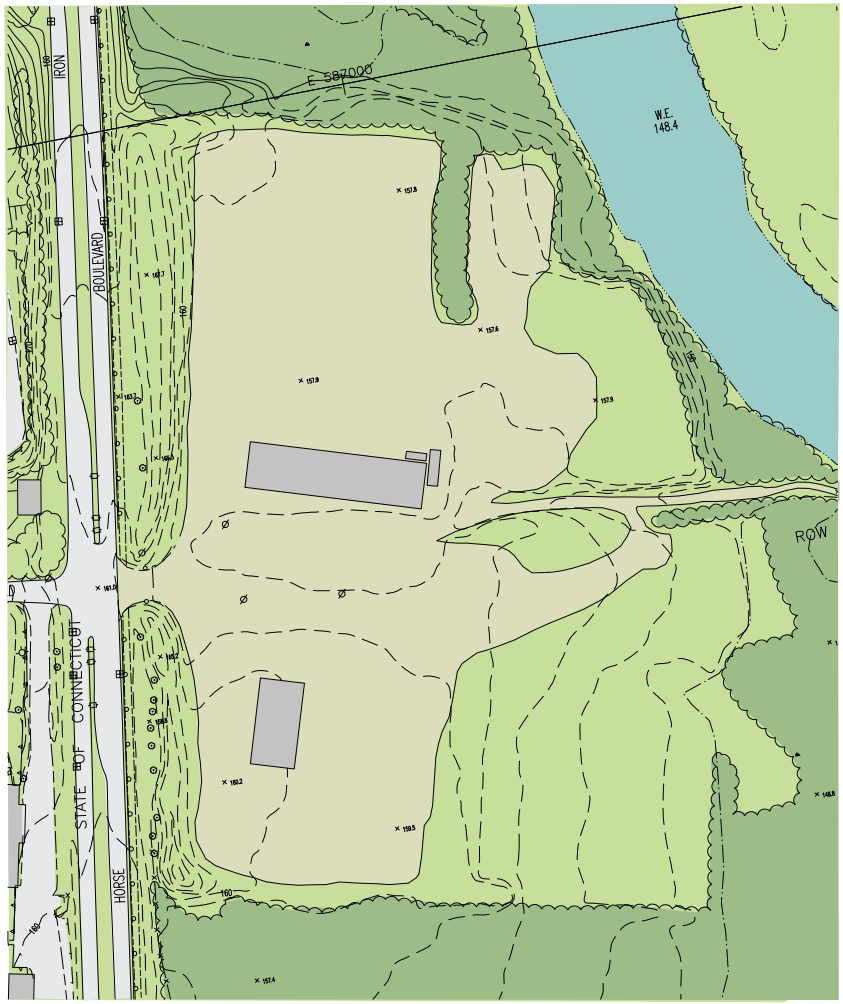

Annual Runoff Volume
900.0
800.0
700.0
600.0
500.0
400.0
300.0
200.0
100.0
0.0
ac-ft
Simsbury Center
R-25
R-40
R-160
Pre-Development
Post-Development Unmitigated

Table 1.1 – Location-Based Adjustments								
	SC-1	SC-2	SC-3	SC-4	SC-5	CIV	OS	Other Zones
Peak Rate	Peak rate reduction per 1.1.2B-1 not required for the 100-year storm event*					100%	100%	110%
Water Quality	100%	100%	100%	100%	100%	100%	100%	110%
Recharge Volume	75%	50%	50%	75%	50%	75%	100%	110%



Test Sites



Test Site #1: Simscroft Farms

Post-Development Conditions

Post-Development			
Total Area	555,440		
Impervious Area (sf)	333,234	60.0%	
Redevelopment credit	no		Existing land cover to be verified
Location-based credit	50%		Simsbury Center Zone SC-5

Test Sites

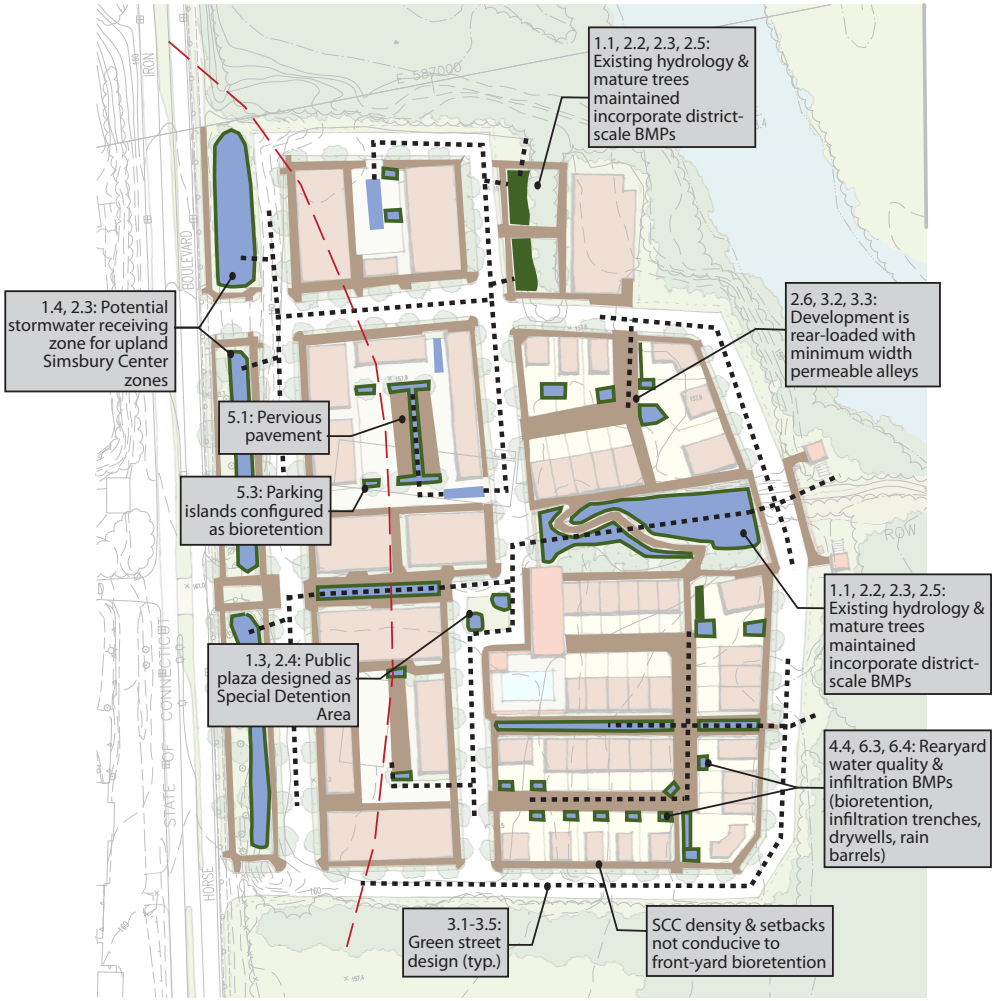
Layout by Russell Preston

Test Site #1: Simscroft Farms

Post-Development Conditions

	Value	%	Notes
Post-Development			
Total Area	555,440		
Impervious Area (sf)	333,234	60.0%	
Redevelopment credit	no		Existing land cover to be verified
Location-based credit	50%		Simsbury Center Zone SC-5
Office Space (sf)	0		
Residential Units	224		

Test Sites



Layout by Russell Preston

Test Site #1: Simscroft Farms

Post-Development Conditions

LEGEND

- Recharge
- Water Quality
- Recharge & Water Quality
- SR/ST Areas
- Tree Credit
- Underground Pipe
- Pervious Pavement
- Approximate FEMA Flood Plain

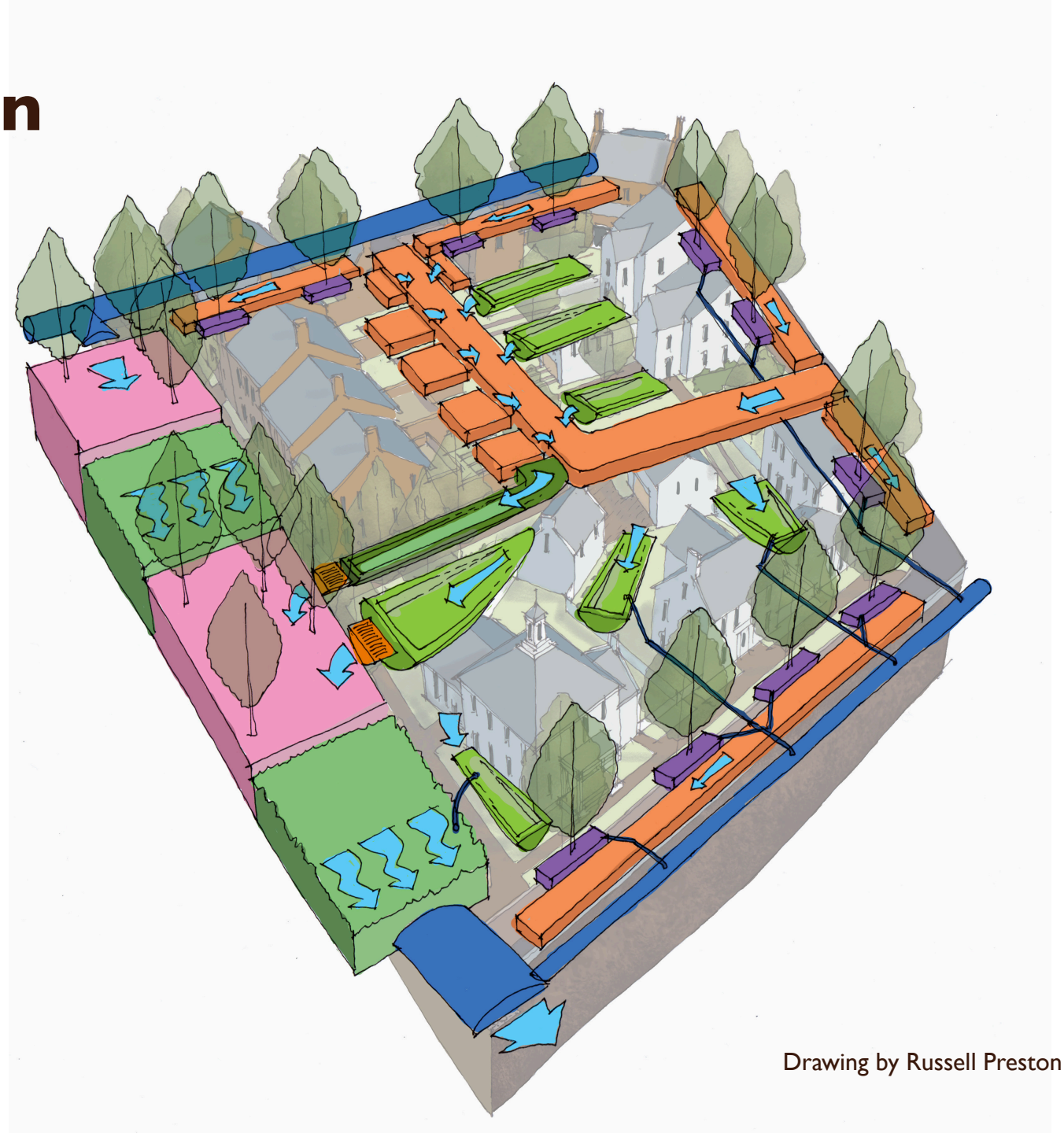
Planning & Design Criteria

1.1	y
1.2	y
1.3	y
1.4	y
2.1	y
2.2	y
2.3	y
2.4	y
2.5	y
2.6	y
2.7	y*
3.1	y
3.2	y
3.3	y
3.4	y*
3.5	y
4.1	y
4.2	y*
4.3	y*
4.4	y*
4.5	y
4.6	n/a
4.7	n/a
4.8	n/a
5.1	y
5.2	y
5.3	y*
5.4	y
5.5	y
6.1	y
6.2	y
6.3	y
6.4	y
6.5	y
6.6	y
6.7	y

Evolution of LID:

Drawing by Russell Preston

Evolution of LID:



Drawing by Russell Preston

Evolution of LID:

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Evolution of LID:

Drawing by
Russell Preston

Evolution of LID:

Photo: Randall Arendt

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