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WATER CANADA THE COMPLETE WATER MAGAZINE

Simplified LID for Residential and Small Commercial Sites

Andy Reese

Amec Foster Wheeler

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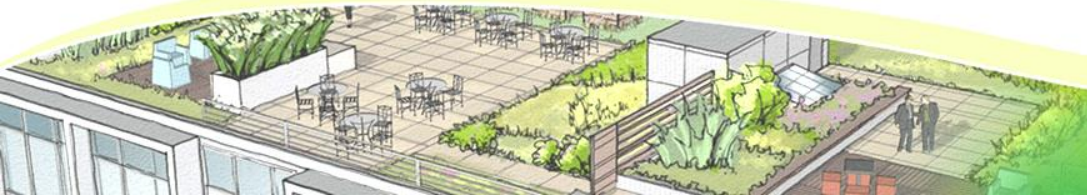
Green is popping up everywhere

- Permit compliance
- TMDL mandates
- Park and recreation planning
- CSO consent decrees
- Livable cities
- Water supply protection
- Federal facilities
- Groundwater replenishment
- “Sustainable” popularity
- LEED or other ratings



Program Drivers: The Big Three

Primary Program Driver	Key Design Consideration
1. CSO Abatement Reduce Overflows	1. Instantaneous CSS Volume Removal
2. Permit Compliance Reduce Pollution	2. Adequate Volume Treatment to Reduce Pollutants
3. Community Development Attractive and Effective	3. Balanced TBL Benefits and Adequate Hydrologic Mimicry

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A Comparison of Two Different Land Plans

PROJECTED RESULTS FROM TOTAL DEVELOPMENT

Total Site	**Conventional Plan**	**Revised Green Plan**
Lot Yield	358	375
Linear Feet - Street	21,770	21,125
Linear Feet - Collector Street	7,360	0
Linear Feet - Drainage Pipe	10,098	6,733
Drainage Sections (Inlets, Boxes, Headwalls)	103	79
Estimated Total Cost	**$4.6 million**	**$3.9 million**

ACTUAL RESULTS FROM PHASE ONE

Total Site (engineer's estimate)	**Conventional Plan**	**Green Plan**
Lot Yield	63	72
Total Cost	$1,028,544	828,523
Cost Per Lot	**$16,326**	**$11,507**

ECONOMIC AND OTHER BENEFITS FROM LOW-IMPACT DEVELOPMENT

Higher Lot Yield	17 additional lots
Higher Lot Value	$3,000 more per lot than competition
Lower Cost per Lot	$4,800 less per lot
Enhanced Marketability	80 percent of lots sold in the first year
Added Amenities	23.5 acres of green space/parks
Recognition	National, state, and professional groups

TOTAL ECONOMIC BENEFIT **More than $2.2 million in savings.**

Source: National Home Builders Association

No, I'm not kidding !

No guarantees, but these approaches <u>can</u> save money while protecting the environment.

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Atlanta: Why use GI on SFR lots?

- **Existing drainage problems in neighborhoods**
- **Redevelopment often maximizes building footprints**
- **No stormwater management required previously**
- **Compounded effects on downstream property owners**
  - Increased flooding
  - Increased Erosion & Sedimentation
  - Incised streams

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Single Family Residential Lots

- **Construction of a new home, tear down & rebuild, & large additions (>1,000 square feet) of impervious surface**
- **Required to capture and treat first 1.0” of runoff ONLY (no detention requirements)**
- **Does not apply to:**
  - Second story additions
  - Renovations
  - Replacing driveways





SO… I ASKED MY HERO TOM SCHUELER…

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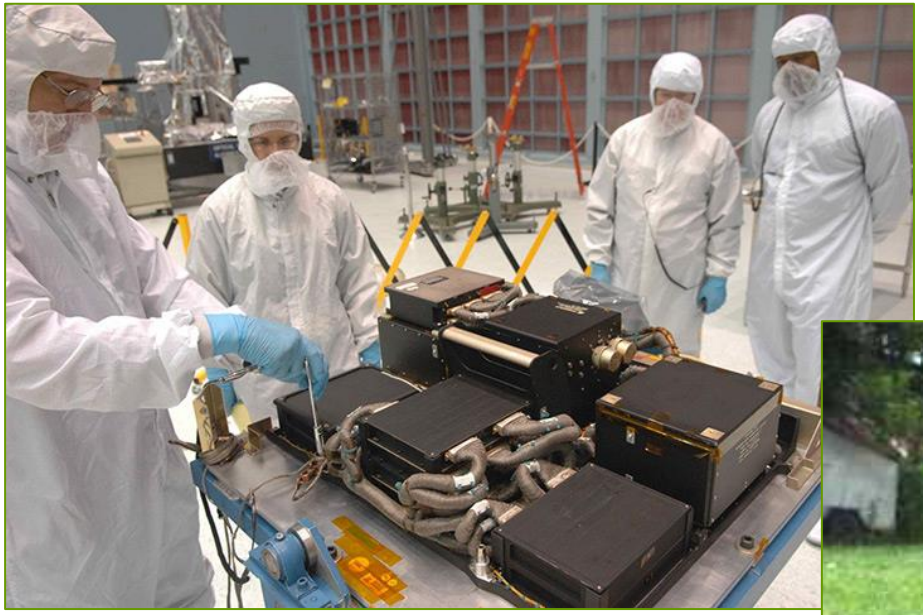
Tom Schueler Chesapeake Bay, Center for Watershed Protection and Washington DC Stormwater program

How we think LID gets built



How LID actually gets built

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So we set some goals:

1. My brother in law using a backhoe can get it right most of the time
2. Almost no mathematics involved
3. No new plans or specs needed
4. Use GI builders are used to building
5. Must work in clay
6. Use things homeowners would maintain anyway
7. Inspect twice if you want it done right once

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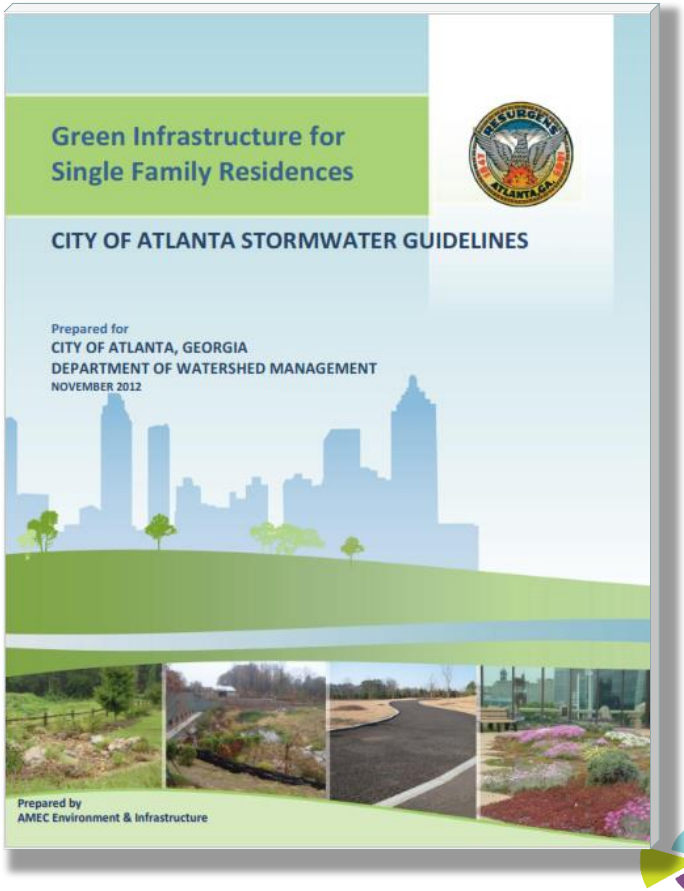
Key characteristics: Residential

- **Basic guidance on key action steps**
- **GI application list**
  - Tables for sizing
  - Slightly conservative
  - Stand alone
- **Tear-off specification and sizing sheet**



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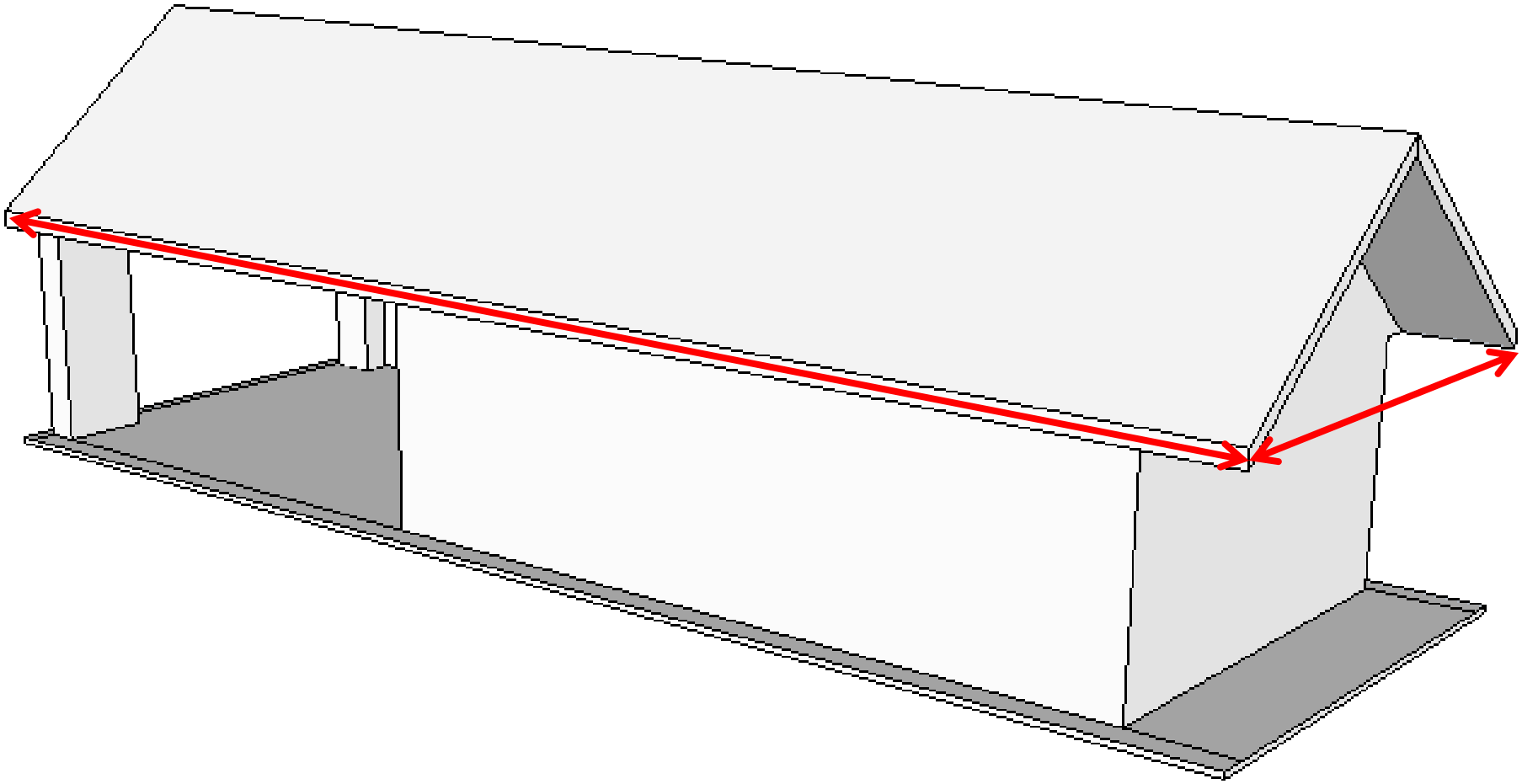
Measuring Area



Measure looking down from heaven

Ignore the roof slant

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Simple “Hardware Store” Guidance

- Gravel
- Perforated Pipe
- Filter Fabric
- Leaf and Trash Screen Options
- Infiltration Testing

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General Sizing Tables

Design Options

Impervious Area Treated

Rooftop Area (square feet)	Depth of Gravel From Top of Pipe (inches)			
	18	24	30	36
	Required Linear Feet of MFD			
100	6	5	4	3
500	30	25	20	15
1000	60	45	40	35
2000	120	95	75	65
3000	185	140	115	100
4000	245	190	155	130
5000	305	235	195	165

Practice Size

- Options within practical range
- Accommodate actual rainfall and runoff data
- Allows for median infiltration duration
- Assumes 0.25-0.50 in/hr infiltration rate

Modified French Drain Example

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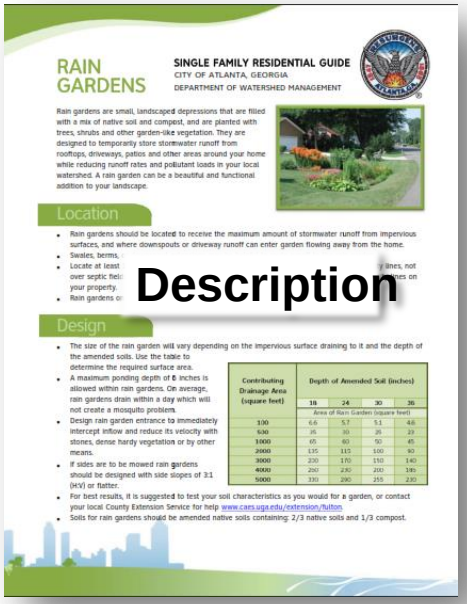
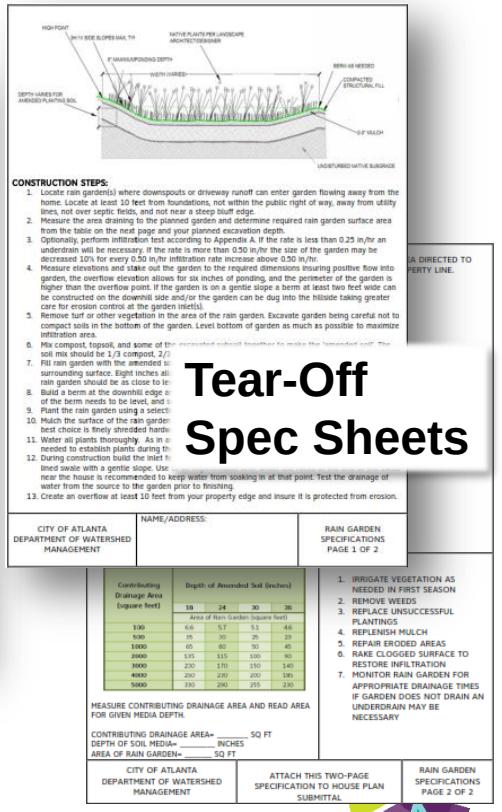
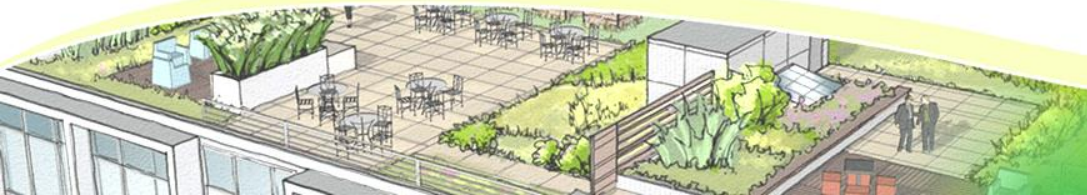
Types of Practices

- Cisterns
- Dry Well
- Vegetated Filter Strips
- Modified French Drain
- Permeable Pavers
- Rain Garden







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Example: Cisterns

- Its all about catching and using water
- 0.6 gallons per square foot
- ≈ 55 gallon barrel per 100 sq ft of roof
- 10 location pointers
- Pump or gravity outflow
- Can get fancy analysis

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Example: Cisterns

CISTERN

SINGLE FAMILY RESIDENTIAL GUIDE
CITY OF ATLANTA, GEORGIA
DEPARTMENT OF WATERSHED MANAGEMENT

Cisterns are low impact development practices that store rainwater for later use. Rain is collected from a downspout system, screened to remove trash and leaves and conveyed to a storage container for subsequent use. Unless an advanced filtration system is used, water stored in the cistern is for non-potable water use only. If properly sized, they can provide significant reductions in stormwater runoff rates, volumes and pollutant loads from residential sites. Rain barrels may be part of an overall stormwater management system; however, by themselves they may not be sufficient to meet the requirements of this ordinance.

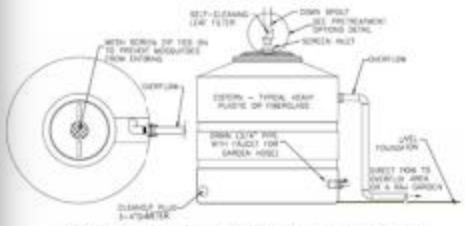
1,500 Gallon Cistern
Source: LID Urban Design Tools

Location

- Consider the size of the contributing drainage areas, and projected water needs, to determine how large a storage tank is needed. Cisterns should drain only impervious areas – preferably rooftops.
- Pick a location keeping in mind: (1) ease in connecting roof drains, (2) overflow to downslope areas, (3) level area, (4) location relative to intended water uses, (5) other utility conflicts, (6) electrical connections if applicable, (7) residential emergency ingress/egress, (8) leaf screen option, (9) location of hoses or other water distribution components, and (10) aesthetic considerations.

Design

- To fully meet the Atlanta standard, cistern capacity must be designed for a 1 inch storm. A good rule of thumb is that when sizing a cistern for the one inch rain standard, each square foot of rooftop will contribute 0.6 gallons of runoff. A one-hundred square foot roof surface will fill a 55 gallon barrel.
- Cisterns come in sizes from a 55 gallon rain barrel to a 1,500 gallon cistern. If the cistern cannot hold the full inch one alternative is to divert overflow to another low impact development structure such as a filter strip, or rain garden.
- Measure contributing roof area width from the drip line of the overhang to the roof peak ignoring the slant, and the length. The width times the length in feet is the drainage area. Multiply that by 0.6 gallons and that is the size of the cistern you will need to fully meet the one-inch rainfall standard.
- All holding tanks should be opaque to prevent algae growth.



TYPICAL COMPONENTS (ATTACH MANUFACTURER'S SPECIFICATIONS)

CONSTRUCTION STEPS:

1. Locate cistern for: (1) ease in connecting roof drains, (2) overflow to downslope area, (3) level area, (4) location relative to intended water uses, (5) other utility conflicts, (6) electrical connections if applicable, (7) emergency ingress/egress, (8) leaf screen option, (9) location of hoses or other water distribution components, and (10) aesthetic considerations.
2. Depending on use review and follow applicable plumbing code.
3. Provide level foundation of compacted earth, blocks, gravel or other hard long lasting surface.
4. Place cistern tank and review all connections for layout and sizing.
5. Cut and route downspouts or other rainwater delivery components, leaf screen option(s) chosen (circle selected options in Pretreatment Options Detail figure), and mosquito screen as applicable. Strap and support as needed.
6. Install water outlet connections including pumps as applicable. Follow manufacturer's specification for all connections and fittings including inlet, overflow, and clean out.
7. Extend overflow to adequate non-eroding discharge point no less than 10 feet from any common property line.
8. Test cistern by filling with water and testing all components in turn – including spraying water on the roof and observing flow.
9. Consider appearance and final landscaping and screening. Complete construction, landscaping, etc.

PRETREATMENT OPTIONS DETAIL

CITY OF ATLANTA DEPARTMENT OF WATERSHED MANAGEMENT	NAME/ADDRESS:	CISTERN SPECIFICATIONS PAGE 1 OF 2

November 2012

SKETCH LAYOUT

ELEVATION VIEWS OF CISTERN AND HOUSE SHOWING ROOF AREA DIRECTED TO CISTERN, DIMENSIONS AND CONNECTIONS AND OVERFLOW RELATIVE TO PROPERTY LINE.

MANUFACTURER'S SPECIFICATIONS AND OTHER DETAILS

TO CISTERN= _____ SQ FT
CISTERN SIZE= _____ GAL

MANUFACTURER

MAINTENANCE:

1. TO MAINTAIN THE STORAGE CAPACITY OF THE CISTERN RAINWATER SHOULD BE USED REGULARLY
2. ROUTINE CHECKS OF THE INTAKE AND LEAF SCREENING COMPONENTS SHOULD BE DONE ONCE IN THE SPRING AND PERIODICALLY DURING THE FALL IF LEAVES FALL ON THE CONTRIBUTING ROOF AREA.
3. INSPECT AND IF NECESSARY CLEAN OUT TANK ANNUALLY BY SCRUBBING AND LETTING WATER DRAIN THROUGH LOW FLOW PLUG. CHECK CONNECTIONS FOR LEAKS; AND INSPECT OVERFLOW FOR EROSION.

CITY OF ATLANTA DEPARTMENT OF WATERSHED MANAGEMENT	ATTACH THIS TWO-PAGE SPECIFICATION TO HOUSE PLAN SUBMITTAL	CISTERN SPECIFICATIONS PAGE 2 OF 2

November 2012

Modified French Drain

- Its all about holding water in rock until it soaks away
  - Keep it from clogging: filter and fabric
  - Right size for 1” rain: porosity + infiltration
  - Assume 24” width
  - Pipe near top not bottom
  - Safe overflow: daylight downstream

Rooftop Area (square feet)	Depth of Gravel From Top of Pipe (inches)			
	18	24	30	36
	Required Linear Feet of MFD			
100	6	5	4	3
500	30	25	20	15
1000	60	45	40	35
2000	120	95	75	65
3000	185	140	115	100
4000	245	190	155	130
5000	305	235	195	165

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City of Atlanta GI Program Support

Development of ordinance, design criteria manuals, training, reviewer checklist, first in state

Results after 8 months?

- 550 sites with 1,300 separate structures
- 6 inspectors – 3x each site incl. erosion
- Very few problems







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Then we did it again for very small commercial:

- **Differences:**
  - Slightly “smarter” people going it
  - Lots of utility conflicts
  - High impervious area applications
  - Must fit within mandatory green space

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Then we did it again for very small commercial:

- **So… we added**
  - "Belt and suspenders" approach
  - Under IA or IA modified practices
  - A better site planning process
  - More design calculations and options

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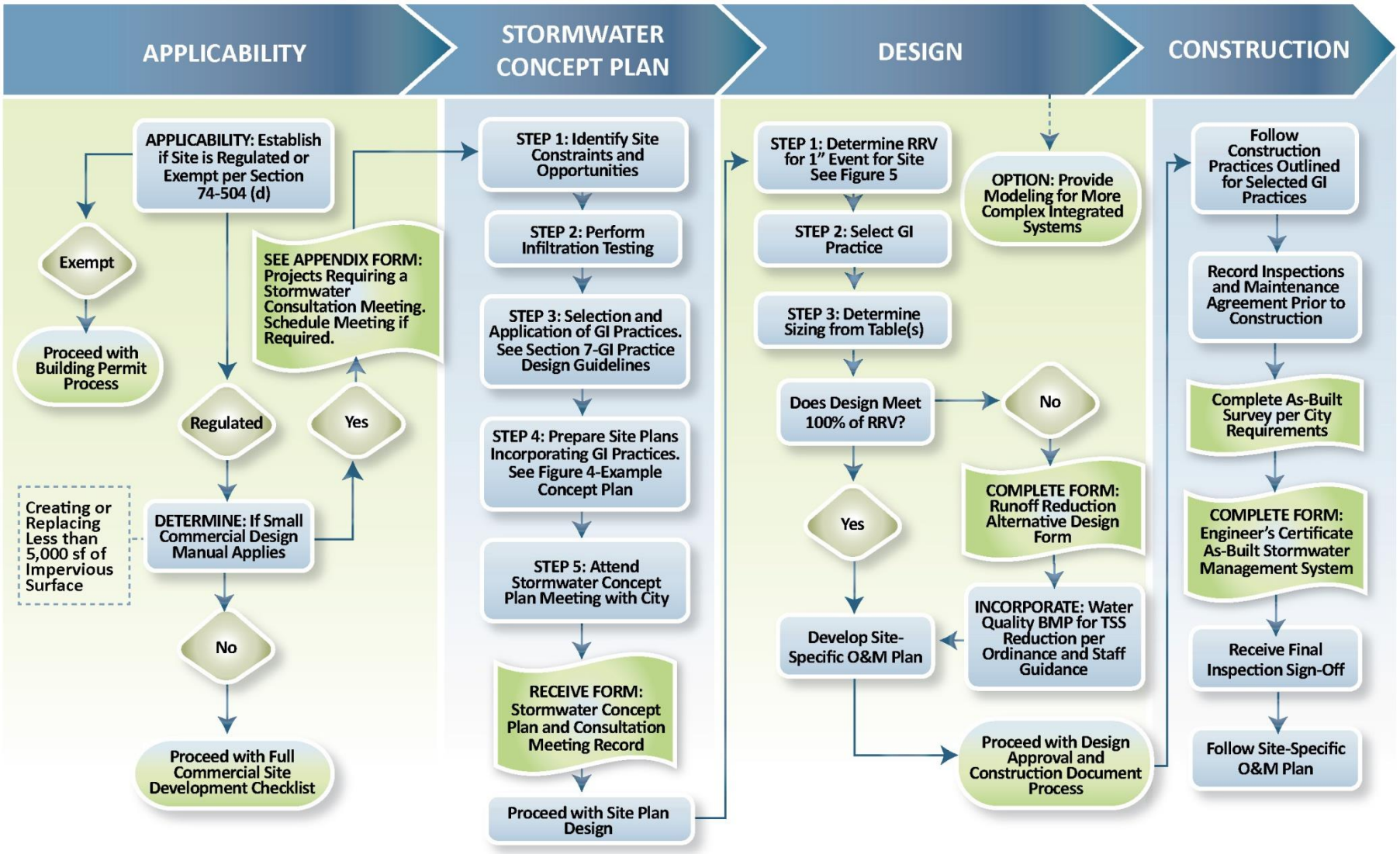
Design steps using the manual



NOTE: For small commercial redevelopment sites involving less than 5,000 sf of impervious surface (new or replaced), stream channel protection, overbank flood, and extreme flood protection will be waived if runoff reduction requirements are met.

http://www.atlantawatershed.org/greeninfrastructure/

Questions ?

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