Module 5 – Simulation Support for EISA Section 438 Compliance

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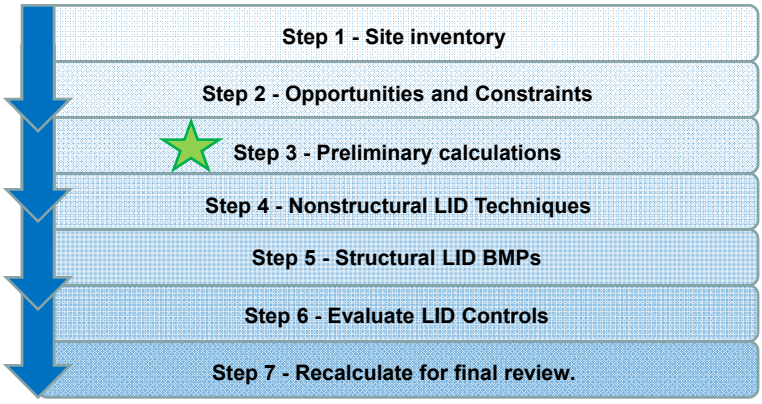
BUILDING STRONG®

Overview

- EISA, Hydrologic Cycle, and Technical Guidance
- EISA Compliance Methodology
- Calculation Procedure for EISA Compliance
- Modeling Basics
- Continue Group Exercise
- Summary

Site Planning for LID

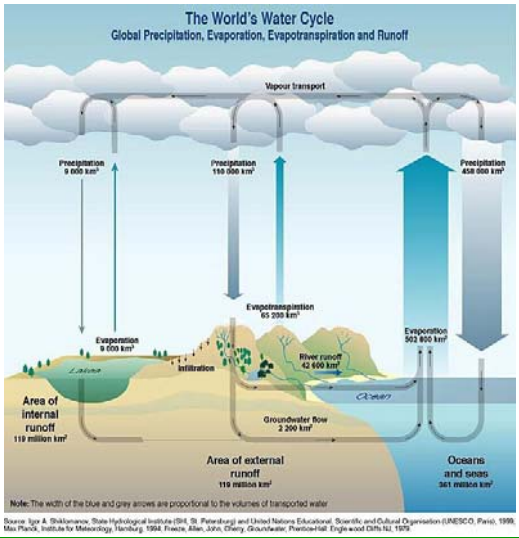


EISA Section 438

- Energy Independence and Security Act

"Storm water runoff requirements for federal development projects. The sponsor of any development or redevelopment project involving a Federal facility with a footprint that ***exceeds 5,000 square feet*** *shall use site planning, design, construction, and maintenance strategies for the property to* ***maintain or restore, to the maximum extent technically feasible, the predevelopment hydrology of the property with regard to the temperature, rate, volume, and duration of flow.****"*

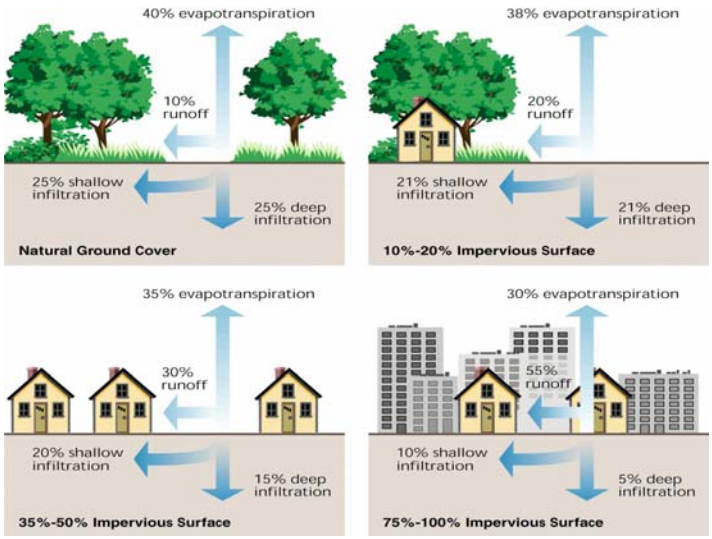
Water Cycle



Source: Igor A. Shiklomanov, State Hydrological Institute (SHI, St. Petersburg) and United Nations Educational, Scientific and Cultural Organisation (UNESCO, Paris), 1999, Max Planck, Institute for Meteorology, Hamburg, 1994, Freeze, Allan, John, Cherry, Groundwater, Prentice-Hall, Englewood Cliffs NJ, 1979

Providing Solutions to Tomorrow's Environmental Problems

Pre and Post-Development Hydrology (USDA)



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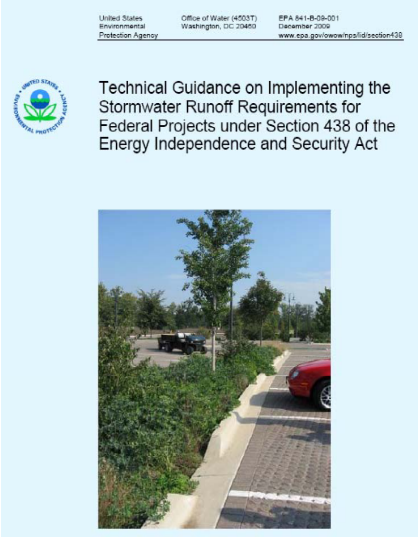
EPA Technical Guidance

EPA 841-B-09-001
December 2009
www.epa.gov/owow/nps/lid/section438



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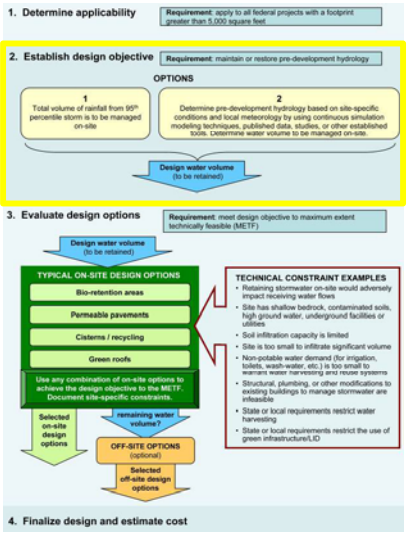
Staying on Track With the EPA & DOD Flowchart



Policy Memorandum, Office of the Under Secretary of Defense, January 2010 included in UFC 3-210-10 Low Impact Development

EPA Technical Guidance on Implementing EISA, 841-B-09-001 December 2009

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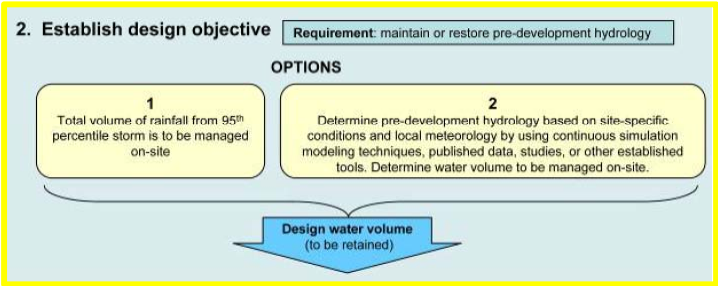
Staying on Track
With the EPA & DOD Flowchart



- Option 1 – Retain runoff from 95th percentile storm
- Option 2 – Continuous simulation model
- UFC 3-210-10 Low Impact Development recommends Option 1 as "most efficient and practical" method

EISA Compliance Methodology

Maintain or Restore the Pre-development Hydrology

- Select Design Objective Option 1, Manage runoff from the 95th percentile storm event
  - Determine the 95th percentile rainfall event for site
  - Evaluate Site Conditions including: project boundary, existing land use, and soil types
  - Calculate pre and post development runoff volumes (Apply Natural Resources Conservation Service (NRCS) Runoff Curve Number Method, formerly the Soil Conservation Service (SCS))
  - Manage the difference between pre- and post-development runoff volumes to comply with EISA.
- Evaluate Low Impact Development (LID) options to manage increased runoff volume.
  - Consider LID features suitable for project site (LID constraints)
  - Ensure selected LID design manages increased runoff volume for 24 hour period
- Accountability
  - Document calculations for hydrologic design (including LID employed on site)
  - Technical Infeasibility, if applicable
- Complete a post construction analysis of LID features

What is the 95th Percentile Storm?

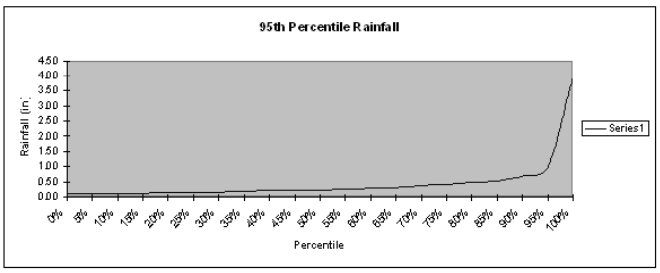
- The 95th percentile rainfall event is the rainfall depth that is greater than or equal to 95% of all storm events over a given period.
- Translation: 95% of the time, a storm event's rainfall total will be equal to or less than this rainfall depth.
  (e.g. Baltimore, MD = 1.6 in)
- Small, frequently occurring storms account for most of a site's annual rainfall. It is it not EISA's intent to manage the remaining 5%: large, very infrequent storms.
- EPA wrote in their Technical Guidance that retaining the 95th percentile runoff volume is analogous to maintaining or restoring the pre-development hydrology with respect to volume, rate, duration, and temperature – therefore complying with EISA.

Developing the 95th Percentile Storm

Rainfall (in)
0.10
0.10
0.10
0.10
0.10
0.10
0.10
0.10
0.10
0.10
0.10
0.10
0.10
0.10
0.10
0.11
0.11
0.11
0.11
0.11
0.11
0.11
0.11
0.11
0.11
0.11
0.11
0.11
0.11
0.11
0.12
0.12
0.12
0.12
0.12

Percentile	Rainfall (in)
0 %	0.10
5 %	0.10
10 %	0.11
15 %	0.12
20 %	0.14
25 %	0.15
30 %	0.16
35 %	0.19
40 %	0.21
45 %	0.22
50 %	0.24
55 %	0.26
60 %	0.29
65 %	0.31
70 %	0.37
75 %	0.42
80 %	0.48
85 %	0.53
90 %	0.69
95 %	0.98
100 %	3.98

95th Percentile Rain
P= 0.9835



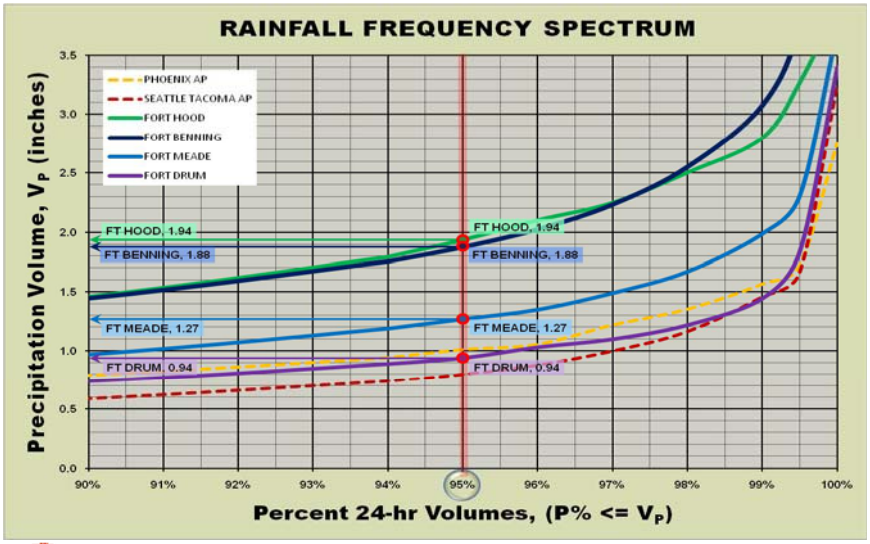
1. Obtain 24-hr precipitation data set (NCDC)
   – http://www.ncdc.noaa.gov/oa/ncdc.html
2. Import into spreadsheet and aggregate into a single column
   – Eliminate storms with rainfall less than 0.1"
3. Calculate using PERCENTILE function or graphically

Example 95th Percentile Storms

City	95th Percentile Event Rainfall Total (in)	City	95th Percentile Event Rainfall Total (in)
Atlanta, GA	1.8	Kansas City, MO	1.7
Baltimore, MD	1.6	Knoxville, TN	1.5
Boston, MA	1.5	Louisville, KY	1.5
Buffalo, NY	1.1	Minneapolis, MN	1.4
Burlington, VT	1.1	New York, NY	1.7
Charleston, WV	1.2	Salt Lake City, UT	0.8
Coeur D'Alene, ID	0.7	Phoenix, AZ	1.0
Cincinnati, OH	1.5	Portland, OR	1.0
Columbus, OH	1.3	Seattle, WA	1.6
Concord, NH	1.3	Washington, DC	1.7
Denver, CO	1.1		

EPA Technical Guidance on Implementing EISA, 841-B-09-001 , December 2009 , page 14

Rainfall Frequency Distribution



Climatology Analysis

	FORT HOOD	FORT BENNING	FORT MEADE	FORT DRUM	PHOENIX AP	SEATTLE TACOMA AP
Start Date	January 1, 1950	January 1, 1959	January 1, 1950	January 1, 1950	January 1, 1950	January 1, 1950
End Date	October 30, 2009	December 31, 2008	October 30, 2009	October 30, 2009	June 30, 2010	June 30, 2010
Years of Data	59.83	50.00	59.83	59.83	58.50	18.75
Total Rainfall	1541.61	2416.94	2428.85	2134.78	432.33	711.97
Average Annual Rainfall	**25.77**	**48.34**	**40.59**	**35.68**	**7.39**	**37.97**
95 Percentile Rainfall Depth	**1.94**	**1.88**	**1.27**	**0.94**	**1.01**	**0.80**
Total Rainfall >= 0.1	1505.38	2352.21	2404.30	1948.43	394.69	668.82
Total Runoff Days	2421	3646	5198	5454	1041	1756
No Runoff Days	15842	14617	16655	12809	1958	1243
Maximum Rain	3.92	5.74	3.72	3.40	2.75	3.25

Project Boundary

- Identify estimated Limit of Disturbance (Project Boundary).
- Evaluate the natural topography to determine natural flow paths.
- Identify man-made features (standard design), such as roads, drainage ditches, etc., that need to be considered since they do alter the natural flow paths.
- Maintain Pre-Project Internal Drainage Boundaries to the maximum extent possible.

Note: DoD definition of pre-development is pre-project "Existing Conditions"

Hydrologic Soil Groups

- Determine Hydrologic Soil Group within the project boundary

Group A – Sandy

Soils in this group have low runoff potential when thoroughly wet. Water is transmitted freely through the soil. Group A soils typically have less than 10 percent clay and more than 90 percent sand or gravel and have gravel or sand textures. Some soils having loamy sand, sandy loam, loam or silt loam textures may be placed in this group if they are well aggregated, of low bulk density, or contain greater than 35 percent rock fragments.

Group B – Sandy Loam

Soils in this group have moderately low runoff potential when thoroughly wet. Water transmission through the soil is unimpeded. Group B soils typically have between 10 percent and 20 percent clay and 50 percent to 90 percent sand and have loamy sand or sandy loam textures. Some soils having loam, silt loam, silt, or sandy clay loam textures may be placed in this group if they are well aggregated, of low bulk density, or contain greater than 35 percent rock fragments.

Hydrologic Soil Groups

Group C – Silty Loam

Soils in this group have moderately high runoff potential when thoroughly wet. Water transmission through the soil is somewhat restricted. Group C soils typically have between 20 percent and 40 percent clay and less than 50 percent sand and have loam, silt loam, sandy clay loam, clay loam, and silty clay loam textures. Some soils having clay, silty clay, or sandy clay textures may be placed in this group if they are well aggregated, of low bulk density, or contain greater than 35 percent rock fragments.

Group D – Clay

Soils in this group have high runoff potential when thoroughly wet. Water movement through the soil is restricted or very restricted. Group D soils typically have greater than 40 percent clay, less than 50 percent sand, and have clayey textures. In some areas, they also have high shrink-swell potential. All soils with a depth to a water impermeable layer less than 50 centimeters [20 inches] and all soils with a water table within 60 centimeters [24 inches] of the surface are in this group, although some may have a dual classification, as described in the next section, if they can be adequately drained.

Evaluation of Land Use

- Pre-development
  - Determine the area (sq-ft / acres) of existing land uses
- Post-development
  - Determine the area (sq-ft / acres) of planned land uses (post project)

EXISTING

PROPOSED

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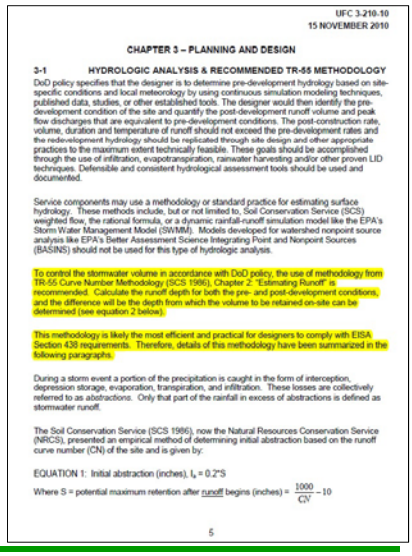
Calculate Runoff Difference

- UFC 3-210-10 recommends using the SCS Runoff Curve Number Method (commonly referred to as TR-55 Method).
- Using site area, soil type, and land use, the pre- and post-development runoff depths are calculated.
- The difference in pre- and post-development runoff is the EISA required volume to be retained on site.



UFC 3-210-10
15 NOVEMBER 2010

CHAPTER 3 – PLANNING AND DESIGN

3-1 HYDROLOGIC ANALYSIS & RECOMMENDED TR-55 METHODOLOGY

DoD policy specifies that the designer is to determine pre-development hydrology based on site-specific conditions and local meteorology by using continuous simulation modeling techniques, published data, studies, or other established tools. The designer would then identify the pre-development condition of the site and quantify the post-development runoff volume and peak flow discharges that are equivalent to pre-development conditions. The post-construction rate, volume, duration and temperature of runoff should not exceed the pre-development rates and the redevelopment hydrology should be replicated through site design and other appropriate practices to the maximum extent technically feasible. These goals should be accomplished through the use of infiltration, evapotranspiration, rainwater harvesting and/or other proven LID techniques. Defensible and consistent hydrological assessment tools should be used and documented.

Service components may use a methodology or standard practice for estimating surface hydrology. These methods include, but or not limited to, Soil Conservation Service (SCS) weighted flow, the rational formula, or a dynamic rainfall-runoff simulation model like the EPA's Storm Water Management Model (SWMM). Models developed for watershed nonpoint source analysis like EPA's Better Assessment Science Integrating Point and Nonpoint Sources (BASINS) should not be used for this type of hydrologic analysis.

To control the stormwater volume in accordance with DoD policy, the use of methodology from TR-55 Curve Number Methodology (SCS 1986), Chapter 2: "Estimating Runoff" is recommended. Calculate the runoff depth for both the pre- and post-development conditions, and the difference will be the depth from which the volume to be retained on-site can be determined (see equation 2 below).

This methodology is likely the most efficient and practical for designers to comply with EISA Section 438 requirements. Therefore, details of this methodology have been summarized in the following paragraphs.

During a storm event a portion of the precipitation is caught in the form of interception, depression storage, evaporation, transpiration, and infiltration. These losses are collectively referred to as *abstractions*. Only that part of the rainfall in excess of abstractions is defined as stormwater runoff.

The Soil Conservation Service (SCS 1986), now the Natural Resources Conservation Service (NRCS), presented an empirical method of determining initial abstraction based on the runoff curve number (CN) of the site and is given by:

EQUATION 1: Initial abstraction (inches), $I_a = 0.2*S$

Where S = potential maximum retention after runoff begins (inches) = $\frac{1000}{CN} - 10$

5

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Runoff Equation

- Soil Conservation Service Method

$$Q = \frac{(P - 0.25)^2}{P + 0.85}$$

Where: Q = direct runoff volume expressed as depth

P = rainfall depth (for EISA, 95th percentile depth)

$$S = \frac{1,000}{CN} - 10 \text{ (when water depths are expressed in inches)}$$

$$S = \frac{25,400}{CN} - 254 \text{ (when water depth expressed in mm)}$$

Runoff Volume to be Retained = ($Q_{post\text{-}development}$ - $Q_{pre\text{-}development}$) x Site Area

SCS Runoff Curve Number

- Runoff Curve Number is a number between 36 - 100 that represents runoff potential
- Related to soil type and land use
- Woods in sandy soil = 36, very low runoff
- Pavement = 98, very high runoff

Cover Description		Curve Numbers for Hydrologic Soil Group:			
Cover Type and Hydrologic Condition	Average Percent Impervious Area[2]	A	B	C	D
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.)[3]:					
Poor condition (grass cover less than 50%)		68	79	86	89
Fair condition (grass cover 50 to 75%)		49	69	79	84
Good condition (grass cover greater than 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and roads:					
Paved; curves and storm sewers (excluding right-of-way)		98	98	98	98
Paved; open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Western desert urban areas:					
Natural desert landscaping (pervious areas only)[4]		63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-in. sand or gravel mulch and basin borders)		96	96	96	96
Urban districts:					
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential districts by average lot size:					
$\frac{1}{8}$ ac. or less (town houses)	65	77	85	90	92
$\frac{1}{4}$ ac.	38	61	75	83	87
$\frac{1}{3}$ ac.	30	57	72	81	86
$\frac{1}{2}$ ac.	25	54	70	80	85
1 ac.	20	51	68	79	84
2 ac.	12	46	65	77	82

SCS Runoff Curve Number

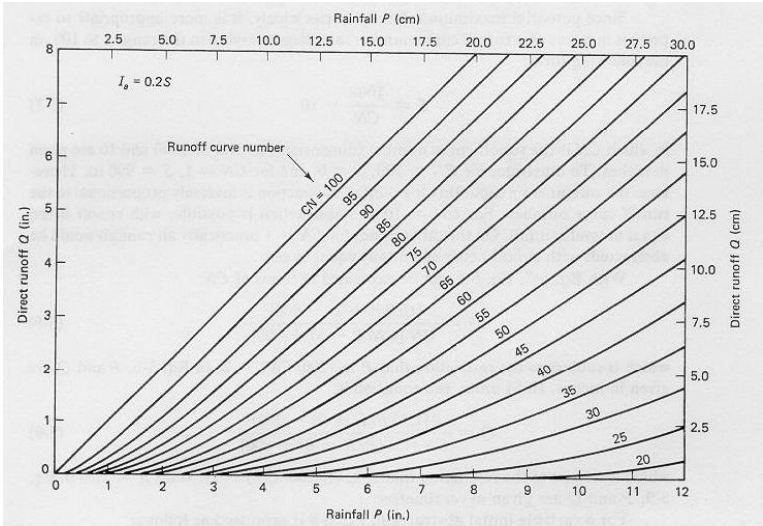
Cover Description		Curve Numbers for Hydrologic Soil Group:			
Cover Type	Hydrologic Condition	A	B	C	D
Pasture, grassland, or range-continuous forage for grazing[2]	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80
Meadow-continuous grass, protected from grazing and generally mowed for hay	—	30	58	71	78
Brush—brush-weed grass mixture with brush being the major element[3]	Poor	48	67	77	83
	Fair	35	56	70	77
	Good	30[4]	48	65	73
Woods—grass combination (orchard or tree farm)[5]	Poor	57	73	82	86
	Fair	43	65	76	82
	Good	32	58	72	79
Woods.[6]	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	30[4]	55	70	77
Farmsteads—buildings, lanes, driveways, and surrounding lots.	—	59	74	82	86

SCS Runoff Curve Number

For Planning Purposes

	HYDROLOGIC SOIL GROUP			
LAND COVER	A	B	C	D
WOODED	36	60	73	79
MEADOW	39	58	71	78
BRUSH - WEEDS	35	56	70	77
LAWN	49	69	79	84
ROADS & DRIVES (^{WO}/C&G)	83	89	92	93
ROADS & DRIVES (^{W}/C&G)	98	98	98	98
PARKING & SIDEWALKS	98	98	98	98
BUILDING ROOF	98	98	98	98
BIO-RETAIN AREA	35	55	70	77
VEGETATIVE ROOF	67	67	67	67
PERMEABLE PAVING	50	65	78	85

Solution of Runoff Calculation



Modeling Lessons

Modeling Principles

- All Models Are Wrong; But Many Models Are Useful (Box)

Corollary:

- All Models are Imperfect; But Many Imperfect Models Add Weight of Evidence
- All Model Predictions are Relative: But Relative Changes Are Useful.

Modeling for EISA

Process

- Have a Suite of Methods (Tools)
- Start with the Simple Methods (Tools)
- Keep It As Simple As Possible, But No Simpler (Einstein)
- It's Data Driven (Smith et al., 2003)

Keep It Simple

"I lift, you grab. ... Was that concept just a little too complex, Carl?

LID Modeling Data Needs

- Land use/Land cover
- Digital Elevation Map (DEM)
- Soil Texture Map
- Facilities Map
- Precipitation

Army LID Planning Tool

INPUT

- Project Site Area (acres)
- 95th Percentile Rainfall Depth (inches) for Installation
- Hydrologic Soil Group:
  - A – Sandy
  - B – Sandy Loam
  - C – Silty Loam
  - D – Clay
- Pre-Project and Post-Project Land Use Areas (acres)

OUTPUT

- Pre-Project and Post-Project Runoff Volumes
- EISA Volume Required to be Retained

Army LID Planning Tool – Page 1

ARMY LID PLANNING TOOL

SIMPLIFIED RUNOFF CURVE NUMBER METHOD FOR PRELIMINARY SELECTION AND SIZING OF LID PRACTICES

FOR COMPLIANCE WITH THE RUNOFF VOLUME CONTROL REQUIREMENT, EISA 438, MODIFIED EPA OPTION 2

V 9.2 — PLANNING ESTIMATES for PRE & POST RUNOFF VOLUMES — Page 1 of 2

DATE:	5-Mar-2014	ARMY INSTALLATION:	FORT MEADE
PLANNER:	EEM		
PROJECT NAME:	ADMIN BLDG		
PROJECT LOCATION:			
PROJECT AREA (acres):	5	95% RAINFALL	1.6

SELECT THE SITE'S OVERALL SOIL TYPE: Sandy-Loam — HSG = B

PRE-PROJECT

LAND COVER	AREA (AC)	% of SITE	CN
WOODED (Fair)	1	20.0%	60
MEADOW	3	60.0%	58
BRUSH & WEEDS (Fair)			
LAWN			
ROADS & DRIVES (w/ C&G)			
ROADS & DRIVES (w/o C&G)			
PARKING, DRIVEWAYS & SIDEWALKS	1	20.0%	98
BUILDING ROOF			
TOTALS	5	100%	

WEIGHTED AVERAGE CN_n = 66

PRE-PROJECT RUNOFF VOLUME (95% RAIN) = 0.02 ACRE-FEET; 7702 GALLONS; 1030 CUBIC FEET

Assumes a one day runoff: 0.01 CFS

POST-PROJECT

LAND COVER	AREA (AC)	% of SITE	CN
WOODED (Fair)			
MEADOW			
BRUSH & WEEDS (Fair)			
LAWN	3	60.0%	69
ROADS & DRIVES (w/ C&G)			
ROADS & DRIVES (w/o C&G)			
PARKING, DRIVEWAYS & SIDEWALKS	2	40.0%	98
BUILDING ROOF			
TOTALS	5	100%	

SELECTION OF OTHER LAND COVER TYPES (USE DROP DOWN MENU)

WEIGHTED AVERAGE CN_d = 81

POST-PROJECT RUNOFF VOLUME (95% RAIN) = 0.15 ACRE-FEET; 49940 GALLONS; 6677 CUBIC FEET

Assumes a one day runoff: 0.08 CFS

MINIMUM RUNOFF RETENTION VOLUME TO COMPLY WITH EISA 438 VOLUME CONTROL REQUIREMENT:

0.13 ACRE-FEET — 5647 CUBIC FEET — 42238 GALLONS

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Calculate Required EISA Volume

Continue group exercise:

- Use example project's pre- and post-development information from previous modules.
- Use Army LID Planning Tool to calculate EISA volume required for project.
- Group discussion of results.

Questions

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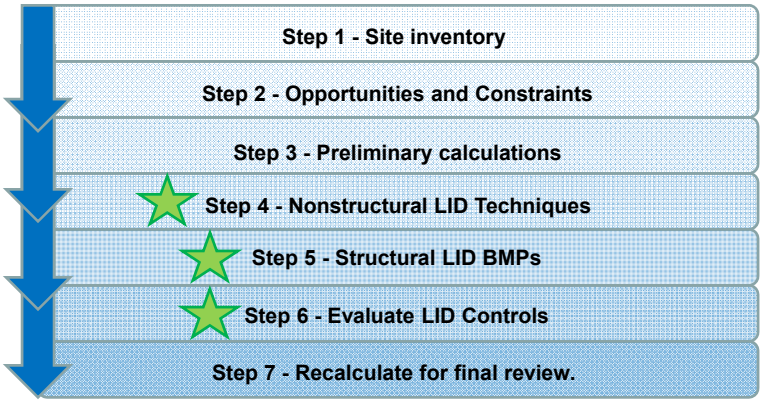
Site Planning for LID



Staying on Track With the EPA & DOD Flowchart

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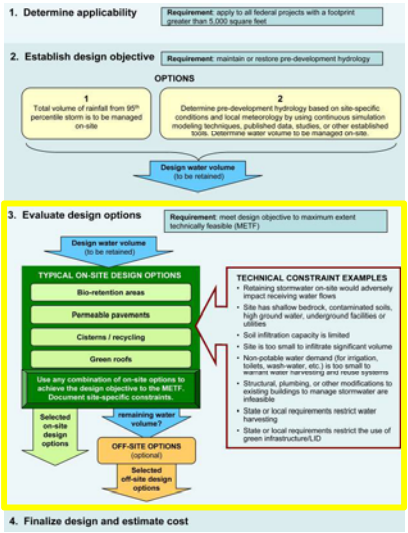

EPA Technical Guidance on Implementing EISA, 841-B-09-001 December 2009

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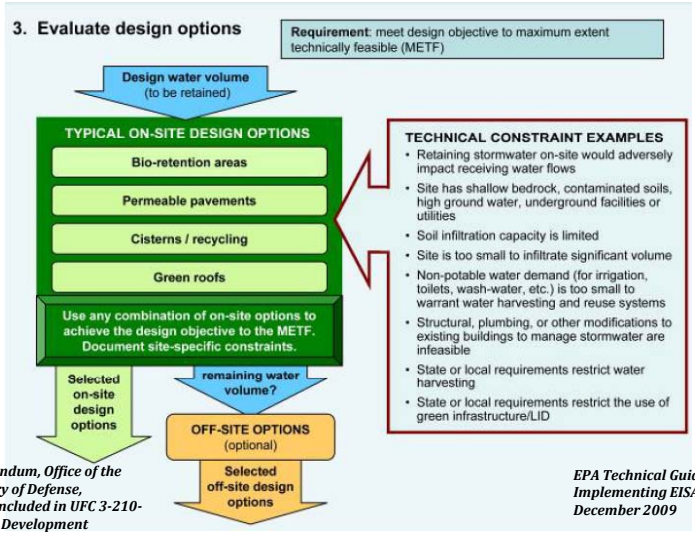
Staying on Track
With the EPA & DOD Flowchart



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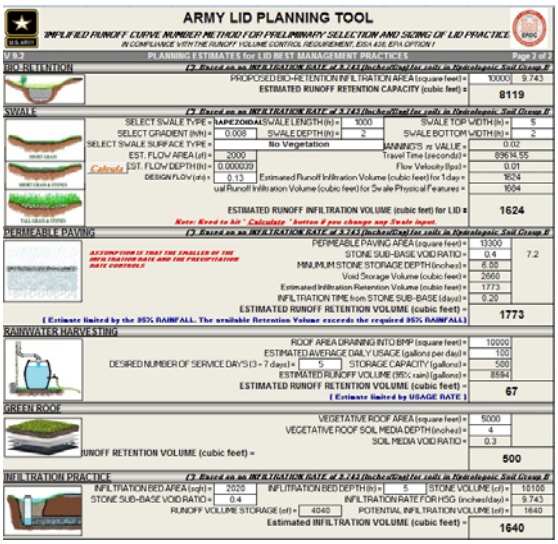
Low Impact Development Strategies

Manage the required runoff volume using LID BMPs.

- Bioretention
- Soil Amendments
- Filter Strips
- Vegetated Buffers
- Grassed Swales
- Dry Wells
- Infiltration Basins/Trenches
- Inlet Pollution Removal Devices
- Rainwater Harvesting (Rain Barrels and Cisterns)
- Tree Box Filters
- Vegetated Roofs
- Permeable Pavements (Pavers, Concrete, Asphalt, Reinforced Turf)

Army LID Planning Tool – Page 2

- Structural BMPs manage a runoff volume by infiltration or reuse.
- Nonstructural BMPs are accounted for by lowering the post-project Curve Number (e.g. reforestation adds "Woods" to post-project land use). Decreasing the post-project runoff results in a reduced EISA volume requirement.



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Select LID BMPs

Continue group exercise:

- We now have the EISA required volume to retain on site.
- Use Army LID Planning Tool to select BMPs and estimate BMP sizing in order to comply with EISA.
- Goal:

Volume Retained by LID BMPs ≥ EISA Required Volume

- Each group presents results.

Summary

- Complying with EISA Section 438 can be achieved by implementation of GI/LID.
- EPA 841-B-09-001 provides technical guidance on implementing the stormwater runoff requirements.
- UFC 3-210-10 incorporates DoD policy memo and recommends using the SCS Curve Number Method to calculate the EISA required volume to be retained on site.
- Potential LID features can be evaluated during project planning.
- Defensible and consistent hydrologic assessment tools should be used and documented.
- The Army LID Planning Tool, a simplified Excel Spreadsheet, is available to assist with the LID planning process.

Questions

Redevelopment Example

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Existing (Pre-Project) Site

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DPW Existing Site Analysis

- Redevelopment project
- Existing site is mostly paved
- Intermittent stream runs through the site
- Small pocket of wetlands within wooded riparian buffer
- Possible groundwater contamination – DPW Environmental study underway
- Variable groundwater table (4'-15' deep)
- Soil Type = HSG "C" Silty Loam

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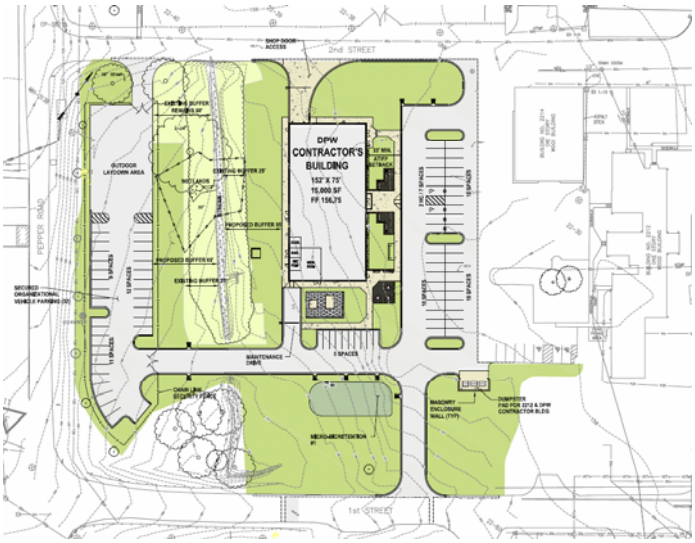
Proposed Site Design



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Impervious Area Totals

Site Area = 3.30 ac

Existing Site Impervious Area = 2.19 ac
Proposed Site Impervious Area = 1.80 ac
Impervious Area Reduced = **0.39 ac**
= **18%**

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Calculate EISA Required Volume

ARMY LID PLANNING TOOL

SIMPLIFIED RUNOFF CURVE NUMBER METHOD FOR PRELIMINARY SELECTION AND SIZING OF LID PRACTICES
FOR COMPLIANCE WITH THE RUNOFF VOLUME CONTROL REQUIREMENT, EISA 438, MODIFIED EPA OPTION 2

V 9.2 — PLANNING ESTIMATES for PRE & POST RUNOFF VOLUMES — Page 1 of 2

DATE:	26-Oct-2012	ARMY INSTALLATION:	FORT MEADE		
PLANNER:	EEM				
PROJECT NAME:	DPW BUILDING				
PROJECT LOCATION:	CHISHOLM AVE				
PROJECT AREA (acres):	3.3	95% RAINFALL	1.6	SELECT THE SITE'S OVERALL SOIL TYPE:	Silty-Loam
HSG =	C				

PRE-PROJECT

LAND COVER	AREA (AC)	% of SITE	CN
WOODED (fair)	0.33	10.0%	73
MEADOW			
BRUSH & WEEDS (fair)			
LAWN	0.78	23.6%	79
ROADS & DRIVES (**/C&G)			
ROADS & DRIVES (*/C&G)			
PARKING, DRIVEWAYS & SIDEWALKS	2.19	66.4%	98
BUILDING ROOF			
TOTALS	3.3	100%	
WEIGHTED AVERAGE CN_n =			91
PRE-PROJECT RUNOFF VOLUME (95% RAIN) =		0.23	ACRE-FEET
		73676	GALLONS
		9850	CUBIC FEET
Assumes a one day runoff		0.11	CFS

POST-PROJECT

LAND COVER	AREA (AC)	% of SITE	CN
WOODED (fair)	0.33	10.0%	73
MEADOW			
BRUSH & WEEDS (fair)			
LAWN	1.17	35.5%	79
ROADS & DRIVES (**/C&G)			
ROADS & DRIVES (*/C&G)			
PARKING, DRIVEWAYS & SIDEWALKS	1.8	54.5%	98
BUILDING ROOF			
TOTALS	3.3	100%	
WEIGHTED AVERAGE CN_d =			89
POST-PROJECT RUNOFF VOLUME (95% RAIN) =		0.19	ACRE-FEET
		63344	GALLONS
		8468	CUBIC FEET
Assumes a one day runoff		0.10	CFS

SELECTION OF OTHER LAND COVER TYPES (USE DROP DOWN MENU)

MINIMUM RUNOFF RETENTION VOLUME TO COMPLY WITH EISA 438 VOLUME CONTROL REQUIREMENT:

-0.03 ACRE-FEET — -1382 CUBIC FEET — -10332 GALLONS

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Calculate EISA Volume

- Existing CN = 91 → 9,850 cf runoff
- Proposed CN = 89 → 8,468 cf runoff
- Difference in Runoff Volume = **-1382 cf**

Since DoD defines "pre-developed" as "pre-project" (in UFC 3-210-10), this redevelopment project results in an improved hydrologic condition (decrease in runoff) and no additional retention is needed to satisfy EISA.

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DoD Definition of "Pre-developed"

UFC 3-210-10
15 NOVEMBER 2010

CHAPTER 2 - POLICY AND GENERAL REQUIREMENTS

2-1 STATUTORY REQUIREMENT

EISA Section 438 established into law new stormwater design requirements for Federal development and redevelopment projects. Under these requirements, Federal projects with a footprint over 5,000 square feet must "maintain or restore, to the maximum extent technically feasible, the predevelopment hydrology of the property with regard to the temperature, rate, volume, and duration of flow".

2-2 DOD POLICY

The Deputy Under Secretary of Defense (Installations and Environment) memorandum of 19 January 2010 (Appendix C) directs DoD components to implement EISA Section 438 using LID techniques in accordance with the methodology illustrated in Figure 1 and further described below. In addition, this policy memo references U.S. Environmental Protection Agency (EPA) *Technical Guidance on Implementing the Stormwater Runoff requirements for Federal Projects under Section 438 of the Energy Independence and Security Act*. Individual Services may have more stringent implementation and applicability requirements relating to Low Impact Development.

2-2.1 Establishing Design Objective and Pre-Development Condition

The overall design objective for each applicable project is to maintain predevelopment hydrology and prevent any net increase in stormwater runoff. DoD defines "predevelopment hydrology" as the pre-project hydrologic conditions of temperature, rate, volume, and duration of stormwater flow from the project site. The analysis of the predevelopment hydrology must include site-specific factors (such as soil type, ground cover, and ground slope) and use modeling or other recognized tools to establish the design objective for the water volume to be managed from the project site.

The increase in runoff between pre- and post-development conditions is to be managed on the project site, to the maximum extent technically feasible, through interception, infiltration, storage, and/or evapotranspiration processes. Other design requirements may need to be considered.

UFC 3-210-10 Low Impact Development, Nov 2013, page 2

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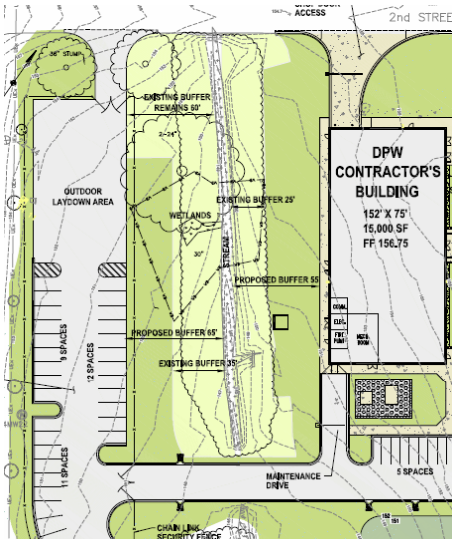
BMPs Implemented to Comply with State SWM Regs



Nonstructural LID BMPs:

- Protect Sensitive Areas
- Reduce Impervious Surfaces
- Riparian Buffer Restoration
- Reforestation

Structural LID BMPs:

- Bioretention
- Grass Swale
- Vegetated Filter Strip

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Technical Infeasibility

2-2.2 Maximum Extent Technically Feasible

The designer shall evaluate project site options to achieve the design objective to the maximum extent technically feasible. The "maximum extent technically feasible" criterion requires full employment of accepted and reasonable stormwater retention and reuse technologies (further described in Chapter 3) subject to site and applicable regulatory constraints (e.g., site size, soil types, vegetation, demand for recycled water, existing structural limitations, state or local prohibitions on water collection). All site-specific technical constraints that limit the full attainment of the design objective shall be documented. If the design objective cannot be met within the project footprint, LID measures may be applied at nearby locations on DoD property (e.g., downstream from the project) within available resources. Examples of technical constraints are as follows:

- Retaining stormwater on-site would adversely impact receiving water flows
- Site has shallow bedrock, contaminated soils, high groundwater table, underground facilities or utilities
- Soil infiltration capacity is limited
- Site is too small to infiltrate significant volume
- Non-potable water demand (irrigation, toilets, wash-water, etc.) is too small to warrant water harvesting and reuse system
- Structural, plumbing, and other modifications to existing building to manage stormwater are infeasible
- State or local regulations restrict water harvesting
- State or local regulations restrict use of green infrastructure/LID.

UFC 3-210-10 Low Impact Development, November 2010, page 2

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Technical Infeasibility

- ASA(IEE) Memo: Sustainable Design and Development Policy Update, 16 Dec 2013

d. Exceptions to this policy may be considered if the Garrison Commander or equivalent determines that compliance with the policy would adversely affect mission performance, security or Antiterrorism/Force Protection (AT/FP) requirements, health, safety, or welfare. Requests for exception must be submitted through the chain of command to the Deputy Assistant Secretary of the Army for Installations, Housing, and Partnerships (DASA(IHP)) and shall include the reference(s) to the specific conflict, proposed mitigation measures to follow the intent of this policy, and justification for the requested exception. Any approved exception shall only apply to the specific policy requirement(s) in conflict for a singular construction activity.

ASA(IEE) Sustainable Design and Development Policy Memo, 16 Dec 2013, Section 3d, page 3

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Questions

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