

Low Impact Development at Naval Facilities: Opportunities and Constraints

*Jim Harris, PE and Khoi Nguyen, PhD, PE
Naval Facility Engineering Command – Atlantic*

Sustainability Track 8027 - May 7, 2009
Environment, Energy & Sustainability Symposium & Exhibition
Denver, CO, May 4-7, 2009

Report Documentation Page				Form Approved OMB No. 0704-0188	
Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.					
1. REPORT DATE 07 MAY 2009		2. REPORT TYPE		3. DATES COVERED 00-00-2009 to 00-00-2009	
4. TITLE AND SUBTITLE Low Impact Development at Naval Facilities: Opportunities and Constraints				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S)				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Naval Facilities Engineering Command - Atlantic, 1322 Patterson Ave. SE, Suite 100, Washington Navy Yard, DC, 20374				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution unlimited					
13. SUPPLEMENTARY NOTES Presented at the NDIA Environment, Energy Security & Sustainability (E2S2) Symposium & Exhibition held 4-7 May 2009 in Denver, CO.					
14. ABSTRACT					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT Same as Report (SAR)	18. NUMBER OF PAGES 18	19a. NAME OF RESPONSIBLE PERSON
a. REPORT unclassified	b. ABSTRACT unclassified	c. THIS PAGE unclassified			

Policy and Regulatory Background



- **Navy Mandate - ASN Penn's Memo of November 16, 2007**
- **Federal Regulations - Energy Independent and Security Act of 2007 (EISA), Section 438**
- **Executive Order 13423 for federal facilities**
- **State/local storm water management regulations**

LID Practice Overview



■ Low Impact Development (LID)

A sustainable storm water management approach that can be used to replicate or restore natural watershed functions (the pre-development hydrologic regime) by implementing engineered small-scale hydrologic controls through infiltrating, filtering, storing, evaporating, and detaining runoff close to its source.

■ Common LID Practices

- *Bioretention*
- *Grass swale*
- *Filter/buffer strips*
- *Infiltration trenches/basins*
- *Inlet device*
- *Rain barrel, cisterns*
- *Tree box filters*
- *Vegetated roof covers*
- *Permeable pavers*
- *Soil amendment*

Recent LID Applications at Naval Facilities



■ Over 25 Navy Projects with LID (2008)

- *Bioretention (4)*
- *Grass swales (20)*
- *Filter/buffer strips (5)*
- *Infiltration trenches/basins (2)*
- *Inlet device (2)*
- *Rain barrels/cisterns (0)*
- *Tree box filters (1)*
- *Vegetated roof cover (1)*
- *Permeable pavement (4)*
- *Soil amendment (0)*

■ Washington Navy Yard Projects

- *Bioretention*
- *Permeable paver*
- *Tree box filters*
- *Vegetated filter strips*
- *Cisterns*
- *Vegetated roof cover*

■ Naval Station Norfolk

- *Bioretention*
- *Tree box filters (planters)*

Wash. Navy Yard LID Retrofit Demonstration Projects



**Bioretention cell
construction at a parking
area**



Wash. Navy Yard LID Retrofit Demonstration Projects



Permeable Paver Installation

(with gravel chips, pavers, perforated underdrain, and impermeable liner)

Wash. Navy Yard LID Retrofit Demonstration Projects



Curb Inlet and Tree Box

LID Projects at Naval Station Norfolk



Planters Treating Roof Drains from Buildings with Metals of Concern (2005)

LID Projects at Naval Station Norfolk



Bioretention Area Treating Roof Drains of a Steam Plant (2007)

LID Projects at Naval Station Norfolk



**Bioretention Area Treating Runoff from a 1.7 Acre Parking Area
(2006)**

LID Projects at Naval Station Norfolk



**Bioretention Areas Treating Runoff from a 10 Acre Parking Area
(2008)**

LID Projects at Naval Station Norfolk



**Bioretention Areas Treating Runoff from a 10 Acre Parking Area
(2008)**

LID Projects at Naval Station Norfolk



Bioretention Areas Treating Runoff from a 10 Acre Parking Area (2008)

General Naval Facility Characteristics



- **Most facilities are located in coastal areas**
- **Concentrated urban-like environment**
- **Limited industrial activities/operations**
- **Many Facilities still have undeveloped land**
- **Continued development and growth expected**

Opportunities on LID Applications



- **Timing and readiness**
- **Experience and expertise in LID implementation needed (planning, design, construction, maintenance, monitoring)**
- **All common LID practices are applicable or potentially applicable in Navy projects**

Constraints on LID Applications

- **Site characteristics**
- **Restoring pre-development hydrology and maintaining no net runoff/pollutant loadings – challenging goals**
- **Limited knowledge and experience with LID (planning, design, construction, life cycle management)**
- **Limited data related to cost, cost-benefit analysis, life-cycle cost analysis**
- **Potential conflicts with other design standards (e.g., road design standards) and state/local water laws (e.g., water harvesting, right of way, ...)**

Conclusions



- **LID – promising and proven practices in sustainable development.**
- **Abundant opportunities for applications of LID in Navy projects.**
- **LID are and will be found in MILCON / Navy projects, regardless of limitations mentioned above.**

QUESTIONS?

