REQUIREMENT

In accordance with the US Army Garrison, Hawaii (USAG-HI) Municipal Separate Storm Sewer System Permit Number HI S000090 effective April 7, 2014, Part D.1.e.(1), USAG-HI is required to submit a Plan for Requiring Low Impact Development (LID) in the Standards to the maximum extent practicable.

LID pertains to storm water management practices which aim to mimic a site's predevelopment hydrology by minimizing ground disturbance and impervious cover and then infiltrating, storing, detaining, evapotranspiring, and/or biotreating storm water runoff close to its source. LID practices treat storm water as a resource rather than a waste product.

This plan will identify the following:

- Criteria for requiring implementation of LID
- Quantitative criteria for a specific design storm to be managed by LID techniques
- Infeasibility criteria for circumstances in which a waiver could be granted for the LID requirements
- List of alternatives that may be implemented when an LID waiver is granted
- Draft LID planning and design example checklist
- Draft LID and permanent post-construction Best Management Practice (BMP) inspection example checklists

CRITERIA FOR REQUIRING IMPLEMENTATION OF LID

Section 438 of the Energy Independence and Security Act of 2007 (EISA) enacted by Congress establishes strict storm water runoff requirements for federal development and redevelopment projects. The legislation reads as follows:

> 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.

Resulting from the legislation, a Deputy Under Secretary of Defense, Installation and Environment memorandum defines Department of Defense (DoD) policy for implementation of EISA Section 438 using LID techniques and requires the policy be incorporated into applicable DoD Unified Facilities Criteria (UFC).

Per DoD policy the criteria for requiring implementation of LID is as follows:

> EISA Section 438 requirements apply to projects that construct facilities with a footprint greater than 5,000 gross square feet, or expand the footprint of existing facilities by more than 5,000 gross square feet. The project footprint consists of all horizontal hard surfaces and disturbed areas associated with the project development, including both

building area and pavements (such as roads, parking, and sidewalks). These requirements do not apply to internal renovations, maintenance, or resurfacing of existing pavements.

QUANTITATIVE CRITERIA FOR DESIGN STORM

The UFC system provides planning, design, and construction criteria for DoD projects. UFC 3-210-10, Low Impact Development, provides technical criteria for the planning and design of applicable projects to comply with storm water requirements under EISA Section 438.

UFC 3-210-10 (Appendix B: Chapter 4 – LID Design, Section 4-1.3) describes investigation into three principal approaches in determining the design storm to be managed by LID techniques:

Prince George's County Methodology (Soil Conservation Service, TR-55 Method):
As previously mentioned any rainfall over and above the initial abstraction will result in direct surface runoff. It is prudent to design and implement IMPs for that rainfall event that exceeds initial abstraction (Eq. 1) in the pre-development conditions. The design methodology would apply a modifying factor of 1.5 times the initial abstraction (as suggested in the Prince George's County LID manual) to serve as a practical approach to design LID-IMP features.

EPA Methodology:
See Technical Guidance on Implementing Section 438 of the Energy Independence and Security Act, Guidance prepared by EPA, December 2009 for Option 1 methodology.

First-Flush Water Quality Volume:
Many States and localities have adopted the conventional approach of collecting and treating the first-flush or water-quality depth of rainfall. These terms are defined by the local regulatory agency. In certain areas, this first flush depth is generally taken to be the first one inch of rainfall. In other localities with sensitive coastal or reservoir watersheds, the first-flush depth is taken to be the first 1.5 inches of rainfall. The water quality volume is equated to the volume of stormwater runoff generated by the first-flush rainfall depth. Therefore, it would be practical to design LID-IMP features to handle the first-flush rainfall depth. The stormwater runoff quality is further improved by the design of conventional SWM practices required to meet the state regulations.

Most Local and State stormwater regulations include a first-flush or water quality depth for 2-, 5-, 10-, 25-, 50-, or 100-year regulated storm events. State and Local requirements for stormwater management shall be met before the LID requirements are satisfied. The SWM BMPs shall be designed to control all regulated storm events, as stipulated by Local and State regulations to handle the peak rate and/or volume of discharge for flood control purposes.

Subsequent to describing the three approaches, UFC 3-210-10 (Appendix B: Chapter 4 – LID Design, Section 4-1.3) states the methodology chosen by DoD as follows:

> *DoD Accepted Methodology*:
> DoD has chosen to use the 95th percentile design storm event in UFC 3-210-10 criteria for determining the LID design volume. When in conflict with other State or Local requirements the most stringent apply.

UFC 3-210-10 (Appendix B: Chapter 4 – LID Design, Section 4-6) provides additional clarification that:

> The design storm event is based on the regional 95th percentile, annual 24-hour rainfall depth averaged over several years (a minimum of 10-year daily, 24-hour precipitation events would be used). The 'design storm' will be used to calculate pre- and post-development LID volumes in order to determine the amount of excess runoff that must be controlled on-site so that the site contributes no net increase downstream.

INFEASIBILITY CRITERIA FOR LID WAIVER

EISA Section 438 and DoD policy require LID to be implemented for applicable projects to the maximum extent technically feasible (METF). UFC 3-210-10, Section 2-2.2, defines METF as follows:

> The "maximum extent technically feasible" criterion requires full employment of accepted and reasonable stormwater retention and reuse technologies … 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 implementation of LID techniques to the METF shall be documented. Documentation shall include reference to the appropriate technical constraint listed below in Table 1, complete description of the limiting factors, supporting evidence such as design calculations and/or laboratory results, and the name and contact information of the waiver applicant.

Table 1 – Technical Constraints Limiting Implementation of LID to the METF	
A	Retaining stormwater on-site would adversely impact receiving water flows
B	Site has shallow bedrock, contaminated soils, high groundwater table, underground facilities or utilities
C	Soil infiltration capacity is limited
D	Site is too small to infiltrate significant volume
E	Non-potable water demand (irrigation, toilets, wash-water, etc.) is too small to warrant water harvesting and reuse system
F	Structural, plumbing, and other modifications to existing building to manage stormwater are infeasible
G	State or local regulations restrict water harvesting
H	State or local regulations restrict use of green infrastructure/LID
X	Other technical constraint documented by the developer/agent and documented as acceptable to the DPW storm drain engineer

(Note: A through H taken from UFC 3-210-10, Section 2-2.2)

LID WAIVER ALTERNATIVE MEASURES

LID waiver applicants shall also provide a description of alternative measures or non-LID BMPs that could be implemented if an LID waiver is granted due to a properly documented technical constraint.

Potential alternative measures include:

- Post-construction treatment control BMPs employing detention, filtration, settling, and/or hydrodynamic separation;
- Retention or biofiltration at an offsite location. (Note: offsite mitigation projects must undergo a proposal and review process and ultimately require DPW approval.)

DRAFT LID PLANNING AND DESIGN EXAMPLE CHECKLIST

An LID planning and design example checklist is being developed as part of the draft revised standards to be submitted to the DOH at a later date. A preliminary draft of the LID planning and design example checklist is provided in Attachment 1.

DRAFT LID AND PERMANENT POST-CONSTRUCTION BMP INSPECTION EXAMPLE CHECKLISTS

LID and permanent post-construction BMP inspection example checklists are being developed as part of the draft revised standards to be submitted to the DOH at a later date. Preliminary drafts of the LID and permanent post-construction BMP inspection example checklists are provided in Attachment 2.

REFERENCES

1. US Army Garrison, Hawaii Municipal Separate Storm Sewer System Permit Number HI S000090, effective April 7, 2014.

2. Energy Independence and Security Act of 2007, Public Law 110-140, 2007.

3. Department of Defense Implementation of Storm Water Requirements under Section 438 of the Energy Independence and Security Act (EISA), Deputy Under Secretary of Defense (Installations and Environment) Memorandum, January 2010.

4. Unified Facilities Criteria, UFC 3-210-10 Low Impact Development, November 2010.

ATTACHMENT 1

Draft LID Planning and Design Example Checklist

LOW IMPACT DEVELOPMENT (LID)
PLANNING & DESIGN CHECKLIST

GENERAL PROJECT INFORMATION
Project Address: _____
Installation: _____ Building No. (if applicable): _____
Project Type: ❑ Residential ❑ Commercial ❑ Industrial ❑ Office / Agency
Project is: ❑ New Development ❑ Redevelopment / Retrofit ❑ Renovation
Project Description: _____
_____
Submittal: ❑ Design / Pre-Construction ❑ Construction Complete

APPLICANT INFORMATION
Agency/Company: _____
Contact Person: _____
Address: _____
Phone: _____ Email: _____

PROJECT FOOTPRINT
EISA Section 438 requirements apply to projects that construct facilities with a footprint greater than 5,000 gross square feet, or expand the footprint of existing facilities by more than 5,000 gross square feet. The project footprint consists of all horizontal hard surfaces and disturbed areas associated with the project development, including both building area and pavements (such as roads, parking, and sidewalks). These requirements do not apply to internal renovations, maintenance, or resurfacing of existing pavements.

Proposed New Facilities Footprint (square feet) _____
Proposed Expanded Footprint of Existing Facilities (square feet) _____
Total Proposed Project Footprint (square feet) _____

EISA SECTION 438 APPLICABILITY
Do EISA Section 438 requirements apply?
❑ Yes ❑ No (Yes if Total Proposed Project Footprint is 5,000 square feet or more. If No, LID techniques apply to the extent practical.)

DESIGN OBJECTIVE
The overall design objective for each project is to maintain predevelopment hydrology and prevent any net increase in storm water runoff. DoD defines "predevelopment hydrology" as the pre-project hydrologic conditions of temperature, rate, volume, and duration of storm water flow from the project site.

The Design Objective is (select one):
❑ Option 1: Total volume of rainfall from 95th percentile storm is to be managed onsite.
❑ Option 2: Determine predevelopment hydrology based on site-specific conditions and local meteorology by using continuous simulation modeling techniques, published data, studies, or other established tools. Determine water volume to be managed onsite.

LOW IMPACT DEVELOPMENT (LID)
PLANNING & DESIGN CHECKLIST

GENERAL PROJECT HYDROLOGY

The design storm will be used to calculate pre- and post-development LID volumes in order to determine the amount of excess runoff that must be controlled onsite so that the site contributes no net increase downstream.

Provide runoff volumes to demonstrate the design objective is being met. Note that complete analysis and calculations shall be provided separately in the project's engineering drainage report.

Pre-project Runoff Volume (cubic feet) _____

Post-project Runoff Volume (cubic feet) _____

Minimum Runoff Retention Volume to Be Managed Onsite (cubic feet) _____

LOW IMPACT DEVELOPMENT BMPs

Low Impact Development (LID) is a stormwater management strategy designed to maintain site hydrology and mitigate the adverse impacts of stormwater runoff and nonpoint source pollution. LID actively manages stormwater runoff by mimicking a project site's pre-development hydrology using design techniques that infiltrate, store, and evaporate runoff close to its source of origin.

Non-structural LID BMPs

Non-structural LID BMPs seek to reduce storm water runoff impacts through sound site planning and design practices that focus on conservation and minimizing impacts. Use of non-structural LID BMPs should be maximized prior to consideration of structural LID BMPs. (For more information, refer to the Army Low Impact Development Technical User Guide, January 2013.)

Review the following non-structural LID BMPs and indicate whether or not they will be incorporated onsite. If not incorporated, provide justification.

Minimize Total Disturbed Area ❑ Incorporated ❑ Not Feasible ❑ Not Applicable

Justification: _____

_____

Preserve Natural Flow Pathways and Patterns ❑ Incorporated ❑ Not Feasible ❑ Not Applicable

Justification: _____

_____

Protect Riparian Buffer Areas / Sensitive Areas ❑ Incorporated ❑ Not Feasible ❑ Not Applicable

Justification: _____

_____

Cluster Development ❑ Incorporated ❑ Not Feasible ❑ Not Applicable

Justification: _____

_____

Minimize Soil Compaction ❑ Incorporated ❑ Not Feasible ❑ Not Applicable

Justification: _____

_____

LOW IMPACT DEVELOPMENT BMPs (CONTINUED)
Non-structural LID BMPs (Continued)

Reduce Impervious Surfaces ❑ Incorporated ❑ Not Feasible ❑ Not Applicable
Justification: _____
_____

Site Fingerprinting ❑ Incorporated ❑ Not Feasible ❑ Not Applicable
Justification: _____
_____

Structural LID BMPs
Structural LID BMPs are small scale treatment controls close to the source of runoff that mimic natural processes. (For more information, refer to the Unified Facilities Criteria 3-210-10, 15 November 2010 and the Army Low Impact Development Technical User Guide, 4 January 2013.)

Review the following structural LID BMPs and indicate whether or not they will be incorporated onsite. If not incorporated, provide justification (refer to the Infeasibility Criteria listed in the Plan for Requiring LID in the Standards). Additionally, provide operations and maintenance requirements necessary for proper function of the BMP.

Bioretention ❑ Incorporated ❑ Not Feasible ❑ Not Applicable
Justification: _____
_____
Operation Requirements: _____
_____
Operation Requirements Frequency: _____
Maintenance Requirements: _____
_____
Maintenance Requirements Frequency: _____

Vegetated Swale ❑ Incorporated ❑ Not Feasible ❑ Not Applicable
Justification: _____
_____
Operation Requirements: _____
_____
Operation Requirements Frequency: _____
Maintenance Requirements: _____
_____
Maintenance Requirements Frequency: _____

LOW IMPACT DEVELOPMENT BMPs (CONTINUED)
Structural LID BMPs (Continued)

Infiltration Trench ❑ Incorporated ❑ Not Feasible ❑ Not Applicable
Justification: _____
_____
Operation Requirements: _____
_____
Operation Requirements Frequency: _____
Maintenance Requirements: _____
_____
Maintenance Requirements Frequency: _____

Permeable Pavement ❑ Incorporated ❑ Not Feasible ❑ Not Applicable
Justification: _____
_____
Operation Requirements: _____
_____
Operation Requirements Frequency: _____
Maintenance Requirements: _____
_____
Maintenance Requirements Frequency: _____

Rainwater Harvesting ❑ Incorporated ❑ Not Feasible ❑ Not Applicable
Justification: _____
_____
Operation Requirements: _____
_____
Operation Requirements Frequency: _____
Maintenance Requirements: _____
_____
Maintenance Requirements Frequency: _____

Green Roof ❑ Incorporated ❑ Not Feasible ❑ Not Applicable
Justification: _____
_____
Operation Requirements: _____
_____
Operation Requirements Frequency: _____
Maintenance Requirements: _____
_____
Maintenance Requirements Frequency: _____

LOW IMPACT DEVELOPMENT BMPs (CONTINUED)
Structural LID BMPs (Continued)

Other Structural LID BMP ❑ Incorporated ❑ Not Feasible ❑ Not Applicable
Description: _____
_____
Justification: _____
_____
Operation Requirements: _____
_____
Operation Requirements Frequency: _____
Maintenance Requirements: _____
_____
Maintenance Requirements Frequency: _____

ALTERNATIVE NON-LID POST-CONSTRUCTION BMPs
Non-LID post-construction treatment control BMPs employ detention, filtration, settling, and/or vortex separation to remove pollutants from storm runoff. Non-LID methods should be considered only if LID BMPs are determined to not be feasible per the Infeasibility Criteria listed in the Plan for Requiring LID in the Standards.

Review the following Non-LID post-construction BMPs and indicate whether or not they will be incorporated onsite. If not incorporated, provide justification. Additionally, provide operations and maintenance requirements necessary for proper function of the BMP.

Underground Detention / Retention Structure ❑ Incorporated ❑ Not Feasible ❑ Not Applicable
(Note that underground structures that allow infiltration may require Underground Injection Control permitting with the State of Hawaii Department of Health. Please contact the DPW Environmental Division, Safe Drinking Water Program for more information.)
Justification: _____
_____
Operation Requirements: _____
_____
Operation Requirements Frequency: _____
Maintenance Requirements: _____
_____
Maintenance Requirements Frequency: _____

ALTERNATIVE NON-LID POST-CONSTRUCTION BMPs (CONTINUED)

Vortex / Hydrodynamic Separator ❑ Incorporated ❑ Not Feasible ❑ Not Applicable
Justification: _____
_____
Operation Requirements: _____
_____
Operation Requirements Frequency: _____
Maintenance Requirements: _____
_____
Maintenance Requirements Frequency: _____

Other Non-LID post-construction BMP ❑ Incorporated ❑ Not Feasible ❑ Not Applicable
Description: _____
_____
Justification: _____
_____
Operation Requirements: _____
_____
Operation Requirements Frequency: _____
Maintenance Requirements: _____
_____
Maintenance Requirements Frequency: _____

LOCATION AND BOUNDARY DRAWING FOR LID AND NON-LID BMPs
A drawing showing the locations and boundaries of all incorporated LID and non-LID BMP features will assist inspectors and operations and maintenance staff with proper identification and assessment of the BMPs.

❑ Location and boundary drawing is attached. (Check box to confirm)

CERTIFICATION STATEMENT
Designer / Applicant: I certify that the design is complete, accurate, and addresses the specified requirements to the best of my knowledge.

Print Name: _____
Signature: _____ Date: _____

REVIEWED BY
Agency: _____
Print Name: _____
Signature: _____ Date: _____
Review Comments Attached: ❑ Yes ❑ No

ATTACHMENT 2

Draft LID and Permanent Post-Construction BMP Inspection Example Checklists

BIORETENTION INSPECTION CHECKLIST

BMP ID Number: _____ Installation: _____ Location: _____
Date: _____ Inspector: _____

Code Key:

NP = No Problem Observed	WN = Work Needed	N/A = Not Applicable

ASSESSMENT	CODE	COMMENTS
Inlet / Outlet		
Structural condition		
Debris accumulation		
Overflow catch basin debris accumulation		
Erosion control (e.g. rock, mat)		
Pretreatment for Sediment		
Device functioning to trap sediment		
Sediment accumulation		
Bioretention Surface		
Sediment accumulation		
Debris accumulation		
Erosion		
Vegetative cover		
Mulch cover		
Overall Functionality		
Is bioretention area functioning properly (professional landscape architect recommended)		

Additional Comments:

HYDRODYNAMIC SEPARATOR INSPECTION CHECKLIST

BMP ID Number: _____ Installation: _____ Location: _____
Date: _____ Inspector: _____

Code Key:

NP = No Problem Observed	WN = Work Needed	N/A = Not Applicable

ASSESSMENT	CODE	COMMENTS
Inflow Points		
Obstruction: vegetation / debris / sediment		
Structural condition		
Filter condition		
Separator Body		
Sediment / debris accumulation		
Separator structural condition		
Central shaft condition		
Oil accumulation		
Standing water		
Outlet Device		
Obstruction: vegetation / debris / sediment		
Erosion / undercutting		
Joint failure / loss of joint material		
Leaking device		
Emergency bypass condition		
Miscellaneous		
Trash / debris		
Access		
Odors present		
Other (describe)		

Additional Comments:

UNDERGROUND DETENTION STRUCTURE INSPECTION CHECKLIST

BMP ID Number: _____ Installation: _____ Location: _____
Date: _____ Inspector: _____

Code Key:

NP = No Problem Observed	WN = Work Needed	N/A = Not Applicable

ASSESSMENT	CODE	COMMENTS
Inflow Points		
Obstruction: trash / debris / sediment		
Structural condition		
Pipe condition		
Other (describe)		
Underground Vault		
Sediment / debris accumulation		
Access hatch condition		
Access ladder / steps condition		
Vault structural condition		
Baffles / weir condition		
Oil accumulation		
Blocked / damaged air vents		
Proper drainage		
Other (describe)		
Outlet Device		
Obstruction: vegetation / debris / sediment		
Erosion / undercutting		
Joint failure / loss of joint material		
Leaking device		
Control valve / bottom drain operation		
Emergency bypass condition		
Displacement / blockage of outlet or rock, apron, mat, etc.		
Other (describe)		
Miscellaneous		
Trash / debris		
Access		
Odors present		
Other (describe)		

UNDERGROUND DETENTION STRUCTURE INSPECTION CHECKLIST

Additional Comments:

Please share your comments with us. Click on the "Submit" button below to email us. Thank you.

SUBMIT