Appendix A: Solutions

David Lewis, Laura Luther, Lesley Davidson, Dain Christensen & Aimee Taniguchi

Table of Contents

This appendix consists of reports that contain a variety of retrofitting options that may be viable for instream and/or upstream implementation. These reports were hand picked because they were the most relevant to the Maunalua Bay stream system. Additional reports may be found in the literature review folder on Scholar Space (Link TBD). Each option targets specific issues within the watershed stream. Most of these options were selected because they aim to reduce sediment within the stream system. Each option will have a brief description and a link to a pdf of the full report or document. Each report is listed in order of relevance towards retrofitting in the Maunalua Bay area.

SGRII Report

This report is a comprehensive review of a variety retrofitting options available for the Wailupe stream system with the primary goal of reducing sediment entering Maunalua Bay, O‘ahu, HI. The report includes retrofitting scale, associated costs and benefits, applicable locations, specifications, and additional information needed to feasibly implement each option. Each retrofitting option presented can by adjusted and applied to any of the channelized stream systems in the Maunalua/East Honolulu watershed.

Table 3-1. Costs Associated with Recommended Management Practices

Implementation Cost					
Management Practice	**Calculated Cost[41]**	**Relative Cost**	**O&M Cost**	**Training Cost**	**References**
Baffle box	$40,000/unit	Moderate	Moderate	Moderate	Vendor quote
Coir logs	$22.50/ft	Moderate	Low	Low	Vendor quote
Curb inlet baskets	$1800/unit	Low	Moderate	Low	(LA-SMD 2000; USEPA 2003; Field et al. 2004)
Extended detention basin	$C = 12.4V^{0.76}$; V in ft^3	Low	Moderate	Low	(Brown and Schueler 1997; LA-SMD 2000; Barr Engineering Company 2001)
Good housekeeping practices	N/A	Low	Moderate	High	(LA-SMD 2000)
Grass swale	$0.25 - $0.50/$ft^2$	Moderate	Moderate	Low	(Barr Engineering Company 2001)
Green roof – Green grid	$14 - $25/sq. ft	Moderate	Low	Low	(Greenroof 2010, LA-SMD 2000)
Infiltration trench	$C = 16.9V^{0.69}$; V in ft^3	Moderate	Low	Low	(Brown and Schueler 1997; LA-SMD 2000; Barr Engineering Company 2001)
Invasive species control	N/A	High	High	Low	(LA-SMD 2000)
Modular wetland	$32,000/unit	Moderate	Moderate	Moderate	Vendor quote
Natural/Native vegetation	N/A	Moderate	Low	Moderate	(LA-SMD 2000)
Porous pavement	$8 - $12/$ft^2$	Moderate	Moderate	Moderate	Vendor quote
Rain barrels	$60 - $135 each	Low	Low	Moderate	(Brown and Schueler 1997)
Subsurface storage	$C = 12.4V^{0.71}$; V in ft^3; $400 per cubic yard	High	High	High	(Brown and Schueler 1997)
Turf reinforcement mats	$2/$ft^2$	Moderate	Low	Low	Vendor quote

[41] Includes installation cost unless noted otherwise.

Table 3-2. Relative Implementation Priorities

Management Practice	Load Reduction Potential	Relative Cost	Implementation Priority
Baffle box	High	High	High
Coir logs	Moderate	Moderate	Moderate
Curb inlet baskets	High	Low	High
Extended detention basin	Moderate	High	High
Good housekeeping practices	Moderate	Low	High
Grass swale	Low	Moderate	Low
Green roof – Green grid	Low	High	Low
Infiltration trench	Moderate	Moderate	Moderate
Invasive species control	Moderate	High	Low
Modular wetland	High	Moderate	High
Natural/Native vegetation	Low	Moderate	Low
Porous pavement*	Moderate	Moderate	Moderate
Rain barrels	Low	Low	Moderate
Subsurface storage	High	High	Moderate
Turf reinforcement mats	High	High	Moderate

Table 3-3. Priority Management Practices by Management Unit

Management Practice	Priority
Upland Forest Management Unit	High
Extended detention basin	High
Invasive species control	Low
Natural/Native vegetation	Low
Steep Slopes Management Unit	High
Baffle box	High
Coir logs	High
Infiltration trench	Moderate
Natural/Native vegetation	Low
Turf reinforcement mats	Moderate
Urban Management Unit	High
Baffle box	High
Curb inlet baskets	High
Good housekeeping practices	Low
Grass swale	Moderate
Green roof – Green grid	Low
Infiltration trench	Moderate
Modular wetland	High
Natural/Native vegetation	Low
Porous pavement	Moderate
Rain barrels	Low
Subsurface storage	Moderate
Stream Channel Management Unit[42]	Moderate
Coir logs	Moderate
Natural/Native vegetation	Moderate
Turf reinforcement mats	High

Figure2-6. Upland Forest Management Unit: Extended Detention Basin Locations (3D)

SPSC Report

The authors of this report wanted to create design guidelines and procedural steps in Regenerative Step Pool Storm Conveyance (SPSC) system. SPSCs target solutions in steep slopes. These guidelines are aimed at best management practices (BMP). SPSCs can be implemented as a stormwater management device to manage water quality treatment as part of a treatment.

RSC Report

The authors of this report give a comprehensive guide to Regenerative Stream Conveyance (RSC) including the guidance on construction teams, site preparation, methods and techniques. Our report emphasizes the need for upland and urban solutions. These guidelines could serve managers looking to implement RSC as a solution in low grade upland tributaries that are accessible or urban parks undergoing renovations.

CODE OF REGENERATIVE CONSTRUCTION

1. ***Avoid tree removal throughout project site***
2. ***Minimize land and soil disturbance in riparian areas***
3. ***Preserve existing micro-topography and re-establish diverse topography in disturbed areas***
4. ***Maintain and enhance groundwater interactions when appropriate***
5. ***Adopt an iterative approach to construction***

Urban Stormwater Retrofit Practices

The authors wanted to create a manual to develop and refine more appropriate methods in order to design and build different retrofit options faster and more cost-effectively. The focus was on retrofitting ideas to restore small watersheds in the urban land use. There is background information on stormwater retrofitting, where retrofitting options can be implemented, different types of stormwater treatment options for the retrofitting options, as well as a created retrofit inventory for the subwatershed.

Stormwater BMP's

The purpose of this handbook is to give general guidance on Best Management Practices (BMPs) for stormwater runoff in order to reduce pollutants. This guide provides a framework for developers to select what BMPs works best in their area, making it adaptable to Hawai‘i's special circumstances.