Urban Low Impact Retrofits and Residential Rain Gardens

A non-profit approach to Storm Water Problems

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Hui o Koʻolaupoko

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Presentation Overview

- Urban Low Impact Retrofits
- Residential Rain Gardens

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Conventional Storm Water Management

- Does not view water as a resource
- Moves water quickly from Point A – Point B

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The problem with “Hydraulic Efficiency”

- Connection to the piped system, gutters, etc. quickly transports water, sediment and other pollutants to our streams and ocean
- Development practices, impervious surfaces, detention ponds, don’t replace nature’s ability to attenuate pollution or infiltrate water
- Dealing with water but not the impacts to resources

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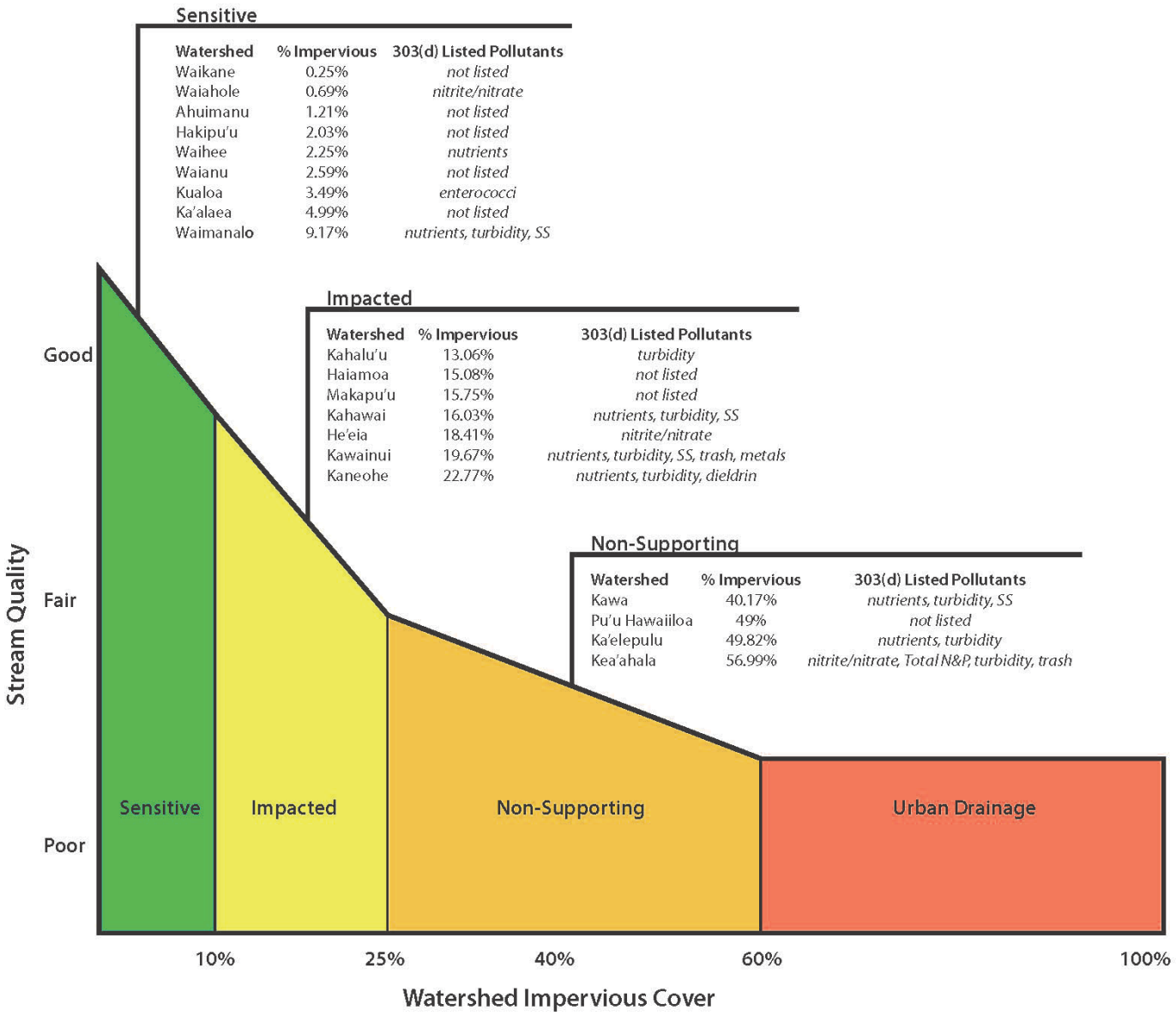
CAUTION
DO NOT ENTER
STREAM MOUTH OPENED
CONTAMINATED AREA
CITY & COUNTY OF HONOLULU, DEPT. OF FACILITY MAINTENANCE

Ko'olaupoko Moku Watersheds



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Case study: Koʻolaupoko Low-Impact Retrofits

- Similar LID techniques can be incorporated into Low-Impact Retrofits (LIR)
  - D: *defined as landscape features which use green infrastructure principles and ideas to manage storm water within a confined urban space.*
- Address conventional development practices
- Gain some pre-development hydrology
- Pollution reduction
- Demonstration projects

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Urban Sub-basin Action Plan

- Assess urban areas and other developed land that contribute to non-point source pollution in Ko‘olaupoko using ecologically-based metrics to identify and prioritized opportunities for LIR implementation.

- USBAP shall inform and guide the implementation of projects to restore to the fullest extent possible a site’s pre-development hydrology and address pollutant by using design techniques that infiltrate, filter, store, evaporate and detain runoff as close to its source as possible

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Benefits of LIR

- Demonstration
- Aesthetics
- Reduction of NPS runoff
  - In Kāne‘ohe, ~ 41 gals of water annually can be infiltrated for every 1 sq. ft. of impervious surface removed

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LIR Identification Methods

5. *Master LIR Project List*

A master LIR project list is created which summarizes the characteristics of each potential LIR project site. The user is able to sort projects through a wide number of variables such as; TMK No., sub-watershed, site name, ZDC, TMK size, percent imperviousness per TMK, visual access, annual rainfall, target rainfall (90^{th}%), hydrologic soil group (HSG) classification, total contributing drainage area (CDA), LIR size, volume provided, volume needed, percent of volume provided, annual runoff reduction, total phosphorus (TP) reduced, total nitrogen (TN) reduced, total suspended solids (TSS) reduced, hotspot score, and LIR ranking score.

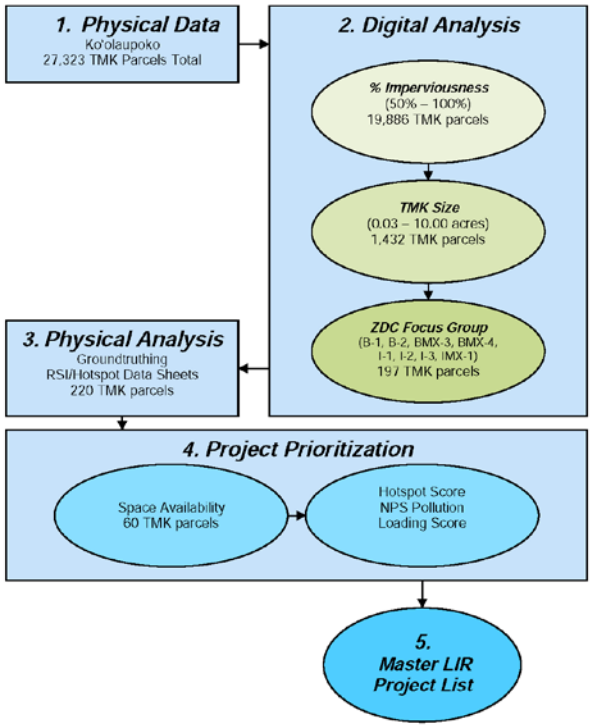

Figure 12 USBAP Process Methodology Diagram

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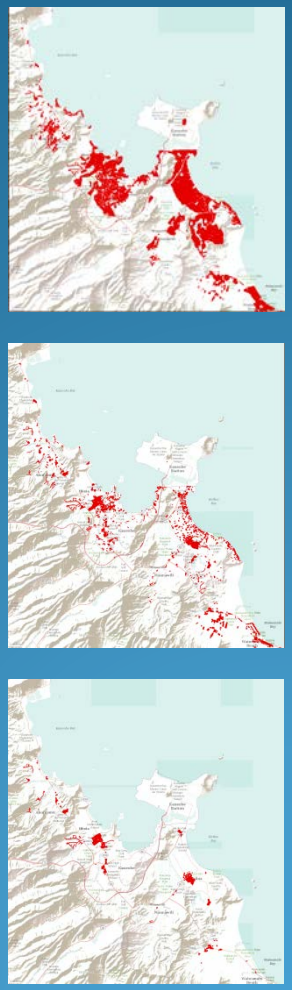
HOK LIR Process in action

From 27,323 TMK parcels

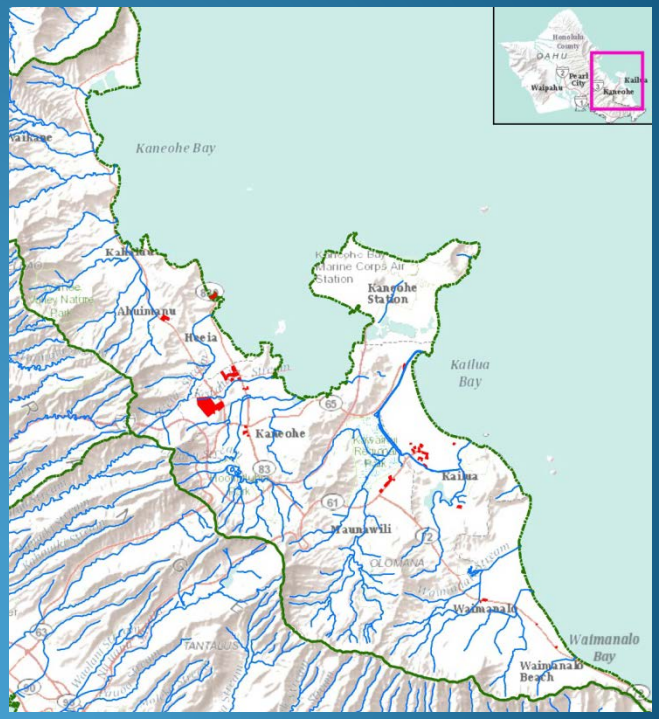
19,886 TMK parcels

1,432 TMK parcels

197 TMK parcels



220 TMK parcels



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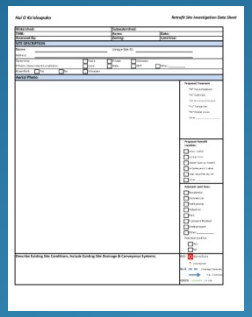
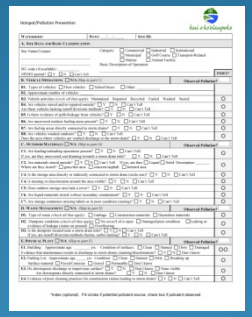
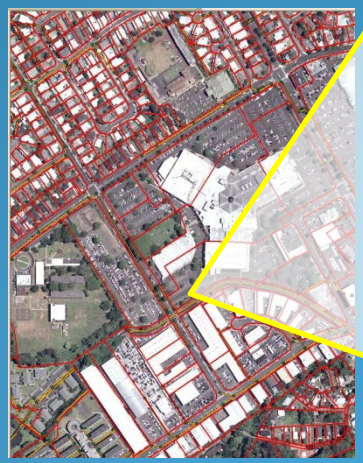
From 220 TMK parcels

192 TMK parcels





53 Potential LIR Projects



Potential LIR Project Site

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Fieldwork: What were we looking for?

Green Infrastructure

Low Impact Retrofits

Low Impact Retrofits are designed to maximize restoration objectives within a confined space. Figure 9 graphically illustrates conventional stormwater conveyance systems vs. LIR stormwater best management practices (BMPs). Typically LIR are constrained by specific site characteristics such as limited space, utilities, stakeholder participation and funding. Each LIR project must meet high standards for performance (NPS pollution load reduction, operation and maintenance), community benefit and aesthetics.

Additionally, on Oah'u, there are limited, if any, incentive programs for private landowners to implement LIR. Property owned by the City and County of Honolulu (CCH) falls under its NPDES permit. As such, the CCH should be implementing retrofits in priority watershed areas with completed total maximum daily loads (TMDL). For other private landowners, their participation will likely be encouraged through incentives such as grant funds or a desire to be good land stewards.

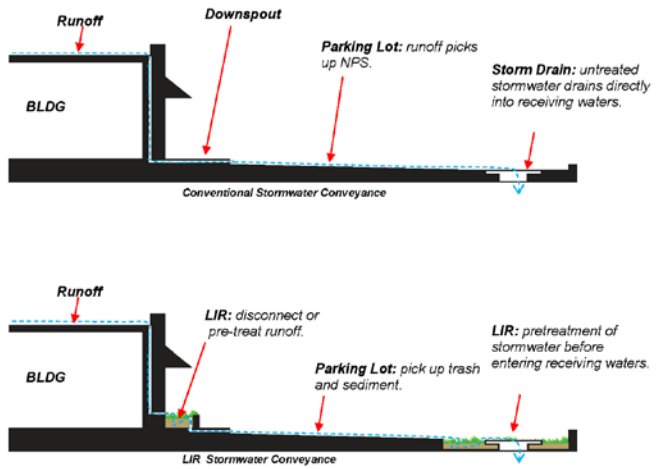

Figure 9 Conventional Stormwater Conveyance System vs. LIR Stormwater BMPs

Simple LIR Schematic

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Windward Community College "A3"; Kāne'ohe Watershed, Kāne'ohe

Project Summary	
Annual Rainfall	74.30"
Target Rainfall Event	1.23"
Hydrologic Soil Group (HSG)	B
Impervious Area Treated (acres)	0.049
Type of LIR Practice	RG
Annual Runoff Reduction (cu. ft)	83
TN Removed (lb/yr)	0.9
TP Removed (lb/yr)	0.1
TSS Removed (lb/yr)	29
Ranking Score	80

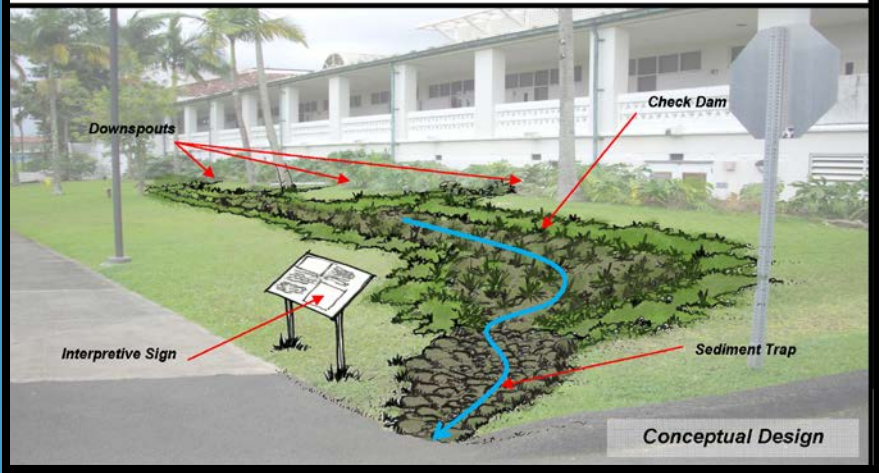
Site Description
The proposed LIR project site is located at the Windward Community College.

Existing Conditions
The surrounding area is well landscaped and maintained. Multiple drainage areas are located within this site. Rooftop generated runoff is directed onto the grassed area to the northeast, while runoff from adjacent impervious surfaces is directed into storm drains located in a grassed depression to the northwest of the structure. This area could also be retrofitted although it is not shown here.

Proposed LIR
Along the eastern frontage, a rain garden could be installed to accept rooftop generated runoff. With a single retrofit installation, multiple downspouts could be directed into the rain garden.

Windward Community College "A3"; Kāne'ohe Watershed, Kāne'ohe

Notes:
Multiple downspouts could be services by a single rain garden. Planting selections should match surrounding landscape motifs as much as possible.



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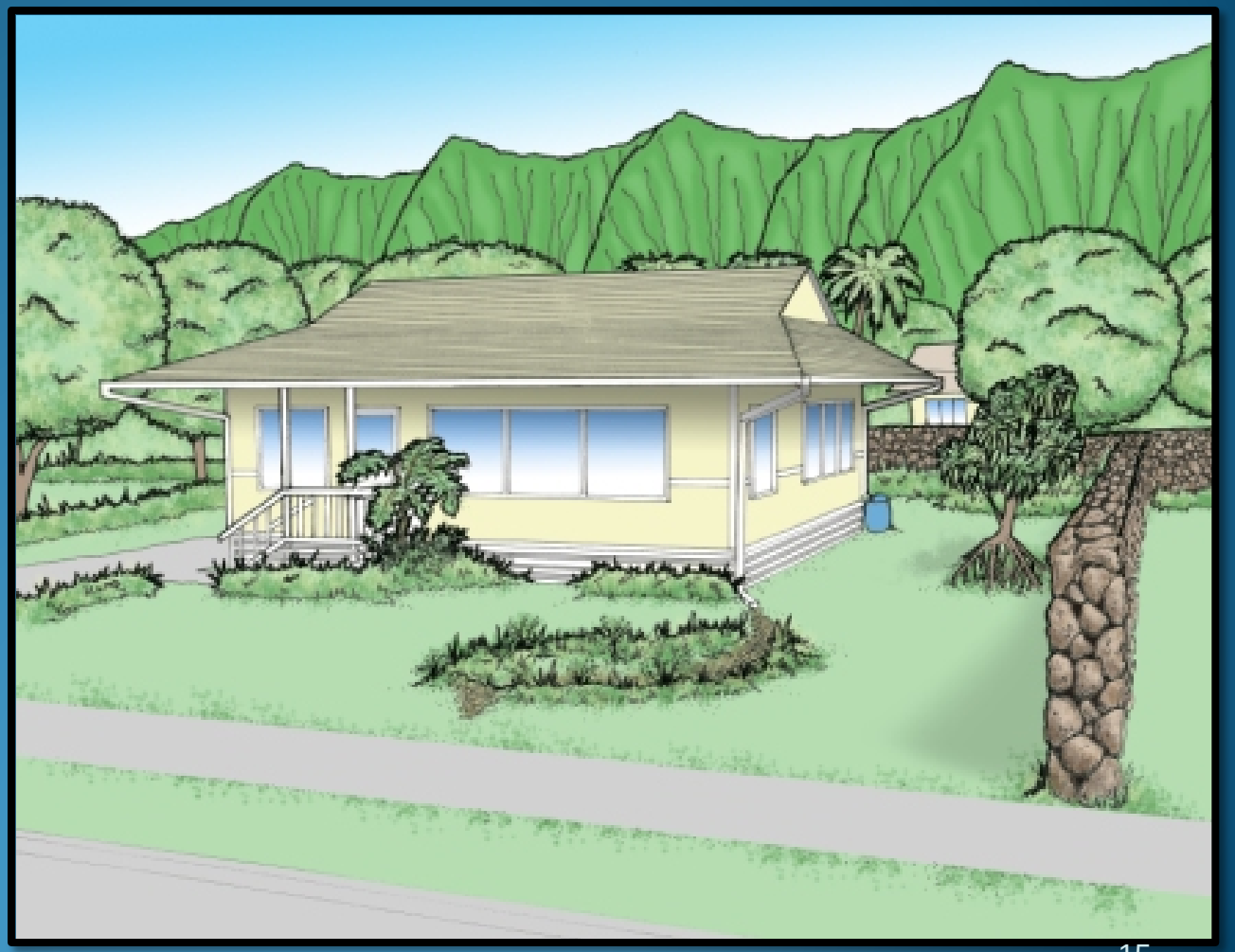
Koʻolaupoko Residential Rain Garden Co-op



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HOK's Rain Garden Co-op

- Developing Hawai'i Rain Garden Manual (Summer 2012)
- Building/cost sharing 50 rain gardens with Ko'olaupoko homeowners
- HPU Students and Professors conducting monitoring

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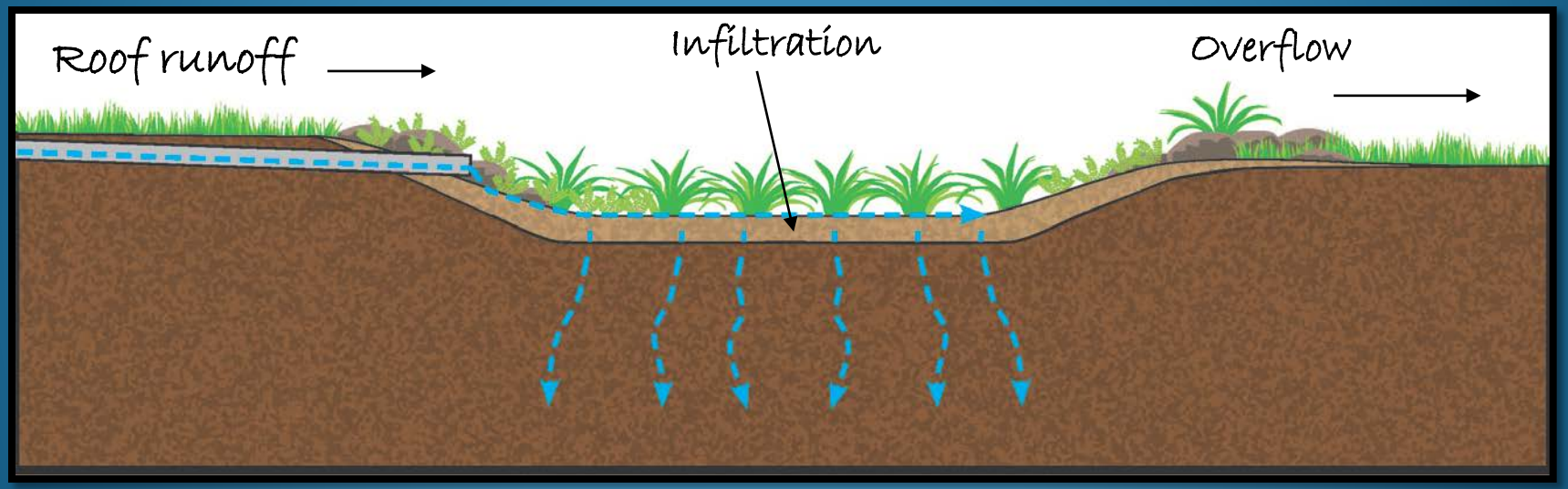
What is a Rain Garden?

A rain garden is a constructed depression planted with native or non-invasive vegetation that allows storm water from impervious surfaces such as roofs and driveways, to collect, briefly store and then infiltrate into the groundwater.



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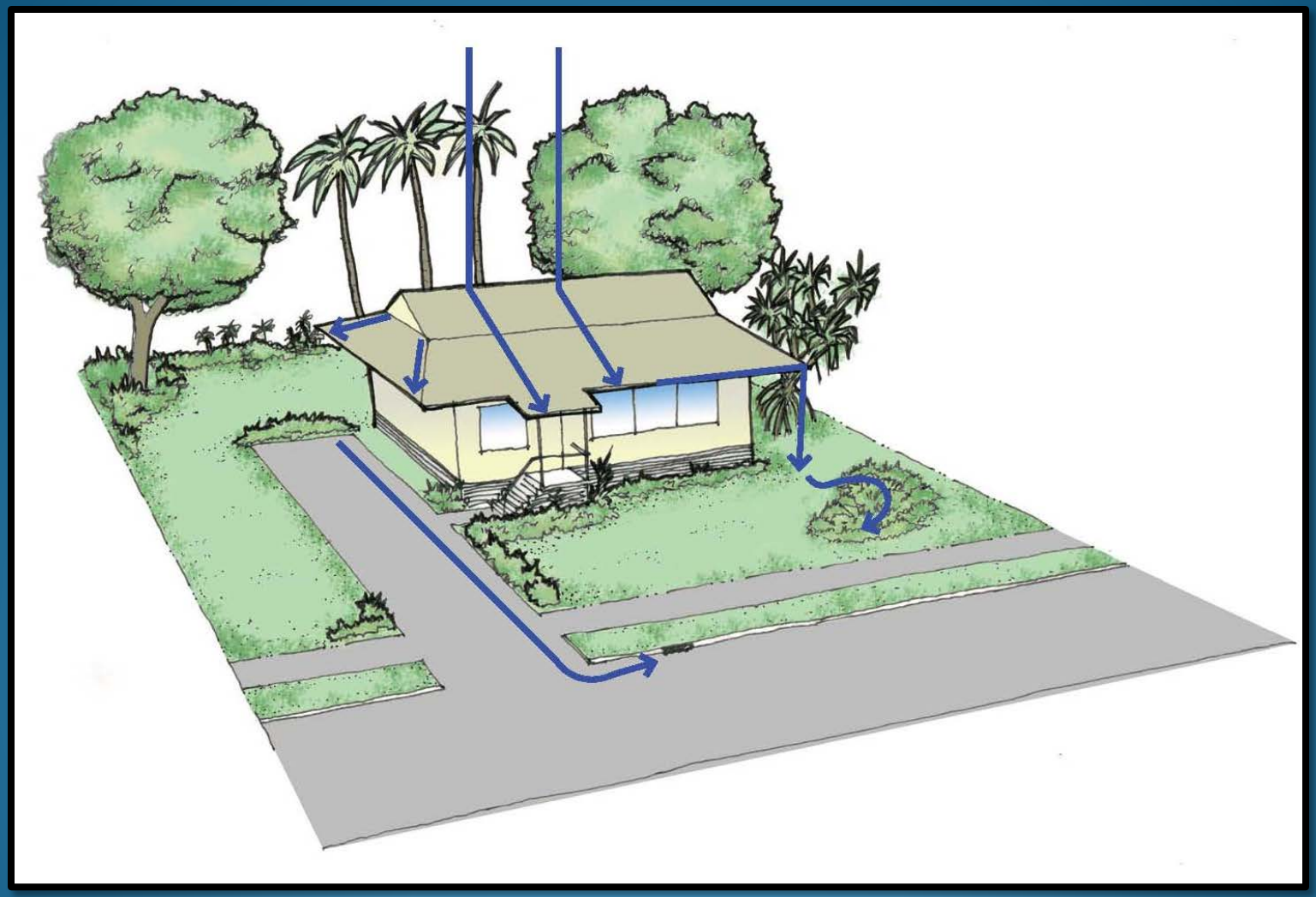
Rain Gardens in your yard



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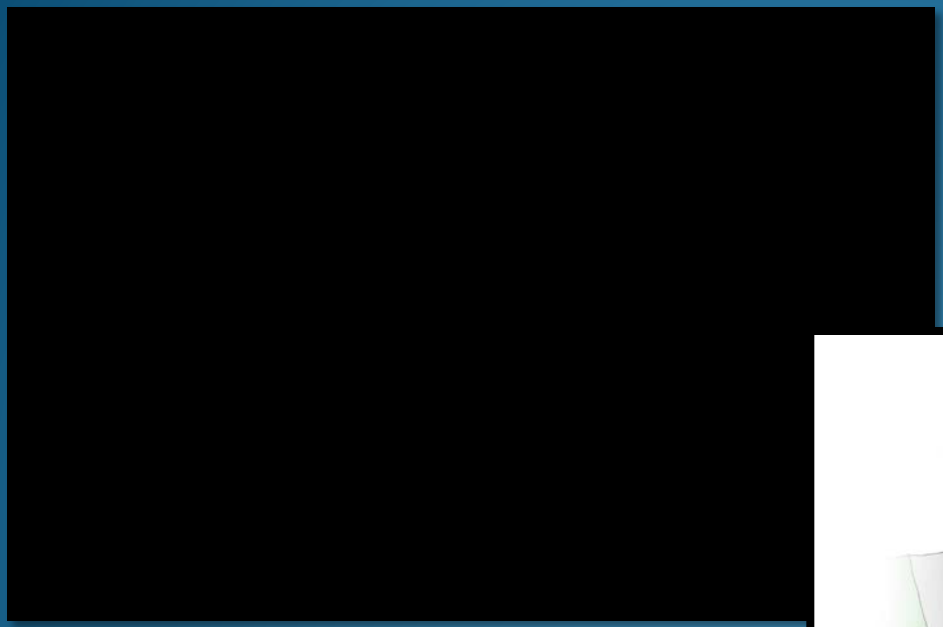
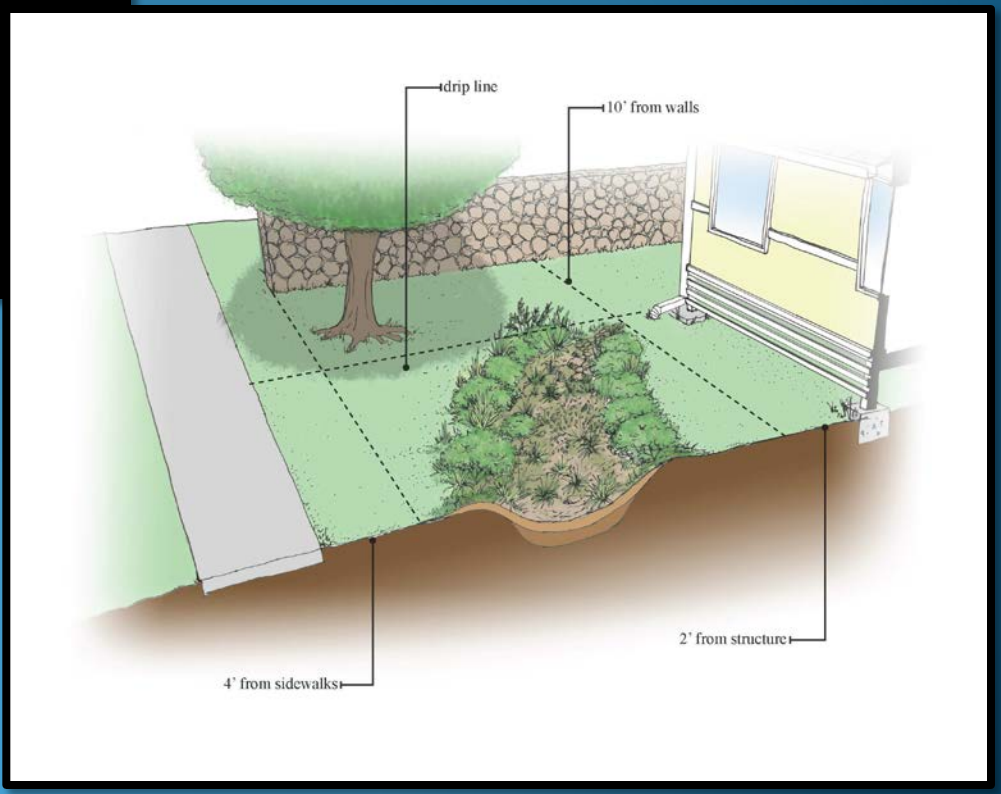
Rain Garden Construction

Infiltration, Sizing & Setbacks

Infiltration is the most important aspect: minimum 1/2” per hour of infiltration





~10% sizing of Contributing Drainage Area

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Rain Garden Benefits

- Reduction of storm water entering streams and ocean
- Reduction of pollutants entering streams and ocean (25-50% for P and 40-60% for N, CWP 2008)
- Groundwater recharge
- Native plants
- Aesthetics

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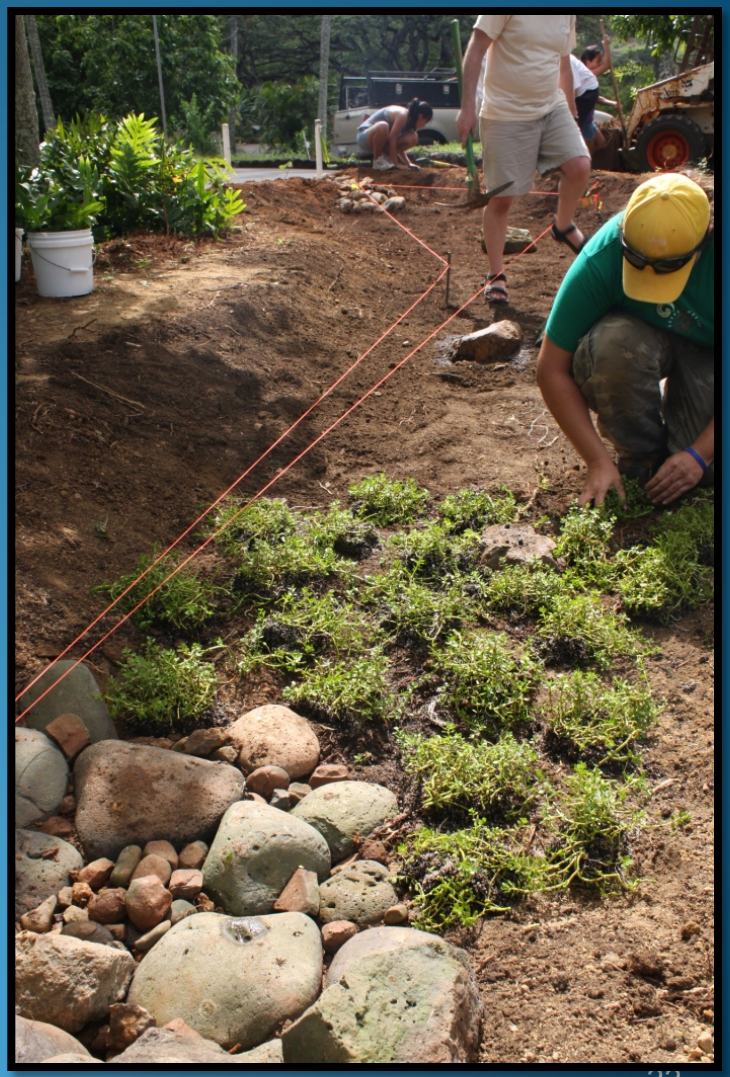
Rain Gardens: what they are not

- They are not a pond or a water feature
  - Water is meant to drain within 24-36 hours
  - This is not enough time for mosquitoes to breed
- They are not designed to be built where water currently ponds

Rain Garden at He‘eia State Park

- University of Hawai‘i Sea Grant
- Oregon State University Sea Grant
- Kama‘āina Kids
- EPA/DOH 319 funded

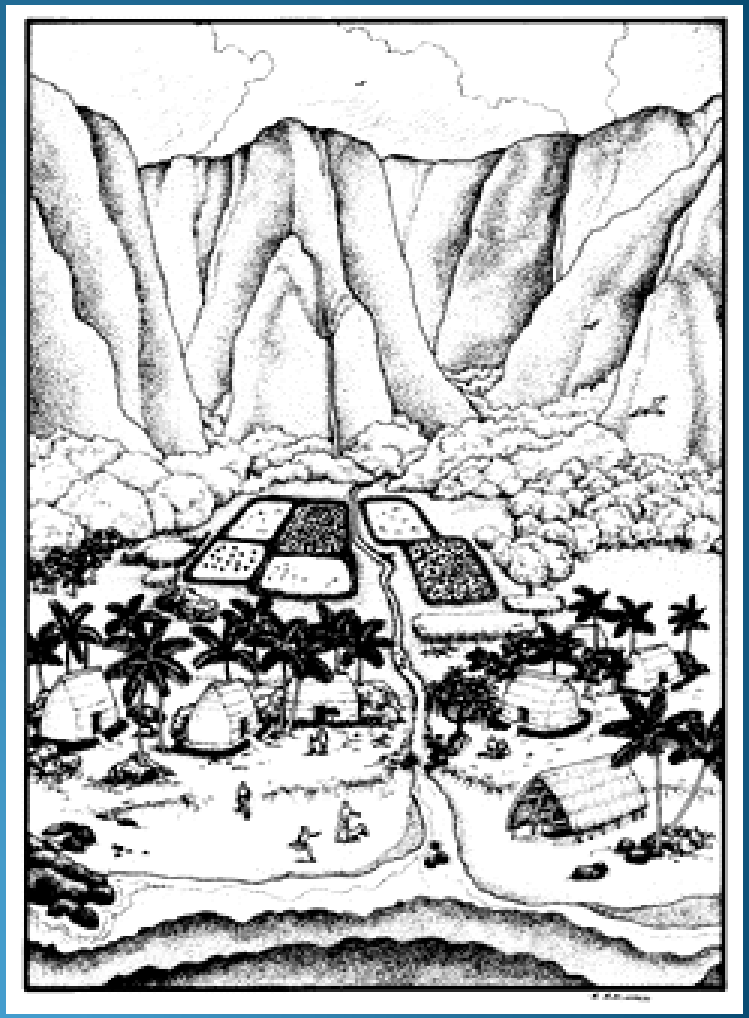


Rain Gardens in Action

- April 28, 2012 HOK is hosting:

  "Save the Rain" Homeowners Workshop for Rain Garden, Rain Barrels and other BMPs to improve storm water runoff.

  11-2 pm at He'eia State Park



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Mahalo to:

- Harold K.L. Castle Foundation
- EPA/Hawai‘i Department of Health: Polluted Control Runoff

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Mahalo!
Questions/Discussion

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