



BUILDING RESILIENCE FROM THE ROOFTOP: RAINWATER HARVESTING IN KAKA'AKO

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Redevelopment in Kaka'ako is booming, and with it comes an opportunity to better manage storm water runoff and protect water quality. As land is developed with impervious surfaces such as roads, sidewalks, driveways and rooftops, rainwater can no longer naturally infiltrate into the ground. Instead, storm water flows into a network of pipes known as the **Municipal Separate Storm Sewer System** (MS4), which conveys runoff directly to nearby streams, harbors and the ocean without treatment. Along the way, it picks up pollutants like animal waste, sediment, pesticides, fertilizers, motor oil and trash, all of which contribute to environmental degradation and water quality problems.

Fortunately, we can install **Best Management Practices** (BMPs) to reduce these impacts and ensure that Kaka'ako's transformation into a vibrant urban community does not come at the expense of Hawai'i's natural resources. BMPs are methods, measures or practices designed to prevent or minimize the pollution of water bodies caused by storm water runoff.



Green roof at Victoria Place in Ward Village

REGULATION OF POST-CONSTRUCTION BMPs IN KAKA'AKO

The Hawai'i Community Development Community (HCDA), the City and County of Honolulu (City), and State of Hawaii Department of Transportation (DOT) have distinct roles in regulating how development projects manage storm water through post-construction BMPs. The City requires new development and redevelopment projects comply with its **Rules Relating to Water Quality** (WQR) (2017, as amended), which mandate post-construction BMPs that reduce pollutants and manage runoff after construction is completed. State DOT (O'ahu District) is responsible for projects within the State Highways Division right-of-way and must comply with its Post-Construction Storm Water Management Program Manual under its MS4 permit. Both programs require prioritizing **Low Impact Development** (LID) strategies to reduce pollutants and mimic natural hydrology.

In contrast, the HCDA primarily serves in an oversight role, ensuring that improvements and redevelopment activities comply with its planning and zoning regulations as outlined in the HCDA Makai and Mauka Area Plan and Rules. This means that even though HCDA governs land use and design standards in Kaka'ako, it generally defers to the City's WQR for storm water quality requirements but maintains greater authority over post-construction requirements on properties it owns or manages. Developers must demonstrate

compliance all agencies' applicable requirements when redeveloping.

TREATING STORM WATER

Treatment Control BMPs are defined by the WQR as engineered technologies designed to remove pollutants from storm water runoff before it is discharged into the storm drain system or receiving waters. In Kaka'ako, the most common treatment BMPs include hydrodynamic separators, dry wells and vegetated swales, all of which operate at or below the ground level.

A look closer reveals **rooftop BMPs**, such as green roofs and cisterns, contributing to storm water management. Green roofs provide usable outdoor space while reducing runoff, whereas **cisterns** collect and store storm water for later use, a practice still relatively uncommon in Kaka'ako. Due to the area's high groundwater levels, BMPs that rely on soil infiltration are not always feasible. However, Hawaii Green Growth notes that the lower Mauka and Makai portions of the Ala Wai watershed, including Kaka'ako, are well suited for rainwater catchment systems such as rain barrels and cisterns.

RAINWATER HARVESTING AND REUSE

Cisterns, or rainwater tanks, are large storage vessels designed to **capture and store storm water runoff**, typically from rooftops. Unlike infiltration BMPs, which send water into the ground, cisterns retain water aboveground for later reuse. Both are considered retention BMPs, under the WQR, helping to reduce runoff.

CASE STUDY: OLA KA 'ILIMA ARTSPACE LOFTS – INTEGRATING GREEN INFRASTRUCTURE IN URBAN HOUSING

Location: HCDA's Kaka'ako Community Development District, Honolulu, Hawai'i

Certification: LEED Platinum (2020)

Overview

Ola Ka 'Ilima Artspace Lofts is an affordable housing development that serves artists and their families while promoting sustainability in a dense urban environment. The project showcases how cultural values and environmental strategies can work hand in hand.

Sustainability Approach

One of the factors contributing to the project's LEED Platinum certification is its use of green infrastructure to manage rainwater and conserve resources. The design incorporates twelve cisterns that provide residents the opportunity to garden within a highly urbanized area by capturing storm water and using it for irrigation in planter beds located throughout the central courtyard. Each resident may claim one planter if desired. Potable water is also available as a backup source.

Low Impact Development (LID) Design Strategies

Ola Ka 'Ilima is one of a few projects that successfully addressed storm water challenges by installing cisterns to capture and store rainwater from the roof for irrigation. This approach helps mitigate runoff, reduce pollutant discharge, and ease pressure on the municipal storm drain system, while also lowering reliance on potable water and providing a practical amenity for residents.



For larger developments installing cisterns to comply with the WQR, sizing is determined by anticipated rainfall and the site's water **demand**, that is, how the harvested rainwater will be used. Common uses include irrigation but can also include other uses such as cooling. Without sufficient demand, water may remain in the tank too long, leaving little capacity for the next storm. The University of Hawai'i offers a Climate Data Portal that provides free, publicly accessible rainfall data.

Under the WQR, one of two equivalent performance standards must be met:

1. Capture at least 80% of the average annual runoff volume and meet 80% of the site's annual water demand.
2. Drain the tank within 48 hours following the end of rainfall. The size of the BMP depends on the site's water demand.

Additional considerations include using tight-fitting covers to prevent contamination and animals from entering the tank, and designing aboveground tanks to block sunlight, which helps prevent algae growth.



Watering system at Ola Ka 'Ilima Artspace Lofts

RESIDENTIAL RAINWATER HARVESTING

Kaka'ako residents and business owners can also contribute to water resiliency and water quality by harvesting rainwater on a smaller scale. Even modest sites can install **rain barrels to capture rainwater**, conserving our drinking water supply while potentially reducing water bills.

Local programs make it easier than ever. The State DOT provides DIY guidance for homeowners, while the Board of Water Supply offers workshops and rebates to purchase ready-made systems. Additionally, the Follow the Drop mobile app can help property owners in Honolulu with sizing and placement.

MAINTENANCE

Whether a larger-scale commercial system or a residential system, maintenance is primarily focused on preventing sediment buildup and clogging, which reduces the capacity of

the system. Basic maintenance tasks include:

- Inspecting, cleaning, and replacing filters and screens as needed.
- Remove debris from roof, gutters, downspouts, first flush devices, roof washers or other collection surfaces.
- Repair leaks.
- Replace worn out or corroded parts and system components when needed.
- If rainwater is used for indoor water supply, inspecting and verifying that treatment systems are operational and meeting minimum water quality requirements as determined by the Department of Health (DOH).

For WQR projects, the **Operations and Maintenance (O&M) Plan** is the key resource for proper maintenance. This plan should include: the owner/developer and designated maintenance contacts, a list of BMPs on site, financial responsibilities, inspection procedures and forms and manufacturers' guidelines.

During the first year of normal operation, BMPs should be inspected monthly or during each storm event. Once maintenance needs are better understood, the frequency can be reduced. Maintenance should be performed as needed based on inspection results, unless otherwise specified by the manufacturer or in the O&M plan. Inspection and maintenance records should be retained for at least five (5) years.

STILL HAVE QUESTIONS?

- For information about HCDA's storm water management program, visit:
<https://dbedt.hawaii.gov/hcda/storm-water-pollution-prevention/>
- For information about rain catchment for homeowners, visit:
<https://www.boardofwatersupply.com/raincatchment>
- For information about post-construction BMP requirements on Oahu, visit:
 - DPP Storm Water Quality Website
<https://www.honolulu.gov/dpp/permitting/storm-water-quality/swq-forms-regulations-resources/>
 - DFM SWQ Construction and Post-Construction BMPs Website
<https://www.honolulu.gov/swq/info-resources/construction-design/>
 - Hawai'i Department of Transportation Storm Water Program Website
<https://hidot.hawaii.gov/stormwater/>
- For information about storm water management nationwide, visit the EPA NPDES website:
<https://www.epa.gov/npdes/stormwater>

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