DEPARTMENT OF PUBLIC WORKS

Adoption of Chapter 15-111
Rules for the Design of Storm Water Treatment
Best Management Practices

1. Chapter 15-111, entitled "Rules for the Design of Storm Water Treatment Best Management Practices", is adopted to read as follows:

"TITLE MC-15

DEPARTMENT OF PUBLIC WORKS

SUBTITLE 01

DIRECTOR OF THE DEPARTMENT OF PUBLIC WORKS

CHAPTER 111

RULES FOR THE DESIGN OF STORM WATER TREATMENT BEST MANAGEMENT PRACTICES

Subchapter 1 General Provisions

§15-111-1 Title
§15-111-2 Purpose

Subchapter 2 Criteria and Standards

§15-111-3 Water quality criteria
§15-111-4 Criteria for sizing of storm water quality facilities
§15-111-5 Management practices to meet criteria
§15-111-6 Water quality design standards

SUBCHAPTER 1

GENERAL PROVISIONS

§15-111-1 Title. The rules in this title shall be known as the "Rules for the Design of Storm Water Treatment Best Management Practices." [Eff 11/25/12] (Auth: MCC §§16.26B.3900, 18.20.135) (Imp: MCC §§16.26B.3900, 18.20.135)

§15-111-2 Purpose. These standards shall establish controls on the timing and rate of discharge of storm water runoff to reduce storm water runoff pollution to the maximum extent practicable through the implementation of best management practices and engineering control facilities designed to reduce the generation of pollutants.

Long-term water quality is generally impacted by the volume and frequency of discharged pollutants. Therefore, the water quality of the ocean and other receiving waters would be impacted more by the runoff from smaller frequent storms or rainfall events, which are the sources of the large majority of the volume and frequency of storm water runoff, rather than large infrequent flood events. Consequently, water quality measures for a development should be designed to mitigate water quality impacts from small frequent storms. [Eff 11/25/12] (Auth: MCC §§16.26B.3900, 18.20.135) (Imp: MCC §§16.26B.3900, 18.20.135)

SUBCHAPTER 2

CRITERIA AND STANDARDS

§15-111-3 Water quality criteria. (a) The purpose of the water quality criteria is to reduce the pollution associated with storm water runoff from new development and significant redevelopment.

(b) The department shall be responsible for the review and enforcement of these rules.

(c) These rules have been adopted to implement the provisions of sections 16.26B.3900 and 18.20.135, Maui County Code, as amended.

(d) The requirements of these rules shall apply as follows:

(1) Projects with a disturbed area of greater than one acre, must meet the specific criteria for sizing of storm water quality facilities. The disturbed area shall be determined by the director. The director may take into consideration all factors, including future construction, such as home construction, even if not immediately constructed with the development of the site improvements.

(2) Projects with a disturbed area of less than one acre, will be subject to approval of a site-specific best management practices ("BMP") plan to be proposed by the developer and approved by the director. These plans should consider and utilize appropriate BMP, including those described in these criteria as well as other non-structural control measures.

(3) All plans for storm water quality facilities on projects with a disturbed area over one acre shall be prepared by a civil engineer, licensed in the State of Hawaii.

(e) Low Impact Development (LID) techniques can be incorporated into site design to satisfy water quality criteria. LID is an approach to land development or redevelopment that is modeled after nature to manage storm water as close to its source as possible by using distributed small scale controls. This approach replicates a site's predevelopment hydrology by using techniques that infiltrate, filter, store, evaporate, and detain runoff close to its source. Techniques are based on the premise that storm water management should not be seen as storm water disposal. Typical practices and controls include conservation of natural areas, bioretention cells, rain barrels, green roofs, permeable pavement, grassed swales, and commercially manufactured filtration or infiltration devices. By implementing LID principles and practices, water can be managed in a way that reduces the impact of built areas and promotes the natural movement of water within an ecosystem or watershed.

(f) The director may exempt projects from the application of these rules if projects are determined to have submitted substantially completed construction drawings before these rules are approved.

(g) These criteria are required to be applied to runoff arising from a site and not from off-site runoff, unless the off-site runoff is entering the site as overland flow, and/or will not be separated from on-site runoff. If off-site runoff is to be conveyed through a water quality facility, then the facility must be designed to meet the requirements as described below for the combined on-site and off-site runoff volumes and/or rates.

(h) These are minimum requirements. If the department determines that additional controls and/or lower thresholds for developments are required to meet the specific water quality needs in watersheds that drain to sensitive receiving waters (as defined by the Hawaii State Department of Health Water Quality Limited Segments ["WQLS"], of Class 1 Inland Waters, of Class AA Marine Waters), additional requirements may be imposed. These may include design requirements that result in larger facilities as well as additional types of structural or non-structural controls. The design solution will be contingent upon the pollutants that are found to be impacting such water bodies and the regulatory status of the water body.

(i) Water quality facilities shall remain privately owned and maintained unless dedication is approved by the Maui County Council.

(j) Parks may be utilized to satisfy water quality facility requirements, with concurrence of the appropriate County agencies.

(k) All water quality facilities will require regular maintenance to ensure their adequate performance. Applicants are required to submit a proposed maintenance plan. The plan should specify the frequency of inspection and maintenance that will occur and who will be responsible. [Eff 11/25/12] (Auth: MCC §§16.26B.3900, 18.20.135) (Imp: MCC §§16.26B.3900, 18.20.135)

§15-111-4 Criteria for sizing of storm water quality facilities. (a) The criteria can be met by:

(1) Either detaining storm water for a length of time that allows storm water pollutants to settle (detention treatment from such methods as extended detention wet and dry ponds, created wetlands, vaults/tanks, etc.);
(2) By use of filtration or infiltration methods (flow-through based treatment from such methods as sand filters, grass swales, other media filters, and infiltration);
(3) Short-term detention can be utilized with a flow-through based treatment system (e.g., a detention pond designed to meter flows

through a swale of filter) to meet the criteria; or

(4) Upstream flow-through treatment and detention treatment can be utilized.

(b) Other proposals to satisfy the water quality criteria may be approved by the director if the proposal is accompanied by a certification and appropriate supporting material from a civil engineer, licensed in the State of Hawaii, that verifies compliance with one of the following (by performance or design):

(1) After construction has been completed and the site is permanently stabilized, reduce the average annual total suspended solid ("TSS") loadings by eighty percent. For the purposes of this measure, an eighty percent TSS reduction is to be determined on an average annual basis for the two-year/twenty-four hour storm.

(2) Reduce the post development loadings of TSS so that the average annual TSS loadings are no greater than predevelopment loadings. [Eff 11/25/12] (Auth: MCC §§16.26B.3900, 18.20.135) (Imp: MCC §§16.26B.3900, 18.20.135)

§15-111-5 <u>Management practices to meet criteria.</u> (a) Detention based water quality control measures allow for the settling of fine particles and pollutants that are associated with these particles. Detention times for water quality control are typically much longer than for flood control. Although a detention system for water quality could be combined with a flood control system, the volume assigned for water quality control must meet minimum detention times. Therefore, this volume will typically not be available for peak rate volume control.

(1) The required design volume for detention based control is equal to the entire runoff volume that would occur from the area contributing to the detention facility with a one-inch rain storm.

(A) The runoff coefficient shall be determined from the following equation as developed by EPA for smaller storms in urban areas:

$C = 0.05 + (0.009) \times (IMP)$

C = Runoff coefficient

IMP = Impervious Area (surface areas which allow little or no infiltration, including pavements, roofs, etc.) for the tributary watershed, expressed as a percentage.

It shall be based upon the ultimate use of the drainage area, unless the water quality feature will be re-built/sized during subsequent phases of construction.

(B) The design storm for detention based water quality systems is a one-inch storm.

(C) The volume calculation will be computed as follows:

$WQDV = C \times 1'' \times A \times 3630$

WQDV = Water quality design volume in cubic feet

C = Runoff coefficient

A = Area of the site in acres

3630 = Conversion factor

(2) For water quality treatment to be effective, longer detention times are required.

(A) The draw-down (or draining) time for the detention volume, which is intended to drain down completely (vs. permanent wet volume), shall be greater than or equal to forty-eight hours. For the bottom half of the detention volume, the draw-down time shall be greater than or equal to thirty-six hours.

(B) For detention based water quality controls with less than or equal to twenty acres of drainage area, the total draw-down time can be reduced to thirty-six hours, with the lower half of the detention volume draw-down time of twenty-four hours, if it can be demonstrated that the outlet sizing (e.g., outlet pipe diameter less than four inches) would not be practical.

(C) The detention system shall be designed to maximize the distance between the inlet and outlet, and to minimize "dead spaces" (areas where little or no exchange occurs during a storm event), thereby limiting short-circuiting. A minimum flow-path length to width ratio of three should be utilized.

(D) The outlet shall be sized to achieve the above required detention times. In addition, it shall be large enough that clogging is unlikely to occur. It should be four inches or larger in diameter. If this is not possible, the use of flow-through based measures as provided in subsection (c) should be considered, unless it can be demonstrated that clogging can be avoided.

(b) Flow-through based water quality control measures are measures where either the flow is passed with little or no storage through a filtration media or is infiltrated. In addition, there are measures or devices which utilize hydraulic particle separation techniques, however, these alone do not typically address the smaller sized fractions of solids which typically have a high proportion of other pollutants such as copper and zinc attached to them that are desired to be removed.

(1) For flow-through treatment, flow-rate shall be calculated as follows:

(A) The runoff coefficient shall be determined from Tables 1, 2 and 3 of these rules.

(B) The required flow rate for treatment is the runoff that would be produced from a rainfall intensity of 0.4 inches per hour. This rate must be maintainable for a minimum of three hours (e.g., detention may be used to meter runoff through the flow-through water quality control measure at lower rates, but still meeting the criteria).

(C) Flow rate calculation shall be based upon the following:

WQFR = C × 0.4" × A

WQFR = Water quality flow rate in cubic feet per second

C = Runoff coefficient

A = Area of the site in acres

(2) For flow-through treatment, the level of treatment shall be addressed as follows:

(A) Infiltrated storm water shall be infiltrated through soils capable of filtering pollutants or other suitable media as described below in Other Filter prior to entering groundwater. Infiltration shall only be used where soil conditions and slope stability are suitable.

(B) Vegetated swales such as wetland/native plants and/or grass swales shall be designed so that at the water quality flow rate ("WQFR"), the swale width is such that the flow depth is no greater than four inches and the hydraulic grade line is no greater than two percent, unless drop structures are employed, between structures. The inflow should be directed towards the upstream end of the swale as much as possible, but should at a minimum occur evenly over the length of the swale. The length of flow in the swale is a minimum of one hundred feet.

(C) Bioretention filters are vegetated, landscaped areas where runoff is directed through vegetation and soils for filtration. In most cases, unless there is shown to be adequate infiltration capacity, underdrains and overflow drains should be included to collect filtered runoff to discharge to the storm drainage system. The ponding depth should be six inches or less with a mulch layer of two to three inches. A sandy planting soil of two to three inches should be used. Each facility should have no more than one acre of tributary area, and should be designed to convey larger flows in a manner that does not cause re-entrainment of trapped materials.

(D) Other filters shall be accompanied by certification from a civil engineer, licensed in the State of Hawaii, that the filter device will remove a minimum of eighty percent TSS from the design flow rate.

(c) Short-term detention facilities may be combined with flow-through facilities to reduce the size of the flow-through facility. For example a detention basin may be employed to meter flows through a filtration system. The applicant must show that the combined system could sufficiently treat, as provided in subsection (b), storm water runoff for the runoff produced by the flow-through treatment rate occurring each hour for a three-hour period.

(d) Flow-through based treatment may be located upstream from and combined with detention based treatment. The two treatment methods can be combined, to reduce the sizing of each. In this case, the flow-through treatment must be designed to treat the runoff produced from a minimum rainfall intensity of 0.2 inches per hour. The treated runoff shall then flow to a downstream detention system that is designed to capture and treat the entire runoff volume that would occur from the area contributing to the detention facility from a 0.6-inch rain storm. The upstream system must be designed so that larger flows will not re-entrain and mobilize materials previously deposited. [Eff 11/25/12] (Auth: MCC §§16.26B.3900, 18.20.135) (Imp: MCC §§16.26B.3900, 18.20.135)

§15-111-06 Water quality design standards. (a) Detention based storm water quality control facilities may be designed as follows:

(1) Wet ponds. The wet pond volume is equal to the water quality design volume and is entirely a permanent wet pond, where storm water exchanges with the pond water to achieve treatment. Detention time requirements do not apply.
(2) Dry extended detention ponds. The pond is normally dry, or has a small wet volume (less than ten percent of the total water quality design volume). Treatment is achieved by releasing flows over an extended period.
(3) Combination wet and extended detention ponds. The permanent wet volume of the pond is greater than ten percent of the total water quality design volume. In this case,

the detention time requirement applies to the extended detention volume.

(4) Storm water marsh. This pond is considered either a shallow combination wet and extended detention pond or a shallow wet pond, depending on the design. Detention time requirements apply to the extended detention volume.

(5) Figure 1 specifies the total extended storage and/or wet volume required for detention based water quality systems per tributary acre based upon the methodology as provided in section 15-111-3. The volume is affected by the percent imperviousness of a site. Minimizing the percentage of imperviousness will reduce the required sizes of water quality facilities.

(6) Figure 2 specifies the average outlet discharge rate from extended detention volumes to achieve the necessary detention times. This average outlet rate will then be used to design the outlet system. Figure 2 applies to all pond and marsh systems, except wet ponds or storm water marshes where the total volume is designed to be permanently wet. In addition, if combination ponds such as wet and extended detention include forty percent or more wet volume, the full to half full discharge rate may be applied to the entire extended detention volume. Otherwise, the volume difference between the permanent wet volume and the half full volume must be released at the half-full to empty discharge rate.

(7) For wet ponds and storm water marshes, the applicant must show a water balance that demonstrates that there will be sufficient dry weather flows to maintain the planned pool volume, without creating stagnate conditions.

(8) For dry extended detention ponds, the applicant must demonstrate that the pond will be able to handle dry-weather flows, such as irrigation return flows, without causing a nuisance such as visual eye sore or stagnate water.

(9) Detention based water quality facilities are recommended to be off-line from flood conveyance. If they are to be on-line or combined with a flood detention facility, then the facility must be designed to pass the appropriate flood without damage to the facility, as well as to minimize re-entrainment of pollutants. The water quality design must be based upon the entire tributary area to the facility.

(b) Flow-through based storm water quality facilities include filtering facilities such as vegetated swales, sand and peat filter, commercial filters, and infiltration facilities. The facility must be able to completely treat the flow rate as determined from Figure 3. Flows above this rate can either be by-passed, or routed through the facility if it can be demonstrated that velocities will not re-entrain captured pollutants.

(c) Short-term detention may be combined with flow-through based water quality control. In this case, detention may be utilized to "meter" flows through a flow-through water quality facility, and thereby reducing sizing of the flow-through facility. Figure 4 presents the flow-through treatment rate required, selected with appropriated detention, for four levels of upstream detention and outlet control. The detention volume in cubic feet per acre would be determined using Figure 1 or the equation in section 15-111-5(a), and modified by the ratio of the chosen detention volume, expressed as rainfall depth in inches, divided by the one inch design storm. The outlet from the detention facility to the treatment facility must be designed to discharge at the selected water quality rate, which is the runoff produced by 0.4 inches of rain per hour minus one-third of the appropriate detention volume expressed in inches of rain per hour at a maximum. The chart is based upon the requirement to be able to treat flows from 0.4 inches of rainfall per hour for up to three hours, if detention is planned upstream.

(d) Flow-through based treatment may be located upstream from and combined with detention based treatment. The two treatment methods can be combined, to reduce the sizing of each. In this case, the flow-through treatment must be designed to treat the runoff produced from a minimum rainfall intensity of 0.2 inches per hour and therefore results from Figures 1, 2, and 3, or as provided in sections 15-111-5(a) and (b), must be scaled accordingly." [Eff 11/25/12] (Auth: MCC §§16.26B.3900, 18.20.135) (Imp: MCC §§16.26B.3900, 18.20.135)

Design Charts.

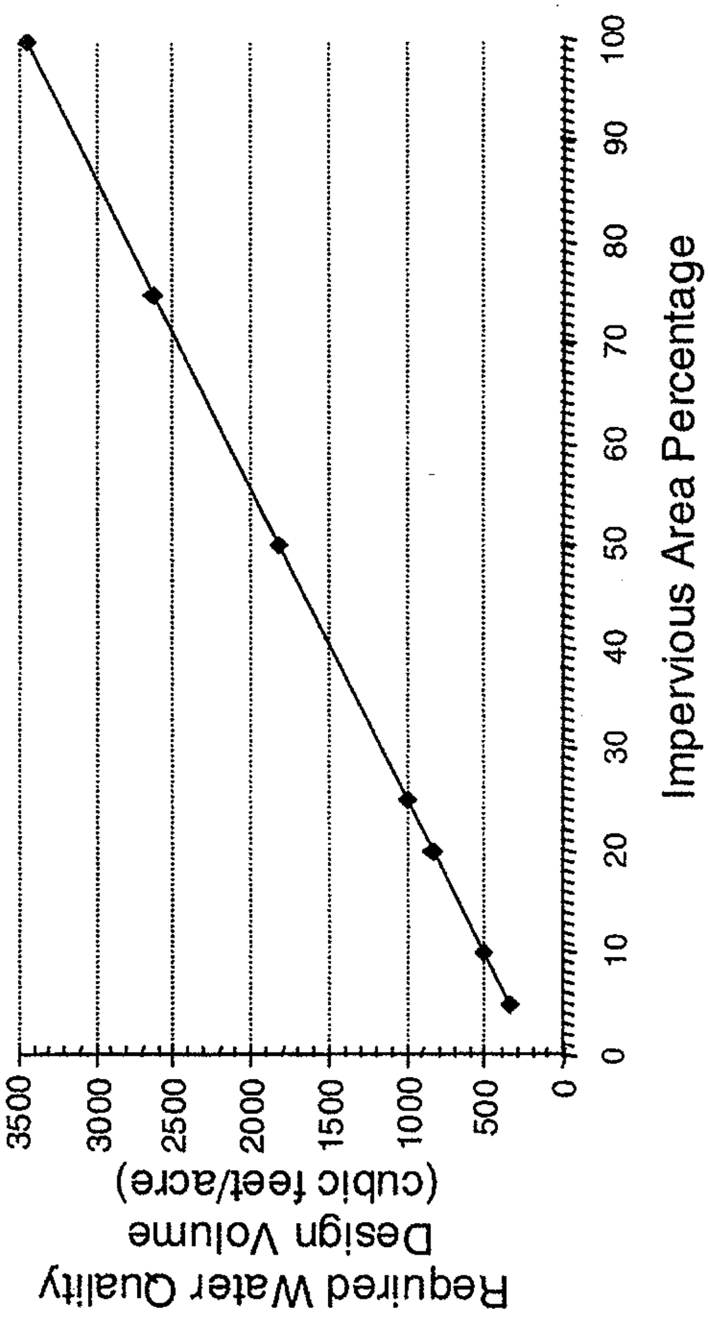

Figure 1
Required Water Quality Design Volume for Detention Based Systems

Figure 2: Required Average Outlet Discharge Rates for Extended Detention Volume

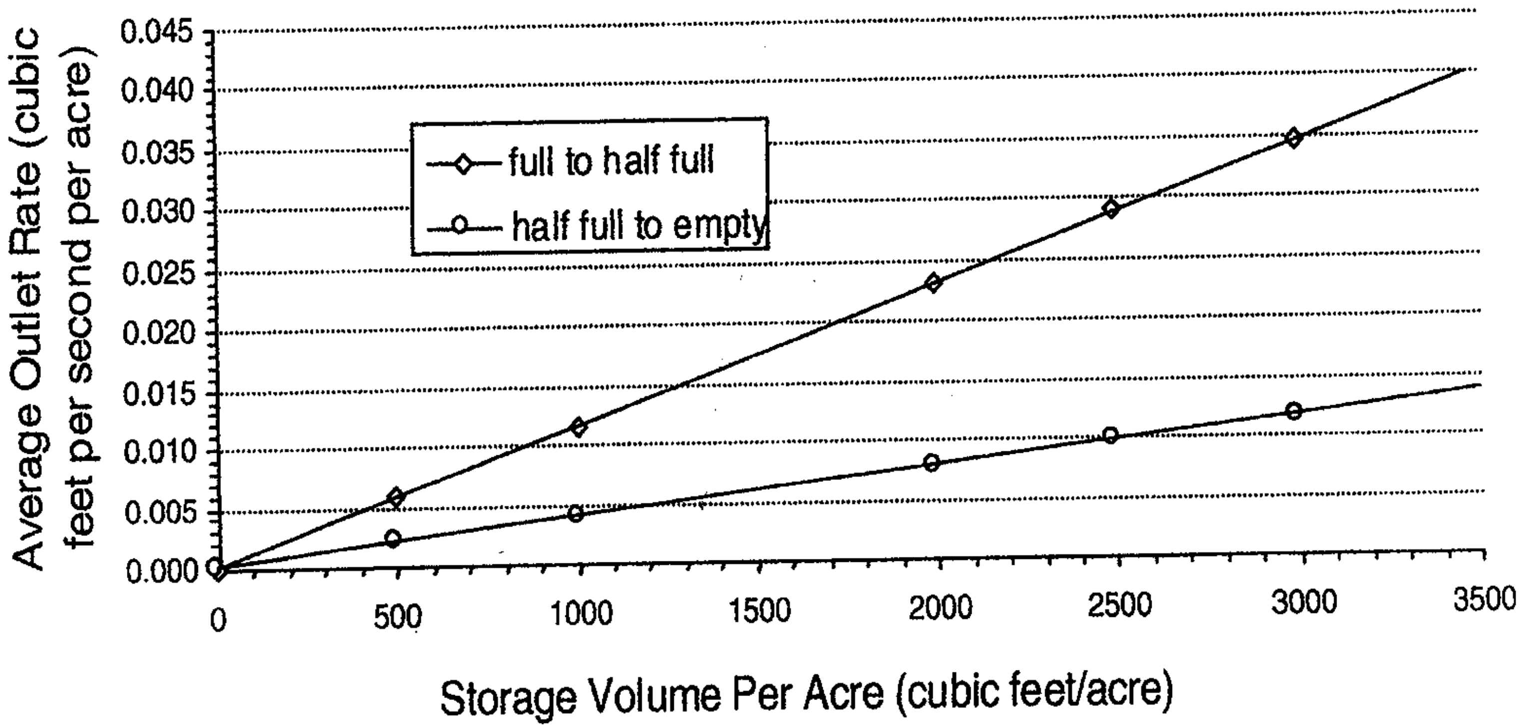

Figure 3
Required Flow-through Based
Storm Water Quality Control Flow Rate

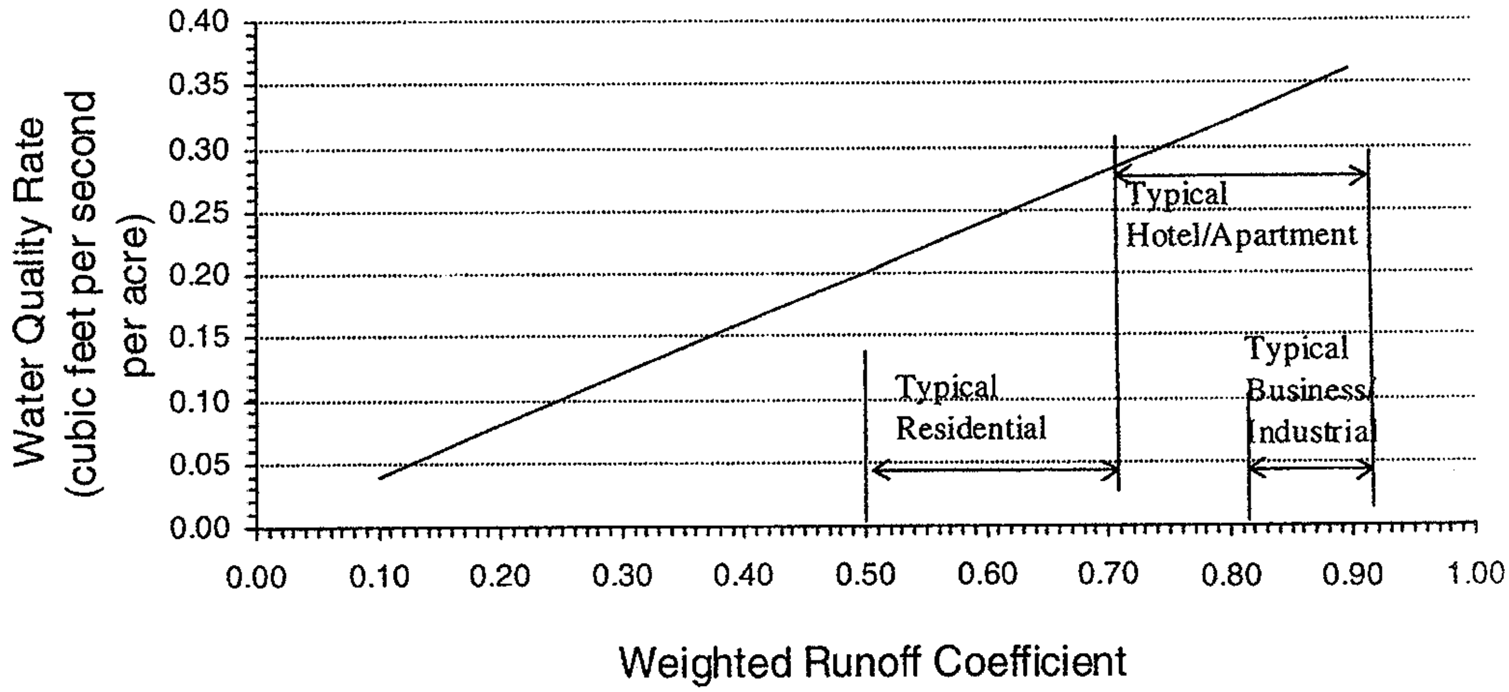

Figure 4: Flow-through Based Water Quality Flow Rate with Upstream Detention Volume

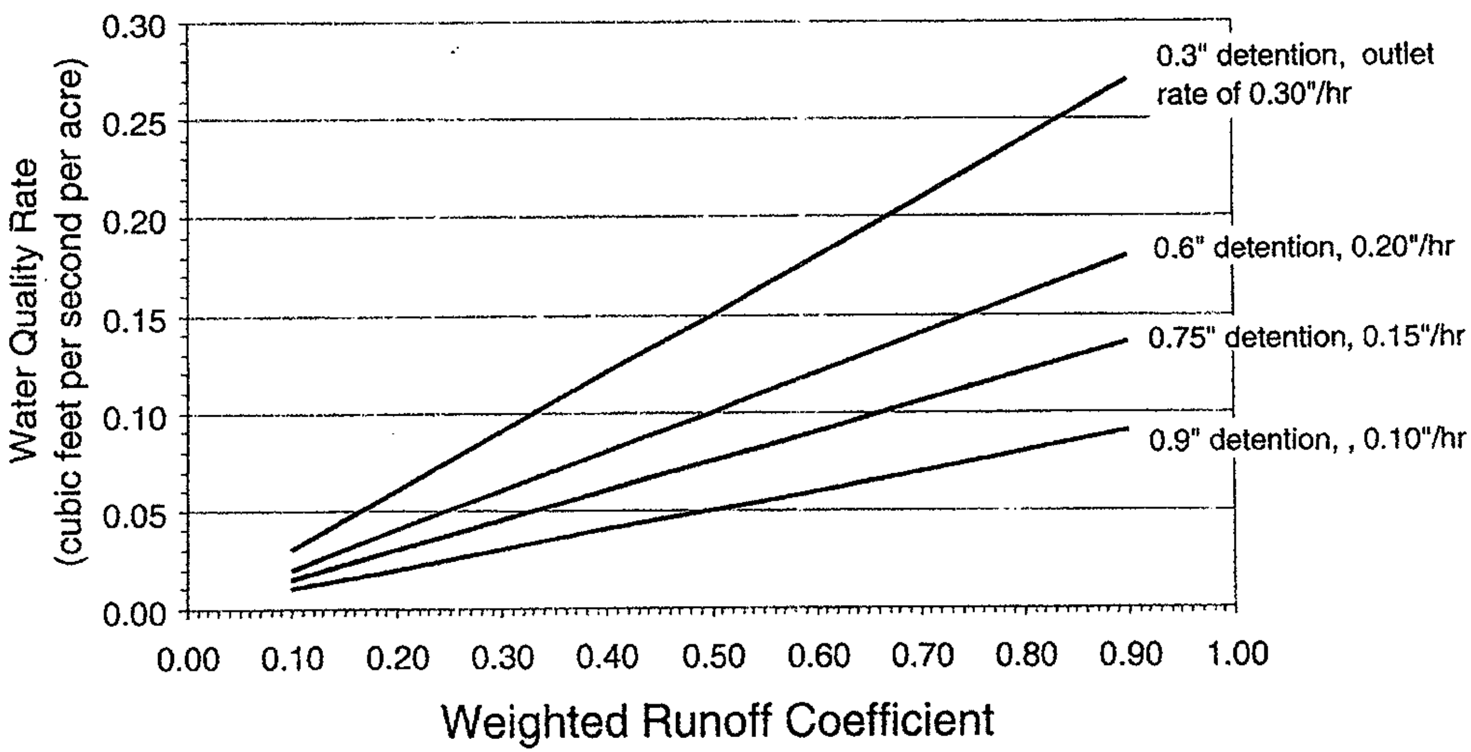

TABLE 1

GUIDE FOR DETERMINATION OF RUNOFF COEFFICIENTS FOR BUILT-UP AREAS

WATERSHED CHARACTERISTICS	EXTREME	HIGH	MODERATE	LOW
INFILTRATION	NEGLIGIBLE 0.20	SLOW 0.14	MEDIUM 0.07	HIGH 0.0
RELIEF	STEEP (>25%) 0.08	HILLY (15-25%) 0.06	ROLLING (5-15%) 0.03	FLAT (0-5%) 0.0
VEGETAL COVER	NONE 0.07	POOR (<10%) 0.05	GOOD (10-50%) 0.03	HIGH (50-90%) 0.0
DEVELOPMENT TYPE	INDUSTRIAL & BUSINESS 0.55	HOTEL-APARTMENT 0.45	RESIDENTIAL 0.40	AGRICULTURAL 0.15

Note: The design coefficient "C" must result from a total of the values for all four watershed characteristics of the site.

TABLE 2

TYPICAL RUNOFF COEFFICIENTS

TYPE OF DRAINAGE AREA	RUNOFF COEFFICIENT C
PARKS, CEMETERIES	0.25
PLAYGROUNDS	0.35
RAILROAD YARD AREAS	0.40
UNIMPROVED AREAS	0.30
STREETS	
ASPHALTIC	0.95
CONCRETE	0.95
BRICK	0.85
DRIVEWAY AND WALKS	0.85
ROOFS	0.95
LAWNS:	
SANDY SOIL, FLAT (2%)	0.10
SANDY SOIL, AVERAGE (2-7%)	0.15
SANDY SOIL, STEEP (7%)	0.20
HEAVY SOIL, FLAT (2%)	0.17
HEAVY SOIL, AVERAGE (2-7%)	0.22
HEAVY SOIL, STEEP (7%)	0.35

TABLE 3

MINIMUM RUNOFF COEFFICIENTS FOR BUILT-UP AREAS

TYPE OF DEVELOPMENT	RUNOFF COEFFICIENT C
RESIDENTIAL AREAS	0.55
HOTEL, APARTMENT AREAS	0.70
BUSINESS AREAS	0.80
INDUSTRIAL AREAS	0.80

Note: Soil type, open space, ground cover, and slope shall be considered in arriving at reasonable and acceptable runoff coefficients.

2. Chapter 15-111, Rules for the Design of Storm Water Treatment Best Management Practices, shall take effect ten days after filing with the Office of the County Clerk, except that these standards shall not apply to structures or work referenced in Section 16.26B.3900, Maui County Code, until that section takes effect as provided by Ordinance Number 3928 (2012).

ADOPTED THIS 9th day of November, 20 12.

COUNTY OF MAUI

DAVID C. GOODE
Director of Public Works

ALAN M. ARAKAWA
Mayor
County of Maui

Approved this 9th day of November, 20 12.

APPROVED AS TO FORM
AND LEGALITY:

MICHAEL J. HOPPER
Deputy Corporation
County of Maui
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Received this 15th day of November, 20 12.

JEFFREY T. KUWADA
County Clerk
County of Maui

<u>CERTIFICATION</u>

I, DAVID C. GOODE, Director of Public Works, County of Maui, do hereby certify:

1. That the foregoing is a full, true and correct copy of the Rules for the Design of Storm Water Treatment Best Management Practices, drafted in Ramseyer format, pursuant to the requirements of Section 91-4.1, Hawaii Revised Statutes, which were adopted on the day of November 9, 2012, following a public hearing that closed on September 10, 2012, and which were filed with the Office of the County Clerk.

2. That the notice of public hearing on the foregoing Rules, which notice included the substance of such Rules, was published in The Maui News on August 10, 2012.

DAVID C. GOODE
Director of Public Works