Round Curb Inlet Filter (R-GISB)

PROVEN STORMWATER TREATMENT TECHNOLOGY

Media Filter

The Bio Clean Round Curb Inlet Media Filter (RGISB-MF) is an advanced level filtration device designed with a multi-layered media filter for increased removal efficiencies.

Performance

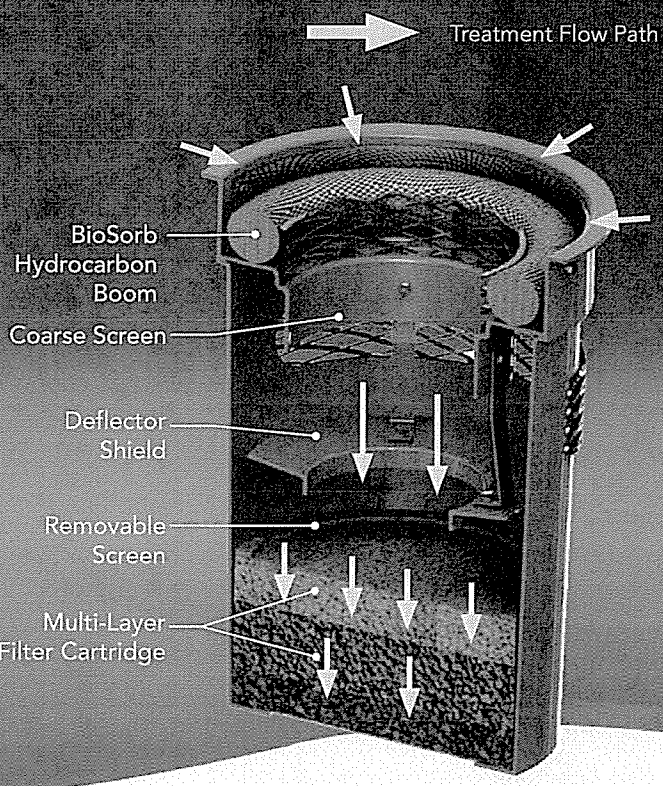
- 85% Removal of Fine TSS
- 69% Removal of Dissolved Phosphorus
- 95% Removal of Copper
- 87% Removal of Lead
- 95% Removal of Zinc
- 90% to 95% Removal of Oils & Grease
- 68% Removal of Fecal Coliform (bacteria)

Specifications

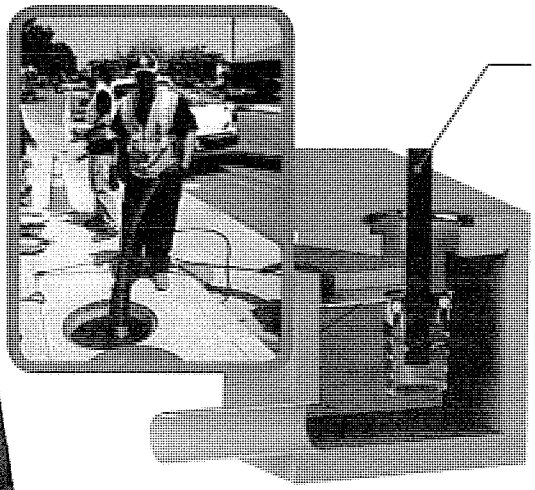
Model #	Media Treatment Flow (CFS)	Screen Treatment Flow (CFS)	Bypass Flow (CFS)
BC-RGISB-MF-22-24	0.12	2	Unlimited

Higher Flow Rate Models Available

Operation



Installation & Maintenance



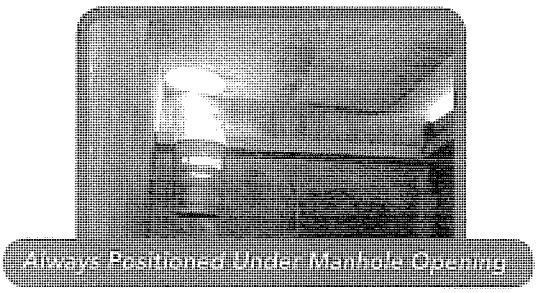
Cleaned Without Catch Basin Entry ✓

Cleaned Easily With Vac Truck ✓

15 Minute Service Time ✓

Application

- Parking Lots
- Roadways



Approvals

City and County of Honolulu

County of San Diego

Meets Full Capture Requirements

2972 San Luis Rey Rd
Oceanside, CA 92058
p 760.433.7640 f 760.433.3176
www.BioCleanEnvironmental.com

BIO CLEAN

NOTES:

1. EXISTING DRAINAGE CONDITIONS WILL BE MAINTAINED. THE AREA (SYSTEM 100) DISCHARGING TO THE FOXBOROUGH LN STORM DRAIN HAS DECREASED TO MAINTAIN THE EXISTING FLOW RATE. RUNOFF FROM THE DEVELOPED AREA WILL BE TREATED USING (2) INLET INSERTS WITH FILTER MEDIUM PRIOR TO OFFSITE DISCHARGE. RUNOFF FROM THE REMAINDER OF THE DEVELOPED AREA (SYSTEMS 200 & 300) WILL BE TREATED USING A WQ/HYDROMODIFICATION BASIN, WHICH WILL ALLOW FOR REMOVAL OF POLLUTANTS PRIOR TO DISCHARGE TO THE WELLINGTON HILL DR STORM DRAIN. DISCHARGE FROM THE BASIN WILL BE DESIGNED TO BENEFIT DOWNSTREAM CONDITIONS. SOME OF THE UNDISTURBED OPEN SPACE ONSITE (STA 1, 2, 3, 4 & SYSTEM 100 STA) WILL BYPASS BMPs, DISCHARGING DIRECTLY OFFSITE AS UNDER EXISTING CONDITIONS.
2. THE FOXBOROUGH LN STORM DRAIN CONFLUENCES WITH THE WELLINGTON HILL DR STORM DRAIN AT THE INTERSECTION OF FOXBOROUGH LN & WELLINGTON HILL DR, APPROXIMATELY 600 FEET DOWNSTREAM FROM THE PROPERTY. THE OFFSITE STORM DRAIN SYSTEM DISCHARGES TO LOS COCHES CREEK, WHICH IS TRIBUTARY TO THE SAN DIEGO RIVER ON ITS WAY TO THE PACIFIC OCEAN.
3. ALL STORM DRAIN INLETS AND CATCH BASINS WITHIN THE PROJECT AREA WILL BE LABELED, STAMPED, OR STENCILED WITH PROHIBITIVE LANGUAGE AND/OR GRAPHICAL ICONS TO DISCOURAGE ILLEGAL DUMPING.
4. SIGNS AND PROHIBITIVE LANGUAGE AND/OR GRAPHICAL ICONS, WHICH PROHIBIT ILLEGAL DUMPING, WILL BE PLACED AT PUBLIC ACCESS POINTS ALONG THE OPEN SPACE WITHIN THE PROJECT AREA.
5. ONLY PEST CONTROL PROFESSIONALS WILL BE USED FOR THE APPLICATION OF PESTICIDES WITHIN HOA MAINTAINED AREAS.
6. HOA MAINTAINED LANDSCAPE AREAS WILL BE DEVELOPED TO INCLUDE EFFICIENT IRRIGATION AND PLANT SELECTION TO PROTECT WATER QUALITY BY MEANS OF WATER CONSERVATION, CANOPY INTERCEPTION, AND PEST RESISTANCE. FLOW REDUCERS AND SHUTOFF VALVES TRIGGERED BY PRESSURE DROP WILL BE USED TO CONTROL WATER LOSS FROM BROKEN SPRINKLER HEADS OR LINES. STEPS WILL BE TAKEN TO PREVENT IRRIGATION DURING AND AFTER PRECIPITATION. FERTILIZERS AND PESTICIDES WILL NOT BE APPLIED WITHIN TWO DAYS OF PREDICTED RAINFALL EVENTS.
7. RESIDENTIAL TRASH STORAGE WILL BE COVERED DUE TO THE USE OF THE STANDARD-ISSUE RESIDENTIAL AUTOMATED REFUSE CONTAINER.
8. MISCELLANEOUS WATER WILL NOT BE ALLOWED TO ENTER THE STORM DRAIN SYSTEM; IT SHALL BE DISCHARGED TO LANDSCAPING OR TO THE SEWER AS APPROPRIATE. BUILDING MATERIALS WILL BE SELECTED FOR WATER QUALITY PROTECTION.
9. SLOPES DISTURBED BY CONSTRUCTION ACTIVITIES WILL BE REVEGETATED AND STABILIZED AS SOON AS POSSIBLE. CONCENTRATED RUNOFF SHALL BE DIRECTED AWAY FROM SLOPES AND TEMPORARY EROSION CONTROL MEASURES WILL BE USED TO ALLOW PERMANENT VEGETATION TIME TO GET ESTABLISHED. TO THE MAXIMUM EXTENT POSSIBLE, THE PERMANENT VEGETATION WILL BE NATIVE VEGETATION WITH VARIABLE ROOT DEPTHS, REQUIRING MINIMAL IRRIGATION, SELECTED FOR EROSION CONTROL AND COMPATIBILITY WITH THE SURROUNDING ECOSYSTEM.
10. EDUCATIONAL MATERIALS ON STORMWATER ISSUES, SIMPLE WAYS TO PREVENT STORMWATER POLLUTION AND HOW TO CONTROL PESTS USING NON-TOXIC MATERIALS (INTEGRATED PEST MANAGEMENT PRINCIPLES), WILL BE MADE AVAILABLE TO HOME OWNERS & MAINTENANCE PERSONNEL.
11. GARAGES WILL PROVIDE COVERED PARKING AND REDUCE POLLUTION INTRODUCTION FROM PARKED VEHICLES WITHIN THE RESIDENTIAL DEVELOPMENT.
12. STREETS HAVE BEEN DESIGNED TO MEET MINIMUM WIDTH REQUIREMENTS.
13. TO THE MAXIMUM EXTENT PRACTICABLE, DRAINAGE FROM ROOFTOPS AND OTHER IMPERVIOUS AREAS WILL BE DIRECTED TO LANDSCAPED OR VEGETATED AREAS PRIOR TO DISCHARGING TO THE STORM DRAIN SYSTEM.
14. APPROXIMATELY 50 ACRES OF OPEN SPACE WILL BE PRESERVED, CONSISTING OF ENVIRONMENTALLY SENSITIVE HILLSIDES, ANNUAL GRASSES, BRUSH, AND NATURAL DRAINAGE CHANNELS.
15. MAINTENANCE OF THE HYDROMOD AND BIORETENTION AREA BASINS WILL BE THE RESPONSIBILITY OF THE BRIGHTWATER RANCH HOA. THE MAINTENANCE OF THE INLET INSERTS WILL BE THE RESPONSIBILITY OF THE COUNTY OF SAN DIEGO.
16. ALL DRAINAGE AND WATER QUALITY FEATURES WITHIN THIS DEVELOPMENT AND OUTSIDE THE PUBLIC RIGHT-OF-WAY WILL BE PRIVATE AND PRIVATELY MAINTAINED.

LEGEND:

- PROJECT BOUNDARY
- DIRECTION OF FLOW
- WQ/HYDROMOD BASIN
- DRAINAGE MANAGEMENT AREA

PROPOSED INLET INSERT W/FILTER MEDIUM. AREA DRAINING INTO INLET= 1.81 ac.

PROPOSED INLET INSERT W/FILTER MEDIUM. AREA DRAINING INTO INLET=3.45 ac.

EXISTING RESIDENTIAL DEVELOPMENT

EXISTING RESIDENTIAL DEVELOPMENT

(1) PROPOSED WQ/HYDROMOD BASIN. AREA DRAINING INTO BASIN= 43.03 ac.

SYSTEM 100 STA

STA 1

STA 2

STA 3

STA 4

STA 5

EXISTING RESIDENTIAL DEVELOPMENT

(1) PROPOSED BIORETENTION AREA BASIN. AREA DRAINING INTO BASIN= 2.52 ac.

EXISTING RESIDENTIAL DEVELOPMENT

N

0 40 80 160 320

GRAPHICAL SCALE
SCALE: 1" = 80'

SCALE:	1"=80'
JOB #:	2862.02
CREATED:	7/01/14

PREPARED BY:

PROJECT DESIGN CONSULTANTS
Planning | Landscape Architecture | Environmental | Engineering | Survey
701 B Street, Suite 800 San Diego, CA 92101
619 235 6471 Tel 619.234.0349 Fax

COUNTY OF SAN DIEGO

BRIGHTWATER RANCH

POST-CONSTRUCTION BMP PLAN
PROPOSED CONDITIONS
EXHIBIT B

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ATTACHMENT C

Drainage Management Area Exhibit

NOTES:

1. EXISTING DRAINAGE CONDITIONS WILL BE MAINTAINED. THE AREA (SYSTEM 100) DISCHARGING TO THE FOXBOROUGH LN STORM DRAIN HAS DECREASED TO MAINTAIN THE EXISTING FLOW RATE. RUNOFF FROM THE DEVELOPED AREA WILL BE TREATED USING (2) INLET INSERTS WITH FILTER MEDIUM PRIOR TO OFFSITE DISCHARGE. RUNOFF FROM THE REMAINDER OF THE DEVELOPED AREA (SYSTEMS 200 & 300) WILL BE TREATED USING A WQ/HYDROMODIFICATION BASIN, WHICH WILL ALLOW FOR REMOVAL OF POLLUTANTS PRIOR TO DISCHARGE TO THE WELLINGTON HILL DR STORM DRAIN. DISCHARGE FROM THE BASIN WILL BE DESIGNED TO BENEFIT DOWNSTREAM CONDITIONS. SOME OF THE UNDISTURBED OPEN SPACE ONSITE (STA 1, 2, 3, 4 & SYSTEM 100 STA) WILL BYPASS BMPs, DISCHARGING DIRECTLY OFFSITE AS UNDER EXISTING CONDITIONS.
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LEGEND:

- PROJECT BOUNDARY
- DIRECTION OF FLOW
- WQ/HYDROMOD BASIN
- DRAINAGE MANAGEMENT AREA
- SELF TREATING AREA

PROPOSED INLET INSERT W/FILTER MEDIUM. AREA DRAINING INTO INLET= 1.81 ac. (NODES 111-113)

PROPOSED INLET INSERT W/FILTER MEDIUM. AREA DRAINING INTO INLET=3.45 ac.(NODES 114-176)

EXISTING RESIDENTIAL DEVELOPMENT

VG RESIDENTIAL DEVELOPMENT

(1) PROPOSED WQ/HYDROMOD BASIN. AREA DRAINING INTO BASIN = 43.03 AC.

BASIN #1

EXISTING WELLINGTON HILL DR.

WELLINGTON HILL CT.

WELLINGTON HILL DR.

JACKSON RIDGE PARKWAY

OPEN SPACE LOT A

EXIST. 30' RD. WATER EASEMENT PER DOC. 90-1609.44

EXISTING WATER TOWER

EXISTING RESIDENTIAL DEVELOPMENT

N25°20'34"W 1498.02

(1) PROPOSED BIORETENTION AREA BASIN. AREA DRAINING INTO BASIN = 2.52 ac.

EXISTING RESIDENTIAL DEVELOPMENT

BLOCK 17 'S TRACT
RANCHO EL CAJON
DB 170 P 71

BIORETENTION AREA #1

BIORETENTION AREA DISCHARGE PIPE WILL CONNECT INTO EXISTING CONCRETE BROW DITCH (NO ENERGY DISSIPATION REQUIRED).

N

0 40 80 160 320

GRAPHICAL SCALE
SCALE: 1" = 80'

SCALE:	1"=80'
JOB #:	2862.02
CREATED:	1/28/15

PREPARED BY:

PROJECT DESIGN CONSULTANTS
Planning | Landscape Architecture | Environmental | Engineering | Survey
701 B Street, Suite 800 San Diego, CA 92101
619.235.6471 Tel 619.234.0349 Fax

COUNTY OF SAN DIEGO

BRIGHTWATER RANCH

POST PROJECT DRAINAGE MANAGEMENT AREAS
PROPOSED CONDITIONS
EXHIBIT C

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D

ATTACHMENT D

Sizing Design Calculations and TC-BMP/LID Design Details

(Provide BMP Sizing Calculator results and/or continuous simulation modeling results, if applicable)

*(**NOTE:** See Hydromodification Management Study prepared by PDC under separate cover for hydromodification continuous simulation modeling results.)*

Input Data SDHM - Brighwater Ranch - Preliminary Sizing

WQ 85th Percentile depth= 0.7

SDHM RESULTS

Results-Basin #1, modeled with Stage-Storage-Discharge (SSD) table-Flinn Springs Rain Gage-0.5Q2

	Total Drainage Area to Basin (not including bypass) (ac)	Impervious Area Draining to Basin (ac)	C(WQ)	WQ Volume (AF)	Basin Volume (AF)	LFT (cfs)	WQ Volume Drawdown (hours)
Basin # 1	43.03	11.23	0.3	0.84	2.3	2.68	25

Notes:

ac = acres

C(WQ)=Water Quality Runoff factor per composite calculation (County SUSMP Table 4-2)

AF=acre-feet=43,560 cubic feet

LFT=Low flow threshold (per SCCWRP Channel Assessment report and SDHM Output)

BMP Sizing Calculations

Table 4-2 Runoff factors for surfaces draining to IMPs (From Jan 2009 Model SUSMP)

Code	Factor	Surface
imp	1	Roofs, Concrete, or Grouted Unit Pavers
per	0.1	Pervious concrete, porous asphalt, crushed aggregate, turfblock, amended, mulched soil, landscape
sup	0.2	Solid Unit pavers on granular base, min. 3/16 inch joint space

IV. Areas Draining to Bioretention Areas

			Bioretention Area #		1			
DMA Name	DMA Area (SF)	Post-project surface type	DMA Runoff Factor	DMA Area x Runoff factor	IMP Sizing Factor	Minimum Area Reqd	Area Provided	Result
	5663	imp	1	5662.8				
	104108	per	0.1	10410.84				
Total	109771			16073.64	0.04	643	998	OK

ROUND GISB MEDIA FILTER WITH EASY MAINTENANCE SHELF SYSTEM

FOR USE IN CURB INLETS

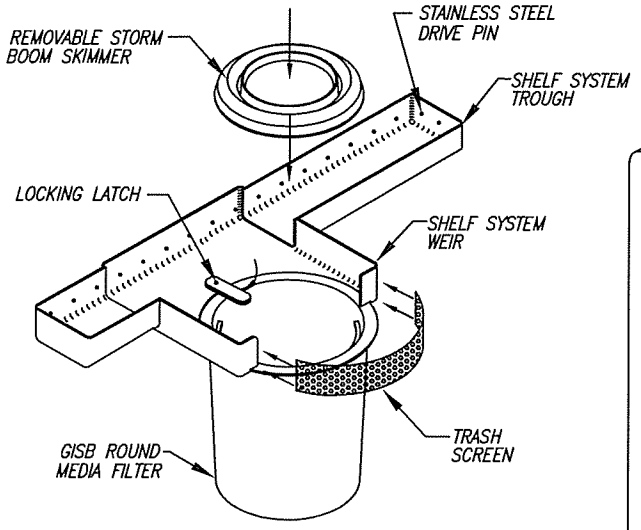


FIGURE 1:
DETAIL OF PARTS

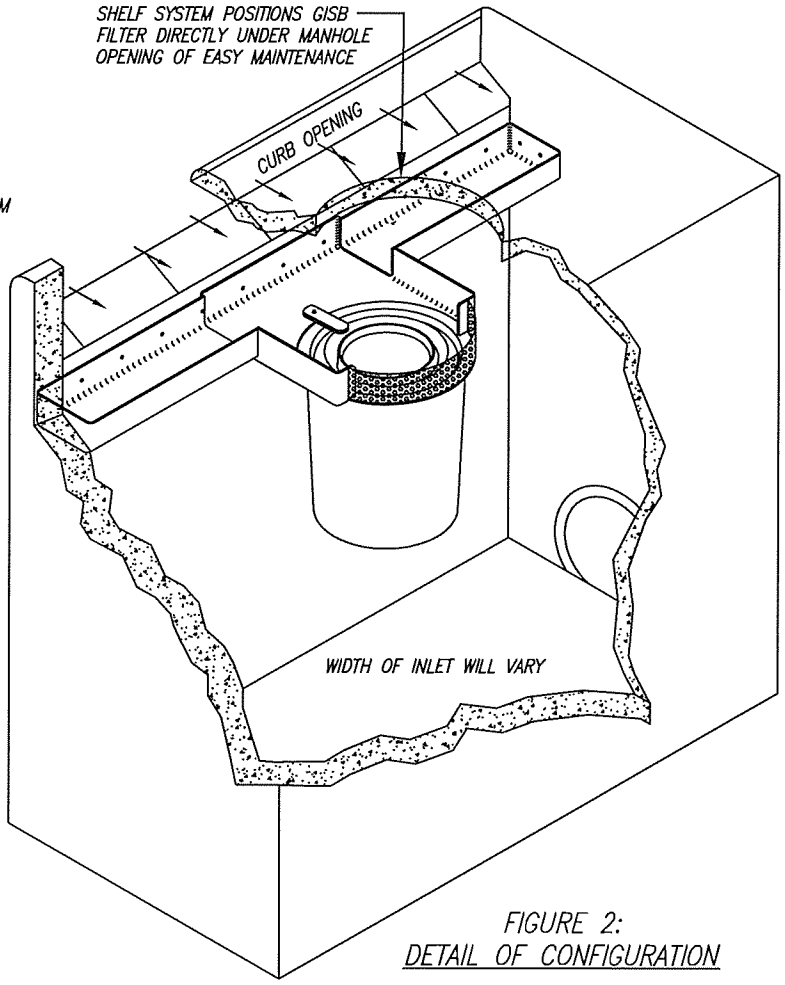


FIGURE 2:
DETAIL OF CONFIGURATION

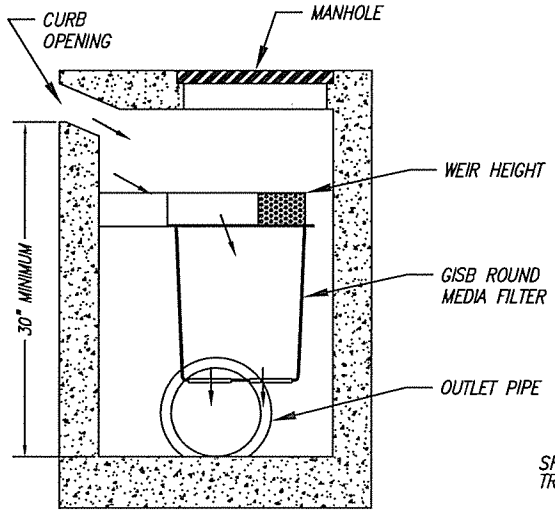


FIGURE 4:
DETAIL OF PROFILE

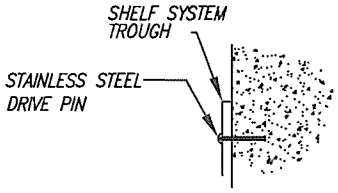


FIGURE 3:
DETAIL OF MOUNTING

NOTES:

1. SHELF SYSTEM PROVIDES FOR ENTIRE COVERAGE OF INLET OPENING SO TO DIVERT ALL FLOW TO BASKET.
2. SHELF SYSTEM MANUFACTURED FROM MARINE GRADE FIBERGLASS, GEL COATED FOR UV PROTECTION.
3. SHELF SYSTEM ATTACHED TO THE CATCH BASIN WITH NON-CORROSIVE HARDWARE.
4. FILTRATION BASKET STRUCTURE MANUFACTURED OF MARINE GRADE FIBERGLASS, GEL COATED FOR UV PROTECTION.
5. FILTRATION BASKET FINE SCREEN AND COARSE CONTAINMENT SCREEN MANUFACTURED FROM STAINLESS STEEL.
6. FILTRATION BASKET HOLDS BOOM OF ABSORBENT MEDIA TO CAPTURE HYDROCARBONS. BOOM IS EASILY REPLACED WITHOUT REMOVING MOUNTING HARDWARE.
7. FILTRATION BASKET LOCATION IS DIRECTLY UNDER MANHOLE FOR EASY MAINTENANCE.
8. LENGTH OF TROUGH CAN VARY FROM 2' TO 30'

DRAWING: GISB MEDIA FILTER SYSTEM		PATENTED	
TREATMENT FLOW RATE: 0.19 CFS		MODEL #: BC-RGISB-MF-22-24	
WARRANTY: 5 YEAR MANUFACTURERS		PROJECT:	
BIO CLEAN ENVIRONMENTAL SERVICES, INC. PO BOX 869 OCEANSIDE, CA 92049 PHONE:760-433-7640 FAX:760-433-3176		REVISIONS:	DATE:
		REVISIONS:	DATE:
DATE:	SCALE: SF = 15	REVISIONS:	DATE:
DRAFTER: J.R.H.	UNITS = INCHES	REVISIONS:	DATE:

BIO CLEAN® ENVIRONMENTAL SERVICES, INC.

WWW.BIOCLEANENVIRONMENTAL.COM

MODEL # GISB-22-24 ROUND HIGH CAPACITY MEDIA FILTER

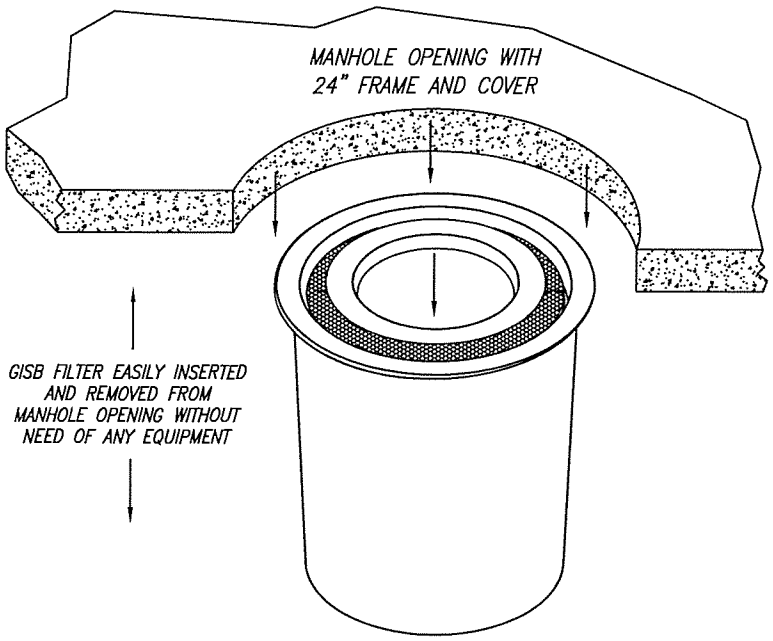


FIGURE 1:
DETAIL OF INSTALLATION

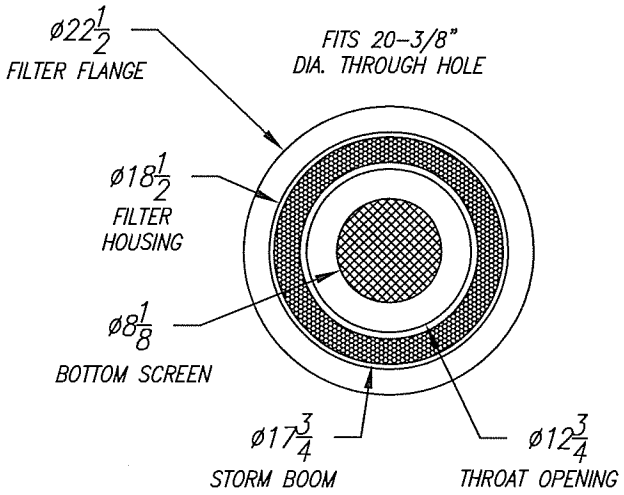


FIGURE 2:
DETAIL OF DIAMETERS

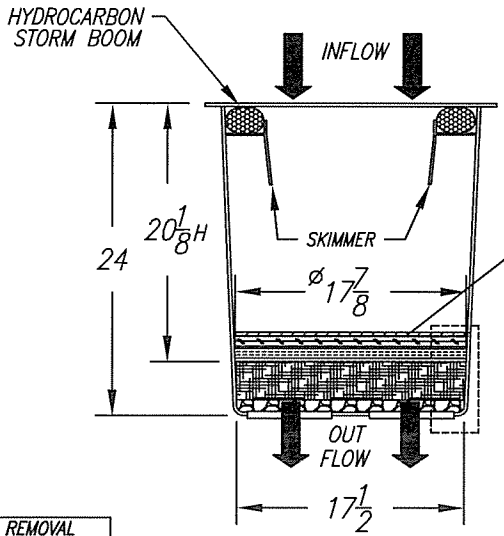


FIGURE 3:
DETAIL OF PARTS

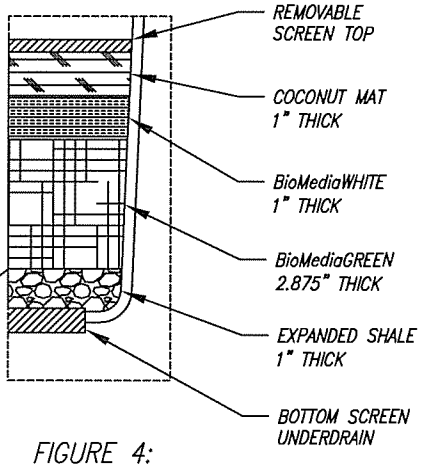


FIGURE 4:
DETAIL OF MEDIA PACK

BioMediaGREEN REMOVAL EFFICIENCIES	
TOTAL SUSPENDED SOLIDS "SIL-CO-SIL 106"	85%
TOTAL PHOSPHORUS	69%
ORTHO PHOSOPHORUS	41%
DISSOLVED COPPER	79%
DISSOLVED LEAD	98%
DISSOLVED ZINC	78%
FECAL COLIFORM BACTERIA	68%
TPH	99%

FLOW RATES - GISB MEDIA FILTER

*MEDIA PACK TREATMENT FLOW RATE				.19 CFS
SURFACE AREA	MAX HEAD	BMG MEDIA THICKNESS	HYDRAULIC CONDUCTIVITY	
$\pi * .76^2 = 1.76$ SF	20.125 IN	2.875 IN	363 M/D	
**TRASH SCREEN TREATMENT FLOW RATE				.88 CFS
SURFACE AREA	MAX HEAD	OPEN AREA	ORIFICE SHAPES	
2.17*0.36 = .78 SF	4.5 IN	49%	ROUND	

BMG DENOTES BioMediaGREEN

*FILTER FLOW RATE CALCULATED USING A HYDRAULIC-CONDUCTIVITY FLOW CALCULATOR (DARCIAN FLOW). HYDRAULIC CONDUCTIVITY OF BioMediaGREEN VERIFIED IN LABORATORY EVALUATION. VARIABLES LISTED ABOVE

**SCREEN FLOW RATE CALCULATED USING THE FOLLOWING EQUATION

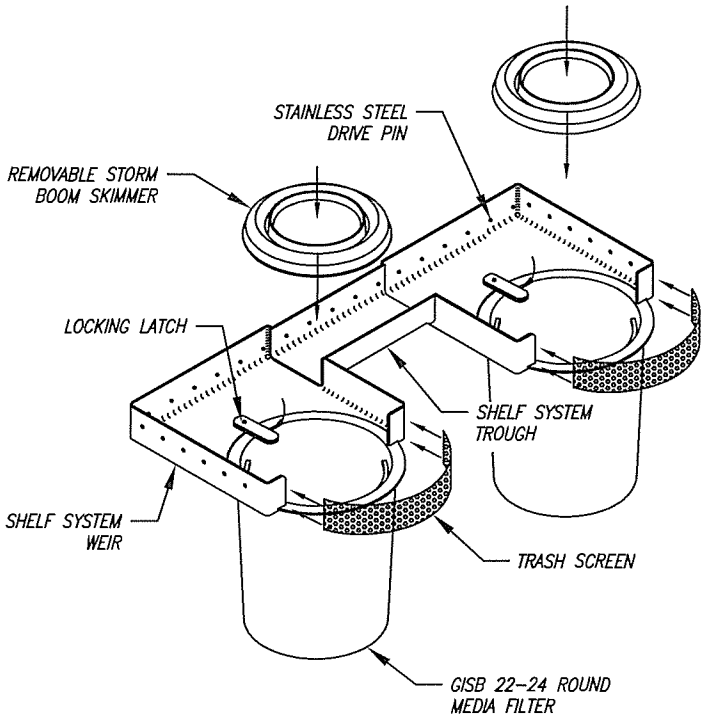
$Q = SO * c_d * A \sqrt{2 * g * h}$ $\quad c_d$ = COFFICIENT of DISCHARGE = .67

DRAWING: GISB MEDIA FILTER DETAILS		PATENTED		SEE PAGE 1 FOR NOTES
TREATMENT FLOW RATE: 0.19 CFS		MODEL #: BC-RGISB-MF-22-24		
WARRANTY: 5 YEAR MANUFACTURERS		PROJECT:		
BIO CLEAN ENVIRONMENTAL SERVICES, INC. PO BOX 869 OCEANSIDE, CA 92049 PHONE:760-433-7640 FAX:760-433-3176		REVISIONS:	DATE:	BIO CLEAN® ENVIRONMENTAL SERVICES, INC. WWW.BIOCLEANENVIRONMENTAL.COM
		REVISIONS:	DATE:	
DATE:	SCALE: SF = 15	REVISIONS:	DATE:	
DRAFTER: J.R.H.	UNITS = INCHES	REVISIONS:	DATE:	PAGE 2

DOUBLE ROUND GISB MEDIA FILTER WITH EASY MAINTENANCE SHELF SYSTEM

FOR USE IN CURB INLETS

SIZED FOR CITY OF TUSTIN MODIFIED INLET TYPE OL



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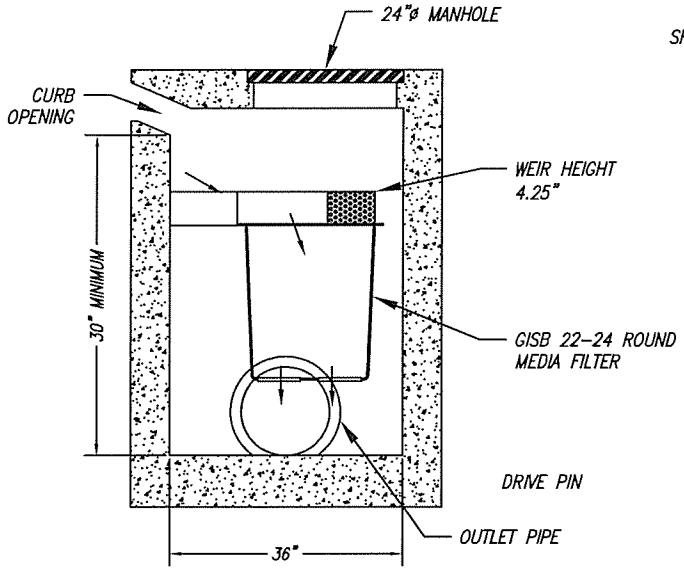

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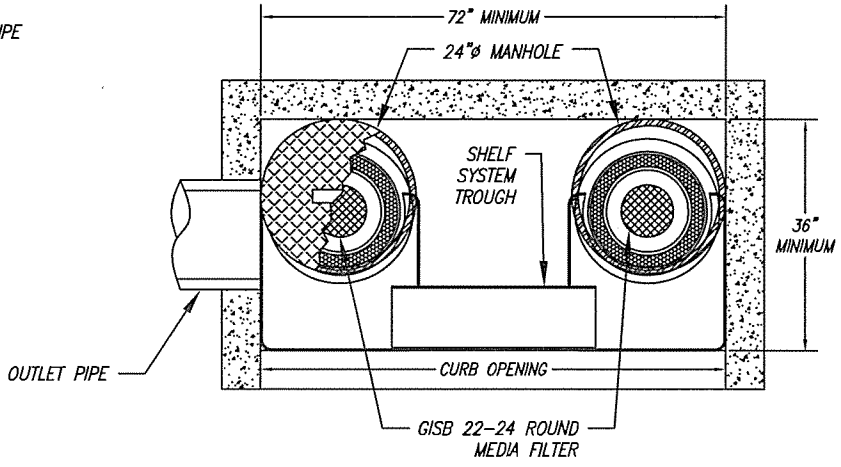
DETAIL OF PROFILE



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DETAIL OF CONFIGURATION

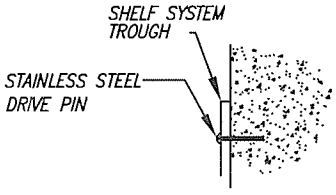

FIGURE 3:
DETAIL OF MOUNTING

DRAWING: DOUBLE GISB MEDIA FILTER SYSTEM		PATENTED	SEE PAGE 1 FOR NOTES
TREATMENT FLOW RATE: 0.38 CFS		MODEL #: BC-RGISB-MF-22-24	
WARRANTY: 5 YEAR MANUFACTURERS		PROJECT:	
BIO CLEAN ENVIRONMENTAL SERVICES, INC. PO BOX 869 OCEANSIDE, CA 92049 PHONE:760-433-7640 FAX:760-433-3176		REVISIONS:	DATE:
		REVISIONS:	DATE:
DATE:	SCALE: SF = 15	REVISIONS:	DATE:
DRAFTER: J.R.H.	UNITS = INCHES	REVISIONS:	DATE:

BIO CLEAN® ENVIRONMENTAL SERVICES, INC.

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ROUND GISB MEDIA FILTER WITH EASY MAINTENANCE SHELF SYSTEM

FOR USE IN CURB INLETS WITH WINGS

SIZED FOR CITY OF TUSTIN STANDARD INLET TYPE OL

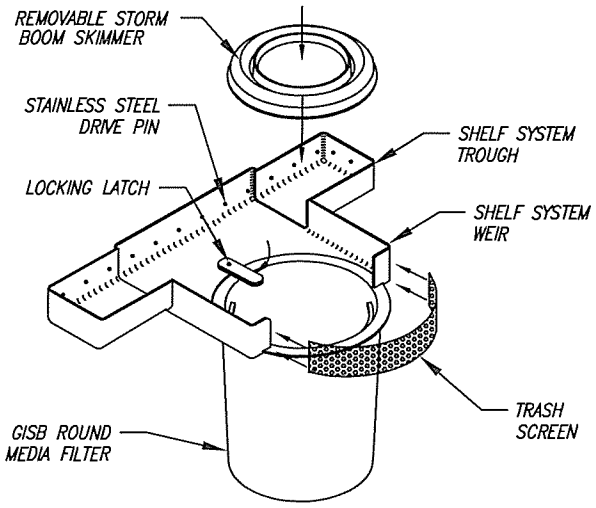

FIGURE 1:
DETAIL OF PARTS

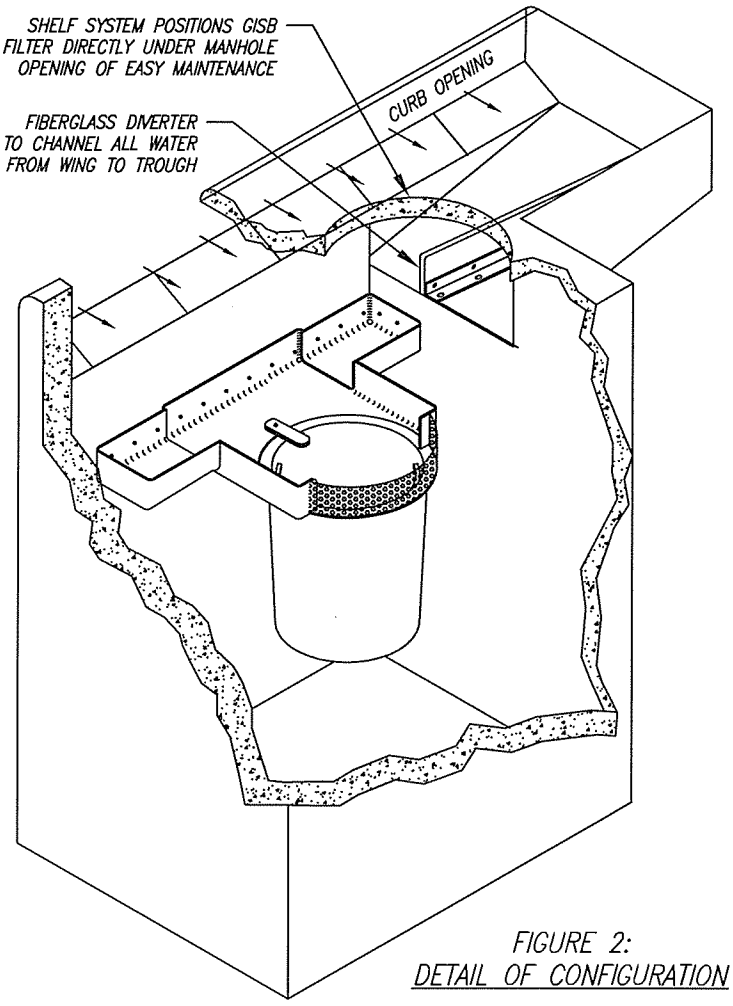

FIGURE 2:
DETAIL OF CONFIGURATION

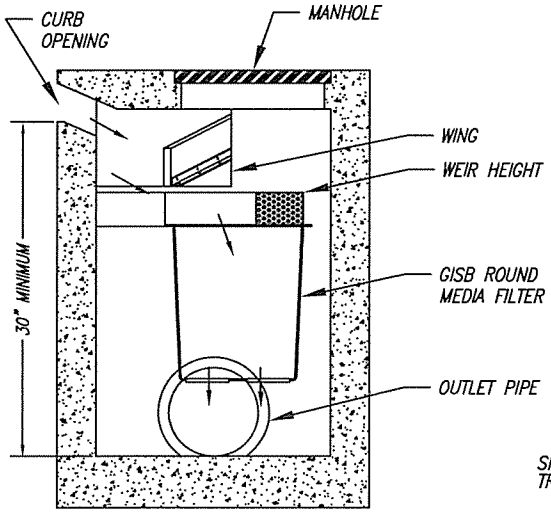

FIGURE 4:
DETAIL OF PROFILE

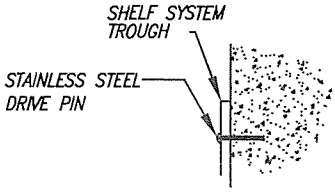

FIGURE 3:
DETAIL OF MOUNTING

NOTES:

1. SHELF SYSTEM PROVIDES FOR ENTIRE COVERAGE OF INLET OPENING SO TO DIVERT ALL FLOW TO BASKET.
2. SHELF SYSTEM MANUFACTURED FROM MARINE GRADE FIBERGLASS, GEL COATED FOR UV PROTECTION.
3. SHELF SYSTEM ATTACHED TO THE CATCH BASIN WITH NON-CORROSIVE HARDWARE.
4. FILTRATION BASKET STRUCTURE MANUFACTURED OF MARINE GRADE FIBERGLASS, GEL COATED FOR UV PROTECTION.
5. FILTRATION BASKET FINE SCREEN AND COARSE CONTAINMENT SCREEN MANUFACTURED FROM STAINLESS STEEL.
6. FILTRATION BASKET HOLDS BOOM OF ABSORBENT MEDIA TO CAPTURE HYDROCARBONS. BOOM IS EASILY REPLACED WITHOUT REMOVING MOUNTING HARDWARE.
7. FILTRATION BASKET LOCATION IS DIRECTLY UNDER MANHOLE FOR EASY MAINTENANCE.
8. LENGTH OF TROUGH CAN VARY FROM 2' TO 30'

DRAWING: GISB MEDIA FILTER SYSTEM		PATENTED	
TREATMENT FLOW RATE: 0.19 CFS		MODEL #: BC-RGISB-MF-22-24	
WARRANTY: 5 YEAR MANUFACTURERS		PROJECT:	
BIO CLEAN ENVIRONMENTAL SERVICES, INC. PO BOX 869 OCEANSIDE, CA 92049 PHONE:760-433-7640 FAX:760-433-3176		REVISIONS:	DATE:
		REVISIONS:	DATE:
DATE:	SCALE: SF = 15	REVISIONS:	DATE:
DRAFTER: J.R.H.	UNITS = INCHES	REVISIONS:	DATE:

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Areas Draining to Structural Treatment BMPs

Node# associated w/drainage area	Impervious Area within DMA (acres)	Pervious Area within DMA (acres)	Total Area (acres)	Water Quality (WQ) Requirement Flowrate[1]		BMP WQ Capacity		Source of Treatment
Node 111-113	0.54	1.27	1.81	0.13	cfs	0.19	cfs	Inlet Inserts with media filtration
Node 114-176	1.04	2.41	3.45	0.26	cfs	0.38	cfs	Inlet Inserts with media filtration

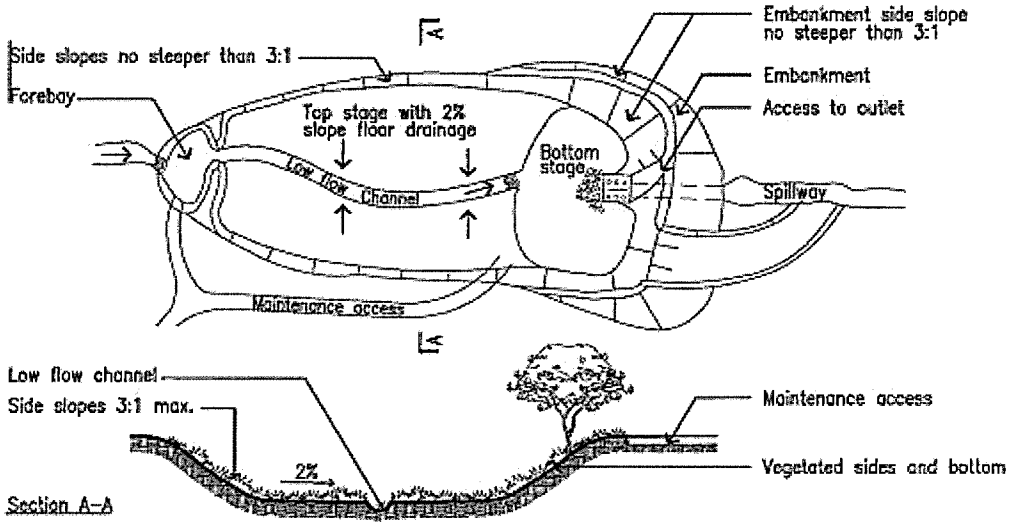
Notes:

1) Water Quality flow rate = C * I * A

where C = composite runoff factor per Table 4-2 of County SUSMP, I = 0.2 in/hr (per pg 48 of County SUSMP), and A = acres

C=[(impervious area * impervious area runoff factor) + (pervious area * pervious area runoff factor)] / total area

Fact Sheet 3. Extended detention (dry) ponds



Conditions, dimensions, and materials shown are typical. Modifications may be required for proper application, consult qualified professional.

Extended detention (dry) ponds store water during storms for a short period of time (from a few hours up to three days), and discharge water to adjacent surface waters. Stormwater design volumes are designed to be stored in such basins for more than 1 day to provide adequate settling time and maximize pollutant removal. The basins are dry between storms, and do not have a permanent pool of water. This tool is best suited for use as part of a treatment train in conjunction with other LID techniques.

CHARACTERISTICS

- If properly designed, ponds can have a lifetime of 50 years.
- Clay or impervious soils should not affect pollutant removal effectiveness, as the main removal mechanism is settling.
- Pollutants removed primarily through gravitational settling of suspended solids, though a small portion of the dissolved pollutant load may be removed by contact with the pond bottom sediments and/or vegetation, and through infiltration.
- Moderate removal of suspended solids (sediment) and heavy metals.
- Low to moderate removal of nutrients and Biological Oxygen Demand (B.O.D.).
- Pollutant removal can be maximized by increasing residence time; two-stage pond design, with the addition of wetland vegetation to lower stages of the pond; sediment trapping forebay to allow efficient maintenance; regular maintenance and sediment cleanout; installing adjustable gate valves to achieve target detention times; designing pond outlet to detain smaller treatment volumes (less than two-year storm event).

APPLICATION

- May be initially used as construction settling basins, but must be re-graded and cleaned out before used as a post-construction pond.
- May be designed for both pollutant removal and flood control.
- May be appropriate for developments of 10 acres or larger.

- Potential for multiple uses including flood control basins; parks, playing fields, and tennis courts; open space; overflow parking lots.

DESIGN

- Coordinate pond design, location, and use with local municipal public works department and/or county flood control department to reduce potential downstream flooding.
- Default conditions for safety have been to fence basins with chain link. Consider aesthetic design elements with safety analyst to address pond barriers, such as fencing and/or vegetation, and shallow side slopes (8:1 to 12:1).
- See County of San Diego Drainage Design Manual

MAINTENANCE

- Regular inspection during wet season for sediment buildup and clogging of inlets and outlets (designing a forebay to trap sediment can decrease frequency of required maintenance, as maintenance efforts are concentrated towards a smaller area of the basin and less disruptive than complete basin cleaning).
- Clean inlet trash rack and outlet standpipe as necessary.
- Clean out basin sediment approximately once per year (this may vary depending on pond depth and design, and if forebay is used).
- Mow and maintain pond vegetation, replant or reseed as necessary to control erosion.

LIMITATIONS

- Limitation of available space.
- Dry detention ponds have only moderate pollutant removal when compared to some other structural treatment controls and are relatively ineffective at removing soluble pollutants.
- Basins must be designed with vector control (max 72 hour residence time), sediment and vegetation removal/maintenance considerations in mind.
- Not suitable on sites with steep slopes.

ECONOMICS

- Least expensive stormwater quality pond option available. 0-25% additional cost when added to conventional stormwater detention facilities.
- Construction cost $0.10-$5.00 per cubic foot of storage (savings from preparing silt basins used during construction for use as extended detention ponds).
- Maintenance cost 3-5% of construction cost annually.

REFERENCES

- California Stormwater Quality Association. (2003, January) California Stormwater BMP Handbook: New Development and Redevelopment.
- For additional information pertaining to extended detention ponds, see the works cited in the San Diego County LID Literature Index.

Extended Detention Basin TC-22

Design Considerations

- Tributary Area
- Area Required
- Hydraulic Head

Description

Dry extended detention ponds (a.k.a. dry ponds, extended detention basins, detention ponds, extended detention ponds) are basins whose outlets have been designed to detain the stormwater runoff from a water quality design storm for some minimum time (e.g., 48 hours) to allow particles and associated pollutants to settle. Unlike wet ponds, these facilities do not have a large permanent pool. They can also be used to provide flood control by including additional flood detention storage.

Targeted Constituents

☑	Sediment	▲
☑	Nutrients	●
☑	Trash	■
☑	Metals	▲
☑	Bacteria	▲
☑	Oil and Grease	▲
☑	Organics	▲

Legend *(Removal Effectiveness)*

● Low ■ High

▲ Medium

California Experience

Caltrans constructed and monitored 5 extended detention basins in southern California with design drain times of 72 hours. Four of the basins were earthen, less costly and had substantially better load reduction because of infiltration that occurred, than the concrete basin. The Caltrans study reaffirmed the flexibility and performance of this conventional technology. The small headloss and few siting constraints suggest that these devices are one of the most applicable technologies for stormwater treatment.

Advantages

- Due to the simplicity of design, extended detention basins are relatively easy and inexpensive to construct and operate.
- Extended detention basins can provide substantial capture of sediment and the toxics fraction associated with particulates.
- Widespread application with sufficient capture volume can provide significant control of channel erosion and enlargement caused by changes to flow frequency

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION

relationships resulting from the increase of impervious cover in a watershed.

Limitations

- Limitation of the diameter of the orifice may not allow use of extended detention in watersheds of less than 5 acres (would require an orifice with a diameter of less than 0.5 inches that would be prone to clogging).
- Dry extended detention ponds have only moderate pollutant removal when compared to some other structural stormwater practices, and they are relatively ineffective at removing soluble pollutants.
- Although wet ponds can increase property values, dry ponds can actually detract from the value of a home due to the adverse aesthetics of dry, bare areas and inlet and outlet structures.

Design and Sizing Guidelines

- Capture volume determined by local requirements or sized to treat 85% of the annual runoff volume.
- Outlet designed to discharge the capture volume over a period of hours.
- Length to width ratio of at least 1.5:1 where feasible.
- Basin depths optimally range from 2 to 5 feet.
- Include energy dissipation in the inlet design to reduce resuspension of accumulated sediment.
- A maintenance ramp and perimeter access should be included in the design to facilitate access to the basin for maintenance activities and for vector surveillance and control.
- Use a draw down time of 48 hours in most areas of California. Draw down times in excess of 48 hours may result in vector breeding, and should be used only after coordination with local vector control authorities. Draw down times of less than 48 hours should be limited to BMP drainage areas with coarse soils that readily settle and to watersheds where warming may be determined to downstream fisheries.

Construction/Inspection Considerations

- Inspect facility after first large to storm to determine whether the desired residence time has been achieved.
- When constructed with small tributary area, orifice sizing is critical and inspection should verify that flow through additional openings such as bolt holes does not occur.

Performance

One objective of stormwater management practices can be to reduce the flood hazard associated with large storm events by reducing the peak flow associated with these storms. Dry extended detention basins can easily be designed for flood control, and this is actually the primary purpose of most detention ponds.

Dry extended detention basins provide moderate pollutant removal, provided that the recommended design features are incorporated. Although they can be effective at removing some pollutants through settling, they are less effective at removing soluble pollutants because of the absence of a permanent pool. Several studies are available on the effectiveness of dry extended detention ponds including one recently concluded by Caltrans (2002).

The load reduction is greater than the concentration reduction because of the substantial infiltration that occurs. Although the infiltration of stormwater is clearly beneficial to surface receiving waters, there is the potential for groundwater contamination. Previous research on the effects of incidental infiltration on groundwater quality indicated that the risk of contamination is minimal.

There were substantial differences in the amount of infiltration that were observed in the earthen basins during the Caltrans study. On average, approximately 40 percent of the runoff entering the unlined basins infiltrated and was not discharged. The percentage ranged from a high of about 60 percent to a low of only about 8 percent for the different facilities. Climatic conditions and local water table elevation are likely the principal causes of this difference. The least infiltration occurred at a site located on the coast where humidity is higher and the basin invert is within a few meters of sea level. Conversely, the most infiltration occurred at a facility located well inland in Los Angeles County where the climate is much warmer and the humidity is less, resulting in lower soil moisture content in the basin floor at the beginning of storms.

Vegetated detention basins appear to have greater pollutant removal than concrete basins. In the Caltrans study, the concrete basin exported sediment and associated pollutants during a number of storms. Export was not as common in the earthen basins, where the vegetation appeared to help stabilize the retained sediment.

Siting Criteria

Dry extended detention ponds are among the most widely applicable stormwater management practices and are especially useful in retrofit situations where their low hydraulic head requirements allow them to be sited within the constraints of the existing storm drain system. In addition, many communities have detention basins designed for flood control. It is possible to modify these facilities to incorporate features that provide water quality treatment and/or channel protection. Although dry extended detention ponds can be applied rather broadly, designers need to ensure that they are feasible at the site in question. This section provides basic guidelines for siting dry extended detention ponds.

In general, dry extended detention ponds should be used on sites with a minimum area of 5 acres. With this size catchment area, the orifice size can be on the order of 0.5 inches. On smaller sites, it can be challenging to provide channel or water quality control because the orifice diameter at the outlet needed to control relatively small storms becomes very small and thus prone to clogging. In addition, it is generally more cost-effective to control larger drainage areas due to the economies of scale.

Extended detention basins can be used with almost all soils and geology, with minor design adjustments for regions of rapidly percolating soils such as sand. In these areas, extended detention ponds may need an impermeable liner to prevent ground water contamination.

The base of the extended detention facility should not intersect the water table. A permanently wet bottom may become a mosquito breeding ground. Research in Southwest Florida (Santana et al., 1994) demonstrated that intermittently flooded systems, such as dry extended detention ponds, produce more mosquitoes than other pond systems, particularly when the facilities remained wet for more than 3 days following heavy rainfall.

A study in Prince George's County, Maryland, found that stormwater management practices can increase stream temperatures (Galli, 1990). Overall, dry extended detention ponds increased temperature by about 5°F. In cold water streams, dry ponds should be designed to detain stormwater for a relatively short time (i.e., 24 hours) to minimize the amount of warming that occurs in the basin.

Additional Design Guidelines

In order to enhance the effectiveness of extended detention basins, the dimensions of the basin must be sized appropriately. Merely providing the required storage volume will not ensure maximum constituent removal. By effectively configuring the basin, the designer will create a long flow path, promote the establishment of low velocities, and avoid having stagnant areas of the basin. To promote settling and to attain an appealing environment, the design of the basin should consider the length to width ratio, cross-sectional areas, basin slopes and pond configuration, and aesthetics (Young et al., 1996).

Energy dissipation structures should be included for the basin inlet to prevent resuspension of accumulated sediment. The use of stilling basins for this purpose should be avoided because the standing water provides a breeding area for mosquitoes.

Extended detention facilities should be sized to completely capture the water quality volume. A micropool is often recommended for inclusion in the design and one is shown in the schematic diagram. These small permanent pools greatly increase the potential for mosquito breeding and complicate maintenance activities; consequently, they are not recommended for use in California.

A large aspect ratio may improve the performance of detention basins; consequently, the outlets should be placed to maximize the flowpath through the facility. The ratio of flowpath length to width from the inlet to the outlet should be at least 1.5:1 (L:W) where feasible. Basin depths optimally range from 2 to 5 feet.

The facility's drawdown time should be regulated by an orifice or weir. In general, the outflow structure should have a trash rack or other acceptable means of preventing clogging at the entrance to the outflow pipes. The outlet design implemented by Caltrans in the facilities constructed in San Diego County used an outlet riser with orifices

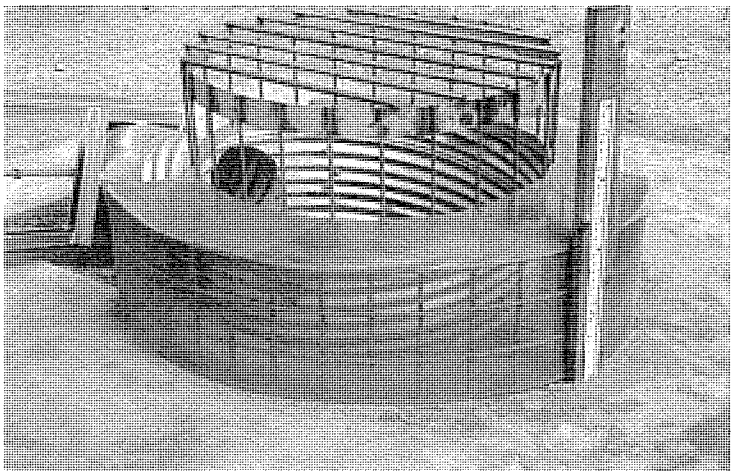


Figure 1
Example of Extended Detention Outlet Structure

sized to discharge the water quality volume, and the riser overflow height was set to the design storm elevation. A stainless steel screen was placed around the outlet riser to ensure that the orifices would not become clogged with debris. Sites either used a separate riser or broad crested weir for overflow of runoff for the 25 and greater year storms. A picture of a typical outlet is presented in Figure 1.

The outflow structure should be sized to allow for complete drawdown of the water quality volume in 72 hours. No more than 50% of the water quality volume should drain from the facility within the first 24 hours. The outflow structure can be fitted with a valve so that discharge from the basin can be halted in case of an accidental spill in the watershed.

Summary of Design Recommendations

(1) Facility Sizing - The required water quality volume is determined by local regulations or the basin should be sized to capture and treat 85% of the annual runoff volume. See Section 5.5.1 of the handbook for a discussion of volume-based design.

Basin Configuration – A high aspect ratio may improve the performance of detention basins; consequently, the outlets should be placed to maximize the flowpath through the facility. The ratio of flowpath length to width from the inlet to the outlet should be at least 1.5:1 (L:W). The flowpath length is defined as the distance from the inlet to the outlet as measured at the surface. The width is defined as the mean width of the basin. Basin depths optimally range from 2 to 5 feet. The basin may include a sediment forebay to provide the opportunity for larger particles to settle out.

A micropool should not be incorporated in the design because of vector concerns. For online facilities, the principal and emergency spillways must be sized to provide 1.0 foot of freeboard during the 25-year event and to safely pass the flow from 100-year storm.

(2) Pond Side Slopes - Side slopes of the pond should be 3:1 (H:V) or flatter for grass stabilized slopes. Slopes steeper than 3:1 (H:V) must be stabilized with an appropriate slope stabilization practice.

(3) Basin Lining – Basins must be constructed to prevent possible contamination of groundwater below the facility.

(4) Basin Inlet – Energy dissipation is required at the basin inlet to reduce resuspension of accumulated sediment and to reduce the tendency for short-circuiting.

(5) Outflow Structure - The facility's drawdown time should be regulated by a gate valve or orifice plate. In general, the outflow structure should have a trash rack or other acceptable means of preventing clogging at the entrance to the outflow pipes.

The outflow structure should be sized to allow for complete drawdown of the water quality volume in 72 hours. No more than 50% of the water quality volume should drain from the facility within the first 24 hours. The outflow structure should be fitted with a valve so that discharge from the basin can be halted in case of an accidental spill in the watershed. This same valve also can be used to regulate the rate of discharge from the basin.

The discharge through a control orifice is calculated from:

$$Q = CA(2g(H-H_o))^{0.5}$$

where: Q = discharge (ft^3/s)
C = orifice coefficient
A = area of the orifice (ft^2)
g = gravitational constant (32.2)
H = water surface elevation (ft)
H_o= orifice elevation (ft)

Recommended values for C are 0.66 for thin materials and 0.80 when the material is thicker than the orifice diameter. This equation can be implemented in spreadsheet form with the pond stage/volume relationship to calculate drain time. To do this, use the initial height of the water above the orifice for the water quality volume. Calculate the discharge and assume that it remains constant for approximately 10 minutes. Based on that discharge, estimate the total discharge during that interval and the new elevation based on the stage volume relationship. Continue to iterate until H is approximately equal to H_o. When using multiple orifices the discharge from each is summed.

(6) Splitter Box - When the pond is designed as an offline facility, a splitter structure is used to isolate the water quality volume. The splitter box, or other flow diverting approach, should be designed to convey the 25-year storm event while providing at least 1.0 foot of freeboard along pond side slopes.

(7) Erosion Protection at the Outfall - For online facilities, special consideration should be given to the facility's outfall location. Flared pipe end sections that discharge at or near the stream invert are preferred. The channel immediately below the pond outfall should be modified to conform to natural dimensions, and lined with large stone riprap placed over filter cloth. Energy dissipation may be required to reduce flow velocities from the primary spillway to non-erosive velocities.

(8) Safety Considerations - Safety is provided either by fencing of the facility or by managing the contours of the pond to eliminate dropoffs and other hazards. Earthen side slopes should not exceed 3:1 (H:V) and should terminate on a flat safety bench area. Landscaping can be used to impede access to the facility. The primary spillway opening must not permit access by small children. Outfall pipes above 48 inches in diameter should be fenced.

Maintenance

Routine maintenance activity is often thought to consist mostly of sediment and trash and debris removal; however, these activities often constitute only a small fraction of the maintenance hours. During a recent study by Caltrans, 72 hours of maintenance was performed annually, but only a little over 7 hours was spent on sediment and trash removal. The largest recurring activity was vegetation management, routine mowing. The largest absolute number of hours was associated with vector control because of mosquito breeding that occurred in the stilling basins (example of standing water to be avoided) installed as energy dissipaters. In most cases, basic housekeeping practices such as removal of debris accumulations and vegetation

management to ensure that the basin dewaters completely in 48-72 hours is sufficient to prevent creating mosquito and other vector habitats.

Consequently, maintenance costs should be estimated based primarily on the mowing frequency and the time required. Mowing should be done at least annually to avoid establishment of woody vegetation, but may need to be performed much more frequently if aesthetics are an important consideration.

Typical activities and frequencies include:

- Schedule semiannual inspection for the beginning and end of the wet season for standing water, slope stability, sediment accumulation, trash and debris, and presence of burrows.
- Remove accumulated trash and debris in the basin and around the riser pipe during the semiannual inspections. The frequency of this activity may be altered to meet specific site conditions.
- Trim vegetation at the beginning and end of the wet season and inspect monthly to prevent establishment of woody vegetation and for aesthetic and vector reasons.
- Remove accumulated sediment and re-grade about every 10 years or when the accumulated sediment volume exceeds 10 percent of the basin volume. Inspect the basin each year for accumulated sediment volume.

Cost

Construction Cost

The construction costs associated with extended detention basins vary considerably. One recent study evaluated the cost of all pond systems (Brown and Schueler, 1997). Adjusting for inflation, the cost of dry extended detention ponds can be estimated with the equation:

$$C = 12.4V^{0.760}$$

where: C = Construction, design, and permitting cost, and
V = Volume (ft^3).

Using this equation, typical construction costs are:

$ 41,600 for a 1 acre-foot pond

$ 239,000 for a 10 acre-foot pond

$ 1,380,000 for a 100 acre-foot pond

Interestingly, these costs are generally slightly higher than the predicted cost of wet ponds (according to Brown and Schueler, 1997) on a cost per total volume basis, which highlights the difficulty of developing reasonably accurate construction estimates. In addition, a typical facility constructed by Caltrans cost about $160,000 with a capture volume of only 0.3 ac-ft.

An economic concern associated with dry ponds is that they might detract slightly from the value of adjacent properties. One study found that dry ponds can actually detract from the

perceived value of homes adjacent to a dry pond by between 3 and 10 percent (Emmerling-Dinovo, 1995).

Maintenance Cost

For ponds, the annual cost of routine maintenance is typically estimated at about 3 to 5 percent of the construction cost (EPA website). Alternatively, a community can estimate the cost of the maintenance activities outlined in the maintenance section. Table 1 presents the maintenance costs estimated by Caltrans based on their experience with five basins located in southern California. Again, it should be emphasized that the vast majority of hours are related to vegetation management (mowing).

Table 1 Estimated Average Annual Maintenance Effort

Activity	Labor Hours	Equipment & Material ($)	Cost
Inspections	4	7	183
Maintenance	49	126	2282
Vector Control	0	0	0
Administration	3	0	132
Materials	-	535	535
Total	**56**	**$668**	**$3,132**

References and Sources of Additional Information

Brown, W., and T. Schueler. 1997. *The Economics of Stormwater BMPs in the Mid-Atlantic Region*. Prepared for Chesapeake Research Consortium. Edgewater, MD. Center for Watershed Protection. Ellicott City, MD.

Denver Urban Drainage and Flood Control District. 1992. *Urban Storm Drainage Criteria Manual—Volume 3: Best Management Practices*. Denver, CO.

Emmerling-Dinovo, C. 1995. Stormwater Detention Basins and Residential Locational Decisions. *Water Resources Bulletin 31(3)*: 515–521

Galli, J. 1990. *Thermal Impacts Associated with Urbanization and Stormwater Management Best Management Practices*. Metropolitan Washington Council of Governments. Prepared for Maryland Department of the Environment, Baltimore, MD.

GKY, 1989, *Outlet Hydraulics of Extended Detention Facilities* for the Northern Virginia Planning District Commission.

MacRae, C. 1996. Experience from Morphological Research on Canadian Streams: Is Control of the Two-Year Frequency Runoff Event the Best Basis for Stream Channel Protection? In *Effects of Watershed Development and Management on Aquatic Ecosystems*. American Society of Civil Engineers. Edited by L. Roesner. Snowbird, UT. pp. 144–162.

Maryland Dept of the Environment, 2000, Maryland Stormwater Design Manual: Volumes 1 & 2, prepared by MDE and Center for Watershed Protection.
http://www.mde.state.md.us/environment/wma/stormwatermanual/index.html

Metzger, M. E., D. F. Messer, C. L. Beitia, C. M. Myers, and V. L. Kramer. 2002. The Dark Side Of Stormwater Runoff Management: Disease Vectors Associated With Structural BMPs. Stormwater 3(2): 24-39.

Santana, F., J. Wood, R. Parsons, and S. Chamberlain. 1994. Control of Mosquito Breeding in Permitted Stormwater Systems. Prepared for Southwest Florida Water Management District, Brooksville, FL.

Schueler, T. 1997. Influence of Ground Water on Performance of Stormwater Ponds in Florida. *Watershed Protection Techniques* 2(4):525–528.

Watershed Management Institute (WMI). 1997. *Operation, Maintenance, and Management of Stormwater Management Systems*. Prepared for U.S. Environmental Protection Agency, Office of Water. Washington, DC.

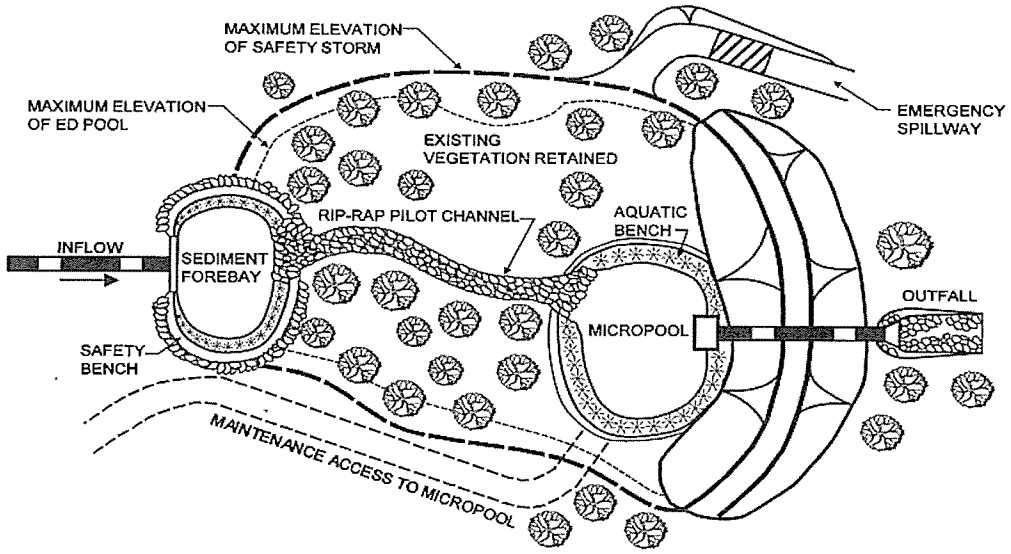
Young, G.K., et al., 1996, *Evaluation and Management of Highway Runoff Water Quality*, Publication No. FHWA-PD-96-032, U.S. Department of Transportation, Federal Highway Administration, Office of Environment and Planning.

Information Resources

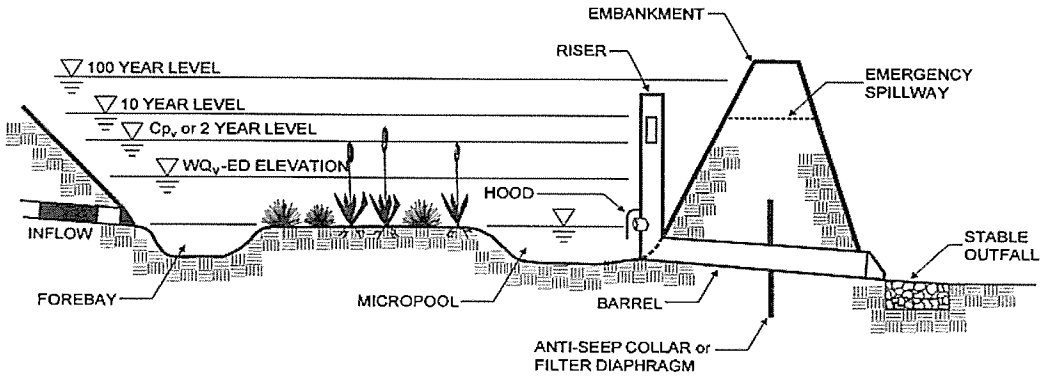
Center for Watershed Protection (CWP), Environmental Quality Resources, and Loiederman Associates. 1997. *Maryland Stormwater Design Manual.* Draft. Prepared for Maryland Department of the Environment, Baltimore, MD.

Center for Watershed Protection (CWP). 1997. *Stormwater BMP Design Supplement for Cold Climates*. Prepared for U.S. Environmental Protection Agency, Office of Wetlands, Oceans and Watersheds. Washington, DC.

U.S. Environmental Protection Agency (USEPA). 1993. *Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters*. EPA-840-B-92-002. U.S. Environmental Protection Agency, Office of Water, Washington, DC.



PLAN VIEW



PROFILE

Schematic of an Extended Detention Basin (MDE, 2000)

Bioretention TC-32

Maintenance Concerns, Objectives, and Goals

- Clogged Soil or Outlet Structures
- Invasive Species
- Vegetation/Landscape Maintenance
- Erosion
- Channelization of Flow
- Aesthetics

General Description

The bioretention best management practice (BMP) functions as a soil and plant-based filtration device that removes pollutants through a variety of physical, biological, and chemical treatment processes. These facilities normally consist of a grass buffer strip, sand bed, ponding area, organic layer or mulch layer, planting soil, and plants. The runoff's velocity is reduced by passing over or through a sand bed and is subsequently distributed evenly along a ponding area. Exfiltration of the stored water in the bioretention area planting soil into the underlying soils occurs over a period of days.

Targeted Constituents

✓	Sediment	■
✓	Nutrients	▲
✓	Trash	■
✓	Metals	■
✓	Bacteria	■
✓	Oil and Grease	■
✓	Organics	■

Legend *(Removal Effectiveness)*

- ● Low
- ■ High
- ▲ Medium

Inspection/Maintenance Considerations

Bioretention requires frequent landscaping maintenance, including measures to ensure that the area is functioning properly, as well as maintenance of the landscaping on the practice. In many cases, bioretention areas initially require intense maintenance, but less maintenance is needed over time. In many cases, maintenance tasks can be completed by a landscaping contractor, who may already be hired at the site. In cold climates the soil may freeze, preventing runoff from infiltrating into the planting soil.

CASQA California Stormwater Quality Association

Inspection Activities	Suggested Frequency
■ Inspect soil and repair eroded areas.	Monthly
■ Inspect for erosion or damage to vegetation, preferably at the end of the wet season to schedule summer maintenance and before major fall runoff to be sure the strips are ready for winter. However, additional inspection after periods of heavy runoff is desirable.	Semi-annual inspection
■ Inspect to ensure grass is well established. If not, either prepare soil and reseed or replace with alternative species. Install erosion control blanket.	
■ Check for debris and litter, and areas of sediment accumulation.	
■ Inspect health of trees and shrubs.	
Maintenance Activities	**Suggested Frequency**
■ Water plants daily for 2 weeks.	At project completion
■ Remove litter and debris.	Monthly
■ Remove sediment.	As needed
■ Remulch void areas.	
■ Treat diseased trees and shrubs.	
■ Mow turf areas.	
■ Repair erosion at inflow points.	
■ Repair outflow structures.	
■ Unclog underdrain.	
■ Regulate soil pH regulation.	
■ Remove and replace dead and diseased vegetation.	Semi-annual
■ Add mulch.	Annual
■ Replace tree stakes and wires.	
■ Mulch should be replaced every 2 to 3 years or when bare spots appear. Remulch prior to the wet season.	Every 2-3 years, or as needed

Additional Information

Landscaping is critical to the function and aesthetic value of bioretention areas. It is preferable to plant the area with native vegetation, or plants that provide habitat value, where possible. Another important design feature is to select species that can withstand the hydrologic regime they will experience. At the bottom of the bioretention facility, plants that tolerate both wet and dry conditions are preferable. At the edges, which will remain primarily dry, upland species will be the most resilient. It is best to select a combination of trees, shrubs, and herbaceous materials.

References

Metropolitan Council, Urban Small Sites Best Management Practices Manual. Available at: http://www.metrocouncil.org/environment/Watershed/BMP/manual.htm

Model Urban Runoff Program: A How-To Guide for Developing Urban Runoff Programs for Small Municipalities. Prepared by City of Monterey, City of Santa Cruz, California Coastal Commission, Monterey Bay National Marine Sanctuary, Association of Monterey Bay Area Governments, Woodward-Clyde, Central Coast Regional Water Quality Control Board. July, 1998, revised February, 2002.

U.S. Environmental Protection Agency, Post-Construction Stormwater Management in New Development & Redevelopment BMP Factsheets. Available at: cfpub.epa.gov/npdes/stormwater/menuofbmps/bmp_files.cfm

Ventura Countywide Stormwater Quality Management Program, Technical Guidance Manual for Stormwater Quality Control Measures. July, 2002.

E

ATTACHMENT E

Geotechnical Certification Sheet

The design of stormwater treatment and other control measures proposed in this plan requiring specific soil infiltration characteristics and/or geological conditions has been reviewed and approved by a registered Civil Engineer, Geotechnical Engineer, or Geologist in the State of California.

_____ _____

Name and registration # Date

*(**NOTE:** Not required because infiltration-type BMPs are not proposed.)*

F

ATTACHMENT F

Maintenance Plan

(Use Chapter 5 of the SUSMP as guidance in developing your Maintenance Plan)

*(**NOTE**: Will be completed during final engineering.)*

STORM WATER OPERATIONS AND MAINTENANCE PLAN

BRIGHTWATER RANCH

COUNTY OF SAN DIEGO, CA

JANUARY 29, 2015

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INTRODUCTION

This portion of text outlines the operation and maintenance requirements for the Brightwater Ranch development stormwater best management practices (BMPs). This is a companion document to the Storm Water Management Plan (SWMP) prepared by Project Design Consultants and acts as a guidance document for future maintenance personnel. The SWMP proposed four treatment control BMPs: two Bioclean Inlet Inserts with media filters, one Water Quality/Hydromodification basin, and one bioretention area. The media filter will be maintained by the County and the other BMPs will be maintained by the HOA.

PROPRIETARY BMP INSTALLATION PROCEDURES

Bioclean Grate Inlet Skimmer Box (GISB) Inlet Insert with Filter Media:

The filter shall be securely installed in the grate inlet with contact surfaces sufficiently joined together so that no filter bypass can occur at low flow. All anchoring devices and fasteners are installed within the interior of the drain inlet. The filter basket is located in the catch basin directly beneath a grate opening for direct services/access from the manhole.

Installation notes to take into account:

- Bioclean inlet filter inserts shall be installed pursuant to manufacturer's recommendations and the details in this portion of text. Refer to inlet insert detail in Attachment D.
- Inlet filter insert shall provide coverage of entire inlet opening, including inlet wing(s) where applicable, to direct all flow to basket(s).
- Attachments to inlet walls shall be made of non-corrosive hardware.
- Filtration basket structure shall be manufactured of marine grade fiberglass, gel coated for ultraviolet protection.
- Filtration basket fine screen and coarse containment screen shall be manufactured of stainless steel.
- For inlet filter inserts that include the shelf system, the shelf system shall be manufactured of marine grade fiberglass and gel coated for ultraviolet protection.

MAINTENACE PROCEDURES

Bioclean Grate Inlet Skimmer Box (GISB) Inlet Insert with Filter Media:

Maintenance is to be performed by the maintenance contractor or other employee of the project owner. Maintenance is to occur a minimum of 4 times per year with replacement of hydrocarbon booms a minimum of twice per year. Maintenance operator shall prepare an inspection record which will include any maintenance activities performed, amount of debris collected and condition of filter. The owner shall retain the inspection record for a minimum of five years from the date of maintenance. Note that any persons performing the maintenance activities must have completed a minimum of OSHA 24-hour hazardous waste worker (hazwoper) training.

Since the filters do not contain fabrics or netting there is no possibility of accidental tearing or breakage during cleaning. The removable skimmer trays allow for unimpeded access and easy replacement of the hydrocarbon boom. The maintenance procedure is as follows:

Step 1- Remove manhole lid to gain access to inlet insert filter. Where possible, the maintenance should be performed from the ground surface. Note: Entry into inlet vault requires certification in confined space training.

Step 2- Remove skimmer tray and vacuum out captured trash, debris, organics, and sediment captured by inlet insert.

Step 3- Remove old hydrocarbon boom and replace with a new boom if filled with hydrocarbons and oils. New boom to be attached to basket with plastic ties through pre-drilled holes in basket. The hydrocarbon boom is classified as a hazardous material and will have to be picked up and disposed of as a hazardous waste. This material can only be handled by a certified hazwoper as noted above.

Step 4- Replace skimmer tray inside filter and replace manhole over the filters.

Step 5- Transport all debris, trash, organics, and sediments to approved facility for disposal in accordance with local and state requirements.

Water Quality/Hydromodification Basin:

The minimum required inspection/maintenance is twice a year and after rain events where the basin must be inspected for bank erosion, damage to vegetation, excessive collection of trash or debris, standing water, and damage or obstruction to inlet or outlet.

Typical activities and frequencies of maintenance are listed below:

- Schedule semiannual inspection for the beginning and end of the wet season for standing water, slope stability, sediment accumulation, trash and debris, and presence of burrows.

- Remove accumulated trash and debris in the basin and around the riser pipe during the semiannual inspections. The frequency of this activity may be altered to meet specific site conditions.

- Trimming/mowing of vegetation shall be performed at the beginning and end of the wet season and inspected monthly to prevent establishment of woody vegetation and for aesthetic and vector reasons (mosquito breeding).

- Remove accumulated sediment and re-grade about every 10 years or when the accumulated sediment volume exceeds 10 percent of the basin volume. Inspect basin each year for accumulated sediment volume.

Bioretention Area Basin:

Bioretention area basins require regular plant, soil, and mulch layer maintenance to ensure optimum infiltration, storage, and pollutant removal capabilities. See table on next page for detailed list of maintenance activities:

Task	Frequency	Indicator Maintenance is Needed	Maintenance Notes
Catchment inspection	Monthly with routine property maintenance	Excessive sediment, trash, or debris accumulation on the surface of bioretention	Permanently stabilize any exposed soil and remove any accumulated sediment. Adjacent pervious areas might need to be re-graded.
Inlet inspection		Internal erosion or excessive sediment, trash, and/or debris accumulation	Check for sediment accumulation to ensure that flow into the bioretention is as designed. Remove any accumulated sediment.
Litter/leaf removal		Accumulation of litter and leafy debris within bioretention area, mulch around outlet, internal erosion	Litter and leaves should be removed to reduce the risk of outlet clogging, reduce nutrient inputs to the bioretention area, and to improve facility aesthetics. Erosion should be repaired and stabilized.

Task	Frequency	Indicator Maintenance is Needed	Maintenance Notes
Pruning	1-2 times per year	Overgrown vegetation that interferes with access, lines of sight, or safety	Nutrients in runoff often cause bioretention vegetation to flourish.
Mowing	2-12 times per year		Frequency depends on location, desired aesthetic appeal, and type of vegetation.
Outlet inspection	1 time per year	Erosion at outlet	Remove any accumulated mulch or sediment.
Mulch removal and replacement	1 time every 2-3 years	2/3 of mulch has decomposed	Remove decomposed fraction and top off with fresh mulch to a total depth of 3-inches.
Temporary watering	1 time every 2-3 days for first 1-2 months, sporadically after established	Until established and during severe drought weather	Watering after the initial year might be required.
Fertilization	1 time initially	Upon planting	One-time spot fertilization for first year of vegetation.
Remove and replace dead plants	As needed	Dead plants	Within the first year, 10% of plants can die. Survival rates increase with time.
Miscellaneous upkeep	As needed	Tasks include trash collection, plant health, spot weeding, removing invasive species, and removing mulch from the overflow device.	

Additional information can be found in the County Low Impact Development Manual:

http://www.sandiegocounty.gov/content/sdc/dpw/watersheds/susmp/lid.html

ATTACHMENT G

Treatment Control BMP Certification for DPW Permitted Land Development Projects

*(**NOTE**: After TC-BMP construction, a TC-BMP Certification form will be completed to verify with County staff that all constructed TC-BMPs on the record plans match the approved TC-BMPs in the most current SWMP.)*

H

ATTACHMENT H

HMP STUDY

*(**NOTE**: See Hydromodification Management Study prepared by PDC under separate cover.)*