Equipment Design/Specification Report

For:

Bio Clean Environmental Services, Inc.

CATCH BASIN INSERTS

CURB INLET BASKET & GRATE INLET SKIMMER BOX

Prepared by:
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EQUIPMENT DESIGN AND SPECIFICATION REPORT

Catch Basin Inserts - Bio Clean Curb Inlet Basket and Grate Inlet Skimmer Box

A. Description/Design/Engineering

Full Trash Capture: The Bio Clean Curb Inlet Basket and Grate Inlet Skimmer Box meet the "full trash capture" definition and provides 100% removal for particles 5 mm and greater. Bio Clean Catch Basin Filters use screen sizes up 4 mesh which has an opening size of 4.76 mm.

Bio Clean Catch Basin Filters have been used since 1994. There are numerous sizes and various configurations of these catch basin filters. Bio Clean Curb Inlet Filters are used exclusively by the City and County of Honolulu, the County of San Diego and the City of San Marcos. These municipalities have chosen to only use Bio Clean Filters because they are the easiest to clean and the most durable.

Bio Clean catch basin filters come in four configurations. Three of them for curb inlets and one for grated/drop inlets.

- Standard Curb Inlet Basket with Easy Maintenance Shelf System – is a filter system for curb and curb-grate inlets of all sizes and configurations.

    a. This filter system comes with the patented easy maintenance shelf system. The shelf system positions the filter directly under the manhole for easy maintenance and reduces maintenance time by 75% (see following Hawaii Report Summary).

    b. The filter is manufactured out of Marine Grade Fiberglass. This filter uses multi-level screening, a hydrocarbon media boom and a bypass which is set at a lower elevation than the top of the basket. This prevents scouring at high flows.

    c. The standard Curb Inlet Basket has a storage capacity of 2.7 cubic feet. The course screen on the top of the basket can hold an additional .56 cubic feet of trash. The shelf system itself also offers several extra cubic feet of storage.

- High Capacity Curb Inlet Basket with Easy Maintenance Shelf System – is similar to the standard Curb Inlet Basket with Easy Maintenance Shelf System, except it has a larger filter basket with a capacity of 3.8 cubic feet.

- Continuous Curb Inlet Basket - is a filter system for curb and curb-grate inlets of all sizes and configurations. It's our standard filter basket without the easy maintenance shelf system.

    a. This filter is available in various lengths and mounts directly under the curb face, as found with other manufactures installation method.

    b. It is also manufactured out of Marine Grade Fiberglas. This filter uses multi-level screening and a hydrocarbon media boom.

    c. The standard Curb Inlet Basket has a storage capacity of 2.7 cubic feet for a standard three foot length (available in different lengths).

- Grate Inlet Skimmer Box – is a filter designed for grated or drop inlets of all sizes.

    a. Any height, width and depth filter can be made.

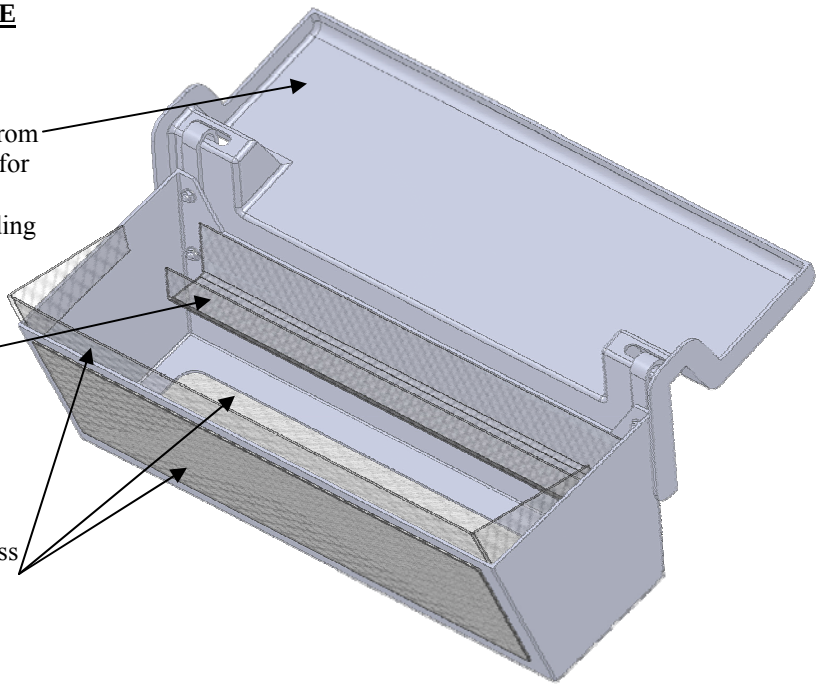
    b. This filter is made of Marine Grade Fiberglass and stainless steel screens and hardware.

    c. This filter uses multi-level screening, hydrocarbon media boom, and a deflector shield protected bypass to eliminate scouring.

Design diagrams or CAD file

The following diagrams show the components and operation of the Bio Clean Catch Basin Filters (standard curb type with shelf system and grate type). AutoCAD drawings are provided on subsequent pages for various configurations.

CURB INLET BASKET with EASY MAINTENANCE SHELF SYSTEM



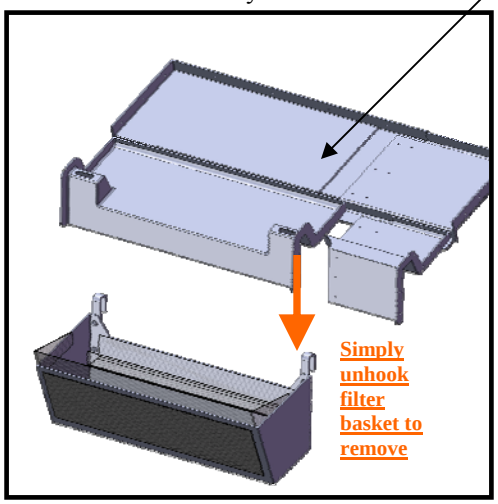
Shelf Weir – fiberglass shelf weir moves the basket out from the curb face and positions it under the manhole or grate for easy cleaning. It allows the basket to attach and be easily removed in seconds. Used with or without a shelf depending on size of the basin.

Media Boom Tray – holds hydrocarbon absorbent booms to remove oils & grease as they enter the filter basket.

Filter Basket – marine grade fiberglass and stainless steel filter basket utilizes three layers of screening from fine to coarse to remove various pollutants.

EASY INSTALLATION AND FILTER BASEKT REMOVAL – Shelf system is assembled in the catch basin. The filter basket is easy removable.

Shelf System – available in all sizes. Its size adjusts to the catch basin's dimensions and manhole position.



EASY MAINTENANCE SHELF SYSTEM – positions the filter basket under the manhole for easy maintenance. No catch basin entry required for cleaning.

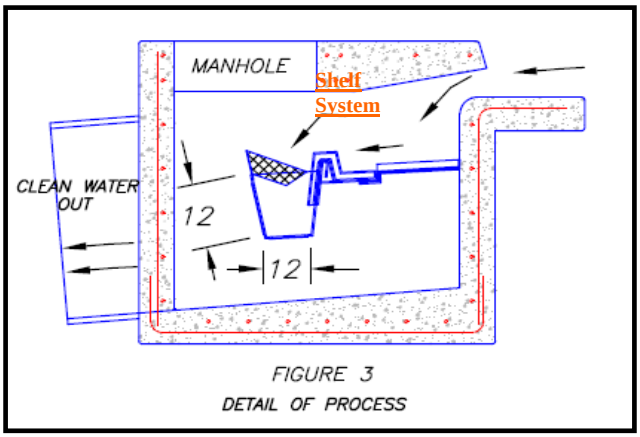


FIGURE 3
DETAIL OF PROCESS

CALIFORNIA CURB SHELF BASKET WATER CLEANSING SYSTEM
SAN DIEGO REGIONAL STANDARD CURB INLET

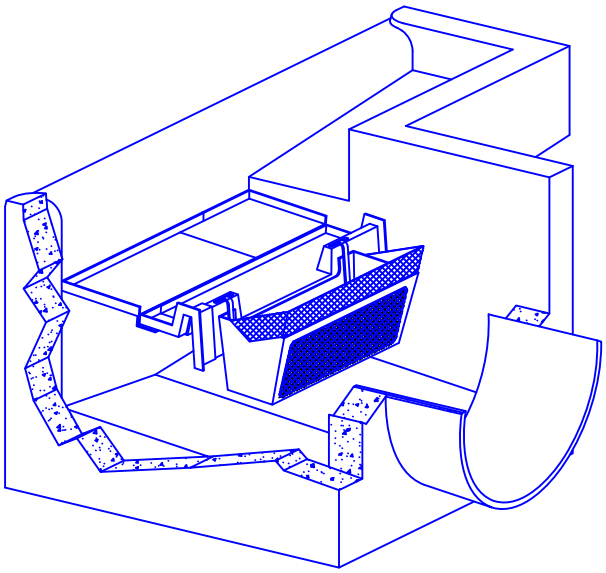


FIGURE 1
DETAIL OF PARTS

WIDTH OF INLET WILL VARY

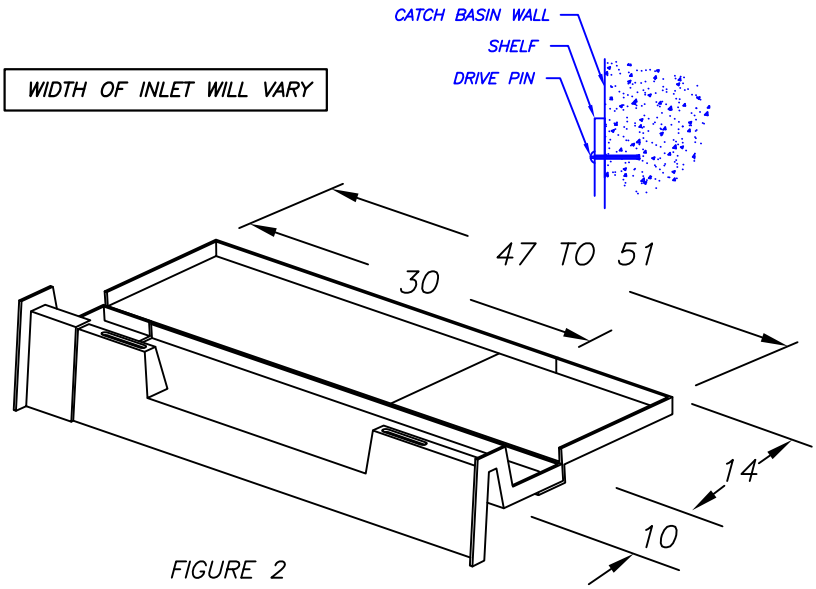


FIGURE 2
DETAIL OF INSTALLATION

REMOVABLE BASKET CATCHES EVERYTHING AND MAY BE REMOVED THROUGH MANHOLE WITHOUT ENTRY.

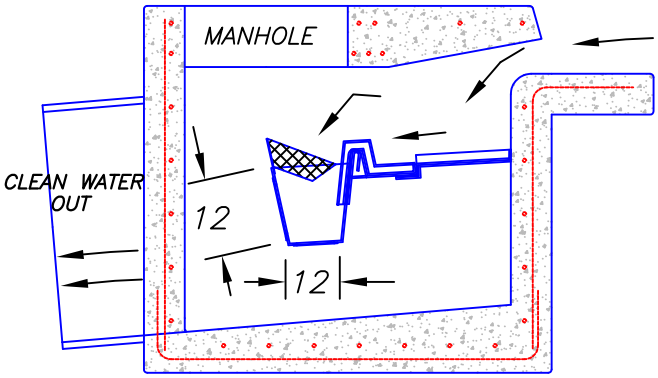


FIGURE 3
DETAIL OF PROCESS

FLOW RATES per 3 FT. Basket				
$Q=SO*c_d*A\sqrt{2*g*h}$ c_d = Coefficient of Discharge = .67				
	SO	$A(ft^2)$	h (ft)	$Q\ (\frac{ft^3}{s})$
Coarse Screen	.62	.84	0.146	1.06
Med Screen	.56	1.36	0.75	3.53
Fine Screen	.68	1.02	1.167	4.01
TOTAL				8.6

The above flow rates are based on unobstructed screens.

SHELF SYSTEM WEIR FLOW CAPACITY	.86 CFS

Flow into basket controled by weir capacity

BOX MANUFACTURED FROM MARINE GRADE FIBERGLASS & GEL COATED FOR UV PROTECTION

5 YEAR MANUFACTURERS WARRANTY

PATENTED

ALL FILTER SCREENS ARE STAINLESS STEEL

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.

SUNTREE QUALITY PRODUCTS ARE BUILT FOR EASY CLEANING AND ARE DESIGNED TO BE PERMANENT INFRASTRUCTURE AND SHOULD LAST FOR DECADES.

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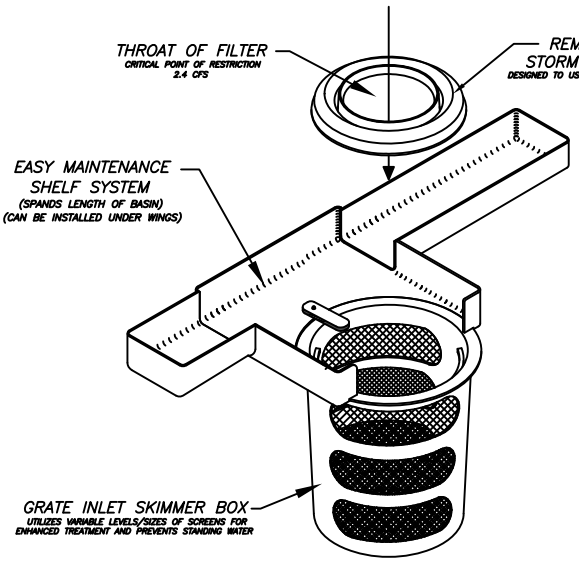
CURB INLET BASKET SYSTEM

DATE: 04/12/04	SCALE:SF = 15
DRAFTER: N.R.B.	UNITS =INCHES

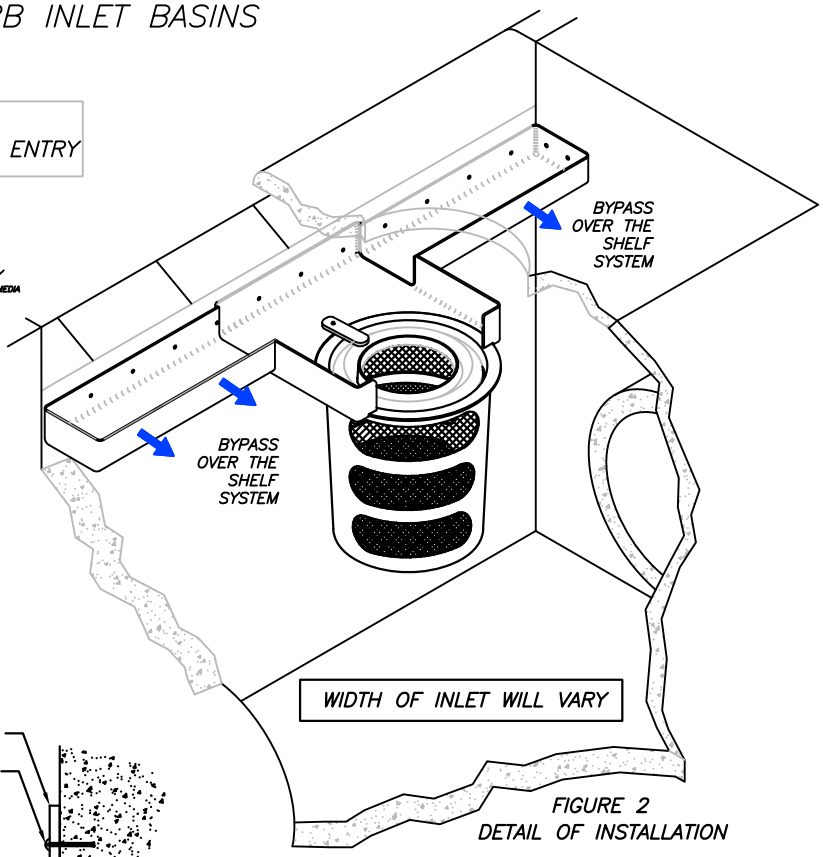
PROJECT:	
REVISIONS:	DATE:
REVISIONS:	DATE:
REVISIONS:	DATE:
REVISIONS:	DATE:
REVISIONS:	DATE:

BIO CLEAN HIGH CAPACITY ROUND GRATE INLET SKIMMER BOX WITH SHELF SYSTEM FOR CURB INLET BASINS

SHELF SYSTEM POSTIONS BASKET UNDER
FOR EASY MAINTENANCE – ELIMINATES CONFINED SPACE ENTRY



DETAIL OF PARTS
FIGURE 1



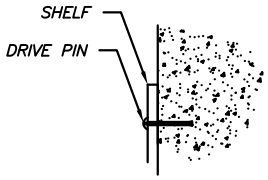


FIGURE 2
DETAIL OF INSTALLATION

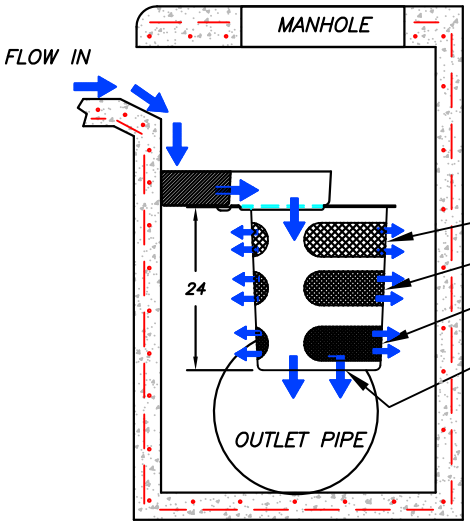


FIGURE 3
DETAIL OF PROCESS

GRATE INLET SKIMMER BASKET FLOW RATES				
$Q=SO*c_d*A\sqrt{2*g*h}$ c_d = Coefficient of Discharge = .67 FOLLOWING FLOW RATES BASED UPON ORIFICE EQUATION AND UNRESTRICTED SCREENS/OPENINGS				
MAX FLOW RATE THROUGH THROAT - CRITICAL POINT OF RESTRICTION				2.4 CFS *
SCREEN FLOW RATES	SO	$A(ft^2)$	h (ft)	$Q\ (\frac{ft^3}{s})$
TOP SIDE SCREENS	1	135.22	5.50	3.42 CFS
CENTER SIDE SCREENS	.62	130.36	11.5	2.95 CFS
BOTTOM SIDE SCREENS	.56	125.50	17.50	3.17 CFS
BOTTOM HORIZONTAL SCREENS	.68	63.14	20.81	2.11 CFS
TOTAL UNOBSTRUCTED FLOW RATES THROUGH SCREENS				11.65 CFS
MAX TREATMENT FLOW RATE BASED ON CRITICAL POINT OF RESTRICTION				2.4 CFS *

*THE PEAK TREATMENT FLOW RATE IS DETERMINED BY THE POINT OF CRITICAL RESTRICTION WHICH IS THE THROAT INTO THE FILTER. THE FILTER SCREENS HAVE THE ABILITY TO TREAT MORE WATER THAN CAN ENTER THE FILTER'S THROAT. THEREFORE THE PEAK TREATMENT OF THE FILTER WILL NEVER BE GREATER THAN 2.4 CFS. THUS THERE IS AN INHERENT SAFETY FACTOR OF GREATER THAN 4 BECAUSE THE THE SCREENS (11.65 CFS) CAN BE 75% CLOGGED AND STILL PROCESS 2.91 CFS WHICH IS GREATER THAN THE THROAT FLOW RATE OF 2.4 CFS.

GRATE INLET SKIMMER BASKET CAN
BE REMOVED THROUGH MANHOLE WITHOUT ENTRY

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.

5 YEAR MANUFACTURERS WARRANTY

PATENTED

ALL FILTER SCREENS
ARE STAINLESS STEEL

SUNTREE QUALITY PRODUCTS ARE BUILT FOR EASY CLEANING AND ARE DESIGNED TO BE PERMANENT INFRASTRUCTURE AND SHOULD LAST FOR DECADES.

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info@biocleanenvironmental.net

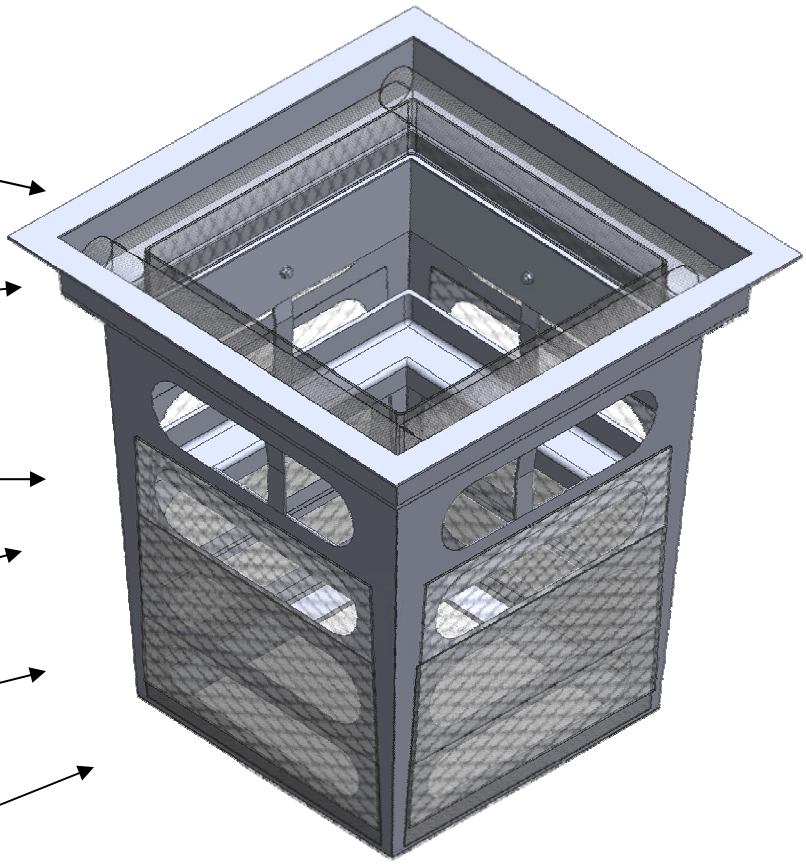
HIGH CAPACITY GISB

DATE: 04/12/04 | SCALE:SF = 15

DRAFTER: N.R.B. | UNITS =INCHES

PROJECT:	
REVISIONS: ZJK	DATE: 9/8/10
REVISIONS:	DATE:
REVISIONS:	DATE:
REVISIONS:	DATE:
REVISIONS:	DATE:

GRATE INLET SKIMMER BOX



Filter Basket – the main body of the Grate Inlet Skimmer Box is manufactured of marine grade fiberglass. All screens and hardware are stainless steel.

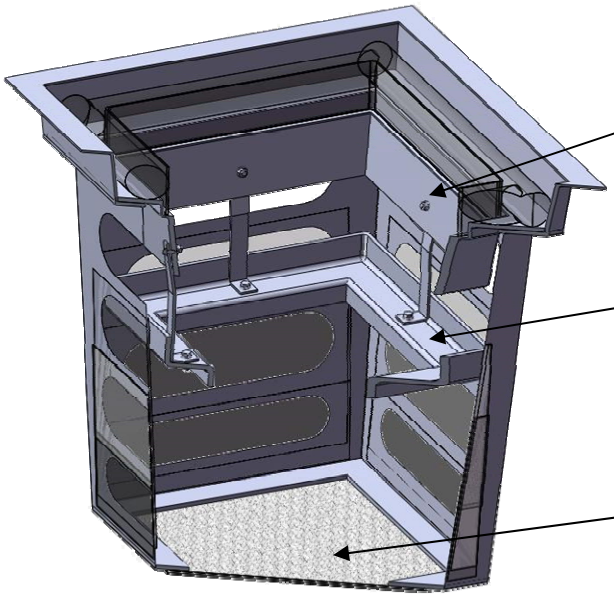
Media Boom Tray – holds hydrocarbon absorbent booms to remove oils & grease as they enter the filter basket.

Bypass – protected by a skimmer to prevent scouring. The bypass is a series of large orifices near the top of the filter basket.

Coarse Screen – ¾" by 1 ¾" flattened expanded stainless steel. A No. 4 mesh will be used for full capture.

Medium Screen – 10 by 10 mesh stainless steel.

Fine Screen – 14 by 18 mesh stainless steel.

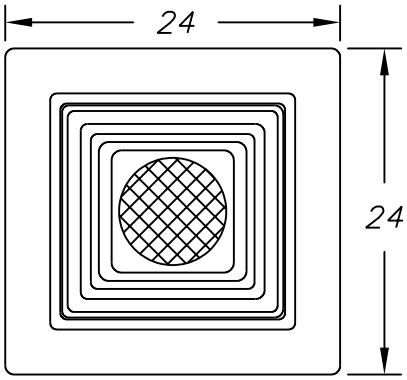


Skimmer Tray – fiberglass tray directs flow through the media booms and protects any water from going into bypass until high flows are present.

Deflector Shield – fiberglass deflector positioned at the bottom of bypass prevents scouring of floatables during high flow conditions.

Fine Screen – 14 by 18 mesh stainless steel.

Part # GISB-24-24-24

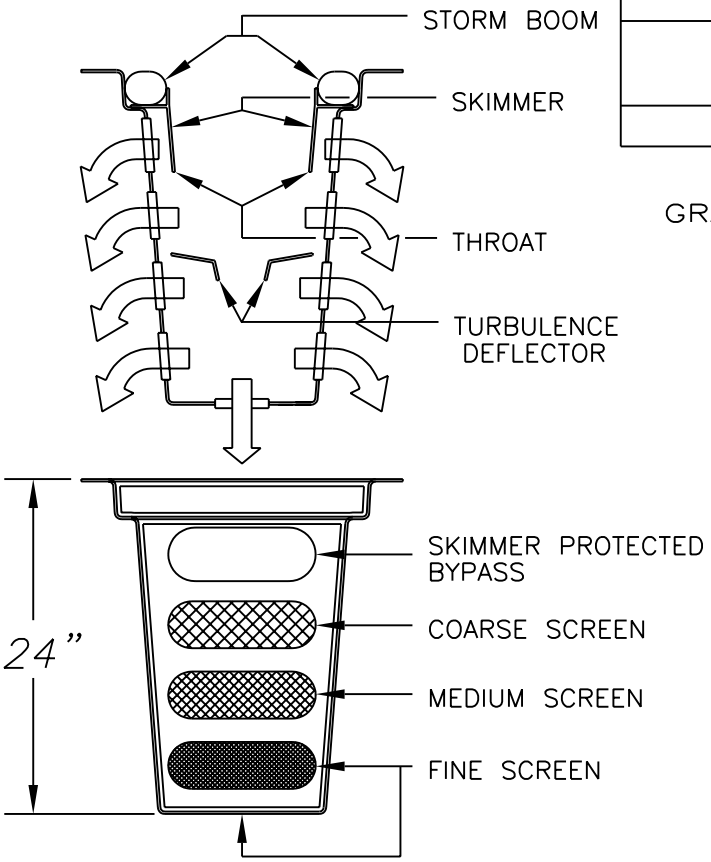


TOP VIEW

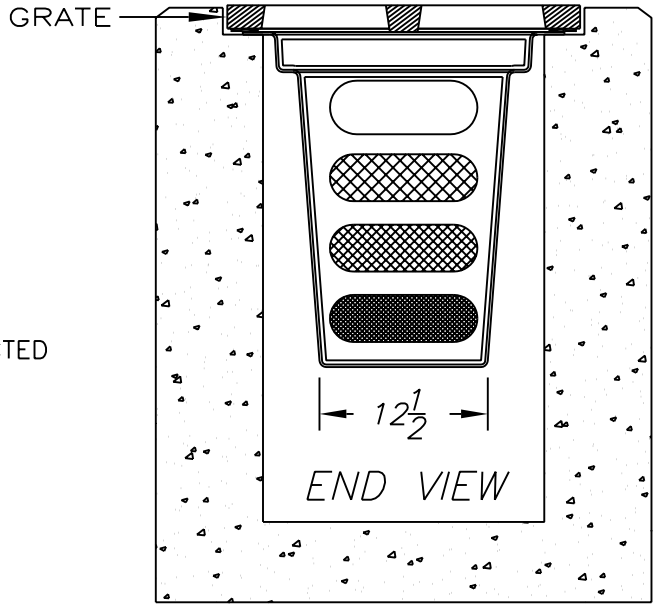
Flow Specifications

Description of filter opening	Percent Open (Based on Screen Dimensions)	Total Square Inches per Unit	Square Inches of Total Unobstructed Openings	Flow Rate (Cubic Feet per Second)
Skimmer protected By-Pass	100%	162.3	162.3	6.7 cfs
Coarse Screen 3/4" x 1-3/4" stainless steel flattened expanded	62%	143.5	89.0	4.3cfs
Medium Screen 10x10 mesh stainless steel	56%	143.5	80.4	4.3cfs
Fine screen 14 x 18 mesh stainless steel	68%	156.1	106.1	6.3cfs
THROAT FLOW RATE Total: 4.4 cfs			TREATED FLOW RATE Total: 14.9cfs	
FLOW RATES BASED ON UNOBSTRUCTED OPENINGS				

FLOW SCHEMATIC



SIDE VIEW



CONCRETE STRUCTURE

BOX MANUFACTURED FROM
MARINE GRADE FIBERGLASS & GEL
COATED FOR UV PROTECTION

5 YEAR MANUFACTURERS WARRANTY

PATENTED

ALL FILTER SCREENS ARE STAINLESS STEEL

REMOVE GRATE
INSERT GISB
REINSTALL GRATE

EXCLUSIVE CALIFORNIA DISTRIBUTOR:
BIO CLEAN ENVIRONMENTAL SERVICE
P.O. BOX 869, OCEANSIDE, CA. 92049
TEL. 760-433-7640 FAX:760-433-3176
Email: info@biocleanenvironmental.net

SUNTREE QUALITY PRODUCTS ARE BUILT FOR EASY CLEANING AND ARE DESIGNED TO BE PERMANENT INFRASTRUCTURE AND SHOULD LAST FOR DECADES.

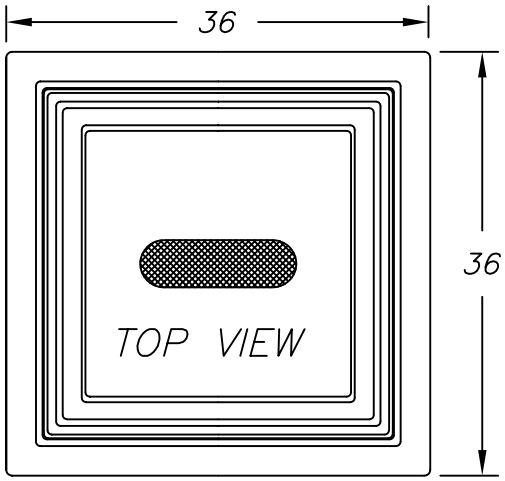
SUNTREE TECHNOLOGIES
798 CLEARLAKE RD. SUITE #2
COCOA FL. 32922
TEL. 321-637-7552 FAX 321-637-7554

GRATE INLET SKIMMER BOX
GISB-24-24-24

DATE: 05/20/04	SCALE: SF = 15
DRAFTER: N.R.B.	UNITS = INCHES

PROJECT:	
REVISIONS:	DATE:
REVISIONS:	DATE:
REVISIONS:	DATE:
REVISIONS:	DATE:
REVISIONS:	DATE:

Part # GISB-36-36-25



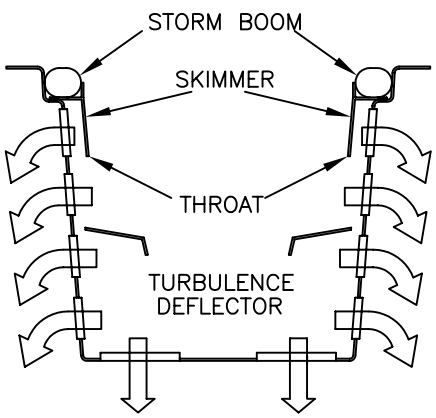
Flow Specifications

Description of filter opening	Percent Open (Based on Screen Dimensions)	Total Square Inches per Unit	Square Inches of Total Unobstructed Openings	Flow Rate (Cubic Feet per Second)
Skimmer protected By-Pass	100%	381.5	381.5	13.4 cfs
Coarse Screen 3/4" x 1-3/4" stainless steel flattened expanded	62%	231.0	143.2	6.2 cfs
Medium Screen 10x10 mesh stainless steel	56%	231.0	129.3	6.4 cfs
Fine screen 14 x 18 mesh stainless steel	68%	283.5	192.8	10.8

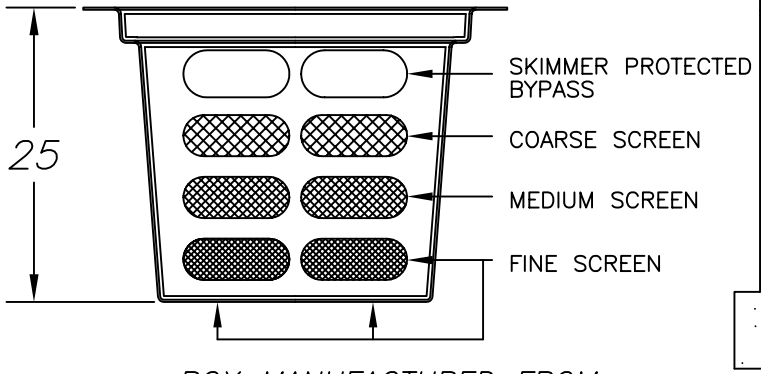
MAXIMUM THROAT FLOW RATE	SCREEN TREATED FLOW RATE
Total: 18.8 cfs	Total: 23.4 cfs

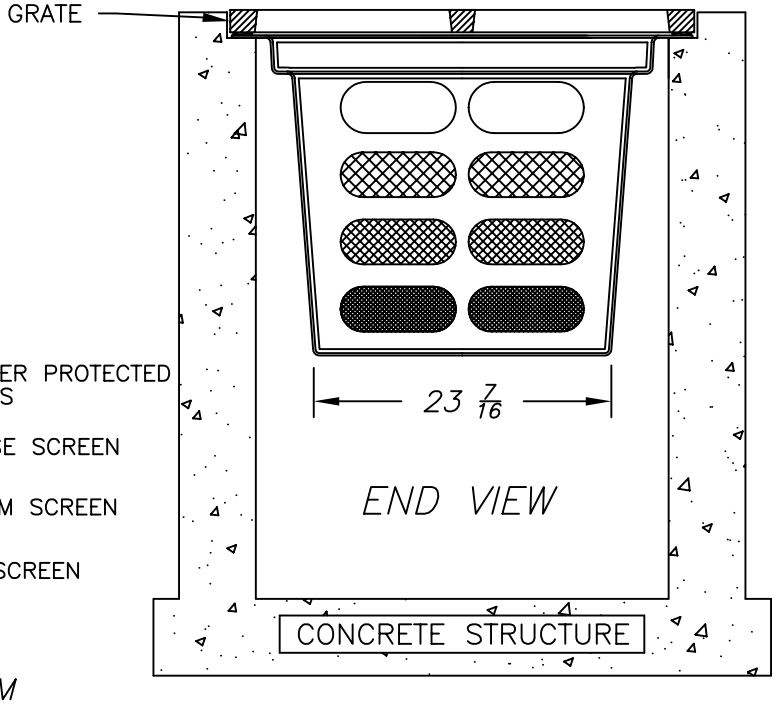
FLOW RATES BASED ON UNOBSTRUCTED SCREEN OPENINGS

FLOW SCHEMATIC



SIDE VIEW





BOX MANUFACTURED FROM MARINE GRADE FIBERGLASS & GEL COATED FOR UV PROTECTION

5 YEAR MANUFACTURERS WARRANTY

PATENTED

ALL FILTER SCREENS ARE STAINLESS STEEL

REMOVE GRATE
INSERT GISB
REINSTALL GRATE

EXCLUSIVE CALIFORNIA DISTRIBUTOR:
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TEL. 321-637-7552 FAX 321-637-7554

GRATE INLET SKIMMER BOX FOR FLORIDA DOT INLET STRUCTURES.

DATE: 04/12/04	SCALE: SF = 15
DRAFTER: N.R.B.	UNITS = INCHES

PROJECT:		
REVISIONS:		DATE:
REVISIONS:		DATE:
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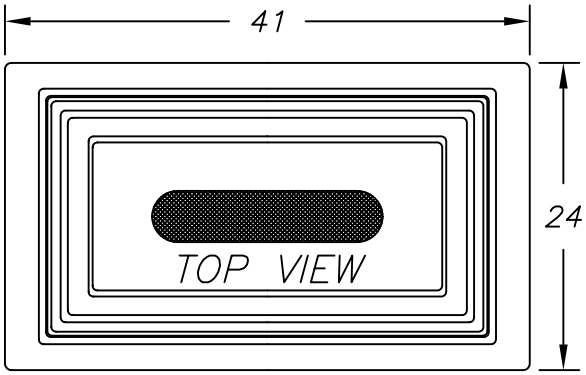
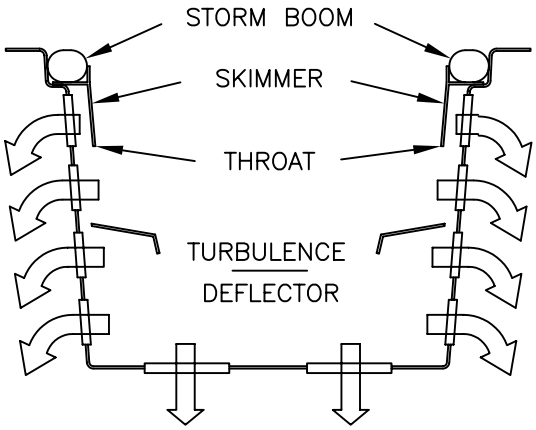
Part # GISB-J-24-41-25



FLOW SCHEMATIC



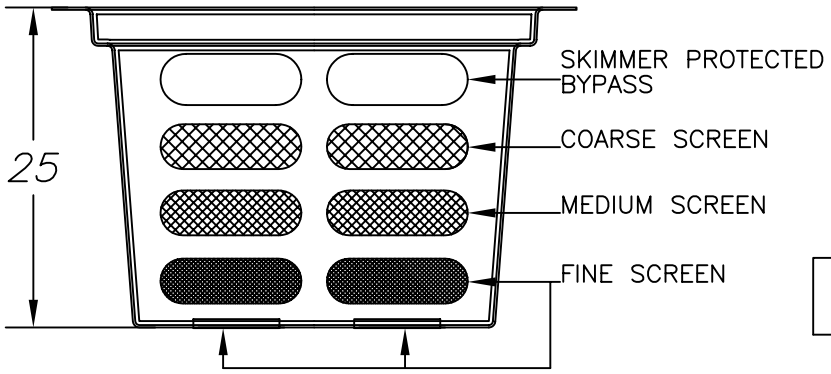
SIDE VIEW

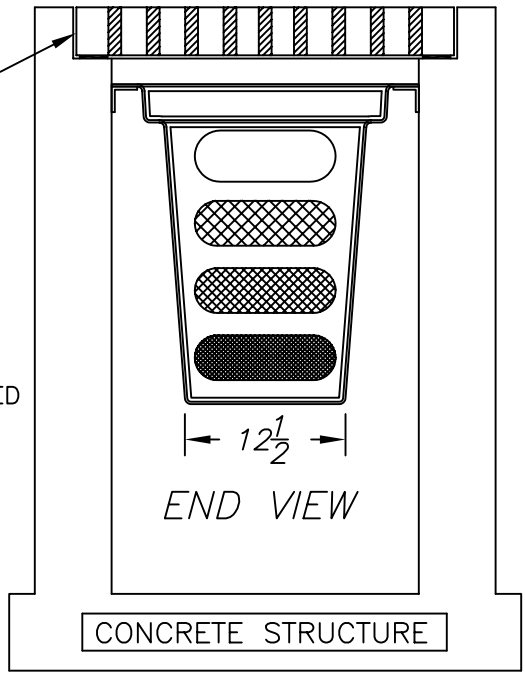
Flow Specifications

Description of filter opening	Percent Open (Based on Screen Dimensions)	Total Square Inches per Unit	Square Inches of Total Unobstructed Openings	Flow Rate (Cubic Feet per Second)
Skimmer protected By-Pass	100%	243.4	243.4	10.0 cfs
Coarse Screen 3/4" x 1-3/4" stainless steel flattened expanded	62%	215.2	133.4	6.4 cfs
Medium Screen 10x10 mesh stainless steel	56%	215.2	120.5	6.5cfs
Fine screen 14 x 18 mesh stainless steel	68%	283.8	193.1	11.6 cfs

THROAT FLOW RATE	TREATED FLOW RATE
Total: 12.0 cfs	Total: 24.5

FLOW RATES BASED ON UNOBSTRUCTED OPENINGS





BOX MANUFACTURED FROM MARINE GRADE FIBERGLASS & GEL COATED FOR UV PROTECTION

5 YEAR MANUFACTURERS WARRANTY

PATENTED

ALL FILTER SCREENS ARE STAINLESS STEEL

MOUNT TO WALL BELOW GRATE WITH MOUNTING KIT CONSISTING OF ALUMINUM ANGLES, TAPCONS, AND DRILL BITS

MOUNTING KIT SOLD SEPARATELY

EXCLUSIVE CALIFORNIA DISTRIBUTOR:
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COCOA FL. 32922
TEL. 321-637-7552 FAX 321-637-7554

GRATE INLET SKIMMER BOX FOR FLORIDA DOT TYPE J INLET STRUCTURES.

DATE: 04/12/04	SCALE: SF = 15
DRAFTER: N.R.B.	UNITS = INCHES

PROJECT:		
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Description of design elements that are 1) standard for all such devices, and 2) tailored to a specific location or catch basin/pipe design

Bio Clean Catch Basin Filters are "turn key" in design. In use since 1994, these filters are available in many sizes and configurations. We have developed many regional standards to meet specific municipality needs and objectives. For example, the County of San Diego utilizes the High Capacity Curb Inlet Basket with Shelf System to maximize cleaning intervals and minimize attention required by maintenance crews.

We have the manufacturing capability to make these filters in customized configurations and sizes. There are limitless options available. The modularized design of the shelf system for curb inlet filters makes it adaptable to any size or type of catch basin. The shelf system is comprised of a shelf weir, which is standard. Weir extensions are added for wider basins. The shelf system comes in various lengths. We have installed these filters in basins up to 30' in length. The Grate Inlet Skimmer Box is available in any size (length, width, depth).

Standard design elements for Curb Inlet Filters:

- Curb Inlet Basket – is the standard filter basket with a length of 34" with a width and depth of 12". Made of marine grade fiberglass and stainless steel.

- Shelf Weir – a standard marine grade fiberglass; weir allows the curb inlet basket to mount (removable) to the shelf system.

- High Capacity Curb Inlet Basket – is the high capacity version of the Curb Inlet Basket. Comes in a standard diameter of 19" and a depth of 24". Made of marine grade fiberglass and stainless steel.

- Continuous Curb Inlet Basket – is available in three standard lengths: 11 ¾", 23 ¾", and 34 ¾" lengths. Width and depth are standard 12". Made of marine grade fiberglass and stainless steel. This filter basket can be used in configurations where the shelf is not required.

Tailored design elements for Curb Inlet Filters:

1. Shelf System – comprised of various sized pieces that mount together to form the shelf system. The shelf system varies dependent on the dimensions and configuration of the catch basin to ensure the filter basket is always mounted under the manhole. The shelf system and weir is available for both the standard Curb Inlet Basket and High Capacity Curb Inlet Basket**. The Shelf System will not interfere with most ARS designs and CPS Devices**.

Standard design elements for Grate/Drop Inlet Filters:

1. Grate Inlet Skimmer Box – the main body of the Grate Inlet Skimmer Box is manufactured of marine grade fiberglass. All screens and hardware are stainless steel. The design of this filter is standard including the filter boom tray, bypass, filter screens, skimmer tray, and deflector shield.

Tailored design elements Grate/Drop Inlet Filters:

1. Size – while the Grate Inlet Skimmer Box is available in several standard sizes, we also offer custom sizes of any width, length and depth. The grate inlets vary from state to state and region to region. By offering customized sizes we can match our filter to the exact dimensions of any catch basin. Depths of catch basins vary greatly. The ability to adjust depth insures a appropriate fit.

Following are pictures and descriptions of some of the ordinary and specialized configurations we offer:

Curb Inlet Basket with Easy Maintenance Shelf System – 4' Wide Basin with One Wing

2 Continuous Curb Inlet Baskets Used in a F Type Basin

Curb Inlet Basket with Easy Maintenance Shelf System Positioned Under Manhole

Curb Inlet Basket with Shelf System Installed in a Grate-Curb Combination Inlet

High Capacity Curb Inlet Basket Shelf System Positioned Under Manhole

Grate Inlet Skimmer Box

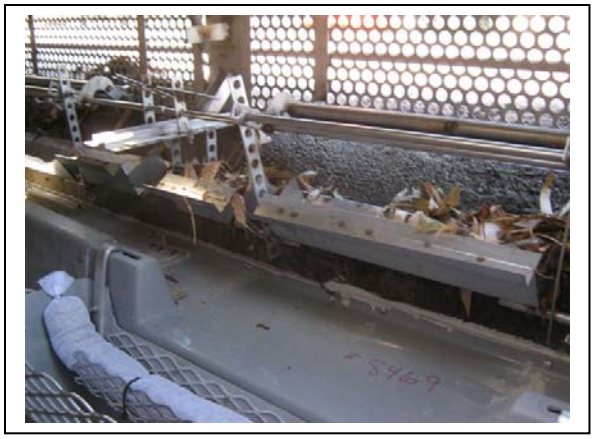
Large Grate Inlet Skimmer Box for a 48” by 48” Catch Basin

Round Grate Inlet Skimmer Box

Customized Grate Inlet Skimmer Boxes for All Sizes and Configurations

Customized Installation of 4 Grate Inlet Skimmer Boxes in a 4’ by 8’ Basin.

Compatibility of Bio Clean Curb Inlet Basket with an ARS installed



Browning Avenue Sidewalk Gap Closure Project, OCTA Transportation, Installed October 2010 in the City of Santa Ana

Flow or range of flows for which device is rated (in cubic feet per second)

The design of the Bio Clean Catch Basin Filter's makes them adaptable to a wide range of catch basin sizes and depths. Table 1 lists:

- Many hypothetical sizing examples for various sized drainage areas from one to 12 acres. The one-year, one-hour and ten-year, one-hour storm intensities were used. Historical regional rainfall data was used to generate these numbers.

- The treatment and bypass flow capacity of the Bio Clean Catch Basin Filters.

The table can be easily customized to input local rainfall intensities. Bio Clean Environmental can generate customized sizing chart for each municipality.

Table 1 uses an orifice coefficient of .6 for calculating treatment flow of the Bio Clean Catch Basin Filter

The treatment flow rates assume the screen is 50% clogged.

Rainfall intensities were gathered from the County of Santa Clara Hydrology Manual for the San Francisco Region. One-year, one-hour data was not readily available to us; if this information can be provided the table can be updated. The two-year storm is much more conservative that the one-year storm and therefore exceeds the requirements of the RFP.

Table 1 satisfies the requirements and specifications in Appendix F. Treatment and bypass flow rates are obtained using the rational method (Q = C * I * A).

Full Trash Capture:

This device meets the "full trash capture" definition and provides 100% removal for particles 5 mm and greater.

Bio Clean Catch Basin Filters use screen sizes up 4 mesh which has an opening size of 4.76 mm.

The following are being used as the average one-year, one-hour (Q_{1-1}) intensities for the following regions:

- **Los Angeles Region = .6 in/hr**
- **San Francisco Region = .5 in/hr** (used a two-year, one-hour storm event from the Santa Clara County Hydrology Manual – one hour return frequency – average of all mean annual precipitation tables 12 to 40 inches).

The following are being used as the average ten-year, one-hour (Q_{10}) intensity for the following regions:

- **Los Angeles Region = 2.8 in/hr**
- **San Francisco Region = 3.0 in/hr** (used a ten-year, one-hour storm event from the Santa Clara County Hydrology Manual – five minute return frequency – average of all mean annual precipitation tables 12 to 40 inches).

The San Francisco averages are a good indication of the general sizing requirements for the region. Here is the equation from the manual:

$$X_{T,D} = A_{T,D} + (B_{T,D}*MAP)$$

Where:

$X_{T,D}$ = precipitation depth for specific period and storm duration (inches)

T = return period (years)

D = storm duration (hours)

$A_{T,D}$, $B_{T,D}$ = coefficients from Table B-1 and -2 (dimensionless)

MAP = Mean Annual Precipitation (inches)

The precipitation intensity (inches/hour), $I_{T,D,}$ is given by:

$$I_{T,D} = X_{T,D}/D$$

The following equations are used to compile the information in Table 1.

Flow through Screen:

$$Q_{screen} = cA_{screen}\sqrt{2gh}$$

Bypass Flow:

$$Q_{bypass} = c_{bypass}A_{bypass}\sqrt{2gh}$$

The orifice equation is most appropriate because the maximum water depth can and will be above the bypass area.

Bio Clean Catch Basin Filters are proven to safely and efficiently capture and store trash and litter until the next scheduled maintenance.

What are the smallest workable catch basin dimensions?

From a perspective of installation, catch basin filters can be made very small. We have installed great inlet filters that are 6" by 6" by 6". Commonly, there are no limiting factors on how small of a catch basin can be.

From a perspective of hydraulics, the smallest catch basin dimensions will be a function of the drainage area the catch basin is receiving; the depth usually being the limiting factor. The question is can a filter be designed that can bypass the 10-year intensity? This becomes difficult with very small basins.

Trash storage capacity of the device when the one year, one hour storm is no longer fully filtered

The peak treatment flow rate of the Bio Clean Catch Basin Filters uses a 50% flow reduction to account for clogging that occurs over time. Therefore, the device can be at 50% storage capacity before the one-year, one-hour storm is no longer fully filtered. In many cases, the flow rate into the filter is much less than the filter screens flow rate and therefore the filter can be close to full capacity before the one-year, one-hour storm is no longer fully filtered. Table 1 shows the treatment and bypass flow rates for the various types of curb inlet filter systems and the grate inlet filters.

Materials used to construct the device

Bio Clean Catch Basin Filters – all filters and components are manufactured **from high strength UV coated marine grade fiberglass.** This is the same material used to make boats.

The expected life of this material is 50+ years. All screens and hardware are made from, type 316, stainless steel.

Note: No Plastic Nets or Fabrics are used in our manufacturing as these materials have shown to rip and tare under moderate loading conditions.

B. Performance Effectiveness for Connector Pipe Screens and Catch Basin Inserts

Performance Effectiveness – See following charts:

Curb Inlet Basket – Removal Efficiencies

Round Curb Inlet Basket/Grate Inlet Skimmer Box – Removal Efficiencies

Trash Capture and Storage Capacity

The standard Curb Inlet Basket has a storage capacity of 2.7 cubic feet. The course screen on the top of the basket can hold an additional .56 cubic feet of trash. The shelf system itself also offers several extra cubic feet of storage.

High Capacity Curb Inlet Basket with Easy Maintenance Shelf System – is similar to the standard Curb Inlet Basket with Easy Maintenance Shelf System, except it has a larger filter basket with a capacity of 3.8 cubic feet.

Continuous Curb Inlet Basket - is a filter system for curb and curb-grate inlets of all sizes and configurations. It's our standard filter basket without the easy maintenance shelf system. It has a storage capacity of 2.7 cubic feet.

Grate Inlet Skimmer Box – is a filter designed for grated or drop inlets of all sizes. The capacity of the filter depends upon the size of the filter. The Grate Inlet Skimmer Box comes in an unlimited range of sizes.

Maximum overflow or bypass flow capacity of the device. How does this compare to the 10-year storm?

The Bio Clean Catch Basin Filters come in two standard types. One for curb inlets and one for grate inlets.

- Grate inlet filters have a standard bypass capacity. The larger the filter, the larger the bypass capacity. The bypass capacity of the filter must be looked at and compared to the 10-year

Curb Inlet Basket - Removal Efficiencies

Removal Efficiencies (mg/L)

	Turbidity (NTU)			Total Nitrates mg/L			Total Iron mg/L			Zinc mg/L		
Location	Inlet	Outlet	Removal Efficiency	Inlet	Outlet	Removal Efficiency	Inlet	Outlet	Removal Efficiency	Inlet	Outlet	Removal Efficiency
University of Southern California			84%			85%	24.3	10.4	64%	24.3	10.4	79%

	Total Suspended Solids		
Location	Inlet	Outlet	Removal Efficiency
Universal Engineering - SS Retention			93%

University of Southern California - Civil and Environmental Engineering. HYDRAULIC PERFORMANCE, POLLUTANT REMOVAL EFFICIENCIES, AND ECONOMIC EVALUATION OF CATCH BASIN INSERT DEVICES 2005 - Independent Test

Universal Engineering Sciences - SUSPENDED SOLIDS RETENTION TESTING - 2007 - Independent Test

Grate Inlet Skimmer Box/Round Curb Inlet Basket - Removal Efficiencies

Numeric Reductions (mg/L)

	Total Suspended Solids mg/L			Total Phosphorus mg/L			Total Nitrogen mg/L		
Location	Inlet	Outlet	Removal Efficiency	Inlet	Outlet	Removal Efficiency	Inlet	Outlet	Removal Efficiency
Site Evaluation - Reedy Creek			74%			57%	24.3	10.4	57%
Creech Engineering Report			73%			79%			79%
Witman's Pond	978	329	66%	18.6	0.452	98%	48.08	9.86	79%
Universal Engineering - 2007 (100 Microns) LATEST REPORT			86%						

	Zinc mg/L			Lead mg/L			Copper mg/L		
Location	Inlet	Outlet	Removal Efficiency	Inlet	Outlet	Removal Efficiency	Inlet	Outlet	Removal Efficiency
UC Irvine						99%			
Longo Toyota	13.7	0.73	95%	1.5	0.2	87%	1.9	0.1	95%

	Ammonia, Salicylate mg/L			Fecal Coliform CFU/100 mL			Cadmium		
Location	Inlet	Outlet	Removal Efficiency	Inlet	Outlet	Removal Efficiency	Inlet	Outlet	Removal Efficiency
Site Evaluation - Reedy Creek	0.38	0.23	39%						
UC Irvine						33%			94%

	Hydrocarbons mg/L		
Location	Inlet	Outlet	Removal Efficiency
UC Irvine			90%
Longo Toyota	199	10.43	95%

Reedy Creek - Site Evaluation of a Grate Inlet Skimmer Box for Debris, Sediment, and Oil & Grease Removal - 1999 - Independent Test

Creech Engineering Report - Pollutant Removal Testing for a Grate Inlet Skimmer Box - 2001

Witman's Pond - Restoration Project - Massachusetts Dept of Environmental Management - 1998 - Independent Test

UC Irvine - Optimization of Stormwater Filtration at the Urban/Watershed Interface - Dept of Environmental Health - 2005 - Independent Test

Longo Toyota - Field Test - City of El Monte - 2002 - Independent Test

Universal Engineering Sciences - Suspended Soils Retention Study - 2007 - Independent Test

storm. Bypass capacity is either limited by the throat flow rate or bypass orifice flow rate; whichever is less.

- Curb inlet filters allow for bypass over the top of the filter and shelf system. The opening area behind the shelf and filter is always greater than the area of the curb opening. Therefore the curb inlet filters do not have an effect on the hydraulics of the catch basin.

C. Siting, Operational and Maintenance

Bio Clean Standard Order Process

1. Set up a meeting or conference call with the municipality to discuss needs and goals of the project.

2 Email or Fax measurement forms to the municipality for preliminary sizing and pricing. Or skip to step 4.

3. Review measurement forms and provide sizing and cost estimates.

4. Have a Bio Clean Installation Technician perform site visits to asses each catch basin and gather measurements and site specifics needs for proper installation.

5. Prepare a proposal along with exact price quotes (including installation) and traffic control pricing.

6. Sign contract and order the manufacturing of the Bio Clean Catch Basin Filters.

7. Coordinate with the municipality and submit a traffic control plan (if required). Once the traffic control plan is approved the installation schedule will be finalized.

8. Dispatch Bio Clean Installation Technician (or local contractor) to start the installation process:

    a. Set up traffic control according to the approved plan. Once traffic control is fully set up installation of the device will begin.

    b. Remove manhole or grate. Set up tripod if needed (dependent on depth). Use gas sensors to test for the presence of harmful gases within the catch basin. Visually inspect the catch basin. Remove any debris that are impeded the installation process. Set up tools and work area.

    (It should be noted that the catch basins should be cleaned prior to installation if needed; cleaning of the catch basin is not part of the installation contract. No work will be performed if substantial water flow is present in the catch basin).

    c. Enter the catch basin and insert Bio Clean Catch Basin Filter into position. Align the mounting holes into the appropriate position. Using a hammer gun drill holes into the catch basin where the mounting/basket will attach.

d. Insert stainless steel drive pins or red heads into the hole. Using a hammer set the pins or red heads into the catch basin wall. If red heads are used, then the nut will be tightened to secure the mounting bracket/shelf

e. Once the mounting bracket or shelf is attached the filter basket will be mounted. All filter baskets can be removed from the basin in just a few seconds. The only thing permanently attached is the shelf system or mounting bracket (Continuous Curb Inlet Basket).

f. Exit catch basin and replace manhole or grate. Insure area is properly cleaned and remove traffic control accordingly. Installation is now complete.

The estimated time to install each device, not including traffic control is 20 minutes for the continuous baskets and grate inlet skimmer baskets, 40 to 60 minutes for the curb inlet basket and high capacity basket with shelf system. Traffic control varies greatly by site and can range from 5 minutes to several hours.

Customary length of time from receipt of order to delivery/installation of devices

The typical lead time for:

- Small orders (less than 50) are four weeks.
- Medium orders (50-100) are six weeks.
- Large orders (100-250) are ten weeks.
- For orders greater than 250 please call the manufacturer for lead time.

Maintenance requirements

The purpose of the Bio Clean Catch Basin Filter is to contain trash within the catch basin, excluding it from the storm drain system. Routine maintenance will be necessary to remove trash from the catch basin to prevent it from accumulating to a point that would affect the performance of filter. Once a filter is full it will simply go into bypass and stop collection trash and debris.

Proposed Maintenance Approach:

- Inspect and clean each catch basin between May 1 and September 30 of each year.
- Inspect and provide additional cleaning of any catch basin filters that are at least 40% full of trash and/or debris.

Maintenance & Cleaning Procedure:

1. Set up necessary traffic control for the area surrounding the catch basin. Traffic control requirements will conform to state and local regulations.

2. Remove manhole or grate to gain access to the catch basin.

3. Inspect the catch basin to observe the level of trash accumulated along with an assessment of the catch basin filter. The device will be visually inspected for any damage.

4. Removal of the trash and debris either by hand or using a vacuum truck. A vacuum truck is recommended.

5. Spray down of the Catch Basin Filter device to remove any debris or litter caught within the screens of the device.

6. All maintenance and disposal will be done in accordance with state and local regulations. Record keeping of disposed material is available upon request.

7. Manholes or grates are replaced and the traffic control is removed in accordance with local and state requirements.

Availability of replacement parts

Replacement parts are available in stock at any time. These pieces can be easily shipped at time of request or the pieces can be delivered and installed by a Bio Clean Environmental Technician.

Life expectancy of the device

The estimated life expectancy of Bio Clean Catch Basin Filters is 10-15 years. Some of the first filters installed in 1996 are still in operation today. The life expectancy of marine grade fiberglass, which is the material that is used in the manufacturing of hulls of boats are made out of, is 50 years.

Warranty coverage and duration

Bio Clean Environmental Services, Inc., hereby warrants the material and workmanship of the marine grade fiberglass frame for a period of ten years and screening for a period of five years from the date of purchase, Bio Clean Environmental warrants that the product is free from all defects in material and workmanship. If a defect in material or workmanship is discovered, Bio Clean Environmental will remedy any defects resulting from faulty material or workmanship. This

warranty is void for any situation where Bio Clean Environmental Services, Inc., determines abuse, misuse or lack of maintenance to be the cause of failure, defect or problem.

D. Vendor's Installation Background

Bio Clean Environmental Services has been installing the Suntree Technology Brand Stormwater filters since 2002 in Southern California.

E. Operating Locations, References, and Certifications:

Photo of installed devices and their locations

Moody & La Palma Ave, City of La Palma, CA
See References Information

Chula Vista Corporate Yard, City of Chula Vista CA, See References Information

Disneyland Resort Central Bakery, Anaheim, CA

Moody Street Improvements, Alaska Ave and New York Ave. City of Cypress, CA

Curb Inlet Basket with Shelf System Installed for LA County

Accumulated Trash & Debris in Filter Basket and Shelf System LA County

Custom Designed Shelf System with High Capacity Basket for a 30' Wide Catch Basin in City of Corona

Hundreds of Pounds of Rocks and Sand Accumulated on the Curb Inlet Basket and Shelf System. This system can hold up to 500 pounds.

Curb Inlet Basket Positioned Under the Manhole for Easy Maintenance
Poplar St. South of Birch, City of Brea

Grate Inlet Skimmer Box at Full Capacity. Bypass Prevents Flooding When Filter is Full
Mission Avenue, Fallbrook CA