

WATER QUALITY



2. Calculate the stormwater quality design flow for the site (or each sub-drainage area that will discharge to a separate BMP) produced by 0.2-inch/hour rainfall by using the rational method equation:

$$Q_{P, SQDF} = C * I * A$$

Where:

C = runoff coefficient obtained from **Table A-1**.

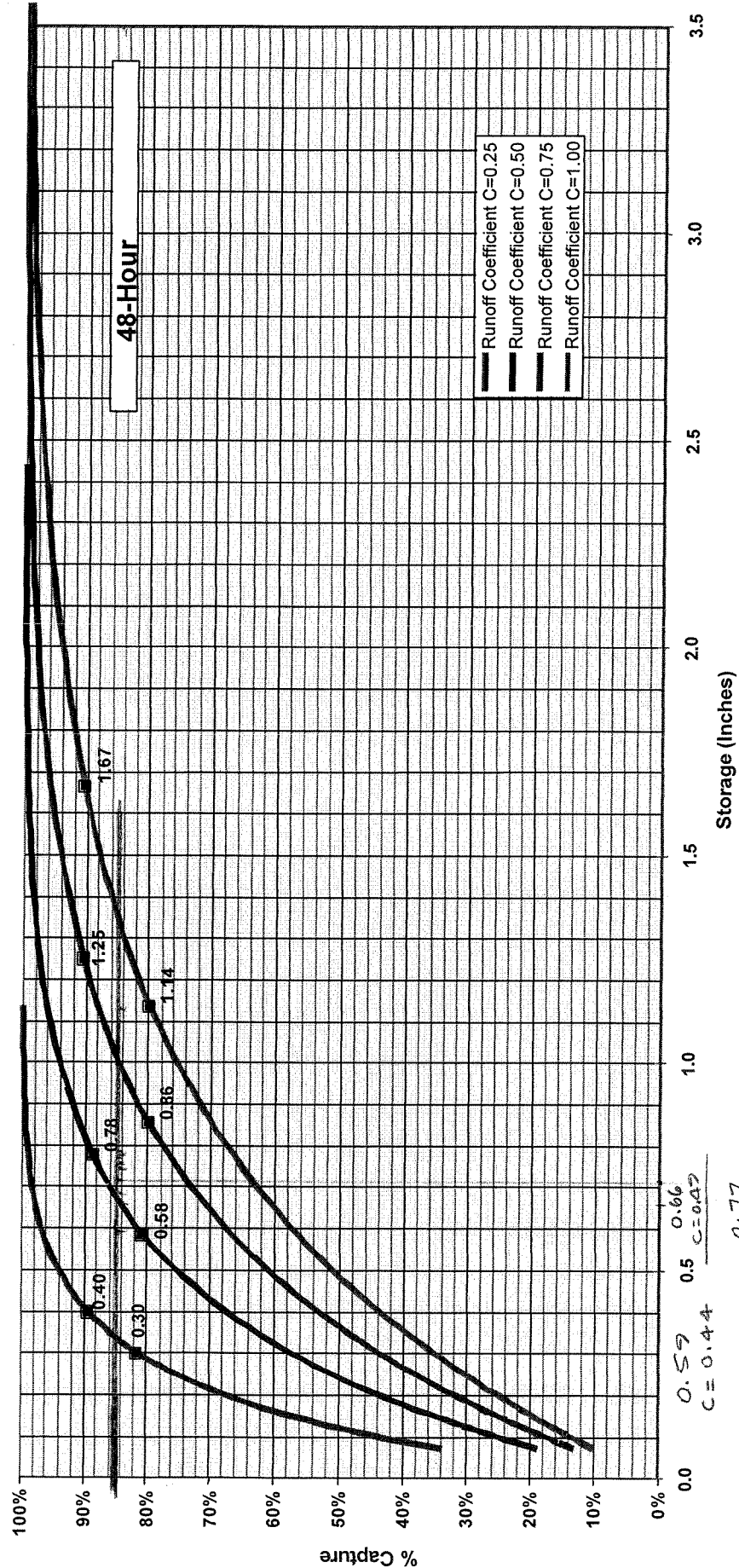
I = rainfall intensity (0.2 in/hr)

A = area of the site or sub-drainage area in acres

Table A-1
C Values Based on Impervious/Pervious Area Ratios

% Impervious	% Pervious	C
0	100	0.15
5	95	0.19
10	90	0.23
15	85	0.26
20	80	0.30
25	75	0.34
30	70	0.38
35	65	0.41
40	60	0.45
45	55	0.49
50	50	0.53
55	45	0.56
60	40	0.60
65	35	0.64
70	30	0.68
75	25	0.71
80	20	0.75
85	15	0.79
90	10	0.83
95	5	0.86
100	0	0.90

Figure A-3
 Volumetric BMP Sizing Curves for
 Orange County Stormwater Quality Management Program
 Silverado Ranger Station (ABOVE 1000 FEET)



September 26, 2003

7-II-55

Orange County Stormwater Program
 Exhibit 7.11 - Model Water Quality Management Plan

6.3 Treatment Control BMPs

Table 6.2 Treatment Control BMPs		
Number	BMP and Objective	Included
<i>Infiltration</i>		
TC-10	Infiltration Trench: A long narrow rock filled trench with no outlet receives water and stores it until it infiltrates into the underlying soil. Its effective are removing most pollutants but can get clogged with sediment. <i>Explanation/Description:</i> Soils do not allow for infiltration BMPs	N
TC-11	Infiltration Basin: A shallow impoundment designed to capture and hold stormwater until it infiltrates into underlying soil. Effective at removing most pollutants but requires large areas and may be constrained by soil types. <i>Explanation/Description:</i> Soils do not allow for infiltration BMPs	N
TC-12	Retention/Irrigation: Stormwater is captured in cistern, basin, trench, or other storage area and is subsequently used for irrigation of site landscaping. <i>Explanation/Description:</i> Reuse was found to be infeasible for a project of this size	N
<i>Detention and Settling</i>		
TC-20	Wet Pond: A constructed basin with a permanent pool of water throughout the year. Differ from wetlands because it is of greater depth. Treats stormwater runoff by settling and biological uptake. <i>Explanation/Description:</i> Wet ponds were found to be infeasible for this project considering space constraints and associated vector issues	N
TC-21	Constructed Wetland: A constructed basin with permanent pool of shallow water throughout most of year with substantial vegetative coverage. <i>Explanation/Description:</i> Constructed wetlands were found to be infeasible for this project considering space constraints and associated vector issues	N
TC-22	Extended Detention Basin: A constructed basin with an outlet designed to detain stormwater for at least 48 hours to allow particles and pollutants to settle. <i>Explanation/Description:</i> An extended detention basin is being utilized for one portion of this project. Other portions will utilize underground detention basins housed in a modular concrete structure manufactured by Old Castle precast.	N
MP-20	Wetland: Similar to a constructed wetland but a self-contained, manufactured module with vegetation that mimics natural wetland processes. <i>Explanation/Description:</i> A series of Modular Wetlands are being utilized downstream of the underground WQV/hydromod detention vaults	Y
<i>Biofiltration</i>		
TC-30	Vegetated Swale: Open, shallow, vegetated channels that collect and slowly convey runoff through the property. Filters runoff through vegetation, subsoil matrix, and/or underlying soils; traps pollutants, promotes infiltration and reduce flow velocity.	N

	<i>Explanation/Description:</i> Infeasible due to project topography	
TC-31	Vegetated Buffer Strip: Vegetated surfaces that are designed to treat sheet flow from adjacent surfaces. Removes pollutants by deceleration, settling, and infiltration.	N
	<i>Explanation/Description:</i> Infeasible due to project topography	
TC-32	Bioretention: A soil and plant based filtration strategy that involved capturing stormwater in depressed landscaped areas. Bioretention practices are flexible strategies for using landscaping as treatment.	Y
	<i>Explanation/Description:</i> The Modular Wetlands operate on the same scientific principles as bioretention system	
Filtration		
TC-40	Media Filter: Usually two-chambered with a pretreatment settling basin and a filter bed filled with sand or other absorptive filter media.	Y
	<i>Explanation/Description:</i> . . .feasible due to project layout	
MP-40	Media Filter: Similar to constructed media filter but manufactured as self-contained filtering vaults, units, or cartridges.	
	<i>Explanation/Description:</i> Modular Wetland is a two-stage system with wetland chambers containing biofiltration/sorptive media. Prior to the wetland chamber are pre-treatment chambers that contain a series of cartridge filters that utilize a coarse granular media to remove fine sediments and hydrocarbons from entering the wetland chambers. This system has been independently tested in the field in both California and Oregon under the TAPE protocol. It has been proven to remove TSS, hydrocarbons, dissolved and particulate nutrients and metals and bacteria at medium to high levels.	Y
Flow Through Separation		
TC-50	Water Quality Inlet: Vaults with chambers including screens, settling areas, and/or filter media to promote settling and/or separation of pollutants from stormwater.	N
	<i>Explanation/Description:</i> Pretreatment provided by vortex separators with built in trash screens	
MP-50	Wet Vault: A vault with a permanent water pool and internal features to promote settling and/or separation of pollutants from stormwater.	N
	<i>Explanation/Description:</i> Pretreatment provided by vortex separators with built in trash screens	
MP-51	Vortex Separator: Similar to wet vaults but round and use centrifugal action as primary separation mechanism.	
	<i>Explanation/Description:</i> Pre-treatment of runoff entering the underground WQV/hydromod vaults are pre-treated by Dual Stage Hydrodynamic separators containing elevated screening systems to remove trash and debris and store in a dry state. The screening system is certified for full capture. Below is a series of three hydrodynamic separation chambers to captures greater than 80% removal of TSS down to 75 microns. The system, known as the Nutrient Separating Baffle Box has been locally tested in the field by the City of Santa Monica and found capable of removing 87% of TSS and 99% of Oils & Grease.	Y

MP-52	<p>Drain Inserts: Boxes, trays, or socks with screens or filter fabric and may also include filter media. They are installed in inlets or catch basins and removal effectiveness for pollutants is generally low except for large sediment.</p> <p><i>Note: Drain inserts cannot be the sole Treatment Control BMP selection for Priority Projects.</i></p>	N
<p><i>Explanation/Description:</i> Pretreatment provided by vortex separators with built in trash screens</p>		
<p>Other</p>		
TC-60	<p>Multiple Systems: A system that uses two or more BMPs in series to increase treatment. Useful when one BMP does not provide sufficient treatment alone.</p> <p><i>Explanation/Description:</i> A treatment train has been utilized to treat stormwater runoff from this project. Influent water is first treated by a vortex separator with built-in screening systems to remove trash and debris. Once runoff is pre-treated it enters underground storage vaults to hold and release the water quality and hydromodification volumes in less than 48 hours. 100% of the water quality volume is treated downstream of the underground storage vaults by a dual-stage biofiltration BMP. This BMP is composed of two chambers. The first chamber contains a series of cartridges utilizing a coarse media to remove fine TSS and hydrocarbons. The second chamber utilizes biological and sorptive filtration media that utilizes ion exchange and various biological processes to capture, break down and cycle harmful pollutants.</p>	Y

6.3.1 SELECTION

Selection of BMPs was based upon the best available technology at the time. Due to the large scale of this project, the dynamics of off-site flow, limited open space and the hydromodification requirements it was found to be the most practicable to utilize volume based design for the main treatment BMP. Due to limited space the hydromodification volumes for each drainage area had to be efficient stored underground in all but one basin. The calculated hydromodification volume and limited footprint required the underground detention tanks to be 14' deep. It was found that only concrete structures could handle the loading of this depth of install while maximizing storage space. The Storm Capture modular pre-cast concrete storage system has a void capacity of 95% making a much more viable option than pipe or other storage methods rated for such depths.

To minimize maintenance on the underground detention tanks and downstream treatment BMPs a vortex separator with elevated screen system was chosen to effectively remove TSS, trash & debris, oils & grease and other particulate pollutants. The Bio Clean Dual Stage Separator (also known as the Nutrient Separating Baffle Box - NSBB) was one of only a few NJ CAT approved devices that was:

- Approved for online use and verified not to scour during larger storm events.
- Full capture certified.
- Captures and stores trash, debris, and oxygen demanding substances in a dry state to prevent nutrient leaching.
- Had been independently tested in the field by a local agency and found capable

of removing 87% of TSS, and 99% of oil & grease.

Following is a performance summary of the independent testing done by the City of Santa Monica:

Pollutant	NSBB Removal Efficiency
TSS Removal	87%
Turbidity	72%
Oils & Grease	99%
Copper	40%

Both Water Quality Design Flows (WQDF) and Water Quality Design Volumes (WQDV) were calculated for each basin. In order to maximize the pre-treatment to the main treatment BMP and better control the flows to that BMP it was chosen to be put downstream of the detention tanks which are sized to hold both the WQDV and hydromodification volume. Only, one biofiltration system (wetland, bioretention, rain garden), manufactured by Modular Wetland Systems, Inc. was designed and has been utilized downstream of detention tanks. The Modular Wetland System utilizes horizontal flow. This allows for greater surface area and more retention time within the media. This system has been thoroughly tested in a volume based setup where it receives continuous flows over extended period of time.

The verified loading rate and superior performance proved that this was a better choice than traditional downward flow sand filters which are notorious for clogging and have very high associated maintenance costs. The Modular Wetland System is approved by the Washington Department of Ecology TAPE protocol. Following is a list of performance numbers from independent field testing done in Oceanside, CA:

- **TSS - 82%** (46 mg/L influent & 8 mg/L effluent) (mean particle size of < 8 microns)
- **Nutrients - 75%** (as nitrate-N) (0.85 mg/L influent & 0.21 mg/L effluent)
- **Copper - > 53%** (influent 0.04 mg/L & effluent **non/detectable**)
- **Zinc - > 79%** (influent 0.24 mg/L & effluent **non/detectable**)
- **TPH – Diesel - 99.99%** (influent 0.29 mg/L & effluent 0.00 mg/L)
- **TPH – Motor Oil - 99.99%** (0.83 mg/L & 0.00 mg/L)
- **Fecal Coliform - 72%** (31,666 MPN/100mL influent & 8,666 MPN/100mL effluent)
- **E. Coli - 83%** (6,280 MPN/100mL influent & 1,058 MPN/100mL effluent)
- **Enterococci - 89%** (558 MPN/100mL influent & 63 MPN/100mL effluent)

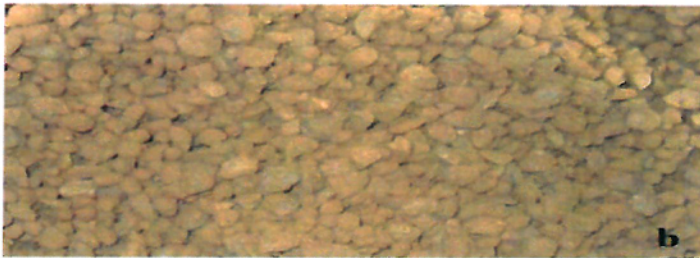
Following is a summary of TAPE testing:

Row Labels	Average of InletResult	Count of InletResult	Average of OutletResult	Count of OutletResult	Percent Removal
Coliform, Fecal Total	719	5	351	5	51%
Copper Total	0.0073	9	0.0038	9	47%
Escherichia coli Total	722	5	260	5	64%
Lead Total	0.007	9	0.002	9	71%
orthophosphate Total	0.023	9	0.012	9	48%
Phosphorus Total	0.119	8	0.038	8	68%
Total Suspended Solids Total	59.8	8	7.7	8	87%
Zinc Total	0.056	9	0.022	9	39%

Wetland Media

The Modular Wetland System utilizes a proprietary blend of bioretention media that provides greater plant growth, moisture retention, evapotranspiration, pollutant removal than standard sand filters and bioretention systems. The media is composed of the following:

- 80% expanded shale (tested by CalTrans and CSUS)
- 20% sand clay loam soil



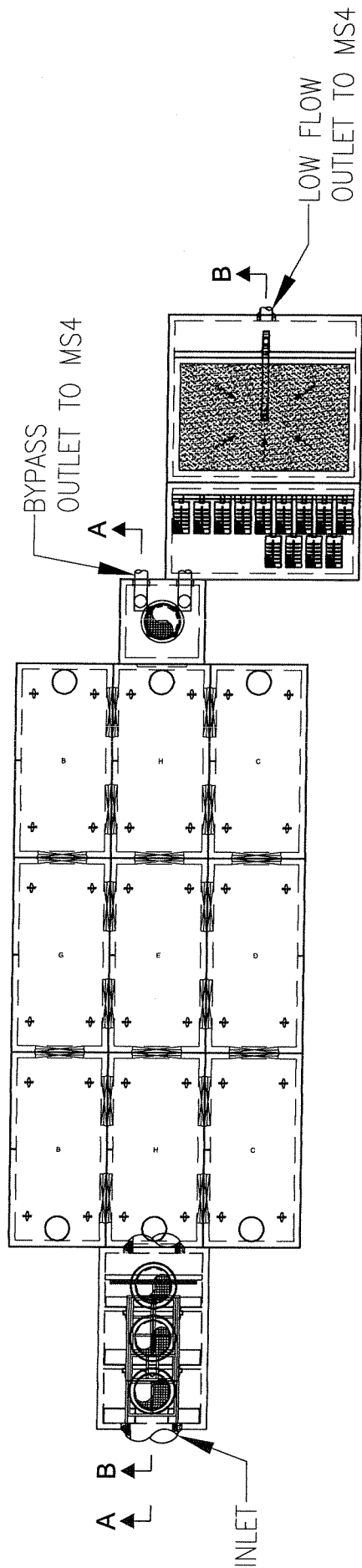
This media mix has been independently tested by the University of California, Davis.

- TKN – 48% Reduction
- NH4-N – 76% Reduction
- NO3-N – 85% Reduction
- P_S – 65% Reduction
- K_S – 53% Reduction
- Zn – 74% Reduction

The testing done on the wetland media proves that it can be highly effective in underground installation where vegetation is prohibitive.

Treatment Control BMP Operational Exhibits

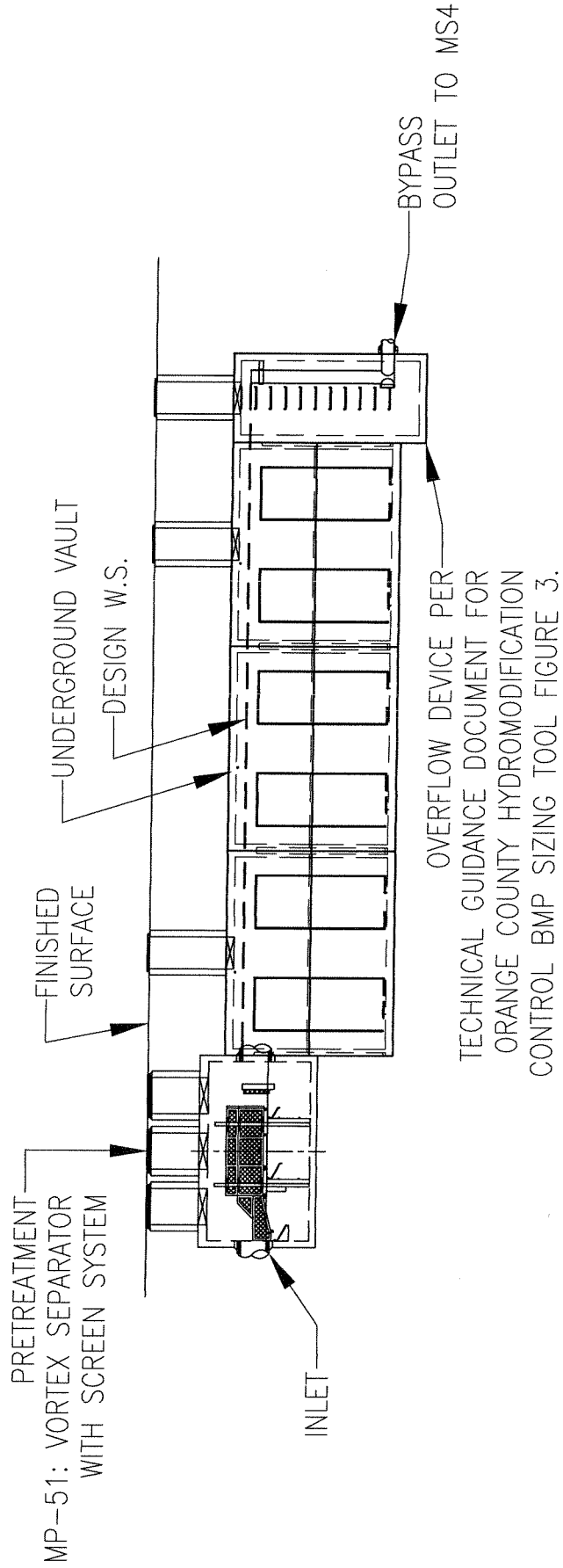
PORTOLA CENTER WATER QUALITY - TREATMENT CONTROL BMP EXHIBIT



PLAN VIEW

PROJECT: PORTOLA CENTER WATER QUALITY 2975 SAN LUIS REY ROAD, OCEANSIDE, CA 92058 P. 760.433.7640 F. 760.433.3179 DRAWING #	
PORTOLA CENTER WATER QUALITY TREATMENT CONTROL BMP EXHIBIT DATE: 8/6/12 SCALE: NTS	
DRAFTER: JOHN	UNITS: FEET
DESIGNED BY:	DATE:
CHECKED BY:	DATE:

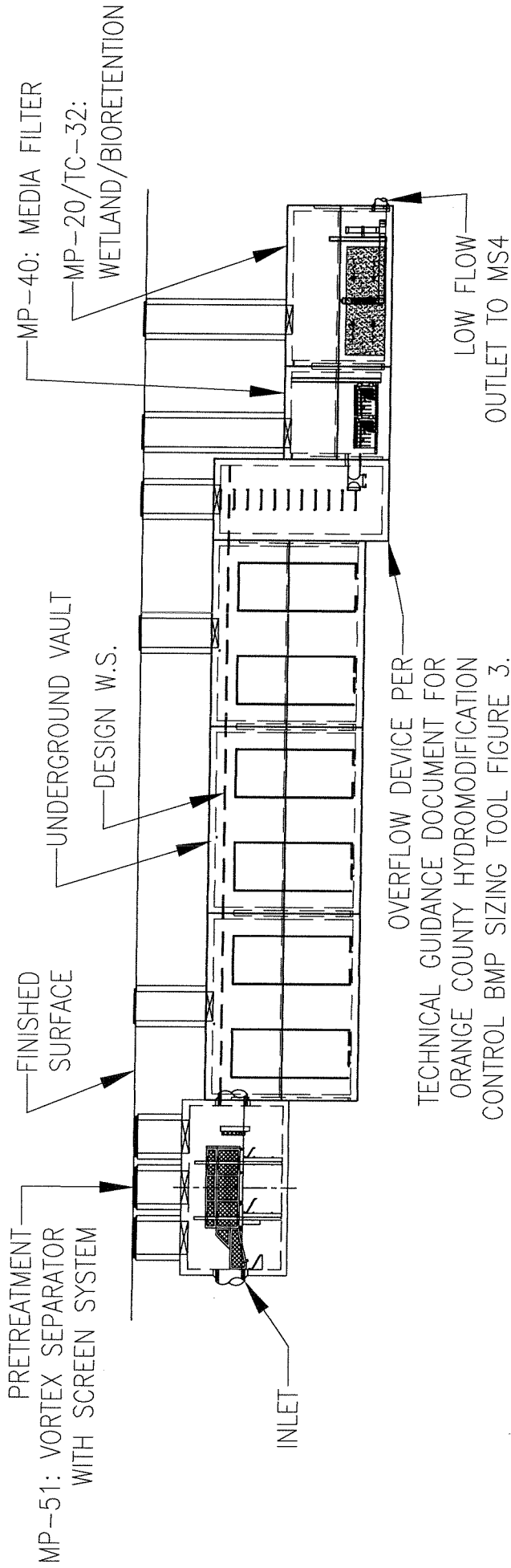
PORTOLA CENTER WATER QUALITY - TREATMENT CONTROL BMP EXHIBIT



SECTION A-A

BIO CLEAN ENVIRONMENTAL SERVICES, INC.		PROJECT:	PORTOLA CENTER WATER QUALITY
2975 SAN LUIS REY ROAD, OCEANSIDE, CA 92058		SUBJECT:	TREATMENT CONTROL BMP EXHIBIT
P. 760.433.7640 F. 760.433.3179		DATE:	8/6/12
PORTOLA CENTER WATER QUALITY		SCALE:	NTS
TREATMENT CONTROL BMP EXHIBIT		DRAWN BY:	JOHN
DATE: 8/6/12		CHECKED BY:	
DRAFTER: JOHN		REVISIONS:	
UNITS: FEET			

PORTOLA CENTER WATER QUALITY - TREATMENT CONTROL BMP EXHIBIT



SECTION B-B

BIO-CLEAN ENVIRONMENTAL SERVICES, INC. 2975 SAN LUIS REY ROAD, OCEANSIDE, CA 92058 P. 760.433.7640 F. 760.433.3179	PROJECT: PORTOLA CENTER WATER QUALITY DRAWING #
PORTOLA CENTER WATER QUALITY TREATMENT CONTROL BMP EXHIBIT	FILE NAME REVISIONS
DATE: 8/6/12 DRAFTER: JOHN	SCALE: NTS UNITS: FEET
	DATE: REVISIONS:

Bio Clean Dual Stage Hydrodynamic Separator Sizing
(Vortex Separator with Elevated Screen System)

Nutrient Separating Baffle Box Sizing - Portola Water Quality - Lake Forest, CA

Basin	Basin Information		Pipe Information		Nutrient Separating Baffle Box Information			
	Treatment Flow (cfs)	Peak Flow (cfs)	Inlet/Outlet (in)	Model	Capacity (cfs)	Head Loss (ft)	HGL at Outlet (ft)	Unit Price
1	0.18	3.60	18.00	3-6-72	1.48	0.30	0.73	\$9,800.00
3	3.89	90.80	36.00	6-12-84	5.92	4.10	2.85	\$28,300.00
4	1.55	31.60	24.00	4-6.5-72	2.14	2.60	1.88	\$13,400.00
5	7.23	178.20	48.00	8-12-96	7.89	5.10	3.77	\$36,704.00
7A & 7B	1.05	21.20	24.00	4-6.5-72	2.14	3.60	1.65	\$13,400.00
8A	0.43	12.40	18.00	3-6-72	1.48	1.30	1.33	\$9,800.00
8B	0.64	16.90	24.00	4-6.5-72	2.14	0.90	1.49	\$13,400.00
9	1.38	29.00	30.00	5-10.5-84	4.32	2.20	1.84	\$23,900.00

Prepared
3-1-2013

Base Price - Does
not include risers
or access hatches

SITE SPECIFIC DATA*	
PROJECT NAME	PORTOLA WATER QUALITY
PROJECT LOCATION	LAKE FOREST, CA
STRUCTURE ID	BASIN 1
WATER QUALITY FLOW RATE (CFS)	0.18
PEAK FLOW RATE (CFS)	3.60
PEAK STORM DURATION (YEARS)	100

PIPE DATA	I.E.	MATERIAL	DIMETER
INLET PIPE 1	*	RCP	18"
OUTLET PIPE 1	*	RCP	18"
RIM ELEVATION		*	
SURFACE LOADING REQUIREMENT		*	
CORROSIVE SOIL CONDITIONS		*	
KNOWN GROUNDWATER ELEVATION		*	

NOTES:

*PER ENGINEER OF RECORD

GENERAL NOTES

- BIO CLEAN TO PROVIDE ALL MATERIALS UNLESS OTHERWISE NOTED.
- ALL DIMENSIONS, ELEVATIONS, SPECIFICATIONS, AND CAPACITIES ARE SUBJECT TO CHANGE. FOR PROJECT SPECIFIC DRAWINGS DETAILING EXACT DIMENSIONS, WEIGHTS, AND ACCESSORIES PLEASE CONTACT BIO CLEAN.
- SLIDING LIDS FOR THE SCREEN SYSTEM ARE AVAILABLE UPON REQUEST.
- FULL CAPTURE SCREEN AVAILABLE UPON REQUEST.

INSTALLATION NOTES

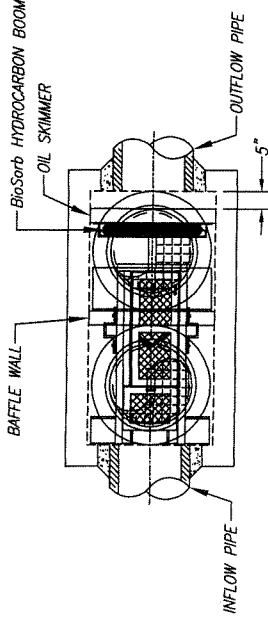
- CONTRACTOR TO PROVIDE ALL LABOR, EQUIPMENT, MATERIALS, AND INCIDENTALS REQUIRED TO OFFLOAD AND INSTALL THE NSBB UNIT AND APPURTENANCES IN ACCORDANCE WITH THIS DRAWING AND THE MANUFACTURERS SPECIFICATIONS, UNLESS OTHERWISE STATED IN MANUFACTURERS CONTRACT.
- MANUFACTURER RECOMMENDS A MINIMUM 6"-12" LEVEL ROCK BASE UNLESS SPECIFIED BY THE PROJECT ENGINEER. CONTRACTOR IS RESPONSIBLE TO VERIFY PROJECT ENGINEERS RECOMMENDED BASE SPECIFICATIONS.
- ALL PIPES MUST BE FLUSH WITH INSIDE SURFACE OF CONCRETE. (PIPES CANNOT INTRUDE BEYOND FLUSH).
- INVERT OF OUTFLOW PIPE MUST BE 3" ABOVE BOTTOM OF SKIMMER WALL.
- ALL GAPS AROUND PIPES SHALL BE SEALED WATER TIGHT WITH A NON-SHRINK GROUT PER MANUFACTURERS STANDARD CONNECTION DETAIL AND SHALL MEET OR EXCEED REGIONAL PIPE CONNECTION STANDARDS.
- CONTRACTOR RESPONSIBLE FOR INSTALLATION OF ALL RISERS, MANHOLES, AND HATCHES. ALL COVERS SHALL BE SHIPPED LOOSE. CONTRACTOR TO GROUT ALL MANHOLES AND HATCHES TO MATCH FINISHED SURFACE UNLESS SPECIFIED OTHERWISE.

NSBB PERFORMANCE DATA

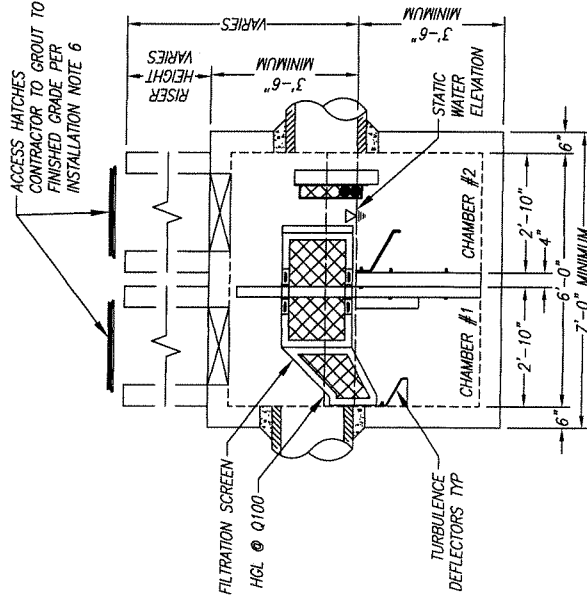
TREATMENT FLOW RATE (CFS)	1.48
SETTLING AREA (SF)	18
LOADING RATE (GPM/SF)	37
SCREEN SYSTEM STORAGE CAPACITY (CF)	11.85
SEDIMENT STORAGE CAPACITY (CF)	50.94
80% TSS REMOVAL @ 125 MICRONS	

NSBB STORAGE CAPACITIES

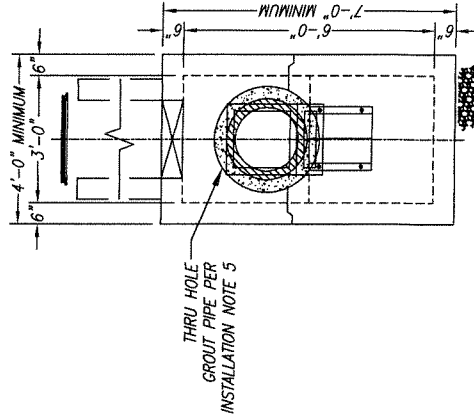
FILTRATION SCREEN CAPACITY	
LENGTH (FT)	4.25
WIDTH (FT)	1.67
HEIGHT (FT)	1.67
TOTAL (CF)	11.85
SEDIMENT CHAMBER CAPACITY	
CHAMBER 1	2.83
CHAMBER 2	2.83
TOTAL	5.66
CHAMBER 1	3.00
CHAMBER 2	3.00
TOTAL	6.00



PLAN VIEW
NTS



ELEVATION VIEW
NTS



END VIEW
NTS

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NSBB-3-6-72
DUAL STAGE HYDRODYNAMIC SEPARATOR
STANDARD DETAIL

SITE SPECIFIC DATA *	
PROJECT NAME	PORTELA WATER QUALITY
PROJECT LOCATION	LAKE FOREST, CA
STRUCTURE ID	BASIN 3
WATER QUALITY FLOW RATE (CFS)	3.89
PEAK FLOW RATE (CFS)	90.80
PEAK STORM DURATION (YEARS)	100

PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1	*	RCP	36"
OUTLET PIPE 1	*	RCP	36"
RIM ELEVATION	*		
SURFACE LOADING REQUIREMENT			
CORROSION SOIL CONDITIONS			
KNOWN GROUNDWATER ELEVATION			

*PER ENGINEER OF RECORD

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- FULL CAPTURE SCREEN AVAILABLE UPON REQUEST.

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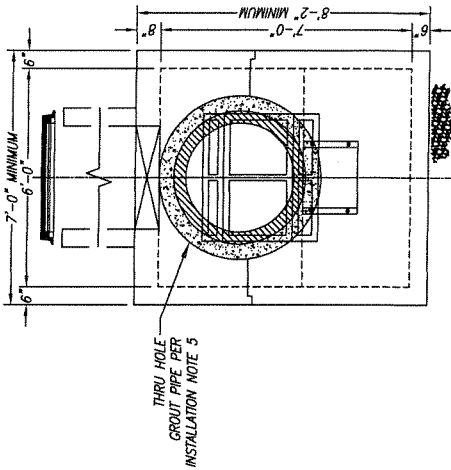
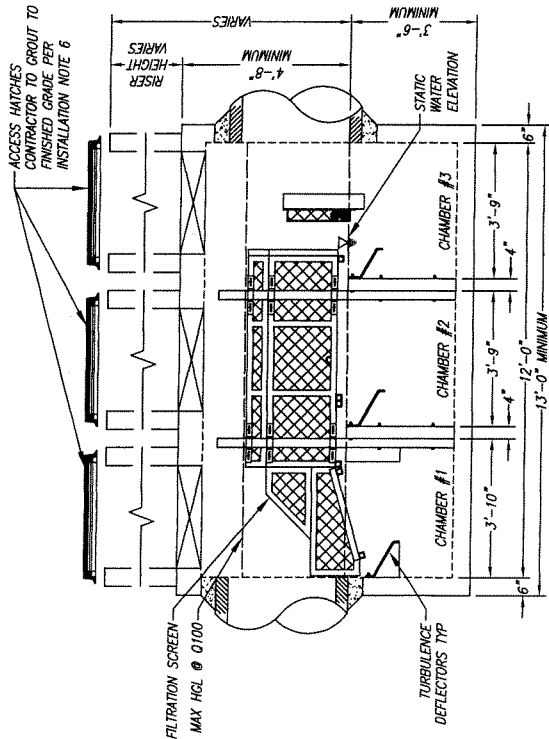
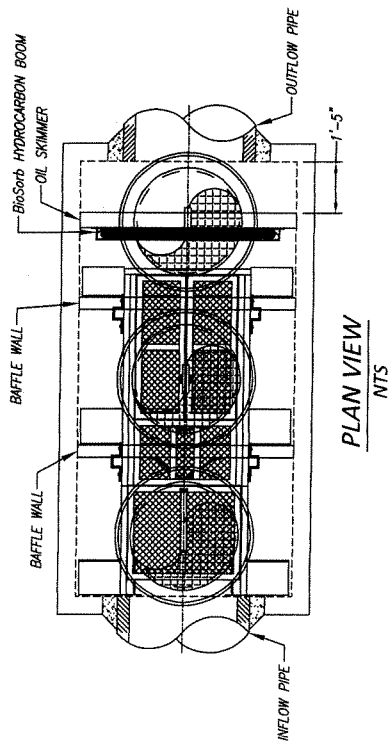
THIS PROJECT ACCORDS MAY BE PROVIDED BY ONE OR MORE OF THE FOLLOWING US PATENTS: 6,426,892; 7,264,306; 7,699,717; 7,504,475; 7,230,979; 7,593,029; 7,593,030; 7,593,031; 7,593,032

NSBB PERFORMANCE DATA

TREATMENT FLOW RATE (CFS)	5.92
SETTLING AREA (SF)	72
LOADING RATE (GPM/SF)	37
SCREEN SYSTEM STORAGE CAPACITY (CF)	78.75
SEDIMENT STORAGE CAPACITY (CF)	1,36.44
80% TSS REMOVAL @ 125 MICRONS	

NSBB STORAGE CAPACITIES

FILTRATION SCREEN CAPACITY			
LENGTH (FT)	WIDTH (FT)	HEIGHT (FT)	TOTAL (CF)
9.00	3.50	2.50	78.75
SEDIMENT CHAMBER CAPACITY			
CHAMBER 1	3.83	6.00	3.00
CHAMBER 2	3.75	6.00	3.00
CHAMBER 3	3.75	6.00	3.00



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NSBB-6-12-84
DUAL STAGE HYDRODYNAMIC SEPARATOR
STANDARD DETAIL

SITE SPECIFIC DATA*	
PROJECT NAME	PORTOLA WATER QUALITY
PROJECT LOCATION	LAKE FOREST, CA
STRUCTURE ID	BASIN 7A & 7B
WATER QUALITY FLOW RATE (CFS)	1.05
PEAK FLOW RATE (CFS)	21.20
PEAK STORM DURATION (YEARS)	100

PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1	*	RCP	24"
OUTLET PIPE 1	*	RCP	24"
RIM ELEVATION		*	
SURFACE LOADING REQUIREMENT			
CORROSIVE SOIL CONDITIONS			
KNOWN GROUNDWATER ELEVATION			

*PER ENGINEER OF RECORD

GENERAL NOTES

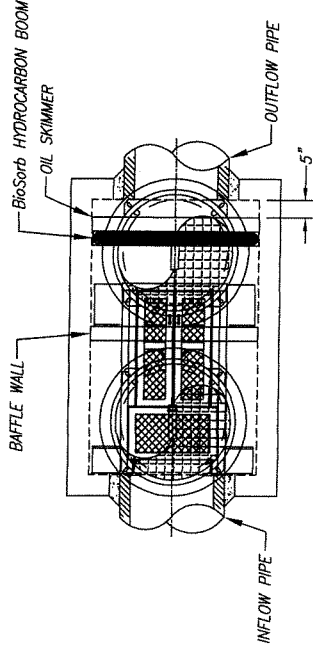
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- FULL CAPTURE SCREEN AVAILABLE UPON REQUEST.

INSTALLATION NOTES

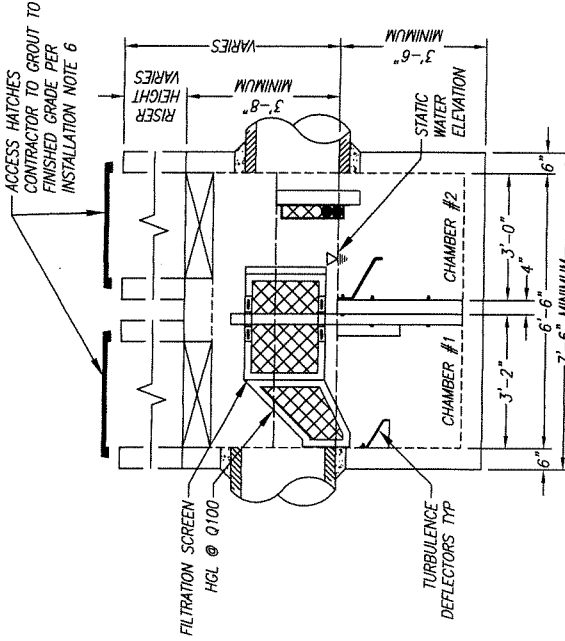
- CONTRACTOR TO PROVIDE ALL LABOR, EQUIPMENT, MATERIALS, AND INCIDENTALS REQUIRED TO OFFLOAD AND INSTALL THE NSBB UNIT AND APPURTENANCES IN ACCORDANCE WITH THIS DRAWING AND THE MANUFACTURERS SPECIFICATIONS, UNLESS OTHERWISE STATED IN MANUFACTURERS CONTRACT.
- MANUFACTURER RECOMMENDS A MINIMUM 6"-12" LEVEL ROCK BASE UNLESS SPECIFIED BY THE PROJECT ENGINEER. CONTRACTOR IS RESPONSIBLE TO VERIFY PROJECT ENGINEERS RECOMMENDED BASE SPECIFICATIONS.
- ALL PIPES MUST BE FLUSH WITH INSIDE SURFACE OF CONCRETE. (PIPES CANNOT INTRUDE BEYOND FLUSH).
- INVERT OF OUTFLOW PIPE MUST BE 3" ABOVE BOTTOM OF SKIMMER WALL.
- ALL GAPS AROUND PIPES SHALL BE SEALED WATER TIGHT WITH A NON-SHRINK GROUT PER MANUFACTURERS STANDARD CONNECTION DETAIL AND SHALL MEET OR EXCEED REGIONAL PIPE CONNECTION STANDARDS.
- CONTRACTOR RESPONSIBLE FOR INSTALLATION OF ALL RISERS, MANHOLES, AND HATCHES. ALL COVERS SHALL BE SHIPPED LOOSE. CONTRACTOR TO GROUT ALL MANHOLES AND HATCHES TO MATCH FINISHED SURFACE UNLESS SPECIFIED OTHERWISE.

NSBB PERFORMANCE DATA	
TREATMENT FLOW RATE (CFS)	2.14
SETTLING AREA (SF)	26
LOADING RATE (GPM/SF)	37
SCREEN SYSTEM STORAGE CAPACITY (CF)	20.40
SEDIMENT STORAGE CAPACITY (CF)	76.08
80% TSS REMOVAL @ 125 MICRONS	

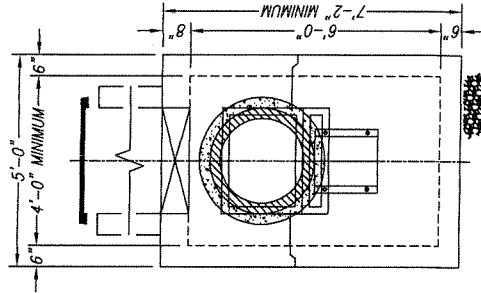
NSBB STORAGE CAPACITIES	
FILTRATION SCREEN CAPACITY	
LENGTH (FT)	4.25
WIDTH (FT)	2.50
HEIGHT (FT)	1.92
TOTAL (CF)	20.40
SEDIMENT CHAMBER CAPACITY	
CHAMBER 1	3.17
	4.00
CHAMBER 2	3.17
	4.00
	3.00
	38.04
	3.00
	38.04



PLAN VIEW
NTS



ELEVATION VIEW
NTS



END VIEW
NTS

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P 760.433.7640 F 760.433.3176

NSBB-4-6.5-72
DUAL STAGE HYDRODYNAMIC SEPARATOR
STANDARD DETAIL

SITE SPECIFIC DATA *	
PROJECT NAME	PORTOLA WATER QUALITY
PROJECT LOCATION	LAKE FOREST, CA
STRUCTURE ID	Basin 5
WATER QUALITY FLOW RATE (CFS)	7.23
PEAK FLOW RATE (CFS)	178.20
PEAK STORM DURATION (YEARS)	100

PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1	*	RCP	48"
OUTLET PIPE 1	*	RCP	48"
RIM ELEVATION	*		
SURFACE LOADING REQUIREMENT			
CORROSIVE SOIL CONDITIONS			
KNOWN GROUNDWATER ELEVATION			
NOTES:			

*PER ENGINEER OF RECORD

GENERAL NOTES

- BIO CLEAN TO PROVIDE ALL MATERIALS UNLESS OTHERWISE NOTED.
- ALL DIMENSIONS, ELEVATIONS, SPECIFICATIONS, AND CAPACITIES ARE SUBJECT TO CHANGE. FOR PROJECT SPECIFIC DRAWINGS DETAILING EXACT DIMENSIONS, WEIGHTS, AND ACCESSORIES PLEASE CONTACT BIO CLEAN.
- SLIDING LIDS FOR THE SCREEN SYSTEM ARE AVAILABLE UPON REQUEST.
- FULL CAPTURE SCREEN AVAILABLE UPON REQUEST.

INSTALLATION NOTES

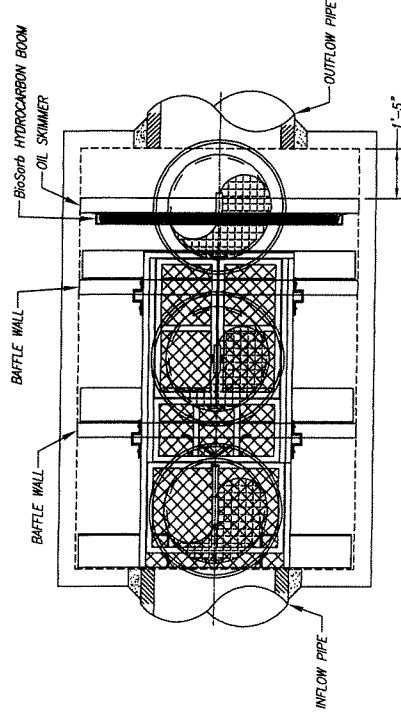
- CONTRACTOR TO PROVIDE ALL LABOR, EQUIPMENT, MATERIALS, AND INCIDENTALS REQUIRED TO OFFLOAD AND INSTALL THE NSBB UNIT AND APPURTENANCES IN ACCORDANCE WITH THIS DRAWING AND THE MANUFACTURERS SPECIFICATIONS, UNLESS OTHERWISE STATED IN MANUFACTURERS CONTRACT.
- MANUFACTURER RECOMMENDS A MINIMUM 6"-12" LEVEL ROCK BASE UNLESS SPECIFIED BY THE PROJECT ENGINEER. CONTRACTOR IS RESPONSIBLE TO VERIFY PROJECT ENGINEERS RECOMMENDED BASE SPECIFICATIONS.
- ALL PIPES MUST BE FLUSH WITH INSIDE SURFACE OF CONCRETE. (PIPES CANNOT INTRUDE BEYOND FLUSH).
- INVERT OF OUTFLOW PIPE MUST BE 3" ABOVE BOTTOM OF SKIMMER WALL.
- ALL GAPS AROUND PIPES SHALL BE SEALED TIGHT WITH A NON-SHRINK GROUT PER MANUFACTURERS STANDARD CONNECTION DETAIL AND SHALL MEET OR EXCEED REGIONAL PIPE CONNECTION STANDARDS.
- CONTRACTOR RESPONSIBLE FOR INSTALLATION OF ALL RISERS, MANHOLES, AND HATCHES. ALL COVERS SHALL BE SHIPPED LOOSE. CONTRACTOR TO GROUT ALL MANHOLES AND HATCHES TO MATCH FINISHED SURFACE UNLESS SPECIFIED OTHERWISE.

NSBB PERFORMANCE DATA

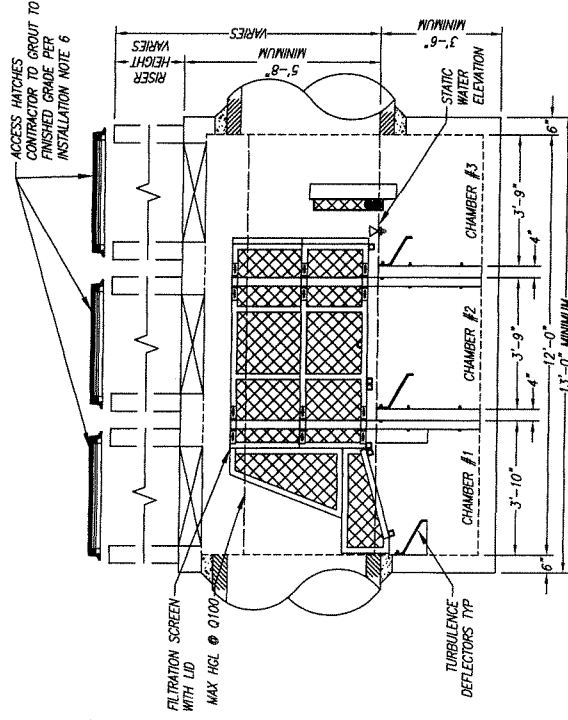
TREATMENT FLOW RATE (CFS)	7.89
SETTLING AREA (SF)	96
LOADING RATE (GPM/SF)	37
SCREEN SYSTEM STORAGE CAPACITY (CF)	113.79
SEDIMENT STORAGE CAPACITY (CF)	181.92
80% TSS REMOVAL @ 125 MICRONS	

NSBB STORAGE CAPACITIES

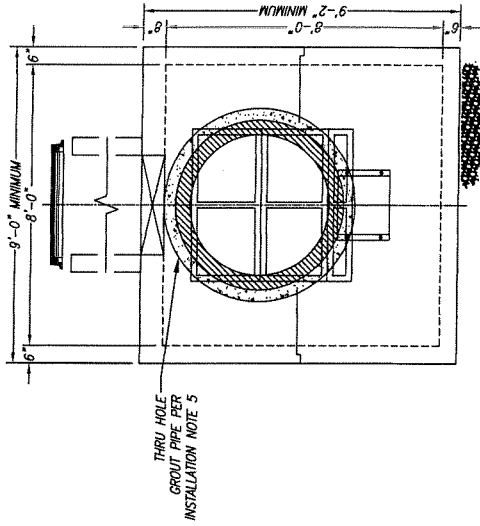
FILTRATION SCREEN CAPACITY			
LENGTH (FT)	WIDTH (FT)	HEIGHT (FT)	TOTAL (CF)
9.00	4.33	2.92	113.79
SEDIMENT CHAMBER CAPACITY			
CHAMBER 1	3.83	8.00	3.00
CHAMBER 2	3.75	8.00	3.00
CHAMBER 3	3.75	8.00	3.00



PLAN VIEW
NTS



ELEVATION VIEW
NTS



END VIEW
NTS

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THE PROJECT DESCRIBED MAY BE FINANCED BY ONE OR MORE OF THE FOLLOWING US PATENTED & COVERED: 7,252,208; 7,408,327; 7,125,414; 7,420,177; RELATED FOREIGN PATENTS OR OTHER PATENT PENDING.

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NSBB-8-12-96
DUAL STAGE HYDRODYNAMIC SEPARATOR
STANDARD DETAIL

SITE SPECIFIC DATA *	
PROJECT NAME	PORTOLA WATER QUALITY
PROJECT LOCATION	LAKE FOREST, CA
STRUCTURE ID	BASIN 4
WATER QUALITY FLOW RATE (CFS)	1.55
PEAK FLOW RATE (CFS)	31.60
PEAK STORM DURATION (YEARS)	100

PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1	*	RCP	24"
OUTLET PIPE 1	*	RCP	24"
RIM ELEVATION	*	*	*
SURFACE LOADING REQUIREMENT			
CORROSIVE SOIL CONDITIONS			
KNOWN GROUNDWATER ELEVATION			

NOTES:

*PER ENGINEER OF RECORD

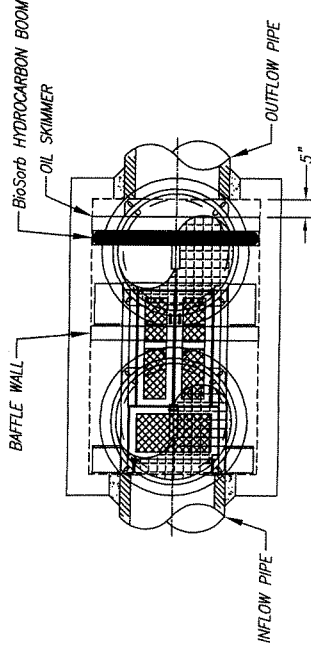
GENERAL NOTES

- BIO CLEAN TO PROVIDE ALL MATERIALS UNLESS OTHERWISE NOTED.
- ALL DIMENSIONS, ELEVATIONS, SPECIFICATIONS, AND CAPACITIES ARE SUBJECT TO CHANGE. FOR PROJECT SPECIFIC DRAWINGS DETAILING EXACT DIMENSIONS, WEIGHTS, AND ACCESSORIES PLEASE CONTACT BIO CLEAN.
- SLIDING LIDS FOR THE SCREEN SYSTEM ARE AVAILABLE UPON REQUEST.
- FULL CAPTURE SCREEN AVAILABLE UPON REQUEST.

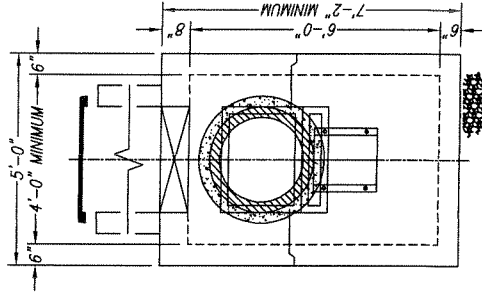
INSTALLATION NOTES

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- ALL PIPES MUST BE FLUSH WITH INSIDE SURFACE OF CONCRETE. (PIPES CANNOT INTRUDE BEYOND FLUSH).
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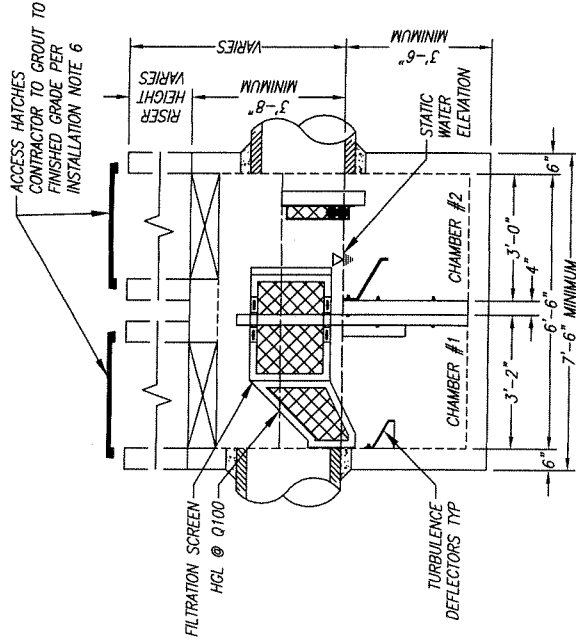
NSBB PERFORMANCE DATA			
TREATMENT FLOW RATE (CFS)	2.14		
SETTLING AREA (SF)	26		
LOADING RATE (GPM/SF)	37		
SCREEN SYSTEM STORAGE CAPACITY (CF)	20.40		
SEDIMENT STORAGE CAPACITY (CF)	76.08		
80% TSS REMOVAL @ 125 MICRONS			
NSBB STORAGE CAPACITIES			
FILTRATION SCREEN CAPACITY			
LENGTH (FT)	WIDTH (FT)	HEIGHT (FT)	TOTAL (CF)
4.25	2.50	1.92	20.40
SEDIMENT CHAMBER CAPACITY			
CHAMBER 1	3.17	4.00	38.04
CHAMBER 2	3.17	4.00	38.04



PLAN VIEW
NTS



END VIEW
NTS



ELEVATION VIEW
NTS

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IN ANY FORM OR BY ANY MEANS, ELECTRONIC OR MECHANICAL, INCLUDING PHOTOCOPYING,
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NSBB-4-6.5-72
DUAL STAGE HYDRODYNAMIC SEPARATOR
STANDARD DETAIL

SITE SPECIFIC DATA*	
PROJECT NAME	PORTOLA WATER QUALITY
PROJECT LOCATION	LAKE FOREST, CA
STRUCTURE ID	BASIN 8A
WATER QUALITY FLOW RATE (CFS)	0.43
PEAK FLOW RATE (CFS)	12.40
PEAK STORM DURATION (YEARS)	100

PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1	*	RCP	18"
OUTLET PIPE 1	*	RCP	18"
RIM ELEVATION		*	
SURFACE LOADING REQUIREMENT			
CORROSIVE SOIL CONDITIONS			
KNOWN GROUNDWATER ELEVATION			

NOTES:

*PER ENGINEER OF RECORD

GENERAL NOTES

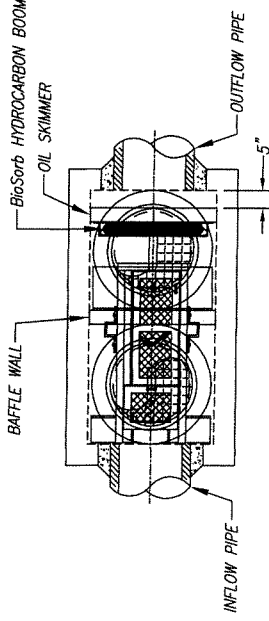
- BIO CLEAN TO PROVIDE ALL MATERIALS UNLESS OTHERWISE NOTED.
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- SLIDING LIDS FOR THE SCREEN SYSTEM ARE AVAILABLE UPON REQUEST.
- FULL CAPTURE SCREEN AVAILABLE UPON REQUEST.

INSTALLATION NOTES

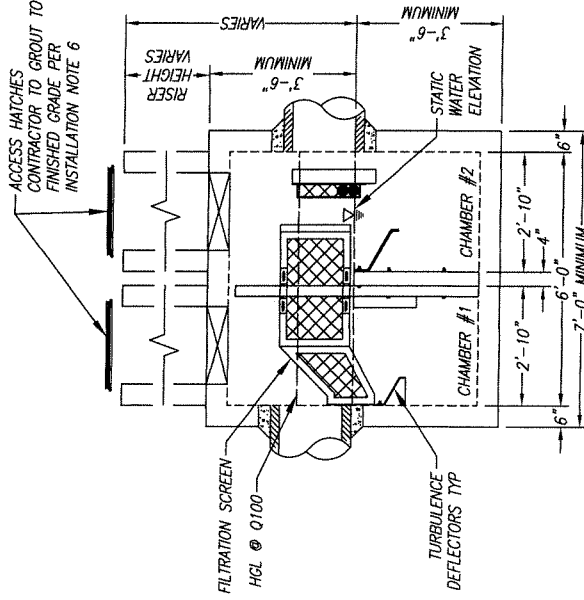
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NSBB PERFORMANCE DATA	
TREATMENT FLOW RATE (CFS)	1.48
SETTLING AREA (SF)	18
LOADING RATE (GPM/SF)	37
SCREEN SYSTEM STORAGE CAPACITY (CF)	11.85
SEDIMENT STORAGE CAPACITY (CF)	50.94
80% TSS REMOVAL @ 125 MICRONS	

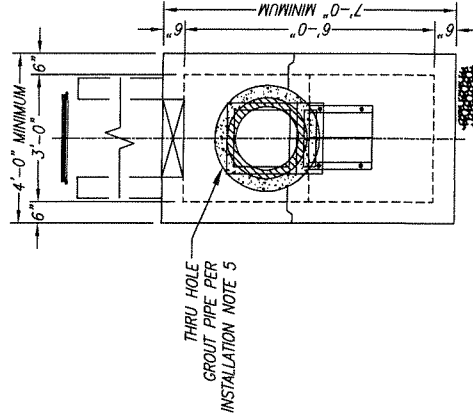
NSBB STORAGE CAPACITIES			
FILTRATION SCREEN CAPACITY			
LENGTH (FT)	WIDTH (FT)	HEIGHT (FT)	TOTAL (CF)
4.25	1.67	1.87	11.85
SEDIMENT CHAMBER CAPACITY			
CHAMBER 1	2.83	3.00	25.47
CHAMBER 2	2.83	3.00	25.47



PLAN VIEW
NTS



ELEVATION VIEW
NTS



END VIEW
NTS

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THE PRODUCT DESCRIBED MAY BE PROVIDED BY ONE OR MORE OF THE FOLLOWING US PATENTS: 6,496,892; 7,284,208; 7,046,327; 7,183,617; 7,270,747; 7,270,748; 7,270,749; 7,270,750; 7,270,751; 7,270,752; 7,270,753; 7,270,754; 7,270,755; 7,270,756; 7,270,757; 7,270,758; 7,270,759; 7,270,760; 7,270,761; 7,270,762; 7,270,763; 7,270,764; 7,270,765; 7,270,766; 7,270,767; 7,270,768; 7,270,769; 7,270,770; 7,270,771; 7,270,772; 7,270,773; 7,270,774; 7,270,775; 7,270,776; 7,270,777; 7,270,778; 7,270,779; 7,270,780; 7,270,781; 7,270,782; 7,270,783; 7,270,784; 7,270,785; 7,270,786; 7,270,787; 7,270,788; 7,270,789; 7,270,790; 7,270,791; 7,270,792; 7,270,793; 7,270,794; 7,270,795; 7,270,796; 7,270,797; 7,270,798; 7,270,799; 7,270,800; 7,270,801; 7,270,802; 7,270,803; 7,270,804; 7,270,805; 7,270,806; 7,270,807; 7,270,808; 7,270,809; 7,270,810; 7,270,811; 7,270,812; 7,270,813; 7,270,814; 7,270,815; 7,270,816; 7,270,817; 7,270,818; 7,270,819; 7,270,820; 7,270,821; 7,270,822; 7,270,823; 7,270,824; 7,270,825; 7,270,826; 7,270,827; 7,270,828; 7,270,829; 7,270,830; 7,270,831; 7,270,832; 7,270,833; 7,270,834; 7,270,835; 7,270,836; 7,270,837; 7,270,838; 7,270,839; 7,270,840; 7,270,841; 7,270,842; 7,270,843; 7,270,844; 7,270,845; 7,270,846; 7,270,847; 7,270,848; 7,270,849; 7,270,850; 7,270,851; 7,270,852; 7,270,853; 7,270,854; 7,270,855; 7,270,856; 7,270,857; 7,270,858; 7,270,859; 7,270,860; 7,270,861; 7,270,862; 7,270,863; 7,270,864; 7,270,865; 7,270,866; 7,270,867; 7,270,868; 7,270,869; 7,270,870; 7,270,871; 7,270,872; 7,270,873; 7,270,874; 7,270,875; 7,270,876; 7,270,877; 7,270,878; 7,270,879; 7,270,880; 7,270,881; 7,270,882; 7,270,883; 7,270,884; 7,270,885; 7,270,886; 7,270,887; 7,270,888; 7,270,889; 7,270,890; 7,270,891; 7,270,892; 7,270,893; 7,270,894; 7,270,895; 7,270,896; 7,270,897; 7,270,898; 7,270,899; 7,270,900; 7,270,901; 7,270,902; 7,270,903; 7,270,904; 7,270,905; 7,270,906; 7,270,907; 7,270,908; 7,270,909; 7,270,910; 7,270,911; 7,270,912; 7,270,913; 7,270,914; 7,270,915; 7,270,916; 7,270,917; 7,270,918; 7,270,919; 7,270,920; 7,270,921; 7,270,922; 7,270,923; 7,270,924; 7,270,925; 7,270,926; 7,270,927; 7,270,928; 7,270,929; 7,270,930; 7,270,931; 7,270,932; 7,270,933; 7,270,934; 7,270,935; 7,270,936; 7,270,937; 7,270,938; 7,270,939; 7,270,940; 7,270,941; 7,270,942; 7,270,943; 7,270,944; 7,270,945; 7,270,946; 7,270,947; 7,270,948; 7,270,949; 7,270,950; 7,270,951; 7,270,952; 7,270,953; 7,270,954; 7,270,955; 7,270,956; 7,270,957; 7,270,958; 7,270,959; 7,270,960; 7,270,961; 7,270,962; 7,270,963; 7,270,964; 7,270,965; 7,270,966; 7,270,967; 7,270,968; 7,270,969; 7,270,970; 7,270,971; 7,270,972; 7,270,973; 7,270,974; 7,270,975; 7,270,976; 7,270,977; 7,270,978; 7,270,979; 7,270,980; 7,270,981; 7,270,982; 7,270,983; 7,270,984; 7,270,985; 7,270,986; 7,270,987; 7,270,988; 7,270,989; 7,270,990; 7,270,991; 7,270,992; 7,270,993; 7,270,994; 7,270,995; 7,270,996; 7,270,997; 7,270,998; 7,270,999; 7,271,000.

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NSBB-3-6-72
DUAL STAGE HYDRODYNAMIC SEPARATOR
STANDARD DETAIL

SITE SPECIFIC DATA *	
PROJECT NAME	PORTOLA WATER QUALITY
PROJECT LOCATION	LAKE FOREST, CA
STRUCTURE ID	BASIN 8B
WATER QUALITY FLOW RATE (CFS)	0.64
PEAK FLOW RATE (CFS)	16.90
PEAK STORM DURATION (YEARS)	100

PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1	*	RCP	24"
OUTLET PIPE 1	*	RCP	24"
RIM ELEVATION	*		
SURFACE LOADING REQUIREMENT			
CORROSIVE SOIL CONDITIONS			
KNOWN GROUNDWATER ELEVATION			

NOTES:

*PER ENGINEER OF RECORD

GENERAL NOTES

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- SLIDING LIDS FOR THE SCREEN SYSTEM ARE AVAILABLE UPON REQUEST.
- FULL CAPTURE SCREEN AVAILABLE UPON REQUEST.

INSTALLATION NOTES

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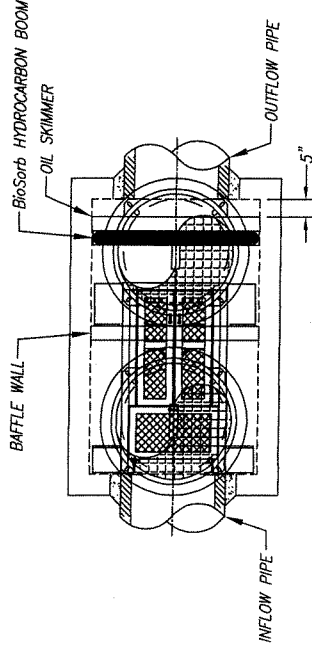
THE PRODUCT DESCRIBED MAY BE PROTECTED BY ONE OR MORE OF THE FOLLOWING US PATENTS: 6,426,882; 7,284,208; 7,444,427; 7,444,475; 7,270,777; ISSUED FOREIGN PATENTS ON OTHER PATENTING JURISDICTIONS.

NSBB PERFORMANCE DATA

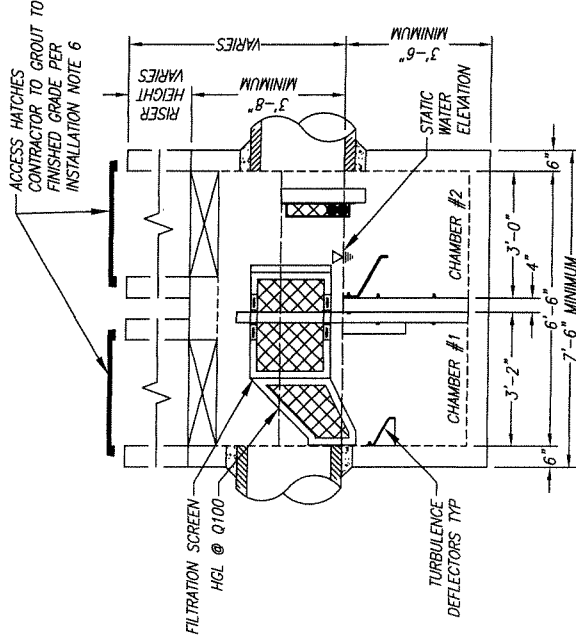
TREATMENT FLOW RATE (CFS)	2.14
SETTLING AREA (SF)	26
LOADING RATE (OPM/SF)	37
SCREEN SYSTEM STORAGE CAPACITY (CF)	20.40
SEDIMENT STORAGE CAPACITY (CF)	76.08
80% TSS REMOVAL @ 125 MICRONS	

NSBB STORAGE CAPACITIES

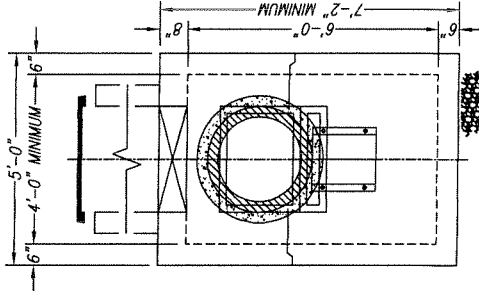
FILTRATION SCREEN CAPACITY			
LENGTH (FT)	WIDTH (FT)	HEIGHT (FT)	TOTAL (CF)
4.25	2.50	1.92	20.40
SEDIMENT CHAMBER CAPACITY			
CHAMBER 1	3.17	4.00	38.04
CHAMBER 2	3.17	4.00	38.04



PLAN VIEW
NTS



ELEVATION VIEW
NTS



END VIEW
NTS

BIO CLEAN
ENVIRONMENTAL SERVICES, INC.
biocleanenvironmental.com
P. 760.433.7640 F. 760.433.3176

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NSBB-4-6.5-72
DUAL STAGE HYDRODYNAMIC SEPARATOR
STANDARD DETAIL

SITE SPECIFIC DATA *	
PROJECT NAME	PORTOLA WATER QUALITY
PROJECT LOCATION	FOREST LAKE, CA
STRUCTURE ID	Basin 9
WATER QUALITY FLOW RATE (CFS)	1.38
PEAK FLOW RATE (CFS)	29
PEAK FLOW DURATION (YEARS)	100

PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1	*	RCP	30"
OUTLET PIPE 1	*	RCP	30"
RIM ELEVATION	*		
SURFACE LOADING REQUIREMENT			
CORROSIVE SOIL CONDITIONS			
KNOWN GROUNDWATER ELEVATION			
NOTES:			

*PER ENGINEER OF RECORD

GENERAL NOTES

- BIO CLEAN TO PROVIDE ALL MATERIALS UNLESS OTHERWISE NOTED.
- ALL DIMENSIONS, ELEVATIONS, SPECIFICATIONS, AND CAPACITIES ARE SUBJECT TO CHANGE. FOR PROJECT SPECIFIC DRAWINGS, DETAILING EXACT DIMENSIONS, WEIGHTS, AND ACCESSORIES PLEASE CONTACT BIO CLEAN.
- SLIDING LIDS FOR THE SCREEN SYSTEM ARE AVAILABLE UPON REQUEST.
- FULL CAPTURE SCREEN AVAILABLE UPON REQUEST.

INSTALLATION NOTES

- CONTRACTOR TO PROVIDE ALL LABOR, EQUIPMENT, MATERIALS, AND INCIDENTALS REQUIRED TO OFFLOAD AND INSTALL THE NSBB UNIT AND APPURTENANCES IN ACCORDANCE WITH THIS DRAWING AND THE MANUFACTURERS SPECIFICATIONS, UNLESS OTHERWISE STATED IN MANUFACTURERS CONTRACT.
- MANUFACTURER RECOMMENDS A MINIMUM 6"-12" LEVEL ROCK BASE UNLESS SPECIFIED BY THE PROJECT ENGINEER. CONTRACTOR IS RESPONSIBLE TO VERIFY PROJECT ENGINEERS RECOMMENDED BASE SPECIFICATIONS.
- ALL PIPES MUST BE FLUSH WITH INSIDE SURFACE OF CONCRETE. (PIPES CANNOT INTRUDE BEYOND FLUSH)
- INVERT OF OUTFLOW PIPE MUST BE 3" ABOVE BOTTOM OF SKIMMER WALL.
- ALL GAPS AROUND PIPES SHALL BE SEALED WATER TIGHT WITH A NON-SHRINK GROUT PER MANUFACTURERS STANDARD CONNECTION DETAIL AND SHALL MEET OR EXCEED REGIONAL PIPE CONNECTION STANDARDS.
- CONTRACTOR RESPONSIBLE FOR INSTALLATION OF ALL RISERS, MANHOLES, AND HATCHES. ALL COVERS SHALL BE SHIPPED LOOSE. CONTRACTOR TO GROUT ALL MANHOLES AND HATCHES TO MATCH FINISHED SURFACE UNLESS SPECIFIED OTHERWISE.

THE PRODUCT DESCRIBED MAY BE PROTECTED BY ONE OR MORE OF THE FOLLOWING US PATENTS: 6,268,692; 7,286,206; 7,046,327; 7,433,171; 7,270,171; ISSUED FOREIGN PATENTS ON OTHER PENDING PENDING

NSBB PERFORMANCE DATA

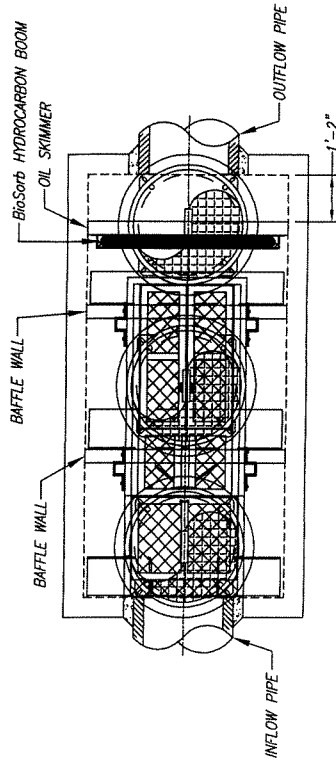
TREATMENT FLOW RATE (CFS)	4.32
SETTLING AREA (SF)	52.50
LOADING RATE (GPM/SF)	37
SCREEN SYSTEM STORAGE CAPACITY (CF)	45.62
SEDIMENT STORAGE CAPACITY (CF)	147.45
80% TSS REMOVAL @ 125 MICRONS	

NSBB STORAGE CAPACITIES

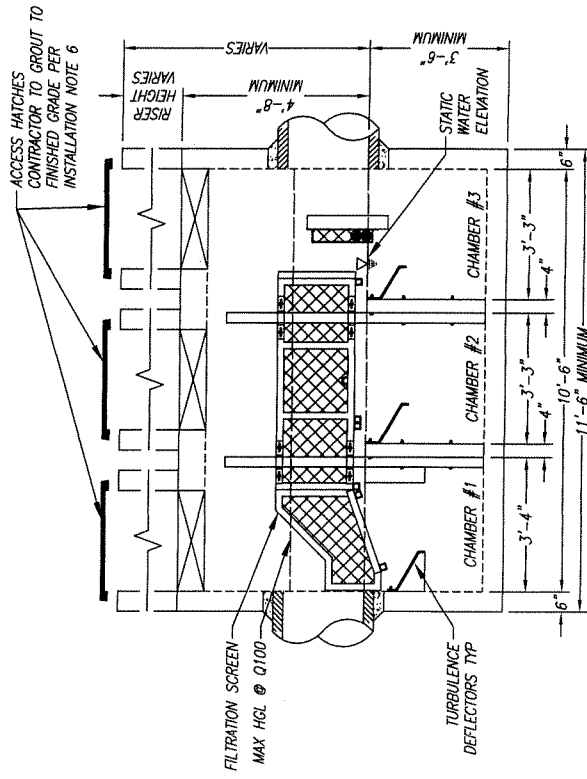
FILTRATION SCREEN CAPACITY		
LENGTH (FT)	WIDTH (FT)	HEIGHT (FT) TOTAL (CF)
7.92	3.00	1.92
1.92	45.62	

SEDIMENT CHAMBER CAPACITY

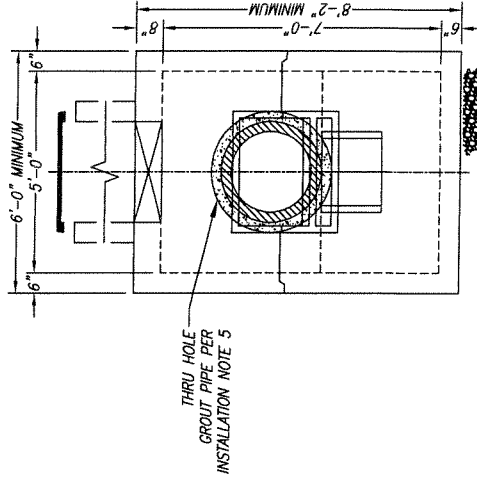
CHAMBER 1	3.33	5.00	3.00	49.95
CHAMBER 2	3.25	5.00	3.00	48.75
CHAMBER 3	3.25	5.00	3.00	48.75



PLAN VIEW
NTS



ELEVATION VIEW
NTS



END VIEW
NTS

NSBB-5-10.5-84
DUAL STAGE HYDRODYNAMIC SEPARATOR
STANDARD DETAIL

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Modular Wetland System Sizing
(Media Filter & Wetland/Bioretenention)

Model # MWS-L-UGV-2-1-S

Horizontal Flow Biotreatment Calculator

Project Name: **Portola**

Basin #: **1**

BMP Type: **Closed Vault with Horizontal Bioretention**

Design Capture Volume (cu-ft):	4356
Associated Tank Discharge Flow @ Volume Accumulate = WQV (cfs):	0.079
Associated Tank Discharge Flow @ Volume Accumulate = WQV (gpm):	35

Total Pre-Treatment Cartridge Surface Area (sq ft):	50	25 sq ft per cartridge
Total Cartridges Needed:	2	
Pre-Treatment Cartridge Infiltration Rate (in/hr):	200	
Pre-Treatment Cartridge Flow Rate (gpm/sq ft):	2	
Pre-Treatment Cartridges Peak Treatment Flow Rate (cfs):	0.111	

Pre-Treatment Cartridge Sized Appropriately: **yes**

Bioretention Media Infiltration Rate (in/hr):	100	TAPE approved loading rate
Bioretention Media Flow Rate (gpm/sq ft):	1	
Total Bioretention Media Surface Area Needed (sq ft):	35	
Total Bioretention Media Surface Area Provided (sq ft):	50.32	
Bioretention Media Peak Treatment Flow Rate (cfs):	0.112	

BMP Sized Appropriately: **yes**

Model # MWS-L-UGV-20-8

Horizontal Flow Biotreatment Calculator

Project Name: **Portola**

Basin # **3**

BMP Type: **Closed Vault with Horizontal Bioretention**

Design Capture Volume (cu-ft):	101059
Associated Tank Discharge Flow @ Volume Accumulate = WQV (cfs):	2.14
Associated Tank Discharge Flow @ Volume Accumulate = WQV (gpm):	961

Total Pre-Treatment Cartridge Surface Area (sq ft):	500	25 sq ft per cartridge
Total Cartridges Needed:	20	
Pre-Treatment Cartridge Infiltration Rate (in/hr):	200	
Pre-Treatment Cartridge Flow Rate (gpm/sq ft):	2	
Pre-Treatment Cartridges Peak Treatment Flow Rate (cfs):	2.228	

Pre-Treatment Cartridge Sized Appropriately: **yes**

Bioretention Media Infiltration Rate (in/hr):	100	
Bioretention Media Flow Rate (gpm/sq ft):	1	TAPE approved loading rate
Total Bioretention Media Surface Area Needed (sq ft):	961	
Total Bioretention Media Surface Area Provided (sq ft):	987.28	
Bioretention Media Peak Treatment Flow Rate (cfs):	2.199	

BMP Sized Appropriately: **yes**

Model # MWS-L-UGV-5-4

Horizontal Flow Biotreatment Calculator

Project Name: **Portola**

Basin # **4**

BMP Type **Closed Vault with Horizontal Bioretention**

Design Capture Volume (cu-ft):	38333
Associated Tank Discharge Flow @ Volume Accumulate = WQV (cfs):	0.54
Associated Tank Discharge Flow @ Volume Accumulate = WQV (gpm):	242

Total Pre-Treatment Cartridge Surface Area (sq ft):	125	25 sq ft per cartridge
Total Cartridges Needed:	5	
Pre-Treatment Cartridge Infiltration Rate (in/hr):	200	
Pre-Treatment Cartridge Flow Rate (gpm/sq ft):	2	
Pre-Treatment Cartridges Peak Treatment Flow Rate (cfs):	0.557	

Pre-Treatment Cartridge Sized Appropriately: **yes**

Bioretention Media Infiltration Rate (in/hr):	100	
Bioretention Media Flow Rate (gpm/sq ft):	1	TAPE approved loading rate
Total Bioretention Media Surface Area Needed (sq ft):	242	
Total Bioretention Media Surface Area Provided (sq ft):	282.08	
Bioretention Media Peak Treatment Flow Rate (cfs):	0.628	

BMP Sized Appropriately: **yes**

Model # MWS-L-UGV-39-28

Horizontal Flow Biotreatment Calculator

Project Name: **Portola**

Basin # **5**

BMP Type: **Closed Vault with Horizontal Bioretention**

Design Capture Volume (cu-ft):	169448
Associated Tank Discharge Flow @ Volume Accumulate = WQV (cfs):	4.32
Associated Tank Discharge Flow @ Volume Accumulate = WQV (gpm):	1939

Total Pre-Treatment Cartridge Surface Area (sq ft):	975	25 sq ft per cartridge
Total Cartridges Needed:	39	
Pre-Treatment Cartridge Infiltration Rate (in/hr):	200	
Pre-Treatment Cartridge Flow Rate (gpm/sq ft):	2	
Pre-Treatment Cartridges Peak Treatment Flow Rate (cfs):	4.344	

Pre-Treatment Cartridge Sized Appropriately: **yes**

Bioretention Media Infiltration Rate (in/hr):	100	TAPE approved loading rate
Bioretention Media Flow Rate (gpm/sq ft):	1	
Total Bioretention Media Surface Area Needed (sq ft):	1939	
Total Bioretention Media Surface Area Provided (sq ft):	1974.56	
Bioretention Media Peak Treatment Flow Rate (cfs):	4.399	

BMP Sized Appropriately: **yes**

Model # MWS-L-UGV-5-4

Horizontal Flow Biotreatment Calculator

Project Name:	Portola
---------------	---------

Basin #	7 A & B
---------	---------

BMP Type	Closed Vault with Horizontal Bioretention
----------	---

Design Capture Volume (cu-ft):	25625
Associated Tank Discharge Flow @ Volume Accumulate = WQV (cfs):	0.51
Associated Tank Discharge Flow @ Volume Accumulate = WQV (gpm):	229

Total Pre-Treatment Cartridge Surface Area (sq ft):	125
Total Cartridges Needed:	5
Pre-Treatment Cartridge Infiltration Rate (in/hr):	200
Pre-Treatment Cartridge Flow Rate (gpm/sq ft):	2
Pre-Treatment Cartridges Peak Treatment Flow Rate (cfs)	0.557

25 sq ft per cartridge

Pre-Treatment Cartridge Sized Appropriately:	yes
--	-----

Bioretention Media Infiltration Rate (in/hr):	100
Bioretention Media Flow Rate (gpm/sq ft):	1
Total Bioretention Media Surface Area Needed (sq ft)	229
Total Bioretention Media Surface Area Provided (sq ft)	282.08
Bioretention Media Peak Treatment Flow Rate (cfs)	0.628

TAPE approved loading rate

BMP Sized Appropriately:	yes
--------------------------	-----

Model # MWS-L-UGV-2-1

Horizontal Flow Biotreatment Calculator

Project Name: **Portola**

Basin # **8 A**

BMP Type **Closed Vault with Horizontal Bioretention**

Design Capture Volume (cu-ft):	10454
Associated Tank Discharge Flow @ Volume Accumulate = WQV (cfs):	0.166
Associated Tank Discharge Flow @ Volume Accumulate = WQV (gpm):	75

Total Pre-Treatment Cartridge Surface Area (sq ft):	50	25 sq ft per cartridge
Total Cartridges Needed:	2	
Pre-Treatment Cartridge Infiltration Rate (in/hr):	200	
Pre-Treatment Cartridge Flow Rate (gpm/sq ft):	2	
Pre-Treatment Cartridges Peak Treatment Flow Rate (cfs):	0.223	

Pre-Treatment Cartridge Sized Appropriately: **yes**

Bioretention Media Infiltration Rate (in/hr):	100	TAPE approved loading rate
Bioretention Media Flow Rate (gpm/sq ft):	1	
Total Bioretention Media Surface Area Needed (sq ft):	75	
Total Bioretention Media Surface Area Provided (sq ft):	78.48	
Bioretention Media Peak Treatment Flow Rate (cfs):	0.175	

BMP Sized Appropriately: **yes**

Model # MWS-L-UGV-3-2

Horizontal Flow Biotreatment Calculator

Project Name: **Portola**

Basin # **8 B**

BMP Type: **Closed Vault with Horizontal Bioretention**

Design Capture Volume (cu-ft):	15682
Associated Tank Discharge Flow @ Volume Accumulate = WQV (cfs):	0.226
Associated Tank Discharge Flow @ Volume Accumulate = WQV (gpm):	101

Total Pre-Treatment Cartridge Surface Area (sq ft):	75	25 sq ft per cartridge
Total Cartridges Needed:	3	
Pre-Treatment Cartridge Infiltration Rate (in/hr):	200	
Pre-Treatment Cartridge Flow Rate (gpm/sq ft):	2	
Pre-Treatment Cartridges Peak Treatment Flow Rate (cfs):	0.334	

Pre-Treatment Cartridge Sized Appropriately: **yes**

Bioretention Media Infiltration Rate (in/hr):	100	TAPE approved loading rate
Bioretention Media Flow Rate (gpm/sq ft):	1	
Total Bioretention Media Surface Area Needed (sq ft):	101	
Total Bioretention Media Surface Area Provided (sq ft):	141.04	
Bioretention Media Peak Treatment Flow Rate (cfs):	0.314	

BMP Sized Appropriately: **yes**

FLOW RATES

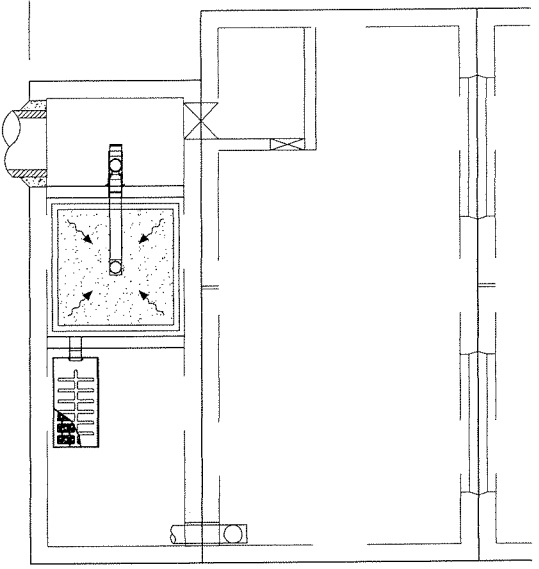
PEAK TREATMENT FLOW RATE
= 0.111 CFS OR 50 GPM

**BIOFILTRATION CHAMBER
SURFACE AREA CALC.**

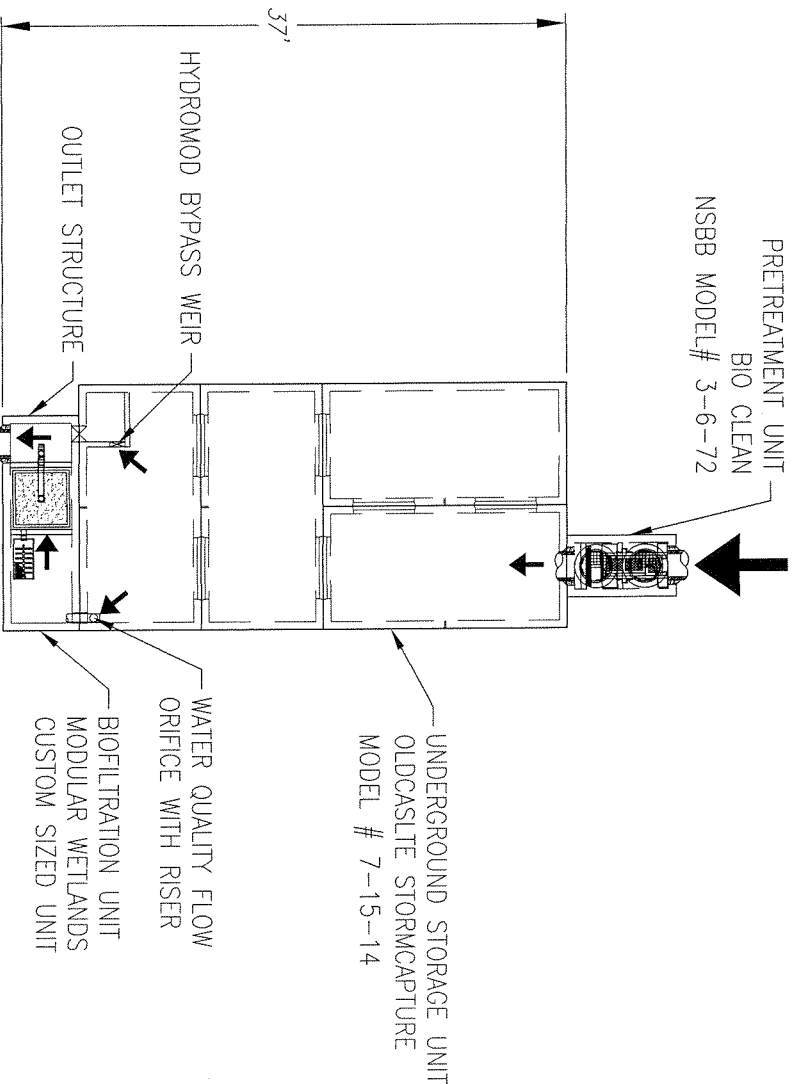
SIZES = 2
3.7' L x 3.4' H = 12.58 SF
SIZES = 4
12.98 x 4 SIZES = 50.32 SF
CELLS = 1
50.32 x 1 CELLS = 50 SF
TOTAL WEILANDS MEDIA SURFACE AREA
= 50 SF
WEILANDS MEDIA LOADING RATE
50 GPM / 50 SF
= 1.00 GPM/SF

**PRETREATMENT FILTER
SURFACE AREA CALC.**

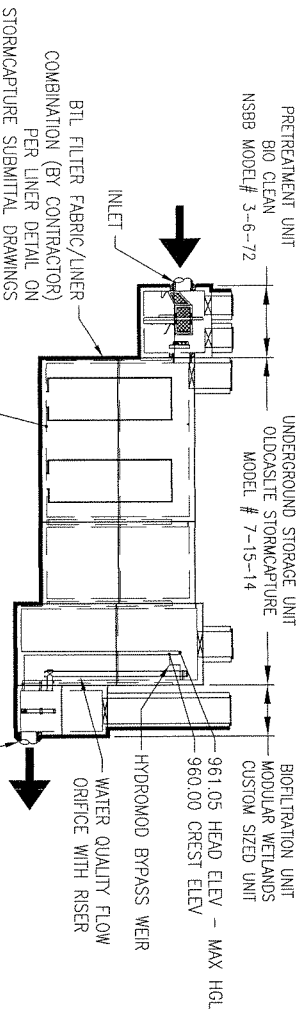
TOTAL PRETREATMENT SURFACE AREA
25 SF x 2 = 50 SF
PRETREATMENT FILTER LOADING RATE
50 GPM / 25 SF
= 2.00 GPM/SF



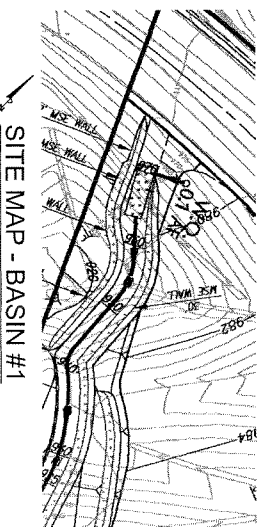
MODULAR WETLANDS DETAIL
NTS



PLAN VIEW
NTS



ELEVATION VIEW
NTS



SITE MAP - BASIN #1
NTS

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OCEANSIDE, CA 92049
www.ModularWetlands.com

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DATE	BY	REV	COMMENTS

TITLE: **BASIN #1**

PROJECT: **PORTOLA WATER QUALITY**

SIZE DWG. NO.:

REV:



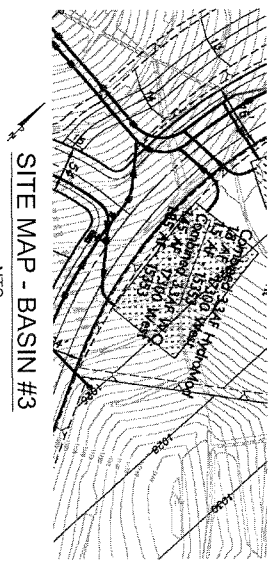
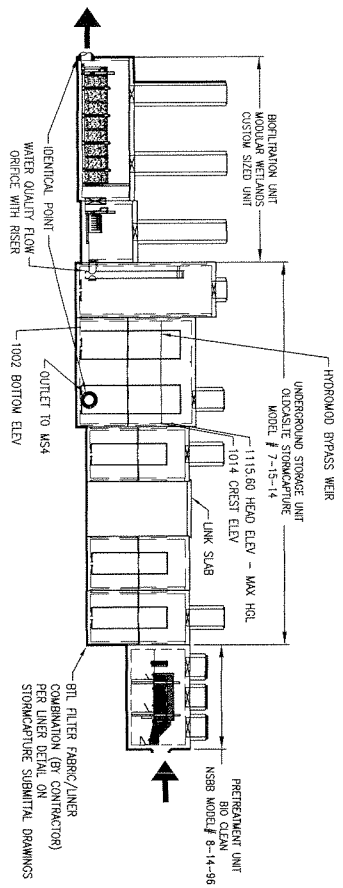
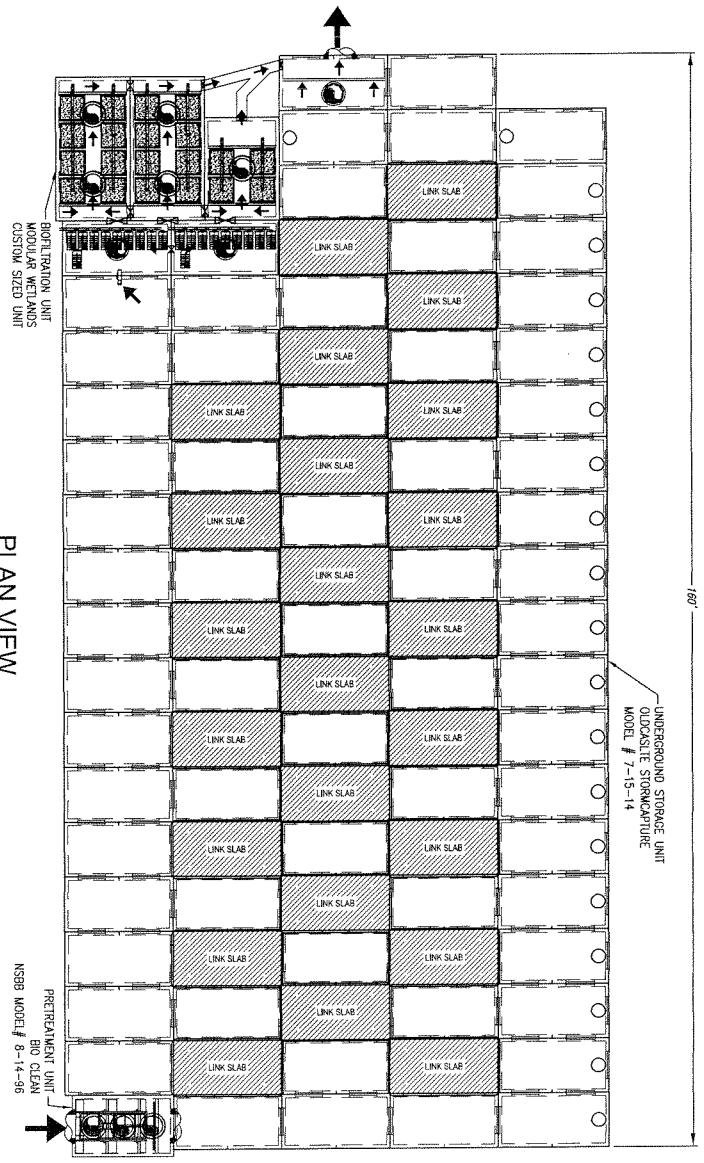
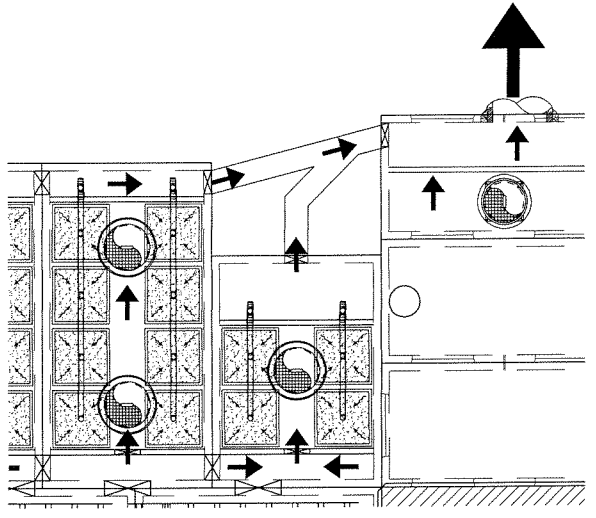
FLOW RATES

PEAK TREATMENT FLOW RATE
= 2.24 CFS OR 1,006.40 GPM

BIORETENTION CHAMBER SURFACE AREA CALCULATIONS

SIZES = 2
3.7' L x 3.4' H = 12.58 SF
SIZES = 4
12.58' x 4' SIZES = 50.32 SF
CELLS = 20
50.32 x 20 CELLS = 1006.40 SF
TOTAL WETLANDS MEDIA SURFACE AREA
= 1006.40 SF
WETLANDS MEDIA LOADING RATE
1006.40 GPM / 1006.40 SF
= 1.00 GPM/SF
PRETREATMENT FILTER SURFACE AREA
25 SF x 20 FILTERS
= 500 SF
PRETREATMENT FILTER LOADING RATE
1006.40 GPM / 500 SF
= 2.01 GPM/SF

PORTOLA CENTER WATER QUALITY BASIN #3



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				SHEET 1 OF 1	

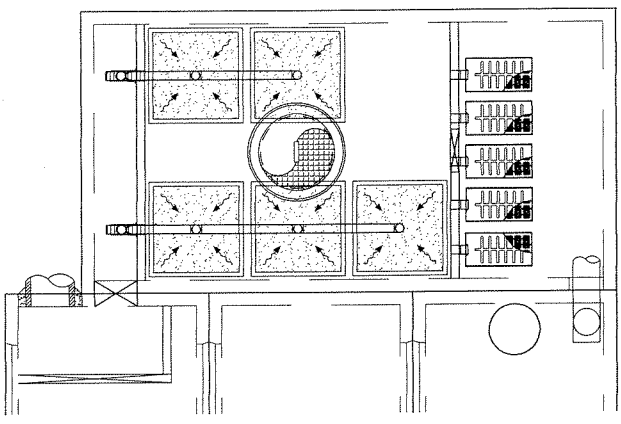
FLOW RATES

PEAK TREATMENT FLOW RATE
= 0.56 CFS OR 251.60 GPM

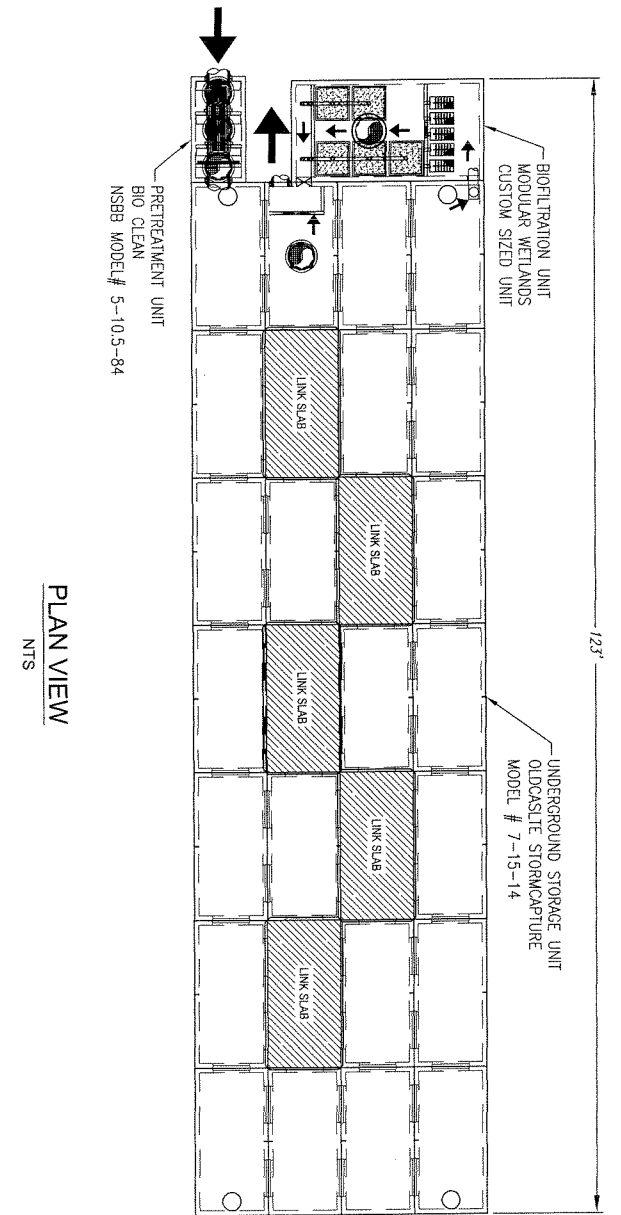
BIOFILTRATION CHAMBER SURFACE AREA CALC.

SOLES = 2
3.7' L x 4.4' H = 12.58 SF
SOLES = 4
12.58 x 4 SOLES = 50.32 SF
CELLS = 5
50.32 x 5 CELLS = 251.60 SF
TOTAL WETLANDS MEDIA SURFACE AREA = 251.60 SF
WETLANDS MEDIA LOADING RATE = 251.60 GPM / 251.60 SF = 1.00 GPM/SF
PRETREATMENT FILTER SURFACE AREA CALC.
TOTAL PRETREATMENT SURFACE AREA = 25 SF x 4 SOLES = 100 SF
PRETREATMENT FILTER LOADING RATE = 251.60 GPM / 100 SF = 2.516 GPM/SF

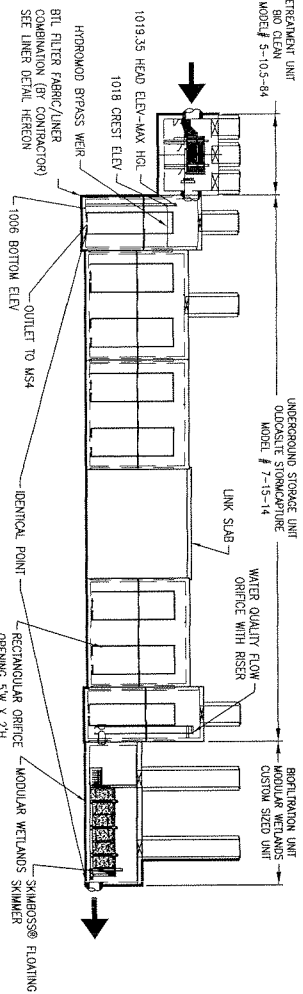
PORTOLA CENTER WATER QUALITY BASIN #4



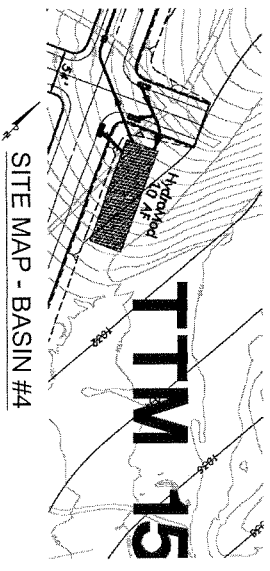
MODULAR WETLANDS DETAIL
NTS



PLAN VIEW
NTS



ELEVATION VIEW/ FLOW PATH DIAGRAM
NTS



SITE MAP - BASIN #4
NTS

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PROPRIETARY AND CONFIDENTIAL	DB/AM	DATE	PORTOLA WATER QUALITY
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	COMMENTS:		REV
			SHEET 1 OF 1

FLOW RATES

PEAK TREATMENT FLOW RATE
= 4.49 CFS OR 2,012.80 GPM

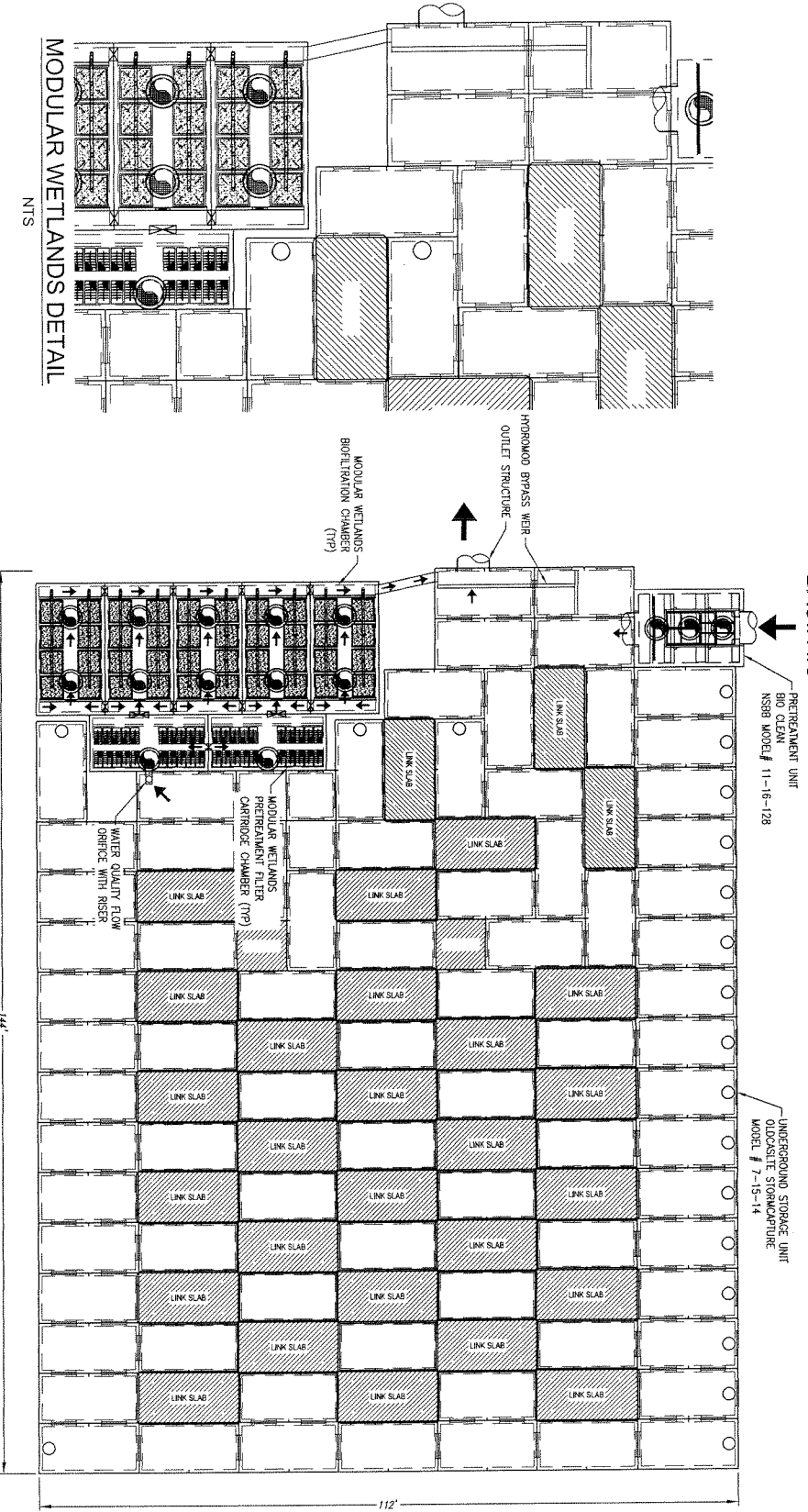
DIGESTION CHAMBER SURFACE AREA CALC

SIZES = 2
31.7' L x 3.4' H = 12.58 SF
SIZES = 4
12.58 x 4 SIZES = 50.32 SF
CELLS = 40
50.32 x 40 CELLS = 2,012.80 SF
TOTAL WETLANDS MEDIA SURFACE AREA
= 2,012.80 SF
WETLANDS MEDIA LOADING RATE
2012.80 GPM / 2,012.80 SF
= 1.00 GPM/SF
PRETREATMENT FILTER SURFACE AREA CALC

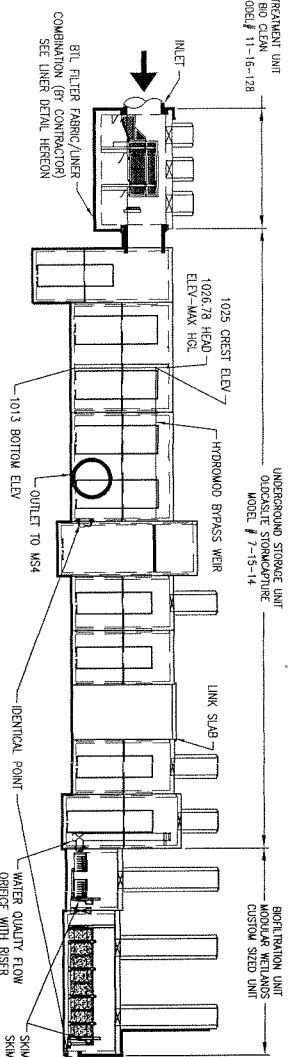
TOTAL PRETREATMENT SURFACE AREA
25 SF x 40 FILTERS
= 1,000 SF
PRETREATMENT FILTER SURFACE AREA
2,012.80 GPM / 1,000 SF
= 2.01 GPM/SF

PORTOLA CENTER WATER QUALITY BASIN #5

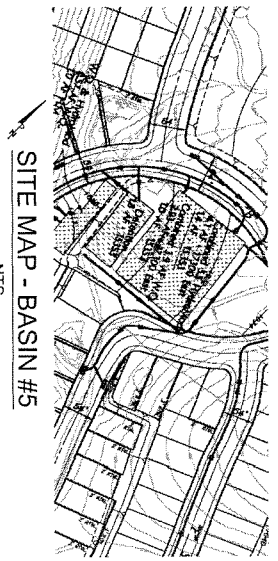
BASIN #5



ELEVATION VIEW



PLAN VIEW



ELEVATION VIEW

NTS

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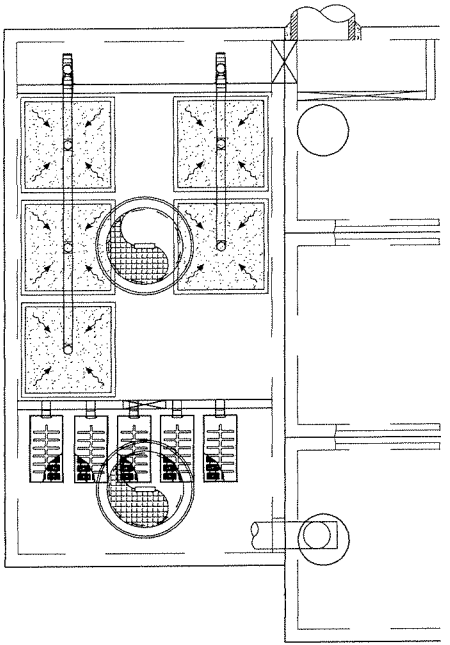
NO.	DATE	BY	REV
1			

TITLE: **BASIN #5**
PORTOLA WATER QUALITY
SIZE DWG. NO.
REV



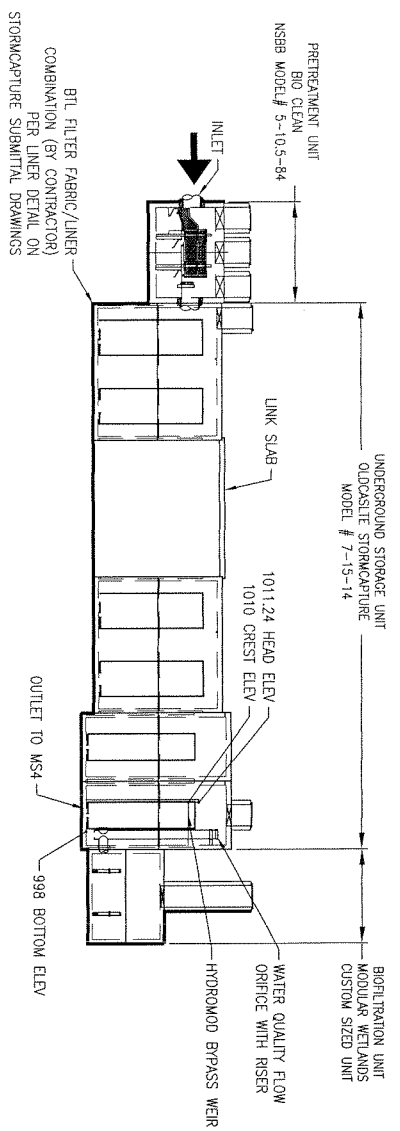
FLOW RATES
 PEAK TREATMENT FLOW RATE
 = 0.56 CFS OR 251.60 GPM

BIOFILTRATION CHAMBER SURFACE AREA CALCUS
 SIZES = 2
 3.7' L x 3.4' H = 12.58 SF
 SIZES = 4
 12.58 x 4 SIZES = 50.32 SF
 CELLS = 5
 50.32 x 5 CELLS = 251.60 SF
 TOTAL WETLANDS MEDIA SURFACE AREA
 = 251.60 SF
 WETLANDS MEDIA LOADING RATE
 251.60 GPM / 251.60 SF
 = 1.00 GPM/SF
PRETREATMENT FILTER SURFACE AREA CALCUS
 TOTAL PRETREATMENT SURFACE AREA
 25 SF = 125 SF
 PRETREATMENT FILTER LOADING RATE
 251.60 GPM / 125 SF
 = 2.01 GPM/SF

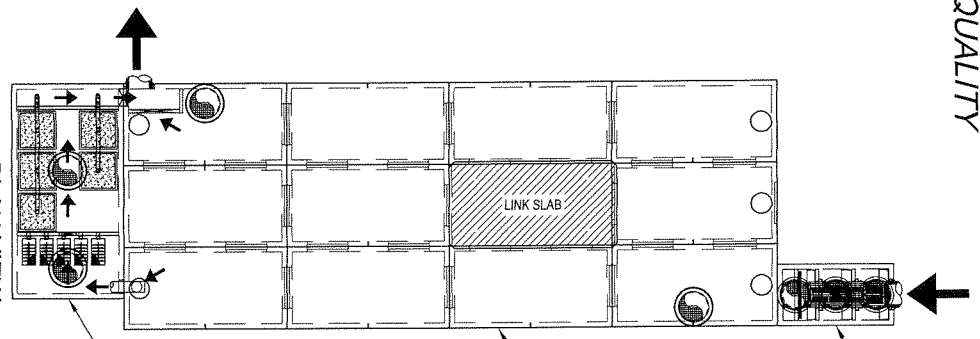


MODULAR WETLANDS DETAIL
 NTS

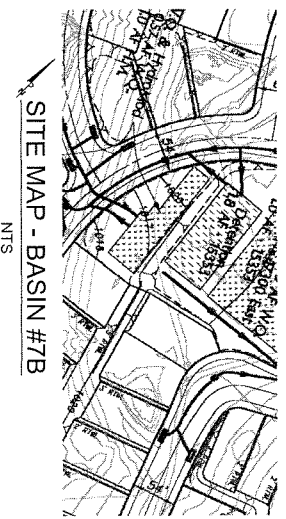
PORTOLA CENTER WATER QUALITY BASIN # 7B



ELEVATION VIEW
 NTS



PLAN VIEW
 NTS



SITE MAP - BASIN #7B
 NTS

MODULAR WETLANDS SYSTEMS INC. P.O. BOX 869 600 W. WASHINGTON ST. PORTLAND, OR 97208 WWW.MWTSYSTEMS.COM		MAKE DATE	TITLE: BASIN #7B
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	COMMENTS	SIZE DWG. NO.	REV
			SHEET 1 OF 1



PORTOLA CENTER WATER QUALITY BASIN #8B

FLOW RATES

PEAK TREATMENT FLOW RATE = 0.34 CFS OR 150.96 GPM

BIOFILTRATION CHAMBER SURFACE AREA CALC.

3.7' L x 3.4' H = 12.58 SF

12.58 x 4 SIZES = 50.32 SF

50.32 x 3 CELLS = 150.96 SF

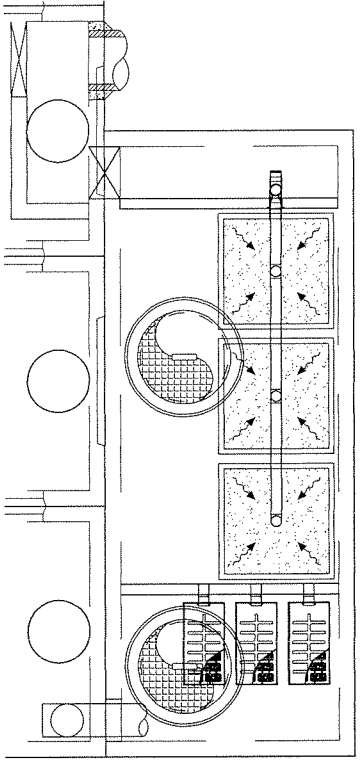
TOTAL WETLANDS MEDIA SURFACE AREA = 150.96 SF

WETLANDS MEDIA LOADING RATE 150.96 GPM / 150.96 SF = 1.00 GPM/SF

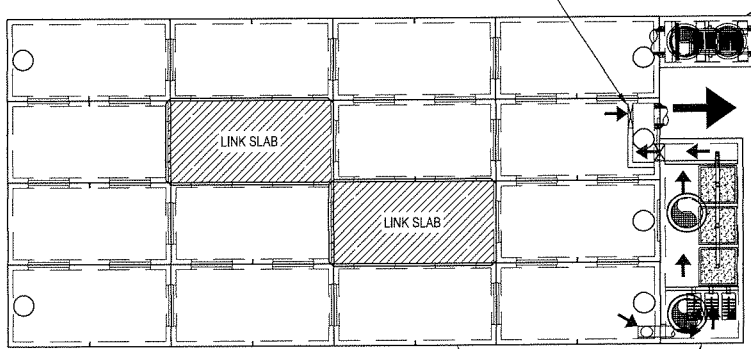
PRETREATMENT FILTER SURFACE AREA CALC.

TOTAL PRETREATMENT SURFACE AREA 25 SF x 7.2 SF = 180 SF

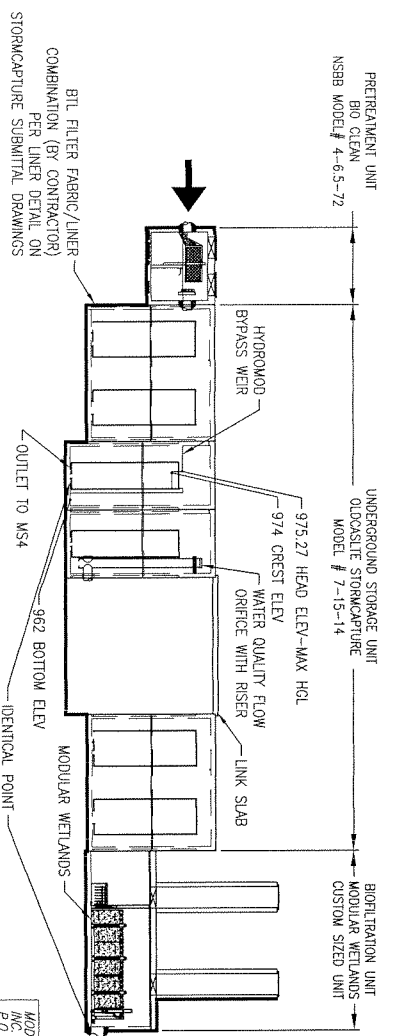
PRETREATMENT FILTER LOADING RATE 150.96 GPM / 75 SF = 2.01 GPM/SF



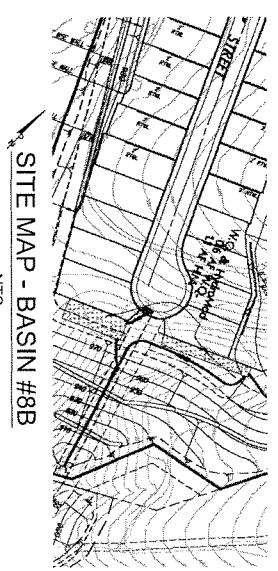
MODULAR WETLANDS DETAIL
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PLAN VIEW
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ELEVATION VIEW
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SITE MAP - BASIN #8B
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