

**STORMWATER CALCULATIONS
ADDENDUM**

555 Hopping Brook Road

Holliston, Massachusetts

Prepared For:

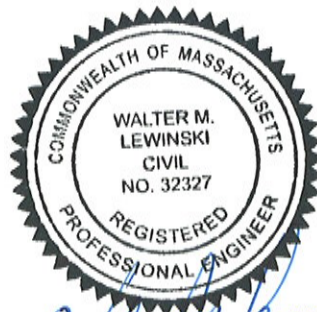
CRG INTEGRATED REAL ESTATE SOLUTIONS
200 BARR HARBOR DRIVE
CONSHOHOCKEN, PA 19248

Prepared By:

**Engineering
Design
Consultants, Inc.**

32 Turnpike Road
Southborough, Massachusetts 01772

MAY 11, 2021



Walter M. Lewinski

TABLE OF CONTENTS

	Page No.
Cover Page	1
Table of Contents	2
LUHHPL Narrative	3
HydroCAD overall diagram	4
Analysis for DMH 13 & Treatment with details	5-20
Analysis for DMH 29 & Treatment with details	21-40
Analysis for DMH 34 & Treatment with details	41-59
Analysis for DMH 43 & Treatment with details	60-80

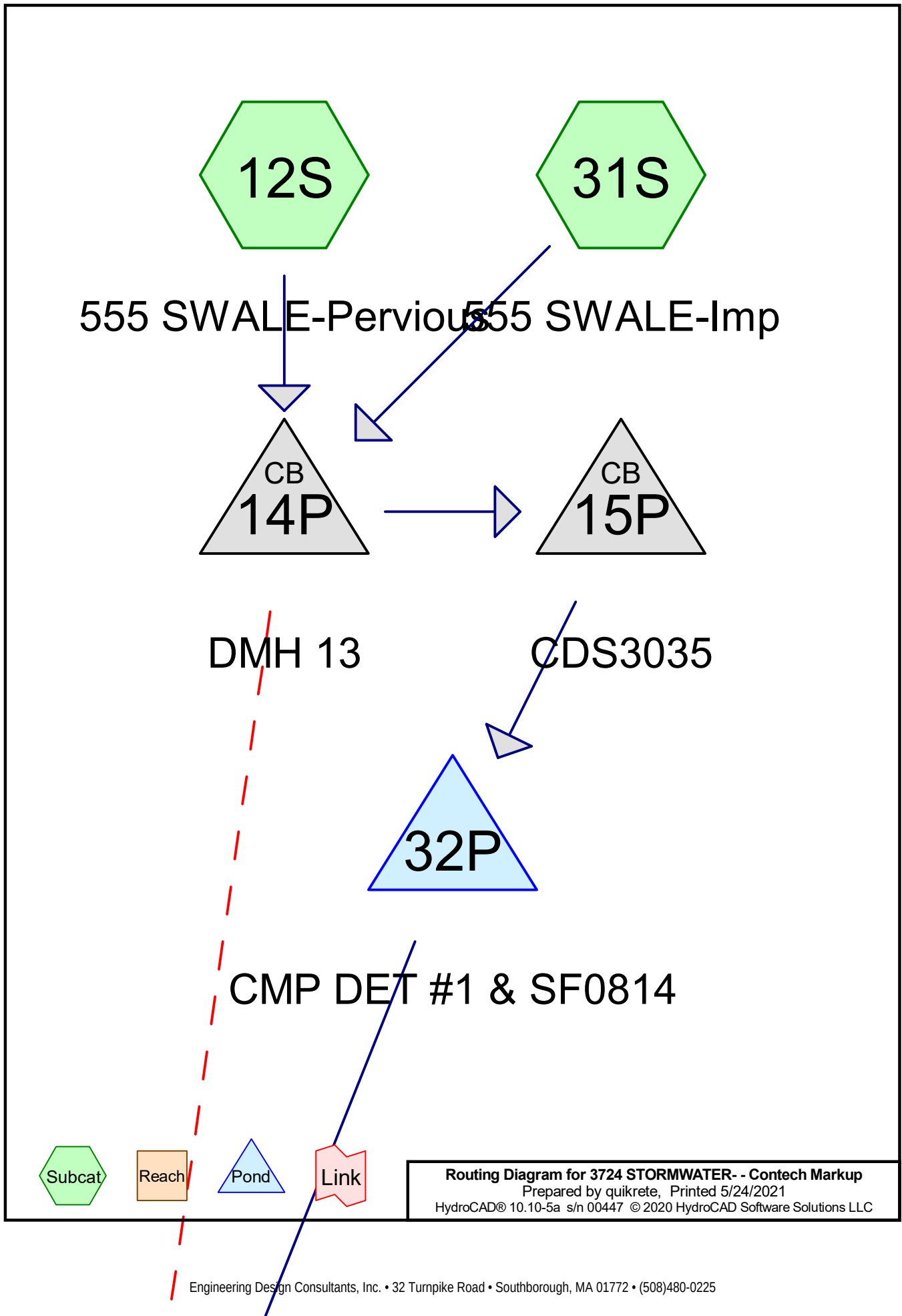
LUHHPL NARRATIVE

This project, “555 Hopping Brook Road”, is a commercial development that encompasses the construction of a building, parking, and driveways including drainage, septic system and utilities.

This project is considered a Land Use with Higher Potential Pollutant Load (LUHHPL) because the trip generation is over 1,000 vehicle trips per day. The plans have been revised to include extra stormwater treatment to meet the DEP’s requirements. Contech StormFilter’s have been added as well as Contech Cascade Separators and a CDS unit, as well as underground Corrugated metal pipe detention systems, that treat all of the paved surfaces on the project.

The following calculations show that the stormwater has been treated for 1-inch of runoff for the paved surfaces. Flow diverting weirs have been added to DMH 13, 29, 34, and 43, so that the 1-inch of runoff will be diverted to the treatment structures. All of the previously mentioned treatment has been added to the previously designed infiltration basins as well the use of deep sump catch basins to maximize the treatment of stormwater runoff from the project.





3724 STORMWATER- - Contech Markup

Prepared by quikrete

Printed 5/24/2021

HydroCAD® 10.10-5a s/n 00447 © 2020 HydroCAD Software Solutions LLC

Page 2

Area Listing (selected nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
221,347	74	>75% Grass cover, Good, HSG C (12S)
218,665	98	Paved parking, HSG C (31S)
440,012	86	TOTAL AREA

3724 STORMWATER- - Contech Markup

Prepared by quikrete

HydroCAD® 10.10-5a s/n 00447 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr WQ Rainfall=1.21"

Printed 5/24/2021

Page 3

Summary for Subcatchment 12S: 555 SWALE-Pervious

Runoff = 0.091 cfs @ 12.45 hrs, Volume= 1,176 cf, Depth> 0.06"

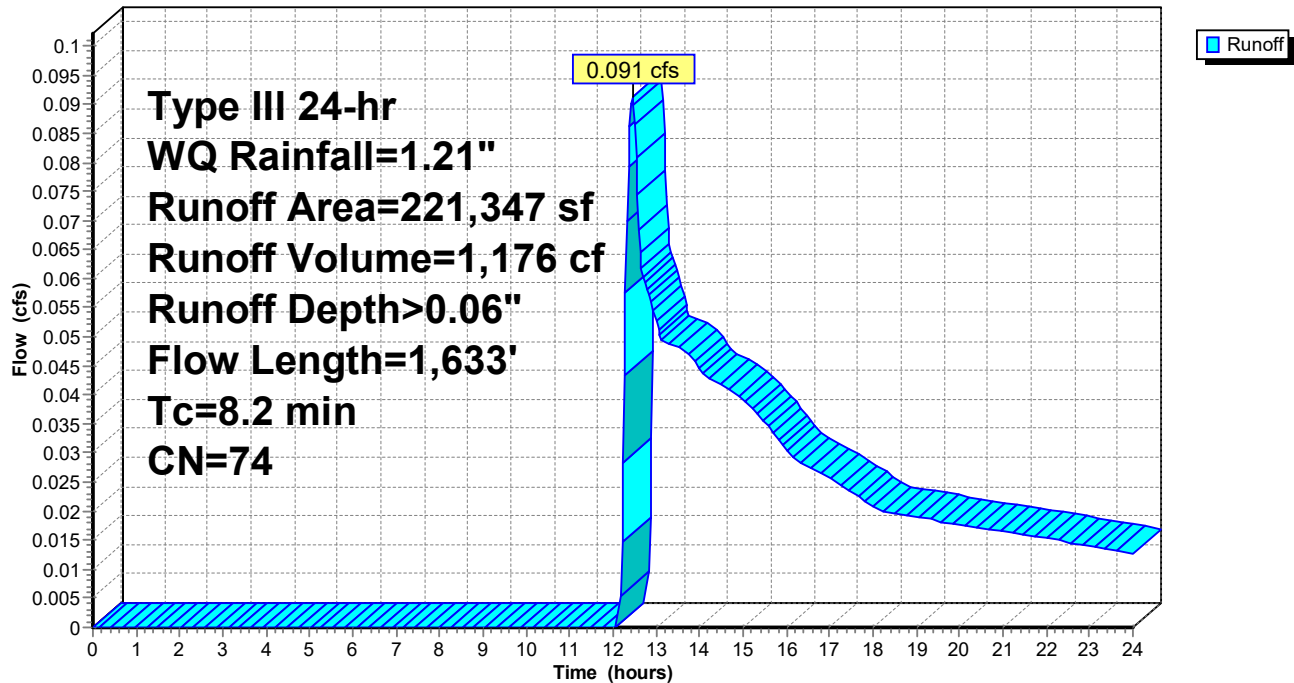
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs
Type III 24-hr WQ Rainfall=1.21"

Area (sf)	CN	Description
221,347	74	>75% Grass cover, Good, HSG C
221,347		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	50	0.0500	0.15		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"
0.2	55	0.0460	4.35		Shallow Concentrated Flow, Paved Kv= 20.3 fps
2.3	1,528	0.0240	11.16	35.05	Pipe Channel, 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013
8.2	1,633	Total			

Subcatchment 12S: 555 SWALE-Pervious

Hydrograph



3724 STORMWATER- - Contech Markup

Type III 24-hr WQ Rainfall=1.21"

Prepared by quikrete

Printed 5/24/2021

HydroCAD® 10.10-5a s/n 00447 © 2020 HydroCAD Software Solutions LLC

Page 4

Summary for Subcatchment 31S: 555 SWALE-Imp

Runoff = 5.128 cfs @ 12.11 hrs, Volume= 18,118 cf, Depth> 0.99"

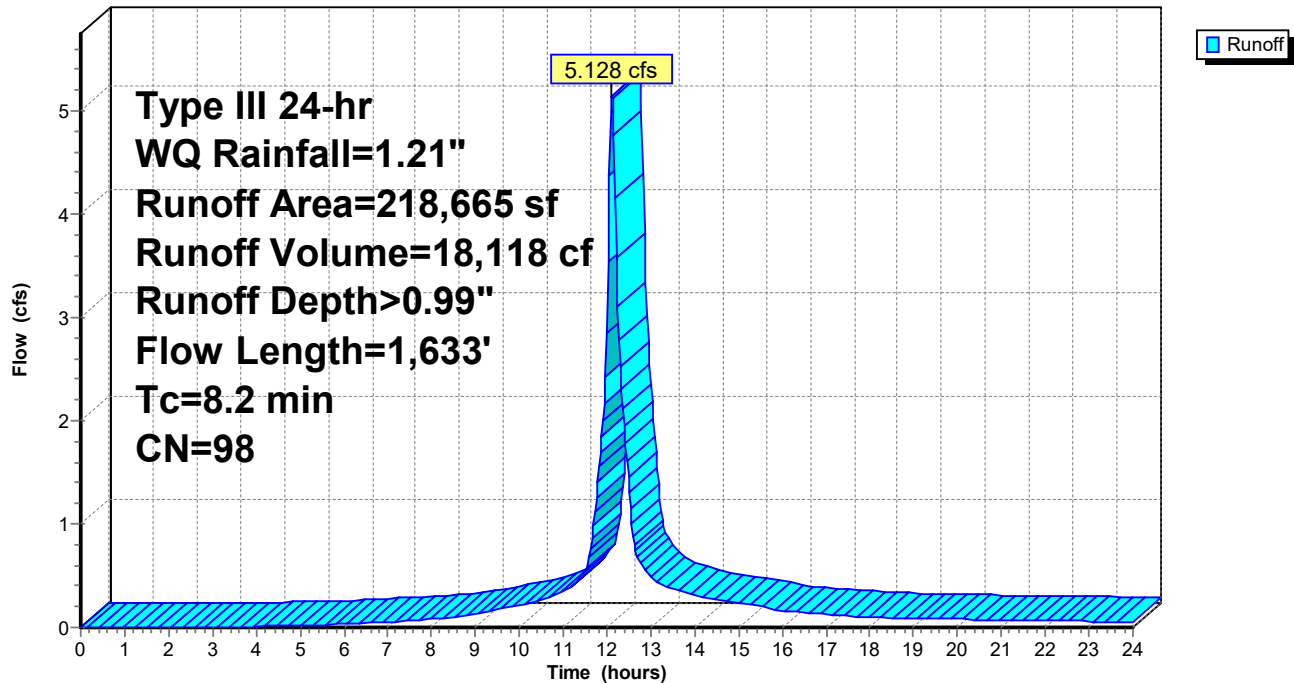
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs
Type III 24-hr WQ Rainfall=1.21"

Area (sf)	CN	Description
218,665	98	Paved parking, HSG C
218,665		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	50	0.0500	0.15		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"
0.2	55	0.0460	4.35		Shallow Concentrated Flow, Paved Kv= 20.3 fps
2.3	1,528	0.0240	11.16	35.05	Pipe Channel, 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013
8.2	1,633	Total			

Subcatchment 31S: 555 SWALE-Imp

Hydrograph



3724 STORMWATER- - Contech Markup

Type III 24-hr WQ Rainfall=1.21"

Prepared by quikrete

Printed 5/24/2021

HydroCAD® 10.10-5a s/n 00447 © 2020 HydroCAD Software Solutions LLC

Page 5

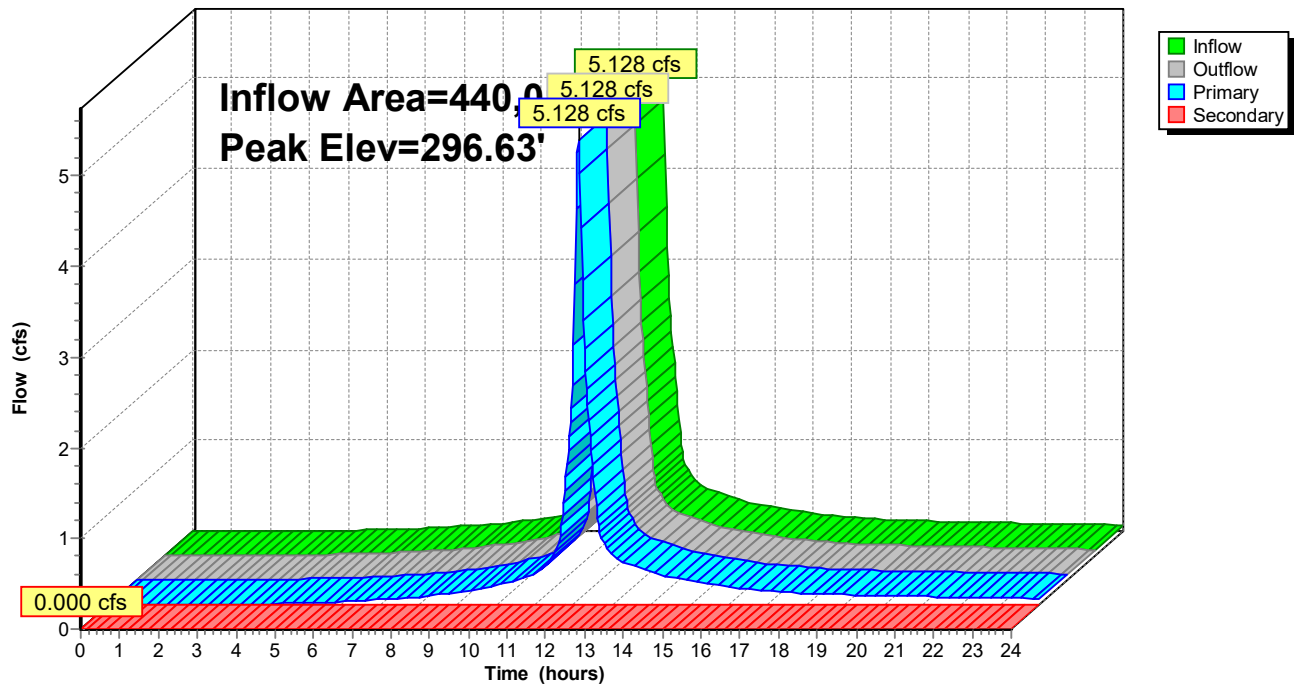
Summary for Pond 14P: DMH 13

Inflow Area = 440,012 sf, 49.70% Impervious, Inflow Depth > 0.53" for WQ event
 Inflow = 5.128 cfs @ 12.11 hrs, Volume= 19,294 cf
 Outflow = 5.128 cfs @ 12.11 hrs, Volume= 19,294 cf, Atten= 0%, Lag= 0.0 min
 Primary = 5.128 cfs @ 12.11 hrs, Volume= 19,294 cf
 Secondary = 0.000 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs

Peak Elev= 296.63' @ 12.13 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	294.89'	24.0" Round Culvert L= 6.8' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 294.89' / 294.55' S= 0.0500 '/' Cc= 0.900 n= 0.120, Flow Area= 3.14 sf
#2	Secondary	296.64'	8.0' long x 0.5' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=4.794 cfs @ 12.11 hrs HW=296.60' TW=296.00' (Dynamic Tailwater)↑**1=Culvert** (Outlet Controls 4.794 cfs @ 2.26 fps)**Secondary OutFlow** Max=0.000 cfs @ 0.00 hrs HW=294.89' TW=273.00' (Dynamic Tailwater)↑**2=Broad-Crested Rectangular Weir** (Controls 0.000 cfs)**Pond 14P: DMH 13****Hydrograph**

3724 STORMWATER- - Contech Markup

Type III 24-hr WQ Rainfall=1.21"

Prepared by quikrete

Printed 5/24/2021

HydroCAD® 10.10-5a s/n 00447 © 2020 HydroCAD Software Solutions LLC

Page 6

Summary for Pond 15P: CDS3035

Inflow Area = 440,012 sf, 49.70% Impervious, Inflow Depth > 0.53" for WQ event
 Inflow = 5.128 cfs @ 12.11 hrs, Volume= 19,294 cf
 Outflow = 5.128 cfs @ 12.11 hrs, Volume= 19,294 cf, Atten= 0%, Lag= 0.0 min
 Primary = 5.128 cfs @ 12.11 hrs, Volume= 19,294 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs
 Peak Elev= 296.56' @ 12.83 hrs

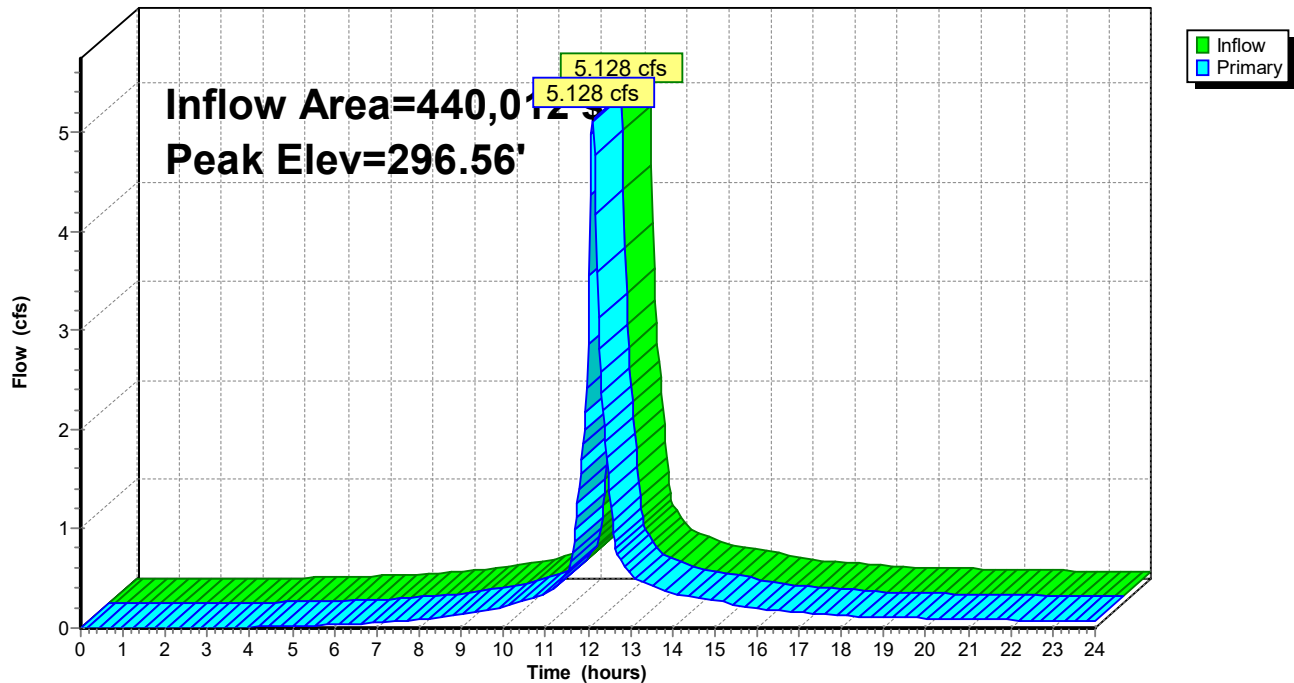
Device	Routing	Invert	Outlet Devices
#1	Primary	294.55'	14.5" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#2	Primary	296.55'	1.5' long Sharp-Crested Rectangular Weir X 2.00 2 End Contraction(s)

Primary OutFlow Max=5.086 cfs @ 12.11 hrs HW=296.00' TW=293.63' (Dynamic Tailwater)

- 1=Orifice/Grate (Orifice Controls 5.086 cfs @ 4.44 fps)
- 2=Sharp-Crested Rectangular Weir (Controls 0.000 cfs)

Pond 15P: CDS3035

Hydrograph



3724 STORMWATER- - Contech Markup

Type III 24-hr WQ Rainfall=1.21"

Prepared by quikrete

Printed 5/24/2021

HydroCAD® 10.10-5a s/n 00447 © 2020 HydroCAD Software Solutions LLC

Page 7

Summary for Pond 32P: CMP DET #1 & SF0814

Inflow Area = 440,012 sf, 49.70% Impervious, Inflow Depth > 0.53" for WQ event
 Inflow = 5.128 cfs @ 12.11 hrs, Volume= 19,294 cf
 Outflow = 0.662 cfs @ 12.81 hrs, Volume= 19,299 cf, Atten= 87%, Lag= 41.8 min
 Primary = 0.662 cfs @ 12.81 hrs, Volume= 19,299 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs
 Peak Elev= 296.55' @ 12.81 hrs Surf.Area= 2,028 sf Storage= 6,556 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)

Center-of-Mass det. time= 80.9 min (876.3 - 795.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	290.73'	0 cf	26.00'W x 78.00'L x 6.00'H Field A 12,168 cf Overall - 6,616 cf Embedded = 5,552 cf x 0.0% Voids
#2A	290.73'	6,616 cf	CMP Round 72 x 9 Inside #1 Effective Size= 72.0"W x 72.0"H => 28.27 sf x 20.00'L = 565.5 cf Overall Size= 72.0"W x 72.0"H x 20.00'L Row Length Adjustment= +10.00' x 28.27 sf x 3 rows 24.00' Header x 28.27 sf x 1 = 678.6 cf Inside
		6,616 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices (Turned on 1 times)
#1	Primary	287.68'	Tube/Siphon/Float Valve X 27.00 0.560" Diameter, C= 0.600, 0.263" Trickle Diameter Starts@290.73' Breaks@288.35'

Primary OutFlow Max=0.662 cfs @ 12.81 hrs HW=296.55' TW=277.38' (Dynamic Tailwater)↑**1=Tube/Siphon/Float Valve** (Orifice Controls 0.662 cfs @ 14.34 fps)

3724 STORMWATER- - Contech Markup

Type III 24-hr WQ Rainfall=1.21"

Prepared by quikrete

Printed 5/24/2021

HydroCAD® 10.10-5a s/n 00447 © 2020 HydroCAD Software Solutions LLC

Page 8

Pond 32P: CMP DET #1 & SF0814 - Chamber Wizard Field A**Chamber Model = CMP Round 72 (Round Corrugated Metal Pipe)**

Effective Size= 72.0"W x 72.0"H => 28.27 sf x 20.00'L = 565.5 cf

Overall Size= 72.0"W x 72.0"H x 20.00'L

Row Length Adjustment= +10.00' x 28.27 sf x 3 rows

72.0" Wide + 36.0" Spacing = 108.0" C-C Row Spacing

3 Chambers/Row x 20.00' Long +10.00' Row Adjustment +6.00' Header x 1 = 76.00' Row Length +12.0"

End Stone x 2 = 78.00' Base Length

3 Rows x 72.0" Wide + 36.0" Spacing x 2 + 12.0" Side Stone x 2 = 26.00' Base Width

72.0" Chamber Height = 6.00' Field Height

9 Chambers x 565.5 cf +10.00' Row Adjustment x 28.27 sf x 3 Rows + 24.00' Header x 28.27 sf = 6,616.2 cf Chamber Storage

12,168.0 cf Field - 6,616.2 cf Chambers = 5,551.8 cf Stone x 0.0% Voids = 0.0 cf Stone Storage

Chamber Storage = 6,616.2 cf = 0.152 af

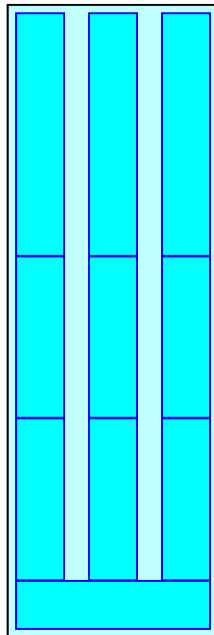
Overall Storage Efficiency = 54.4%

Overall System Size = 78.00' x 26.00' x 6.00'

9 Chambers

450.7 cy Field

205.6 cy Stone



3724 STORMWATER- - Contech Markup

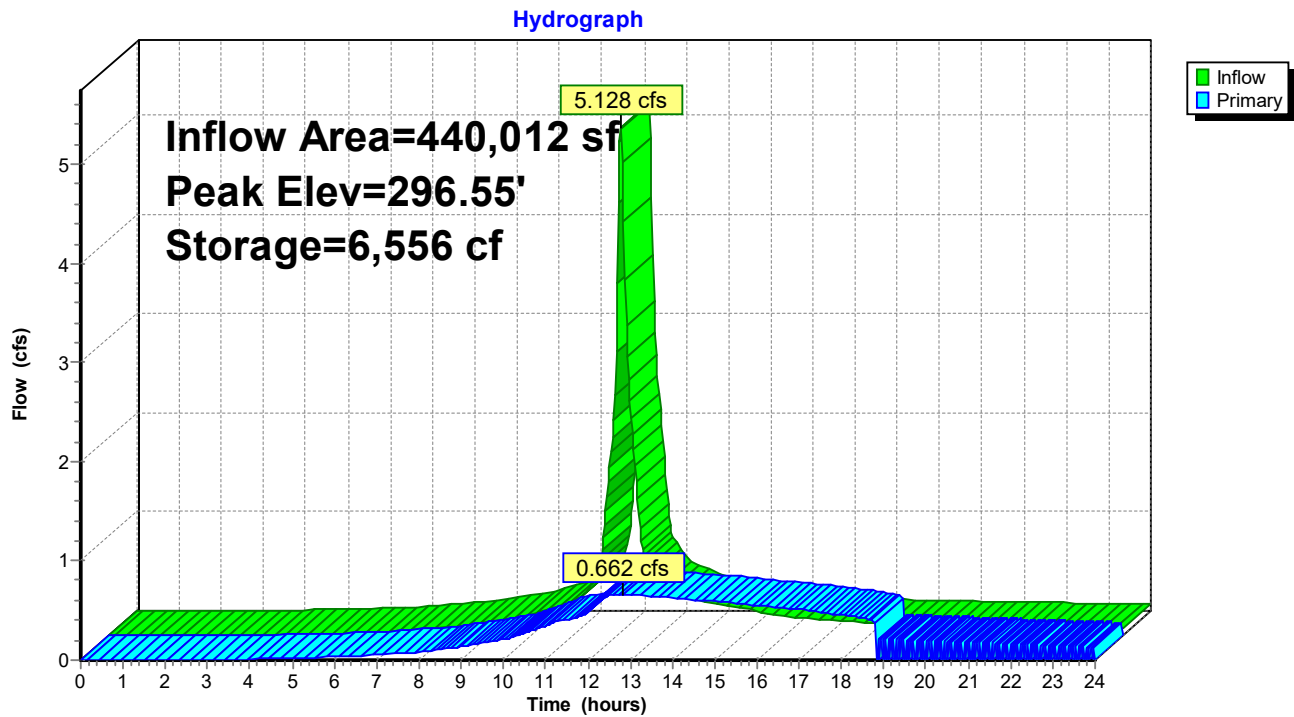
Type III 24-hr WQ Rainfall=1.21"

Prepared by quikrete

Printed 5/24/2021

HydroCAD® 10.10-5a s/n 00447 © 2020 HydroCAD Software Solutions LLC

Page 9

Pond 32P: CMP DET #1 & SF0814



Determining Number of Cartridges for Systems Downstream of Detention

CONTECH Stormwater Solutions Inc. Engineer:
Date

DRA
5/21/2021

Site Information

Project Name	555 Hopping Brook Road
Project State	MA
Project Location	Holliston
Drainage Area, Ad	9.71 ac
Impervious Area, Ai	5.02 ac
Pervious Area, Ap	4.69
% Impervious	52 %
Runoff Coefficient, Rc	0.52

Upstream Detention System

Detention pretreatment credit (from removal efficiency calcs)	50%
--	------------

Mass loading calculations

Mean Annual Rainfall, P	49.8 in
Agency required % removal	80%
Percent Runoff Capture	90%
Mean Annual Runoff, V_t	814,052 ft ³
Event Mean Concentration of Pollutant, EMC	70 mg/l
Annual Mass Load, M_{total}	3,555 lbs

Water Quality Volume

90% Rainfall Depth	1.00 in
WQ Volume to be treated	0.417 ac-ft
WQ Volume to be treated by filters	18,163 ft ³

Filter System

Filtration brand	StormFilter
Cartridge height	27 in
Specific Flow Rate	1.00 gpm/ft ²

Number of cartridges - mass loading

Mass removed by pretreatment system, M_{pre}	1,778 lbs
Mass load to filters after pretreatment, M_{pass1}	1,778 lbs
Mass to be captured by filters, M_{filter}	1,422 lbs
Allowable Cartridge Flow rate, Q_{cart}	11.25 gpm
Mass load per cartridge, M_{cart} (lbs)	54 lbs
Number of Cartridges required, N_{mass}	27
Treatment Capacity	0.68 cfs

Determine Critical Sizing Value

Method to Use:	MASS-LOADING
----------------	---------------------

SUMMARY

Treatment Flow Rate, cfs	0.68
Cartridge Flow Rate, gpm	11.3
Number of Cartridges	27

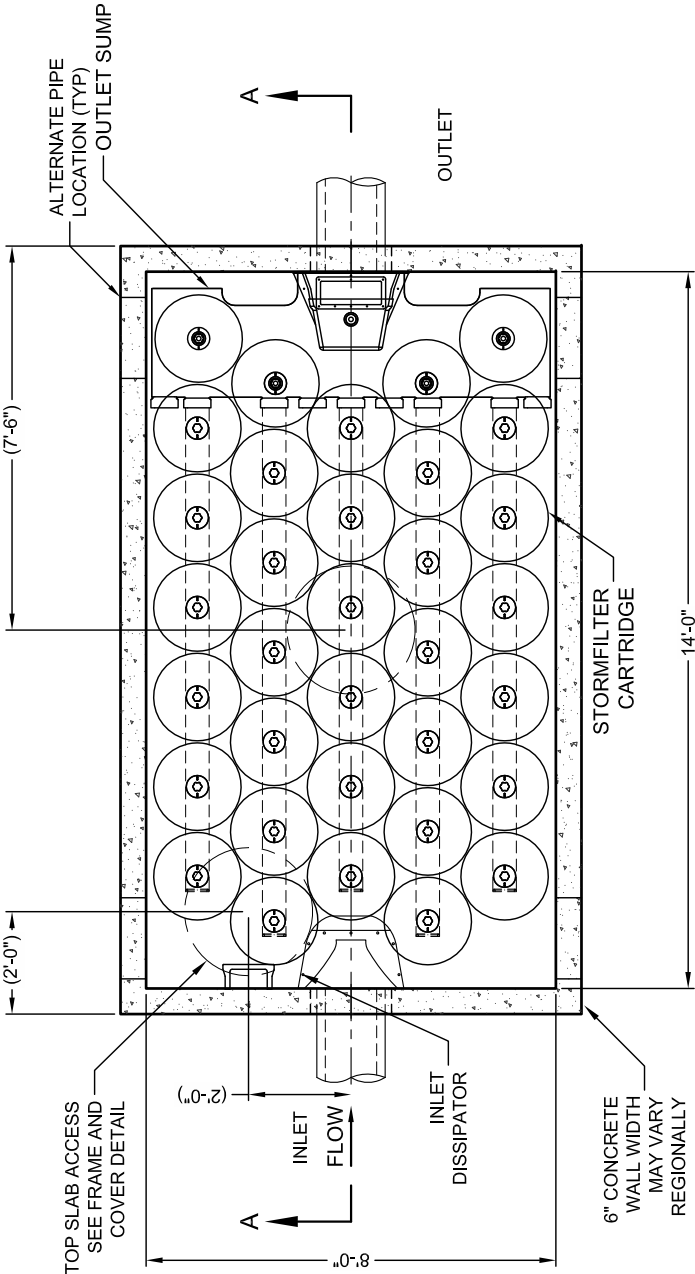
STORMFILTER DESIGN NOTES

STORMFILTER TREATMENT CAPACITY IS A FUNCTION OF THE CARTRIDGE SELECTION AND THE NUMBER OF CARTRIDGES. THE STANDARD VAULT STYLE IS SHOWN WITH THE MAXIMUM NUMBER OF CARTRIDGES (34). VAULT STYLE OPTIONS INCLUDE INLET BAY (27), INLET BAY/OUTLET BAY (22), OUTLET BAY (29), INLET BAY/FULL HEIGHT BAFFLE (28), FULL HEIGHT BAFFLE WALL (25). STORMFILTER 8X14 PEAK HYDRAULIC CAPACITY IS 1.8 CFS. IF THE SITE CONDITIONS EXCEED 1.8 CFS AN UPSTREAM BYPASS STRUCTURE IS REQUIRED.

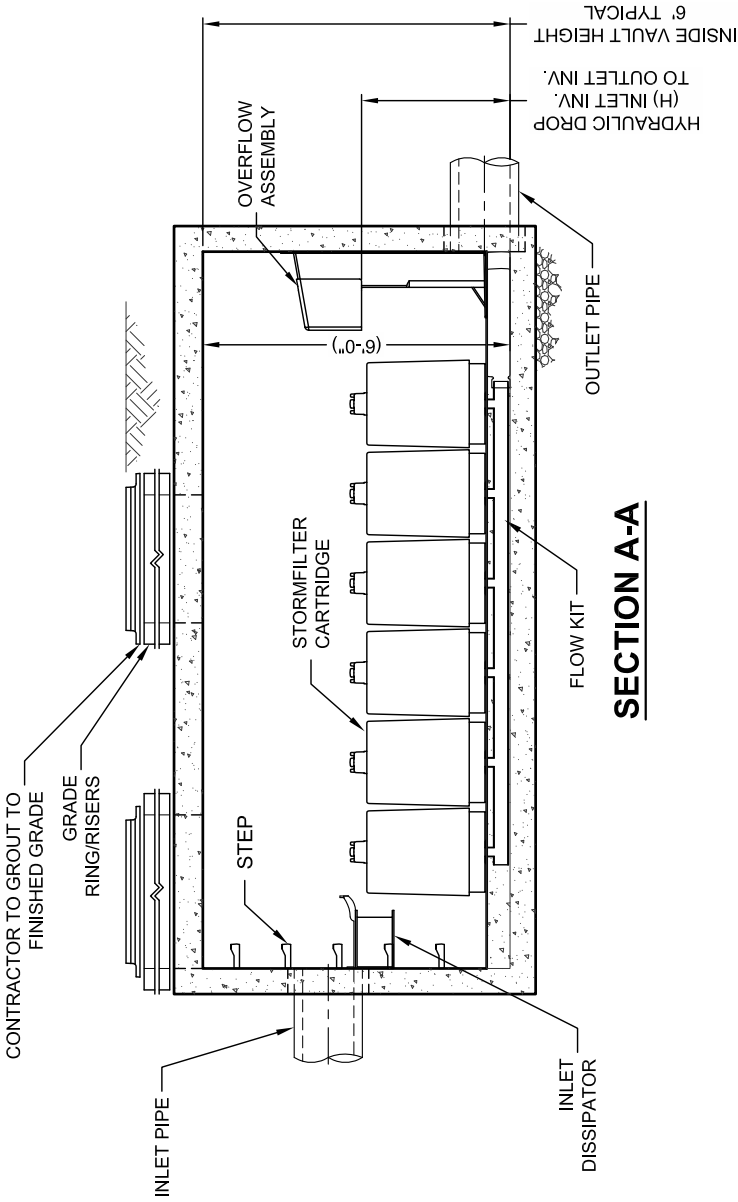
CARTRIDGE SELECTION

CARTRIDGE HEIGHT		27"		18"		LOW DROP	
RECOMMENDED HYDRAULIC DROP (H)		3.05'		2.3'		1.8'	
SPECIFIC FLOW RATE (gpm/sf)	2 gpm/sf	1.67* gpm/sf	1 gpm/sf	2 gpm/sf	1.67* gpm/sf	1 gpm/sf	1 gpm/sf
CARTRIDGE FLOW RATE (gpm)	22.5	18.79	11.25	15	12.53	7.5	10
		8.35		5			

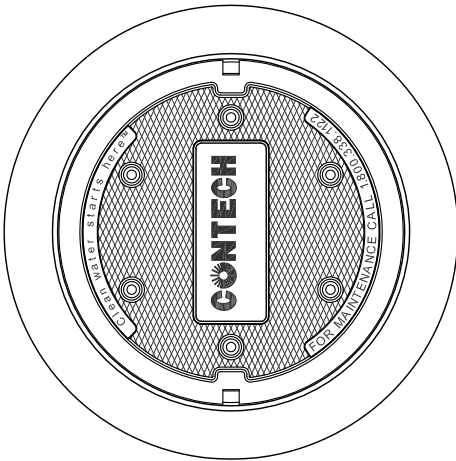
* 1.67 gpm/sf SPECIFIC FLOW RATE IS APPROVED WITH PHOSPHOSORB® (PSORB) MEDIA ONLY



PLAN VIEW
VAULT STYLE: OUTLET SUMP (NIB)



SECTION A-A



FRAME AND COVER
(DIAMETER VARIES)
N.T.S.

SITE SPECIFIC DATA REQUIREMENTS	
STRUCTURE ID	*
WATER QUALITY FLOW RATE (cfs)	*
PEAK FLOW RATE (cfs)	*
RETURN PERIOD OF PEAK FLOW (yrs)	*
CARTRIDGE HEIGHT (27", 18", LOW DROP(LD))	*
NUMBER OF CARTRIDGES REQUIRED	*
CARTRIDGE FLOW RATE	*
MEDIA TYPE (PERLITE, ZPG, PSORB)	*
PIPE DATA:	I.E. MATERIAL DIAMETER
INLET PIPE #1	* *
INLET PIPE #2	* *
OUTLET PIPE	* *
UPSTREAM RIM ELEVATION	*
DOWNSTREAM RIM ELEVATION	*
ANTI-FLOTATION BALLAST	WIDTH HEIGHT
NOTES/SPECIAL REQUIREMENTS:	*
* PER ENGINEER OF RECORD	

GENERAL NOTES

- CONTECH TO PROVIDE ALL MATERIALS UNLESS NOTED OTHERWISE.
- DIMENSIONS MARKED WITH () ARE REFERENCE DIMENSIONS. ACTUAL DIMENSIONS MAY VARY.
- FOR SITE SPECIFIC DRAWINGS WITH DETAILED VAULT DIMENSIONS AND WEIGHTS, PLEASE CONTACT YOUR CONTECH ENGINEERED SOLUTIONS LLC REPRESENTATIVE. www.ContechES.com
- STORMFILTER WATER QUALITY STRUCTURE SHALL BE IN ACCORDANCE WITH ALL DESIGN DATA AND INFORMATION CONTAINED IN THIS DRAWING.
- STRUCTURE SHALL MEET AASHTO HS20 LOAD RATING, ASSUMING EARTH COVER OF 0' - 5' AND GROUNDWATER ELEVATION AT, OR BELOW, THE OUTLET PIPE INVERT ELEVATION. ENGINEER OF RECORD TO CONFIRM ACTUAL GROUNDWATER ELEVATION. CASTINGS SHALL MEET AASHTO M306 AND BE CAST WITH THE CONTECH LOGO.
- FILTER CARTRIDGES SHALL BE MEDIA-FILLED, PASSIVE, SIPHON ACTUATED, RADIAL FLOW, AND SELF CLEANING. RADIAL MEDIA DEPTH SHALL BE 7-INCHES. FILTER MEDIA CONTACT TIME SHALL BE AT LEAST 38 SECONDS.
- SPECIFIC FLOW RATE IS EQUAL TO THE FILTER TREATMENT CAPACITY (gpm) DIVIDED BY THE FILTER CONTACT SURFACE AREA (sq ft).
- STORMFILTER STRUCTURE SHALL BE PRECAST CONFORMING TO ASTM C-857 AND AASHTO LOAD FACTOR DESIGN METHOD.

INSTALLATION NOTES

- ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
- CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE STORMFILTER VAULT (LIFTING CLUTCHES PROVIDED).
- CONTRACTOR TO INSTALL JOINT SEALANT BETWEEN ALL VAULT SECTIONS AND ASSEMBLE VAULT.
- CONTRACTOR TO PROVIDE, INSTALL, AND GROUT PIPES. MATCH OUTLET PIPE INVERT WITH OUTLET BAY FLOOR.
- CONTRACTOR TO TAKE APPROPRIATE MEASURES TO PROTECT CARTRIDGES FROM CONSTRUCTION-RELATED EROSION RUNOFF.

CDS3035-6-C DESIGN NOTES

CDS3035-6-C RATED TREATMENT CAPACITY IS 6.5 CFS, OR PER LOCAL REGULATIONS.

THE STANDARD CDS3035-6-C CONFIGURATION IS SHOWN. ALTERNATE CONFIGURATIONS ARE AVAILABLE AND ARE LISTED BELOW. SOME CONFIGURATIONS MAY BE COMBINED TO SUIT SITE REQUIREMENTS.

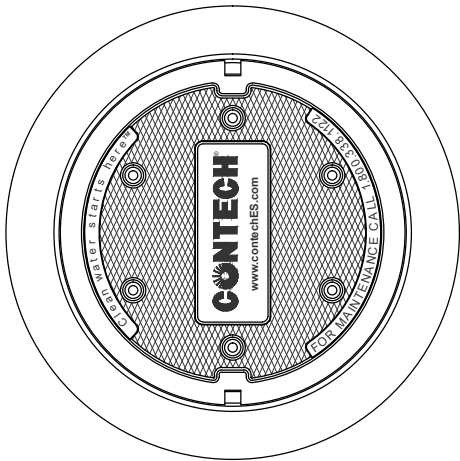
CONFIGURATION DESCRIPTION

GRATED INLET ONLY (NO INLET PIPE)

GRATED INLET WITH INLET PIPE OR PIPES

CURB INLET ONLY (NO INLET PIPE)

CURB INLET WITH INLET PIPE OR PIPES



FRAME AND COVER

(DIAMETER VARIES)

N.T.S.

SITE SPECIFIC DATA REQUIREMENTS

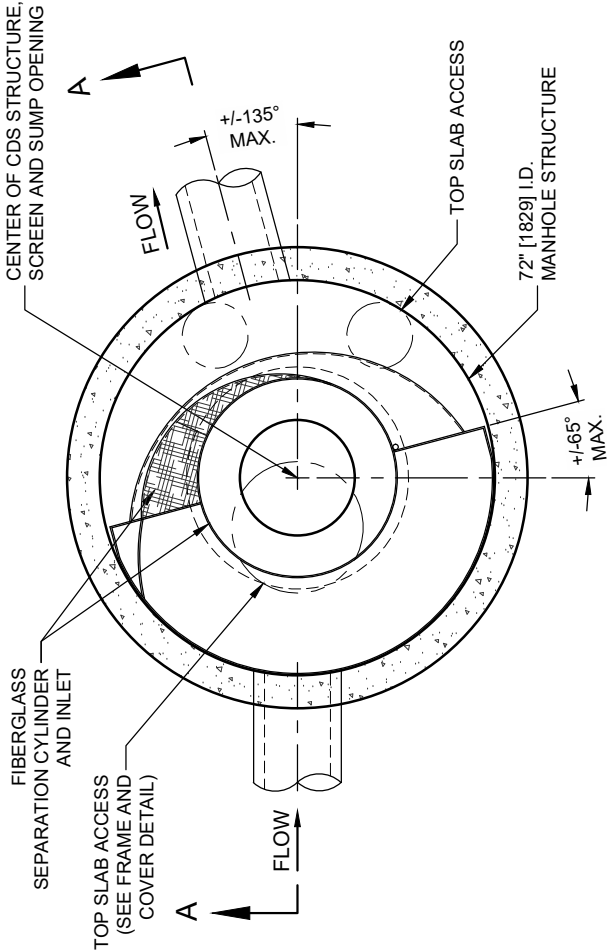
STRUCTURE ID		
WATER QUALITY FLOW RATE (CFS OR L/s)		*
PEAK FLOW RATE (CFS OR L/s)		*
RETURN PERIOD OF PEAK FLOW (YRS)		*
SCREEN APERTURE (2400 OR 4700)		*
PIPE DATA:	I.E.	MATERIAL
INLET PIPE 1	*	*
INLET PIPE 2	*	*
OUTLET PIPE	*	*
RIM ELEVATION	*	
ANTI-FLOTATION BALLAST	WIDTH	HEIGHT
	*	*
NOTES/SPECIAL REQUIREMENTS:		
* PER ENGINEER OF RECORD		

GENERAL NOTES

1. CONTECH TO PROVIDE ALL MATERIALS UNLESS NOTED OTHERWISE.
2. DIMENSIONS MARKED WITH () ARE REFERENCE DIMENSIONS. ACTUAL DIMENSIONS MAY VARY.
3. FOR FABRICATION DRAWINGS WITH DETAILED STRUCTURE DIMENSIONS AND WEIGHTS, PLEASE CONTACT YOUR CONTECH ENGINEER SOLUTIONS LLC REPRESENTATIVE. www.contechES.com
4. CDS WATER QUALITY STRUCTURE SHALL BE IN ACCORDANCE WITH ALL DESIGN DATA AND INFORMATION CONTAINED IN THIS DRAWING.
5. STRUCTURE SHALL MEET AASHTO HS20 AND CASTINGS SHALL MEET HS20 (AASHTO M 306) LOAD RATING, ASSUMING GROUNDWATER ELEVATION AT OR BELOW THE OUTLET PIPE INVERT ELEVATION. ENGINEER OF RECORD TO CONFIRM ACTUAL GROUNDWATER ELEVATION.
6. PVC HYDRAULIC SHEAR PLATE IS PLACED ON SHELF AT BOTTOM OF SCREEN CYLINDER. REMOVE AND REPLACE AS NECESSARY DURING MAINTENANCE CLEANING.

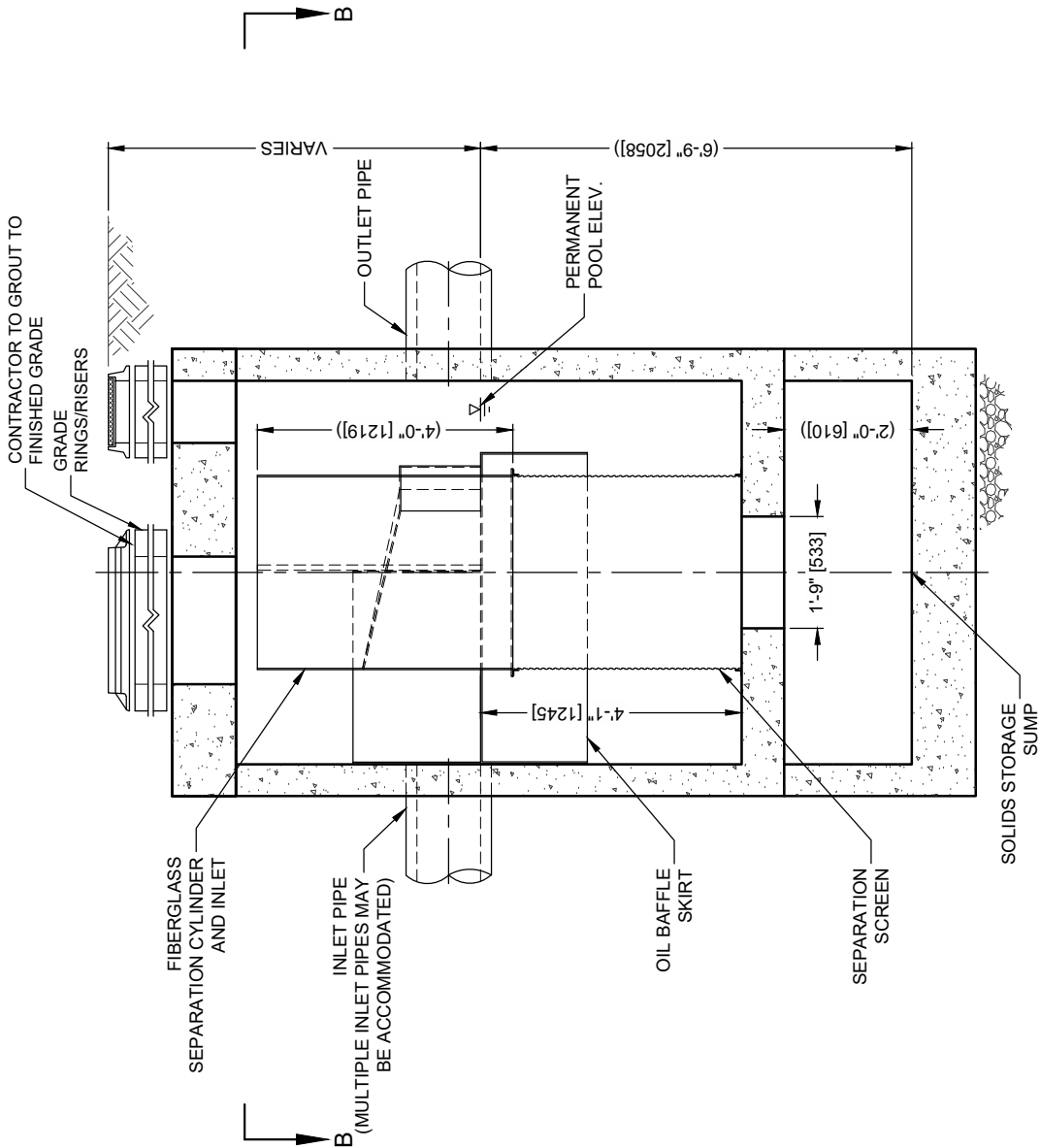
INSTALLATION NOTES

- A. ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
- B. CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE CDS MANHOLE STRUCTURE (LIFTING CLUTCHES PROVIDED).
- C. CONTRACTOR TO ADD JOINT SEALANT BETWEEN ALL STRUCTURE SECTIONS, AND ASSEMBLE STRUCTURE.
- D. CONTRACTOR TO PROVIDE, INSTALL, AND GROUT PIPES. MATCH PIPE INVERTS WITH ELEVATIONS SHOWN.
- E. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO ASSURE UNIT IS WATER TIGHT, HOLDING WATER TO FLOWLINE INVERT MINIMUM. IT IS SUGGESTED THAT ALL JOINTS BELOW PIPE INVERTS ARE GROUTED



PLAN VIEW B-B

N.T.S.



ELEVATION A-A

N.T.S.



THIS PRODUCT MAY BE PROTECTED BY ONE OR MORE OF THE FOLLOWING U.S. PATENTS: 5,788,848; 6,641,720; 6,511,595; 6,581,783. REGISTERED FOREIGN PATENTS AND OTHER PATENTS BEING GRANTED.

CONTECH.
ENGINEERED SOLUTIONS LLC

www.contechES.com

9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069

800-338-1122 513-645-7000 513-645-7993 FAX

CDS3035-6-C

ONLINE CDS

STANDARD DETAIL

PROJECT SUMMARY

CALCULATION DETAILS

- LOADING = HS20 & HS25
- APPROX. LINEAR FOOTAGE = 365 lf.

STORAGE SUMMARY

- STORAGE VOLUME REQUIRED = 18,163 cf.
- PIPE STORAGE VOLUME = 18,347 cf.
- BACKFILL STORAGE VOLUME = 0 cf.
- TOTAL STORAGE PROVIDED = 18,404 cf.

PIPE DETAILS

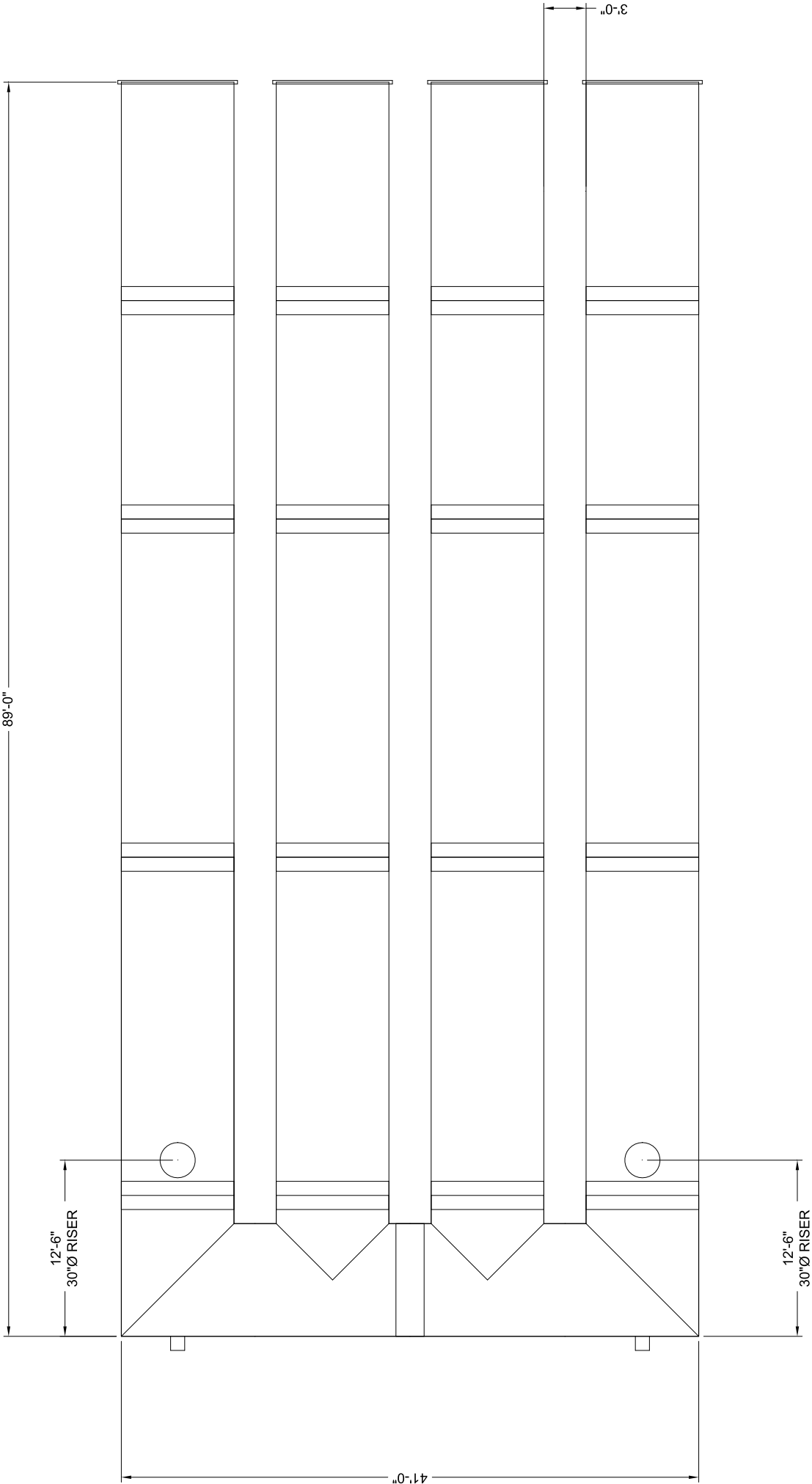
- DIAMETER = 96 IN.
- CORRUGATION = 5x1
- GAGE = 16
- COATING = ALT2
- WALL TYPE = Solid
- BARRELL SPACING = 36 IN.

BACKFILL DETAILS

- WIDTH AT ENDS = 12 IN.
- ABOVE PIPE = 0 IN.
- WIDTH AT SIDES = 12 IN.
- BELOW PIPE = 0 IN.

NOTES

- ALL RISER AND STUB DIMENSIONS ARE TO CENTERLINE. ALL ELEVATIONS, DIMENSIONS, AND LOCATIONS OF RISERS AND INLETS, SHALL BE VERIFIED BY THE ENGINEER OF RECORD PRIOR TO RELEASING FOR FABRICATION.
- ALL FITTINGS AND REINFORCEMENT COMPLY WITH ASTM A998.
- ALL RISERS AND STUBS ARE 2²/₃" x 1¹/₂" CORRUGATION AND 16 GAGE UNLESS OTHERWISE NOTED.
- RISERS TO BE FIELD TRIMMED TO GRADE.
- QUANTITY OF PIPE SHOWN DOES NOT PROVIDE EXTRA PIPE FOR CONNECTING THE SYSTEM TO EXISTING PIPE OR DRAINAGE STRUCTURES. OUR SYSTEM AS DETAILED PROVIDES NOMINAL INLET AND/OR OUTLET PIPE STUB FOR CONNECTION TO EXISTING DRAINAGE FACILITIES. IF ADDITIONAL PIPE IS NEEDED IT IS THE RESPONSIBILITY OF THE CONTRACTOR.
- BAND TYPE TO BE DETERMINED UPON FINAL DESIGN.
- THE PROJECT SUMMARY IS REFLECTIVE OF THE DYODS DESIGN, QUANTITIES ARE APPROX. AND SHOULD BE VERIFIED UPON FINAL DESIGN AND APPROVAL. FOR EXAMPLE, TOTAL EXCAVATION DOES NOT CONSIDER ALL VARIABLES SUCH AS SHORING AND ONLY ACCOUNTS FOR MATERIAL WITHIN THE ESTIMATED EXCAVATION FOOTPRINT.
- THESE DRAWINGS ARE FOR CONCEPTUAL PURPOSES AND DO NOT REFLECT ANY LOCAL PREFERENCES OR REGULATIONS. PLEASE CONTACT YOUR LOCAL CONTECH REP FOR MODIFICATIONS.



ASSEMBLY
SCALE: 1" = 10'

The design and information shown on this drawing is provided as advisory only. It is not to be used for construction without the approval of the design engineer. The design engineer is not responsible for any errors or omissions in this drawing. The design engineer is not responsible for any errors or omissions in this drawing. The design engineer is not responsible for any errors or omissions in this drawing.		PROJECT No.: 4952		SEQ. No.: 7952	DATE: 5/21/2021
DESIGNED: DYO		DRAWN: DYO		DYO	
CHECKED: DYO		APPROVED: DYO		DYO	
SHEET NO.: D1		96"Ø UNDERGROUND DETENTION SYSTEM - -		555 HOPPING BROOK ROAD	
				HOLLISTON, MA	
				SITE DESIGNATION:	

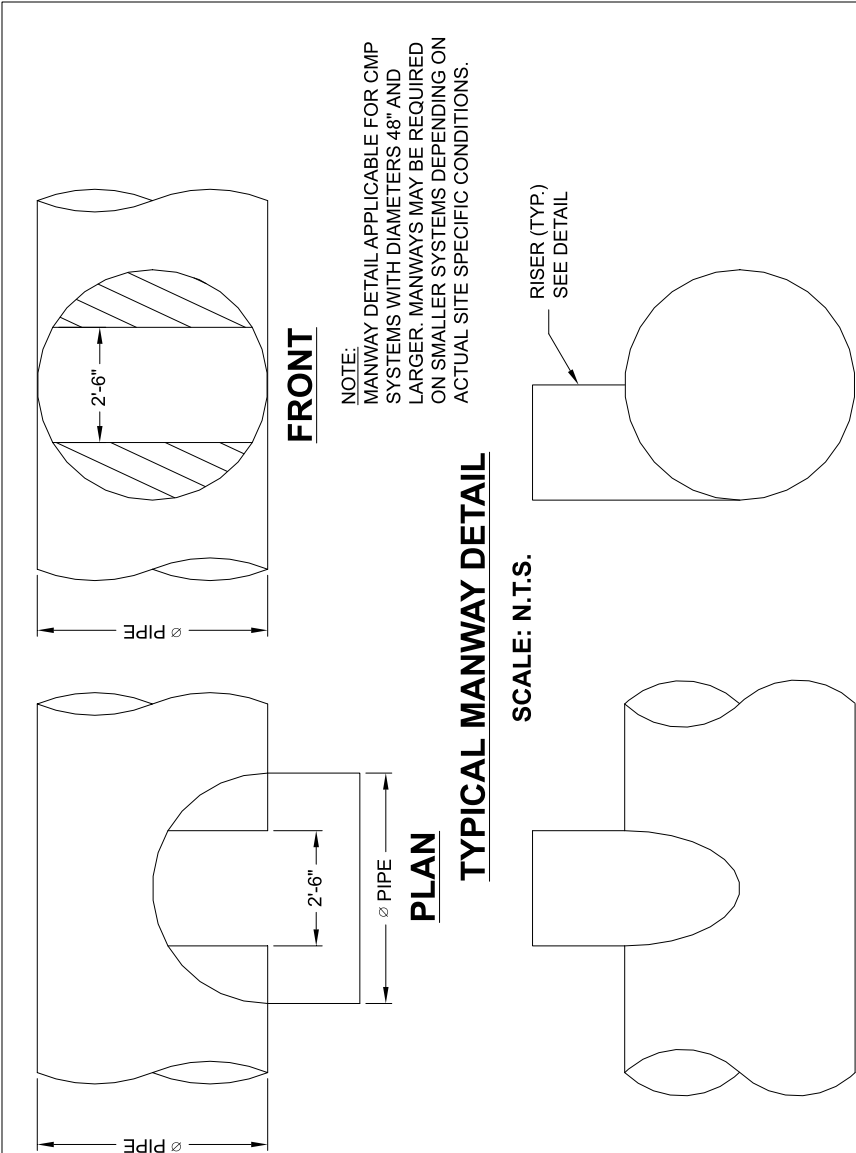
**CONTECH®**
CMP DETENTION SYSTEMS

**DYODS**
DRAWING

**CONTECH®**
ENGINEERED SOLUTIONS LLC
www.ContechES.com

9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

REVISION DESCRIPTION	DATE	BY
----------------------	------	----



TYPICAL MANWAY DETAIL

SCALE: N.T.S.

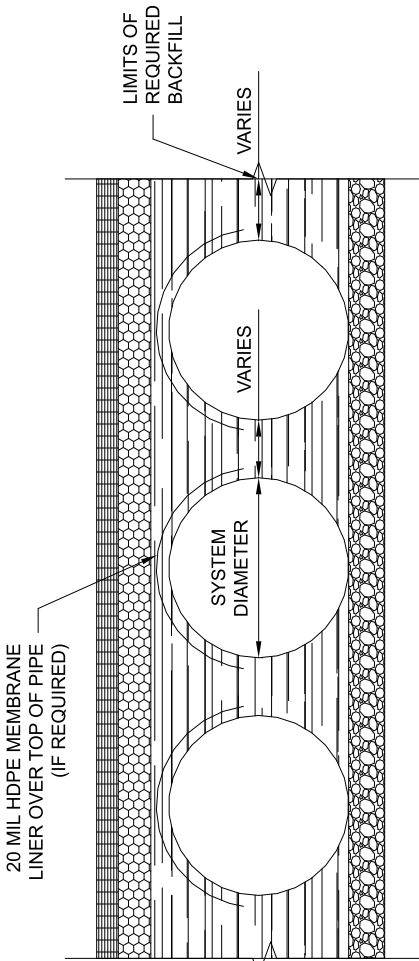
ELEVATION

END

NOTE: LADDERS ARE OPTIONAL AND ARE NOT REQUIRED FOR ALL SYSTEMS.

TYPICAL RISER DETAIL

SCALE: N.T.S.



TYPICAL SECTION VIEW

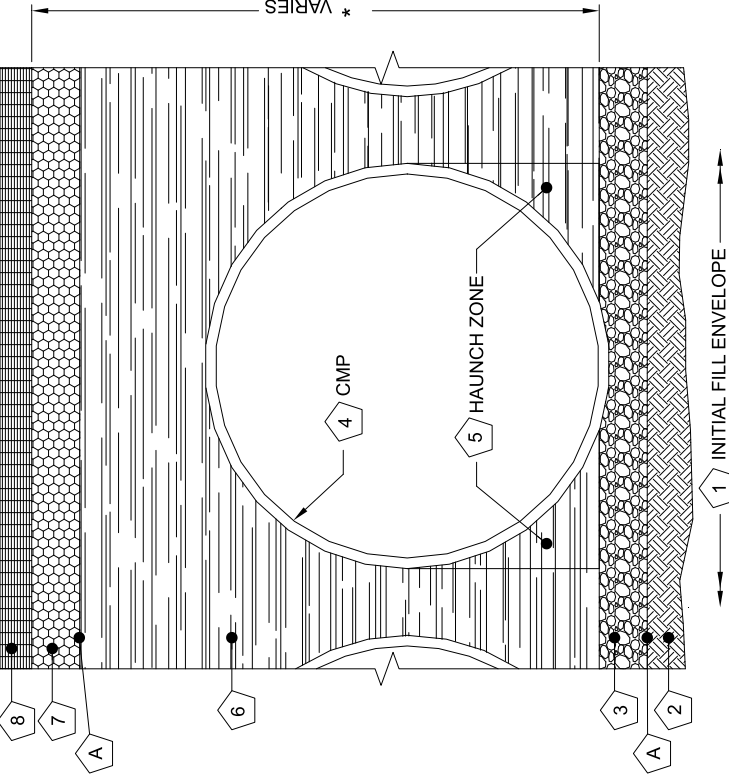
LINER OVER ROWS

SCALE: N.T.S.

NOTE: IF SALTING AGENTS FOR SNOW AND ICE REMOVAL ARE USED ON OR NEAR THE PROJECT, AN HDPE MEMBRANE LINER IS RECOMMENDED WITH THE SYSTEM. THE IMPERMEABLE LINER IS INTENDED TO HELP PROTECT THE SYSTEM FROM THE POTENTIAL ADVERSE EFFECTS THAT MAY RESULT FROM A CHANGE IN THE SURROUNDING ENVIRONMENT OVER A PERIOD OF TIME. PLEASE REFER TO THE CORRUGATED METAL PIPE DETENTION DESIGN GUIDE FOR ADDITIONAL INFORMATION.

DETENTION SYSTEMS - CMP DETENTION / CMP DRAINAGE			
Material Location	Description	Material Designation	Designation
Rigid or Flexible Pavement (if applicable)			
Road Base (if applicable)			
Geotextile Layer	Non-Woven Geotextile	CONTECH C-40 or C-45	Engineer Decision for consideration to prevent soil migration into varying soil types
Backfill	Well graded granular material which may contain small amounts of silt or clay.	AASHTO M 145- A-1, A-2, A-3	Placed in 8" +/- loose lifts and compacted to 90% Standard Proctor Per AASHTO T 99
Bedding Stone	Well graded granular bedding material w/maximum particle size of 3"	AASHTO M43 - 3, 357, 4, 467, 5, 56, 57	Engineer to determine if bedding is required. Pipe may be placed on the trench bottom of a relatively loose, native suitable well graded & granular material. For Arch pipes it is recommended to be shaped to a relatively flat bottom or fine-grade the foundation to a slight v-shape. Unsuitable material should be over-excavated and re-placed with a 4"-6" layer of well graded & granular stone per the material designation. See AASHTO 26.3.8.1 / 26.5.3 Bedding info.
Geotextile Layer	Non-Woven Geotextile	CONTECH C-40 or C-45	Engineer Decision for consideration to prevent soil migration into varying soil types

Note: Backfill using controlled low-strength material (CLSM, "flash fill" or "flowable fill") when the spacing between the pipes will not allow for placement and adequate compaction of the backfill.



1 MINIMUM WIDTH DEPENDS ON SITE CONDITIONS AND ENGINEERING JUDGEMENT

2 FOUNDATION/BEDDING PREPARATION

3 PRIOR TO PLACING THE BEDDING, THE FOUNDATION MUST BE CONSTRUCTED TO A UNIFORM AND STABLE GRADE. IN THE EVENT THAT UNSUITABLE FOUNDATION MATERIALS ARE ENCOUNTERED DURING EXCAVATION, THEY SHALL BE REMOVED AND BROUGHT BACK TO THE GRADE WITH A FILL MATERIAL AS APPROVED BY THE ENGINEER.

4 HAUNCH ZONE MATERIAL SHALL BE PLACED AND UNIFORMLY COMPACTED WITHOUT SOFT SPOTS.

5 BACKFILL

WHEN PLACING THE FIRST LIFTS OF BACKFILL IT IS IMPORTANT TO MAKE SURE THAT THE BACKFILL IS PROPERLY COMPACTED UNDER AND AROUND THE PIPE HAUNCHES. BACKFILL SHALL BE PLACED SUCH THAT THERE IS NO MORE THAN A TWO LIFT (16") DIFFERENTIAL BETWEEN ANY OF THE PIPES AT ANY TIME DURING THE BACKFILL PROCESS. THE BACKFILL SHALL BE ADVANCED ALONG THE LENGTH OF THE DETENTION SYSTEM AT THE SAME RATE TO AVOID DIFFERENTIAL LOADING ON THE PIPE.

OTHER ALTERNATE BACKFILL MATERIAL MAY BE ALLOWED DEPENDING ON SITE SPECIFIC CONDITIONS, AS APPROVED BY SITE ENGINEER.

The design and information shown on this drawing is provided by the user and is not to be used for any other purpose without the written consent of Contech Engineered Solutions LLC ("Contech"). Neither this drawing, nor any part thereof, may be used, reproduced or modified in any manner without the prior written consent of Contech. Failure to comply is done at the user's own risk and Contech expressly disclaims any liability or responsibility for such use.

If discrepancies between the supplied information upon which this drawing is based and the actual conditions are discovered as site work progresses, these discrepancies must be reported to Contech immediately for re-evaluation of the design. Contech accepts no liability for designs based on missing, incomplete or inaccurate information supplied by others.

CONTECH
ENGINEERED SOLUTIONS LLC
www.ContechES.com

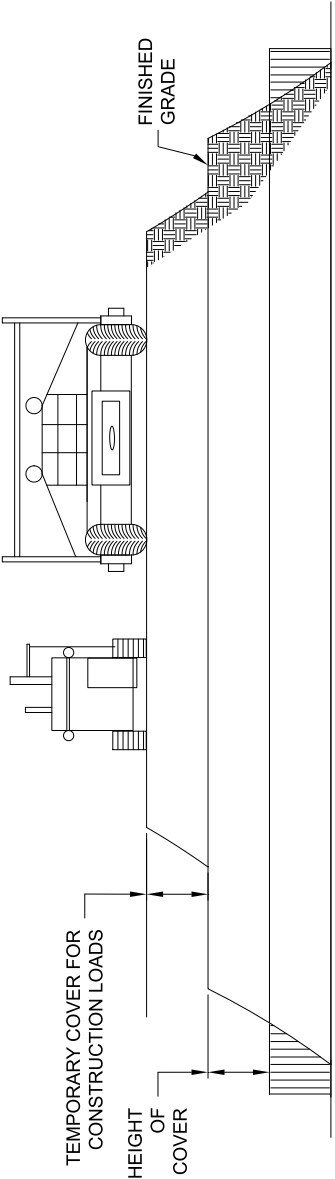
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

CONTECH
CMP DETENTION SYSTEMS

CONTECH
DYODS
DRAWING

96"Ø UNDERGROUND DETENTION SYSTEM - -
555 HOPPING BROOK ROAD
HOLLISTON, MA
SITE DESIGNATION:

PROJECT No.: 4952	SEQ. No.: 7952	DATE: 5/21/2021
DESIGNED: DYO	DRAWN: DYO	
CHECKED: DYO	APPROVED: DYO	
SHEET NO.: D2		



CONSTRUCTION LOADS

FOR TEMPORARY CONSTRUCTION VEHICLE LOADS, AN EXTRA AMOUNT OF COMPACTED COVER MAY BE REQUIRED OVER THE TOP OF THE PIPE. THE HEIGHT-OF-COVER SHALL MEET THE MINIMUM REQUIREMENTS SHOWN IN THE TABLE BELOW. THE USE OF HEAVY CONSTRUCTION EQUIPMENT NECESSITATES GREATER PROTECTION FOR THE PIPE THAN FINISHED GRADE COVER MINIMUMS FOR NORMAL HIGHWAY TRAFFIC.

PIPE SPAN, INCHES	AXLE LOADS (kips)			
	18-50	50-75	75-110	110-150
MINIMUM COVER (FT)	2.0	2.5	3.0	3.0
	3.0	3.0	3.5	4.0
	3.0	3.5	4.0	4.0
	3.5	4.0	4.5	4.5

*MINIMUM COVER MAY VARY, DEPENDING ON LOCAL CONDITIONS. THE CONTRACTOR MUST PROVIDE THE ADDITIONAL COVER REQUIRED TO AVOID DAMAGE TO THE PIPE. MINIMUM COVER IS MEASURED FROM THE TOP OF THE PIPE TO THE TOP OF THE MAINTAINED CONSTRUCTION ROADWAY SURFACE.

CONSTRUCTION LOADING DIAGRAM

SCALE: N.T.S.

SPECIFICATION FOR DESIGNED DETENTION SYSTEM:

SCOPE
THIS SPECIFICATION COVERS THE MANUFACTURE AND INSTALLATION OF THE DESIGNED DETENTION SYSTEM DETAILED IN THE PROJECT PLANS.

MATERIAL
THE MATERIAL SHALL CONFORM TO THE APPLICABLE REQUIREMENTS LISTED BELOW:

ALUMINIZED TYPE 2 STEEL COILS SHALL CONFORM TO THE REQUIREMENTS OF AASHTO M-274 OR ASTM A-92.

THE GALVANIZED STEEL COILS SHALL CONFORM TO THE REQUIREMENTS OF AASHTO M-218 OR ASTM A-929.

THE POLYMER COATED STEEL COILS SHALL CONFORM TO THE REQUIREMENTS OF AASHTO M-246 OR ASTM A-742.

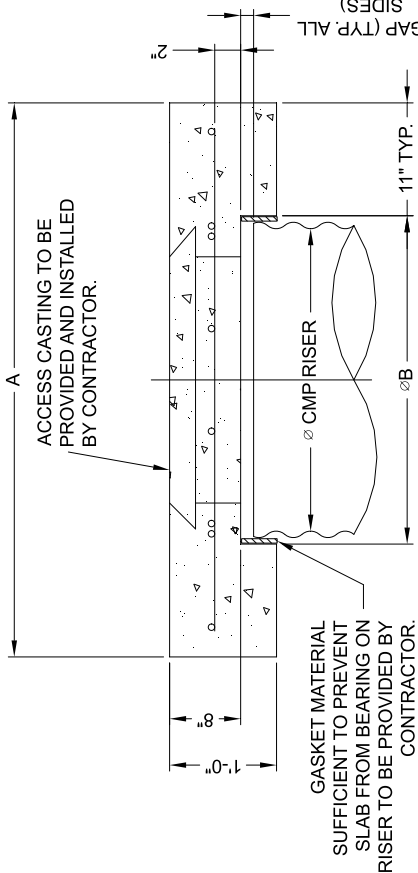
THE ALUMINUM COILS SHALL CONFORM TO THE APPLICABLE OF AASHTO M-197 OR ASTM B-744.

CONSTRUCTION LOADS
CONSTRUCTION LOADS MAY BE HIGHER THAN FINAL LOADS. FOLLOW THE MANUFACTURER'S OR NCSPA GUIDELINES.

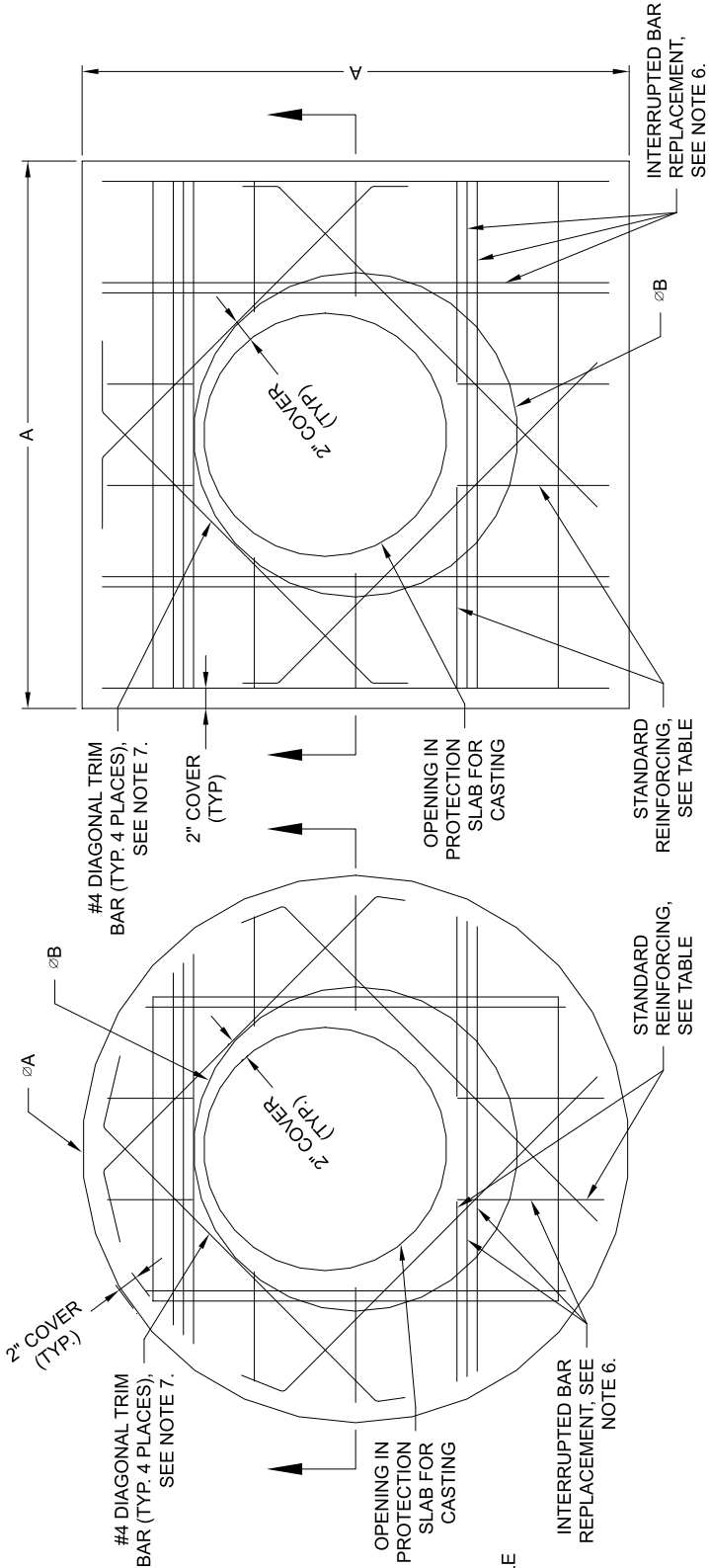
NOTE:
THESE DRAWINGS ARE FOR CONCEPTUAL PURPOSES AND DO NOT REFLECT ANY LOCAL PREFERENCES OR REGULATIONS. PLEASE CONTACT YOUR LOCAL CONTECH REP FOR MODIFICATIONS.

The design and information shown on this drawing is provided for informational purposes only. It is not to be used for construction or as a basis for any other project. The user of this drawing, in any form, is responsible for its accuracy and for its use. The user of this drawing, in any form, is responsible for its accuracy and for its use. The user of this drawing, in any form, is responsible for its accuracy and for its use.

If discrepancies between the supplied information upon which this drawing is based and the actual conditions are discovered as site work progresses, these discrepancies must be reported to Contech immediately for re-evaluation of the design. Contech accepts no liability for designs based on missing, incomplete or inaccurate information supplied by others.



SECTION VIEW



ROUND OPTION PLAN VIEW

NOTES:

- DESIGN IN ACCORDANCE WITH AASHTO, 17th EDITION.
- DESIGN LOAD HS25.
- EARTH COVER = 1' MAX.
- CONCRETE STRENGTH = 3,500 psi
- REINFORCING STEEL = ASTM A615, GRADE 60.
- PROVIDE ADDITIONAL REINFORCING AROUND OPENINGS EQUAL TO THE BARS INTERRUPTED, HALF EACH SIDE. ADDITIONAL BARS TO BE IN THE SAME PLANE.

REINFORCING TABLE

Ø CMP RISER	A	Ø B	REINFORCING	**BEARING PRESSURE (PSF)
24"	Ø 4' 4'X4'	26"	#5 @ 12" OCEW #5 @ 12" OCEW	2,410 1,780
30"	Ø 4'-6" 4'-6" X 4'-6"	32"	#5 @ 12" OCEW #5 @ 12" OCEW	2,120 1,530
36"	Ø 5' 5' X 5'	38"	#5 @ 10" OCEW #5 @ 10" OCEW	1,890 1,350
42"	Ø 5'-6" 5'-6" X 5'-6"	44"	#5 @ 10" OCEW #5 @ 9" OCEW	1,720 1,210
48"	Ø 6' 6' X 6'	50"	#5 @ 9" OCEW #5 @ 8" OCEW	1,600 1,100

** ASSUMED SOIL BEARING CAPACITY

SQUARE OPTION PLAN VIEW

- TRIM OPENING WITH DIAGONAL #4 BARS, EXTEND BARS A MINIMUM OF 12" BEYOND OPENING, BEND BARS AS REQUIRED TO MAINTAIN BAR COVER.
- PROTECTION SLAB AND ALL MATERIALS TO BE PROVIDED AND INSTALLED BY CONTRACTOR.
- DETAIL DESIGN BY DELTA ENGINEERING, BINGHAMTON, NY.

MANHOLE CAP DETAIL

SCALE: N.T.S.

96"Ø UNDERGROUND DETENTION SYSTEM - -

555 HOPPING BROOK ROAD

HOLLISTON, MA

SITE DESIGNATION:

CONTECH®
ENGINEERED SOLUTIONS LLC
www.ContechES.com

9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

CONTECH
DYODS
DRAWING

IT IS ALWAYS THE RESPONSIBILITY OF THE CONTRACTOR TO FOLLOW OSHA GUIDELINES FOR SAFE PRACTICES.

DATE	REVISION DESCRIPTION	BY

CONTECH®
ENGINEERED SOLUTIONS LLC
www.ContechES.com

9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

CONTECH®
CMP DETENTION SYSTEMS

CONTECH
DYODS
DRAWING

96"Ø UNDERGROUND DETENTION SYSTEM - -

555 HOPPING BROOK ROAD

HOLLISTON, MA

SITE DESIGNATION:

PROJECT No.:	SEQ. No.:	DATE:
4952	7952	5/21/2021
DESIGNED:	DRAWN:	
DYO	DYO	DYO
CHECKED:	APPROVED:	
DYO	DYO	DYO
SHEET NO.:	D3	

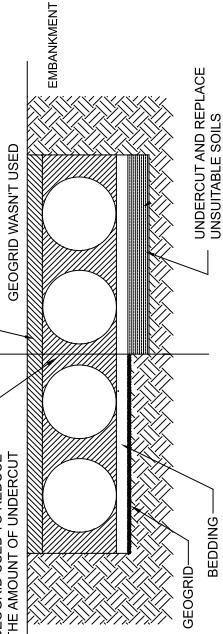
CMP DETENTION INSTALLATION GUIDE

PROPER INSTALLATION OF A FLEXIBLE UNDERGROUND DETENTION SYSTEM WILL ENSURE LONG-TERM PERFORMANCE. THE CONFIGURATION OF THESE SYSTEMS OFTEN REQUIRES SPECIAL CONSTRUCTION PRACTICES THAT DIFFER FROM CONVENTIONAL FLEXIBLE PIPE CONSTRUCTION. CONTECH ENGINEERED SOLUTIONS STRONGLY SUGGESTS SCHEDULING A PRE-CONSTRUCTION MEETING WITH YOUR LOCAL SALES ENGINEER TO DETERMINE IF ADDITIONAL MEASURES, NOT COVERED IN THIS GUIDE, ARE APPROPRIATE FOR YOUR SITE.

FOUNDATION

CONSTRUCT A FOUNDATION THAT CAN SUPPORT THE DESIGN LOADING APPLIED BY THE PIPE AND ADJACENT BACKFILL WEIGHT AS WELL AS MAINTAIN ITS INTEGRITY DURING CONSTRUCTION.

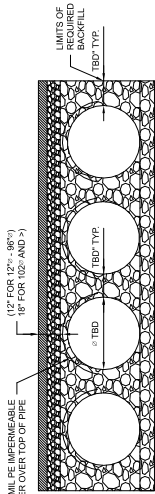
IF SOFT OR UNSUITABLE SOILS ARE ENCOUNTERED, REMOVE THE POOR SOILS DOWN TO A SUITABLE DEPTH AND THEN BUILD UP TO THE APPROPRIATE ELEVATION WITH A COMPETENT BACKFILL MATERIAL. THE STRUCTURAL FILL MATERIAL GRADATION SHOULD NOT ALLOW THE MIGRATION OF FINES, WHICH CAN CAUSE SETTLEMENT OF THE DETENTION SYSTEM OR PAVEMENT ABOVE. IF THE STRUCTURAL FILL MATERIAL IS NOT COMPATIBLE WITH THE UNDERLYING SOILS AN ENGINEERING FABRIC SHOULD BE USED AS A SEPARATOR. IN SOME CASES, USING A STIFF REINFORCING GEOGRID, REDUCES OVER EXCAVATION AND REPLACEMENT FILL QUANTITIES.



GRADE THE FOUNDATION SUBGRADE TO A UNIFORM OR SLIGHTLY SLOPING GRADE. IF THE SUBGRADE IS CLAY OR RELATIVELY NON-POROUS AND THE CONSTRUCTION SEQUENCE WILL LAST FOR AN EXTENDED PERIOD OF TIME, IT IS BEST TO SLOPE THE GRADE TO ONE END OF THE SYSTEM. THIS WILL ALLOW EXCESS WATER TO DRAIN QUICKLY, PREVENTING SATURATION OF THE SUBGRADE.

GEOMEMBRANE BARRIER

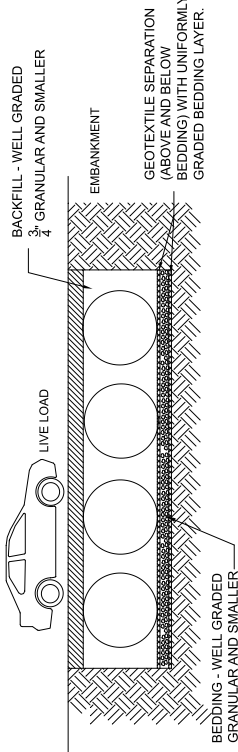
A SITE'S RESISTIVITY MAY CHANGE OVER TIME WHEN VARIOUS TYPES OF SALTING AGENTS ARE USED, SUCH AS ROAD SALTS FOR DEICING AGENTS. IF SALTING AGENTS ARE USED ON OR NEAR THE PROJECT SITE, A GEOMEMBRANE BARRIER IS RECOMMENDED WITH THE SYSTEM. THE GEOMEMBRANE LINER IS INTENDED TO HELP PROTECT THE SYSTEM FROM THE POTENTIAL ADVERSE EFFECTS THAT MAY RESULT FROM THE USE OF SUCH AGENTS INCLUDING PREMATURE CORROSION AND REDUCED ACTUAL STRENGTH. THE ENGINEER OF RECORD IS TO EVALUATE WHETHER SALTING AGENTS WILL BE USED ON OR NEAR THE PROJECT SITE, AND USE HIS/HER BEST JUDGEMENT TO DETERMINE IF ANY ADDITIONAL PROTECTIVE MEASURES ARE REQUIRED. BELOW IS A TYPICAL DETAIL SHOWING THE PLACEMENT OF A GEOMEMBRANE BARRIER FOR PROJECTS WHERE SALTING AGENTS ARE USED ON OR NEAR THE PROJECT SITE.



IN-SITU TRENCH WALL

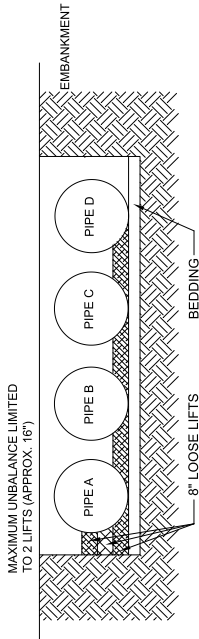
IF EXCAVATION IS REQUIRED, THE TRENCH WALL NEEDS TO BE CAPABLE OF SUPPORTING THE LOAD THAT THE PIPE SHEDS AS THE SYSTEM IS LOADED. IF SOILS ARE NOT CAPABLE OF SUPPORTING THESE LOADS, THE PIPE CAN DEFLECT. PERFORM A SIMPLE SOIL PRESSURE CHECK USING THE APPLIED LOADS TO DETERMINE THE LIMITS OF EXCAVATION BEYOND THE SPRING LINE OF THE OUTER MOST PIPES.

IN MOST CASES THE REQUIREMENTS FOR A SAFE WORK ENVIRONMENT AND PROPER BACKFILL PLACEMENT AND COMPACTION TAKE CARE OF THIS CONCERN.



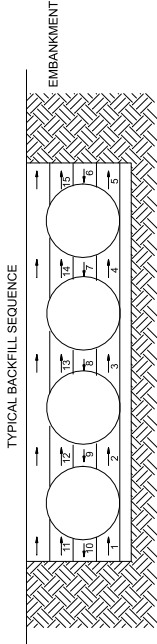
BACKFILL PLACEMENT

MATERIAL SHALL BE WORKED INTO THE PIPE HAUNCHES BY MEANS OF SHOVEL-SLICING, RODDING, AIR TAMPER, VIBRATORY ROD, OR OTHER EFFECTIVE METHODS.



IF AASHTO T99 PROCEDURES ARE DETERMINED INFEEASIBLE BY THE GEOTECHNICAL ENGINEER OF RECORD, COMPACTION IS CONSIDERED ADEQUATE WHEN NO FURTHER YIELDING OF THE MATERIAL IS OBSERVED UNDER THE COMPACTOR, OR UNDER FOOT, AND THE GEOTECHNICAL ENGINEER OF RECORD (OR REPRESENTATIVE THEREOF) IS SATISFIED WITH THE LEVEL OF COMPACTION.

FOR LARGE SYSTEMS, CONVEYOR SYSTEMS, BACKHOES WITH LONG REACHES OR DRAGLINES WITH STONE BUCKETS MAY BE USED TO PLACE BACKFILL. ONCE MINIMUM COVER FOR CONSTRUCTION LOADING ACROSS THE ENTIRE WIDTH OF THE SYSTEM IS REACHED, ADVANCE THE EQUIPMENT TO THE END OF THE RECENTLY PLACED FILL, AND BEGIN THE SEQUENCE AGAIN UNTIL THE SYSTEM IS COMPLETELY BACKFILLED. THIS TYPE OF CONSTRUCTION SEQUENCE PROVIDES ROOM FOR STOCKPILED BACKFILL DIRECTLY BEHIND THE BACKHOE, AS WELL AS THE MOVEMENT OF CONSTRUCTION TRAFFIC. MATERIAL STOCKPILES ON TOP OF THE BACKFILLED DETENTION SYSTEM SHOULD BE LIMITED TO 8- TO 10- FEET HIGH AND MUST PROVIDE BALANCED LOADING ACROSS ALL BARRELS. TO DETERMINE THE PROPER COVER OVER THE PIPES TO ALLOW THE MOVEMENT OF CONSTRUCTION EQUIPMENT SEE TABLE 1, OR CONTACT YOUR LOCAL CONTECH SALES ENGINEER.



CMP DETENTION SYSTEM INSPECTION AND MAINTENANCE

UNDERGROUND STORMWATER DETENTION AND INFILTRATION SYSTEMS MUST BE INSPECTED AND MAINTAINED AT REGULAR INTERVALS FOR PURPOSES OF PERFORMANCE AND LONGEVITY.

INSPECTION

INSPECTION IS THE KEY TO EFFECTIVE MAINTENANCE OF CMP DETENTION SYSTEMS AND IS EASILY PERFORMED. CONTECH RECOMMENDS ONGOING, ANNUAL INSPECTIONS. SITES WITH HIGH TRASH LOAD OR SMALL OUTLET CONTROL ORIFICES MAY NEED MORE FREQUENT INSPECTIONS. THE RATE AT WHICH THE SYSTEM COLLECTS POLLUTANTS WILL DEPEND MORE ON SITE SPECIFIC ACTIVITIES RATHER THAN THE SIZE OR CONFIGURATION OF THE SYSTEM.

INSPECTIONS SHOULD BE PERFORMED MORE OFTEN IN EQUIPMENT WASHDOWN AREAS, IN CLIMATES WHERE SANDING AND/OR SALTING OPERATIONS TAKE PLACE, AND IN OTHER VARIOUS INSTANCES IN WHICH ONE WOULD EXPECT HIGHER ACCUMULATIONS OF SEDIMENT OR ABRASIVE/ CORROSIVE CONDITIONS. A RECORD OF EACH INSPECTION IS TO BE MAINTAINED FOR THE LIFE OF THE SYSTEM

MAINTENANCE

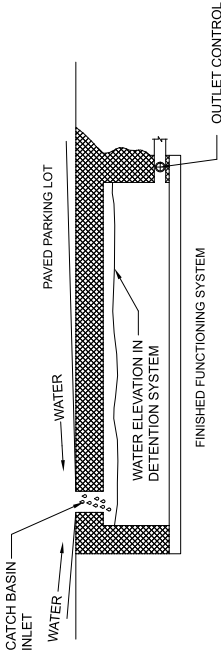
CMP DETENTION SYSTEMS SHOULD BE CLEANED WHEN AN INSPECTION REVEALS ACCUMULATED SEDIMENT OR TRASH IS CLOGGING THE DISCHARGE ORIFICE.

ACCUMULATED SEDIMENT AND TRASH CAN TYPICALLY BE EVACUATED THROUGH THE MANHOLE OVER THE OUTLET ORIFICE. IF MAINTENANCE IS NOT PERFORMED AS RECOMMENDED, SEDIMENT AND TRASH MAY ACCUMULATE IN FRONT OF THE OUTLET ORIFICE. MANHOLE COVERS SHOULD BE SECURELY SEATED FOLLOWING CLEANING ACTIVITIES. CONTECH SUGGESTS THAT ALL SYSTEMS BE DESIGNED WITH AN ACCESS/INSPECTION MANHOLE SITUATED AT OR NEAR THE INLET AND THE OUTLET ORIFICE. SHOULD IT BE NECESSARY TO GET INSIDE THE SYSTEM TO PERFORM MAINTENANCE ACTIVITIES, ALL APPROPRIATE PRECAUTIONS REGARDING CONFINED SPACE ENTRY AND OSHA REGULATIONS SHOULD BE FOLLOWED.

ANNUAL INSPECTIONS ARE BEST PRACTICE FOR ALL UNDERGROUND SYSTEMS. DURING THIS INSPECTION, IF EVIDENCE OF SALTING/DE-ICING AGENTS IS OBSERVED WITHIN THE SYSTEM, IT IS BEST PRACTICE FOR THE SYSTEM TO BE RINSED, INCLUDING ABOVE THE SPRING LINE SOON AFTER THE SPRING THAW AS PART OF THE MAINTENANCE PROGRAM FOR THE SYSTEM.

MAINTAINING AN UNDERGROUND DETENTION OR INFILTRATION SYSTEM IS EASIEST WHEN THERE IS NO FLOW ENTERING THE SYSTEM. FOR THIS REASON, IT IS A GOOD IDEA TO SCHEDULE THE CLEANOUT DURING DRY WEATHER.

THE FOREGOING INSPECTION AND MAINTENANCE EFFORTS HELP ENSURE UNDERGROUND PIPE SYSTEMS USED FOR STORMWATER STORAGE CONTINUE TO FUNCTION AS INTENDED BY IDENTIFYING RECOMMENDED REGULAR INSPECTION AND MAINTENANCE PRACTICES. INSPECTION AND MAINTENANCE RELATED TO THE STRUCTURAL INTEGRITY OF THE PIPE OR THE SOUNDNESS OF PIPE JOINT CONNECTIONS IS BEYOND THE SCOPE OF THIS GUIDE.



ADDITIONAL CONSIDERATIONS

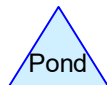
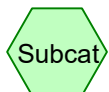
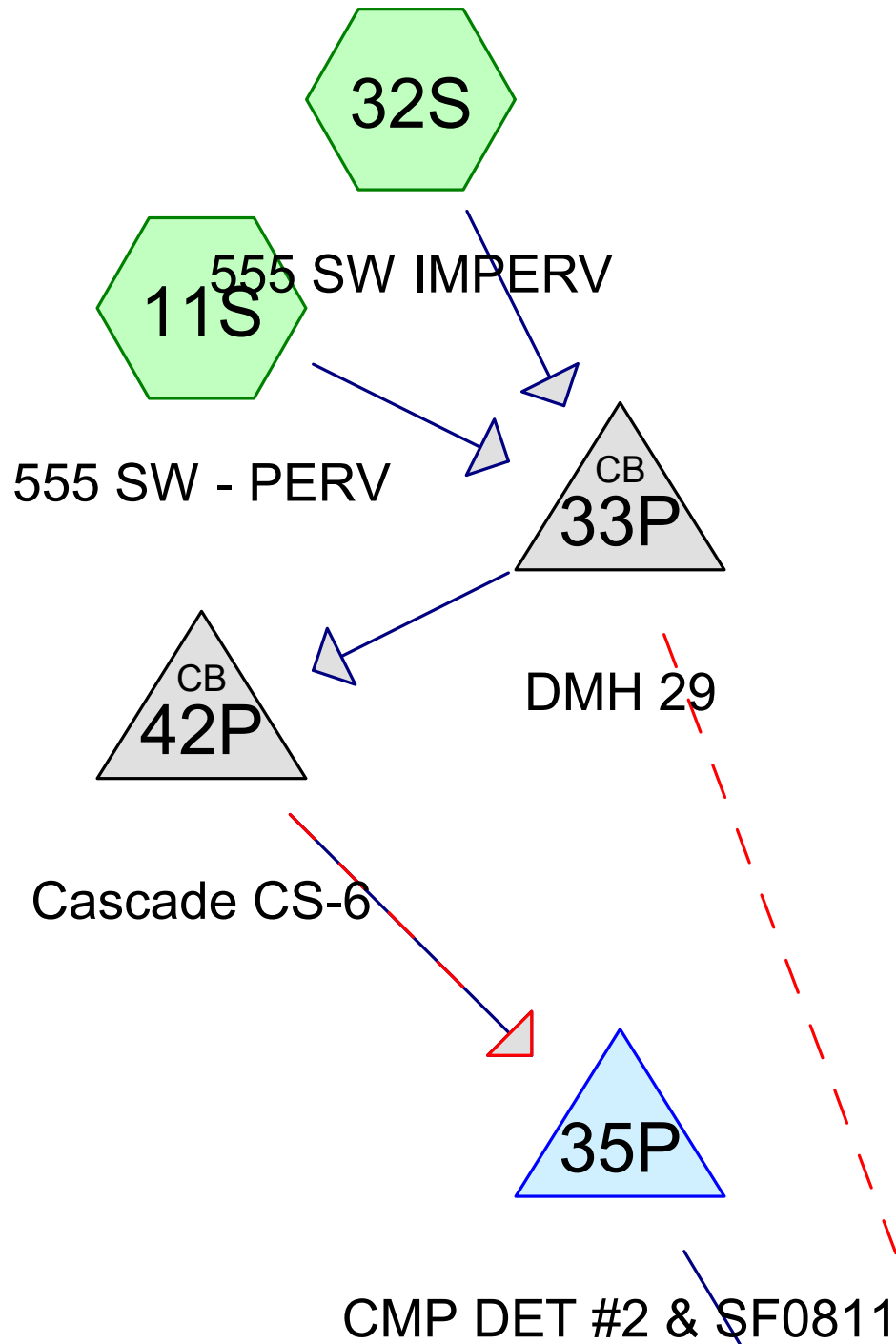
BECAUSE MOST SYSTEMS ARE CONSTRUCTED BELOW-GRADE, RAINFALL CAN RAPIDLY FILL THE EXCAVATION; POTENTIALLY CAUSING FLOATATION AND MOVEMENT OF THE PREVIOUSLY PLACED PIPES. TO HELP MITIGATE POTENTIAL PROBLEMS, IT IS BEST TO START THE INSTALLATION AT THE DOWNSTREAM END WITH THE OUTLET ALREADY CONSTRUCTED TO ALLOW A ROUTE FOR THE WATER TO ESCAPE. TEMPORARY DIVERSION MEASURES MAY BE REQUIRED FOR HIGH FLOWS DUE TO THE RESTRICTED NATURE OF THE OUTLET PIPE.

96"Ø UNDERGROUND DETENTION SYSTEM - -
555 HOPPING BROOK ROAD
HOLLISTON, MA
SITE DESIGNATION:

CONTECH
ENGINEERED SOLUTIONS LLC
www.ContechES.com
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

CONTECH
dYODS
DRAWING

PROJECT No.:	4952	SEQ. No.:	7952	DATE:	5/21/2021
DESIGNED:	DYO	DRAWN:	DYO		
CHECKED:	DYO	APPROVED:	DYO		
SHEET NO.:	D4				



Routing Diagram for 3724 STORMWATER- - Contech Markup

Prepared by quikrete, Printed 5/25/2021

HydroCAD® 10.10-5a s/n 00447 © 2020 HydroCAD Software Solutions LLC

3724 STORMWATER- - Contech Markup

Prepared by quikrete

Printed 5/25/2021

HydroCAD® 10.10-5a s/n 00447 © 2020 HydroCAD Software Solutions LLC

Page 2

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	WQ	Type III 24-hr		Default	24.00	1	1.21	2

3724 STORMWATER- - Contech Markup

Prepared by quikrete

Printed 5/25/2021

HydroCAD® 10.10-5a s/n 00447 © 2020 HydroCAD Software Solutions LLC

Page 3

Area Listing (selected nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
173,010	74	>75% Grass cover, Good, HSG C (11S)
181,276	98	Paved parking, HSG C (32S)
354,286	86	TOTAL AREA

3724 STORMWATER- - Contech Markup*Type III 24-hr WQ Rainfall=1.21"*

Prepared by quikrete

Printed 5/25/2021

HydroCAD® 10.10-5a s/n 00447 © 2020 HydroCAD Software Solutions LLC

Page 4

Time span=0.00-24.00 hrs, dt=0.03 hrs, 801 points
 Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
 Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 11S: 555 SW - PERV

Runoff Area=173,010 sf 0.00% Impervious Runoff Depth>0.06"
 Flow Length=1,949' Tc=8.6 min CN=74 Runoff=0.071 cfs 919 cf

Subcatchment 32S: 555 SW IMPERV

Runoff Area=181,276 sf 100.00% Impervious Runoff Depth>0.99"
 Flow Length=1,949' Tc=8.6 min CN=98 Runoff=4.200 cfs 15,019 cf

Pond 33P: DMH 29

Peak Elev=292.85' Inflow=4.200 cfs 15,938 cf
 Primary=4.200 cfs 15,938 cf Secondary=0.000 cfs 0 cf Outflow=4.200 cfs 15,938 cf

Pond 35P: CMP DET #2 & SF0811

Peak Elev=292.53' Storage=5,464 cf Inflow=4.200 cfs 15,938 cf
 Outflow=0.563 cfs 15,907 cf

Pond 42P: Cascade CS-6

Peak Elev=292.54' Inflow=4.200 cfs 15,938 cf
 Primary=4.200 cfs 15,938 cf Secondary=0.000 cfs 0 cf Outflow=4.200 cfs 15,938 cf

Total Runoff Area = 354,286 sf Runoff Volume = 15,938 cf Average Runoff Depth = 0.54"
48.83% Pervious = 173,010 sf 51.17% Impervious = 181,276 sf

3724 STORMWATER- - Contech Markup

Prepared by quikrete

HydroCAD® 10.10-5a s/n 00447 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr WQ Rainfall=1.21"

Printed 5/25/2021

Page 5

Summary for Subcatchment 11S: 555 SW - PERV

Runoff = 0.071 cfs @ 12.46 hrs, Volume= 919 cf, Depth> 0.06"

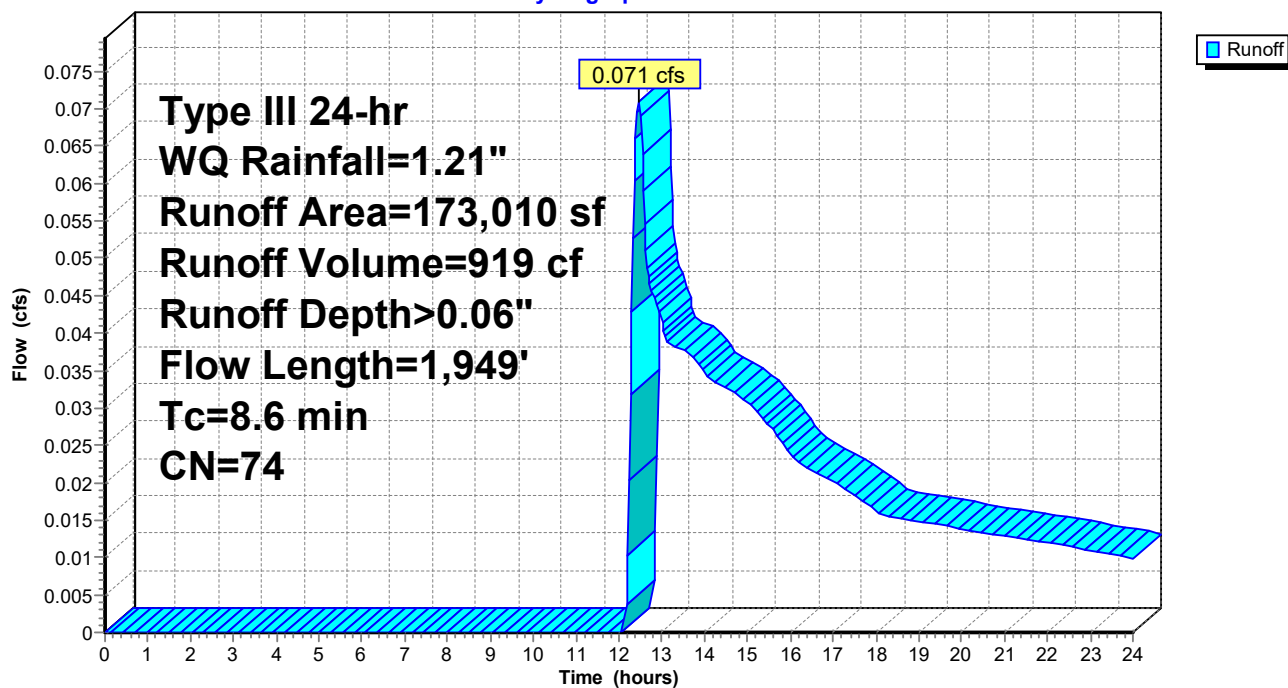
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs
Type III 24-hr WQ Rainfall=1.21"

Area (sf)	CN	Description
173,010	74	>75% Grass cover, Good, HSG C
173,010		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.7	50	0.0800	0.18		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"
1.6	330	0.0270	3.34		Shallow Concentrated Flow, Paved Kv= 20.3 fps
2.3	1,569	0.0240	11.16	35.05	Pipe Channel, RCP_Round 24" 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013
8.6	1,949	Total			

Subcatchment 11S: 555 SW - PERV

Hydrograph



3724 STORMWATER- - Contech Markup

Type III 24-hr WQ Rainfall=1.21"

Prepared by quikrete

Printed 5/25/2021

HydroCAD® 10.10-5a s/n 00447 © 2020 HydroCAD Software Solutions LLC

Page 6

Summary for Subcatchment 32S: 555 SW IMPERV

Runoff = 4.200 cfs @ 12.12 hrs, Volume= 15,019 cf, Depth> 0.99"

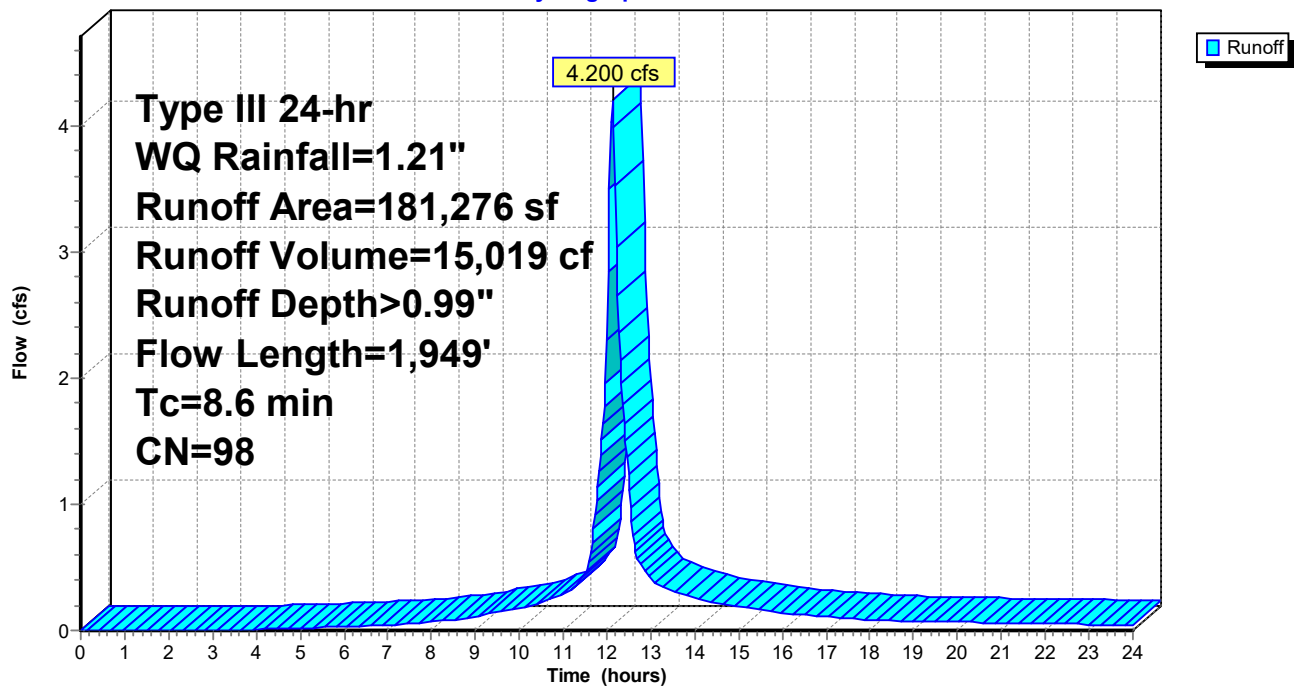
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs
Type III 24-hr WQ Rainfall=1.21"

Area (sf)	CN	Description
181,276	98	Paved parking, HSG C
181,276		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.7	50	0.0800	0.18		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"
1.6	330	0.0270	3.34		Shallow Concentrated Flow, Paved Kv= 20.3 fps
2.3	1,569	0.0240	11.16	35.05	Pipe Channel, RCP_Round 24" 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013
8.6	1,949	Total			

Subcatchment 32S: 555 SW IMPERV

Hydrograph



3724 STORMWATER- - Contech Markup

Type III 24-hr WQ Rainfall=1.21"

Prepared by quikrete

Printed 5/25/2021

HydroCAD® 10.10-5a s/n 00447 © 2020 HydroCAD Software Solutions LLC

Page 7

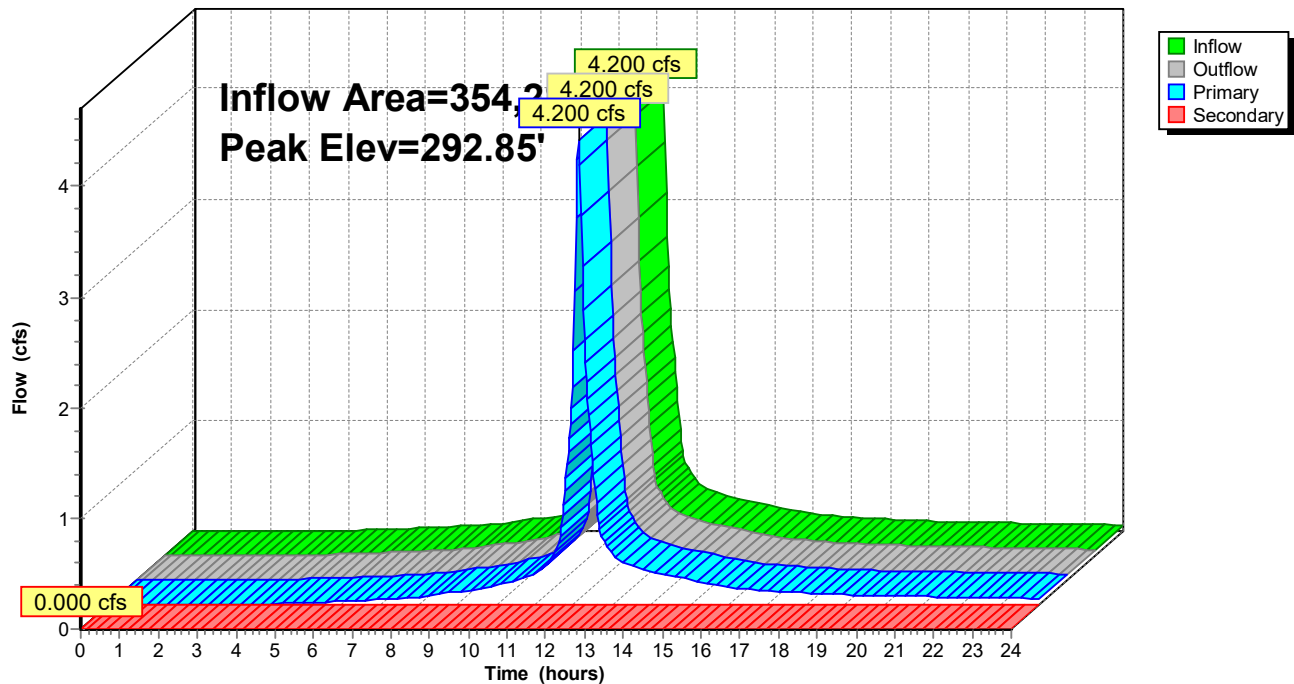
Summary for Pond 33P: DMH 29

Inflow Area = 354,286 sf, 51.17% Impervious, Inflow Depth > 0.54" for WQ event
 Inflow = 4.200 cfs @ 12.12 hrs, Volume= 15,938 cf
 Outflow = 4.200 cfs @ 12.12 hrs, Volume= 15,938 cf, Atten= 0%, Lag= 0.0 min
 Primary = 4.200 cfs @ 12.12 hrs, Volume= 15,938 cf
 Secondary = 0.000 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs

Peak Elev= 292.85' @ 12.13 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	290.83'	24.0" Round Culvert L= 10.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 290.83' / 290.69' S= 0.0140 '/' Cc= 0.900 n= 0.120, Flow Area= 3.14 sf
#2	Secondary	292.87'	8.0' long x 0.5' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=3.965 cfs @ 12.12 hrs HW=292.84' TW=292.47' (Dynamic Tailwater)↑**1=Culvert** (Outlet Controls 3.965 cfs @ 1.56 fps)**Secondary OutFlow** Max=0.000 cfs @ 0.00 hrs HW=290.83' TW=273.00' (Dynamic Tailwater)↑**2=Broad-Crested Rectangular Weir** (Controls 0.000 cfs)**Pond 33P: DMH 29****Hydrograph**

3724 STORMWATER- - Contech Markup*Type III 24-hr WQ Rainfall=1.21"*

Prepared by quikrete

Printed 5/25/2021

HydroCAD® 10.10-5a s/n 00447 © 2020 HydroCAD Software Solutions LLC

Page 8

Stage-Discharge for Pond 33P: DMH 29

Elevation (feet)	Discharge (cfs)	Primary (cfs)	Secondary (cfs)
290.83	0.000	0.000	0.000
290.88	0.002	0.002	0.000
290.93	0.008	0.008	0.000
290.98	0.020	0.020	0.000
291.03	0.038	0.038	0.000
291.08	0.063	0.063	0.000
291.13	0.095	0.095	0.000
291.18	0.134	0.134	0.000
291.23	0.181	0.181	0.000
291.28	0.236	0.236	0.000
291.33	0.299	0.299	0.000
291.38	0.370	0.370	0.000
291.43	0.449	0.449	0.000
291.48	0.537	0.537	0.000
291.53	0.632	0.632	0.000
291.58	0.736	0.736	0.000
291.63	0.848	0.848	0.000
291.68	0.968	0.968	0.000
291.73	1.096	1.096	0.000
291.78	1.231	1.231	0.000
291.83	1.373	1.373	0.000
291.88	1.523	1.523	0.000
291.93	1.680	1.680	0.000
291.98	1.843	1.843	0.000
292.03	2.012	2.012	0.000
292.08	2.187	2.187	0.000
292.13	2.368	2.368	0.000
292.18	2.554	2.554	0.000
292.23	2.744	2.744	0.000
292.28	2.939	2.939	0.000
292.33	3.137	3.137	0.000
292.38	3.338	3.338	0.000
292.43	3.543	3.543	0.000
292.48	3.749	3.749	0.000
292.53	3.956	3.956	0.000
292.58	4.165	4.165	0.000
292.63	4.373	4.373	0.000
292.68	4.581	4.581	0.000
292.73	4.787	4.787	0.000
292.78	4.991	4.991	0.000
292.83	5.192	5.192	0.000

3724 STORMWATER- - Contech Markup

Type III 24-hr WQ Rainfall=1.21"

Prepared by quikrete

Printed 5/25/2021

HydroCAD® 10.10-5a s/n 00447 © 2020 HydroCAD Software Solutions LLC

Page 9

Summary for Pond 35P: CMP DET #2 & SF0811

Inflow Area = 354,286 sf, 51.17% Impervious, Inflow Depth > 0.54" for WQ event
 Inflow = 4.200 cfs @ 12.12 hrs, Volume= 15,938 cf
 Outflow = 0.563 cfs @ 12.79 hrs, Volume= 15,907 cf, Atten= 87%, Lag= 40.1 min
 Primary = 0.563 cfs @ 12.79 hrs, Volume= 15,907 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs
 Peak Elev= 292.53' @ 12.79 hrs Surf.Area= 1,690 sf Storage= 5,464 cf

Plug-Flow detention time= 81.6 min calculated for 15,907 cf (100% of inflow)
 Center-of-Mass det. time= 80.3 min (875.4 - 795.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	286.71'	0 cf	26.00'W x 65.00'L x 6.00'H Field A 10,140 cf Overall - 5,513 cf Embedded = 4,627 cf x 0.0% Voids
#2A	286.71'	5,513 cf	CMP Round 72 x 6 Inside #1 Effective Size= 72.0"W x 72.0"H => 28.27 sf x 20.00'L = 565.5 cf Overall Size= 72.0"W x 72.0"H x 20.00'L Row Length Adjustment= +17.00' x 28.27 sf x 3 rows 24.00' Header x 28.27 sf x 1 = 678.6 cf Inside
		5,513 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices (Turned on 1 times)
#1	Device 2	286.71'	12.0" Round Culvert L= 5.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 286.71' / 286.68' S= 0.0060 ' S= 0.0060 ' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf
#2	Primary	283.66'	Tube/Siphon/Float Valve X 22.00 0.572" Diameter, C= 0.600, 0.263" Trickle Diameter Starts@286.71' Breaks@284.33'

Primary OutFlow Max=0.563 cfs @ 12.79 hrs HW=292.53' TW=277.51' (Dynamic Tailwater)

↑ **2=Tube/Siphon/Float Valve** (Orifice Controls 0.563 cfs @ 14.34 fps)

↑ **1=Culvert** (Passes 0.563 cfs of 8.720 cfs potential flow)

3724 STORMWATER- - Contech Markup

Type III 24-hr WQ Rainfall=1.21"

Prepared by quikrete

Printed 5/25/2021

HydroCAD® 10.10-5a s/n 00447 © 2020 HydroCAD Software Solutions LLC

Page 10

Pond 35P: CMP DET #2 & SF0811 - Chamber Wizard Field A**Chamber Model = CMP Round 72 (Round Corrugated Metal Pipe)**

Effective Size= 72.0"W x 72.0"H => 28.27 sf x 20.00'L = 565.5 cf

Overall Size= 72.0"W x 72.0"H x 20.00'L

Row Length Adjustment= +17.00' x 28.27 sf x 3 rows

72.0" Wide + 36.0" Spacing = 108.0" C-C Row Spacing

2 Chambers/Row x 20.00' Long +17.00' Row Adjustment +6.00' Header x 1 = 63.00' Row Length +12.0"

End Stone x 2 = 65.00' Base Length

3 Rows x 72.0" Wide + 36.0" Spacing x 2 + 12.0" Side Stone x 2 = 26.00' Base Width

72.0" Chamber Height = 6.00' Field Height

6 Chambers x 565.5 cf +17.00' Row Adjustment x 28.27 sf x 3 Rows + 24.00' Header x 28.27 sf = 5,513.5 cf Chamber Storage

10,140.0 cf Field - 5,513.5 cf Chambers = 4,626.5 cf Stone x 0.0% Voids = 0.0 cf Stone Storage

Chamber Storage = 5,513.5 cf = 0.127 af

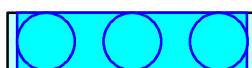
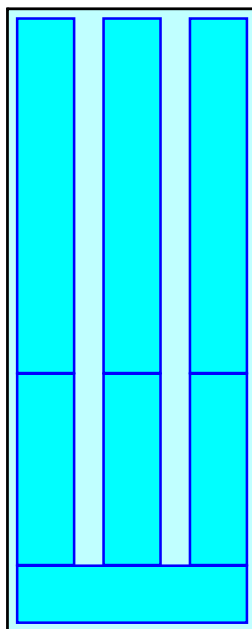
Overall Storage Efficiency = 54.4%

Overall System Size = 65.00' x 26.00' x 6.00'

6 Chambers

375.6 cy Field

171.4 cy Stone



3724 STORMWATER- - Contech Markup

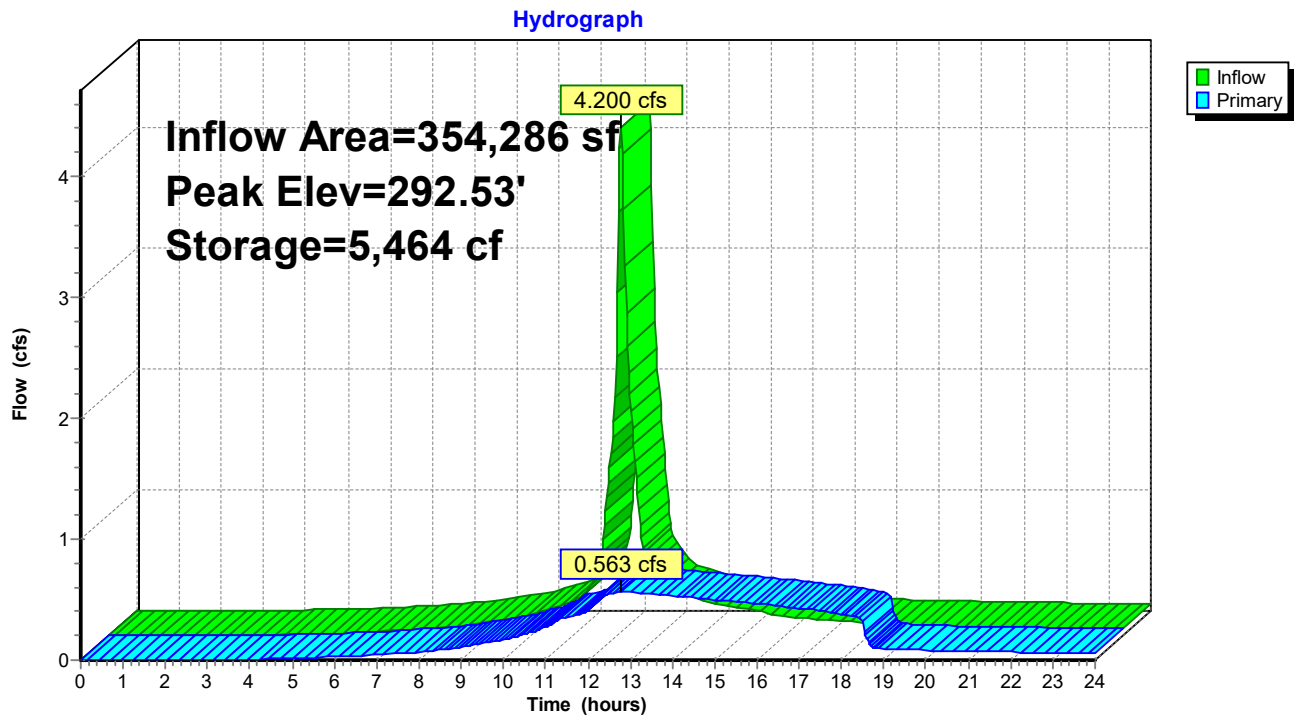
Prepared by quikrete

HydroCAD® 10.10-5a s/n 00447 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr WQ Rainfall=1.21"

Printed 5/25/2021

Page 11

Pond 35P: CMP DET #2 & SF0811

3724 STORMWATER- - Contech Markup*Type III 24-hr WQ Rainfall=1.21"*

Prepared by quikrete

Printed 5/25/2021

HydroCAD® 10.10-5a s/n 00447 © 2020 HydroCAD Software Solutions LLC

Page 12

Stage-Discharge for Pond 35P: CMP DET #2 & SF0811

Elevation (feet)	Primary (cfs)	Primary+ (cfs)	Elevation (feet)	Primary (cfs)	Primary+ (cfs)
284.33	0.000	0.000	289.73	0.466	0.466
284.43	0.000	0.000	289.83	0.470	0.470
284.53	0.000	0.000	289.93	0.473	0.473
284.63	0.000	0.000	290.03	0.477	0.477
284.73	0.000	0.000	290.13	0.481	0.481
284.83	0.000	0.000	290.23	0.485	0.485
284.93	0.000	0.000	290.33	0.488	0.488
285.03	0.000	0.000	290.43	0.492	0.492
285.13	0.000	0.000	290.53	0.495	0.495
285.23	0.000	0.000	290.63	0.499	0.499
285.33	0.000	0.000	290.73	0.503	0.503
285.43	0.000	0.000	290.83	0.506	0.506
285.53	0.000	0.000	290.93	0.510	0.510
285.63	0.000	0.000	291.03	0.513	0.513
285.73	0.000	0.000	291.13	0.517	0.517
285.83	0.000	0.000	291.23	0.520	0.520
285.93	0.000	0.000	291.33	0.524	0.524
286.03	0.000	0.000	291.43	0.527	0.527
286.13	0.000	0.000	291.53	0.530	0.530
286.23	0.000	0.000	291.63	0.534	0.534
286.33	0.000	0.000	291.73	0.537	0.537
286.43	0.000	0.000	291.83	0.540	0.540
286.53	0.000	0.000	291.93	0.544	0.544
286.63	0.000	0.000	292.03	0.547	0.547
286.73	0.001	0.001	292.13	0.550	0.550
286.83	0.044	0.044	292.23	0.553	0.553
286.93	0.142	0.142	292.33	0.557	0.557
287.03	0.289	0.289	292.43	0.560	0.560
287.13	0.352	0.352	292.53	0.563	0.563
287.23	0.357	0.357	292.63	0.566	0.566
287.33	0.362	0.362			
287.43	0.367	0.367			
287.53	0.372	0.372			
287.63	0.377	0.377			
287.73	0.381	0.381			
287.83	0.386	0.386			
287.93	0.391	0.391			
288.03	0.395	0.395			
288.13	0.400	0.400			
288.23	0.404	0.404			
288.33	0.409	0.409			
288.43	0.413	0.413			
288.53	0.417	0.417			
288.63	0.421	0.421			
288.73	0.426	0.426			
288.83	0.430	0.430			
288.93	0.434	0.434			
289.03	0.438	0.438			
289.13	0.442	0.442			
289.23	0.446	0.446			
289.33	0.450	0.450			
289.43	0.454	0.454			
289.53	0.458	0.458			
289.63	0.462	0.462			

3724 STORMWATER- - Contech Markup

Type III 24-hr WQ Rainfall=1.21"

Prepared by quikrete

Printed 5/25/2021

HydroCAD® 10.10-5a s/n 00447 © 2020 HydroCAD Software Solutions LLC

Page 13

Summary for Pond 42P: Cascade CS-6

Inflow Area = 354,286 sf, 51.17% Impervious, Inflow Depth > 0.54" for WQ event
 Inflow = 4.200 cfs @ 12.12 hrs, Volume= 15,938 cf
 Outflow = 4.200 cfs @ 12.12 hrs, Volume= 15,938 cf, Atten= 0%, Lag= 0.0 min
 Primary = 4.200 cfs @ 12.12 hrs, Volume= 15,938 cf
 Secondary = 0.000 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs

Peak Elev= 292.54' @ 12.81 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	290.69'	Tube/Siphon/Float Valve X 2.00 1.610" Diameter, C= 0.600 1.9' Long Tube, Hazen-Williams C= 130 Inlet / Outlet Elev. = 288.49' / 290.69'
#2	Primary	292.00'	Tube/Siphon/Float Valve 15.000" Diameter, C= 0.600 1.1' Long Tube, Hazen-Williams C= 130 Inlet / Outlet Elev. = 291.02' / 292.00'
#3	Secondary	292.85'	1.5' long Sharp-Crested Rectangular Weir X 2.00 2 End Contraction(s)

Primary OutFlow Max=4.189 cfs @ 12.12 hrs HW=292.47' TW=289.65' (Dynamic Tailwater)

1=Tube/Siphon/Float Valve (Tube Controls 0.171 cfs @ 6.04 fps)

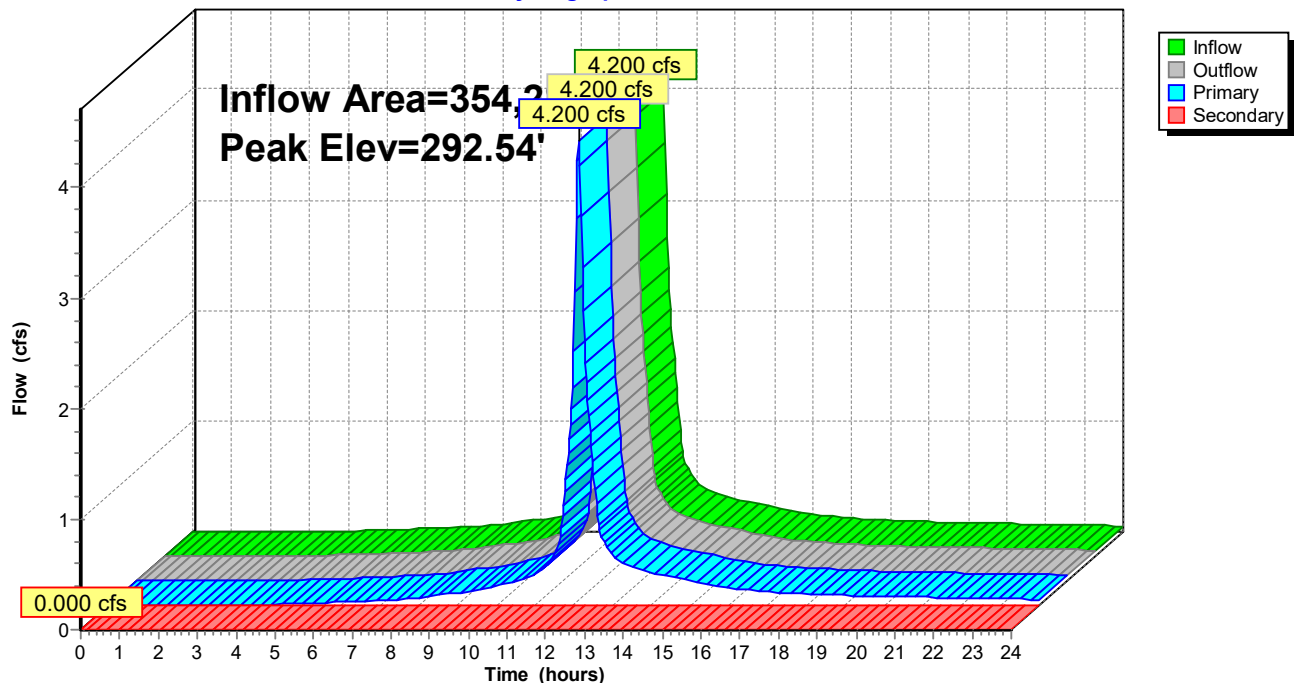
2=Tube/Siphon/Float Valve (Tube Controls 4.018 cfs @ 3.27 fps)

Secondary OutFlow Max=0.000 cfs @ 0.00 hrs HW=288.49' TW=284.33' (Dynamic Tailwater)

3=Sharp-Crested Rectangular Weir (Controls 0.000 cfs)

Pond 42P: Cascade CS-6

Hydrograph



3724 STORMWATER- - Contech Markup*Type III 24-hr WQ Rainfall=1.21"*

Prepared by quikrete

Printed 5/25/2021

HydroCAD® 10.10-5a s/n 00447 © 2020 HydroCAD Software Solutions LLC

Page 14

Stage-Discharge for Pond 42P: Cascade CS-6

Elevation (feet)	Discharge (cfs)	Primary (cfs)	Secondary (cfs)
288.49	0.000	0.000	0.000
288.59	0.000	0.000	0.000
288.69	0.000	0.000	0.000
288.79	0.000	0.000	0.000
288.89	0.000	0.000	0.000
288.99	0.000	0.000	0.000
289.09	0.000	0.000	0.000
289.19	0.000	0.000	0.000
289.29	0.000	0.000	0.000
289.39	0.000	0.000	0.000
289.49	0.000	0.000	0.000
289.59	0.000	0.000	0.000
289.69	0.000	0.000	0.000
289.79	0.000	0.000	0.000
289.89	0.000	0.000	0.000
289.99	0.000	0.000	0.000
290.09	0.000	0.000	0.000
290.19	0.000	0.000	0.000
290.29	0.000	0.000	0.000
290.39	0.000	0.000	0.000
290.49	0.000	0.000	0.000
290.59	0.000	0.000	0.000
290.69	0.000	0.000	0.000
290.79	0.040	0.040	0.000
290.89	0.057	0.057	0.000
290.99	0.070	0.070	0.000
291.09	0.080	0.080	0.000
291.19	0.090	0.090	0.000
291.29	0.099	0.099	0.000
291.39	0.107	0.107	0.000
291.49	0.114	0.114	0.000
291.59	0.121	0.121	0.000
291.69	0.128	0.128	0.000
291.79	0.134	0.134	0.000
291.89	0.140	0.140	0.000
291.99	0.146	0.146	0.000
292.09	1.664	1.664	0.000
292.19	2.560	2.560	0.000
292.29	3.334	3.334	0.000
292.39	3.846	3.846	0.000
292.49	4.296	4.296	0.000
292.59	4.702	4.702	0.000
292.69	5.075	5.075	0.000
292.79	5.422	5.422	0.000



Determining Number of Cartridges for Systems Downstream of Detention

CONTECH Stormwater Solutions Inc. Engineer:
Date

DRA
5/25/2021

Site Information

Project Name
Project State
Project Location
Drainage Area, Ad
Impervious Area, Ai
Pervious Area, Ap
% Impervious
Runoff Coefficient, Rc

555 Hopping Brook Road - DMH 29
MA
Holliston

8.13 ac
4.16 ac
3.97
51 %
0.51

Upstream Detention System

Detention pretreatment credit
(from removal efficiency calcs)

50%

Mass loading calculations

Mean Annual Rainfall, P
Agency required % removal
Percent Runoff Capture
Mean Annual Runoff, V_t
Event Mean Concentration of Pollutant, EMC
Annual Mass Load, M_{total}

49.8 in
80%
90%
675,522 ft³
70 mg/l
2,950 lbs

Water Quality Volume

90% Rainfall Depth
WQ Volume to be treated
WQ Volume to be treated by filters

1.00 in
0.346 ac-ft
15,072 ft³

Filter System

Filtration brand
Cartridge height
Specific Flow Rate

StormFilter
27 in
1.00 gpm/ft²

Number of cartridges - mass loading

Mass removed by pretreatment system, M_{pre}
Mass load to filters after pretreatment, M_{pass1}
Mass to be captured by filters, M_{filter}
Allowable Cartridge Flow rate, Q_{cart}
Mass load per cartridge, M_{cart} (lbs)
Number of Cartridges required, N_{mass}
Treatment Capacity

1,475 lbs
1,475 lbs
1,180 lbs
11.25 gpm
54 lbs
22
0.55 cfs

Determine Critical Sizing Value

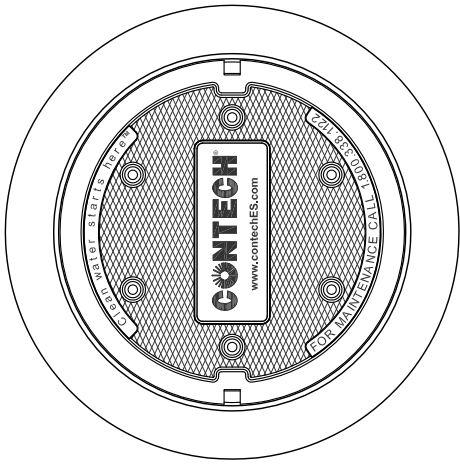
Method to Use:

MASS-LOADING

SUMMARY

Treatment Flow Rate, cfs	0.55
Cartridge Flow Rate, gpm	11.3
Number of Cartridges	22

VAULT STYLE: OUTLET SUMP (NIB)



(DIAMETER VARIES)

SITE SPECIFIC DATA REQUIREMENTS

STRUCTURE ID		*
WATER QUALITY FLOW RATE (cfs)		*
PEAK FLOW RATE (cfs)		*
RETURN PERIOD OF PEAK FLOW (yrs)		*
CARTRIDGE HEIGHT (27", 18", LOW DROP(LD))		*
NUMBER OF CARTRIDGES REQUIRED		*
CARTRIDGE FLOW RATE		*
MEDIA TYPE (PERLITE, ZPG, PSORB)		*
PIPE DATA:	I.E.	MATERIAL
INLET PIPE #1	*	*
INLET PIPE #2	*	*
OUTLET PIPE	*	*
UPSTREAM RIM ELEVATION		*
DOWNSTREAM RIM ELEVATION		*
ANTI-FLOTATION BALLAST	WIDTH	HEIGHT
	*	*
NOTES/SPECIAL REQUIREMENTS:		
* PER ENGINEER OF RECORD		

1. CONTECH TO PROVIDE ALL MATERIALS UNLESS NOTED OTHERWISE.

2. DIMENSIONS MARKED WITH () ARE REFERENCE DIMENSIONS. ACTUAL DIMENSIONS MAY VARY.
3. FOR SITE SPECIFIC DRAWINGS WITH DETAILED VAULT DIMENSIONS AND WEIGHTS, PLEASE CONTACT YOUR CONTECH ENGINEERED SOLUTIONS LLC REPRESENTATIVE: www.ContechES.com
4. STORMFILTER WATER QUALITY STRUCTURE SHALL BE IN ACCORDANCE WITH ALL DESIGN DATA AND INFORMATION CONTAINED IN THIS DRAWING.
5. STRUCTURE SHALL MEET AASHTO HS20 LOAD RATING, ASSUMING EARTH COVER OF 0' - 5' AND GROUNDWATER ELEVATION AT, OR BELOW, THE OUTLET PIPE INVERT ELEVATION. ENGINEER OF RECORD TO CONFIRM ACTUAL GROUNDWATER ELEVATION. CASTINGS SHALL MEET AASHTO M308 AND BE CAST WITH THE CONTECH LOGO.
6. FILTER CARTRIDGES SHALL BE MEDIA-FILLED, PASSIVE, SIPHON ACTUATED, RADIAL FLOW, AND SELF CLEANING. RADIAL MEDIA DEPTH SHALL BE 7-INCHES. FILTER MEDIA CONTACT TIME SHALL BE AT LEAST 38 SECONDS.
7. SPECIFIC FLOW RATE IS EQUAL TO THE FILTER TREATMENT CAPACITY (gpm) DIVIDED BY THE FILTER CONTACT SURFACE AREA (sq ft).
8. STORMFILTER STRUCTURE SHALL BE PRECAST CONFORMING TO ASTM C-857 AND AASHTO LOAD FACTOR DESIGN METHOD.

A. ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.

- C. CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE STORMFILTER VAULT (LIFTING CLUTCHES PROVIDED).
- D. CONTRACTOR TO INSTALL JOINT SEALANT BETWEEN ALL VAULT SECTIONS AND ASSEMBLE VAULT.
- E. CONTRACTOR TO PROVIDE, INSTALL, AND GROUT PIPES. MATCH OUTLET PIPE INVERT WITH OUTLET BAY FLOOR.
- F. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO PROTECT CARTRIDGES FROM CONSTRUCTION-RELATED EROSION RUNOFF.

 The Stormwater Management
StormFilter®

THIS PRODUCT MAY BE PROTECTED BY ONE OR MORE OF THE FOLLOWING
U.S. PATENTS: 5,322,624; 5,624,578; 5,797,527; 5,965,157; 6,027,639; 6,049,046;
6,133,001; 6,133,002; 6,133,003; 6,133,004; 6,133,005; 6,133,006; 6,133,007; 6,133,008; 6,133,009; 6,133,010; 6,133,011; 6,133,012; 6,133,013; 6,133,014; 6,133,015; 6,133,016; 6,133,017; 6,133,018; 6,133,019; 6,133,020; 6,133,021; 6,133,022; 6,133,023; 6,133,024; 6,133,025; 6,133,026; 6,133,027; 6,133,028; 6,133,029; 6,133,030; 6,133,031; 6,133,032; 6,133,033; 6,133,034; 6,133,035; 6,133,036; 6,133,037; 6,133,038; 6,133,039; 6,133,040; 6,133,041; 6,133,042; 6,133,043; 6,133,044; 6,133,045; 6,133,046; 6,133,047; 6,133,048; 6,133,049; 6,133,050; 6,133,051; 6,133,052; 6,133,053; 6,133,054; 6,133,055; 6,133,056; 6,133,057; 6,133,058; 6,133,059; 6,133,060; 6,133,061; 6,133,062; 6,133,063; 6,133,064; 6,133,065; 6,133,066; 6,133,067; 6,133,068; 6,133,069; 6,133,070; 6,133,071; 6,133,072; 6,133,073; 6,133,074; 6,133,075; 6,133,076; 6,133,077; 6,133,078; 6,133,079; 6,133,080; 6,133,081; 6,133,082; 6,133,083; 6,133,084; 6,133,085; 6,133,086; 6,133,087; 6,133,088; 6,133,089; 6,133,090; 6,133,091; 6,133,092; 6,133,093; 6,133,094; 6,133,095; 6,133,096; 6,133,097; 6,133,098; 6,133,099; 6,133,100; 6,133,101; 6,133,102; 6,133,103; 6,133,104; 6,133,105; 6,133,106; 6,133,107; 6,133,108; 6,133,109; 6,133,110; 6,133,111; 6,133,112; 6,133,113; 6,133,114; 6,133,115; 6,133,116; 6,133,117; 6,133,118; 6,133,119; 6,133,120; 6,133,121; 6,133,122; 6,133,123; 6,133,124; 6,133,125; 6,133,126; 6,133,127; 6,133,128; 6,133,129; 6,133,130; 6,133,131; 6,133,132; 6,133,133; 6,133,134; 6,133,135; 6,133,136; 6,133,137; 6,133,138; 6,133,139; 6,133,140; 6,133,141; 6,133,142; 6,133,143; 6,133,144; 6,133,145; 6,133,146; 6,133,147; 6,133,148; 6,133,149; 6,133,150; 6,133,151; 6,133,152; 6,133,153; 6,133,154; 6,133,155; 6,133,156; 6,133,157; 6,133,158; 6,133,159; 6,133,160; 6,133,161; 6,133,162; 6,133,163; 6,133,164; 6,133,165; 6,133,166; 6,133,167; 6,133,168; 6,133,169; 6,133,170; 6,133,171; 6,133,172; 6,133,173; 6,133,174; 6,133,175; 6,133,176; 6,133,177; 6,133,178; 6,133,179; 6,133,180; 6,133,181; 6,133,182; 6,133,183; 6,133,184; 6,133,185; 6,133,186; 6,133,187; 6,133,188; 6,133,189; 6,133,190; 6,133,191; 6,133,192; 6,133,193; 6,133,194; 6,133,195; 6,133,196; 6,133,197; 6,133,198; 6,133,199; 6,133,200; 6,133,201; 6,133,202; 6,133,203; 6,133,204; 6,133,205; 6,133,206; 6,133,207; 6,133,208; 6,133,209; 6,133,210; 6,133,211; 6,133,212; 6,133,213; 6,133,214; 6,133,215; 6,133,216; 6,133,217; 6,133,218; 6,133,219; 6,133,220; 6,133,221; 6,133,222; 6,133,223; 6,133,224; 6,133,225; 6,133,226; 6,133,227; 6,133,228; 6,133,229; 6,133,230; 6,133,231; 6,133,232; 6,133,233; 6,133,234; 6,133,235; 6,133,236; 6,133,237; 6,133,238; 6,133,239; 6,133,240; 6,133,241; 6,133,242; 6,133,243; 6,133,244; 6,133,245; 6,133,246; 6,133,247; 6,133,248; 6,133,249; 6,133,250; 6,133,251; 6,133,252; 6,133,253; 6,133,254; 6,133,255; 6,133,256; 6,133,257; 6,133,258; 6,133,259; 6,133,260; 6,133,261; 6,133,262; 6,133,263; 6,133,264; 6,133,265; 6,133,266; 6,133,267; 6,133,268; 6,133,269; 6,133,270; 6,133,271; 6,133,272; 6,133,273; 6,133,274; 6,133,275; 6,133,276; 6,133,277; 6,133,278; 6,133,279; 6,133,280; 6,133,281; 6,133,282; 6,133,283; 6,133,284; 6,133,285; 6,133,286; 6,133,287; 6,133,288; 6,133,289; 6,133,290; 6,133,291; 6,133,292; 6,133,293; 6,133,294; 6,133,295; 6,133,296; 6,133,297; 6,133,298; 6,133,299; 6,133,300; 6,133,301; 6,133,302; 6,133,303; 6,133,304; 6,133,305; 6,133,306; 6,133,307; 6,133,308; 6,133,309; 6,133,310; 6,133,311; 6,133,312; 6,133,313; 6,133,314; 6,133,315; 6,133,316; 6,133,317; 6,133,318; 6,133,319; 6,133,320; 6,133,321; 6,133,322; 6,133,323; 6,133,324; 6,133,325; 6,133,326; 6,133,327; 6,133,328; 6,133,329; 6,133,330; 6,133,331; 6,133,332; 6,133,333; 6,133,334; 6,133,335; 6,133,336; 6,133,337; 6,133,338; 6,133,339; 6,133,340; 6,133,341; 6,133,342; 6,133,343; 6,133,344; 6,133,345; 6,133,346; 6,133,347; 6,133,348; 6,133,349; 6,133,350; 6,133,351; 6,133,352; 6,133,353; 6,133,354; 6,133,355; 6,133,356; 6,133,357; 6,133,358; 6,133,359; 6,133,360; 6,133,361; 6,133,362; 6,133,363; 6,133,364;

STORMFILTER

STANDARD DETAIL

PROJECT SUMMARY

CALCULATION DETAILS

- LOADING = HS20 & HS25
- APPROX. LINEAR FOOTAGE = 195 lf.

STORAGE SUMMARY

- STORAGE VOLUME REQUIRED = N/A
- PIPE STORAGE VOLUME = 5,513 cf.
- BACKFILL STORAGE VOLUME = 0 cf.
- TOTAL STORAGE PROVIDED = 5,513 cf.

PIPE DETAILS

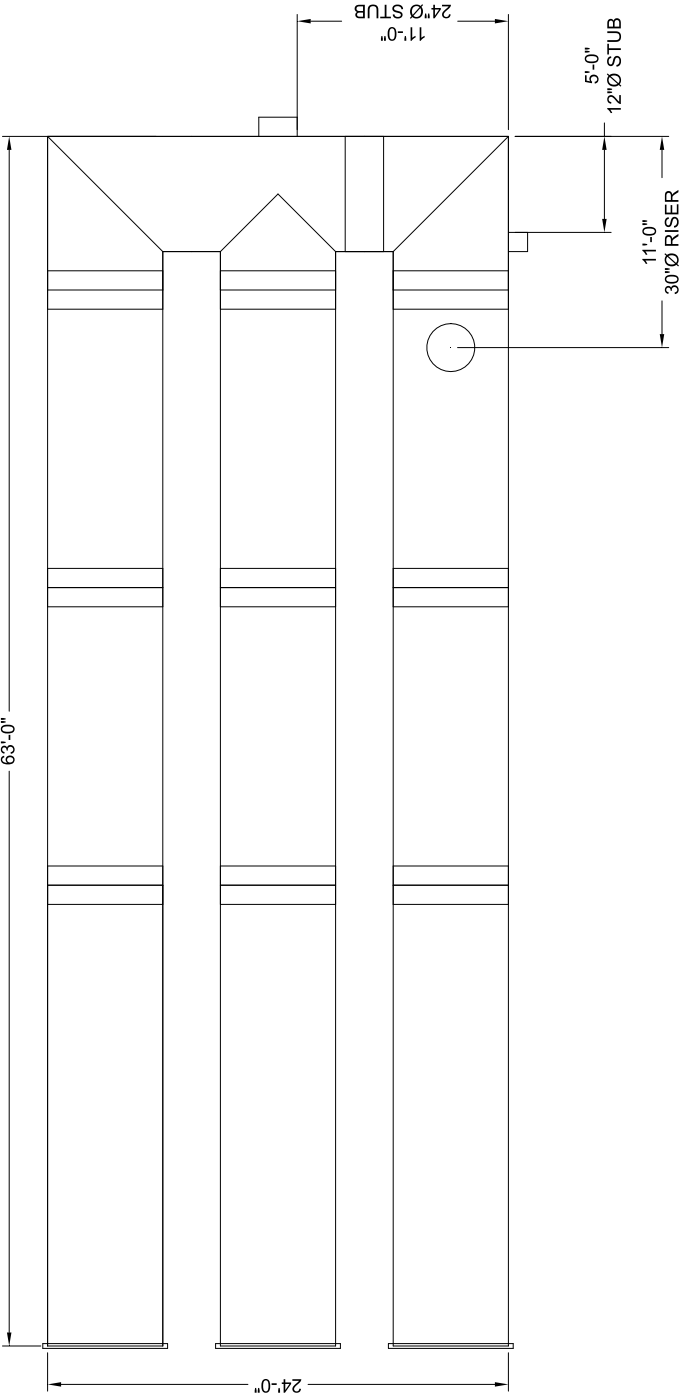
- DIAMETER = 72 IN.
- CORRUGATION = 5x1
- GAGE = 16
- COATING = ALT2
- WALL TYPE = Solid
- BARRELL SPACING = 36 IN.

BACKFILL DETAILS

- WIDTH AT ENDS = 12 IN.
- ABOVE PIPE = 0 IN.
- WIDTH AT SIDES = 12 IN.
- BELOW PIPE = 0 IN.

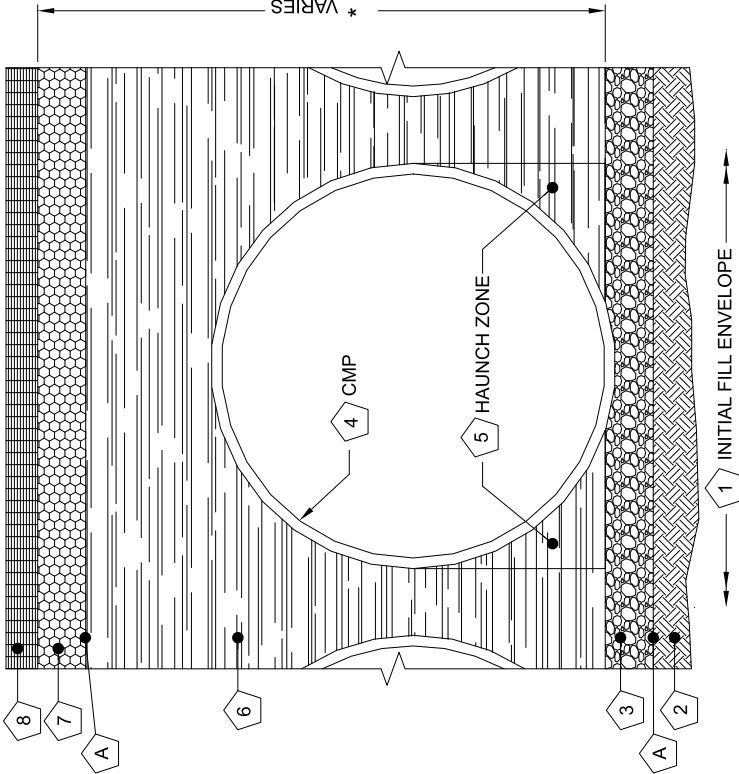
NOTES

- ALL RISER AND STUB DIMENSIONS ARE TO CENTERLINE. ALL ELEVATIONS, DIMENSIONS, AND LOCATIONS OF RISERS AND INLETS, SHALL BE VERIFIED BY THE ENGINEER OF RECORD PRIOR TO RELEASING FOR FABRICATION.
- ALL FITTINGS AND REINFORCEMENT COMPLY WITH ASTM A998.
- ALL RISERS AND STUBS ARE 2²/₃" x 1¹/₂" CORRUGATION AND 16 GAGE UNLESS OTHERWISE NOTED.
- RISERS TO BE FIELD TRIMMED TO GRADE.
- QUANTITY OF PIPE SHOWN DOES NOT PROVIDE EXTRA PIPE FOR CONNECTING THE SYSTEM TO EXISTING PIPE OR DRAINAGE STRUCTURES. OUR SYSTEM AS DETAILED PROVIDES NOMINAL INLET AND/OR OUTLET PIPE STUB FOR CONNECTION TO EXISTING DRAINAGE FACILITIES. IF ADDITIONAL PIPE IS NEEDED IT IS THE RESPONSIBILITY OF THE CONTRACTOR.
- BAND TYPE TO BE DETERMINED UPON FINAL DESIGN.
- THE PROJECT SUMMARY IS REFLECTIVE OF THE DYODS DESIGN, QUANTITIES ARE APPROX. AND SHOULD BE VERIFIED UPON FINAL DESIGN AND APPROVAL. FOR EXAMPLE, TOTAL EXCAVATION DOES NOT CONSIDER ALL VARIABLES SUCH AS SHORING AND ONLY ACCOUNTS FOR MATERIAL WITHIN THE ESTIMATED EXCAVATION FOOTPRINT.
- THESE DRAWINGS ARE FOR CONCEPTUAL PURPOSES AND DO NOT REFLECT ANY LOCAL PREFERENCES OR REGULATIONS. PLEASE CONTACT YOUR LOCAL CONTECH REP FOR MODIFICATIONS.



ASSEMBLY
SCALE: 1" = 10'

The design and information shown on this drawing is provided as advisory only. It is not to be used for construction without the approval of the design engineer. The design engineer is not responsible for any errors or omissions in this drawing. The design engineer is not responsible for any errors or omissions in this drawing. The design engineer is not responsible for any errors or omissions in this drawing.		CONTECH® ENGINEERED SOLUTIONS LLC www.ContechES.com 9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069 800-338-1122 513-645-7000 513-645-7993 FAX		CONTECH® DYODS CMP DETENTION SYSTEMS DRAWING		72"Ø UNDERGROUND DETENTION SYSTEM - - 555 HOPPING BROOK ROAD HOLLISTON, MA SITE DESIGNATION:		PROJECT No.: 4952	SEQ. No.: 8014	DATE: 5/25/2021
If discrepancies between the supplied information upon which this drawing is based and the actual conditions are discovered as site work progresses, these discrepancies must be reported to Contech immediately for re-evaluation of the design. Contech accepts no liability for designs based on missing, incomplete or inaccurate information supplied by others.								DESIGNED: DYO	DRAWN: DYO	5/25/2021
								CHECKED: DYO	APPROVED: DYO	
								SHEET NO.:	D1	



DETENTION SYSTEMS - CMP DETENTION / CMP DRAINAGE			
Material Location Rigid or Flexible Pavement (if applicable)	Description	Material Designation	Designation
8	Road Base (if applicable)		
7	Geotextile Layer	Non-Woven Geotextile	Engineer Decision for consideration to prevent soil migration into varying soil types
A	Backfill	Well graded granular material which may contain small amounts of silt or clay.	CONTECH C-40 or C-45 AASHTO M 145- A-1, A-2, A-3
6	Bedding Stone	Well graded granular bedding material w/maximum particle size of 3"	AASHTO M43 - 3, 357, 4, 467, 5, 56, 57
3	Geotextile Layer	Non-Woven Geotextile	Engineer to determine if bedding is required. Pipe may be placed on the trench bottom of a relatively loose, native suitable well graded & granular material. For Arch pipes it is recommended to be shaped to a relatively flat bottom or fine-grade the foundation to a slight v-shape. Unsuitable material should be over-excavated and re-placed with a 4"-6" layer of well graded & granular stone per the material designation. See AASHTO 26.3.8.1 / 26.5.3 Bedding info.
A		CONTECH C-40 or C-45	Engineer Decision for consideration to prevent soil migration into varying soil types
*	Note: Backfill using controlled low-strength material (CLSM, "flash fill" or "flowable fill") when the spacing between the pipes will not allow for placement and adequate compaction of the backfill.		

- 1

MINIMUM WIDTH DEPENDS ON SITE CONDITIONS AND ENGINEERING JUDGEMENT
- 2

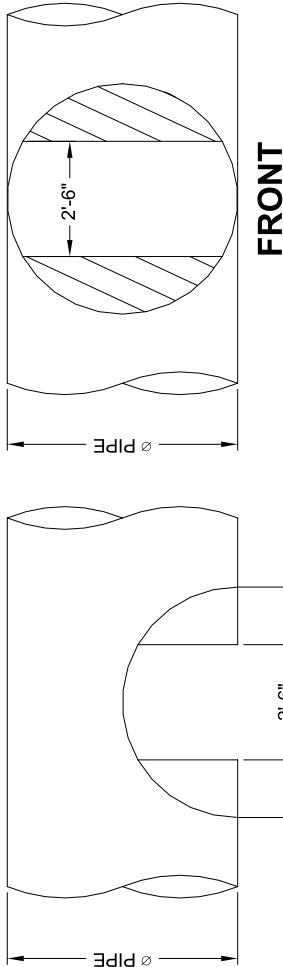
FOUNDATION/BEDDING PREPARATION
- 3

PRIOR TO PLACING THE BEDDING, THE FOUNDATION MUST BE CONSTRUCTED TO A UNIFORM AND STABLE GRADE. IN THE EVENT THAT UNSUITABLE FOUNDATION MATERIALS ARE ENCOUNTERED DURING EXCAVATION, THEY SHALL BE REMOVED AND BROUGHT BACK TO THE GRADE WITH A FILL MATERIAL AS APPROVED BY THE ENGINEER.
- 5

HAUNCH ZONE MATERIAL SHALL BE PLACED AND UNIFORMLY COMPACTED WITHOUT SOFT SPOTS.
- BACKFILL

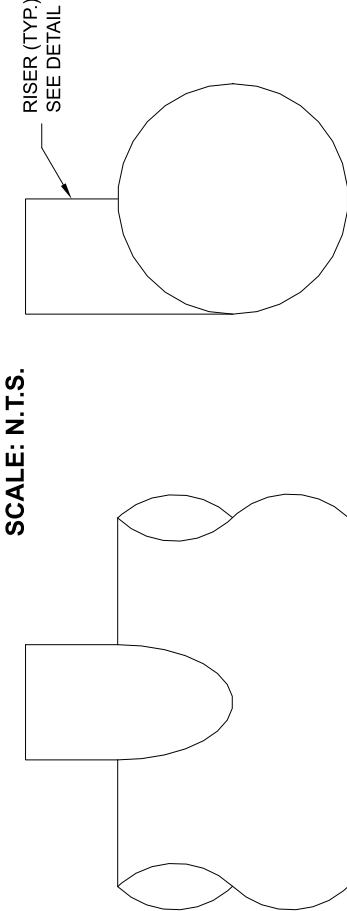
WHEN PLACING THE FIRST LIFTS OF BACKFILL IT IS IMPORTANT TO MAKE SURE THAT THE BACKFILL IS PROPERLY COMPACTED UNDER AND AROUND THE PIPE HAUNCHES. BACKFILL SHALL BE PLACED SUCH THAT THERE IS NO MORE THAN A TWO LIFT (16") DIFFERENTIAL BETWEEN ANY OF THE PIPES AT ANY TIME DURING THE BACKFILL PROCESS. THE BACKFILL SHALL BE ADVANCED ALONG THE LENGTH OF THE DETENTION SYSTEM AT THE SAME RATE TO AVOID DIFFERENTIAL LOADING ON THE PIPE.

OTHER ALTERNATE BACKFILL MATERIAL MAY BE ALLOWED DEPENDING ON SITE SPECIFIC CONDITIONS, AS APPROVED BY SITE ENGINEER.



NOTE:
MANWAY DETAIL APPLICABLE FOR CMP SYSTEMS WITH DIAMETERS 48" AND LARGER. MANWAYS MAY BE REQUIRED ON SMALLER SYSTEMS DEPENDING ON ACTUAL SITE SPECIFIC CONDITIONS.

TYPICAL MANWAY DETAIL



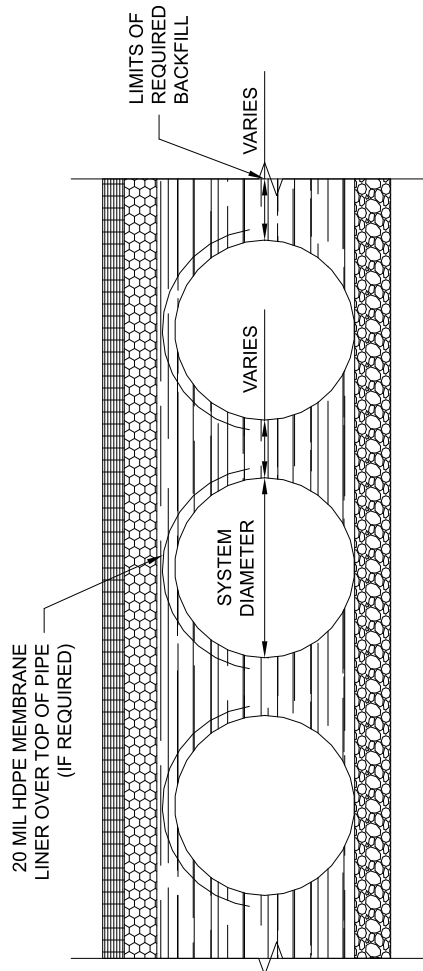
ELEVATION

TYPICAL RISER DETAIL

SCALE: N.T.S.

END

NOTE:
LADDERS ARE OPTIONAL AND ARE NOT REQUIRED FOR ALL SYSTEMS.



TYPICAL SECTION VIEW

LINER OVER ROWS
SCALE: N.T.S.

NOTE: IF SALTING AGENTS FOR SNOW AND ICE REMOVAL ARE USED ON OR NEAR THE PROJECT, AN HDPE MEMBRANE LINER IS RECOMMENDED WITH THE SYSTEM. THE IMPERMEABLE LINER IS INTENDED TO HELP PROTECT THE SYSTEM FROM THE POTENTIAL ADVERSE EFFECTS THAT MAY RESULT FROM A CHANGE IN THE SURROUNDING ENVIRONMENT OVER A PERIOD OF TIME. PLEASE REFER TO THE CORRUGATED METAL PIPE DETENTION DESIGN GUIDE FOR ADDITIONAL INFORMATION.

The design and information shown on this drawing is provided by the user and is not to be used for any other purpose without the written consent of Contech Engineered Solutions LLC ("Contech"). Neither this drawing, nor any part thereof, may be used, reproduced or modified in any manner without the prior written consent of Contech. Failure to comply is done at the user's own risk and Contech expressly disclaims any liability or responsibility for such use.

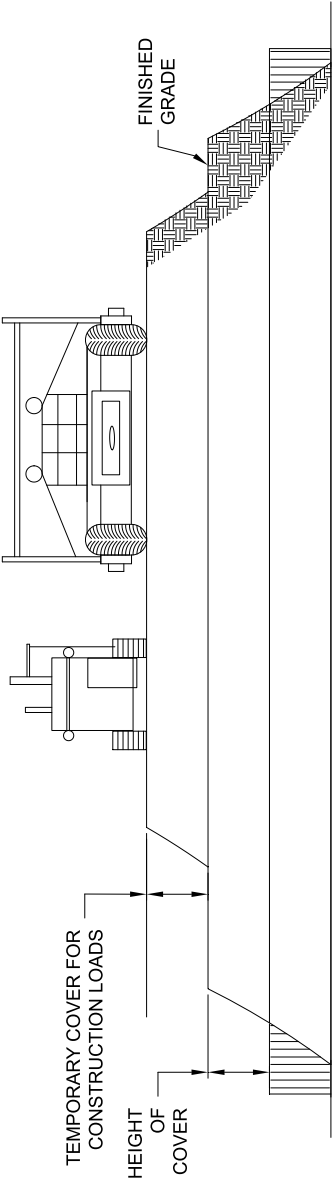
If discrepancies between the supplied information upon which this drawing is based and the actual conditions encountered as site work progresses, these discrepancies must be reported to Contech immediately for re-evaluation of the design. Contech accepts no liability for designs based on missing, incomplete or inaccurate information supplied by others.

CONTECH®
ENGINEERED SOLUTIONS LLC
www.ContechES.com
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

CONTECH®
CMR DETENTION SYSTEMS
CONTECH
DYODS
DRAWING

72"Ø UNDERGROUND DETENTION SYSTEM - -
555 HOPPING BROOK ROAD
HOLLISTON, MA
SITE DESIGNATION:

PROJECT No.: 4952	SEQ. No.: 8014	DATE: 5/25/2021
DESIGNED: DYO	DRAWN: DYO	
CHECKED: DYO	APPROVED: DYO	
SHEET NO.: D2		



CONSTRUCTION LOADS

FOR TEMPORARY CONSTRUCTION VEHICLE LOADS, AN EXTRA AMOUNT OF COMPACTED COVER MAY BE REQUIRED OVER THE TOP OF THE PIPE. THE HEIGHT-OF-COVER SHALL MEET THE MINIMUM REQUIREMENTS SHOWN IN THE TABLE BELOW. THE USE OF HEAVY CONSTRUCTION EQUIPMENT NECESSITATES GREATER PROTECTION FOR THE PIPE THAN FINISHED GRADE COVER MINIMUMS FOR NORMAL HIGHWAY TRAFFIC.

PIPE SPAN, INCHES	AXLE LOADS (kips)			
	18-50	50-75	75-110	110-150
MINIMUM COVER (FT)	2.0	2.5	3.0	3.0
	3.0	3.0	3.5	4.0
	3.0	3.5	4.0	4.0
	3.5	4.0	4.5	4.5

*MINIMUM COVER MAY VARY, DEPENDING ON LOCAL CONDITIONS. THE CONTRACTOR MUST PROVIDE THE ADDITIONAL COVER REQUIRED TO AVOID DAMAGE TO THE PIPE. MINIMUM COVER IS MEASURED FROM THE TOP OF THE PIPE TO THE TOP OF THE MAINTAINED CONSTRUCTION ROADWAY SURFACE.

CONSTRUCTION LOADING DIAGRAM

SCALE: N.T.S.

SPECIFICATION FOR DESIGNED DETENTION SYSTEM:

SCOPE
THIS SPECIFICATION COVERS THE MANUFACTURE AND INSTALLATION OF THE DESIGNED DETENTION SYSTEM DETAILED IN THE PROJECT PLANS.

MATERIAL
THE MATERIAL SHALL CONFORM TO THE APPLICABLE REQUIREMENTS LISTED BELOW:

ALUMINIZED TYPE 2 STEEL COILS SHALL CONFORM TO THE REQUIREMENTS OF AASHTO M-274 OR ASTM A-92.

THE GALVANIZED STEEL COILS SHALL CONFORM TO THE REQUIREMENTS OF AASHTO M-218 OR ASTM A-929.

THE POLYMER COATED STEEL COILS SHALL CONFORM TO THE REQUIREMENTS OF AASHTO M-246 OR ASTM A-742.

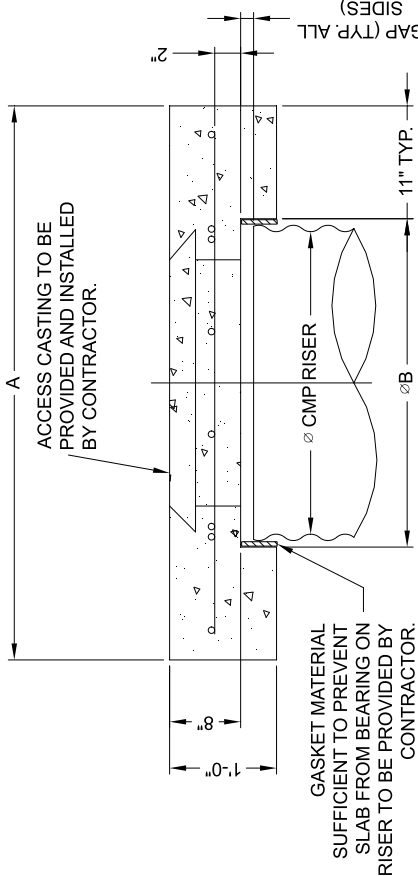
THE ALUMINUM COILS SHALL CONFORM TO THE APPLICABLE OF AASHTO M-197 OR ASTM B-744.

CONSTRUCTION LOADS
CONSTRUCTION LOADS MAY BE HIGHER THAN FINAL LOADS. FOLLOW THE MANUFACTURER'S OR NCSPA GUIDELINES.

NOTE:
THESE DRAWINGS ARE FOR CONCEPTUAL PURPOSES AND DO NOT REFLECT ANY LOCAL PREFERENCES OR REGULATIONS. PLEASE CONTACT YOUR LOCAL CONTECH REP FOR MODIFICATIONS.

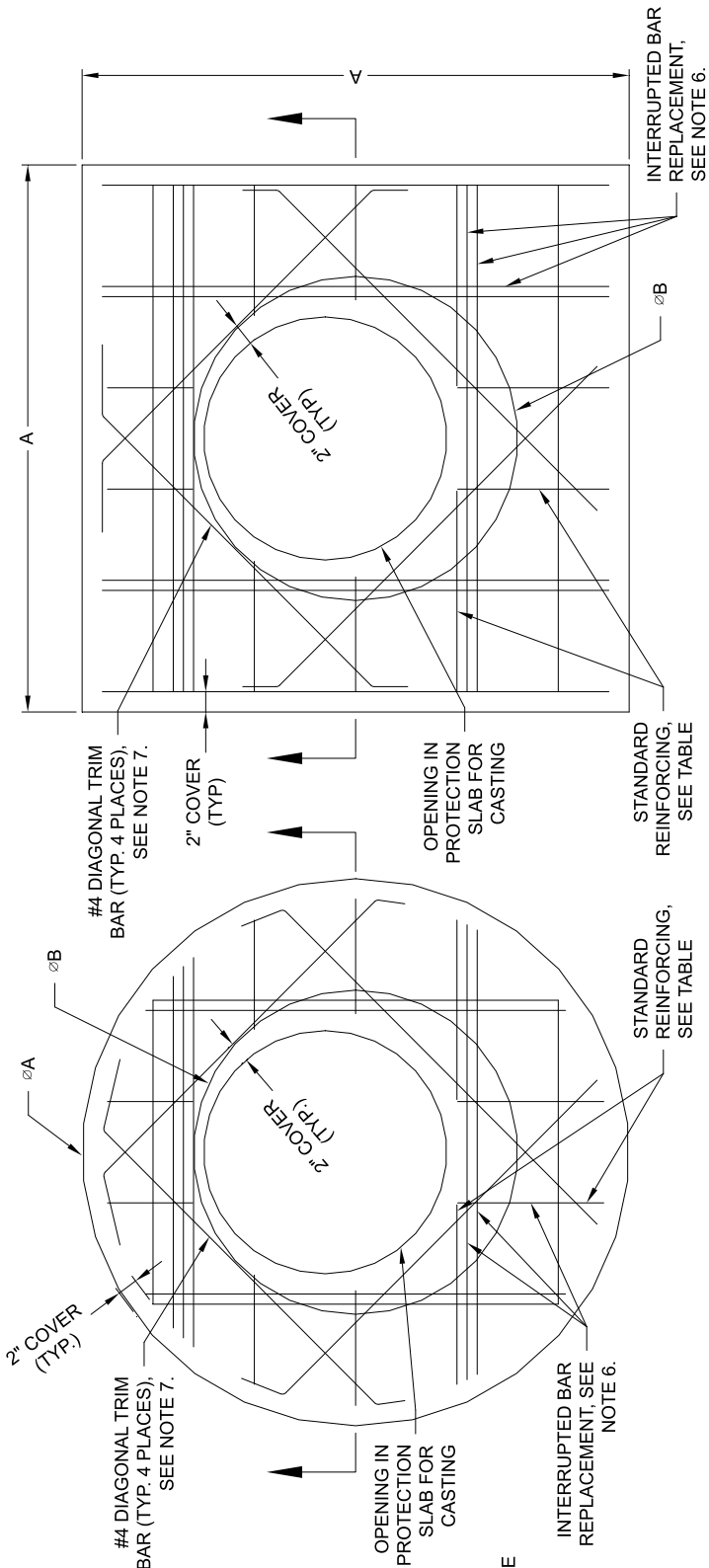
The design and information shown on this drawing is provided for informational purposes only. It is not to be used for construction or any other purpose without the prior written consent of Contech Engineered Solutions LLC ("Contech"). Neither this drawing, nor any part thereof, may be used, reproduced or modified in any manner without the prior written consent of Contech. Failure to comply is done at the user's own risk and Contech expressly disclaims any liability or responsibility for such use.

If discrepancies between the supplied information upon which this drawing is based and the actual conditions are discovered as site work progresses, these discrepancies must be reported to Contech immediately for re-evaluation of the design. Contech accepts no liability for designs based on missing, incomplete or inaccurate information supplied by others.



SECTION VIEW

** ASSUMED SOIL BEARING CAPACITY



ROUND OPTION PLAN VIEW

NOTES:

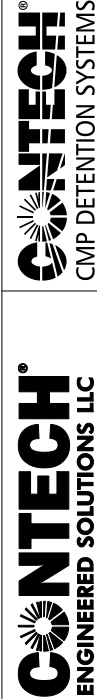
- DESIGN IN ACCORDANCE WITH AASHTO, 17th EDITION.
- DESIGN LOAD HS25.
- EARTH COVER = 1' MAX.
- CONCRETE STRENGTH = 3,500 psi
- REINFORCING STEEL = ASTM A615, GRADE 60.
- PROVIDE ADDITIONAL REINFORCING AROUND OPENINGS EQUAL TO THE BARS INTERRUPTED, HALF EACH SIDE. ADDITIONAL BARS TO BE IN THE SAME PLANE.

SQUARE OPTION PLAN VIEW

- TRIM OPENING WITH DIAGONAL #4 BARS, EXTEND BARS A MINIMUM OF 12" BEYOND OPENING, BEND BARS AS REQUIRED TO MAINTAIN BAR COVER.
- PROTECTION SLAB AND ALL MATERIALS TO BE PROVIDED AND INSTALLED BY CONTRACTOR.
- DETAIL DESIGN BY DELTA ENGINEERING, BINGHAMTON, NY.

MANHOLE CAP DETAIL

SCALE: N.T.S.



9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX



CONTECH
DYODS
DRAWING

72"Ø UNDERGROUND DETENTION SYSTEM - -
555 HOPPING BROOK ROAD
HOLLISTON, MA
SITE DESIGNATION:

REINFORCING TABLE

Ø CMP RISER	A	Ø B	REINFORCING	**BEARING PRESSURE (PSF)
24"	Ø 4' 4'X4'	26"	#5 @ 12" OCEW #5 @ 12" OCEW	2,410 1,780
30"	Ø 4'-6" 4'-6" X 4'-6"	32"	#5 @ 12" OCEW #5 @ 12" OCEW	2,120 1,530
36"	Ø 5' 5' X 5'	38"	#5 @ 10" OCEW #5 @ 10" OCEW	1,890 1,350
42"	Ø 5'-6" 5'-6" X 5'-6"	44"	#5 @ 10" OCEW #5 @ 9" OCEW	1,720 1,210
48"	Ø 6' 6' X 6'	50"	#5 @ 9" OCEW #5 @ 8" OCEW	1,600 1,100

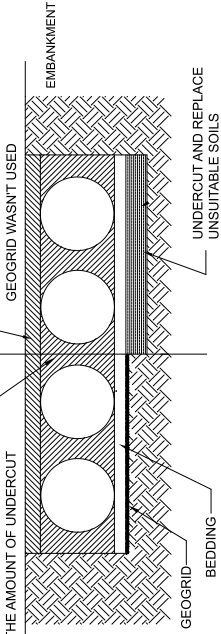
CMP DETENTION INSTALLATION GUIDE

PROPER INSTALLATION OF A FLEXIBLE UNDERGROUND DETENTION SYSTEM WILL ENSURE LONG-TERM PERFORMANCE. THE CONFIGURATION OF THESE SYSTEMS OFTEN REQUIRES SPECIAL CONSTRUCTION PRACTICES THAT DIFFER FROM CONVENTIONAL FLEXIBLE PIPE CONSTRUCTION. CONTECH ENGINEERED SOLUTIONS STRONGLY SUGGESTS SCHEDULING A PRE-CONSTRUCTION MEETING WITH YOUR LOCAL SALES ENGINEER TO DETERMINE IF ADDITIONAL MEASURES, NOT COVERED IN THIS GUIDE, ARE APPROPRIATE FOR YOUR SITE.

FOUNDATION

CONSTRUCT A FOUNDATION THAT CAN SUPPORT THE DESIGN LOADING APPLIED BY THE PIPE AND ADJACENT BACKFILL WEIGHT AS WELL AS MAINTAIN ITS INTEGRITY DURING CONSTRUCTION.

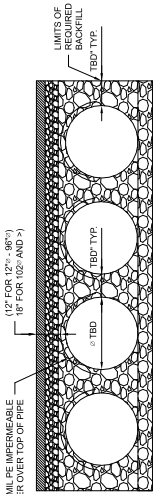
IF SOFT OR UNSUITABLE SOILS ARE ENCOUNTERED, REMOVE THE POOR SOILS DOWN TO A SUITABLE DEPTH AND THEN BUILD UP TO THE APPROPRIATE ELEVATION WITH A COMPETENT BACKFILL MATERIAL. THE STRUCTURAL FILL MATERIAL GRADATION SHOULD NOT ALLOW THE MIGRATION OF FINES, WHICH CAN CAUSE SETTLEMENT OF THE DETENTION SYSTEM OR PAVEMENT ABOVE. IF THE STRUCTURAL FILL MATERIAL IS NOT COMPATIBLE WITH THE UNDERLYING SOILS AN ENGINEERING FABRIC SHOULD BE USED AS A SEPARATOR. IN SOME CASES, USING A STIFF REINFORCING GEOGRID, REDUCES OVER EXCAVATION AND REPLACEMENT FILL QUANTITIES.



GRADE THE FOUNDATION SUBGRADE TO A UNIFORM OR SLIGHTLY SLOPING GRADE. IF THE SUBGRADE IS CLAY OR RELATIVELY NON-POROUS AND THE CONSTRUCTION SEQUENCE WILL LAST FOR AN EXTENDED PERIOD OF TIME, IT IS BEST TO SLOPE THE GRADE TO ONE END OF THE SYSTEM. THIS WILL ALLOW EXCESS WATER TO DRAIN QUICKLY, PREVENTING SATURATION OF THE SUBGRADE.

GEOMEMBRANE BARRIER

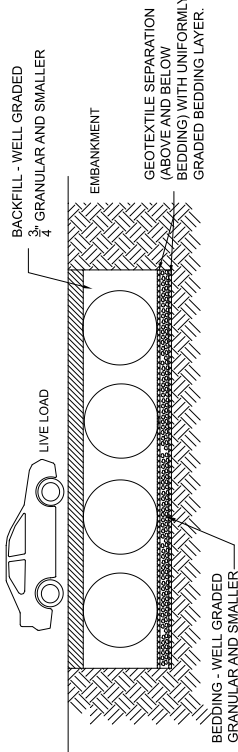
A SITE'S RESISTIVITY MAY CHANGE OVER TIME WHEN VARIOUS TYPES OF SALTING AGENTS ARE USED, SUCH AS ROAD SALTS FOR DEICING AGENTS. IF SALTING AGENTS ARE USED ON OR NEAR THE PROJECT SITE, A GEOMEMBRANE BARRIER IS RECOMMENDED WITH THE SYSTEM. THE GEOMEMBRANE LINER IS INTENDED TO HELP PROTECT THE SYSTEM FROM THE POTENTIAL ADVERSE EFFECTS THAT MAY RESULT FROM THE USE OF SUCH AGENTS INCLUDING PREMATURE CORROSION AND REDUCED ACTUAL LIFE OF THE SYSTEM'S ENGINEER OF RECORD IS TO EVALUATE WHETHER SALTING AGENTS WILL BE USED ON OR NEAR THE PROJECT SITE, AND USE HIS/HER BEST JUDGEMENT TO DETERMINE IF ANY ADDITIONAL PROTECTIVE MEASURES ARE REQUIRED. BELOW IS A TYPICAL DETAIL SHOWING THE PLACEMENT OF A GEOMEMBRANE BARRIER FOR PROJECTS WHERE SALTING AGENTS ARE USED ON OR NEAR THE PROJECT SITE.



IN-SITU TRENCH WALL

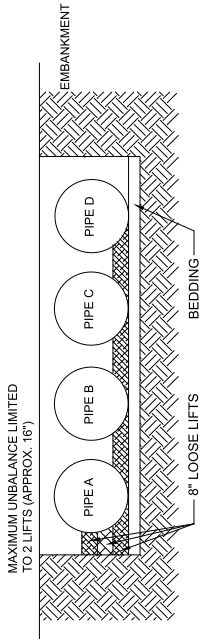
IF EXCAVATION IS REQUIRED, THE TRENCH WALL NEEDS TO BE CAPABLE OF SUPPORTING THE LOAD THAT THE PIPE SHEDS AS THE SYSTEM IS LOADED. IF SOILS ARE NOT CAPABLE OF SUPPORTING THESE LOADS, THE PIPE CAN DEFLECT. PERFORM A SIMPLE SOIL PRESSURE CHECK USING THE APPLIED LOADS TO DETERMINE THE LIMITS OF EXCAVATION BEYOND THE SPRING LINE OF THE OUTER MOST PIPES.

IN MOST CASES THE REQUIREMENTS FOR A SAFE WORK ENVIRONMENT AND PROPER BACKFILL PLACEMENT AND COMPACTION TAKE CARE OF THIS CONCERN.



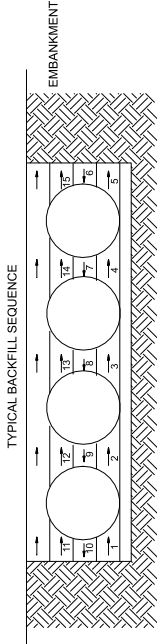
BACKFILL PLACEMENT

MATERIAL SHALL BE WORKED INTO THE PIPE HAUNCHES BY MEANS OF SHOVEL-SLICING, RODDING, AIR TAMPER, VIBRATORY ROD, OR OTHER EFFECTIVE METHODS.



IF AASHTO T99 PROCEDURES ARE DETERMINED INFEEASIBLE BY THE GEOTECHNICAL ENGINEER OF RECORD, COMPACTION IS CONSIDERED ADEQUATE WHEN NO FURTHER YIELDING OF THE MATERIAL IS OBSERVED UNDER THE COMPACTOR, OR UNDER FOOT, AND THE GEOTECHNICAL ENGINEER OF RECORD (OR REPRESENTATIVE THEREOF) IS SATISFIED WITH THE LEVEL OF COMPACTION.

FOR LARGE SYSTEMS, CONVEYOR SYSTEMS, BACKHOES WITH LONG REACHES OR DRAGLINES WITH STONE BUCKETS MAY BE USED TO PLACE BACKFILL. ONCE MINIMUM COVER FOR CONSTRUCTION LOADING ACROSS THE ENTIRE WIDTH OF THE SYSTEM IS REACHED, ADVANCE THE EQUIPMENT TO THE END OF THE RECENTLY PLACED FILL, AND BEGIN THE SEQUENCE AGAIN UNTIL THE SYSTEM IS COMPLETELY BACKFILLED. THIS TYPE OF CONSTRUCTION SEQUENCE PROVIDES ROOM FOR STOCKPILED BACKFILL DIRECTLY BEHIND THE BACKHOE, AS WELL AS THE MOVEMENT OF CONSTRUCTION TRAFFIC. MATERIAL STOCKPILES ON TOP OF THE BACKFILLED DETENTION SYSTEM SHOULD BE LIMITED TO 8- TO 10- FEET HIGH AND MUST PROVIDE BALANCED LOADING ACROSS ALL BARRELS. TO DETERMINE THE PROPER COVER OVER THE PIPES TO ALLOW THE MOVEMENT OF CONSTRUCTION EQUIPMENT SEE TABLE 1, OR CONTACT YOUR LOCAL CONTECH SALES ENGINEER.



CMP DETENTION SYSTEM INSPECTION AND MAINTENANCE

UNDERGROUND STORMWATER DETENTION AND INFILTRATION SYSTEMS MUST BE INSPECTED AND MAINTAINED AT REGULAR INTERVALS FOR PURPOSES OF PERFORMANCE AND LONGEVITY.

INSPECTION

INSPECTION IS THE KEY TO EFFECTIVE MAINTENANCE OF CMP DETENTION SYSTEMS AND IS EASILY PERFORMED. CONTECH RECOMMENDS ONGOING, ANNUAL INSPECTIONS. SITES WITH HIGH TRASH LOAD OR SMALL OUTLET CONTROL ORIFICES MAY NEED MORE FREQUENT INSPECTIONS. THE RATE AT WHICH THE SYSTEM COLLECTS POLLUTANTS WILL DEPEND MORE ON SITE SPECIFIC ACTIVITIES RATHER THAN THE SIZE OR CONFIGURATION OF THE SYSTEM.

INSPECTIONS SHOULD BE PERFORMED MORE OFTEN IN EQUIPMENT WASHDOWN AREAS, IN CLIMATES WHERE SANDING AND/OR SALTING OPERATIONS TAKE PLACE, AND IN OTHER VARIOUS INSTANCES IN WHICH ONE WOULD EXPECT HIGHER ACCUMULATIONS OF SEDIMENT OR ABRASIVE/ CORROSIVE CONDITIONS. A RECORD OF EACH INSPECTION IS TO BE MAINTAINED FOR THE LIFE OF THE SYSTEM

MAINTENANCE

CMP DETENTION SYSTEMS SHOULD BE CLEANED WHEN AN INSPECTION REVEALS ACCUMULATED SEDIMENT OR TRASH IS CLOGGING THE DISCHARGE ORIFICE.

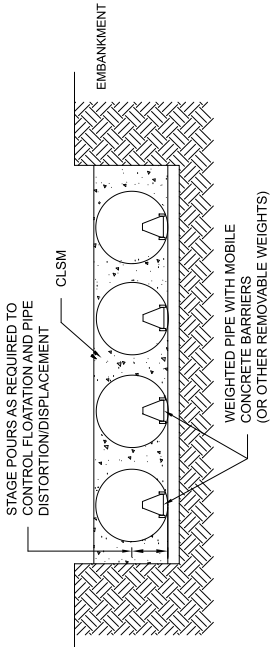
ACCUMULATED SEDIMENT AND TRASH CAN TYPICALLY BE EVACUATED THROUGH THE MANHOLE OVER THE OUTLET ORIFICE. IF MAINTENANCE IS NOT PERFORMED AS RECOMMENDED, SEDIMENT AND TRASH MAY ACCUMULATE IN FRONT OF THE OUTLET ORIFICE. MANHOLE COVERS SHOULD BE SECURELY SEATED FOLLOWING CLEANING ACTIVITIES. CONTECH SUGGESTS THAT ALL SYSTEMS BE DESIGNED WITH AN ACCESS/INSPECTION MANHOLE SITUATED AT OR NEAR THE INLET AND THE OUTLET ORIFICE. SHOULD IT BE NECESSARY TO GET INSIDE THE SYSTEM TO PERFORM MAINTENANCE ACTIVITIES, ALL APPROPRIATE PRECAUTIONS REGARDING CONFINED SPACE ENTRY AND OSHA REGULATIONS SHOULD BE FOLLOWED.

ANNUAL INSPECTIONS ARE BEST PRACTICE FOR ALL UNDERGROUND SYSTEMS. DURING THIS INSPECTION, IF EVIDENCE OF SALTING/DE-ICING AGENTS IS OBSERVED WITHIN THE SYSTEM, IT IS BEST PRACTICE FOR THE SYSTEM TO BE RINSED, INCLUDING ABOVE THE SPRING LINE SOON AFTER THE SPRING THAW AS PART OF THE MAINTENANCE PROGRAM FOR THE SYSTEM.

MAINTAINING AN UNDERGROUND DETENTION OR INFILTRATION SYSTEM IS EASIEST WHEN THERE IS NO FLOW ENTERING THE SYSTEM. FOR THIS REASON, IT IS A GOOD IDEA TO SCHEDULE THE CLEANOUT DURING DRY WEATHER.

THE FOREGOING INSPECTION AND MAINTENANCE EFFORTS HELP ENSURE UNDERGROUND PIPE SYSTEMS USED FOR STORMWATER STORAGE CONTINUE TO FUNCTION AS INTENDED BY IDENTIFYING RECOMMENDED REGULAR INSPECTION AND MAINTENANCE PRACTICES. INSPECTION AND MAINTENANCE RELATED TO THE STRUCTURAL INTEGRITY OF THE PIPE OR THE SOUNDNESS OF PIPE JOINT CONNECTIONS IS BEYOND THE SCOPE OF THIS GUIDE.

WHEN FLOWABLE FILL IS USED, YOU MUST PREVENT PIPE FLOATATION. TYPICALLY, SMALL LIFTS ARE PLACED BETWEEN THE PIPES AND THEN ALLOWED TO SET-UP PRIOR TO THE PLACEMENT OF THE NEXT LIFT. THE ALLOWABLE THICKNESS OF THE CLSM LIFT IS A FUNCTION OF A PROPER BALANCE BETWEEN THE UPLIFT FORCE OF THE CLSM, THE OPPOSING WEIGHT OF THE PIPE, AND THE EFFECT OF OTHER RESTRAINING MEASURES. THE PIPE CAN CARRY LIMITED FLUID PRESSURE WITHOUT PIPE DISTORTION OR DISPLACEMENT, WHICH ALSO AFFECTS THE CLSM LIFT THICKNESS. YOUR LOCAL CONTECH SALES ENGINEER CAN HELP DETERMINE THE PROPER LIFT THICKNESS.

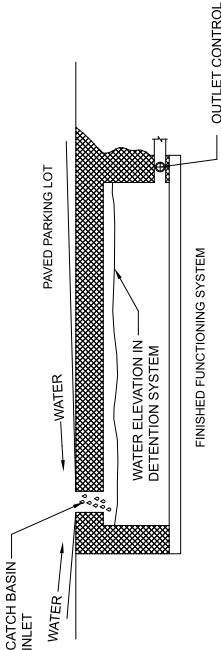


CONSTRUCTION LOADING

TYPICALLY, THE MINIMUM COVER SPECIFIED FOR A PROJECT ASSUMES H-20 LIVE LOAD. BECAUSE CONSTRUCTION LOADS OFTEN EXCEED DESIGN LIVE LOADS, INCREASED TEMPORARY MINIMUM COVER REQUIREMENTS ARE NECESSARY. SINCE CONSTRUCTION EQUIPMENT VARIES FROM JOB TO JOB, IT IS BEST TO ADDRESS EQUIPMENT SPECIFIC MINIMUM COVER REQUIREMENTS WITH YOUR LOCAL CONTECH SALES ENGINEER DURING YOUR PRE-CONSTRUCTION MEETING.

ADDITIONAL CONSIDERATIONS

BECAUSE MOST SYSTEMS ARE CONSTRUCTED BELOW-GRADE, RAINFALL CAN RAPIDLY FILL THE EXCAVATION; POTENTIALLY CAUSING FLOATATION AND MOVEMENT OF THE PREVIOUSLY PLACED PIPES. TO HELP MITIGATE POTENTIAL PROBLEMS, IT IS BEST TO START THE INSTALLATION AT THE DOWNSTREAM END WITH THE OUTLET ALREADY CONSTRUCTED TO ALLOW A ROUTE FOR THE WATER TO ESCAPE. TEMPORARY DIVERSION MEASURES MAY BE REQUIRED FOR HIGH FLOWS DUE TO THE RESTRICTED NATURE OF THE OUTLET PIPE.

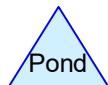
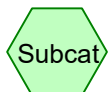
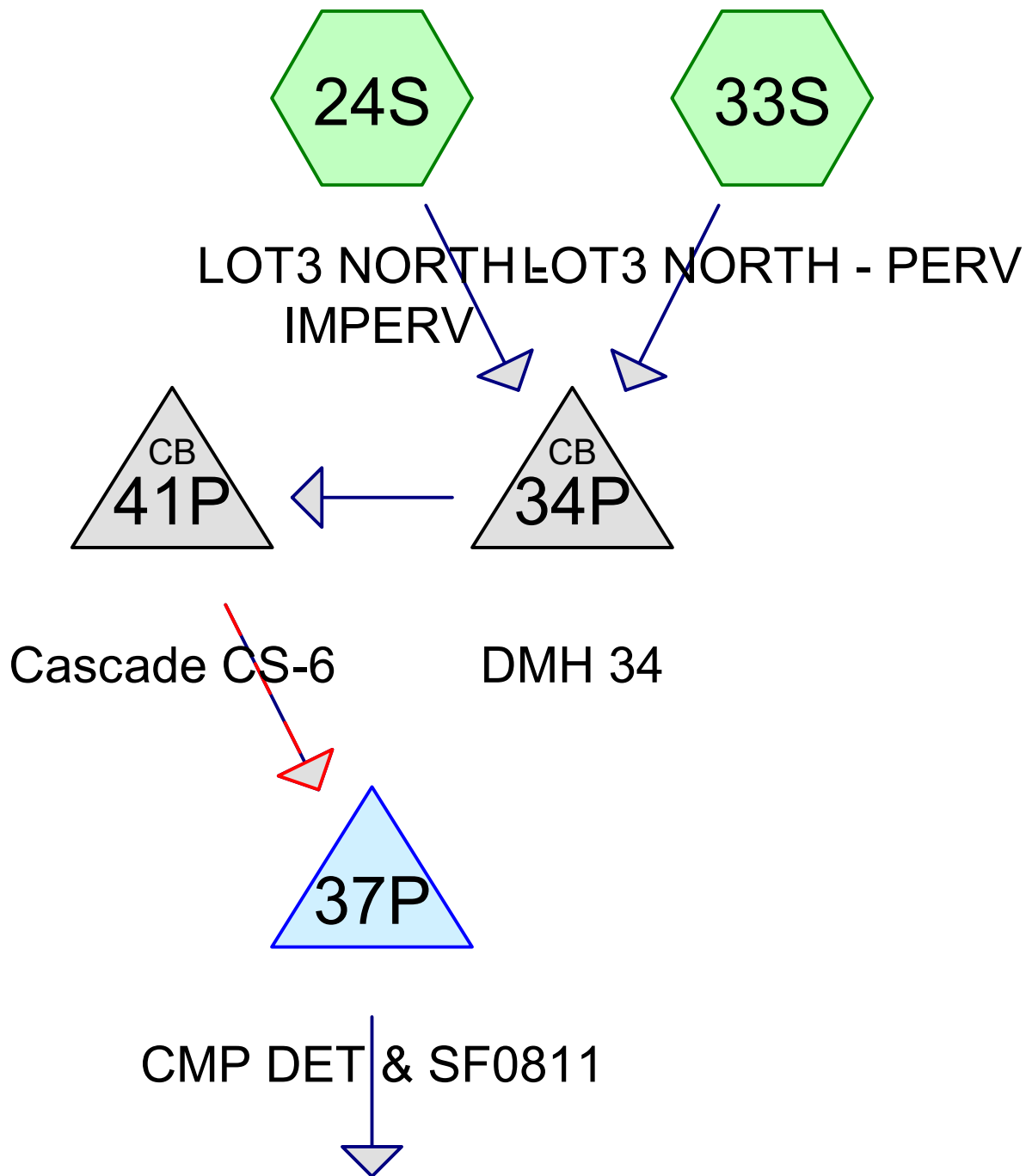


72"Ø UNDERGROUND DETENTION SYSTEM - -
555 HOPPING BROOK ROAD
HOLLISTON, MA
SITE DESIGNATION:

CONTECH®
ENGINEERED SOLUTIONS LLC
www.ContechES.com
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX
CONTECH
dYODS
DRAWING
CMP DETENTION SYSTEMS

The design and information shown on this drawing is provided by Contech Engineered Solutions LLC ("Contech"). Neither this drawing, nor any part thereof, may be used, reproduced or modified in any manner without the prior written consent of Contech. Failure to comply is done at the user's own risk and Contech expressly disclaims any liability or responsibility for such use.		If discrepancies between the supplied information upon which this drawing is based and the actual conditions are discovered as site work progresses, these discrepancies must be reported to Contech immediately for re-evaluation of the design. Contech accepts no liability for designs based on missing, incomplete or inaccurate information supplied by others.	
		DATE	REVISION DESCRIPTION
			BY

PROJECT No.: 4952	SEQ. No.: 8014	DATE: 5/25/2021
DESIGNED: DYO	DRAWN: DYO	
CHECKED: DYO	APPROVED: DYO	
SHEET NO.: D4		



Routing Diagram for 3724 STORMWATER- - Contech Markup
Prepared by quikrete, Printed 5/25/2021
HydroCAD® 10.10-5a s/n 00447 © 2020 HydroCAD Software Solutions LLC

3724 STORMWATER- - Contech Markup

Prepared by quikrete

Printed 5/25/2021

HydroCAD® 10.10-5a s/n 00447 © 2020 HydroCAD Software Solutions LLC

Page 2

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	WQ	Type III 24-hr		Default	24.00	1	1.21	2

3724 STORMWATER- - Contech Markup*Type III 24-hr WQ Rainfall=1.21"*

Prepared by quikrete

Printed 5/25/2021

HydroCAD® 10.10-5a s/n 00447 © 2020 HydroCAD Software Solutions LLC

Page 3

Time span=0.00-24.00 hrs, dt=0.03 hrs, 801 points

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q

Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 24S: LOT3 NORTH - IMPERV Runoff Area=199,841 sf 100.00% Impervious Runoff Depth>0.99"
 Flow Length=588' Tc=9.0 min CN=98 Runoff=4.573 cfs 16,556 cf

Subcatchment 33S: LOT3 NORTH - PERV Runoff Area=90,573 sf 0.00% Impervious Runoff Depth>0.06"
 Flow Length=588' Tc=9.0 min CN=74 Runoff=0.037 cfs 481 cf

Pond 34P: DMH 34 Peak Elev=338.35' Inflow=4.573 cfs 17,037 cf
 Primary=4.573 cfs 17,037 cf Secondary=0.000 cfs 0 cf Outflow=4.573 cfs 17,037 cf

Pond 37P: CMP DET & SF0811 Peak Elev=338.17' Storage=6,326 cf Inflow=4.573 cfs 17,037 cf
 Outflow=0.602 cfs 16,993 cf

Pond 41P: Cascade CS-6 Peak Elev=338.18' Inflow=4.573 cfs 17,037 cf
 Primary=4.573 cfs 17,037 cf Secondary=0.000 cfs 0 cf Outflow=4.573 cfs 17,037 cf

Total Runoff Area = 290,414 sf Runoff Volume = 17,037 cf Average Runoff Depth = 0.70"
31.19% Pervious = 90,573 sf 68.81% Impervious = 199,841 sf

3724 STORMWATER- - Contech Markup

Type III 24-hr WQ Rainfall=1.21"

Prepared by quikrete

Printed 5/25/2021

HydroCAD® 10.10-5a s/n 00447 © 2020 HydroCAD Software Solutions LLC

Page 4

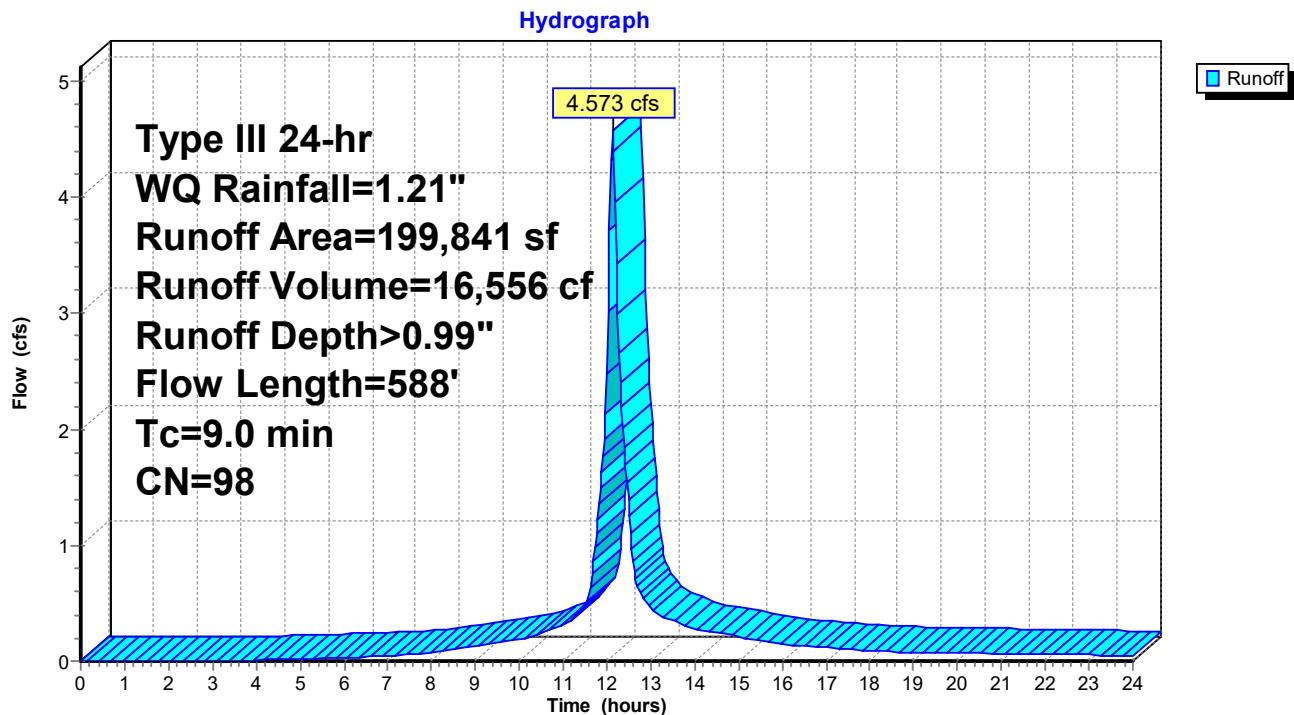
Summary for Subcatchment 24S: LOT3 NORTH - IMPERV

Runoff = 4.573 cfs @ 12.12 hrs, Volume= 16,556 cf, Depth> 0.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs
Type III 24-hr WQ Rainfall=1.21"

Area (sf)	CN	Description
199,841	98	Paved parking, HSG C
199,841		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.8	50	0.0470	0.14		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"
2.0	186	0.0470	1.52		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
0.8	160	0.0270	3.34		Shallow Concentrated Flow, Paved Kv= 20.3 fps
0.4	192	0.0100	7.20	22.62	Pipe Channel, 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013
9.0	588	Total			

Subcatchment 24S: LOT3 NORTH - IMPERV

3724 STORMWATER- - Contech Markup

Type III 24-hr WQ Rainfall=1.21"

Prepared by quikrete

Printed 5/25/2021

HydroCAD® 10.10-5a s/n 00447 © 2020 HydroCAD Software Solutions LLC

Page 5

Summary for Subcatchment 33S: LOT3 NORTH - PERV

Runoff = 0.037 cfs @ 12.46 hrs, Volume= 481 cf, Depth> 0.06"

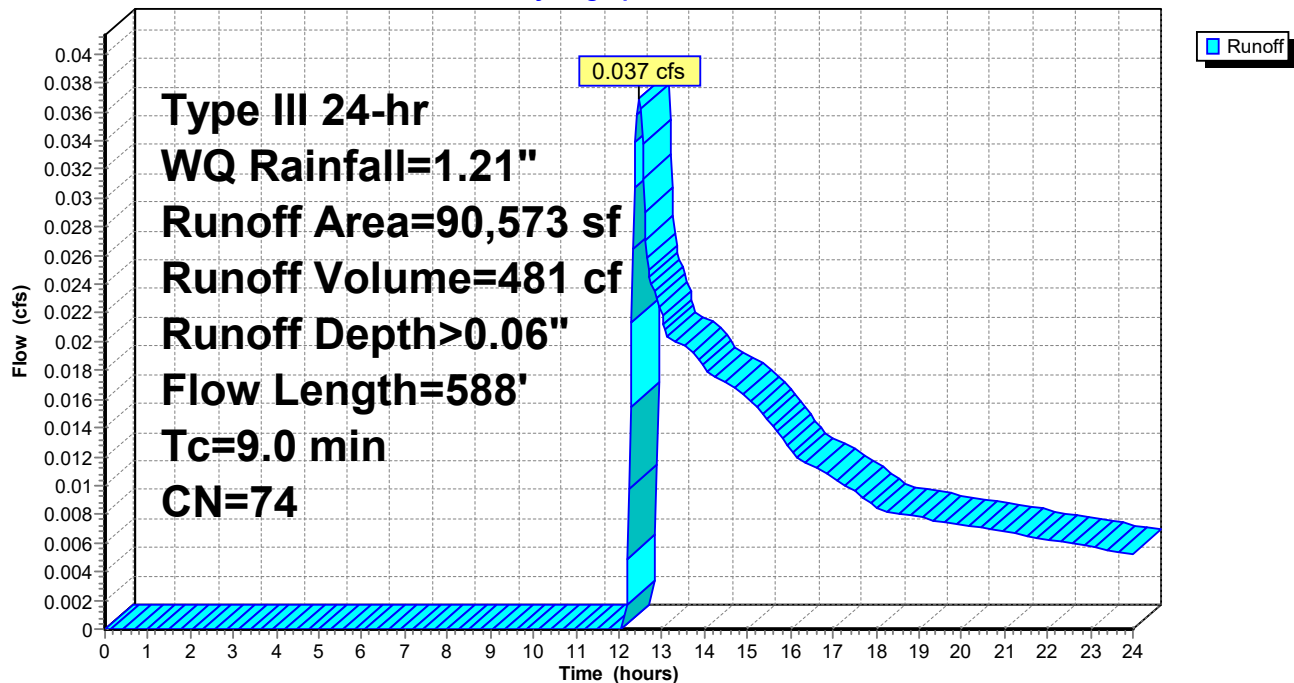
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs
Type III 24-hr WQ Rainfall=1.21"

Area (sf)	CN	Description
90,573	74	>75% Grass cover, Good, HSG C
90,573		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.8	50	0.0470	0.14		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"
2.0	186	0.0470	1.52		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
0.8	160	0.0270	3.34		Shallow Concentrated Flow, Paved Kv= 20.3 fps
0.4	192	0.0100	7.20	22.62	Pipe Channel, 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013
9.0	588	Total			

Subcatchment 33S: LOT3 NORTH - PERV

Hydrograph



3724 STORMWATER- - Contech Markup

Type III 24-hr WQ Rainfall=1.21"

Prepared by quikrete

Printed 5/25/2021

HydroCAD® 10.10-5a s/n 00447 © 2020 HydroCAD Software Solutions LLC

Page 6

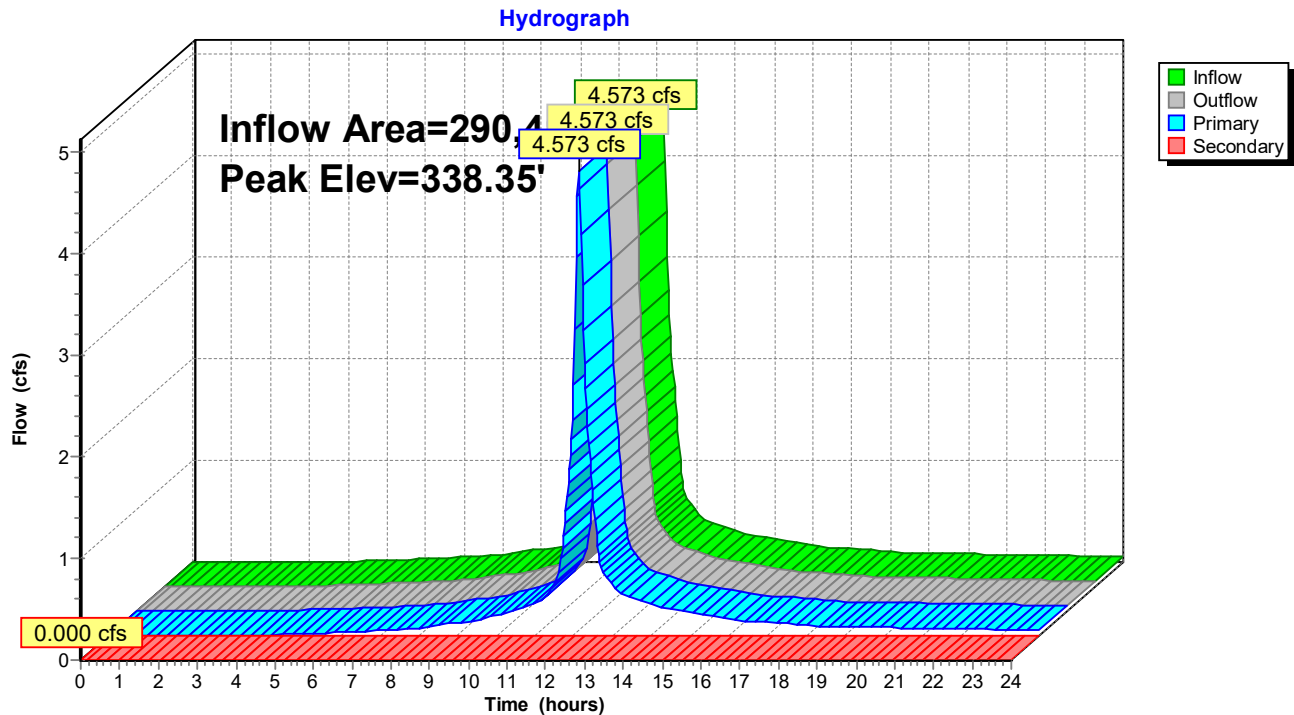
Summary for Pond 34P: DMH 34

Inflow Area = 290,414 sf, 68.81% Impervious, Inflow Depth > 0.70" for WQ event
 Inflow = 4.573 cfs @ 12.12 hrs, Volume= 17,037 cf
 Outflow = 4.573 cfs @ 12.12 hrs, Volume= 17,037 cf, Atten= 0%, Lag= 0.0 min
 Primary = 4.573 cfs @ 12.12 hrs, Volume= 17,037 cf
 Secondary = 0.000 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs

Peak Elev= 338.35' @ 12.15 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	336.31'	24.0" Round Culvert L= 3.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 336.31' / 336.30' S= 0.0033 ' S Cc= 0.900 n= 0.120, Flow Area= 3.14 sf
#2	Secondary	338.47'	8.0' long x 0.5' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=3.933 cfs @ 12.12 hrs HW=338.31' TW=338.16' (Dynamic Tailwater)↑**1=Culvert** (Outlet Controls 3.933 cfs @ 1.55 fps)**Secondary OutFlow** Max=0.000 cfs @ 0.00 hrs HW=336.31' (Free Discharge)↑**2=Broad-Crested Rectangular Weir** (Controls 0.000 cfs)**Pond 34P: DMH 34**

3724 STORMWATER- - Contech Markup*Type III 24-hr WQ Rainfall=1.21"*

Prepared by quikrete

Printed 5/25/2021

HydroCAD® 10.10-5a s/n 00447 © 2020 HydroCAD Software Solutions LLC

Page 7

Stage-Discharge for Pond 34P: DMH 34

Elevation (feet)	Discharge (cfs)	Primary (cfs)	Secondary (cfs)
336.31	0.000	0.000	0.000
336.36	0.001	0.001	0.000
336.41	0.007	0.007	0.000
336.46	0.019	0.019	0.000
336.51	0.038	0.038	0.000
336.56	0.067	0.067	0.000
336.61	0.106	0.106	0.000
336.66	0.155	0.155	0.000
336.71	0.215	0.215	0.000
336.76	0.286	0.286	0.000
336.81	0.369	0.369	0.000
336.86	0.465	0.465	0.000
336.91	0.572	0.572	0.000
336.96	0.691	0.691	0.000
337.01	0.822	0.822	0.000
337.06	0.964	0.964	0.000
337.11	1.119	1.119	0.000
337.16	1.285	1.285	0.000
337.21	1.462	1.462	0.000
337.26	1.650	1.650	0.000
337.31	1.848	1.848	0.000
337.36	2.057	2.057	0.000
337.41	2.276	2.276	0.000
337.46	2.504	2.504	0.000
337.51	2.740	2.740	0.000
337.56	2.986	2.986	0.000
337.61	3.239	3.239	0.000
337.66	3.500	3.500	0.000
337.71	3.767	3.767	0.000
337.76	4.041	4.041	0.000
337.81	4.321	4.321	0.000
337.86	4.605	4.605	0.000
337.91	4.894	4.894	0.000
337.96	5.186	5.186	0.000
338.01	5.481	5.481	0.000
338.06	5.778	5.778	0.000
338.11	6.077	6.077	0.000
338.16	6.375	6.375	0.000
338.21	6.672	6.672	0.000
338.26	6.968	6.968	0.000
338.31	7.261	7.261	0.000
338.36	7.549	7.549	0.000
338.41	7.832	7.832	0.000
338.46	8.107	8.107	0.000

3724 STORMWATER- - Contech Markup

Type III 24-hr WQ Rainfall=1.21"

Prepared by quikrete

Printed 5/25/2021

HydroCAD® 10.10-5a s/n 00447 © 2020 HydroCAD Software Solutions LLC

Page 8

Summary for Pond 37P: CMP DET & SF0811

Inflow Area = 290,414 sf, 68.81% Impervious, Inflow Depth > 0.70" for WQ event
 Inflow = 4.573 cfs @ 12.12 hrs, Volume= 17,037 cf
 Outflow = 0.602 cfs @ 12.78 hrs, Volume= 16,993 cf, Atten= 87%, Lag= 39.6 min
 Primary = 0.602 cfs @ 12.78 hrs, Volume= 16,993 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs
 Peak Elev= 338.17' @ 12.78 hrs Surf.Area= 1,976 sf Storage= 6,326 cf

Plug-Flow detention time= 95.7 min calculated for 16,971 cf (100% of inflow)
 Center-of-Mass det. time= 93.9 min (883.4 - 789.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	332.47'	0 cf	26.00'W x 76.00'L x 6.00'H Field A 11,856 cf Overall - 6,447 cf Embedded = 5,409 cf x 0.0% Voids
#2A	332.47'	6,447 cf	CMP Round 72 x 9 Inside #1 Effective Size= 72.0"W x 72.0"H => 28.27 sf x 20.00'L = 565.5 cf Overall Size= 72.0"W x 72.0"H x 20.00'L Row Length Adjustment= +8.00' x 28.27 sf x 3 rows 24.00' Header x 28.27 sf x 1 = 678.6 cf Inside
		6,447 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices (Turned on 1 times)
#1	Device 2	332.47'	12.0" Round Culvert L= 5.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 332.47' / 332.47' S= 0.0000 ' S= 0.0000 ' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf
#2	Primary	331.40'	Tube/Siphon/Float Valve X 24.00 0.606" Diameter, C= 0.600, 0.263" Trickle Diameter Starts@332.47' Breaks@332.07'

Primary OutFlow Max=0.602 cfs @ 12.78 hrs HW=338.17' TW=303.40' (Dynamic Tailwater)

↑ **2=Tube/Siphon/Float Valve** (Orifice Controls 0.602 cfs @ 12.53 fps)

↑ **1=Culvert** (Passes 0.602 cfs of 8.623 cfs potential flow)

3724 STORMWATER- - Contech Markup

Type III 24-hr WQ Rainfall=1.21"

Prepared by quikrete

Printed 5/25/2021

HydroCAD® 10.10-5a s/n 00447 © 2020 HydroCAD Software Solutions LLC

Page 9

Pond 37P: CMP DET & SF0811 - Chamber Wizard Field A**Chamber Model = CMP Round 72 (Round Corrugated Metal Pipe)**

Effective Size= 72.0"W x 72.0"H => 28.27 sf x 20.00'L = 565.5 cf

Overall Size= 72.0"W x 72.0"H x 20.00'L

Row Length Adjustment= +8.00' x 28.27 sf x 3 rows

72.0" Wide + 36.0" Spacing = 108.0" C-C Row Spacing

3 Chambers/Row x 20.00' Long +8.00' Row Adjustment +6.00' Header x 1 = 74.00' Row Length +12.0" End Stone x 2 = 76.00' Base Length

3 Rows x 72.0" Wide + 36.0" Spacing x 2 + 12.0" Side Stone x 2 = 26.00' Base Width

72.0" Chamber Height = 6.00' Field Height

9 Chambers x 565.5 cf +8.00' Row Adjustment x 28.27 sf x 3 Rows + 24.00' Header x 28.27 sf = 6,446.5 cf Chamber Storage

11,856.0 cf Field - 6,446.5 cf Chambers = 5,409.5 cf Stone x 0.0% Voids = 0.0 cf Stone Storage

Chamber Storage = 6,446.5 cf = 0.148 af

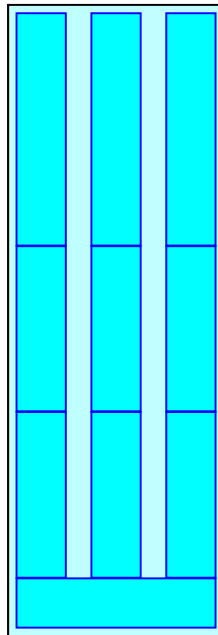
Overall Storage Efficiency = 54.4%

Overall System Size = 76.00' x 26.00' x 6.00'

9 Chambers

439.1 cy Field

200.4 cy Stone



3724 STORMWATER- - Contech Markup

Type III 24-hr WQ Rainfall=1.21"

Prepared by quikrete

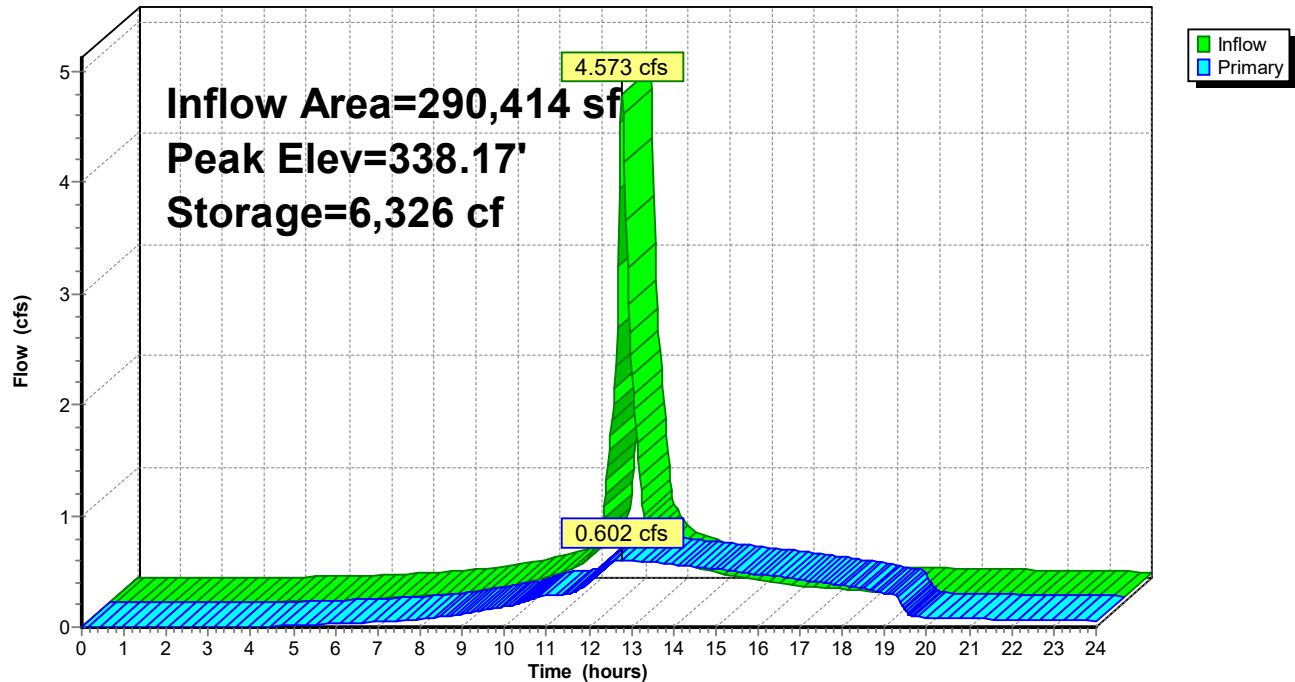
Printed 5/25/2021

HydroCAD® 10.10-5a s/n 00447 © 2020 HydroCAD Software Solutions LLC

Page 10

Pond 37P: CMP DET & SF0811

Hydrograph



3724 STORMWATER- - Contech Markup*Type III 24-hr WQ Rainfall=1.21"*

Prepared by quikrete

Printed 5/25/2021

HydroCAD® 10.10-5a s/n 00447 © 2020 HydroCAD Software Solutions LLC

Page 11

Stage-Discharge for Pond 37P: CMP DET & SF0811

Elevation (feet)	Primary (cfs)	Primary+ (cfs)	Elevation (feet)	Primary (cfs)	Primary+ (cfs)
332.07	0.000	0.000	337.47	0.570	0.570
332.17	0.000	0.000	337.57	0.575	0.575
332.27	0.000	0.000	337.67	0.580	0.580
332.37	0.000	0.000	337.77	0.584	0.584
332.47	0.000	0.000	337.87	0.589	0.589
332.57	0.021	0.021	337.97	0.593	0.593
332.67	0.094	0.094	338.07	0.598	0.598
332.77	0.216	0.216	338.17	0.602	0.602
332.87	0.281	0.281	338.27	0.607	0.607
332.97	0.290	0.290	338.37	0.611	0.611
333.07	0.299	0.299	338.47	0.615	0.615
333.17	0.308	0.308			
333.27	0.317	0.317			
333.37	0.325	0.325			
333.47	0.333	0.333			
333.57	0.341	0.341			
333.67	0.349	0.349			
333.77	0.356	0.356			
333.87	0.364	0.364			
333.97	0.371	0.371			
334.07	0.378	0.378			
334.17	0.385	0.385			
334.27	0.392	0.392			
334.37	0.399	0.399			
334.47	0.406	0.406			
334.57	0.412	0.412			
334.67	0.419	0.419			
334.77	0.425	0.425			
334.87	0.431	0.431			
334.97	0.437	0.437			
335.07	0.443	0.443			
335.17	0.449	0.449			
335.27	0.455	0.455			
335.37	0.461	0.461			
335.47	0.467	0.467			
335.57	0.473	0.473			
335.67	0.478	0.478			
335.77	0.484	0.484			
335.87	0.489	0.489			
335.97	0.495	0.495			
336.07	0.500	0.500			
336.17	0.506	0.506			
336.27	0.511	0.511			
336.37	0.516	0.516			
336.47	0.521	0.521			
336.57	0.526	0.526			
336.67	0.531	0.531			
336.77	0.536	0.536			
336.87	0.541	0.541			
336.97	0.546	0.546			
337.07	0.551	0.551			
337.17	0.556	0.556			
337.27	0.561	0.561			
337.37	0.566	0.566			

3724 STORMWATER- - Contech Markup

Type III 24-hr WQ Rainfall=1.21"

Prepared by quikrete

Printed 5/25/2021

HydroCAD® 10.10-5a s/n 00447 © 2020 HydroCAD Software Solutions LLC

Page 12

Summary for Pond 41P: Cascade CS-6

Inflow Area = 290,414 sf, 68.81% Impervious, Inflow Depth > 0.70" for WQ event
 Inflow = 4.573 cfs @ 12.12 hrs, Volume= 17,037 cf
 Outflow = 4.573 cfs @ 12.12 hrs, Volume= 17,037 cf, Atten= 0%, Lag= 0.0 min
 Primary = 4.573 cfs @ 12.12 hrs, Volume= 17,037 cf
 Secondary = 0.000 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs

Peak Elev= 338.18' @ 12.81 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	336.30'	Tube/Siphon/Float Valve X 2.00 1.610" Diameter, C= 0.600 1.9' Long Tube, Hazen-Williams C= 130 Inlet / Outlet Elev. = 334.40' / 336.30'
#2	Primary	337.61'	Tube/Siphon/Float Valve 15.000" Diameter, C= 0.600 1.1' Long Tube, Hazen-Williams C= 130 Inlet / Outlet Elev. = 336.63' / 337.61'
#3	Secondary	338.46'	1.5' long Sharp-Crested Rectangular Weir X 2.00 2 End Contraction(s)

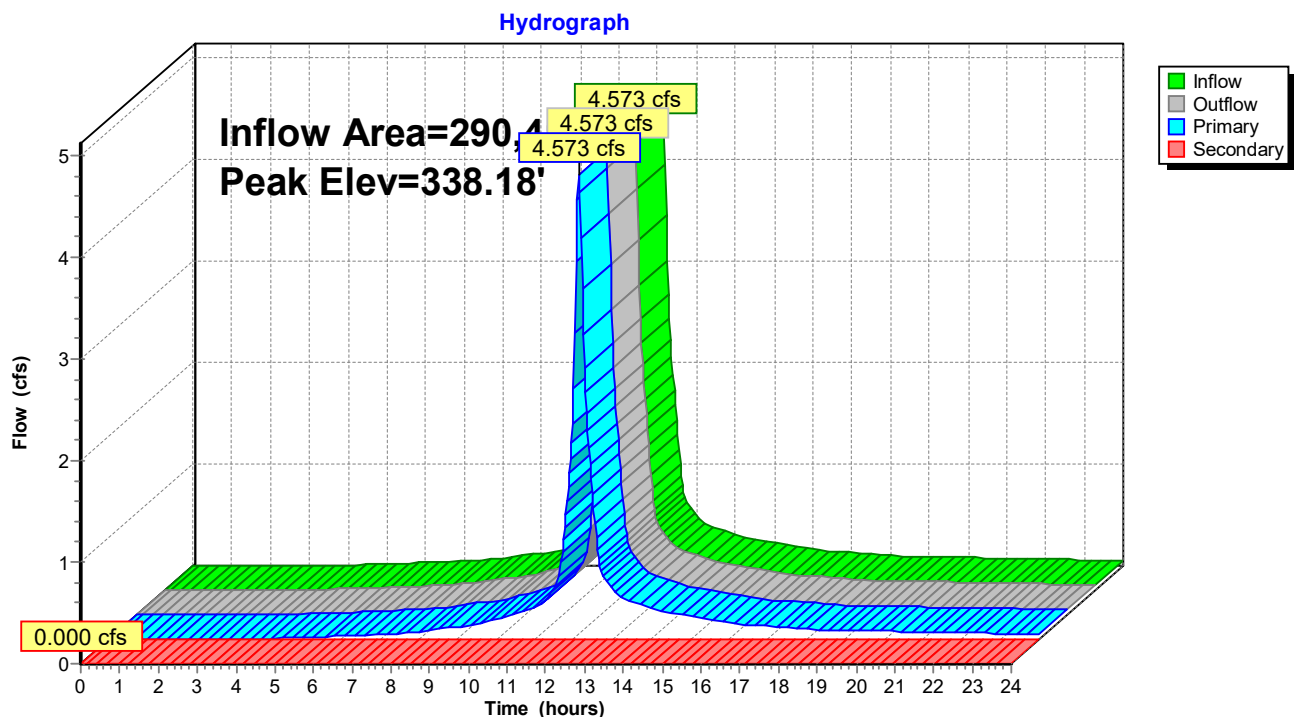
Primary OutFlow Max=4.555 cfs @ 12.12 hrs HW=338.16' TW=335.50' (Dynamic Tailwater)

1=Tube/Siphon/Float Valve (Tube Controls 0.175 cfs @ 6.19 fps)

2=Tube/Siphon/Float Valve (Tube Controls 4.380 cfs @ 3.57 fps)

Secondary OutFlow Max=0.000 cfs @ 0.00 hrs HW=334.40' TW=332.07' (Dynamic Tailwater)

3=Sharp-Crested Rectangular Weir (Controls 0.000 cfs)

Pond 41P: Cascade CS-6

3724 STORMWATER- - Contech Markup*Type III 24-hr WQ Rainfall=1.21"*

Prepared by quikrete

Printed 5/25/2021

HydroCAD® 10.10-5a s/n 00447 © 2020 HydroCAD Software Solutions LLC

Page 13

Stage-Discharge for Pond 41P: Cascade CS-6

Elevation (feet)	Discharge (cfs)	Primary (cfs)	Secondary (cfs)
334.40	0.000	0.000	0.000
334.50	0.000	0.000	0.000
334.60	0.000	0.000	0.000
334.70	0.000	0.000	0.000
334.80	0.000	0.000	0.000
334.90	0.000	0.000	0.000
335.00	0.000	0.000	0.000
335.10	0.000	0.000	0.000
335.20	0.000	0.000	0.000
335.30	0.000	0.000	0.000
335.40	0.000	0.000	0.000
335.50	0.000	0.000	0.000
335.60	0.000	0.000	0.000
335.70	0.000	0.000	0.000
335.80	0.000	0.000	0.000
335.90	0.000	0.000	0.000
336.00	0.000	0.000	0.000
336.10	0.000	0.000	0.000
336.20	0.000	0.000	0.000
336.30	0.000	0.000	0.000
336.40	0.040	0.040	0.000
336.50	0.057	0.057	0.000
336.60	0.070	0.070	0.000
336.70	0.080	0.080	0.000
336.80	0.090	0.090	0.000
336.90	0.099	0.099	0.000
337.00	0.107	0.107	0.000
337.10	0.114	0.114	0.000
337.20	0.121	0.121	0.000
337.30	0.128	0.128	0.000
337.40	0.134	0.134	0.000
337.50	0.140	0.140	0.000
337.60	0.146	0.146	0.000
337.70	1.664	1.664	0.000
337.80	2.560	2.560	0.000
337.90	3.334	3.334	0.000
338.00	3.846	3.846	0.000
338.10	4.296	4.296	0.000
338.20	4.702	4.702	0.000
338.30	5.075	5.075	0.000
338.40	5.422	5.422	0.000



Determining Number of Cartridges for Systems Downstream of Detention

CONTECH Stormwater Solutions Inc. Engineer:

Date

DRA

5/25/2021

Site Information

Project Name

555 Hopping Brook Road - DMH 34

Project State

MA

Project Location

Holliston

Drainage Area, Ad

6.67 ac

Impervious Area, Ai

4.59 ac

Pervious Area, Ap

2.08

% Impervious

69 %

Runoff Coefficient, Rc

0.67

Upstream Detention System

Detention pretreatment credit
(from removal efficiency calcs)

50%

Mass loading calculations

Mean Annual Rainfall, P

49.8 in

Agency required % removal

80%

Percent Runoff Capture

90%

Mean Annual Runoff, V_t

726,000 ft³

Event Mean Concentration of Pollutant, EMC

70 mg/l

Annual Mass Load, M_{total}

3,171 lbs

Water Quality Volume

90% Rainfall Depth

1.00 in

WQ Volume to be treated

0.372 ac-ft

WQ Volume to be treated by filters

16,198 ft³

Filter System

Filtration brand

StormFilter

Cartridge height

27 in

Specific Flow Rate

1.00 gpm/ft²

Number of cartridges - mass loading

Mass removed by pretreatment system, M_{pre}

1,585 lbs

Mass load to filters after pretreatment, M_{pass1}

1,585 lbs

Mass to be captured by filters, M_{filter}

1,268 lbs

Allowable Cartridge Flow rate, Q_{cart}

11.25 gpm

Mass load per cartridge, M_{cart} (lbs)

54 lbs

Number of Cartridges required, N_{mass}

24

Treatment Capacity

0.60 cfs

Determine Critical Sizing Value

Method to Use:

MASS-LOADING

SUMMARY

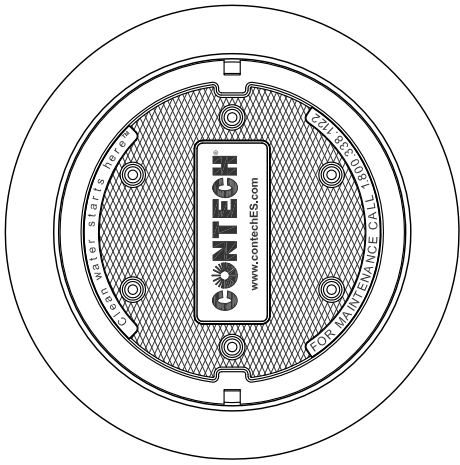
Treatment Flow Rate, cfs	0.60
Cartridge Flow Rate, gpm	11.25
Number of Cartridges	24

STORMFILTER DESIGN NOTES

STORMFILTER TREATMENT CAPACITY IS A FUNCTION OF THE CARTRIDGE SELECTION AND THE NUMBER OF CARTRIDGES. THE STANDARD VAULT STYLE IS SHOWN WITH THE MAXIMUM NUMBER OF CARTRIDGES (26). VAULT STYLE OPTIONS INCLUDE INLET BAY (17), INLET BAY/OUTLET BAY (12), OUTLET BAY (21), FULL HEIGHT BAFFLE WALL (17). STORMFILTER 8X11 PEAK HYDRAULIC CAPACITY IS 1.8 CFS. IF THE SITE CONDITIONS EXCEED 1.8 CFS AN UPSTREAM BYPASS STRUCTURE IS REQUIRED.

CARTRIDGE SELECTION					
CARTRIDGE HEIGHT	27"	18"	LOW DROP		
RECOMMENDED HYDRAULIC DROP (H)	3.05'	2.3'			
SPECIFIC FLOW RATE (gpm/sf)	2 gpm/sf	1 gpm/sf	1.67" gpm/sf	1 gpm/sf	1.67" gpm/sf
CARTRIDGE FLOW RATE (gpm)	22.5	18.79	15	12.53	10
				7.5	8.35
					5

* 1.67 gpm/sf SPECIFIC FLOW RATE IS APPROVED WITH PHOSPHOSORB® (PSORB) MEDIA ONLY



FRAME AND COVER
(DIAMETER VARIES)

N.T.S.

SITE SPECIFIC DATA REQUIREMENTS			
STRUCTURE ID			*
WATER QUALITY FLOW RATE (cfs)			*
PEAK FLOW RATE (cfs)			*
RETURN PERIOD OF PEAK FLOW (yrs)			*
CARRIDGE HEIGHT (27", 18", LOW DROP(LD))			*
NUMBER OF CARTRIDGES REQUIRED			*
CARRIDGE FLOW RATE			*
MEDIA TYPE (PERLITE, ZPG, PSORB)			*
PIPE DATA:	I.E.	MATERIAL	DIAMETER
INLET PIPE #1	*	*	*
INLET PIPE #2	*	*	*
OUTLET PIPE	*	*	*
UPSTREAM RIM ELEVATION			*
DOWNSTREAM RIM ELEVATION			*
ANTI-FLOTATION BALLAST		WIDTH	HEIGHT
		*	*
NOTES/SPECIAL REQUIREMENTS:			
* PER ENGINEER OF RECORD			

GENERAL NOTES

1. CONTECH TO PROVIDE ALL MATERIALS UNLESS NOTED OTHERWISE.
2. DIMENSIONS MARKED WITH () ARE REFERENCE DIMENSIONS. ACTUAL DIMENSIONS MAY VARY.
3. FOR SITE SPECIFIC DRAWINGS WITH DETAILED VAULT DIMENSIONS AND WEIGHTS, PLEASE CONTACT YOUR CONTECH ENGINEERED SOLUTIONS LLC REPRESENTATIVE. www.ContechES.com
4. STORM/FILTER WATER QUALITY STRUCTURE SHALL BE IN ACCORDANCE WITH ALL DESIGN DATA AND INFORMATION CONTAINED IN THIS DRAWING.
5. STRUCTURE SHALL MEET AASHTO HS20 LOAD RATING, ASSUMING EARTH COVER OF 0' - 5' AND GROUNDWATER ELEVATION AT, OR BELOW, THE OUTLET PIPE INVERT ELEVATION. ENGINEER OF RECORD TO CONFIRM ACTUAL GROUNDWATER ELEVATION. CASTINGS SHALL MEET AASHTO M306 AND BE CAST WITH THE CONTECH LOGO.
6. FILTER CARTRIDGES SHALL BE MEDIA-FILLED, PASSIVE, SIPHON ACTUATED, RADIAL FLOW, AND SELF CLEANING. RADIAL MEDIA DEPTH SHALL BE 7-INCHES. FILTER MEDIA CONTACT TIME SHALL BE AT LEAST 38 SECONDS.
7. SPECIFIC FLOW RATE IS EQUAL TO THE FILTER TREATMENT CAPACITY (gpm) DIVIDED BY THE FILTER CONTACT SURFACE AREA (sq ft).
8. STORM/FILTER STRUCTURE SHALL BE PRECAST CONFORMING TO ASTM C-857 AND AASHTO LOAD FACTOR DESIGN METHOD.

INSTALLATION NOTES

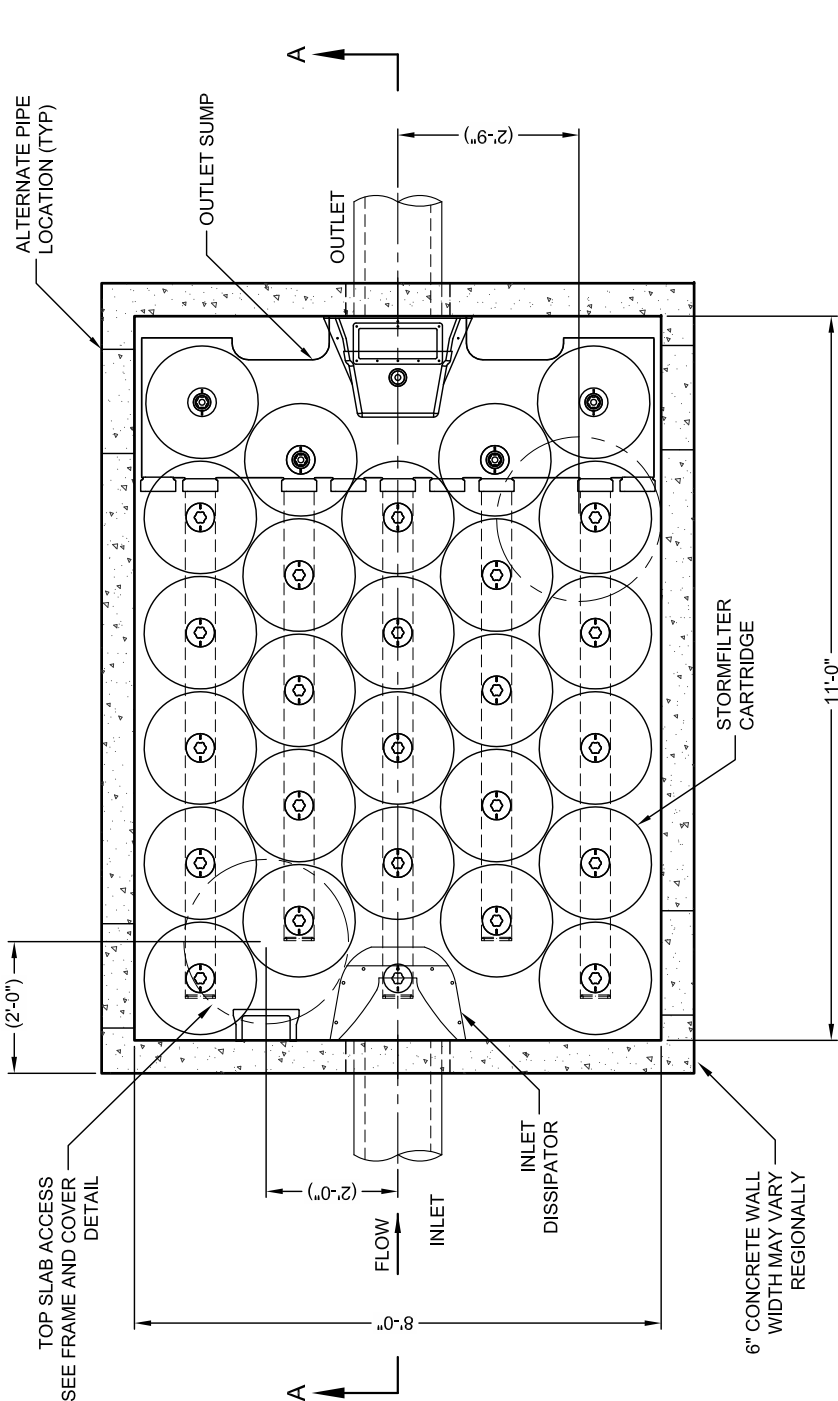
- A. ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
- B. CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE STORMFILTER VAULT (LIFTING CLUTCHES PROVIDED).
- C. CONTRACTOR TO INSTALL JOINT SEALANT BETWEEN ALL VAULT SECTIONS AND ASSEMBLY VAULT.
- D. CONTRACTOR TO PROVIDE, INSTALL, AND GROUT PIPES. MATCH OUTLET PIPE INVERT WITH OUTLET BAY FLOOR.
- E. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO PROTECT CARTRIDGES FROM CONSTRUCTION-RELATED EROSION RUNOFF.



www.contechES.com
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

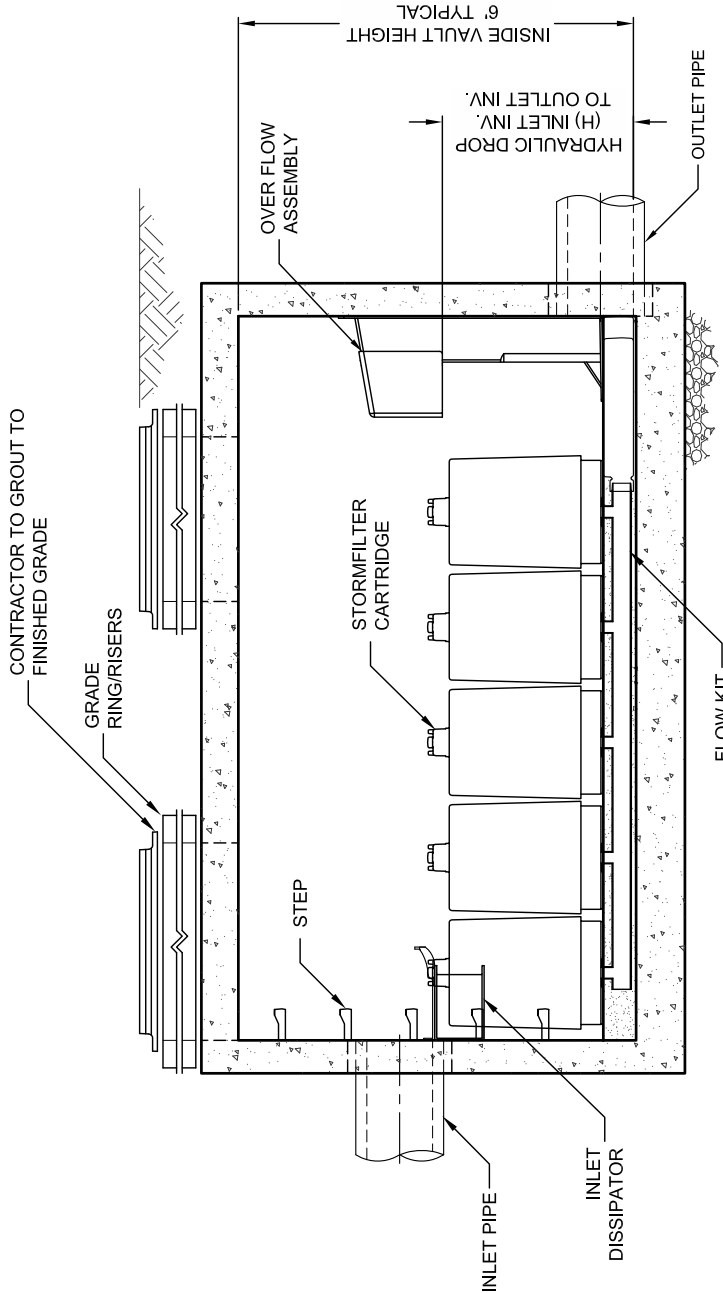
STORMFILTER

STANDARD DETAIL



PLAN VIEW

VAULT STYLE: OUTLET SUMP (NIB)



SECTION A-A



PROJECT SUMMARY

CALCULATION DETAILS

- **LOADING = HS20 & HS25**
- **APPROX. LINEAR FOOTAGE = 228 lf.**

STORAGE SUMMARY

- STORAGE VOLUME REQUIRED = N/A
- PIPE STORAGE VOLUME = 6,447 cf.
- BACKFILL STORAGE VOLUME = 0 cf.
- TOTAL STORAGE PROVIDED = 6,447 cf.

PIPE DETAILS

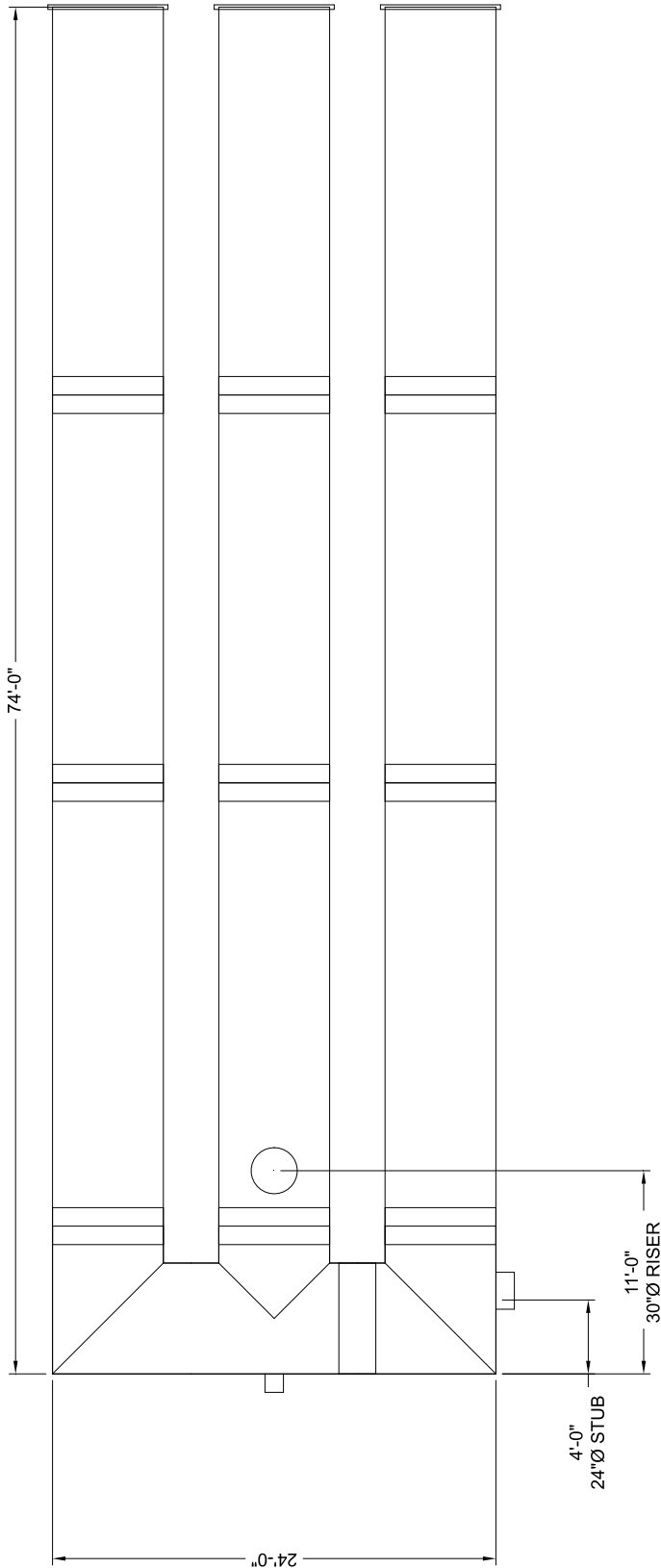
- DIAMETER = 72 IN.
- CORRUGATION = 5x1
- GAGE = 16
- COATING = ALT2
- WALL TYPE = Solid
- BARRELL SPACING = 36 IN.

BACKFILL DETAILS

- WIDTH AT ENDS = 12 IN.
- ABOVE PIPE = 0 IN.
- WIDTH AT SIDES = 12 IN.
- BELOW PIPE = 0 IN.

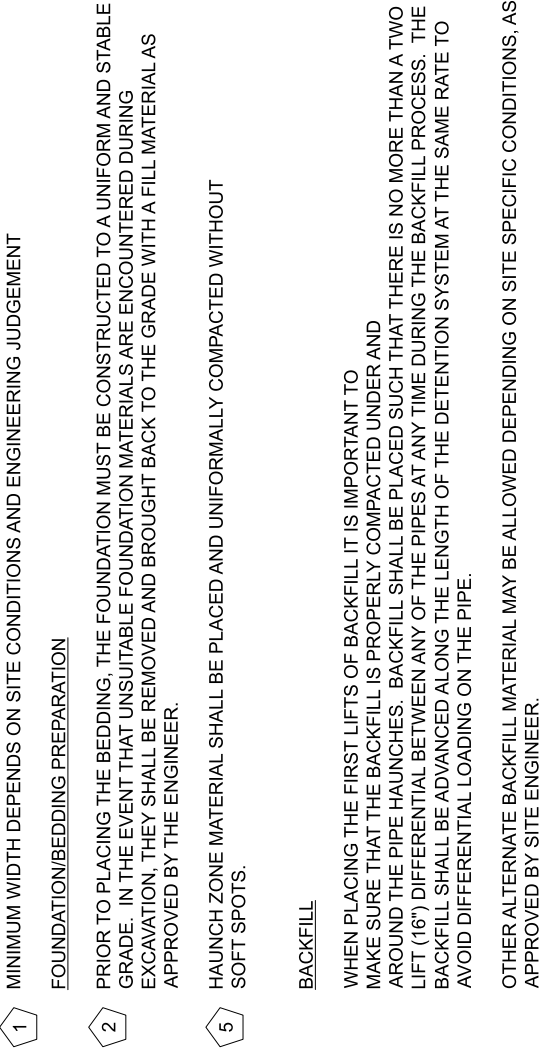
NOTES

- ALL RISER AND STUB DIMENSIONS ARE TO CENTERLINE. ALL ELEVATIONS, DIMENSIONS, AND LOCATIONS OF RISERS AND INLETS, SHALL BE VERIFIED BY THE ENGINEER OF RECORD PRIOR TO RELEASING FOR FABRICATION.
- ALL FITTINGS AND REINFORCEMENT COMPLY WITH ASTM A998.
- ALL RISERS AND STUBS ARE $2\frac{1}{2}" \times \frac{1}{2}"$ CORRUGATION AND 16 GAGE UNLESS OTHERWISE NOTED.
- RISERS TO BE FIELD TRIMMED TO GRADE.
- QUANTITY OF PIPE SHOWN DOES NOT PROVIDE EXTRA PIPE FOR CONNECTING THE SYSTEM TO EXISTING PIPE OR DRAINAGE STRUCTURES. OUR SYSTEM AS DETAILED PROVIDES NOMINAL INLET AND/OR OUTLET PIPE STUB FOR CONNECTION TO EXISTING DRAINAGE FACILITIES. IF ADDITIONAL PIPE IS NEEDED IT IS THE RESPONSIBILITY OF THE CONTRACTOR.
- BAND TYPE TO BE DETERMINED UPON FINAL DESIGN.
- THE PROJECT SUMMARY IS REFLECTIVE OF THE DYODS DESIGN QUANTITIES ARE APPROX. AND SHOULD BE VERIFIED UPON FINAL DESIGN AND APPROVAL. FOR EXAMPLE, TOTAL EXCAVATION DOES NOT CONSIDER ALL VARIABLES SUCH AS SHORING AND ONLY ACCOUNTS FOR MATERIAL WITHIN THE ESTIMATED EXCAVATION FOOTPRINT.
- THESE DRAWINGS ARE FOR CONCEPTUAL PURPOSES AND DO NOT REFLECT ANY LOCAL PREFERENCES OR REGULATIONS. PLEASE CONTACT YOUR LOCAL CONTECH REP FOR MODIFICATIONS.



ASSEMBLY
SCALE: 1" = 10'

[illegible]



8 7 A 6 3 A *

[illegible]

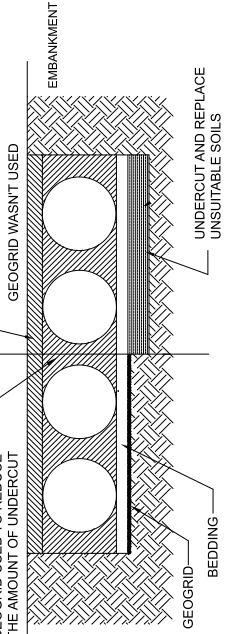
CMP DETENTION INSTALLATION GUIDE

PROPER INSTALLATION OF A FLEXIBLE UNDERGROUND DETENTION SYSTEM WILL ENSURE LONG-TERM PERFORMANCE. THE CONFIGURATION OF THESE SYSTEMS OFTEN REQUIRES SPECIAL CONSTRUCTION PRACTICES THAT DIFFER FROM CONVENTIONAL FLEXIBLE PIPE CONSTRUCTION. CONTECH ENGINEERED SOLUTIONS STRONGLY SUGGESTS SCHEDULING A PRE-CONSTRUCTION MEETING WITH YOUR LOCAL SALES ENGINEER TO DETERMINE IF ADDITIONAL MEASURES, NOT COVERED IN THIS GUIDE, ARE APPROPRIATE FOR YOUR SITE.

FOUNDATION

CONSTRUCT A FOUNDATION THAT CAN SUPPORT THE DESIGN LOADING APPLIED BY THE PIPE AND ADJACENT BACKFILL WEIGHT AS WELL AS MAINTAIN ITS INTEGRITY DURING CONSTRUCTION.

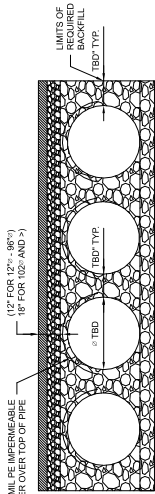
IF SOFT OR UNSUITABLE SOILS ARE ENCOUNTERED, REMOVE THE POOR SOILS DOWN TO A SUITABLE DEPTH AND THEN BUILD UP TO THE APPROPRIATE ELEVATION WITH A COMPETENT BACKFILL MATERIAL. THE STRUCTURAL FILL MATERIAL GRADATION SHOULD NOT ALLOW THE MIGRATION OF FINES, WHICH CAN CAUSE SETTLEMENT OF THE DETENTION SYSTEM OR PAVEMENT ABOVE. IF THE STRUCTURAL FILL MATERIAL IS NOT COMPATIBLE WITH THE UNDERLYING SOILS AN ENGINEERING FABRIC SHOULD BE USED AS A SEPARATOR. IN SOME CASES, USING A STIFF REINFORCING GEOGRID, REDUCES OVER EXCAVATION AND REPLACEMENT FILL QUANTITIES.



GRADE THE FOUNDATION SUBGRADE TO A UNIFORM OR SLIGHTLY SLOPING GRADE. IF THE SUBGRADE IS CLAY OR RELATIVELY NON-POROUS AND THE CONSTRUCTION SEQUENCE WILL LAST FOR AN EXTENDED PERIOD OF TIME, IT IS BEST TO SLOPE THE GRADE TO ONE END OF THE SYSTEM. THIS WILL ALLOW EXCESS WATER TO DRAIN QUICKLY, PREVENTING SATURATION OF THE SUBGRADE.

GEOMEMBRANE BARRIER

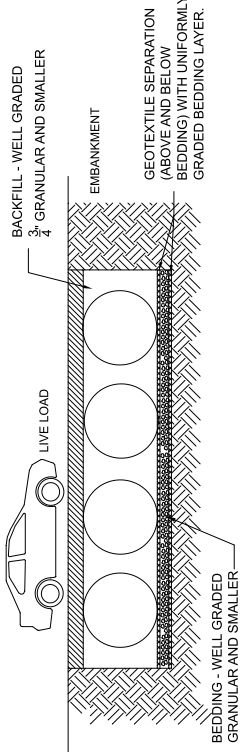
A SITE'S RESISTIVITY MAY CHANGE OVER TIME WHEN VARIOUS TYPES OF SALTING AGENTS ARE USED, SUCH AS ROAD SALTS FOR DEICING AGENTS. IF SALTING AGENTS ARE USED ON OR NEAR THE PROJECT SITE, A GEOMEMBRANE BARRIER IS RECOMMENDED WITH THE SYSTEM. THE GEOMEMBRANE LINER IS INTENDED TO HELP PROTECT THE SYSTEM FROM THE POTENTIAL ADVERSE EFFECTS THAT MAY RESULT FROM THE USE OF SUCH AGENTS INCLUDING PREMATURE CORROSION AND REDUCED ACTUAL STRENGTH. THE ENGINEER OF RECORD IS TO EVALUATE WHETHER SALTING AGENTS WILL BE USED ON OR NEAR THE PROJECT SITE, AND USE HIS/HER BEST JUDGEMENT TO DETERMINE IF ANY ADDITIONAL PROTECTIVE MEASURES ARE REQUIRED. BELOW IS A TYPICAL DETAIL SHOWING THE PLACEMENT OF A GEOMEMBRANE BARRIER FOR PROJECTS WHERE SALTING AGENTS ARE USED ON OR NEAR THE PROJECT SITE.



IN-SITU TRENCH WALL

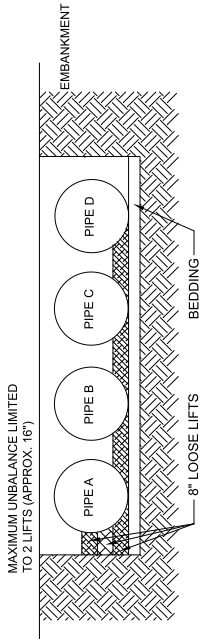
IF EXCAVATION IS REQUIRED, THE TRENCH WALL NEEDS TO BE CAPABLE OF SUPPORTING THE LOAD THAT THE PIPE SHEDS AS THE SYSTEM IS LOADED. IF SOILS ARE NOT CAPABLE OF SUPPORTING THESE LOADS, THE PIPE CAN DEFLECT. PERFORM A SIMPLE SOIL PRESSURE CHECK USING THE APPLIED LOADS TO DETERMINE THE LIMITS OF EXCAVATION BEYOND THE SPRING LINE OF THE OUTER MOST PIPES.

IN MOST CASES THE REQUIREMENTS FOR A SAFE WORK ENVIRONMENT AND PROPER BACKFILL PLACEMENT AND COMPACTION TAKE CARE OF THIS CONCERN.



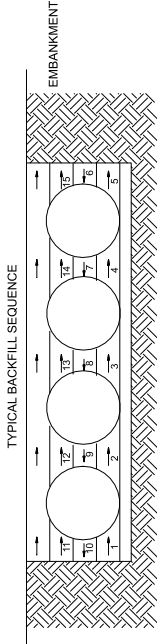
BACKFILL PLACEMENT

MATERIAL SHALL BE WORKED INTO THE PIPE HAUNCHES BY MEANS OF SHOVEL-SLICING, RODDING, AIR TAMPER, VIBRATORY ROD, OR OTHER EFFECTIVE METHODS.



IF AASHTO T99 PROCEDURES ARE DETERMINED INFEEASIBLE BY THE GEOTECHNICAL ENGINEER OF RECORD, COMPACTION IS CONSIDERED ADEQUATE WHEN NO FURTHER YIELDING OF THE MATERIAL IS OBSERVED UNDER THE COMPACTOR, OR UNDER FOOT, AND THE GEOTECHNICAL ENGINEER OF RECORD (OR REPRESENTATIVE THEREOF) IS SATISFIED WITH THE LEVEL OF COMPACTION.

FOR LARGE SYSTEMS, CONVEYOR SYSTEMS, BACKHOES WITH LONG REACHES OR DRAGLINES WITH STONE BUCKETS MAY BE USED TO PLACE BACKFILL. ONCE MINIMUM COVER FOR CONSTRUCTION LOADING ACROSS THE ENTIRE WIDTH OF THE SYSTEM IS REACHED, ADVANCE THE EQUIPMENT TO THE END OF THE RECENTLY PLACED FILL, AND BEGIN THE SEQUENCE AGAIN UNTIL THE SYSTEM IS COMPLETELY BACKFILLED. THIS TYPE OF CONSTRUCTION SEQUENCE PROVIDES ROOM FOR STOCKPILED BACKFILL DIRECTLY BEHIND THE BACKHOE, AS WELL AS THE MOVEMENT OF CONSTRUCTION TRAFFIC. MATERIAL STOCKPILES ON TOP OF THE BACKFILLED DETENTION SYSTEM SHOULD BE LIMITED TO 8- TO 10- FEET HIGH AND MUST PROVIDE BALANCED LOADING ACROSS ALL BARRELS. TO DETERMINE THE PROPER COVER OVER THE PIPES TO ALLOW THE MOVEMENT OF CONSTRUCTION EQUIPMENT SEE TABLE 1, OR CONTACT YOUR LOCAL CONTECH SALES ENGINEER.



CMP DETENTION SYSTEM INSPECTION AND MAINTENANCE

UNDERGROUND STORMWATER DETENTION AND INFILTRATION SYSTEMS MUST BE INSPECTED AND MAINTAINED AT REGULAR INTERVALS FOR PURPOSES OF PERFORMANCE AND LONGEVITY.

INSPECTION

INSPECTION IS THE KEY TO EFFECTIVE MAINTENANCE OF CMP DETENTION SYSTEMS AND IS EASILY PERFORMED. CONTECH RECOMMENDS ONGOING, ANNUAL INSPECTIONS. SITES WITH HIGH TRASH LOAD OR SMALL OUTLET CONTROL ORIFICES MAY NEED MORE FREQUENT INSPECTIONS. THE RATE AT WHICH THE SYSTEM COLLECTS POLLUTANTS WILL DEPEND MORE ON SITE SPECIFIC ACTIVITIES RATHER THAN THE SIZE OR CONFIGURATION OF THE SYSTEM.

INSPECTIONS SHOULD BE PERFORMED MORE OFTEN IN EQUIPMENT WASHDOWN AREAS, IN CLIMATES WHERE SANDING AND/OR SALTING OPERATIONS TAKE PLACE, AND IN OTHER VARIOUS INSTANCES IN WHICH ONE WOULD EXPECT HIGHER ACCUMULATIONS OF SEDIMENT OR ABRASIVE/ CORROSIVE CONDITIONS. A RECORD OF EACH INSPECTION IS TO BE MAINTAINED FOR THE LIFE OF THE SYSTEM

MAINTENANCE

CMP DETENTION SYSTEMS SHOULD BE CLEANED WHEN AN INSPECTION REVEALS ACCUMULATED SEDIMENT OR TRASH IS CLOGGING THE DISCHARGE ORIFICE.

ACCUMULATED SEDIMENT AND TRASH CAN TYPICALLY BE EVACUATED THROUGH THE MANHOLE OVER THE OUTLET ORIFICE. IF MAINTENANCE IS NOT PERFORMED AS RECOMMENDED, SEDIMENT AND TRASH MAY ACCUMULATE IN FRONT OF THE OUTLET ORIFICE. MANHOLE COVERS SHOULD BE SECURELY SEATED FOLLOWING CLEANING ACTIVITIES. CONTECH SUGGESTS THAT ALL SYSTEMS BE DESIGNED WITH AN ACCESS/INSPECTION MANHOLE SITUATED AT OR NEAR THE INLET AND THE OUTLET ORIFICE. SHOULD IT BE NECESSARY TO GET INSIDE THE SYSTEM TO PERFORM MAINTENANCE ACTIVITIES, ALL APPROPRIATE PRECAUTIONS REGARDING CONFINED SPACE ENTRY AND OSHA REGULATIONS SHOULD BE FOLLOWED.

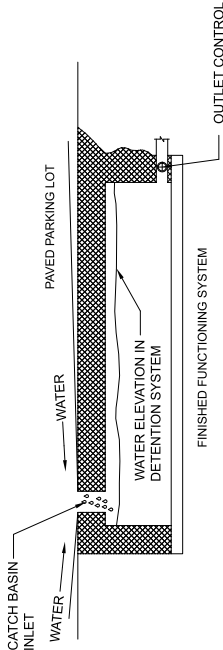
ANNUAL INSPECTIONS ARE BEST PRACTICE FOR ALL UNDERGROUND SYSTEMS. DURING THIS INSPECTION, IF EVIDENCE OF SALTING/DE-ICING AGENTS IS OBSERVED WITHIN THE SYSTEM, IT IS BEST PRACTICE FOR THE SYSTEM TO BE RINSED, INCLUDING ABOVE THE SPRING LINE SOON AFTER THE SPRING THAW AS PART OF THE MAINTENANCE PROGRAM FOR THE SYSTEM.

MAINTAINING AN UNDERGROUND DETENTION OR INFILTRATION SYSTEM IS EASIEST WHEN THERE IS NO FLOW ENTERING THE SYSTEM. FOR THIS REASON, IT IS A GOOD IDEA TO SCHEDULE THE CLEANOUT DURING DRY WEATHER.

THE FOREGOING INSPECTION AND MAINTENANCE EFFORTS HELP ENSURE UNDERGROUND PIPE SYSTEMS USED FOR STORMWATER STORAGE CONTINUE TO FUNCTION AS INTENDED BY IDENTIFYING RECOMMENDED REGULAR INSPECTION AND MAINTENANCE PRACTICES. INSPECTION AND MAINTENANCE RELATED TO THE STRUCTURAL INTEGRITY OF THE PIPE OR THE SOUNDNESS OF PIPE JOINT CONNECTIONS IS BEYOND THE SCOPE OF THIS GUIDE.

ADDITIONAL CONSIDERATIONS

BECAUSE MOST SYSTEMS ARE CONSTRUCTED BELOW-GRADE, RAINFALL CAN RAPIDLY FILL THE EXCAVATION; POTENTIALLY CAUSING FLOATATION AND MOVEMENT OF THE PREVIOUSLY PLACED PIPES. TO HELP MITIGATE POTENTIAL PROBLEMS, IT IS BEST TO START THE INSTALLATION AT THE DOWNSTREAM END WITH THE OUTLET ALREADY CONSTRUCTED TO ALLOW A ROUTE FOR THE WATER TO ESCAPE. TEMPORARY DIVERSION MEASURES MAY BE REQUIRED FOR HIGH FLOWS DUE TO THE RESTRICTED NATURE OF THE OUTLET PIPE.



The design and information shown on this drawing is provided by Contech Engineered Solutions LLC ("Contech"). Neither this drawing, nor any part thereof, may be used, reproduced or modified in any manner without the prior written consent of Contech. Failure to comply is done at the user's own risk and Contech expressly disclaims any liability or responsibility for such use.

If discrepancies between the supplied information upon which this drawing is based and the actual conditions are discovered as site work progresses, these discrepancies must be reported to Contech immediately for re-evaluation of the design. Contech accepts no liability for designs based on missing, incomplete or inaccurate information supplied by others.

CONTECH®

ENGINEERED SOLUTIONS LLC

www.ContechES.com

9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069

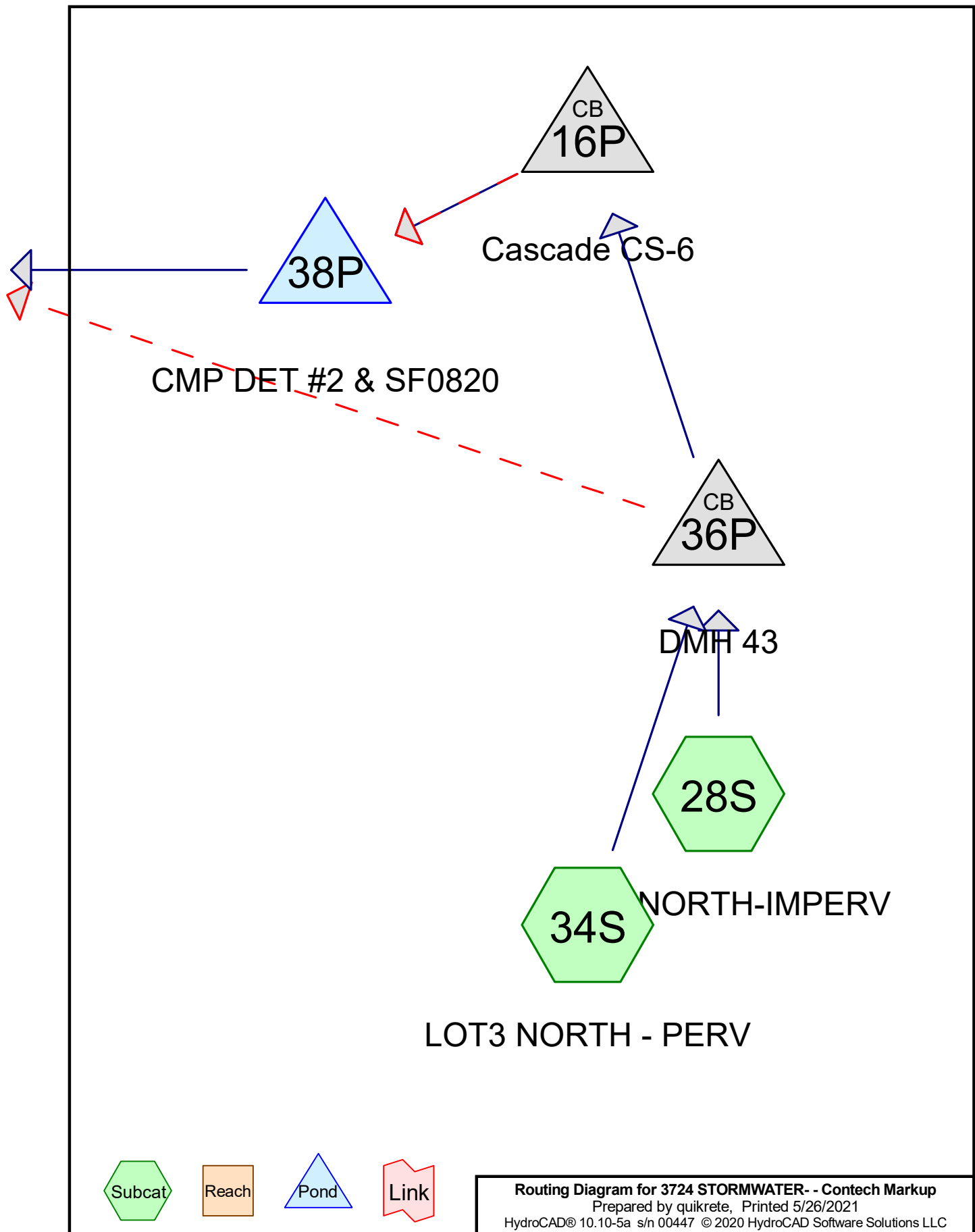
800-338-1122 513-645-7000 513-645-7993 FAX

CONTECH
dYODS
DRAWING

72"Ø UNDERGROUND DETENTION SYSTEM - -
555 HOPPING BROOK ROAD
HOLLISTON, MA
SITE DESIGNATION:

PROJECT No.:	SEQ. No.:	DATE:
4952	8023	5/25/2021
DESIGNED:	DRAWN:	
DYO	DYO	DYO
CHECKED:	APPROVED:	
DYO	DYO	DYO
SHEET NO.:	D4	

Engineering Design Consultants, Inc. • 32 Turnpike Road • Southborough, MA 01772 • (508)480-0225



3724 STORMWATER- - Contech Markup

Prepared by quikrete

Printed 5/26/2021

HydroCAD® 10.10-5a s/n 00447 © 2020 HydroCAD Software Solutions LLC

Page 2

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	WQ	Type III 24-hr		Default	24.00	1	1.21	2

3724 STORMWATER- - Contech Markup

Prepared by quikrete

Printed 5/26/2021

HydroCAD® 10.10-5a s/n 00447 © 2020 HydroCAD Software Solutions LLC

Page 3

Area Listing (selected nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
68,977	74	>75% Grass cover, Good, HSG C (34S)
181,690	98	Paved parking, HSG C (28S)
250,667	91	TOTAL AREA

3724 STORMWATER- - Contech Markup*Type III 24-hr WQ Rainfall=1.21"*

Prepared by quikrete

Printed 5/26/2021

HydroCAD® 10.10-5a s/n 00447 © 2020 HydroCAD Software Solutions LLC

Page 4

Time span=0.00-24.00 hrs, dt=0.03 hrs, 801 points

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q

Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 28S: LOT3 NORTH-IMPERV Runoff Area=181,690 sf 100.00% Impervious Runoff Depth>0.99"
Flow Length=632' Tc=8.6 min CN=98 Runoff=4.209 cfs 15,054 cf

Subcatchment 34S: LOT3 NORTH - PERV Runoff Area=68,977 sf 0.00% Impervious Runoff Depth>0.06"
Flow Length=632' Tc=8.6 min CN=74 Runoff=0.028 cfs 366 cf

Pond 16P: Cascade CS-6 Peak Elev=336.42' Inflow=4.209 cfs 15,420 cf
Primary=4.209 cfs 15,420 cf Secondary=0.000 cfs 0 cf Outflow=4.209 cfs 15,420 cf

Pond 36P: DMH 43 Peak Elev=336.45' Inflow=4.209 cfs 15,420 cf
Primary=4.209 cfs 15,420 cf Secondary=0.000 cfs 0 cf Outflow=4.209 cfs 15,420 cf

Pond 38P: CMP DET #2 & SF0820 Peak Elev=336.42' Storage=5,684 cf Inflow=4.209 cfs 15,420 cf
Outflow=0.532 cfs 15,349 cf

Total Runoff Area = 250,667 sf Runoff Volume = 15,420 cf Average Runoff Depth = 0.74"
27.52% Pervious = 68,977 sf 72.48% Impervious = 181,690 sf

3724 STORMWATER- - Contech Markup

Type III 24-hr WQ Rainfall=1.21"

Prepared by quikrete

Printed 5/26/2021

HydroCAD® 10.10-5a s/n 00447 © 2020 HydroCAD Software Solutions LLC

Page 5

Summary for Subcatchment 28S: LOT3 NORTH-IMPERV

Runoff = 4.209 cfs @ 12.12 hrs, Volume= 15,054 cf, Depth> 0.99"

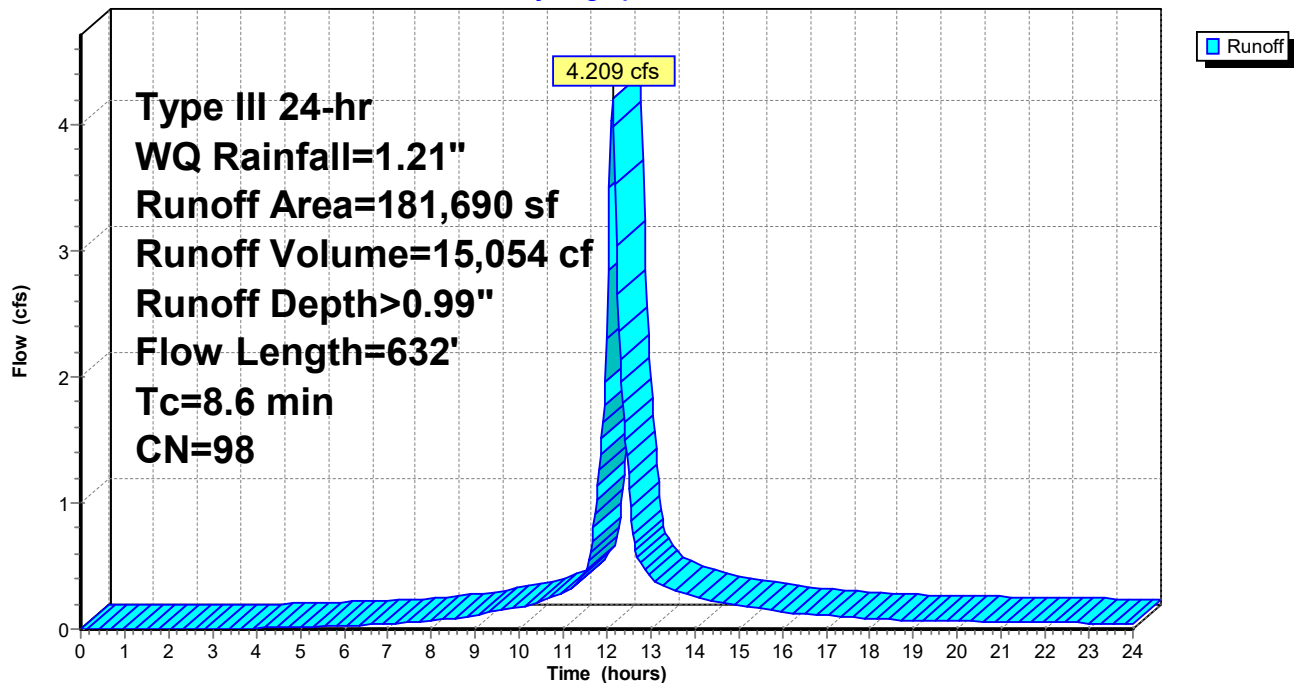
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs
Type III 24-hr WQ Rainfall=1.21"

Area (sf)	CN	Description
181,690	98	Paved parking, HSG C
181,690		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	50	0.0400	0.13		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"
0.1	32	0.3500	4.14		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
1.8	310	0.0200	2.87		Shallow Concentrated Flow, Paved Kv= 20.3 fps
0.5	240	0.0110	7.55	23.73	Pipe Channel, 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013
8.6	632	Total			

Subcatchment 28S: LOT3 NORTH-IMPERV

Hydrograph



3724 STORMWATER- - Contech Markup

Type III 24-hr WQ Rainfall=1.21"

Prepared by quikrete

Printed 5/26/2021

HydroCAD® 10.10-5a s/n 00447 © 2020 HydroCAD Software Solutions LLC

Page 6

Summary for Subcatchment 34S: LOT3 NORTH - PERV

Runoff = 0.028 cfs @ 12.46 hrs, Volume= 366 cf, Depth> 0.06"

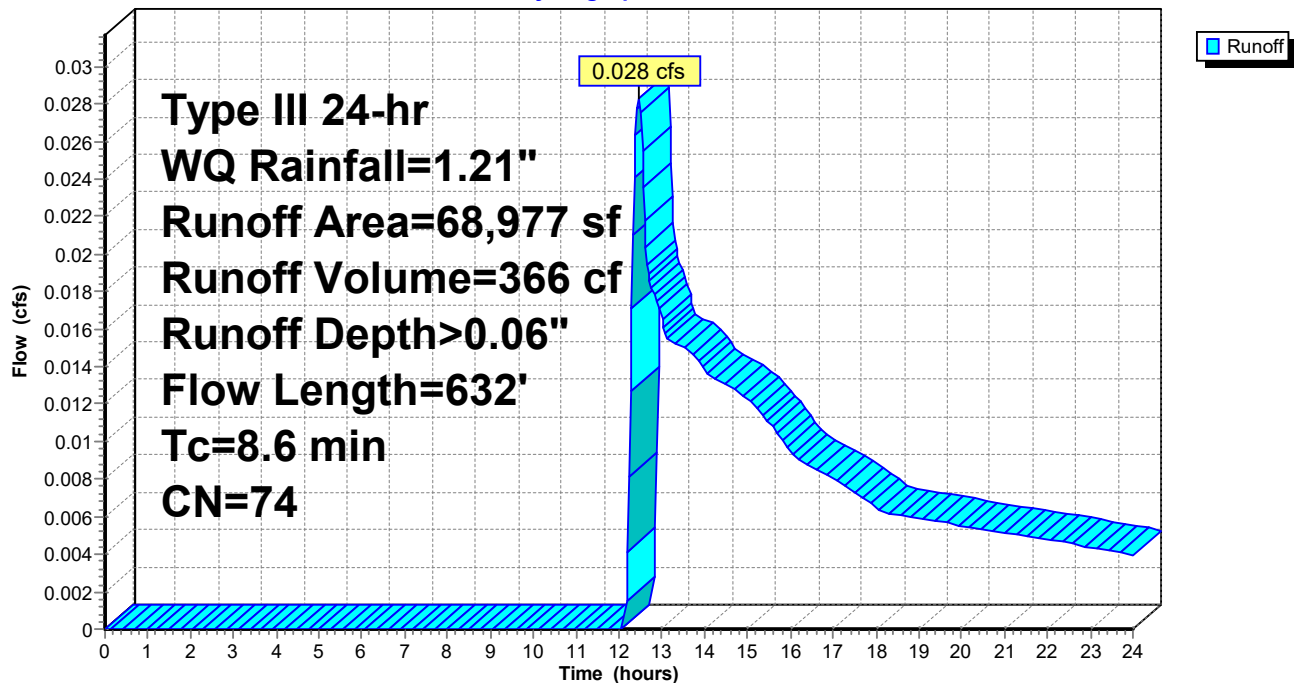
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs
Type III 24-hr WQ Rainfall=1.21"

Area (sf)	CN	Description
68,977	74	>75% Grass cover, Good, HSG C
68,977		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	50	0.0400	0.13		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"
0.1	32	0.3500	4.14		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
1.8	310	0.0200	2.87		Shallow Concentrated Flow, Paved Kv= 20.3 fps
0.5	240	0.0110	7.55	23.73	Pipe Channel, 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013
8.6	632	Total			

Subcatchment 34S: LOT3 NORTH - PERV

Hydrograph



3724 STORMWATER- - Contech Markup

Type III 24-hr WQ Rainfall=1.21"

Prepared by quikrete

Printed 5/26/2021

HydroCAD® 10.10-5a s/n 00447 © 2020 HydroCAD Software Solutions LLC

Page 7

Summary for Pond 16P: Cascade CS-6

Inflow Area = 250,667 sf, 72.48% Impervious, Inflow Depth > 0.74" for WQ event
 Inflow = 4.209 cfs @ 12.12 hrs, Volume= 15,420 cf
 Outflow = 4.209 cfs @ 12.12 hrs, Volume= 15,420 cf, Atten= 0%, Lag= 0.0 min
 Primary = 4.209 cfs @ 12.12 hrs, Volume= 15,420 cf
 Secondary = 0.000 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs

Peak Elev= 336.42' @ 12.82 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	334.29'	Tube/Siphon/Float Valve X 2.00 1.610" Diameter, C= 0.600 1.9' Long Tube, Hazen-Williams C= 130 Inlet / Outlet Elev. = 332.09' / 334.29'
#2	Primary	335.60'	Tube/Siphon/Float Valve 15.000" Diameter, C= 0.600 1.1' Long Tube, Hazen-Williams C= 130 Inlet / Outlet Elev. = 334.62' / 335.60'
#3	Secondary	336.45'	1.5' long Sharp-Crested Rectangular Weir X 2.00 2 End Contraction(s)

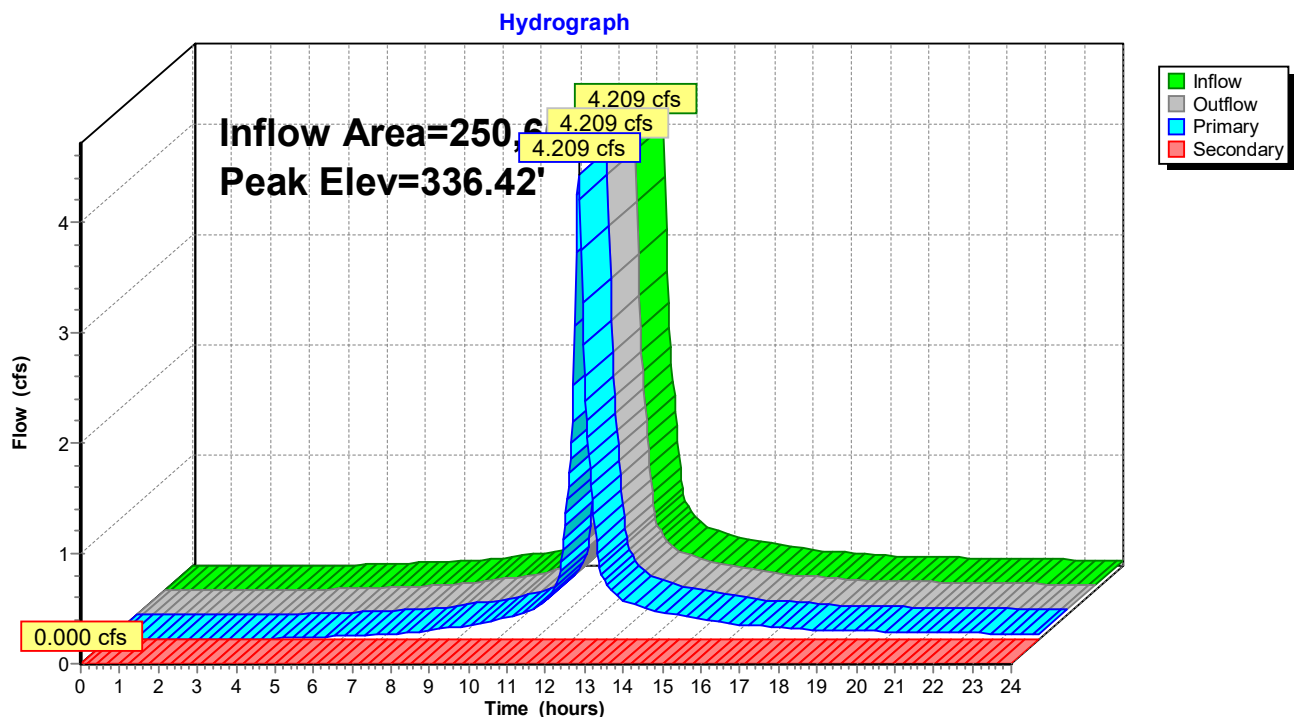
Primary OutFlow Max=4.188 cfs @ 12.12 hrs HW=336.07' TW=334.77' (Dynamic Tailwater)

1=Tube/Siphon/Float Valve (Tube Controls 0.146 cfs @ 5.16 fps)

2=Tube/Siphon/Float Valve (Tube Controls 4.042 cfs @ 3.29 fps)

Secondary OutFlow Max=0.000 cfs @ 0.00 hrs HW=332.09' TW=331.87' (Dynamic Tailwater)

3=Sharp-Crested Rectangular Weir (Controls 0.000 cfs)

Pond 16P: Cascade CS-6

3724 STORMWATER- - Contech Markup*Type III 24-hr WQ Rainfall=1.21"*

Prepared by quikrete

Printed 5/26/2021

HydroCAD® 10.10-5a s/n 00447 © 2020 HydroCAD Software Solutions LLC

Page 8

Stage-Discharge for Pond 16P: Cascade CS-6

Elevation (feet)	Discharge (cfs)	Primary (cfs)	Secondary (cfs)
332.09	0.000	0.000	0.000
332.19	0.000	0.000	0.000
332.29	0.000	0.000	0.000
332.39	0.000	0.000	0.000
332.49	0.000	0.000	0.000
332.59	0.000	0.000	0.000
332.69	0.000	0.000	0.000
332.79	0.000	0.000	0.000
332.89	0.000	0.000	0.000
332.99	0.000	0.000	0.000
333.09	0.000	0.000	0.000
333.19	0.000	0.000	0.000
333.29	0.000	0.000	0.000
333.39	0.000	0.000	0.000
333.49	0.000	0.000	0.000
333.59	0.000	0.000	0.000
333.69	0.000	0.000	0.000
333.79	0.000	0.000	0.000
333.89	0.000	0.000	0.000
333.99	0.000	0.000	0.000
334.09	0.000	0.000	0.000
334.19	0.000	0.000	0.000
334.29	0.000	0.000	0.000
334.39	0.040	0.040	0.000
334.49	0.057	0.057	0.000
334.59	0.070	0.070	0.000
334.69	0.080	0.080	0.000
334.79	0.090	0.090	0.000
334.89	0.099	0.099	0.000
334.99	0.107	0.107	0.000
335.09	0.114	0.114	0.000
335.19	0.121	0.121	0.000
335.29	0.128	0.128	0.000
335.39	0.134	0.134	0.000
335.49	0.140	0.140	0.000
335.59	0.146	0.146	0.000
335.69	1.664	1.664	0.000
335.79	2.560	2.560	0.000
335.89	3.334	3.334	0.000
335.99	3.846	3.846	0.000
336.09	4.296	4.296	0.000
336.19	4.702	4.702	0.000
336.29	5.075	5.075	0.000
336.39	5.422	5.422	0.000

3724 STORMWATER- - Contech Markup

Type III 24-hr WQ Rainfall=1.21"

Prepared by quikrete

Printed 5/26/2021

HydroCAD® 10.10-5a s/n 00447 © 2020 HydroCAD Software Solutions LLC

Page 9

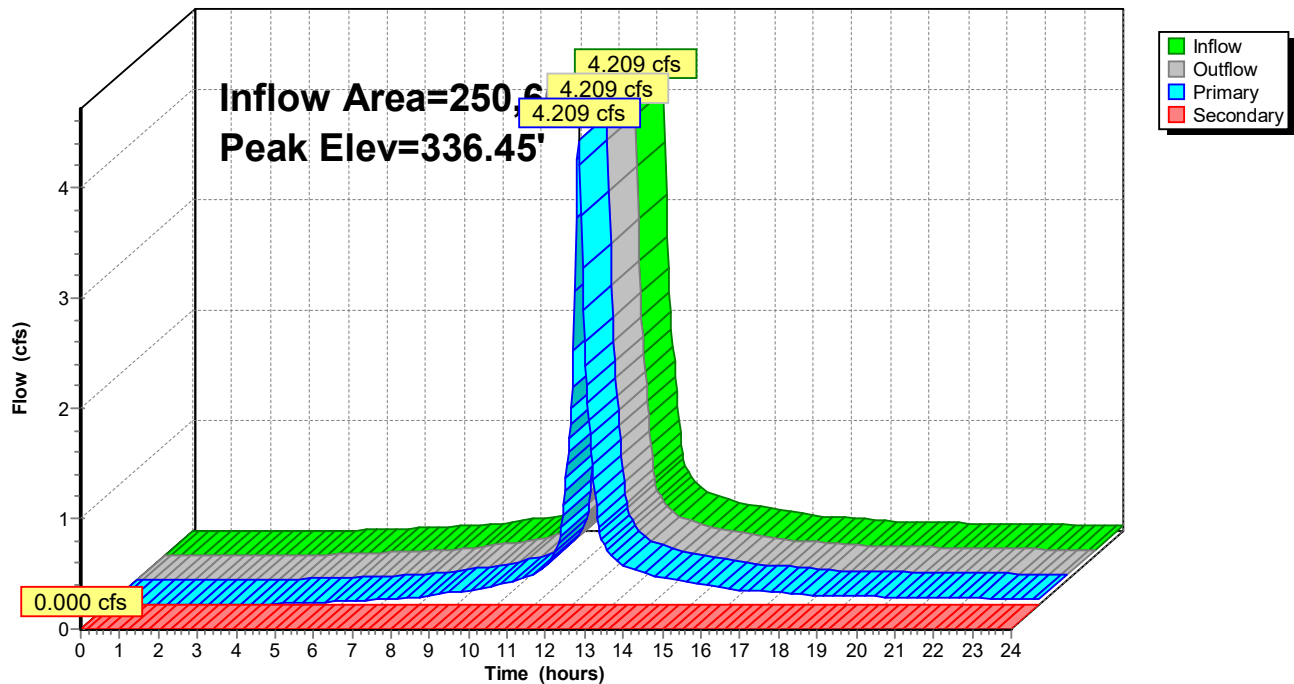
Summary for Pond 36P: DMH 43

Inflow Area = 250,667 sf, 72.48% Impervious, Inflow Depth > 0.74" for WQ event
 Inflow = 4.209 cfs @ 12.12 hrs, Volume= 15,420 cf
 Outflow = 4.209 cfs @ 12.12 hrs, Volume= 15,420 cf, Atten= 0%, Lag= 0.0 min
 Primary = 4.209 cfs @ 12.12 hrs, Volume= 15,420 cf
 Secondary = 0.000 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs

Peak Elev= 336.45' @ 12.13 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	334.82'	24.0" Round Culvert L= 5.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 334.82' / 334.79' S= 0.0060 '/' Cc= 0.900 n= 0.120, Flow Area= 3.14 sf
#2	Secondary	336.46'	8.0' long x 0.5' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=3.977 cfs @ 12.12 hrs HW=336.44' TW=336.07' (Dynamic Tailwater)↑**1=Culvert** (Outlet Controls 3.977 cfs @ 1.99 fps)**Secondary OutFlow** Max=0.000 cfs @ 0.00 hrs HW=334.82' TW=300.50' (Dynamic Tailwater)↑**2=Broad-Crested Rectangular Weir** (Controls 0.000 cfs)**Pond 36P: DMH 43****Hydrograph**

3724 STORMWATER- - Contech Markup*Type III 24-hr WQ Rainfall=1.21"*

Prepared by quikrete

Printed 5/26/2021

HydroCAD® 10.10-5a s/n 00447 © 2020 HydroCAD Software Solutions LLC

Page 10

Stage-Discharge for Pond 36P: DMH 43

Elevation (feet)	Discharge (cfs)	Primary (cfs)	Secondary (cfs)
334.82	0.000	0.000	0.000
334.87	0.001	0.001	0.000
334.92	0.007	0.007	0.000
334.97	0.017	0.017	0.000
335.02	0.035	0.035	0.000
335.07	0.059	0.059	0.000
335.12	0.092	0.092	0.000
335.17	0.134	0.134	0.000
335.22	0.185	0.185	0.000
335.27	0.245	0.245	0.000
335.32	0.316	0.316	0.000
335.37	0.396	0.396	0.000
335.42	0.486	0.486	0.000
335.47	0.587	0.587	0.000
335.52	0.698	0.698	0.000
335.57	0.819	0.819	0.000
335.62	0.950	0.950	0.000
335.67	1.091	1.091	0.000
335.72	1.242	1.242	0.000
335.77	1.402	1.402	0.000
335.82	1.571	1.571	0.000
335.87	1.749	1.749	0.000
335.92	1.936	1.936	0.000
335.97	2.132	2.132	0.000
336.02	2.335	2.335	0.000
336.07	2.545	2.545	0.000
336.12	2.763	2.763	0.000
336.17	2.987	2.987	0.000
336.22	3.217	3.217	0.000
336.27	3.453	3.453	0.000
336.32	3.694	3.694	0.000
336.37	3.939	3.939	0.000
336.42	4.188	4.188	0.000
336.47	4.462	4.439	0.022
336.52	5.023	4.693	0.329
336.57	5.766	4.949	0.817
336.62	6.639	5.206	1.434
336.67	7.622	5.462	2.160
336.72	8.725	5.717	3.008
336.77	9.928	5.971	3.957
336.82	11.226	6.221	5.004

3724 STORMWATER- - Contech Markup

Type III 24-hr WQ Rainfall=1.21"

Prepared by quikrete

Printed 5/26/2021

HydroCAD® 10.10-5a s/n 00447 © 2020 HydroCAD Software Solutions LLC

Page 11

Summary for Pond 38P: CMP DET #2 & SF0820

Inflow Area = 250,667 sf, 72.48% Impervious, Inflow Depth > 0.74" for WQ event
 Inflow = 4.209 cfs @ 12.12 hrs, Volume= 15,420 cf
 Outflow = 0.532 cfs @ 12.79 hrs, Volume= 15,349 cf, Atten= 87%, Lag= 40.6 min
 Primary = 0.532 cfs @ 12.79 hrs, Volume= 15,349 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs
 Peak Elev= 336.42' @ 12.79 hrs Surf.Area= 3,167 sf Storage= 5,684 cf

Plug-Flow detention time= 94.8 min calculated for 15,349 cf (100% of inflow)
 Center-of-Mass det. time= 91.9 min (880.1 - 788.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	333.00'	0 cf	26.50'W x 119.50'L x 3.50'H Field A 11,084 cf Overall - 5,720 cf Embedded = 5,364 cf x 0.0% Voids
#2A	333.00'	5,720 cf	CMP Round 42 x 25 Inside #1 Effective Size= 42.0"W x 42.0"H => 9.62 sf x 20.00'L = 192.4 cf Overall Size= 42.0"W x 42.0"H x 20.00'L Row Length Adjustment= +14.00' x 9.62 sf x 5 rows 24.50' Header x 9.62 sf x 1 = 235.7 cf Inside
		5,720 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices (Turned on 1 times)
#1	Device 2	333.00'	12.0" Round Culvert L= 5.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 333.00' / 332.98' S= 0.0040 ' / ' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf
#2	Primary	331.20'	Tube/Siphon/Float Valve X 48.00 0.430" Diameter, C= 0.600, 0.263" Trickle Diameter Starts@333.00' Breaks@331.87'

Primary OutFlow Max=0.532 cfs @ 12.79 hrs HW=336.42' TW=303.26' (Dynamic Tailwater)

↑ **2=Tube/Siphon/Float Valve** (Orifice Controls 0.532 cfs @ 11.00 fps)

↑ **1=Culvert** (Passes 0.532 cfs of 6.457 cfs potential flow)

3724 STORMWATER- - Contech Markup

Type III 24-hr WQ Rainfall=1.21"

Prepared by quikrete

Printed 5/26/2021

HydroCAD® 10.10-5a s/n 00447 © 2020 HydroCAD Software Solutions LLC

Page 12

Pond 38P: CMP DET #2 & SF0820 - Chamber Wizard Field A**Chamber Model = CMP Round 42 (Round Corrugated Metal Pipe)**

Effective Size= 42.0"W x 42.0"H => 9.62 sf x 20.00'L = 192.4 cf

Overall Size= 42.0"W x 42.0"H x 20.00'L

Row Length Adjustment= +14.00' x 9.62 sf x 5 rows

42.0" Wide + 21.0" Spacing = 63.0" C-C Row Spacing

5 Chambers/Row x 20.00' Long +14.00' Row Adjustment +3.50' Header x 1 = 117.50' Row Length +12.0"

End Stone x 2 = 119.50' Base Length

5 Rows x 42.0" Wide + 21.0" Spacing x 4 + 12.0" Side Stone x 2 = 26.50' Base Width

42.0" Chamber Height = 3.50' Field Height

25 Chambers x 192.4 cf +14.00' Row Adjustment x 9.62 sf x 5 Rows + 24.50' Header x 9.62 sf = 5,719.8 cf
Chamber Storage

11,083.6 cf Field - 5,719.8 cf Chambers = 5,363.9 cf Stone x 0.0% Voids = 0.0 cf Stone Storage

Chamber Storage = 5,719.8 cf = 0.131 af

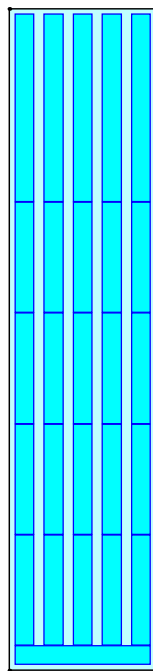
Overall Storage Efficiency = 51.6%

Overall System Size = 119.50' x 26.50' x 3.50'

25 Chambers

410.5 cy Field

198.7 cy Stone



3724 STORMWATER- - Contech Markup

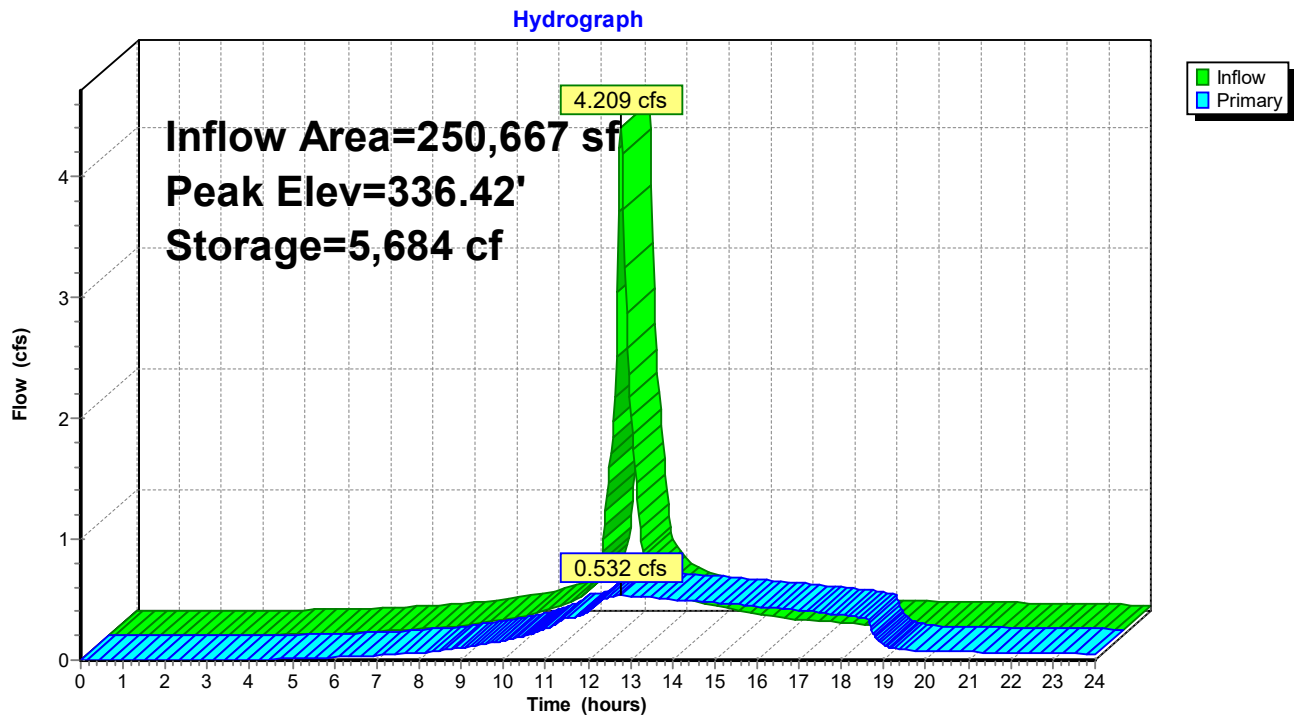
Prepared by quikrete

HydroCAD® 10.10-5a s/n 00447 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr WQ Rainfall=1.21"

Printed 5/26/2021

Page 13

Pond 38P: CMP DET #2 & SF0820

3724 STORMWATER- - Contech Markup

Type III 24-hr WQ Rainfall=1.21"

Prepared by quikrete

Printed 5/26/2021

HydroCAD® 10.10-5a s/n 00447 © 2020 HydroCAD Software Solutions LLC

Page 14

Stage-Discharge for Pond 38P: CMP DET #2 & SF0820

Elevation (feet)	Primary (cfs)	Primary+ (cfs)	Elevation (feet)	Primary (cfs)	Primary+ (cfs)
331.87	0.000	0.000	334.57	0.428	0.428
331.92	0.000	0.000	334.62	0.431	0.431
331.97	0.000	0.000	334.67	0.434	0.434
332.02	0.000	0.000	334.72	0.437	0.437
332.07	0.000	0.000	334.77	0.440	0.440
332.12	0.000	0.000	334.82	0.443	0.443
332.17	0.000	0.000	334.87	0.447	0.447
332.22	0.000	0.000	334.92	0.450	0.450
332.27	0.000	0.000	334.97	0.453	0.453
332.32	0.000	0.000	335.02	0.456	0.456
332.37	0.000	0.000	335.07	0.459	0.459
332.42	0.000	0.000	335.12	0.461	0.461
332.47	0.000	0.000	335.17	0.464	0.464
332.52	0.000	0.000	335.22	0.467	0.467
332.57	0.000	0.000	335.27	0.470	0.470
332.62	0.000	0.000	335.32	0.473	0.473
332.67	0.000	0.000	335.37	0.476	0.476
332.72	0.000	0.000	335.42	0.479	0.479
332.77	0.000	0.000	335.47	0.482	0.482
332.82	0.000	0.000	335.52	0.484	0.484
332.87	0.000	0.000	335.57	0.487	0.487
332.92	0.000	0.000	335.62	0.490	0.490
332.97	0.000	0.000	335.67	0.493	0.493
333.02	0.001	0.001	335.72	0.496	0.496
333.07	0.013	0.013	335.77	0.498	0.498
333.12	0.040	0.040	335.82	0.501	0.501
333.17	0.081	0.081	335.87	0.504	0.504
333.22	0.134	0.134	335.92	0.506	0.506
333.27	0.199	0.199	335.97	0.509	0.509
333.32	0.275	0.275	336.02	0.512	0.512
333.37	0.343	0.343	336.07	0.514	0.514
333.42	0.347	0.347	336.12	0.517	0.517
333.47	0.351	0.351	336.17	0.520	0.520
333.52	0.355	0.355	336.22	0.522	0.522
333.57	0.359	0.359	336.27	0.525	0.525
333.62	0.363	0.363	336.32	0.527	0.527
333.67	0.366	0.366	336.37	0.530	0.530
333.72	0.370	0.370	336.42	0.533	0.533
333.77	0.374	0.374	336.47	0.535	0.535
333.82	0.377	0.377			
333.87	0.381	0.381			
333.92	0.384	0.384			
333.97	0.388	0.388			
334.02	0.391	0.391			
334.07	0.395	0.395			
334.12	0.398	0.398			
334.17	0.402	0.402			
334.22	0.405	0.405			
334.27	0.408	0.408			
334.32	0.412	0.412			
334.37	0.415	0.415			
334.42	0.418	0.418			
334.47	0.421	0.421			
334.52	0.425	0.425			



Determining Number of Cartridges for Systems Downstream of Detention

CONTECH Stormwater Solutions Inc. Engineer:
Date

DRA
5/26/2021

Site Information

Project Name
Project State
Project Location
Drainage Area, Ad
Impervious Area, Ai
Pervious Area, Ap
% Impervious
Runoff Coefficient, Rc

555 Hopping Brook Road - DMH 43
MA
Holliston

5.75 ac
4.17 ac
1.58
72 %
0.70

Upstream Detention System

Detention pretreatment credit
(from removal efficiency calcs)

50%

Mass loading calculations

Mean Annual Rainfall, P
Agency required % removal
Percent Runoff Capture
Mean Annual Runoff, V_t
Event Mean Concentration of Pollutant, EMC
Annual Mass Load, M_{total}

49.8 in
80%
90%
657,563 ft³
70 mg/l
2,872 lbs

Water Quality Volume

90% Rainfall Depth
WQ Volume to be treated
WQ Volume to be treated by filters

1.00 in
0.337 ac-ft
14,671 ft³

Filter System

Filtration brand
Cartridge height
Specific Flow Rate

StormFilter
12 in
1.00 gpm/ft²

Number of cartridges - mass loading

Mass removed by pretreatment system, M_{pre}
Mass load to filters after pretreatment, M_{pass1}
Mass to be captured by filters, M_{filter}
Allowable Cartridge Flow rate, Q_{cart}
Mass load per cartridge, M_{cart} (lbs)
Number of Cartridges required, N_{mass}
Treatment Capacity

1,436 lbs
1,436 lbs
1,149 lbs
5.00 gpm
24 lbs
48
0.53 cfs

Determine Critical Sizing Value

Method to Use:

MASS-LOADING

SUMMARY

Treatment Flow Rate, cfs	0.53
Cartridge Flow Rate, gpm	5.00
Number of Cartridges	48

STORMFILTER DESIGN NOTES

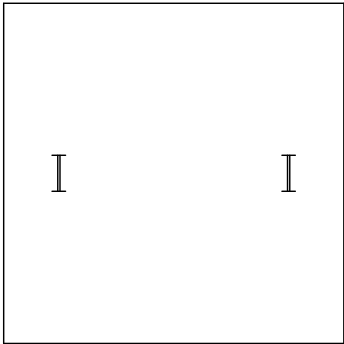
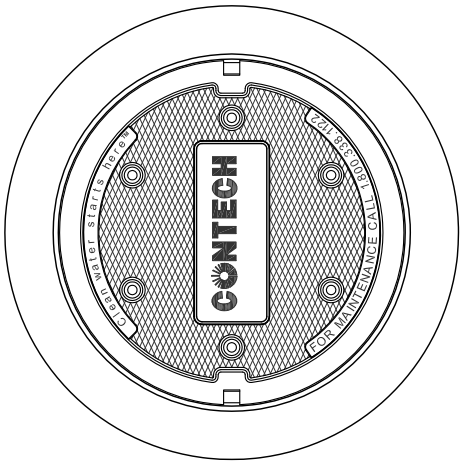
STORMFILTER TREATMENT CAPACITY IS A FUNCTION OF THE CARTRIDGE SELECTION AND THE NUMBER OF CARTRIDGES. THE STANDARD VAULT STYLE IS SHOWN WITH THE MAXIMUM NUMBER OF CARTRIDGES (51). VAULT STYLE OPTIONS INCLUDE INLET BAY (39), INLET BAY/OUTLET BAY (39), OUTLET BAY (46), INLET BAY/FULL HEIGHT BAFFLE WALL (35),FULL HEIGHT BAFFLE WALL (42). STORMFILTER 8X20 PEAK HYDRAULIC CAPACITY IS 1.8 CFS. IF THE SITE CONDITIONS EXCEED 1.8 CFS AN UPSTREAM BYPASS STRUCTURE IS REQUIRED.

CARTRIDGE SELECTION

CARTRIDGE HEIGHT	27"		18"		LOW DROP	
RECOMMENDED HYDRAULIC DROP (H)	3.05'		2.3'		1.8'	
SPECIFIC FLOW RATE (gpm/sf)	2 gpm/sf	1.67* gpm/sf	1 gpm/sf	2 gpm/sf	1 gpm/sf	1 gpm/sf
CARTRIDGE FLOW RATE (gpm)	22.5	18.79	11.25	15	10	5

* 1.67 gpm/sf SPECIFIC FLOW RATE IS APPROVED WITH PHOSPHOSORB ® (PSORB) MEDIA ONLY

SITE SPECIFIC DATA REQUIREMENTS	
STRUCTURE ID	*
WATER QUALITY FLOW RATE (cfs)	*
PEAK FLOW RATE (cfs)	*
RETURN PERIOD OF PEAK FLOW (yrs)	*
CARTRIDGE HEIGHT (27", 18", LOW DROP(LD))	*
NUMBER OF CARTRIDGES REQUIRED	*
CARTRIDGE FLOW RATE	*
MEDIA TYPE (PERLITE, ZPG, PSORB)	*
PIPE DATA:	I.E. MATERIAL DIAMETER
INLET PIPE #1	* *
INLET PIPE #2	* *
OUTLET PIPE	* *
UPSTREAM RIM ELEVATION	*
DOWNSTREAM RIM ELEVATION	*
ANTI-FLOTATION BALLAST	WIDTH HEIGHT
NOTES/SPECIAL REQUIREMENTS:	
* PER ENGINEER OF RECORD	



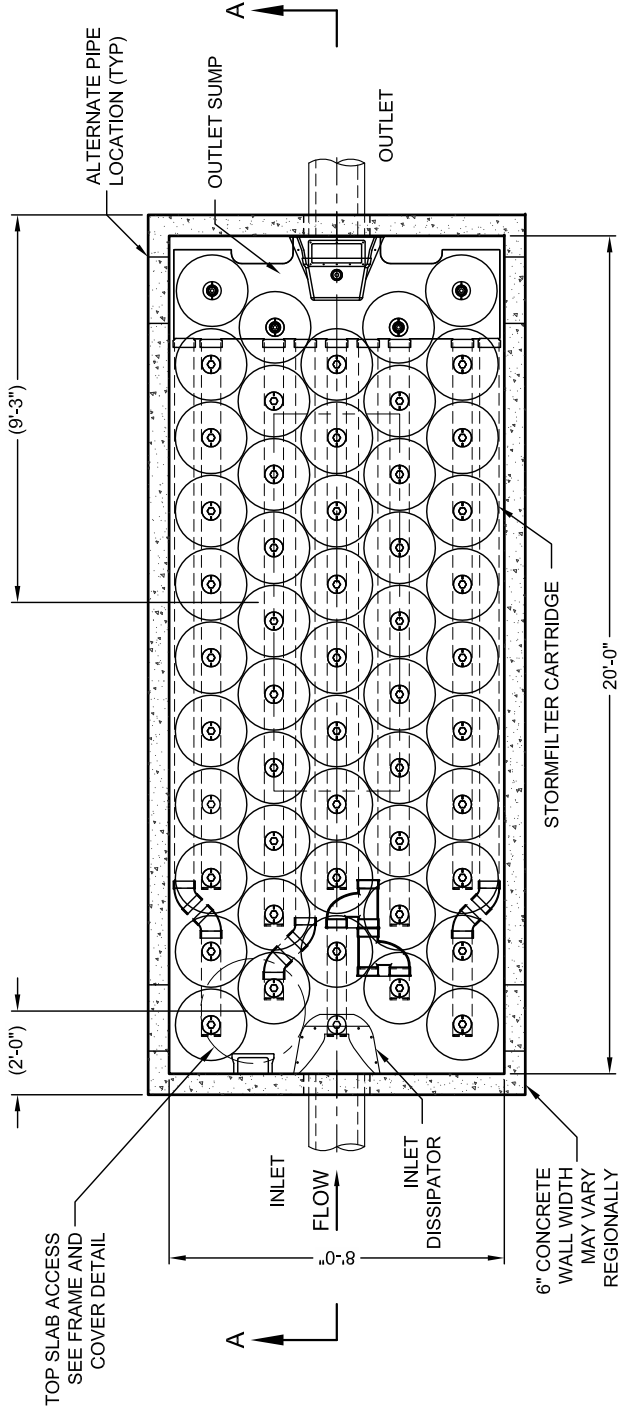
FRAME, COVER, AND HATCH
(SIZE AND CONFIGURATION VARY)

GENERAL NOTES

- CONTECH TO PROVIDE ALL MATERIALS UNLESS NOTED OTHERWISE.
- DIMENSIONS MARKED WITH () ARE REFERENCE DIMENSIONS. ACTUAL DIMENSIONS MAY VARY.
- FOR SITE SPECIFIC DRAWINGS WITH DETAILED VAULT DIMENSIONS AND WEIGHTS, PLEASE CONTACT YOUR CONTECH ENGINEERED SOLUTIONS LLC REPRESENTATIVE. www.ContechES.com
- STORMFILTER WATER QUALITY STRUCTURE SHALL BE IN ACCORDANCE WITH ALL DESIGN DATA AND INFORMATION CONTAINED IN THIS DRAWING.
- STRUCTURE SHALL MEET AASHTO HS20 LOAD RATING, ASSUMING EARTH COVER OF 0' - 5' AND GROUNDWATER ELEVATION AT, OR BELOW, THE OUTLET PIPE INVERT ELEVATION. ENGINEER OF RECORD TO CONFIRM ACTUAL GROUNDWATER ELEVATION. CASTINGS SHALL MEET AASHTO M306 AND BE CAST WITH THE CONTECH LOGO.
- FILTER CARTRIDGES SHALL BE MEDIA-FILLED, PASSIVE, SIPHON ACTUATED, RADIAL FLOW, AND SELF CLEANING. RADIAL MEDIA DEPTH SHALL BE 7-INCHES. FILTER MEDIA CONTACT TIME SHALL BE AT LEAST 38 SECONDS.
- SPECIFIC FLOW RATE IS EQUAL TO THE FILTER TREATMENT CAPACITY (gpm) DIVIDED BY THE FILTER CONTACT SURFACE AREA (sq ft).
- STORMFILTER STRUCTURE SHALL BE PRECAST CONFORMING TO ASTM C-857 AND AASHTO LOAD FACTOR DESIGN METHOD.

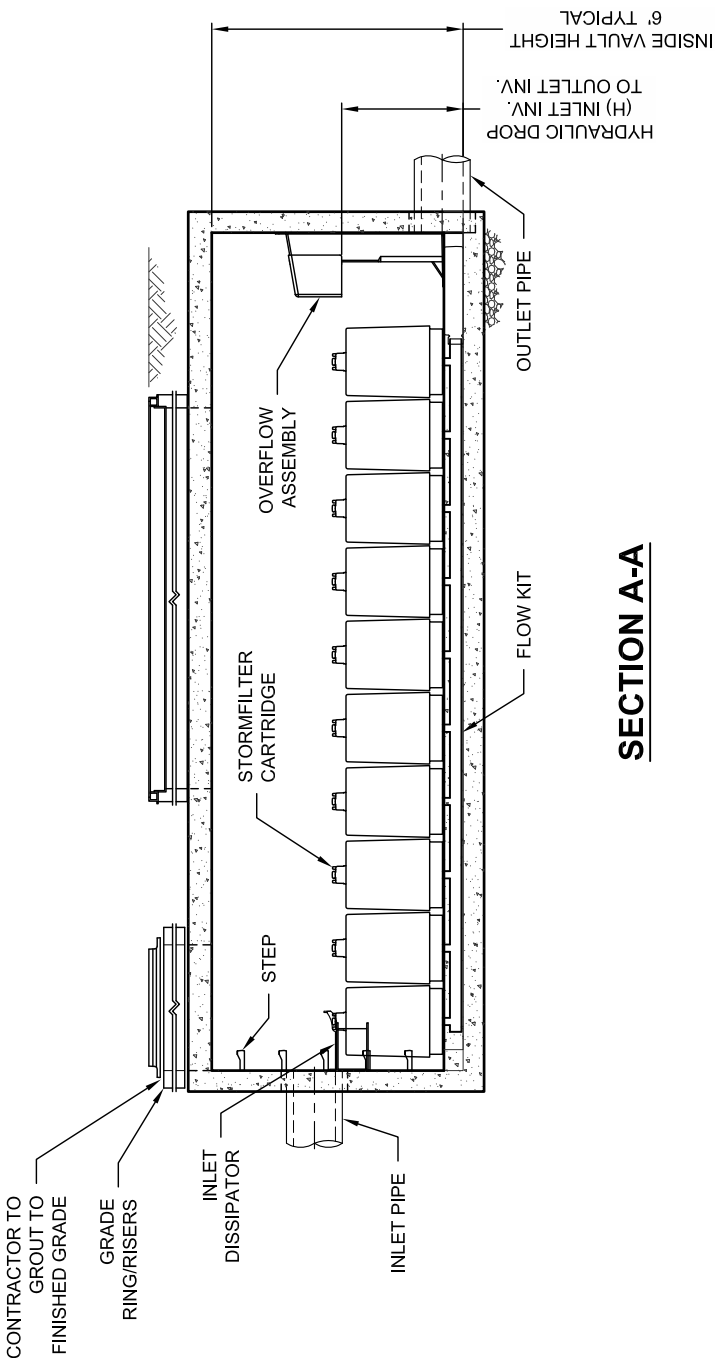
INSTALLATION NOTES

- ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
- CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE STORMFILTER VAULT (LIFTING CLUTCHES PROVIDED).
- CONTRACTOR TO INSTALL JOINT SEALANT BETWEEN ALL VAULT SECTIONS AND ASSEMBLE VAULT.
- CONTRACTOR TO PROVIDE, INSTALL, AND GROUT PIPES. MATCH OUTLET PIPE INVERT WITH OUTLET BAY FLOOR.
- CONTRACTOR TO TAKE APPROPRIATE MEASURES TO PROTECT CARTRIDGES FROM CONSTRUCTION-RELATED EROSION RUNOFF.



PLAN VIEW

VAULT STYLE: OUTLET SUMP (NIB)



SECTION A-A

PROJECT SUMMARY

CALCULATION DETAILS

- LOADING = HS20 & HS25
- APPROX. LINEAR FOOTAGE = 595 lf.

STORAGE SUMMARY

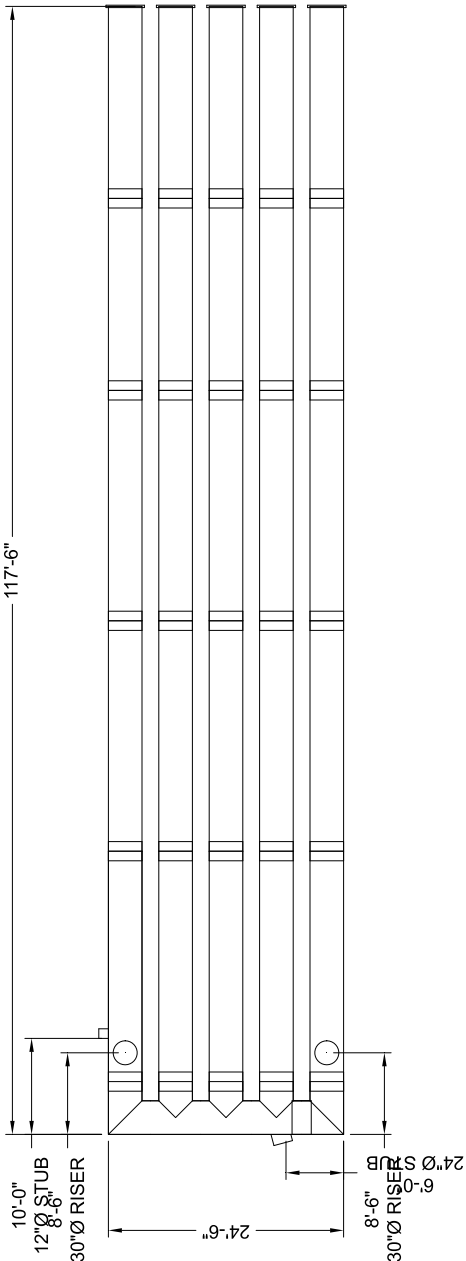
- STORAGE VOLUME REQUIRED = N/A
- PIPE STORAGE VOLUME = 5,720 cf.
- BACKFILL STORAGE VOLUME = 0 cf.
- TOTAL STORAGE PROVIDED = 5,747 cf.

PIPE DETAILS

- DIAMETER = 42 IN.
- CORRUGATION = 2 2/3x1/2
- GAGE = 16
- COATING = ALT2
- WALL TYPE = Solid
- BARRELL SPACING = 21 IN.

BACKFILL DETAILS

- WIDTH AT ENDS = 12 IN.
- ABOVE PIPE = 0 IN.
- WIDTH AT SIDES = 12 IN.
- BELOW PIPE = 0 IN.

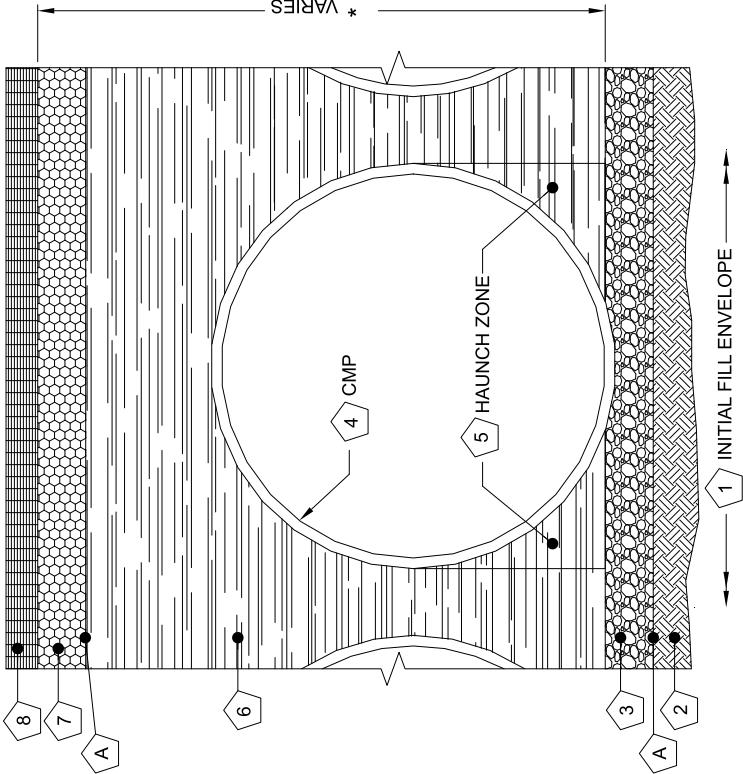


NOTES

- ALL RISER AND STUB DIMENSIONS ARE TO CENTERLINE. ALL ELEVATIONS, DIMENSIONS, AND LOCATIONS OF RISERS AND INLETS, SHALL BE VERIFIED BY THE ENGINEER OF RECORD PRIOR TO RELEASING FOR FABRICATION.
- ALL FITTINGS AND REINFORCEMENT COMPLY WITH ASTM A998.
- ALL RISERS AND STUBS ARE 2²/₃" x 1¹/₂" CORRUGATION AND 16 GAGE UNLESS OTHERWISE NOTED.
- RISERS TO BE FIELD TRIMMED TO GRADE.
- QUANTITY OF PIPE SHOWN DOES NOT PROVIDE EXTRA PIPE FOR CONNECTING THE SYSTEM TO EXISTING PIPE OR DRAINAGE STRUCTURES. OUR SYSTEM AS DETAILED PROVIDES NOMINAL INLET AND/OR OUTLET PIPE STUB FOR CONNECTION TO EXISTING DRAINAGE FACILITIES. IF ADDITIONAL PIPE IS NEEDED IT IS THE RESPONSIBILITY OF THE CONTRACTOR.
- BAND TYPE TO BE DETERMINED UPON FINAL DESIGN.
- THE PROJECT SUMMARY IS REFLECTIVE OF THE DYODS DESIGN, QUANTITIES ARE APPROX. AND SHOULD BE VERIFIED UPON FINAL DESIGN AND APPROVAL. FOR EXAMPLE, TOTAL EXCAVATION DOES NOT CONSIDER ALL VARIABLES SUCH AS SHORING AND ONLY ACCOUNTS FOR MATERIAL WITHIN THE ESTIMATED EXCAVATION FOOTPRINT.
- THESE DRAWINGS ARE FOR CONCEPTUAL PURPOSES AND DO NOT REFLECT ANY LOCAL PREFERENCES OR REGULATIONS. PLEASE CONTACT YOUR LOCAL CONTECH REP FOR MODIFICATIONS.

ASSEMBLY
SCALE: 1" = 20'

The design and information shown on this drawing is provided as advisory only. It is not to be used for construction without the approval of the design engineer. Neither this drawing, nor any part thereof, may be used, reproduced or modified in any manner without the prior written consent of Contech. Failure to comply is done at the user's own risk and Contech expressly disclaims any liability or responsibility for such use.		CONTECH® ENGINEERED SOLUTIONS LLC www.ContechES.com 9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069 800-338-1122 513-645-7000 513-645-7993 FAX		CONTECH DYODS DRAWING		42"Ø UNDERGROUND DETENTION SYSTEM - - 555 HOPPING BROOK ROAD HOLLISTON, MA SITE DESIGNATION:		PROJECT No.: 4952	SEQ. No.: 8039	DATE: 5/26/2021
								DESIGNED: DYO	DRAWN: DYO	DYO
								CHECKED: DYO	APPROVED: DYO	DYO
								SHEET NO.: D1		



DETENTION SYSTEMS - CMP DETENTION / CMP DRAINAGE			
Material Location Rigid or Flexible Pavement (if applicable)	Description	Material Designation	Designation
8	Road Base (if applicable)		
7	Geotextile Layer	Non-Woven Geotextile	Engineer Decision for consideration to prevent soil migration into varying soil types
A	Backfill	CONTECH C-40 or C-45	Placed in 8" +/- loose lifts and compacted to 90% Standard Proctor Per AASHTO T 99
6	Bedding Stone	Well graded granular material which may contain small amounts of silt or clay.	Engineer to determine if bedding is required. Pipe may be placed on the trench bottom of a relatively loose, native suitable well graded & granular material. For Arch pipes it is recommended to be shaped to a relatively flat bottom or fine-grade the foundation to a slight v-shape. Unsuitable material should be over-excavated and re-placed with a 4"-6" layer of well graded & granular stone per the material designation. See AASHTO 26.3.8.1 / 26.5.3 Bedding info.
3		AASHTO M43 - 3,357, 4,467, 5, 56, 57	
A		CONTECH C-40 or C-45	Engineer Decision for consideration to prevent soil migration into varying soil types
*	Note: Backfill using controlled low-strength material (CLSM, "flash fill" or "flowable fill") when the spacing between the pipes will not allow for placement and adequate compaction of the backfill.		

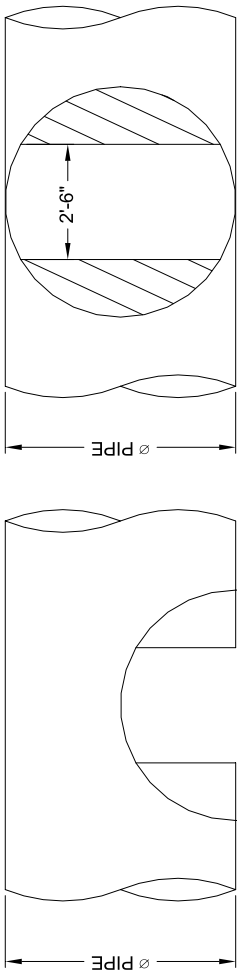
- 1
- 2
- 5
- MINIMUM WIDTH DEPENDS ON SITE CONDITIONS AND ENGINEERING JUDGEMENT
- FOUNDATION/BEDDING PREPARATION
- PRIOR TO PLACING THE BEDDING, THE FOUNDATION MUST BE CONSTRUCTED TO A UNIFORM AND STABLE GRADE. IN THE EVENT THAT UNSUITABLE FOUNDATION MATERIALS ARE ENCOUNTERED DURING EXCAVATION, THEY SHALL BE REMOVED AND BROUGHT BACK TO THE GRADE WITH A FILL MATERIAL AS APPROVED BY THE ENGINEER.

HAUNCH ZONE MATERIAL SHALL BE PLACED AND UNIFORMLY COMPACTED WITHOUT SOFT SPOTS.

BACKFILL

WHEN PLACING THE FIRST LIFTS OF BACKFILL IT IS IMPORTANT TO MAKE SURE THAT THE BACKFILL IS PROPERLY COMPACTED UNDER AND AROUND THE PIPE HAUNCHES. BACKFILL SHALL BE PLACED SUCH THAT THERE IS NO MORE THAN A TWO LIFT (16") DIFFERENTIAL BETWEEN ANY OF THE PIPES AT ANY TIME DURING THE BACKFILL PROCESS. THE BACKFILL SHALL BE ADVANCED ALONG THE LENGTH OF THE DETENTION SYSTEM AT THE SAME RATE TO AVOID DIFFERENTIAL LOADING ON THE PIPE.

OTHER ALTERNATE BACKFILL MATERIAL MAY BE ALLOWED DEPENDING ON SITE SPECIFIC CONDITIONS, AS APPROVED BY SITE ENGINEER.



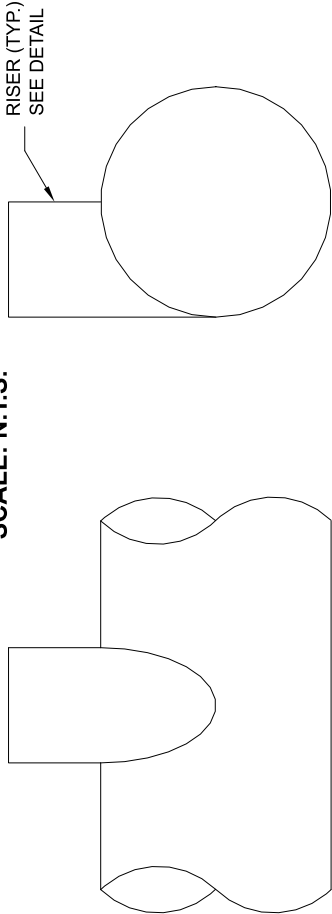
FRONT

NOTE:
MANWAY DETAIL APPLICABLE FOR CMP SYSTEMS WITH DIAMETERS 48" AND LARGER. MANWAYS MAY BE REQUIRED ON SMALLER SYSTEMS DEPENDING ON ACTUAL SITE SPECIFIC CONDITIONS.

PLAN

TYPICAL MANWAY DETAIL

SCALE: N.T.S.



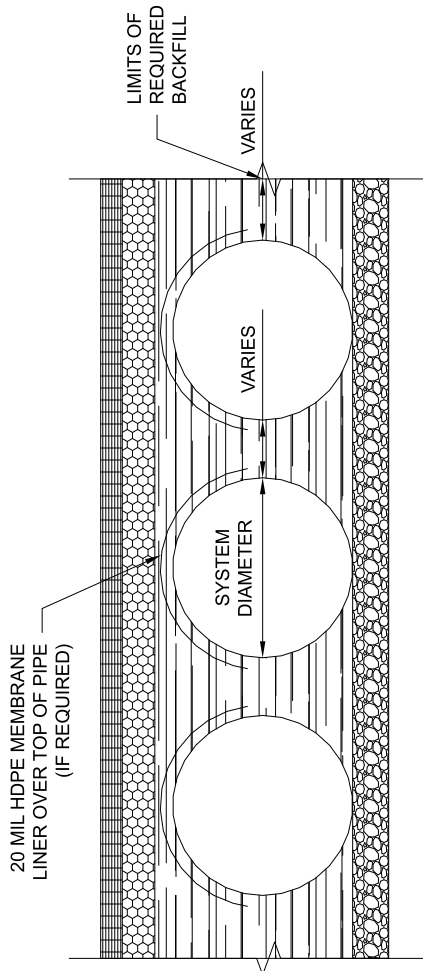
ELEVATION

END

NOTE:
LADDERS ARE OPTIONAL AND ARE NOT REQUIRED FOR ALL SYSTEMS.

TYPICAL RISER DETAIL

SCALE: N.T.S.



TYPICAL SECTION VIEW

LINER OVER ROWS

SCALE: N.T.S.

NOTE: IF SALTING AGENTS FOR SNOW AND ICE REMOVAL ARE USED ON OR NEAR THE PROJECT, AN HDPE MEMBRANE LINER IS RECOMMENDED WITH THE SYSTEM. THE IMPERMEABLE LINER IS INTENDED TO HELP PROTECT THE SYSTEM FROM THE POTENTIAL ADVERSE EFFECTS THAT MAY RESULT FROM A CHANGE IN THE SURROUNDING ENVIRONMENT OVER A PERIOD OF TIME. PLEASE REFER TO THE CORRUGATED METAL PIPE DETENTION DESIGN GUIDE FOR ADDITIONAL INFORMATION.

The design and information shown on this drawing is provided by the user and is not to be used for any other purpose without the written consent of Contech Engineered Solutions LLC ("Contech"). Neither this drawing, nor any part thereof, may be used, reproduced or modified in any manner without the prior written consent of Contech. Failure to comply is done at the user's own risk and Contech expressly disclaims any liability or responsibility for such use.

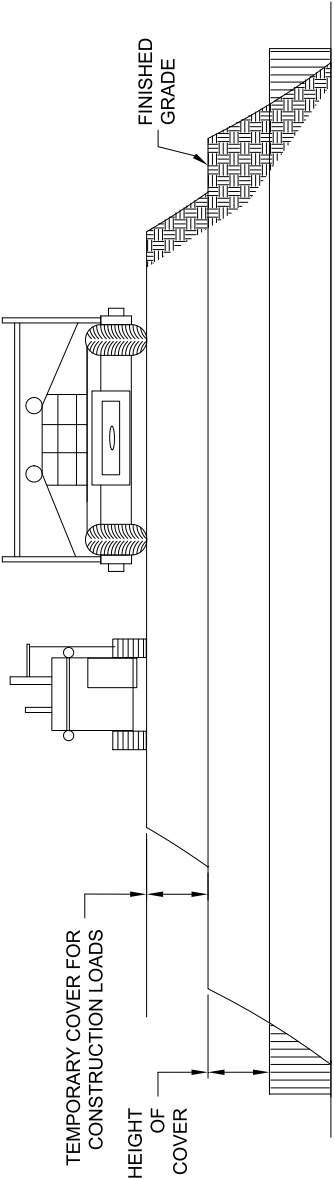
If discrepancies between the supplied information upon which this drawing is based and the actual conditions encountered as site work progresses, these discrepancies must be reported to Contech immediately for re-evaluation of the design. Contech accepts no liability for designs based on missing, incomplete or inaccurate information supplied by others.

CONTECH®
ENGINEERED SOLUTIONS LLC
www.ContechES.com
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

CONTECH®
CMPTETENTION SYSTEMS
CONTECH
DYODS
DRAWING

42"Ø UNDERGROUND DETENTION SYSTEM - -
555 HOPPING BROOK ROAD
HOLLISTON, MA
SITE DESIGNATION:

PROJECT No.: 4952	SEQ. No.: 8039	DATE: 5/26/2021
DESIGNED: DYO	DRAWN: DYO	
CHECKED: DYO	APPROVED: DYO	
SHEET NO.: D2		



CONSTRUCTION LOADS

FOR TEMPORARY CONSTRUCTION VEHICLE LOADS, AN EXTRA AMOUNT OF COMPACTED COVER MAY BE REQUIRED OVER THE TOP OF THE PIPE. THE HEIGHT-OF-COVER SHALL MEET THE MINIMUM REQUIREMENTS SHOWN IN THE TABLE BELOW. THE USE OF HEAVY CONSTRUCTION EQUIPMENT NECESSITATES GREATER PROTECTION FOR THE PIPE THAN FINISHED GRADE COVER MINIMUMS FOR NORMAL HIGHWAY TRAFFIC.

PIPE SPAN, INCHES	AXLE LOADS (kips)			
	18-50	50-75	75-110	110-150
MINIMUM COVER (FT)	2.0	2.5	3.0	3.0
	3.0	3.0	3.5	4.0
	3.0	3.5	4.0	4.0
	3.5	4.0	4.5	4.5
	126-144			

*MINIMUM COVER MAY VARY, DEPENDING ON LOCAL CONDITIONS. THE CONTRACTOR MUST PROVIDE THE ADDITIONAL COVER REQUIRED TO AVOID DAMAGE TO THE PIPE. MINIMUM COVER IS MEASURED FROM THE TOP OF THE PIPE TO THE TOP OF THE MAINTAINED CONSTRUCTION ROADWAY SURFACE.

CONSTRUCTION LOADING DIAGRAM

SCALE: N.T.S.

SPECIFICATION FOR DESIGNED DETENTION SYSTEM:

SCOPE
THIS SPECIFICATION COVERS THE MANUFACTURE AND INSTALLATION OF THE DESIGNED DETENTION SYSTEM DETAILED IN THE PROJECT PLANS.

MATERIAL
THE MATERIAL SHALL CONFORM TO THE APPLICABLE REQUIREMENTS LISTED BELOW:

ALUMINIZED TYPE 2 STEEL COILS SHALL CONFORM TO THE REQUIREMENTS OF AASHTO M-274 OR ASTM A-92.

THE GALVANIZED STEEL COILS SHALL CONFORM TO THE REQUIREMENTS OF AASHTO M-218 OR ASTM A-929.

THE POLYMER COATED STEEL COILS SHALL CONFORM TO THE REQUIREMENTS OF AASHTO M-246 OR ASTM A-742.

THE ALUMINUM COILS SHALL CONFORM TO THE APPLICABLE OF AASHTO M-197 OR ASTM B-744.

CONSTRUCTION LOADS
CONSTRUCTION LOADS MAY BE HIGHER THAN FINAL LOADS. FOLLOW THE MANUFACTURER'S OR NCSPA GUIDELINES.

NOTE:
THESE DRAWINGS ARE FOR CONCEPTUAL PURPOSES AND DO NOT REFLECT ANY LOCAL PREFERENCES OR REGULATIONS. PLEASE CONTACT YOUR LOCAL CONTECH REP FOR MODIFICATIONS.

The design and information shown on this drawing is provided for informational purposes only. It is not intended to be used as a basis for construction or as a substitute for the design of the project. The user of this drawing is responsible for obtaining all necessary permits and approvals. The user of this drawing is responsible for obtaining all necessary permits and approvals. The user of this drawing is responsible for obtaining all necessary permits and approvals.

If discrepancies between the supplied information upon which this drawing is based and the actual conditions are discovered as site work progresses, these discrepancies must be reported to Contech immediately for re-evaluation of the design. Contech accepts no liability for designs based on missing, incomplete or inaccurate information supplied by others.

REVISION DESCRIPTION

BY

DATE

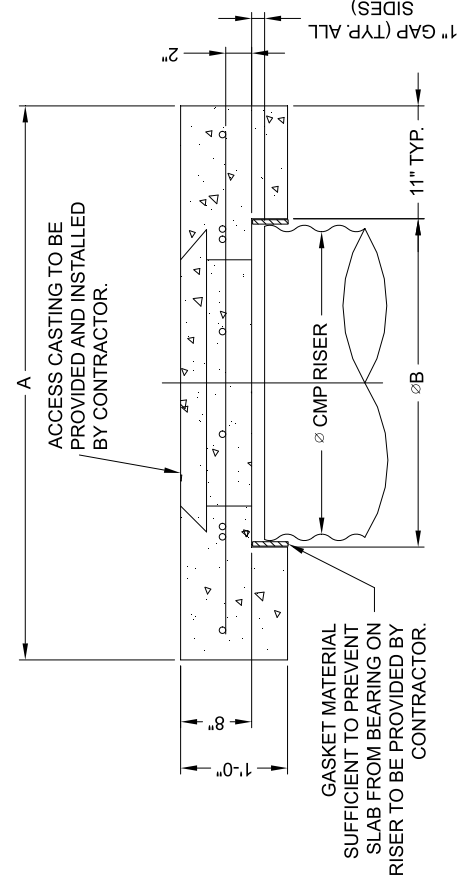
CONTECH®
ENGINEERED SOLUTIONS LLC
www.ContechES.com
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

CONTECH®
CMF DETENTION SYSTEMS

CONTECH
DYODS
DRAWING

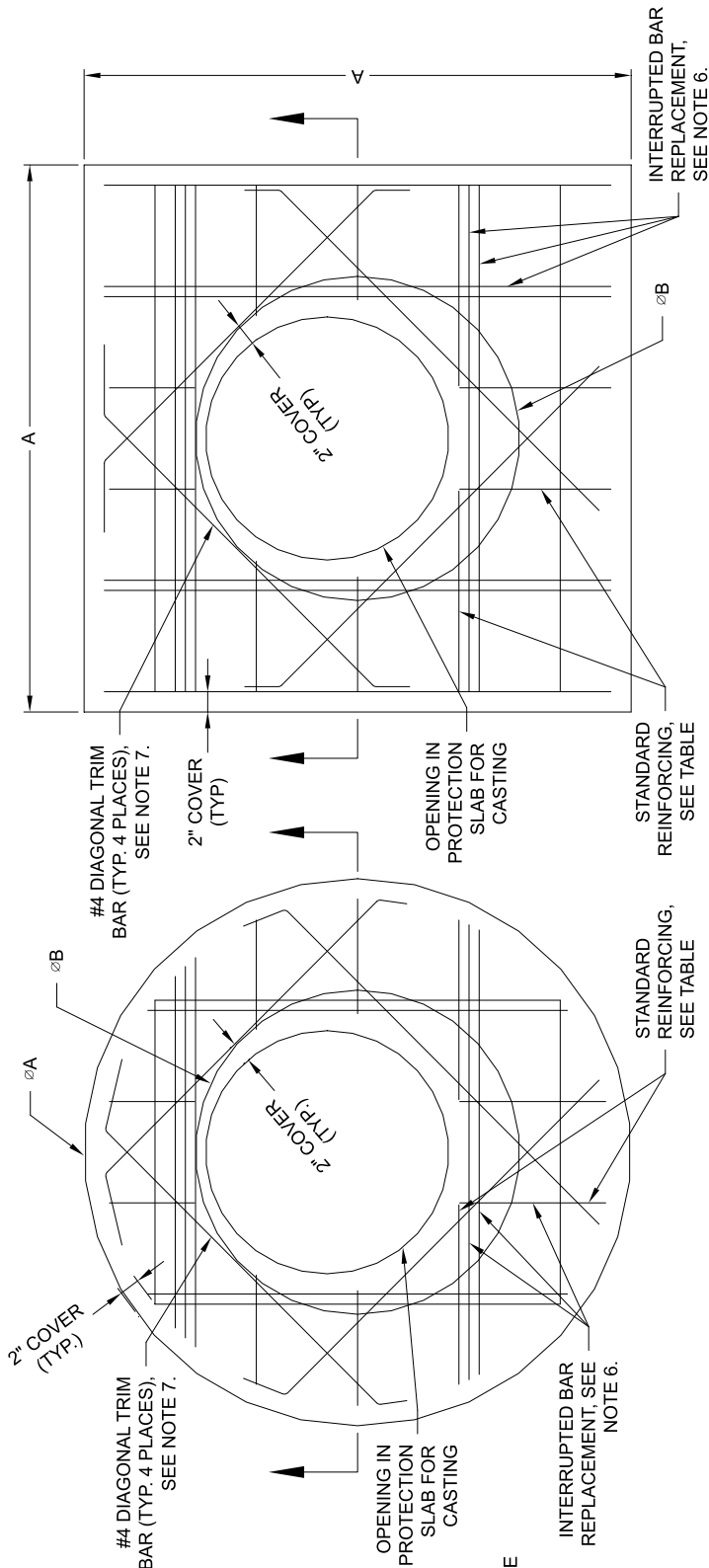
42"Ø UNDERGROUND DETENTION SYSTEM - -
555 HOPPING BROOK ROAD
HOLLISTON, MA
SITE DESIGNATION:

PROJECT No.:	4952	SEQ. No.:	8039	DATE:	5/26/2021
DESIGNED:	DYO	DRAWN:	DYO	DYO	
CHECKED:	DYO	APPROVED:	DYO	DYO	
SHEET NO.:	D3				



SECTION VIEW

** ASSUMED SOIL BEARING CAPACITY



ROUND OPTION PLAN VIEW

NOTES:

- DESIGN IN ACCORDANCE WITH AASHTO, 17th EDITION.
- DESIGN LOAD HS25.
- EARTH COVER = 1' MAX.
- CONCRETE STRENGTH = 3,500 psi
- REINFORCING STEEL = ASTM A615, GRADE 60.
- PROVIDE ADDITIONAL REINFORCING AROUND OPENINGS EQUAL TO THE BARS INTERRUPTED, HALF EACH SIDE. ADDITIONAL BARS TO BE IN THE SAME PLANE.

SQUARE OPTION PLAN VIEW

- TRIM OPENING WITH DIAGONAL #4 BARS, EXTEND BARS A MINIMUM OF 12" BEYOND OPENING, BEND BARS AS REQUIRED TO MAINTAIN BAR COVER.
- PROTECTION SLAB AND ALL MATERIALS TO BE PROVIDED AND INSTALLED BY CONTRACTOR.
- DETAIL DESIGN BY DELTA ENGINEERING, BINGHAMTON, NY.

MANHOLE CAP DETAIL

SCALE: N.T.S.

CMP DETENTION SYSTEM INSPECTION AND MAINTENANCE

UNDERGROUND STORMWATER DETENTION AND INFILTRATION SYSTEMS MUST BE INSPECTED AND MAINTAINED AT REGULAR INTERVALS FOR PURPOSES OF PERFORMANCE AND LONGEVITY.

INSPECTION

INSPECTION IS THE KEY TO EFFECTIVE MAINTENANCE OF CMP DETENTION SYSTEMS AND IS EASILY PERFORMED. CONTECH RECOMMENDS ONGOING, ANNUAL INSPECTIONS. SITES WITH HIGH TRASH LOAD OR SMALL OUTLET CONTROL ORIFICES MAY NEED MORE FREQUENT INSPECTIONS. THE RATE AT WHICH THE SYSTEM COLLECTS POLLUTANTS WILL DEPEND MORE ON SITE SPECIFIC ACTIVITIES RATHER THAN THE SIZE OR CONFIGURATION OF THE SYSTEM.

INSPECTIONS SHOULD BE PERFORMED MORE OFTEN IN EQUIPMENT WASHDOWN AREAS, IN CLIMATES WHERE SANDING AND/OR SALTING OPERATIONS TAKE PLACE, AND IN OTHER VARIOUS INSTANCES IN WHICH ONE WOULD EXPECT HIGHER ACCUMULATIONS OF SEDIMENT OR ABRASIVE/ CORROSIVE CONDITIONS. A RECORD OF EACH INSPECTION IS TO BE MAINTAINED FOR THE LIFE OF THE SYSTEM

MAINTENANCE

CMP DETENTION SYSTEMS SHOULD BE CLEANED WHEN AN INSPECTION REVEALS ACCUMULATED SEDIMENT OR TRASH IS CLOGGING THE DISCHARGE ORIFICE.

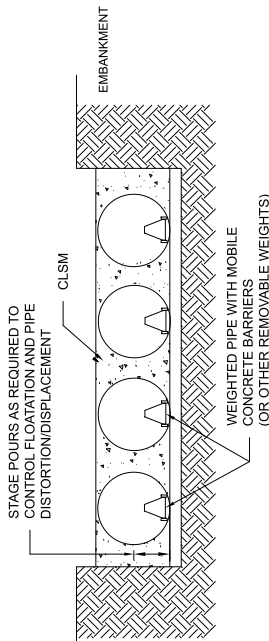
ACCUMULATED SEDIMENT AND TRASH CAN TYPICALLY BE EVACUATED THROUGH THE MANHOLE OVER THE OUTLET ORIFICE. IF MAINTENANCE IS NOT PERFORMED AS RECOMMENDED, SEDIMENT AND TRASH MAY ACCUMULATE IN FRONT OF THE OUTLET ORIFICE. MANHOLE COVERS SHOULD BE SECURELY SEATED FOLLOWING CLEANING ACTIVITIES. CONTECH SUGGESTS THAT ALL SYSTEMS BE DESIGNED WITH AN ACCESS/INSPECTION MANHOLE SITUATED AT OR NEAR THE INLET AND THE OUTLET ORIFICE. SHOULD IT BE NECESSARY TO GET INSIDE THE SYSTEM TO PERFORM MAINTENANCE ACTIVITIES, ALL APPROPRIATE PRECAUTIONS REGARDING CONFINED SPACE ENTRY AND OSHA REGULATIONS SHOULD BE FOLLOWED.

ANNUAL INSPECTIONS ARE BEST PRACTICE FOR ALL UNDERGROUND SYSTEMS. DURING THIS INSPECTION, IF EVIDENCE OF SALTING/DE-ICING AGENTS IS OBSERVED WITHIN THE SYSTEM, IT IS BEST PRACTICE FOR THE SYSTEM TO BE RINSED, INCLUDING ABOVE THE SPRING LINE SOON AFTER THE SPRING THAW AS PART OF THE MAINTENANCE PROGRAM FOR THE SYSTEM.

MAINTAINING AN UNDERGROUND DETENTION OR INFILTRATION SYSTEM IS EASIEST WHEN THERE IS NO FLOW ENTERING THE SYSTEM. FOR THIS REASON, IT IS A GOOD IDEA TO SCHEDULE THE CLEANOUT DURING DRY WEATHER.

THE FOREGOING INSPECTION AND MAINTENANCE EFFORTS HELP ENSURE UNDERGROUND PIPE SYSTEMS USED FOR STORMWATER STORAGE CONTINUE TO FUNCTION AS INTENDED BY IDENTIFYING RECOMMENDED REGULAR INSPECTION AND MAINTENANCE PRACTICES. INSPECTION AND MAINTENANCE RELATED TO THE STRUCTURAL INTEGRITY OF THE PIPE OR THE SOUNDNESS OF PIPE JOINT CONNECTIONS IS BEYOND THE SCOPE OF THIS GUIDE.

WHEN FLOWABLE FILL IS USED, YOU MUST PREVENT PIPE FLOATATION. TYPICALLY, SMALL LIFTS ARE PLACED BETWEEN THE PIPES AND THEN ALLOWED TO SET-UP PRIOR TO THE PLACEMENT OF THE NEXT LIFT. THE ALLOWABLE THICKNESS OF THE CLSM LIFT IS A FUNCTION OF A PROPER BALANCE BETWEEN THE UPLIFT FORCE OF THE CLSM, THE OPPOSING WEIGHT OF THE PIPE, AND THE EFFECT OF OTHER RESTRAINING MEASURES. THE PIPE CAN CARRY LIMITED FLUID PRESSURE WITHOUT PIPE DISTORTION OR DISPLACEMENT, WHICH ALSO AFFECTS THE CLSM LIFT THICKNESS. YOUR LOCAL CONTECH SALES ENGINEER CAN HELP DETERMINE THE PROPER LIFT THICKNESS.

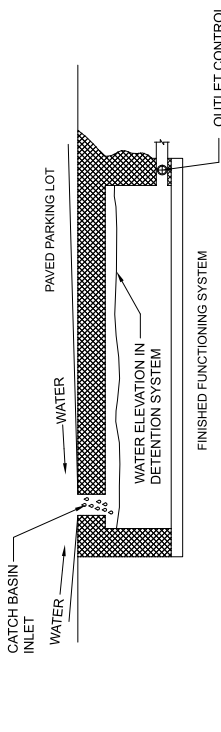


CONSTRUCTION LOADING

TYPICALLY, THE MINIMUM COVER SPECIFIED FOR A PROJECT ASSUMES H-20 LIVE LOAD. BECAUSE CONSTRUCTION LOADS OFTEN EXCEED DESIGN LIVE LOADS, INCREASED TEMPORARY MINIMUM COVER REQUIREMENTS ARE NECESSARY. SINCE CONSTRUCTION EQUIPMENT VARIES FROM JOB TO JOB, IT IS BEST TO ADDRESS EQUIPMENT SPECIFIC MINIMUM COVER REQUIREMENTS WITH YOUR LOCAL CONTECH SALES ENGINEER DURING YOUR PRE-CONSTRUCTION MEETING.

ADDITIONAL CONSIDERATIONS

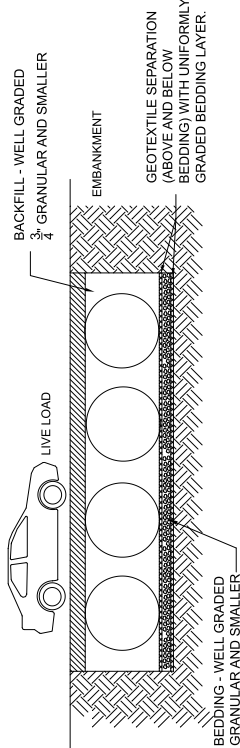
BECAUSE MOST SYSTEMS ARE CONSTRUCTED BELOW-GRADE, RAINFALL CAN RAPIDLY FILL THE EXCAVATION; POTENTIALLY CAUSING FLOATION AND MOVEMENT OF THE PREVIOUSLY PLACED PIPES. TO HELP MITIGATE POTENTIAL PROBLEMS, IT IS BEST TO START THE INSTALLATION AT THE DOWNSTREAM END WITH THE OUTLET ALREADY CONSTRUCTED TO ALLOW A ROUTE FOR THE WATER TO ESCAPE. TEMPORARY DIVERSION MEASURES MAY BE REQUIRED FOR HIGH FLOWS DUE TO THE RESTRICTED NATURE OF THE OUTLET PIPE.



IN-SITU TRENCH WALL

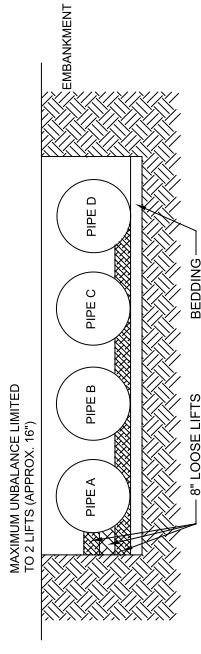
IF EXCAVATION IS REQUIRED, THE TRENCH WALL NEEDS TO BE CAPABLE OF SUPPORTING THE LOAD THAT THE PIPE SHEDS AS THE SYSTEM IS LOADED. IF SOILS ARE NOT CAPABLE OF SUPPORTING THESE LOADS, THE PIPE CAN DEFLECT. TO PERFORM A SIMPLE SOIL PRESSURE CHECK USING THE APPLIED LOADS TO DETERMINE THE LIMITS OF EXCAVATION BEYOND THE SPRING LINE OF THE OUTER MOST PIPES.

IN MOST CASES THE REQUIREMENTS FOR A SAFE WORK ENVIRONMENT AND PROPER BACKFILL PLACEMENT AND COMPACTION TAKE CARE OF THIS CONCERN.



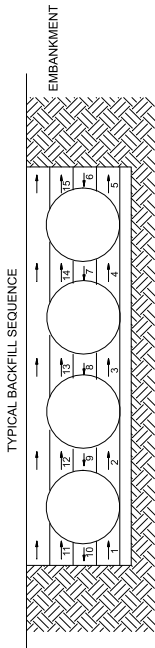
BACKFILL PLACEMENT

MATERIAL SHALL BE WORKED INTO THE PIPE HAUNCHES BY MEANS OF SHOVEL-SLICING, RODDING, AIR TAMPER, VIBRATORY ROD, OR OTHER EFFECTIVE METHODS.



IF AASHTO T99 PROCEDURES ARE DETERMINED INFEASIBLE BY THE GEOTECHNICAL ENGINEER OF RECORD, COMPACTION IS CONSIDERED ADEQUATE WHEN NO FURTHER YIELDING OF THE MATERIAL IS OBSERVED UNDER THE COMPACTOR, OR UNDER FOOT, AND THE GEOTECHNICAL ENGINEER OF RECORD (OR REPRESENTATIVE THEREOF) IS SATISFIED WITH THE LEVEL OF COMPACTION.

FOR LARGE SYSTEMS, CONVEYOR SYSTEMS, BACKHOES WITH LONG REACHES OR DRAGLINES WITH STONE BUCKETS MAY BE USED TO PLACE BACKFILL. ONCE MINIMUM COVER FOR CONSTRUCTION LOADING ACROSS THE ENTIRE WIDTH OF THE SYSTEM IS REACHED, ADVANCE THE EQUIPMENT TO THE END OF THE RECENTLY PLACED FILL, AND BEGIN THE SEQUENCE AGAIN UNTIL THE SYSTEM IS COMPLETELY BACKFILLED. THIS TYPE OF CONSTRUCTION SEQUENCE PROVIDES ROOM FOR STOCKPILED BACKFILL DIRECTLY BEHIND THE BACKHOE, AS WELL AS THE MOVEMENT OF CONSTRUCTION TRAFFIC. MATERIAL STOCKPILES ON TOP OF THE BACKFILLED DETENTION SYSTEM SHOULD BE LIMITED TO 8- TO 10- FEET HIGH AND MUST PROVIDE BALANCED LOADING ACROSS ALL BARRELS. TO DETERMINE THE PROPER COVER OVER THE PIPES TO ALLOW THE MOVEMENT OF CONSTRUCTION EQUIPMENT SEE TABLE 1, OR CONTACT YOUR LOCAL CONTECH SALES ENGINEER.



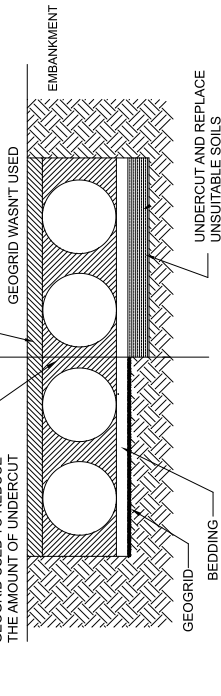
CMP DETENTION INSTALLATION GUIDE

PROPER INSTALLATION OF A FLEXIBLE UNDERGROUND DETENTION SYSTEM WILL ENSURE LONG-TERM PERFORMANCE. THE CONFIGURATION OF THESE SYSTEMS OFTEN REQUIRES SPECIAL CONSTRUCTION PRACTICES THAT DIFFER FROM CONVENTIONAL FLEXIBLE PIPE CONSTRUCTION. CONTECH ENGINEERED SOLUTIONS STRONGLY SUGGESTS SCHEDULING A PRE-CONSTRUCTION MEETING WITH YOUR LOCAL SALES ENGINEER TO DETERMINE IF ADDITIONAL MEASURES, NOT COVERED IN THIS GUIDE, ARE APPROPRIATE FOR YOUR SITE.

FOUNDATION

CONSTRUCT A FOUNDATION THAT CAN SUPPORT THE DESIGN LOADING APPLIED BY THE PIPE AND ADJACENT BACKFILL WEIGHT AS WELL AS MAINTAIN ITS INTEGRITY DURING CONSTRUCTION.

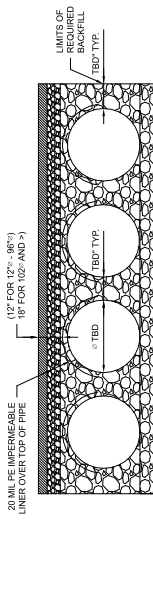
IF SOFT OR UNSUITABLE SOILS ARE ENCOUNTERED, REMOVE THE POOR SOILS DOWN TO A SUITABLE DEPTH AND THEN BUILD UP TO THE APPROPRIATE ELEVATION WITH A COMPETENT BACKFILL MATERIAL. THE STRUCTURAL FILL MATERIAL GRADATION SHOULD NOT ALLOW THE MIGRATION OF FINES, WHICH CAN CAUSE SETTLEMENT OF THE DETENTION SYSTEM OR PAVEMENT ABOVE. IF THE STRUCTURAL FILL MATERIAL IS NOT COMPATIBLE WITH THE UNDERLYING SOILS, AN ENGINEERING FABRIC SHOULD BE USED AS A SEPARATOR. IN SOME CASES, USING A STIFF REINFORCING GEOGRID, REDUCES OVER EXCAVATION AND REPLACEMENT FILL QUANTITIES.



GRADE THE FOUNDATION SUBGRADE TO A UNIFORM OR SLIGHTLY SLOPING GRADE. IF THE SUBGRADE IS CLAY OR RELATIVELY NON-POROUS AND THE CONSTRUCTION SEQUENCE WILL LAST FOR AN EXTENDED PERIOD OF TIME, IT IS BEST TO SLOPE THE GRADE TO ONE END OF THE SYSTEM. THIS WILL ALLOW EXCESS WATER TO DRAIN QUICKLY, PREVENTING SATURATION OF THE SUBGRADE.

GEOMEMBRANE BARRIER

A SITE'S RESISTIVITY MAY CHANGE OVER TIME WHEN VARIOUS TYPES OF SALTING AGENTS ARE USED. SUCH AS ROAD SALTS FOR DEICING AGENTS. IF SALTING AGENTS ARE USED ON OR NEAR THE PROJECT SITE, A GEOMEMBRANE BARRIER IS RECOMMENDED WITH THE SYSTEM. THE GEOMEMBRANE LINER IS INTENDED TO HELP PROTECT THE SYSTEM FROM THE POTENTIAL ADVERSE EFFECTS THAT MAY RESULT FROM THE USE OF SUCH AGENTS INCLUDING PREMATURE CORROSION AND REDUCED ACTUAL PERMEABILITY. THE ENGINEER OF RECORD IS TO EVALUATE WHETHER SALTING AGENTS WILL BE USED ON OR NEAR THE PROJECT SITE, AND USE HIS/HER BEST JUDGEMENT TO DETERMINE IF ANY ADDITIONAL PROTECTIVE MEASURES ARE REQUIRED. BELOW IS A TYPICAL DETAIL SHOWING THE PLACEMENT OF A GEOMEMBRANE BARRIER FOR PROJECTS WHERE SALTING AGENTS ARE USED ON OR NEAR THE PROJECT SITE.

[illegible]

CASCADE SEPARATOR DESIGN NOTES

CS-6 RATED TREATMENT CAPACITY IS 5.6 CFS, OR PER LOCAL REGULATIONS. THE STANDARD CS-6 CONFIGURATION IS SHOWN. ALTERNATE CONFIGURATIONS ARE AVAILABLE AND ARE LISTED BELOW. SOME CONFIGURATIONS MAY BE COMBINED TO SUIT SITE REQUIREMENTS.

CONFIGURATION DESCRIPTION

GRATED INLET ONLY (NO INLET PIPE)

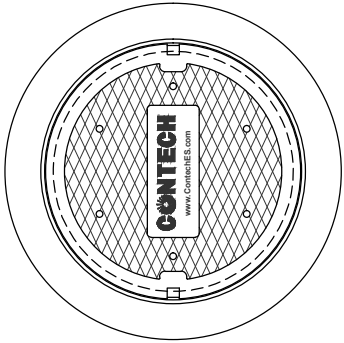
GRATED INLET WITH INLET PIPE OR PIPES

CURB INLET ONLY (NO INLET PIPE)

CURB INLET WITH INLET PIPE OR PIPES

SITE SPECIFIC DATA REQUIREMENTS

STRUCTURE ID	
WATER QUALITY FLOW RATE (cfs [L/s])	
PEAK FLOW RATE (cfs [L/s])	
RETURN PERIOD OF PEAK FLOW (yrs)	
RIM ELEVATION	
PIPE DATA:	
INLET PIPE 1	
INLET PIPE 2	
OUTLET PIPE	



FRAME AND COVER

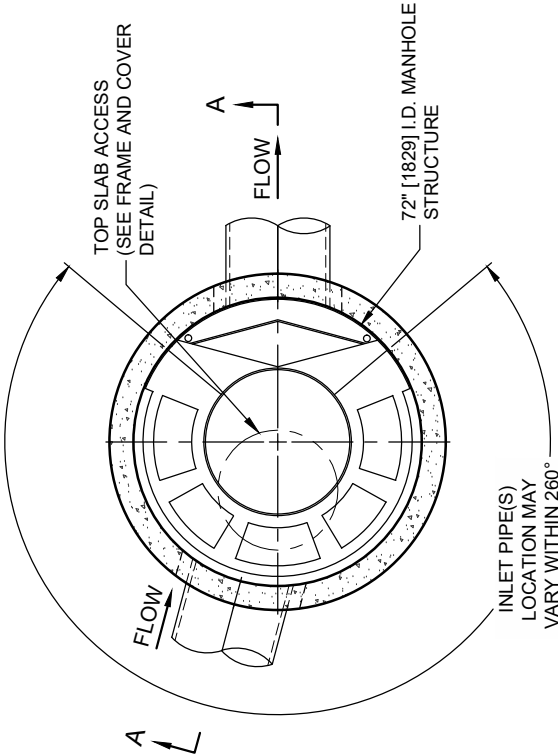
(DIAMETER VARIES)
NOT TO SCALE

GENERAL NOTES

- CONTECH TO PROVIDE ALL MATERIALS UNLESS NOTED OTHERWISE.
- FOR SITE SPECIFIC DRAWINGS WITH DETAILED STRUCTURE DIMENSIONS AND WEIGHT, PLEASE CONTACT YOUR CONTECH ENGINEERED SOLUTIONS LLC REPRESENTATIVE. www.contechES.com
- CASCADE SEPARATOR WATER QUALITY STRUCTURE SHALL BE IN ACCORDANCE WITH ALL DESIGN DATA AND INFORMATION CONTAINED IN THIS DRAWING. CONTRACTOR TO CONFIRM STRUCTURE MEETS REQUIREMENTS OF PROJECT.
- CASCADE SEPARATOR STRUCTURE SHALL MEET AASHTO HS20 LOAD RATING, ASSUMING EARTH COVER OF 0' - 2' [610], AND GROUNDWATER ELEVATION AT, OR BELOW, THE OUTLET PIPE INVERT ELEVATION. ENGINEER OF RECORD TO CONFIRM ACTUAL GROUNDWATER ELEVATION. CASTINGS SHALL MEET AASHTO M306 AND BE CAST WITH THE CONTECH LOGO.
- CASCADE SEPARATOR STRUCTURE SHALL BE PRECAST CONCRETE CONFORMING TO ASTM C478 AND AASHTO LOAD FACTOR DESIGN METHOD.
- ALTERNATE UNITS ARE SHOWN IN MILLIMETERS [mm].

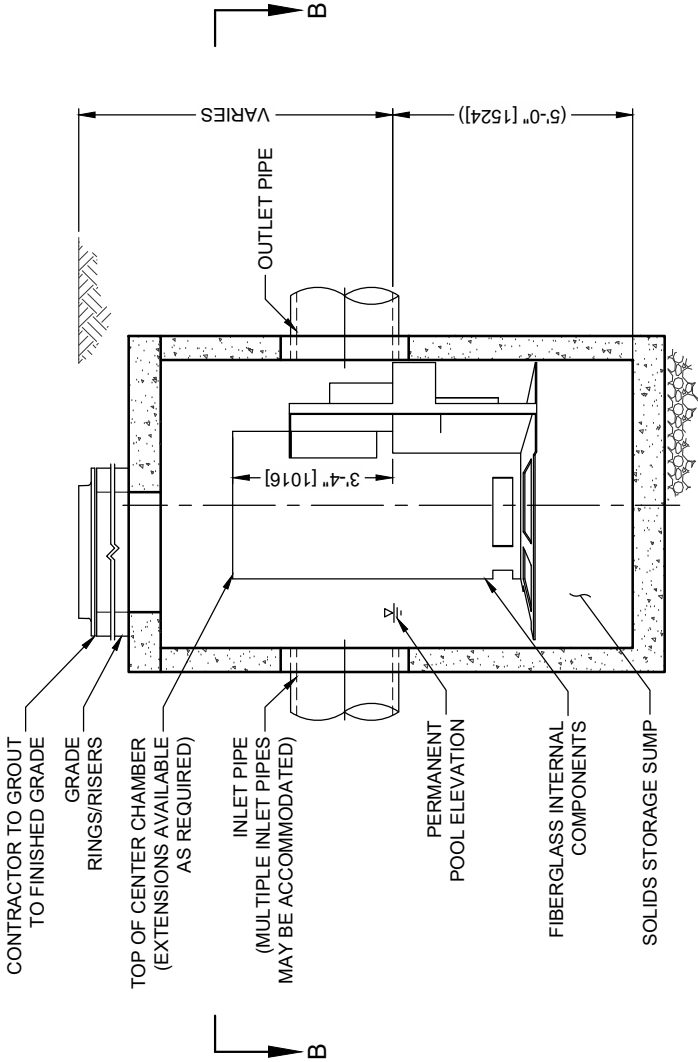
INSTALLATION NOTES

- ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
- CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE CASCADE SEPARATOR MANHOLE STRUCTURE.
- CONTRACTOR TO INSTALL JOINT SEALANT BETWEEN ALL STRUCTURE SECTIONS AND ASSEMBLE STRUCTURE.
- CONTRACTOR TO PROVIDE, INSTALL, AND GROUT INLET AND OUTLET PIPE(S). MATCH PIPE INVERTS WITH ELEVATIONS SHOWN. ALL PIPE CENTERLINES TO MATCH PIPE OPENING CENTERLINES.
- CONTRACTOR TO TAKE APPROPRIATE MEASURES TO ASSURE UNIT IS WATER TIGHT, HOLDING WATER TO FLOWLINE INVERT MINIMUM. IT IS SUGGESTED THAT ALL JOINTS BELOW PIPE INVERTS ARE GROUTED.



PLAN VIEW B-B

NOT TO SCALE



ELEVATION A-A

NOT TO SCALE

CASCADE separator™

CONTECH® ENGINEERED SOLUTIONS LLC

www.contechES.com
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

CS-6 CASCADE SEPARATOR STANDARD DETAIL