



Contactor® & Recharger®

Stormwater Chambers *The Chamber with the Stripe®*



Manual Calculations for Designing CULTEC Stormwater Systems



CULTEC

Minimum Fill Requirements

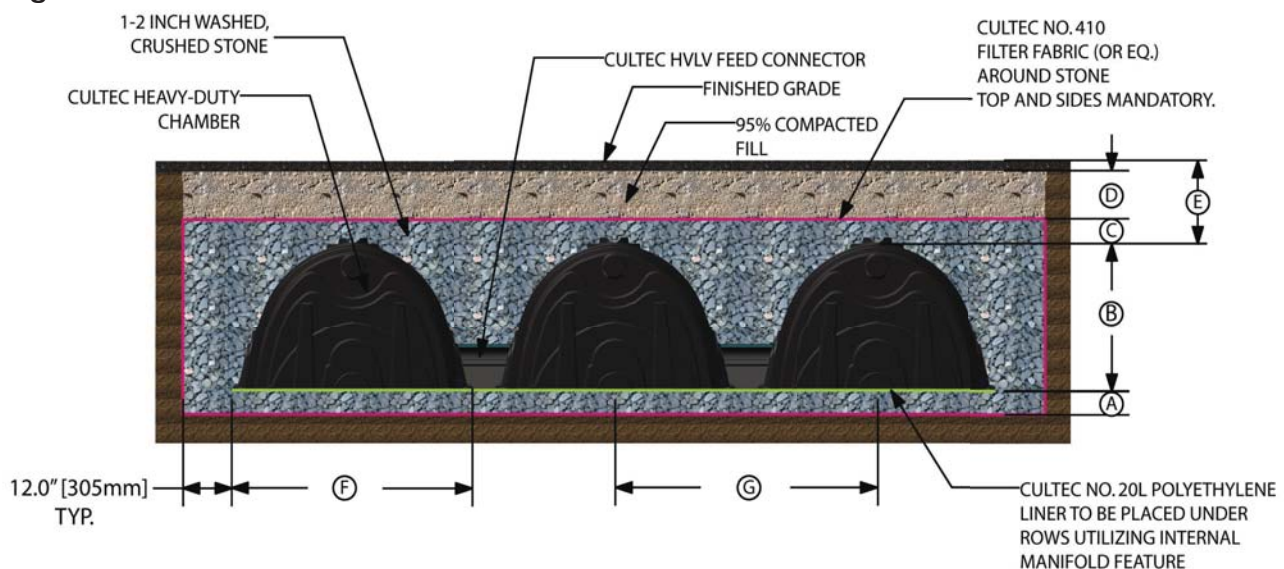
These requirements are for traffic applications only. If these models and design parameters do not meet your needs, please call CULTEC's Technical Department at 1-800-4-CULTEC, Ext. 2003 (1-800-428-5832, Ext. 2003) for further information and assistance.

Refer to CULTEC's most current installation instructions for further details including but not limited to acceptable fill materials and vehicle loads.

Table 1

	See Fig. 1	Contacto [®] 100HD	Recharge [®] 150XLHD	Recharge [®] 280HD	Recharge [®] 330XLHD	Recharge [®] V8HD
Typical Center to Center Spacing	G	3.33' 1.02 m	3.25' 0.99 m	4.33' 1.32 m	4.83' 1.47 m	5.5' 1.68 m
Chamber width	F	36" 914 mm	33" 838 mm	47" 1194 mm	52" 1321 mm	60" 1524 mm
Max. depth of cover allowed above crown of chamber	E	12' 3.66 m	12' 3.66 m	12' 3.66 m	12' 3.66 m	8' 2.44 m
Min. depth required of 95% Compacted Fill for Paved Traffic Application	D	8" 203 mm	8" 203 mm	8" 203 mm	10" 254 mm	12" 305 mm
Min. depth required of 95% Compacted Fill for Unpaved Traffic Application	D	10" 254 mm	10" 254 mm	10" 254 mm	12" 254 mm	14" 356 mm
Min. depth of stone required above units for traffic applications	C	6" 152 mm	6" 152 mm	6" 152 mm	6" 152 mm	6" 152 mm
Chamber height	B	12.5" 318 mm	18.5" 470 mm	26.5" 673 mm	30.5" 775 mm	32" 813 mm
Min. depth of stone base	A	6" 152 mm	6" 152 mm	6" 152 mm	6" 152 mm	6" 152 mm

Fig. 1



System Sizing Calculations

For more detailed calculations you may use our MS-Excel based CULTEC Stormwater Design Calculator at www.cultec.com or contact our Technical Department for free design assistance.

We are also modeled in HydroCAD®, Autodesk® Storm and Sanitary Analysis, Bentley Systems' PondPack® V8i and Streamline Technologies' ICPR® modeling software.

Separate calculations will be listed for the Recharger® V8HD series because of its unique chamber length characteristics. For Recharger V8HD System Sizing Calculations, refer to Pages 9-14.

Other models are available, ask our Technical Department if you need further information.

Bed Area and Quantity of Stone Required will be increased by the required min. 1 foot (305 mm) stone border and installed chamber length adjustments - *not calculated below*.

Volume of Excavation will be increased by the required min. 1 foot (305 mm) stone border and final backfill requirements - *not included below*.

Determine the Required Storage Volume (V_s)

Required Storage Volume (V_s) = Given

Determine the Number of Chambers Required (C)

Number of Chambers Required (C) C = Required Storage Volume ÷ Chamber and Stone Base Storage per Unit

$$C = V_s \div D_u$$

Table 2

	Bare Chamber Storage	Chamber and Stone Storage per Unit (D_u)		
		6"	12"	18"
		152 mm	305 mm	457 mm
Contactor® 100HD	14 ft ³	28.81 ft ³	33.81 ft ³	38.81 ft ³
	0.4 m ³	0.82 m ³	0.96 m ³	1.10 m ³
Recharger® 150XLHD	27.16 ft ³	50.17 ft ³	56.83 ft ³	63.49 ft ³
	0.77 m ³	1.42 m ³	1.61 m ³	1.80 m ³
Recharger® 280HD	42.55 ft ³	64.46 ft ³	70.53 ft ³	76.59 ft ³
	1.21 m ³	1.83 m ³	2 m ³	2.17 m ³
Recharger® 330XLHD	52.21 ft ³	79.26 ft ³	86.03 ft ³	92.79 ft ³
	1.48 m ³	2.24 m ³	2.44 m ³	2.63 m ³

This is an approximation only. Actual number of chambers required may be reduced when stone border storage and chamber length adjustments per row are calculated. The Chamber and Stone Storages above are based on the installed chamber length, stone base as listed in the table, 6" (152 mm) stone above the unit and typical center to center spacing. Assumes 40% stone void.

System Sizing Calculations - *continued*

Determine the Required Bed Area (A)

Bed Area (A) $A = \text{Number of Chambers} \times \text{Surface Area Required per Unit}$

$$A = C \times A_c$$

Table 3

	Typical Center to Center Spacing	Surface Area Required per Unit (A_c)
Contactor® 100HD	3.33'	25 ft ²
	1.02 m	2.32 m ²
Recharger® 150XLHD	3.25'	33.31 ft ²
	0.99 m	3.09 m ²
Recharger® 280HD	4.33'	30.33 ft ²
	1.32 m	2.82 m ²
Recharger® 330XLHD	4.83'	33.83 ft ²
	1.47 m	3.14 m ²

Surface area per unit is based on the installed chamber length and typical center to center spacing. Chamber length adjustments per row and stone border requirements are not calculated.

Determine the Stone Required (V_{st})

Quantity of Stone Required (V_{st}) $V_{st} = \text{Number of Chambers Required} \times \text{Stone Required per Chamber}$

$$V_{st} = C \times S_c$$

Table 4

	Stone Required per Chamber Based on Stone Foundation Depth (S_c)		
	6"	12"	18"
	152 mm	305 mm	457 mm
Contactor® 100HD	1.37 yd ³	1.84 yd ³	2.30 yd ³
	1.05 m ³	1.40 m ³	1.76 m ³
Recharger® 150XLHD	2.13 yd ³	2.75 yd ³	3.36 yd ³
	1.63 m ³	2.10 m ³	2.57 m ³
Recharger® 280HD	2.03 yd ³	2.59 yd ³	3.15 yd ³
	1.55 m ³	1.98 m ³	2.41 m ³
Recharger® 330XLHD	2.50 yd ³	3.13 yd ³	3.76 yd ³
	1.91 m ³	2.39 m ³	2.87 m ³

Based on installed chamber length. Assumes stone base as listed in table above, 6" (152 mm) stone above the units and typical center to center spacing for models listed above. Chamber length adjustments per row and stone border requirements are not calculated.

System Sizing Calculations - *continued*

Table 5

	Min. Effective Depth Determined by Stone Base (D _c)		
	6"	12"	18"
	152 mm	305 mm	457 mm
Contactor® 100HD	2.04'	2.54'	3.04'
	0.62 m	0.77 m	0.93 m
Recharger® 150XLHD	2.54'	3.04'	3.54'
	0.77 m	0.93 m	1.08 m
Recharger® 280HD	3.21'	3.71'	4.21'
	0.98 m	1.13 m	1.28 m
Recharger® 330XLHD	3.54'	4.04'	4.54'
	1.08 m	1.23 m	1.38 m

Based on stone base as listed, chamber height, and minimum fill requirements for paved, traffic application. The "Minimum Effective Depth" does not take into consideration any additional fill requirements or final grade materials above the 6" (152 mm) of stone above the units.

Once you have determined your bed layout (number of rows wide x number of chambers per row), you can then proceed to these calculations.

How to Calculate Bed Length (L_b)

Bed Length (L_b) $L_b = [(\# \text{ of Chambers per Row} \times \text{Installed Chamber Length}) + \text{Chamber Length Adjustment per Row}] + (2 \times \text{Stone Border Width})$

$$L_b = [(\# \text{ of Chambers per Row} \times L_{ui}) + L_a] + (2 \times 1' (0.3 \text{ m}))$$

Table 6

	Installed Chamber Length (L _{ui})	Chamber Length Adjustment per Row (L _a)
Contactor® 100HD	7.5'	0.5'
	2.29 m	0.15 m
Recharger® 150XLHD	10.25'	0.75'
	3.12 m	0.23 m
Recharger® 280HD	7'	1'
	2.13 m	0.3 m
Recharger® 330XLHD	7'	1.5'
	2.13 m	0.45 m

A typical stone border is 1' (0.3 m) wide around the perimeter of the chamber bed.

System Sizing Calculations - *continued*

How to Calculate Bed Width (W_b)

Bed Width (W_b) = W_b U.S. = (# of Chambers Wide x Min. Center to Center Spacing) + [2 ((12" - Min. Chamber Spacing Between Rows)/12)]

W_b U.S. = (# of Chambers Wide x D_{uw}) + [2((12" - C_{sp})/12)]

W_b Metric = (# of Chambers Wide x Min. Center to Center Spacing) + [2 ((305 mm - Min. Chamber Spacing Between Rows)/1000)]

W_b Metric = (# of Chambers Wide x D_{uw}) + [2 ((305 mm - C_{sp})/1000)]

Table 7

	Min. Center to Center Spacing (D_{uw})	Min. Chamber Spacing Between Rows (C_{sp})
Contactor® 100HD	3.33' 1.02 m	4" 102 mm
Recharger® 150XLHD	3.25' 0.99 m	6" 152 mm
Recharger® 280HD	4.33' 1.32 m	5" 127 mm
Recharger® 330XLHD	4.83' 1.47 m	6" 152 mm

Additional Calculations

How to Calculate Actual Bed Area (A_a)

Actual Bed Area (A_a) A_a = Bed Length x Bed Width

A_a = L_b x W_b

How to Calculate Filter Fabric Required (F_b)

Filter Fabric Required (F_b) = F_b = [((Bed Width x Min. Effective Depth) x 2 Endwalls) + ((Bed Length x Min. Effective Depth) x 2 Sidewalls) + (Actual Bed Area x 2 layers)] + 15% for waste

F_b = [((W_b x D_c) x 2) + ((L_b x D_c) x 2) + (A_a x 2)] + 15%

This calculates Filter Fabric for top, sides and bottom of system. Filter Fabric is mandatory for the top and sides of the stormwater system; it is recommended for the bottom of the system.

How to Calculate CULTEC No. 20L Polyethylene Liner Required (P)

CULTEC No. 20L™ Polyethylene Liner Required (P) = P For internal manifold on one side only = Bed Width

P For internal manifold on one side only = W_b

P For internal manifold on two sides = 2 x Bed Width

P For internal manifold on two sides = 2 x W_b

This is based on a 6' (1.83 m) wide roll. Calculates liner runs at 6' (1.83 m) wide and spanning the width of the bed.

Additional Calculations - *continued*

How to Calculate HVLV Feed Connectors Required (H)

- HVLV™ Feed Connectors Required (H) =
- H *For internal manifold on one side only* = Number of Rows Wide - 1
 - H *For internal manifold on one side only* = R-1
 - H *For internal manifold on two sides* = (2 x Number of Rows Wide) - 2
 - H *For internal manifold on two sides* = (2 x R) - 2





CULTEC Stormwater System Worksheet

Project: _____

Location: _____

Calculated By: _____

CULTEC Chamber model proposed for this design (*check one*):

Date: _____

- Contactor 100HD Recharger 280HD
 Recharger 150XLHD Recharger 330XLHD

System Requirements	Calculation	Circle Unit of Measure
Required Storage Volume (V_s)	= Given = _____	ft ³ m ³
Number of chambers required (C)	= $V_s \div D_u$ (See Table 2, pg. 3) = _____ $V_s \div$ _____ D_u	pieces
Required Bed Area (A)	= $C \times A_c$ (See Table 3, pg. 4) = _____ C x _____ A_c	ft ² m ²
Stone Required (V_{st})	= $C \times S_c$ (See Table 4, pg. 4) = _____ C x _____ S_c	yd ³ m ³

These are to be used as quick calculations only. Stone borders and chamber length adjustments are not calculated and will affect each system requirement.

For more detailed calculations you may use our MS-Excel based CULTEC Stormwater Design Calculator at www.cultec.com or contact our Technical Department at 1-800-428-5832 for free design assistance.

Cost Estimate	Quantity	Cost	Total
Chambers (C)	_____ x	\$ _____ / Chamber =	= \$ _____
Stone (V_{st})	_____ x	\$ _____ / yd ³ m ³	= \$ _____
		Subtotal =	\$ _____
Cost per ft ³ (m ³)	= Subtotal ÷ Required Storage Volume (V_s)		= \$ _____

Some additional items required but not included are: manifold, polyethylene liner, and filter fabric.

System Sizing Calculations for Recharger® V8HD

Determine the Required Storage Volume (V_s)

Required Storage Volume (V_s) = Given

Determine the Desired Bed Width (W_{bd})

Desired Bed Width (W_{bd}) = Given

Determine the Number of Rows Wide the System Will Have (R)

Number of Rows Wide (R) R = ROUND DOWN (Desired Bed Width - (2 x Width of Additional Stone on Sidewalls of Stone Border)) ÷ Typical Center to Center Spacing

$$R = \text{ROUND DOWN } (W_{bd} - (2 \times W_{ab})) \div C_{sp}$$

Table 8

	Typical Center to Center Spacing (C_{sp})	Width of Additional Stone on Sidewalls of Stone Border - Outside of Design Unit (W_{ab})
Recharger® V8HD	5.5' 1.68 m	0.75' 0.23 m

Determine the Number of Starter and End Chambers Required (C_{se})

Number of Starter Units Required (S) S = Number of Rows Wide

$$S = R$$

Number of End Units Required (E) E = Number of Rows Wide

$$E = R$$

Total Number of Starter and End Units Required (C_{se}) C_{se} = Number of Starter Units Required + Number of End Units Required

$$C_{se} = S + E$$

Determine the Number of Intermediate Chambers Required (I)

Storage Provided by Starter and End Units (V_{se}) V_{se} = Total Number of Starter and End Units Required x Chamber and Stone Base Storage per Starter or End

$$V_{se} = C_{se} \times D_u$$

Storage Required by Intermediate Units (V_i) V_i = Required Storage Volume - Storage Provided by Starter and End Units

$$V_i = V_s - V_{se}$$

System Sizing Calculations for Recharger® V8HD - *continued*

Number of Intermediate Chambers Required (I) $I = \text{Storage Required by Intermediate Units} \div \text{Chamber and Stone Base Storage per Intermediate}$
 $= V_i \div D_u$

Table 9

	Bare Chamber Storage	Chamber and Stone Base Storage (D_u)		
		6" 152 mm	12" 305 mm	18" 457 mm
Recharger® V8SHD Starter or V8EHD End	39.78 ft ³ 1.13 m ³	60.84 ft ³ 1.72 m ³	65.88 ft ³ 1.87 m ³	70.92 ft ³ 2.01 m ³
Recharger® V8IHD Intermediate	65.09 ft ³ 1.84 m ³	99.56 ft ³ 2.82 m ³	107.81 ft ³ 3.05 m ³	116.06 ft ³ 3.29 m ³

This is an approximation only. Actual number of chambers required may be reduced when stone border storage and chamber length adjustments per row are calculated.

The Chamber and Stone Base Storages above are based on the installed chamber length, stone base as listed in the table, 6" (152 mm) stone above the unit and typical center to center spacing. Assumes 40% stone void.

Determine the Required Bed Area (A)

Bed Area (A) $A = (\text{Total Number of Starter and End Chambers} \times \text{Surface Area Required per Unit}) + (\text{Number of Intermediate Units Required} \times \text{Surface Area per Unit})$
 $A = (C_{se} \times A_c) + (I \times A_c)$

Table 10

	Typical Center to Center Spacing	Surface Area (A_c)
Recharger® V8SHD Starter or V8EHD End	5.5' 1.68 m	25.21 ft ² 2.34 m ²
Recharger® V8IHD Intermediate	5.5' 1.68 m	41.25 ft ² 3.83 m ²

Surface area per unit is based on the installed chamber length and typical center to center spacing. Chamber length adjustments per row are not calculated.

Determine the Stone Required (V_{st})

Quantity of Stone Required (V_{st}) $V_{st} = (\text{Total Number of Starter and End Chambers Required} \times \text{Stone Required per Chamber}) + (\text{Number of Intermediate Units Required} \times \text{Stone Required per Chamber})$
 $V_{st} = (C_{se} \times S_c) + (I \times S_c)$

System Sizing Calculations for Recharger® V8HD - *continued*

Table 11

	Stone Required per Chamber Based on Stone Foundation Depth (S_c)		
	6"	12"	18"
	152 mm	305 mm	457 mm
Recharger® V8SHD Starter or V8EHD End	1.95 yd ³ 1.49 m ³	2.42 yd ³ 1.85 m ³	2.88 yd ³ 2.20 m ³
Recharger® V8IHD Intermediate	3.19 yd ³ 2.44 m ³	3.95 yd ³ 3.02 m ³	4.72 yd ³ 3.61 m ³

Based on installed chamber length. Assumes stone base as listed in table above, 6" (152 mm) stone above the units and typical center to center spacing. Stone border requirements are not calculated above.

Table 12

	Min. Effective Depth Determined by Stone Base (D_c)		
	6"	12"	18"
	152 mm	305 mm	457 mm
Recharger® V8HD	3.67' 1.12 m	4.17' 1.27 m	4.67' 1.42 m

Based on stone base as listed, chamber height, and minimum fill requirements for paved, traffic application. The "Minimum Effective Depth" does not take into consideration any additional fill requirements or final grade materials above the 6" (152 mm) of stone above the units.

Additional Calculations for Recharger® V8HD

Once you have determined your bed layout (number of rows wide x number of chambers per row), you can then proceed to these calculations.

How to Calculate Bed Length (L_b)

Number of Intermediate Units per Row (I_r) $I_r = \text{Number of Intermediate Units Required} \div \text{Number of Rows}$

$$I_r = I \div R$$

Bed Length (L_b) $L_b = (2 \times \text{Installed Chamber Length of Starter Unit}) + (\# \text{ of Intermediate Chambers per Row} \times \text{Installed Chamber Length of Intermediate Unit}) + (2 \times \text{Stone Border Width})$

$$L_b = (2 \times L_{ui}) + (I_r \times L_{ui}) + (2 \times 1' (0.3 \text{ m}))$$

Table 13

	Installed Chamber Length (L_{ui})
Recharger® V8SHD Starter or V8EHD End	4.58' 1.40 m
Recharger® V8IHD Intermediate	7.5' 2.29 m

A typical stone border is 1' (0.3 m) wide around the perimeter of the chamber bed.

How to Calculate Bed Width (W_b)

Bed Width (W_b) $W_b \text{ U.S.} = (\# \text{ of Rows Wide} \times \text{Min. Center to Center Spacing}) + [2 ((12'' - \text{Min. Chamber Spacing Between Rows})/12)]$

$$W_b \text{ U.S.} = (R \times D_{uw}) + [2((12'' - C_{sp})/12)]$$

$W_b \text{ Metric} = (\# \text{ of Rows Wide} \times \text{Min. Center to Center Spacing}) + [(2 \times 305 \text{ mm}) - \text{Min. Chamber Spacing Between Rows}]/1000]$

$$W_b \text{ Metric} = (\# \text{ of Chambers Wide} \times D_{uw}) + [(2 \times 305 \text{ mm}) - C_{sp}]/1000]$$

Table 14

	Min. Center to Center Spacing (D_{uw})	Min. Chamber Spacing Between Rows (C_{sp})
Recharger® V8HD	5.5' 1.68 m	6" 152 mm

How to Calculate Actual Bed Area (A_a)

Actual Bed Area (A_a) $A_a = \text{Bed Length} \times \text{Bed Width}$

$$A_a = L_b \times W_b$$

Additional Calculations for Recharger[®] V8HD - *continued*

How to Calculate Filter Fabric Required (F_b)

Filter Fabric Required (F_b) $F_b = [((\text{Bed Width} \times \text{Min. Effective Depth}) \times 2 \text{ Endwalls}) + ((\text{Bed Length} \times \text{Min. Effective Depth}) \times 2 \text{ Sidewalls}) + (\text{Actual Bed Area} \times 2 \text{ layers})] + 15\% \text{ for waste}$

$$F_b = [(W_b \times D_c) \times 2] + [(L_b \times D_c) \times 2] + (A_a \times 2) + 15\%$$

This calculates Filter Fabric for top, sides and bottom of system. Filter Fabric is mandatory for the top and sides of the storm-water system; it is recommended for the bottom of the system.

How to Calculate CULTEC No. 20L Polyethylene Liner Required (P)

CULTEC No. 20L[™] Polyethylene Liner Required (P) P *For internal manifold on one side only* = Bed Width

P *For internal manifold on one side only* = W_b

P *For internal manifold on two sides* = 2 x Bed Width

P *For internal manifold on two sides* = 2 x W_b

This is based on a 6' (1.83 m) wide roll. Calculates liner runs at 6' (1.83 m) wide and spanning the width of the bed.

How to Calculate HVLV Feed Connectors Required (H)

HVLV[™] Feed Connectors Required (H) H *For internal manifold on one side only* = Number of Rows Wide - 1

H *For internal manifold on one side only* = $R - 1$

H *For internal manifold on two sides* = (2 x Number of Rows Wide) - 2

H *For internal manifold on two sides* = (2 x R) - 2

CULTEC Recharger® V8HD Stormwater System Worksheet

Project: _____

Location: _____

Calculated By: _____

CULTEC Chamber model proposed for this design: Recharger V8HD

Date: _____

System Requirements	Calculation	Circle Unit of Measure
Required Storage Volume (V_s)	= Given = _____	ft ³ m ³
Desired Bed Width (W_{bd})	= Given = _____	ft m
Number of Rows Wide (R)	= ROUND DOWN ($W_{bd} - (2 \times W_{ab})$) ÷ C_{sp} (See Table 8, pg. 9) = ROUND DOWN (_____ $W_{bd} - (2 \times$ _____ $W_{ab})$) ÷ _____ C_{sp}	Rows
Number of Starter and End Chambers Required (C_{se})	= $2 \times R$ = $2 \times$ _____ R	pieces
Storage Provided by Starter and End Units (V_{se})	= $C_{se} \times D_u$ (See Table 9, pg. 10) = _____ $C_{se} \times$ _____ D_u	ft ² m ²
Storage Required by Intermediate Units (V_i)	= $V_s - V_{se}$ = _____ $V_s -$ _____ V_{se}	ft ² m ²
Number of Intermediate Chambers Required (I)	= $V_i \div D_u$ (See Table 9, pg. 10) = _____ $V_i \div$ _____ D_u	pieces
Required Bed Area (A)	= $(C_{se} \times A_c) + (I \times A_c)$ (See Table 10, pg. 10) = (_____ $C_{se} \times$ _____ A_c) + (_____ $I \times$ _____ A_c)	ft ² m ²
Stone Required (V_{st})	= $(C_{se} \times S_c) + (I \times S_c)$ (See Table 11, pg. 11) = (_____ $C_{se} \times$ _____ S_c) + (_____ $I \times$ _____ S_c)	yd ³ m ³

These are to be used as quick calculations only. Stone borders and chamber length adjustments are not calculated and will affect each system requirement. For more detailed calculations you may use our MS-Excel based CULTEC Stormwater Design Calculator at www.cultec.com or contact our Technical Department at 1-800-428-5832 for free design assistance.

Cost Estimate	Quantity	Cost	Total
Starter & End Chambers (C_{se})	_____ x	\$ _____ / Chamber =	= \$ _____
Intermediate Chambers (I)	_____ x	\$ _____ / Chamber =	= \$ _____
Stone (V_{st})	_____ x	\$ _____ / (circle one) yd ³ m ³	= \$ _____
		Subtotal	= \$ _____
Cost per ft ³ (m ³)	= Subtotal ÷ Required Storage Volume (V_s)		= \$ _____

Some additional items required but not included are: manifold, polyethylene liner, and filter fabric.



CULTEC

Chamber of Choice™

CULTEC, Inc.

878 Federal Road • P.O. Box 280 • Brookfield, CT 06804 USA
Phone: 203-775-4416 • Toll Free: 1-800-4-CULTEC • Fax: 203-775-1462
Web: www.cultec.com • E-mail: custservice@cultec.com

