MICRO-BIORETENTION VOLUME
MB-1

$Sv = [Af \times (d_{media} \times \eta_{media})] + (Af \times d_{ponding})$

Sv = Storgae Volume		
Surface Area (Af)	148	ft^2
Avg. Surface Area (Afav)	119.9	ft^2
Depth of Filter Media (d_{media})	2	ft
Filter Media Effective Porosity (η_{media})	0.4	
Max. Ponding Depth ($d_{ponding}$)	1	ft
Volume	243.92	ft^3

MB-1 VOLUME CALCULATION

MICRO-BIORETENTION VOLUME
MB-2

$Sv = SA_{bottom} \times [(d_{media} \times \eta_{media}) + (d_{gravel} \times \eta_{gravel})] + (SA_{average} \times d_{ponding})$

$Sv = [Afavg \times (d_{media} \times \eta_{media})] + (Af \times d_{ponding})$

Surface Area (Af)	148	ft^2
Avg. Surface Area (Afav)	105.2	ft^2
Depth of Filter Media (d_{media})	2	ft
Filter Media Effective Porosity (η_{media})	0.4	
Max. Ponding Depth ($d_{ponding}$)	1	ft
Volume	232.16	ft^3

MB-2 VOLUME CALCULATION

MICRO-BIORETENTION VOLUME
MB-3

$Sv = [Afavg \times (d_{media} \times \eta_{media})] + (Af \times d_{ponding})$

Surface Area (Af)	148	ft^2
Avg. Surface Area (Afav)	105.2	ft^2
Depth of Filter Media (d_{media})	2	ft
Filter Media Effective Porosity (η_{media})	0.4	
Max. Ponding Depth ($d_{ponding}$)	1	ft
Volume	232.16	ft^3

MB-3 VOLUME CALCULATION

MICRO-BIORETENTION VOLUME
MB-4

$Sv = [Afavg \times (d_{media} \times \eta_{media})] + (Af \times d_{ponding})$

Surface Area (Af)	148	ft^2
Avg. Surface Area (Afav)	104.8	ft^2
Depth of Filter Media (d_{media})	2	ft
Filter Media Effective Porosity (η_{media})	0.4	
Max. Ponding Depth ($d_{ponding}$)	1	ft
Volume	231.84	ft^3

MB-4 VOLUME CALCULATION

MICRO-BIORETENTION VOLUME
MB-5

$Sv = [Afavg \times (d_{media} \times \eta_{media})] + (Af \times d_{ponding})$

Surface Area (Af)	148	ft^2
Avg. Surface Area (Afav)	104.74	ft^2
Depth of Filter Media (d_{media})	2	ft
Filter Media Effective Porosity (η_{media})	0.4	
Max. Ponding Depth ($d_{ponding}$)	1	ft
Volume	231.792	ft^3

MB-5 VOLUME CALCULATION

MICRO-BIORETENTION VOLUME
MB-6

$Sv = [Afavg \times (d_{media} \times \eta_{media})] + (Af \times d_{ponding})$

Surface Area (Af)	166.7	ft^2
Avg. Surface Area (Afav)	132.35	ft^2
Depth of Filter Media (d_{media})	2	ft
Filter Media Effective Porosity (η_{media})	0.4	
Max. Ponding Depth ($d_{ponding}$)	1	ft
Volume	272.58	ft^3

MB-6 VOLUME CALCULATION

SUMMARY OF VOLUME PROVIDED

Micro Bioretention	Avg Width (Ft.)	Depth of Filter media (Ft)	Depth of Gravel Layer (Ft.)	Top Surface Area (SF)	Bottom Surface Area (SF)	Avg Surface Area (SF)	Maximum Ponding Depth (Ft.)	Volume Required CF (see SWM-4)	**Volume Provided (CF)**
MB-1	4	2	1.25	148	91.8	119.9	1	213	**244**
MB-2	4	2	1.25	148	62.4	105.2	1	213	**232**
MB-3	4	2	1.25	148	62.4	105.2	1	213	**232**
MB-4	4	2	1.25	148	61.6	104.8	1	213	**232**
MB-5	4	2	1.25	148	61.5	104.7	1	213	**232**
MB-6	4	2	1.25	166.7	98.0	132.4	1	213	**273**
TOTAL								1278	**1444**

SUMMARY OF VOLUME PROVIDED

M.A Design Group LLC
Consulting Engineers

USER: **MA**
DATE: 9/29/16
CHECKED BY:
PROJECT No.: **1401**
FILE: **SWMVOL**

Herena USA, 1622-1634 E Lombard Street

ENVIRONMENTAL SITE DESIGN CALCULATION (REDEVELOPMENT)

SITE INFORMATION

Site Area	**0.75 AC**	**(Property)**
Existing Imp. Area	0.74 AC	(94%)
Proposed Imp. Area	0.64 AC	(100%)
New Imp. Area (Proposed Imp. Area - Ex. Imp. Area)	-0.10 AC	
Redevelopment Imp. Area (1/2 Existing Imp. Area)	0.37 AC	
Total Imp. Area to Treat (A_T) = Redev. + New Imp.	**0.27 AC**	

Note: This is a redevelopment project because existing condition imperviousness (94%) is greater than 40% and land use is commercial so:
P_E = 1.00 in

In this case, Environmental Site Design volume (ESDv) and Water Quality Volume (WQv) are the same.

SITE AREA =	**0.75 AC**
IMPERVIOUS AREA =	**0.64 AC**
RAINFALL ZONE:	**Eastern**

WATER QUALITY VOLUME (WQv)

Area For WQv = 0.27 AC
I = PERCENT IMPERVIOUS AREA = 52.5%
P_E = 1.0 in
Rv = 0.05 + 0.009(I) = 0.818

WQv = (P)(Rv)(A)/12 = 0.018 AC-FT OR 0.82 IN **OR 802 FT3**

REQ'D WATER QUALITY VOLUME (WQv) = 802 CU FT

NOTE: NO Rev, Cpv, Qp, OR Qf REQUIRED FOR REDEVELOPMENT.

PROJECT ESD CALCULATION

ESD # 7121

Professional Certification: I hereby certify that these documents were prepared or approved by me, and that I am a duly licensed professional engineer under the laws of the State of Maryland.
License No. 21718 , Expiration Date: 2017-09-16

Architect
FIT Architects & Design Consultants
(434)260-1292
ftemelisso.fitadc@gmail.com

Civil / Structural
M.A Design Group LLC
Consulting Engineers
1705 Chester Mill Road
Silver Spring, MD 20906

MEP
SiTa Engineering,
1334 9th Street,
NW Suite 206
Washington DC, 20001

Owner / Client
Herena USA, LLC
210 E. Lexington Street
Baltimore, Maryland 21202

Herena USA
E. Lomabard Street
1622–1634 Lombard Street
922 S.Bethel Street
Baltimore, MD 21212

REV	DESCRIPTION	DATE
4	SWM–ES	05/20/2017
3	SWM–ES	09/29/2016
2	SWM–ES	08/15/2016
1	BID–SET	02/5/2016

REVISION HISTORY

STATE OF MARYLAND
MAMO ASSEFA
21718
PROFESSIONAL ENGINEER
05/31/17

Date: 02/5/2016
Project # 1501.01

STORMWATER MANAEGMENT CALCULATIONS

SWM–4

NOTE:
DO NOT SCALE DRAWINGS. CONTRACTORS SHALL VERIFY ALL DIMENSIONS BEFORE INSTALLATION.

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