STORMWATER MANAGEMENT REPORT

for

3446 Midway Road
DeKalb County, Georgia

CES No. 5121.00

Date: July 23, 2018

FOR REVIEW

Prepared for:
Ali Ihsan and Associates, LLC
401 Cook Drive
Ellenwood, Georgia 30294

Prepared by:

Columbia Engineering
LAND PLANNERS • CIVIL ENGINEERS • LANDSCAPE ARCHITECTS • SURVEYORS

2862 Buford Highway
Suite 200
Duluth, Georgia 30096

Table of Contents

Exhibits:

Appendices:

Introduction

The subject site is located at the southwest corner of Midway Road and Beech Drive, at 3446 Midway Road in Parcel 15-218-13-061, 15th District, Land Lot 218, Dekalb County, Georgia. See Exhibit A, Location Map. The 1.119-acre site is currently an unoccupied commercial building with driveway access from Midway Road and Beech Drive. The proposed development includes six single-family detached homes with associated parking, driveways, walking trails, gazebo, landscaping and stormwater management measures. Currently this site is going through rezoning from R-75 to RSM. Since this site has not been engineered, the Best Management Practice (BMP) measures selected have been preliminary designed to ensure these measures can be used to achieve the stormwater management goals for the site.

This report addresses Stormwater Quantity Management and Stormwater Quality Management for the development per DeKalb County requirements.

Stormwater Quantity Management

Existing Conditions:

The subject site is currently an unoccupied fire-damaged commercial building with driveways and trees. It was formerly used as a T-shirt factory.

The overall site has been separated into two (2) drainage basins – Drainage Basin #1 and Drainage Basin #2. The site is at the top of the drainage basin and therefore neither basins have offsite area. See Exhibit B, Existing Conditions Drainage Map.

The Drainage Basin #1 consists of 0.43 acres and drains in a southwesterly direction. This basin has 0.10 acres of existing impervious area, 0.01 acres of asphalt/gravel driveway mix area, and 0.14 acres of gravel/open space mix area. The remaining acreage is open space. This basin has a weighted Curve Number (CN) of 81 with a 5-minute time of concentration. This basin discharges to Cobbs Creek.

The Drainage Basin #2 consists of 0.69 acres and drains in an easterly direction towards Midway Road. This basin has 0.07 acres of existing impervious area and 0.18 acres of asphalt/gravel driveway mix area. The remaining acreage is open space. This basin has a weighted CN of 78 with a 5-minute time of concentration. This basin discharges to an unnamed tributary to Cobbs Creek and ultimately discharges to Cobbs Creek.

Post-Developed Conditions:

The proposed development consists of six single-family detached homes totaling 8,700 square feet. Vehicular access is proposed via a central private drive with a hammerhead shape. Open space areas around the homes are proposed to be enhanced with a walking trail, landscaping, a gazebo, and stormwater management measures. Time of concentration will remain the same from the existing conditions. For this analysis, the overall development has been considered to be 60% impervious and 40% pervious (open space.)

The post-developed site will have the same two (2) drainage basins – Drainage Basin #1 and Drainage Basin #2. Drainage Basin #1 consists of 0.43 acres, of which 0.26 acres is impervious area, with a weighted CN of 83. Drainage Basin #2 consists of 0.69 acres, of which 0.41 acres is impervious area, with a weighted CN of 83.

All of the post-development drainage basins ultimately discharges to Cobbs Creek. See Exhibit C, Post-Developed Conditions.

The proposed stormwater management measures has been preliminary designed to include water quality, channel protection, and flood protection.

Methodology:
The entire site consists of Group B Hydrologic Soil type. For the existing and post-developed conditions, the curve number (CN) for impervious areas was set at 98. The CN for the existing landscape area, considered to be open space in fair condition, was set at 69. The existing asphalt/gravel mix area has a CN of 92. The existing gravel/open space mix area has a CN of 82. The CN for post-developed landscaped areas, considered to be open space in good condition, was set at 74.

The rainfall events in inches are based on the 24-hour precipitation for the City of Atlanta and were obtained from the Georgia Stormwater Management Manual.

Stormwater Quality Management

Per the Georgia Stormwater Management Manual, the first flush runoff from all proposed disturbed areas should be treated in a water quality BMP measure. The Site Development Review Tool was used to evaluate the expected stormwater runoff quality from the proposed site design. The goal of using the Site Development Review Tool is to prepare a stormwater management system design that achieves either runoff reduction of the first one inch of rainfall or 80% reduction in the average annual total suspended solids (TSS) loading leaving the site from the 1.2-inch storm. For the purpose of this analysis, both the runoff reduction and 80% reduction in the average annual TSS where meet during the preliminary design. Below summarizes the target and achieved runoff reduction and water quality volume for both drainage basins.

Water Quality Analysis Summary

Drainage Basin	Total Runoff Reduction Storm (in)	Target Runoff Reduction Volume (cf)	Runoff Reduction Volume Achieved (cf)	Target Water Quality Volume (cf)	%TSS Removal Achieved
#1	1.00	921	921	1,105	100%
#2	1.00	1,464	1,464	1,757	100%
Total	**1.00**	**2,385**	**2,385**	**2,862**	**100%**

Drainage Basin #1 and #2 both have an increase in impervious; therefore, water quality (either runoff reduction or 80% TSS reduction) is required. Downspout Disconnect and Bioretention Areas BMP measures have been recommended for each drainage basin for this site to achieve the target water quality requirements. Downspout Disconnect is when the rooftop runoff from each house is spread across lawns from the downspouts to allow the water to slowly inflate into the soils. Bioretention Areas are landscaped areas that utilize engineered soils with vegetation to capture and treat runoff. By using both BMP measures in series, the water quality requirement has been meet for each drainage basin. See Exhibit D, Site Plan with BMP Measures. Also see the Appendices for the calculations and BMP measures information.

Results

The results of the Georgia Stormwater Management Manual Stormwater Quality Site Development Review Tool are summarized below showing that the post-developed runoff volume with the BMP measures will be less than the existing runoff volume for the 1 through 25-year storm events. Complete calculations are included in Appendix A.

Drainage Basin Summary Table

Drainage Basin	Existing Area (acres)	Post-Developed Area (acres)	Existing CN	Post-Developed CN	Existing Tc (min.)	Post-Developed Tc (min.)
#1	0.43	0.43	81	83	5	5
#2	0.69	0.69	78	83	5	5

Drainage Basin #1 Analysis Summary

Storm Event (years)	Existing Runoff Volume (in)	Post-Developed Runoff Volume without BMP (in)	Post-Developed Runoff Volume with BMP (in)
1	1.56	1.76	1.17
2	2.15	2.37	1.78
25	4.27	4.56	3.97
100	5.61	5.92	5.33

Drainage Basin #2 Analysis Summary

Storm Event (years)	Existing Runoff Volume (in)	Post-Developed Runoff Volume without BMP (in)	Post-Developed Runoff Volume with BMP (in)
1	1.39	1.75	1.16
2	1.95	2.37	1.78
25	4.00	4.55	3.96
100	5.31	5.91	5.33

Conclusion

The Site Development Review Tool includes the channel and flood protection calculations. As shown in the results table above, the post-developed runoff volume will be reduced using the BMP measures for the 1 through 25-year storm event for both basins. The 100-year storm event shows a 0.02-inch increase for Basin #2 only, but this additional volume will be handled through an oversized bioretention area.

We conclude that by treating the increase impervious areas of the 1.119-acre site with both the Downspout Disconnect and Bioretention Areas BMP measures in series, the target water quality volume will be achieved and the channel protection and flood protection volume will be reduced downstream.

EXHIBITS

LOCATION MAP

PARCEL ID 15-218-13-061,
15TH DISTRICT, LANDLOT 218,
DEKALB COUNTY, DECATUR, GEORGIA

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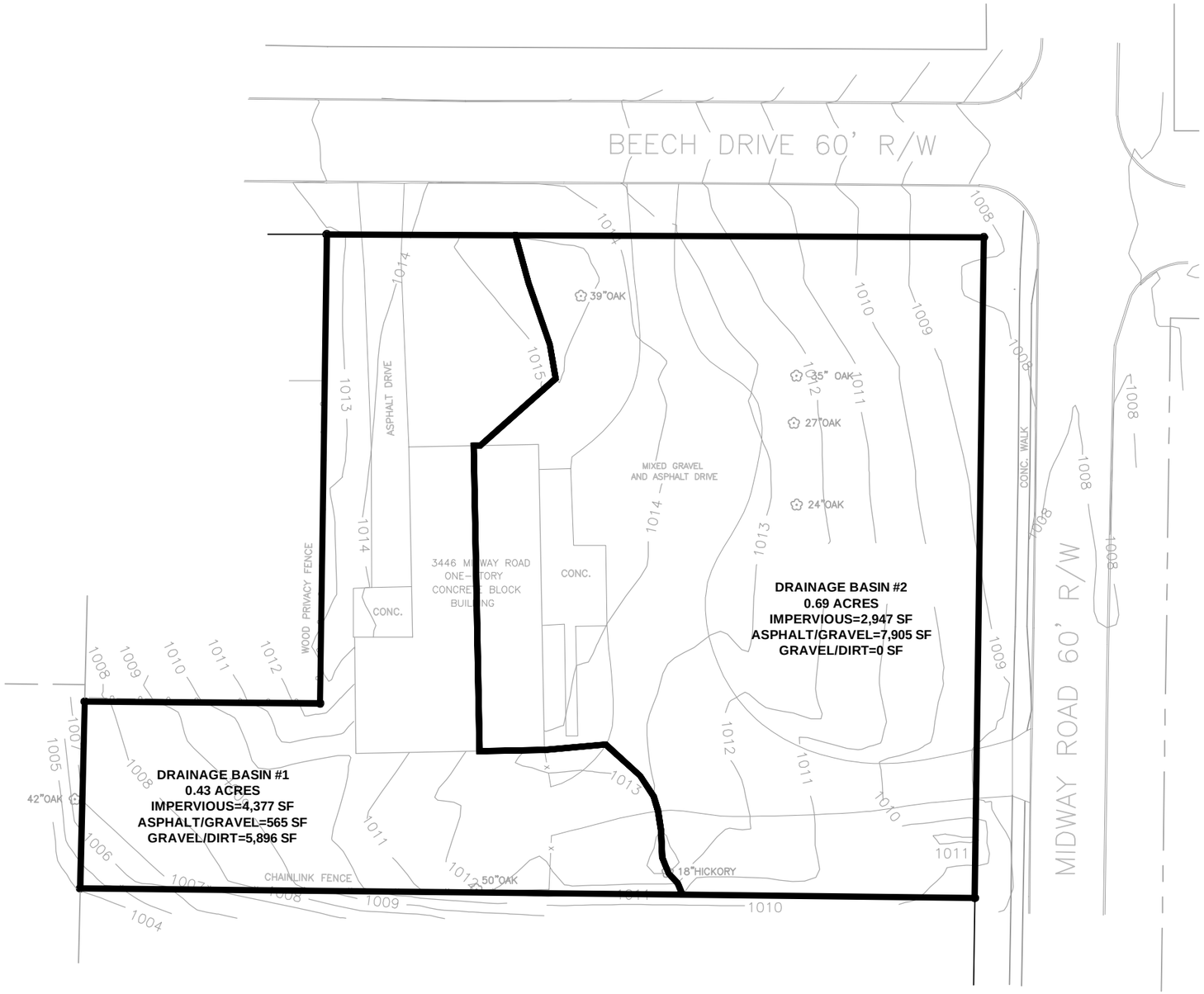
2862 BUFORD HIGHWAY
SUITE 200
DULUTH, GEORGIA 30096
(770) 925-0357

	CLIENT: ALI IHSAN & ASSOCIATES, LLC	SHEET NO.
	PROJECT NAME: 3446 MIDWAY ROAD	A
PROJECT NO.:5121.00	PROJECT LOCATION: 3446 MIDWAY ROAD	
DATE: 7/23/2018	SHEET TITLE: LOCATION MAP	



GRAPHIC SCALE

40 0 20 40 80 160

(IN FEET)
1 inch = 40 ft.

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STORMWATER EXHIBIT FOR

ALI IHSAN & ASSOCIATES, LLC

3446 MIDWAY ROAD
DECATUR, GEORGIA

REVISIONS	DATE

DRAWING TITLE

EXISTING CONDITIONS DRAINAGE MAP

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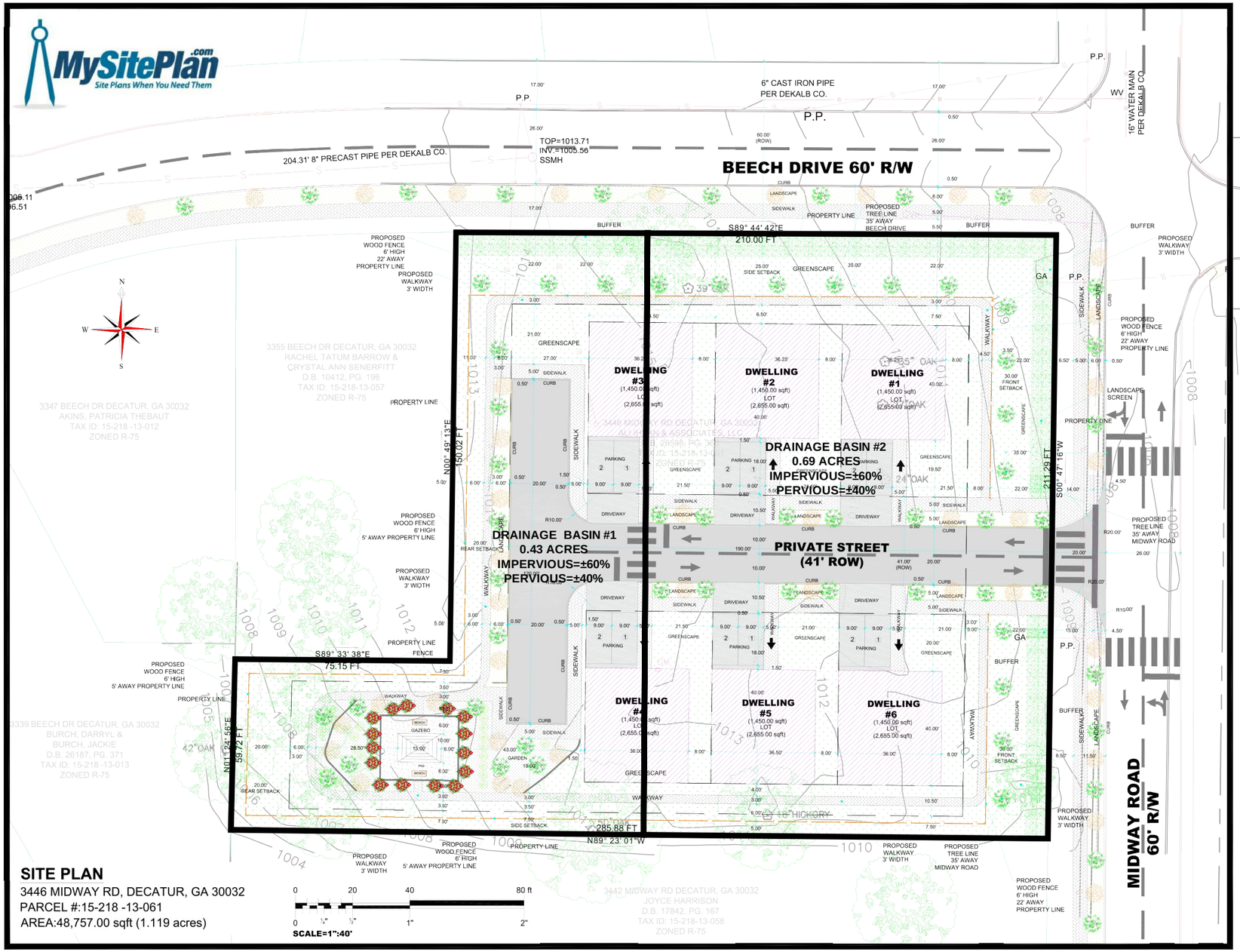
DATE:	7/23/18	EX B
PROJECT NO.	5121.00	



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3446 MIDWAY ROAD

DECATUR, GEORGIA

REVISIONS	DATE

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POST-DEVELOPED CONDITIONS DRAINAGE MAP

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DATE:	7/23/18	EX C
PROJECT NO.	5121.00	

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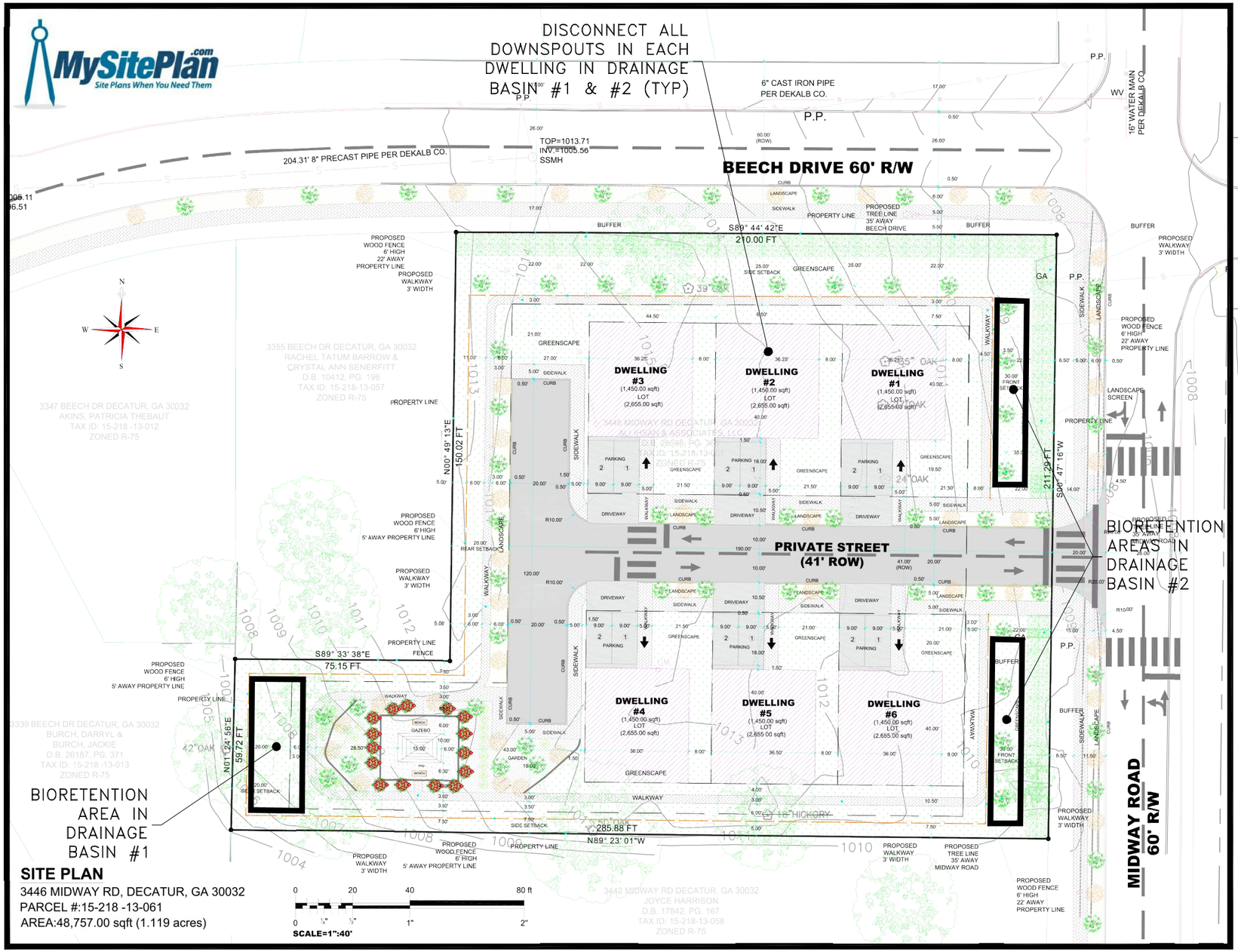

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STORMWATER EXHIBIT FOR

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3446 MIDWAY ROAD
DECATUR, GEORGIA

REVISIONS	DATE

DRAWING TITLE

SITE PLAN WITH BMP MEASURES

DWG FILE: Q:\5121.00\DWG\CIVIL\5121.00.DWG		
DRAWN BY:	GAF	DRAWING NO.
DATE:	7/23/18	EX D
PROJECT NO.	5121.00	

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APPENDIX A

Georgia Stormwater Management Manual
Stormwater Quality Site Development Review Tool
Version 2.2

General Information

Name of Developer:	Ali Ihsan & Associates	**Date Submitted:**	7/23/2018
Development Name:	3446 Midway Road	**Permit Number:**	Z-18-22025
Site Location / Address:	3446 Midway Road	**Developer Contact:**	Ali Alim Ihsan
	Decatur, GA	**Phone Number:**	
		Name of Engineer(s):	Kaysie Glazer, PE
Development Type:	Medium Density Residential	**Maintenance Responsibility:**	Owner

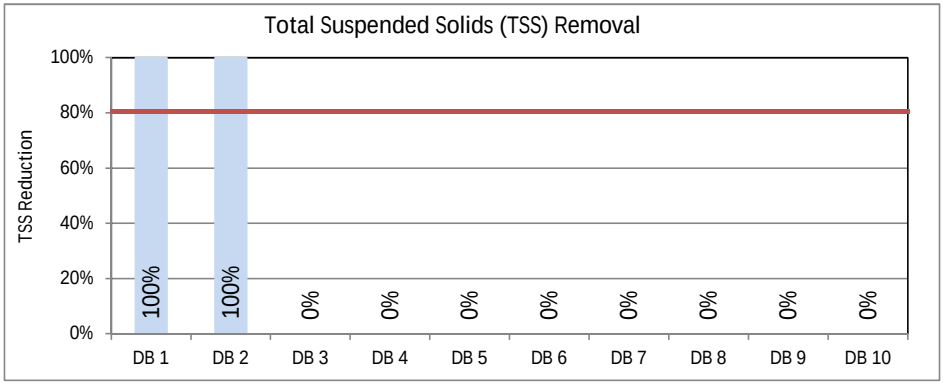
Site Summary

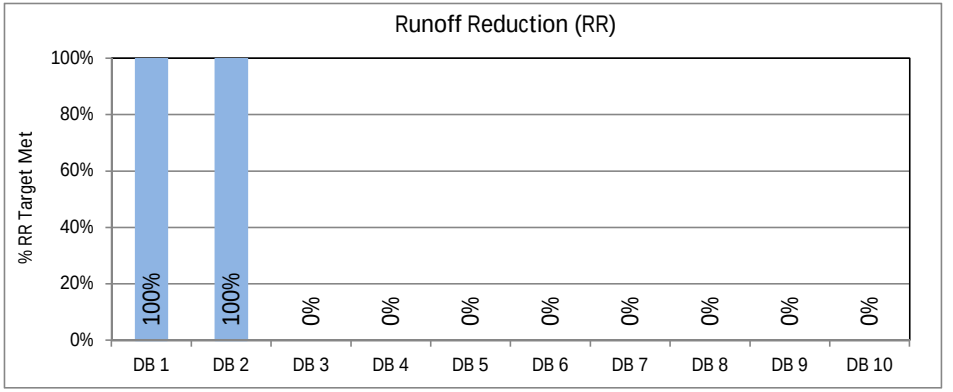
Total Pre-Development Area (ac):	**1.12**
Total Post-Development Area (ac):	**1.12**
Total Treated Area (ac):	**1.12**
Total Untreated Area (ac):	**0.00**

		I (ac)	P (ac)	CA (ac)
Drainage Basin #1	**DB 1**	0.26	0.17	0.00
Drainage Basin #2	**DB 2**	0.41	0.28	0.00
Drainage Basin 3	**DB 3**	0.00	0.00	0.00
Drainage Basin 4	**DB 4**	0.00	0.00	0.00
Drainage Basin 5	**DB 5**	0.00	0.00	0.00
Drainage Basin 6	**DB 6**	0.00	0.00	0.00
Drainage Basin 7	**DB 7**	0.00	0.00	0.00
Drainage Basin 8	**DB 8**	0.00	0.00	0.00
Drainage Basin 9	**DB 9**	0.00	0.00	0.00
Drainage Basin 10	**DB 10**	0.00	0.00	0.00
	TOTAL	**0.67**	**0.45**	**0.00**

I = Impervious Area, P = Pervious Area, CA = Conservation Area

Target Runoff Reduction Volume Achieved?	**Yes**
Target TSS Removal Achieved?	**Yes**
Total Target Runoff Reduction Volume (cf)	2,385
Runoff Reduction Volume Achieved (cf)	2,385
Total Target Water Quality Volume (cf)	2,862
% TSS Removal Achieved	100%





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Tracking #:		**Conditions of Approval:**	
Reviewed By:			
Date Approved:			

Georgia Stormwater Management Manual
Stormwater Quality Site Development Review Tool, v2.2

Development Name: 3446 Midway Road
Drainage Basin Name: Drainage Basin #1

data input cells
calculation cells
constant values

Site Data

Indicate Pre-Development Land Cover and Runoff Curve Numbers in the Site's Disturbed Area

Cover Type	HSG* A (acres)	CN	HSG B (acres)	CN	HSG C (acres)	CN	HSG D (acres)	CN	Total	% Cover
Impervious		98	0.10	98		98		98	0.10	23%
Open space - Fair condition (grass cover 50% to 75%)		49	0.18	69		79		84	0.18	42%
Select a land cover type…		0		0		0		0	0.00	0%
Select a land cover type…		0		0		0		0	0.00	0%
Select a land cover type…		0		0		0		0	0.00	0%
Asphalt(98)/Gravel(85) Mix			0.01	92					0.01	2%
Gravel(85)/Open Space(79) Mix			0.14	82					0.14	33%
Total	0.00		0.43		0.00		0.00		0.43	100%

*HSG = hydrologic soil group

Impervious (ac)	0.10
Weighted CN	81
Potential Max Soil Retention, S_{pre} (in)	2.42

Indicate Post-Development Land Cover and Runoff Curve Numbers in the Site's Disturbed Area

Cover Type	HSG A (acres)	CN	HSG B (acres)	CN	HSG C (acres)	CN	HSG D (acres)	CN	Total	% Cover
Impervious		98	0.26	98		98		98	0.26	60%
Open space - Good condition (grass cover > 75%)		39	0.17	61		74		80	0.17	40%
Select a land cover type…		0		0		0		0	0.00	0%
Select a land cover type…		0		0		0		0	0.00	0%
Select a land cover type…		0		0		0		0	0.00	0%
Local Jurisdiction Input									0.00	0%
Other									0.00	0%
Total	0.00		0.43		0.00		0.00		0.43	100%

Impervious (ac)	0.26
Rv	0.59
Weighted CN	83
Potential Max Soil Retention, S_{post} (in)	2.02

Conservation Area Credits

Scenario 1: Natural Conservation Area **See the GSMM Volume 2, Section 2.3.3.3 for more information.*

☐ Check the box if a portion of the post-developed area is protected by a conservation easement or equivalent form of protection.

Area (ac) of development protected by a conservation easement or equivalent form of protection.

Note: The green cell will unlock if the Scenario 1 box above is checked

Scenario 2: Site Reforestation/Revegetation **See the GSMM Volume 2, Section 4.22 for more information.*

☐ Check the box if a portion of the post-developed area employs site reforestation/revegetation and is protected by a conservation easement or equivalent form of protection.

Area (ac) of development reforested/revegetated and protected by a conservation easement or equivalent form of protection.

Note: The green cell will unlock if the Scenario 2 box above is checked

Scenario 3: Soil Restoration **See the GSMM Volume 2, Section 4.23 for more information.*

☐ Check the box if a portion of the post-developed area employs soil restoration and is protected by a conservation easement or equivalent form of protection.

Area (ac) of development with restored soils and protected by a conservation easement or equivalent form of protection.

Note: The green cell will unlock if the Scenario 3 box above is checked

Scenario 4: Site Reforestation/Revegetation & Soil Restoration **See the GSMM Volume 2, Section 4.22 and 4.23 for more information.*

☐ Check the box if the same portion of the post-developed area employs site reforestation/revegetation and soil restoration, and is protected by a conservation easement or equivalent form of protection.

Area (ac) with restored soils in a reforested & revegetated area and protected by a conservation easement or equivalent form of protection.

Note: The green cell will unlock if the Scenario 4 box above is checked

Total Conservation Area Credit (acres) **0.00**

Georgia Stormwater Management Manual
Stormwater Quality Site Development Review Tool, v2.2

Development Name: 3446 Midway Road
Drainage Basin Name: Drainage Basin #1

data input cells
calculation cells
constant values

Water Quality Goals

Target Runoff Reduction Storm (in): 1.00

Total Site Area for Water Quality Volume (acres): 0.43
Target Runoff Reduction Volume (cf): 921
Target Water Quality Volume (cf): 1,105

Select BMPs for Runoff Reduction and Water Quality

		Area Draining to Each BMP			Storage Volume Provided by BMP (cf)	RR Conveyance Volume Provided by BMP (cf)	Down-stream BMP	Runoff Reduction Calculations						WQ Calculations	
		On-site Pervious Area (acres)	On-site Impervious Area (acres)	Offsite Area (acres)				RR Volume from Direct Drainage (cf)	RR Volume from Upstream Practices (cf)	Total RR Volume Received by BMP (cf)	Runoff Reduction %	RR Achieved (cf)	Remaining RR Volume (cf)	WQ_v from Direct Drainage (cf)	Effective TSS Removal %
BMP 1	Downspout Disconnect (A & B hydrologic soils)		0.08			276	BMP 2	276	0	276	50%	138	138	331	80%
BMP 2	Bioretention Basin (w/o underdrain)	0.17	0.18		800			645	138	783	100%	783	0	774	100%
BMP 3	Select a BMP…							0	0	0	N/A	0	0	0	N/A
BMP 4	Select a BMP…							0	0	0	N/A	0	0	0	N/A
BMP 5	Select a BMP…							0	0	0	N/A	0	0	0	N/A
BMP 6	Select a BMP…							0	0	0	N/A	0	0	0	N/A
BMP 7	Select a BMP…							0	0	0	N/A	0	0	0	N/A
BMP 8	Select a BMP…							0	0	0	N/A	0	0	0	N/A
BMP 9	Select a BMP…							0	0	0	N/A	0	0	0	N/A
BMP 10	Select a BMP…							0	0	0	N/A	0	0	0	N/A
	TOTAL	0.17	0.26	0.00				921				921		1,105	
	UNTREATED AREA (acres)	0.00	0.00												

Target Runoff Reduction Volume (cf)	921
Target Achieved?	Yes!
Remaining Runoff Reduction Volume (cf)	0

Target Water Quality Volume (cf)	1,105
% TSS Removal Achieved	100%
Target Achieved?	Yes!
Remaining TSS Removal %	0%

Georgia Stormwater Management Manual
Stormwater Quality Site Development Review Tool, v2.2

Development Name: 3446 Midway Road
Drainage Basin Name: Drainage Basin #1

data input cells
calculation cells
constant values

Channel and Flood Protection Calculations

	1-yr, 24-hr storm	2-yr, 24-hr storm	25-yr, 24-hr storm	100-yr, 24-hr storm
Target Rainfall Event (in)	3.36	4.08	6.48	7.92

	1-yr, 24-hr storm	2-yr, 24-hr storm	25-yr, 24-hr storm	100-yr, 24-hr storm
Pre-Development Runoff Volume (in)	1.56	2.15	4.27	5.61
Post Development Runoff Volume (in) with no BMPs	1.76	2.37	4.56	5.92
Post-Development Runoff Volume (in) with BMPs	1.17	1.78	3.97	5.33
Adjusted CN	**74**	**76**	**78**	**78**

*See Stormwater Management Standards to Determine Detention Requirements.

Comments

Georgia Stormwater Management Manual
Stormwater Quality Site Development Review Tool, v2.2

Development Name: 3446 Midway Road
Drainage Basin Name: Drainage Basin #2

data input cells
calculation cells
constant values

Site Data

Indicate Pre-Development Land Cover and Runoff Curve Numbers in the Site's Disturbed Area

Cover Type	HSG* A (acres)	CN	HSG B (acres)	CN	HSG C (acres)	CN	HSG D (acres)	CN	Total	% Cover
Impervious		98	0.07	98		98		98	0.07	10%
Open space - Fair condition (grass cover 50% to 75%)		49	0.44	69		79		84	0.44	64%
Select a land cover type…		0		0		0		0	0.00	0%
Select a land cover type…		0		0		0		0	0.00	0%
Select a land cover type…		0		0		0		0	0.00	0%
Asphalt(98)/Gravel(85) Mix			0.18	92					0.18	26%
Other									0.00	0%
Total	0.00		0.69		0.00		0.00		0.69	100%

*HSG = hydrologic soil group

Impervious (ac)	0.07
Weighted CN	78
Potential Max Soil Retention, S_{pre} (in)	2.83

Indicate Post-Development Land Cover and Runoff Curve Numbers in the Site's Disturbed Area

Cover Type	HSG A (acres)	CN	HSG B (acres)	CN	HSG C (acres)	CN	HSG D (acres)	CN	Total	% Cover
Impervious		98	0.41	98		98		98	0.41	60%
Open space - Good condition (grass cover > 75%)		39	0.28	61		74		80	0.28	40%
Select a land cover type…		0		0		0		0	0.00	0%
Select a land cover type…		0		0		0		0	0.00	0%
Select a land cover type…		0		0		0		0	0.00	0%
Local Jurisdiction Input									0.00	0%
Other									0.00	0%
Total	0.00		0.69		0.00		0.00		0.69	100%

Impervious (ac)	0.41
Rv	0.59
Weighted CN	83
Potential Max Soil Retention, S_{post} (in)	2.03

Conservation Area Credits

Scenario 1: Natural Conservation Area **See the GSMM Volume 2, Section 2.3.3.3 for more information.*

☐ Check the box if a portion of the post-developed area is protected by a conservation easement or equivalent form of protection.

Area (ac) of development protected by a conservation easement or equivalent form of protection.

Note: The green cell will unlock if the Scenario 1 box above is checked

Scenario 2: Site Reforestation/Revegetation **See the GSMM Volume 2, Section 4.22 for more information.*

☐ Check the box if a portion of the post-developed area employs site reforestation/revegetation and is protected by a conservation easement or equivalent form of protection.

Area (ac) of development reforested/revegetated and protected by a conservation easement or equivalent form of protection.

Note: The green cell will unlock if the Scenario 2 box above is checked

Scenario 3: Soil Restoration **See the GSMM Volume 2, Section 4.23 for more information.*

☐ Check the box if a portion of the post-developed area employs soil restoration and is protected by a conservation easement or equivalent form of protection.

Area (ac) of development with restored soils and protected by a conservation easement or equivalent form of protection.

Note: The green cell will unlock if the Scenario 3 box above is checked

Scenario 4: Site Reforestation/Revegetation & Soil Restoration **See the GSMM Volume 2, Section 4.22 and 4.23 for more information.*

☐ Check the box if the same portion of the post-developed area employs site reforestation/revegetation and soil restoration, and is protected by a conservation easement or equivalent form of protection.

Area (ac) with restored soils in a reforested & revegetated area and protected by a conservation easement or equivalent form of protection.

Note: The green cell will unlock if the Scenario 4 box above is checked

Total Conservation Area Credit (acres) **0.00**

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Stormwater Quality Site Development Review Tool, v2.2

Development Name: 3446 Midway Road
Drainage Basin Name: Drainage Basin #2

data input cells
calculation cells
constant values

Water Quality Goals

Target Runoff Reduction Storm (in): 1.00

Total Site Area for Water Quality Volume (acres)	0.69
Target Runoff Reduction Volume (cf)	1,464
Target Water Quality Volume (cf)	1,757

Select BMPs for Runoff Reduction and Water Quality

		Area Draining to Each BMP			Storage Volume Provided by BMP (cf)	RR Conveyance Volume Provided by BMP (cf)	Down-stream BMP	Runoff Reduction Calculations						WQ Calculations	
		On-site Pervious Area (acres)	On-site Impervious Area (acres)	Offsite Area (acres)				RR Volume from Direct Drainage (cf)	RR Volume from Upstream Practices (cf)	Total RR Volume Received by BMP (cf)	Runoff Reduction %	RR Achieved (cf)	Remaining RR Volume (cf)	WQ_v from Direct Drainage (cf)	Effective TSS Removal %
BMP 1	Downspout Disconnect (A & B hydrologic soils)		0.12			414	BMP 2	414	0	414	50%	207	207	497	80%
BMP 2	Bioretention Basin (w/o underdrain)	0.28	0.29		1,300			1,050	207	1,257	100%	1,257	0	1,260	100%
BMP 3	Select a BMP…							0	0	0	N/A	0	0	0	N/A
BMP 4	Select a BMP…							0	0	0	N/A	0	0	0	N/A
BMP 5	Select a BMP…							0	0	0	N/A	0	0	0	N/A
BMP 6	Select a BMP…							0	0	0	N/A	0	0	0	N/A
BMP 7	Select a BMP…							0	0	0	N/A	0	0	0	N/A
BMP 8	Select a BMP…							0	0	0	N/A	0	0	0	N/A
BMP 9	Select a BMP…							0	0	0	N/A	0	0	0	N/A
BMP 10	Select a BMP…							0	0	0	N/A	0	0	0	N/A
	TOTAL	0.28	0.41	0.00				1,464				1,464		1,757	
	UNTREATED AREA (acres)	0.00	0.00												

Target Runoff Reduction Volume (cf)	1,464
Target Achieved?	Yes!
Remaining Runoff Reduction Volume (cf)	0

Target Water Quality Volume (cf)	1,757
% TSS Removal Achieved	100%
Target Achieved?	Yes!
Remaining TSS Removal %	0%

Georgia Stormwater Management Manual
Stormwater Quality Site Development Review Tool, v2.2

Development Name: 3446 Midway Road
Drainage Basin Name: Drainage Basin #2

data input cells
calculation cells
constant values

Channel and Flood Protection Calculations

	1-yr, 24-hr storm	2-yr, 24-hr storm	25-yr, 24-hr storm	100-yr, 24-hr storm
Target Rainfall Event (in)	3.36	4.08	6.48	7.92

	1-yr, 24-hr storm	2-yr, 24-hr storm	25-yr, 24-hr storm	100-yr, 24-hr storm
Pre-Development Runoff Volume (in)	1.39	1.95	4.00	5.31
Post Development Runoff Volume (in) with no BMPs	1.75	2.37	4.55	5.91
Post-Development Runoff Volume (in) with BMPs	1.16	1.78	3.96	5.33
Adjusted CN	**74**	**76**	**77**	**78**

*See Stormwater Management Standards to Determine Detention Requirements.

Comments

APPENDIX B

4.2 Bioretention Areas

Description: Shallow stormwater basin or landscaped area that utilizes engineered soils or native, well-draining soil and vegetation to capture and treat runoff.

LID/GI Consideration: Low land requirement, adaptable to many situations, and often a small BMP used to treat runoff close to the source.

KEY CONSIDERATIONS

DESIGN CRITERIA

- Maximum contributing drainage area of 5 acres
- Treatment area consists of ponding area, organic/mulch layer, planting media, and vegetation
- Requires landscaping plan
- Standing water has a maximum drain time of 24 hours
- Pretreatment recommended to prevent clogging of underdrains or native soil
- Ponding depth should be a maximum of 12 inches, preferably 9 inches

ADVANTAGES / BENEFITS

- Applicable to small drainage areas
- Effective pollutant removals
- Appropriate for small areas with high impervious cover, particularly parking lots
- Natural integration into landscaping for urban landscape enhancement
- Good retrofit capability
- Can be planned as an aesthetic feature and meet local planting requirements

DISADVANTAGES / LIMITATIONS

- Requires landscaping
- Not recommended for areas with steep slopes
- Medium to high capital cost
- Medium cost maintenance burden
- Soils may clog over time (may require cleaning or replacing)

MAINTENANCE REQUIREMENTS

- Inspect and repair or replace treatment area components such as mulch, plants, and scour protection, as needed
- Ensure bioretention area is draining properly so it does not become a breeding ground for mosquitos
- Remove trash and debris
- Ensure mulch is 3-4 inches thick in the practice
- Requires plant maintenance plan

POLLUTANT REMOVAL

- 85% **Total Suspended Solids**
- 95% **Metals** - Cadmium, Copper, Lead, and Zinc removal
- 80/60% **Nutrients** - Total Phosphorus / Total Nitrogen removal
- 90% **Pathogens** – Fecal Coliform

STORMWATER MANAGEMENT SUITABILITY

- ✓ Runoff Reduction
- ✓ Water Quality
- ★ Channel Protection
- ★ Overbank Flood Protection
- ★ Extreme Flood Protection

✓ suitable for this practice
★ may provide partial benefits

IMPLEMENTATION CONSIDERATIONS

- L Land Requirement
- M/H Capital Cost
- M Maintenance Burden

Residential Subdivision Use: *Yes*
High Density/Ultra-Urban: *Yes*
Roadway Projects: *Yes*

Soils: *Engineered soil media is composed of sand, fines, and organic matter*

Other Considerations: Use of native plants is recommended

L=Low M=Moderate H=High

RUNOFF REDUCTION CREDIT

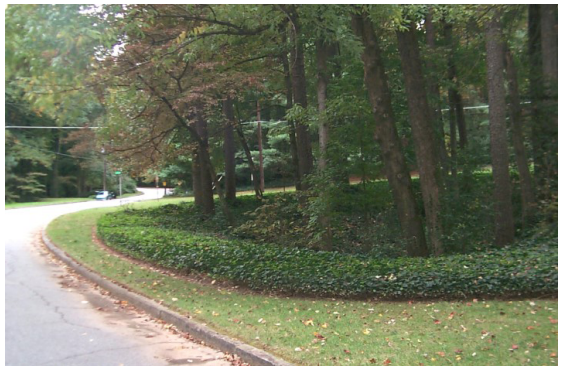
- 100% of the runoff reduction volume provided (no underdrain)
- 75% of the runoff reduction volume provided (upturned underdrain system)
- 50% of the runoff reduction volume provided (underdrain)

4.2.1 General Description

Bioretention areas are structural stormwater controls that capture and infiltrate, or at least temporarily store the water quality volume (WQ_v) using soils and vegetation in shallow basins or landscaped areas.

Bioretention areas are engineered controls that convey runoff to the "treatment area," which consists of a ponding area, organic or mulch layer, planting soil, and vegetation. If the native soils are adequate, the captured stormwater runoff will infiltrate into the surrounding soils. If not, the filtered runoff is typically collected and returned to the conveyance system, through an underdrain system. Bioretention areas slightly differ from rain gardens in that they are an engineered structure that has a larger drainage area and may include an underdrain. For additional information of designing a Rain Garden in a residential lot, see the following website: https://www.atlantawatershed.org/greeninfrastructure/atlanta-residential-gi-nov-2012022013/

There are numerous design applications for bioretention areas including along highway and roadway drainage swales, within larger landscaped pervious areas, and as landscaped islands in impervious or high-density environments. A variety of bioretention areas are shown **Figure 4.2-1 through Figure 4.2-4.**



Left: **Figure 4.2-1** Landscaped Bioretention Area

Middle Left: **Figure 4.2-2** Landscaped Island

Bottom: **Figure 4.2-3** Bioretention Area near Parking Lot

Middle Right: **Figure 4.2-4** Bioretention Area after Storm

4.4 Downspout Disconnects

Figure 4.4.1 Downspout Disconnect
Source: (Center for Watershed Protection)

Description: Where site characteristics permit, downspout disconnects can be used to spread rooftop runoff from individual downspouts across lawns and other pervious areas, where it is slowed, filtered and allowed to infiltrate into the native soils.

LID/GI Considerations: If properly designed, downspout disconnects can provide measurable reductions in post-construction stormwater runoff rates, volumes and pollutant loads on development sites.

KEY CONSIDERATIONS

DESIGN CRITERIA

- Maximum length of flow path in contributing drainage areas is 75 feet
- Minimum length of flow path in pervious areas below downspout disconnects is 15 feet and equal to or greater than the length of the flow path in the contributing drainage area
- Maximum impervious rooftop drainage area to one disconnected downspout is 2,500 square feet
- Maximum slope of pervious area beneath the downspout is 6 percent
- Runoff must be conveyed as sheet flow from the downspout and across open areas to maintain proper disconnect
- Downspout disconnects should be designed to convey stormwater runoff away from buildings to prevent damage to building foundations

ADVANTAGES / BENEFITS

- Helps restore pre-development hydrology on development sites
- Reduces post-construction stormwater runoff rates, volumes and pollutant loads
- Relatively low construction cost and long-term maintenance burden
- Encourages groundwater recharge

DISADVANTAGES / LIMITATIONS

- Provides greater stormwater management benefits on sites with permeable soils (i.e., hydrologic soil group A and B soils)
- Level spreaders must be needed at the downspout to dissipate flow
- Clay soils or soils that have been compacted by construction equipment greatly reduce the effectiveness of this practice, and soil amendments may be needed

ROUTINE MAINTENANCE REQUIREMENTS

- Maintenance of areas receiving disconnected runoff is generally the same as that required for other lawn or landscaped areas.
- Areas receiving runoff should be protected from future compaction (e.g., by planting trees or shrubs along the perimeter).
- Gutters and downspouts should be kept clear of dirt, debris, vegetation, and other buildup.
- Downspout disconnects are often used in conjunction with other BMPs. Ensure that upstream and/or downstream BMPs are maintained in accordance with this manual.

POLLUTANT REMOVAL

- 60% **Total Suspended Solids**
- 40% **Metals** - Cadmium, Copper, Lead, and Zinc removal
- 25/25% **Nutrients** - Total Phosphorus / Total Nitrogen removal
- N/A **Pathogens** – Fecal Coliform

STORMWATER MANAGEMENT SUITABILITY

- ✓ Runoff Reduction
- ✓ Water Quality
- Channel Protection
- Overbank Flood Protection
- Extreme Flood Protection

✓ suitable for this practice
★ may provide partial benefits

IMPLEMENTATION CONSIDERATIONS

- L Land Requirement
- L Capital Cost
- L Maintenance Burden

Residential Subdivision Use: *Yes*
High Density/Ultra-Urban: *Not recommended*
Roadway Projects: *Not applicable*

Soils: *Disconnects should be directed over HSG A, B, or C (e.g., sands, sandy loams, loams).*

Other Considerations: Erosion and sediment control practices should not be located in vegetated areas receiving disconnected runoff. Construction vehicles and equipment should avoid areas receiving disconnected runoff to minimize disturbance and compaction.

L=Low M=Moderate H=High

RUNOFF REDUCTION CREDIT

- 50% of the RR_v conveyed to the practice (A & B hydrologic soils)
- 25% of the RR_v conveyed to the practice (C & D hydrologic soils)

4.4.1 General Description

As the name implies, a downspout disconnect is the most basic of all low impact development practices that can be used to "receive" rooftop runoff. Where site characteristics permit, they can be used to spread rooftop runoff from individual downspouts across lawns and other pervious areas, where it is slowed, filtered, and allowed to infiltrate into the soil. If properly designed, downspout disconnects can provide measurable reductions in post-construction stormwater runoff rates, volumes, and pollutant loads on development sites.

In order to use downspout disconnects to receive post-construction stormwater runoff, downspouts must be designed to discharge to a lawn or other pervious area (**Figure 4.4.2**). The pervious area located below the downspout disconnect should slope away from buildings and other impervious surfaces to prevent damage to building foundations and discourage rooftop runoff from entering the storm drain system.

The primary concern associated with a downspout disconnect (**Figure 4.4.3**) is the length of the flow path over the lawn or other pervious area below the disconnection point. To provide adequate residence time for stormwater runoff, the length of the flow path in the pervious area below a downspout disconnect should be equal to or greater than the length of the flow path of the contributing drainage area. If this cannot be accomplished, due to site characteristics or constraints, site planning and design teams should consider using other low impact development practices. A typical schematic for a downspout disconnect is shown in **Figure 4.4-3**.

Figure 4.4.2 Downspout Disconnects to Pervious Areas
(Source: Center for Watershed Protection)