BRIAR CHAPEL - TRANSECT ZONE
Frontage by Zone/Area

T3 Zone	Phase 6 N	Ph 7	Cumulative (LF)	Cumulative (%)
50,500 LF	5,000 LF	2,355 LF	7,355 LF	15%
T4a Zone	**Phase 6 N**	**Ph 7**	**Cumulative (LF)**	**Cumulative (%)**
30,000 LF	600 LF	3,440 LF	4,040 LF	13%
T4b Zone	**Phase 6 N**	**Ph 7**	**Cumulative (LF)**	**Cumulative (%)**
5,500 LF	00 LF	780 LF	780 LF	14%

Date Submitted April 12, 2013

McKIM & CREED

LETTER OF TRANSMITTAL

TO: NCDENR – DWQ 401 Unit	DATE: January 23, 2013
512 N Salisbury Street Archdale Building -9th Floor Raleigh, NC 27604	PROJECT NO: 2735-0090 TASK NO: EXP RE: Briar Chapel – Phase 7
ATTENTION: Ms. Annette Lucas	TRANSMITTAL NO: 1 PAGE 1 OF 1

WE ARE SENDING: ☐ Originals ☒ Prints ☐ Shop Drawings ☐ Samples
☐ Specifications ☒ Calculations ☐ Other -

Quantity	Drawing No.	Rev.	Description	Status
2			Stormwater Design Plans	G
2			Narrative & Supporting Calculations	G
2			Level Spreader/Vegetated Filter Strip O&M Agreement (1 Original, 1 copy)	G
2			Level Spreader/Vegetated Filter Strip Design Supplements	G

Issue Status Code: A. Preliminary B. Fabrication Only C. For Information D. Bid
E. Construction F. For Review & Comments G. For Approval H. See Remarks

REMARKS:

Annette,

Please find the enclosed documents for your review. Please let us know if you have any questions or comments. Thank you.

1730 Varsity Drive, Suite 500 Raleigh, NC 27606 919/233-8091 Fax 919/233-8031

Cc:

McKIM & CREED, INC.

Signed Gareth Avant

Gareth Avant, PE

401 NARRATIVE & SUPPORTING CALCULATIONS

Briar Chapel Development
Phase 7

Chatham County, North Carolina
January 24, 2013

Prepared for:

BRIAR CHAPEL™
by
Newland COMMUNITIES

NNP Briar Chapel, LLC
16 Windy Knoll Circle
Chapel Hill, North Carolina 27516

Prepared By:

McKIM&CREED

1730 Varsity Drive, Suite 500
Raleigh, North Carolina 27606
Phone: (919) 233.8091
Fax: (919) 233.8031

M&C Project No. 02735-0090

PROJECT DESCRIPITON

The purpose of the project is to construct water, sewer and roadway infrastructure to support 166 residential lots within the Briar Chapel development. This will be the first of several phases of construction in this proximity.

Based on the conditions of the approved 401 Water Quality Certification, NCDENR-DWQ will require runoff from the roads to be captured and treated for 85% TSS removal before being discharged into existing stream buffers. To meet this requirement, three temporary level spreader/vegetative filter strips will be constructed at various points of discharge around the site. In addition, a large portion of the runoff from this phase of construction will be directed to Wet Detention Pond #12 as approved under the Great Ridge Parkway Extension project (DWQ Project # 05-0732v25) on January 14, 2013.

Upon completion of the project's construction, the proposed public roads will be turned over to and maintained by NCDOT.

SITE DESCRIPTION

The project area is approximately 52.7 acres of disturbed area located within the BC South development area, adjacent to Great Ridge Parkway and near the Margaret B Pollard Middle School.

This portion of the development generally takes place on the north side of a ridge that bisects the site from north to south. The slopes in the site range from 5-20% in localized areas.

SOILS

According to the Chatham County Generalized Soil Survey, the soils located on the site are classified as Wedowee sandy loam, 2% to 15% slopes (WeB, WeC, WeD).

The following soil descriptions are associated with the soils found on the site:

> We(X) – Wedowee sandy loam soils are often found in piedmont uplands, along ridges and side slopes. Permeability is moderate and the soils are well drained. Soils have a low shrink/swell potential. The seasonal high water is generally more than 6.0 feet below the surface.

LEVEL SPREADER/VEGETATIVE FILTER STRIP DESIGN

Level spreaders/vegetative filter strips will be used in areas where future development will commence in a reasonably short period of time and larger devices would be cumbersome to site and build on a temporary basis. In addition, these devices will treat runoff from smaller drainage areas and will accept smaller flows.

Water quality flows were calculated using methods provided in the NC BMP Manual. For the proposed engineered level spreader/vegetated filter strip devices, the runoff was determined using a 1 in/hr rainfall. The outlet pipe to the level spreader was sized using the runoff. The overflow pipe for events larger than 1 in/hr was set at a higher outlet elevation to ensure that the flows are kept separate.

MAINTENANCE CONSIDERATIONS

The property owner shall be responsible for periodic inspection and maintenance of all temporary erosion control measures devices. Any measure that fails to function as intended shall be repaired immediately.

POINT PRECIPITATION FREQUENCY ESTIMATES FROM NOAA ATLAS 14

CHAPEL HILL 2 W, NORTH CAROLINA (31-1677) 35.9086 N 79.0794 W 462 feet

from "Precipitation-Frequency Atlas of the United States" NOAA Atlas 14, Volume 2, Version 3
G.M. Bonnin, D. Martin, B. Lin, T. Parzybok, M.Yekta, and D. Riley
NOAA, National Weather Service, Silver Spring, Maryland, 2004

Extracted: Wed Jan 20 2010

Confidence Limits | Seasonality | Location Maps | Other Info. | GIS data | Maps | Docs | Return to State Map

Precipitation Intensity Estimates (in/hr)

ARI* (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
1	4.93	3.94	3.28	2.25	1.40	0.84	0.60	0.36	0.21	0.12	0.07	0.04	0.03	0.02	0.01	0.01	0.01	0.01
2	5.81	4.64	3.89	2.69	1.69	1.01	0.72	0.43	0.25	0.15	0.09	0.05	0.03	0.03	0.02	0.01	0.01	0.01
5	6.70	5.36	4.52	3.21	2.06	1.25	0.89	0.53	0.32	0.19	0.11	0.06	0.04	0.03	0.02	0.02	0.01	0.01
10	7.38	5.90	4.98	3.61	2.35	1.43	1.03	0.62	0.37	0.22	0.12	0.07	0.04	0.03	0.02	0.02	0.01	0.01
25	8.11	6.46	5.46	4.04	2.69	1.66	1.20	0.73	0.44	0.25	0.15	0.08	0.05	0.04	0.03	0.02	0.02	0.01
50	8.62	6.86	5.79	4.36	2.95	1.85	1.34	0.82	0.50	0.29	0.16	0.09	0.06	0.04	0.03	0.02	0.02	0.02
100	9.07	7.21	6.07	4.65	3.20	2.02	1.48	0.91	0.56	0.32	0.18	0.10	0.06	0.05	0.03	0.02	0.02	0.02
200	9.44	7.49	6.30	4.90	3.44	2.20	1.63	1.01	0.62	0.35	0.20	0.11	0.07	0.05	0.03	0.03	0.02	0.02
500	9.85	7.79	6.54	5.21	3.73	2.43	1.82	1.14	0.71	0.40	0.22	0.12	0.08	0.06	0.04	0.03	0.02	0.02
1000	10.19	8.02	6.71	5.43	3.96	2.62	1.98	1.24	0.78	0.43	0.24	0.13	0.08	0.06	0.04	0.03	0.02	0.02

* These precipitation frequency estimates are based on a partial duration series. ARI is the Average Recurrence Interval.
Please refer to NOAA Atlas 14 Document for more information. NOTE: Formatting forces estimates near zero to appear as zero.

* Upper bound of the 90% confidence interval Precipitation Intensity Estimates (in/hr)

ARI** (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
1	5.39	4.31	3.59	2.46	1.53	0.92	0.65	0.39	0.23	0.13	0.08	0.04	0.03	0.02	0.01	0.01	0.01	0.01
2	6.36	5.08	4.26	2.94	1.85	1.11	0.79	0.47	0.28	0.16	0.09	0.05	0.03	0.03	0.02	0.01	0.01	0.01
5	7.31	5.86	4.94	3.51	2.25	1.37	0.97	0.58	0.34	0.20	0.12	0.06	0.04	0.03	0.02	0.02	0.01	0.01
10	8.06	6.44	5.43	3.94	2.56	1.57	1.12	0.68	0.40	0.23	0.13	0.07	0.05	0.04	0.02	0.02	0.02	0.01
25	8.83	7.04	5.95	4.41	2.93	1.82	1.31	0.79	0.48	0.27	0.16	0.09	0.05	0.04	0.03	0.02	0.02	0.01
50	9.38	7.48	6.31	4.75	3.22	2.02	1.47	0.89	0.54	0.31	0.17	0.10	0.06	0.05	0.03	0.02	0.02	0.02
100	9.89	7.85	6.62	5.07	3.49	2.22	1.62	0.99	0.60	0.34	0.19	0.11	0.07	0.05	0.03	0.02	0.02	0.02
200	10.32	8.18	6.88	5.35	3.75	2.41	1.78	1.09	0.67	0.38	0.21	0.12	0.07	0.06	0.04	0.03	0.02	0.02
500	10.78	8.52	7.15	5.69	4.08	2.66	1.99	1.23	0.76	0.43	0.24	0.13	0.08	0.06	0.04	0.03	0.02	0.02
1000	11.14	8.77	7.34	5.94	4.34	2.87	2.16	1.36	0.85	0.46	0.26	0.14	0.09	0.07	0.04	0.03	0.02	0.02

* The upper bound of the confidence interval at 90% confidence level is the value which 5% of the simulated quantile values for a given frequency are greater than.
** These precipitation frequency estimates are based on a partial duration series. ARI is the Average Recurrence Interval.
Please refer to NOAA Atlas 14 Document for more information. NOTE: Formatting prevents estimates near zero to appear as zero.

* Lower bound of the 90% confidence interval Precipitation Intensity Estimates (in/hr)

ARI** (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day

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from "Precipitation-Frequency Atlas of the United States" NOAA Atlas 14, Volume 2, Version 3
G.M. Bonnin, D. Martin, B. Lin, T. Parzybok, M.Yekta, and D. Riley
NOAA, National Weather Service, Silver Spring, Maryland, 2004

Extracted: Tue Jan 19 2010

Confidence Limits | Seasonality | Location Maps | Other Info. | GIS data | Maps | Docs | Return to State Map

Precipitation Frequency Estimates (inches)

ARI* (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
1	0.41	0.66	0.82	1.12	1.40	1.68	1.79	2.15	2.54	2.96	3.46	3.87	4.44	5.05	6.76	8.39	10.69	12.84
2	0.48	0.77	0.97	1.34	1.69	2.02	2.16	2.59	3.06	3.58	4.17	4.64	5.30	6.00	7.97	9.88	12.52	14.97
5	0.56	0.89	1.13	1.60	2.06	2.49	2.66	3.20	3.80	4.47	5.17	5.71	6.44	7.21	9.41	11.47	14.32	16.89
10	0.61	0.98	1.25	1.80	2.35	2.87	3.08	3.71	4.44	5.17	5.95	6.54	7.34	8.15	10.56	12.72	15.72	18.37
25	0.68	1.08	1.36	2.02	2.69	3.33	3.61	4.37	5.28	6.11	6.99	7.68	8.57	9.42	12.11	14.36	17.55	20.28
50	0.72	1.14	1.45	2.18	2.95	3.70	4.04	4.92	5.99	6.86	7.81	8.57	9.54	10.43	13.34	15.62	18.95	21.72
100	0.76	1.20	1.52	2.33	3.20	4.05	4.46	5.47	6.71	7.62	8.64	9.49	10.53	11.44	14.57	16.87	20.31	23.11
200	0.79	1.25	1.57	2.45	3.44	4.40	4.89	6.03	7.47	8.41	9.49	10.44	11.56	12.47	15.83	18.12	21.67	24.46
500	0.82	1.30	1.64	2.60	3.73	4.86	5.46	6.80	8.53	9.50	10.66	11.73	12.96	13.87	17.55	19.80	23.46	26.21
1000	0.85	1.34	1.68	2.72	3.96	5.23	5.93	7.44	9.43	10.35	11.58	12.76	14.06	14.97	18.89	21.09	24.83	27.53

* These precipitation frequency estimates are based on a partial duration series. ARI is the Average Recurrence Interval.
Please refer to NOAA Atlas 14 Document for more information. NOTE: Formatting forces estimates near zero to appear as zero.

* Upper bound of the 90% confidence interval Precipitation Frequency Estimates (inches)

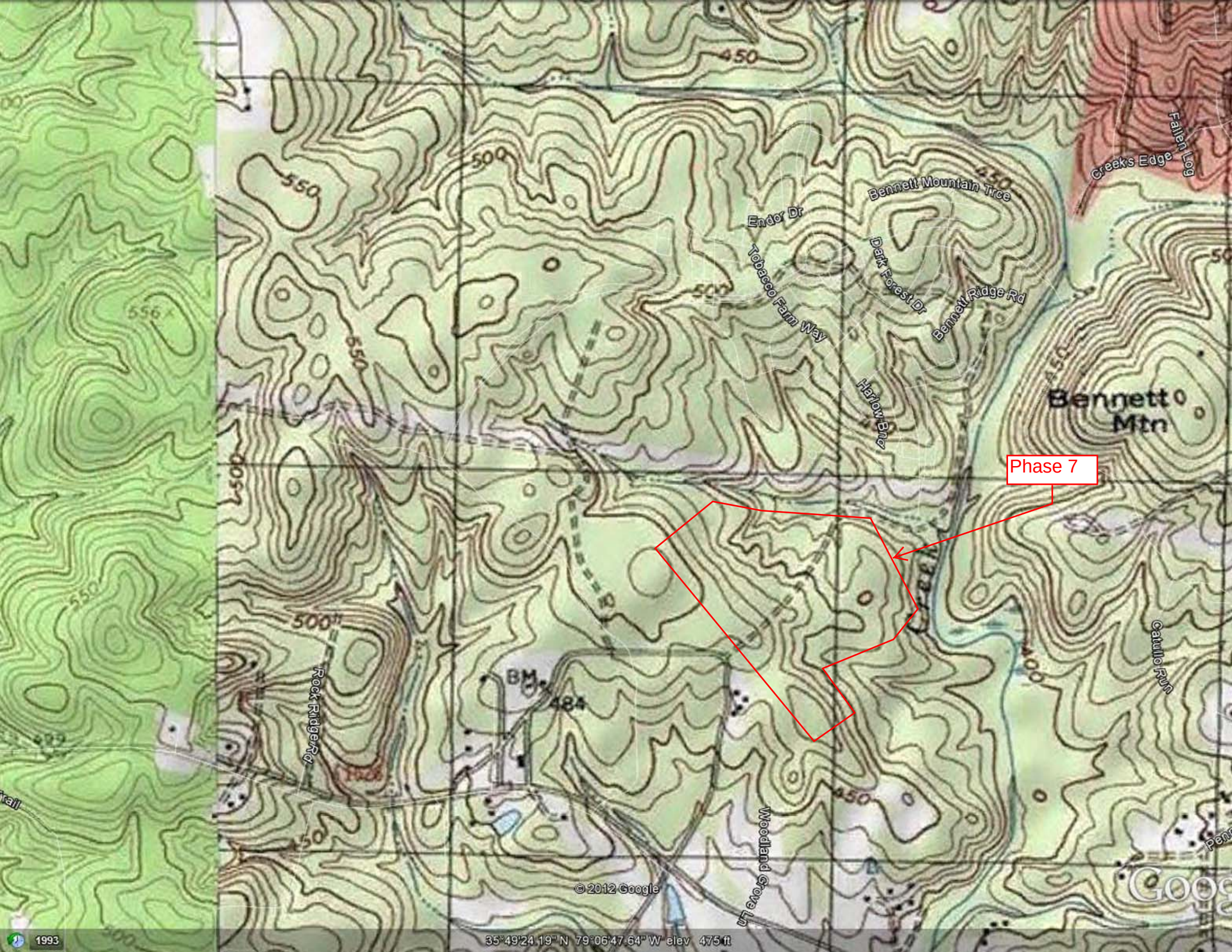
ARI** (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
1	0.45	0.72	0.90	1.23	1.53	1.84	1.96	2.35	2.77	3.16	3.70	4.14	4.73	5.37	7.14	8.87	11.24	13.44
2	0.53	0.85	1.06	1.47	1.85	2.22	2.37	2.83	3.34	3.82	4.46	4.96	5.64	6.38	8.43	10.42	13.15	15.68
5	0.61	0.98	1.23	1.75	2.25	2.73	2.92	3.50	4.15	4.77	5.53	6.09	6.86	7.66	9.95	12.10	15.04	17.69
10	0.67	1.07	1.36	1.97	2.56	3.14	3.37	4.05	4.83	5.51	6.36	6.99	7.82	8.66	11.17	13.41	16.51	19.25
25	0.74	1.17	1.49	2.20	2.93	3.64	3.94	4.76	5.73	6.54	7.47	8.22	9.14	10.02	12.82	15.15	18.44	21.26
50	0.78	1.25	1.58	2.38	3.22	4.04	4.41	5.35	6.47	7.34	8.35	9.19	10.19	11.11	14.14	16.50	19.92	22.80
100	0.82	1.31	1.66	2.53	3.49	4.43	4.87	5.94	7.25	8.17	9.27	10.19	11.26	12.21	15.48	17.85	21.39	24.28
200	0.86	1.36	1.72	2.68	3.75	4.82	5.34	6.56	8.06	9.03	10.19	11.22	12.38	13.33	16.86	19.21	22.85	25.73
500	0.90	1.42	1.79	2.84	4.08	5.32	5.96	7.39	9.20	10.21	11.47	12.65	13.91	14.86	18.72	21.04	24.81	27.63
1000	0.93	1.46	1.83	2.97	4.34	5.74	6.50	8.11	10.19	11.15	12.49	13.79	15.14	16.07	20.20	22.46	26.31	29.07

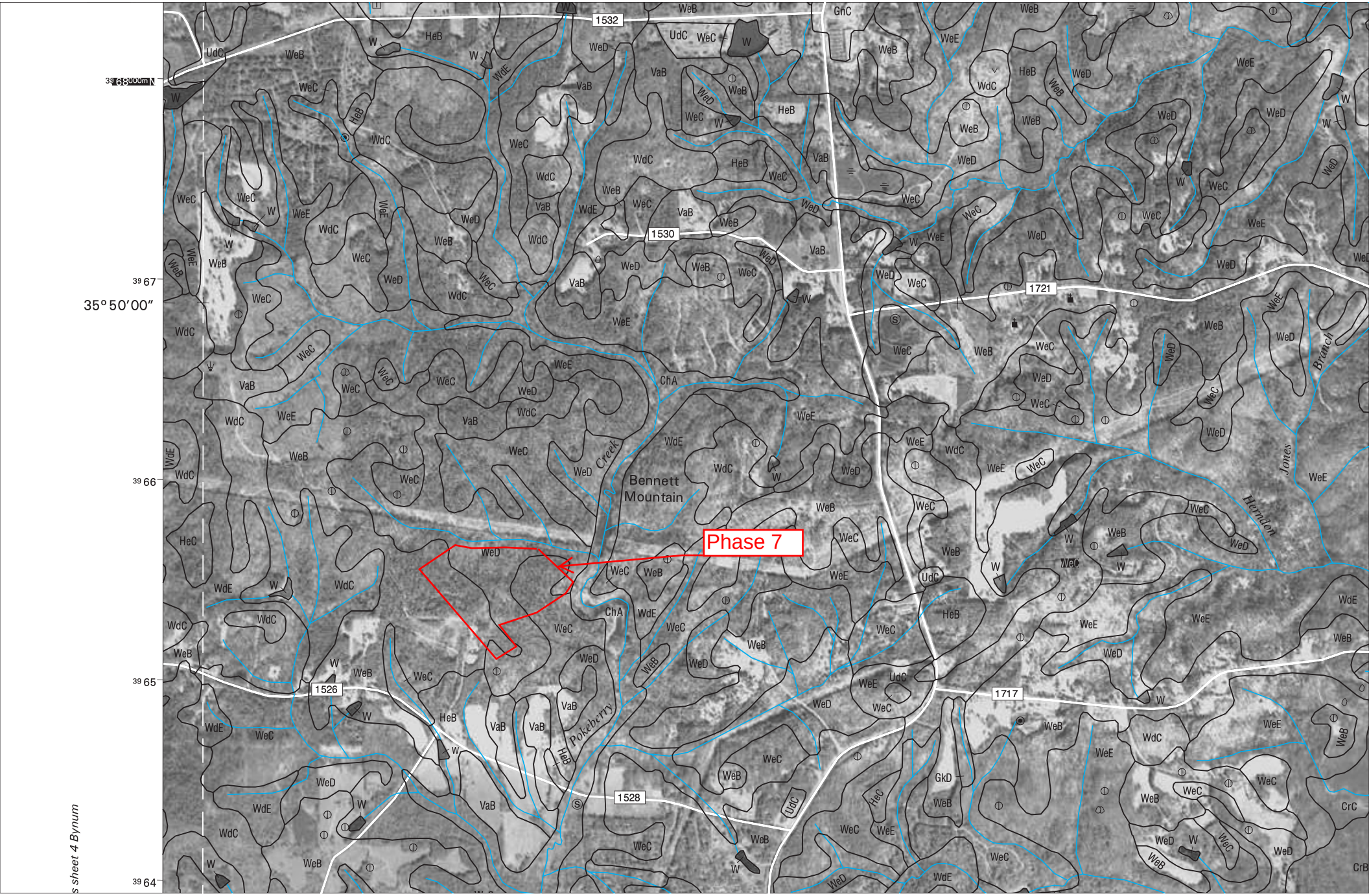
* The upper bound of the confidence interval at 90% confidence level is the value which 5% of the simulated quantile values for a given frequency are greater than.
** These precipitation frequency estimates are based on a partial duration series. ARI is the Average Recurrence Interval.
Please refer to NOAA Atlas 14 Document for more information. NOTE: Formatting prevents estimates near zero to appear as zero.

* Lower bound of the 90% confidence interval Precipitation Frequency Estimates (inches)

ARI** (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day

MAPS


Phase 7
Bennett Mtn
Bennett Mountain Trce
Creeks Edge
Fallen Log
Endor Dr
Tobacco Farm Way
Dark Forest Dr
Bennett Ridge Rd
Harlow Brae
Rock Ridge Rd
Woodland Grove Ln
Catullo Run
BM
484
© 2012 Google
1993
35°49'24.19" N 79°06'47.64" W elev 475 ft



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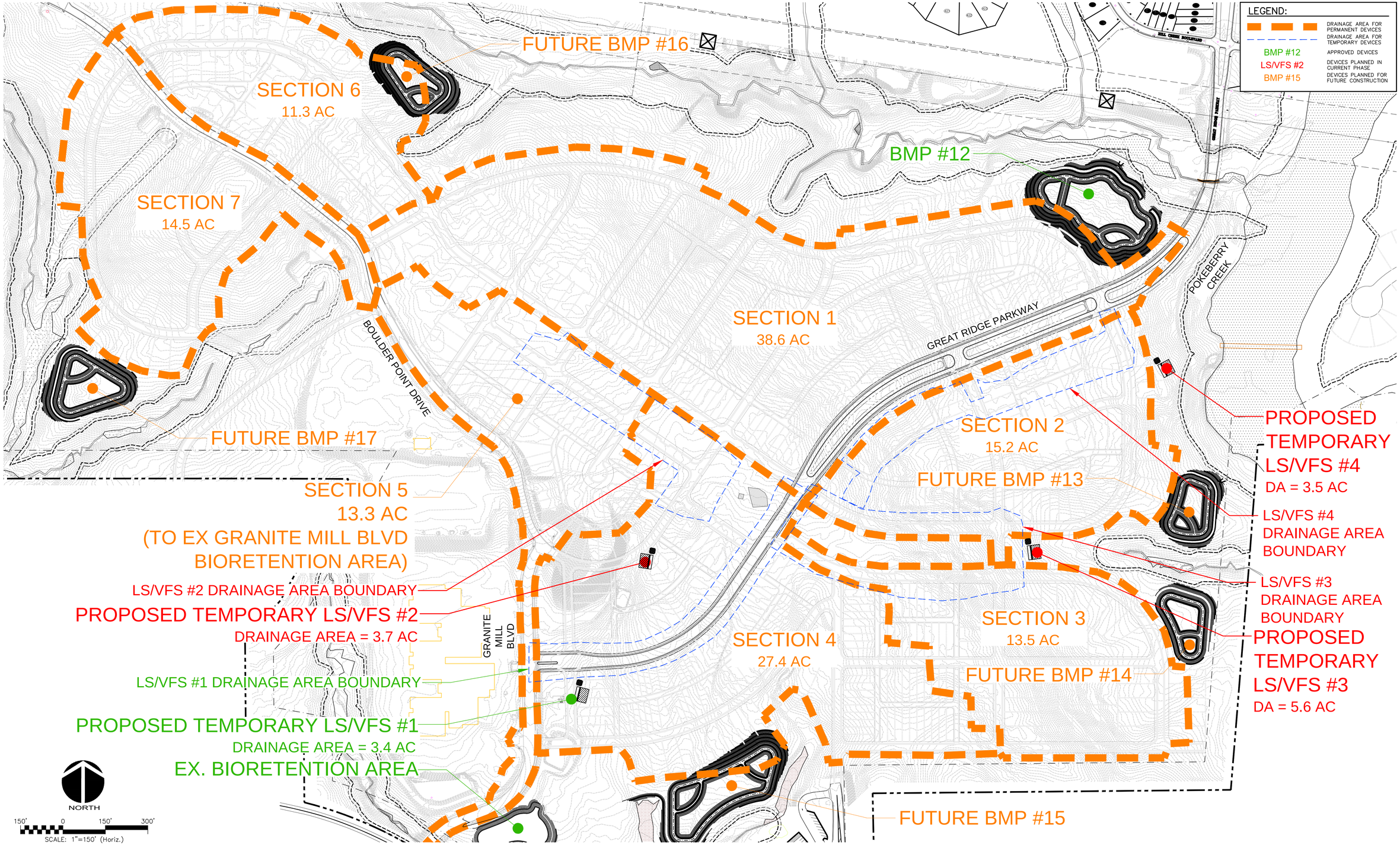


REV. NO.	DESCRIPTIONS	DATE
1	SUBMITTAL TO DWQ 401 UNIT FOR PHASE 7 PROJECT	2013.01.24
1	SUBMITTAL TO DWQ 401 UNIT FOR GREAT RIDGE PARKWAY EXTENSION PROJECT	2012.12.19

REVISIONS

SEAL

SEAL

McKIM&CREED
1730 Varsity Drive, Suite 500
Raleigh, North Carolina 27606
Phone: (919)233-8091, Fax: (919)233-8031
F-1222

www.mckimcreed.com

BRIAR CHAPEL™
by Newland COMMUNITIES

BRIAR CHAPEL
GREAT RIDGE PARKWAY EXTENSION
CHATHAM COUNTY, NORTH CAROLINA

BC SOUTH DRAINAGE AREA MAP

DATE:	DECEMBER 19, 2012
MCE PROJ. #	02735-0080
DRAWN	GCA
DESIGNED	GCA
CHECKED	CHS
PROJ. MGR.	CHS

SCALE
HORIZONTAL: 1" = 150'
VERTICAL: N/A

M&C FILE NUMBER: DA MAP
DRAWING NUMBER: MAP 1

STATUS: FOR PERMIT ONLY
REVISION: 1

LS/VFS DESIGN

BRIAR CHAPEL - PHASE 7

STORM DRAINAGE DESIGN SUMMARY TABLE

Upstream Node	Upstream Rim Elevation (ft)	Upstream Invert (ft)	HGL In (ft)	Downstream Node	Downstream Rim Elevation (ft)	Downstream Invert (ft)	HGL Out (ft)	Length (ft)	Slope (%)	Upstream Inlet Area (acres)	System CA (acres)	System Intensity (in/h)	Total System Flow (cfs)	Pipe Diameter (in)	Pipe Full Flow Capacity (cfs)	Average Velocity (ft/s)	Material	Manning's n	Flows to
CI-251	478.60	470.50	472.44	FES-250	475.00	470.90	471.96	48	0.008	0.14	2.63	1.00	2.50	24	20.65	4.45	RCP	0.013	LS/VFS #2
CI-301	452.12	439.60	442.34	FES-300	450.00	440.70	440.95	76	0.014	0.11	1.21	1.00	1.29	24	27.21	4.45	RCP	0.013	LS/VFS #3
SDMH-321	447.00	433.00	434.20	FES-320	437.00	432.00	432.88	42	0.024	(N/A)	1.36	1.00	1.44	18	16.21	5.66	RCP	0.013	LS/VFS #3
CB-351	436.64	429.40	430.52	FES-350	434.00	429.10	430.19	25	0.012	0.29	1.05	1.00	1.06	15	7.08	4.14	RCP	0.013	LS/VFS #4
CB-361	451.12	446.85	447.93	FES-360	450.00	446.65	447.67	23	0.009	0.22	0.88	1.00	0.88	15	6.02	3.51	RCP	0.013	LS/VFS #4

Permit Number:_____
(to be provided by DWQ)
Drainage Area Number:_____

Filter Strip, Restored Riparian Buffer and Level Spreader Operation and Maintenance Agreement

I will keep a maintenance record on this BMP. This maintenance record will be kept in a log in a known set location. Any deficient BMP elements noted in the inspection will be corrected, repaired or replaced immediately. These deficiencies can affect the integrity of structures, safety of the public, and the removal efficiency of the BMP.

Important maintenance procedures:

- Immediately after the filter strip is established, any newly planted vegetation will be watered twice weekly if needed until the plants become established (commonly six weeks).
- Once a year, the filter strip will be reseeded to maintain a dense growth of vegetation
- Stable groundcover will be maintained in the drainage area to reduce the sediment load to the vegetation.
- Two to three times a year, grass filter strips will be mowed and the clippings harvested to promote the growth of thick vegetation with optimum pollutant removal efficiency. Turf grass should not be cut shorter than 3 to 5 inches and may be allowed to grow as tall as 12 inches depending on aesthetic requirements (NIPC, 1993). Forested filter strips do not require this type of maintenance.
- Once a year, the soil will be aerated if necessary.
- Once a year, soil pH will be tested and lime will be added if necessary.

After the filter strip is established, it will be inspected **quarterly and within 24 hours after every storm event greater than 1.0 inch (or 1.5 inches if in a Coastal County).** Records of operation and maintenance will be kept in a known set location and will be available upon request.

Inspection activities shall be performed as follows. Any problems that are found shall be repaired immediately.

BMP element:	Potential problem:	How I will remediate the problem:
The entire filter strip system	Trash/debris is present.	Remove the trash/debris.
The flow splitter device (if applicable)	The flow splitter device is clogged.	Unclog the conveyance and dispose of any sediment off-site.
	The flow splitter device is damaged.	Make any necessary repairs or replace if damage is too large for repair.

BMP element:	Potential problem:	How I will remediate the problem:
The swale and the level lip	The swale is clogged with sediment.	Remove the sediment and dispose of it off-site.
	The level lip is cracked, settled, undercut, eroded or otherwise damaged.	Repair or replace lip.
	There is erosion around the end of the level spreader that shows stormwater has bypassed it.	Regrade the soil to create a berm that is higher than the level lip, and then plant a ground cover and water until it is established. Provide lime and a one-time fertilizer application.
	Trees or shrubs have begun to grow on the swale or just downslope of the level lip.	Remove them.
The bypass channel	Areas of bare soil and/or erosive gullies have formed.	Regrade the soil if necessary to remove the gully, and then reestablish proper erosion control.
	Turf reinforcement is damaged or ripap is rolling downhill.	Study the site to see if a larger bypass channel is needed (enlarge if necessary). After this, reestablish the erosion control material.
The filter strip	Grass is too short or too long (if applicable).	Maintain grass at a height of approximately three to six inches.
	Areas of bare soil and/or erosive gullies have formed.	Regrade the soil if necessary to remove the gully, and then plant a ground cover and water until it is established. Provide lime and a one-time fertilizer application.
	Sediment is building up on the filter strip.	Remove the sediment and restabilize the soil with vegetation if necessary. Provide lime and a one-time fertilizer application.
	Plants are desiccated.	Provide additional irrigation and fertilizer as needed.
	Plants are dead, diseased or dying.	Determine the source of the problem: soils, hydrology, disease, etc. Remedy the problem and replace plants. Provide a one-time fertilizer application.
	Nuisance vegetation is choking out desirable species.	Remove vegetation by hand if possible. If pesticide is used, do not allow it to get into the receiving water.
The receiving water	Erosion or other signs of damage have occurred at the outlet.	Contact the NC Division of Water Quality local Regional Office, or the 401 Oversight Unit at 919-733-1786.

Permit Number:_____
(to be provided by DWQ)

I acknowledge and agree by my signature below that I am responsible for the performance of the maintenance procedures listed above. I agree to notify DWQ of any problems with the system or prior to any changes to the system or responsible party.

Project name:Briar Chapel - Phase 7

BMP drainage area number: LS/VFS #2

Print name: Kevin Graham

Title: Vice President, Operations

Address:16 Windy Knoll Circle, Chapel Hill, NC 27516

Phone: (919) 951-0709

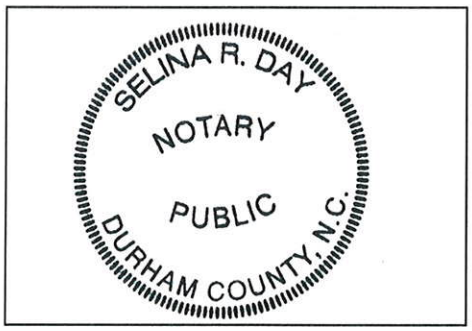
Signature: Kevin Graham

Date: 1/16/13

Note: The legally responsible party should not be a homeowners association unless more than 50% of the lots have been sold and a resident of the subdivision has been named the president.

I, Selina R. Day, a Notary Public for the State of North Carolina, County of Durham, do hereby certify that Kevin Graham personally appeared before me this 16 day of January, 2013, and acknowledge the due execution of the forgoing filter strip, riparian buffer, and/or level spreader maintenance requirements.

Witness my hand and official seal,



SEAL

My commission expires August 30, 2014

Permit Number:_____
(to be provided by DWQ)
Drainage Area Number:_____

Filter Strip, Restored Riparian Buffer and Level Spreader Operation and Maintenance Agreement

I will keep a maintenance record on this BMP. This maintenance record will be kept in a log in a known set location. Any deficient BMP elements noted in the inspection will be corrected, repaired or replaced immediately. These deficiencies can affect the integrity of structures, safety of the public, and the removal efficiency of the BMP.

Important maintenance procedures:

- Immediately after the filter strip is established, any newly planted vegetation will be watered twice weekly if needed until the plants become established (commonly six weeks).
- Once a year, the filter strip will be reseeded to maintain a dense growth of vegetation
- Stable groundcover will be maintained in the drainage area to reduce the sediment load to the vegetation.
- Two to three times a year, grass filter strips will be mowed and the clippings harvested to promote the growth of thick vegetation with optimum pollutant removal efficiency. Turf grass should not be cut shorter than 3 to 5 inches and may be allowed to grow as tall as 12 inches depending on aesthetic requirements (NIPC, 1993). Forested filter strips do not require this type of maintenance.
- Once a year, the soil will be aerated if necessary.
- Once a year, soil pH will be tested and lime will be added if necessary.

After the filter strip is established, it will be inspected **quarterly and within 24 hours after every storm event greater than 1.0 inch (or 1.5 inches if in a Coastal County)**. Records of operation and maintenance will be kept in a known set location and will be available upon request.

Inspection activities shall be performed as follows. Any problems that are found shall be repaired immediately.

BMP element:	Potential problem:	How I will remediate the problem:
The entire filter strip system	Trash/debris is present.	Remove the trash/debris.
The flow splitter device (if applicable)	The flow splitter device is clogged.	Unclog the conveyance and dispose of any sediment off-site.
	The flow splitter device is damaged.	Make any necessary repairs or replace if damage is too large for repair.

BMP element:	Potential problem:	How I will remediate the problem:
The swale and the level lip	The swale is clogged with sediment.	Remove the sediment and dispose of it off-site.
	The level lip is cracked, settled, undercut, eroded or otherwise damaged.	Repair or replace lip.
	There is erosion around the end of the level spreader that shows stormwater has bypassed it.	Regrade the soil to create a berm that is higher than the level lip, and then plant a ground cover and water until it is established. Provide lime and a one-time fertilizer application.
	Trees or shrubs have begun to grow on the swale or just downslope of the level lip.	Remove them.
The bypass channel	Areas of bare soil and/or erosive gullies have formed.	Regrade the soil if necessary to remove the gully, and then reestablish proper erosion control.
	Turf reinforcement is damaged or ripap is rolling downhill.	Study the site to see if a larger bypass channel is needed (enlarge if necessary). After this, reestablish the erosion control material.
The filter strip	Grass is too short or too long (if applicable).	Maintain grass at a height of approximately three to six inches.
	Areas of bare soil and/or erosive gullies have formed.	Regrade the soil if necessary to remove the gully, and then plant a ground cover and water until it is established. Provide lime and a one-time fertilizer application.
	Sediment is building up on the filter strip.	Remove the sediment and restabilize the soil with vegetation if necessary. Provide lime and a one-time fertilizer application.
	Plants are desiccated.	Provide additional irrigation and fertilizer as needed.
	Plants are dead, diseased or dying.	Determine the source of the problem: soils, hydrology, disease, etc. Remedy the problem and replace plants. Provide a one-time fertilizer application.
	Nuisance vegetation is choking out desirable species.	Remove vegetation by hand if possible. If pesticide is used, do not allow it to get into the receiving water.
The receiving water	Erosion or other signs of damage have occurred at the outlet.	Contact the NC Division of Water Quality local Regional Office, or the 401 Oversight Unit at 919-733-1786.

Permit Number:_____
(to be provided by DWQ)

I acknowledge and agree by my signature below that I am responsible for the performance of the maintenance procedures listed above. I agree to notify DWQ of any problems with the system or prior to any changes to the system or responsible party.

Project name:Briar Chapel - Phase 7

BMP drainage area number: LS/VFS #3

Print name: Kevin Graham

Title: Vice President, Operations

Address:16 Windy Knoll Circle, Chapel Hill, NC 27516

Phone: (919) 951-0709

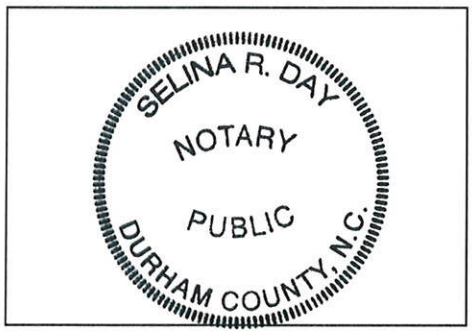
Signature: Kevin Graham

Date: 1/16/13

Note: The legally responsible party should not be a homeowners association unless more than 50% of the lots have been sold and a resident of the subdivision has been named the president.

I, Selina R. Day, a Notary Public for the State of North Carolina, County of Durham, do hereby certify that Kevin Graham personally appeared before me this 16 day of January, 2013, and acknowledge the due execution of the forgoing filter strip, riparian buffer, and/or level spreader maintenance requirements.

Witness my hand and official seal,



SEAL

My commission expires August 30, 2014

Permit Number:_____
(to be provided by DWQ)
Drainage Area Number:_____

Filter Strip, Restored Riparian Buffer and Level Spreader Operation and Maintenance Agreement

I will keep a maintenance record on this BMP. This maintenance record will be kept in a log in a known set location. Any deficient BMP elements noted in the inspection will be corrected, repaired or replaced immediately. These deficiencies can affect the integrity of structures, safety of the public, and the removal efficiency of the BMP.

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BMP element:	Potential problem:	How I will remediate the problem:
The entire filter strip system	Trash/debris is present.	Remove the trash/debris.
The flow splitter device (if applicable)	The flow splitter device is clogged.	Unclog the conveyance and dispose of any sediment off-site.
	The flow splitter device is damaged.	Make any necessary repairs or replace if damage is too large for repair.

BMP element:	Potential problem:	How I will remediate the problem:
The swale and the level lip	The swale is clogged with sediment.	Remove the sediment and dispose of it off-site.
	The level lip is cracked, settled, undercut, eroded or otherwise damaged.	Repair or replace lip.
	There is erosion around the end of the level spreader that shows stormwater has bypassed it.	Regrade the soil to create a berm that is higher than the level lip, and then plant a ground cover and water until it is established. Provide lime and a one-time fertilizer application.
	Trees or shrubs have begun to grow on the swale or just downslope of the level lip.	Remove them.
The bypass channel	Areas of bare soil and/or erosive gullies have formed.	Regrade the soil if necessary to remove the gully, and then reestablish proper erosion control.
	Turf reinforcement is damaged or ripap is rolling downhill.	Study the site to see if a larger bypass channel is needed (enlarge if necessary). After this, reestablish the erosion control material.
The filter strip	Grass is too short or too long (if applicable).	Maintain grass at a height of approximately three to six inches.
	Areas of bare soil and/or erosive gullies have formed.	Regrade the soil if necessary to remove the gully, and then plant a ground cover and water until it is established. Provide lime and a one-time fertilizer application.
	Sediment is building up on the filter strip.	Remove the sediment and restabilize the soil with vegetation if necessary. Provide lime and a one-time fertilizer application.
	Plants are desiccated.	Provide additional irrigation and fertilizer as needed.
	Plants are dead, diseased or dying.	Determine the source of the problem: soils, hydrology, disease, etc. Remedy the problem and replace plants. Provide a one-time fertilizer application.
	Nuisance vegetation is choking out desirable species.	Remove vegetation by hand if possible. If pesticide is used, do not allow it to get into the receiving water.
The receiving water	Erosion or other signs of damage have occurred at the outlet.	Contact the NC Division of Water Quality local Regional Office, or the 401 Oversight Unit at 919-733-1786.

Permit Number:_____
(to be provided by DWQ)

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Project name:Briar Chapel - Phase 7

BMP drainage area number: LS/VFS #4

Print name: Kevin Graham

Title: Vice President, Operations

Address:16 Windy Knoll Circle, Chapel Hill, NC 27516

Phone: (919) 951-0709

Signature: [signature]

Date: 1/16/13

Note: The legally responsible party should not be a homeowners association unless more than 50% of the lots have been sold and a resident of the subdivision has been named the president.

I, Selina R. Day, a Notary Public for the State of North Carolina, County of Durham, do hereby certify that Kevin Graham personally appeared before me this 16 day of January, 2013, and acknowledge the due execution of the forgoing filter strip, riparian buffer, and/or level spreader maintenance requirements.

Witness my hand and official seal,

SELINA R. DAY NOTARY PUBLIC DURHAM COUNTY, N.C.

SEAL

My commission expires August 30, 2014

STORMWATER MANAGEMENT PERMIT APPLICATION FORM
401 CERTIFICATION APPLICATION FORM

LEVEL SPREADER - VEGETATED FILTER STRIP (LS-VFS) SUPPLEMENT

This form must be completely filled out, printed, initialed, and submitted.

I. PROJECT INFORMATION

Project name	Briar Chapel Development - Phase 7
Contact name	Gareth Avant
Phone number	919.233.8091
Date	January 23, 2013
Drainage area number	#2

II. DESIGN INFORMATION

The purpose of the LS-VFS	Pollutant removal: 40% TSS, 30% TN, 35% TP
Stormwater enters LS-VFS from	The drainage area
Type of VFS	Engineered filter strip (graded & sodded, slope < 8%)
Explanation of any "Other" responses above	

If Stormwater Enters the LS-VFS from the Drainage Area

Drainage area	163,077	ft^2
Impervious surface area	47,505	ft^2
Percent impervious	29.13	%
Rational C coefficient	0.69	
Peak flow from the 1 in/hr storm	2.58	cfs
Time of concentration	5.00	min
Rainfall intensity, 10-yr storm	7.38	in/hr
Peak flow from the 10-yr storm	19.06	cfs
Design storm	1 inch/hour storm	
Maximum amount of flow directed to the LS-VFS	2.5	cfs
Is a flow bypass system going to be used?	Y	(Y or N)
Explanation of any "Other" responses above		

If Stormwater Enters the LS-VFS from a BMP

Do not complete this section of the form.

Type of BMP	Pick one:		
Peak discharge from the BMP during the design storm		cfs	
Peak discharge from the BMP during the 10-year storm		cfs	Do not complete this section of the form.
Maximum capacity of a 100-foot long LS-VFS	10	cfs	
Peak flow directed to the LS-VFS		cfs	Do not complete this section of the form.
Is a flow bypass system going to be used?		(Y or N)	
Explanation of any "Other" responses above			

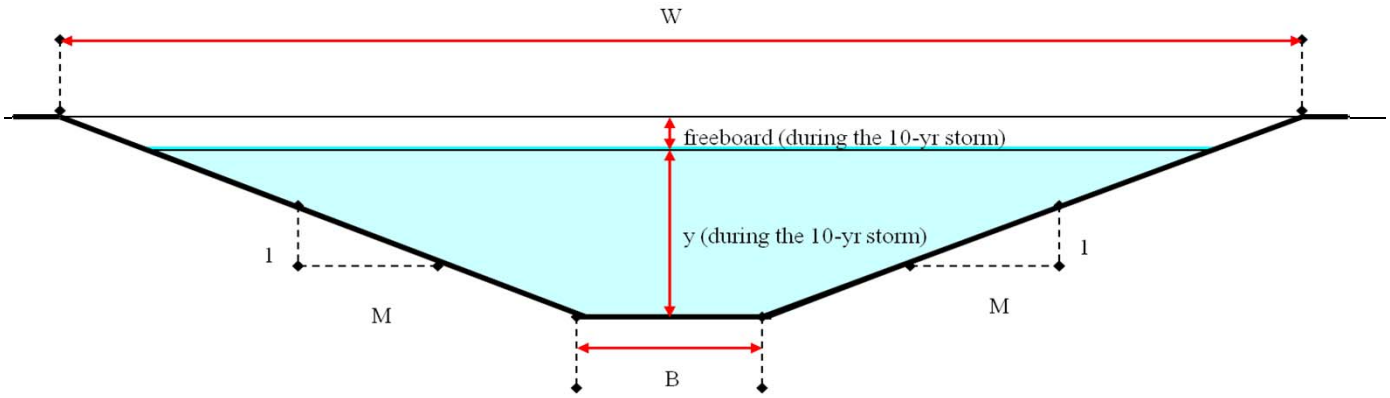
LS-VFS Design

Forebay surface area	400	sq ft	Forebay is adequately sized.
Depth of forebay at stormwater entry point	24	in	Depth is appropriate.
Depth of forebay at stormwater exit point	6	in	Depth is appropriate.
Feet of level lip needed per cfs	10	ft/cfs	
Computed minimum length of the level lip needed	25	ft	

Length of level lip provided	50	ft	
Width of VFS	30	ft	
Elevation at downslope base of level lip	469.25	fmsl	
Elevation at the end of the VFS that is farthest from the LS	467.75	fmsl	
Slope (from level lip to the end of the VFS)	5.00	%	
Are any draws present in the VFS?	N	(Y or N)	OK
Is there a collector swale at the end of the VFS?	N	(Y or N)	

Bypass System Design (if applicable)

Is a bypass system provided?	Y	(Y or N)	
Is there an engineered flow splitting device?	Y	(Y or N)	Please provide plan details of flow splitter & supporting calcs.
Dimensions of the channel (see diagram below):			
M	Existing Channel	ft	
B		ft	
W		ft	
y (flow depth for 10-year storm)		ft	
freeboard (during the 10-year storm)		ft	
Peak velocity in the channel during the 10-yr storm	18.24	ft/sec	
Channel lining material	Pick one:		
Does the bypass discharge through a wetland?	N	(Y or N)	
Does the channel enter the stream at an angle?	Y	(Y or N)	
Explanation of any "Other" responses above			



III. REQUIRED ITEMS CHECKLIST

EDIT Please indicate the page or plan sheet numbers where the supporting documentation can be found. **An incomplete submittal package will result in a request for additional information. This will delay final review and approval of the project.** Initial in the space provided to indicate the following design requirements have been met. If the applicant has designated an agent, the agent may initial below. **If a requirement has not been met, attach justification.**

Requried Item:	Initials	Page or plan sheet number and any notes:
1. Plans (1" - 50' or larger) of the entire site showing: - Design at ultimate build-out, - Off-site drainage (if applicable), - Delineated drainage basins (include Rational C coefficient per basin), - Forebay (if applicable), - High flow bypass system, - Maintenance access, - Proposed drainage easement and public right of way (ROW), and - Boundaries of drainage easement.	GCA	C3.2-C3.3

2. Plan details (1" = 30' or larger) for the level spreader showing: - Forebay (if applicable), - High flow bypass system, - One foot topo lines between the level lip and top of stream bank, - Proposed drainage easement, and - Design at ultimate build-out.	GCA	D4.1
3. Section view of the level spreader (1" = 20' or larger) showing: - Underdrain system (if applicable), - Level lip, - Upslope channel, and - Downslope filter fabric.	GCA	D4.1
4. Plan details of the flow splitting device and supporting calculations (if applicable).		D4.1
5. A construction sequence that shows how the level spreader will be protected from sediment until the entire drainage area is stabilized.	GCA	C3.2-C3.3
6. If a non-engineered VFS is being used, then provide a photograph of the VFS showing that no draws are present.		N/A
7. The supporting calculations.	GCA	Narrative & calculations booklet
8. A copy of the signed and notarized operation and maintenance (O&M) agreement.	GCA	Included

STORMWATER MANAGEMENT PERMIT APPLICATION FORM
401 CERTIFICATION APPLICATION FORM

LEVEL SPREADER - VEGETATED FILTER STRIP (LS-VFS) SUPPLEMENT

This form must be completely filled out, printed, initialed, and submitted.

I. PROJECT INFORMATION

Project name	Briar Chapel Development - Phase 7
Contact name	Gareth Avant
Phone number	919.233.8091
Date	January 23, 2013
Drainage area number	#3

II. DESIGN INFORMATION

The purpose of the LS-VFS	Pollutant removal: 40% TSS, 30% TN, 35% TP
Stormwater enters LS-VFS from	The drainage area
Type of VFS	Engineered filter strip (graded & sodded, slope < 8%)
Explanation of any "Other" responses above	

If Stormwater Enters the LS-VFS from the Drainage Area

Drainage area	243,922	ft^2
Impervious surface area	62,469	ft^2
Percent impervious	25.61	%
Rational C coefficient	0.69	
Peak flow from the 1 in/hr storm	3.86	cfs
Time of concentration	5.00	min
Rainfall intensity, 10-yr storm	7.38	in/hr
Peak flow from the 10-yr storm	28.51	cfs
Design storm	1 inch/hour storm	
Maximum amount of flow directed to the LS-VFS	2.73	cfs
Is a flow bypass system going to be used?	Y	(Y or N)
Explanation of any "Other" responses above		

If Stormwater Enters the LS-VFS from a BMP

Do not complete this section of the form.

Type of BMP	Pick one:		
Peak discharge from the BMP during the design storm		cfs	
Peak discharge from the BMP during the 10-year storm		cfs	Do not complete this section of the form.
Maximum capacity of a 100-foot long LS-VFS	10	cfs	
Peak flow directed to the LS-VFS		cfs	Do not complete this section of the form.
Is a flow bypass system going to be used?		(Y or N)	
Explanation of any "Other" responses above			

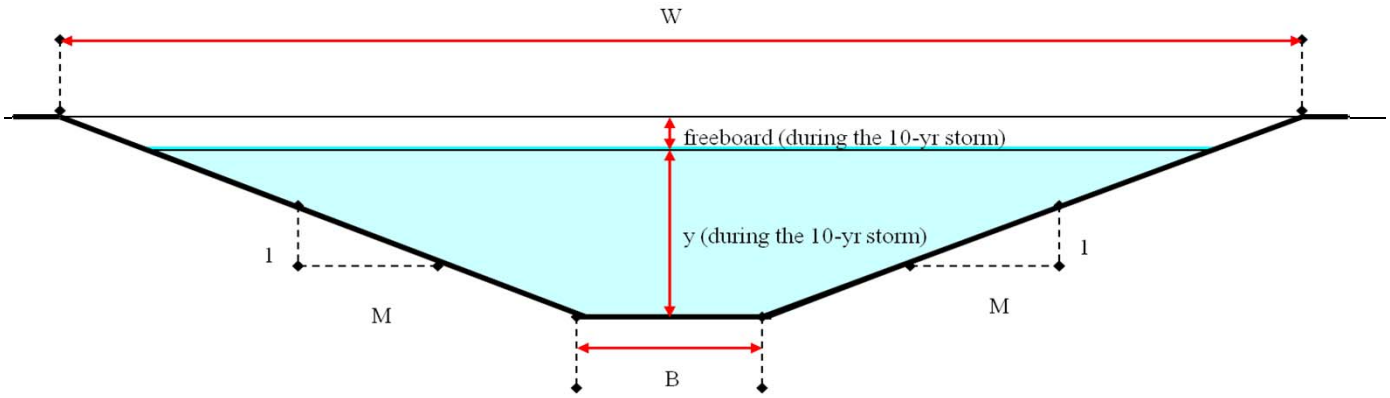
LS-VFS Design

Forebay surface area	400	sq ft	Forebay is adequately sized.
Depth of forebay at stormwater entry point	24	in	Depth is appropriate.
Depth of forebay at stormwater exit point	6	in	Depth is appropriate.
Feet of level lip needed per cfs	10	ft/cfs	
Computed minimum length of the level lip needed	27	ft	

Length of level lip provided	50	ft	
Width of VFS	30	ft	
Elevation at downslope base of level lip	433.25	fmsl	
Elevation at the end of the VFS that is farthest from the LS	431.75	fmsl	
Slope (from level lip to the end of the VFS)	5.00	%	
Are any draws present in the VFS?	N	(Y or N)	OK
Is there a collector swale at the end of the VFS?	N	(Y or N)	

Bypass System Design (if applicable)

Is a bypass system provided?	Y	(Y or N)	
Is there an engineered flow splitting device?	Y	(Y or N)	Please provide plan details of flow splitter & supporting calcs.
Dimensions of the channel (see diagram below):			
M	Existing Channel	ft	
B		ft	
W		ft	
y (flow depth for 10-year storm)		ft	
freeboard (during the 10-year storm)		ft	
Peak velocity in the channel during the 10-yr storm	18.10	ft/sec	
Channel lining material	Pick one:		
Does the bypass discharge through a wetland?	N	(Y or N)	
Does the channel enter the stream at an angle?	Y	(Y or N)	
Explanation of any "Other" responses above			



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Requried Item:	Initials	Page or plan sheet number and any notes:
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2. Plan details (1" = 30' or larger) for the level spreader showing: - Forebay (if applicable), - High flow bypass system, - One foot topo lines between the level lip and top of stream bank, - Proposed drainage easement, and - Design at ultimate build-out.	GCA	D4.1
3. Section view of the level spreader (1" = 20' or larger) showing: - Underdrain system (if applicable), - Level lip, - Upslope channel, and - Downslope filter fabric.	GCA	D4.1
4. Plan details of the flow splitting device and supporting calculations (if applicable).		D4.1
5. A construction sequence that shows how the level spreader will be protected from sediment until the entire drainage area is stabilized.	GCA	C3.2-C3.3
6. If a non-engineered VFS is being used, then provide a photograph of the VFS showing that no draws are present.		N/A
7. The supporting calculations.	GCA	Narrative & calculations booklet
8. A copy of the signed and notarized operation and maintenance (O&M) agreement.	GCA	Included

STORMWATER MANAGEMENT PERMIT APPLICATION FORM
401 CERTIFICATION APPLICATION FORM

LEVEL SPREADER - VEGETATED FILTER STRIP (LS-VFS) SUPPLEMENT

This form must be completely filled out, printed, initialed, and submitted.

I. PROJECT INFORMATION

Project name	Briar Chapel Development - Phase 7
Contact name	Gareth Avant
Phone number	919.233.8091
Date	January 23, 2013
Drainage area number	#4

II. DESIGN INFORMATION

The purpose of the LS-VFS	Pollutant removal: 40% TSS, 30% TN, 35% TP
Stormwater enters LS-VFS from	The drainage area
Type of VFS	Engineered filter strip (graded & sodded, slope < 8%)
Explanation of any "Other" responses above	

If Stormwater Enters the LS-VFS from the Drainage Area

Drainage area	151,391	ft^2	
Impervious surface area	87,075	ft^2	
Percent impervious	57.52	%	
Rational C coefficient	0.77		
Peak flow from the 1 in/hr storm	2.68	cfs	
Time of concentration	5.00	min	
Rainfall intensity, 10-yr storm	7.38	in/hr	
Peak flow from the 10-yr storm	19.75	cfs	
Design storm	1 inch/hour storm		
Maximum amount of flow directed to the LS-VFS	1.94	cfs	
Is a flow bypass system going to be used?	Y	(Y or N)	
Explanation of any "Other" responses above			

If Stormwater Enters the LS-VFS from a BMP

Do not complete this section of the form.

Type of BMP	Pick one:		
Peak discharge from the BMP during the design storm		cfs	
Peak discharge from the BMP during the 10-year storm		cfs	Do not complete this section of the form.
Maximum capacity of a 100-foot long LS-VFS	10	cfs	
Peak flow directed to the LS-VFS		cfs	Do not complete this section of the form.
Is a flow bypass system going to be used?		(Y or N)	
Explanation of any "Other" responses above			

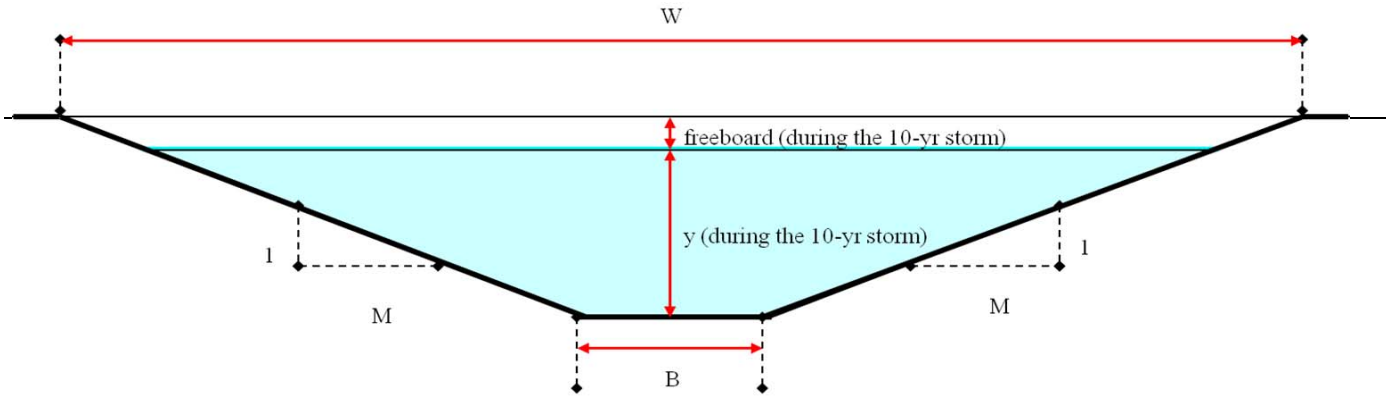
LS-VFS Design

Forebay surface area	400	sq ft	Forebay is adequately sized.
Depth of forebay at stormwater entry point	24	in	Depth is appropriate.
Depth of forebay at stormwater exit point	6	in	Depth is appropriate.
Feet of level lip needed per cfs	10	ft/cfs	
Computed minimum length of the level lip needed	19	ft	

Length of level lip provided	50	ft	
Width of VFS	30	ft	
Elevation at downslope base of level lip	428.25	fmsl	
Elevation at the end of the VFS that is farthest from the LS	426.75	fmsl	
Slope (from level lip to the end of the VFS)	5.00	%	
Are any draws present in the VFS?	N	(Y or N)	OK
Is there a collector swale at the end of the VFS?	N	(Y or N)	

Bypass System Design (if applicable)

Is a bypass system provided?	Y	(Y or N)	
Is there an engineered flow splitting device?	Y	(Y or N)	Please provide plan details of flow splitter & supporting calcs.
Dimensions of the channel (see diagram below):			
M	Existing Channel	ft	
B		ft	
W		ft	
y (flow depth for 10-year storm)		ft	
freeboard (during the 10-year storm)		ft	
Peak velocity in the channel during the 10-yr storm	18.10	ft/sec	
Channel lining material	Pick one:		
Does the bypass discharge through a wetland?	N	(Y or N)	
Does the channel enter the stream at an angle?	Y	(Y or N)	
Explanation of any "Other" responses above			



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2. Plan details (1" = 30' or larger) for the level spreader showing: - Forebay (if applicable), - High flow bypass system, - One foot topo lines between the level lip and top of stream bank, - Proposed drainage easement, and - Design at ultimate build-out.	GCA	D4.1
3. Section view of the level spreader (1" = 20' or larger) showing: - Underdrain system (if applicable), - Level lip, - Upslope channel, and - Downslope filter fabric.	GCA	D4.1
4. Plan details of the flow splitting device and supporting calculations (if applicable).		D4.1
5. A construction sequence that shows how the level spreader will be protected from sediment until the entire drainage area is stabilized.	GCA	C3.2-C3.3
6. If a non-engineered VFS is being used, then provide a photograph of the VFS showing that no draws are present.		N/A
7. The supporting calculations.	GCA	Narrative & calculations booklet
8. A copy of the signed and notarized operation and maintenance (O&M) agreement.	GCA	Included

North Carolina Department of Environment and Natural Resources
Division of Water Quality

Pat McCrory
Governor

Charles Wakild, P. E.
Director

John E. Skvarla, III
Secretary

March 8, 2013

DWQ Project # 05-0732v26
Chatham County

Mr. Bill Mumford, Assistant Vice President
NNP – Briar Chapel LLC
16 Windy Knoll Circle
Chapel Hill, NC 27516

Subject Property: **Briar Chapel, Phase 7**

APPROVAL OF MODIFIED STORMWATER PLAN

Dear Mr. Mumford:

On January 11, 2008, the Division of Water Quality (DWQ) issued a revised 401 Water Quality Certification to temporarily impact 339 linear feet of stream and 0.157 acre of 404 wetlands and to permanently impact 1,666 linear feet of stream and 0.159 acre of 404 wetland in order to construct the Briar Chapel Subdivision in Chatham County.

In order to meet Condition 10 of the 401 Certification for this project, a temporary stormwater management plan (SMP) for roadway portion of Briar Chapel – Phase 7, dated January 23, 2013, was received on January 29, 2013.

The DWQ approves the temporary SMP as satisfying Condition 10 of the General Water Quality Certification until the remainder of Phase 7 is developed. The final SMP for Phase 7 must be received and approved by the DWQ before construction of the lots is commenced. The approved final SMP for Phase 7 must be constructed and operational before any permanent building or other structure associated with that phase is occupied.

This approval is for the purpose and design that you described in your application. If you change your project, you must notify us and you may be required to send us a new SMP. This approval requires to you follow the conditions listed in the General Water Quality Certification for the project and the following additional conditions listed below:

1. The temporary SMP approved by the DWQ consists of three (3) level spreaders and all associated stormwater conveyances, inlet and outlet strictures, and the grading and drainage patterns depicted on plan sheets dated January 23, 2013. The plans and specifications for Phase 7 approved by DWQ are incorporated by reference into this approval and are enforceable by DWQ

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provided however that any modification of the design for the stormwater management system that is accepted by DWQ shall take precedence over the original plans and specifications.

1. The maximum allowable drainage area for the approved level spreaders shall be in accordance with the table below. Built-upon area includes, but is not limited to, roofed structures, asphalt, concrete, gravel, brick, slate, coquina and parking areas, but does not include raised, uncovered open slat decking or the water surface of swimming pools. Any changes to these maximum areas shall require the applicant to submit and receive approval for a revised stormwater management plan by the DWQ.

Level spreader #	Max. drainage area (sf)	Max built upon area (sf)
2	163,077	47,505
3	243,922	62,469
4	151,391	87,075

2. The footprint of all stormwater management devices as well as an additional 10-foot wide area on all sides of the devices shall be located in either public rights-of-way, dedicated common areas or recorded easement areas. The final plats for the project showing all such rights-of-way, common areas and easement areas shall be in accordance with the approved plans.

3. Maintenance activities for the level spreaders shall be performed in accordance with the notarized O&M agreements signed by Kevin Graham (Vice President, Operations) on January 16, 2013. The O&M agreement must transfer with the sale of the land or transfer of ownership/responsibility for the BMP facility. DWQ must be notified promptly of every transfer.

4. The applicant and/or authorized agent shall provide a completed Certificate of Completion form to the DWQ within thirty (30) days of project completion (available at http://portal.ncdenr.org/web/wq/swp/ws/401/certsandpermits/apply/forms).

Thank you for your attention to this matter. If you have any questions or wish to discuss these matters further, please do not hesitate to contact me at (919) 807-6381.

Sincerely,

Annette Lucas, P.E.
Wetlands, Buffers and Stormwater Compliance and Permitting (Webscape) Unit

AML/aml

Cc: Becky Fox, EPA
USACE, Raleigh
Cherri Smith, DWQ Raleigh Regional Office
Chatham County Public Works Dept., P.O. Box 1550, Pittsboro, NC 27312
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