BRIAR CHAPEL – PHASE 6 NORTH

Chatham County, North Carolina

FINAL STORMWATER MANAGEMENT PLAN DESIGN CALCULATIONS

Project Number:	NEW-12000
Designed By:	Jeremy V. Finch, PE
Date:	June 2012
NC LIC:	#C-2093

EcoEngineering
A division of The John R. McAdams Company, Inc.
RESEARCH TRIANGLE PARK

P. O. Box 14005 Research Triangle Park, NC 27709
919-287-4262 FAX 919-361-2269
www.ecoengr.com

LIMITED LIABILITY COMPANY ANNUAL REPORT

E-Filed Annual Report
-1-0-5468752

Do not data enter manually.

NAME OF LIMITED LIABILITY COMPANY: *NNP-Briar Chapel, LLC*

STATE OF INCORPORATION: *DE*

SECRETARY OF STATE L.L.C. ID NUMBER: *0631973*

NATURE OF BUSINESS: *Real Estate Development*

REGISTERED AGENT: *National Registered Agents, Inc.*

REGISTERED OFFICE MAILING ADDRESS: *120 Penmarc Drive*
Raleigh, NC 27603

REGISTERED OFFICE STREET ADDRESS: *120 Penmarc Drive*
Raleigh, NC 27603 Wake County

PRINCIPAL OFFICE TELEPHONE NUMBER: *8584557503*

PRINCIPAL OFFICE MAILING ADDRESS: *9820 Towne Centre Drive Suite 100*
San Diego, CA 92121

PRINCIPAL OFFICE STREET ADDRESS: *9820 Towne Centre Drive Suite 100*
San Diego, CA 92121

MANAGERS/MEMBERS/ORGANIZERS:

Name: Newland National Partners, LP
Title: Manager
Address:
9820 Towne Centre Drive Suite 100
San Diego, CA 92121

CERTIFICATION OF ANNUAL REPORT MUST BE COMPLETED BY ALL LIMITED LIABILITY COMPANIES

Newland National Partners, LP — 04/15/2011

FORM MUST BE SIGNED BY A MANAGER/MEMBER — DATE

Dolores A Valle — Manager

TYPE OR PRINT NAME — TYPE OR PRINT TITLE

ANNUAL REPORT FEE: $200 MAIL TO: Secretary of State • Corporations Division • Post Office Box 29525 • Raleigh, NC 27626-0525

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BRIAR CHAPEL – PHASE 6 NORTH

CHATHAM COUNTY, NORTH CAROLINA

FINAL STORMWATER MANAGEMENT PLAN DESIGN

NEW-12000

June 2012

Jeremy V. Finch, PE
Project Manager

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BRIAR CHAPEL – PHASE 6 NORTH

Final Stormwater Management Plan Design

General Description

Located off of US Highway 15-501, north of Andrews Store Road and south of Mann's Chapel Road in Chatham County, NC is the proposed development known as Briar Chapel. Phase 6 North of the proposed development is approximately 37-acres and will consist of the construction of single-family lots along with the associated utility, parking, and roadway infrastructure.

The overall proposed Briar Chapel development is located within the Cape Fear River Basin, and drains to a stream (Pokeberry Creek) classified as Water Supply IV (WS-IV), and Nutrient Sensitive Waters (NSW). As a result of the proposed development exceeding the maximum allowable limit for stream impacts, an individual permit issued by The United States Army Corps of Engineers (USACE) was required (Clean Water Act Section 404 permit). Also, a Clean Water Act Section 401 Water Quality Certification from NCDWQ was attached to the individual permit. Under the 401 Water Quality Certification issued by NCDWQ, the proposed site will be required to comply with the following stormwater management requirements:

1. *A final written stormwater management plan for each subwatershed (including signed and notarized Operation and Maintenance agreements) shall be submitted to the 401 Oversight and Express Permitting Unit. The stormwater management plan may be submitted to DWQ in phases for written approval as long as no impact to wetlands or streams occur in that phase until written approval is received from DWQ.*

2. *The stormwater plans shall utilize constructed wetlands, bioretention areas, wet ponds followed by forested filter strips and similar best management practices designed to remove nutrients. The stormwater management plan must include plans, specifications, and worksheets for stormwater management facilities that are appropriate for the surface water classification and designed to remove at least 85% TSS according to the most recent version of the NCDENR Stormwater Best Management Practices Manual.*

3. *For low density areas of the project with low impervious surface area, engineered stormwater management facilities are not expected. For these areas of lower impervious area, similar best management practices that remove nutrients such as grassed swales and vegetated riparian buffers should be sufficient rather than more intensive engineered stormwater devices such as constructed wetlands.*

In addition to the above DWQ stormwater requirements, the following stormwater quality and quantity items are required per Section 8.3 ("Stormwater Controls") of the Chatham County Compact Communities Ordinance:

1. *Control and treat the first inch of runoff from the project site and from any offsite drainage routed to an on-site control structure. Ensure that the draw down time for this treatment volume is a minimum of forty eight (48) hours and a maximum of one hundred and twenty (120) hours.*

2. *Maintain the discharge rate for the treatment volume at or below the pre-development discharge rate for the 1-year, 24-hour storm.*

The proposed stormwater management plan for Phase 6 North of Briar Chapel will be designed to protect the downstream environment. The plan incorporates biologically based stormwater management techniques to manage both water quantity and quality aspects of site runoff. As can be seen in this report, stormwater

management for Phase 6 North will be accomplished by incorporating an engineered stormwater best management practice facility to capture and treat the stormwater runoff from developed areas. The specific stormwater treatment device that will be used is a wet detention basin designed to remove a minimum of 90% average annual total suspended solids (TSS), provide slow release (i.e. 2 to 5 days) of the difference in pre- to post-development peak runoff rate for the 1-year, 24-hour storm. This report contains the final design calculations for the proposed wet detention basin located in Phase 6 North of Briar Chapel. Please refer to the summary of results and discussion of results sections of this report for additional information.

Calculation Methodology

- Rainfall data for the Chatham County, NC region is from NOAA Atlas 14, with a partial duration series assumption. The rainfall depths were entered into a spreadsheet that calculated a center-weighted storm based upon the NOAA Atlas 14 depths. The 1-year/24-hour rainfall depth is 2.95 inches, the 2-Year/24-hour rainfall depth is 3.56 inches, the 10-Year/24-hour rainfall depth is 5.16 inches, and the 100-year/24-hour rainfall depth is 7.62 inches. All of these "computed" storms were modeled within the hydrologic model. Please reference the rainfall data section within this report for additional information.

- Using maps contained within the Chatham County Soil Survey, the watershed soils were determined to be from hydrologic soil group (HSG) 'B' soils. Since the method chosen to compute the post-development peak flow rates and runoff volumes is dependent upon the soil type, all hydrologic calculations are based upon the assumption of HSG 'B' soils.

- A composite SCS Curve Number was calculated for the post-development condition using SCS curve numbers and land cover conditions. Land cover conditions for the post-development condition were taken from the proposed development plan.

- The post-development time of concentration to the wet detention basin was assumed to be 5 minutes in the post-development condition.

- All on-site topo was taken from a flown aerial topographic survey by others provided to The John R. McAdams Company, Inc. by McKim & Creed. The drainage map for the post-development condition has been included in this report.

- PondPack Version V8i, by Haestad Methods, was used to generate post-development peak flow rates and generate the stage-discharge rating curve for the proposed wet detention basin. Final routing calculations for the wet detention basin were also performed within Pondpack.

- The stage-storage rating curve and stage-storage function for the proposed wet detention basin was generated externally in a spreadsheet and then input into Pondpack.

- A velocity dissipater is provided at the end of the principal spillway outlet for the wet detention basin to prevent erosion and scour in the downstream area. The dissipater is constructed using riprap, underlain with a woven geotextile filter fabric. The filter fabric is used to minimize the loss of soil particles beneath the riprap apron. The dissipater is sized for the 10-year storm event using the NYDOT method. It is a permanent feature of the outlet.

- Water quality sizing calculations for each facility were performed in accordance with the N.C. Stormwater Best Management Practices manual (NCDENR July 2007). The wet detention basin surface area was sized by multiplying the drainage area to the facility by the interpolated SA/DA ratio from the *Surface Area to Drainage Area Ratio for Permanent Pool Sizing to Achieve 90% TSS Pollutant Removal Efficiency in the Mountain & Piedmont* Regions. The minimum temporary pool volume was determined by calculating the 1-inch runoff volume using the Simple Method.

Conclusion

If the development on this tract is built as proposed within this report, then the requirements set forth in the Water Quality Certification #3402 (WQC #3402) and Section 8.3 ("Stormwater Controls") of the Chatham County Compact Communities Ordinance will be met with the proposed wet detention basin. However, modifications to the proposed development may require that this analysis be revised. Some modifications that would **require** this analysis to be revised include:

1. The proposed site impervious surface exceeds the amount accounted for in this report.
2. The post-development watershed breaks change significantly from those used to prepare this report.

The above modifications may result in the assumptions within this report becoming invalid. The computations within this report will need to be revisited if any of the above conditions become apparent as development of the proposed site moves forward.

SUMMARY OF RESULTS

BRIAR CHAPEL – PHASE 6 NORTH
NEW-12000

BRIAR CHAPEL - PHASE 6 NORTH
NEW-12000

SUMMARY OF RESULTS

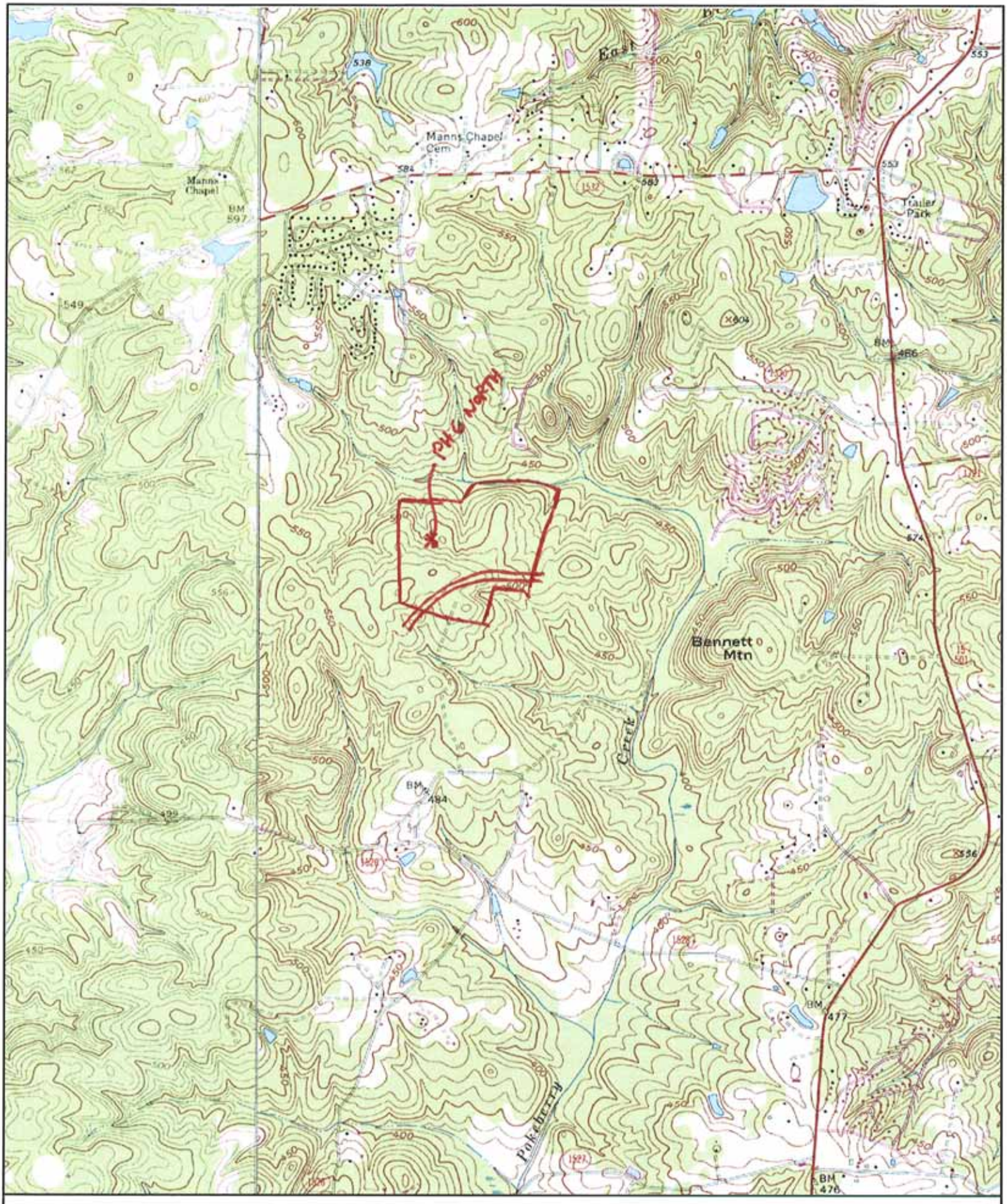
J. FINCH, PE
6/14/2012

WET POND

Return Period	Inflow [cfs]	Outflow [cfs]	Max. WSE [ft]	Freeboard [ft]
1-Year	43.46	0.36	474.39	2.61
2-Year	60.48	2.20	474.60	2.40
10-Year	96.67	24.41	475.04	1.96
25-Year	114.39	50.33	475.38	1.62
100-Year	138.31	70.98	475.94	1.06

Design Drainage Area =	20.69	acres
Design Impervious Area =	10.26	acres
% Impervious =	49.6%	
Top of Dam =	477.00	ft
Normal Pool Elevation =	472.00	ft
Surface Area at NWSE =	25,869	sf
Minimum Required Surface Area at NWSE =	23,085	sf
Water Quality Volume Storage Provided =	80,105	cf
Minimum Required Water Quality Volume Storage =	37,264	cf
Design Drawdown Time =	2.62	days
Riser Length =	5	ft
Riser Width =	5	ft
Riser Crest =	474.50	ft
Barrel Diameter =	30	inches
# of Barrels =	1	
Invert In =	466.00	feet
Invert Out =	462.00	feet
Length =	83	feet
Slope =	0.0482	ft/ft

USGS MAP



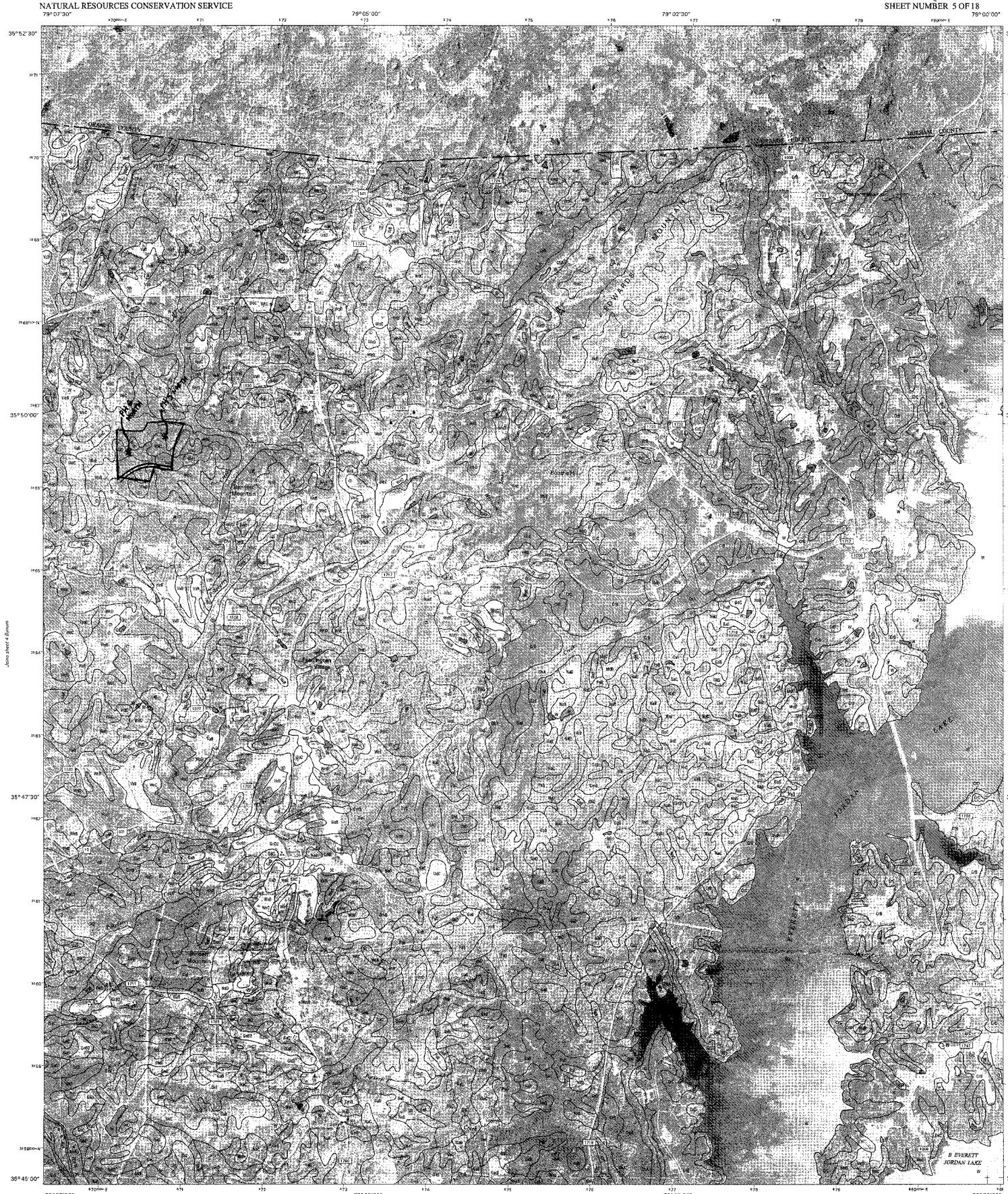
Name: m:\NC3pro\35079G1A.P24
Date: 3/15/2012
Scale: 1 inch equals 2000 feet

Location: 035° 49' 36.37" N 079° 06' 41.37" W

SOILS INFORMATION

UNITED STATES
DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

CHATHAM COUNTY, NORTH CAROLINA
FARRINGTON QUADRANGLE
SHEET NUMBER 5 OF 18



This soil survey was compiled by the U.S. Department of Agriculture, Natural Resources Conservation Service and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1973-1999 aerial photography. Administrative boundaries were acquired from the State of North Carolina. Boundaries may have been edited to conform with features represented on the publication orthophotography or to enhance the clarity of the soils information.

North American Datum of 1983(NAD83); GRS80 Spheroid 1000-meter ticks: Universal Transverse Mercator, zone 17. Coordinate grid ticks and land division data, if shown, are approximately positioned. Digital data are available for this quadrangle.

SCALE 1:24000

MILES

FEET

KILOMETERS

NORTH

QUADRANGLE LOCATION

4		6
10	11	12

4 BYNUM
6 GREEN LEVEL
10 PITTSBORO
11 MERRY OAKS
12 NEW HILL

INDEX TO ADJOINING 7.5 MAPS

FARRINGTON, NORTH CAROLINA
7.5 MINUTE SERIES
SHEET NUMBER 5 OF 18

Soil map delineations extending beyond the dashed white quadrangle neatline are for reference only and are included on adjacent map sheets.

FEMA FIRM PANEL MAP

STATE OF NORTH CAROLINA FIRM PANEL LOCATOR DIAGRAM

DATUM INFORMATION

The projection used in the preparation of this map was the North Carolina State Plane (FIPSZONE 3200). The horizontal datum was the North American Datum of 1983, (NAD83 adjusted). Differences in datum, ellipsoid, projection, or Universal Transverse Mercator zones used in the production of FIRMS for adjacent jurisdictions may result in slight positional differences in map features across jurisdictional boundaries. These differences do not affect the accuracy of this FIRM. All coordinates on this map are in U.S. Survey Feet, where
1 U.S. Survey Foot = 1200/3937 Meters.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988 (NAVD 88). These flood elevations must be compared to structure and ground elevations referenced to the same vertical datum. An average offset between NAVD 88 and the National Geodetic Vertical Datum of 1929 (NGVD 29) has been computed for each North Carolina county. This offset was then applied to the NGVD 29 flood elevations that were not revised during the creation of this statewide format FIRM. The offsets for each county shown on this FIRM panel are shown in the vertical datum offset table below. Where a county boundary and a flooding source with unrevised NGVD 29 flood elevations are coincident, an individual offset has been calculated and applied during the creation of this statewide format FIRM. See Section 6.0 of the accompanying Flood Insurance Study report for further information on the conversion of elevations between NAVD 88 and NGVD 29. To obtain current elevation, description, and/or location information for bench marks shown on this map, please contact the North Carolina Geodetic Survey at the address shown below. You may also contact the Information Services Branch of the National Geodetic Survey at (301) 713-3242, or visit its website at http://www.ngs.noaa.gov.

North Carolina Geodetic Survey
121 West Jones Street
Raleigh, NC 27601
(919) 733-3836
http://www.ncgs.state.nc.us

County Average Vertical Datum Offset Table

County	Vertical Datum Offset (ft)
Wake	-0.6

Source: NGVD 29 = NAVD 88 + (-0.6)

All streams listed in the Flood Hazard Data Table below were studied by detailed methods using field survey. Other flood hazard data shown on this map may have been derived using either a coastal analysis or limited detailed Riverine analysis. More information on the flooding sources studied by these analyses is contained in the Flood Insurance Study report.

LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD EVENT

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A — No Base Flood Elevation determined.
ZONE AE — Base Flood Elevations determined.
ZONE AH — Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO — Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR — Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99 — Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE VE — Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X — Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X — Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D — Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

1% annual chance floodplain boundary
0.2% annual chance floodplain boundary
Floodway boundary
Zone D boundary
CBRS and OPA boundary
Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
Base Flood Elevation line and value; elevation in feet*
Base Flood Elevation value where uniform within zone; elevation in feet*
* Referenced to the North American Vertical Datum of 1988
Cross section line
Transect line
Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
1000-meter Universal Transverse Mercator grid ticks, zone 17
2000-foot grid values: North Carolina State Plane coordinate system (FIPSZONE 3200, State Plane NAD 83 feet)
North Carolina Geodetic Survey bench mark (for more information visit http://www.ncgs.state.nc.us)
National Geodetic Survey bench mark (for more information visit http://www.ngs.noaa.gov)
5000-foot UPS (U.S. no Vertical Control Datum or Contiguous Orientation) feature tickes (for more information visit http://www.ncgs.state.nc.us)
River Mile

GRID NORTH
MAP SCALE 1" = 800' (1 : 9,600)

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The community map repository should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where Base Flood Elevations (BFEs) and/or floodways have been determined, users are encouraged to consult the Flood Profiles, Floodway Data, Limited Detailed Flood Hazard Data, and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Boundaries of regulatory floodways shown on the FIRM for flooding sources studied by detailed methods were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data for flooding sources studied by detailed methods as well as encroachment widths for flooding sources studied by limited detailed methods are provided in the Flood Insurance Study (FIS) report for this jurisdiction. The FIS report also provides instructions for determining a floodway using non-encroachment widths for flooding sources studied by limited detailed methods.

Certain areas not in Special Flood Hazard Areas may be protected by flood control structures. Refer to Section 4.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures in this jurisdiction.

Base map information and geospatial data used to develop this FIRM were obtained from various organizations, including the participating local communities, state and federal agencies, and/or other sources. The primary base for this FIRM is aerial imagery acquired by Iredell County. The data control of collection for this imagery is 2005. Information and geospatial data supplied by the local communities, from their FEMA base map specifications were considered the preferred source for development of this base map. See geospatial metadata for the associated digital FIRM for additional information about base map preparation.

Base map features shown on this map, such as roadside lands, are based on the most up-to-date data available at the time of publication. Changes in the referenced lands may have occurred since this map was published. Map users should consult the appropriate community official or website to verify current conditions of jurisdictional boundaries and base map features. This map may contain roads that were not considered in the hydraulic analysis of streams where no base hydraulic model was created during the production of this statewide format FIRM.

This map reflects more detailed and up-to-date stream channel configurations than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these more detailed channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map.

Please refer to the separately printed **Map** Index for an overview map of the county showing the layout of map panels, community map repository addresses, and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

If you have questions about this map, or questions concerning the National Flood Insurance Program in general, please call 1-877-FEMA MAP (1-877-336-2627) or visit the FEMA website at http://www.fema.gov.

An accompanying Flood Insurance Study report, Letter of Map Revision (LOMR) or Letter of Map Amendment (LOMA) revising portions of this panel, and digital versions of this FIRM may be available. Visit the North Carolina Floodplain Mapping Program website at http://www.ncfloodmaps.com, or contact the FEMA Map Service Center at 1-800-358-9616 for information on all related products associated with this FIRM. The FEMA Map Service Center may also be reached by Fax at 1-800-358-9620 and its website at http://www.msc.fema.gov.

MAP REPOSITORY
Refer to listing of Map Repositories on Map Index or visit http://www.ncfloodmaps.com

EFFECTIVE DATE OF FLOOD INSURANCE RATE MAP PANEL
FEBRUARY 2, 2007

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

For community map revision history prior to statewide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent, the North Carolina Division of Emergency Management or the National Flood Insurance Program at the following phone numbers or websites:

NC Division of Emergency Management
(919) 715-8000 http://www.ncdcm.net/ncdcm/mitig.htm
National Flood Insurance Program
1-800-638-6620 http://www.fema.gov/business/nfip

Cooperating Technical State

This digital Flood Insurance Rate Map (FIRM) was produced through a unique cooperative partnership between the State of North Carolina and the Federal Emergency Management Agency (FEMA). The State of North Carolina has implemented a long term approach of floodplain management to decrease the costs associated with flooding. This is demonstrated by the State's commitment to map floodplain areas at the local level. As a part of this effort, the state of North Carolina has joined in a Cooperating Technical State agreement with FEMA to produce and maintain the digital FIRM.

www.ncfloodmaps.com

NFIP NATIONAL FLOOD INSURANCE PROGRAM

PANEL 9765J

FIRM
FLOOD INSURANCE RATE MAP
NORTH CAROLINA

PANEL 9765

COMMUNITY — NUMBER — PANEL — SUFFIX

REVISED TO REFLECT
LOMR EFFECTIVE: JANUARY 14, 2011

EFFECTIVE DATE
FEBRUARY 2, 2007

MAP NUMBER
3710976500J

State of North Carolina
Federal Emergency Management Agency

RAINFALL INFORMATION

Center Weighted Storm Computation - Based on NOAA Atlas 14 Results

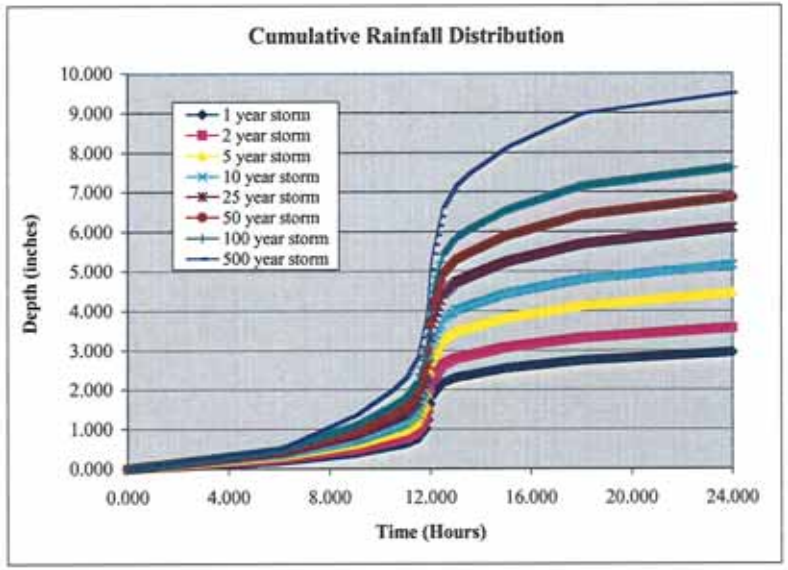
Copy input data from NOAA Atlas 14:

1) Have NOAA Atlas 14 results in Internet Explorer Window
2) Copy from ARI of one year to 1000 year, 60 day precipitation value. Do not include column headings, "1" will be in upper left of selection, 1000-yr; 60-day result in lower right of selection.
3) Paste with starting point at ARI of 1 year (first cell in the ARI column, cell A12). Cannot paste special to preserve format, format is via macro in next step
4) Place cursor on ARI of 1 year (cell A12), and press CTRL+f for format - make sure that A12 is the only cell selected before running the format macro.
5) Copy results of output data (below rainfall input) into PondPack

ARI (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hours	6 hours	12 hours	24 hours	48 hours	4 days	7 days	10 days	20 days	30 days	45 days	60 days
1	0.41	0.66	0.83	1.14	1.42	1.68	1.79	2.15	2.54	2.95	3.45	3.65	3.85	4.43	5.04	6.76	8.38	10.68
2	0.49	0.78	0.98	1.36	1.71	2.03	2.16	2.59	3.06	3.56	4.15	4.39	4.62	5.29	5.99	7.97	9.86	12.51
5	0.56	0.9	1.14	1.63	2.08	2.51	2.68	3.21	3.81	4.46	5.15	5.42	5.69	6.43	7.2	9.41	11.46	14.31
10	0.62	0.99	1.26	1.82	2.37	2.88	3.09	3.72	4.44	5.16	5.93	6.23	6.53	7.33	8.14	10.55	12.7	15.71
25	0.68	1.09	1.38	2.04	2.72	3.34	3.62	4.38	5.28	6.1	6.97	7.32	7.67	8.56	9.41	12.1	14.34	17.53
50	0.72	1.15	1.46	2.2	2.98	3.71	4.05	4.92	5.97	6.85	7.79	8.18	8.56	9.54	10.41	13.32	15.59	18.92
100	0.76	1.21	1.53	2.35	3.23	4.06	4.47	5.46	6.69	7.62	8.63	9.05	9.48	10.54	11.42	14.55	16.84	20.27
200	0.79	1.26	1.59	2.47	3.47	4.41	4.89	6.02	7.44	8.4	9.48	9.96	10.43	11.56	12.45	15.8	18.09	21.62
500	0.83	1.31	1.65	2.62	3.77	4.86	5.46	6.78	8.48	9.49	10.66	11.19	11.73	12.97	13.85	17.51	19.76	23.4
1000	0.85	1.35	1.69	2.74	4	5.22	5.93	7.41	9.36	10.34	11.58	12.17	12.76	14.09	14.95	18.85	21.04	24.75

Output Data to Export to PondPack, 5 minute intervals

Time (min)	Time (hours)	1 year (min)	2 year (min)	5 year (min)	10 year (min)	25 year (min)	50 year (min)	100 year (min)	500 year (min)
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5	0.083	0.003	0.003	0.005	0.005	0.006	0.006	0.006	0.007
10	0.167	0.006	0.007	0.009	0.010	0.011	0.012	0.013	0.014
15	0.250	0.009	0.010	0.014	0.015	0.017	0.018	0.019	0.021
20	0.333	0.011	0.014	0.018	0.020	0.023	0.024	0.026	0.028
25	0.417	0.014	0.017	0.023	0.025	0.028	0.031	0.032	0.035
30	0.500	0.017	0.021	0.027	0.030	0.034	0.037	0.039	0.042
35	0.583	0.020	0.024	0.032	0.035	0.040	0.043	0.045	0.049
40	0.667	0.023	0.028	0.036	0.040	0.046	0.049	0.052	0.056
45	0.750	0.026	0.031	0.041	0.045	0.051	0.055	0.058	0.063
50	0.833	0.028	0.035	0.045	0.050	0.057	0.061	0.065	0.070
55	0.917	0.031	0.038	0.050	0.055	0.063	0.067	0.071	0.077
60	1.000	0.034	0.042	0.054	0.060	0.068	0.073	0.078	0.084
65	1.083	0.037	0.045	0.059	0.065	0.074	0.079	0.084	0.091
70	1.167	0.040	0.049	0.063	0.070	0.080	0.086	0.090	0.098
75	1.250	0.043	0.052	0.068	0.075	0.085	0.092	0.097	0.105
80	1.333	0.046	0.056	0.072	0.080	0.091	0.098	0.103	0.112
85	1.417	0.048	0.059	0.077	0.085	0.097	0.104	0.110	0.119
90	1.500	0.051	0.063	0.081	0.090	0.103	0.110	0.116	0.126
95	1.583	0.054	0.066	0.086	0.095	0.108	0.116	0.123	0.133
100	1.667	0.057	0.069	0.090	0.100	0.114	0.122	0.129	0.140
105	1.750	0.060	0.073	0.095	0.105	0.120	0.128	0.136	0.147
110	1.833	0.063	0.076	0.099	0.110	0.125	0.134	0.142	0.154
115	1.917	0.065	0.080	0.104	0.115	0.131	0.141	0.149	0.161
120	2.000	0.068	0.083	0.108	0.120	0.137	0.147	0.155	0.168



Output Data to Export to PondPack, 5 minute intervals

Time (min)	Time (hours)	1 year (min)	2 year (min)	5 year (min)	10 year (min)	25 year (min)	50 year (min)	100 year (min)	500 year (min)
125	2.083	0.071	0.087	0.113	0.125	0.142	0.153	0.161	0.175
130	2.167	0.074	0.090	0.117	0.130	0.148	0.159	0.168	0.182
135	2.250	0.077	0.094	0.122	0.135	0.154	0.165	0.174	0.189
140	2.333	0.080	0.097	0.126	0.140	0.159	0.171	0.181	0.196
145	2.417	0.083	0.101	0.131	0.145	0.165	0.177	0.187	0.203
150	2.500	0.085	0.104	0.135	0.150	0.171	0.183	0.194	0.210
155	2.583	0.088	0.108	0.140	0.155	0.177	0.189	0.200	0.217
160	2.667	0.091	0.111	0.144	0.160	0.182	0.196	0.207	0.224
165	2.750	0.094	0.115	0.149	0.165	0.188	0.202	0.213	0.231
170	2.833	0.097	0.118	0.153	0.170	0.194	0.208	0.220	0.238
175	2.917	0.100	0.122	0.158	0.175	0.199	0.214	0.226	0.245
180	3.000	0.103	0.125	0.163	0.180	0.205	0.220	0.233	0.253
185	3.083	0.105	0.128	0.167	0.185	0.211	0.226	0.239	0.260
190	3.167	0.108	0.132	0.172	0.190	0.216	0.232	0.245	0.267
195	3.250	0.111	0.135	0.176	0.195	0.222	0.238	0.252	0.274
200	3.333	0.114	0.139	0.181	0.200	0.228	0.244	0.258	0.281
205	3.417	0.117	0.142	0.185	0.205	0.233	0.251	0.265	0.288
210	3.500	0.120	0.146	0.190	0.210	0.239	0.257	0.271	0.295
215	3.583	0.122	0.149	0.194	0.215	0.245	0.263	0.278	0.302
220	3.667	0.125	0.153	0.199	0.220	0.251	0.269	0.284	0.309
225	3.750	0.128	0.156	0.203	0.225	0.256	0.275	0.291	0.316
230	3.833	0.131	0.160	0.208	0.230	0.262	0.281	0.297	0.323
235	3.917	0.134	0.163	0.212	0.235	0.268	0.287	0.304	0.330
240	4.000	0.137	0.167	0.217	0.240	0.273	0.293	0.310	0.337
245	4.083	0.140	0.170	0.221	0.245	0.279	0.299	0.316	0.344
250	4.167	0.142	0.174	0.226	0.250	0.285	0.306	0.323	0.351
255	4.250	0.145	0.177	0.230	0.255	0.290	0.312	0.329	0.358
260	4.333	0.148	0.181	0.235	0.260	0.296	0.318	0.336	0.365
265	4.417	0.151	0.184	0.239	0.265	0.302	0.324	0.342	0.372
270	4.500	0.154	0.188	0.244	0.270	0.308	0.330	0.349	0.379
275	4.583	0.157	0.191	0.248	0.275	0.313	0.336	0.355	0.386
280	4.667	0.159	0.194	0.253	0.280	0.319	0.342	0.362	0.393
285	4.750	0.162	0.198	0.257	0.285	0.325	0.348	0.368	0.400
290	4.833	0.165	0.201	0.262	0.290	0.330	0.354	0.375	0.407
295	4.917	0.168	0.205	0.266	0.295	0.336	0.361	0.381	0.414
300	5.000	0.171	0.208	0.271	0.300	0.342	0.367	0.388	0.421
305	5.083	0.174	0.212	0.275	0.305	0.347	0.373	0.394	0.428
310	5.167	0.177	0.215	0.280	0.310	0.353	0.379	0.400	0.435
315	5.250	0.179	0.219	0.284	0.315	0.359	0.385	0.407	0.442
320	5.333	0.182	0.222	0.289	0.320	0.364	0.391	0.413	0.449
325	5.417	0.185	0.226	0.293	0.325	0.370	0.397	0.420	0.456
330	5.500	0.188	0.229	0.298	0.330	0.376	0.403	0.426	0.463
335	5.583	0.191	0.233	0.302	0.335	0.382	0.409	0.433	0.470
340	5.667	0.194	0.236	0.307	0.340	0.387	0.416	0.439	0.477
345	5.750	0.196	0.240	0.311	0.345	0.393	0.422	0.446	0.484
350	5.833	0.199	0.243	0.316	0.350	0.399	0.428	0.452	0.491
355	5.917	0.202	0.247	0.320	0.355	0.404	0.434	0.459	0.498
360	6.000	0.205	0.250	0.325	0.360	0.410	0.440	0.465	0.505

Output Data to Export to PondPack, 5 minute intervals

Time (min)	Time (hours)	1 year (min)	2 year (min)	5 year (min)	10 year (min)	25 year (min)	50 year (min)	100 year (min)	500 year (min)
365	6.083	0.210	0.257	0.333	0.370	0.422	0.455	0.482	0.529
370	6.167	0.216	0.263	0.342	0.380	0.435	0.469	0.499	0.552
375	6.250	0.221	0.270	0.350	0.390	0.447	0.484	0.516	0.576
380	6.333	0.227	0.276	0.358	0.400	0.460	0.498	0.533	0.599
385	6.417	0.232	0.283	0.367	0.410	0.472	0.513	0.550	0.623
390	6.500	0.238	0.289	0.375	0.420	0.485	0.528	0.568	0.647
395	6.583	0.243	0.296	0.383	0.430	0.497	0.542	0.585	0.670
400	6.667	0.248	0.302	0.392	0.440	0.510	0.557	0.602	0.694
405	6.750	0.254	0.309	0.400	0.450	0.522	0.571	0.619	0.718
410	6.833	0.259	0.315	0.408	0.460	0.535	0.586	0.636	0.741
415	6.917	0.265	0.322	0.417	0.470	0.547	0.600	0.653	0.765
420	7.000	0.270	0.328	0.425	0.480	0.560	0.615	0.670	0.788
425	7.083	0.275	0.335	0.433	0.490	0.572	0.630	0.687	0.812
430	7.167	0.281	0.341	0.442	0.500	0.585	0.644	0.704	0.836
435	7.250	0.286	0.348	0.450	0.510	0.597	0.659	0.721	0.859
440	7.333	0.292	0.354	0.458	0.520	0.610	0.673	0.738	0.883
445	7.417	0.297	0.361	0.467	0.530	0.622	0.688	0.755	0.906
450	7.500	0.303	0.368	0.475	0.540	0.635	0.703	0.773	0.930
455	7.583	0.308	0.374	0.483	0.550	0.647	0.717	0.790	0.954
460	7.667	0.313	0.381	0.492	0.560	0.660	0.732	0.807	0.977
465	7.750	0.319	0.387	0.500	0.570	0.672	0.746	0.824	1.001
470	7.833	0.324	0.394	0.508	0.580	0.685	0.761	0.841	1.024
475	7.917	0.330	0.400	0.517	0.590	0.697	0.775	0.858	1.048
480	8.000	0.335	0.407	0.525	0.600	0.710	0.790	0.875	1.072
485	8.083	0.340	0.413	0.533	0.610	0.722	0.805	0.892	1.095
490	8.167	0.346	0.420	0.542	0.620	0.735	0.819	0.909	1.119
495	8.250	0.351	0.426	0.550	0.630	0.747	0.834	0.926	1.143
500	8.333	0.357	0.433	0.558	0.640	0.760	0.848	0.943	1.166
505	8.417	0.362	0.439	0.567	0.650	0.772	0.863	0.960	1.190
510	8.500	0.368	0.446	0.575	0.660	0.785	0.878	0.978	1.213
515	8.583	0.373	0.452	0.583	0.670	0.797	0.892	0.995	1.237
520	8.667	0.378	0.459	0.592	0.680	0.810	0.907	1.012	1.261
525	8.750	0.384	0.465	0.600	0.690	0.822	0.921	1.029	1.284
530	8.833	0.389	0.472	0.608	0.700	0.835	0.936	1.046	1.308
535	8.917	0.395	0.478	0.617	0.710	0.847	0.950	1.063	1.331
540	9.000	0.400	0.485	0.625	0.720	0.860	0.965	1.080	1.355
545	9.083	0.410	0.497	0.640	0.737	0.881	0.989	1.108	1.392
550	9.167	0.420	0.509	0.654	0.755	0.902	1.013	1.135	1.428
555	9.250	0.430	0.521	0.669	0.772	0.923	1.038	1.163	1.465
560	9.333	0.440	0.533	0.684	0.790	0.944	1.062	1.190	1.502
565	9.417	0.450	0.545	0.699	0.807	0.966	1.086	1.218	1.538
570	9.500	0.460	0.557	0.713	0.825	0.987	1.110	1.245	1.575
575	9.583	0.470	0.569	0.728	0.842	1.008	1.134	1.273	1.612
580	9.667	0.480	0.581	0.743	0.860	1.029	1.158	1.300	1.648
585	9.750	0.490	0.593	0.758	0.877	1.050	1.183	1.328	1.685
590	9.833	0.500	0.604	0.772	0.895	1.071	1.207	1.355	1.722
595	9.917	0.510	0.616	0.787	0.912	1.092	1.231	1.383	1.758
600	10.000	0.520	0.628	0.802	0.930	1.113	1.255	1.410	1.795

Output Data to Export to PondPack, 5 minute intervals

Time (min)	Time (hours)	1 year (min)	2 year (min)	5 year (min)	10 year (min)	25 year (min)	50 year (min)	100 year (min)	500 year (min)
605	10.083	0.530	0.640	0.816	0.947	1.134	1.279	1.438	1.832
610	10.167	0.540	0.652	0.831	0.965	1.156	1.303	1.465	1.868
615	10.250	0.550	0.664	0.846	0.982	1.177	1.328	1.493	1.905
620	10.333	0.560	0.676	0.861	1.000	1.198	1.352	1.520	1.942
625	10.417	0.570	0.688	0.875	1.018	1.219	1.376	1.548	1.978
630	10.500	0.580	0.700	0.890	1.035	1.240	1.400	1.575	2.015
635	10.583	0.589	0.711	0.904	1.053	1.263	1.428	1.609	2.065
640	10.667	0.598	0.722	0.918	1.070	1.287	1.457	1.643	2.115
645	10.750	0.608	0.733	0.933	1.088	1.310	1.485	1.678	2.165
650	10.833	0.617	0.743	0.947	1.105	1.333	1.513	1.712	2.215
655	10.917	0.626	0.754	0.961	1.123	1.357	1.542	1.746	2.265
660	11.000	0.635	0.765	0.975	1.140	1.380	1.570	1.780	2.315
665	11.083	0.657	0.792	1.011	1.183	1.432	1.631	1.849	2.406
670	11.167	0.678	0.818	1.047	1.225	1.483	1.692	1.918	2.497
675	11.250	0.700	0.845	1.083	1.268	1.535	1.753	1.988	2.588
680	11.333	0.722	0.872	1.118	1.310	1.587	1.813	2.057	2.678
685	11.417	0.743	0.898	1.154	1.353	1.638	1.874	2.126	2.769
690	11.500	0.765	0.925	1.190	1.395	1.690	1.935	2.195	2.860
695	11.583	0.831	1.006	1.294	1.518	1.839	2.104	2.384	3.096
700	11.667	0.896	1.087	1.399	1.642	1.988	2.273	2.573	3.331
705	11.750	0.962	1.168	1.503	1.765	2.137	2.442	2.762	3.567
710	11.833	1.027	1.249	1.608	1.888	2.286	2.611	2.951	3.802
715	11.917	1.237	1.494	1.898	2.208	2.636	2.981	3.336	4.212
720	12.000	1.647	1.984	2.458	2.828	3.316	3.701	4.096	5.042
725	12.083	1.857	2.229	2.748	3.148	3.666	4.071	4.481	5.452
730	12.167	1.923	2.311	2.852	3.272	3.814	4.239	4.669	5.688
735	12.250	1.988	2.392	2.957	3.395	3.963	4.408	4.858	5.923
740	12.333	2.054	2.473	3.061	3.518	4.112	4.577	5.047	6.159
745	12.417	2.119	2.554	3.166	3.642	4.261	4.746	5.236	6.394
750	12.500	2.185	2.635	3.270	3.765	4.410	4.915	5.425	6.630
755	12.583	2.207	2.662	3.306	3.807	4.462	4.976	5.494	6.721
760	12.667	2.228	2.688	3.342	3.850	4.513	5.037	5.563	6.812
765	12.750	2.250	2.715	3.378	3.892	4.565	5.098	5.633	6.903
770	12.833	2.272	2.742	3.413	3.935	4.617	5.158	5.702	6.993
775	12.917	2.293	2.768	3.449	3.977	4.668	5.219	5.771	7.084
780	13.000	2.315	2.795	3.485	4.020	4.720	5.280	5.840	7.175
785	13.083	2.324	2.806	3.499	4.037	4.743	5.308	5.874	7.225
790	13.167	2.333	2.817	3.513	4.055	4.767	5.337	5.908	7.275
795	13.250	2.343	2.828	3.528	4.072	4.790	5.365	5.943	7.325
800	13.333	2.352	2.838	3.542	4.090	4.813	5.393	5.977	7.375
805	13.417	2.361	2.849	3.556	4.107	4.837	5.422	6.011	7.425
810	13.500	2.370	2.860	3.570	4.125	4.860	5.450	6.045	7.475
815	13.583	2.380	2.872	3.585	4.142	4.881	5.474	6.073	7.512
820	13.667	2.390	2.884	3.599	4.160	4.902	5.498	6.100	7.548
825	13.750	2.400	2.896	3.614	4.177	4.923	5.523	6.128	7.585
830	13.833	2.410	2.908	3.629	4.195	4.944	5.547	6.155	7.622
835	13.917	2.420	2.920	3.644	4.213	4.966	5.571	6.183	7.658
840	14.000	2.430	2.932	3.658	4.230	4.987	5.595	6.210	7.695

Output Data to Export to PondPack, 5 minute intervals

Time (min)	Time (hours)	1 year (min)	2 year (min)	5 year (min)	10 year (min)	25 year (min)	50 year (min)	100 year (min)	500 year (min)
845	14.083	2.440	2.944	3.673	4.248	5.008	5.619	6.238	7.732
850	14.167	2.450	2.956	3.688	4.265	5.029	5.643	6.265	7.768
855	14.250	2.460	2.968	3.703	4.283	5.050	5.668	6.293	7.805
860	14.333	2.470	2.979	3.717	4.300	5.071	5.692	6.320	7.842
865	14.417	2.480	2.991	3.732	4.318	5.092	5.716	6.348	7.878
870	14.500	2.490	3.003	3.747	4.335	5.113	5.740	6.375	7.915
875	14.583	2.500	3.015	3.761	4.353	5.134	5.764	6.403	7.952
880	14.667	2.510	3.027	3.776	4.370	5.156	5.788	6.430	7.988
885	14.750	2.520	3.039	3.791	4.388	5.177	5.813	6.458	8.025
890	14.833	2.530	3.051	3.806	4.405	5.198	5.837	6.485	8.062
895	14.917	2.540	3.063	3.820	4.423	5.219	5.861	6.513	8.098
900	15.000	2.550	3.075	3.835	4.440	5.240	5.885	6.540	8.135
905	15.083	2.555	3.082	3.843	4.450	5.253	5.900	6.557	8.159
910	15.167	2.561	3.088	3.852	4.460	5.265	5.914	6.574	8.182
915	15.250	2.566	3.095	3.860	4.470	5.278	5.929	6.591	8.206
920	15.333	2.572	3.101	3.868	4.480	5.290	5.943	6.608	8.229
925	15.417	2.577	3.108	3.877	4.490	5.303	5.958	6.625	8.253
930	15.500	2.583	3.114	3.885	4.500	5.315	5.973	6.643	8.277
935	15.583	2.588	3.121	3.893	4.510	5.328	5.987	6.660	8.300
940	15.667	2.593	3.127	3.902	4.520	5.340	6.002	6.677	8.324
945	15.750	2.599	3.134	3.910	4.530	5.353	6.016	6.694	8.348
950	15.833	2.604	3.140	3.918	4.540	5.365	6.031	6.711	8.371
955	15.917	2.610	3.147	3.927	4.550	5.378	6.045	6.728	8.395
960	16.000	2.615	3.153	3.935	4.560	5.390	6.060	6.745	8.418
965	16.083	2.620	3.160	3.943	4.570	5.403	6.075	6.762	8.442
970	16.167	2.626	3.166	3.952	4.580	5.415	6.089	6.779	8.466
975	16.250	2.631	3.173	3.960	4.590	5.428	6.104	6.796	8.489
980	16.333	2.637	3.179	3.968	4.600	5.440	6.118	6.813	8.513
985	16.417	2.642	3.186	3.977	4.610	5.453	6.133	6.830	8.536
990	16.500	2.648	3.193	3.985	4.620	5.465	6.148	6.848	8.560
995	16.583	2.653	3.199	3.993	4.630	5.478	6.162	6.865	8.584
1000	16.667	2.658	3.206	4.002	4.640	5.490	6.177	6.882	8.607
1005	16.750	2.664	3.212	4.010	4.650	5.503	6.191	6.899	8.631
1010	16.833	2.669	3.219	4.018	4.660	5.515	6.206	6.916	8.654
1015	16.917	2.675	3.225	4.027	4.670	5.528	6.220	6.933	8.678
1020	17.000	2.680	3.232	4.035	4.680	5.540	6.235	6.950	8.702
1025	17.083	2.685	3.238	4.043	4.690	5.553	6.250	6.967	8.725
1030	17.167	2.691	3.245	4.052	4.700	5.565	6.264	6.984	8.749
1035	17.250	2.696	3.251	4.060	4.710	5.578	6.279	7.001	8.773
1040	17.333	2.702	3.258	4.068	4.720	5.590	6.293	7.018	8.796
1045	17.417	2.707	3.264	4.077	4.730	5.603	6.308	7.035	8.820
1050	17.500	2.713	3.271	4.085	4.740	5.615	6.323	7.053	8.843
1055	17.583	2.718	3.277	4.093	4.750	5.628	6.337	7.070	8.867
1060	17.667	2.723	3.284	4.102	4.760	5.640	6.352	7.087	8.891
1065	17.750	2.729	3.290	4.110	4.770	5.653	6.366	7.104	8.914
1070	17.833	2.734	3.297	4.118	4.780	5.665	6.381	7.121	8.938
1075	17.917	2.740	3.303	4.127	4.790	5.678	6.395	7.138	8.961
1080	18.000	2.745	3.310	4.135	4.800	5.690	6.410	7.155	8.985

Output Data to Export to PondPack, 5 minute intervals

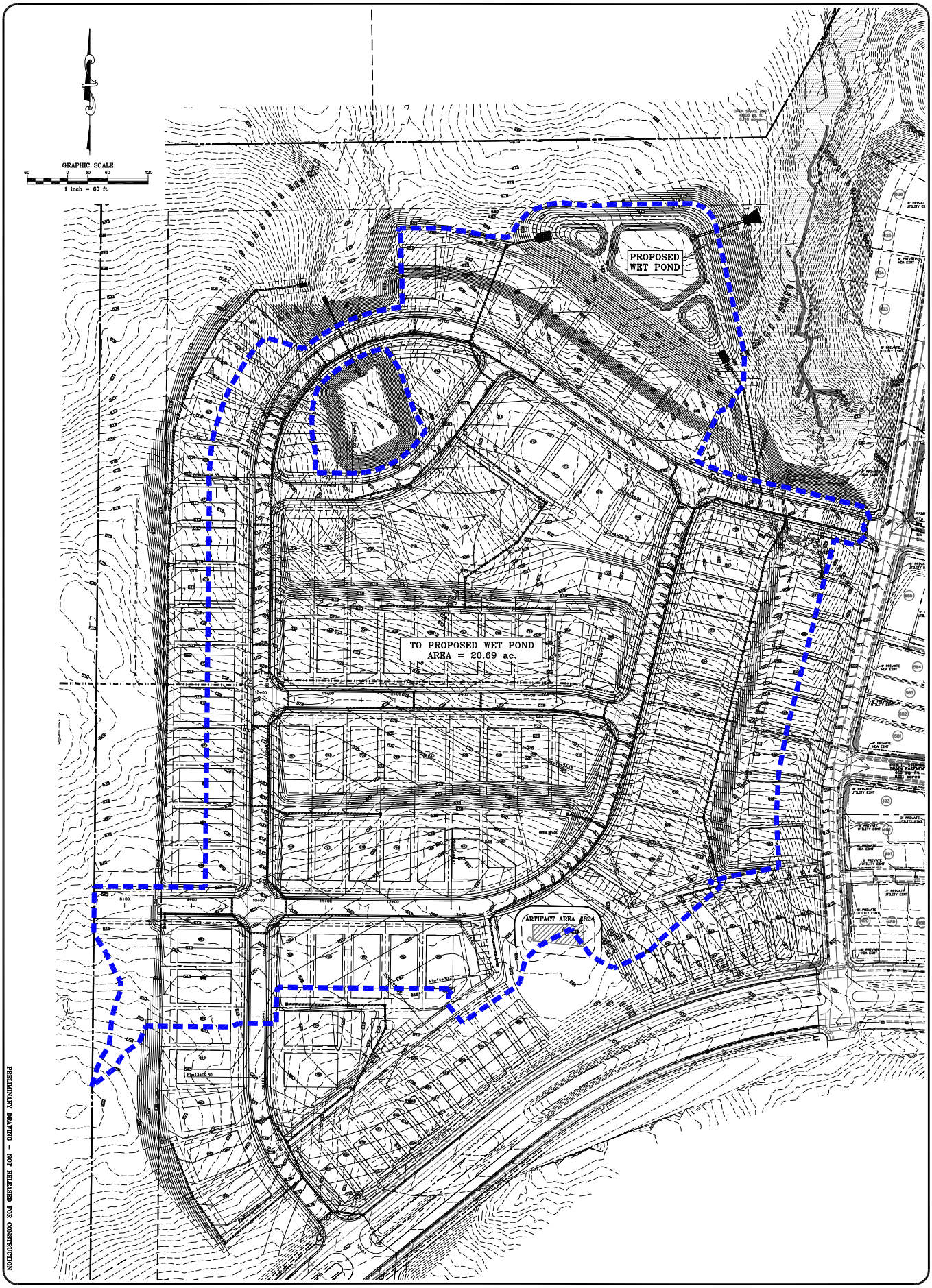
Time (min)	Time (hours)	1 year (min)	2 year (min)	5 year (min)	10 year (min)	25 year (min)	50 year (min)	100 year (min)	500 year (min)
1085	18.083	2.748	3.313	4.140	4.805	5.696	6.416	7.161	8.992
1090	18.167	2.751	3.317	4.144	4.810	5.701	6.422	7.168	8.999
1095	18.250	2.754	3.320	4.149	4.815	5.707	6.428	7.174	9.006
1100	18.333	2.756	3.324	4.153	4.820	5.713	6.434	7.181	9.013
1105	18.417	2.759	3.327	4.158	4.825	5.718	6.441	7.187	9.020
1110	18.500	2.762	3.331	4.162	4.830	5.724	6.447	7.194	9.027
1115	18.583	2.765	3.334	4.167	4.835	5.730	6.453	7.200	9.034
1120	18.667	2.768	3.338	4.171	4.840	5.736	6.459	7.207	9.041
1125	18.750	2.771	3.341	4.176	4.845	5.741	6.465	7.213	9.048
1130	18.833	2.773	3.345	4.180	4.850	5.747	6.471	7.220	9.055
1135	18.917	2.776	3.348	4.185	4.855	5.753	6.477	7.226	9.062
1140	19.000	2.779	3.352	4.189	4.860	5.758	6.483	7.233	9.069
1145	19.083	2.782	3.355	4.194	4.865	5.764	6.489	7.239	9.076
1150	19.167	2.785	3.359	4.198	4.870	5.770	6.496	7.245	9.083
1155	19.250	2.788	3.362	4.203	4.875	5.775	6.502	7.252	9.090
1160	19.333	2.791	3.366	4.207	4.880	5.781	6.508	7.258	9.097
1165	19.417	2.793	3.369	4.212	4.885	5.787	6.514	7.265	9.104
1170	19.500	2.796	3.373	4.216	4.890	5.793	6.520	7.271	9.111
1175	19.583	2.799	3.376	4.221	4.895	5.798	6.526	7.278	9.118
1180	19.667	2.802	3.379	4.225	4.900	5.804	6.532	7.284	9.125
1185	19.750	2.805	3.383	4.230	4.905	5.810	6.538	7.291	9.132
1190	19.833	2.808	3.386	4.234	4.910	5.815	6.544	7.297	9.139
1195	19.917	2.810	3.390	4.239	4.915	5.821	6.551	7.304	9.146
1200	20.000	2.813	3.393	4.243	4.920	5.827	6.557	7.310	9.153
1205	20.083	2.816	3.397	4.248	4.925	5.832	6.563	7.316	9.160
1210	20.167	2.819	3.400	4.252	4.930	5.838	6.569	7.323	9.167
1215	20.250	2.822	3.404	4.257	4.935	5.844	6.575	7.329	9.174
1220	20.333	2.825	3.407	4.261	4.940	5.849	6.581	7.336	9.181
1225	20.417	2.828	3.411	4.266	4.945	5.855	6.587	7.342	9.188
1230	20.500	2.830	3.414	4.270	4.950	5.861	6.593	7.349	9.195
1235	20.583	2.833	3.418	4.275	4.955	5.867	6.599	7.355	9.202
1240	20.667	2.836	3.421	4.279	4.960	5.872	6.606	7.362	9.209
1245	20.750	2.839	3.425	4.284	4.965	5.878	6.612	7.368	9.216
1250	20.833	2.842	3.428	4.288	4.970	5.884	6.618	7.375	9.223
1255	20.917	2.845	3.432	4.293	4.975	5.889	6.624	7.381	9.230
1260	21.000	2.848	3.435	4.298	4.980	5.895	6.630	7.388	9.238
1265	21.083	2.850	3.438	4.302	4.985	5.901	6.636	7.394	9.245
1270	21.167	2.853	3.442	4.307	4.990	5.906	6.642	7.400	9.252
1275	21.250	2.856	3.445	4.311	4.995	5.912	6.648	7.407	9.259
1280	21.333	2.859	3.449	4.316	5.000	5.918	6.654	7.413	9.266
1285	21.417	2.862	3.452	4.320	5.005	5.923	6.661	7.420	9.273
1290	21.500	2.865	3.456	4.325	5.010	5.929	6.667	7.426	9.280
1295	21.583	2.867	3.459	4.329	5.015	5.935	6.673	7.433	9.287
1300	21.667	2.870	3.463	4.334	5.020	5.941	6.679	7.439	9.294
1305	21.750	2.873	3.466	4.338	5.025	5.946	6.685	7.446	9.301
1310	21.833	2.876	3.470	4.343	5.030	5.952	6.691	7.452	9.308
1315	21.917	2.879	3.473	4.347	5.035	5.958	6.697	7.459	9.315
1320	22.000	2.882	3.477	4.352	5.040	5.963	6.703	7.465	9.322

Output Data to Export to PondPack, 5 minute intervals

Time (min)	Time (hours)	1 year (min)	2 year (min)	5 year (min)	10 year (min)	25 year (min)	50 year (min)	100 year (min)	500 year (min)
1325	22.083	2.885	3.480	4.356	5.045	5.969	6.709	7.471	9.329
1330	22.167	2.887	3.484	4.361	5.050	5.975	6.716	7.478	9.336
1335	22.250	2.890	3.487	4.365	5.055	5.980	6.722	7.484	9.343
1340	22.333	2.893	3.491	4.370	5.060	5.986	6.728	7.491	9.350
1345	22.417	2.896	3.494	4.374	5.065	5.992	6.734	7.497	9.357
1350	22.500	2.899	3.498	4.379	5.070	5.998	6.740	7.504	9.364
1355	22.583	2.902	3.501	4.383	5.075	6.003	6.746	7.510	9.371
1360	22.667	2.904	3.504	4.388	5.080	6.009	6.752	7.517	9.378
1365	22.750	2.907	3.508	4.392	5.085	6.015	6.758	7.523	9.385
1370	22.833	2.910	3.511	4.397	5.090	6.020	6.764	7.530	9.392
1375	22.917	2.913	3.515	4.401	5.095	6.026	6.771	7.536	9.399
1380	23.000	2.916	3.518	4.406	5.100	6.032	6.777	7.543	9.406
1385	23.083	2.919	3.522	4.410	5.105	6.037	6.783	7.549	9.413
1390	23.167	2.922	3.525	4.415	5.110	6.043	6.789	7.555	9.420
1395	23.250	2.924	3.529	4.419	5.115	6.049	6.795	7.562	9.427
1400	23.333	2.927	3.532	4.424	5.120	6.054	6.801	7.568	9.434
1405	23.417	2.930	3.536	4.428	5.125	6.060	6.807	7.575	9.441
1410	23.500	2.933	3.539	4.433	5.130	6.066	6.813	7.581	9.448
1415	23.583	2.936	3.543	4.437	5.135	6.072	6.819	7.588	9.455
1420	23.667	2.939	3.546	4.442	5.140	6.077	6.826	7.594	9.462
1425	23.750	2.941	3.550	4.446	5.145	6.083	6.832	7.601	9.469
1430	23.833	2.944	3.553	4.451	5.150	6.089	6.838	7.607	9.476
1435	23.917	2.947	3.557	4.455	5.155	6.094	6.844	7.614	9.483
1440	24.000	2.950	3.560	4.460	5.160	6.100	6.850	7.620	9.490

HYDROLOGIC CALCULATIONS

BRIAR CHAPEL – PHASE 6 NORTH
NEW-12000



PRELIMINARY DRAWING - NOT RELEASED FOR CONSTRUCTION

BRIAR CHAPEL

PHASE 6 NORTH

BALDWIN AND WILLIAMS TOWNSHIPS, CHATHAM COUNTY NC

POST-DEVELOPMENT WATERSHED MAP

McADAMS

POST

PROJECT MGR: JF
DESIGNED BY: JF
DRAWN BY: JF
CHECKED BY: JF
DATE: 06-13-2012
SCALE: 1"=60'
PROJECT NO.: NEW-12000

OWNER:
BRIAR CHAPEL™
by Newland COMMUNITIES
NNP-BRIAR CHAPEL, L.L.C.
16 WINDY KNOLL CIRCLE
CHAPEL HILL, NORTH CAROLINA 27516

REVISIONS:
1. -

EcoEngineering
A division of The John R. McAdams Company, Inc.
ENGINEERS • PLANNERS • SURVEYORS • ENVIRONMENTAL
RESEARCH TRIANGLE PARK • CHARLOTTE
2905 Meridian Parkway, Durham NC 27713
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HYDROLOGIC CALCULATIONS

Post-Development-To Wet Pond

I. SCS CURVE NUMBERS

HSG	Impervious	Open	Wooded
A	98	39	30
B	98	61	55
C	98	74	70
D	98	80	77

Assume:

HSG 'A' = 0.0%
HSG 'B' = 100.0%
HSG 'C' = 0.0%
HSG 'D' = 0.0%

Cover Condition	SCS CN	Comments
Impervious	98	-
Open	61	Assume good condition
Wooded	55	Assume good condition
Water	100	-

II. POST-DEVELOPMENT

==> To Wet Pond

A. Watershed Breakdown

Total Number of Single-Family 50' Lots =	37	lots
Assumed Impervious Area Per Single-Family 50' Lot =	3,500	square feet
Total Impervious Area from Single-Family 50' Lots =	129,500	square feet
=	2.97	acres
Total Number of Single-Family 60' Lots =	23.25	lots
Assumed Impervious Area Per Single-Family 60' Lot =	3,800	square feet
Total Impervious Area from Single-Family 60' Lots =	88,350	square feet
=	2.03	acres
Total Number of Single-Family 50' Corner Lots =	11	lots
Assumed Impervious Area Per Single-Family 50' Corner Lot =	3,700	square feet
Total Impervious Area from Single-Family 50' Corner Lots =	40,700	square feet
=	0.93	acres
Total Number of Single-Family 60' Corner Lots =	5.5	lots
Assumed Impervious Area Per Single-Family 60' Corner Lot =	4,000	square feet
Total Impervious Area from Single-Family 60' Corner Lots =	22,000	square feet
=	0.51	acres
Total Open Space Lots =	2	lots
Assumed Impervious Area Per Open Space Lot =	5,000	square feet
Total Impervious Area from Open Space Lots =	10,000	square feet
=	0.23	acres
Total Sidewalk Impervious Area =	32,704	square feet
=	0.75	acres
Total Roadway Impervious Area =	123,537	square feet
=	2.84	acres

Contributing Area	SCS CN	Area [acres]	Comments
On-site open	61	9.84	Assume good condition
On-site impervious	98	10.26	-
On-site wooded	55	0.00	Assume good condition
On-site pond	100	0.59	-
Off-site open	61	0.00	Assume good condition
Off-site impervious	98	0.00	-
Off-site wooded	55	0.00	Assume good condition
Off-site pond	100	0.00	-

Total area =	20.69	acres
	0.0323	sq.mi.
Composite SCS CN =	80	
% Impervious =	49.6%	

B. Time of Concentration Information

Due to the amount of piped and overland pavement flow, the post-development time of concentration was assumed to be 5 minute

Time of Concentration =	5.00	minutes
SCS Lag Time =	3.00	minutes (SCS Lag = 0.6* Tc)
=	0.0500	hours
Time Increment =	0.87	minutes (= 0.29*SCS Lag)

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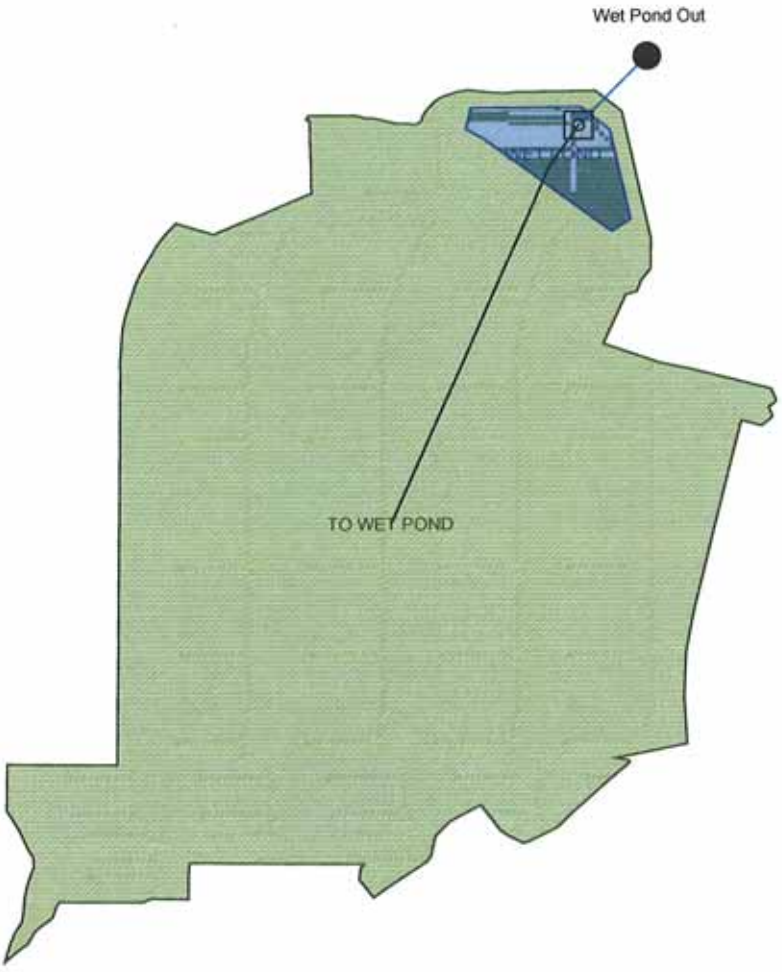
Scenario: Post



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Subsection: Master Network Summary

Catchments Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ft³)	Time to Peak (min)	Peak Flow (ft³/s)
TO WET POND	Post-1	1	90,942.000	722.000	43.46
TO WET POND	Post-2	2	126,338.000	721.000	60.48
TO WET POND	Post-10	10	227,527.000	721.000	96.67
TO WET POND	Post-25	25	290,462.000	721.000	114.39
TO WET POND	Post-100	100	395,443.000	721.000	138.31

Node Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ft³)	Time to Peak (min)	Peak Flow (ft³/s)
Wet Pond Out	Post-1	1	14,621.000	1,440.000	0.36
Wet Pond Out	Post-2	2	45,610.000	901.000	2.20
Wet Pond Out	Post-10	10	146,061.000	751.000	24.41
Wet Pond Out	Post-25	25	208,656.000	729.000	50.33
Wet Pond Out	Post-100	100	313,207.000	728.000	70.98

Pond Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ft³)	Time to Peak (min)	Peak Flow (ft³/s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ft³)
WET POND (IN)	Post-1	1	90,942.000	722.000	43.46	(N/A)	(N/A)
WET POND (OUT)	Post-1	1	14,621.000	1,440.000	0.36	474.39	76,322.000
WET POND (IN)	Post-2	2	126,338.000	721.000	60.48	(N/A)	(N/A)
WET POND (OUT)	Post-2	2	45,610.000	901.000	2.20	474.60	83,510.000
WET POND (IN)	Post-10	10	227,527.000	721.000	96.67	(N/A)	(N/A)
WET POND (OUT)	Post-10	10	146,061.000	751.000	24.41	475.04	99,361.000
WET POND (IN)	Post-25	25	290,462.000	721.000	114.39	(N/A)	(N/A)
WET POND (OUT)	Post-25	25	208,656.000	729.000	50.33	475.38	111,706.000
WET POND (IN)	Post-100	100	395,443.000	721.000	138.31	(N/A)	(N/A)
WET POND (OUT)	Post-100	100	313,207.000	728.000	70.98	475.94	131,884.000

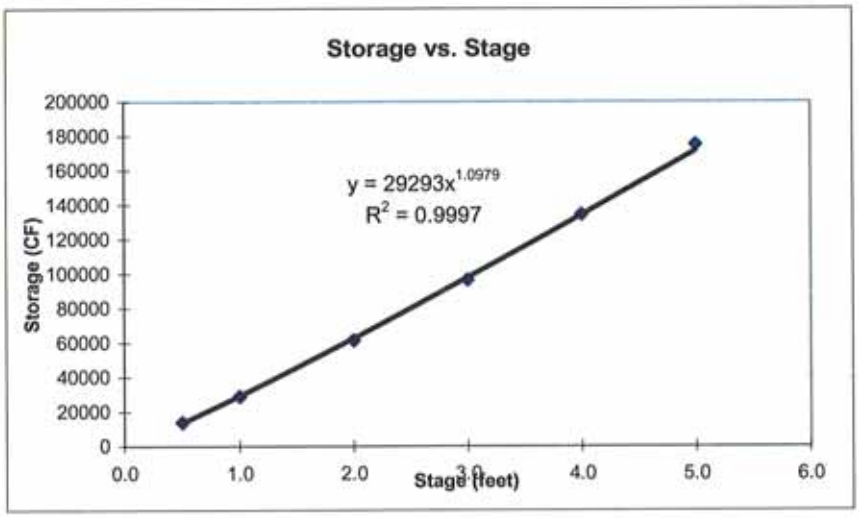
WET POND FINAL DESIGN CALCULATIONS

BRIAR CHAPEL – PHASE 6 NORTH
NEW-12000

Stage-Storage Function

Project Name: Briar Chapel - Phase 6 North
Designer: J. Finch, PE
Job Number: NEW-12000
Date: 5/10/2012

Contour (feet)	Stage (feet)	Contour Area (SF)	Average Contour Area (SF)	Incremental Contour Volume (CF)	Accumulated Contour Volume (CF)	Estimated Volume w/ S-S Fxn (CF)
472.00	0.0	25,869				
472.50	0.5	29,691	27780	13890	13890	0.51
473.00	1.0	31,131	30411	15206	29096	0.99
474.00	2.0	33,737	32434	32434	61529	1.97
475.00	3.0	36,442	35089	35089	96619	2.97
476.00	4.0	39,246	37844	37844	134462	4.01
477.00	5.0	42,150	40698	40698	175160	5.10



Ks =	29293
b =	1.0979

WET POND

==> *Stage - Storage Function*

Ks = 29293
b = 1.0979
Zo = 472.00

Elevation [feet]	Storage [cf]	[acre-feet]
472.00	0	0.000
472.20	5005	0.115
472.40	10712	0.246
472.60	16718	0.384
472.80	22928	0.526
473.00	29293	0.672
473.20	35785	0.822
473.40	42384	0.973
473.60	49076	1.127
473.80	55851	1.282
474.00	62700	1.439
474.20	69616	1.598
474.40	76595	1.758
474.60	83630	1.920
474.80	90719	2.083
475.00	97858	2.247
475.20	105043	2.411
475.40	112273	2.577
475.60	119544	2.744
475.80	126855	2.912
476.00	134204	3.081
476.20	141589	3.250
476.40	149008	3.421
476.60	156461	3.592
476.80	163945	3.764
477.00	171460	3.936

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Subsection: Outlet Input Data
Label: Wet Pond

Requested Pond Water Surface Elevations	
Minimum (Headwater)	472.00 ft
Increment (Headwater)	0.10 ft
Maximum (Headwater)	477.00 ft

Outlet Connectivity

Structure Type	Outlet ID	Direction	Outfall	E1 (ft)	E2 (ft)
Inlet Box	Riser - 1	Forward	Culvert - 1	474.50	477.00
Orifice-Circular	Orifice - 1	Forward	Culvert - 1	472.00	477.00
Culvert-Circular	Culvert - 1	Forward	TW	466.00	477.00
Tailwater Settings	Tailwater			(N/A)	(N/A)

Subsection: Outlet Input Data
Label: Wet Pond

Structure ID: Riser - 1 Structure Type: Inlet Box	
Number of Openings	1
Elevation	474.50 ft
Orifice Area	25.0 ft²
Orifice Coefficient	0.600
Weir Length	20.00 ft
Weir Coefficient	3.00 (ft^0.5)/s
K Reverse	1.000
Manning's n	0.000
Kev, Charged Riser	0.000
Weir Submergence	False
Orifice H to crest	False

Subsection: Outlet Input Data
Label: Wet Pond

Structure ID: Culvert - 1 Structure Type: Culvert-Circular	
Number of Barrels	1
Diameter	30.0 in
Length	83.00 ft
Length (Computed Barrel)	83.10 ft
Slope (Computed)	0.048 ft/ft

Outlet Control Data	
Manning's n	0.013
Ke	0.500
Kb	0.009
Kr	0.000
Convergence Tolerance	0.00 ft

Inlet Control Data	
Equation Form	Form 1
K	0.0098
M	2.0000
C	0.0398
Y	0.6700
T1 ratio (HW/D)	0.000
T2 ratio (HW/D)	1.283
Slope Correction Factor	-0.500

Use unsubmerged inlet control 0 equation below T1 elevation.
Use submerged inlet control 0 equation above T2 elevation

In transition zone between unsubmerged and submerged inlet control,
interpolate between flows at T1 & T2...

T1 Elevation	466.00 ft	T1 Flow	27.16 ft^3/s
T2 Elevation	469.21 ft	T2 Flow	31.05 ft^3/s

Subsection: Outlet Input Data
Label: Wet Pond

Structure ID: Orifice - 1 Structure Type: Orifice-Circular	
Number of Openings	1
Elevation	472.00 ft
Orifice Diameter	3.0 in
Orifice Coefficient	0.600

Structure ID: TW Structure Type: TW Setup, DS Channel	
Tailwater Type	Free Outfall

Convergence Tolerances	
Maximum Iterations	30
Tailwater Tolerance (Minimum)	0.01 ft
Tailwater Tolerance (Maximum)	0.50 ft
Headwater Tolerance (Minimum)	0.01 ft
Headwater Tolerance (Maximum)	0.50 ft
Flow Tolerance (Minimum)	0.001 ft^3/s
Flow Tolerance (Maximum)	10.000 ft^3/s

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Subsection: Composite Rating Curve
Label: Wet Pond

Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft^3/s)	Tailwater Elevation (ft)	Convergence Error (ft)
472.00	0.00	(N/A)	0.00
472.10	0.02	(N/A)	0.00
472.20	0.06	(N/A)	0.00
472.30	0.10	(N/A)	0.00
472.40	0.12	(N/A)	0.00
472.50	0.14	(N/A)	0.00
472.60	0.16	(N/A)	0.00
472.70	0.18	(N/A)	0.00
472.80	0.19	(N/A)	0.00
472.90	0.21	(N/A)	0.00
473.00	0.22	(N/A)	0.00
473.10	0.23	(N/A)	0.00
473.20	0.25	(N/A)	0.00
473.30	0.26	(N/A)	0.00
473.40	0.27	(N/A)	0.00
473.50	0.28	(N/A)	0.00
473.60	0.29	(N/A)	0.00
473.70	0.30	(N/A)	0.00
473.80	0.30	(N/A)	0.00
473.90	0.31	(N/A)	0.00
474.00	0.32	(N/A)	0.00
474.10	0.33	(N/A)	0.00
474.20	0.34	(N/A)	0.00
474.30	0.35	(N/A)	0.00
474.40	0.36	(N/A)	0.00
474.50	0.37	(N/A)	0.00
474.60	2.27	(N/A)	0.00
474.70	5.74	(N/A)	0.00
474.80	10.25	(N/A)	0.00
474.90	15.57	(N/A)	0.00
475.00	21.62	(N/A)	0.00
475.10	28.29	(N/A)	0.00
475.20	35.55	(N/A)	0.00
475.30	43.36	(N/A)	0.00
475.40	51.63	(N/A)	0.00
475.50	60.31	(N/A)	0.00
475.60	69.26	(N/A)	0.00
475.70	69.96	(N/A)	0.00
475.80	70.39	(N/A)	0.00
475.90	70.82	(N/A)	0.00
476.00	71.25	(N/A)	0.00

EcoEngineering
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Subsection: Composite Rating Curve
Label: Wet Pond

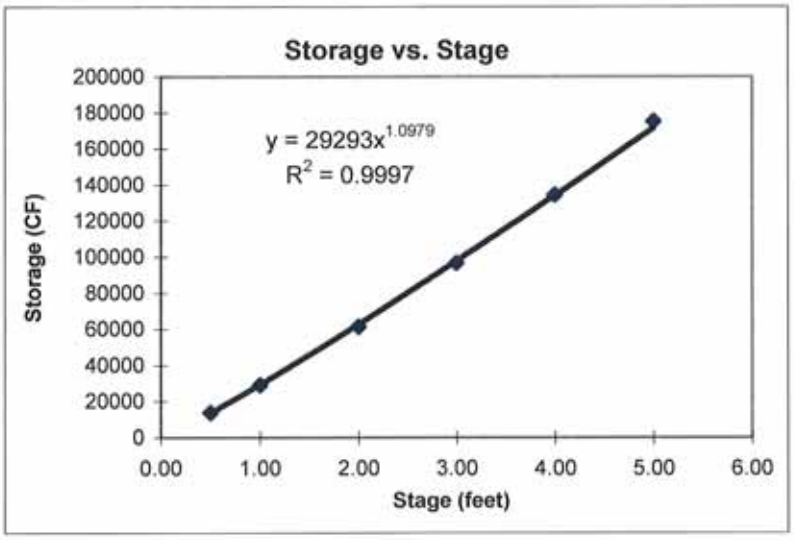
Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft^3/s)	Tailwater Elevation (ft)	Convergence Error (ft)
476.10	71.67	(N/A)	0.00
476.20	72.10	(N/A)	0.00
476.30	72.52	(N/A)	0.00
476.40	72.93	(N/A)	0.00
476.50	73.34	(N/A)	0.00
476.60	73.75	(N/A)	0.00
476.70	74.17	(N/A)	0.00
476.80	74.57	(N/A)	0.00
476.90	74.98	(N/A)	0.00
477.00	75.38	(N/A)	0.00

Contributing Structures
(no Q: Riser - 1,Orifice - 1,Culvert - 1)
Orifice - 1,Culvert - 1 (no Q: Riser - 1)
Orifice - 1,Culvert - 1 (no Q: Riser - 1)
Orifice - 1,Culvert - 1 (no Q: Riser - 1)
Orifice - 1,Culvert - 1 (no Q: Riser - 1)
Orifice - 1,Culvert - 1 (no Q: Riser - 1)
Orifice - 1,Culvert - 1 (no Q: Riser - 1)
Orifice - 1,Culvert - 1 (no Q: Riser - 1)
Orifice - 1,Culvert - 1 (no Q: Riser - 1)
Orifice - 1,Culvert - 1 (no Q: Riser - 1)
Orifice - 1,Culvert - 1 (no Q: Riser - 1)
Orifice - 1,Culvert - 1 (no Q: Riser - 1)
Orifice - 1,Culvert - 1 (no Q: Riser - 1)
Orifice - 1,Culvert - 1 (no Q: Riser - 1)
Orifice - 1,Culvert - 1 (no Q: Riser - 1)
Orifice - 1,Culvert - 1 (no Q: Riser - 1)
Orifice - 1,Culvert - 1 (no Q: Riser - 1)
Orifice - 1,Culvert - 1 (no Q: Riser - 1)
Orifice - 1,Culvert - 1 (no Q: Riser - 1)
Orifice - 1,Culvert - 1 (no Q: Riser - 1)
Orifice - 1,Culvert - 1 (no Q: Riser - 1)
Orifice - 1,Culvert - 1 (no Q: Riser - 1)
Orifice - 1,Culvert - 1 (no Q: Riser - 1)
Orifice - 1,Culvert - 1 (no Q: Riser - 1)
Orifice - 1,Culvert - 1 (no Q: Riser - 1)
Orifice - 1,Culvert - 1 (no Q: Riser - 1)
Riser - 1,Orifice - 1,Culvert - 1
Riser - 1,Orifice - 1,Culvert - 1
Riser - 1,Orifice - 1,Culvert - 1
Riser - 1,Orifice - 1,Culvert - 1

STAGE-STORAGE FUNCTION - ABOVE NORMAL POOL

Contour (feet)	Stage (feet)	Contour Area (SF)	Average Contour Area (SF)	Incremental Contour Volume (CF)	Accumulated Contour Volume (CF)	Estimated Stage w/ S-S Fxn (feet)
472.00	0.00	25,869				
472.50	0.50	29,691	27780	13890	13890	0.51
473.00	1.00	31,131	30411	15206	29096	0.99
474.00	2.00	33,737	32434	32434	61529	1.97
475.00	3.00	36,442	35089	35089	96619	2.97
476.00	4.00	39,246	37844	37844	134462	4.01
477.00	5.00	42,150	40698	40698	175160	5.10



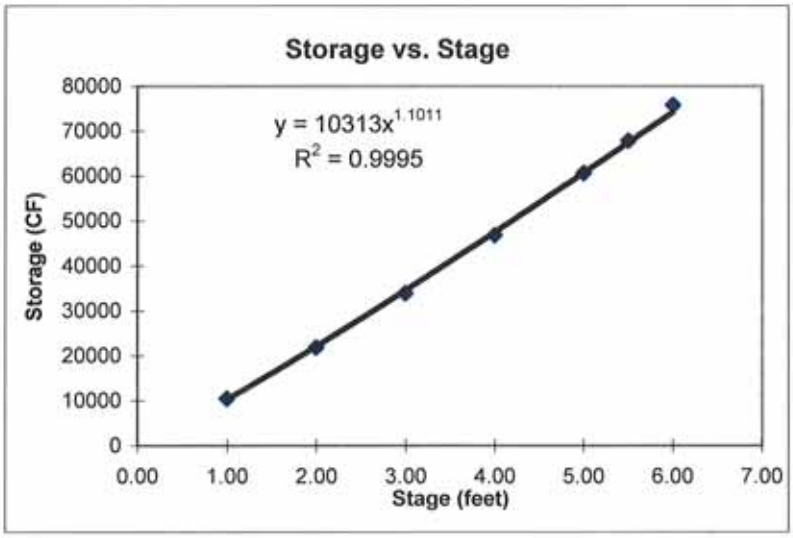
K_S =	29293
b =	1.0979

WET DETENTION POND

Below NWSE - Main Pool

STAGE-STORAGE FUNCTION - MAIN POOL

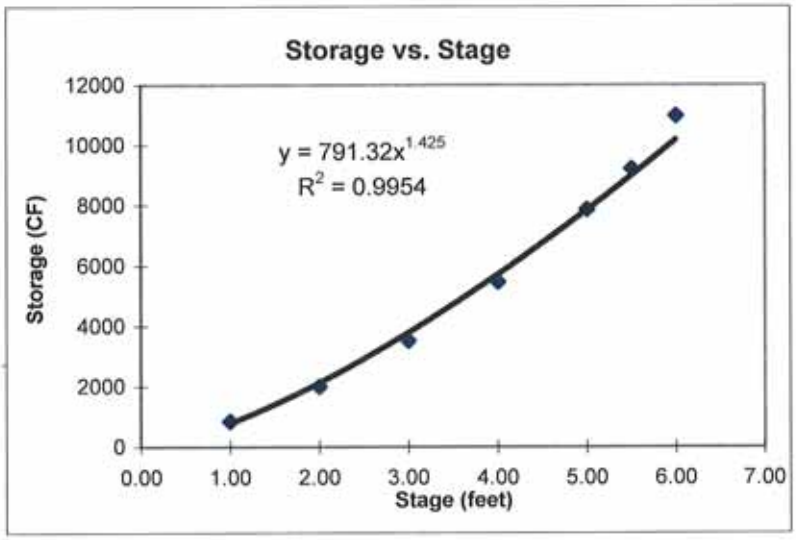
Contour (feet)	Stage (feet)	Contour Area (SF)	Average Contour Area (SF)	Incremental Contour Volume (CF)	Accumulated Contour Volume (CF)	Estimated Stage w/ S-S Fxn (feet)
466.00	0.00	10,127				
467.00	1.00	10,897	10512	10512	10512	1.02
468.00	2.00	11,692	11294	11294	21806	1.97
469.00	3.00	12,512	12102	12102	33907	2.95
470.00	4.00	13,357	12934	12934	46842	3.95
471.00	5.00	14,227	13792	13792	60633	5.00
471.50	5.50	14,672	14449	7225	67858	5.53
472.00	6.00	17,128	15900	7950	75808	6.12



K_S =	10313
b =	1.1011

STAGE-STORAGE FUNCTION - NORTH FOREBAY

Contour (feet)	Stage (feet)	Contour Area (SF)	Average Contour Area (SF)	Incremental Contour Volume (CF)	Accumulated Contour Volume (CF)	Estimated Stage w/ S-S Fxn (feet)
466.00	0.00	744				
467.00	1.00	963	853	853	853	1.05
468.00	2.00	1,320	1142	1142	1995	1.91
469.00	3.00	1,724	1522	1522	3517	2.85
470.00	4.00	2,174	1949	1949	5466	3.88
471.00	5.00	2,615	2395	2395	7861	5.01
471.50	5.50	2,821	2718	1359	9220	5.60
472.00	6.00	4,156	3488	1744	10964	6.33



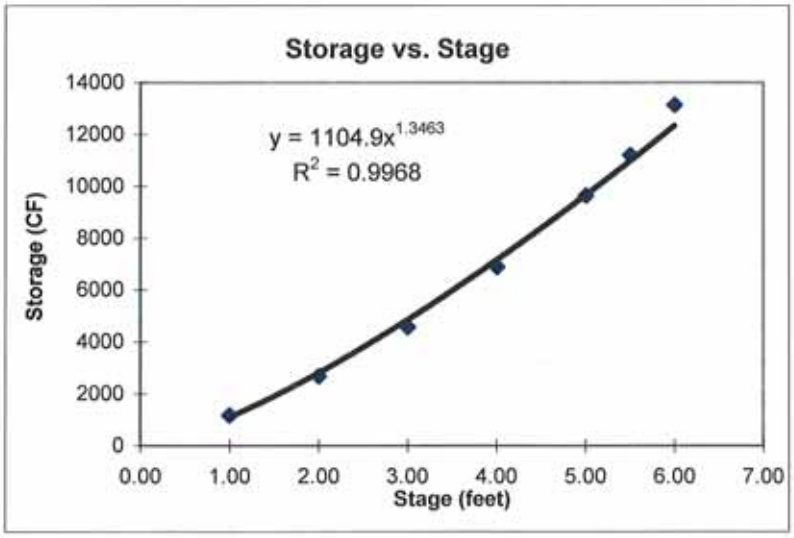
K_S =	791.32
b =	1.4250

WET DETENTION POND

Below NWSE - Forebay #2

STAGE-STORAGE FUNCTION - NORTH FOREBAY

Contour (feet)	Stage (feet)	Contour Area (SF)	Average Contour Area (SF)	Incremental Contour Volume (CF)	Accumulated Contour Volume (CF)	Estimated Stage w/ S-S Fxn (feet)
460.00	0.00	1,009				
461.00	1.00	1,333	1171	1171	1171	1.04
462.00	2.00	1,693	1513	1513	2684	1.93
463.00	3.00	2,090	1891	1891	4575	2.87
464.00	4.00	2,524	2307	2307	6882	3.89
465.00	5.00	2,994	2759	2759	9641	5.00
465.50	5.50	3,207	3100	1550	11191	5.58
466.00	6.00	4,586	3896	1948	13139	6.29



K_S =	1104.9
b =	1.3463

BRIAR CHAPEL - PHASE 6 NORTH
NEW-12000

WET DETENTION POND

Summary

J. FINCH, PE
6/14/2012

I. TOTAL VOLUME OF FACILITY

Volume of Main Pool =	75,808	cf
Volume of Forebay #1 =	10,964	cf
Volume of Forebay #2 =	13,139	cf
Total Volume Below NWSE =	99,911	cf
=	2.29	acre-ft
Total Volume Above NWSE =	175,160	cf
=	4.02	acre-ft
Total Volume of Facility =	275,071	cf
=	6.31	acre-ft

II. FOREBAY PERCENTAGE OF PERMANENT POOL VOLUME

Per NCDWQ design guidelines, the forebay volume should equal approximately 20% of the total permanent pool volume.

Total Volume Below NWSE =	99,911	cf
Volume of Forebay #1 =	10,964	cf
Volume of Forebay #2 =	13,139	cf
Total Volume of Forebays =	24,103	cf
% Forebay =	24.1%	

III. AVERAGE DEPTH OF POND

Total Volume Below NWSE =	99,911	cf
Surface Area at NWSE =	25,869	sf
Average Depth =	3.86	ft

Table 10-3

Surface Area to Drainage Area Ratio for Permanent Pool Sizing to Achieve *90 Percent* TSS Pollutant Removal Efficiency in the *Mountain and Piedmont* Regions, Adapted from Driscoll, 1986

Percent Impervious Cover	Permanent Pool Average Depth (ft)												
	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5	8.0	8.5	9.0
10%	0.9	0.8	0.8	0.7	0.6	0.6	0.5	0.5	0.5	0.5	0.4	0.4	0.4
20%	1.5	1.3	1.1	1.0	1.0	0.9	0.9	0.9	0.8	0.8	0.8	0.7	0.7
30%	1.9	1.8	1.7	1.5	1.4	1.4	1.3	1.1	1.0	1.0	1.0	0.9	0.9
40%	2.5	2.3	2.0	1.9	1.8	1.7	1.6	1.6	1.5	1.4	1.3	1.2	1.1
50%	3.0	2.8	2.5	2.3	2.0	1.9	1.9	1.8	1.7	1.6	1.6	1.5	1.5
60%	3.5	3.2	2.8	2.7	2.5	2.4	2.2	2.1	1.9	1.9	1.8	1.8	1.7
70%	4.0	3.7	3.3	3.1	2.8	2.7	2.5	2.4	2.2	2.1	2.0	2.0	1.9
80%	4.5	4.1	3.8	3.5	3.3	3.0	2.8	2.7	2.6	2.4	2.3	2.1	2.0
90%	5.0	4.5	4.0	3.8	3.5	3.3	3.0	2.9	2.8	2.7	2.6	2.5	2.4

Table 10-4

Surface Area to Drainage Area Ratio for Permanent Pool Sizing to Achieve *90 Percent* TSS Pollutant Removal Efficiency in the *Coastal Region*, Adapted from Driscoll, 1986

Percent Impervious Cover	Permanent Pool Average Depth (ft)									
	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5′
10%	1.3	1.0	0.8	0.7	0.6	0.5	0.4	0.3	0.2	0.1
20%	2.4	2.0	1.8	1.7	1.5	1.4	1.2	1.0	0.9	0.6
30%	3.5	3.0	2.7	2.5	2.2	1.9	1.6	1.3	1.1	0.8
40%	4.5	4.0	3.5	3.1	2.8	2.5	2.1	1.8	1.4	1.1
50%	5.6	5.0	4.3	3.9	3.5	3.1	2.7	2.3	1.9	1.5
60%	7.0	6.0	5.3	4.8	4.3	3.9	3.4	2.9	2.4	1.9
70%	8.1	7.0	6.0	5.5	5.0	4.5	3.9	3.4	2.9	2.3
80%	9.4	8.0	7.0	6.4	5.7	5.2	4.6	4.0	3.4	2.8
90%	10.7	9.0	7.9	7.2	6.5	5.9	5.2	4.6	3.9	3.3
100%	12	10.0	8.8	8.1	7.3	6.6	5.8	5.1	4.3	3.6

The engineering design of a wet detention basin must include a 10-foot-wide (minimum) vegetated shelf around the full perimeter of the basin. The inside edge of the shelf shall be no deeper than 6" below the permanent pool level, and the outside edge shall be 6" above the permanent pool level. For a 10′ wide shelf, the resulting slope is 10:1. With half the required shelf below the water (maximum depth of 6 inches), and half the required shelf above the water, the vegetated shelf will provide a location for a diverse population of emergent wetland vegetation that enhances biological pollutant removal, provides a habitat for wildlife, protects the shoreline from erosion, and improves sediment trap efficiency. A 10′ wide shelf also provides a safety feature prior to the deeper permanent pool.

Short-circuiting of the stormwater must be prevented. The most direct way of minimizing short-circuiting is to maximize the length of the flow path between the inlet and the outlet: basins with long and narrow shapes can maximize the length of the flow path. Long and narrow but irregularly shaped wet detention basins may appear more

BRIAR CHAPEL - PHASE 6 NORTH
NEW-12000

WET DETENTION POND
Surface Area Calculation

J. FINCH, PE
6/14/2012

WET DETENTION BASIN SUMMARY

From ***Stormwater Best Management Practices Manual***. NCDENR: Division of Water Quality, October 2007.

Enter the drainage area characteristics ==>

Total drainage area to pond =	20.69	acres
Total impervious area to pond =	10.26	acres

Note The basin must be sized to treat all impervious surface runoff draining into the pond, not just the impervious surface from on-site development.

Drainage area = **20.69** acres @ **49.6%** impervious

Estimate the surface area required at pond normal pool elevation ==>

Wet Detention Basins are based on an minimum average depth of = 3.86 feet ***(Calculated)***

From the DWQ BMP Handbook (10/2007), the required SA/DA ratio for ***90% TSS Removal*** *==>*

		3.5	3.86	4.0
Lower Boundary =>	40.0	2.3		2.0
Site % impervious =>	49.6	2.78	***2.56***	2.5
Upper Boundary =>	50.0	2.8		2.5

Therefore, SA/DA required = ***2.56***

Surface area required at normal pool =	23,085	ft^2
=	0.53	acres
Surface area provided at normal pool =	25,869	ft^2

BRIAR CHAPEL - PHASE 6 NORTH
NEW-12000

WATER QUALITY VOLUME CALCULATIONS

J. FINCH, PE
6/14/2012

==> *Determination of Water Quality Volume (1" Rainfall Depth)*

Proposed Conditions ==>

$$WQ_V = (P)(R_V)(A)/12$$

where,

WQ_V = water quality volume (in acre-ft)
R_V = 0.05+0.009(I) where I is percent impervious cover
A = area in acres
P = rainfall (in inches)

Input data:

Total area, A =	20.69	acres
=	901,122	sf
Impervious area =	10.26	acres
=	446,791	sf
Percent impervious cover, I =	49.6	%
Rainfall, P =	1.0	inches

Calculated values:

R_V =	0.50	
WQ_V =	0.855	acre-ft
=	**37,264**	cf.

==> *Associated Depth above Wet Pond Permanent Pool*

Ks =	29293	
b =	1.0979	
V =	37264	
Normal Pool Elevation =	472.00	feet
Riser Crest Elevation =	474.50	feet
WQ Elevation =	473.25	feet

J. FINCH, PE
6/14/2012

Inverted Siphon Design Sheet

D orifice =	3	inch
# orifices =	1	
Ks =	29293	
b =	1.0979	
Cd siphon =	0.60	
Normal Pool Elevation =	473.00	feet
Volume @ Normal Pool =	0	cf
Orifice Invert =	473.00	feet
WSEL @ 1" Runoff Volume =	474.25	feet

WSEL (feet)	Vol. Stored (cf)	Siphon Flow (cfs)	Avg. Flow (cfs)	Incr. Vol. (cf)	Incr. Time (sec)
474.25	37264	0.250			
474.14	33691	0.237	0.244	3573	14673
474.03	30152	0.224	0.231	3539	15344
473.92	26649	0.210	0.217	3503	16136
473.81	23187	0.195	0.203	3462	17092
473.70	19770	0.179	0.187	3416	18278
473.59	16406	0.161	0.170	3364	19810
473.48	13102	0.141	0.151	3304	21908
473.37	9872	0.117	0.129	3230	25057
473.26	6735	0.087	0.102	3137	30683
473.15	3726.4	0.040	0.064	3008	47222

Drawdown Time =	2.62 days

By comparison, if calculated by the average head over the orifice (assuming average head is one-third the total depth), the result would be:

Average driving head on orifice =	0.373	feet
Orifice composite loss coefficient =	0.600	
Cross-sectional area of 3" orifice =	0.049	sf

Q = 0.1444 cfs

Drawdown Time = Volume / Flowrate / 86400 (sec/day)

Drawdown Time =	2.99 days

Conclusion : Use 1 - 3" Diameter Inverted Siphon to drawdown the accumulated volume from the 1.0" storm runoff, with a required time of about 2.62 days.

BRIAR CHAPEL
NEW-12000

J. FINCH, PE
5/10/2012

Square Riser/Barrel Anti-Flotation Calculation Sheet

Input Data ==>

Inside length of riser =	5.00	feet	
Inside width of riser =	5.00	feet	
Wall thickness of riser =	6.00	inches	
Base thickness of riser =	8.00	inches	
Base length of riser =	6.00	feet	
Base width of riser =	6.00	feet	
Inside height of Riser =	8.50	feet	
Concrete unit weight =	142.0	PCF	Note: NC Products lists unit wt. of manhole concrete at 142 PCF.
OD of barrel exiting manhole =	44.00	inches	
Size of drain pipe (if present) =	8.0	inches	
Trash Rack water displacement =	61.74	CF	

Concrete Present in Riser Structure ==>

Total amount of concrete:

Base of Riser =	24.000	CF
Riser Walls =	93.500	CF

Adjust for openings:

Opening for barrel =	5.280	CF
Opening for drain pipe =	0.175	CF

Total Concrete present, adjusted for openings =	***112.046 CF***
Weight of concrete present =	***15911 lbs***

Amount of water displaced by Riser Structure ==>

Displacement by concrete =	112.046	CF
Displacement by open air in riser =	212.500	CF
Displacement by trash rack =	61.740	CF

Total water displaced by riser/barrel structure =	***386.286 CF***
Weight of water displaced =	***24104 lbs***

Calculate amount of concrete to be added to riser ==>

Safety factor to use =	1.25	(recommend 1.25 or higher)
Must add =	14220	lbs concrete for buoyancy

Concrete unit weight for use =	142	PCF (note above observation for NCP concrete)
Buoyant weight of this concrete =	79.60	PCF
Buoyant, with safety factor applied =	63.68	PCF

Therefore, must add =	223.301	CF of concrete
Standard based described above =	24.000	CF of concrete
Therefore, base design must have =	247.301	CF of concrete

Calculate size of base for riser assembly ==>

Length =	9.000	feet	
Width =	9.000	feet	
Thickness =	37.0	inches	
Concrete Present =	249.750	CF	OK

Check validity of base as designed ==>

Total Water Displaced =	612.036	CF	
Total Concrete Present =	337.796	CF	
Total Water Displaced =	38191	lbs	
Total Concrete Present =	47967	lbs	
Actual safety factor =	*1.26*		OK

Results of design ==>

Base length =	**9.00**	**feet**
Base width =	**9.00**	**feet**
Base Thickness =	**37.00**	**inches**
CY of concrete total in base =	**9.25**	**CY**
Concrete unit weight in added base >=	**142**	**PCF**

Briar Chapel – Phase 6 North

Project # NEW-12000
VELOCITY DISSIPATOR DESIGN
Designed By: J. Finch, PE

Velocity Dissipator – Proposed Wet Pond

NRCD Land Quality Section
Pipe Design

Entering the following values will provide you with the expected outlet velocity and depth of flow in a pipe, assuming the Mannings roughness number is constant over the entire length of the pipe.

flow Q in cfs : 25 Flow depth (ft) = 0.90
slope S in % : 4.82 Outlet velocity (fps) = 15.698
pipe diameter D in in. : 30
Manning number n : 0.013

NRCD Land Quality Section
NYDOT Dissipator Design Results

Pipe diameter (ft)	2.50
Outlet velocity (fps)	15.70
Apron length (ft)	20.00

AVG DIAM (inches)	STONE CLASS	THICKNESS (inches)
3	A	9
6	B	22
» 13	B or 1	22 «
23	2	27

Width Calculation

WIDTH = La + Do
WIDTH = 20 + 2.5
WIDTH = 23 FEET

CONCLUSION

Use NCDOT Class '1' Rip Rap
20'L x 23'W x 22"Thick