# CERTIFICATE OF AUTHENTICITY

**THIS IS TO CERTIFY THAT THE FOLLOWING ELECTRONIC RECORDS ARE TRUE AND ACCURATE REPRODUCTIONS OF THE ORIGINAL RECORDS OF JAMES CITY COUNTY GENERAL SERVICES DEPARTMENT- STORMWATER DIVISION; WERE SCANNED IN THE REGULAR COURSE OF BUSINESS PURSUANT TO GUIDELINES ESTABLISHED BY THE LIBRARY OF VIRGINIA AND ARCHIVES; AND HAVE BEEN VERIFIED IN THE CUSTODY OF THE INDIVIDUAL LISTED BELOW.**

**BMP NUMBER:** **PC072**

**DATE VERIFIED:** **July 6, 2012**

**QUALITY ASSURANCE TECHNICIAN:** **Leah Hardenbergh**

Leah Hardenbergh

**LOCATION: WILLIAMSBURG, VIRGINIA**

# Stormwater Division

## MEMORANDUM

**DATE:** March 13, 2010

**TO:** Michael J. Gillis, Virginia Correctional Enterprises Document Management Services

**FROM:** Jo Anna Ripley, Stormwater

**PO:** 270712

**RE:** Files Approved for Scanning

---

**General File ID or BMP ID:** PC072

**PIN:** 3240100033

**Subdivision, Tract, Business or Owner Name (if known):** King of Glory Lutheran Church

**Property Description:**

**Site Address:** 4897 Longhill Road

*(For internal use only)* **Box** 2 **Drawer:** 2

**Agreements:** (in file as of scan date) **Book or Doc#:** **Page:**

Comments

**James City County, Virginia**
**Environmental Division**

**Stormwater Management/BMP Facilities**
**Record Drawing/Construction Certification**
*Review Tracking Form*

County Plan No.: SP-118-00 (AMENDS SP-7-95)
Project Name: KING OF GLORY LUTHERAN CHURCH COMMUNITY & EDUCATION CENTER EXPANSION
Stormwater Management Facility: INFIL BASIN
Phase: ☒ I ☐ II ☐ III

- ☒ Information Received. Date: NOV 18 '02 SIMMONS
- ☒ Administrative Check.
  - ☒ Record Drawing Date: NOV 15 02 SIMMONS
  - ☒ Construction Certification Date: NOV 15 '02 SIMMONS
  - ☒ RD/CC Standard Forms (Required after Feb 1st 2001Only)
  - ☒ Insp/Maint Agreement Info: PREVIOUS 6/20/95. SEE LOG.
  - ☒ BMP Maintenance Plan Location: SHEET C4
  - ☐ Other:
- ☒ Standard E&SC Note on Approved Plan Requiring RD/CC or County comment in plan review file.
  ☒ Yes ☐ No Location: NOTE # 19 ON SHEET C4
- ☒ Assign County BMP ID Code Code: PC072
- ☒ Log into Division's "As-Built" Tracking Log
- ☒ Add Location to GIS Database Map. Obtain GIS site information (GPIN, Owner, Site Area, Address, etc.)
- ☒ Preliminary Log into BMP Database (BMP ID #, Site Plan #, GPIN, Project Name)
- ☒ Active Project File Review (correspondence, H&H, etc.).
- ☒ Initial As-Built File setup (label, copy hydraulics, BMP information, etc.).
- ☒ Inspector Check of RD/CC.
- ☒ Pre-Inspection Drawing Review - Approved Plan (Quick look prior to field inspection).
- ☒ Final Inspection (FI) Performed Date: DEC 6 '02
- ☒ Record Drawing (RD) Review Date: DEC 4 '02
- ☒ Construction Certification (CC) Review Date: DEC 04 '02
- ☒ Actions:
  - ☐ No comments.
  - ☒ Comments. Letter Forwarded. Date:
    - ☒ Record Drawing (RD)
    - ☐ Construction Certification (CC)
    - ☒ Construction-Related (CR)
    - ☐ Site Issues (SI)
    - ☐ Other :
- ☐ Second Submission: RD 12/12/02.
- ☐ Third Submission:
- ☐ Acceptable for stormwater managment facility purposes (RD/CC/CR/Other). Proceed with bond release.
- ☐ Notify Darryl/Joan/Pat of acceptability using email (preferred), form or verbal.
- ☒ Check/Clean active file of any remaining material and finish "As-Built" file.
- ☒ Add to County BMP Inventory/Inspection schedule (Phase I, II or III).
- ☒ Copy Final Inspection Report into County BMP Inspection Program file.
- ☐ Digital Photographs obtained.
- ☐ Add to JCC Hydrology & Hydraulic database (optional).

BMP Certification Information Acceptable

Plan Reviewer: [signature] Date: 12-11-02

**James City County, Virginia**
**Environmental Division**

# Stormwater Management / BMP Facilities
# Record Drawing and Construction Certification Forms

***( Note: In accordance with the requirements of the Chesapeake Bay Preservation Ordinance, Chapter 23, Section 23-10(4), BMP's shall be designed and constructed in accordance with the manual entitled James City County Guidelines for Design and Construction of Stormwater Management BMP's. Erosion and sediment control policy and approved plans generally require that at the completion of the project and prior to release of surety, an "as-built" plan prepared by a registered Professional Engineer or Certified Land Surveyor must be provided for the drainage system for the project, including any Best Management Practice (BMP) facilities. In addition, for BMP facilities involving the construction of an impounding structure or dam embankment, certification is required by a Professional Engineer who has inspected the structure during its construction. Currently there are over 20 water quality type BMP's accepted by the County. )***

**Section 1 - Site Information:**

Project Name: KING OF GLORY COMMUNITY CENTER EXPANSION
Structure/BMP Name: INFIL BASIN
Project Location: 4897 LONGHILL ROAD, WMBG., VA 23188
BMP Location: SOUTHERN END OF PROPERTY
County Plan No.: SP - 118 - 00 (orig SP-7-95)

Project Type: ☐ Residential ☐ Business ☐ Commercial ☐ Office ☐ Institutional ☐ Industrial ☐ Public ☐ Roadway ☑ Other CHURCH

Tax Map/Parcel No.: 32-4-01-0-0033
BMP ID Code (if known): PC 072
Zoning District:: R-2
Land Use: Church
Site Area (sf or acres): 6.04 ACRES

Brief Description of Stormwater Management/BMP Facility: EXPANSION OF AN EXISTING WET BMP FACILITY, TO PROVIDE ADDITIONAL WATER QUALITY & WATER QUANTITY ASSOCIATED WITH THE INCREASED IMPERVIOUS AREA AS DESIGNED BY DIG, INC. FACILITY DESIGNED AS AN 8-POINT, TYPE A, WET POND

Nearest Visible Landmark to SWM/BMP Facility: CEMETARY SOUTH OF POND

Nearest Vertical Ground Control ( if known ):
☐ JCC Geodetic Ground Control ☐ USGS ☐ Temporary ☐ Arbitrary ☑ Other
Station Number or Name: FINISH FLOOR ELEV. CHURCH
Datum or Reference Elevation: 90.50
Control Description: CHURCH SLAB ELEVATION
Control Location from Subject Facility: —

**Section 2 - Stormwater Management / BMP Facility Construction Information:**

PreConstruction Meeting Held for Construction of SWM/BMP Facility: ☐ Yes ☐ No ☑ Unknown
Approx. Construction Start Date for SWM/BMP Facility: 09.03.2002
Facility Monitored by County Representative during Construction: ☐ Yes ☐ No ☑ Unknown
Name of Site Work Contractor Who Constructed Facility: RANDY TAYLOR
Name of Professional Firm Who Routinely Monitored Construction: N/A
Date of Completion for SWM/BMP Facility: 10/02 +/-
Date of Record Drawing/Construction Certification Submittal: 11.13.2002

***( Note: Record Drawing and Construction Certifications are required within thirty (30) days of the completion of Stormwater Management and/or BMP facility construction. Record Drawings and Construction Certifications must be reviewed and approved by the James City County Environmental Division prior to final inspection, acceptance and bond or surety release. )***

**Section 3 - Owner / Designer / Contractor Information:**

Owner/Developer: *(Note: Site Owner or Applicant responsible for development of the project.)*

Name: KING OF GLORY CHURCH
Mailing Address: 4897 LONGHILL ROAD
WILLIAMSBURG, VIRGINIA 23188
Business Phone: 757-258-9701 Fax:
Contact Person: LEE SCHMIDT Title: BLDG. COMM, CHAIR

Design Professional: *( Note: Professional Engineer or Certified Land Surveyor responsible for the design and preparation of plans and specifications for the Stormwater Management / BMP facility. )*

Firm Name: DJG, INC.
Mailing Address: 449 McLAWS CIRCLE
WILLIAMSBURG, VA 23187
Business Phone: 757-253-0673
Fax: 757-253-2319
Responsible Plan Preparer: H.L. PHILLIP GOERING
Title: P.E.
Plan Name: KING OF GLORY CHURCH EXPANSION
Firm's Project No. 2000250
Plan Date: 3-6-01
Sheet No.'s Applicable to SWM/BMP Facility: ____ / ____ / ____ / ____ / ____

BMP Contractor: *(Note: Site Work Contractor directly responsible for construction of the Stormwater Management / BMP facility.)*

Name: TOANO CONTRACTORS, INC.
Mailing Address: 8589 RICHMOND ROAD
TOANO, VIRGINIA 23168
Business Phone: 757-566-0097
Fax: 757-566-8874
Contact Person: RANDY TAYLOR
Site Foreman/Supervisor: RANDY TAYLOR - VICE PRESIDENT
Specialty Subcontractors & Purpose (for BMP Construction Only): N/A

**Section 4 - Professional Certifications:**

Certifying Professionals: *( Note: A Registered Professional Engineer or Certified Land Surveyor is responsible for preparation of a Record Drawing, sometimes referred to as an As-Built plan, for the drainage system for the project including any Stormwater Management/BMP Facilities. A Registered Professional Engineer is responsible for the inspection, monitoring and certification of Stormwater Management / BMP facilities during its construction. )*

**Record Drawing and Construction Certifications for Stormwater Management / BMP Facilities**

**Record Drawing Certification**

Firm Name: LANDTECH RESOURCES
Mailing Address: 5810-F MOORETOWN RD., WMBG, VA 23188
Business Phone: 757-565-1677
Fax: 757-565-0782

Name: MATTHEW H. CONNOLLY
Title: PRESIDENT
Signature:
Date: 10-29-02

I hereby certify to the best of my knowledge and belief that this record drawing represents the actual condition of the Stormwater Management / BMP facility. The facility appears to conform with the provisions of the approved design plan, specifications and stormwater management plan, except as specifically noted.

COMMONWEALTH OF VIRGINIA
MATTHEW H. CONNOLLY
No. 002053
10-29-02
LAND SURVEYOR

( Seal )

Virginia Registered Professional Engineer or Certified Land Surveyor

**Construction Certification**

Firm Name: SIMMONS ENGINEERING, INC.
Mailing Address: 5000 NEW POINT ROAD, SUITE 2202 WILLIAMSBURG, VA 23188
Business Phone: 757.258.5000
Fax: 757.258.3758

Name: STEVEN W. STAFFORD, P.E.
Title: OWNER / SENIOR ENGINEER
Signature:
Date: 11.13.2002

I hereby certify to the best of my knowledge and belief that this Stormwater Management/BMP facility was ~~monitored and~~ constructed in accordance with the provisions of the approved design plan, specifications and stormwater management plan, except as specifically noted.

CONTINUOUS ON-SITE INSPECTION OF BACKFILL, COMPACTION & OTHER SOILS WORK IS NOT INCLUDED IN THIS CERTIFICATION.

COMMONWEALTH OF VIRGINIA
STEVEN W. STAFFORD
No. 028158
11.15.2002
PROFESSIONAL ENGINEER

( Seal )

Virginia Registered Professional Engineer

SOILS EMBANK NOT CERTIFIED.

**Section 5 - Record Drawing and Construction Certification Requirements and Instructions:**

- ❒ PreConstruction Meeting - Provides an opportunity to review SWM / BMP facility construction, maintenance and operation plans and address any questions regarding construction and/or monitoring of the structure. The design engineer, certifying professionals (if different), Owner/Applicant, Contractor and County representative(s) are encouraged to attend the preconstruction meeting. Advanced notice to the Environmental Division is requested. Usually, this requirement can be met simultaneously with Erosion and Sediment Control preconstruction meetings held for the project.

- ❒ A fully completed ***STORMWATER MANAGEMENT / BMP FACILITIES, RECORD DRAWING and CONSTRUCTION CERTIFICATION FORM*** and ***RECORD DRAWING CHECKLIST***. All applicable sections shall be completed in their entirety and certification statements signed and sealed by the registered professional responsible for individual record drawing and/or construction certification.

- ❒ The Record Drawing shall be prepared by a Registered Professional Engineer or Certified Land Surveyor for the drainage system of the project including any Best Management Practices.

- ❒ Construction Certification. Construction of Stormwater Management / BMP facilities which contain impoundments, embankments and related engineered appurtenances including subgrade preparation, compacted soils, structural fills, liners, geosynthetics, filters, seepage controls, cutoffs, toe drains, hydraulic flow control structures, etc. shall be visually observed and monitored by a Registered Professional Engineer or his/her authorized representative. The Engineer must certify that the structure, embankment and associated appurtenances were built in accordance with the approved design plan, specifications and stormwater management plan and standard accepted construction practice and shall submit a written certification and/or drawings to the Environmental Division as required. Soil and compaction test reports, concrete test reports, inspection reports, logs and other required construction material or installation documentation may be required by the Environmental Division to substantiate the certification, if specifically requested. The Engineer shall have the authority and responsibility to make minor changes to the approved plan, in coordination with the assigned County inspector, in order to compensate for unsafe or unusual conditions encountered during construction such as those related to bedrock, soils, groundwater, topography, etc. as long as changes do not adversely affect the integrity of the structure(s). Major changes to the approved design plan or structure must be reviewed and approved by the original design professional and the James City County Environmental Division.

- ❒ Record Drawing and Construction Certifications are required within **thirty (30) days** of the completion of Stormwater Management / BMP facility construction. Submittals must be reviewed and accepted by James City County Environmental Division prior to final inspection, acceptance and bond/surety release.

  N/A **Dual Purpose Facilities** - Completion of construction also includes an interim stage for Stormwater Management / BMP facilities which serve dual purpose as temporary sediment basins during construction and as permanent stormwater management / BMP facilities following construction, once development and stabilization are substantially complete. For these dual purpose facilities, construction certification is required once the temporary sediment basin phase of construction is complete. Final record drawing and construction certification of additional permanent components is required once permanent facility construction is complete.

  *Interim Construction Certification* is required for those dual purpose embankment-type facilities that are generally ten (10) feet or greater in dam height (*) and may not be converted, modified or begin function as a permanent SWM / BMP structure for a period generally ranging from six (6) to eighteen (18) months or more from issuance of a Land Disturbance permit for construction.

Interim or final record drawing and construction certifications are not required for temporary sediment basins which are designed and constructed in accordance with current minimum standards and specifications for temporary sediment basins per the Virginia Erosion and Sediment Control Handbook (VESCH); have a temporary service life of less than eighteen (18) months; and will be removed completely once associated disturbed areas are stabilized, unless a distinct hazard to the public's health, safety and welfare is determined by the Environmental Division due to the size or presence of the structure or due to evidence of improper construction.

(*Note: Dam Height as referenced above is generally defined as the vertical distance from the natural bed of the stream or waterway at the downstream toe of the embankment to the top of the embankment structure in accordance with 4VAC50-20-30, Virginia Impoundment Structure Regulations and the Virginia Dam Safety Program.)

❒ Record Drawings shall provide, at a minimum, all information as shown within these requirements and the attached **RECORD DRAWING CHECKLIST** specific to the type of SWM/BMP facility being constructed. Other additional record data may be formally requested by the James City County Environmental Division. *(Note: Refer to the current edition of the James City County Guidelines for Design and Construction of Stormwater Management BMP's manual for a complete list of acceptable BMP's. Currently there are over 20 acceptable water quality type BMP's accepted by the County.)*

❒ Record Drawings shall consist of blue/black line prints and a reproducible (mylar, sepia, diazo, etc.) set of the approved stormwater management plan including applicable plan views, profiles, sections, details, maintenance plans, etc. as related to the subject SWM / BMP facility. The set shall indicate **"RECORD DRAWING "** in large text in the lower right hand corner of each sheet with record elevations, dimensions and data drawn in a clearly annotated format and/or boxed beside design values. Approved design plan values, dimensions and data shall not be removed or erased. Drawing sheet revision blocks shall be modified as required to indicate record drawing status. Elevations to the nearest 0.1' are sufficiently accurate except where higher accuracy is needed to show positive drainage. Certification statements as shown in Section 4 of the Record Drawing and Construction Certification Form, ***or similar forms thereof***, and professional signatures and seals, with dates matching that of the record drawing status in the revision or title block, are also required on all associated record drawing plans, prints or reproducibles.

❒ Submission Requirements. Initial and subsequent submissions for review shall consist of a minimum of one (1) blue/black line set for record drawings and one copy of the construction certification documents with appropriate transmittal. Under certain circumstances, it is understood that the record drawing and construction certification submissions may be performed by different professional firms. Therefore, record drawing submission may be in advance of construction certification or vice versa. Upon approval and prior to release of bond/surety, final submission shall include one (1) reproducible set of the record drawings, one (1) blue/black line set of the record drawings and one (1) copy of the construction certification. Also for current and/or future incorporation into the County BMP database and GIS system, it is requested that the record drawings also be submitted to the Environmental Division on a diskette or CD-ROM in an acceptable electronic file format such as *.dxf, *.dwg, etc. or in a standard scanned and readable format. The electronic file requirement can be discussed and coordinated with Environmental Division staff at the time of final submission.

# STORMWATER MANAGEMENT / BMP FACILITIES
# RECORD DRAWING CHECKLIST

*( Key for Checklist is as follows: XX Acceptable N/A Not Applicable Inc Incomplete )*

## I. Methods and Presentation: *( Required for all Stormwater Management / BMP facilities.)*

XX 1. All constructed facilities meet approved design plans, unless otherwise shown. Record information or deviations from approved design plan shown in clearly annotated format and/or boxed beside design values.

XX 2. Elevations to the nearest 0.1' unless higher accuracy is needed to show positive drainage.

XX 3. All plan sheets labeled with "RECORD DRAWING" in large text in lower right hand corner (Approved County Plan Number and BMP ID Code can be included if known).

XX 4. All plan sheet revision blocks modified to indicate date and record drawing status.

XX 5. All plan sheets have certification statements and certifying professional's signature and seal.

## II. Minimum Standards: *(Required for all Stormwater Management / BMP facilities, as applicable.)*

XX 1. All requirements of Section I (Methods and Presentation) apply to this section.

XX 2. Plan Views: Show general location, arrangement and dimensions. Location and alignment shall generally match approved design plans.

XX 3. Profile or elevations along top or berm of the facility. At a minimum, elevations are required at each end, at intervals not to exceed 50 feet and where low spots may be present. Top of embankment or berm elevations must be no less than design elevation plus any settlement allowances.

XX 4. Top widths, berm widths and embankment side slopes.

XX 5. Show length, width and depth of facility or grading, contours or spot elevations as required to verify permanent pool and design storage volumes were met or were reasonably close to the approved design. Evaluation of as-built grading, contours, spot elevations, or cross-sections, may be necessary by the professional to ensure approved design configurations, depths and volumes were closely maintained. If grading or elevations are significantly different from the approved plan, the Environmental Division shall be contacted immediately to determine whether the variation is acceptable or whether further evidence will be required. Facilities which do not closely resemble approved plan grades, elevations or configurations may require regrading by the Contractor; check volumetric computations; and/or a check hydraulic routing to ensure approved design water surface elevations, discharges or freeboard were closely maintained.

XX 6. Cross-section of the embankment through the principal spillway or outlet barrel. Must extend at least 100 ft. downstream of the pipe outlet or to recorded site property line, whichever is closer. Proper correlation is required between principal spillway (control structure) crest, emergency spillway crest, orifice and weirs and the top of the dam or facility. All elevations and dimensions must reasonably match the design plan or be sequentially relative to each other and the facility must reflect the required design storage volume(s) and/or design depth.

N/A 7. Profile or elevations along the entire centerline of the emergency spillway. Emergency spillway may be steeper, but no flatter or narrower than design.

XX 8. Elevation of the principal spillway crest or outlet crest of the structure.

XX 9. Primary control structure (riser) diameter or dimensions, height, type of material and base size. Indicate provisions for access that are present such as steps, ladders, etc.

XX 10. Dimensions, locations and elevations of outlet orifices, weirs, slots and drains.

XX 11. Type and size of anti-vortex and trash rack device. Height, diameter, dimensions, bar spacings (if applicable) and elevations relative to the principal spillway crest. Indicate if lockable hatch is present or not.

INC. 12. Type, location, size and number of anti-seep collars or documentation of other methods utilized for seepage control. **May need to obtain this information during construction.**

INC 13. Top of impervious core embankment, core trench limits and elevation of cut-off trench bottom. **May need to obtain this information during construction.**

XX 14. Elevation of the principal spillway barrel (outlet pipe) inlet and outlet invert.

XX 15. Outlet barrel diameter, length, slope, type and thickness class of material and type of flared end sections, headwall or endwall.

INC 16. Outfall protection dimension, type and depth of rock and if underlain filter fabric is present.

INC 17. BMP interior and periphery landscaping zones conform with arrangements and requirements of the approved design plan.

XX 18. Maintenance plan taken from approved design plan transposed onto record drawing set.

N/A 19. Fencing location and type, if applicable to facility.

XX 20. BMP vicinity properly cleaned of stockpiles and construction debris.

XX 21. No visual signs of erosion or channel degradation immediately downstream of facility.

N/A 22. Any other information formally requested by the Environmental Division specific to the constructed SWM/BMP facility.

*( Key for Checklist is as follows: XX Acceptable N/A Not Applicable Inc Incomplete )*

## III. Group A - Wet Ponds *( Includes A-1 Small Wet Ponds; A-2 Wet Ponds; A-3 Wet Ext Det Ponds. )*

XX A1. All requirements of Section II, Minimum Standards, apply to Group A facilities.

XX A2. Principal spillway consists of ~~reinforced concrete pipe~~ HDPE with ~~O-Ring gaskets for~~ watertight joint construction.

N/A A3. Sediment forebays or pretreatment devices provided at inlets to pond. Generally 4 to 6 ft. deep.

N/A A4. Access for maintenance and equipment is provided to the forebay(s). Access corridors are at least 12 ft. wide, have a maximum slope of 15 percent and are adequately stabilized to withstand heavy equipment or vehicle use.

N/A A5. Adequate fixed vertical sediment depth markers installed in the forebay(s) for future sediment monitoring purposes.

N/A A6. Pond liner (if required) provided. Either clay liners, polyliners, bentonite liners or use of chemical soil additives based on requirements of the approved plan.

N/A A7. Minimum 6 percent slope safety bench extending a minimum of 15 feet outward from normal pool edge and/or an aquatic bench extending a minimum of 10 feet inward from the normal shoreline with a maximum depth of 12 inches below the normal pool elevation, if applicable, per the approved design plans. (Note: Safety benches may be waived if pond side slopes are no steeper than 4H:1V). 4:1 PROVIDED

N/A A8. No trees are present within a zone 15 feet around the embankment toe and 25 feet from the principal spillway structure. EMBANKMENT CONSISTS OF EX. MATERIAL & POND IS EXCAVATED.

XX A9. Wet permanent pool, typically 3 to 6 feet deep, is provided and maintains level within facility.

XX A10. Low flow orifice has a non-clogging mechanism.

N/A A11. A pond drain pipe with valve was provided.

XX A12. Pond side slopes are not steeper than 3H:1V, unless approved plan allowed for steeper slope.

N/A A13. End walls above barrels (outlet pipe) greater than 48 inch in diameter are fenced to prevent a fall hazard.

## STORMWATER MANAGEMENT / BMP FACILITIES
## RECORD DRAWING CHECKLIST

*( Key for Checklist is as follows:* ***XX*** *Acceptable* ***N/A*** *Not Applicable* ***Inc*** *Incomplete )*

N/A **IV.** **Group B - Wetlands** *( Includes B-1 Shallow Marsh; B-2 Ext Det Shallow Wetlands; B-3 Pond Wetland System and B-4 Pocket Wetland )*

_____ B1. Same requirements as Group A Wet Ponds.

_____ B2. Minimum 2:1 length to width flow path provided across the facility.

_____ B3. Micropool provided at or around outlet from BMP (generally 3 to 6 ft. deep).

_____ B4. Wetland type landscaping provided in accordance with approved plan. Includes correct pondscaping zones, plant species, planting arrangements, wetland beds, etc. Wetland plants include 5 to 7 emergent wetland species. Individual plants at 18 inches on center in clumps.

_____ B5. Adequate wetland buffer provided (Typically 25 ft. outward from maximum design water surface elevation and 15 ft. setback to structures).

_____ B6. No more than one-half (½) of the wetland surface area is planted.

_____ B7. Topsoil or wetland mulch provided to support vigorous growth of wetland plants.

_____ B8. Planting zones staked or flagged in field and locations subsequently established by appropriate field surveying methods for record drawing presentation.

*( Key for Checklist is as follows: XX Acceptable N/A Not Applicable Inc Incomplete )*

N/A **V. Group C - Infiltration Practices** *( Includes C-1 Infiltration Trench; C-2 Infiltration Trench; C-3 Infiltration Basin; and C-4 Infiltration Basin )*

_____ C1. All requirements of Section II, Minimum Standards, apply to Group C facilities as applicable.

_____ C2. Facility is not located on fill slopes or on natural ground in excess of six (6) percent.

_____ C3. Pretreatment devices provided prior to entry into the infiltration facility. Acceptable pretreatment devices include sediment forebays, sediment basins, sediment traps, sump pits or inlets, grass channels, plunge pools or other acceptable measures.

_____ C4. Three (3) or more of the following pretreatment devices provided to protect long term integrity of structure: grass channel; grass filter strip; bottom sand layer; upper filter fabric layer; use of washed bank run gravel aggregate.

_____ C5. Sides of infiltration practice lined with filter fabric.

_____ C6. Facility was not used for erosion and sediment control purposes and sediment was prevented from entering the facility to the greatest extent possible during construction.

_____ C7. Stabilization and acceptable vegetative cover established over contributing drainage area prior to conveyance of stormwater to the facility.

_____ C8. Minimum one hundred (100) foot separation horizontally from any known water supply well and minimum one hundred (100) foot separation upslope from any building.

_____ C9. Minimum twenty-five (25) foot separation down gradient from any structure.

_____ C10. Stormwater outfalls provided for overflow associated with larger design storms.

_____ C11. No visual signs of erosion or channel degradation immediately downstream of facility.

_____ C12. Facility does not currently cause any apparent surface or subsurface water problems to downgrade properties.

_____ C13. Observation well provided.

_____ C14. Adequate, direct access provided to the facility for future maintenance, operation and inspection.

# STORMWATER MANAGEMENT / BMP FACILITIES
# RECORD DRAWING CHECKLIST

*( Key for Checklist is as follows: XX Acceptable N/A Not Applicable Inc Incomplete )*

N/A **VI. Group D - Filtering Systems** *( Includes D-1 Bioretention Cells; D-2 Surface Sand Filters; D-3 Underground Sand Filters; D-4 Perimeter Sand Filters; D-5 Organic Filters; and D-6 Pocket Sand Filters )*

_____ D1. All requirements of Section II, Minimum Standards, apply to Group D facilities.

_____ D2. Sediment pretreatment devices provided.

_____ D3. For D-1 BMPs (Bioretention Cells), pretreatment consisting of a grass filter strip below level spreader (deflector); a gravel diaphragm; and mulch and planting soil layers were provided.

_____ D4. For D-1 BMPs (Bioretention Cells), plantings consist of native plant species; vegetation provided was based on zones of hydric tolerances; trees and understory of shrubs and herbaceous materials were provided; woody vegetation is absent from inflow locations; and trees are located around facility perimeter.

_____ D5. Facility was not used for erosion and sediment control purposes and sediment was prevented from entering the facility to the greatest extent possible during construction.

_____ D6. No visible signs of accumulated silt/sediment were present in the facility following construction or alternately, accumulated silt/sediment was properly removed .

_____ D7. Filtering system is off-line from storm drainage conveyance system.

_____ D8. Overflow outlet has adequate erosion protection.

_____ D9. Deflector, diversion, flow splitter or regulator structure provided to divert the water quality volume to the filtering structure.

_____ D10. Minimum four (4) inch perforated underdrain provided in a clean aggregate envelope layer beneath the facility.

_____ D11. Minimum fifty (50) foot separation from any slope fifteen (15) percent or greater. Minimum one hundred (100) foot separation horizontally from any known water supply well. Minimum one hundred (100) foot separation upslope and twenty-five (25) foot separation downslope from any building.

_____ D12. Stabilization and acceptable vegetative cover established over contributing drainage area prior to conveyance of stormwater to the facility.

_____ D13. No visual signs of erosion or channel degradation immediately downstream of facility.

_____ D14. Adequate, direct access provided to the pretreatment area and/or filter bed for future maintenance.

*( Key for Checklist is as follows: XX Acceptable N/A Not Applicable Inc Incomplete )*

N/A **VII. Group E - Open Channel Systems** *( Includes E-1 Wet Swales (Check Dams); E-2 Dry Swales; and E-3 Biofilters )*

_____ E1. All requirements of Section II, Minimum Standards, apply to Group E facilities as applicable.

_____ E2. Open channel system has constructed longitudinal slope of less than four (4) percent.

_____ E3. No visual signs of erosion in the open channel system's soil and/or vegetative cover.

_____ E4. Open channel side slopes are no steeper than 2H:1V at any location. Preferred channel sideslope is 3H:1V or flatter.

_____ E5. No visual signs of ponding are present at any location in the open channel system, except at rock check dam locations for E-1 systems (Wet Swales).

_____ E6. For E-2 BMPs (Dry Swales), an underdrain system was provided.

_____ E7. Treated timber or rock check dams provided as pretreatment devices for the open channel system.

_____ E8. Gravel diaphragm provided in areas where lateral sheet flow from impervious surfaces are directly connected to the open channel system.

_____ E9. Grass cover/stabilization in the open channel system appears adaptable to the specific soils and hydric conditions for the site and along the channel system.

_____ E10. Open channel system areas with grass covers higher than four (4) to six (6) inches were properly mowed.

_____ E11. Facility was not used for erosion and sediment control purposes and sediment was prevented from entering the facility to the greatest extent possible during construction.

_____ E12. No visible signs of accumulated silt/sediment were present in the facility following construction or alternately, accumulated silt/sediment was properly removed and no adverse affects to the function of the facility are anticipated.

_____ E13. For E-3 BMPs (Biofilters), the bottom width is six (6) feet maximum at any location.

_____ E14. For E-3 BMPs (Biofilters), sideslopes are 3H:1V maximum at any location.

_____ E15. For E-3 BMPs (Biofilters), the constructed channel slope is less than or equal to three (3) percent at any location.

_____ E16. For E-3 BMPs (Biofilters), the constructed grass channel is approximately equivalent to the constructed roadway length.

# STORMWATER MANAGEMENT / BMP FACILITIES
# RECORD DRAWING CHECKLIST

*( Key for Checklist is as follows: XX Acceptable N/A Not Applicable Inc Incomplete )*

N/A **VIII. Group F - Extended Dry Detention** *( Includes F-1 Timber Walls; and F-2 Dry Extended Detention with Forebay )*

_____ F1. All requirements of Section II, Minimum Standards, apply to Group F facilities.

_____ F2. Basin bottom has positive slope and drainage from all basin inflow points to the riser (or outflow) location.

_____ F3. Timber wall BMP used in intermittent stream only. (ie. Prohibited in perennial streams.)

_____ F4. Forebay provided approximately 20 ft. upstream of the facility. Forebays generally 4 to 6 feet in depth.

_____ F5. A reverse slope pipe, vertical stand pipe or mini-barrel and riser was provided to prevent clogging.

_____ F6. Principal spillway and outlet barrel provided consisting of reinforced concrete pipe with O-Ring gaskets for watertight joint construction.

_____ F7. Mini-barrel and riser, if used, contains a removable trash rack to reduce clogging.

_____ F8. Low flow orifice, if used, has a minimum diameter of three (3) inches or two (2) inches if internal orifice control was utilized and a small, cage type external trash rack.

_____ F9. Timbers properly reinforced or concrete footing provided if soil conditions were prohibitive.

_____ F10. Timber wall cross members extended to a minimum depth of two (2) feet below ground elevation.

_____ F11. Protection against erosion and scour from the low flow orifice and weir-flow trajectory provided.

_____ F12. Stilling basin or standard outlet protection provided at principal spillway outlet.

_____ F13. Adequate, direct access provided to the facility. Access corridor to facility is at least ten (10) feet wide, slope is less than twenty (20) percent and appropriate stabilization provided for equipment and vehicle use. Access extends to forebay, standpipe and timber wall, as applicable.

_____ F14. No visual signs of undercutting of timber walls or clogging of the low orifice were present.

_____ F15. No visual signs of erosion or channel degradation immediately downstream of facility.

_____ F16. No visible signs of accumulated silt/sediment were present in the facility following construction or alternately, accumulated silt/sediment was properly removed and no adverse affects to the function of the facility are anticipated.

## STORMWATER MANAGEMENT / BMP FACILITIES
## RECORD DRAWING CHECKLIST

*( Key for Checklist is as follows: XX Acceptable N/A Not Applicable Inc Incomplete )*

**IX. Group G - Open Spaces** *( Includes All Open Space Types G-1; G-2; and G-3 )*

XX G1. All requirements of Section II, Minimum Standards, apply to Group G facilities as applicable.

XX G2. Constructed impervious areas appear to conform with locations indicated on the approved plan and appear less than sixty (60) percent impervious in accordance with the requirements of the James City County Chesapeake Bay Preservation Ordinance.

INC G3. Dedicated open space areas are in undisturbed common areas, conservation easements or are protected by other enforceable instruments that ensures perpetual protection.

INC G4. Provisions included to clearly specify how the natural vegetated areas utilized as dedicated open space will be managed and field identified (marked).

INC G5. Adequate protection measures were implemented during construction to protect the defined dedicated open space areas.

INC G6. Dedicated open space areas were not disturbed during construction (ie. cleared, grubbed or graded).

## STORMWATER MANAGEMENT / BMP FACILITIES
## RECORD DRAWING CHECKLIST

***( Key for Checklist is as follows: XX Acceptable N/A Not Applicable Inc Incomplete )***

### X. Storm Drainage Systems (Associated with BMP's Only)

*( Includes all incidental stormwater drainage conveyance systems associated with SWM/BMP facilities such as onsite or offsite storm drains, open channels, inlets, manholes, junctions, outlet protections, deflectors, etc. These facilities are external to the treatment function of, but are directly associated with drainage to and/or from a constructed SWM/BMP facility. The intent of this portion of the certification is to accurately identify the type and quantity of inflow or outflow points associated with the facility for future reference. The Professional may use his/her own discretion to determine inclusive facilities to meet the intent of this section. As a general rule, storm drainage systems would include incidental facilities to the nearest access structure upslope or downslope from the normal physical limits of the facility or 800 feet of storm drainage conveyance system length, whichever is less. )*

XX SD1. All requirements of Section II, Minimum Standards, apply to Storm Drainage Systems.

XX SD2. Horizontal location of all pipe and structures relative to the SWM/BMP facility.

XX SD3. Type, top elevation and invert elevation of all access type structures (inlets, manholes, etc.).

XX SD4. Material type, size or diameter, class, invert elevations, lengths and slopes for all pipe segments.

INC. SD5. Class, length, width and depth of riprap and outlet protections or dimensions of special energy dissipation structures.

N/A **XII. Other Systems** *( Includes any non-typical, specialty, manufactured or innovative stormwater management/BMP practices or systems generally accepted for use as or in conjunction with other acceptable stormwater management / BMP practices. Requires evidence of prior satisfactory industry use and prior Environmental Division approval, waiver or exception .)*

____ O1. All requirements of Section II, Minimum Standards, apply to this section.

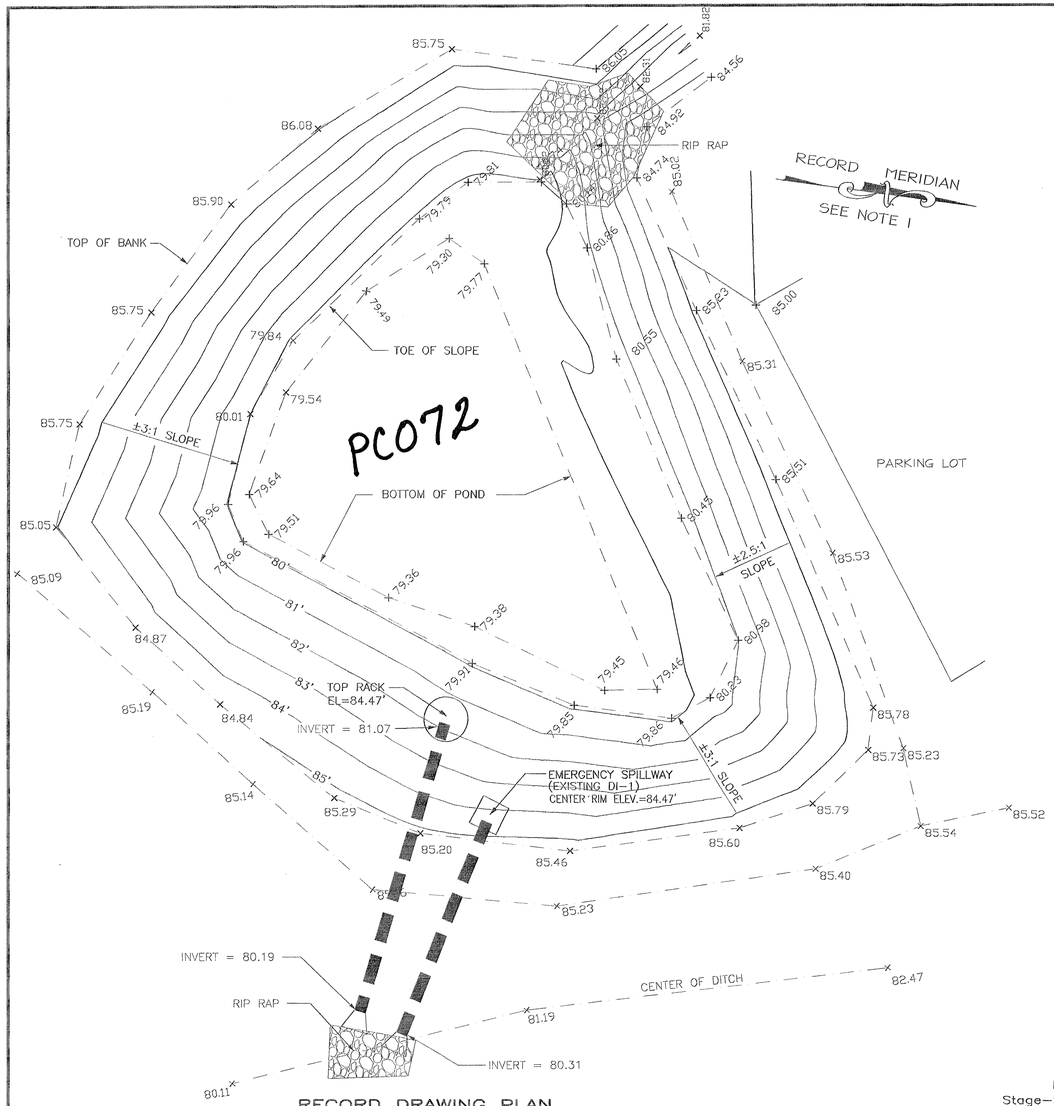
____ O2. Certification criteria to be determined on a case-by-case basis by the Environmental Division specific to the proposed SWM/BMP facility.

## XIII. References

*( The James City County Record Drawing and Construction Certification Forms and Checklists for Stormwater Management / BMP facilities were developed using the following sources and references. )*


- ❒ Baltimore County, Maryland Soil Conservation District, As-Built Stormwater Management Pond Checklist.
- ❒ James City County, Virginia, Guidelines for Design and Construction of Stormwater Management BMP's (October 1999).
- ❒ James City County, Virginia, Stormwater Detention/Retention Basin Design Checklist and Erosion and Sediment Control and Stormwater Management Design Plan Checklists.
- ❒ James City County Stormwater Policy Framework, Final Report of the James City County BMP Policy Project, October 1998, The Center for Watershed Protection.
- ❒ Prince Georges County, Maryland, As-Built Requirements Retention or Detention Pond/Basin.
- ❒ Prince William County, Virginia, Stormwater Management Fact Sheet.
- ❒ Stafford County, Virginia, As-Built Plan Checklist.
- ❒ Stormwater Management Design Manual, NRCS Maryland Code No. 378, Pond Standards and Specifications.
- ❒ USEPA/Watershed Management Institute, Stormwater Management Inspection Forms.
- ❒ Virginia Impounding Structure Regulations (Dam Safety), Department of Conservation & Recreation, 1997.
- ❒ Virginia Erosion and Sediment Control Handbook, Third Edition 1992, Virginia Department of Conservation and Recreation, Division of Soil and Water Conservation.
- ❒ Virginia Stormwater Management Handbook, 1999 edition, Virginia Department of Conservation and Recreation, Division of Soil and Water Conservation.


File: Shared\SWMProg\BMP\Certif\RDCC.wpd




## RECORD DRAWING PLAN

SCALE 1" = 10'

## BMP MAINTENANCE PLAN

*BMP Description: This BMP serves a drainage area of +/- 4.16 acres associated with the King of Glory Lutheran Church site. The facility is a 8 point, wet-type stormwater management facility, County Group 'C4' BMP. A wet-type facility has a permanent pool which provides for all of the required water quality volume storage. Principal structures associated with the BMP consist of a 30 inch vertical RCP riser, 18 inch HDPE outlet barrel and an existing VDOT DI-1 structure with a grate-on-slope which is utilized as the emergency overflow spillway. There is a 9 inch opening in the riser to provide for water quantity drawdown. During the 100-year storm, the maximum water level should rise to about 2 feet below the top of dam. During a storm event larger than the 100-year, the emergency spillway, which is the existing DI-1 on the side slope, will discharge flow.

Inspection and maintenance of the BMP facility will consist of the following additional measures:

1. Inspect for sediment buildup by visual observation and a physical determination of sediment depth within pond storage areas. If the depth of sediment reaches the depth above the Cleanout Elevation removal is required. At the same time, or at least once per year, clean pretreatment devices, the riser bottom and outlet pipes of accumulated sediments. Dispose of sediments removed from the facility at an acceptable disposal area. (Note: Cleanout Elevation of 79.65 feet is equal to 10 percent of the Water Quality Volume)

2. Perform maintenance mowing of pond grasses at least twice each year. Grasses such as tall fescue should be mowed in early summer after emergence of the heads on cool season grasses and in late fall to prevent seeds of annual weeds from maturing. Mowing of legumes can be less frequent. Trees, shrubs and woody vegetation are not permitted to grow along or on any part of the embankment that was constructed using engineered (compacted) fills.

3. Perform soil sampling on stabilized pond soil areas at least once every 4 years. Soil sampling and testing should be performed by qualified independent soil testing laboratory such as VPI & SU. Apply additional lime and fertilizer in accordance with test recommendations.

4. In stabilized pond areas, if vegetation covers less than 40% of soil surfaces, lime, fertilize and seed in accordance with recommendations for new seedings. If vegetation covers more than 40% but less than 70% of soil surfaces, lime, fertilize and over seed in accordance with current seeding recommendations or requirements of the Virginia Erosion and Sediment Control Handbook (VESCH).

5. Perform quarterly inspections of the riser section and crest spillway for the observance of collected trash and debris. Immediately remove any trash or debris that prevents the movement of water. Remove any trash and litter downstream and at storm drain or channel inflow locations to maintain the integrity of the structure and provide an attractive appearance.

6. Perform yearly structural inspections of the facility for damage. Structural inspection shall be performed on the concrete riser, anti-vortex device, trash rack, orifices/weirs, outlet barrel and pond embankment. Exposed metal surfaces shall be repainted or re-galvanized to minimize rust damage or replace if rust damage is irreversible. If damage is evident, further investigation by a professional engineer may be required to assess the integrity of the structure.

7. Perform quarterly inspections of the graded side slopes of the facility for signs of animal/rodent borrows or slope erosion. Immediately perform necessary repairs, refilling or reseeding.

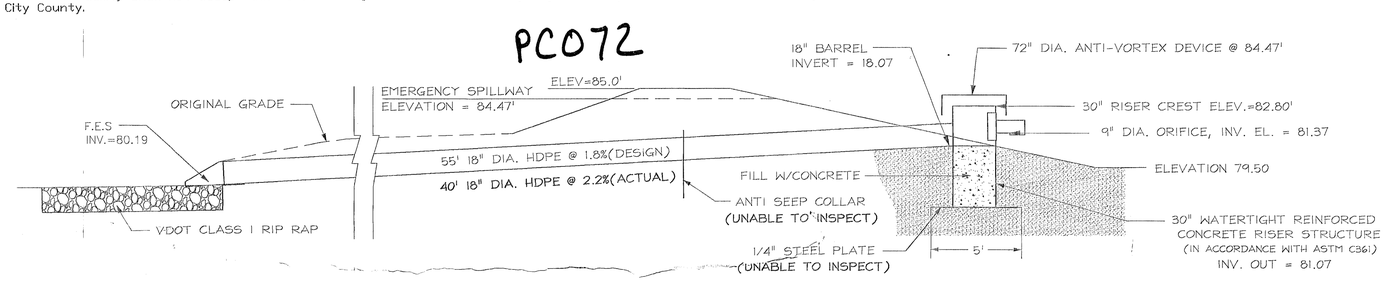
8. Perform yearly observations of perimeter are surrounding the facility to ensure changes in land use, topography or access have not occurred and do not affect the operation, maintenance, access or safety features as provided. Appropriate action is required to ensure adequacy and to provide a clear, safe passage for maintenance vehicles to the engineered embankment and principal flow control structures.

9. Inspect and exercise pond drain valves, if provided, on a regular basis.

10. Record Keeping. The owner or designated representative shall keep reasonable, accurate written records of inspections performed for the structure. Records shall document routine maintenance and/or repairs performed. Copies shall be provided to the County upon request.

11. The facility shall not accept additional drainage or be modified in any way without prior consent or approval by the Environmental Division of James City County.

PC072

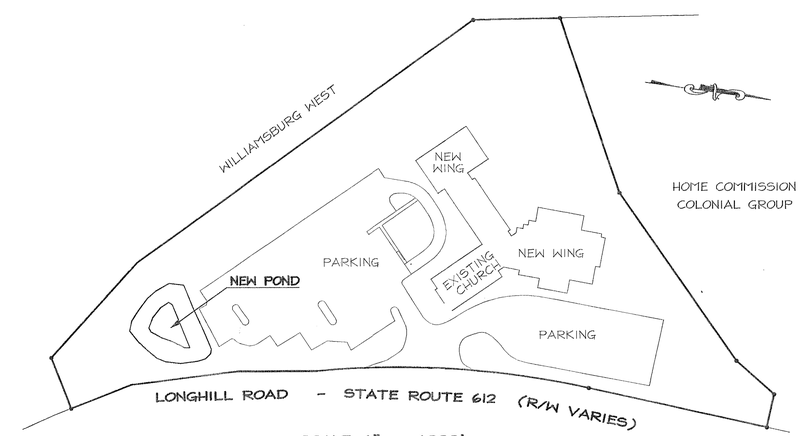



## BMP OUTLET STRUCTURES

NTS

## BMP TABLE TABLE

| | DESIGN ELEVATION(FT) | AS-BUILT ELEVATION(FT) |
|---|---|---|
| BOTTOM | 79.50 | **79.50** |
| 9" DIA ORIFICE | 81.00 | **81.37** |
| 30" DIA. RISER | 82.75 | **82.80** |




SCALE 1" = 1000'

King of Glory BMP Record Drawings
Stage–Storage Worksheet Design Volumes

| Elevation | Area (sf) | Average Area (sf) | Contour Interval (ft) | Volume (cf) | Cumulative Volume (cf) | Cumulative Volume (ac-ft) |
|---|---|---|---|---|---|---|
| 79.5 | 2,389 | | | | 0 | 0.000 |
| | | 2,555 | 0.50 | 1,278 | | |
| 80 | 2,721 | | | | 1,278 | 0.029 |
| | | 3,188 | 1.00 | 3,188 | | |
| 81 | 3,655 | | | | 4,466 | 0.103 |
| | | 4,130 | 1.00 | 4,130 | | |
| 82 | 4,604 | | | | 8,595 | 0.197 |
| | | 5,095 | 1.00 | 5,095 | | |
| 83 | 5,586 | | | | 13,690 | 0.314 |
| | | 6,096 | 1.00 | 6,096 | | |
| 84 | 6,606 | | | | 19,786 | 0.454 |

King of Glory BMP Record Drawings
Stage–Storage Worksheet Actual Volumes

| Elevation | Area (sf) | Average Area (sf) | Contour Interval (ft) | Volume (cf) | Cumulative Volume (cf) | Cumulative Volume (ac-ft) |
|---|---|---|---|---|---|---|
| 79.5 | 1,684 | | | | 0 | 0.000 |
| | | 2,151 | 0.50 | 1,076 | | |
| 80 | 2,618 | | | | 1,076 | 0.025 |
| | | 3,125 | 1.00 | 3,125 | | |
| 81 | 3.631 | | | | 4,200 | 0.096 |
| | | 4,037 | 1.00 | 4,037 | | |
| 82 | 4,442 | | | | 8,237 | 0.189 |
| | | 4,874 | 1.00 | 4,874 | | |
| 83 | 5,305 | | | | 13,110 | 0.301 |
| | | 5,762 | 1.00 | 5,762 | | |
| 84 | 6,219 | | | | 18,872 | 0.433 |

King of Glory BMP Record Drawings
Stage–Storage–Discharge Worksheet Actual Volumes

| | | Storage Volume | | Water Quality Orifice a= 0.0031 El= 81.37 | | Primary Outlet Rim Length= 10 El= 82.80 | | Total Flow (Q) | |
|---|---|---|---|---|---|---|---|---|---|
| Elevation | Description | Cubic Feet | Ac. Ft. | Head (h) | Flow (cfs) | Head (h) | Flow (cfs) | Flow (cfs) | Elevation |
| 79.50 | BMP Bottom | 0.00 | 0.000 | 0.00 | 0.000 | 0.00 | 0.00 | 0.00 | 79.50 |
| 80.00 | | 1,076.00 | 0.025 | 0.00 | 0.000 | 0.00 | 0.00 | 0.00 | 80.00 |
| 80.50 | | 2,638.00 | 0.061 | 0.00 | 0.000 | 0.00 | 0.00 | 0.00 | 80.50 |
| 81.00 | 9–inch Dia. Orifice | 4,200.00 | 0.096 | 0.00 | 0.000 | 0.00 | 0.00 | 0.00 | 81.00 |
| 81.37 | 9–inch Dia. Orifice (Actual) | 5,693.69 | 0.131 | 0.00 | 0.000 | 0.00 | 0.00 | 0.00 | 81.37 |
| 81.50 | | 6,218.50 | 0.143 | 0.13 | 0.005 | 0.00 | 0.00 | 0.01 | 81.50 |
| 81.77 | 2–Yr. Design WSE | 7,308.49 | 0.168 | 0.40 | 0.009 | 0.00 | 0.00 | 0.01 | 81.77 |
| 82.00 | | 8,237.00 | 0.189 | 0.63 | 0.012 | 0.00 | 0.00 | 0.01 | 82.00 |
| 82.45 | 10–Yr. Design WSE | 10,429.85 | 0.239 | 1.08 | 0.016 | 0.00 | 0.00 | 0.02 | 82.45 |
| 82.50 | | 10,673.50 | 0.245 | 1.13 | 0.016 | 0.00 | 0.00 | 0.02 | 82.50 |
| 83.00 | | 13,110.00 | 0.301 | 1.63 | 0.019 | 0.20 | 2.59 | 2.61 | 83.00 |
| 83.13 | 100–Yr. Design WSE | 13,859.06 | 0.318 | 1.76 | 0.020 | 0.33 | 5.50 | 5.52 | 83.13 |
| 83.20 | | 14,262.40 | 0.327 | 1.83 | 0.020 | 0.40 | 7.34 | 7.36 | 83.20 |
| 83.50 | | 15,991.00 | 0.367 | 2.13 | 0.022 | 0.70 | 16.98 | 17.01 | 83.50 |
| 84.00 | | 18,872.00 | 0.433 | 2.63 | 0.024 | 1.20 | 38.12 | 38.15 | 84.00 |

SCALE: 1" = 10'
DATE: 10/24/02
JOB: 02-144
DRAWN BY: MHC
SHEET: 1 OF 1

COMMONWEALTH OF VIRGINIA
MATTHEW H. CONNOLLY
No. 002053
12-12-02
LAND SURVEYOR


**LandTech Resources, Inc.**
Surveying • Mapping • GPS
5810-E Mooretown Road, Williamsburg, VA 23188
Phone: (757) 565-1677 Fax: (757) 565-0782
web: landtechresources.com


KING OF GLORY LUTHERAN CHURCH
COMMUNITY CENTER AND CHURCH EXPANSION PROJECT
# BMP RECORD DRAWING PLAN
County Plan Number SP-118-00 - BMP ID Code: PC 072
James City County, Virginia


Simmons Engineering, Inc.
Civil Engineering Design And Consulting
Williamsburg Business Center
4732 Longhill Road, Suite 3103
Williamsburg VA 23188
Voice: (757) 258-5000
Fax: (757) 258-3758
E-mail: rcspe@QuixNet.net

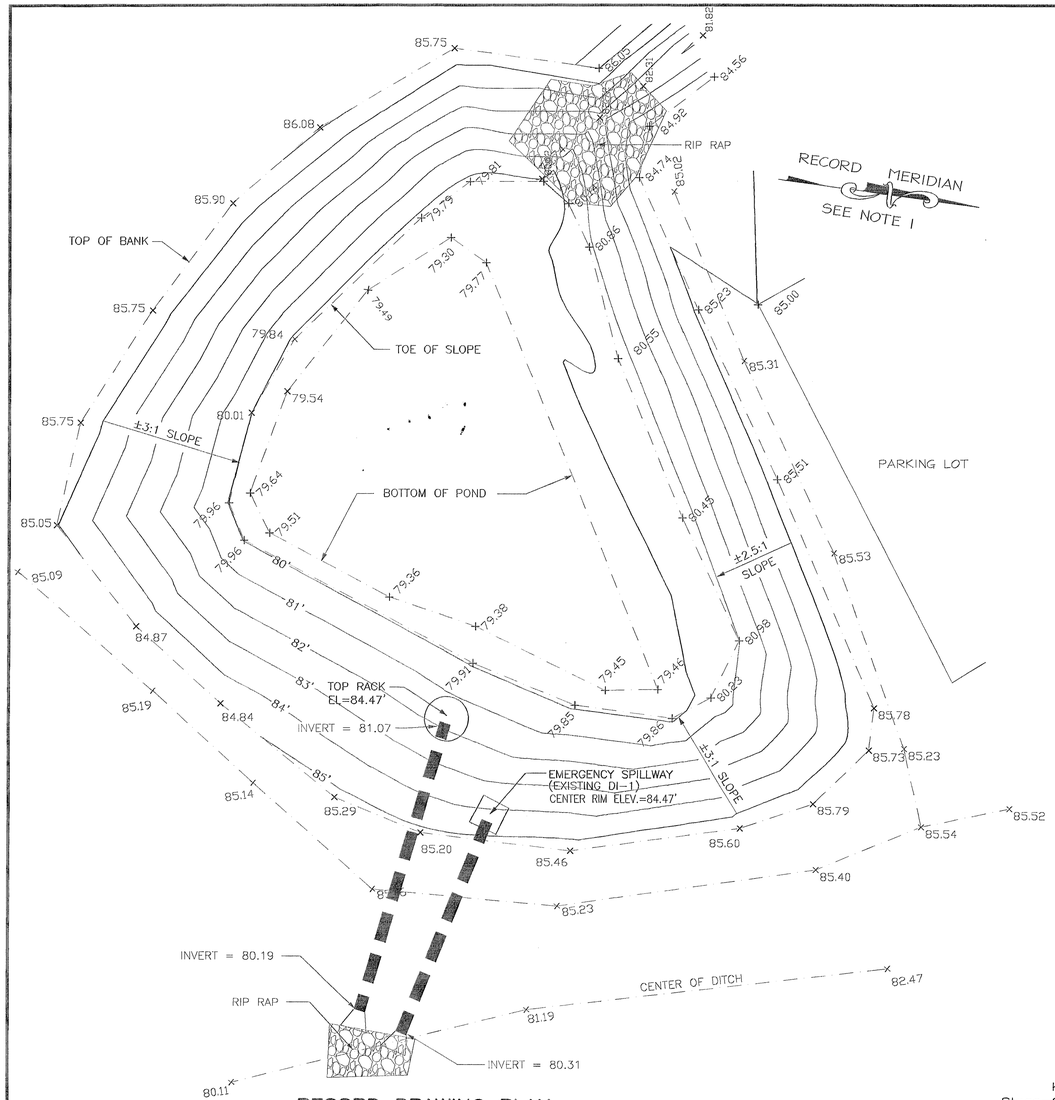

| NO. | DATE | REVISION / COMMENT / NOTE |
|---|---|---|
| 1 | 12-12-02 | JCC COMMENTS FAXED 12-06-02 |

APPROVED
James City County
Environmental Division
By: [signature]
Date: 12/12/02

DEC 4 2002
RECEIVED
ENVIRONMENTAL DIVISION

COMMONWEALTH OF VIRGINIA
STEVEN W. STAFFORD
No. 028158
12.12.2002
PROFESSIONAL ENGINEER

PC072_KING_OF_GLORY_LUTHERAN_CHURCH - 021




## RECORD DRAWING PLAN

SCALE 1" = 10'

## BMP MAINTENANCE PLAN

*BMP Description: This BMP serves a drainage area of +/- 4.16 acres associated with the King of Glory Lutheran Church site. The facility is a 8 point, wet-type stormwater management facility, County Group 'C4' BMP. A wet-type facility has a permanent pool which provides for all of the required water quality volume storage. Principal structures associated with the BMP consist of a 30 inch vertical RCP riser, 18 inch HDPE outlet barrel and an existing VDOT DI-1 structure with a grate-on-slope which is utilized as the emergency overflow spillway. There is a 9 inch opening in the riser to provide for water quantity drawdown. During the 100-year storm, the maximum water level should rise to about 2 feet below the top of dam. During a storm event larger than the 100-year, the emergency spillway, which is the existing DI-1 on the side slope, will discharge flow.

Inspection and maintenance of the BMP facility will consist of the following additional measures:

1. Inspect for sediment buildup by visual observation and a physical determination of sediment depth within pond storage areas. If the depth of sediment reaches the depth above the Cleanout Elevation removal is required. At the same time, or at least once per year, clean pretreatment devices, the riser bottom and outlet pipes of accumulated sediments. Dispose of sediments removed from the facility at an acceptable disposal area. (Note: Cleanout Elevation of 79.65 feet is equal to 10 percent of the Water Quality Volume)

2. Perform maintenance mowing of pond grasses at least twice each year. Grasses such as tall fescue should be mowed in early summer after emergence of the heads on cool season grasses and in late fall to prevent seeds of annual weeds from maturing. Mowing of legumes can be less frequent. Trees, shrubs and woody vegetation are not permitted to grow along or on any part of the embankment that was constructed using engineered (compacted) fills.

3. Perform soil sampling on stabilized pond soil areas at least once every 4 years. Soil sampling and testing should be performed by qualified independent soil testing laboratory such as VPI & SU. Apply additional lime and fertilizer in accordance with test recommendations.

4. In stabilized pond areas, if vegetation covers less that 40 % of soil surfaces, lime, fertilize and seed in accordance with recommendations for new seedings. If vegetation covers more than 40% but less than 70% of soil surfaces, lime, fertilize and over seed in accordance with current seeding recommendations or requirements of the Virginia Erosion and Sediment Control Handbook (VESCH).

5. Perform quarterly inspections of the riser section and crest spillway for the observance of collected trash and debris. Immediately remove any trash or debris that prevents the movement of water. Remove any trash and litter downstream and at storm drain or channel inflow locations to maintain the integrity of the structure and provide an attractive appearance.

6. Perform yearly structural inspections of the facility for damage. Structural inspection shall be performed on the concrete riser, anti-vortex device, trash rack, orifices/weirs, outlet barrel and pond embankment. Exposed metal surfaces shall be repainted or re-galvanized to minimize rust damage or replace if rust damage is irreversible. If damage is evident, further investigation by a professional engineer may be required to assess the integrity of the structure.

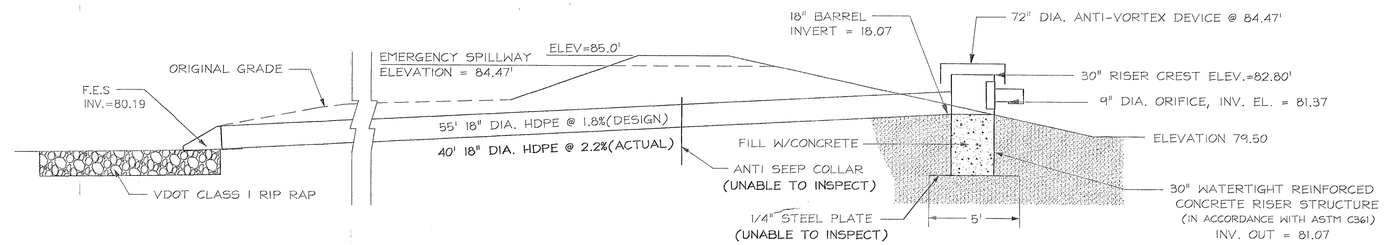
7. Perform quarterly inspections of the graded side slopes of the facility for signs of animal/rodent borrows or slope erosion. Immediately perform necessary repairs, refilling or reseeding.

8. Perform yearly observations of perimeter are surrounding the facility to ensure changes in land use, topography or access have not occurred and do not affect the operation, maintenance, access or safety features as provided. Appropriate action is required to ensure adequacy and to provide a clear, safe passage for maintenance vehicles to the engineered embankment and principal flow control structures.

9. Inspect and exercise pond drain valves, if provided, on a regular basis.

10. Record Keeping. The owner or designated representative shall keep reasonable, accurate written records of inspections performed for the structure. Records shall document routine maintenance and/or repairs performed. Copies shall be provided to the County upon request.

11. The facility shall not accept additional drainage or be modified in any way without prior consent or approval by the Environmental Division of James City County.

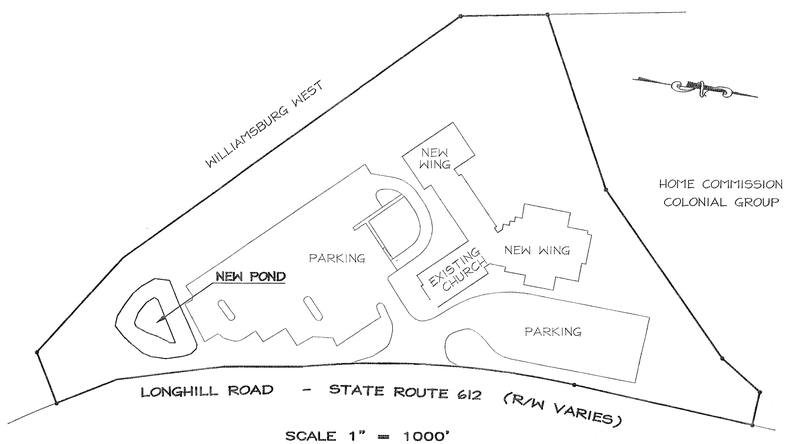



## BMP OUTLET STRUCTURES

NTS

## BMP TABLE TABLE

| | DESIGN ELEVATION(FT) | AS-BUILT ELEVATION(FT) |
|---|---|---|
| BOTTOM | 79.50 | **79.50** |
| 9" DIA ORIFICE | 81.00 | **81.37** |
| 30" DIA. RISER | 82.75 | **82.80** |




SCALE 1" = 1000'

King of Glory BMP Record Drawings
Stage-Storage-Discharge Worksheet Actual Volumes

| Elevation | Description | Storage Volume Cubic Feet | Storage Volume Ac. Ft. | Water Quality Orifice a= 0.0031 El= 81.37 Head (h) | Water Quality Orifice Flow (cfs) | Primary Outlet Rim Length= 10 El= 82.80 Head (h) | Primary Outlet Rim Flow (cfs) | Total Flow (Q) Flow (cfs) | Total Flow (Q) Elevation |
|---|---|---|---|---|---|---|---|---|---|
| 79.50 | BMP Bottom | 0.00 | 0.000 | 0.00 | 0.000 | 0.00 | 0.00 | 0.00 | 79.50 |
| 80.00 | | 1,076.00 | 0.025 | 0.00 | 0.000 | 0.00 | 0.00 | 0.00 | 80.00 |
| 80.50 | | 2,638.00 | 0.061 | 0.00 | 0.000 | 0.00 | 0.00 | 0.00 | 80.50 |
| 81.00 | 9-inch Dia. Orifice | 4,200.00 | 0.096 | 0.00 | 0.000 | 0.00 | 0.00 | 0.00 | 81.00 |
| 81.37 | 9-inch Dia. Orifice (Actual) | 5,693.69 | 0.131 | 0.00 | 0.000 | 0.00 | 0.00 | 0.00 | 81.37 |
| 81.50 | | 6,218.50 | 0.143 | 0.13 | 0.005 | 0.00 | 0.00 | 0.01 | 81.50 |
| 81.77 | 2-Yr. Design WSE | 7,308.49 | 0.168 | 0.40 | 0.009 | 0.00 | 0.00 | 0.01 | 81.77 |
| 82.00 | | 8,237.00 | 0.189 | 0.63 | 0.012 | 0.00 | 0.00 | 0.01 | 82.00 |
| 82.45 | 10-Yr. Design WSE | 10,429.85 | 0.239 | 1.08 | 0.016 | 0.00 | 0.00 | 0.02 | 82.45 |
| 82.50 | | 10,673.50 | 0.245 | 1.13 | 0.016 | 0.00 | 0.00 | 0.02 | 82.50 |
| 83.00 | | 13,110.00 | 0.301 | 1.63 | 0.019 | 0.20 | 2.59 | 2.61 | 83.00 |
| 83.13 | 100-Yr. Design WSE | 13,859.06 | 0.318 | 1.76 | 0.020 | 0.33 | 5.50 | 5.52 | 83.13 |
| 83.20 | | 14,262.40 | 0.327 | 1.83 | 0.020 | 0.40 | 7.34 | 7.36 | 83.20 |
| 83.50 | | 15,991.00 | 0.367 | 2.13 | 0.022 | 0.70 | 16.98 | 17.01 | 83.50 |
| 84.00 | | 18,872.00 | 0.433 | 2.63 | 0.024 | 1.20 | 38.12 | 38.15 | 84.00 |

King of Glory BMP Record Drawings
Stage-Storage Worksheet Design Volumes

| Elevation | Area (sf) | Average Area (sf) | Contour Interval (ft) | Volume (cf) | Cumulative Volume (cf) | Cumulative Volume (ac-ft) |
|---|---|---|---|---|---|---|
| 79.5 | 2,389 | | | | 0 | 0.000 |
| | | 2,555 | 0.50 | 1,278 | | |
| 80 | 2,721 | | | | 1,278 | 0.029 |
| | | 3,188 | 1.00 | 3,188 | | |
| 81 | 3,655 | | | | 4,466 | 0.103 |
| | | 4,130 | 1.00 | 4,130 | | |
| 82 | 4,604 | | | | 8,595 | 0.197 |
| | | 5,095 | 1.00 | 5,095 | | |
| 83 | 5,586 | | | | 13,690 | 0.314 |
| | | 6,096 | 1.00 | 6,096 | | |
| 84 | 6,606 | | | | 19,786 | 0.454 |

King of Glory BMP Record Drawings
Stage-Storage Worksheet Actual Volumes

| Elevation | Area (sf) | Average Area (sf) | Contour Interval (ft) | Volume (cf) | Cumulative Volume (cf) | Cumulative Volume (ac-ft) |
|---|---|---|---|---|---|---|
| 79.5 | 1,684 | | | | 0 | 0.000 |
| | | 2,151 | 0.50 | 1,076 | | |
| 80 | 2,618 | | | | 1,076 | 0.025 |
| | | 3,125 | 1.00 | 3,125 | | |
| 81 | 3.631 | | | | 4,200 | 0.096 |
| | | 4,037 | 1.00 | 4,037 | | |
| 82 | 4,442 | | | | 8,237 | 0.189 |
| | | 4,874 | 1.00 | 4,874 | | |
| 83 | 5,305 | | | | 13,110 | 0.301 |
| | | 5,762 | 1.00 | 5,762 | | |
| 84 | 6,219 | | | | 18,872 | 0.433 |

SCALE: 1" = 10'
DATE: 10/24/02
JOB: 02-144
DRAWN BY: MHC
SHEET: 1 OF 1

COMMONWEALTH OF VIRGINIA
MATTHEW H. CONNOLLY
No. 002053
12-12-02
LAND SURVEYOR


**LandTech Resources, Inc.**
Surveying • Mapping • GPS
5810-E Mooretown Road, Williamsburg, VA 23188
Phone: (757) 565-1677 Fax: (757) 565-0782
web: landtechresources.com


KING OF GLORY LUTHERAN CHURCH
COMMUNITY CENTER AND CHURCH EXPANSION PROJECT

# BMP RECORD DRAWING PLAN

County Plan Number SP-118-00 - BMP ID Code: PC 072

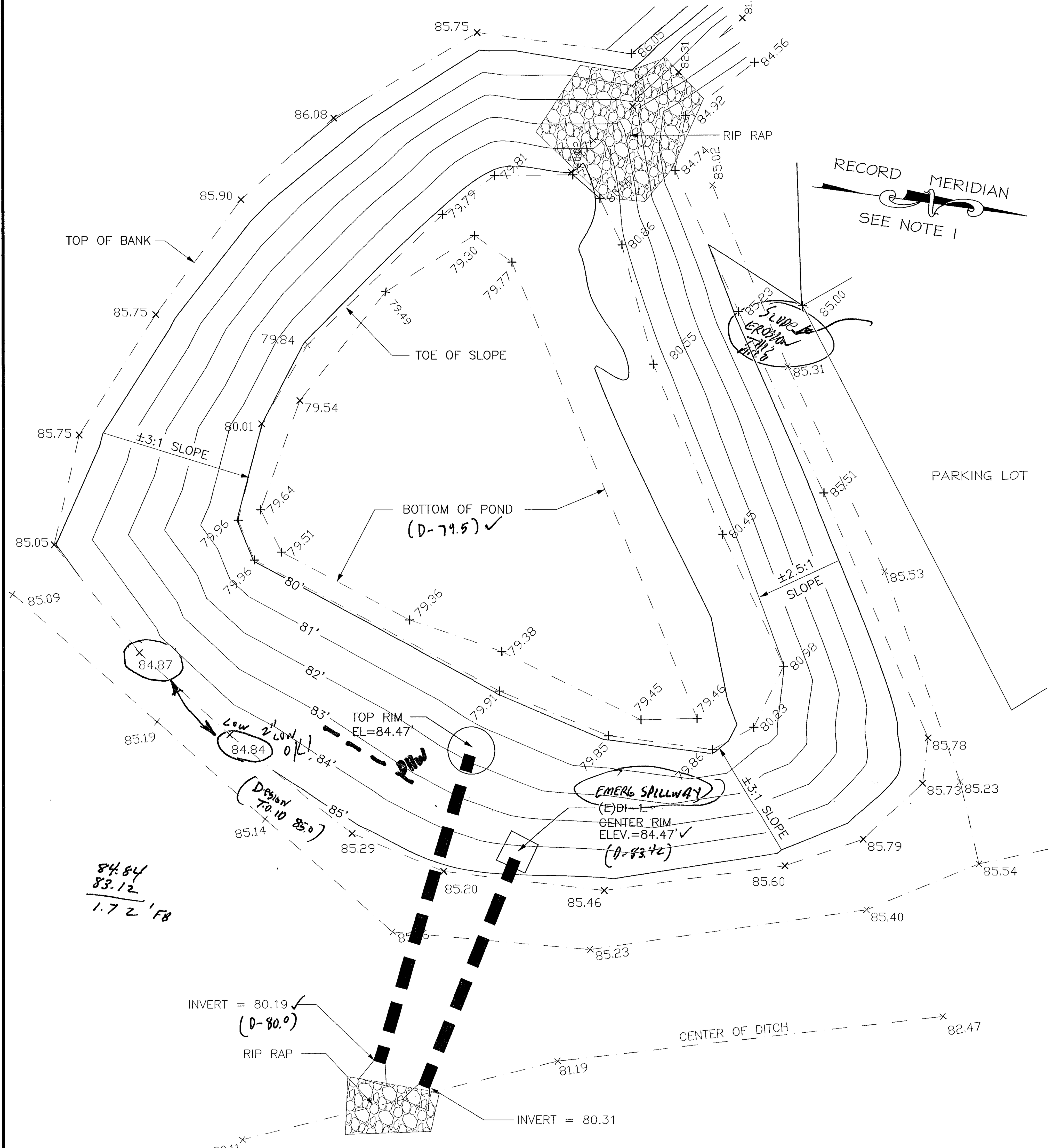
James City County, Virginia


Simmons Engineering, Inc.
Civil Engineering Design And Consulting
Wiliamsburg Business Center
4732 Longhill Road, Suite 3103
Williamsburg VA 23188
Voice: (757) 258-5000
Fax: (757) 258-3758
E-mail: rcspe@QuixNet.net


| NO. | DATE | REVISION / COMMENT / NOTE |
|---|---|---|
| 1 | 12-12-02 | JCC COMMENTS FAXED 12-06-02 |

APPROVED
James City County
Environmental Division
By:
Date: 12-17-02
DEC 2002

COMMONWEALTH OF VIRGINIA
STEVEN W. STAFFORD
No. 028158
12.12.2002
PROFESSIONAL ENGINEER




## RECORD DRAWING PLAN

SCALE 1" = 10'

## BMP MAINTENANCE PLAN

*BMP Description: This BMP serves a drainage area of +/- 4.16 acres associated with the King of Glory Lutheran Church site. The facility is a 8 point, wet-type stormwater management facility, County Group "C4" BMP. A wet-type facility has a permanent pool which provides for all of the required water quality volume storage. Principal structures associated with the BMP consist of a 30 inch vertical RCP riser, 18 inch HDPE outlet barrel and an existing VDOT DI-1 structure with a grate-on-slope which is utilized as the emergency overflow spillway. There is a 9 inch opening in the riser to provide for water quantity drawdown. During the 100-year storm, the maximum water level should rise to about 2 feet below the top of dam. During a storm event larger than the 100-year, the emergency spillway, which is the existing DI-1 on the side slope, will discharge flow.

Inspection and maintenance of the BMP facility will consist of the following additional measures:

1. Inspect for sediment buildup by visual observation and a physical determination of sediment depth within pond storage areas. If the depth of sediment reaches the depth above the Cleanout Elevation removal is required. At the same time, or at least once per year, clean pretreatment devices, the riser bottom and outlet pipes of accumulated sediments. Dispose of sediments removed from the facility at an acceptable disposal area. (Note: Cleanout Elevation corresponds to 10 percent of the Water Quality Volume).

2. Perform maintenance mowing of pond grasses at least twice each year. Grasses such as tall fescue should be mowed in early summer after emergence of the heads on cool season grasses and in late fall to prevent seeds of annual weeds from maturing. Mowing of legumes can be less frequent. Trees, shrubs and woody vegetation are not permitted to grow along or on any part of the embankment that was constructed using engineered (compacted) fills.

3. Perform soil sampling on stabilized pond soil areas at least once every 4 years. Soil sampling and testing should be performed by qualified independent soil testing laboratory such as VPI & SU. Apply additional lime and fertilizer in accordance with test recommendations. % of soil surfaces, lime, fertilize and seed in accordance with recommendations for new seedings. If vegetation covers more than 40%

4. In stabilized pond areas, if vegetation covers less that 40 but less than 70% of soil surfaces, lime, fertilize and over seed in accordance with current seeding recommendations or requirements of the Virginia Erosion and Sediment Control Handbook (VESCH).

5. Perform quarterly inspections of the riser section and crest spillway for the observance of collected trash and debris. Immediately remove any trash or debris that prevents the movement of water. Remove any trash and litter downstream and at storm drain or channel inflow locations to maintain the integrity of the structure and provide an attractive appearance.

6. Perform yearly structural inspections of the facility for damage. Structural inspection shall be performed on the concrete riser, anti-vortex device, trash rack, orifices/weirs, outlet barrel and pond embankment. Exposed metal surfaces shall be repainted or re-galvanized to minimize rust damage or replace if rust damage is irreversible. If damage is evident, further investigation by a professional engineer may be required to assess the integrity of the structure.

7. Perform quarterly inspections of the graded side slopes of the facility for signs of animal/rodent borrows or slope erosion. Immediately perform necessary repairs, refilling or reseeding.

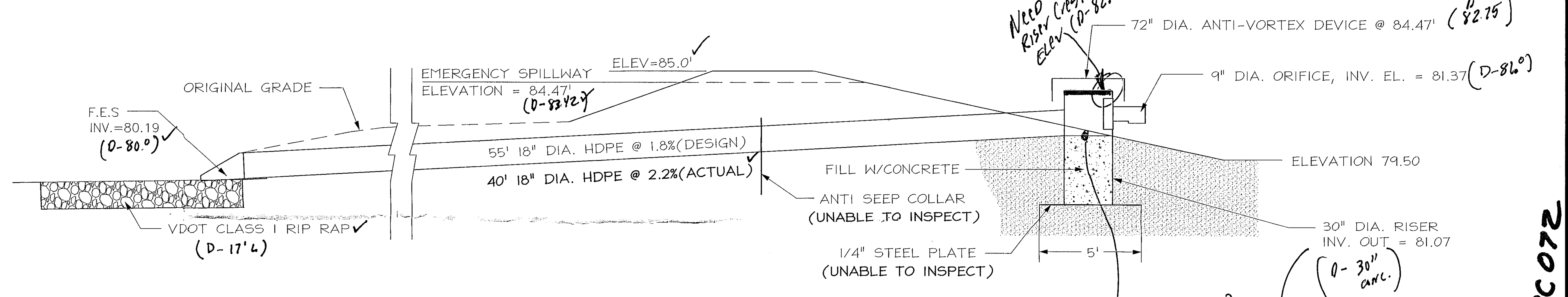
8. Perform yearly observations of perimeter are surrounding the facility to ensure changes in land use, topography or access have not occurred and do not affect the operation, maintenance, access or safety features as provided. Appropriate action is required to ensure adequacy and to provide a clear, safe passage for maintenance vehicles to the engineered embankment and principal flow control structures.

9. Inspect and exercise pond drain valves, if provided, on a regular basis.

10. Record Keeping. The owner or designated representative shall keep reasonable, accurate written records of inspections performed for the structure. Records shall document routine maintenance and/or repairs performed. Copies shall be provided to the County upon request.

11. The facility shall not accept additional drainage or be modified in any way without prior consent or approval by the Environmental Division of James City County.

WHAT IS CO ELEV




## BMP OUTLET STRUCTURES

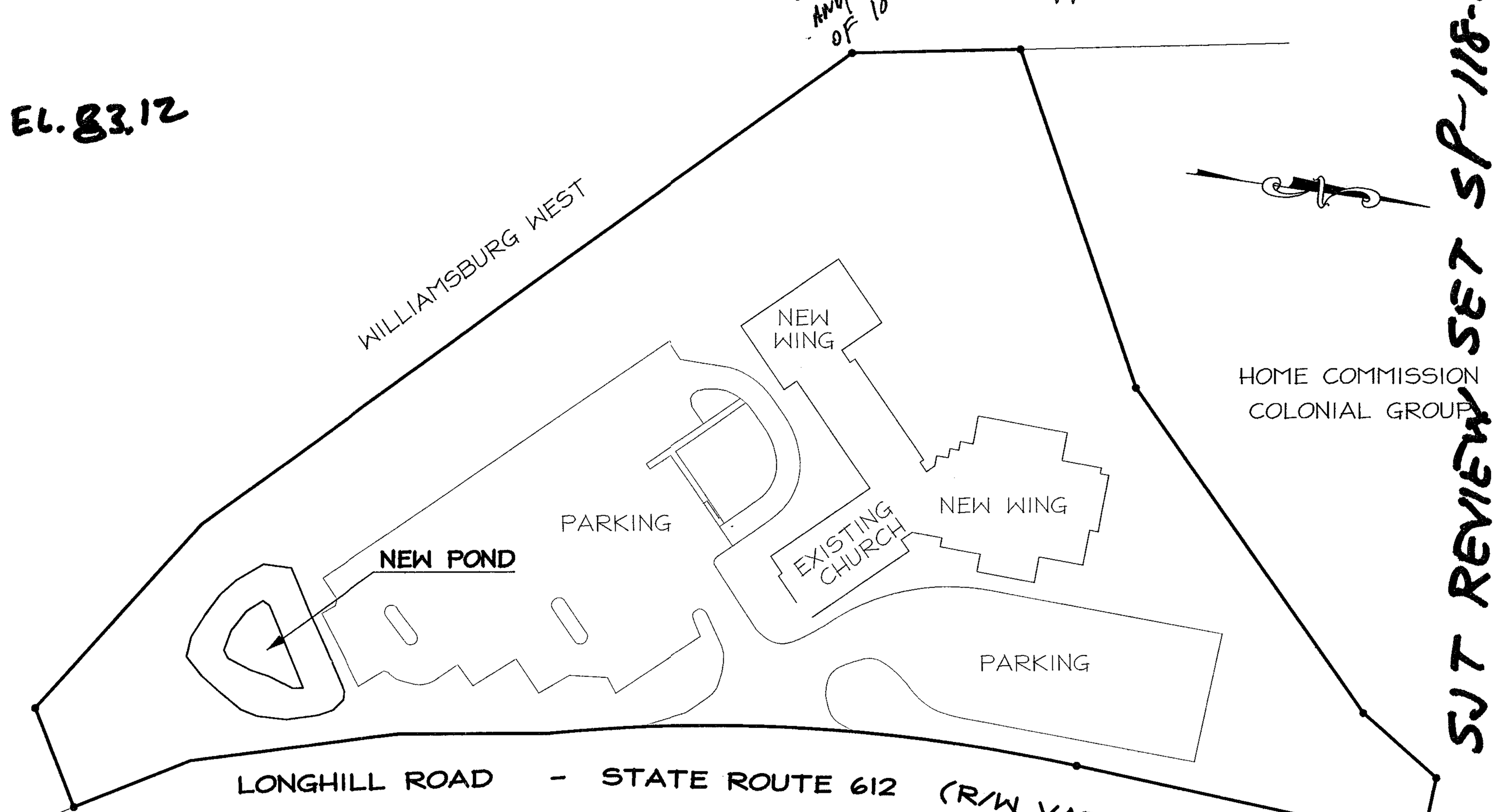
NTS

## BMP TABLE TABLE

| | DESIGN ELEVATION(FT) | AS-BUILT ELEVATION(FT) |
|---|---|---|
| BOTTOM | 79.50 ✓ | **79.50** ✓ |
| 9" DIA ORIFICE | 81.00 ✓ | **81.37** ✓ |
| 30" DIA. RISER | 82.75 ✓ | **82.80** ✓ |

RISER CREST

D.H.W = EL. 83.12




SCALE 1" = 1000'

SJT REVIEW SET SP-118-00; PC072

King of Glory BMP Record Drawings
Stage—Storage Worksheet Design Volumes

| Elevation | Area (sf) | Average Area (sf) | Contour Interval (ft) | Volume (cf) | Cumulative Volume (cf) | Cumulative Volume (AC-FT.) |
|---|---|---|---|---|---|---|
| 79.5 | 2,389 | | | | 0 | 0.000 |
| | | 2,555 | 0.50 | 1,278 | | |
| 80 | 2,721 | | | | 1,278 | 0.029 |
| | | 3,188 | 1.00 | 3,188 | | |
| 81 | 3,655 | | | | 4,466 | 0.103 |
| | | 4,130 | 1.00 | 4,130 | | |
| 82 | 4,604 | | | | 8,595 | 0.197 |
| | | 5,095 | 1.00 | 5,095 | | |
| 83 | 5,586 | | | | 13,690 | 0.314 |
| | | 6,096 | 1.00 | 6,096 | | |
| 84 | 6,606 | | | | 19,786 | 0.454 |

RC 82.75

King of Glory BMP Record Drawings
Stage—Storage Worksheet Actual Volumes

| Elevation | Area (sf) | Average Area (sf) | Contour Interval (ft) | Volume (cf) | Cumulative Volume (cf) | Cumulative Volume (AC-FT) |
|---|---|---|---|---|---|---|
| 79.5 | 1,684 | | | | 0 | 0.000 |
| | | 2,151 | 0.50 | 1,076 | | |
| 80 | 2,618 | | | | 1,076 | 0.025 |
| | | 3,125 | 1.00 | 3,125 | | |
| 81 | 3.631 | | | | 4,200 | 0.096 |
| | | 4,037 | 1.00 | 4,037 | | |
| 82 | 4,442 | | | | 8,237 | 0.189 |
| | | 4,874 | 1.00 | 4,874 | | |
| 83 | 5,305 | | | | 13,110 | 0.301 |
| | | 5,762 | 1.00 | 5,762 | | |
| 84 | 6,219 | | | | 18,872 | 0.433 |

UNDERSIZE, CLOSE!

King of Glory BMP Record Drawings
Stage—Storage—Discharge Worksheet Actual Volumes

| Elevation | Description | Storage Volume Cubic Feet | Storage Volume Ac. Ft. | Water Quality Orifice (a= 0.0031, El= 81.37) Head (h) | Water Quality Orifice Flow (cfs) | Primary Outlet Rim (Length= 10, El= 82.80) Head (h) | Primary Outlet Rim Flow (cfs) | Total Flow (Q) Flow (cfs) | Total Flow (Q) Elevation |
|---|---|---|---|---|---|---|---|---|---|
| 79.50 | BMP Bottom | 0.00 | 0.000 | 0.00 | 0.000 | 0.00 | 0.00 | 0.00 | 79.50 |
| 80.00 | | 1,076.00 | 0.025 | 0.00 | 0.000 | 0.00 | 0.00 | 0.00 | 80.00 |
| 80.50 | | 2,638.00 | 0.061 | 0.00 | 0.000 | 0.00 | 0.00 | 0.00 | 80.50 |
| 81.00 | 9-inch Dia. Orifice | 4,200.00 | 0.096 | 0.00 | 0.000 | 0.00 | 0.00 | 0.00 | 81.00 |
| 81.37 | 9-inch Dia. Orifice (Actual) | 5,693.69 | 0.131 | 0.00 | 0.000 | 0.00 | 0.00 | 0.00 | 81.37 |
| 81.50 | | 6,218.50 | 0.143 | 0.13 | 0.005 | 0.00 | 0.00 | 0.01 | 81.50 |
| 81.77 | 2-Yr. Design WSE | 7,308.49 | 0.168 | 0.40 | 0.009 | 0.00 | 0.00 | 0.01 | 81.77 |
| 82.00 | | 8,237.00 | 0.189 | 0.63 | 0.012 | 0.00 | 0.00 | 0.01 | 82.00 |
| 82.45 | 10-Yr. Design WSE | 10,429.85 | 0.239 | 1.08 | 0.016 | 0.00 | 0.00 | 0.02 | 82.45 |
| 82.50 | | 10,673.50 | 0.245 | 1.13 | 0.016 | 0.00 | 0.00 | 0.02 | 82.50 |
| 83.00 | | 13,110.00 | 0.301 | 1.63 | 0.019 | 0.20 | 2.59 | 2.61 | 83.00 |
| 83.13 | 100-Yr. Design WSE | 13,859.06 | 0.318 | 1.76 | 0.020 | 0.33 | 5.50 | 5.52 | 83.13 |
| 83.20 | | 14,262.40 | 0.327 | 1.83 | 0.020 | 0.40 | 7.34 | 7.36 | 83.20 |
| 83.50 | | 15,991.00 | 0.367 | 2.13 | 0.022 | 0.70 | 16.98 | 17.01 | 83.50 |
| 84.00 | | 18,872.00 | 0.433 | 2.63 | 0.024 | 1.20 | 38.12 | 38.15 | 84.00 |

SCALE: 1" = 10'
DATE: 10/24/02
JOB: 02-144
DRAWN BY: MHC
SHEET: 1 OF 1

COMMONWEALTH OF VIRGINIA — MATTHEW H. CONNOLLY — No. 002053 — 11-15-02 — LAND SURVEYOR


**LandTech Resources, Inc.**
Surveying • Mapping • GPS
5810-E Mooretown Road, Williamsburg, VA 23188
Phone: (757) 565-1677 Fax: (757) 565-0782
web: landtechresources.com


KING OF GLORY LUTHERAN CHURCH
COMMUNITY CENTER AND CHURCH EXPANSION PROJECT

# BMP RECORD DRAWING PLAN

James City County, Virginia

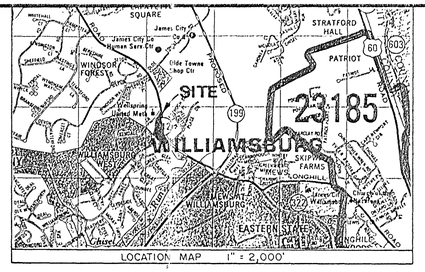

Simmons Engineering, Inc.
Civil Engineering Design And Consulting
Wiliamsburg Business Center
4732 Longhill Road, Suite 3103
Williamsburg VA 23188
Voice: (757) 258-5000
Fax: (757) 258-3758
E-mail: rcspe@QuixNet.net


| NO. | DATE | REVISION / COMMENT / NOTE |
|---|---|---|

COMMONWEALTH OF VIRGINIA — STEVEN W. STAFFORD — No. 028156 — 11.15.2002 — PROFESSIONAL ENGINEER

SURVEYED BY: L.V. WOODSON & ASSOCIATES, INC.
ENGINEERS, SURVEYORS & PLANNERS
105 BACON AVE.
WILLIAMSBURG, VA. 23185

DATED: 9/15/94



LOCATION MAP 1" = 2,000'

## LEGEND

| | |
|---|---|
| 81 | EXIST. ELEVATION |
| 77.1 | PROPOSED ELEVATION |
| T.C. | TOP OF CURB |
| T.W. | TOP OF WALK/WALL |
| E.P. | EDGE OF PAVEMENT |
| S.C.O. | SEWER CLEANOUT |
| W.M. | WATER METER |
| M.G. | MATCH GRADE |
| F.L. | FLOW LINE |
| O.G. | ON FINISHED GRADE |
| M.H. | MANHOLE |
| S.M.H. | SANITARY MANHOLE |
| T/P | TELEPHONE POLE |
| # | UTILITY POLE |
| V.G. | VALLEY GUTTER |
| | WATER VALVE |
| —OHT— | OVERHEAD TELEPHONE |
| —OHE— | OVERHEAD ELECTRIC |
| —UTT— | UNDERGROUND TELEPHONE CABLE |
| —UEE— | UNDERGROUND ELECTRIC |
| | NEW DRAINAGE PIPE |
| | NEW CURB DROP INLET (C.D.I.) |
| | NEW CONCRETE |
| | PAVEMENT TO BE REMOVED |
| | NEW PAVEMENT |
| —SAN— | SANITARY SEWER |
| —W— | WATER LINE |
| | NEW YARD BASIN (Y.B.) |
| B.O.V. | BLOW OFF VALVE |

4897 LONGHILL ROAD
269,108 SF
6.18 ACRES

3.74 AC TO SWALES & BMP

0.42 AC TO BMP

0.59 AC @ 0.6

DRAINAGE AREAS
1/23/95

COUNTRY CLUB DRIVE VAR R/W

MATCH LINE

ZONED R-2

WEST WILLIAMSBURG ZONED R-2 & R-3

OPEN SPACE 16,900SF

30' OPEN SPACE 39,805 SF

CHECK DAM (TYP)

GRASS SWALE @ 0.40%

DISPOSE OF EXCESS SUITABLE EXCAVATED SOIL IN FUTURE BUILDING AREA

FUTURE BUILDING 12,395SF

CONC. WHEEL BLOCKS (TYP)

PROPOSED CHURCH
FFE = 90.50
7,600 SF

4" SAN @ 1.04% MIN

CONC. WALK

RAMP 12:1 MAX.

4' WALK

HC SIGNS (TYP)

UNDERGROUND SEWAGE PUMP STATION TOP ELEV: 90.5

INFILTRATION BASIN BMP BOTTOM: 79.5

RIP-RAP

36'-18" RCP @ 0.70%

INV: 80.0

DI RIM: 83.00 INV: 80.27

INV 84.3

184'-15" RCP @ 1.9%

DBL. YEL. TO REMAIN

110' 4" WHITE LANE LINE

GRADE DITCH 90' @ 0.43%

REMOVE EXIST. PAVEMENT MARKINGS & RESTRIPE FOR LEFT TURN LANE

150' WHITE MINI SKIPS @ 4'O.C

LONGHILL RD

VAR R/W

1/2" PVC SCHED. 80 MIN. COVER: 36"

1/2" G.V.

CONNECT TO EXIST. 2" FM

APPROX. 230' TO SAN. INV: 87.0±

10' EASEMENT J.C.S.A (D.B. 320 PG. 415)

EXIST. F.H.

3/4" W.M

1/2" W. CU

30' OPEN SPACE

1" = 30'

THE GROUP
ARCHITECTURE • ENGINEERING • CONSTRUCTION
100 LAKEMONT, SUITE 2, VIRGINIA BEACH, VA. 23452
PHONE: (804) 340-0022 • FAX: (804) 486-5462

# KING OF GLORY LUTHERAN CHURCH

SITE PLAN

JAMES CITY COUNTY VIRGINIA

ENGINEER:
SPECTRA GROUP INC.
325 OFFICE SQUARE LANE
VIRGINIA BEACH, VIRGINIA
23462

| | |
|---|---|
| Designed: | |
| Drawn: | |
| Checked: | |
| Scale: | |
| Date: | |
| File No: | |
| Project No: | |

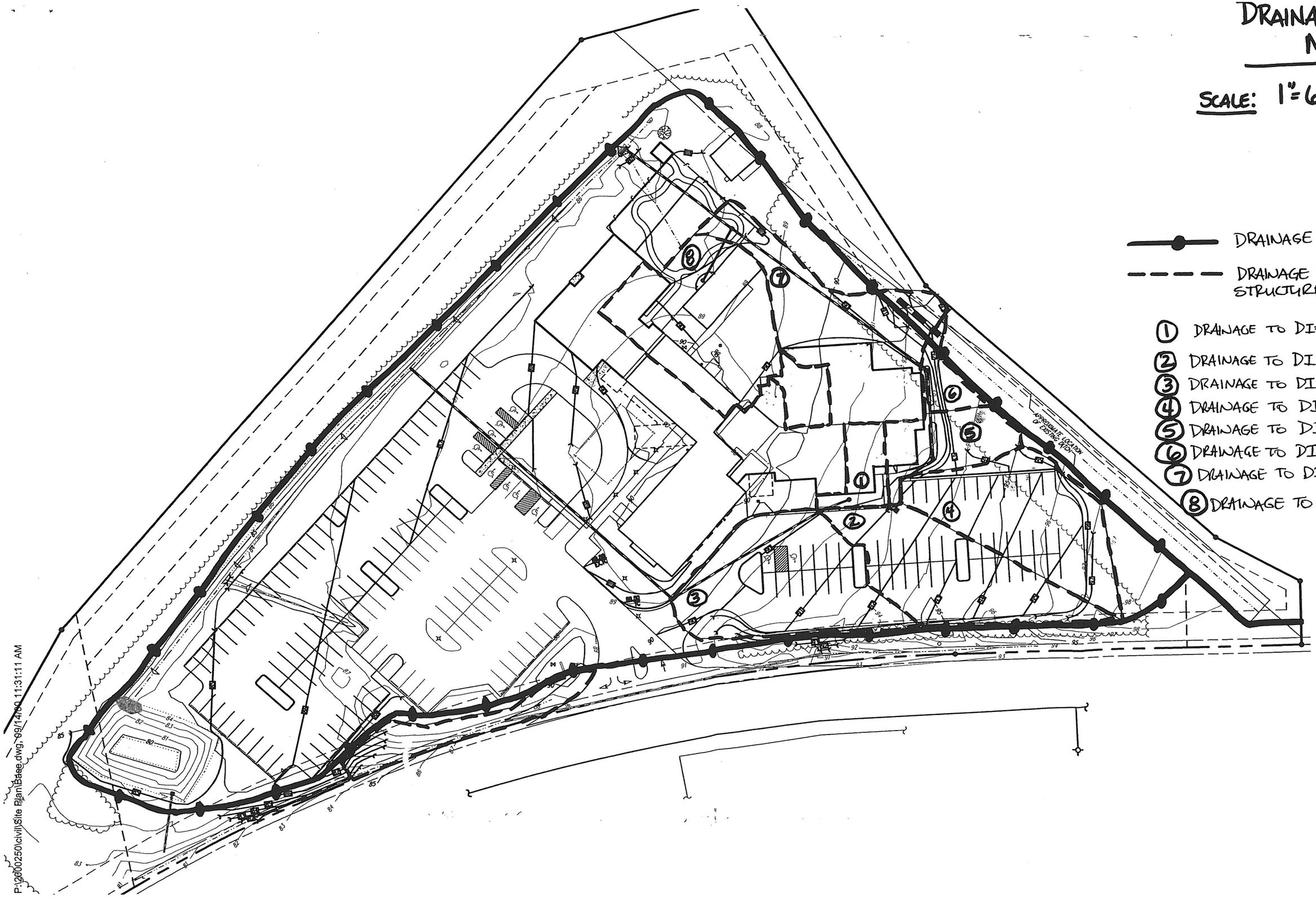
Sheet No: 1

of 4 Sheets

PC072_KING_OF_GLORY_LUTHERAN_CHURCH - 028

# DRAINAGE AREA MAP

**SCALE:** 1" = 60' (DFL)




DRAINAGE TO BMP (4.16AC)

DRAINAGE TO PROPOSED STRUCTURES / PIPES

1. DRAINAGE TO DI#1 = 1900SF
2. DRAINAGE TO DI#2 = 8895 SF
3. DRAINAGE TO DI#3 = 10630SF
4. DRAINAGE TO DI #4 = 9315SF
5. DRAINAGE TO DI #5 = 3722SF
6. DRAINAGE TO DI #6 = 1510 SF
7. DRAINAGE TO DI #7 = 10390 SF
8. DRAINAGE TO DI#8 = 11685SF

P:\2000250\civil\Site Plan\Base.dwg, 99/14/99 11:31:11 AM

SURVEYED BY: L.V. WOODSON & ASSOCIATES, INC.
ENGINEERS, SURVEYORS & PLANNERS
105 BACON AVE.
WILLIAMSBURG, VA. 23185

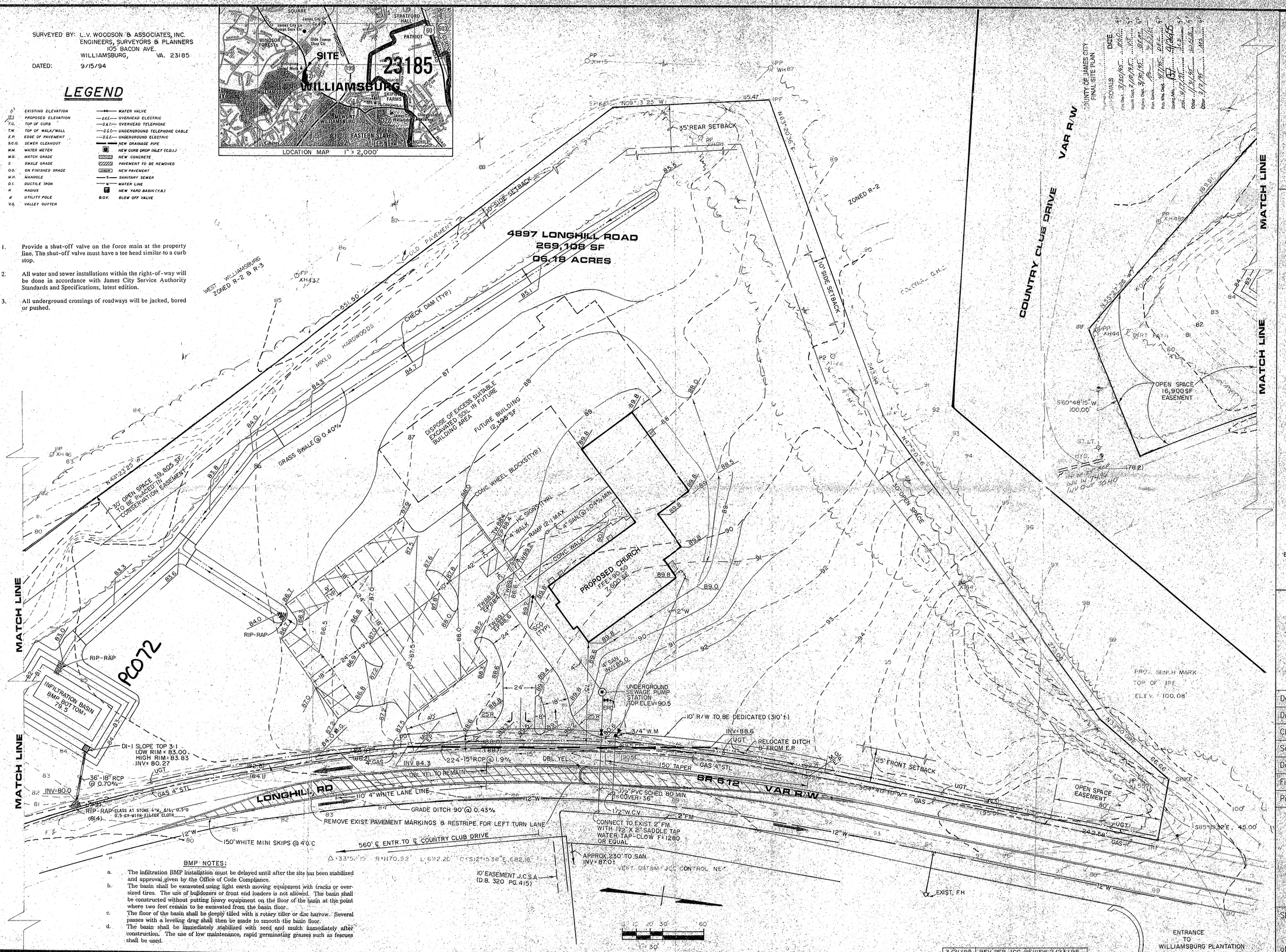
DATED: 9/15/94

## LEGEND

| | |
|---|---|
| 51 | EXISTING ELEVATION |
| 51 | PROPOSED ELEVATION |
| T.C. | TOP OF CURB |
| T.W. | TOP OF WALK/WALL |
| E.P. | EDGE OF PAVEMENT |
| S.C.O. | SEWER CLEANOUT |
| W.M. | WATER METER |
| M.G. | MATCH GRADE |
| S | SWALE GRADE |
| O.G. | ON FINISHED GRADE |
| M.H. | MANHOLE |
| D.I. | DUCTILE IRON |
| R | RADIUS |
| ø | UTILITY POLE |
| V.G. | VALLEY GUTTER |
| | WATER VALVE |
| | OVERHEAD ELECTRIC |
| | OVERHEAD TELEPHONE |
| | UNDERGROUND TELEPHONE CABLE |
| | UNDERGROUND ELECTRIC |
| | NEW DRAINAGE PIPE |
| | NEW CURB DROP INLET (C.D.I.) |
| | NEW CONCRETE |
| | PAVEMENT TO BE REMOVED |
| | NEW PAVEMENT |
| | SANITARY SEWER |
| | WATER LINE |
| | NEW YARD BASIN (Y.B.) |
| B.O.V. | BLOW OFF VALVE |

1. Provide a shut-off valve on the force main at the property line. The shut-off valve must have a tee head similar to a curb stop.
2. All water and sewer installations within the right-of-way will be done in accordance with James City Service Authority Standards and Specifications, latest edition.
3. All underground crossings of roadways will be jacked, bored or pushed.




BMP NOTES:

a. The infiltration BMP installation must be delayed until after the site has been stabilized and approval given by the Office of Code Compliance.
b. The basin shall be excavated using light earth moving equipment with tracks or oversized tires. The use of bulldozers or front end loaders is not allowed. The basin shall be constructed without putting heavy equipment on the floor of the basin at the point where two feet remain to be excavated from the basin floor.
c. The floor of the basin shall be deeply tilled with a rotary tiller or disc harrow. Several passes with a leveling drag shall then be made to smooth the basin floor.
d. The basin shall be immediately stabilized with seed and mulch immediately after construction. The use of low maintenance, rapid germinating grasses such as fescues shall be used.

| | |
|---|---|
| 3/21/95 | REV. PER JCC REVIEW 2/23/95 |

THE GROUP
ARCHITECTURE • ENGINEERING • CONSTRUCTION
100 LANDMARK SQUARE • VIRGINIA BEACH, VA. 23452
PHONE: (804) 340-0322 • FAX: (804) 498-8482

COUNTY OF JAMES CITY
FINAL SITE PLAN
APPROVALS

| | DATE |
|---|---|
| Site Dev.: | 3/30/95 |
| Health Dept.: | 7/10/95 |
| Highway Dept.: | 3/29/95 |
| Plan Comm.: | |
| Pub. Wks. Dept.: | 4/12/95 |
| Zoning Adm.: | 4/12/95 |
| Attorney: | 4/12/95 |
| Owner: | 1/31/95 |
| Owner: | 3/13/95 |

RECEIVED APR 1995 PLANNING DEPARTMENT

SP-7-95

# KING OF GLORY LUTHERAN CHURCH

## SITE PLAN

JAMES CITY COUNTY, VIRGINIA

ENGINEER:
SPECTRA GROUP INC.
325 OFFICE SQUARE LANE
VIRGINIA BEACH, VIRGINIA
23462

Designed:
Drawn:
Checked:
Scale:
Date: 4/7/95
File No:
Project No:

COMMONWEALTH OF VIRGINIA
DONALD J. MCKENNA
No. 22222
1/23/95
PROFESSIONAL ENGINEER

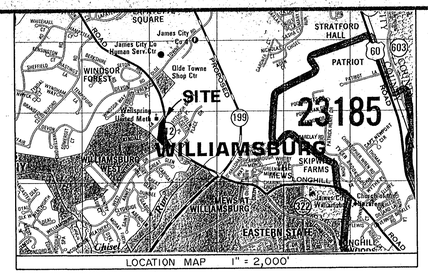
Sheet No: 1
of 4 Sheets

E94 907

PC072_KING_OF_GLORY_LUTHERAN_CHURCH - 030

SURVEYED BY: L.V. WOODSON & ASSOCIATES, INC.
ENGINEERS, SURVEYORS & PLANNERS
105 BACON AVE.
WILLIAMSBURG, VA. 23185

DATED: 9/15/94



LOCATION MAP 1" = 2,000'

## EROSION CONTROL LEGEND

- (CE) CONSTRUCTION ENTRANCE
- (TO) TOPSOILING
- (PS) PERMANENT SEEDING

4897 LONGHILL ROAD
269,108 SF
06.19 ACRES

LIMITS OF CLEARING AND GRADING

CHECK DAM (TYP)

TEMP ROCK CHECK DAM (TYP)

GRASS SWALE @ 0.40%

DISPOSE OF EXCESS SUITABLE EXCAVATED SOIL IN FUTURE BUILDING AREA

FUTURE BUILDING

PROPOSED CHURCH
FFE=90.50

4' WALK

RAMP 12:1 MAX.

CONC WALK

BERMS OR DITCHES MAY BE REQUIRED TO DIRECT RUNOFF FROM PARKING AREA TO BMP

HYDROSEED OR MULCH BMP

EXCAVATE BASIN TO ELEV 81 COMPLETE BASIN CONSTRUCTION UPON STABILIZATION OF SITE

BMP BOTTOM = 79.5

SEWAGE PUMP STATION

INV 87.8

LIMITS OF CLEARING AND GRADING

INV 84.3

184'-15" RCP @ 1.9%

GRADE DITCH 90' @ 0.43%

CONNECT TO EXIST. 2" FM

APPROX. 230' TO SAN. INV = 87.0±

EXIST. F.H

LONGHILL RD

VAR R/W

COUNTRY CLUB DRIVE

MATCH LINE

LIMITS OF CLEARING & GRADING

open space easement 16,900 SF

1" = 30'

**THIS PLAN IS FOR EROSION CONTROL ONLY**
**DO NOT USE FOR ANY OTHER CONSTRUCTION**

4/26/95 ⚠ ADD NOTE

THE GROUP
ARCHITECTURE • ENGINEERING • CONSTRUCTION
100 LANDMARK SQUARE, VIRGINIA BEACH, VA. 23452.
PHONE: (804) 340-0322 FAX: (804) 428-8452

# KING OF GLORY LUTHERAN CHURCH
## EROSION CONTROL PLAN

JAMES CITY COUNTY VIRGINIA

ENGINEER:
SPECTRA GROUP INC.
325 OFFICE SQUARE LANE
VIRGINIA BEACH, VIRGINIA
23462

| | |
|---|---|
| Designed: | |
| Drawn: | |
| Checked: | |
| Scale: | |
| Date: | 4/7/95 |
| File No: | |
| Project No: | |

COMMONWEALTH OF VIRGINIA
RONALD J. MICKIEWICZ
10029
1/23/95
PROFESSIONAL ENGINEER

Sheet No: 2
of 4 Sheets

E94 907

PC072_KING_OF_GLORY_LUTHERAN_CHURCH - 031

SP-118-00

# LAND USE SUMMARY

TAX MAP NO. 32-4-01-0-0033

* PROPERTY IS LOCATED IN FIRM ZONE X (AREA OUTSIDE 500-YR. FLOOD PLAIN, AS SHOWN ON COMMUNITY PANEL NO. 510201 0035 B.

ZONING OF SITE: R-2

OPEN SPACE DATA:

- TOTAL SITE AREA = 6.04 AC.
  SITE AREA COVERED BY BUILDINGS: 23,757 S.F. (9%) (16,068 S.F. PROPOSED)
  SITE AREA COVERED BY PARKING LOT/WALKS: 80,340 S.F. (31%) (59,170 S.F. PROPOSED)
  SITE AREA COVERED BY OPEN SPACE: 159,000 S.F. (60%)
  – OPEN SPACE EASEMENTS: 84,456 S.F. (32.1%)
  TOTAL AREA TO BE DISTURBED (INCL. GRADING): 2.40 AC.
- YARD REQUIREMENTS:
  FRONT YARD = 25'
  SIDE YARD = 10'
  REAR YARD = 35'

BUILDING DATA:

- TOTAL FLOOR AREA OF EACH BUILDING:
  FELLOWSHIP HALL/COMMUNITY CENTER: 10,843 S.F.
  PRESCHOOL/CLASSROOM WING: 5,216 S.F.
- HEIGHT (& NO. OF FLOORS) OF EACH BUILDING:
  FELLOWSHIP HALL/COMMUNITY CENTER: 34' (1 FLOOR)
  PRESCHOOL/CLASSROOM WING: 31' (1 FLOOR)
- TYPE OF OCCUPANCY (PER BUILDING CODE):
  FELLOWSHIP HALL/COMMUNITY CENTER: A3 (ASSEMBLY)
  PRESCHOOL/CLASSROOM WING: E (EDUCATIONAL)

PARKING REQUIREMENTS:

- REQUIRED PARKING CALCULATION:
  1 SPACE PER 5 SEATS (COMMUNITY CENTER CONTROLS W/OCCUPANT LOAD OF 534) = 534/5 = 107 SPACES REQUIRED (5 TO BE HANDICAP, 1 OF WHICH SHOULD BE VAN-ACCESSIBLE)
- PROVIDED PARKING:
  161 TOTAL SPACES PROVIDED
  – 151 STANDARD SPACES
  – 6 HANDICAP SPACES SEPARATED WITH 5' STRIPED AISLE
  – 4 VAN-ACCESSIBLE HANDICAP SPACES SEPARATED WITH 9' STRIPED AISLE

*STD. SIZE OF SPACE: 9' x 18'

# CONTACTS

## OWNER

KING OF GLORY CHURCH
4897 LONGHILL RD.
WILLIAMSBURG, VA 23188

MR. LEE SCHMIDT, MR. MEL GREWE
BUILDING COMMITTEE CO-CHAIRMEN
(757) 258-9701

## ARCHITECT/ ENGINEERS

DJG, INC.
449 McLAWS CIRCLE
WILLIAMSBURG, VA 23187

MATTHEW G. BURTON, AIA
PROJECT MANAGER
(757) 253-0673 – FAX: 253-2319
E-MAIL: williamsburg@djginc.com



COMMONWEALTH OF VIRGINIA
H. L. PHILLIP GOERING
No. 033584
PROFESSIONAL ENGINEER
3-6-01

THIS DOCUMENT IS THE SOLE PROPERTY OF DJG, INC. OF WILLIAMSBURG, VIRGINIA. THE REPRODUCTION, IN WHOLE OR PART, OR THE MODIFICATION OF ANY DETAIL OR DESIGN IS NOT TO BE MADE WITHOUT THE EXPRESS WRITTEN CONSENT OF DJG, INC., COPYRIGHT 2000.

REVISIONS

| NO. | DATE | DESCRIPTION |
|---|---|---|
| 1 | 12/12/00 | REVISIONS PER COUNTY COMMENTS (11/02/00) |
| 2 | 03/06/01 | REVISIONS PER COUNTY COMMENTS (02/21/01) |

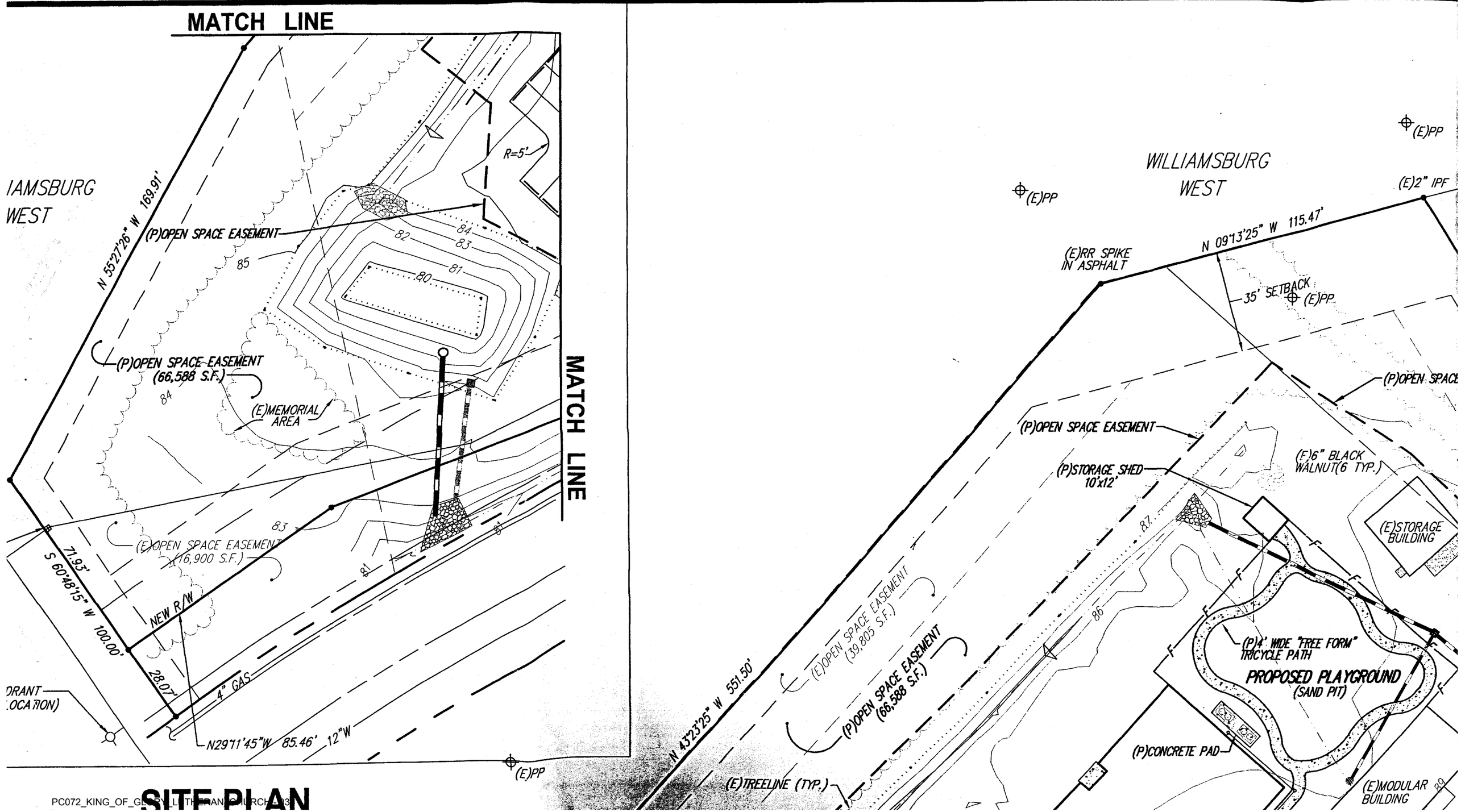
TITLE SHEET

KING OF GLORY LUTHERAN CHURCH
COMMUNITY CENTER AND
EDUCATION EXPANSION
JAMES CITY COUNTY, VIRGINIA

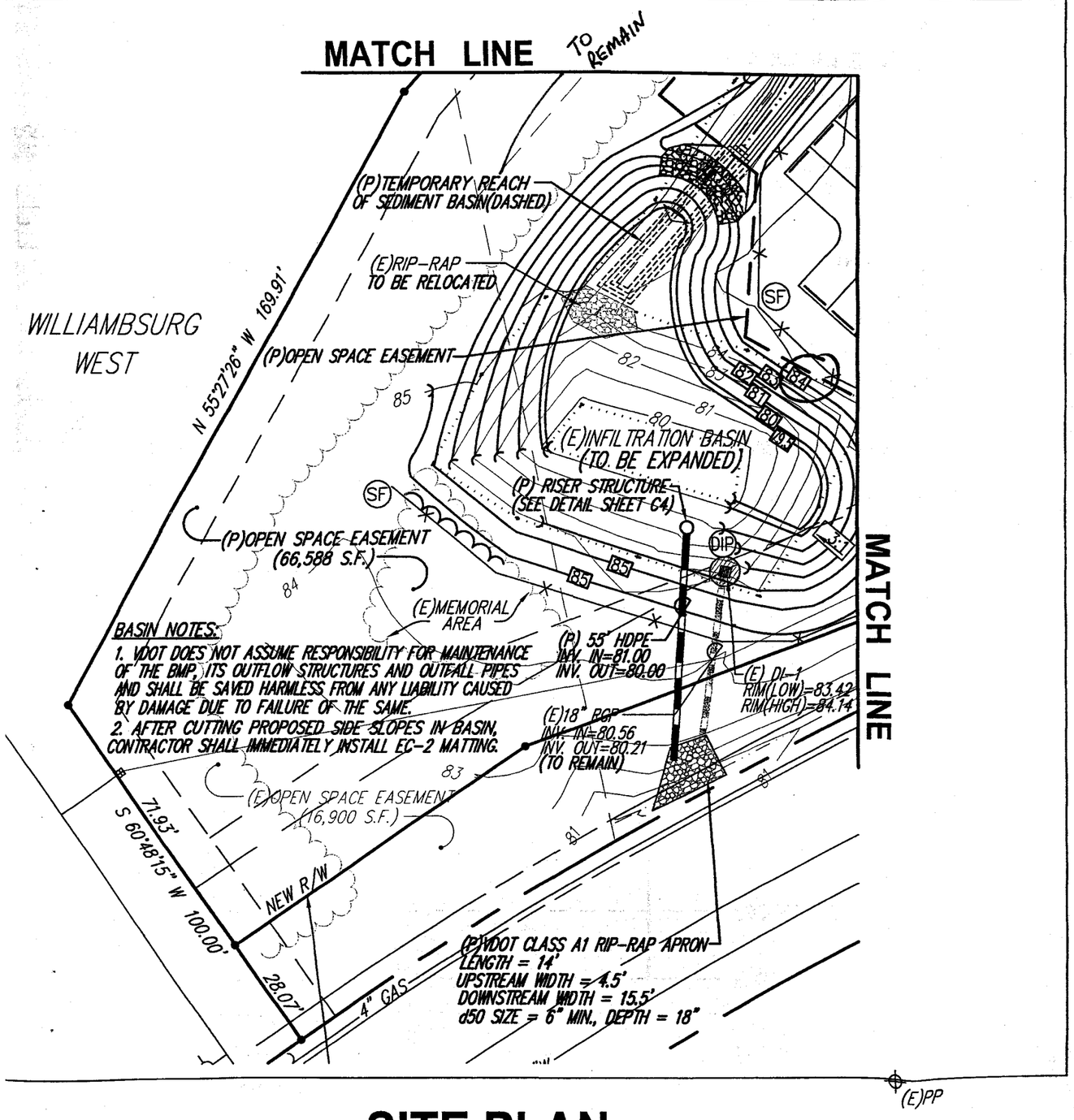
| SCALE | DESIGNED | DRAWN | CHECKED | DATE |
|---|---|---|---|---|
| AS NOTED | -- | DFL | HLPG | 9/18/00 |

COMMISSION NUMBER
2000250

SHEET NUMBER
TS1
1 OF 6

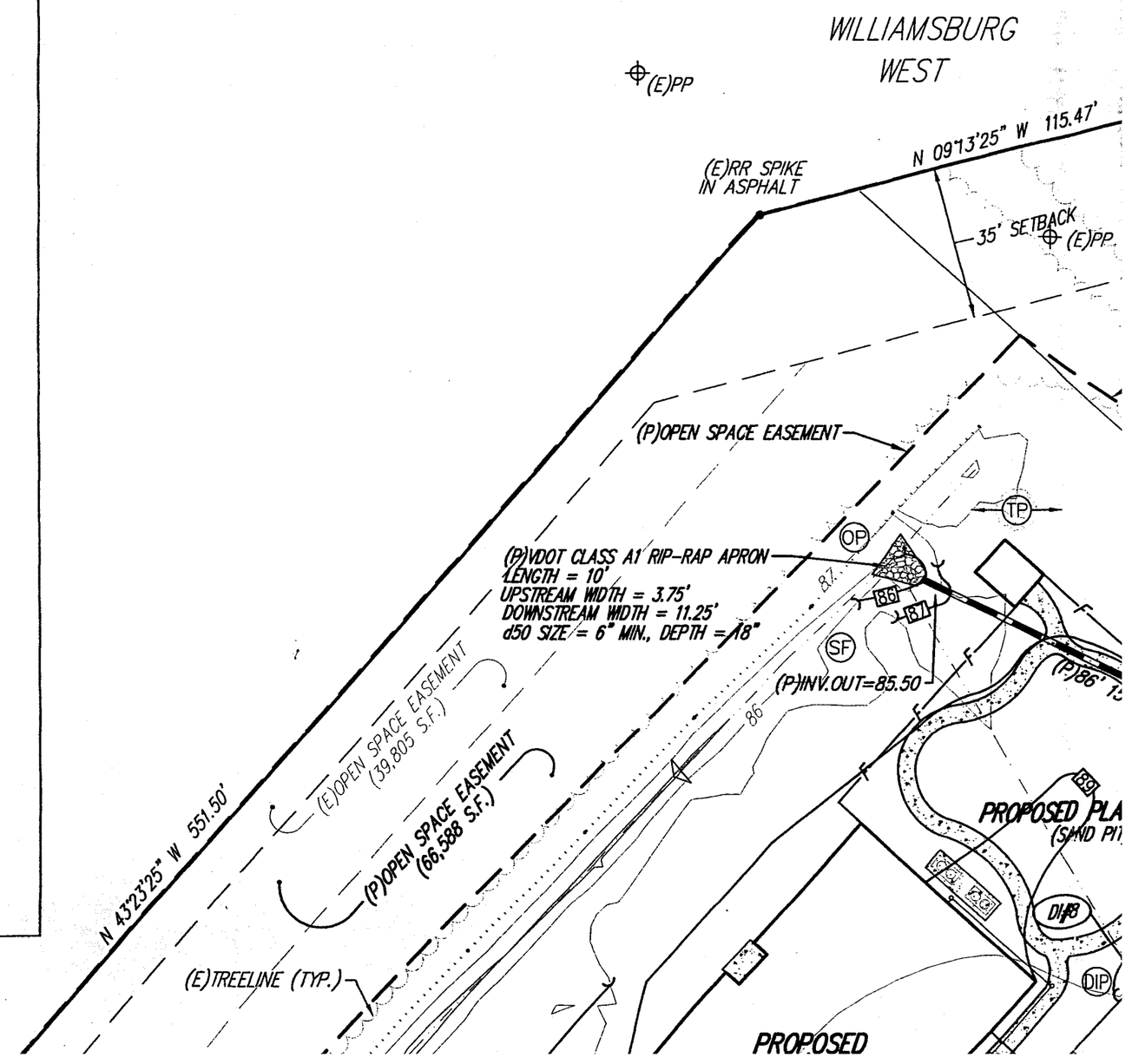

MATCH LINE
IAMSBURG
WEST
N 55°27'26" W 169.91'
(P)OPEN SPACE EASEMENT
R=5'
85
82
83
84
81
80
(P)OPEN SPACE EASEMENT
(66,588 S.F.)
84
(E)MEMORIAL
AREA
MATCH LINE
83
(E)OPEN SPACE EASEMENT
(16,900 S.F.)
81
84
71.93'
S 60°48'15" W 100.00'
NEW R/W
28.07'
4" GAS
N29°11'45"W 85.46' 12"W
DRANT
LOCATION)
(E)PP
N 43°23'25" W 551.50'
(E)OPEN SPACE EASEMENT
(39,805 S.F.)
(P)OPEN SPACE EASEMENT
(66,588 S.F.)
(E)TREELINE (TYP.)
(E)PP
WILLIAMSBURG
WEST
(E)PP
(E)PP
(E)2" IPF
N 09°13'25" W 115.47'
(E)RR SPIKE
IN ASPHALT
35' SETBACK
(E)PP
(P)OPEN SPACE
(P)OPEN SPACE EASEMENT
(P)STORAGE SHED
10'x12'
(E)6" BLACK
WALNUT(6 TYP.)
(E)STORAGE
BUILDING
87
86
(P)4' WIDE "FREE FORM"
TRICYCLE PATH
PROPOSED PLAYGROUND
(SAND PIT)
(P)CONCRETE PAD
(E)MODULAR
BUILDING
80

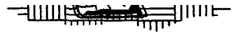
# SITE PLAN




# SITE PLAN

SCALE: 1"=30'

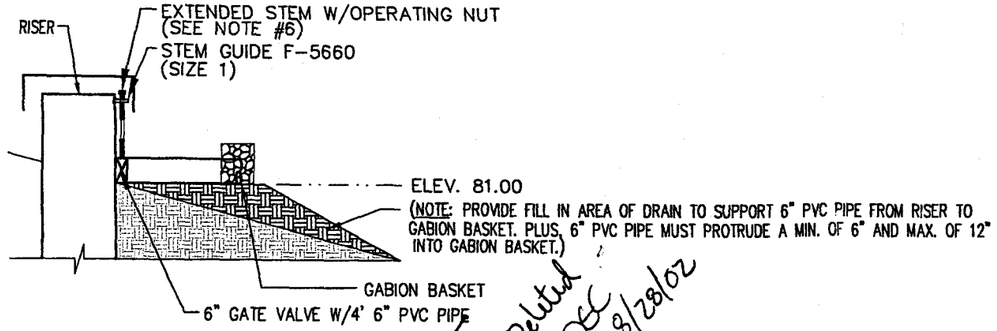




## SILT FENCE (W/ WIRE SUPPORT) VESCH 3.05

SF

NOT TO SCALE



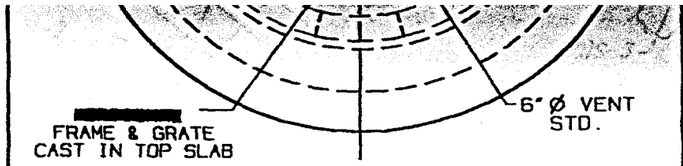

Deleted DEC 8/28/02

## MAINTENANCE DRAIN

NOT TO SCALE

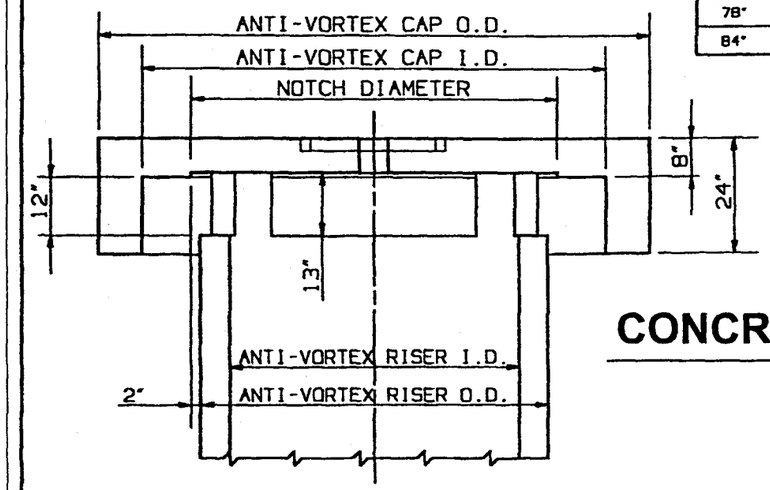
NOTES:

1. POND DRAIN TO INCLUDED A MANUAL GATE VALVE, 6" PVC LINE SET EVEN W/BARREL INVERT @ EL. 81.00 & GABION BASKET FOR MAINTENANCE DRAINAGE OF THE POND.
2. CORE TRENCH SHALL BE A MIN. OF 4' DEEP x 4' WIDE. DIMENSIONS MAY NEED TO BE INCREASED PER GEOTECHNICAL ENGINEERS RECOMMENDATIONS.
3. THE EMBANKMENT SHALL BE STABILIZED WITH PERMANENT VEGETATION IMMEDIATELY AFTER INSTALLATION IN ACCORDANCE WITH MINIMUM STANDARD 3.05 OF THE VIRGINIA STORMWATER MANAGEMENT HANDBOOK(VSMH). THE POND SIDE SLOPES SHOULD BE VEGETATED WITH VEGETATION FOR COASTAL PLAIN "ZONE 3".
4. THE POND'S OUTLET BARREL (18" HDPE) SHALL BE INSTALLED IN ACCORDANCE WITH VDOT PLASTIC PIPE STANDARD PB-1.
5. ALL CONNECTIONS MADE ARE TO BE WATERTIGHT.
6. CONTRACTOR TO ADJUST DRAIN PVC PIPE & ORIFICE PROTECTION ELBOW AS NECESSARY TO AVOID CONFLICT. ALSO, THESE ITEMS ARE TO BE ORIENTED GENERALLY TOWARDS THE CENTER OF POND.




PLAN

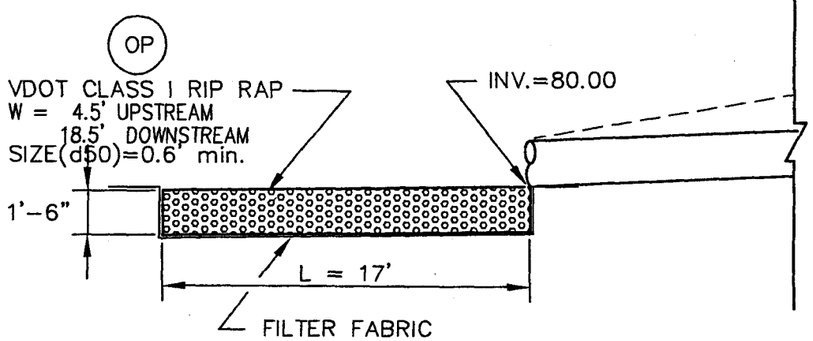
| | | | | |
|---|---|---|---|---|
| 27" | 33½" | 60" | 70" OR 72" | 37½" |
| 30" | 37" | 60" | 70" OR 72" | 41" |
| 36" | 44" | 60" | 70" OR 72" | 48" |
| 42" | 51" | 72" | 86" | 55" |
| 48" | 58" | 84" | 100" | 62" |
| 54" | 66½" | 84" | 100" | 70½" |
| 60" | 72" | 96" | 114" | 76" |
| 66" | 80½" | 96" | 114" | 84½" |
| 72" | 86" | 108" | 128" | 90" |
| 78" | 94½" | 126" | 147" | 98½" |
| 84" | 100" | 126" | 147" | 104" |

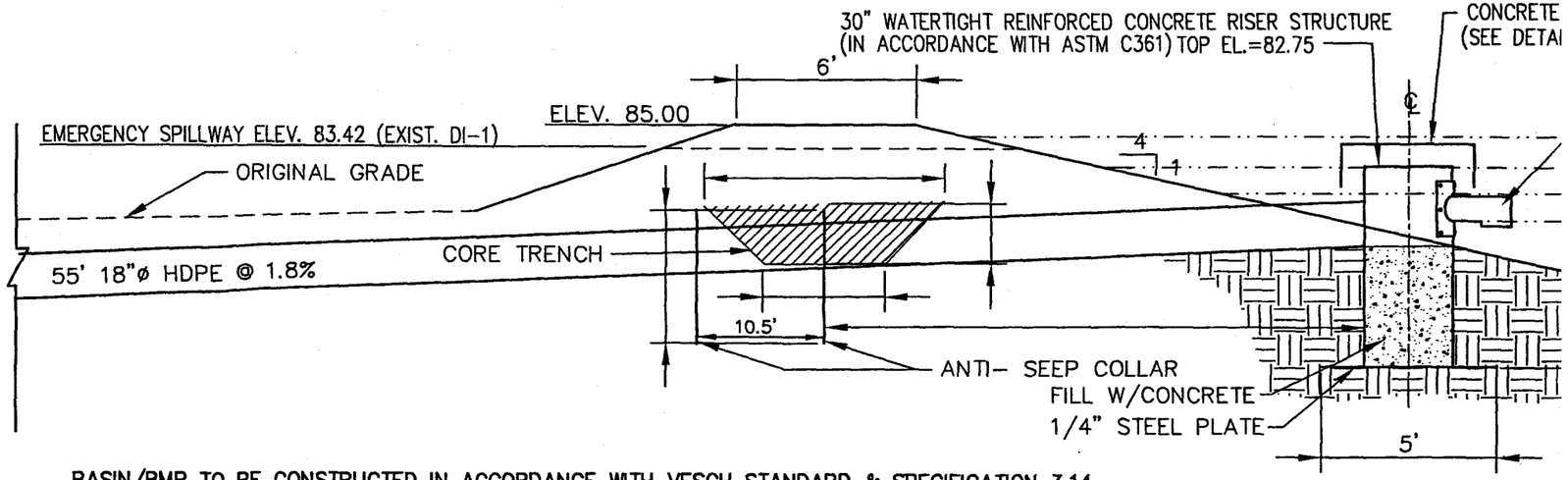



SECTION

## CONCRETE ANTI-VOR

NOT TO SCALE

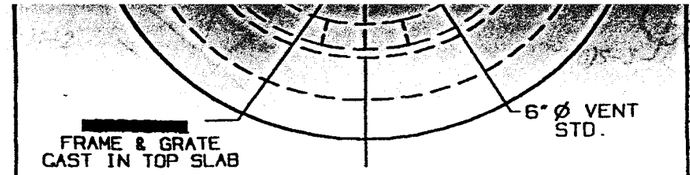



BASIN/BMP TO BE CONSTRUCTED IN ACCORDANCE WITH VESCH STANDARD & SPECIFICATION 3.14

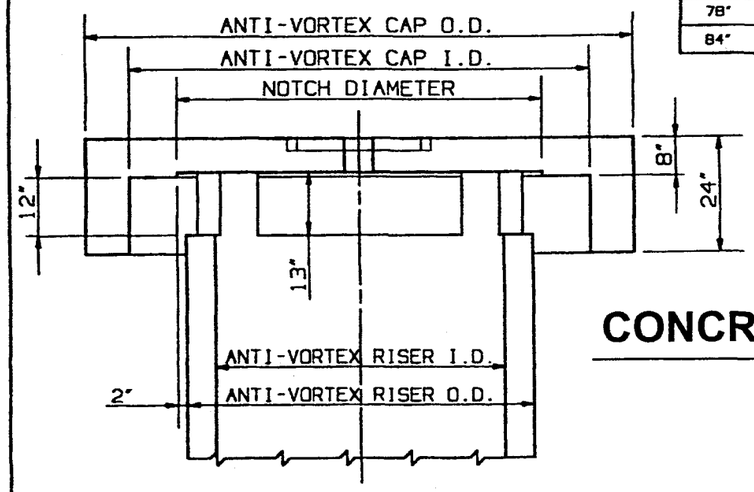
## PRINCIPAL SPILLWAY

NOT TO SCALE




PLAN

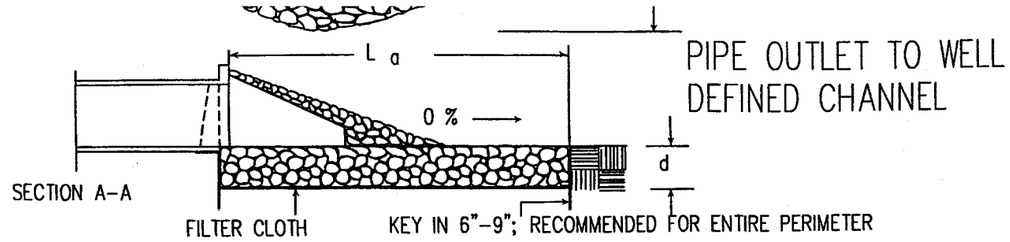
| | | | | | |
|---|---|---|---|---|---|
| 24" | 30" | 48" | [illegible] | [illegible] | [illegible] |
| 27" | 33½" | 60" | 70" OR 72" | 37½" | 2.28 T |
| 30" | 37" | 60" | 70" OR 72" | 41" | 2.26 T |
| 36" | 44" | 60" | 70" OR 72" | 48" | 2.22 T |
| 42" | 51" | 72" | 86" | 55" | 3.16 T |
| 48" | 58" | 84" | 100" | 62" | 4.27 T |
| 54" | 66½" | 84" | 100" | 70½" | 4.20 T |
| 60" | 72" | 96" | 114" | 76" | 5.48 T |
| 66" | 80½" | 96" | 114" | 84½" | 5.39 T |
| 72" | 86" | 108" | 128" | 90" | 6.83 T |
| 78" | 94½" | 126" | 147" | 98½" | 8.97 T |
| 84" | 100" | 126" | 147" | 104" | 8.90 T |




SECTION

## CONCRETE ANTI-VORTEX

NOT TO SCALE

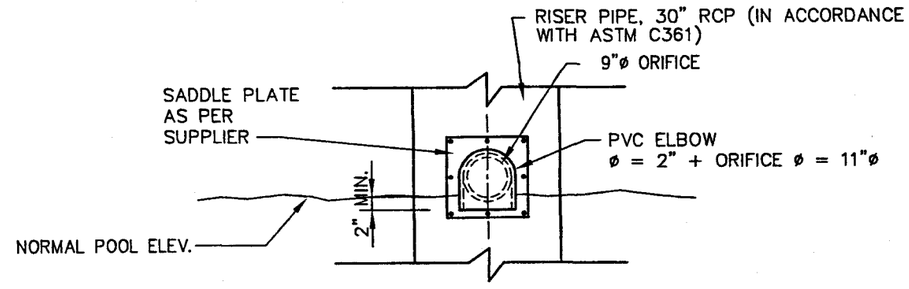



NOTES:
1. APRON LINING MAY BE RIPRAP, GROUTED RIPRAP, GABION BASKET, OR CONCRETE.
2. La IS THE LENGTH OF THE RIPRAP APRON AS CALCULATED USING PLATES 3.18-3 AND 3.18-4.
3. d = 1.5 TIMES THE MAXIMUM STONE DIAMETER, BUT NOT LESS THAN 6 INCHES.

## RIP-RAP PIPE OUTLET PROTECTION (VESCH STD. 3.18-1)

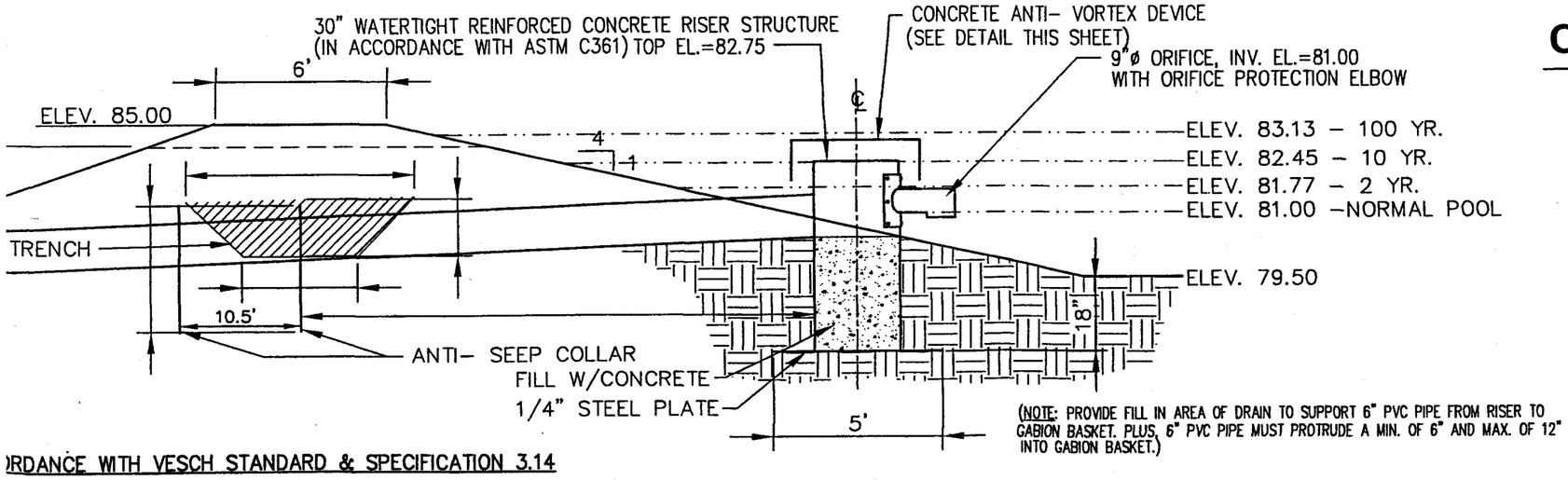
OP

NOT TO SCALE




## ORIFICE WITH PROTECTION ELBOW

NOT TO SCALE




(NOTE: PROVIDE FILL IN AREA OF DRAIN TO SUPPORT 6" PVC PIPE FROM RISER TO GABION BASKET. PLUS, 6" PVC PIPE MUST PROTRUDE A MIN. OF 6" AND MAX. OF 12" INTO GABION BASKET.)

ORDANCE WITH VESCH STANDARD & SPECIFICATION 3.14

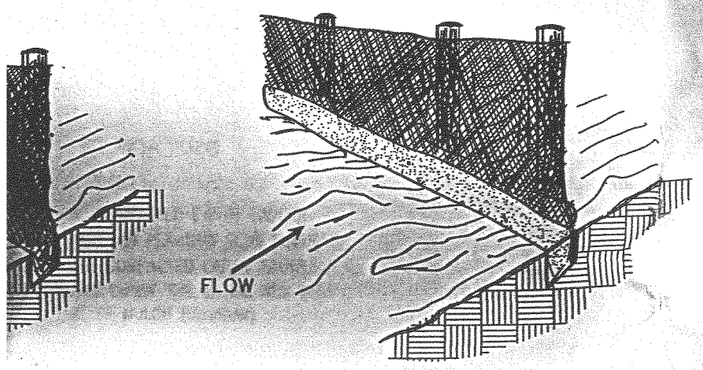
## AL SPILLWAY

T TO SCALE

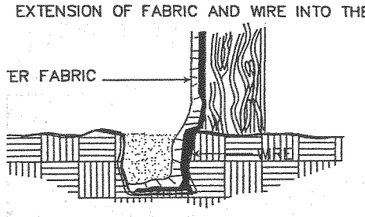
CIP C NC

INTO THE TRENCH.

EXCAVATED SOIL.



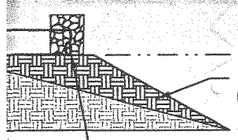

EXTENSION OF FABRIC AND WIRE INTO THE TRENCH.




## NCE (W/ WIRE SUPPORT) VESCH 3.05

ALE

TENDED STEM W/OPERATING NUT
EE NOTE #6)
TEM GUIDE F-5660
IZE 1)



ELEV. 81.00

(NOTE: PROVIDE FILL IN AREA OF DRAIN TO SUPPORT 6" PVC PIPE FROM RISER TO GABION BASKET. PLUS, 6" PVC PIPE MUST PROTRUDE A MIN. OF 6" AND MAX. OF 12" INTO GABION BASKET.)

GABION BASKET

6" GATE VALVE W/4' 6" PVC PIPE

Deleted DEC 8/28/02

## ITENANCE DRAIN

NOT TO SCALE

6" PVC LINE SET EVEN
OR MAINTENANCE DRAINAGE OF THE POND.

DE. DIMENSIONS MAY NEED TO BE
NDATIONS.

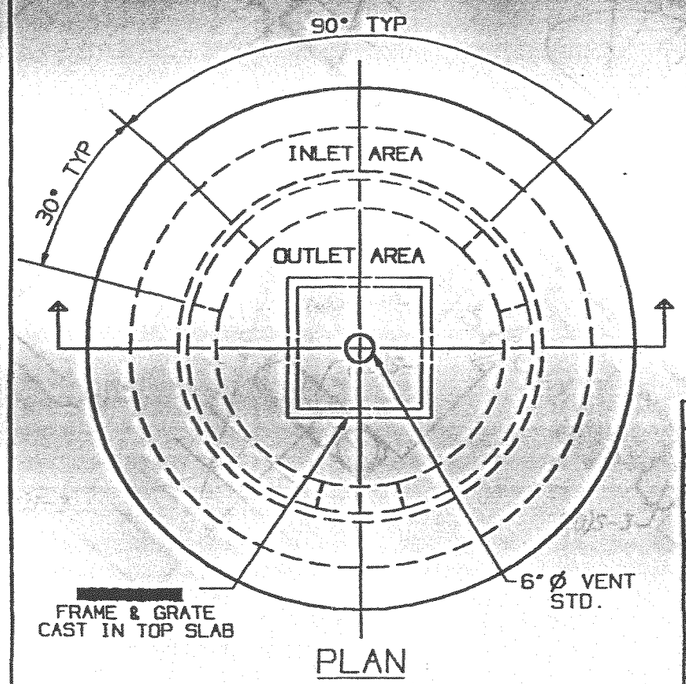
ANENT VEGETATION IMMEDIATELY AFTER
STANDARD 3.05 OF THE VIRGINIA
SIDE SLOPES SHOULD BE VEGETATED WITH

INSTALLED IN ACCORDANCE

ION ELBOW AS NECESSARY TO AVOID
LY TOWARDS THE CENTER OF POND.

DIP

NOT TO SCALE

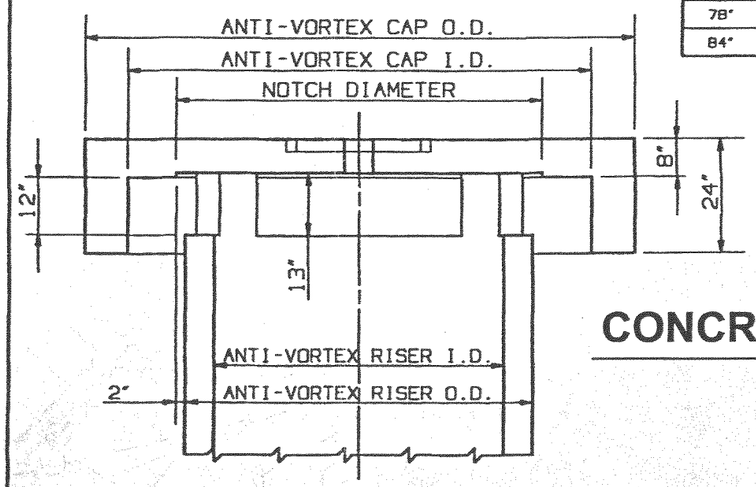



PLAN

NOTE:

1. ANTI-VORTEX DEVICE (CAP AND RISER) MANUFACTURED IN ACCORDANCE WITH ASTM C478.
2. DIMENSIONS SUBJECT TO PERMISSIBLE VARIATIONS OF ASTM C478.
3. INLET AREA (AREA BETWEEN DEVICE I.D. AND RISER O.D.) IS GREATER THAN OUTLET AREA (AREA OF RISER I.D.)
4. SLAB REINFORCEMENT TO BE ASTM A615 #4 BARS @ 6" E.W. CIRCUMFERENTIAL REINFORCEMENT TO BE Asc = 1 @ 0.150 2x6 W2.5 x w2.5 WWF MINIMUM. MATERIAL PROPERTIES: fy = 60 ksi. fc = 4 ksi. CONCRETE COVER OVER REINFORCEMENT (CCOR) = 1". UNLESS NOTED
5. DI-1 FRAME & GRATE IS AVAILABLE FOR 48" I.D. RISERS AND LARGER.

| RISER | | ANTI-VORTEX CAP | | NOTCH DIAMETER | APPROX. CAP WEIGHT |
|---|---|---|---|---|---|
| I.D. | O.D. | I.D. | O.D. | | |
| 24" | 30" | 48" | 58" | 34" | 1.49 T |
| 27" | 33½" | 60" | 70" OR 72" | 37½" | 2.28 T |
| 30" | 37" | 60" | 70" OR 72" | 41" | 2.26 T |
| 36" | 44" | 60" | 70" OR 72" | 48" | 2.22 T |
| 42" | 51" | 72" | 86" | 55" | 3.16 T |
| 48" | 58" | 84" | 100" | 62" | 4.27 T |
| 54" | 66½" | 84" | 100" | 70½" | 4.20 T |
| 60" | 72" | 96" | 114" | 76" | 5.48 T |
| 66" | 80½" | 96" | 114" | 84½" | 5.39 T |
| 72" | 86" | 108" | 128" | 90" | 6.83 T |
| 78" | 94½" | 126" | 147" | 96½" | 8.97 T |
| 84" | 100" | 126" | 147" | 104" | 8.90 T |




SECTION

## CONCRETE ANTI-VORTEX

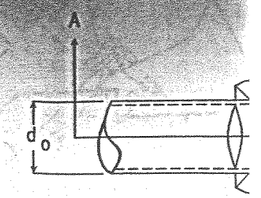
NOT TO SCALE

clear, safe passage for mainte
control structures.

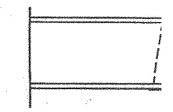
9. Inspect and exercise pond

10. Record Keeping. The own
records of inspections perform
and/or repairs performed. Co

11. The facility shall not acce
or approval by the Environmer




PLAN VIEW



SECTION A-A

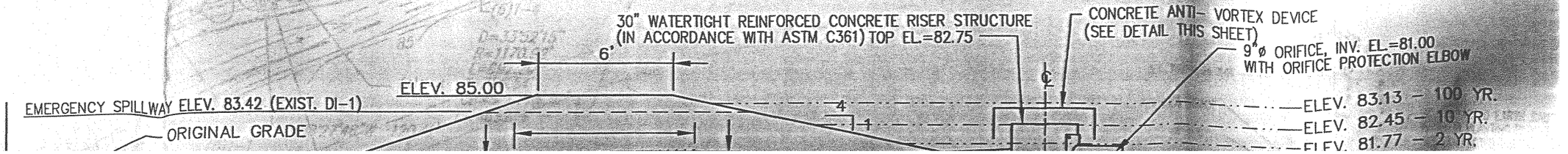
FIL

NOTES: 1. APRON
BASKE
2. La IS
USING
3. d = 1
LESS

OP

## PROT

NORM

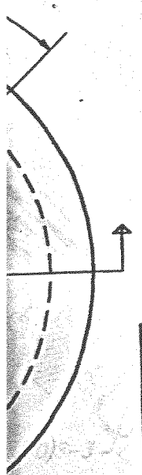


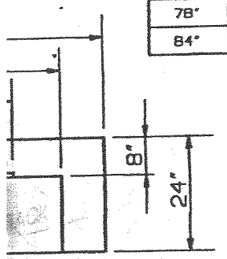
TO SCALE

NOTE:

1. ANTI-VORTEX DEVICE (CAP AND RISER) MANUFACTURED IN ACCORDANCE WITH ASTM C478.
2. DIMENSIONS SUBJECT TO PERMISSIBLE VARIATIONS OF ASTM C478.
3. INLET AREA (AREA BETWEEN DEVICE I.D. AND RISER O.D.) IS GREATER THAN OUTLET AREA (AREA OF RISER I.D.)
4. SLAB REINFORCEMENT TO BE ASTM A615 #4 BARS @ 8" E.W. CIRCUMFERENTIAL REINFORCEMENT TO BE Asc = 1 @ 0.150 2x6 W2.5 x w2.5 WWF MINIMUM. MATERIAL PROPERTIES: fy = 60 ksi. fc = 4 ksi. CONCRETE COVER OVER REINFORCEMENT (CCOR) = 1". UNLESS NOTED
5. DI-1 FRAME & GRATE IS AVAILABLE FOR 48" I.D. RISERS AND LARGER.

| RISER | | ANTI-VORTEX CAP | | NOTCH DIAMETER | APPROX. CAP WEIGHT |
|---|---|---|---|---|---|
| I.D. | O.D. | I.D. | O.D. | | |
| 24" | 30" | 48" | 58" | 34" | 1.49 T |
| 27" | 33½" | 60" | 70" OR 72" | 37½" | 2.28 T |
| 30" | 37" | 60" | 70" OR 72" | 41" | 2.26 T |
| 36" | 44" | 60" | 70" OR 72" | 48" | 2.22 T |
| 42" | 51" | 72" | 86" | 55" | 3.16 T |
| 48" | 58" | 84" | 100" | 62" | 4.27 T |
| 54" | 66½" | 84" | 100" | 70½" | 4.20 T |
| 60" | 72" | 96" | 114" | 76" | 5.48 T |
| 66" | 80½" | 96" | 114" | 84½" | 5.39 T |
| 72" | 86" | 108" | 128" | 90" | 6.83 T |
| 78" | 94½" | 126" | 147" | 98½" | 8.97 T |
| 84" | 100" | 126" | 147" | 104" | 8.90 T |




## CONCRETE ANTI-VORTEX

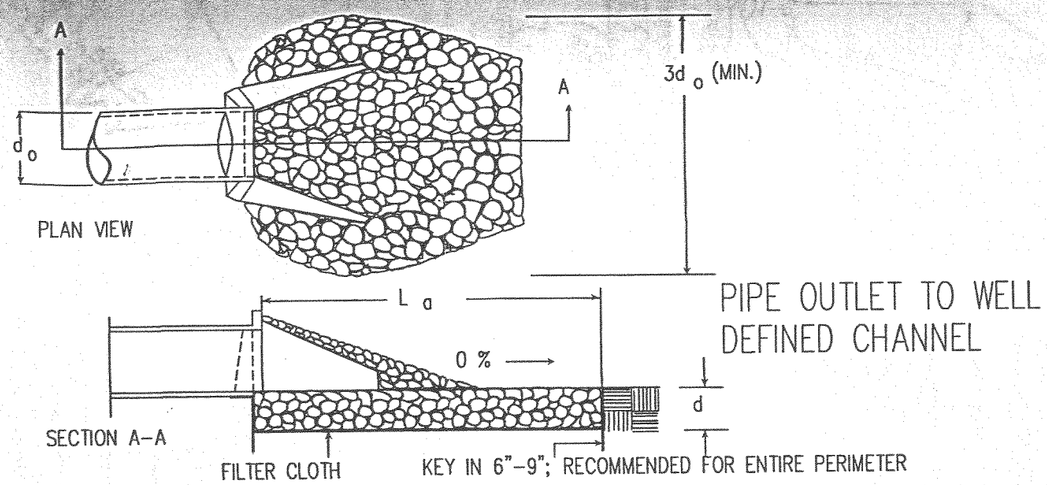
NOT TO SCALE

control structures.

9. Inspect and exercise pond drain valves, if provided, on a regular basis.

10. Record Keeping. The owner or designated representative shall keep reasonable, accurate written records of inspections performed for the structure. Records shall document routine maintenance and/or repairs performed. Copies shall be provided to the County upon request.

11. The facility shall not accept additional drainage or be modified in any way without prior consent or approval by the Environmental Division of James City County.

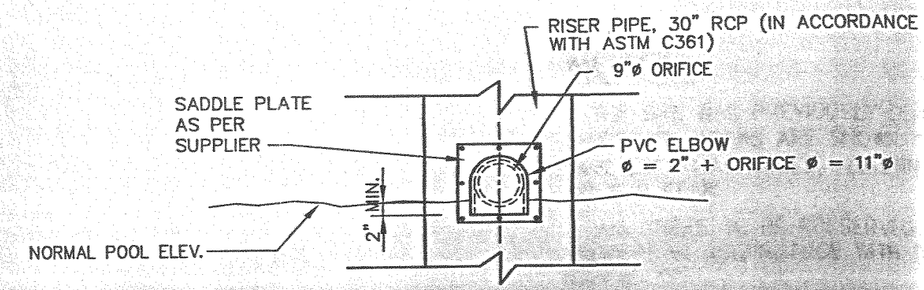



NOTES: 1. APRON LINING MAY BE RIPRAP, GROUTED RIPRAP, GABION BASKET, OR CONCRETE.
2. La IS THE LENGTH OF THE RIPRAP APRON AS CALCULATED USING PLATES 3.18-3 AND 3.18-4.
3. d = 1.5 TIMES THE MAXIMUM STONE DIAMETER, BUT NOT LESS THAN 6 INCHES.

## RIP-RAP PIPE OUTLET PROTECTION (VESCH STD. 3.18-1)

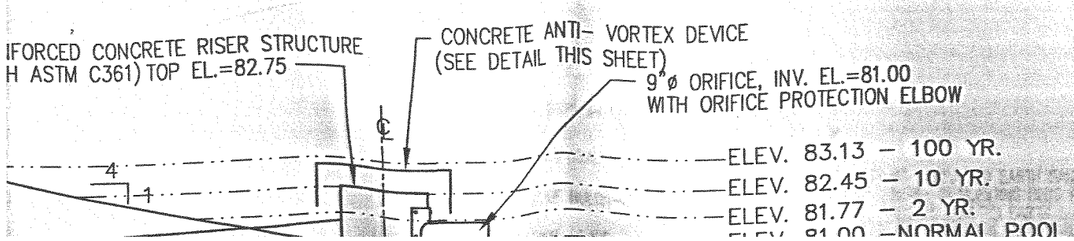
OP

NOT TO SCALE




## ORIFICE WITH PROTECTION ELBOW

NOT TO SCALE




PROJECT. THE INSTALLATION OF DRAINAGE
PRECEDENCE OVER ALL UNDERGROUND UTILITIES. OUTFALL
DRAINAGE STRUCTURES SHALL BE STABILIZED IMMEDIATELY
CONSTRUCTION OF SAME. THIS INCLUDES INSTALLATION OF
CONTROL STONE OR PAVED DITCHES WHERE REQUIRED. AN
OUTFALLS REQUIRED FOR STREET MUST BE COMPLETED BEF
GRADING OR UTILITY INSTALLATION BEGINS.

9. PERMANENT OR TEMPORARY SOIL STABILIZATION MUST BI
DENUDED AREAS WITHIN 7 DAYS AFTER FINAL GRADE IS RE
PORTION OF THE SITE. SOIL STABILIZATION MUST ALSO BE
DENUDED AREAS WHICH MAY NOT BE A FINAL GRADE BUT
DORMANT (UNDISTURBED) FOR LONGER THAN 30 DAYS. SC
MEASURES INCLUDE VEGETATIVE ESTABLISHMENT, MULCHING
EARLY APPLICATION OF GRAVEL BASE MATERIAL ON AREAS

10. NO MORE THAN 300 FEET OF SANITARY SEWER, STORM
UNDERGROUND UTILITY LINES ARE TO BE OPEN AT ONE TIM
INSTALLATION OF ANY PORTION OF THESE ITEMS, ALL DISTU
TO BE IMMEDIATELY STABILIZED (I.E., THE SAME DAY).

11. IF DISTURBED AREA STABILIZATION IS TO BE ACCOMPLIS
MONTHS OF DECEMBER, JANUARY, OR FEBRUARY, STABILIZA
CONSIST OF MULCHING IN ACCORDANCE WITH SPECIFICATION
WILL THEN TAKE PLACE AS SOON AS THE SEASON PERMITS

12. THE TERM SEEDING, FINAL VEGETATIVE COVER OR STAB
PLAN SHALL MEAN THE SUCCESSFUL GERMINATION AND ES
STABLE GRASS COVER FROM A PROPERLY PREPARED SEED
THE SPECIFIED AMOUNTS OF SEED, LIME, AND FERTILIZER I
WITH SPECIFICATION 3.32, PERMANENT SEEDING. IRRIGATIO
REQUIRED AS NECESSARY TO ENSURE ESTABLISHMENT OF

13. ALL SLOPES STEEPER THAN 3:1 SHALL REQUIRE THE U
BLANKETS SUCH AS EXCELSIOR BLANKETS TO AID IN THE
VEGETATIVE COVER. INSTALLATION SHALL BE IN ACCORDA
SPECIFICATION 3.35, MULCHING AND MANUFACTURER'S INST
SLOPES SHALL BE CREATED STEEPER THAN 2:1.

14. INLET PROTECTION IN ACCORDANCE WITH SPECIFICATION
PROVIDED FOR ALL STORM DRAIN INLETS AS SOON AS PRA
CONSTRUCTION OF SAME.

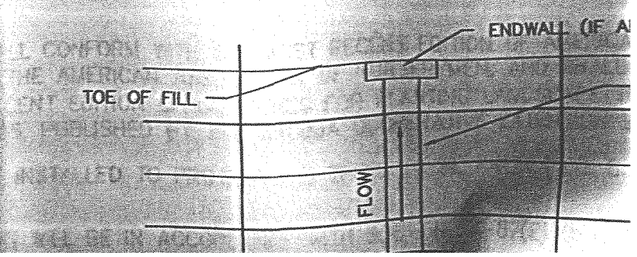
15. TEMPORARY LINERS, SUCH AS POLYETHYLENE SHEETS,
FOR ALL PAVED DITCHES UNTIL THE PERMANENT CONCRETE
INSTALLED.

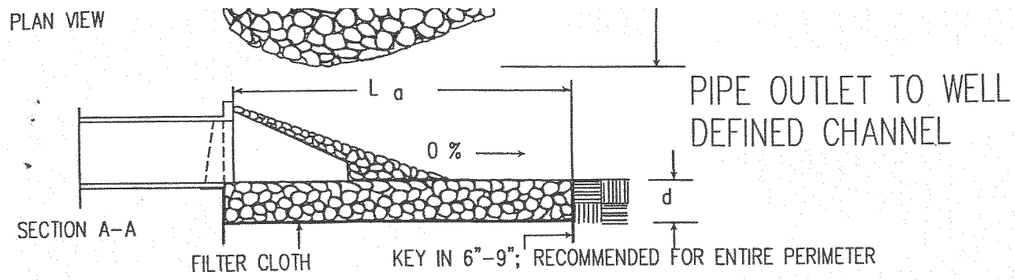
16. PAVED DITCHES SHALL BE REQUIRED WHEREVER EROSIC
PARTICULAR ATTENTION SHALL BE PAID TO THOSE AREAS
EXCEED 3 PERCENT.

17. TEMPORARY EROSION CONTROL MEASURES SUCH AS SI
BE REMOVED UNTIL ALL DISTURBED AREAS ARE STABILIZED
STABILIZATION IS COMPLETE, MEASURES SHALL BE REMOVE
TRAPPED SEDIMENT SHALL BE SPREAD AND SEEDED.

18. ALL SEDIMENT TRAPS AND BASINS SHALL REMAIN IN P
MAJORITY OF THE SINGLE-FAMILY HOUSES HAVE BEEN CO
SHALL NOT BE REMOVED WITHOUT AUTHORIZATION FROM T
COUNTY ENVIRONMENTAL DIVISION.

19. AS-BUILT DRAWINGS MUST BE PROVIDED FOR ALL DETI
ALSO UPON COMPLETION, THE CONSTRUCTION OF ALL DETE
FACILITIES SHALL BE CERTIFIED BY A PROFESSIONAL ENGIN
INSPECTED THE STRUCTURE DURING CONSTRUCTION. THE
SHALL STATE THAT TO THE BEST OF HIS/HER JUDGMENT,
BELIEF, THE STRUCTURE WAS CONSTRUCTED IN ACCORDAN
APPROVAL PLANS AND SPECIFICATIONS.



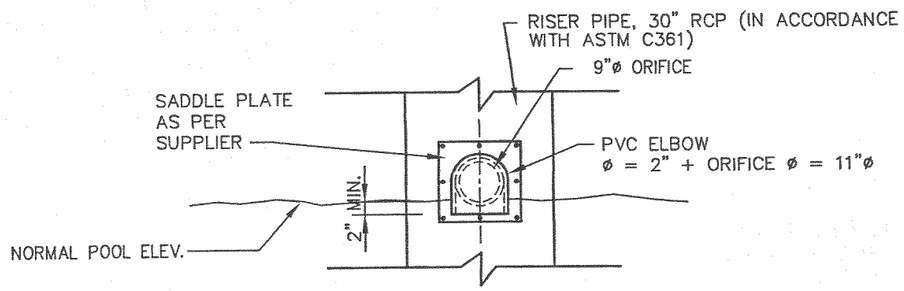



NOTES: 1. APRON LINING MAY BE RIPRAP, GROUTED RIPRAP, GABION BASKET, OR CONCRETE.
2. La IS THE LENGTH OF THE RIPRAP APRON AS CALCULATED USING PLATES 3.18-3 AND 3.18-4.
3. d = 1.5 TIMES THE MAXIMUM STONE DIAMETER, BUT NOT LESS THAN 6 INCHES.

## RIP-RAP PIPE OUTLET PROTECTION (VESCH STD. 3.18-1)

OP

NOT TO SCALE




## ORIFICE WITH PROTECTION ELBOW

NOT TO SCALE

..=81.00
CTION ELBOW

13 – 100 YR.
45 – 10 YR.
77 – 2 YR.
00 –NORMAL POOL

50

) SUPPORT 6" PVC PIPE FROM RISER TO PROTRUDE A MIN. OF 6" AND MAX. OF 12"

12. THE TERM SEEDING, FINAL VEGETATIVE COVER OR STABILIZATION, ON THIS PLAN SHALL MEAN THE SUCCESSFUL GERMINATION AND ESTABLISHMENT OF A STABLE GRASS COVER FROM A PROPERLY PREPARED SEEDBED CONTAINING THE SPECIFIED AMOUNTS OF SEED, LIME, AND FERTILIZER IN ACCORDANCE WITH SPECIFICATION 3.32, PERMANENT SEEDING. IRRIGATION SHALL BE REQUIRED AS NECESSARY TO ENSURE ESTABLISHMENT OF GRASS COVER.

13. ALL SLOPES STEEPER THAN 3:1 SHALL REQUIRE THE USE OF EROSION CONTROL BLANKETS SUCH AS EXCELSIOR BLANKETS TO AID IN THE ESTABLISHMENT OF A VEGETATIVE COVER. INSTALLATION SHALL BE IN ACCORDANCE WITH SPECIFICATION 3.35, MULCHING AND MANUFACTURER'S INSTRUCTIONS. NO SLOPES SHALL BE CREATED STEEPER THAN 2:1.

14. INLET PROTECTION IN ACCORDANCE WITH SPECIFICATION 3.07 SHALL BE PROVIDED FOR ALL STORM DRAIN INLETS AS SOON AS PRACTICAL FOLLOWING CONSTRUCTION OF SAME.

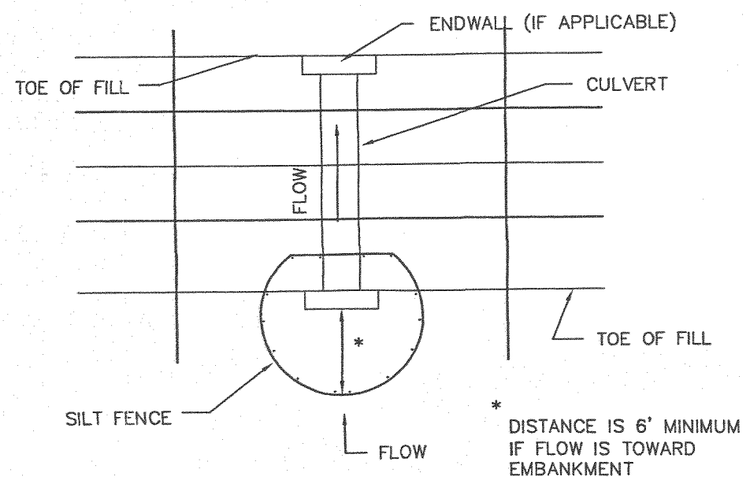
15. TEMPORARY LINERS, SUCH AS POLYETHYLENE SHEETS, SHALL BE PROVIDED FOR ALL PAVED DITCHES UNTIL THE PERMANENT CONCRETE LINER IS INSTALLED.

16. PAVED DITCHES SHALL BE REQUIRED WHEREVER EROSION IS EVIDENT. PARTICULAR ATTENTION SHALL BE PAID TO THOSE AREAS WHERE GRADES EXCEED 3 PERCENT.

17. TEMPORARY EROSION CONTROL MEASURES SUCH AS SILT FENCE ARE NOT TO BE REMOVED UNTIL ALL DISTURBED AREAS ARE STABILIZED. AFTER STABILIZATION IS COMPLETE, MEASURES SHALL BE REMOVED WITHIN 30 DAYS. TRAPPED SEDIMENT SHALL BE SPREAD AND SEEDED.

18. ALL SEDIMENT TRAPS AND BASINS SHALL REMAIN IN PLACE UNTIL THE MAJORITY OF THE SINGLE-FAMILY HOUSES HAVE BEEN CONSTRUCTED AND SHALL NOT BE REMOVED WITHOUT AUTHORIZATION FROM THE JAMES CITY COUNTY ENVIRONMENTAL DIVISION.

19. AS-BUILT DRAWINGS MUST BE PROVIDED FOR ALL DETENTION/BMP FACILITIES. ALSO UPON COMPLETION, THE CONSTRUCTION OF ALL DETENTION/BMP FACILITIES SHALL BE CERTIFIED BY A PROFESSIONAL ENGINEER WHO INSPECTED THE STRUCTURE DURING CONSTRUCTION. THE CERTIFICATION SHALL STATE THAT TO THE BEST OF HIS/HER JUDGMENT, KNOWLEDGE, AND BELIEF, THE STRUCTURE WAS CONSTRUCTED IN ACCORDANCE WITH THE APPROVAL PLANS AND SPECIFICATIONS.




## CIP CULVERT INLET PROTECTION VESCH 3.08

NOT TO SCALE

THIS DOCUMENT I REPRODUCTION, II NOT TO BE MADE

| NO. | DATE |
|---|---|
| 1 | 12/12/00 R |
| 2 | 03/06/01 R |

**E & S CONTROL DETAILS AND NOTES**

KING OF GLORY LUTHERAN CHURCH
**COMMUNITY CENTER AND EDUCATION EXPANSION**
JAMES CITY COUNTY, VIRGINIA

| SCALE | DESIGNED | DRAWN | CHECKED | DATE |
|---|---|---|---|---|
| AS NOTED | — | DFL | HLPG | 9/18/00 |

COMMISSION NUMBER
**2000250**

SHEET NUMBER
**C4**
5 OF 6

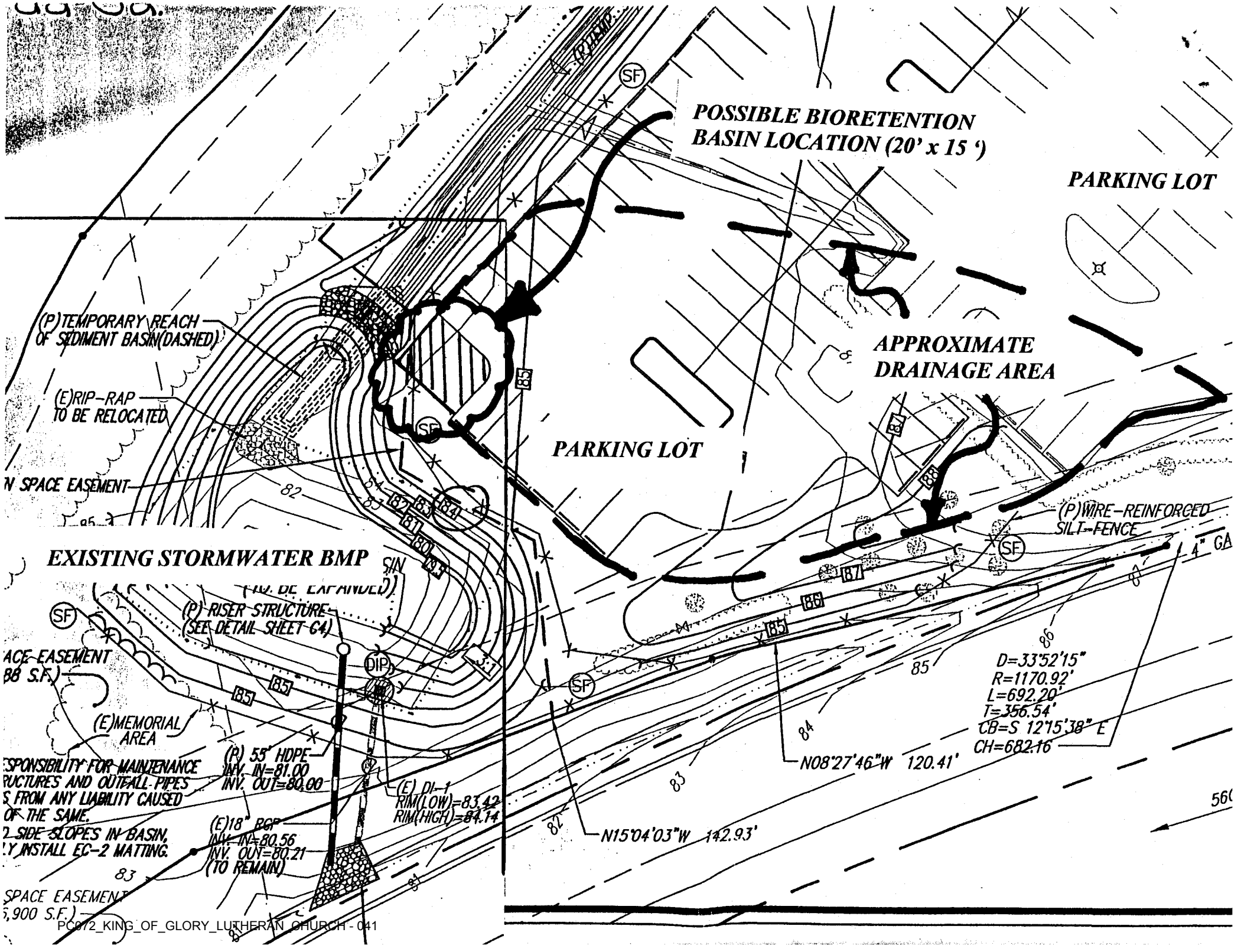
32-3

KING of GLORY

DRAINAGE AREA
1/23/95
1" = 200'

9 AC
C .30
Tc = 30 min
I10 = 3.5 in/hr
Q = 9.5 CFS

Exist
24"
@ 3.0%
CAP = 40 CFS


POSSIBLE BIORETENTION BASIN LOCATION (20' x 15')
PARKING LOT
APPROXIMATE DRAINAGE AREA
PARKING LOT
(P)TEMPORARY REACH OF SEDIMENT BASIN(DASHED)
(E)RIP-RAP TO BE RELOCATED
N SPACE EASEMENT
EXISTING STORMWATER BMP
(P) RISER STRUCTURE (SEE DETAIL SHEET G4)
ACE EASEMENT 88 S.F.)
(E)MEMORIAL AREA
SPONSIBILITY FOR MAINTENANCE RUCTURES AND OUTFALL PIPES S FROM ANY LIABILITY CAUSED OF THE SAME.
2 SIDE SLOPES IN BASIN, Y INSTALL EC-2 MATTING.
(P) 55' HDPE INV. IN=81.00 INV. OUT=80.00
(E)18" RCP INV. IN=80.56 INV. OUT=80.21 (TO REMAIN)
(E) DI-1 RIM(LOW)=83.42 RIM(HIGH)=84.14
N15°04'03"W 142.93'
N08°27'46"W 120.41'
D=33°52'15" R=1170.92' L=692.20' T=356.54' CB=S 12°15'38" E CH=682.16
(P)WIRE-REINFORCED SILT-FENCE
4" GA
SPACE EASEMENT 5,900 S.F.)

ASPHALT SURFACE: Minimum 2.0 inches of Asphalt concrete, type SM-2A.

In preparation for a stable subgrade support for the pavement section, the following construction steps are recommended:

1. Following pavement rough grading operations, the exposed subgrade should be observed under proofrolling. This proofrolling should be accomplished with a fully loaded dump truck or 7 to 10 ton drum roller to check for pockets of soft material hidden beneath a thin crust of better soil. Any unsuitable materials thus exposed should be removed and replaced with a well-compacted material. The inspection of these phases should be performed by the qualified inspector.

2. If excessively unstable subgrade is observed during proofrolling and/or fill placement, it is expected that these weak areas can be stabilized through undercutting and, if necessary, the use of a Geotextile fabric (such as Mirafi 500x or equivalent). Generally, increasing the stone base thickness layer to about 10 to 12 inches will serve as a bridge lift to alleviate any slight instabilities.

## BMP SYSTEM DESIGN

One boring was drilled at the location of P-1 in the BMP area and as shown on the attached sketch, **Figure 1**. The purpose of the boring was to determine the soils conditions and the groundwater table level at the P-1 location to a depth of 6 feet. The results of this boring indicated similar soil conditions as for the remainder of the site. One (1) field permeability test was performed at the P-1 location, between the depths of 4 and 6 feet. The purpose of this test was to determine the hydraulic conductivity of the shallow soils.

The field permeability test was conducted by initially installing a 2-inch diameter PVC pipes (piezometers) with flush joints to a depth of 6 feet. The pipe was open-ended and screened over the bottom 2 foot (test interval between elevations 4 and 6 feet) using a 0.010-inch slot size openings, with riser solid pipe leading from above the screen to about 9 inches above grade. Coarse sand

(#2) was then backfilled in the screened annular space of the piezometer plus 4 inches, and a 6-inch bentonite seal placed over the sand. The purpose of this piezometer construction method is to restrict upward [test] water flow between piezometer hole and outside wall of riser pipe. The bentonite seal and the neat cement-bentonite mix were allowed to cure for a period of 1 hour prior to beginning the permeability test. A detail of the piezometer construction is shown on the attached **Figure 2.**

Following the curing period, water was pumped into the piezometer in order to create a mounding effect (bell-shaped mound) surrounding the screened section. Once groundwater mounding was achieved, additional water was applied into the piezometers and the rate of drop was recorded.

The collected field data was reduced using a computer model representing the U. S. Department of the Navy, Naval Facilities Engineering Command equation for determining the coefficient of permeability of the subject soil stratum. Accordingly, a permeability value of about $4.2 \times 10^{-4}$ cm/s was calculated for this stratum. Laboratory testing performed on a sample obtained from about 5 feet (P-1) indicated that the sample contained about 27.2% fines (silt and clay). In sizing the BMP system, the K values presented in this report should be used conservatively with proper application of a safety factor (minimum 2.0).

It is noted that the soils beneath a depth of 5 feet appeared to contain less fines, thus having a higher permeability value (i.e. $1 \times 10^{-3}$ cm/sec to $5 \times 10^{-3}$ cm/sec).

$4 \times 10^{-4} \frac{cm}{sec} \times \frac{3600\ sec}{hr} \times \frac{in}{2.54\ cm} = 0.56\ in/hr$ ✓

The height of the groundwater mound and the rate of recovery of the BMP system depend upon several factors including:

* The thickness, porosity, and hydraulic conductivity of the receiving superficial (or water table) aquifer,
* ambient groundwater level in the superficial aquifer,
* the leakage coefficient of the semi-confining unit (if any), inter-aquifer head difference, and transmissibility of these aquifers,
* the geometry of the hydraulically loaded area, and
* the influence of nearby surface and subsurface drainage features such as canals, creeks, and wetlands.

SP. 118.00

# King of Glory Lutheran Church Expansion Project

James City County, VA

MAR 2001
RECEIVED
PLANNING DEPARTMENT

***RESUBMITTAL #2 - STORMWATER MANAGEMENT CALCULATIONS***

PC072

BY

DJG, INC.
449 McLAWS CIRCLE
WILLIAMSBURG, VIRGINIA 23185
PHONE: (757)253-0673
FAX: (757)253-2319

COMMONWEALTH OF VIRGINIA
H. L. PHILLIP GOERING
No. 033584
3-6-01
PROFESSIONAL ENGINEER

March 6, 2001
DJG COMMISSION NO: 2000250

DJG INC.
Committed to Excellence
449 McLaws Circle • P. O. Box 3505, Williamsburg, VA 23187
(757) 253-0673 • Fax (757) 253-2319 • E-Mail: williamsburg@djginc.com
Norfolk - Virginia Beach Area (757) 874-5015

PROJECT KOG CHURCH EXPANSION
DATE 12/21/00 COMM NO.
CAL DFR CKD PAGE # 1/2
TITLE SEDIMENT TRAP / BMP CALCS.

- E & S CONTROL:

  - DISTURBED ACRES = 2.43 AC.
  - STORAGE REQUIRED: $V_{S(WET)} = 67 yd^3/AC = 163 yd^3$
    $V_{S(DRY)} = 67 yd^3/AC = 163 yd^3$
    TOTAL $V_{S(WET+DRY)} = 326 yd^3 (8,802 FT^3)$

  - STORAGE PROVIDED:
    $V_{S(DRY)}$ EXISTING SWALE TO BASIN ≈ 4,600 FT³ ✓ OK

    $V_{S(WET)}$ EXCAVATE 3' WITHIN EXISTING SWALE FROM THE OUTFALL OF DI#3 TO BASIN ≈ 4,160 FT³ → *EXCEPTION: NEARLY ALL DRAINAGE TO THIS AREA DRAINS TO PROPOSED STRUCTURES FIRST WHICH HAVE INLET PROTECTION, THEREFORE SOME SEDIMENT WILL BE FILTERED OUT BEFORE REACHING THE PROPOSED TRAP.

- BMP MODIFICATION:

  - PREDEVELOPMENT RUNOFF:
    A = 4.14 AC
    C = 0.2
    CA = 0.828
    $T_c$ = 30 min.
    $q_o = CiA$ = 2.23 CFS ← $Q_2$(PRE)
    $q = CiA$ = 3 CFS ← $Q_{10}$(PRE)

    a = 130.3
    b = 18.5
    $I_2$ = 2.69 IN/HR
    $I_{10}$ = 3.6 IN/HR

  POSTDEVELOPMENT:
    A = 4.14 AC (6)
    CN = 80

  - SITE AREAS:
    TOTAL SITE A = 6.18 AC 6.038
    BUILDINGS (EXIST. + PROPOSED) = 25,759 SF
    PARKING / WALKS (EXIST. + PROPOSED) = 81,800 SF.
    TOTAL IMPERVIOUS COVER = 107,759 SF (40% of SITE)

DJG INC.
Committed to Excellence
449 McLaws Circle • P. O. Box 3505, Williamsburg, VA 23187
(757) 253-0673 • Fax (757) 253-2319 • E-Mail: williamsburg@djginc.com
Norfolk - Virginia Beach Area (757) 874-5015

PROJECT
DATE COMM NO.
CAL CKD PAGE # 2/2
TITLE

- 8-PT. BMP @ 0.5" WET STORAGE / IMPERVIOUS ACRE:

$$107{,}759\,\text{s.f.} \times \left(0.5'' \times \frac{1'}{12''}\right) = \underline{\underline{4{,}482\,\text{ft}^3}}$$ (WET STORAGE REQUIRED)

DJG INC.
Committed to Excellence
449 McLaws Circle • P. O. Box 3505, Williamsburg, VA 23187
(757) 253-0673 • Fax (757) 253-2319 • E-Mail: williamsburg@djginc.com
Norfolk - Virginia Beach Area (757) 874-5015

PROJECT KING OF GLORY CHURCH
DATE 11/17/00 COMM NO. 20002500
CAL DFL CKD PAGE #
TITLE RIP RAP CALCULATIONS

- RIPRAP APRON @ OUTFALL FROM DI # 7:

  15" (CAPACITY) ⟹ 7.51 CFS

  La = 10'
  UPSTREAM WIDTH = $3D_o$ = 3.75'
  DOWNSTREAM WIDTH = $D_o + La$ = 1.25 + 10' = 11.25'
  RIPRAP SIZE ($d_{50}$) = 6" min.

- RIPRAP APRON @ OUTFALL FROM DI # 3:

  15" (CAPACITY) ⟹ 6.45 CFS.

  La = 9'
  UPSTREAM WIDTH = $3D_o$ = 3.75'
  DOWNSTREAM WIDTH = $D_o + La$ = 10.25'
  RIPRAP SIZE ($d_{50}$) = 6" min.

- RIPRAP APRON @ OUTFALL FROM RISER:

  $Q_{10}$ (18" HDPE) = 15.6 CFS

  La = 14'
  UPSTREAM WIDTH = $3D_o$
  DOWNSTREAM WIDTH = $D_o + La$ = 15.5'
  RIPRAP SIZE ($d_{50}$) = 6" min.

Calculated By: DFL Date: 12/4/00
Checked By: HLPG Date:

***DJG, INC***
P.O. BOX 3505
WILLIAMSBURG, VIRGINIA 23187
**STORMWATER MANAGEMENT POND DESIGN**

PROJECT NO. 2000250
PROJECT DESC. KING OF GLORY LUTHERAN CHURCH EXPANSION
**EXISTING BASIN - MODIFIED**
SHEET 1 OF 1

BASIN STORAGE VOLUME:

| ELEV. | AREA (FT) | SUM (Ai+Aj)/2 | VOL. (CU.FT) | SUM VOL. (CU.FT) |
|---|---|---|---|---|
| 79.5 | 2307 | - | - | - |
| 80 | 2718 | 2512.5 | 1256 | 1256 |
| 81 | 3660 | 3189 | 3189 | 4445 |
| 82 | 4605 | 4132.5 | 4133 | 8578 |
| 83 | 5630 | 5117.5 | 5118 | 13695 |
| 84 | 9496 | 7563 | 7563 | 21258 |
| 85 | 12815 | 11156 | 11156 | 32414 |

STORAGE ALGORITHM:

| | | | | | |
|---|---|---|---|---|---|
| Z1 = | 0.5 | S1 = | 1256 | S2/S1 = | 25.8020 |
| Z2 = | 5.5 | S2 = | 32414 | Z2/Z1 = | 11.0 |

b = (ln(S2/S1))/(ln(Z2/Z1)) Ks = S2/(Z2^b) S(CU.FT)=Ks(Z^b)

b = 1.356 Ks = 3215

PRINCIPAL SPILLWAY:

| RISER | ORIFICE (1) DIA. (IN) | EMERG.SPILLWAY DIM. (FT. SQUARE) | BARREL DIA. (IN) | BARREL LEN. (FT) |
|---|---|---|---|---|
| 30 | 9 | 2.5 | 18 | 55 |

| | | |
|---|---|---|
| ORIFICE (1) AREA, A (SQ.FT) = | | 0.44156 |
| BARREL AREA (SQ. FT)= | | 1.76625 |
| n = | 0.009 | |
| C = | 0.6 | |
| Q = CA(64.4*Ho)^0.5 | | |
| BARREL INV.OUT = | | 80 |

STAGE-DISCHARGE-STORAGE:

| | ELEV. | STAGE (FT) | Hp (FT) | Qp (CFS) | $H_{Q(1)}$ (FT) | $Q_{Q(1)}$ (CFS) | He.s.(FT) | Qe.s. (CFS) | SUM Q (CFS) | STORAGE (CU.FT) | DRY STORAGE (CU.FT) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 79.50 | 0.00 | - | - | - | - | - | - | - | 0 | 0 |
| OR.(9") | 81.00 | 1.50 | - | - | - | - | - | - | - | 5570 | 0 |
| | 82.00 | 2.50 | - | - | 0.625 | 1.68 | - | - | 1.68 | 11132 | 5562 |
| | 82.25 | 2.75 | - | - | 0.875 | 1.99 | - | - | 1.99 | 12667 | 7097 |
| C.R. | 82.75 | 3.25 | - | - | 1.375 | 2.49 | - | - | 2.49 | 15886 | 10316 |
| | 83.00 | 3.50 | 2.25 | 12.76 | 1.625 | 2.71 | - | - | 15.47 | 17565 | 11995 |
| | 84.00 | 4.50 | 3.25 | 15.33 | 2.625 | 3.44 | 0.6 | 9.82 | 28.60 | 24694 | 19124 |
| | 84.50 | 5.00 | 3.75 | 16.47 | 3.125 | 3.76 | 1.1 | 9.82 | 30.05 | 28485 | 22915 |
| T.O.B. | 85.00 | 5.50 | 4.25 | 17.53 | 3.625 | 4.05 | 1.6 | 9.82 | 30.28 | 32414 | 26844 |

$Q_{CAPACITY}$ (18" HDPE BARREL FROM RISER @ 1.8%) = 20.46 CFS

$Q_{CAPACITY}$ (18" RCP BARREL FROM EXISTING DI-1 @ 0.875%) = 9.82 CFS

KING OF GLORY EXPANSION - MODIFIED BASIN ROUTING

KING OF GLORY EXPANSION - MODIFIED BASIN ROUTING

INPUT DESIGN DATA

DESIGN STORM FOR ANALYSIS = 2 YEAR
DRAINAGE AREA (ACRES) = 4.14
AVERAGE SLOPE OF DRAINAGE AREA (%) = 1.5
HYDRAULIC LENGTH (FT) = 450
IMPERVIOUS SURFACE (%) = 40
HYDRAULIC LENGTH MODIFIED (%) = 70
COMPOSITE CURVE NUMBER = 80
SLOPE ADJUSTMENT FACTOR = 1
PONDING ADJUSTMENT FACTOR = 1

RESULTS OF HYDRAULIC CALCULATIONS
(SCS TR-55 & TP-149 PROCEDURES)

WATERSHED LAG ADJUSTED (IMPER. AREAS & CHAN. IMPROV.) IS .062 HOURS
TIME OF CONCENTRATION ADJUSTED IS .103 HOURS
THE PEAK DISCHARGE FROM THIS WATERSHED IS 8 C.F.S.

THE FOLLOWING ARE TIME INCREMENTS AND ORDINATES OF THE INFLOW HYDROGRAPH

| (HOURS) | (C.F.S.) |
|---|---|
| 0,0 | |
| .025 | .513 |
| .05 | 1.607 |
| .074 | 3.329 |
| .099 | 4.915 |
| .124 | 6.294 |
| .149 | 7.429 |
| .174 | 8.262 |
| .198 | 7.937 |
| .223 | 6.702 |
| .248 | 4.549 |
| .273 | 2.773 |
| .297 | 1.407 |
| .322 | .475 |
| .347 | 0 |

| STAGE (FT) | DISCHARGE (CFS) | STORAGE (CF) |
|---|---|---|
| 81 | 0 | 0 |
| 82 | 1.68 | 5562 |
| 82.75 | 2.49 | 10316 |
| 83 | 15.47 | 11995 |
| 84 | 28.6 | 19124 |
| 85 | 30.28 | 26844 |

THE FOLLOWING ARE TIME INCREMENTS AND ORDINATES OF THE OUTFLOW HYDOGRAPH

| (HOURS) | (C.F.S.) |
|---|---|
| 0.000 | 0.007 |
| 0.025 | 0.035 |
| 0.050 | 0.100 |
| 0.074 | 0.207 |
| 0.099 | 0.350 |
| 0.124 | 0.523 |
| 0.149 | 0.718 |
| 0.174 | 0.914 |
| 0.198 | 1.085 |
| 0.223 | 1.205 |
| 0.248 | 1.271 |
| 0.273 | 1.293 ← $Q_{MAX}$ ← $Q_{PRE}$ |
| 0.297 | 1.283 |
| 0.322 | 1.255 |
| 0.347 | 1.222 |
| 0.372 | 1.189 |
| 0.397 | 1.158 |
| 0.421 | 1.127 |
| 0.446 | 1.097 |
| 0.471 | 1.068 |
| 0.496 | 1.039 |
| 0.521 | 1.012 |
| 0.545 | 0.985 |
| 0.570 | 0.959 |
| 0.595 | 0.933 |
| 0.620 | 0.908 |
| 0.645 | 0.884 |
| 0.669 | 0.861 |
| 0.694 | 0.838 |
| 0.719 | 0.816 |
| 0.744 | 0.794 |
| 0.768 | 0.773 |
| 0.793 | 0.752 |
| 0.818 | 0.732 |
| 0.843 | 0.713 |
| 0.868 | 0.694 |
| 0.892 | 0.675 |
| 0.917 | 0.657 |
| 0.942 | 0.640 |

MAXIMUM OUTFLOW IS 1.293 C.F.S.
MAXIMUM STAGE IS 81.76965 FT.
MAXIMUM STORAGE IS 4280 CUBIC FEET

KING OF GLORY EXPANSION - MODIFIED BASIN ROUTING

KING OF GLORY EXPANSION - MODIFIED BASIN ROUTING

INPUT DESIGN DATA

DESIGN STORM FOR ANALYSIS = 10 YEAR
DRAINAGE AREA (ACRES) = 4.14
AVERAGE SLOPE OF DRAINAGE AREA (%) = 1.5
HYDRAULIC LENGTH (FT) = 450
IMPERVIOUS SURFACE (%) = 40
HYDRAULIC LENGTH MODIFIED (%) = 70
COMPOSITE CURVE NUMBER = 80
SLOPE ADJUSTMENT FACTOR = 1
PONDING ADJUSTMENT FACTOR = 1

RESULTS OF HYDRAULIC CALCULATIONS
(SCS TR-55 & TP-149 PROCEDURES)

WATERSHED LAG ADJUSTED (IMPER. AREAS & CHAN. IMPROV.) IS .062 HOURS
TIME OF CONCENTRATION ADJUSTED IS .103 HOURS
THE PEAK DISCHARGE FROM THIS WATERSHED IS 16 C.F.S.

THE FOLLOWING ARE TIME INCREMENTS AND ORDINATES OF THE INFLOW HYDROGRAPH

| (HOURS) | (C.F.S.) |
|---|---|
| 0,0 | |
| .025 | 1.075 |
| .05 | 3.345 |
| .074 | 6.878 |
| .099 | 10.042 |
| .124 | 12.704 |
| .149 | 14.802 |
| .174 | 16.235 |
| .198 | 15.415 |
| .223 | 12.907 |
| .248 | 8.719 |
| .273 | 5.29 |
| .297 | 2.672 |
| .322 | .898 |
| .347 | 0 |

| STAGE (FT) | DISCHARGE (CFS) | STORAGE (CF) |
|---|---|---|
| 81 | 0 | 0 |
| 82 | 1.68 | 5562 |
| 82.75 | 2.49 | 10316 |
| 83 | 15.47 | 11995 |
| 84 | 28.6 | 19124 |
| 85 | 30.28 | 26844 |

THE FOLLOWING ARE TIME INCREMENTS AND ORDINATES OF THE OUTFLOW HYDOGRAPH

| (HOURS) | (C.F.S.) |
|---|---|
| 0.000 | 0.014 |
| 0.025 | 0.073 |
| 0.050 | 0.207 |
| 0.074 | 0.426 |
| 0.099 | 0.717 |
| 0.124 | 1.064 |
| 0.149 | 1.449 |
| 0.174 | 1.766 |
| 0.198 | 1.953 |
| 0.223 | 2.086 |
| 0.248 | 2.161 |
| 0.273 | 2.188 $Q_{max} < Q_{PEE}$ |
| 0.297 | 2.182 |
| 0.322 | 2.156 |
| 0.347 | 2.123 |
| 0.372 | 2.091 |
| 0.397 | 2.060 |
| 0.421 | 2.029 |
| 0.446 | 1.998 |
| 0.471 | 1.968 |
| 0.496 | 1.938 |
| 0.521 | 1.909 |
| 0.545 | 1.880 |
| 0.570 | 1.852 |
| 0.595 | 1.824 |
| 0.620 | 1.796 |
| 0.645 | 1.769 |
| 0.669 | 1.742 |
| 0.694 | 1.716 |
| 0.719 | 1.690 |
| 0.744 | 1.653 |
| 0.768 | 1.609 |
| 0.793 | 1.566 |
| 0.818 | 1.525 |
| 0.843 | 1.484 |
| 0.868 | 1.445 |
| 0.892 | 1.406 |
| 0.917 | 1.369 |
| 0.942 | 1.332 |

MAXIMUM OUTFLOW IS 2.188 C.F.S.
MAXIMUM STAGE IS 82.448 FT.
MAXIMUM STORAGE IS 8371 CUBIC FEET

KING OF GLORY EXPANSION - MODIFIED BASIN ROUTING

KING OF GLORY EXPANSION - MODIFIED BASIN ROUTING

INPUT DESIGN DATA

DESIGN STORM FOR ANALYSIS = 100 YEAR
DRAINAGE AREA (ACRES) = 4.14
AVERAGE SLOPE OF DRAINAGE AREA (%) = 1.5
HYDRAULIC LENGTH (FT) = 450
IMPERVIOUS SURFACE (%) = 40
HYDRAULIC LENGTH MODIFIED (%) = 70
COMPOSITE CURVE NUMBER = 80
SLOPE ADJUSTMENT FACTOR = 1
PONDING ADJUSTMENT FACTOR = 1

RESULTS OF HYDRAULIC CALCULATIONS
(SCS TR-55 & TP-149 PROCEDURES)

WATERSHED LAG ADJUSTED (IMPER. AREAS & CHAN. IMPROV.) IS .062 HOURS
TIME OF CONCENTRATION ADJUSTED IS .103 HOURS
THE PEAK DISCHARGE FROM THIS WATERSHED IS 31 C.F.S.

THE FOLLOWING ARE TIME INCREMENTS AND ORDINATES OF THE INFLOW HYDROGRAPH

| (HOURS) | (C.F.S.) |
|---|---|
| 0,0 | |
| .025 | 2.147 |
| .05 | 6.641 |
| .074 | 13.588 |
| .099 | 19.687 |
| .124 | 24.696 |
| .149 | 28.513 |
| .174 | 30.968 |
| .198 | 29.157 |
| .223 | 24.264 |
| .248 | 16.335 |
| .273 | 9.877 |
| .297 | 4.972 |
| .322 | 1.667 |
| .347 | 0 |

| STAGE (FT) | DISCHARGE (CFS) | STORAGE (CF) |
|---|---|---|
| 81 | 0 | 0 |
| 82 | 1.68 | 5562 |
| 82.75 | 2.49 | 10316 |
| 83 | 15.47 | 11995 |
| 84 | 28.6 | 19124 |
| 85 | 30.28 | 26844 |

THE FOLLOWING ARE TIME INCREMENTS AND ORDINATES OF THE OUTFLOW HYDOGRAPH

| (HOURS) | (C.F.S.) |
|---|---|
| 0.000 | 0.029 |
| 0.025 | 0.145 |
| 0.050 | 0.410 |
| 0.074 | 0.841 |
| 0.099 | 1.409 |
| 0.124 | 1.907 |
| 0.149 | 2.327 |
| 0.174 | 11.166 |
| 0.198 | 16.557 |
| 0.223 | 17.125 |
| 0.248 | 16.515 |
| 0.273 | 14.336 |
| 0.297 | 8.685 |
| 0.322 | 4.657 |
| 0.347 | 2.483 |
| 0.372 | 2.446 |
| 0.397 | 2.409 |
| 0.421 | 2.373 |
| 0.446 | 2.337 |
| 0.471 | 2.302 |
| 0.496 | 2.267 |
| 0.521 | 2.233 |
| 0.545 | 2.199 |
| 0.570 | 2.166 |
| 0.595 | 2.133 |
| 0.620 | 2.101 |
| 0.645 | 2.069 |
| 0.669 | 2.038 |
| 0.694 | 2.007 |
| 0.719 | 1.977 |
| 0.744 | 1.947 |
| 0.768 | 1.918 |
| 0.793 | 1.889 |
| 0.818 | 1.860 |
| 0.843 | 1.832 |
| 0.868 | 1.805 |
| 0.892 | 1.777 |
| 0.917 | 1.751 |
| 0.942 | 1.724 |

```
MAXIMUM OUTFLOW IS    17.125    C.F.S.
MAXIMUM STAGE IS    83.12605    FT.
MAXIMUM STORAGE IS    12893    CUBIC FEET
```

DJG INC.
Committed to Excellence
449 McLaws Circle • P. O. Box 3505, Williamsburg, VA 23187
(757) 253-0673 • Fax (757) 253-2319 • E-Mail: williamsburg@djginc.com
Norfolk - Virginia Beach Area (757) 874-5015

PROJECT KING OF GLORY CHURCH
DATE 9/14/00 COMM NO. 2000250
CAL DG CKD PAGE # 4/8
TITLE STORMWATER MGMT. CALCULATIONS

STORM PIPE SYSTEMS:

- DI #1:
  - A = 1900 SF
  - C = 0.73
  - $T_c$ = 5 MIN
  - $i_{10}$ = 7 IN/HR

  $Q_{10}$ = 0.22 CFS
  20' HDPE @ 0.5% ⇒ 10" CAPACITY = 2.23 CFS ✓

- DI #2:
  - A = 8895 SF (DI), 10795 SF (PIPE)
  - C = 0.85
  - $T_c$ = 5.5 MIN
  - $i_{10}$ = 6.9 IN/HR

  $Q_{10}$ (DI) = 1.20 CFS
  $Q_{10}$ (PIPE) = 1.45 CFS
  120' RCP @ 0.83% ⇒ 12" CAP = 2.82 CFS ✓

- DI #3:
  - A = 10630 SF (DI), 21425 SF (PIPE)
  - C = 0.85
  - $T_c$ = 5.75 MIN
  - $i_{10}$ = 6.8 IN/HR

  $Q_{10}$ (DI) = 1.41 CFS
  $Q_{10}$ (PIPE) = 2.84 CFS
  244' RCP @ 1% ⇒ 12" CAP = 3.56 CFS ✓
  USE 15" CAP = 6.45 CFS ✓

- OUTFALL TO EXIST. CHANNEL EL. 84.50

- PROPOSED PIPE UNDER SERVICE ACCESS: $Q_{CAP}$ DITCH ≈ 188 CFS
  $Q_{CAP}$ 48" RCP @ 3% = 248 CFS ∴ ADEQUATE ✓

- PROPOSED PIPE DOWNSTREAM OF 12" RCP UNDER ENTRANCE:
  - EXISTING 12" RCP UPSTREAM @ 1.83% $Q_{CAP}$ = 4.81 CFS
  - INCREASE OF FLOW TO PROPOSED PIPE DOWNSTREAM OF 12" RCP
    - A = 3380 SF
    - C = 0.40
    - $T_c$ = 9 MIN + 1 MIN = 10 MIN
    - $i_{10}$ = 6 IN/HR
    - $Q_{10}$ (INCREASE) = 0.2 CFS

    $Q_{10}$ (TO PROPOSED PIPE) = 4.81 CFS + 0.2 CFS = 5.01 CFS REQUIRED
  - PROPOSED 66' HDPE @ 1.5% ⇒ 12" CAP = 6.30 CFS ✓
    USE 15" HDPE CAP = 11.4 CFS ←

DJG INC.
Committed to Excellence
449 McLaws Circle • P. O. Box 3505, Williamsburg, VA 23187
(757) 253-0673 • Fax (757) 253-2319 • E-Mail: williamsburg@djginc.com
Norfolk - Virginia Beach Area (757) 874-5015

PROJECT KING OF GLORY CHURCH
DATE 9/14/00 COMM NO.
CAL DFL CKD PAGE # 5/8
TITLE STORMWATER MGMT. CALCULATIONS

STORM PIPE SYSTEMS (CONTINUED):

- DI #4:
  - A = 9315 SF
  - C = 0.83
  - $T_c$ = 5.5 MIN
  - $i_{10}$ = 6.9 IN/HR

  $Q_{10}$ = 1.22 CFS
  24' HDPE @ 4.2% ⇒ 8" CAP. = 3.58 CFS ✓
  USE 12" CAP = 10.54 CFS ✓

- DI #5:
  - A = 3722 SF (DI), 13037 SF (PIPE)
  - C = 0.46 (DI), 0.72 (PIPE)
  - $T_c$ = 8.5 MIN
  - $i_{10}$ = 6.2 IN/HR

  $Q_{10}$ = 1.33 CFS
  60' HDPE @ 0.67% ⇒ 8" CAP = 1.43 CFS ✓
  USE 12" CAP = 4.21 CFS ✓

- DI #6:
  - A = 1510 SF (DI), 14547 SF (PIPE)
  - C = 0.40 (DI), 0.69 (PIPE)
  - $T_c$ = 7.5 MIN
  - $i_{10}$ = 6.4 IN/HR

  $Q_{10}$ = 1.47 CFS
  168' HDPE @ 0.60% ⇒ 12" CAP = 3.99 CFS ✓

- DI #7:
  - A = 10390 SF (DI), 36622 SF (PIPE)
  - C = 0.70 (DI), 0.71 (PIPE)
  - $T_c$ = 15.5 MIN
  - $i_{10}$ = 5.1 IN/HR

  $Q_{10}$ = 3.04 CFS
  92' HDPE @ 0.65% ⇒ 12" CAP = 4.15 CFS ✓
  USE 15" CAP = 7.51 CFS ✓

- DI #8:
  - A = 11685 SF
  - C = 0.73
  - $T_c$ = 11 MIN
  - $i_{10}$ = 5.8 IN/HR

  $Q_{10}$ = 1.14 CFS
  40' HDPE @ 1% ⇒ 8" CAP = 1.74 CFS ✓
  USE 10" CAP = 3.16 CFS ✓

- OUTFALL TO EXISTING CHANNEL EL. 85.50

(* SEE PLANS FOR RIM & INVERT ELEVATIONS)

User Name: dawnl
Project: King of Glory

DI#2

6/8

Date: 09-14-00
Time: 10:29:52
Page: 1

Hec22 Calculation Report:

Results:

| | | |
|---|---|---|
| Flow Intercepted: | 1.20 | cfs |
| Flow Bypassed: | 0.00 | cfs |
| Inlet Length: | 11.38 L=12' | ft |
| Splash-over Velocity: | 0.00 | ft/s |
| Ponding Width: | 3.88 | ft |
| Depth at Curb: | 0.22 | ft |

Efficiency:

| | | |
|---|---|---|
| Curb | 100.00 | % |
| Grate | * | % |
| Slotted | * | % |
| Total: | 100.00 | % |

Flow Data Input:

| | | |
|---|---|---|
| Input Method: | Known Flow | |
| Known Flow: | 1.20 | cfs |

Inlet Parameters:

| | | |
|---|---|---|
| Computation Type: | Grade | |
| Inlet Type: | Curb | |
| Longitudinal Slope: | 0.02 | ft/ft |
| Manning's n: | 0.015 | |
| Pavement Cross Slope: | 0.03 | ft/ft |
| Gutter Cross Slope: | 0.08 | ft/ft |
| Local Depression: | 0.00 | in |
| Gutter Width: | 2.00 | ft |
| Curb Opening Length: | 11.38 | ft |
| Curb Throat Type: | Horizontal | |
| Inclined Throat Angle: | 0.0000 | deg |
| Inlet Opening Height: | 0.50 | in |
| Curb Weir Coefficient: | 2.300 | |
| Curb Orifice Coefficient: | 0.670 | |

DI #3

7/8

User Name: dawnl
Project: King of Glory

Date: 09-14-00
Time: 10:30:53
Page: 1

Hec22 Calculation Report:

Results:

| | | |
|---|---|---|
| Flow Intercepted: | 1.41 ← | cfs |
| Flow Bypassed: | 0.00 | cfs |
| Inlet Length: | 10.71 ← L=12' | ft |
| Splash-over Velocity: | 0.00 | ft/s |
| Ponding Width: | 6.50 | ft |
| Depth at Curb: | 0.26 | ft |
| Efficiency: | | |
| Curb | 100.00 | % |
| Grate | * | % |
| Slotted | * | % |
| Total: | 100.00 | % |

Flow Data Input:

| | | |
|---|---|---|
| Input Method: | Known Flow | |
| Known Flow: | 1.41 | cfs |

Inlet Parameters:

| | | |
|---|---|---|
| Computation Type: | Grade | |
| Inlet Type: | Curb | |
| Longitudinal Slope: | 0.01 | ft/ft |
| Manning's n: | 0.015 | |
| Pavement Cross Slope: | 0.02 | ft/ft |
| Gutter Cross Slope: | 0.08 | ft/ft |
| Local Depression: | 0.00 | in |
| Gutter Width: | 2.00 | ft |
| Curb Opening Length: | 10.71 | ft |
| Curb Throat Type: | Horizontal | |
| Inclined Throat Angle: | 0.0000 | deg |
| Inlet Opening Height: | 0.50 | in |
| Curb Weir Coefficient: | 2.300 | |
| Curb Orifice Coefficient: | 0.670 | |

DI #4

8/8

User Name: dawnl
Project: King of Glory

Date: 09-14-00
Time: 10:31:20
Page: 1

Hec22 Calculation Report:

Results:

| | | |
|---|---|---|
| Flow Intercepted: | 1.22 ← | cfs |
| Flow Bypassed: | 0.00 | cfs |
| Inlet Length: | 11.47 ← L=12' | ft |
| Splash-over Velocity: | 0.00 | ft/s |
| Ponding Width: | 3.92 | ft |
| Depth at Curb: | 0.22 | ft |

Efficiency:

| | | |
|---|---|---|
| Curb | 100.00 | % |
| Grate | * | % |
| Slotted | * | % |
| Total: | 100.00 | % |

Flow Data Input:

| | | |
|---|---|---|
| Input Method: | Known Flow | |
| Known Flow: | 1.22 | cfs |

Inlet Parameters:

| | | |
|---|---|---|
| Computation Type: | Grade | |
| Inlet Type: | Curb | |
| Longitudinal Slope: | 0.02 | ft/ft |
| Manning's n: | 0.015 | |
| Pavement Cross Slope: | 0.03 | ft/ft |
| Gutter Cross Slope: | 0.08 | ft/ft |
| Local Depression: | 0.00 | in |
| Gutter Width: | 2.00 | ft |
| Curb Opening Length: | 11.47 | ft |
| Curb Throat Type: | Horizontal | |
| Inclined Throat Angle: | 0.0000 | deg |
| Inlet Opening Height: | 0.50 | in |
| Curb Weir Coefficient: | 2.300 | |
| Curb Orifice Coefficient: | 0.670 | |

DJG INC.
Committed to Excellence
449 McLaws Circle • P. O. Box 3505, Williamsburg, VA 23187
(757) 253-0673 • Fax (757) 253-2319 • E-Mail: williamsburg@djginc.com
Norfolk - Virginia Beach Area (757) 874-5015

PROJECT KING OF GLORY CHURCH
DATE 11/17/00 COMM NO. 2000250
CAL DFL CKD PAGE #
TITLE RIP RAP CALCULATIONS

- RIPRAP APRON @ OUTFALL FROM DI # 7:

  15" (CAPACITY) ⟹ 7.51 CFS

  $L_a = 10'$
  UPSTREAM WIDTH = $3D_o = 3.75'$
  DOWNSTREAM WIDTH = $D_o + L_a = 1.25 + 10' = 11.25'$
  RIPRAP SIZE ($d_{50}$) = 6" min.

- RIPRAP APRON @ OUTFALL FROM DI # 3:

  15" (CAPACITY) ⟹ 6.45 CFS.

  $L_a = 9'$
  UPSTREAM WIDTH = $3D_o = 3.75'$
  DOWNSTREAM WIDTH = $D_o + L_a = 10.25'$
  RIPRAP SIZE ($d_{50}$) = 6" min.

- RIPRAP APRON @ OUTFALL FROM RISER:

  $Q_{10}$ (18" HDPE) = 15.6 CFS

  $L_a = 14'$
  UPSTREAM WIDTH = $3D_o$
  DOWNSTREAM WIDTH = $D_o + L_a = 15.5'$
  RIPRAP SIZE ($d_{50}$) = 6" min.

SP-118-00

# King of Glory Lutheran Church

James City County, VA

***STORMWATER MANAGEMENT CALCULATIONS***

PC072

BY

DJG, INC.
449 McLAWS CIRCLE
WILLIAMSBURG, VIRGINIA 23185
PHONE: (757)253-0673
FAX: (757)253-2319

September 18, 2000
DJG COMMISSION NO: 2000250

DJG INC.
Committed to Excellence
1006 Richmond Rd. • P. O. Box 3505, Williamsburg, VA 23187
(757) 253-0673 • Fax (757) 253-239 • E-Mail: djginc@visi.net
Norfolk - Virginia Beach Area (757) 874-5015

PROJECT KING OF GLORY LUTHERAN
DATE 9/8/00 COMM NO. 2000250
CAL DFL CKD _____ PAGE # 1/8
TITLE SWM CALCULATIONS

BMP CALCULATIONS:

- TOTAL SITE AREA: 6.18AC (269,108 SF)
  - BUILDINGS (EXISTING & PROPOSED) = 25,759 SF
  - PARKING AREAS / WALKS = 81,800 SF
  - TOTAL IMPERVIOUS COVER = 107,559 SF (40%)
  - TOTAL OPEN SPACE = 161,549 SF (60%)

- BMP INFILTRATION BASIN:
  - EXISTING STORAGE TO LOW EDGE OF DI (FROM EL. 79.5 → EL. 83.42) $V_S = 6,910 FT^3$ (3.92')
  - EXISTING STORAGE TO TOP OF BANK ABOVE RIM (FROM EL. 83.42 → EL. 84.30) $V_S = 3,810 FT^3$ (0.88')
  - TOTAL STORAGE VOLUME (EXISTING) = $10,720 FT^3$ (4.8')
  - DRAINAGE AREA TO BMP (EXISTING = PROPOSED): A = 4.16AC
  - 8 pt. BMP - INFILTRATION BASIN @ 0.5"/IMP. ACRE:
    $107,759 SF \times \left(0.5" \times \frac{1'}{12"}\right) = 4,482 FT^3$ STORAGE REQUIRED

10 pt - $8960 ft^3$

  - INFILTRATION TIME
    $K = 1 \times 10^{-3} cm/sec = 3.9 \times 10^{-4} in/sec$
    $Q = h_g KA$ $h_g = 1$, $K = 3.3 \times 10^{-5} cfs/SF$, $A = 864 SF$
    $Q = 0.0285 cfs$
    $T = 4482 FT^3 / .0285 cfs = 44$ HRS
  - STORAGE TO POINT OF DISCHARGE: $6,910 FT^3$
  - STORAGE ABOVE DISCHARGE:
    BASIN ($3,810 FT^3$) + DITCH ($1,015 FT^3$) ≈ $4,825 FT^3$

DJG INC.
Committed to Excellence
1006 Richmond Rd. • P. O. Box 3505, Williamsburg, VA 23187
(757) 253-0673 • Fax (757) 253-239 • E-Mail: djginc@visi.net
Norfolk - Virginia Beach Area (757) 874-5015

PROJECT KING OF GLORY LUTHERAN
DATE 9/11/00 COMM NO. 2000250
CAL DFL CKD _____ PAGE # 2/8
TITLE SWM CALCULATIONS

BMP CALCULATIONS (CONTINUED):

DEVELOPED RUNOFF:
$A = 4.14 AC$
$C = 0.65$
$CA = 2.69$
$t_c = 24 min$
$I_2 = 3.0 IN/HR$

EXISTING RUNOFF:
$A = 4.14 AC$
$C = 0.40$
$CA = 1.656$
$T_c = 30 min$
$a = 130.3$ 25yr
$b = 18.5$
$I_2 = 2.69 IN/HR$

$q_o = CiA = 0.4 \times 2.69 \times 4.14 = 4.45 cfs$ - This needs to be pre-devel vell from previous calcs - not ex. conditions - 2.25 cfs

$$T_c = \sqrt{\frac{2CAa(b - t_c/4)}{q_o}} - b = \sqrt{\frac{2(2.69)(130.3)(18.5 - 24/4)}{4.45 cfs}} - 18.5$$

$T_c = 25.9$

$$I = \frac{130.3}{18.5 + 25.9} = 2.93$$

$$V_o = \left[Q_o T_c + \frac{Q_o t_c}{4} - \frac{q_o T_c}{2} - \frac{3 q_o t_c}{4}\right] 60$$

$$V_o = \left[(7.88)(30) + \frac{(30)(24)}{4} - \frac{(4.45)(30)}{2} - \frac{(3)(4.45)(24)}{2}\right] 60$$

$V_o = 11,367 FT^3$ ← REQUIRED STORAGE ABOVE OUTLET

*AVAILABLE STORAGE ABOVE OUTLET ≈ $4,825 FT^3$
∴ NEED ADDITIONAL $6,542 FT^3$ STORAGE ABOVE OUTLET

• PROPOSED: TOP OF BANK RAISED TO EL. 85.00

→ BMP STORAGE ABOVE OUTLET - INCREASE OF $4,510 FT^3$
→ DITCH STORAGE - INCREASE OF $2,560 FT^3$
→ TOTAL STORAGE INCREASE OF $7,070 FT^3$ ✓

$7070 FT^3 > 6542 FT^3$ ∴ ADEQUATE

KING OF GLORY
LUTHERAN CHURCH
9/8/00
PAGE# 3/8



# Table 2

## Worksheet for BMP Point System

### A. STRUCTURAL BMP POINT ALLOCATION

| BMP | BMP Points | | Fraction of Site Served by BMP | | Weighted BMP Points |
|---|---|---|---|---|---|
| INFILTRATION | 10 8 | x | 67.3% | = | 6.7 5.38 |
| Grass Swale | 2 | x | 61% | = | 1.22 |
| | | x | | = | |
| | | x | | = | |

TOTAL WEIGHTED STRUCTURAL BMP POINTS: _____

### B. NATURAL OPEN SPACE CREDIT

is this all in conservation easement?

| Fraction of Site | | Natural Open Space Credit | | Points for Natural Open Space |
|---|---|---|---|---|
| 21% 60% | x | 0.1 (0.1 per 1%) | = | 2.1 6 |
| | x | (0.15 per 1%) | = | |

TOTAL NATURAL OPEN SPACE CREDIT: 6

### C. TOTAL WEIGHTED POINTS

| 7.42 5.38 | + | 2.1 6 | = | 10.02 11.38 |
|---|---|---|---|---|
| Structural BMP Points | | Natural Open Space Points | | Total |

THE SPECTRA GROUP
325 Office Square Lane, Virginia Beach, Virginia 23462
(804) 497-5862
ENGINEERING △ SURVEYING △ UTILITY LOCATION △ PIPELINE TV INSPECTION

JOB 694-907 KING OF GLORY
SHEET NO. 2 OF 2
CALCULATED BY RJ McKenzie DATE 1/23/95
CHECKED BY DATE
SCALE

CHECK TIME TO INFILTRATE 3500 ft³
FROM SOIL TEST
K = 1 x 10⁻³ CM/SEC TO 5 x 10⁻³ CM/SEC

USE 1 x 10⁻³ CM/SEC = 3.9 x 10⁻⁴ IN/SEC.

OR 3.3 x 10⁻⁵ CFS/SF

Q = hg K A

hg = 1.0
K = 3.3 x 10⁻⁵ CFS/SF
A = 18 x 48 = 864 SF.

Q = 1.0 x 3.3 x 10⁻⁵ x 864 = 0.0285 CFS

TIME TO INFILTRATE 3500 ft³

T = 3500 ft³ ÷ 0.0285 CFS = 122,755 SEC
= 34 hrs OK

CK OVERFLOW PIPE
AREA = 4.16 AC

SAY TC = 20 MIN.
I10 = 4.5 in/hr.
C = 0.40

Q = 0.4 x 4.16 x 4.5

Q = 7.5 CFS

18" @ 0.7% CAP = 9.0 CFS OK

Need to route 2 yr storm

THE SPECTRA GROUP
325 Office Square Lane, Virginia Beach, Virginia 23462
(804) 497-5862
ENGINEERING △ SURVEYING △ UTILITY LOCATION △ PIPELINE TV INSPECTION

JOB E94-907 KING OF GLORY
SHEET NO. 1 OF 2
CALCULATED BY R.T. MCCLOWLEY DATE 1/23/95
CHECKED BY _____ DATE _____
SCALE _____

# DRAINAGE DESIGN CALCULATIONS:

## ENTRANCE PIPE:

AREA = 0.59 ac  C = 0.60
$T_c$ = 15 min  $I_{10}$ = 4.5 in/hr.

Q = CIA = 0.60 × 4.5 × 0.59 = 1.6 CFS

USE 15" RCPC 0.43 %  CAPACITY = 4.4 CFS
V = 3.5 fps  O/C

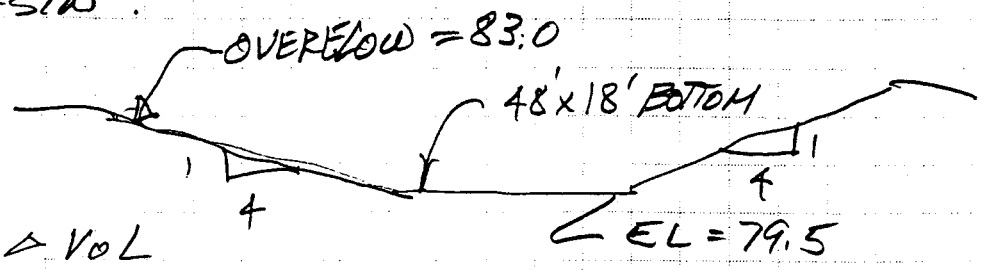
## BMP INFILTRATION BASIN:

IMPERVIOUS SURFACE = 7,600 SF BLDG.
19,843 SF PARKING
1,278 SF WALKS
12,395 SF FUTURE BLDG
41,116 SF SAY 42000 SF

SIZE FOR
1" RUNOFF FROM IMPERVIOUS AREA.

42,000 SF × 1/12 = 3,500 ft³ STORAGE REQ'D.

PROPOSED BASIN.




| EL | AREA | △ VOL |
|---|---|---|
| 83 | 3496 | 7630 ft³ > 3500 OK |
| 79.5 | 864 | |

THE SPECTRA GROUP
325 Office Square Lane, Virginia Beach, Virginia 23462
(804) 497-5862
ENGINEERING △ SURVEYING △ UTILITY LOCATION △ PIPELINE TV INSPECTION

JOB E94-907 King of Glory
SHEET NO. 1 OF
CALCULATED BY RJMuckiewicz DATE 3/23/95
CHECKED BY DATE
SCALE

2 year storm flood routing through BMP.

Check time to fill BMP to point where water discharges through 18" pipe.

Storage vol to point of discharge = 7,630 ft³

Developed runoff = C = 0.40 Area = 4.14 Ac $I_2$

| Time | CA | I in/hr | Vol ft³ |
|---|---|---|---|
| 20 min | 1.65 | 3.38 | 6,692 |
| 30 min | 1.65 | 2.69 | 7,989 ≈ 7,630 |

Use $T_c$ = 30 min for developed $T_c$.

Determine reqd storage above outlet.

| Developed Runoff | Existing Runoff | |
|---|---|---|
| A = 4.14 | A = 4.14 | a = 130.3 |
| C = 0.40 | C = 0.20 | b = 18.5 |
| CA = 1.656 | CA = 0.828 | $I = \frac{a}{b+t_c} = \frac{130.3}{18.5+30} = 2.69$ in/hr |
| $t_c$ = 30 min | $T_c$ = 30 min | |
| $I_2$ = 2.69 | | |

$q_o = CIA = 0.20 \times 2.69 \times 4.14 = 2.23$ cfs

$$T_c = \sqrt{\frac{2CAa\,(b - t_c/4)}{q_o}} - b$$

$$T_c = \sqrt{\frac{2(1.656)(130.3)(18.5 - 30/4)}{2.23}} - 18.5 = 27.6$$

$$I = \frac{130.3}{18.5 + 27.6} = 2.83$$

$$\begin{array}{r} 7630 \\ +\ 5535 \\ \hline 13{,}165 \end{array}$$

$$V_o = \left[Q_o T_c + \frac{Q_o t_c}{4} - \frac{q_o T_c}{2} - \frac{3 q_o t_c}{4}\right] 60$$

$$V_o = \left[(4.69)(30) + \frac{(4.69)(30)}{4} - \frac{(2.23)(30)}{2} - 3\frac{(2.23)(30)}{4}\right] 60 = 5{,}535 \text{ ft}^3$$

Available storage EL 83 to 84 + ditch ≈ 5341 ≈ 5535 ok

Ck outlet grate use perimeter over 4 for partial blockage and sloped top Q/P = 2.23/2.25 = 0.98 H ≈ 0.5' ok

KING OF GLORY
LUTHERAN CHURCH
1/23/95

TABLE 3

WORKSHEET FOR BMP POINT SYSTEM

A. STRUCTURAL BMP POINT ALLOCATION

| BMP | BMP Points | | Fraction of Site Served by BMP | | Weighted BMP Points |
|---|---|---|---|---|---|
| GRASS SWALE #15 | 2 | x | 61% | = | 1.22 |
| INFILTRATION #9 | 10 | x | 67% | = | 6.73 |
| | | x | | = | |
| | | x | | = | |

TOTAL WEIGHTED STRUCTURAL BMP POINTS: 7.95

B. NATURAL OPEN SPACE CREDIT

| Fraction of Site | | Natural Open Space Credit | | Points for Natural Open Space |
|---|---|---|---|---|
| 21% | x | 0.1 per 1% (0.1 per 1%) | = | 2.10 |

C. TOTAL WEIGHTED POINTS

7.95 (Structural BMP Points) + 2.10 (Natural Open Space Points) = 10.05 (TOTAL)

Site = 6.18 ac

Open Space = 39,805 + 16,900 = 56,705 = 1.3 ac

$\frac{1.3}{6.18}$ = 21% - ok



TEL:804-253-6850

THE SPECTRA GROUP
325 Office Square Lane, Virginia Beach, Virginia 23462
(804) 497-5862
ENGINEERING △ SURVEYING △ UTILITY LOCATION △ PIPELINE TV INSPECTION

JOB E94-907 KING OF GLORY
SHEET NO. 1 OF 2
CALCULATED BY R.T. MCCLOWICZ DATE 1/23/95
CHECKED BY _____ DATE _____
SCALE _____

# DRAINAGE DESIGN CALCULATIONS:

## ENTRANCE PIPE:

AREA = 0.59 ac  C = 0.60
$T_c$ = 15 min  $I_{10}$ = 4.5 in/hr.

$Q = CIA = 0.60 \times 4.5 \times 0.59 = 1.6$ CFS

USE 15" RCPC 0.43 % CAPACITY = 4.4 CFS
V = 3.5 fps O/C

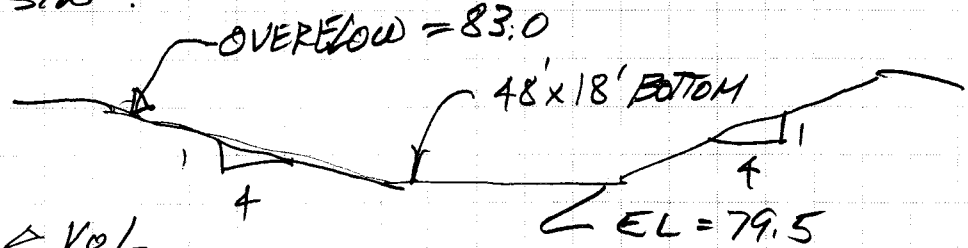
## BMP INFILTRATION BASIN:

IMPERVIOUS SURFACE = 7600 SF BLDG.
19,843 SF PARKING
1,278 SF WALKS
12,395 SF FUTURE BLDG
41,116 SF SAY 42000 SF

SIZE FOR
1" RUNOFF FROM IMPERVIOUS AREA.

42,000 SF × 1/12 = 3,500 ft³ STORAGE REQ.

PROPOSED BASIN.




| EL | AREA | △VOL |
|---|---|---|
| 83 | 3496 | 7630 ft³ > 3500 OK |
| 79.5 | 864 | |

THE SPECTRA GROUP
325 Office Square Lane, Virginia Beach, Virginia 23462
(804) 497-5862
ENGINEERING △ SURVEYING △ UTILITY LOCATION △ PIPELINE TV INSPECTION

JOB 694-907 KING OF GLORY
SHEET NO. 2 OF 2
CALCULATED BY RJ MICKIEWICZ DATE 1/23/95
CHECKED BY DATE
SCALE

CHECK TIME TO INFILTRATE 3,500 $ft^3$
FROM SOIL TEST
$K = 1 \times 10^{-3}$ CM/SEC to $5 \times 10^{-3}$ CM/SEC

USE $1 \times 10^{-3}$ CM/SEC $= 3.9 \times 10^{-4}$ IN/SEC.

OR $3.3 \times 10^{-5}$ CFS/SF

$Q = h_g K A$

$h_g = 1.0$
$K = 3.3 \times 10^{-5}$ CFS/SF
$A = 18 \times 48 = 864$ SF.

$Q = 1.0 \times 3.3 \times 10^{-5} \times 864 = 0.0285$ CFS

TIME TO INFILTRATE 3500 $ft^3$

$T = 3500\ ft^3 \div 0.0285$ CFS $= 122{,}755$ SEC
$= 34$ hrs OK

CK OVERFLOW PIPE
AREA - 4.16 AC

SAY $T_C = 20$ MIN.
$I_{10} = 4.5$ in/hr.
$C = 0.40$

$Q = 0.4 \times 4.16 \times 4.5$

$Q = 7.5$ CFS

18" @ 0.7% CAP $= 9.0$ CFS OK

Need to route 2 yr. storm

THE SPECTRA GROUP
325 Office Square Lane, Virginia Beach, Virginia 23462
(804) 497-5862
ENGINEERING △ SURVEYING △ UTILITY LOCATION △ PIPELINE TV INSPECTION

JOB E94-907 King of Glory
SHEET NO. 1 OF
CALCULATED BY RTMuckenfuss DATE 3/23/95
CHECKED BY DATE
SCALE

2 year storm flood routing through BMP.

Check time to fill BMP to point where water discharges through 18" pipe.

Storage vol to point of discharge = 7,630 ft³

Developed runoff = C = 0.40 Area = 4.14 Ac $I_2$

| Time | CA | I in/hr. | Vol ft³ |
|---|---|---|---|
| 20 min | 1.65 | 3.38 | 6,692 |
| 30 min | 1.65 | 2.69 | 7,989 ≈ 7,630 |

Use $T_c$ = 30 min for developed $T_c$.

Determine reqd storage above outlet.

| Developed Runoff | Existing Runoff | |
|---|---|---|
| A = 4.14 | A = 4.14 | a = 130.3 |
| C = 0.40 | C = 0.20 | b = 18.5 |
| CA = 1.656 | CA = 0.828 | $I = \frac{a}{b+t_c} = \frac{130.3}{18.5+30} = 2.69$ in/hr |
| $t_c$ = 30 min | $T_c$ = 30 min | |
| $I_2$ = 2.69 | | |

$q_o = CIA = 0.20 \times 2.69 \times 4.14 = 2.23$ cfs

$$T_c = \sqrt{\frac{2CAa\,(b - t_c/4)}{q_o}} - b$$

$$T_c = \sqrt{\frac{2(1.656)(130.3)(18.5 - 30/4)}{2.23}} - 18.5 = 27.6$$

$$I = \frac{130.3}{18.5 + 27.6} = 2.83$$

7630
+ 5535
13,165

$$V_o = \left[Q_o T_c + \frac{Q_o t_c}{4} - \frac{q_o T_c}{2} - \frac{3 q_o t_c}{4}\right] 60$$

$$V_o = \left[(4.69)(30) + \frac{(4.69)(30)}{4} - \frac{(2.23)(30)}{2} - 3\frac{(2.23)(30)}{4}\right] 60 = 5{,}535 \text{ ft}^3$$

Available storage EL 83 to 84 + ditch ≈ 5341 ≈ 5535 ok

Ck outlet grate use perimeter over 4 for partial blockage and sloped top Q/P = 2.23/2.25 = 0.98 H ≈ 0.5' ok

DJG #2000250
KING OF GLORY LUTHERAN CHURCH - (Rev. 3/6/01 DFL)



# Table 2

## Worksheet for BMP Point System

### A. STRUCTURAL BMP POINT ALLOCATION

| BMP | BMP Points | | Fraction of Site Served by BMP | | Weighted BMP Points |
|---|---|---|---|---|---|
| INFILTRATION | 8 | x | 70% | = | 5.60 |
| SWALE/FOREBAY | 2 | x | 60% | = | 1.20 |
| | | x | | = | |
| | | x | | = | |

TOTAL WEIGHTED STRUCTURAL BMP POINTS: 6.80

### B. NATURAL OPEN SPACE CREDIT

| Fraction of Site | | Natural Open Space Credit | | Points for Natural Open Space |
|---|---|---|---|---|
| 84,456sf = 1.94ac / 6.04ac (OPEN SPACE EASEMENTS) = 32.1% | x | 10 (0.1 per 1%) | = | 3.21 |
| | x | (0.15 per 1%) | = | |

TOTAL NATURAL OPEN SPACE CREDIT: 3.21

### C. TOTAL WEIGHTED POINTS

6.80 (Structural BMP Points) + 3.21 (Natural Open Space Points) = 10.01 (Total)

KING OF GLORY
LUTHERAN CHURCH
1/23/95

TABLE 3

WORKSHEET FOR BMP POINT SYSTEM

A. STRUCTURAL BMP POINT ALLOCATION

| BMP | BMP Points | | Fraction of Site Served by BMP | | Weighted BMP Points |
|---|---|---|---|---|---|
| GRASS SWALE #15 | 2 | x | 61% | = | 1.22 |
| INFILTRATION #9 | 10 | x | 67% | = | 6.73 |
| | | x | | = | |
| | | x | | = | |

TOTAL WEIGHTED STRUCTURAL BMP POINTS: 7.95

B. NATURAL OPEN SPACE CREDIT

| Fraction of Site | | Natural Open Space Credit | | Points for Natural Open Space |
|---|---|---|---|---|
| 21% | x | 0.1 per 1% (0.1 per 1%) | = | 2.10 |

C. TOTAL WEIGHTED POINTS

7.95 (Structural BMP Points) + 2.10 (Natural Open Space Points) = 10.05 (TOTAL)

SITE = 6.18 ac

Open Space = 39,805 + 16,900 = 56,705 = 1.3 ac

$\frac{1.3}{6.18}$ = 21% - ok

SCOTT/DARRYL, GOOD JOB!

# King of Glory Lutheran Church & Preschool

4897 Longhill Road • Williamsburg, VA 23188
Church (757) 258-9701 • Preschool (757) 258-1070 • Fax (757) 564-9810

Timothy M. Hinz, Pastor
Lawrence J. McReynolds, Director of Music & Outreach
Ruth A. McReynolds, Preschool Director

October 21, 2003

RECEIVED
OCT 29 2003
BY:

John Horne, Manager
Development Management
101-E Mounts Bay Road
Williamsburg, VA 23188

Dear John:

King of Glory Lutheran Church is most appreciative of your work in enhancing our small watershed management efforts. The project will minimize runoff, sediment, as pollution water exits the church property.

The plantings installed in the "rain garden" and in the floor of the retention pond will spread and make the area very appealing.

Please feel free to bring in groups to observe and demonstrate ways to treat storm water run-off. We truly appreciate the expense and the volunteer help we received from James City County. Please convey our appreciation for all the engineer design and set-up work conducted by Scott Thomas.

Sincerely yours,

Timothy M. Hinz

Rev. Timothy Hinz

Doug Zoller

Doug Zoller
Landscape Trustee

Accredited by NAEYC's National Academy of Early Childhood Programs

*"Who is he, this King of Glory? The LORD Almighty — He is the King of Glory." Psalm 24:10*

# DEVELOPMENT MANAGEMENT

101-E MOUNTS BAY ROAD, P.O. BOX 8784, WILLIAMSBURG, VIRGINIA 23187-8784
(757) 253-6671 Fax: (757) 253-6850 E-MAIL: devtman@james-city.va.us

CODE COMPLIANCE
(757) 253-6626
codecomp@james-city.va.us

ENVIRONMENTAL DIVISION
(757) 253-6670
environ@james-city.va.us

PLANNING
(757) 253-6685
planning@james-city.va.us

COUNTY ENGINEER
(757) 253-6678

INTEGRATED PEST MANAGEMENT
(757) 253-2620


March 11, 2003

Mr. Douglas Zoller
King of Glory Lutheran Church
4897 Longhill Road
Williamsburg, Va. 23188

Re: PRIDE - Rain Garden Demonstration

Dear Mr. Zoller:

I want to take this opportunity to thank you and the King of Glory Lutheran Church for a timely review and consideration of the information packet which I sent to Mr. Lee Schmidt on December 17th 2002. This information suggested the potential for a bioretention (rain garden) demonstration project at the King of Glory Lutheran Church site under the County's PRIDE program.

Based on my follow-up discussion with you, it is my understanding that there appears to be sincere interest in this project and the board of trustees discussed and granted preliminary approval to move forward with the concept as previously outlined (attached).

As mentioned previously, this type of project and partnership is considered a great opportunity for the PRIDE watershed education initiative recently unveiled by the County. We have short and long term plans to sponsor various demonstration projects within the County using a variety of watershed protection tools at different types of sites and locations. This project would meet one of our goals is to sponsor a small demonstration project which spotlights the use of bioretention - or sometimes referred to as rain gardens - in a small retrofit application. te.

It is our intent to schedule this event in the fall of this year, perhaps a Saturday in October, as the weather at that time of the year is still pretty nice and we are still within the growing season suitable for landscaping. We still need some time to work out details on the project and will contact you as soon as possible to arrange a meeting with you or the board of trustees and a set specific date for the event. In the meantime could you please review the October schedule for the church to ensure there are no major conflicts with any of the Saturday's in October 2003.

We are very excited about this project and look forward to working with King of Glory Lutheran Church. On the interim, if you have any questions please contact me at 757-253-6639, Mike Woolson (Watershed Planner) at 757-253-6823 or Lisa Meddin (Watershed Education Coordinator) at 757-253-6859.

Sincerely,

Scott J. Thomas, P.E.
Civil Engineer
Environmental Division

cc: Lisa Meddin, Watershed Education Coordinator
Michael Woolson, Watershed Planner

# DEVELOPMENT MANAGEMENT

101-E MOUNTS BAY ROAD, P.O. BOX 8784, WILLIAMSBURG, VIRGINIA 23187-8784
(757) 253-6671 Fax: (757) 253-6850 E-MAIL: devtman@james-city.va.us

CODE COMPLIANCE
(757) 253-6626
codecomp@james-city.va.us

ENVIRONMENTAL DIVISION
(757) 253-6670
environ@james-city.va.us

PLANNING
(757) 253-6685
planning@james-city.va.us

COUNTY ENGINEER
(757) 253-6678

INTEGRATED PEST MANAGEMENT
(757) 253-2620


December 17, 2002

Mr. Lee Schmidt
King of Glory Lutheran Church
4897 Longhill Road
Williamsburg, Va. 23188

Re: PRIDE/Bioretention Information

Dear Mr. Schmidt:

In followup to our meeting on December 12th 2002, I am forwarding information to you about the concept of incorporating a bioretention basin at the corner of the expanded parking lot near the existing infiltration BMP pond. If the Church or the Building Committee has sincere interest, I anticipate that this type of project could be considered by County staff as a candidate under the PRIDE watershed education initiative recently unveiled by the County.

The County PRIDE team has a preliminary agenda to sponsor various demonstration projects within the County using a variety of watershed protection tools at different types of sites and locations. One of our goals is to sponsor a small demonstration project which spotlights the use of bioretention - or sometimes referred to as rain gardens - in a small retrofit application specific to a commercial, business, institutional or office site. Depending on available funding and interest and participation by the owner, this project may qualify as a demonstration or workshop type event under the PRIDE program.

If you have any questions about the technical aspects of bioretention, please contact me at 757-253-6639 or Mike Woolson, Watershed Planner at 757-253-6823. For additional information about the PRIDE program, you can contact me or Lisa Meddin, Watershed Education Coordinator, at 757-253-6859.

Sincerely,

Scott J. Thomas, P.E.
Civil Engineer
Environmental Division

cc: Lisa Meddin, Watershed Education Coordinator
Michael Woolson, Watershed Planner

SIT File

# DEVELOPMENT MANAGEMENT

101-E MOUNTS BAY ROAD, P.O. BOX 8784, WILLIAMSBURG, VIRGINIA 23187-8784
(757) 253-6671 Fax: (757) 253-6850 E-MAIL: devtman@james-city.va.us

CODE COMPLIANCE
(757) 253-6626
codecomp@james-city.va.us

ENVIRONMENTAL DIVISION
(757) 253-6670
environ@james-city.va.us

PLANNING
(757) 253-6685
planning@james-city.va.us

COUNTY ENGINEER
(757) 253-6678

INTEGRATED PEST MANAGEMENT
(757) 253-2620

December 6, 2002

Mr. Lee Schmidt
King of Glory Lutheran Church
4897 Longhill Road
Williamsburg, Va. 23188

• Reinspect 12/12/02 item #7 will be reseeded. ∴ ADDRESSED
• RD Rsub 12/12/02.

Re: King of Glory Community Center Expansion
County Plan No. SP-118-00
County BMP ID Code: PC 072

Dear Mr. Schmidt:

The Environmental Division has reviewed a record drawing and construction certification as submitted to our office on November 18th 2002 for the BMP associated with the above referenced project. The record drawing provides as-built information for an infiltration basin facility situated in the south corner of the site.

Based on our review of the project and a concurrent field inspection as performed on December 6th 2002, the following items must be addressed prior to release of the developer's surety instrument for the stormwater management/BMP facility at the site:

***Construction Certification:***

✓ 1. The construction certification dated November 15th 2002 is **satisfactory**, as a majority of the fill embankment was existing material and expanded portions of the pond were excavated.

***Record Drawing:***

✓ 12-17-02 2. Clearly show the following on the "BMP Outlet Structures" detail: the crest elevation of the 30-inch diameter riser (or riser slots); the invert (bottom) elevation of the riser or alternatively the upstream invert elevation of the 18-inch barrel; and show riser material.

✓ 12-17-02 3. Clearly label the existing DI-1 grate structure (El. 84.47) as an emergency spillway on the record drawing plan view.

✓ 12-17-02 4. The unit label for cumulative volume columns in the Stage-Storage design and actual volume worksheets in the lower left hand corner of the record drawing should be expressed in acre-ft., not cubic feet. The values appear to represent volumes in standard acre-ft. units.

✓ 12-17-02 5. Provide an approximate cleanout elevation or depth in Item # 1 in the BMP Maintenance Plan.

19.05

✓ 12-17-02

6. If possible add the following County identifiers to the lower right hand corner of the record drawing: County Plan Number SP-118-00 and BMP ID Code: PC 072.

***Construction - Related Items:***

✓ OK 12/12/02

7. Sheet flow runoff from the expanded (south) parking area adjacent to the BMP collects to a low spot in the west corner and is directed over the interior side slope of the basin in a concentrated manner. This slope was EC-2 matted and seeded for stabilization; however, during our field inspection, stabilization was sparse, matting was displaced are bare soil conditions were reoccurring. It would appear that if not corrected, this area will be a persistent slope erosion problem area. Stabilize the slope at this location with seed and EC-3 matting specifically able to handle concentrated flow on steep slopes. Use of turf-reinforcement matting is suggested rather than EC-2 matting.

Once this work is satisfactorily completed, the bond for the project can be released. Contact our office appropriately for reinspection of the basin slope area. One reproducible and one blue/black line set of the record drawings will be required once the above items are adequately addressed.

Please contact me at 757-253-6639 or the assigned Environmental Division inspector, Ms. Beth Davis, at 757-253-6702 if you have any further comments or questions.

Sincerely,

Scott J. Thomas, P.E.
Civil Engineer
Environmental Division

cc: Matthew Connolly, LandTech Resources (via fax)
Steve Stafford, Simmons Engineering Inc. (via fax)
Beth Davis, JCC Environmental Division Inspector

G:\AsBuilts\SP11800.pc072

AB File


# DEVELOPMENT MANAGEMENT

101-E MOUNTS BAY ROAD, P.O. BOX 8784, WILLIAMSBURG, VIRGINIA 23187-8784
(757) 253-6671 Fax: (757) 253-6850 E-MAIL: devtman@james-city.va.us

CODE COMPLIANCE
(757) 253-6626
codecomp@james-city.va.us

ENVIRONMENTAL DIVISION
(757) 253-6670
environ@james-city.va.us

PLANNING
(757) 253-6685
planning@james-city.va.us

COUNTY ENGINEER
(757) 253-6678

INTEGRATED PEST MANAGEMENT
(757) 253-2620


December 6, 2002

Mr. Lee Schmidt
King of Glory Lutheran Church
4897 Longhill Road
Williamsburg, Va. 23188

Re: King of Glory Community Center Expansion
County Plan No. SP-118-00
County BMP ID Code: PC 072

Dear Mr. Schmidt:

The Environmental Division has reviewed a record drawing and construction certification as submitted to our office on November 18th 2002 for the BMP associated with the above referenced project. The record drawing provides as-built information for an infiltration basin facility situated in the south corner of the site.

Based on our review of the project and a concurrent field inspection as performed on December 6th 2002, the following items must be addressed prior to release of the developer's surety instrument for the stormwater management/BMP facility at the site:

***Construction Certification:***

1. The construction certification dated November 15th 2002 is **satisfactory**, as a majority of the fill embankment was existing material and expanded portions of the pond were excavated.

***Record Drawing:***

2. Clearly show the following on the "BMP Outlet Structures" detail: the crest elevation of the 30-inch diameter riser (or riser slots); the invert (bottom) elevation of the riser or alternatively the upstream invert elevation of the 18-inch barrel; and show riser material.

3. Clearly label the existing DI-1 grate structure (El. 84.47) as an emergency spillway on the record drawing plan view.

4. The unit label for cumulative volume columns in the Stage-Storage design and actual volume worksheets in the lower left hand corner of the record drawing should be expressed in acre-ft., not cubic feet. The values appear to represent volumes in standard acre-ft. units.

5. Provide an approximate cleanout elevation or depth in Item # 1 in the BMP Maintenance Plan.

6. If possible add the following County identifiers to the lower right hand corner of the record drawing: County Plan Number SP-118-00 and BMP ID Code: PC 072.

***Construction - Related Items:***

7. Sheet flow runoff from the expanded (south) parking area adjacent to the BMP collects to a low spot in the west corner and is directed over the interior side slope of the basin in a concentrated manner. This slope was EC-2 matted and seeded for stabilization; however, during our field inspection, stabilization was sparse, matting was displaced are bare soil conditions were reoccurring. It would appear that if not corrected, this area will be a persistent slope erosion problem area. Stabilize the slope at this location with seed and EC-3 matting specifically able to handle concentrated flow on steep slopes. Use of turf-reinforcement matting is suggested rather than EC-2 matting.

Once this work is satisfactorily completed, the bond for the project can be released. Contact our office appropriately for reinspection of the basin slope area. One reproducible and one blue/black line set of the record drawings will be required once the above items are adequately addressed.

Please contact me at 757-253-6639 or the assigned Environmental Division inspector, Ms. Beth Davis, at 757-253-6702 if you have any further comments or questions.

Sincerely,

Scott J. Thomas, P.E.
Civil Engineer
Environmental Division

cc: Matthew Connolly, LandTech Resources (via fax)
Steve Stafford, Simmons Engineering Inc. (via fax)
Beth Davis, JCC Environmental Division Inspector

G:\AsBuilts\SP11800.pc072

MEMO TO FILE

FROM: Fran Geissler
DATE: July 24, 2009
SUBJECT: PC072

Personal conversation today with Scott Thomas revealed that Scott has given the King of Glory Church permission to maintain trees on the embankment adjoining Longhill Rd. Notes written on the 12/6/02 inspection report confirm his approval of this practice as long as the trees are maintained. Care should be taken during future inspections to determine whether trees are causing stability issues within the embankment. We may want to consider recommending alternative plantings along the embankment to shield Longhill Rd.

PROTECTED WITH PRIDE IN JAMES CITY COUNTY

# *King of Glory Lutheran Church Parking Lot*
# *Small Bioretention Demonstration Project*

## *Project Idea*

During close-out of the King of Glory Lutheran Church Community Center Expansion project (County Plan SP-118-00) and review of certification material for the expanded infiltration BMP (County BMP ID Code No. PC 072), Environmental Division staff and Mr. Lee Schmidt of the King of Glory Church Building Committee discussed action that was taken by Church personnel to correct a minor drainage problem situated at the south end of the expanded parking area.

Due to parking lot grading and overland sheet flow across paved parking areas, runoff was concentrating at this corner of the new parking area. As runoff ponded at this corner, overflow was being directed to vegetated areas and the interior side slope of the BMP basin in an erosive manner. In an effort to correct the drainage problem, Church volunteers installed a stone diaphragm, two small plastic drainage inlets and plastic storm drain pipe in this corner of the parking lot. The small drainage system now safely conveys drainage from this corner to the parking lot to the onsite stormwater conveyance channel.

Based on preliminary research and a field visit (and if Church representatives concur), James City County Environmental Division staff feels a great opportunity exists to convert an existing grass and tree landscaped area situated at this corner of the site into a small bioretention type stormwater management/Best Management Practice (BMP), especially if the drainage problem resurfaces or is persistent at this location.

The subject area is approximately 20 ft. long and 15 feet wide or roughly about 300 square feet in size and would service about ¼ acre of drainage area. Initial interest and permission would be necessary from the Church and it's Building Committee to proceed with the project under the PRIDE watershed education program of James City County. Future discussions would be necessary for County staff to work up more detailed sketches, present it to the Church for approval and for the County and the Church or Building Committee to mutually plan the event, arrange for volunteers and schedule a demonstration project work day. Any direct material costs to construct the basin would fall under the PRIDE program.

It would be our desire to coordinate and work with the Church and Building Committee to use the project as a demonstration project for retrofitting an existing area into a small bioretention facility, consistent with the Powhatan Creek Watershed Management Plan, the Chesapeake Bay Preservation ordinance and low impact development principles encouraged by Chesapeake Bay Local Assistance Department and the Virginia Department of Conservation and Recreation.

Design and construction would generally be consistent with the provisions of the Minimum Standard 3.11 of the Virginia Stormwater Management Handbook, the County BMP manual and performance criteria established by the Center for Watershed Protection and other sources. Due to the size and scope of the project, detailed drawings or design would not be necessary; however, concept design and preparation of field sketches or details would be performed by County staff.

***What is a Bioretention Basin?***

A bioretention basin, which is sometimes referred to as a rain garden, is a low impact water quality practice which removes pollutants from stormwater runoff associated with impervious areas such as roofs, parking lots, driveways, etc. Bioretention basins are created in low-lying areas where flow and velocity are within reasonable tolerances. Bioretention basins are typically located beneath landscaped areas but are depressed (bowl-shaped), rather than raised or bermed like typical landscape islands that are routinely visible in most residential, commercial and business areas. Bioretention basins generally consist of the following components (Note: from the surface down):

- Native tree, shrub, ground cover and flower landscaping;
- A mulch layer 2-4 inches deep;
- An underlying planting soil layer which consists of a specialized mixture of sand, topsoil and organic material usually 2 to 4 ft. deep;
- A stone and perforated pipe underdrain;
- Geotextile to provide separation between the planting soil layer and underdrain. Geotextile helps to prevent clogging of the underdrain;
- An overflow device in the basin or a safe surface overflow path.

Runoff which flows into bioretention basins temporarily ponds in shallow depths of 6 to 9 inches and over the next few hours the mulch, soil and underdrain layers store, absorb and filter rainwater. Although the device acts as a filter, stormwater is also infiltrated into natural soils surrounding and below the basin, thus providing for recharge of groundwater sources. If there is an excessive amount of water, stormwater through the filter is discharged into the subsurface perforated pipe underdrain or into a surface overflow device, such as an inlet, and discharged back into a downstream man-made storm drain system or a natural adequate receiving channel. For this proposed demonstration project, it is anticipated overflow would be into either an online plastic drain within the basin area or by surface overflow into the existing stormwater conveyance channel to the west of the proposed basin location. The drain pipe as installed by the Building Committee to correct the previous drainage problem could be utilized to the greatest extent practical as the underdrain or overflow device for the bioretention basin.

A wide variety of native landscape plants are specifically selected and planted within the surface layer of bioretention basins. Plants would be very similar to existing landscaping at the site or as preferred by the church; however, a better growing media and the ability for plants to tolerate changing moisture levels would be present. For this project, native plants known to thrive in low-lying places in our region will be used. Plants would include a variety of trees, shrubs, flowers and ground cover specifically selected to conform with the character of the parking lot and the Church building.

Maintenance is minimal if the facility is properly designed and constructed and no more difficult to maintain than that required for normal landscaped areas. The basin would be well-drained due to the underlying engineered soils and underdrain system. Once the plants are established, occasional inspection, weeding and mulch replacement is all that is typically necessary. Future maintenance would be by the Church, although the County would provide guidance as necessary.

It is anticipated that landscaping characteristics within the cell would be greatly enhanced as the soil and moisture conditions would be more beneficial to the landscaped plant community. Existing trees within the area will be salvaged to the greatest extent possible.

Once constructed, the landscaped area will look the same, if not better, than existing conditions and the plants will be much more tolerant of extreme wet or prolonged drought conditions. The bioretention area will provide a distinct stormwater management and water quality benefit, is consistent with the initiatives of the Powhatan Creek Watershed Management Plan, and will be utilized by County staff and the Church as a great educational tool and demonstration site for the use of better site design and low-impact development stormwater management techniques.

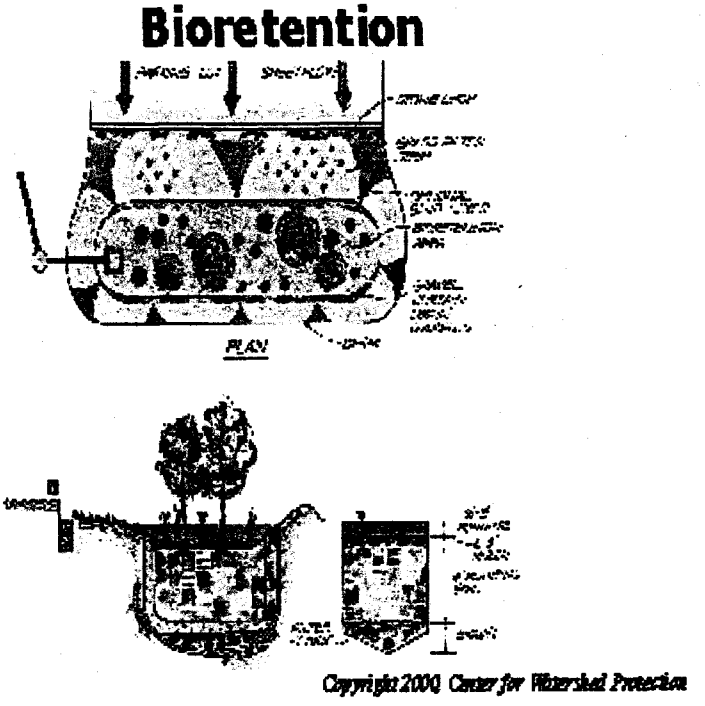
The project area is situated within identified Subwatershed 207 (Upper Chisel Run) and Catchment 207-201-1 of the Powhatan Creek Watershed Management and Stormwater Master Plans, respectively. Specific stormwater strategies for this subwatershed and catchment include encouraging stormwater retrofitting. This project would serve as an example of how to rework existing areas to provide stormwater water quality benefits. Refer to the Environmental Division portion of the County web site for additional information about the Powhatan Creek Watershed Management Plan.

***For Consideration***

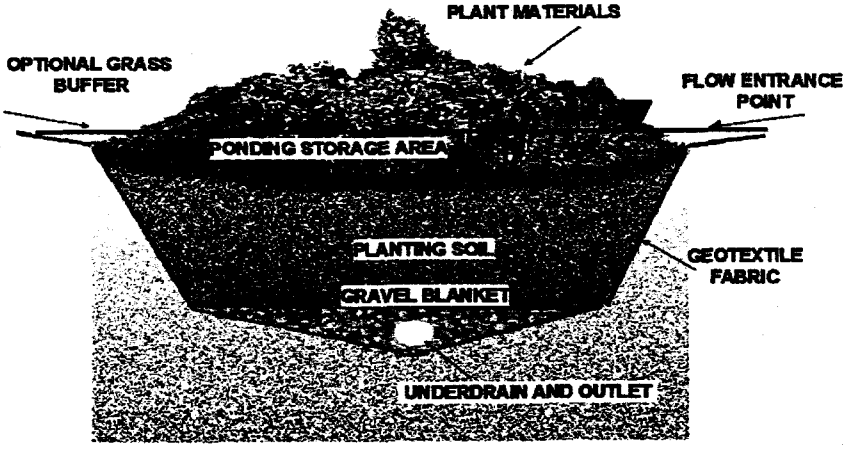
Attached is sketch map of the proposed location for the basin; some example photographs and a variety of information about Bioretention Basins for consideration by the church and the Building Committee. For consideration under the PRIDE program, contact Lisa Meddin (Watershed Education Coordinator) at 757-253-6859, Scott Thomas (Civil Engineer) at 757-253-6639 or Mike Woolson (Watershed Planner) at 757-253-6823.

Also, if members have access to computers and the internet, please visit the County's website at www.james-city.va.us and the County's PRIDE watershed education website at www.protectedwithpride.org.

Another good website for information on rain gardens is www.lid-stormwater.net




*Typical Plan and Section*




*Typical Section*

COPY

COUNTY OF JAMES CITY, VIRGINIA

**DECLARATION OF COVENANTS**
**INSPECTION/MAINTENANCE OF DRAINAGE SYSTEM**

**Please type or print legibly in black ink. Covenantor(s) should submit this form to the JCC Engineering and Resource Protection Division, 101-E Mounts Bay Road, Williamsburg, VA 23185.**

THIS DECLARATION OF COVENANTS, made this 10 day of November, 20 11, between KING OF GLORY LUTHERAN CHURCH, and all successors in interest, ("COVENANTOR(S)"), owner(s) of the following property:

Parcel Identification Number(s): 3240100033
Legal Description(s): PLAT OF PROPERTY LOCATED AT 4897 LONGHILL ROAD.
Project or Subdivision Name: KING OF GLORY LUTHERAN CHURCH
Document/Instrument No(s): 090006836
or Deed Book _____, Page No. _____,
and the County of James City, Virginia ("COUNTY.")

WITNESSETH:

I (We), the COVENANTOR(S), with full authority to execute deeds, mortgages, other covenants, and all rights, titles and interests in the property described above, do hereby covenant with the COUNTY as follows:

1. The COVENANTOR(S) shall provide maintenance for the drainage system including any runoff control facilities, conveyance systems and associated easements, hereinafter referred to as the "SYSTEM," located on and serving the above-described property to ensure that the SYSTEM is and remains in proper working condition in accordance with approved design standards, and with the law and applicable executive regulations. The SYSTEM shall not include any elements located within any Virginia Department of Transportation rights-of-way.

2. If necessary, the COVENANTOR(S) shall levy regular or special assessments against all present or subsequent owners of property served by the SYSTEM to ensure that the SYSTEM is properly maintained.

3. The COVENANTOR(S) shall provide and maintain perpetual access from public right-of-ways to the SYSTEM for the COUNTY, its agent and its contractor.

4. The COVENANTOR(S) shall grant the COUNTY, its agent and its contractor a right of entry to the SYSTEM for the purpose of inspecting, monitoring, operating, installing, constructing, reconstructing, maintaining or repairing the SYSTEM.

5. If, after reasonable notice by the COUNTY, the COVENANTOR(S) shall fail to maintain the SYSTEM in accordance with the approved design standards and with the law and applicable executive regulations, the COUNTY may perform all necessary repair or maintenance work, and the COUNTY may assess the COVENANTOR(S) and/or all property served by the SYSTEM for the cost of the work and any applicable penalties.

---

**Prepared by (Name, Address & Phone):**
MATTHEW H. CONNOLLY
205-E BULIFANTS BLVD.
WILLIAMSBURG, VA 23188
757-565-1677

**Return to:**
JCC Attorney's Office
101-C Mount's Bay Road
Williamsburg, VA 23185
(757) 253-6612

Instrument # 110024501
Recorded on Dec. 6, 2011

6. The COVENANTOR(S) shall indemnify and save the COUNTY harmless from any and all claims for damages to persons or property arising from the installation, construction, maintenance, repair, operation or use of the SYSTEM.

7. The COVENANTOR(s) shall promptly notify the COUNTY when the COVENANTOR(S) legally transfers any of the COVENANTOR(S) responsibilities for the SYSTEM. The COVENANTOR(S) shall supply the COUNTY with a copy of any document of transfer, executed by both parties.

8. The covenants contained herein shall run with the land and shall bind the COVENANTOR(S) and the COVENANTOR(S)' heirs, executors, administrators, successors and assignees, and shall bind all present and subsequent owners of property served by the SYSTEM.

9. This COVENANT shall be recorded in the County Land Records.

IN WITNESS WHEREOF, the COVENANTOR(S) has executed this DECLARATION OF COVENANTS as of the date first above written.

COVENANTOR(S)

Elizabeth H Elgert
Signature

Elizabeth H. Elgert, President, King of Glory Lutheran Church
Print Name and Title

ACKNOWLEDGMENT

COMMONWEALTH OF VIRGINIA
CITY/COUNTY OF JAMES CITY, to wit:

I hereby certify that on this 10 day of NOVEMBER, 20 11, before the subscribed, a Notary Public for the Commonwealth of Virginia, personally appeared ELIZABETH H. ELGERT and did acknowledge the foregoing instrument to be his/her Act.

IN WITNESS WHEREOF, I have hereunto set my hand and official seal this 10 day of NOVEMBER, 20 11.

[SEAL]

WILLIAM S. FELTS NOTARY PUBLIC REG # 7389139 COMMISSION EXPIRES 1/31/2015 COMMONWEALTH OF VIRGINIA

Will S Felts
Notary Public

Notary Registration Number: 7389139

My Commission expires: 1-31-2015

Approved as to form:

Adam Kinsman
County Attorney

Drainage1_pre_doc
(Revised 5-11)

# James City County Engineering and Resource Protection Division
# Stormwater Management/BMP Record Drawing and Construction Certification Review Tracking Form

Project Name: King of Glory Lutheran Church Gravel Pking. Lot Expansion
County Plan No. (List any amendments): SP-86-11
Stormwater Management Facility Type: Dry Swale to PC-072
BMP Phase #: ☐ I ☐ II ☐ III

- ☒ Information Package Submittal Date: 2/24/12
- ☒ Completeness Check:
  - ☒ Record Drawing Date/By: 2/24/12
  - ☒ Construction Certification Date/By: 2/24/12
  - ☒ RD/CC Standard Forms (Ensure that all forms for the BMP type are included)
  - ☐ Insp/Maint Agreement # / Date: 11002450 1/12/2/11
  - ☒ BMP Maintenance Plan Location: (Existing) Sheet C7
  - ☐ Special Considerations: Tilled Pond bottom to rejuvinate soil infiltration
- ☒ Standard E&SC Notes on Approved Plan Requiring RD/CC or County comment in plan review
  Location (sheet #): C5
- ☒ **County BMP ID Code #**: PC-072
- ☒ Log into Division's "As-Built Tracking Log"
- ☒ Obtain basic site information (GPIN, Owner, Address, etc.)
- ☒ ~~Log into Access~~ Database (BMP ID #, Plan No., GPIN, Project Name, etc.)
- ☒ Copy from Active Project File (correspondence, H&H, design computations, etc.).
- ☒ Create As-Built File using Project File information (File label, folder, copy plan/details/design information, etc.).
- ☒ Inspector Review of RD/CC (consult with Chief Engineer prior to completion of comments).
- ☒ Record Drawing Review against Approved Plan prior to Field Inspection.
- ☒ Final Site Inspection (FI) Performed Date: 2/29/12
- ☒ Record Drawing (RD) Review Date: 2/29/12
- ☒ Construction Certification (CC) Review Date: 2/29/12
- ☒ Actions:
  - ☒ No comments.
  - ☐ Comments. Letter Forwarded. Date:
  - ☐ Record Drawing (RD)
  - ☐ Construction Certification (CC)
  - ☐ Construction-Related (CR)
  - ☐ Site Issues (SI)
  - ☐ Other :
- ☒ Resubmittal (# and date): N/A
- ☒ Re-inspection (if necessary): N/A
- ☒ Drainage System Information Acceptable (RD/CC/System Info). Ok for bond release.
- ☒ Complete "Surety Request Form".
- ☒ Final Inspection of active file copying any relevant information to "As-Built" file.
- ☒ On County BMP Inventory (Phase I, II or III).
- ☒ Copy Final Inspection Report into County BMP Inspection Program file.
- ☒ Provide Digital Photographs of BMP and save into County BMP Inventory.
- N/A Request mylar/reproducible from As-Built plan preparer.
- ☒ Complete "As-built Tracking Log".
- ☒ Last check of BMP Access Database (County BMP Inventory).
- ☐ Add BMP to JCC Hydrology & Hydraulic database (optional).
- ☐ Add BMP to Municipal BMP list (if a County-owned facility)
- ☐ Add BMP to PRIDE BMP ratings database.

***Final Sign-Off***

Inspector: [signature] Date: 3/1/12

Chief Engineer: [signature] Date: 3/6/12

*** See separate checklist, if needed.

VICINITY MAP
SCALE: 1"=2000'

# RECORD DRAWING
# OF
# KING OF GLORY LUTHERAN CHURCH
# GRAVEL PARKING LOT EXPANSION

JAMES CITY COUNTY VIRGINIA

SUP-0022-2009
SP-0060-2010
SP-086-11

Environmental Division
FEB 24 2012
RECEIVED

## TABLE OF CONTENTS


| SHEET NO. | SHEET NO. |
|---|---|
| C1 | COVER SHEET |
| C2 | STORM AS-BUILT PLAN |
| C3 | BMP AS-BUILT PLAN |


## STATISTICAL INFORMATION

| | |
|---|---|
| ZONE | R2-GENERAL RESIDENTIAL |
| DISTRICT | JAMESTOWN |
| TAX MAP NO. | 3240100033 |
| ADDRESS | 4897 LONGHILL ROAD |
| PROPOSED USE | CHURCH PARKING LOT EXPANSION |
| WATER | PUBLIC (JCSA INSIDE PSA) |
| SEWER | PUBLIC (JCSA INSIDE PSA) |
| SITE AREA | 13.85 ACRES |
| DISTURBED AREA | 0.7± ACRES |
| EXISTING IMPERVIOUS AREA | 2.59 ACRES |
| ADDITIONAL GRAVEL AREA | 0.58 ACRES |
| IMPERVIOUS AREA REMOVED | 0.25 ACRES |
| TOTAL IMPERVIOUS AREA | 2.92 ACRES |
| PARKING SPACES | |
| EXISTING: | 161 |
| ADDITIONAL: | 70 |
| TOTAL: | 231 |

NOTES:

1) PER FEMA COMMUNITY PANEL NUMBER 51095C0120C DATED 9/28/07 THE SITE APPEARS TO BE IN FLOOD ZONE "X".
2) TOPOGRAPHIC SURVEY SHOWN HEREON IS BASED ON FIELD SURVEY BY LANDTECH RESOURCES INC. – JULY 2011.
3) PARCEL BOUNDARY SHOWN HEREON IS BASED ON "ALTA/ACSM LAND TITLE SURVEY OF 4881 LONGHILL ROAD", PREPARED BY LANDTECH RESOURCES, INC. DATED 9/4/083/2/87, UNRECORDED.
4) THE EXISTENCE AND LOCATION (HORIZONTAL AND VERTICAL) OF EXISTING UTILITIES ARE NOT GUARANTEED AND SHALL BE FIELD VERIFIED BY THE CONTRACTOR.
5) A LAND DISTURBING PERMIT AND SILTATION AGREEMENT WITH SURETY ARE REQUIRED FOR THIS PROJECT.
6) THIS PROJECT IS LOCATED IN SUBWATERSHED 207 OF THE POWHATAN CREEK WATERSHED.
7) THE PROFESSIONAL ENGINEER WHOSE SEAL IS AFFIXED HEREON SHALL ACT AS THE "RESPONSIBLE LAND DISTURBER" FOR THE PLAN REVIEW PHASE OF THIS PROJECT. ONCE THE PLANS ARE APPROVED BY THE COUNTY THE OWNER/DEVELOPER SHALL PROVIDE THE COUNTY WITH THE NAME OF THE "RESPONSIBLE LAND DISTURBER" FOR THE CONSTRUCTION PHASE OF THE PROJECT.
8) PER "SOIL SURVEY OF JAMES CITY AND YORK COUNTIES AND THE CITY OF WILLIAMSBURG VIRGINIA" THE ON-SITE SOIL CONSISTS OF SUFFOLK (31B) & KEMPSVILL (18B).
9) ALL NEW UTILITIES SHALL BE PLACED UNDERGROUND.
10) ALL NEW SIGNS SHALL BE IN ACCORDANCE WITH ARTICLE II, DIVISION 3 OF THE JAMES CITY ZONING ORDINANCE AND MUST RECEIVE A SIGN PERMIT FROM THE COUNTY ZONING OFFICE.
11) EVERYTHING BEYOND THE RIGHT-OF-WAY LINE WILL BE CONSIDERED PRIVATE AND NOT MAINTAINED BY VDOT.
12) THE OWNER WILL BE REQUIRED TO OBTAIN A VSMP PERMIT FROM THE VIRGINIA DEPARTMENT OF CONSERVATION AND RECREATION IF THE DISTURBED AREA IS GREATER THAN 2,500 SF. THIS PERMIT WILL REQUIRE A STORMWATER POLLUTION PREVENTION PLAN.
13) ALL DRAINAGE EASEMENTS DESIGNATED ON THE PLAN SHALL REMAIN PRIVATE.
14) THE DRC REVIEWED AND RECOMMENDED APPROVAL OF THIS REQUEST ON JULY 27, 2011.
15) THE PLANNING COMMISSION APPROVAL THIS REQUEST ON AUGUST 3, 2011.
16) THIS CASE IS ASSOCIATED WITH SUP-0022-2009 APPROVED BY THE JAMES CITY COUNTY BOARD OF SUPERVISORS ON 12/8/09.
17) ALL UTILITY EXTENSIONS, UPGRADES OR RELOCATIONS REQUIRED SHALL BE AT THE APPLICANT'S SOLE EXPENSE.
18) BENCHMARK: STATION NO. 312, EASTING(X) 11990385.589, NORTHING(Y) 3636283.323, ELEVATION=74.23
    HORIZONTAL DATUM: JAMES CITY COUNTY
    GEODETIC CONTROL NETWORK
    VIRGINIA STATE PLANE COORDINATE
    SYSTEM – SOUTH ZONE
    NAD 83 (HARN ADJ 96)
    VERTICAL DATUM: JAMES CITY COUNTY
    GEODETIC CONTROL NETWORK
    NAVD 88

**RECORD DRAWING CERTIFICATION:**

I HEREBY CERTIFY TO THE BEST OF MY KNOWLIEF THAT THIS RECORD DRAWING REPRESENTS THE ACUTAL CONDITION OF THE STORMWATER MANAGEMENT / BMP FACILITY. THE FACILITY APPEARS TO CONFORM WITH THE PROVISIONS OF THE APPROVED DESIGN PLAN, SPECIFICATIONS AND STORMWATER MANAGEMENT PLAN, EXCEPT AS SPECIFICALLY NOTED.

MATTHEW H. CONNOLLY, LIC NO. 2053 — 2/23/12 DATE

## OWNER/DEVELOPER

KING OF GLORY LUTHERAN CHURCH
4897 LONGHILL ROAD
WILLIAMSBURG, VA. 23188
(757) 258-9701
(757) 564-9810 FAX
CONTACT: MATTHEW CONNOLLY

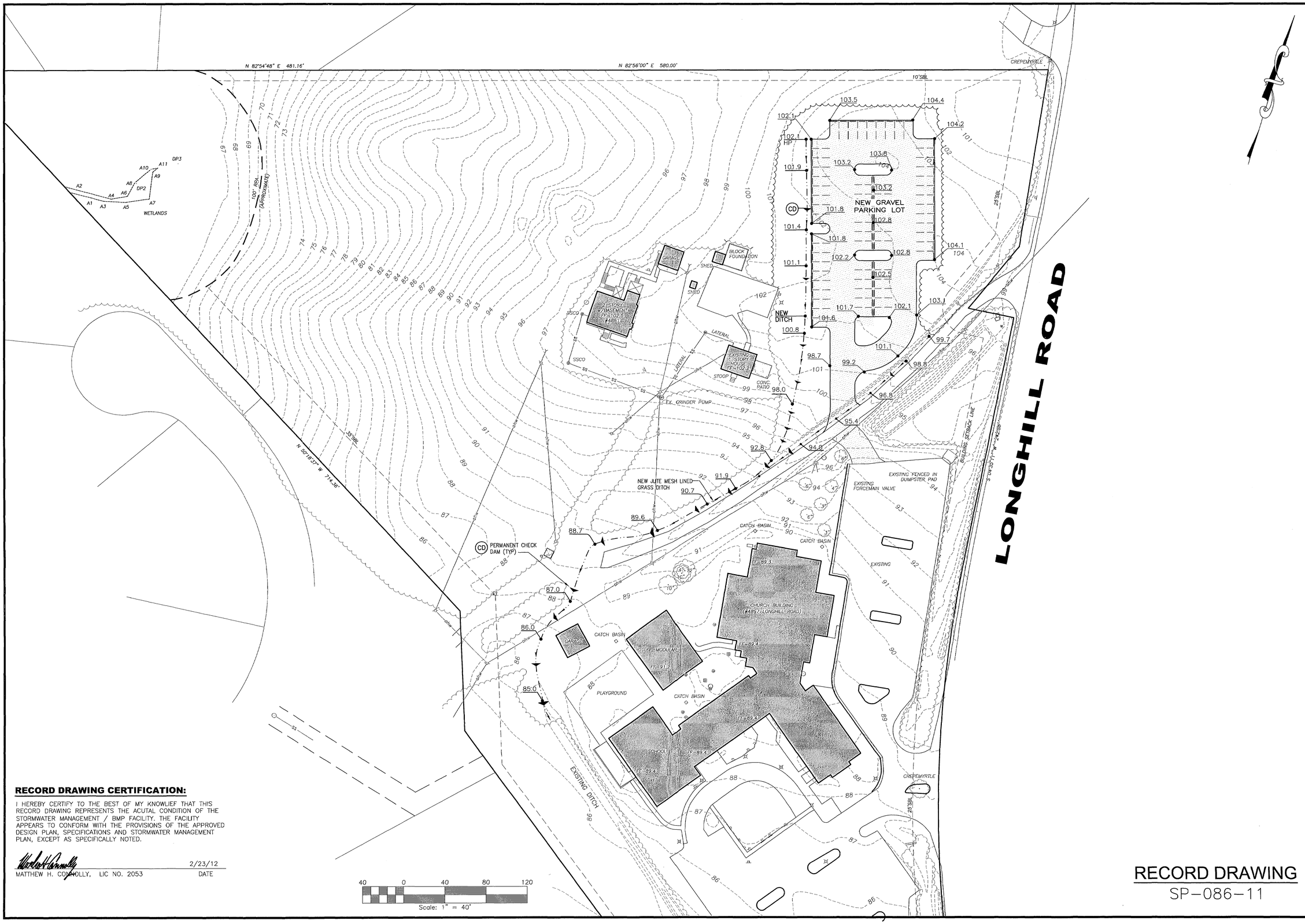
| NO. | DATE | REVISION / COMMENT / NOTE |
|---|---|---|
| | | |

RECORD DRAWING
SP-086-11

LandTech Resources, Inc.
Surveying • Engineering • GPS
205 Bulifants Blvd., Ste E, Williamsburg, VA 23188
Phone: (757) 565-1677 Fax: (757) 565-0782
web: landtechresources.com

COMMONWEALTH OF VIRGINIA
MATTHEW H. CONNOLLY
Lic. No. 2053
2/23/12
LAND SURVEYOR

JOB: 11-208
DWG NO: 11-208CS
DATE: 2/23/12
DRAWN BY: MHC
SHEET: C1 OF 3




**RECORD DRAWING CERTIFICATION:**

I HEREBY CERTIFY TO THE BEST OF MY KNOWLIEF THAT THIS RECORD DRAWING REPRESENTS THE ACUTAL CONDITION OF THE STORMWATER MANAGEMENT / BMP FACILITY. THE FACILITY APPEARS TO CONFORM WITH THE PROVISIONS OF THE APPROVED DESIGN PLAN, SPECIFICATIONS AND STORMWATER MANAGEMENT PLAN, EXCEPT AS SPECIFICALLY NOTED.

MATTHEW H. CONNOLLY, LIC NO. 2053 — 2/23/12 DATE

40 0 40 80 120
Scale: 1" = 40'

RECORD DRAWING
SP-086-11

# RECORD DRAWING OF KING OF GLORY LUTHERAN CHURCH GRAVEL PARKING LOT EXPANSION

4897 LONGHILL ROAD
STORM AS-BUILT PLAN

James City County — Virginia

| NO. | DATE | REVISION / COMMENT / NOTE |
|---|---|---|
| | | |

COMMONWEALTH OF VIRGINIA — MATTHEW H. CONNOLLY — Lic. No. 2053 — 2/23/12 — LAND SURVEYOR


LandTech Resources, Inc.
Surveying GPS Engineering
205 Bulifants Blvd., Ste. E, Williamsburg, VA 23188
Phone: (757) 565-1677 Fax: (757) 565-0782
web: landtechresources.com

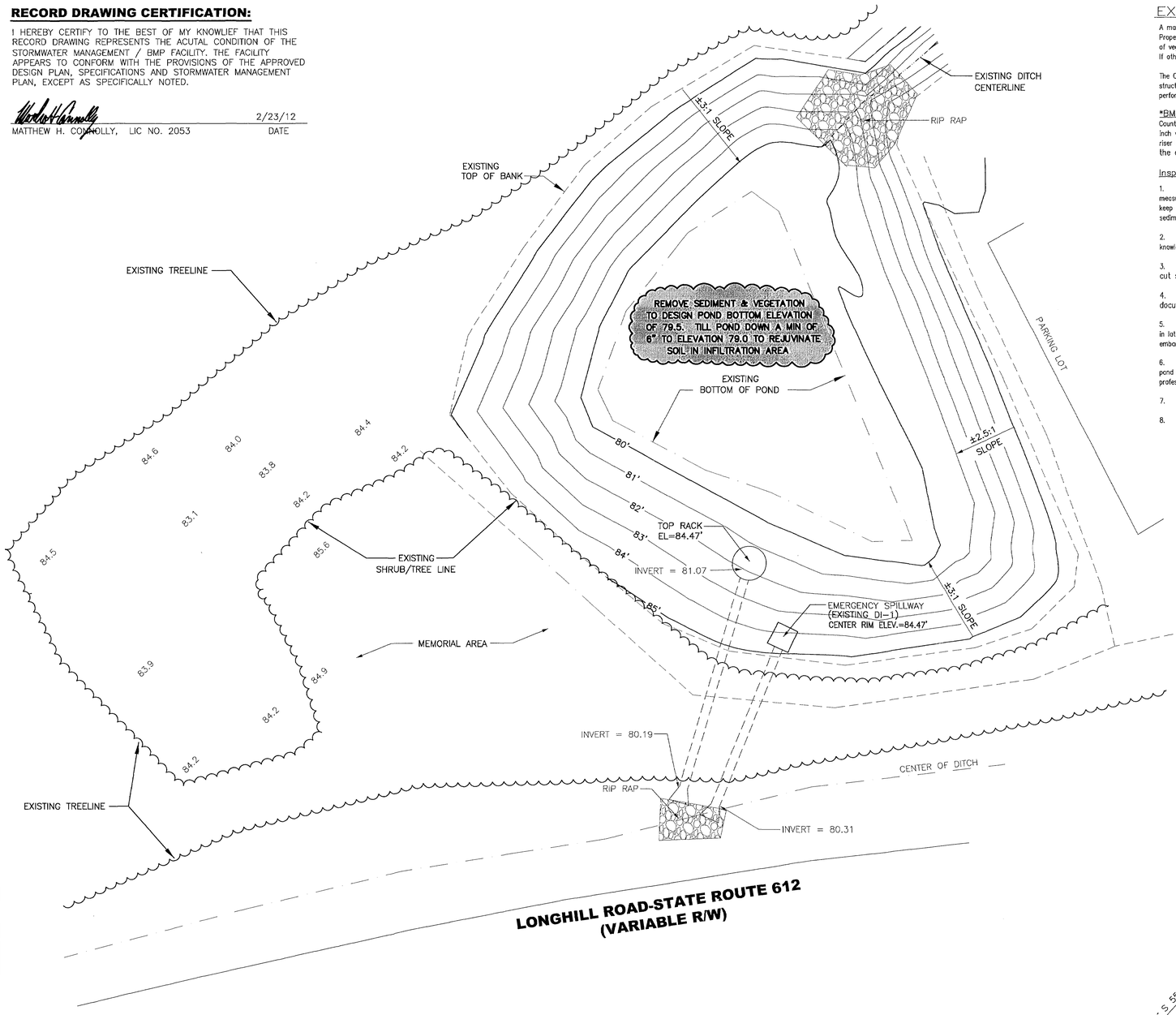

SCALE: 1" = 40'
DATE: 2/23/12
JOB: 11-208
DRAWN BY: MHC
SHEET: C2 OF 3

## RECORD DRAWING CERTIFICATION:

I HEREBY CERTIFY TO THE BEST OF MY KNOWLIEF THAT THIS RECORD DRAWING REPRESENTS THE ACUTAL CONDITION OF THE STORMWATER MANAGEMENT / BMP FACILITY. THE FACILITY APPEARS TO CONFORM WITH THE PROVISIONS OF THE APPROVED DESIGN PLAN, SPECIFICATIONS AND STORMWATER MANAGEMENT PLAN, EXCEPT AS SPECIFICALLY NOTED.

2/23/12

MATTHEW H. CONNOLLY, LIC NO. 2053 — DATE




## EXISTING BMP MAINTENANCE PLAN

A maintenance program is required to ensure the Stormwater Management/Best Management Practice (BMP) infiltration facility functions as designed and to provide for reasonable aesthetic conditions. Proper maintenance is encouraged to prevent the introduction of debris and sediment into pretreatment areas, the BMP infiltration area and downstream waterways. Following installation and establishment of vegetation in disturbed site areas, inspections for sediment buildups will be performed at least quarterly. It is anticipated that under normal conditions, sediment removal will be required once per year. If other construction or related land-disturbing activities are performed upslope of the BMP, adequate protection measures shall be implemented with inspections performed at least once weekly.

The Owner or its designated representative will inspect the SWM/BMP structure after each significant rainfall event or following working day if a weekend or holiday occurs. A significant rainfall for this structure is defined as one (1) inch or more of gauged rainfall within a 24 hour period. Once per year (more or less) a representative of the County may jointly inspect the structure. Appropriate action, performed at the cost of the owner will be taken to ensure appropriate maintenance. Keys to locked access points or structures shall be made available to the County upon request.

*BMP Description: This Infiltration BMP serves a drainage area of +/- 6.48 acres associated with the King of Glory Lutheran Church site. The facility is a 8 point Infiltration Basin, County Type "C-3" BMP which treats a minimum of 0.5 inches of runoff for the contributing impervious drainage area. Principal structures associated with the BMP consist of a 30 inch vertical RCP riser, 18 inch HDPE outlet barrel and an existing VDOT DI-1 structure with a grate-on-slope which is utilized as the emergency overflow spillway. There is a 9 inch opening in the riser to provide for water quantity drawdown. During the 100-year storm, the maximum water level should rise to about 1 feet below the top of dam. During a storm event larger than the 100-year, the emergency spillway, which is the existing DI-1 on the side slope, will discharge flow.

Inspection and maintenance of the BMP facility will consist of the following additional measures:

1. Immediately remove trash, debris or sediment that prevents the movement of water and to maintain the integrity of the structure and provide for an attractive appearance. Property maintenance measures including the removal of trash, litter and sediment from surrounding grass, parking and stabilized contributing areas should be performed weekly to prevent migration into the BMP. During winter keep snow removal materials such as sand, salt or cinders away from the infiltration area to the greatest extent possible. Trash and litter collection is encouraged daily around the BMP. Dispose of sediments removed from the facility at an acceptable disposal area.

2. Many factors will affect the operation of an infiltration system. Routine inspections and maintenance should be performed by the same assigned individual in order to establish a baseline knowledge of how the system functions under different site and weather conditions.

3. Routinely inspect vegetated filter strips adjacent to the facility. A healthy stand of grass should be maintained at all times. Mow the filter strips with lawnmowers at high setting to achieve a cut stand of grass 4 inches or higher. Grass clippings shall be bagged as mowing progresses so cuttings will not plug the filter bottom.

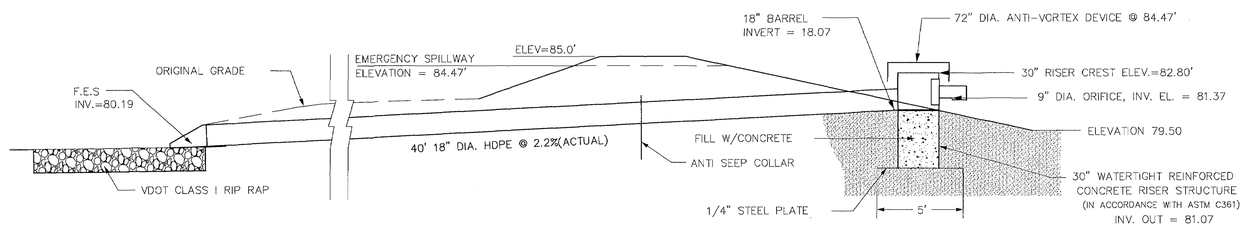
4. Record Keeping. The owner or designated representative shall keep reasonable, accurate written records of inspections performed for the structure. Records shall document routine maintenance and/or repairs performed. Copies shall be provided to the County upon request.

5. Perform maintenance mowing of pond grasses at least twice each year. Grasses such as tall fescue should be mowed in early summer after emergence of the heads on cool season grasses and in late fall to prevent seeds of annual weeds from maturing. Mowing of legumes can be less frequent. Trees, shrubs and woody vegetation are not permitted to grow along or on any part of the embankment that was constructed using engineered (compacted) fills.

6. Perform yearly structural inspections of the facility for damage. Structural inspection shall be performed on the concrete riser, anti-vortex device, trash rack, orifices/weirs, outlet barrel and pond embankment. Exposed metal surfaces shall be repainted or re-galvanized to minimize rust damage or replace if rust damage is irreversible. If damage is evident, further investigation by a professional engineer may be required to assess the integrity of the structure.

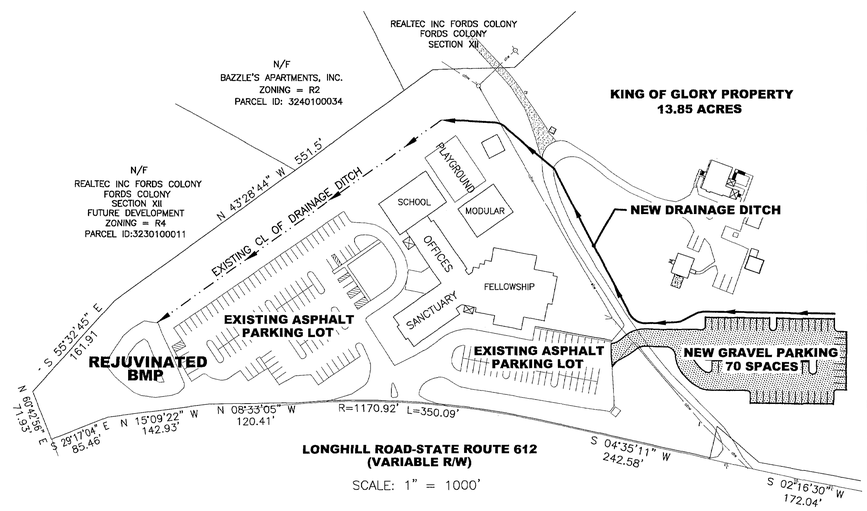
7. Perform quarterly inspections of the graded side slopes of the facility for signs of animal/rodent burrows or slope erosion. Immediately perform necessary repairs, refilling or reseeding.

8. The facility shall not accept additional drainage or be modified in any way without prior consent or approval by the Environmental Division of James City County.




EXISTING BMP OUTLET STRUCTURES

NTS




RECORD DRAWING

SP-086-11

# RECORD DRAWING OF KING OF GLORY LUTHERAN CHURCH GRAVEL PARKING LOT EXPANSION

4897 LONGHILL ROAD

BMP AS-BUILT PLAN

James City County — Virginia

| NO. | DATE | REVISION / COMMENT / NOTE |
|---|---|---|
| | | |

COMMONWEALTH OF VIRGINIA — MATTHEW H. CONNOLLY — Lic. No. 2053 — 2/23/12 — LAND SURVEYOR


LandTech Resources, Inc.
Surveying • Engineering • GPS
205 Bulifants Blvd., Ste E, Williamsburg, VA 23188
Phone: (757) 565-1677 Fax: (757) 565-0782
web: landtechresources.com


SCALE: 1" = 10'

DATE: 2/23/12

JOB: 11-208

DRAWN BY: MHC

SHEET: C3 OF 3

SP- 0086 - 2011

VICINITY MAP
SCALE: 1"=2000'

# SITE PLAN OF KING OF GLORY LUTHERAN CHURCH GRAVEL PARKING LOT EXPANSION

JAMES CITY COUNTY VIRGINIA

SUP-0022-2009

SP-0060-2010

SP-086-11

RECEIVED OCT 2011 Planning Department

COUNTY OF JAMES CITY
FINAL SITE PLAN
APPROVALS DATE
Fire Dept. JD/JA 9/13/11
Health Dept.
VDOT
Planning CMJ 11-2-11
Environ. SSK/JA 11/2/11
Zoning Adm. TYNG 11/2/11
JCSA CP/JA 9/19/11
County Eng.
RSA
Other

## TABLE OF CONTENTS


| SHEET NO. | SHEET NO. |
|---|---|
| C1 | COVER SHEET |
| C2 | DEMOLITION PLAN |
| C3 | OVERALL PLAN |
| C4 | LAYOUT PLAN |
| C5 | GRADING PLAN |
| C6 | DETAIL SHEET |
| C7 | BMP DETAIL SHEET |
| L1 | LANDSCAPE PLAN |
| L2 | LANDSCAPE NOTES |


## STATISTICAL INFORMATION

| | |
|---|---|
| ZONE | R2–GENERAL RESIDENTIAL |
| DISTRICT | JAMESTOWN |
| TAX MAP NO. | 3240100033 |
| ADDRESS | 4897 LONGHILL ROAD |
| PROPOSED USE | CHURCH PARKING LOT EXPANSION |
| WATER | PUBLIC (JCSA INSIDE PSA) |
| SEWER | PUBLIC (JCSA INSIDE PSA) |
| SITE AREA | 13.85 ACRES |
| DISTURBED AREA | 0.7± ACRES |
| EXISTING IMPERVIOUS AREA | 2.59 ACRES |
| ADDITIONAL GRAVEL AREA | 0.58 ACRES |
| IMPERVIOUS AREA REMOVED | 0.25 ACRES |
| TOTAL IMPERVIOUS AREA | 2.92 ACRES |
| PARKING SPACES | |
| EXISTING: | 161 |
| ADDITIONAL: | 70 |
| TOTAL: | 231 |

THIS PLAN IS AN AMENDMENT TO SITE PLAN SP–0060–2010 AND SUP–0022–2009 TO ADD A GRAVEL PARKING LOT WITH 70 ADDITIONAL PARKING SPACES.

NOTES:

1) PER FEMA COMMUNITY PANEL NUMBER 51095C0120C DATED 9/28/07 THE SITE APPEARS TO BE IN FLOOD ZONE "X".
2) TOPOGRAPHIC SURVEY SHOWN HEREON IS BASED ON FIELD SURVEY BY LANDTECH RESOURCES INC. – JULY 2011.
3) PARCEL BOUNDARY SHOWN HEREON IS BASED ON "ALTA/ACSM LAND TITLE SURVEY OF 4881 LONGHILL ROAD", PREPARED BY LANDTECH RESOURCES, INC. DATED 9/4/083/2/87, UNRECORDED.
4) THE EXISTENCE AND LOCATION (HORIZONTAL AND VERTICAL) OF EXISTING UTILITIES ARE NOT GUARANTEED AND SHALL BE FIELD VERIFIED BY THE CONTRACTOR.
5) A LAND DISTURBING PERMIT AND SILTATION AGREEMENT WITH SURETY ARE REQUIRED FOR THIS PROJECT.
6) THIS PROJECT IS LOCATED IN SUBWATERSHED 207 OF THE POWHATAN CREEK WATERSHED.
7) THE PROFESSIONAL ENGINEER WHOSE SEAL IS AFFIXED HEREON SHALL ACT AS THE "RESPONSIBLE LAND DISTURBER" FOR THE PLAN REVIEW PHASE OF THIS PROJECT. ONCE THE PLANS ARE APPROVED BY THE COUNTY THE OWNER/DEVELOPER SHALL PROVIDE THE COUNTY WITH THE NAME OF THE "RESPONSIBLE LAND DISTURBER" FOR THE CONSTRUCTION PHASE OF THE PROJECT.
8) PER "SOIL SURVEY OF JAMES CITY AND YORK COUNTIES AND THE CITY OF WILLIAMSBURG VIRGINIA" THE ON–SITE SOIL CONSISTS OF SUFFOLK (31B) & KEMPSVILL (18B).
9) ALL NEW UTILITIES SHALL BE PLACED UNDERGROUND.
10) ALL NEW SIGNS SHALL BE IN ACCORDANCE WITH ARTICLE II, DIVISION 3 OF THE JAMES CITY ZONING ORDINANCE AND MUST RECEIVE A SIGN PERMIT FROM THE COUNTY ZONING OFFICE.
11) EVERYTHING BEYOND THE RIGHT–OF–WAY LINE WILL BE CONSIDERED PRIVATE AND NOT MAINTAINED BY VDOT.
12) THE OWNER WILL BE REQUIRED TO OBTAIN A VSMP PERMIT FROM THE VIRGINIA DEPARTMENT OF CONSERVATION AND RECREATION IF THE DISTURBED AREA IS GREATER THAN 2,500 SF. THIS PERMIT WILL REQUIRE A STORMWATER POLLUTION PREVENTION PLAN.
13) ALL DRAINAGE EASEMENTS DESIGNATED ON THE PLAN SHALL REMAIN PRIVATE.
14) THE DRC REVIEWED AND RECOMMENDED APPROVAL OF THIS REQUEST ON JULY 27, 2011.
15) THE PLANNING COMMISSION APPROVAL THIS REQUEST ON AUGUST 3, 2011.
16) THIS CASE IS ASSOCIATED WITH SUP–0022–2009 APPROVED BY THE JAMES CITY COUNTY BOARD OF SUPERVISORS ON 12/8/09.
17) ALL UTILITY EXTENSIONS, UPGRADES OR RELOCATIONS REQUIRED SHALL BE AT THE APPLICANT'S SOLE EXPENSE.
18) BENCHMARK: STATION NO. 312, EASTING(X) 11990385.589, NORTHING(Y) 3636283.323, ELEVATION=74.23
HORIZONTAL DATUM: JAMES CITY COUNTY GEODETIC CONTROL NETWORK VIRGINIA STATE PLANE COORDINATE SYSTEM – SOUTH ZONE NAD 83 (HARN ADJ 96)
VERTICAL DATUM: JAMES CITY COUNTY GEODETIC CONTROL NETWORK NAVD 88

| NO. | DATE | REVISION / COMMENT / NOTE |
|---|---|---|
| 1 | 10/07/11 | REVISED PER COUNTY COMMENT LETTER DATED 9–21–2011 |
| 2 | 10/28/11 | REVISED PER COUNTY COMMENT LETTER DATED 10–26–2011 |


OWNER/DEVELOPER
KING OF GLORY LUTHERAN CHURCH
4897 LONGHILL ROAD
WILLIAMSBURG, VA. 23188
(757) 258–9701
(757) 564–9810 FAX
CONTACT: MATTHEW CONNOLLY


BEFORE DIGGING CALL "MISS UTILITY" OF VIRGINIA AT 1 - 800 - 552 - 7001


LandTech Resources, Inc.
Surveying • Engineering • GPS
205 Bulifants Blvd., Ste E, Williamsburg, VA 23188
Phone: (757) 565–1677 Fax: (757) 565–0782
web: landtechresources.com

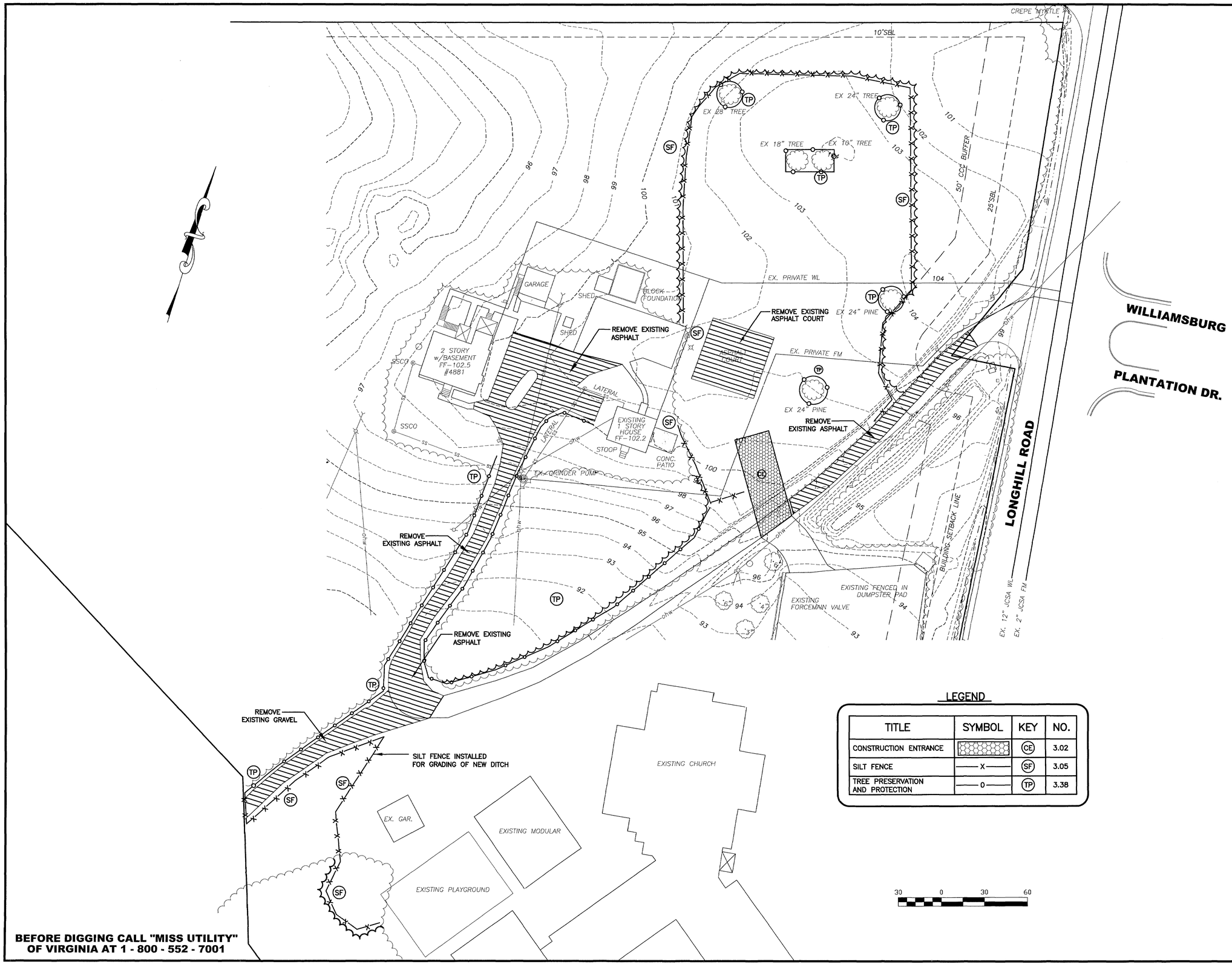

COMMONWEALTH OF VIRGINIA
MATTHEW H. CONNOLLY
Lic. No. 2053
10–28–2011
LAND SURVEYOR

JOB: 11–208
DWG NO: 11–208CS
DATE: 8/19/11
DRAWN BY: KMJ
SHEET: C1 OF 9

# SITE PLAN OF KING OF GLORY LUTHERAN CHURCH GRAVEL PARKING LOT EXPANSION

4897 LONGHILL ROAD
DEMOLITION PLAN

James City County — Virginia




## LEGEND

| TITLE | SYMBOL | KEY | NO. |
|---|---|---|---|
| CONSTRUCTION ENTRANCE | | CE | 3.02 |
| SILT FENCE | —— X —— | SF | 3.05 |
| TREE PRESERVATION AND PROTECTION | —— O —— | TP | 3.38 |

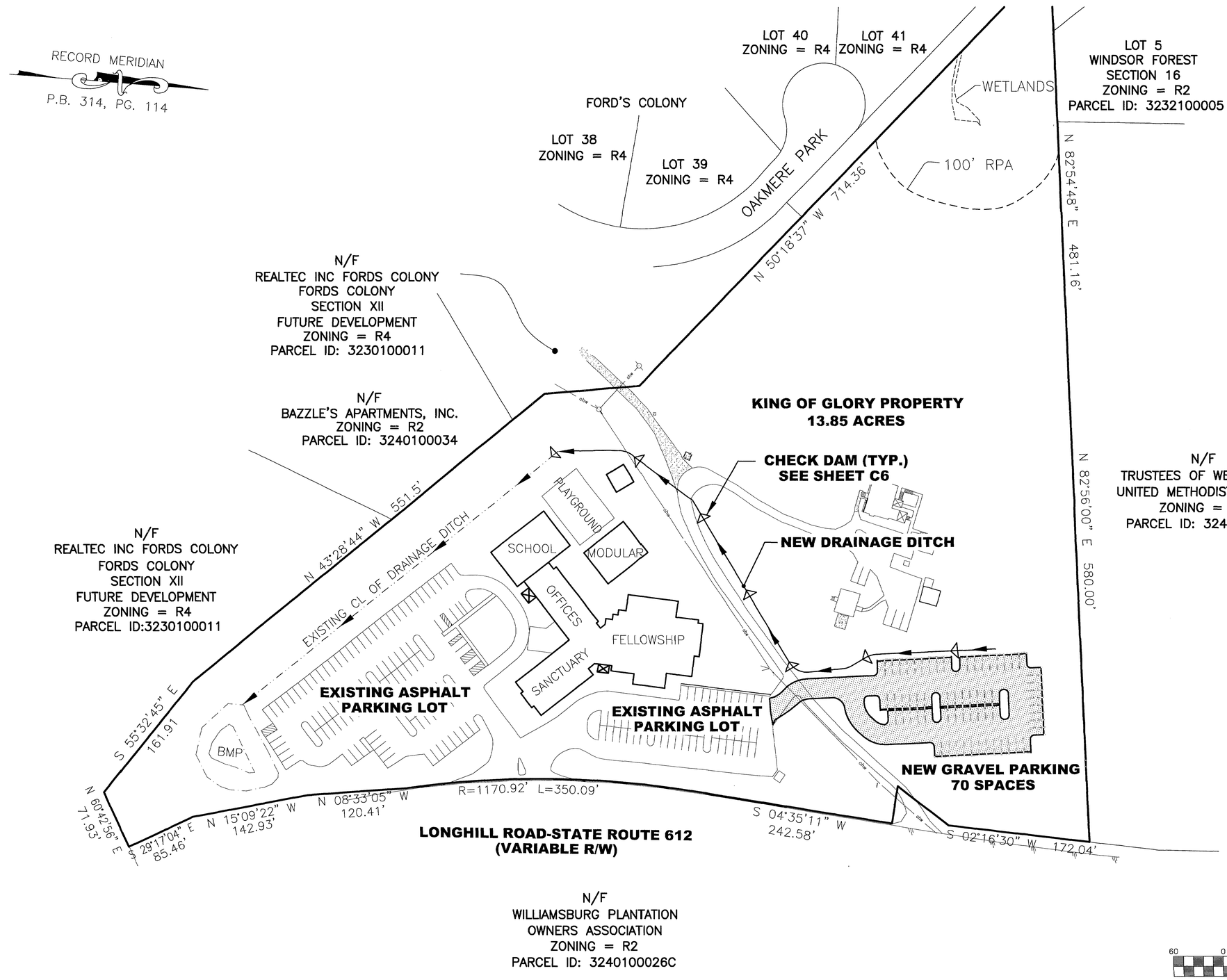
**BEFORE DIGGING CALL "MISS UTILITY" OF VIRGINIA AT 1 - 800 - 552 - 7001**

| NO. | DATE | REVISION / COMMENT / NOTE |
|---|---|---|
| 1 | 10-07-11 | REVISED PER COUNTY COMMENT LETTER DATED 9-21-2011 |
| 2 | 10-28-11 | REVISED PER COUNTY COMMENT LETTER DATED 10-26-2011 |

COMMONWEALTH OF VIRGINIA
MATTHEW H. CONNOLLY
Lic. No. 2005
10-28-2011
PROFESSIONAL LAND SURVEYOR


LandTech Resources, Inc.
Surveying GPS Engineering
205 Bulifants Blvd., Ste. F, Williamsburg, VA 23188
Phone: (757) 565-1677 Fax: (757) 565-0782
web: landtechresources.com


SCALE: 1" = 30'
DATE: 8/19/11
JOB: 11-208
DRAWN BY: KMJ
SHEET: C2 OF 9




# SITE PLAN OF KING OF GLORY
# LUTHERAN CHURCH GRAVEL PARKING LOT EXPANSION

4897 LONGHILL ROAD
OVERALL PLAN

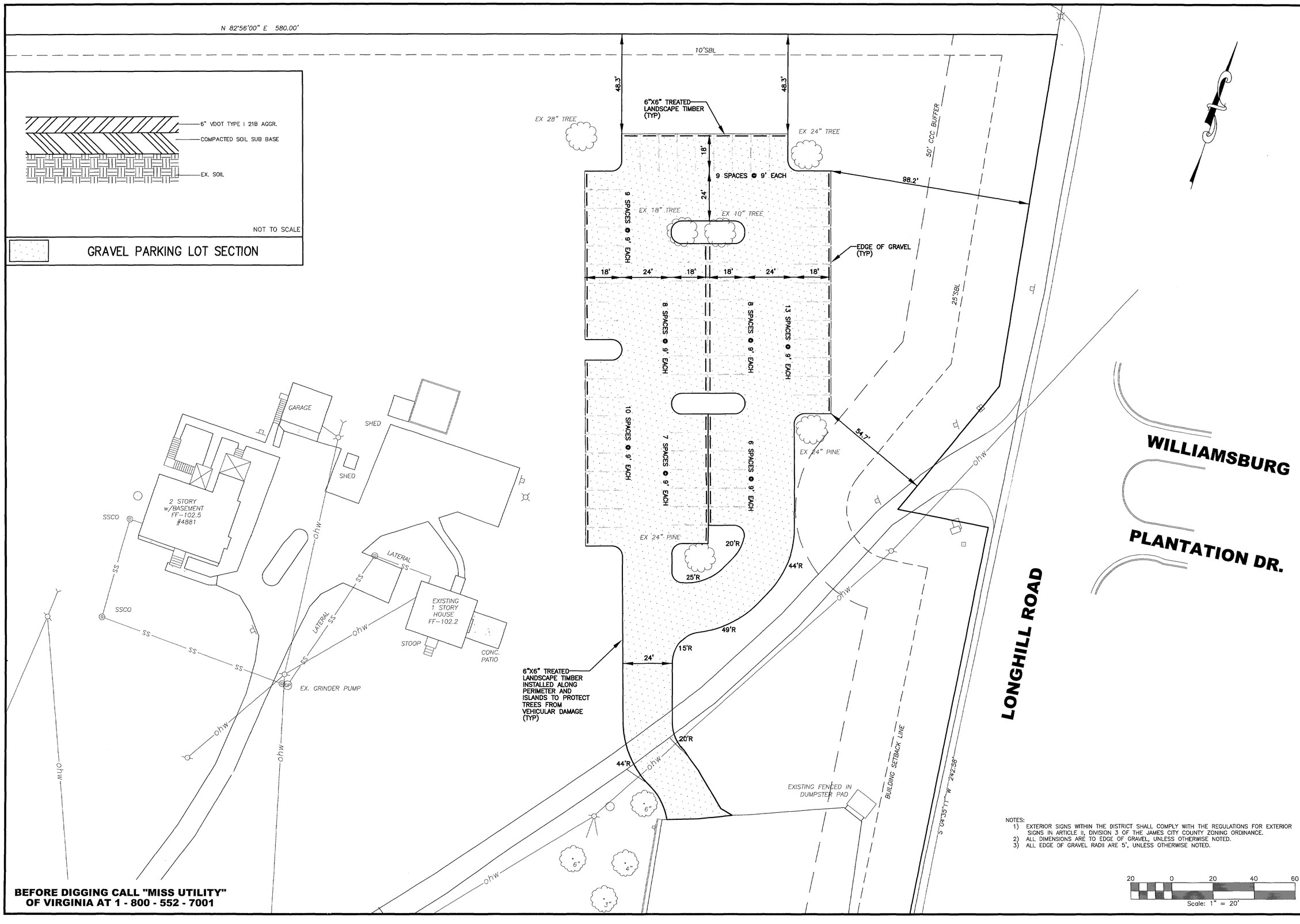
James City County — Virginia

| NO. | DATE | REVISION / COMMENT / NOTE |
|---|---|---|
| 1 | 10/07/2011 | REVISED PER COUNTY COMMENT LETTER DATED 9-21-2011 |
| 1 | 10/28/2011 | REVISED PER COUNTY COMMENT LETTER DATED 10-26-2011 |

COMMONWEALTH OF VIRGINIA
MATTHEW H. CONNOLLY
Lic. No. 2056
10-28-2011
LAND SURVEYOR


LandTech Resources, Inc.
Surveying GPS Engineering
205 Bulifants Blvd., Ste. E, Williamsburg, VA 23188
Phone: (757) 565-1877 Fax: (757) 565-0782
web: landtechresources.com


SCALE: 1" = 60'
DATE: 8/19/11
JOB: 11-208
DRAWN BY: KMJ
SHEET: C3 OF 9




6" VDOT TYPE I 21B AGGR.
COMPACTED SOIL SUB BASE
EX. SOIL
NOT TO SCALE

GRAVEL PARKING LOT SECTION

NOTES:
1) EXTERIOR SIGNS WITHIN THE DISTRICT SHALL COMPLY WITH THE REGULATIONS FOR EXTERIOR SIGNS IN ARTICLE II, DIVISION 3 OF THE JAMES CITY COUNTY ZONING ORDINANCE.
2) ALL DIMENSIONS ARE TO EDGE OF GRAVEL, UNLESS OTHERWISE NOTED.
3) ALL EDGE OF GRAVEL RADII ARE 5', UNLESS OTHERWISE NOTED.

**BEFORE DIGGING CALL "MISS UTILITY" OF VIRGINIA AT 1 - 800 - 552 - 7001**

# SITE PLAN OF KING OF GLORY LUTHERAN CHURCH GRAVEL PARKING LOT EXPANSION

4897 LONGHILL ROAD
LAYOUT PLAN

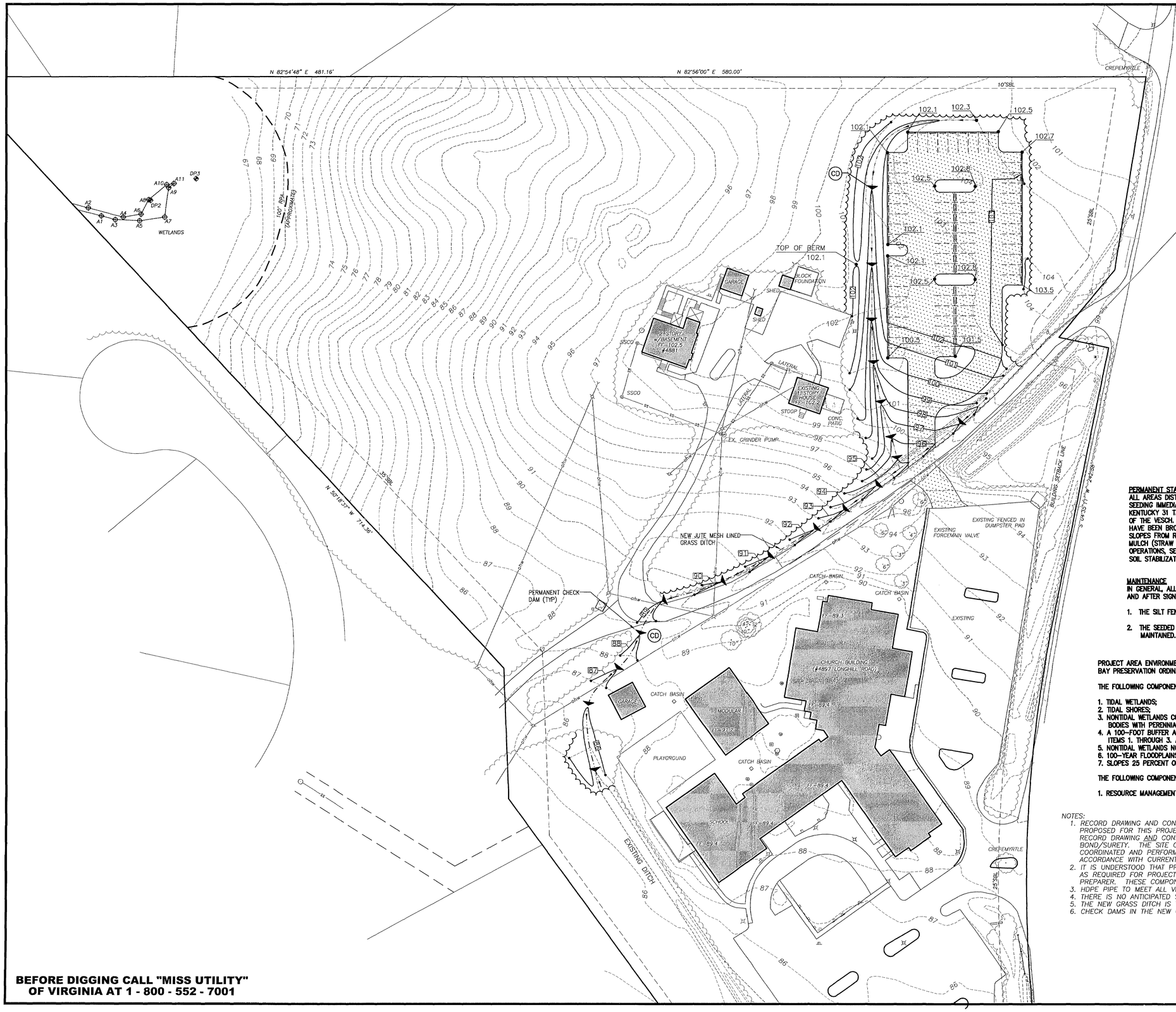
James City County — Virginia

| NO. | DATE | REVISION / COMMENT / NOTE |
|---|---|---|
| 1 | 10/07/11 | REVISED PER COUNTY COMMENT LETTER DATED 9-21-2011 |

COMMONWEALTH OF VIRGINIA
MATTHEW N. CONROY
Lic. No. 2065
10-11-2011
LAND SURVEYOR


LandTech Resources, Inc.
Surveying GPS Engineering
205 Bulifants Blvd., Ste. C Williamsburg, VA 23188
Phone: (757) 565-1877 Fax: (757) 565-0782
web: landtechresources.com


SCALE: 1" = 20'
DATE: 8/19/11
JOB: 11-208
DRAWN BY: KMJ
SHEET: C4 OF 9




## LEGEND

| TITLE | SYMBOL | KEY | NO. |
|---|---|---|---|
| OUTLET PROTECTION | | OP | 3.18 |
| PERMANENT SEEDING | PS | PS | 3.32 |
| SOIL STABILIZATION BLANKETS & MATTING | | B/M | 3.36 |

## PROPOSED SEQUENCE OF CONSTRUCTION

1) CONTACT THE JCC ENVIRONMENTAL DIVISION INSPECTOR 48 HOURS PRIOR TO ARRANGE A PRE-CONSTRUCTION MEETING.
2) INSTALL SILT FENCE, CONSTRUCTION ENTRANCE AND TREE PROTECTION AS DEPICTED ON SHEET C2 & C7 PRIOR TO CLEARING AND GRADING.
3) CLEAR DESIGNATED TREES.
4) GRADE NEW DITCH AND STABILIZE SLOPES WITH JUTE MESH.
5) ROUGH GRADE PARKING LOT. APPLY TOPSOIL AND FINAL STABILIZATION TO ALL DISTURBED AREAS EXCLUDING ASPHALT PARKING LOT.
6) INSTALL STONE BASE TO PARKING LOT.
7) TILL AND REJUVENATE EXISTING BMP BOTTOM.
8) REMOVE ALL TEMPORARY E & S MEASURES ONCE ALL DISTURBED AREAS ASSOCIATED WITH THE PROJECT ARE STABILIZED AND AFTER RECEIVING APPROVAL TO DO SO BY THE JAMES CITY COUNTY ENVIRONMENTAL DIVISION.

**PERMANENT STABILIZATION**

**ALL AREAS DISTURBED BY CONSTRUCTION SHALL BE STABILIZED WITH PERMANENT SEEDING IMMEDIATELY FOLLOWING FINISH GRADING. SEEDING SHALL BE DONE WITH KENTUCKY 31 TALL FESCUE ACCORDING TO STD. & SPEC. 3.32, "PERMANENT SEEDING", OF THE VESCH. EROSION BLANKETS WILL BE INSTALLED OVER FILL SLOPES WHICH HAVE BEEN BROUGHT TO FINAL GRADE AND HAVE BEEN SEEDED TO PROTECT THE SLOPES FROM RILL AND GULLY EROSION TO ALLOW THE SEED TO GERMINATE PROPERLY. MULCH (STRAW OR FIBER) WILL BE USED ON RELATIVELY FLAT AREAS. IN ALL SEEDING OPERATIONS, SEED, FERTILIZER, AND LIME WILL BE APPLIED PRIOR TO MULCHING. SOIL STABILIZATION MATTING TO BE VESCH TYPICAL TREATMENT-1 (JUTE MESH).**

**MAINTENANCE**

**IN GENERAL, ALL EROSION AND SEDIMENT CONTROL MEASURES WILL BE CHECKED DAILY AND AFTER SIGNIFICANT RAINFALL. THE FOLLOWING ITEMS WILL BE CHECKED IN PARTICULAR:**

1. **THE SILT FENCE WILL BE CHECKED REGULARLY FOR SEDIMENT CLEANOUT.**
2. **THE SEEDED AREAS WILL BE CHECKED REGULARLY TO ENSURE THAT A GOOD STAND IS MAINTAINED. AREAS SHOULD BE FERTILIZED AND RESEEDED AS NEEDED.**

**PROJECT AREA ENVIRONMENTAL INVENTORY IN ACCORDANCE WITH SECTION 23-10(2) OF THE CHESAPEAKE BAY PRESERVATION ORDINANCE:**

**THE FOLLOWING COMPONENTS DO NOT APPEAR TO BE PRESENT ONSITE:**

1. **TIDAL WETLANDS;**
2. **TIDAL SHORES;**
3. **NONTIDAL WETLANDS CONNECTED BY SURFACE FLOW AND CONTIGUOUS TO TIDAL WETLANDS OR WATER BODIES WITH PERENNIAL FLOW (i.e. RPA WETLANDS);**
4. **A 100-FOOT BUFFER AREA LOCATED ADJACENT TO AND LANDWARD OF THE COMPONENTS LISTED IN ITEMS 1. THROUGH 3. ABOVE, AND ALONG BOTH SIDES OF ANY WATER BODY WITH PERENNIAL FLOW;**
5. **NONTIDAL WETLANDS NOT INCLUDED IN ITEM 3 (i.e. RMA WETLANDS);**
6. **100-YEAR FLOODPLAINS AS DESINATED BY CHAPTER 24 OF THE COUNTY CODE; AND**
7. **SLOPES 25 PERCENT OR GREATER.**

**THE FOLLOWING COMPONENTS APPEAR TO BE PRESENT ONSITE:**

1. **RESOURCE MANAGEMENT AREAS (ALL AREAS OUTSIDE THE RPA).**

*NOTES:*

1. *RECORD DRAWING AND CONSTRUCTION CERTIFICATION. THE STORMWATER CONVEYANCE SYSTEM PROPOSED FOR THIS PROJECT WILL REQUIRE SUBMISSION, REVIEW, AND APPROVAL OF A RECORD DRAWING AND CONSTRUCTION CERTIFICATION PRIOR TO RELEASE OF THE POSTED BOND/SURETY. THE SITE CONTRACTOR SHALL ENSURE THIS ACTIVITY IS ADEQUATELY COORDINATED AND PERFORMED BEFORE, DURING, AND FOLLOWING CONSTRUCTION IN ACCORDANCE WITH CURRENT COUNTY GUIDELINES.*
2. *IT IS UNDERSTOOD THAT PREPARATION OF RECORD DRAWINGS AND CONSTRUCTION CERTIFICATIONS AS REQUIRED FOR PROJECT FACILITIES MAY NOT NECESSARILY BE PERFORMED BY THE PLAN PREPARER. THESE COMPONENTS MAY BE PERFORMED BY OTHERS.*
3. *HDPE PIPE TO MEET ALL VDOT STANDARDS AND SPECIFICATIONS.*
4. *THERE IS NO ANTICIPATED STOCKPILE AREA ASSOCIATED WITH THIS PROJECT.*
5. *THE NEW GRASS DITCH IS TO BE LINED WITH JUTE MESH.*
6. *CHECK DAMS IN THE NEW GRASS DITCH ARE PERMANENT.*

40 0 40 80 120
Scale: 1" = 40'

**BEFORE DIGGING CALL "MISS UTILITY" OF VIRGINIA AT 1 - 800 - 552 - 7001**

# SITE PLAN OF KING OF GLORY LUTHERAN CHURCH GRAVEL PARKING LOT EXPANSION

4897 LONGHILL ROAD
GRADING PLAN

James City County — Virginia

| NO. | DATE | REVISION / COMMENT / NOTE |
|---|---|---|
| 1 | 10-07-11 | REVISED PER COUNTY COMMENT LETTER DATED 9-21-2011 |
| 2 | 10-28-11 | REVISED PER COUNTY COMMENT LETTER DATED 10-26-2011 |

COMMONWEALTH OF VIRGINIA
MICHAEL K. MOORE
Lic. No. 2205
10-28-2011
LAND SURVEYOR


LandTech Resources, Inc.
Surveying GPS Engineering
205 Bulifants Blvd., Ste. E, Williamsburg, VA 23188
Phone: (757) 565-1677 Fax: (757) 565-0782
web: landtechresources.com


SCALE: 1" = 40'
DATE: 8/19/11
JOB: 11-208
DRAWN BY: KMJ
SHEET: C5 OF 9

# GENERAL
# EROSION AND SEDIMENT CONTROL NOTES

JAMES CITY COUNTY ENVIRONMENTAL DIVISION

REVISED 7/6/01

THE PURPOSE OF THE EROSION CONTROL MEASURES SHOWN ON THESE PLANS SHALL BE TO PRECLUDE THE TRANSPORT OF ALL WATERBORNE SEDIMENTS RESULTING FROM CONSTRUCTION ACTIVITIES FROM ENTERING ONTO ADJACENT PROPERTIES OR STATE WATERS. IF FIELD INSPECTION REVEALS THE INADEQUACY OF THE PLAN TO CONFINE SEDIMENTS TO THE PROJECT SITE ALL APPROPRIATE MODIFICATIONS WILL BE MADE TO CORRECT ANY PLAN DEFICIENCIES. IN ADDITION TO THESE NOTES, ALL PROVISIONS OF THE VIRGINIA EROSION AND SEDIMENT CONTROL REGULATIONS WILL APPLY TO THIS PROJECT.

1. ALL EROSION AND SEDIMENT CONTROL MEASURES SHALL BE INSTALLED AND MAINTAINED IN ACCORDANCE WITH THE VIRGINIA EROSION AND SEDIMENT CONTROL HANDBOOK, 3RD EDITION, 1992. THE CONTRACTOR SHALL BE THOROUGHLY FAMILIAR WITH ALL APPLICABLE MEASURES CONTAINED THEREIN THAT MAY BE PERTINENT TO THIS PROJECT, INCLUDING MINIMUM STANDARDS 1 THROUGH 19. IF THE APPROVED EROSION AND SEDIMENT CONTROL PLAN IS FOUND TO BE INADEQUATE IN THE FIELD, THE MINIMUM STANDARDS WILL APPLY IN ADDITION TO THE PROVISIONS OF THE APPROVED PLAN.

2. AS A PREREQUISITE TO APPROVAL OF AN EROSION AND SEDIMENT CONTROL PLAN FOR LAND ACTIVITIES, THE NAME OF A RESPONSIBLE LAND-DISTURBER SHALL BE PROVIDED. THE RESPONSIBLE LAND-DISTURBER SHALL BE AN INDIVIDUAL WHO HOLDS A VALID CERTIFICATE OF COMPETENCE ISSUED BY THE VIRGINIA DEPARTMENT OF CONSERVATION AND IS DEFINED AS THE PERSON IN CHARGE OF AND RESPONSIBLE FOR CARRYING OUT THE LAND-DISTURBING ACTIVTIY. PERMITS OR PLANS WITHOUT THIS INFORMATION ARE DEEMED INCOMPLETE AND WILL NOT BE APPROVED UNTIL PROPER NOTIFICATION IS RECEIVED. ALSO, IF THE PERSON DESIGNATED AS RESPONSIBLE LAND-DISTURBER CHANGES BETWEEN THE TIME OF PLAN APPROVAL AND THE SCHEDULED PRECONSTRUCTION MEETING, THE ENVIRONMENTAL DIVISION SHALL BE INFORMED OF THE CHANCE, IN WRITING, 24 HOURS IN ADVANCE OF THE RECONSTRUCTION MEETING.

3. A PRECONSTRUCTION MEETING SHALL BE HELD ON-SITE BETWEEN THE COUNTY, THE DEVELOPER, THE PROJECT ENGINEER, THE RESPONSIBLE LAND-DISTURBER AND THE CONTRACTOR PRIOR TO ISSUANCE OF THE LAND DISTURBING PERMIT. THE CONTRACTOR SHALL SUBMIT A SEQUENCE OF CONSTRUCTION TO THE COUNTY FOR APPROVAL PRIOR TO THE PRECONSTRUCTION MEETING. THE DESIGNATED RESPONSIBLE LAND-DISTURBER IS REQUIRED TO ATTEND THE RECONSTRUCTION MEETING FOR THE PROJECT.

4. ALL POINTS OF CONSTRUCTION INGRESS AND EGRESS SHALL BE PROTECTED BY A TEMPORARY CONSTRUCTION ENTRANCE TO PREVENT TRACKING OF MUD ONTO PUBLIC RIGHT-OF-WAY. AN ENTRANCE PERMIT FROM VDOT IS REQUIRED PRIOR TO ANY CONSTRUCTION ACTIVITIES WITHIN STATE RIGHT-OF-WAYS. WHERE SEDIMENT IS TRANSPORTED ONTO A PUBLIC ROAD SURFACE, THE ROAD SHALL BE THOROUGHLY CLEANED AT THE END OF EACH DAY (STD. & SPEC. 3.02).

5. SEDIMENT BASINS AND TRAPS (STD. & SPEC. 3.13 AND 3.14), PERIMETER DIKES (STD. & SPEC. 3.09 AND 3.12), SEDIMENT FILTER BARRIERS (STD. & SPEC. 3.05) AND OTHER MEASURES INTENDED TO TRAP SEDIMENT ON-SITE MUST BE CONSTRUCTED AS A FIRST STEP IN GRADING AND MUST BE MADE FUNCTIONAL PRIOR TO ANY UPSLOPE LAND DISTURBANCE TAKING PLACE. EARTHEN STRUCTURES SUCH AS DAMS, DIKES AND DIVERSIONS MUST BE SEEDED AND MULCHED IMMEDIATELY AFTER INSTALLATION. PERIODIC INSPECTIONS OF THE EROSION CONTROL MEASURES BY THE OWNER OR OWNER'S REPRESENTATIVE SHALL BE MADE TO ASSESS THEIR CONDITIONS. ANY NECESSARY MAINTENANCE OF THE MEASURES SHALL BE ACCOMPLISHED IMMEDIATELY AND SHALL INCLUDE THE REPAIR OF MEASURES DAMAGED BY ANY SUBCONTRACTOR INCLUDING THOSE OF THE PUBLIC UTILITY COMPANIES.

6. SURFACE FLOWS OVER CUT AND FILL SLOPES SHALL BE CONTROLLED BY EITHER REDIRECTING FLOWS FROM TRANSVERSING THE SLOPES OF BY INSTALLING MECHANICAL DEVICES TO SAFELY LOWER WATER DOWNSLOPE WITHOUT CAUSING EROSION. A TEMPORARY FILL DIVERSION (STD. & SPEC. 3.10) AND SLOPE DRAIN (STD. & SPEC. 3.15) SHALL BE INSTALLED PRIOR TO THE END OF EACH WORKING DAY.

7. SEDIMENT CONTROL MEASURES MAY REQUIRE MINOR FIELD ADJUSTMENTS AT TIME OF CONSTRUCTION TO ENSURE THEIR INTENDED PURPOSE IS ACCOMPLISHED. ENVIRONMENTAL DIVISION APPROVAL WILL BE REQUIRED FOR OTHER DEVIATIONS FROM THE APPROVED PLAN.

8. THE CONTRACTOR SHALL PLACE SOIL STOCKPILES AT THE LOCATIONS SHOWN ON THE PLAN. SOIL STOCKPILES SHALL BE STABILIZED OR PROTECTED WITH SEDIMENT TRAPPING MEASURES. OFF-SITE WASTE OR BORROW AREAS SHALL BE APPROVED BY THE ENVIRONMENTAL DIVISION PRIOR TO THE IMPORT OF ANY BORROW OR EXPORT OF ANY WASTE TO OR FROM THE PROJECT SITE.

9. THE CONTRACTOR SHALL COMPLETE DRAINAGE FACILITIES WITHIN 30 DAYS FOLLOWING COMPLETION OF ROUGH GRADING AT ANY POINT WITHIN THE PROJECT. THE INSTALLATION OF DRAINAGE FACILITIES SHALL TAKE PRECEDENCE OVER ALL UNDERGROUND UTILITIES. OUTFALL DITCHES FROM DRAINAGE STRUCTURES SHALL BE STABILIZED IMMEDIATELY AFTER CONSTRUCTION OF THE SAME (STD. & SPEC. 3.18). THIS INCLUDES INSTALLATION OF EROSION CONTROL STONE OR PAVED DITCHES WHERE REQUIRED. ANY DRAINAGE OUTFALLS REQUIRED FOR A STREET MUST BE COMPLETED BEFORE STREET GRADING OR UTILITY INSTALLATION BEGINS.

10. PERMANENT OR TEMPORARY SOIL STABILIZATION SHALL BE APPLIED TO DENUDED AREAS WITHIN SEVEN DAYS AFTER FINAL GRADE IS REACHED ON ANY PORTION OF THE SITE. TEMPORARY SOIL STABILIZATION SHALL BE APPLIED WITHIN SEVEN DAYS TO DENUDED AREAS THAT MAY NOT BE AT FINAL GRADE BUT WILL REMAIN DORMANT FOR LONGER THAN 30 DAYS. PERMANENT STABILIZATION SHALL BE APPLIED TO AREAS THAT ARE TO BE LEFT DORMANT FOR MORE THAN ONE YEAR.

11. NO MORE THAN 300 FEET OF SANITARY SEWER, STORM DRAIN, WATER OR UNDERGROUND UTILITY LINES ARE TO BE OPEN AT ONE TIME. FOLLOWING INSTALLATION OF ANY PORTION OF THESE ITEMS, ALL DISTURBED AREAS ARE TO BE IMMEDIATELY STABILIZED (I.E., THE SAME DAY).

12. IF DISTURBED AREA STABILIZATION IS TO BE ACCOMPLISHED DURING THE MONTHS OF DECEMBER, JANUARY OR FEBRUARY, STABILIZATION SHALL CONSIST OF MULCHING (STD. & SPEC. 3.35). SEEDING WILL THEN TAKE PLACE AS SOON AS THE SEASON PERMITS.

13. THE TERM SEEDING, FINAL VEGETATIVE COVER OR STABILIZATION ON THIS PLAN SHALL MEAN THE SUCCESSFUL GERMINATION AND ESTABLISHMENT OF A STABLE GRASS COVER FROM A PROPERLY PREPARED SEEDBED CONTAINING THE SPECIFIED AMOUNTS OF SEED, LIME AND FERTILIZER (STD. & SPEC. 3.32). IRRIGATION SHALL BE REQUIRED AS NECESSARY TO ENSURE ESTABLISHMENT OF GRASS COVER.

14. ALL SLOPES STEEPER THAN 3H:1V SHALL REQUIRE THE USE OF EROSION CONTROL BLANKETS AND MATTINGS TO AID IN THE ESTABLISHMENT OF A VEGETATIVE COVER. INSTALLATION SHALL BE IN ACCORDANCE WITH STD. & SPEC. 3.35, MULCHING; STD. & SPEC. 3.36, SOIL STABILIZATION BLANKETS; AND MATTING AND MANUFACTURERS INSTRUCTIONS. NO SLOPES SHALL BE CREATED STEEPER THAN 2H:1V.

15. INLET PROTECTION (STD. & SPEC. 3.07 AND 3.08) SHALL BE PROVIDED FOR ALL STORM DRAIN AND CULVERT INLETS FOLLOWING CONSTRUCTION OF THE SAME.

16. TEMPORARY LINERS, SUCH AS POLYETHYLENE SHEETS, SHALL BE PROVIDED FOR ALL PAVED DITCHES UNTIL THE PERMANENT CONCRETE LINER IS INSTALLED.

17. PAVED DITCHES SHALL BE REQUIRED WHEREVER ACCELERATED EROSION IS EVIDENT. PARTICULAR ATTENTION SHALL BE PAID TO THOSE AREAS WHERE GRADES EXCEED 3 PERCENT.

18. TEMPORARY EROSION CONTROL MEASURES SUCH AS SILT FENCE ARE NOT TO BE REMOVED UNTIL ALL DISTURBED AREAS ARE STABILIZED. TRAPPED SEDIMENT SHALL BE SPREAD, SEEDED AND MULCHED. AFTER THE PROJECT AND STABILIZATION ARE COMPLETE, ALL EROSION AND SEDIMENT CONTROL MEASURES SHALL BE REMOVED WITHIN 30 DAYS.

19. NO SEDIMENT TRAP OR SEDIMENT BASIN SHALL BE REMOVED UNTIL A) AT LEAST 75 PERCENT OF THE LOTS WITHIN THE DRAINAGE AREA TO THE TRAP OR BASIN HAVE BEEN SOLD TO A THIRD PARTY (UNRELATED TO THE DEVELOPER) FOR THE CONSTRUCTION OF HOMES AND/OR B) 60 PERCENT OF THE SINGLE FAMILY LOTS WITHIN THE DRAINAGE AREA TO THE TRAP OR BASIN HAVE BEEN COMPLETED AND THE SOIL STABILIZED. A BULK SALE OF THE LOTS TO ANOTHER BUILDER DOES NOT SATISFY THIS PROVISION. SEDIMENT TRAPS AND SEDIMENT BASINS SHALL NOT BE REMOVED WITHOUT THE EXPRESS AUTHORIZATION OF THE JAMES CITY ENVIRONMENTAL DIVISION.

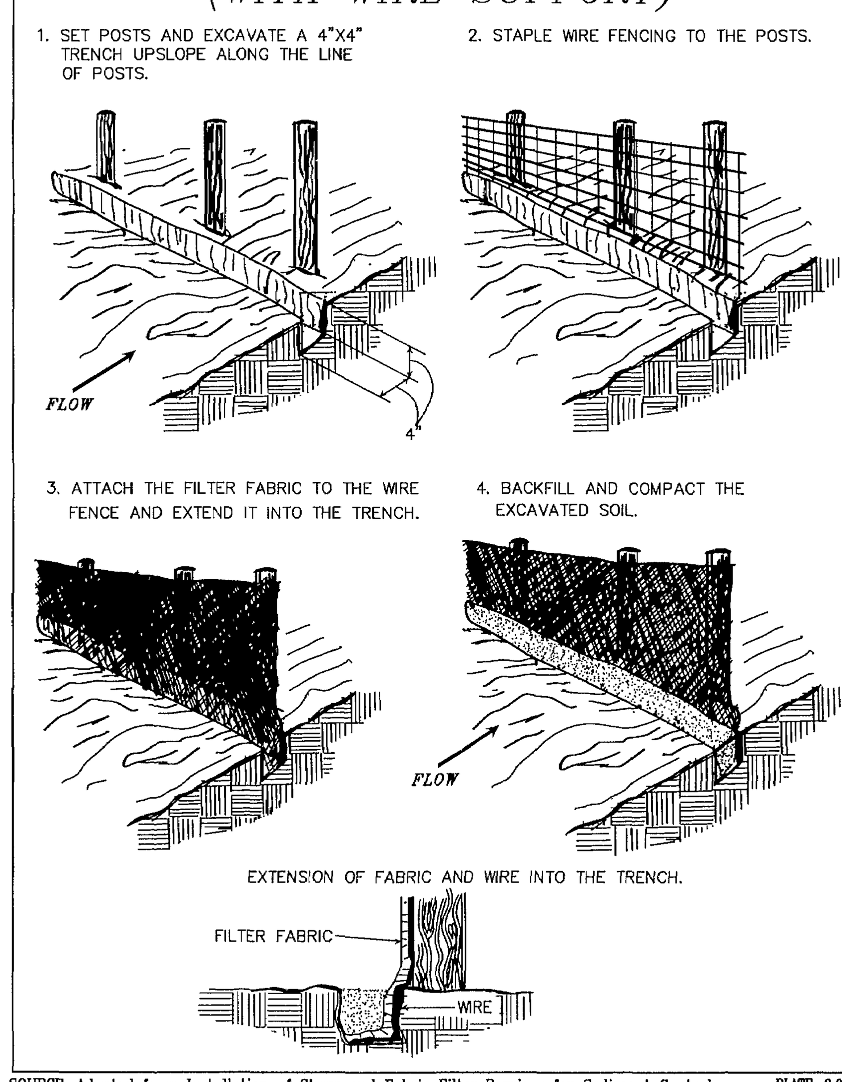
20. RECORD DRAWINGS (AS-BUILTS) AND CONSTRUCTION CERTIFICATIONS ARE BOTH REQUIRED FOR NEWLY CONSTRUCTED OR MODIFIED STORMWATER MANAGEMENT/BMP FACILITIES. CERTIFICATION ACTIVITIES SHALL BE ADEQUATELY COORDINATED AND PERFORMED BEFORE, DURING AND FOLLOWING CONSTRUCTION IN ACCORDANCE WITH THE CURRENT VERSION OF THE JAMES CITY COUNTY ENVIRONMENTAL DIVISION, STORMWATER MANAGEMENT/BMP FACILITIES, RECORD DRAWINGS AND CONSTRUCTION CERTIFICATION, STANDARD FORMS & INSTRUCTIONS.

21. DESIGN AND CONSTRUCTION OF PRIVATE-TYPE SITE DRAINAGE SYSTEMS OUTSIDE VDOT RIGHTS-OF-WAY SHALL BE PERFORMED IN ACCORDANCE WITH THE CURRENT VERSION OF THE JAMES CITY COUNTY ENVIRONMENTAL DIVISION, STORMWATER DRAINAGE CONVEYANCE SYSTEMS, (NON-BMP RELATED), GENERAL DESIGN AND CONSTRUCTION GUIDELINES.

# GENERAL NOTES

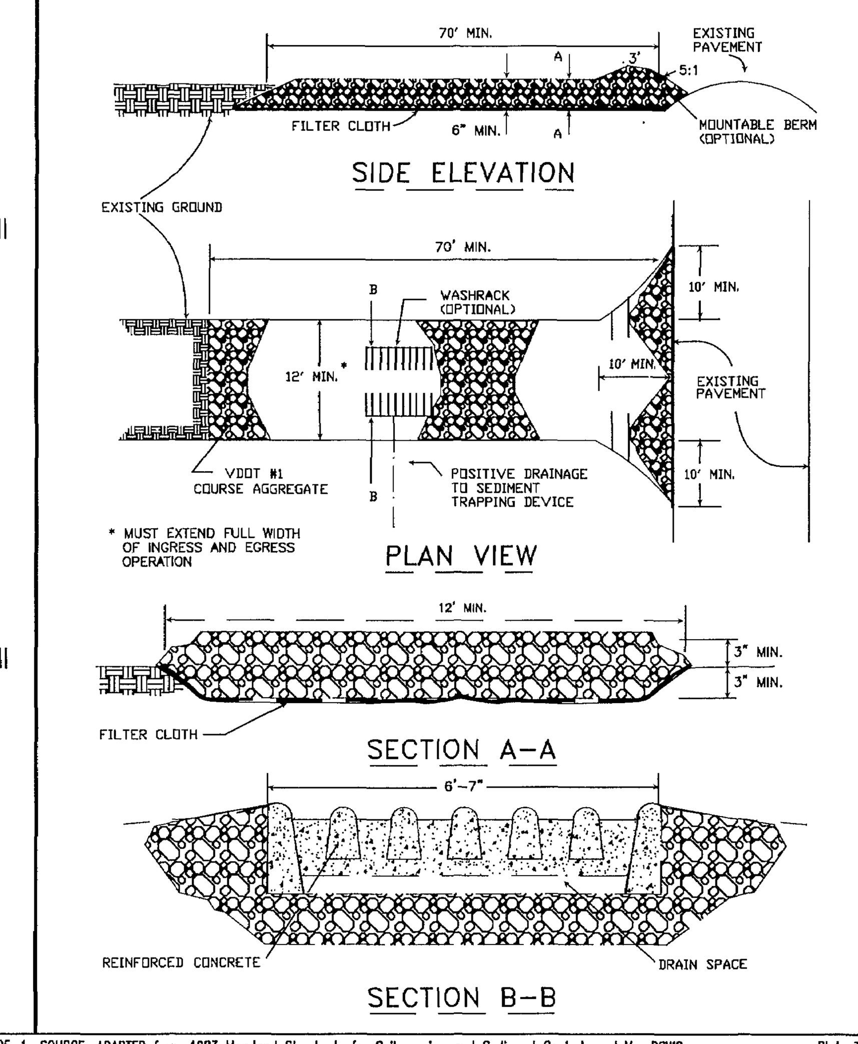
1. ALL CONSTRUCTION SHALL CONFORM TO CURRENT COUNTY AND/OR VDOT STANDARDS AND SPECIFICATIONS UNLESS OTHERWISE SPECIFIED.
2. CONTRACTOR SHALL SECURE THE LATEST EDITION OF THE VIRGINIA EROSION AND SEDIMENT CONTROL HANDBOOK AND COMPLY WITH ALL COUNTY REQUIREMENTS FOR EROSION AND SEDIMENT CONTROL.
3. ALL CUTS, VEGETATION AND DELETERIOUS MATERIAL ENCOUNTERED SHALL BE REMOVED AND DISPOSED OF OFF SITE.
4. SELECT MATERIAL IS REQUIRED FOR FILL AND BACKFILL UNDER PARKING LOT, FOOTINGS, AND STRUCTURES. IT SHALL BE PLACED IN LAYERS NOT TO EXCEED EIGHT INCHES (8") IN THICKNESS AND COMPACTED TO 95% OF MAXIMUM DENSITY AS DETERMINED BY ASTM D-698.
5. ALL CONCRETE SHALL BE CLASS A-3 AIR ENTRAINED (3000 PSI).
6. ALL GREEN AREA, WITHIN LIMITS OF CONSTRUCTION, TO BE TOPSOILED, FERTILIZED, SEEDED, AND MULCHED.
7. CONTRACTOR SHALL OBTAIN AT HIS OWN EXPENSE, ANY PERMIT OR BOND IF REQUIRED BY ANY GOVERNMENT AGENCY.
8. CONTRACTOR SHALL BE RESPONSIBLE FOR LOCATING, PROTECTING, AND RESOLVING ANY CONFLICTS WITH EXISTING UTILITIES AND SHALL REPAIR, AT HIS OWN EXPENSE, ALL UTILITIES TO BE RELOCATED OR DAMAGED BY CONSTRUCTION.
9. ANY ERRORS OR DISCREPANCIES SHALL BE REPORTED TO THE ARCHITECT/ENGINEER OR THE SURVEYOR BEFORE PROCEEDING WITH THE WORK.
10. DEWATERING OR EXCAVATION, IF NEEDED, IS PART OF THIS CONTRACT.
11. BEFORE DIGGING CALL "MISS UTILITY" OF VIRGINIA 1-800-552-7001.
12. CONTRACTOR SHALL OBTAIN PERMITS FROM THE STATE HIGHWAY DEPARTMENT PRIOR TO ANY WORK IN THE STATE'S RIGHT-OF-WAY. THE CONTRACTOR SHALL RESTORE AND CLEAN UP THE SITE TO THE SATISFACTION OF THE HIGHWAY DEPARTMENT.
13. CONTRACTOR MUST OBTAIN ALL NECESSARY BUILDING PERMITS PRIOR TO CONSTRUCTION.

## CONSTRUCTION OF A SILT FENCE (WITH WIRE SUPPORT)




SOURCE: Adapted from Installation of Straw and Fabric Filter Barriers for Sediment Control, Sherwood & Wyant PLATE. 3.05-1

## STONE CONSTRUCTION ENTRANCE




SOURCE: ADAPTED from 1983 Maryland Standards for Soil erosion and Sediment Control, and Va. DSWC Plate 3.02-1

**TABLE 3.32-D**
**SITE SPECIFIC SEDDING MIXTURES FOR COASTAL PLAIN AREA**

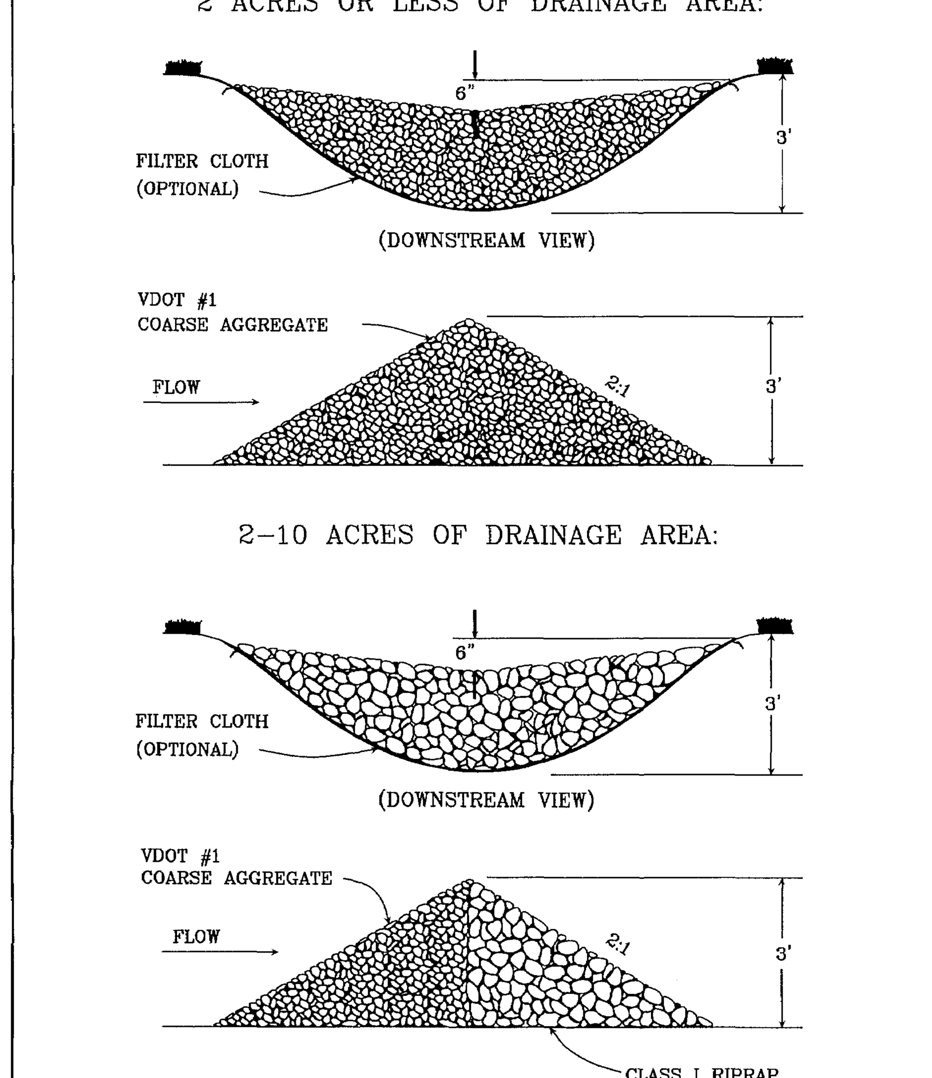
| | TOTAL LBS. PER ACRE |
|---|---|
| MINIMUM CARE LAWN | |
| – COMMERCIAL OR RESIDENTIAL | |
| – KENTUCKY 31 OR TURF-TYPE TALL FESCUE | 125–200 LBS. |
| OR | |
| – COMMON BERMUDAGRASS ** | 75 LBS. |
| HIGH-MAINTENANCE LAWN | |
| – KENTUCKY 31 OR TURF-TYPE TALL FESCUE | |
| OR | |
| – HYBRID BERMUDAGRASS (SEED) ** | 40 LBS. (UNHULLED) 30 LBS. (HALLED) |
| OR | |
| – HYBRID BERMUDAGRASS ( BY OTHER VEGETATIVE ESTABLISHMENT METHOD, SEE STD. & SPEC. 3.34) | |
| GENERAL SLOPE (3:1 OR LESS) | |
| – KENTUCKY 31 FESCUE | 128 LBS. |
| – RED TOP GRASS | 2 LBS. |
| – SEASONAL NURSE CROP * | 20 LBS. |
| | 150 LBS. |
| LOW MAINTENANCE SLOPE (STEEPER THAN 3:1) | |
| – KENTUCKY 31 TALL FESCUE | 93–108 LBS. |
| – COMMON BERMUDAGRASS ** | 0–15 LBS. |
| – RED TOP GRASS | 2 LBS. |
| – SEASONAL NURSE CROP * | 20 LBS. |
| – SERICEA LESPEDEZA ** | 20 LBS. |
| | 150 LBS. |

* USE SEASONAL NURSE CROP IN ACCORDANCE WITH SEEDING DATES AS STATED BELOW:

| | |
|---|---|
| FEBRUARY, MARCH THROUGH APRIL | ANNUAL RYE |
| MAY 1ST THROUGH AUGUST | FOXTAIL MILLET |
| SEPTEMBER, OCTOBER THROUGH NOVEMBER 15TH | ANNUAL RYE |
| NOVEMBER 16TH THROUGH JANUARY | WINTER RYE |

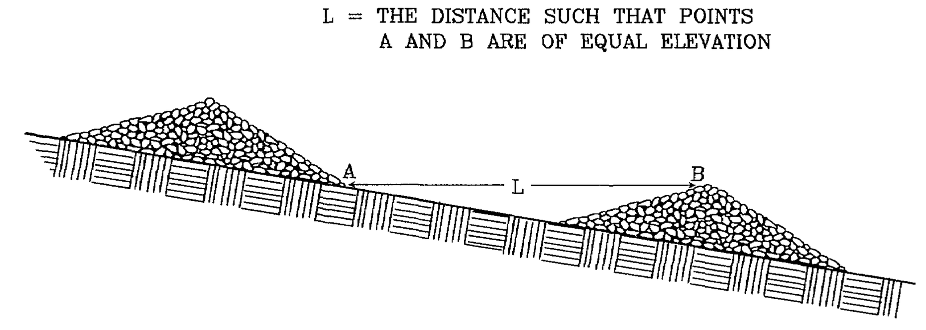
** MAY THROUGH OCTOBER, USE HULLED SEED. ALL OTHER SEEDING PERIODS, USE UNHULLED SEED. WEEPING LOVEGRASS MAY BE ADDED TO ANY SLOPE OR LOW-MAINTENANCE MIX DURING WARM SEEDING PERIODS; ADD 10–20 LBS./ACRE IN MIXES.

## ROCK CHECK DAM

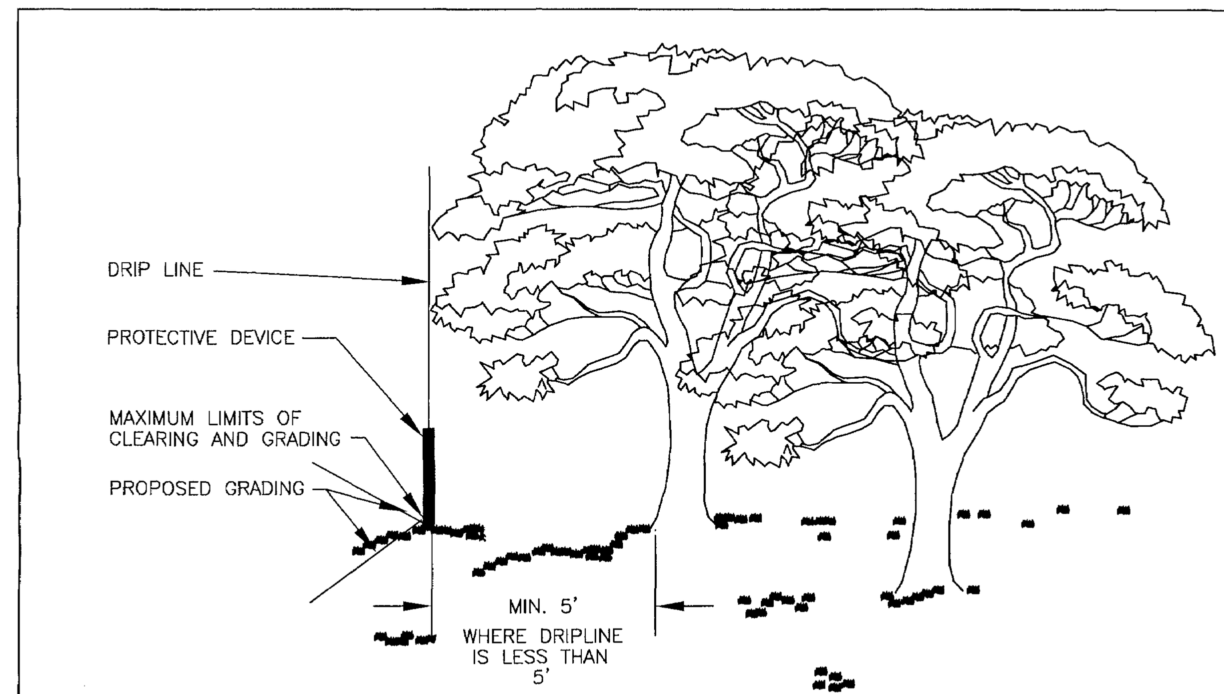



SOURCE: VA. DSWC PLATE. 3.20-1

## SPACING BETWEEN CHECK DAMS



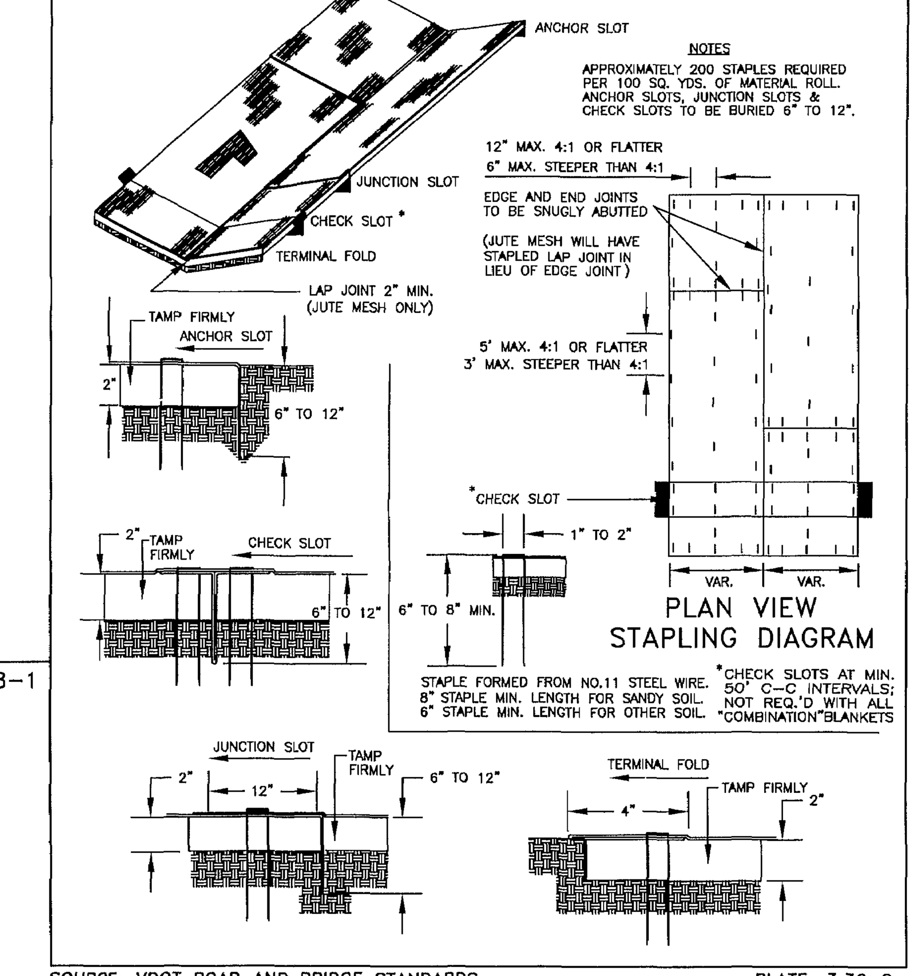

SOURCE: VA. DSWC PLATE. 3.20-2



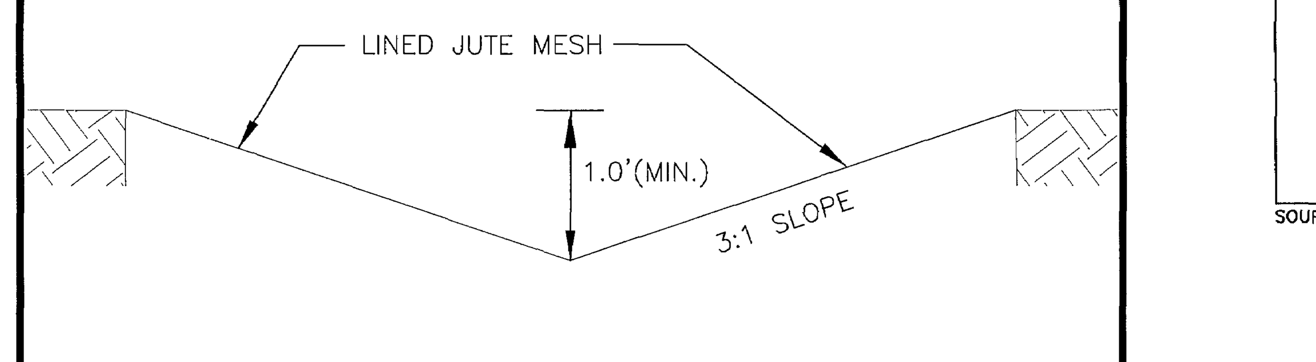

CONSTRUCTION OPERATIONS RELATIVE TO THE LOCATION OF PROTECTED TREES

Source: Public Facilities Manual, Vol. III, Fairfax Co., Va., 1976 Plate 3.38-1

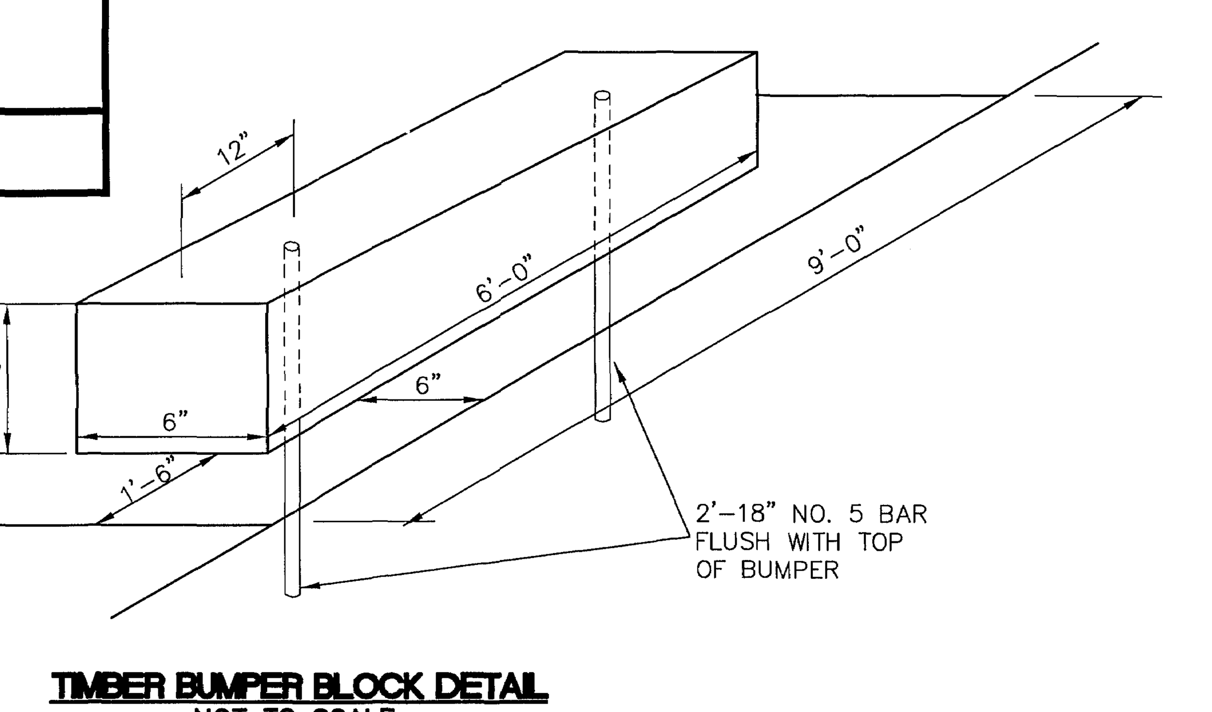
## TYPICAL TREATMENT – 1 (SOIL STABILIZATION BLANKET) INSTALLATION CRITERIA




SOURCE: VDOT ROAD AND BRIDGE STANDARDS PLATE: 3.36-2




NEW GRASS DITCH DETAIL (N.T.S.)




**TIMBER BUMPER BLOCK DETAIL**
NOT TO SCALE

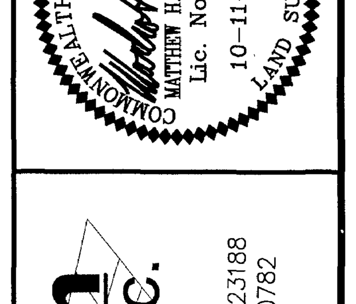
# SITE PLAN OF KING OF GLORY LUTHERAN CHURCH GRAVEL PARKING LOT EXPANSION

4897 LONGHILL ROAD

DETAIL SHEET

James City County Virginia

| NO. | DATE | REVISION / COMMENT / NOTE |
|---|---|---|
| 1 | 10-07-11 | REVISED PER COUNTY COMMENT LETTER DATED 9-21-2011 |





LandTech Resources, Inc.
Surveying • Engineering • GPS
205 Bulifants Blvd., Ste E, Williamsburg, VA 23188
Phone: (757) 565-1677 Fax: (757) 565-0782
web: landtechresources.com

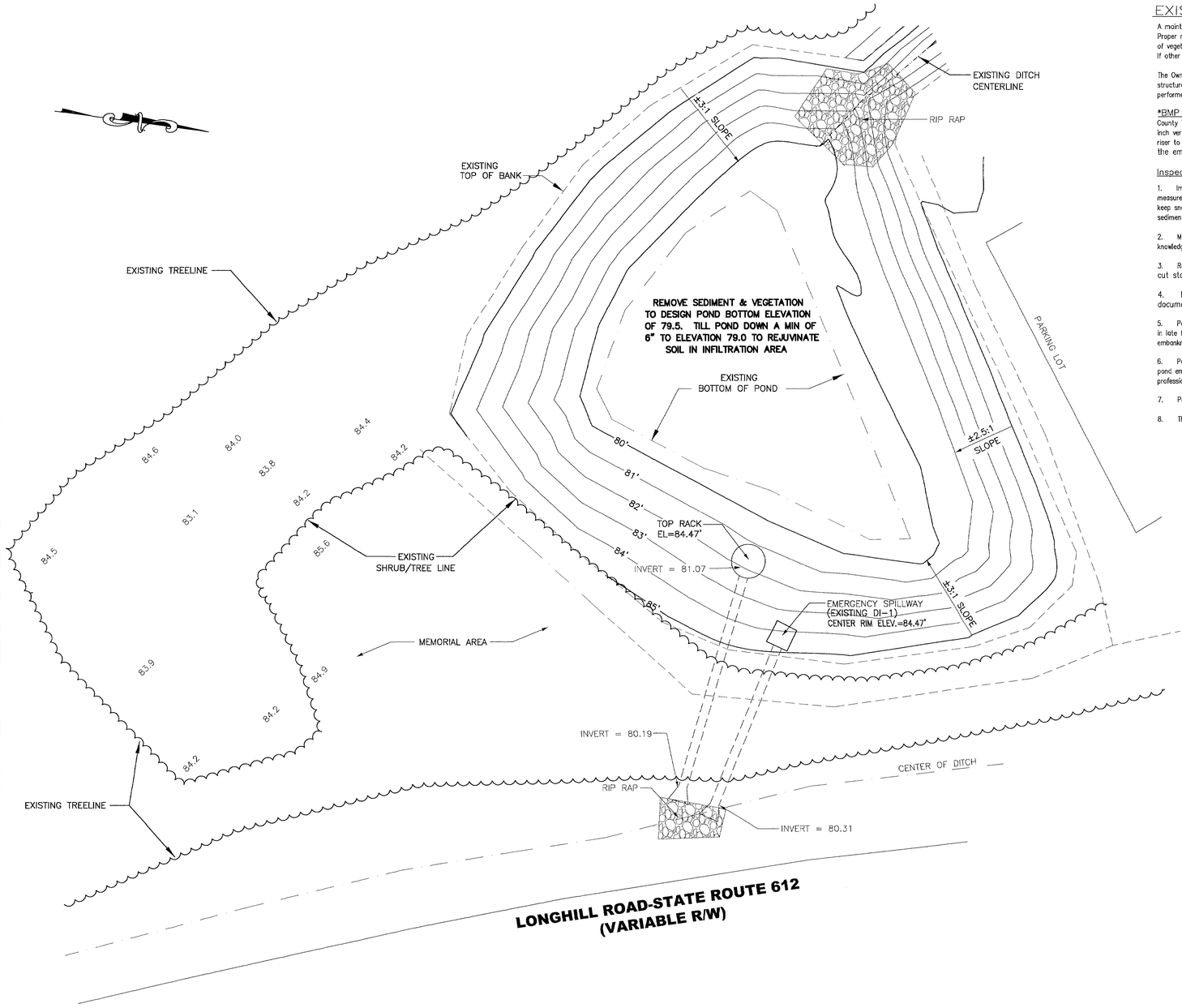

SCALE: 1" = 20'

DATE: 8/19/11

JOB: 11-208

DRAWN BY: KMJ

SHEET: C6 OF 9




## EXISTING BMP MAINTENANCE PLAN

A maintenance program is required to ensure the Stormwater Management/Best Management Practice (BMP) infiltration facility functions as designed and to provide for reasonable aesthetic conditions. Proper maintenance is encouraged to prevent the introduction of debris and sediment into pretreatment areas, the BMP infiltration area and downstream waterways. Following installation and establishment of vegetation in disturbed site areas, inspections for sediment buildups will be performed at least quarterly. It is anticipated that under normal conditions, sediment removal will be required once per year. If other construction or related land-disturbing activities are performed upslope of the BMP, adequate protection measures shall be implemented with inspections performed at least once weekly.

The Owner or its designated representative will inspect the SWM/BMP structure after each significant rainfall event or following working day if a weekend or holiday occurs. A significant rainfall for this structure is defined as one (1) inch or more of gauged rainfall within a 24 hour period. Once per year (more or less) a representative of the County may jointly inspect the structure. Appropriate action, performed at the cost of the owner will be taken to ensure appropriate maintenance. Keys to locked access points or structures shall be made available to the County upon request.

*BMP Description: This infiltration BMP serves a drainage area of +/- 6.48 acres associated with the King of Glory Lutheran Church site. The facility is a 8 point Infiltration Basin, County Type "C-3" BMP which treats a minimum of 0.5 inches of runoff for the contributing impervious drainage area. Principal structures associated with the BMP consist of a 30 inch vertical RCP riser, 18 inch HDPE outlet barrel and an existing VDOT DI-1 structure with a grate-on-slope which is utilized as the emergency overflow spillway. There is a 9 inch opening in the riser to provide for water quantity drawdown. During the 100-year storm, the maximum water level should rise to about 1 feet below the top of dam. During a storm event larger than the 100-year, the emergency spillway, which is the existing DI-1 on the side slope, will discharge flow.

Inspection and maintenance of the BMP facility will consist of the following additional measures:

1. Immediately remove trash, debris or sediment that prevents the movement of water and to maintain the integrity of the structure and provide for an attractive appearance. Property maintenance measures including the removal of trash, litter and sediment from surrounding grass, parking and stabilized contributing areas should be performed weekly to prevent migration into the BMP. During winter keep snow removal materials such as sand, salt or cinders away from the infiltration area to the greatest extent possible. Trash and litter collection is encouraged daily around the BMP. Dispose of sediments removed from the facility at an acceptable disposal area.

2. Many factors will affect the operation of an infiltration system. Routine inspections and maintenance should be performed by the same assigned individual in order to establish a baseline knowledge of how the system functions under different site and weather conditions.

3. Routinely inspect vegetated filter strips adjacent to the facility. A healthy stand of grass should be maintained at all times. Mow the filter strips with lawnmowers at high setting to achieve a cut stand of grass 4 inches or higher. Grass clippings shall be bagged as mowing progresses so cuttings will not plug the filter bottom.

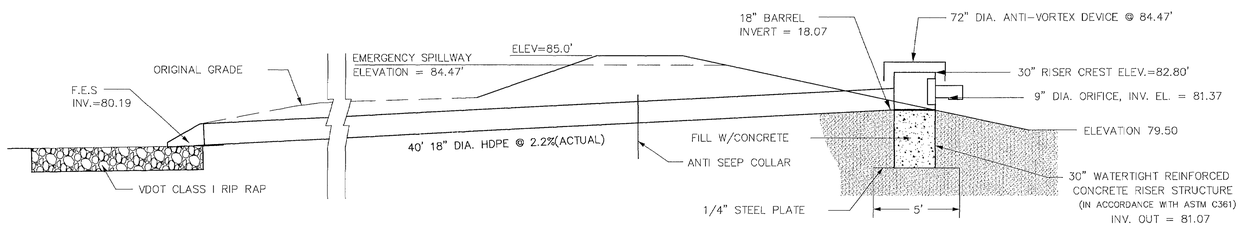
4. Record Keeping. The owner or designated representative shall keep reasonable, accurate written records of inspections performed for the structure. Records shall document routine maintenance and/or repairs performed. Copies shall be provided to the County upon request.

5. Perform maintenance mowing of pond grasses at least twice each year. Grasses such as tall fescue should be mowed in early summer after emergence of the heads on cool season grasses and in late fall to prevent seeds of annual weeds from maturing. Mowing of legumes can be less frequent. Trees, shrubs and woody vegetation are not permitted to grow along or on any part of the embankment that was constructed using engineered (compacted) fills.

6. Perform yearly structural inspections of the facility for damage. Structural inspection shall be performed on the concrete riser, anti-vortex device, trash rack, orifices/weirs, outlet barrel and pond embankment. Exposed metal surfaces shall be repainted or re-galvanized to minimize rust damage or replace if rust damage is irreversible. If damage is evident, further investigation by a professional engineer may be required to assess the integrity of the structure.

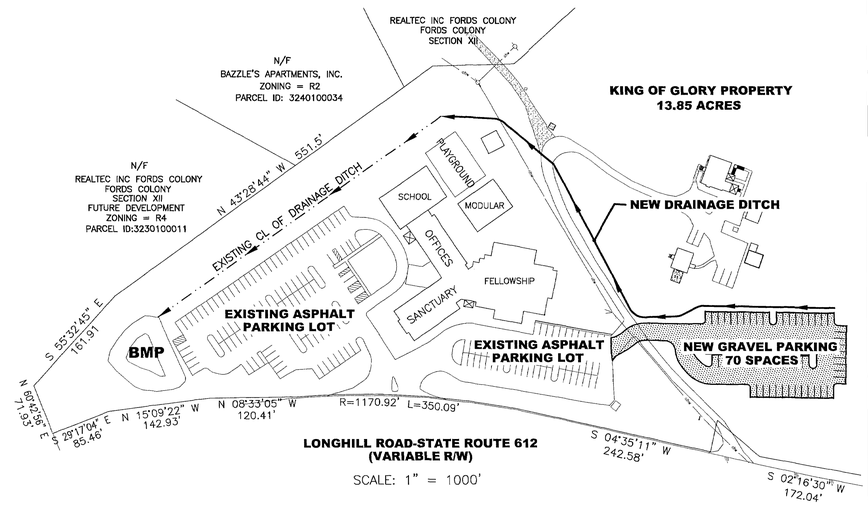
7. Perform quarterly inspections of the graded side slopes of the facility for signs of animal/rodent burrows or slope erosion. Immediately perform necessary repairs, refilling or reseeding.

8. The facility shall not accept additional drainage or be modified in any way without prior consent or approval by the Environmental Division of James City County.




EXISTING BMP OUTLET STRUCTURES

NTS




# SITE PLAN OF KING OF GLORY LUTHERAN CHURCH GRAVEL PARKING LOT EXPANSION

4897 LONGHILL ROAD

POND DETAIL SHEET

James City County — Virginia

| NO. | DATE | REVISION / COMMENT / NOTE |
|---|---|---|
| 1 | 10-07-11 | REVISED PER COUNTY COMMENT LETTER DATED 9-21-2011 |
| 2 | 10-28-11 | REVISED PER COUNTY COMMENT LETTER DATED 10-26-2011 |

COMMONWEALTH OF VIRGINIA — MATTHEW H. CONWAY — Lic. No. 2052 — 10-28-2011 — LAND SURVEYOR


LandTech Resources, Inc.
Surveying • Engineering • GPS
205 Bulifants Blvd., Ste E, Williamsburg, VA 23188
Phone: (757) 565-1677 Fax: (757) 565-0782
web: landtechresources.com

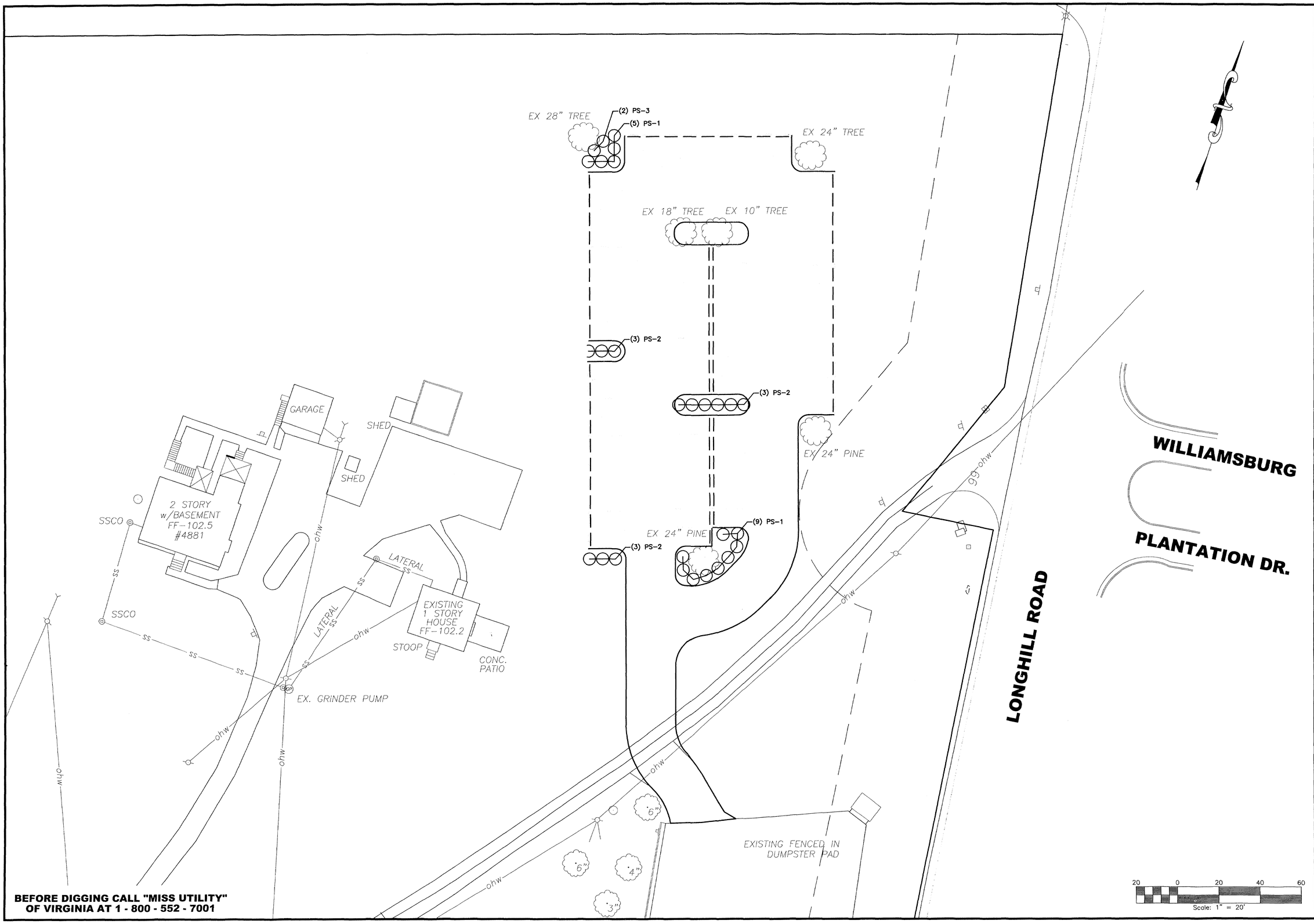

SCALE: 1" = 10'

DATE: 8/19/11

JOB: 11-208

DRAWN BY: KMJ

SHEET: C7 OF 9




**BEFORE DIGGING CALL "MISS UTILITY" OF VIRGINIA AT 1 - 800 - 552 - 7001**

# SITE PLAN OF KING OF GLORY LUTHERAN CHURCH GRAVEL PARKING LOT EXPANSION

4897 LONGHILL ROAD
LANDSCAPE PLAN

James City County Virginia

| NO. | DATE | REVISION / COMMENT / NOTE |
|---|---|---|
| | | |

COMMONWEALTH OF VIRGINIA
MARY K. HUCHAS
Cert. No. 000450
5-31-11
LANDSCAPE ARCHITECT


LandTech Resources, Inc.
Surveying GPS Engineering
205 Bulifants Blvd., Ste. F, Williamsburg, VA 23188
Phone: (757) 565-1677 Fax: (757) 565-0782
web: landtechresources.com


SCALE: 1" = 20'
DATE: 8/19/11
JOB: 11-208
DRAWN BY: KMJ
SHEET: L1 OF 9

| LANDSCAPE CALCULATIONS | | |
|---|---|---|
| **PARKING LOT** | | |
| 70 PROPOSED PARKING SPACES | | |
| **REQUIRED LANDSCAPING:** | | |
| (1)TREE AND (2) SHRUBS PER | | |
| 5 PARKING SPACES IN THE PARKING LOT | | |
| **TOTAL TREES REQUIRED:** | **14** | |
| **TOTAL SHRUBS REQUIRED:** | **28** | |
| **TOTAL EXISTING TREES RETAINED:** | **TREE CREDITS** | **TYPE** |
| (1) 28" EXISTING TREE (SPECIMEN) | 3 | DECIDUOUS |
| (1) 24" EXISTING TREE(SPECIMEN) | 3 | DECIDUOUS |
| (1) 24" EXISTING PINE(SPECIMEN) | 3 | EVERGREEN |
| (1) 24" EXISTING PINE (SPECIMEN) | 3 | EVERGREEN |
| (1) 18" EXISTING TREE (MATURE) | 2 | DECIDUOUS |
| (1) 10" EXISTING TREE(MATURE) | 2 | DECIDUOUS |
| **TOTAL EXISTING TREE CREDITS PROVIDED:** | **16** | |
| **TOTAL PROPOSED SHRUBS PROVIDED:** | **28** | |

| PLANT SCHEDULE | | | | |
|---|---|---|---|---|
| **PARKING LOT** | | | | |
| **ABBREV.** | **QUANTITY** | **BOTANICAL NAME** | **COMMON NAME** | **SIZE** |
| **SHRUBS** | | | | |
| PS-1 | 14 | Juniperus horizontalis 'Youngstown' | Andorra Compact Juniper | 18"-24" CONTAINER OR B & B |
| PS-2 | 12 | Juniperus chinenis 'Sargentii' | Sargent Juniper | 18"-24" CONTAINER OR B & B |
| PS-3 | 2 | Ilex glabra 'Shamrock' | Shamrock Inkberry Holly | 18"-24" CONTAINER OR B & B |

## GENERAL PLANTING NOTES

1. THE LANDSCAPE CONTRACTOR AND OWNER ARE RESPONSIBLE FOR ADHERENCE TO ALL REQUIREMENTS OF THE JAMES CITY COUNTY ZONING ORDINANCE.
2. THE LANDSCAPE CONTRACTOR AND OWNER ARE RESPONSIBLE FOR COORDINATING THE ACCURATE LOCATION AND MARKING OF ALL PRIVATE AND PUBLIC UNDERGROUND UTILITIES PRIOR TO THE COMMENCEMENT OF ANY LAND DISTURBANCE WITHIN THE PROJECT LIMITS.
3. SEE PLANT SCHEDULES FOR SPECIFIC PROPOSED PLANT SPECIES. IF THERE IS A DISCREPANCY BETWEEN THE LANDSCAPE PLAN VIEW AND THE PLANT SCHEDULE, THE PLANT SCHEDULE INFORMATION GOVERNS.
4. LANDSCAPE CONTRACTOR SHALL REFER TO THE STANDARDIZED LANDSCAPE SPECIFICATIONS FOR THE STATE OF VIRGINIA, LATEST EDITION, FOR ADDITIONAL SPECIFICATIONS PERTAINING TO PLANTING. SPECIFICATIONS SHOWN ON THESE PLANS SHALL SUPERSEDE THOSE DETAILED WITH THE ABOVE-REFERENCED SPECIFICATIONS MANUAL. (COPIES OF THESE SPECIFICATIONS ARE AVAILABLE FOR A FEE FROM THE VIRGINIA CHAPTER OF THE AMERICAN SOCIETY OF LANDSCAPE ARCHITECTS, VIRGINIA NURSERYMEN'S ASSOCIATION, INC., OR THE VIRGINIA SOCIETY OF LANDSCAPE DESIGNERS.
5. LANDSCAPE CONTRACTOR SHALL PROVIDE COPIES OF THE LANDSCAPE BID(S) TO THE ENGINEER AND THE LANDSCAPE ARCHITECT PRIOR TO THE COMMENCEMENT OF CONSTRUCTION.
6. REFER TO CIVIL DRAWINGS FOR ALL DETAILED SITE INFORMATION.
7. LANDSCAPE CONTRACTOR SHALL COORDINATE LANDSCAPE WORK WITH ALL OTHER TRADES.
8. ROUGH GRADING SHALL BE COMPLETED BY THE GENERAL SITE CONTRACTOR. THE LANDSCAPE CONTRACTOR SHALL COMPLETE THE FINE GRADING AND SITE STABILIZATION.
9. LANDSCAPE CONTRACTOR SHALL COORDINATE WITH THE OWNER IN ORDER TO CONFIRM THE TYPE OF SEED OR SOD TO BE PROVIDED AND INSTALLED WITHIN ALL DISTURBED AREAS WITHIN THE PROJECT LIMITS.
10. MINOR FIELD ADJUSTMENTS MAY BE NECESSARY DUE TO EXISTING SITE CONDITIONS AND/OR PROPOSED SITE IMPROVEMENTS. LANDSCAPE CONTRACTOR SHALL NOTIFY JAMES CITY COUNTY, THE ENGINEER AND THE LANDSCAPE ARCHITECT FOR REVIEW AND APPROVAL PRIOR TO COMPLETING MINOR FIELD ADJUSTMENTS.
11. OWNER RESERVES THE RIGHT TO SUBSTITUTE PLANT MATERIAL TYPE, SIZE AND/OR QUANTITY. ALL PROPOSED SUBSTITUTIONS SHALL MEET ALL APPLICABLE JAMES CITY COUNTY ZONING ORDINANCE REQUIREMENTS. ALL PROPOSED SUBSTITUTIONS SHALL BE REVIEWED AND APPROVED BY THE ENGINEER, LANDSCAPE ARCHITECT, AND JAMES CITY COUNTY PRIOR TO INSTALLATION. SUBSEQUENTLY, THE ENGINEER OR LANDSCAPE ARCHITECT WILL NOTIFY JAMES CITY COUNTY REGARDING THE PROPOSED PLANT MATERIAL SUBSTITUTIONS.
12. PROPOSED PLANT MATERIAL MAY BE PLANTED AS LONG AS THE SOIL IS NOT FROZEN.
13. ALL PLANT MATERIAL SHALL BE FREE OF DISEASE OR INSECT INFESTATION.
14. PLANT MATERIAL SHALL BE KEPT MOIST AT ALL TIMES, COVERED DURING TRANSPORT TO THE SITE, AND STORED ON-SITE IN A PROTECTED, SHADED AREA UNTIL PLANTING IS COMPLETED.
15. PLANT MATERIAL SHALL BE INSTALLED WITHIN AN EXCAVATED PLANTING PIT, WITH A WIDTH APPROXIMATELY TWO (2) TO THREE (3) TIMES THE PLANT MATERIAL BALL DIAMETER. BACKFILL SHALL BE NATIVE PLANTING SOIL, FREE OF DEBRIS, WEEDS, ROCKS, ETC. A 6 INCH EARTH SAUCER (COMPACTED) SHALL BE INSTALLED ENCIRCLING THE COMPLETED PLANTING. MULCH SHRUBS AND TREES WITH A 4 INCH DEPTH OF SHREDDED HARDWOOD BARK MULCH COMPLETELY ENCIRCLING THE PLANTING PIT WITHIN THE EARTH SAUCER. TREES SHALL BE STAKED WITH A MINIMUM OF TWO (2) WOODEN STAKES (2" X 2" X 8') INSTALLED WITH A DEPTH OF 3 FEET BELOW FINISHED GRADE. GUY WIRE SHALL BE EITHER HIGH QUALITY BRAIDED RUBBER GUY WIRES OR GALVANIZED WIRE ATTACHED TO THE WOODEN STAKES WITH TWO (2) BLACK NYLON STRAPS ENCIRCLING THE TREE TRUNK.
16. LANDSCAPE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL WATERING AND MAINTENCE OF INSTALLED PLANT MATERIAL UNTIL THE FINAL REVIEW AND ACCEPTANCE OF THE INSTALLED PLANT MATERIAL BY THE OWNER.
17. LANDSCAPE CONTRACTOR SHALL PROVIDE THE OWNER WITH A ONE (1) YEAR SURVIVAL WARRANTY FOR ALL PROPOSED PLANT MATERIAL INSTALLED. THE ONE (1) YEAR SURVIVAL WARRANTY SHALL COMMENCE AFTER THE FINAL REVIEW AND ACCEPTANCE OF THE INSTALLED PLANT MATERIAL BY THE OWNER. THE OWNER IS RESPONSIBLE FOR THE PERPETUAL MAINTENANCE OF ALL LANDSCAPING FEATURES.
18. LANDSCAPE CONTRACTOR SHALL NOT BE RESPONSIBLE FOR THE LOSS OF PLANT MATERIAL THAT HAS BEEN DAMAGED BY VANDALISM, FIRE, OR OTHER ACTIVITIES BEYOND THE LANDSCAPE CONTRACTOR'S CONTROL.
19. THE OWNER IS RESPONSIBLE FOR THE PERPETUAL MAINTENANCE OF ALL LANDSCAPING WITHIN THE PROJECT LIMITS IN ACCORDANCE WITH THE REQUIREMENTS OF THE JAMES CITY COUNTY ZONING ORDINANCE.

# SITE PLAN OF KING OF GLORY LUTHERAN CHURCH GRAVEL PARKING LOT EXPANSION

4897 LONGHILL ROAD

LANDSCAPE NOTES

James City County Virginia

| NO. | DATE | REVISION / COMMENT / NOTE |
|---|---|---|

COMMONWEALTH OF VIRGINIA
MARY E. HIGGINS
Cert. No. 000450
8/31/11
LANDSCAPE ARCHITECT

LandTech Resources, Inc.
Surveying GPS Engineering
205 Bulifants Blvd., Ste. F, Williamsburg, VA 23188
Phone: (757) 565-1677 Fax: (757) 565-0782
web: landtechresources.com

SCALE: 1" = 20'

DATE: 8/19/11

JOB: 11-208

DRAWN BY: KMJ

SHEET: L2 OF 9

# TRANSMITTAL

Environmental Division

OCT 31 2011

RECEIVED

**DATE:** October 31, 2011

**TO:** Engineering and Resource Protection

**FROM:** Jason Purse, Senior Planner

**SUBJECT:** **SP-0086-2011, King of Glory Parking Amendment (Resubmittal)**

4897 Longhill Road

**ITEMS ATTACHED:** Site Plan

**ACTION:** Please review and return comments by November 14, 2011

Plan is approved by the Engineering and Resource Protection Division. A Land Disturbing Permit and Siltation Agreement, with surety, is required for this project. Storm facility inspection fees and a Declaration of Covenants - Inspection/Maintenance Agreement are required for this project. Registration for a state VSMP general permit for construction activities is required through the Virginia DCR.

11-02-11

0.7 Acres Disturbed
PC watershed
HUC Code JL31

Environmental Division

SEP 7 2011

RECEIVED

James City County, Virginia
Environmental Division

# Erosion and Sediment Control and Stormwater Management Design Plan Checklists

*Table of Contents*

---


| Contents | | Page |
|---|---|---|
| **Erosion and Sediment Control Plan** | | |
| I. | General | 1 |
| II. | Site Plan | 1 |
| III. | Narrative | 3 |
| IV. | Calculations | 4 |
| **Stormwater Management Design Plan** | | |
| I. | General | 5 |
| II. | Stormwater Conveyance Systems | 7 |
| III. | Stormwater Management / BMP Facilities | 8 |
| IV. | Outlet Protections | 14 |
| V. | Additional Comments and Information | 14 |


GENERAL INFORMATION

Project Name: King of Glory Church Gravel Parking Lot
Owner / Applicant: Matthew Connolly
Plan Preparer: LandTech Resources Email:
Project Location: 4897 Longhill Road
Tax Map / Parcel: 3240100033
County Plan No. (if known):
County BMP Type: E-2 Dry Swale (E-2)

Other information submitted in addition to this checklist (Check all that apply):

- ☒ Design or Construction Drawings (Plans, Profiles, Details, etc.).
- ☒ Erosion & Sediment Control Plan (Plans, Details, etc.).
- ☒ Erosion & Sediment Control Plan Design Report.
- ☒ Stormwater Management Design Plan (Plans, Profiles, Details, etc.).
- ☒ Stormwater Management Design Report.
- ☐ Other, List:

***Issue Date***
***March 1, 2001***

*JAMES CITY COUNTY, VIRGINIA*
*ENVIRONMENTAL DIVISION*

# *EROSION AND SEDIMENT CONTROL PLAN CHECKLIST*

## I. *GENERAL:*

| Yes | No | N/A | |
|---|---|---|---|
| ☒ | ☐ | ☐ | *FAMILIARITY* with current versions of Chapter 8, Erosion and Sedimentation Control and Chapter 23, Chesapeake Bay Preservation ordinances of the Code of James City County, Virginia and the Virginia Erosion and Sediment Control Handbook (VESCH). |
| ☒ | ☐ | ☐ | *LAND DISTURBING PERMIT AND SILTATION AGREEMENT* with surety are required for the project. |
| ☐ | ☐ | ☒ | *VARIANCE* if necessary, requested in writing, for the plan approving authority to waive or modify any of the minimum standards and specifications of the VESCH deemed inappropriate based on site conditions specific to this review case only. Variances which are approved shall be properly documented in the plan and become part of the approved erosion and sediment control plan for the site. |

## II. *SITE PLAN:*

| Yes | No | N/A | |
|---|---|---|---|
| ☒ | ☐ | ☐ | *VICINITY MAP* locating the site in relation to the surrounding area. Include any major landmarks which might assist in physically locating the site. |
| ☒ | ☐ | ☐ | *INDICATE NORTH* direction in relation to the site. |
| ☒ | ☐ | ☐ | *LIMITS OF CLEARING AND GRADING* for the site including that required for implementation of erosion and sediment controls, stockpile areas and utilities. |
| ☒ | ☐ | ☐ | *DISTURBED AREA ESTIMATES* in acres or square feet for the project. |
| ☒ | ☐ | ☐ | *EXISTING TOPOGRAPHY* or contours for the site at no more than 5 foot contour interval. |
| ☒ | ☐ | ☐ | *FINAL TOPOGRAPHY*, contours or proposed site grading in accordance with the design plan which indicates changes to existing topography and drainage patterns at no more than 2 foot contour interval (or 1 foot contours where required). |
| ☒ | ☐ | ☐ | *EXISTING AND PROPOSED SPOT ELEVATIONS* to supplement existing and proposed contours, topography or site grading information. Spot elevations may replace final contours in some instances, especially if terrain is in a low lying area or relatively flat. |
| ☒ | ☐ | ☐ | *EXISTING VEGETATION* including existing tree lines, grassed or unique vegetation areas. |

| Yes | No | N/A | |
|---|---|---|---|
| ☒ | ☐ | ☐ | *EXISTING SITE FEATURES* including roads, buildings, homes, utilities, streams, fences, structures and other important surface features of the site. |
| ☒ | ☐ | ☐ | *SOILS MAP* with soil symbols, boundaries and legend in accordance with the current Soil Survey of James City and York Counties and the City of Williamsburg, Virginia. |
| ☒ | ☐ | ☐ | *ENVIRONMENTAL INVENTORY* in accordance with Section 23-10(2) of the Chesapeake Bay Preservation Ordinance of James City County. Inventory generally includes: tidal shores and wetlands, non-tidal wetlands, resource protection area, hydric soils and slopes steeper than 25 percent. For wetlands, provide a copy of issued permits or satisfactory evidence that appropriate permits are being pursued for the entire project. |
| ☒ | ☐ | ☐ | *100-YEAR FLOODPLAIN LIMITS* or any special flood hazard areas or flood zones based on appropriate Federal Management Agency Flood Insurance Rate Maps (FIRMs) or Flood Hazard Boundary Maps (FHBMs) of James City County, Virginia. |
| ☒ | ☐ | ☐ | *DRAINAGE AREAS* for offsite and onsite areas, existing or proposed as applicable. Include drainage divides and directional labels for all subareas at points of interest and size (in acres), weighted runoff coefficient or curve number and times of concentration for each subarea. |
| ☒ | ☐ | ☐ | *CRITICAL EROSION AREAS* which require special consideration or unique erosion and sediment control measures. Refer to the VESCH, Chapter 6 for criteria. |
| ☒ | ☐ | ☐ | *DEVELOPMENT PLAN* for the site showing all improvements such as buildings, structures, parking areas, access roadways, above and below ground utilities, stormwater management and drainage facilities, trails or sidewalks, proposed vegetation and landscaping, amenities, etc. |
| ☒ | ☐ | ☐ | *LOCATION OF PRACTICES* proposed for erosion and sediment control, tree protection and temporary stormwater management due to land disturbance activities at the site. Use standard abbreviations, labels and symbols consistent for plan views based on minimum standards and specifications in Chapter 3 of the VESCH. |
| ☒ | ☐ | ☐ | *TEMPORARY STOCKPILE AREAS* or staging and equipment storage areas as required for onsite or offsite construction activities or indicate that none are anticipated for this project. |
| ☐ | ☐ | ☒ | *OFFSITE LAND DISTURBING AREAS* including borrow sites, waste areas, utility extensions, etc. and required erosion and sediment controls. If none are anticipated for the project, then indicate on the plans by general or erosion and sediment control notes. |
| ☒ | ☐ | ☐ | *DETAILS* or alternately, appropriate reference to current minimum standards and specifications of the VESCH for each measure proposed for the project. Non-modified, standard duplicated details (silt fence, diversion dikes, etc.) may be referenced to the current version of the VESCH. Specific dimensional or modified standards (basins, traps, outlet protections, check dams, etc.) require presentation on detail sheets. Schedules or tables may be used for multiple site measures such as sediment traps, basins, channels, slope drains, etc. Any modification to standard details should be clearly defined, explained and illustrated. |

| Yes | No | N/A | |
|---|---|---|---|
| ☑ | ☐ | ☐ | *MAINTENANCE PLAN* or alternately, appropriate reference to current minimum standards and specifications of the VESCH, outlining the inspection frequency and maintenance requirements for all erosion and sediment control measures proposed for the project. |
| ☐ | ☐ | ☑ | *TRENCH DEWATERING* methods and erosion and sediment controls, if anticipated for the project. |
| ☑ | ☐ | ☐ | *CONSTRUCTION SEQUENCE* outlining the anticipated sequence for installation of erosion and sediment controls and site, grading and utility work to be performed for the project by the site contractor. |
| ☐ | ☐ | ☑ | *PHASING PLAN* if required for larger project sites that are to be developed in stages or phases. |
| ☑ | ☐ | ☐ | *STANDARD COUNTY NOTES* are required to be placed on the erosion and sediment control plan. Refer to the standard James City County Erosion and Sediment Control Notes dated May 5, 1999. |
| ☑ | ☐ | ☐ | *PROFESSIONAL SEAL AND SIGNATURE* required on final and complete approved plans, drawings, technical reports and specifications. |

## III. ***NARRATIVE:***

| Yes | No | N/A | |
|---|---|---|---|
| ☑ | ☐ | ☐ | *PROJECT DESCRIPTION* briefly describing the nature and purpose of the land disturbing activity and the acreage to be disturbed. |
| ☑ | ☐ | ☐ | *EXISTING SITE CONDITIONS* description of existing topography, land use, cover and drainage patterns at the site. |
| ☑ | ☐ | ☐ | *ADJACENT AREA* descriptions of neighboring onsite or offsite areas such as streams, lakes, property, roads, etc. and potential impacts due to concentrated flow or runoff from the land disturbing activity. |
| ☑ | ☐ | ☐ | *OFFSITE DISTURBED AREA* descriptions of proposed borrow sites, waste or surplus areas, utility extensions and erosion and sediment controls to be implemented. |
| ☑ | ☐ | ☐ | *SOILS DESCRIPTION* briefly summarizing site, disturbed area and drainage basin soils including name, unit, hydrologic soil group (HSG) classification, surface runoff potential, erodibility, permeability, depth, texture, structure, erosion hazards, shrink-swell potential, limitations for use and anticipated depths to bedrock and the seasonal water table, as applicable. |
| ☑ | ☐ | ☐ | *CRITICAL AREAS* on the site which many have potentially serious erosion and sediment control problems and special considerations required (ie. steep slopes, hydric soils, channels, springs, sinkholes, water supply reservoirs, groundwater recharge areas, etc.) |

Yes No N/A

☒ ☐ ☐ *PROPOSED EROSION & SEDIMENT CONTROL MEASURES* inclusive to the specific erosion and sediment control plan as proposed for the land disturbing activity. Measures should be consistent with those proposed on the site drawings. Address general use, installation, limitations, sequencing and maintenance requirements for each control measure.

☒ ☐ ☐ *STABILIZATION MEASURES* required for the site, either temporary or permanent, and during and following construction including temporary and permanent seeding and mulching, paving, stone, soil stabilization blankets and matting, sodding, landscaping or special stabilization techniques to be utilized at the site.

☒ ☐ ☐ *STORMWATER MANAGEMENT CONSIDERATIONS* for the site, either of temporary or permanent nature, and strategies, sequences and measures required for control. May reference the stormwater management plan for the site, if prepared, for permanent stormwater management facilities and control of drainage once the site is stabilized.

## IV. *CALCULATIONS:*

Yes No N/A

☒ ☐ ☐ *CALCULATIONS AND COMPUTATIONS* associated with hydrology, hydraulics and design of proposed temporary and permanent erosion and sediment control measures including: sediment traps and basins, diversions, stormwater conveyance channels, culverts, slope drains, outlet protections, etc. Computations are not required on the construction plan and may be attached in a supplemental erosion and sediment control plan design report, if presented in a clear and organized format.

☐ ☐ ☒ *TEMPORARY SEDIMENT BASIN DESIGN DATA SHEET* submitted for each basin along with schematic or sketch cross-section showing applicable design and construction data, storage volumes (wet-dry), dimensions and elevations. Peak design runoff to be based on the 2- or 25-year design storm event based on maximum disturbed site conditions (existing, interim or proposed conditions) in accordance with Minimum Standard 3.14 of the VESCH.

*JAMES CITY COUNTY, VIRGINIA*
*ENVIRONMENTAL DIVISION*

# *STORMWATER MANAGEMENT DESIGN PLAN CHECKLIST*

## I. *GENERAL:*

| Yes | No | N/A | |
|---|---|---|---|
| ☑ | ☐ | ☐ | *FAMILIARITY* with current versions of the James City County Guidelines for Design and Construction of Stormwater Management BMPs manual; Chapter 8, Erosion and Sediment Control and Chapter 23, Chesapeake Bay Preservation ordinances of the Code of James City County, Virginia; the Virginia Erosion and Sediment Control Handbook (VESCH); and the Virginia Stormwater Management Handbook (VSMH). |
| ☐ | ☐ | ☑ | *WAIVER OR EXCEPTION* if necessary, requested in writing, for the plan approving authority to waive or except the requirements of Chapter 23, Chesapeake Bay Preservation ordinance in accordance with procedure established in Sections 23-14 through 23-17 of the ordinance. Applies to this review case only. |
| ☐ | ☐ | ☑ | *VARIANCE REQUEST* if necessary, requested in writing for the plan approving authority to waive or modify any of the minimum standards and specifications of the VESCH deemed inappropriate based on site conditions specific to this review case only. Variances which are approved shall be properly documented in the plan and become part of the approved erosion and sediment control plan for the site. |
| ☑ | ☐ | ☐ | *PROFESSIONAL SEAL AND SIGNATURE* required on final and complete approved stormwater management plans, drawings, technical reports and specifications. |
| ☑ | ☐ | ☐ | *WORKSHEET FOR BMP POINT SYSTEM* to ensure the stormwater management plan for the project attains at least 10 BMP points (New Development) or traditional pollutant load reduction computations per the Chesapeake Bay Local Assistance Manual (Redevelopment Only). |
| ☐ | ☐ | ☑ | *PROPOSED CONSERVATION EASEMENT AREAS* for any natural open space points claimed in the BMP worksheet. |
| ☑ | ☐ | ☐ | *INSPECTION/MAINTENANCE AGREEMENT* is required to be prepared and executed with the County for the project. |
| ☑ | ☐ | ☐ | *FEMA FIRM PANEL* reference with designated special flood hazard areas or zone designations associated with the site, as applicable. |
| ☑ | ☐ | ☐ | *DRAINAGE AREA MAP* at a maximum scale of 1"=200' scale showing drainage area boundaries for pre- and postdevelopment conditions and associated time of concentration flow paths. Labels to include drainage area size, runoff coefficient or curve number and time of concentration for each subarea shown on the map. |

| Yes | No | N/A | |
|---|---|---|---|
| ☑ | ☐ | ☐ | *SOILS MAP* with soil symbols, boundaries and legend in accordance with the current Soil Survey of James City and York Counties and the City of Williamsburg, Virginia with approximate locations of the project site, BMPs and applicable drainage basins. |
| ☑ | ☐ | ☐ | *STORMWATER MANAGEMENT NARRATIVE* in a brief and simple format which describes the project; location; site and drainage basin soil characteristics; receiving water or drainage facility; existing site and drainage basin conditions (topography, land use, cover, slopes, etc.); proposed site development; proposed stormwater management and drainage plan including County BMP type selected; summary of hydrology and hydraulics; maintenance program; and any special assumptions utilized for development of the stormwater management and drainage design plan or computations. |
| ☐ | ☐ | ☑ | *TEMPORARY STORMWATER MANAGEMENT* (if applicable) for control of stormwater runoff encountered during construction activities in addition to measures provided in the erosion and sediment control plan or stormwater management/drainage plan for the site. Adequate protection measures or sequencing provided. |
| ☐ | ☐ | ☑ | *MODIFICATION PLAN* clearly defined for temporary sediment control structures which will be converted to permanent SWM/BMP structures. Includes appropriate hydrologic and hydraulic computations, conversions, sequencing and cleanout information or details. Normally related to primary control structures associated with dry detention or wet retention ponds. Normally not permitted for Group C or D categories such as bioretention, infiltration and filtering system facilities. |
| ☑ | ☐ | ☐ | *STORMWATER MANAGEMENT and DRAINAGE DESIGN REPORT* in a bound 8-1/2 x 11 inch size format. Report shall generally include a title sheet, date, project identification, owner and preparer information, table of contents, narrative, summaries and computations as required. Computations may include: backwater, closed conduit, headwater, hydraulic, hydraulic grade line, hydrology, inlet, open channel, storm sewer, water quality, extended detention or stream channel protection and muti-stage storm routing calculations, as applicable, for the project. Computation data may include hand or computer generated computations, maps or schematics. All information should be presented in a clear, easy to follow format and should closely match construction plan information. |
| ☑ | ☐ | ☐ | *PLAN VIEW* at 1 inch = 50 ft. scale or less (1" = 40', 1" = 30', etc.) |
| ☑ | ☐ | ☐ | North arrow and plan legend. |
| ☑ | ☐ | ☐ | Property lines. |
| ☑ | ☐ | ☐ | Adjacent property information. |
| ☑ | ☐ | ☐ | Existing site features and existing impervious cover areas. |
| ☑ | ☐ | ☐ | Impervious cover tabulations. |
| ☑ | ☐ | ☐ | Existing drainage facilities (natural or manmade). |
| ☑ | ☐ | ☐ | Existing environmentally sensitive areas (RPA, wetlands, floodplain, steep slopes, critical soils, buffers, etc.). |
| ☑ | ☐ | ☐ | Existing and proposed contours (1' or 2' contour interval) and spot elevations as necessary to define high and low topography. |
| ☑ | ☐ | ☐ | Existing and proposed easement locations. |

| Yes | No | N/A | |
|---|---|---|---|
| ☑ | ☐ | ☐ | Proposed site improvements and proposed impervious cover areas. |
| ☑ | ☐ | ☐ | Proposed stormwater conveyance, drainage and management facilities with appropriate labeled construction data and information. |
| ☑ | ☐ | ☐ | Proposed landscaping and seeding plans (disturbed areas, pond interior, etc.). |
| ☑ | ☐ | ☐ | Proposed slope stabilization areas (riprap, blankets, mattings, walls, etc.). |
| ☐ | ☐ | ☑ | Delineation of permanent pools and the 1-, 2-, 10- and 100-year Design Water Surface Elevations. |
| ☐ | ☐ | ☑ | Delineation of ponding, headwater, surcharge or backwater areas which may affect adjacent existing or proposed buildings, structures or upstream adjacent properties. |
| ☐ | ☐ | ☑ | Test boring locations with reference surface elevations (if known). |
| ☑ | ☐ | ☐ | Risers, barrels, underdrains, overflows and outlet protections. |
| ☐ | ☐ | ☑ | Emergency spillway level section and outlet channel. |
| ☑ | ☐ | ☐ | Existing and proposed site utilities and protection measures. |
| ☑ | ☐ | ☐ | Erosion and sediment control measures (for site or BMP). |
| ☑ | ☐ | ☐ | Maintenance or access corridors to permanent stormwater management, BMP or drainage facilities. |

## II. *STORMWATER CONVEYANCE SYSTEMS:*

| Yes | No | N/A | |
|---|---|---|---|
| ☑ | ☐ | ☐ | *PLAN VIEWS* |
| ☑ | ☐ | ☐ | Storm drain lengths, sizes, types, classes and slopes for all segments. Label directly on plan or use structure/pipe schedule. |
| ☑ | ☐ | ☐ | Access structure (inlets, manholes, junctions, etc.) rim elevations, inverts, type and required grate or top unit and lengths labeled. |
| ☑ | ☐ | ☐ | All structure numbers labeled. |
| ☑ | ☐ | ☐ | Adequate horizontal clearance from other site utilities or structures. |
| ☐ | ☐ | ☑ | *PROFILES* generally are not required but are encouraged to expedite review. If not provided, ensure all pipe segments have adequate minimum cover, do not exceed maximum depths of cover for the type/class of pipe specified and do not conflict with other site utilities or excavation areas. |
| ☑ | ☐ | ☐ | *DETAILS* |
| ☑ | ☐ | ☐ | Typical storm drain bedding details or reference note. |
| ☑ | ☐ | ☐ | Standard details or reference note for all proposed access structure types (inlets, manholes, junctions, etc.). |
| ☐ | ☐ | ☑ | Inlet shaping detail or applicable reference note. |
| ☑ | ☐ | ☐ | Step detail or applicable reference note (if depth 4 ft. or more). |
| ☐ | ☐ | ☑ | Typical open channel details with designation, location, shape, type, bottom width, top width, lining, slope, length, side slope, and installation depth required for construction. Channel design data as necessary may also be included. |
| ☑ | ☐ | ☐ | Outlet protections at all pipe outfalls. |

Yes No N/A

☒ ☐ ☐ *STORMWATER CONVEYANCE SYSTEM COMPUTATIONS*

- ☐ ☐ ☒ Storm Sewer Design computations based on 10-year design event.
- ☐ ☐ ☒ Hydraulic Grade Line computations based on 10-year design event.
- ☐ ☐ ☒ Inlet computations based on current VDOT procedure for spread, ponding depth and grate size required.
- ☐ ☐ ☒ Culvert Headwater computations. Design based on 10-year design storm event and check only for 100-year storm event.
- ☐ ☐ ☒ Open Channel computations based on 2-year design event for velocity and 10-year design event for capacity.
- ☒ ☐ ☐ Standard outlet protection or special energy dissipators.
- ☐ ☐ ☒ Pipe thickness design computations, as required, for selected pipe type (live load, minimum cover, maximum height of cover, etc.).
- ☒ ☐ ☐ Adequate channel computations for receiving channels (based on field measured channel section data).

## III. ***STORMWATER MANAGEMENT / BMP FACILITIES***:

Yes No N/A

☒ ☐ ☐ *HYDROLOGY* - An SCS based methodology is required for the design of stormwater management/BMP facilities with watersheds exceeding 20 acres. Under 20 acres, other generally accepted methodologies such as the modified rational, critical storm are allowable. Refer to Chapter 5 of the VESCH or Chapter 5 of the VSMH.

- ☒ ☐ ☐ Runoff Curve Number or Coefficient determinations: predeveloped and ultimate development land use scenarios.
- ☒ ☐ ☐ Time of concentration: predeveloped and ultimate development indicating overland, shallow concentrated, and channel flow components (200 ft. maximum length for overland flow).
- ☒ ☐ ☐ Hydrograph generation (tabular or graphical): pre- and postdevelopment conditions for the 1-, 2-, 10-, and 100-year design storm events.

☒ ☐ ☐ *FACILITY CONFIGURATION and MINIMUM SEPARATIONS*

- ☒ ☐ ☐ Screening and layout consistent with Section 24-98(d) of the Chapter 24 Zoning ordinance (landscaping, screening, visibility, etc.).
- ☐ ☐ ☒ Basic considerations for safety and unauthorized entry.
- ☒ ☐ ☐ Proper length to width ratio (Typically 2H:1V).
- ☐ ☐ ☒ Facilities with deep pools (4 feet or more in depth) provided with two benches. Fifteen (15) ft. safety bench outward from normal pool at maximum 6 percent slope and aquatic bench inward from normal shoreline below normal pool. Narrower widths may be considered on a case-by-case basis.
- ☐ ☐ ☒ Pond buffer minimum 25 feet outward from maximum design WSEL. Additional setbacks may be required to permanent structures.
- ☐ ☐ ☒ No trees, shrubs or woody plants within 15 feet of embankment toe or 25 feet from principal spillway structure.

| Yes | No | N/A | |
|---|---|---|---|
| ☑ | ☐ | ☐ | Infiltration and filtering system facilities generally located at least 100 feet horizontally from any water supply well; 100 feet from any downslope building; and 25 feet from any upslope buildings, unless site specific investigation allows for reduced separation. |

| Yes | No | N/A | |
|---|---|---|---|
| ☑ | ☐ | ☐ | *HYDRAULIC COMPUTATIONS* |
| ☑ | ☐ | ☐ | Elevation- or Stage- Storage curve and/or tabular data. |
| ☑ | ☐ | ☐ | Weir / Orifice Control - Extended Detention. |
| ☐ | ☐ | ☑ | Weir / Orifice Control - riser 1-year control for channel protection. |
| ☑ | ☐ | ☐ | Weir / Orifice Control - riser 2-year control for quantity (if required). |
| ☐ | ☐ | ☑ | Weir / Orifice Control - riser 10-year control for quantity (if required). |
| ☑ | ☐ | ☐ | Inlet / Outlet (barrel) control - (All Storms). |
| ☑ | ☐ | ☐ | Check for barrel control prior to riser orifice flow to prevent slug flow-water hammer conditions. |
| ☐ | ☐ | ☑ | Emergency spillway capacity and depth of flow. |
| ☑ | ☐ | ☐ | Elevation - Discharge (Outlet Rating) curve and/or table. Provide all supporting calculations and/or design assumptions. |
| ☑ | ☐ | ☐ | Adequate channel computations for receiving channel. May be waived if facility is designed based on current Stream Channel Protection criteria. |

| | | | |
|---|---|---|---|
| ☑ | ☐ | ☐ | *POND or RESERVOIR ROUTING* |
| ☑ | ☐ | ☐ | Storage-Indication Routing of postdeveloped inflow hydrographs for the 1-, 2-, 10-, and 100-year design storms. Preference is for structure to discharge up to the 10-year storm through the principal spillway and pass the 100-year storm with a minimum 1 foot of freeboard through a combination principal and emergency spillways. If no emergency spillway is provided, riser must be large enough to pass the design high water flow and trash without overtopping the facility, have 3 square feet or more of cross-sectional area, contain a hood type inlet and have a minimum freeboard of 2 feet. Token spillways with minimum 8 ft. width are also recommended at or above the design 100-year storm elevation. |
| ☐ | ☐ | ☑ | Downstream hydrographs at established study points, if conditions warrant (ie. facility discharge combined with uncontrolled bypass). |

| | | | |
|---|---|---|---|
| ☑ | ☐ | ☐ | *MISCELLANEOUS COMPUTATIONS* |
| ☐ | ☐ | ☑ | Water quality volume for permanent pool based on selected BMP treatment volume (WQv). |
| ☑ | ☐ | ☐ | Water quality volume for extended detention based on selected BMP treatment volume (WQv) with drawdown computations. |
| ☐ | ☐ | ☑ | Drawdown computations for the 1-year, 24 hour detention for stream channel protection criteria. |
| ☐ | ☐ | ☑ | Pond drain computations (within 24 hours). |
| ☐ | ☐ | ☑ | Anti-seep collar design (concrete preferred) or match material type. |
| ☐ | ☐ | ☑ | Filter diaphragm design (or alternative method of controlling seepage). |

Yes No N/A

- ☐ ☐ ☑ Riser / base structure flotation analyses. FS = 1.25 minimum.
- ☐ ☐ ☑ Downstream danger reach study and/or emergency action plan (if conditions warrant).
- ☐ ☐ ☑ Upstream backwater analyses onto offsite adjacent property (if conditions warrant).
- ☐ ☐ ☑ 100 year floodplain impacts (if conditions warrant).

Yes No N/A

☐ ☐ ☑ *GEOTECHNICAL REQUIREMENTS*

- ☐ ☐ ☑ Geotechnical Report with recommendations specific to BMP facility type selected. Report prepared by a registered professional engineer. Requires submission, review and approval prior to issuance of Land Disturbance Permit.
- ☐ ☐ ☑ Initial Feasibility Testing requirements satisfied as per Appendix E of the James City County Guidelines for Design and Construction of Stormwater Management BMPs manual. (Infiltration, Bioretention and Filtering System BMP types only).
- ☐ ☐ ☑ Concept Design Testing requirements satisfied as per Appendix E of the James City County Guidelines for Design and Construction of Stormwater Management BMPs manual. (Infiltration, Bioretention and Filtering System BMP types only).
- ☐ ☐ ☑ Minimum Boring locations: borrow area, pool area, principal control structure, top of facility near one abutment and emergency spillway if provided.
- ☐ ☐ ☑ Boring logs with Unified Soil Classification (ASTM D2487), soils descriptions and depths to bedrock and the seasonal water table indicated.
- ☐ ☐ ☑ Standard County Record Drawing/Construction Certification note provided on plan. *Note: It is understood that preparation of record drawings and construction certifications as required for project facilities may not necessarily be performed by the plan preparer. These components may be performed by others.*

☑ ☐ ☐ *PRINCIPAL SPILLWAY PROFILE AND ASSOCIATED DETAILS*

☑ ☐ ☐ *EXISTING GROUND AND PROPOSED GRADE*

- ☑ ☐ ☐ Embankment or excavation side slopes labeled (3H:1V maximum).
- ☐ ☐ ☑ Minimum top width labeled (per VESCH or VSMH requirements).
- ☑ ☐ ☐ Removal of unsuitable material under proposed facility (per Geotechnical Report requirements).

**Yes No N/A**

☐ ☐ ☒ *CORE TRENCH*

- ☐ ☐ ☒ Material (per plan or Geotechnical Report).
- ☐ ☐ ☒ Bottom width (4' minimum or greater as dictated by Geotechnical Report recommendations).
- ☐ ☐ ☒ Side slopes (1:1 maximum steepness)
- ☐ ☐ ☒ Depth (4' minimum or greater as dictated by Geotechnical Report).

☒ ☐ ☐ *PRINCIPAL CONTROL STRUCTURE. RISER OR SIMILAR STRUCTURE (DETAILS REQUIRED FOR ALL ITEMS)*

- ☒ ☐ ☐ Durable, watertight, resistant material (concrete preferred).
- ☒ ☐ ☐ Riser diameter is at least 1.25 times larger than barrel diameter.
- ☒ ☐ ☐ All pertinent dimensions and elevations shown.
- ☒ ☐ ☐ Control orifice or weir dimensions and elevations shown.
- ☒ ☐ ☐ Trash rack - removable - for each release.
- ☐ ☐ ☒ Anti-vortex device, baffle or plate.
- ☒ ☐ ☐ Riser base structure with dimensions and embedment specifications (concrete preferred).
- ☒ ☐ ☐ Interior access (steps, ladders, etc.) for maintenance for structures over 4 feet in height. Excessively high risers may need some form of exterior access on top portion.
- ☒ ☐ ☐ Low flow orifice with trash rack device.

☒ ☐ ☐ *PRINCIPAL CONTROL STRUCTURE OUTLET BARREL*

- ☒ ☐ ☐ Material (ASTM C-361 reinforced concrete pipe) with watertight joints. Prior approval required for all other pipe material (other RCP types, CMP, CPP, PVC, etc.).
- ☐ ☐ ☒ Support and bedding requirements for barrel - concrete cradles, etc. or as recommended by the Geotechnical Report.
- ☒ ☐ ☐ Pipe inverts, length, size, class and slope shown.
- ☒ ☐ ☐ Flared end section or endwall provided on barrel outlet.

☐ ☐ ☒ *SEEPAGE CONTROL*

- ☐ ☐ ☒ Phreatic line shown (4:1 slope measured from the intersection of the embankment and the principal spillway design high water).

- ☐ ☐ ☒ *ANTI-SEEP COLLARS*
  - ☐ ☐ ☒ Anti-seep collar, concrete preferred.
  - ☐ ☐ ☒ Size - 15 percent increase in length of saturation using outside pipe diameter.
  - ☐ ☐ ☒ Spacing and location on barrel (located at least 2 feet from a pipe joint).

☐ ☐ ☒ *FILTER DIAPHRAGMS*

☐ ☐ ☒ Design based on latest NRCS design methods and certified by a professional engineer.

**Yes No N/A**

☒ ☐ ☐ *ELEVATION AND DIMENSIONAL DESIGN DATA*

☒ ☐ ☐ Top of facility - construction height and settled height (10 percent settlement).

☐ ☐ ☒ Crest of principal control structure spillway at least one (1) foot below crest of emergency spillway, if provided.

☒ ☐ ☐ Minimum freeboard of one (1) foot above the 100-year design high water elevation for facilities <u>with</u> an emergency spillway.

☐ ☐ ☒ Minimum freeboard of two (2) feet above the 100-year design high water elevation for facilities <u>without</u> an emergency spillway or in accordance with the SCS National Engineering Handbook (prior approval required).

☒ ☐ ☐ Basin Sediment Clean-Out elevation (permanent mode). Typically 10 to 25 percent of water quality volume.

☒ ☐ ☐ *CROSS SECTION THROUGH FACILITY*

☐ ☐ ☒ Existing Ground.

☒ ☐ ☐ Proposed grade.

☒ ☐ ☐ Top of facility - constructed and settled.

☐ ☐ ☒ Location of emergency spillway with side slopes labeled (emergency spillway in cut).

☐ ☐ ☒ Bottom of core trench (4' minimum).

☐ ☐ ☒ Location of each soil boring.

☒ ☐ ☐ Barrel location.

☐ ☐ ☒ Existing and proposed utility location/protection.

☐ ☐ ☒ *EMERGENCY SPILLWAY PROFILE*

☐ ☐ ☒ Existing ground.

☐ ☐ ☒ Inlet, level (control) and outlet sections per SCS.

☐ ☐ ☒ Spillway and crest elevations.

☐ ☐ ☒ *PRETREATMENT DEVICES* of adequate depth and properly designed using required pretreatment volumes for the selected County BMP facility type. Including, but not limited to: sediment forebays, sediment basins, sumps, grass channels, gravel diaphragms, plunge pools, chamber separators, manufactured systems or other acceptable methods.

| Yes | No | N/A | |
|---|---|---|---|
| ☑ | ☐ | ☐ | *CONSTRUCTION SPECIFICATIONS and NOTES* |
| ☑ | ☐ | ☐ | Anticipated sequence of construction for BMP (consistent with erosion and sediment control plan). |
| ☐ | ☐ | ☑ | Provisions to control base stream or storm flow conditions encountered during construction. |
| ☐ | ☐ | ☑ | Site and subgrade preparation requirements. |
| ☐ | ☐ | ☑ | Embankment, fill and backfill material soil and placement (lift) thickness requirements. |
| ☐ | ☐ | ☑ | Compaction and soil moisture content requirements. |
| ☐ | ☐ | ☑ | Geosynthetics for drainage, filtration, moisture barrier, separation, and reinforcement purposes. |
| ☐ | ☐ | ☑ | Clay or synthetic (PVC or HDPE) pond liners. |
| ☑ | ☐ | ☐ | Storm drain, underdrain and pipe conduit requirements. |
| ☐ | ☐ | ☑ | Minimum depth of pipe cover for temporary (construction) and final cover conditions. |
| ☐ | ☐ | ☑ | Permanent shutoff valve and pond drain. |
| ☐ | ☐ | ☑ | Concrete requirements for structural components. |
| ☑ | ☐ | ☐ | Riprap and slope protection. |
| ☐ | ☐ | ☑ | Access or maintenance road surface, base, subbase. |
| ☑ | ☐ | ☐ | Temporary and permanent stabilization measures. |
| ☐ | ☐ | ☑ | Temporary or permanent safety fencing. |
| ☐ | ☐ | ☑ | BMP Landscaping (deep, shallow, fringe, perimeter,etc.) |
| ☐ | ☐ | ☑ | Dust and traffic control (if warranted). |
| ☑ | ☐ | ☐ | Construction monitoring and certification by professional. |
| ☐ | ☐ | ☑ | Other: _____ |
| ☐ | ☐ | ☑ | Other: _____. |
| ☑ | ☐ | ☐ | *MAINTENANCE PROVISIONS* |
| ☑ | ☐ | ☐ | Entity responsible for maintenance identified.. |
| ☑ | ☐ | ☐ | Maintenance Plan which outlines the long-term schedule for inspection/maintenance of the facility and forebays |
| ☐ | ☐ | ☑ | Maintenance access from public right-of-way or publicly traveled road. |
| ☐ | ☐ | ☑ | Maintenance easement provided encompassing high water pool and buffer, principal and emergency spillways, outlet structures, forebays, embankment area and possible sediment-removal stockpile areas. |
| ☐ | ☐ | ☑ | Minimum 6 foot wide public safety shelf (landing) or alternative fencing. |

## IV. *OUTLET PROTECTIONS:*

| Yes | No | N/A | |
|---|---|---|---|
| ☑ | ☐ | ☐ | Sized for maximum design release (generally 10-year storm). |
| ☑ | ☐ | ☐ | Flared end section or endwall. |
| ☑ | ☐ | ☐ | Dimensions. |
| ☑ | ☐ | ☐ | Rock or riprap size, quantity and placement thickness. |
| ☑ | ☐ | ☐ | Slope at 0 percent (Level Grade). |
| ☑ | ☐ | ☐ | Geotextiles (nonwoven). |
| ☐ | ☐ | ☑ | Special energy dissipators are required for design discharge velocities that exceed eighteen (18) feet per second; or if use of standard outlet protection would result in velocities exceeding permissible channel velocities; or if space restricts or limits their use. |

## V. *ADDITIONAL COMMENTS OR INFORMATION SPECIFIC TO THE PLAN:*

Plan Preparer: Kenneth M. Jenkins

Date: 8/31/11

SWMProg/BMP/Checklist/ChkList

DRAINS TO
PC072

Environmental Division

FEB 24 2012

RECEIVED

**James City County, Virginia**
**Stormwater Division**

**Stormwater Facilities - BMP and Conveyance Systems**
**Record Drawing and Construction Certification Forms**

***Note: In accordance with the requirements of the Chesapeake Bay Preservation Ordinance, Chapter 23, Section 23-10(4), BMPs shall be designed and constructed in accordance with the manual entitled* James City County Guidelines for Design and Construction of Stormwater Management BMPs. *The Subdivision Ordinance, Chapter 19-62, the Zoning Ordinance, Chapter 24-159, and approved construction plans generally require that at the completion of the project and prior to release of surety, an "as-built" plan prepared by a registered Professional Engineer or Certified Land Surveyor must be provided for the drainage system for the project including any Best Management Practice (BMP) facilities. In addition, for BMP facilities, written construction certification is required by a Professional Engineer who inspected the structure during its construction. Currently there are over 20 water quality type BMPs accepted by the County.***

**Section 1 - Site Information:**

Project Name: King of Glory Lutheran Church Gravel Parking Lot

Structure/BMP Name: King of Glory Infiltration Facility BMP

Project Location: 4897 Longhill Road

BMP Location: Southern Corner of the Property

County Plan No.: SP - 086 - 11

Project Type:
- ☐ Residential
- ☐ Business
- ☐ Commercial
- ☐ Office
- ☒ Institutional
- ☐ Industrial
- ☐ Public
- ☐ Roadway
- ☐ Other _____

Tax Map/Parcel No.: 3240100033

BMP ID Code (if known): _____

Zoning District: R2

Land Use: Church

Site Area (sf or acres): 13.85

Brief Description of Stormwater Management/BMP Facility: Existing JCC C-3 Infiltration Basin BMP with tilled pond bottom to rejuvinate soil in the infiltration area

Nearest Visible Landmark to SWM/BMP Facility: Left Front Corner of Property

Nearest Vertical Ground Control (if known):

☐ JCC Geodetic Ground Control ☐ USGS ☒ Temporary ☐ Arbitrary ☐ Other

Station Number or Name: _____

Datum or Reference Elevation: Elev 89.40

Control Description: Existing Church Finished Floor Elev

Control Location from Subject Facility: North of Existing BMP

**Section 2 - Stormwater Management / BMP Facility Construction Information:**

Preconstruction Meeting Held for Construction of SWM/BMP Facility: ☒ Yes ☐ No ☐ Unknown

Approx. Construction Start Date for SWM/BMP Facility: November 2011

Facility Monitored by County Representative during Construction: ☐ Yes ☐ No ☒ Unknown

Name of Site Work Contractor Who Constructed Facility: Gilley Construction, LLC

Name of Professional Firm Who Routinely Monitored Construction: LandTech Resources, Inc

Date of Completion for SWM/BMP Facility: January 2012

Date of Record Drawing/Construction Certification Submittal: 2/23/12

***(Note: Record Drawing and Construction Certifications are required within thirty (30) days of the completion of construction of a Stormwater Facility – BMP or Conveyance system. Record Drawings and Construction Certifications must be reviewed and approved by the James City County Stormwater Division prior to final inspection, acceptance and surety release. )***

**Section 3 - Owner / Designer / Contractor Information:**

Owner/Developer: *(Note: Site Owner or Applicant responsible for development of the project.)*

Name: King of Glory Lutheran Church

Mailing Address: 4897 Longhill Rd. Williamsburg, VA 23188

Business Phone: 258-9701 Fax: 564-9810

Contact Person: Jim Baldridge Title: Building Comm. Chair

Design Professional: *(Note: Professional Engineer or Certified Land Surveyor responsible for the design and preparation of plans and specifications for the Stormwater facilities.)*

Firm Name: LandTech Resources, Inc

Mailing Address: 205-E Bulifants Blvd. Williamsburg Va 23187

Business Phone: 565-1677 Fax: 565-0782

Responsible Plan Preparer: Matthew Connolly

Title: President

Plan Name: King of Glory Lutheran Church Gravel Parking Lot

Firm's Project No. 11-208 Plan Date: 8/19/11

Sheet No. Applicable to SWM/BMP Facility: C3 / C5 / C7 / ____ / ____

Stormwater Facility Contractor: *(Note: Site Work Contractor directly responsible for construction of the Stormwater facilities.)*

Name: Gilley Construction, LLC

Mailing Address: 223 Gate House Blvd Williamsburg, VA 23185

Business Phone: 812-0768 Fax: ____

Contact Person: Edwin Gilley

Site Foreman/Supervisor: ____

Specialty Subcontractors & Purpose (for BMP Construction Only): ____

**Section 4 - Professional Certifications:**

Certifying Professionals: *A Registered Professional Engineer or Certified Land Surveyor is responsible for preparation of a Record Drawing, sometimes referred to as an As-Built plan, for the stormwater facilities for the project including all BMP and conveyance systems. A Registered Professional Engineer is responsible for the inspection, monitoring and certification of all stormwater facilities – BMP and conveyance systems during their construction.*

**Record Drawing and Construction Certifications for Stormwater Facilities - BMP and Conveyance Systems**

**Record Drawing Certification**

Firm Name: LandTech Resources, Inc.
Mailing Address: 205-E Bulfants Blvd
Williamsburg Va 23188
Business Phone: 565-1677
Fax: 565-0782

Name: MATTHEW H. CONNOLLY
Title: PRESIDENT
Signature:
Date: 2-24-2012

I hereby certify to the best of my knowledge and belief that this record drawing represents the actual condition of the Stormwater Facilities. The facilities appear to conform to the provisions of the approved construction plans and specifications except as specifically noted.

COMMONWEALTH OF VIRGINIA
MATTHEW H. CONNOLLY
Lic. No. 2053
2/24/2012
LAND SURVEYOR

(Seal)
Virginia Registered Professional Engineer
or Certified Land Surveyor

**Construction Certification**

Firm Name: LandTech Resources, Inc
Mailing Address: 205-E Bulfants Blvd
Williamsburg, Va. 23188
Business Phone: 565-1677
Fax: 565-0782

Name: MATTHEW H. CONNOLLY
Title: PRESIDENT
Signature:
Date: 2-24-2012

I hereby certify to the best of my knowledge and belief that these Stormwater Facilities were monitored and constructed in accordance with the provisions of the approved construction plans and specifications except as specifically noted.

COMMONWEALTH OF VIRGINIA
MATTHEW H. CONNOLLY
Lic. No. 48347
2/24/2012
PROFESSIONAL ENGINEER

(Seal)
Virginia Registered
Professional Engineer

**Section 5 - Record Drawing and Construction Certification Requirements and Instructions:**

☒ Preconstruction Meeting - Provides an opportunity to review stormwater facilities construction, maintenance and operation plans, and address any questions regarding construction and/or monitoring of the structure. The certifying professionals, geotechnical engineer, Owner/Applicant, Contractor and County representative(s) are required to attend the preconstruction meeting. Advance notice to the Stormwater Division is required. Usually, this requirement can be met simultaneously with Erosion and Sediment Control preconstruction meeting held for the project.

☒ A fully completed ***Stormwater Facilities – BMP and Conveyance Systems, RECORD DRAWING and CONSTRUCTION CERTIFICATION FORM*** and ***RECORD DRAWING CHECKLIST***. All applicable sections shall be completed in their entirety and certification statements signed and sealed by the registered professional responsible for individual record drawing and/or construction certification.

☒ The Record Drawing shall be prepared by a Registered Professional Engineer or Certified Land Surveyor for the stormwater facilities including all BMPs and conveyance systems.

☒ Construction Certification. Construction of Stormwater BMP facilities which contain impoundments, embankments and related engineered appurtenances including subgrade preparation, compacted soils, structural fills, liners, geosynthetics, filters, seepage controls, cutoffs, toe drains, hydraulic flow control structures, etc. shall be visually observed and monitored by a Registered Professional Engineer or his/her authorized representative. The Engineer must certify that the structure, embankment and associated appurtenances were built in accordance with the approved construction plans and specifications, and standard accepted construction practice and shall submit a written certification and/or drawings to the Stormwater Division as required. Soil and compaction test reports, concrete test reports, inspection reports, logs and other required construction material or installation documentation shall be required by the Stormwater Division to substantiate the certification. The Engineer shall have the authority and responsibility to make minor changes to the approved plan, in coordination with the assigned County inspector, in order to compensate for unsafe or unusual conditions encountered during construction such as those related to bedrock, soils, groundwater, topography, etc. as long as changes do not adversely affect the integrity of the structure(s). Major changes to the approved design plan or structure must be reviewed and approved by the original design professional and the James City County Environmental Division with notification to the Stormwater Division.

☒ Record Drawing and Construction Certifications are required within **thirty (30) days** of the completion of any Stormwater Facility - BMP or conveyance system. Submittals must be reviewed and accepted by James City County Stormwater Division prior to final inspection, acceptance, surety release or issuance of a Certificate of Occupancy.

**Dual Purpose Facilities** - Completion of construction also includes any interim stage for Stormwater BMP facilities which serve a dual purpose as temporary sediment basins during construction and as permanent stormwater BMP facilities following completion of development and stabilization. For these dual purpose facilities, construction certification is required once the temporary sediment basin phase of construction is complete. Final record drawing and construction certification of additional permanent components is required once permanent facility construction is complete.

*Interim Construction Certification* is required for those dual purpose embankment-type facilities that are generally ten (10) feet or greater in dam height (*) and may not be converted, modified or begin function as a permanent SWM / BMP structure for a period generally ranging from six (6) to eighteen (18) months or more from issuance of a Land Disturbance permit for construction.

Interim or final record drawing and construction certifications are not required for temporary sediment basins which are designed and constructed in accordance with current minimum standards and specifications for temporary sediment basins per the Virginia Erosion and Sediment Control Handbook (VESCH); have a temporary service life of less than eighteen (18) months; and will be removed completely once associated disturbed areas are stabilized, unless a distinct hazard to the public's health, safety and welfare is determined by the Stormwater Division due to the size or presence of the structure or due to evidence of improper construction.

(*Note: Dam Height as referenced above is generally defined as the vertical distance from the natural bed of the stream or waterway at the downstream toe of the embankment to the top of the embankment structure in accordance with 4VAC50-20-30, Virginia Impoundment Structure Regulations and the Virginia Dam Safety Program.)

Record Drawings shall provide, at a minimum, all information as shown within these requirements and the attached **RECORD DRAWING CHECKLIST** specific to the type of SWM/BMP facility being constructed. Other additional record data may be formally requested by the James City County Stormwater Division. *(Note: Refer to the current edition of the James City County Guidelines for Design and Construction of Stormwater Management BMP's manual for a complete list of acceptable BMP's. Currently there are over 20 acceptable water quality type BMP's accepted by the County.)*

Record Drawings shall consist of blue/black line prints and a reproducible (mylar, sepia, diazo, etc.) set of the approved stormwater facilities construction plan including applicable plan views, profiles, sections, details, maintenance plans, etc. as related to the subject Stormwater Facility. The set shall indicate **"RECORD DRAWING"** in large text in the lower right hand corner of each sheet with record elevations, dimensions and data drawn in a clearly annotated format and/or boxed beside design values. Approved design plan values, dimensions and data shall not be removed or erased. Drawing sheet revision blocks shall be modified as required to indicate record drawing status. Elevations to the nearest 0.1' are sufficiently accurate except where higher accuracy is needed to show positive drainage. Certification statements as shown in Section 4 of the Record Drawing and Construction Certification Form, ***or similar forms thereof***, and professional signatures and seals, with dates matching that of the record drawing status in the revision or title block, are also required on all associated record drawing plans, prints or reproducibles.

Submission Requirements. Initial and subsequent submissions for review shall consist of a minimum of one (1) blue/black line set for record drawings and one copy of the construction certification documents with appropriate transmittal. Under certain circumstances, it is understood that the record drawing and construction certification submissions may be performed by different professional firms. Therefore, record drawing submission may be in advance of construction certification or vice versa. Upon approval and prior to release of surety or a Certificate of Occupancy, final submission shall include one (1) reproducible set of the record drawings, one (1) blue/black line set of the record drawings and one (1) copy of the construction certification. Also for current and/or future incorporation into the County BMP database and GIS system, it is requested that the record drawings also be submitted to the Stormwater Division on a diskette or CD-ROM in an acceptable electronic file format such as *.dxf, *.dwg, etc. or in a standard scanned and readable format. The electronic file requirement can be discussed and coordinated with Stormwater Division staff at the time of final submission.

## STORMWATER FACILITY - BMP AND CONVEYANCE SYSTEM
## RECORD DRAWING CHECKLIST

*( Key for Checklist is as follows:* ***XX*** *Acceptable* ***N/A*** *Not Applicable* ***Inc*** *Incomplete )*

**I. Methods and Presentation:** *( Required for all Stormwater Management / BMP facilities.)*

XX 1. All constructed facilities meet approved design plans, unless otherwise shown. Record information or deviations from approved design plan shown in clearly annotated format and/or boxed beside design values.

XX 2. Elevations to the nearest 0.1' unless higher accuracy is needed to show positive drainage.

XX 3. All plan sheets labeled with "RECORD DRAWING" in large text in lower right hand corner. Include approved County Plan Number and BMP ID Code if known.

XX 4. All plan sheet revision blocks modified to indicate date and record drawing status.

XX 5. All plan sheets have certification statements and certifying professional's signature and seal.

**II. Minimum Standards:** *(Required for all Stormwater Management / BMP facilities, as applicable.)*

XX 1. All requirements of Section I (Methods and Presentation) apply to this section.

XX 2. Plan Views: Show general location, arrangement and dimensions. Location and alignment shall generally match approved design plans.

XX 3. Profile or elevations along top or berm of the facility. At a minimum, elevations are required at each end, at intervals not to exceed 50 feet and where low spots may be present. Top of embankment or berm elevations must be no less than design elevation plus any settlement allowances.

XX 4. Top widths, berm widths and embankment side slopes.

XX 5. Show length, width and depth of facility or grading, contours or spot elevations as required to verify permanent pool and design storage volumes were met or were reasonably close to the approved design. Evaluation of as-built grading, contours, spot elevations, or cross-sections, may be necessary by the professional to ensure approved design configurations, depths and volumes were closely maintained. If grading or elevations are significantly different from the approved plan, the Stormwater Division shall be contacted immediately to determine whether the variation is acceptable or whether further evidence will be required. Facilities which do not closely resemble approved plan grades, elevations or configurations may require regrading by the Contractor; check volumetric computations; and/or a check hydraulic routing to ensure approved design water surface elevations, discharges or freeboard were closely maintained.

XX 6. Cross-section of the embankment through the principal spillway or outlet barrel. Must extend at least 100 ft. downstream of the pipe outlet or to recorded site property line, whichever is closer. Proper correlation is required between principal spillway (control structure) crest, emergency spillway crest, orifice and weirs and the top of the dam or facility. All elevations and dimensions must reasonably match the design plan or be sequentially relative to each other and the facility must reflect the required design storage

volume(s) and/or design depth.

YX 7. Profile or elevations along the entire centerline of the emergency spillway. Emergency spillway may be steeper, but no flatter or narrower than design.

YX 8. Elevation of the principal spillway crest or outlet crest of the structure.

YX 9. Primary control structure (riser) diameter or dimensions, height, type of material and base size. Indicate provisions for access that are present such as steps, ladders, etc.

YX 10. Dimensions, locations and elevations of outlet orifices, weirs, slots and drains.

YX 11. Type and size of anti-vortex and trash rack device. Height, diameter, dimensions, bar spacings (if applicable) and elevations relative to the principal spillway crest. Indicate if lockable hatch is present or not.

NA 12. Type, location, size and number of anti-seep collars or documentation of other methods utilized for seepage control. **May need to obtain this information during construction.**

NA 13. Top of impervious core embankment, core trench limits and elevation of cut-off trench bottom. **May need to obtain this information during construction.**

YX 14. Elevation of the principal spillway barrel (outlet pipe) inlet and outlet invert.

YX 15. Outlet barrel diameter, length, slope, type and thickness class of material and type of flared end sections, headwall or endwall.

YX 16. Outfall protection dimension, type and depth of rock and if underlain filter fabric is present.

NA 17. BMP interior and periphery landscaping zones conform with arrangements and requirements of the approved design plan.

YX 18. Maintenance plan taken from approved design plan transposed onto record drawing set.

NA 19. Fencing location and type, if applicable to facility.

YX 20. BMP vicinity properly cleaned of stockpiles and construction debris.

YX 21. No visual signs of erosion or channel degradation immediately downstream of facility.

YX 22. Any other information formally requested by the Stormwater Division specific to the constructed Stormwater BMP facility.

**STORMWATER FACILITY - BMP AND CONVEYANCE SYSTEM**
**RECORD DRAWING CHECKLIST**

***( Key for Checklist is as follows: XX Acceptable N/A Not Applicable Inc Incomplete )***

**V. Group C - Infiltration Practices** *( Includes C-1 Infiltration Trench; C-2 Infiltration Trench; C-3 Infiltration Basin; and C-4 Infiltration Basin )*

XX C1. All requirements of Section II, Minimum Standards, apply to Group C facilities as applicable.

XX C2. Facility is not located on fill slopes or on natural ground in excess of six (6) percent.

NA C3. Pretreatment devices provided prior to entry into the infiltration facility. Acceptable pretreatment devices include sediment forebays, sediment basins, sediment traps, sump pits or inlets, grass channels, plunge pools or other acceptable measures.

NA C4. Three (3) or more of the following pretreatment devices provided to protect long term integrity of structure: grass channel; grass filter strip; bottom sand layer; upper filter fabric layer; use of washed bank run gravel aggregate.

NA C5. Sides of infiltration practice lined with filter fabric.

XX C6. Facility was not used for erosion and sediment control purposes and sediment was prevented from entering the facility to the greatest extent possible during construction.

XX C7. Stabilization and acceptable vegetative cover established over contributing drainage area prior to conveyance of stormwater to the facility.

XX C8. Minimum one hundred (100) foot separation horizontally from any known water supply well and minimum one hundred (100) foot separation upslope from any building.

XX C9. Minimum twenty-five (25) foot separation down gradient from any structure.

XX C10. Stormwater outfalls provided for overflow associated with larger design storms.

XX C11. No visual signs of erosion or channel degradation immediately downstream of facility.

XX C12. Facility does not currently cause any apparent surface or subsurface water problems to downgrade properties.

NA C13. Observation well provided.

XX C14. Adequate, direct access provided to the facility for future maintenance, operation and inspection.

Environmental Division
OCT 13 2011
RECEIVED

# Stormwater Analysis

for

## King of Glory Lutheran Church

### Site Plan for New Gravel Parking Lot

SP-86-11

**October 6, 2011**

**Project Number 00-KOG**

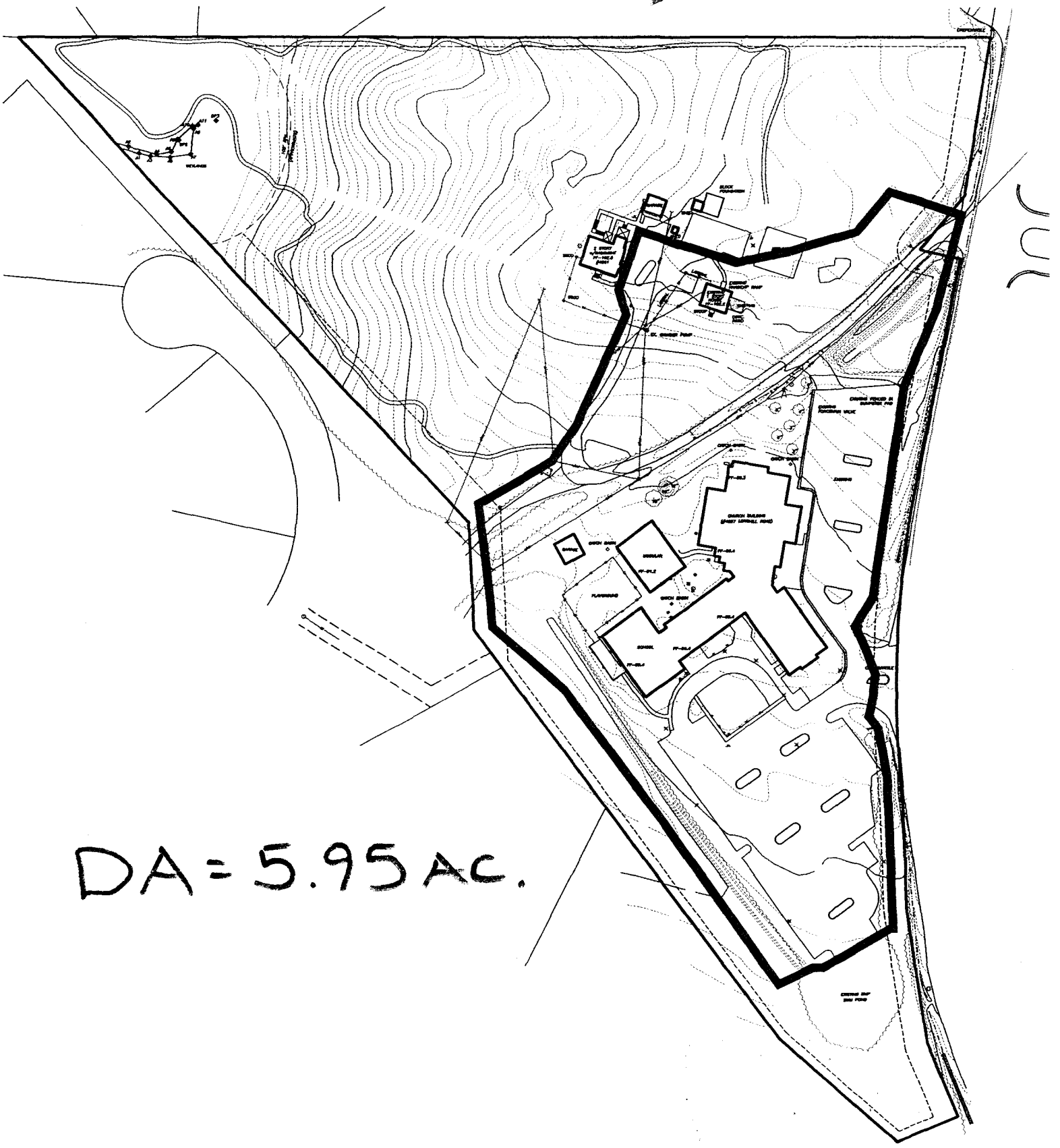
**SUP-0022-2009**

**LandTech Resources, Inc.**
**205 Bulifants Blvd., Ste. E, Williamsburg, VA**
**Phone 757-565-1677 Fax 757-565-0782**

# PRE-DEVELOPMENT CALCULATIONS

COMMONWEALTH OF VIRGINIA
MATTHEW H. CONNOLLY
Lic. No. 2053
10/11/2011
LAND SURVEYOR

# DA PRE (N.T.S.)



DA = 5.95 AC.

# Worksheet 2: Runoff curve number and runoff #11-208

| Project | By | Date |
|---|---|---|
| KING OF GLORY | MHC | 10-6-11 |
| **Location** | **Checked** | **Date** |
| JAMES CITY COUNTY | | |

Check one: ☑ Present ☐ Developed

## 1. Runoff curve number

| Soil name and hydrologic group (appendix A) | Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio) | CN [1/] Table 2-2 | CN [1/] Figure 2-3 | CN [1/] Figure 2-4 | Area ☒ acres ☐ mi² ☐ % | Product of CN x area |
|---|---|---|---|---|---|---|
| KEMPSVILLE (B) | PAVEMENT | 98 | | | 2.596 | 254.4 |
| " " | OPEN SPACE | 61 | | | 3.353 | 204.5 |
| | | | | | | |
| | $S = \frac{1000}{77.1} - 10 = 2.97$ | | | | | |
| | $Q = \frac{(P-.2S)^2}{(P+.8S)}$ | | | | | |
| | $Q = 3.31$ | | | | | |
| | | | | | | |
| | | | | Totals ➡ | 5.949 | 458.6 |

[1/] Use only one CN source per line

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{458.6}{5.949} = 77.08$ ; **Use CN ➡** 77.1

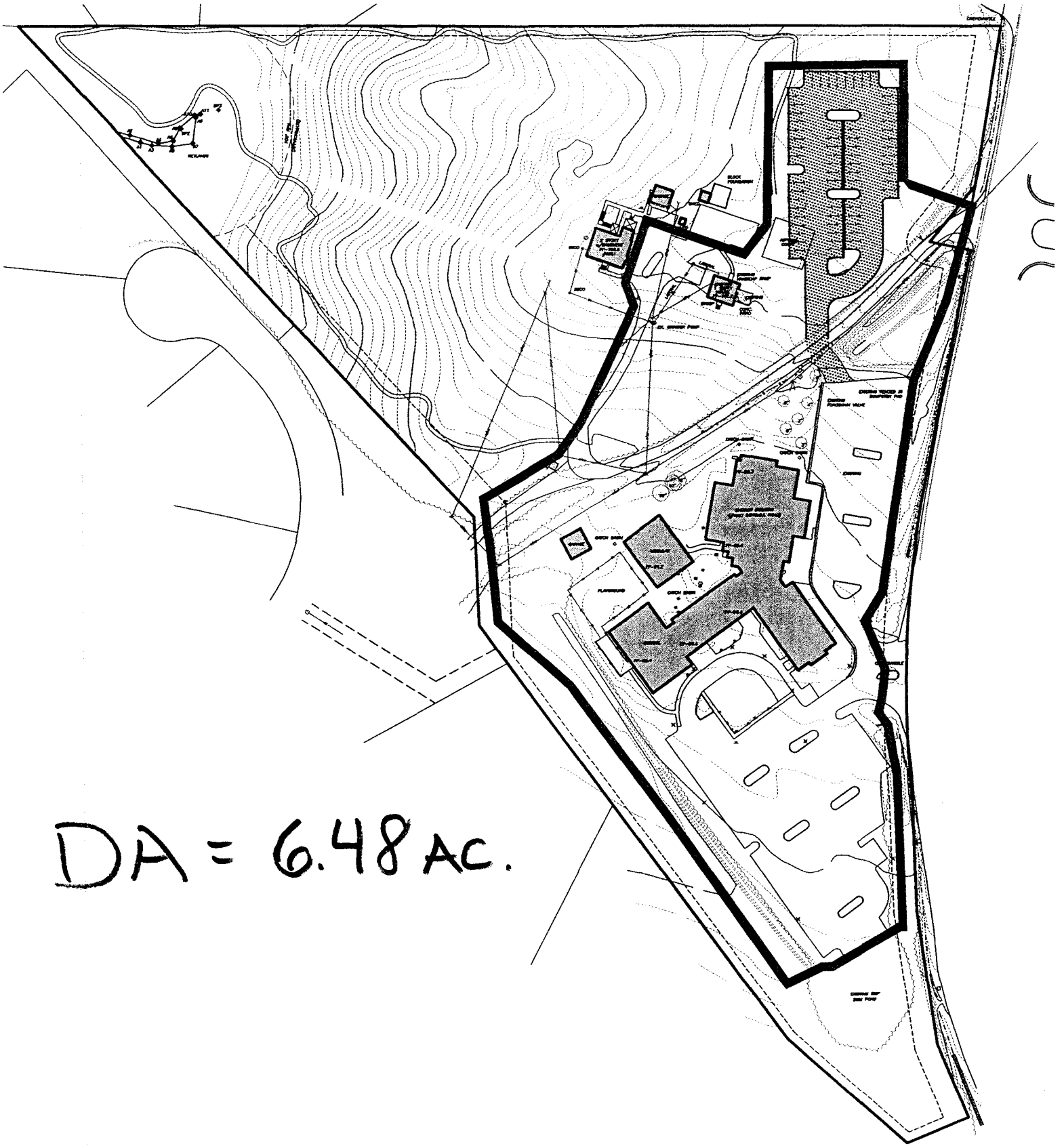
## 2. Runoff

| | | Storm #1 | Storm #2 | Storm #3 |
|---|---|---|---|---|
| Frequency | yr | 10 | | |
| Rainfall, P (24-hour) | in | 5.8 | | |
| Runoff, Q | in | 3.31 | | |

(Use P and CN with table 2-1, figure 2-1, or equations 2-3 and 2-4)

# POST-DEVELOPMENT CALCULATIONS/CONCLUSIONS

# DA POST (N.T.S.)



DA = 6.48 AC.

# Worksheet 2: Runoff curve number and runoff

| Project | By | Date |
|---|---|---|
| KING OF GLORY | MHC | 10-6-11 |
| **Location** | **Checked** | **Date** |
| JAMES CITY CO. | | |

Check one: ☐ Present ☑ Developed

## 1. Runoff curve number

| Soil name and hydrologic group (appendix A) | Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio) | CN [1/] Table 2-2 | CN [1/] Figure 2-3 | CN [1/] Figure 2-4 | Area ☒ acres ☐ mi² ☐ % | Product of CN x area |
|---|---|---|---|---|---|---|
| KEMPSVILLE (B) | PAVEMENT | 98 | | | 2.872 | 281.4 |
| " " | OPEN SPACE | 61 | | | 3.602 | 219.7 |
| | | | | | | |
| | $S = \frac{1000}{77.4} - 10 = 2.92$ | | | | | |
| | $Q = \frac{(P - .2S)^2}{(P + .8S)}$ | | | | | |
| | | | | | | |
| | $Q = 3.34$ | | | | | |
| | | | | Totals ➡ | 6.474 | 501.1 |

[1/] Use only one CN source per line

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{501.1}{6.474} = 77.4$ ; **Use CN ➡** 77.4

## 2. Runoff

| | | Storm #1 | Storm #2 | Storm #3 |
|---|---|---|---|---|
| Frequency | yr | 10 | | |
| Rainfall, P (24-hour) | in | 5.8 | | |
| Runoff, Q | in | 3.34 | | |

(Use P and CN with table 2-1, figure 2-1, or equations 2-3 and 2-4)

**LandTech Resources, Inc.**
Surveying • Engineering • GPS
201 Bulifants Blvd., Suite A, Williamsburg, VA 23188
Phone: (757) 565-1677 Fax: (757) 565-0782
web: landtechresources.com

PROJECT NAME: KOG
PROJECT NO.: 11-208
SHEET NO.: 1 OF 2
CALCULATED BY: MH DATE: 10-6-11
SCALE: N/A

BASED ON "VESC" CHS, V-33

SITE RUNOFF VOLUME

$$\frac{(\text{IN. RUNOFF}) \times \text{S.F.}}{12 \text{ IN/FT}} = \text{C.F.}$$

SEE PREVIOUS PAGE FOR RUNOFF BASED ON TR55 W.S. #2

EXIST. CONDITION

5.95 AC.

$$\frac{3.31 * 259,138}{12 \text{ IN/FT}} = 71,479 \text{ FT}^3$$

POST CONDITION

6.47 AC $\frac{78,492 - 12}{282,007} = 3.34$

$$\frac{3.34 * 282,007}{12 \text{ IN/FT}} = 78,492$$

POST RUNOFF (IN)

78,492 − 71,479 = 7,013 FT³ ADDITIONAL

* THE ADDITION OF THE NEW GRAVEL PARKING LOT INCREASES THE SITE VOLUME FOR THE EXIST. BMP BY 7,013 FT³

SEE PG. 2 OF 2 FOR CONCLUSION

**LandTech Resources, Inc.**
Surveying • Engineering • GPS
201 Bulifants Blvd., Suite A, Williamsburg, VA 23188
Phone: (757) 565-1677 Fax: (757) 565-0782
web: landtechresources.com

PROJECT NAME: KOG
PROJECT NO.: 11-208
SHEET NO.: 2 OF 2
CALCULATED BY: MHC DATE: 10-6-11
SCALE:

BASED ON DIG CALCS. OF BMP VOL DONE FOR MODULAR EXPANSION AND LANDTECHS ADDED CALCS FOR DRIVEWAY CONNECTION, THE CURRENT VOLUME ROUTED TO THE POND FOR THE 10YEAR STORM IS 9,173 FT³. THE POND HAS A CAPACITY OF 13,400 FT³

CONCLUSION:

9,173 + 7,013 = 16,186 SO ⇒

16,186 - 13,400 = 2,786 FT³.

* THE EXISTING BMP NEEDS TO BE EXPANDED BY 2,786 FT³. REFER TO SITE PLAN FOR DESIGN.

# POST-DEVELOPMENT EXISTING DITCH ANALYSIS

EXISTING DITCH W/NEW PARKING

# Worksheet 2: Runoff curve number and runoff

| | | |
|---|---|---|
| Project: KING OF GLORY | By: MHC | Date: 11-6-11 |
| Location: JAMES CITY COUNTY | Checked | Date |

Check one: ☐ Present ☑ Developed

## 1. Runoff curve number

| Soil name and hydrologic group (appendix A) | Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio) | CN [1] Table 2-2 | CN [1] Figure 2-3 | CN [1] Figure 2-4 | Area ☒ acres ☐ mi² ☐ % | Product of CN x area |
|---|---|---|---|---|---|---|
| KEMPSVILLE (B) | PAVEMENT | 98 | | | 2.872 | 281.4 |
| " " | OPEN SPACE | 61 | | | 3.602 | 219.7 |
| | | | | | | |
| | $S = \frac{1000}{77.4} - 10 = 2.92$ | | | | | |
| | $Q = \frac{(P - .2S)^2}{(P + .8S)}$ | | | | | |
| | | | | | | |
| | $Q = 3.34$ | | | | | |

[1] Use only one CN source per line

Totals ➡ 6.474 | 501.1

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{501.1}{6.474} = 77.4$ ; Use CN ➡ 77.4

## 2. Runoff

| | | Storm #1 | Storm #2 | Storm #3 |
|---|---|---|---|---|
| Frequency | yr | 10 | | |
| Rainfall, P (24-hour) | in | 5.8 | | |
| Runoff, Q | in | 3.34 | | |

(Use P and CN with table 2-1, figure 2-1, or equations 2-3 and 2-4)

EX. DITCH W/NEW PARKING

# Worksheet 3: Time of Concentration ($T_c$) or travel time ($T_t$)

| Project | By | Date |
|---|---|---|
| KING OF GLORY | MHC | 10-6-11 |
| **Location** | **Checked** | **Date** |
| JAMES CITY CO. | | |

Check one: ☐ Present ☒ Developed

Check one: ☒ $T_c$ ☐ $T_t$ through subarea

Notes: Space for as many as two segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

**Sheet flow:** (Applicable to $T_c$ only)

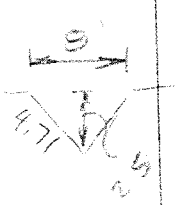
| | Segment ID | A-B | | |
|---|---|---|---|---|
| 1. Surface description (table 3-1) | | GRAVEL | | |
| 2. Manning's roughness coefficient, n (table 3-1) | | .011 | | |
| 3. Flow length, L (total L † 300 ft) ft | | 120 | | |
| 4. Two-year 24-hour rainfall, $P_2$ in | | 3.5 | | |
| 5. Land slope, s ft/ft | | .02 | | |
| 6. $T_t = \frac{0.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute $T_t$ hr | | 0.02 | + — | = 0.02 |

**Shallow concentrated flow:**

| | Segment ID | | | |
|---|---|---|---|---|
| 7. Surface description (paved or unpaved) | | | | |
| 8. Flow length, L ft | | | | |
| 9. Watercourse slope, s ft/ft | | | | |
| 10. Average velocity, V (figure 3-1) ft/s | | | | |
| 11. $T_t = \frac{L}{3600\ V}$ Compute $T_t$ hr | | | + | = |

**Channel flow:**

| | Segment ID | B-C | | |
|---|---|---|---|---|
| 12. Cross sectional flow area, a $ft^2$ | | 10 | | |
| 13. Wetted perimeter, $p_w$ ft | | 9.42 | | |
| 14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r ft | | 1.06 | | |
| 15 Channel slope, s ft/ft | | 0.016 | | |
| 16. Manning's roughness coefficient, n | | 0.03 | | |
| 17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V ft/s | | 6.5 | | |
| 18. Flow length, L ft | | 1166 | | |
| 19. $T_t = \frac{L}{3600\ V}$ Compute $T_t$ hr | | 0.05 | + | = 0.05 |




20. Watershed or subarea $T_c$ or $T_t$ (add $T_t$ in steps 6, 11, and 19) Hr 0.07

EX. DITCH W/NEW PARKING

# Worksheet 4: Graphical Peak Discharge method

| Project | By | Date |
|---|---|---|
| KING OF GLORY | MHC | 10-6-11 |
| **Location** | **Checked** | **Date** |
| | | |

Check one: ☐ Present ☒ Developed EXISTING DITCH W/NEW PARKING ANALYSIS

1. Data

Drainage area ..... $A_m$ = 0.0101 $mi^2$ (acres/640)

Runoff curve number ..... CN = 77 (From worksheet 2)

Time of concentration ..... $T_c$ = 0.07 hr (From worksheet 3)

Rainfall distribution ..... = II (I, IA, II III)

Pond and swamp areas sprea throughout watershed ..... = - - percent of $A_m$ ( - - acres or $mi^2$ covered)

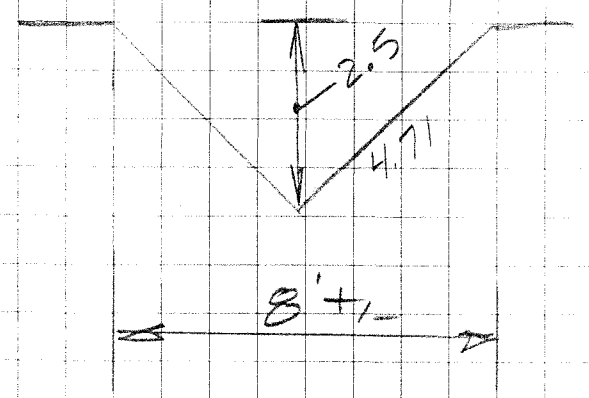
| | | Storm #1 | Storm #2 | Storm #3 |
|---|---|---|---|---|
| 2. Frequency | yr | 10 | | |
| 3. Rainfall, P (24-hour) | in | 5.8 | | |
| 4. Initial abstraction, $I_a$ (Use CN with table 4-1) | in | .597 | | |
| 5. Compute $I_a/P$ | | 0.10 | | |
| 6. Unit peak discharge, $q_u$ (Use $T_c$ and $I_a/P$ with exhibit 4– II ) | csm/in | 980 | | |
| 7. Runoff, Q (From worksheet 2) Figure 2-6 | in | 3.34 | | |
| 8. Pond and swamp adjustment factor, $F_p$ (Use percent pond and swamp area with table 4-2. Factor is 1.0 for zero percent pond ans swamp area.) | | 1.0 | | |
| 9. Peak discharge, $q_p$ | $ft^3/s$ | 33 | | |

( Where $q_p = q_u A_m Q F_p$ )

**LandTech**
Resources, Inc.
Surveying • Engineering • GPS
201 Bulifants Blvd., Suite A, Williamsburg, VA 23188
Phone: (757) 565-1677 Fax: (757) 565-0782
web: landtechresources.com

PROJECT NAME KOG
PROJECT NO. 11-208
SHEET NO. OF
CALCULATED BY MHC DATE
SCALE N/A

EXISTING DITCH TO BMP




A = 10 FT²
WP = 9.42
R = 1.06

$$Q = \frac{1.49}{.03} 10 * 1.06^{.67} 0.016^{.5} = 65 \text{ CFS}$$

CONCLUSION:

EXISTING CHANNEL CAN HOLD/CONVEY 65 CFS. THE ADDITIONAL RUNOFF FROM THE NEW PARKING PLUS EXISTING SITE IS 33 CFS REFER TO WORKSHEET 4. SO DITCH IS O.K. ✓

# POST-DEVELOPMENT NEW DITCH DESIGN

NEW DITCH CALCS

# Worksheet 2: Runoff curve number and runoff

| Project | By | Date |
|---|---|---|
| KING OF GLORY | MHC | 10-6-11 |
| Location | Checked | Date |
| JAMES CITY CO | | |

Check one: ☐ Present ☒ Developed

## 1. Runoff curve number

| Soil name and hydrologic group (appendix A) | Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio) | CN [1/] Table 2-2 | CN [1/] Figure 2-3 | CN [1/] Figure 2-4 | Area ☒ acres ☐ mi² ☐ % | Product of CN x area |
|---|---|---|---|---|---|---|
| KEMPSVILLE (B) | PAVEMENT | 98 | | | .56 | 54.9 |
| " " | OPEN | 61 | | | 1.44 | 87.8 |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

[1/] Use only one CN source per line

Totals ➡ 2.0 | 142.7

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{142.7}{2} = 71.35$ ; Use CN ➡ 71

## 2. Runoff

| | | Storm #1 | Storm #2 | Storm #3 |
|---|---|---|---|---|
| Frequency | yr | 10 | | |
| Rainfall, P (24-hour) | in | 5.8 | | |
| Runoff, Q | in | 2.7 | | |

(Use P and CN with table 2-1, figure 2-1, or equations 2-3 and 2-4)

NEW DITCH CALCS

# Worksheet 3: Time of Concentration ($T_c$) or travel time ($T_t$)

| Project | By | Date |
|---|---|---|
| KING OF GLORY | MHC | 10-6-11 |
| **Location** | **Checked** | **Date** |
| JAMES CITY CO. | | |

Check one: ☐ Present ☒ Developed

Check one: ☐ $T_c$ ☐ $T_t$ through subarea

Notes: Space for as many as two segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

## Sheet flow (to 300 ft)

| | Segment ID | A-B | | |
|---|---|---|---|---|
| 1. Surface description (table 3-1) | | GRAVEL | | |
| 2. Manning's roughness coefficient, n (table 3-1) | | 0.011 | | |
| 3. Flow length, L (total L † 300 ft) ft | | 120 | | |
| 4. Two-year 24-hour rainfall, $P_2$ in | | 3.5 | | |
| 5. Land slope, s ft/ft | | .02 | | |
| 6. $T_t = \frac{0.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute $T_t$ hr | | 0.02 | + | = 0.02 |

## Shallow concentrated flow

| | Segment ID | | | |
|---|---|---|---|---|
| 7. Surface description (paved or unpaved) | | | | |
| 8. Flow length, L ft | | | | |
| 9. Watercourse slope, s ft/ft | | | | |
| 10. Average velocity, V (figure 3-1) ft/s | | | | |
| 11. $T_t = \frac{L}{3600\ V}$ Compute $T_t$ hr | | | + | = |

## Channel flow

| | Segment ID | B-C | | |
|---|---|---|---|---|
| 12. Cross sectional flow area, a $ft^2$ | | 3.0 | | |
| 13. Wetted perimeter, $p_w$ ft | | 6.32 | | |
| 14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r ft | | 0.47 | | |
| 15 Channel slope, s ft/ft | | 0.016 | | |
| 16. Manning's roughness coefficient, n | | 0.03 | | |
| 17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V ft/s | | 4.0 | | |
| 18. Flow length, L ft | | 605 | | |
| 19. $T_t = \frac{L}{3600\ V}$ Compute $T_t$ hr | | 0.04 | + | = 0.04 |

20. Watershed or subarea $T_c$ or $T_t$ (add $T_t$ in steps 6, 11, and 19) Hr 0.06

NEW DITCH CALCS

# Worksheet 4: Graphical Peak Discharge method

| Project | By | Date |
|---|---|---|
| KING OF GLORY | MHC | 10-6-11 |
| **Location** | **Checked** | **Date** |
| JAMES CITY COUNTY | | |

Check one: ☐ Present ☑ Developed

FLOW CALCS TO END OF PROP. DITCH

1. Data

Drainage area ..... $A_m$ = 0.0031 $mi^2$ (acres/640)

Runoff curve number ..... CN = 71 (From worksheet 2)

Time of concentration ..... $T_c$ = 0.06 hr (From worksheet 3)

Rainfall distribution ..... = II (I, IA, II, III)

Pond and swamp areas sprea throughout watershed ..... = -- percent of $A_m$ ( -- acres or $mi^2$ covered)

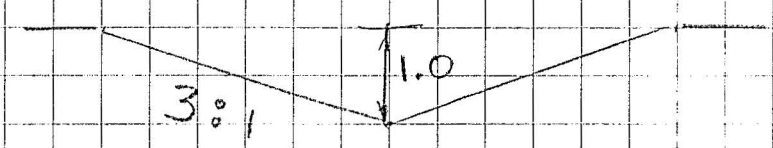
| | | Storm #1 | Storm #2 | Storm #3 |
|---|---|---|---|---|
| 2. Frequency | yr | 10 | | |
| 3. Rainfall, P (24-hour) | in | 5.8 | | |
| 4. Initial abstraction, $I_a$ (Use CN with table 4-1) | in | .817 | | |
| 5. Compute $I_a/P$ | | .14 | | |
| 6. Unit peak discharge, $q_u$ (Use $T_c$ and $I_a/P$ with exhibit 4– 11 ) | csm/in | 980 | | |
| 7. Runoff, Q (From worksheet 2) Figure 2-6 | in | 2.7 | | |
| 8. Pond and swamp adjustment factor, $F_p$ (Use percent pond and swamp area with table 4-2. Factor is 1.0 for zero percent pond ans swamp area.) | | 1.0 | | |
| 9. Peak discharge, $q_p$ | $ft^3/s$ | 8.2 | | |

( Where $q_p = q_u A_m Q F_p$ )

**LandTech Resources, Inc.**
Surveying • Engineering • GPS
201 Bulifants Blvd., Suite A, Williamsburg, VA 23188
Phone: (757) 565-1677 Fax: (757) 565-0782
web: landtechresources.com

PROJECT NAME: KOG
PROJECT NO.: 11-208
SHEET NO. ____ OF ____
CALCULATED BY: MHC DATE: 10-6-11
SCALE: ____

# NEW DITCH CALCS.




A = 3.0
WP = 6.32
R = 0.47

$$Q = \frac{1.49}{0.03} * 3 * .47^{.67} * .016^{.5}$$

Q = 11.36 MAX CAPACITY

* BASED ON Q CALC FROM WORK SHEET 4, THE NEW PARKING GENERATES A FLOW OF 8.2 CFS SO THE ABOVE DITCH DESIGN IS O.K. ✓

# SPECIAL STORMWATER CRITERIA (SSC) CALCULATIONS

**LandTech**
Resources, Inc.
Surveying • Engineering • GPS
201 Bulifants Blvd., Suite A, Williamsburg, VA 23188
Phone: (757) 565-1677 Fax: (757) 565-0782
web: landtechresources.com

PROJECT NAME: KING OF GLORY
PROJECT NO.: 11-208
SHEET NO.: 1 OF 1
CALCULATED BY: MHC DATE: 10-7-11
SCALE:

## SPECIAL STORMWATER CRITERIA

SITE AREA = 13.85 ACRES

DISTURBED AREA = 0.7 +/- ACRES

SSC CLASS 2 = 2 UNIT MEASURES ARE REQUIRED FROM THE SSCP MENU

SSCP # 18 - CHECK DAMS IN NEW DITCH = 1 UNIT

SSCP # 28 - JUTE MESH ALONG NEW DITCH = 1 UNIT

2 UNITS PROVIDED

Environmental Division
SEP 7 2011
RECEIVED

RECEIVED
SEP 2011

# Erosion and Sediment Control Narrative

for

# King of Glory Lutheran Church Gravel Parking Lot Expansion

**August 31, 2011**

**Project Number 11-208**

LandTech Resources, Inc.
205 Bulifants Blvd., Ste E, Williamsburg, VA
Phone 757-565-1677 Fax 757-565-0782

# Erosion and Sediment Control Narrative

for

# King of Glory Lutheran Church Gravel Parking Lot Expansion

**August 31, 2011**

**Project Number 11-208**

**LandTech Resources, Inc.**
**205 Bulifants Blvd., Ste. E, Williamsburg, VA**
**Phone 757-565-1677** **Fax 757-565-0782**

# TABLE OF CONTENTS

*SECTION*

PROJECT DESCRIPTION

EXISTING CONDITIONS

ADJACENT AREAS

OFF-SITE AREA

SOILS

Suffolk fine sandy loam (31B)

CRITICAL EROSION AREAS

EROSION AND SEDIMENT CONTROL MEASURES

STRUCTURAL PRACTICES

Temporary Stone Construction Entrance – 3.02
Silt Fence – 3.05
Outlet Protection – 3.18
Soil Stabilization Blankets and Matting – 3.36
Tree Preservation & Protection – 3.38

VEGETATIVE PRACTICES

Permanent Seeding – 3.32

MANAGEMENT STRATEGIES

PERMANENT STABILIZATION

STORMWATER MANAGEMENT

CALCULATIONS

MAINTENANCE

Temporary Stone Construction Entrance – 3.02
Silt Fence – 3.05
Permanent Seeding – 3.32
Soil Stabilization Blankets and Matting – 3.36

APPENDICES

BMP Design APPENDIX A

## PROJECT DESCRIPTION

The project consists of the development of 0.7+/- acres for a temporary 70 space gravel parking lot and BMP at King of Glory Lutheran Church in James City County, Virginia. After construction is complete the site will contain a total of 2.97 acres covered by impervious surfaces. The total disturbed area is approximately 0.7 acres.

## EXISTING CONDITIONS

Currently the site contains three buildings and asphalt parking area. It is wooded and slopes from the front to the rear.

## ADJACENT AREAS

The site is bounded on the north by Wellspring United Methodist Church, on the east by Longhill Road and Williamsburg Plantation timeshares across the road, on the south and west by Ford's Colony.

## OFF-SITE AREA

There are no off-site areas proposed to be disturbed in association with this project. However, if it becomes necessary to disturb off-site areas, a revised erosion and sediment control plan will be prepared and submitted to the county for review and approval.

## SOILS

### Suffolk fine sandy loam (31B)

This soil is deep, gently sloping, well drained.

Typically, the surface layer of this soil is very dark grayish brown fine sandy loam about 4 inches thick. The subsurface layer is yellowish brown fine sandy loam 10 inches thick. The subsoil is strong brown fine sandy loam and sandy clay loam 26 inches thick. The substratum is brown loamy fine sand to a depth of at least 64 inches.

The permeability of this Suffolk soil is moderate and the erosion hazard is moderate. The subsoil has low shrink-swell potential.

## CRITCAL EROSION AREAS

The critical erosion areas associated with this site are the existing offsite natural drainage way located off the western boundary of the property. To prevent sediment from leaving the site to this area, it is imperative that the contractor install all erosion and sediment control measures shown on these plans before any land disturbing activities commence. Regular inspection and maintenance is also required for all erosion and sediment control measures to keep them functioning as designed.

## EROSION AND SEDIMENT CONTROL MEASURES

Unless otherwise indicated, all structural and vegetative erosion and sediment control practices shall be constructed and maintained according to minimum standards and specifications of the latest edition of Virginia Erosion and Sediment Control Handbook (VESCH). The minimum standards shall be adhered to unless otherwise waived or approved by variance.

## STRUCTURAL PRACTICES

### Temporary Stone Construction Entrance – 3.02

A construction entrance shall be provided at the point of ingress and egress to reduce the amount of mud transported onto paved public roads by motor vehicles and runoff.

### Silt Fence – 3.05

Silt fence shall be placed around the limits of clearing to intercept and detain small amounts of sediment from disturbed areas during construction operations.

### Outlet Protection – 3.18

Outlet protection shall be installed at the outfall of the dry swale BMP to prevent scour, to protect the outlet structure, and to minimize the potential for downstream erosion by reducing the velocity and energy of concentrated stormwater flows.

### Soil Stabilization Blankets and Matting – 3.36

Jute mesh shall be provided to aid in controlling erosion on the fill slopes by providing a microclimate which protects young vegetation and promotes its establishment.

### Tree Preservation & Protection – 3.38

Tree protection shall be provided to protect desirable trees from mechanical and other injury during land disturbing and construction activity.

## VEGETATIVE PRACTICES

### Permanent Seeding – 3.32

All denuded areas, which will be left dormant for extended periods of time, shall be seeded with permanent vegetation immediately following grading. Selection of the seed mixture will depend on the time of year it is applied.

## MANAGEMENT STRATEGIES

- Sediment trapping measures will be installed as the first step in grading and will be seeded and mulched immediately following installation.
- Temporary seeding or other stabilization will follow immediate after grading.
- The contractor shall be responsible for the installation and maintenance of all erosion and sediment control practices depicted on the Plans.
- After achieving adequate stabilization, the temporary controls will be cleaned and removed. Any areas disturbed in the removal process shall be graded, top soiled, and seeded accordingly.

## PERMANENT STABILIZATION

All areas disturbed by construction shall be stabilized with permanent seeding immediately following finish grading. Seeding shall be accomplished with Kentucky 31 Tall Fescue according to Standards and Specifications 3.32, Permanent Seeding of the VESCH. Soil stabilization blankets will be installed over slopes, which have been brought to final grade and have been seeded to protect the slopes from rill and gully erosion and to allow seed to germinate properly. Mulch (straw or fiber) will be used on relatively flat areas. In all seeding operations, seed, fertilizer and lime will be applied prior to mulching.

## STORMWATER MANAGEMENT

This project is for the construction of 0.7+/- acres for a temporary 70 space gravel parking lot and BMP in James City County, Virginia. To meet the stormwater quality requirements of the James City County BMP Point System and the stormwater quantity requirements of Minimum Standard 19 of the Virginia Stormwater Management Handbook a James City County E-2 BMP (Dry Swale) will be designed to treat the additional stormwater runoff from the gravel parking lot. To meet the water quality requirements the BMP treats 0.58 acres for 10 points. The dry swale stores and infiltrates the water quality volume and releases the 2-year post-development storm of 3.06 cfs at 0.17 cfs. The dry swale uses a 50-foot long rigid lip weir as the discharge device. Since the stormwater discharge is not concentrated the 10-year storm discharge is not required to be analyzed.

## CALCULATIONS

Appendix A contains design calculations for the BMP design.

## MAINTENANCE

In general, all erosion and sediment control measures will be checked daily and after each significant rainfall. The following items will be checked in particular:

**Temporary Stone Construction Entrance – 3.02**

The entrance shall be maintained in a condition, which will prevent tracking or flow of mud onto public rights-of-way. This may require periodic dressing with additional stone or the washing and reworking of existing stone as conditions demand. All materials spilled, dropped, washed, or tracked from vehicles onto roadways or into storm drains must be removed immediately. The use of water trucks to remove materials dropped, washed, or tracked onto roadways will not be permitted under any circumstances.

**Silt Fence – 3.05**

Silt fences shall be inspected immediately after each rainfall and at least daily during prolonged rainfall. Any required repairs shall be made immediately.

Close attention shall be paid to the repair of damaged silt fence resulting from end runs and undercutting.

Should the fabric on a silt fence decompose or become ineffective prior to the end of the expected usable life and the barrier still be necessary, the fabric shall be replaced promptly.

Sediment deposits should be removed after each storm event. They must be removed when deposits reach approximately one-half the height of the barrier.

Any sediment deposits remaining in place after the silt fence is not longer required shall be dressed to conform with the existing grade, prepared and seeded.

**Permanent Seeding – 3.32**

The seeded/mulched areas should be checked regularly to ensure that a good stand is established and maintained. Areas should be fertilized, mulched and re-seeded as needed. When it is clear that plants have not germinated on an area or have died, these areas must be re-seeded immediately to prevent erosion damage. However, it is extremely important to determine for what reason germination did not take place and make any corrective action necessary prior to re-seeding the area.

- Fertilizer shall be applied using approved fertilization methods and equipment.
- Formulations and application rates shall conform to the guidelines given in VESCH.
- Maintain a ground cover or organic mulch around trees that is adequate to prevent erosion, protect roots, and hold water.

**Soil Stabilization Blankets and Matting – 3.36**

All soil stabilization blankets and matting should be inspected periodically following installation, particularly after rainstorms to check for erosion and undermining. Any dislocation or failure should be repaired immediately. If washouts or breakage occurs, reinstall the material after

repairing damage to the slope. Continue to monitor these areas until which time they become permanently stabilized; at that time an annual inspection should be adequate.

# APPENDIX A

# Worksheet 3: Time of Concentration ($T_c$) or travel time ($T_t$)

| Project | By | Date |
|---|---|---|
| King of Glory | KMJ | 8/23/11 |
| **Location** | **Checked** | **Date** |
| James City County, Va | | |

Check one: ☒ Present ☐ Developed

Check one: ☒ $T_c$ ☐ $T_t$ through subarea

Notes: Space for as many as two segments per flow type can be used for each worksheet.
Include a map, schematic, or description of flow segments.

## Sheet flow (Applicable to Tc only)

| | Segment ID | | |
|---|---|---|---|
| 1. Surface description (table 3-1) | Woods | | |
| 2. Manning's roughness coefficient, n (table 3-1) | 0.40 | | |
| 3. Flow length, L (total L † 300 ft) ft | 120 | | |
| 4. Two-year 24-hour rainfall, $P_2$ in | 3.5 | | |
| 5. Land slope, s ft/ft | .016 | | |
| 6. $T_t = \frac{0.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute $T_t$ hr | 0.43 | + | = 0.43 |

## Shallow concentrated flow

| | Segment ID | | |
|---|---|---|---|
| 7. Surface description (paved or unpaved) | | | |
| 8. Flow length, L ft | | | |
| 9. Watercourse slope, s ft/ft | | | |
| 10. Average velocity, V (figure 3-1) ft/s | | | |
| 11. $T_t = \frac{L}{3600\ V}$ Compute $T_t$ hr | | + | = |

## Channel flow

| | Segment ID | | |
|---|---|---|---|
| 12. Cross sectional flow area, a $ft^2$ | | | |
| 13. Wetted perimeter, $p_w$ ft | | | |
| 14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r ft | | | |
| 15 Channel slope, s ft/ft | | | |
| 16. Manning's roughness coefficient, n | | | |
| 17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V ft/s | | | |
| 18. Flow length, L ft | | | |
| 19. $T_t = \frac{L}{3600\ V}$ Compute $T_t$ hr | | + | = |

20. Watershed or subarea $T_c$ or $T_t$ (add $T_t$ in steps 6, 11, and 19) Hr 0.43

# Worksheet 2: Runoff curve number and runoff

| Project | By | Date |
|---|---|---|
| King of Glory | KMJ | 8/23/11 |
| **Location** | **Checked** | **Date** |
| James City County, Va. | | |

Check one: ☒ Present ☐ Developed

## 1. Runoff curve number

| Soil name and hydrologic group (appendix A) | Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio) | CN [1/] Table 2-2 | CN [1/] Figure 2-3 | CN [1/] Figure 2-4 | Area ☒ acres ☐ mi² ☐ % | Product of CN x area |
|---|---|---|---|---|---|---|
| Suffolk (B) | Woods (Good Cover) | 55 | | | 0.58 | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | Totals ➡ | 0.58 | |

[1/] Use only one CN source per line

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ = _____ = _____ ; **Use CN ➡** 55

## 2. Runoff

| | | Storm #1 | Storm #2 | Storm #3 | Storm #4 |
|---|---|---|---|---|---|
| Frequency | yr | 1 | 2 | 10 | 100 |
| Rainfall, P (24-hour) | in | 2.8 | 3.5 | 5.8 | 8.0 |
| Runoff, Q | in | 0.1 | 0.4 | 1.4 | 2.7 |

(Use P and CN with table 2-1, figure 2-1, or equations 2-3 and 2-4)

# Worksheet 5a: Basic watershed data

| Project | Location | By | Date |
|---|---|---|---|
| King of Glory | James City County, Va | KWJ | 8/23/11 |
| Check one: ☒ Present ☐ Developed | Frequency (yr) | Checked | Date |

| Subarea name STREAM | Drainage area $A_m$ ($mi^2$) | Time of concentration $T_c$ (hr) | Travel time through subarea $T_t$ (hr) | Downstream subarea names | Travel time summation to outlet $\Sigma T_t$ (hr) | 24-hr rainfall P (in) | Runoff curve number CN | Runoff Q (in) | $A_mQ$ ($mi^2$—in) | Initial abstraction $I_a$ (in) | $I_a/P$ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | .0009 | 0.43 | | | | 2.8 | 55 | 0.1 | .0001 | 1.636 | 0.58 |
| 2 | .0009 | 0.43 | | | | 3.5 | 55 | 0.4 | .0004 | 1.636 | 0.47 |
| 10 | .0009 | 0.43 | | | | 5.8 | 55 | 1.4 | .0013 | 1.636 | 0.28 |
| | | | | | | | | | | | |
| 100 | .0009 | 0.43 | | | | 8.0 | 55 | 2.7 | .0024 | 1.636 | 0.21 |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | From worksheet 3 | | | | | From worksheet 2 | | | From table 5-1 | |

# Worksheet 5b: Basic watershed data

| Project | Location | By | Date |
|---|---|---|---|
| King of Glory | James City County, Va. | KHJ | 8/23/11 |
| Check one: ☒ Present ☐ Developed | Frequency (yr) | Checked | Date |

| Subarea name | Basic watershed data used 1/ | | | | Select and enter hydrograph times in hours from exhibit 5-II 2/ | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Subarea $T_c$ (hr) | $\Sigma T_t$ to outlet (hr) | $I_a/P$ | $A_mQ$ ( $mi^2$—in ) | | | | 12.4 | 12.5 | | | | | | | |
| | | | | | Discharges at selected hydrograph times 3/ ( cfs ) | | | | | | | | | | | |
| 1 | 0.43 | | 0.58 | .0001 | | | | | 0.03 | | | | | | | |
| 2 | 0.43 | | 0.47 | .0004 | | | | | .10 | | | | | | | |
| 10 | 0.43 | | 0.28 | .0013 | | | | 0.64 | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| 100 | 0.43 | | 0.21 | .0024 | | | | 1.19 | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| Composite hydrograph at outlet | | | | | | | | | | | | | | | | |

1/ Worksheet 5a. Rounded as needed for use with exhibit 5.
2/ Enter rainfall distribution type used.
3/ Hydrograph discharge for selected times is $A_mQ$ multiplied by tabular discharge from appropriate exhibit 5.

# Worksheet 2: Runoff curve number and runoff

| Project | By | Date |
|---|---|---|
| King of Glory | KMJ | 8/23/11 |
| **Location** | **Checked** | **Date** |
| James City County, Va. | | |

Check one: ☐ Present ☒ Developed

## 1. Runoff curve number

| Soil name and hydrologic group (appendix A) | Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio) | CN [1/] Table 2-2 | CN [1/] Figure 2-3 | CN [1/] Figure 2-4 | Area ☒ acres ☐ mi² ☐ % | Product of CN x area |
|---|---|---|---|---|---|---|
| Suffolk (B) | Pavement | 98 | | | 0.58 | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

[1/] Use only one CN source per line

**Totals** ➡ 0.58

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ = _____ = _____ ; **Use CN** ➡ 98 ✓

## 2. Runoff

| | | Storm #1 | Storm #2 | Storm #3 |
|---|---|---|---|---|
| Frequency | yr | 1 | 10 | 100 |
| Rainfall, P (24-hour) | in | 2.8 | 5.8 | 8.0 |
| Runoff, Q (Use P and CN with table 2-1, figure 2-1, or equations 2-3 and 2-4) | in | 2.6 | 5.6 | 7.8 |

# Worksheet 3: Time of Concentration ($T_c$) or travel time ($T_t$)

| Project | By | Date |
|---|---|---|
| King of Glory | KMS | 8/23/11 |
| **Location** | **Checked** | **Date** |
| James City County, Va. | | |

Check one: ☐ Present ☒ Developed

Check one: ☒ $T_c$ ☐ $T_t$ through subarea

Notes: Space for as many as two segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

## Sheet flow (Applicable to Tc only)

| | Segment ID | | |
|---|---|---|---|
| 1. Surface description (table 3-1) | Paved | | |
| 2. Manning's roughness coefficient, n (table 3-1) | .011 | | |
| 3. Flow length, L (total L † 300 ft) ft | 120 | | |
| 4. Two-year 24-hour rainfall, $P_2$ in | 3.5 | | |
| 5. Land slope, s ft/ft | .01 | | |
| 6. $T_t = \frac{0.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute $T_t$ hr | .03 | + | = .03 |

## Shallow concentrated flow

| | Segment ID | | |
|---|---|---|---|
| 7. Surface description (paved or unpaved) | | | |
| 8. Flow length, L ft | | | |
| 9. Watercourse slope, s ft/ft | | | |
| 10. Average velocity, V (figure 3-1) ft/s | | | |
| 11. $T_t = \frac{L}{3600\ V}$ Compute $T_t$ hr | | + | = |

## Channel flow

| | Segment ID | | |
|---|---|---|---|
| 12. Cross sectional flow area, a $ft^2$ | | | |
| 13. Wetted perimeter, $p_w$ ft | | | |
| 14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r ft | | | |
| 15 Channel slope, s ft/ft | | | |
| 16. Manning's roughness coefficient, n | | | |
| 17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V ft/s | | | |
| 18. Flow length, L ft | | | |
| 19. $T_t = \frac{L}{3600\ V}$ Compute $T_t$ hr | | + | = |

20. Watershed or subarea $T_c$ or $T_t$ (add $T_t$ in steps 6, 11, and 19) Hr .03

# Worksheet 5a: Basic watershed data

| Project | Location | By | Date |
|---|---|---|---|
| King of Glory | James City County, Va. | KHH | 8/23/11 |
| Check one: ☐ Present ☒ Developed | Frequency (yr) | Checked | Date |

| ~~Subarea name~~ STORM | Drainage area $A_m$ (mi²) | Time of concentration $T_c$ (hr) | Travel time through subarea $T_t$ (hr) | Downstream subarea names | Travel time summation to outlet $\Sigma T_t$ (hr) | 24-hr rainfall P (in) | Runoff curve number CN | Runoff Q (in) | $A_mQ$ (mi²—in) | Initial abstraction $I_a$ (in) | $I_a/P$ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | .0009 | .03 | | | | 2.8 | 98 | 2.6 | .0023 | 0.041 | .01 |
| | | | | | | | | | | | |
| 10 | .0009 | .03 | | | | 5.8 | 98 | 5.6 | .0050 | 0.041 | .01 |
| | | | | | | | | | | | |
| 100 | .0009 | .03 | | | | 8.0 | 98 | 7.8 | .0070 | 0.041 | .01 |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | From worksheet 3 | | | | | From worksheet 2 | | | From table 5-1 | |

# Worksheet 5b: Basic watershed data

| Project | Location | By | Date |
|---|---|---|---|
| King of Glory | James City County, Va. | KWJ | 8/23/11 |
| Check one: ☐ Present ☒ Developed | Frequency (yr) | Checked | Date |

| Subarea name | Basic watershed data used 1/ | | | | Select and enter hydrograph times in hours from exhibit 5-II 2/ | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| STORM | Subarea $T_c$ (hr) | $\Sigma T_t$ to outlet (hr) | $I_a/P$ | $A_mQ$ ($mi^2$—in) | | | | 12.1 | | | | | | | | |
| | | | | | Discharges at selected hydrograph times 3/ (cfs) | | | | | | | | | | | |
| 1 | .03 | | .01 | .0023 | | | | 2.32 | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| 10 | .03 | | .01 | .0050 | | | | 5.05 | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| 100 | .03 | | .01 | .0070 | | | | 7.07 | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| Composite hydrograph at outlet | | | | | | | | | | | | | | | | |

1/ Worksheet 5a. Rounded as needed for use with exhibit 5.
2/ Enter rainfall distribution type used.
3/ Hydrograph discharge for selected times is $A_mQ$ multiplied by tabular discharge from appropriate exhibit 5.

# Worksheet for BMP Point System

A. STRUCTURAL BMP POINT ALLOCATION

| BMP | BMP Points | | Fraction of Site Served by BMP | | Weighted BMP Points |
|---|---|---|---|---|---|
| E-2 | 10 | x | 1.0 | = | 10 |
| | | x | | = | |
| | | x | | = | |
| | | x | | = | |

TOTAL WEIGHTED STRUCTURAL BMP POINTS: 10

B. NATURAL OPEN SPACE CREDIT

| Fraction of Site | | Natural Open Space Credit | | Points for Natural Open Space |
|---|---|---|---|---|
| | x | (0.1 per 1%) | = | |
| | x | (0.15 per 1%) | = | |

TOTAL NATURAL OPEN SPACE CREDIT: Ø

C. TOTAL WEIGHTED POINTS

| 10 | + | Ø | = | 10.0 |
|---|---|---|---|---|
| Structural BMP Points | | Natural Open Space Points | | Total |

# 2-Year Hydrograph

# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Wednesday, Aug 24, 2011

## Hyd. No. 1

Post-Development

| | | | |
|---|---|---|---|
| Hydrograph type | = SCS Runoff | Peak discharge | = 3.057 cfs |
| Storm frequency | = 2 yrs | Time to peak | = 11.92 hrs |
| Time interval | = 1 min | Hyd. volume | = 6,447 cuft |
| Drainage area | = 0.580 ac | Curve number | = 98 |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = USER | Time of conc. (Tc) | = 1.8 min |
| Total precip. | = 3.50 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |

### Hydrograph Discharge Table

( Printed values >= 1.00% of Qp.)

| Time -- Outflow (hrs cfs) | | Time -- Outflow (hrs cfs) | | Time -- Outflow (hrs cfs) | | Time -- Outflow (hrs cfs) | |
|---|---|---|---|---|---|---|---|
| 6.70 | 0.031 | 7.32 | 0.034 | 7.93 | 0.037 | 8.55 | 0.047 |
| 6.72 | 0.031 | 7.33 | 0.034 | 7.95 | 0.037 | 8.57 | 0.047 |
| 6.73 | 0.031 | 7.35 | 0.034 | 7.97 | 0.037 | 8.58 | 0.047 |
| 6.75 | 0.031 | 7.37 | 0.034 | 7.98 | 0.037 | 8.60 | 0.048 |
| 6.77 | 0.031 | 7.38 | 0.034 | 8.00 | 0.037 | 8.62 | 0.048 |
| 6.78 | 0.031 | 7.40 | 0.034 | 8.02 | 0.037 | 8.63 | 0.048 |
| 6.80 | 0.031 | 7.42 | 0.034 | 8.03 | 0.037 | 8.65 | 0.049 |
| 6.82 | 0.031 | 7.43 | 0.034 | 8.05 | 0.037 | 8.67 | 0.049 |
| 6.83 | 0.031 | 7.45 | 0.034 | 8.07 | 0.038 | 8.68 | 0.049 |
| 6.85 | 0.031 | 7.47 | 0.034 | 8.08 | 0.038 | 8.70 | 0.050 |
| 6.87 | 0.031 | 7.48 | 0.034 | 8.10 | 0.038 | 8.72 | 0.050 |
| 6.88 | 0.032 | 7.50 | 0.035 | 8.12 | 0.039 | 8.73 | 0.050 |
| 6.90 | 0.032 | 7.52 | 0.035 | 8.13 | 0.039 | 8.75 | 0.050 |
| 6.92 | 0.032 | 7.53 | 0.035 | 8.15 | 0.039 | 8.77 | 0.051 |
| 6.93 | 0.032 | 7.55 | 0.035 | 8.17 | 0.040 | 8.78 | 0.051 |
| 6.95 | 0.032 | 7.57 | 0.035 | 8.18 | 0.040 | 8.80 | 0.051 |
| 6.97 | 0.032 | 7.58 | 0.035 | 8.20 | 0.040 | 8.82 | 0.052 |
| 6.98 | 0.032 | 7.60 | 0.035 | 8.22 | 0.040 | 8.83 | 0.052 |
| 7.00 | 0.032 | 7.62 | 0.035 | 8.23 | 0.041 | 8.85 | 0.052 |
| 7.02 | 0.032 | 7.63 | 0.035 | 8.25 | 0.041 | 8.87 | 0.053 |
| 7.03 | 0.032 | 7.65 | 0.035 | 8.27 | 0.041 | 8.88 | 0.053 |
| 7.05 | 0.032 | 7.67 | 0.035 | 8.28 | 0.042 | 8.90 | 0.053 |
| 7.07 | 0.032 | 7.68 | 0.035 | 8.30 | 0.042 | 8.92 | 0.054 |
| 7.08 | 0.032 | 7.70 | 0.035 | 8.32 | 0.042 | 8.93 | 0.054 |
| 7.10 | 0.033 | 7.72 | 0.036 | 8.33 | 0.043 | 8.95 | 0.054 |
| 7.12 | 0.033 | 7.73 | 0.036 | 8.35 | 0.043 | 8.97 | 0.055 |
| 7.13 | 0.033 | 7.75 | 0.036 | 8.37 | 0.043 | 8.98 | 0.055 |
| 7.15 | 0.033 | 7.77 | 0.036 | 8.38 | 0.044 | 9.00 | 0.055 |
| 7.17 | 0.033 | 7.78 | 0.036 | 8.40 | 0.044 | 9.02 | 0.056 |
| 7.18 | 0.033 | 7.80 | 0.036 | 8.42 | 0.044 | 9.03 | 0.056 |
| 7.20 | 0.033 | 7.82 | 0.036 | 8.43 | 0.044 | 9.05 | 0.056 |
| 7.22 | 0.033 | 7.83 | 0.036 | 8.45 | 0.045 | 9.07 | 0.056 |
| 7.23 | 0.033 | 7.85 | 0.036 | 8.47 | 0.045 | 9.08 | 0.056 |
| 7.25 | 0.033 | 7.87 | 0.036 | 8.48 | 0.045 | 9.10 | 0.056 |
| 7.27 | 0.033 | 7.88 | 0.036 | 8.50 | 0.046 | 9.12 | 0.056 |
| 7.28 | 0.033 | 7.90 | 0.036 | 8.52 | 0.046 | 9.13 | 0.056 |
| 7.30 | 0.034 | 7.92 | 0.037 | 8.53 | 0.046 | 9.15 | 0.056 |

*Continues on next page...*

Post-Development

## Hydrograph Discharge Table

| Time (hrs | Outflow cfs) | Time (hrs | Outflow cfs) | Time (hrs | Outflow cfs) | Time (hrs | Outflow cfs) |
|---|---|---|---|---|---|---|---|
| 9.17 | 0.056 | 10.05 | 0.073 | 10.93 | 0.125 | 11.82 | 1.793 |
| 9.18 | 0.056 | 10.07 | 0.073 | 10.95 | 0.126 | 11.83 | 2.004 |
| 9.20 | 0.056 | 10.08 | 0.074 | 10.97 | 0.127 | 11.85 | 2.214 |
| 9.22 | 0.056 | 10.10 | 0.075 | 10.98 | 0.129 | 11.87 | 2.424 |
| 9.23 | 0.056 | 10.12 | 0.076 | 11.00 | 0.130 | 11.88 | 2.635 |
| 9.25 | 0.056 | 10.13 | 0.076 | 11.02 | 0.131 | 11.90 | 2.846 |
| 9.27 | 0.056 | 10.15 | 0.077 | 11.03 | 0.133 | 11.92 | 3.057 << |
| 9.28 | 0.056 | 10.17 | 0.078 | 11.05 | 0.136 | 11.93 | 2.995 |
| 9.30 | 0.056 | 10.18 | 0.079 | 11.07 | 0.139 | 11.95 | 2.591 |
| 9.32 | 0.056 | 10.20 | 0.079 | 11.08 | 0.142 | 11.97 | 2.162 |
| 9.33 | 0.056 | 10.22 | 0.080 | 11.10 | 0.145 | 11.98 | 1.686 |
| 9.35 | 0.056 | 10.23 | 0.081 | 11.12 | 0.148 | 12.00 | 1.256 |
| 9.37 | 0.056 | 10.25 | 0.082 | 11.13 | 0.151 | 12.02 | 0.829 |
| 9.38 | 0.056 | 10.27 | 0.082 | 11.15 | 0.154 | 12.03 | 0.543 |
| 9.40 | 0.056 | 10.28 | 0.083 | 11.17 | 0.157 | 12.05 | 0.409 |
| 9.42 | 0.056 | 10.30 | 0.084 | 11.18 | 0.160 | 12.07 | 0.369 |
| 9.43 | 0.057 | 10.32 | 0.085 | 11.20 | 0.163 | 12.08 | 0.360 |
| 9.45 | 0.057 | 10.33 | 0.085 | 11.22 | 0.166 | 12.10 | 0.353 |
| 9.47 | 0.057 | 10.35 | 0.086 | 11.23 | 0.169 | 12.12 | 0.346 |
| 9.48 | 0.057 | 10.37 | 0.087 | 11.25 | 0.172 | 12.13 | 0.339 |
| 9.50 | 0.057 | 10.38 | 0.088 | 11.27 | 0.175 | 12.15 | 0.331 |
| 9.52 | 0.057 | 10.40 | 0.088 | 11.28 | 0.178 | 12.17 | 0.324 |
| 9.53 | 0.057 | 10.42 | 0.089 | 11.30 | 0.181 | 12.18 | 0.317 |
| 9.55 | 0.057 | 10.43 | 0.090 | 11.32 | 0.184 | 12.20 | 0.310 |
| 9.57 | 0.058 | 10.45 | 0.091 | 11.33 | 0.187 | 12.22 | 0.302 |
| 9.58 | 0.058 | 10.47 | 0.091 | 11.35 | 0.190 | 12.23 | 0.295 |
| 9.60 | 0.059 | 10.48 | 0.092 | 11.37 | 0.193 | 12.25 | 0.288 |
| 9.62 | 0.059 | 10.50 | 0.093 | 11.38 | 0.196 | 12.27 | 0.281 |
| 9.63 | 0.060 | 10.52 | 0.094 | 11.40 | 0.199 | 12.28 | 0.273 |
| 9.65 | 0.060 | 10.53 | 0.095 | 11.42 | 0.202 | 12.30 | 0.266 |
| 9.67 | 0.061 | 10.55 | 0.096 | 11.43 | 0.205 | 12.32 | 0.259 |
| 9.68 | 0.061 | 10.57 | 0.097 | 11.45 | 0.208 | 12.33 | 0.252 |
| 9.70 | 0.062 | 10.58 | 0.098 | 11.47 | 0.211 | 12.35 | 0.245 |
| 9.72 | 0.062 | 10.60 | 0.100 | 11.48 | 0.214 | 12.37 | 0.237 |
| 9.73 | 0.063 | 10.62 | 0.101 | 11.50 | 0.217 | 12.38 | 0.230 |
| 9.75 | 0.063 | 10.63 | 0.102 | 11.52 | 0.228 | 12.40 | 0.223 |
| 9.77 | 0.064 | 10.65 | 0.103 | 11.53 | 0.259 | 12.42 | 0.216 |
| 9.78 | 0.064 | 10.67 | 0.105 | 11.55 | 0.314 | 12.43 | 0.208 |
| 9.80 | 0.065 | 10.68 | 0.106 | 11.57 | 0.383 | 12.45 | 0.201 |
| 9.82 | 0.065 | 10.70 | 0.107 | 11.58 | 0.456 | 12.47 | 0.194 |
| 9.83 | 0.066 | 10.72 | 0.108 | 11.60 | 0.530 | 12.48 | 0.187 |
| 9.85 | 0.066 | 10.73 | 0.110 | 11.62 | 0.604 | 12.50 | 0.179 |
| 9.87 | 0.067 | 10.75 | 0.111 | 11.63 | 0.679 | 12.52 | 0.173 |
| 9.88 | 0.067 | 10.77 | 0.112 | 11.65 | 0.753 | 12.53 | 0.168 |
| 9.90 | 0.068 | 10.78 | 0.113 | 11.67 | 0.828 | 12.55 | 0.164 |
| 9.92 | 0.068 | 10.80 | 0.115 | 11.68 | 0.902 | 12.57 | 0.162 |
| 9.93 | 0.069 | 10.82 | 0.116 | 11.70 | 0.977 | 12.58 | 0.161 |
| 9.95 | 0.069 | 10.83 | 0.117 | 11.72 | 1.052 | 12.60 | 0.159 |
| 9.97 | 0.070 | 10.85 | 0.118 | 11.73 | 1.128 | 12.62 | 0.157 |
| 9.98 | 0.070 | 10.87 | 0.120 | 11.75 | 1.203 | 12.63 | 0.156 |
| 10.00 | 0.071 | 10.88 | 0.121 | 11.77 | 1.290 | 12.65 | 0.154 |
| 10.02 | 0.071 | 10.90 | 0.122 | 11.78 | 1.416 | 12.67 | 0.153 |
| 10.03 | 0.072 | 10.92 | 0.124 | 11.80 | 1.591 | 12.68 | 0.151 |

*Continues on next page...*

Post-Development

## Hydrograph Discharge Table

| Time (hrs | Outflow cfs) | Time (hrs | Outflow cfs) | Time (hrs | Outflow cfs) | Time (hrs | Outflow cfs) |
|---|---|---|---|---|---|---|---|
| 12.70 | 0.149 | 13.58 | 0.088 | 14.47 | 0.065 | 15.35 | 0.053 |
| 12.72 | 0.148 | 13.60 | 0.087 | 14.48 | 0.065 | 15.37 | 0.053 |
| 12.73 | 0.146 | 13.62 | 0.086 | 14.50 | 0.064 | 15.38 | 0.053 |
| 12.75 | 0.144 | 13.63 | 0.086 | 14.52 | 0.064 | 15.40 | 0.052 |
| 12.77 | 0.143 | 13.65 | 0.085 | 14.53 | 0.064 | 15.42 | 0.052 |
| 12.78 | 0.141 | 13.67 | 0.085 | 14.55 | 0.064 | 15.43 | 0.052 |
| 12.80 | 0.139 | 13.68 | 0.084 | 14.57 | 0.064 | 15.45 | 0.052 |
| 12.82 | 0.138 | 13.70 | 0.083 | 14.58 | 0.063 | 15.47 | 0.052 |
| 12.83 | 0.136 | 13.72 | 0.083 | 14.60 | 0.063 | 15.48 | 0.051 |
| 12.85 | 0.134 | 13.73 | 0.082 | 14.62 | 0.063 | 15.50 | 0.051 |
| 12.87 | 0.133 | 13.75 | 0.081 | 14.63 | 0.063 | 15.52 | 0.051 |
| 12.88 | 0.131 | 13.77 | 0.081 | 14.65 | 0.062 | 15.53 | 0.051 |
| 12.90 | 0.129 | 13.78 | 0.080 | 14.67 | 0.062 | 15.55 | 0.050 |
| 12.92 | 0.128 | 13.80 | 0.079 | 14.68 | 0.062 | 15.57 | 0.050 |
| 12.93 | 0.126 | 13.82 | 0.079 | 14.70 | 0.062 | 15.58 | 0.050 |
| 12.95 | 0.124 | 13.83 | 0.078 | 14.72 | 0.062 | 15.60 | 0.050 |
| 12.97 | 0.123 | 13.85 | 0.078 | 14.73 | 0.061 | 15.62 | 0.049 |
| 12.98 | 0.121 | 13.87 | 0.077 | 14.75 | 0.061 | 15.63 | 0.049 |
| 13.00 | 0.119 | 13.88 | 0.076 | 14.77 | 0.061 | 15.65 | 0.049 |
| 13.02 | 0.118 | 13.90 | 0.076 | 14.78 | 0.061 | 15.67 | 0.049 |
| 13.03 | 0.117 | 13.92 | 0.075 | 14.80 | 0.060 | 15.68 | 0.049 |
| 13.05 | 0.115 | 13.93 | 0.074 | 14.82 | 0.060 | 15.70 | 0.048 |
| 13.07 | 0.115 | 13.95 | 0.074 | 14.83 | 0.060 | 15.72 | 0.048 |
| 13.08 | 0.114 | 13.97 | 0.073 | 14.85 | 0.060 | 15.73 | 0.048 |
| 13.10 | 0.113 | 13.98 | 0.072 | 14.87 | 0.060 | 15.75 | 0.048 |
| 13.12 | 0.112 | 14.00 | 0.072 | 14.88 | 0.059 | 15.77 | 0.047 |
| 13.13 | 0.111 | 14.02 | 0.071 | 14.90 | 0.059 | 15.78 | 0.047 |
| 13.15 | 0.110 | 14.03 | 0.071 | 14.92 | 0.059 | 15.80 | 0.047 |
| 13.17 | 0.109 | 14.05 | 0.070 | 14.93 | 0.059 | 15.82 | 0.047 |
| 13.18 | 0.108 | 14.07 | 0.070 | 14.95 | 0.058 | 15.83 | 0.047 |
| 13.20 | 0.107 | 14.08 | 0.070 | 14.97 | 0.058 | 15.85 | 0.046 |
| 13.22 | 0.107 | 14.10 | 0.070 | 14.98 | 0.058 | 15.87 | 0.046 |
| 13.23 | 0.106 | 14.12 | 0.070 | 15.00 | 0.058 | 15.88 | 0.046 |
| 13.25 | 0.105 | 14.13 | 0.069 | 15.02 | 0.058 | 15.90 | 0.046 |
| 13.27 | 0.104 | 14.15 | 0.069 | 15.03 | 0.057 | 15.92 | 0.045 |
| 13.28 | 0.103 | 14.17 | 0.069 | 15.05 | 0.057 | 15.93 | 0.045 |
| 13.30 | 0.102 | 14.18 | 0.069 | 15.07 | 0.057 | 15.95 | 0.045 |
| 13.32 | 0.101 | 14.20 | 0.068 | 15.08 | 0.057 | 15.97 | 0.045 |
| 13.33 | 0.100 | 14.22 | 0.068 | 15.10 | 0.056 | 15.98 | 0.045 |
| 13.35 | 0.099 | 14.23 | 0.068 | 15.12 | 0.056 | 16.00 | 0.044 |
| 13.37 | 0.099 | 14.25 | 0.068 | 15.13 | 0.056 | 16.02 | 0.044 |
| 13.38 | 0.098 | 14.27 | 0.068 | 15.15 | 0.056 | 16.03 | 0.044 |
| 13.40 | 0.097 | 14.28 | 0.067 | 15.17 | 0.056 | 16.05 | 0.044 |
| 13.42 | 0.096 | 14.30 | 0.067 | 15.18 | 0.055 | 16.07 | 0.044 |
| 13.43 | 0.095 | 14.32 | 0.067 | 15.20 | 0.055 | 16.08 | 0.044 |
| 13.45 | 0.094 | 14.33 | 0.067 | 15.22 | 0.055 | 16.10 | 0.044 |
| 13.47 | 0.093 | 14.35 | 0.066 | 15.23 | 0.055 | 16.12 | 0.044 |
| 13.48 | 0.092 | 14.37 | 0.066 | 15.25 | 0.054 | 16.13 | 0.043 |
| 13.50 | 0.091 | 14.38 | 0.066 | 15.27 | 0.054 | 16.15 | 0.043 |
| 13.52 | 0.091 | 14.40 | 0.066 | 15.28 | 0.054 | 16.17 | 0.043 |
| 13.53 | 0.090 | 14.42 | 0.066 | 15.30 | 0.054 | 16.18 | 0.043 |
| 13.55 | 0.089 | 14.43 | 0.065 | 15.32 | 0.054 | 16.20 | 0.043 |
| 13.57 | 0.088 | 14.45 | 0.065 | 15.33 | 0.053 | 16.22 | 0.043 |

*Continues on next page...*

Post-Development

## Hydrograph Discharge Table

| Time -- Outflow (hrs cfs) | | Time -- Outflow (hrs cfs) | | Time -- Outflow (hrs cfs) | |
|---|---|---|---|---|---|
| 16.23 | 0.043 | 17.12 | 0.039 | 18.00 | 0.035 |
| 16.25 | 0.043 | 17.13 | 0.039 | 18.02 | 0.034 |
| 16.27 | 0.043 | 17.15 | 0.039 | 18.03 | 0.034 |
| 16.28 | 0.043 | 17.17 | 0.039 | 18.05 | 0.034 |
| 16.30 | 0.043 | 17.18 | 0.038 | 18.07 | 0.034 |
| 16.32 | 0.043 | 17.20 | 0.038 | 18.08 | 0.034 |
| 16.33 | 0.043 | 17.22 | 0.038 | 18.10 | 0.034 |
| 16.35 | 0.042 | 17.23 | 0.038 | 18.12 | 0.034 |
| 16.37 | 0.042 | 17.25 | 0.038 | 18.13 | 0.034 |
| 16.38 | 0.042 | 17.27 | 0.038 | 18.15 | 0.034 |
| 16.40 | 0.042 | 17.28 | 0.038 | 18.17 | 0.034 |
| 16.42 | 0.042 | 17.30 | 0.038 | 18.18 | 0.034 |
| 16.43 | 0.042 | 17.32 | 0.038 | 18.20 | 0.034 |
| 16.45 | 0.042 | 17.33 | 0.038 | 18.22 | 0.034 |
| 16.47 | 0.042 | 17.35 | 0.038 | 18.23 | 0.033 |
| 16.48 | 0.042 | 17.37 | 0.038 | 18.25 | 0.033 |
| 16.50 | 0.042 | 17.38 | 0.038 | 18.27 | 0.033 |
| 16.52 | 0.042 | 17.40 | 0.037 | 18.28 | 0.033 |
| 16.53 | 0.042 | 17.42 | 0.037 | 18.30 | 0.033 |
| 16.55 | 0.041 | 17.43 | 0.037 | 18.32 | 0.033 |
| 16.57 | 0.041 | 17.45 | 0.037 | 18.33 | 0.033 |
| 16.58 | 0.041 | 17.47 | 0.037 | 18.35 | 0.033 |
| 16.60 | 0.041 | 17.48 | 0.037 | 18.37 | 0.033 |
| 16.62 | 0.041 | 17.50 | 0.037 | 18.38 | 0.033 |
| 16.63 | 0.041 | 17.52 | 0.037 | 18.40 | 0.033 |
| 16.65 | 0.041 | 17.53 | 0.037 | 18.42 | 0.033 |
| 16.67 | 0.041 | 17.55 | 0.037 | 18.43 | 0.032 |
| 16.68 | 0.041 | 17.57 | 0.037 | 18.45 | 0.032 |
| 16.70 | 0.041 | 17.58 | 0.037 | 18.47 | 0.032 |
| 16.72 | 0.041 | 17.60 | 0.036 | 18.48 | 0.032 |
| 16.73 | 0.041 | 17.62 | 0.036 | 18.50 | 0.032 |
| 16.75 | 0.041 | 17.63 | 0.036 | 18.52 | 0.032 |
| 16.77 | 0.040 | 17.65 | 0.036 | 18.53 | 0.032 |
| 16.78 | 0.040 | 17.67 | 0.036 | 18.55 | 0.032 |
| 16.80 | 0.040 | 17.68 | 0.036 | 18.57 | 0.032 |
| 16.82 | 0.040 | 17.70 | 0.036 | 18.58 | 0.032 |
| 16.83 | 0.040 | 17.72 | 0.036 | 18.60 | 0.032 |
| 16.85 | 0.040 | 17.73 | 0.036 | 18.62 | 0.032 |
| 16.87 | 0.040 | 17.75 | 0.036 | 18.63 | 0.032 |
| 16.88 | 0.040 | 17.77 | 0.036 | 18.65 | 0.031 |
| 16.90 | 0.040 | 17.78 | 0.036 | 18.67 | 0.031 |
| 16.92 | 0.040 | 17.80 | 0.036 | 18.68 | 0.031 |
| 16.93 | 0.040 | 17.82 | 0.035 | 18.70 | 0.031 |
| 16.95 | 0.040 | 17.83 | 0.035 | 18.72 | 0.031 |
| 16.97 | 0.039 | 17.85 | 0.035 | 18.73 | 0.031 |
| 16.98 | 0.039 | 17.87 | 0.035 | 18.75 | 0.031 |
| 17.00 | 0.039 | 17.88 | 0.035 | 18.77 | 0.031 |
| 17.02 | 0.039 | 17.90 | 0.035 | 18.78 | 0.031 |
| 17.03 | 0.039 | 17.92 | 0.035 | 18.80 | 0.031 |
| 17.05 | 0.039 | 17.93 | 0.035 | 18.82 | 0.031 |
| 17.07 | 0.039 | 17.95 | 0.035 | 18.83 | 0.031 |
| 17.08 | 0.039 | 17.97 | 0.035 | | |
| 17.10 | 0.039 | 17.98 | 0.035 | *...End* | |

# 100-Year Hydrograph

# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Wednesday, Aug 31, 2011

## Hyd. No. 1

Post-Development

| | | | |
|---|---|---|---|
| Hydrograph type | = SCS Runoff | Peak discharge | = 7.041 cfs |
| Storm frequency | = 100 yrs | Time to peak | = 11.92 hrs |
| Time interval | = 1 min | Hyd. volume | = 15,317 cuft |
| Drainage area | = 0.580 ac | Curve number | = 98 |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = USER | Time of conc. (Tc) | = 1.8 min |
| Total precip. | = 8.00 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |

### Hydrograph Discharge Table

( Printed values >= 1.00% of Qp.)

| Time -- Outflow (hrs cfs) | | Time -- Outflow (hrs cfs) | | Time -- Outflow (hrs cfs) | | Time -- Outflow (hrs cfs) | |
|---|---|---|---|---|---|---|---|
| 5.70 | 0.071 | 6.32 | 0.077 | 6.93 | 0.083 | 7.55 | 0.089 |
| 5.72 | 0.071 | 6.33 | 0.077 | 6.95 | 0.083 | 7.57 | 0.089 |
| 5.73 | 0.071 | 6.35 | 0.077 | 6.97 | 0.083 | 7.58 | 0.089 |
| 5.75 | 0.071 | 6.37 | 0.077 | 6.98 | 0.083 | 7.60 | 0.089 |
| 5.77 | 0.071 | 6.38 | 0.077 | 7.00 | 0.083 | 7.62 | 0.089 |
| 5.78 | 0.071 | 6.40 | 0.078 | 7.02 | 0.084 | 7.63 | 0.090 |
| 5.80 | 0.072 | 6.42 | 0.078 | 7.03 | 0.084 | 7.65 | 0.090 |
| 5.82 | 0.072 | 6.43 | 0.078 | 7.05 | 0.084 | 7.67 | 0.090 |
| 5.83 | 0.072 | 6.45 | 0.078 | 7.07 | 0.084 | 7.68 | 0.090 |
| 5.85 | 0.072 | 6.47 | 0.078 | 7.08 | 0.084 | 7.70 | 0.090 |
| 5.87 | 0.072 | 6.48 | 0.078 | 7.10 | 0.084 | 7.72 | 0.090 |
| 5.88 | 0.072 | 6.50 | 0.079 | 7.12 | 0.085 | 7.73 | 0.090 |
| 5.90 | 0.073 | 6.52 | 0.079 | 7.13 | 0.085 | 7.75 | 0.091 |
| 5.92 | 0.073 | 6.53 | 0.079 | 7.15 | 0.085 | 7.77 | 0.091 |
| 5.93 | 0.073 | 6.55 | 0.079 | 7.17 | 0.085 | 7.78 | 0.091 |
| 5.95 | 0.073 | 6.57 | 0.079 | 7.18 | 0.085 | 7.80 | 0.091 |
| 5.97 | 0.073 | 6.58 | 0.079 | 7.20 | 0.085 | 7.82 | 0.091 |
| 5.98 | 0.073 | 6.60 | 0.080 | 7.22 | 0.086 | 7.83 | 0.091 |
| 6.00 | 0.074 | 6.62 | 0.080 | 7.23 | 0.086 | 7.85 | 0.092 |
| 6.02 | 0.074 | 6.63 | 0.080 | 7.25 | 0.086 | 7.87 | 0.092 |
| 6.03 | 0.074 | 6.65 | 0.080 | 7.27 | 0.086 | 7.88 | 0.092 |
| 6.05 | 0.074 | 6.67 | 0.080 | 7.28 | 0.086 | 7.90 | 0.092 |
| 6.07 | 0.074 | 6.68 | 0.080 | 7.30 | 0.086 | 7.92 | 0.092 |
| 6.08 | 0.074 | 6.70 | 0.080 | 7.32 | 0.086 | 7.93 | 0.092 |
| 6.10 | 0.075 | 6.72 | 0.081 | 7.33 | 0.087 | 7.95 | 0.093 |
| 6.12 | 0.075 | 6.73 | 0.081 | 7.35 | 0.087 | 7.97 | 0.093 |
| 6.13 | 0.075 | 6.75 | 0.081 | 7.37 | 0.087 | 7.98 | 0.093 |
| 6.15 | 0.075 | 6.77 | 0.081 | 7.38 | 0.087 | 8.00 | 0.093 |
| 6.17 | 0.075 | 6.78 | 0.081 | 7.40 | 0.087 | 8.02 | 0.093 |
| 6.18 | 0.075 | 6.80 | 0.081 | 7.42 | 0.087 | 8.03 | 0.094 |
| 6.20 | 0.076 | 6.82 | 0.082 | 7.43 | 0.088 | 8.05 | 0.094 |
| 6.22 | 0.076 | 6.83 | 0.082 | 7.45 | 0.088 | 8.07 | 0.095 |
| 6.23 | 0.076 | 6.85 | 0.082 | 7.47 | 0.088 | 8.08 | 0.096 |
| 6.25 | 0.076 | 6.87 | 0.082 | 7.48 | 0.088 | 8.10 | 0.096 |
| 6.27 | 0.076 | 6.88 | 0.082 | 7.50 | 0.088 | 8.12 | 0.097 |
| 6.28 | 0.076 | 6.90 | 0.082 | 7.52 | 0.088 | 8.13 | 0.098 |
| 6.30 | 0.077 | 6.92 | 0.083 | 7.53 | 0.089 | 8.15 | 0.099 |

*Continues on next page...*

Post-Development

## Hydrograph Discharge Table

| Time (hrs | Outflow cfs) | Time (hrs | Outflow cfs) | Time (hrs | Outflow cfs) | Time (hrs | Outflow cfs) |
|---|---|---|---|---|---|---|---|
| 8.17 | 0.099 | 9.05 | 0.137 | 9.93 | 0.166 | 10.82 | 0.275 |
| 8.18 | 0.100 | 9.07 | 0.137 | 9.95 | 0.167 | 10.83 | 0.278 |
| 8.20 | 0.101 | 9.08 | 0.137 | 9.97 | 0.168 | 10.85 | 0.281 |
| 8.22 | 0.101 | 9.10 | 0.137 | 9.98 | 0.169 | 10.87 | 0.284 |
| 8.23 | 0.102 | 9.12 | 0.137 | 10.00 | 0.170 | 10.88 | 0.287 |
| 8.25 | 0.103 | 9.13 | 0.137 | 10.02 | 0.172 | 10.90 | 0.290 |
| 8.27 | 0.104 | 9.15 | 0.137 | 10.03 | 0.173 | 10.92 | 0.293 |
| 8.28 | 0.104 | 9.17 | 0.137 | 10.05 | 0.175 | 10.93 | 0.296 |
| 8.30 | 0.105 | 9.18 | 0.137 | 10.07 | 0.176 | 10.95 | 0.299 |
| 8.32 | 0.106 | 9.20 | 0.137 | 10.08 | 0.178 | 10.97 | 0.301 |
| 8.33 | 0.106 | 9.22 | 0.137 | 10.10 | 0.180 | 10.98 | 0.304 |
| 8.35 | 0.107 | 9.23 | 0.137 | 10.12 | 0.182 | 11.00 | 0.307 |
| 8.37 | 0.108 | 9.25 | 0.137 | 10.13 | 0.183 | 11.02 | 0.311 |
| 8.38 | 0.109 | 9.27 | 0.137 | 10.15 | 0.185 | 11.03 | 0.315 |
| 8.40 | 0.109 | 9.28 | 0.137 | 10.17 | 0.187 | 11.05 | 0.321 |
| 8.42 | 0.110 | 9.30 | 0.137 | 10.18 | 0.189 | 11.07 | 0.328 |
| 8.43 | 0.111 | 9.32 | 0.137 | 10.20 | 0.190 | 11.08 | 0.335 |
| 8.45 | 0.112 | 9.33 | 0.137 | 10.22 | 0.192 | 11.10 | 0.342 |
| 8.47 | 0.112 | 9.35 | 0.137 | 10.23 | 0.194 | 11.12 | 0.349 |
| 8.48 | 0.113 | 9.37 | 0.137 | 10.25 | 0.196 | 11.13 | 0.356 |
| 8.50 | 0.114 | 9.38 | 0.137 | 10.27 | 0.197 | 11.15 | 0.363 |
| 8.52 | 0.115 | 9.40 | 0.138 | 10.28 | 0.199 | 11.17 | 0.370 |
| 8.53 | 0.115 | 9.42 | 0.138 | 10.30 | 0.201 | 11.18 | 0.377 |
| 8.55 | 0.116 | 9.43 | 0.138 | 10.32 | 0.203 | 11.20 | 0.384 |
| 8.57 | 0.117 | 9.45 | 0.138 | 10.33 | 0.204 | 11.22 | 0.391 |
| 8.58 | 0.117 | 9.47 | 0.138 | 10.35 | 0.206 | 11.23 | 0.398 |
| 8.60 | 0.118 | 9.48 | 0.138 | 10.37 | 0.208 | 11.25 | 0.405 |
| 8.62 | 0.119 | 9.50 | 0.138 | 10.38 | 0.210 | 11.27 | 0.412 |
| 8.63 | 0.120 | 9.52 | 0.138 | 10.40 | 0.211 | 11.28 | 0.419 |
| 8.65 | 0.120 | 9.53 | 0.138 | 10.42 | 0.213 | 11.30 | 0.426 |
| 8.67 | 0.121 | 9.55 | 0.139 | 10.43 | 0.215 | 11.32 | 0.433 |
| 8.68 | 0.122 | 9.57 | 0.140 | 10.45 | 0.217 | 11.33 | 0.440 |
| 8.70 | 0.123 | 9.58 | 0.141 | 10.47 | 0.218 | 11.35 | 0.447 |
| 8.72 | 0.123 | 9.60 | 0.142 | 10.48 | 0.220 | 11.37 | 0.454 |
| 8.73 | 0.124 | 9.62 | 0.144 | 10.50 | 0.222 | 11.38 | 0.461 |
| 8.75 | 0.125 | 9.63 | 0.145 | 10.52 | 0.224 | 11.40 | 0.468 |
| 8.77 | 0.125 | 9.65 | 0.146 | 10.53 | 0.226 | 11.42 | 0.475 |
| 8.78 | 0.126 | 9.67 | 0.147 | 10.55 | 0.229 | 11.43 | 0.482 |
| 8.80 | 0.127 | 9.68 | 0.148 | 10.57 | 0.231 | 11.45 | 0.489 |
| 8.82 | 0.128 | 9.70 | 0.149 | 10.58 | 0.234 | 11.47 | 0.496 |
| 8.83 | 0.128 | 9.72 | 0.151 | 10.60 | 0.237 | 11.48 | 0.503 |
| 8.85 | 0.129 | 9.73 | 0.152 | 10.62 | 0.240 | 11.50 | 0.510 |
| 8.87 | 0.130 | 9.75 | 0.153 | 10.63 | 0.243 | 11.52 | 0.534 |
| 8.88 | 0.131 | 9.77 | 0.154 | 10.65 | 0.246 | 11.53 | 0.607 |
| 8.90 | 0.131 | 9.78 | 0.155 | 10.67 | 0.249 | 11.55 | 0.735 |
| 8.92 | 0.132 | 9.80 | 0.156 | 10.68 | 0.252 | 11.57 | 0.896 |
| 8.93 | 0.133 | 9.82 | 0.158 | 10.70 | 0.255 | 11.58 | 1.067 |
| 8.95 | 0.134 | 9.83 | 0.159 | 10.72 | 0.258 | 11.60 | 1.240 |
| 8.97 | 0.134 | 9.85 | 0.160 | 10.73 | 0.261 | 11.62 | 1.412 |
| 8.98 | 0.135 | 9.87 | 0.161 | 10.75 | 0.263 | 11.63 | 1.584 |
| 9.00 | 0.136 | 9.88 | 0.162 | 10.77 | 0.266 | 11.65 | 1.757 |
| 9.02 | 0.136 | 9.90 | 0.163 | 10.78 | 0.269 | 11.67 | 1.929 |
| 9.03 | 0.137 | 9.92 | 0.165 | 10.80 | 0.272 | 11.68 | 2.102 |

*Continues on next page...*

Post-Development

## Hydrograph Discharge Table

| Time (hrs | Outflow cfs) | Time (hrs | Outflow cfs) | Time (hrs | Outflow cfs) | Time (hrs | Outflow cfs) |
|---|---|---|---|---|---|---|---|
| 11.70 | 2.275 | 12.58 | 0.369 | 13.47 | 0.214 | 14.35 | 0.152 |
| 11.72 | 2.448 | 12.60 | 0.365 | 13.48 | 0.212 | 14.37 | 0.152 |
| 11.73 | 2.620 | 12.62 | 0.362 | 13.50 | 0.210 | 14.38 | 0.151 |
| 11.75 | 2.793 | 12.63 | 0.358 | 13.52 | 0.208 | 14.40 | 0.151 |
| 11.77 | 2.992 | 12.65 | 0.354 | 13.53 | 0.206 | 14.42 | 0.150 |
| 11.78 | 3.283 | 12.67 | 0.350 | 13.55 | 0.204 | 14.43 | 0.150 |
| 11.80 | 3.685 | 12.68 | 0.346 | 13.57 | 0.203 | 14.45 | 0.149 |
| 11.82 | 4.149 | 12.70 | 0.343 | 13.58 | 0.201 | 14.47 | 0.149 |
| 11.83 | 4.633 | 12.72 | 0.339 | 13.60 | 0.200 | 14.48 | 0.148 |
| 11.85 | 5.114 | 12.73 | 0.335 | 13.62 | 0.198 | 14.50 | 0.148 |
| 11.87 | 5.596 | 12.75 | 0.331 | 13.63 | 0.197 | 14.52 | 0.147 |
| 11.88 | 6.077 | 12.77 | 0.327 | 13.65 | 0.195 | 14.53 | 0.147 |
| 11.90 | 6.559 | 12.78 | 0.324 | 13.67 | 0.194 | 14.55 | 0.146 |
| 11.92 | 7.041 << | 12.80 | 0.320 | 13.68 | 0.193 | 14.57 | 0.146 |
| 11.93 | 6.895 | 12.82 | 0.316 | 13.70 | 0.191 | 14.58 | 0.145 |
| 11.95 | 5.961 | 12.83 | 0.312 | 13.72 | 0.190 | 14.60 | 0.145 |
| 11.97 | 4.971 | 12.85 | 0.308 | 13.73 | 0.188 | 14.62 | 0.144 |
| 11.98 | 3.877 | 12.87 | 0.305 | 13.75 | 0.187 | 14.63 | 0.144 |
| 12.00 | 2.886 | 12.88 | 0.301 | 13.77 | 0.185 | 14.65 | 0.143 |
| 12.02 | 1.906 | 12.90 | 0.297 | 13.78 | 0.184 | 14.67 | 0.143 |
| 12.03 | 1.249 | 12.92 | 0.293 | 13.80 | 0.182 | 14.68 | 0.142 |
| 12.05 | 0.941 | 12.93 | 0.289 | 13.82 | 0.181 | 14.70 | 0.142 |
| 12.07 | 0.848 | 12.95 | 0.286 | 13.83 | 0.179 | 14.72 | 0.141 |
| 12.08 | 0.828 | 12.97 | 0.282 | 13.85 | 0.178 | 14.73 | 0.141 |
| 12.10 | 0.811 | 12.98 | 0.278 | 13.87 | 0.177 | 14.75 | 0.140 |
| 12.12 | 0.794 | 13.00 | 0.274 | 13.88 | 0.175 | 14.77 | 0.140 |
| 12.13 | 0.778 | 13.02 | 0.271 | 13.90 | 0.174 | 14.78 | 0.139 |
| 12.15 | 0.761 | 13.03 | 0.268 | 13.92 | 0.172 | 14.80 | 0.139 |
| 12.17 | 0.745 | 13.05 | 0.265 | 13.93 | 0.171 | 14.82 | 0.138 |
| 12.18 | 0.728 | 13.07 | 0.263 | 13.95 | 0.169 | 14.83 | 0.138 |
| 12.20 | 0.711 | 13.08 | 0.261 | 13.97 | 0.168 | 14.85 | 0.137 |
| 12.22 | 0.695 | 13.10 | 0.259 | 13.98 | 0.166 | 14.87 | 0.137 |
| 12.23 | 0.678 | 13.12 | 0.257 | 14.00 | 0.165 | 14.88 | 0.136 |
| 12.25 | 0.661 | 13.13 | 0.255 | 14.02 | 0.163 | 14.90 | 0.135 |
| 12.27 | 0.645 | 13.15 | 0.253 | 14.03 | 0.162 | 14.92 | 0.135 |
| 12.28 | 0.628 | 13.17 | 0.251 | 14.05 | 0.162 | 14.93 | 0.134 |
| 12.30 | 0.611 | 13.18 | 0.249 | 14.07 | 0.161 | 14.95 | 0.134 |
| 12.32 | 0.595 | 13.20 | 0.247 | 14.08 | 0.161 | 14.97 | 0.133 |
| 12.33 | 0.578 | 13.22 | 0.244 | 14.10 | 0.160 | 14.98 | 0.133 |
| 12.35 | 0.561 | 13.23 | 0.242 | 14.12 | 0.159 | 15.00 | 0.132 |
| 12.37 | 0.545 | 13.25 | 0.240 | 14.13 | 0.159 | 15.02 | 0.132 |
| 12.38 | 0.528 | 13.27 | 0.238 | 14.15 | 0.158 | 15.03 | 0.131 |
| 12.40 | 0.512 | 13.28 | 0.236 | 14.17 | 0.158 | 15.05 | 0.131 |
| 12.42 | 0.495 | 13.30 | 0.234 | 14.18 | 0.157 | 15.07 | 0.130 |
| 12.43 | 0.478 | 13.32 | 0.232 | 14.20 | 0.157 | 15.08 | 0.130 |
| 12.45 | 0.462 | 13.33 | 0.230 | 14.22 | 0.156 | 15.10 | 0.129 |
| 12.47 | 0.445 | 13.35 | 0.228 | 14.23 | 0.156 | 15.12 | 0.129 |
| 12.48 | 0.428 | 13.37 | 0.226 | 14.25 | 0.155 | 15.13 | 0.128 |
| 12.50 | 0.412 | 13.38 | 0.224 | 14.27 | 0.155 | 15.15 | 0.128 |
| 12.52 | 0.396 | 13.40 | 0.222 | 14.28 | 0.154 | 15.17 | 0.127 |
| 12.53 | 0.385 | 13.42 | 0.220 | 14.30 | 0.154 | 15.18 | 0.127 |
| 12.55 | 0.378 | 13.43 | 0.218 | 14.32 | 0.153 | 15.20 | 0.126 |
| 12.57 | 0.373 | 13.45 | 0.216 | 14.33 | 0.153 | 15.22 | 0.126 |

*Continues on next page...*

Post-Development

## Hydrograph Discharge Table

| Time (hrs | Outflow cfs) | Time (hrs | Outflow cfs) | Time (hrs | Outflow cfs) | Time (hrs | Outflow cfs) |
|---|---|---|---|---|---|---|---|
| 15.23 | 0.125 | 16.12 | 0.100 | 17.00 | 0.090 | 17.88 | 0.081 |
| 15.25 | 0.125 | 16.13 | 0.100 | 17.02 | 0.090 | 17.90 | 0.080 |
| 15.27 | 0.124 | 16.15 | 0.099 | 17.03 | 0.090 | 17.92 | 0.080 |
| 15.28 | 0.124 | 16.17 | 0.099 | 17.05 | 0.090 | 17.93 | 0.080 |
| 15.30 | 0.123 | 16.18 | 0.099 | 17.07 | 0.089 | 17.95 | 0.080 |
| 15.32 | 0.123 | 16.20 | 0.099 | 17.08 | 0.089 | 17.97 | 0.080 |
| 15.33 | 0.122 | 16.22 | 0.099 | 17.10 | 0.089 | 17.98 | 0.079 |
| 15.35 | 0.122 | 16.23 | 0.099 | 17.12 | 0.089 | 18.00 | 0.079 |
| 15.37 | 0.121 | 16.25 | 0.098 | 17.13 | 0.089 | 18.02 | 0.079 |
| 15.38 | 0.121 | 16.27 | 0.098 | 17.15 | 0.089 | 18.03 | 0.079 |
| 15.40 | 0.120 | 16.28 | 0.098 | 17.17 | 0.088 | 18.05 | 0.079 |
| 15.42 | 0.120 | 16.30 | 0.098 | 17.18 | 0.088 | 18.07 | 0.078 |
| 15.43 | 0.119 | 16.32 | 0.098 | 17.20 | 0.088 | 18.08 | 0.078 |
| 15.45 | 0.119 | 16.33 | 0.097 | 17.22 | 0.088 | 18.10 | 0.078 |
| 15.47 | 0.118 | 16.35 | 0.097 | 17.23 | 0.088 | 18.12 | 0.078 |
| 15.48 | 0.118 | 16.37 | 0.097 | 17.25 | 0.087 | 18.13 | 0.078 |
| 15.50 | 0.117 | 16.38 | 0.097 | 17.27 | 0.087 | 18.15 | 0.078 |
| 15.52 | 0.117 | 16.40 | 0.097 | 17.28 | 0.087 | 18.17 | 0.077 |
| 15.53 | 0.116 | 16.42 | 0.097 | 17.30 | 0.087 | 18.18 | 0.077 |
| 15.55 | 0.116 | 16.43 | 0.096 | 17.32 | 0.087 | 18.20 | 0.077 |
| 15.57 | 0.115 | 16.45 | 0.096 | 17.33 | 0.087 | 18.22 | 0.077 |
| 15.58 | 0.115 | 16.47 | 0.096 | 17.35 | 0.086 | 18.23 | 0.077 |
| 15.60 | 0.114 | 16.48 | 0.096 | 17.37 | 0.086 | 18.25 | 0.076 |
| 15.62 | 0.113 | 16.50 | 0.096 | 17.38 | 0.086 | 18.27 | 0.076 |
| 15.63 | 0.113 | 16.52 | 0.095 | 17.40 | 0.086 | 18.28 | 0.076 |
| 15.65 | 0.112 | 16.53 | 0.095 | 17.42 | 0.086 | 18.30 | 0.076 |
| 15.67 | 0.112 | 16.55 | 0.095 | 17.43 | 0.085 | 18.32 | 0.076 |
| 15.68 | 0.111 | 16.57 | 0.095 | 17.45 | 0.085 | 18.33 | 0.076 |
| 15.70 | 0.111 | 16.58 | 0.095 | 17.47 | 0.085 | 18.35 | 0.075 |
| 15.72 | 0.110 | 16.60 | 0.095 | 17.48 | 0.085 | 18.37 | 0.075 |
| 15.73 | 0.110 | 16.62 | 0.094 | 17.50 | 0.085 | 18.38 | 0.075 |
| 15.75 | 0.109 | 16.63 | 0.094 | 17.52 | 0.085 | 18.40 | 0.075 |
| 15.77 | 0.109 | 16.65 | 0.094 | 17.53 | 0.084 | 18.42 | 0.075 |
| 15.78 | 0.108 | 16.67 | 0.094 | 17.55 | 0.084 | 18.43 | 0.074 |
| 15.80 | 0.108 | 16.68 | 0.094 | 17.57 | 0.084 | 18.45 | 0.074 |
| 15.82 | 0.107 | 16.70 | 0.093 | 17.58 | 0.084 | 18.47 | 0.074 |
| 15.83 | 0.107 | 16.72 | 0.093 | 17.60 | 0.084 | 18.48 | 0.074 |
| 15.85 | 0.106 | 16.73 | 0.093 | 17.62 | 0.083 | 18.50 | 0.074 |
| 15.87 | 0.106 | 16.75 | 0.093 | 17.63 | 0.083 | 18.52 | 0.074 |
| 15.88 | 0.105 | 16.77 | 0.093 | 17.65 | 0.083 | 18.53 | 0.073 |
| 15.90 | 0.105 | 16.78 | 0.093 | 17.67 | 0.083 | 18.55 | 0.073 |
| 15.92 | 0.104 | 16.80 | 0.092 | 17.68 | 0.083 | 18.57 | 0.073 |
| 15.93 | 0.104 | 16.82 | 0.092 | 17.70 | 0.083 | 18.58 | 0.073 |
| 15.95 | 0.103 | 16.83 | 0.092 | 17.72 | 0.082 | 18.60 | 0.073 |
| 15.97 | 0.103 | 16.85 | 0.092 | 17.73 | 0.082 | 18.62 | 0.072 |
| 15.98 | 0.102 | 16.87 | 0.092 | 17.75 | 0.082 | 18.63 | 0.072 |
| 16.00 | 0.102 | 16.88 | 0.091 | 17.77 | 0.082 | 18.65 | 0.072 |
| 16.02 | 0.101 | 16.90 | 0.091 | 17.78 | 0.082 | 18.67 | 0.072 |
| 16.03 | 0.101 | 16.92 | 0.091 | 17.80 | 0.081 | 18.68 | 0.072 |
| 16.05 | 0.101 | 16.93 | 0.091 | 17.82 | 0.081 | 18.70 | 0.072 |
| 16.07 | 0.100 | 16.95 | 0.091 | 17.83 | 0.081 | 18.72 | 0.071 |
| 16.08 | 0.100 | 16.97 | 0.091 | 17.85 | 0.081 | 18.73 | 0.071 |
| 16.10 | 0.100 | 16.98 | 0.090 | 17.87 | 0.081 | 18.75 | 0.071 |

*Continues on next page...*

Post-Development

## Hydrograph Discharge Table

| Time -- (hrs | Outflow cfs) |
|---|---|
| 18.77 | 0.071 |
| 18.78 | 0.071 |
| 18.80 | 0.070 |

*...End*

**LandTech**
Resources, Inc.
Surveying • Engineering • GPS
201 Bulifants Blvd., Suite A, Williamsburg, VA 23188
Phone: (757) 565-1677 Fax: (757) 565-0782
web: landtechresources.com

PROJECT NAME: King of Glory
PROJECT NO.: 11-208
SHEET NO. ____ OF ____
CALCULATED BY: KMS DATE: 8/23/11
SCALE ____

DESIGN DRY SWALE

BMP E-2

Treatment Volume = 1.0 in/imp. acre

Impervious Area = 0.58 ac = 25,265 sf

$$WQv = \frac{25{,}265\ sf \mid 1\ in \mid 1\ ft}{\mid 12\ in} = 2{,}105\ cf$$

**LandTech**
Resources, Inc.
Surveying • Engineering • GPS
201 Bulifants Blvd., Suite A, Williamsburg, VA 23188
Phone: (757) 565-1677 Fax: (757) 565-0782
web: landtechresources.com

PROJECT NAME King of Glory
PROJECT NO. 11-208
SHEET NO. OF
CALCULATED BY KHJ DATE 8/30/11
SCALE

DRY SWALE BMP
STAGE - STORAGE

| ELEV (ft) | ΔELEV (ft) | SA (sf) | STORAGE (cf) | TOTAL STORAGE (cf) |
|---|---|---|---|---|
| 98.0 | | 1282 | | 0 |
| | 1.0 | | 1951 | |
| 99.0 | | 2620 | | 1951 |
| | 1.0 | | 3318 | |
| 100.0 | | 4016 | | 5269 |
| | 1.0 | | 4742 | |
| 101.0 | | 5468 | | 10,011 |

Water Quality Volume of 2,105cf
MSGG to Elev 99.05

Water Quality should not be diper than 4"

**LandTech**
Resources, Inc.
Surveying • Engineering • GPS
201 Bulifants Blvd., Suite A, Williamsburg, VA 23188
Phone: (757) 565-1677 Fax: (757) 565-0782
web: landtechresources.com

PROJECT NAME King of Glory
PROJECT NO. 11-208
SHEET NO. OF
CALCULATED BY KHJ DATE 8/30/11
SCALE

DESIGN OUTLET WEIR

Outlet weir to be 6"x6" treated timber rigid lip along the western edge of the outfall at Elev 93.00
Length = 50'

# 2-Year Routing

# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Wednesday, Aug 31, 2011

## Hyd. No. 2

Post-Development

| | | | |
|---|---|---|---|
| Hydrograph type | = Reservoir | ~~Peak discharge~~ | ~~= 0.160 cfs~~ |
| Storm frequency | = 2 yrs | Time to peak | = 12.53 hrs |
| Time interval | = 1 min | Hyd. volume | = 4,395 cuft |
| Inflow hyd. No. | = 1 - Post-Development | Reservoir name | = Dry Swale |
| Max. Elevation | = 99.69 ft | Max. Storage | = 4,240 cuft |

Storage Indication method used.

### Hydrograph Discharge Table

( Printed values >= 1.00% of Qp. Print interval = 10)

| Time (hrs) | Inflow cfs | Elevation ft | Clv A cfs | Clv B cfs | Clv C cfs | PfRsr cfs | Wr A cfs | Wr B cfs | Wr C cfs | Wr D cfs | Exfil cfs | Outflow cfs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 11.83 | 2.004 | 99.18 | 8.921 | 0.035 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.035 |
| 12.00 | 1.256 | 99.60 | 8.921 | 0.155 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.155 |
| 12.17 | 0.324 | 99.66 | 8.921 | 0.164 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.164 |
| 12.33 | 0.252 | 99.68 | 8.921 | 0.168 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.168 |
| 12.50 | 0.179 | 99.69 | 8.921 | 0.169 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.169 |
| 12.67 | 0.153 | 99.69 | 8.921 | 0.169 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.169 |
| 12.83 | 0.136 | 99.68 | 8.921 | 0.168 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.168 |
| 13.00 | 0.119 | 99.68 | 8.921 | 0.167 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.167 |
| 13.17 | 0.109 | 99.67 | 8.921 | 0.166 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.166 |
| 13.33 | 0.100 | 99.66 | 8.921 | 0.164 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.164 |
| 13.50 | 0.091 | 99.64 | 8.921 | 0.162 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.162 |
| 13.67 | 0.085 | 99.63 | 8.921 | 0.159 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.159 |
| 13.83 | 0.078 | 99.62 | 8.921 | 0.157 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.157 |
| 14.00 | 0.072 | 99.60 | 8.921 | 0.154 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.154 |
| 14.17 | 0.069 | 99.59 | 8.921 | 0.152 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.152 |
| 14.33 | 0.067 | 99.57 | 8.921 | 0.149 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.149 |
| 14.50 | 0.064 | 99.56 | 8.921 | 0.146 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.146 |
| 14.67 | 0.062 | 99.54 | 8.921 | 0.143 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.143 |
| 14.83 | 0.060 | 99.53 | 8.921 | 0.140 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.140 |
| 15.00 | 0.058 | 99.51 | 8.921 | 0.137 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.137 |
| 15.17 | 0.056 | 99.50 | 8.921 | 0.135 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.135 |
| 15.33 | 0.053 | 99.49 | 8.921 | 0.131 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.131 |
| 15.50 | 0.051 | 99.47 | 8.921 | 0.128 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.128 |
| 15.67 | 0.049 | 99.46 | 8.921 | 0.125 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.125 |
| 15.83 | 0.047 | 99.44 | 8.921 | 0.122 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.122 |
| 16.00 | 0.044 | 99.43 | 8.921 | 0.119 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.119 |
| 16.17 | 0.043 | 99.42 | 8.921 | 0.116 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.116 |
| 16.33 | 0.043 | 99.40 | 8.921 | 0.113 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.113 |
| 16.50 | 0.042 | 99.39 | 8.921 | 0.110 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.110 |
| 16.67 | 0.041 | 99.38 | 8.921 | 0.106 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.106 |
| 16.83 | 0.040 | 99.37 | 8.921 | 0.103 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.103 |
| 17.00 | 0.039 | 99.36 | 8.921 | 0.100 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.100 |
| 17.17 | 0.039 | 99.35 | 8.921 | 0.097 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.097 |
| 17.33 | 0.038 | 99.34 | 8.921 | 0.094 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.094 |
| 17.50 | 0.037 | 99.33 | 8.921 | 0.091 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.091 |
| 17.67 | 0.036 | 99.32 | 8.921 | 0.088 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.088 |
| 17.83 | 0.035 | 99.31 | 8.921 | 0.086 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.086 |
| 18.00 | 0.035 | 99.30 | 8.921 | 0.083 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.083 |
| 18.17 | 0.034 | 99.29 | 8.921 | 0.079 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.079 |
| 18.33 | 0.033 | 99.28 | 8.921 | 0.076 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.076 |

*Continues on next page...*

Post-Development

## Hydrograph Discharge Table

| Time (hrs) | Inflow cfs | Elevation ft | Clv A cfs | Clv B cfs | Clv C cfs | PfRsr cfs | Wr A cfs | Wr B cfs | Wr C cfs | Wr D cfs | Exfil cfs | Outflow cfs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 18.50 | 0.032 | 99.27 | 8.921 | 0.072 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.072 |
| 18.67 | 0.031 | 99.27 | 8.921 | 0.069 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.069 |
| 18.83 | 0.031 | 99.26 | 8.921 | 0.067 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.067 |
| 19.00 | 0.030 | 99.25 | 8.921 | 0.064 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.064 |
| 19.17 | 0.029 | 99.25 | 8.921 | 0.061 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.061 |
| 19.33 | 0.028 | 99.24 | 8.921 | 0.059 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.059 |
| 19.50 | 0.027 | 99.24 | 8.921 | 0.057 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.057 |
| 19.67 | 0.027 | 99.23 | 8.921 | 0.054 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.054 |
| 19.83 | 0.026 | 99.23 | 8.921 | 0.052 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.052 |
| 20.00 | 0.025 | 99.22 | 8.921 | 0.050 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.050 |
| 20.17 | 0.025 | 99.22 | 8.921 | 0.048 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.048 |
| 20.33 | 0.025 | 99.21 | 8.921 | 0.047 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.047 |
| 20.50 | 0.024 | 99.21 | 8.921 | 0.045 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.045 |
| 20.67 | 0.024 | 99.21 | 8.921 | 0.043 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.043 |
| 20.83 | 0.024 | 99.20 | 8.921 | 0.042 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.042 |
| 21.00 | 0.024 | 99.20 | 8.921 | 0.041 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.041 |
| 21.17 | 0.024 | 99.20 | 8.921 | 0.040 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.040 |
| 21.33 | 0.024 | 99.19 | 8.921 | 0.039 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.039 |
| 21.50 | 0.023 | 99.19 | 8.921 | 0.038 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.038 |
| 21.67 | 0.023 | 99.19 | 8.921 | 0.037 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.037 |
| 21.83 | 0.023 | 99.19 | 8.921 | 0.036 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.036 |
| 22.00 | 0.023 | 99.18 | 8.921 | 0.035 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.035 |
| 22.17 | 0.023 | 99.18 | 8.921 | 0.034 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.034 |
| 22.33 | 0.023 | 99.18 | 8.921 | 0.034 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.034 |
| 22.50 | 0.023 | 99.18 | 8.921 | 0.033 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.033 |
| 22.67 | 0.022 | 99.18 | 8.921 | 0.032 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.032 |
| 22.83 | 0.022 | 99.17 | 8.921 | 0.032 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.032 |
| 23.00 | 0.022 | 99.17 | 8.921 | 0.031 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.031 |
| 23.17 | 0.022 | 99.17 | 8.921 | 0.031 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.031 |
| 23.33 | 0.022 | 99.17 | 8.921 | 0.030 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.030 |
| 23.50 | 0.022 | 99.17 | 8.921 | 0.030 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.030 |
| 23.67 | 0.021 | 99.17 | 8.921 | 0.029 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.029 |
| 23.83 | 0.021 | 99.17 | 8.921 | 0.029 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.029 |
| 24.00 | 0.021 | 99.16 | 8.921 | 0.028 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.028 |
| 24.17 | 0.000 | 99.16 | 8.921 | 0.027 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.027 |
| 24.33 | 0.000 | 99.16 | 8.921 | 0.025 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.025 |
| 24.50 | 0.000 | 99.15 | 8.921 | 0.023 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.023 |
| 24.67 | 0.000 | 99.15 | 8.921 | 0.022 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.022 |
| 24.83 | 0.000 | 99.14 | 8.921 | 0.021 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.021 |
| 25.00 | 0.000 | 99.14 | 8.921 | 0.019 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.019 |
| 25.17 | 0.000 | 99.14 | 8.921 | 0.018 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.018 |
| 25.33 | 0.000 | 99.13 | 8.921 | 0.017 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.017 |
| 25.50 | 0.000 | 99.13 | 8.921 | 0.016 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.016 |
| 25.67 | 0.000 | 99.13 | 8.921 | 0.015 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.015 |
| 25.83 | 0.000 | 99.12 | 8.921 | 0.014 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.014 |
| 26.00 | 0.000 | 99.12 | 8.921 | 0.013 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.013 |
| 26.17 | 0.000 | 99.12 | 8.921 | 0.012 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.012 |
| 26.33 | 0.000 | 99.12 | 8.921 | 0.012 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.012 |
| 26.50 | 0.000 | 99.12 | 8.921 | 0.011 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.011 |
| 26.67 | 0.000 | 99.11 | 8.921 | 0.010 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.010 |
| 26.83 | 0.000 | 99.11 | 8.921 | 0.010 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.010 |
| 27.00 | 0.000 | 99.11 | 8.921 | 0.009 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.009 |
| 27.17 | 0.000 | 99.11 | 8.921 | 0.008 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.008 |
| 27.33 | 0.000 | 99.11 | 8.921 | 0.008 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.008 |

*Continues on next page...*

Post-Development

## Hydrograph Discharge Table

| Time (hrs) | Inflow cfs | Elevation ft | Clv A cfs | Clv B cfs | Clv C cfs | PfRsr cfs | Wr A cfs | Wr B cfs | Wr C cfs | Wr D cfs | Exfil cfs | Outflow cfs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 27.50 | 0.000 | 99.11 | 8.921 | 0.007 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.007 |
| 27.67 | 0.000 | 99.10 | 8.921 | 0.007 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.007 |
| 27.83 | 0.000 | 99.10 | 8.921 | 0.007 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.007 |
| 28.00 | 0.000 | 99.10 | 8.921 | 0.006 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.006 |
| 28.17 | 0.000 | 99.10 | 8.921 | 0.006 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.006 |
| 28.33 | 0.000 | 99.10 | 8.921 | 0.006 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.006 |
| 28.50 | 0.000 | 99.10 | 8.921 | 0.005 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.005 |
| 28.67 | 0.000 | 99.10 | 8.921 | 0.005 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.005 |
| 28.83 | 0.000 | 99.10 | 8.921 | 0.005 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.005 |
| 29.00 | 0.000 | 99.10 | 8.921 | 0.005 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.005 |
| 29.17 | 0.000 | 99.09 | 8.921 | 0.005 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.005 |
| 29.33 | 0.000 | 99.09 | 8.921 | 0.005 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.005 |
| 29.50 | 0.000 | 99.09 | 8.921 | 0.005 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.005 |
| 29.67 | 0.000 | 99.09 | 8.921 | 0.005 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.005 |
| 29.83 | 0.000 | 99.09 | 8.921 | 0.005 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.005 |
| 30.00 | 0.000 | 99.09 | 8.921 | 0.005 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.005 |
| 30.17 | 0.000 | 99.09 | 8.921 | 0.005 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.005 |
| 30.33 | 0.000 | 99.09 | 8.921 | 0.005 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.005 |
| 30.50 | 0.000 | 99.09 | 8.921 | 0.005 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.005 |
| 30.67 | 0.000 | 99.09 | 8.921 | 0.005 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.005 |
| 30.83 | 0.000 | 99.09 | 8.921 | 0.005 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.005 |
| 31.00 | 0.000 | 99.08 | 8.921 | 0.005 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.005 |
| 31.17 | 0.000 | 99.08 | 8.921 | 0.005 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.005 |
| 31.33 | 0.000 | 99.08 | 8.921 | 0.005 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.005 |
| 31.50 | 0.000 | 99.08 | 8.921 | 0.005 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.005 |
| 31.67 | 0.000 | 99.08 | 8.921 | 0.005 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.005 |
| 31.83 | 0.000 | 99.08 | 8.921 | 0.004 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.004 |
| 32.00 | 0.000 | 99.08 | 8.921 | 0.004 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.004 |
| 32.17 | 0.000 | 99.08 | 8.921 | 0.004 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.004 |
| 32.33 | 0.000 | 99.08 | 8.921 | 0.004 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.004 |
| 32.50 | 0.000 | 99.08 | 8.921 | 0.004 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.004 |
| 32.67 | 0.000 | 99.08 | 8.921 | 0.004 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.004 |
| 32.83 | 0.000 | 99.08 | 8.921 | 0.004 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.004 |
| 33.00 | 0.000 | 99.08 | 8.921 | 0.004 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.004 |
| 33.17 | 0.000 | 99.07 | 8.921 | 0.004 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.004 |
| 33.33 | 0.000 | 99.07 | 8.921 | 0.004 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.004 |
| 33.50 | 0.000 | 99.07 | 8.921 | 0.004 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.004 |
| 33.67 | 0.000 | 99.07 | 8.921 | 0.004 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.004 |
| 33.83 | 0.000 | 99.07 | 8.921 | 0.004 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.004 |
| 34.00 | 0.000 | 99.07 | 8.921 | 0.004 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.004 |
| 34.17 | 0.000 | 99.07 | 8.921 | 0.004 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.004 |
| 34.33 | 0.000 | 99.07 | 8.921 | 0.004 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.004 |
| 34.50 | 0.000 | 99.07 | 8.921 | 0.004 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.004 |
| 34.67 | 0.000 | 99.07 | 8.921 | 0.004 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.004 |
| 34.83 | 0.000 | 99.07 | 8.921 | 0.004 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.004 |
| 35.00 | 0.000 | 99.07 | 8.921 | 0.004 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.004 |
| 35.17 | 0.000 | 99.07 | 8.921 | 0.004 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.004 |
| 35.33 | 0.000 | 99.07 | 8.921 | 0.004 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.004 |
| 35.50 | 0.000 | 99.06 | 8.921 | 0.004 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.004 |
| 35.67 | 0.000 | 99.06 | 8.921 | 0.004 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.004 |
| 35.83 | 0.000 | 99.06 | 8.921 | 0.004 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.004 |
| 36.00 | 0.000 | 99.06 | 8.921 | 0.003 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.003 |
| 36.17 | 0.000 | 99.06 | 8.921 | 0.003 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.003 |
| 36.33 | 0.000 | 99.06 | 8.921 | 0.003 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.003 |

*Continues on next page...*

Post-Development

## Hydrograph Discharge Table

| Time (hrs) | Inflow cfs | Elevation ft | Clv A cfs | Clv B cfs | Clv C cfs | PfRsr cfs | Wr A cfs | Wr B cfs | Wr C cfs | Wr D cfs | Exfil cfs | Outflow cfs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 36.50 | 0.000 | 99.06 | 8.921 | 0.003 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.003 |
| 36.67 | 0.000 | 99.06 | 8.921 | 0.003 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.003 |
| 36.83 | 0.000 | 99.06 | 8.921 | 0.003 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.003 |
| 37.00 | 0.000 | 99.06 | 8.921 | 0.003 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.003 |
| 37.17 | 0.000 | 99.06 | 8.921 | 0.003 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.003 |
| 37.33 | 0.000 | 99.06 | 8.921 | 0.003 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.003 |
| 37.50 | 0.000 | 99.06 | 8.921 | 0.003 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.003 |
| 37.67 | 0.000 | 99.06 | 8.921 | 0.003 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.003 |
| 37.83 | 0.000 | 99.06 | 8.921 | 0.003 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.003 |
| 38.00 | 0.000 | 99.06 | 8.921 | 0.003 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.003 |
| 38.17 | 0.000 | 99.06 | 8.921 | 0.003 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.003 |
| 38.33 | 0.000 | 99.05 | 8.921 | 0.003 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.003 |
| 38.50 | 0.000 | 99.05 | 8.921 | 0.003 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.003 |
| 38.67 | 0.000 | 99.05 | 8.921 | 0.003 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.003 |
| 38.83 | 0.000 | 99.05 | 8.921 | 0.003 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.003 |
| 39.00 | 0.000 | 99.05 | 8.921 | 0.003 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.003 |
| 39.17 | 0.000 | 99.05 | 8.921 | 0.003 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.003 |
| 39.33 | 0.000 | 99.05 | 8.921 | 0.003 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.003 |
| 39.50 | 0.000 | 99.05 | 8.921 | 0.003 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.003 |
| 39.67 | 0.000 | 99.05 | 8.921 | 0.003 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.003 |
| 39.83 | 0.000 | 99.05 | 8.921 | 0.003 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.003 |
| 40.00 | 0.000 | 99.05 | 8.921 | 0.003 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.003 |
| 40.17 | 0.000 | 99.05 | 8.921 | 0.003 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.003 |
| 40.33 | 0.000 | 99.05 | 8.921 | 0.003 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.003 |
| 40.50 | 0.000 | 99.05 | 8.921 | 0.003 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.003 |
| 40.67 | 0.000 | 99.05 | 8.921 | 0.003 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.003 |
| 40.83 | 0.000 | 99.05 | 8.921 | 0.003 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.003 |
| 41.00 | 0.000 | 99.05 | 8.921 | 0.003 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.003 |
| 41.17 | 0.000 | 99.05 | 8.921 | 0.003 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.003 |
| 41.33 | 0.000 | 99.05 | 8.921 | 0.003 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.003 |
| 41.50 | 0.000 | 99.05 | 8.921 | 0.003 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.003 |
| 41.67 | 0.000 | 99.04 | 8.921 | 0.002 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.002 |
| 41.83 | 0.000 | 99.04 | 8.921 | 0.002 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.002 |
| 42.00 | 0.000 | 99.04 | 8.921 | 0.002 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.002 |
| 42.17 | 0.000 | 99.04 | 8.921 | 0.002 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.002 |
| 42.33 | 0.000 | 99.04 | 8.921 | 0.002 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.002 |
| 42.50 | 0.000 | 99.04 | 8.921 | 0.002 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.002 |
| 42.67 | 0.000 | 99.04 | 8.921 | 0.002 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.002 |
| 42.83 | 0.000 | 99.04 | 8.921 | 0.002 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.002 |
| 43.00 | 0.000 | 99.04 | 8.921 | 0.002 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.002 |
| 43.17 | 0.000 | 99.04 | 8.921 | 0.002 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.002 |
| 43.33 | 0.000 | 99.04 | 8.921 | 0.002 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.002 |
| 43.50 | 0.000 | 99.04 | 8.921 | 0.002 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.002 |
| 43.67 | 0.000 | 99.04 | 8.921 | 0.002 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.002 |
| 43.83 | 0.000 | 99.04 | 8.921 | 0.002 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.002 |
| 44.00 | 0.000 | 99.04 | 8.921 | 0.002 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.002 |
| 44.17 | 0.000 | 99.04 | 8.921 | 0.002 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.002 |
| 44.33 | 0.000 | 99.04 | 8.921 | 0.002 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.002 |
| 44.50 | 0.000 | 99.04 | 8.921 | 0.002 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.002 |
| 44.67 | 0.000 | 99.04 | 8.921 | 0.002 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.002 |
| 44.83 | 0.000 | 99.04 | 8.921 | 0.002 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.002 |
| 45.00 | 0.000 | 99.04 | 8.921 | 0.002 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.002 |
| 45.17 | 0.000 | 99.04 | 8.921 | 0.002 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.002 |
| 45.33 | 0.000 | 99.04 | 8.921 | 0.002 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.002 |

*Continues on next page...*

Post-Development

## Hydrograph Discharge Table

| Time (hrs) | Inflow cfs | Elevation ft | Clv A cfs | Clv B cfs | Clv C cfs | PfRsr cfs | Wr A cfs | Wr B cfs | Wr C cfs | Wr D cfs | Exfil cfs | Outflow cfs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 45.50 | 0.000 | 99.04 | 8.921 | 0.002 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.002 |
| 45.67 | 0.000 | 99.04 | 8.921 | 0.002 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.002 |
| 45.83 | 0.000 | 99.03 | 8.921 | 0.002 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.002 |
| 46.00 | 0.000 | 99.03 | 8.921 | 0.002 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.002 |
| 46.17 | 0.000 | 99.03 | 8.921 | 0.002 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.002 |
| 46.33 | 0.000 | 99.03 | 8.921 | 0.002 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.002 |
| 46.50 | 0.000 | 99.03 | 8.921 | 0.002 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.002 |
| 46.67 | 0.000 | 99.03 | 8.921 | 0.002 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.002 |
| 46.83 | 0.000 | 99.03 | 8.921 | 0.002 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.002 |
| 47.00 | 0.000 | 99.03 | 8.921 | 0.002 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.002 |
| 47.17 | 0.000 | 99.03 | 8.921 | 0.002 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.002 |
| 47.33 | 0.000 | 99.03 | 8.921 | 0.002 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.002 |
| 47.50 | 0.000 | 99.03 | 8.921 | 0.002 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.002 |
| 47.67 | 0.000 | 99.03 | 8.921 | 0.002 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.002 |
| 47.83 | 0.000 | 99.03 | 8.921 | 0.002 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.002 |

*...End*

# Pond Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Wednesday, Aug 31, 2011

## Pond No. 1 - Dry Swale

## Pond Data

**Contours** - User-defined contour areas. Average end area method used for volume calculation. Begining Elevation = 98.00 ft

### Stage / Storage Table

| Stage (ft) | Elevation (ft) | Contour area (sqft) | Incr. Storage (cuft) | Total storage (cuft) |
|---|---|---|---|---|
| 0.00 | 98.00 | 1,282 | 0 | 0 |
| 1.00 | 99.00 | 2,620 | 1,951 | 1,951 |
| 2.00 | 100.00 | 4,016 | 3,318 | 5,269 |
| 3.00 | 101.00 | 5,468 | 4,742 | 10,011 |

### Culvert / Orifice Structures

| | [A] | [B] | [C] | [PrfRsr] |
|---|---|---|---|---|
| Rise (in) | = 15.00 | 3.00 | 0.00 | 0.00 |
| Span (in) | = 15.00 | 3.00 | 0.00 | 0.00 |
| No. Barrels | = 1 | 1 | 0 | 0 |
| Invert El. (ft) | = 95.00 | 99.05 | 0.00 | 0.00 |
| Length (ft) | = 133.00 | 0.00 | 0.00 | 0.00 |
| Slope (%) | = 1.50 | 0.00 | 0.00 | n/a |
| N-Value | = .013 | .013 | .013 | n/a |
| Orifice Coeff. | = 0.60 | 0.60 | 0.60 | 0.60 |
| Multi-Stage | = n/a | Yes | No | No |

### Weir Structures

| | [A] | [B] | [C] | [D] |
|---|---|---|---|---|
| Crest Len (ft) | = 10.00 | 0.00 | 0.00 | 0.00 |
| Crest El. (ft) | = 99.70 | 0.00 | 0.00 | 0.00 |
| Weir Coeff. | = 3.33 | 3.33 | 3.33 | 3.33 |
| Weir Type | = Riser | --- | --- | --- |
| Multi-Stage | = Yes | No | No | No |

Exfil.(in/hr) = 0.000 (by Wet area)

TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

### Stage / Storage / Discharge Table

| Stage ft | Storage cuft | Elevation ft | Clv A cfs | Clv B cfs | Clv C cfs | PrfRsr cfs | Wr A cfs | Wr B cfs | Wr C cfs | Wr D cfs | Exfil cfs | User cfs | Total cfs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.00 | 0 | 98.00 | 0.00 | 0.00 | --- | --- | 0.00 | --- | --- | --- | --- | --- | 0.000 |
| 1.00 | 1,951 | 99.00 | 8.92 oc | 0.00 | --- | --- | 0.00 | --- | --- | --- | --- | --- | 0.000 |
| 2.00 | 5,269 | 100.00 | 8.92 oc | 0.21 ic | --- | --- | 5.47 | --- | --- | --- | --- | --- | 5.686 |
| 3.00 | 10,011 | 101.00 | 11.95 oc | 0.03 ic | --- | --- | 11.92 s | --- | --- | --- | --- | --- | 11.95 |

# 100-Year Routing

# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Wednesday, Aug 31, 2011

## Hyd. No. 2

Post-Development

| | | | |
|---|---|---|---|
| Hydrograph type | = Reservoir | Peak discharge | = 6.311 cfs |
| Storm frequency | = 100 yrs | Time to peak | = 11.95 hrs |
| Time interval | = 1 min | Hyd. volume | = 13,253 cuft |
| Inflow hyd. No. | = 1 - Post-Development | Reservoir name | = Dry Swale |
| Max. Elevation | = 100.02 ft | Max. Storage | = 5,369 cuft |

Storage Indication method used.

### Hydrograph Discharge Table

( Printed values >= 1.00% of Qp. Print interval = 10)

| Time (hrs) | Inflow cfs | Elevation ft | Clv A cfs | Clv B cfs | Clv C cfs | PfRsr cfs | Wr A cfs | Wr B cfs | Wr C cfs | Wr D cfs | Exfil cfs | Outflow cfs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10.67 | 0.249 | 99.25 | 8.921 | 0.064 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.064 |
| 10.83 | 0.278 | 99.29 | 8.921 | 0.079 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.079 |
| 11.00 | 0.307 | 99.33 | 8.921 | 0.091 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.091 |
| 11.17 | 0.370 | 99.37 | 8.921 | 0.103 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.103 |
| 11.33 | 0.440 | 99.42 | 8.921 | 0.117 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.117 |
| 11.50 | 0.510 | 99.49 | 8.921 | 0.132 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.132 |
| 11.67 | 1.929 | 99.66 | 8.921 | 0.164 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.164 |
| 11.83 | 4.633 | 99.91 | 8.921 | 0.203 | ----- | ----- | 3.283 | ----- | ----- | ----- | ----- | 3.486 |
| 12.00 | 2.886 | 99.96 | 8.921 | 0.209 | ----- | ----- | 4.511 | ----- | ----- | ----- | ----- | 4.721 |
| 12.17 | 0.745 | 99.78 | 8.921 | 0.184 | ----- | ----- | 0.842 | ----- | ----- | ----- | ----- | 1.026 |
| 12.33 | 0.578 | 99.75 | 8.921 | 0.179 | ----- | ----- | 0.514 | ----- | ----- | ----- | ----- | 0.692 |
| 12.50 | 0.412 | 99.73 | 8.921 | 0.176 | ----- | ----- | 0.326 | ----- | ----- | ----- | ----- | 0.502 |
| 12.67 | 0.350 | 99.72 | 8.921 | 0.174 | ----- | ----- | 0.210 | ----- | ----- | ----- | ----- | 0.384 |
| 12.83 | 0.312 | 99.72 | 8.921 | 0.174 | ----- | ----- | 0.160 | ----- | ----- | ----- | ----- | 0.334 |
| 13.00 | 0.274 | 99.71 | 8.921 | 0.173 | ----- | ----- | 0.121 | ----- | ----- | ----- | ----- | 0.294 |
| 13.17 | 0.251 | 99.71 | 8.921 | 0.173 | ----- | ----- | 0.091 | ----- | ----- | ----- | ----- | 0.263 |
| 13.33 | 0.230 | 99.71 | 8.921 | 0.172 | ----- | ----- | 0.069 | ----- | ----- | ----- | ----- | 0.241 |
| 13.50 | 0.210 | 99.70 | 8.921 | 0.172 | ----- | ----- | 0.048 | ----- | ----- | ----- | ----- | 0.220 |
| 13.67 | 0.194 | 99.70 | 8.921 | 0.172 | ----- | ----- | 0.031 | ----- | ----- | ----- | ----- | 0.202 |
| 13.83 | 0.179 | 99.70 | 8.921 | 0.171 | ----- | ----- | 0.016 | ----- | ----- | ----- | ----- | 0.187 |
| 14.00 | 0.165 | 99.70 | 8.921 | 0.171 | ----- | ----- | 0.001 | ----- | ----- | ----- | ----- | 0.172 |
| 14.17 | 0.158 | 99.70 | 8.921 | 0.171 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.171 |
| 14.33 | 0.153 | 99.70 | 8.921 | 0.170 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.170 |
| 14.50 | 0.148 | 99.69 | 8.921 | 0.170 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.170 |
| 14.67 | 0.143 | 99.69 | 8.921 | 0.169 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.169 |
| 14.83 | 0.138 | 99.68 | 8.921 | 0.168 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.168 |
| 15.00 | 0.132 | 99.68 | 8.921 | 0.167 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.167 |
| 15.17 | 0.127 | 99.67 | 8.921 | 0.166 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.166 |
| 15.33 | 0.122 | 99.66 | 8.921 | 0.165 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.165 |
| 15.50 | 0.117 | 99.65 | 8.921 | 0.163 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.163 |
| 15.67 | 0.112 | 99.65 | 8.921 | 0.162 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.162 |
| 15.83 | 0.107 | 99.64 | 8.921 | 0.160 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.160 |
| 16.00 | 0.102 | 99.63 | 8.921 | 0.159 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.159 |
| 16.17 | 0.099 | 99.62 | 8.921 | 0.157 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.157 |
| 16.33 | 0.097 | 99.61 | 8.921 | 0.155 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.155 |
| 16.50 | 0.096 | 99.60 | 8.921 | 0.153 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.153 |
| 16.67 | 0.094 | 99.58 | 8.921 | 0.151 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.151 |
| 16.83 | 0.092 | 99.57 | 8.921 | 0.149 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.149 |
| 17.00 | 0.090 | 99.56 | 8.921 | 0.147 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.147 |
| 17.17 | 0.088 | 99.55 | 8.921 | 0.145 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.145 |

*Continues on next page...*

Post-Development

## Hydrograph Discharge Table

| Time (hrs) | Inflow cfs | Elevation ft | Clv A cfs | Clv B cfs | Clv C cfs | PfRsr cfs | Wr A cfs | Wr B cfs | Wr C cfs | Wr D cfs | Exfil cfs | Outflow cfs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 17.33 | 0.087 | 99.54 | 8.921 | 0.143 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.143 |
| 17.50 | 0.085 | 99.53 | 8.921 | 0.141 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.141 |
| 17.67 | 0.083 | 99.52 | 8.921 | 0.139 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.139 |
| 17.83 | 0.081 | 99.51 | 8.921 | 0.137 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.137 |
| 18.00 | 0.079 | 99.50 | 8.921 | 0.135 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.135 |
| 18.17 | 0.077 | 99.49 | 8.921 | 0.133 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.133 |
| 18.33 | 0.076 | 99.48 | 8.921 | 0.131 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.131 |
| 18.50 | 0.074 | 99.47 | 8.921 | 0.129 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.129 |
| 18.67 | 0.072 | 99.46 | 8.921 | 0.126 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.126 |
| 18.83 | 0.070 | 99.45 | 8.921 | 0.124 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.124 |
| 19.00 | 0.068 | 99.44 | 8.921 | 0.122 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.122 |
| 19.17 | 0.066 | 99.43 | 8.921 | 0.120 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.120 |
| 19.33 | 0.065 | 99.42 | 8.921 | 0.118 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.118 |
| 19.50 | 0.063 | 99.41 | 8.921 | 0.115 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.115 |
| 19.67 | 0.061 | 99.41 | 8.921 | 0.113 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.113 |
| 19.83 | 0.059 | 99.40 | 8.921 | 0.111 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.111 |
| 20.00 | 0.057 | 99.39 | 8.921 | 0.108 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.108 |
| 20.17 | 0.057 | 99.38 | 8.921 | 0.106 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.106 |
| 20.33 | 0.056 | 99.37 | 8.921 | 0.103 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.103 |
| 20.50 | 0.056 | 99.36 | 8.921 | 0.101 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.101 |
| 20.67 | 0.056 | 99.35 | 8.921 | 0.099 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.099 |
| 20.83 | 0.055 | 99.34 | 8.921 | 0.096 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.096 |
| 21.00 | 0.055 | 99.34 | 8.921 | 0.094 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.094 |
| 21.17 | 0.054 | 99.33 | 8.921 | 0.092 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.092 |
| 21.33 | 0.054 | 99.32 | 8.921 | 0.090 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.090 |
| 21.50 | 0.054 | 99.32 | 8.921 | 0.089 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.089 |
| 21.67 | 0.053 | 99.31 | 8.921 | 0.087 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.087 |
| 21.83 | 0.053 | 99.31 | 8.921 | 0.085 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.085 |
| 22.00 | 0.053 | 99.30 | 8.921 | 0.083 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.083 |
| 22.17 | 0.052 | 99.29 | 8.921 | 0.081 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.081 |
| 22.33 | 0.052 | 99.29 | 8.921 | 0.079 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.079 |
| 22.50 | 0.052 | 99.28 | 8.921 | 0.077 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.077 |
| 22.67 | 0.051 | 99.28 | 8.921 | 0.075 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.075 |
| 22.83 | 0.051 | 99.28 | 8.921 | 0.073 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.073 |
| 23.00 | 0.050 | 99.27 | 8.921 | 0.072 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.072 |
| 23.17 | 0.050 | 99.27 | 8.921 | 0.070 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.070 |
| 23.33 | 0.050 | 99.26 | 8.921 | 0.068 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.068 |
| 23.50 | 0.049 | 99.26 | 8.921 | 0.067 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.067 |
| 23.67 | 0.049 | 99.26 | 8.921 | 0.066 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.066 |
| 23.83 | 0.049 | 99.26 | 8.921 | 0.064 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.064 |
| 24.00 | 0.048 | 99.25 | 8.921 | 0.063 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.063 |

*...End*

# Pond Report



Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Wednesday, Aug 31, 2011

## Pond No. 1 - Dry Swale

## Pond Data

Contours - User-defined contour areas. Average end area method used for volume calculation. Begining Elevation = 98.00 ft

### Stage / Storage Table

| Stage (ft) | Elevation (ft) | Contour area (sqft) | Incr. Storage (cuft) | Total storage (cuft) |
|---|---|---|---|---|
| 0.00 | 98.00 | 1,282 | 0 | 0 |
| 1.00 | 99.00 | 2,620 | 1,951 | 1,951 |
| 2.00 | 100.00 | 4,016 | 3,318 | 5,269 |
| 3.00 | 101.00 | 5,468 | 4,742 | 10,011 |

### Culvert / Orifice Structures

| | [A] | [B] | [C] | [PrfRsr] |
|---|---|---|---|---|
| Rise (in) | = 15.00 | 3.00 | 0.00 | 0.00 |
| Span (in) | = 15.00 | 3.00 | 0.00 | 0.00 |
| No. Barrels | = 1 | 1 | 0 | 0 |
| Invert El. (ft) | = 95.00 | 99.05 | 0.00 | 0.00 |
| Length (ft) | = 133.00 | 0.00 | 0.00 | 0.00 |
| Slope (%) | = 1.50 | 0.00 | 0.00 | n/a |
| N-Value | = .013 | .013 | .013 | n/a |
| Orifice Coeff. | = 0.60 | 0.60 | 0.60 | 0.60 |
| Multi-Stage | = n/a | Yes | No | No |

### Weir Structures

| | [A] | [B] | [C] | [D] |
|---|---|---|---|---|
| Crest Len (ft) | = 10.00 | 0.00 | 0.00 | 0.00 |
| Crest El. (ft) | = 99.70 | 0.00 | 0.00 | 0.00 |
| Weir Coeff. | = 3.33 | 3.33 | 3.33 | 3.33 |
| Weir Type | = Riser | --- | --- | --- |
| Multi-Stage | = Yes | No | No | No |

Exfil.(in/hr) = 0.000 (by Wet area)

TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

### Stage / Storage / Discharge Table

| Stage ft | Storage cuft | Elevation ft | Clv A cfs | Clv B cfs | Clv C cfs | PrfRsr cfs | Wr A cfs | Wr B cfs | Wr C cfs | Wr D cfs | Exfil cfs | User cfs | Total cfs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.00 | 0 | 98.00 | 0.00 | 0.00 | --- | --- | 0.00 | --- | --- | --- | --- | --- | 0.000 |
| 1.00 | 1,951 | 99.00 | 8.92 oc | 0.00 | --- | --- | 0.00 | --- | --- | --- | --- | --- | 0.000 |
| 2.00 | 5,269 | 100.00 | 8.92 oc | 0.21 ic | --- | --- | 5.47 | --- | --- | --- | --- | --- | 5.686 |
| 3.00 | 10,011 | 101.00 | 11.95 oc | 0.03 ic | --- | --- | 11.92 s | --- | --- | --- | --- | --- | 11.95 |

# Existing BMP Analysis

for

# King of Glory Lutheran Church
# Gravel Parking Lot Expansion

SP-86-11
(Form. SP-118-00
PC 072)

**October 28, 2011**

**Project Number 11-208**

RECEIVED
OCT 2011
Environmental Division
OCT 31 2011
RECEIVED

LandTech Resources, Inc.
205 Bulifants Blvd., Ste E, Williamsburg, VA
Phone 757-565-1677 Fax 757-565-0782

## Barry Moses

**From:** Kenny Jenkins [kjenkins@landtechresources.com]
**Sent:** Tuesday, October 25, 2011 2:03 PM
**To:** Barry Moses; William Cain
**Cc:** 'Connolly, Matt'
**Subject:** King of Glory Pond Routing

Gentlemen, I have prepared all the routings we discussed earlier today and here is what I have come up with:

Water Quality: Based on existing conditions the existing BMP provides 0.6-inches of water quality volume per impervious acre. Based on proposed conditions the existing BMP provides 0.5-inches of water quality volume per impervious acre.

2-Year Storm: Based on existing conditions the existing BMP releases the pre-development storm at 2.12 cfs at an elevation of 82.74. Based on proposed conditions the existing BMP releases the post-development storm at 2.88 cfs at an elevation of 82.88.

10-Year Storm: Based on existing conditions the existing BMP releases the pre-development storm at 13.58 cfs at an elevation of 83.56. Based on proposed conditions the existing BMP releases the post-development storm at 14.41 cfs at an elevation of 83.72.

100-Year Storm: Based on existing conditions the existing BMP releases the pre-development storm at 20.99 cfs at an elevation of 84.67. Based on proposed conditions the existing BMP releases the post-development storm at 24.24 cfs at an elevation of 84.79.

The Top Elevation of the existing BMP embankment is 85.0+.

Based on the above minimal increases I would recommend that we accept the existing BMP as meeting the water quality and quantity requirements for the proposed temporary gravel parking lot. I think any additional disturbance to the existing BMP to gain more storage volume would do more harm than good. Let me know what you think and I would be happy to meet with you guys to discuss further.

Thanks,

Kenneth M. Jenkins, II, P.E.
LandTech Resources, Inc.
205-E Bulifants Blvd.
Williamsburg, VA 23188
(757) 565-1677
(757) 565-0782 Fax

# Existing BMP Analysis

for

# King of Glory Lutheran Church
# Gravel Parking Lot Expansion

**October 28, 2011**

**Project Number 11-208**

COMMONWEALTH OF VIRGINIA
K.M. JENKINS II
Lic. No. 022872
10/28/11
PROFESSIONAL ENGINEER


## LandTech Resources, Inc.

**205 Bulifants Blvd., Ste. E, Williamsburg, VA**

**Phone 757-565-1677** **Fax 757-565-0782**

## PROJECT DESCRIPTION

The project consists of the development of 0.7+/- acres for a temporary 70 space gravel parking lot and BMP at King of Glory Lutheran Church in James City County, Virginia. After construction is complete the site will contain a total of 2.92 acres covered by impervious surfaces. The total disturbed area is approximately 0.7 acres.

## STORMWATER MANAGEMENT

This project is for the construction of 0.7+/- acres for a temporary 70 space gravel parking lot in James City County, Virginia. To meet the stormwater quality requirements of the James City County BMP Point System and the stormwater quantity requirements of Minimum Standard 19 of the Virginia Stormwater Management Handbook the stormwater runoff from the proposed gravel parking lot will be directed to the existing James City County C-3 BMP (Infiltration Basin) for treatment. The existing infiltration basin provides 0.5" of water quality volume per impervious acre for the existing sites impervious area plus the additional impervious area from the proposed gravel parking lot. For the 2-year storm the existing BMP releases the existing conditions stormwater runoff at 2.12 cfs at an elevation of 82.74. For the 2-year storm the existing BMP releases the proposed conditions runoff at 2.88 cfs at an elevation of 82.88. For the 10-year storm the existing BMP releases the existing conditions stormwater runoff at 13.58 cfs at an elevation of 83.56. For the 10-year storm the existing BMP releases the proposed conditions runoff at 14.41 cfs at an elevation of 83.72. For the 100-year storm the existing BMP releases the existing conditions stormwater runoff at 20.99 cfs at an elevation of 84.67. For the 100-year storm the existing BMP releases the proposed conditions runoff at 24.24 cfs at an elevation of 84.79. The top elevation of the existing BMP embankment is 85.0+

## CALCULATIONS

Appendix A contains analysis calculations for the existing BMP.

# APPENDIX A

# Existing BMP Pre-Development Analysis

# Worksheet 2: Runoff curve number and runoff

| Project | By | Date |
|---|---|---|
| King of Glory Church | KMJ | 10/25/11 |
| **Location** | **Checked** | **Date** |
| James City County, Va. | | |

Check one: ☒ Present ☐ Developed

## 1. Runoff curve number

| Soil name and hydrologic group (appendix A) | Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio) | CN 1/ Table 2-2 | CN 1/ Figure 2-3 | CN 1/ Figure 2-4 | Area ☒ acres ☐ mi² ☐ % | Product of CN x area |
|---|---|---|---|---|---|---|
| Kempsville (B) | Roof / Pavement | 98 | | | 2.60 | 254.80 |
| Kempsville (B) | Grass | 61 | | | 1.82 | 111.02 |
| Kempsville (B) | Woods | 55 | | | 1.53 | 84.15 |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | Totals ➡ 5.95 | 449.97 |

1/ Use only one CN source per line

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{449.97}{5.95} = 75.6 \quad ; \quad \text{Use CN} \Rightarrow \boxed{76}$$

## 2. Runoff

| | | Storm #1 | Storm #2 | Storm #3 |
|---|---|---|---|---|
| Frequency | yr | 2 | 10 | 100 |
| Rainfall, P (24-hour) | in | 3.5 | 5.8 | 8.0 |
| Runoff, Q | in | 1.3 | 3.2 | 5.1 |

(Use P and CN with table 2-1, figure 2-1, or equations 2-3 and 2-4)

# Worksheet 3: Time of Concentration ($T_c$) or travel time ($T_t$)

| Project | By | Date |
|---|---|---|
| King of Glory Church | KWS | 10/25/11 |
| **Location** | **Checked** | **Date** |
| James City County, Va. | | |

Check one: ☒ Present ☐ Developed

Check one: ☒ $T_c$ ☐ $T_t$ through subarea

Notes: Space for as many as two segments per flow type can be used for each worksheet.
Include a map, schematic, or description of flow segments.

## Sheet flow (Applicable to Tc only)

| Segment ID | | |
|---|---|---|
| 1. Surface description (table 3-1) | Asphalt | Woods |
| 2. Manning's roughness coefficient, n (table 3-1) | .011 | 0.40 |
| 3. Flow length, L (total L † 300 ft) ft | 50 | 250 |
| 4. Two-year 24-hour rainfall, $P_2$ in | 3.5 | 3.5 |
| 5. Land slope, s ft/ft | .03 | .046 |
| 6. $T_t = \frac{0.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute $T_t$ hr | .01 + | .51 = .52 |

## Shallow concentrated flow

| Segment ID | | |
|---|---|---|
| 7. Surface description (paved or unpaved) | | |
| 8. Flow length, L ft | | |
| 9. Watercourse slope, s ft/ft | | |
| 10. Average velocity, V (figure 3-1) ft/s | | |
| 11. $T_t = \frac{L}{3600\ V}$ Compute $T_t$ hr | + | = |

## Channel flow

| Segment ID | | |
|---|---|---|
| 12. Cross sectional flow area, a $ft^2$ | 10 | |
| 13. Wetted perimeter, $p_w$ ft | 9.42 | |
| 14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r ft | 1.06 | |
| 15 Channel slope, s ft/ft | .016 | |
| 16. Manning's roughness coefficient, n | .04 | |
| 17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V ft/s | 6.5 | |
| 18. Flow length, L ft | 630 | |
| 19. $T_t = \frac{L}{3600\ V}$ Compute $T_t$ hr | .03 + | = .03 |

20. Watershed or subarea $T_c$ or $T_t$ (add $T_t$ in steps 6, 11, and 19) Hr .55

# Worksheet 5a: Basic watershed data

| Project | Location | By | Date |
|---|---|---|---|
| King of Glory Church | James City County, Va. | KMJ | 10/25/11 |
| Check one: ☒ Present ☐ Developed | Frequency (yr) | Checked | Date |

| ~~Subarea name~~ STORM | Drainage area $A_m$ (mi²) | Time of concentration $T_c$ (hr) | Travel time through subarea $T_t$ (hr) | Downstream subarea names | Travel time summation to outlet $\Sigma T_t$ (hr) | 24-hr rainfall P (in) | Runoff curve number CN | Runoff Q (in) | $A_mQ$ (mi²—in) | Initial abstraction $I_a$ (in) | $I_a/P$ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | .0093 | 0.55 | | | | 3.5 | 76 | 1.3 | .0121 | 0.632 | .18 |
| | | | | | | | | | | | |
| 10 | .0093 | 0.55 | | | | 5.8 | 76 | 3.2 | .0298 | 0.632 | .11 |
| | | | | | | | | | | | |
| 100 | .0093 | 0.55 | | | | 8.0 | 76 | 5.1 | .0474 | 0.632 | .08 |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | From worksheet 3 | | | | | From worksheet 2 | | | From table 5-1 | |

# Worksheet 5b: Basic watershed data

| Project | Location | By | Date |
|---|---|---|---|
| King at Glory Church | James City County, Va. | KMJ | 10/25/11 |
| Check one: ☒ Present ☐ Developed | Frequency (yr) | Checked | Date |

| Subarea name | Basic watershed data used 1/ | | | | Select and enter hydrograph times in hours from exhibit 5-II 2/ | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Subarea $T_c$ (hr) | $\Sigma T_t$ to outlet (hr) | $I_a/P$ | $A_mQ$ ( $mi^2$—in ) | | | | 12.4 | | | | | | | | |
| | | | | | Discharges at selected hydrograph times 3/ ( cfs ) | | | | | | | | | | | |
| 2 | 0.55 | | .18 | .0121 | | | | 6.40 | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| 1C | 0.55 | | .11 | .0298 | | | | 15.76 | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| 1CC | 0.55 | | .08 | .0474 | | | | 25.07 | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| Composite hydrograph at outlet | | | | | | | | | | | | | | | | |

1/ Worksheet 5a. Rounded as needed for use with exhibit 5.
2/ Enter rainfall distribution type used.
3/ Hydrograph discharge for selected times is $A_mQ$ multiplied by tabular discharge from appropriate exhibit 5.

# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Tuesday, Oct 25, 2011

## Hyd. No. 3

Pre-Development BMP

| | | | |
|---|---|---|---|
| Hydrograph type | = Reservoir | Peak discharge | = 2.116 cfs |
| Storm frequency | = 2 yrs | Time to peak | = 12.70 hrs |
| Time interval | = 1 min | Hyd. volume | = 23,659 cuft |
| Inflow hyd. No. | = 1 - Pre-Development Conditions | Reservoir name | = Existing BMP |
| Max. Elevation | = 82.74 ft | Max. Storage | = 11,820 cuft |

Storage Indication method used.

### Hydrograph Discharge Table

( Printed values >= 1.00% of Qp Print interval = 5)

| Time (hrs) | Inflow cfs | Elevation ft | Clv A cfs | Clv B cfs | Clv C cfs | PfRsr cfs | Wr A cfs | Wr B cfs | Wr C cfs | Wr D cfs | Exfil cfs | Outflow cfs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 12.25 | 6.619 | 81.75 | ----- | 0.471 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.471 |
| 12.33 | 6.033 | 82.12 | ----- | 1.315 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.315 |
| 12.42 | 5.220 | 82.38 | ----- | 1.691 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.691 |
| 12.50 | 4.331 | 82.56 | ----- | 1.920 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.920 |
| 12.58 | 3.407 | 82.68 | ----- | 2.052 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 2.052 |
| 12.67 | 2.512 | 82.73 | ----- | 2.110 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 2.110 |
| 12.75 | 1.776 | 82.73 | ----- | 2.111 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 2.111 |
| 12.83 | 1.398 | 82.70 | ----- | 2.075 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 2.075 |
| 12.92 | 1.249 | 82.65 | ----- | 2.025 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 2.025 |
| 13.00 | 1.135 | 82.60 | ----- | 1.969 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.969 |
| 13.08 | 1.043 | 82.55 | ----- | 1.907 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.907 |
| 13.17 | 0.969 | 82.50 | ----- | 1.843 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.843 |
| 13.25 | 0.911 | 82.44 | ----- | 1.775 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.775 |
| 13.33 | 0.863 | 82.39 | ----- | 1.708 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.708 |
| 13.42 | 0.822 | 82.34 | ----- | 1.638 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.638 |
| 13.50 | 0.784 | 82.29 | ----- | 1.569 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.569 |
| 13.58 | 0.750 | 82.24 | ----- | 1.498 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.498 |
| 13.67 | 0.719 | 82.20 | ----- | 1.431 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.431 |
| 13.75 | 0.690 | 82.15 | ----- | 1.363 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.363 |
| 13.83 | 0.663 | 82.11 | ----- | 1.299 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.299 |
| 13.92 | 0.637 | 82.08 | ----- | 1.228 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.228 |
| 14.00 | 0.613 | 82.04 | ----- | 1.157 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.157 |
| 14.08 | 0.590 | 82.01 | ----- | 1.091 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.091 |
| 14.17 | 0.569 | 81.98 | ----- | 1.014 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.014 |
| 14.25 | 0.549 | 81.95 | ----- | 0.938 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.938 |
| 14.33 | 0.532 | 81.92 | ----- | 0.872 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.872 |
| 14.42 | 0.518 | 81.89 | ----- | 0.815 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.815 |
| 14.50 | 0.505 | 81.87 | ----- | 0.765 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.765 |
| 14.58 | 0.495 | 81.86 | ----- | 0.721 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.721 |
| 14.67 | 0.486 | 81.84 | ----- | 0.683 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.683 |
| 14.75 | 0.478 | 81.83 | ----- | 0.650 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.650 |
| 14.83 | 0.470 | 81.81 | ----- | 0.621 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.621 |
| 14.92 | 0.463 | 81.80 | ----- | 0.595 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.595 |
| 15.00 | 0.456 | 81.79 | ----- | 0.574 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.574 |
| 15.08 | 0.449 | 81.79 | ----- | 0.556 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.556 |
| 15.17 | 0.441 | 81.78 | ----- | 0.539 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.539 |
| 15.25 | 0.434 | 81.77 | ----- | 0.524 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.524 |
| 15.33 | 0.426 | 81.77 | ----- | 0.510 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.510 |
| 15.42 | 0.419 | 81.76 | ----- | 0.497 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.497 |
| 15.50 | 0.411 | 81.75 | ----- | 0.484 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.484 |

*Continues on next page...*

Pre-Development BMP

## Hydrograph Discharge Table

| Time (hrs) | Inflow cfs | Elevation ft | Clv A cfs | Clv B cfs | Clv C cfs | PfRsr cfs | Wr A cfs | Wr B cfs | Wr C cfs | Wr D cfs | Exfil cfs | Outflow cfs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 15.58 | 0.404 | 81.75 | ----- | 0.473 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.473 |
| 15.67 | 0.396 | 81.74 | ----- | 0.462 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.462 |
| 15.75 | 0.388 | 81.74 | ----- | 0.451 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.451 |
| 15.83 | 0.381 | 81.73 | ----- | 0.441 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.441 |
| 15.92 | 0.373 | 81.73 | ----- | 0.432 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.432 |
| 16.00 | 0.365 | 81.73 | ----- | 0.422 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.422 |
| 16.08 | 0.357 | 81.72 | ----- | 0.413 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.413 |
| 16.17 | 0.350 | 81.72 | ----- | 0.404 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.404 |
| 16.25 | 0.343 | 81.71 | ----- | 0.395 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.395 |
| 16.33 | 0.337 | 81.71 | ----- | 0.387 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.387 |
| 16.42 | 0.331 | 81.71 | ----- | 0.379 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.379 |
| 16.50 | 0.327 | 81.70 | ----- | 0.372 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.372 |
| 16.58 | 0.323 | 81.70 | ----- | 0.365 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.365 |
| 16.67 | 0.320 | 81.70 | ----- | 0.359 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.359 |
| 16.75 | 0.317 | 81.69 | ----- | 0.354 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.354 |
| 16.83 | 0.314 | 81.69 | ----- | 0.349 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.349 |
| 16.92 | 0.311 | 81.69 | ----- | 0.345 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.345 |
| 17.00 | 0.309 | 81.69 | ----- | 0.341 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.341 |
| 17.08 | 0.306 | 81.68 | ----- | 0.336 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.336 |
| 17.17 | 0.303 | 81.68 | ----- | 0.332 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.332 |
| 17.25 | 0.300 | 81.68 | ----- | 0.329 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.329 |
| 17.33 | 0.298 | 81.68 | ----- | 0.325 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.325 |
| 17.42 | 0.295 | 81.67 | ----- | 0.321 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.321 |
| 17.50 | 0.292 | 81.67 | ----- | 0.318 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.318 |
| 17.58 | 0.290 | 81.67 | ----- | 0.315 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.315 |
| 17.67 | 0.287 | 81.67 | ----- | 0.311 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.311 |
| 17.75 | 0.284 | 81.67 | ----- | 0.308 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.308 |
| 17.83 | 0.281 | 81.67 | ----- | 0.305 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.305 |
| 17.92 | 0.278 | 81.66 | ----- | 0.302 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.302 |
| 18.00 | 0.276 | 81.66 | ----- | 0.299 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.299 |
| 18.08 | 0.273 | 81.66 | ----- | 0.296 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.296 |
| 18.17 | 0.270 | 81.66 | ----- | 0.293 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.293 |
| 18.25 | 0.267 | 81.66 | ----- | 0.290 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.290 |
| 18.33 | 0.264 | 81.66 | ----- | 0.287 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.287 |
| 18.42 | 0.262 | 81.65 | ----- | 0.284 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.284 |
| 18.50 | 0.259 | 81.65 | ----- | 0.281 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.281 |
| 18.58 | 0.256 | 81.65 | ----- | 0.278 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.278 |
| 18.67 | 0.253 | 81.65 | ----- | 0.275 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.275 |
| 18.75 | 0.250 | 81.65 | ----- | 0.272 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.272 |
| 18.83 | 0.247 | 81.65 | ----- | 0.269 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.269 |
| 18.92 | 0.245 | 81.64 | ----- | 0.266 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.266 |
| 19.00 | 0.242 | 81.64 | ----- | 0.263 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.263 |
| 19.08 | 0.239 | 81.64 | ----- | 0.261 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.261 |
| 19.17 | 0.236 | 81.64 | ----- | 0.258 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.258 |
| 19.25 | 0.233 | 81.64 | ----- | 0.255 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.255 |
| 19.33 | 0.230 | 81.64 | ----- | 0.252 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.252 |
| 19.42 | 0.227 | 81.63 | ----- | 0.249 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.249 |
| 19.50 | 0.224 | 81.63 | ----- | 0.246 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.246 |
| 19.58 | 0.221 | 81.63 | ----- | 0.243 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.243 |
| 19.67 | 0.218 | 81.63 | ----- | 0.240 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.240 |
| 19.75 | 0.215 | 81.63 | ----- | 0.237 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.237 |
| 19.83 | 0.212 | 81.63 | ----- | 0.234 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.234 |
| 19.92 | 0.210 | 81.62 | ----- | 0.232 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.232 |
| 20.00 | 0.207 | 81.62 | ----- | 0.229 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.229 |

*Continues on next page...*

Pre-Development BMP

## Hydrograph Discharge Table

| Time (hrs) | Inflow cfs | Elevation ft | Clv A cfs | Clv B cfs | Clv C cfs | PfRsr cfs | Wr A cfs | Wr B cfs | Wr C cfs | Wr D cfs | Exfil cfs | Outflow cfs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 20.08 | 0.204 | 81.62 | ----- | 0.226 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.226 |
| 20.17 | 0.201 | 81.62 | ----- | 0.223 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.223 |
| 20.25 | 0.198 | 81.62 | ----- | 0.220 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.220 |
| 20.33 | 0.196 | 81.62 | ----- | 0.217 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.217 |
| 20.42 | 0.194 | 81.61 | ----- | 0.214 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.214 |
| 20.50 | 0.193 | 81.61 | ----- | 0.212 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.212 |
| 20.58 | 0.192 | 81.61 | ----- | 0.209 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.209 |
| 20.67 | 0.191 | 81.61 | ----- | 0.207 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.207 |
| 20.75 | 0.190 | 81.61 | ----- | 0.205 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.205 |
| 20.83 | 0.190 | 81.61 | ----- | 0.203 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.203 |
| 20.92 | 0.189 | 81.61 | ----- | 0.201 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.201 |
| 21.00 | 0.189 | 81.61 | ----- | 0.200 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.200 |
| 21.08 | 0.188 | 81.61 | ----- | 0.198 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.198 |
| 21.17 | 0.188 | 81.61 | ----- | 0.197 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.197 |
| 21.25 | 0.187 | 81.60 | ----- | 0.196 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.196 |
| 21.33 | 0.187 | 81.60 | ----- | 0.195 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.195 |
| 21.42 | 0.186 | 81.60 | ----- | 0.194 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.194 |
| 21.50 | 0.186 | 81.60 | ----- | 0.193 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.193 |
| 21.58 | 0.185 | 81.60 | ----- | 0.192 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.192 |
| 21.67 | 0.184 | 81.60 | ----- | 0.191 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.191 |
| 21.75 | 0.184 | 81.60 | ----- | 0.190 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.190 |
| 21.83 | 0.183 | 81.60 | ----- | 0.189 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.189 |
| 21.92 | 0.183 | 81.60 | ----- | 0.189 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.189 |
| 22.00 | 0.182 | 81.60 | ----- | 0.188 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.188 |
| 22.08 | 0.182 | 81.60 | ----- | 0.187 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.187 |
| 22.17 | 0.181 | 81.60 | ----- | 0.187 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.187 |
| 22.25 | 0.181 | 81.60 | ----- | 0.186 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.186 |
| 22.33 | 0.180 | 81.60 | ----- | 0.186 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.186 |
| 22.42 | 0.180 | 81.60 | ----- | 0.185 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.185 |
| 22.50 | 0.179 | 81.60 | ----- | 0.185 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.185 |
| 22.58 | 0.179 | 81.60 | ----- | 0.184 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.184 |
| 22.67 | 0.178 | 81.60 | ----- | 0.184 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.184 |
| 22.75 | 0.177 | 81.60 | ----- | 0.183 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.183 |
| 22.83 | 0.177 | 81.60 | ----- | 0.183 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.183 |
| 22.92 | 0.176 | 81.60 | ----- | 0.182 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.182 |
| 23.00 | 0.176 | 81.59 | ----- | 0.182 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.182 |
| 23.08 | 0.175 | 81.59 | ----- | 0.181 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.181 |
| 23.17 | 0.175 | 81.59 | ----- | 0.181 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.181 |
| 23.25 | 0.174 | 81.59 | ----- | 0.180 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.180 |
| 23.33 | 0.174 | 81.59 | ----- | 0.179 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.179 |
| 23.42 | 0.173 | 81.59 | ----- | 0.179 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.179 |
| 23.50 | 0.173 | 81.59 | ----- | 0.178 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.178 |
| 23.58 | 0.172 | 81.59 | ----- | 0.178 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.178 |
| 23.67 | 0.171 | 81.59 | ----- | 0.177 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.177 |
| 23.75 | 0.171 | 81.59 | ----- | 0.177 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.177 |
| 23.83 | 0.170 | 81.59 | ----- | 0.176 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.176 |
| 23.92 | 0.170 | 81.59 | ----- | 0.176 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.176 |
| 24.00 | 0.169 | 81.59 | ----- | 0.175 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.175 |
| 24.08 | 0.164 | 81.59 | ----- | 0.174 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.174 |
| 24.17 | 0.151 | 81.59 | ----- | 0.173 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.173 |
| 24.25 | 0.130 | 81.59 | ----- | 0.170 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.170 |
| 24.33 | 0.101 | 81.58 | ----- | 0.165 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.165 |
| 24.42 | 0.072 | 81.58 | ----- | 0.158 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.158 |
| 24.50 | 0.048 | 81.57 | ----- | 0.150 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.150 |

*Continues on next page...*

Pre-Development BMP

## Hydrograph Discharge Table

| Time (hrs) | Inflow cfs | Elevation ft | Clv A cfs | Clv B cfs | Clv C cfs | PfRsr cfs | Wr A cfs | Wr B cfs | Wr C cfs | Wr D cfs | Exfil cfs | Outflow cfs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 24.58 | 0.029 | 81.56 | ----- | 0.140 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.140 |
| 24.67 | 0.015 | 81.55 | ----- | 0.129 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.129 |
| 24.75 | 0.005 | 81.54 | ----- | 0.119 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.119 |
| 24.83 | 0.001 | 81.54 | ----- | 0.108 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.108 |
| 24.92 | 0.000 | 81.53 | ----- | 0.099 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.099 |
| 25.00 | 0.000 | 81.52 | ----- | 0.090 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.090 |
| 25.08 | 0.000 | 81.52 | ----- | 0.082 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.082 |
| 25.17 | 0.000 | 81.51 | ----- | 0.075 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.075 |
| 25.25 | 0.000 | 81.50 | ----- | 0.068 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.068 |
| 25.33 | 0.000 | 81.50 | ----- | 0.062 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.062 |
| 25.42 | 0.000 | 81.49 | ----- | 0.060 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.060 |
| 25.50 | 0.000 | 81.49 | ----- | 0.057 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.057 |
| 25.58 | 0.000 | 81.49 | ----- | 0.055 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.055 |
| 25.67 | 0.000 | 81.48 | ----- | 0.052 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.052 |
| 25.75 | 0.000 | 81.48 | ----- | 0.050 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.050 |
| 25.83 | 0.000 | 81.47 | ----- | 0.048 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.048 |
| 25.92 | 0.000 | 81.47 | ----- | 0.046 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.046 |
| 26.00 | 0.000 | 81.47 | ----- | 0.044 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.044 |
| 26.08 | 0.000 | 81.46 | ----- | 0.042 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.042 |
| 26.17 | 0.000 | 81.46 | ----- | 0.040 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.040 |
| 26.25 | 0.000 | 81.46 | ----- | 0.038 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.038 |
| 26.33 | 0.000 | 81.46 | ----- | 0.037 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.037 |
| 26.42 | 0.000 | 81.45 | ----- | 0.035 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.035 |
| 26.50 | 0.000 | 81.45 | ----- | 0.034 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.034 |
| 26.58 | 0.000 | 81.45 | ----- | 0.032 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.032 |
| 26.67 | 0.000 | 81.45 | ----- | 0.031 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.031 |
| 26.75 | 0.000 | 81.44 | ----- | 0.029 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.029 |
| 26.83 | 0.000 | 81.44 | ----- | 0.028 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.028 |
| 26.92 | 0.000 | 81.44 | ----- | 0.027 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.027 |
| 27.00 | 0.000 | 81.44 | ----- | 0.026 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.026 |
| 27.08 | 0.000 | 81.44 | ----- | 0.025 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.025 |
| 27.17 | 0.000 | 81.43 | ----- | 0.024 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.024 |
| 27.25 | 0.000 | 81.43 | ----- | 0.023 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.023 |
| 27.33 | 0.000 | 81.43 | ----- | 0.022 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.022 |

*...End*

# Pond Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Tuesday, Oct 25, 2011

## Pond No. 1 - Existing BMP

### Pond Data

**Contours** - User-defined contour areas. Average end area method used for volume calculation. Begining Elevation = 79.50 ft

### Stage / Storage Table

| Stage (ft) | Elevation (ft) | Contour area (sqft) | Incr. Storage (cuft) | Total storage (cuft) |
|---|---|---|---|---|
| 0.00 | 79.50 | 1,684 | 0 | 0 |
| 0.50 | 80.00 | 2,618 | 1,076 | 1,076 |
| 1.50 | 81.00 | 3,631 | 3,125 | 4,200 |
| 2.50 | 82.00 | 4,442 | 4,037 | 8,237 |
| 3.50 | 83.00 | 5,305 | 4,874 | 13,110 |
| 4.50 | 84.00 | 6,219 | 5,762 | 18,872 |
| 5.50 | 85.00 | 8,403 | 7,311 | 26,183 |

### Culvert / Orifice Structures

| | [A] | [B] | [C] | [PrfRsr] |
|---|---|---|---|---|
| **Rise (in)** | = 18.00 | 9.00 | 0.00 | 0.00 |
| **Span (in)** | = 18.00 | 9.00 | 0.00 | 0.00 |
| **No. Barrels** | = 1 | 1 | 0 | 0 |
| **Invert El. (ft)** | = 81.07 | 81.37 | 0.00 | 0.00 |
| **Length (ft)** | = 40.00 | 0.00 | 0.00 | 0.00 |
| **Slope (%)** | = 2.20 | 0.00 | 0.00 | n/a |
| **N-Value** | = .013 | .013 | .013 | n/a |
| **Orifice Coeff.** | = 0.60 | 0.60 | 0.60 | 0.60 |
| **Multi-Stage** | = n/a | No | No | No |

### Weir Structures

| | [A] | [B] | [C] | [D] |
|---|---|---|---|---|
| **Crest Len (ft)** | = 7.85 | 10.00 | 0.00 | 0.00 |
| **Crest El. (ft)** | = 82.80 | 84.47 | 0.00 | 0.00 |
| **Weir Coeff.** | = 3.33 | 3.33 | 3.33 | 3.33 |
| **Weir Type** | = Riser | Rect | --- | --- |
| **Multi-Stage** | = Yes | No | No | No |

**Exfil.(in/hr)** = 0.000 (by Contour)
**TW Elev. (ft)** = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

### Stage / Storage / Discharge Table

| Stage ft | Storage cuft | Elevation ft | Clv A cfs | Clv B cfs | Clv C cfs | PrfRsr cfs | Wr A cfs | Wr B cfs | Wr C cfs | Wr D cfs | Exfil cfs | User cfs | Total cfs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.00 | 0 | 79.50 | 0.00 | 0.00 | --- | --- | 0.00 | 0.00 | --- | --- | --- | --- | 0.000 |
| 0.50 | 1,076 | 80.00 | 0.00 | 0.00 | --- | --- | 0.00 | 0.00 | --- | --- | --- | --- | 0.000 |
| 1.50 | 4,200 | 81.00 | 0.00 | 0.00 | --- | --- | 0.00 | 0.00 | --- | --- | --- | --- | 0.000 |
| 2.50 | 8,237 | 82.00 | 0.00 | 1.07 ic | --- | --- | 0.00 | 0.00 | --- | --- | --- | --- | 1.071 |
| 3.50 | 13,110 | 83.00 | 2.37 ic | 2.38 ic | --- | --- | 2.34 | 0.00 | --- | --- | --- | --- | 4.721 |
| 4.50 | 18,872 | 84.00 | 12.40 ic | 3.19 ic | --- | --- | 12.39 s | 0.00 | --- | --- | --- | --- | 15.58 |
| 5.50 | 26,183 | 85.00 | 15.13 ic | 3.84 ic | --- | --- | 15.12 s | 12.85 | --- | --- | --- | --- | 31.81 |

# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Tuesday, Oct 25, 2011

## Hyd. No. 3

Pre-Development BMP

| | | | |
|---|---|---|---|
| Hydrograph type | = Reservoir | Peak discharge | = 13.58 cfs |
| Storm frequency | = 10 yrs | Time to peak | = 12.37 hrs |
| Time interval | = 1 min | Hyd. volume | = 63,210 cuft |
| Inflow hyd. No. | = 1 - Pre-Development Conditions | Reservoir name | = Existing BMP |
| Max. Elevation | = 83.56 ft | Max. Storage | = 16,353 cuft |

Storage Indication method used.

### Hydrograph Discharge Table

( Printed values >= 1.00% of Qp. Print interval = 5)

| Time (hrs) | Inflow cfs | Elevation ft | Clv A cfs | Clv B cfs | Clv C cfs | PfRsr cfs | Wr A cfs | Wr B cfs | Wr C cfs | Wr D cfs | Exfil cfs | Outflow cfs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 11.92 | 6.183 | 81.68 | ----- | 0.329 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.329 |
| 12.00 | 9.812 | 82.17 | ----- | 1.389 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.389 |
| 12.08 | 13.18 | 82.77 | ----- | 2.155 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 2.155 |
| 12.17 | 15.59 | 83.25 | 7.643 | 2.605 | ----- | ----- | 7.643 | ----- | ----- | ----- | ----- | 10.25 |
| 12.25 | 15.99 | 83.45 | 10.12 | 2.780 | ----- | ----- | 10.12 | ----- | ----- | ----- | ----- | 12.90 |
| 12.33 | 14.32 | 83.56 | 10.68 | 2.862 | ----- | ----- | 10.68 | ----- | ----- | ----- | ----- | 13.54 |
| 12.42 | 12.18 | 83.54 | 10.61 | 2.850 | ----- | ----- | 10.61 | ----- | ----- | ----- | ----- | 13.46 |
| 12.50 | 9.916 | 83.43 | 9.980 | 2.762 | ----- | ----- | 9.979 | ----- | ----- | ----- | ----- | 12.74 |
| 12.58 | 7.633 | 83.27 | 8.089 | 2.622 | ----- | ----- | 8.089 | ----- | ----- | ----- | ----- | 10.71 |
| 12.67 | 5.497 | 83.13 | 5.117 | 2.506 | ----- | ----- | 5.085 | ----- | ----- | ----- | ----- | 7.592 |
| 12.75 | 3.804 | 83.04 | 3.100 | 2.417 | ----- | ----- | 3.061 | ----- | ----- | ----- | ----- | 5.478 |
| 12.83 | 2.964 | 82.96 | 1.731 | 2.342 | ----- | ----- | 1.706 | ----- | ----- | ----- | ----- | 4.048 |
| 12.92 | 2.638 | 82.91 | 0.962 | 2.293 | ----- | ----- | 0.946 | ----- | ----- | ----- | ----- | 3.240 |
| 13.00 | 2.389 | 82.88 | 0.634 | 2.261 | ----- | ----- | 0.623 | ----- | ----- | ----- | ----- | 2.884 |
| 13.08 | 2.188 | 82.85 | 0.394 | 2.232 | ----- | ----- | 0.387 | ----- | ----- | ----- | ----- | 2.619 |
| 13.17 | 2.028 | 82.82 | 0.188 | 2.207 | ----- | ----- | 0.185 | ----- | ----- | ----- | ----- | 2.392 |
| 13.25 | 1.901 | 82.80 | 0.016 | 2.187 | ----- | ----- | 0.016 | ----- | ----- | ----- | ----- | 2.203 |
| 13.33 | 1.797 | 82.78 | ----- | 2.165 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 2.165 |
| 13.42 | 1.709 | 82.76 | ----- | 2.139 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 2.139 |
| 13.50 | 1.628 | 82.73 | ----- | 2.109 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 2.109 |
| 13.58 | 1.554 | 82.70 | ----- | 2.076 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 2.076 |
| 13.67 | 1.487 | 82.66 | ----- | 2.039 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 2.039 |
| 13.75 | 1.424 | 82.63 | ----- | 2.000 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 2.000 |
| 13.83 | 1.367 | 82.59 | ----- | 1.960 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.960 |
| 13.92 | 1.313 | 82.56 | ----- | 1.916 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.916 |
| 14.00 | 1.262 | 82.52 | ----- | 1.872 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.872 |
| 14.08 | 1.213 | 82.48 | ----- | 1.826 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.826 |
| 14.17 | 1.168 | 82.44 | ----- | 1.778 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.778 |
| 14.25 | 1.126 | 82.41 | ----- | 1.730 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.730 |
| 14.33 | 1.090 | 82.37 | ----- | 1.681 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.681 |
| 14.42 | 1.059 | 82.33 | ----- | 1.632 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.632 |
| 14.50 | 1.033 | 82.30 | ----- | 1.584 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.584 |
| 14.58 | 1.011 | 82.27 | ----- | 1.535 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.535 |
| 14.67 | 0.992 | 82.24 | ----- | 1.488 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.488 |
| 14.75 | 0.974 | 82.21 | ----- | 1.443 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.443 |
| 14.83 | 0.958 | 82.18 | ----- | 1.399 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.399 |
| 14.92 | 0.943 | 82.15 | ----- | 1.357 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.357 |
| 15.00 | 0.927 | 82.13 | ----- | 1.318 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.318 |
| 15.08 | 0.912 | 82.10 | ----- | 1.281 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.281 |
| 15.17 | 0.896 | 82.08 | ----- | 1.238 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.238 |

*Continues on next page...*

Pre-Development BMP

## Hydrograph Discharge Table

| Time (hrs) | Inflow cfs | Elevation ft | Clv A cfs | Clv B cfs | Clv C cfs | PfRsr cfs | Wr A cfs | Wr B cfs | Wr C cfs | Wr D cfs | Exfil cfs | Outflow cfs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 15.25 | 0.880 | 82.06 | ----- | 1.196 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.196 |
| 15.33 | 0.864 | 82.04 | ----- | 1.158 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.158 |
| 15.42 | 0.849 | 82.02 | ----- | 1.122 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.122 |
| 15.50 | 0.833 | 82.01 | ----- | 1.089 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.089 |
| 15.58 | 0.817 | 81.99 | ----- | 1.052 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.052 |
| 15.67 | 0.801 | 81.98 | ----- | 1.012 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.012 |
| 15.75 | 0.785 | 81.96 | ----- | 0.975 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.975 |
| 15.83 | 0.769 | 81.95 | ----- | 0.942 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.942 |
| 15.92 | 0.753 | 81.93 | ----- | 0.912 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.912 |
| 16.00 | 0.736 | 81.92 | ----- | 0.884 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.884 |
| 16.08 | 0.720 | 81.91 | ----- | 0.859 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.859 |
| 16.17 | 0.705 | 81.90 | ----- | 0.834 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.834 |
| 16.25 | 0.690 | 81.89 | ----- | 0.812 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.812 |
| 16.33 | 0.677 | 81.88 | ----- | 0.791 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.791 |
| 16.42 | 0.666 | 81.88 | ----- | 0.771 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.771 |
| 16.50 | 0.657 | 81.87 | ----- | 0.753 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.753 |
| 16.58 | 0.649 | 81.86 | ----- | 0.736 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.736 |
| 16.67 | 0.642 | 81.86 | ----- | 0.721 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.721 |
| 16.75 | 0.636 | 81.85 | ----- | 0.708 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.708 |
| 16.83 | 0.630 | 81.85 | ----- | 0.695 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.695 |
| 16.92 | 0.624 | 81.84 | ----- | 0.684 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.684 |
| 17.00 | 0.618 | 81.84 | ----- | 0.674 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.674 |
| 17.08 | 0.613 | 81.83 | ----- | 0.664 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.664 |
| 17.17 | 0.607 | 81.83 | ----- | 0.655 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.655 |
| 17.25 | 0.601 | 81.83 | ----- | 0.647 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.647 |
| 17.33 | 0.596 | 81.82 | ----- | 0.639 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.639 |
| 17.42 | 0.590 | 81.82 | ----- | 0.631 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.631 |
| 17.50 | 0.584 | 81.82 | ----- | 0.624 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.624 |
| 17.58 | 0.579 | 81.81 | ----- | 0.617 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.617 |
| 17.67 | 0.573 | 81.81 | ----- | 0.610 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.610 |
| 17.75 | 0.567 | 81.81 | ----- | 0.603 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.603 |
| 17.83 | 0.561 | 81.80 | ----- | 0.597 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.597 |
| 17.92 | 0.556 | 81.80 | ----- | 0.591 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.591 |
| 18.00 | 0.550 | 81.80 | ----- | 0.584 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.584 |
| 18.08 | 0.544 | 81.80 | ----- | 0.579 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.579 |
| 18.17 | 0.538 | 81.79 | ----- | 0.573 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.573 |
| 18.25 | 0.532 | 81.79 | ----- | 0.567 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.567 |
| 18.33 | 0.527 | 81.79 | ----- | 0.562 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.562 |
| 18.42 | 0.521 | 81.79 | ----- | 0.556 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.556 |
| 18.50 | 0.515 | 81.78 | ----- | 0.550 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.550 |
| 18.58 | 0.509 | 81.78 | ----- | 0.545 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.545 |
| 18.67 | 0.503 | 81.78 | ----- | 0.539 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.539 |
| 18.75 | 0.497 | 81.78 | ----- | 0.533 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.533 |
| 18.83 | 0.492 | 81.77 | ----- | 0.527 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.527 |
| 18.92 | 0.486 | 81.77 | ----- | 0.521 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.521 |
| 19.00 | 0.480 | 81.77 | ----- | 0.516 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.516 |
| 19.08 | 0.474 | 81.77 | ----- | 0.510 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.510 |
| 19.17 | 0.468 | 81.76 | ----- | 0.504 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.504 |
| 19.25 | 0.462 | 81.76 | ----- | 0.498 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.498 |
| 19.33 | 0.456 | 81.76 | ----- | 0.492 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.492 |
| 19.42 | 0.450 | 81.75 | ----- | 0.486 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.486 |
| 19.50 | 0.444 | 81.75 | ----- | 0.481 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.481 |
| 19.58 | 0.439 | 81.75 | ----- | 0.475 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.475 |
| 19.67 | 0.433 | 81.75 | ----- | 0.469 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.469 |

*Continues on next page...*

## Hydrograph Discharge Table

| Time (hrs) | Inflow cfs | Elevation ft | Clv A cfs | Clv B cfs | Clv C cfs | PfRsr cfs | Wr A cfs | Wr B cfs | Wr C cfs | Wr D cfs | Exfil cfs | Outflow cfs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 19.75 | 0.427 | 81.74 | ----- | 0.463 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.463 |
| 19.83 | 0.421 | 81.74 | ----- | 0.457 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.457 |
| 19.92 | 0.415 | 81.74 | ----- | 0.451 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.451 |
| 20.00 | 0.409 | 81.74 | ----- | 0.445 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.445 |
| 20.08 | 0.403 | 81.73 | ----- | 0.439 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.439 |
| 20.17 | 0.397 | 81.73 | ----- | 0.433 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.433 |
| 20.25 | 0.392 | 81.73 | ----- | 0.428 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.428 |
| 20.33 | 0.388 | 81.73 | ----- | 0.422 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.422 |
| 20.42 | 0.384 | 81.72 | ----- | 0.416 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.416 |
| 20.50 | 0.381 | 81.72 | ----- | 0.411 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.411 |
| 20.58 | 0.379 | 81.72 | ----- | 0.407 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.407 |
| 20.67 | 0.377 | 81.72 | ----- | 0.402 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.402 |
| 20.75 | 0.376 | 81.71 | ----- | 0.398 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.398 |
| 20.83 | 0.374 | 81.71 | ----- | 0.395 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.395 |
| 20.92 | 0.373 | 81.71 | ----- | 0.392 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.392 |
| 21.00 | 0.372 | 81.71 | ----- | 0.389 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.389 |
| 21.08 | 0.371 | 81.71 | ----- | 0.386 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.386 |
| 21.17 | 0.370 | 81.71 | ----- | 0.384 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.384 |
| 21.25 | 0.369 | 81.71 | ----- | 0.382 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.382 |
| 21.33 | 0.368 | 81.71 | ----- | 0.380 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.380 |
| 21.42 | 0.367 | 81.71 | ----- | 0.378 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.378 |
| 21.50 | 0.366 | 81.70 | ----- | 0.376 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.376 |
| 21.58 | 0.364 | 81.70 | ----- | 0.374 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.374 |
| 21.67 | 0.363 | 81.70 | ----- | 0.373 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.373 |
| 21.75 | 0.362 | 81.70 | ----- | 0.371 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.371 |
| 21.83 | 0.361 | 81.70 | ----- | 0.370 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.370 |
| 21.92 | 0.360 | 81.70 | ----- | 0.368 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.368 |
| 22.00 | 0.359 | 81.70 | ----- | 0.367 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.367 |
| 22.08 | 0.358 | 81.70 | ----- | 0.366 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.366 |
| 22.17 | 0.356 | 81.70 | ----- | 0.365 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.365 |
| 22.25 | 0.355 | 81.70 | ----- | 0.364 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.364 |
| 22.33 | 0.354 | 81.70 | ----- | 0.363 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.363 |
| 22.42 | 0.353 | 81.70 | ----- | 0.361 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.361 |
| 22.50 | 0.352 | 81.70 | ----- | 0.360 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.360 |
| 22.58 | 0.351 | 81.70 | ----- | 0.359 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.359 |
| 22.67 | 0.350 | 81.70 | ----- | 0.358 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.358 |
| 22.75 | 0.348 | 81.69 | ----- | 0.357 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.357 |
| 22.83 | 0.347 | 81.69 | ----- | 0.356 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.356 |
| 22.92 | 0.346 | 81.69 | ----- | 0.355 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.355 |
| 23.00 | 0.345 | 81.69 | ----- | 0.354 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.354 |
| 23.08 | 0.344 | 81.69 | ----- | 0.352 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.352 |
| 23.17 | 0.343 | 81.69 | ----- | 0.351 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.351 |
| 23.25 | 0.342 | 81.69 | ----- | 0.350 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.350 |
| 23.33 | 0.340 | 81.69 | ----- | 0.349 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.349 |
| 23.42 | 0.339 | 81.69 | ----- | 0.348 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.348 |
| 23.50 | 0.338 | 81.69 | ----- | 0.347 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.347 |
| 23.58 | 0.337 | 81.69 | ----- | 0.346 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.346 |
| 23.67 | 0.336 | 81.69 | ----- | 0.344 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.344 |
| 23.75 | 0.335 | 81.69 | ----- | 0.343 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.343 |
| 23.83 | 0.334 | 81.69 | ----- | 0.342 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.342 |
| 23.92 | 0.332 | 81.69 | ----- | 0.341 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.341 |
| 24.00 | 0.331 | 81.68 | ----- | 0.340 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.340 |
| 24.08 | 0.321 | 81.68 | ----- | 0.338 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.338 |
| 24.17 | 0.295 | 81.68 | ----- | 0.335 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.335 |

*Continues on next page...*

Pre-Development BMP

## Hydrograph Discharge Table

| Time (hrs) | Inflow cfs | Elevation ft | Clv A cfs | Clv B cfs | Clv C cfs | PfRsr cfs | Wr A cfs | Wr B cfs | Wr C cfs | Wr D cfs | Exfil cfs | Outflow cfs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 24.25 | 0.254 | 81.68 | ----- | 0.327 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.327 |
| 24.33 | 0.198 | 81.67 | ----- | 0.315 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.315 |
| 24.42 | 0.142 | 81.66 | ----- | 0.297 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.297 |
| 24.50 | 0.095 | 81.65 | ----- | 0.274 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.274 |
| 24.58 | 0.057 | 81.63 | ----- | 0.250 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.249 |
| 24.67 | 0.029 | 81.62 | ----- | 0.224 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.224 |
| 24.75 | 0.010 | 81.61 | ----- | 0.198 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.198 |
| 24.83 | 0.001 | 81.59 | ----- | 0.178 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.178 |
| 24.92 | 0.000 | 81.58 | ----- | 0.162 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.162 |
| 25.00 | 0.000 | 81.57 | ----- | 0.148 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.148 |

*...End*

# Pond Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Tuesday, Oct 25, 2011

## Pond No. 1 - Existing BMP

### Pond Data

**Contours** - User-defined contour areas. Average end area method used for volume calculation. Begining Elevation = 79.50 ft

### Stage / Storage Table

| Stage (ft) | Elevation (ft) | Contour area (sqft) | Incr. Storage (cuft) | Total storage (cuft) |
|---|---|---|---|---|
| 0.00 | 79.50 | 1,684 | 0 | 0 |
| 0.50 | 80.00 | 2,618 | 1,076 | 1,076 |
| 1.50 | 81.00 | 3,631 | 3,125 | 4,200 |
| 2.50 | 82.00 | 4,442 | 4,037 | 8,237 |
| 3.50 | 83.00 | 5,305 | 4,874 | 13,110 |
| 4.50 | 84.00 | 6,219 | 5,762 | 18,872 |
| 5.50 | 85.00 | 8,403 | 7,311 | 26,183 |

### Culvert / Orifice Structures

| | [A] | [B] | [C] | [PrfRsr] |
|---|---|---|---|---|
| **Rise (in)** | = 18.00 | 9.00 | 0.00 | 0.00 |
| **Span (in)** | = 18.00 | 9.00 | 0.00 | 0.00 |
| **No. Barrels** | = 1 | 1 | 0 | 0 |
| **Invert El. (ft)** | = 81.07 | 81.37 | 0.00 | 0.00 |
| **Length (ft)** | = 40.00 | 0.00 | 0.00 | 0.00 |
| **Slope (%)** | = 2.20 | 0.00 | 0.00 | n/a |
| **N-Value** | = .013 | .013 | .013 | n/a |
| **Orifice Coeff.** | = 0.60 | 0.60 | 0.60 | 0.60 |
| **Multi-Stage** | = n/a | No | No | No |

### Weir Structures

| | [A] | [B] | [C] | [D] |
|---|---|---|---|---|
| **Crest Len (ft)** | = 7.85 | 10.00 | 0.00 | 0.00 |
| **Crest El. (ft)** | = 82.80 | 84.47 | 0.00 | 0.00 |
| **Weir Coeff.** | = 3.33 | 3.33 | 3.33 | 3.33 |
| **Weir Type** | = Riser | Rect | --- | --- |
| **Multi-Stage** | = Yes | No | No | No |

**Exfil.(in/hr)** = 0.000 (by Contour)
**TW Elev. (ft)** = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

### Stage / Storage / Discharge Table

| Stage ft | Storage cuft | Elevation ft | Clv A cfs | Clv B cfs | Clv C cfs | PrfRsr cfs | Wr A cfs | Wr B cfs | Wr C cfs | Wr D cfs | Exfil cfs | User cfs | Total cfs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.00 | 0 | 79.50 | 0.00 | 0.00 | --- | --- | 0.00 | 0.00 | --- | --- | --- | --- | 0.000 |
| 0.50 | 1,076 | 80.00 | 0.00 | 0.00 | --- | --- | 0.00 | 0.00 | --- | --- | --- | --- | 0.000 |
| 1.50 | 4,200 | 81.00 | 0.00 | 0.00 | --- | --- | 0.00 | 0.00 | --- | --- | --- | --- | 0.000 |
| 2.50 | 8,237 | 82.00 | 0.00 | 1.07 ic | --- | --- | 0.00 | 0.00 | --- | --- | --- | --- | 1.071 |
| 3.50 | 13,110 | 83.00 | 2.37 ic | 2.38 ic | --- | --- | 2.34 | 0.00 | --- | --- | --- | --- | 4.721 |
| 4.50 | 18,872 | 84.00 | 12.40 ic | 3.19 ic | --- | --- | 12.39 s | 0.00 | --- | --- | --- | --- | 15.58 |
| 5.50 | 26,183 | 85.00 | 15.13 ic | 3.84 ic | --- | --- | 15.12 s | 12.85 | --- | --- | --- | --- | 31.81 |

# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Tuesday, Oct 25, 2011

## Hyd. No. 3

Pre-Development BMP

| | | | |
|---|---|---|---|
| Hydrograph type | = Reservoir | Peak discharge | = 20.99 cfs |
| Storm frequency | = 100 yrs | Time to peak | = 12.38 hrs |
| Time interval | = 1 min | Hyd. volume | = 105,056 cuft |
| Inflow hyd. No. | = 1 - Pre-Development Conditions | Reservoir name | = Existing BMP |
| Max. Elevation | = 84.67 ft | Max. Storage | = 23,776 cuft |

Storage Indication method used.

### Hydrograph Discharge Table

( Printed values >= 1.00% of Qp. Print interval = 5)

| Time (hrs) | Inflow cfs | Elevation ft | Clv A cfs | Clv B cfs | Clv C cfs | PfRsr cfs | Wr A cfs | Wr B cfs | Wr C cfs | Wr D cfs | Exfil cfs | Outflow cfs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 11.25 | 1.509 | 81.64 | ----- | 0.252 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.252 |
| 11.33 | 1.656 | 81.73 | ----- | 0.428 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.428 |
| 11.42 | 1.829 | 81.82 | ----- | 0.630 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.630 |
| 11.50 | 2.028 | 81.91 | ----- | 0.844 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.844 |
| 11.58 | 2.305 | 82.00 | ----- | 1.061 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.061 |
| 11.67 | 2.890 | 82.08 | ----- | 1.242 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.242 |
| 11.75 | 4.083 | 82.21 | ----- | 1.452 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.452 |
| 11.83 | 6.358 | 82.43 | ----- | 1.756 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.756 |
| 11.92 | 10.59 | 82.82 | 0.132 | 2.201 | ----- | ----- | 0.130 | ----- | ----- | ----- | ----- | 2.331 |
| 12.00 | 16.36 | 83.24 | 7.419 | 2.596 | ----- | ----- | 7.419 | ----- | ----- | ----- | ----- | 10.02 |
| 12.08 | 21.59 | 83.59 | 10.84 | 2.887 | ----- | ----- | 10.84 | ----- | ----- | ----- | ----- | 13.72 |
| 12.17 | 25.21 | 84.04 | 12.51 | 3.220 | ----- | ----- | 12.50 | ----- | ----- | ----- | ----- | 15.72 |
| 12.25 | 25.59 | 84.42 | 13.63 | 3.477 | ----- | ----- | 13.62 | 0.031 | ----- | ----- | ----- | 17.13 |
| 12.33 | 22.78 | 84.65 | 14.25 | 3.624 | ----- | ----- | 14.24 | 2.589 | ----- | ----- | ----- | 20.45 |
| 12.42 | 19.24 | 84.66 | 14.27 | 3.629 | ----- | ----- | 14.26 | 2.752 | ----- | ----- | ----- | 20.64 |
| 12.50 | 15.53 | 84.56 | 14.02 | 3.570 | ----- | ----- | 14.02 | 1.041 | ----- | ----- | ----- | 18.63 |
| 12.58 | 11.85 | 84.40 | 13.58 | 3.465 | ----- | ----- | 13.57 | ----- | ----- | ----- | ----- | 17.04 |
| 12.67 | 8.445 | 84.13 | 12.81 | 3.286 | ----- | ----- | 12.80 | ----- | ----- | ----- | ----- | 16.09 |
| 12.75 | 5.790 | 83.73 | 11.46 | 3.000 | ----- | ----- | 11.46 | ----- | ----- | ----- | ----- | 14.46 |
| 12.83 | 4.492 | 83.31 | 8.957 | 2.660 | ----- | ----- | 8.957 | ----- | ----- | ----- | ----- | 11.62 |
| 12.92 | 3.991 | 83.08 | 3.992 | 2.459 | ----- | ----- | 3.948 | ----- | ----- | ----- | ----- | 6.407 |
| 13.00 | 3.609 | 83.00 | 2.324 | 2.380 | ----- | ----- | 2.291 | ----- | ----- | ----- | ----- | 4.671 |
| 13.08 | 3.302 | 82.95 | 1.578 | 2.333 | ----- | ----- | 1.555 | ----- | ----- | ----- | ----- | 3.887 |
| 13.17 | 3.058 | 82.92 | 1.140 | 2.305 | ----- | ----- | 1.122 | ----- | ----- | ----- | ----- | 3.427 |
| 13.25 | 2.862 | 82.90 | 0.849 | 2.286 | ----- | ----- | 0.835 | ----- | ----- | ----- | ----- | 3.121 |
| 13.33 | 2.704 | 82.88 | 0.710 | 2.270 | ----- | ----- | 0.698 | ----- | ----- | ----- | ----- | 2.968 |
| 13.42 | 2.569 | 82.87 | 0.576 | 2.254 | ----- | ----- | 0.566 | ----- | ----- | ----- | ----- | 2.820 |
| 13.50 | 2.446 | 82.85 | 0.450 | 2.239 | ----- | ----- | 0.442 | ----- | ----- | ----- | ----- | 2.681 |
| 13.58 | 2.334 | 82.84 | 0.333 | 2.225 | ----- | ----- | 0.327 | ----- | ----- | ----- | ----- | 2.552 |
| 13.67 | 2.230 | 82.83 | 0.224 | 2.212 | ----- | ----- | 0.220 | ----- | ----- | ----- | ----- | 2.432 |
| 13.75 | 2.136 | 82.81 | 0.124 | 2.200 | ----- | ----- | 0.122 | ----- | ----- | ----- | ----- | 2.321 |
| 13.83 | 2.048 | 82.80 | 0.032 | 2.188 | ----- | ----- | 0.031 | ----- | ----- | ----- | ----- | 2.220 |
| 13.92 | 1.966 | 82.79 | ----- | 2.177 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 2.177 |
| 14.00 | 1.889 | 82.78 | ----- | 2.161 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 2.161 |
| 14.08 | 1.815 | 82.76 | ----- | 2.141 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 2.141 |
| 14.17 | 1.746 | 82.74 | ----- | 2.118 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 2.118 |
| 14.25 | 1.683 | 82.71 | ----- | 2.093 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 2.093 |
| 14.33 | 1.629 | 82.69 | ----- | 2.064 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 2.064 |
| 14.42 | 1.582 | 82.66 | ----- | 2.034 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 2.034 |
| 14.50 | 1.542 | 82.63 | ----- | 2.002 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 2.002 |

*Continues on next page...*

Pre-Development BMP

## Hydrograph Discharge Table

| Time (hrs) | Inflow cfs | Elevation ft | Clv A cfs | Clv B cfs | Clv C cfs | PfRsr cfs | Wr A cfs | Wr B cfs | Wr C cfs | Wr D cfs | Exfil cfs | Outflow cfs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 14.58 | 1.509 | 82.60 | ----- | 1.971 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.971 |
| 14.67 | 1.479 | 82.58 | ----- | 1.937 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.937 |
| 14.75 | 1.453 | 82.55 | ----- | 1.904 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.904 |
| 14.83 | 1.429 | 82.52 | ----- | 1.871 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.871 |
| 14.92 | 1.405 | 82.49 | ----- | 1.839 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.839 |
| 15.00 | 1.381 | 82.47 | ----- | 1.805 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.805 |
| 15.08 | 1.358 | 82.44 | ----- | 1.773 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.773 |
| 15.17 | 1.334 | 82.42 | ----- | 1.741 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.741 |
| 15.25 | 1.310 | 82.39 | ----- | 1.708 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.708 |
| 15.33 | 1.286 | 82.37 | ----- | 1.675 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.675 |
| 15.42 | 1.262 | 82.34 | ----- | 1.643 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.643 |
| 15.50 | 1.238 | 82.32 | ----- | 1.611 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.611 |
| 15.58 | 1.214 | 82.30 | ----- | 1.579 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.579 |
| 15.67 | 1.190 | 82.27 | ----- | 1.546 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.546 |
| 15.75 | 1.166 | 82.25 | ----- | 1.514 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.514 |
| 15.83 | 1.142 | 82.23 | ----- | 1.482 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.482 |
| 15.92 | 1.118 | 82.21 | ----- | 1.451 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.451 |
| 16.00 | 1.093 | 82.19 | ----- | 1.420 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.420 |
| 16.08 | 1.069 | 82.17 | ----- | 1.388 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.388 |
| 16.17 | 1.046 | 82.15 | ----- | 1.357 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.357 |
| 16.25 | 1.024 | 82.13 | ----- | 1.327 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.327 |
| 16.33 | 1.005 | 82.11 | ----- | 1.298 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.298 |
| 16.42 | 0.988 | 82.10 | ----- | 1.268 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.268 |
| 16.50 | 0.974 | 82.08 | ----- | 1.234 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.234 |
| 16.58 | 0.962 | 82.06 | ----- | 1.203 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.203 |
| 16.67 | 0.951 | 82.05 | ----- | 1.173 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.173 |
| 16.75 | 0.942 | 82.04 | ----- | 1.147 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.147 |
| 16.83 | 0.933 | 82.02 | ----- | 1.122 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.122 |
| 16.92 | 0.924 | 82.01 | ----- | 1.099 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.099 |
| 17.00 | 0.916 | 82.00 | ----- | 1.078 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.078 |
| 17.08 | 0.907 | 81.99 | ----- | 1.053 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.053 |
| 17.17 | 0.899 | 81.98 | ----- | 1.028 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.028 |
| 17.25 | 0.890 | 81.97 | ----- | 1.006 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.006 |
| 17.33 | 0.882 | 81.96 | ----- | 0.986 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.986 |
| 17.42 | 0.873 | 81.96 | ----- | 0.968 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.968 |
| 17.50 | 0.864 | 81.95 | ----- | 0.952 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.952 |
| 17.58 | 0.856 | 81.94 | ----- | 0.936 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.936 |
| 17.67 | 0.847 | 81.94 | ----- | 0.922 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.922 |
| 17.75 | 0.838 | 81.93 | ----- | 0.909 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.909 |
| 17.83 | 0.830 | 81.93 | ----- | 0.897 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.897 |
| 17.92 | 0.821 | 81.92 | ----- | 0.885 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.885 |
| 18.00 | 0.812 | 81.92 | ----- | 0.874 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.874 |
| 18.08 | 0.804 | 81.91 | ----- | 0.863 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.863 |
| 18.17 | 0.795 | 81.91 | ----- | 0.852 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.852 |
| 18.25 | 0.786 | 81.91 | ----- | 0.842 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.842 |
| 18.33 | 0.778 | 81.90 | ----- | 0.832 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.832 |
| 18.42 | 0.769 | 81.90 | ----- | 0.822 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.822 |
| 18.50 | 0.760 | 81.89 | ----- | 0.813 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.813 |
| 18.58 | 0.752 | 81.89 | ----- | 0.803 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.803 |
| 18.67 | 0.743 | 81.89 | ----- | 0.794 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.794 |
| 18.75 | 0.734 | 81.88 | ----- | 0.785 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.785 |
| 18.83 | 0.725 | 81.88 | ----- | 0.776 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.776 |
| 18.92 | 0.717 | 81.87 | ----- | 0.767 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.767 |
| 19.00 | 0.708 | 81.87 | ----- | 0.758 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.758 |

*Continues on next page...*

## Hydrograph Discharge Table

| Time (hrs) | Inflow cfs | Elevation ft | Clv A cfs | Clv B cfs | Clv C cfs | PfRsr cfs | Wr A cfs | Wr B cfs | Wr C cfs | Wr D cfs | Exfil cfs | Outflow cfs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 19.08 | 0.699 | 81.87 | ----- | 0.749 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.749 |
| 19.17 | 0.690 | 81.86 | ----- | 0.740 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.740 |
| 19.25 | 0.682 | 81.86 | ----- | 0.731 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.731 |
| 19.33 | 0.673 | 81.86 | ----- | 0.722 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.722 |
| 19.42 | 0.664 | 81.85 | ----- | 0.713 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.713 |
| 19.50 | 0.655 | 81.85 | ----- | 0.704 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.704 |
| 19.58 | 0.646 | 81.85 | ----- | 0.695 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.695 |
| 19.67 | 0.637 | 81.84 | ----- | 0.687 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.687 |
| 19.75 | 0.629 | 81.84 | ----- | 0.678 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.678 |
| 19.83 | 0.620 | 81.83 | ----- | 0.669 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.669 |
| 19.92 | 0.611 | 81.83 | ----- | 0.660 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.660 |
| 20.00 | 0.602 | 81.83 | ----- | 0.651 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.651 |
| 20.08 | 0.593 | 81.82 | ----- | 0.642 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.642 |
| 20.17 | 0.585 | 81.82 | ----- | 0.634 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.634 |
| 20.25 | 0.577 | 81.82 | ----- | 0.625 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.625 |
| 20.33 | 0.571 | 81.81 | ----- | 0.616 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.616 |
| 20.42 | 0.565 | 81.81 | ----- | 0.608 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.608 |
| 20.50 | 0.561 | 81.81 | ----- | 0.601 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.601 |
| 20.58 | 0.558 | 81.80 | ----- | 0.594 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.594 |
| 20.67 | 0.555 | 81.80 | ----- | 0.588 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.588 |
| 20.75 | 0.553 | 81.80 | ----- | 0.582 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.582 |
| 20.83 | 0.551 | 81.80 | ----- | 0.578 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.578 |
| 20.92 | 0.549 | 81.79 | ----- | 0.574 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.574 |
| 21.00 | 0.548 | 81.79 | ----- | 0.570 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.570 |
| 21.08 | 0.546 | 81.79 | ----- | 0.566 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.566 |
| 21.17 | 0.544 | 81.79 | ----- | 0.563 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.563 |
| 21.25 | 0.543 | 81.79 | ----- | 0.560 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.560 |
| 21.33 | 0.541 | 81.79 | ----- | 0.558 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.558 |
| 21.42 | 0.539 | 81.79 | ----- | 0.555 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.555 |
| 21.50 | 0.537 | 81.78 | ----- | 0.552 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.552 |
| 21.58 | 0.536 | 81.78 | ----- | 0.550 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.550 |
| 21.67 | 0.534 | 81.78 | ----- | 0.548 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.548 |
| 21.75 | 0.532 | 81.78 | ----- | 0.546 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.546 |
| 21.83 | 0.531 | 81.78 | ----- | 0.543 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.543 |
| 21.92 | 0.529 | 81.78 | ----- | 0.541 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.541 |
| 22.00 | 0.527 | 81.78 | ----- | 0.539 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.539 |
| 22.08 | 0.525 | 81.78 | ----- | 0.537 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.537 |
| 22.17 | 0.524 | 81.78 | ----- | 0.536 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.535 |
| 22.25 | 0.522 | 81.78 | ----- | 0.534 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.534 |
| 22.33 | 0.520 | 81.78 | ----- | 0.532 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.532 |
| 22.42 | 0.519 | 81.77 | ----- | 0.530 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.530 |
| 22.50 | 0.517 | 81.77 | ----- | 0.528 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.528 |
| 22.58 | 0.515 | 81.77 | ----- | 0.526 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.526 |
| 22.67 | 0.513 | 81.77 | ----- | 0.524 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.524 |
| 22.75 | 0.512 | 81.77 | ----- | 0.523 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.523 |
| 22.83 | 0.510 | 81.77 | ----- | 0.521 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.521 |
| 22.92 | 0.508 | 81.77 | ----- | 0.519 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.519 |
| 23.00 | 0.507 | 81.77 | ----- | 0.517 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.517 |
| 23.08 | 0.505 | 81.77 | ----- | 0.516 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.516 |
| 23.17 | 0.503 | 81.77 | ----- | 0.514 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.514 |
| 23.25 | 0.501 | 81.77 | ----- | 0.512 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.512 |
| 23.33 | 0.500 | 81.77 | ----- | 0.510 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.510 |
| 23.42 | 0.498 | 81.76 | ----- | 0.509 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.509 |
| 23.50 | 0.496 | 81.76 | ----- | 0.507 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.507 |

*Continues on next page.*

Pre-Development BMP

## Hydrograph Discharge Table

| Time (hrs) | Inflow cfs | Elevation ft | Clv A cfs | Clv B cfs | Clv C cfs | PfRsr cfs | Wr A cfs | Wr B cfs | Wr C cfs | Wr D cfs | Exfil cfs | Outflow cfs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 23.58 | 0.494 | 81.76 | ----- | 0.505 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.505 |
| 23.67 | 0.493 | 81.76 | ----- | 0.503 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.503 |
| 23.75 | 0.491 | 81.76 | ----- | 0.502 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.502 |
| 23.83 | 0.489 | 81.76 | ----- | 0.500 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.500 |
| 23.92 | 0.487 | 81.76 | ----- | 0.498 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.498 |
| 24.00 | 0.486 | 81.76 | ----- | 0.496 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.496 |
| 24.08 | 0.471 | 81.76 | ----- | 0.494 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.494 |
| 24.17 | 0.433 | 81.76 | ----- | 0.488 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.488 |
| 24.25 | 0.373 | 81.75 | ----- | 0.475 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.475 |
| 24.33 | 0.291 | 81.74 | ----- | 0.454 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.454 |
| 24.42 | 0.208 | 81.73 | ----- | 0.423 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.423 |
| 24.50 | 0.139 | 81.71 | ----- | 0.385 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.385 |
| 24.58 | 0.084 | 81.69 | ----- | 0.348 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.348 |
| 24.67 | 0.043 | 81.67 | ----- | 0.312 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.312 |
| 24.75 | 0.015 | 81.65 | ----- | 0.277 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.277 |
| 24.83 | 0.002 | 81.63 | ----- | 0.243 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.243 |
| 24.92 | 0.000 | 81.61 | ----- | 0.213 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.213 |

*...End*

# Pond Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Tuesday, Oct 25, 2011

## Pond No. 1 - Existing BMP

## Pond Data

**Contours** - User-defined contour areas. Average end area method used for volume calculation. Begining Elevation = 79.50 ft

## Stage / Storage Table

| Stage (ft) | Elevation (ft) | Contour area (sqft) | Incr. Storage (cuft) | Total storage (cuft) |
|---|---|---|---|---|
| 0.00 | 79.50 | 1,684 | 0 | 0 |
| 0.50 | 80.00 | 2,618 | 1,076 | 1,076 |
| 1.50 | 81.00 | 3,631 | 3,125 | 4,200 |
| 2.50 | 82.00 | 4,442 | 4,037 | 8,237 |
| 3.50 | 83.00 | 5,305 | 4,874 | 13,110 |
| 4.50 | 84.00 | 6,219 | 5,762 | 18,872 |
| 5.50 | 85.00 | 8,403 | 7,311 | 26,183 |

## Culvert / Orifice Structures

| | [A] | [B] | [C] | [PrfRsr] |
|---|---|---|---|---|
| **Rise (in)** | = 18.00 | 9.00 | 0.00 | 0.00 |
| **Span (in)** | = 18.00 | 9.00 | 0.00 | 0.00 |
| **No. Barrels** | = 1 | 1 | 0 | 0 |
| **Invert El. (ft)** | = 81.07 | 81.37 | 0.00 | 0.00 |
| **Length (ft)** | = 40.00 | 0.00 | 0.00 | 0.00 |
| **Slope (%)** | = 2.20 | 0.00 | 0.00 | n/a |
| **N-Value** | = .013 | .013 | .013 | n/a |
| **Orifice Coeff.** | = 0.60 | 0.60 | 0.60 | 0.60 |
| **Multi-Stage** | = n/a | No | No | No |

## Weir Structures

| | [A] | [B] | [C] | [D] |
|---|---|---|---|---|
| **Crest Len (ft)** | = 7.85 | 10.00 | 0.00 | 0.00 |
| **Crest El. (ft)** | = 82.80 | 84.47 | 0.00 | 0.00 |
| **Weir Coeff.** | = 3.33 | 3.33 | 3.33 | 3.33 |
| **Weir Type** | = Riser | Rect | --- | --- |
| **Multi-Stage** | = Yes | No | No | No |

**Exfil.(in/hr)** = 0.000 (by Contour)

**TW Elev. (ft)** = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

## Stage / Storage / Discharge Table

| Stage ft | Storage cuft | Elevation ft | Clv A cfs | Clv B cfs | Clv C cfs | PrfRsr cfs | Wr A cfs | Wr B cfs | Wr C cfs | Wr D cfs | Exfil cfs | User cfs | Total cfs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.00 | 0 | 79.50 | 0.00 | 0.00 | --- | --- | 0.00 | 0.00 | --- | --- | --- | --- | 0.000 |
| 0.50 | 1,076 | 80.00 | 0.00 | 0.00 | --- | --- | 0.00 | 0.00 | --- | --- | --- | --- | 0.000 |
| 1.50 | 4,200 | 81.00 | 0.00 | 0.00 | --- | --- | 0.00 | 0.00 | --- | --- | --- | --- | 0.000 |
| 2.50 | 8,237 | 82.00 | 0.00 | 1.07 ic | --- | --- | 0.00 | 0.00 | --- | --- | --- | --- | 1.071 |
| 3.50 | 13,110 | 83.00 | 2.37 ic | 2.38 ic | --- | --- | 2.34 | 0.00 | --- | --- | --- | --- | 4.721 |
| 4.50 | 18,872 | 84.00 | 12.40 ic | 3.19 ic | --- | --- | 12.39 s | 0.00 | --- | --- | --- | --- | 15.58 |
| 5.50 | 26,183 | 85.00 | 15.13 ic | 3.84 ic | --- | --- | 15.12 s | 12.85 | --- | --- | --- | --- | 31.81 |

# Existing BMP Post-Development Analysis

# POOR QUALITY

## ORIGINAL(S) FOLLOW

## THIS IS THE BEST COPY AVAILABLE

*VCE DOCUMENT CONVERSION*

**LandTech Resources, Inc.**
Surveying • Engineering • GPS
201 Bulifants Blvd., Suite A, Williamsburg, VA 23188
Phone: (757) 565-1677 Fax: (757) 565-0782
web: landtechresources.com

PROJECT NAME: King of Glory
PROJECT NO.: 11-208
SHEET NO. ____ OF ____
CALCULATED BY: KMJ DATE: 10/25/11
SCALE: ____

## DETERMINE EXISTING INFILTRATION WATER QUALITY VOLUME

Existing Water Quality Volume = 5,694 cf

Existing Impervious Area = 2.60ac = 113,256 sf

Treatment Volume = $\frac{113{,}256\,sf \mid 1\,in \mid 1\,ft}{\mid \mid 12\,in}$ = 9,438 cf

Existing Pond Provides 0.6" of Water Quality Volume

Proposed Impervious Area = 2.87ac = 125,017 cf

Treatment Volume = $\frac{125{,}017\,cf \mid 0.5\,in \mid 1\,ft}{\mid \mid 12\,in}$ = 5,209 cf

Existing BMP provides water quality treatment of 0.5" inches per impervious acre. Since the provided 5,694 cf is greater than the required 5,209 cf.

# Worksheet 2: Runoff curve number and runoff

| Project | By | Date |
|---|---|---|
| King of Glory Church | KMJ | 10/25/11 |
| **Location** | **Checked** | **Date** |
| James City County, Va. | | |

Check one: ☐ Present ☒ Developed

## 1. Runoff curve number

| Soil name and hydrologic group (appendix A) | Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio) | CN 1/ Table 2-2 | CN 1/ Figure 2-3 | CN 1/ Figure 2-4 | Area ☒ acres ☐ mi² ☐ % | Product of CN x area |
|---|---|---|---|---|---|---|
| Kempsville (B) | Roof / Road / Gravel | 98 | | | 2.87 | 281.26 |
| Kempsville (B) | Grass | 61 | | | 2.21 | 134.81 |
| Kempsville (B) | Woods | 55 | | | 1.40 | 77.00 |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | **Totals** ➡ 6.48 | 493.07 |

1/ Use only one CN source per line

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{493.07}{6.48} = 76.1$ ; **Use CN** ➡ 76

## 2. Runoff

| | | Storm #1 | Storm #2 | Storm #3 |
|---|---|---|---|---|
| Frequency | yr | 2 | 10 | 100 |
| Rainfall, P (24-hour) | in | 3.5 | 5.8 | 8.0 |
| Runoff, Q | in | 1.3 | 3.2 | 5.1 |

(Use P and CN with table 2-1, figure 2-1, or equations 2-3 and 2-4)

# Worksheet 3: Time of Concentration ($T_c$) or travel time ($T_t$)

| Project | By | Date |
|---|---|---|
| King of Glory Church | KMJ | 10/25/11 |
| **Location** | **Checked** | **Date** |
| James City County, Va. | | |

Check one: ☐ Present ☒ Developed

Check one: ☒ $T_c$ ☐ $T_t$ through subarea

Notes: Space for as many as two segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

## Sheet flow (Applicable to Tc only)

| Segment ID | | |
|---|---|---|
| 1. Surface description (table 3-1) | Asphalt | Woods |
| 2. Manning's roughness coefficient, n (table 3-1) | .011 | 0.40 |
| 3. Flow length, L (total L † 300 ft) ft | 50 | 250 |
| 4. Two-year 24-hour rainfall, $P_2$ in | 3.5 | 3.5 |
| 5. Land slope, s ft/ft | .03 | .046 |
| 6. $T_t = \frac{0.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute $T_t$ hr | .01 + | .51 = .52 |

## Shallow concentrated flow

| Segment ID | | |
|---|---|---|
| 7. Surface description (paved or unpaved) | | |
| 8. Flow length, L ft | | |
| 9. Watercourse slope, s ft/ft | | |
| 10. Average velocity, V (figure 3-1) ft/s | | |
| 11. $T_t = \frac{L}{3600\ V}$ Compute $T_t$ hr | + | = |

## Channel flow

| Segment ID | | |
|---|---|---|
| 12. Cross sectional flow area, a $ft^2$ | 10 | |
| 13. Wetted perimeter, $p_w$ ft | 9.42 | |
| 14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r ft | 1.06 | |
| 15 Channel slope, s ft/ft | .016 | |
| 16. Manning's roughness coefficient, n | .04 | |
| 17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V ft/s | 6.5 | |
| 18. Flow length, L ft | 630 | |
| 19. $T_t = \frac{L}{3600\ V}$ Compute $T_t$ hr | .03 + | = .03 |

20. Watershed or subarea $T_c$ or $T_t$ (add $T_t$ in steps 6, 11, and 19) Hr .55

# Worksheet 5a: Basic watershed data

| Project | Location | By | Date |
|---|---|---|---|
| King of Glory Church | James City County, Va. | KMJ | 10/25/11 |
| Check one: ☐ Present ☒ Developed | Frequency (yr) | Checked | Date |

| ~~Subarea~~ name STORM | Drainage area $A_m$ ($mi^2$) | Time of concentration $T_c$ (hr) | Travel time through subarea $T_t$ (hr) | Downstream subarea names | Travel time summation to outlet $\Sigma T_t$ (hr) | 24-hr rainfall P (in) | Runoff curve number CN | Runoff Q (in) | $A_mQ$ ($mi^2$—in) | Initial abstraction $I_a$ (in) | $I_a/P$ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | .0101 | 0.55 | | | | 3.5 | 76 | 1.3 | .0131 | 0.632 | .18 |
| | | | | | | | | | | | |
| 10 | .0101 | 0.55 | | | | 5.8 | 76 | 3.2 | .0323 | 0.632 | .11 |
| | | | | | | | | | | | |
| 100 | .0101 | 0.55 | | | | 8.0 | 76 | 5.1 | .0515 | 0.632 | .08 |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | From worksheet 3 | | | | | From worksheet 2 | | | From table 5-1 | |

# Worksheet 5b: Basic watershed data

| Project | Location | By | Date |
|---|---|---|---|
| King of Glory Church | James City County, Va. | KHJ | 10/25/11 |
| Check one: ☐ Present ☒ Developed | Frequency (yr) | Checked | Date |

| Subarea name | Basic watershed data used 1/ | | | | Select and enter hydrograph times in hours from exhibit 5-II 2/ | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Subarea $T_c$ (hr) | $\Sigma T_t$ to outlet (hr) | $I_a/P$ | $A_mQ$ ($mi^2$—in) | | | | | 12.4 | | | | | | | |
| | | | | | Discharges at selected hydrograph times 3/ (cfs) | | | | | | | | | | | |
| 2 | 0.55 | | .18 | .0131 | | | | | 6.93 | | | | | | | |
| | | | | | | | | | | | | | | | | |
| 10 | 0.55 | | .11 | .0323 | | | | | 17.09 | | | | | | | |
| | | | | | | | | | | | | | | | | |
| 100 | 0.55 | | .08 | .0515 | | | | | 27.24 | | | | | | | |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| Composite hydrograph at outlet | | | | | | | | | | | | | | | | |

1/ Worksheet 5a. Rounded as needed for use with exhibit 5.
2/ Enter rainfall distribution type used.
3/ Hydrograph discharge for selected times is $A_mQ$ multiplied by tabular discharge from appropriate exhibit 5.

# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Tuesday, Oct 25, 2011

## Hyd. No. 4

Post-Development BMP

| | | | |
|---|---|---|---|
| Hydrograph type | = Reservoir | Peak discharge | = 2.879 cfs |
| Storm frequency | = 2 yrs | Time to peak | = 12.65 hrs |
| Time interval | = 1 min | Hyd. volume | = 26,268 cuft |
| Inflow hyd. No. | = 2 - Post-Development Developn | Reservoir name | = Existing BMP |
| Max. Elevation | = 82.88 ft | Max. Storage | = 12,500 cuft |

Storage Indication method used.

### Hydrograph Discharge Table

( Printed values >= 1.00% of Qp. Print interval = 5)

| Time (hrs) | Inflow cfs | Elevation ft | Clv A cfs | Clv B cfs | Clv C cfs | PfRsr cfs | Wr A cfs | Wr B cfs | Wr C cfs | Wr D cfs | Exfil cfs | Outflow cfs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 12.25 | 7.209 | 81.89 | ----- | 0.815 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.815 |
| 12.33 | 6.570 | 82.26 | ----- | 1.530 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.530 |
| 12.42 | 5.685 | 82.54 | ----- | 1.890 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.890 |
| 12.50 | 4.717 | 82.73 | ----- | 2.112 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 2.112 |
| 12.58 | 3.710 | 82.85 | 0.417 | 2.235 | ----- | ----- | 0.409 | ----- | ----- | ----- | ----- | 2.644 |
| 12.67 | 2.735 | 82.87 | 0.625 | 2.260 | ----- | ----- | 0.614 | ----- | ----- | ----- | ----- | 2.874 |
| 12.75 | 1.934 | 82.85 | 0.389 | 2.231 | ----- | ----- | 0.382 | ----- | ----- | ----- | ----- | 2.614 |
| 12.83 | 1.523 | 82.80 | 0.019 | 2.187 | ----- | ----- | 0.018 | ----- | ----- | ----- | ----- | 2.205 |
| 12.92 | 1.361 | 82.76 | ----- | 2.139 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 2.139 |
| 13.00 | 1.236 | 82.71 | ----- | 2.086 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 2.086 |
| 13.08 | 1.136 | 82.65 | ----- | 2.026 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 2.026 |
| 13.17 | 1.056 | 82.60 | ----- | 1.964 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.964 |
| 13.25 | 0.992 | 82.54 | ----- | 1.898 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.898 |
| 13.33 | 0.940 | 82.49 | ----- | 1.831 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.831 |
| 13.42 | 0.895 | 82.43 | ----- | 1.762 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.762 |
| 13.50 | 0.854 | 82.38 | ----- | 1.694 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.694 |
| 13.58 | 0.817 | 82.33 | ----- | 1.624 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.624 |
| 13.67 | 0.783 | 82.28 | ----- | 1.555 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.555 |
| 13.75 | 0.751 | 82.23 | ----- | 1.486 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.486 |
| 13.83 | 0.722 | 82.19 | ----- | 1.419 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.419 |
| 13.92 | 0.694 | 82.15 | ----- | 1.353 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.352 |
| 14.00 | 0.668 | 82.11 | ----- | 1.290 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.290 |
| 14.08 | 0.643 | 82.07 | ----- | 1.218 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.218 |
| 14.17 | 0.619 | 82.04 | ----- | 1.149 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.149 |
| 14.25 | 0.598 | 82.01 | ----- | 1.085 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.085 |
| 14.33 | 0.579 | 81.97 | ----- | 1.008 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.008 |
| 14.42 | 0.564 | 81.94 | ----- | 0.936 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.936 |
| 14.50 | 0.550 | 81.92 | ----- | 0.873 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.873 |
| 14.58 | 0.539 | 81.90 | ----- | 0.819 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.819 |
| 14.67 | 0.529 | 81.88 | ----- | 0.772 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.772 |
| 14.75 | 0.520 | 81.86 | ----- | 0.731 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.731 |
| 14.83 | 0.512 | 81.85 | ----- | 0.695 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.695 |
| 14.92 | 0.504 | 81.83 | ----- | 0.665 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.665 |
| 15.00 | 0.497 | 81.82 | ----- | 0.637 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.637 |
| 15.08 | 0.489 | 81.81 | ----- | 0.614 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.614 |
| 15.17 | 0.481 | 81.80 | ----- | 0.592 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.592 |
| 15.25 | 0.472 | 81.79 | ----- | 0.574 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.574 |
| 15.33 | 0.464 | 81.79 | ----- | 0.558 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.558 |
| 15.42 | 0.456 | 81.78 | ----- | 0.544 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.544 |
| 15.50 | 0.448 | 81.77 | ----- | 0.530 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.530 |

*Continues on next page...*

Post-Development BMP

## Hydrograph Discharge Table

| Time (hrs) | Inflow cfs | Elevation ft | Clv A cfs | Clv B cfs | Clv C cfs | PfRsr cfs | Wr A cfs | Wr B cfs | Wr C cfs | Wr D cfs | Exfil cfs | Outflow cfs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 15.58 | 0.440 | 81.77 | ----- | 0.517 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.517 |
| 15.67 | 0.431 | 81.76 | ----- | 0.505 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.505 |
| 15.75 | 0.423 | 81.76 | ----- | 0.493 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.493 |
| 15.83 | 0.415 | 81.75 | ----- | 0.482 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.482 |
| 15.92 | 0.406 | 81.75 | ----- | 0.471 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.471 |
| 16.00 | 0.398 | 81.74 | ----- | 0.461 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.461 |
| 16.08 | 0.389 | 81.74 | ----- | 0.451 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.451 |
| 16.17 | 0.381 | 81.73 | ----- | 0.441 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.441 |
| 16.25 | 0.373 | 81.73 | ----- | 0.431 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.431 |
| 16.33 | 0.367 | 81.73 | ----- | 0.422 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.422 |
| 16.42 | 0.361 | 81.72 | ----- | 0.413 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.413 |
| 16.50 | 0.356 | 81.72 | ----- | 0.405 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.405 |
| 16.58 | 0.352 | 81.71 | ----- | 0.397 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.397 |
| 16.67 | 0.348 | 81.71 | ----- | 0.390 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.390 |
| 16.75 | 0.345 | 81.71 | ----- | 0.384 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.384 |
| 16.83 | 0.342 | 81.70 | ----- | 0.378 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.378 |
| 16.92 | 0.339 | 81.70 | ----- | 0.372 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.372 |
| 17.00 | 0.336 | 81.70 | ----- | 0.367 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.367 |
| 17.08 | 0.333 | 81.70 | ----- | 0.363 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.363 |
| 17.17 | 0.330 | 81.70 | ----- | 0.359 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.359 |
| 17.25 | 0.327 | 81.69 | ----- | 0.355 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.355 |
| 17.33 | 0.324 | 81.69 | ----- | 0.351 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.351 |
| 17.42 | 0.321 | 81.69 | ----- | 0.348 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.348 |
| 17.50 | 0.318 | 81.69 | ----- | 0.344 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.344 |
| 17.58 | 0.315 | 81.69 | ----- | 0.341 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.341 |
| 17.67 | 0.312 | 81.68 | ----- | 0.338 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.338 |
| 17.75 | 0.309 | 81.68 | ----- | 0.334 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.334 |
| 17.83 | 0.306 | 81.68 | ----- | 0.331 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.331 |
| 17.92 | 0.303 | 81.68 | ----- | 0.328 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.328 |
| 18.00 | 0.300 | 81.68 | ----- | 0.324 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.324 |
| 18.08 | 0.297 | 81.67 | ----- | 0.321 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.321 |
| 18.17 | 0.294 | 81.67 | ----- | 0.318 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.318 |
| 18.25 | 0.291 | 81.67 | ----- | 0.315 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.315 |
| 18.33 | 0.288 | 81.67 | ----- | 0.312 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.312 |
| 18.42 | 0.285 | 81.67 | ----- | 0.309 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.309 |
| 18.50 | 0.282 | 81.67 | ----- | 0.305 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.305 |
| 18.58 | 0.279 | 81.66 | ----- | 0.302 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.302 |
| 18.67 | 0.276 | 81.66 | ----- | 0.299 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.299 |
| 18.75 | 0.273 | 81.66 | ----- | 0.296 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.296 |
| 18.83 | 0.269 | 81.66 | ----- | 0.293 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.293 |
| 18.92 | 0.266 | 81.66 | ----- | 0.290 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.290 |
| 19.00 | 0.263 | 81.66 | ----- | 0.287 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.287 |
| 19.08 | 0.260 | 81.65 | ----- | 0.284 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.284 |
| 19.17 | 0.257 | 81.65 | ----- | 0.280 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.280 |
| 19.25 | 0.254 | 81.65 | ----- | 0.277 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.277 |
| 19.33 | 0.251 | 81.65 | ----- | 0.274 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.274 |
| 19.42 | 0.247 | 81.65 | ----- | 0.271 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.271 |
| 19.50 | 0.244 | 81.64 | ----- | 0.268 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.268 |
| 19.58 | 0.241 | 81.64 | ----- | 0.265 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.265 |
| 19.67 | 0.238 | 81.64 | ----- | 0.262 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.262 |
| 19.75 | 0.235 | 81.64 | ----- | 0.258 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.258 |
| 19.83 | 0.231 | 81.64 | ----- | 0.255 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.255 |
| 19.92 | 0.228 | 81.64 | ----- | 0.252 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.252 |
| 20.00 | 0.225 | 81.63 | ----- | 0.249 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.249 |

*Continues on next page...*

Post-Development BMP

## Hydrograph Discharge Table

| Time (hrs) | Inflow cfs | Elevation ft | Clv A cfs | Clv B cfs | Clv C cfs | PfRsr cfs | Wr A cfs | Wr B cfs | Wr C cfs | Wr D cfs | Exfil cfs | Outflow cfs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 20.08 | 0.222 | 81.63 | ----- | 0.246 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.246 |
| 20.17 | 0.219 | 81.63 | ----- | 0.243 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.243 |
| 20.25 | 0.216 | 81.63 | ----- | 0.239 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.239 |
| 20.33 | 0.214 | 81.63 | ----- | 0.236 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.236 |
| 20.42 | 0.212 | 81.63 | ----- | 0.233 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.233 |
| 20.50 | 0.210 | 81.62 | ----- | 0.231 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.231 |
| 20.58 | 0.209 | 81.62 | ----- | 0.228 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.228 |
| 20.67 | 0.208 | 81.62 | ----- | 0.226 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.226 |
| 20.75 | 0.207 | 81.62 | ----- | 0.223 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.223 |
| 20.83 | 0.207 | 81.62 | ----- | 0.221 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.221 |
| 20.92 | 0.206 | 81.62 | ----- | 0.219 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.219 |
| 21.00 | 0.206 | 81.62 | ----- | 0.218 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.218 |
| 21.08 | 0.205 | 81.62 | ----- | 0.216 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.216 |
| 21.17 | 0.204 | 81.61 | ----- | 0.215 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.215 |
| 21.25 | 0.204 | 81.61 | ----- | 0.213 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.213 |
| 21.33 | 0.203 | 81.61 | ----- | 0.212 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.212 |
| 21.42 | 0.203 | 81.61 | ----- | 0.211 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.211 |
| 21.50 | 0.202 | 81.61 | ----- | 0.210 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.210 |
| 21.58 | 0.201 | 81.61 | ----- | 0.209 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.209 |
| 21.67 | 0.201 | 81.61 | ----- | 0.208 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.208 |
| 21.75 | 0.200 | 81.61 | ----- | 0.207 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.207 |
| 21.83 | 0.200 | 81.61 | ----- | 0.206 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.206 |
| 21.92 | 0.199 | 81.61 | ----- | 0.205 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.205 |
| 22.00 | 0.199 | 81.61 | ----- | 0.205 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.205 |
| 22.08 | 0.198 | 81.61 | ----- | 0.204 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.204 |
| 22.17 | 0.197 | 81.61 | ----- | 0.203 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.203 |
| 22.25 | 0.197 | 81.61 | ----- | 0.202 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.202 |
| 22.33 | 0.196 | 81.61 | ----- | 0.202 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.202 |
| 22.42 | 0.196 | 81.61 | ----- | 0.201 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.201 |
| 22.50 | 0.195 | 81.61 | ----- | 0.200 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.200 |
| 22.58 | 0.194 | 81.61 | ----- | 0.199 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.200 |
| 22.67 | 0.194 | 81.61 | ----- | 0.199 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.199 |
| 22.75 | 0.193 | 81.61 | ----- | 0.198 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.198 |
| 22.83 | 0.193 | 81.61 | ----- | 0.198 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.198 |
| 22.92 | 0.192 | 81.60 | ----- | 0.197 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.197 |
| 23.00 | 0.191 | 81.60 | ----- | 0.196 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.196 |
| 23.08 | 0.191 | 81.60 | ----- | 0.196 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.196 |
| 23.17 | 0.190 | 81.60 | ----- | 0.195 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.195 |
| 23.25 | 0.190 | 81.60 | ----- | 0.194 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.194 |
| 23.33 | 0.189 | 81.60 | ----- | 0.194 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.194 |
| 23.42 | 0.188 | 81.60 | ----- | 0.193 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.193 |
| 23.50 | 0.188 | 81.60 | ----- | 0.193 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.193 |
| 23.58 | 0.187 | 81.60 | ----- | 0.192 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.192 |
| 23.67 | 0.187 | 81.60 | ----- | 0.191 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.191 |
| 23.75 | 0.186 | 81.60 | ----- | 0.191 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.191 |
| 23.83 | 0.185 | 81.60 | ----- | 0.190 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.190 |
| 23.92 | 0.185 | 81.60 | ----- | 0.189 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.189 |
| 24.00 | 0.184 | 81.60 | ----- | 0.189 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.189 |
| 24.08 | 0.179 | 81.60 | ----- | 0.188 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.188 |
| 24.17 | 0.164 | 81.60 | ----- | 0.187 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.187 |
| 24.25 | 0.142 | 81.60 | ----- | 0.184 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.184 |
| 24.33 | 0.110 | 81.59 | ----- | 0.179 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.179 |
| 24.42 | 0.079 | 81.59 | ----- | 0.171 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.171 |
| 24.50 | 0.053 | 81.58 | ----- | 0.162 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.162 |

*Continues on next page...*

Post-Development BMP

## Hydrograph Discharge Table

| Time (hrs) | Inflow cfs | Elevation ft | Clv A cfs | Clv B cfs | Clv C cfs | PfRsr cfs | Wr A cfs | Wr B cfs | Wr C cfs | Wr D cfs | Exfil cfs | Outflow cfs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 24.58 | 0.032 | 81.57 | ----- | 0.151 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.151 |
| 24.67 | 0.016 | 81.56 | ----- | 0.140 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.140 |
| 24.75 | 0.006 | 81.55 | ----- | 0.128 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.128 |
| 24.83 | 0.001 | 81.54 | ----- | 0.117 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.117 |
| 24.92 | 0.000 | 81.53 | ----- | 0.107 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.107 |
| 25.00 | 0.000 | 81.53 | ----- | 0.097 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.097 |
| 25.08 | 0.000 | 81.52 | ----- | 0.089 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.089 |
| 25.17 | 0.000 | 81.51 | ----- | 0.081 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.081 |
| 25.25 | 0.000 | 81.51 | ----- | 0.074 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.074 |
| 25.33 | 0.000 | 81.50 | ----- | 0.067 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.067 |
| 25.42 | 0.000 | 81.50 | ----- | 0.062 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.062 |
| 25.50 | 0.000 | 81.49 | ----- | 0.059 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.059 |
| 25.58 | 0.000 | 81.49 | ----- | 0.057 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.057 |
| 25.67 | 0.000 | 81.49 | ----- | 0.054 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.054 |
| 25.75 | 0.000 | 81.48 | ----- | 0.052 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.052 |
| 25.83 | 0.000 | 81.48 | ----- | 0.050 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.050 |
| 25.92 | 0.000 | 81.47 | ----- | 0.048 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.048 |
| 26.00 | 0.000 | 81.47 | ----- | 0.046 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.046 |
| 26.08 | 0.000 | 81.47 | ----- | 0.044 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.044 |
| 26.17 | 0.000 | 81.46 | ----- | 0.042 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.042 |
| 26.25 | 0.000 | 81.46 | ----- | 0.040 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.040 |
| 26.33 | 0.000 | 81.46 | ----- | 0.038 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.038 |
| 26.42 | 0.000 | 81.46 | ----- | 0.037 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.037 |
| 26.50 | 0.000 | 81.45 | ----- | 0.035 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.035 |
| 26.58 | 0.000 | 81.45 | ----- | 0.033 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.033 |
| 26.67 | 0.000 | 81.45 | ----- | 0.032 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.032 |
| 26.75 | 0.000 | 81.45 | ----- | 0.031 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.031 |
| 26.83 | 0.000 | 81.44 | ----- | 0.029 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.029 |

*...End*

# Pond Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Tuesday, Oct 25, 2011

## Pond No. 1 - Existing BMP

### Pond Data

**Contours** - User-defined contour areas. Average end area method used for volume calculation. Begining Elevation = 79.50 ft

### Stage / Storage Table

| Stage (ft) | Elevation (ft) | Contour area (sqft) | Incr. Storage (cuft) | Total storage (cuft) |
|---|---|---|---|---|
| 0.00 | 79.50 | 1,684 | 0 | 0 |
| 0.50 | 80.00 | 2,618 | 1,076 | 1,076 |
| 1.50 | 81.00 | 3,631 | 3,125 | 4,200 |
| 2.50 | 82.00 | 4,442 | 4,037 | 8,237 |
| 3.50 | 83.00 | 5,305 | 4,874 | 13,110 |
| 4.50 | 84.00 | 6,219 | 5,762 | 18,872 |
| 5.50 | 85.00 | 8,403 | 7,311 | 26,183 |

### Culvert / Orifice Structures

| | [A] | [B] | [C] | [PrfRsr] |
|---|---|---|---|---|
| **Rise (in)** | = 18.00 | 9.00 | 0.00 | 0.00 |
| **Span (in)** | = 18.00 | 9.00 | 0.00 | 0.00 |
| **No. Barrels** | = 1 | 1 | 0 | 0 |
| **Invert El. (ft)** | = 81.07 | 81.37 | 0.00 | 0.00 |
| **Length (ft)** | = 40.00 | 0.00 | 0.00 | 0.00 |
| **Slope (%)** | = 2.20 | 0.00 | 0.00 | n/a |
| **N-Value** | = .013 | .013 | .013 | n/a |
| **Orifice Coeff.** | = 0.60 | 0.60 | 0.60 | 0.60 |
| **Multi-Stage** | = n/a | No | No | No |

### Weir Structures

| | [A] | [B] | [C] | [D] |
|---|---|---|---|---|
| **Crest Len (ft)** | = 7.85 | 10.00 | 0.00 | 0.00 |
| **Crest El. (ft)** | = 82.80 | 84.47 | 0.00 | 0.00 |
| **Weir Coeff.** | = 3.33 | 3.33 | 3.33 | 3.33 |
| **Weir Type** | = Riser | Rect | --- | --- |
| **Multi-Stage** | = Yes | No | No | No |

**Exfil.(in/hr)** = 0.000 (by Contour)

**TW Elev. (ft)** = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

### Stage / Storage / Discharge Table

| Stage ft | Storage cuft | Elevation ft | Clv A cfs | Clv B cfs | Clv C cfs | PrfRsr cfs | Wr A cfs | Wr B cfs | Wr C cfs | Wr D cfs | Exfil cfs | User cfs | Total cfs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.00 | 0 | 79.50 | 0.00 | 0.00 | --- | --- | 0.00 | 0.00 | --- | --- | --- | --- | 0.000 |
| 0.50 | 1,076 | 80.00 | 0.00 | 0.00 | --- | --- | 0.00 | 0.00 | --- | --- | --- | --- | 0.000 |
| 1.50 | 4,200 | 81.00 | 0.00 | 0.00 | --- | --- | 0.00 | 0.00 | --- | --- | --- | --- | 0.000 |
| 2.50 | 8,237 | 82.00 | 0.00 | 1.07 ic | --- | --- | 0.00 | 0.00 | --- | --- | --- | --- | 1.071 |
| 3.50 | 13,110 | 83.00 | 2.37 ic | 2.38 ic | --- | --- | 2.34 | 0.00 | --- | --- | --- | --- | 4.721 |
| 4.50 | 18,872 | 84.00 | 12.40 ic | 3.19 ic | --- | --- | 12.39 s | 0.00 | --- | --- | --- | --- | 15.58 |
| 5.50 | 26,183 | 85.00 | 15.13 ic | 3.84 ic | --- | --- | 15.12 s | 12.85 | --- | --- | --- | --- | 31.81 |

# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Tuesday, Oct 25, 2011

## Hyd. No. 4

Post-Development BMP

| | | | |
|---|---|---|---|
| Hydrograph type | = Reservoir | Peak discharge | = 14.41 cfs |
| Storm frequency | = 10 yrs | Time to peak | = 12.38 hrs |
| Time interval | = 1 min | Hyd. volume | = 69,344 cuft |
| Inflow hyd. No. | = 2 - Post-Development Developn | Reservoir name | = Existing BMP |
| Max. Elevation | = 83.72 ft | Max. Storage | = 17,276 cuft |

Storage Indication method used.

### Hydrograph Discharge Table

( Printed values >= 1.00% of Qp. Print interval = 5)

| Time (hrs) | Inflow cfs | Elevation ft | Clv A cfs | Clv B cfs | Clv C cfs | PfRsr cfs | Wr A cfs | Wr B cfs | Wr C cfs | Wr D cfs | Exfil cfs | Outflow cfs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 11.92 | 6.734 | 81.82 | ----- | 0.634 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.634 |
| 12.00 | 10.69 | 82.31 | ----- | 1.603 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.603 |
| 12.08 | 14.35 | 82.95 | 1.663 | 2.338 | ----- | ----- | 1.638 | ----- | ----- | ----- | ----- | 3.976 |
| 12.17 | 16.98 | 83.34 | 9.221 | 2.684 | ----- | ----- | 9.221 | ----- | ----- | ----- | ----- | 11.91 |
| 12.25 | 17.41 | 83.57 | 10.77 | 2.876 | ----- | ----- | 10.77 | ----- | ----- | ----- | ----- | 13.65 |
| 12.33 | 15.60 | 83.71 | 11.36 | 2.979 | ----- | ----- | 11.35 | ----- | ----- | ----- | ----- | 14.33 |
| 12.42 | 13.27 | 83.71 | 11.37 | 2.981 | ----- | ----- | 11.37 | ----- | ----- | ----- | ----- | 14.35 |
| 12.50 | 10.80 | 83.60 | 10.91 | 2.898 | ----- | ----- | 10.91 | ----- | ----- | ----- | ----- | 13.81 |
| 12.58 | 8.313 | 83.41 | 9.837 | 2.743 | ----- | ----- | 9.835 | ----- | ----- | ----- | ----- | 12.58 |
| 12.67 | 5.986 | 83.20 | 6.612 | 2.566 | ----- | ----- | 6.612 | ----- | ----- | ----- | ----- | 9.177 |
| 12.75 | 4.143 | 83.07 | 3.746 | 2.448 | ----- | ----- | 3.703 | ----- | ----- | ----- | ----- | 6.150 |
| 12.83 | 3.228 | 82.98 | 2.111 | 2.366 | ----- | ----- | 2.081 | ----- | ----- | ----- | ----- | 4.448 |
| 12.92 | 2.873 | 82.93 | 1.250 | 2.312 | ----- | ----- | 1.231 | ----- | ----- | ----- | ----- | 3.543 |
| 13.00 | 2.601 | 82.89 | 0.790 | 2.280 | ----- | ----- | 0.776 | ----- | ----- | ----- | ----- | 3.056 |
| 13.08 | 2.383 | 82.87 | 0.562 | 2.252 | ----- | ----- | 0.552 | ----- | ----- | ----- | ----- | 2.805 |
| 13.17 | 2.209 | 82.84 | 0.357 | 2.228 | ----- | ----- | 0.351 | ----- | ----- | ----- | ----- | 2.578 |
| 13.25 | 2.070 | 82.82 | 0.180 | 2.206 | ----- | ----- | 0.177 | ----- | ----- | ----- | ----- | 2.383 |
| 13.33 | 1.957 | 82.80 | 0.032 | 2.188 | ----- | ----- | 0.031 | ----- | ----- | ----- | ----- | 2.219 |
| 13.42 | 1.861 | 82.79 | ----- | 2.171 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 2.171 |
| 13.50 | 1.773 | 82.77 | ----- | 2.148 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 2.148 |
| 13.58 | 1.693 | 82.74 | ----- | 2.122 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 2.122 |
| 13.67 | 1.619 | 82.71 | ----- | 2.092 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 2.092 |
| 13.75 | 1.551 | 82.68 | ----- | 2.059 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 2.059 |
| 13.83 | 1.488 | 82.65 | ----- | 2.023 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 2.023 |
| 13.92 | 1.430 | 82.62 | ----- | 1.986 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.986 |
| 14.00 | 1.374 | 82.58 | ----- | 1.946 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.946 |
| 14.08 | 1.321 | 82.55 | ----- | 1.904 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.904 |
| 14.17 | 1.272 | 82.51 | ----- | 1.861 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.861 |
| 14.25 | 1.226 | 82.47 | ----- | 1.816 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.816 |
| 14.33 | 1.187 | 82.44 | ----- | 1.770 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.770 |
| 14.42 | 1.153 | 82.40 | ----- | 1.725 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.725 |
| 14.50 | 1.125 | 82.37 | ----- | 1.678 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.678 |
| 14.58 | 1.101 | 82.33 | ----- | 1.632 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.632 |
| 14.67 | 1.080 | 82.30 | ----- | 1.588 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.588 |
| 14.75 | 1.061 | 82.27 | ----- | 1.543 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.543 |
| 14.83 | 1.044 | 82.24 | ----- | 1.500 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.500 |
| 14.92 | 1.027 | 82.22 | ----- | 1.459 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.459 |
| 15.00 | 1.010 | 82.19 | ----- | 1.419 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.419 |
| 15.08 | 0.993 | 82.17 | ----- | 1.380 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.380 |
| 15.17 | 0.976 | 82.14 | ----- | 1.343 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.343 |

*Continues on next page...*

Post-Development BMP

## Hydrograph Discharge Table

| Time (hrs) | Inflow cfs | Elevation ft | Clv A cfs | Clv B cfs | Clv C cfs | PfRsr cfs | Wr A cfs | Wr B cfs | Wr C cfs | Wr D cfs | Exfil cfs | Outflow cfs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 15.25 | 0.959 | 82.12 | ----- | 1.308 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.308 |
| 15.33 | 0.941 | 82.10 | ----- | 1.275 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.275 |
| 15.42 | 0.924 | 82.08 | ----- | 1.234 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.234 |
| 15.50 | 0.907 | 82.06 | ----- | 1.196 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.196 |
| 15.58 | 0.889 | 82.04 | ----- | 1.161 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.161 |
| 15.67 | 0.872 | 82.03 | ----- | 1.128 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.128 |
| 15.75 | 0.855 | 82.01 | ----- | 1.096 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.096 |
| 15.83 | 0.837 | 82.00 | ----- | 1.065 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.065 |
| 15.92 | 0.820 | 81.98 | ----- | 1.026 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.026 |
| 16.00 | 0.802 | 81.97 | ----- | 0.990 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.990 |
| 16.08 | 0.785 | 81.95 | ----- | 0.958 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.958 |
| 16.17 | 0.768 | 81.94 | ----- | 0.927 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.927 |
| 16.25 | 0.752 | 81.93 | ----- | 0.900 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.900 |
| 16.33 | 0.738 | 81.92 | ----- | 0.874 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.874 |
| 16.42 | 0.726 | 81.91 | ----- | 0.850 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.850 |
| 16.50 | 0.715 | 81.90 | ----- | 0.829 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.829 |
| 16.58 | 0.707 | 81.89 | ----- | 0.809 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.809 |
| 16.67 | 0.699 | 81.89 | ----- | 0.792 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.792 |
| 16.75 | 0.692 | 81.88 | ----- | 0.776 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.776 |
| 16.83 | 0.686 | 81.87 | ----- | 0.761 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.761 |
| 16.92 | 0.680 | 81.87 | ----- | 0.748 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.748 |
| 17.00 | 0.674 | 81.86 | ----- | 0.737 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.737 |
| 17.08 | 0.667 | 81.86 | ----- | 0.726 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.726 |
| 17.17 | 0.661 | 81.85 | ----- | 0.716 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.716 |
| 17.25 | 0.655 | 81.85 | ----- | 0.706 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.706 |
| 17.33 | 0.649 | 81.85 | ----- | 0.697 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.697 |
| 17.42 | 0.643 | 81.84 | ----- | 0.689 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.689 |
| 17.50 | 0.636 | 81.84 | ----- | 0.680 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.680 |
| 17.58 | 0.630 | 81.84 | ----- | 0.673 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.673 |
| 17.67 | 0.624 | 81.83 | ----- | 0.665 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.665 |
| 17.75 | 0.618 | 81.83 | ----- | 0.658 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.658 |
| 17.83 | 0.611 | 81.83 | ----- | 0.651 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.651 |
| 17.92 | 0.605 | 81.82 | ----- | 0.644 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.644 |
| 18.00 | 0.599 | 81.82 | ----- | 0.637 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.637 |
| 18.08 | 0.592 | 81.82 | ----- | 0.630 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.630 |
| 18.17 | 0.586 | 81.82 | ----- | 0.623 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.623 |
| 18.25 | 0.580 | 81.81 | ----- | 0.617 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.617 |
| 18.33 | 0.574 | 81.81 | ----- | 0.610 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.610 |
| 18.42 | 0.567 | 81.81 | ----- | 0.603 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.603 |
| 18.50 | 0.561 | 81.80 | ----- | 0.597 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.597 |
| 18.58 | 0.554 | 81.80 | ----- | 0.590 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.590 |
| 18.67 | 0.548 | 81.80 | ----- | 0.584 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.584 |
| 18.75 | 0.542 | 81.80 | ----- | 0.578 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.578 |
| 18.83 | 0.535 | 81.79 | ----- | 0.572 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.572 |
| 18.92 | 0.529 | 81.79 | ----- | 0.566 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.566 |
| 19.00 | 0.523 | 81.79 | ----- | 0.560 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.560 |
| 19.08 | 0.516 | 81.79 | ----- | 0.554 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.554 |
| 19.17 | 0.510 | 81.78 | ----- | 0.548 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.548 |
| 19.25 | 0.503 | 81.78 | ----- | 0.542 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.542 |
| 19.33 | 0.497 | 81.78 | ----- | 0.535 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.535 |
| 19.42 | 0.490 | 81.77 | ----- | 0.529 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.529 |
| 19.50 | 0.484 | 81.77 | ----- | 0.523 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.523 |
| 19.58 | 0.478 | 81.77 | ----- | 0.517 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.517 |
| 19.67 | 0.471 | 81.77 | ----- | 0.510 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.510 |

*Continues on next page...*

Post-Development BMP

## Hydrograph Discharge Table

| Time (hrs) | Inflow cfs | Elevation ft | Clv A cfs | Clv B cfs | Clv C cfs | PfRsr cfs | Wr A cfs | Wr B cfs | Wr C cfs | Wr D cfs | Exfil cfs | Outflow cfs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 19.75 | 0.465 | 81.76 | ----- | 0.504 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.504 |
| 19.83 | 0.458 | 81.76 | ----- | 0.497 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.497 |
| 19.92 | 0.452 | 81.76 | ----- | 0.491 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.491 |
| 20.00 | 0.445 | 81.75 | ----- | 0.485 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.485 |
| 20.08 | 0.439 | 81.75 | ----- | 0.478 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.478 |
| 20.17 | 0.433 | 81.75 | ----- | 0.472 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.472 |
| 20.25 | 0.427 | 81.75 | ----- | 0.466 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.466 |
| 20.33 | 0.422 | 81.74 | ----- | 0.459 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.459 |
| 20.42 | 0.418 | 81.74 | ----- | 0.453 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.453 |
| 20.50 | 0.415 | 81.74 | ----- | 0.448 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.448 |
| 20.58 | 0.413 | 81.73 | ----- | 0.443 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.443 |
| 20.67 | 0.411 | 81.73 | ----- | 0.438 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.438 |
| 20.75 | 0.409 | 81.73 | ----- | 0.434 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.434 |
| 20.83 | 0.408 | 81.73 | ----- | 0.430 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.430 |
| 20.92 | 0.407 | 81.73 | ----- | 0.427 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.427 |
| 21.00 | 0.405 | 81.73 | ----- | 0.424 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.424 |
| 21.08 | 0.404 | 81.72 | ----- | 0.421 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.421 |
| 21.17 | 0.403 | 81.72 | ----- | 0.418 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.418 |
| 21.25 | 0.402 | 81.72 | ----- | 0.416 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.416 |
| 21.33 | 0.401 | 81.72 | ----- | 0.414 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.414 |
| 21.42 | 0.399 | 81.72 | ----- | 0.412 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.412 |
| 21.50 | 0.398 | 81.72 | ----- | 0.410 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.410 |
| 21.58 | 0.397 | 81.72 | ----- | 0.408 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.408 |
| 21.67 | 0.396 | 81.72 | ----- | 0.406 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.406 |
| 21.75 | 0.394 | 81.72 | ----- | 0.404 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.404 |
| 21.83 | 0.393 | 81.72 | ----- | 0.403 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.403 |
| 21.92 | 0.392 | 81.72 | ----- | 0.401 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.401 |
| 22.00 | 0.391 | 81.72 | ----- | 0.400 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.400 |
| 22.08 | 0.389 | 81.71 | ----- | 0.398 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.398 |
| 22.17 | 0.388 | 81.71 | ----- | 0.397 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.397 |
| 22.25 | 0.387 | 81.71 | ----- | 0.395 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.395 |
| 22.33 | 0.386 | 81.71 | ----- | 0.394 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.394 |
| 22.42 | 0.384 | 81.71 | ----- | 0.393 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.393 |
| 22.50 | 0.383 | 81.71 | ----- | 0.391 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.391 |
| 22.58 | 0.382 | 81.71 | ----- | 0.390 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.390 |
| 22.67 | 0.381 | 81.71 | ----- | 0.389 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.389 |
| 22.75 | 0.380 | 81.71 | ----- | 0.387 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.387 |
| 22.83 | 0.378 | 81.71 | ----- | 0.386 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.386 |
| 22.92 | 0.377 | 81.71 | ----- | 0.385 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.385 |
| 23.00 | 0.376 | 81.71 | ----- | 0.384 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.384 |
| 23.08 | 0.375 | 81.71 | ----- | 0.382 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.382 |
| 23.17 | 0.373 | 81.71 | ----- | 0.381 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.381 |
| 23.25 | 0.372 | 81.71 | ----- | 0.380 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.380 |
| 23.33 | 0.371 | 81.71 | ----- | 0.379 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.379 |
| 23.42 | 0.370 | 81.70 | ----- | 0.377 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.377 |
| 23.50 | 0.368 | 81.70 | ----- | 0.376 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.376 |
| 23.58 | 0.367 | 81.70 | ----- | 0.375 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.375 |
| 23.67 | 0.366 | 81.70 | ----- | 0.374 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.374 |
| 23.75 | 0.364 | 81.70 | ----- | 0.372 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.372 |
| 23.83 | 0.363 | 81.70 | ----- | 0.371 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.371 |
| 23.92 | 0.362 | 81.70 | ----- | 0.370 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.370 |
| 24.00 | 0.361 | 81.70 | ----- | 0.368 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.368 |
| 24.08 | 0.349 | 81.70 | ----- | 0.367 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.367 |
| 24.17 | 0.321 | 81.70 | ----- | 0.363 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.363 |

*Continues on next page...*

Post-Development BMP

## Hydrograph Discharge Table

| Time (hrs) | Inflow cfs | Elevation ft | Clv A cfs | Clv B cfs | Clv C cfs | PfRsr cfs | Wr A cfs | Wr B cfs | Wr C cfs | Wr D cfs | Exfil cfs | Outflow cfs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 24.25 | 0.277 | 81.69 | ----- | 0.355 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.355 |
| 24.33 | 0.216 | 81.69 | ----- | 0.342 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.342 |
| 24.42 | 0.154 | 81.67 | ----- | 0.322 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.322 |
| 24.50 | 0.103 | 81.66 | ----- | 0.298 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.298 |
| 24.58 | 0.062 | 81.65 | ----- | 0.271 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.271 |
| 24.67 | 0.032 | 81.63 | ----- | 0.243 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.243 |
| 24.75 | 0.011 | 81.62 | ----- | 0.215 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.215 |
| 24.83 | 0.001 | 81.60 | ----- | 0.189 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.189 |
| 24.92 | 0.000 | 81.59 | ----- | 0.172 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.172 |
| 25.00 | 0.000 | 81.58 | ----- | 0.157 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.157 |

*...End*

# Pond Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Tuesday, Oct 25, 2011

## Pond No. 1 - Existing BMP

### Pond Data

**Contours** - User-defined contour areas. Average end area method used for volume calculation. Begining Elevation = 79.50 ft

### Stage / Storage Table

| Stage (ft) | Elevation (ft) | Contour area (sqft) | Incr. Storage (cuft) | Total storage (cuft) |
|---|---|---|---|---|
| 0.00 | 79.50 | 1,684 | 0 | 0 |
| 0.50 | 80.00 | 2,618 | 1,076 | 1,076 |
| 1.50 | 81.00 | 3,631 | 3,125 | 4,200 |
| 2.50 | 82.00 | 4,442 | 4,037 | 8,237 |
| 3.50 | 83.00 | 5,305 | 4,874 | 13,110 |
| 4.50 | 84.00 | 6,219 | 5,762 | 18,872 |
| 5.50 | 85.00 | 8,403 | 7,311 | 26,183 |

### Culvert / Orifice Structures

| | [A] | [B] | [C] | [PrfRsr] |
|---|---|---|---|---|
| Rise (in) | = 18.00 | 9.00 | 0.00 | 0.00 |
| Span (in) | = 18.00 | 9.00 | 0.00 | 0.00 |
| No. Barrels | = 1 | 1 | 0 | 0 |
| Invert El. (ft) | = 81.07 | 81.37 | 0.00 | 0.00 |
| Length (ft) | = 40.00 | 0.00 | 0.00 | 0.00 |
| Slope (%) | = 2.20 | 0.00 | 0.00 | n/a |
| N-Value | = .013 | .013 | .013 | n/a |
| Orifice Coeff. | = 0.60 | 0.60 | 0.60 | 0.60 |
| Multi-Stage | = n/a | No | No | No |

### Weir Structures

| | [A] | [B] | [C] | [D] |
|---|---|---|---|---|
| Crest Len (ft) | = 7.85 | 10.00 | 0.00 | 0.00 |
| Crest El. (ft) | = 82.80 | 84.47 | 0.00 | 0.00 |
| Weir Coeff. | = 3.33 | 3.33 | 3.33 | 3.33 |
| Weir Type | = Riser | Rect | --- | --- |
| Multi-Stage | = Yes | No | No | No |

Exfil.(in/hr) = 0.000 (by Contour)
TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

### Stage / Storage / Discharge Table

| Stage ft | Storage cuft | Elevation ft | Clv A cfs | Clv B cfs | Clv C cfs | PrfRsr cfs | Wr A cfs | Wr B cfs | Wr C cfs | Wr D cfs | Exfil cfs | User cfs | Total cfs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.00 | 0 | 79.50 | 0.00 | 0.00 | --- | --- | 0.00 | 0.00 | --- | --- | --- | --- | 0.000 |
| 0.50 | 1,076 | 80.00 | 0.00 | 0.00 | --- | --- | 0.00 | 0.00 | --- | --- | --- | --- | 0.000 |
| 1.50 | 4,200 | 81.00 | 0.00 | 0.00 | --- | --- | 0.00 | 0.00 | --- | --- | --- | --- | 0.000 |
| 2.50 | 8,237 | 82.00 | 0.00 | 1.07 ic | --- | --- | 0.00 | 0.00 | --- | --- | --- | --- | 1.071 |
| 3.50 | 13,110 | 83.00 | 2.37 ic | 2.38 ic | --- | --- | 2.34 | 0.00 | --- | --- | --- | --- | 4.721 |
| 4.50 | 18,872 | 84.00 | 12.40 ic | 3.19 ic | --- | --- | 12.39 s | 0.00 | --- | --- | --- | --- | 15.58 |
| 5.50 | 26,183 | 85.00 | 15.13 ic | 3.84 ic | --- | --- | 15.12 s | 12.85 | --- | --- | --- | --- | 31.81 |

# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Tuesday, Oct 25, 2011

## Hyd. No. 4

Post-Development BMP

| | | | |
|---|---|---|---|
| Hydrograph type | = Reservoir | Peak discharge | = 24.24 cfs |
| Storm frequency | = 100 yrs | Time to peak | = 12.35 hrs |
| Time interval | = 1 min | Hyd. volume | = 114,917 cuft |
| Inflow hyd. No. | = 2 - Post-Development Developn | Reservoir name | = Existing BMP |
| Max. Elevation | = 84.79 ft | Max. Storage | = 24,620 cuft |

Storage Indication method used.

### Hydrograph Discharge Table

( Printed values >= 1.00% of Qp Print interval = 5)

| Time (hrs) | Inflow cfs | Elevation ft | Clv A cfs | Clv B cfs | Clv C cfs | PfRsr cfs | Wr A cfs | Wr B cfs | Wr C cfs | Wr D cfs | Exfil cfs | Outflow cfs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 11.17 | 1.509 | 81.66 | ----- | 0.301 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.301 |
| 11.25 | 1.644 | 81.75 | ----- | 0.479 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.479 |
| 11.33 | 1.803 | 81.84 | ----- | 0.674 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.674 |
| 11.42 | 1.992 | 81.92 | ----- | 0.876 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.876 |
| 11.50 | 2.208 | 82.00 | ----- | 1.077 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.077 |
| 11.58 | 2.511 | 82.08 | ----- | 1.227 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.227 |
| 11.67 | 3.148 | 82.17 | ----- | 1.383 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.383 |
| 11.75 | 4.447 | 82.31 | ----- | 1.593 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.593 |
| 11.83 | 6.924 | 82.54 | ----- | 1.897 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.897 |
| 11.92 | 11.53 | 82.95 | 1.623 | 2.335 | ----- | ----- | 1.599 | ----- | ----- | ----- | ----- | 3.934 |
| 12.00 | 17.81 | 83.31 | 8.982 | 2.662 | ----- | ----- | 8.982 | ----- | ----- | ----- | ----- | 11.64 |
| 12.08 | 23.52 | 83.71 | 11.37 | 2.982 | ----- | ----- | 11.37 | ----- | ----- | ----- | ----- | 14.35 |
| 12.17 | 27.45 | 84.19 | 12.99 | 3.329 | ----- | ----- | 12.98 | ----- | ----- | ----- | ----- | 16.31 |
| 12.25 | 27.87 | 84.63 | 14.19 | 3.610 | ----- | ----- | 14.18 | 2.102 | ----- | ----- | ----- | 19.89 |
| 12.33 | 24.80 | 84.78 | 14.60 | 3.708 | ----- | ----- | 14.57 | 5.902 | ----- | ----- | ----- | 24.18 |
| 12.42 | 20.95 | 84.75 | 14.50 | 3.684 | ----- | ----- | 14.48 | 4.862 | ----- | ----- | ----- | 23.02 |
| 12.50 | 16.91 | 84.64 | 14.21 | 3.616 | ----- | ----- | 14.21 | 2.309 | ----- | ----- | ----- | 20.13 |
| 12.58 | 12.90 | 84.48 | 13.80 | 3.517 | ----- | ----- | 13.79 | 0.139 | ----- | ----- | ----- | 17.45 |
| 12.67 | 9.197 | 84.24 | 13.12 | 3.357 | ----- | ----- | 13.11 | ----- | ----- | ----- | ----- | 16.47 |
| 12.75 | 6.306 | 83.87 | 11.97 | 3.103 | ----- | ----- | 11.97 | ----- | ----- | ----- | ----- | 15.07 |
| 12.83 | 4.892 | 83.43 | 9.974 | 2.761 | ----- | ----- | 9.972 | ----- | ----- | ----- | ----- | 12.73 |
| 12.92 | 4.347 | 83.13 | 5.123 | 2.507 | ----- | ----- | 5.092 | ----- | ----- | ----- | ----- | 7.599 |
| 13.00 | 3.931 | 83.03 | 2.878 | 2.407 | ----- | ----- | 2.841 | ----- | ----- | ----- | ----- | 5.248 |
| 13.08 | 3.596 | 82.97 | 1.947 | 2.356 | ----- | ----- | 1.919 | ----- | ----- | ----- | ----- | 4.275 |
| 13.17 | 3.330 | 82.94 | 1.445 | 2.324 | ----- | ----- | 1.424 | ----- | ----- | ----- | ----- | 3.748 |
| 13.25 | 3.117 | 82.92 | 1.119 | 2.303 | ----- | ----- | 1.102 | ----- | ----- | ----- | ----- | 3.405 |
| 13.33 | 2.945 | 82.90 | 0.886 | 2.289 | ----- | ----- | 0.871 | ----- | ----- | ----- | ----- | 3.160 |
| 13.42 | 2.798 | 82.89 | 0.756 | 2.276 | ----- | ----- | 0.743 | ----- | ----- | ----- | ----- | 3.018 |
| 13.50 | 2.664 | 82.88 | 0.640 | 2.262 | ----- | ----- | 0.629 | ----- | ----- | ----- | ----- | 2.890 |
| 13.58 | 2.541 | 82.86 | 0.524 | 2.248 | ----- | ----- | 0.515 | ----- | ----- | ----- | ----- | 2.762 |
| 13.67 | 2.429 | 82.85 | 0.412 | 2.234 | ----- | ----- | 0.405 | ----- | ----- | ----- | ----- | 2.639 |
| 13.75 | 2.326 | 82.84 | 0.307 | 2.222 | ----- | ----- | 0.301 | ----- | ----- | ----- | ----- | 2.523 |
| 13.83 | 2.230 | 82.82 | 0.208 | 2.210 | ----- | ----- | 0.205 | ----- | ----- | ----- | ----- | 2.414 |
| 13.92 | 2.141 | 82.81 | 0.116 | 2.199 | ----- | ----- | 0.114 | ----- | ----- | ----- | ----- | 2.313 |
| 14.00 | 2.057 | 82.80 | 0.030 | 2.188 | ----- | ----- | 0.030 | ----- | ----- | ----- | ----- | 2.218 |
| 14.08 | 1.977 | 82.79 | ----- | 2.177 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 2.177 |
| 14.17 | 1.902 | 82.78 | ----- | 2.162 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 2.162 |
| 14.25 | 1.833 | 82.76 | ----- | 2.143 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 2.143 |
| 14.33 | 1.774 | 82.74 | ----- | 2.122 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 2.122 |
| 14.42 | 1.723 | 82.72 | ----- | 2.098 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 2.098 |

*Continues on next page...*

Post-Development BMP

## Hydrograph Discharge Table

| Time (hrs) | Inflow cfs | Elevation ft | Clv A cfs | Clv B cfs | Clv C cfs | PfRsr cfs | Wr A cfs | Wr B cfs | Wr C cfs | Wr D cfs | Exfil cfs | Outflow cfs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 14.50 | 1.680 | 82.69 | ----- | 2.073 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 2.073 |
| 14.58 | 1.643 | 82.67 | ----- | 2.045 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 2.045 |
| 14.67 | 1.611 | 82.65 | ----- | 2.017 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 2.017 |
| 14.75 | 1.582 | 82.62 | ----- | 1.989 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.989 |
| 14.83 | 1.556 | 82.60 | ----- | 1.961 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.961 |
| 14.92 | 1.530 | 82.57 | ----- | 1.932 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.932 |
| 15.00 | 1.504 | 82.55 | ----- | 1.902 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.902 |
| 15.08 | 1.479 | 82.52 | ----- | 1.874 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.874 |
| 15.17 | 1.453 | 82.50 | ----- | 1.845 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.845 |
| 15.25 | 1.427 | 82.47 | ----- | 1.814 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.814 |
| 15.33 | 1.401 | 82.45 | ----- | 1.784 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.784 |
| 15.42 | 1.375 | 82.43 | ----- | 1.754 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.754 |
| 15.50 | 1.348 | 82.40 | ----- | 1.725 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.725 |
| 15.58 | 1.322 | 82.38 | ----- | 1.694 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.694 |
| 15.67 | 1.296 | 82.36 | ----- | 1.663 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.663 |
| 15.75 | 1.270 | 82.33 | ----- | 1.632 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.632 |
| 15.83 | 1.243 | 82.31 | ----- | 1.602 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.602 |
| 15.92 | 1.217 | 82.29 | ----- | 1.570 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.570 |
| 16.00 | 1.191 | 82.27 | ----- | 1.538 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.538 |
| 16.08 | 1.165 | 82.25 | ----- | 1.506 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.506 |
| 16.17 | 1.139 | 82.23 | ----- | 1.475 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.475 |
| 16.25 | 1.115 | 82.21 | ----- | 1.444 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.444 |
| 16.33 | 1.094 | 82.19 | ----- | 1.413 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.413 |
| 16.42 | 1.076 | 82.17 | ----- | 1.383 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.383 |
| 16.50 | 1.061 | 82.15 | ----- | 1.353 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.353 |
| 16.58 | 1.047 | 82.13 | ----- | 1.325 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.325 |
| 16.67 | 1.036 | 82.11 | ----- | 1.299 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.299 |
| 16.75 | 1.026 | 82.10 | ----- | 1.273 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.273 |
| 16.83 | 1.016 | 82.08 | ----- | 1.244 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.244 |
| 16.92 | 1.007 | 82.07 | ----- | 1.216 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.216 |
| 17.00 | 0.997 | 82.06 | ----- | 1.191 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.191 |
| 17.08 | 0.988 | 82.05 | ----- | 1.167 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.167 |
| 17.17 | 0.979 | 82.04 | ----- | 1.145 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.145 |
| 17.25 | 0.969 | 82.03 | ----- | 1.125 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.125 |
| 17.33 | 0.960 | 82.02 | ----- | 1.106 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.106 |
| 17.42 | 0.951 | 82.01 | ----- | 1.088 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.088 |
| 17.50 | 0.941 | 82.00 | ----- | 1.071 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.071 |
| 17.58 | 0.932 | 81.99 | ----- | 1.049 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.049 |
| 17.67 | 0.923 | 81.98 | ----- | 1.029 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.029 |
| 17.75 | 0.913 | 81.98 | ----- | 1.011 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.011 |
| 17.83 | 0.904 | 81.97 | ----- | 0.994 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.994 |
| 17.92 | 0.894 | 81.96 | ----- | 0.978 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.978 |
| 18.00 | 0.885 | 81.96 | ----- | 0.963 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.963 |
| 18.08 | 0.875 | 81.95 | ----- | 0.950 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.950 |
| 18.17 | 0.866 | 81.94 | ----- | 0.937 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.937 |
| 18.25 | 0.856 | 81.94 | ----- | 0.924 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.924 |
| 18.33 | 0.847 | 81.93 | ----- | 0.912 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.912 |
| 18.42 | 0.838 | 81.93 | ----- | 0.900 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.900 |
| 18.50 | 0.828 | 81.93 | ----- | 0.889 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.889 |
| 18.58 | 0.819 | 81.92 | ----- | 0.878 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.878 |
| 18.67 | 0.809 | 81.92 | ----- | 0.868 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.868 |
| 18.75 | 0.800 | 81.91 | ----- | 0.857 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.857 |
| 18.83 | 0.790 | 81.91 | ----- | 0.847 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.847 |
| 18.92 | 0.780 | 81.90 | ----- | 0.837 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.837 |

*Continues on next page...*

Post-Development BMP

## Hydrograph Discharge Table

| Time (hrs) | Inflow cfs | Elevation ft | Clv A cfs | Clv B cfs | Clv C cfs | PfRsr cfs | Wr A cfs | Wr B cfs | Wr C cfs | Wr D cfs | Exfil cfs | Outflow cfs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 19.00 | 0.771 | 81.90 | ----- | 0.826 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.826 |
| 19.08 | 0.761 | 81.90 | ----- | 0.816 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.816 |
| 19.17 | 0.752 | 81.89 | ----- | 0.807 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.807 |
| 19.25 | 0.742 | 81.89 | ----- | 0.797 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.797 |
| 19.33 | 0.733 | 81.88 | ----- | 0.787 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.787 |
| 19.42 | 0.723 | 81.88 | ----- | 0.777 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.777 |
| 19.50 | 0.713 | 81.88 | ----- | 0.767 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.767 |
| 19.58 | 0.704 | 81.87 | ----- | 0.758 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.758 |
| 19.67 | 0.694 | 81.87 | ----- | 0.748 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.748 |
| 19.75 | 0.685 | 81.86 | ----- | 0.738 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.738 |
| 19.83 | 0.675 | 81.86 | ----- | 0.729 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.729 |
| 19.92 | 0.665 | 81.86 | ----- | 0.719 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.719 |
| 20.00 | 0.656 | 81.85 | ----- | 0.709 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.709 |
| 20.08 | 0.646 | 81.85 | ----- | 0.700 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.700 |
| 20.17 | 0.637 | 81.84 | ----- | 0.690 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.690 |
| 20.25 | 0.629 | 81.84 | ----- | 0.681 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.681 |
| 20.33 | 0.621 | 81.84 | ----- | 0.671 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.671 |
| 20.42 | 0.616 | 81.83 | ----- | 0.663 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.663 |
| 20.50 | 0.611 | 81.83 | ----- | 0.654 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.654 |
| 20.58 | 0.607 | 81.83 | ----- | 0.647 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.647 |
| 20.67 | 0.604 | 81.82 | ----- | 0.640 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.640 |
| 20.75 | 0.602 | 81.82 | ----- | 0.634 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.634 |
| 20.83 | 0.600 | 81.82 | ----- | 0.629 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.629 |
| 20.92 | 0.598 | 81.82 | ----- | 0.624 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.624 |
| 21.00 | 0.596 | 81.81 | ----- | 0.619 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.619 |
| 21.08 | 0.595 | 81.81 | ----- | 0.615 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.615 |
| 21.17 | 0.593 | 81.81 | ----- | 0.612 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.612 |
| 21.25 | 0.591 | 81.81 | ----- | 0.609 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.609 |
| 21.33 | 0.589 | 81.81 | ----- | 0.605 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.605 |
| 21.42 | 0.587 | 81.81 | ----- | 0.603 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.603 |
| 21.50 | 0.585 | 81.81 | ----- | 0.600 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.600 |
| 21.58 | 0.583 | 81.80 | ----- | 0.597 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.597 |
| 21.67 | 0.582 | 81.80 | ----- | 0.595 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.595 |
| 21.75 | 0.580 | 81.80 | ----- | 0.593 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.593 |
| 21.83 | 0.578 | 81.80 | ----- | 0.590 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.590 |
| 21.92 | 0.576 | 81.80 | ----- | 0.588 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.588 |
| 22.00 | 0.574 | 81.80 | ----- | 0.586 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.586 |
| 22.08 | 0.572 | 81.80 | ----- | 0.584 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.584 |
| 22.17 | 0.570 | 81.80 | ----- | 0.582 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.582 |
| 22.25 | 0.569 | 81.80 | ----- | 0.580 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.580 |
| 22.33 | 0.567 | 81.80 | ----- | 0.578 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.578 |
| 22.42 | 0.565 | 81.80 | ----- | 0.576 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.576 |
| 22.50 | 0.563 | 81.80 | ----- | 0.574 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.575 |
| 22.58 | 0.561 | 81.79 | ----- | 0.573 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.573 |
| 22.67 | 0.559 | 81.79 | ----- | 0.571 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.571 |
| 22.75 | 0.557 | 81.79 | ----- | 0.569 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.569 |
| 22.83 | 0.555 | 81.79 | ----- | 0.567 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.567 |
| 22.92 | 0.554 | 81.79 | ----- | 0.565 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.565 |
| 23.00 | 0.552 | 81.79 | ----- | 0.563 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.563 |
| 23.08 | 0.550 | 81.79 | ----- | 0.561 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.561 |
| 23.17 | 0.548 | 81.79 | ----- | 0.559 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.559 |
| 23.25 | 0.546 | 81.79 | ----- | 0.558 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.558 |
| 23.33 | 0.544 | 81.79 | ----- | 0.556 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.556 |
| 23.42 | 0.542 | 81.79 | ----- | 0.554 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.554 |

*Continues on next page...*

Post-Development BMP

## Hydrograph Discharge Table

| Time (hrs) | Inflow cfs | Elevation ft | Clv A cfs | Clv B cfs | Clv C cfs | PfRsr cfs | Wr A cfs | Wr B cfs | Wr C cfs | Wr D cfs | Exfil cfs | Outflow cfs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 23.50 | 0.540 | 81.78 | ----- | 0.552 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.552 |
| 23.58 | 0.538 | 81.78 | ----- | 0.550 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.550 |
| 23.67 | 0.537 | 81.78 | ----- | 0.548 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.548 |
| 23.75 | 0.535 | 81.78 | ----- | 0.546 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.546 |
| 23.83 | 0.533 | 81.78 | ----- | 0.544 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.544 |
| 23.92 | 0.531 | 81.78 | ----- | 0.543 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.543 |
| 24.00 | 0.529 | 81.78 | ----- | 0.541 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.541 |
| 24.08 | 0.512 | 81.78 | ----- | 0.538 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.538 |
| 24.17 | 0.471 | 81.78 | ----- | 0.531 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.531 |
| 24.25 | 0.406 | 81.77 | ----- | 0.518 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.518 |
| 24.33 | 0.316 | 81.76 | ----- | 0.494 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.494 |
| 24.42 | 0.226 | 81.74 | ----- | 0.460 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.460 |
| 24.50 | 0.151 | 81.72 | ----- | 0.419 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.419 |
| 24.58 | 0.091 | 81.70 | ----- | 0.374 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.374 |
| 24.67 | 0.047 | 81.68 | ----- | 0.335 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.335 |
| 24.75 | 0.017 | 81.66 | ----- | 0.297 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.297 |
| 24.83 | 0.002 | 81.64 | ----- | 0.261 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.261 |

*...End*

# Pond Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Tuesday, Oct 25, 2011

## Pond No. 1 - Existing BMP

### Pond Data

**Contours** - User-defined contour areas. Average end area method used for volume calculation. Begining Elevation = 79.50 ft

### Stage / Storage Table

| Stage (ft) | Elevation (ft) | Contour area (sqft) | Incr. Storage (cuft) | Total storage (cuft) |
|---|---|---|---|---|
| 0.00 | 79.50 | 1,684 | 0 | 0 |
| 0.50 | 80.00 | 2,618 | 1,076 | 1,076 |
| 1.50 | 81.00 | 3,631 | 3,125 | 4,200 |
| 2.50 | 82.00 | 4,442 | 4,037 | 8,237 |
| 3.50 | 83.00 | 5,305 | 4,874 | 13,110 |
| 4.50 | 84.00 | 6,219 | 5,762 | 18,872 |
| 5.50 | 85.00 | 8,403 | 7,311 | 26,183 |

### Culvert / Orifice Structures

| | [A] | [B] | [C] | [PrfRsr] |
|---|---|---|---|---|
| **Rise (in)** | = 18.00 | 9.00 | 0.00 | 0.00 |
| **Span (in)** | = 18.00 | 9.00 | 0.00 | 0.00 |
| **No. Barrels** | = 1 | 1 | 0 | 0 |
| **Invert El. (ft)** | = 81.07 | 81.37 | 0.00 | 0.00 |
| **Length (ft)** | = 40.00 | 0.00 | 0.00 | 0.00 |
| **Slope (%)** | = 2.20 | 0.00 | 0.00 | n/a |
| **N-Value** | = .013 | .013 | .013 | n/a |
| **Orifice Coeff.** | = 0.60 | 0.60 | 0.60 | 0.60 |
| **Multi-Stage** | = n/a | No | No | No |

### Weir Structures

| | [A] | [B] | [C] | [D] |
|---|---|---|---|---|
| **Crest Len (ft)** | = 7.85 | 10.00 | 0.00 | 0.00 |
| **Crest El. (ft)** | = 82.80 | 84.47 | 0.00 | 0.00 |
| **Weir Coeff.** | = 3.33 | 3.33 | 3.33 | 3.33 |
| **Weir Type** | = Riser | Rect | --- | --- |
| **Multi-Stage** | = Yes | No | No | No |

**Exfil.(in/hr)** = 0.000 (by Contour)
**TW Elev. (ft)** = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

### Stage / Storage / Discharge Table

| Stage ft | Storage cuft | Elevation ft | Clv A cfs | Clv B cfs | Clv C cfs | PrfRsr cfs | Wr A cfs | Wr B cfs | Wr C cfs | Wr D cfs | Exfil cfs | User cfs | Total cfs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.00 | 0 | 79.50 | 0.00 | 0.00 | --- | --- | 0.00 | 0.00 | --- | --- | --- | --- | 0.000 |
| 0.50 | 1,076 | 80.00 | 0.00 | 0.00 | --- | --- | 0.00 | 0.00 | --- | --- | --- | --- | 0.000 |
| 1.50 | 4,200 | 81.00 | 0.00 | 0.00 | --- | --- | 0.00 | 0.00 | --- | --- | --- | --- | 0.000 |
| 2.50 | 8,237 | 82.00 | 0.00 | 1.07 ic | --- | --- | 0.00 | 0.00 | --- | --- | --- | --- | 1.071 |
| 3.50 | 13,110 | 83.00 | 2.37 ic | 2.38 ic | --- | --- | 2.34 | 0.00 | --- | --- | --- | --- | 4.721 |
| 4.50 | 18,872 | 84.00 | 12.40 ic | 3.19 ic | --- | --- | 12.39 s | 0.00 | --- | --- | --- | --- | 15.58 |
| 5.50 | 26,183 | 85.00 | 15.13 ic | 3.84 ic | --- | --- | 15.12 s | 12.85 | --- | --- | --- | --- | 31.81 |

NOV 2002
RECEIVED
ENVIRONMENTAL DIVISION

**James City County, Virginia**
**Environmental Division**

# Stormwater Management / BMP Facilities Record Drawing and Construction Certification

*Standard Forms & Instructions*

---

Contents — Page

**Record Drawing and Construction Certification Forms**

| | | |
|---|---|---|
| Section 1 - Site Information | | 1 |
| Section 2 - Construction Information | | 2 |
| Section 3 - Owner / Designer / Contractor Information | | 2 |
| Section 4 - Professional Certifications | | 3 |
| Section 5 - Certification Requirements and Instructions | | 4 |

**Record Drawing Checklist**

| | | | |
|---|---|---|---|
| I. | Methods and Presentation | (Required for All Facilities) | 6 |
| II. | Minimum Standards | (Required for All Facilities) | 6 |
| III. | Group A - Wet Ponds | | 8 |
| IV. | Group B - Wetlands | | 9 |
| V. | Group C - Infiltration Practices | | 10 |
| VI. | Group D - Filtering Systems | | 11 |
| VII. | Group E - Open Channel Systems | | 12 |
| VIII. | Group F - Extended Dry Detention | | 13 |
| IX. | Group G - Open Spaces | | 14 |
| X. | Storm Drainage Systems | (Associated with BMP's Only) | 15 |
| XII. | Other Systems | | 15 |
| XIII. | References | | 16 |


KING OF GLORY LUTHERAN CHURCH
COMMUNITY + EDUCATION CENTER EXPANSION
SP-118-00; AMENDS SP-7-95
PC 072
3240100033
4897 LONGHILL ROAD
5.96 AC; R2 (6.04 AC)

***Issue Date***
***February 1, 2001***

# James City County Environmental Division
# Stormwater Management / BMP Inspection Report
# Detention and Retention Pond Facilities

SP-7-95
AMEND SP-118-00

County BMP ID Code (if known): PC072

Name of Facility: King of Glory Lutheran Church BMP No.: 1 of 1 Date: 12/6/02

Location: 4897 Longhill Road

Name of Owner: King of Glory

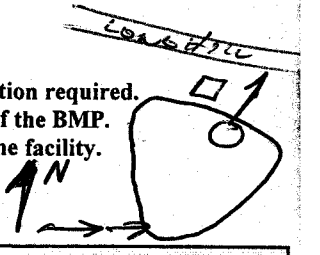
Name of Inspector: Wet Pond + Infil Facility (More wet Pond than INFIL)

Type of Facility: St Thomas

Weather Conditions: Cloudy, Cold 30's Type: ☒ Final Inspection ☐ County BMP Inspection Program ☐ Owner Inspection

**If an inspection item is not applicable, mark NA, otherwise mark the appropriate column.**

**O.K. - The item checked is in adequate condition and the maintenance program is currently satisfactory. No action required.**
**Routine - The item checked requires attention, but does not present an immediate threat to the function/integrity of the BMP.**
**Urgent - The item checked requires immediate attention to keep the BMP operational and to prevent damage to the facility.**




**Provide an explanation and details in the comment column, if routine or urgent are marked.**

| Facility Item | O.K. | Routine | Urgent | Comments |
|---|---|---|---|---|
| **Embankments and Side Slopes:** | 2H:1V DS / 3H:1V US; Mostly Excavated | | | |
| Grass Height | ✓ | | | 2-4" Height |
| Vegetation Condition | ✓ | | | Some Landscaping |
| Tree Growth | ✓ | | | Trees + Shrubs OK |
| Erosion | ✓ | | | |
| Trash & Debris | ✓ | | | |
| Seepage | ✓ | | | None Observed |
| Fencing or Benches | ✓ | | | |
| **Interior Landscaping/Planted Areas:** | ☒ None ☐ Constructed Wetland/Shallow Marsh ☐ Naturally Established Vegetation | | | |
| Vegetated Conditions | ✓ | | | Wet Pond |
| Trash & Debris | ✓ | | | Interior SS Well Veg + |
| Floating Material | ✓ | | | Matted EC-2 except for |
| Erosion | ✓ | | | one area at parking lot. |
| Sediment | ✓ | | | |
| Dead Plant | ✓ | | | |
| Aesthetics | ✓ | | | |
| Other | | | | |
| Notes: Serves Exist Bldg + Parking / Expansion Bldg + Park | | | | |

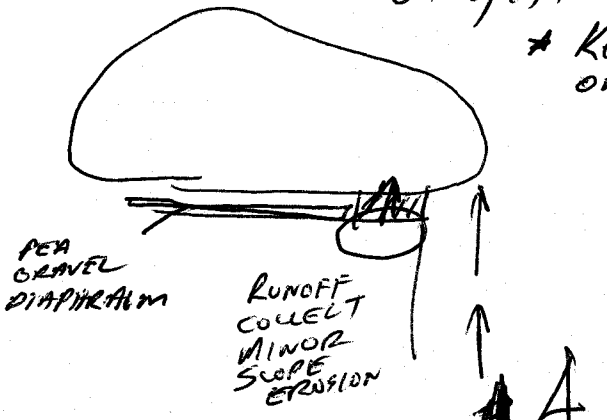
| Facility Item | O.K. | Routine | Urgent | Comments |
|---|---|---|---|---|
| **Water Pools:** ☒ Permanent Pool (Retention Basin) ☐ Shallow Marsh (Detention Basin) ☐ None, Dry (Detention Basin) | | | | |
| Shoreline Erosion | ✓ | | | None Good Stand |
| Algae | ✓ | | | None, Ice 1" |
| Trash & Debris | ✓ | | | |
| Sediment | ✓ | | | |
| Aesthetics | | | | |
| Other | | | | N.P. 1.5' Below LFORIF |
| **Inflows (Describe Types/Locations):** 5' Deep V Channel. | | | | |
| Condition of Structure | ✓ | | | |
| Erosion | ✓ | | | |
| Trash and Debris | ✓ | | | |
| Sediment | ✓ | | | Minor 2" |
| Outlet Protection | | | | |
| Other | | | | Class I Riprap @ pond |
| **Principal Flow Control Structure - Riser, Intake, etc. (Describe Type):** 30" RCP Riser w/ RCP CAP | | | | |
| Condition of Structure | ✓ | | | DI-1 Top Grate on CAP |
| Corrosion | ✓ | | | |
| Trash and Debris | ✓ | | | |
| Sediment | ✓ | | | |
| Vegetation | ✓ | | | |
| Other | ✓ | | | 6" PVC turndown LF Orif. |
| **Principal Outlet Structure - Barrel, Conduit, etc. :** ~~18"~~ 18" HDPE (next to 18" RCP outfall) | | | | |
| Condition of Structure | ✓ | | | w/ CPP end sect |
| Settlement | ✓ | | | |
| Trash & Debris | ✓ | | | |
| Erosion/Sediment | ✓ | | | |
| Outlet Protection | ✓ | | | Class I riprap in outfall/road |
| Other | | | | channel. V channel |
| **Emergency Spillway (Overflow):** DI-Grate 10' from New RCP Riser, in embankment | | | | |
| Vegetation | ✓ | | | |
| Lining | ✓ | | | |
| Erosion | ✓ | | | |
| Trash & Debris | ✓ | | | |
| Other | ✓ | | | |
| Notes: | | | | |

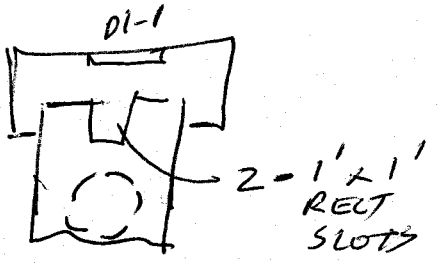
| Facility Item | O.K. | Routine | Urgent | Comments |
|---|---|---|---|---|
| **Nuisance Type Conditions:** | | | | |
| Mosquito Breeding | ✓ | | | |
| Animal Burrows | ✓ | | | |
| Graffiti | ✓ | | | |
| Other | ✓ | | | |
| **Surrounding Perimeter Conditions:** South + West Woods, East Longhill RD, North Parking | | | | |
| Land Uses | ✓ | | | |
| Vegetation | ✓ | | | |
| Trash & Debris | ✓ | | | |
| Aesthetics | ✓ | | | Looks good, well vegetated |
| Access /Maintenance Roads or Paths | ✓ | | | Longhill Rd to Parking Area South |
| Other | ✓ | | | More Wet Pond than INFIL Basin. |

**Remarks:**

* Monitor pond interior side slope at corner of South parking lot area. Runoff collects to low point + traverses over slope. EC-2 + mulch. May be problem in future. Stable now, but unveget.

* Keep trees and shrubs maintained on pond embankment.




**Overall Environmental Division Internal Rating:** A

**Signature:** Scott Thomas P.E.

**Date:** 12/6/02 2:30pm

**Title:** Civil Engineer Env Div

SWMProg\BMP\CoInspProg\DetRet.wpd

# James City County Environmental Division
# Stormwater Management / BMP Inspection Report
# Detention and Retention Pond Facilities

County BMP ID Code (if known): Drains to PC-072

Name of Facility: King of Glory Lutheran Church - Gravel Parking Lot BMP No.: ____ of ____ Date: 3/1/12

Location: 4897 Longhill Road

Name of Owner: Jim Baldridge - Building Comm. Chair

Name of Inspector: Amy Parker

Type of Facility: Grass lined swale with permanent CDS (drains to PC-072)

Weather Conditions: Sunny Type: ☒ Final Inspection ☐ County BMP Inspection Program ☐ Owner Inspection

**If an inspection item is not applicable, mark NA, otherwise mark the appropriate column.**

**O.K. - The item checked is in adequate condition and the maintenance program is currently satisfactory. No action required.**
**Routine - The item checked requires attention, but does not present an immediate threat to the function/integrity of the BMP.**
**Urgent - The item checked requires immediate attention to keep the BMP operational and to prevent damage to the facility.**

**Provide an explanation and details in the comment column, if routine or urgent are marked.**

| Facility Item | O.K. | Routine | Urgent | Comments |
|---|---|---|---|---|
| **Embankments and Side Slopes:** Swale | | | | |
| Grass Height | ✓ | | | |
| Vegetation Condition | ✓ | | | |
| Tree Growth | ✓ | | | |
| Erosion | ✓ | | | |
| Trash & Debris | ✓ | | | |
| Seepage | N/A | | | |
| Fencing or Benches | N/A | | | |
| **Interior Landscaping/Planted Areas:** ☒ None ☐ Constructed Wetland/Shallow Marsh ☐ Naturally Established Vegetation | | | | |
| Vegetated Conditions | | | | |
| Trash & Debris | | | | |
| Floating Material | | | | |
| Erosion | | | | |
| Sediment | | | | |
| Dead Plant | | | | |
| Aesthetics | | | | |
| Other | | | | |
| Notes: | | | | |

| Facility Item | O.K. | Routine | Urgent | Comments |
|---|---|---|---|---|
| **Water Pools:** ❒ Permanent Pool (Retention Basin) ❒ Shallow Marsh (Detention Basin) ☒ None, Dry (Detention Basin) | | | | |
| Shoreline Erosion | | | | |
| Algae | | | | |
| Trash & Debris | | | | |
| Sediment | | | | |
| Aesthetics | | | | |
| Other | | | | |
| **Inflows (Describe Types/Locations):** Swale from new parking lot to existing BMP | | | | |
| Condition of Structure | ✓ | | | |
| Erosion | ✓ | | | |
| Trash and Debris | ✓ | | | |
| Sediment | ✓ | | | |
| Outlet Protection | | | | |
| Other | ✓ | | | Permanent CDs in place, clean |
| **Principal Flow Control Structure - Riser, Intake, etc. (Describe Type):** N/A | | | | |
| Condition of Structure | | | | |
| Corrosion | | | | |
| Trash and Debris | | | | |
| Sediment | | | | |
| Vegetation | | | | |
| Other | | | | |
| **Principal Outlet Structure - Barrel, Conduit, etc. :** N/A | | | | |
| Condition of Structure | | | | |
| Settlement | | | | |
| Trash & Debris | | | | |
| Erosion/Sediment | | | | |
| Outlet Protection | | | | |
| Other | | | | |
| **Emergency Spillway (Overflow):** N/A | | | | |
| Vegetation | | | | |
| Lining | | | | |
| Erosion | | | | |
| Trash & Debris | | | | |
| Other | | | | |
| Notes: | | | | |
| | | | | |

| Facility Item | O.K. | Routine | Urgent | Comments |
|---|---|---|---|---|
| **Nuisance Type Conditions:** N/A | | | | |
| Mosquito Breeding | | | | |
| Animal Burrows | | | | |
| Graffiti | | | | |
| Other | | | | |
| **Surrounding Perimeter Conditions**: | | | | |
| Land Uses | ✓ | | | |
| Vegetation | ✓ | | | |
| Trash & Debris | ✓ | | | |
| Aesthetics | ✓ | | | |
| Access /Maintenance Roads or Paths | ✓ | | | |
| Other | | | | |

**Remarks:**

**Overall Environmental Division Internal Rating:** 4

**Signature:** Amy Parke **Date:** 3/1/12

**Title:** Environmental Inspector

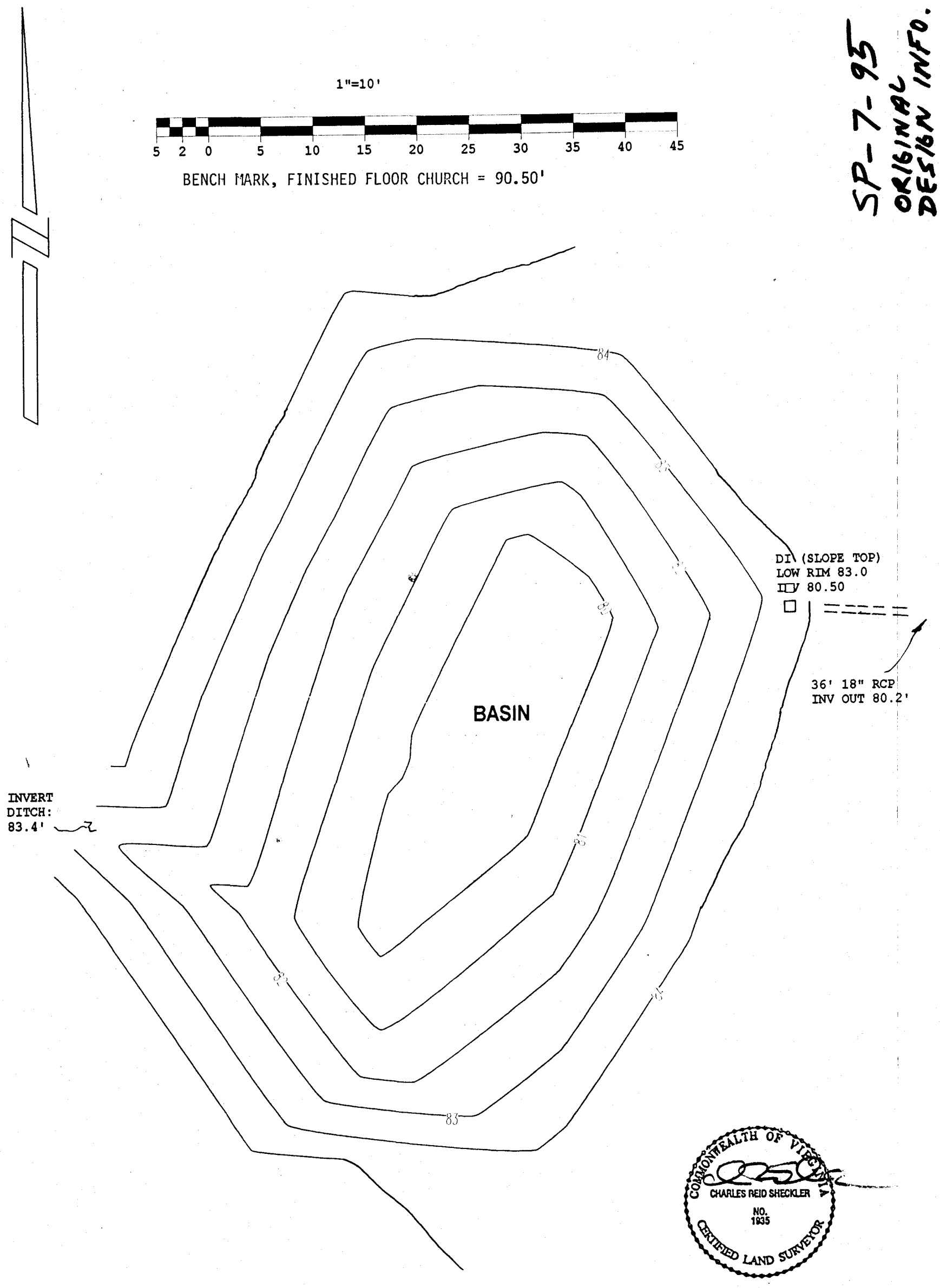
SWMProg\BMP\CoInspProg\InspForms\DetRet.wpd

SP-7-95
ORIGINAL
DESIGN INFO.

1"=10'

5 2 0 5 10 15 20 25 30 35 40 45

BENCH MARK, FINISHED FLOOR CHURCH = 90.50'

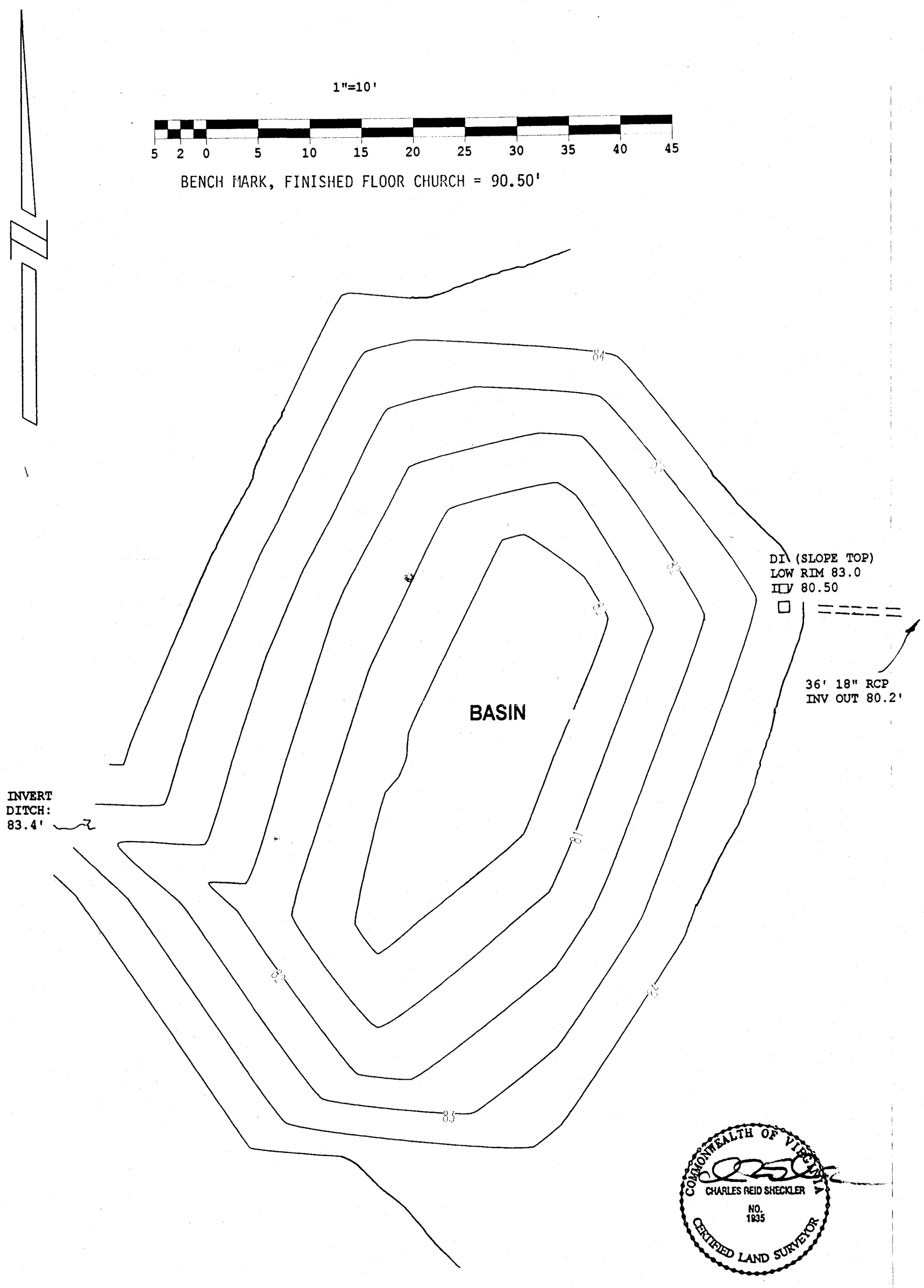



COMMONWEALTH OF VIRGINIA
CHARLES REID SHECKLER
NO. 1935
CERTIFIED LAND SURVEYOR

THE WOODSON COMPANY 184 SHADOW LANE SURRY VIRGINIA 23883 800-308-6443

AS-BUILTSURVEY, DETENTION BASIN, LUTHERN CHURCH-MISSOURI SYNOD, @ 4897 LONGHILL ROAD
STANDING IN THE NAME OF: THE SOUTHEASTERN DISTRICT OF TH LUTHER CHURCH-MISSOURI SYNOD
JAMES CITY COUNTY, VIRGINIA

SCALE 1" = 10' DATE: 3/23/1999 JO: A5778-D REFERENCE: DB 116/140




*THE WOODSON COMPANY 184 SHADOW LANE SURRY VIRGINIA 23883 800-308-6443*

**AS-BUILTSURVEY, DETENTION BASIN, LUTHERN CHURCH-MISSOURI SYNOD, @ 4897 LONGHILL ROAD**
**STANDING IN THE NAME OF: THE SOUTHEASTERN DISTRICT OF TH LUTHER CHURCH-MISSOURI SYNOD**
**JAMES CITY COUNTY, VIRGINIA**

**SCALE 1" = 10' DATE: 3/23/1999 JO: A5778-D REFERENCE: DB 116/140**

***Record Drawing/Construction Certification Submittal for a BMP Facility***

Date: 11/27/02

Inspector:
- ☒ Pat Menichino
- ☐ Gerry Lewis
- ☒ Beth Davis
- ☐ Mike Woolson
- ☐ Joe Buchite
- ☐ Other: _____

Project: KING OF GLORY LUTHERAN CHURCH EXPANSION
BMP Facility: INFILTRATION BASIN
Plan No. SP-118-00
BMP ID Code: PC 072

I have received a transmittal for a ☒ Record Drawing and ☒ Construction Certification for the above referenced facility on NOV 18 2002. Prior to full engineering review of these items and a field inspection, I am first forwarding the items to you to cursory review in case any major field changes were performed that I should be aware of and/or to ensure the record drawing accurately portrays what you saw in the field. Please review the drawing and return to me promptly so I can proceed with the review for certification purposes.

During my review, I will look at issues related to the BMP and its primary inflow and outflow conveyance systems, and will make comment in the following areas: Record Drawing (RD), Construction Certification (CC) and Construction-Related (CR) punch list items. If you have any other related non-BMP site issues such as erosion, stabilization, removal of erosion & sediment controls, etc. that are not related to the BMP, I can easily add these items to any comment letter that I may forward to the Owner/Engineer. Let me know if any outstanding site issues remain.

If I don't hear from you I will ask you if any other outstanding issues remain before I forward any letters to the Owner/Engineer.

Scott

SWMProg\BMP\ConInsp\Insp.trans

Comments on back →

SP-118-00

Sheet Number C2: CED 10-22-02
The ditch draining to BMP, which served as a temporary sediment trap, does not have to be restored back to original grade. Despite plan elevations, runoff has positive drainage in field. OK per PTM on 10-22-02.

Sheet Number C4: Maintenance Drain deleted per DEC on 8/28/02.

No outstanding site issues. All temporary E&S measures have been removed and stabilization complete. CED 12-2-02.