# Clarksburg Town Center
# Water Quality for Phase 2C/2D

Sand Filter Basin No. 11
Bio-Retention/Recharge Facilities
15, 17, 18 & 19
Recharge Area No. 21
Water Quality Manhole 3 & 4

Prepared by: J. Strulic
August, 2003

CPJ Associates
Charles P. Johnson & Associates, Inc.
Planners • Engineers • Landscape Architects • Surveyors
1751 Elton Road 3rd Floor Silver Spring, Maryland 20903
301.434.7000 Fx. 301.434.9394 Frederick, MD – Fairfax, VA

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## Clarksburg Town Center – Phase 2C/2D Stormwater Narrative

The area known as phase 2 of Clarksburg Town Center is divided into four sections designated as 2A, 2B, 2C and 2D. Previously approved SCP # 205466 provided for rough graded sediment control for phase 2, along with finished grading and building construction for phase 2A & 2B. Also approved under that permit was SWM Pond # 3 which provides quantity control for all of phase 2B, 2C, and 2D along with Water Quality Sand Filter # 11.

This submission will revise the above plan to include water quality control for phase 2C & 2D. The primary quality control for phase 2C and 2D will be a surface sand filter basin located adjacent to Burdette Forest Rd. The sand filter is sized for 1" over the impervious area draining to it minus any area draining to any redundant facilities recharge facilities. This facility will also provide quality control for 1.25 Ac of parking lot for the proposed public school site.

Because Clarksburg T.C. is located in a special protection area all quality control must be in the form of a redundant treatment train with sand filter No. 11 providing final control. Redundant controls located within the drainage area of sand filter 11 and also designed under this plan are SWM facilities, 15,17,18,19 & 20 along with two Stormceptor water quality manholes. The first Stormceptor is located along the diversion pipe leading into sand filter no. 10. It provides water quality pre-treatment for the 3.20 ac. of road/driveway impervious area draining to sand filter no. 11. The second stormceptor (WQ4) provides pretreatment for 1.10 Ac of private road way impervious area.

Facility No. 15, 17, 18, 19 & 20 are bio-retention areas with a ground water recharge trench located underneath. It receives drainage via overland flow and is pre-treated by the bio-retention area prior to getting into the recharge trench.

Facility No. 21 is a recharge basin that provides groundwater recharge for the outfall of sand filter No. 11.

A maximum 12" ponding depth is provided above all bio-retention facilities. Should any of these quality facilities fail, emergency bypasses are provided in the form of HDPE overflow and overflow pipes weirs in facility No. 15, 17, 18, 19 where there would ultimately be conveyed to sand filter No. 11 via the storm drain system.

## Summary of Required Recharge Volume in Phase 2

- Total Drainage Area = 44.50 Ac
  Avg. 67% Impervious Coverage = 29.80 Ac (Impervious Area)

- Total Recharge Volume ($Re_v$) required for phase 2:
  $Re_v = (S\ R_v A) / 12$ S=0.26 (B soil)
  $R_v = 0.05 + 0.009\ I$ I= total imp. area
  $= 0.05 + 0.009\ (67)$
  $R_v = 0.653$

$Re_v = (0.26)(0.653)(44.50\ Ac) / 12 = 0.630$ Ac-ft = 27,443 CF
Total In Stone Storage Required = 27,443 CF X 0.4 (Void Ratio) = 68,608 CF

## Summary Table of Recharge Provided in SWM Facilities

| SWM Facility # | Imp. D.A. (Ac) | In-Stone Storage Volume Provided for recharge (CF) |
|---|---|---|
| Ex.9 | 0.30 | 3,375 |
| Ex.10 | 0.15 | 1,400 |
| Ex.SF10 | 12.50 | 2,570 |
| Ex.12 | 0.20 | 2,050 |
| Ex.13 | 1.20 | 11,250 |
| Prop. SF 11 | 14.15 | 4,725 |
| Prop.15 | 0.82 | 7,500 |
| Prop.17 | 0.55 | 5,184 |
| Prop.18 | 0.54 | 4,950 |
| Prop.19 | 0.34 | 3,096 |
| Prop 21 | 2.5 | 23,850 |
| | Total $Re_v$ Provided = | 69,950 CF |

69,950 CF > 68,608 CF

SHA - RANI MALVIYA
BIO-HABITATS - MIKE CUNNINGHAM
JJS
JES - ORIGINAL

3

DEPARTMENT OF PERMITTING SERVICES

Douglas M. Duncan
*County Executive*

May 9, 2002

Robert C. Hubbard
*Director*

Mr. Jeffery Strulic
Charles P. Johnson & Associates
1751 Elton Road
Silver Spring, MD 20903

Re: Stormwater Management ***CONCEPT*** Request
for Clarksburg Town Center Phase 2
Preliminary Plan #: 1-95042
SM File #: 204464
Tract Size/Zone: 70.3 acres/RMX-2
Total Concept Area: 70.3 acres
Tax Plate: EW
Lots/Block: G, I, J, K, L, M, N, P, R, S & T
Parcel: A
Liber/Folio: 6776/876, 8825/755
Montg. Co. Grid: 09D03
Watershed: Little Seneca Creek

**SPECIAL PROTECTION AREA**

Dear Mr. Seidleck:

Based on a review by the Department of Permitting Services, the Final Water Quality Plan (FWQP) for the above mentioned site is conditionally approved.

**Site Description:** The site is the remaining portion of the Clarksburg Town Center and consists of 70.3 acres located between Clarksburg Road, Peidmont Road, and Stringtown Road. The proposed zoning of the site is RMX-2 and will consist of mixed residential (single-family detached, townhouses, apartments and condominiums) along with a school, park and associated infrastructure. This site is located in the Clarksburg Special Protection Area (SPA) of the Little Seneca Creek Watershed.

**Stormwater Management:** Water quantity control for this phase will be provided via an extended detention dry pond and the existing wet pond #1. Pond #1 provides infiltration for the one-year storm and pond #3 will provide control of the one-year storm, with an adjustable release rate for a maximum of 24 hours detention time in accordance with the new state standards. Quality control will be provided via a treatment train that consists of vegetated conveyance swales, bio-retention structures (for small drainage areas), surface sand filters, infiltration structures (where feasible) and ground water recharge areas for the rooftops. In areas where open section roads are not feasible, additional water quality structures are required to offset the lost benefits that open section roadways provide. These offsetting structures may include additional infiltration structures, bio-retention structures or surface sand filters. Areas that are intended for vehicular use are to be pretreated prior to entering any water quality structures. The water quality structures must be sized to treat a minimum of one-inch over the proposed impervious area.

The locations of open section and closed section roads along with the locations and nature of all of the proposed water quality control structures (including the offsetting water quality structures for the loss of open section roads) must be clearly identified on the initial sediment control/stormwater management/water quality plan. Additional monitoring may be required depending on the final location and configuration of the water quality structures.

AN ALL-AMERICA COMMUNITY

**Sediment Control:** Redundant sediment control structures are to be used throughout the site. These are to include upland sediment traps, which drain to secondary traps down grade, or when this is not feasible, sediment traps with forebays will be acceptable. All sediment-trapping structures are to be equipped with dewatering devices. The following features are to be incorporated into the detailed stormwater manage/sediment control plan:

1. All pertinent stormwater management structures must be designed, approved, permitted, and bonded with the initial sediment control plan. Phasing or otherwise delaying permitting of stormwater structures will be unacceptable.

2. The earth dikes that feed the sediment traps are to be constructed as a type B dike utilizing trapezoidal channels to reduce flow rates.

3. The site grading shall be phased, whenever possible, to limit disturbance and immediate stabilization is to be emphasized.

4. Silt fence alone will not be allowed as a perimeter control. The use of multiple rows of super silt fence will be acceptable for small areas of disturbance.

**Performance Goals and BMP Monitoring:** See the attached addendum dated May 8, 2002, and for further information contact Keith Van Ness at MCDEP.

NOTE: The addendum to the Final Water Quality Plan for Clarksburg Phase II detailing the Performance Goals, how the goals will be met, and a detailed BMP Monitoring Plan must be received and approved by DPS prior to submission of detailed sediment control and stormwater management plans.

**Conditions of Approval:** The following conditions must be addressed in the initial submission of the sediment control plan: This list may not be all-inclusive and may change based on available information at the time of the review:

1. Due to the relatively low use of open section roads, every opportunity to provide additional groundwater recharge throughout the site must be taken. This is to include areas along the backs of lots and any other open area (e.g., parking islands, under play fields, tot lots, open space around buildings, etc.). If sufficient recharge can not be provided in these areas, lots may have to be deleted.

2. Should MNCPPC/EPD determine that all pond embankments must be moved back from the environmental buffers 15 feet, MCDPS may require a realignment of lot lines to assure adequate space for all structures.

3. Under no circumstances will any slope into, on, or around any stormwater structure be allowed to be steeper than three feet horizontal to one-foot vertical ratio. Any location where this occurs may be required to either, realign lot lines or constructed re-enforced concrete retaining walls. Note: Wood retaining walls will be unacceptable on the stormwater manage parcels.

4. All stormwater management structures, along with a 12-foot wide driveway for access, will be required to be located on stormwater parcels. This is not applicable where the structures are constructed under parking lots or in islands.

5. Provide safe conveyance of all runoff to one of the stormwater management structures as shown by the drainage divides on the plan.

6. All recharge structures will be excavated to existing ground; none are to be constructed in fill.

7. Sand filter #10 and the infiltration structure above it will need to be reversed or combined to provide a series treatment system.

8. Sand filter #10's underdrain will discharge to the stream valley, not back to the storm drain system.

9. It appears that sand filter #10 will be designed as a NRCS-MD 378 pond. As one, it will be required to meet most criteria. Further discussion should take place prior to beginning its design.

10. A further review of the roof top areas to the recharge structures may need to be adjusted due to architecture designs.

11. It appears that a few lots near proposed quantity control structure drain directly into the structure without being treated for quality control. Quality control is required for all impervious areas.

12. Provide clear access to all stormwater management structures from a public right-of-way.

13. The proposed water quality inlets must be approved by DPS (a drop manhole will not be acceptable).

14. Water quality structures used for sediment control must have a minimum undisturbed buffer of two feet from the bottom of the sediment trap to the bottom of the stormwater structure.

15. At a minimum, one foot of stone (dead storage) is to be provided below the outlet pipe of all of the proposed surface sand filters to provide additional groundwater recharge.

16. All of the proposed stream crossings are to use environmentally sensitive design criteria.

17. Percolation tests must be performed to determine the feasibility of providing infiltration structures for water quality and ground water recharge.

18. Provide a tree-planting plan to allow for shading of the dry pond outfalls (into the low flow channels and out of the ponds).

19. MCDPS reserves the right to require the developer to provide full-time, third-party, on-site, sediment control inspection if the department decides the goals of the Water Quality Plan are not being met.

Any divergence from the information provided to this office; or additional information received during the development process; or a change in an applicable Executive Regulation may constitute grounds to rescind or amend any approval actions taken, and to reevaluate the site for additional or amended Water Quality Plan requirements.

If you have any questions regarding these actions, please feel free to contact Richard Gee at (240) 777-6333 or Leo Galanko at (240) 777-6242.

Sincerely,

Leo M. Galanko/for

Richard B. Brush, Manager
Water Resources Plan Review Section
Division of Land Development Services

RRB: enm: CN204464

cc: M. Shaneman
M. Pfefferle
L. Galanko
SM File # 204464

Qn: on-site 70.3 ac
Ql: on-site 70.03 ac.

DEPARTMENT OF ENVIRONMENTAL PROTECTION

Douglas M. Duncan
*County Executive*

James A. Caldwell
*Director*

**Attachment to the Final Water Quality Plan for Clarksburg Town Center Phase II**
**Description of Monitoring Requirements**

Date: May 8, 2002
Preliminary Plan #: 1-95042
SM File #: 204464

The purpose of this attachment is to add specificity to the county BMP monitoring protocols and to the BMP monitoring plan described in the addendum to the FWQP for Clarksburg Town Center Phase II. Some supplemental monitoring, QA/QC, data analysis, reporting and record keeping tasks will be explained in this attachment.

This BMP monitoring is being done to address whether the site performance goals outlined in the addendum to the FWQP for Clarksburg Town Center Phase II were met or not. The purpose of the data analysis and reporting is to describe quantitatively how the performance goals were met. Monitoring efforts and reports must employ scientific methods in an attempt to determine effectiveness of BMPs. Monitoring is to be done according to DEP BMP Monitoring Protocols. However, these monitoring protocols are intended to provide a framework only. Some supplemental requirements are provided in this attachment. Thorough and careful analysis of data is required. Data analysis methods employed may vary depending on the results obtained. Methods and assumptions should be detailed. DEP BMP Monitoring Protocols are available at http://www.co.mo.md.us/services/dep/Publications/pdf%20files/bmpprotocols.pdf

**Specific Monitoring Requirements**

1. BMP monitoring reports must include a table with dates of all major construction activities which take place on the site. (Groundbreaking, clearing, grading, BMP construction, BMP conversion, pond maintenance, sediment spills and cleanup, etc.)

2. Annual base flow and flow-weighted stormwater samples will continue to be collected as during pre-construction. Results should be compared to previous results to determine the effects of BMPs and the project overall.

3. Continuous flow data will be collected as during pre-construction. Results will evaluate the effect of BMPs and the project on stream flows. Lag times, base flows, storm peaks, and other parameters will examined and compared to pre-construction conditions.

4. Stream water temperatures will be monitored at the three locations designated during the pre-construction period. This monitoring will occur from June 1 through October 1 each year. Equipment accuracy is to be checked prior to use in spring. An accuracy check after retrieval in fall may be necessary depending on results obtained. Consult with equipment manufacturer or DEP for appropriate procedures. All accuracy checks are to be submitted with data analysis and reports. Temperature loggers should be set to take readings as frequently as possible. Consult with DEP if readings will be taken less frequently than every 30 minutes. Data from the loggers is to be closely compared to preconstruction conditions to identify any patterns indicating temperature impacts of the project. Rainfall, air temperature and flow data should be considered in the analysis. Rain and temperature gages will be maintained on the site to collect the relevant data. Analysis should be presented with illustrative graphs and conclusions regarding BMP effectiveness.

5. TSS grab sample locations will be established at a sediment pond on the site during construction. Exact sampling locations will be determined by DEP in the field to allow evaluation of the effectiveness of redundant sediment traps. Sampling is to be done quarterly during storm events throughout the construction phase. Storms should have at least one half inch of rainfall in a 24 hour period to be counted towards this requirement. Samples should be collected within 24 hours after the storm. The storms during which the data was collected should also be characterized for duration and total rainfall. Storm frequency (return interval) should be reported as described in Technical Paper #40 of USDOC Weather Bureau. Results should be examined to determine the efficiency of the structure and percent removal of pollutants. Data should be compared to past periods and graphs should be provided to support conclusions.

6. Quarterly photographic monitoring of selected outfalls will be required to determine the stability of the area. DEP will locate sites for these photos in the field with the consultant. Photos should be taken from the same location, height, etc. to facilitate comparison. An object of known size should be included with each shot to provide a frame of reference. Reports should evaluate whether flows from the structure are causing erosion or instability.

7. Embeddedness readings will continue as during pre-construction. Photos of the stream bottom should be taken concurrently with embeddedness readings. Reports should compare pre-construction data with data collected during subsequent periods to evaluate the effect of the project. Graphs should be presented along with conclusions.

8. Groundwater monitoring will continue as during pre-construction. Actual elevation of the groundwater should be reported as well as the depth to water from the ground surface. Data should be analyzed to determine the effectiveness of site design and stormwater management in providing infiltration and maintaining groundwater levels. Data from the pre-construction period should be compared to results obtained in subsequent periods. Graphs should be provided to support conclusions.

9. Cross sections established during pre-construction will be monumented and surveyed annually. Data will be plotted and compared over time to evaluate channel stability in the tributary. Photos of the cross section looking upstream and downstream should be collected annually also. Photos should be taken from the same location, height, etc. to facilitate comparison. An object of known size should be included with each shot to provide a frame of reference. Reports should evaluate whether the BMPs are effectively preventing degradation of the channel.

10. Sampling of water quality BMP's will be performed to ascertain their effectiveness and the benefits of redundant design. Grab samples will be collected from the baseflow of pond 3. Automated flow-weighted stormwater samples will be collected from additional BMPs (bioretention filters, groundwater recharge trenches, clean water recharge trenches and sand filters) at inflow and outflow points. Stormwater samples require 0.5 to 1 inch of rain over a 24 hour period not to exceed one inch over 24 hours. Reports should include information on the duration, total rainfall and return interval of the storm based on the site rain gage. Samples will be analyzed for TSS, nitrate, ortho-phosphorus, metals, BOD, TKN, total phosphorus, petroleum hydrocarbons and herbicides/pesticides. Loadings should be estimated where possible and comparisons made to published results for other BMP designs.

Monitoring requirements 1 through 9 will be in effect throughout the construction period. Following completion of construction, TSS monitoring of the sediment pond (requirement 5) will terminate. Post-construction monitoring (requirements 1-4, and 6-9) will continue for five years after construction. Sampling of water quality BMPs (requirement 10) will also have a duration of five years. Reports on BMP monitoring are due to DEP by May 30 and October 31 of each year. County code requires that reports be submitted quarterly. These quarterly reports may be incorporated in these semi-annual reports. This should be reflected in the title of the documents. BMP monitoring reports are to be delivered with data in an electronic format to Mark Sommerfield at Montgomery County DEP and also to Leo Galanko at Montgomery County DPS. Monitoring requirements 1 through 9 above will be in effect throughout the construction phase of the project. Post construction monitoring TSS readings from the sediment ponds (requirement #5) will not be required. The other monitoring requirements will be in effect for three years after the development is completed. Questions on the monitoring requirements and procedures may be directed to the following personnel.


| Mark Sommerfield | Doug Marshall | Leo Galanko |
|---|---|---|
| (240) 777-7737 | (240) 777-7740 | (240) 777-6242 |
| mark.sommerfield@co.mo.md.us | douglas.marshall@co.mo.md.us | leo.galanko@co.mo.md.us |

SOIL SURVEY OF
MONTGOMERY COUNTY, MARYLAND
SHEET NUMBER 7

Sand Filter Basin No. 11

$V = (1.0") \times (14.15 Ac.)\frac{(1\ in.)}{12\ ft}\frac{(43{,}560\ CF)}{1\ ac.}$

$V = 51{,}365$ CF

A = 20.40Ac. (Phase 2)
I = 67%
$A_I$ = 13.70 Ac. (Phase 2)
$A_I$ = 1.25 Ac (School Site)
A = 13.70 - 0.80 ac. (Imp. DA from facilities 18 & 19) = 12.90 Ac. + 1.25 Ac (school)=
Adesign = 14.15 Ac

Calculate minimum sand surface required:
(10% of total volume)
A = 51,365 CF x 0.10 = 5137 SF
A(Provided) = 5850 SF

Inflow pipe calculations based on 1.0" of runoff using SCS tabular method:

Str. 825 (Site)
q = q + AQ
Q = 1.0"
qt = 1010 cfs
A = 12.90 Ac.
q = (1010) (12.90 / 640) (1.0") = 20.36 cfs

Str. 6 (School Site)
q = q+AQ
Q = 1.0"
qt = 1010 cfs
A = 1.25 Ac
q = (1010)(1.25/640)(1.0") = 1.97 cfs

First flush WSEL = 641.10

# STORMWATER MANAGEMENT STORAGE TABLE

## Clarksburg Town Center - Sand Filter No. 11

SCALE: 1"= 30

| ELEVATION | PLAN. | AREA | AV. AREA | DIF. ELV. | STORAGE | Total Storage | Total Storage | ELEVATION |
|---|---|---|---|---|---|---|---|---|
| Feet | Sq. Inch | SF | SF | Feet | Cubic Ft. | Cubic Ft. | Acres- Ft. | **Feet** |
| 636.50 | 8.50 | 7,650.00 | 7,650.00 | 0.00 | 0.00 | 0.00 | 0.0000 | **636.50** |
| 638.00 | 11.00 | 9,900.00 | 8,775.00 | 1.50 | 13,162.50 | 13,162.50 | 0.3022 | **638.00** |
| 640.00 | 14.10 | 12,690.00 | 11,295.00 | 2.00 | 22,590.00 | 35,752.50 | 0.8208 | **640.00** |
| 642.00 | 17.50 | 15,750.00 | 14,220.00 | 2.00 | 28,440.00 | 64,192.50 | 1.4737 | **642.00** |
| 644.00 | 21.20 | 19,080.00 | 17,415.00 | 2.00 | 34,830.00 | 99,022.50 | 2.2732 | **644.00** |

WQ = 51,365 CF

WQ Elev = 641.10

**Project** **Designer** **Date**

PIPE CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE
July 9, 2003

Flow Splitr-comps (Str 825)

PROGRAM INPUT DATA:

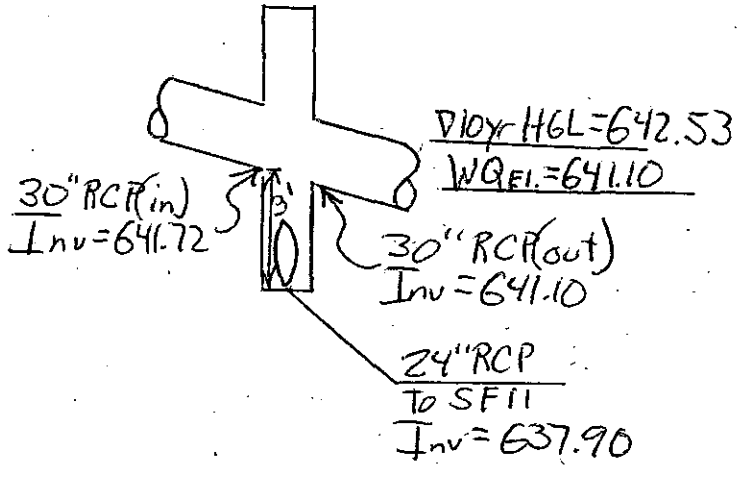
| DESCRIPTION | VALUE |
|---|---|
| Culvert Diameter (feet) | 2.00 |
| FHWA Chart Number (1,2 or 3) | 1 |
| Scale Number on Chart (Type of Culvert Entrance) | 1 |
| Manning's Roughness Coefficient (n-value) | 0.0130 |
| Entrance Loss Coefficient of Culvert Opening | 1.00 |
| Culvert Length (feet) | 65.0 |
| Culvert Slope (feet per foot) | 0.0200 |

PROGRAM RESULTS:

| Flow Rate (cfs) | Tailwater Depth (ft) | Headwater (ft) Inlet Control | Headwater (ft) Outlet Control | Normal Depth (ft) | Critical Depth (ft) | Depth at Outlet (ft) | Outlet Velocity (fps) |
|---|---|---|---|---|---|---|---|
| 20.3 | 1.00 | 3.01 | 2.34 | 1.16 | 1.62 | 1.16 | 10.78 |
| 20.3 | 2.00 | 3.01 | 2.53 | 1.16 | 1.62 | 1.16 | 10.78 |



$Q_{WQ}$ = 20.30 cfs
Req'd H = 3.0'



PIPE CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE
July 9, 2003

Flow Splitter (Str 70 School site)

PROGRAM INPUT DATA:

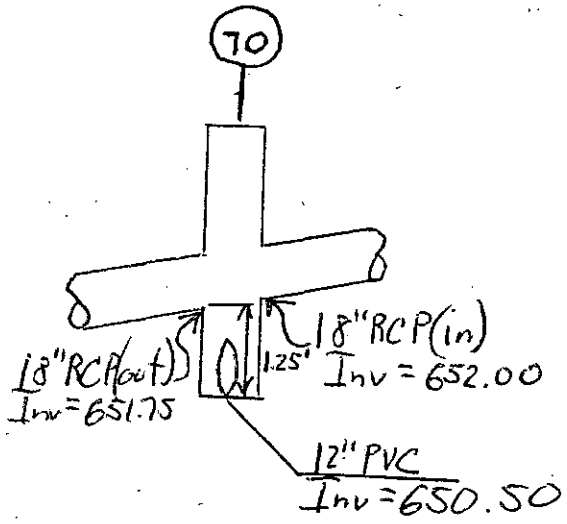
| DESCRIPTION | VALUE |
|---|---|
| Culvert Diameter (feet) | 1.00 |
| FHWA Chart Number (1,2 or 3) | 1 |
| Scale Number on Chart (Type of Culvert Entrance) | 1 |
| Manning`s Roughness Coefficient (n-value) | 0.0120 |
| Entrance Loss Coefficient of Culvert Opening | 1.00 |
| Culvert Length (feet) | 200.0 |
| Culvert Slope (feet per foot) | 0.0800 |

PROGRAM RESULTS:

| Flow Rate (cfs) | Tailwater Depth (ft) | Headwater (ft) Inlet Control | Outlet Control | Normal Depth (ft) | Critical Depth (ft) | Depth at Outlet (ft) | Outlet Velocity (fps) |
|---|---|---|---|---|---|---|---|
| 2.0 | 4.50 (WQ Depth) | 0.92 | -10.76 | 0.29 | 0.60 | 0.29 | 10.58 |



$Q_{WQ} = 1.97$ cfs
Req'd H = 0.92



PIPE CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE
July 10, 2003

Flow Splitter Str 70

PROGRAM INPUT DATA:

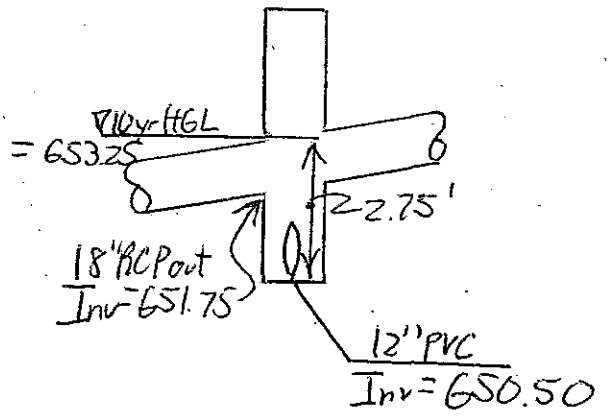
| DESCRIPTION | VALUE |
|---|---|
| Culvert Diameter (feet) | 1.00 |
| FHWA Chart Number (1,2 or 3) | 1 |
| Scale Number on Chart (Type of Culvert Entrance) | 1 |
| Manning's Roughness Coefficient (n-value) | 0.0120 |
| Entrance Loss Coefficient of Culvert Opening | 1.00 |
| Culvert Length (feet) | 200.0 |
| Culvert Slope (feet per foot) | 0.0800 |

PROGRAM RESULTS:

| Flow Rate (cfs) | Tailwater Depth (ft) | Headwater (ft) Inlet Control | Headwater (ft) Outlet Control | Normal Depth (ft) | Critical Depth (ft) | Depth at Outlet (ft) | Outlet Velocity (fps) |
|---|---|---|---|---|---|---|---|
| 5.7 | 6.00 | 2.75 | -4.07 | 0.51 | 0.95 | 0.51 | 13.98 |



$Q_{max}$ (To SFII) = 5.7 cfs (10yr HGL w/ submerged orifice) Tailwater = 6'



Circular Channel Analysis & Design
Solved with Manning's Equation

Open Channel - Uniform flow

Worksheet Name:

Comment: 12" PVC Splitter Pipe from School

Solve For Full Flow Capacity

Given Input Data:

| | |
|---|---|
| Diameter..... | 1.00 ft |
| Slope..... | 0.0800 ft/ft |
| Manning's n..... | 0.012 |
| Discharge..... | 10.92 cfs |

Computed Results:

| | |
|---|---|
| Full Flow Capacity..... | 10.92 cfs |
| Full Flow Depth..... | 1.00 ft |
| Velocity..... | 13.90 fps |
| Flow Area..... | 0.79 sf |
| Critical Depth.... | 1.00 ft |
| Critical Slope.... | 0.0757 ft/ft |
| Percent Full..... | 100.00 % |
| Full Capacity..... | 10.92 cfs |
| QMAX @.94D..... | 11.74 cfs |
| Froude Number..... | FULL |

10.92 cfs > 5.7 cfs
orifice inlet control

Open Channel Flow Module, Version 3.16 (c) 1990
Haestad Methods, Inc. * 37 Brookside Rd * Waterbury, Ct 06708

Table 14

# DESIGN DATA FOR EARTH SPILLWAYS

Emergency Spillway

| STAGE (Hp) IN FEET | SPILLWAY VARIABLES | BOTTOM WIDTH (b) IN FEET | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 8 | 10 | 12 | 14 | 16 | 18 | 20 | 22 | 24 | 26 | 28 | 30 | 32 | 34 | 36 | 38 | 40 |
| 0.5 | Q | 6 | 7 | 8 | 10 | 11 | 13 | 14 | 15 | 17 | 18 | 20 | 21 | 22 | 24 | 25 | 27 | 28 |
| | V | 2.7 | 2.7 | 2.7 | 2.7 | 2.7 | 2.7 | 2.7 | 2.7 | 2.7 | 2.7 | 2.7 | 2.7 | 2.7 | 2.7 | 2.7 | 2.7 | 2.7 |
| | S | 3.9 | 3.9 | 3.9 | 3.9 | 3.8 | 3.8 | 3.8 | 3.8 | 3.8 | 3.8 | 3.8 | 3.8 | 3.8 | 3.8 | 3.8 | 3.8 | 3.8 |
| 0.6 | Q | 8 | 10 | 12 | 14 | 16 | 18 | 20 | 22 | 24 | 26 | 28 | 30 | 32 | 34 | 35 | 37 | 39 |
| | V | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 |
| | S | 3.7 | 3.7 | 3.7 | 3.7 | 3.6 | 3.7 | 3.6 | 3.6 | 3.6 | 3.6 | 3.6 | 3.6 | 3.6 | 3.6 | 3.6 | 3.6 | 3.6 |
| 0.7 (0.75) | Q | 11 | 13 | 16 | 18 | 20 | 23 | 25 | 28 | 30 | 33 | 35 | 38 | 41 | 43 | 44 | 46 | 48 |
| | V | 3.2 | 3.2 | 3.3 | 3.3 | 3.3 | 3.3 | 3.3 | 3.3 | 3.3 | 3.3 | 3.3 | 3.3 | 3.3 | 3.3 | 3.3 | 3.3 | 3.3 |
| | S | 3.5 | 3.5 | 3.4 | 3.4 | 3.4 | 3.4 | 3.4 | 3.4 | 3.4 | 3.4 | 3.4 | 3.4 | 3.4 | 3.4 | 3.4 | 3.4 | 3.4 |
| 0.8 | Q | 13 | 16 | 19 | 22 | 26 | 29 | 32 | 35 | 38 | 42 | 45 | 46 | 48 | 51 | 54 | 57 | 60 |
| | V | 3.5 | 3.5 | 3.5 | 3.6 | 3.6 | 3.6 | 3.6 | 3.6 | 3.6 | 3.6 | 3.6 | 3.6 | 3.6 | 3.6 | 3.6 | 3.6 | 3.6 |
| | S | 3.3 | 3.3 | 3.3 | 3.2 | 3.2 | 3.2 | 3.2 | 3.2 | 3.2 | 3.2 | 3.2 | 3.2 | 3.2 | 3.2 | 3.2 | 3.2 | 3.2 |
| 0.9 | Q | 17 | 20 | 24 | 28 | 32 | 35 | 39 | 43 | 47 | 51 | 53 | 57 | 60 | 64 | 68 | 71 | 75 |
| | V | 3.7 | 3.8 | 3.8 | 3.8 | 3.8 | 3.8 | 3.8 | 3.8 | 3.8 | 3.8 | 3.8 | 3.8 | 3.8 | 3.8 | 3.8 | 3.8 | 3.8 |
| | S | 3.2 | 3.1 | 3.1 | 3.1 | 3.1 | 3.1 | 3.1 | 3.1 | 3.1 | 3.1 | 3.1 | 3.1 | 3.1 | 3.1 | 3.1 | 3.1 | 3.1 |
| 1.0 | Q | 20 | 24 | 29 | 33 | 38 | 42 | 47 | 51 | 56 | 61 | 63 | 68 | 72 | 77 | 81 | 86 | 90 |
| | V | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| | S | 3.1 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 |
| 1.1 | Q | 23 | 28 | 34 | 39 | 44 | 49 | 54 | 60 | 65 | 70 | 74 | 79 | 84 | 89 | 95 | 100 | 105 |
| | V | 4.2 | 4.2 | 4.2 | 4.3 | 4.3 | 4.3 | 4.3 | 4.3 | 4.3 | 4.3 | 4.3 | 4.3 | 4.3 | 4.3 | 4.3 | 4.3 | 4.3 |
| | S | 2.9 | 2.9 | 2.9 | 2.9 | 2.9 | 2.9 | 2.9 | 2.9 | 2.9 | 2.8 | 2.8 | 2.8 | 2.8 | 2.8 | 2.8 | 2.8 | 2.8 |
| 1.2 | Q | 28 | 33 | 40 | 45 | 51 | 58 | 64 | 69 | 76 | 80 | 86 | 92 | 98 | 104 | 110 | 116 | 122 |
| | V | 4.4 | 4.4 | 4.4 | 4.4 | 4.4 | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 |
| | S | 2.9 | 2.9 | 2.8 | 2.8 | 2.8 | 2.8 | 2.8 | 2.8 | 2.8 | 2.8 | 2.8 | 2.8 | 2.8 | 2.8 | 2.8 | 2.8 | 2.8 |
| 1.3 | Q | 32 | 38 | 46 | 53 | 58 | 65 | 73 | 80 | 86 | 91 | 99 | 106 | 112 | 119 | 125 | 133 | 140 |
| | V | 4.5 | 4.6 | 4.6 | 4.6 | 4.6 | 4.6 | 4.7 | 4.7 | 4.7 | 4.7 | 4.7 | 4.7 | 4.7 | 4.7 | 4.7 | 4.7 | 4.7 |
| | S | 2.8 | 2.8 | 2.8 | 2.7 | 2.7 | 2.7 | 2.7 | 2.7 | 2.7 | 2.7 | 2.7 | 2.7 | 2.7 | 2.7 | 2.7 | 2.7 | 2.7 |
| 1.4 | Q | 37 | 44 | 51 | 59 | 66 | 74 | 82 | 90 | 96 | 103 | 111 | 119 | 127 | 134 | 142 | 150 | 158 |
| | V | 4.7 | 4.8 | 4.8 | 4.8 | 4.8 | 4.8 | 4.8 | 4.8 | 4.8 | 4.9 | 4.9 | 4.9 | 4.9 | 4.9 | 4.9 | 4.9 | 4.9 |
| | S | 2.8 | 2.7 | 2.7 | 2.7 | 2.7 | 2.7 | 2.7 | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 |
| 1.5 | Q | 41 | 50 | 58 | 66 | 75 | 85 | 92 | 101 | 108 | 116 | 123 | 133 | 142 | 150 | 160 | 169 | 178 |
| | V | 4.8 | 4.9 | 4.9 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.1 | 5.1 | 5.1 |
| | S | 2.7 | 2.7 | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 | 2.5 | 2.5 | 2.5 |
| 1.6 | Q | 46 | 56 | 65 | 75 | 84 | 94 | 104 | 112 | 122 | 132 | 142 | 149 | 158 | 168 | 178 | 187 | 197 |
| | V | 5.0 | 5.1 | 5.1 | 5.1 | 5.1 | 5.2 | 5.2 | 5.2 | 5.2 | 5.2 | 5.2 | 5.2 | 5.2 | 5.2 | 5.2 | 5.2 | 5.2 |
| | S | 2.6 | 2.6 | 2.6 | 2.6 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 |
| 1.7 | Q | 52 | 62 | 72 | 83 | 94 | 105 | 115 | 126 | 135 | 145 | 156 | 167 | 175 | 187 | 196 | 206 | 217 |
| | V | 5.2 | 5.2 | 5.2 | 5.3 | 5.3 | 5.3 | 5.3 | 5.4 | 5.4 | 5.4 | 5.4 | 5.4 | 5.4 | 5.4 | 5.4 | 5.4 | 5.4 |
| | S | 2.6 | 2.6 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 |
| 1.8 | Q | 58 | 69 | 81 | 93 | 104 | 116 | 127 | 138 | 150 | 160 | 171 | 182 | 194 | 204 | 214 | 226 | 233 |
| | V | 5.3 | 5.4 | 5.4 | 5.5 | 5.5 | 5.5 | 5.5 | 5.5 | 5.5 | 5.5 | 5.5 | 5.6 | 5.6 | 5.6 | 5.6 | 5.6 | 5.6 |
| | S | 2.5 | 2.5 | 2.5 | 2.5 | 2.4 | 2.4 | 2.4 | 2.4 | 2.4 | 2.4 | 2.4 | 2.4 | 2.4 | 2.4 | 2.4 | 2.4 | 2.4 |
| 1.9 | Q | 64 | 76 | 88 | 102 | 114 | 127 | 140 | 152 | 164 | 175 | 188 | 201 | 213 | 225 | 235 | 248 | 260 |
| | V | 5.5 | 5.5 | 5.5 | 5.6 | 5.6 | 5.6 | 5.7 | 5.7 | 5.7 | 5.7 | 5.7 | 5.7 | 5.7 | 5.7 | 5.7 | 5.7 | 5.7 |
| | S | 2.5 | 2.5 | 2.5 | 2.4 | 2.4 | 2.4 | 2.4 | 2.4 | 2.4 | 2.4 | 2.4 | 2.4 | 2.4 | 2.4 | 2.4 | 2.4 | 2.4 |
| 2.0 | Q | 71 | 83 | 97 | 111 | 125 | 138 | 153 | 164 | 178 | 193 | 204 | 218 | 232 | 245 | 256 | 269 | 283 |
| | V | 5.6 | 5.7 | 5.7 | 5.7 | 5.8 | 5.8 | 5.8 | 5.8 | 5.8 | 5.8 | 5.8 | 5.9 | 5.9 | 5.9 | 5.9 | 5.9 | 5.9 |
| | S | 2.5 | 2.4 | 2.4 | 2.4 | 2.4 | 2.4 | 2.4 | 2.4 | 2.3 | 2.3 | 2.3 | 2.3 | 2.3 | 2.3 | 2.3 | 2.3 | 2.3 |
| 2.1 | Q | 77 | 91 | 107 | 122 | 135 | 149 | 162 | 177 | 192 | 207 | 220 | 234 | 250 | 267 | 276 | 291 | 305 |
| | V | 5.7 | 5.8 | 5.9 | 5.9 | 5.9 | 5.9 | 5.9 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 |
| | S | 2.4 | 2.4 | 2.4 | 2.4 | 2.4 | 2.3 | 2.3 | 2.3 | 2.3 | 2.3 | 2.3 | 2.3 | 2.3 | 2.3 | 2.3 | 2.3 | 2.3 |

DATA TO RIGHT OF HEAVY VERTICAL LINES SHOULD BE USED WITH CAUTION, AS THE RESULTING SECTIONS WILL BE EITHER POORLY PROPORTIONED, OR HAVE VELOCITIES IN EXCESS OF 6 FEET PER SECOND.

Source: USDA-SCS

$Q_{max} = 5.7$ cfs

$w = 8'$

$d = 0.5$ ft

CPJ Associates
Charles P. Johnson & Associates, Inc.
Planners • Engineers • Landscape Architects • Surveyors
1751 Elton Road 3rd Floor Silver Spring, Maryland 20903
301.434.7000 Fx. 301.434.9394 Frederick, MD – Fairfax, VA

BY AB DATE 04/06/04 SUBJECT Clarksburg Town Center -Phase 2 SHEET NO. 1 OF 1

CHECKED BY _____ DATE _____ **STORMWATER MANAGEMENT COMPUTATIONS** JOB NO. 29100

Clarksburg Town Center - Sand Filter No. 11

FILTER DIAPHRAGM
FOR
12" PVC CULVERT

ASSUMED PHREATIC LINE @ 4:1 SLOPE FROM 10 YEAR WSEL = 643.20

Outer Diameter ($D_o$) of 12" = 12" (1.0 ft)
Invert Elev = 630.30; Top of Pipe Elev = 631.30

Per TR-60 and MD-378:

Filter diaphragm width = 3 x $D_o$, to either side of conduit
= 3 x (1) = **3'**
(minimum projection of diaphragm on sides)

Filter diaphragm height = 3 x $D_o$ or 10-yr WSEL, whichever comes first
= 3 x (1) = 3' + 631.30 = 634.30
10-yr WSEL = 643.20
Therefore top of diaphragm = **633.30**

Filter diaphragm depth To be set minimum 2ft below bottom of concrete cradle;
Cradle bottom elevation = 630.30

Therefore bottom of diaphragm = **628.30**

OVERALL DIMENSIONS:

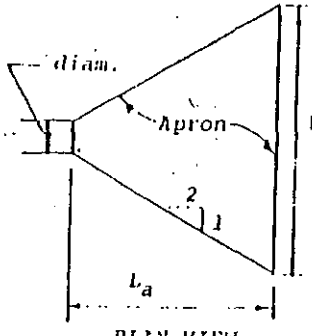
PIPE INSIDE DIAMETER = 1.0'

MINIMUM DIAPHRAGM HEIGHT = (1.0) + (2)+ (3.00') = 6.00'
MINIMUM DIAPHRAGM WIDTH = (1.0) + (3.0)+ (3.0) = 7.00'

▸ USE DIAPHRAGM DIMENSIONS = **6'-0" HIGH x 7'-0" WIDE**

**USE ONLY SAND THAT MEETS THE REQUIREMENTS OF ASTM C-33 FOR DIAPHRAGM**

DESIGN OF OUTLET PROTECTION
MINIMUM TAILWATER CONDITION (Tw <0.5 diam.)
End Section ES




$W = diam. + L_a$

*Median stone diameter, $d_{50}$, is the stone size which 50% of the riprap mixture, by weight, is larger than.*

*Velocities shown are for pipes flowing full.*

# STORM WATER MANAGEMENT FACILITIES
# PHASE 2

SWM #9

Impervious Area to Facility = 13,068 SF (0.30 ac.)

Storage Required = 13,068 SF x (1'/12") = 1089 CF

In Stone Storage = 1089 / 0.4 (void ratio) = 2723 CF

Storage Provided = 25'L x 45'W x 3.0 D = 3375 CF

SWM #10 ← Revised for new pool layout

Impervious Area to Facility = 4,356 SF (0.10 AC)

Storage Required = 4,356 SF x (1'/12") = 363 CF

In Stone Storage = 363 / 0.4 (void ratio) = 908 CF

Storage Provided = 310 SF x 3.0 D = 930 CF

## Design Computations for Bio-Retention/Recharge Area 15

- Bio-Retention System

$$Wqv = \frac{(1.0)\,(Rv)(A)}{12}$$

A = 1.20 Ac
I = 68%

Rv = 0.05 + 0.009 (I)
= 0.05 + 0.009 (68)
Rv = 0.662

WQv = (1.0) (0.662) (1.20) / 12 = 0.055Ac.ft = 2395 CF (Volume required)

- Volume provided = 2430 CF
  Ap = (Sand Filter Area) = 2000 SF

- Min length of underdrain pipes:
  L= 2000 SF x 0.05 = 100.00 ft

- Recharge Trench (1" runoff x Imp. Area)
  Impervious Area to Facility = 0.82 Ac = 35,719 SF
  Storage Req'd = 35,719 SF x (1ft/12in) = 2977 CF

  Storage Provided = 2977CF / 0.4 (Void Ratio) = 7443 CF (In Stone Storage Required)

  Volume Provided = 2000 SF (Surface Area) X 3.75'
  = 7500 CF

  7500CF>7443CF

# STORMWATER MANAGEMENT STORAGE TABLE

## Bio-Retention / Recharge Area 15

SCALE: 1"= 30

| ELEVATION | PLAN. | AREA | AV. AREA | DIF. ELV. | STORAGE | Total Storage | Total Storage | ELEVATION |
|---|---|---|---|---|---|---|---|---|
| Feet | Sq. Inch | SF | SF | Feet | Cubic Ft. | Cubic Ft. | Acres- Ft. | Feet |
| ---------- | | | | | | | | |
| ---------- | | | | | | | | |
| 649.00 | 2.25 | 2,025.00 | 2,025.00 | 0.00 | 0.00 | 0.00 | 0.0000 | **649.00** |
| 650.00 | 3.15 | 2,835.00 | 2,430.00 | 1.00 | 2,430.00 | 2,430.00 | 0.0558 | **650.00** |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

**Project** **Designer** **Date**

## Design Computations for Bio-Retention/Recharge Area 17

- Bio-Retention System

$$Wqv = \frac{(1.0)\,(Rv)(A)}{12}$$

A = 0.80 Ac
I = 68%

$Rv = 0.05 + 0.009\,(I)$
$= 0.05 + 0.009\,(68)$
$Rv = 0.662$

WQv = (1.0) (0.662) (0.80) / 12 = 0.044Ac.ft = 1916 CF (Volume required)

- Volume provided = 2020 CF
  Ap = (Sand Filter Area) = 1700 SF

- Min length of underdrain pipes:
  L= 1700 SF x 0.05 = 85 ft

- Recharge Trench (1" runoff x Imp. Area)
  Impervious Area to Facility = 0.55 Ac = 23,958 SF
  Storage Req'd = 23,958 SF x (1ft/12in) = 1997 CF

  Storage Provided = 1997CF X 0.4 (Void Ratio) = 4993 CF (In Stone Storage Required)

  Volume Provided = 1620 SF (Surface Area) X 3.20'
  = 5184 CF

  5184CF>4993CF

# STORMWATER MANAGEMENT STORAGE TABLE

## Bio-Retention / Recharge Area 17

SCALE: 1"= 30

| ELEVATION | PLAN. | AREA | AV. AREA | DIF. ELV. | STORAGE | Total Storage | Total Storage | ELEVATION |
|---|---|---|---|---|---|---|---|---|
| Feet | Sq. Inch | SF | SF | Feet | Cubic Ft. | Cubic Ft. | Acres- Ft. | Feet |
| --- | | | | | | | | |
| --- | | | | | | | | |
| 667.00 | 1.95 | 1,755.00 | 1,755.00 | 0.00 | 0.00 | 0.00 | 0.0000 | **667.00** |
| 668.00 | 2.54 | 2,286.00 | 2,020.50 | 1.00 | 2,020.50 | 2,020.50 | 0.0464 | **668.00** |

**Project** **Designer** **Date**

## Design Computations for Bio-Retention/Recharge Area 18

- Bio-Retention System

$$Wqv = \frac{(1.0)\,(Rv)(A)}{12}$$

A = 0.80 Ac
I = 68%

Rv = 0.05 + 0.009 (I)
= 0.05 + 0.009 (68)
Rv = 0.662

WQv = (1.0) (0.662) (0.80) / 12 = 0.044Ac.ft = 1917 CF (Volume required)

- Volume provided = 2115 CF
  Ap = (Sand Filter Area) = 1800 SF

- Min length of underdrain pipes:
  L= 1800 SF x 0.05 = 90 ft
  Provide 2 – 45ft PVC underdrains.

- Recharge Trench (1" runoff x Imp. Area)
  Impervious Area to Facility = 0.54 Ac = 23,522 SF
  Storage Req'd = 23,522 SF x (1ft/12in) = 1960 CF

  Storage Provided = 1960CF X 0.4 (Void Ratio) = 4900 CF (In Stone Storage Required)

  Volume Provided = 1800 SF (Surface Area) X 2.75'
  = 4950 CF

  4950CF>4900CF

# STORMWATER MANAGEMENT STORAGE TABLE

## Bio-Retention / Recharage Area 18

SCALE: 1"= 30

| ELEVATION | PLAN. | AREA | AV. AREA | DIF. ELV. | STORAGE | Total Storage | Total Storage | ELEVATION |
|---|---|---|---|---|---|---|---|---|
| Feet | Sq. Inch | SF | SF | Feet | Cubic Ft. | Cubic Ft. | Acres- Ft. | **Feet** |
| --- | | | | | | | | |
| --- | | | | | | | | |
| 669.00 | 2.00 | 1,800.00 | 1,800.00 | 0.00 | 0.00 | 0.00 | 0.0000 | **669.00** |
| 670.00 | 2.70 | 2,430.00 | 2,115.00 | 1.00 | 2,115.00 | 2,115.00 | 0.0486 | **670.00** |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

**Project** **Designer** **Date**

## Design Computations for Bio-Retention/Recharge Area 19

- Bio-Retention System

$$Wqv = \frac{(1.0)\,(Rv)(A)}{12}$$

A = 0.34 Ac
I = 68%

Rv = 0.05 + 0.009 (I)
= 0.05 + 0.009 (68)
Rv = 0.662

WQv = (1.0) (0.662) (0.34) / 12 = 0.0188Ac.ft = 819 CF (Volume required)

- Volume provided = 870 CF
  Ap = (Sand Filter Area) = 720 SF

- Min length of underdrain pipes:
  L= 720 SF x 0.05 = 36.00 ft
  Provide 2 – 18 ft PVC underdrains.

- Recharge Trench (1" runoff x Imp. Area)
  Impervious Area to Facility = 0.34 Ac = 14,810 SF
  Storage Req'd = 14,810 SF x (1ft/12in) = 1234 CF

  Storage Provided = 1234CF X 0.4 (Void Ratio) = 3085 CF (In Stone Storage Required)

  Volume Provided = 720 SF (Surface Area) X 4.30'
  = 3096 CF

  3096CF>3085CF

# STORMWATER MANAGEMENT STORAGE TABLE

## Bio-Retention / Recharage Area 19

SCALE: 1"= 30

| ELEVATION | PLAN. | AREA | AV. AREA | DIF. ELV. | STORAGE | Total Storage | Total Storage | ELEVATION |
|---|---|---|---|---|---|---|---|---|
| Feet | Sq. Inch | SF | SF | Feet | Cubic Ft. | Cubic Ft. | Acres- Ft. | Feet |
| 680.00 | 0.75 | 675.00 | 675.00 | 0.00 | 0.00 | 0.00 | 0.0000 | **680.00** |
| 681.00 | 1.19 | 1,071.00 | 873.00 | 1.00 | 873.00 | 873.00 | 0.0200 | **681.00** |

**Project** **Designer** **Date**

## Design Computations for Groundwater Recharge Basin No. 21

- Recharge Trench (1" runoff x Imp. Area)
  Impervious Area to Facility = 2.5' Ac = 108,900
  Storage Req'd = 108,900 x (1 ft/12in) = 9075 CF

In stone storage = 9075 / 0.4 (Void Rate) = 22688 CF
Storage Provide = 3,180 SF (Surface area) x 7.5' (Depth)

= 23,850 CF

W:\WPFILES\MISC\Design Basin 21.wpd

Figure 6 Storm *ceptor*® Sizing Guideline

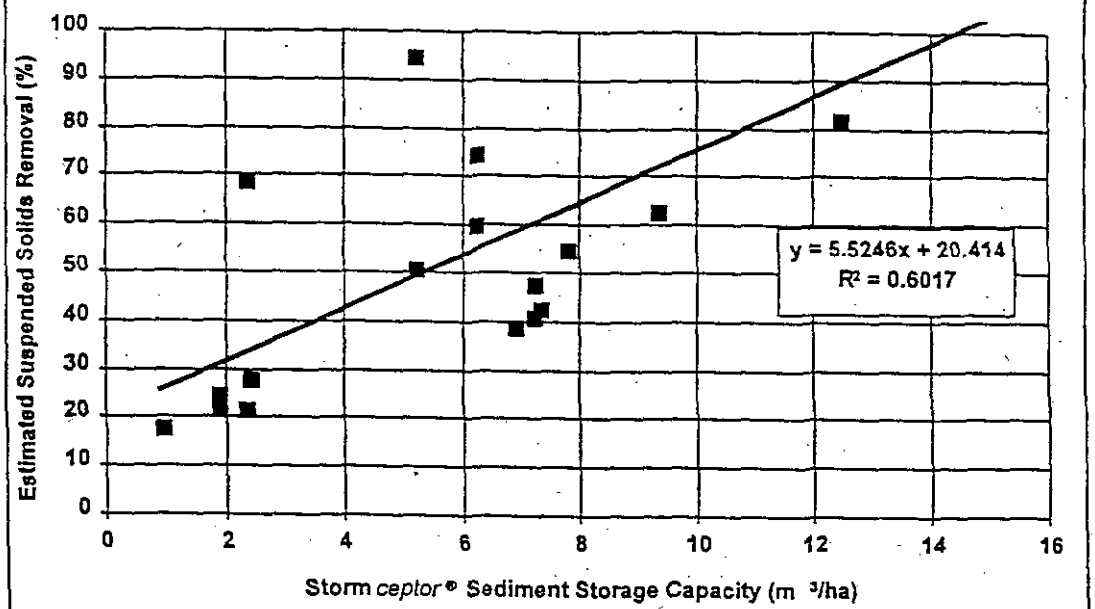



**Table 4. Maximum Impervious Drainage Area Guidelines (ac)**

| Stormceptor® Model (STA / STC) | Sensitive Area (80% TSS removal) | Standard Area (70% TSS removal) | Degraded Area (60% TSS removal) | Treatment Train (50% TSS removal) |
|---|---|---|---|---|
| 900 | 0.45 | 0.55 | 0.70 | 0.90 |
| 1200 | 0.70 | 0.85 | 1.05 | 1.45 WQ4 |
| 1800 | 1.25 | 1.50 | 1.90 | 2.55 |
| 2400 | 1.65 | 2.00 | 2.50 | 3.35 WQ3 |
| 3600 | 2.60 | 3.15 | 3.95 | 5.30 |
| 4800 | 3.60 | 4.30 | 5.40 | 7.25 |
| 6000 | 4.60 | 5.55 | 6.95 | 9.25 |
| 7200 | 5.55 | 6.70 | 8.40 | 11.25 |

Table 4 indicates that there are 4 design levels for the **Stormceptor®**. The first three design levels are based on the classification of the receiving waters (river, watercourse). These design levels are for stormwater management plans in which the **Stormceptor®** is the **only** stormwater quality measure being implemented. The fourth design level is intended for situations in which the **Stormceptor®** is

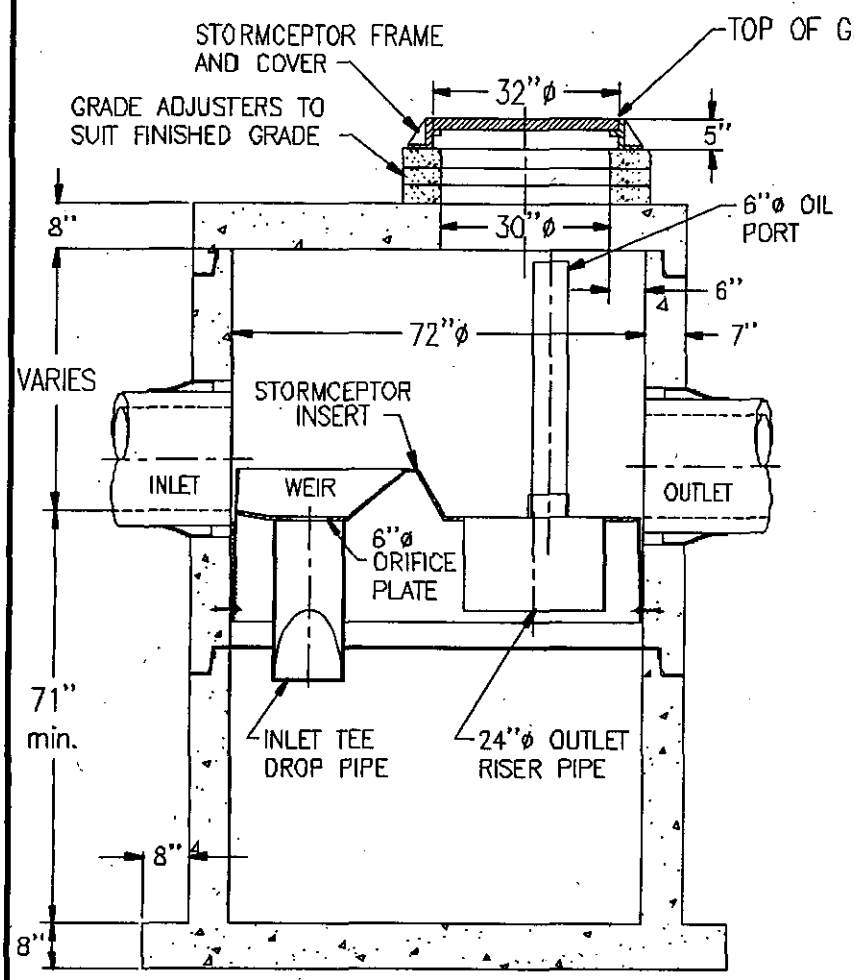
Stormceptor®

# Hydro Conduit

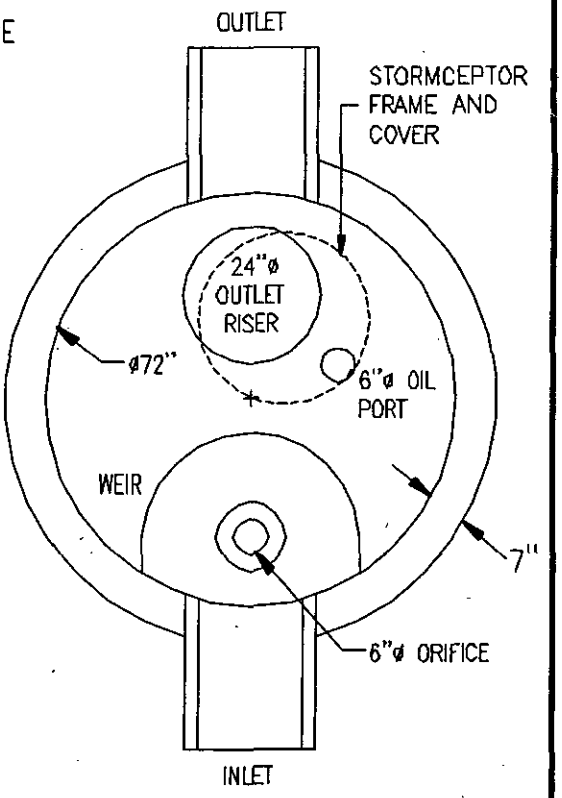
STC 1200 Precast Concrete Stormceptor
(1200 US Gallon Capacity)

PROJECT:
LOCATION:

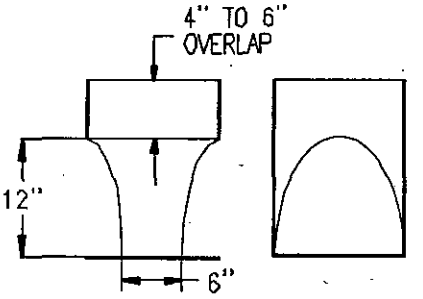
DR. BY: N. BALDWIN
CK. BY:
DATE: FEB. 13, 2001
SCALE: N.T.S.
DWG.#




SECTION THRU CHAMBER




PLAN VIEW OF INSERT




ENLARGED INLET TEE DROP PIPE

NOTE :

1. THE USE OF FLEXIBLE CONNECTIONS IS RECOMMENDED AT THE INLET AND OUTLET WHERE APPLICABLE.
2. THE COVER SHOULD BE POSITIONED OVER THE 24"ø OUTLET RISER PIPE AND THE 6"ø OIL PORT.
3. THE STORMCEPTOR SYSTEM IS PROTECTED BY ONE OR MORE OF THE FOLLOWING U.S. PATENTS: #4985148, #5498331, #5725760, #5753115, #5849181.

| REV. | DESCRIPTION | BY: | DATE |
|---|---|---|---|
| | | | |

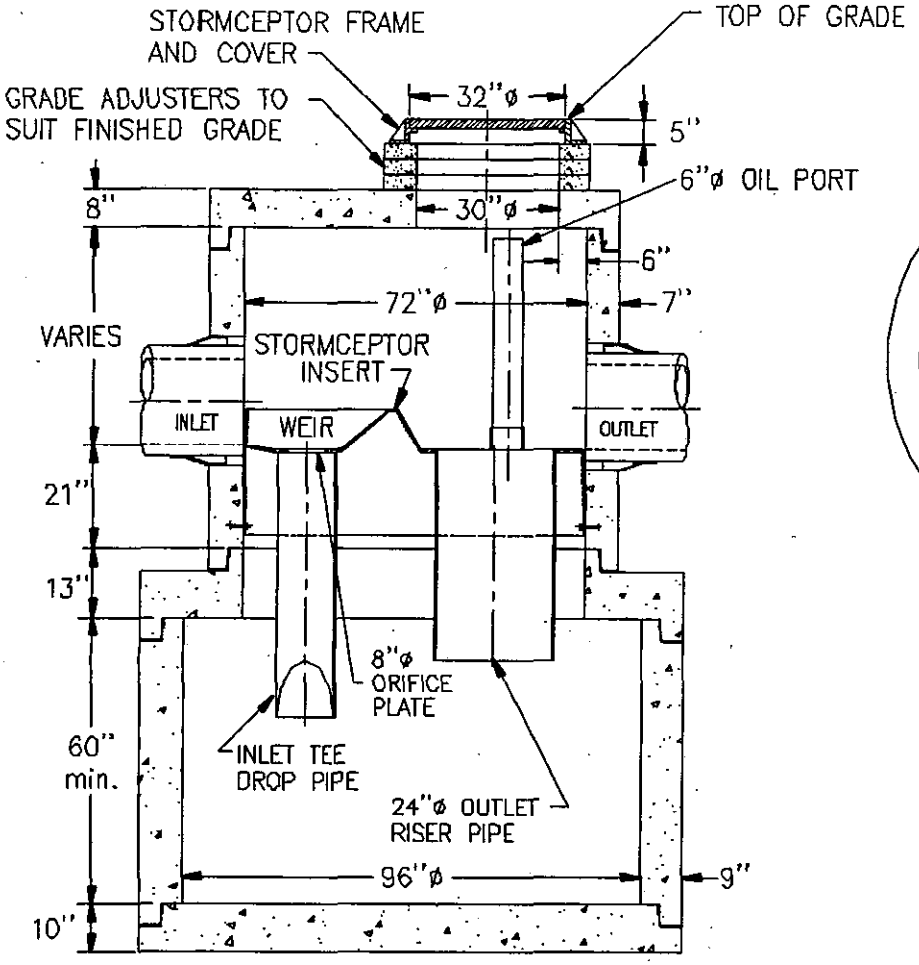
Stormceptor®

# Hydro Conduit

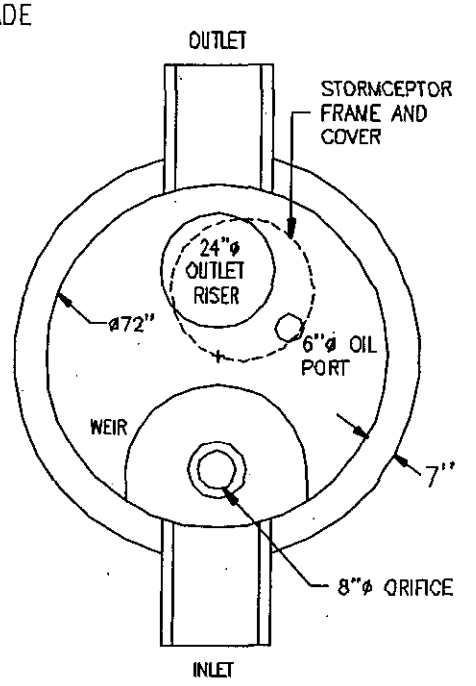
STC 2400 Precast Concrete Stormceptor
(2400 US Gallon Capacity)

PROJECT:
LOCATION:

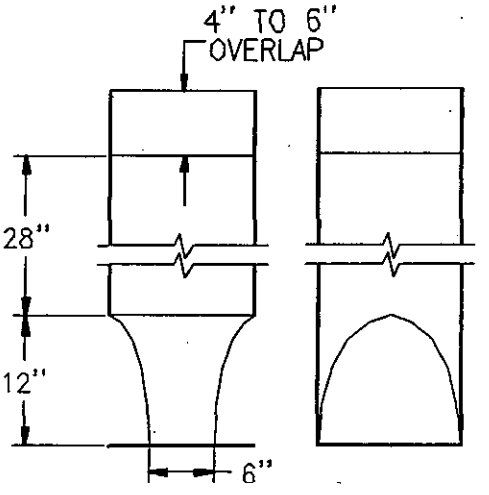
DR. BY: N. BALDWIN
CK. BY:
DATE: FEB. 13, 2001
SCALE: N.T.S.
DWG.#




SECTION THRU CHAMBER




PLAN VIEW OF INSERT




ENLARGED INLET TEE DROP PIPE

NOTE :

1. THE USE OF FLEXIBLE CONNECTIONS IS RECOMMENDED AT THE INLET AND OUTLET WHERE APPLICABLE.
2. THE COVER SHOULD BE POSITIONED OVER THE 24"ø OUTLET RISER PIPE AND THE 6"ø OIL PORT.
3. THE STORMCEPTOR SYSTEM IS PROTECTED BY ONE OR MORE OF THE FOLLOWING U.S. PATENTS: #4985148, #5498331, #5725760, #5753115, #5849181.

| REV. | DESCRIPTION | BY: | DATE |
|---|---|---|---|
| | | | |

Charles P. Johnson & Associates, Inc.
PLANNERS • ENGINEERS • LANDSCAPE ARCHITECTS • SURVEYORS
1751 ELTON ROAD • SILVER SPRING, MARYLAND • 20903
(301) 434-7000 FAIRFAX, VA

Prepared By: JB
Checked By: JES
Date: 08/01/03

**Engineer's Preliminary Cost Estimate**
**For**

Job Number

Sheet 1 of 1

| ITEM | UNIT | APPROXIMATE QUANTITY | APPROXIMATE UNIT PRICE | APPROXIMATE COST |
|---|---|---|---|---|
| 12" PVC | LF | 120 | $ 12.35 | $ 1,482.00 |
| 24" R.C. CL IV | LF | 52 | $ 39.00 | $ 2,028.00 |
| 6" PVC-Sch40 | LF | 459 | $ 15.00 | $ 6,885.00 |
| 6" D.I.P. | LF | 8 | $ 25.00 | $ 200.00 |
| 48" Manhole | EA | 2 | $ 3,200.00 | $ 6,400.00 |
| 24" End Section | EA | 1 | $ 550.00 | $ 50.00 |
| STC 3600 Stormceptor | EA | 1 | $ 17,750.00 | $ 17,750.00 |
| STC 1200 Stormceptor | EA | 1 | $ 9,660.00 | $ 9,660.00 |
| Cleanouts | EA | 8 | $ 50.00 | $ 400.00 |
| MSHA CL 1 Riprap | SY | 25 | $ 50.00 | $ 1,250.00 |
| Sand | CY | 300 | $ 23.00 | $ 6,900.00 |
| Stone | CY | 700 | $ 14.00 | $ 9,800.00 |
| Core Trench – Select Fill | CY | 1450 | $ 20.00 | $ 29,000.00 |
| Excavation | CY | 1800 | $ 8.00 | $ 14,400.00 |
| Seeding & Mulching (NOTE: includes area of SF#11 & Recharge #21) | SY | 8100 | $ 2.00 | $ 16,200.00 |
| 12" PVC Sch 40 | LF | 215 | $ 20.00 | $ 4300.00 |
| 12" DIP | LF | 8 | $ 32.00 | $ 256.00 |
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| | | | | $ 127,461.00 |

NOTE

This estimate is prepared as a guide only, is based upon preliminary information, and is subject to possible change. Charles P. Johnson & Associates makes no warranty, either express or implied, that actual quantities and costs will not vary from the amounts indicated and assumes no liability for such variances.

**Charles P. Johnson & Associates, Inc.**
Planners • Engineers • Landscape Architects • Surveyors
1751 Elton Road 3rd Floor Silver Spring, Maryland 20903
301.434.7000 Fx. 301.434.9394 Frederick, MD – Fairfax, VA

Prepared By: JB
Checked By: JES
Date: 08/01/03

# Engineer's Preliminary Cost Estimate
## For
### CLARKSBURG TOWN CENTER
**Recharge and Bio-Retention Facilities # 15, 17, 18, 19 & 21**

Job Number: 29-100 Sheet 1 of 1

| ITEM | UNIT | APPROXIMATE QUANTITY | APPROXIMATE UNIT PRICE | APPROXIMATE COST |
|---|---|---|---|---|
| 6" PVC - Sch 40 | LF | 550 | $ 15.00 | $ 8,250.00 |
| Cleanouts | EA | 18 | $ 50.00 | $ 900.00 |
| Sand | CY | 170 | $ 23.00 | $ 3,910.00 |
| Stone | CY | 1,400 | $ 14.00 | $ 19,600.00 |
| Excavation | CY | 1,900 | $ 8.00 | $ 15,200.00 |
| Mulch | SY | 330 | $ 5.50 | $ 1,815.00 |
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| | | | TOTAL | $ 49,675.00 |

NOTE

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