THE STERLING CO.

The Villages at Shady Creek

STORMWATER MANAGEMENT FACILITIES REPORT

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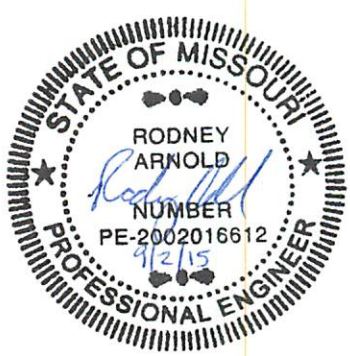
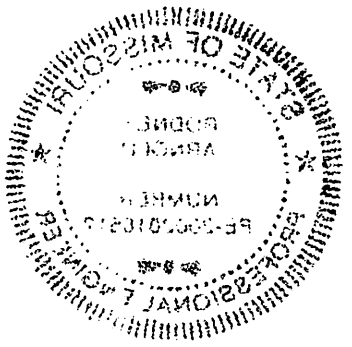
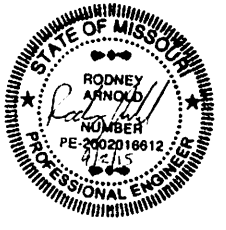



STATE OF MISSOURI
PROFESSIONAL ENGINEER

THE VILLAGES AT SHADY CREEK

15 YEAR, 20 MINUTE STORM SEWER HYDRAULICS w/ STARTING HYDRAULIC GRADE OF 100 YEAR HIGHWATER

LineNo	LineID	LineSize	FlowRate	InvertDn	InvertUp	LineLength	LineSlope	VelAve	Grnd/RimElev Dn	Grnd/RimElev Up	HGLDn	HGLUp	Rim Hw	CriticalDepth	EGLDn	EGLUp	EnergyLoss	CapacityFull	n-valuePipe
		(in)	(cfs)	(ft)	(ft)	(ft)	(%)	(ft/s)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	
3	5 6	30	20.53	550.53	550 72	38.00	0.50	4.18	553.41	555.62	554.05	554.15	1.25	1.54	554.32	554.42	0.095	29.00	0.013
4	6 7	24	16.94	550.92	551.09	35.00	0.49	5.39	555.62	555.62	554.37	554.57	0.82	1.48	554.83	555.02	0.196	15.77	0.013
5	7 8	24	12.78	551.29	551.53	48 52	0.49	4.07	555.62	557.00	554.80	554.95	1.92	1.28	555.05	555.21	0.155	15.91	0.013
6	8 9	24	12.34	551.73	552 86	113 00	1.00	3.93	557.00	559.50	555.08	555.42	3.96	1.26	555.32	555.66	0.336	22 62	0.013
7	9 10	18	10.27	553.06	559 86	170.00	4.00	6 21	559.50	566.50	555.54	561.09 j	5 41	1.23	556.06	561 77	1.623	21.00	0.013
8	10 11	15	7.14	560.06	570 37	172 00	5.99	6.49	566 50	576.70	561.09	571.44	5.26	1.07	561.73	572.07	0.000	15.81	0.013
9	11 12	12	2.79	570.57	578 47	93.00	8.49	4.25	576.70	583.50	571.44	579.19 j	4.31	0.72	571.77	579.52	0.000	10 38	0.013
10	12 13	12	1 81	578.67	589 55	68.00	16.00	4.16	583.50	595.00	579.19	590.12	4.88	0 57	579.42	590.36	0.000	14.25	0.013



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INTRODUCTION:

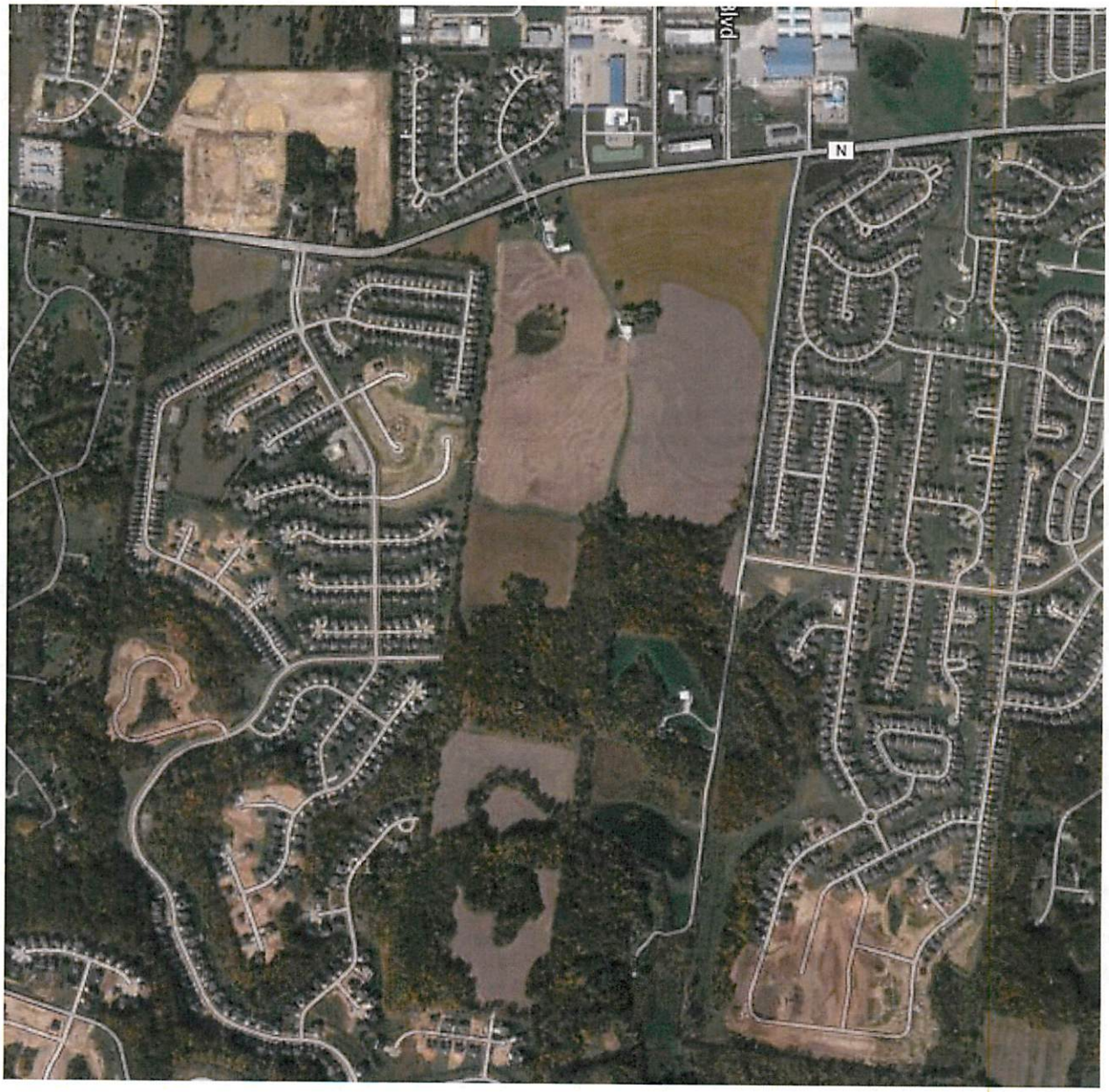
The Villages at Shady Creek is a proposed 338 lot single family development located along the west side of Curtis Lane at State Highway N, in the City of O'Fallon, Missouri. A location map of the site is included on page 3 of this report.

Flood control and water quality for the development will be provided within six impoundment areas (Dry Ponds, Wet Ponds/Lakes, Wet Extended Detention (ED) Ponds) located along the northern property boundary, central property areas and eastern property boundary. All impoundment areas are designated by the City of O'Fallon as BMP's.

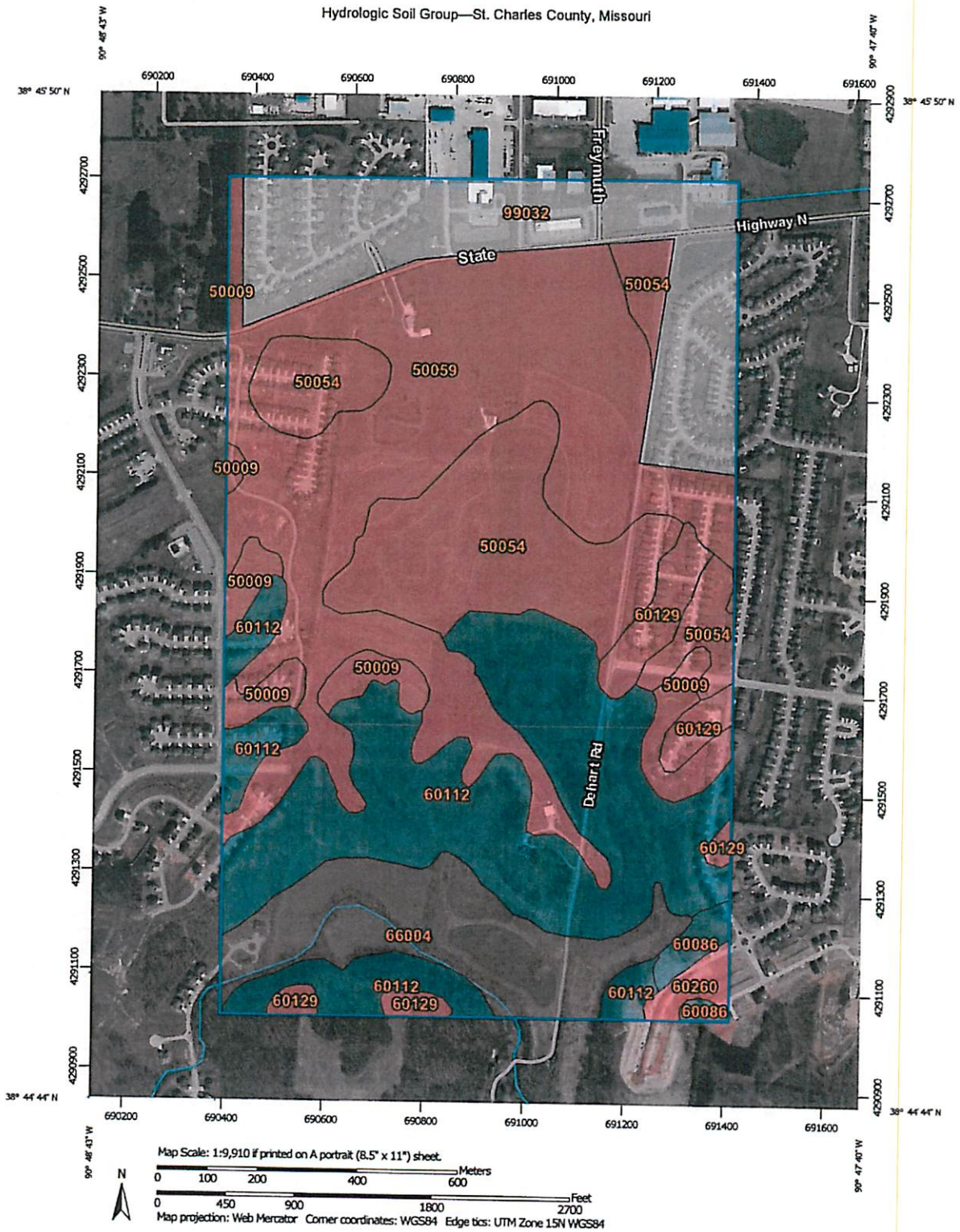
In part this report was prepared in order to demonstrate the adequacy of the basins per the City of O'Fallon flood control requirements for stormwater control facilities. Therefore an analysis of the existing project site has been completed to determine the release rates for the project and is included in the following pages of this report.

The 1-year, 2-year, 25-year and 100-year, 24-hour inflow hydrographs were determined by the SCS Method, using Haested's "Pondpack" computer program. The precipitation depths used were 2.5 inches, 3.1 inches, 5.8 inches and 7.2 inches for the 1-year, 2-year, 25-year and 100-year storms, respectively. These depths were determined from National Weather Service Charts (see appendix).

The existing soil disposition at the site was determined from the NRCS Web Soil Survey. The output of this survey is included as well as a natural resources plan exhibit. It was found that the existing soil falls under the Hydrologic Soil Groups C & D. The pre-developed conditions of on-site soils were modeled using C & D Soils. For the post-developed conditions the on-site soil was also modeled as C & D Soils.



LOCATION MAP


Hydrologic Soil Group—St. Charles County, Missouri
90° 48' 43" W
90° 47' 40" W
38° 45' 50" N
38° 44' 44" N
690200
690400
690600
690800
691000
691200
691400
691600
4292900
4292700
4292500
4292300
4292100
4291900
4291700
4291500
4291300
4291100
4290900
Freymuth
Highway N
State
Dehner Rd
99032
50009
50054
50059
60112
60129
66004
60086
60260
Map Scale: 1:9,910 if printed on A portrait (8.5" x 11") sheet.
N
0 100 200 400 600 Meters
0 450 900 1800 2700 Feet
Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 15N WGS84
USDA
Natural Resources Conservation Service
Web Soil Survey
National Cooperative Soil Survey
12/19/2014
Page 1 of 4

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils

Soil Rating Polygons
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: St. Charles County, Missouri
Survey Area Data: Version 13, Aug 5, 2014

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Oct 1, 2010—Mar 9, 2012

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — St. Charles County, Missouri (MO183)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
50009	Keswick silt loam, 9 to 14 percent slopes, eroded	D	17.1	4.0%
50054	Armster silt loam, 5 to 9 percent slopes	D	64.6	15.1%
50059	Mexico silt loam, 1 to 4 percent slopes, eroded	D	123.2	28.9%
60086	Crider silt loam, 9 to 14 percent slopes, eroded	C	4.0	0.9%
60112	Goss very gravelly silt loam, 14 to 45 percent slopes	C	101.7	23.8%
60129	Hatton silt loam, 5 to 9 percent slopes	D	13.8	3.2%
60260	Weller silt loam, 5 to 9 percent slopes	D	3.4	0.8%
66004	Dockery silt loam, 0 to 2 percent slopes, frequently flooded	B/D	38.7	9.1%
99032	Urban land-Orthents complex, 1 to 9 percent slopes		60.0	14.1%
Totals for Area of Interest			426.6	100.0%

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Higher

MAINTENANCE AND OPERATION PLAN

MAINTENANCE MANUAL
INTRODUCTION

In accordance with City of O'Fallon regulations, the Villages at Shady Creek homeowners association is responsible for inspecting and maintaining the stormwater BMP's as approved. Research and experience have demonstrated that regular and thorough maintenance is necessary for Stormwater BMP's to perform effectively and reliably. They have also demonstrated that failure to perform such maintenance can lead to diminished performance, deterioration and failure, in addition to a range of health and safety problems including mosquito breeding, vermin, and the potential for drowning. This maintenance manual contains specific preventative and corrective maintenance tasks for the BMP's within this subdivision. The party responsible for maintenance of the BMP facilities must evaluate this plans effectiveness annually and if necessary make appropriate modifications to the plan.

SELECTION OF STORMWATER MANAGER

The Villages at Shady Creek Homeowners Association shall select a Trustee who will be responsible for BMP maintenance. This person shall be referred to as the stormwater manager. The stormwater manager must be aware of the purpose of the BMP's and consequences of facility failure, particularly those failures caused by inadequate maintenance. The stormwater manager shall maintain a complete file including plans, reports, and maintenance and inspection logs.

CONTACT INFORMATION

Villages at Shady Creek Homeowners Association
2299 Technology Drive, Suite 150
O'Fallon, Missouri 63368
Contact: To be Determined
Phone: 636-695-3197
Contact may be reassigned by the directing trustee.

The responsible party will maintain all private stormwater facilities in good working order. Minimum maintenance of the private facilities shall include routine inspection, maintenance and removal of sediment, debris, oil and foreign material from the storm sewers, inlets and manholes; and routine inspection, maintenance and cleaning so that the operation and capacity of the stormwater facilities continues to function properly.

Water Quality Area P.O.I. 1 is located within a Wet Extended Detention (ED) Pond/Basin. Basin G which is located along the rear of lots 260-266 in the northwest corner of the site. The stormwater first passes through the pretreatment areas (forbays) before entering the wet extended detention area through a 2' high rock dyke (berm). The permanent pool (wet extended detention basin) will remove additional pollutants through settling of particulates, organic matter, metals, bacteria and organics as storwater runoff resides in the pond. The wet extended detention pond facility (BMP) has sediment forebays which provide a ponding area prior to reaching the permanent pool of the Wet Extended Detention Pond so that larger particles and sediment from the first flush of the storm can be settled out. Trash accumulated in the forebay should be removed after each storm and disposed of properly. If silt accumulates in a forebay it should be removed once ¼ of the volume has been reduced. Removal and disposal of the silt should be done according to local regulations.

Water Quality Area P.O.I. 2 is located within a Wet Pond/Lake. Lake H located east of Lake St. Louis Blvd. along the rear of lots 285-287 in the northeast corner of the site. The proposed Wet Pond/Lake H has been designed to have a minimum 10 foot wide aquatic bench. The aquatic bench fluctuates in water depth from 0 inches to 12 inches above the normal water elevation of the lake. The aquatic bench is the shallow area just inside the perimeter of the normal pool that promotes growth of aquatic and wetland plants. This bench also serves as a safety feature and reduces shoreline erosion.

Water Quality Area P.O.I. 3 is located within a Wet Pond/Lake. Lake E is located along the rear of lots 54-59 and 63-65 along the central east property line. The proposed Wet Pond/Lake E has been designed to have a minimum 12 foot wide aquatic bench. The aquatic bench fluctuates in water depth from 0 inches to 12 inches above the normal water elevation of the lake. The aquatic bench is the shallow area just inside the perimeter of the normal pool that promotes growth of aquatic and wetland plants. This bench also serves as a safety feature and reduces shoreline erosion.

Water Quality Area P.O.I. 4 is located within a Wet Pond/Lake. Lake C is located along the rear of lots 34-38 and 43-46 within the south central portion of the site. The proposed Wet Pond/Lake C has been designed to have a minimum 12 foot wide aquatic bench. The aquatic bench fluctuates in water depth from 0 inches to 12 inches above the normal water elevation of the lake. The aquatic bench is the shallow area just inside the perimeter of the normal pool that promotes growth of aquatic and wetland plants. This bench also serves as a safety feature and reduces shoreline erosion. Additionally a safety bench is located just above the aquatic bench. An 8 ft. wide pedestrian trail is located on the safety bench.

Water Quality Area P.O.I. 6A is located in Infiltration Basin A which is located immediately south to lots 12 and 13 in the southwest corner of the site. The infiltration basin shall have an infiltration bed area. The stormwater first passes through the

pretreatment areas before entering the infiltration area through a 2' high rock dyke (berm). The infiltration areas filled with stone will remove additional pollutants within the underground reservoir for treating the stormwater runoff. The infiltration bed area consists of 3 layers which are 6" of sand bottom, 36" of clean rock and 2" of pea gravel top layer. The existing soils below the infiltration area well draining allowing the stormwater to infiltrate. The infiltration area is designed to remove stormwater pollutants and are not intended to trap sediment. The approximate time necessary for the cell to completely drain is 40 hours. This infiltration basin facility (BMP) has a sediment forebay which provides a ponding area prior to the infiltration area so that larger particles and sediment from the first flush of the storm can be settled out. Trash accumulated in the forebay should be removed after each storm and disposed of properly. If silt does accumulate in the forebay it should be removed once ¼ of the volume has been reduced. Removal and disposal of the silt should be done according to local regulations.

Water Quality Area P.O.I. 6B is located in Sandfilter Basin B which is located immediately south to lots 19, 20 and 21 in the southeast corner of the site. The sandfilter areas shall have a filter bed area that will be covered with topsoil which will be seeded or sodded. The stormwater first passes through the pretreatment areas (forebays) before entering the sandfilter through a 2' high rock dyke (berm). The sandfilter area will remove additional pollutants prior to leaving the BMP utilizing filtering and infiltration from vegetation methods to treat the runoff. The sandfilter consists of 3 layers which are 3" of topsoil, 18" of clean washed "concrete" sand and 6" perforated pipe/8" thick gravel underdrain system. The underdrain within the clean gravel will be perched a minimum of 6 inches. The approximate time necessary for the cell to completely drain is 40 hours. The sandfilter basin facility (BMP) has sediment forebays which provide a ponding area prior to the sandfilter so that larger particles and sediment from the first flush of the storm can be settled out. Trash accumulated in the forebay should be removed after each storm and disposed of properly. If silt does accumulate in a forebay it should be removed once ¼ of the volume has been reduced. Removal and disposal of the silt should be done according to local regulations.

PREVENTATIVE MAINTENANCE

The purpose of preventative maintenance is to assure that the BMP's remain operational and safe at all times, while minimizing the need for emergency and corrective maintenance.

1. Grass Cutting

A regularly scheduled program of mowing and trimming of grass at a BMP during the growing season will help to maintain a tightly knit turf, and will also help to prevent diseases, pests and the intrusion of weeds. The actual mowing requirements of an area should be tailored to the specific site conditions, grass type, and seasonal variations in the climate. In general, most turf of bioretention cells is located along the perimeter and interior side slopes of the cell. Grass should not be allowed to grow more than 2 to 3 inches between cuttings. Allowing the grass to grow more than this amount prior to cutting may result in damage to the grass' growing points and limit its continued healthy growth. Grass along the perimeter and side slopes should be kept between 6 and 12 inches tall to maintain proper operation of the facility and health of the overall turf.

2. Weeding

BMP areas require weeding of unwanted plant materials. Weeds utilize moisture that should be more readily available to desirable plants within the cell and should be removed on a monthly if not weekly basis. A substantial mulch layer should help to control the amount of weeds that will propagate within a cell.

3. Watering

During hot and dry periods it may be necessary to water a BMP area to maintain the health of the plant material. If plants wilt during the day, but recover at night then watering is not needed. If they do not recover it may be an indication that watering may be necessary. Alternatively an approximate way to check for appropriate moisture in the soil is to insert a screwdriver into the soil 4 inches, if the soil is moist at that depth, watering is not needed. If the soil is dry and the plants were planted within the last three years watering may be needed.

4. Fertilization

Typically fertilization within a BMP facility is not required due to the design facets of the facility that make it high in nutrients, specifically nitrogen. However if it does appear that fertilization is necessary, an organic fertilizer will provide nutrients as needed without disrupting the composition of the facilities implements planting soil. It should be noted that excess fertilization can lead to weak plant growth, promotes disease and pest outbreaks and may inhibit soil life.

5. Mulching

The facility should be inspected bimonthly for areas of thinning mulch. A thickness of 2" of mulch should be maintained over the facility at all times. The physical properties of the mulch aid in the removal of heavy metals from stormwater runoff. Re-mulching of

the entire bed should be completed approximately once every six to twelve months to maintain the appropriate mulch cover. Any areas devoid of a 2" thick layer of mulch should be reapplied immediately to maintain appropriate cover. It should also be noted that the mulch layer should be no thicker than three inches; a thicker layer can inhibit plant growth and oxygenation of the planting soil.

6. Dividing and Replanting

Herbaceous plants within the facility should thrive and expand and eventually an overcrowding situation could arise. If overcrowding becomes an issue, the perennial plants should be divided in the spring or fall. Plants that do not perform well, or die should also be replaced, possibly with the varieties that have thrived and require dividing.

7. Trimming and Harvesting

It is currently acceptable for ornamental grasses seed heads and perennial seed heads to be left standing during the winter to attract winter wildlife interest and beneficial insects. Most plants should not be cut back until spring when new growth emerges and then only to avoid a mass of spent plant growth lettered throughout the facility. Plants may be pinched, pruned, sheared or dead-headed during the growing season to encourage flowering, bushier plants or for a fresh set of leaves. Diseased or damaged plants limbs should be removed as necessary. If a plant is pest infested the plant shall be removed and the area cleaned up in the fall to prevent a winter time carry over. Trees and shrubs may be trimmed for shape or to maximize fruit production. Hardwoods should be trimmed/pruned in late winter or early spring before bud break to prevent damage of the tree/shrub.

8. Removal and Disposal of Trash and Debris

A regularly scheduled program of debris and trash removal from storm water BMP's will reduce the chance of outlet structures, trash racks and other components becoming clogged and inoperable during storm events. Any accumulation of trash along the flow diverters or overflow bypass inlet should be removed immediately. Additionally, removal of trash and debris will prevent possible damage to vegetated areas and eliminate potential mosquito breeding habitats. Disposal of debris and trash must comply with all local, county, state and federal waste flow control regulations. Only suitable disposal and recycling sites should be utilized.

9. Waste Disposal

When cleaning a BMP, standing "clear, unpolluted water" can be decanted and discharged to the storm sewer system. Water that has become turbid during cleaning should be either, (1) pumped and hauled to an acceptable wastewater disposal facility or (2) treated by filtration, such as pumped through a bag filter, and discharged to the sanitary sewer system.

Definitions

Clear water: Water that has settled its solids for 24 hours and can be pumped out of the BMP without re-suspending the solids.

Unpolluted water: Defined as meaning "any water that may be discharged under NPDES regulations into waters of the State without having to be authorized by a NPDES permit and which will not cause any violations of State or Federal water quality standards".

10. Sediment Removal and Disposal

Accumulated sediment should be removed before it threatens the operation or storage volume of a BMP. Disposal of sediment must comply with all local, county, state, and federal regulations, only suitable disposal sites should be utilized. The sediment removal program in infiltrations facilities must also include provisions for monitoring the porosity of the sub-base, and replacement or cleansing of the pervious materials as necessary. If the sediment deposit within the grass swales reaches a depth of one inch the swale should be cleaned immediately as described above.

11. Elimination of Potential Mosquito Breeding Habitats

The most effective mosquito control program is one that eliminates potential breeding habitats. Almost any stagnant pool of water can be attractive to mosquitoes, and the source of a large mosquito population. Ponded water in areas such as open cans and bottles, debris and sediment accumulations, and areas of ground settlement provide ideal locations for mosquito breeding. A maintenance program dedicated to eliminating potential breeding areas is certainly preferable to controlling the health and nuisance effects of flying mosquitoes.

13. Inspections

Regularly scheduled inspections of the facility should be performed by qualified inspectors. The primary purpose of the inspections is to ascertain the operational condition and safety of the facility, particularly the condition of embankments, outlet structures, and other safety-related aspects. Inspections will also provide information on the effectiveness of regularly scheduled Preventative and Aesthetic Maintenance procedures, and will help to identify where changes in the extent and scheduling of the procedures are warranted. Finally, the facility inspections should also be used to determine the need for and timing of Corrective Maintenance procedures. It should be noted that, in addition to regularly scheduled inspections, an informal inspection should be performed during every visit to a stormwater BMP by maintenance or supervisory personnel.

14. Reporting:

The recording of all maintenance work and inspections provide valuable data on the facility condition. Review of this information will also help to establish more efficient and beneficial maintenance procedures and practices. Along with the written reports, a chain of command for reporting and solving maintenance problems and addressing maintenance needs should be established. From field personnel to the stormwater

manager, everyone should be encouraged to report any problems or suggest any changes to the maintenance program.

CORRECTIVE MAINTENANCE

Corrective maintenance is required on a regular basis to correct problems or malfunctions and to restore the intended operation and safe condition of a BMP. Corrective maintenance can be performed on a routine or non-scheduled basis as site conditions dictate.

1. Removal of Debris and Sediment

Accumulation of sediment, debris or trash which impedes the operation and/or discharge capacity of a BMP should be removed and properly disposed of in a timely manner. Should any sediment accumulate within the bioretention facility, it should be removed immediately. Normal household garden tools are appropriate for removal of debris, trash and minor accumulations of sediment. A qualified landscape contractor should be employed for the removal of large sediment accumulations. The lack of an available disposal site should not delay the removal of trash debris and/or sediment. A temporary disposal sites may be utilized if necessary.

2. Dam, Embankment, and Slope Repairs

Any damage to dams, embankments, and side slopes must be repaired promptly. This damage can be the result of heavy rain or flooding, vandalism, animals, vehicles, or neglect. Typical minor problems include surface and/or rutting can be handled with the use of household garden tools. Minor problems that reoccur frequently may require the services of a contractor or landscaper to establish a permanent repair. Major damage such as seepage, embankment failure or sliding and severe cracking will require the services of a qualified contractor or landscaper with the equipment and personal necessary to complete necessary to complete the repairs. In some cases it may be necessary to employ a geotechnical engineer to review the damage and make recommendations for the proper repair work. The immediacy of the repairs will depend upon the nature of the damage and its effects on the operation and safety of the facility.

3. Dewatering

It may be necessary to remove ponded water from within a malfunctioning BMP. This ponding may be the result of a blocked principal outlet (detention facility), inoperable low level outlet (retention facility), loss of infiltration capacity (infiltration facility) or failed underdrain system. Portable pumps may be necessary to remove the ponded water temporarily until a permanent solution is devised and or repair can be implemented. Water should be pumped to the facilities overflow storm sewer or drainage facility.

4. Prevention/Extermination of Mosquitoes

If neglected, a BMP can readily become an ideal mosquito breeding area. Prevention of shallow ponding areas within the facilities will help to limit the number of breeding areas for mosquito larvae. Prevention includes removing trash such as cups or bags that may hold small amounts of water that are ideal breeding spots for mosquitos. It also

includes filling any ruts in the bottom of the basin and annual inspection of the underdrains to ensure that a drainage path in the bottom of facilities is maintained. If extermination of mosquitoes is necessary it will usually require the services of an expert, such as the local Mosquito Extermination Commission. Proper procedures carried out by trained personnel can control the mosquitoes with a minimum of damage or disturbance to the environment. If mosquito control in a facility becomes necessary, the preventative maintenance program should also be re-evaluated, and more emphasis placed on control of mosquito breeding habitats.

5. Erosion Repair

Vegetative cover or other protective measures are necessary to prevent the loss of soil from the erosive forces of wind and water. Where a re-seeding program has not been effective in maintaining a non–erosive vegetative cover, or other factors have exposed soils to erosion, corrective steps should be initiated to prevent further loss of soil and any subsequent danger to the stability of the facility. Soil loss can be controlled by a variety of materials and methods, including riprap, sod, seeding, and re-grading. The local Soil Conservation District can provide valuable assistance in recommending materials and methodologies to control erosion.

6. Elimination of Brush, Roots and Animal Burrows

The stability of dams, embankments, and side slopes can be impaired by large roots and animal burrows. Additionally, burrows can present a safety hazard for maintenance personnel. Brush with extensive, woody root systems should be completely removed from dams and embankments that are not a part of a BMP facility to prevent their destabilization and the creation of seepage routes. Roots should also be completely removed to prevent their decomposition within the dam or embankment. Root voids and burrows should be plugged by filling with material similar to the existing material, and capped just below grade with stone, concrete or other material, If plugging of the burrows does not discourage the animals from returning, further measures should be taken to either remove the animal population or to make critical areas of the facility unattractive to them.

7. Snow and Ice Removal

Accumulations of snow and ice can threaten the functioning of a BMP, particularly at inlets, outlets, and emergency spillways. Providing the equipment, materials and personnel to monitor and remove snow and ice from these critical areas is necessary to assure the continued functioning of the facility during the winter months.

HAZARDOUS WASTE

The following general guidance is based on the federal regulations, 40 CFR 262.11-Hazardous Waste Determination. (Note-regulations are subject to change in the future and this is offered only as general information available at this time.) The generator of the waste should determine if the waste is a special waste using the following method:

1. Determine if the waste is excluded from being a hazardous waste per 10 CSR 25-4.261(2)(A) and 40 CFR 261.4; then

2. Determine if the waste is listed as a hazardous waste per 10 CSR 25-4.261(2)(D) and 40 CFR 261 subpart D; then
3. Determine if the waste is a characteristic hazardous waste (i.e. ignitable, corrosive, reactive, or toxic). Consider the materials used or the processes used to generate the waste based on this knowledge, determine the appropriate testing and analysis in accordance with 10 CSR 25-4.261(2)(C) and 40 CFR 261 subpart C.

Testing for hazardous waste characteristics requires sampling at the point of generation. If the analyses detect any property characteristic of hazardous waste, you must manage the waste as a hazardous waste. It is very important to understand that hazardous waste remains a hazardous waste when diluted or stabilized, unless it is specifically excluded from the definition of hazardous after the process (40 CFR 261.3). You may not dilute hazardous waste solely for the purpose of rendering it non-hazardous, unless dilution is warranted in an emergency response situation or where the dilution is part of a hazardous waste treatment process regulation or exempted under 10 CSR 25-7 or 10 CSR 25-9. You may not dispose of regulated hazardous wastes in any sanitary, demolition, utility waste landfill in Missouri.

The following table lists typical properties of characteristic hazardous waste. This is not a complete listing, but only a guideline to determine if a waste may be a characteristic hazardous waste.

Ignitability:

Catches fire easily through friction, absorption or moisture or spontaneous chemical changes.

Corrosivity:

pH<2.0 prpH>12.5

Reactivity:

Wastes that are normally unstable, react violently with water, can explode or release poisonous gases.

Toxicity:

TCLP, EPA Method 1311, any contaminates listed in Table 1 or 40 CFR 261.24 equal or greater than the listed concentration.

Once the waste is determined to be non-hazardous and contain no free liquids, you must request approval from the owner/operator to dispose of the special waste at the landfill by filling out and signing the generator's portion of the Special Waste Disposal Request Form. You must identify health hazards associated with the material, as well as any special shipping, handling or safety requirements. For example, note whether the material should be transported in covered containers or whether it is a respiratory hazard. The material Safety Data Sheet, if one exists for the material, lists some of this information. The completed Special Waste Disposal Request Form, along with appropriate test results and other pertinent information are then sent to the receiving landfill for the landfill owner or operator's review and signature prior to acceptance and disposal of the waste. Until a landfill accepts the water for disposal, it is the owner's responsibility to manage the waste in an environmentally sound manner. Free liquids must have pollutant components removed to or below regulatory thresholds before the

free liquid may be discharged to the environment, or pretreatment or treatment facility, as and where allowable by the local authority or jurisdiction. Do not discharge the liquids or liquid slurry, captured by the cleaning and maintenance process into any storm or sanitary structures.

Approved wastes shall be disposed of at the West Lake Quarry and Material Company landfill located at 13550 St. Charles Rock Road, Bridgeton, MO 63044, or approved equivalent.

MAINTENANCE ACCESS

All storm water BMP's are an integral part of this project. Access to the storm water BMP's shall be restricted for maintenance purposes only. The storm water BMP's are **not** to be considered as playgrounds or used for recreational activities. All signage identifying the designated storm water BMP's and areas shall be maintained. All access restrictions shall be enforced by the owner.

WATER QUALITY BMP MAINTENANCE

Maintenance of the water quality areas (Wet Ponds/Lakes, Wet Extended Detention (ED) Ponds and Infiltration Basins/Trench) is critical to its performance specifically during the first four years following its construction. During the first year following construction the water quality areas maintenance should occur monthly during the growing season and quarterly for the rest of the year and from that point forward.

Inspection of the water quality areas will determine which of the aforementioned general maintenance procedures need to be undertaken and to what degree. All water quality areas components must be inspected for clogging and/or excessive debris and sediment accumulation every three months. Such components include inlet locations, pre-treatment/forebay areas, plant materials, trench bed and overflow structures.

Specific maintenance operations for water quality areas facilities can also include sediment removal which should take place when all runoff has drained from the facility and when the facility is reasonably dry and/or drained so that removal of the material does not cause more damage than necessary. In addition, the inflow shall be blocked so that the stormwater will bypass the facility until such time as it is deemed operational. When establishing or restoring vegetation, monthly inspections of vegetation health should be performed during the first growing season or until vegetation is established. Once established, inspections should be performed every three months. If vegetation has greater than 50% damage, the area should be re-established in accordance with the original specifications and the inspection requirements presented above. All use of fertilizers, mechanical treatments, pesticides and other means to assure optimum vegetation health must not compromise the intended purpose of the water quality planting areas. The normal drain or drawdown time should be used to evaluate the BMP actual performance. If significant increases or decreases in the normal drain time are observed, the planting area, trench system, and tailwater levels must be evaluated and appropriate measures taken to comply with the maximum drain or drawdown time requirements and maintain the proper functioning of the facility. If the water fails to drain or drawdown after the end of a storm, corrective measures must be taken.

POND MAINTENANCE & INSPECTION SCHEDULE

3.2.1.7 Inspection and Maintenance Requirements

Table 3.2.1-1 Typical Maintenance Activities for Ponds
(Source: WMI, 1997)

Activity	Schedule
• Clean and remove debris from inlet and outlet structures. • Mow side slopes.	Monthly
• If wetland components are included, inspect for invasive vegetation.	Semiannual Inspection
• Inspect for damage, paying particular attention to the control structure. • Check for signs of eutrophic conditions. • Note signs of hydrocarbon build-up, and remove appropriately. • Monitor for sediment accumulation in the facility and forebay. • Examine to ensure that inlet and outlet devices are free of debris and operational. • Check all control gates, valves or other mechanical devices.	Annual Inspection
• Repair undercut or eroded areas.	As Needed
• Perform wetland plant management and harvesting.	Annually (if needed)
• Remove sediment from the forebay.	5 to 7 years or after 50% of the total forebay capacity has been lost
• Monitor sediment accumulations, and remove sediment when the pool volume has become reduced significantly, or the pond becomes eutrophic.	10 to 20 years or after 25% of the permanent pool volume has been lost

Additional Maintenance Considerations and Requirements

- A sediment marker should be located in the forebay to determine when sediment removal is required.
- Sediments excavated from stormwater ponds that do not receive runoff from designated hotspots are not considered toxic or hazardous material and can be safely disposed of by either land application or landfilling. Sediment testing may be required prior to sediment disposal when a hotspot land use is present.
- Periodic mowing of the pond buffer is only required along maintenance rights-of-way and the embankment. The remaining buffer can be managed as a meadow (mowing every other year) or forest.
- Care should be exercised during pond drawdowns to prevent downstream discharge of sediments, anoxic water, or high flows with erosive velocities. The approving jurisdiction should be notified before draining a stormwater pond.

⚠ Regular inspection and maintenance is critical to the effective operation of stormwater ponds as designed. Maintenance responsibility for a pond and its buffer should be vested with a responsible authority by means of a legally binding and enforceable maintenance agreement that is executed as a condition of plan approval.

INFILTRATION TRENCH MAINTENANCE & INSPECTION SCHEDULE

3.2.5.7 Inspection and Maintenance Requirements

Table 3.2.4-2 Typical Maintenance Activities for Infiltration Trenches
(Source: EPA, 1999)

Activity	Schedule
• Ensure that contributing area, facility and inlets are clear of debris. • Ensure that the contributing area is stabilized. • Remove sediment and oil/grease from pretreatment devices, as well as overflow structures. • Mow grass filter strips should be mowed as necessary. Remove grass clippings.	Monthly
• Check observation wells following 3 days of dry weather. Failure to percolate within this time period indicates clogging. • Inspect pretreatment devices and diversion structures for sediment build-up and structural damage. • Remove trees that start to grow in the vicinity of the trench.	Semi-annual Inspection
• Replace pea gravel/topsoil and top surface filter fabric (when clogged).	As needed
• Perform total rehabilitation of the trench to maintain design storage capacity. • Excavate trench walls to expose clean soil.	Upon Failure

Additional Maintenance Considerations and Requirements

- A record should be kept of the dewatering time of an infiltration trench to determine if maintenance is necessary.
- Removed sediment and media may usually be disposed of in a landfill.

⚠ Regular inspection and maintenance is critical to the effective operation of infiltration trench facilities as designed. Maintenance responsibility for a infiltration trench should be vested with a responsible authority by means of a legally binding and enforceable maintenance agreement that is executed as a condition of plan approval.

SURFACE SAND FILTER MAINTENANCE & INSPECTION SCHEDULE

3.2.4.7 Inspection and Maintenance Requirements

Table 3.2.4-1. Typical Maintenance Activities for Sand Filters
(Source: WMI, 1997; Pitt, 1997)

Activity	Schedule
• Ensure that contributing area, facility, inlets and outlets are clear of debris. • Ensure that the contributing area is stabilized and mowed, with clippings removed. • Remove trash and debris. • Check to ensure that the filter surface is not clogging (also check after moderate and major storms). • Ensure that activities in the drainage area minimize oil/grease and sediment entry to the system. • If permanent water level is present (perimeter sand filter), ensure that the chamber does not leak, and normal pool level is retained.	Monthly
• Check to see that the filter bed is clean of sediment, and the sediment chamber is not more than 50% full or 6 inches, whichever is less, of sediment. Remove sediment as necessary. • Make sure that there is no evidence of deterioration, spalling or cracking of concrete. • Inspect grates (perimeter sand filter). • Inspect inlets, outlets and overflow spillway to ensure good condition and no evidence of erosion. • Repair or replace any damaged structural parts. • Stabilize any eroded areas. • Ensure that flow is not bypassing the facility. • Ensure that no noticeable odors are detected outside the facility.	Annually
• If filter bed is clogged or partially clogged, manual manipulation of the surface layer of sand may be required. Remove the top few inches of sand, roto-till or otherwise cultivate the surface, and replace media with sand meeting the design specifications. • Replace any filter fabric that has become clogged.	As needed

Additional Maintenance Considerations and Requirements

- A record should be kept of the dewatering time for a sand filter to determine if maintenance is necessary.
- When the filtering capacity of the sand filter facility diminishes substantially (i.e., when water ponds on the surface of the filter bed for more than 48 hours), then the top layers of the filter media (topsoil and 2 to 3 inches of sand) will need to be removed and replaced. This will typically need to be done every 3 to 5 years for low sediment applications, more often for areas of high sediment yield or high oil and grease.
- Removed sediment and media may usually be disposed of in a landfill.

⚠ Regular inspection and maintenance is critical to the effective operation of sand filter facilities as designed. Maintenance responsibility for a sand filter system should be vested with a responsible authority by means of a legally binding and enforceable maintenance agreement that is executed as a condition of plan approval.

WATER QUALITY

Water quality for the proposed improvements associated with the Villages at Shady Creek development will be provided in six basins. Details of the water quality requirements are outlined on the next several pages and drainage areas for the BMP are attached.

DRAINAGE AREA POI #1

Drainage area for POI #1 consists of the northwestern portion of the site and the stormwater runoff generated from the area will be treated within the Wet Extended Detention (ED) Pond/Basin G.

Wet Extended Detention (ED) Pond/Basin G:

Basin G is located at the northwestern end of the development, located along the rear of lots 260-266. The tributary area to Basin G is **20.74** Ac. which consists of the northwestern portion of the site and some offsite area. The limits of the drainage area are shown on the exhibit attached to this report. The total onsite area to the Basin G is **14.26** Ac, **5.44** acres of that area is comprised of impervious areas such as roof, pavement and sidewalk areas.

From this information the required water quality volume for the basin was determined:

WATER QUALITY VOLUME

Where:

P	=	1.14 in
A_{TOT}	=	Total Drainage Basin Area
A_{IMP}	=	Impervious Area (roofs, pavement & sidewalk areas)
R_v	=	0.05 + 0.009(I)
I	=	A_{IMP} / A_{TOT}

WQ_v	=	(P)(R_v)(A)/12
R_v	=	0.05 + 0.009(I); 0.05+0.009(**38.15%**) = **0.3934**
WQ_v	=	[(1.14)(**0.3934**)(**14.26**)]/12 = **0.5329**
	=	**0.5329**ac. ft. x 43,560 sq. ft./ac = **23,212 ft^3** Req'd Volume
		WQ_v required above permanent pool is **50% = 11,606 ft^3**

The forebays are required to have a minimum pretreatment volume of 25% of the water quality volume calculated for area P.O.I.#1 or **5,803** ft^3. The forebays have a bottom elevation of 628.00 and 630.00 and a total volume of **7,199** ft^3 at elevation 631.5. Therefore the pretreatment volume is met for the forebay.

Outflow from the forebay is through a rock dyke. Details and sections of the forebay and basin are shown on the exhibit attached.

The overall basin BMP facility, including forebays, must have a volume equal to 100% of the overall water quality volume requirement (50% below the permanent pool elevation and 50% above the permanent pool elevation). Basin G has a bottom elevation of 624 and a normal ponding elevation of 631.50, a total volume of **14,074** ft^3 between elevation 631.5 and 632.00 is provided in the BMP. Also a total volume of **79,742** ft^3 between elevation 624.0 and 631.50 is provided in the BMP meeting the required volume of **11,606 ft^3**.

Basin G storage volume provided:

Elev.	Area sq. ft.	Vol. cu. ft.	Vol. Sum. cu. ft.
624.00	3,849	0	0
626.00	6,449	10,187	10,187
628.00	10,135	16,446	26,633
630.00	14,332	24,346	50,979
631.50	24,468	28,763	79,742
632.00	31,997	14,074	93,816
634.00	44,164	75,835	169,651
636.00	54,025	98,024	267,675
637.50	61,589	86,649	354,323

Forbays - Basin G storage volume provided:

Elev.	Area sq. ft.	Vol. cu. ft.	Vol. Sum. cu. ft.
628.00	816	0	0
630.00	1,883	2,626	2,626
630.50	2,276	1,038	3,664
631.00	3,412	1,412	5,076
631.50	5,137	2,123	7,199
632.00	6,892	2,997	10,195
634.00	12,594	19,202	29,397

Basin G Summary :

WQ_v	=	**23,212 ft^3**
$WQ_{v50\%}$	=	**11,606 ft^3**
Forebay Volume Required ($WQ_{v25\%}$)	=	**5,803 ft^3**
Forebay Volume Provided	=	**7,199 ft^3**
Basin Volume (including forebays) Total Provided	=	**93,816 ft^3**

DRAINAGE AREA POI #2

Drainage area for POI #2 consists of the northeastern portion of the site and the stormwater runoff generated from the area will be treated in the Wet Pond H.

Wet Pond H:

Wet pond H is located at the northeastern end of the development, located east of Lake Saint Louis Blvd. along the rear of lots 285-287. The tributary area to Basin H is **8.55**Ac. which consists of the northeastern portions of the site. The limits of the drainage area are shown on the exhibit attached to this report. The total area to the Basin H is **8.55** Ac, **2.82** acres of that area is comprised of impervious areas such as roof, pavement and sidewalk areas.

Total of Area P.O.I. #2:	**8.55**Acres
Impervious Area:	**2.82**Acres
% Impervious of Area P.O.I. #2:	**32.98%**

From this information the required water quality volume for the basin was determined:

WATER QUALITY VOLUME

Where:

P	=	1.14 in
A_{TOT}	=	Total Drainage Basin Area
A_{IMP}	=	Impervious Area (roofs, pavement & sidewalk areas)
R_v	=	0.05 + 0.009(I)
I	=	A_{IMP} / A_{TOT}

WQ_v	=	(P)(R_v)(A)/12
R_v	=	0.05 + 0.009(I); 0.05+0.009(**32.98%**) = **0.3468**
WQ_v	=	[(1.14)(**0.3468**)(**8.55**)]/12 = **0.2817**
	=	**0.2817**ac. ft. x 43,560 sq. ft./ac = **12,271ft^3** Req'd Volume

The forebays are required to have a minimum pretreatment volume of 25% of the water quality volume calculated for area P.O.I. #2 or **3,068**ft^3. The forebays have a bottom elevation of 626.00 and a total volume of **4,762**ft^3 at elevation 633.00. Therefore the pretreatment volume is met for the forebay.

The proposed pond has been designed to have a minimum 10 foot wide aquatic bench. The aquatic bench fluctuates in water depth from 0 inches to 12 inches. The normal water elevation of the pond is designed as 637.00.

By providing a permanent pool and aquatic bench the water quality requirement is met by wet pond H. For details see the plans.

Basin H storage volume provided:

Elev.	Area sq. ft.	Vol. cu. ft.	Vol. Sum. cu. ft.
624.00	2,541	0	0
626.00	3,761	6,262	6,262
628.00	5,234	8,955	15,217
630.00	6,966	12,159	27,376
632.00	8,923	15,849	43,224
634.00	11,011	19,897	63,122
636.00	13,225	24,202	87,324
637.00	19,273	16,154	103,478
638.00	21,215	20,236	123,715
640.00	25,268	46,424	170,139
641.00	27,380	26,317	196,456

Forebays - Basin H storage volume provided:

Elev.	Area sq. ft.	Vol. cu. ft.	Vol. Sum. cu. ft.
626.00	4	0	0
628.00	173	136	136
630.00	612	740	876
632.00	1,408	1,966	2,841
634.00	2,484	3,841	6,683

DRAINAGE AREA POI #3

Drainage area for POI #3 consists of the north central portions of the site and the stormwater runoff generated from the area will be treated in the Wet Pond E.

Wet Pond E:

Wet pond E is located in the north central portion of the site. The total disturbed area contributory to pond E is **75.46** Ac. which consists of the north central portion of the site and some offsite areas. The total onsite area to the pond E is **71.67** Ac, **27.09** acres of that area is comprised of impervious areas such as roof, pavement and sidewalk areas.

Total of Area P.O.I. #3:	**71.67**Acres
Impervious Area:	**27.09**Acres
% Impervious of Area P.O.I. #3:	**37.80%**

From this information the required water quality volume for Wet pond E was determined:

WQ_v = $(P)(R_v)(A)/12$

R_v = $0.05 + 0.009(I)$; $0.05+0.009(\mathbf{37.80\%}) = \mathbf{0.3902}$

WQ_v = $[(1.14)(\mathbf{0.3902})(\mathbf{71.67})]/12 = \mathbf{2.6567}$

= **2.6567**ac. ft. x 43,560 sq. ft./ac = **115,727 ft^3** Req'd Volume

The forebay is required to have a minimum pretreatment volume of 25% of the water quality volume calculated for area P.O.I. #3 or **28,932**ft^3. The forebay has a bottom elevation of **590.00**and a total volume of **30,350**ft^3 at a depth of 5 feet. Therefore the pretreatment volume is met for the forebay.

The proposed pond has been designed to have a minimum 12 foot wide aquatic bench. The aquatic bench fluctuates in water depth from 0 inches to 12 inches. The normal water elevation of the pond is designed as 602.00.

By providing a permanent pool and aquatic bench the water quality requirement is met by wet pond E. For details see the plans.

Basin E storage volume provided:

Elev.	Area sq. ft.	Vol. cu. ft.	Vol. Sum. cu. ft.
582.00	19,283	0	0
584.00	23,370	42,588	42,588
586.00	27,735	51,043	93,630
588.00	32,369	60,044	153,675
590.00	40,829	73,034	226,709
592.00	47,781	88,519	315,228
594.00	55,201	102,893	418,121
596.00	63,150	118,262	536,383
598.00	71,624	134,685	671,068
600.00	80,621	152,156	823,224
601.00	87,013	83,797	907,021
602.00	105,767	96,238	1,003,259
604.00	117,580	223,243	1,226,501
606.00	143,021	260,186	1,486,688

Forebay - Basin E storage volume provided:

Elev.	Area sq. ft.	Vol. cu. ft.	Vol. Sum. cu. ft.
590.00	3,580	0	0
592.00	5,409	8,926	8,926
594.00	7,463	12,817	21,746
596.00	9,802	17,212	38,955
598.00	12,422	22,172	61,128
600.00	15,322	27,693	88,821

DRAINAGE AREA POI #4

Drainage area for POI #4 consists of the south central portions of the site and the stormwater runoff generated from the area will be treated in the Wet Pond C.

Wet Pond C:

Wet pond C is located to the south central portion of the site. The total disturbed area contributory to pond C is **25.84** which consists of the south central portion of the site and some offsite area. The total onsite area to the pond C is **24.11** Ac, **8.05** acres of that area is comprised of impervious areas such as roof, pavement and sidewalk areas.

Total of Area P.O.I. #4:	**24.11**Acres
Impervious Area:	**8.05**Acres
% Impervious of Area P.O.I. #4:	**32.94%**

From this information the required water quality volume for Wet pond C was determined:

WQ_v = (P)(R_v)(A)/12

R_v = 0.05 + 0.009(I); 0.05+0.009(**33.39%**) = **0.3505**

WQ_v = [(1.14)(**0.3505**)(**24.11**)]/12 = **0.8028**

= **0.8028**ac. ft. x 43,560 sq. ft./ac = **34,970 ft^3** Req'd Volume

The forebay is required to have a minimum pretreatment volume of 25% of the water quality volume calculated for area P.O.I. #4 or **87,250**ft^3. The forebay has a bottom elevation of **590.00**and a total volume of **12,891**ft^3 at a depth of 5 feet. Therefore the pretreatment volume is met for the forebay.

The proposed pond has been designed to have a minimum 12 foot wide aquatic bench. The aquatic bench fluctuates in water depth from 0 inches to 12 inches. The normal water elevation of the pond is designed as 598.50.

By providing a permanent pool, aquatic bench the water quality requirement is met by wet pond C. For details see the plans.

Infiltration Basin C storage volume provided:

Elev.	Area sq. ft.	Vol. cu. ft.	Vol. Sum. cu. ft.
582.00	6,588	0	0
584.00	9,499	15,998	15,998
586.00	12,914	22,326	38,324
588.00	16,731	29,563	67,887
590.00	21,717	38,340	106,227
592.00	28,055	49,637	155,864
594.00	35,260	63,178	219,042
596.00	42,914	78,049	297,090
597.50	49,039	68,914	366,004
598.00	57,775	26,674	392,678
598.50	67,313	31,242	423,919
600.00	75,130	106,779	530,698
600.50	94,402	42,291	572,989
602.00	103,542	148,405	721,395

Forebay - Basin C storage volume provided:

Elev.	Area sq. ft.	Vol. cu. ft.	Vol. Sum. cu. ft.
590.00	707	0	0
591.00	1,281	980	980
592.00	1,998	1,626	2,606
594.00	3,687	5,599	8,206
596.00	5,760	9,370	17,576
597.00	6,976	6,358	23,934

DRAINAGE AREA POI #6A

Drainage area for POI #6A consists of the southwestern portions of the site and the stormwater runoff generated from the area will be treated in the Infiltration Basin A.

Water Quality Basin A:

Basin A is located at the southwestern end of the development across Wyndgate Valley Drive from lot 12. The tributary area to Basin A is **8.62**Ac. which consists of the southwestern portions of the site and some offsite area. The limits of the drainage area are shown on the exhibit attached to this report. The total onsite area to Basin A is **4.65** Ac, **1.29** acres of that area is comprised of impervious areas such as roof, pavement and sidewalk areas.

From this information the required water quality volume for the basin was determined:

WATER QUALITY VOLUME

Where:

P	=	1.14 in
A_{TOT}	=	Total Drainage Basin Area
A_{IMP}	=	Impervious Area (roofs, pavement & sidewalk areas)
R_v	=	0.05 + 0.009(I)
I	=	A_{IMP} / A_{TOT}

WQ_v = (P)(R_v)(A)/12

R_v = 0.05 + 0.009(I); 0.05+0.009(**27.74%**) = **0.2997**

WQ_v = [(1.14)(**0.2997**)(**4.65**)]/12 = **0.1324**

= **0.1324**ac. ft. x 43,560 sq. ft./ac = **5,767 ft^3** Req'd Volume

The forebay is required to have a minimum pretreatment volume of 25% of the water quality volume calculated for area P.O.I. 6A or **1,442**ft^3. The forebay has a bottom elevation of **550** and a total volume of **2,213**ft^3 at a depth of 24 inches. Therefore the pretreatment volume is met for the forebay.

Outflow from the forebay is through a rock dyke. Details and sections of the forebay and basin are shown on the exhibit attached.

The overall basin BMP facility, including forebay, must have a volume equal to 75% of the overall water quality volume requirement of **4,325**ft^3. The filter cell has a bottom elevation of 550 and also includes an infiltration bed area which consists of 3 layers (6" of sand bottom, 36" of clean rock and 2" of pea gravel top layer). The voids volume within the 3' clean rock trench is (3,664 sq. ft. surface area) x (3 ft. deep layer) = 10,992 cu. ft. x 40% void ratio = **4,397** cu. ft. which is greater then the required volume.

Basin A storage volume provided:

Elev.	Area sq. ft.	Vol. cu. ft.	Vol. Sum. cu. ft.
550.00	5,895	0	0
552.00	8,983	14,770	14,770
554.00	12,275	21,173	35,943
555.00	13,922	13,090	49,032

Forebays - Basin A storage volume provided:

Elev.	Area sq. ft.	Vol. cu. ft.	Vol. Sum. cu. ft.
550.00	785	0	0
552.00	1,463	2,213	2,213

In addition to the required volume, the filter must also meet a surface area requirement as stated in Chapter 3 of the Georgia Stormwater manual. Per the manual the Infiltration Trench shall have a required filter bed area per the following equation:

$A_f = (WQ_v) / [(n)(d_f) + (k)(t_f)/12]$

Where:

A_f	=	surface area (ft^2)
WQ_v	=	water quality volume (ft^3)
d_f	=	trench depth (ft) = 3 ft per Typical Detail
k	=	coeff of percolation/permeability of filter (in/hour) = 10.0 in/hour
t_f	=	design fill time (hours) = 2.0 hours
n	=	porosity = 0.32

A_f = (**5,767** ft^3) / [(**0.32**)(**3.0** ft) + (**6.0** in/hour)(**2.0** hours)/12] = (**5,767** ft^3) / (**1.96**ft) = **2,942 ft^2**

The basin has a filter bed area of **3,664 ft^2**; therefore the minimum filter bed area requirement is met.

Basin A Summary :

WQ_v	=	**5,767 ft^3**
$WQ_{v75\%}$	=	**4,325 ft^3**
Forebay Volume Required ($WQ_{v25\%}$)	=	**1,442 ft^3**
Forebay Volume Provided	=	**2,213 ft^3**
Filter Surface Area Required	=	**2,942 ft^2**
Filter Surface Area Provided	=	**3,664 ft^2**
Basin Volume (including forebays) Total Provided	=	**14,770 ft^3**

DRAINAGE AREA POI #6B

Drainage area for POI #6B consists of the southeastern portions of the site and the stormwater runoff generated from the area will be treated in the Sand Filter Basin B.

Water Quality Basin B:

Basin B is located at the southeastern end of the development along the rear of lots 18-21. The tributary area to the basin is **10.86**Ac. which consists of the southeastern portions of the site and some offsite area. The limits of the drainage area are shown on the exhibit attached to this report. The total onsite area to Basin B is **10.64** Ac, **2.90** acres of that area is comprised of impervious areas such as roof, pavement and sidewalk areas.

From this information the required water quality volume for the basin was determined:

WATER QUALITY VOLUME

Where:

P	=	1.14 in
A_{TOT}	=	Total Drainage Basin Area
A_{IMP}	=	Impervious Area (roofs, pavement & sidewalk areas)
R_v	=	0.05 + 0.009(I)
I	=	A_{IMP} / A_{TOT}

WQ_v	=	(P)(R_v)(A)/12
R_v	=	0.05 + 0.009(I); 0.05+0.009(**27.26%**) = **0.2953**
WQ_v	=	[(1.14)(**0.2953**)(**10.64**)]/12 = **0.2985**
	=	**0.2985**ac. ft. x 43,560 sq. ft./ac = **13,004ft^3** Req'd Volume

The forebays are required to have a minimum pretreatment volume of 25% of the water quality volume calculated for area P.O.I. 6B or **3,251**ft^3. The forebays have a bottom elevation of **552** and a total volume of **3,712**ft^3 at a depth of 12 inches. Therefore the pretreatment volume is met for the forebays.

Outflow from the forebays is through a rock dyke. Details and sections of the forebays and basin are shown on the exhibit attached.

The overall basin BMP facility, including forebays, must have a volume equal to 75% of the overall water quality volume requirement of **9,753**ft^3. The filter cell has a bottom elevation of 551.70 and at a ponding depth of 1.3 feet in the soil filter cell and including the forebay, a total volume of **11,269**ft^3 at 553.00 is provided in the BMP.

Basin B storage volume provided:

Elev.	Area sq. ft.	Vol. cu. ft.	Vol. Sum. cu. ft.
551.70	4,539	0	0
552.00	8,429	1,915	1,915
553.00	10,310	9,354	11,269
554.00	12,248	11,265	22,534

Forebays - Basin B storage volume provided:

Elev.	Area sq. ft.	Vol. cu. ft.	Vol. Sum. cu. ft.
552.00	3,137	0	0
553.00	4,319	3,712	3,712

In addition to the required volume, the filter must also meet a surface area requirement per the following equation:

$A_f = (WQ_v)(d_f)/[(k)(h_f+d_f)(t_f)]$

Where:
WQ_v = Computed Water Quality Vol – ft^3
d_f = Thickness of the filter bed media – 1.5 ft
k = Permeability Coefficient of the soil – 3.5 ft/day
h_f = Avg. height of water above filter media – 0.65 ft
t_f = Design filter bed drain time – 1.67 days

A_f = (**13,004**ft^3)(1.5 ft) / [(3.5 ft/day) (0.65 ft + 1.5 ft) (1.67 days)]= **1,552** ft^2

The basin has a filter bed area of **2,000** ft^2; therefore the minimum filter bed area requirement is met.

The forebays must also meet a surface area requirement and is determined from the following equation:

$A_{sf} = 0.066(WQ_v)$
$A_{sf} = 0.066$(**13,004**) = **858** ft^2

The total surface area of the forebays is **3137** ft^2 so the requirement is met.

Basin B Summary :

WQ_v	=	**13,004 ft^3**
$WQ_{v75\%}$	=	**9,753 ft^3**
Forebay Volume Required ($WQ_{v25\%}$)	=	**3,251 ft^3**
Forebay Volume Provided	=	**3,712 ft^3**
Filter Surface Area Required	=	**1,552 ft^2**
Filter Surface Area Provided	=	**2,000 ft^2**
Sand Filter Volume (including forebays) Total Provided	=	**11,269 ft^3**

Flood Protection:

Under pre-developed conditions there are six outfall points that will be analyzed. The North Watershed consists of outfall points P.O.I. #1 and P.O.I. #2. The South Watershed consists of outfall points P.O.I. #3, P.O.I. #4, P.O.I. #5 and P.O.I. #6. A pre-developed drainage area exhibit is attached and shows the limits of the existing drainage areas, the outfall points and the time of concentration flowpaths.

The post developed area to the proposed basins is shown on the following Post-Developed Drainage Area Map attached. The North Watershed consists of outfall points P.O.I. #1 and P.O.I. #2. The South Watershed consists of outfall points P.O.I. #3, P.O.I. #4, P.O.I. #5 and P.O.I. #6. The composition of the ground modeled, the time of concentration flowpaths are all labeled on the exhibit. The detention basin was designed based a comparison of the peak discharges at each point of interest for both existing and proposed conditions. The following is a summary of the results of the analysis:

STORM EVENT	PEAK DISCHARGE @ THE POINTS OF INTEREST	
	EXISTING	PROPOSED
1 Year – P.O.I. #1	**22.12**cfs	**3.80**cfs
2 Year – P.O.I. #1	**33.12**cfs	**6.68**cfs
25 Year – P.O.I. #1	**87.95**cfs	**21.08**cfs
100 Year – P.O.I. #1	**117.53**cfs	**26.63**cfs
1 Year – P.O.I. #2	**8.32**cfs	**2.87**cfs
2 Year – P.O.I. #2	**12.64**cfs	**4.34**cfs
25 Year – P.O.I. #2	**34.38**cfs	**16.16**cfs
100 Year – P.O.I. #2	**46.28**cfs	**47.73**cfs

1 Year – P.O.I. #3	**54.04**cfs	**27.98**cfs
2 Year – P.O.I. #3	**85.21**cfs	**45.52**cfs
25 Year – P.O.I. #3	**246.37**cfs	**194.58**cfs
100 Year – P.O.I. #3	**335.27**cfs	**231.88**cfs
1 Year – P.O.I. #4	**12.94**cfs	**2.26**cfs
2 Year – P.O.I. #4	**21.96**cfs	**3.60**cfs
25 Year – P.O.I. #4	**71.46**cfs	**24.51**cfs
100 Year – P.O.I. #4	**99.84**cfs	**46.22**cfs
1 Year – P.O.I. #5	**1.72**cfs	**0.49**cfs
2 Year – P.O.I. #5	**2.69**cfs	**0.69**cfs
25 Year – P.O.I. #5	**7.73**cfs	**1.61**cfs
100 Year – P.O.I. #5	**10.51**cfs	**2.09**cfs
1 Year – P.O.I. #6	**20.38**cfs	**30.34**cfs
2 Year – P.O.I. #6	**32.66**cfs	**45.73**cfs
25 Year – P.O.I. #6	**96.97**cfs	**122.81**cfs
100 Year – P.O.I. #6	**132.90**cfs	**164.33**cfs

STORM EVENT	**PEAK DISCHARGE @ THE POINTS OF INTEREST COMBINED NORTH WATERSHED P.O.I. #1 & P.O.I. #2**	
	EXISTING	PROPOSED
1 Year – P.O.I. NORTH	**30.44**cfs	**6.67**cfs
2 Year – P.O.I. NORTH	**45.76**cfs	**11.02**cfs

25 Year – P.O.I. NORTH	122.33cfs	37.24cfs
100 Year – P.O.I. NORTH	163.81cfs	74.36cfs

STORM EVENT	PEAK DISCHARGE @ THE POINTS OF INTEREST COMBINED SOUTH WATERSHED P.O.I. #3, P.O.I. #4, P.O.I. #5 & P.O.I. #6	
	EXISTING	PROPOSED
1 Year – P.O.I. SOUTH	89.08cfs	61.07cfs
2 Year – P.O.I. SOUTH	142.52cfs	95.54cfs
25 Year – P.O.I. SOUTH	422.53cfs	343.51cfs
100 Year – P.O.I. SOUTH	578.52cfs	444.52cfs

Water Quality Basin #A High Water Elevations: (Dam = 555.00)

	1yr 24hr	2yr 24hr	25yr 24hr	100yr 24hr
Basin	551.24	551.55	553.60	554.05

Water Quality Basin #B High Water Elevations: (Dam = 554.00)

	1yr 24hr	2yr 24hr	25yr 24hr	100yr 24hr
Basin	553.17	553.30	553.63	553.77

Detention Basin #C High Water Elevations: (Dam = 602.00)

	1yr 24hr	2yr 24hr	25yr 24hr	100yr 24hr
Basin	599.29	599.65	600.40	600.70

Detention Basin #D High Water Elevations: (Dam = 620.00)

	1yr 24hr	2yr 24hr	25yr 24hr	100yr 24hr
Basin	615.21	615.64	617.27	618.09

Detention Basin #E High Water Elevations: (Dam = 606.00)

	1yr 24hr	2yr 24hr	25yr 24hr	100yr 24hr
Basin	602.95	603.31	604.43	605.00

Detention Basin #F High Water Elevations: (Dam = 618.00)

	1yr 24hr	2yr 24hr	25yr 24hr	100yr 24hr
Basin	614.85	615.16	616.40	617.02

Detention Basin #G High Water Elevations: (Dam = 637.50)

	1yr 24hr	2yr 24hr	25yr 24hr	100yr 24hr	Blocked Low Flow 100yr 24hr
Basin	632.86	633.31	635.19	636.11	636.18

Detention Basin #H High Water Elevations: (Dam = 641.00)

	1yr 24hr	2yr 24hr	25yr 24hr	100yr 24hr
Basin	637.86	638.19	639.55	639.96

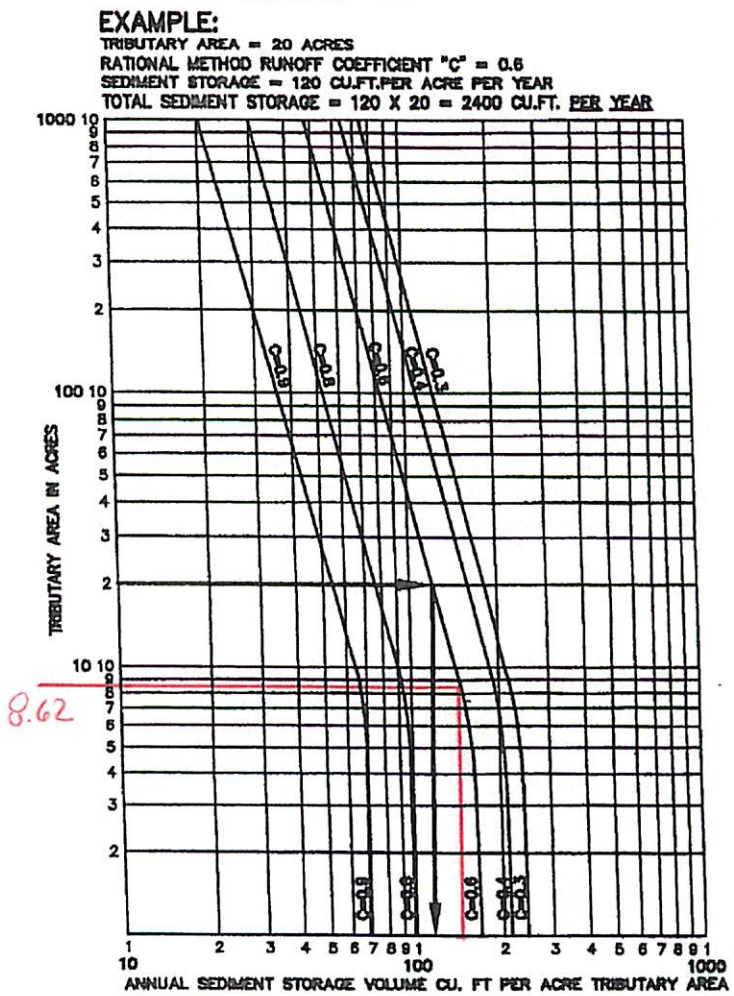
WATER QUALITY BASIN #A ANNUAL SEDIMENT STORAGE

SHADY CREEK

SUBDIVISION AND LAND DEVELOPMENT

FIGURE #1

BASIN A



SEDIMENT STORAGE = 150 CU FT/AC/YR

ANNUAL SEDIMENT STORAGE

150 X 8.62 AC X 2 YRS = 2586 CU FT.

405 Attachment 1:3

Supp. #15, 11/13

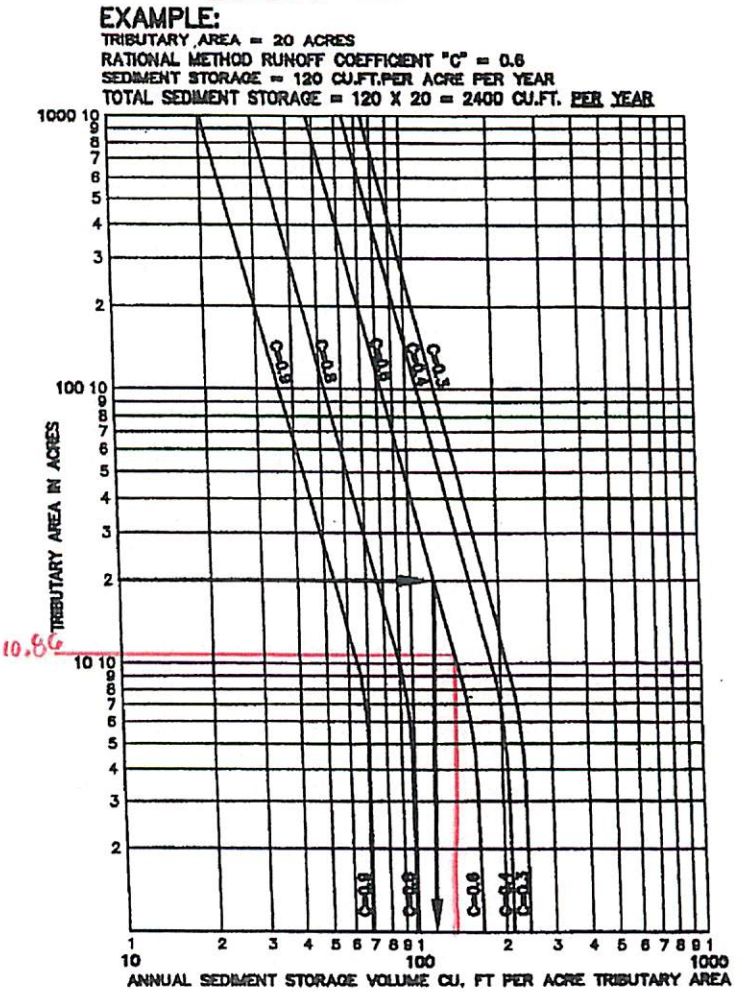
WATER QUALITY BASIN #B ANNUAL SEDIMENT STORAGE

SHADY CREEK

SUBDIVISION AND LAND DEVELOPMENT

FIGURE #1

BASIN B



ANNUAL SEDIMENT STORAGE

SEDIMENT STORAGE = 150 CUFT/AC/YR

405 Attachment 1:3 Supp. #15, 11/13

150 X 10.86 Ac x 2 YR = 3258 CU FT

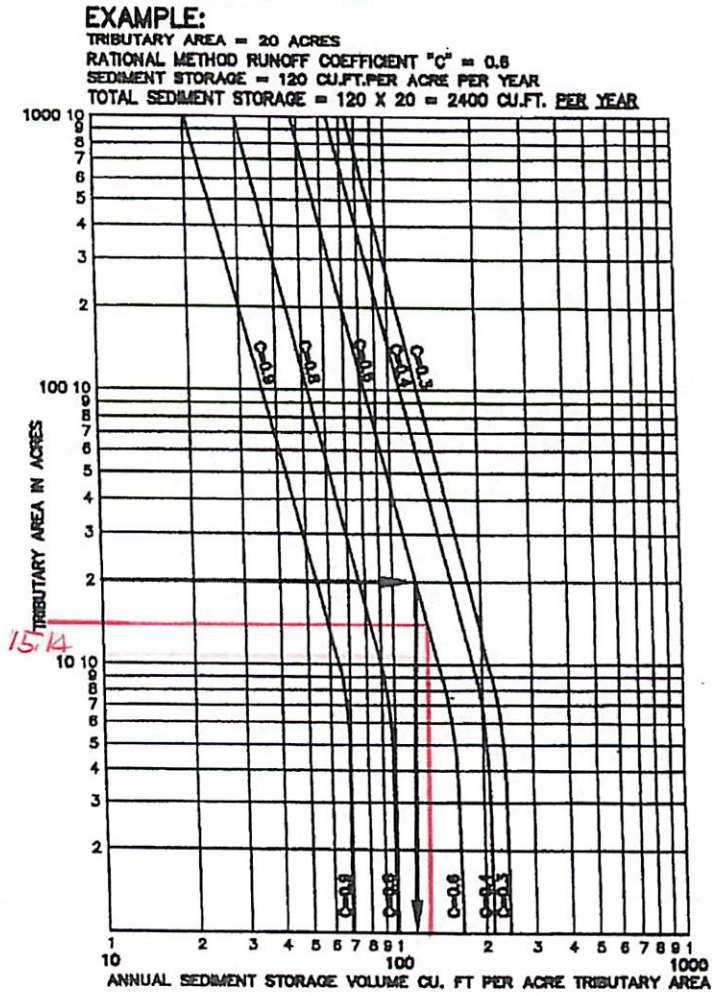
BASIN #C ANNUAL SEDIMENT STORAGE

SHADY CREEK

SUBDIVISION AND LAND DEVELOPMENT

FIGURE #1

BASIN C



SEDIMENT STORAGE = 140 CU FT/AC/YR

ANNUAL SEDIMENT STORAGE

140 × 15.14 AC × 2 YRS = 4239 CU FT.

405 Attachment 1:3

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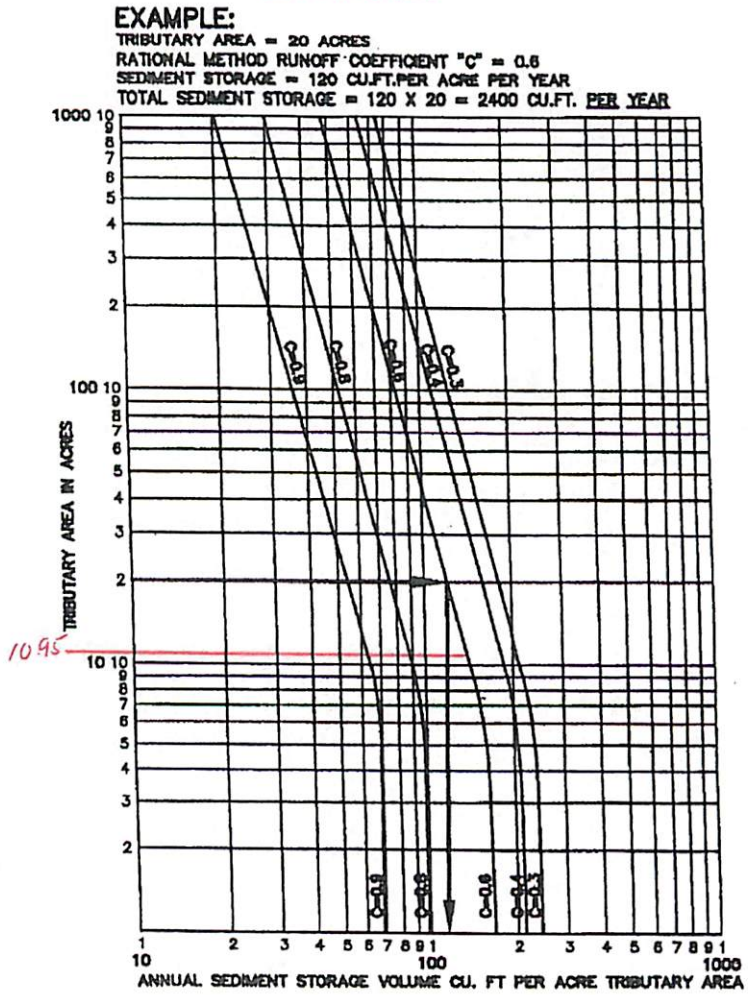
BASIN #D ANNUAL SEDIMENT STORAGE

SHADY CREEK

SUBDIVISION AND LAND DEVELOPMENT

FIGURE #1

BASIN D



SEDIMENT STORAGE = 150 CUFT/AC/YR

ANNUAL SEDIMENT STORAGE

150 X 10.95 AC X 2YR = 3285 CU FT.

405 Attachment 1:3

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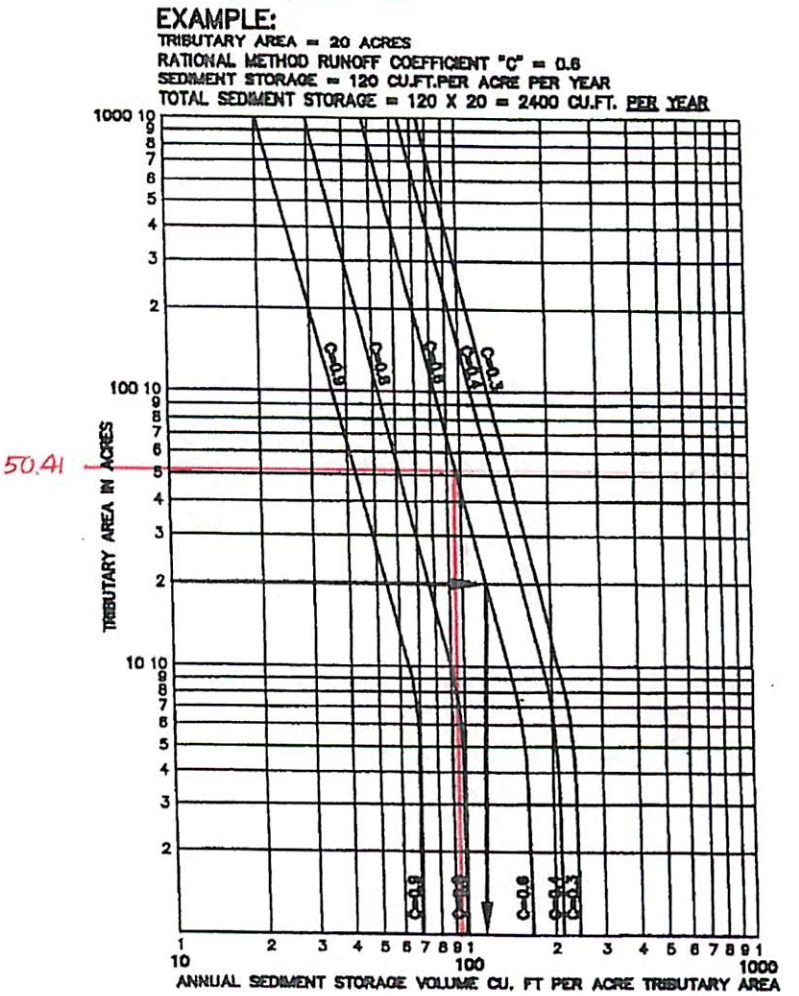
BASIN #E ANNUAL SEDIMENT STORAGE

SHADY CREEK

SUBDIVISION AND LAND DEVELOPMENT

FIGURE #1

BASIN E



SEDIMENT STORAGE = 95 CU FT/AC/YR

ANNUAL SEDIMENT STORAGE

95 X 50.41 AC x 2 YR = 9578 CU FT

405 Attachment 1:3

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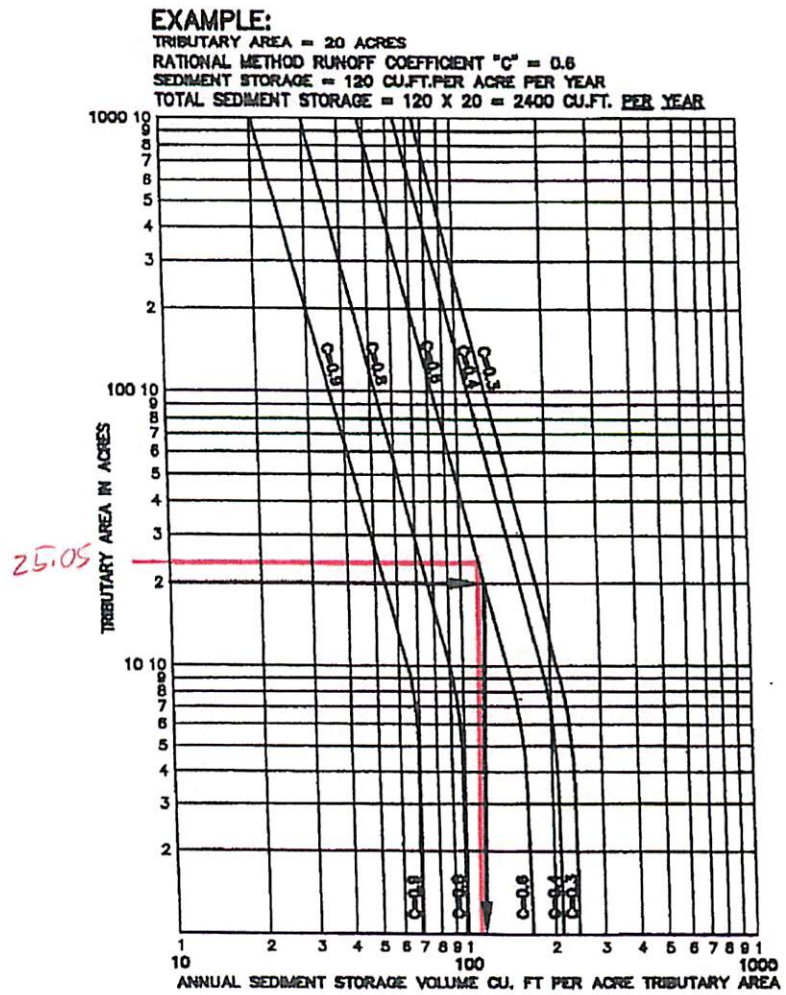
BASIN #F ANNUAL SEDIMENT STORAGE

SHADY CREEK

SUBDIVISION AND LAND DEVELOPMENT

FIGURE #1

BASIN F



SEDIMENT STORAGE=115 CUFT/AC/YR

ANNUAL SEDIMENT STORAGE

115 X 25.05 AC X 2 YR = 5762 CUFT

405 Attachment 1:3

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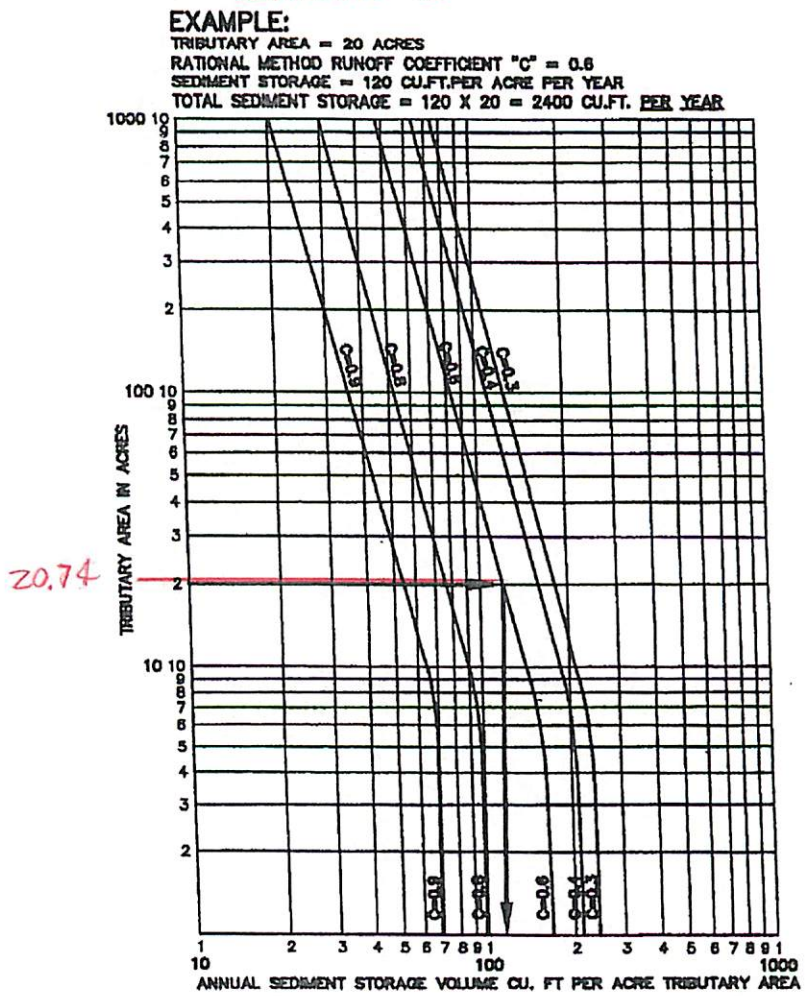
BASIN #G ANNUAL SEDIMENT STORAGE

SHADY CREEK
SUBDIVISION AND LAND DEVELOPMENT

FIGURE #1

BASIN G



SEDIMENT STORAGE = 120 CU FT/AC/YR

ANNUAL SEDIMENT STORAGE

120 X 20.74 AC X2 YR = 4977 CU FT

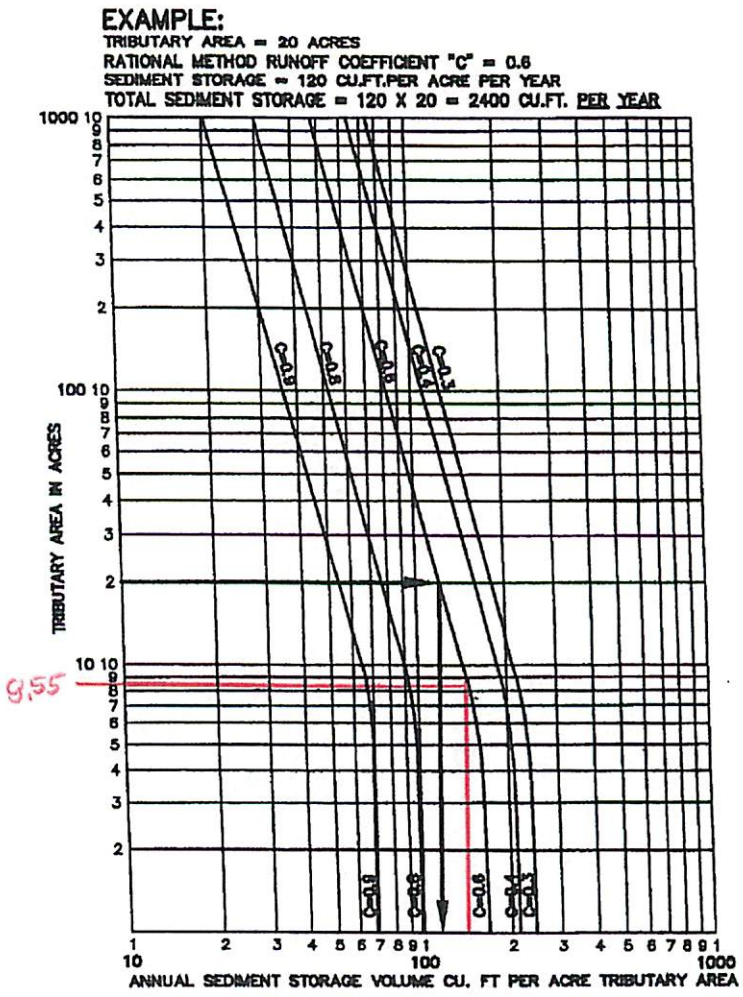
405 Attachment 1:3 Supp. #15, 11/13

BASIN #H ANNUAL SEDIMENT STORAGE

SHADY CREEK
SUBDIVISION AND LAND DEVELOPMENT

FIGURE #1

BASIN H



SEDIMENT STORAGE = 150 CUFT/AC/YR

ANNUAL SEDIMENT STORAGE

150 X 8.55AC X 2YR = 2565 CU FT

405 Attachment 1:3

Supp. #15, 11/13

Appendix

A

Existing Anaalysis 1-year, 2-year, 25-Year and 100-Year 24 Hour

==========
JOB TITLE
==========

Project Date: 3/2/2015
Project Engineer:
Project Title: The Villages at Shady Creek
Project Comments:
THE VILLAGES AT SHADY CREEK
DETENTION ANALYSIS
14-03-087
EXISITNG CONDITIONS
3/2/15

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MASTER DESIGN STORM SUMMARY

Network Storm Collection: MSD NEW

Return Event	Total Depth in	Rainfall Type	RNF ID
Pre 1	2.5000	Synthetic Curve	TypeII 24hr
Pre 2	3.1000	Synthetic Curve	TypeII 24hr
Pre100	7.2000	Synthetic Curve	TypeII 24hr
Pre 25	5.8000	Synthetic Curve	TypeII 24hr

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

Node ID	Type	Return Event	HYG Vol cu.ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage cu.ft
EX-1A	AREA	1	59847		12.1242	16.07		
EX-1A	AREA	2	87439		12.1242	23.84		
EX-1A	AREA	100	306065		12.1242	82.44		
EX-1A	AREA	25	228089		12.1242	62.04		
EX-1B	AREA	1	20908		12.0741	6.52		
EX-1B	AREA	2	31178		12.0741	9.90		
EX-1B	AREA	100	114774		12.0407	36.34		
EX-1B	AREA	25	84710		12.0407	27.01		
EX-2A	AREA	1	27781		12.0908	8.32		
EX-2A	AREA	2	41427		12.0908	12.64		
EX-2A	AREA	100	152501		12.0574	46.28		
EX-2A	AREA	25	112555		12.0574	34.38		

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

Node ID	Type	Return Event	HYG Vol cu.ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage cu.ft
EX-3A	AREA	1	209992		12.1576	50.74		
EX-3A	AREA	2	319969		12.1576	80.24		
EX-3A	AREA	100	1241061		12.1576	317.33		
EX-3A	AREA	25	906901		12.1576	233.09		
EX-3B	AREA	1	10324		12.1409	2.68		
EX-3B	AREA	2	15395		12.1075	4.10		
EX-3B	AREA	100	56674		12.1075	15.30		
EX-3B	AREA	25	41829		12.1075	11.36		
EX-3C	AREA	1	2389		12.1242	.65		
EX-3C	AREA	2	3423		12.0908	.94		
EX-3C	AREA	100	11414		12.0908	3.10		
EX-3C	AREA	25	8586		12.0908	2.35		
EX-4A	AREA	1	44469		12.0908	11.91		
EX-4A	AREA	2	71085		12.0908	20.38		
EX-4A	AREA	100	308301		12.0908	92.93		
EX-4A	AREA	25	220605		12.0908	66.63		
EX-4B	AREA	1	4648		11.9739	1.79		
EX-4B	AREA	2	7164		11.9572	2.83		
EX-4B	AREA	100	28546		11.9405	11.43		
EX-4B	AREA	25	20753		11.9405	8.35		
EX-5A	AREA	1	5433		12.0574	1.72		
EX-5A	AREA	2	8279		12.0574	2.69		
EX-5A	AREA	100	32114		12.0407	10.51		
EX-5A	AREA	25	23467		12.0407	7.73		
EX-6A	AREA	1	51735		12.0574	16.22		
EX-6A	AREA	2	80667		12.0574	26.31		
EX-6A	AREA	100	330412		12.0407	109.49		
EX-6A	AREA	25	238971		12.0407	79.57		

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

Node ID	Type	Return Event	HYG Vol cu.ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage cu.ft
EX-6B	AREA	1	13519		12.0741	4.21		
EX-6B	AREA	2	20160		12.0741	6.39		
EX-6B	AREA	100	74213		12.0407	23.41		
EX-6B	AREA	25	54774		12.0407	17.40		
*P.O.I. #1	JCT	1	80755		12.1075	22.12		
*P.O.I. #1	JCT	2	118617		12.0908	33.12		
*P.O.I. #1	JCT	100	420838		12.0741	117.53		
*P.O.I. #1	JCT	25	312799		12.0741	87.95		
*P.O.I. #2	JCT	1	27781		12.0908	8.32		
*P.O.I. #2	JCT	2	41427		12.0908	12.64		
*P.O.I. #2	JCT	100	152501		12.0574	46.28		
*P.O.I. #2	JCT	25	112556		12.0574	34.38		
*P.O.I. #3	JCT	1	222705		12.1576	54.04		
*P.O.I. #3	JCT	2	338788		12.1576	85.21		
*P.O.I. #3	JCT	100	1309148		12.1409	335.27		
*P.O.I. #3	JCT	25	957317		12.1576	246.37		
*P.O.I. #4	JCT	1	49117		12.0908	12.94		
*P.O.I. #4	JCT	2	78248		12.0908	21.96		
*P.O.I. #4	JCT	100	336848		12.0574	99.84		
*P.O.I. #4	JCT	25	241358		12.0574	71.46		
*P.O.I. #5	JCT	1	5433		12.0574	1.72		
*P.O.I. #5	JCT	2	8279		12.0574	2.69		
*P.O.I. #5	JCT	100	32114		12.0407	10.51		
*P.O.I. #5	JCT	25	23467		12.0407	7.73		
*P.O.I. #6	JCT	1	65254		12.0574	20.38		
*P.O.I. #6	JCT	2	100827		12.0574	32.66		
*P.O.I. #6	JCT	100	404626		12.0407	132.90		
*P.O.I. #6	JCT	25	293745		12.0407	96.97		

NETWORK SUMMARY -- NODES
(Trun.= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left & Rt)

DEFAULT Design Storm File,ID = MSD NEW

Storm Tag Name = Pre 1

Data Type, File, ID = Synthetic Storm TypeII 24hr
Storm Frequency = 1 yr
Total Rainfall Depth= 2.5000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Node ID	Type	HYG Vol cu.ft	Trun.	Qpeak hrs	Qpeak cfs	Max WSEL ft
EX-1A	AREA	59847		12.1242	16.07	
EX-1B	AREA	20908		12.0741	6.52	
EX-2A	AREA	27781		12.0908	8.32	
EX-3A	AREA	209992		12.1576	50.74	
EX-3B	AREA	10324		12.1409	2.68	
EX-3C	AREA	2389		12.1242	.65	
EX-4A	AREA	44469		12.0908	11.91	
EX-4B	AREA	4648		11.9739	1.79	
EX-5A	AREA	5433		12.0574	1.72	
EX-6A	AREA	51735		12.0574	16.22	
EX-6B	AREA	13519		12.0741	4.21	
Outfall P.O.I. #1	JCT	80755		12.1075	22.12	
Outfall P.O.I. #2	JCT	27781		12.0908	8.32	
Outfall P.O.I. #3	JCT	222705		12.1576	54.04	
Outfall P.O.I. #4	JCT	49117		12.0908	12.94	
Outfall P.O.I. #5	JCT	5433		12.0574	1.72	
Outfall P.O.I. #6	JCT	65254		12.0574	20.38	

NETWORK SUMMARY -- NODES
(Trun.= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left & Rt)

DEFAULT Design Storm File,ID = MSD NEW

Storm Tag Name = Pre 2

Data Type, File, ID = Synthetic Storm TypeII 24hr
Storm Frequency = 2 yr
Total Rainfall Depth= 3.1000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Node ID	Type	HYG Vol cu.ft	Trun.	Qpeak hrs	Qpeak cfs	Max WSEL ft
EX-1A	AREA	87439		12.1242	23.84	
EX-1B	AREA	31178		12.0741	9.90	
EX-2A	AREA	41427		12.0908	12.64	
EX-3A	AREA	319969		12.1576	80.24	
EX-3B	AREA	15395		12.1075	4.10	
EX-3C	AREA	3423		12.0908	.94	
EX-4A	AREA	71085		12.0908	20.38	
EX-4B	AREA	7164		11.9572	2.83	
EX-5A	AREA	8279		12.0574	2.69	
EX-6A	AREA	80667		12.0574	26.31	
EX-6B	AREA	20160		12.0741	6.39	
Outfall P.O.I. #1	JCT	118617		12.0908	33.12	
Outfall P.O.I. #2	JCT	41427		12.0908	12.64	
Outfall P.O.I. #3	JCT	338788		12.1576	85.21	
Outfall P.O.I. #4	JCT	78248		12.0908	21.96	
Outfall P.O.I. #5	JCT	8279		12.0574	2.69	
Outfall P.O.I. #6	JCT	100827		12.0574	32.66	

NETWORK SUMMARY -- NODES
(Trun.= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left & Rt)

DEFAULT Design Storm File,ID = MSD NEW

Storm Tag Name = Pre 25

Data Type, File, ID = Synthetic Storm TypeII 24hr
Storm Frequency = 25 yr
Total Rainfall Depth= 5.8000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Node ID	Type	HYG Vol cu.ft	Trun.	Qpeak hrs	Qpeak cfs	Max WSEL ft
EX-1A	AREA	228089		12.1242	62.04	
EX-1B	AREA	84710		12.0407	27.01	
EX-2A	AREA	112555		12.0574	34.38	
EX-3A	AREA	906901		12.1576	233.09	
EX-3B	AREA	41829		12.1075	11.36	
EX-3C	AREA	8586		12.0908	2.35	
EX-4A	AREA	220605		12.0908	66.63	
EX-4B	AREA	20753		11.9405	8.35	
EX-5A	AREA	23467		12.0407	7.73	
EX-6A	AREA	238971		12.0407	79.57	
EX-6B	AREA	54774		12.0407	17.40	
Outfall P.O.I. #1	JCT	312799		12.0741	87.95	
Outfall P.O.I. #2	JCT	112556		12.0574	34.38	
Outfall P.O.I. #3	JCT	957317		12.1576	246.37	
Outfall P.O.I. #4	JCT	241358		12.0574	71.46	
Outfall P.O.I. #5	JCT	23467		12.0407	7.73	
Outfall P.O.I. #6	JCT	293745		12.0407	96.97	

NETWORK SUMMARY -- NODES
(Trun.= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left & Rt)

DEFAULT Design Storm File,ID = MSD NEW

Storm Tag Name = Pre100

Data Type, File, ID = Synthetic Storm TypeII 24hr
Storm Frequency = 100 yr
Total Rainfall Depth= 7.2000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Node ID	Type	HYG Vol cu.ft	Trun.	Qpeak hrs	Qpeak cfs	Max WSEL ft
EX-1A	AREA	306065		12.1242	82.44	
EX-1B	AREA	114774		12.0407	36.34	
EX-2A	AREA	152501		12.0574	46.28	
EX-3A	AREA	1241061		12.1576	317.33	
EX-3B	AREA	56674		12.1075	15.30	
EX-3C	AREA	11414		12.0908	3.10	
EX-4A	AREA	308301		12.0908	92.93	
EX-4B	AREA	28546		11.9405	11.43	
EX-5A	AREA	32114		12.0407	10.51	
EX-6A	AREA	330412		12.0407	109.49	
EX-6B	AREA	74213		12.0407	23.41	
Outfall P.O.I. #1	JCT	420838		12.0741	117.53	
Outfall P.O.I. #2	JCT	152501		12.0574	46.28	
Outfall P.O.I. #3	JCT	1309148		12.1409	335.27	
Outfall P.O.I. #4	JCT	336848		12.0574	99.84	
Outfall P.O.I. #5	JCT	32114		12.0407	10.51	
Outfall P.O.I. #6	JCT	404626		12.0407	132.90	

Title... Project Date: 3/2/2015
Project Engineer:
Project Title: The Villages at Shady Creek
Project Comments:
THE VILLAGES AT SHADY CREEK
DETENTION ANALYSIS
14-03-087
EXISITNG CONDITIONS
3/2/15

DESIGN STORMS SUMMARY

Design Storm File,ID = MSD NEW

Storm Tag Name = Pre 1

Data Type, File, ID = Synthetic Storm TypeII 24hr
Storm Frequency = 1 yr
Total Rainfall Depth= 2.5000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Storm Tag Name = Pre 2

Data Type, File, ID = Synthetic Storm TypeII 24hr
Storm Frequency = 2 yr
Total Rainfall Depth= 3.1000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Storm Tag Name = Pre100

Data Type, File, ID = Synthetic Storm TypeII 24hr
Storm Frequency = 100 yr
Total Rainfall Depth= 7.2000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Storm Tag Name = Pre 25

Data Type, File, ID = Synthetic Storm TypeII 24hr
Storm Frequency = 25 yr
Total Rainfall Depth= 5.8000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

DESIGN STORMS SUMMARY

Design Storm File,ID = MSD NEW

Storm Tag Name = Pre 1

Data Type, File, ID = Synthetic Storm TypeII 24hr
Storm Frequency = 1 yr
Total Rainfall Depth= 2.5000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Storm Tag Name = Pre 2

Data Type, File, ID = Synthetic Storm TypeII 24hr
Storm Frequency = 2 yr
Total Rainfall Depth= 3.1000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Storm Tag Name = Pre100

Data Type, File, ID = Synthetic Storm TypeII 24hr
Storm Frequency = 100 yr
Total Rainfall Depth= 7.2000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Storm Tag Name = Pre 25

Data Type, File, ID = Synthetic Storm TypeII 24hr
Storm Frequency = 25 yr
Total Rainfall Depth= 5.8000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

CUMULATIVE RAINFALL FRACTIONS
Output Time increment = .1000 hrs
Time hrs | Time on left represents time for first value in each row.

Time hrs					
.0000	.000	.001	.002	.003	.004
.5000	.005	.006	.007	.008	.009
1.0000	.011	.012	.013	.014	.015
1.5000	.016	.017	.018	.020	.021
2.0000	.022	.023	.024	.026	.027
2.5000	.028	.029	.031	.032	.033
3.0000	.035	.036	.037	.038	.040
3.5000	.041	.042	.044	.045	.047
4.0000	.048	.049	.051	.052	.054
4.5000	.055	.057	.058	.060	.061
5.0000	.063	.065	.066	.068	.070
5.5000	.071	.073	.075	.076	.078
6.0000	.080	.082	.084	.085	.087
6.5000	.089	.091	.093	.095	.097
7.0000	.099	.101	.103	.105	.107
7.5000	.109	.111	.113	.116	.118
8.0000	.120	.122	.125	.127	.130
8.5000	.132	.135	.138	.141	.144
9.0000	.147	.150	.153	.157	.160
9.5000	.163	.166	.170	.173	.177
10.0000	.181	.185	.189	.194	.199
10.5000	.204	.209	.215	.221	.228
11.0000	.235	.243	.251	.261	.271
11.5000	.283	.307	.354	.431	.568
12.0000	.663	.682	.699	.713	.725
12.5000	.735	.743	.751	.759	.766
13.0000	.772	.778	.784	.789	.794
13.5000	.799	.804	.808	.812	.816
14.0000	.820	.824	.827	.831	.834
14.5000	.838	.841	.844	.847	.850
15.0000	.854	.856	.859	.862	.865
15.5000	.868	.870	.873	.875	.878
16.0000	.880	.882	.885	.887	.889
16.5000	.891	.893	.895	.898	.900
17.0000	.902	.904	.906	.908	.910
17.5000	.912	.914	.915	.917	.919
18.0000	.921	.923	.925	.926	.928
18.5000	.930	.931	.933	.935	.936
19.0000	.938	.939	.941	.942	.944
19.5000	.945	.947	.948	.949	.951
20.0000	.952	.953	.955	.956	.957
20.5000	.958	.960	.961	.962	.964
21.0000	.965	.966	.967	.968	.970
21.5000	.971	.972	.973	.975	.976

CUMULATIVE RAINFALL FRACTIONS
Output Time increment = .1000 hrs
Time on left represents time for first value in each row.

Time hrs					
22.0000	.977	.978	.979	.981	.982
22.5000	.983	.984	.985	.986	.988
23.0000	.989	.990	.991	.992	.993
23.5000	.994	.996	.997	.998	.999
24.0000	1.000				

CUMULATIVE RAINFALL FRACTIONS
Output Time increment = .1000 hrs
Time hrs | Time on left represents time for first value in each row.

Time hrs					
.0000	.000	.001	.002	.003	.004
.5000	.005	.006	.007	.008	.009
1.0000	.011	.012	.013	.014	.015
1.5000	.016	.017	.018	.020	.021
2.0000	.022	.023	.024	.026	.027
2.5000	.028	.029	.031	.032	.033
3.0000	.035	.036	.037	.038	.040
3.5000	.041	.042	.044	.045	.047
4.0000	.048	.049	.051	.052	.054
4.5000	.055	.057	.058	.060	.061
5.0000	.063	.065	.066	.068	.070
5.5000	.071	.073	.075	.076	.078
6.0000	.080	.082	.084	.085	.087
6.5000	.089	.091	.093	.095	.097
7.0000	.099	.101	.103	.105	.107
7.5000	.109	.111	.113	.116	.118
8.0000	.120	.122	.125	.127	.130
8.5000	.132	.135	.138	.141	.144
9.0000	.147	.150	.153	.157	.160
9.5000	.163	.166	.170	.173	.177
10.0000	.181	.185	.189	.194	.199
10.5000	.204	.209	.215	.221	.228
11.0000	.235	.243	.251	.261	.271
11.5000	.283	.307	.354	.431	.568
12.0000	.663	.682	.699	.713	.725
12.5000	.735	.743	.751	.759	.766
13.0000	.772	.778	.784	.789	.794
13.5000	.799	.804	.808	.812	.816
14.0000	.820	.824	.827	.831	.834
14.5000	.838	.841	.844	.847	.850
15.0000	.854	.856	.859	.862	.865
15.5000	.868	.870	.873	.875	.878
16.0000	.880	.882	.885	.887	.889
16.5000	.891	.893	.895	.898	.900
17.0000	.902	.904	.906	.908	.910
17.5000	.912	.914	.915	.917	.919
18.0000	.921	.923	.925	.926	.928
18.5000	.930	.931	.933	.935	.936
19.0000	.938	.939	.941	.942	.944
19.5000	.945	.947	.948	.949	.951
20.0000	.952	.953	.955	.956	.957
20.5000	.958	.960	.961	.962	.964
21.0000	.965	.966	.967	.968	.970
21.5000	.971	.972	.973	.975	.976

CUMULATIVE RAINFALL FRACTIONS
Output Time increment = .1000 hrs
Time on left represents time for first value in each row.

Time hrs					
22.0000	.977	.978	.979	.981	.982
22.5000	.983	.984	.985	.986	.988
23.0000	.989	.990	.991	.992	.993
23.5000	.994	.996	.997	.998	.999
24.0000	1.000				

CUMULATIVE RAINFALL FRACTIONS
Output Time increment = .1000 hrs
Time on left represents time for first value in each row.

Time hrs					
.0000	.000	.001	.002	.003	.004
.5000	.005	.006	.007	.008	.009
1.0000	.011	.012	.013	.014	.015
1.5000	.016	.017	.018	.020	.021
2.0000	.022	.023	.024	.026	.027
2.5000	.028	.029	.031	.032	.033
3.0000	.035	.036	.037	.038	.040
3.5000	.041	.042	.044	.045	.047
4.0000	.048	.049	.051	.052	.054
4.5000	.055	.057	.058	.060	.061
5.0000	.063	.065	.066	.068	.070
5.5000	.071	.073	.075	.076	.078
6.0000	.080	.082	.084	.085	.087
6.5000	.089	.091	.093	.095	.097
7.0000	.099	.101	.103	.105	.107
7.5000	.109	.111	.113	.116	.118
8.0000	.120	.122	.125	.127	.130
8.5000	.132	.135	.138	.141	.144
9.0000	.147	.150	.153	.157	.160
9.5000	.163	.166	.170	.173	.177
10.0000	.181	.185	.189	.194	.199
10.5000	.204	.209	.215	.221	.228
11.0000	.235	.243	.251	.261	.271
11.5000	.283	.307	.354	.431	.568
12.0000	.663	.682	.699	.713	.725
12.5000	.735	.743	.751	.759	.766
13.0000	.772	.778	.784	.789	.794
13.5000	.799	.804	.808	.812	.816
14.0000	.820	.824	.827	.831	.834
14.5000	.838	.841	.844	.847	.850
15.0000	.854	.856	.859	.862	.865
15.5000	.868	.870	.873	.875	.878
16.0000	.880	.882	.885	.887	.889
16.5000	.891	.893	.895	.898	.900
17.0000	.902	.904	.906	.908	.910
17.5000	.912	.914	.915	.917	.919
18.0000	.921	.923	.925	.926	.928
18.5000	.930	.931	.933	.935	.936
19.0000	.938	.939	.941	.942	.944
19.5000	.945	.947	.948	.949	.951
20.0000	.952	.953	.955	.956	.957
20.5000	.958	.960	.961	.962	.964
21.0000	.965	.966	.967	.968	.970
21.5000	.971	.972	.973	.975	.976

CUMULATIVE RAINFALL FRACTIONS
Output Time increment = .1000 hrs
Time on left represents time for first value in each row.

Time hrs					
22.0000	.977	.978	.979	.981	.982
22.5000	.983	.984	.985	.986	.988
23.0000	.989	.990	.991	.992	.993
23.5000	.994	.996	.997	.998	.999
24.0000	1.000				

CUMULATIVE RAINFALL FRACTIONS
Output Time increment = .1000 hrs
Time on left represents time for first value in each row.

Time hrs					
.0000	.000	.001	.002	.003	.004
.5000	.005	.006	.007	.008	.009
1.0000	.011	.012	.013	.014	.015
1.5000	.016	.017	.018	.020	.021
2.0000	.022	.023	.024	.026	.027
2.5000	.028	.029	.031	.032	.033
3.0000	.035	.036	.037	.038	.040
3.5000	.041	.042	.044	.045	.047
4.0000	.048	.049	.051	.052	.054
4.5000	.055	.057	.058	.060	.061
5.0000	.063	.065	.066	.068	.070
5.5000	.071	.073	.075	.076	.078
6.0000	.080	.082	.084	.085	.087
6.5000	.089	.091	.093	.095	.097
7.0000	.099	.101	.103	.105	.107
7.5000	.109	.111	.113	.116	.118
8.0000	.120	.122	.125	.127	.130
8.5000	.132	.135	.138	.141	.144
9.0000	.147	.150	.153	.157	.160
9.5000	.163	.166	.170	.173	.177
10.0000	.181	.185	.189	.194	.199
10.5000	.204	.209	.215	.221	.228
11.0000	.235	.243	.251	.261	.271
11.5000	.283	.307	.354	.431	.568
12.0000	.663	.682	.699	.713	.725
12.5000	.735	.743	.751	.759	.766
13.0000	.772	.778	.784	.789	.794
13.5000	.799	.804	.808	.812	.816
14.0000	.820	.824	.827	.831	.834
14.5000	.838	.841	.844	.847	.850
15.0000	.854	.856	.859	.862	.865
15.5000	.868	.870	.873	.875	.878
16.0000	.880	.882	.885	.887	.889
16.5000	.891	.893	.895	.898	.900
17.0000	.902	.904	.906	.908	.910
17.5000	.912	.914	.915	.917	.919
18.0000	.921	.923	.925	.926	.928
18.5000	.930	.931	.933	.935	.936
19.0000	.938	.939	.941	.942	.944
19.5000	.945	.947	.948	.949	.951
20.0000	.952	.953	.955	.956	.957
20.5000	.958	.960	.961	.962	.964
21.0000	.965	.966	.967	.968	.970
21.5000	.971	.972	.973	.975	.976

CUMULATIVE RAINFALL FRACTIONS
Output Time increment = .1000 hrs
Time on left represents time for first value in each row.

Time hrs					
22.0000	.977	.978	.979	.981	.982
22.5000	.983	.984	.985	.986	.988
23.0000	.989	.990	.991	.992	.993
23.5000	.994	.996	.997	.998	.999
24.0000	1.000				

::
TIME OF CONCENTRATION CALCULATOR
::

Segment #1: Tc: TR-55 Sheet

Mannings n	.2400
Hydraulic Length	100.00 ft
2yr, 24hr P	3.1000 in
Slope	.020000 ft/ft

Avg.Velocity .11 ft/sec

Segment #1 Time: .2416 hrs

Segment #2: Tc: TR-55 Shallow

Hydraulic Length	500.00 ft
Slope	.030000 ft/ft
Unpaved	

Avg.Velocity 2.79 ft/sec

Segment #2 Time: .0497 hrs

Segment #3: Tc: TR-55 Shallow

Hydraulic Length	500.00 ft
Slope	.010000 ft/ft
Unpaved	

Avg.Velocity 1.61 ft/sec

Segment #3 Time: .0861 hrs

==========
Total Tc: .3774 hrs
==========

Tc Equations used...

==== SCS TR-55 Sheet Flow ==========

Tc = (.007 * ((n * Lf)**0.8)) / ((P**.5) * (Sf**.4))

Where: Tc = Time of concentration, hrs
n = Mannings n
Lf = Flow length, ft
P = 2yr, 24hr Rain depth, inches
Sf = Slope, %

==== SCS TR-55 Shallow Concentrated Flow ==========

Unpaved surface:
V = 16.1345 * (Sf**0.5)

Paved surface:
V = 20.3282 * (Sf**0.5)

Tc = (Lf / V) / (3600sec/hr)

Where: V = Velocity, ft/sec
Sf = Slope, ft/ft
Tc = Time of concentration, hrs
Lf = Flow length, ft

::
TIME OF CONCENTRATION CALCULATOR
::

Segment #1: Tc: TR-55 Sheet

Mannings n	.2400
Hydraulic Length	100.00 ft
2yr, 24hr P	3.1000 in
Slope	.040000 ft/ft

Avg.Velocity .15 ft/sec

Segment #1 Time: .1831 hrs

Segment #2: Tc: TR-55 Shallow

Hydraulic Length	400.00 ft
Slope	.030000 ft/ft
Unpaved	

Avg.Velocity 2.79 ft/sec

Segment #2 Time: .0398 hrs

Segment #3: Tc: TR-55 Shallow

Hydraulic Length	300.00 ft
Slope	.010000 ft/ft
Unpaved	

Avg.Velocity 1.61 ft/sec

Segment #3 Time: .0516 hrs

==========
Total Tc: .2745 hrs
==========

Tc Equations used...

==== SCS TR-55 Sheet Flow ==========

Tc = (.007 * ((n * Lf)**0.8)) / ((P**.5) * (Sf**.4))

Where: Tc = Time of concentration, hrs
n = Mannings n
Lf = Flow length, ft
P = 2yr, 24hr Rain depth, inches
Sf = Slope, %

==== SCS TR-55 Shallow Concentrated Flow ==========

Unpaved surface:
V = 16.1345 * (Sf**0.5)

Paved surface:
V = 20.3282 * (Sf**0.5)

Tc = (Lf / V) / (3600sec/hr)

Where: V = Velocity, ft/sec
Sf = Slope, ft/ft
Tc = Time of concentration, hrs
Lf = Flow length, ft

::
TIME OF CONCENTRATION CALCULATOR
::

Segment #1: Tc: TR-55 Sheet

Mannings n	.2400
Hydraulic Length	90.00 ft
2yr, 24hr P	3.1000 in
Slope	.020000 ft/ft
Avg.Velocity	.11 ft/sec

Segment #1 Time: .2221 hrs

Segment #2: Tc: TR-55 Shallow

Hydraulic Length	650.00 ft
Slope	.020000 ft/ft
Unpaved	
Avg.Velocity	2.28 ft/sec

Segment #2 Time: .0791 hrs

==========
Total Tc: .3012 hrs
==========

Tc Equations used...

==== SCS TR-55 Sheet Flow ==========

Tc = (.007 * ((n * Lf)**0.8)) / ((P**.5) * (Sf**.4))

Where: Tc = Time of concentration, hrs
n = Mannings n
Lf = Flow length, ft
P = 2yr, 24hr Rain depth, inches
Sf = Slope, %

==== SCS TR-55 Shallow Concentrated Flow ==========

Unpaved surface:
V = 16.1345 * (Sf**0.5)

Paved surface:
V = 20.3282 * (Sf**0.5)

Tc = (Lf / V) / (3600sec/hr)

Where: V = Velocity, ft/sec
Sf = Slope, ft/ft
Tc = Time of concentration, hrs
Lf = Flow length, ft

::
TIME OF CONCENTRATION CALCULATOR
::

Segment #1: Tc: TR-55 Sheet

Mannings n	.2400
Hydraulic Length	100.00 ft
2yr, 24hr P	3.1000 in
Slope	.020000 ft/ft

Avg.Velocity .11 ft/sec

Segment #1 Time: .2416 hrs

Segment #2: Tc: TR-55 Shallow

Hydraulic Length	1200.00 ft
Slope	.030000 ft/ft
Unpaved	

Avg.Velocity 2.79 ft/sec

Segment #2 Time: .1193 hrs

Segment #3: Tc: TR-55 Channel

Flow Area	39.3500 sq.ft
Wetted Perimeter	41.12 ft
Hydraulic Radius	.96 ft
Slope	.020000 ft/ft
Mannings n	.0300
Hydraulic Length	1550.00 ft

Avg.Velocity 6.82 ft/sec

Segment #3 Time: .0631 hrs

==========
Total Tc: .4240 hrs
==========

Tc Equations used...

==== SCS TR-55 Sheet Flow ==========

Tc = (.007 * ((n * Lf)**0.8)) / ((P**.5) * (Sf**.4))

Where: Tc = Time of concentration, hrs
n = Mannings n
Lf = Flow length, ft
P = 2yr, 24hr Rain depth, inches
Sf = Slope, %

==== SCS TR-55 Shallow Concentrated Flow ==========

Unpaved surface:
V = 16.1345 * (Sf**0.5)

Paved surface:
V = 20.3282 * (Sf**0.5)

Tc = (Lf / V) / (3600sec/hr)

Where: V = Velocity, ft/sec
Sf = Slope, ft/ft
Tc = Time of concentration, hrs
Lf = Flow length, ft

==== SCS Channel Flow ==

R = Aq / Wp
V = (1.49 * (R**(2/3)) * (Sf**-0.5)) / n

Tc = (Lf / V) / (3600sec/hr)

Where: R = Hydraulic radius
Aq = Flow area, sq.ft.
Wp = Wetted perimeter, ft
V = Velocity, ft/sec
Sf = Slope, ft/ft
n = Mannings n
Tc = Time of concentration, hrs
Lf = Flow length, ft

::
TIME OF CONCENTRATION CALCULATOR
::

Segment #1: Tc: TR-55 Sheet

Mannings n	.2400
Hydraulic Length	100.00 ft
2yr, 24hr P	3.1000 in
Slope	.020000 ft/ft
Avg.Velocity	.11 ft/sec

Segment #1 Time: .2416 hrs

Segment #2: Tc: TR-55 Shallow

Hydraulic Length	900.00 ft
Slope	.020000 ft/ft
Unpaved	
Avg.Velocity	2.28 ft/sec

Segment #2 Time: .1096 hrs

Segment #3: Tc: TR-55 Channel

Flow Area	39.3500 sq.ft
Wetted Perimeter	41.12 ft
Hydraulic Radius	.96 ft
Slope	.020000 ft/ft
Mannings n	.0300
Hydraulic Length	900.00 ft
Avg.Velocity	6.82 ft/sec

Segment #3 Time: .0367 hrs

==========
Total Tc: .3879 hrs
==========

Tc Equations used...

==== SCS TR-55 Sheet Flow ==========

Tc = (.007 * ((n * Lf)**0.8)) / ((P**.5) * (Sf**.4))

Where: Tc = Time of concentration, hrs
n = Mannings n
Lf = Flow length, ft
P = 2yr, 24hr Rain depth, inches
Sf = Slope, %

==== SCS TR-55 Shallow Concentrated Flow ==========

Unpaved surface:
V = 16.1345 * (Sf**0.5)

Paved surface:
V = 20.3282 * (Sf**0.5)

Tc = (Lf / V) / (3600sec/hr)

Where: V = Velocity, ft/sec
Sf = Slope, ft/ft
Tc = Time of concentration, hrs
Lf = Flow length, ft

==== SCS Channel Flow ==

R = Aq / Wp
V = (1.49 * (R**(2/3)) * (Sf**-0.5)) / n

Tc = (Lf / V) / (3600sec/hr)

Where: R = Hydraulic radius
Aq = Flow area, sq.ft.
Wp = Wetted perimeter, ft
V = Velocity, ft/sec
Sf = Slope, ft/ft
n = Mannings n
Tc = Time of concentration, hrs
Lf = Flow length, ft

::
TIME OF CONCENTRATION CALCULATOR
::

Segment #1: Tc: TR-55 Sheet

Mannings n	.2400
Hydraulic Length	90.00 ft
2yr, 24hr P	3.1000 in
Slope	.020000 ft/ft

Avg.Velocity .11 ft/sec

Segment #1 Time: .2221 hrs

Segment #2: Tc: TR-55 Shallow

Hydraulic Length	420.00 ft
Slope	.040000 ft/ft
Unpaved	

Avg.Velocity 3.23 ft/sec

Segment #2 Time: .0362 hrs

Segment #3: Tc: TR-55 Shallow

Hydraulic Length	700.00 ft
Slope	.040000 ft/ft
Unpaved	

Avg.Velocity 3.23 ft/sec

Segment #3 Time: .0603 hrs

Segment #4: Tc: TR-55 Channel

Flow Area	39.3500	sq.ft
Wetted Perimeter	41.12	ft
Hydraulic Radius	.96	ft
Slope	.020000	ft/ft
Mannings n	.0300	
Hydraulic Length	1300.00	ft
Avg.Velocity	6.82	ft/sec

Segment #4 Time: .0529 hrs

Total Tc: .3715 hrs

Tc Equations used...

==== SCS TR-55 Sheet Flow ==========

Tc = (.007 * ((n * Lf)**0.8)) / ((P**.5) * (Sf**.4))

Where: Tc = Time of concentration, hrs
n = Mannings n
Lf = Flow length, ft
P = 2yr, 24hr Rain depth, inches
Sf = Slope, %

==== SCS TR-55 Shallow Concentrated Flow ==========

Unpaved surface:
V = 16.1345 * (Sf**0.5)

Paved surface:
V = 20.3282 * (Sf**0.5)

Tc = (Lf / V) / (3600sec/hr)

Where: V = Velocity, ft/sec
Sf = Slope, ft/ft
Tc = Time of concentration, hrs
Lf = Flow length, ft

==== SCS Channel Flow ==

R = Aq / Wp
V = (1.49 * (R**(2/3)) * (Sf**-0.5)) / n

Tc = (Lf / V) / (3600sec/hr)

Where: R = Hydraulic radius
Aq = Flow area, sq.ft.
Wp = Wetted perimeter, ft
V = Velocity, ft/sec
Sf = Slope, ft/ft
n = Mannings n
Tc = Time of concentration, hrs
Lf = Flow length, ft

::
TIME OF CONCENTRATION CALCULATOR
::

Segment #1: Tc: TR-55 Sheet

Mannings n	.2400
Hydraulic Length	100.00 ft
2yr, 24hr P	3.1000 in
Slope	.020000 ft/ft
Avg.Velocity	.11 ft/sec

Segment #1 Time: .2416 hrs

Segment #2: Tc: TR-55 Shallow

Hydraulic Length	400.00 ft
Slope	.055000 ft/ft
Unpaved	
Avg.Velocity	3.78 ft/sec

Segment #2 Time: .0294 hrs

Segment #3: Tc: TR-55 Channel

Flow Area	14.8400 sq.ft
Wetted Perimeter	25.42 ft
Hydraulic Radius	.58 ft
Slope	.040000 ft/ft
Mannings n	.0300
Hydraulic Length	1150.00 ft
Avg.Velocity	6.94 ft/sec

Segment #3 Time: .0460 hrs

==========
Total Tc: .3170 hrs
==========

Tc Equations used...

==== SCS TR-55 Sheet Flow ==========

Tc = (.007 * ((n * Lf)**0.8)) / ((P**.5) * (Sf**.4))

Where: Tc = Time of concentration, hrs
n = Mannings n
Lf = Flow length, ft
P = 2yr, 24hr Rain depth, inches
Sf = Slope, %

==== SCS TR-55 Shallow Concentrated Flow ==========

Unpaved surface:
V = 16.1345 * (Sf**0.5)

Paved surface:
V = 20.3282 * (Sf**0.5)

Tc = (Lf / V) / (3600sec/hr)

Where: V = Velocity, ft/sec
Sf = Slope, ft/ft
Tc = Time of concentration, hrs
Lf = Flow length, ft

==== SCS Channel Flow ==

R = Aq / Wp
V = (1.49 * (R**(2/3)) * (Sf**-0.5)) / n

Tc = (Lf / V) / (3600sec/hr)

Where: R = Hydraulic radius
Aq = Flow area, sq.ft.
Wp = Wetted perimeter, ft
V = Velocity, ft/sec
Sf = Slope, ft/ft
n = Mannings n
Tc = Time of concentration, hrs
Lf = Flow length, ft

::
TIME OF CONCENTRATION CALCULATOR
::

Segment #1: Tc: TR-55 Sheet

Mannings n	.2400
Hydraulic Length	50.00 ft
2yr, 24hr P	3.1000 in
Slope	.120000 ft/ft
Avg.Velocity	.20 ft/sec

Segment #1 Time: .0678 hrs

Segment #2: Tc: TR-55 Shallow

Hydraulic Length	750.00 ft
Slope	.060000 ft/ft
Unpaved	
Avg.Velocity	3.95 ft/sec

Segment #2 Time: .0527 hrs

==========
Total Tc: .1205 hrs
==========

Tc Equations used...

==== SCS TR-55 Sheet Flow ==========

Tc = (.007 * ((n * Lf)**0.8)) / ((P**.5) * (Sf**.4))

Where: Tc = Time of concentration, hrs
n = Mannings n
Lf = Flow length, ft
P = 2yr, 24hr Rain depth, inches
Sf = Slope, %

==== SCS TR-55 Shallow Concentrated Flow ==========

Unpaved surface:
V = 16.1345 * (Sf**0.5)

Paved surface:
V = 20.3282 * (Sf**0.5)

Tc = (Lf / V) / (3600sec/hr)

Where: V = Velocity, ft/sec
Sf = Slope, ft/ft
Tc = Time of concentration, hrs
Lf = Flow length, ft

::
TIME OF CONCENTRATION CALCULATOR
::

Segment #1: Tc: TR-55 Sheet

Mannings n	.2400	
Hydraulic Length	100.00	ft
2yr, 24hr P	3.1000	in
Slope	.020000	ft/ft
Avg.Velocity	.11	ft/sec

Segment #1 Time: .2416 hrs

Segment #2: Tc: TR-55 Shallow

Hydraulic Length	150.00	ft
Slope	.040000	ft/ft
Unpaved		
Avg.Velocity	3.23	ft/sec

Segment #2 Time: .0129 hrs

==========
Total Tc: .2546 hrs
==========

Tc Equations used...

==== SCS TR-55 Sheet Flow ==========

Tc = (.007 * ((n * Lf)**0.8)) / ((P**.5) * (Sf**.4))

Where: Tc = Time of concentration, hrs
n = Mannings n
Lf = Flow length, ft
P = 2yr, 24hr Rain depth, inches
Sf = Slope, %

==== SCS TR-55 Shallow Concentrated Flow ==========

Unpaved surface:
V = 16.1345 * (Sf**0.5)

Paved surface:
V = 20.3282 * (Sf**0.5)

Tc = (Lf / V) / (3600sec/hr)

Where: V = Velocity, ft/sec
Sf = Slope, ft/ft
Tc = Time of concentration, hrs
Lf = Flow length, ft

::
TIME OF CONCENTRATION CALCULATOR
::

Segment #1: Tc: TR-55 Sheet

Mannings n	.2400	
Hydraulic Length	80.00	ft
2yr, 24hr P	3.1000	in
Slope	.020000	ft/ft
Avg.Velocity	.11	ft/sec

Segment #1 Time: .2021 hrs

Segment #2: Tc: TR-55 Shallow

Hydraulic Length	600.00	ft
Slope	.090000	ft/ft
Unpaved		
Avg.Velocity	4.84	ft/sec

Segment #2 Time: .0344 hrs

Segment #3: Tc: TR-55 Channel

Flow Area	16.4800	sq.ft
Wetted Perimeter	32.83	ft
Hydraulic Radius	.50	ft
Slope	.100000	ft/ft
Mannings n	.0300	
Hydraulic Length	450.00	ft
Avg.Velocity	9.92	ft/sec

Segment #3 Time: .0126 hrs

==========
Total Tc: .2492 hrs
==========

Tc Equations used...

==== SCS TR-55 Sheet Flow ==========

Tc = (.007 * ((n * Lf)**0.8)) / ((P**.5) * (Sf**.4))

Where: Tc = Time of concentration, hrs
n = Mannings n
Lf = Flow length, ft
P = 2yr, 24hr Rain depth, inches
Sf = Slope, %

==== SCS TR-55 Shallow Concentrated Flow ==========

Unpaved surface:
V = 16.1345 * (Sf**0.5)

Paved surface:
V = 20.3282 * (Sf**0.5)

Tc = (Lf / V) / (3600sec/hr)

Where: V = Velocity, ft/sec
Sf = Slope, ft/ft
Tc = Time of concentration, hrs
Lf = Flow length, ft

==== SCS Channel Flow ==

R = Aq / Wp
V = (1.49 * (R**(2/3)) * (Sf**-0.5)) / n

Tc = (Lf / V) / (3600sec/hr)

Where: R = Hydraulic radius
Aq = Flow area, sq.ft.
Wp = Wetted perimeter, ft
V = Velocity, ft/sec
Sf = Slope, ft/ft
n = Mannings n
Tc = Time of concentration, hrs
Lf = Flow length, ft

::
TIME OF CONCENTRATION CALCULATOR
::

Segment #1: Tc: TR-55 Sheet

Mannings n	.2400
Hydraulic Length	100.00 ft
2yr, 24hr P	3.1000 in
Slope	.020000 ft/ft

Avg.Velocity .11 ft/sec

Segment #1 Time: .2416 hrs

Segment #2: Tc: TR-55 Shallow

Hydraulic Length	150.00 ft
Slope	.200000 ft/ft
Unpaved	

Avg.Velocity 7.22 ft/sec

Segment #2 Time: .0058 hrs

Segment #3: Tc: TR-55 Shallow

Hydraulic Length	500.00 ft
Slope	.080000 ft/ft
Unpaved	

Avg.Velocity 4.56 ft/sec

Segment #3 Time: .0304 hrs

==========
Total Tc: .2779 hrs
==========

Tc Equations used...

==== SCS TR-55 Sheet Flow ==========

Tc = (.007 * ((n * Lf)**0.8)) / ((P**.5) * (Sf**.4))

Where: Tc = Time of concentration, hrs
n = Mannings n
Lf = Flow length, ft
P = 2yr, 24hr Rain depth, inches
Sf = Slope, %

==== SCS TR-55 Shallow Concentrated Flow ==========

Unpaved surface:
V = 16.1345 * (Sf**0.5)

Paved surface:
V = 20.3282 * (Sf**0.5)

Tc = (Lf / V) / (3600sec/hr)

Where: V = Velocity, ft/sec
Sf = Slope, ft/ft
Tc = Time of concentration, hrs
Lf = Flow length, ft

RUNOFF CURVE NUMBER DATA

Soil/Surface Description	CN	Area acres	Impervious Adjustment %C	%UC	Adjusted CN
100% IMPERVIOUS	98	1.520			98.00
TYPE D/ GRASS	80	14.530			80.00
TYPE D/ WOODS	77	.470			77.00
COMPOSITE AREA & WEIGHTED CN --->		16.520			81.57 (82)

RUNOFF CURVE NUMBER DATA

Soil/Surface Description	CN	Area acres	Impervious Adjustment %C	%UC	Adjusted CN
TYPE D/ GRASS	80	6.480			80.00
COMPOSITE AREA & WEIGHTED CN --->		6.480			80.00 (80)

RUNOFF CURVE NUMBER DATA

Soil/Surface Description	CN	Area acres	Impervious Adjustment %C	%UC	Adjusted CN
TYPE D/ GRASS	80	8.570			80.00
TYPE D/ WOODS	77	.040			77.00
COMPOSITE AREA & WEIGHTED CN --->		8.610			79.99 (80)

RUNOFF CURVE NUMBER DATA

Soil/Surface Description	CN	Area acres	Impervious Adjustment %C	%UC	Adjusted CN
TYPE C/ GRASS	74	1.720			74.00
TYPE C/ WOODS	70	13.760			70.00
TYPE D/ GRASS	80	52.160			80.00
TYPE D/ WOODS	77	5.780			77.00
COMPOSITE AREA & WEIGHTED CN --->		73.420			77.75 (78)

RUNOFF CURVE NUMBER DATA

Soil/Surface Description	CN	Area acres	Impervious Adjustment %C	%UC	Adjusted CN
TYPE D/ GRASS	80	3.200			80.00
COMPOSITE AREA & WEIGHTED CN --->		3.200			80.00 (80)

RUNOFF CURVE NUMBER DATA

Soil/Surface Description	CN	Area acres	Impervious Adjustment %C	%UC	Adjusted CN
100% IMP	98	.120			98.00
TYPE D/ GRASS	80	.470			80.00
COMPOSITE AREA & WEIGHTED CN --->		.590			83.66 (84)

RUNOFF CURVE NUMBER DATA

Soil/Surface Description	CN	Area acres	Impervious Adjustment %C	%UC	Adjusted CN
TYPE C/ GRASS	74	1.130			74.00
TYPE C/ WOODS	70	10.540			70.00
TYPE D/ GRASS	80	4.750			80.00
TYPE D/ WOODS	77	3.720			77.00
COMPOSITE AREA & WEIGHTED CN --->		20.140			73.88 (74)

RUNOFF CURVE NUMBER DATA

Soil/Surface Description	CN	Area acres	Impervious Adjustment %C	%UC	Adjusted CN
TYPE D/ GRASS	80	.830			80.00
TYPE C/ GRASS	74	.900			74.00
COMPOSITE AREA & WEIGHTED CN --->		1.730			76.88 (77)

RUNOFF CURVE NUMBER DATA

Soil/Surface Description	CN	Area acres	Impervious Adjustment %C	%UC	Adjusted CN
TYPE D/ GRASS	80	1.190			80.00
TYPE D/ WOODS	77	.570			77.00
TYPE C/ GRASS	74	.060			74.00
TYPE C/ WOODS	70	.080			70.00
COMPOSITE AREA & WEIGHTED CN --->		1.900			78.49 (78)

RUNOFF CURVE NUMBER DATA

Soil/Surface Description	CN	Area acres	Impervious Adjustment %C	%UC	Adjusted CN
TYPE C/ GRASS	74	1.660			74.00
TYPE C/ WOODS	70	7.180			70.00
TYPE D/ GRASS	80	10.110			80.00
TYPE D/ WOODS	77	1.570			77.00
COMPOSITE AREA & WEIGHTED CN --->		20.520			75.79 (76)

RUNOFF CURVE NUMBER DATA

Soil/Surface Description	CN	Area acres	Impervious Adjustment %C	%UC	Adjusted CN
100% IMPERVIOUS	98	.860			98.00
TYPE D/ GRASS	80	.480			80.00
TYPE C/ GRASS	74	2.850			74.00
COMPOSITE AREA & WEIGHTED CN --->		4.190			79.61 (80)

SCS UNIT HYDROGRAPH METHOD
(Computational Notes)

DEFINITION OF TERMS: ----------

At = Total area (acres): At = Ai+Ap
Ai = Impervious area (acres)
Ap = Pervious area (acres)
CNi = Runoff curve number for impervious area
CNp = Runoff curve number for pervious area
fLoss = f loss constant infiltration (depth/time)
gKs = Saturated Hydraulic Conductivity (depth/time)
Md = Volumetric Moisture Deficit
Psi = Capillary Suction (length)
hK = Horton Infiltration Decay Rate (time^-1)
fo = Initial Infiltration Rate (depth/time)
fc = Ultimate(capacity)Infiltration Rate (depth/time)
Ia = Initial Abstraction (length)
dt = Computational increment (duration of unit excess rainfall)
Default dt is smallest value of 0.1333Tc, rtm, and th
(Smallest dt is then adjusted to match up with Tp)
UDdt = User specified override computational main time increment
(only used if UDdt is => .1333Tc)
D(t) = Point on distribution curve (fraction of P) for time step t

K = 2 / (1 + (Tr/Tp)): default K = 0.75: (for Tr/Tp = 1.67)
Ks = Hydrograph shape factor
= Unit Conversions * K:
= ((1hr/3600sec) * (1ft/12in) * ((5280ft)**2/sq.mi)) * K
Default Ks = 645.333 * 0.75 = 484

Lag = Lag time from center of excess runoff (dt) to Tp: Lag = 0.6Tc
P = Total precipitation depth, inches
Pa(t) = Accumulated rainfall at time step t
Pi(t) = Incremental rainfall at time step t
qp = Peak discharge (cfs) for 1in. runoff, for 1hr, for 1 sq.mi.
= (Ks * A * Q) / Tp (where Q = 1in. runoff, A=sq.mi.)
Qu(t) = Unit hydrograph ordinate (cfs) at time step t
Q(t) = Final hydrograph ordinate (cfs) at time step t
Rai(t)= Accumulated runoff (inches) at time step t for impervious area
Rap(t)= Accumulated runoff (inches) at time step t for pervious area
Rii(t)= Incremental runoff (inches) at time step t for impervious area
Rip(t)= Incremental runoff (inches) at time step t for pervious area
R(t) = Incremental weighted total runoff (inches)
Rtm = Time increment for rainfall table
Si = S for impervious area: Si = (1000/CNi) - 10
Sp = S for pervious area: Sp = (1000/CNp) - 10
t = Time step (row) number
Tc = Time of concentration
Tb = Time (hrs) of entire unit hydrograph: Tb = Tp + Tr
Tp = Time (hrs) to peak of a unit hydrograph: Tp = (dt/2) + Lag
Tr = Time (hrs) of receding limb of unit hydrograph: Tr = ratio of Tp

SCS UNIT HYDROGRAPH METHOD
(Computational Notes)

PRECIPITATION: ----------
Column (1): Time for time step t
Column (2): D(t) = Point on distribution curve for time step t
Column (3): Pi(t) = Pa(t) - Pa(t-1): Col.(4) - Preceding Col.(4)
Column (4): Pa(t) = D(t) x P: Col.(2) x P

PERVIOUS AREA RUNOFF (using SCS Runoff CN Method) ----------
Column (5): Rap(t) = Accumulated pervious runoff for time step t
If (Pa(t) is <= 0.2Sp) then use: Rap(t) = 0.0
If (Pa(t) is > 0.2Sp) then use:

Rap(t) = (Col.(4)-0.2Sp)**2 / (Col.(4)+0.8Sp)

Column (6): Rip(t) = Incremental pervious runoff for time step t
Rip(t) = Rap(t) - Rap(t-1)
Rip(t) = Col.(5) for current row - Col.(5) for preceding row.

IMPERVIOUS AREA RUNOFF ----------
Column (7 & 8)... Did not specify to use impervious areas.

INCREMENTAL WEIGHTED RUNOFF: ----------
Column (9): R(t) = (Ap/At) x Rip(t) + (Ai/At) x Rii(t)
R(t) = (Ap/At) x Col.(6) + (Ai/At) x Col.(8)

SCS UNIT HYDROGRAPH METHOD: ----------
Column (10): Q(t) is computed with the SCS unit hydrograph method
using R() and Qu().

SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 1 year storm
Duration = 24.0000 hrs Rain Depth = 2.5000 in
Rain Dir = H:\Document\Derrick\14-03-087 Shady Creek\
Rain File -ID = - TypeII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir = H:\Document\Derrick\14-03-087 Shady Creek\
HYG File - ID = work_pad.hyg - EX-1A Pre 1
Tc = .3774 hrs
Drainage Area = 16.520 acres Runoff CN= 82

==========
Computational Time Increment = .05032 hrs
Computed Peak Time = 12.1279 hrs
Computed Peak Flow = 16.12 cfs

Time Increment for HYG File = .0167 hrs
Peak Time, Interpolated Output = 12.1241 hrs
Peak Flow, Interpolated Output = 16.07 cfs
==========

DRAINAGE AREA

ID:EX-1A
CN = 82
Area = 16.520 acres
S = 2.1951 in
0.2S = .4390 in

Cumulative Runoff

.9980 in
59848 cu.ft

HYG Volume... 59847 cu.ft (area under HYG curve)

***** SCS UNIT HYDROGRAPH PARAMETERS *****

Time Concentration, Tc = .37742 hrs (ID: EX-1A)
Computational Incr, Tm = .05032 hrs = 0.20000 Tp

Unit Hyd. Shape Factor = 483.432 (37.46% under rising limb)
K = 483.43/645.333, K = .7491 (also, K = 2/(1+(Tr/Tp))
Receding/Rising, Tr/Tp = 1.6698 (solved from K = .7491)

Unit peak, qp = 49.59 cfs
Unit peak time Tp = .25162 hrs
Unit receding limb, Tr = 1.00647 hrs
Total unit time, Tb = 1.25808 hrs

SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 2 year storm
Duration = 24.0000 hrs Rain Depth = 3.1000 in
Rain Dir = H:\Document\Derrick\14-03-087 Shady Creek\
Rain File -ID = - TypeII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir = H:\Document\Derrick\14-03-087 Shady Creek\
HYG File - ID = work_pad.hyg - EX-1A Pre 2
Tc = .3774 hrs
Drainage Area = 16.520 acres Runoff CN= 82

==========
Computational Time Increment = .05032 hrs
Computed Peak Time = 12.1279 hrs
Computed Peak Flow = 23.89 cfs

Time Increment for HYG File = .0167 hrs
Peak Time, Interpolated Output = 12.1241 hrs
Peak Flow, Interpolated Output = 23.84 cfs
==========

DRAINAGE AREA

ID:EX-1A
CN = 82
Area = 16.520 acres
S = 2.1951 in
0.2S = .4390 in

Cumulative Runoff

1.4581 in
87440 cu.ft

HYG Volume... 87439 cu.ft (area under HYG curve)

***** SCS UNIT HYDROGRAPH PARAMETERS *****

Time Concentration, Tc = .37742 hrs (ID: EX-1A)
Computational Incr, Tm = .05032 hrs = 0.20000 Tp

Unit Hyd. Shape Factor = 483.432 (37.46% under rising limb)
K = 483.43/645.333, K = .7491 (also, K = 2/(1+(Tr/Tp))
Receding/Rising, Tr/Tp = 1.6698 (solved from K = .7491)

Unit peak, qp = 49.59 cfs
Unit peak time Tp = .25162 hrs
Unit receding limb, Tr = 1.00647 hrs
Total unit time, Tb = 1.25808 hrs

SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 25 year storm
Duration = 24.0000 hrs Rain Depth = 5.8000 in
Rain Dir = H:\Document\Derrick\14-03-087 Shady Creek\
Rain File -ID = - TypeII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir = H:\Document\Derrick\14-03-087 Shady Creek\
HYG File - ID = work_pad.hyg - EX-1A Pre 25
Tc = .3774 hrs
Drainage Area = 16.520 acres Runoff CN= 82

==========
Computational Time Increment = .05032 hrs
Computed Peak Time = 12.1279 hrs
Computed Peak Flow = 62.07 cfs

Time Increment for HYG File = .0167 hrs
Peak Time, Interpolated Output = 12.1241 hrs
Peak Flow, Interpolated Output = 62.04 cfs
==========

DRAINAGE AREA

ID:EX-1A
CN = 82
Area = 16.520 acres
S = 2.1951 in
0.2S = .4390 in

Cumulative Runoff

3.8036 in
228090 cu.ft

HYG Volume... 228089 cu.ft (area under HYG curve)

***** SCS UNIT HYDROGRAPH PARAMETERS *****

Time Concentration, Tc = .37742 hrs (ID: EX-1A)
Computational Incr, Tm = .05032 hrs = 0.20000 Tp

Unit Hyd. Shape Factor = 483.432 (37.46% under rising limb)
K = 483.43/645.333, K = .7491 (also, K = 2/(1+(Tr/Tp))
Receding/Rising, Tr/Tp = 1.6698 (solved from K = .7491)

Unit peak, qp = 49.59 cfs
Unit peak time Tp = .25162 hrs
Unit receding limb, Tr = 1.00647 hrs
Total unit time, Tb = 1.25808 hrs

SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 100 year storm
Duration = 24.0000 hrs Rain Depth = 7.2000 in
Rain Dir = H:\Document\Derrick\14-03-087 Shady Creek\
Rain File -ID = - TypeII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir = H:\Document\Derrick\14-03-087 Shady Creek\
HYG File - ID = work_pad.hyg - EX-1A Pre100
Tc = .3774 hrs
Drainage Area = 16.520 acres Runoff CN= 82

==========
Computational Time Increment = .05032 hrs
Computed Peak Time = 12.1279 hrs
Computed Peak Flow = 82.47 cfs

Time Increment for HYG File = .0167 hrs
Peak Time, Interpolated Output = 12.1241 hrs
Peak Flow, Interpolated Output = 82.44 cfs
==========

DRAINAGE AREA

ID:EX-1A
CN = 82
Area = 16.520 acres
S = 2.1951 in
0.2S = .4390 in

Cumulative Runoff

5.1039 in
306067 cu.ft

HYG Volume... 306065 cu.ft (area under HYG curve)

***** SCS UNIT HYDROGRAPH PARAMETERS *****

Time Concentration, Tc = .37742 hrs (ID: EX-1A)
Computational Incr, Tm = .05032 hrs = 0.20000 Tp

Unit Hyd. Shape Factor = 483.432 (37.46% under rising limb)
K = 483.43/645.333, K = .7491 (also, K = 2/(1+(Tr/Tp))
Receding/Rising, Tr/Tp = 1.6698 (solved from K = .7491)

Unit peak, qp = 49.59 cfs
Unit peak time Tp = .25162 hrs
Unit receding limb, Tr = 1.00647 hrs
Total unit time, Tb = 1.25808 hrs

Storm... TypeII 24hr Tag: Pre 1

SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 1 year storm
Duration = 24.0000 hrs Rain Depth = 2.5000 in
Rain Dir = H:\Document\Derrick\14-03-087 Shady Creek\
Rain File -ID = - TypeII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir = H:\Document\Derrick\14-03-087 Shady Creek\
HYG File - ID = work_pad.hyg - EX-1B Pre 1
Tc = .2745 hrs
Drainage Area = 6.480 acres Runoff CN= 80

==========
Computational Time Increment = .03661 hrs
Computed Peak Time = 12.0798 hrs
Computed Peak Flow = 6.54 cfs

Time Increment for HYG File = .0167 hrs
Peak Time, Interpolated Output = 12.0740 hrs
Peak Flow, Interpolated Output = 6.52 cfs
==========

DRAINAGE AREA

ID:EX-1B
CN = 80
Area = 6.480 acres
S = 2.5000 in
0.2S = .5000 in

Cumulative Runoff

.8889 in
20909 cu.ft

HYG Volume... 20908 cu.ft (area under HYG curve)

***** SCS UNIT HYDROGRAPH PARAMETERS *****

Time Concentration, Tc = .27454 hrs (ID: EX-1B)
Computational Incr, Tm = .03661 hrs = 0.20000 Tp

Unit Hyd. Shape Factor = 483.432 (37.46% under rising limb)
K = 483.43/645.333, K = .7491 (also, K = 2/(1+(Tr/Tp))
Receding/Rising, Tr/Tp = 1.6698 (solved from K = .7491)

Unit peak, qp = 26.74 cfs
Unit peak time Tp = .18303 hrs
Unit receding limb, Tr = .73211 hrs
Total unit time, Tb = .91513 hrs

SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 2 year storm
Duration = 24.0000 hrs Rain Depth = 3.1000 in
Rain Dir = H:\Document\Derrick\14-03-087 Shady Creek\
Rain File -ID = - TypeII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir = H:\Document\Derrick\14-03-087 Shady Creek\
HYG File - ID = work_pad.hyg - EX-1B Pre 2
Tc = .2745 hrs
Drainage Area = 6.480 acres Runoff CN= 80

==========
Computational Time Increment = .03661 hrs
Computed Peak Time = 12.0798 hrs
Computed Peak Flow = 9.90 cfs

Time Increment for HYG File = .0167 hrs
Peak Time, Interpolated Output = 12.0740 hrs
Peak Flow, Interpolated Output = 9.90 cfs
==========

DRAINAGE AREA

ID:EX-1B
CN = 80
Area = 6.480 acres
S = 2.5000 in
0.2S = .5000 in

Cumulative Runoff

1.3255 in
31179 cu.ft

HYG Volume... 31178 cu.ft (area under HYG curve)

***** SCS UNIT HYDROGRAPH PARAMETERS *****

Time Concentration, Tc = .27454 hrs (ID: EX-1B)
Computational Incr, Tm = .03661 hrs = 0.20000 Tp

Unit Hyd. Shape Factor = 483.432 (37.46% under rising limb)
K = 483.43/645.333, K = .7491 (also, K = 2/(1+(Tr/Tp))
Receding/Rising, Tr/Tp = 1.6698 (solved from K = .7491)

Unit peak, qp = 26.74 cfs
Unit peak time Tp = .18303 hrs
Unit receding limb, Tr = .73211 hrs
Total unit time, Tb = .91513 hrs

SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 25 year storm
Duration = 24.0000 hrs Rain Depth = 5.8000 in
Rain Dir = H:\Document\Derrick\14-03-087 Shady Creek\
Rain File -ID = - TypeII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir = H:\Document\Derrick\14-03-087 Shady Creek\
HYG File - ID = work_pad.hyg - EX-1B Pre 25
Tc = .2745 hrs
Drainage Area = 6.480 acres Runoff CN= 80

==========
Computational Time Increment = .03661 hrs
Computed Peak Time = 12.0432 hrs
Computed Peak Flow = 27.10 cfs

Time Increment for HYG File = .0167 hrs
Peak Time, Interpolated Output = 12.0406 hrs
Peak Flow, Interpolated Output = 27.01 cfs
==========

DRAINAGE AREA

ID:EX-1B
CN = 80
Area = 6.480 acres
S = 2.5000 in
0.2S = .5000 in

Cumulative Runoff

3.6013 in
84711 cu.ft

HYG Volume... 84710 cu.ft (area under HYG curve)

***** SCS UNIT HYDROGRAPH PARAMETERS *****

Time Concentration, Tc = .27454 hrs (ID: EX-1B)
Computational Incr, Tm = .03661 hrs = 0.20000 Tp

Unit Hyd. Shape Factor = 483.432 (37.46% under rising limb)
K = 483.43/645.333, K = .7491 (also, K = 2/(1+(Tr/Tp))
Receding/Rising, Tr/Tp = 1.6698 (solved from K = .7491)

Unit peak, qp = 26.74 cfs
Unit peak time Tp = .18303 hrs
Unit receding limb, Tr = .73211 hrs
Total unit time, Tb = .91513 hrs

SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 100 year storm
Duration = 24.0000 hrs Rain Depth = 7.2000 in
Rain Dir = H:\Document\Derrick\14-03-087 Shady Creek\
Rain File -ID = - TypeII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir = H:\Document\Derrick\14-03-087 Shady Creek\
HYG File - ID = work_pad.hyg - EX-1B Pre100
Tc = .2745 hrs
Drainage Area = 6.480 acres Runoff CN= 80

==========
Computational Time Increment = .03661 hrs
Computed Peak Time = 12.0432 hrs
Computed Peak Flow = 36.45 cfs

Time Increment for HYG File = .0167 hrs
Peak Time, Interpolated Output = 12.0406 hrs
Peak Flow, Interpolated Output = 36.34 cfs
==========

DRAINAGE AREA

ID:EX-1B
CN = 80
Area = 6.480 acres
S = 2.5000 in
0.2S = .5000 in

Cumulative Runoff

4.8793 in
114774 cu.ft

HYG Volume... 114774 cu.ft (area under HYG curve)

***** SCS UNIT HYDROGRAPH PARAMETERS *****

Time Concentration, Tc = .27454 hrs (ID: EX-1B)
Computational Incr, Tm = .03661 hrs = 0.20000 Tp

Unit Hyd. Shape Factor = 483.432 (37.46% under rising limb)
K = 483.43/645.333, K = .7491 (also, K = 2/(1+(Tr/Tp))
Receding/Rising, Tr/Tp = 1.6698 (solved from K = .7491)

Unit peak, qp = 26.74 cfs
Unit peak time Tp = .18303 hrs
Unit receding limb, Tr = .73211 hrs
Total unit time, Tb = .91513 hrs

Storm... TypeII 24hr Tag: Pre 1

SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 1 year storm
Duration = 24.0000 hrs Rain Depth = 2.5000 in
Rain Dir = H:\Document\Derrick\14-03-087 Shady Creek\
Rain File -ID = - TypeII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir = H:\Document\Derrick\14-03-087 Shady Creek\
HYG File - ID = work_pad.hyg - EX-2A Pre 1
Tc = .3012 hrs
Drainage Area = 8.610 acres Runoff CN= 80

==========
Computational Time Increment = .04017 hrs
Computed Peak Time = 12.0898 hrs
Computed Peak Flow = 8.33 cfs

Time Increment for HYG File = .0167 hrs
Peak Time, Interpolated Output = 12.0907 hrs
Peak Flow, Interpolated Output = 8.32 cfs
==========

DRAINAGE AREA

ID:EX-2A
CN = 80
Area = 8.610 acres
S = 2.5000 in
0.2S = .5000 in

Cumulative Runoff

.8889 in
27782 cu.ft

HYG Volume... 27781 cu.ft (area under HYG curve)

***** SCS UNIT HYDROGRAPH PARAMETERS *****

Time Concentration, Tc = .30124 hrs (ID: EX-2A)
Computational Incr, Tm = .04017 hrs = 0.20000 Tp

Unit Hyd. Shape Factor = 483.432 (37.46% under rising limb)
K = 483.43/645.333, K = .7491 (also, K = 2/(1+(Tr/Tp))
Receding/Rising, Tr/Tp = 1.6698 (solved from K = .7491)

Unit peak, qp = 32.38 cfs
Unit peak time Tp = .20083 hrs
Unit receding limb, Tr = .80331 hrs
Total unit time, Tb = 1.00413 hrs

SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 2 year storm
Duration = 24.0000 hrs Rain Depth = 3.1000 in
Rain Dir = H:\Document\Derrick\14-03-087 Shady Creek\
Rain File -ID = - TypeII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir = H:\Document\Derrick\14-03-087 Shady Creek\
HYG File - ID = work_pad.hyg - EX-2A Pre 2
Tc = .3012 hrs
Drainage Area = 8.610 acres Runoff CN= 80

==========
Computational Time Increment = .04017 hrs
Computed Peak Time = 12.0898 hrs
Computed Peak Flow = 12.66 cfs

Time Increment for HYG File = .0167 hrs
Peak Time, Interpolated Output = 12.0907 hrs
Peak Flow, Interpolated Output = 12.64 cfs
==========

DRAINAGE AREA

ID:EX-2A
CN = 80
Area = 8.610 acres
S = 2.5000 in
0.2S = .5000 in

Cumulative Runoff

1.3255 in
41427 cu.ft

HYG Volume... 41427 cu.ft (area under HYG curve)

***** SCS UNIT HYDROGRAPH PARAMETERS *****

Time Concentration, Tc = .30124 hrs (ID: EX-2A)
Computational Incr, Tm = .04017 hrs = 0.20000 Tp

Unit Hyd. Shape Factor = 483.432 (37.46% under rising limb)
K = 483.43/645.333, K = .7491 (also, K = 2/(1+(Tr/Tp))
Receding/Rising, Tr/Tp = 1.6698 (solved from K = .7491)

Unit peak, qp = 32.38 cfs
Unit peak time Tp = .20083 hrs
Unit receding limb, Tr = .80331 hrs
Total unit time, Tb = 1.00413 hrs

SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 25 year storm
Duration = 24.0000 hrs Rain Depth = 5.8000 in
Rain Dir = H:\Document\Derrick\14-03-087 Shady Creek\
Rain File -ID = - TypeII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir = H:\Document\Derrick\14-03-087 Shady Creek\
HYG File - ID = work_pad.hyg - EX-2A Pre 25
Tc = .3012 hrs
Drainage Area = 8.610 acres Runoff CN= 80

==========
Computational Time Increment = .04017 hrs
Computed Peak Time = 12.0496 hrs
Computed Peak Flow = 34.40 cfs

Time Increment for HYG File = .0167 hrs
Peak Time, Interpolated Output = 12.0573 hrs
Peak Flow, Interpolated Output = 34.38 cfs
==========

DRAINAGE AREA

ID:EX-2A
CN = 80
Area = 8.610 acres
S = 2.5000 in
0.2S = .5000 in

Cumulative Runoff

3.6013 in
112556 cu.ft

HYG Volume... 112555 cu.ft (area under HYG curve)

***** SCS UNIT HYDROGRAPH PARAMETERS *****

Time Concentration, Tc = .30124 hrs (ID: EX-2A)
Computational Incr, Tm = .04017 hrs = 0.20000 Tp

Unit Hyd. Shape Factor = 483.432 (37.46% under rising limb)
K = 483.43/645.333, K = .7491 (also, K = 2/(1+(Tr/Tp))
Receding/Rising, Tr/Tp = 1.6698 (solved from K = .7491)

Unit peak, qp = 32.38 cfs
Unit peak time Tp = .20083 hrs
Unit receding limb, Tr = .80331 hrs
Total unit time, Tb = 1.00413 hrs

SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 100 year storm
Duration = 24.0000 hrs Rain Depth = 7.2000 in
Rain Dir = H:\Document\Derrick\14-03-087 Shady Creek\
Rain File -ID = - TypeII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir = H:\Document\Derrick\14-03-087 Shady Creek\
HYG File - ID = work_pad.hyg - EX-2A Pre100
Tc = .3012 hrs
Drainage Area = 8.610 acres Runoff CN= 80

==========
Computational Time Increment = .04017 hrs
Computed Peak Time = 12.0496 hrs
Computed Peak Flow = 46.34 cfs

Time Increment for HYG File = .0167 hrs
Peak Time, Interpolated Output = 12.0573 hrs
Peak Flow, Interpolated Output = 46.28 cfs
==========

DRAINAGE AREA

ID:EX-2A
CN = 80
Area = 8.610 acres
S = 2.5000 in
0.2S = .5000 in

Cumulative Runoff

4.8793 in
152501 cu.ft

HYG Volume... 152501 cu.ft (area under HYG curve)

***** SCS UNIT HYDROGRAPH PARAMETERS *****

Time Concentration, Tc = .30124 hrs (ID: EX-2A)
Computational Incr, Tm = .04017 hrs = 0.20000 Tp

Unit Hyd. Shape Factor = 483.432 (37.46% under rising limb)
K = 483.43/645.333, K = .7491 (also, K = 2/(1+(Tr/Tp))
Receding/Rising, Tr/Tp = 1.6698 (solved from K = .7491)

Unit peak, qp = 32.38 cfs
Unit peak time Tp = .20083 hrs
Unit receding limb, Tr = .80331 hrs
Total unit time, Tb = 1.00413 hrs

Storm... TypeII 24hr Tag: Pre 1

SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 1 year storm
Duration = 24.0000 hrs Rain Depth = 2.5000 in
Rain Dir = H:\Document\Derrick\14-03-087 Shady Creek\
Rain File -ID = - TypeII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir = H:\Document\Derrick\14-03-087 Shady Creek\
HYG File - ID = work_pad.hyg - EX-3A Pre 1
Tc = .4240 hrs
Drainage Area = 73.420 acres Runoff CN= 78

==========
Computational Time Increment = .05654 hrs
Computed Peak Time = 12.1560 hrs
Computed Peak Flow = 50.79 cfs

Time Increment for HYG File = .0167 hrs
Peak Time, Interpolated Output = 12.1575 hrs
Peak Flow, Interpolated Output = 50.74 cfs
==========

DRAINAGE AREA

ID:EX-3A
CN = 78
Area = 73.420 acres
S = 2.8205 in
0.2S = .5641 in

Cumulative Runoff

.7879 in
209994 cu.ft

HYG Volume... 209992 cu.ft (area under HYG curve)

***** SCS UNIT HYDROGRAPH PARAMETERS *****

Time Concentration, Tc = .42404 hrs (ID: EX-3A)
Computational Incr, Tm = .05654 hrs = 0.20000 Tp

Unit Hyd. Shape Factor = 483.432 (37.46% under rising limb)
K = 483.43/645.333, K = .7491 (also, K = 2/(1+(Tr/Tp))
Receding/Rising, Tr/Tp = 1.6698 (solved from K = .7491)

Unit peak, qp = 196.18 cfs
Unit peak time Tp = .28270 hrs
Unit receding limb, Tr = 1.13079 hrs
Total unit time, Tb = 1.41348 hrs

SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 2 year storm
Duration = 24.0000 hrs Rain Depth = 3.1000 in
Rain Dir = H:\Document\Derrick\14-03-087 Shady Creek\
Rain File -ID = - TypeII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir = H:\Document\Derrick\14-03-087 Shady Creek\
HYG File - ID = work_pad.hyg - EX-3A Pre 2
Tc = .4240 hrs
Drainage Area = 73.420 acres Runoff CN= 78

==========
Computational Time Increment = .05654 hrs
Computed Peak Time = 12.1560 hrs
Computed Peak Flow = 80.35 cfs

Time Increment for HYG File = .0167 hrs
Peak Time, Interpolated Output = 12.1575 hrs
Peak Flow, Interpolated Output = 80.24 cfs
==========

DRAINAGE AREA

ID:EX-3A
CN = 78
Area = 73.420 acres
S = 2.8205 in
0.2S = .5641 in

Cumulative Runoff

1.2006 in
319971 cu.ft

HYG Volume... 319969 cu.ft (area under HYG curve)

***** SCS UNIT HYDROGRAPH PARAMETERS *****

Time Concentration, Tc = .42404 hrs (ID: EX-3A)
Computational Incr, Tm = .05654 hrs = 0.20000 Tp

Unit Hyd. Shape Factor = 483.432 (37.46% under rising limb)
K = 483.43/645.333, K = .7491 (also, K = 2/(1+(Tr/Tp))
Receding/Rising, Tr/Tp = 1.6698 (solved from K = .7491)

Unit peak, qp = 196.18 cfs
Unit peak time Tp = .28270 hrs
Unit receding limb, Tr = 1.13079 hrs
Total unit time, Tb = 1.41348 hrs

SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 25 year storm
Duration = 24.0000 hrs Rain Depth = 5.8000 in
Rain Dir = H:\Document\Derrick\14-03-087 Shady Creek\
Rain File -ID = - TypeII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir = H:\Document\Derrick\14-03-087 Shady Creek\
HYG File - ID = work_pad.hyg - EX-3A Pre 25
Tc = .4240 hrs
Drainage Area = 73.420 acres Runoff CN= 78

==========
Computational Time Increment = .05654 hrs
Computed Peak Time = 12.1560 hrs
Computed Peak Flow = 233.54 cfs

Time Increment for HYG File = .0167 hrs
Peak Time, Interpolated Output = 12.1575 hrs
Peak Flow, Interpolated Output = 233.09 cfs
==========

DRAINAGE AREA

ID:EX-3A
CN = 78
Area = 73.420 acres
S = 2.8205 in
0.2S = .5641 in

Cumulative Runoff

3.4028 in
906905 cu.ft

HYG Volume... 906901 cu.ft (area under HYG curve)

***** SCS UNIT HYDROGRAPH PARAMETERS *****

Time Concentration, Tc = .42404 hrs (ID: EX-3A)
Computational Incr, Tm = .05654 hrs = 0.20000 Tp

Unit Hyd. Shape Factor = 483.432 (37.46% under rising limb)
K = 483.43/645.333, K = .7491 (also, K = 2/(1+(Tr/Tp))
Receding/Rising, Tr/Tp = 1.6698 (solved from K = .7491)

Unit peak, qp = 196.18 cfs
Unit peak time Tp = .28270 hrs
Unit receding limb, Tr = 1.13079 hrs
Total unit time, Tb = 1.41348 hrs

SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 100 year storm
Duration = 24.0000 hrs Rain Depth = 7.2000 in
Rain Dir = H:\Document\Derrick\14-03-087 Shady Creek\
Rain File -ID = - TypeII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir = H:\Document\Derrick\14-03-087 Shady Creek\
HYG File - ID = work_pad.hyg - EX-3A Pre100
Tc = .4240 hrs
Drainage Area = 73.420 acres Runoff CN= 78

==========
Computational Time Increment = .05654 hrs
Computed Peak Time = 12.1560 hrs
Computed Peak Flow = 317.98 cfs

Time Increment for HYG File = .0167 hrs
Peak Time, Interpolated Output = 12.1575 hrs
Peak Flow, Interpolated Output = 317.33 cfs
==========

DRAINAGE AREA

ID:EX-3A
CN = 78
Area = 73.420 acres
S = 2.8205 in
0.2S = .5641 in

Cumulative Runoff

4.6566 in
1241064 cu.ft

HYG Volume... 1241061 cu.ft (area under HYG curve)

***** SCS UNIT HYDROGRAPH PARAMETERS *****

Time Concentration, Tc = .42404 hrs (ID: EX-3A)
Computational Incr, Tm = .05654 hrs = 0.20000 Tp

Unit Hyd. Shape Factor = 483.432 (37.46% under rising limb)
K = 483.43/645.333, K = .7491 (also, K = 2/(1+(Tr/Tp))
Receding/Rising, Tr/Tp = 1.6698 (solved from K = .7491)

Unit peak, qp = 196.18 cfs
Unit peak time Tp = .28270 hrs
Unit receding limb, Tr = 1.13079 hrs
Total unit time, Tb = 1.41348 hrs

Storm... TypeII 24hr Tag: Pre 1

SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 1 year storm
Duration = 24.0000 hrs Rain Depth = 2.5000 in
Rain Dir = H:\Document\Derrick\14-03-087 Shady Creek\
Rain File -ID = - TypeII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir = H:\Document\Derrick\14-03-087 Shady Creek\
HYG File - ID = work_pad.hyg - EX-3B Pre 1
Tc = .3879 hrs
Drainage Area = 3.200 acres Runoff CN= 80

==========
Computational Time Increment = .05171 hrs
Computed Peak Time = 12.1529 hrs
Computed Peak Flow = 2.69 cfs

Time Increment for HYG File = .0167 hrs
Peak Time, Interpolated Output = 12.1408 hrs
Peak Flow, Interpolated Output = 2.68 cfs
==========

DRAINAGE AREA

ID:EX-3B
CN = 80
Area = 3.200 acres
S = 2.5000 in
0.2S = .5000 in

Cumulative Runoff

.8889 in
10325 cu.ft

HYG Volume... 10324 cu.ft (area under HYG curve)

***** SCS UNIT HYDROGRAPH PARAMETERS *****

Time Concentration, Tc = .38786 hrs (ID: EX-3B)
Computational Incr, Tm = .05171 hrs = 0.20000 Tp

Unit Hyd. Shape Factor = 483.432 (37.46% under rising limb)
K = 483.43/645.333, K = .7491 (also, K = 2/(1+(Tr/Tp))
Receding/Rising, Tr/Tp = 1.6698 (solved from K = .7491)

Unit peak, qp = 9.35 cfs
Unit peak time Tp = .25857 hrs
Unit receding limb, Tr = 1.03429 hrs
Total unit time, Tb = 1.29287 hrs

SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 2 year storm
Duration = 24.0000 hrs Rain Depth = 3.1000 in
Rain Dir = H:\Document\Derrick\14-03-087 Shady Creek\
Rain File -ID = - TypeII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir = H:\Document\Derrick\14-03-087 Shady Creek\
HYG File - ID = work_pad.hyg - EX-3B Pre 2
Tc = .3879 hrs
Drainage Area = 3.200 acres Runoff CN= 80

==========
Computational Time Increment = .05171 hrs
Computed Peak Time = 12.1012 hrs
Computed Peak Flow = 4.10 cfs

Time Increment for HYG File = .0167 hrs
Peak Time, Interpolated Output = 12.1074 hrs
Peak Flow, Interpolated Output = 4.10 cfs
==========

DRAINAGE AREA

ID:EX-3B
CN = 80
Area = 3.200 acres
S = 2.5000 in
0.2S = .5000 in

Cumulative Runoff

1.3255 in
15397 cu.ft

HYG Volume... 15395 cu.ft (area under HYG curve)

***** SCS UNIT HYDROGRAPH PARAMETERS *****

Time Concentration, Tc = .38786 hrs (ID: EX-3B)
Computational Incr, Tm = .05171 hrs = 0.20000 Tp

Unit Hyd. Shape Factor = 483.432 (37.46% under rising limb)
K = 483.43/645.333, K = .7491 (also, K = 2/(1+(Tr/Tp))
Receding/Rising, Tr/Tp = 1.6698 (solved from K = .7491)

Unit peak, qp = 9.35 cfs
Unit peak time Tp = .25857 hrs
Unit receding limb, Tr = 1.03429 hrs
Total unit time, Tb = 1.29287 hrs

SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 25 year storm
Duration = 24.0000 hrs Rain Depth = 5.8000 in
Rain Dir = H:\Document\Derrick\14-03-087 Shady Creek\
Rain File -ID = - TypeII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir = H:\Document\Derrick\14-03-087 Shady Creek\
HYG File - ID = work_pad.hyg - EX-3B Pre 25
Tc = .3879 hrs
Drainage Area = 3.200 acres Runoff CN= 80

==========
Computational Time Increment = .05171 hrs
Computed Peak Time = 12.1012 hrs
Computed Peak Flow = 11.38 cfs

Time Increment for HYG File = .0167 hrs
Peak Time, Interpolated Output = 12.1074 hrs
Peak Flow, Interpolated Output = 11.36 cfs
==========

DRAINAGE AREA

ID:EX-3B
CN = 80
Area = 3.200 acres
S = 2.5000 in
0.2S = .5000 in

Cumulative Runoff

3.6013 in
41832 cu.ft

HYG Volume... 41829 cu.ft (area under HYG curve)

***** SCS UNIT HYDROGRAPH PARAMETERS *****

Time Concentration, Tc = .38786 hrs (ID: EX-3B)
Computational Incr, Tm = .05171 hrs = 0.20000 Tp

Unit Hyd. Shape Factor = 483.432 (37.46% under rising limb)
K = 483.43/645.333, K = .7491 (also, K = 2/(1+(Tr/Tp))
Receding/Rising, Tr/Tp = 1.6698 (solved from K = .7491)

Unit peak, qp = 9.35 cfs
Unit peak time Tp = .25857 hrs
Unit receding limb, Tr = 1.03429 hrs
Total unit time, Tb = 1.29287 hrs

SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 100 year storm
Duration = 24.0000 hrs Rain Depth = 7.2000 in
Rain Dir = H:\Document\Derrick\14-03-087 Shady Creek\
Rain File -ID = - TypeII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir = H:\Document\Derrick\14-03-087 Shady Creek\
HYG File - ID = work_pad.hyg - EX-3B Pre100
Tc = .3879 hrs
Drainage Area = 3.200 acres Runoff CN= 80

==========
Computational Time Increment = .05171 hrs
Computed Peak Time = 12.1012 hrs
Computed Peak Flow = 15.35 cfs

Time Increment for HYG File = .0167 hrs
Peak Time, Interpolated Output = 12.1074 hrs
Peak Flow, Interpolated Output = 15.30 cfs
==========

DRAINAGE AREA

ID:EX-3B
CN = 80
Area = 3.200 acres
S = 2.5000 in
0.2S = .5000 in

Cumulative Runoff

4.8793 in
56679 cu.ft

HYG Volume... 56674 cu.ft (area under HYG curve)

***** SCS UNIT HYDROGRAPH PARAMETERS *****

Time Concentration, Tc = .38786 hrs (ID: EX-3B)
Computational Incr, Tm = .05171 hrs = 0.20000 Tp

Unit Hyd. Shape Factor = 483.432 (37.46% under rising limb)
K = 483.43/645.333, K = .7491 (also, K = 2/(1+(Tr/Tp))
Receding/Rising, Tr/Tp = 1.6698 (solved from K = .7491)

Unit peak, qp = 9.35 cfs
Unit peak time Tp = .25857 hrs
Unit receding limb, Tr = 1.03429 hrs
Total unit time, Tb = 1.29287 hrs

Storm... TypeII 24hr Tag: Pre 1

SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 1 year storm
Duration = 24.0000 hrs Rain Depth = 2.5000 in
Rain Dir = H:\Document\Derrick\14-03-087 Shady Creek\
Rain File -ID = - TypeII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir = H:\Document\Derrick\14-03-087 Shady Creek\
HYG File - ID = work_pad.hyg - EX-3C Pre 1
Tc = .3715 hrs
Drainage Area = .590 acres Runoff CN= 84

==========
Computational Time Increment = .04953 hrs
Computed Peak Time = 12.1345 hrs
Computed Peak Flow = .65 cfs

Time Increment for HYG File = .0167 hrs
Peak Time, Interpolated Output = 12.1241 hrs
Peak Flow, Interpolated Output = .65 cfs
==========

DRAINAGE AREA

ID:EX-3C
CN = 84
Area = .590 acres
S = 1.9048 in
0.2S = .3810 in

Cumulative Runoff

1.1159 in
2390 cu.ft

HYG Volume... 2389 cu.ft (area under HYG curve)

***** SCS UNIT HYDROGRAPH PARAMETERS *****

Time Concentration, Tc = .37146 hrs (ID: EX-3C)
Computational Incr, Tm = .04953 hrs = 0.20000 Tp

Unit Hyd. Shape Factor = 483.432 (37.46% under rising limb)
K = 483.43/645.333, K = .7491 (also, K = 2/(1+(Tr/Tp))
Receding/Rising, Tr/Tp = 1.6698 (solved from K = .7491)

Unit peak, qp = 1.80 cfs
Unit peak time Tp = .24764 hrs
Unit receding limb, Tr = .99057 hrs
Total unit time, Tb = 1.23821 hrs

SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 2 year storm
Duration = 24.0000 hrs Rain Depth = 3.1000 in
Rain Dir = H:\Document\Derrick\14-03-087 Shady Creek\
Rain File -ID = - TypeII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir = H:\Document\Derrick\14-03-087 Shady Creek\
HYG File - ID = work_pad.hyg - EX-3C Pre 2
Tc = .3715 hrs
Drainage Area = .590 acres Runoff CN= 84

==========
Computational Time Increment = .04953 hrs
Computed Peak Time = 12.1345 hrs
Computed Peak Flow = .94 cfs

Time Increment for HYG File = .0167 hrs
Peak Time, Interpolated Output = 12.1241 hrs
Peak Flow, Interpolated Output = .94 cfs
==========

DRAINAGE AREA

ID:EX-3C
CN = 84
Area = .590 acres
S = 1.9048 in
0.2S = .3810 in

Cumulative Runoff

1.5989 in
3424 cu.ft

HYG Volume... 3423 cu.ft (area under HYG curve)

***** SCS UNIT HYDROGRAPH PARAMETERS *****

Time Concentration, Tc = .37146 hrs (ID: EX-3C)
Computational Incr, Tm = .04953 hrs = 0.20000 Tp

Unit Hyd. Shape Factor = 483.432 (37.46% under rising limb)
K = 483.43/645.333, K = .7491 (also, K = 2/(1+(Tr/Tp))
Receding/Rising, Tr/Tp = 1.6698 (solved from K = .7491)

Unit peak, qp = 1.80 cfs
Unit peak time Tp = .24764 hrs
Unit receding limb, Tr = .99057 hrs
Total unit time, Tb = 1.23821 hrs

SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 25 year storm
Duration = 24.0000 hrs Rain Depth = 5.8000 in
Rain Dir = H:\Document\Derrick\14-03-087 Shady Creek\
Rain File -ID = - TypeII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir = H:\Document\Derrick\14-03-087 Shady Creek\
HYG File - ID = work_pad.hyg - EX-3C Pre 25
Tc = .3715 hrs
Drainage Area = .590 acres Runoff CN= 84

==========
Computational Time Increment = .04953 hrs
Computed Peak Time = 12.0850 hrs
Computed Peak Flow = 2.35 cfs

Time Increment for HYG File = .0167 hrs
Peak Time, Interpolated Output = 12.0907 hrs
Peak Flow, Interpolated Output = 2.35 cfs
==========

DRAINAGE AREA

ID:EX-3C
CN = 84
Area = .590 acres
S = 1.9048 in
0.2S = .3810 in

Cumulative Runoff

4.0097 in
8588 cu.ft

HYG Volume... 8586 cu.ft (area under HYG curve)

***** SCS UNIT HYDROGRAPH PARAMETERS *****

Time Concentration, Tc = .37146 hrs (ID: EX-3C)
Computational Incr, Tm = .04953 hrs = 0.20000 Tp

Unit Hyd. Shape Factor = 483.432 (37.46% under rising limb)
K = 483.43/645.333, K = .7491 (also, K = 2/(1+(Tr/Tp))
Receding/Rising, Tr/Tp = 1.6698 (solved from K = .7491)

Unit peak, qp = 1.80 cfs
Unit peak time Tp = .24764 hrs
Unit receding limb, Tr = .99057 hrs
Total unit time, Tb = 1.23821 hrs

SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 100 year storm
Duration = 24.0000 hrs Rain Depth = 7.2000 in
Rain Dir = H:\Document\Derrick\14-03-087 Shady Creek\
Rain File -ID = - TypeII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir = H:\Document\Derrick\14-03-087 Shady Creek\
HYG File - ID = work_pad.hyg - EX-3C Pre100
Tc = .3715 hrs
Drainage Area = .590 acres Runoff CN= 84

==========
Computational Time Increment = .04953 hrs
Computed Peak Time = 12.0850 hrs
Computed Peak Flow = 3.10 cfs

Time Increment for HYG File = .0167 hrs
Peak Time, Interpolated Output = 12.0907 hrs
Peak Flow, Interpolated Output = 3.10 cfs
==========

DRAINAGE AREA

ID:EX-3C
CN = 84
Area = .590 acres
S = 1.9048 in
0.2S = .3810 in

Cumulative Runoff

5.3302 in
11416 cu.ft

HYG Volume... 11414 cu.ft (area under HYG curve)

***** SCS UNIT HYDROGRAPH PARAMETERS *****

Time Concentration, Tc = .37146 hrs (ID: EX-3C)
Computational Incr, Tm = .04953 hrs = 0.20000 Tp

Unit Hyd. Shape Factor = 483.432 (37.46% under rising limb)
K = 483.43/645.333, K = .7491 (also, K = 2/(1+(Tr/Tp))
Receding/Rising, Tr/Tp = 1.6698 (solved from K = .7491)

Unit peak, qp = 1.80 cfs
Unit peak time Tp = .24764 hrs
Unit receding limb, Tr = .99057 hrs
Total unit time, Tb = 1.23821 hrs

Storm... TypeII 24hr Tag: Pre 1

SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 1 year storm
Duration = 24.0000 hrs Rain Depth = 2.5000 in
Rain Dir = H:\Document\Derrick\14-03-087 Shady Creek\
Rain File -ID = - TypeII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir = H:\Document\Derrick\14-03-087 Shady Creek\
HYG File - ID = work_pad.hyg - EX-4A Pre 1
Tc = .3170 hrs
Drainage Area = 20.140 acres Runoff CN= 74

==========
Computational Time Increment = .04227 hrs
Computed Peak Time = 12.0900 hrs
Computed Peak Flow = 11.91 cfs

Time Increment for HYG File = .0167 hrs
Peak Time, Interpolated Output = 12.0907 hrs
Peak Flow, Interpolated Output = 11.91 cfs
==========

DRAINAGE AREA

ID:EX-4A
CN = 74
Area = 20.140 acres
S = 3.5135 in
0.2S = .7027 in

Cumulative Runoff

.6082 in
44468 cu.ft

HYG Volume... 44469 cu.ft (area under HYG curve)

***** SCS UNIT HYDROGRAPH PARAMETERS *****

Time Concentration, Tc = .31705 hrs (ID: EX-4A)
Computational Incr, Tm = .04227 hrs = 0.20000 Tp

Unit Hyd. Shape Factor = 483.432 (37.46% under rising limb)
K = 483.43/645.333, K = .7491 (also, K = 2/(1+(Tr/Tp))
Receding/Rising, Tr/Tp = 1.6698 (solved from K = .7491)

Unit peak, qp = 71.98 cfs
Unit peak time Tp = .21136 hrs
Unit receding limb, Tr = .84546 hrs
Total unit time, Tb = 1.05682 hrs

SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 2 year storm
Duration = 24.0000 hrs Rain Depth = 3.1000 in
Rain Dir = H:\Document\Derrick\14-03-087 Shady Creek\
Rain File -ID = - TypeII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir = H:\Document\Derrick\14-03-087 Shady Creek\
HYG File - ID = work_pad.hyg - EX-4A Pre 2
Tc = .3170 hrs
Drainage Area = 20.140 acres Runoff CN= 74

==========
Computational Time Increment = .04227 hrs
Computed Peak Time = 12.0900 hrs
Computed Peak Flow = 20.39 cfs

Time Increment for HYG File = .0167 hrs
Peak Time, Interpolated Output = 12.0907 hrs
Peak Flow, Interpolated Output = 20.38 cfs
==========

DRAINAGE AREA

ID:EX-4A
CN = 74
Area = 20.140 acres
S = 3.5135 in
0.2S = .7027 in

Cumulative Runoff

.9723 in
71083 cu.ft

HYG Volume... 71085 cu.ft (area under HYG curve)

***** SCS UNIT HYDROGRAPH PARAMETERS *****

Time Concentration, Tc = .31705 hrs (ID: EX-4A)
Computational Incr, Tm = .04227 hrs = 0.20000 Tp

Unit Hyd. Shape Factor = 483.432 (37.46% under rising limb)
K = 483.43/645.333, K = .7491 (also, K = 2/(1+(Tr/Tp))
Receding/Rising, Tr/Tp = 1.6698 (solved from K = .7491)

Unit peak, qp = 71.98 cfs
Unit peak time Tp = .21136 hrs
Unit receding limb, Tr = .84546 hrs
Total unit time, Tb = 1.05682 hrs

SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 25 year storm
Duration = 24.0000 hrs Rain Depth = 5.8000 in
Rain Dir = H:\Document\Derrick\14-03-087 Shady Creek\
Rain File -ID = - TypeII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir = H:\Document\Derrick\14-03-087 Shady Creek\
HYG File - ID = work_pad.hyg - EX-4A Pre 25
Tc = .3170 hrs
Drainage Area = 20.140 acres Runoff CN= 74

==========
Computational Time Increment = .04227 hrs
Computed Peak Time = 12.0900 hrs
Computed Peak Flow = 66.69 cfs

Time Increment for HYG File = .0167 hrs
Peak Time, Interpolated Output = 12.0907 hrs
Peak Flow, Interpolated Output = 66.63 cfs
==========

DRAINAGE AREA

ID:EX-4A
CN = 74
Area = 20.140 acres
S = 3.5135 in
0.2S = .7027 in

Cumulative Runoff

3.0174 in
220598 cu.ft

HYG Volume... 220605 cu.ft (area under HYG curve)

***** SCS UNIT HYDROGRAPH PARAMETERS *****

Time Concentration, Tc = .31705 hrs (ID: EX-4A)
Computational Incr, Tm = .04227 hrs = 0.20000 Tp

Unit Hyd. Shape Factor = 483.432 (37.46% under rising limb)
K = 483.43/645.333, K = .7491 (also, K = 2/(1+(Tr/Tp))
Receding/Rising, Tr/Tp = 1.6698 (solved from K = .7491)

Unit peak, qp = 71.98 cfs
Unit peak time Tp = .21136 hrs
Unit receding limb, Tr = .84546 hrs
Total unit time, Tb = 1.05682 hrs

SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 100 year storm
Duration = 24.0000 hrs Rain Depth = 7.2000 in
Rain Dir = H:\Document\Derrick\14-03-087 Shady Creek\
Rain File -ID = - TypeII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir = H:\Document\Derrick\14-03-087 Shady Creek\
HYG File - ID = work_pad.hyg - EX-4A Pre100
Tc = .3170 hrs
Drainage Area = 20.140 acres Runoff CN= 74

==========
Computational Time Increment = .04227 hrs
Computed Peak Time = 12.0900 hrs
Computed Peak Flow = 93.02 cfs

Time Increment for HYG File = .0167 hrs
Peak Time, Interpolated Output = 12.0907 hrs
Peak Flow, Interpolated Output = 92.93 cfs
==========

DRAINAGE AREA

ID:EX-4A
CN = 74
Area = 20.140 acres
S = 3.5135 in
0.2S = .7027 in

Cumulative Runoff

4.2169 in
308292 cu.ft

HYG Volume... 308301 cu.ft (area under HYG curve)

***** SCS UNIT HYDROGRAPH PARAMETERS *****

Time Concentration, Tc = .31705 hrs (ID: EX-4A)
Computational Incr, Tm = .04227 hrs = 0.20000 Tp

Unit Hyd. Shape Factor = 483.432 (37.46% under rising limb)
K = 483.43/645.333, K = .7491 (also, K = 2/(1+(Tr/Tp))
Receding/Rising, Tr/Tp = 1.6698 (solved from K = .7491)

Unit peak, qp = 71.98 cfs
Unit peak time Tp = .21136 hrs
Unit receding limb, Tr = .84546 hrs
Total unit time, Tb = 1.05682 hrs