



**CASH WAGGNER
& ASSOCIATES, PC**
CONSULTING ENGINEERS • LAND SURVEYORS

DATE: 10.08.14

PROJECT NO.: 14-1878

REFERENCE: Kinway Park

YOUR FILE NO.:

ATTENTION: Jeff Mueller

COMPANY: Vanderburgh County
Surveyor

ADDRESS: Civic Center Complex –
Room 325

CITY, ST, ZIP: Evansville, IN 47708

PHONE:

THE FOLLOWING ITEMS:

COPIES:	ORIG./LAST REV. DATE:	DESCRIPTION:
1	10.08.14	Revised Drainage Plans & Details
1	10.08.14	Revised Drainage Report
1	10.08.14	Drainage Variance Request

ARE TRANSMITTED:

- PER YOUR REQUEST
- FOR YOUR FILES
- FOR REVIEW & COMMENT
- OTHER

FOR YOUR:

- APPROVAL
- USE
- INFORMATION
- OTHER

APPROVED

OCT 14 2014

**VANDERBURGH COUNTY
DRAINAGE BOARD**

COMMENTS:

Regarding the adjoiningers that have called to discuss concerns about drainage from or to our site. Ralph Effinger was concerned about the amount of discharge from the basin outlet. The current flow for undeveloped conditions that is exiting our site at the northeast corner is 55.67 cfs. The proposed release rate at the northeast corner for the developed subdivision is 17.66 cfs for the 25-year storm. The proposed detention basin will be storing and holding back a significant amount of water therefore reducing the amount of water discharging to adjoining properties. Michael Evans was concerned about drainage from his property. He has a 4" drainage pipe that was stubbed approximately 10 feet onto our property. Since the entire west side of the subdivision has been lowered, a portion of this pipe has since been removed and will now discharge into the rear yard of Lot 24 and drain to Swale #5. A 10' drainage easement has been reserved for drainage from this pipe. Bob Warren with the Evansville Convention Visitors Bureau has had discussions with the subdivision developer, Kenny Reinbrecht, and he has informed us the he has no issues with this project.

FROM:

GLEN MERITT, JR., P.E.

cc: File

10/9/2014

LETTER OF TRANSMITTAL

414 CITADEL CIRCLE
SUITE B
EVANSVILLE, IN 47715
PH: 812.401.5561
FAX: 812.401.5563
GMERITT@CASHWAGGNER.COM



CASH WAGGNER
& ASSOCIATES, PC
CONSULTING ENGINEERS • LAND SURVEYORS

October 8, 2014

Mr. Jeff Mueller
Vanderburgh County Surveyor
Room 325 Civic Center - 1 NW Martin Luther King Jr. Blvd.
Evansville, IN 47708

**RE: Drainage Report
Kinway Park
Heckel Road
Our Project #: 14-1878**

Mr. Mueller:

Below is a summary of the drainage calculations for the above-referenced project.

SITE DESCRIPTION

This development consists of a single family residential subdivision with 61 lots and its associated improvements (i.e. roads, utilities). The entire project will be constructed in one phase and the entire property will be disturbed during construction of the subdivision. The site is located on an 18.49-acre parcel west of the Evansville Softball Complex approximately 1650 feet east of the Oak Hill Road and Heckel Road intersection.

DRAINAGE PATTERNS

The existing site was previously utilized as a cultivated field. The entire site drains in an easterly direction and runoff sheet flows to an existing ditch located near the east property line. This ditch flows north to the northeast corner of the site, then east and exits the site. All runoff ultimately drains to Firlick Creek.

The proposed development has been divided into 16 developed drainage sub-basins with the 25-year flow calculated for each sub-basin. See attached Developed Sub-basin Exhibit for locations of each sub-basin. There are also two off-site sub-basins west of our site that will be routed through the proposed drainage improvements for this subdivision. Off-Site Sub-basin #3 (OS-3) drains to the north across Lots 19 - 21 in Ensle Place and discharge to the adjoining property to the north. An area drain and 4" pipe has recently been installed on Lot 19 of Ensle Place. This drain collects a small amount of water, depicted as Off-Site Sub-basin #4 (OS-4), between the house and the south garage. The 4" pipe runs in a northeast direction and discharges onto the Kinway Park project on the northwest side of Lot 24. See attached Off-Site Sub-basin Exhibit for locations of each sub-basin. A drainage swale and storm sewer network will be installed within the development to capture the majority of the storm water runoff and convey it to the detention basin located along the east property line. The primary and emergency spillway of the detention basin discharge to the existing ditch located at the northeast corner of the site.

APPROVED

OCT 14 2014

**VANDERBURGH COUNTY
DRAINAGE BOARD**

APPROVED

OCT 14 2014

CALCULATIONS

**VANDERBURGH COUNTY
DRAINAGE BOARD**

The Rational Method and HEPIC Manual were utilized in performing the drainage calculations for this project. All storm sewers and swales were designed to carry the 25-year developed runoff. Detention basin #1 was designed to contain the peak 25-year developed runoff from the site while allowing a release rate less than the peak 10-year undeveloped runoff rate from the site. The emergency spillway for the detention basin was designed to carry the 100-year storm flow.

Below is a summary of the detention basin design elements:

		NOTES
Detention Basin #1 Developed Q(25)	49.21 - cfs	
Detention Basin #1 Developed Q(100)	60.51 - cfs	
Detention Basin #1 Undeveloped Q(10)	21.08 - cfs	UN-1
10/25-yr. Req'd Volume	98,065 c.f.	
Undetained Developed Q(25)	3.31 - cfs	#1 and #17
Off-Site Existing Q(25)	37.90 - cfs	OS-1
Allowable Release Rate	55.67 - cfs	Undeveloped Q(10) - Undetained Developed Q(25) + Off-Site Q(25)
<i>Proposed Release Rate</i>	<i>20.97 - cfs</i>	<i>Detention Basin Discharge + Undetained Runoff</i>
<i>Outfall Structure</i>	<i>(2) 28-LF of 14"x23" Elliptical RCP</i>	<i>P-547 and P-551</i>
Outfall I.E.	381.90	
25-year Storage Vol. Elev.	383.02	
HW (25-yr. elev. - I.E.)	1.12 - ft.	
Minimum Top/Bank	383.90	



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CASH WAGGNER & ASSOCIATES, PC

414 CITADEL CIRCLE, STE. B
EVANSVILLE, IN 47715

PH: 812.401.5561
FAX: 812.401.5563

DEVELOPED DRAINAGE BASIN CALCULATIONS

Basin No.: OS-4		Total Area = 5,168 S.F. 0.12 Acres			
Surface				C	N
Structures	=	1,517 S.F.	=	0.03 Ac.	0.92 0.02
Pavement	=	0 S.F.	=	0.00 Ac.	0.92 0.02
Drives	=	0 S.F.	=	0.00 Ac.	0.92 0.02
Patios	=	0 S.F.	=	0.00 Ac.	0.92 0.02
Sidewalks	=	0 S.F.	=	0.00 Ac.	0.92 0.02
Lawn (0-2%)	3,651 S.F.	=	0.08 Ac.	0.15 0.40	
Lawn (2-5%)	0 S.F.	=	0.00 Ac.	0.25 0.40	
Lawn (5-10%)	0 S.F.	=	0.00 Ac.	0.40 0.40	
Lawn (>10%)	0 S.F.	=	0.00 Ac.	0.55 0.40	
Woods (>10%)	0 S.F.	=	0.00 Ac.	0.48 0.60	
Water	0 S.F.	=	0.00 Ac.	1.00 0.00	
Misc.	0 S.F.	=	0.00 Ac.	0.92 0.02	

Weighted c =	0.376
Weighted N =	0.288
Sheet Flow	
L =	50 Ft.
H =	0.8 Ft.
S =	0.0150 Ft./Ft.
t1 =	7.67 Minutes
Open Channel Flow	
L =	0 Ft.
H =	0.0 Ft.
S =	# DIV/01 Ft./Ft.
v =	3.30 Ft./sec.
t2 =	0.00 Minutes
tc =	7.67 Minutes
I(10) =	In./Hr.
I(25) =	6.523 In./Hr.
I(50) =	In./Hr.
I(100) =	7.752 In./Hr.
Q(10) =	0.00 CFS
Q(25) =	0.29 CFS
Q(50) =	0.00 CFS
Q(100) =	0.35 CFS

(Min. 5 minutes)



CASH WAGGNER
& ASSOCIATES, PC
CONSULTING ENGINEERS • LAND SURVEYORS

October 8, 2014

Vanderburgh County Drainage Board
Civic Center Complex - Room 305
Evansville, IN 47708

**RE: Kinway Park
Sidewalk Waiver Request
Project No.: 14-1878**

On behalf of the owner, Two Kins Investments, LLC, we request a variance to allow homes to be constructed within 10 feet of the lake maintenance and storm drainage easement for Detention Basin #1 within Kinway Park Subdivison.

If you have any questions or require additional information, please contact our office.

Sincerely,

Glen Meritt, Jr.
Project Engineer

cc: File

W:\14878\Documents\Drainage Variance Ltr.doc

Approved by the Vanderburgh County Drainage Board on this 14TH day of OCTOBER 2014.

Stephen Melcher, President

Joe Kiefer, Vice President

Marsha Abell, Member

KINWAY-FINAL DRAINAGE PLAN

SUBMITTED 9-22-2014 Revisions submitted 10-9-2014

REVIEWED BY Jeffrey D. Mueller, PE 9-26_-2014

13.04.095 Conditions of drainage plan approval.

In order for an applicant to obtain approval of a final drainage plan, the following requirements must be met:

F. The person, persons, partnership, corporation, or other entity to whom approval of the drainage plan is granted must be the person, persons, partnership, corporation, or entity who will be responsible for accomplishing the project for which the drainage plan is developed. **Provide information regarding the name of the developer of the project (name of partnership, corporation, etc, address, and phone number plus a name of a contact person of the partnership or corporation).** Two Kins Investments, LLC, Wayne Kinney, 9210 Petersburg Road, Evansville, IN 47725 (812) 449-8731

13.04.160 Contents of preliminary drainage plan.

A. The contents of the preliminary drainage plan shall include a map based on the most current county planimetric maps, or a topographic map prepared from a more recent aerial photo reconnaissance that provides more accurate data, complete with contour lines, and showing the following:

1. The extent and area of each watershed affecting the design of the drainage facilities for the project; **Provided**
2. The soil types based on the most current information available from the SWCD; **Provided**
3. Zone "A" floodplain based on the current FIRM panels;
4. The existing man-made and natural waterways, ponds, basins, pipes, culverts, and other drainage facilities or features within or affecting the project; **Provided**
5. The preliminary layout and design of the streets, and all stormwater drainage facilities, including depressed pavements used to convey or temporarily store overflow from the heavier storms, and all outlets for the storm water drainage facilities; **Provided**
6. The existing streams, floodways, and floodplains to be maintained, and new channels to be constructed, their locations, cross sections, profiles, and materials used; **Provided**
7. The proposed culverts and bridges to be built, with the specific materials to be used, elevations, waterway openings, and the basis of their design; **Provided**

8. Existing detention basins or ponds within the project, or outside the project but affecting it, to be maintained, enlarged, or otherwise altered, together with any new basins or ponds to be built; and their basis of design; **Provided**

9. The estimated depth and amount of storage required of the basins and ponds, and their available freeboards; **Provided**

10. The estimated location and percentage of impervious surface existing and expected to be constructed at completion of the project; **Provided**

11. Any interim plan which is to be incorporated into the project pending its completion according to the final drainage plan.

B. Notations and Explanations on the Preliminary Plan. All notations necessary to indicate the existing conditions, and the proposed functions of the various features shown thereon; and shall include the following.

C. Geographic Orientation Required. A north arrow, scale, location insert, and other information necessary for geographic clarification shall be included on a preliminary plan. **Provided**

D. Data Required to Accompany Preliminary Plan. Descriptive data sufficient to support the feasibility of the preliminary drainage plan with regard to the requirements of this chapter, including calculations of the predevelopment and post development runoff rates using rainfall data supplied herein shall accompany a preliminary drainage plan. **Provided**

E. Recommendation of Preliminary Plans Restricted. No preliminary drainage plan shall be recommended to the drainage board by their technical advisors unless the preliminary drainage plan shall be a workable plan according to the same criteria as, and capable of being incorporated into, a final drainage plan. **Provided**

F. Determination of Sufficiency. The drainage board shall decide the sufficiency of the preliminary drainage plan, and any conditions or additional requirements to be applied to the preliminary drainage plan. **Approved by Drainage Board on 8/19/2014**

13.04.165 Contents of the final drainage plan.

The contents of the final drainage plan shall include all the items listed above for a preliminary drainage plan, plus:

A. Soils Map. A soils map indicating soils names and their hydrologic classification must be provided for a proposed project. **Provided in preliminary**

B. Location and Topographic Map. In addition, a location and topographic map must be provided showing the land to be developed, and such adjoining land whose location and topography may affect or

be affected by the layout or drainage of the project. **There is no information regarding drainage from Ensle Place north of OS-1. Provided**

C. Contour Intervals.

1. The contour intervals shown on the topographic map shall be two and one-half feet for slopes less than four percent; and five feet for slopes four percent or greater; or best available; **Provided**

2. The location of streams and other stormwater conveyance channels, both natural and man-made; and the vertical and horizontal limits of the one hundred (100) year floodplain, according to FIRM panels, and/or the building commissioner; all properly identified; **Provided on proposed plat submitted with plans**

3. The normal shoreline of lakes, ponds, swamps, and basins, their floodplains, and lines of inflow and outflow; **Provided**

4. The location of exiting regulated drains, farm drains, inlets and outfalls; **Not addressed**

5. Storm, sanitary, and combined sewers, and outfalls; **Provided**

6. Wells, septic tank systems, and outfalls, if any; **Not addressed According to SWP3 there are no sinkholes, abandoned or dry wells.**

7. Seeps, springs, sinkholes, caves, shafts, faults, or other such geological features visible, or of record; **Not addressed According to SWP3 there are no sinkholes, abandoned or dry wells.**

8. The limits of the entire proposed project and the limits of the expected extent of land disturbance required to accomplish the project; **Unless otherwise stated, it will be assumed that the entire project area will be disturbed. Per submittal, entire site is to be disturbed.**

9. The location of the streets, lot lines, and easements; **Drawing C114 shows a minimum width of 16' for swale #3 but the drainage easement for this swale is only shown at 15' Minimum width required is 13' per revised drawing.**

10. A scale, preferably one inch equals fifty (50) feet; **Provided, 1"=50'**

11. An arrow indicating North. ; **Provided**

D. On-Site Bench Mark Required. A benchmark determined by "Mean Sea Level Datum 1929," is required to be located within the project limits. **None Shown**

13.04.170 Final drainage plan layout.

A. In addition to the requirements listed for a preliminary drainage plan, the final drainage plan shall depict the following:

1. The extent and area of each watershed tributary to the drainage facilities within the project; **Provided**
2. The final layout and design of proposed storm sewers, their inlet and outfall locations and elevations, the receiving streams or channels; all with the basis of their design; **Provided**
3. The location and design of the proposed street system, including depressed pavements used to convey or detain overflow from storm sewers and over-the-curb runoff resulting from heavier rainstorms, and the outlets for such overflows; all with their designed elevations; **John can you provide comments to this section?**
4. The locations, cross sections, and profiles of existing streams, floodways, and floodplains to be maintained, and the same for all new channels to be constructed; **No information on existing streams, specifically where emergency spillway will discharge; see #9**
5. The materials, elevations, waterway openings, size, and basis for design of the proposed culverts and bridges; **Provided**
6. Existing ponds and basins to be altered, enlarged, filled, or maintained; and new ponds, basins, swales, to be built, and the basis of their design; **Provided**
7. The location and percentage of impervious surfaces existing and expected to be constructed; **Provided**
8. The material types sizes slopes grades and other details of all the stormwater drainage facilities;

There is a 20' Drainage Easement shown on lots 24, 25, 34, 35, 44, 45, 55 and 56 but no swales are shown. Please provide information on how drainage will be handled in this area. Per conversation, drainage will flow on each individual lot through front yards. Therefore the drainage easements have been eliminated.

Swale #5 appears to handle water from the northern portion of Enslie Place but the swale does not begin until lot 23. How will water be conveyed on lots 24 and the remaining portion of lot 23; is the existing ditch to be utilized? Swale 5 was shown extended.

Swale #3 shows an average slope of 1.46%, however a short portion of this swale is at a much steeper slope where it captures the water from the outflow of the lake in Enslie Place. Please provide detail on the swale on lot 44 including erosion control measures. Per discussion on phone, the grading on site will be such that this will not be an issue.

9. The estimated depth and amount of storage required in the new ponds or basins, the freeboard above the normal pool and highwater pool of wet basins, and details of the emergency overflows from the basins; **There is insufficient detail on how water from the emergency spillway will be handled from its discharge point to the northeast corner of the property. How will the discharge be funneled into the existing ditch and not cause wash on the adjoining property?** A note on the drawing states that the existing ground at east property line will serve as a drain.

10. For all controlled release basins, a plot or tabulation of the storage volumes with corresponding water surface elevations, and a plot or tabulation of the basin outflow rates for those water surface elevations; **Provided**

11. The location of any applicable "impacted drainage areas" or other areas designated to remain totally undisturbed, natural, or for common and/or recreational use. **None shown**

B. Protection of Structures From One Hundred Year Flooding. All structures to be occupied as residences or businesses shall have finished floor elevations two feet above the high water calculated to occur during a one hundred (100) year return period storm for the subject building site; and the required floor elevations shall be depicted on the plan drawings for such affected sites. **Provided on proposed plat submitted with plans**

13.04.175 Submittal of a written drainage design report.

The final drainage plan shall be accompanied by a written report containing the following:

A. Any significant stormwater drainage problems existing or anticipated to be associated with the project; **The County Surveyors Office has been contacted by 3 parties regarding the drainage from this project. On September 8, 2014 Mr Ralph Effinger, 629 East Columbia, 47711, 424-7847 (cell 459-0522) visited the office to express his concern regarding the amount of discharge from the outlet lake. Mr. Effinger owns the property immediately north of the project. The office was also contacted by Michael Evans of 6625 Colonial Drive (502-593-9430) regarding concern with the drainage off of his property. The office was also received an email on August 18, 2014 from Michael Schopmeyer representing the Evansville Convention Visitors Bureau (owner of the property directly east of the project. It was the understanding of the Surveyors Office that the ECVB was to meet with the developer to discuss their concerns. Please address any discussions regarding these issues. Addressed in revision**

13.04.125 Building permits conditioned.

The Vanderburgh County building commissioner shall not allow construction of buildings, or other impervious structures or facilities to commence at the site of a project requiring final drainage plan approval until:

A. Such approval has been expressed by the drainage board;

B. And all storm drainage facilities are constructed. **See comment under Section 13.04.130**

13.04.130 Phased development of large projects allowed.

Large projects may be divided into phases for the purpose of constructing drainage facilities and obtaining permits in accordance with the requirements of this chapter. **Please describe if all facilities will be constructed prior to the construction of any buildings or if the subdivision is to be phased. If the project is to be phased, please describe what facilities will be constructed prior to proceeding forward.** Per revised comments-entire project to be completed in one phase.

13.04.440 General detention/retention basin design requirements.

The following design principles shall be observed for detention and retention basins:

C. Basin Distance From Dwellings. All stormwater detention facilities shall be separated by not less than fifty (50) feet from any building or structure to be occupied by humans. **It appears on lake lots 6 through 19 that if homes are 50' from the lake, that the lots will not be of sufficient size to allow construction of a home. Please provide a letter to the Drainage Board requesting a variance approval to relax the 50' requirement and state in the variance letter the require distance that will be requested.**

Under 13.04.440 Section U and 13.04.460 provide the required maintenance statements and the maintenance responsibilities as required.

U. Maintenance Report Required for Basin.

1. A brief and concise report shall be prepared, by the design engineer, consisting of a description of the location, intended function of all parts appurtenant to the basin, together with a description of the ways in which the basin and its appurtenances should be maintained, all worded in language easily understood by residential or commercial property owners; and
2. The report shall be attached to the restrictions for the property on which the basin and its parts are located.
3. Such restrictions shall be shown to exist prior to the board's final approval of the drainage plan for a project whose plans include a basin.

13.04.460 Responsibility for drainage facility maintenance.

The installation, maintenance, repair, and replacement of all stormwater drainage facilities, and erosion and siltation control measures for a project during the period of construction, and until final approval by the county engineer, shall be the responsibility of the land developer(s), and/or the property owner(s) of record.

The assignment of responsibility for the maintenance and repair of all stormwater drainage systems and facilities outside of county accepted road rights-of-way after the completion of the project, and final

approval thereof by the county engineer, shall be determined before the final drainage plan is approved; and shall be documented by appropriate covenants and restrictions applied to the subdivision and to the property deeds thereof, and shall be printed clearly upon all recorded plats of the project.

Other comments-drawings have a confidentiality statement in the title block. This should be removed from any future submittals as drawings once submitted are public record and no adherence to the consent provisions will occur.



**CASH WAGGNER
& ASSOCIATES, PC**
CONSULTING ENGINEERS & LAND SURVEYORS

DATE: 09.18.14

ATTENTION: Jeff Mueller

PROJECT NO.: 14-1878

COMPANY: Vanderburgh County
Surveyor

REFERENCE: Kinway Park

ADDRESS: Civic Center Complex -
Room 325

YOUR FILE NO.:

CITY, ST, ZIP: Evansville, IN 47708

PHONE:

THE FOLLOWING ITEMS:

COPIES:	ORIG./LAST REV. DATE:	DESCRIPTION:
1	09.16.14	Drainage Plans, Road Plans & Details
1	09.16.14	Drainage Report

LETTER OF TRANSMITTAL

ARE TRANSMITTED:

- PER YOUR REQUEST
- FOR YOUR FILES
- FOR REVIEW & COMMENT
- OTHER

FOR YOUR:

- APPROVAL
- USE
- INFORMATION
- OTHER

VIA:

- COURIER
- FOR PICK UP
- USPS
- NEXT DAY
- FED EX
- UPS
- DHL
- SATURDAY DELIVERY
- TRACKING # _____
- OTHER DELIVERED

COMMENTS:

Please review the attached drainage plan, details, sub-basin exhibits and if acceptable take to the next available County Commissioners meeting for Preliminary Drainage Plan approval. If you have any questions or comments, please give me a call. Thank you

414 CITADEL CIRCLE
SUITE B
EVANSVILLE, IN 47715
PH: 812.401.5561
FAX: 812.401.5563
GMERITT@CASHWAGGNER.COM

FROM:


GLEN MERITT, JR., P.E.

cc: File

**RECEIVED BY THE
VANDERBURGH COUNTY
SURVEYOR'S OFFICE**



CASH WAGGNER
& ASSOCIATES, PC
CONSULTING ENGINEERS • LAND SURVEYORS

September 16, 2014

Mr. Jeff Mueller
Vanderburgh County Surveyor
Room 325 Civic Center - 1 NW Martin Luther King Jr. Blvd.
Evansville, IN 47708

**RE: Drainage Report
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Heckel Road
Our Project #: 14-1878**

Mr. Mueller:

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DRAINAGE PATTERNS

The existing site was previously utilized as a cultivated field. The entire site drains in an easterly direction and runoff sheet flows to an existing ditch located near the east property line. This ditch flows north to the northeast corner of the site, then east and exits the site. All runoff ultimately drains to Firlick Creek.

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CALCULATIONS

The Rational Method and HERPICC Manual were utilized in performing the drainage calculations for this project. All storm sewers and swales were designed to carry the 25-year developed runoff. Detention basin #1 was designed to contain the peak 25-year developed runoff from the site while allowing a release rate less than the peak 10-year undeveloped runoff rate from the site. The emergency spillway for the detention basin was designed to carry the 100-year storm flow.

RECEIVED BY THE
VANDERBURGH COUNTY
SURVEYOR'S OFFICE

Below is a summary of the detention basin design elements:

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Detention Basin #1 Developed Q(100)	60.51 - cfs	
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Minimum Top/Bank	383.90	



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CASH WAGGNER & ASSOCIATES, PC

414 CITADEL CIRCLE, STE. B
EVANSVILLE, IN 47715

PH: 812.401.5561
FAX: 812.401.5563

DETENTION FACILITY DESIGN VOLUME CALCULATIONS

PROJECT: Kinway Park		DETENTION FACILITY DESIGN RETURN PERIOD: 25 YRS			
		RELEASE RATE RETURN PERIOD: 10 YRS			
WATERSHED AREA:		36.67 ACRES			
DEVELOPED RUNOFF COEFFICIENT (C _d):		0.508			
STORM DURATION T _d (HRS)	RAINFALL INTENSITY I _d (INCH/HR)	INFLOW RATE I(T _d) (C _d *I _d *A) (CFS)	OUTFLOW RATE O (C _u *I _u *A) (CFS)	STORAGE RATE ΔS I(T _d)-O (CFS)	REQUIRED STORAGE S _d (I(T _d)-O)*T _d /12 (ACRE-FT)
0.08	7.208	134.27	17.66	116.61	0.810
0.17	5.925	110.37	17.66	92.71	1.288
0.25	5.033	93.76	17.66	76.10	1.585
0.33	4.571	85.14	17.66	67.48	1.875
0.42	4.108	76.53	17.66	58.87	2.044
0.50	3.646	67.92	17.66	50.26	2.094
0.58	3.385	63.05	17.66	45.39	2.206
0.67	3.123	58.18	17.66	40.52	2.251
0.75	2.862	53.31	17.66	35.65	2.228
0.83	2.601	48.45	17.66	30.79	2.138
0.92	2.339	43.58	17.66	25.92	1.980
1.00	2.078	38.71	17.66	21.05	1.754
1.25	1.909	35.55	17.66	17.89	1.864
1.50	1.739	32.39	17.66	14.73	1.842
1.75	1.570	29.24	17.66	11.58	1.688
2.00	1.400	26.08	17.66	8.42	1.403
PEAK STORAGE (ACRE/FT):					2.25
PEAK STORAGE (CUBIC FT):					98,065

Kinway Park

Detention Basin #1

PROPOSED DESIGN RELEASE RATE

25-year

CALCULATIONS FOR PIPE FLOWING FULL

(Pressure Conditions)

SOLVE FOR Q

\emptyset = 1.5 FT.
h'= 0 IN.
h= 0.75 FT.
Ke= 0.5
Ko= 1
n= 0.012
L= 28 FT.
HW= 1.5 FT.

Q= 8.83 CFS

\emptyset = diameter of orifice (pipe)

Ke= entrance coefficient

Ko= outfall coefficient

n= manning's 'n'

L= length of orifice (pipe)

Q= allowable release rate

$h = h' + \emptyset/2$

h'= ht. of water

above orifice

HW= h' + \emptyset

DETENTION FACILITY DESIGN VOLUME CALCULATIONS

PROJECT: Kinway Park

DETENTION FACILITY DESIGN RETURN PERIOD:

100 YRS

RELEASE RATE RETURN PERIOD:

10 YRS

WATERSHED AREA:

36.67 ACRES

DEVELOPED RUNOFF COEFFICIENT (C_d):

0.508

STORM DURATION T _d (HRS)	RAINFALL INTENSITY I _d (INCH/HR)	INFLOW RATE I(T _d) (C _d *I _d *A) (CFS)	OUTFLOW RATE O (C _u *I _u *A) (CFS)	STORAGE RATE ΔS I(T _d)-O (CFS)	REQUIRED STORAGE S _d (I(T _d)-O)*T _d /12 (ACRE-FT)
0.08	8.469	157.76	20.68	137.08	0.952
0.17	7.126	132.75	20.68	112.07	1.556
0.25	6.194	115.38	20.68	94.70	1.973
0.33	5.665	105.54	20.68	84.86	2.357
0.42	5.137	95.69	20.68	75.01	2.604
0.50	4.608	85.84	20.68	65.16	2.715
0.58	4.284	79.80	20.68	59.12	2.874
0.67	3.960	73.76	20.68	53.08	2.949
0.75	3.636	67.72	20.68	47.04	2.940
0.83	3.311	61.68	20.68	41.00	2.848
0.92	2.987	55.65	20.68	34.97	2.671
1.00	2.663	49.61	20.68	28.93	2.411
1.25	2.444	45.52	20.68	24.84	2.587
1.50	2.224	41.43	20.68	20.75	2.594
1.75	2.005	37.34	20.68	16.66	2.430
2.00	1.785	33.25	20.68	12.57	2.095

PEAK STORAGE (ACRE/FT): 2.95
PEAK STORAGE (CUBIC FT): 128,459

Kinway Park

Detention Basin #1

PROPOSED DESIGN RELEASE RATE

100-year

CALCULATIONS FOR PIPE FLOWING FULL

(Pressure Conditions)

SOLVE FOR Q

\emptyset = 1.5 FT.
h'= 3.35 IN.
h= 1.0292 FT.
Ke= 0.5
Ko= 1
n= 0.012
L= 28 FT.
HW= 1.7792 FT.

Q= 10.34 CFS

\emptyset = diameter of orifice (pipe) h= h' + \emptyset /2
Ke= entrance coefficient h'= ht. of water
Ko= outfall coefficient above orifice
n= manning's 'n' HW= h' + \emptyset
L= length of orifice (pipe)
Q= allowable release rate

Kinway Park

Detention Basin

PROVIDED DETENTION VOLUMES

(per ACAD)

	<u>Elevation</u>	<u>Area</u> <u>(s.f.)</u>	<u>Avg. Area</u> <u>(s.f.)</u>	<u>Inc. Vol.</u> <u>(c.f.)</u>	<u>Cumulative Vol.</u> <u>(c.f.)</u>
Pool	381.90	82,424			
	382.90	91,157	86,791	86,791	86,791
E.O.S.	383.40	95,561	93,359	46,680	133,470
T.B.	383.90	99,990	97,776	48,888	182,358

Detention volume provided at Elev. 383.4 = 133,470 c.f.

TOTAL DETENTION VOLUME PROVIDED = 133,470 c.f.

Total, required 25-YR detention volume = 98,065 c.f.

25-YR Req'd detention volume provided @ Elev. = 383.02 ft.

Req'd HW= 1.12 ft.

Detention volume provided at Elev. 383.9 = 182,358 c.f.

Total, required 100-YR detention volume = 128,459 c.f.

100-YR Req'd detention volume provided @ Elev. = 383.35 ft.

Req'd HW= 1.45 ft.

Weighted c calculations for sub-basins captured by Detention Basin

DEVELOPED WEIGHTED c CALCULATIONS

Total Area = 36.67 Acres

Sub-basin	Area (A)	c	c x A
#2	0.79 Ac.	0.634	0.014
#3	0.80 Ac.	0.616	0.013
#4	0.67 Ac.	0.616	0.011
#5	1.67 Ac.	0.381	0.017
#6	0.64 Ac.	0.626	0.011
#7	0.63 Ac.	0.627	0.011
#8	0.48 Ac.	0.607	0.008
#9	1.57 Ac.	0.373	0.016
#10	0.67 Ac.	0.620	0.011
#11	0.71 Ac.	0.611	0.012
#12	0.71 Ac.	0.610	0.012
#13	1.47 Ac.	0.394	0.016
#14	0.58 Ac.	0.630	0.010
#15	0.79 Ac.	0.629	0.014
#16	5.34 Ac.	0.636	0.093
OS-1	19.15 Ac.	0.460	0.240

Weighted c = 0.508

Open Channel Flow Calculations

Swale #: **Emergency Spillway**

Side slope = 4
 Bottom width = 36
 Manning's coefficient = 0.035
 Slope of channel = 0.05

Depth (ft)	Wetted Perimeter (ft)	Area (ft ²)	Hydraulic Radius (ft)	Hydraulic Depth (ft)	Flowrate (cfs)	Velocity (ft/s)	F value
0.0	36.00	0.00	0.00	0.00	0.00	#DIV/0!	1.0
0.1	36.82	3.64	0.10	0.10	7.41	2.04	1.1
0.2	37.65	7.36	0.20	0.20	23.80	3.21	1.2
0.3	38.47	11.16	0.29	0.29	48.55	4.17	1.3
0.4	39.30	15.04	0.38	0.38	75.47	5.02	1.4
0.5	40.12	19.00	0.47	0.48	109.88	5.78	1.5

STORM SEWER CALCULATIONS

Design Return Period: 25 Year

Mannings 'n': 0.012

Project Name: Kinway Park

Project #: 14-1878
Date: 8/20/14

1	SUB-BASIN NO.	UPSTREAM STRUCTURE	PIPE #	DOWNSTREAM STRUCTURE	LENGTH (ft)	C _I	A _I (ac)	C _M	SUM C _M	T _I (min)	Teum (min)	I (in/hr)	Q (cfs)	PIPE DIA. (in)	PIPE SLOPE (ft/ft)	I.E. (Upstream)	I.E. (Downstream)	CAP (cfs)	TRAVEL VELOCITY (ft/sec)	TIME (min)
1	2	500	501	502	64	0.634	0.79	0.50	0.50	16.27	16.27	4.916	2.46	12	0.0050	383.69	383.37	2.73	3.48	0.31
1	3	502	503	504	26	0.616	0.80	0.49	0.99	16.67	16.67	4.879	4.85	15	0.0062	383.37	383.21	5.51	4.49	0.10
1	4	504	505	506	131	0.616	0.67	0.41	1.41	15.72	16.77	4.869	6.85	18	0.0044	383.21	382.63	7.55	4.27	0.51
2	5	506	508	510	193	0.381	1.67	0.64	0.64	16.39	16.39	4.907	3.12	12	0.0101	384.25	382.30	3.88	4.94	0.65
2	6	510	511	512	17			0.64	0.64	17.04	17.04	4.844	3.08	12	0.0235	382.30	381.90	5.91	7.53	0.04
3	6	514	515	516	41	0.626	0.64	0.40	0.40	15.61	15.61	4.977	1.99	12	0.0050	383.30	383.10	2.73	3.48	0.20
3	7	516	517	518	39	0.627	0.63	0.40	0.80	15.35	15.81	4.958	3.94	12	0.0130	383.10	382.59	4.40	5.60	0.12
3	8	518	519	520	120	0.607	0.48	0.29	1.09	14.24	15.92	4.348	5.36	18	0.0058	382.59	381.90	8.63	4.88	0.41
4	9	522	523	524	55	0.373	1.57	0.59	0.59	16.58	16.58	6.027	41.43	36	0.0042	382.60	382.37	46.81	6.63	0.14
4	10	524	525	526	112			0.59	0.59	16.72	16.72	6.027	41.43	35	0.0042	382.37	381.90	46.81	6.63	0.28
5	11	528	529	530	42	0.611	0.71	0.43	0.43	16.52	16.52	4.892	2.12	12	0.0060	383.11	382.86	2.99	3.81	0.18
5	12	530	531	532	34	0.620	0.67	0.42	0.85	16.26	16.70	4.876	4.14	15	0.0044	382.86	382.71	4.64	3.78	0.15
5	13	532	533	534	120	0.610	0.71	0.43	1.28	16.38	16.85	4.864	6.23	18	0.0068	382.71	381.90	9.35	5.29	0.38
6	13	536	537	538	163	0.394	1.47	0.58	0.58	15.58	15.58	4.979	2.88	12	0.0190	385.00	381.90	5.32	6.77	0.40
7	14	540	541	542	26	0.630	0.58	0.37	0.37	16.69	16.69	4.877	1.78	12	0.0050	384.34	384.21	2.73	3.48	0.12
7	15	542	543	544	117	0.639	0.79	0.50	0.86	16.65	16.81	4.866	4.20	12	0.0155	384.21	382.40	4.80	6.12	0.32
8	16	544	545	546	90	0.409	3.80	1.55	1.55	18.58	18.58	4.702	7.31	18	0.0051	385.00	384.54	8.12	4.60	0.33

29" x 45" Elliptical RCP

DEVELOPED DRAINAGE BASIN CALCULATIONS

Basin No.:		1		Total Area =		57,226 S.F.	
						1.31 Acres	
Surface				C	N		
Structures	3	@	2000	=	6,000 S.F.	=	0.14 Ac.
Pavement				=	0 S.F.	=	0.00 Ac.
Drives	0	@	700	=	0 S.F.	=	0.00 Ac.
Patios	6	@	100	=	600 S.F.	=	0.01 Ac.
Sidewalks				=	0 S.F.	=	0.00 Ac.
Lawn (0-2%)			0 S.F.	=	0.00 Ac.	=	0.15 0.40
Lawn (2-5%)			30,626 S.F.	=	0.70 Ac.	=	0.25 0.40
Lawn (5-10%)			0 S.F.	=	0.00 Ac.	=	0.40 0.40
Lawn (>10%)			20,000 S.F.	=	0.46 Ac.	=	0.55 0.40
Water			0 S.F.	=	0.00 Ac.	=	1.00 0.00
Misc.			0 S.F.	=	0.00 Ac.	=	0.92 0.02

Weighted c =	0.432
Weighted N =	0.356
Sheet Flow	
L =	136 Ft.
H =	3.0 Ft.
S =	0.0221 Ft./Ft.
t1 =	12.34 Minutes
(Min. 5 minutes)	
Open Channel Flow	
L =	302 Ft.
H =	3.0 Ft.
S =	0.0099 Ft./Ft.
v =	2.00 Ft./sec.
t2 =	2.52 Minutes
tc =	14.86 Minutes
I(10) =	In./Hr.
I(25) =	5.058 In./Hr.
I(50) =	In./Hr.
I(100) =	6.220 In./Hr.
Q(10) =	0.00 CFS
Q(25) =	2.87 CFS
Q(50) =	0.00 CFS
Q(100) =	3.53 CFS

DEVELOPED DRAINAGE BASIN CALCULATIONS

Basin No.:		2		Total Area =		34,346 S.F.	
						0.79 Acres	
Surface				C	N		
Structures	3	@	2000	=	6,000 S.F.	=	0.14 Ac.
Pavement				=	9,039 S.F.	=	0.21 Ac.
Drives	6	@	700	=	4,200 S.F.	=	0.10 Ac.
Patios	0	@	100	=	0 S.F.	=	0.00 Ac.
Sidewalks				=	0 S.F.	=	0.00 Ac.
Lawn (0-2%)			0 S.F.	=	0.00 Ac.	=	0.15 0.40
Lawn (2-5%)			14,107 S.F.	=	0.32 Ac.	=	0.25 0.40
Lawn (5-10%)			0 S.F.	=	0.00 Ac.	=	0.40 0.40
Lawn (>10%)			1,000 S.F.	=	0.02 Ac.	=	0.55 0.40
Woods (>10%)			0 S.F.	=	0.00 Ac.	=	0.48 0.60
Water			0 S.F.	=	0.00 Ac.	=	1.00 0.00
Misc.			0 S.F.	=	0.00 Ac.	=	0.92 0.02

Weighted c =	0.634
Weighted N =	0.187
Sheet Flow	
L =	300 Ft.
H =	3.2 Ft.
S =	0.0106 Ft./Ft.
t1 =	15.67 Minutes
(Min. 5 minutes)	
Shallow Concentrated Flow	
L =	73 Ft.
H =	0.8 Ft.
S =	0.0105 Ft./Ft.
v =	2.05 Ft./sec.
t2 =	0.59 Minutes
tc =	16.27 Minutes
I(10) =	In./Hr.
I(25) =	4.916 In./Hr.
I(50) =	In./Hr.
I(100) =	6.060 In./Hr.
Q(10) =	0.00 CFS
Q(25) =	2.46 CFS
Q(50) =	0.00 CFS
Q(100) =	3.03 CFS

(From HERRPICC Figure 3.4.5)

DEVELOPED DRAINAGE BASIN CALCULATIONS

Basin No.:		3		Total Area =		34,699 S.F.	
						0.80 Acres	
Surface				C		N	
Structures	3	@	2000	=	6,000 S.F.	=	0.14 Ac.
Pavement				=	8,285 S.F.	=	0.19 Ac.
Drives	6	@	700	=	4,200 S.F.	=	0.10 Ac.
Patios	0	@	100	=	0 S.F.	=	0.00 Ac.
Sidewalks				=	0 S.F.	=	0.00 Ac.
Lawn (0-2%)			0 S.F.	=	0 S.F.	=	0.00 Ac.
Lawn (2-5%)			15,214 S.F.	=	15,214 S.F.	=	0.35 Ac.
Lawn (5-10%)			0 S.F.	=	0 S.F.	=	0.00 Ac.
Lawn (>10%)			1,000 S.F.	=	1,000 S.F.	=	0.02 Ac.
Water			0 S.F.	=	0 S.F.	=	0.00 Ac.
Misc.			0 S.F.	=	0 S.F.	=	0.00 Ac.

Weighted c =	0.616
Weighted N =	0.198
Sheet Flow	
L =	300 Ft.
H =	3.2 Ft.
S =	0.0106 Ft./Ft.
t1 =	16.08 Minutes
Shallow Concentrated Flow	
L =	73 Ft.
H =	0.8 Ft.
S =	0.0105 Ft./Ft.
v =	2.05 Ft./sec.
t2 =	0.59 Minutes
tc =	16.67 Minutes
I(10) =	in./Hr.
I(25) =	4.879 in./Hr.
I(50) =	in./Hr.
I(100) =	6.017 in./Hr.
Q(10) =	0.00 CFS
Q(25) =	2.39 CFS
Q(50) =	0.00 CFS
Q(100) =	2.95 CFS

(Min. 5 minutes)

(From HERPICC Figure 3.4.5)

DEVELOPED DRAINAGE BASIN CALCULATIONS

Basin No.:		4		Total Area =		29,201 S.F.	
						0.67 Acres	
Surface				C		N	
Structures	2.75	@	2000	=	5,500 S.F.	=	0.13 Ac.
Pavement				=	6,251 S.F.	=	0.14 Ac.
Drives	6	@	700	=	4,200 S.F.	=	0.10 Ac.
Patios	0	@	100	=	0 S.F.	=	0.00 Ac.
Sidewalks				=	0 S.F.	=	0.00 Ac.
Lawn (0-2%)			0 S.F.	=	0 S.F.	=	0.00 Ac.
Lawn (2-5%)			13,250 S.F.	=	13,250 S.F.	=	0.30 Ac.
Lawn (5-10%)			0 S.F.	=	0 S.F.	=	0.00 Ac.
Lawn (>10%)			0 S.F.	=	0 S.F.	=	0.00 Ac.
Woods (>10%)			0 S.F.	=	0 S.F.	=	0.00 Ac.
Water			0 S.F.	=	0 S.F.	=	0.00 Ac.
Misc.			0 S.F.	=	0 S.F.	=	0.00 Ac.

Weighted c =	0.616
Weighted N =	0.192
Sheet Flow	
L =	254 Ft.
H =	2.0 Ft.
S =	0.0080 Ft./Ft.
t1 =	15.72 Minutes
Shallow Concentrated Flow	
L =	0 Ft.
H =	0.0 Ft.
S =	#DIV/0! Ft./Ft.
v =	2.70 Ft./sec.
t2 =	0.00 Minutes
tc =	15.72 Minutes
I(10) =	in./Hr.
I(25) =	4.956 in./Hr.
I(50) =	in./Hr.
I(100) =	6.118 in./Hr.
Q(10) =	0.00 CFS
Q(25) =	2.05 CFS
Q(50) =	0.00 CFS
Q(100) =	2.53 CFS

(Min. 5 minutes)

(From HERPICC Figure 3.4.5)

DEVELOPED DRAINAGE BASIN CALCULATIONS

Basin No.:	5			Total Area =	72,601 S.F.				
					1.67 Acres				
Surface				C	N				
Structures	5.5	@	2000	=	11,000 S.F.	=	0.25 Ac.	0.92	0.02
Pavement				=	0 S.F.	=	0.00 Ac.	0.92	0.02
Drives	0	@	700	=	0 S.F.	=	0.00 Ac.	0.92	0.02
Patios	11	@	100	=	1,100 S.F.	=	0.03 Ac.	0.92	0.02
Sidewalks				=	0 S.F.	=	0.00 Ac.	0.92	0.02
Lawn (0-2%)				=	0 S.F.	=	0.00 Ac.	0.15	0.40
Lawn (2-5%)				=	55,701 S.F.	=	1.28 Ac.	0.25	0.40
Lawn (5-10%)				=	0 S.F.	=	0.00 Ac.	0.40	0.40
Lawn (>10%)				=	4,800 S.F.	=	0.11 Ac.	0.55	0.40
Woods (>10%)				=	0 S.F.	=	0.00 Ac.	0.48	0.60
Water				=	0 S.F.	=	0.00 Ac.	1.00	0.00
Misc.				=	0 S.F.	=	0.00 Ac.	0.92	0.02

Weighted c =	0.381
Weighted N =	0.337
Sheet Flow	
L =	113 Ft.
H =	1.1 Ft.
S =	0.0096 Ft./Ft.
t1 =	13.37 Minutes
(Min. 5 minutes)	
Open Channel Flow	
L =	353 Ft.
H =	3.1 Ft.
S =	0.0088 Ft./Ft.
v =	1.95 Ft./sec.
t2 =	3.02 Minutes
tc =	16.39 Minutes
I(10) =	In./Hr.
I(25) =	4.904 In./Hr.
I(50) =	In./Hr.
I(100) =	6.047 In./Hr.
Q(10) =	0.00 CFS
Q(25) =	3.12 CFS
Q(50) =	0.00 CFS
Q(100) =	3.84 CFS

DEVELOPED DRAINAGE BASIN CALCULATIONS

Basin No.:	6			Total Area =	27,756 S.F.				
					0.64 Acres				
Surface				C	N				
Structures	2.5	@	2000	=	5,000 S.F.	=	0.11 Ac.	0.92	0.02
Pavement				=	6,731 S.F.	=	0.15 Ac.	0.92	0.02
Drives	5	@	700	=	3,500 S.F.	=	0.08 Ac.	0.92	0.02
Patios	0	@	100	=	0 S.F.	=	0.00 Ac.	0.92	0.02
Sidewalks				=	0 S.F.	=	0.00 Ac.	0.92	0.02
Lawn (0-2%)				=	0 S.F.	=	0.00 Ac.	0.15	0.40
Lawn (2-5%)				=	11,775 S.F.	=	0.27 Ac.	0.25	0.40
Lawn (5-10%)				=	0 S.F.	=	0.00 Ac.	0.40	0.40
Lawn (>10%)				=	750 S.F.	=	0.02 Ac.	0.55	0.40
Woods (>10%)				=	0 S.F.	=	0.00 Ac.	0.48	0.60
Water				=	0 S.F.	=	0.00 Ac.	1.00	0.00
Misc.				=	0 S.F.	=	0.00 Ac.	0.92	0.02

Weighted c =	0.626
Weighted N =	0.191
Sheet Flow	
L =	294 Ft.
H =	3.2 Ft.
S =	0.0109 Ft./Ft.
t1 =	15.61 Minutes
(Min. 5 minutes)	
Shallow Concentrated Flow	
L =	0 Ft.
H =	0.0 Ft.
S =	#DIV/0! Ft./Ft.
v =	1.65 Ft./sec.
t2 =	0.00 Minutes
tc =	15.61 Minutes
I(10) =	In./Hr.
I(25) =	4.977 In./Hr.
I(50) =	In./Hr.
I(100) =	6.130 In./Hr.
Q(10) =	0.00 CFS
Q(25) =	1.98 CFS
Q(50) =	0.00 CFS
Q(100) =	2.44 CFS

(From HERPICC Figure 3.4.5)

DEVELOPED DRAINAGE BASIN CALCULATIONS

Basin No.:		7		Total Area =		27,467 S.F.	
						0.63 Acres	
Surface				C	N		
Structures	2.5	@	2000	=	5,000 S.F.	=	0.11 Ac.
Pavement				=	6,624 S.F.	=	0.15 Ac.
Drives	5	@	700	=	3,500 S.F.	=	0.08 Ac.
Patios	0	@	100	=	0 S.F.	=	0.00 Ac.
Sidewalks				=	0 S.F.	=	0.00 Ac.
Lawn (0-2%)			0 S.F.	=		=	0.00 Ac.
Lawn (2-5%)			11,593 S.F.	=		=	0.27 Ac.
Lawn (5-10%)			0 S.F.	=		=	0.00 Ac.
Lawn (>10%)			750 S.F.	=		=	0.02 Ac.
Water			0 S.F.	=		=	0.00 Ac.
Misc.			0 S.F.	=		=	0.00 Ac.

Weighted c =	0.627
Weighted N =	0.191
Sheet Flow	
L =	294 Ft.
H =	3.4 Ft.
S =	0.0116 Ft./Ft.
t1 =	15.36 Minutes
Shallow Concentrated Flow	
L =	0 Ft.
H =	0.0 Ft.
S =	#DIV/0! Ft./Ft.
v =	2.80 Ft./sec.
t2 =	0.00 Minutes
tc =	15.36 Minutes
I(10) =	In./Hr.
I(25) =	5.000 In./Hr.
I(50) =	In./Hr.
I(100) =	6.156 In./Hr.
Q(10) =	0.00 CFS
Q(25) =	1.98 CFS
Q(50) =	0.00 CFS
Q(100) =	2.43 CFS

(Min. 5 minutes)

(From HERPICC Figure 3.4.5)

DEVELOPED DRAINAGE BASIN CALCULATIONS

Basin No.:		8		Total Area =		20,775 S.F.	
						0.48 Acres	
Surface				C	N		
Structures	2	@	2000	=	4,000 S.F.	=	0.09 Ac.
Pavement				=	4,271 S.F.	=	0.10 Ac.
Drives	4	@	700	=	2,800 S.F.	=	0.06 Ac.
Patios	0	@	100	=	0 S.F.	=	0.00 Ac.
Sidewalks				=	0 S.F.	=	0.00 Ac.
Lawn (0-2%)			0 S.F.	=		=	0.00 Ac.
Lawn (2-5%)			9,704 S.F.	=		=	0.22 Ac.
Lawn (5-10%)			0 S.F.	=		=	0.00 Ac.
Lawn (>10%)			0 S.F.	=		=	0.00 Ac.
Woods (>10%)			0 S.F.	=		=	0.00 Ac.
Water			0 S.F.	=		=	0.00 Ac.
Misc.			0 S.F.	=		=	0.00 Ac.

Weighted c =	0.607
Weighted N =	0.197
Sheet Flow	
L =	212 Ft.
H =	1.9 Ft.
S =	0.0089 Ft./Ft.
t1 =	14.24 Minutes
Shallow Concentrated Flow	
L =	0 Ft.
H =	0.0 Ft.
S =	#DIV/0! Ft./Ft.
v =	1.95 Ft./sec.
t2 =	0.00 Minutes
tc =	14.24 Minutes
I(10) =	In./Hr.
I(25) =	5.169 In./Hr.
I(50) =	In./Hr.
I(100) =	6.336 In./Hr.
Q(10) =	0.00 CFS
Q(25) =	1.50 CFS
Q(50) =	0.00 CFS
Q(100) =	1.83 CFS

(Min. 5 minutes)

(From HERPICC Figure 3.4.5)

DEVELOPED DRAINAGE BASIN CALCULATIONS

Basin No.:	9	Total Area =		68,209 S.F.	
				1.57 Acres	
Surface				C	N
Structures	5	@	2000 =	10,000 S.F. =	0.23 Ac. 0.92 0.02
Pavement			=	0 S.F. =	0.00 Ac. 0.92 0.02
Drives	0	@	700 =	0 S.F. =	0.00 Ac. 0.92 0.02
Patios	10	@	100 =	1,000 S.F. =	0.02 Ac. 0.92 0.02
Sidewalks			=	0 S.F. =	0.00 Ac. 0.92 0.02
Lawn (0-2%)			0 S.F. =	0.00 Ac.	0.15 0.40
Lawn (2-5%)			52,709 S.F. =	1.21 Ac.	0.25 0.40
Lawn (5-10%)			0 S.F. =	0.00 Ac.	0.40 0.40
Lawn (>10%)			0 S.F. =	0.00 Ac.	0.55 0.40
Woods (>10%)			4,500 S.F. =	0.10 Ac.	0.48 0.60
Water			0 S.F. =	0.00 Ac.	1.00 0.00
Misc.			0 S.F. =	0.00 Ac.	0.92 0.02

Weighted c =	0.373
Weighted N =	0.352
Sheet Flow	
L =	146 Ft.
H =	2.1 Ft.
S =	0.0140 Ft./Ft.
t1 =	14.09 Minutes
Open Channel Flow	
L =	268 Ft.
H =	2.8 Ft.
S =	0.0106 Ft./Ft.
v =	1.80 Ft./sec.
t2 =	2.48 Minutes
tc =	16.58 Minutes
I(10) =	In./Hr.
I(25) =	4.887 In./Hr.
I(50) =	In./Hr.
I(100) =	6.027 In./Hr.
Q(10) =	0.00 CFS
Q(25) =	2.86 CFS
Q(50) =	0.00 CFS
Q(100) =	3.52 CFS

(Min. 5 minutes)

DEVELOPED DRAINAGE BASIN CALCULATIONS

Basin No.:	10	Total Area =		29,011 S.F.	
				0.67 Acres	
Surface				C	N
Structures	2.5	@	2000 =	5,000 S.F. =	0.11 Ac. 0.92 0.02
Pavement			=	7,200 S.F. =	0.17 Ac. 0.92 0.02
Drives	5	@	700 =	3,500 S.F. =	0.08 Ac. 0.92 0.02
Patios	0	@	100 =	0 S.F. =	0.00 Ac. 0.92 0.02
Sidewalks			=	0 S.F. =	0.00 Ac. 0.92 0.02
Lawn (0-2%)			0 S.F. =	0.00 Ac.	0.15 0.40
Lawn (2-5%)			12,561 S.F. =	0.29 Ac.	0.25 0.40
Lawn (5-10%)			0 S.F. =	0.00 Ac.	0.40 0.40
Lawn (>10%)			750 S.F. =	0.02 Ac.	0.55 0.40
Woods (>10%)			0 S.F. =	0.00 Ac.	0.48 0.60
Water			0 S.F. =	0.00 Ac.	1.00 0.00
Misc.			0 S.F. =	0.00 Ac.	0.92 0.02

Weighted c =	0.620
Weighted N =	0.194
Sheet Flow	
L =	299 Ft.
H =	2.9 Ft.
S =	0.0097 Ft./Ft.
t1 =	16.25 Minutes
Open Channel Flow	
L =	0 Ft.
H =	0.0 Ft.
S =	#DIV/0! Ft./Ft.
v =	1.50 Ft./sec.
t2 =	0.00 Minutes
tc =	16.26 Minutes
I(10) =	In./Hr.
I(25) =	4.916 In./Hr.
I(50) =	In./Hr.
I(100) =	6.061 In./Hr.
Q(10) =	0.00 CFS
Q(25) =	2.03 CFS
Q(50) =	0.00 CFS
Q(100) =	2.50 CFS

(Min. 5 minutes)

DEVELOPED DRAINAGE BASIN CALCULATIONS

Basin No.:	11			Total Area =	31,129 S.F.		
					0.71 Acres		
Surface						C	N
Structures	2.5	@	2000	=	5,000 S.F. =	0.11 Ac.	0.92 0.02
Pavement				=	7,936 S.F. =	0.18 Ac.	0.92 0.02
Drives	5	@	700	=	3,500 S.F. =	0.08 Ac.	0.92 0.02
Patios	0	@	100	=	0 S.F. =	0.00 Ac.	0.92 0.02
Sidewalks				=	0 S.F. =	0.00 Ac.	0.92 0.02
Lawn (0-2%)			0 S.F.	=		0.00 Ac.	0.15 0.40
Lawn (2-5%)			13,943 S.F.	=		0.32 Ac.	0.25 0.40
Lawn (5-10%)			0 S.F.	=		0.00 Ac.	0.40 0.40
Lawn (>10%)			750 S.F.	=		0.02 Ac.	0.55 0.40
Woods (>10%)			0 S.F.	=		0.00 Ac.	0.48 0.60
Water			0 S.F.	=		0.00 Ac.	1.00 0.00
Misc.			0 S.F.	=		0.00 Ac.	0.92 0.02

Weighted c =	0.611
Weighted N =	0.199
Sheet Flow	
L =	299 Ft.
H =	2.9 Ft.
S =	0.0096 Ft./Ft.
t1 =	16.52 Minutes
Shallow Concentrated Flow	
L =	0 Ft.
H =	0.0 Ft.
S =	#DIV/0! Ft./Ft.
v =	3.00 Ft./sec.
t2 =	0.00 Minutes
tc =	16.52 Minutes
I(10) =	In./Hr.
I(25) =	4.892 In./Hr.
I(50) =	In./Hr.
I(100) =	6.033 In./Hr.
Q(10) =	0.00 CFS
Q(25) =	2.14 CFS
Q(50) =	0.00 CFS
Q(100) =	2.63 CFS

(Min. 5 minutes)

(From HERPICC Figure 3.4.5)

DEVELOPED DRAINAGE BASIN CALCULATIONS

Basin No.:	12			Total Area =	31,142 S.F.		
					0.71 Acres		
Surface						C	N
Structures	3.25	@	2000	=	6,500 S.F. =	0.15 Ac.	0.92 0.02
Pavement				=	6,021 S.F. =	0.14 Ac.	0.92 0.02
Drives	6	@	700	=	4,200 S.F. =	0.10 Ac.	0.92 0.02
Patios	0	@	100	=	0 S.F. =	0.00 Ac.	0.92 0.02
Sidewalks				=	0 S.F. =	0.00 Ac.	0.92 0.02
Lawn (0-2%)			0 S.F.	=		0.00 Ac.	0.15 0.40
Lawn (2-5%)			14,421 S.F.	=		0.33 Ac.	0.25 0.40
Lawn (5-10%)			0 S.F.	=		0.00 Ac.	0.40 0.40
Lawn (>10%)			0 S.F.	=		0.00 Ac.	0.55 0.40
Woods (>10%)			0 S.F.	=		0.00 Ac.	0.48 0.60
Water			0 S.F.	=		0.00 Ac.	1.00 0.00
Misc.			0 S.F.	=		0.00 Ac.	0.92 0.02

Weighted c =	0.610
Weighted N =	0.196
Sheet Flow	
L =	266 Ft.
H =	2.0 Ft.
S =	0.0076 Ft./Ft.
t1 =	16.38 Minutes
Shallow Concentrated Flow	
L =	0 Ft.
H =	0.0 Ft.
S =	#DIV/0! Ft./Ft.
v =	3.00 Ft./sec.
t2 =	0.00 Minutes
tc =	16.38 Minutes
I(10) =	In./Hr.
I(25) =	4.905 In./Hr.
I(50) =	In./Hr.
I(100) =	6.048 In./Hr.
Q(10) =	0.00 CFS
Q(25) =	2.14 CFS
Q(50) =	0.00 CFS
Q(100) =	2.64 CFS

(Min. 5 minutes)

(From HERPICC Figure 3.4.5)

DEVELOPED DRAINAGE BASIN CALCULATIONS

Basin No.:	13	Total Area =	63,830 S.F.	
			1.47 Acres	
Surface			C	N
Structures	5 @ 2000	= 10,000 S.F. =	0.23 Ac.	0.92 0.02
Pavement		= 0 S.F. =	0.00 Ac.	0.92 0.02
Drives	0 @ 700	= 0 S.F. =	0.00 Ac.	0.92 0.02
Patios	10 @ 100	= 1,000 S.F. =	0.02 Ac.	0.92 0.02
Sidewalks		= 0 S.F. =	0.00 Ac.	0.92 0.02
Lawn (0-2%)	0 S.F.	=	0.00 Ac.	0.15 0.40
Lawn (2-5%)	46,830 S.F.	=	1.08 Ac.	0.25 0.40
Lawn (5-10%)	0 S.F.	=	0.00 Ac.	0.40 0.40
Lawn (>10%)	6,000 S.F.	=	0.14 Ac.	0.55 0.40
Woods (>10%)	0 S.F.	=	0.00 Ac.	0.48 0.60
Water	0 S.F.	=	0.00 Ac.	1.00 0.00
Misc.	0 S.F.	=	0.00 Ac.	0.92 0.02

Weighted c =	0.394
Weighted N =	0.335
Sheet Flow	
L =	112 Ft.
H =	1.2 Ft.
S =	0.0111 Ft./Ft.
t1 =	12.85 Minutes
Open Channel Flow	
L =	311 Ft.
H =	2.8 Ft.
S =	0.0089 Ft./Ft.
v =	1.90 Ft./sec.
t2 =	2.73 Minutes
tc =	15.58 Minutes
I(10) =	In./Hr.
I(25) =	4.979 In./Hr.
I(50) =	In./Hr.
I(100) =	6.133 In./Hr.
Q(10) =	0.00 CFS
Q(25) =	2.87 CFS
Q(50) =	0.00 CFS
Q(100) =	3.54 CFS

(Min. 5 minutes)

DEVELOPED DRAINAGE BASIN CALCULATIONS

Basin No.:	14	Total Area =	25,357 S.F.	
			0.58 Acres	
Surface			C	N
Structures	2.5 @ 2000	= 5,000 S.F. =	0.11 Ac.	0.92 0.02
Pavement		= 5,420 S.F. =	0.12 Ac.	0.92 0.02
Drives	5 @ 700	= 3,500 S.F. =	0.08 Ac.	0.92 0.02
Patios	0 @ 100	= 0 S.F. =	0.00 Ac.	0.92 0.02
Sidewalks		= 0 S.F. =	0.00 Ac.	0.92 0.02
Lawn (0-2%)	0 S.F.	=	0.00 Ac.	0.15 0.40
Lawn (2-5%)	10,437 S.F.	=	0.24 Ac.	0.25 0.40
Lawn (5-10%)	0 S.F.	=	0.00 Ac.	0.40 0.40
Lawn (>10%)	1,000 S.F.	=	0.02 Ac.	0.55 0.40
Woods (>10%)	0 S.F.	=	0.00 Ac.	0.48 0.60
Water	0 S.F.	=	0.00 Ac.	1.00 0.00
Misc.	0 S.F.	=	0.00 Ac.	0.92 0.02

Weighted c =	0.630
Weighted N =	0.191
Sheet Flow	
L =	300 Ft.
H =	2.6 Ft.
S =	0.0085 Ft./Ft.
t1 =	16.69 Minutes
Shallow Concentrated Flow	
L =	0 Ft.
H =	0.0 Ft.
S =	#DIV/0! Ft./Ft.
v =	3.10 Ft./sec.
t2 =	0.00 Minutes
tc =	16.69 Minutes
I(10) =	In./Hr.
I(25) =	4.877 In./Hr.
I(50) =	In./Hr.
I(100) =	6.015 In./Hr.
Q(10) =	0.00 CFS
Q(25) =	1.79 CFS
Q(50) =	0.00 CFS
Q(100) =	2.20 CFS

(Min. 5 minutes)

(From HEPIC Figure 3.4.5)

DEVELOPED DRAINAGE BASIN CALCULATIONS

Basin No.:	15	Total Area =		34,216 S.F.		
				0.79 Acres		
Surface				C	N	
Structures	4	@	2000 = 8,000 S.F. =	0.18 Ac.	0.92	0.02
Pavement			= 5,750 S.F. =	0.13 Ac.	0.92	0.02
Drives	8	@	700 = 5,600 S.F. =	0.13 Ac.	0.92	0.02
Patios	0	@	100 = 0 S.F. =	0.00 Ac.	0.92	0.02
Sidewalks			= 0 S.F. =	0.00 Ac.	0.92	0.02
Lawn (0-2%)			0 S.F. =	0.00 Ac.	0.15	0.40
Lawn (2-5%)			14,866 S.F. =	0.34 Ac.	0.25	0.40
Lawn (5-10%)			0 S.F. =	0.00 Ac.	0.40	0.40
Lawn (>10%)			0 S.F. =	0.00 Ac.	0.55	0.40
Woods (>10%)			0 S.F. =	0.00 Ac.	0.48	0.60
Water			0 S.F. =	0.00 Ac.	1.00	0.00
Misc.			0 S.F. =	0.00 Ac.	0.92	0.02

Weighted c =	0.629
Weighted N =	0.185
Sheet Flow	
L =	300 Ft.
H =	2.4 Ft.
S =	0.0080 Ft./Ft.
t1 =	16.65 Minutes
Shallow Concentrated Flow	
L =	0 Ft.
H =	0.0 Ft.
S =	#DIV/0! Ft./Ft.
v =	3.20 Ft./sec.
t2 =	0.00 Minutes
tc =	16.65 Minutes
I(10) =	In./Hr.
I(25) =	4.880 In./Hr.
I(50) =	In./Hr.
I(100) =	6.020 In./Hr.
Q(10) =	0.00 CFS
Q(25) =	2.41 CFS
Q(50) =	0.00 CFS
Q(100) =	2.97 CFS

(Min. 5 minutes)

(From HERPICC Figure 3.4.5)

DEVELOPED DRAINAGE BASIN CALCULATIONS

Basin No.:	16	Total Area =		232,723 S.F.		
				5.34 Acres		
Surface				C	N	
Structures	12	@	2000 = 24,000 S.F. =	0.55 Ac.	0.92	0.02
Pavement			= 0 S.F. =	0.00 Ac.	0.92	0.02
Drives	0	@	700 = 0 S.F. =	0.00 Ac.	0.92	0.02
Patios	24	@	100 = 2,400 S.F. =	0.06 Ac.	0.92	0.02
Sidewalks			= 0 S.F. =	0.00 Ac.	0.92	0.02
Lawn (0-2%)			0 S.F. =	0.00 Ac.	0.15	0.40
Lawn (2-5%)			89,526 S.F. =	2.06 Ac.	0.25	0.40
Lawn (5-10%)			0 S.F. =	0.00 Ac.	0.40	0.40
Lawn (>10%)			34,373 S.F. =	0.79 Ac.	0.55	0.40
Woods (>10%)			0 S.F. =	0.00 Ac.	0.48	0.60
Water			87,424 S.F. =	1.89 Ac.	1.00	0.00
Misc.			0 S.F. =	0.00 Ac.	0.92	0.02

Weighted c =	0.636
Weighted N =	0.215
Sheet Flow	
L =	189 Ft.
H =	2.7 Ft.
S =	0.0145 Ft./Ft.
t1 =	12.54 Minutes
Open Channel Flow	
L =	250 Ft.
H =	4.6 Ft.
S =	0.0184 Ft./Ft.
v =	2.30 Ft./sec.
t2 =	1.81 Minutes
tc =	14.35 Minutes
I(10) =	In./Hr.
I(25) =	5.149 In./Hr.
I(50) =	In./Hr.
I(100) =	6.315 In./Hr.
Q(10) =	0.00 CFS
Q(25) =	17.49 CFS
Q(50) =	0.00 CFS
Q(100) =	21.46 CFS

(Min. 5 minutes)

DEVELOPED DRAINAGE BASIN CALCULATIONS

Basin No.:		17		Total Area =		4,124 S.F.	
						0.09 Acres	
Surface				C		N	
Structures	0	@	2000	=	0 S.F. =	0.00 Ac.	0.92 0.02
Pavement				=	1,050 S.F. =	0.02 Ac.	0.92 0.02
Drives	0	@	700	=	0 S.F. =	0.00 Ac.	0.92 0.02
Patios	0	@	100	=	0 S.F. =	0.00 Ac.	0.92 0.02
Sidewalks				=	0 S.F. =	0.00 Ac.	0.92 0.02
Lawn (0-2%)				=	0 S.F. =	0.00 Ac.	0.15 0.40
Lawn (2-5%)				=	0 S.F. =	0.00 Ac.	0.25 0.40
Lawn (5-10%)				=	0 S.F. =	0.00 Ac.	0.40 0.40
Lawn (>10%)			3,074	S.F. =		0.07 Ac.	0.55 0.40
Woods (>10%)				=	0 S.F. =	0.00 Ac.	0.48 0.60
Water				=	0 S.F. =	0.00 Ac.	1.00 0.00
Misc.				=	0 S.F. =	0.00 Ac.	0.92 0.02

Weighted c =	0.644
Weighted N =	0.303
Sheet Flow	
L =	21 Ft.
H =	2.5 Ft.
S =	0.1190 Ft./Ft.
t1 =	5.00 Minutes
Shallow Concentrated Flow	
L =	0 Ft.
H =	0.0 Ft.
S =	#DIV/0! Ft./Ft.
v =	3.20 Ft./sec.
t2 =	0.00 Minutes
tc =	5.00 Minutes
I(10) =	In./Hr.
I(25) =	7.208 In./Hr.
I(50) =	In./Hr.
I(100) =	6.469 In./Hr.
Q(10) =	0.00 CFS
Q(25) =	0.44 CFS
Q(50) =	0.00 CFS
Q(100) =	0.52 CFS

(Min. 5 minutes)

(From HEPICCC Figure 3.4.5)

DEVELOPED DRAINAGE BASIN CALCULATIONS

Basin No.: OS-1		Total Area = 834,114 S.F. 19.15 Acres							
Surface						C	N		
Structures	21	@	3000	=	63,000 S.F.	=	1.45 Ac.	0.92	0.02
Pavement				=	47,825 S.F.	=	1.10 Ac.	0.92	0.02
Drives	15	@	1000	=	15,000 S.F.	=	0.34 Ac.	0.92	0.02
Patios	21	@	100	=	2,100 S.F.	=	0.05 Ac.	0.92	0.02
Sidewalks				=	0 S.F.	=	0.00 Ac.	0.92	0.02
Lawn (0-2%)			0 S.F.	=	0 S.F.	=	0.00 Ac.	0.15	0.40
Lawn (2-5%)			414,361 S.F.	=		=	9.51 Ac.	0.25	0.40
Lawn (5-10%)			200,000 S.F.	=		=	4.59 Ac.	0.40	0.40
Lawn (>10%)			20,000 S.F.	=		=	0.46 Ac.	0.55	0.40
Woods (>10%)			0 S.F.	=		=	0.00 Ac.	0.48	0.60
Water			71,828 S.F.	=		=	1.65 Ac.	1.00	0.00
Misc.			0 S.F.	=		=	0.00 Ac.	0.92	0.02

Weighted c =	0.460
Weighted N =	0.307
Sheet Flow	
L =	300 Ft.
H =	6.0 Ft.
S =	0.0200 Ft./Ft.
t1 =	17.05 Minutes
Shallow Concentrated Flow	
L =	184 Ft.
H =	3.0 Ft.
S =	0.0163 Ft./Ft.
v =	2.00 Ft./sec.
t2 =	1.53 Minutes
Shallow Concentrated Flow	
L =	365 Ft.
H =	2.5 Ft.
S =	0.0068 Ft./Ft.
v =	1.65 Ft./sec.
t3 =	3.69 Minutes
Closed Conduit Flow	
L =	229 Ft.
H =	3.0 Ft.
S =	0.0131 Ft./Ft.
v =	5.63 Ft./sec.
t4 =	0.68 Minutes
tc =	22.95 Minutes
i(10) =	In./Hr.
i(25) =	4.298 In./Hr.
i(50) =	In./Hr.
i(100) =	5.353 In./Hr.
Q(10) =	0.00 CFS
Q(25) =	37.90 CFS
Q(50) =	0.00 CFS
Q(100) =	47.20 CFS

(Min. 5 minutes)

(From HERPICC Figure 3.4.5)

(From HERPICC Figure 3.4.5)

DEVELOPED DRAINAGE BASIN CALCULATIONS

Basin No.: OS-2

Total Area = 108,595 S.F.
2.49 Acres

Surface							C	N	
Structures	3	@	3000	=	9,000 S.F.	=	0.21 Ac.	0.92	0.02
Pavement				=	8,800 S.F.	=	0.20 Ac.	0.92	0.02
Drives	6	@	1000	=	6,000 S.F.	=	0.14 Ac.	0.92	0.02
Patios	0	@	100	=	0 S.F.	=	0.00 Ac.	0.92	0.02
Sidewalks				=	0 S.F.	=	0.00 Ac.	0.92	0.02
Lawn (0-2%)			0 S.F.	=		=	0.00 Ac.	0.15	0.40
Lawn (2-5%)			84,795 S.F.	=		=	1.95 Ac.	0.25	0.40
Lawn (5-10%)			0 S.F.	=		=	0.00 Ac.	0.40	0.40
Lawn (>10%)			0 S.F.	=		=	0.00 Ac.	0.55	0.40
Woods (>10%)			0 S.F.	=		=	0.00 Ac.	0.48	0.60
Water			0 S.F.	=		=	0.00 Ac.	1.00	0.00
Misc.			0 S.F.	=		=	0.00 Ac.	0.92	0.02

Weighted c = 0.397

Weighted N = 0.317

Sheet Flow

L = 126 Ft.

H = 1.0 Ft.

S = 0.0079 Ft./Ft.

t1 = 14.31 Minutes

(Min. 5 minutes)

Open Channel Flow

L = 845 Ft.

H = 23.0 Ft.

S = 0.0272 Ft./Ft.

v = 3.30 Ft./sec.

t2 = 4.27 Minutes

tc = 18.58 Minutes

I(10) = In./Hr.

I(25) = 4.702 In./Hr.

I(50) = In./Hr.

I(100) = 5.815 In./Hr.

Q(10) = 0.00 CFS

Q(25) = 4.65 CFS

Q(50) = 0.00 CFS

Q(100) = 5.75 CFS

UNDEVELOPED DRAINAGE BASIN CALCULATIONS

Basin No.: UN-1

Total Area = 805,212 S.F.

18.49 Acres

Surface					C	N
Structures	=	0 S.F.	=	0.00 Ac.	0.92	0.02
Drives (Asphalt)	=	0 S.F.	=	0.00 Ac.	0.92	0.02
Drives (Gravel)	=	0 S.F.	=	0.00 Ac.	0.92	0.15
Pavement	=	0 S.F.	=	0.00 Ac.	0.92	0.02
Patios	=	0 S.F.	=	0.00 Ac.	0.92	0.02
Sidewalks	=	0 S.F.	=	0.00 Ac.	0.92	0.02
Cult. Field (0-2')		603,829 S.F.	=	13.86 Ac.	0.20	0.20
Cult. Field (2-5%)		60,000 S.F.	=	1.38 Ac.	0.35	0.20
Cult. Field (5-10%)		141,383 S.F.	=	3.25 Ac.	0.50	0.20
Cult. Field (>10%)		0 S.F.	=	0.00 Ac.	0.65	0.20
Water		S.F.	=	0.00 Ac.	1.00	0.00
Misc.		S.F.	=	0.00 Ac.	0.92	0.02

Weighted c =	0.264
Weighted N =	0.200
Sheet Flow	
L =	300 Ft.
H =	6.8 Ft.
S =	0.0227 Ft./Ft.
t1 =	13.55 Minutes
Shallow Concentrated Flow	
L =	321 Ft.
H =	2.5 Ft.
S =	0.0078 Ft./Ft.
v =	1.45 Ft./sec.
t2 =	3.69 Minutes
Open Channel Flow	
L =	0 Ft.
H =	0.0 Ft.
S =	#DIV/0! Ft./Ft.
v =	1.15 Ft./sec.
t3 =	0.00 Minutes
tc =	17.24
I(10) =	4.323 In./Hr.
I(25) =	0.000 In./Hr.
I(50) =	0.000 In./Hr.
I(100) =	0.000 In./Hr.
Q(10) =	21.08 CFS
Q(25) =	0.00 CFS
Q(50) =	0.00 CFS
Q(100) =	0.00 CFS

(Min. 5 minutes)

(From HERPICC Figure 3.4.5)

Open Channel Flow Calculations

Swale #: 1

Side slope = 3
 Bottom width = 1
 Manning's coefficient = 0.035
 Slope of channel = 0.0099

Depth (ft)	Wetted Perimeter (ft)	Area (ft ²)	Hydraulic Radius (ft)	Hydraulic Depth (ft)	Flowrate (cfs)	Velocity (ft/s)	F value
0.0	1.00	0.00	0.00	0.00	0.00	#DIV/0!	1.0
0.1	1.63	0.13	0.08	0.08	0.10	0.78	1.1
0.2	2.26	0.32	0.14	0.15	0.37	1.15	1.2
0.3	2.90	0.57	0.20	0.20	0.82	1.43	1.3
0.4	3.53	0.88	0.25	0.26	1.48	1.88	1.4
0.5	4.16	1.25	0.30	0.31	2.37	1.90	1.5
0.55	4.48	1.46	0.33	0.34	2.92	2.00	1.6
0.7	5.11	1.92	0.38	0.39	4.22	2.20	1.7
0.8	5.74	2.44	0.42	0.44	5.83	2.39	1.8
0.9	6.38	3.02	0.47	0.49	7.76	2.57	1.9
1.0	7.01	3.66	0.52	0.55	10.04	2.75	2.0

Open Channel Flow Calculations

Swale #: 2

Side slope = 3
 Bottom width = 1
 Manning's coefficient = 0.035
 Slope of channel = 0.0106

Depth (ft)	Wetted Perimeter (ft)	Area (ft ²)	Hydraulic Radius (ft)	Hydraulic Depth (ft)	Flowrate (cfs)	Velocity (ft/s)	F value
0.0	1.00	0.00	0.00	0.00	0.00	#DIV/0!	1.0
0.1	1.63	0.13	0.08	0.08	0.11	0.81	1.1
0.2	2.26	0.32	0.14	0.15	0.38	1.19	1.2
0.3	2.90	0.57	0.20	0.20	0.85	1.48	1.3
0.32	3.02	0.63	0.21	0.21	0.96	1.54	1.4
0.4	3.53	0.88	0.25	0.26	1.53	1.74	1.4
0.5	4.16	1.25	0.30	0.31	2.46	1.97	1.5
0.6	4.79	1.68	0.35	0.37	3.66	2.18	1.6
0.7	5.43	2.17	0.40	0.42	5.16	2.38	1.7
0.8	6.06	2.72	0.45	0.47	6.99	2.57	1.8
0.9	6.69	3.33	0.50	0.52	9.17	2.75	1.9
1.0	7.32	4.00	0.55	0.57	11.71	2.93	2.0

Open Channel Flow Calculations

Swale #: 3

Side slope = 3
 Bottom width = 4
 Manning's coefficient = 0.035
 Slope of channel = 0.0146

Depth (ft)	Wetted Perimeter (ft)	Area (ft ²)	Hydraulic Radius (ft)	Hydraulic Depth (ft)	Flowrate (cfs)	Velocity (ft/s)	F value
0.0	4.00	0.00	0.00	0.00	0.00	#DIV/0!	1.0
0.1	4.63	0.43	0.09	0.09	0.45	1.05	1.1
0.2	5.26	0.92	0.17	0.18	1.48	1.61	1.2
0.3	5.90	1.47	0.25	0.25	2.99	2.04	1.3
0.32	6.02	1.59	0.26	0.27	3.36	2.11	1.4
0.4	6.53	2.08	0.32	0.33	4.99	2.40	1.4
0.5	7.16	2.75	0.38	0.39	7.47	2.72	1.5
0.6	7.79	3.48	0.45	0.46	10.46	3.00	1.6
0.7	8.43	4.27	0.51	0.52	13.98	3.27	1.7
0.8	9.06	5.12	0.57	0.58	18.00	3.52	1.8
0.9	9.69	6.03	0.62	0.64	22.81	3.75	1.9
1.0	10.32	7.00	0.68	0.70	27.79	3.97	2.0
1.1	10.96	8.03	0.73	0.76	33.58	4.18	2.1
1.2	11.59	9.12	0.79	0.81	39.99	4.38	2.2
1.3	12.22	10.27	0.84	0.87	47.04	4.58	2.3
1.4	12.85	11.48	0.89	0.93	54.76	4.77	2.4
1.5	13.49	12.75	0.95	0.98	63.17	4.95	2.5

Open Channel Flow Calculations

Swale #: 4

Side slope = 3
 Bottom width = 1
 Manning's coefficient = 0.035
 Slope of channel = 0.0103

Depth (ft)	Wetted Perimeter (ft)	Area (ft ²)	Hydraulic Radius (ft)	Hydraulic Depth (ft)	Flowrate (cfs)	Velocity (ft/s)	F value
0.0	1.00	0.00	0.00	0.00	0.00	#DIV/0!	1.0
0.1	1.63	0.13	0.08	0.08	0.10	0.80	1.1
0.2	2.26	0.32	0.14	0.15	0.38	1.17	1.2
0.3	2.90	0.57	0.20	0.20	0.83	1.46	1.3
0.32	3.02	0.63	0.21	0.21	0.95	1.51	1.4
0.4	3.53	0.88	0.25	0.26	1.51	1.71	1.4
0.5	4.16	1.25	0.30	0.31	2.42	1.84	1.5
0.6	4.54	1.50	0.33	0.34	3.10	2.07	1.6
0.7	5.17	1.97	0.38	0.40	4.46	2.27	1.7
0.8	5.81	2.49	0.43	0.45	6.13	2.46	1.8
0.9	6.44	3.08	0.48	0.50	8.13	2.84	1.9
1.0	7.07	3.72	0.53	0.55	10.50	2.82	2.0

Open Channel Flow Calculations

Swale #: 5

Side slope = 3
 Bottom width = 1
 Manning's coefficient = 0.035
 Slope of channel = 0.0184

Depth (ft)	Wetted Perimeter (ft)	Area (ft ²)	Hydraulic Radius (ft)	Hydraulic Depth (ft)	Flowrate (cfs)	Velocity (ft/s)	F value
0.0	1.00	0.00	0.00	0.00	0.00	#DIV/0!	1.0
0.1	1.63	0.13	0.08	0.08	0.14	1.07	1.1
0.2	2.26	0.32	0.14	0.15	0.50	1.57	1.2
0.3	2.90	0.57	0.20	0.20	1.11	1.95	1.3
0.32	3.02	0.63	0.21	0.21	1.27	2.02	1.4
0.4	3.53	0.88	0.25	0.26	2.01	2.29	1.4
0.5	4.16	1.25	0.30	0.31	3.24	2.59	1.5
0.6	4.79	1.68	0.35	0.37	4.82	2.87	1.6
0.7	5.43	2.17	0.40	0.42	6.80	3.13	1.7
0.8	6.06	2.72	0.45	0.47	9.21	3.39	1.8
0.9	6.69	3.33	0.50	0.52	12.08	3.63	1.9
1.0	7.32	4.00	0.55	0.57	15.43	3.86	2.0

Open Channel Flow Calculations

Swale #: 6

Side slope = 3
 Bottom width = 1
 Manning's coefficient = 0.035
 Slope of channel = 0.005

Depth (ft)	Wetted Perimeter (ft)	Area (ft ²)	Hydraulic Radius (ft)	Hydraulic Depth (ft)	Flowrate (cfs)	Velocity (ft/s)	F value
0.0	1.00	0.00	0.00	0.00	0.00	#DIV/0!	1.0
0.1	1.63	0.13	0.08	0.08	0.07	0.58	1.1
0.2	2.26	0.32	0.14	0.15	0.28	0.82	1.2
0.3	2.90	0.57	0.20	0.20	0.58	1.02	1.3
0.32	3.02	0.63	0.21	0.21	0.66	1.05	1.4
0.4	3.53	0.88	0.25	0.26	1.05	1.19	1.4
0.5	4.16	1.25	0.30	0.31	1.69	1.35	1.5
0.6	4.79	1.68	0.35	0.37	2.51	1.50	1.6
0.7	5.43	2.17	0.40	0.42	3.55	1.63	1.7
0.8	6.06	2.72	0.45	0.47	4.80	1.76	1.8
0.9	6.69	3.33	0.50	0.52	6.29	1.89	1.9
1.0	7.32	4.00	0.55	0.57	8.04	2.01	2.0

Open Channel Flow Calculations

Swale #: 7

Side slope = 3
 Bottom width = 1
 Manning's coefficient = 0.035
 Slope of channel = 0.016

Depth (ft)	Wetted Perimeter (ft)	Area (ft ²)	Hydraulic Radius (ft)	Hydraulic Depth (ft)	Flowrate (cfs)	Velocity (ft/s)	F value
0.0	1.00	0.00	0.00	0.00	0.00	#DIV/0!	1.0
0.1	1.63	0.13	0.08	0.08	0.13	1.00	1.1
0.2	2.26	0.32	0.14	0.15	0.47	1.46	1.2
0.3	2.90	0.57	0.20	0.20	1.04	1.82	1.3
0.32	3.02	0.63	0.21	0.21	1.18	1.89	1.4
0.4	3.53	0.88	0.25	0.26	1.88	2.13	1.4
0.5	4.16	1.25	0.30	0.31	3.02	2.41	1.5
0.6	4.79	1.68	0.35	0.37	4.50	2.68	1.6
0.7	5.43	2.17	0.40	0.42	6.34	2.92	1.7
0.8	6.06	2.72	0.45	0.47	8.59	3.18	1.8
0.9	6.69	3.33	0.50	0.52	11.28	3.38	1.9
1.0	7.32	4.00	0.55	0.57	14.39	3.60	2.0