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# ASSUMPTION OF BLESSED VIRGIN MARY
## Stormwater Detention Study

**7004**

**March 2003**

*Prepared For:*

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[redacted]

**ASSUMPTION OF BLESSED VIRGIN MARY**
**Stormwater Detention Study**
**7004**

**March 2003**

A new church and parking lot are proposed for Assumption Church north of the existing church in the City of O'Fallon, Missouri. The development is tributary to Peruque Creek. The stormwater detention requirement is differential runoff.

Pondpack version 8.0 by Haestad Methods was used to model stormwater runoff before development and stormwater runoff after development. The proposed development takes place on approximately 6 acres, with 11.3 acres of the site making up the immediate watershed for this development. The following table summarizes the peak runoff from the tributary area before development and the peak discharge after development. The table also summarizes the amount of pervious and impervious area of the site before and after development.

| Storm Frequency | Pre-Development | | | Post-Development | | | Differential Runoff |
|---|---|---|---|---|---|---|---|
| | Imp. | Perv. | CFS | Imp. | Perv. | CFS | CFS |
| 2-year storm | 3.03 Ac. | 8.29 Ac. | 15.78 | 6.36 Ac. | 4.94 Ac. | 18.77 | 2.99 |
| 15-year storm | " | " | 28.12 | " | " | 31.13 | 3.01 |
| 25-year storm | " | " | 30.63 | " | " | 33.60 | 2.97 |
| 100-year storm | " | " | 42.14 | " | " | 44.83 | 2.69 |

Due to site constraints and Corp of Engineer Permitting requirements, the stormwater detention for this development cannot be handled in the immediate area of the proposed church site, but will be accounted for in a detention basin located towards the southwest corner of the church property. This detention basin at the southwest corner was proposed to serve the detention needs of a parking lot that was designed by others. This basin that was originally designed by others will be revised and sized to account for the increased runoff from the proposed church and the allowable release rate adjusted accordingly.

The watershed for the detention basin is 8.28 acres. Pondpack version 8.0 by Haestad Methods was used to model the stormwater runoff for this watershed and is summarized in the table below.

| Storm Frequency | Pre-Development | Post-Development | Differential Runoff |
|---|---|---|---|
| 2-year storm | 13.18 cfs | 16.85 cfs | 3.67 cfs |
| 15-year storm | 24.79 cfs | 29.47 cfs | 4.68 cfs |
| 25-year storm | 27.17 cfs | 32.01 cfs | 4.84 cfs |
| 100-year storm | 38.17 cfs | 43.62 cfs | 5.45 cfs |

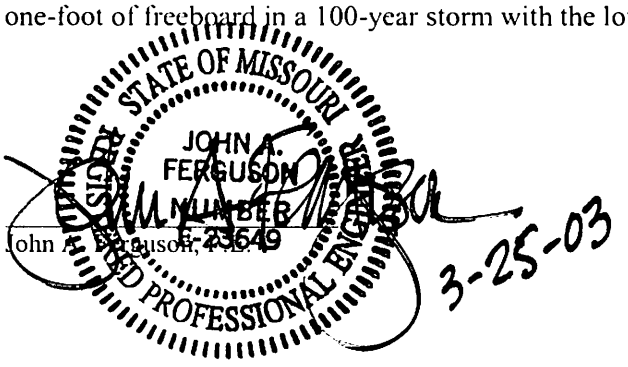
The allowable release rate for the detention basin will be the Pre-Development runoff of the immediate watershed of the detention basin minus the increase in runoff created by the proposed Church development. The table below summarizes the allowable release rates for the respective storm events.

| Storm Frequency | Pre-Development Basin Watershed | Differential Runoff Church Development | Allowable Release Rate for Basin |
|---|---|---|---|
| 2-year storm | 13.18 cfs | 2.99 cfs | 10.19 cfs |
| 15-year storm | 21.8 cfs | 3.01 cfs | 18.79 cfs |
| 25-year storm | 27.17 cfs | 2.97 cfs | 24.2 cfs |
| 100-year storm | 38.17 cfs | 2.69 cfs | 35.48 cfs |

Detention Routing

| Storm Frequency | Allow. Release Rate (cfs) | Basin Release Rate (cfs) | Basin WSEL |
|---|---|---|---|
| 2-year storm | 10.19 | 6.20 | 503.58 |
| 15-year | 18.79 | 9.04 | 505.12 |
| 25-year storm | 24.2 | 10.18 | 505.37 |
| 100-year storm | 35.48 | 15.29 | 506.46 |

A computer model was generated to check the detention basin in a 100-year storm with the low flow opening blocked and the water level at the elevation of the overflow structure at the beginning of the storm. The calculated high water in this condition in a 100-year storm is at elevation 508.11; the top of berm for the detention basin is at elevation 510.0. There is more than one-foot of freeboard in a 100-year storm with the low-flow openings blocked.




John A. Ferguson, P.E. 25649

[redacted]

**PRE-DEVELOPED**

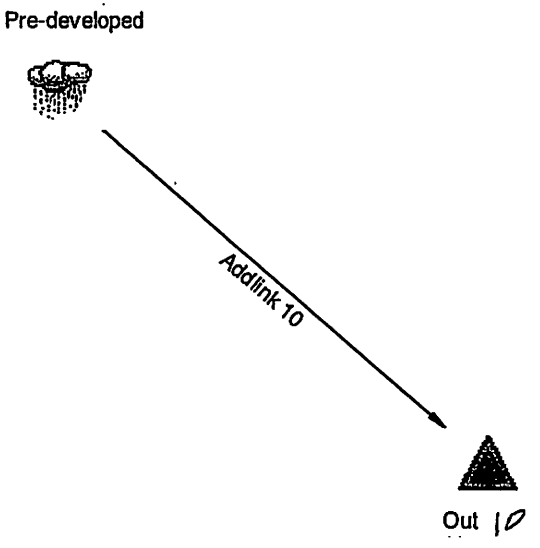
**ASSUMPTION BVM**

Job File: H:\HAESTAD\ppkw\b7004\ASSUMPTION PREDEV.PPW
Rain Dir: H:\HAESTAD\ppkw\b7004\

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

Assumption of the Blessed Virgin Mary Church

This represents the pre-developed runoff for the development site for the 2-year, 15-year, 25-year, and 100-year 24-hour Type II rainfalls.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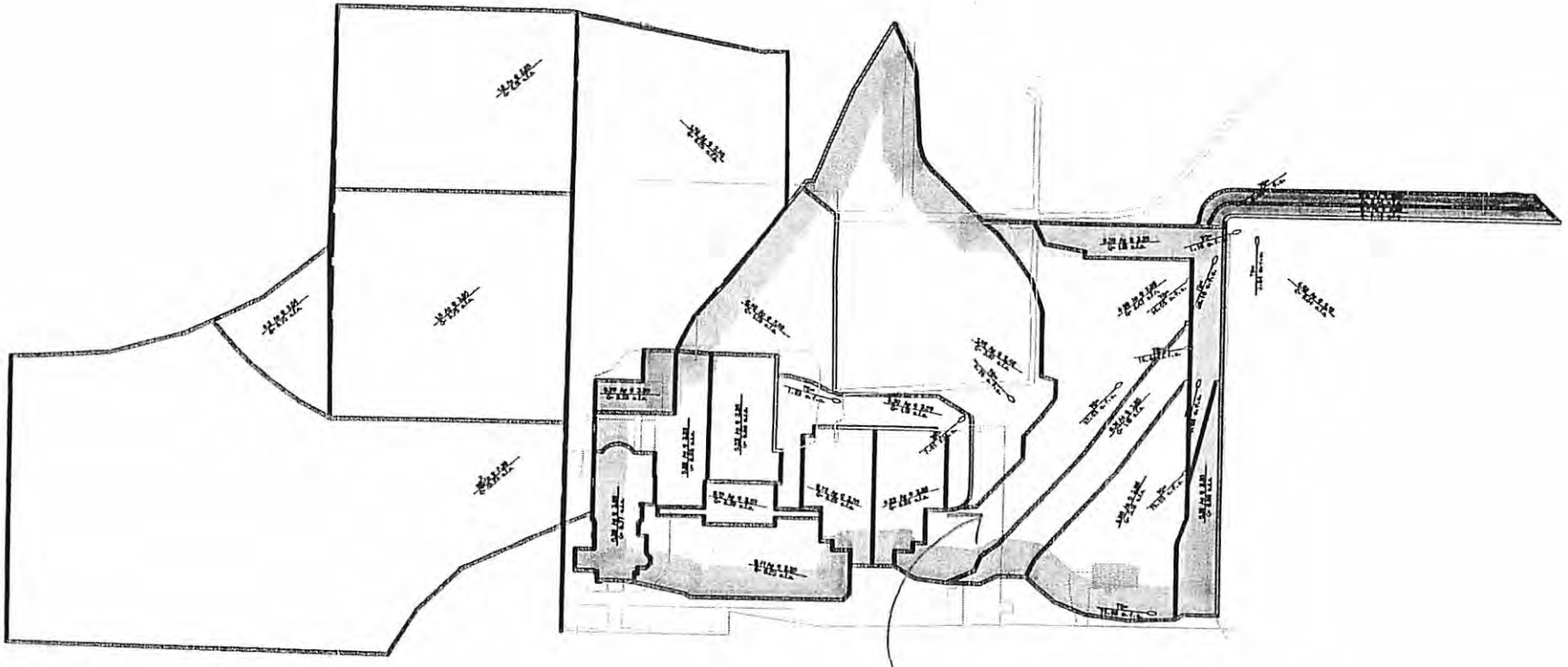
ASSUMPTION BVM
WATERSHED

# Table of Contents

Table of Contents (continued)

## MASTER DESIGN STORM SUMMARY

Network Storm Collection: MSD

| Return Event | Total Depth in | Rainfall Type | RNF ID |
|---|---|---|---|
| 100yr | 7.2000 | Synthetic Curve | TypeII 24hr |
| 2year | 3.5000 | Synthetic Curve | TypeII 24hr |
| 25year | 5.6000 | Synthetic Curve | TypeII 24hr |
| 15 | 5.2500 | 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 |
|---|---|---|---|---|---|---|---|---|
| *OUT 10 | JCT | 100 | 223318 | -- | 12.2500 | 42.14 | | |
| *OUT 10 | JCT | 2 | 82714 | | 12.3000 | 15.78 | | |
| *OUT 10 | JCT | 25 | 161069 | | 12.2500 | 30.63 | | |
| *OUT 10 | JCT | 15 | 147669 | | 12.2500 | 28.12 | | |
| PRE-DEVELOPED | AREA | 100 | 223318 | | 12.2500 | 42.14 | | |
| PRE-DEVELOPED | AREA | 2 | 82714 | | 12.3000 | 15.78 | | |
| PRE-DEVELOPED | AREA | 25 | 161069 | | 12.2500 | 30.63 | | |
| PRE-DEVELOPED | AREA | 15 | 147669 | | 12.2500 | 28.12 | | |

File.... H:\HAESTAD\ppkw\b7004\
Title... Assumption of the Blessed Virgin Mary Church

This represents the pre-developed runoff for the development site for the 2-year, 15-year, 25-year, and 100-year 24-hour Type II rainfalls.

DESIGN STORMS SUMMARY

Design Storm File,ID = MSD

Storm Tag Name = 100yr
---
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 = 2year
---
Data Type, File, ID = Synthetic Storm TypeII 24hr
Storm Frequency = 2 yr
Total Rainfall Depth= 3.5000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Storm Tag Name = 25year
---
Data Type, File, ID = Synthetic Storm TypeII 24hr
Storm Frequency = 25 yr
Total Rainfall Depth= 5.6000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Storm Tag Name = 15
---
Data Type, File, ID = Synthetic Storm TypeII 24hr
Storm Frequency = 15 yr
Total Rainfall Depth= 5.2500 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

Storm Tag Name = 100yr
---
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 = 2year
---
Data Type, File, ID = Synthetic Storm TypeII 24hr
Storm Frequency = 2 yr
Total Rainfall Depth= 3.5000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Storm Tag Name = 25year
---
Data Type, File, ID = Synthetic Storm TypeII 24hr
Storm Frequency = 25 yr
Total Rainfall Depth= 5.6000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Storm Tag Name = 15
---
Data Type, File, ID = Synthetic Storm TypeII 24hr
Storm Frequency = 15 yr
Total Rainfall Depth= 5.2500 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

File.... H:\HAESTAD\ppkw\b7004\ASSUMPTION PREDEV.PPW

::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
TIME OF CONCENTRATION CALCULATOR
::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::

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Segment #1: Tc: TR-55 Sheet

| | | |
|---|---|---|
| Mannings n | .3000 | |
| Hydraulic Length | 140.90 | ft |
| 2yr, 24hr P | 3.5000 | in |
| Slope | .020000 | ft/ft |
| Avg.Velocity | .11 | ft/sec |

Segment #1 Time: .3577 hrs

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Segment #2: Tc: TR-55 Sheet

| | | |
|---|---|---|
| Mannings n | .3000 | |
| Hydraulic Length | 160.60 | ft |
| 2yr, 24hr P | 3.5000 | in |
| Slope | .062000 | ft/ft |
| Avg.Velocity | .18 | ft/sec |

Segment #2 Time: .2526 hrs

---

Segment #3: Tc: TR-55 Shallow

| | | |
|---|---|---|
| Hydraulic Length | 84.00 | ft |
| Slope | .048000 | ft/ft |
| Unpaved | | |
| Avg.Velocity | 3.53 | ft/sec |

Segment #3 Time: .0066 hrs

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File.... H:\HAESTAD\ppkw\b7004\ASSUMPTION PREDEV.PPW

Segment #4: Tc: TR-55 Shallow

| | | |
|---|---|---|
| Hydraulic Length | 82.50 | ft |
| Slope | .120000 | ft/ft |
| Unpaved | | |
| Avg.Velocity | 5.59 | ft/sec |

Segment #4 Time: .0041 hrs

---

Segment #5: Tc: TR-55 Shallow

| | | |
|---|---|---|
| Hydraulic Length | 125.30 | ft |
| Slope | .032000 | ft/ft |
| Unpaved | | |
| Avg.Velocity | 2.89 | ft/sec |

Segment #5 Time: .0121 hrs

---

Segment #6: Tc: TR-55 Channel

| | | |
|---|---|---|
| Flow Area | 74.2600 | sq.ft |
| Wetted Perimeter | 29.88 | ft |
| Hydraulic Radius | 2.49 | ft |
| Slope | .013000 | ft/ft |
| Mannings n | .1000 | |
| Hydraulic Length | 469.80 | ft |
| Avg.Velocity | 3.12 | ft/sec |

Segment #6 Time: .0419 hrs

---

==========
Total Tc: .6749 hrs
==========

File.... H:\HAESTAD\ppkw\b7004\ASSUMPTION PREDEV.PPW

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Tc Equations used...

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==== 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

File.... H:\HAESTAD\ppkw\b7004\ASSUMPTION PREDEV.PPW

==== 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

File.... H:\HAESTAD\ppkw\b7004\ASSUMPTION PREDEV.PPW

RUNOFF CURVE NUMBER DATA

| Soil/Surface Description | CN | Area acres | Impervious Adjustment %C | %UC | Adjusted CN |
|---|---|---|---|---|---|
| Impervious, D soils | 98 | 3.030 | | | 98.00 |
| Pervious, D soils | 80 | 8.270 | | | 80.00 |
| COMPOSITE AREA & WEIGHTED CN ---> | | 11.300 | | | 84.83 (85) |

# 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: 15 year storm
Duration = 24.0000 hrs Rain Depth = 5.2500 in
Rain Dir = H:\HAESTAD\ppkw\b7004\
Rain File -ID = - TypeII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir = H:\HAESTAD\ppkw\b7004\
HYG File - ID = - PRE-DEVELOPED 15
Tc = .6749 hrs
Drainage Area = 11.300 acres Runoff CN= 85

==========
Computational Time Increment = .08998 hrs
Computed Peak Time = 12.2377 hrs
Computed Peak Flow = 28.14 cfs

Time Increment for HYG File = .0500 hrs
Peak Time, Interpolated Output = 12.2500 hrs
Peak Flow, Interpolated Output = 28.12 cfs
==========

DRAINAGE AREA
---
ID:PRE-DEVELOPED
CN = 85
Area = 11.300 acres
S = 1.7647 in
0.2S = .3529 in

Cumulative Runoff
---
3.5998 in
147661 cu.ft

HYG Volume... 147669 cu.ft (area under HYG curve)

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

Time Concentration, Tc = .67487 hrs (ID: PRE-DEVELOPED)
Computational Incr, Tm = .08998 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 = 18.97 cfs
Unit peak time Tp = .44992 hrs
Unit receding limb, Tr = 1.79967 hrs
Total unit time, Tb = 2.24958 hrs

SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 100 year storm
Duration = 24.0000 hrs Rain Depth = 7.2000 in
Rain Dir = H:\HAESTAD\ppkw\b7004\
Rain File -ID = - TypeII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir = H:\HAESTAD\ppkw\b7004\
HYG File - ID = - PRE-DEVELOPED 100yr
Tc = .6749 hrs
Drainage Area = 11.300 acres Runoff CN= 85

==========
Computational Time Increment = .08998 hrs
Computed Peak Time = 12.2377 hrs
Computed Peak Flow = 42.20 cfs

Time Increment for HYG File = .0500 hrs
Peak Time, Interpolated Output = 12.2500 hrs
Peak Flow, Interpolated Output = 42.14 cfs
==========

DRAINAGE AREA
---
ID:PRE-DEVELOPED
CN = 85
Area = 11.300 acres
S = 1.7647 in
0.2S = .3529 in

Cumulative Runoff
---
5.4440 in
223306 cu.ft

HYG Volume... 223318 cu.ft (area under HYG curve)

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

Time Concentration, Tc = .67487 hrs (ID: PRE-DEVELOPED)
Computational Incr, Tm = .08998 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 = 18.97 cfs
Unit peak time Tp = .44992 hrs
Unit receding limb, Tr = 1.79967 hrs
Total unit time, Tb = 2.24958 hrs

SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 2 year storm
Duration = 24.0000 hrs Rain Depth = 3.5000 in
Rain Dir = H:\HAESTAD\ppkw\b7004\
Rain File -ID = - TypeII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir = H:\HAESTAD\ppkw\b7004\
HYG File - ID = - PRE-DEVELOPED 2year
Tc = .6749 hrs
Drainage Area = 11.300 acres Runoff CN= 85

==========
Computational Time Increment = .08998 hrs
Computed Peak Time = 12.3277 hrs
Computed Peak Flow = 15.81 cfs

Time Increment for HYG File = .0500 hrs
Peak Time, Interpolated Output = 12.3000 hrs
Peak Flow, Interpolated Output = 15.78 cfs
==========

DRAINAGE AREA
---
ID:PRE-DEVELOPED
CN = 85
Area = 11.300 acres
S = 1.7647 in
0.2S = .3529 in

Cumulative Runoff
---
2.0164 in
82710 cu.ft

HYG Volume... 82714 cu.ft (area under HYG curve)

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

Time Concentration, Tc = .67487 hrs (ID: PRE-DEVELOPED)
Computational Incr, Tm = .08998 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 = 18.97 cfs
Unit peak time Tp = .44992 hrs
Unit receding limb, Tr = 1.79967 hrs
Total unit time, Tb = 2.24958 hrs

SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 25 year storm
Duration = 24.0000 hrs Rain Depth = 5.6000 in
Rain Dir = H:\HAESTAD\ppkw\b7004\
Rain File -ID = - TypeII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir = H:\HAESTAD\ppkw\b7004\
HYG File - ID = - PRE-DEVELOPED 25year
Tc = .6749 hrs
Drainage Area = 11.300 acres Runoff CN= 85

==========
Computational Time Increment = .08998 hrs
Computed Peak Time = 12.2377 hrs
Computed Peak Flow = 30.66 cfs

Time Increment for HYG File = .0500 hrs
Peak Time, Interpolated Output = 12.2500 hrs
Peak Flow, Interpolated Output = 30.63 cfs
==========

DRAINAGE AREA
---
ID:PRE-DEVELOPED
CN = 85
Area = 11.300 acres
S = 1.7647 in
0.2S = .3529 in

Cumulative Runoff
---
3.9265 in
161061 cu.ft

HYG Volume... 161069 cu.ft (area under HYG curve)

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

Time Concentration, Tc = .67487 hrs (ID: PRE-DEVELOPED)
Computational Incr, Tm = .08998 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))
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Unit peak, qp = 18.97 cfs
Unit peak time Tp = .44992 hrs
Unit receding limb, Tr = 1.79967 hrs
Total unit time, Tb = 2.24958 hrs

Index of Starting Page Numbers for ID Names

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**POST-DEVELOPED**

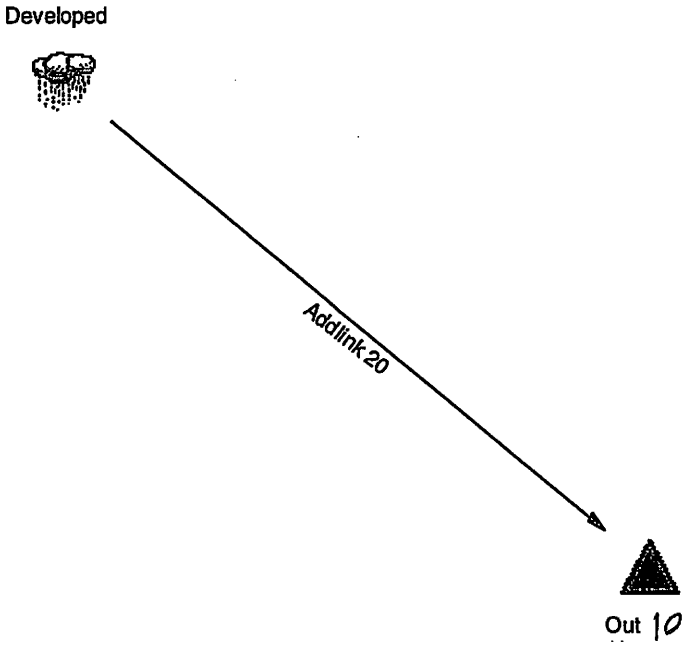
**ASSUMPTION BVM**

Job File: H:\HAESTAD\ppkw\b7004\ASSUMPTION DEV 2.PPW
Rain Dir: H:\HAESTAD\ppkw\b7004\

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

Assumption of the Blessed Virgin Mary Church

This represents the developed condition runoff for the 2-year, 15-year, 25-year, and 100-year 24-hour Type II rainfalls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Out 10

# Table of Contents

Table of Contents (continued)

## MASTER DESIGN STORM SUMMARY

Network Storm Collection: MSD

| Return Event | Total Depth in | Rainfall Type | RNF ID |
|---|---|---|---|
| 100yr | 7.2000 | Synthetic Curve | TypeII 24hr |
| 2year | 3.5000 | Synthetic Curve | TypeII 24hr |
| 25year | 5.6000 | Synthetic Curve | TypeII 24hr |
| 15 | 5.2500 | 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 |
|---|---|---|---|---|---|---|---|---|
| DEVELOPED | AREA | 100 | 246927 | | 12.2500 | 44.83 | | |
| DEVELOPED | AREA | 2 | 100421 | | 12.3000 | 18.77 | | |
| DEVELOPED | AREA | 25 | 182834 | | 12.2500 | 33.60 | | |
| DEVELOPED | AREA | 15 | 168921 | | 12.2500 | 31.13 | | |
| *OUT 10 | JCT | 100 | 246927 | | 12.2500 | 44.83 | | |
| *OUT 10 | JCT | 2 | 100421 | | 12.3000 | 18.77 | | |
| *OUT 10 | JCT | 25 | 182834 | | 12.2500 | 33.60 | | |
| *OUT 10 | JCT | 15 | 168921 | | 12.2500 | 31.13 | | |

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

DEFAULT Design Storm File,ID = MSD

Storm Tag Name = 15

Data Type, File, ID = Synthetic Storm TypeII 24hr
Storm Frequency = 15 yr
Total Rainfall Depth= 5.2500 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 |
|---|---|---|---|---|---|---|
| DEVELOPED | AREA | 168921 | | 12.2500 | 31.13 | |
| Outfall OUT 10 | JCT | 168921 | | 12.2500 | 31.13 | |

File.... H:\HAESTAD\ppkw\b7004\
Title... Assumption of the Blessed Virgin Mary Church

This represents the developed condition runoff for
the 2-year, 15-year, 25-year, and 100-year 24-hour
Type II rainfalls

DESIGN STORMS SUMMARY

Design Storm File,ID = MSD

Storm Tag Name = 100yr
---
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 = 2year
---
Data Type, File, ID = Synthetic Storm TypeII 24hr
Storm Frequency = 2 yr
Total Rainfall Depth= 3.5000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Storm Tag Name = 25year
---
Data Type, File, ID = Synthetic Storm TypeII 24hr
Storm Frequency = 25 yr
Total Rainfall Depth= 5.6000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Storm Tag Name = 15
---
Data Type, File, ID = Synthetic Storm TypeII 24hr
Storm Frequency = 15 yr
Total Rainfall Depth= 5.2500 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

Storm Tag Name = 100yr
---
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 = 2year
---
Data Type, File, ID = Synthetic Storm TypeII 24hr
Storm Frequency = 2 yr
Total Rainfall Depth= 3.5000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Storm Tag Name = 25year
---
Data Type, File, ID = Synthetic Storm TypeII 24hr
Storm Frequency = 25 yr
Total Rainfall Depth= 5.6000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Storm Tag Name = 15
---
Data Type, File, ID = Synthetic Storm TypeII 24hr
Storm Frequency = 15 yr
Total Rainfall Depth= 5.2500 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 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 |
| 22.0000 | .977 | .978 | .979 | .981 | .982 |
| 22.5000 | .983 | .984 | .985 | .986 | .988 |

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

| Time hrs | | | | | |
|---|---|---|---|---|---|
| 23.0000 | .989 | .990 | .991 | .992 | .993 |
| 23.5000 | .994 | .996 | .997 | .998 | .999 |
| 24.0000 | 1.000 | | | | |

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

| Time hrs | | | | | |
|---|---|---|---|---|---|
| .0000 | .0000 | .0053 | .0106 | .0160 | .0214 |
| .5000 | .0269 | .0324 | .0381 | .0437 | .0494 |
| 1.0000 | .0551 | .0610 | .0668 | .0727 | .0786 |
| 1.5000 | .0847 | .0907 | .0969 | .1030 | .1093 |
| 2.0000 | .1155 | .1219 | .1282 | .1347 | .1411 |
| 2.5000 | .1477 | .1542 | .1609 | .1676 | .1744 |
| 3.0000 | .1811 | .1880 | .1949 | .2019 | .2088 |
| 3.5000 | .2159 | .2230 | .2302 | .2374 | .2447 |
| 4.0000 | .2520 | .2594 | .2669 | .2745 | .2822 |
| 4.5000 | .2901 | .2980 | .3060 | .3142 | .3224 |
| 5.0000 | .3308 | .3392 | .3478 | .3564 | .3652 |
| 5.5000 | .3741 | .3830 | .3921 | .4013 | .4106 |
| 6.0000 | .4200 | .4295 | .4391 | .4488 | .4586 |
| 6.5000 | .4686 | .4786 | .4887 | .4990 | .5093 |
| 7.0000 | .5198 | .5303 | .5410 | .5517 | .5626 |
| 7.5000 | .5736 | .5846 | .5958 | .6071 | .6185 |
| 8.0000 | .6300 | .6418 | .6542 | .6670 | .6804 |
| 8.5000 | .6943 | .7088 | .7237 | .7392 | .7552 |
| 9.0000 | .7718 | .7886 | .8054 | .8222 | .8390 |
| 9.5000 | .8558 | .8730 | .8910 | .9099 | .9297 |
| 10.0000 | .9503 | .9719 | .9948 | 1.0189 | 1.0443 |
| 10.5000 | 1.0710 | 1.0994 | 1.1298 | 1.1624 | 1.1970 |
| 11.0000 | 1.2338 | 1.2741 | 1.3194 | 1.3698 | 1.4253 |
| 11.5000 | 1.4858 | 1.6109 | 1.8604 | 2.2616 | 2.9813 |
| 12.0000 | 3.4808 | 3.5803 | 3.6679 | 3.7435 | 3.8071 |
| 12.5000 | 3.8588 | 3.9031 | 3.9446 | 3.9835 | 4.0196 |
| 13.0000 | 4.0530 | 4.0843 | 4.1141 | 4.1425 | 4.1693 |
| 13.5000 | 4.1948 | 4.2189 | 4.2420 | 4.2641 | 4.2851 |
| 14.0000 | 4.3050 | 4.3243 | 4.3431 | 4.3616 | 4.3798 |
| 14.5000 | 4.3976 | 4.4149 | 4.4320 | 4.4486 | 4.4650 |
| 15.0000 | 4.4809 | 4.4965 | 4.5116 | 4.5265 | 4.5409 |
| 15.5000 | 4.5551 | 4.5688 | 4.5821 | 4.5951 | 4.6078 |
| 16.0000 | 4.6200 | 4.6320 | 4.6439 | 4.6556 | 4.6673 |
| 16.5000 | 4.6787 | 4.6901 | 4.7013 | 4.7124 | 4.7234 |
| 17.0000 | 4.7342 | 4.7449 | 4.7555 | 4.7659 | 4.7762 |
| 17.5000 | 4.7864 | 4.7964 | 4.8063 | 4.8161 | 4.8257 |
| 18.0000 | 4.8353 | 4.8446 | 4.8539 | 4.8630 | 4.8720 |
| 18.5000 | 4.8809 | 4.8896 | 4.8982 | 4.9067 | 4.9150 |
| 19.0000 | 4.9232 | 4.9313 | 4.9392 | 4.9470 | 4.9547 |
| 19.5000 | 4.9622 | 4.9697 | 4.9769 | 4.9841 | 4.9911 |
| 20.0000 | 4.9980 | 5.0048 | 5.0116 | 5.0184 | 5.0251 |
| 20.5000 | 5.0318 | 5.0385 | 5.0451 | 5.0518 | 5.0584 |
| 21.0000 | 5.0649 | 5.0715 | 5.0780 | 5.0845 | 5.0910 |
| 21.5000 | 5.0974 | 5.1038 | 5.1102 | 5.1166 | 5.1230 |
| 22.0000 | 5.1293 | 5.1356 | 5.1418 | 5.1480 | 5.1542 |
| 22.5000 | 5.1604 | 5.1666 | 5.1727 | 5.1788 | 5.1849 |

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

| Time hrs | | | | | |
|---|---|---|---|---|---|
| 23.0000 | 5.1909 | 5.1970 | 5.2030 | 5.2089 | 5.2149 |
| 23.5000 | 5.2208 | 5.2267 | 5.2326 | 5.2384 | 5.2442 |
| 24.0000 | 5.2500 | | | | |

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 |
| 22.0000 | .977 | .978 | .979 | .981 | .982 |
| 22.5000 | .983 | .984 | .985 | .986 | .988 |

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

| Time hrs | | | | | |
|---|---|---|---|---|---|
| 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 |
| 22.0000 | .977 | .978 | .979 | .981 | .982 |
| 22.5000 | .983 | .984 | .985 | .986 | .988 |

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

| Time hrs | | | | | |
|---|---|---|---|---|---|
| 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 |
| 22.0000 | .977 | .978 | .979 | .981 | .982 |
| 22.5000 | .983 | .984 | .985 | .986 | .988 |

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

| Time hrs | | | | | |
|---|---|---|---|---|---|
| 23.0000 | .989 | .990 | .991 | .992 | .993 |
| 23.5000 | .994 | .996 | .997 | .998 | .999 |
| 24.0000 | 1.000 | | | | |

File.... H:\HAESTAD\ppkw\b7004\ASSUMPTION DEV 2.PPW

TIME OF CONCENTRATION CALCULATOR

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Segment #1: Tc: TR-55 Sheet

| | | |
|---|---|---|
| Mannings n | .3000 | |
| Hydraulic Length | 81.30 | ft |
| 2yr, 24hr P | 3.5000 | in |
| Slope | .032000 | ft/ft |
| Avg.Velocity | .12 | ft/sec |

Segment #1 Time: .1909 hrs

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Segment #2: Tc: TR-55 Sheet

| | | |
|---|---|---|
| Mannings n | .3000 | |
| Hydraulic Length | 86.40 | ft |
| 2yr, 24hr P | 3.5000 | in |
| Slope | .023000 | ft/ft |
| Avg.Velocity | .10 | ft/sec |

Segment #2 Time: .2287 hrs

---

Segment #3: Tc: TR-55 Sheet

| | | |
|---|---|---|
| Mannings n | .3000 | |
| Hydraulic Length | 145.10 | ft |
| 2yr, 24hr P | 3.5000 | in |
| Slope | .048000 | ft/ft |
| Avg.Velocity | .16 | ft/sec |

Segment #3 Time: .2580 hrs

---

File.... H:\HAESTAD\ppkw\b7004\ASSUMPTION DEV 2.PPW

Segment #4: Tc: TR-55 Shallow

| | | |
|---|---|---|
| Hydraulic Length | 85.90 | ft |
| Slope | .093000 | ft/ft |
| Unpaved | | |
| Avg.Velocity | 4.92 | ft/sec |

Segment #4 Time: .0048 hrs

---

Segment #5: Tc: TR-55 Channel

| | | |
|---|---|---|
| Flow Area | 5.0000 | sq.ft |
| Wetted Perimeter | 8.38 | ft |
| Hydraulic Radius | .60 | ft |
| Slope | .045000 | ft/ft |
| Mannings n | .0350 | |
| Hydraulic Length | 179.60 | ft |
| Avg.Velocity | 6.40 | ft/sec |

Segment #5 Time: .0078 hrs

---

Total Tc: .6902 hrs

File.... H:\HAESTAD\ppkw\b7004\ASSUMPTION DEV 2.PPW

---

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

File.... H:\HAESTAD\ppkw\b7004\ASSUMPTION DEV 2.PPW

==== 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

File.... H:\HAESTAD\ppkw\b7004\ASSUMPTION DEV 2.PPW

RUNOFF CURVE NUMBER DATA

| Soil/Surface Description | CN | Area acres | Impervious Adjustment %C | Impervious Adjustment %UC | Adjusted CN |
|---|---|---|---|---|---|
| Impervious, D soils | 98 | 6.360 | | | 98.00 |
| Pervious, D soils | 80 | 4.940 | | | 80.00 |
| COMPOSITE AREA & WEIGHTED CN ---> | | 11.300 | | | 90.13 (90) |

## 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: 15 year storm
Duration = 24.0000 hrs Rain Depth = 5.2500 in
Rain Dir = H:\HAESTAD\ppkw\b7004\
Rain File -ID = - TypeII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir = H:\HAESTAD\ppkw\b7004\
HYG File - ID = - DEVELOPED 15
Tc = .6902 hrs
Drainage Area = 11.300 acres Runoff CN= 90

==========
Computational Time Increment = .09203 hrs
Computed Peak Time = 12.2400 hrs
Computed Peak Flow = 31.15 cfs

Time Increment for HYG File = .0500 hrs
Peak Time, Interpolated Output = 12.2500 hrs
Peak Flow, Interpolated Output = 31.13 cfs
==========

DRAINAGE AREA
---
ID:DEVELOPED
CN = 90
Area = 11.300 acres
S = 1.1111 in
0.2S = .2222 in

Cumulative Runoff
---
4.1178 in
168907 cu.ft

HYG Volume... 168921 cu.ft (area under HYG curve)

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

Time Concentration, Tc = .69023 hrs (ID: DEVELOPED)
Computational Incr, Tm = .09203 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 = 18.55 cfs
Unit peak time Tp = .46015 hrs
Unit receding limb, Tr = 1.84060 hrs
Total unit time, Tb = 2.30075 hrs

SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 100 year storm
Duration = 24.0000 hrs Rain Depth = 7.2000 in
Rain Dir = H:\HAESTAD\ppkw\b7004\
Rain File -ID = - TypeII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir = H:\HAESTAD\ppkw\b7004\
HYG File - ID = - DEVELOPED 100yr
Tc = .6902 hrs
Drainage Area = 11.300 acres Runoff CN= 90

==========
Computational Time Increment = .09203 hrs
Computed Peak Time = 12.2400 hrs
Computed Peak Flow = 44.88 cfs

Time Increment for HYG File = .0500 hrs
Peak Time, Interpolated Output = 12.2500 hrs
Peak Flow, Interpolated Output = 44.83 cfs
==========

DRAINAGE AREA
---
ID:DEVELOPED
CN = 90
Area = 11.300 acres
S = 1.1111 in
0.2S = .2222 in

Cumulative Runoff
---
6.0193 in
246905 cu.ft

HYG Volume... 246927 cu.ft (area under HYG curve)

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

Time Concentration, Tc = .69023 hrs (ID: DEVELOPED)
Computational Incr, Tm = .09203 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 = 18.55 cfs
Unit peak time Tp = .46015 hrs
Unit receding limb, Tr = 1.84060 hrs
Total unit time, Tb = 2.30075 hrs

SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 2 year storm
Duration = 24.0000 hrs Rain Depth = 3.5000 in
Rain Dir = H:\HAESTAD\ppkw\b7004\
Rain File -ID = - TypeII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir = H:\HAESTAD\ppkw\b7004\
HYG File - ID = - DEVELOPED 2year
Tc = .6902 hrs
Drainage Area = 11.300 acres Runoff CN= 90

==========
Computational Time Increment = .09203 hrs
Computed Peak Time = 12.3320 hrs
Computed Peak Flow = 18.77 cfs

Time Increment for HYG File = .0500 hrs
Peak Time, Interpolated Output = 12.3000 hrs
Peak Flow, Interpolated Output = 18.77 cfs
==========

DRAINAGE AREA
---
ID:DEVELOPED
CN = 90
Area = 11.300 acres
S = 1.1111 in
0.2S = .2222 in

Cumulative Runoff
---
2.4480 in
100413 cu.ft

HYG Volume... 100421 cu.ft (area under HYG curve)

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

Time Concentration, Tc = .69023 hrs (ID: DEVELOPED)
Computational Incr, Tm = .09203 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 = 18.55 cfs
Unit peak time Tp = .46015 hrs
Unit receding limb, Tr = 1.84060 hrs
Total unit time, Tb = 2.30075 hrs

SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 25 year storm
Duration = 24.0000 hrs Rain Depth = 5.6000 in
Rain Dir = H:\HAESTAD\ppkw\b7004\
Rain File -ID = - TypeII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir = H:\HAESTAD\ppkw\b7004\
HYG File - ID = - DEVELOPED 25year
Tc = .6902 hrs
Drainage Area = 11.300 acres Runoff CN= 90

==========
Computational Time Increment = .09203 hrs
Computed Peak Time = 12.2400 hrs
Computed Peak Flow = 33.63 cfs

Time Increment for HYG File = .0500 hrs
Peak Time, Interpolated Output = 12.2500 hrs
Peak Flow, Interpolated Output = 33.60 cfs
==========

DRAINAGE AREA
---
ID:DEVELOPED
CN = 90
Area = 11.300 acres
S = 1.1111 in
0.2S = .2222 in

Cumulative Runoff
---
4.4569 in
182819 cu.ft

HYG Volume... 182834 cu.ft (area under HYG curve)

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

Time Concentration, Tc = .69023 hrs (ID: DEVELOPED)
Computational Incr, Tm = .09203 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)

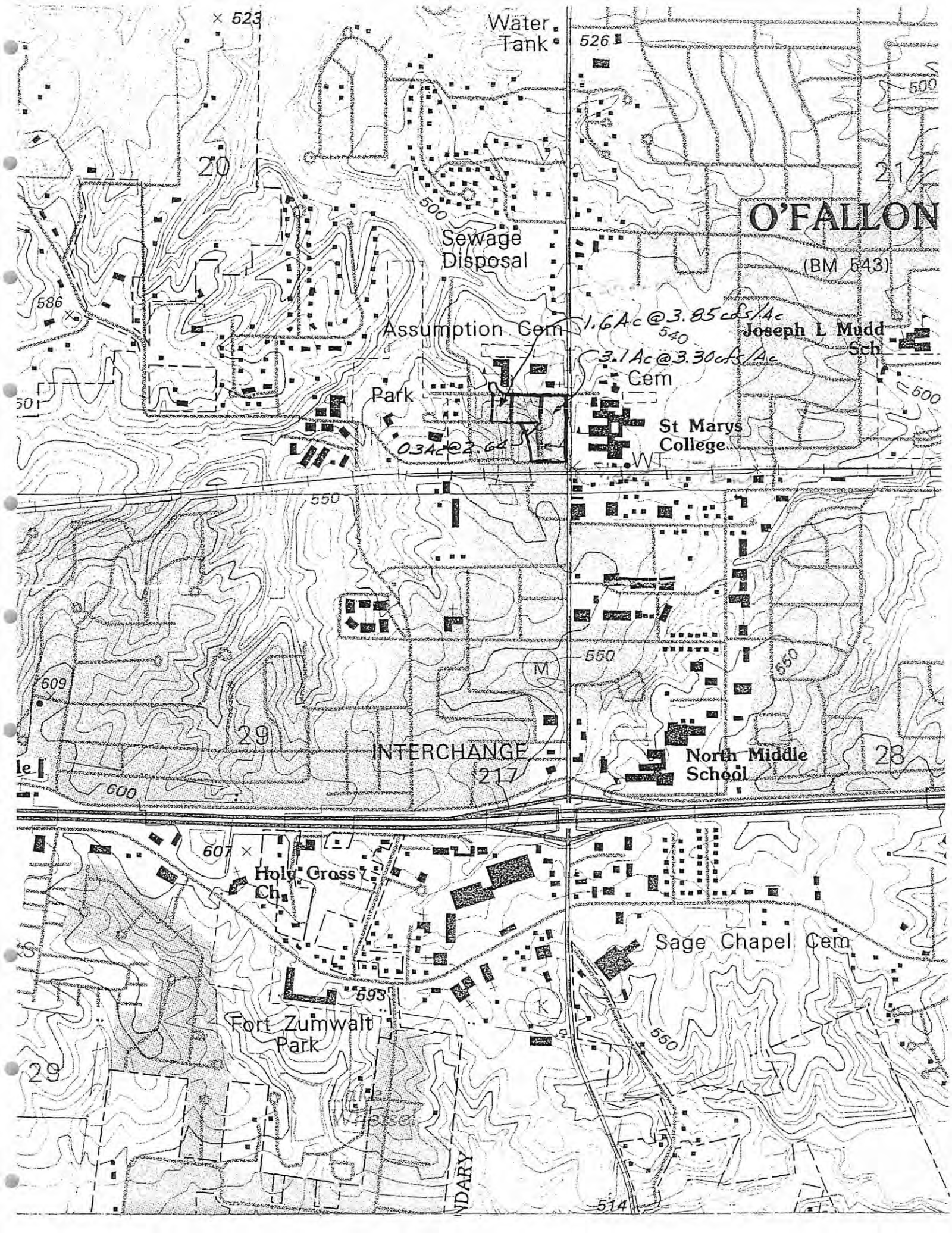
Unit peak, qp = 18.55 cfs
Unit peak time Tp = .46015 hrs
Unit receding limb, Tr = 1.84060 hrs
Total unit time, Tb = 2.30075 hrs

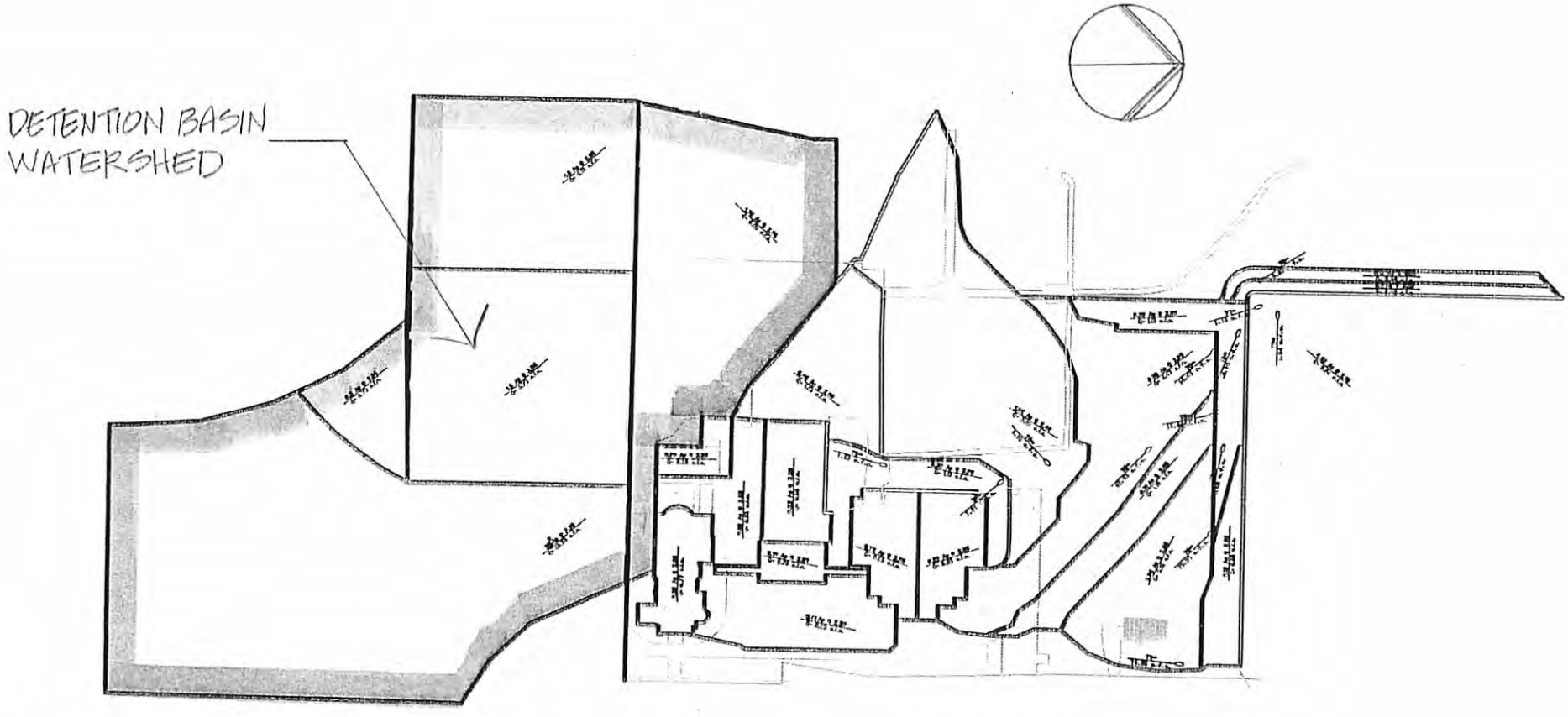
Index of Starting Page Numbers for ID Names

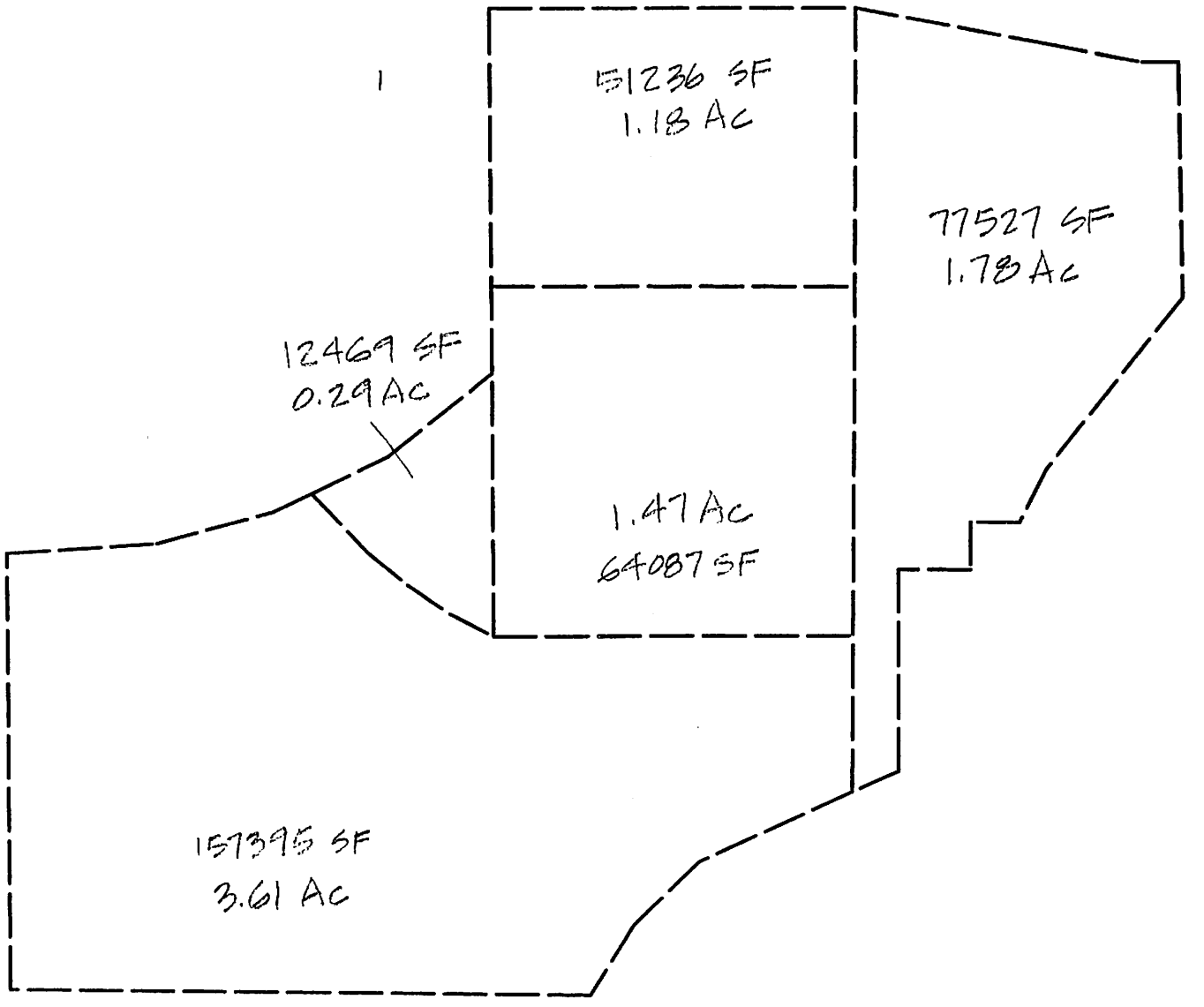
[redacted]

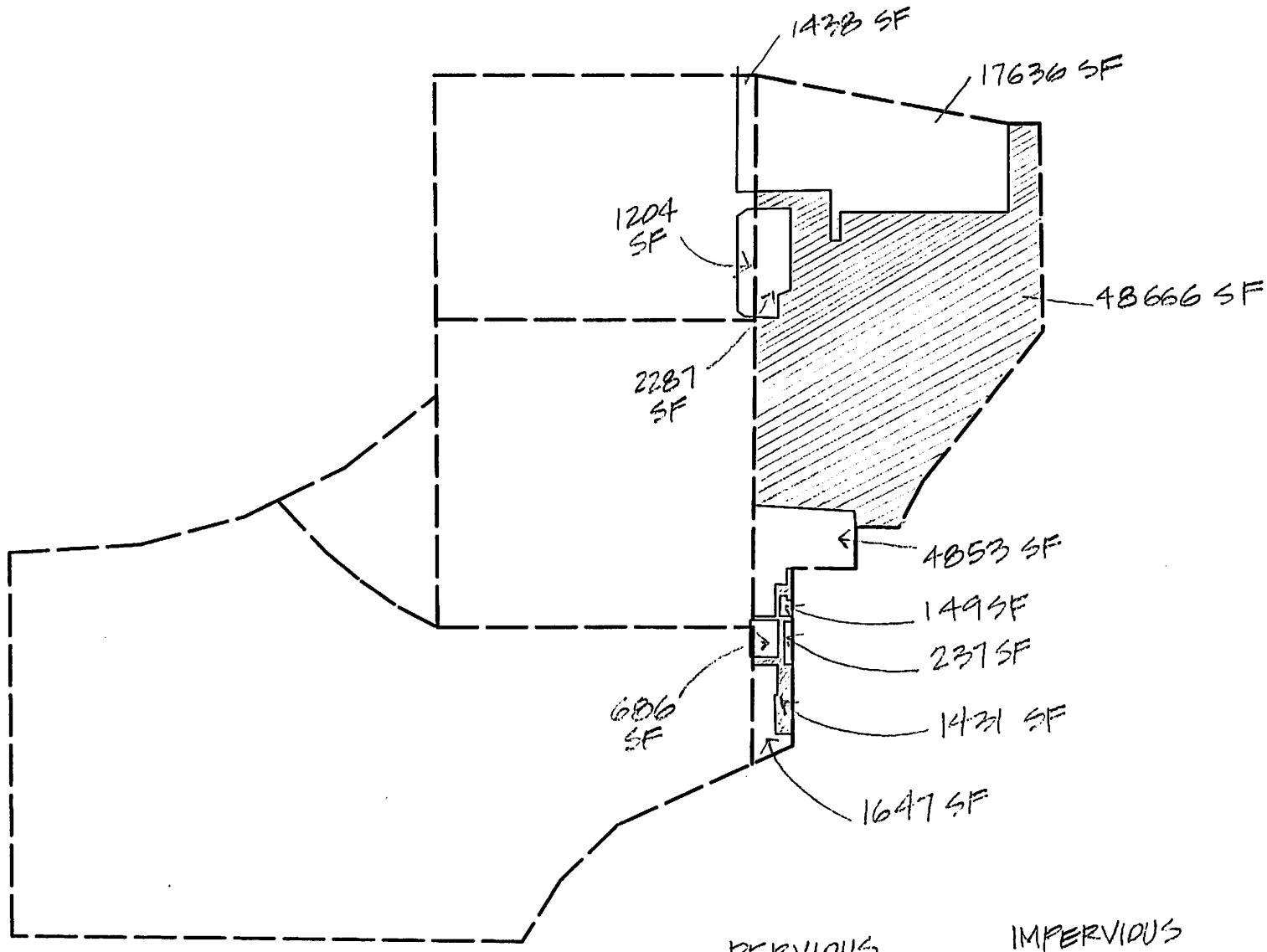
**PRE-DEVELOPED**

**DETENTION BASIN WATERSHED AT SW CORNER**


Water Tank
526
523
20
21
O'FALLON
(BM 543)
Sewage Disposal
500
586
Assumption Cem
1.6Ac @3.85 cds/Ac
540
3.1Ac @3.30 cds/Ac
Joseph L Mudd Sch
Cem
Park
0.3Ac @2.6
St Marys College
WT
550
609
29
INTERCHANGE 217
M
560
660
North Middle School
28
600
607
Holy Cross Ch
Sage Chapel Cem
593
K
Fort Zumwalt Park
29
550
514


DETENTION BASIN
WATERSHED


51236 SF
1.18 Ac
77527 SF
1.78 Ac
12469 SF
0.29 Ac
1.47 Ac
64087 SF
157395 SF
3.61 Ac



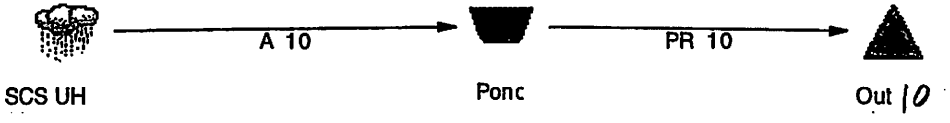

PERVIOUS
27195 SF
= 0.63 AC

IMPERVIOUS
48666
1431
50097 SF
= 1.15 AC

Job File: H:\HAESTAD\ppkw\b7004\ELMER PREDEV 2.PPW
Rain Dir: H:\HAESTAD\ppkw\b7004\

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

Predeveloped flows to detention basin area


A 10
PR 10
SCS UH
Ponc
Out 10

# Table of Contents

Table of Contents (continued)

## MASTER DESIGN STORM SUMMARY

Network Storm Collection: MSD

| Return Event | Total Depth in | Rainfall Type | RNF ID |
|---|---|---|---|
| 100yr | 7.2000 | Synthetic Curve | TypeII 24hr |
| 2year | 3.5000 | Synthetic Curve | TypeII 24hr |
| 25year | 5.6000 | Synthetic Curve | TypeII 24hr |
| 15 | 5.2500 | 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 ac-ft | Trun | Qpeak hrs | Qpeak cfs | Max WSEL ft | Max Pond Storage ac-ft |
|---|---|---|---|---|---|---|---|---|
| *OUT 10 | JCT | 100 | 3.444 | | 12.1500 | 38.17 | | |
| *OUT 10 | JCT | 2 | 1.179 | | 12.1500 | 13.18 | | |
| *OUT 10 | JCT | 25 | 2.429 | | 12.1500 | 27.17 | | |
| *OUT 10 | JCT | 15 | 2.213 | | 12.1500 | 24.79 | | |
| SCS UH 10 | AREA | 100 | 3.444 | | 12.1500 | 38.17 | | |
| SCS UH 10 | AREA | 2 | 1.179 | | 12.1500 | 13.18 | | |
| SCS UH 10 | AREA | 25 | 2.429 | | 12.1500 | 27.17 | | |
| SCS UH 10 | AREA | 15 | 2.213 | | 12.1500 | 24.79 | | |

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

DEFAULT Design Storm File,ID = MSD

Storm Tag Name = 15

Data Type, File, ID = Synthetic Storm TypeII 24hr
Storm Frequency = 15 yr
Total Rainfall Depth= 5.2500 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 ac-ft | Trun. | Qpeak hrs | Qpeak cfs | Max WSEL ft |
|---|---|---|---|---|---|---|---|
| Outfall | OUT 10 | JCT | 2.213 | | 12.1500 | 24.79 | |
| | SCS UH 10 | AREA | 2.213 | | 12.1500 | 24.79 | |

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

DEFAULT Design Storm File,ID = MSD

Storm Tag Name = 100yr

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 ac-ft | Trun. | Qpeak hrs | Qpeak cfs | Max WSEL ft |
|---|---|---|---|---|---|---|
| Outfall OUT 10 | JCT | 3.444 | | 12.1500 | 38.17 | |
| SCS UH 10 | AREA | 3.444 | | 12.1500 | 38.17 | |

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

DEFAULT Design Storm File,ID = MSD

Storm Tag Name = 2year

Data Type, File, ID = Synthetic Storm TypeII 24hr
Storm Frequency = 2 yr
Total Rainfall Depth= 3.5000 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 ac-ft | Trun. | Qpeak hrs | Qpeak cfs | Max WSEL ft |
|---|---|---|---|---|---|---|---|
| Outfall | OUT 10 | JCT | 1.179 | | 12.1500 | 13.18 | |
| | SCS UH 10 | AREA | 1.179 | | 12.1500 | 13.18 | |

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

DEFAULT Design Storm File,ID = MSD

Storm Tag Name = 25year

Data Type, File, ID = Synthetic Storm TypeII 24hr
Storm Frequency = 25 yr
Total Rainfall Depth= 5.6000 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 ac-ft | Trun. | Qpeak hrs | Qpeak cfs | Max WSEL ft |
|---|---|---|---|---|---|---|---|
| Outfall | OUT 10 | JCT | 2.429 | | 12.1500 | 27.17 | |
| | SCS UH 10 | AREA | 2.429 | | 12.1500 | 27.17 | |

File.... H:\HAESTAD\ppkw\b7004\
Title... Predeveloped flows to detention basin area

DESIGN STORMS SUMMARY

Design Storm File,ID = MSD

Storm Tag Name = 100yr
---
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 = 2year
---
Data Type, File, ID = Synthetic Storm TypeII 24hr
Storm Frequency = 2 yr
Total Rainfall Depth= 3.5000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Storm Tag Name = 25year
---
Data Type, File, ID = Synthetic Storm TypeII 24hr
Storm Frequency = 25 yr
Total Rainfall Depth= 5.6000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Storm Tag Name = 15
---
Data Type, File, ID = Synthetic Storm TypeII 24hr
Storm Frequency = 15 yr
Total Rainfall Depth= 5.2500 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

Storm Tag Name = 100yr
---
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 = 2year
---
Data Type, File, ID = Synthetic Storm TypeII 24hr
Storm Frequency = 2 yr
Total Rainfall Depth= 3.5000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Storm Tag Name = 25year
---
Data Type, File, ID = Synthetic Storm TypeII 24hr
Storm Frequency = 25 yr
Total Rainfall Depth= 5.6000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Storm Tag Name = 15
---
Data Type, File, ID = Synthetic Storm TypeII 24hr
Storm Frequency = 15 yr
Total Rainfall Depth= 5.2500 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

File.... H:\HAESTAD\ppkw\b7004\ELMER PREDEV 2.PPW

TIME OF CONCENTRATION CALCULATOR

---

Segment #1: Tc: TR-55 Sheet

| | | |
|---|---|---|
| Mannings n | .2400 | |
| Hydraulic Length | 300.00 | ft |
| 2yr, 24hr P | 3.5000 | in |
| Slope | .050000 | ft/ft |
| Avg.Velocity | .22 | ft/sec |

Segment #1 Time: .3796 hrs

---

Segment #2: Tc: TR-55 Channel

| | | |
|---|---|---|
| Flow Area | 10.0000 | sq.ft |
| Wetted Perimeter | 20.00 | ft |
| Hydraulic Radius | .50 | ft |
| Slope | .030000 | ft/ft |
| Mannings n | .0300 | |
| Hydraulic Length | 260.00 | ft |
| Avg.Velocity | 5.42 | ft/sec |

Segment #2 Time: .0133 hrs

---

Segment #3: Tc: TR-55 Channel

| | | |
|---|---|---|
| Flow Area | 10.0000 | sq.ft |
| Wetted Perimeter | 20.00 | ft |
| Hydraulic Radius | .50 | ft |
| Slope | .030000 | ft/ft |
| Mannings n | .0300 | |
| Hydraulic Length | 260.00 | ft |
| Avg.Velocity | 5.42 | ft/sec |

Segment #3 Time: .0133 hrs

---

File.... H:\HAESTAD\ppkw\b7004\ELMER PREDEV 2.PPW

Segment #4: Tc: TR-55 Channel

| | | |
|---|---|---|
| Flow Area | 2.4050 | sq.ft |
| Wetted Perimeter | 5.50 | ft |
| Hydraulic Radius | .44 | ft |
| Slope | .010000 | ft/ft |
| Mannings n | .0130 | |
| Hydraulic Length | 75.00 | ft |
| Avg.Velocity | 6.60 | ft/sec |

Segment #4 Time: .0032 hrs

---

Segment #5: Tc: TR-55 Channel

| | | |
|---|---|---|
| Flow Area | 10.0000 | sq.ft |
| Wetted Perimeter | 10.00 | ft |
| Hydraulic Radius | 1.00 | ft |
| Slope | .010000 | ft/ft |
| Mannings n | .0300 | |
| Hydraulic Length | 200.00 | ft |
| Avg.Velocity | 4.97 | ft/sec |

Segment #5 Time: .0112 hrs

---

==========
Total Tc: .4206 hrs
==========

File.... H:\HAESTAD\ppkw\b7004\ELMER PREDEV 2.PPW

---

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 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

File.... H:\HAESTAD\ppkw\b7004\ELMER PREDEV 2.PPW

RUNOFF CURVE NUMBER DATA

| Soil/Surface Description | CN | Area acres | Impervious Adjustment %C | %UC | Adjusted CN |
|---|---|---|---|---|---|
| Multi Family Soil Group B | 85 | 2.100 | | | 85.00 |
| 1/4 Acre lots Soil Group B | 75 | 1.300 | | | 75.00 |
| Pavement | 98 | 1.500 | | | 98.00 |
| Open Space Soil Group B | 61 | 1.600 | | | 61.00 |
| impervious, roof/pave, Soil B | 98 | 1.150 | | | 98.00 |
| pervious, Soil B | 61 | .630 | | | 61.00 |
| COMPOSITE AREA & WEIGHTED CN ---> | | 8.280 | | | 81.13 (81) |

## 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: 15 year storm
Duration = 24.0000 hrs Rain Depth = 5.2500 in
Rain Dir = H:\HAESTAD\ppkw\b7004\
Rain File -ID = - TypeII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir = H:\HAESTAD\ppkw\b7004\
HYG File - ID = - SCS UH 10 15
Tc = .4206 hrs
Drainage Area = 8.280 acres Runoff CN= 81

==========
Computational Time Increment = .05608 hrs
Computed Peak Time = 12.1135 hrs
Computed Peak Flow = 25.02 cfs

Time Increment for HYG File = .0500 hrs
Peak Time, Interpolated Output = 12.1500 hrs
Peak Flow, Interpolated Output = 24.79 cfs
==========

DRAINAGE AREA
---
ID:SCS UH 10
CN = 81
Area = 8.280 acres
S = 2.3457 in
0.2S = .4691 in

Cumulative Runoff
---
3.2073 in
2.213 ac-ft

HYG Volume... 2.213 ac-ft (area under HYG curve)

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

Time Concentration, Tc = .42061 hrs (ID: SCS UH 10)
Computational Incr, Tm = .05608 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 = 22.30 cfs
Unit peak time Tp = .28041 hrs
Unit receding limb, Tr = 1.12162 hrs
Total unit time, Tb = 1.40203 hrs

SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 100 year storm
Duration = 24.0000 hrs Rain Depth = 7.2000 in
Rain Dir = H:\HAESTAD\ppkw\b7004\
Rain File -ID = - TypeII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir = H:\HAESTAD\ppkw\b7004\
HYG File - ID = - SCS UH 10 100yr
Tc = .4206 hrs
Drainage Area = 8.280 acres Runoff CN= 81

==========
Computational Time Increment = .05608 hrs
Computed Peak Time = 12.1135 hrs
Computed Peak Flow = 38.70 cfs

Time Increment for HYG File = .0500 hrs
Peak Time, Interpolated Output = 12.1500 hrs
Peak Flow, Interpolated Output = 38.17 cfs
==========

DRAINAGE AREA
---
ID:SCS UH 10
CN = 81
Area = 8.280 acres
S = 2.3457 in
0.2S = .4691 in

Cumulative Runoff
---
4.9914 in
3.444 ac-ft

HYG Volume... 3.444 ac-ft (area under HYG curve)

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

Time Concentration, Tc = .42061 hrs (ID: SCS UH 10)
Computational Incr, Tm = .05608 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 = 22.30 cfs
Unit peak time Tp = .28041 hrs
Unit receding limb, Tr = 1.12162 hrs
Total unit time, Tb = 1.40203 hrs

SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 2 year storm
Duration = 24.0000 hrs Rain Depth = 3.5000 in
Rain Dir = H:\HAESTAD\ppkw\b7004\
Rain File -ID = - TypeII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir = H:\HAESTAD\ppkw\b7004\
HYG File - ID = - SCS UH 10 2year
Tc = .4206 hrs
Drainage Area = 8.280 acres Runoff CN= 81

==========
Computational Time Increment = .05608 hrs
Computed Peak Time = 12.1135 hrs
Computed Peak Flow = 13.19 cfs

Time Increment for HYG File = .0500 hrs
Peak Time, Interpolated Output = 12.1500 hrs
Peak Flow, Interpolated Output = 13.18 cfs
==========

DRAINAGE AREA
---
ID:SCS UH 10
CN = 81
Area = 8.280 acres
S = 2.3457 in
0.2S = .4691 in

Cumulative Runoff
---
1.7086 in
1.179 ac-ft

HYG Volume... 1.179 ac-ft (area under HYG curve)

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

Time Concentration, Tc = .42061 hrs (ID: SCS UH 10)
Computational Incr, Tm = .05608 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 = 22.30 cfs
Unit peak time Tp = .28041 hrs
Unit receding limb, Tr = 1.12162 hrs
Total unit time, Tb = 1.40203 hrs

SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 25 year storm
Duration = 24.0000 hrs Rain Depth = 5.6000 in
Rain Dir = H:\HAESTAD\ppkw\b7004\
Rain File -ID = - TypeII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir = H:\HAESTAD\ppkw\b7004\
HYG File - ID = - SCS UH 10 25year
Tc = .4206 hrs
Drainage Area = 8.280 acres Runoff CN= 81

==========
Computational Time Increment = .05608 hrs
Computed Peak Time = 12.1135 hrs
Computed Peak Flow = 27.46 cfs

Time Increment for HYG File = .0500 hrs
Peak Time, Interpolated Output = 12.1500 hrs
Peak Flow, Interpolated Output = 27.17 cfs
==========

DRAINAGE AREA
---
ID:SCS UH 10
CN = 81
Area = 8.280 acres
S = 2.3457 in
0.2S = .4691 in

Cumulative Runoff
---
3.5211 in
2.430 ac-ft

HYG Volume... 2.429 ac-ft (area under HYG curve)

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

Time Concentration, Tc = .42061 hrs (ID: SCS UH 10)
Computational Incr, Tm = .05608 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 = 22.30 cfs
Unit peak time Tp = .28041 hrs
Unit receding limb, Tr = 1.12162 hrs
Total unit time, Tb = 1.40203 hrs

SUMMARY FOR HYDROGRAPH ADDITION
at Node: OUT 10

HYG Directory: H:\HAESTAD\ppkw\b7004\

| Upstream Link ID | Upstream Node ID | HYG file | HYG ID | HYG tag |
|---|---|---|---|---|
| A 10 | SCS UH 10 | | SCS UH 10 | 15 |

INFLOWS TO: OUT 10

| HYG file | HYG ID | HYG tag | Volume ac-ft | Peak Time hrs | Peak Flow cfs |
|---|---|---|---|---|---|
| | SCS UH 10 | 15 | 2.213 | 12.1500 | 24.79 |

TOTAL FLOW INTO: OUT 10

| HYG file | HYG ID | HYG tag | Volume ac-ft | Peak Time hrs | Peak Flow cfs |
|---|---|---|---|---|---|
| | OUT 10 | 15 | 2.213 | 12.1500 | 24.79 |

TOTAL NODE INFLOW...
HYG file =
HYG ID = OUT 10
HYG Tag = 15

| | |
|---|---|
| Peak Discharge = | 24.79 cfs |
| Time to Peak = | 12.1500 hrs |
| HYG Volume = | 2.213 ac-ft |

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

| Time hrs | | | | | |
|---|---|---|---|---|---|
| 6.6500 | .00 | .00 | .00 | .00 | .01 |
| 6.9000 | .01 | .01 | .01 | .02 | .02 |
| 7.1500 | .02 | .03 | .03 | .03 | .04 |
| 7.4000 | .04 | .05 | .05 | .05 | .06 |
| 7.6500 | .06 | .07 | .07 | .07 | .08 |
| 7.9000 | .08 | .09 | .09 | .10 | .10 |
| 8.1500 | .10 | .11 | .11 | .12 | .13 |
| 8.4000 | .13 | .14 | .15 | .15 | .16 |
| 8.6500 | .17 | .18 | .19 | .19 | .20 |
| 8.9000 | .21 | .22 | .23 | .24 | .25 |
| 9.1500 | .26 | .27 | .28 | .29 | .30 |
| 9.4000 | .31 | .32 | .32 | .33 | .34 |
| 9.6500 | .35 | .35 | .36 | .37 | .39 |
| 9.9000 | .40 | .41 | .43 | .45 | .46 |
| 10.1500 | .48 | .50 | .52 | .54 | .57 |
| 10.4000 | .59 | .62 | .64 | .67 | .70 |
| 10.6500 | .73 | .76 | .80 | .83 | .88 |
| 10.9000 | .92 | .96 | 1.01 | 1.06 | 1.11 |
| 11.1500 | 1.17 | 1.24 | 1.31 | 1.40 | 1.49 |
| 11.4000 | 1.59 | 1.70 | 1.81 | 1.97 | 2.21 |
| 11.6500 | 2.64 | 3.35 | 4.44 | 6.03 | 8.28 |
| 11.9000 | 11.29 | 14.99 | 19.10 | 22.50 | 24.54 |
| 12.1500 | 24.79 | 23.41 | 20.93 | 18.00 | 15.13 |
| 12.4000 | 12.62 | 10.66 | 9.18 | 7.97 | 6.96 |
| 12.6500 | 6.12 | 5.43 | 4.85 | 4.39 | 4.01 |
| 12.9000 | 3.70 | 3.44 | 3.23 | 3.05 | 2.88 |
| 13.1500 | 2.74 | 2.61 | 2.49 | 2.40 | 2.31 |
| 13.4000 | 2.24 | 2.18 | 2.12 | 2.06 | 2.00 |
| 13.6500 | 1.95 | 1.90 | 1.85 | 1.81 | 1.76 |
| 13.9000 | 1.72 | 1.68 | 1.64 | 1.60 | 1.57 |
| 14.1500 | 1.53 | 1.50 | 1.47 | 1.44 | 1.42 |
| 14.4000 | 1.40 | 1.38 | 1.36 | 1.34 | 1.33 |
| 14.6500 | 1.31 | 1.30 | 1.29 | 1.27 | 1.26 |

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

| Time hrs | | | | | |
|---|---|---|---|---|---|
| 14.9000 | 1.25 | 1.23 | 1.22 | 1.21 | 1.20 |
| 15.1500 | 1.18 | 1.17 | 1.16 | 1.14 | 1.13 |
| 15.4000 | 1.12 | 1.11 | 1.09 | 1.08 | 1.07 |
| 15.6500 | 1.05 | 1.04 | 1.03 | 1.02 | 1.00 |
| 15.9000 | .99 | .98 | .96 | .95 | .94 |
| 16.1500 | .93 | .91 | .90 | .89 | .89 |
| 16.4000 | .88 | .87 | .87 | .86 | .86 |
| 16.6500 | .85 | .84 | .84 | .84 | .83 |
| 16.9000 | .83 | .82 | .82 | .81 | .81 |
| 17.1500 | .80 | .80 | .79 | .79 | .78 |
| 17.4000 | .78 | .77 | .77 | .77 | .76 |
| 17.6500 | .76 | .75 | .75 | .74 | .74 |
| 17.9000 | .73 | .73 | .72 | .72 | .71 |
| 18.1500 | .71 | .71 | .70 | .70 | .69 |
| 18.4000 | .69 | .68 | .68 | .67 | .67 |
| 18.6500 | .66 | .66 | .65 | .65 | .64 |
| 18.9000 | .64 | .63 | .63 | .63 | .62 |
| 19.1500 | .62 | .61 | .61 | .60 | .60 |
| 19.4000 | .59 | .59 | .58 | .58 | .57 |
| 19.6500 | .57 | .56 | .56 | .55 | .55 |
| 19.9000 | .54 | .54 | .54 | .53 | .53 |
| 20.1500 | .52 | .52 | .51 | .51 | .51 |
| 20.4000 | .51 | .50 | .50 | .50 | .50 |
| 20.6500 | .50 | .50 | .50 | .50 | .49 |
| 20.9000 | .49 | .49 | .49 | .49 | .49 |
| 21.1500 | .49 | .49 | .49 | .49 | .49 |
| 21.4000 | .48 | .48 | .48 | .48 | .48 |
| 21.6500 | .48 | .48 | .48 | .48 | .48 |
| 21.9000 | .47 | .47 | .47 | .47 | .47 |
| 22.1500 | .47 | .47 | .47 | .47 | .47 |
| 22.4000 | .47 | .46 | .46 | .46 | .46 |
| 22.6500 | .46 | .46 | .46 | .46 | .46 |
| 22.9000 | .46 | .46 | .45 | .45 | .45 |
| 23.1500 | .45 | .45 | .45 | .45 | .45 |
| 23.4000 | .45 | .45 | .45 | .44 | .44 |
| 23.6500 | .44 | .44 | .44 | .44 | .44 |
| 23.9000 | .44 | .44 | .44 | .43 | .41 |
| 24.1500 | .38 | .33 | .27 | .22 | .17 |
| 24.4000 | .12 | .09 | .07 | .05 | .04 |
| 24.6500 | .03 | .02 | .02 | .01 | .01 |
| 24.9000 | .01 | .00 | .00 | .00 | .00 |
| 25.1500 | .00 | .00 | | | |

SUMMARY FOR HYDROGRAPH ADDITION
at Node: OUT 10

HYG Directory: H:\HAESTAD\ppkw\b7004\

| Upstream Link ID | Upstream Node ID | HYG file | HYG ID | HYG tag |
|---|---|---|---|---|
| A 10 | SCS UH 10 | | SCS UH 10 | 100yr |

INFLOWS TO: OUT 10

| HYG file | HYG ID | HYG tag | Volume ac-ft | Peak Time hrs | Peak Flow cfs |
|---|---|---|---|---|---|
| | SCS UH 10 | 100yr | 3.444 | 12.1500 | 38.17 |

TOTAL FLOW INTO: OUT 10

| HYG file | HYG ID | HYG tag | Volume ac-ft | Peak Time hrs | Peak Flow cfs |
|---|---|---|---|---|---|
| | OUT 10 | 100yr | 3.444 | 12.1500 | 38.17 |

TOTAL NODE INFLOW...
HYG file =
HYG ID = OUT 10
HYG Tag = 100yr

| | |
|---|---|
| Peak Discharge = | 38.17 cfs |
| Time to Peak = | 12.1500 hrs |
| HYG Volume = | 3.444 ac-ft |

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

| Time hrs | | | | | |
|---|---|---|---|---|---|
| 5.3000 | .00 | .00 | .00 | .01 | .01 |
| 5.5500 | .01 | .02 | .02 | .03 | .03 |
| 5.8000 | .03 | .04 | .05 | .05 | .06 |
| 6.0500 | .06 | .07 | .07 | .08 | .08 |
| 6.3000 | .09 | .09 | .10 | .11 | .11 |
| 6.5500 | .12 | .12 | .13 | .14 | .14 |
| 6.8000 | .15 | .15 | .16 | .17 | .17 |
| 7.0500 | .18 | .19 | .19 | .20 | .20 |
| 7.3000 | .21 | .22 | .22 | .23 | .24 |
| 7.5500 | .24 | .25 | .26 | .26 | .27 |
| 7.8000 | .28 | .29 | .29 | .30 | .31 |
| 8.0500 | .31 | .32 | .33 | .34 | .35 |
| 8.3000 | .36 | .37 | .38 | .39 | .41 |
| 8.5500 | .42 | .44 | .45 | .47 | .48 |
| 8.8000 | .50 | .52 | .53 | .55 | .57 |
| 9.0500 | .59 | .60 | .62 | .64 | .66 |
| 9.3000 | .67 | .68 | .70 | .71 | .72 |
| 9.5500 | .73 | .74 | .75 | .77 | .78 |
| 9.8000 | .80 | .82 | .84 | .87 | .90 |
| 10.0500 | .92 | .95 | .99 | 1.02 | 1.05 |
| 10.3000 | 1.09 | 1.13 | 1.17 | 1.22 | 1.26 |
| 10.5500 | 1.31 | 1.36 | 1.41 | 1.46 | 1.52 |
| 10.8000 | 1.59 | 1.66 | 1.73 | 1.80 | 1.88 |
| 11.0500 | 1.97 | 2.05 | 2.15 | 2.26 | 2.38 |
| 11.3000 | 2.52 | 2.67 | 2.84 | 3.02 | 3.21 |
| 11.5500 | 3.46 | 3.86 | 4.57 | 5.73 | 7.50 |
| 11.8000 | 10.07 | 13.62 | 18.30 | 23.97 | 30.15 |
| 12.0500 | 35.16 | 38.03 | 38.17 | 35.87 | 31.94 |
| 12.3000 | 27.37 | 22.94 | 19.08 | 16.08 | 13.81 |
| 12.5500 | 11.96 | 10.41 | 9.13 | 8.08 | 7.21 |
| 12.8000 | 6.50 | 5.93 | 5.46 | 5.08 | 4.76 |
| 13.0500 | 4.48 | 4.24 | 4.02 | 3.83 | 3.66 |
| 13.3000 | 3.51 | 3.39 | 3.28 | 3.19 | 3.10 |

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

| Time hrs | | | | | |
|---|---|---|---|---|---|
| 13.5500 | 3.01 | 2.93 | 2.85 | 2.78 | 2.70 |
| 13.8000 | 2.64 | 2.57 | 2.51 | 2.45 | 2.39 |
| 14.0500 | 2.34 | 2.28 | 2.23 | 2.18 | 2.14 |
| 14.3000 | 2.10 | 2.06 | 2.03 | 2.01 | 1.98 |
| 14.5500 | 1.96 | 1.93 | 1.91 | 1.89 | 1.87 |
| 14.8000 | 1.85 | 1.83 | 1.81 | 1.79 | 1.78 |
| 15.0500 | 1.76 | 1.74 | 1.72 | 1.70 | 1.68 |
| 15.3000 | 1.66 | 1.64 | 1.62 | 1.61 | 1.59 |
| 15.5500 | 1.57 | 1.55 | 1.53 | 1.51 | 1.49 |
| 15.8000 | 1.47 | 1.45 | 1.43 | 1.42 | 1.40 |
| 16.0500 | 1.38 | 1.36 | 1.34 | 1.33 | 1.31 |
| 16.3000 | 1.30 | 1.28 | 1.27 | 1.26 | 1.25 |
| 16.5500 | 1.25 | 1.24 | 1.23 | 1.22 | 1.22 |
| 16.8000 | 1.21 | 1.20 | 1.19 | 1.19 | 1.18 |
| 17.0500 | 1.17 | 1.17 | 1.16 | 1.15 | 1.15 |
| 17.3000 | 1.14 | 1.13 | 1.13 | 1.12 | 1.11 |
| 17.5500 | 1.11 | 1.10 | 1.09 | 1.09 | 1.08 |
| 17.8000 | 1.07 | 1.07 | 1.06 | 1.05 | 1.05 |
| 18.0500 | 1.04 | 1.03 | 1.02 | 1.02 | 1.01 |
| 18.3000 | 1.00 | 1.00 | .99 | .98 | .98 |
| 18.5500 | .97 | .96 | .96 | .95 | .94 |
| 18.8000 | .94 | .93 | .92 | .92 | .91 |
| 19.0500 | .90 | .90 | .89 | .88 | .87 |
| 19.3000 | .87 | .86 | .85 | .85 | .84 |
| 19.5500 | .83 | .83 | .82 | .81 | .81 |
| 19.8000 | .80 | .79 | .78 | .78 | .77 |
| 20.0500 | .76 | .76 | .75 | .75 | .74 |
| 20.3000 | .74 | .73 | .73 | .73 | .72 |
| 20.5500 | .72 | .72 | .72 | .72 | .71 |
| 20.8000 | .71 | .71 | .71 | .71 | .71 |
| 21.0500 | .71 | .70 | .70 | .70 | .70 |
| 21.3000 | .70 | .70 | .70 | .70 | .69 |
| 21.5500 | .69 | .69 | .69 | .69 | .69 |
| 21.8000 | .69 | .68 | .68 | .68 | .68 |
| 22.0500 | .68 | .68 | .68 | .68 | .67 |
| 22.3000 | .67 | .67 | .67 | .67 | .67 |
| 22.5500 | .67 | .66 | .66 | .66 | .66 |
| 22.8000 | .66 | .66 | .66 | .65 | .65 |
| 23.0500 | .65 | .65 | .65 | .65 | .65 |
| 23.3000 | .65 | .64 | .64 | .64 | .64 |
| 23.5500 | .64 | .64 | .64 | .63 | .63 |
| 23.8000 | .63 | .63 | .63 | .63 | .63 |
| 24.0500 | .62 | .59 | .54 | .47 | .39 |
| 24.3000 | .31 | .24 | .18 | .13 | .10 |
| 24.5500 | .07 | .05 | .04 | .03 | .02 |
| 24.8000 | .02 | .01 | .01 | .01 | .00 |
| 25.0500 | .00 | .00 | .00 | .00 | |

SUMMARY FOR HYDROGRAPH ADDITION
at Node: OUT 10

HYG Directory: H:\HAESTAD\ppkw\b7004\

| Upstream Link ID | Upstream Node ID | HYG file | HYG ID | HYG tag |
|---|---|---|---|---|
| A 10 | SCS UH 10 | | SCS UH 10 | 2year |

INFLOWS TO: OUT 10

| HYG file | HYG ID | HYG tag | Volume ac-ft | Peak Time hrs | Peak Flow cfs |
|---|---|---|---|---|---|
| | SCS UH 10 | 2year | 1.179 | 12.1500 | 13.18 |

TOTAL FLOW INTO: OUT 10

| HYG file | HYG ID | HYG tag | Volume ac-ft | Peak Time hrs | Peak Flow cfs |
|---|---|---|---|---|---|
| | OUT 10 | 2year | 1.179 | 12.1500 | 13.18 |

TOTAL NODE INFLOW...
HYG file =
HYG ID = OUT 10
HYG Tag = 2year

| | |
|---|---|
| Peak Discharge = | 13.18 cfs |
| Time to Peak = | 12.1500 hrs |
| HYG Volume = | 1.179 ac-ft |

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

| Time hrs | | | | | |
|---|---|---|---|---|---|
| 8.7500 | .00 | .00 | .00 | .01 | .01 |
| 9.0000 | .01 | .01 | .02 | .02 | .02 |
| 9.2500 | .03 | .03 | .04 | .04 | .04 |
| 9.5000 | .05 | .05 | .06 | .06 | .07 |
| 9.7500 | .07 | .08 | .08 | .09 | .09 |
| 10.0000 | .10 | .11 | .11 | .12 | .13 |
| 10.2500 | .14 | .15 | .16 | .17 | .18 |
| 10.5000 | .19 | .20 | .21 | .23 | .24 |
| 10.7500 | .26 | .27 | .29 | .31 | .33 |
| 11.0000 | .35 | .37 | .40 | .43 | .46 |
| 11.2500 | .49 | .53 | .57 | .62 | .67 |
| 11.5000 | .72 | .80 | .91 | 1.11 | 1.44 |
| 11.7500 | 1.96 | 2.74 | 3.88 | 5.44 | 7.42 |
| 12.0000 | 9.69 | 11.64 | 12.89 | 13.18 | 12.56 |
| 12.2500 | 11.31 | 9.79 | 8.28 | 6.94 | 5.89 |
| 12.5000 | 5.10 | 4.45 | 3.90 | 3.45 | 3.07 |
| 12.7500 | 2.76 | 2.50 | 2.29 | 2.12 | 1.98 |
| 13.0000 | 1.86 | 1.76 | 1.67 | 1.59 | 1.51 |
| 13.2500 | 1.45 | 1.40 | 1.35 | 1.31 | 1.27 |
| 13.5000 | 1.24 | 1.20 | 1.17 | 1.14 | 1.11 |
| 13.7500 | 1.08 | 1.06 | 1.03 | 1.01 | .99 |
| 14.0000 | .96 | .94 | .92 | .90 | .88 |
| 14.2500 | .86 | .85 | .83 | .82 | .81 |
| 14.5000 | .80 | .79 | .78 | .78 | .77 |
| 14.7500 | .76 | .75 | .74 | .74 | .73 |
| 15.0000 | .72 | .71 | .71 | .70 | .69 |
| 15.2500 | .69 | .68 | .67 | .66 | .66 |
| 15.5000 | .65 | .64 | .63 | .63 | .62 |
| 15.7500 | .61 | .60 | .60 | .59 | .58 |
| 16.0000 | .57 | .56 | .56 | .55 | .54 |
| 16.2500 | .54 | .53 | .53 | .52 | .52 |
| 16.5000 | .52 | .51 | .51 | .51 | .50 |
| 16.7500 | .50 | .50 | .49 | .49 | .49 |

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

| Time hrs | | | | | |
|---|---|---|---|---|---|
| 17.0000 | .49 | .48 | .48 | .48 | .48 |
| 17.2500 | .47 | .47 | .47 | .47 | .46 |
| 17.5000 | .46 | .46 | .45 | .45 | .45 |
| 17.7500 | .45 | .44 | .44 | .44 | .44 |
| 18.0000 | .43 | .43 | .43 | .42 | .42 |
| 18.2500 | .42 | .42 | .41 | .41 | .41 |
| 18.5000 | .41 | .40 | .40 | .40 | .39 |
| 18.7500 | .39 | .39 | .39 | .38 | .38 |
| 19.0000 | .38 | .38 | .37 | .37 | .37 |
| 19.2500 | .36 | .36 | .36 | .36 | .35 |
| 19.5000 | .35 | .35 | .34 | .34 | .34 |
| 19.7500 | .34 | .33 | .33 | .33 | .32 |
| 20.0000 | .32 | .32 | .32 | .31 | .31 |
| 20.2500 | .31 | .31 | .31 | .30 | .30 |
| 20.5000 | .30 | .30 | .30 | .30 | .30 |
| 20.7500 | .30 | .30 | .30 | .30 | .30 |
| 21.0000 | .30 | .30 | .29 | .29 | .29 |
| 21.2500 | .29 | .29 | .29 | .29 | .29 |
| 21.5000 | .29 | .29 | .29 | .29 | .29 |
| 21.7500 | .29 | .29 | .29 | .29 | .29 |
| 22.0000 | .29 | .28 | .28 | .28 | .28 |
| 22.2500 | .28 | .28 | .28 | .28 | .28 |
| 22.5000 | .28 | .28 | .28 | .28 | .28 |
| 22.7500 | .28 | .28 | .28 | .28 | .28 |
| 23.0000 | .27 | .27 | .27 | .27 | .27 |
| 23.2500 | .27 | .27 | .27 | .27 | .27 |
| 23.5000 | .27 | .27 | .27 | .27 | .27 |
| 23.7500 | .27 | .27 | .27 | .26 | .26 |
| 24.0000 | .26 | .26 | .25 | .23 | .20 |
| 24.2500 | .17 | .13 | .10 | .07 | .05 |
| 24.5000 | .04 | .03 | .02 | .02 | .01 |
| 24.7500 | .01 | .01 | .01 | .00 | .00 |
| 25.0000 | .00 | .00 | .00 | | |

SUMMARY FOR HYDROGRAPH ADDITION
at Node: OUT 10

HYG Directory: H:\HAESTAD\ppkw\b7004\

| Upstream Link ID | Upstream Node ID | HYG file | HYG ID | HYG tag |
|---|---|---|---|---|
| A 10 | SCS UH 10 | | SCS UH 10 | 25year |

INFLOWS TO: OUT 10

| HYG file | HYG ID | HYG tag | Volume ac-ft | Peak Time hrs | Peak Flow cfs |
|---|---|---|---|---|---|
| | SCS UH 10 | 25year | 2.429 | 12.1500 | 27.17 |

TOTAL FLOW INTO: OUT 10

| HYG file | HYG ID | HYG tag | Volume ac-ft | Peak Time hrs | Peak Flow cfs |
|---|---|---|---|---|---|
| | OUT 10 | 25year | 2.429 | 12.1500 | 27.17 |

TOTAL NODE INFLOW...
HYG file =
HYG ID = OUT 10
HYG Tag = 25year

| | |
|---|---|
| Peak Discharge = | 27.17 cfs |
| Time to Peak = | 12.1500 hrs |
| HYG Volume = | 2.429 ac-ft |

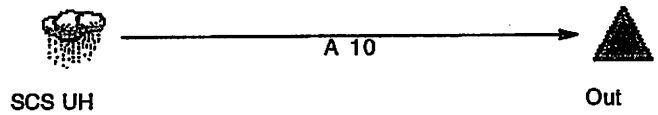
HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

| Time hrs | | | | | |
|---|---|---|---|---|---|
| 6.3500 | .00 | .00 | .00 | .00 | .01 |
| 6.6000 | .01 | .01 | .01 | .02 | .02 |
| 6.8500 | .03 | .03 | .03 | .04 | .04 |
| 7.1000 | .04 | .05 | .05 | .06 | .06 |
| 7.3500 | .07 | .07 | .07 | .08 | .08 |
| 7.6000 | .09 | .09 | .10 | .10 | .11 |
| 7.8500 | .11 | .12 | .12 | .13 | .13 |
| 8.1000 | .13 | .14 | .15 | .15 | .16 |
| 8.3500 | .16 | .17 | .18 | .19 | .20 |
| 8.6000 | .20 | .21 | .22 | .23 | .24 |
| 8.8500 | .25 | .26 | .28 | .29 | .30 |
| 9.1000 | .31 | .32 | .33 | .34 | .35 |
| 9.3500 | .36 | .37 | .38 | .39 | .40 |
| 9.6000 | .40 | .41 | .42 | .43 | .45 |
| 9.8500 | .46 | .47 | .49 | .51 | .53 |
| 10.1000 | .55 | .57 | .59 | .61 | .63 |
| 10.3500 | .66 | .69 | .72 | .75 | .78 |
| 10.6000 | .81 | .84 | .88 | .92 | .96 |
| 10.8500 | 1.01 | 1.06 | 1.11 | 1.16 | 1.22 |
| 11.1000 | 1.27 | 1.34 | 1.41 | 1.50 | 1.59 |
| 11.3500 | 1.69 | 1.80 | 1.92 | 2.05 | 2.23 |
| 11.6000 | 2.50 | 2.98 | 3.76 | 4.97 | 6.74 |
| 11.8500 | 9.22 | 12.52 | 16.58 | 21.05 | 24.75 |
| 12.1000 | 26.94 | 27.17 | 25.63 | 22.90 | 19.68 |
| 12.3500 | 16.53 | 13.78 | 11.63 | 10.01 | 8.69 |
| 12.6000 | 7.58 | 6.66 | 5.90 | 5.28 | 4.77 |
| 12.8500 | 4.35 | 4.01 | 3.74 | 3.51 | 3.31 |
| 13.1000 | 3.13 | 2.97 | 2.83 | 2.70 | 2.60 |
| 13.3500 | 2.51 | 2.43 | 2.36 | 2.30 | 2.23 |
| 13.6000 | 2.17 | 2.11 | 2.06 | 2.01 | 1.96 |
| 13.8500 | 1.91 | 1.86 | 1.82 | 1.78 | 1.73 |
| 14.1000 | 1.69 | 1.66 | 1.62 | 1.59 | 1.56 |
| 14.3500 | 1.53 | 1.51 | 1.49 | 1.47 | 1.45 |

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

| Time hrs | | | | | |
|---|---|---|---|---|---|
| 14.6000 | 1.44 | 1.42 | 1.41 | 1.39 | 1.38 |
| 14.8500 | 1.36 | 1.35 | 1.34 | 1.32 | 1.31 |
| 15.1000 | 1.29 | 1.28 | 1.27 | 1.25 | 1.24 |
| 15.3500 | 1.22 | 1.21 | 1.20 | 1.18 | 1.17 |
| 15.6000 | 1.15 | 1.14 | 1.13 | 1.11 | 1.10 |
| 15.8500 | 1.08 | 1.07 | 1.06 | 1.04 | 1.03 |
| 16.1000 | 1.01 | 1.00 | .99 | .98 | .97 |
| 16.3500 | .96 | .95 | .94 | .94 | .93 |
| 16.6000 | .92 | .92 | .91 | .91 | .90 |
| 16.8500 | .90 | .89 | .89 | .88 | .88 |
| 17.1000 | .87 | .87 | .86 | .86 | .85 |
| 17.3500 | .85 | .84 | .84 | .83 | .83 |
| 17.6000 | .82 | .82 | .81 | .81 | .80 |
| 17.8500 | .80 | .79 | .79 | .78 | .78 |
| 18.1000 | .77 | .77 | .76 | .76 | .75 |
| 18.3500 | .75 | .74 | .74 | .73 | .73 |
| 18.6000 | .72 | .72 | .71 | .71 | .70 |
| 18.8500 | .70 | .69 | .69 | .68 | .68 |
| 19.1000 | .67 | .66 | .66 | .65 | .65 |
| 19.3500 | .64 | .64 | .63 | .63 | .62 |
| 19.6000 | .62 | .61 | .61 | .60 | .60 |
| 19.8500 | .59 | .59 | .58 | .58 | .57 |
| 20.1000 | .57 | .56 | .56 | .55 | .55 |
| 20.3500 | .55 | .55 | .54 | .54 | .54 |
| 20.6000 | .54 | .54 | .54 | .54 | .53 |
| 20.8500 | .53 | .53 | .53 | .53 | .53 |
| 21.1000 | .53 | .53 | .53 | .53 | .52 |
| 21.3500 | .52 | .52 | .52 | .52 | .52 |
| 21.6000 | .52 | .52 | .52 | .52 | .51 |
| 21.8500 | .51 | .51 | .51 | .51 | .51 |
| 22.1000 | .51 | .51 | .51 | .51 | .50 |
| 22.3500 | .50 | .50 | .50 | .50 | .50 |
| 22.6000 | .50 | .50 | .50 | .50 | .49 |
| 22.8500 | .49 | .49 | .49 | .49 | .49 |
| 23.1000 | .49 | .49 | .49 | .49 | .48 |
| 23.3500 | .48 | .48 | .48 | .48 | .48 |
| 23.6000 | .48 | .48 | .48 | .48 | .47 |
| 23.8500 | .47 | .47 | .47 | .47 | .46 |
| 24.1000 | .44 | .41 | .36 | .30 | .23 |
| 24.3500 | .18 | .13 | .10 | .07 | .06 |
| 24.6000 | .04 | .03 | .02 | .02 | .01 |
| 24.8500 | .01 | .01 | .00 | .00 | .00 |
| 25.1000 | .00 | .00 | .00 | | |

Index of Starting Page Numbers for ID Names


A 10
SCS UH
Out

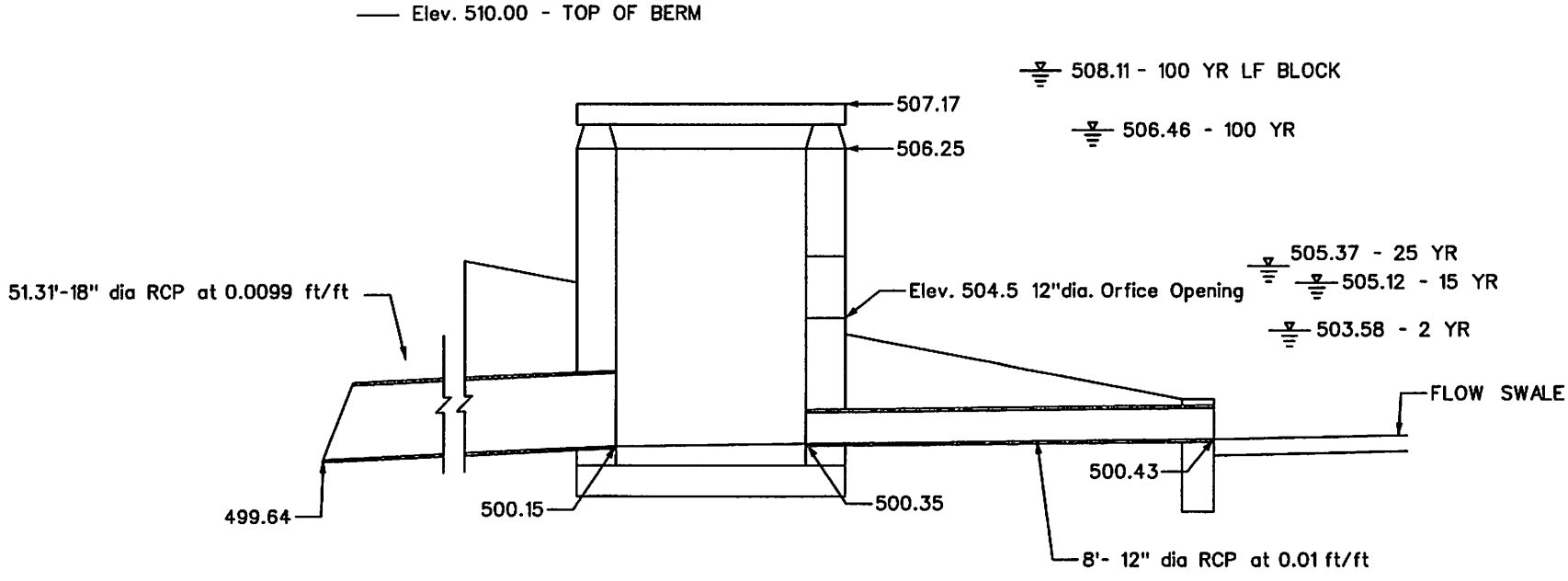
[redacted]

**POST-DEVELOPED**

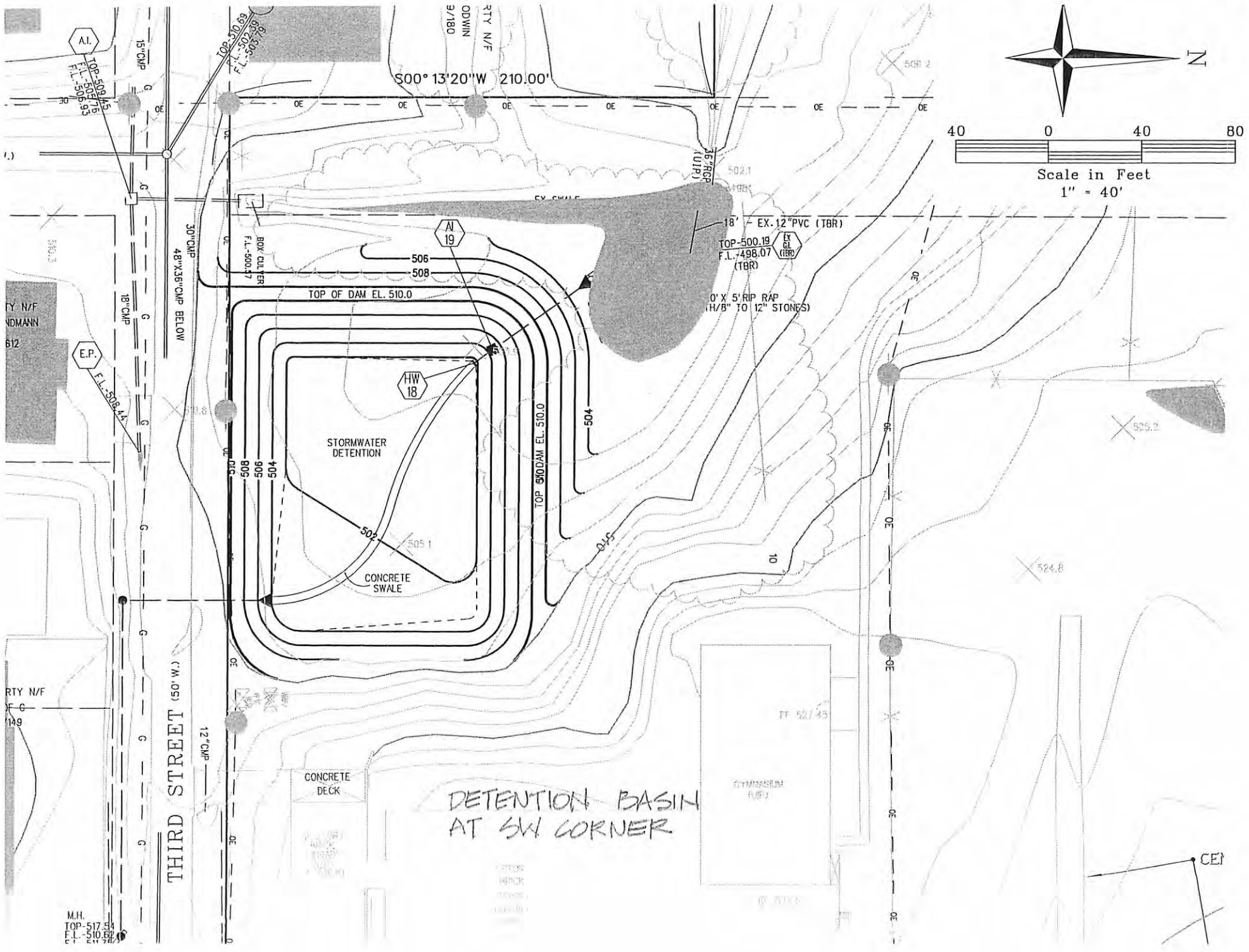
**DETENTION BASIN AT SW CORNER**

**POST-DEVELOPED**

**DETENTION BASIN AT SW CORNER**



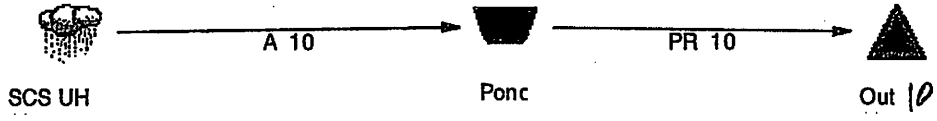

OUTLET STRUCTURE
DETENTION BASIN @ SW CORNER


S00° 13'20"W 210.00'
N
40 0 40 80
Scale in Feet
1" = 40'
A.I.
TOP-510.69
F.L.-502.39
F.L.-503.79
15"CMP
TOP-509.45
F.L.-505.79
F.L.-506.93
30"CMP
48"X36"CMP BELOW
18"CMP
BOX CULVER
F.L.-500.47
36"RCP
(U/P)
18" - EX. 12"PVC (TBR)
TOP-500.19
F.L.-498.07
(TBR)
Ex GI (TBR)
AI 19
506
508
TOP OF DAM EL. 510.0
0' X 5' RIP RAP
H/B" TO 12" STONES)
E.P.
F.L.-506.44
HW 18
STORMWATER DETENTION
504
510
508
506
504
TOP DAM EL. 510.0
502
505.1
CONCRETE SWALE
THIRD STREET (50' W.)
12"CMP
CONCRETE DECK
DETENTION BASIN
AT SW CORNER
FF 521.45
GYMNASIUM (UP)
M.H.
TOP-517.54
F.L.-510.62
525.2
524.8
CEI

Job File: H:\HAESTAD\ppkw\b7004\ELMER DETENTION DEV REVISED.PPW
Rain Dir: H:\HAESTAD\ppkw\b7004\

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

Developed flows to proposed Assumption detention basin


A 10
PR 10
SCS UH
Ponc
Out 10