

## Project Information

|                           |                             |
|---------------------------|-----------------------------|
| Calculator Version:       | Version 4: July 2020        |
| Project Name:             | Mankato Apartments Existing |
| User Name / Company Name: | Jones, Haugh & Smith Inc    |
| Date:                     | 6/25/2025                   |
| Project Description:      | Mankato Apartments          |
| Construction Permit?:     | Yes                         |

## Site Information

|                                 |       |
|---------------------------------|-------|
| Retention Requirement (inches): | 1.1   |
| Site's Zip Code:                | 56001 |
| Annual Rainfall (inches):       | 30.7  |
| Phosphorus EMC (mg/l):          | 0.3   |
| TSS EMC (mg/l):                 | 54.5  |

### Total Site Area

| Land Cover                                                                      | A Soils<br>(acres) | B Soils<br>(acres) | C Soils<br>(acres)      | D Soils<br>(acres) | Total<br>(acres) |
|---------------------------------------------------------------------------------|--------------------|--------------------|-------------------------|--------------------|------------------|
| Forest/Open Space - Undisturbed, protected forest/open space or reforested land |                    |                    |                         | 0                  | 0                |
| Managed Turf - disturbed, graded for yards or other turf to be mowed/managed    |                    |                    |                         | 2.74               | 2.74             |
|                                                                                 |                    |                    | Impervious Area (acres) |                    | 1.26             |
|                                                                                 |                    |                    | Total Area (acres)      |                    | 4                |

### Site Areas Routed to BMPs

| Land Cover                                                                      | A Soils<br>(acres) | B Soils<br>(acres) | C Soils<br>(acres)      | D Soils<br>(acres) | Total<br>(acres) |
|---------------------------------------------------------------------------------|--------------------|--------------------|-------------------------|--------------------|------------------|
| Forest/Open Space - Undisturbed, protected forest/open space or reforested land |                    |                    |                         |                    | 0                |
| Managed Turf - disturbed, graded for yards or other turf to be mowed/managed    |                    |                    |                         |                    | 0                |
|                                                                                 |                    |                    | Impervious Area (acres) |                    |                  |
|                                                                                 |                    |                    | Total Area (acres)      |                    | 0                |

## Summary Information

### Performance Goal Requirement

Performance goal volume retention requirement: 5031 ft<sup>3</sup>  
Volume removed by BMPs towards performance goal: ft<sup>3</sup>  
**Percent volume removed towards performance goal** %

### Annual Volume and Pollutant Load Reductions

Post development annual runoff volume 4.3333 acre-ft  
Annual runoff volume removed by BMPs: acre-ft  
**Percent annual runoff volume removed:** %

Post development annual particulate P load: 1.9448 lbs  
Annual particulate P removed by BMPs: lbs  
Post development annual dissolved P load: 1.591 lbs  
Annual dissolved P removed by BMPs: 0 lbs  
Total P removed by BMPs 0 lbs  
**Percent annual total phosphorus removed:** %

Post development annual TSS load: 642.4 lbs  
Annual TSS removed by BMPs: lbs  
**Percent annual TSS removed:** %

## BMP Summary

### Performance Goal Summary

| BMP Name | BMP Volume Capacity (ft <sup>3</sup> ) | Volume Recieved (ft <sup>3</sup> ) | Volume Retained (ft <sup>3</sup> ) | Volume Outflow (ft <sup>3</sup> ) | Percent Retained |
|----------|----------------------------------------|------------------------------------|------------------------------------|-----------------------------------|------------------|
|----------|----------------------------------------|------------------------------------|------------------------------------|-----------------------------------|------------------|

### Annual Volume Summary

| BMP Name | Volume From Direct Watershed (acre-ft) | Volume From Upstream BMPs (acre-ft) | Volume Retained (acre-ft) | Volume outflow (acre-ft) | Percent Retained (%) |
|----------|----------------------------------------|-------------------------------------|---------------------------|--------------------------|----------------------|
|----------|----------------------------------------|-------------------------------------|---------------------------|--------------------------|----------------------|

### Particulate Phosphorus Summary

| BMP Name | Load From Direct Watershed (lbs) | Load From Upstream BMPs (lbs) | Load Retained (lbs) | Outflow Load (lbs) | Percent Retained |
|----------|----------------------------------|-------------------------------|---------------------|--------------------|------------------|
|----------|----------------------------------|-------------------------------|---------------------|--------------------|------------------|

### Dissolved Phosphorus Summary

| BMP Name | Load From<br>Direct<br>Watershed<br>(lbs) | Load From<br>Upstream<br>BMPs<br>(lbs) | Load<br>Retained<br>(lbs) | Outflow<br>Load<br>(lbs) | Percent<br>Retained |
|----------|-------------------------------------------|----------------------------------------|---------------------------|--------------------------|---------------------|
|----------|-------------------------------------------|----------------------------------------|---------------------------|--------------------------|---------------------|

#### Total Phosphorus Summary

| BMP Name | Load From<br>Direct<br>Watershed<br>(lbs) | Load From<br>Upstream<br>BMPs<br>(lbs) | Load<br>Retained<br>(lbs) | Outflow<br>Load<br>(lbs) | Percent<br>Retained |
|----------|-------------------------------------------|----------------------------------------|---------------------------|--------------------------|---------------------|
|----------|-------------------------------------------|----------------------------------------|---------------------------|--------------------------|---------------------|

#### TSS Summary

| BMP Name | Load From<br>Direct<br>Watershed<br>(lbs) | Load From<br>Upstream<br>BMPs<br>(lbs) | Load<br>Retained<br>(lbs) | Outflow<br>Load<br>(lbs) | Percent<br>Retained |
|----------|-------------------------------------------|----------------------------------------|---------------------------|--------------------------|---------------------|
|----------|-------------------------------------------|----------------------------------------|---------------------------|--------------------------|---------------------|

#### BMP Schematic

## Project Information

|                           |                                        |
|---------------------------|----------------------------------------|
| Calculator Version:       | Version 4: July 2020                   |
| Project Name:             | Mankato Apartments Proposed Conditions |
| User Name / Company Name: | Jones, Haugh & Smith Inc               |
| Date:                     | 6/25/2025                              |
| Project Description:      | Mankato Apartments                     |
| Construction Permit?:     | Yes                                    |

## Site Information

|                                 |       |
|---------------------------------|-------|
| Retention Requirement (inches): | 1.1   |
| Site's Zip Code:                | 56001 |
| Annual Rainfall (inches):       | 30.7  |
| Phosphorus EMC (mg/l):          | 0.3   |
| TSS EMC (mg/l):                 | 54.5  |

### Total Site Area

| Land Cover                                                                      | A Soils<br>(acres) | B Soils<br>(acres) | C Soils<br>(acres)      | D Soils<br>(acres) | Total<br>(acres) |
|---------------------------------------------------------------------------------|--------------------|--------------------|-------------------------|--------------------|------------------|
| Forest/Open Space - Undisturbed, protected forest/open space or reforested land |                    |                    |                         | 0                  | 0                |
| Managed Turf - disturbed, graded for yards or other turf to be mowed/managed    |                    |                    |                         | 1.5                | 1.5              |
|                                                                                 |                    |                    | Impervious Area (acres) |                    | 2.5              |
|                                                                                 |                    |                    | Total Area (acres)      |                    | 4                |

### Site Areas Routed to BMPs

| Land Cover                                                                      | A Soils<br>(acres) | B Soils<br>(acres) | C Soils<br>(acres)      | D Soils<br>(acres) | Total<br>(acres) |
|---------------------------------------------------------------------------------|--------------------|--------------------|-------------------------|--------------------|------------------|
| Forest/Open Space - Undisturbed, protected forest/open space or reforested land |                    |                    |                         |                    | 0                |
| Managed Turf - disturbed, graded for yards or other turf to be mowed/managed    |                    |                    |                         | 1.5                | 1.5              |
|                                                                                 |                    |                    | Impervious Area (acres) |                    | 2.5              |
|                                                                                 |                    |                    | Total Area (acres)      |                    | 4                |

## Summary Information

### Performance Goal Requirement

|                                                        |      |                 |
|--------------------------------------------------------|------|-----------------|
| Performance goal volume retention requirement:         | 9982 | ft <sup>3</sup> |
| Volume removed by BMPs towards performance goal:       |      | ft <sup>3</sup> |
| <b>Percent volume removed towards performance goal</b> |      | <b>%</b>        |

### Annual Volume and Pollutant Load Reductions

|                                              |          |          |
|----------------------------------------------|----------|----------|
| Post development annual runoff volume        | 6.3319   | acre-ft  |
| Annual runoff volume removed by BMPs:        | 0        | acre-ft  |
| <b>Percent annual runoff volume removed:</b> | <b>0</b> | <b>%</b> |

|                                                 |           |          |
|-------------------------------------------------|-----------|----------|
| Post development annual particulate P load:     | 2.8417    | lbs      |
| Annual particulate P removed by BMPs:           | 1.705     | lbs      |
| Post development annual dissolved P load:       | 2.325     | lbs      |
| Annual dissolved P removed by BMPs:             | 0         | lbs      |
| Total P removed by BMPs                         | 1.705     | lbs      |
| <b>Percent annual total phosphorus removed:</b> | <b>33</b> | <b>%</b> |

|                                    |           |          |
|------------------------------------|-----------|----------|
| Post development annual TSS load:  | 938.6     | lbs      |
| Annual TSS removed by BMPs:        | 563.2     | lbs      |
| <b>Percent annual TSS removed:</b> | <b>60</b> | <b>%</b> |

## BMP Summary

### Performance Goal Summary

| BMP Name                        | BMP Volume Capacity (ft <sup>3</sup> ) | Volume Recieved (ft <sup>3</sup> ) | Volume Retained (ft <sup>3</sup> ) | Volume Outflow (ft <sup>3</sup> ) | Percent Retained |
|---------------------------------|----------------------------------------|------------------------------------|------------------------------------|-----------------------------------|------------------|
| 1 - Constructed stormwater pond | 0                                      | 9982                               | 0                                  | 9982                              | 0                |

### Annual Volume Summary

| BMP Name                        | Volume From Direct Watershed (acre-ft) | Volume From Upstream BMPs (acre-ft) | Volume Retained (acre-ft) | Volume outflow (acre-ft) | Percent Retained (%) |
|---------------------------------|----------------------------------------|-------------------------------------|---------------------------|--------------------------|----------------------|
| 1 - Constructed stormwater pond | 6.3319                                 | 0                                   | 0                         | 6.3319                   | 0                    |

### Particulate Phosphorus Summary

| BMP Name                        | Load From Direct Watershed (lbs) | Load From Upstream BMPs (lbs) | Load Retained (lbs) | Outflow Load (lbs) | Percent Retained |
|---------------------------------|----------------------------------|-------------------------------|---------------------|--------------------|------------------|
| 1 - Constructed stormwater pond | 2.8417                           | 0                             | 1.705               | 1.1367             | 60               |

**Dissolved Phosphorus Summary**

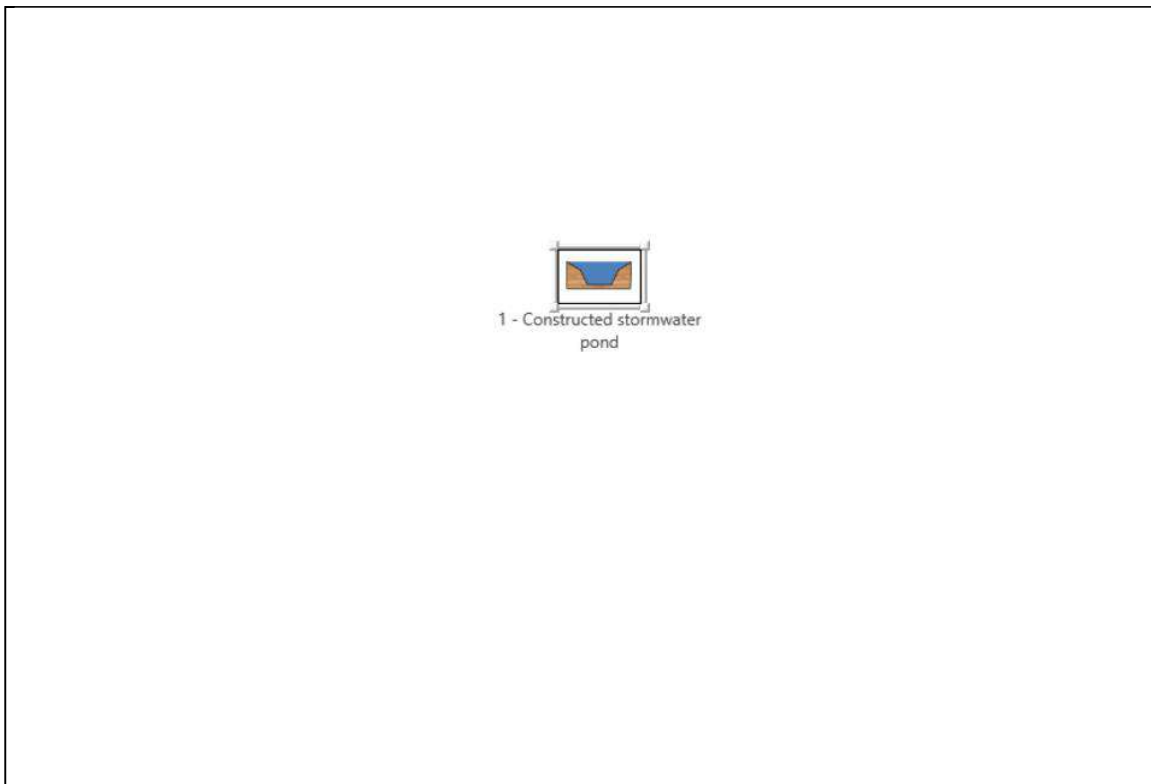
| BMP Name                        | Load From Direct Watershed (lbs) | Load From Upstream BMPs (lbs) | Load Retained (lbs) | Outflow Load (lbs) | Percent Retained |
|---------------------------------|----------------------------------|-------------------------------|---------------------|--------------------|------------------|
| 1 - Constructed stormwater pond | 2.3251                           | 0                             | 0                   | 2.3251             | 0                |

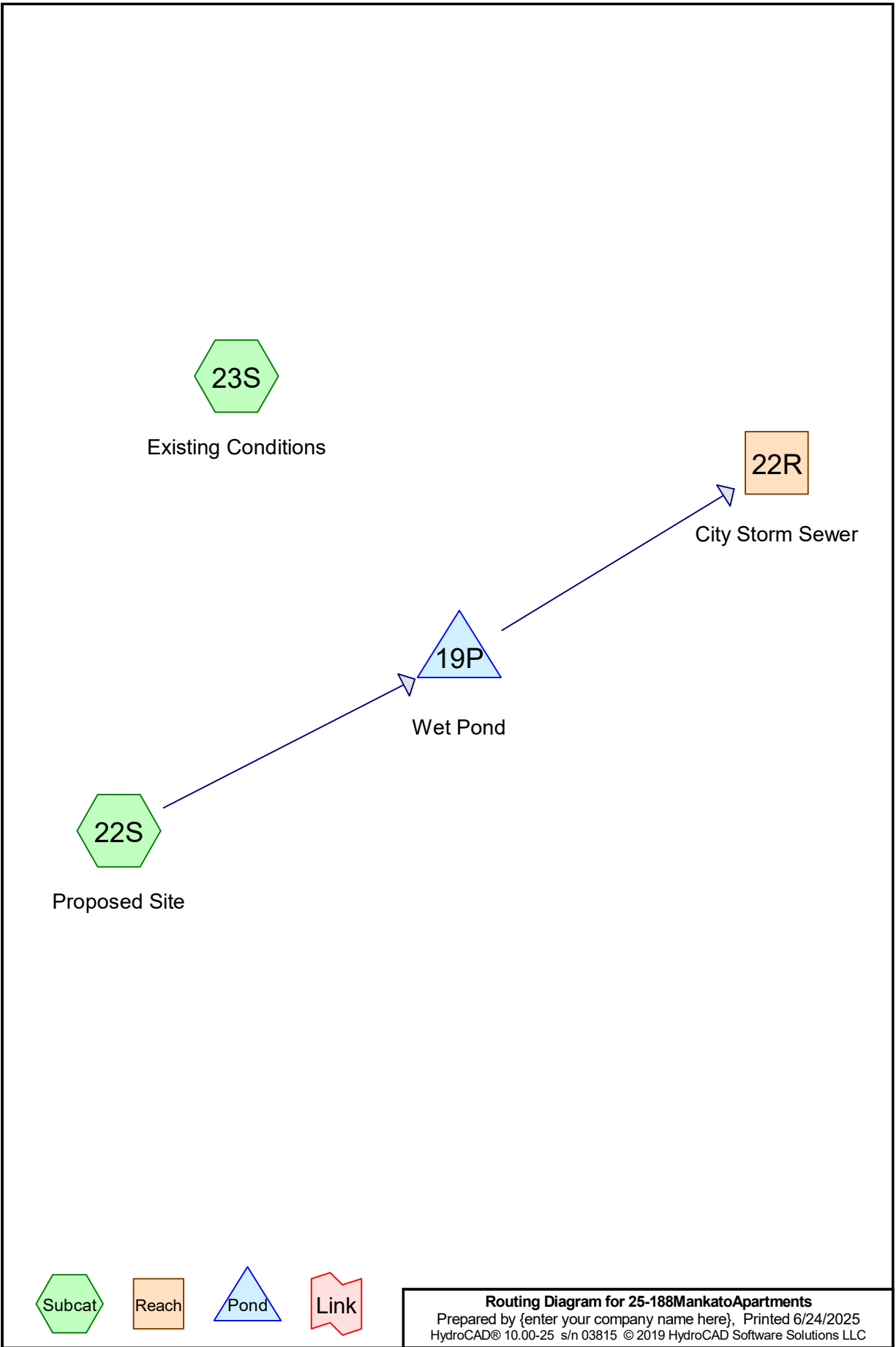
**Total Phosphorus Summary**

| BMP Name                        | Load From Direct Watershed (lbs) | Load From Upstream BMPs (lbs) | Load Retained (lbs) | Outflow Load (lbs) | Percent Retained |
|---------------------------------|----------------------------------|-------------------------------|---------------------|--------------------|------------------|
| 1 - Constructed stormwater pond | 5.1668                           | 0                             | 1.705               | 3.4618             | 30               |

**TSS Summary**

| BMP Name                        | Load From Direct Watershed (lbs) | Load From Upstream BMPs (lbs) | Load Retained (lbs) | Outflow Load (lbs) | Percent Retained |
|---------------------------------|----------------------------------|-------------------------------|---------------------|--------------------|------------------|
| 1 - Constructed stormwater pond | 938.64                           | 0                             | 563.18              | 375.46             | 60               |

**BMP Schematic**



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Page 2

**Area Listing (all nodes)**

| Area<br>(acres) | CN        | Description<br>(subcatchment-numbers) |
|-----------------|-----------|---------------------------------------|
| 1.500           | 39        | >75% Grass cover, Good, HSG A (22S)   |
| 2.740           | 80        | >75% Grass cover, Good, HSG D (23S)   |
| 1.260           | 96        | Gravel surface, HSG D (23S)           |
| 1.500           | 98        | Paved parking, HSG D (22S)            |
| 1.000           | 98        | Roofs, HSG D (22S)                    |
| <b>8.000</b>    | <b>80</b> | <b>TOTAL AREA</b>                     |



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Page 3

**Soil Listing (all nodes)**

| Area<br>(acres) | Soil<br>Group | Subcatchment<br>Numbers |
|-----------------|---------------|-------------------------|
| 1.500           | HSG A         | 22S                     |
| 0.000           | HSG B         |                         |
| 0.000           | HSG C         |                         |
| 6.500           | HSG D         | 22S, 23S                |
| 0.000           | Other         |                         |
| <b>8.000</b>    |               | <b>TOTAL AREA</b>       |

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Page 4

**Ground Covers (all nodes)**

| HSG-A<br>(acres) | HSG-B<br>(acres) | HSG-C<br>(acres) | HSG-D<br>(acres) | Other<br>(acres) | Total<br>(acres) | Ground<br>Cover        | Subcatchment<br>Numbers |
|------------------|------------------|------------------|------------------|------------------|------------------|------------------------|-------------------------|
| 1.500            | 0.000            | 0.000            | 2.740            | 0.000            | 4.240            | >75% Grass cover, Good | 22S, 23S                |
| 0.000            | 0.000            | 0.000            | 1.260            | 0.000            | 1.260            | Gravel surface         | 23S                     |
| 0.000            | 0.000            | 0.000            | 1.500            | 0.000            | 1.500            | Paved parking          | 22S                     |
| 0.000            | 0.000            | 0.000            | 1.000            | 0.000            | 1.000            | Roofs                  | 22S                     |
| <b>1.500</b>     | <b>0.000</b>     | <b>0.000</b>     | <b>6.500</b>     | <b>0.000</b>     | <b>8.000</b>     | <b>TOTAL AREA</b>      |                         |

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Page 5

**Pipe Listing (all nodes)**

| Line# | Node<br>Number | In-Invert<br>(feet) | Out-Invert<br>(feet) | Length<br>(feet) | Slope<br>(ft/ft) | n     | Diam/Width<br>(inches) | Height<br>(inches) | Inside-Fill<br>(inches) |
|-------|----------------|---------------------|----------------------|------------------|------------------|-------|------------------------|--------------------|-------------------------|
| 1     | 19P            | 987.50              | 984.00               | 50.0             | 0.0700           | 0.012 | 12.0                   | 0.0                | 0.0                     |
| 2     | 19P            | 987.50              | 987.50               | 20.0             | 0.0000           | 0.013 | 18.0                   | 0.0                | 0.0                     |

**25-188MankatoApartments***Type II 24-hr 2-Year Rainfall=2.95"*

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Page 6

Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment 22S: Proposed Site**

Runoff Area=4.000 ac 62.50% Impervious Runoff Depth=0.98"  
Tc=20.0 min CN=76 Runoff=4.14 cfs 0.327 af

**Subcatchment 23S: Existing Conditions**

Runoff Area=4.000 ac 0.00% Impervious Runoff Depth=1.55"  
Tc=30.0 min CN=85 Runoff=5.34 cfs 0.515 af

**Reach 22R: City Storm Sewer**

Inflow=1.17 cfs 0.321 af  
Outflow=1.17 cfs 0.321 af

**Pond 19P: Wet Pond**

Peak Elev=988.20' Storage=0.113 af Inflow=4.14 cfs 0.327 af  
Outflow=1.17 cfs 0.321 af

**Total Runoff Area = 8.000 ac Runoff Volume = 0.843 af Average Runoff Depth = 1.26"**  
**68.75% Pervious = 5.500 ac 31.25% Impervious = 2.500 ac**

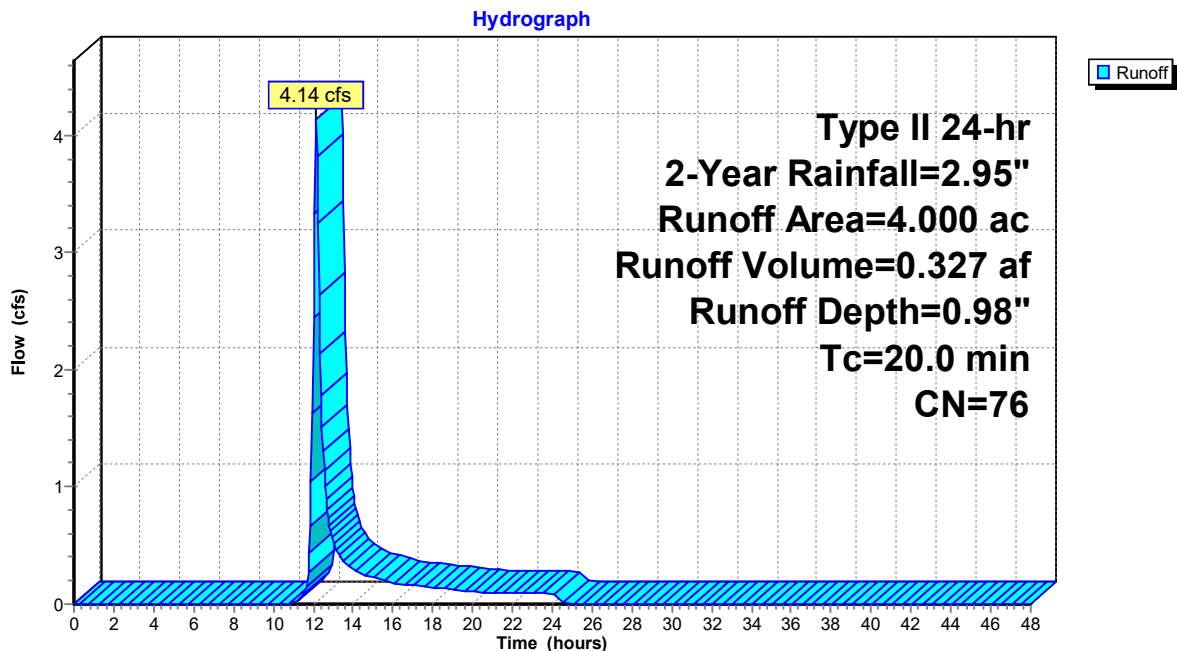
**Summary for Subcatchment 22S: Proposed Site**

Runoff = 4.14 cfs @ 12.14 hrs, Volume= 0.327 af, Depth= 0.98"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs  
Type II 24-hr 2-Year Rainfall=2.95"

| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 1.000     | 98 | Roofs, HSG D                  |
| 1.500     | 98 | Paved parking, HSG D          |
| 1.500     | 39 | >75% Grass cover, Good, HSG A |
| 4.000     | 76 | Weighted Average              |
| 1.500     |    | 37.50% Pervious Area          |
| 2.500     |    | 62.50% Impervious Area        |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description   |
|----------|---------------|---------------|-------------------|----------------|---------------|
| 20.0     |               |               |                   |                | Direct Entry, |

**Subcatchment 22S: Proposed Site**

**Summary for Subcatchment 23S: Existing Conditions**

Runoff = 5.34 cfs @ 12.25 hrs, Volume= 0.515 af, Depth= 1.55"

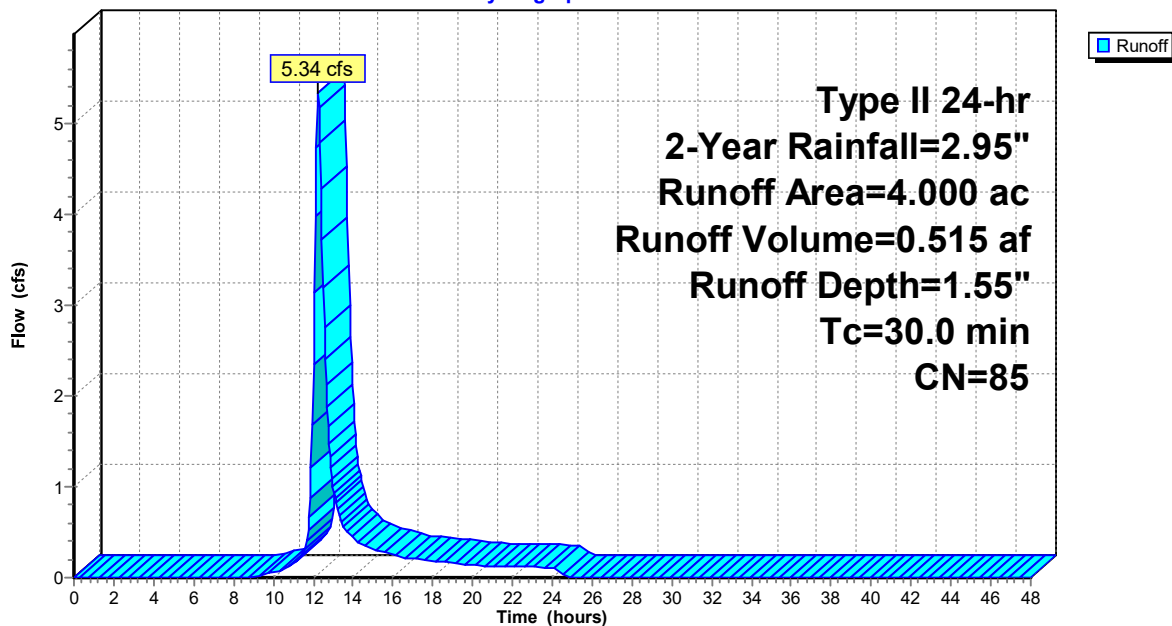
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs  
Type II 24-hr 2-Year Rainfall=2.95"

| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 2.740     | 80 | >75% Grass cover, Good, HSG D |
| 1.260     | 96 | Gravel surface, HSG D         |
| 4.000     | 85 | Weighted Average              |
| 4.000     |    | 100.00% Pervious Area         |

| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description   |
|-------------|------------------|------------------|----------------------|-------------------|---------------|
| 30.0        |                  |                  |                      |                   | Direct Entry, |

**Subcatchment 23S: Existing Conditions**

Hydrograph

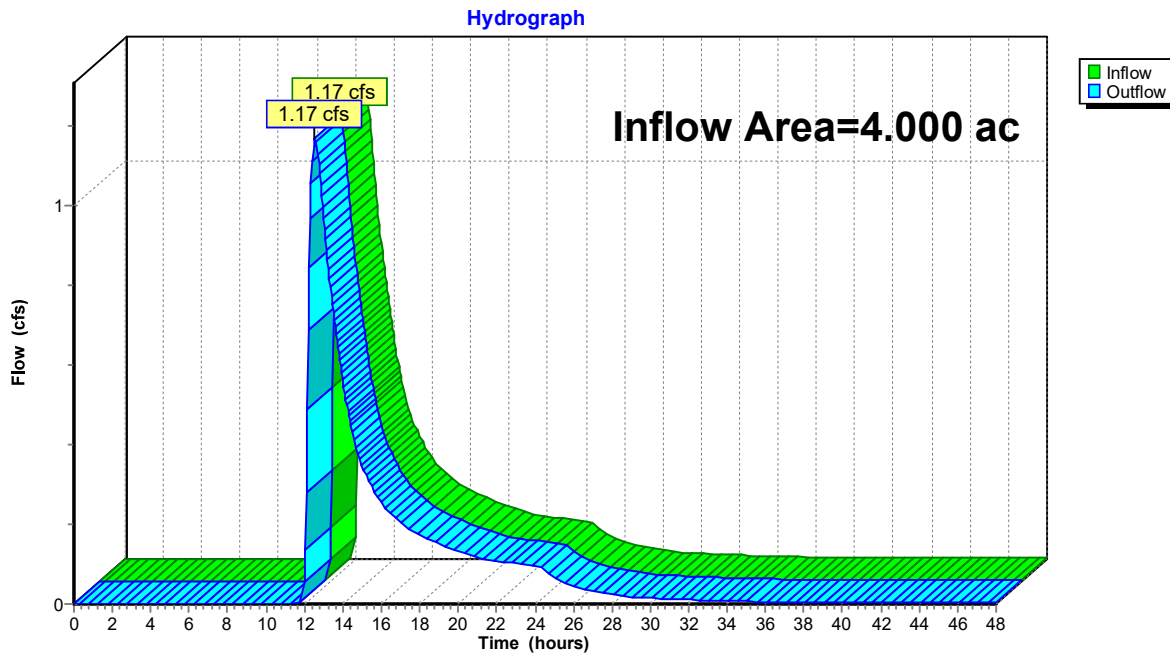


**Summary for Reach 22R: City Storm Sewer**

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 4.000 ac, 62.50% Impervious, Inflow Depth > 0.96" for 2-Year event  
Inflow = 1.17 cfs @ 12.54 hrs, Volume= 0.321 af  
Outflow = 1.17 cfs @ 12.54 hrs, Volume= 0.321 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

**Reach 22R: City Storm Sewer**

### Summary for Pond 19P: Wet Pond

Inflow Area = 4.000 ac, 62.50% Impervious, Inflow Depth = 0.98" for 2-Year event  
 Inflow = 4.14 cfs @ 12.14 hrs, Volume= 0.327 af  
 Outflow = 1.17 cfs @ 12.54 hrs, Volume= 0.321 af, Atten= 72%, Lag= 24.1 min  
 Primary = 1.17 cfs @ 12.54 hrs, Volume= 0.321 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2  
 Peak Elev= 988.20' @ 12.54 hrs Surf.Area= 0.182 ac Storage= 0.113 af

Plug-Flow detention time= 135.4 min calculated for 0.321 af (98% of inflow)  
 Center-of-Mass det. time= 126.2 min ( 996.3 - 870.1 )

| Volume | Invert  | Avail.Storage | Storage Description                               |
|--------|---------|---------------|---------------------------------------------------|
| #1     | 987.50' | 0.832 af      | <b>Custom Stage Data (Prismatic)</b> Listed below |

| Elevation<br>(feet) | Surf.Area<br>(acres) | Inc.Store<br>(acre-feet) | Cum.Store<br>(acre-feet) |
|---------------------|----------------------|--------------------------|--------------------------|
| 987.50              | 0.120                | 0.000                    | 0.000                    |
| 988.00              | 0.170                | 0.072                    | 0.072                    |
| 989.00              | 0.230                | 0.200                    | 0.272                    |
| 990.00              | 0.280                | 0.255                    | 0.528                    |
| 991.00              | 0.330                | 0.305                    | 0.832                    |

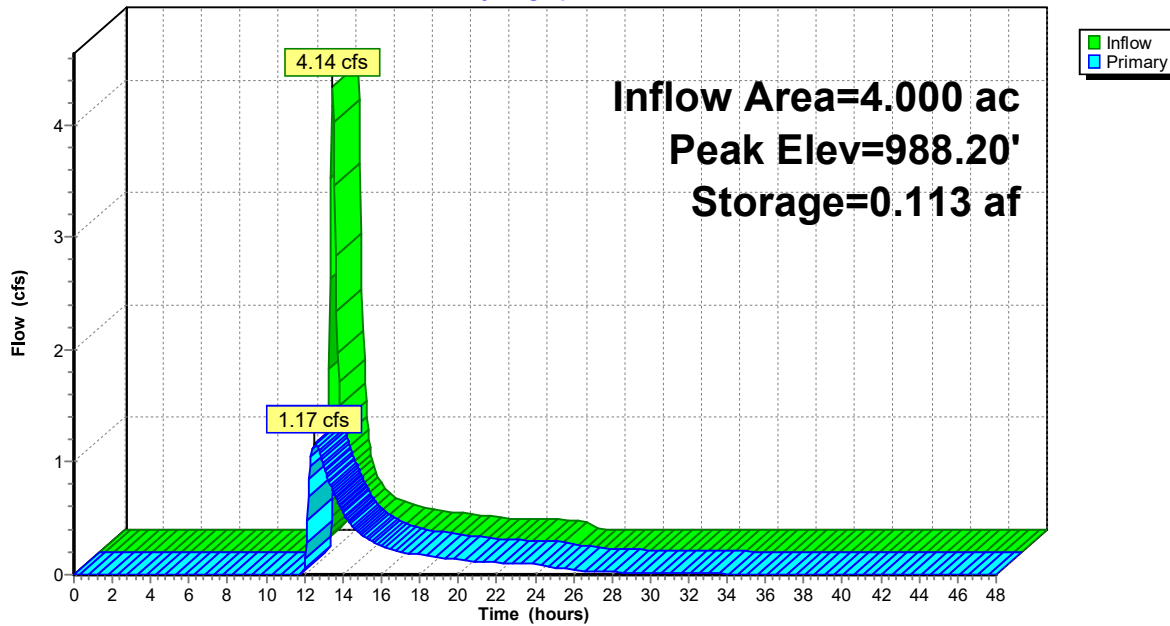
| Device | Routing  | Invert  | Outlet Devices                                                                                                                                                                   |
|--------|----------|---------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| #1     | Device 2 | 987.50' | <b>30.0 deg x 0.7' long x 1.00' rise Sharp-Crested Vee/Trap Weir</b><br>Cv= 2.61 (C= 3.26)                                                                                       |
| #2     | Primary  | 987.50' | <b>12.0" Round Culvert</b> L= 50.0' Ke= 1.000<br>Inlet / Outlet Invert= 987.50' / 984.00' S= 0.0700 '/' Cc= 0.900<br>n= 0.012 Concrete pipe, finished, Flow Area= 0.79 sf        |
| #3     | Device 2 | 988.50' | <b>5.0' long x 0.5' breadth Broad-Crested Rectangular Weir</b><br>Head (feet) 0.20 0.40 0.60 0.80 1.00<br>Coef. (English) 2.80 2.92 3.08 3.30 3.32                               |
| #4     | Device 1 | 987.50' | <b>18.0" Round Culvert</b> L= 20.0' Ke= 1.000<br>Inlet / Outlet Invert= 987.50' / 987.50' S= 0.0000 '/' Cc= 0.900<br>n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf |

**Primary OutFlow** Max=1.17 cfs @ 12.54 hrs HW=988.20' (Free Discharge)  
 2=Culvert (Passes 1.17 cfs of 1.26 cfs potential flow)  
 1=Sharp-Crested Vee/Trap Weir (Passes 1.17 cfs of 1.63 cfs potential flow)  
 4=Culvert (Barrel Controls 1.17 cfs @ 2.12 fps)  
 3=Broad-Crested Rectangular Weir ( Controls 0.00 cfs)



## Pond 19P: Wet Pond

## Hydrograph



**25-188MankatoApartments***Type II 24-hr 10-Year Rainfall=4.50"*

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Page 12

Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment 22S: Proposed Site**

Runoff Area=4.000 ac 62.50% Impervious Runoff Depth=2.13"  
Tc=20.0 min CN=76 Runoff=9.37 cfs 0.710 af

**Subcatchment 23S: Existing Conditions**

Runoff Area=4.000 ac 0.00% Impervious Runoff Depth=2.91"  
Tc=30.0 min CN=85 Runoff=10.06 cfs 0.970 af

**Reach 22R: City Storm Sewer**

Inflow=2.74 cfs 0.704 af  
Outflow=2.74 cfs 0.704 af

**Pond 19P: Wet Pond**

Peak Elev=988.93' Storage=0.259 af Inflow=9.37 cfs 0.710 af  
Outflow=2.74 cfs 0.704 af

**Total Runoff Area = 8.000 ac Runoff Volume = 1.680 af Average Runoff Depth = 2.52"**  
**68.75% Pervious = 5.500 ac 31.25% Impervious = 2.500 ac**

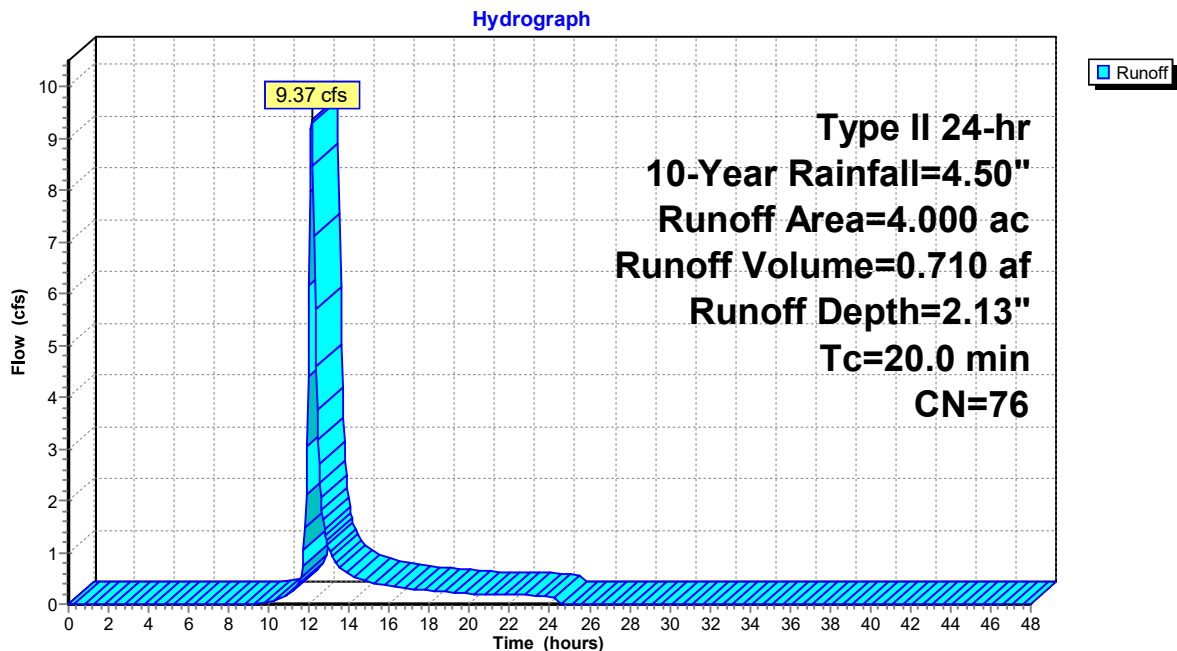
**Summary for Subcatchment 22S: Proposed Site**

Runoff = 9.37 cfs @ 12.13 hrs, Volume= 0.710 af, Depth= 2.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs  
Type II 24-hr 10-Year Rainfall=4.50"

| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 1.000     | 98 | Roofs, HSG D                  |
| 1.500     | 98 | Paved parking, HSG D          |
| 1.500     | 39 | >75% Grass cover, Good, HSG A |
| 4.000     | 76 | Weighted Average              |
| 1.500     |    | 37.50% Pervious Area          |
| 2.500     |    | 62.50% Impervious Area        |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description   |
|----------|---------------|---------------|-------------------|----------------|---------------|
| 20.0     |               |               |                   |                | Direct Entry, |

**Subcatchment 22S: Proposed Site**

### Summary for Subcatchment 23S: Existing Conditions

Runoff = 10.06 cfs @ 12.24 hrs, Volume= 0.970 af, Depth= 2.91"

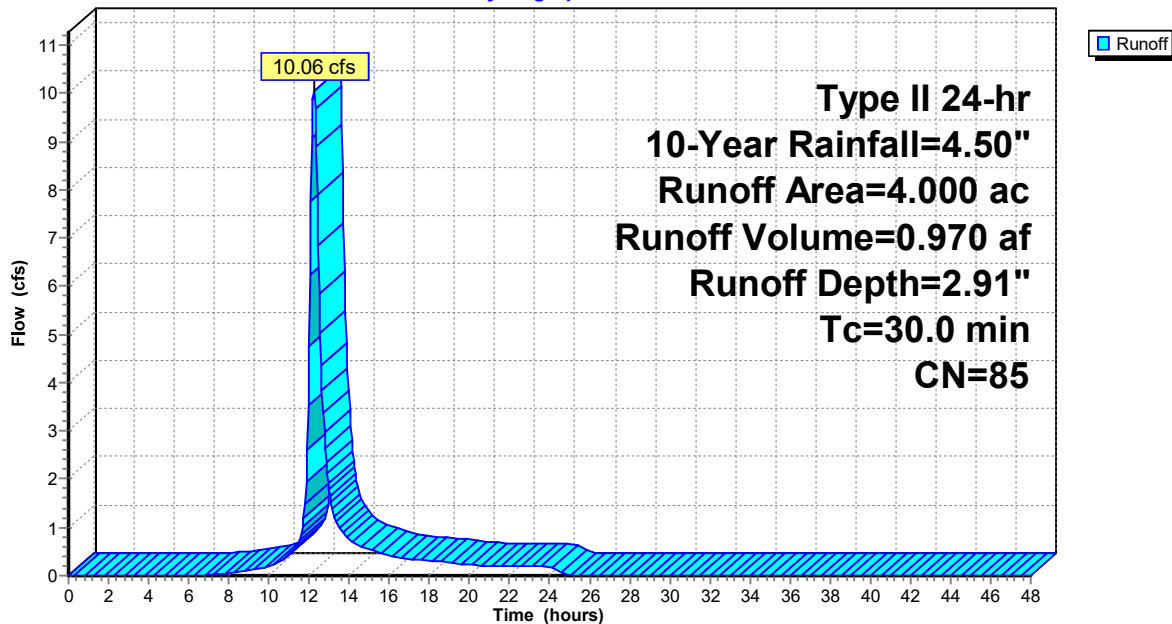
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs  
Type II 24-hr 10-Year Rainfall=4.50"

| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 2.740     | 80 | >75% Grass cover, Good, HSG D |
| 1.260     | 96 | Gravel surface, HSG D         |
| 4.000     | 85 | Weighted Average              |
| 4.000     |    | 100.00% Pervious Area         |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description   |
|----------|---------------|---------------|-------------------|----------------|---------------|
| 30.0     |               |               |                   |                | Direct Entry, |

### Subcatchment 23S: Existing Conditions

Hydrograph

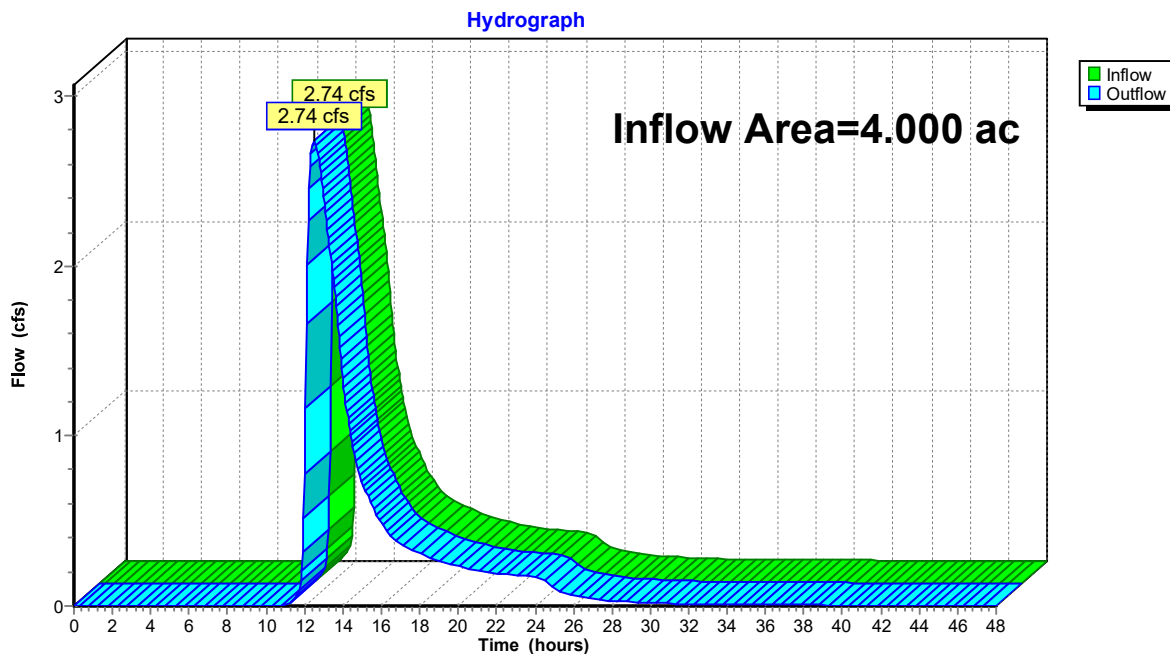


**Summary for Reach 22R: City Storm Sewer**

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 4.000 ac, 62.50% Impervious, Inflow Depth > 2.11" for 10-Year event  
Inflow = 2.74 cfs @ 12.50 hrs, Volume= 0.704 af  
Outflow = 2.74 cfs @ 12.50 hrs, Volume= 0.704 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

**Reach 22R: City Storm Sewer**

### Summary for Pond 19P: Wet Pond

Inflow Area = 4.000 ac, 62.50% Impervious, Inflow Depth = 2.13" for 10-Year event  
 Inflow = 9.37 cfs @ 12.13 hrs, Volume= 0.710 af  
 Outflow = 2.74 cfs @ 12.50 hrs, Volume= 0.704 af, Atten= 71%, Lag= 22.0 min  
 Primary = 2.74 cfs @ 12.50 hrs, Volume= 0.704 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2  
 Peak Elev= 988.93' @ 12.50 hrs Surf.Area= 0.226 ac Storage= 0.259 af

Plug-Flow detention time= 96.2 min calculated for 0.703 af (99% of inflow)  
 Center-of-Mass det. time= 92.3 min ( 939.4 - 847.1 )

| Volume | Invert  | Avail.Storage | Storage Description                               |
|--------|---------|---------------|---------------------------------------------------|
| #1     | 987.50' | 0.832 af      | <b>Custom Stage Data (Prismatic)</b> Listed below |

| Elevation<br>(feet) | Surf.Area<br>(acres) | Inc.Store<br>(acre-feet) | Cum.Store<br>(acre-feet) |
|---------------------|----------------------|--------------------------|--------------------------|
| 987.50              | 0.120                | 0.000                    | 0.000                    |
| 988.00              | 0.170                | 0.072                    | 0.072                    |
| 989.00              | 0.230                | 0.200                    | 0.272                    |
| 990.00              | 0.280                | 0.255                    | 0.528                    |
| 991.00              | 0.330                | 0.305                    | 0.832                    |

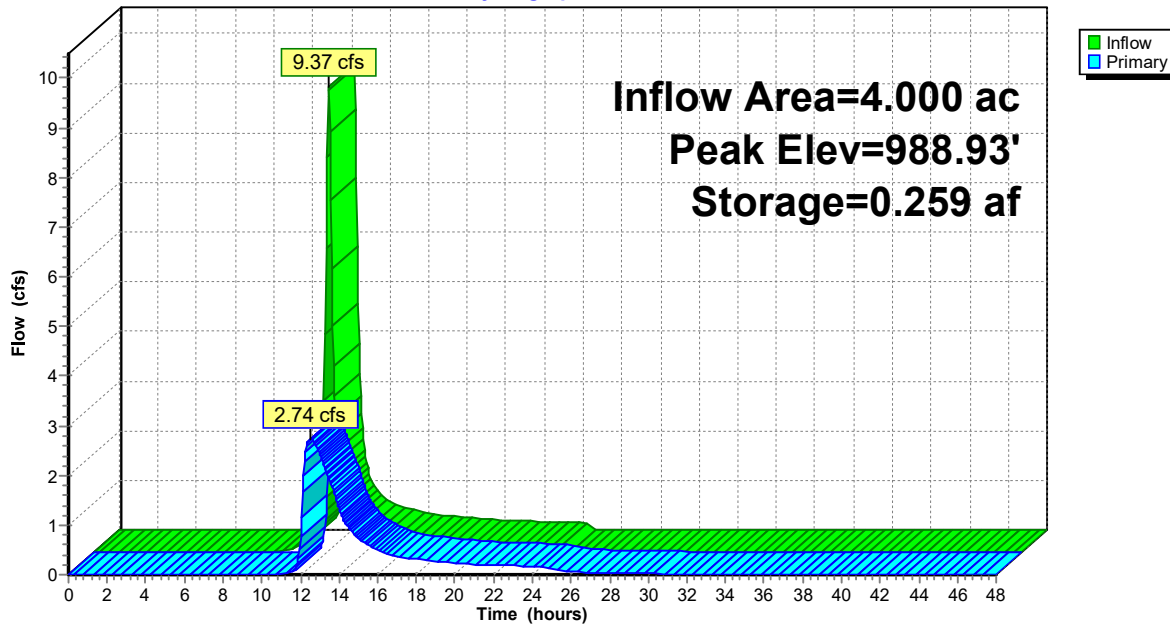
| Device | Routing  | Invert  | Outlet Devices                                                                                                                                                                   |
|--------|----------|---------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| #1     | Device 2 | 987.50' | <b>30.0 deg x 0.7' long x 1.00' rise Sharp-Crested Vee/Trap Weir</b><br>Cv= 2.61 (C= 3.26)                                                                                       |
| #2     | Primary  | 987.50' | <b>12.0" Round Culvert</b> L= 50.0' Ke= 1.000<br>Inlet / Outlet Invert= 987.50' / 984.00' S= 0.0700 '/' Cc= 0.900<br>n= 0.012 Concrete pipe, finished, Flow Area= 0.79 sf        |
| #3     | Device 2 | 988.50' | <b>5.0' long x 0.5' breadth Broad-Crested Rectangular Weir</b><br>Head (feet) 0.20 0.40 0.60 0.80 1.00<br>Coef. (English) 2.80 2.92 3.08 3.30 3.32                               |
| #4     | Device 1 | 987.50' | <b>18.0" Round Culvert</b> L= 20.0' Ke= 1.000<br>Inlet / Outlet Invert= 987.50' / 987.50' S= 0.0000 '/' Cc= 0.900<br>n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf |

**Primary OutFlow** Max=2.74 cfs @ 12.50 hrs HW=988.93' (Free Discharge)

↑ **2=Culvert** (Inlet Controls 2.74 cfs @ 3.49 fps)  
 ↑ **1=Sharp-Crested Vee/Trap Weir** (Passes < 4.40 cfs potential flow)  
 ↑ **4=Culvert** (Passes < 4.29 cfs potential flow)  
 ↑ **3=Broad-Crested Rectangular Weir** (Passes < 4.17 cfs potential flow)

## Pond 19P: Wet Pond

## Hydrograph



**25-188MankatoApartments***Type II 24-hr 100-Year Rainfall=7.86"*

Prepared by {enter your company name here}

Printed 6/24/2025

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Page 18

Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment 22S: Proposed Site**

Runoff Area=4.000 ac 62.50% Impervious Runoff Depth=5.03"  
Tc=20.0 min CN=76 Runoff=22.18 cfs 1.677 af

**Subcatchment 23S: Existing Conditions**

Runoff Area=4.000 ac 0.00% Impervious Runoff Depth=6.08"  
Tc=30.0 min CN=85 Runoff=20.58 cfs 2.026 af

**Reach 22R: City Storm Sewer**

Inflow=4.52 cfs 1.671 af  
Outflow=4.52 cfs 1.671 af

**Pond 19P: Wet Pond**

Peak Elev=990.54' Storage=0.693 af Inflow=22.18 cfs 1.677 af  
Outflow=4.52 cfs 1.671 af

**Total Runoff Area = 8.000 ac Runoff Volume = 3.703 af Average Runoff Depth = 5.55"**  
**68.75% Pervious = 5.500 ac 31.25% Impervious = 2.500 ac**



### Summary for Subcatchment 22S: Proposed Site

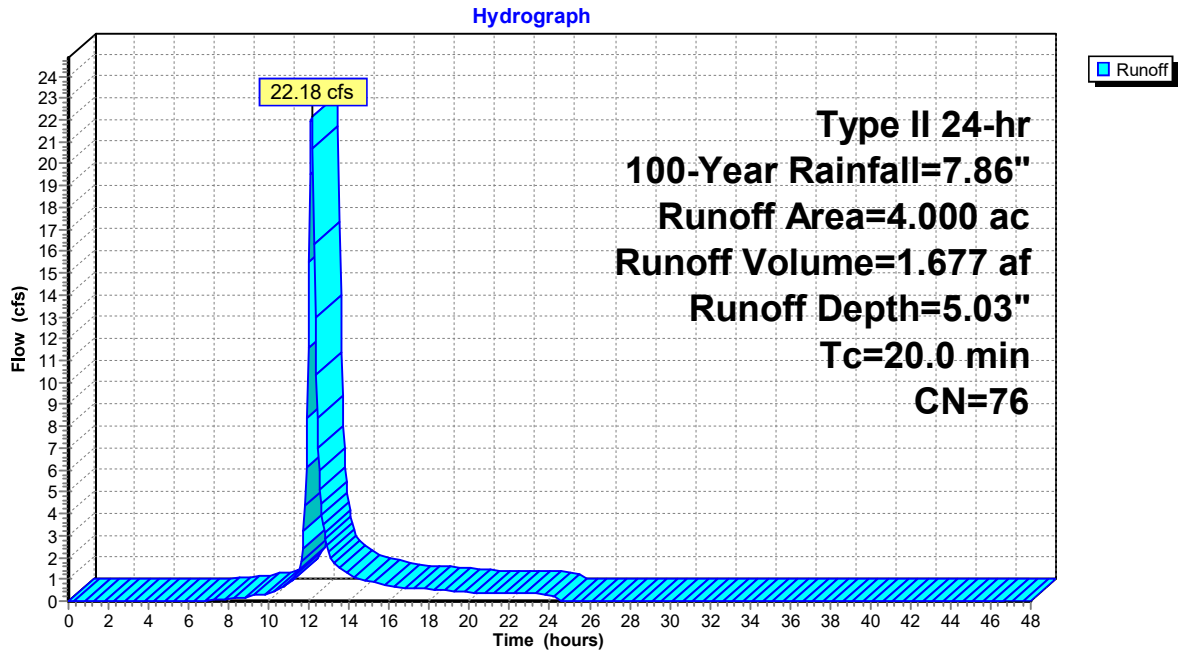
Runoff = 22.18 cfs @ 12.12 hrs, Volume= 1.677 af, Depth= 5.03"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs  
Type II 24-hr 100-Year Rainfall=7.86"

| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 1.000     | 98 | Roofs, HSG D                  |
| 1.500     | 98 | Paved parking, HSG D          |
| 1.500     | 39 | >75% Grass cover, Good, HSG A |
| 4.000     | 76 | Weighted Average              |
| 1.500     |    | 37.50% Pervious Area          |
| 2.500     |    | 62.50% Impervious Area        |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description   |
|----------|---------------|---------------|-------------------|----------------|---------------|
| 20.0     |               |               |                   |                | Direct Entry, |

### Subcatchment 22S: Proposed Site



**Summary for Subcatchment 23S: Existing Conditions**

Runoff = 20.58 cfs @ 12.23 hrs, Volume= 2.026 af, Depth= 6.08"

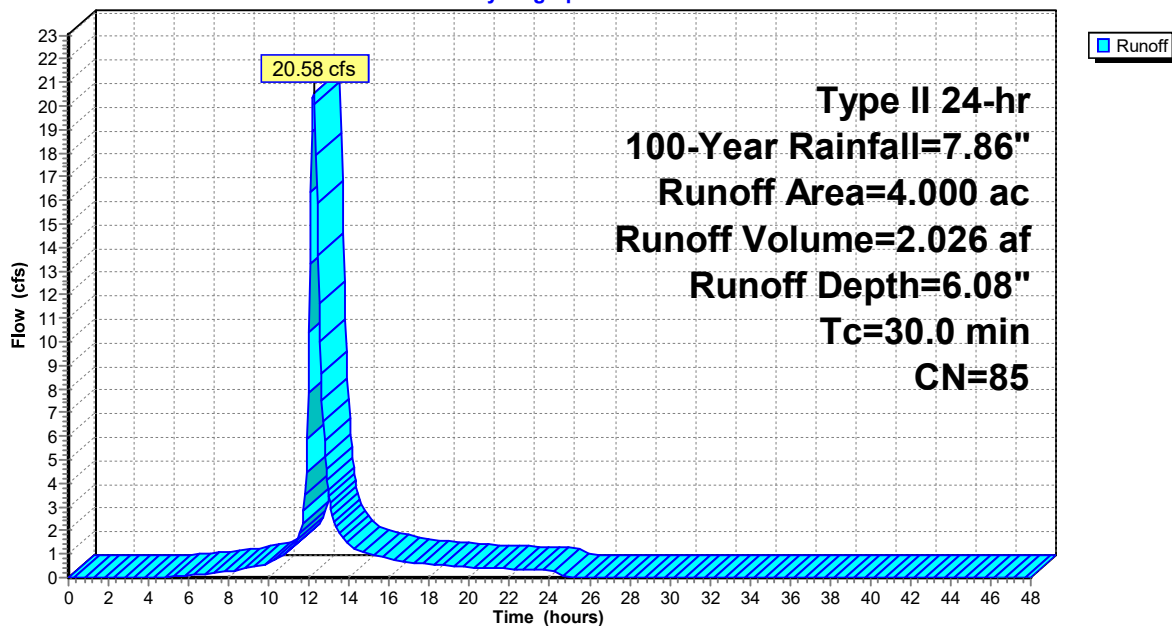
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs  
Type II 24-hr 100-Year Rainfall=7.86"

| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 2.740     | 80 | >75% Grass cover, Good, HSG D |
| 1.260     | 96 | Gravel surface, HSG D         |
| 4.000     | 85 | Weighted Average              |
| 4.000     |    | 100.00% Pervious Area         |

| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description   |
|-------------|------------------|------------------|----------------------|-------------------|---------------|
| 30.0        |                  |                  |                      |                   | Direct Entry, |

**Subcatchment 23S: Existing Conditions**

Hydrograph



**Summary for Reach 22R: City Storm Sewer**

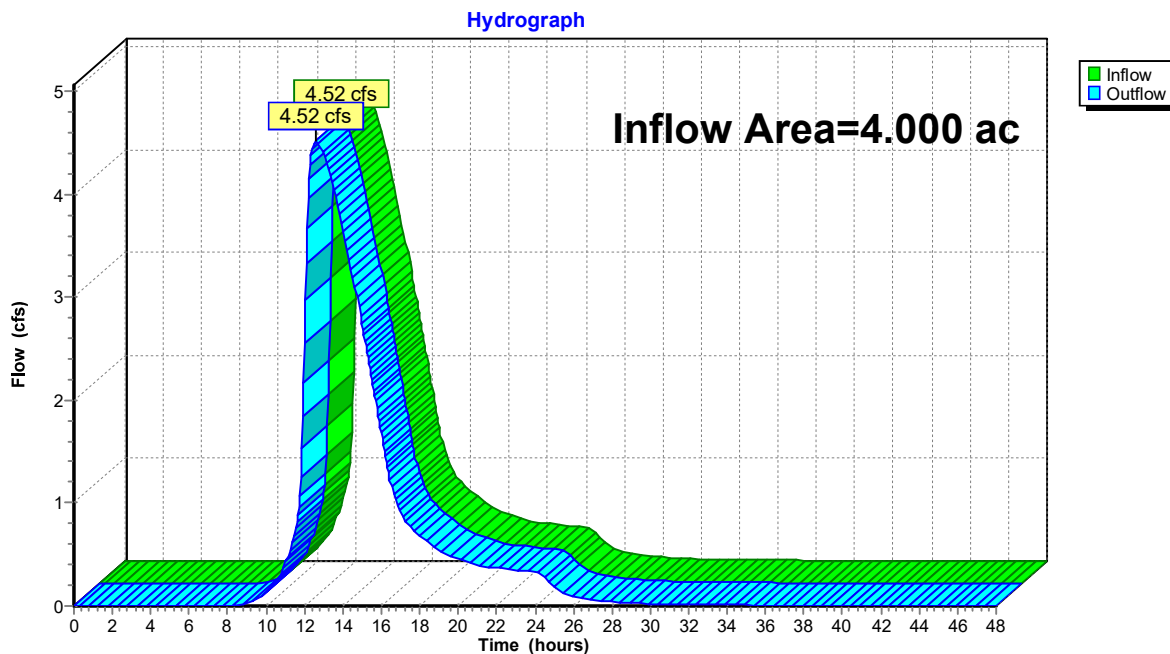
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 4.000 ac, 62.50% Impervious, Inflow Depth > 5.01" for 100-Year event

Inflow = 4.52 cfs @ 12.60 hrs, Volume= 1.671 af

Outflow = 4.52 cfs @ 12.60 hrs, Volume= 1.671 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

**Reach 22R: City Storm Sewer**

### Summary for Pond 19P: Wet Pond

Inflow Area = 4.000 ac, 62.50% Impervious, Inflow Depth = 5.03" for 100-Year event  
 Inflow = 22.18 cfs @ 12.12 hrs, Volume= 1.677 af  
 Outflow = 4.52 cfs @ 12.60 hrs, Volume= 1.671 af, Atten= 80%, Lag= 28.4 min  
 Primary = 4.52 cfs @ 12.60 hrs, Volume= 1.671 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2  
 Peak Elev= 990.54' @ 12.60 hrs Surf.Area= 0.307 ac Storage= 0.693 af

Plug-Flow detention time= 95.0 min calculated for 1.671 af (100% of inflow)  
 Center-of-Mass det. time= 92.6 min ( 915.2 - 822.6 )

| Volume | Invert  | Avail.Storage | Storage Description                               |
|--------|---------|---------------|---------------------------------------------------|
| #1     | 987.50' | 0.832 af      | <b>Custom Stage Data (Prismatic)</b> Listed below |

| Elevation<br>(feet) | Surf.Area<br>(acres) | Inc.Store<br>(acre-feet) | Cum.Store<br>(acre-feet) |
|---------------------|----------------------|--------------------------|--------------------------|
| 987.50              | 0.120                | 0.000                    | 0.000                    |
| 988.00              | 0.170                | 0.072                    | 0.072                    |
| 989.00              | 0.230                | 0.200                    | 0.272                    |
| 990.00              | 0.280                | 0.255                    | 0.528                    |
| 991.00              | 0.330                | 0.305                    | 0.832                    |

| Device | Routing  | Invert  | Outlet Devices                                                                                                                                                                   |
|--------|----------|---------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| #1     | Device 2 | 987.50' | <b>30.0 deg x 0.7' long x 1.00' rise Sharp-Crested Vee/Trap Weir</b><br>Cv= 2.61 (C= 3.26)                                                                                       |
| #2     | Primary  | 987.50' | <b>12.0" Round Culvert</b> L= 50.0' Ke= 1.000<br>Inlet / Outlet Invert= 987.50' / 984.00' S= 0.0700 '/' Cc= 0.900<br>n= 0.012 Concrete pipe, finished, Flow Area= 0.79 sf        |
| #3     | Device 2 | 988.50' | <b>5.0' long x 0.5' breadth Broad-Crested Rectangular Weir</b><br>Head (feet) 0.20 0.40 0.60 0.80 1.00<br>Coef. (English) 2.80 2.92 3.08 3.30 3.32                               |
| #4     | Device 1 | 987.50' | <b>18.0" Round Culvert</b> L= 20.0' Ke= 1.000<br>Inlet / Outlet Invert= 987.50' / 987.50' S= 0.0000 '/' Cc= 0.900<br>n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf |

**Primary OutFlow** Max=4.52 cfs @ 12.60 hrs HW=990.54' (Free Discharge)

2=Culvert (Inlet Controls 4.52 cfs @ 5.76 fps)  
 1=Sharp-Crested Vee/Trap Weir (Passes < 7.47 cfs potential flow)  
 4=Culvert (Passes < 9.66 cfs potential flow)  
 3=Broad-Crested Rectangular Weir (Passes < 48.44 cfs potential flow)

## Pond 19P: Wet Pond

## Hydrograph

