PRELIMINARY DRAINAGE REPORT

FOR

HANOVER FALLS CENTER
LOTS 1 THRU 10 & OUTLOTS “A” THRU “F”

156th Street and State Street
Omaha, Nebraska

Prepared By:

E & A Consulting Group, Inc.
10909 Mill Valley Road, Suite 100
Omaha, NE 68154
Ph. 402-895-4700

E & A Project Number: P2019.212.004

January 17, 2020
1. Executive Summary

1.1 Project Description
The Hanover Falls Center, Lots 1 thru 10 & Outlots “A” thru “e” is a new development that consist of developing 45.22 acres of open land into a mixed use development. This development falls under the jurisdiction of the City of Omaha with an approximate location of 156th and State Street (reference Appendix A - Site Vicinity Map). The project includes the following improvements:

- 10 Mixed Use Lots
- (2) Detention Basins
- Sanitary Sewer Infrastructure
- Storm Sewer Infrastructure
- Domestic / Fire Water Service
- Grading / Paving

This report presents a hydrology and hydraulics (H & H) study of existing conditions and the proposed development with incorporated Best Management Practices (BMPs) for storm water runoff. BMPs are presented in Section 2 – Post Construction Stormwater Management Plan (PCSMP) based on guidelines from the governing jurisdiction.

1.2 Pre-Developed Site

1.2.1 Existing Usage of Land
The existing site consists two different land uses that were accounted for in this report. The majority of the site (36.4 acres) consists of the straight row agriculture with light crop residue. A curve number of 83 was used for this land use. The remainder of the site (8.74 acres) is a mixture of grasses and trees in a large broad waterway that runs through western one third of the site. A curve number of 76 was used for this portion of the property.

1.2.2 Wetlands and Preservation of Natural Areas
A wetland delineation was performed by E & A Consulting Group, Inc. Wetlands were found in the broad waterway on the property. The waterway will be placed into an outlot. A private drive will be constructed across the southwest portion of the waterway. A 160-foot culvert will be placed in the waterway beneath the rode. Approximately .01 acre of wetland will be disturbed as part of this project.

1.2.3 Site Soil Information
Soil classification for stormwater runoff calculations for the project site are assumed to be hydrologic soil Type C.
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1.2.3 Site Soil Information
Soil classification for stormwater runoff calculations for the project site are assumed to be hydrologic soil Type C.
1.2.4 Existing Topography
Existing site topography was provided by the E & A, Survey Department. Existing topography of the broad waterway was obtained using LIDAR information as provided by ArcGIS.

1.2.5 Pre-Development Site Hydrology
The project site is part of the Little Papillion Creek Watershed of the larger Papillion Creek, which drains into the Missouri River.

The site features average to steep slopes (3.5% - 10%) towards the south. The is divided into two drainage areas by an existing ridgeline running north and south. The west portion (impact point one) of the property (29.24 acres) drains to an unnamed creek that runs through the southwest corner of the property. The creek is drains beneath State Street via a box culvert. The eastern portion (impact point two) of site drains to open ditches along 156th Street and State Street. These ditches are drained by twin a 36” RCP culvert beneath State Street. Both drainage areas eventually drain to Standing Bear Lake to south.

Calculation of runoff was performed using the Hydraflow Hydrographs modeling software. The model was set to use the SCS, TR-55 method with distributed Type II precipitation and a Time of Concentration was calculated for each drainage basin using the TR-55 method.

The following assumptions, referenced from the Omaha Regional Stormwater Design Manual (ORSDM) were made in the calculation of pre-development runoff.

<table>
<thead>
<tr>
<th>Storm Event</th>
<th>Rainfall (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-Year</td>
<td>3.0</td>
</tr>
<tr>
<td>10-Year</td>
<td>4.6</td>
</tr>
<tr>
<td>100-Year</td>
<td>6.7</td>
</tr>
</tbody>
</table>

Table 2.0 – Used SCS Curve Numbers in Calculation of Pre-Development Runoff

<table>
<thead>
<tr>
<th>Land Classification</th>
<th>CN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Row Crops, Straight Row with Crop Residue, Poor Condition</td>
<td>83</td>
</tr>
<tr>
<td>Woods – Grass Combination, Fair Condition</td>
<td>76</td>
</tr>
</tbody>
</table>
The following table summarizes the calculated pre-development runoff. For a visual representation of areas please reference Appendix C, Pre-Development Drainage Map. For details on calculated flows, reference Appendix I, PCSMP Hydraflow Software Model Report.

### Table 3.0 – Pre-Development Runoff per Impact Point Summary

<table>
<thead>
<tr>
<th>Impact Point</th>
<th>Pre-Development Area (ID)</th>
<th>Area (acres)</th>
<th>CN</th>
<th>Time of Concentration</th>
<th>2-YR Peak Flow (cfs)</th>
<th>10-YR Peak Flow (cfs)</th>
<th>100-YR Peak Flow (cfs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Pre Dev West</td>
<td>29.24</td>
<td>81</td>
<td>11.7 min.</td>
<td>55.03</td>
<td>111.12</td>
<td>188.44</td>
</tr>
<tr>
<td>2</td>
<td>Pre Dev East</td>
<td>16.09</td>
<td>83</td>
<td>12.1 min</td>
<td>33.54</td>
<td>65.11</td>
<td>107.92</td>
</tr>
</tbody>
</table>

### 1.3 Post Developed Site

#### 1.3.1 Proposed Usage of Land
The proposed usage will be Mixed Use. It is best described as Commercial District for drainage calculation purposes.

#### 1.3.2 Post-Development Site Hydrology
The proposed site is composed of new Mixed Use lots (commercial and multi-family) that drain into the public right of way. The site will remain divided into two drainage areas after grading has been completed. Lots 3, 4, and 5 (4.66 acres total) will be responsible for providing treatment and detention of post development runoff on a lot level. Storm sewer will be provided for future connection to BMP outlets. These lots will be the only lots draining to impact point two post development on the east side of the property. The post development calculations for impact point two have been excluded from this report.

The remainder of the site (39.50 acres) will be collected into public storm sewer which will drain into two dry detention basins. The detention basins will outlet into the broad waterway that runs through the site. Basin A will collect everything north and east of the waterway. Basin B will collect the drainage area south and west of the waterway and a private drive that crosses the waterway.

The new storm drain system was sized using the Rational Method. This method was chosen as opposed to the SCS method for its natural computational factor of safety. Pipes and structures were designed to carry the 10-year storm while the worst case 100-year storm being carried with a combination of the pipe system and surface flow within the public right-of-way. The following assumptions, referenced from the Omaha Regional Stormwater Design Manual were made in the pipe sizing calculations.
Table 4.0 – Summary of ORSDM Referenced Assumptions for Pipe Sizing Calculations.

<table>
<thead>
<tr>
<th>Pipes Sizing Calculations</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Time of Concentration,</td>
<td>Rainfall Intensity (in/hr)</td>
<td>Runoff Coefficient</td>
<td></td>
</tr>
<tr>
<td>Minimum (min.)</td>
<td>5</td>
<td>8.7</td>
<td>0.85</td>
</tr>
</tbody>
</table>

For a visual representation of the new storm drain system please reference Appendix D, Post Development Drainage Map. For calculation details reference Appendix E, Storm Drain Sizing Calculations, Appendix F, and Appendix G, Inlet Efficiency Calculations.

The following tables summarize the calculated Post Development runoff and assumptions made for calculations. For a visual representation of areas please see Appendix H, Post Construction Stormwater Management Plan. For details on calculated flows, reference Appendix I, PCSMP Hydraflow Software Model Report.

Table 5.0 – Used SCS Curve Numbers in Calculation of Post Development Runoff.

<table>
<thead>
<tr>
<th>SCS Method Curve Numbers (CN)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land Classification</td>
</tr>
<tr>
<td>Woods – Grass Combination, Fair Condition</td>
</tr>
<tr>
<td>Fully Developed Urban Areas Open Space, Good Condition</td>
</tr>
<tr>
<td>Commercial District</td>
</tr>
</tbody>
</table>

Table 6.0 – Post Development Runoff per Area Summary.

<table>
<thead>
<tr>
<th>Impact Point</th>
<th>Post Development Area (ID)</th>
<th>Area (acres)</th>
<th>CN</th>
<th>TC (min.)</th>
<th>2-YR Peak Flow (cfs)</th>
<th>10-YR Peak Flow (cfs)</th>
<th>100-YR Peak Flow (cfs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basin A</td>
<td>A1</td>
<td>25.96</td>
<td>94</td>
<td>10</td>
<td>38.75</td>
<td>64.90</td>
<td>123.63</td>
</tr>
<tr>
<td>Basin B</td>
<td>A2</td>
<td>5.07</td>
<td>94</td>
<td>5</td>
<td>1.28</td>
<td>15.92</td>
<td>30.69</td>
</tr>
<tr>
<td>Uncaptured A</td>
<td>A3</td>
<td>7.97</td>
<td>76</td>
<td>5</td>
<td>1.54</td>
<td>3.32</td>
<td>5.93</td>
</tr>
<tr>
<td>Uncaptured B</td>
<td>A4</td>
<td>.089</td>
<td>76</td>
<td>5</td>
<td>13.75</td>
<td>29.69</td>
<td>53.08</td>
</tr>
<tr>
<td>Post Dev West</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>41.52</td>
<td>99.98</td>
<td>154.90</td>
</tr>
</tbody>
</table>

*The Post Dev West Area is the combination of tributary areas to impact point 1 (Basin A & Basin B + Uncaptured A + Uncaptured B).
Table 7.0 – Pre-Developed vs Developed Runoff per Impact Point Summary.

<table>
<thead>
<tr>
<th>Impact Point</th>
<th>Tributary</th>
<th>2-YR Peak Flow (cfs)</th>
<th>10-YR Peak Flow (cfs)</th>
<th>100-YR Peak Flow (cfs)</th>
<th>2-YR Lower or Equal to Pre-Development Runoff?</th>
<th>10-YR or 100-YR Adverse Impact?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Pre-Dev. West</td>
<td>55.03</td>
<td>111.12</td>
<td>188.44</td>
<td>YES</td>
<td>NO</td>
</tr>
<tr>
<td></td>
<td>Post Dev West</td>
<td>41.52</td>
<td>99.98</td>
<td>154.90</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*The Post Dev West Area is the combination of tributary areas to impact point 1 (Basin A & Basin B + Uncaptured).

1.3.3 Culverts

There will a culvert constructed in the southwest corner of the property that will serve Lots 9 and 10. The culvert was sized use Hydraflow Hydrographs and the SCS method. The time of concentration used was 5 minutes due to the small drainage area. The drainage area for this culvert is 0.58 acres and has been included on the Storm Sewer Drainage Map. The calculations showed that a single 24” RCP culvert is sufficient.

There will also be a culvert constructed to serve a private drive that will connect Street “D” to the Hanover Falls residential subdivision to the north. The culvert was sized use Hydraflow Hydrographs and the SCS method. The time of concentration used was 10 minutes. The drainage area for this culvert is 48.33 acres and is shown on the Private Drive Culvert Drainage Area Map. The calculations showed that a twin 5-foot by 5-foot box culvert sufficient.

Both culverts will provide 2 feet of freeboard for the 50-year storm in accordance with Section 2.4.2 of the Omaha Regional Stormwater Design Manual, and the 100-year flow does overtop the street. The culvert report from Hydraflow Hydrographs is attached.

2. Post Construction Stormwater Management Plan (PCSMP)

2.1 Jurisdiction and Requirements

This project is located west of 72nd street therefore according to the City of Omaha PCSMP guidelines it falls under the MS4 Permit and shall meet the following requirements:

- PCSMP that includes BMP’s.
- Provide water quality control of the first 1/2-inch site runoff.
- Maintain runoff to equal or less than pre-project 2-year storm event.
• Maintain “No Adverse Impact” downstream.

The new development has increased runoff rates due to decreased pervious area. Please see section 2.2 of this report for further details on the proposed BMP strategy.

2.2 Best Management Practices (BMPs)

2.2.1 Proposed Treatment BMPs
The installation of dry detention basins was the chosen BMP to mitigate the following requirements:
• Provide Water Quality Control of the 1/2-inch of site runoff.
• Maintain Post Development runoff to equal or less than Pre-Development.
• Maintain “No Adverse Impact” Downstream.

Basins are able to treat storm water pollutants and reduce the amount of suspended solids by detaining water and allowing the solids to settle while bacteria and established vegetation help remove hydrocarbons, phosphorus and nitrogen.

In addition, the basins were designed to control the discharge rates of Post Development. This was accomplished through the design of a multi-stage release system. The diagram below details the storm event and the orifice it is allowed to pass. The orifice is sized to discharge the corresponding storm event at a rate equal or less than Pre-Development. Appendix E, PCSMP Map shows the proposed basins and tributary areas. Reference Appendix I, PCSMP Hydraflow Software Model Report for detailed basin sizing calculations.
2.2.2 Water Quality Control

The required Water Quality Volume (WQV) is calculated with the following formula:

\[ \text{WQV, ft}^3 = (1/2\text{-inch runoff}) \times (1/12) \times (\text{Tributary Area, ft}^2) \]

The following table summarizes the required and provided WQV per installed Basin.

**Table 8.0 – Post Development Water Quality Volume (WQV) Summary.**

<table>
<thead>
<tr>
<th>Basin</th>
<th>Tributary Area (acres)</th>
<th>Water Quality Volume Required (ft³)</th>
<th>Water Quality Volume Provided (ft³)</th>
<th>Adequate?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basin A</td>
<td>25.96</td>
<td>47,117.4</td>
<td>66,487</td>
<td>YES</td>
</tr>
<tr>
<td>Basin B</td>
<td>4.76</td>
<td>8,639.4</td>
<td>13,098.5</td>
<td>YES</td>
</tr>
<tr>
<td>Uncaptured</td>
<td>3.00</td>
<td>5,445.0</td>
<td>0</td>
<td>NO</td>
</tr>
<tr>
<td><strong>Total Developed Area</strong></td>
<td><strong>33.67</strong></td>
<td><strong>61,201.8</strong></td>
<td><strong>79,585.5</strong></td>
<td><strong>YES</strong></td>
</tr>
</tbody>
</table>

*The Uncaptured Area does not include areas of the waterway that are disturbed as part of the grading. This area includes all disturbed areas and the small sections of the public street that do not drain to a basin.*
3. References


4. Appendix
VICINITY MAP

HANOVER FALLS CENTER
LOTS 1 THRU 10 & OUTLOTS "A" THRU "E"
OMAHA, NEBRASKA

Job No.: P2019.212.004  Date: 11/08/2019

Drawn by: BTC  Not to Scale  Sht: 1 of 1

Brett Conyers  11/7/2019 6:24 PM  K:\Projects\2019\212\p04\Engineering\CAD Files\Drainage Study\PRE PLAT DRAINAGE STUDY-000.dwg
<table>
<thead>
<tr>
<th>Pipe Number</th>
<th>Area (A)</th>
<th>Runoff Coefficient (C)</th>
<th>A ′ C</th>
<th>Sum A ′ C</th>
<th>Time of Concentration (t)</th>
<th>Intensity (I)</th>
<th>Runoff (Qr)</th>
<th>Pipe Slope (S₀)</th>
<th>Pipe Length (L)</th>
<th>Pipe Diameter (D)</th>
<th>Pipe Capacity (Qp)</th>
<th>Pipe Velocity (Vp)</th>
<th>Time in Section (T_p)</th>
<th>Intensity (I100)</th>
<th>Flow (Q100)</th>
<th>Overflow Route Slope (Sov)</th>
<th>Street and ROW Width (Wst)</th>
<th>Street Capacity (Qst)</th>
<th>Swale Capacity (Qsw)</th>
<th>Swale plus Pipe Capacity (Qp+sw)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Lot 1 Connection</strong></td>
<td><strong>Lot 2 Connection</strong></td>
<td><strong>Lot 3 Connection</strong></td>
<td><strong>Lot 4 Connection</strong></td>
<td><strong>Lot 5 Connection</strong></td>
<td><strong>Lot 6 Connection</strong></td>
<td><strong>Lot 7 Connection</strong></td>
<td><strong>Outlet to Basin, 100 Year Storm Overflows Into Basin</strong></td>
<td><strong>Sheet 1 of 1</strong></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

Notes: ** Indicates that Factor of Safety has been included in this flow calculation. Note: See drainage area map for pipe locations.
<table>
<thead>
<tr>
<th>Pipe Number</th>
<th>Area (A)</th>
<th>Runoff Coefficient (C)</th>
<th>A * C</th>
<th>Sum A * C</th>
<th>Time of Concentration (Tc)</th>
<th>Intensity (I)</th>
<th>Runoff (Qr)</th>
<th>Time in Section (Tp)</th>
<th>Overflow Route Slope (Sr)</th>
<th>Flow (Qw)</th>
<th>Street and ROW Width (Wst)</th>
<th>Street Capacity (Qst)</th>
<th>Swale Width (W)</th>
<th>Swale Capacity (Qsw)</th>
<th>Overflow plus Pipe Capacity (Qov)</th>
<th>Comments</th>
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<tr>
<td>33</td>
<td>1.72</td>
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<td>1.46</td>
<td>1.46</td>
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<td>32</td>
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<td>32.00</td>
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<td>12</td>
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</tbody>
</table>

Notes: ** - Indicates that Factor of Safety has been included in this flow calculation.

Note: See drainage area map for pipe locations.
**Legend**

<table>
<thead>
<tr>
<th>Hyd.</th>
<th>Origin</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>SCS Runoff</td>
<td>Pre Dev East</td>
</tr>
<tr>
<td>2</td>
<td>SCS Runoff</td>
<td>Pre Dev West</td>
</tr>
<tr>
<td>3</td>
<td>SCS Runoff</td>
<td>Uncaptured B</td>
</tr>
<tr>
<td>4</td>
<td>SCS Runoff</td>
<td>Developed Southwest</td>
</tr>
<tr>
<td>5</td>
<td>SCS Runoff</td>
<td>Developed Northwest</td>
</tr>
<tr>
<td>6</td>
<td>Reservoir</td>
<td>Basin A</td>
</tr>
<tr>
<td>7</td>
<td>Reservoir</td>
<td>Basin B</td>
</tr>
<tr>
<td>8</td>
<td>SCS Runoff</td>
<td>Uncaptured A</td>
</tr>
<tr>
<td>9</td>
<td>Combine</td>
<td>Total West Post Construction</td>
</tr>
</tbody>
</table>

Project: Pre Plat-000.gpw

Thursday, 01 / 16 / 2020
Watershed Model Schematic

Hydrograph Return Period Recap

2 - Year
Summary Report
Hydrograph Reports
  Hydrograph No. 1, SCS Runoff, Pre Dev East
  Hydrograph No. 2, SCS Runoff, Pre Dev West
  Hydrograph No. 3, SCS Runoff, Uncaptured B
  Hydrograph No. 4, SCS Runoff, Developed Southwest
  Hydrograph No. 5, SCS Runoff, Developed Northwest
  Hydrograph No. 6, Reservoir, Basin A
  Pond Report - Basin A
  Hydrograph No. 7, Reservoir, Basin B
  Pond Report - Basin B
  Hydrograph No. 8, SCS Runoff, Uncaptured A
  Hydrograph No. 9, Combine, Total West Post Construction

10 - Year
Summary Report
Hydrograph Reports
  Hydrograph No. 1, SCS Runoff, Pre Dev East
  Hydrograph No. 2, SCS Runoff, Pre Dev West
  Hydrograph No. 3, SCS Runoff, Uncaptured B
  Hydrograph No. 4, SCS Runoff, Developed Southwest
  Hydrograph No. 5, SCS Runoff, Developed Northwest
  Hydrograph No. 6, Reservoir, Basin A
  Hydrograph No. 7, Reservoir, Basin B
  Hydrograph No. 8, SCS Runoff, Uncaptured A
  Hydrograph No. 9, Combine, Total West Post Construction

100 - Year
Summary Report
Hydrograph Reports
  Hydrograph No. 1, SCS Runoff, Pre Dev East
  Hydrograph No. 2, SCS Runoff, Pre Dev West
  Hydrograph No. 3, SCS Runoff, Uncaptured B
  Hydrograph No. 4, SCS Runoff, Developed Southwest
  Hydrograph No. 5, SCS Runoff, Developed Northwest
  Hydrograph No. 6, Reservoir, Basin A
  Hydrograph No. 7, Reservoir, Basin B
  Hydrograph No. 8, SCS Runoff, Uncaptured A
  Hydrograph No. 9, Combine, Total West Post Construction
<table>
<thead>
<tr>
<th>Hyd. No.</th>
<th>Hydrograph type (origin)</th>
<th>Inflow hyd(s)</th>
<th>Peak Outflow (cfs)</th>
<th>Hydrograph Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>SCS Runoff</td>
<td></td>
<td>33.54</td>
<td>65.11</td>
</tr>
<tr>
<td>2</td>
<td>SCS Runoff</td>
<td></td>
<td>55.03</td>
<td>111.12</td>
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<td>9</td>
<td>Combine 3, 6, 7, 8</td>
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Proj. file: Pre Plat-000.gpw  
Thursday, 01 / 16 / 2020
<table>
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<th>Hyd. No.</th>
<th>Hydrograph type (origin)</th>
<th>Peak flow (cfs)</th>
<th>Time interval (min)</th>
<th>Time to Peak (min)</th>
<th>Hyd. volume (cuft)</th>
<th>Inflow hyd(s)</th>
<th>Maximum elevation (ft)</th>
<th>Total strge used (cuft)</th>
<th>Hydrograph Description</th>
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<td>Pre Dev East</td>
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<tr>
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<td>2</td>
<td>718</td>
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<td>Uncaptured B</td>
</tr>
<tr>
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<td>18.84</td>
<td>2</td>
<td>716</td>
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<td>2</td>
<td>718</td>
<td>3,074</td>
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<td>Uncaptured A</td>
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<tr>
<td>9</td>
<td>Combine</td>
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<td>2</td>
<td>730</td>
<td>298,575</td>
<td>3, 6, 7, 8</td>
<td>-----</td>
<td>-----</td>
<td>Total West Post Construction</td>
</tr>
</tbody>
</table>

Pre Plat-000.gpw

Return Period: 2 Year

Thursday, 01 / 16 / 2020
Hyd. No. 1

Pre Dev East

Hydrograph type = SCS Runoff
Storm frequency = 2 yrs
Time interval = 2 min
Drainage area = 16.090 ac
Basin Slope = 0.0 %
Tc method = TR55
Total precip. = 3.00 in
Storm duration = 24 hrs

Peak discharge = 33.54 cfs
Time to peak = 720 min
Hyd. volume = 87,129 cuft
Curve number = 83
Hydraulic length = 0 ft
Time of conc. (Tc) = 12.10 min
Distribution = Type II
Shape factor = 484
Hyd. No. 2
Pre Dev West

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydrograph type</td>
<td>SCS Runoff</td>
</tr>
<tr>
<td>Storm frequency</td>
<td>2 yrs</td>
</tr>
<tr>
<td>Time interval</td>
<td>2 min</td>
</tr>
<tr>
<td>Drainage area</td>
<td>29.240 ac</td>
</tr>
<tr>
<td>Basin Slope</td>
<td>4.5 %</td>
</tr>
<tr>
<td>Tc method</td>
<td>TR55</td>
</tr>
<tr>
<td>Total precip.</td>
<td>3.00 in</td>
</tr>
<tr>
<td>Storm duration</td>
<td>24 hrs</td>
</tr>
<tr>
<td>Peak discharge</td>
<td>55.03 cfs</td>
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<tr>
<td>Time to peak</td>
<td>720 min</td>
</tr>
<tr>
<td>Hyd. volume</td>
<td>143,772 cuft</td>
</tr>
<tr>
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<td>Hydraulic length</td>
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<td>Time of conc. (Tc)</td>
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<td>Distribution</td>
<td>Type II</td>
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<tr>
<td>Shape factor</td>
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</table>
Hyd. No. 3

Uncaptured B

Hydrograph type = SCS Runoff
Storm frequency = 2 yrs
Time interval = 2 min
Drainage area = 7.970 ac
Basin Slope = 0.0 %
Tc method = User
Total precip. = 3.00 in
Storm duration = 24 hrs

Peak discharge = 13.75 cfs
Time to peak = 718 min
Hyd. volume = 27,531 cuft
Curve number = 76
Hydraulic length = 0 ft
Time of conc. (Tc) = 5.00 min
Distribution = Type II
Shape factor = 484

Uncaptured B

Q (cfs)

0.00 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.20 2.40 2.60 2.80 3.00 3.20 3.40 3.60 3.80 4.00 4.20 4.40 4.60 4.80 5.00 5.20 5.40 5.60 5.80 6.00 6.20 6.40 6.60 6.80 7.00 7.20 7.40 7.60 7.80 8.00 8.20 8.40 8.60 8.80 9.00 9.20 9.40 9.60 9.80 10.00 10.20 10.40 10.60 10.80 11.00 11.20 11.40 11.60 11.80 12.00 12.20 12.40 12.60 12.80 13.00 13.20 13.40 13.60 13.80 14.00

Time (min)

0 120 240 360 480 600 720 840 960 1080 1200 1320 1440 1560

Q (cfs)

Hyd. No. 3 -- 2 Year
Hyd. No. 4
Developed Southwest

Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

Thursday, 01 / 16 / 2020

Hydrograph type = SCS Runoff
Peak discharge = 18.84 cfs

Storm frequency = 2 yrs
Time to peak = 716 min

Time interval = 2 min
Hyd. volume = 40,548 cuft

Drainage area = 5.070 ac
Curve number = 94

Basin Slope = 0.0 %
Hydraulic length = 0 ft

Tc method = User
Time of conc. (Tc) = 5.00 min

Total precip. = 3.00 in
Distribution = Type II

Storm duration = 24 hrs
Shape factor = 484

---

**Developed Southwest**

Hyd. No. 4 -- 2 Year

Q (cfs)

0.00 0.00 3.00 3.00 6.00 6.00 9.00 9.00 12.00 12.00 15.00 15.00 18.00 18.00 21.00 21.00

0.00 120 240 360 480 600 720 840 960 1080 1200

Time (min)

Hyd No. 4
Hyd. No. 5
Developed Northwest

Hydrograph type = SCS Runoff  Peak discharge = 84.28 cfs
Storm frequency = 2 yrs  Time to peak = 720 min
Time interval = 2 min  Hyd. volume = 228,381 cuft
Drainage area = 25.960 ac  Curve number = 94
Basin Slope = 0.0 %  Hydraulic length = 0 ft
Tc method = User  Time of conc. (Tc) = 10.00 min
Total precip. = 3.00 in  Distribution = Type II
Storm duration = 24 hrs  Shape factor = 484

Developed Northwest
Hyd. No. 5 -- 2 Year

<table>
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<tr>
<th>Time (min)</th>
<th>Q (cfs)</th>
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<tr>
<td>80.00</td>
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<tr>
<td>90.00</td>
<td>90.00</td>
</tr>
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</table>

Hyd No. 5
Hyd. No. 6
Basin A

Hydrograph type = Reservoir
Storm frequency = 2 yrs
Time interval = 2 min
Inflow hyd. No. = 5 - Developed Northwest
Reservoir name = Basin A

Peak discharge = 38.75 cfs
Time to peak = 730 min
Hyd. volume = 228,356 cuft
Max. Elevation = 1178.32 ft
Max. Storage = 97,811 cuft

Total storage used = 97,811 cuft
Pond Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Thursday, 01 / 16 / 2020

Pond No. 1 - Basin A

Pond Data

Contours - User-defined contour areas. Average end area method used for volume calculation. Beginning Elevation = 1173.00 ft

Stage / Storage Table

<table>
<thead>
<tr>
<th>Stage (ft)</th>
<th>Elevation (ft)</th>
<th>Contour area (sqft)</th>
<th>Incr. Storage (cuft)</th>
<th>Total storage (cuft)</th>
</tr>
</thead>
<tbody>
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<td>11,712</td>
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Culvert / Orifice Structures

<table>
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<th>Span (in)</th>
<th>No. Barrels</th>
<th>Invert El. (ft)</th>
<th>Length (ft)</th>
<th>Slope (%)</th>
<th>N-Value</th>
<th>Orifice Coeff.</th>
<th>Multi-Stage</th>
<th>Crest Len (ft)</th>
<th>Crest El. (ft)</th>
<th>Weir Coeff.</th>
<th>Weir Type</th>
<th>Multi-Stage</th>
<th>Exfil.(in/hr)</th>
<th>TW Elev. (ft)</th>
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<td>36.00</td>
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<td>1181.00</td>
<td>3.33</td>
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</tbody>
</table>

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

Stage (ft) vs. Discharge (cfs)
Hyd. No. 7

Basin B

Hydrograph type = Reservoir
Storm frequency = 2 yrs
Time interval = 2 min
Inflow hyd. No. = 4 - Developed Southwest
Reservoir name = Basin B

Peak discharge = 1.283 cfs
Time to peak = 752 min
Hyd. volume = 39,612 cuft
Max. Elevation = 1187.34 ft
Max. Storage = 24,438 cuft

Storage Indication method used.

Basin B
Hyd. No. 7 -- 2 Year

Total storage used = 24,438 cuft
Pond Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020
Thursday, 01 / 16 / 2020

Pond No. 2 - Basin B

Pond Data

Contours - User-defined contour areas. Average end area method used for volume calculation. Beginning Elevation = 1184.00 ft

Stage / Storage Table

<table>
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<th>Stage (ft)</th>
<th>Elevation (ft)</th>
<th>Contour area (sqft)</th>
<th>Incr. Storage (cuft)</th>
<th>Total storage (cuft)</th>
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Culvert / Orifice Structures

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<th>Rise (in)</th>
<th>Span (in)</th>
<th>No. Barrels</th>
<th>Invert El. (ft)</th>
<th>Length (ft)</th>
<th>Slope (%)</th>
<th>N-Value</th>
<th>Orifice Coeff.</th>
<th>Multi-Stage</th>
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<td>= 0.80</td>
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Weir Structures

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<th>Weir Coeff.</th>
<th>Weir Type</th>
<th>Multi-Stage</th>
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<tbody>
<tr>
<td>= 5.76</td>
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<td>= 3.33</td>
<td>= 1</td>
<td>= Yes</td>
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</table>

<table>
<thead>
<tr>
<th>Exfil.(in/hr)</th>
<th>TW Elev. (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>= 0.00 (by Wet area)</td>
<td>= 0.00</td>
</tr>
</tbody>
</table>

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

Stage / Discharge
Hyd. No. 8

Uncaptured A

Hyd. No. 8

Hydrograph type = SCS Runoff
Peak discharge = 1.536 cfs
Storm frequency = 2 yrs
Time to peak = 718 min
Time interval = 2 min
Hyd. volume = 3,074 cuft
Drainage area = 0.890 ac
Curve number = 76
Basin Slope = 0.0 %
Hydraulic length = 0 ft
Tc method = User
Time of conc. (Tc) = 5.00 min
Total precip. = 3.00 in
Distribution = Type II
Storm duration = 24 hrs
Shape factor = 484
Hyd. No. 9

Total West Post Construction

Hydrograph type = Combine  Peak discharge = 41.52 cfs
Storm frequency = 2 yrs  Time to peak = 730 min
Time interval = 2 min  Hyd. volume = 298,575 cuft
Inflow hyds. = 3, 6, 7, 8  Contrib. drain. area = 8.860 ac

Total West Post Construction

Hyd. No. 9 -- 2 Year

Q (cfs)

Hyd No. 9

Hyd No. 3

Hyd No. 6

Hyd No. 7

Hyd No. 8
<table>
<thead>
<tr>
<th>Hyd. No.</th>
<th>Hydrograph type (origin)</th>
<th>Peak flow (cfs)</th>
<th>Time interval (min)</th>
<th>Time to Peak (min)</th>
<th>Hyd. volume (cuft)</th>
<th>Inflow hyd(s)</th>
<th>Maximum elevation (ft)</th>
<th>Total strge used (cuft)</th>
<th>Hydrograph Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>SCS Runoff</td>
<td>65.11</td>
<td>2</td>
<td>720</td>
<td>169,530</td>
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<td>Pre Dev East</td>
</tr>
<tr>
<td>2</td>
<td>SCS Runoff</td>
<td>111.12</td>
<td>2</td>
<td>720</td>
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<tr>
<td>3</td>
<td>SCS Runoff</td>
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<td>2</td>
<td>716</td>
<td>59,939</td>
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<td>Uncaptured B</td>
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<tr>
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<td>716</td>
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<td>5</td>
<td>SCS Runoff</td>
<td>136.30</td>
<td>2</td>
<td>720</td>
<td>380,338</td>
<td>-----</td>
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<td>Developed Northwest</td>
</tr>
<tr>
<td>6</td>
<td>Reservoir</td>
<td>64.90</td>
<td>2</td>
<td>730</td>
<td>380,313</td>
<td>5</td>
<td>1180.01</td>
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</tr>
<tr>
<td>7</td>
<td>Reservoir</td>
<td>15.92</td>
<td>2</td>
<td>722</td>
<td>66,581</td>
<td>4</td>
<td>1188.08</td>
<td>31,423</td>
<td>Basin B</td>
</tr>
<tr>
<td>8</td>
<td>SCS Runoff</td>
<td>3.315</td>
<td>2</td>
<td>716</td>
<td>6,693</td>
<td>-----</td>
<td>-----</td>
<td>-----</td>
<td>Uncaptured A</td>
</tr>
<tr>
<td>9</td>
<td>Combine</td>
<td>99.98</td>
<td>2</td>
<td>720</td>
<td>513,526</td>
<td>3, 6, 7, 8</td>
<td>-----</td>
<td>-----</td>
<td>Total West Post Construction</td>
</tr>
</tbody>
</table>

Pre Plat-000.gpw  
Return Period: 10 Year  
Thursday, 01 / 16 / 2020
**Hyd. No. 1**

Pre Dev East

Hydrograph type = SCS Runoff  
Storm frequency = 10 yrs  
Time interval = 2 min  
Drainage area = 16.090 ac  
Basin Slope = 0.0 %  
Tc method = TR55  
Total precip. = 4.60 in  
Storm duration = 24 hrs  

Peak discharge = 65.11 cfs  
Time to peak = 720 min  
Hyd. volume = 169,530 cuft  
Curve number = 83  
Hydraulic length = 0 ft  
Time of conc. (Tc) = 12.10 min  
Distribution = Type II  
Shape factor = 484
Hyd. No. 2

Pre Dev West

Hydrograph type = SCS Runoff
Storm frequency = 10 yrs
Time interval = 2 min
Drainage area = 29.240 ac
Basin Slope = 4.5 %
Tc method = TR55
Total precip. = 4.60 in
Storm duration = 24 hrs

Peak discharge = 111.12 cfs
Time to peak = 720 min
Hyd. volume = 288,394 cuft
Curve number = 81
Hydraulic length = 1823 ft
Time of conc. (Tc) = 11.70 min
Distribution = Type II
Shape factor = 484

---

Pre Dev West

Hyd. No. 2 -- 10 Year

Q (cfs)

<table>
<thead>
<tr>
<th>Time (min)</th>
<th>Q (cfs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.00</td>
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<tr>
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<tr>
<td>480</td>
<td>0.00</td>
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<tr>
<td>720</td>
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<td>840</td>
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<tr>
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<tr>
<td>1440</td>
<td>0.00</td>
</tr>
<tr>
<td>1560</td>
<td>0.00</td>
</tr>
</tbody>
</table>

Hyd No. 2
Hyd. No. 3

Uncaptured B

Hydrograph type = SCS Runoff  Peak discharge = 29.69 cfs
Storm frequency = 10 yrs  Time to peak = 716 min
Time interval = 2 min  Hyd. volume = 59,939 cuft
Drainage area = 7.970 ac  Curve number = 76
Basin Slope = 0.0 %  Hydraulic length = 0 ft
Tc method = User  Time of conc. (Tc) = 5.00 min
Total precip. = 4.60 in  Distribution = Type II
Storm duration = 24 hrs  Shape factor = 484

Uncaptured B

Hyd. No. 3 -- 10 Year

Q (cfs)

Time (min)
Hydrograph Report

Hyd. No. 4
Developed Southwest

Hydrograph type = SCS Runoff
Storm frequency = 10 yrs
Time interval = 2 min
Drainage area = 5.070 ac
Basin Slope = 0.0 %
Tc method = User
Total precip. = 4.60 in
Storm duration = 24 hrs

Peak discharge = 30.35 cfs
Time to peak = 716 min
Hyd. volume = 67,527 cuft
Curve number = 94
Hydraulic length = 0 ft
Time of conc. (Tc) = 5.00 min
Distribution = Type II
Shape factor = 484

---

Developed Southwest
Hyd. No. 4 -- 10 Year

<table>
<thead>
<tr>
<th>Time (min)</th>
<th>Q (cfs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.00</td>
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<tr>
<td>120</td>
<td>0.00</td>
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<td>240</td>
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</tr>
<tr>
<td>1080</td>
<td>0.00</td>
</tr>
<tr>
<td>1200</td>
<td>0.00</td>
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</tbody>
</table>

Hyd No. 4
Hyd. No. 5

Developed Northwest

Hydrograph type = SCS Runoff
Storm frequency = 10 yrs
Time interval = 2 min
Drainage area = 25.960 ac
Basin Slope = 0.0 %
Tc method = User
Total precip. = 4.60 in
Storm duration = 24 hrs

Peak discharge = 136.30 cfs
Time to peak = 720 min
Hyd. volume = 380,338 cuft
Curve number = 94
Hydraulic length = 0 ft
Time of conc. (Tc) = 10.00 min
Distribution = Type II
Shape factor = 484

---

Q (cfs)

Developed Northwest

Hyd. No. 5 -- 10 Year

---

Q (cfs)

Time (min)

Hyd No. 5
Hyd. No. 6

Basin A

Hydrograph type = Reservoir
Storm frequency = 10 yrs
Time interval = 2 min
Inflow hyd. No. = 5 - Developed Northwest
Reservoir name = Basin A

Peak discharge = 64.90 cfs
Time to peak = 730 min
Hyd. volume = 380,313 cuft
Max. Elevation = 1180.01 ft
Max. Storage = 143,866 cuft

Total storage used = 143,866 cuft

Storage Indication method used.
Hyd. No. 7

Basin B

Hydrograph type = Reservoir
Storm frequency = 10 yrs
Time interval = 2 min
Inflow hyd. No. = 4 - Developed Southwest
Reservoir name = Basin B

Peak discharge = 15.92 cfs
Time to peak = 722 min
Hyd. volume = 66,581 cuft
Max. Elevation = 1188.08 ft
Max. Storage = 31,423 cuft

Total storage used = 31,423 cuft
Hyd. No. 8

Uncaptured A

Hydrograph type = SCS Runoff  Peak discharge = 3.315 cfs
Storm frequency = 10 yrs  Time to peak = 716 min
Time interval = 2 min  Hyd. volume = 6,693 cuft
Drainage area = 0.890 ac  Curve number = 76
Basin Slope = 0.0 %  Hydraulic length = 0 ft
Tc method = User  Time of conc. (Tc) = 5.00 min
Total precip. = 4.60 in  Distribution = Type II
Storm duration = 24 hrs  Shape factor = 484
Hyd. No. 9

Total West Post Construction

Hydrograph type = Combine
Storm frequency = 10 yrs
Time interval = 2 min
Inflow hyds. = 3, 6, 7, 8

Peak discharge = 99.98 cfs
Time to peak = 720 min
Hyd. volume = 513,526 cuft
Contrib. drain. area = 8.860 ac
<table>
<thead>
<tr>
<th>Hyd. No.</th>
<th>Hydrograph type (origin)</th>
<th>Peak flow (cfs)</th>
<th>Time interval (min)</th>
<th>Time to Peak (min)</th>
<th>Hyd. volume (cuft)</th>
<th>Inflow hyd(s)</th>
<th>Maximum elevation (ft)</th>
<th>Total strge used (cuft)</th>
<th>Hydrograph Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>SCS Runoff</td>
<td>107.92</td>
<td>2</td>
<td>720</td>
<td>285,816</td>
<td>-----</td>
<td>-----</td>
<td>-----</td>
<td>Pre Dev East</td>
</tr>
<tr>
<td>2</td>
<td>SCS Runoff</td>
<td>188.44</td>
<td>2</td>
<td>720</td>
<td>495,487</td>
<td>-----</td>
<td>-----</td>
<td>-----</td>
<td>Pre Dev West</td>
</tr>
<tr>
<td>3</td>
<td>SCS Runoff</td>
<td>53.08</td>
<td>2</td>
<td>716</td>
<td>108,258</td>
<td>-----</td>
<td>-----</td>
<td>-----</td>
<td>Uncaptured B</td>
</tr>
<tr>
<td>4</td>
<td>SCS Runoff</td>
<td>45.25</td>
<td>2</td>
<td>716</td>
<td>103,360</td>
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<td>-----</td>
<td>-----</td>
<td>Developed Southwest</td>
</tr>
<tr>
<td>5</td>
<td>SCS Runoff</td>
<td>203.62</td>
<td>2</td>
<td>720</td>
<td>582,159</td>
<td>-----</td>
<td>-----</td>
<td>-----</td>
<td>Developed Northwest</td>
</tr>
<tr>
<td>6</td>
<td>Reservoir</td>
<td>123.63</td>
<td>2</td>
<td>728</td>
<td>582,133</td>
<td>5</td>
<td>1181.51</td>
<td>192,056</td>
<td>Basin A</td>
</tr>
<tr>
<td>7</td>
<td>Reservoir</td>
<td>30.69</td>
<td>2</td>
<td>720</td>
<td>102,405</td>
<td>4</td>
<td>1188.82</td>
<td>39,419</td>
<td>Basin B</td>
</tr>
<tr>
<td>8</td>
<td>SCS Runoff</td>
<td>5.928</td>
<td>2</td>
<td>716</td>
<td>12,089</td>
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<td>Uncaptured A</td>
</tr>
<tr>
<td>9</td>
<td>Combine</td>
<td>154.90</td>
<td>2</td>
<td>720</td>
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<td>Total West Post Construction</td>
</tr>
</tbody>
</table>

Pre Plat-000.gpw

Return Period: 100 Year

Thursday, 01 / 16 / 2020
Hyd. No. 1

Pre Dev East

Hydrograph type = SCS Runoff
Storm frequency = 100 yrs
Time interval = 2 min
Drainage area = 16.090 ac
Basin Slope = 0.0 %
Tc method = TR55
Total precip. = 6.70 in
Storm duration = 24 hrs

Peak discharge = 107.92 cfs
Time to peak = 720 min
Hyd. volume = 285,816 cuft
Curve number = 83
Hydraulic length = 0 ft
Time of conc. (Tc) = 12.10 min
Distribution = Type II
Shape factor = 484
Hyd. No. 2

Pre Dev West

Hydrograph type = SCS Runoff  Peak discharge = 188.44 cfs
Storm frequency = 100 yrs  Time to peak = 720 min
Time interval = 2 min  Hyd. volume = 495,487 cuft
Drainage area = 29.240 ac  Curve number = 81
Basin Slope = 4.5 %  Hydraulic length = 1823 ft
Tc method = TR55  Time of conc. (Tc) = 11.70 min
Total precip. = 6.70 in  Distribution = Type II
Storm duration = 24 hrs  Shape factor = 484

Pre Dev West
Hyd. No. 2 -- 100 Year

Q (cfs)

0.00 30.00 60.00 90.00 120.00 150.00 180.00 210.00

Time (min)
0 0 0 0 0 0 0 0

Hyd No. 2
Hyd. No. 3

Uncaptured B

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
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</thead>
<tbody>
<tr>
<td>Hydrograph type</td>
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</tr>
<tr>
<td>Storm frequency</td>
<td>100 yrs</td>
</tr>
<tr>
<td>Time interval</td>
<td>2 min</td>
</tr>
<tr>
<td>Drainage area</td>
<td>7.970 ac</td>
</tr>
<tr>
<td>Basin Slope</td>
<td>0.0 %</td>
</tr>
<tr>
<td>Tc method</td>
<td>User</td>
</tr>
<tr>
<td>Total precip.</td>
<td>6.70 in</td>
</tr>
<tr>
<td>Storm duration</td>
<td>24 hrs</td>
</tr>
<tr>
<td>Peak discharge</td>
<td>53.08 cfs</td>
</tr>
<tr>
<td>Time to peak</td>
<td>716 min</td>
</tr>
<tr>
<td>Hyd. volume</td>
<td>108,258 cuft</td>
</tr>
<tr>
<td>Curve number</td>
<td>76</td>
</tr>
<tr>
<td>Hydraulic length</td>
<td>0 ft</td>
</tr>
<tr>
<td>Time of conc. (Tc)</td>
<td>5.00 min</td>
</tr>
<tr>
<td>Distribution</td>
<td>Type II</td>
</tr>
<tr>
<td>Shape factor</td>
<td>484</td>
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</tbody>
</table>

Uncaptured B
Hyd. No. 3 -- 100 Year

Q (cfs) vs Time (min) graph showing a peak discharge of 53.08 cfs at 716 min, with a total volume of 108,258 cuft and a shape factor of 484.
Hyd. No. 4

Developed Southwest

Hydrograph type = SCS Runoff
Storm frequency = 100 yrs
Time interval = 2 min
Drainage area = 5.070 ac
Basin Slope = 0.0 %
Tc method = User
Total precip. = 6.70 in
Storm duration = 24 hrs

Peak discharge = 45.25 cfs
Time to peak = 716 min
Hyd. volume = 103,360 cuft
Curve number = 94
Hydraulic length = 0 ft
Time of conc. (Tc) = 5.00 min
Distribution = Type II
Shape factor = 484

Developed Southwest

Q (cfs)

Hyd. No. 4 -- 100 Year

Q (cfs)

Time (min)

Hyd No. 4
Hyd. No. 5
Developed Northwest

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
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<tbody>
<tr>
<td>Hydrograph type</td>
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</tr>
<tr>
<td>Storm frequency</td>
<td>100 yrs</td>
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<tr>
<td>Time interval</td>
<td>2 min</td>
</tr>
<tr>
<td>Drainage area</td>
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<tr>
<td>Basin Slope</td>
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<td>Tc method</td>
<td>User</td>
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<tr>
<td>Total precip.</td>
<td>6.70 in</td>
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<tr>
<td>Storm duration</td>
<td>24 hrs</td>
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<tr>
<td>Peak discharge</td>
<td>203.62 cfs</td>
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<tr>
<td>Time to peak</td>
<td>720 min</td>
</tr>
<tr>
<td>Hyd. volume</td>
<td>582,159 cuft</td>
</tr>
<tr>
<td>Curve number</td>
<td>94</td>
</tr>
<tr>
<td>Hydraulic length</td>
<td>0 ft</td>
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<td>Time of conc. (Tc)</td>
<td>10.00 min</td>
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<tr>
<td>Distribution</td>
<td>Type II</td>
</tr>
<tr>
<td>Shape factor</td>
<td>484</td>
</tr>
</tbody>
</table>

Developed Northwest
Hyd. No. 5 -- 100 Year
Hyd. No. 6
Basin A

Hydrograph type = Reservoir  Peak discharge = 123.63 cfs
Storm frequency = 100 yrs  Time to peak = 728 min
Time interval = 2 min  Hyd. volume = 582,133 cuft
Inflow hyd. No. = 5 - Developed Northwest  Max. Elevation = 1181.51 ft
Reservoir name = Basin A  Max. Storage = 192,056 cuft

Storage Indication method used.
Hyd. No. 7
Basin B

Hydrograph type = Reservoir  Peak discharge = 30.69 cfs
Storm frequency = 100 yrs  Time to peak = 720 min
Time interval = 2 min  Hyd. volume = 102,405 cuft
Inflow hyd. No. = 4 - Developed Southwest  Max. Elevation = 1188.82 ft
Reservoir name = Basin B  Max. Storage = 39,419 cuft

Storage Indication method used.

![Graph showing hydrograph for Basin B, Hyd. No. 7 - 100 Year]

Total storage used = 39,419 cuft
Hyd. No. 8

Uncaptured A

Hydrograph type = SCS Runoff
Storm frequency = 100 yrs
Time interval = 2 min
Drainage area = 0.890 ac
Basin Slope = 0.0 %
Tc method = User
Total precip. = 6.70 in
Storm duration = 24 hrs

Peak discharge = 5.928 cfs
Time to peak = 716 min
Hyd. volume = 12,089 cu ft
Curve number = 76
Hydraulic length = 0 ft
Time of conc. (Tc) = 5.00 min
Distribution = Type II
Shape factor = 484
Hyd. No. 9

Total West Post Construction

Hydrograph type = Combine
Storm frequency = 100 yrs
Time interval = 2 min
Inflow hyds. = 3, 6, 7, 8

Peak discharge = 154.90 cfs
Time to peak = 720 min
Hyd. volume = 804,884 cuft
Contrib. drain. area = 8.860 ac
Southwest Drive Culvert

Invert Elev Dn (ft) = 1190.75
Pipe Length (ft) = 101.00
Slope (%) = 2.97
Invert Elev Up (ft) = 1193.75
Rise (in) = 24.0
Shape = Circular
Span (in) = 24.0
No. Barrels = 1
n-Value = 0.012
Culvert Type = Circular Concrete
Culvert Entrance = Square edge w/headwall (C)
Coeff. K,M,c,Y,k = 0.0098, 2, 0.0398, 0.67, 0.5

Calculations
Qmin (cfs) = 4.12
Qmax (cfs) = 4.70
Tailwater Elev (ft) = (dc+D)/2

Highlighted
Qtotal (cfs) = 4.67
Qpipe (cfs) = 4.67
Qovertop (cfs) = 0.00
Veloc Dn (ft/s) = 2.02
Veloc Up (ft/s) = 4.27
HGL Dn (ft) = 1192.13
HGL Up (ft) = 1194.51
Hw Elev (ft) = 1194.79
Hw/D (ft) = 0.52
Flow Regime = Inlet Control
Private Drive Culvert

Invert Elev Dn (ft) = 1178.97
Pipe Length (ft) = 157.00
Slope (%) = 2.17
Invert Elev Up (ft) = 1182.38
Rise (in) = 60.0
Shape = Box
Span (in) = 60.0
No. Barrels = 2
n-Value = 0.012
Culvert Type = Flared Wingwalls
Culvert Entrance = 90D and 15D wingwall flares
Coeff. K,M,c,Y,k = 0.061, 0.75, 0.04, 0.8, 0.5

Embankment
Top Elevation (ft) = 1190.00
Top Width (ft) = 38.00
Crest Width (ft) = 10.00

Calculations
Qmin (cfs) = 266.26
Qmax (cfs) = 310.38
Tailwater Elev (ft) = (dc+D)/2

Highlighted
Qtotal (cfs) = 266.26
Qpipe (cfs) = 266.26
Qovertop (cfs) = 0.00
Veloc Dn (ft/s) = 6.83
Veloc Up (ft/s) = 9.51
HGL Dn (ft) = 1182.87
HGL Up (ft) = 1185.18
Hw Elev (ft) = 1187.12
Hw/D (ft) = 0.95
Flow Regime = Inlet Control