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DRAINAGE CALCULATIONS

For

Holy Name Medical Center

Block 3002 Lots 2, 3, 4, 5, 6, 7 and 8
Block 3003 Lots 2, 3, 4, 8, 9, 10, 11, 12, 13 and 14

Teaneck

Bergen County

New Jersey

Project #01-160-21

Revised: 12-27-22

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Introduction:

The following calculations are in support of a site plan for Holy Name Medical Center, Lots 2, 3, 4, 5, 6, 7, and 8 in Block 3002 and Lots 2, 3, 4, 8, 9, 10, 11, 12, 13 and 14 in Block 3003 in the City of Teaneck. The plan proposes a the redevelopment of the Westerly portion of the Site which will include a new Childcare Center and parking lot expansion.

The portion of the site to be redeveloped is currently developed with 4 residential dwellings, garage, driveways and parking area for the Holy Name Medical center. Currently the site drains to the Holy Name Medical Center's existing drainage system that discharges to Teaneck Road System. The project area primarily drains to onsite main drainage line that flows thru the South end of the Site to the Teaneck Road drainage system. A smaller portion of the project area drains to a drainage line at the North end of the Site to the Teaneck Road system. The runoff in both directions was estimated.

Under proposed conditions there are two new infiltration systems proposed to attenuate the runoff from the proposed project area. With the systems in place, there will be a reduction in the rate of storm water runoff to the existing drainage system.

Storm Water Requirements

The project proposes to disturb approximately 2.8 acres and increase impervious coverage by approximately 0.8 acres on site, so the project is considered to be a Major Development.

The project proposes an increase in impervious coverage, which will result in an increase the storm water runoff. The project proposes to control stormwater runoff using a non-structural low-impact development approach. The design proposes "Green Infrastructure" BMPs consisting of porous pavement and 2 small scale infiltration systems. The design will also include 2 Filterra NJDEP approved "green Infrastructure" water quality treatments units. The overall system is designed to meet NJDEP Stormwater requirements. The runoff to the existing system from the Project Area will meet the NJDEP stormwater reductions for the 2yr (50%), 10yr(25%), and 100yr(20%) NOAA 24 hr. Region D Storms.

In addition the sub-area that drains from the site to residential lot 7 was analyzed. A portion of he site flows thru Lot 7 and into the drainage system located on the south end of the Holy Name site. The runoff from the site that flows to lot 7 will also be reduced for the 2 yr., 10 yr., 25 yr. and 100 yr. storms.

The rainfall intensities were taken from the NOAA Database (Pipe Flow) and NOAA 24 Hour Region D (HydroCAD).

All proposed storm drains are sized using Manning's equation and are adequate to handle the 25 year design storm.

Water Quality

The proposed site development will increase impervious coverage by more than 0.25 acres as compared to existing conditions, the permeable pavers and Filterra water quality treatment units are proposed for water quality treatment. Both the porous pavement and Filterra treatment units provide 80% TSS removal according to NJDEP. The porous pavement systems are designed to retain the entire volume of the NJDEP 1 yr. Water Quality Design storm.

Recharge

According the Web soil survey, the soils in the area of the site are mapped as Dunellen - Urban Land soils and Udorthents. With the infiltration systems in place the design will meet NJDEP Recharge Requirements.

The NJDEP GSR-32 Annual Groundwater Recharge Analysis program was used to estimate ground water recharge.

Stormwater Runoff Summary:

Project Area = 3.30 acres

The NOAA Type D - 24 hr - 2yr, 10yr, 25yr & 100yr Design Storm was estimated using HydroCAD 10 Software Solutions LLC

Existing Conditions:

| Project Area | HSG "A" | HSG "D" | Q2 | Q10 | Q25 | Q100 |
|--------------------------------------|--|--------------|----------|----------|----------|-----------|
| To South Drainage Line | Impervious Coverage = 0.790 Open space = 0.780 | 0.46 1.11 | 3.23 cfs | 6.31 cfs | 8.29 cfs | 12.51 cfs |
| South Line Sub- Area = | 3.140 ac. | | | | | |
| To North Drainage Line | HSG "A" Impervious Coverage = 0.130 Open space = 0.030 | | 0.41 cfs | 0.63 cfs | 0.79 cfs | 1.09 cfs |
| North Line Sub- Area = | 0.160 ac. | | | | | |
| Total Project Area (To Teaneck Rd) = | 3.300 ac. | | 3.37 cfs | 6.31 cfs | 8.57 cfs | 12.89 cfs |

See Appendix A for HydroCAD Calculations

| Area To Be Disturbed | HSG "A" | HSG "D" | Q2 | Q10 | Q25 | Q100 |
|----------------------|---|--------------|----------|----------|----------|-----------|
| South | Impervious Coverage = 0.77 Open space = 0.78 Total Area = 2.640 | 0.36 0.73 | 2.63 cfs | 4.91 cfs | 6.69 cfs | 10.12 cfs |
| North | Impervious Coverage = 0.130 Open space = 0.030 Total Area = 0.160 | | 0.41 cfs | 0.63 cfs | 0.79 cfs | 1.09 cfs |
| Total Area TBD = | 2.800 ac. | | 2.78 cfs | 5.13 cfs | 6.97 cfs | 10.51 cfs |

See Appendix B for HydroCAD Calculations

Required Reductions

| | Q2 | Q10 | Q25 | Q100 |
|--------------------------|----------|----------|----------|-----------|
| RSIS Req'd Red. = 50% | 50% | 25% | 25% | 20% |
| RSIS Req'd Red. (cfs) = | 1.39 cfs | 1.28 cfs | 1.74 cfs | 2.10 cfs |
| Allowable Runoff (cfs) = | 1.98 cfs | 5.03 cfs | 6.83 cfs | 10.79 cfs |

Proposed Conditions:

| | | | | | | | | |
|---|----------------|-----------------------|---------|----------|----------|----------|-----------|--|
| To Infiltrat. / Det. System #1 | | HSG "A" | HSG "D" | | | | | |
| Impervious Coverage = | 0.580 | 0.80 | | Q2 | Q10 | Q25 | Q100 | |
| Open space = | 0.190 | 0.37 | Inflow | 4.14 cfs | 6.78 cfs | 8.69 cfs | 12.22 cfs | |
| Total to system = | 1.940 | | Outflow | 0.36 cfs | 0.83 cfs | 3.02 cfs | 6.69 cfs | |
| Bypass Systems - South Line | | Impervious Coverage = | 0.360 | 0.14 | | | | |
| | Open space = | 0.160 | 0.22 | Q2 | Q10 | Q25 | Q100 | |
| | Total Bypass = | 0.88 | | 1.55 cfs | 2.67 cfs | 3.50 cfs | 5.08 cfs | |
| Total To South Line | | 2.82 | ac. | Q2 | Q10 | Q25 | Q100 | |
| | | | | 1.64 cfs | 3.09 cfs | 4.59 cfs | 9.86 cfs | |
| To Infiltrat. System #2 | | HSG "A" | HSG "D" | | | | | |
| Impervious Coverage = | 0.160 | 0.04 | Q2 | Q10 | Q25 | Q100 | | |
| Open space = | 0.080 | 0.00 | Inflow | 0.61 cfs | 0.94 cfs | 1.17 cfs | 1.66 cfs | |
| Total to system = | 0.280 | | Outflow | 0.00 cfs | 0.00 cfs | 0.07 cfs | 0.66 cfs | |
| Bypass Systems - North Line | | Impervious Coverage = | 0.120 | | | | | |
| | Open space = | 0.080 | | Q2 | Q10 | Q25 | Q100 | |
| | Total Bypass = | 0.20 | | 0.38 cfs | 0.58 cfs | 0.73 cfs | 1.07 cfs | |
| Total To North Line | | 0.48 | ac. | Q2 | Q10 | Q25 | Q100 | |
| | | | | 0.38 cfs | 0.58 cfs | 0.73 cfs | 1.07 cfs | |
| Total Project Area (To Teaneck Rd) = | | 3.30 | ac. | Q2 | Q10 | Q25 | Q100 | |
| | | | | 1.91 cfs | 3.57 cfs | 4.83 cfs | 10.75 cfs | |

See Appendix C for HydroCAD Calculations

Runoff Reduction Summary

| | | | | |
|---------------------------|-----------------|-----------------|-----------------|-----------------|
| To South Line | 1.59 cfs | 3.22 cfs | 3.70 cfs | 2.65 cfs |
| To North Line | 0.03 cfs | 0.05 cfs | 0.06 cfs | 0.02 cfs |
| Total Project Area | 1.46 cfs | 2.74 cfs | 3.74 cfs | 2.14 cfs |
| Reduction (%) | 52.5% | 53.4% | 53.7% | 20.4% |

(Reductions based of Limit of Disturbance)

Runoff To Lot 7 Summary:

Sub Area Analysis

The NOAA Type D - 24 hr - 2yr, 10yr, 25yr & 100yr Design Storm was estimated using HydroCAD 10 Software Solutions LLC

Existing Conditions: To Lot 7 / South Line

| | | | | | |
|--|--|-----------|------------|------------|-------------|
| HSG "D" Impervious Coverage = 0.440 Open space = 1.060 | | | | | |
| Sub- Area (Lot 7) = 1.500 ac. | | <u>Q2</u> | <u>Q10</u> | <u>Q25</u> | <u>Q100</u> |
| | | 2.64 cfs | 4.69 cfs | 6.16 cfs | 8.84 cfs |

See Appendix E for HydroCAD Calculations

Proposed Conditions: To Lot 7 / South Line

| | | | | | |
|--|--|-----------|------------|------------|-------------|
| HSG "D" Impervious Coverage = 0.340 Open space = 0.760 | | | | | |
| Sub- Area (Lot 7) = 1.100 ac. | | <u>Q2</u> | <u>Q10</u> | <u>Q25</u> | <u>Q100</u> |
| | | 1.96 cfs | 3.46 cfs | 4.54 cfs | 6.50 cfs |

See Appendix E for HydroCAD Calculations

Runoff Reduction Summary

| | | | | | |
|------------|-------------|----------|----------|----------|----------|
| Total Site | Existing = | 2.64 cfs | 4.69 cfs | 6.16 cfs | 8.84 cfs |
| | Proposed = | 1.96 cfs | 3.46 cfs | 4.54 cfs | 6.50 cfs |
| | Reduction = | 0.68 cfs | 1.23 cfs | 1.62 cfs | 2.34 cfs |



NOAA Atlas 14, Volume 2, Version 3
 Location name: Teaneck, New Jersey, USA*
 Latitude: 40.8838°, Longitude: -74.0115°
 Elevation: 92.43 ft**
 * source: ESRI Maps
 ** source: USGS



POINT PRECIPITATION FREQUENCY ESTIMATES

G.M. Bonnin, D. Martin, B. Lin, T. Parzybok, M.Yekta, and D. Riley

NOAA, National Weather Service, Silver Spring, Maryland

[PF tabular](#) | [PF graphical](#) | [Maps & aerials](#)

PF tabular

| PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches/hour)¹ | | | | | | | | | | |
|---|-------------------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|
| Duration | Average recurrence interval (years) | | | | | | | | | |
| | 1 | 2 | 5 | 10 | 25 | 50 | 100 | 200 | 500 | 1000 |
| 5-min | 4.08 (3.71-4.48) | 4.86 (4.43-5.35) | 5.80 (5.26-6.38) | 6.50 (5.88-7.14) | 7.39 (6.65-8.12) | 8.02 (7.19-8.82) | 8.68 (7.73-9.56) | 9.30 (8.22-10.3) | 10.1 (8.82-11.2) | 10.7 (9.26-12.0) |
| 10-min | 3.21 (2.92-3.53) | 3.85 (3.50-4.24) | 4.57 (4.15-5.03) | 5.11 (4.63-5.61) | 5.76 (5.19-6.33) | 6.24 (5.60-6.87) | 6.71 (5.98-7.40) | 7.16 (6.33-7.91) | 7.73 (6.74-8.59) | 8.12 (7.01-9.07) |
| 15-min | 2.66 (2.41-2.92) | 3.18 (2.90-3.50) | 3.80 (3.45-4.19) | 4.26 (3.85-4.67) | 4.82 (4.34-5.29) | 5.22 (4.68-5.74) | 5.61 (5.00-6.19) | 5.99 (5.29-6.62) | 6.46 (5.63-7.18) | 6.78 (5.86-7.58) |
| 30-min | 1.79 (1.63-1.97) | 2.17 (1.97-2.39) | 2.66 (2.41-2.93) | 3.02 (2.74-3.32) | 3.49 (3.14-3.84) | 3.84 (3.44-4.22) | 4.19 (3.73-4.62) | 4.53 (4.00-5.00) | 4.97 (4.33-5.53) | 5.30 (4.58-5.92) |
| 60-min | 1.11 (1.00-1.22) | 1.35 (1.23-1.48) | 1.69 (1.53-1.86) | 1.95 (1.76-2.14) | 2.30 (2.07-2.53) | 2.57 (2.30-2.83) | 2.85 (2.54-3.14) | 3.13 (2.76-3.45) | 3.51 (3.06-3.90) | 3.80 (3.29-4.25) |
| 2-hr | 0.684 (0.620-0.754) | 0.830 (0.753-0.916) | 1.05 (0.948-1.16) | 1.22 (1.10-1.34) | 1.45 (1.30-1.60) | 1.64 (1.47-1.81) | 1.84 (1.63-2.03) | 2.04 (1.79-2.26) | 2.32 (2.01-2.58) | 2.55 (2.18-2.85) |
| 3-hr | 0.508 (0.462-0.559) | 0.616 (0.561-0.680) | 0.778 (0.707-0.859) | 0.905 (0.821-0.999) | 1.08 (0.976-1.19) | 1.23 (1.10-1.35) | 1.38 (1.23-1.52) | 1.54 (1.35-1.70) | 1.76 (1.52-1.95) | 1.94 (1.66-2.16) |
| 6-hr | 0.330 (0.301-0.362) | 0.399 (0.365-0.439) | 0.501 (0.457-0.550) | 0.583 (0.530-0.639) | 0.698 (0.630-0.765) | 0.793 (0.712-0.869) | 0.892 (0.794-0.979) | 0.997 (0.879-1.10) | 1.15 (0.995-1.27) | 1.27 (1.09-1.41) |
| 12-hr | 0.202 (0.183-0.224) | 0.244 (0.222-0.271) | 0.308 (0.279-0.341) | 0.360 (0.325-0.398) | 0.435 (0.390-0.479) | 0.498 (0.443-0.549) | 0.565 (0.497-0.623) | 0.638 (0.555-0.705) | 0.742 (0.635-0.822) | 0.829 (0.699-0.922) |
| 24-hr | 0.114 (0.105-0.124) | 0.138 (0.127-0.150) | 0.175 (0.161-0.192) | 0.207 (0.190-0.226) | 0.255 (0.232-0.277) | 0.296 (0.267-0.321) | 0.340 (0.304-0.371) | 0.390 (0.345-0.425) | 0.464 (0.403-0.506) | 0.526 (0.451-0.577) |
| 2-day | 0.066 (0.061-0.073) | 0.080 (0.074-0.089) | 0.103 (0.094-0.113) | 0.121 (0.110-0.133) | 0.149 (0.134-0.164) | 0.173 (0.155-0.190) | 0.199 (0.176-0.219) | 0.228 (0.200-0.251) | 0.270 (0.233-0.300) | 0.306 (0.260-0.342) |
| 3-day | 0.047 (0.043-0.051) | 0.056 (0.052-0.062) | 0.072 (0.066-0.078) | 0.085 (0.078-0.092) | 0.104 (0.094-0.113) | 0.120 (0.108-0.130) | 0.137 (0.123-0.150) | 0.156 (0.139-0.171) | 0.185 (0.161-0.203) | 0.209 (0.179-0.231) |
| 4-day | 0.037 (0.034-0.040) | 0.044 (0.041-0.048) | 0.056 (0.052-0.061) | 0.066 (0.061-0.072) | 0.081 (0.074-0.088) | 0.093 (0.085-0.101) | 0.106 (0.096-0.115) | 0.121 (0.108-0.131) | 0.142 (0.125-0.155) | 0.160 (0.139-0.175) |
| 7-day | 0.025 (0.023-0.027) | 0.030 (0.028-0.032) | 0.037 (0.034-0.040) | 0.043 (0.040-0.046) | 0.052 (0.048-0.056) | 0.059 (0.054-0.064) | 0.067 (0.061-0.072) | 0.075 (0.068-0.081) | 0.087 (0.077-0.095) | 0.097 (0.085-0.106) |
| 10-day | 0.020 (0.018-0.021) | 0.024 (0.022-0.025) | 0.029 (0.027-0.031) | 0.033 (0.031-0.036) | 0.040 (0.037-0.043) | 0.045 (0.041-0.048) | 0.051 (0.046-0.054) | 0.057 (0.051-0.061) | 0.065 (0.058-0.070) | 0.072 (0.063-0.078) |
| 20-day | 0.013 (0.012-0.014) | 0.016 (0.015-0.017) | 0.019 (0.018-0.020) | 0.021 (0.020-0.023) | 0.025 (0.023-0.026) | 0.027 (0.025-0.029) | 0.030 (0.028-0.032) | 0.032 (0.030-0.035) | 0.036 (0.033-0.039) | 0.039 (0.035-0.042) |
| 30-day | 0.011 (0.010-0.012) | 0.013 (0.012-0.014) | 0.015 (0.014-0.016) | 0.017 (0.016-0.018) | 0.019 (0.018-0.021) | 0.021 (0.020-0.022) | 0.023 (0.021-0.024) | 0.024 (0.023-0.026) | 0.026 (0.024-0.028) | 0.028 (0.026-0.030) |
| 45-day | 0.009 (0.009-0.010) | 0.011 (0.010-0.012) | 0.013 (0.012-0.013) | 0.014 (0.013-0.015) | 0.016 (0.015-0.017) | 0.017 (0.016-0.018) | 0.018 (0.017-0.019) | 0.019 (0.018-0.021) | 0.021 (0.019-0.022) | 0.022 (0.020-0.024) |
| 60-day | 0.008 (0.008-0.009) | 0.010 (0.009-0.010) | 0.011 (0.011-0.012) | 0.012 (0.012-0.013) | 0.014 (0.013-0.015) | 0.015 (0.014-0.016) | 0.016 (0.015-0.017) | 0.017 (0.016-0.017) | 0.018 (0.016-0.019) | 0.018 (0.017-0.020) |

¹ Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS). Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values. Please refer to NOAA Atlas 14 document for more information.

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PF graphical

Table 5-3: Runoff Coefficients for the Rational Method

| Land Use | Description | Hydrologic Soils Group | | | | |
|--|---|------------------------|------|------|------|------|
| | | A | B | C | D | |
| Cultivated Land | without conservation treatment | 0.49 | 0.67 | 0.81 | 0.88 | |
| | with conservation treatment | 0.27 | 0.43 | 0.67 | 0.67 | |
| Pasture or Range Land Meadow | poor condition | 0.38 | 0.63 | 0.78 | 0.84 | |
| | good condition | --- | 0.25 | 0.51 | 0.65 | |
| | good condition | --- | --- | 0.41 | 0.61 | |
| Wood or Forest Land | thin stand, poor cover, no mulch | --- | 0.34 | 0.59 | 0.70 | |
| | good cover | --- | --- | 0.45 | 0.59 | |
| Open Spaces, Lawns, Parks, Golf Courses, Cemeteries | Good Condition | --- | 0.25 | 0.51 | 0.65 | |
| | Fair Condition | --- | 0.45 | 0.63 | 0.74 | |
| Commercial and Business Area | 85% impervious | 0.84 | 0.90 | 0.93 | 0.96 | |
| | Industrial Districts | 0.67 | 0.81 | 0.88 | 0.92 | |
| Residential Average Lot Size (acres) | average % impervious | | | | | |
| | 1/8 | 65 | 0.59 | 0.76 | 0.86 | 0.90 |
| | 1/4 | 38 | 0.29 | 0.55 | 0.70 | 0.80 |
| | 1/3 | 30 | --- | 0.49 | 0.67 | 0.78 |
| | 1/2 | 25 | --- | 0.45 | 0.65 | 0.76 |
| | 1 | 20 | --- | 0.41 | 0.63 | 0.74 |
| Paved Areas | parking lots, roofs, driveways, etc. | 0.99 | 0.99 | 0.99 | 0.99 | |
| Streets and Roads | paved with curbs & storm sewers | 0.99 | 0.99 | 0.99 | 0.99 | |
| | gravel | 0.57 | 0.76 | 0.84 | 0.88 | |
| | dirt | 0.49 | 0.69 | 0.80 | 0.84 | |

Source: New Jersey Department of Environmental Protection, Land Use Management Program. 1988. Technical Manual for Land Use Regulation Program, Bureau of Inland and Coastal Regulations, NJDEP Flood Hazard Area Permits.

Drainage Area Size and Land Cover Limitations

As previously mentioned on Page 9, there are some basic assumptions when applying the Rational Method. The maximum size limit for a drainage area is 20 ac. The drainage area must also have homogeneous land cover and topography, meaning the same runoff coefficient and slope apply to the entire drainage area. Furthermore, the rainfall distribution on a drainage area is assumed to be uniform over the entire drainage area.

NEW JERSEY 24 HOUR RAINFALL FREQUENCY DATA

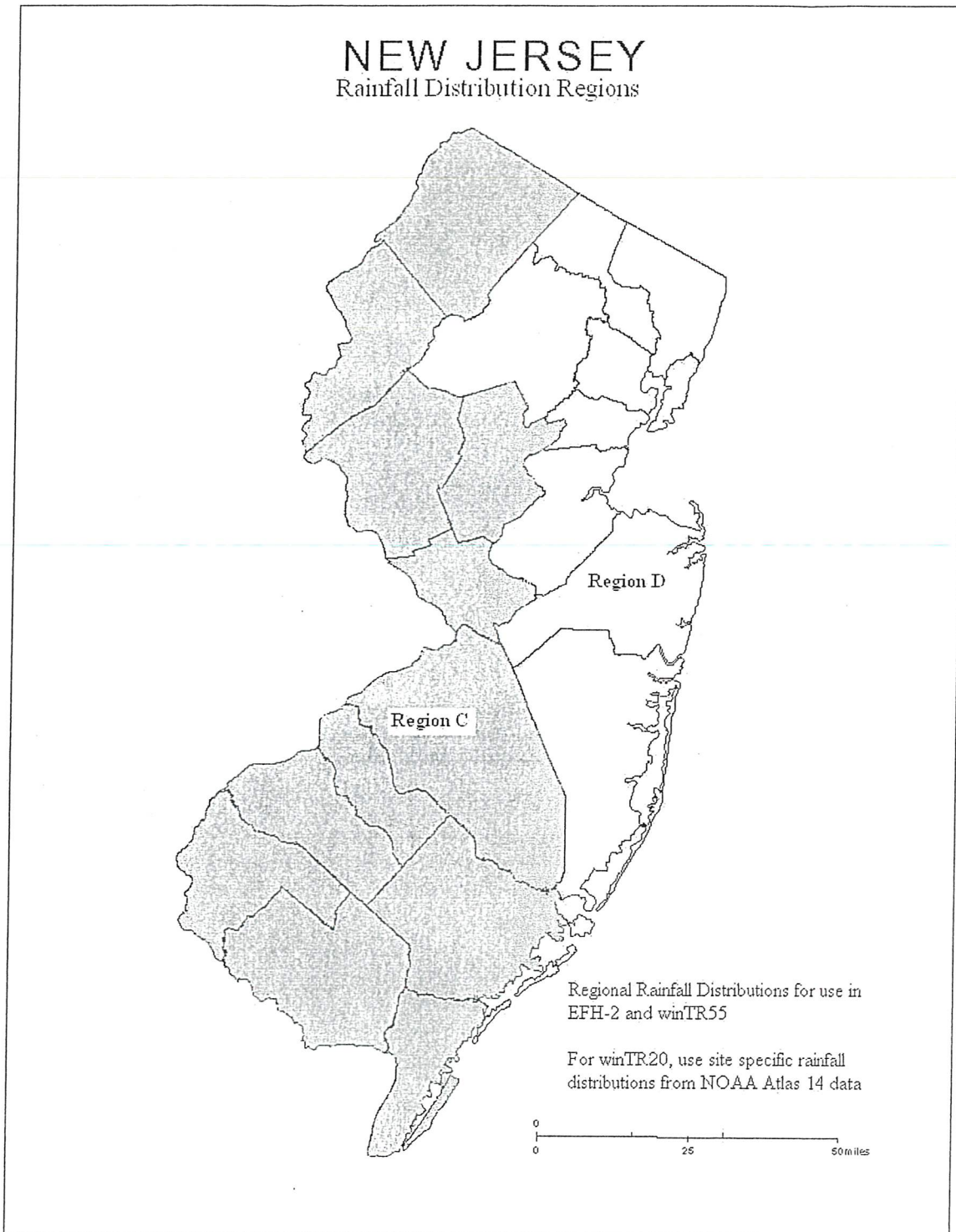
Rainfall amounts in Inches

| County | 1 year | 2 year | 5 year | 10 year | 25 year | 50 year | 100 year |
|------------|--------|--------|--------|---------|---------|---------|----------|
| Atlantic | 2.72 | 3.31 | 4.30 | 5.16 | 6.46 | 7.61 | 8.90 |
| Bergen | 2.75 | 3.34 | 4.27 | 5.07 | 6.28 | 7.32 | 8.47 |
| Burlington | 2.77 | 3.36 | 4.34 | 5.18 | 6.45 | 7.56 | 8.81 |
| Camden | 2.73 | 3.31 | 4.25 | 5.06 | 6.28 | 7.34 | 8.52 |
| Cape May | 2.67 | 3.25 | 4.22 | 5.07 | 6.34 | 7.47 | 8.73 |
| Cumberland | 2.69 | 3.27 | 4.25 | 5.09 | 6.37 | 7.49 | 8.76 |
| Essex | 2.85 | 3.44 | 4.40 | 5.22 | 6.44 | 7.49 | 8.66 |
| Gloucester | 2.71 | 3.29 | 4.24 | 5.05 | 6.29 | 7.36 | 8.55 |
| Hudson | 2.73 | 3.31 | 4.23 | 5.02 | 6.19 | 7.20 | 8.31 |
| Hunterdon | 2.80 | 3.38 | 4.26 | 5.00 | 6.09 | 7.02 | 8.03 |
| Mercer | 2.74 | 3.31 | 4.23 | 5.01 | 6.19 | 7.20 | 8.33 |
| Middlesex | 2.76 | 3.35 | 4.30 | 5.12 | 6.36 | 7.43 | 8.63 |
| Monmouth | 2.79 | 3.38 | 4.38 | 5.23 | 6.53 | 7.66 | 8.94 |
| Morris | 2.94 | 3.54 | 4.47 | 5.24 | 6.37 | 7.32 | 8.35 |
| Ocean | 2.81 | 3.42 | 4.45 | 5.33 | 6.68 | 7.87 | 9.20 |
| Passaic | 2.87 | 3.47 | 4.42 | 5.23 | 6.43 | 7.47 | 8.62 |
| Salem | 2.69 | 3.26 | 4.20 | 5.00 | 6.22 | 7.28 | 8.45 |
| Somerset | 2.76 | 3.34 | 4.25 | 5.01 | 6.15 | 7.13 | 8.21 |
| Sussex | 2.68 | 3.22 | 4.02 | 4.70 | 5.72 | 6.60 | 7.58 |
| Union | 2.80 | 3.39 | 4.35 | 5.17 | 6.42 | 7.49 | 8.69 |
| Warren | 2.78 | 3.34 | 4.18 | 4.89 | 5.93 | 6.83 | 7.82 |

Notes: The average point rainfall amounts listed above were developed from data contained in NOAA Atlas 14 Volume 2.

Point rainfall estimates for specific locations may be obtained from the Precipitation Frequency Data Server located at <http://www.nws.noaa.gov/ohd/hdsc/>

For most hydrologic design procedures, the rainfall amounts listed above may be rounded to the nearest tenth of an inch.



Time Of Concentration Worksheet

Sheet Flow

- 1 Surface description
- 2 Manning's roughness Coeff. N
- 3 Flow Length, L
- 4 2 yr, 24 hr Rainfall, P₂
- 5 Land Slope, S
- 6 $T_t = 0.007 (nL)0.8 / P_2^{0.5} S^{0.4}$

Existing Conditions:
To South Line

| | |
|-------------|-------------|
| A-B | Segment ID |
| Dense Grass | (table 3-1) |
| 0.24 | (table 3-1) |
| 100 | ft |
| 3.3 | in. |
| 0.01 | ft/ft |
| Tt = 0.309 | hr |

Shallow Concentrated Flow

- 7 Surface Description (Paved or Unpaved)
- 8 Flow Length, L
- 9 Watercourse Slope, S
- 10 Average Velocity, V
- 11 $T_t = L / 3600 V$

| | |
|------------|-----------------|
| B-C | Segment ID |
| UnPaved | |
| 90 | ft |
| 0.010 | ft/ft |
| 1.6 | fps(Figure 3-1) |
| Tt = 0.016 | hr |

Pipe Flow

- 12 Cross sectional flow area, A
- 13 Wetted perimeter, P_w
- 14 Hydraulic Radius, R = A/P_w
- 15 Slope, S
- 16 Manning's Coef., n
- 17 Velocity V = $1.49 R^{2/3} S^{1/2} / n$
- 18 Flow Length, L
- 19 $T_t = L / 3600 V$

| | |
|------------|----------|
| Segment ID | C-D |
| | 1.23 |
| | 3.93 |
| | 0.31 |
| | 0.05 |
| | 0.013 |
| | 11.8 |
| | 330 |
| | 0.008 hr |

20 Total Tc

0.33 hrs 20 min

Pipe Flow

- Area, A = πR^2
- $P_w = 2\pi R$
- R = A/P_w
- $V = (1.49 R^{2/3} S^{1/2}) / n$
- $T_t = L / (3600 * V)$

| Dia | Area | P _w | R | Slope | n | V |
|-----|------|----------------|------|-------|-------|------|
| 15 | 1.23 | 3.93 | 0.31 | 0.05 | 0.013 | 11.8 |

Assume 20 min To South Line

Assume 6 min To North Line

Time Of Concentration Worksheet

Proposed Conditions: - System #1

Sheet Flow

- 1 Surface description
- 2 Manning's roughness Coeff. N
- 3 Flow Length, L
- 4 2 yr, 24 hr Rainfall, P₂
- 5 Land Slope, S
- 6 $T_t = 0.007 (nL)0.8 / P_2^{0.5} S^{0.4}$

| | |
|-------------|-------------|
| A-B | Segment ID |
| Dense Grass | (table 3-1) |
| 0.24 | (table 3-1) |
| 42 | ft |
| 3.3 | in. |
| 0.01 | ft/ft |
| Tt = 0.154 | hr |

Max Sheet Flow (McCuen - Spiess Limitation)

$Max. L = (100\sqrt{S}) / N$
 $Max. L = 42 \text{ ft.}$

Shallow Concentrated Flow

- 7 Surface Description (Paved or Unpaved)
- 8 Flow Length, L
- 9 Watercourse Slope, S
- 10 Average Velocity, V
- 11 $T_t = L / 3600 V$

| | |
|------------|-----------------|
| B-C | Segment ID |
| Paved | |
| 75 | ft |
| 0.040 | ft/ft |
| 4 | fps(Figure 3-1) |
| Tt = 0.005 | hr |

Pipe Flow

- 12 Cross sectional flow area, A
- 13 Wetted perimeter, Pw
- 14 Hydraulic Radius, R = A/Pw
- 15 Slope, S
- 16 Manning's Coef., n
- 17 Velocity $V = 1.49 R^{2/3} S^{1/2} / n$
- 18 Flow Length, L
- 19 $T_t = L / 3600 V$

| | |
|------------|-------|
| Segment ID | C-D |
| | 1.23 |
| | 3.93 |
| | 0.31 |
| | 0.02 |
| | 0.013 |
| | 7.4 |
| | 150 |
| | 0.006 |
| | hr |

20 Total Tc

0.17 hrs **10** min

Pipe Flow

- Area, $A = \pi R^2$
- $P_w = 2\pi R$
- $R = A/P_w$
- $V = (1.49R^{2/3}S^{1/2})/n$
- $T_t = L / (3600*V)$

| Dia | Area | Pw | R | Slope | n | V |
|-----|------|------|------|-------|-------|-----|
| 15 | 1.23 | 3.93 | 0.31 | 0.02 | 0.013 | 7.4 |

Assume 10 min

Time Of Concentration Worksheet

Proposed Conditions: - System #2

Sheet Flow

- 1 Surface description
- 2 Manning's roughness Coeff. N
- 3 Flow Length, L
- 4 2 yr, 24 hr Rainfall, P₂
- 5 Land Slope, S
- 6 Tt = 0.007 (nL)^{0.8} / P₂^{0.5} S^{0.4}

| | | | |
|------|-------------|-------------|----------|
| | A-B | Segment ID | |
| | Dense Grass | (table 3-1) | |
| | 0.24 | (table 3-1) | |
| | 55 | ft | |
| | 3.3 | in. | |
| | 0.03 | ft/ft | |
| Tt = | 0.123 | hr | 7 |

Max Sheet Flow (McCuen - Spiess Limitation)

Max. L = (100√S) / N

Max. L = 72 ft.

Assume 7 min

Time Of Concentration Worksheet

Proposed Conditions: - BYPASS

Sheet Flow

- 1 Surface description
- 2 Manning's roughness Coeff. N
- 3 Flow Length, L
- 4 2 yr, 24 hr Rainfall, P₂
- 5 Land Slope, S
- 6 $Tt = 0.007 (nL)^{0.8} / P_2^{0.5} S^{0.4}$

| | |
|-------------|-------------|
| A-B | Segment ID |
| Dense Grass | (table 3-1) |
| 0.24 | (table 3-1) |
| 70 | ft |
| 3.3 | in. |
| 0.03 | ft/ft |
| Tt = 0.150 | hr |

Max Sheet Flow (McCuen - Spiess Limitation)

Max. L = (100√S) / N

Max. L = 72 ft.

Shallow Concentrated Flow

- 7 Surface Description (Paved or Unpaved)
- 8 Flow Length, L
- 9 Watercourse Slope, S
- 10 Average Velocity, V
- 11 $Tt = L / 3600 V$

| | |
|------------|-----------------|
| B-C | Segment ID |
| UnPaved | |
| 120 | ft |
| 0.040 | ft/ft |
| 4 | fps(Figure 3-1) |
| Tt = 0.008 | hr |

Total Tc

0.16 hrs 9.5 min

Assume 10 min To South Line

Time Of Concentration Worksheet

To Lot 7 - Exist / Proposed

Sheet Flow

- 1 Surface description
- 2 Manning's roughness Coeff. N
- 3 Flow Length, L
- 4 2 yr, 24 hr Rainfall, P₂
- 5 Land Slope, S
- 6 $T_t = 0.007 (nL)^{0.8} / P_2^{0.5} S^{0.4}$

| | |
|-------------|-------------|
| A-B | Segment ID |
| Dense Grass | (table 3-1) |
| 0.24 | (table 3-1) |
| 100 | ft |
| 3.3 | in. |
| 0.04 | ft/ft |
| Tt = 0.177 | hr |

Shallow Concentrated Flow

- 7 Surface Description (Paved or Unpaved)
- 8 Flow Length, L
- 9 Watercourse Slope, S
- 10 Average Velocity, V
- 11 $T_t = L / 3600 V$

| | |
|------------|-----------------|
| B-C | Segment ID |
| UnPaved | |
| 70 | ft |
| 0.030 | ft/ft |
| 2.8 | fps(Figure 3-1) |
| Tt = 0.007 | hr |

| | |
|------------|-----------------|
| B-C | Segment ID |
| UnPaved | |
| 30 | ft |
| 0.030 | ft/ft |
| 3.5 | fps(Figure 3-1) |
| Tt = 0.002 | hr |

Channel Flow

- 12 Cross sectional flow area, A
- 13 Wetted perimeter, Pw
- 14 Hydraulic Radius, R = A/Pw
- 15 Slope, S
- 16 Manning's Coef., n
- 17 Velocity $V = 1.49 R^{2/3} S^{1/2} / n$
- 18 Flow Length, L
- 19 $T_t = L / 3600 V$

| | |
|------------|-----|
| Segment ID | C-D |
| 0.78 | |
| 3.54 | |
| 0.22 | |
| 0.05 | |
| 0.035 | |
| 2.4 | |
| 70 | |
| 0.008 | hr |

20 Total Tc

0.19 hrs **12** min

Assume 12 min To Lot 7

Open Channel

Flow depth = 0.25 ft.
 Channel Width Bot Width B = 3 ft.
 Slope S = 2.50% approx
 Z1 = 0.4 :1
 Z2 = 0.4 :1
 Manning's n = 0.035

WP = 3.53852 sf
 Flow Area A = 1 sf
 Hyd. Radius = 0.21902
 Flow Q = 1.90 cfs
 Velocity V = 2.446 ft/sec

$Q = (1.49/n) * A R^{2/3} S^{1/2}$
 $R = A/WP$
 $WP = B + ((dz1)^2 + d^2)^{1/2} + ((dZ2)^2 + d^2)^{1/2}$
 $A = d(B + d/2(Z1 + Z2))$
 $V = Q/A$
 Z1 = side Slope Lf side
 Z2 = side Slope Rt side

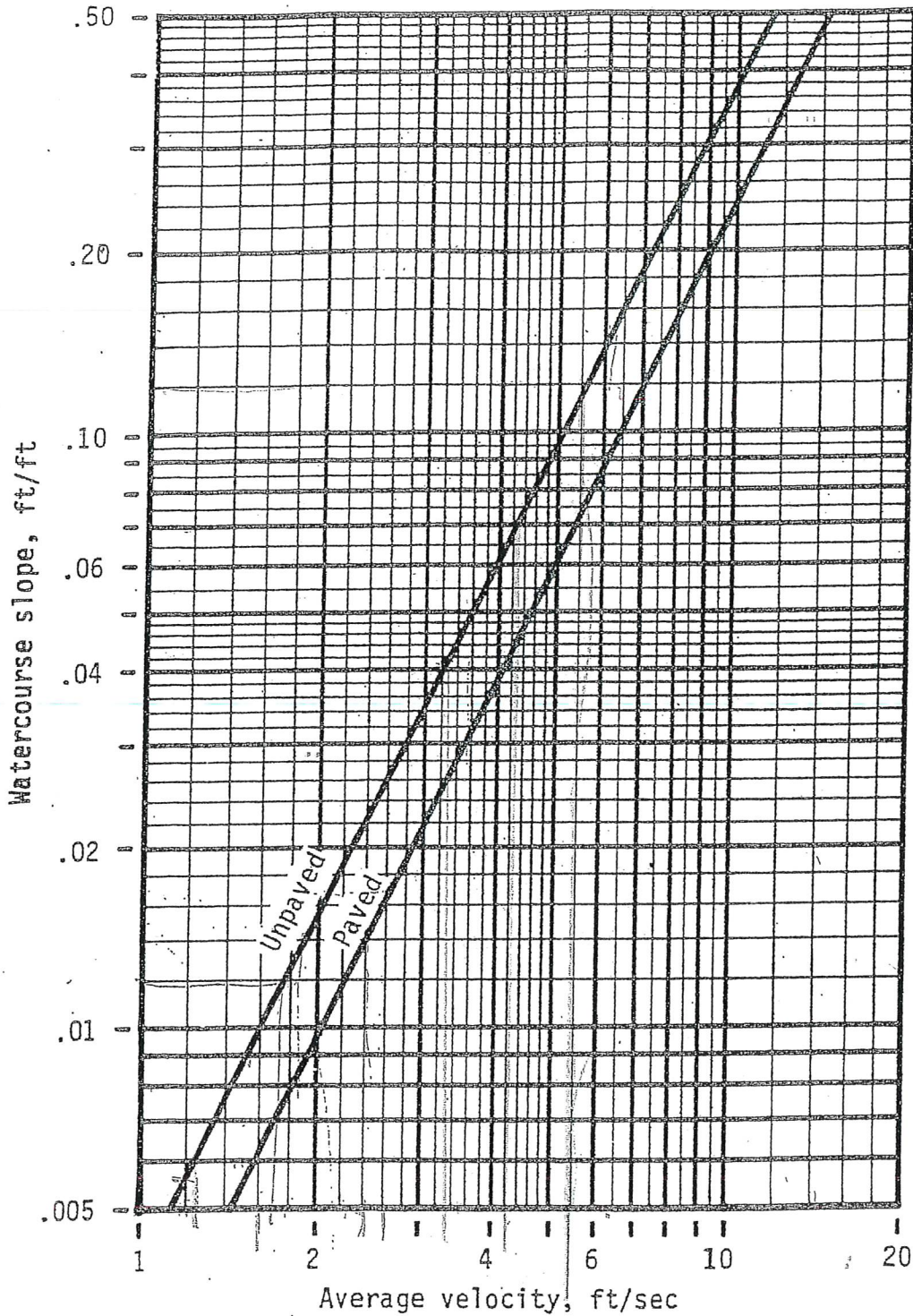


Table 3-1.—Roughness coefficients (Manning's n) for sheet flow

| Surface description | n^1 |
|---|-------|
| Smooth surfaces (concrete, asphalt, gravel, or bare soil) | 0.01 |
| Fallow (no residue) | 0.05 |
| Cultivated soils: | |
| Residue cover $\leq 20\%$ | 0.06 |
| Residue cover $> 20\%$ | 0.17 |
| Grass: | |
| Short grass prairie | 0.15 |
| Dense grasses ² | 0.24 |
| Bermudagrass | 0.41 |
| Range (natural) | 0.13 |
| Woods: ³ | |
| Light underbrush | 0.40 |
| Dense underbrush | 0.80 |

¹The n values are a composite of information compiled by Enggr (1986).

²Includes species such as weeping lovegrass, bluegrass, buffalo grass, blue grama grass, and native grass mixtures.

³When selecting n , consider cover to a height of about 0.1 ft. It is the only part of the plant cover that will obstruct sheet flow.

Figure 3-1.—Average velocities for estimating travel time for shallow concentrated flow.

Water Quality Summary

NJAC 7:8-5.5 Stormwater runoff quality standards

Eighty percent TSS removal of the anticipated load, expressed as an annual average shall be achieved for the stormwater runoff from the net increase of motor vehicle surface.

| | | |
|-----------------------------|------|--------------------|
| Proposed Traffic Areas = | 1.62 | ac. (parking lots) |
| Existing Traffic Areas = | 0.97 | ac. (parking lots) |
| Increase in Imp. coverage = | 0.65 | ac. |

% TSS Removal Required:

| | Area ac. | Required TSS Removal % | Wt. Average Area x % |
|---------------------------|-------------|---------------------------|-------------------------|
| Increase in Imp. coverage | 0.65 | 80% | 0.52 |

% TSS Removal Proposed:

| | NJDEP Req'd % | Proposed Area Ac. | Area x % |
|----------------------------|------------------|----------------------|----------|
| Pavement / Porous Pavement | 80% | 0.88 | 0.70 |
| Filterra #1 | 80% | 0.15 | 0.12 |
| Filterra #2 | 80% | 0.06 | 0.05 |
| Bypass Treatment | 0% | 0.53 | 0.00 |
| | Total = | 1.62 | 0.87 |

Weighted Average:

| | Area x % |
|----------|---------------|
| Required | 0.52 |
| Proposed | 0.87 |
| | Prop. > Req'd |

Water Quality Summary

| AREA I.D. | Pavement Area Ac. | Qwq cfs |
|--|----------------------|--------------------------|
| Porous Pavement | | |
| Pavement To Porous Pav't | 0.56 | |
| Area of Porous Pavement | 0.32 | (80% TSS Remov.) |
| Ratio: | 1.75 | : 1 |
| <i>(See Porous Pavement Calculations)</i> | | |
| Green Infrastructure Filters - NJDEP Approved Filters | | |
| Filtterra Filter # 1 | 0.15 | 0.44 (80% TSS Remov.) |
| Filtterra Filter # 2 | 0.07 | 0.20 |
| <i>(See Hydro-CAD WQ Calculations)</i> | | |

| Contech Engineering Solutions | | | | | |
|--|---------------------------------|---|--|--|--------------------------------|
| Filtterra HC Bioretention System | | | | | |
| NJDEP 80% TSS Removal | | | | | |
| <u>WQ Filter Sizing</u> | <u>Design 1yr</u> <u>cfs</u> | <u>NJDEP Approved</u> <u>Flow rate - cfs</u> | <u>Total Imp.</u> <u>Area to Filter</u> | <u>NJDEP Approved</u> <u>Treatment Area ac.</u> | <u>Pav't to</u> <u>Unit</u> |
| Filtterra Filter # 1 <i>(Model FT 1206 - 6 ft. x 12 ft.)</i> | 0.44 | 0.50 | 0.168 | 1.81 | 0.15 |
| Filtterra Filter # 2 <i>(Model FT 1206 - 4 ft. x 8 ft.)</i> | 0.20 | 0.24 | 0.075 | 0.024 | 0.07 |

Permeable Paver Design

AREA 1

| | | | | |
|----------------------|------------|-----------|--|---------|
| | Area | Area | <u>THE RATIONAL METHOD</u> | Q = CIA |
| Concrete / Macadam = | 5,900 sf. | 0.135 ac. | Q = Runoff | |
| Permeable pavement = | 4,870 sf. | 0.112 ac. | C = Flow Coef. (0.65 Pervious Area, 0.99 Impervious) | |
| Pervious Area = | 390 sf. | 0.009 ac. | I = Rainfall Intensities Taken from NOAA Database | |
| Total Area = | 11,160 sf. | 0.256 ac. | A = Area | |

Ratio: 1.2 : 1 (< 3 : 1 OK)
(Ratio of Pavement to Perm. Pavers)

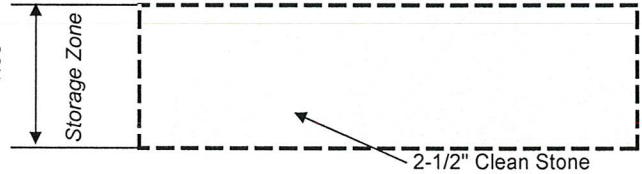
Permeable Paving Detail (nts)

Storage Volume Calculation:

Perm Paver Area = 4,870 sf.
Stone Depth = 1.33 ft.
Stone Volume = 6,477 cf.

Storage in Stone = 0.40 Voids Ratio x Stone Volume

Storage in Perm Pav't = 2591 cubic feet



Profile (nts)

WQ Storm Volume

lwq 0.625 in/hr
Td = 120 min.

| Area ID | Area Ac. | Imperv. Area Ac. | Perv. Area Ac. | C AVERAGE | CXA ACRES | Q _{wq} cfs |
|-------------------|----------|------------------|----------------|-----------|-----------|---------------------|
| Perm Pav't Area 1 | 0.256 | 0.247 | 0.009 | 0.98 | 0.251 | 0.157 |

Volume of storm: Area under Hydrograph = Required Storage
Required Storage = Q_{wq} x (Td) x 60
Required Storage = 1128 cf < 2591 cf - Prop. Storage

Note: Seepage Rate NOT accounted for in design!

AREA 2

| | | |
|----------------------|-----------|-----------|
| | Area | Area |
| Concrete / Macadam = | 7,680 sf. | 0.176 ac. |
| Permeable pavement = | 4,870 sf. | 0.112 ac. |
| Pervious Area = | 1,170 sf. | 0.027 ac. |
| Total Area = | 13720 sf. | 0.315 ac. |

Ratio: 1.6 : 1 (< 3 : 1 OK)
(Ratio of Pavement to Perm. Pavers)

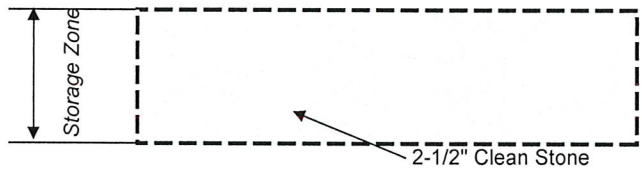
Permeable Paving Detail (nts)

Storage Volume Calculation:

Perm Paver Area = 4,870 sf.
Stone Depth = 1.33 ft.
Stone Volume = 6,477 cf.

Storage in Stone = 0.40 Voids Ratio x Stone Volume

Storage in Perm Pav't = 2591 cubic feet



Profile (nts)

WQ Storm Volume

lwq 0.625 in/hr
Td = 120 min.

| Area ID | Area Ac. | Imperv. Area Ac. | Perv. Area Ac. | C AVERAGE | CXA ACRES | Q _{wq} cfs |
|-------------------|----------|------------------|----------------|-----------|-----------|---------------------|
| Perm Pav't Area 1 | 0.315 | 0.288 | 0.027 | 0.96 | 0.303 | 0.189 |

Volume of storm: Area under Hydrograph = Required Storage
Required Storage = Q_{wq} x (Td) x 60
Required Storage = 1362 cf < 2591 cf - Prop. Storage

Note: Seepage Rate NOT accounted for in design!

Permeable Paver Design

AREA 3

| | | | | |
|----------------------|-----------|-----------|--|---------|
| | Area | Area | <u>THE RATIONAL METHOD</u> | Q = CIA |
| Concrete / Macadam = | 5,350 sf. | 0.123 ac. | Q = Runoff | |
| Permeable pavement = | 1,800 sf. | 0.041 ac. | C = Flow Coef. (0.65 Pervious Area, 0.99 Impervious) | |
| Pervious Area = | 180 sf. | 0.004 ac. | I = Rainfall Intensities Taken from NOAA Database | |
| Total Area = | 7330 sf. | 0.168 ac. | A = Area | |

Ratio: 2.97 : 1 (< 3 : 1 OK)
(Ratio of Pavement to Perm. Pavers)

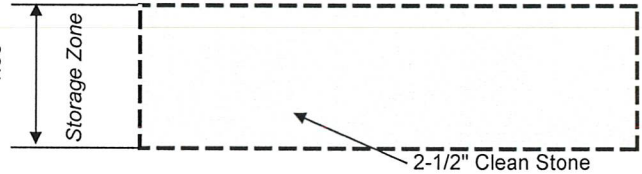
Permeable Paving Detail (nts)

Storage Volume Calculation:

| | |
|-------------------|-----------|
| Perm Paver Area = | 1,800 sf. |
| Stone Depth = | 1.33 ft. |
| Stone Volume = | 2,394 cf. |

Storage in Stone 0.40 Voids Ratio x Stone Volume

Storage in Perm Pav't = 958 cubic feet



Profile (nts)

WQ Storm Volume

lwq 0.625 in/hr
Td = 120 min.

| Area ID | Area Ac. | Imperv. Area Ac. | Perv. Area Ac. | C AVERAGE | CXA ACRES | Q _{wq} cfs |
|-------------------|----------|------------------|----------------|-----------|-----------|---------------------|
| Perm Pav't Area 4 | 0.168 | 0.164 | 0.004 | 0.98 | 0.165 | 0.103 |

Volume of storm: Area under Hydrograph = Required Storage
Required Storage = Q_{wq} x (Td) x 60
Required Storage = 743 cf < 958 cf - Prop. Storage

Note: Seepage Rate NOT accounted for in design!

AREA 4

| | | |
|----------------------|-----------|-----------|
| | Area | Area |
| Concrete / Macadam = | 6,900 sf. | 0.158 ac. |
| Permeable pavement = | 2,430 sf. | 0.056 ac. |
| Pervious Area = | 390 sf. | 0.009 ac. |
| Total Area = | 9720 sf. | 0.223 ac. |

Ratio: 2.84 : 1 (< 3 : 1 OK)
(Ratio of Pavement to Perm. Pavers)

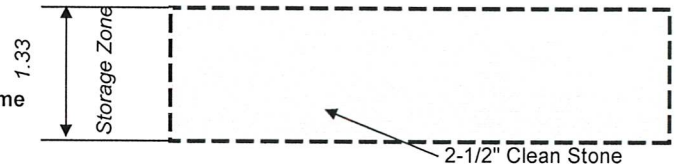
Permeable Paving Detail (nts)

Storage Volume Calculation:

| | |
|-------------------|-----------|
| Perm Paver Area = | 2,430 sf. |
| Stone Depth = | 1.33 ft. |
| Stone Volume = | 3,232 cf. |

Storage in Stone 0.40 Voids Ratio x Stone Volume

Storage in Perm Pav't = 1293 cubic feet



Profile (nts)

WQ Storm Volume

lwq 0.625 in/hr
Td = 120 min.

| Area ID | Area Ac. | Imperv. Area Ac. | Perv. Area Ac. | C AVERAGE | CXA ACRES | Q _{wq} cfs |
|-------------------|----------|------------------|----------------|-----------|-----------|---------------------|
| Perm Pav't Area 5 | 0.223 | 0.214 | 0.009 | 0.98 | 0.218 | 0.136 |

Volume of storm: Area under Hydrograph = Required Storage
Required Storage = Q_{wq} x (Td) x 60
Required Storage = 980 cf < 1293 cf - Prop. Storage

Note: Seepage Rate NOT accounted for in design!



State of New Jersey

DEPARTMENT OF ENVIRONMENTAL PROTECTION

DIVISION OF WATER QUALITY
Bureau of Stormwater Permitting
401 East State Street
P.O. Box 420 Mail Code 401-02B
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www.nj.gov/dep/dwq/bnpc_home.htm

PHILIP D. MURPHY
Governor

SHEILA Y. OLIVER
Lt. Governor

SHAWN M. LATOURETTE
Acting Commissioner

February 12, 2021

Derek M. Berg
Director – Stormwater Regulatory Management - East
Contech Engineered Solutions LLC
71 US Route 1, Suite F
Scarborough, ME 04074

Re: MTD Lab Certification
Filterra® HC Bioretention System
Off-line Installation Approved

TSS Removal Rate 80%

Dear Mr. Berg:

The Stormwater Management rules under N.J.A.C. 7:8-5.5(b) and 5.7(c) allow the use of manufactured treatment devices (MTDs) for compliance with the design and performance standards at N.J.A.C. 7:8-5 if the pollutant removal rates have been verified by the New Jersey Corporation for Advanced Technology (NJCAT) and have been certified by the New Jersey Department of Environmental Protection (NJDEP). Contech Engineered Solutions LLC has requested a Laboratory Certification for the Filterra® HC Bioretention System (Filterra® HC.)

The project falls under the “Procedure for Obtaining Verification of a Stormwater Manufactured Treatment Device from New Jersey Corporation for Advance Technology” dated January 25, 2013. The applicable protocol is the “New Jersey Department of Environmental Protection Laboratory Protocol to Assess Total Suspended Solids Removal by a Filtration Manufactured Treatment Device” dated January 25, 2013.

NJCAT verification documents submitted to the NJDEP indicate that the requirements of the aforementioned protocol have been met or exceeded. The NJCAT letter also included a recommended certification TSS removal rate and the required maintenance plan. The NJCAT Verification Report with the Verification Appendix (dated January 2021) for this device is published online at http://www.njcat.org/uploads/newDocs/NJCATFilterraTechnologyVerificationReportFinal_.pdf.

The NJDEP certifies the use of the Filterra® HC stormwater treatment unit by Contech Engineered Solutions LLC at a TSS removal rate of 80% when designed, operated, and maintained in accordance with the information provided in the Verification Appendix and the following conditions:

1. The maximum treatment flow rate (MTFR) for the manufactured treatment device (MTD) is calculated using the New Jersey Water Quality Design Storm (1.25 inches in 2 hrs) in N.J.A.C. 7:8-5.5. The MTFR is calculated based on a verified loading rate of 3.12 gpm/ft² of effective filtration treatment area.
2. The Filterra® HC stormwater treatment unit shall be installed using the same configuration reviewed by NJCAT, and sized in accordance with the criteria specified in item 7 below.
3. This device cannot be used in series with another MTD or a media filter (such as a sand filter) to achieve an enhanced removal rate for total suspended solids (TSS) removal under N.J.A.C. 7:8-5.5.
4. Additional design criteria for MTDs can be found in the New Jersey Stormwater Best Management Practices (NJ Stormwater BMP) Manual, which can be found online at www.njstormwater.org.
5. The maintenance plan for a site using this device shall incorporate, at a minimum, the maintenance requirements for the Filterra® HC. A copy of the maintenance plan is attached to this certification. However, it is recommended to review the maintenance website at <https://www.conteches.com/Portals/0/Documents/Maintenance%20Guides/Filterra%20HC%20OM%20Packet.pdf> for any changes to the maintenance requirements.
6. For an MTD to be considered “green infrastructure” (GI) in accordance with the March 2, 2020 amendments to the Stormwater Management rules at N.J.A.C. 7:8, the MTD must meet the GI definition noted at amended N.J.A.C. 7:8-1.2. Specifically, the MTD shall (1) treat stormwater runoff through infiltration into subsoil; and/or (2) treat stormwater runoff through filtration by vegetation or soil; or (3) store stormwater runoff for reuse.

The Filterra® HC filters stormwater runoff through an engineered biofiltration soil media and, thus, meets the definition of GI. Filterra® HC can be configured with or without a precast vault. Installations that will not include a precast vault will additionally need to comply the NJDEP Stormwater BMP Manual conditions regarding separation from the seasonal high water table and, if infiltration is proposed as an outlet, minimum vertical saturated hydraulic conductivity of the subsoil. Installations without a precast vault that do not rely on infiltration are required to maintain at least a one-foot separation from the seasonal high water table measured from the lowest point of the system. Installations without a precast vault that utilize infiltration are required to have the most hydraulically restrictive soil layer below the MTD meet the minimum tested vertical saturated hydraulic conductivity of one inch per hour and have at least two feet of separation from the seasonal high water table measured from the lowest point of the system.

7. Sizing Requirement:

The example below demonstrates the sizing procedure for the Filterra® HC:

Example: A 0.25-acre impervious site is to be treated to 80% TSS removal using the Filterra® HC. The impervious site runoff (Q) based on the New Jersey Water Quality Design Storm was determined to be 0.79 cfs.

The selection of the appropriate model of Filterra® HC is based upon both the maximum inflow drainage area and the MTFR. It is necessary to calculate the required model using both methods and to use the largest model determined by the two methods.

Inflow Drainage Area Evaluation:

The drainage area to the Filterra® HC in this example is 0.25 acres. Included in Table 1 below, all of the Filterra® HC models are designed with a maximum allowable drainage area greater than 0.25 acres. Specifically, the Filterra® HC with a 4'x4' media bay and a maximum allowable drainage area of 0.40 acres would be the smallest model able to treat runoff without exceeding the maximum allowable drainage area.

Maximum Treatment Flow Rate (MTFR) Evaluation:

The site runoff (Q) was based on the following:

time of concentration = 10 minutes

$i = 3.2$ in/hr (page 5-8, Fig. 5-3 of the NJ Stormwater BMP Manual)

$c = 0.99$ (runoff coefficient for impervious)

$Q = ciA = 0.99 \times 3.2 \times 0.25 = 0.79$ cfs

Given the site runoff is 0.79 cfs and based on the MTFR's listed in Table 1 below, the Filterra® HC with a 16'x8' media bay and an MTFR of 0.889 cfs would be the smallest model that could be used to treat the impervious area without exceeding the MTFR. If using more than one unit for treating runoff, the units should be configured such that the flowrate to each unit does not exceed the design MTFR for each unit and ensuring the entire 0.25 acre area is treated.

The MTFR evaluation results will be used since that method results in the highest minimum configuration determined by the two methods.

The sizing table corresponding to the available system models is noted below:

Table 1. Filterra® HC MTFRs and Maximum Allowable Drainage Areas

| | Available Filterra® Media Bay Sizes (feet) | Effective Filtration Treatment Area (ft ²) | Treatment Flow Rate (cfs) | Maximum Allowable Drainage Area (ac) |
|--|--|--|--|---|
| Standard Configuration Filtrerra and Filterra Bioscape Vaults | 4x4 | 16 | 0.111 | 0.40 |
| | 4x6 or 6x4 | 24 | 0.167 | 0.60 |
| | 4.5x7.83 or 7.83x4.5 (Nominal 4x8 8x4) | 35.24 | 0.245 | 0.89 |
| | 6x6 | 36 | 0.250 | 0.91 |
| | 6x8 or 8x6 | 48 | 0.333 | 1.21 |
| | 6x10 or 10x6 | 60 | 0.417 | 1.51 |
| | 6x12 or 12x6 | 72 | 0.500 | 1.81 |
| | 7x13 or 13x7 | 91 | 0.632 | 2.29 |
| | 14x8 | 112 | 0.778 | 2.82 |
| | 16x8 | 128 | 0.889 | 3.22 |
| | 18x8 | 144 | 1.000 | 3.62 |
| | 20x8 | 160 | 1.111 | 4.03 |
| | 22x8 | 176 | 1.222 | 4.43 |
| Peak Diversion Filtrerra Vaults | 4x4 | 16 | 0.111 | 0.40 |
| | 4.5x5.83 (Nominal 4x6) | 26.24 | 0.182 | 0.66 |
| | 6x4 | 24 | 0.167 | 0.60 |
| | 6x6 | 36 | 0.250 | 0.91 |
| | 6x8 | 48 | 0.333 | 1.21 |
| | 6x10 or 10x6 | 60 | 0.417 | 1.51 |
| | 7x10 | 70 | 0.486 | 1.76 |
| | 8x10.5 | 84 | 0.583 | 2.11 |
| | 8x12.5 | 100 | 0.694 | 2.52 |
| | Custom and/or Filterra Bioscape | Media Area in ft ² | 0.00694 * (Media Area in ft ²) | 0.0252 * (Media Area in ft ²) |

Be advised a detailed maintenance plan is mandatory for any project with a Stormwater BMP subject to the Stormwater Management rules, N.J.A.C. 7:8. The plan must include all of the items identified in the Stormwater Management rules, N.J.A.C. 7:8-5.8. Such items include, but are not limited to, the list of inspection and maintenance equipment and tools, specific corrective and preventative maintenance tasks, indication of problems in the system, and training of maintenance personnel. Additional information can be found in Chapter 8: Maintenance and Retrofit of Stormwater Management Measures.

If you have any questions regarding the above information, please contact me at (609) 633-7021.

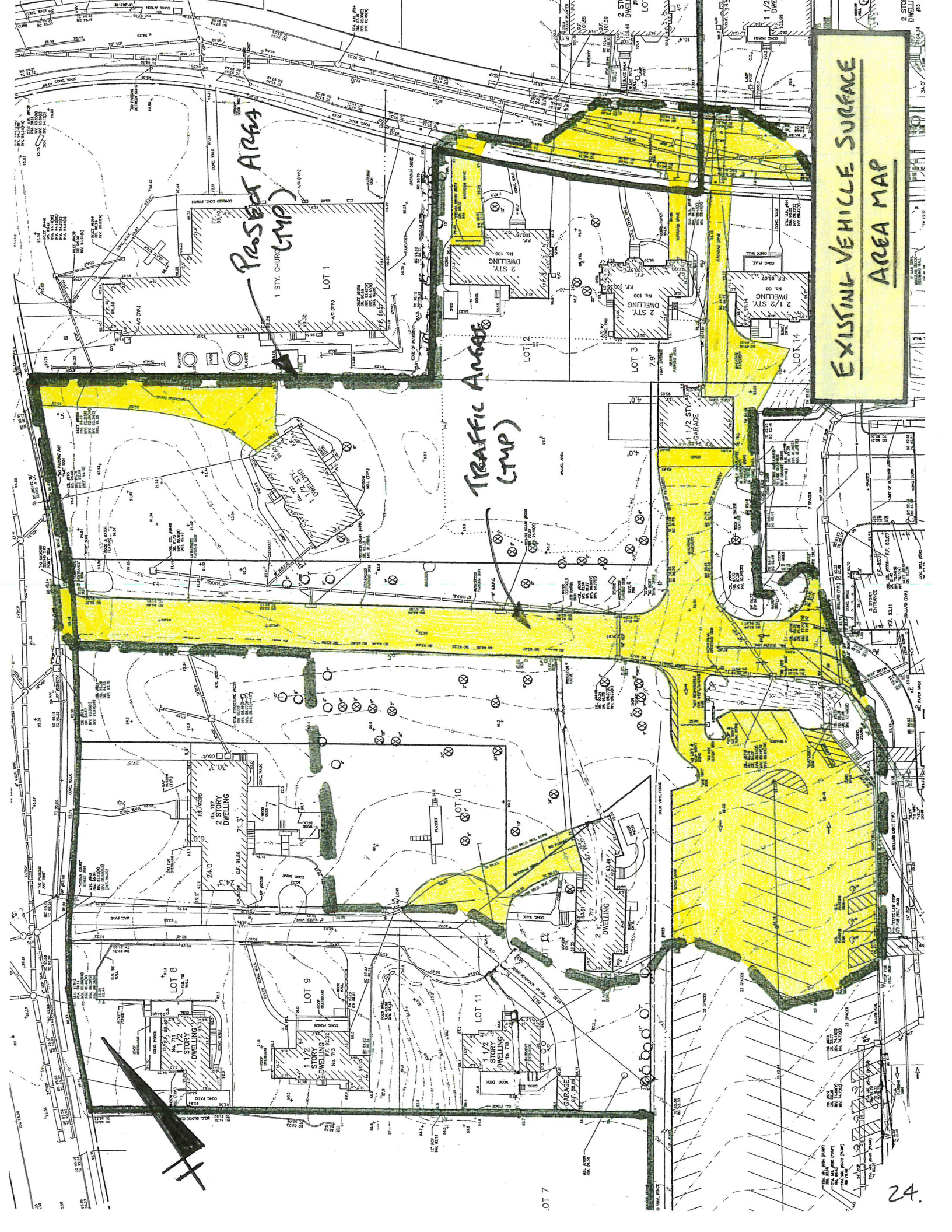
Sincerely,



Gabriel Mahon, Chief
Bureau of Stormwater Permitting

Attachment: Maintenance Plan

cc: Chron File
Richard Magee, NJCAT
Vince Mazzei, NJDEP – Water & Land Management
Nancy Kempel, NJDEP– BSTP
Keith Stampfel, NJDEP – DLRP
Dennis Contois, NJDEP – DLRP

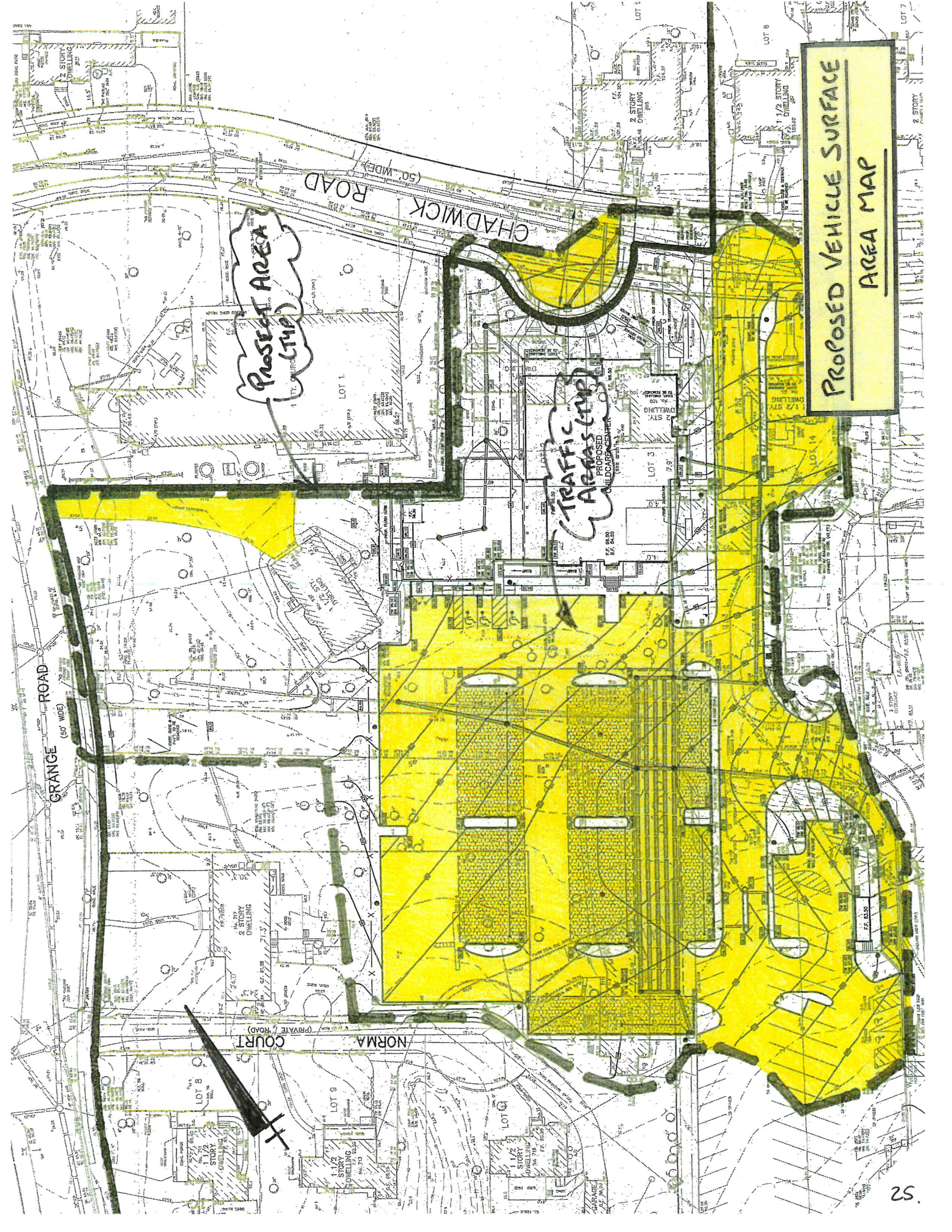


PROSELYT AREA
(TMP)

TRAFFIC ANCHOR
(TMP)

EXISTING VEHICLE SURFACE
AREA MAP

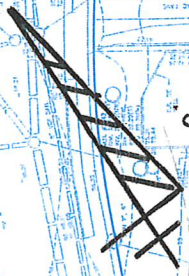
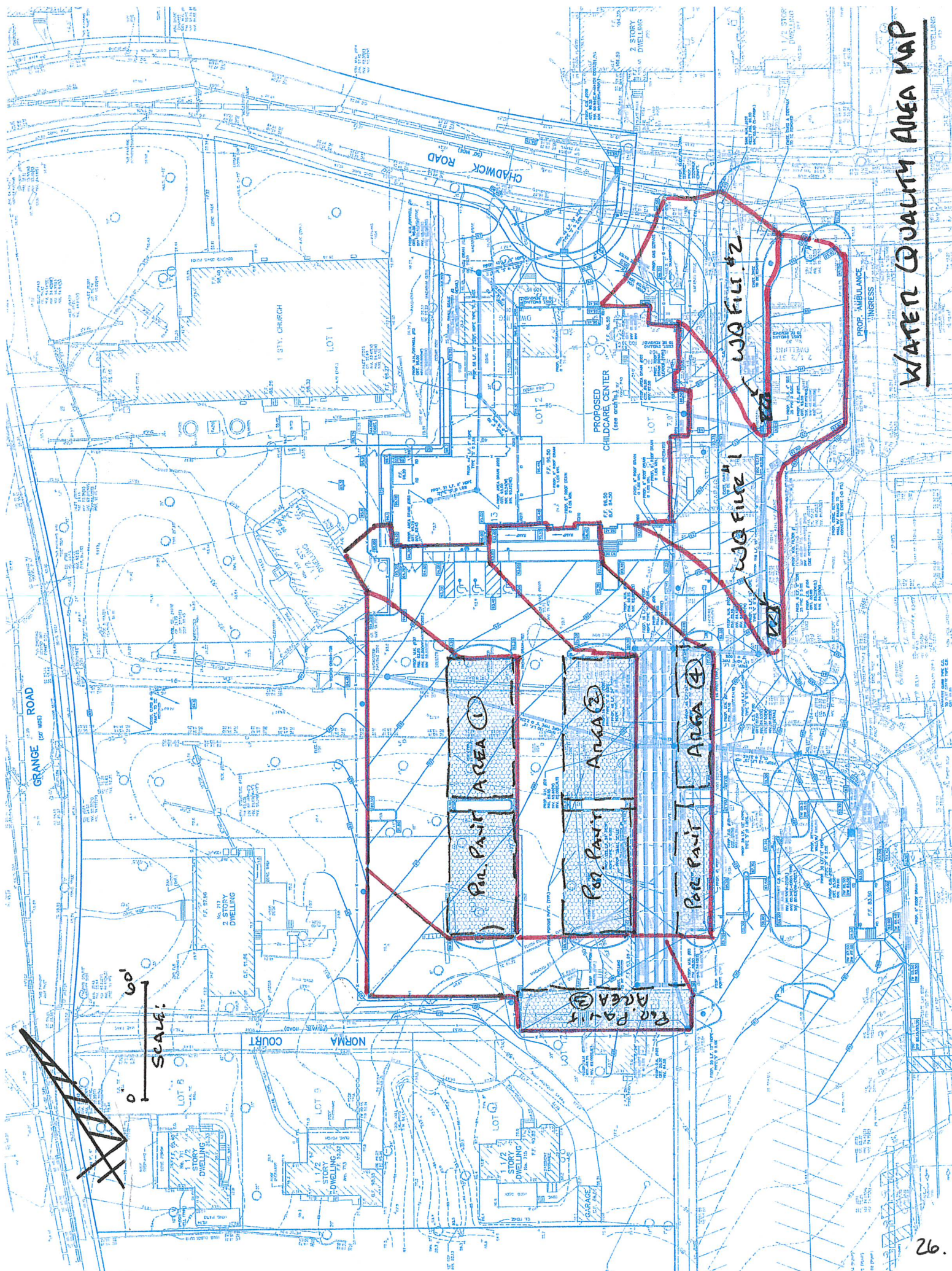




Project Area

Traffic Areas (Imp)

PROPOSED VEHICLE SURFACE
AREA MAP



SCALE:
0 60'

Pole Pavt AREA ①

Pole Pavt AREA ②

Pole Pavt AREA ④

Pole Pavt AREA ③

WQ FILE #1

WQ FILE #2

WATER QUALITY AREA MAP

Drainage Areas

| AREA I.D. | AREA Ac. | IMPERV. Area Ac. | PERV. Area Ac. | C AVERAGE | CXA ACRES |
|---------------------------|--------------|---------------------|-------------------|--------------|--------------|
| CS 100 | 0.367 | 0.340 | 0.027 | 0.96 | 0.354 |
| RD D5 | 0.103 | 0.103 | 0.000 | 0.99 | 0.102 |
| CB 101 | 0.413 | 0.398 | 0.015 | 0.98 | 0.404 |
| CB 102 | 0.168 | 0.164 | 0.004 | 0.98 | 0.165 |
| MH 103 | 0.000 | 0.000 | 0.000 | - | - |
| CB 104 | 0.244 | 0.168 | 0.076 | 0.88 | 0.216 |
| CB 105 | 0.138 | 0.075 | 0.063 | 0.83 | 0.115 |
| AD 106 | 0.003 | 0.003 | 0.000 | 0.99 | 0.003 |
| MH 107 / Ex CB 4946 | 0.504 | 0.129 | 0.375 | 0.74 | 0.371 |
| CB 108 | 0.059 | 0.054 | 0.005 | 0.96 | 0.057 |
| To System #1 | 1.940 | 1.380 | 0.560 | | |
| Bypass | 0.880 | 0.500 | 0.380 | | |
| Total South Line | 2.820 | 1.880 | 0.940 | | |
| CB 200 | 0.015 | 0.013 | 0.002 | 0.94 | 0.014 |
| CB 201 | 0.128 | 0.071 | 0.057 | 0.84 | 0.107 |
| MH R1 (Syst#2) | 0.025 | 0.002 | 0.023 | 0.68 | 0.017 |
| RD R1 | 0.052 | 0.052 | 0.000 | 0.99 | 0.051 |
| MH R2 (Syst#2) | 0.065 | 0.008 | 0.057 | 0.69 | 0.045 |
| RD R2 | 0.052 | 0.052 | 0.000 | 0.99 | 0.051 |
| AD 202 | 0.052 | 0.052 | 0.000 | 0.99 | 0.051 |
| AD 203 | 0.034 | 0.034 | 0.000 | 0.99 | 0.034 |
| To System #2 | 0.280 | 0.200 | 0.080 | | |
| Bypass | 0.200 | 0.120 | 0.080 | | |
| Total North Line | 0.480 | 0.320 | 0.160 | | |
| Total Project Area | 3.300 | 2.200 | 1.100 | | |

THE RATIONAL METHOD

$$Q = CIA \quad Q = \text{Runoff}$$

$C = \text{Flow Coef. (0.65 Pervious Area, 0.99 Impervious)}$

$I = \text{Rainfall Intensities Taken from NOAA Database}$

$A = \text{Area}$

Pipe Flow Calculations

| To | From | C x A | Tc min | Storm Freq Yr | I25 in/hr | Q25 cfs | Q-cap. cfs | CAPACITY USED % | PIPE DIA inches | SLOPE % grade | N-VALUE | MATERIAL type |
|-----------------|----------------|-------|-------------------------------|------------------|--------------|------------|---------------|--------------------|--------------------|------------------|---------|------------------|
| EX CB 5119 | CS 100 | | 25 Yr. Peak Outflow Syst.#1 = | | | 3.02 | 11.44 | 26% | 15 | 3.14% | 0.013 | CL III RCP |
| MH D5 (Syst #1) | RD D5 | 0.102 | 10 | 25 | 5.76 | 0.59 | 1.57 | 37% | 8 | 1.00% | 0.010 | HDPE |
| CS 100 | CB 101 | 0.404 | 10 | 25 | 5.76 | 2.33 | 4.63 | 50% | 12 | 1.00% | 0.010 | HDPE |
| MH D3 (Syst #1) | CB 102 | 0.165 | 10 | 25 | 5.76 | 0.95 | 6.55 | 15% | 12 | 2.00% | 0.010 | HDPE |
| MH D5 (Syst #1) | MH 103 | 0.334 | 10 | 25 | 5.76 | 1.92 | 8.39 | 23% | 15 | 1.00% | 0.010 | HDPE |
| MH 103 | CB 104 | 0.216 | 10 | 25 | 5.76 | 1.24 | 18.77 | 7% | 15 | 5.00% | 0.010 | HDPE |
| MH 103 | CB 105 | 0.118 | 10 | 25 | 5.76 | 0.68 | 11.54 | 6% | 15 | 1.89% | 0.010 | HDPE |
| CB 105 | AD 106 | 0.003 | 10 | 25 | 5.76 | 0.02 | 0.89 | 2% | 6 | 1.50% | 0.010 | HDPE |
| MH D2 (Syst #1) | MH 107 | 0.371 | 10 | 25 | 5.76 | 2.14 | 6.91 | 31% | 12 | 2.23% | 0.010 | HDPE |
| EX CB 5116 | CB 108 | 0.057 | 10 | 25 | 5.76 | 0.33 | 6.55 | 5% | 12 | 2.00% | 0.010 | HDPE |
| Ex MH #914 | CB 200 | 0.122 | 10 | 25 | 5.76 | 0.70 | 22.61 | 3% | 24 | 1.00% | 0.013 | RCP |
| CB 200 | CB 201 | 0.107 | 10 | 25 | 5.76 | 0.62 | 11.87 | 5% | 15 | 2.00% | 0.010 | HDPE |
| CB 201 | MH R1 (Syst#2) | | 25 Yr. Peak Outflow Syst.#2 = | | | 0.00 | 0.83 | 0% | 6 | 1.31% | 0.010 | HDPE |
| MH R1 (Syst#2) | RD R1 | 0.051 | 10 | 25 | 5.76 | 0.30 | 1.57 | 19% | 8 | 1.00% | 0.010 | HDPE |
| MH R2 (Syst#2) | RD R2 | 0.051 | 10 | 25 | 5.76 | 0.30 | 1.57 | 19% | 8 | 1.00% | 0.010 | HDPE |
| MH R2 (Syst#2) | AD 202 | 0.085 | 10 | 25 | 5.76 | 0.49 | 1.92 | 25% | 8 | 1.50% | 0.010 | HDPE |
| AD 202 | AD 203 | 0.034 | 10 | 25 | 5.76 | 0.19 | 1.57 | 12% | 8 | 1.00% | 0.010 | HDPE |

THE RATIONAL METHOD

$Q = C/A$ Q = Runoff

C = Flow Coef. (0.65 Pervious Area, 0.99 Impervious)

I = Rainfall Intensities Taken from NOAA Database

A = Area

Storage In Infiltration / Detention System - SYSTEM #1:

| <u>Stone</u> | | | <u>MH's</u> | | |
|--------------|------|-----|--------------------|-------|---------|
| Length = | 195 | ft. | Inner Dia. = | 4 | ft. |
| Width = | 26 | ft. | Outer Dia. = | 5 | ft. |
| Area = | 5070 | sf | Inside Area = | 13 | sf |
| | | | Outsideside Area = | 20 | sf |
| | | | # of Structs's = | 6 | |
| | | | Total Area = | 75.4 | Inside |
| | | | Total Area = | 117.8 | Outside |

Total Stone Area = 5070

Total Struct lArea = 75.4
Total Struct Area = 117.8

Inside
Outside

| Elevation feet | Stone Volume Bot of Stone 80.50 | Vol of MH's Bottom 82.00 | Volume Pipes In Sys. cf | Pipe Storage In Sys. cf | MH Storage Bottom 82.00 | Total Storage Vol. cf. |
|-------------------|---------------------------------------|--------------------------------|-------------------------------|-------------------------------|-------------------------------|------------------------------|
| 80.50 | 0 | 0 | 0 | 0 | 0 | 0 |
| 80.75 | 1268 | 0 | 0 | 0 | 0 | 507 |
| 81.00 | 2535 | 0 | 0 | 0 | 0 | 1014 |
| 81.25 | 3803 | 0 | 0 | 0 | 0 | 1521 |
| 81.50 | 5070 | 0 | 0 | 0 | 0 | 2028 |
| 81.75 | 6338 | 0 | 0 | 0 | 0 | 2535 |
| 82.00 | 7605 | 0 | 235 | 0 | 0 | 2948 |
| 82.25 | 8873 | 29 | 642 | 221 | 19 | 3520 |
| 82.50 | 10140 | 59 | 1133 | 597 | 38 | 4214 |
| 82.75 | 11408 | 88 | 1672 | 1046 | 57 | 4961 |
| 83.00 | 12675 | 118 | 2227 | 1526 | 75 | 5733 |
| 83.25 | 13943 | 147 | 2774 | 2006 | 94 | 6509 |
| 83.50 | 15210 | 177 | 3285 | 2455 | 113 | 7267 |
| 83.75 | 16478 | 206 | 3726 | 2831 | 132 | 7981 |
| 84.00 | 17745 | 236 | 4037 | 3050 | 151 | 8590 |
| 84.25 | 19013 | 265 | 4084 | 3050 | 170 | 9086 |
| 84.50 | 20280 | 295 | 4084 | 3050 | 188 | 9600 |
| 84.75 | 21548 | 324 | 4084 | 3050 | 207 | 10114 |
| 85.00 | 22815 | 353 | 4084 | 3050 | 226 | 10628 |
| 85.25 | 24083 | 383 | 4084 | 3050 | 245 | 11142 |
| 85.50 | 25350 | 412 | 4084 | 3050 | 264 | 11656 |
| 85.75 | 26618 | 442 | 4084 | 3050 | 283 | 12170 |
| 86.00 | 27885 | 471 | 4084 | 3050 | 302 | 12684 |
| 86.25 | 29153 | 501 | 4084 | 3050 | 320 | 13198 |
| 86.50 | 30420 | 530 | 4084 | 3050 | 339 | 13712 |
| 86.75 | 30420 | 560 | 4084 | 3050 | 358 | 13719 |
| 87.00 | 30420 | 589 | 4084 | 3050 | 377 | 13726 |
| 87.25 | 30420 | 619 | 4084 | 3050 | 396 | 13733 |
| 87.50 | 30420 | 648 | 4084 | 3050 | 415 | 13741 |

Seepage

Bed Area = 5,070 sf
 Porous Paving = 13,970 sf (Area 1, 2, 3, 4)
 Total Area = 19,040 sf
 Seep. Rate = 1.60 in/hr - (Measured in Field)
 Seep. Rate = 0.80 in/hr - Design
 Seep. Rate = 0.35 cfs

| PIPE STORAGE - EAST | | | | | | | | | | | | | | | |
|---------------------|-----------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------------|------------|------------|------------|------------|
| Elevation feet | Total Volume cubic-ft | CS 100 | | | | | | | | | | | | | |
| | | D1 D1 | D2 D2 | D3 D3 | D4 D4 | D5 D5 | D6 D6 | D7 D7 | D8 D8 | D9 D9 | D10 D10 | D11 D11 | D12 D12 | D13 D13 | D14 D14 |
| Run Number--> | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
| 81.00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 81.25 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 81.50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 81.75 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 82.00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 82.25 | 221 | 5 | 4 | 27 | 27 | 4 | 14 | 14 | 4 | 27 | 27 | 14 | 14 | 14 | 14 |
| 82.50 | 597 | 11 | 10 | 72 | 72 | 10 | 37 | 37 | 10 | 74 | 74 | 39 | 39 | 39 | 39 |
| 82.75 | 1,046 | 19 | 17 | 127 | 127 | 17 | 66 | 66 | 17 | 129 | 129 | 68 | 68 | 68 | 68 |
| 83.00 | 1,526 | 27 | 25 | 185 | 185 | 25 | 96 | 96 | 25 | 188 | 188 | 99 | 99 | 99 | 99 |
| 83.25 | 2,006 | 35 | 33 | 244 | 244 | 33 | 126 | 126 | 33 | 248 | 248 | 130 | 130 | 130 | 130 |
| 83.50 | 2,455 | 42 | 40 | 298 | 298 | 40 | 154 | 154 | 40 | 303 | 303 | 159 | 159 | 159 | 159 |
| 83.75 | 2,831 | 48 | 47 | 344 | 344 | 47 | 178 | 178 | 47 | 350 | 350 | 184 | 184 | 184 | 184 |
| 84.00 | 3,050 | 50 | 50 | 371 | 371 | 50 | 192 | 192 | 50 | 377 | 377 | 198 | 198 | 198 | 198 |
| 84.25 | 3,050 | 50 | 50 | 371 | 371 | 50 | 192 | 192 | 50 | 377 | 377 | 198 | 198 | 198 | 198 |
| 84.50 | 3,050 | 50 | 50 | 371 | 371 | 50 | 192 | 192 | 50 | 377 | 377 | 198 | 198 | 198 | 198 |
| 84.75 | 3,050 | 50 | 50 | 371 | 371 | 50 | 192 | 192 | 50 | 377 | 377 | 198 | 198 | 198 | 198 |
| 85.00 | 3,050 | 50 | 50 | 371 | 371 | 50 | 192 | 192 | 50 | 377 | 377 | 198 | 198 | 198 | 198 |
| 85.25 | 3,050 | 50 | 50 | 371 | 371 | 50 | 192 | 192 | 50 | 377 | 377 | 198 | 198 | 198 | 198 |
| 85.50 | 3,050 | 50 | 50 | 371 | 371 | 50 | 192 | 192 | 50 | 377 | 377 | 198 | 198 | 198 | 198 |
| 85.75 | 3,050 | 50 | 50 | 371 | 371 | 50 | 192 | 192 | 50 | 377 | 377 | 198 | 198 | 198 | 198 |
| 86.00 | 3,050 | 50 | 50 | 371 | 371 | 50 | 192 | 192 | 50 | 377 | 377 | 198 | 198 | 198 | 198 |
| 86.25 | 3,050 | 50 | 50 | 371 | 371 | 50 | 192 | 192 | 50 | 377 | 377 | 198 | 198 | 198 | 198 |
| 86.50 | 3,050 | 50 | 50 | 371 | 371 | 50 | 192 | 192 | 50 | 377 | 377 | 198 | 198 | 198 | 198 |
| 86.75 | 3,050 | 50 | 50 | 371 | 371 | 50 | 192 | 192 | 50 | 377 | 377 | 198 | 198 | 198 | 198 |
| 87.00 | 3,050 | 50 | 50 | 371 | 371 | 50 | 192 | 192 | 50 | 377 | 377 | 198 | 198 | 198 | 198 |
| 87.25 | 3,050 | 50 | 50 | 371 | 371 | 50 | 192 | 192 | 50 | 377 | 377 | 198 | 198 | 198 | 198 |
| 87.50 | 3,050 | 50 | 50 | 371 | 371 | 50 | 192 | 192 | 50 | 377 | 377 | 198 | 198 | 198 | 198 |

| PIPE STORAGE - EAST | | | | | | | | | | | | | | |
|---------------------|---------------|-----|----|-----|-----|-----|----|-----|-----|-----|-----|-----|-----|-----|
| Elevation feet | Run Number--> | | D1 | | D2 | | D3 | | D4 | | D5 | | D6 | |
| | D1 | D2 | D3 | D4 | D5 | D6 | D7 | D8 | D9 | D10 | D11 | D12 | D13 | D14 |
| 81.00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 81.25 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 81.50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 81.75 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 82.00 | 4 | 29 | 4 | 29 | 15 | 15 | 4 | 30 | 30 | 30 | 16 | 16 | 16 | 16 |
| 82.25 | 642 | 79 | 11 | 41 | 41 | 41 | 11 | 81 | 81 | 81 | 42 | 42 | 42 | 42 |
| 82.50 | 19 | 140 | 19 | 140 | 72 | 72 | 19 | 142 | 142 | 142 | 75 | 75 | 75 | 75 |
| 82.75 | 28 | 207 | 28 | 207 | 107 | 107 | 28 | 210 | 210 | 210 | 110 | 110 | 110 | 110 |
| 83.00 | 37 | 275 | 37 | 275 | 142 | 142 | 37 | 280 | 280 | 280 | 147 | 147 | 147 | 147 |
| 83.25 | 46 | 343 | 46 | 343 | 177 | 177 | 46 | 349 | 349 | 349 | 183 | 183 | 183 | 183 |
| 83.50 | 55 | 406 | 55 | 406 | 210 | 210 | 55 | 413 | 413 | 413 | 217 | 217 | 217 | 217 |
| 83.75 | 62 | 460 | 62 | 460 | 238 | 238 | 62 | 468 | 468 | 468 | 246 | 246 | 246 | 246 |
| 84.00 | 68 | 499 | 68 | 499 | 258 | 258 | 68 | 507 | 507 | 507 | 266 | 266 | 266 | 266 |
| 84.25 | 68 | 505 | 68 | 505 | 261 | 261 | 68 | 513 | 513 | 513 | 269 | 269 | 269 | 269 |
| 84.50 | 68 | 505 | 68 | 505 | 261 | 261 | 68 | 513 | 513 | 513 | 269 | 269 | 269 | 269 |
| 84.75 | 68 | 505 | 68 | 505 | 261 | 261 | 68 | 513 | 513 | 513 | 269 | 269 | 269 | 269 |
| 85.00 | 68 | 505 | 68 | 505 | 261 | 261 | 68 | 513 | 513 | 513 | 269 | 269 | 269 | 269 |
| 85.25 | 68 | 505 | 68 | 505 | 261 | 261 | 68 | 513 | 513 | 513 | 269 | 269 | 269 | 269 |
| 85.50 | 68 | 505 | 68 | 505 | 261 | 261 | 68 | 513 | 513 | 513 | 269 | 269 | 269 | 269 |
| 85.75 | 68 | 505 | 68 | 505 | 261 | 261 | 68 | 513 | 513 | 513 | 269 | 269 | 269 | 269 |
| 86.00 | 68 | 505 | 68 | 505 | 261 | 261 | 68 | 513 | 513 | 513 | 269 | 269 | 269 | 269 |
| 86.25 | 68 | 505 | 68 | 505 | 261 | 261 | 68 | 513 | 513 | 513 | 269 | 269 | 269 | 269 |
| 86.50 | 68 | 505 | 68 | 505 | 261 | 261 | 68 | 513 | 513 | 513 | 269 | 269 | 269 | 269 |
| 86.75 | 68 | 505 | 68 | 505 | 261 | 261 | 68 | 513 | 513 | 513 | 269 | 269 | 269 | 269 |
| 87.00 | 68 | 505 | 68 | 505 | 261 | 261 | 68 | 513 | 513 | 513 | 269 | 269 | 269 | 269 |
| 87.25 | 68 | 505 | 68 | 505 | 261 | 261 | 68 | 513 | 513 | 513 | 269 | 269 | 269 | 269 |
| 87.50 | 68 | 505 | 68 | 505 | 261 | 261 | 68 | 513 | 513 | 513 | 269 | 269 | 269 | 269 |

Storage In Infiltration System #2:

| | | | | | |
|--------------|------|-----|--------------------|------|---------|
| Stone | | | MH's | | |
| Length = | 75 | ft. | Inner Dia. = | 6 | ft. |
| Width = | 16.0 | ft. | Outer Dia. = | 7 | ft. |
| Area = | 1200 | sf | Inside Area = | 28 | sf |
| | | | Outsideside Area = | 38 | sf |
| | | | # of Structs's = | 2 | |
| | | | Total Area = | 56.5 | Inside |
| | | | Total Area = | 77.0 | Outside |

Total Stone Area = 1200

Total Struct IArea = 56.5
Total Struct Area = 77.0

Inside
Outside

| Elevation feet | Stone Volume Bot of Stone 88.50 | Vol of MH's Bottom 91.20 | Volume Pipes In Sys. cf | Pipe Storage In Sys. cf | MH Storage Bottom 91.20 | Total Storage Vol. cf. |
|-------------------|---------------------------------------|--------------------------------|-------------------------------|-------------------------------|-------------------------------|------------------------------|
| 88.50 | 0 | 0 | 0 | 0 | 0 | 0 |
| 88.75 | 300 | 0 | 0 | 0 | 0 | 120 |
| 89.00 | 600 | 0 | 0 | 0 | 0 | 240 |
| 89.25 | 900 | 0 | 0 | 0 | 0 | 360 |
| 89.50 | 1200 | 0 | 0 | 0 | 0 | 480 |
| 89.75 | 1500 | 0 | 0 | 0 | 0 | 600 |
| 90.00 | 1800 | 0 | 0 | 0 | 0 | 720 |
| 90.25 | 2100 | 0 | 0 | 0 | 0 | 840 |
| 90.50 | 2400 | 0 | 0 | 0 | 0 | 960 |
| 90.75 | 2700 | 0 | 0 | 0 | 0 | 1080 |
| 91.00 | 3000 | 0 | 0 | 0 | 0 | 1200 |
| 91.25 | 3300 | 4 | 0 | 0 | 3 | 1321 |
| 91.50 | 3600 | 23 | 0 | 0 | 17 | 1448 |
| 91.75 | 3900 | 42 | 0 | 0 | 31 | 1574 |
| 92.00 | 4200 | 62 | 0 | 0 | 45 | 1701 |
| 92.25 | 4500 | 81 | 0 | 0 | 59 | 1827 |
| 92.50 | 4800 | 100 | 2 | 0 | 74 | 1953 |
| 92.75 | 5100 | 119 | 14 | 9 | 88 | 2083 |
| 93.00 | 5400 | 139 | 30 | 23 | 102 | 2217 |
| 93.25 | 5700 | 158 | 47 | 37 | 116 | 2351 |
| 93.50 | 6000 | 177 | 60 | 46 | 130 | 2481 |
| 93.75 | 6300 | 196 | 62 | 46 | 144 | 2606 |
| 94.00 | 6600 | 216 | 62 | 46 | 158 | 2733 |
| 94.25 | 6900 | 235 | 62 | 46 | 172 | 2859 |
| 94.50 | 7200 | 254 | 62 | 46 | 187 | 2986 |
| 94.75 | 7200 | 273 | 62 | 46 | 201 | 2992 |
| 95.00 | 7200 | 292 | 62 | 46 | 215 | 2999 |

Seepage

Bed Area = 1,200 sf

(Area 8, 9 & 10)

Total Area = 1,200 sf

Seep. Rate = 2.10 in/hr - (Measured in Field)

Seep. Rate = 1.00 in/hr - Design

Seep. Rate = 0.028 cfs

System 2 - Storage below Outfall = 2217 Cf
 Stone Area = 1200 sf
 Effective Depth = 1.85 ft
 Effective Depth = 22 in

| PIPE STORAGE- WEST | | MH/DW R1 |
|---------------------------|------------------------------|------------------------|
| | | MH/DW R2 |
| | Run Number--> | 1 |
| | Low Invert, ft | 92.50 |
| | High Invert, ft | 92.50 |
| | Length, ft | 58 |
| | Inside Dia., in | 12 |
| | Slope, % | 0.00% |
| Elevation feet | Total Volume cubic-ft | Volume cubic-ft |
| 88.50 | 0 | 0 |
| 88.75 | 0 | 0 |
| 89.00 | 0 | 0 |
| 89.25 | 0 | 0 |
| 89.50 | 0 | 0 |
| 89.75 | 0 | 0 |
| 90.00 | 0 | 0 |
| 90.25 | 0 | 0 |
| 90.50 | 0 | 0 |
| 90.75 | 0 | 0 |
| 91.00 | 0 | 0 |
| 91.25 | 0 | 0 |
| 91.50 | 0 | 0 |
| 91.75 | 0 | 0 |
| 92.00 | 0 | 0 |
| 92.25 | 0 | 0 |
| 92.50 | 0 | 0 |
| 92.75 | 9 | 9 |
| 93.00 | 23 | 23 |
| 93.25 | 37 | 37 |
| 93.50 | 46 | 46 |
| 93.75 | 46 | 46 |
| 94.00 | 46 | 46 |
| 94.25 | 46 | 46 |
| 94.50 | 46 | 46 |
| 94.75 | 46 | 46 |
| 95.00 | 46 | 46 |

| PIPE STORAGE- WEST | | MH/DW R1 |
|--------------------|-----------------------|-----------------|
| | | MH/DW R2 |
| | Run Number--> | 1 |
| | Low Invert, ft | 92.43 |
| | High Invert, ft | 92.43 |
| | Length, ft | 58 |
| | Outside Dia., in | 14 |
| | Slope, % | 0.00% |
| Elevation feet | Total Volume cubic-ft | Volume cubic-ft |
| 88.50 | 0 | 0 |
| 88.75 | 0 | 0 |
| 89.00 | 0 | 0 |
| 89.25 | 0 | 0 |
| 89.50 | 0 | 0 |
| 89.75 | 0 | 0 |
| 90.00 | 0 | 0 |
| 90.25 | 0 | 0 |
| 90.50 | 0 | 0 |
| 90.75 | 0 | 0 |
| 91.00 | 0 | 0 |
| 91.25 | 0 | 0 |
| 91.50 | 0 | 0 |
| 91.75 | 0 | 0 |
| 92.00 | 0 | 0 |
| 92.25 | 0 | 0 |
| 92.50 | 2 | 2 |
| 92.75 | 14 | 14 |
| 93.00 | 30 | 30 |
| 93.25 | 47 | 47 |
| 93.50 | 60 | 60 |
| 93.75 | 62 | 62 |
| 94.00 | 62 | 62 |
| 94.25 | 62 | 62 |
| 94.50 | 62 | 62 |
| 94.75 | 62 | 62 |
| 95.00 | 62 | 62 |

NJDEP RECHARGE CALCULATIONS

The NJDEP GSR-32 Annual Groundwater Recharge Analysis program was used to estimate ground water recharge.

Summary:

| | | |
|--|---------------|-----------|
| Existing Annual Groundwater Recharge Estimate = | 40,492 | cf |
| Proposed Annual Groundwater Recharge Estimate = | 25,495 | cf |
| Post-Development Annual Recharge Deficit = | 14,997 | cf |
| | | |
| BMP Estimated Annual Recharge Retention System #2 = | 25,180 | cf |
| <i>(Conservatively neglects recharge from system #1)</i> | | |
| | | |
| Proposed Annual Recharge = | 50,675 | cf |
| | | |
| Proposed Annual Recharge Increase = | 10,183 | cf |
| | | |
| % Recharge Increase = | 25% | |

Annual Groundwater Recharge Analysis (based on GSR-32)

| | | |
|-------------------------|-----------------------|-----------------|
| Select Township ↓ | Average Annual P (in) | Climatic Factor |
| BERGEN CO., TEANECK TWP | 44.7 | 1.45 |

| | |
|----------------|--------------------------|
| Project Name: | Holy Name Medical Center |
| Description: | Recharge Calculations |
| Analysis Date: | 11/28/22 |

| Pre-Developed Conditions | | | | | |
|--------------------------|--------------|------------------|------------|----------------------|-------------------------|
| Land Segment | Area (acres) | TR-55 Land Cover | Soil | Annual Recharge (in) | Annual Recharge (cu.ft) |
| 1 | 0.81 | Open space | Dunellen | 13.8 | 40,492 |
| 2 | 0.92 | Impervious areas | Dunellen | 0.0 | - |
| 3 | 1.11 | Open space | Udorthents | 0.0 | - |
| 4 | 0.46 | Impervious areas | Udorthents | 0.0 | - |
| 5 | | | | | |
| 6 | | | | | |
| 7 | 0 | | | | |
| 8 | 0 | | | | |
| 9 | 0 | | | | |
| 10 | 0 | | | | |
| 11 | 0 | | | | |
| 12 | 0 | | | | |
| 13 | 0 | | | | |
| 14 | 0 | | | | |
| 15 | 0 | | | | |
| Total = | 3.3 | | | 3.4 | 40,492 |

| Post-Developed Conditions | | | | | |
|---------------------------|--------------|------------------|------------|----------------------|-------------------------|
| Land Segment | Area (acres) | TR-55 Land Cover | Soil | Annual Recharge (in) | Annual Recharge (cu.ft) |
| 1 | 0.51 | Open space | Dunellen | 13.8 | 25,495 |
| 2 | 1.22 | Impervious areas | Dunellen | 0.0 | - |
| 3 | 0.59 | Open space | Udorthents | 0.0 | - |
| 4 | 0.98 | Impervious areas | Udorthents | 0.0 | - |
| 5 | 0 | | | | |
| 6 | 0 | | | | |
| 7 | 0 | | | | |
| 8 | 0 | | | | |
| 9 | 0 | | | | |
| 10 | 0 | | | | |
| 11 | 0 | | | | |
| 12 | 0 | | | | |
| 13 | 0 | | | | |
| 14 | 0 | | | | |
| 15 | 0 | | | | |
| Total = | 3.3 | | | 2.1 | 25,495 |

| | |
|--|-------------|
| Annual Recharge Requirements Calculation ↓ | |
| % of Pre-Developed Annual Recharge to Preserve = | 100% |
| Post-Development Annual Recharge Deficit= 14,997 (cubic feet) | |
| Recharge Efficiency Parameters Calculations (area averages) | |
| RWC= 1.90 (in) | DRWC= 0.00 |
| ERWC = 0.52 (in) | EDRWC= 0.00 |

| | |
|---|--------|
| Annual Recharge Requirements Calculation ↓ | |
| Total Annual Recharge (in) | 2.1 |
| Total Annual Recharge (cu.ft) | 25,495 |
| Total Impervious Area (sq.ft) | 95,832 |

Procedure to fill the Pre-Development and Post-Development Conditions Tables

For each land segment, first enter the area, then select TR-55 Land Cover, then select Soil. Start from the top of the table and proceed downward. Don't leave blank rows (with A=0) in between your segment entries. Rows with A=0 will not be displayed or used in calculations. For impervious areas outside of standard lots select "Impervious Areas" as the Land Cover. Soil type for impervious areas are only required if an infiltration facility will be built within these areas.

| Project Name | | Description | | Analysis Date | | BMP or LID Type | |
|--|-------------------|--|----------|--|--|------------------------|-------------------------------------|
| Holy Name Medical Center | | Recharge Calculations | | 11/28/22 | | Infiltration System #2 | |
| Recharge BMP Input Parameters | | Root Zone Water Capacity Calculated Parameters | | Recharge Design Parameters | | | |
| Parameter | Symbol | Value | Unit | Parameter | Symbol | Value | Unit |
| BMP Area | ABMP | 1200.0 | sq.ft | Empty Portion of RWC under Post-D Natural Recharge | ERWC | 0.82 | in |
| BMP Effective Depth, this is the design variable Upper level of the BMP surface (negative if above ground) | dBMP | 22.0 | in | ERWC Modified to consider dEXC | EDRWC | 0.00 | in |
| Depth of lower surface of BMP, must be >= dBMP _u | dBMP _u | 42.0 | in | Empty Portion of RWC under Infiltr. BMP | RERWC | 0.00 | in |
| Post-development Land Segment Location of BMP | dEXC | 90.0 | in | | | | |
| Input Zero if Location is distributed or undetermined | SegBMP | 2 | unitless | | | | |
| | | | | BMP Calculated Size Parameters | | | |
| | | | | ABMP/Aimp | Aratio | 0.14 | unitless |
| | | | | BMP Volume | VBMP | 2,200 | cu.ft |
| | | | | System Performance Calculated Parameters | | | |
| | | | | Annual BMP Recharge Volume | | 25,180 | cu.ft |
| | | | | Avg BMP Recharge Efficiency | | 100.0% | Represents % Infiltration Recharged |
| | | | | %Rainfall became Runoff | | 77.7% | % |
| | | | | %Runoff Infiltrated | | 100.0% | % |
| | | | | %Runoff Recharged | | 9.1% | % |
| | | | | %Rainfall Recharged | | 7.1% | % |
| | | | | Recharge Requirement over Imp. Area | dr | 1.9 | in |
| <p>How to solve for different recharge volumes: By default the spreadsheet assigns the values of total deficit recharge volume "Vdef" and "Aimp" from the "Annual Recharge" sheet to "Vdef" and "Aimp" on this page. This allows solution for a single BMP to handle the entire recharge requirement assuming the runoff from entire impervious area is available to the BMP. To solve for a smaller BMP or a LID-IIMP to recharge only part of the recharge requirement, set Vdef to your target value and Aimp to impervious area directly connected to your infiltration facility and then solve for ABMP or dBMP. To go back to the default configuration click the "Default Vdef & Aimp" button.</p> | | | | | | | |
| | | | | PARAMETERS FROM ANNUAL RECHARGE WORKSHEET | | | |
| Post-D Deficit Recharge (or desired recharge volume) | Vdef | 14,997 | cu.ft | | | | |
| Post-D Impervious Area (or target Impervious Area) | Aimp | 8,700 | sq.ft | | | | |
| Root Zone Water Capacity | RWC | 2.97 | in | | | | |
| RWC Modified to consider dEXC | DRWC | 0.00 | in | | | | |
| Climatic Factor | C-factor | 1.45 | no units | | | | |
| Average Annual P | Pavg | 44.7 | in | | | | |
| Recharge Requirement over Imp. Area | dr | 1.9 | in | | | | |
| | | | | Calculation Check Messages | | | |
| | | | | Volume Balance -> | Solve Problem to satisfy Annual Recharge | | |
| | | | | dBMP Check -> | OK | | |
| | | | | dEXC Check -> | OK | | |
| | | | | BMP Location -> | OK | | |
| | | | | OTHER NOTES | | | |
| <p>Design is accurate only after BMP dimensions are updated to make rech volume= deficit volume. The portion of BMP infiltration prior to filling and the area occupied by BMP are ignored in these calculations. Results are sensitive to dBMP. make sure dBMP selected is small enough for BMP to empty in less than 3 days. For land Segment Location of BMP if you select "impervious areas" RWC will be minimal but not zero as determined by the soil type and a shallow root zone for this Land Cover allowing consideration of lateral flow and other losses.</p> | | | | | | | |

Mounding Analysis:

Water Quality Storm Volume

Infiltration System #1

| | |
|---|-------------------------|
| See HydroCAD Calculations for WQ Volume Calculation | WQ Vol. cf. 5,201 |
|---|-------------------------|

Mounding Analysis: Summary of "Hantush Spreadsheet Calculations"

| | | | | | | | | |
|---|-----------------------|-------------------------------|-----------------------------|--|----------------------------------|---------------------------|----------------------------|-------------------|
| Width = 195 ft. | | | | Soil Permeability | | | | |
| 1/2 Width (y) = 97.5 ft. | | | | Recharge Rate = 0.8 in/hr | | | | |
| Length = 28 ft. | | | | Kh = 0.8 (Outside Coastal Zone R=Kh) | | | | |
| 1/2 Length (x) = 14 ft. | | | | Sy = 0.15 Specific Yield (default value) | | | | |
| Infiltration System Area = 5460 sf | | | | hi (0) = 10 Initial Thickness of saturation zone (default value) | | | | |
| | Bed Area sf | Recharge Rate in/hr | Recharge Rate cfs | WQ Storm Volume cf | Time to Drain (t) hrs. | Bot to SHGW ft. | Mounding ht. ft. | |
| Trial #1 | 5460 | 0.8 | 0.10111 | 5,201 | 14.3 | 4.2 | 5.6 | Try Another Trial |
| Trial #2 | 5460 | 0.4 | 0.05056 | 5,201 | 28.6 | 4.2 | 4.8 | Try Another Trial |
| Trial #3 | 5460 | 0.2 | 0.02528 | 5,201 | 57.2 | 4.2 | 4.0 | OK! |
| < 72 hrs OK. (See Hantush Speadsheet Calculation) | | | | | | | | |

Groundwater Estimate:

Bottom of System Elev. = 80.5
 Estimated Ground Water = 76.3 Approx.(based on Soil tests)
 4.2 ft.(Depth to SHGW)

Water Quality Storm Volume

Infiltration System #2

| | |
|---|-----------------------|
| See HydroCAD Calculations for WQ Volume Calculation | WQ Vol. cf. 751 |
|---|-----------------------|

Mounding Analysis: Summary of "Hantush Spreadsheet Calculations"

| | | | | | | | | |
|---|-----------------------|-------------------------------|-----------------------------|--|----------------------------------|---------------------------|----------------------------|-------------------|
| Width = 75 ft. | | | | Soil Permeability | | | | |
| 1/2 Width (y) = 37.5 ft. | | | | Recharge Rate = 1.0 in/hr | | | | |
| Length = 16 ft. | | | | Kh = 1.0 (Outside Coastal Zone R=Kh) | | | | |
| 1/2 Length (x) = 8 ft. | | | | Sy = 0.15 Specific Yield (default value) | | | | |
| Infiltration System Area = 1200 sf | | | | hi (0) = 10 Initial Thickness of saturation zone (default value) | | | | |
| | Bed Area sf | Recharge Rate in/hr | Recharge Rate cfs | WQ Storm Volume cf | Time to Drain (t) hrs. | Bot to SHGW ft. | Mounding ht. ft. | |
| Trial #1 | 1200 | 1.0 | 0.02778 | 751 | 7.5 | 2.7 | 3.2 | Try Another Trial |
| Trial #2 | 1200 | 0.5 | 0.01389 | 751 | 15.0 | 2.7 | 2.7 | OK! |
| < 72 hrs OK. (See Hantush Speadsheet Calculation) | | | | | | | | |

Groundwater Estimate:

Bottom of System Elev. = 88.5
 Estimated Ground Water = 85.8 Approx.(based on Soil tests)
 2.7 ft.(Depth to SHGW)

Input Values

| |
|--------|
| 0.20 |
| 0.150 |
| 0.80 |
| 13.000 |
| 97.500 |
| 61.60 |
| 10.00 |

R Recharge rate (permeability rate) (in/hr)
Specific yield, Sy (dimensionless)
 default value is 0.15; max value is 0.2 provided that a lab test data is submitted
Horizontal hydraulic conductivity (in/hr)
Kh = 5xRecharge Rate (R) in the costal plan; Kh=R outside the coastal plan
x 1/2 length of basin (x direction, in feet)
y 1/2 width of basin (y direction, in feet)
t Duration of infiltration period (hours)
hi(0) Initial thickness of saturated zone (feet)

| |
|--------|
| 14.012 |
| 4.012 |

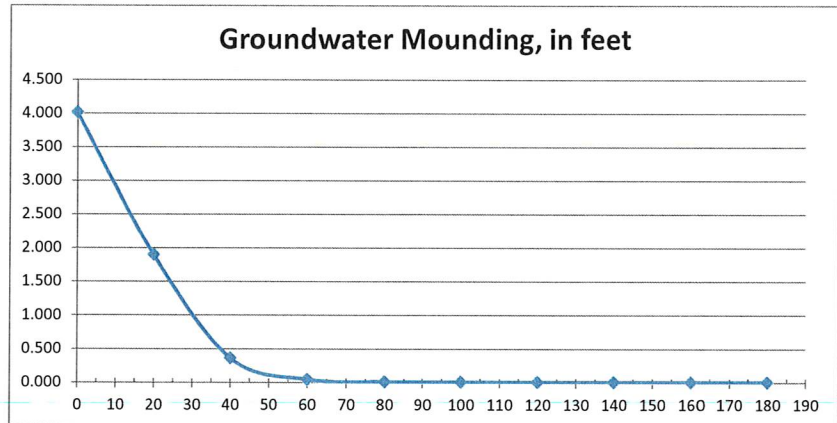
h(max) Maximum thickness of saturated zone (beneath center of basin at end of infiltration period)
Δh(max) Maximum groundwater mounding (beneath center of basin at end of infiltration period)

Distance from center of basin in x direction, in feet

| Ground-water Mounding, in feet | Distance from center of basin in x direction, in feet |
|--------------------------------|---|
| 4.012 | 0 |
| 1.893 | 20 |
| 0.356 | 40 |
| 0.040 | 60 |
| 0.005 | 80 |
| 0.002 | 100 |
| 0.002 | 120 |
| 0.002 | 140 |
| 0.002 | 160 |
| 0.002 | 180 |



Re-Calculate Now



Disclaimer

This spreadsheet solving the Hantush (1967) equation for ground-water mounding beneath an infiltration basin is made available to the general public as a convenience for those wishing to replicate values documented in the USGS Scientific Investigations Report 2010-5102 "Groundwater mounding beneath hypothetical stormwater infiltration basins" or to calculate values based on user-specified site conditions. Any changes made to the spreadsheet (other than values identified as user-specified) after transmission from the USGS could have unintended, undesirable consequences. These consequences could include, but may not be limited to: erroneous output, numerical instabilities, and violations of underlying assumptions that are inherent in results presented in the accompanying USGS published report. The USGS assumes no responsibility for the consequences of any changes made to the spreadsheet. If changes are made to the spreadsheet, the user is responsible for documenting the changes and justifying the results and conclusions.

SYSTEM #2

Input Values

| | | |
|--------|----------|---|
| 0.50 | R | Recharge rate (permeability rate) (in/hr) |
| | | Specific yield, S_y (dimensionless) |
| 0.150 | S_y | default value is 0.15; max value is 0.2 provided that a lab test data is submitted |
| | | Horizontal hydraulic conductivity (in/hr) |
| 1.00 | K_h | $K_h = 5 \times \text{Recharge Rate (R)}$ in the costal plan; $K_h=R$ outside the costal plan |
| 8.000 | x | 1/2 length of basin (x direction, in feet) |
| 37.500 | y | 1/2 width of basin (y direction, in feet) |
| 15.00 | t | Duration of infiltration period (hours) |
| 10.00 | $h_i(0)$ | Initial thickness of saturated zone (feet) |

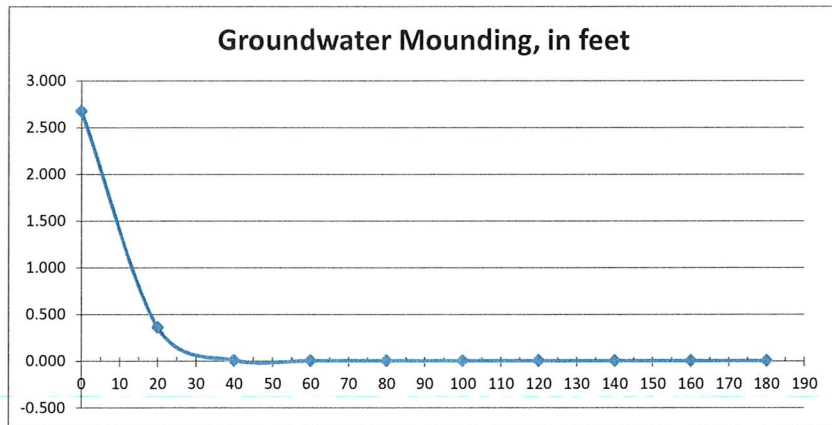
| | | |
|--------|------------------------|---|
| 12.671 | $h(\text{max})$ | Maximum thickness of saturated zone (beneath center of basin at end of infiltration period) |
| 2.671 | $\Delta h(\text{max})$ | Maximum groundwater mounding (beneath center of basin at end of infiltration period) |

Distance from
Ground-water center of basin in x
Mounding, in feet direction, in feet

| | |
|-------|-----|
| 2.671 | 0 |
| 0.358 | 20 |
| 0.007 | 40 |
| 0.001 | 60 |
| 0.001 | 80 |
| 0.001 | 100 |
| 0.001 | 120 |
| 0.001 | 140 |
| 0.001 | 160 |
| 0.001 | 180 |



Re-Calculate Now



Disclaimer

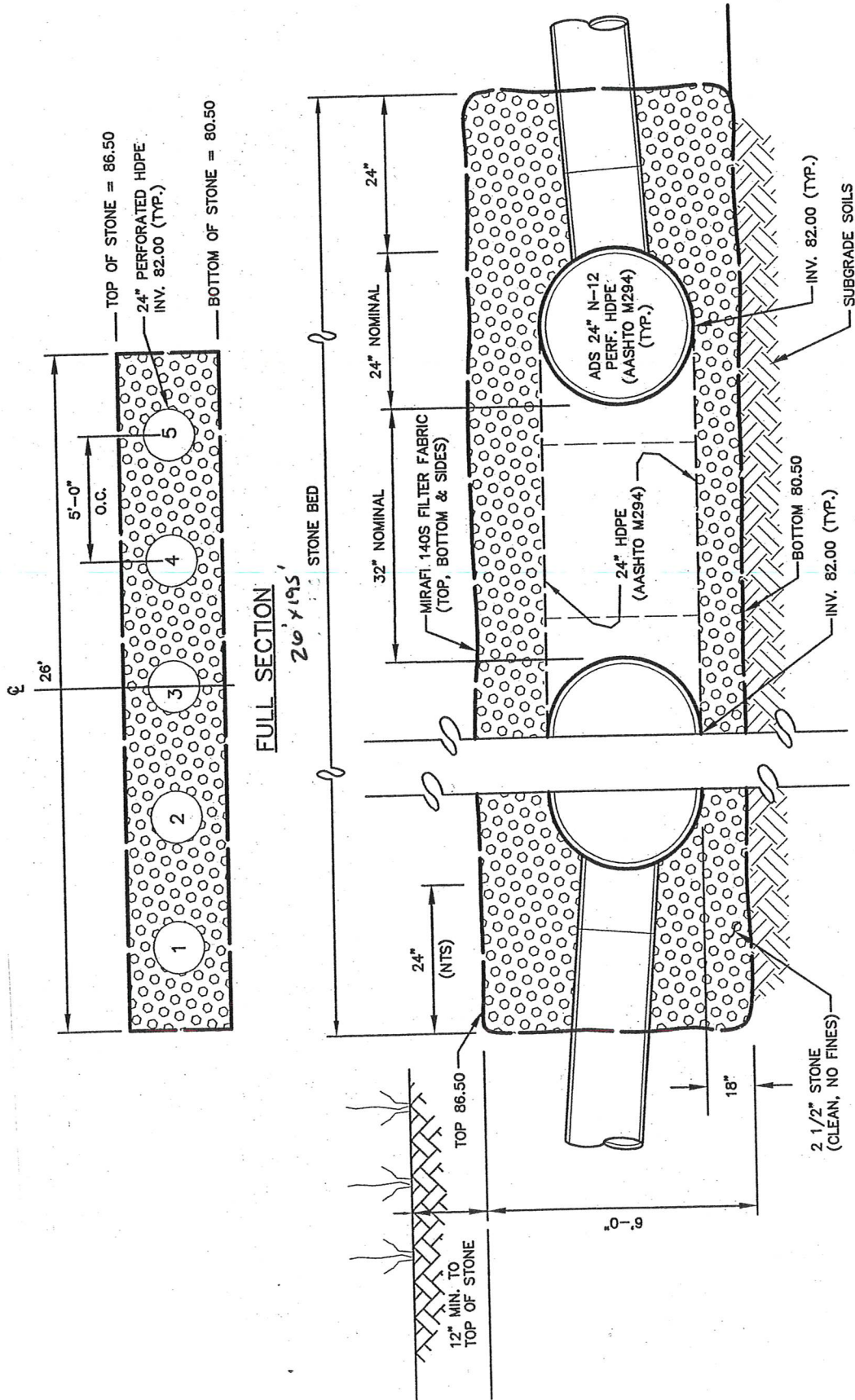
This spreadsheet solving the Hantush (1967) equation for ground-water mounding beneath an infiltration basin is made available to the general public as a convenience for those wishing to replicate values documented in the USGS Scientific Investigations Report 2010-5102 "Groundwater mounding beneath hypothetical stormwater infiltration basins" or to calculate values based on user-specified site conditions. Any changes made to the spreadsheet (other than values identified as user-specified) after transmission from the USGS could have unintended, undesirable consequences. These consequences could include, but may not be limited to: erroneous output, numerical instabilities, and violations of underlying assumptions that are inherent in results presented in the accompanying USGS published report. The USGS assumes no responsibility for the consequences of any changes made to the spreadsheet. If changes are made to the spreadsheet, the user is responsible for documenting the changes and justifying the results and conclusions.

Hydrologic Soil Group—Bergen County, New Jersey

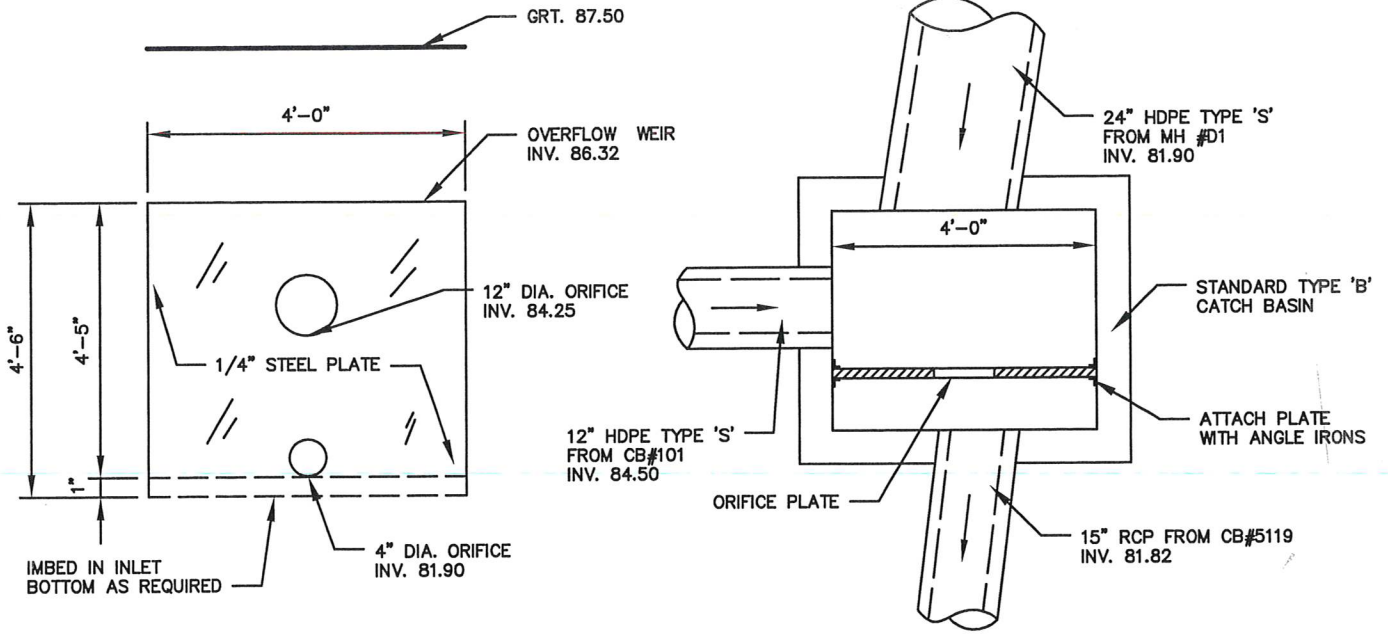


Hydrologic Soil Group

| Map unit symbol | Map unit name | Rating | Acres in AOI | Percent of AOI |
|------------------------------------|--|--------|--------------|----------------|
| DuuB | Dunellen-Urban land complex, 3 to 8 percent slopes | A | 4.3 | 5.0% |
| DuuC | Dunellen-Urban land complex, 8 to 15 percent slopes | A | 23.6 | 27.7% |
| DuuD | Dunellen-Urban land complex, 15 to 25 percent slopes | A | 10.2 | 12.0% |
| UdkttB | Udorthents, loamy, 0 to 8 percent slopes, frequently flooded | D | 0.0 | 0.0% |
| UdwuB | Udorthents, wet substratum-Urban land complex | D | 24.9 | 29.2% |
| UR | Urban land | | 22.2 | 26.1% |
| Totals for Area of Interest | | | 85.1 | 100.0% |



SECTION THROUGH SMALL SCALE INFILTRATION SYSTEM #1 N.T.S.

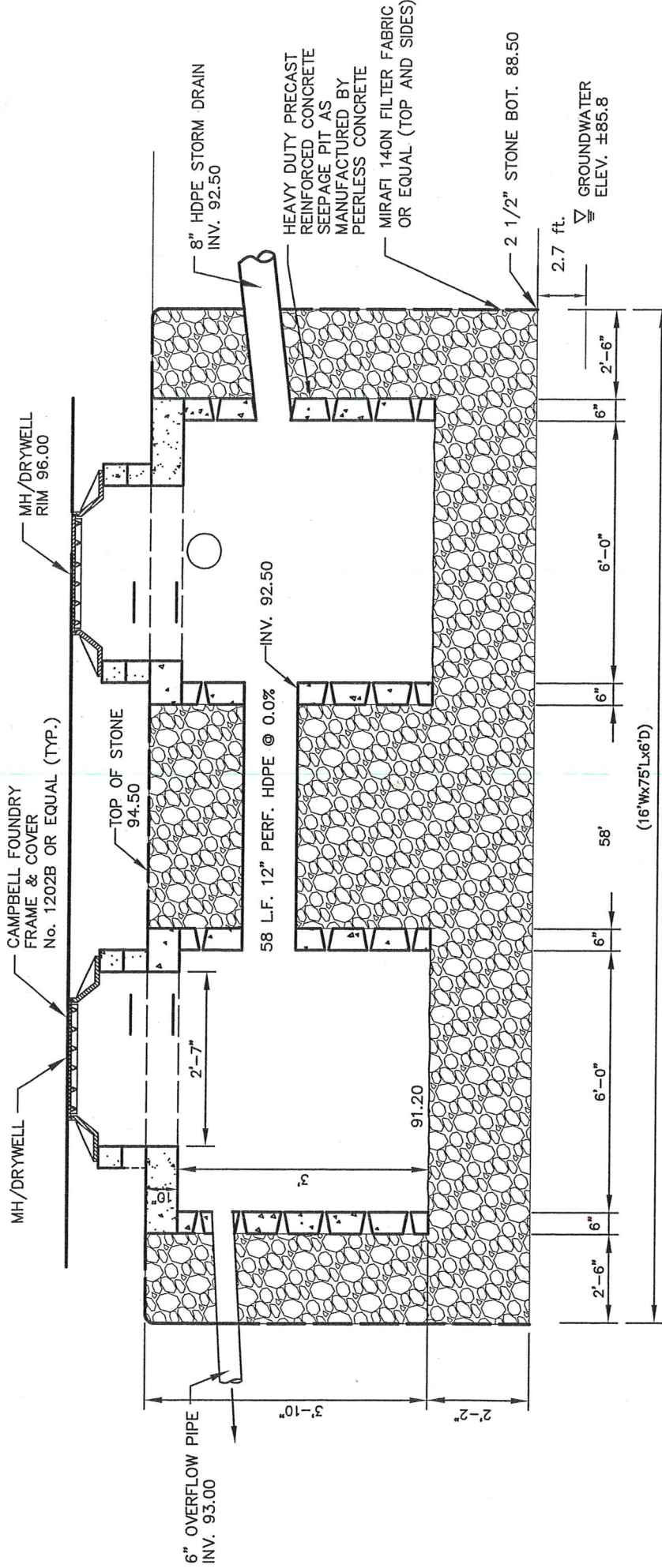


ORIFICE/WEIR PLATE DETAILS

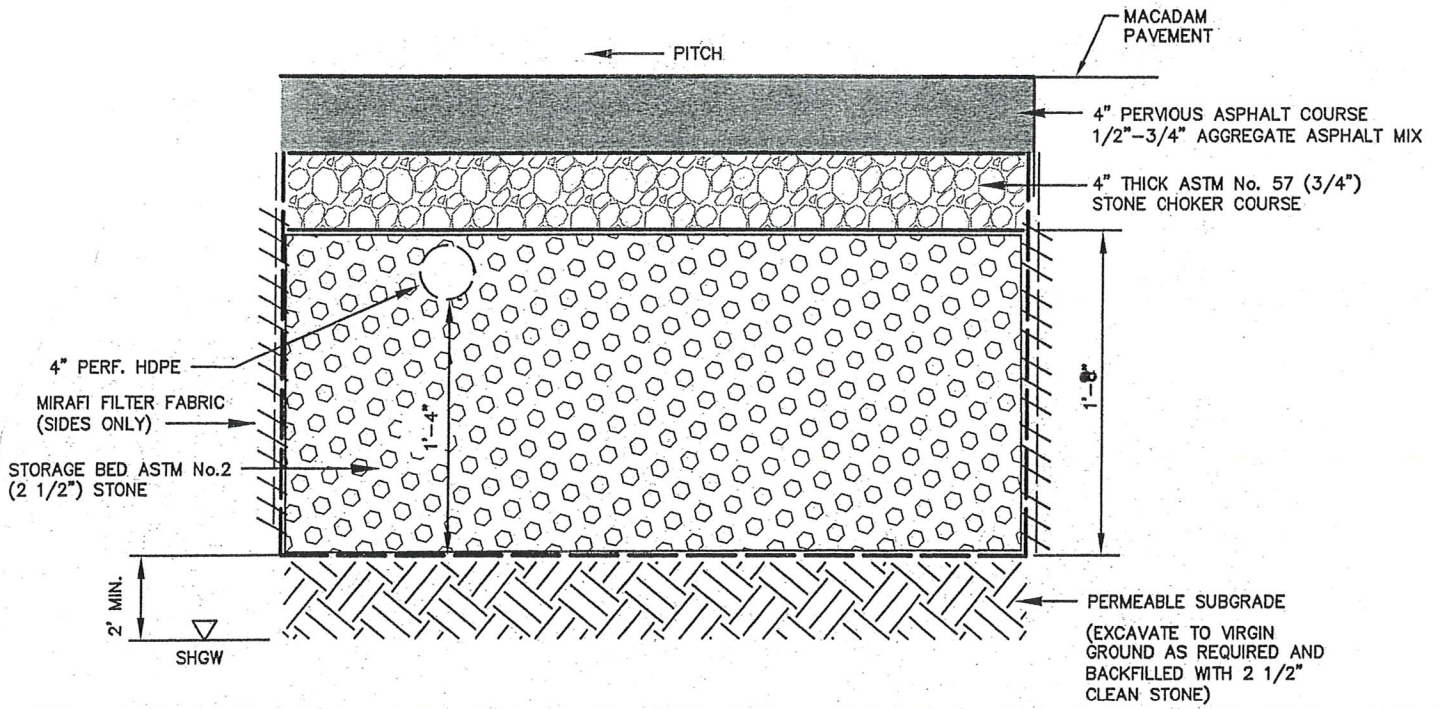
INLET PLAN VIEW

CONTROL STRUCTURE #100 DETAILS

N.T.S.

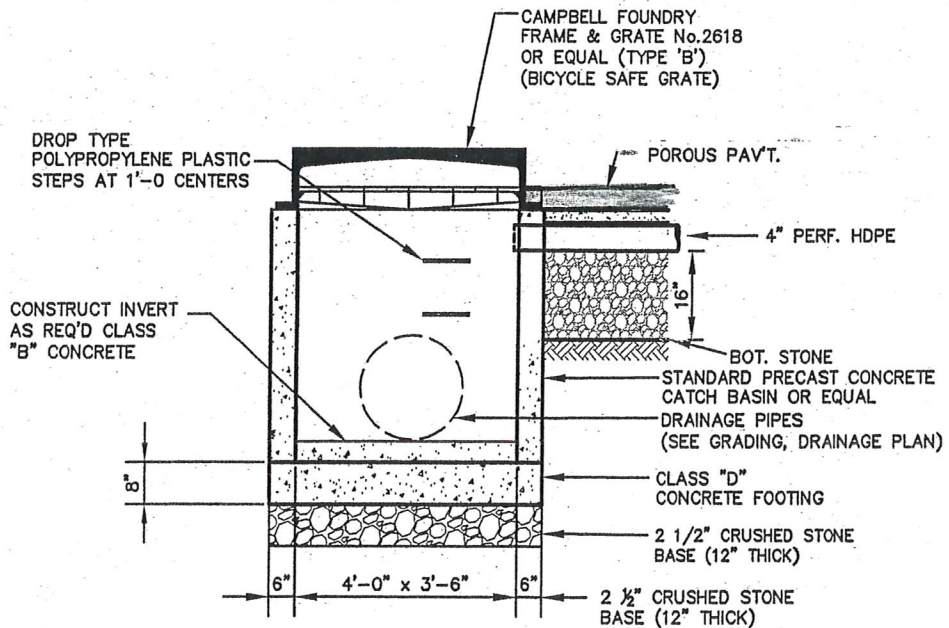


SMALL SCALE INFILTRATION SYSTEM #2 NTS



POROUS PAVEMENT DETAIL

N.T.S.



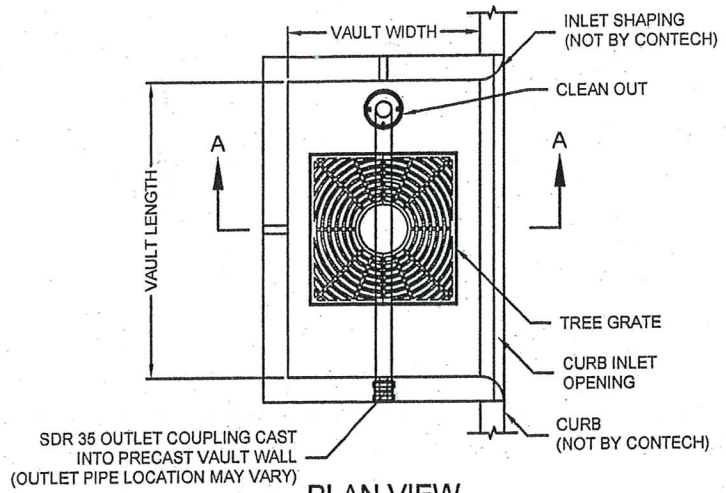
CATCH BASINS AT PERMEABLE PAVER AREAS



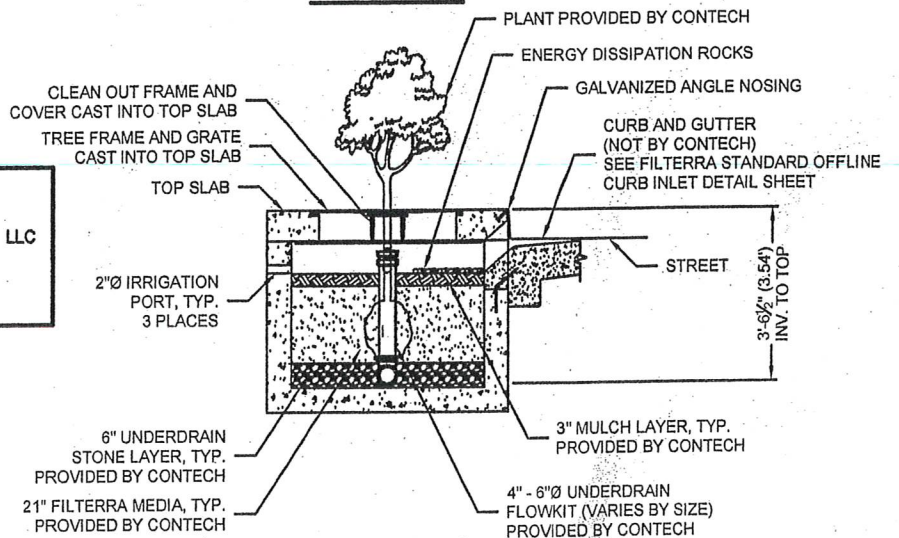
THIS PRODUCT MAY BE PROTECTED BY ONE OR MORE OF THE FOLLOWING U.S. PATENTS: 5,277,274; 6,663,311; 7,251,454; 7,435,261; 7,833,412; RELATED FOREIGN PATENTS.

CONTECH
ENGINEERED SOLUTIONS LLC

9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX



PLAN VIEW



SECTION A-A

FILTERRA WATER QUALITY FILTER

AS MANUFACTURED BY CONTECH ENGINEERED SOLUTIONS LLC

- *W.Q. FILTER #1 (FT1206) 6'x12'
- *W.Q. FILTER #2 (FT0804) 4'x8'

NOTES:

1. SEE DRAINAGE PLAN FOR PIPE ORIENTATION, RIM ELEVATIONS AND INVERT ELEVATIONS.
2. DETAILS SHOWN ARE FOR PLANNING PURPOSES ONLY AND NOT FOR CONSTRUCTION. PRIOR TO CONSTRUCTION DETAILED SHOP DRAWINGS ARE TO BE PREPARED.

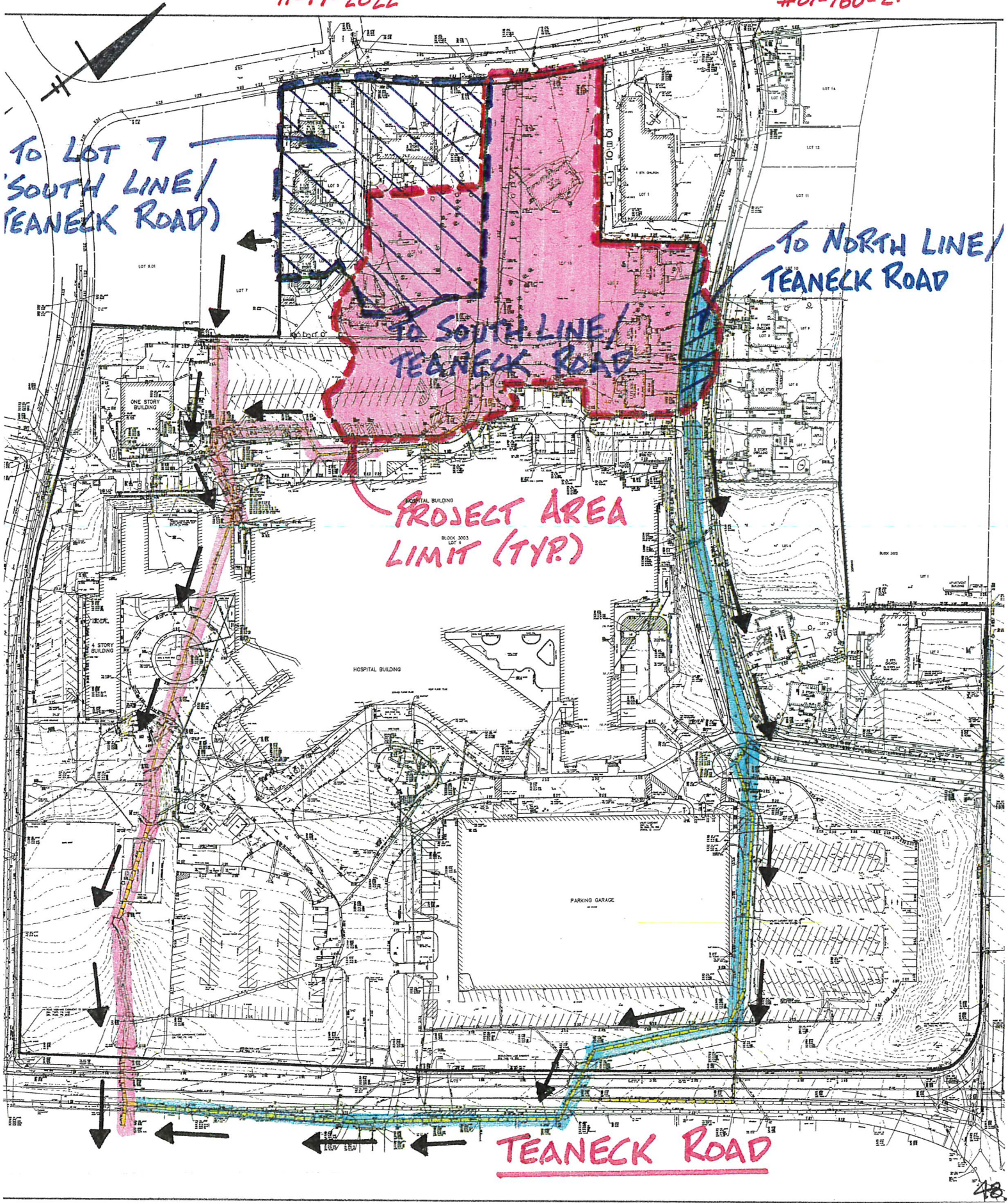
WATER QUALITY FILTER DETAILS

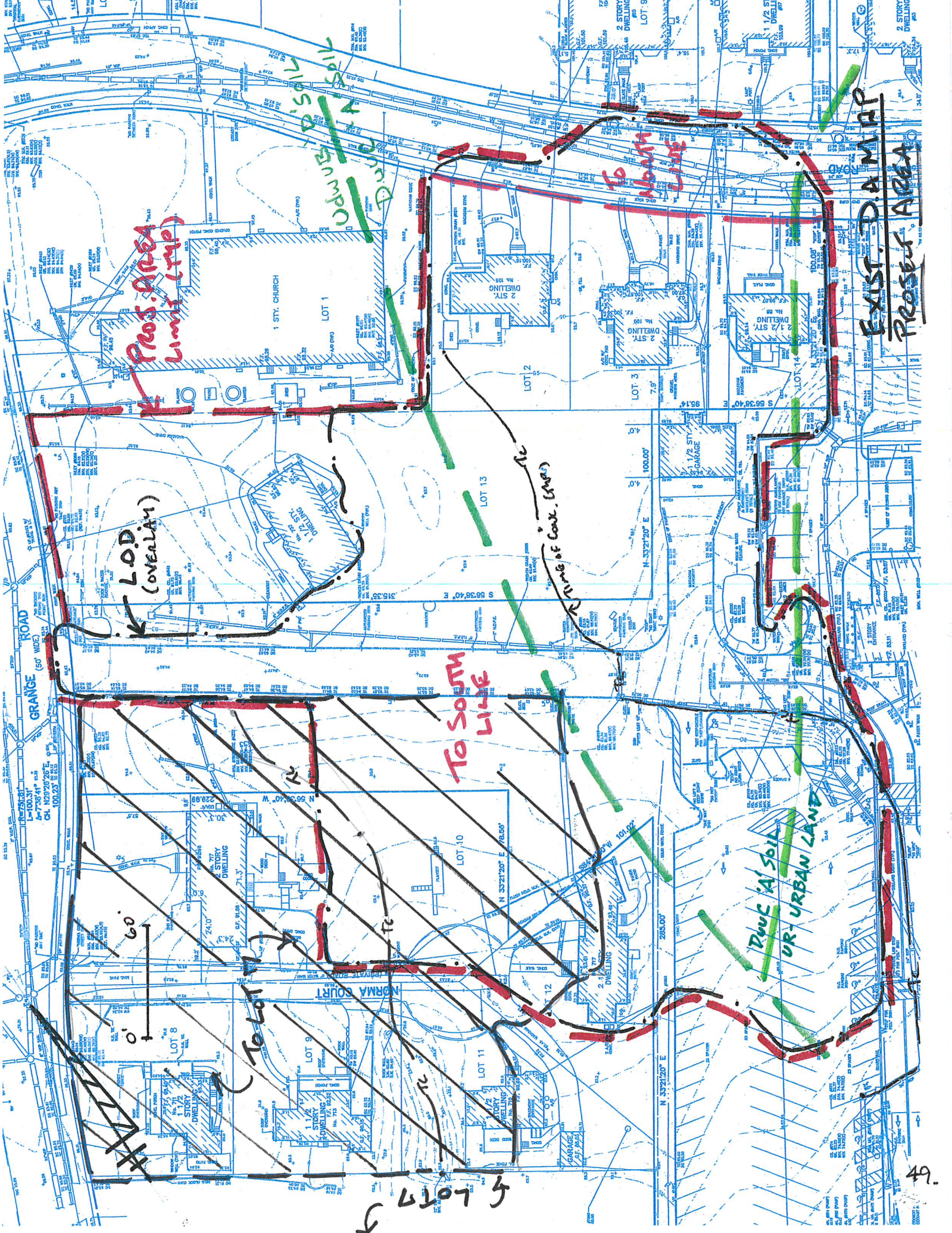
NTS

EXISTING OVERALL DRAINAGE AREA EXHIBIT

11-17-2022

#01-160-21





Prop. Area Limit (r.p.)

L.O.D. (OVERLAY)

To SOUTH LINE

To NORTH LINE

EXIST. DAM AP
PROPOSED AREA

DUNE A' SOIL
UR-URBAN LAND

Name of Cont. (SHE)

To Lot 11

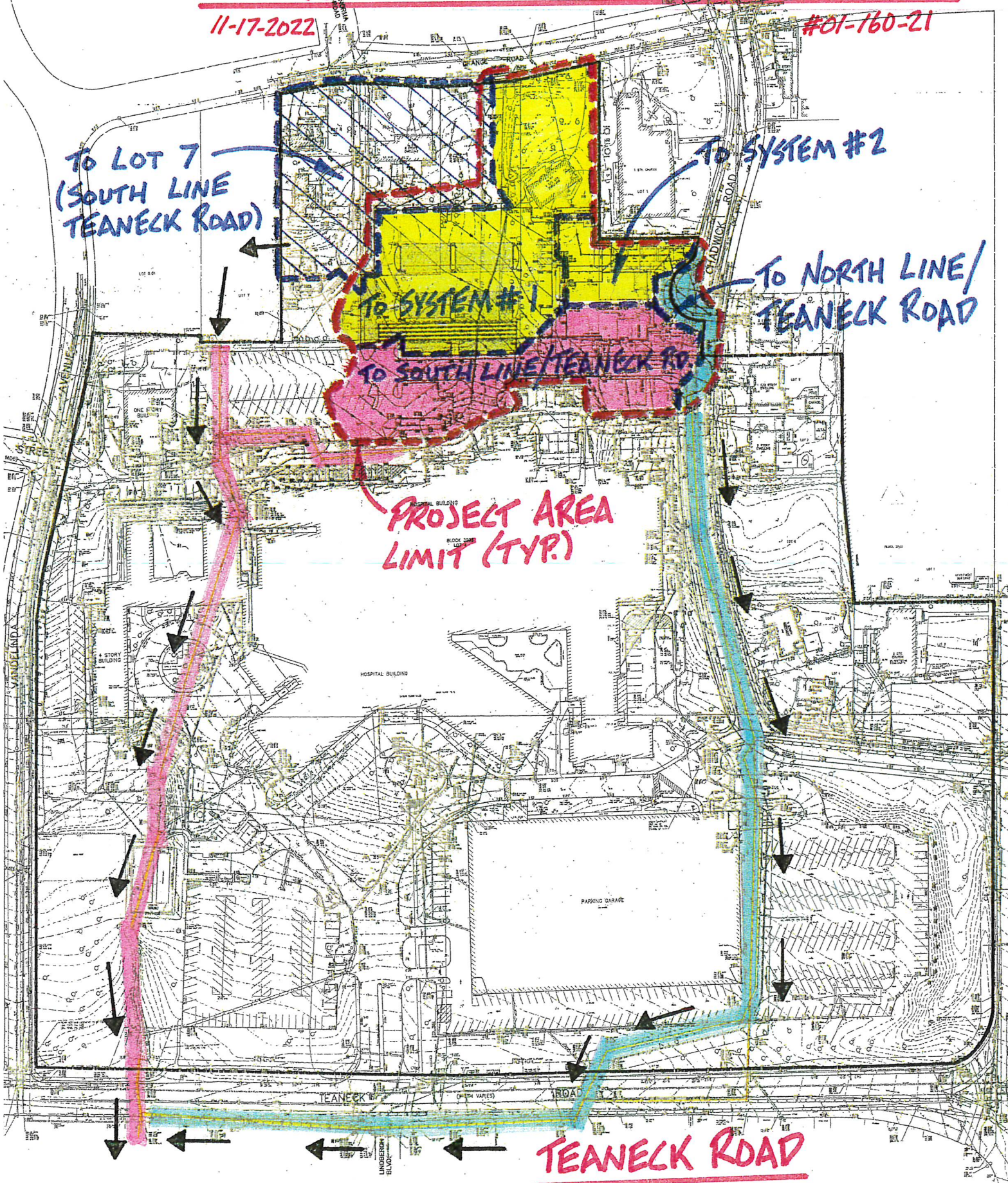
60'

Lot 3

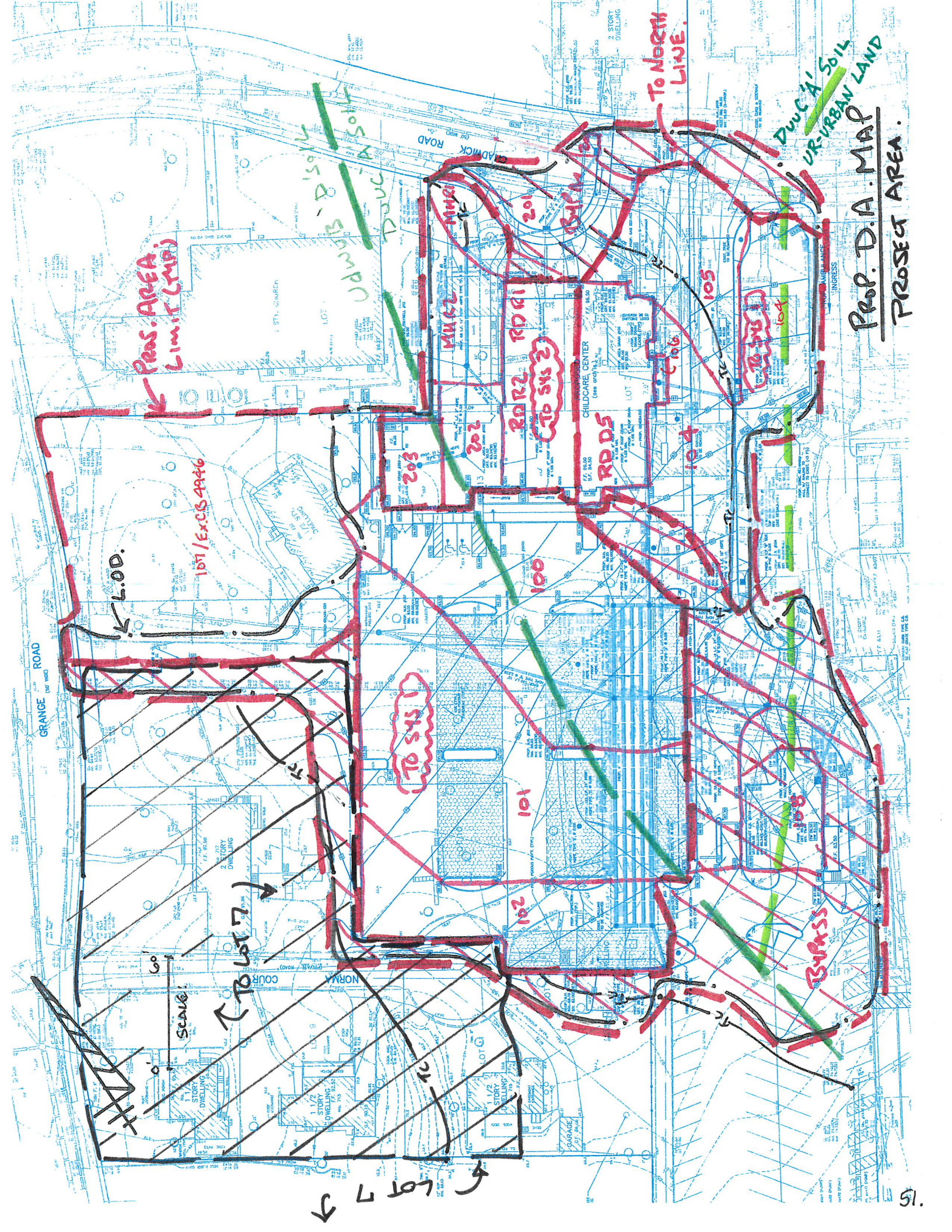
PROPOSED OVERALL DRAINAGE AREA EXHIBIT

11-17-2022

#01-160-21



TEANECK ROAD



Prop. Area Limit (P.A.L.)

DWC A' SOIL
UR-BAN LAND

TO NORTH LINE.

DWC A' SOIL
UR-BAN LAND

Prop. D.A. MAP
PROJECT AREA.

L.O.D.

101 / Ex. C15 4A46

TO SYS 1

TO SYS 2

TO SYS 3

BRASS

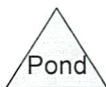
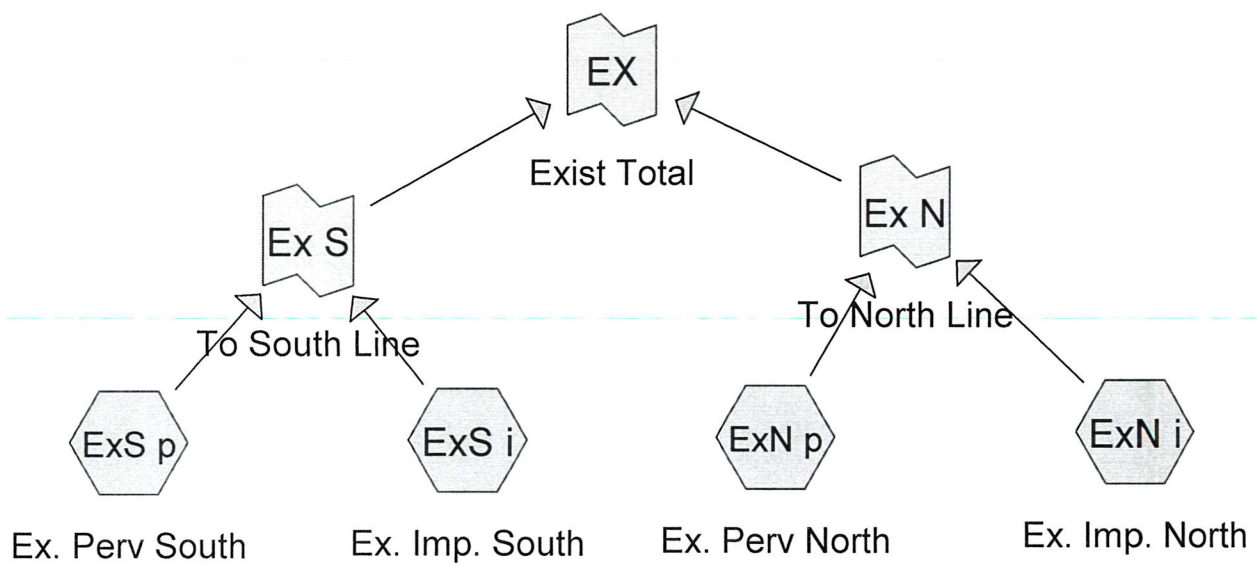
SCALE: 1" = 10'

TO LOT 7

TO LOT 7

Appendix A

**HydroCAD Calculations - Existing Conditions
2yr, 10yr, 25yr & 100yr Storms**



Time span=0.00-96.00 hrs, dt=0.01 hrs, 9601 points
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
 Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Link EX: Exist Total Inflow=3.37 cfs 19,566 cf
 Primary=3.37 cfs 19,566 cf

Link Ex N: To North Line Inflow=0.41 cfs 1,466 cf
 Primary=0.41 cfs 1,466 cf

Link Ex S: To South Line Inflow=3.23 cfs 18,100 cf
 Primary=3.23 cfs 18,100 cf

Subcatchment ExN i: Ex. Imp. North Runoff Area=0.130 ac 100.00% Impervious Runoff Depth=3.11"
 Tc=6.0 min CN=98 Runoff=0.41 cfs 1,466 cf

Subcatchment ExN p: Ex. Perv North Runoff Area=0.030 ac 0.00% Impervious Runoff Depth=0.00"
 Tc=6.0 min CN=39 Runoff=0.00 cfs 0 cf

Subcatchment ExS i: Ex. Imp. South Runoff Area=1.250 ac 100.00% Impervious Runoff Depth=3.11"
 Tc=20.0 min CN=98 Runoff=2.63 cfs 14,098 cf

Subcatchment ExS p: Ex. Perv South Runoff Area=1.890 ac 0.00% Impervious Runoff Depth=0.58"
 Tc=20.0 min CN=63 Runoff=0.63 cfs 4,002 cf

Total Runoff Area = 143,748 sf Runoff Volume = 19,566 cf Average Runoff Depth = 1.63"
58.18% Pervious = 83,635 sf 41.82% Impervious = 60,113 sf

Summary for Link EX: Exist Total

Inflow Area = 143,748 sf, 41.82% Impervious, Inflow Depth = 1.63" for 2yr NOAA event
 Inflow = 3.37 cfs @ 12.29 hrs, Volume= 19,566 cf
 Primary = 3.37 cfs @ 12.29 hrs, Volume= 19,566 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

Summary for Link Ex N: To North Line

Inflow Area = 6,970 sf, 81.25% Impervious, Inflow Depth = 2.52" for 2yr NOAA event
 Inflow = 0.41 cfs @ 12.13 hrs, Volume= 1,466 cf
 Primary = 0.41 cfs @ 12.13 hrs, Volume= 1,466 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

Summary for Link Ex S: To South Line

Inflow Area = 136,778 sf, 39.81% Impervious, Inflow Depth = 1.59" for 2yr NOAA event
 Inflow = 3.23 cfs @ 12.29 hrs, Volume= 18,100 cf
 Primary = 3.23 cfs @ 12.29 hrs, Volume= 18,100 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

Summary for Subcatchment ExN i: Ex. Imp. North

Runoff = 0.41 cfs @ 12.13 hrs, Volume= 1,466 cf, Depth= 3.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
 NOAA 24-hr D 2yr NOAA Rainfall=3.34"

| Area (ac) | CN | Description |
|-----------|----|-------------------------|
| 0.130 | 98 | Paved parking, HSG A |
| 0.130 | | 100.00% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|---------------------|
| 6.0 | | | | | Direct Entry, Ex TC |

Summary for Subcatchment ExN p: Ex. Perv North

Runoff = 0.00 cfs @ 24.01 hrs, Volume= 0 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
 NOAA 24-hr D 2yr NOAA Rainfall=3.34"

| Area (ac) | CN | Description |
|-----------|----|-------------------------------|
| 0.030 | 39 | >75% Grass cover, Good, HSG A |
| 0.030 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|--------------------|
| 6.0 | | | | | Direct Entry, ExTc |

Summary for Subcatchment ExS i: Ex. Imp. South

Runoff = 2.63 cfs @ 12.29 hrs, Volume= 14,098 cf, Depth= 3.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
 NOAA 24-hr D 2yr NOAA Rainfall=3.34"

| Area (ac) | CN | Description |
|-----------|----|-------------------------|
| 0.790 | 98 | Paved parking, HSG A |
| 0.460 | 98 | Paved parking, HSG D |
| 1.250 | 98 | Weighted Average |
| 1.250 | | 100.00% Impervious Area |

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

Summary for Subcatchment ExS p: Ex. Perv South

Runoff = 0.63 cfs @ 12.34 hrs, Volume= 4,002 cf, Depth= 0.58"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
 NOAA 24-hr D 2yr NOAA Rainfall=3.34"

| Area (ac) | CN | Description |
|-----------|----|-------------------------------|
| 0.780 | 39 | >75% Grass cover, Good, HSG A |
| 1.110 | 80 | >75% Grass cover, Good, HSG D |
| 1.890 | 63 | Weighted Average |
| 1.890 | | 100.00% Pervious Area |

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

Time span=0.00-96.00 hrs, dt=0.01 hrs, 9601 points
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
 Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Link EX: Exist Total Inflow=6.31 cfs 34,891 cf
 Primary=6.31 cfs 34,891 cf

Link Ex N: To North Line Inflow=0.63 cfs 2,304 cf
 Primary=0.63 cfs 2,304 cf

Link Ex S: To South Line Inflow=6.09 cfs 32,587 cf
 Primary=6.09 cfs 32,587 cf

Subcatchment ExN i: Ex. Imp. North Runoff Area=0.130 ac 100.00% Impervious Runoff Depth=4.83"
 Tc=6.0 min CN=98 Runoff=0.63 cfs 2,281 cf

Subcatchment ExN p: Ex. Perv North Runoff Area=0.030 ac 0.00% Impervious Runoff Depth=0.21"
 Tc=6.0 min CN=39 Runoff=0.00 cfs 23 cf

Subcatchment ExS i: Ex. Imp. South Runoff Area=1.250 ac 100.00% Impervious Runoff Depth=4.83"
 Tc=20.0 min CN=98 Runoff=4.02 cfs 21,930 cf

Subcatchment ExS p: Ex. Perv South Runoff Area=1.890 ac 0.00% Impervious Runoff Depth=1.55"
 Tc=20.0 min CN=63 Runoff=2.08 cfs 10,657 cf

Total Runoff Area = 143,748 sf Runoff Volume = 34,891 cf Average Runoff Depth = 2.91"
58.18% Pervious = 83,635 sf 41.82% Impervious = 60,113 sf

Summary for Link EX: Exist Total

Inflow Area = 143,748 sf, 41.82% Impervious, Inflow Depth = 2.91" for 10yr NOAA event
 Inflow = 6.31 cfs @ 12.29 hrs, Volume= 34,891 cf
 Primary = 6.31 cfs @ 12.29 hrs, Volume= 34,891 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

Summary for Link Ex N: To North Line

Inflow Area = 6,970 sf, 81.25% Impervious, Inflow Depth = 3.97" for 10yr NOAA event
 Inflow = 0.63 cfs @ 12.13 hrs, Volume= 2,304 cf
 Primary = 0.63 cfs @ 12.13 hrs, Volume= 2,304 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

Summary for Link Ex S: To South Line

Inflow Area = 136,778 sf, 39.81% Impervious, Inflow Depth = 2.86" for 10yr NOAA event
 Inflow = 6.09 cfs @ 12.29 hrs, Volume= 32,587 cf
 Primary = 6.09 cfs @ 12.29 hrs, Volume= 32,587 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

Summary for Subcatchment ExN i: Ex. Imp. North

Runoff = 0.63 cfs @ 12.13 hrs, Volume= 2,281 cf, Depth= 4.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
 NOAA 24-hr D 10yr NOAA Rainfall=5.07"

| Area (ac) | CN | Description |
|-----------|----|-------------------------|
| 0.130 | 98 | Paved parking, HSG A |
| 0.130 | | 100.00% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|---------------------|
| 6.0 | | | | | Direct Entry, Ex TC |

Summary for Subcatchment ExN p: Ex. Perv North

Runoff = 0.00 cfs @ 12.94 hrs, Volume= 23 cf, Depth= 0.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
 NOAA 24-hr D 10yr NOAA Rainfall=5.07"

| Area (ac) | CN | Description |
|-----------|----|-------------------------------|
| 0.030 | 39 | >75% Grass cover, Good, HSG A |
| 0.030 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|--------------------|
| 6.0 | | | | | Direct Entry, ExTc |

Summary for Subcatchment ExS i: Ex. Imp. South

Runoff = 4.02 cfs @ 12.29 hrs, Volume= 21,930 cf, Depth= 4.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
 NOAA 24-hr D 10yr NOAA Rainfall=5.07"

| Area (ac) | CN | Description |
|-----------|----|-------------------------|
| 0.790 | 98 | Paved parking, HSG A |
| 0.460 | 98 | Paved parking, HSG D |
| 1.250 | 98 | Weighted Average |
| 1.250 | | 100.00% Impervious Area |

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

Summary for Subcatchment ExS p: Ex. Perv South

Runoff = 2.08 cfs @ 12.31 hrs, Volume= 10,657 cf, Depth= 1.55"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
 NOAA 24-hr D 10yr NOAA Rainfall=5.07"

| Area (ac) | CN | Description |
|-----------|----|-------------------------------|
| 0.780 | 39 | >75% Grass cover, Good, HSG A |
| 1.110 | 80 | >75% Grass cover, Good, HSG D |
| 1.890 | 63 | Weighted Average |
| 1.890 | | 100.00% Pervious Area |

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

Time span=0.00-96.00 hrs, dt=0.01 hrs, 9601 points
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
 Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Link EX: Exist Total Inflow=8.57 cfs 46,611 cf
 Primary=8.57 cfs 46,611 cf

Link Ex N: To North Line Inflow=0.79 cfs 2,909 cf
 Primary=0.79 cfs 2,909 cf

Link Ex S: To South Line Inflow=8.29 cfs 43,702 cf
 Primary=8.29 cfs 43,702 cf

Subcatchment ExN i: Ex. Imp. North Runoff Area=0.130 ac 100.00% Impervious Runoff Depth=6.04"
 Tc=6.0 min CN=98 Runoff=0.78 cfs 2,851 cf

Subcatchment ExN p: Ex. Perv North Runoff Area=0.030 ac 0.00% Impervious Runoff Depth=0.53"
 Tc=6.0 min CN=39 Runoff=0.01 cfs 58 cf

Subcatchment ExS i: Ex. Imp. South Runoff Area=1.250 ac 100.00% Impervious Runoff Depth=6.04"
 Tc=20.0 min CN=98 Runoff=4.99 cfs 27,414 cf

Subcatchment ExS p: Ex. Perv South Runoff Area=1.890 ac 0.00% Impervious Runoff Depth=2.37"
 Tc=20.0 min CN=63 Runoff=3.31 cfs 16,289 cf

Total Runoff Area = 143,748 sf Runoff Volume = 46,611 cf Average Runoff Depth = 3.89"
58.18% Pervious = 83,635 sf 41.82% Impervious = 60,113 sf

Summary for Link EX: Exist Total

Inflow Area = 143,748 sf, 41.82% Impervious, Inflow Depth = 3.89" for 25yr NOAA event
 Inflow = 8.57 cfs @ 12.29 hrs, Volume= 46,611 cf
 Primary = 8.57 cfs @ 12.29 hrs, Volume= 46,611 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

Summary for Link Ex N: To North Line

Inflow Area = 6,970 sf, 81.25% Impervious, Inflow Depth = 5.01" for 25yr NOAA event
 Inflow = 0.79 cfs @ 12.13 hrs, Volume= 2,909 cf
 Primary = 0.79 cfs @ 12.13 hrs, Volume= 2,909 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

Summary for Link Ex S: To South Line

Inflow Area = 136,778 sf, 39.81% Impervious, Inflow Depth = 3.83" for 25yr NOAA event
 Inflow = 8.29 cfs @ 12.29 hrs, Volume= 43,702 cf
 Primary = 8.29 cfs @ 12.29 hrs, Volume= 43,702 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

Summary for Subcatchment ExN i: Ex. Imp. North

Runoff = 0.78 cfs @ 12.13 hrs, Volume= 2,851 cf, Depth= 6.04"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
 NOAA 24-hr D 25yr NOAA Rainfall=6.28"

| Area (ac) | CN | Description |
|-----------|----|-------------------------|
| 0.130 | 98 | Paved parking, HSG A |
| 0.130 | | 100.00% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|---------------------|
| 6.0 | | | | | Direct Entry, Ex TC |

Summary for Subcatchment ExN p: Ex. Perv North

Runoff = 0.01 cfs @ 12.17 hrs, Volume= 58 cf, Depth= 0.53"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
 NOAA 24-hr D 25yr NOAA Rainfall=6.28"

| Area (ac) | CN | Description |
|-----------|----|-------------------------------|
| 0.030 | 39 | >75% Grass cover, Good, HSG A |
| 0.030 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|--------------------|
| 6.0 | | | | | Direct Entry, ExTc |

Summary for Subcatchment ExS i: Ex. Imp. South

Runoff = 4.99 cfs @ 12.29 hrs, Volume= 27,414 cf, Depth= 6.04"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
 NOAA 24-hr D 25yr NOAA Rainfall=6.28"

| Area (ac) | CN | Description |
|-----------|----|-------------------------|
| 0.790 | 98 | Paved parking, HSG A |
| 0.460 | 98 | Paved parking, HSG D |
| 1.250 | 98 | Weighted Average |
| 1.250 | | 100.00% Impervious Area |

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

Summary for Subcatchment ExS p: Ex. Perv South

Runoff = 3.31 cfs @ 12.30 hrs, Volume= 16,289 cf, Depth= 2.37"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
 NOAA 24-hr D 25yr NOAA Rainfall=6.28"

| Area (ac) | CN | Description |
|-----------|----|-------------------------------|
| 0.780 | 39 | >75% Grass cover, Good, HSG A |
| 1.110 | 80 | >75% Grass cover, Good, HSG D |
| 1.890 | 63 | Weighted Average |
| 1.890 | | 100.00% Pervious Area |

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

Time span=0.00-96.00 hrs, dt=0.01 hrs, 9601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Link EX: Exist Total Inflow=12.89 cfs 69,104 cf
Primary=12.89 cfs 69,104 cf

Link Ex N: To North Line Inflow=1.09 cfs 4,032 cf
Primary=1.09 cfs 4,032 cf

Link Ex S: To South Line Inflow=12.51 cfs 65,072 cf
Primary=12.51 cfs 65,072 cf

Subcatchment ExN i: Ex. Imp. North Runoff Area=0.130 ac 100.00% Impervious Runoff Depth=8.23"
Tc=6.0 min CN=98 Runoff=1.05 cfs 3,884 cf

Subcatchment ExN p: Ex. Perv North Runoff Area=0.030 ac 0.00% Impervious Runoff Depth=1.36"
Tc=6.0 min CN=39 Runoff=0.04 cfs 148 cf

Subcatchment ExS i: Ex. Imp. South Runoff Area=1.250 ac 100.00% Impervious Runoff Depth=8.23"
Tc=20.0 min CN=98 Runoff=6.74 cfs 37,343 cf

Subcatchment ExS p: Ex. Perv South Runoff Area=1.890 ac 0.00% Impervious Runoff Depth=4.04"
Tc=20.0 min CN=63 Runoff=5.77 cfs 27,729 cf

Total Runoff Area = 143,748 sf Runoff Volume = 69,104 cf Average Runoff Depth = 5.77"
58.18% Pervious = 83,635 sf 41.82% Impervious = 60,113 sf

Summary for Link EX: Exist Total

Inflow Area = 143,748 sf, 41.82% Impervious, Inflow Depth = 5.77" for 100yr NOAA event
 Inflow = 12.89 cfs @ 12.29 hrs, Volume= 69,104 cf
 Primary = 12.89 cfs @ 12.29 hrs, Volume= 69,104 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

Summary for Link Ex N: To North Line

Inflow Area = 6,970 sf, 81.25% Impervious, Inflow Depth = 6.94" for 100yr NOAA event
 Inflow = 1.09 cfs @ 12.13 hrs, Volume= 4,032 cf
 Primary = 1.09 cfs @ 12.13 hrs, Volume= 4,032 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

Summary for Link Ex S: To South Line

Inflow Area = 136,778 sf, 39.81% Impervious, Inflow Depth = 5.71" for 100yr NOAA event
 Inflow = 12.51 cfs @ 12.29 hrs, Volume= 65,072 cf
 Primary = 12.51 cfs @ 12.29 hrs, Volume= 65,072 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

Summary for Subcatchment ExN i: Ex. Imp. North

Runoff = 1.05 cfs @ 12.13 hrs, Volume= 3,884 cf, Depth= 8.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
 NOAA 24-hr D 100yr NOAA Rainfall=8.47"

| Area (ac) | CN | Description |
|-----------|----|-------------------------|
| 0.130 | 98 | Paved parking, HSG A |
| 0.130 | | 100.00% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|---------------------|
| 6.0 | | | | | Direct Entry, Ex TC |

Summary for Subcatchment ExN p: Ex. Perv North

Runoff = 0.04 cfs @ 12.14 hrs, Volume= 148 cf, Depth= 1.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
 NOAA 24-hr D 100yr NOAA Rainfall=8.47"

| Area (ac) | CN | Description |
|-----------|----|-------------------------------|
| 0.030 | 39 | >75% Grass cover, Good, HSG A |
| 0.030 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|--------------------|
| 6.0 | | | | | Direct Entry, ExTc |

Summary for Subcatchment ExS i: Ex. Imp. South

Runoff = 6.74 cfs @ 12.29 hrs, Volume= 37,343 cf, Depth= 8.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
 NOAA 24-hr D 100yr NOAA Rainfall=8.47"

| Area (ac) | CN | Description |
|-----------|----|-------------------------|
| 0.790 | 98 | Paved parking, HSG A |
| 0.460 | 98 | Paved parking, HSG D |
| 1.250 | 98 | Weighted Average |
| 1.250 | | 100.00% Impervious Area |

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

Summary for Subcatchment ExS p: Ex. Perv South

Runoff = 5.77 cfs @ 12.29 hrs, Volume= 27,729 cf, Depth= 4.04"

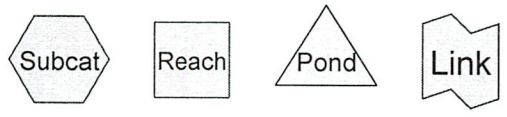
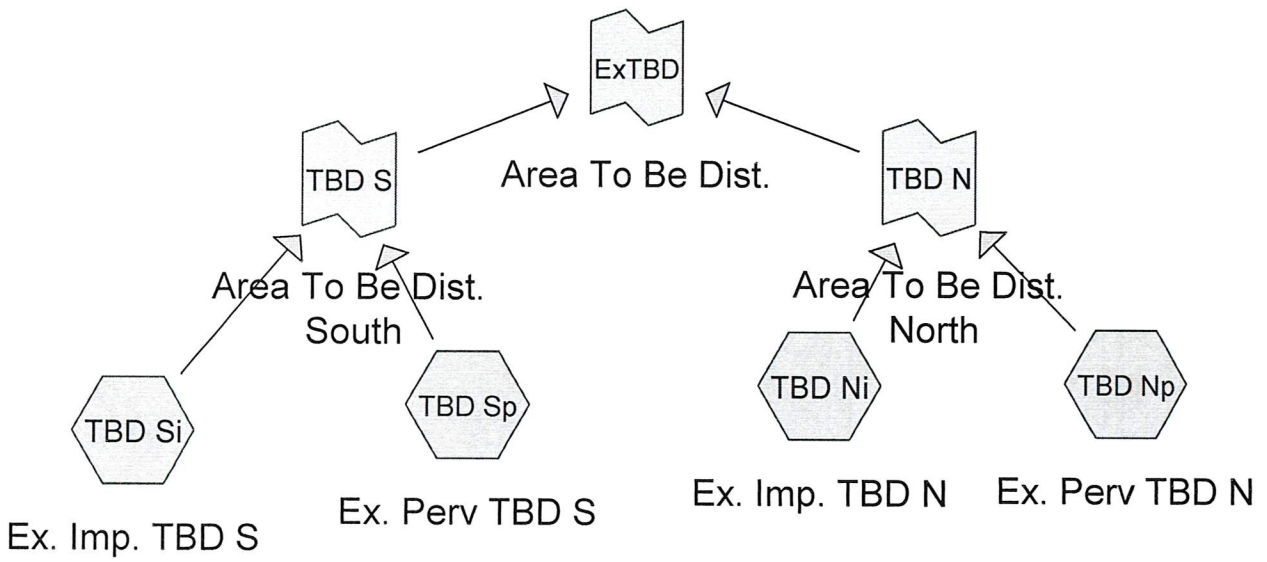
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
 NOAA 24-hr D 100yr NOAA Rainfall=8.47"

| Area (ac) | CN | Description |
|-----------|----|-------------------------------|
| 0.780 | 39 | >75% Grass cover, Good, HSG A |
| 1.110 | 80 | >75% Grass cover, Good, HSG D |
| 1.890 | 63 | Weighted Average |
| 1.890 | | 100.00% Pervious Area |

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

Appendix B

**HydroCAD Calculations - Area To Be Disturbed
2yr, 10yr, 25yr & 100yr Storms**



Time span=0.00-96.00 hrs, dt=0.01 hrs, 9601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Link ExTBD: Area To Be Dist.

Inflow=2.78 cfs 16,554 cf
Primary=2.78 cfs 16,554 cf

Link TBD N: Area To Be Dist. North

Inflow=0.41 cfs 1,466 cf
Primary=0.41 cfs 1,466 cf

Subcatchment TBD Ni: Ex. Imp. TBD N

Runoff Area=0.130 ac 100.00% Impervious Runoff Depth=3.11"
Tc=6.0 min CN=98 Runoff=0.41 cfs 1,466 cf

Subcatchment TBD Np: Ex. Perv TBD N

Runoff Area=0.030 ac 0.00% Impervious Runoff Depth=0.00"
Tc=6.0 min CN=39 Runoff=0.00 cfs 0 cf

Link TBD S: Area To Be Dist. South

Inflow=2.63 cfs 15,087 cf
Primary=2.63 cfs 15,087 cf

Subcatchment TBD Si: Ex. Imp. TBD S

Runoff Area=1.130 ac 100.00% Impervious Runoff Depth=3.11"
Tc=20.0 min CN=98 Runoff=2.38 cfs 12,745 cf

Subcatchment TBD Sp: Ex. Perv TBD S

Runoff Area=1.510 ac 0.00% Impervious Runoff Depth=0.43"
Tc=20.0 min CN=59 Runoff=0.29 cfs 2,342 cf

Total Runoff Area = 121,968 sf Runoff Volume = 16,554 cf Average Runoff Depth = 1.63"
55.00% Pervious = 67,082 sf 45.00% Impervious = 54,886 sf

Summary for Link ExTBD: Area To Be Dist.

Inflow Area = 121,968 sf, 45.00% Impervious, Inflow Depth = 1.63" for 2yr NOAA event
 Inflow = 2.78 cfs @ 12.29 hrs, Volume= 16,554 cf
 Primary = 2.78 cfs @ 12.29 hrs, Volume= 16,554 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

Summary for Link TBD N: Area To Be Dist. North

Inflow Area = 6,970 sf, 81.25% Impervious, Inflow Depth = 2.52" for 2yr NOAA event
 Inflow = 0.41 cfs @ 12.13 hrs, Volume= 1,466 cf
 Primary = 0.41 cfs @ 12.13 hrs, Volume= 1,466 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

Summary for Subcatchment TBD Ni: Ex. Imp. TBD N

Runoff = 0.41 cfs @ 12.13 hrs, Volume= 1,466 cf, Depth= 3.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
 NOAA 24-hr D 2yr NOAA Rainfall=3.34"

| Area (ac) | CN | Description |
|-----------|----|-------------------------|
| 0.130 | 98 | Paved parking, HSG A |
| 0.130 | | 100.00% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|---------------------|
| 6.0 | | | | | Direct Entry, Ex TC |

Summary for Subcatchment TBD Np: Ex. Perv TBD N

Runoff = 0.00 cfs @ 24.01 hrs, Volume= 0 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
 NOAA 24-hr D 2yr NOAA Rainfall=3.34"

| Area (ac) | CN | Description |
|-----------|----|-------------------------------|
| 0.030 | 39 | >75% Grass cover, Good, HSG A |
| 0.030 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|--------------------|
| 6.0 | | | | | Direct Entry, ExTc |

Summary for Link TBD S: Area To Be Dist. South

Inflow Area = 114,998 sf, 42.80% Impervious, Inflow Depth = 1.57" for 2yr NOAA event
 Inflow = 2.63 cfs @ 12.29 hrs, Volume= 15,087 cf
 Primary = 2.63 cfs @ 12.29 hrs, Volume= 15,087 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

Summary for Subcatchment TBD Si: Ex. Imp. TBD S

Runoff = 2.38 cfs @ 12.29 hrs, Volume= 12,745 cf, Depth= 3.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
 NOAA 24-hr D 2yr NOAA Rainfall=3.34"

| Area (ac) | CN | Description |
|-----------|----|-------------------------|
| 0.770 | 98 | Paved parking, HSG A |
| 0.360 | 98 | Paved parking, HSG D |
| 1.130 | 98 | Weighted Average |
| 1.130 | | 100.00% Impervious Area |

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

Summary for Subcatchment TBD Sp: Ex. Perv TBD S

Runoff = 0.29 cfs @ 12.38 hrs, Volume= 2,342 cf, Depth= 0.43"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
 NOAA 24-hr D 2yr NOAA Rainfall=3.34"

| Area (ac) | CN | Description |
|-----------|----|-------------------------------|
| 0.780 | 39 | >75% Grass cover, Good, HSG A |
| 0.730 | 80 | >75% Grass cover, Good, HSG D |
| 1.510 | 59 | Weighted Average |
| 1.510 | | 100.00% Pervious Area |

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

Time span=0.00-96.00 hrs, dt=0.01 hrs, 9601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Link ExTBD: Area To Be Dist. Inflow=5.13 cfs 29,113 cf
Primary=5.13 cfs 29,113 cf

Link TBD N: Area To Be Dist. North Inflow=0.63 cfs 2,304 cf
Primary=0.63 cfs 2,304 cf

Subcatchment TBD Ni: Ex. Imp. TBD N Runoff Area=0.130 ac 100.00% Impervious Runoff Depth=4.83"
Tc=6.0 min CN=98 Runoff=0.63 cfs 2,281 cf

Subcatchment TBD Np: Ex. Perv TBD N Runoff Area=0.030 ac 0.00% Impervious Runoff Depth=0.21"
Tc=6.0 min CN=39 Runoff=0.00 cfs 23 cf

Link TBD S: Area To Be Dist. South Inflow=4.91 cfs 26,809 cf
Primary=4.91 cfs 26,809 cf

Subcatchment TBD Si: Ex. Imp. TBD S Runoff Area=1.130 ac 100.00% Impervious Runoff Depth=4.83"
Tc=20.0 min CN=98 Runoff=3.63 cfs 19,825 cf

Subcatchment TBD Sp: Ex. Perv TBD S Runoff Area=1.510 ac 0.00% Impervious Runoff Depth=1.27"
Tc=20.0 min CN=59 Runoff=1.30 cfs 6,984 cf

Total Runoff Area = 121,968 sf Runoff Volume = 29,113 cf Average Runoff Depth = 2.86"
55.00% Pervious = 67,082 sf 45.00% Impervious = 54,886 sf

Summary for Link ExTBD: Area To Be Dist.

Inflow Area = 121,968 sf, 45.00% Impervious, Inflow Depth = 2.86" for 10yr NOAA event
 Inflow = 5.13 cfs @ 12.29 hrs, Volume= 29,113 cf
 Primary = 5.13 cfs @ 12.29 hrs, Volume= 29,113 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

Summary for Link TBD N: Area To Be Dist. North

Inflow Area = 6,970 sf, 81.25% Impervious, Inflow Depth = 3.97" for 10yr NOAA event
 Inflow = 0.63 cfs @ 12.13 hrs, Volume= 2,304 cf
 Primary = 0.63 cfs @ 12.13 hrs, Volume= 2,304 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

Summary for Subcatchment TBD Ni: Ex. Imp. TBD N

Runoff = 0.63 cfs @ 12.13 hrs, Volume= 2,281 cf, Depth= 4.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
 NOAA 24-hr D 10yr NOAA Rainfall=5.07"

| Area (ac) | CN | Description |
|-----------|----|-------------------------|
| 0.130 | 98 | Paved parking, HSG A |
| 0.130 | | 100.00% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|---------------------|
| 6.0 | | | | | Direct Entry, Ex TC |

Summary for Subcatchment TBD Np: Ex. Perv TBD N

Runoff = 0.00 cfs @ 12.94 hrs, Volume= 23 cf, Depth= 0.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
 NOAA 24-hr D 10yr NOAA Rainfall=5.07"

| Area (ac) | CN | Description |
|-----------|----|-------------------------------|
| 0.030 | 39 | >75% Grass cover, Good, HSG A |
| 0.030 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|--------------------|
| 6.0 | | | | | Direct Entry, ExTc |

Summary for Link TBD S: Area To Be Dist. South

Inflow Area = 114,998 sf, 42.80% Impervious, Inflow Depth = 2.80" for 10yr NOAA event
 Inflow = 4.91 cfs @ 12.29 hrs, Volume= 26,809 cf
 Primary = 4.91 cfs @ 12.29 hrs, Volume= 26,809 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

Summary for Subcatchment TBD Si: Ex. Imp. TBD S

Runoff = 3.63 cfs @ 12.29 hrs, Volume= 19,825 cf, Depth= 4.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
 NOAA 24-hr D 10yr NOAA Rainfall=5.07"

| Area (ac) | CN | Description |
|-----------|----|-------------------------|
| 0.770 | 98 | Paved parking, HSG A |
| 0.360 | 98 | Paved parking, HSG D |
| 1.130 | 98 | Weighted Average |
| 1.130 | | 100.00% Impervious Area |

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

Summary for Subcatchment TBD Sp: Ex. Perv TBD S

Runoff = 1.30 cfs @ 12.33 hrs, Volume= 6,984 cf, Depth= 1.27"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
 NOAA 24-hr D 10yr NOAA Rainfall=5.07"

| Area (ac) | CN | Description |
|-----------|----|-------------------------------|
| 0.780 | 39 | >75% Grass cover, Good, HSG A |
| 0.730 | 80 | >75% Grass cover, Good, HSG D |
| 1.510 | 59 | Weighted Average |
| 1.510 | | 100.00% Pervious Area |

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

Time span=0.00-96.00 hrs, dt=0.01 hrs, 9601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Link ExTBD: Area To Be Dist.

Inflow=6.97 cfs 38,762 cf
Primary=6.97 cfs 38,762 cf

Link TBD N: Area To Be Dist. North

Inflow=0.79 cfs 2,909 cf
Primary=0.79 cfs 2,909 cf

Subcatchment TBD Ni: Ex. Imp. TBD N

Runoff Area=0.130 ac 100.00% Impervious Runoff Depth=6.04"
Tc=6.0 min CN=98 Runoff=0.78 cfs 2,851 cf

Subcatchment TBD Np: Ex. Perv TBD N

Runoff Area=0.030 ac 0.00% Impervious Runoff Depth=0.53"
Tc=6.0 min CN=39 Runoff=0.01 cfs 58 cf

Link TBD S: Area To Be Dist. South

Inflow=6.69 cfs 35,853 cf
Primary=6.69 cfs 35,853 cf

Subcatchment TBD Si: Ex. Imp. TBD S

Runoff Area=1.130 ac 100.00% Impervious Runoff Depth=6.04"
Tc=20.0 min CN=98 Runoff=4.51 cfs 24,782 cf

Subcatchment TBD Sp: Ex. Perv TBD S

Runoff Area=1.510 ac 0.00% Impervious Runoff Depth=2.02"
Tc=20.0 min CN=59 Runoff=2.19 cfs 11,071 cf

Total Runoff Area = 121,968 sf Runoff Volume = 38,762 cf Average Runoff Depth = 3.81"
55.00% Pervious = 67,082 sf 45.00% Impervious = 54,886 sf

Summary for Link ExTBD: Area To Be Dist.

Inflow Area = 121,968 sf, 45.00% Impervious, Inflow Depth = 3.81" for 25yr NOAA event
 Inflow = 6.97 cfs @ 12.29 hrs, Volume= 38,762 cf
 Primary = 6.97 cfs @ 12.29 hrs, Volume= 38,762 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

Summary for Link TBD N: Area To Be Dist. North

Inflow Area = 6,970 sf, 81.25% Impervious, Inflow Depth = 5.01" for 25yr NOAA event
 Inflow = 0.79 cfs @ 12.13 hrs, Volume= 2,909 cf
 Primary = 0.79 cfs @ 12.13 hrs, Volume= 2,909 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

Summary for Subcatchment TBD Ni: Ex. Imp. TBD N

Runoff = 0.78 cfs @ 12.13 hrs, Volume= 2,851 cf, Depth= 6.04"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
 NOAA 24-hr D 25yr NOAA Rainfall=6.28"

| Area (ac) | CN | Description |
|-----------|----|-------------------------|
| 0.130 | 98 | Paved parking, HSG A |
| 0.130 | | 100.00% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|---------------------|
| 6.0 | | | | | Direct Entry, Ex TC |

Summary for Subcatchment TBD Np: Ex. Perv TBD N

Runoff = 0.01 cfs @ 12.17 hrs, Volume= 58 cf, Depth= 0.53"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
 NOAA 24-hr D 25yr NOAA Rainfall=6.28"

| Area (ac) | CN | Description |
|-----------|----|-------------------------------|
| 0.030 | 39 | >75% Grass cover, Good, HSG A |
| 0.030 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|--------------------|
| 6.0 | | | | | Direct Entry, ExTc |

Summary for Link TBD S: Area To Be Dist. South

Inflow Area = 114,998 sf, 42.80% Impervious, Inflow Depth = 3.74" for 25yr NOAA event
 Inflow = 6.69 cfs @ 12.29 hrs, Volume= 35,853 cf
 Primary = 6.69 cfs @ 12.29 hrs, Volume= 35,853 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

Summary for Subcatchment TBD Si: Ex. Imp. TBD S

Runoff = 4.51 cfs @ 12.29 hrs, Volume= 24,782 cf, Depth= 6.04"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
 NOAA 24-hr D 25yr NOAA Rainfall=6.28"

| Area (ac) | CN | Description |
|-----------|----|-------------------------|
| 0.770 | 98 | Paved parking, HSG A |
| 0.360 | 98 | Paved parking, HSG D |
| 1.130 | 98 | Weighted Average |
| 1.130 | | 100.00% Impervious Area |

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

Summary for Subcatchment TBD Sp: Ex. Perv TBD S

Runoff = 2.19 cfs @ 12.31 hrs, Volume= 11,071 cf, Depth= 2.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
 NOAA 24-hr D 25yr NOAA Rainfall=6.28"

| Area (ac) | CN | Description |
|-----------|----|-------------------------------|
| 0.780 | 39 | >75% Grass cover, Good, HSG A |
| 0.730 | 80 | >75% Grass cover, Good, HSG D |
| 1.510 | 59 | Weighted Average |
| 1.510 | | 100.00% Pervious Area |

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

Time span=0.00-96.00 hrs, dt=0.01 hrs, 9601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Link ExTBD: Area To Be Dist.

Inflow=10.51 cfs 57,376 cf
Primary=10.51 cfs 57,376 cf

Link TBD N: Area To Be Dist. North

Inflow=1.09 cfs 4,032 cf
Primary=1.09 cfs 4,032 cf

Subcatchment TBD Ni: Ex. Imp. TBD N

Runoff Area=0.130 ac 100.00% Impervious Runoff Depth=8.23"
Tc=6.0 min CN=98 Runoff=1.05 cfs 3,884 cf

Subcatchment TBD Np: Ex. Perv TBD N

Runoff Area=0.030 ac 0.00% Impervious Runoff Depth=1.36"
Tc=6.0 min CN=39 Runoff=0.04 cfs 148 cf

Link TBD S: Area To Be Dist. South

Inflow=10.12 cfs 53,344 cf
Primary=10.12 cfs 53,344 cf

Subcatchment TBD Si: Ex. Imp. TBD S

Runoff Area=1.130 ac 100.00% Impervious Runoff Depth=8.23"
Tc=20.0 min CN=98 Runoff=6.09 cfs 33,758 cf

Subcatchment TBD Sp: Ex. Perv TBD S

Runoff Area=1.510 ac 0.00% Impervious Runoff Depth=3.57"
Tc=20.0 min CN=59 Runoff=4.03 cfs 19,585 cf

Total Runoff Area = 121,968 sf Runoff Volume = 57,376 cf Average Runoff Depth = 5.64"
55.00% Pervious = 67,082 sf 45.00% Impervious = 54,886 sf

Summary for Link ExTBD: Area To Be Dist.

Inflow Area = 121,968 sf, 45.00% Impervious, Inflow Depth = 5.64" for 100yr NOAA event
 Inflow = 10.51 cfs @ 12.29 hrs, Volume= 57,376 cf
 Primary = 10.51 cfs @ 12.29 hrs, Volume= 57,376 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

Summary for Link TBD N: Area To Be Dist. North

Inflow Area = 6,970 sf, 81.25% Impervious, Inflow Depth = 6.94" for 100yr NOAA event
 Inflow = 1.09 cfs @ 12.13 hrs, Volume= 4,032 cf
 Primary = 1.09 cfs @ 12.13 hrs, Volume= 4,032 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

Summary for Subcatchment TBD Ni: Ex. Imp. TBD N

Runoff = 1.05 cfs @ 12.13 hrs, Volume= 3,884 cf, Depth= 8.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
 NOAA 24-hr D 100yr NOAA Rainfall=8.47"

| Area (ac) | CN | Description |
|-----------|----|-------------------------|
| 0.130 | 98 | Paved parking, HSG A |
| 0.130 | | 100.00% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|---------------------|
| 6.0 | | | | | Direct Entry, Ex TC |

Summary for Subcatchment TBD Np: Ex. Perv TBD N

Runoff = 0.04 cfs @ 12.14 hrs, Volume= 148 cf, Depth= 1.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
 NOAA 24-hr D 100yr NOAA Rainfall=8.47"

| Area (ac) | CN | Description |
|-----------|----|-------------------------------|
| 0.030 | 39 | >75% Grass cover, Good, HSG A |
| 0.030 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|--------------------|
| 6.0 | | | | | Direct Entry, ExTc |

Summary for Link TBD S: Area To Be Dist. South

Inflow Area = 114,998 sf, 42.80% Impervious, Inflow Depth = 5.57" for 100yr NOAA event
 Inflow = 10.12 cfs @ 12.29 hrs, Volume= 53,344 cf
 Primary = 10.12 cfs @ 12.29 hrs, Volume= 53,344 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

Summary for Subcatchment TBD Si: Ex. Imp. TBD S

Runoff = 6.09 cfs @ 12.29 hrs, Volume= 33,758 cf, Depth= 8.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
 NOAA 24-hr D 100yr NOAA Rainfall=8.47"

| Area (ac) | CN | Description |
|-----------|----|-------------------------|
| 0.770 | 98 | Paved parking, HSG A |
| 0.360 | 98 | Paved parking, HSG D |
| 1.130 | 98 | Weighted Average |
| 1.130 | | 100.00% Impervious Area |

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

Summary for Subcatchment TBD Sp: Ex. Perv TBD S

Runoff = 4.03 cfs @ 12.29 hrs, Volume= 19,585 cf, Depth= 3.57"

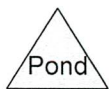
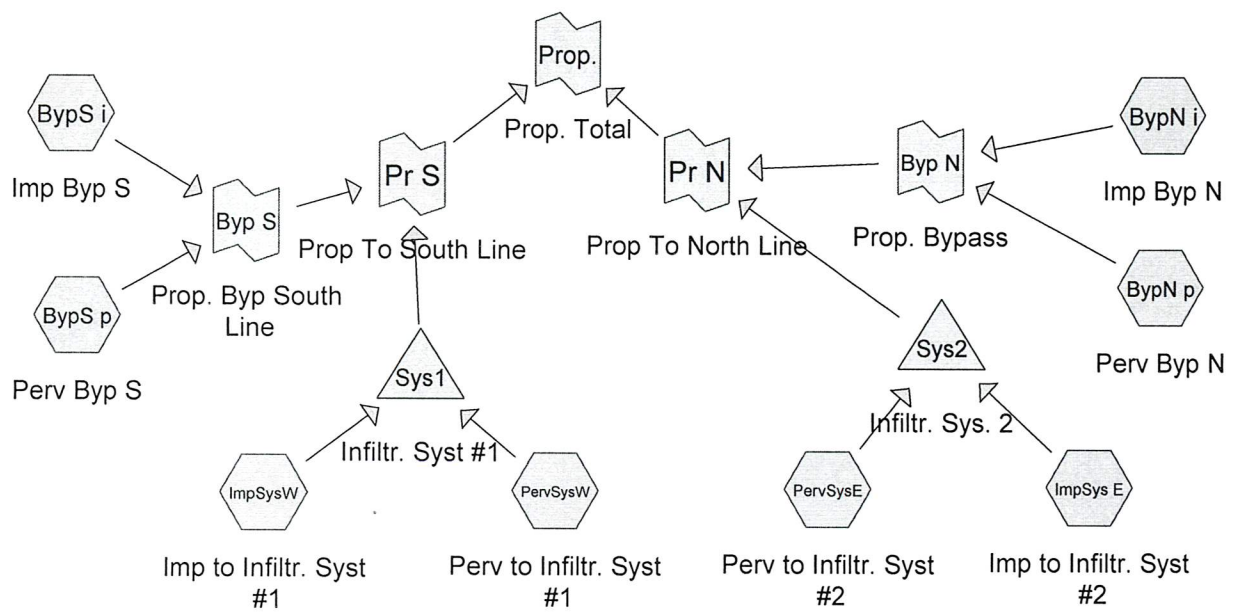
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
 NOAA 24-hr D 100yr NOAA Rainfall=8.47"

| Area (ac) | CN | Description |
|-----------|----|-------------------------------|
| 0.780 | 39 | >75% Grass cover, Good, HSG A |
| 0.730 | 80 | >75% Grass cover, Good, HSG D |
| 1.510 | 59 | Weighted Average |
| 1.510 | | 100.00% Pervious Area |

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

Appendix C

**HydroCAD Calculations - Proposed Conditions
2yr, 10yr, 25yr & 100yr Storms**



Time span=0.00-96.00 hrs, dt=0.01 hrs, 9601 points
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
 Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

| | |
|--|--|
| Link Byp N: Prop. Bypass | Inflow=0.38 cfs 1,354 cf Primary=0.38 cfs 1,354 cf |
| Link Byp S: Prop. Byp South Line | Inflow=1.55 cfs 6,444 cf Primary=1.55 cfs 6,444 cf |
| Subcatchment BypN i: Imp Byp N | Runoff Area=0.120 ac 100.00% Impervious Runoff Depth=3.11" Tc=6.0 min CN=98 Runoff=0.38 cfs 1,353 cf |
| Subcatchment BypN p: Perv Byp N | Runoff Area=0.080 ac 0.00% Impervious Runoff Depth=0.00" Tc=6.0 min CN=39 Runoff=0.00 cfs 1 cf |
| Subcatchment BypS i: Imp Byp S | Runoff Area=0.500 ac 100.00% Impervious Runoff Depth=3.11" Tc=10.0 min CN=98 Runoff=1.38 cfs 5,639 cf |
| Subcatchment BypS p: Perv Byp S | Runoff Area=0.380 ac 0.00% Impervious Runoff Depth=0.58" Tc=10.0 min CN=63 Runoff=0.17 cfs 805 cf |
| Subcatchment ImpSys E: Imp to Infiltr. | Runoff Area=0.200 ac 100.00% Impervious Runoff Depth=3.11" Tc=7.0 min CN=98 Runoff=0.61 cfs 2,256 cf |
| Subcatchment ImpSysW: Imp to Infiltr. | Runoff Area=1.380 ac 100.00% Impervious Runoff Depth=3.11" Tc=10.0 min CN=98 Runoff=3.80 cfs 15,564 cf |
| Subcatchment PervSysE: Perv to Infiltr. | Runoff Area=0.080 ac 0.00% Impervious Runoff Depth=0.00" Tc=7.0 min CN=39 Runoff=0.00 cfs 1 cf |
| Subcatchment PervSysW: Perv to Infiltr. | Runoff Area=0.560 ac 0.00% Impervious Runoff Depth=0.71" Tc=10.0 min CN=66 Runoff=0.35 cfs 1,453 cf |
| Link Pr N: Prop To North Line | Inflow=0.38 cfs 1,354 cf Primary=0.38 cfs 1,354 cf |
| Link Pr S: Prop To South Line | Inflow=1.64 cfs 9,154 cf Primary=1.64 cfs 9,154 cf |
| Link Prop.: Prop. Total | Inflow=1.91 cfs 10,509 cf Primary=1.91 cfs 10,509 cf |
| Pond Sys1: Infiltr. Syst #1 | Peak Elev=82.82' Storage=5,164 cf Inflow=4.14 cfs 17,018 cf Discarded=0.35 cfs 14,307 cf Primary=0.36 cfs 2,710 cf Outflow=0.71 cfs 17,018 cf |
| Pond Sys2: Infiltr. Sys. 2 | Peak Elev=90.66' Storage=1,035 cf Inflow=0.61 cfs 2,256 cf Discarded=0.03 cfs 2,256 cf Primary=0.00 cfs 0 cf Outflow=0.03 cfs 2,256 cf |
| Total Runoff Area = 143,748 sf Runoff Volume = 27,072 cf Average Runoff Depth = 2.26" | |
| 33.33% Pervious = 47,916 sf 66.67% Impervious = 95,832 sf | |

Summary for Link Byp N: Prop. Bypass

Inflow Area = 8,712 sf, 60.00% Impervious, Inflow Depth = 1.87" for 2yr NOAA event
 Inflow = 0.38 cfs @ 12.13 hrs, Volume= 1,354 cf
 Primary = 0.38 cfs @ 12.13 hrs, Volume= 1,354 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

Summary for Link Byp S: Prop. Byp South Line

Inflow Area = 38,333 sf, 56.82% Impervious, Inflow Depth = 2.02" for 2yr NOAA event
 Inflow = 1.55 cfs @ 12.17 hrs, Volume= 6,444 cf
 Primary = 1.55 cfs @ 12.17 hrs, Volume= 6,444 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

Summary for Subcatchment BypN i: Imp Byp N

Runoff = 0.38 cfs @ 12.13 hrs, Volume= 1,353 cf, Depth= 3.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
 NOAA 24-hr D 2yr NOAA Rainfall=3.34"

| Area (ac) | CN | Description |
|-----------|----|-------------------------|
| 0.120 | 98 | Paved parking, HSG A |
| 0.120 | | 100.00% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|---------------------|
| 6.0 | | | | | Direct Entry, Ex TC |

Summary for Subcatchment BypN p: Perv Byp N

Runoff = 0.00 cfs @ 24.01 hrs, Volume= 1 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
 NOAA 24-hr D 2yr NOAA Rainfall=3.34"

| Area (ac) | CN | Description |
|-----------|----|-------------------------------|
| 0.080 | 39 | >75% Grass cover, Good, HSG A |
| 0.080 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|--------------------|
| 6.0 | | | | | Direct Entry, ExTc |

Summary for Subcatchment BypS i: Imp Byp S

Runoff = 1.38 cfs @ 12.17 hrs, Volume= 5,639 cf, Depth= 3.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
 NOAA 24-hr D 2yr NOAA Rainfall=3.34"

| Area (ac) | CN | Description |
|-----------|----|-------------------------|
| 0.360 | 98 | Paved parking, HSG A |
| 0.140 | 98 | Paved parking, HSG D |
| 0.500 | 98 | Weighted Average |
| 0.500 | | 100.00% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|---------------|
| 10.0 | | | | | Direct Entry, |

Summary for Subcatchment BypS p: Perv Byp S

Runoff = 0.17 cfs @ 12.19 hrs, Volume= 805 cf, Depth= 0.58"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
 NOAA 24-hr D 2yr NOAA Rainfall=3.34"

| Area (ac) | CN | Description |
|-----------|----|-------------------------------|
| 0.160 | 39 | >75% Grass cover, Good, HSG A |
| 0.220 | 80 | >75% Grass cover, Good, HSG D |
| 0.380 | 63 | Weighted Average |
| 0.380 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|---------------|
| 10.0 | | | | | Direct Entry, |

Summary for Subcatchment ImpSys E: Imp to Infiltr. Syst #2

Runoff = 0.61 cfs @ 12.14 hrs, Volume= 2,256 cf, Depth= 3.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
 NOAA 24-hr D 2yr NOAA Rainfall=3.34"

| Area (ac) | CN | Description |
|-----------|----|-------------------------|
| 0.160 | 98 | Paved parking, HSG A |
| 0.040 | 98 | Paved parking, HSG D |
| 0.200 | 98 | Weighted Average |
| 0.200 | | 100.00% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|-------------|------------------|------------------|----------------------|-------------------|---------------|
| 7.0 | | | | | Direct Entry, |

Summary for Subcatchment ImpSysW: Imp to Infiltr. Syst #1

Runoff = 3.80 cfs @ 12.17 hrs, Volume= 15,564 cf, Depth= 3.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 2yr NOAA Rainfall=3.34"

| Area (ac) | CN | Description |
|-----------|----|-------------------------|
| 0.800 | 98 | Paved parking, HSG D |
| 0.580 | 98 | Paved parking, HSG A |
| 1.380 | 98 | Weighted Average |
| 1.380 | | 100.00% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|-------------|------------------|------------------|----------------------|-------------------|---------------|
| 10.0 | | | | | Direct Entry, |

Summary for Subcatchment PervSysE: Perv to Infiltr. Syst #2

Runoff = 0.00 cfs @ 24.01 hrs, Volume= 1 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 2yr NOAA Rainfall=3.34"

| Area (ac) | CN | Description |
|-----------|----|-------------------------------|
| 0.080 | 39 | >75% Grass cover, Good, HSG A |
| 0.080 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|-------------|------------------|------------------|----------------------|-------------------|---------------|
| 7.0 | | | | | Direct Entry, |

Summary for Subcatchment PervSysW: Perv to Infiltr. Syst #1

Runoff = 0.35 cfs @ 12.19 hrs, Volume= 1,453 cf, Depth= 0.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 2yr NOAA Rainfall=3.34"

| Area (ac) | CN | Description |
|-----------|----|-------------------------------|
| 0.370 | 80 | >75% Grass cover, Good, HSG D |
| 0.190 | 39 | >75% Grass cover, Good, HSG A |
| 0.560 | 66 | Weighted Average |
| 0.560 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|-------------|------------------|------------------|----------------------|-------------------|---------------|
| 10.0 | | | | | Direct Entry, |

Summary for Link Pr N: Prop To North Line

Inflow Area = 20,909 sf, 66.67% Impervious, Inflow Depth = 0.78" for 2yr NOAA event
 Inflow = 0.38 cfs @ 12.13 hrs, Volume= 1,354 cf
 Primary = 0.38 cfs @ 12.13 hrs, Volume= 1,354 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

Summary for Link Pr S: Prop To South Line

Inflow Area = 122,839 sf, 66.67% Impervious, Inflow Depth = 0.89" for 2yr NOAA event
 Inflow = 1.64 cfs @ 12.19 hrs, Volume= 9,154 cf
 Primary = 1.64 cfs @ 12.19 hrs, Volume= 9,154 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

Summary for Link Prop.: Prop. Total

Inflow Area = 143,748 sf, 66.67% Impervious, Inflow Depth = 0.88" for 2yr NOAA event
 Inflow = 1.91 cfs @ 12.18 hrs, Volume= 10,509 cf
 Primary = 1.91 cfs @ 12.18 hrs, Volume= 10,509 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

Summary for Pond Sys1: Infiltr. Syst #1

Inflow Area = 84,506 sf, 71.13% Impervious, Inflow Depth = 2.42" for 2yr NOAA event
 Inflow = 4.14 cfs @ 12.17 hrs, Volume= 17,018 cf
 Outflow = 0.71 cfs @ 12.74 hrs, Volume= 17,018 cf, Atten= 83%, Lag= 34.3 min
 Discarded = 0.35 cfs @ 11.13 hrs, Volume= 14,307 cf
 Primary = 0.36 cfs @ 12.74 hrs, Volume= 2,710 cf

Routing by Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 2
 Peak Elev= 82.82' @ 12.74 hrs Surf.Area= 0 sf Storage= 5,164 cf

Plug-Flow detention time= 68.8 min calculated for 17,018 cf (100% of inflow)
 Center-of-Mass det. time= 68.8 min (842.3 - 773.5)

| Volume #1 | Invert | Avail.Storage | Storage Description |
|--------------|--------|---------------|--------------------------------|
| | 80.50' | 13,741 cf | Custom Stage Data Listed below |

| Elevation (feet) | Cum.Store (cubic-feet) |
|---------------------|---------------------------|
| 80.50 | 0 |
| 80.75 | 507 |
| 81.00 | 1,014 |
| 81.25 | 1,521 |
| 81.50 | 2,028 |
| 81.75 | 2,535 |
| 82.00 | 2,948 |
| 82.25 | 3,520 |
| 82.50 | 4,214 |
| 82.75 | 4,961 |
| 83.00 | 5,733 |
| 83.25 | 6,509 |
| 83.50 | 7,267 |
| 83.75 | 7,981 |
| 84.00 | 8,590 |
| 84.25 | 9,086 |
| 84.50 | 9,600 |
| 84.75 | 10,114 |
| 85.00 | 10,628 |
| 85.25 | 11,142 |
| 85.50 | 11,656 |
| 85.75 | 12,170 |
| 86.00 | 12,684 |
| 86.25 | 13,198 |
| 86.50 | 13,712 |
| 86.75 | 13,719 |
| 87.00 | 13,726 |
| 87.25 | 13,733 |
| 87.50 | 13,741 |

| Device | Routing | Invert | Outlet Devices |
|--------|-----------|--------|---|
| #1 | Discarded | 80.50' | 0.35 cfs Exfiltration at all elevations |
| #2 | Primary | 81.90' | 15.0" Round Culvert L= 20.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 81.90' / 81.80' S= 0.0050 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 1.23 sf |
| #3 | Device 2 | 81.90' | 4.0" Vert. Orifice/Grate C= 0.600 |
| #4 | Device 2 | 84.25' | 12.0" Vert. Orifice/Grate C= 0.600 |
| #5 | Device 2 | 86.32' | 4.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s) |

Discarded OutFlow Max=0.35 cfs @ 11.13 hrs HW=80.57' (Free Discharge)

↑ **1=Exfiltration** (Exfiltration Controls 0.35 cfs)

Primary OutFlow Max=0.36 cfs @ 12.74 hrs HW=82.82' (Free Discharge)

↑ **2=Culvert** (Passes 0.36 cfs of 2.29 cfs potential flow)

↑ **3=Orifice/Grate** (Orifice Controls 0.36 cfs @ 4.17 fps)

↑ **4=Orifice/Grate** (Controls 0.00 cfs)

↑ **5=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond Sys2: Infiltr. Sys. 2

Inflow Area = 12,197 sf, 71.43% Impervious, Inflow Depth = 2.22" for 2yr NOAA event
 Inflow = 0.61 cfs @ 12.14 hrs, Volume= 2,256 cf
 Outflow = 0.03 cfs @ 10.40 hrs, Volume= 2,256 cf, Atten= 95%, Lag= 0.0 min
 Discarded = 0.03 cfs @ 10.40 hrs, Volume= 2,256 cf
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
 Peak Elev= 90.66' @ 14.28 hrs Surf.Area= 0 sf Storage= 1,035 cf

Plug-Flow detention time= 291.4 min calculated for 2,256 cf (100% of inflow)
 Center-of-Mass det. time= 291.4 min (1,049.9 - 758.5)

| Volume | Invert | Avail.Storage | Storage Description |
|--------|--------|---------------|---------------------------------------|
| #1 | 88.50' | 2,999 cf | Custom Stage Data Listed below |

| Elevation (feet) | Cum.Store (cubic-feet) |
|---------------------|---------------------------|
| 88.50 | 0 |
| 88.75 | 120 |
| 89.00 | 240 |
| 89.25 | 360 |
| 89.50 | 480 |
| 89.75 | 600 |
| 90.00 | 720 |
| 90.25 | 840 |
| 90.50 | 960 |
| 90.75 | 1,080 |
| 91.00 | 1,200 |
| 91.25 | 1,321 |
| 91.50 | 1,448 |
| 91.75 | 1,574 |
| 92.00 | 1,701 |
| 92.25 | 1,827 |
| 92.50 | 1,953 |
| 92.75 | 2,083 |
| 93.00 | 2,217 |
| 93.25 | 2,351 |
| 93.50 | 2,481 |
| 93.75 | 2,606 |
| 94.00 | 2,733 |
| 94.25 | 2,859 |
| 94.50 | 2,986 |
| 94.75 | 2,992 |
| 95.00 | 2,999 |

| Device | Routing | Invert | Outlet Devices |
|--------|-----------|--------|--|
| #1 | Discarded | 88.50' | 0.03 cfs Exfiltration at all elevations |
| #2 | Primary | 93.00' | 6.0" Round Culvert L= 42.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 93.00' / 91.95' S= 0.0250 ' / ' Cc= 0.900 |

n= 0.010 PVC, smooth interior, Flow Area= 0.20 sf

Discarded OutFlow Max=0.03 cfs @ 10.40 hrs HW=88.57' (Free Discharge)

↳1=Exfiltration (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=88.50' (Free Discharge)

↳2=Culvert (Controls 0.00 cfs)

Time span=0.00-96.00 hrs, dt=0.01 hrs, 9601 points
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
 Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

| | |
|--|--|
| Link Byp N: Prop. Bypass | Inflow=0.58 cfs 2,168 cf Primary=0.58 cfs 2,168 cf |
| Link Byp S: Prop. Byp South Line | Inflow=2.67 cfs 10,915 cf Primary=2.67 cfs 10,915 cf |
| Subcatchment BypN i: Imp Byp N | Runoff Area=0.120 ac 100.00% Impervious Runoff Depth=4.83" Tc=6.0 min CN=98 Runoff=0.58 cfs 2,105 cf |
| Subcatchment BypN p: Perv Byp N | Runoff Area=0.080 ac 0.00% Impervious Runoff Depth=0.21" Tc=6.0 min CN=39 Runoff=0.00 cfs 62 cf |
| Subcatchment BypS i: Imp Byp S | Runoff Area=0.500 ac 100.00% Impervious Runoff Depth=4.83" Tc=10.0 min CN=98 Runoff=2.10 cfs 8,772 cf |
| Subcatchment BypS p: Perv Byp S | Runoff Area=0.380 ac 0.00% Impervious Runoff Depth=1.55" Tc=10.0 min CN=63 Runoff=0.57 cfs 2,143 cf |
| Subcatchment ImpSys E: Imp to Infiltr. | Runoff Area=0.200 ac 100.00% Impervious Runoff Depth=4.83" Tc=7.0 min CN=98 Runoff=0.94 cfs 3,509 cf |
| Subcatchment ImpSysW: Imp to Infiltr. | Runoff Area=1.380 ac 100.00% Impervious Runoff Depth=4.83" Tc=10.0 min CN=98 Runoff=5.81 cfs 24,211 cf |
| Subcatchment PervSysE: Perv to Infiltr. | Runoff Area=0.080 ac 0.00% Impervious Runoff Depth=0.21" Tc=7.0 min CN=39 Runoff=0.00 cfs 62 cf |
| Subcatchment PervSysW: Perv to Infiltr. | Runoff Area=0.560 ac 0.00% Impervious Runoff Depth=1.78" Tc=10.0 min CN=66 Runoff=0.98 cfs 3,609 cf |
| Link Pr N: Prop To North Line | Inflow=0.58 cfs 2,168 cf Primary=0.58 cfs 2,168 cf |
| Link Pr S: Prop To South Line | Inflow=3.09 cfs 19,556 cf Primary=3.09 cfs 19,556 cf |
| Link Prop.: Prop. Total | Inflow=3.57 cfs 21,724 cf Primary=3.57 cfs 21,724 cf |
| Pond Sys1: Infiltr. Syst #1 | Peak Elev=84.45' Storage=9,507 cf Inflow=6.78 cfs 27,820 cf Discarded=0.35 cfs 19,179 cf Primary=0.83 cfs 8,641 cf Outflow=1.18 cfs 27,820 cf |
| Pond Sys2: Infiltr. Sys. 2 | Peak Elev=92.39' Storage=1,898 cf Inflow=0.94 cfs 3,571 cf Discarded=0.03 cfs 3,571 cf Primary=0.00 cfs 0 cf Outflow=0.03 cfs 3,571 cf |
| Total Runoff Area = 143,748 sf Runoff Volume = 44,473 cf Average Runoff Depth = 3.71" | |
| 33.33% Pervious = 47,916 sf 66.67% Impervious = 95,832 sf | |

Summary for Link Byp N: Prop. Bypass

Inflow Area = 8,712 sf, 60.00% Impervious, Inflow Depth = 2.99" for 10yr NOAA event
 Inflow = 0.58 cfs @ 12.13 hrs, Volume= 2,168 cf
 Primary = 0.58 cfs @ 12.13 hrs, Volume= 2,168 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

Summary for Link Byp S: Prop. Byp South Line

Inflow Area = 38,333 sf, 56.82% Impervious, Inflow Depth = 3.42" for 10yr NOAA event
 Inflow = 2.67 cfs @ 12.17 hrs, Volume= 10,915 cf
 Primary = 2.67 cfs @ 12.17 hrs, Volume= 10,915 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

Summary for Subcatchment BypN i: Imp Byp N

Runoff = 0.58 cfs @ 12.13 hrs, Volume= 2,105 cf, Depth= 4.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
 NOAA 24-hr D 10yr NOAA Rainfall=5.07"

| Area (ac) | CN | Description |
|-----------|----|-------------------------|
| 0.120 | 98 | Paved parking, HSG A |
| 0.120 | | 100.00% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|---------------------|
| 6.0 | | | | | Direct Entry, Ex TC |

Summary for Subcatchment BypN p: Perv Byp N

Runoff = 0.00 cfs @ 12.94 hrs, Volume= 62 cf, Depth= 0.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
 NOAA 24-hr D 10yr NOAA Rainfall=5.07"

| Area (ac) | CN | Description |
|-----------|----|-------------------------------|
| 0.080 | 39 | >75% Grass cover, Good, HSG A |
| 0.080 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|--------------------|
| 6.0 | | | | | Direct Entry, ExTc |

Summary for Subcatchment BypS i: Imp Byp S

Runoff = 2.10 cfs @ 12.17 hrs, Volume= 8,772 cf, Depth= 4.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 10yr NOAA Rainfall=5.07"

| Area (ac) | CN | Description |
|-----------|----|-------------------------|
| 0.360 | 98 | Paved parking, HSG A |
| 0.140 | 98 | Paved parking, HSG D |
| 0.500 | 98 | Weighted Average |
| 0.500 | | 100.00% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|---------------|
| 10.0 | | | | | Direct Entry, |

Summary for Subcatchment BypS p: Perv Byp S

Runoff = 0.57 cfs @ 12.18 hrs, Volume= 2,143 cf, Depth= 1.55"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 10yr NOAA Rainfall=5.07"

| Area (ac) | CN | Description |
|-----------|----|-------------------------------|
| 0.160 | 39 | >75% Grass cover, Good, HSG A |
| 0.220 | 80 | >75% Grass cover, Good, HSG D |
| 0.380 | 63 | Weighted Average |
| 0.380 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|---------------|
| 10.0 | | | | | Direct Entry, |

Summary for Subcatchment ImpSys E: Imp to Infiltr. Syst #2

Runoff = 0.94 cfs @ 12.14 hrs, Volume= 3,509 cf, Depth= 4.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 10yr NOAA Rainfall=5.07"

| Area (ac) | CN | Description |
|-----------|----|-------------------------|
| 0.160 | 98 | Paved parking, HSG A |
| 0.040 | 98 | Paved parking, HSG D |
| 0.200 | 98 | Weighted Average |
| 0.200 | | 100.00% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|-------------|------------------|------------------|----------------------|-------------------|---------------|
| 7.0 | | | | | Direct Entry, |

Summary for Subcatchment ImpSysW: Imp to Infiltr. Syst #1

Runoff = 5.81 cfs @ 12.17 hrs, Volume= 24,211 cf, Depth= 4.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 10yr NOAA Rainfall=5.07"

| Area (ac) | CN | Description |
|-----------|----|-------------------------|
| 0.800 | 98 | Paved parking, HSG D |
| 0.580 | 98 | Paved parking, HSG A |
| 1.380 | 98 | Weighted Average |
| 1.380 | | 100.00% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|-------------|------------------|------------------|----------------------|-------------------|---------------|
| 10.0 | | | | | Direct Entry, |

Summary for Subcatchment PervSysE: Perv to Infiltr. Syst #2

Runoff = 0.00 cfs @ 12.95 hrs, Volume= 62 cf, Depth= 0.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 10yr NOAA Rainfall=5.07"

| Area (ac) | CN | Description |
|-----------|----|-------------------------------|
| 0.080 | 39 | >75% Grass cover, Good, HSG A |
| 0.080 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|-------------|------------------|------------------|----------------------|-------------------|---------------|
| 7.0 | | | | | Direct Entry, |

Summary for Subcatchment PervSysW: Perv to Infiltr. Syst #1

Runoff = 0.98 cfs @ 12.18 hrs, Volume= 3,609 cf, Depth= 1.78"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 10yr NOAA Rainfall=5.07"

| Area (ac) | CN | Description |
|-----------|----|-------------------------------|
| 0.370 | 80 | >75% Grass cover, Good, HSG D |
| 0.190 | 39 | >75% Grass cover, Good, HSG A |
| 0.560 | 66 | Weighted Average |
| 0.560 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|-------------|------------------|------------------|----------------------|-------------------|---------------|
| 10.0 | | | | | Direct Entry, |

Summary for Link Pr N: Prop To North Line

Inflow Area = 20,909 sf, 66.67% Impervious, Inflow Depth = 1.24" for 10yr NOAA event
 Inflow = 0.58 cfs @ 12.13 hrs, Volume= 2,168 cf
 Primary = 0.58 cfs @ 12.13 hrs, Volume= 2,168 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

Summary for Link Pr S: Prop To South Line

Inflow Area = 122,839 sf, 66.67% Impervious, Inflow Depth = 1.91" for 10yr NOAA event
 Inflow = 3.09 cfs @ 12.18 hrs, Volume= 19,556 cf
 Primary = 3.09 cfs @ 12.18 hrs, Volume= 19,556 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

Summary for Link Prop.: Prop. Total

Inflow Area = 143,748 sf, 66.67% Impervious, Inflow Depth = 1.81" for 10yr NOAA event
 Inflow = 3.57 cfs @ 12.17 hrs, Volume= 21,724 cf
 Primary = 3.57 cfs @ 12.17 hrs, Volume= 21,724 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

Summary for Pond Sys1: Infiltr. Syst #1

Inflow Area = 84,506 sf, 71.13% Impervious, Inflow Depth = 3.95" for 10yr NOAA event
 Inflow = 6.78 cfs @ 12.17 hrs, Volume= 27,820 cf
 Outflow = 1.18 cfs @ 12.73 hrs, Volume= 27,820 cf, Atten= 83%, Lag= 33.4 min
 Discarded = 0.35 cfs @ 10.48 hrs, Volume= 19,179 cf
 Primary = 0.83 cfs @ 12.73 hrs, Volume= 8,641 cf

Routing by Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 2

Peak Elev= 84.45' @ 12.73 hrs Surf.Area= 0 sf Storage= 9,507 cf

Plug-Flow detention time= 93.1 min calculated for 27,820 cf (100% of inflow)

Center-of-Mass det. time= 93.1 min (861.5 - 768.4)

| Volume #1 | Invert 80.50' | Avail.Storage 13,741 cf | Storage Description Custom Stage Data Listed below |
|--------------|------------------|----------------------------|---|
|--------------|------------------|----------------------------|---|

| Elevation (feet) | Cum.Store (cubic-feet) |
|---------------------|---------------------------|
| 80.50 | 0 |
| 80.75 | 507 |
| 81.00 | 1,014 |
| 81.25 | 1,521 |
| 81.50 | 2,028 |
| 81.75 | 2,535 |
| 82.00 | 2,948 |
| 82.25 | 3,520 |
| 82.50 | 4,214 |
| 82.75 | 4,961 |
| 83.00 | 5,733 |
| 83.25 | 6,509 |
| 83.50 | 7,267 |
| 83.75 | 7,981 |
| 84.00 | 8,590 |
| 84.25 | 9,086 |
| 84.50 | 9,600 |
| 84.75 | 10,114 |
| 85.00 | 10,628 |
| 85.25 | 11,142 |
| 85.50 | 11,656 |
| 85.75 | 12,170 |
| 86.00 | 12,684 |
| 86.25 | 13,198 |
| 86.50 | 13,712 |
| 86.75 | 13,719 |
| 87.00 | 13,726 |
| 87.25 | 13,733 |
| 87.50 | 13,741 |

| Device | Routing | Invert | Outlet Devices |
|--------|-----------|--------|---|
| #1 | Discarded | 80.50' | 0.35 cfs Exfiltration at all elevations |
| #2 | Primary | 81.90' | 15.0" Round Culvert L= 20.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 81.90' / 81.80' S= 0.0050 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 1.23 sf |
| #3 | Device 2 | 81.90' | 4.0" Vert. Orifice/Grate C= 0.600 |
| #4 | Device 2 | 84.25' | 12.0" Vert. Orifice/Grate C= 0.600 |
| #5 | Device 2 | 86.32' | 4.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s) |

Discarded OutFlow Max=0.35 cfs @ 10.48 hrs HW=80.57' (Free Discharge)

↳ **1=Exfiltration** (Exfiltration Controls 0.35 cfs)

Primary OutFlow Max=0.83 cfs @ 12.73 hrs HW=84.45' (Free Discharge)

↳ **2=Culvert** (Passes 0.83 cfs of 8.21 cfs potential flow)

↳ **3=Orifice/Grate** (Orifice Controls 0.65 cfs @ 7.44 fps)

↳ **4=Orifice/Grate** (Orifice Controls 0.18 cfs @ 1.54 fps)

↳ **5=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond Sys2: Infiltr. Sys. 2

Inflow Area = 12,197 sf, 71.43% Impervious, Inflow Depth = 3.51" for 10yr NOAA event
 Inflow = 0.94 cfs @ 12.14 hrs, Volume= 3,571 cf
 Outflow = 0.03 cfs @ 9.23 hrs, Volume= 3,571 cf, Atten= 97%, Lag= 0.0 min
 Discarded = 0.03 cfs @ 9.23 hrs, Volume= 3,571 cf
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
 Peak Elev= 92.39' @ 15.84 hrs Surf.Area= 0 sf Storage= 1,898 cf

Plug-Flow detention time= 551.0 min calculated for 3,571 cf (100% of inflow)
 Center-of-Mass det. time= 551.0 min (1,305.9 - 754.9)

| Volume | Invert | Avail.Storage | Storage Description |
|--------|--------|---------------|---------------------------------------|
| #1 | 88.50' | 2,999 cf | Custom Stage Data Listed below |

| Elevation (feet) | Cum.Store (cubic-feet) |
|---------------------|---------------------------|
| 88.50 | 0 |
| 88.75 | 120 |
| 89.00 | 240 |
| 89.25 | 360 |
| 89.50 | 480 |
| 89.75 | 600 |
| 90.00 | 720 |
| 90.25 | 840 |
| 90.50 | 960 |
| 90.75 | 1,080 |
| 91.00 | 1,200 |
| 91.25 | 1,321 |
| 91.50 | 1,448 |
| 91.75 | 1,574 |
| 92.00 | 1,701 |
| 92.25 | 1,827 |
| 92.50 | 1,953 |
| 92.75 | 2,083 |
| 93.00 | 2,217 |
| 93.25 | 2,351 |
| 93.50 | 2,481 |
| 93.75 | 2,606 |
| 94.00 | 2,733 |
| 94.25 | 2,859 |
| 94.50 | 2,986 |
| 94.75 | 2,992 |
| 95.00 | 2,999 |

| Device | Routing | Invert | Outlet Devices |
|--------|-----------|--------|--|
| #1 | Discarded | 88.50' | 0.03 cfs Exfiltration at all elevations |
| #2 | Primary | 93.00' | 6.0" Round Culvert L= 42.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 93.00' / 91.95' S= 0.0250 ' / Cc= 0.900 |

n= 0.010 PVC, smooth interior, Flow Area= 0.20 sf

Discarded OutFlow Max=0.03 cfs @ 9.23 hrs HW=88.57' (Free Discharge)

↳1=Exfiltration (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=88.50' (Free Discharge)

↳2=Culvert (Controls 0.00 cfs)

Time span=0.00-96.00 hrs, dt=0.01 hrs, 9601 points
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
 Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

| | |
|--|--|
| Link Byp N: Prop. Bypass | Inflow=0.73 cfs 2,785 cf Primary=0.73 cfs 2,785 cf |
| Link Byp S: Prop. Byp South Line | Inflow=3.50 cfs 14,240 cf Primary=3.50 cfs 14,240 cf |
| Subcatchment BypN i: Imp Byp N | Runoff Area=0.120 ac 100.00% Impervious Runoff Depth=6.04" Tc=6.0 min CN=98 Runoff=0.72 cfs 2,632 cf |
| Subcatchment BypN p: Perv Byp N | Runoff Area=0.080 ac 0.00% Impervious Runoff Depth=0.53" Tc=6.0 min CN=39 Runoff=0.02 cfs 154 cf |
| Subcatchment BypS i: Imp Byp S | Runoff Area=0.500 ac 100.00% Impervious Runoff Depth=6.04" Tc=10.0 min CN=98 Runoff=2.61 cfs 10,965 cf |
| Subcatchment BypS p: Perv Byp S | Runoff Area=0.380 ac 0.00% Impervious Runoff Depth=2.37" Tc=10.0 min CN=63 Runoff=0.90 cfs 3,275 cf |
| Subcatchment ImpSys E: Imp to Infiltr. | Runoff Area=0.200 ac 100.00% Impervious Runoff Depth=6.04" Tc=7.0 min CN=98 Runoff=1.16 cfs 4,386 cf |
| Subcatchment ImpSysW: Imp to Infiltr. | Runoff Area=1.380 ac 100.00% Impervious Runoff Depth=6.04" Tc=10.0 min CN=98 Runoff=7.21 cfs 30,265 cf |
| Subcatchment PervSysE: Perv to Infiltr. | Runoff Area=0.080 ac 0.00% Impervious Runoff Depth=0.53" Tc=7.0 min CN=39 Runoff=0.02 cfs 154 cf |
| Subcatchment PervSysW: Perv to Infiltr. | Runoff Area=0.560 ac 0.00% Impervious Runoff Depth=2.65" Tc=10.0 min CN=66 Runoff=1.49 cfs 5,386 cf |
| Link Pr N: Prop To North Line | Inflow=0.73 cfs 3,181 cf Primary=0.73 cfs 3,181 cf |
| Link Pr S: Prop To South Line | Inflow=4.59 cfs 28,392 cf Primary=4.59 cfs 28,392 cf |
| Link Prop.: Prop. Total | Inflow=4.83 cfs 31,573 cf Primary=4.83 cfs 31,573 cf |
| Pond Sys1: Infiltr. Syst #1 | Peak Elev=85.11' Storage=10,864 cf Inflow=8.69 cfs 35,651 cf Discarded=0.35 cfs 21,499 cf Primary=3.02 cfs 14,152 cf Outflow=3.37 cfs 35,651 cf |
| Pond Sys2: Infiltr. Sys. 2 | Peak Elev=93.15' Storage=2,296 cf Inflow=1.17 cfs 4,540 cf Discarded=0.03 cfs 4,144 cf Primary=0.07 cfs 396 cf Outflow=0.10 cfs 4,540 cf |
| Total Runoff Area = 143,748 sf Runoff Volume = 57,216 cf Average Runoff Depth = 4.78" | |
| 33.33% Pervious = 47,916 sf 66.67% Impervious = 95,832 sf | |

Summary for Link Byp N: Prop. Bypass

Inflow Area = 8,712 sf, 60.00% Impervious, Inflow Depth = 3.84" for 25yr NOAA event
 Inflow = 0.73 cfs @ 12.13 hrs, Volume= 2,785 cf
 Primary = 0.73 cfs @ 12.13 hrs, Volume= 2,785 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

Summary for Link Byp S: Prop. Byp South Line

Inflow Area = 38,333 sf, 56.82% Impervious, Inflow Depth = 4.46" for 25yr NOAA event
 Inflow = 3.50 cfs @ 12.17 hrs, Volume= 14,240 cf
 Primary = 3.50 cfs @ 12.17 hrs, Volume= 14,240 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

Summary for Subcatchment BypN i: Imp Byp N

Runoff = 0.72 cfs @ 12.13 hrs, Volume= 2,632 cf, Depth= 6.04"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
 NOAA 24-hr D 25yr NOAA Rainfall=6.28"

| Area (ac) | CN | Description |
|-----------|----|-------------------------|
| 0.120 | 98 | Paved parking, HSG A |
| 0.120 | | 100.00% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|---------------------|
| 6.0 | | | | | Direct Entry, Ex TC |

Summary for Subcatchment BypN p: Perv Byp N

Runoff = 0.02 cfs @ 12.17 hrs, Volume= 154 cf, Depth= 0.53"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
 NOAA 24-hr D 25yr NOAA Rainfall=6.28"

| Area (ac) | CN | Description |
|-----------|----|-------------------------------|
| 0.080 | 39 | >75% Grass cover, Good, HSG A |
| 0.080 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|--------------------|
| 6.0 | | | | | Direct Entry, ExTc |

Summary for Subcatchment BypS i: Imp Byp S

Runoff = 2.61 cfs @ 12.17 hrs, Volume= 10,965 cf, Depth= 6.04"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 25yr NOAA Rainfall=6.28"

| Area (ac) | CN | Description |
|-----------|----|-------------------------|
| 0.360 | 98 | Paved parking, HSG A |
| 0.140 | 98 | Paved parking, HSG D |
| 0.500 | 98 | Weighted Average |
| 0.500 | | 100.00% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|---------------|
| 10.0 | | | | | Direct Entry, |

Summary for Subcatchment BypS p: Perv Byp S

Runoff = 0.90 cfs @ 12.18 hrs, Volume= 3,275 cf, Depth= 2.37"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 25yr NOAA Rainfall=6.28"

| Area (ac) | CN | Description |
|-----------|----|-------------------------------|
| 0.160 | 39 | >75% Grass cover, Good, HSG A |
| 0.220 | 80 | >75% Grass cover, Good, HSG D |
| 0.380 | 63 | Weighted Average |
| 0.380 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|---------------|
| 10.0 | | | | | Direct Entry, |

Summary for Subcatchment ImpSys E: Imp to Infiltr. Syst #2

Runoff = 1.16 cfs @ 12.14 hrs, Volume= 4,386 cf, Depth= 6.04"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 25yr NOAA Rainfall=6.28"

| Area (ac) | CN | Description |
|-----------|----|-------------------------|
| 0.160 | 98 | Paved parking, HSG A |
| 0.040 | 98 | Paved parking, HSG D |
| 0.200 | 98 | Weighted Average |
| 0.200 | | 100.00% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|-------------|------------------|------------------|----------------------|-------------------|---------------|
| 7.0 | | | | | Direct Entry, |

Summary for Subcatchment ImpSysW: Imp to Infiltr. Syst #1

Runoff = 7.21 cfs @ 12.17 hrs, Volume= 30,265 cf, Depth= 6.04"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 25yr NOAA Rainfall=6.28"

| Area (ac) | CN | Description |
|-----------|----|-------------------------|
| 0.800 | 98 | Paved parking, HSG D |
| 0.580 | 98 | Paved parking, HSG A |
| 1.380 | 98 | Weighted Average |
| 1.380 | | 100.00% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|-------------|------------------|------------------|----------------------|-------------------|---------------|
| 10.0 | | | | | Direct Entry, |

Summary for Subcatchment PervSysE: Perv to Infiltr. Syst #2

Runoff = 0.02 cfs @ 12.19 hrs, Volume= 154 cf, Depth= 0.53"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 25yr NOAA Rainfall=6.28"

| Area (ac) | CN | Description |
|-----------|----|-------------------------------|
| 0.080 | 39 | >75% Grass cover, Good, HSG A |
| 0.080 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|-------------|------------------|------------------|----------------------|-------------------|---------------|
| 7.0 | | | | | Direct Entry, |

Summary for Subcatchment PervSysW: Perv to Infiltr. Syst #1

Runoff = 1.49 cfs @ 12.18 hrs, Volume= 5,386 cf, Depth= 2.65"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 25yr NOAA Rainfall=6.28"

| Area (ac) | CN | Description |
|-----------|----|-------------------------------|
| 0.370 | 80 | >75% Grass cover, Good, HSG D |
| 0.190 | 39 | >75% Grass cover, Good, HSG A |
| 0.560 | 66 | Weighted Average |
| 0.560 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|-------------|------------------|------------------|----------------------|-------------------|---------------|
| 10.0 | | | | | Direct Entry, |

Summary for Link Pr N: Prop To North Line

Inflow Area = 20,909 sf, 66.67% Impervious, Inflow Depth = 1.83" for 25yr NOAA event
 Inflow = 0.73 cfs @ 12.13 hrs, Volume= 3,181 cf
 Primary = 0.73 cfs @ 12.13 hrs, Volume= 3,181 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

Summary for Link Pr S: Prop To South Line

Inflow Area = 122,839 sf, 66.67% Impervious, Inflow Depth = 2.77" for 25yr NOAA event
 Inflow = 4.59 cfs @ 12.32 hrs, Volume= 28,392 cf
 Primary = 4.59 cfs @ 12.32 hrs, Volume= 28,392 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

Summary for Link Prop.: Prop. Total

Inflow Area = 143,748 sf, 66.67% Impervious, Inflow Depth = 2.64" for 25yr NOAA event
 Inflow = 4.83 cfs @ 12.32 hrs, Volume= 31,573 cf
 Primary = 4.83 cfs @ 12.32 hrs, Volume= 31,573 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

Summary for Pond Sys1: Infiltr. Syst #1

Inflow Area = 84,506 sf, 71.13% Impervious, Inflow Depth = 5.06" for 25yr NOAA event
 Inflow = 8.69 cfs @ 12.17 hrs, Volume= 35,651 cf
 Outflow = 3.37 cfs @ 12.39 hrs, Volume= 35,651 cf, Atten= 61%, Lag= 12.8 min
 Discarded = 0.35 cfs @ 9.83 hrs, Volume= 21,499 cf
 Primary = 3.02 cfs @ 12.39 hrs, Volume= 14,152 cf

Routing by Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 2
 Peak Elev= 85.11' @ 12.39 hrs Surf.Area= 0 sf Storage= 10,864 cf

Plug-Flow detention time= 87.1 min calculated for 35,651 cf (100% of inflow)
 Center-of-Mass det. time= 87.1 min (853.1 - 766.0)

| Volume | Invert | Avail.Storage | Storage Description |
|--------|--------|---------------|--------------------------------|
| #1 | 80.50' | 13,741 cf | Custom Stage Data Listed below |

| Elevation (feet) | Cum.Store (cubic-feet) |
|---------------------|---------------------------|
| 80.50 | 0 |
| 80.75 | 507 |
| 81.00 | 1,014 |
| 81.25 | 1,521 |
| 81.50 | 2,028 |
| 81.75 | 2,535 |
| 82.00 | 2,948 |
| 82.25 | 3,520 |
| 82.50 | 4,214 |
| 82.75 | 4,961 |
| 83.00 | 5,733 |
| 83.25 | 6,509 |
| 83.50 | 7,267 |
| 83.75 | 7,981 |
| 84.00 | 8,590 |
| 84.25 | 9,086 |
| 84.50 | 9,600 |
| 84.75 | 10,114 |
| 85.00 | 10,628 |
| 85.25 | 11,142 |
| 85.50 | 11,656 |
| 85.75 | 12,170 |
| 86.00 | 12,684 |
| 86.25 | 13,198 |
| 86.50 | 13,712 |
| 86.75 | 13,719 |
| 87.00 | 13,726 |
| 87.25 | 13,733 |
| 87.50 | 13,741 |

| Device | Routing | Invert | Outlet Devices |
|--------|-----------|--------|---|
| #1 | Discarded | 80.50' | 0.35 cfs Exfiltration at all elevations |
| #2 | Primary | 81.90' | 15.0" Round Culvert L= 20.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 81.90' / 81.80' S= 0.0050 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 1.23 sf |
| #3 | Device 2 | 81.90' | 4.0" Vert. Orifice/Grate C= 0.600 |
| #4 | Device 2 | 84.25' | 12.0" Vert. Orifice/Grate C= 0.600 |
| #5 | Device 2 | 86.32' | 4.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s) |

Discarded OutFlow Max=0.35 cfs @ 9.83 hrs HW=80.57' (Free Discharge)

↳ **1=Exfiltration** (Exfiltration Controls 0.35 cfs)

Primary OutFlow Max=3.02 cfs @ 12.39 hrs HW=85.11' (Free Discharge)

↳ **2=Culvert** (Passes 3.02 cfs of 9.51 cfs potential flow)

↳ **3=Orifice/Grate** (Orifice Controls 0.73 cfs @ 8.41 fps)

↳ **4=Orifice/Grate** (Orifice Controls 2.28 cfs @ 3.17 fps)

↳ **5=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond Sys2: Infiltr. Sys. 2

Inflow Area = 12,197 sf, 71.43% Impervious, Inflow Depth = 4.47" for 25yr NOAA event
 Inflow = 1.17 cfs @ 12.14 hrs, Volume= 4,540 cf
 Outflow = 0.10 cfs @ 13.39 hrs, Volume= 4,540 cf, Atten= 92%, Lag= 74.8 min
 Discarded = 0.03 cfs @ 8.02 hrs, Volume= 4,144 cf
 Primary = 0.07 cfs @ 13.39 hrs, Volume= 396 cf

Routing by Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
 Peak Elev= 93.15' @ 13.39 hrs Surf.Area= 0 sf Storage= 2,296 cf

Plug-Flow detention time= 602.4 min calculated for 4,539 cf (100% of inflow)
 Center-of-Mass det. time= 602.4 min (1,356.5 - 754.0)

| Volume | Invert | Avail.Storage | Storage Description |
|--------|--------|---------------|---------------------------------------|
| #1 | 88.50' | 2,999 cf | Custom Stage Data Listed below |

| Elevation (feet) | Cum.Store (cubic-feet) |
|---------------------|---------------------------|
| 88.50 | 0 |
| 88.75 | 120 |
| 89.00 | 240 |
| 89.25 | 360 |
| 89.50 | 480 |
| 89.75 | 600 |
| 90.00 | 720 |
| 90.25 | 840 |
| 90.50 | 960 |
| 90.75 | 1,080 |
| 91.00 | 1,200 |
| 91.25 | 1,321 |
| 91.50 | 1,448 |
| 91.75 | 1,574 |
| 92.00 | 1,701 |
| 92.25 | 1,827 |
| 92.50 | 1,953 |
| 92.75 | 2,083 |
| 93.00 | 2,217 |
| 93.25 | 2,351 |
| 93.50 | 2,481 |
| 93.75 | 2,606 |
| 94.00 | 2,733 |
| 94.25 | 2,859 |
| 94.50 | 2,986 |
| 94.75 | 2,992 |
| 95.00 | 2,999 |

| Device | Routing | Invert | Outlet Devices |
|--------|-----------|--------|---|
| #1 | Discarded | 88.50' | 0.03 cfs Exfiltration at all elevations |
| #2 | Primary | 93.00' | 6.0" Round Culvert L= 42.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 93.00' / 91.95' S= 0.0250 '/ Cc= 0.900 |

n= 0.010 PVC, smooth interior, Flow Area= 0.20 sf

Discarded OutFlow Max=0.03 cfs @ 8.02 hrs HW=88.57' (Free Discharge)

↑1=Exfiltration (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=0.06 cfs @ 13.39 hrs HW=93.15' (Free Discharge)

↑2=Culvert (Inlet Controls 0.06 cfs @ 1.31 fps)

Time span=0.00-96.00 hrs, dt=0.01 hrs, 9601 points
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
 Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

| | |
|--|---|
| Link Byp N: Prop. Bypass | Inflow=1.07 cfs 3,980 cf Primary=1.07 cfs 3,980 cf |
| Link Byp S: Prop. Byp South Line | Inflow=5.08 cfs 20,512 cf Primary=5.08 cfs 20,512 cf |
| Subcatchment BypN i: Imp Byp N | Runoff Area=0.120 ac 100.00% Impervious Runoff Depth=8.23" Tc=6.0 min CN=98 Runoff=0.97 cfs 3,585 cf |
| Subcatchment BypN p: Perv Byp N | Runoff Area=0.080 ac 0.00% Impervious Runoff Depth=1.36" Tc=6.0 min CN=39 Runoff=0.10 cfs 395 cf |
| Subcatchment BypS i: Imp Byp S | Runoff Area=0.500 ac 100.00% Impervious Runoff Depth=8.23" Tc=10.0 min CN=98 Runoff=3.53 cfs 14,937 cf |
| Subcatchment BypS p: Perv Byp S | Runoff Area=0.380 ac 0.00% Impervious Runoff Depth=4.04" Tc=10.0 min CN=63 Runoff=1.55 cfs 5,575 cf |
| Subcatchment ImpSys E: Imp to Infiltr. | Runoff Area=0.200 ac 100.00% Impervious Runoff Depth=8.23" Tc=7.0 min CN=98 Runoff=1.57 cfs 5,975 cf |
| Subcatchment ImpSysW: Imp to Infiltr. | Runoff Area=1.380 ac 100.00% Impervious Runoff Depth=8.23" Tc=10.0 min CN=98 Runoff=9.74 cfs 41,227 cf |
| Subcatchment PervSysE: Perv to Infiltr. | Runoff Area=0.080 ac 0.00% Impervious Runoff Depth=1.36" Tc=7.0 min CN=39 Runoff=0.09 cfs 395 cf |
| Subcatchment PervSysW: Perv to Infiltr. | Runoff Area=0.560 ac 0.00% Impervious Runoff Depth=4.40" Tc=10.0 min CN=66 Runoff=2.49 cfs 8,936 cf |
| Link Pr N: Prop To North Line | Inflow=1.07 cfs 5,889 cf Primary=1.07 cfs 5,889 cf |
| Link Pr S: Prop To South Line | Inflow=9.86 cfs 45,665 cf Primary=9.86 cfs 45,665 cf |
| Link Prop.: Prop. Total | Inflow=10.75 cfs 51,553 cf Primary=10.75 cfs 51,553 cf |
| Pond Sys1: Infiltr. Syst #1 | Peak Elev=86.48' Storage=13,669 cf Inflow=12.22 cfs 50,163 cf Discarded=0.35 cfs 25,010 cf Primary=6.69 cfs 25,152 cf Outflow=7.04 cfs 50,163 cf |
| Pond Sys2: Infiltr. Sys. 2 | Peak Elev=93.56' Storage=2,509 cf Inflow=1.66 cfs 6,370 cf Discarded=0.03 cfs 4,461 cf Primary=0.52 cfs 1,909 cf Outflow=0.55 cfs 6,370 cf |
| Total Runoff Area = 143,748 sf Runoff Volume = 81,025 cf Average Runoff Depth = 6.76" | |
| 33.33% Pervious = 47,916 sf 66.67% Impervious = 95,832 sf | |

Summary for Link Byp N: Prop. Bypass

Inflow Area = 8,712 sf, 60.00% Impervious, Inflow Depth = 5.48" for 100yr NOAA event
 Inflow = 1.07 cfs @ 12.13 hrs, Volume= 3,980 cf
 Primary = 1.07 cfs @ 12.13 hrs, Volume= 3,980 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

Summary for Link Byp S: Prop. Byp South Line

Inflow Area = 38,333 sf, 56.82% Impervious, Inflow Depth = 6.42" for 100yr NOAA event
 Inflow = 5.08 cfs @ 12.17 hrs, Volume= 20,512 cf
 Primary = 5.08 cfs @ 12.17 hrs, Volume= 20,512 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

Summary for Subcatchment BypN i: Imp Byp N

Runoff = 0.97 cfs @ 12.13 hrs, Volume= 3,585 cf, Depth= 8.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
 NOAA 24-hr D 100yr NOAA Rainfall=8.47"

| Area (ac) | CN | Description |
|-----------|----|-------------------------|
| 0.120 | 98 | Paved parking, HSG A |
| 0.120 | | 100.00% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|---------------------|
| 6.0 | | | | | Direct Entry, Ex TC |

Summary for Subcatchment BypN p: Perv Byp N

Runoff = 0.10 cfs @ 12.14 hrs, Volume= 395 cf, Depth= 1.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
 NOAA 24-hr D 100yr NOAA Rainfall=8.47"

| Area (ac) | CN | Description |
|-----------|----|-------------------------------|
| 0.080 | 39 | >75% Grass cover, Good, HSG A |
| 0.080 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|--------------------|
| 6.0 | | | | | Direct Entry, ExTc |

Summary for Subcatchment BypS i: Imp Byp S

Runoff = 3.53 cfs @ 12.17 hrs, Volume= 14,937 cf, Depth= 8.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
 NOAA 24-hr D 100yr NOAA Rainfall=8.47"

| Area (ac) | CN | Description |
|-----------|----|-------------------------|
| 0.360 | 98 | Paved parking, HSG A |
| 0.140 | 98 | Paved parking, HSG D |
| 0.500 | 98 | Weighted Average |
| 0.500 | | 100.00% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|---------------|
| 10.0 | | | | | Direct Entry, |

Summary for Subcatchment BypS p: Perv Byp S

Runoff = 1.55 cfs @ 12.18 hrs, Volume= 5,575 cf, Depth= 4.04"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
 NOAA 24-hr D 100yr NOAA Rainfall=8.47"

| Area (ac) | CN | Description |
|-----------|----|-------------------------------|
| 0.160 | 39 | >75% Grass cover, Good, HSG A |
| 0.220 | 80 | >75% Grass cover, Good, HSG D |
| 0.380 | 63 | Weighted Average |
| 0.380 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|---------------|
| 10.0 | | | | | Direct Entry, |

Summary for Subcatchment ImpSys E: Imp to Infiltr. Syst #2

Runoff = 1.57 cfs @ 12.14 hrs, Volume= 5,975 cf, Depth= 8.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
 NOAA 24-hr D 100yr NOAA Rainfall=8.47"

| Area (ac) | CN | Description |
|-----------|----|-------------------------|
| 0.160 | 98 | Paved parking, HSG A |
| 0.040 | 98 | Paved parking, HSG D |
| 0.200 | 98 | Weighted Average |
| 0.200 | | 100.00% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|-------------|------------------|------------------|----------------------|-------------------|---------------|
| 7.0 | | | | | Direct Entry, |

Summary for Subcatchment ImpSysW: Imp to Infiltr. Syst #1

Runoff = 9.74 cfs @ 12.17 hrs, Volume= 41,227 cf, Depth= 8.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
 NOAA 24-hr D 100yr NOAA Rainfall=8.47"

| Area (ac) | CN | Description |
|-----------|----|-------------------------|
| 0.800 | 98 | Paved parking, HSG D |
| 0.580 | 98 | Paved parking, HSG A |
| 1.380 | 98 | Weighted Average |
| 1.380 | | 100.00% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|-------------|------------------|------------------|----------------------|-------------------|---------------|
| 10.0 | | | | | Direct Entry, |

Summary for Subcatchment PervSysE: Perv to Infiltr. Syst #2

Runoff = 0.09 cfs @ 12.16 hrs, Volume= 395 cf, Depth= 1.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
 NOAA 24-hr D 100yr NOAA Rainfall=8.47"

| Area (ac) | CN | Description |
|-----------|----|-------------------------------|
| 0.080 | 39 | >75% Grass cover, Good, HSG A |
| 0.080 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|-------------|------------------|------------------|----------------------|-------------------|---------------|
| 7.0 | | | | | Direct Entry, |

Summary for Subcatchment PervSysW: Perv to Infiltr. Syst #1

Runoff = 2.49 cfs @ 12.18 hrs, Volume= 8,936 cf, Depth= 4.40"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
 NOAA 24-hr D 100yr NOAA Rainfall=8.47"

| Area (ac) | CN | Description |
|-----------|----|-------------------------------|
| 0.370 | 80 | >75% Grass cover, Good, HSG D |
| 0.190 | 39 | >75% Grass cover, Good, HSG A |
| 0.560 | 66 | Weighted Average |
| 0.560 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|-------------|------------------|------------------|----------------------|-------------------|---------------|
| 10.0 | | | | | Direct Entry, |

Summary for Link Pr N: Prop To North Line

Inflow Area = 20,909 sf, 66.67% Impervious, Inflow Depth = 3.38" for 100yr NOAA event
 Inflow = 1.07 cfs @ 12.13 hrs, Volume= 5,889 cf
 Primary = 1.07 cfs @ 12.13 hrs, Volume= 5,889 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

Summary for Link Pr S: Prop To South Line

Inflow Area = 122,839 sf, 66.67% Impervious, Inflow Depth = 4.46" for 100yr NOAA event
 Inflow = 9.86 cfs @ 12.21 hrs, Volume= 45,665 cf
 Primary = 9.86 cfs @ 12.21 hrs, Volume= 45,665 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

Summary for Link Prop.: Prop. Total

Inflow Area = 143,748 sf, 66.67% Impervious, Inflow Depth = 4.30" for 100yr NOAA event
 Inflow = 10.75 cfs @ 12.27 hrs, Volume= 51,553 cf
 Primary = 10.75 cfs @ 12.27 hrs, Volume= 51,553 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

Summary for Pond Sys1: Infiltr. Syst #1

Inflow Area = 84,506 sf, 71.13% Impervious, Inflow Depth = 7.12" for 100yr NOAA event
 Inflow = 12.22 cfs @ 12.17 hrs, Volume= 50,163 cf
 Outflow = 7.04 cfs @ 12.30 hrs, Volume= 50,163 cf, Atten= 42%, Lag= 7.6 min
 Discarded = 0.35 cfs @ 8.88 hrs, Volume= 25,010 cf
 Primary = 6.69 cfs @ 12.30 hrs, Volume= 25,152 cf

Routing by Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 2
 Peak Elev= 86.48' @ 12.30 hrs Surf.Area= 0 sf Storage= 13,669 cf

Plug-Flow detention time= 80.9 min calculated for 50,163 cf (100% of inflow)
 Center-of-Mass det. time= 80.9 min (843.6 - 762.7)

| Volume #1 | Invert 80.50' | Avail.Storage 13,741 cf | Storage Description Custom Stage Data Listed below |
|--------------|------------------|----------------------------|---|
|--------------|------------------|----------------------------|---|

| Elevation (feet) | Cum.Store (cubic-feet) |
|---------------------|---------------------------|
| 80.50 | 0 |
| 80.75 | 507 |
| 81.00 | 1,014 |
| 81.25 | 1,521 |
| 81.50 | 2,028 |
| 81.75 | 2,535 |
| 82.00 | 2,948 |
| 82.25 | 3,520 |
| 82.50 | 4,214 |
| 82.75 | 4,961 |
| 83.00 | 5,733 |
| 83.25 | 6,509 |
| 83.50 | 7,267 |
| 83.75 | 7,981 |
| 84.00 | 8,590 |
| 84.25 | 9,086 |
| 84.50 | 9,600 |
| 84.75 | 10,114 |
| 85.00 | 10,628 |
| 85.25 | 11,142 |
| 85.50 | 11,656 |
| 85.75 | 12,170 |
| 86.00 | 12,684 |
| 86.25 | 13,198 |
| 86.50 | 13,712 |
| 86.75 | 13,719 |
| 87.00 | 13,726 |
| 87.25 | 13,733 |
| 87.50 | 13,741 |

| Device | Routing | Invert | Outlet Devices |
|--------|-----------|--------|--|
| #1 | Discarded | 80.50' | 0.35 cfs Exfiltration at all elevations |
| #2 | Primary | 81.90' | 15.0" Round Culvert L= 20.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 81.90' / 81.80' S= 0.0050 '/ Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 1.23 sf |
| #3 | Device 2 | 81.90' | 4.0" Vert. Orifice/Grate C= 0.600 |
| #4 | Device 2 | 84.25' | 12.0" Vert. Orifice/Grate C= 0.600 |
| #5 | Device 2 | 86.32' | 4.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s) |

Discarded OutFlow Max=0.35 cfs @ 8.88 hrs HW=80.57' (Free Discharge)

↳ **1=Exfiltration** (Exfiltration Controls 0.35 cfs)

Primary OutFlow Max=6.67 cfs @ 12.30 hrs HW=86.48' (Free Discharge)

↳ **2=Culvert** (Passes 6.67 cfs of 11.75 cfs potential flow)

↳ **3=Orifice/Grate** (Orifice Controls 0.88 cfs @ 10.11 fps)

↳ **4=Orifice/Grate** (Orifice Controls 4.97 cfs @ 6.33 fps)

↳ **5=Sharp-Crested Rectangular Weir** (Weir Controls 0.82 cfs @ 1.30 fps)

Summary for Pond Sys2: Infiltr. Sys. 2

Inflow Area = 12,197 sf, 71.43% Impervious, Inflow Depth = 6.27" for 100yr NOAA event
 Inflow = 1.66 cfs @ 12.14 hrs, Volume= 6,370 cf
 Outflow = 0.55 cfs @ 12.34 hrs, Volume= 6,370 cf, Atten= 67%, Lag= 12.0 min
 Discarded = 0.03 cfs @ 6.53 hrs, Volume= 4,461 cf
 Primary = 0.52 cfs @ 12.34 hrs, Volume= 1,909 cf

Routing by Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
 Peak Elev= 93.56' @ 12.34 hrs Surf.Area= 0 sf Storage= 2,509 cf

Plug-Flow detention time= 476.8 min calculated for 6,370 cf (100% of inflow)
 Center-of-Mass det. time= 476.8 min (1,230.2 - 753.4)

| Volume | Invert | Avail.Storage | Storage Description |
|--------|--------|---------------|---------------------------------------|
| #1 | 88.50' | 2,999 cf | Custom Stage Data Listed below |

| Elevation (feet) | Cum.Store (cubic-feet) |
|---------------------|---------------------------|
| 88.50 | 0 |
| 88.75 | 120 |
| 89.00 | 240 |
| 89.25 | 360 |
| 89.50 | 480 |
| 89.75 | 600 |
| 90.00 | 720 |
| 90.25 | 840 |
| 90.50 | 960 |
| 90.75 | 1,080 |
| 91.00 | 1,200 |
| 91.25 | 1,321 |
| 91.50 | 1,448 |
| 91.75 | 1,574 |
| 92.00 | 1,701 |
| 92.25 | 1,827 |
| 92.50 | 1,953 |
| 92.75 | 2,083 |
| 93.00 | 2,217 |
| 93.25 | 2,351 |
| 93.50 | 2,481 |
| 93.75 | 2,606 |
| 94.00 | 2,733 |
| 94.25 | 2,859 |
| 94.50 | 2,986 |
| 94.75 | 2,992 |
| 95.00 | 2,999 |

| Device | Routing | Invert | Outlet Devices |
|--------|-----------|--------|---|
| #1 | Discarded | 88.50' | 0.03 cfs Exfiltration at all elevations |
| #2 | Primary | 93.00' | 6.0" Round Culvert L= 42.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 93.00' / 91.95' S= 0.0250 '/ Cc= 0.900 |

n= 0.010 PVC, smooth interior, Flow Area= 0.20 sf

Discarded OutFlow Max=0.03 cfs @ 6.53 hrs HW=88.57' (Free Discharge)

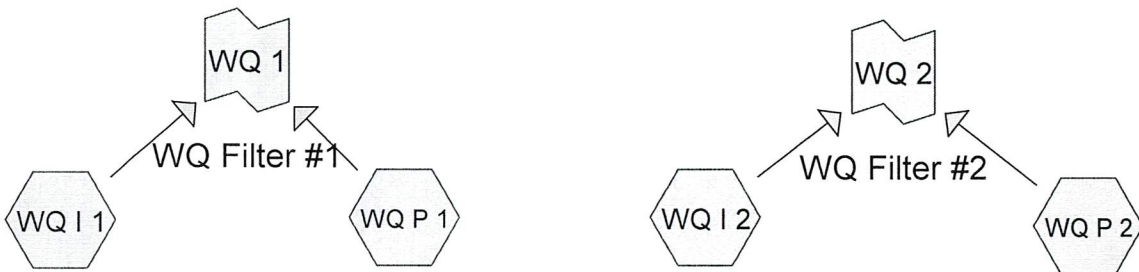
↑1=Exfiltration (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=0.52 cfs @ 12.34 hrs HW=93.56' (Free Discharge)

↑2=Culvert (Inlet Controls 0.52 cfs @ 2.66 fps)

Appendix D

**HydroCAD Calculations - WQ Filter Sizing Calculations
1yr WQ Storm**

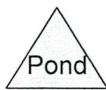


Imp To WQ Filter #1

Perv To WQ Filter #1

Imp To WQ Filter #2

Perv To WQ Filter #2



Time span=0.00-96.00 hrs, dt=0.01 hrs, 9601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Link WQ 1: WQ Filter #1

Inflow=0.44 cfs 631 cf
Primary=0.44 cfs 631 cf

Link WQ 2: WQ Filter #2

Inflow=0.20 cfs 282 cf
Primary=0.20 cfs 282 cf

Subcatchment WQ I 1: Imp To WQ Filter #1 Runoff Area=0.168 ac 100.00% Impervious Runoff Depth=1.03"
Tc=10.0 min CN=98 Runoff=0.44 cfs 631 cf

Subcatchment WQ I 2: Imp To WQ Filter #2 Runoff Area=0.075 ac 100.00% Impervious Runoff Depth=1.03"
Tc=10.0 min CN=98 Runoff=0.20 cfs 282 cf

Subcatchment WQ P 1: Perv To WQ Filter #1 Runoff Area=0.076 ac 0.00% Impervious Runoff Depth=0.00"
Tc=10.0 min CN=39 Runoff=0.00 cfs 0 cf

Subcatchment WQ P 2: Perv To WQ Filter #2 Runoff Area=0.063 ac 0.00% Impervious Runoff Depth=0.00"
Tc=10.0 min CN=39 Runoff=0.00 cfs 0 cf

Total Runoff Area = 16,640 sf Runoff Volume = 913 cf Average Runoff Depth = 0.66"
36.39% Pervious = 6,055 sf 63.61% Impervious = 10,585 sf

Summary for Link WQ 1: WQ Filter #1

Inflow Area = 10,629 sf, 68.85% Impervious, Inflow Depth = 0.71" for 1 YR WQ event
 Inflow = 0.44 cfs @ 1.15 hrs, Volume= 631 cf
 Primary = 0.44 cfs @ 1.15 hrs, Volume= 631 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

Summary for Link WQ 2: WQ Filter #2

Inflow Area = 6,011 sf, 54.35% Impervious, Inflow Depth = 0.56" for 1 YR WQ event
 Inflow = 0.20 cfs @ 1.15 hrs, Volume= 282 cf
 Primary = 0.20 cfs @ 1.15 hrs, Volume= 282 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

Summary for Subcatchment WQ I 1: Imp To WQ Filter #1

Runoff = 0.44 cfs @ 1.15 hrs, Volume= 631 cf, Depth= 1.03"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
 NJ DEP 2-hr 1 YR WQ Rainfall=1.25"

| Area (ac) | CN | Description |
|-----------|----|-------------------------|
| 0.168 | 98 | Paved parking, HSG A |
| 0.168 | | 100.00% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|---------------|
| 10.0 | | | | | Direct Entry, |

Summary for Subcatchment WQ I 2: Imp To WQ Filter #2

Runoff = 0.20 cfs @ 1.15 hrs, Volume= 282 cf, Depth= 1.03"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
 NJ DEP 2-hr 1 YR WQ Rainfall=1.25"

| Area (ac) | CN | Description |
|-----------|----|-------------------------|
| 0.075 | 98 | Paved parking, HSG A |
| 0.075 | | 100.00% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|---------------|
| 10.0 | | | | | Direct Entry, |

Summary for Subcatchment WQ P 1: Perv To WQ Filter #1

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
 NJ DEP 2-hr 1 YR WQ Rainfall=1.25"

| Area (ac) | CN | Description |
|-----------|----|-------------------------------|
| 0.076 | 39 | >75% Grass cover, Good, HSG A |
| 0.076 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|---------------|
| 10.0 | | | | | Direct Entry, |

Summary for Subcatchment WQ P 2: Perv To WQ Filter #2

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"

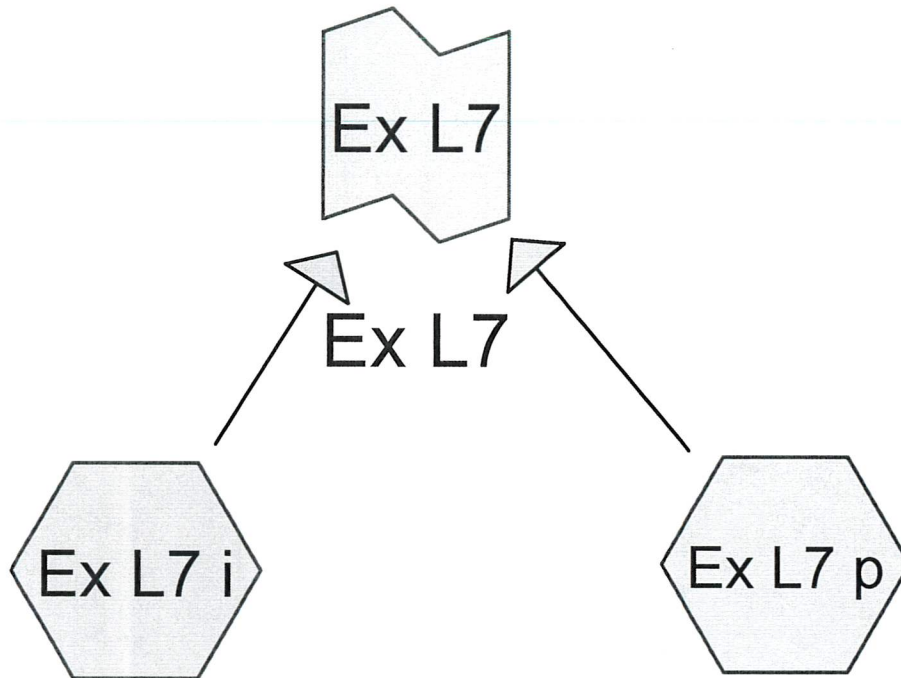
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
 NJ DEP 2-hr 1 YR WQ Rainfall=1.25"

| Area (ac) | CN | Description |
|-----------|----|-------------------------------|
| 0.063 | 39 | >75% Grass cover, Good, HSG A |
| 0.063 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|---------------|
| 10.0 | | | | | Direct Entry, |

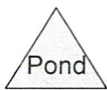
Appendix E

**HydroCAD Calculations - Runoff To Lot 7
2yr, 10yr, 25yr & 100yr Storms**



Existing to Lot 7
Imp.

Exist to Lot 7 Perv.



Time span=0.00-96.00 hrs, dt=0.01 hrs, 9601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Link Ex L7: Ex L7

Inflow=2.64 cfs 0.247 af
Primary=2.64 cfs 0.247 af

Subcatchment Ex L7 i: Existing to Lot 7 Runoff Area=0.440 ac 100.00% Impervious Runoff Depth=3.11"
Tc=12.0 min CN=98 Runoff=1.14 cfs 0.114 af

Subcatchment Ex L7 p: Exist to Lot 7 Perv. Runoff Area=1.060 ac 0.00% Impervious Runoff Depth=1.51"
Tc=12.0 min CN=80 Runoff=1.51 cfs 0.133 af

Total Runoff Area = 1.500 ac Runoff Volume = 0.247 af Average Runoff Depth = 1.98"
70.67% Pervious = 1.060 ac 29.33% Impervious = 0.440 ac

Summary for Link Ex L7: Ex L7

Inflow Area = 1.500 ac, 29.33% Impervious, Inflow Depth = 1.98" for 2yr NOAA event
 Inflow = 2.64 cfs @ 12.20 hrs, Volume= 0.247 af
 Primary = 2.64 cfs @ 12.20 hrs, Volume= 0.247 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

Summary for Subcatchment Ex L7 i: Existing to Lot 7 Imp.

Runoff = 1.14 cfs @ 12.19 hrs, Volume= 0.114 af, Depth= 3.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
 NOAA 24-hr D 2yr NOAA Rainfall=3.34"

| Area (ac) | CN | Description |
|-----------|----|-------------------------|
| 0.440 | 98 | Paved parking, HSG D |
| 0.440 | | 100.00% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|---------------------|
| 12.0 | | | | | Direct Entry, Ex TC |

Summary for Subcatchment Ex L7 p: Exist to Lot 7 Perv.

Runoff = 1.51 cfs @ 12.20 hrs, Volume= 0.133 af, Depth= 1.51"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
 NOAA 24-hr D 2yr NOAA Rainfall=3.34"

| Area (ac) | CN | Description |
|-----------|----|-------------------------------|
| 1.060 | 80 | >75% Grass cover, Good, HSG D |
| 1.060 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|--------------------|
| 12.0 | | | | | Direct Entry, ExTc |

Time span=0.00-96.00 hrs, dt=0.01 hrs, 9601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Link Ex L7: Ex L7

Inflow=4.69 cfs 0.438 af
Primary=4.69 cfs 0.438 af

Subcatchment Ex L7 i: Existing to Lot 7 Runoff Area=0.440 ac 100.00% Impervious Runoff Depth=4.83"
Tc=12.0 min CN=98 Runoff=1.74 cfs 0.177 af

Subcatchment Ex L7 p: Exist to Lot 7 Perv. Runoff Area=1.060 ac 0.00% Impervious Runoff Depth=2.95"
Tc=12.0 min CN=80 Runoff=2.95 cfs 0.261 af

Total Runoff Area = 1.500 ac Runoff Volume = 0.438 af Average Runoff Depth = 3.51"
70.67% Pervious = 1.060 ac 29.33% Impervious = 0.440 ac

Summary for Link Ex L7: Ex L7

Inflow Area = 1.500 ac, 29.33% Impervious, Inflow Depth = 3.51" for 10yr NOAA event
 Inflow = 4.69 cfs @ 12.20 hrs, Volume= 0.438 af
 Primary = 4.69 cfs @ 12.20 hrs, Volume= 0.438 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

Summary for Subcatchment Ex L7 i: Existing to Lot 7 Imp.

Runoff = 1.74 cfs @ 12.19 hrs, Volume= 0.177 af, Depth= 4.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
 NOAA 24-hr D 10yr NOAA Rainfall=5.07"

| Area (ac) | CN | Description |
|-----------|----|-------------------------|
| 0.440 | 98 | Paved parking, HSG D |
| 0.440 | | 100.00% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|---------------------|
| 12.0 | | | | | Direct Entry, Ex TC |

Summary for Subcatchment Ex L7 p: Exist to Lot 7 Perv.

Runoff = 2.95 cfs @ 12.20 hrs, Volume= 0.261 af, Depth= 2.95"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
 NOAA 24-hr D 10yr NOAA Rainfall=5.07"

| Area (ac) | CN | Description |
|-----------|----|-------------------------------|
| 1.060 | 80 | >75% Grass cover, Good, HSG D |
| 1.060 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|--------------------|
| 12.0 | | | | | Direct Entry, ExTc |

Time span=0.00-96.00 hrs, dt=0.01 hrs, 9601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Link Ex L7: Ex L7

Inflow=6.16 cfs 0.578 af
Primary=6.16 cfs 0.578 af

Subcatchment Ex L7 i: Existing to Lot 7

Runoff Area=0.440 ac 100.00% Impervious Runoff Depth=6.04"
Tc=12.0 min CN=98 Runoff=2.16 cfs 0.222 af

Subcatchment Ex L7 p: Exist to Lot 7 Perv.

Runoff Area=1.060 ac 0.00% Impervious Runoff Depth=4.03"
Tc=12.0 min CN=80 Runoff=4.00 cfs 0.356 af

Total Runoff Area = 1.500 ac Runoff Volume = 0.578 af Average Runoff Depth = 4.62"
70.67% Pervious = 1.060 ac 29.33% Impervious = 0.440 ac

Summary for Link Ex L7: Ex L7

Inflow Area = 1.500 ac, 29.33% Impervious, Inflow Depth = 4.62" for 25yr NOAA event
 Inflow = 6.16 cfs @ 12.20 hrs, Volume= 0.578 af
 Primary = 6.16 cfs @ 12.20 hrs, Volume= 0.578 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

Summary for Subcatchment Ex L7 i: Existing to Lot 7 Imp.

Runoff = 2.16 cfs @ 12.19 hrs, Volume= 0.222 af, Depth= 6.04"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
 NOAA 24-hr D 25yr NOAA Rainfall=6.28"

| Area (ac) | CN | Description |
|-----------|----|-------------------------|
| 0.440 | 98 | Paved parking, HSG D |
| 0.440 | | 100.00% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|---------------------|
| 12.0 | | | | | Direct Entry, Ex TC |

Summary for Subcatchment Ex L7 p: Exist to Lot 7 Perv.

Runoff = 4.00 cfs @ 12.20 hrs, Volume= 0.356 af, Depth= 4.03"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
 NOAA 24-hr D 25yr NOAA Rainfall=6.28"

| Area (ac) | CN | Description |
|-----------|----|-------------------------------|
| 1.060 | 80 | >75% Grass cover, Good, HSG D |
| 1.060 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|--------------------|
| 12.0 | | | | | Direct Entry, ExTc |

Time span=0.00-96.00 hrs, dt=0.01 hrs, 9601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Link Ex L7: Ex L7

Inflow=8.84 cfs 0.838 af
Primary=8.84 cfs 0.838 af

Subcatchment Ex L7 i: Existing to Lot 7 Runoff Area=0.440 ac 100.00% Impervious Runoff Depth=8.23"
Tc=12.0 min CN=98 Runoff=2.91 cfs 0.302 af

Subcatchment Ex L7 p: Exist to Lot 7 Perv. Runoff Area=1.060 ac 0.00% Impervious Runoff Depth=6.07"
Tc=12.0 min CN=80 Runoff=5.92 cfs 0.536 af

Total Runoff Area = 1.500 ac Runoff Volume = 0.838 af Average Runoff Depth = 6.70"
70.67% Pervious = 1.060 ac 29.33% Impervious = 0.440 ac

Summary for Link Ex L7: Ex L7

Inflow Area = 1.500 ac, 29.33% Impervious, Inflow Depth = 6.70" for 100yr NOAA event
 Inflow = 8.84 cfs @ 12.20 hrs, Volume= 0.838 af
 Primary = 8.84 cfs @ 12.20 hrs, Volume= 0.838 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

Summary for Subcatchment Ex L7 i: Existing to Lot 7 Imp.

Runoff = 2.91 cfs @ 12.19 hrs, Volume= 0.302 af, Depth= 8.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
 NOAA 24-hr D 100yr NOAA Rainfall=8.47"

| Area (ac) | CN | Description |
|-----------|----|-------------------------|
| 0.440 | 98 | Paved parking, HSG D |
| 0.440 | | 100.00% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|---------------------|
| 12.0 | | | | | Direct Entry, Ex TC |

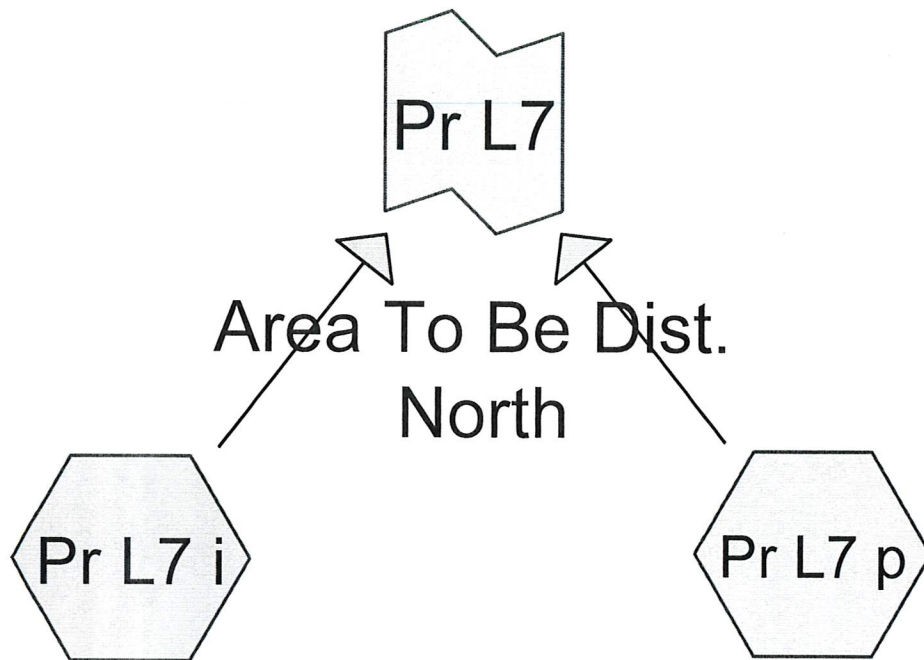
Summary for Subcatchment Ex L7 p: Exist to Lot 7 Perv.

Runoff = 5.92 cfs @ 12.20 hrs, Volume= 0.536 af, Depth= 6.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
 NOAA 24-hr D 100yr NOAA Rainfall=8.47"

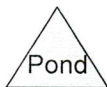
| Area (ac) | CN | Description |
|-----------|----|-------------------------------|
| 1.060 | 80 | >75% Grass cover, Good, HSG D |
| 1.060 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|--------------------|
| 12.0 | | | | | Direct Entry, ExTc |



Prop To Lot 7 Imp

Prop to Lot 7 Perv.



Time span=0.00-96.00 hrs, dt=0.01 hrs, 9601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Link Pr L7: Area To Be Dist. North

Inflow=1.96 cfs 0.184 af
Primary=1.96 cfs 0.184 af

Subcatchment Pr L7 i: Prop To Lot 7 Imp

Runoff Area=0.340 ac 100.00% Impervious Runoff Depth=3.11"
Tc=12.0 min CN=98 Runoff=0.88 cfs 0.088 af

Subcatchment Pr L7 p: Prop to Lot 7 Perv.

Runoff Area=0.760 ac 0.00% Impervious Runoff Depth=1.51"
Tc=12.0 min CN=80 Runoff=1.08 cfs 0.096 af

Total Runoff Area = 1.100 ac Runoff Volume = 0.184 af Average Runoff Depth = 2.00"
69.09% Pervious = 0.760 ac 30.91% Impervious = 0.340 ac

Summary for Link Pr L7: Area To Be Dist. North

Inflow Area = 1.100 ac, 30.91% Impervious, Inflow Depth = 2.00" for 2yr NOAA event
 Inflow = 1.96 cfs @ 12.20 hrs, Volume= 0.184 af
 Primary = 1.96 cfs @ 12.20 hrs, Volume= 0.184 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

Summary for Subcatchment Pr L7 i: Prop To Lot 7 Imp

Runoff = 0.88 cfs @ 12.19 hrs, Volume= 0.088 af, Depth= 3.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
 NOAA 24-hr D 2yr NOAA Rainfall=3.34"

| Area (ac) | CN | Description |
|-----------|----|-------------------------|
| 0.340 | 98 | Paved parking, HSG D |
| 0.340 | | 100.00% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|---------------------|
| 12.0 | | | | | Direct Entry, Ex TC |

Summary for Subcatchment Pr L7 p: Prop to Lot 7 Perv.

Runoff = 1.08 cfs @ 12.20 hrs, Volume= 0.096 af, Depth= 1.51"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
 NOAA 24-hr D 2yr NOAA Rainfall=3.34"

| Area (ac) | CN | Description |
|-----------|----|-------------------------------|
| 0.760 | 80 | >75% Grass cover, Good, HSG D |
| 0.760 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|--------------------|
| 12.0 | | | | | Direct Entry, ExTc |

Time span=0.00-96.00 hrs, dt=0.01 hrs, 9601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Link Pr L7: Area To Be Dist. North

Inflow=3.46 cfs 0.324 af
Primary=3.46 cfs 0.324 af

Subcatchment Pr L7 i: Prop To Lot 7 Imp Runoff Area=0.340 ac 100.00% Impervious Runoff Depth=4.83"
Tc=12.0 min CN=98 Runoff=1.34 cfs 0.137 af

Subcatchment Pr L7 p: Prop to Lot 7 Perv. Runoff Area=0.760 ac 0.00% Impervious Runoff Depth=2.95"
Tc=12.0 min CN=80 Runoff=2.12 cfs 0.187 af

Total Runoff Area = 1.100 ac Runoff Volume = 0.324 af Average Runoff Depth = 3.53"
69.09% Pervious = 0.760 ac 30.91% Impervious = 0.340 ac

Summary for Link Pr L7: Area To Be Dist. North

Inflow Area = 1.100 ac, 30.91% Impervious, Inflow Depth = 3.53" for 10yr NOAA event
 Inflow = 3.46 cfs @ 12.20 hrs, Volume= 0.324 af
 Primary = 3.46 cfs @ 12.20 hrs, Volume= 0.324 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

Summary for Subcatchment Pr L7 i: Prop To Lot 7 Imp

Runoff = 1.34 cfs @ 12.19 hrs, Volume= 0.137 af, Depth= 4.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
 NOAA 24-hr D 10yr NOAA Rainfall=5.07"

| Area (ac) | CN | Description |
|-----------|----|-------------------------|
| 0.340 | 98 | Paved parking, HSG D |
| 0.340 | | 100.00% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|---------------------|
| 12.0 | | | | | Direct Entry, Ex TC |

Summary for Subcatchment Pr L7 p: Prop to Lot 7 Perv.

Runoff = 2.12 cfs @ 12.20 hrs, Volume= 0.187 af, Depth= 2.95"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
 NOAA 24-hr D 10yr NOAA Rainfall=5.07"

| Area (ac) | CN | Description |
|-----------|----|-------------------------------|
| 0.760 | 80 | >75% Grass cover, Good, HSG D |
| 0.760 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|--------------------|
| 12.0 | | | | | Direct Entry, ExTc |

Time span=0.00-96.00 hrs, dt=0.01 hrs, 9601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Link Pr L7: Area To Be Dist. North

Inflow=4.54 cfs 0.427 af
Primary=4.54 cfs 0.427 af

Subcatchment Pr L7 i: Prop To Lot 7 Imp Runoff Area=0.340 ac 100.00% Impervious Runoff Depth=6.04"
Tc=12.0 min CN=98 Runoff=1.67 cfs 0.171 af

Subcatchment Pr L7 p: Prop to Lot 7 Perv. Runoff Area=0.760 ac 0.00% Impervious Runoff Depth=4.03"
Tc=12.0 min CN=80 Runoff=2.87 cfs 0.256 af

Total Runoff Area = 1.100 ac Runoff Volume = 0.427 af Average Runoff Depth = 4.66"
69.09% Pervious = 0.760 ac 30.91% Impervious = 0.340 ac

Summary for Link Pr L7: Area To Be Dist. North

Inflow Area = 1.100 ac, 30.91% Impervious, Inflow Depth = 4.66" for 25yr NOAA event
 Inflow = 4.54 cfs @ 12.20 hrs, Volume= 0.427 af
 Primary = 4.54 cfs @ 12.20 hrs, Volume= 0.427 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

Summary for Subcatchment Pr L7 i: Prop To Lot 7 Imp

Runoff = 1.67 cfs @ 12.19 hrs, Volume= 0.171 af, Depth= 6.04"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
 NOAA 24-hr D 25yr NOAA Rainfall=6.28"

| Area (ac) | CN | Description |
|-----------|----|-------------------------|
| 0.340 | 98 | Paved parking, HSG D |
| 0.340 | | 100.00% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|---------------------|
| 12.0 | | | | | Direct Entry, Ex TC |

Summary for Subcatchment Pr L7 p: Prop to Lot 7 Perv.

Runoff = 2.87 cfs @ 12.20 hrs, Volume= 0.256 af, Depth= 4.03"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
 NOAA 24-hr D 25yr NOAA Rainfall=6.28"

| Area (ac) | CN | Description |
|-----------|----|-------------------------------|
| 0.760 | 80 | >75% Grass cover, Good, HSG D |
| 0.760 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|--------------------|
| 12.0 | | | | | Direct Entry, ExTc |

Time span=0.00-96.00 hrs, dt=0.01 hrs, 9601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Link Pr L7: Area To Be Dist. North

Inflow=6.50 cfs 0.617 af
Primary=6.50 cfs 0.617 af

Subcatchment Pr L7 i: Prop To Lot 7 Imp

Runoff Area=0.340 ac 100.00% Impervious Runoff Depth=8.23"
Tc=12.0 min CN=98 Runoff=2.25 cfs 0.233 af

Subcatchment Pr L7 p: Prop to Lot 7 Perv.

Runoff Area=0.760 ac 0.00% Impervious Runoff Depth=6.07"
Tc=12.0 min CN=80 Runoff=4.25 cfs 0.384 af

Total Runoff Area = 1.100 ac Runoff Volume = 0.617 af Average Runoff Depth = 6.74"
69.09% Pervious = 0.760 ac 30.91% Impervious = 0.340 ac

Summary for Link Pr L7: Area To Be Dist. North

Inflow Area = 1.100 ac, 30.91% Impervious, Inflow Depth = 6.74" for 100yr NOAA event
 Inflow = 6.50 cfs @ 12.20 hrs, Volume= 0.617 af
 Primary = 6.50 cfs @ 12.20 hrs, Volume= 0.617 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

Summary for Subcatchment Pr L7 i: Prop To Lot 7 Imp

Runoff = 2.25 cfs @ 12.19 hrs, Volume= 0.233 af, Depth= 8.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
 NOAA 24-hr D 100yr NOAA Rainfall=8.47"

| Area (ac) | CN | Description |
|-----------|----|-------------------------|
| 0.340 | 98 | Paved parking, HSG D |
| 0.340 | | 100.00% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|---------------------|
| 12.0 | | | | | Direct Entry, Ex TC |

Summary for Subcatchment Pr L7 p: Prop to Lot 7 Perv.

Runoff = 4.25 cfs @ 12.20 hrs, Volume= 0.384 af, Depth= 6.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
 NOAA 24-hr D 100yr NOAA Rainfall=8.47"

| Area (ac) | CN | Description |
|-----------|----|-------------------------------|
| 0.760 | 80 | >75% Grass cover, Good, HSG D |
| 0.760 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|--------------------|
| 12.0 | | | | | Direct Entry, ExTc |

Appendix F

**Percolation Soil Testing Report & Test Location Map
(By Johnson Soils)**



66 Glen Avenue
Glen Rock, NJ 07452
Telephone: 201-301-1045
Fax: 201-857-8002
Email: info@johnsonsoils.com

November 17, 2022

BOSWELL ENGINEERING
330 Phillips Avenue
South Hackensack, NJ 07606

Attn: Frank J. Rossi

Re: Percolation Testing
88, 100 & 106 Chadwick Road & 737 Grange Road
Teaneck, NJ
JSC Job #22-219.1

To whom it may concern:

The following test pits were inspected on November 11, 2022 at the proposed storm water management locations. The test pits were dug with an excavator by RFC Excavating and provided by Boswell Engineering.

All testing was performed in accordance with the BMP Manual, Chapter 12.

The test pit log is as follows:

TP-1 (Existing surface grade 89.6 +/-)

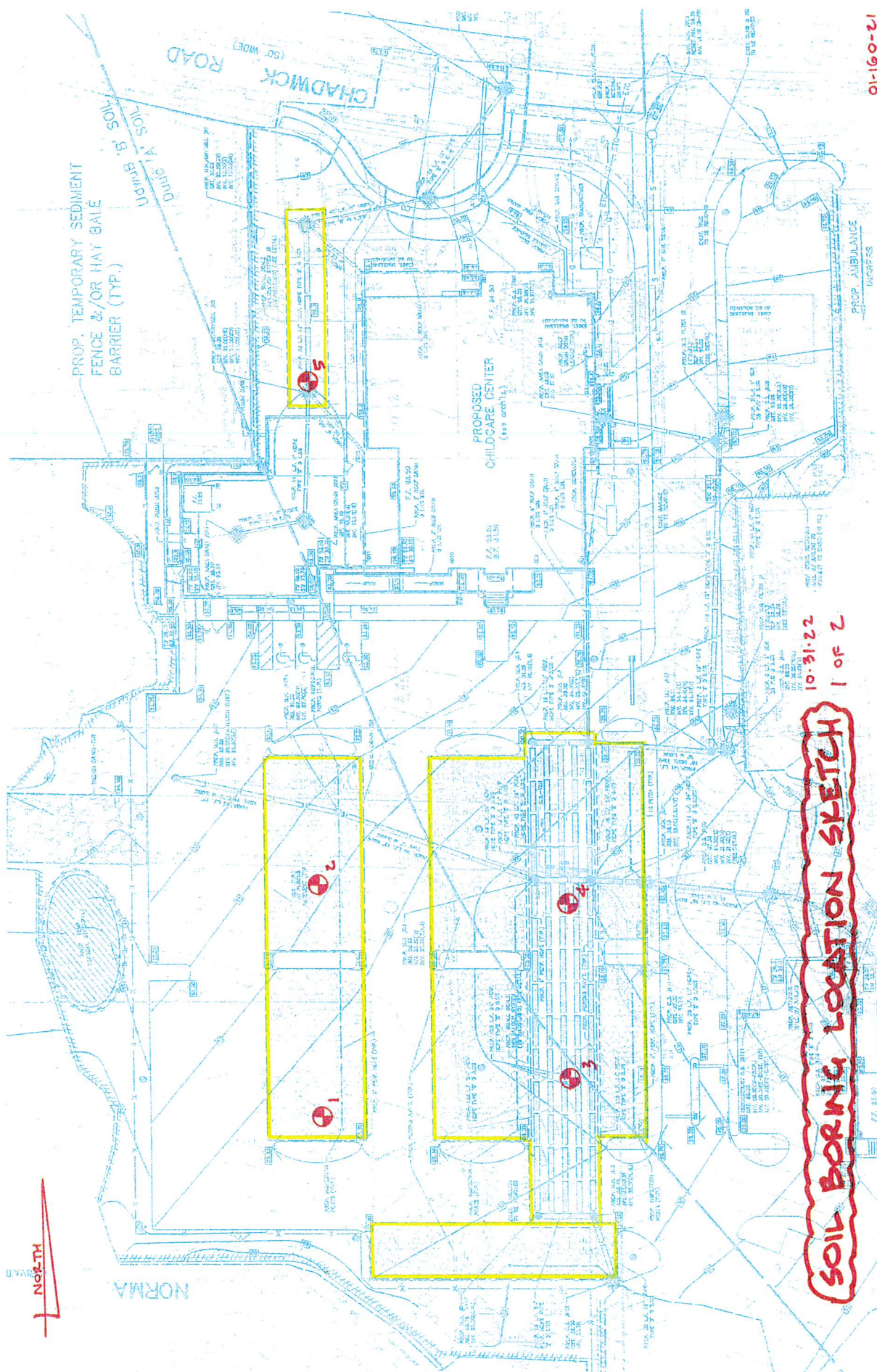
0" – 8" Topsoil
8" – 28" Yellow Brown fine to medium Sand and Silt
28" – 11'8" Red Brown fine to medium Sand and Gravel, little Silt and
Cobbles

No Mottling
Water at 10'8"
Seasonal High Water Table at 10'8"
The percolation rate at a depth of 8'8" is 1.3 in/hr.

TP-2 (Existing surface grade 93.0 +/-)

0" – 12" Topsoil
12" – 32" Yellow Brown fine to medium Sand and Silt
32" – 13' Red Brown fine to medium Sand and Gravel, little Silt and
Cobbles

No Mottling
Water at 12'8"
Seasonal High Water Table at 12'8"
The percolation rate at a depth of 10'8" is 1.2 in/hr.



PROP. TEMPORARY SEDIMENT
FENCE &/OR HAY BALE
BARRIER (TYP.)

CHADWICK ROAD
(50' WIDE)

NORMA

PROPOSED CHILD CARE CENTER
(199 sq ft.)

PROP. AMBULANCE
INGRESS

North

SOIL BORING LOCATION SKETCH

10-31-22
1 OF 2

12-09-10



Teaneck Township
 ZONING OFFICER
 818 TEANECK ROAD
 TEANECK, NJ 07666
 (201) 837-1600 FAX(201) 837-4802
 DMELFI@TEANECKNJ.GOV

Application Date: 8/26/2022
 Application Number: 20220614
 Permit Number: _____
 Project Number: _____
 Fee: \$250

Denial of Application

Date: 1/13/2023

To: HOLY NAME REAL ESTATE CORP
 718 TEANECK RD
 TEANECK, NJ 07666

CC: APP TELE:(201) 833-3595
 APP EMAIL:SMOSSER@HOLYNAMEHOSPITAL

RE: 100 CHADWICK ROAD
 BLOCK: 3003 LOT: 2 QUAL: ZONE: H

DEAR HOLY NAME REAL ESTATE CORP,

NEW CHILDCARE CENTER WITH A PLAY AREA, AND EXPANDED PARKING AREA WITH RELATED SITE AND PARKING IMPROVEMENTS, INCLUDING THE CREATION OF A CUL-DE-SAC ON CHADWICK ROAD, REMOVING THE GRANGE ROAD DRIVEWAY, INSTALLING A FENCE 6 FEET HIGH & GENERATOR AS PER THE BUILDING PLANS DATED 8-23 22 AND SITE PLANS DATED 8-19-22.

REVISED BUILDING PLANS DATED 10-14-2023
 REVISED SITE PLAN DATED 12-27-2023

Your request is hereby denied based upon the following requirements:

PLANNING BOARD APPROVAL REQUIRED

33-3 SUBDIVISION

The term subdivision shall also apply to resubdivision.
 In whole and / or part of Block 3002 Lot 2,3,4,5,6,7 & 8.
 Block 3003 Lot 2,3,4,8,9,10,12,13&14

33-17 SITE PLAN APPROVAL REQUIRED.

33-15(b)8 WAIVERS REQUESTED

Proposed right of way radius is 35.5 feet / required is 50 feet.
 Proposed roadway radius is 27.5 feet / required is 40 feet.

RSIS EXCEPTIONS REQUESTED

Proposed right of way radius is 35.5 feet / required is 48 feet.
 Proposed roadway radius is 27.5 feet / required is 40 feet.

FYI

Testimony should be given in regards to parking vs the complete project..

The following comments were made during the denial process:

SUBMITTAL OF ANY NEW DOCUMENTS MAY REQUIRE ADDITIONAL VARIANCES OR WAIVERS

Sincerely,



DAN MELFI, ZONING OFFICIAL