

SUBJECT ENGLISH STATION - 510 GRAND AVESHEET NO. 1 OF 7
PROJECT NO. 263951
DATE 12-20-2018
BY CMD
CHK'D _____SOIL REMEDIATION PROJECT - STORMWATER RUNOFF CALCULATIONS

THE SITE HAS TWO EXISTING CATCH BASIN STRUCTURES WHICH RECEIVE SURFACE RUNOFF FROM RELATIVELY SMALL AREAS OF THE SITE. THOSE TWO CATCH BASINS DISCHARGE DIRECTLY TO THE MILL RIVER VIA PIPE OUTFALL THAT PENETRATE THE PERIMETER STEEL BULKHEAD. THE REMAINDER OF THE SITE DISCHARGES SURFACE RUNOFF VIA OVERLAND FLOW TO THE STEEL BULKHEAD AND INTO THE RIVER. ROOF DRAINAGE FROM THE MAIN POWER PLANT BUILDING IS VIA PIPED DISCHARGES TO THE MILL RIVER. THE PROJECT WILL ONLY AFFECT SURFACE CONDITIONS AND DRAINAGE AREAS TO THE TWO EXISTING CATCH BASINS SLIGHTLY. THE FOLLOWING CALCULATIONS PROVIDE ASSESSMENT THE PROJECT WILL HAVE ON THESE TWO BASIN DISCHARGES. DUE TO A SIGNIFICANT PORTION OF THE SITE BEING CHANGED FROM PAVED AREA TO GRASS COVER, AND THE DEMOLITION OF STATION B, THE OVERALL COMBINED SITE RUNOFF COEFFICIENT CHANGES FROM 0.666 FOR EXISTING CONDITIONS TO 0.490 FOR PROPOSED CONDITIONS.

DUE TO THE RELATIVELY SMALL DRAINAGE AREAS FOR THE TWO CATCH BASINS, THE RATIONAL METHOD HAS BEEN SELECTED TO CALCULATE STORMWATER RUNOFF.

CATCH BASIN - CB-1 (NORTHEAST CORNER OF MAIN BLDG)

EXISTING DRAINAGE AREA = 0.34 ACRES

100% OF THE DRAINAGE AREA IS BITUMINOUS PAVEMENT
THE RECOMMENDED RANGE OF THE RUNOFF COEFFICIENT (C)
FOR PAVED AREAS IS 0.70 TO 0.95. A VALUE OF
 $C = 0.80$ WILL BE USED FOR DESIGN

SUBJECT ENGLISH STATION - 510 GRAND AVESHEET NO. 2 OF 7
PROJECT NO. 203951
DATE 12-20-2018
BY CMA
CHK'D _____CB-1 EXISTING CONTINUED

THE TIME OF CONCENTRATION FOR CB-1 IS ESTIMATED USING THE FOLLOWING FORMULA FOR SHEET FLOW. SINCE THE LENGTH OF SHEET FLOW IS RELATIVELY SHORT (150 FT.), THERE IS NOT A COMPONENT OF OVERLAND FLOW THAT WILL BE PART OF T_c FOR THIS BASIN.

$$T_L = \frac{0.007(nL)^{0.8}}{P_2^{0.5} S^{0.4}}$$

T_L - Travel Time (Hr.)

n - Manning's Coef. - For Asphalt Pavement $n = 0.011$

L - Flow Length = 150 ft.

P_2 - 2 yr, 24 hr. RAINFALL DEPTH = 3.42 in.

S - SLOPE = $(9.0 - 7.5)/150 \text{ FT} = 0.01 \text{ FT/FT}$

$$T_L = \frac{0.007(0.011 \times 150)^{0.8}}{(3.42)^{0.5} \times (0.01)^{0.4}} = 0.036 \text{ HR} = 2.1 \text{ MIN}$$

SINCE $T_L < 5 \text{ MIN}$, USE MINIMUM ALLOWABLE $T_L = 5 \text{ MIN}$

RAINFALL INTENSITY FROM TWEED-NEW HAVEN AIRPORT
NOAA STATION ID 06-5273

$$I_{2 \text{ YR}} = 4.97 \text{ IN/HR}$$

$$I_{10 \text{ YR}} = 7.51 \text{ IN/HR}$$

$$I_{25 \text{ YR}} = 9.11 \text{ IN/HR}$$

$$I_{50 \text{ YR}} = 10.3 \text{ IN/HR}$$

$$I_{100 \text{ YR}} = 11.6 \text{ IN/HR}$$

SUBJECT ENGLISH STATION - 510 GRAND AVE.SHEET NO. 3 OF 7
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THE CALCULATED FLOWS FOR THE 25YR, 50YR & 100YR
RAINFALL EVENTS WILL BE ADJUSTED BASED ON
THE FOLLOWING FREQUENCY FACTORS FOR THE
RATIONAL FORMULA

STORM	C _f
25YR	- 1.1
50YR	- 1.2
100YR	- 1.25

Rational Formula $Q = CC_f IA$

Q = PEAK RUNOFF (FT³/SEC)

C = RUNOFF COEFFICIENT

I = RAINFALL INTENSITY (INCHES/HOUR)

A = DRAINAGE AREA (ACRES)

$$Q_{25YR} = 0.80(4.97)(0.34) = 1.35 \text{ CFS}$$

$$Q_{10YR} = 0.80(7.51)(0.34) = 2.04 \text{ CFS}$$

$$Q_{25YR} = 0.80(9.11)(0.34)(1.1) = 2.73 \text{ CFS}$$

$$Q_{50YR} = 0.80(10.3)(0.34)(1.2) = 3.36 \text{ CFS}$$

$$Q_{100YR} = 0.80(11.6)(0.34)(1.25) = 3.94 \text{ CFS}$$

DESIGN STORM FOR CATCH BASIN INLET WILL BE Q_{10YR}

THE EXISTING BASIN SITS IN A SAG AT THE NORTHEAST
CORNER OF THE BUILDING. USING THE LTDOT DRAINAGE
MANUAL FOR A TYPE "C-L" BASIN IN A SAG, THE
FOLLOWING EQUATION APPLIES



FOR GRATES OPERATING AS A WEIR (DEPTH ≤ 0.4 FT) THE FOLLOWING EQUATION APPLIES:

$$d = \left(\frac{Q C_{FS}}{C P} \right)^{2/3}$$

d = depth of water (FT.)

Q = FLOW (CFS)

P = PERIMETER OF GRATE (FT) - 7.33 FT.

C = 3.0

C_{FS} = FACTOR OF SAFETY FOR CLOGGING - USE 1.25

$$d_{10yr} = \left(\frac{2.04 (1.25)}{3.0 (7.33)} \right)^{2/3} = 0.24 \text{ FT} \quad \therefore \text{INLET IS OPERATING AS A WEIR}$$

TOP OF GRATE ≈ 7.0 FT NGVD, WHICH IS 1 FT BELOW FLOOR SLAB GRADE AND 0.5 FT BELOW THE SURFACE OVERFLOW POINT TO THE BULKHEAD.

CB-1 PROPOSED CONDITION

REGRADING IN PARCEL A TO CONSTRUCT THE SOIL CAP WILL RESULT IN ADDITIONAL SURFACE DRAINAGE CONTRIBUTING TO CB-1. ALL OF THE ADDITIONAL AREA WILL BE GRASS VEGETATION SURFACE CONDITION. THE GRASS AREA IS GENERALLY A 25% SLOPE. THE BASE OF THE SLOPE WILL HAVE A 4'x4' STONE FILLED INFILTRATION TRENCH, WHICH WILL DECREASE RUNOFF FROM SMALLER STORM EVENTS. THE INFILTRATION TRENCH WILL NOT BE COUNTED FOR THE DESIGN ANALYSIS.

SUBJECT ENGLISH STATION - 510 GRAND AVESHEET NO. 5 OF 7
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CB-1 PROPOSED DRAINAGE AREA = 0.59 ACRES

RUNOFF COEFFICIENT

PAVED AREA = 0.35 ACRES - C = 0.80

GRASS AREA = 0.24 ACRES - C = 0.15

$$C_{\text{COMPOSITE}} = \frac{0.8(.35) + 0.15(.24)}{0.59} = 0.54$$

TIME OF CONCENTRATION

SHEET FLOW OVER GRASS SURFACE = 80 FT

n = 0.24 FOR DENSE GRASSES $S' = 1.25 \text{ FT/FT}$

$$T_{E1} = \frac{0.007(0.24 \times 80)^{0.8}}{(3.42)^{0.5} \times (0.25)^{0.4}} = 0.07 \text{ HR} = 4.2 \text{ MIN}$$

SHALLOW CONCENTRATED FLOW - PAVED SURFACE = 60 FT

SLOPE = 0.01 FT/FT

$$V = 16.1345(S)^{0.5}$$

$$V = 16.1345(0.01)^{0.5} = 1.61 \text{ FT/SEC}$$

$$T_{E2} = 80 \text{ FT} / 1.16 \text{ FT/SEC} = 49 \text{ SEC} = 0.8 \text{ MIN}$$

$$T_C = T_{E1} + T_{E2} = 4.2 \text{ MIN} + 0.8 \text{ MIN} = 5 \text{ MIN}$$

$$\therefore Q_{10YR} (\text{PROPOSED}) = 0.54(7.51)(0.59) = 2.39 \text{ CFS}$$

DEPTH OVER GRATE ASSUMING WEIR FLOW

$$d_{10YR} = \left(\frac{2.39(1.25)}{3.0(7.33)} \right)^{2/3} = 0.26 \text{ FT} \quad \therefore \text{INLET IS OPERATING AS A WEIR}$$

DEPTH IS ONLY 0.02 FT HIGHER THAN EXISTING AND
BELOW OVERFLOW