HYDROLOGY

L18/D25
ONE PLAN

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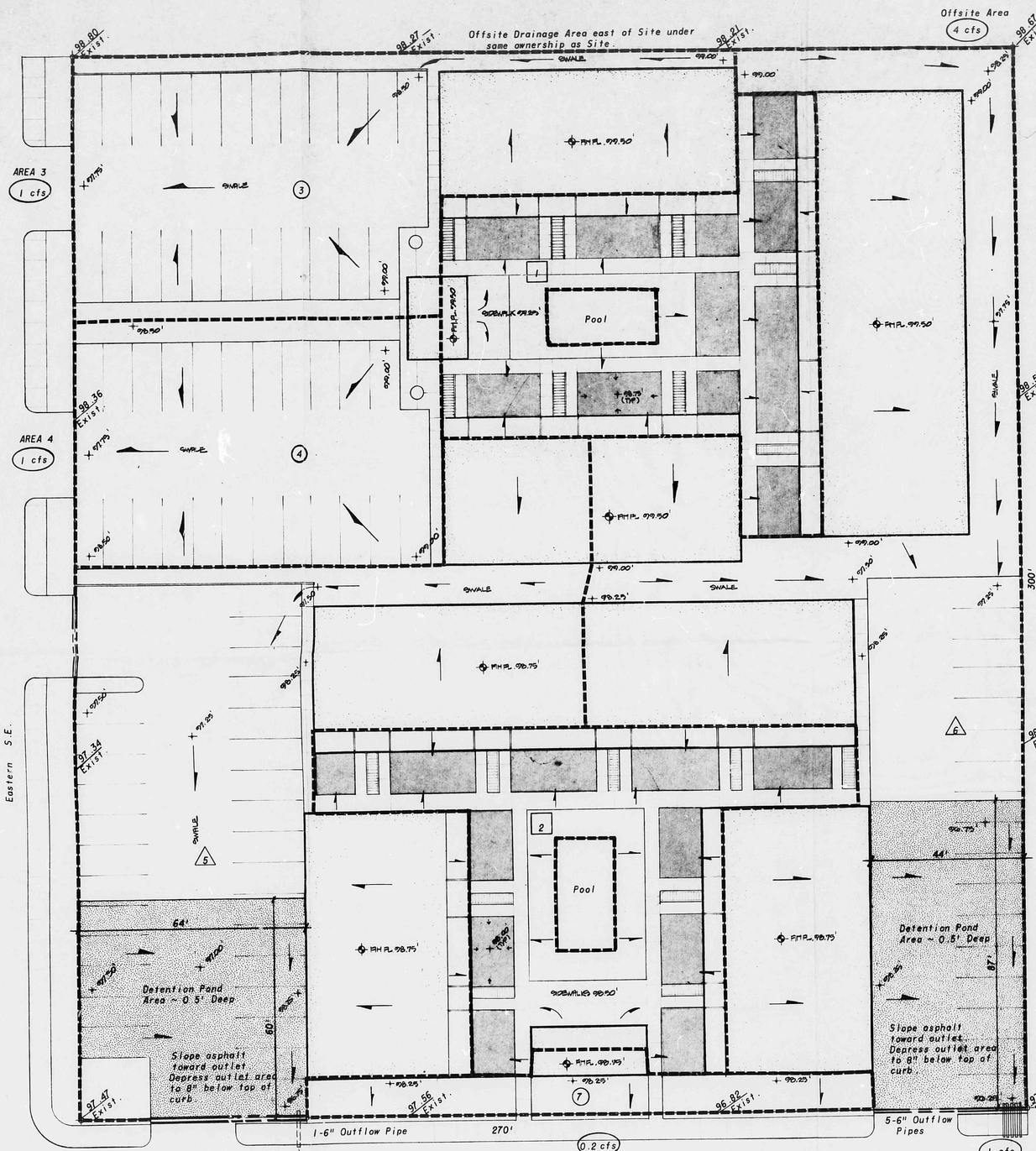


Area 1 = 0.20 Ac.
Area 2 = 0.22 Ac.
Area 3 = 0.26 Ac.
Area 4 = 0.17 Ac.
Area 5 = 0.43 Ac.
Area 6 = 0.56 Ac.
Area 7 = 0.04 Ac.

1. Determine flow rate of undeveloped site for a 100 year-6 hour storm:

A. Area of site = 1.9 Ac.
C = 0.35
For a Tc = 10 min., $I = \frac{189}{t+25} = \frac{189}{35} = 5.40$"/hr.

Q = CIA = (0.35)(5.40)(1.9) = 4 cfs

2. Determine flow rate of offsite area to east of site for a 100 year-6 hour storm.

A. Area of offsite drainage area = 1.9 Ac.
C = 0.35
For a Tc = 10 min., $I = \frac{189}{t+25} = \frac{189}{35} = 5.40$"/hr.

Q = CIA = (0.35)(5.40)(1.9) = 4 cfs

3. Design Criteria - Developed storm runoff rate of the site cannot exceed undeveloped storm runoff rate. Reductions in drainage runoff rates will be accomplished by the use of retention and detention ponds on the site. Offsite drainage flows will be passed through the site with entrance at the southeast corner of the site, and exit at the southwest corner of the site.

A-1 Area 1 - Retention Ponding

Total area = 8,377 ft.^{2}
Grass area = 2,892 ft.^{2}
Roof, conc. area = 5,485 ft.^{2}

Runoff coeff. for grass = 0.20; conc., roofs = 0.90
Compute Composite "C" Factor -

$\frac{(2892)}{(8,377)}(0.20) = 0.07$

$\frac{(5,485)}{(8,377)}(0.90) = \frac{0.59}{0.66}$ = Composite "C" - Area 1

2 Calculate Total Volume of Runoff - Area 1

From Precipitation Map of Albuquerque for a 100 year - 6 hour storm, rainfall for site = 2.4"
Vol. of Runoff = (Area)(Comp. "C")(Rainfall)
$= \frac{(8,377 \text{ ft.}^2)(0.66)(2.4")}{12"/\text{ft.}} = 1106 \text{ ft.}^3$ runoff

Available ponding within grass areas = 2,892 ft.^{2}
Avg. pond depth = 0.38' deep

B-1 Area 2 - Retention Ponding

Total Area = 8,955 ft.^{2}
Grass Area = 2,676 ft.^{2}
Roof, conc. area = 6,279 ft.^{2}

Runoff Coeff. for grass = 0.20; conc., roofs = 0.90
Compute Composite "C" Factor -

$\frac{(2,676)}{(8,955)}(0.20) = 0.06$

$\frac{(6,279)}{(8,955)}(0.90) = \frac{0.63}{0.69}$ = Composite "C" - Area 2

2 Calculate Total Volume of Runoff - Area 2

Volume of Runoff = (Area)(Comp. "C")(Rainfall)
$= \frac{(8,955)(0.69)(2.4)}{12} = 1236 \text{ ft.}^3$

Available ponding within grass areas = 2,676 ft.^{2}
Avg. pond depth = 0.46' deep

C-1 Area 3 - Unrestricted Runoff

Calculate Developed Runoff Rate, Q = CIA, where C = 0.90, Tc = 10 min, I = 5.4
Q = (0.90)(5.4)(0.26) = 1 cfs

2 Area 4 - Unrestricted Runoff

Calculate Developed Runoff Rate, Q = CIA, where C = 0.90, Tc = 10 min., I = 5.4
Q = (0.90)(5.4)(0.17) = 1 cfs

3 Area 5 - Detention Ponding

Calculate Developed Runoff Rate, Q = CIA, where C = 0.90, Tc = 10 min., I = 5.4
Q = (0.90)(5.4)(0.43) = 2 cfs

The following is the format for calculating the peak discharge and allowable runoff from each sub-area. (Reference "Water and Sewer Works", December 1973, Page 41)

A. Area = 0.43 Ac.; set allowable outflow dishcarge at 0.5 cfs

B. From design criteria, calculate Qo

$Qo = \frac{\text{Allowable outflow}}{\text{Acreage x Runoff coeff.}}$

$Qo = \frac{0.50}{(0.43)(0.90)} = 1.29$ cfs/Ac. Imp.

C. Calculate time in minutes that max. volume of storage will occur from the orifice outlet storage time equation.

$T = -25 + \sqrt{\frac{7087.5}{Qo}} = -25 + \sqrt{\frac{7087.5}{1.29}} = 49.1$ minutes

D. Calculate max. volume of storage per acre imperviousness from orifice outlet storage equation.

$V_s = \frac{11,340T}{T+25} - 40\,QoT$

$= \frac{11,340(49.1)}{74.1} - 40\,(1.29)(49.1)$

$= 4976.62$ ft.^{3}/Ac. Imp.

E. Calculate total volume of storage required for the contributing area

V_t = x #Ac. x Runoff Coefficient
= (4975.28)(0.43)(0.90)
= 1926 ft.^{3} of storage required while outletting at 0.50 cfs

F. Select an outflow pipe from the orifice formula that will yield the allowable outflow of 0.5 cfs under a head 0.5'

$Q = ca\sqrt{2gh}$ - note c = 0.80 from trial and error solutions from Table 4-10, Handbook of Hydraulics, King & Brater, 1963.

Solving for "a"

$a = \frac{Q}{c\sqrt{2gh}} = \frac{0.50}{0.80\sqrt{(32.2)(0.50)}} = 0.11$ ft.^{2}

Select 1 - 4-1/2" diameter pipe.

4 Area 6 - Detention Ponding

Calculate Developed Runoff Rate, Q = CIA, where C = 0.90, Tc = 10 min., I = 5.4
Q = (0.90)(5.4)(0.56) = 3 cfs

Following the above format,

A. Area = 0.56 Acs.; allowable discharge for area 6 would be 1.0 cfs, for a total site discharge of 3.7 cfs < 4.0 cfs undeveloped.

Qo = 1.98 cfs/Ac. Imp.

T = 34.8 minutes

V_s = 3837.29 ft.^{3}/Ac. Imp.

V_t = 1934 ft.^{3} of storage required

Select an outflow pipe(s) that will allow the 1 cfs from area 6 to exit, plus the 4 cfs from the offsite drainage area east of the site.

$a = \frac{5 \text{ cfs}}{0.8\sqrt{(32.2)(0.5)}} = 1.10$ ft.^{2} Select 5 - 6" diameter pipes

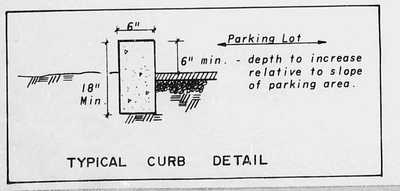
5 Area 7 - Unrestricted Runoff

Calculate Developed Runoff Rate, Q = CIA, where C = 0.90, Tc = 10 min., I = 5.4
Q = (0.90)(5.4)(0.04) = 0.2 cfs

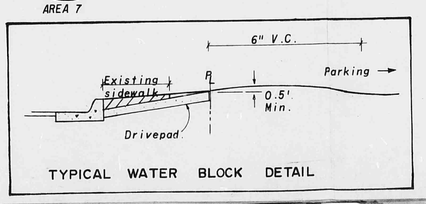
DRAINAGE SURVEY
SITE GRADING PLAN

LEGEND:

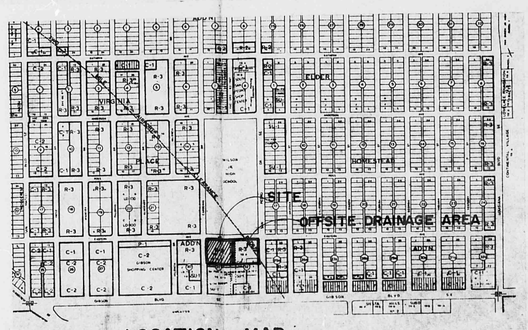
- Grass Retention Pond Area
- Surface Runoff Direction
- Sub-Drainage Area Boundary
- Asphalt Detention Pond Area
- 4 cfs — Surface Drainage Runoff Rate in cu.ft./sec.
- Water Block
- 1 — Retention Area Designations
- 5 — Detention Area Designations
- 3 — Unrestricted Drainage Area Designations



TYPICAL CURB DETAIL



TYPICAL WATER BLOCK DETAIL



LOCATION MAP

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L18/D25

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