HYDROLOGY K12/D5 ATRISCO PLAZA SHOPPING CENTER

K12/D5

Atrisco Plaza
SHOPPING CENTER
3 Plans

DRAINAGE REPORT 8/12/05

ATRISCO PLAZA SHOPPING CENTER

The land parcel under consideration is located on Central Avenue West, bounded by Central, Atrisco Drive, N.W., and the M.R.G.C.D. Isleta Drain Eastment. Zoning atlas reference is K-12-Z.

The land is presently largely undeveloped and bare. The slope is flat, approximately 3' in 1000', and drainage was formerly into the Isleta Drain. By agreement the open ditch was replaced by storm sewer and use of the easement granted for parking, landscaping and utilities. Permission was given by M.R.G.C.D. to allow storm water flow into the new storm sewer.

At the request of Bruno Conegliano, City Hydrology Engineer, the grading plan was revised to restrict the flow into the Isleta Drain to a minimum.

The total land area, including the M.R.G.C.D. easement is 17.37 acres or 756,864 sq. ft. This area includes 68,632 sq. ft. of landscaping consisting of grassed areas with tress and shrubs. The retention volume required is:

Landscaped Area	V = 0.18 x 68,632 x .4 =	4,942 cu. ft.
Balance	V = 0.18 x 688,232 =	123,882 cu. ft.
		128,824 cu. ft.

This volume is for the 100 year storm, and no comprehensive values being available, it was decided to allow the accumulated storm water to dissipate over a 24 hour period. The ponding areas are lettered and the area inlets numbered. (See Grading Plan). The volume retention values are tabulated on the following page.

POND	AREA S.F.	OVERFLOW ELEVATION	GRATE ELEVATION	VOLUME C.F.
A	85,500	99.25	97.50	74,800
B	36,560	99.70	97.20	30,462
C	11,625	99.00	97.29	9,940
D	21,375	98.70	97.50	12,825
E	7,250	96.74	96.16	2,175
*Flow thru to Isleta drain 5,472 c.f. x 6 hours				32,832 C.F.
TOTAL VOLUME REQUIRED TO FILL PONDS				163,034 c.y.

All pipe runs for the storm sewer are to be corrugated metal pipe. Flow quantities are computed by the Manning formula with an "N" value = 0.021. Flow quantities are as shown below:

PIPE RUN	ACCUMULATED VOLUME C.F.	MAX. Q CFS	PIPE SIZE	GRADIENT	COMPUTED Q CFS
MH #1 - MH #2	87,625	1.01	10"	0.30%	0.75
MH #2 - Inlet #1	87,625	1.01	10"	0.30%	0.75
Inlet #1 - Inlet #4	12,825	0.15	6"	0.22%	0.16

Drainage thru the area inlets is controlled by orifice plates, with 1-1/8" diameter drilled orifices, placed on the inlet structure. Design for the required perforations is as tabulated below:

AREA INLET	VOLUME C.F.	RELEASE TIME	RELEASE RATE CFS	FLOW RATE PER ORIFICE CPS	PERFORATION
1	74,800	24 Hrs.	0.87	0.019	46
2	30,462	24 Hrs.	0.35	0.019	18
3	9,940	24 Hrs.	0.12	0.019	6
4	12,825	24 Hrs.	0.15	0.019	8
5	2,175	24 Hrs.	0.03	0.019	2

*Flow rate through orifice to Isleta drain, 5,472 cu. ft. per hour.

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The land is presently largely undeveloped and bare. The slope is flat, approximately 3' in 1000', and drainage was formerly into the Isleta Drain. By agreement the open ditch was replaced by sotrm sewer and use of the easement granted for parking, landscaping and utilities. Permission was given by M.R.G.C.D. to allow storm water flow into the new storm sewer.

At the request of Mr. Bruno Conegliano, City Hydrology Engineer, the grading plan was revised to restrict the flow into the Isleta Drain to a minimum.

The total land area, including the M.R.G.C.D. easement is 17.37 acres or 756,864 sq. ft. This area is reduced by 68,632 sq. ft. of landscaping. The retention volume required is:

$$V = 0.18 \times 688,232 = 123,882 \text{ cu. ft.}$$

This volume is for the 100 year sotrm, and no comprehensive values being available, it was decided to allow the accumulated storm water to dissipate over a 24 hour period. The ponding areas are lettered and the area inlets numbered. (See Grading Plan). The volume retention values are tabulated below.

POND	AREA S.F.	OVERFLOW ELEVATION	[redacted]	GRATE ELEVATION	HEAD OVER GRATE	VOLUME C.F.
A	85,500	99.25	[redacted]	97.50	~~3.4~~ 1.75	74,800
B	36,560	99.70	[redacted]	97.20	~~3.93~~	30,462
C	11,625	99.00	[redacted]	97.29	~~4.04~~ 1.71	9,940
D	21,375	98.70	[redacted]	97.50	~~2.54~~	12,825
E	7,250	96.74	[redacted]	96.16	~~[illegible]~~	2,175
				TOTAL VOLUME		130,202 C.F.

Total capacity 130,202 cu. ft. plus flow through of 5,472 cu. ft. per hour times duration of rainfall.

All pipe runs for the storm sewer are to be corugated metal pipe. Flow quantities are computed by the Manning formula with an "N" value = 0.021. Flow quantities are as shown below:

PIPE RUN	ACCUMULATED VOLUME-C.F.	MAX. Q CFS	PIPE SIZE	GRADIENT	COMPUTED Q CFS
MH #1 - MH #2	87,625	1.01	10"	0.30%	0.75
MH # 2 - Inlet #1	87,625	1.01	10"	0.30%	0.75
Inlet #1 - Inlet #4	12,825	0.15	6"	0.22%	0.16

Drainage thru the area inlets is controlled by orifice plates, with 1-1/8" diameter drilled orifices, placed on the inlet structure. Design for the required perforations is as tabulated below:

	AREA INLET	VOLUME C.F.	RELEASE TIME	RELEASE RATE CFS	FLOW RATE PER ORIFICE CFS	PERFORATION
A	1	74,800	24 Hrs.	0.87	0.019	46
B	2	30,462	24 Hrs.	0.35	0.019	18
C	3	9,940	24 Hrs.	0.12	0.019	6
D	4	12,825	24 Hrs.	0.15	0.019	8
E	5	2,175	24 Hrs.	0.03	0.019	2
				1.52		

Flow rate into Isleta drain 5,472 cubic feet per hour.

ORFICE CALCULATIONS

USE .61 (SEE KING'S HANDBOOK 4-6)

$Q = C A \sqrt{2gh}$

AREA OF 1 1/8" DIA HOLE $= \pi \frac{D^2}{4} = \pi \frac{(1.125)^2}{4} = .994$ INCHES SQUARED $= .0069$ ft²

AREA INLET	HEAD	DISCHARGE 1 1/8" DIA HOLE		TIMES # of HOLES
1	1.75	$Q = .61(.0069)ft^2\sqrt{2g(1.75)}$	$= .045$ cfs	$\frac{.045 \text{ cfs}}{\text{HOLE}} \times 46$ HOLES $= 2.1$ cfs
2	2.50	$Q = .61(.0069)ft^2\sqrt{2g(2.50)}$	$= .053$ cfs	$.053 \times 18$ HOLES $= .96$
3	1.71	$Q = .61(.0069)\sqrt{2g(1.71)}$	$= .044$	$.044 \times 6$ HOLES $= .26$
4	1.2	$Q = .61(.0069)\sqrt{2g(1.2)}$	$= .037$	$.037 \times 8$ HOLES $= .30$
5	.58	$Q = .61(.0069)\sqrt{2g(.58)}$	$= .026$	$.026 \times 2$ HOLES $= .05$
				3.67 cfs

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The land is presently largely undeveloped and bare. The slope is flat, approximately 3' in 1000', and drainage was formerly into the Isleta Drain. By agreement the open ditch was replaced by storm sewer and use of the easement granted for parking, landscaping and utilities. Permission was given by MRGCD to allow storm water flow into the new storm sewer.

At the request of Mr. Bruno Conegliano, City Hydrology Engineer, the grading plan was revised to restrict the flow into the Isleta Drain to a minimum.

The total land area, including the M.R.G.C.D. easement is 18.18 acres or 791,921 sq. ft. The retention volume required is:

$$V = 0.18 \times 791{,}921 = 142{,}546 \text{ cu. ft.}$$

This volume is for the 100 year storm, and no comprehensive values being available, it was decided to allow the accumulated storm water to dissipate over a 24 hour period. The ponding areas are lettered and the area inlets numbered. (See Grading Plan). The volume retention values are tabulated below.

POND	AREA S.F.	OVERFLOW ELEVATION	GRATE ELEVATION	VOLUME C.F.
A	85,500	99.25	97.50	74,800
B	41,125	99.58	97.42	44,415
C	11,625	99.00	97.29	9,940
D	21,375	98.70	97.50	12,825
E	7,250	96.74	96.16	2,175
			TOTAL VOLUME	144,155 C.F.

All pipe runs for the storm sewer are to be corugated metal pipe. Flow quantities are computed by the Manning formula with an "N" value = 0.021. Flow quantities are as shown below:

PIPE RUN	ACCUMULATED VOLUME-C.F.	MAX. Q CFS	PIPE SIZE	GRADIENT	COMPUTED Q CFS
MH #1 - MH #2	87,625	1.01	10"	0.30%	0.75
MH #2 - Inlet #1	87,625	1.01	10"	0.30%	0.75
Inlet #1 - Inlet #4	12,825	0.15	6"	0.22%	0.16

Drainage thru the area inlets is controlled by orifice plates, with 1-1/8" diameter drilled orifices, placed on the inlet structure. Design for the required perforations is as tabulated below:

AREA INLET	VOLUME C.F.	RELEASE TIME	RELEASE RATE CFS	FLOW RATE PER ORIFICE CFS	PERFORATION
1	74,800	24 Hrs.	0.87	0.019	46
2	44,415	24 Hrs.	0.51	0.019	27
3	9,940	24 Hrs.	0.12	0.019	6
4	12,825	24 Hrs.	0.15	0.019	8
5	2,175	24 Hrs.	0.03	0.019	2

1) ORFICE VALUES – NO CALCULATIONS

2) NOTES ON PLAN DO NOT AGREE WITH "DRAINAGE REPORT"

3) DISCREPANCIES WITH CONTOURS – THEY CRISS-CROSS

4) ALSO I CALCULATE A HIGHER RELEASE RATE THAN THEY INDICATE

5) NO CONSIDERATION IS GIVEN TO LANDSCAPE RUNOFF.

6) I CANNOT AGREE WITH DISCHARGE RATE FOR THEIR PROPOSED PIPE

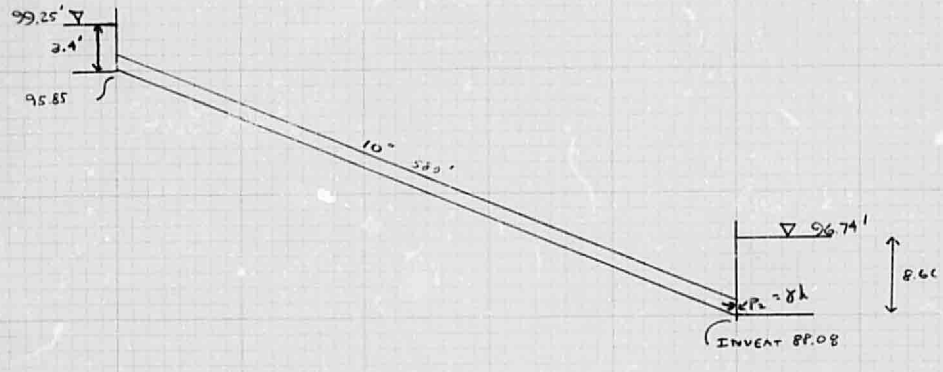
POND A (INLET 1)
INVERT 95.85

MANHOLE 2
NO INVERT GIVEN – SO USE NEAREST INVERT UPSTREAM, WHICH IS POND E INVERT 88.08'

∴ GRADIENT IS $\frac{95.85' - 88.08'}{585'} = .0133$ OR 1.33%

USING THIS GRADIENT AS OPPOSED TO THE HYDRAULIC GRADIENT AND GOING INTO KINGS HANDBOOK (6-50), THEY Q FOR A 12" DIA PIPE WITH AN N .018 IS 2.5 cfs

10" " " " " " " " 1.6 cfs



USING ENERGY EQ

ASSUME NO HEAD LOSS

$$\cancel{\frac{P_1}{\gamma}}^{\,0\,\text{PAS}} + \cancel{\frac{V_1^2}{2g}}^{\,0} + Z_1 = \frac{P_2}{\gamma} + \frac{V^2}{2g} + \cancel{h_L}^{\,0} + Z_2$$

$$Z_1 = \frac{P_2}{\gamma} + \frac{V^2}{2g} + Z_2$$

$$\sqrt{\left(Z_1 - Z_2 - \frac{P_2}{\gamma}\right) 2g} = V$$

$$\sqrt{(99.25 - 88.08 - 8.66)\, 2g} =$$

$$12.7 = V$$

$$Q = VA$$

Area of 10" DIA PIPE = $\pi \left(\frac{10''/12}{4}\right)^2 = .55\ ft^2$

$\therefore$ $Q = 12.7\ fps \times .55\ ft^2$

$= 6.9\ cfs$

POND D

OVERFLOW 98.70
INVERT 96.35
2.35 h

ORFICE CALCULATION

C = .61

DIA/OPENING = 1 1/8" = 1.13" = .094 ft

TOTAL AREA OF OPENING = $\left(\frac{.094}{4}\right)^2 \pi \times$ # OPENINGS = .056 ft²

$Q = .61(.056)\sqrt{2g(2.35)} = .42$ cfs

PIPE CALCULATIONS BY BERNOULLI (ASSUME A FREE OUTFALL)

$$\cancel{\frac{P_1}{\gamma}}^{0} + \cancel{\frac{V_1^2}{2g}}^{0} + Z_1 = \cancel{\frac{P_2}{\gamma}}^{0} + \frac{V_2^2}{2g} + Z_2 + \cancel{H_L}^{0}$$

$\sqrt{(Z_1 - Z_2)2g} = V$

$\sqrt{(98.7 - 96.35)(2)(32.2)} = V$

$1.23 = V$

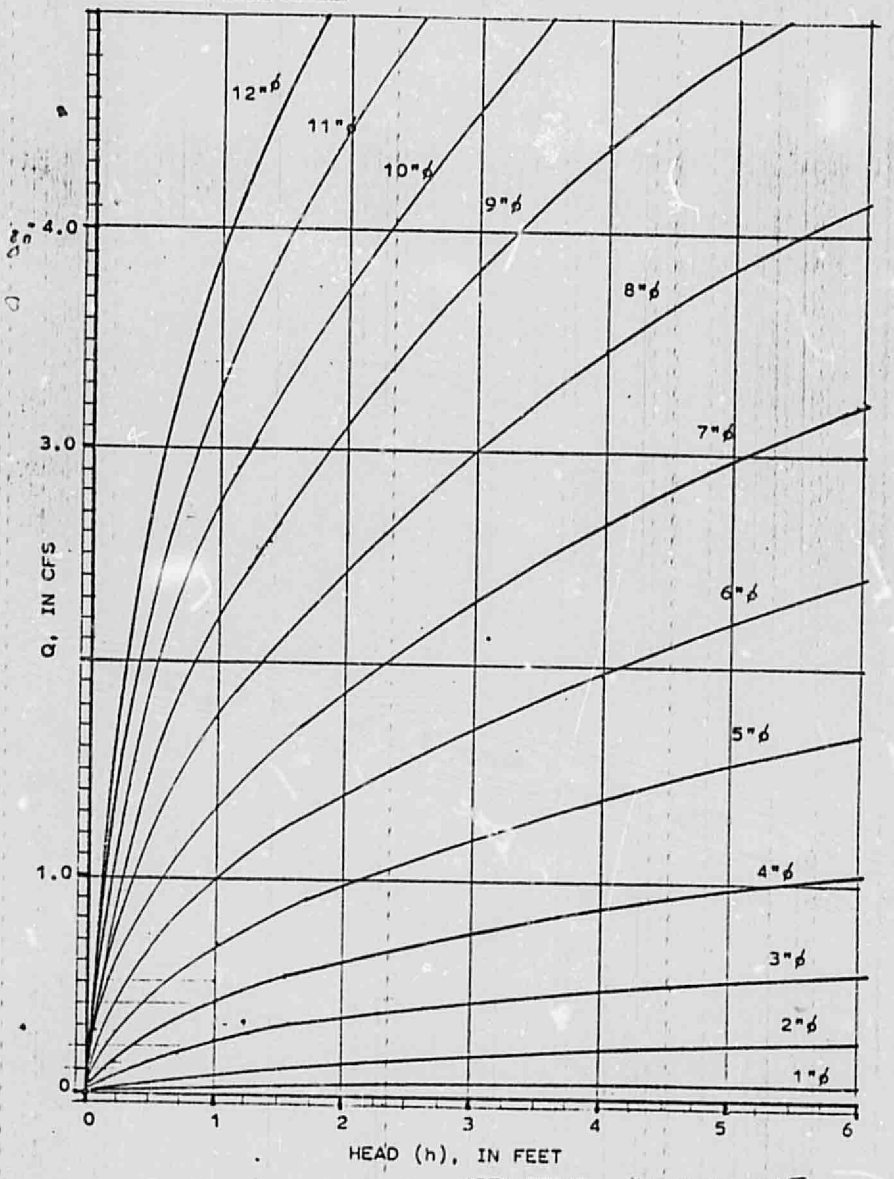
$\frac{(1.23)^2}{2g} = \frac{V^2}{2g}$

$2.35' = \frac{V^2}{2g}$

$Q = VA$

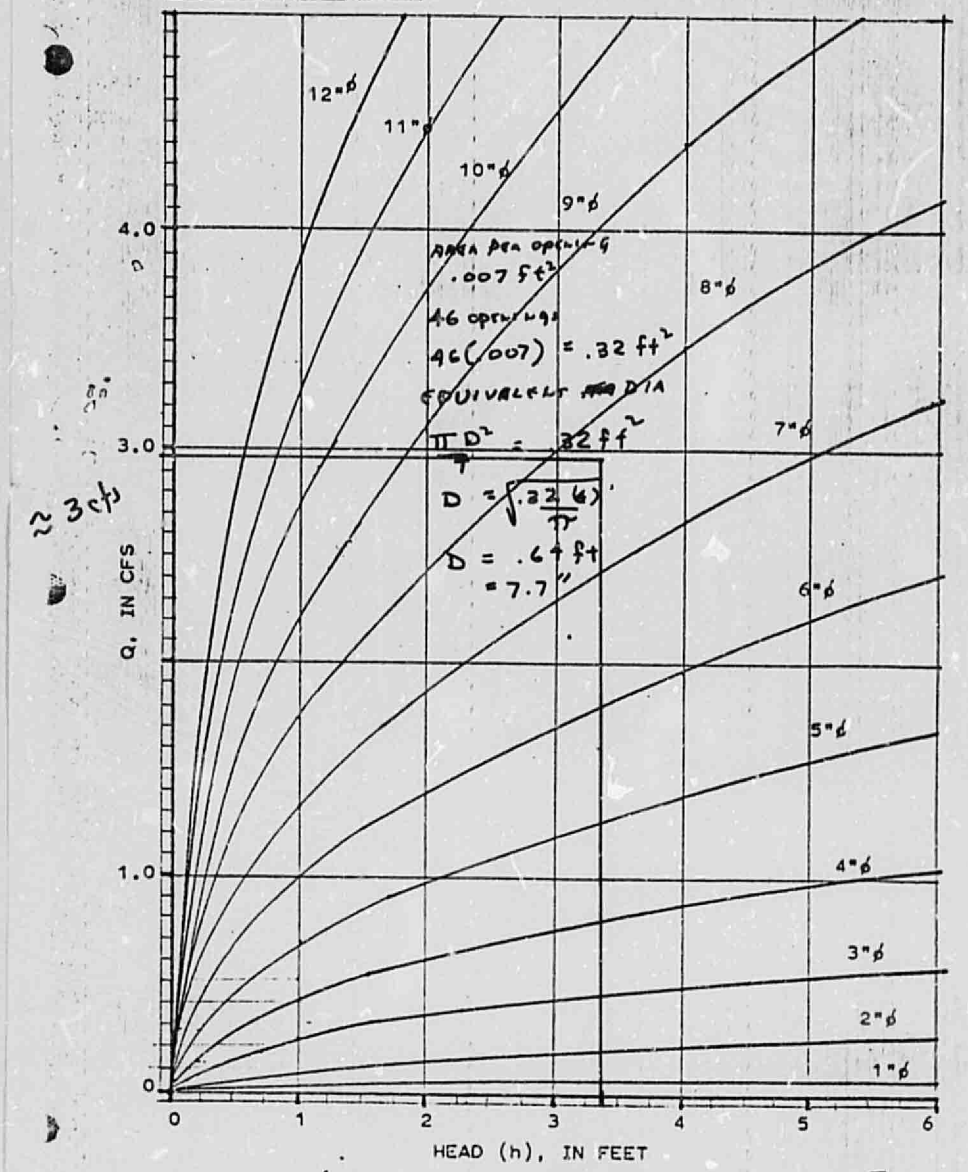
$= (1.23)\pi\left(\frac{.5}{4}\right)^2 = .24$ cfs

DISCHARGE PIPE SIZES



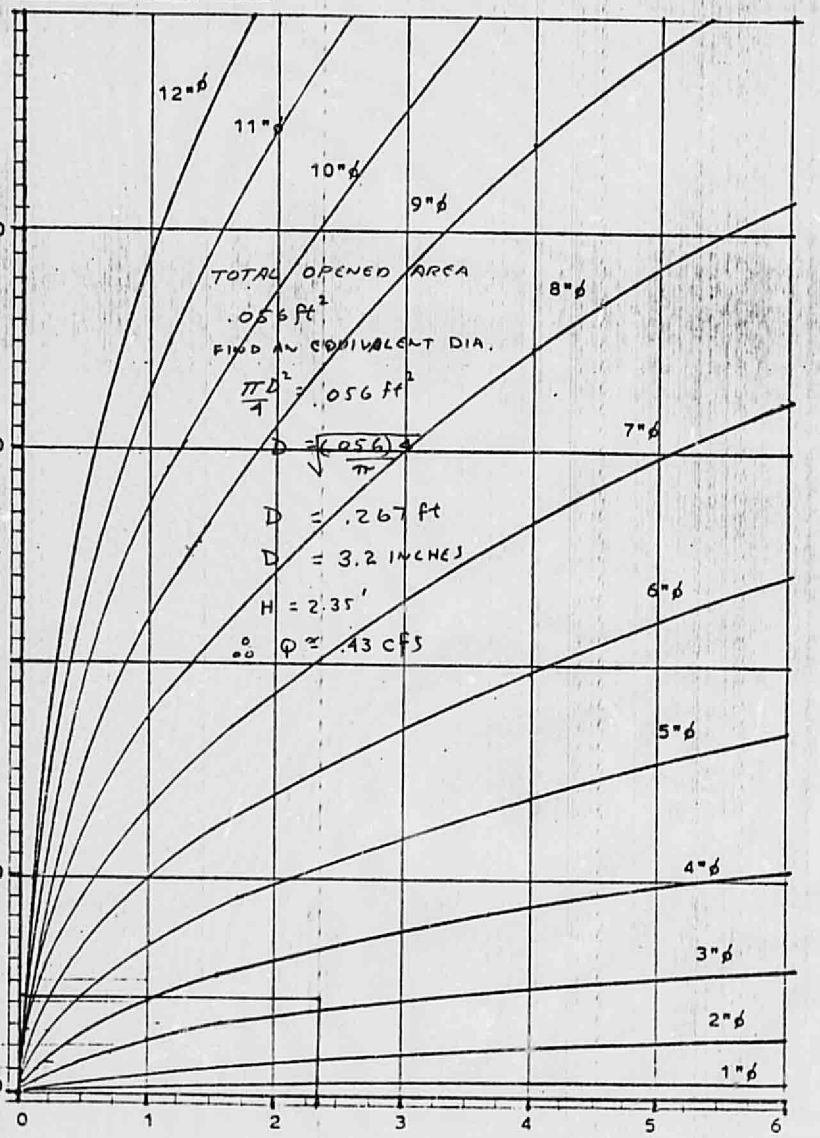
AREA REQ'D = 0.2 x Q x $1/\sqrt{h}$

DISCHARGE PIPE SIZES



AREA REQ'D = 0.2 × Q × 1/√h

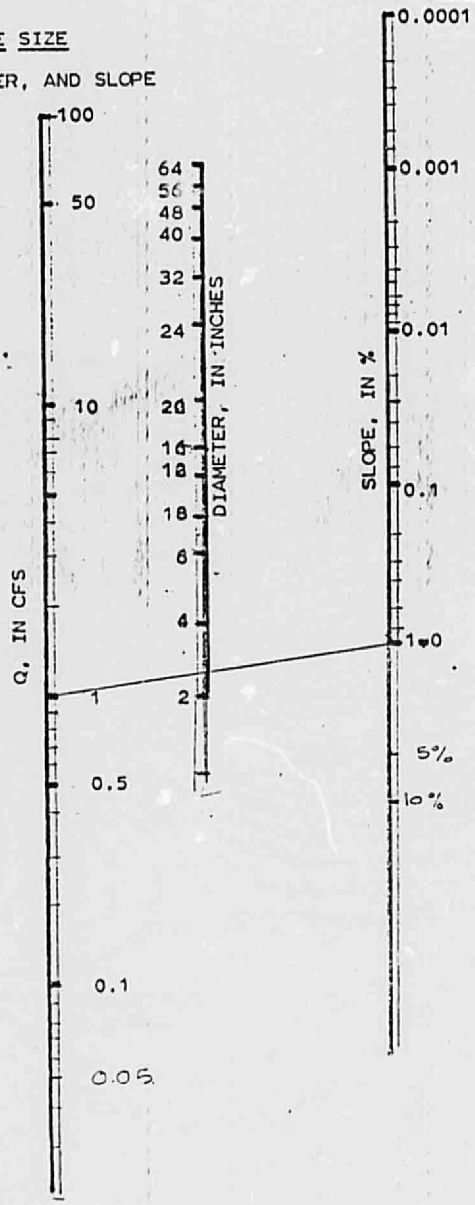
DISCHARGE PIPE SIZES



AREA REQ'D = 0.2 × Q × 1/√h

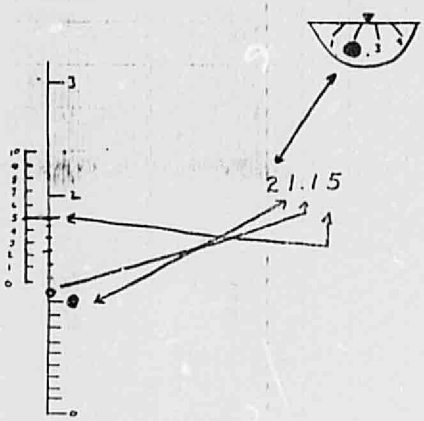
DRAINAGE PIPE SIZE

BY Q, DIAMETER, AND SLOPE



SOURCE: 9

G-11
J-14



READING IN DIRECT SQUARE INCHES FROM PLANIMETER

21.15 SQ INCHES

TO FIND ACTUAL SQUARE FEET

ASSUME 1" = 200 ft

∴ 1 in² = 40,000 ft² [(200 ft x 200 ft) = 40000]

MULTIPLY READING IN SQUARE INCHES TIMES THE SCALE SQUARED

21.15 SQ·INCHES (40,000 ft²) = 846,000 ft²