DECEMBER 23, 2005

SUPPLEMENTAL INFORMATION

FOR

VENTANA SQUARE NORTH

BY

ISAACSON & ARFMAN, P.A.
Consulting Engineering Associates
123 Monroe Street N.E.
Albuquerque, New Mexico 87108
Ph. 505-268-8828 Fax. 505-268-2632

Job Name:	**Ventana Square North**
Client:	
Date Prepared:	22-Dec-05
Date Modified:	December 22, 2005
Precipitation Zone:	1

CALCULATIONS: Ventana Square North : December 22, 2005

Calculations are based on the Drainage Design Criteria for City of Albuquerque Section 22.2, DPM, Vol 2, dated Jan., 1993

ON-SITE

AREA OF SITE: 356880 SF = 8.193 Ac.

FULLY DEVELOPED (BASINS 1 - 5)

On-Site Historic Land Condition

Area a	=	0	SF
Area b	=	17844	SF
Area c	=	35688	SF
Area d	=	303348	SF
Total Area	=	356880	SF

EXCESS PRECIPITATION:

Precip. Zone 1

Ea = 0.44

Eb = 0.67

Ec = 0.99

Ed = 1.97

On-Site Weighted Excess Precipitation (100-Year, 6-Hour Storm)

$$\text{Weighted } E = \frac{EaAa + EbAb + EcAc + EdAd}{Aa + Ab + Ac + Ad}$$

Developed E = 1.81 in.

On-Site Volume of Runoff: V360 = E*A / 12

Developed V360 = 53740 CF

On-Site Peak Discharge Rate: Qp = QpaAa+QpbAb+QpcAc+QpdAd / 43,560

For Precipitation Zone 1

Qpa = 1.29

Qbb = 2.03

Qpc = 2.87

Qpd = 4.37

Historic Qp = 33.6 CFS

BASIN NO. 1	DESCRIPTION	DRAINS TO INLET 1

Area of basin flows = 70395 SF = 1.6 Ac.

The following calculations are based on Treatment areas as shown in table to the right

Sub-basin Weighted Excess Precipitation (see formula above)

Weighted E = 1.81 in.

Sub-basin Volume of Runoff (see formula above)

V360 = 10600 CF

Sub-basin Peak Discharge Rate: (see formula above)

Qp = 6.6 cfs

SINGLE 'D'

TREATMENT	
A =	0%
B =	5%
C =	10%
D =	85%

BASIN NO. 2	DESCRIPTION	DRAINS TO INLET 2

Area of basin flows = 34320 SF = 0.8 Ac.

The following calculations are based on Treatment areas as shown in table to the right

Sub-basin Weighted Excess Precipitation (see formula above)

Weighted E = 1.81 in.

Sub-basin Volume of Runoff (see formula above)

V360 = 5168 CF

Sub-basin Peak Discharge Rate: (see formula above)

Qp = 3.2 cfs

SINGLE 'D'

TREATMENT	
A =	0%
B =	5%
C =	10%
D =	85%

BASIN NO. 3	DESCRIPTION	DRAINS TO INLET 3

Area of basin flows = 19535 SF = 0.4 Ac.

The following calculations are based on Treatment areas as shown in table to the right

Sub-basin Weighted Excess Precipitation (see formula above)

Weighted E = 1.81 in.

Sub-basin Volume of Runoff (see formula above)

V360 = 2942 CF

Sub-basin Peak Discharge Rate: (see formula above)

Qp = 1.8 cfs

SINGLE 'D'

TREATMENT	
A =	0%
B =	5%
C =	10%
D =	85%

BASIN NO. 4	DESCRIPTION	DRAINS TO INLET 4

Area of basin flows = 171315 SF = 3.9 Ac.

The following calculations are based on Treatment areas as shown in table to the right

Sub-basin Weighted Excess Precipitation (see formula above)

Weighted E = 1.81 in.

Sub-basin Volume of Runoff (see formula above)

V360 = 25797 CF

Sub-basin Peak Discharge Rate: (see formula above)

Qp = 16.1 cfs

DOUBLE 'D'

TREATMENT	
A =	0%
B =	5%
C =	10%
D =	85%

BASIN NO. 5	DESCRIPTION	DRAINS TO INLET 5

Area of basin flows = 61315 SF = 1.4 Ac.

The following calculations are based on Treatment areas as shown in table to the right

Sub-basin Weighted Excess Precipitation (see formula above)

Weighted E = 1.81 in.

Sub-basin Volume of Runoff (see formula above)

V360 = 9237 CF

Sub-basin Peak Discharge Rate: (see formula above)

Qp = 5.8 cfs

DOUBLE 'D'

TREATMENT	
A =	0%
B =	5%
C =	10%
D =	85%

BASIN NO. 6	DESCRIPTION	OFF-SITE (WALGREENS) DRAINS TO INLET 5

Area of basin flows = 87665 SF = 2.0 Ac.

The following calculations are based on Treatment areas as shown in table to the right

Sub-basin Weighted Excess Precipitation (see formula above)

Weighted E = 1.81 in.

Sub-basin Volume of Runoff (see formula above)

V360 = 13205 CF

Sub-basin Peak Discharge Rate: (see formula above)

Qp = 8.3 cfs

TREATMENT	
A =	0%
B =	5%
C =	10%
D =	85%

ALBUQUERQUE GRATE CAPACITY CALCULATIONS

Using orifice equation Q=CA * (2gh)^0.5

C	=	0.6
A	=	4.80
g	=	32.2
h	=	0.5
Q	=	16.34
Clogging Factor	=	50%
Qclog	=	8.17

Note: Area (A) at left, is based on the open area of a single COA Albuquerque Grate. Based on calculations shown, a single inlet with a head (h) of 0.5 ft. will accept 16.34 cfs. If the inlet becomes 50% clogged, at an h = 0.5 , the inlet will accept 8.17 cfs.

Note: The above calculations references 0.5' head. The following chart refers to head values from 0.1' to 1.0' for additional info.

h = 0.1' →	7.31	cfs	h = 0.6' →	17.90	cfs
h = 0.2' →	10.34	cfs	h = 0.7' →	19.34	cfs
h = 0.3' →	12.66	cfs	h = 0.8' →	20.67	cfs
h = 0.4' →	14.62	cfs	h = 0.9' →	21.93	cfs
h = 0.5' →	16.34	cfs	h = 1.0' →	23.11	cfs

12" ADS N-12 @ 0.0300'/'
Worksheet for Circular Channel

Project Description	
Project File	c:\haestad\academic\fmw\1474.fm2
Worksheet	12" ADS Storm Drain
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Full Flow Capacity

Input Data		
Mannings Coefficient	0.012	
Channel Slope	0.030000	ft/ft
Diameter	12.00	in

Results		
Depth	1.00	ft
Discharge	6.68	cfs
Flow Area	0.79	ft²
Wetted Perimeter	3.14	ft
Top Width	0.00	ft
Critical Depth	0.97	ft
Percent Full	100.00	
Critical Slope	0.026421	ft/ft
Velocity	8.51	ft/s
Velocity Head	1.13	ft
Specific Energy	FULL	ft
Froude Number	FULL	
Maximum Discharge	7.19	cfs
Full Flow Capacity	6.68	cfs ←
Full Flow Slope	0.030000	ft/ft

(A) = 6.6 cfs

(C) = 1.8 cfs

12" ADS N-12 @ 0.0200'/'
Worksheet for Circular Channel

Project Description	
Project File	c:\haestad\academic\fmw\1474.fm2
Worksheet	12" ADS Storm Drain
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Full Flow Capacity

Input Data		
Mannings Coefficient	0.012	
Channel Slope	0.020000	ft/ft
Diameter	12.00	in

Results		
Depth	1.00	ft
Discharge	5.46	cfs
Flow Area	0.79	ft²
Wetted Perimeter	3.14	ft
Top Width	0.00	ft
Critical Depth	0.94	ft
Percent Full	100.00	
Critical Slope	0.017284	ft/ft
Velocity	6.95	ft/s
Velocity Head	0.75	ft
Specific Energy	FULL	ft
Froude Number	FULL	
Maximum Discharge	5.87	cfs
Full Flow Capacity	5.46	cfs
Full Flow Slope	0.020000	ft/ft

(B) = 3.2 cfs

30" ADS N-12 @ 0.0.0100'/'
Worksheet for Circular Channel

Project Description	
Project File	c:\haestad\academic\fmw\1474.fm2
Worksheet	12" ADS Storm Drain
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Full Flow Capacity

Input Data		
Mannings Coefficient	0.012	
Channel Slope	0.010000	ft/ft
Diameter	30.00	in

Results		
Depth	2.50	ft
Discharge	44.43	cfs
Flow Area	4.91	ft²
Wetted Perimeter	7.85	ft
Top Width	0.00	ft
Critical Depth	2.22	ft
Percent Full	100.00	
Critical Slope	0.008929	ft/ft
Velocity	9.05	ft/s
Velocity Head	1.27	ft
Specific Energy	FULL	ft
Froude Number	FULL	
Maximum Discharge	47.80	cfs
Full Flow Capacity	44.43	cfs
Full Flow Slope	0.010000	ft/ft

← (E) = 30.2 cfs

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Developed E = 1.81 in.

On-Site Volume of Runoff: V360 = E*A / 12

Developed V360 = 53740 CF

On-Site Peak Discharge Rate: Qp = QpaAa+QpbAb+QpcAc+QpdAd / 43,560

For Precipitation Zone 1

Qpa = 1.29

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Qpc = 2.87

Qpd = 4.37

Historic Qp = 33.6 CFS

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Area of basin flows = 70395 SF = 1.6 Ac.

The following calculations are based on Treatment areas as shown in table to the right

Sub-basin Weighted Excess Precipitation (see formula above)

Weighted E = 1.81 in.

SINGLE 'D'

Sub-basin Volume of Runoff (see formula above)

V360 = 10600 CF

Sub-basin Peak Discharge Rate: (see formula above)

Qp = 6.6 cfs

TREATMENT	
A =	0%
B =	5%
C =	10%
D =	85%

BASIN NO. 2	DESCRIPTION	DRAINS TO INLET 2

Area of basin flows = 34320 SF = 0.8 Ac.

The following calculations are based on Treatment areas as shown in table to the right

Sub-basin Weighted Excess Precipitation (see formula above)

Weighted E = 1.81 in.

SINGLE 'D'

Sub-basin Volume of Runoff (see formula above)

V360 = 5168 CF

Sub-basin Peak Discharge Rate: (see formula above)

Qp = 3.2 cfs

TREATMENT	
A =	0%
B =	5%
C =	10%
D =	85%

BASIN NO. 3	DESCRIPTION	DRAINS TO INLET 3

Area of basin flows = 19535 SF = 0.4 Ac.

The following calculations are based on Treatment areas as shown in table to the right

Sub-basin Weighted Excess Precipitation (see formula above)

Weighted E = 1.81 in.

SINGLE 'D'

Sub-basin Volume of Runoff (see formula above)

V360 = 2942 CF

Sub-basin Peak Discharge Rate: (see formula above)

Qp = 1.8 cfs

TREATMENT	
A =	0%
B =	5%
C =	10%
D =	85%

BASIN NO. 4	DESCRIPTION	DRAINS TO INLET 4

Area of basin flows = 171315 SF = 3.9 Ac.

The following calculations are based on Treatment areas as shown in table to the right

Sub-basin Weighted Excess Precipitation (see formula above)

Weighted E = 1.81 in.

DOUBLE 'D'

Sub-basin Volume of Runoff (see formula above)

V360 = 25797 CF

Sub-basin Peak Discharge Rate: (see formula above)

Qp = 16.1 cfs

TREATMENT	
A =	0%
B =	5%
C =	10%
D =	85%

BASIN NO. 5	DESCRIPTION	DRAINS TO INLET 5

Area of basin flows = 61315 SF = 1.4 Ac.

The following calculations are based on Treatment areas as shown in table to the right

Sub-basin Weighted Excess Precipitation (see formula above)

Weighted E = 1.81 in.

DOUBLE 'D'

Sub-basin Volume of Runoff (see formula above)

V360 = 9237 CF

Sub-basin Peak Discharge Rate: (see formula above)

Qp = 5.8 cfs

TREATMENT	
A =	0%
B =	5%
C =	10%
D =	85%

BASIN NO. 6	DESCRIPTION	OFF-SITE (WALGREENS) DRAINS TO INLET 5

Area of basin flows = 87665 SF = 2.0 Ac.

The following calculations are based on Treatment areas as shown in table to the right

Sub-basin Weighted Excess Precipitation (see formula above)

Weighted E =	1.81 in.

Sub-basin Volume of Runoff (see formula above)

V360 =	13205 CF

Sub-basin Peak Discharge Rate: (see formula above)

Qp =	8.3 cfs

TREATMENT	
A =	0%
B =	5%
C =	10%
D =	85%

ALBUQUERQUE GRATE CAPACITY CALCULATIONS

Using orifice equation Q=CA * (2gh)^0.5

C	=	0.6
A	=	4.80
g	=	32.2
h	=	0.5
Q	=	16.34
Clogging Factor	=	50%
Qclog	=	8.17

Note: Area (A) at left, is based on the open area of a single COA Albuquerque Grate. Based on calculations shown, a single inlet with a head (h) of 0.5 ft. will accept 16.34 cfs. If the inlet becomes 50% clogged, at an h = 0.5 , the inlet will accept 8.17 cfs.

Note: The above calculations references 0.5' head. The following chart refers to head values from 0.1' to 1.0' for additional info.

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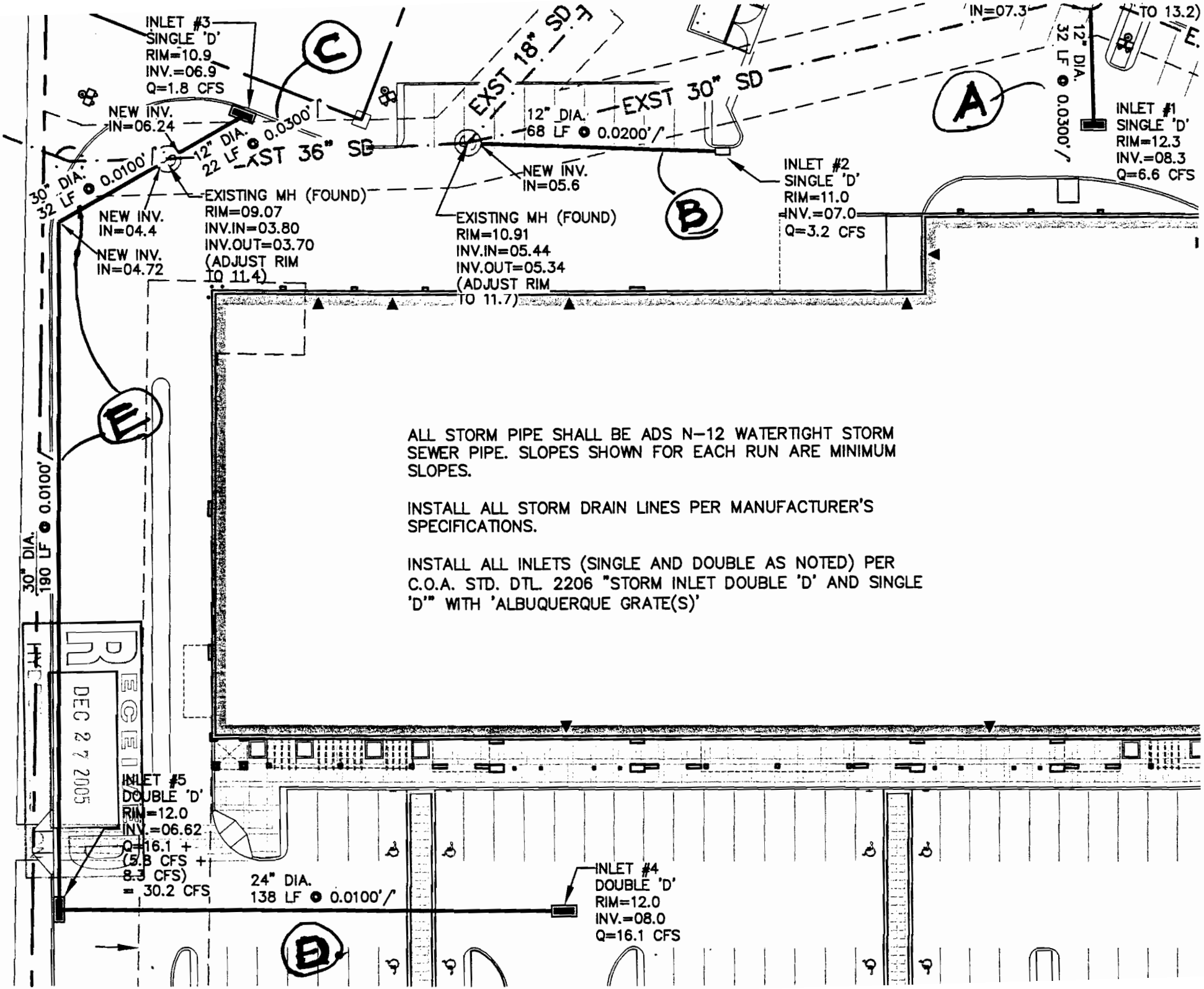
h = 0.2' ⟶	10.34	cfs	h = 0.7' ⟶	19.34	cfs
h = 0.3' ⟶	12.66	cfs	h = 0.8' ⟶	20.67	cfs
h = 0.4' ⟶	14.62	cfs	h = 0.9' ⟶	21.93	cfs
h = 0.5' ⟶	16.34	cfs	h = 1.0' ⟶	23.11	cfs


INLET #3
SINGLE 'D'
RIM=10.9
INV.=06.9
Q=1.8 CFS
NEW INV.
IN=06.24
12" DIA.
22 LF @ 0.0300'
EXST 36" SD
30" DIA.
32 LF @ 0.0100'
NEW INV.
IN=04.4
NEW INV.
IN=04.72
EXISTING MH (FOUND)
RIM=09.07
INV.IN=03.80
INV.OUT=03.70
(ADJUST RIM
TO 11.4)
EXST 18" SD
12" DIA.
68 LF @ 0.0200'
EXST 30" SD
NEW INV.
IN=05.6
EXISTING MH (FOUND)
RIM=10.91
INV.IN=05.44
INV.OUT=05.34
(ADJUST RIM
TO 11.7)
INLET #2
SINGLE 'D'
RIM=11.0
INV.=07.0
Q=3.2 CFS
IN=07.3
TO 13.2)
12" DIA.
32 LF @ 0.0300'
INLET #1
SINGLE 'D'
RIM=12.3
INV.=08.3
Q=6.6 CFS
A
B
C
E
30" DIA.
190 LF @ 0.0100'
ALL STORM PIPE SHALL BE ADS N-12 WATERTIGHT STORM SEWER PIPE. SLOPES SHOWN FOR EACH RUN ARE MINIMUM SLOPES.
INSTALL ALL STORM DRAIN LINES PER MANUFACTURER'S SPECIFICATIONS.
INSTALL ALL INLETS (SINGLE AND DOUBLE AS NOTED) PER C.O.A. STD. DTL. 2206 "STORM INLET DOUBLE 'D' AND SINGLE 'D'" WITH 'ALBUQUERQUE GRATE(S)'
RECEIVED
DEC 27 2005
INLET #5
DOUBLE 'D'
RIM=12.0
INV.=06.62
Q=16.1 +
(5.8 CFS +
8.3 CFS)
= 30.2 CFS
24" DIA.
138 LF @ 0.0100'
INLET #4
DOUBLE 'D'
RIM=12.0
INV.=08.0
Q=16.1 CFS
D

12" ADS N-12 @ 0.0300'/'
Worksheet for Circular Channel

Project Description	
Project File	c:\haestad\academic\fmw\1474.fm2
Worksheet	12" ADS Storm Drain
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Full Flow Capacity

Input Data		
Mannings Coefficient	0.012	
Channel Slope	0.030000	ft/ft
Diameter	12.00	in

Results		
Depth	1.00	ft
Discharge	6.68	cfs
Flow Area	0.79	ft²
Wetted Perimeter	3.14	ft
Top Width	0.00	ft
Critical Depth	0.97	ft
Percent Full	100.00	
Critical Slope	0.026421	ft/ft
Velocity	8.51	ft/s
Velocity Head	1.13	ft
Specific Energy	FULL	ft
Froude Number	FULL	
Maximum Discharge	7.19	cfs
Full Flow Capacity	6.68	cfs ←
Full Flow Slope	0.030000	ft/ft

(A) = 6.6 cfs

(C) = 1.8 cfs

12" ADS N-12 @ 0.0200'/'
Worksheet for Circular Channel

Project Description	
Project File	c:\haestad\academic\fmw\1474.fm2
Worksheet	12" ADS Storm Drain
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Full Flow Capacity

Input Data		
Mannings Coefficient	0.012	
Channel Slope	0.020000	ft/ft
Diameter	12.00	in

Results		
Depth	1.00	ft
Discharge	5.46	cfs
Flow Area	0.79	ft^2
Wetted Perimeter	3.14	ft
Top Width	0.00	ft
Critical Depth	0.94	ft
Percent Full	100.00	
Critical Slope	0.017284	ft/ft
Velocity	6.95	ft/s
Velocity Head	0.75	ft
Specific Energy	FULL	ft
Froude Number	FULL	
Maximum Discharge	5.87	cfs
Full Flow Capacity	5.46	cfs
Full Flow Slope	0.020000	ft/ft

(B) = 3.2 cfs

30" ADS N-12 @ 0.0.0100'/'
Worksheet for Circular Channel

Project Description	
Project File	c:\haestad\academic\fmw\1474.fm2
Worksheet	12" ADS Storm Drain
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Full Flow Capacity

Input Data		
Mannings Coefficient	0.012	
Channel Slope	0.010000	ft/ft
Diameter	30.00	in

Results		
Depth	2.50	ft
Discharge	44.43	cfs
Flow Area	4.91	ft²
Wetted Perimeter	7.85	ft
Top Width	0.00	ft
Critical Depth	2.22	ft
Percent Full	100.00	
Critical Slope	0.008929	ft/ft
Velocity	9.05	ft/s
Velocity Head	1.27	ft
Specific Energy	FULL	ft
Froude Number	FULL	
Maximum Discharge	47.80	cfs
Full Flow Capacity	44.43	cfs
Full Flow Slope	0.010000	ft/ft

← (E) = 30.2 cfs