DRAINAGE CALCULATIONS

I. REFERENCES:

A. City of Albuquerque Development Process Manual (DPM) Volume 2, Design Criteria, Chapter 22, Drainage, Flood Control and Erosion Control.

B. Soil Survey of Bernalillo County and Parts of Sandoval and Valencia Counties, New Mexico, United States Department of Agriculture, Soil Conservation Service.

C. Floodway Map, Panels 26 and 29, Federal Emergency Management Agency.

II. GENERAL INFORMATION:

A. Soil Type (Ref.B., Sheet No. 31) Soil type is Cu (cut/fill land), Hydrologic Soil Group A.

B. Imperviousness:

Type of Surface	Existing Area Sq.Ft.	Acres	Proposed Area Sq.Ft.	Acres
Building Roof	-	-	12,000	0.2755
Concrete Surfaces	-	-	351	0.0081
Asphalt Surfaces	-	-	10,710	0.2459
Landscaping	-	-	2,836	0.0651
Undeveloped surface	28,009	0.6431	2,112	0.0485
Site total	28,009	0.6431	28,009	0.6431
Percent impervious	0%		82%	

C. "C" Factor (See Ref. A., Plate 22.2 C-1)
1. Undeveloped "C" Factor = 0.16
2. Developed "C" Factor = 0.66

D. Rainfall, 100-year, 6-hour, R_6: (See Ref.A., Plate 22.2 D-1) R_6 = 2.25 inches.

E. Time of Concentration, T_c: Use Kirpich Equation. Assume longest possible route. L = 260' Delta Elev. = 5'
S = 0.0192
$T_c = 0.0078(260^{0.77}/0.0192^{0.385}$ = 2.6 minutes.
Use 10 minutes.

F. Rainfall Intensity, I: (See Ref. A. Plate 22.2 D-2)
$I = R_6 \times 6.84 \times T_c^{-0.51} = 2.25 \times 6.84 \times (10)^{-0.51}$
I = 4.76 In/Hr

III. PEAK DISCHARGE:

A. Existing Conditions. (Use Rational Equation.)
Q_{100} = 0.16 x 4.76 x 0.643 = 0.49 cfs
Q_{10} = 0.657 x 0.49 = 0.32 cfs

B. Developed Conditions.
Q_{100} = 0.66 x 4.76 x 0.643 = 2.02 cfs
Q_{10} = 0.657 x 2.02 = 1.33 cfs

IV. CONCRETE CHANNEL CAPACITY:

A. Runoff quantity.
Drainage area = 75 x 45 = 3375 sq.ft. = 0.0675 acres.
C = 1.0 I = 4.76 inches / hour
Q_{100} = 1.0 x 4.76 x 0.0775 = 0.41 cfs

B. Capacity of channel at north end of building:
Use Mannings equation. Assume 4 inch depth of flow.
A = 0.33 x 1.0 = 0.33 sq. ft. P = (2 x 0.33) + 1.0
P = 1.66 R = A/P = 0.33/1.66 = 0.1988
$Q = 0.33\ (1.486/0.013)\ 0.1988^{2/3} \times 0.0084^{1/2}$ = 1.17cfs
The capacity of the channel is adequate.

V. CATCH BASIN AT S.W. CORNER OF PARKING LOT:
Overflow elevation 27.23
Spring line elevation 25.09
Head h 2.14
$Q = 0.6 \times 0.0873\ (2 \times 32.2 \times 2.14)^{1/2}$ = 0.61 cfs

VI. CAPACITY OF SPILLWAY (AROUND END OF PARKING LOT CURB NOSE.)

Flow depth is 0.25 feet. Parking lot slope is 10:1
Area = 0.25 x 2.5 = 0.625 sq.ft. P = 0.25 + 2.5 = 2.75 ft.
Hydraulic Radius, R, is A/P = 0.625/2.75 = 0.2273 ft.
Slope of driveway at that point is approximately 10%
Determine capacity by Manning's Equation.

$Q = A(1.486/0.017)(0.2273)^{2/3}(0.10)^{1/2}$ = 6.43 cfs

Since the total site descharge (Q_{100}) is only 2.02 cfs, The emergency spillway will easily handle the required flow before the pond overtops the curb and erodes the hillside.

DRAINAGE COMMENTS

1. THE SITE IS LOCATED AT THE END OF PAVING ON ELM STREET. THERE IS VIRTUALLY NO RUNOFF GENERATED ON ELM STREET SOUTH OF THE SITE. THERE IS A "HIGH POINT" ON ELM STREET ABOUT 100 FEET NORTH OF THE DRIVE PAD. THERE IS A "LOW POINT" ON ELM STREET NEAR THE NORTH END OF THE DRIVE PAD. ALL DRAINAGE FROM THE SITE WILL CROSS ELM STREET AT THIS LOW POINT AND WILL RUN DOWN THE NORTH SIDE OF HAZELDINE AVENUE WHERE DOUBLE "C" CATCH BASINS WILL INTERCEPT THE FLOW AT FOUR LOCATIONS BEFORE IT REACHES BROADWAY. (ACTUALLY, THE FIRST CATCH BASIN WILL BE CAPABLE OF INTERCEPTING THE SITE RUNOFF.

2. THERE IS A 48-INCH STORM SEWER IN THE ALLEY NORTH OF THE SITE. IT TURNS SOUTH ON ELM STREET AND WEST AGAIN ON HAZELDINE AVENUE. AT THE PRE-DESIGN CONFERENCE, THE RECOMMENDATION WAS MADE THAT ALL SITE FLOW BE DISCHARGED DIRECTLY INTO THE STORM SEWER. HOWEVER, THE STORM SEWER IS VERY DEEP AND THEREFORE WOULD REQUIRE CONSIDERABLE EXCAVATION AND REMOVAL AND REPLACEMENT OF CURB AND GUTTER AND PAVEMENT. AT A SUBSEQUENT MEETING WITH THE ENGINEER, IT WAS DETERMINED THAT THE REQUIREMENT FOR DIRECT CONNECTION TO THE STORM SEWER COULD BE WAIVED FOR THE FOLLOWING:
   A. THE SITE IS AN INFILL AREA.
   B. THE SITE IS ESSENTIALLY AT THE TOP OF THE DRAINAGE BASIN AND, THEREFORE, THE SITE FLOW WILL NOT HAVE TO COMPETE WITH OTHER SIGNIFICANT FLOW FOR THE DOWNSTREAM DOUBLE "C" CATCH BASINS. THESE FOUR CATCH BASINS WILL HAVE A TOTAL POTENTIAL OF RECEIVING A MINIMUM OF 20 cfs. THE SITE FLOW IS ONLY 2 cfs.
   C. SITE DISCHARGE WILL BE SLOWED SOMEWHAT BY THE SMALL AMOUNT OF PARKING LOT PONDING. HOWEVER, DUE TO NECESSARY STEEPNESS OF THE PARKING LOT, THE POND IS VERY LIMITED AND IS NOT CONSIDERED A CONTROLLED DISCHARGE SITUATION.

3. THE SWALE EAST OF THE BUILDING IS PAVED TO PREVENT WATER FROM ENTERING THE SOIL IN THE VICINTY OF THE FOUNDATION SINCE THERE IS REASON TO BELIEVE THE SOIL MAY BE EXPANSIVE.

4. THE CONCRETE CHANNEL AT THE NORTH END OF THE BUILDING IS USED TO INSURE THAT NO DRAINAGE FORM THE BUILDING ENTERS THE ALLEY AND CAUSES EROSION PROBLEMS.

5. A CATCH BASIN WAS EMPLOYED IN THE S.W. CORNER OF THE PARKING LOT IN LIEU OF A SIMPLE PIPE THROUGH THE CURB SO THAT THE HEAD ON THE 4" PIPE WOULD BE GREATER AND, THUS, THE DISCHARGE WOULD ALSO BE GREATER.

6. REGARDING GRADES FOR THE ALLEY NORTH OF THE SITE, A VARIANCE WILL BE REQUESTED BY LETTER LISTING THE FOLLOWING REASONS THAT THE GRADES ARE AN UNNECESSARY EXPENSE TO THE OWNER:
   a. THE PROPOSED SITE DOES NOT ACCESS ON THE ALLEY.
   b. EXISTING BUILDINGS EXTEND NEARLY THE FULL LENGTH OF THE ALLEY ON THE NORTH SIDE BUT NONE OF THEM FRONT ON THE ALLEY.
   c. THE REMAINING PARCEL OF PROPERTY FRONTING ON THE SOUTH SIDE OF THE ALLEY ALSO FRONTS ON THE I-25 ENTRANCE RAMP. THEREFORE, DEVELOPMENT OF THIS PARCEL MAY NOT BE PRACTICAL.
   d. THERE IS A 48" DIAMETER STORM SEWER IN THE ALLEY AND THE ALLEY SLOPE IS NEARLY FIVE PERCENT FROM EAST TO WEST SO THERE IS VIRTUALLY NO CHANCE OF "UNDRAINABLE" POCKETS OCCURING ALONG THE ALLEY.

7. THERE IS VIRTUALLY NO OFFSITE FLOW SINCE THE SITE IS NEAR OR AT THE TOP OF THE HILL. THE AREA EAST OF THE SITE IS VERY FLAT ALLOWING MOSY OF THE PRECIPITATION WILL BE ABSORBED SINCE THE SOIL IS HYDROLOGIC SOIL GROUP "A". WHAT LITTLE AMOUNT THAT DOES FLOW TOWARD THE SITE IS ACCEPTED.

EROSION CONTROL NOTE

THE CONTRACTOR SHALL BE RESPONSIBLE FOR INSURING THE FOLLOWING:

1. NO SEDIMENT-BEARING WATER SHALL LEAVE THE SITE DURING CONSTRUCTION.

2. DURING GRADING OPERATIONS AND UNTIL THE PROJECT HAS BEEN COMPLETED, ALL ADJACENT PROPERTY, RIGHTS-OF-WAY, AND EASEMENTS SHALL BE PROTECTED FROM FLOODING.

3. ANY AND ALL SEDIMENTATION ORIGINATING ON THE SITE WHICH IS DEPOSITED WITHIN PUBLIC RIGHT-OF-WAY SHALL BE PROMPTLY AND THOROUGHLY REMOVED BY THE CONTRACTOR.

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