DRAINAGE REPORT

for

1298 NORTH COLLEG AVENUE

June 12, 1985

Prepared for:

LARRY MICKELSON

Prepared by:

D & W, Inc.

Consulting Engineers & Land Surveyors

[illegible] & W INC.
COLORADO REGISTERED PROFESSIONAL
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June 12, 1985 File No. 69-7N-1-54

City of Fort Collins
Storm Drainage Division
300 West Laporte Avenue
P.O. Box 580
Fort Collins, CO 80522

Attn: Mr. Tom Gathman
Re: Drainage Report for proposed Burger Inn, 1298 North College Ave.

Dear Tom:

Submitted herewith is the drainage report for 1298 North College Avenue. The hydrology and hydraulic analyses are in compliance with the City of Fort Collins, "Storm Drainage Design Criteria: date May, 1984.

Based on the conclusion of this report, the applicant would like to request a variance from the City of Fort Collins' requirement on site detention.

If you have any questions, comments or need additional information please advise.

Respectfully submitted,

M. Worayeth

Mohamed S. Worayeth P.E.
President

MSW:hb

cc: Mr Larry Mickelson

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DRAINAGE REPORT

This drainage report is compiled from the following references.

1. Storm Drainage Criteria, City of Fort Collins, May 1984.
2. Dry Creek Major Drainage Way Planning, City of Fort Collins, April, 1980.
3. Federal Emergency Management Agency (FIMA) Maps.
4. D & W, Inc. Survey and Topo Map.
5. Reigles Design Group, Architectural Plan.

The drainage report is for 1298 North College Avenue. The site exist along the east side of College Avenue, north of Conifer Street and south of Bristlecone Street. The size of the site is 0.913 acres. The site is zoned HB - Highway Business, within the limits of Fort Collins city.

I. Estimated runoff quantity "Q" in cfs under existing conditions.

1. Using Rational Method Runoff Storm Drainage criteria for 2 year initial storm, based on design storm frequencies for Highway Business.

   a - The existing description of zoning is classified as highway business with Runoff Coefficient equal to 0.95 (C = 0.95)
   b - The average slope with 1.09 foot drop within 185 feet long is 0.006 (S = 0.6%).
   c - Area of the proposed site is 0.913 acres = 39,775.00 square feet.
   d - To determine time of concentration in minutes

$$T_c = \frac{1.87\ (\ 1.1 - C\ C_f)\ D^{1/2}}{S^{1/3}}$$

Where

T_c = Time of concentration, minutes
S = Slope of basin, %
C = Rational Method Runoff Coefficient
D = Length of basin, feet
C_f = Frequency adjustment factor

S = 0.6% C = 0.95
D = 185 feet C_f = 1.0 for 2 year storm

Then $$T_c = \frac{1.87\ (\ 1.1 - 0.95 \times 1.0\ )(\ 185)^{1/2}}{(\ 0.006\ )^{1/3}} = 21.00 \text{ minutes}$$

e - Determine precipitation in inches per hour from figure (3-1) Storm Drainage Design.
I = 1.8 inches/hour

f - Determine runoff quantity

$$Q = C_f CIA$$

Where Q = Flow quantity, CFS
A = Total area of basin, acres
C_f = Frequency adjustment factor
C = Runoff Coefficient
I = Rainfall intensity, inches/hour

Then $Q = (1.0) \times (0.95) \times (1.8) \times (0.913) = 1.561$ CFS

2. Using Rational Method Runoff Storm Drainage criteria for 10 - year initial storm.

C_f = 1.0 C = 0.95
D = 185 feet S = 0.006

Then T_c = 21 minutes

From figure (3-1) I = 3.7 inches/hour

$Q = C_f CIA$
$= (1.0) \times (0.95) \times (3.7)(0.913) = 3.21$ CFS

3. 100 - Year Major Storm for existing conditions.

C_f = 1.25 C = 0.95
$C_f C$ = (1.25) x (0.95) = 1.19 which should not exceed 1.0, Then $C_f C = 1.0$

T_c = 14 minutes
From figure (3-1) I = 6.2 inches/hour

$$Q = (1.0) \times (6.2)\ (0.913) = 5.66 \text{ CFS}$$

II. Estimated Runoff Quantity "Q" in CFS after proposed development.

1. Determine runoff quantity for 2 year Design storm returned period as initial storm.

Under HB - Highway Business Zoning, the Rational Method Runoff Coefficient is 0.95 (C = 0.95). If we calculate the Composite Runoff Coefficient it will be as follows:

Run off Coefficient	Area Square Feet
Asphalt and Roof, C = 0.95	31,422.25
Lawns with slope 2%, C = 0.10	8,352.75

The Composite Runoff C

$$C = \left(\sum_{i=1}^{N} C_i A_i\right) / A_t$$

Where

- C = Composite Runoff Coefficient
- C_i = Runoff Coefficient for specific area A
- A_i = Area of surface with Runoff Coefficient C
- N = Number of different surfaces to be considered
- A_t = Total area over which C is applicable;

The sum of all A_i's is equal to A_t

$$C = \frac{(0.95) \times (31,422.25) + (0.10) \times (8,352.75)}{39,775.00} = 0.77$$

Time of Concentration in minutes for 2 year storm
T_c = 46.18 minutes

Precipitation in inches/hour from figure (3-1)

$$I = 1.1 \text{ inch/hour}$$

Runoff quantity for 2 year storm

$$Q = 0.773 \text{ CFS}$$

The difference in runoff quantity for 2 year initial storm

before and after proposed development is

Before development	Q = 1.561 CFS
After development	Q = 0.773 CFS
Difference	= 0.788 CFS les runoff

Since the amount of runoff is reduced after development than before, as a result of developing new landscaped area to the proposed site.

2. Determine runoff quantity for 10 year Design storm returned period as initial storm.

Time of concentration

T_c = 46.18 minutes

Precipitation in inches/hour from figure (3-1)

I = 1.7 inch/hour

Runoff quantity for 10 year initial storm

Q = 1.2 CFS

Also, the difference in runoff quantity for 10 year initial storm before and after proposed development is

Before development	Q = 3.21 CFS
After development	Q = 1.20 CFS
Difference	= 2.01 CFS less runoff

3. Determine runoff quantity for 100 year major Design storm return period.

Time of concentration

T_c = 19.24 minutes

Precipitation in inches/hour from figure (3-1)

I = 5.3 inches/hour

Runoff quantity for 100 year major storm

Q = (0.963) x (5.3) x (0.913) = 4.66 CFS

Finally, the difference in runoff quantity for 100 year major storm before and after proposed development is

Before development	Q = 5.66 CFS
After development	Q = 4.66 CFS
Difference	= 1.00 CFS less runoff

Conclusion

The proposed development at 1298 North College Avenue will cause a reduction in the amount of runoff quantity by

0.788 CFS for 2 year storm
2.01 CFS for 10 year storm
1.00 CFS for 100 year storm

Since the existing condition has no detention pond and because the proposed development will reduce the runoff that is generated by precipitation, the applicant would like to request a variance from the City of Fort Collins' requirement for detention pond. However, the site is located within the 100 year flood plain for Dry Creek and a small part of the property on the southwest corner is in the flood way of Dry Creek.

P.S. You will find enclosed a plat by D & W, Inc. which shows the existing structure, contours and existing elevations. Also, from major drainageway planning for Dry Creek, April 1980, the following information concerning the flood elevation was gathered.

100 year flood elevation @ section 26 is 4974.20 feet.
10 year flood elevation @ section 26 is 4973.50 feet.