

DRAINAGE REPORT
FOR
PINECLIFF MASTER PLAN

H. J. Kraettli & Sons, Inc.
15 North Iowa Avenue
Colorado Springs, Colorado 80909



H. J. KRAETTLI & SONS CONSULTING ENGINEERS

15 NORTH IOWA

PHONE 473-3774

COLORADO SPRINGS, COLORADO 80909



June 19, 1979

Mr. Gary Haynes
Colorado Springs City Engineer
101 W. Costilla
Colorado Springs, CO 80903

Dear Sir:

Transmitted herewith is the Drainage Report for Pinecliff Master Plan. This development is located in Section 24, Township 13 South, Range 67 West of the 6th P.M., El Paso County, Colorado.

If there are any questions or additional information required, please contact us at your convenience.

Respectfully submitted,

H. J. KRAETTLI & SONS, INC.

9646
Roger G. Berge
REGISTERED PROFESSIONAL ENGINEER
STATE OF COLORADO
Colorado No. 9646

RGB/jel

MASTER DRAINAGE REPORT

FOR

PINECLIFF

June 19, 1979

H. J. Kraettli & Sons, Inc.

Colorado Springs, Colorado

Prepared By:

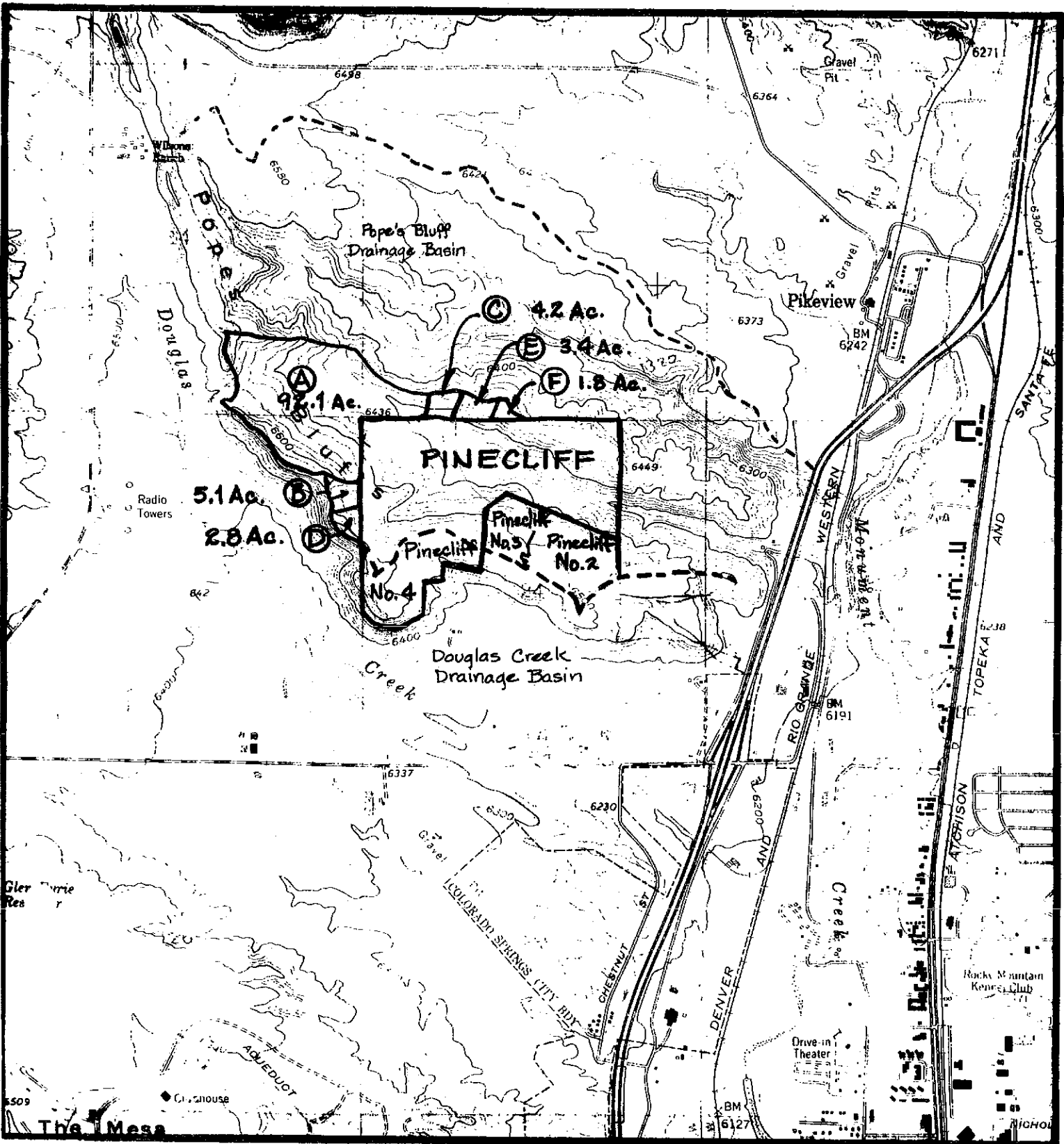
Roger G. Berge
Colorado P.E. No. 9646

Drainage Plan Approval for platting purposes only. Final structure sizing is subject to submittal of street layout in accordance with the letter dated September 14, 1979 from David R. Sellon and Company (see copy attached).
Exhibit "A" page 16

Gary R. Raynes
Acting City Engineer
Sept. 20, 1979

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4.2 Ac. (C)
 3.4 Ac. (E)
 1.8 Ac. (F)
 1.1 Ac. (A)
 5.1 Ac. (B)
 2.8 Ac. (D)

PINECLIFF

Pinecliff No. 1
 Pinecliff No. 2
 Pinecliff No. 4

VICINITY MAP

1" = 2000'

REPORT

GENERAL:

Pinecliff is a large tract of land encompassing most of the North half of Section 24 in Township 13 South, Range 67 West of the 6th P.M. The Southeast corner abuts the previously recorded Pinecliff No. 2 and No. 3. The remainder of the tract abuts unplatted lands.

For the most part, Pinecliff lies on or just to the North and East of Popes Bluff and therefore most of the tract is included in the Popes Bluff Drainage Basin. However, the southernmost 30.4 acres lies on the South side of the Bluff and must therefore be considered draining into the ~~Mesa Drainage Basin~~. These two separate basins and their required drainage structures have been so designated in the body of this report. Both basins are steeply sloping valleys that flow generally Southeasterly and have been considered to have soils in the Hydrologic Soil Group C range.

METHOD OF COMPUTATIONS:

Runoff quantities were computed using the modified SCS Methodology as developed and approved by the City of Colorado Springs City Engineering Division. The graph as distributed by the above Engineering Division and the graph as distributed by the Soil Conservation Service of the State of Colorado were used to determine times of concentrations and the later has been included in the back of this report.

EXTERIOR DRAINAGE:

There is considerable acreage contributing runoff to the drainage quantities of Pinecliff. These areas are fully delineated on the Vicinity Map on page 4. Their relation to the various points selected for computation of quantities can best be seen however through reference to the Master Drainage Plan included with this report.

The largest of the exterior drainage areas, Area A, and interior Drainage Area 1 are expected to deliver 64.7 cfs at the North boundary of the development when they reach developed state.

No separate runoff quantities have been obtained for the remaining exterior drainage areas but rather they have been incorporated into the acreages used to compute quantities at various interior accumulation points.

INTERIOR DRAINAGE:

Where no preliminary lot layout is available at this time for the entire development, we have broken the acreage down into various valleys that will contribute sizeable quantities to the total storm runoff. It is also anticipated that intersections will most likely fall near the accumulation points selected.

Where a preliminary lot layout is available, flow quantities have been determined at the location of anticipated low points where installation of drainage structures would be required.

Each location will receive drainage from a summation of the pertinent drainage areas identified by numbers on the Master Drainage Plan (See Calculations Sheets) and each has been checked for both the 5 year design storm and the 100 year design storm to determine the point at which the higher design criteria will become applicable. This point falls approximately two thirds of the way downstream through the development (e.g. the Popes Bluff Drainage Basin).

POPES BLUFF DRAINAGE BASIN PLANNED IMPROVEMENTS:

Exterior Drainage Area A and its tributary Interior Drainage Area 1 collects such a large quantity of runoff up to the Northern boundary of Pinecliff, that an underground system need be provided for the upper two-thirds of the development. Where it becomes necessary to change to the 100 year design storm, we plan on going to an open concrete-lined ditch to be carried to the end of the development and temporarily outletted onto 20 C.Y. of riprap to prevent major channel erosion. It is anticipated that sizes will range from 30" RCP set at a 1.0% minimum slope at the runoff's entry point on the Northern boundary up to 42" RCP set at a 1.4% minimum slope at the two-third's point. Catch basins to pick up street flow have been spaced intermittently where the drainage system is underground. When the system changes to an open flow ditch, 6 curb openings spaced intermittently will be provided to take the gutter flow off into the ditch. In this basin, all drainage structures are expected to be located within street rights-of-way.

IMPROVEMENT COST ESTIMATE:

24" RCP	380 L.F. @ \$	20.25 per L.F.	\$ 7,695.00
30" RCP	960 L.F. @ \$	25.24 per L.F.	24,230.40
36" RCP	570 L.F. @ \$	33.64 per L.F.	19,174.80
42" RCP	860 L.F. @ \$	42.60 per L.F.	36,636.00
Concrete Lined Ditch	1100 L.F. @ \$	48.40 per L.F.	53,240.00
10' D-10R Catch Basins	13 C.B. @ \$	1,500.00 per C.B.	19,500.00
Manholes	6 M.H. @ \$	550.00 per M.H.	3,300.00
6' Curb Openings	6 C.O. @ \$	350.00 per C.O.	2,100.00
Riprap	20 C.Y. @ \$	20.00 per C.Y.	400.00

TOTAL

\$166,276.20

DRAINAGE AND BRIDGE FEES:

The summary of fees for Popes Bluff Drainage Basin is as follows:

1979 Drainage Fees: 144.10 Acres @ \$818.00 per Acre = \$117,873.80.

1979 Bridge Fees: 144.10 Acres @ \$142.00 per Acre = \$ 20,462.20.

DOUGLAS CREEK DRAINAGE BASIN PLANNED IMPROVEMENTS:

The major portion of Tract A as designated on the Master Drainage Plan flows into a different drainage basin than the rest of the development. Since this acreage is on the outer reaches of the basin and has no exterior drainage flowing onto it, very low quantities of runoff are developed. We do, however, anticipate two sag points on the street profiles which will require two catch basins and 24" RCP culverts to carry the flow until it can be outletted into the existing channels nearby.

IMPROVEMENT COST ESTIMATE:

24" RCP	850 L.F. @ \$ 23.00 per L.F.	\$19,550.00
Rock Excavation	850 L.F. @ \$ 4.00 per L.F.	3,400.00
4' D-10R Catch Basins	2 C.B. @ \$1,200.00 per C.B.	2,400.00
10' D-10R Catch Basins	2 C.B. @ \$1,500.00 per C.B.	3,000.00
Riprap	30 C.Y. @ \$ 30.00 per C.Y.	900.00
TOTAL		\$29,250.00

DRAINAGE AND BRIDGE FEES:

The summary of fees for Douglas Creek Drainage Basin is as follows:

1979 Drainage Fees: 28.9 Acres @ \$1,797.00 per Acre = \$51,933.30.

1979 Bridge Fees: 28.9 Acres @ \$ 69.00 per Acre = \$ 1,994.10.

DRAINAGE CALCULATIONS FOR TRACTS A, B, C, D, PINECLIFF

Basin	Acreage	Sq. Mi.	Land Use	%	Curve Number	Rainfall Q	L (ft.)	H (ft.)	Flow Type	t _c (hr.)	Q _p csm/in.	q (cfs)
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POPES BLUFF DRAINAGE BASIN:

A,1	97.2	0.152	1/3 Acre Lots	38	81		1000	140	Overland	0.154			
			Park & Pres. Ests.	59	70		1400	60	Gutter Flow	0.095			
			Streets	3	98		800	55	Pipe	0.010			
			<u>Weighted Ave.</u>		<u>75.0</u>	(5)	0.435	<u>3200</u>	<u>255</u>		<u>0.259</u>	980	(5) 64.7
						(100)	1.300						(100) 193.5

Design for 5 year storm - Carry 23.2 cfs in street as gutter flow and 41.5 cfs in pipe. Provide 2 10' D-10R Catch Basins at intersection. Use 420 L.F. of 30" RCP @ 1.0% minimum slope.

A,1 B,2,C,	29.0 <u>126.2</u>	0.197	1/3 Acre Lots	45	81								
			Park & Pres. Ests.	50	70								
			Streets	5	98								
			<u>Weighted Ave.</u>		<u>76.4</u>	(5)	0.484	<u>420</u>	<u>8</u>	Pipe	<u>0.009</u>		
						(100)	1.388	<u>3620</u>	<u>263</u>		<u>0.268</u>	960	(5) 91.5

Design for 5 year storm - Carry 28.4 cfs in street and 63.1 cfs in pipe. Use 2 10' D-10R Catch Basins @ intersection and 540 L.F. 30" RCP @ 2.3% minimum slope.

A,1 B,2,C, D,3,E,	44.2 <u>170.4</u>	0.266	1/3 Acre Lots	54	81								
			Park & Pres. Ests.	40	70								
			Streets	6	98								
			<u>Weighted Ave.</u>		<u>77.6</u>	(5)	0.526	<u>540</u>	<u>17</u>	Pipe	<u>0.009</u>		
						(100)	1.472	<u>4160</u>	<u>280</u>		<u>0.277</u>	950	(5) 132.9

Design for 5 year storm - Carry 30.7 cfs in street and 102.2 cfs in pipe. Use 3 10' D-10R Catch Basins at intersection and 570 L.F. 36" RCP at 2.2% minimum slope.

A,1			1/3 Acre Lots	56	81								
B,2,C,			Park & Pres. Ests.	37	70								
D,3,E,	22.7	0.302	Streets	7	98								
4,F,G,	193.1		Weighted Ave.		78.1	(5) 0.544	570	20	Pipe	0.009		940	(5) 154.4
						(100) 1.507	4730	300		0.286			(100) 427.8

Design for 5 year storm - Use 2 10' D-10R Catch Basins at intersection and 890 L.F. 42" RCP at 1.4% minimum slope. Carry 26.9 cfs in street and 127.5 cfs in pipe.

A,1			1/3 Acre Lots	56	81								
B,2,C,			Park & Pres. Ests.										
D,3,E,			Good Cover	32	70								
4,F,G,	29.9	0.348	Poor Cover	5	84								
5,H,	223.0		Streets	7	98								
			Weighted Ave.		78.8	(5) 0.572	890	24	Pipe	0.011		930	(5) 185.1
						(100) 1.556	5620	324		0.297			(100) 503.6

(Note: Moved point of change 30 feet upstream to be below 500 cfs.) Change design to 100 year storm - Use 4 10' D-10R Catch Basins in street an 1100 L.F. Concrete Lined Ditch at 3.2% minimum slope.

A,1			1/3 Acre Lots	59	81								
B,2,C,			Park & Pres. Ests.										
D,3,E,			Good Cover	26	70								
4,F,G,			Poor Cover	7	84								
5,H,21	54.4	0.433	Streets	8	98								
6,I,J,K	277.4		Weighted Ave.		79.7	(100) 1.619	970	31	Pipe	0.013		910	(100) 637.9
							6590	345		0.310			

Design for 100 year storm - Use 6 6' curb openings spaced in street, exit subd. onto 20 C.Y. riprap.

7	11.9	0.019	1/3 Acre Lots	43	81								
			Preservation Ests.										
			Poor Cover	48	84								
			Streets	9	98								
			Weighted Ave.		84.0	0.710	570	110	Overland	0.049		1300	17.2

8	1.0	0.002	Preservation Ests. Poor Cover	100	84	0.71	400	115	Overland	0.029	1300	1.8
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MESA DRAINAGE BASIN:

9	3.5	0.005	1/3 Acre Lots Streets <u>Weighted Ave.</u>	87 13 83.2	81 98	0.776	420	28	Overland	0.065	1300	5.5
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9,10	8.0	0.013	1/3 Acre Lots Streets <u>Weighted Ave.</u>	82 18 84.1	81 98	(5) 0.825	<u>160</u> 580	<u>13</u> 41	Overland	<u>0.022</u> 0.087	1300	(5) 13.4
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Use 1 10' D-10R Catch Basin on West side and 1 4' D-10R Catch Basin on East side of Street w/210 L.F. 24" RCP to outlet into natural channel.

9,10,11	10.1	0.016	1/3 Acre Lots Streets <u>Weighted Ave.</u>	88 12 83.0	81 98	0.765	<u>350</u> 930	<u>53</u> 94	Nat. Channel	<u>0.025</u> 0.112	1260	15.2
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12	1.2	0.002	1/2 Acre Lots	100	80	0.62	230	54	Overland	0.013	1300	1.5
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13	2.7	0.004	1/2 Acre Lots	100	80	0.62	210	53	Overland	0.012	1300	3.4
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14	2.5	0.004	1/2 Acre Lots Streets <u>Weighted Ave.</u>	75 25 84.5	80 98	0.845	<u>590</u> 90 680	<u>57</u> 1 58	Overland Gutter	<u>0.074</u> 0.012 0.086	1300	4.3
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14,15	6.8	0.011	1/2 Acre Lots	71	80		680	58		0.086		
			Streets	29	98		440	2	Gutter	0.087		
			Weighted Ave.		85.2	(5) 0.88	1120	60		0.173	1100	(5) 10.3
<p style="text-align: center;"><u>Use 1 4' D-10R Catch Basin on North side and 1 10' D-10R Catch Basin on South side of street w/225 L.F. 24" RCP to outlet into natural channel.</u></p>												
14,15,16	9.9	0.015	1/2 Acre Lots	78	80		200	35	Pipe	0.015		
			Streets	22	98		100	7	Nat. Chan.	0.010		
			Weighted Ave.		84.0	0.82	1420	102		0.198	1060	13.4
17	0.9	0.001	1/2 Acre Lots	100	80	0.62	165	54	Overland	0.008	1300	1.1
18	1.8	0.003	1/2 Acre Lots	100	80	0.62	180	45	Overland	0.010	1300	2.3
19	0.9	0.001	1/2 Acre Lots	100	80	0.62	170	8	Overland	0.030	1300	1.1
20	0.4	0.001	Preservation Ests. Poor Cover	100	84	0.71	120	70	Overland	0.010	1300	0.6

CONCRETE LINED DITCH

Pinecliff No. 4

Q from calculations = 503.6 c.f.s.

$$\begin{array}{l} n = 0.013 \\ S = 3.2\% \\ \text{assume } b = 2' \\ m = 1 \end{array} \quad \frac{Qn}{b^{8/3} S_o^{1/2}} = \frac{503.6 (0.013)}{(2)^{8/3} (0.032)^{1/2}} = 5.764$$

$$\frac{Yn}{b} = 1.69$$

Yn (depth) = 3.38' = 3'-6" approximate

USE DITCH OF b=2', d=3'-6", plus 1' additional for freeboard, m=1

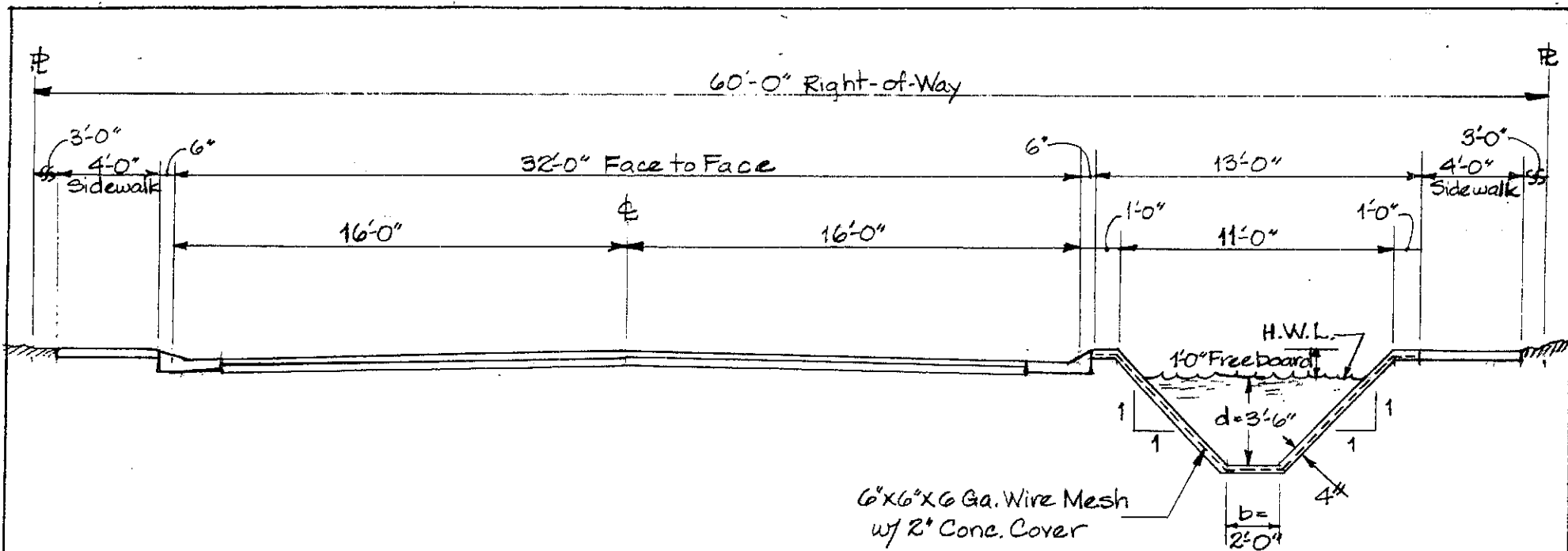
MAXIMUM CAPACITY OF PROPOSED DITCH

$$V = \frac{1.486}{n} R^{2/3} S_o^{1/2}$$

A = 29.25 S.F.
WP = 14.73 Ft.
R = 1.99 Ft.

$$V = \frac{1.486}{0.013} (2.00)^{2/3} (0.032)^{1/2} = 32.31 \text{ f.p.s.}$$

$$Q = VA = 945.1 \text{ c.f.s.}$$



TYPICAL SECTION CONCRETE-LINED DITCH

$$d = 3.50'$$

$$n = 0.013$$

$$S = 3.2\%$$

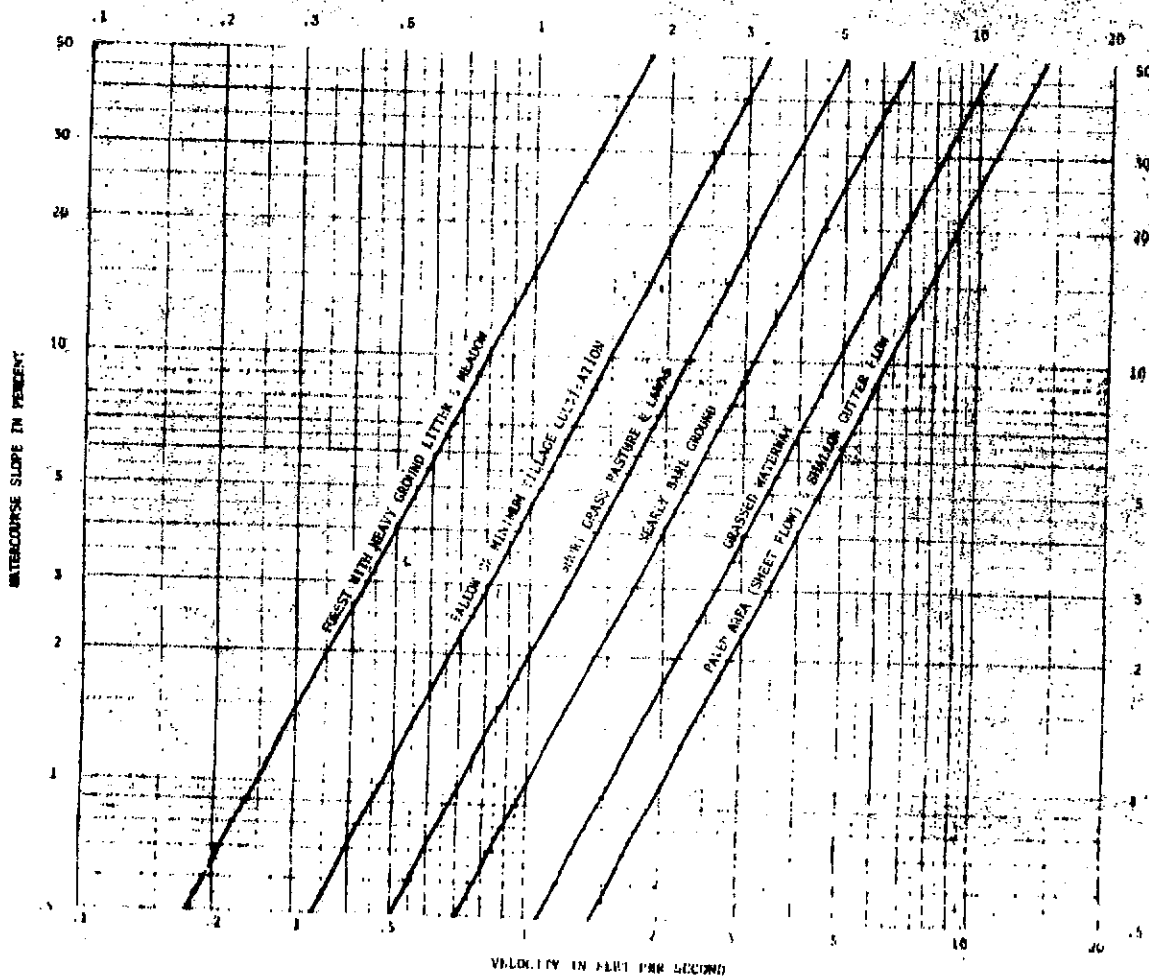
$$A = 19.25 \text{ ft.}^2$$

$$WP = 11.90 \text{ ft.}$$

$$R = 1.618 \text{ ft.}$$

$$\text{Velocity} = 28.18 \text{ fps (by Mannings Equation)}$$

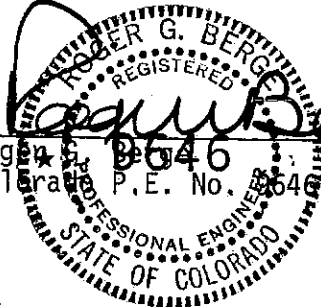
$$\text{Capacity} = 542.4 \text{ cfs}$$



Average Velocities for Estimating Travel Time
for Overland Flow

CERTIFICATION

I, Roger G. Berge, a registered engineer in the State of Colorado, hereby certify that the attached drainage plan and report were prepared under my direction and supervision and are correct to the best of my knowledge and belief. I further certify that said drainage report is in accordance with all City of Colorado Springs Ordinances, specifications and criteria.


Roger G. Berge
Colorado P.E. No. 8646

OWNERS STATEMENT

"The developer has read and will comply with all of the requirements specified in this drainage report as approved by the City Engineer."

PINECLIFF No. 4

By David P. Sellen
Title owner

Exhibit "A"

David R. Sellon & Company

Master Drainage Report
for

PINECLIFF

June 19, 1979

September 14, 1979

Mr. DeWitt Miller
Director of Public Works
Public Works Department
City of Colorado Springs
P. O. Box 1575
Colorado Springs, CO 80901

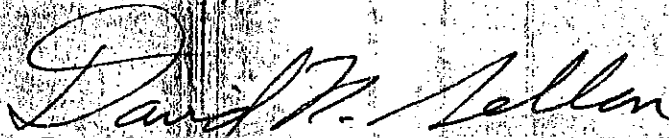
RE: Pinecliff Subdivision
Filing No. 4

Dear Deke:

As we agreed, we will provide the City of Colorado Springs with a preliminary street plan in conjunction with the Master Drainage Plan within a 90-day period of our meeting.

We appreciate your cooperation.

Sincerely,


David R. Sellon

DRS/w

225 E. Cheyenne Mt. Blvd.
Colorado Springs, CO 80906
(303) 576-4700