W 4

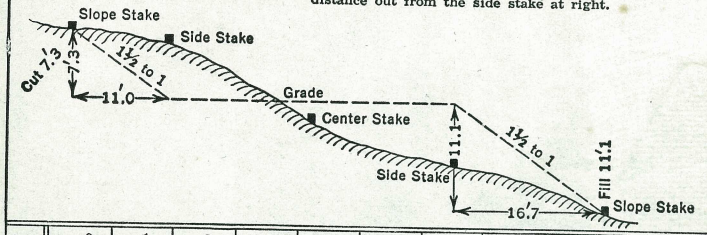
LEVEL BOOK

MURRAY DAM
MICROMETER
READINGS
BOOK NO 4

DISTANCES FROM SIDE STAKES FOR CROSS-SECTIONING

Roadway of any Width. Side Slopes 1½ to 1.

In the figure below: opposite 7 under "Cut or Fill" and under .3 read 11.0, the distance out from the side stake at left. Also, opposite 11 under "Cut or Fill" and under .1 read 16.7, the distance out from the side stake at right.



Cut or Fill	0	.1	.2	.3	.4	.5	.6	.7	.8	.9	Cut or Fill
	Distance out from Side or Shoulder Stake										
0	0.0	0.2	0.3	0.5	0.6	0.8	0.9	1.1	1.2	1.4	0
1	1.5	1.7	1.8	2.0	2.1	2.3	2.4	2.6	2.7	2.9	1
2	3.0	3.2	3.3	3.5	3.6	3.8	3.9	4.1	4.2	4.4	2
3	4.5	4.7	4.8	5.0	5.1	5.3	5.4	5.6	5.7	5.9	3
4	6.0	6.2	6.3	6.5	6.6	6.8	6.9	7.1	7.2	7.4	4
5	7.5	7.7	7.8	8.0	8.1	8.3	8.4	8.6	8.7	8.9	5
6	9.0	9.2	9.3	9.5	9.6	9.8	9.9	10.1	10.2	10.4	6
7	10.5	10.7	10.8	11.0	11.1	11.3	11.4	11.6	11.7	11.9	7
8	12.0	12.2	12.3	12.5	12.6	12.8	12.9	13.1	13.2	13.4	8
9	13.5	13.7	13.8	14.0	14.1	14.3	14.4	14.6	14.7	14.9	9
10	15.0	15.2	15.3	15.5	15.6	15.8	15.9	16.1	16.2	16.4	10
11	16.5	16.7	16.8	17.0	17.1	17.3	17.4	17.6	17.7	17.9	11
12	18.0	18.2	18.3	18.5	18.6	18.8	18.9	19.1	19.2	19.4	12
13	19.5	19.7	19.8	20.0	20.1	20.3	20.4	20.6	20.7	20.9	13
14	21.0	21.2	21.3	21.5	21.6	21.8	21.9	22.1	22.2	22.4	14
15	22.5	22.7	22.8	23.0	23.1	23.3	23.4	23.6	23.7	23.9	15
16	24.0	24.2	24.3	24.5	24.6	24.8	24.9	25.1	25.2	25.4	16
17	25.5	25.7	25.8	26.0	26.1	26.3	26.4	26.6	26.7	26.9	17
18	27.0	27.2	27.3	27.5	27.6	27.8	27.9	28.1	28.2	28.4	18
19	28.5	28.7	28.8	29.0	29.1	29.3	29.4	29.6	29.7	29.9	19
20	30.0	30.2	30.3	30.5	30.6	30.8	30.9	31.1	31.2	31.4	20
21	31.5	31.7	31.8	32.0	32.1	32.3	32.4	32.6	32.7	32.9	21
22	33.0	33.2	33.3	33.5	33.6	38.8	33.9	34.1	34.2	34.4	22
23	34.5	34.7	34.8	35.0	35.1	35.3	35.4	35.6	35.7	35.9	23
24	36.0	36.2	36.3	36.5	36.6	36.8	36.9	37.1	37.2	37.4	24
25	37.5	37.7	37.8	38.0	38.1	38.3	38.4	38.6	38.7	38.9	25
26	39.0	39.2	39.3	39.5	39.6	39.8	39.9	40.1	40.2	40.4	26
27	40.5	40.7	40.8	41.0	41.1	41.3	41.4	41.6	41.7	41.9	27
28	42.0	42.2	42.3	42.5	42.6	42.8	42.9	43.1	43.2	43.4	28
29	43.5	43.7	43.8	44.0	44.1	44.3	44.4	44.6	44.7	44.9	29
30	45.0	45.2	45.3	45.5	45.6	45.8	45.9	46.1	46.2	46.4	30
31	46.5	46.7	46.8	47.0	47.1	47.3	47.4	47.6	47.7	47.9	31
32	48.0	48.2	48.3	48.5	48.6	48.8	48.9	49.1	49.2	49.4	32
33	49.5	49.7	49.8	50.0	50.1	50.3	50.4	50.6	50.7	50.9	33
34	51.0	51.2	51.3	51.5	51.6	51.8	51.9	52.1	52.2	52.4	34
35	52.5	52.7	52.8	53.0	53.1	53.3	53.4	53.6	53.7	53.9	35
36	54.0	54.2	54.3	54.5	54.6	54.8	54.9	55.1	55.2	55.4	36
37	55.5	55.7	55.8	56.0	56.1	56.3	56.4	56.6	56.7	56.9	37
38	57.0	57.2	57.3	57.5	57.6	57.8	57.9	58.1	58.2	58.4	38
39	58.5	58.7	58.8	59.0	59.1	59.3	59.4	59.6	59.7	59.9	39
40	60.0	60.2	60.3	60.5	60.6	60.8	60.9	61.1	61.2	61.4	40

KEUFFEL & ESSER CO., N. Y.

Book No 4

Micrometer Readings at Murray Dam

FOUR BOOKS ON MURRAY READINGS.
RECEIVED FROM HELIX I.D., DEC. 1961,
D Ferrand.

BOOK #1 - FEB. 1933 TO FEB. 1939
" #2 - MAR. 1939 TO APR. 1948
STORED IN OLD FILES AT ALVARADO.
D Ferrand. 7/20/68

1959

Buttress 25

Date	Time	Temp.	Ga	Read	Tender
9-4	1:30	82°	95.55	412	GB
10-6	9:00	74°	95.55	412	GB
10-21	3:00	80°	94.16	412	GB
11-6	3:30	83°	86.16	412	GB
11-23	1:30	77°	84.96	411	GB
12-9	2:00	69°	85.62	412	GB
		1960			
1-6	10:30	54°	85.43	412	GB
1-29	8:30	57°	85.94	412	GB
2-24	10:00	63°	85.98	412	GB
5-16	2:00	69°	95.26	412	GB
5-31	2:00	64°	94.50	412	GB
6-14	3:30	74°	95.18	412	GB
3-23	10:00	68°	84.44	412	GB
4-11	2:00	72°	89.78	412	GB
5-6	2:30	70°	95.00	412	GB

1959

Buttress #21

Date	Rt A	Diag
9-4	515	455
10-6	514	455
10-21	514	455
11-6	511	456
11-23	514	458
12-9	516	458

1960

1-6	518	459
1-29	513	456
2-24	514	456
5-16	514	458
5-31	516	455
6-14	515	455
3-23	513	456
4-11	514	456
5-6	514	454

1959

Buttress #13

Date	Rt A	Diag
9-4	461	491
10-6	468	492
10-21	468	491
11-6	468	491
11-23	467	491
12-9	469	492

1960

1-6	470	492
1-29	470	492
2-24	460	492
5-16	468	492
5-31	469	491
6-14	469	491
3-23	469	492
4-11	469	492
5-6	468	492

1959

Buttress # 10

Date	RA	Diag
9-4	543	514
10-6	547	515
10-21	544	514
11-6	549	514
11-23	550	513
12-9	552	514
	1960	
1-6	562	515
1-29	556	515
2-24	560	515
5-16	552	514
5-31	556	516
6-14	552	515
3-23	552	514
4-11	553	515
5-6	559	515

1959

Buttress # 9

Date	RA	Diag
9-4	513	537
10-6	512	537
10-21	513	538
11-6	510	539
11-23	510	538
12-9	509	536
	1960	
1-6	514	540
1-29	507	537
2-24	507	536
5-16	509	537
5-31	516	540
6-14	512	537
3-23	506	535
4-11	510	537
5-6	514	539

1959

Buttress #7

Date	Rtx	Diag
9-4	479	502
10-6	478	502
10-21	478	538
11-6	499	502
11-23	475	501
12-9	475	501
	1960	
1-6	482	505
1-29	480	504
2-24	483	506
5-16	482	503
5-31	484	505
6-14	481	502
3-23	482	506
4-11	483	506
5-6	483	503

1959

Buttress #6

Date	Rtx	Diag
9-4	465	433
10-6	470	433
10-21	469	434
11-6	462	434
11-23	460	430
12-9	468	427
	1960	
1-6	468	425
1-29	467	428
2-24	467	428
5-16	460	427
5-31	474	433
6-14	462	435
3-23	466	430
4-11	469	432
5-6	461	434

1959

Buttress #5

Date	RH	Diag
9-4	505	462
10-6	507	462
10-21	507	463
11-6	506	463
11-23	511	464
12-9	513	465

1960

1-6	518	466
1-29	515	466
2-24	518	468
5-16	516	460
5-31	507	462
6-14	504	463
3-23	513	467
4-11	508	465
5-6	506	463

1960

Buttress #25

Date	Time	Temp	Ga	Read	Tender
6-28	2:30	79°	95.87	412	GB
7-12	3:30	80°	93.89	412	GB
7-26	9:30	75°	95.96	412	OB
8-8	10:00	70°	95.64	412	GB
8-25	9:30	75°	95.40	412	GB
9-13	2:00	92°	95.56	412	GB
9-30	9:00	70°	95.89	412	GB
10-18	10:00	70°	95.46	412	GB
11-7	2:00	65°	95.69	412	OB
11-29	3:15	62°	86.08	412	GB
12-20	3:00	66°	85.66	412	GB

1961

1-1	2:00	65°	86.00	412	GB
1-17	3:00	80°	84.45	412	GB
2-7	3:00	68°	85.67	412	GB
2-21	3:00	78°	85.06	412	GB

1960

Bathhouse 21

Date	Rt	Diag
6-28	517	457
7-12	515	455
7-26	516	456
8-8	519	457
8-25	516	456
9-13	515	457
9-30	520	458
10-18	520	457
11-7	519	456
11-29	515	457
12-20	511	456
	1961	
1-1	519	456
1-17	510	457
2-7	514	458
2-21	512	456

1960

Bathhouse 13

Date	Rt	Diag
6-28	461	491
7-12	468	491
7-26	468	493
8-8	468	492
8-25	468	493
9-13	468	491
9-30	468	492
10-18	468	492
11-7	468	492
11-29	469	492
12-20	468	492
	1961	
1-1	468	492
1-17	468	491
2-7	469	492
2-21	468	491

1960

Buttress #10

Date	Rt	Diag
6-28	539	514
7-12	549	515
7-26	542	515
8-8	541	516
8-25	542	515
9-13	531	514
9-30	530	516
10-18	533	515
11-7	538	516
11-29	560	515
12-20	553	514
	1961	
1-1	557	516
1-17	468	491
2-7	469	492
2-21	468	491

1960

Buttress #9

Date	Rt	Diag
6-28	514	538
7-12	511	536
7-26	513	536
8-8	515	538
8-25	513	536
9-13	514	537
9-30	516	538
10-18	517	539
11-7	515	538
11-29	510	539
12-20	509	538
	1961	
1-1	514	538
1-17	508	538
2-7	511	538
2-21	510	539

1960

Bathhouse #7

Date	RH	Digg
6-28	482	504
7-12	479	502
7-26	481	503
8-8	483	504
8-25	481	503
9-13	478	501
9-30	482	503
10-18	507	503
11-7	480	501
11-29	481	505
12-20	478	504
	1961	
1-1	480	502
1-17	475	502
2-7	480	504
2-21	478	504

1960

Bathhouse #6

Date	RH	Digg
6-28	469	434
7-12	471	435
7-26	460	434
8-8	473	434
8-25	460	434
9-13	464	425
9-30	475	434
10-18	472	433
11-7	469	432
11-29	470	431
12-20	464	432
	1961	
1-1	467	432
1-17	462	433
2-7	469	430
2-21	466	433

1960

Buttress #5

Date	Pt 4	Diag
6-28	505	463
7-12	504	462
7-26	504	463
8-8	506	463
9-25	504	463
9-13	502	462
9-30	507	463
10-18	510	463
11-7	509	462
11-29	515	464
12-20	511	465
	1961	
1-1	509	462
1-17	509	465
2-7	513	465
2-21	507	463

1961

Buttress #25

Date	Time	Temp	Ga	Read	Tender
3-10	10[00]	62°	85[57]	412	GB
3-30	9[00]	62°	87[38]	412	GB
4-24	10[00]	66°	87[80]	412	GB
5-23	2[00]	67	95[32]	412	Wk
6-6	2[00]	77	95[60]	412	Wk
6-21	10[30]	76	95[89]	412	Wk

1961
Buttress #21

Date	RH	Diag
3-10	517	458
3-30	518	459
4-24	519	460
5-23	520	458
6-6	520	458
6-21	520	457

1961
Buttress #13

Date	RH	Diag
3-10	468	492
3-30	470	492
4-24	469	492
5-23	468	492
6-6	468	491
6-21	469	493

1961

Bathroom #10

Date	RA	Diag
3-18	559	515
3-30	565	517
4-24	562	517
5-23	561	517
6-6	560	517
6-21	557	517

1961

Bathroom #9

Date	RA	Diag
3-10	513	538
3-30	514	534
4-24	515	539
5-23	519	540
6-6	517	539
6-21	516	538

1961

Buttress #7

Date	Rt	Diag
3-10	484	506
3-30	485	506
4-24	486	506
5-23	483	503
6-6	484	503
6-21	482	502

1961

Buttress #6

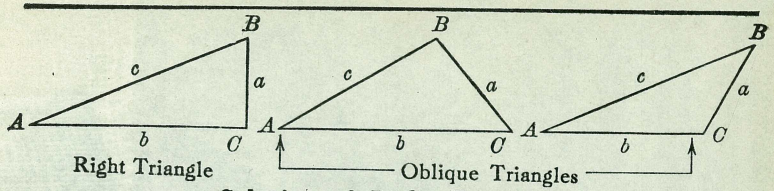
Date	Rt	Diag
3-10	469	429
3-30	474	428
4-24	465*	431
5-23	474	434
6-6	474	434
6-21	474	434

1961

Buttress #5

Date	Rise	Dip
3-10	515	465
3-30	514	464
4-24	515	465
5-23	508	462
6-6	507	462
6-21	506	462

TRIGONOMETRIC FORMULÆ



Right Triangle — Oblique Triangles

Solution of Right Triangles

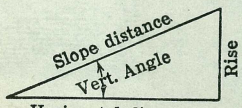
For Angle A. $\sin = \frac{a}{c}$, $\cos = \frac{b}{c}$, $\tan = \frac{a}{b}$, $\cot = \frac{b}{a}$, $\sec = \frac{c}{b}$, $\operatorname{cosec} = \frac{c}{a}$

Given	Required	
a, b	A, B, c	$\tan A = \frac{a}{b} = \cot B$, $c = \sqrt{a^2 + b^2} = a\sqrt{1 + \frac{b^2}{a^2}}$
a, c	A, B, b	$\sin A = \frac{a}{c} = \cos B$, $b = \sqrt{(c+a)(c-a)} = c\sqrt{1 - \frac{a^2}{c^2}}$
A, a	B, b, c	$B = 90° - A$, $b = a \cot A$, $c = \frac{a}{\sin A}$
A, b	B, a, c	$B = 90° - A$, $a = b \tan A$, $c = \frac{b}{\cos A}$
A, c	B, a, b	$B = 90° - A$, $a = c \sin A$, $b = c \cos A$,

Solution of Oblique Triangles

Given	Required	
A, B, a	b, c, C	$b = \frac{a \sin B}{\sin A}$, $C = 180° - (A + B)$, $c = \frac{a \sin C}{\sin A}$
A, a, b	B, c, C	$\sin B = \frac{b \sin A}{a}$, $C = 180° - (A + B)$, $c = \frac{a \sin C}{\sin A}$
a, b, C	A, B, c	$A + B = 180° - C$, $\tan \frac{1}{2}(A - B) = \frac{(a-b)\tan \frac{1}{2}(A+B)}{a+b}$, $c = \frac{a \sin C}{\sin A}$
a, b, c	A, B, C	$s = \frac{a+b+c}{2}$, $\sin \frac{1}{2}A = \sqrt{\frac{(s-b)(s-c)}{bc}}$, $\sin \frac{1}{2}B = \sqrt{\frac{(s-a)(s-c)}{ac}}$, $C = 180° - (A+B)$
a, b, c	Area	$s = \frac{a+b+c}{2}$, area $= \sqrt{s(s-a)(s-b)(s-c)}$
A, b, c	Area	area $= \frac{b c \sin A}{2}$
A, B, C, a	Area	area $= \frac{a^2 \sin B \sin C}{2 \sin A}$

REDUCTION TO HORIZONTAL



Horizontal distance = Slope distance multiplied by the cosine of the vertical angle. Thus: slope distance = 319.4 ft. Vert. angle = 5° 10′. From Table, Page IX. cos 5° 10′ = .9959. Horizontal distance = 319.4 × .9959 = 318.09 ft. Horizontal distance also = Slope distance minus slope distance times (1—cosine of vertical angle) With the same figures as in the preceding example, the following result is obtained. Cosine 5° 10′ = .9959. 1 — .9959 = .0041. 319.4 × .0041 = 1.31. 319.4 — 1.31 = 318.09 ft.

When the rise is known, the horizontal distance is approximately:—the slope distance less the square of the rise divided by twice the slope distance. Thus: rise = 14 ft., slope distance = 302.6 ft. Horizontal distance $= 302.6 - \frac{14 \times 14}{2 \times 302.6} = 302.6 - 0.32 = 302.28$ ft.