

DEPARTMENT OF MINES
SOUTH AUSTRALIA

RB 70/61

Geological Survey
Drafting Branch

Progress Report No. 2

Flinders Ranges Helicopter Survey
Elevation Control.

by

A.B. HACK
SURVEY ASSISTANT GRADE I

INDEXED

15.5.85 G.A.R.
Date Initials

DEPARTMENT OF MINES
SOUTH AUSTRALIA

Progress Report No. 2
Flinders Ranges Helicopter Survey
Elevation Control

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Equipment

Zeiss Ni025 Automatic Level DM. No. 36
2 double faced staffs
2 staff bubbles
2 transfer discs
2 x 350 ft. of $\frac{1}{4}$ " ski rope
Department of Lands concrete Benchmarks
Full steel droppers
Half steel droppers
Level Books 414 and 415

Rept. Bk. No. 70/61
G.S. No. 4449
DM. No. 584/69

20th April, 1970

DEPARTMENT OF MINES
SOUTH AUSTRALIA

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Elevation Control

INTRODUCTION

This report continues the survey requested by Exploration Geophysics in September, 1969 for Helicopter Survey Elevation Control Erkelens 1970.

The two sections in this report are firstly from Department of Lands Benchmark 1641 at Beltana via Warraweena and Arrowie to Department of Lands Benchmark 4930 at Edwards Well and secondly from Oraparinna BM7278 via Brachina Gorge to the Hawker-Copley main road on the west and Oraparinna via Martins Well to Department of Lands Benchmark 3649^A near Woolshed Well to the east.

The second traverse connected to the survey by S.C. WILLS from Hawker.

The one mile mosaics used were Beltana, Cadnia and Arrowie on the Copley four mile sheet for the first line and the one mile mosaics of Edeowie, Oraparinna, Reaphook and Willippa on the Parachilna four mile sheet for the second line.

The Lands Department supplied concrete benchmarks and allocated a block of Third Order Benchmarks Numbers as the results of this work would be useful to them and the actual benchmarks would later be incorporated into their level system.

FIELD WORK

The first section was started on the 20th October 1969 and completed on the 7th November 1969. This was the Beltana to Edwards Well line which was marked out at approximately one mile intervals. The department of Lands concrete Benchmarks were placed at every fourth mile with the brass plaque being left about four inches above ground. The other positions were marked by yellow topped half steel droppers driven firmly into the ground with about six inches left protruding and numbered aluminium tags were bolted on for identification.

The benchmarks were further marked by a ring of stones around the half steel droppers while the concrete benchmarks were marked by a full steel dropper and three radiating arms of stones.

The second section was similarly marked with all positions of benchmarks photo located on the appropriate mosaics where possible.

The concrete benchmarks were located in a level cleared area to enable the helicopter to land alongside the benchmark during the helicopter portion of the survey.

Both lines were levelled in one direction only but by the use of the double faced staffs an immediate check on the readings was available. The two vehicles each towed 350 ft. lengths of ski rope to enable rapid balancing of backsight and foresight distances.

The misclosure of 0.62 ft. on the Beltana to Edwards Well line was distributed over the whole line a distance of 94 miles.

The second traverse ran into closure difficulties due to roadworks on the Hawker-Copley main road which either destroyed or made relocation of Benchmarks impossible. Some fifteen miles of roadway were affected and this stretch included the Benchmarks originally intended for closure. A temporary measure

of using the top of the girders on the Brachina Creek Railway Bridge on the Port Augusta-Maree standard gauge railway was tried. From enquiries made to the Commonwealth Railways this value was obtained and resulted in a closure of 0.04 ft. on adjusted values.

The second traverse had in the meantime been adjusted with a value of BM7278 as obtained from BM3649A and from BM884 at Hawker by S.C. WILLS (Progress Report No. 3). This gave a traverse of 104 miles for a misclosure of 0.53 ft. 0.33 ft. was distributed over the section from Oraparinna (BM7278) to near Woolshed Well (BM3649A). The section from Oraparinna to Brachina Railway Bridge was recalculated on the adjusted value at BM7278 and the small misclosure left.

CONCLUSION

The method of using double faced staffs does not fully overcome the problem of errors and results obtained were generally outside the limits set for Third Order Levelling. However these specifications require the line to be levelled in both directions and the results obtained by using the double faced staff were sufficient for this project and the extra time required to meet the Third Order Levelling Specifications was not warranted.

Beltana Traverse misclosure 0.62 ft. Third Order value = $0.05\sqrt{\text{Mileage}}$ = 0.48 ft. max.

Oraparinna Traverse misclosure 0.53 ft. on closure with BM at Hawker. Third Order value 0.50 ft. max. Closure with Railway level gave 0.29 ft. with Third Order value 0.45 ft. max.

The misclosures on both traverses were in the same sense giving the impression that the readings are consistently reduced on backsights and increased on foresights.


A.B. HACK

SURVEY ASSISTANT GRADE I

ABH:FdA
20.4.70

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REFERENCES

ERKELENS, J., 1979. Flinders Ranges Helicopter Survey Elevation Control Progress Report No. 1, S.Aust. Dept. of Mines.

WILLS, S.C., 1970. Flinders Ranges Helicopter Survey Elevation Control Progress Report No. 3, S.Aust. Dept. of Mines.

COMPUTATIONS 3RD ORDER LEVELS

AREA , Flinders Ranges

FROM Beltana (BM1641 D+L

TO Edwards Well (BM4930 D+L)

DATE Nov. 1969

SURVEYOR A.B. HACK

INSTRUMENT Zeiss NL.025 BM.36 DATUM M.S.L. Pt. Adelaide = 0

LB 414	SECTION		(Miles) LENGTH		B.M.	OBSERV. ELEVTN.	CORR.	ADJTD ELEVTN	REMARKS
	PAGES	FROM	TO	SEC.	TOT.				
1		1641				1641	759.886		D+L B.M. (Concrete)
1		1641	6941	1.0	1.0	6941	791.50	+0.01	791.51 steel dropper
1		6941	6942	1.1	2.1	6942	831.07	+0.01	831.08 " "
2		6942	6943	0.9	3.0	6943	870.24	+0.02	870.26 " "
41		6943	6944	1.0	4.0	6944	908.06	+0.03	908.09 concrete
42		6944	6945	1.5	5.5	6945	975.86	+0.03	975.89 steel dropper
42		6945	6946	1.1	6.6	6946	980.40	+0.04	980.44 " "
43		6946	6947	1.0	7.6	6947	1051.55	+0.05	1051.60 " "
43		6947	6948	1.3	8.9	6948	1093.61	+0.06	1093.67 concrete
44		6948	6949	1.1	10.0	6949	1132.75	+0.06	1132.81 steel dropper
17		6949	6950	1.1	11.1	6950	1175.64	+0.07	1175.71 " "
16		6950	6951	1.0	12.1	6951	1214.09	+0.08	1214.17 " "
16		6951	6952	1.1	13.2	6952	1261.64	+0.08	1261.72 concrete
15		6942	6953	1.1	14.3	6953	1322.60	+0.09	1322.69 steel dropper
15		6953	6954	1.4	15.7	6954	1390.08	+0.10	1390.18 " "
14		6954	6955	0.8	16.5	6955	1416.52	+0.10	1416.62 " "
14		6955	6956	0.5	17.0	6956	1399.33	+0.11	1399.44 concrete
14		6956	6957	0.9	17.9	6957	1443.95	+0.12	1444.07 steel dropper
13		6957	6958	1.1	19.0	6958	1527.20	+0.13	1527.33 " "
13		6958	6959	1.0	20.0	6959	1685.90	+0.13	1686.03 " "
12		6959	6960	1.1	21.1	6960	1767.17	+0.14	1767.31 concrete
12		6960	6961	0.9	22.0	6961	1820.90	+0.15	1821.05 steel dropper
11		6961	6962	1.0	23.0	6962	1863.67	+0.15	1863.82 " "

COMPUTATIONS 3RD ORDER LEVELS

AREA Flinders Ranges

FROM Beltana

TO Edwards Well

DATE Nov. 1969 SURVEYOR A.B. HACK INSTRUMENT Zeiss Ni025 DM.36 DATUM M.S.L. Pt. Adelaide = 0

DATE	SURVEYOR	(Miles) LENGTH			B.M.	OBSERV. ELEVTN.	CORR.	ADJTD ELEVTN	REMARKS
LB 414	SECTION		SEC.	TOT.					
PAGES	FROM	TO							
10	6962	6963	1.1	24.1	6963	1906.84	+0.16	1907.00	steel dropper
10	6963	6964	1.0	25.1	6964	2082.79	+0.17	2082.96	concrete
9	6964	6965	1.2	26.3	6965	2175.83	+0.17	2176.00	steel dropper
9	6965	6966	0.9	27.2	6966	2220.07	+0.18	2220.25	" "
8	6966	6967	1.0	28.2	6967	2224.44	+0.19	2224.63	" "
8	6967	6968	1.2	29.4	6968	2146.16	+0.20	2146.36	concrete
7	6968	6969	0.9	30.3	6969	2059.23	+0.20	2059.43	steel dropper
7	6969	6970	1.4	31.7	6970	1988.83	+0.21	1989.04	" "
6	6970	6971	0.7	32.4	6971	1949.93	+0.22	1950.15	" "
6	6971	6972	1.3	33.7	6972	1894.73	+0.22	1894.95	concrete
5	6972	6973	1.0	34.7	6973	1848.41	+0.23	1848.64	steel dropper
5	6973	6974	1.3	36.0	6974	1789.71	+0.24	1789.95	" "
4	6974	6975	0.9	36.9	6975	1791.67	+0.25	1791.92	" "
4	6975	6976	0.8	37.7	6976	1763.46	+0.25	1763.71	concrete
4	6976	6977	1.0	38.7	6977	1737.27	+0.26	1737.53	steel dropper
3	6977	6978	1.0	39.7	6978	1702.99	+0.27	1703.26	" "
3	6978	6979	1.0	40.7	6979	1643.39	+0.27	1643.66	" "
2	6979	6980	1.6	42.3	6980	1520.04	+0.28	1520.32	concrete
18	6980	6981	1.0	43.3	6981	1510.75	+0.29	1511.04	steel dropper
18	6981	6982	1.0	44.3	6982	1538.81	+0.29	1539.10	" "
18	6982	6983	1.1	45.4	6983	1508.72	+0.30	1509.02	" "
19	6983	6984	1.0	46.4	6984	1654.67	+0.31	1654.98	concrete
19	6984	6985	1.2	47.6	6985	1801.33	+0.32	1801.65	steel dropper

COMPUTATIONS 3RD ORDER LEVELS

AREA Flinders Ranges

FROM Beltana

TO Edwards Well

DATE Nov. 1969 SURVEYOR A.B. HACK INSTRUMENT Zeiss Ni025 DM36 DATUM M.S.L. Pt. Adelaide = 0

LB 414	SECTION		(Miles) LENGTH		B.M.	OBSERV. ELEVTN.	CORR.	ADJTD ELEVTN	REMARKS
	PAGES	FROM	TO	SEC.	TOT.				
20		6985	6986	0.9	48.5	6986	1781.01	+0.32	1781.33 steel dropper
21		6986	6987	0.9	49.4	6987	1795.57	+0.33	" " "
21		6987	6988	1.2	50.6	6988	1638.06	+0.34	1638.40 concrete
22		6988	6989	1.0	51.6	6989	1584.38	+0.34	1584.72 steel dropper
22		6989	6990	1.0	52.6	6990	1526.03	+0.35	1526.38 " "
23		6990	6991	1.0	53.6	6991	1459.77	+0.36	1460.13 " "
23		6991	6992	1.1	54.7	6992	1375.34	+0.36	1375.70 concrete
24		6992	6993	0.8	55.5	6993	1348.05	+0.37	1348.42 steel dropper
24		6993	6994	1.0	56.5	6994	1388.37	+0.38	1388.75 " "
25		6994	6995	1.2	57.7	6995	1403.50	+0.39	1403.89 " "
25		6995	6996	1.3	59.0	6996	1278.52	+0.39	1278.91 concrete
26		6996	6997	0.9	59.9	6997	1204.07	+0.40	1204.47 steel dropper
26		6997	6998	1.0	60.9	6998	1131.70	+0.41	1132.11 " "
27		6998	6999	1.1	62.0	6999	1072.84	+0.41	1073.25 " "
27		6999	7000	1.0	63.0	7000	1010.68	+0.42	1011.10 concrete
28		7000	7001	1.0	64.0	7001	938.56	+0.43	938.99 steel dropper
28		7001	7002	1.0	65.0	7002	876.67	+0.43	877.10 " "
29		7002	7003	1.1	66.1	7003	816.16	+0.44	816.60 " "
29		7003	7004	1.0	67.1	7004	813.83	+0.45	814.28 concrete
30		7004	7005	1.1	68.2	7005	760.51	+0.46	760.97 steel dropper
30		7005	7006	1.1	69.3	7006	796.47	+0.46	796.93 " "
31		7006	7007	1.0	70.3	7007	771.11	+0.47	771.58 " "
31		7007	7008	0.8	71.1	7008	765.63	+0.48	766.11 concrete

COMPUTATIONS 3RD ORDER LEVELS

AREA Flinders Ranges

FROM Beltana (BM1641) D↑L

TO Edwards Well (BM4930)
D+L

DATE Nov. 1969 SURVEYOR A.B. HACK INSTRUMENT Zeiss Ni025 DATUM M.S.L. Pt. Adelaide = 0

LB 414	SECTION		(Miles) LENGTH		B.M.	OBSERV. ELEVTN.	CORR.	ADJTD ELEVTN	REMARKS
PAGES	FROM	TO	SEC.	TOT.					
31	7008	7009	1.3	72.4	7009	701.42	+0.48	701.90	steel dropper
32	7009	7010	1.0	73.4	7010	642.36	+0.49	642.85	" "
32	7010	7011	1.0	74.4	7011	628.83	+0.50	629.33	" "
33	7011	7012	1.1	75.5	7012	558.95	+0.50	559.55	concrete
33	7012	7013	1.1	76.6	7013	507.99	+0.51	508.50	steel dropper
34	7013	7014	1.3	77.9	7014	331.05	+0.52	331.57	" "
35	7014	7015	1.1	79.0	7015	268.40	+0.52	268.92	" "
35	7015	7016	1.0	80.0	7016	226.92	+0.53	227.45	concrete
36	7016	7017	1.0	81.0	7017	190.54	0.54	191.08	steel dropper
36	7017	7018	1.0	82.0	7018	158.04	+0.55	158.59	" "
36	7018	7019	0.8	82.8	7019	134.60	+0.55	135.15	" "
37	7019	7020	1.3	84.1	7020	106.15	+0.56	106.71	concrete
37	7020	7021	1.0	85.1	7021	108.86	+0.57	109.43	steel dropper
38	7021	7022	1.2	86.3	7022	102.46	+0.57	103.03	" "
38	7022	7023	1.0	87.3	7023	96.90	+0.58	97.48	" "
39	7023	7024	1.0	88.3	7024	90.06	+0.59	90.65	" "
39	7024	7025	1.1	89.4	7025	80.45	+0.60	81.05	" "
40	7025	7026	1.3	90.7	7026	66.43	+0.60	67.03	" "
40	7026	7027	1.1	91.8	7027	65.16	+0.61	65.77	" "
40	7027	7028	1.0	92.8	7028	55.26	+0.61	55.87	" "
41	7028	4930	0.9	93.7	4930	43.273	+0.619	43.892	D+L B.M. concrete
					3rd order misclosure = 0.484 max.				

COMPUTATIONS 3RD ORDER LEVELS

AREA Flinders Ranges FROM Oraparinna (BM7278) TO Brachina Creek Rlwy. Bridge

DATE Feb. 1970 SURVEYOR A.B. HACK INSTRUMENT Zeiss Ni025 DM.36 DATUM M.S.L. Pt. Adelaide = 0

LB 414	SECTION		(Miles) LENGTH		B.M.	OBSERV. ELEVTN.	CORR.	ADJTD ELEVTN	REMARKS
			SEC.	TOT.					
PAGES	FROM	TO							
45					7278	1863.55	+0.33	1863.88	steel dropper (vide test)
45	7278	7279	1.0	1.0	7279	1801.25	"	1801.58	concrete
46	7279	7280	1.0	2.0	7280	1682.72	"	1683.05	steel droppers
46	7280	7281	1.1	3.1	7281	1600.05	"	1600.38	" "
47	7281	7282	1.0	4.1	7282	1516.43	"	1516.76	" "
47	7282	7283	0.9	5.0	7283	1418.62	"	1418.95	concrete
48	7283	7284	1.0	6.0	7284	1384.82	"	1385.15	steel dropper
48	7284	7285	1.0	7.0	7285	1325.76	"	1326.09	" "
49	7285	7286	1.0	8.0	7286	1317.87	"	1318.20	" "
49	7286	7287	1.0	9.0	7287	1194.85	"	1195.18	concrete
50	7287	7288	1.0	10.0	7288	1133.78	"	1134.11	steel dropper
50	7288	7289	1.0	11.0	7289	1066.63	"	1066.96	" "
51	7289	7290	1.0	12.0	7290	962.22	"	962.55	" "
51	7290	7291	0.8	12.8	7291	961.12	"	961.45	concrete
52	7291	7292	1.2	14.0	7292	865.08	"	865.41	steel dropper
52	7292	7293	1.0	15.0	7293	810.06	"	810.39	" "
53	7293	7294	1.6	16.6	7294	742.12	"	742.45	" "
53	7294	7295	0.6	17.2	7295	707.23	"	707.56	Concrete
54	7295	7296	1.0	18.2	7296	713.58	"	713.91	steel dropper
54	7296	7297	1.1	19.3	7297	601.68	"	602.01	" "
LB415/P20	7297	7298	0.9	20.2	7298	568.95	"	569.28	" "
20	7298	7299	1.1	21.3	7299	531.66	"	531.99	concrete
21	7299	7300	1.0	22.3	7300	499.86	"	500.19	steel dropper

COMPUTATIONS 3RD ORDER LEVELS

AREA Flinders Ranges

FROM Oraparinna

TO Brachina Creek Rlwy. Bridge

DATE Feb. 1970 SURVEYOR A.B. HACK

INSTRUMENT Zeiss Ni025 DM.36 DATUM M.S.L. Pt. Adelaide = 0

[illegible]

COMPUTATIONS 3RD ORDER LEVELS

AREA Flinders Ranges FROM Oraparinna (BM7278) TO NEAR Woolshed Well BM3649^A

DATE Feb. 1970 SURVEYOR A.B. HACK INSTRUMENT Zeiss Ni025 DM.36 DATUM M.S.L. Pt. Adelaide = 0

LB 415	SECTION		(Miles) LENGTH		B.M.	OBSERV. ELEVTN.	CORR.	ADJTD ELEVTN	REMARKS
	PAGES	FROM	TO	SEC.	TOT.				
1					7278	1863.55	+0.33	1863.88	steel dropper (vide text)
1		7278	7321	1.1	1.1	7321	1857.45	+0.33	1857.78 " "
1		7321	7322	1.0	2.1	7322	1934.00	+0.32	" "
2		7322	7323	1.1	3.2	7323	1854.90	+0.31	concrete
2		7323	7324	1.0	4.2	7324	1738.75	+0.31	steel dropper
3		7324	7325	1.0	5.2	7325	1656.79	+0.30	" "
3		7325	7326	1.0	6.2	7326	1610.05	+0.30	" "
4		7326	7327	1.0	7.2	7327	1570.51	+0.29	concrete
4		7327	7328	1.1	8.3	7328	1501.95	+0.29	steel dropper
5		7328	7329	1.0	9.3	7329	1448.49	+0.28	" "
5		7329	7330	1.0	10.3	7330	1492.97	+0.28	" "
5		7330	7331	1.1	11.4	7331	1430.13	+0.27	concrete
6		7331	7332	1.0	12.4	7332	1328.53	+0.27	steel dropper
6		7332	7333	1.0	13.4	7333	1201.66	+0.26	" "
7		7333	7334	1.1	14.5	7334	1095.34	+0.26	" "
8		7334	7335	1.1	15.6	7335	1035.29	+0.25	concrete
8		7335	7336	1.0	16.6	7336	987.40	+0.25	steel dropper
8		7336	7337	1.0	17.6	7337	917.02	+0.24	" "
9		7337	7338	1.1	18.7	7338	846.06	+0.23	" "
9		7338	7339	1.0	19.7	7339	777.18	+0.23	concrete
10		7339	7340	1.0	20.7	7340	761.14	+0.22	steel dropper
10		7340	7341	1.2	21.9	7341	730.13	+0.21	" "
27		7341	7342	1.0	22.9	7342	672.33	+0.20	" "

COMPUTATIONS 3RD ORDER LEVELS

AREA Flinders Ranges

FROM Oraparinna

TO Near Woolshed Well

DATE Feb. 1970

SURVEYOR A.B. HACK

INSTRUMENT Zeiss Ni025 DM.36

DATUM M.S.L. Pt. Adelaide = 0

LB 415 PAGES	SECTION		(Miles) LENGTH		B.M.	OBSERV. ELEVTN.	CORR.	ADJTD ELEVTN	REMARKS
	FROM	TO	SEC.	TOT.					
26	7342	7343	1.1	24.0	7343	625.65	+0.20	625.85	concrete
26	7343	7344	0.8	24.8	7344	857.73	+0.20	587.93	steel dropper
26	7344	7345	1.2	26.0	7345	559.84	+0.19	560.03	" "
25	7345	7346	1.0	27.0	7346	566.01	+0.19	566.20	" "
25	7346	7347	1.0	28.0	7347	566.93	+0.18	567.11	concrete
24	7347	7348	1.1	29.1	7348	563.36	+0.18	563.54	steel dropper
24	7348	7349	1.0	30.1	7349	554.85	+0.17	555.02	" "
24	7349	7350	1.1	31.2	7450	566.85	+0.17	567.02	" "
23	7350	7351	0.9	32.1	7351	578.44	+0.16	578.60	concrete
23	7351	7352	1.2	33.3	7352	570.17	+0.16	570.33	steel dropper
23	7352	7353	1.0	34.3	7353	551.98	+0.15	552.13	" "
19	7353	7354	0.9	35.2	7354	582.27	+0.14	582.41	" "
19	7354	7355	1.0	36.2	7355	596.34	+0.13	596.47	concrete
18	7355	7356	1.0	37.2	7356	656.50	+0.13	656.63	steel dropper
18	7356	7357	1.0	38.2	7357	693.26	+0.12	693.38	" "
17	7357	7358	1.1	39.3	7358	657.19	+0.12	657.31	" "
17	7358	7359	1.1	40.4	7359	592.01	+0.11	592.12	concrete
16	7359	7360	1.0	41.4	7360	529.34	+0.11	529.45	steel dropper
16	7360	7361	1.1	42.5	7361	478.38	+0.10	478.48	" "
15	7361	7362	1.1	43.6	7362	447.24	+0.10	447.34	" "
15	7362	7363	1.0	44.6	7363	401.12	+0.09	401.21	concrete
15	7363	7364	1.0	45.6	7364	399.00	+0.09	399.09	steel dropper
14	7364	7365	1.0	46.6	7365	374.97	+0.08	375.05	" "

COMPUTATIONS 3RD ORDER LEVELS

AREA Flinders Ranges

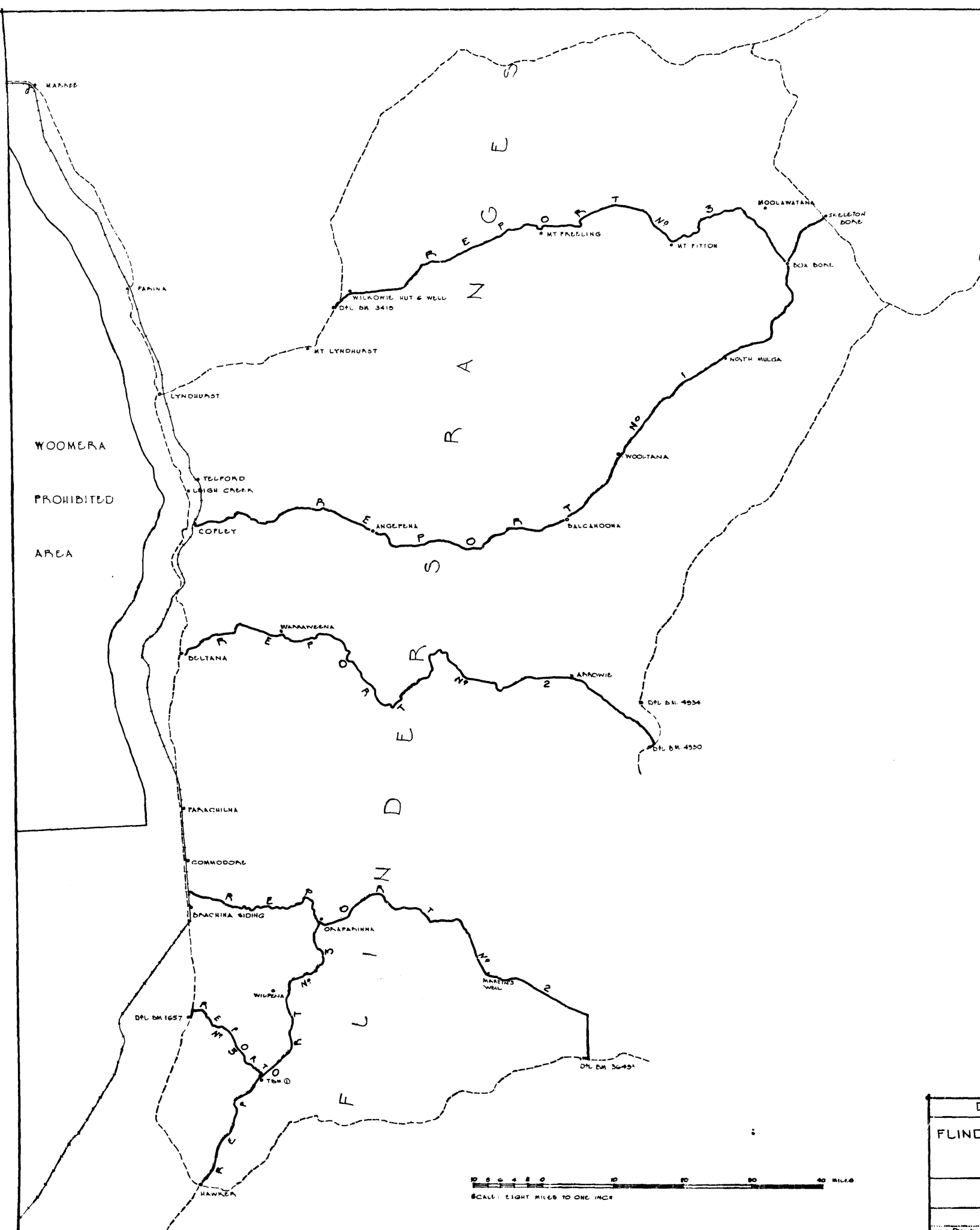
FROM Oraparinna (BM7278)

TO Near Woolshed Well (BM3649A D L),

DATE Feb. Feb. 1970 SURVEYOR A. B. HACK

INSTRUMENT Zeiss Ni025 DM.36 DATUM M.S.L. Pt. Adelaide = 0

[illegible]



DEPARTMENT OF MINES - SOUTH AUSTRALIA			
FLINDERS RANGES HELICOPTER SURVEY			
ELEVATION CONTROL LINES			
	Drawn S.C.W.	Scale	AS SHOWN
	Ted	DRS.	70/217
	Urd	C.F.	
	Ed	DATE	31 st MARCH 1970
Director of Mines			