1962/93
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COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

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RECORD No. 1962/93

SLATY CREEK DAM SITE GEOPHYSICAL SURVEY NEAR CLONCURRY,

QUEENSLAND 1960

by

W. A. WIEBENGA and P. E. MANN

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ILLUSTRATIONS

SUMMARY

This Record describes a geophysical survey on proposed dam sites in Slaty Creek, 15 miles south-west of Cloncurry, Queensland, made at the request of the Irrigation and Water Supply Commission.

Geological evidence in the area shows the major problem to be considered in selecting a suitable dam site is the permeability of the bedrock; this is caused by faulting or shearing, and by jointing and leaching of the calcareous sandstone.

Two alternative schemes were proposed. The first one involved construction of dams at sites A1 and A2; the second one involved construction of a dam at site B only.

The geophysical investigation indicates a probable fault or shear pattern. Sites A1 and A2 are unfavourable because the bedrock is fractured too much and weathering is very deep. Site B is more favourable, but the centre line would be intersected by two faults.

Some suggestions are made for further drilling and testing of water-loss from the drill holes along Traverse Z.

1. INTRODUCTION

The town of Cloncurry draws its water supply from a bore located in the Cloncurry River. Since 1956, McIntyre and Associates, consulting civil engineers to the Cloncurry Shire Council, have made preliminary surveys of a possible dam site on Slaty Creek, approximately 15 miles south-west of Cloncurry. The approximate co-ordinates of the site are 333387 on the Cloncurry sheet of the Australia 4-mile series.

The purpose of the dam is for water storage and to provide the township with an improved water supply for domestic, agricultural, and industrial uses. Two schemes have been suggested (see site plan on Plate 3); viz the construction of a single earth and rock-fill dam at site B, or the construction of two earth and rock-fill dams at sites A1 and A2. An excavated spillway-channel and a gravity-feed pipeline to the Cloncurry township are included in both schemes.

A geological investigation of the dam-sites, spillway area, and reservoir perimeter was made by the Department of Development and Mines, Geological Survey of Queensland (Watkins and Shipway, 1960) between January and July 1960. The dam-site area was mapped geologically by McIntyre and Associates (Williams, 1960). Contract diamond drilling and testing of loss of water from the drill holes was carried out for the consulting engineers at sites A1, A2, and B, and at the spillway site.

A geophysical survey of the dam sites and spillway area was undertaken by the Bureau of Mineral Resources, Geology and Geophysics, at the request of the Irrigation and Water Supply Commission of Queensland, on behalf of the Cloncurry Shire Council. The Bureau's geophysical party consisted of P.E. Mann (geophysicist and party leader), D.J. Harwood (geophysicist), and J.P. Pigott (geophysical assistant); four field assistants were supplied by the Commission. The field work at Slaty Creek was done from the 30th June to 22nd July 1960.

McIntyre and Associates carried out the topographical surveying of the sites.

2. GEOLOGY

The regional geology of the Slaty Creek area is described by Carter (1959) and the more detailed geology of the dam sites by Williams (1960) and Watkins and Shipway (1960).

The area is part of the Cloncurry Mineral Field in which copper, lead, gold, and other minerals have been deposited in metamorphosed and highly altered rocks of Precambrian age. These rocks, comprising sediments and igneous rocks, have been extensively folded and faulted and are, in general, deeply weathered; the topography is moderately hilly.

Williams (1960) differs slightly from Watkins and Shipway (1960) in the petrological description of the rock types and the geological boundaries in the dam site area; they also disagree on the tectonics of the area. Plate 2 is the geological map presented by Watkins and Shipway. A general description of the rock types after Watkins and Shipway is as follows:

Calcareous sandstone, sandstone and iron oxide rocks. Geological evidence strongly suggests that these three rock types were formed from a single stratigraphical unit. The calcareous sandstone now present may be taken as the original parent material.

The calcareous sandstone group is a diverse assemblage and includes sandy limestone, argillaceous limestone, and calcareous sandstone, generally containing variable amounts of carbonate. The carbonate is probably of two origins, namely deposited clastic grains and carbonate introduced during diagenesis. The dark-grey rocks are usually unweathered except on joint planes.

The light-grey to fawn, variably porous, fine to medium-grained sandstone probably represents calcareous sandstone that has been leached by ground water. Iron-stained joints dissecting the rock are common.

The term 'iron oxide rocks' includes sheared sandstone, breccia, haematite-quartz and haematite-carbonate rock and iron-stained sandstone. The rock types probably represent the result of leaching and ferruginisation in brecciated faults or shear zones.

Mudstone, a fine-grained rock, partially recrystallized at depth, was mapped on the right abutment of site A2 and in diamond-drill holes 11, 11A, and 12.

Slate, partly graphitic, and fine-grained, with poorly developed jointing, tends to grade into the thin-bedded quartzite.

Thin-bedded quartzite bands separated by massive quartzite have been mapped. The beds range from 2 or 3 in. thick to 3 or 4 ft thick and often grade laterally into the massive quartzite. The thin-bedded quartzite is generally darker in colour and of finer grain than the massive quartzite.

Massive quartzite veins and segregations of quartz are common, and bedding is indistinguishable. The rock is criss-crossed with joints.

Tectonic breccia, although not a stratigraphic unit, is mapped as a rock type. Quartzite breccia, sandstone breccia, and heavily-iron-stained rock make up the bulk of the assemblage; mudstone breccia and slate breccia are also present.

Evidence of faulting in the dam-site area is indicated by the outcrop of tectonic breccia on the right abutment of site A2. Heavy fracturing has been observed in drill cores and in the slate outcrop to the east. The brecciation and fracturing are a major structural feature which can be traced south along the ridge for at least 1000 ft. To the north of the centreline of site A2 the breccia disappears under talus material and alluvium and has not been mapped on the opposite side of the valley.

The southern edge of the 'island' near Y12 is covered mainly with iron oxide and breccia. It is therefore probable that a major fault zone striking approximately east is present along the edge of the island, passes underneath the alluvium, and then cuts across the axis of site B. The presence of this fault would adequately explain the dislocation of the bedding and the non-continuation of the tectonic breccia previously described. The dominant direction of the jointing is 080 to 110 degrees magnetic, with a variable southerly dip. Minor feather-faults from the major fault can be seen along the quartzite ridge from site B. A minor strike-fault appears to be present between the units that are mapped as thin-bedded massive quartzite.

Outcrops at site A1 near X21 strike approximately 135-140 degrees magnetic with a dip of 50 to 60 degrees to the east. On the left abutment of site B the strike is approximate 60 degrees with a steep easterly dip. On the right abutment at the same site, and on the ridge past site A1, the strike varies between 000 and 020 degrees magnetic with a dip of 70 degrees to the east.

3. METHODS AND EQUIPMENT

Seismic refraction method

In engineering seismic investigations the velocities of longitudinal and transverse waves can frequently be correlated with, and used to identify, different rock-types, and degree of weathering, jointing, or shearing near the surface. They provide data from which the elastic constants of the rocks may be determined (Leet, 1950, p. 45-46).

For a description of the seismic refraction method, reference is made to Heiland (1946, p. 548), and Polak and Hawkins (1956, p. 3).

The seismic equipment used during this survey was a 12-channel Midwestern refraction/reflection seismograph. TIC geophones having a natural frequency of 20 c/s were used to detect longitudinal waves. The following types of spread were shot:

Weathering spreads: These were used to obtain the thickness and seismic velocity of soil and surface layers. Geophones were spaced 10 ft apart and shots were fired 10, 50, and 100 ft beyond each end of the spread, and in line with it.

Normal spreads: Geophones were spaced 50 ft apart. Shots were fired 50 ft and 200 ft or more beyond each end of the spread, and in line with it.

Resistivity method

The resistivity method (Jakosky, 1949) was used to confirm the presence of fault or shear zones that were indicated by the seismic method. Fracturing or brecciation (by faulting or shearing) increase the porosity of a rock, and assuming that the pore space is filled with liquid, the rock resistivity is lowered. Hence, in resistivity traversing with Wenner electrode spacings of 50 or 100 ft, zones of low apparent-resistivity will indicate or confirm the presence of fault or shear zones.

The equipment used consisted of a YEW earth resistance meter, and 'Tellohm' meter.

Magnetic method

The magnetic method (Jakosky, 1949, p.161-231) involves measuring differences in the Earth's magnetic field from place to place; these differences are caused by uneven distribution of rocks of different magnetic susceptibility. Usually differences in the vertical magnetic intensity are measured. In certain areas magnetic anomalies can indicate features such as faults, dykes, and boundaries between near-surface formations. In some areas magnetic measurements can be used to obtain approximate depth estimates to a basement covered with sediments.

For the magnetic measurements an Askania variometer was used.

4. RESULTS

Seismic velocities

Seismic velocities, as measured by the seismic refraction method, are characteristic of certain rock types. Hence, if some geological control is available, these velocities may be used to identify rocks in geological terms. The following table shows an interpretation of measured velocities in geological terms, prepared with the help of the available geological information.

Longitudinal wave velocity (ft/sec)	Rock type
1000 ±	Soil
2000 to 3000	Scree material, valley-flank deposits, not water-saturated.
3000 to 4500	Alluvium, predominantly clay, water-saturated
4500 to 6000	Alluvium, predominantly sand and gravel, water-saturated
3000 to 7000	Decomposed, very-weathered to weathered bedrock
7000 to 13,000	Sheared, fractured, or jointed bedrock, slightly-weathered to weathered or recemented. Seismic velocity across shear or fault zone is generally lower than in direction of shear or fault; this is called velocity anisotropy.
13,000 to 17,000	Slightly weathered and/or fractured bedrock to unweathered bedrocks. Rocks may be more or less recemented.
17,000 or more	Silicified rocks, recemented unweathered rocks

The identification of rock types, however, can be ambiguous; e.g. a measured seismic velocity of 6000 ft/sec could represent either weathered bedrock or compact, water-saturated alluvial sediments.

Plate 3 shows the seismic velocities measured in the deepest refractor observed in the bedrock. These velocities vary considerably; this is caused by variations in fracturing, weathering, or rock type.

Difference in velocities measured on two traverses at their intersection is named 'velocity anisotropy', and may be explained by assuming that the velocity along the joint or fracture planes is greater than the velocity across these planes. On Plate 3 this may be observed at the intersection of Traverses Y and YA; Z, ZB, and ZA; ZA and ZAA; Z and ZC; X and XB; W and WA.

Cross-sections and profiles

Plate 5, 6, and 7 show the seismic cross-sections, with resistivity and magnetic profiles. Plate 4 shows a bedrock contour plan, constructed from the deepest refractors of the seismic cross-sections of Plates 5 and 6. The plates are self-explanatory and a discussion will be limited to some notable features.

On Traverse W (Plate 7) the deep feature near the intersection with Traverse WA is interpreted as a fault or shear zone. Drill holes 17, 18, 19, and 20 (see Plate 8) all terminate in highly-weathered rock of about 7000-ft/sec seismic velocity. The deep shear zone is not clearly shown along Traverse WA, probably because the depths are computed from seismic waves that are refracted from the side of the shear zone. In this locality the shear zone is probably approximately parallel to Traverse WA.

On Traverse Y (see Plate 8) the drilling data show that the 8000 to 10,000-ft/sec seismic refractor corresponds to an iron oxide rock (Watkins, 1960, Plate E11-2). The depth to the unweathered or slightly-weathered bedrock is not known but the drilling data indicate that between Y5 and Y6 the depth exceeds 150 ft.

A study of the seismic velocities within the lowest refractor (see Plate 3) and the resistivity values (Plates 5 and 6) discloses a probable pattern of major shears or faults:

- F_1 a fault or shear zone, approximately through ZC6, Z9, and YA3.
- F_2 a fault or shear zone, through Z19, ZC20, X5, and XA13.
- F_3 a fault or shear zone, through ZB18, YA4, ZA21, and XB8.
- F_4 a fault or shear zone, through XA11, X8, and XB13.

E_1 of Plate 2 is based on the location of the brecciated iron oxide rocks and the consideration that Slaty Creek probably flows through a gap in the ridge, formed by faulting (Watkins, 1960, p. 6). F_1, based on geophysical data, takes the place of E_1.

F_1, F_2, F_3, and F_4 are plotted on the inset (site plan) of Plate 3 (scale 1 inch to 1000 ft). Viewed in this scale, the fault pattern suggests that the isolated ridge (passing through ZAA12) referred to as 'island' by Watkins (1960, p.5), was displaced from its position between the northern and southern ridges by faulting along F_1 and F_2. Probably additional block-faulting took place along F_2 and F_4.

Accuracy

An estimate of the accuracy by comparing the seismic results with the drilling results (Plate 8) is difficult because:

(a) The drill-core recovery is low and the drilling logs are not reliable (Watkins, 1960).

(b) There are marked differences in weathering in both vertical and horizontal directions.

(c) On Traverse W the drill holes terminated in weathered bedrock, and on Traverse Y the deepest refractor mapped coincided with a horizon of iron oxide rock.

Only on Traverse X the calculated depth to the deepest refractor is roughly the same as the depth to a partly weathered and leached bedrock. Past experience shows that in this type of terrain depth estimates from seismic work are usually not better than within 20 per cent.

5. CONCLUSION

One of the major problems in selecting a dam site in this area is that the geological evidence shows that the bedrock is permeable in many places. A dam on a permeable bedrock would allow considerable water-leakage. Permeable bedrock is associated with faulting and shearing, jointing and fracturing. Because these characteristics of a permeable bedrock are also associated with low seismic velocities and relatively high porosities, investigation with seismic and resistivity methods can indicate the critical localities where the bedrock may be tested in more detail by drilling and by tests of water-loss in drill holes.

Seismic and resistivity work have shown that at sites A1 (Traverse X) and A2 (Traverse Y) bedrock is extensively fractured and very deeply weathered and consequently the site is probably unsuitable.

Site B (Traverse Z) seems more favourable, but the centre line of the dam is intersected by two faults F_1 and F_2 (see Plates 3 and 4). The critical places to be tested by drilling and water-loss tests are, in order of priority: between Z7 and Z10, at Z19, and between Z3 and Z4.

6. REFERENCES

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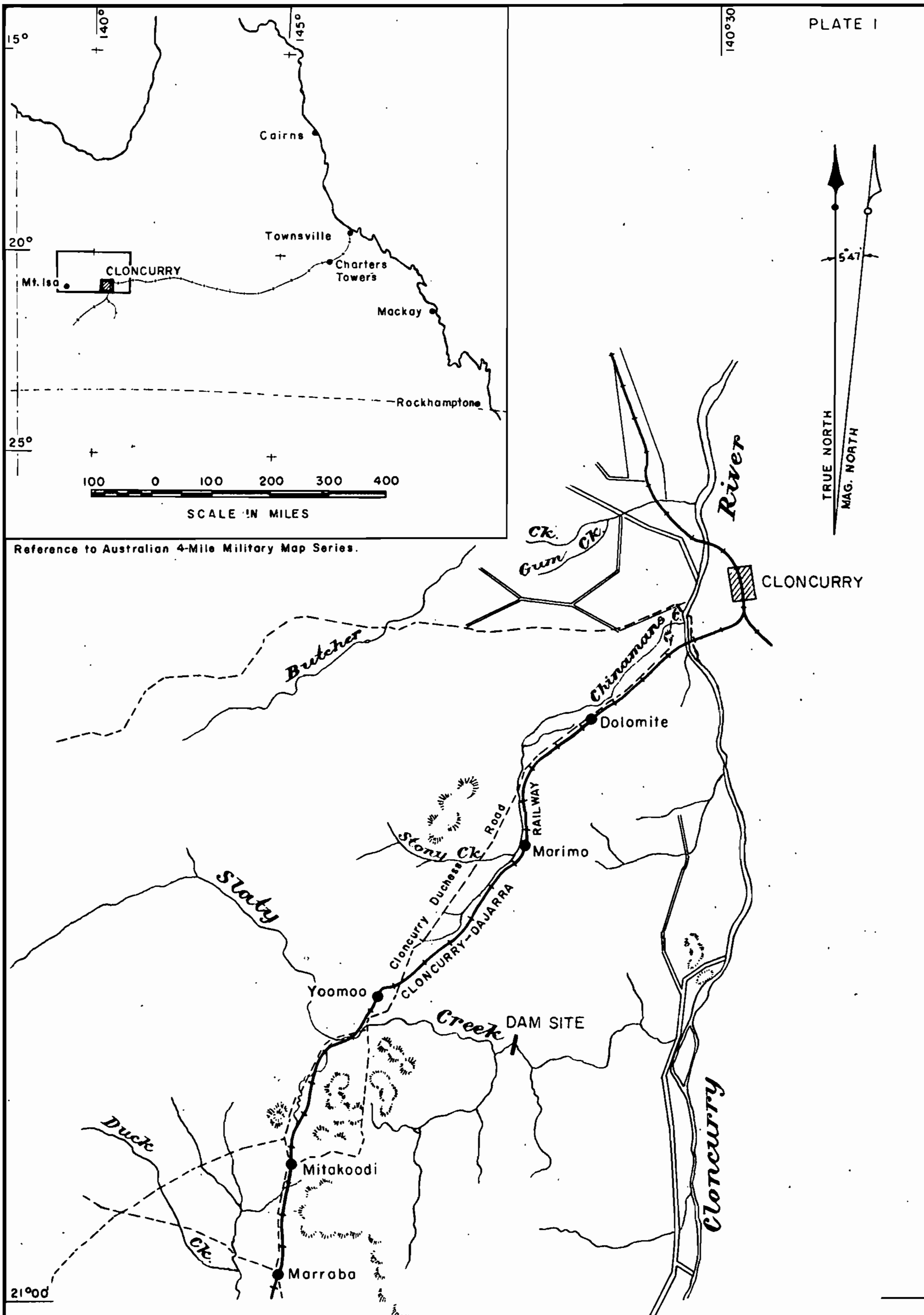


SLATY CREEK DAM SITE,
GEOPHYSICAL SURVEY, QUEENSLAND, 1960

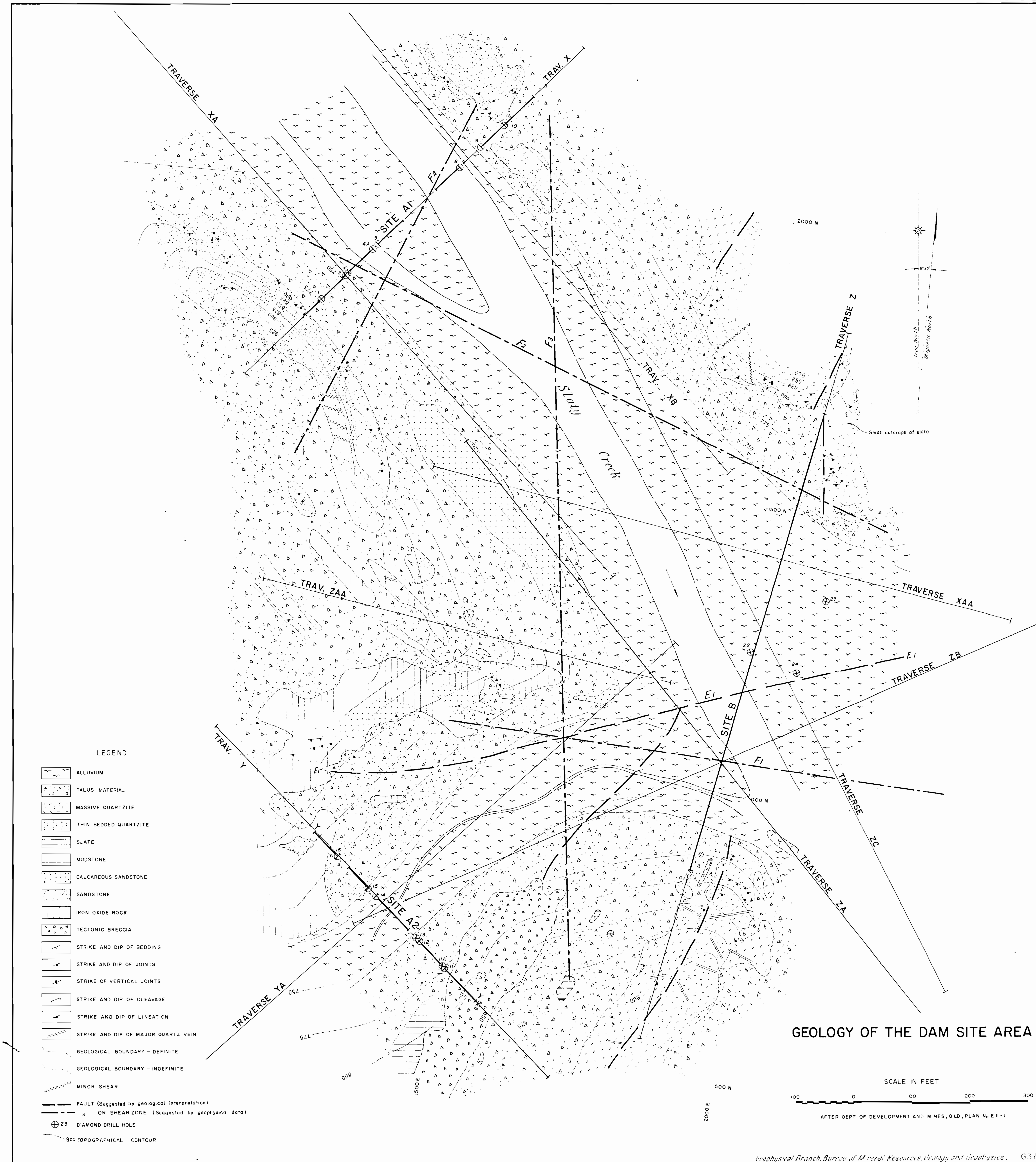
LOCALITY MAP

SCALE IN MILES

4 3 2 1 0 2 4 8

Geophysical Branch, Bureau of Mineral Resources, Geology & Geophysics G 379 - 2

To Accompany Record No. 1962/93



SLATY CK AREA, QLD.

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To Accompany Report No 1962/93

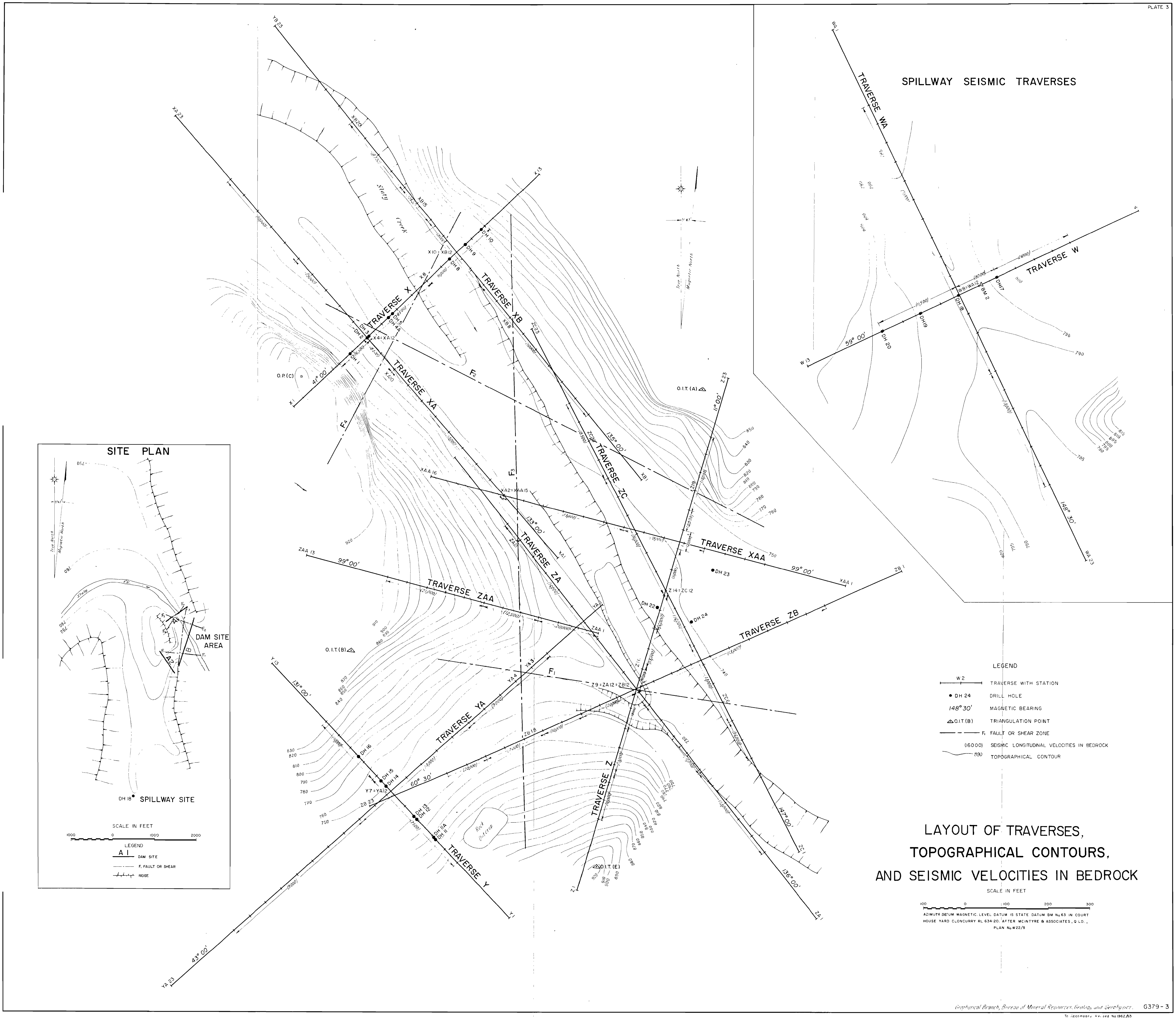
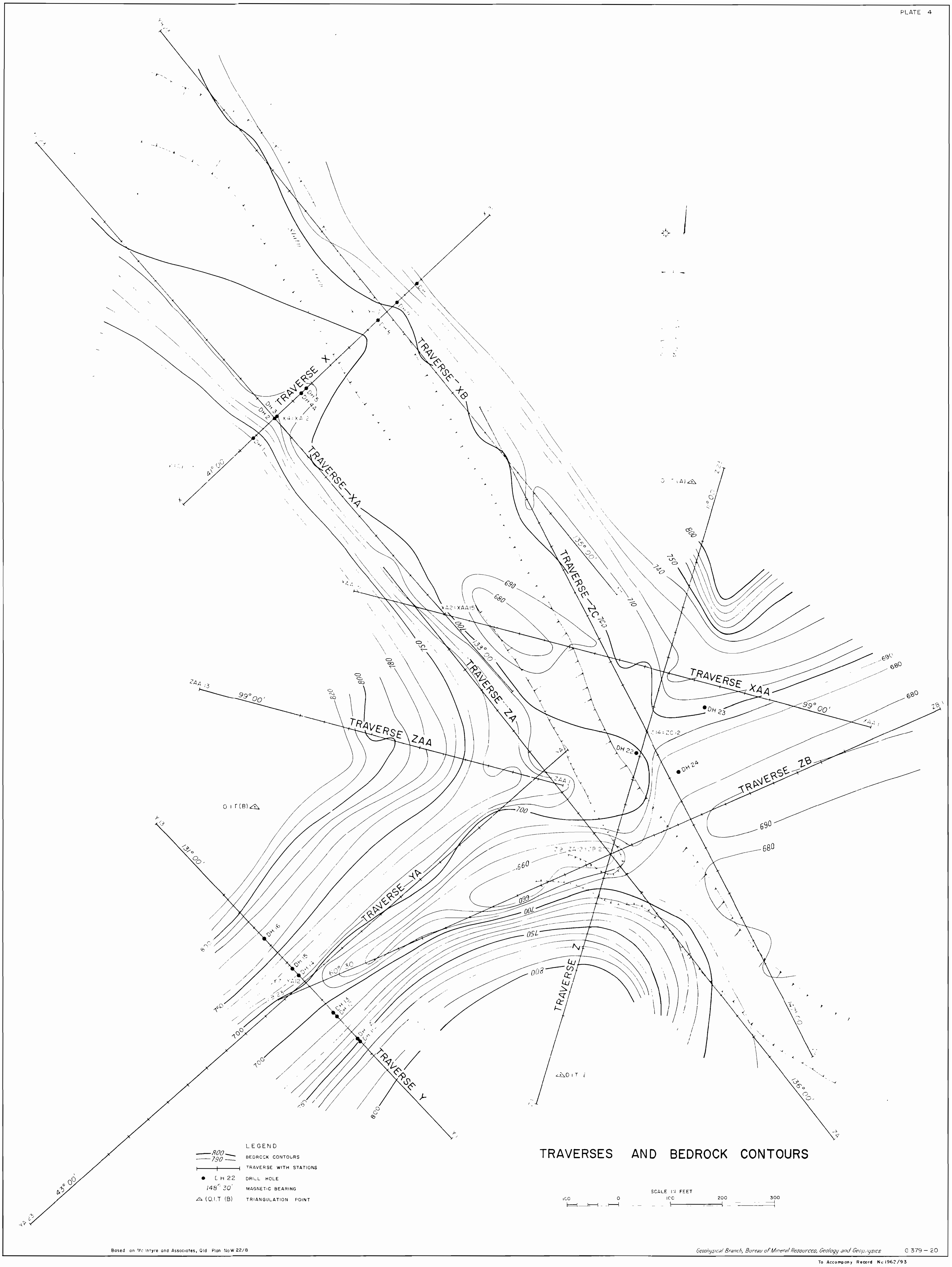


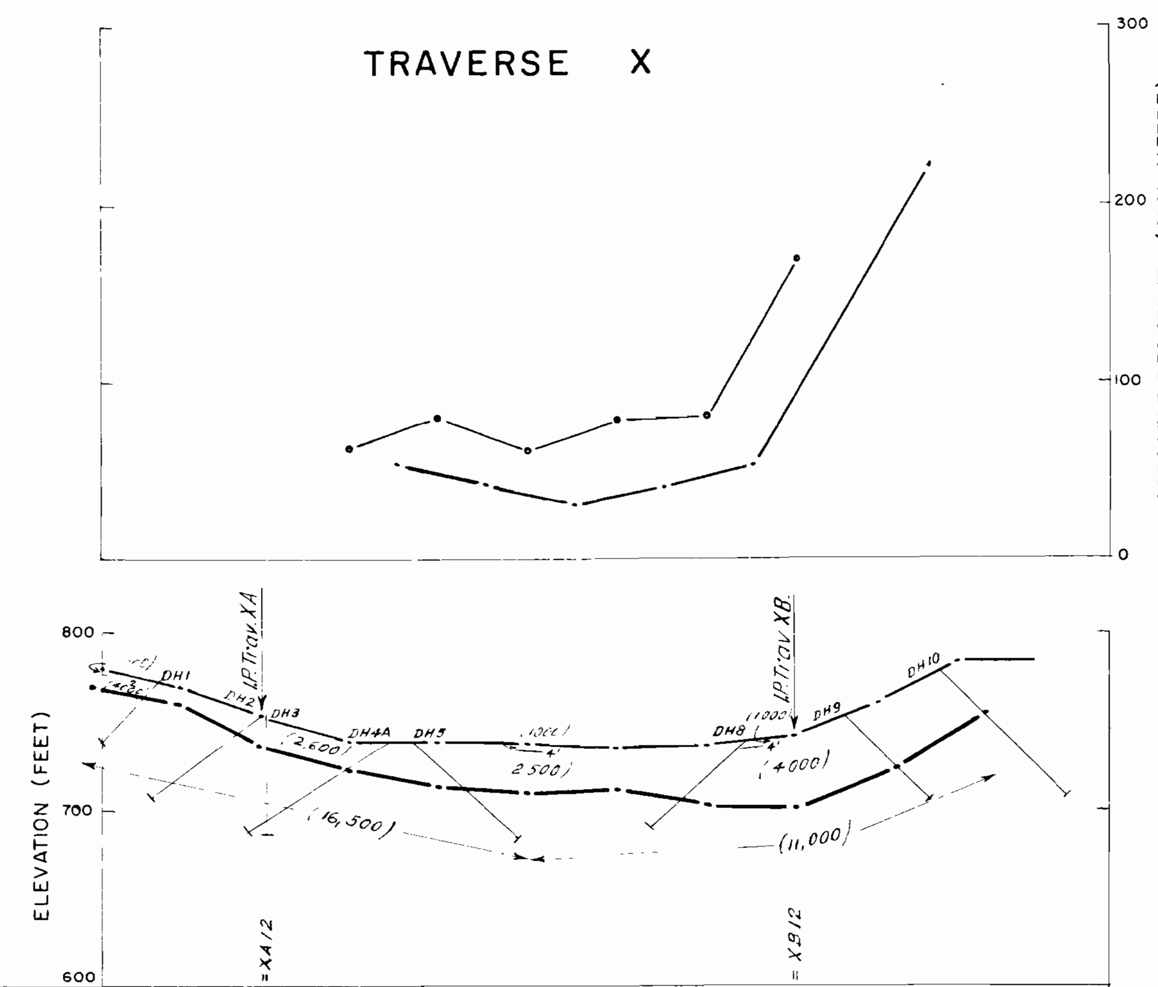
PLATE 3
SPILLWAY SEISMIC TRAVERSES
TRAVERSE WA
TRAVERSE W
59° 00'
148° 30'
SITE PLAN
DAM SITE AREA
SPILLWAY SITE
SCALE IN FEET
LEGEND
DAM SITE
FAULT OR SHEAR
RIDGE
TRAVERSE X
TRAVERSE XA
TRAVERSE XB
TRAVERSE XAA
TRAVERSE ZC
TRAVERSE ZA
TRAVERSE ZAA
TRAVERSE ZB
TRAVERSE YA
TRAVERSE Y
TRAVERSE Z
Slaty Creek
Rock Outcrop
O.I.T. (A)
O.I.T. (B)
O.I.T. (E)
O.P.(C)
LEGEND
TRAVERSE WITH STATION
DRILL HOLE
MAGNETIC BEARING
TRIANGULATION POINT
FAULT OR SHEAR ZONE
SEISMIC LONGITUDINAL VELOCITIES IN BEDROCK
TOPOGRAPHICAL CONTOUR
LAYOUT OF TRAVERSES,
TOPOGRAPHICAL CONTOURS,
AND SEISMIC VELOCITIES IN BEDROCK
SCALE IN FEET
AZIMUTH DATUM MAGNETIC. LEVEL DATUM IS STATE DATUM BM No.63 IN COURT HOUSE YARD CLONCURRY RL 634·20. AFTER MCINTYRE & ASSOCIATES, Q.LD., PLAN No.W22/8
Geophysical Branch, Bureau of Mineral Resources, Geology and Geophysics.
G379-3



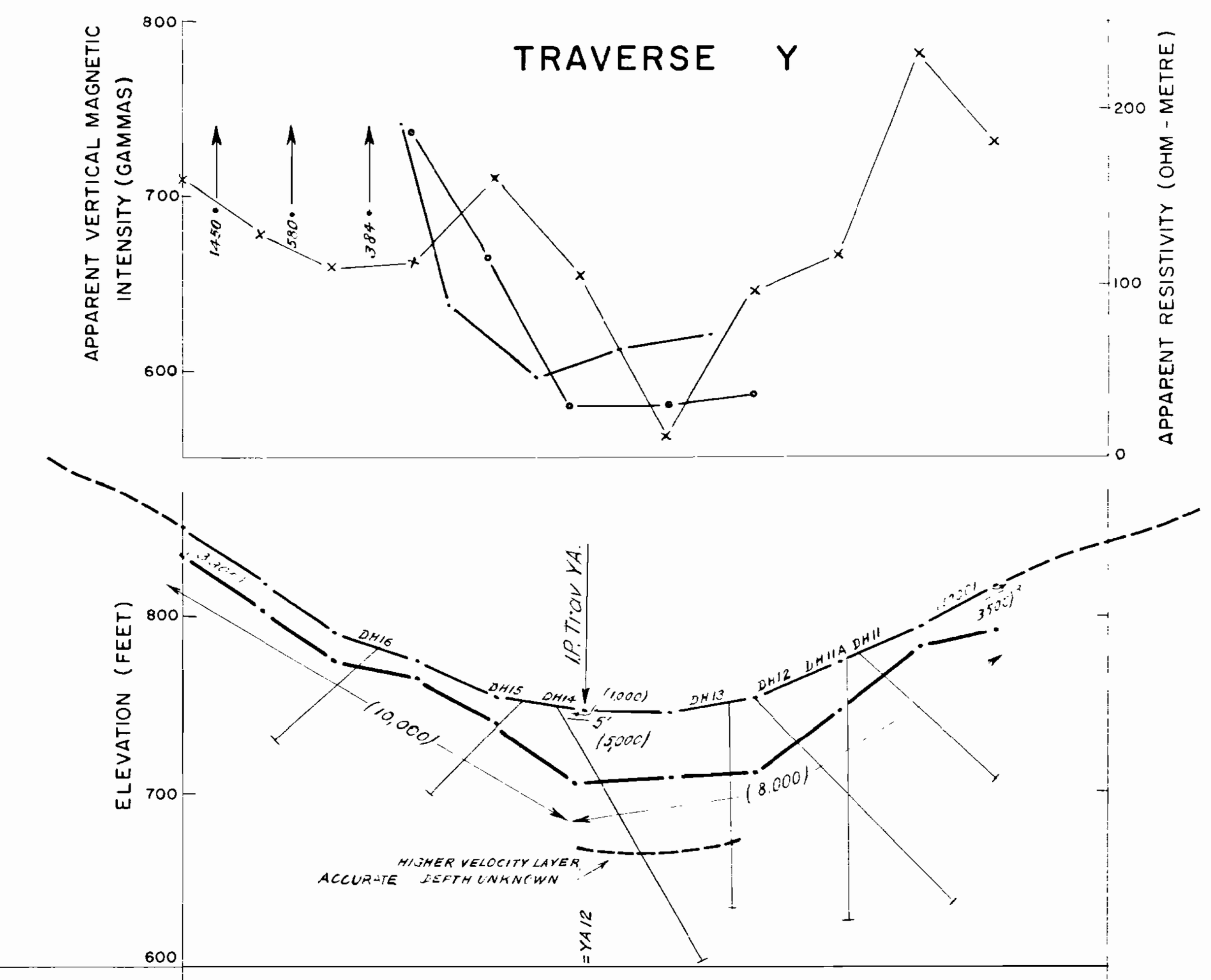
TRAVERSES AND BEDROCK CONTOURS

SLATY CK, CLONCURRY, QLD.

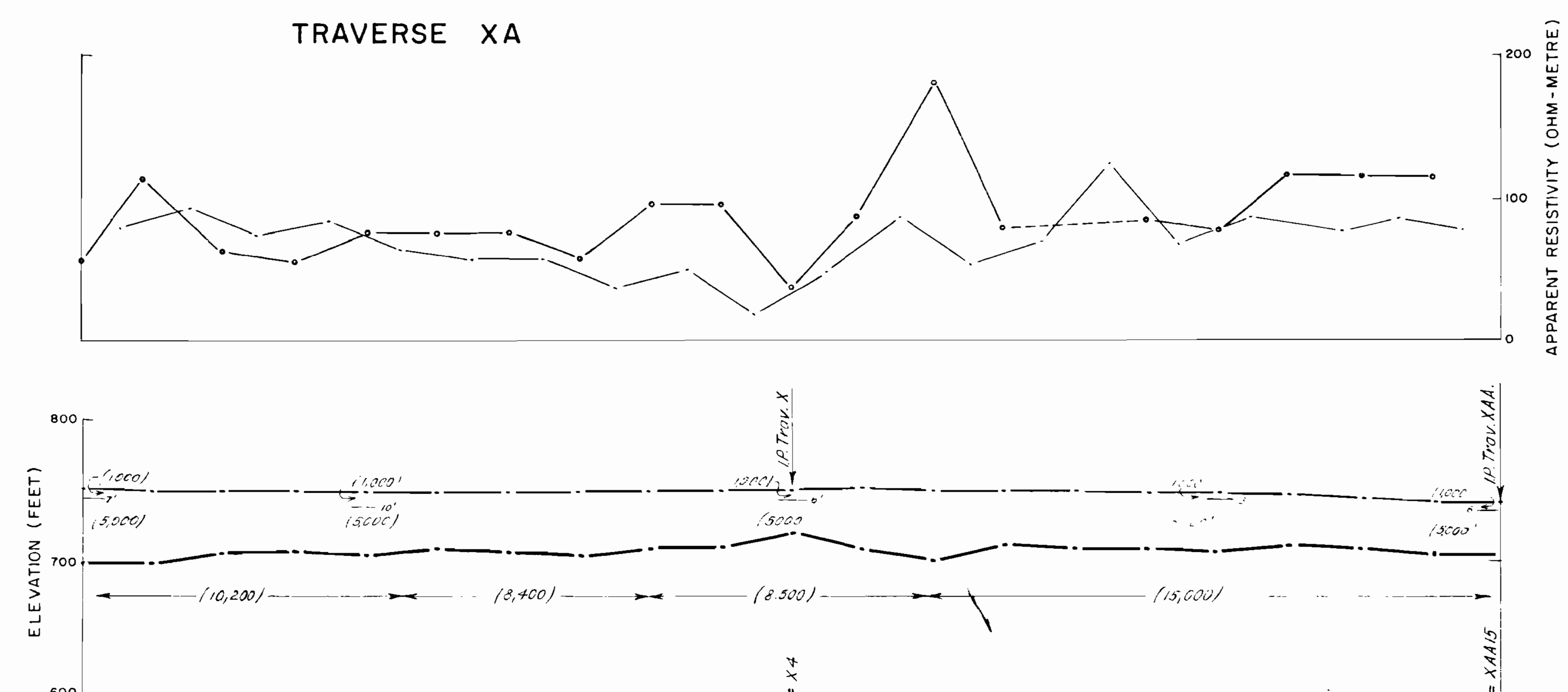
To Accompany Record No 1962/93



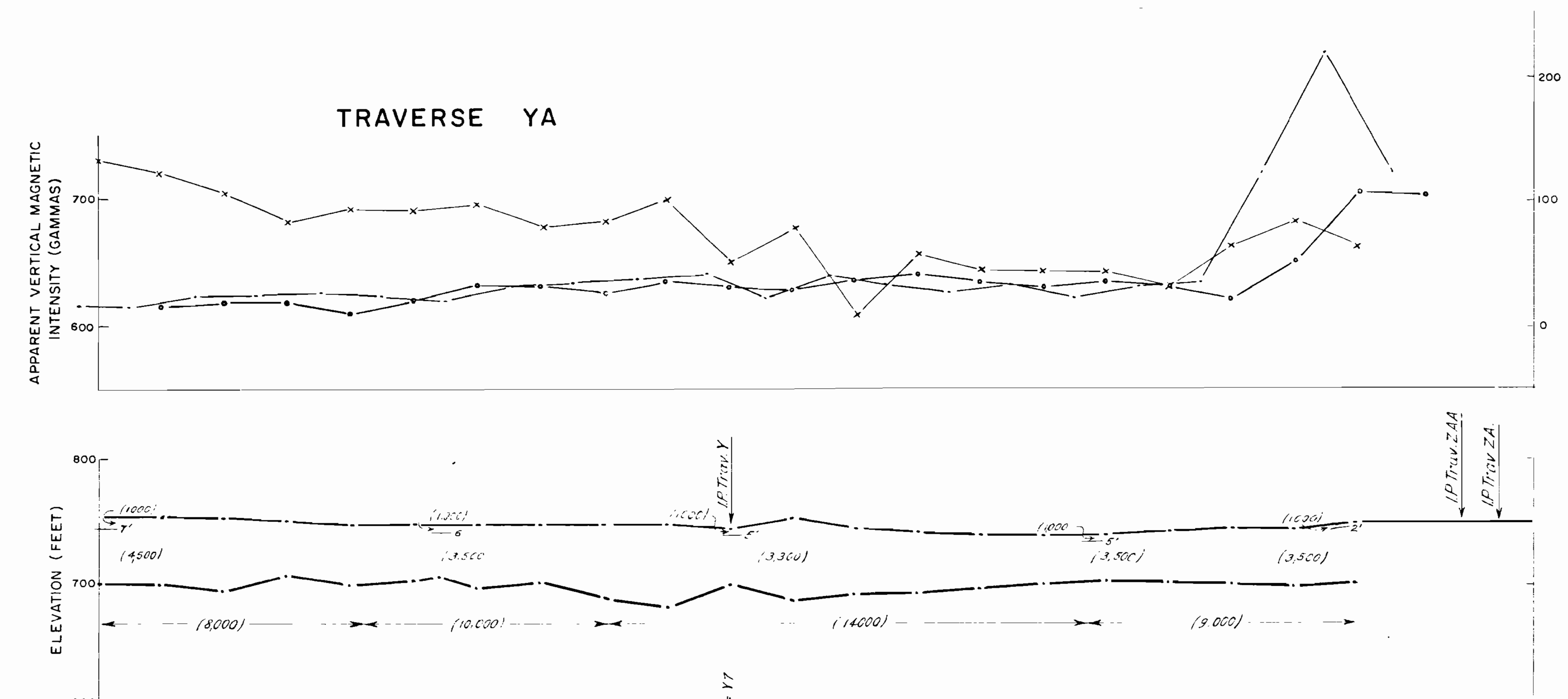
STATION NUMBER	2	3	4	5	6	7	8	9	10	11	12
STATION ELEVATION	791	767	748	736	735	734	730	731	739	754	779
DEPTH TO BEDROCK	13	16	21	17	25	27	21	32	40	38	35



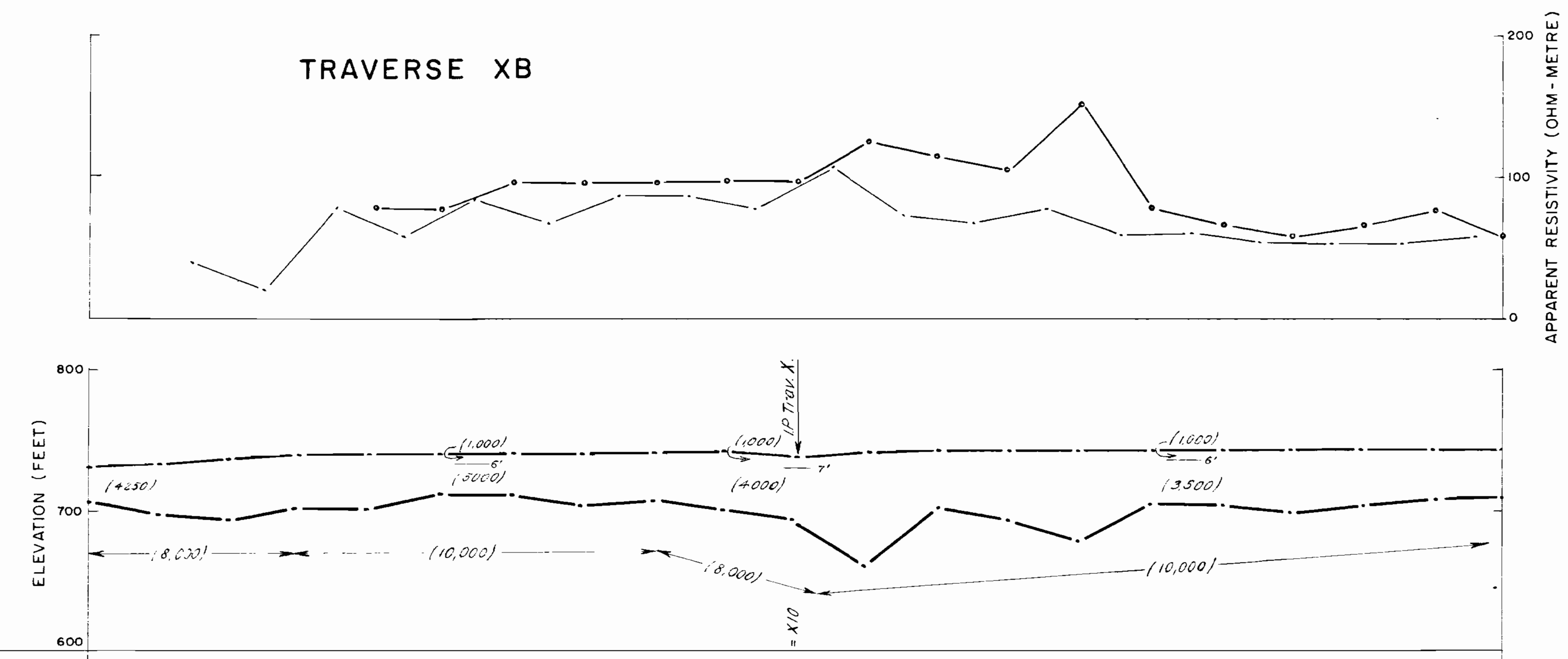
STATION NUMBER	12	11	10	9	8	7	6	5	4	3	2
STATION ELEVATION	843	820	791	771	752	744	743	752	771	791	816
DEPTH TO BEDROCK	13	15	15	8	16	40	44	43	25	12	26



STATION NUMBER	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2
STATION ELEVATION	751	749	749	748	747	746	745	748	747	747	748	750	747	748	747	745	744	743	742	741	740
DEPTH TO BEDROCK	53	53	46	43	45	37	42	45	39	37	31	45	47	40	43	37	40	33	36	39	25



STATION NUMBER	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2
STATION ELEVATION	752	752	751	750	748	749	748	743	748	748	743	751	744	742	740	740	740	742	744	744	749
DEPTH TO BEDROCK	59	54	58	43	50	42	51	47	59	68	43	69	52	49	45	38	37	40	46	45	46



STATION NUMBER	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2
STATION ELEVATION	731	732	737	738	741	741	742	742	743	744	739	744	743	743	742	741	741	742	742	743	743
DEPTH TO BEDROCK	25	32	42	34	39	27	29	35	34	40	46	75	39	48	62	38	38	46	39	34	36

LEGEND

- (2,600) — Formation with seismic velocity 2,600 ft/sec
- 14' — Depth to formation with different seismic velocity
- 100 ft electrode spacing, resistivity traverse
- 50 ft " " " "
- Apparent vertical magnetic intensity
- Surface
- Unweathered bedrock
- DH10 — Diamond drill hole No10

TRAVERSES X, XA, XB, Y, AND YA

SEISMIC CROSS-SECTIONS, WITH VERTICAL MAGNETIC INTENSITY AND APPARENT RESISTIVITY PROFILES

HORIZONTAL AND VERTICAL SCALES IN FEET

100 50 0 100 200 300 400

Level Datum is State Datum. B.M. No.63 in Court House Yard Cloncurry R.L. 634·20

Based on Mc Intyre and Associates QLD. Plan No. W22/9

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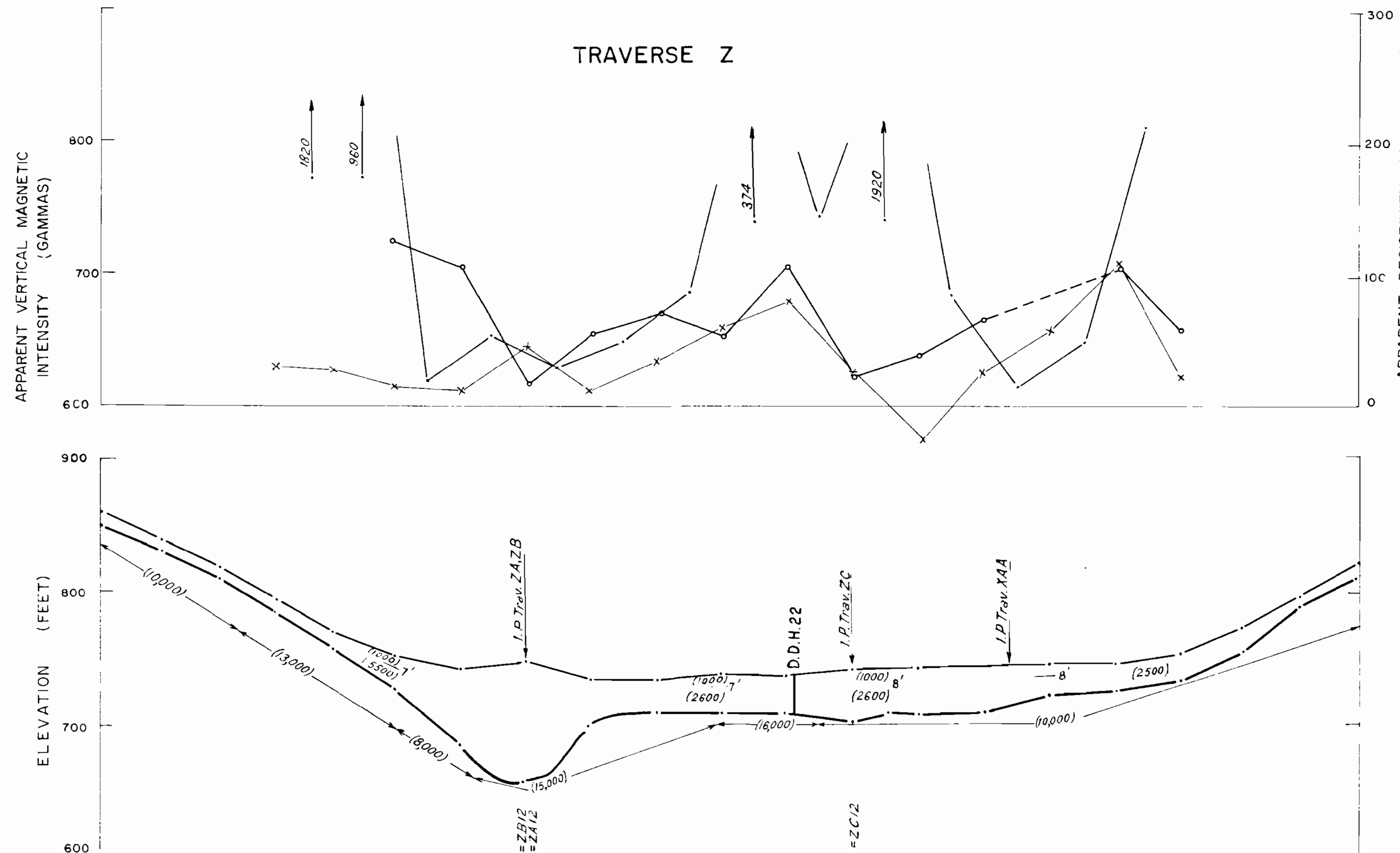
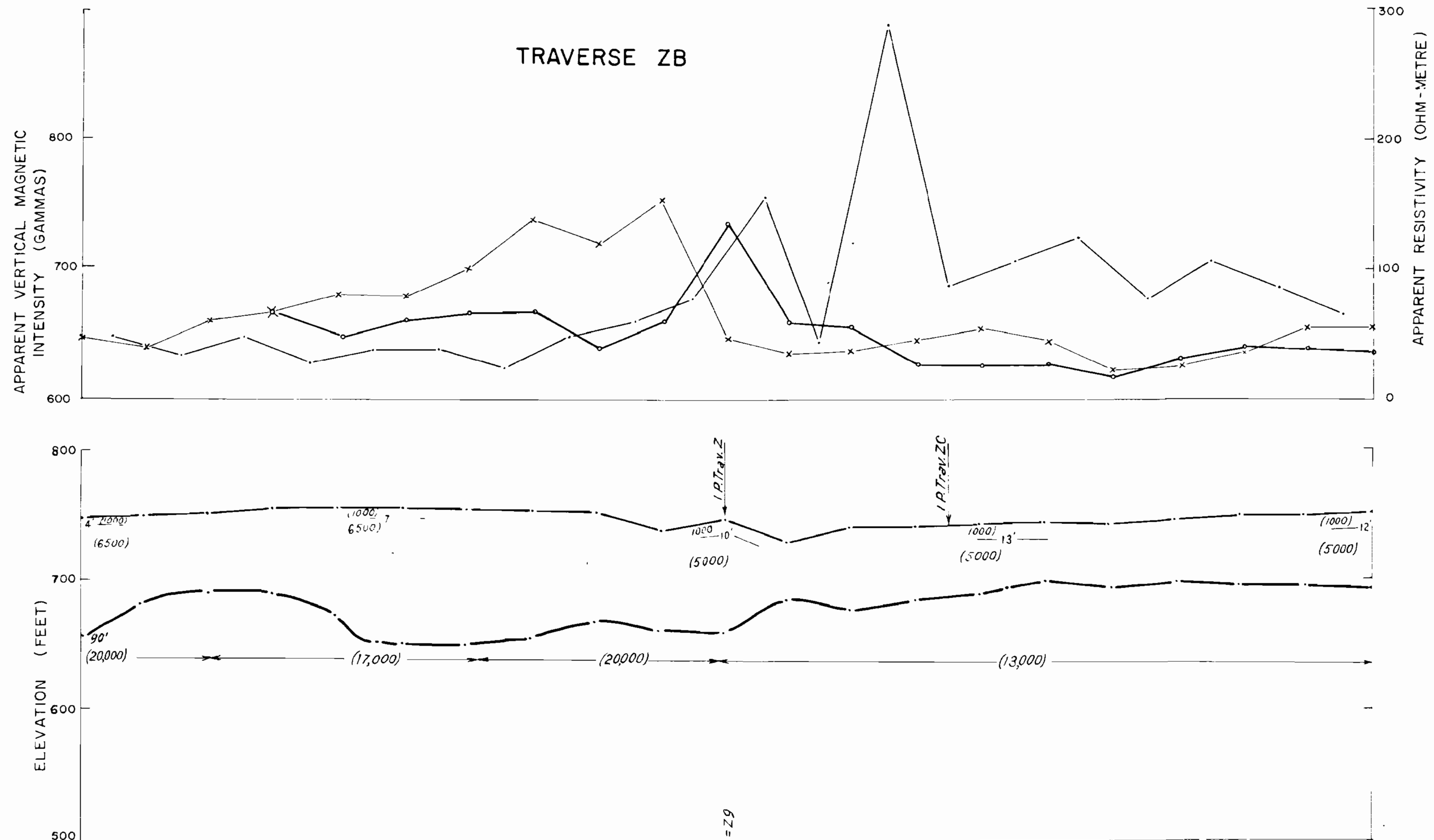
SLATY CK. QLD. 1960

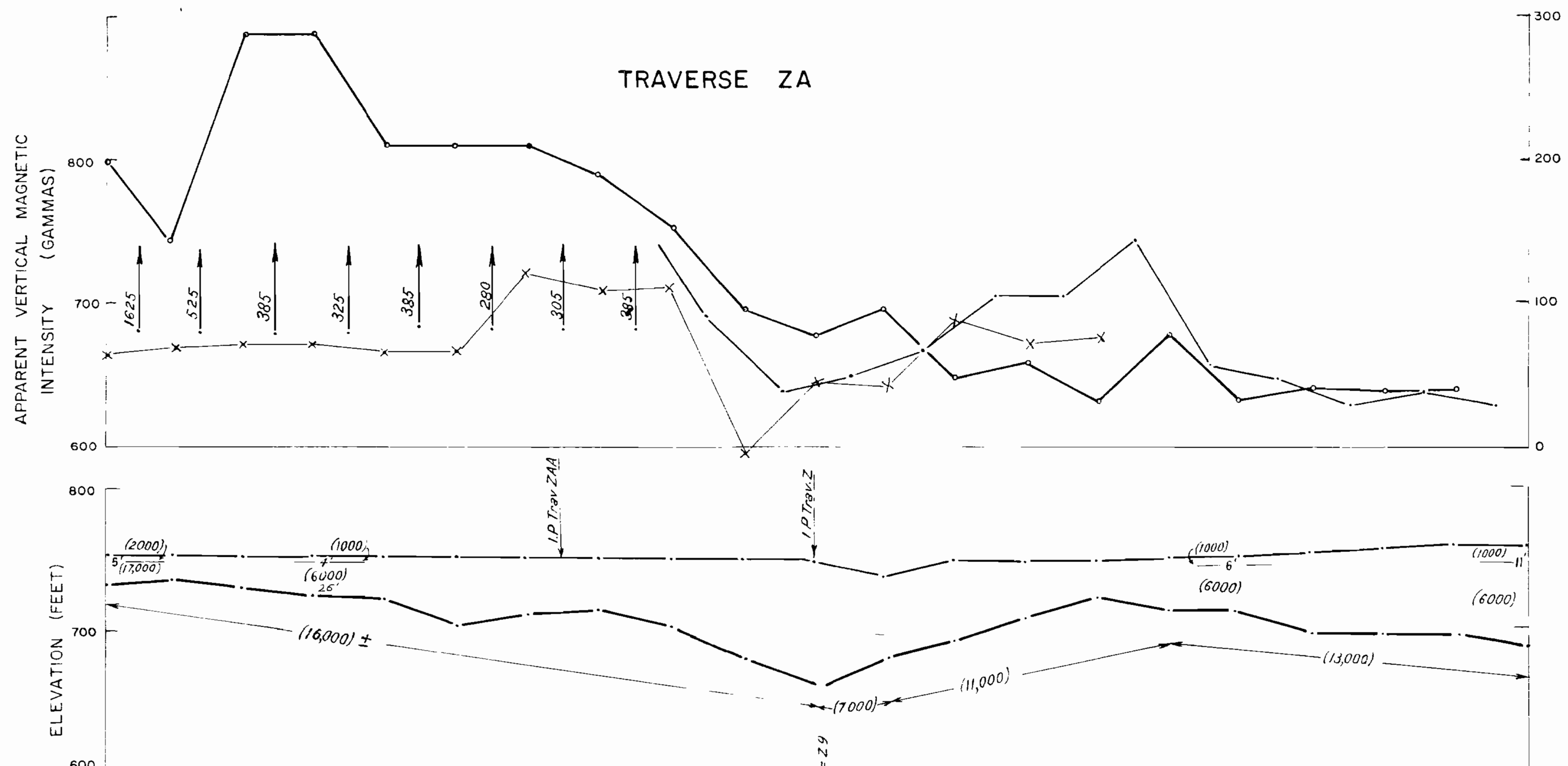
PLATE 6



STATION NUMBER	2	3	4	5	6	7	8	9	10	11	12	13	14	15		17	18	19	20	21	22
STATION ELEVATION	859	837	816	791	767	750	738	745	732	731	736	733	738	739		742	743	750	771	794	819
DEPTH TO BEDROCK	9	7	7	8	9	23	56	90	36	24	30	27	38	35	34	25	20	19	16	11	10



STATION NUMBER	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2
STATION ELEVATION	747	749	750	753	754	753	752	751	750	734	745	727	738	738	740	741	741	743	745	746	748
DEPTH TO BEDROCK	78	68	58	63	80	103	103	94	82	78	89	46	62	55	54	45	50	47	54	54	58



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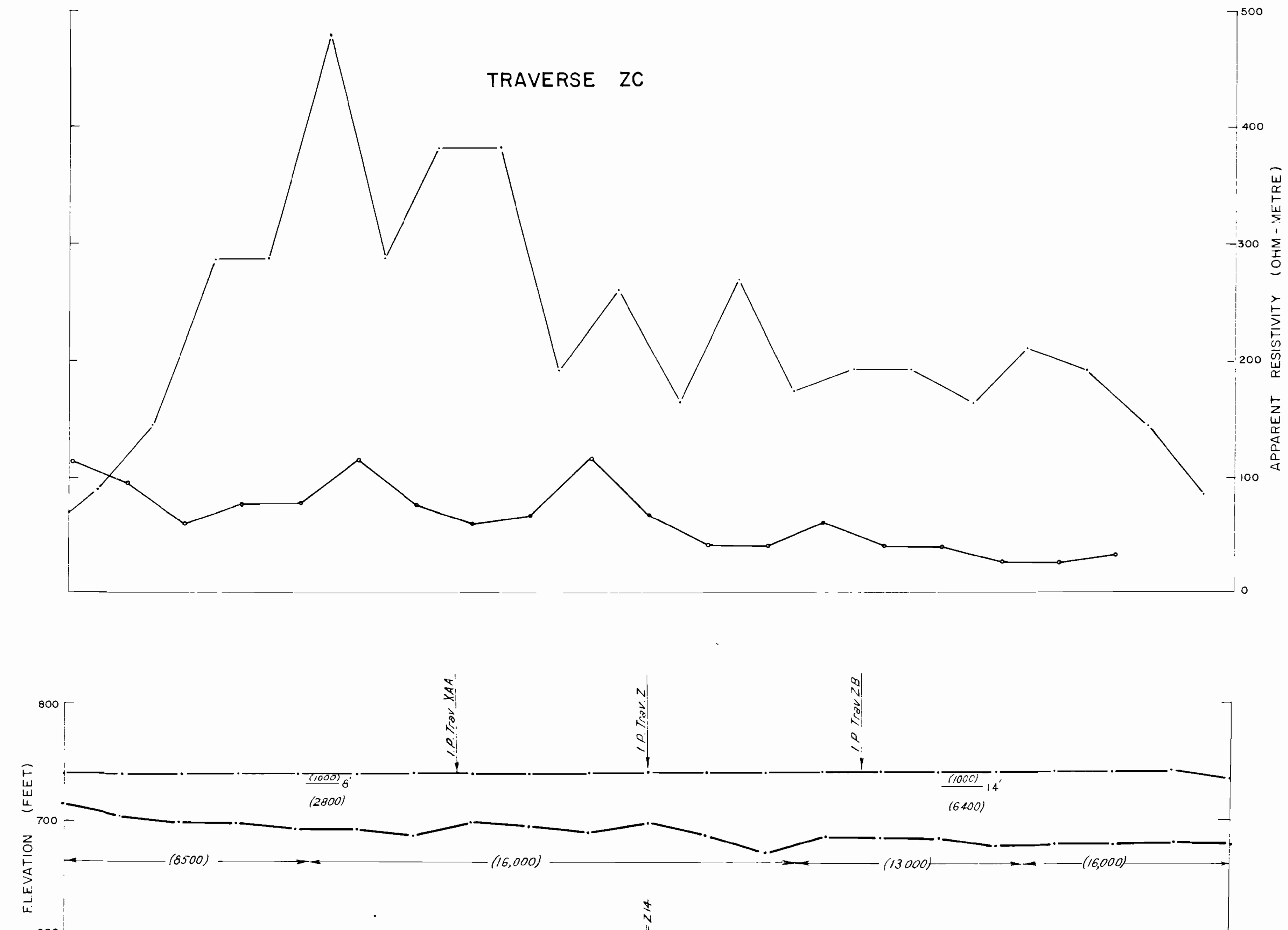
STATION ELEVATION	753	752	752	751	751	750	749	749	749	748	745	734	747	744	745	748	749	752	754	755	755
DEPTH TO BEDROCK	21	18	21	26	28	46	39	35	46	73	86	59	59	38	25	38	40	57	61	65	72



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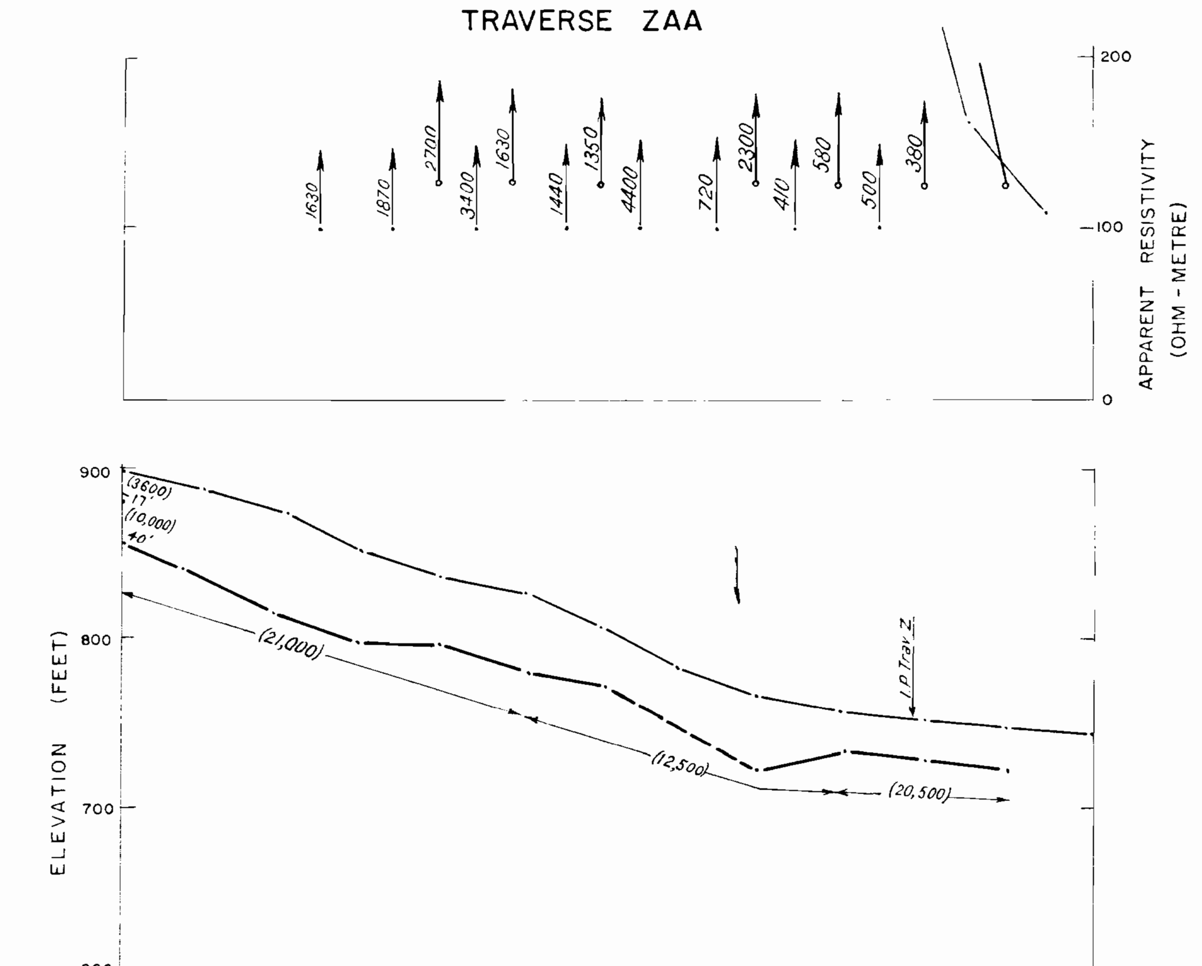
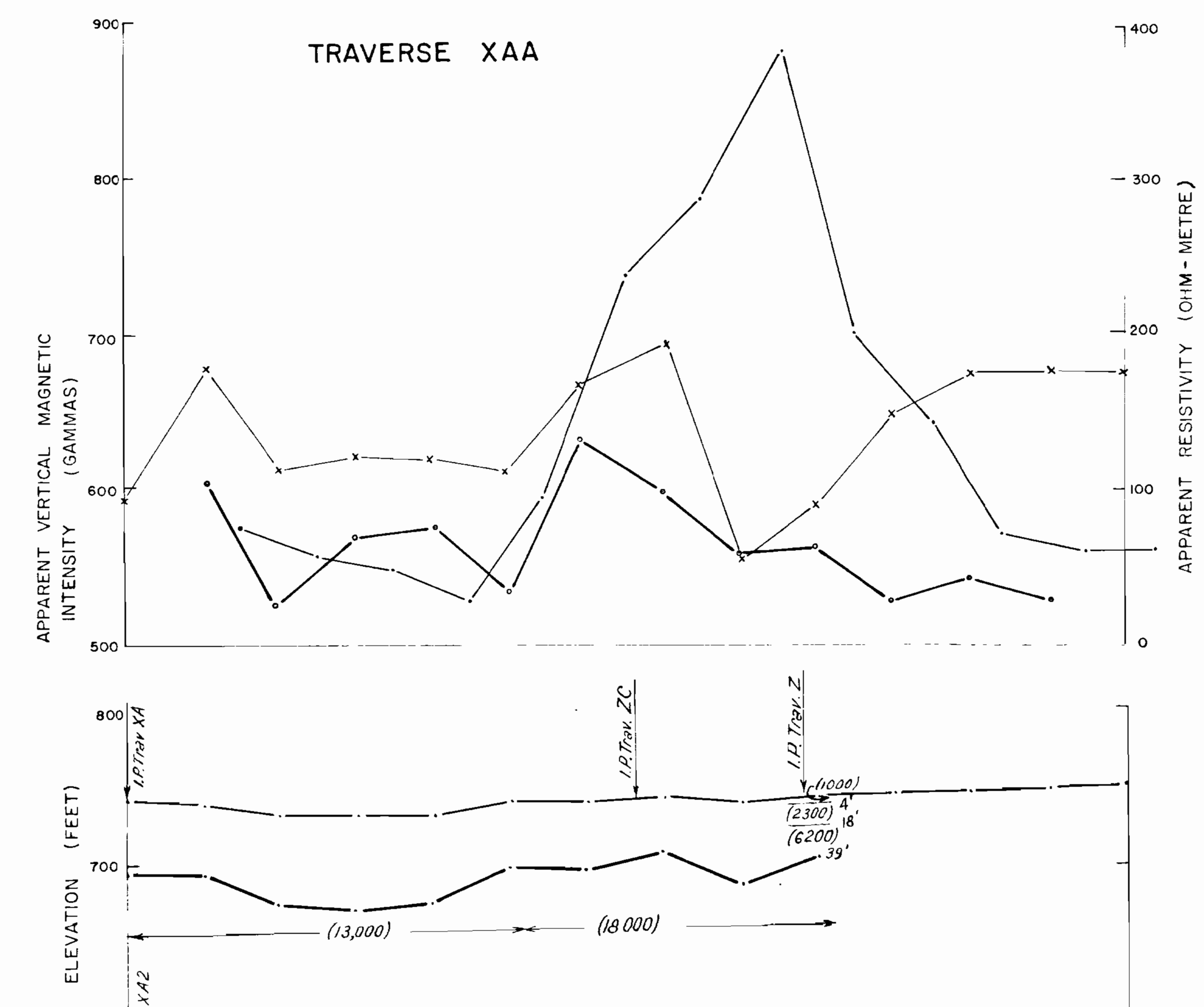
STATION ELEVATION	740	739	739	741	741	740	741	740	739	738	738	739	739	739	739	739	739	739	740	741	731
DEPTH TO BEDROCK	26	34	39	41	47	45	51	44	45	48	42	52	67	56	59	57	60	60	63	60	54



STATION NUMBER	12	11	10	9	8	7	6	5	4	3	2	1
STATION ELEVATION	900	888	873	851	837	828	808	784	767	758	753	749
DEPTH TO BEDROCK	40	47	56	53	37	46	35	29	13	22	24	23



STATION NUMBER	15	14	13	12	11	10	9	8	7	6	5	4	3	2
STATION ELEVATION	740	739	739	731	731	740	740	741	739	742	743	744	746	748
DEPTH TO BEDROCK	45	45	57	60	54	42	42	36	51	39				

LEGEND

(16,000) Formation with seismic velocity 16,000 ft/sec
14' Depth to formation with different seismic velocity
100 ft electrode spacing, resistivity traverse
50 ft " " " "
Apparent vertical magnetic intensity
Surface
Unweathered bedrock

TRAVERSES Z, ZA, ZAA, ZB, ZC, AND XAA

SEISMIC CROSS-SECTIONS, WITH VERTICAL MAGNETIC INTENSITY AND APPARENT RESISTIVITY PROFILES

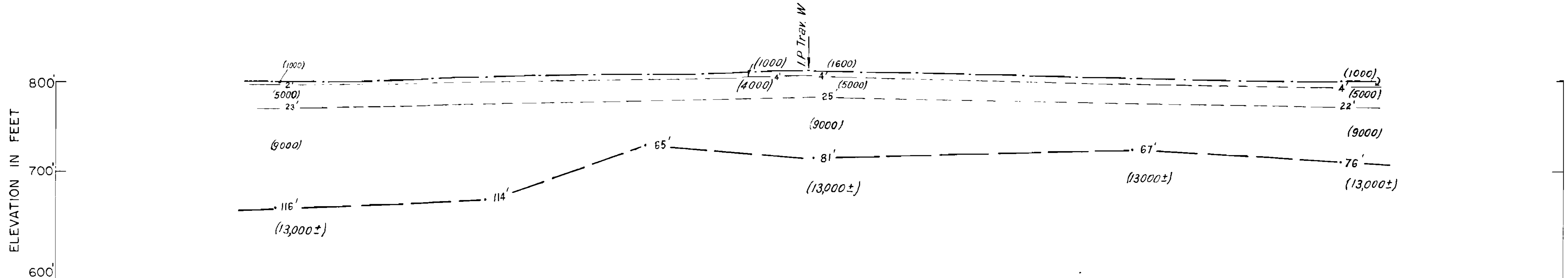
HORIZONTAL AND VERTICAL SCALES IN FEET

SLATY CK. QLD. 1960

BASED ON Mc INTYRE AND ASSOCIATES QUEENSLAND PLAN No. W 22/10

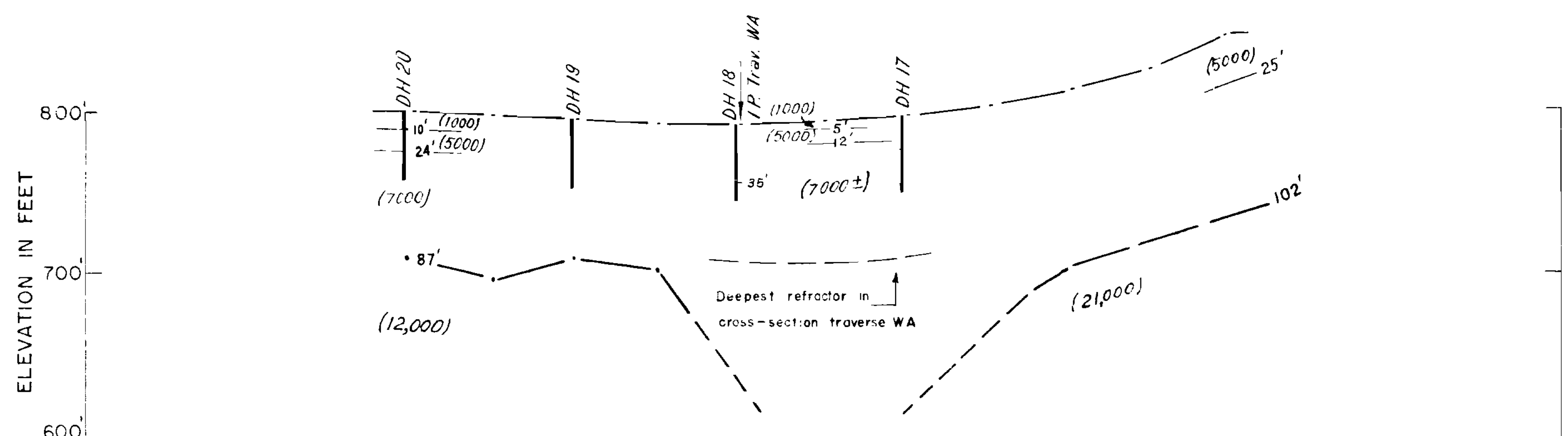
Geophysical Branch, Bureau of Mineral Resources, Geology & Geophysics. G379-21
To Accompany Record No 1962/93

TRAVERSE WA



STATION NUMBER	1	2	3	4	5	6	7	8	9	10	11	12 = W8	13	14	15	16	17	18	19	20	21	22	23
STATION ELEVATION		783	783	784	785	786	787	788	788	789	791	792	791	791	790	789	788	787	786	786	786	785	
DEPTH TO BEDROCK		116				114			65			81						67				76	

TRAVERSE W



STATION NUMBER	13	12	11	10	9	8 WA 12	7	6	5	4	3	2	1
STATION ELEVATION		799	797	794	792	792	793	797	802	811	826	845	
DEPTH TO BEDROCK		87	96	97	90				102			102	

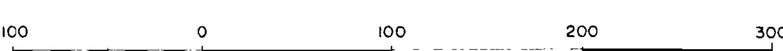
LEGEND

(4250)	FORMATION WITH SEISMIC VELOCITY IN FT/SEC
—— 16'	DEPTH TO FORMATION WITH DIFFERENT SEISMIC VELOCITY
DH 18	DRILL HOLE WITH NUMBER
I.P. Trav. W	INTERSECTION POINT
– – – – – – –	FRACTURED BEDROCK BOUNDARY
•——•——	BEDROCK BOUNDARY HIGHEST VELOCITY REFRACTOR

SPILLWAY TRAVERSES W AND WA

SEISMIC CROSS – SECTIONS

HORIZONTAL AND VERTICAL SCALES IN FEET



AFTER McINTYRE & ASSOCIATES PLAN No W22/11

LEVEL DATUM IS STATE DATUM BM No63 IN COURTHOUSE YARD CLONCURRY R.L. 634·20

SLATY CREEK DAM SITE, Q'LD, 1960

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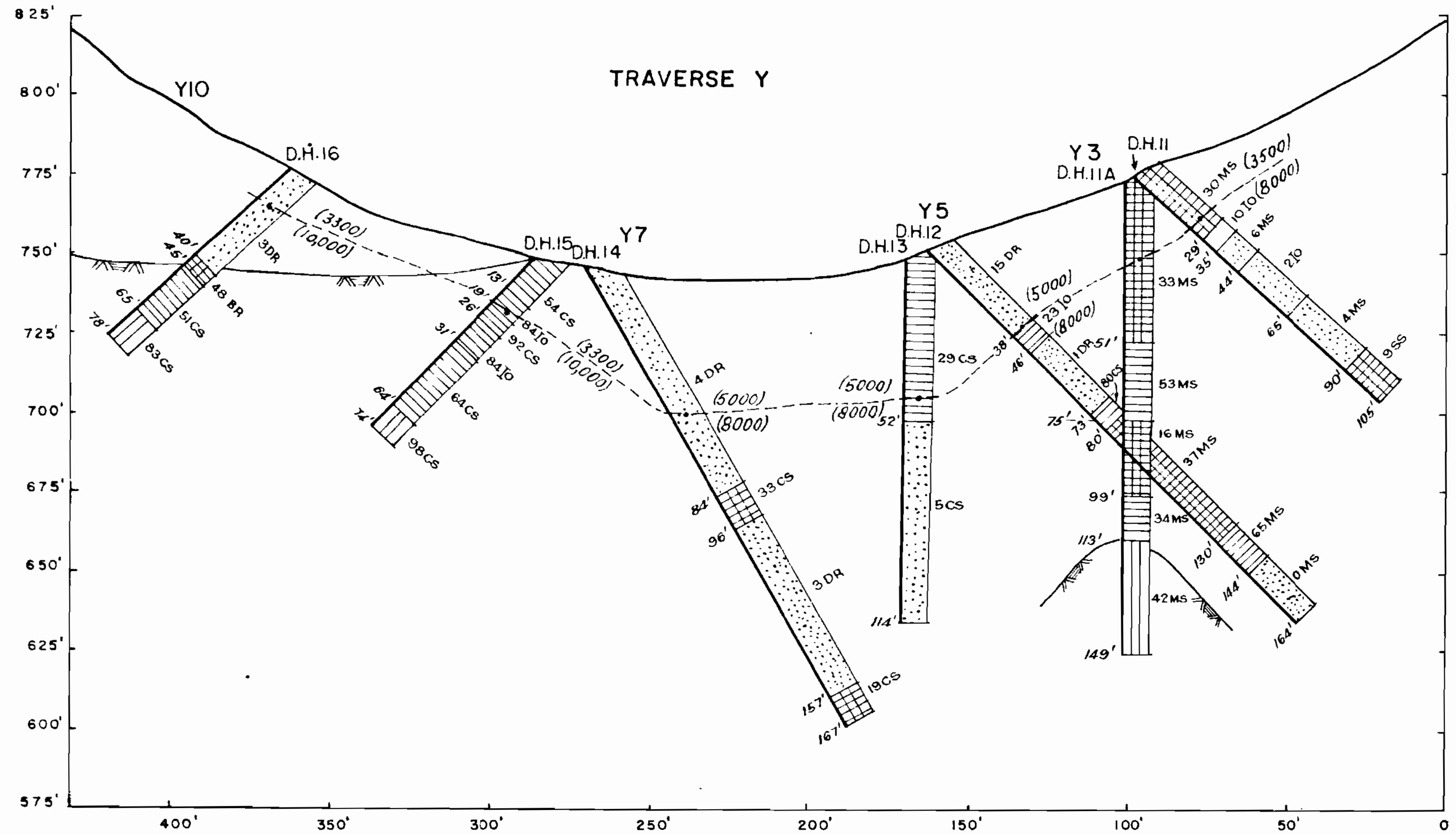
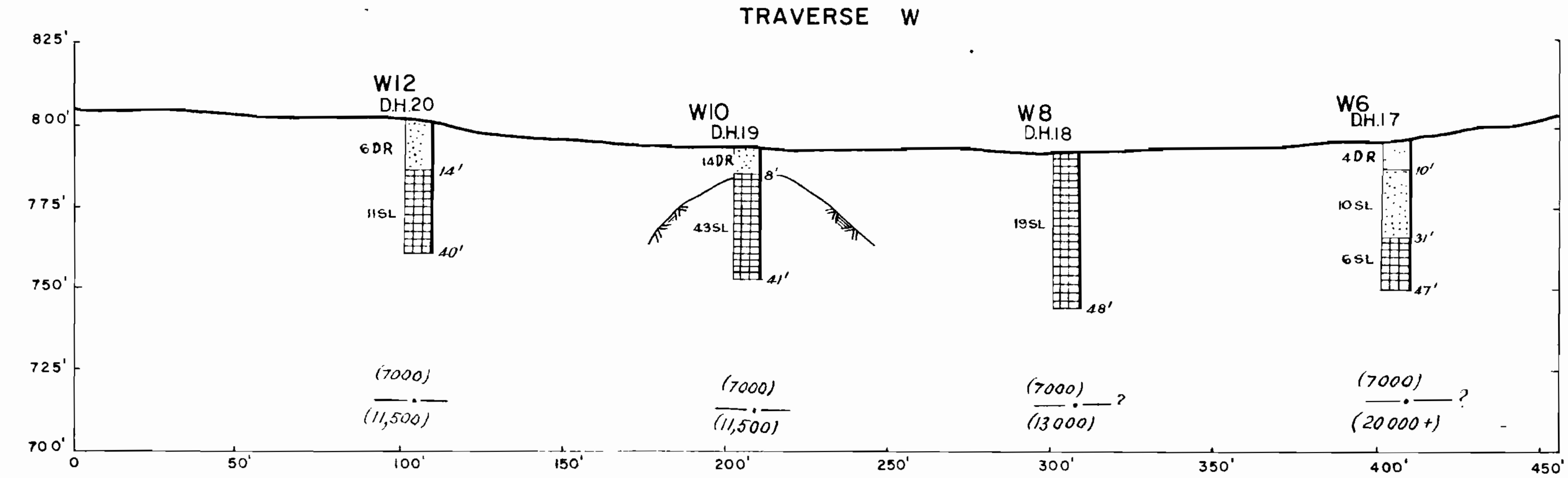
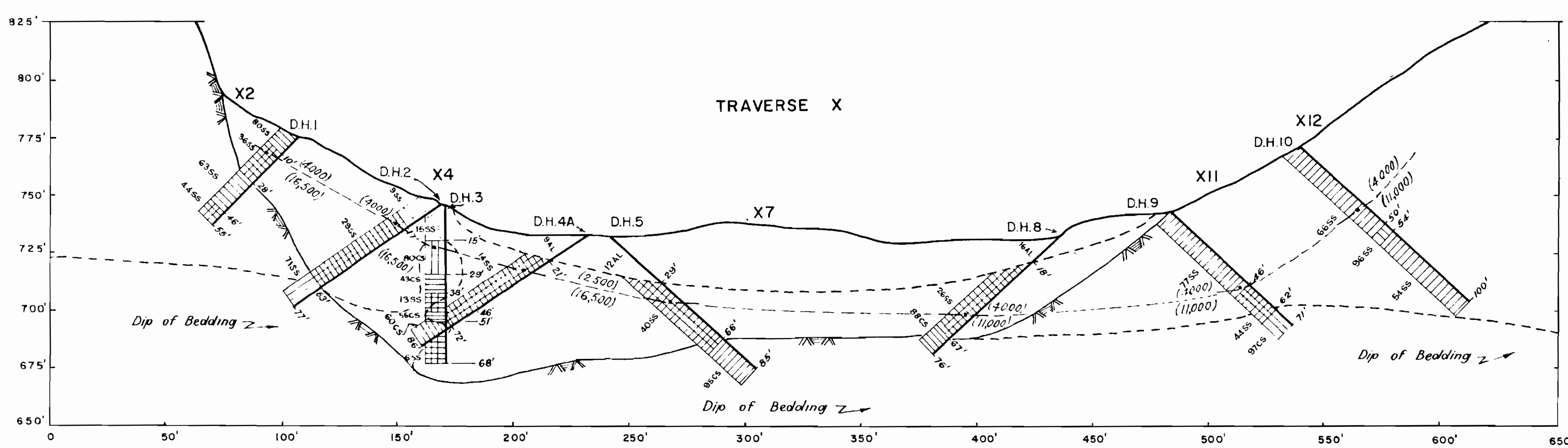
PLATE 8



SECTION A2

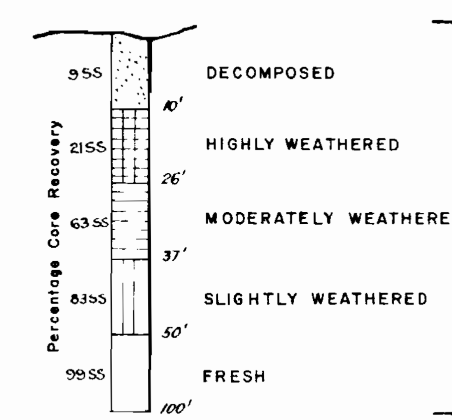




SECTION A1

LEGEND

AL	ALLUVIUM : sand and gravel.
TA	TALUS MATERIAL
CS	CALCAREOUS SANDSTONE : metamorphosed calcareous, meta-sediments, calcareous sandstones, sandy limestones etc.
SS	SANDSTONE : leached.
IO	IRON OXIDE ROCK : haematite or limonite has replaced original rock almost entirely.
MS	MUDSTONE : very fine grained metamorphic rock, partial replacement by carbonates common.
SL	SLATE : grey to black slates and shales, graphitic in part.
BR	BRECCIA : fragments of silt size calcareous material in iron oxide matrix.
DR	DECOMPOSED ROCK : recovered core insufficient to determine rock type or rock so highly weathered that determination is impossible.
	ROCK SURFACE
X2	SEISMIC STATION



Typical description of Core including Percentage Core Recovery, Rock Type, Degree of Weathering of Rock and Depth to Geological Boundary

INTERSECTION OF SEISMIC REFRACTORS WITH DRILL HOLE CENTRE LINE

(11,000) SEISMIC VELOCITY (FT/SEC)

GEOLOGICAL SECTIONS

BASED ON DIAMOND DRILLING

VERTICAL AND HORIZONTAL SCALES IN FEET

50 0 50 100 150 200

Based on Department of Development and Mines Q.L.D. Plan No. E11-2

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TO ACCOMPANY RECORDS No 1962/93