Soils Section

Rept. Bk. No. 60/104
G.S. No. 3151
D.M. 1299/64

DEPARTMENT OF MINES
SOUTH AUSTRALIA

GEOLOGICAL SURVEY

ENGINEERING AND SOILS GEOLOGY SECTION

REPORT ON SITE INVESTIGATION
PROPOSED E. AND W.S. DEPT. PUMPING STATION - TAILEM BEND
Part Section 37, Hundred Seymour

by

R. D. Steel
Assistant Senior Geologist

26th May, 1965

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REPORT ON SITE INVESTIGATION
PROPOSED E. AND W.S. DEPT. PUMPING STATION - TAILEM BEND
Pt. Section 37, Hundred Seymour

INTRODUCTION

The request to investigate the site of proposed pumping station at Tailem Bend was received in a letter dated 10th October, 1964, from the Engineer in Chief, Engineering and Water Supply Department.

The station is situated at the base of 50 feet high cliffs, on the eastern bank of the River Murray and is designed to pump water to the township of Keith, a distance of 84 miles.

The pumping units will be installed in a hollow rectangular concrete block, seated at R.L. 96', i.e. 13.5 feet below normal river level.

The site was initially inspected on 14th July, 1964, in company with S. Ronan of the E. and W. S. Department. Two test pits were logged, one ten feet deep at the base of the cliffs and the other 4 feet deep at the cliff top. Sections were also measured down the cliff face. Three percussion drill-holes 30 feet deep have since been constructed to test the foundation conditions to RL 86' or 10 feet below excavation level. The graphic geological logs of these holes (Scale 5 feet to one inch) are included as Figs. 2, 3 and 4 respectively. Fig. 1 is a site location plan and geological cross section.

GENERAL SITE GEOLOGY

Tailem Bend is situated in the south-western portion of the Physiographic Province known as the Murray Basin.

The geological succession at the pumping station site extending from the cliff top to the base of the drillholes can

be summarized in the following table:

Depth (feet) from clifftop	R.L. (feet)	Age	Unit	Description
0 - 4	163 - 159	Pleistocene	Topsoil	+Calcareous sandy silt, with 60% kunkar fragments, up to 0.1 ft. size.
4 - 8	159 - 155	"	Kunkar	Hard massive blocks up to 3 feet size.
8 - 10	155 - 153	"		Rubbly limestone: Kunkarized fragments up to 2 inch size in semi-cemented friable marl matrix.
10 - 15	153 - 148	"		CLAY SOIL, low plasticity finely sandy. Breaks into prismatic structure units up to 2 inch size. Grey and brown mottled.
15 - 37	148 - 126	Upper Pliocene	N.W. Bend Formation	Hard white, calcareous rubbly sandstone, grading to grey and brown mottled shelly sand.
37 - 53	126 - 110	Miocene?	Mannum Formation?	Zone completely obscured by slope wash but possibly yellow to yellow-brown limestone.
53 - 77	110 - 86	Oligo-Miocene	Ettrick Formation	Yellow and yellow-grey fossiliferous marl. Hard lumps in more friable sandy matrix.

The lower portion of the cliff face is covered by slope wash material with an interesting sequence of aboriginal midden deposits (including bone and shell remains) at the river's edge.

CONCLUSIONS

At the proposed excavation level (R.L. 96') the station will be founded entirely in the Ettrick Marl Formation. As revealed in the drillholes this material consists of irregular to subangular, weakly to strongly cemented limestone fragments in a softer more friable sandy, calcareous matrix. Gravel

fragments normally constitute 60 to 80% of the material, at least to R.L. 96 feet. There are a few very hard bands between R.L's 101' and 108' which could not be tube sampled and had to be drilled by percussion bit.

Below the proposed foundation level the marl is essentially a silt soil of low plasticity, with an average of 5-10% gravel fragments, but locally may be as much as 70%. As evidenced by the blows per foot of penetration, the silt appears to be very dense and well compacted.

The proposed bearing load is estimated at 1500 lbs. per square foot, which is less than present overburden pressure. Bearing capacity of the underlying marl at the recommended foundation depth i.e. R.L. 96 feet should therefore be adequate. The structure may however, be subjected to uplift forces should the river level rise significantly in flood. It may be found necessary to anchor the station to the substratum but at least to the depth tested, the marl appears to be too friable and rubbly for this purpose.

R. D. Steel
Assistant Senior Geologist
ENGINEERING AND SOILS GEOLOGY SECTION

RDS:AWK:AGK
25/5/65

DEPARTMENT OF MINES - SOUTH AUSTRALIA

LOG OF PERCUSSION DRILL HOLE

HOLE NO. 1

SHEET 1 OF 1

PROJECT PUMPING STATION — Hirer E & WS Dept.

LOCATION TAILEM BEND — Sec. Hd SEYMOUR.

FEATURE TEST OF FOUNDATIONS — Depth 30 feet. R.L. — Coords

FIG.

SOIL TYPE GEOLOGICAL DESCRIPTION	CASING R.L. (FEET)	DEPTH (FEET)	GRAPHIC LOG	GROUP SYMBOL	SOIL DESCRIPTION GROUP NAME	CONSISTENCY REL. DENSITY	MOISTURE CONTENT	WATER LEVELS	PENETRATION DATA BLOWS FOOT / Hand Penetrometer Qu. tons p. sq. ft.
RECENT — Organic topsoil & river alluvium. Contains lime nodules, root fragments and fresh water fossil shells.				ML GM	SILT SOIL, low plasticity. Dark grey to blackish. Contains 20% GRAVEL. Av. 0·02 to 0·5 feet. max. size 0·3 feet.	COMPACT	MOIST		
OLIGO - MIOCENE FORMATION ETTRICK — Fossiliferous Sandy marl. Consists of irregular to sub-angular, weakly to strongly cemented limestone fragments in softer more friable, sandy and calcareous matrix. Numerous micro and macro fossil fragments.		5		GP to ML	GRAVEL, poorly graded yellow brown to pale grey-brown. 0·01 to 0·2 feet. Av. occasionally 0·3 feet. Contains 30% SILTSOIL, clayey to sandy & calcareous as matrix.	MATRIX CONTACT	WET	W.L.	Generally unable to record.
		10				HARD		W.C.	Drilled
				GW	80% GRAVEL up to 0·3 feet.	MATRIX CONTACT HARD			136
		15		GW - ML	Fragments mainly 0·05 to 0·2 feet, with 40% sandy silt matrix.	SOFTISH HARD			186
		20			Fragments mainly up to 0·5 feet, 40% sandy SILT matrix.	MATRIX GRAVEL	MOIST		
				ML	SILTSOIL, low plasticity sandy, calcareous. Yellow-brown. Contains 10% GRAVEL up to 0·04 feet.	SOFTISH	VERY		
		25		GP - ML	GRAVEL, poorly graded. Av. 0·1 to 0·2 feet, occ. 0·5 feet. Yellow-brown. Contains 30% SILTSOIL. low plasticity, as matrix.	MATRIX GRAVEL COMPACT HARD			131 104 206
		30		ML	SILTSOIL, low plasticity. Yellow-brown. Contains 10% GRAVEL → 0·2 ft.				
					END OF HOLE 30ft.				

TYPE OF SAMPLE	HYDROLOGY	CONSISTENCY	REL. DENSITY	MOISTURE
Open Tube	Water cut	VS-Very Soft	VL-Very Loose	H-Humid
Sealed Tube	Static. level	S-Soft	L-Loose	D-Damp
Auger barrel	Supply	F-Firm	C-Compact	M-Moist
Slush pump	Analysis (p.p.m)	St-Stiff	D-Dense	W-Wet
Casing	← Water level. (Date)	VSt-Very Stiff	VD-Very Dense	S-Saturated
		H-Hard		

Plant No. 17 — Logged RDS & JACP

Type Ruston — Date Apr. '65

Driller A. Tucker — Traced RDS

Started 17.3.65 — Checked RH

Finished 18.3.65 — R.D.S.

PLAN No. S4313 Je 4

Vertical Scale 5 feet to 1 inch

DEPARTMENT OF MINES - SOUTH AUSTRALIA

LOG OF PERCUSSION DRILL HOLE

HOLE NO. 2

SHEET 1 OF 1

PROJECT PUMPING STATION / Hirer E & WS Dept

LOCATION TAILEM BEND Sec. Hd SEYMOUR.

FEATURE TEST OF FOUNDATIONS Depth 31ft. R.L. Coords FIG.

SOIL TYPE GEOLOGICAL DESCRIPTION	CASING R.L. (FEET)	DEPTH (FEET)	GRAPHIC LOG	GROUP SYMBOL	SOIL DESCRIPTION GROUP NAME	CONSISTENCY REL. DENSITY	MOISTURE CONTENT	WATER LEVELS	PENETRATION DATA BLOWS PER 12" Hand Penetrometer Qu. tons p. sq. ft.
RECENT: Slopewash material. Contains numerous pockets of whitish earthy lime & fragments of hard fossiliferous limestone.	6" casing	5		SM SC	SAND, fine grained, excess silty and clay fines. Grey-brown. Contains 30% GRAVEL, 0·05 → 0·5 feet max. size.	COMPACT	MOIST	14·3·65 W.L.	
OLIGO – MIOCENE ETTRICK FORMATION: Fossiliferous Sandy marl. Consists of irregular to sub-angular, weakly to strongly cemented limestone fragments, in softer, more friable, sandy and calcareous matrix. Numerous micro and macro fossil fragments.		10		GP ML	GRAVEL, poorly graded Av. 0·2 – 0·3 ft. max. 0·4 ft. Yellow-brown. Contains 20% SILT SOIL, low to high plasticity as matrix.	MATRIX COMPACT	V.M.	W.L.	Generally unable to record.
				GW	Possibly 80–90% GRAVEL up to 0·5 ft.	HARD			152/29 Drilled
		15		GW ML	GRAVEL, well graded 0·05 – 0·3 ft. Av. size. Yellow-grey. Contains 40% 40% SILT SOIL, low plasticity, sandy, as matrix.	MATRIX – COMPACT TO EARLY – SOFT			
		20							228
		25		ML	SILT SOIL low to medium plasticity. Yellow-brown to light grey-brown. Contains 5-10% GRAVEL well graded. Av. 0·05–0·1 ft. Max. size 0·2 feet.	COMPACT – FRIABLE	WET		
		30			END OF HOLE 31 FEET.				
		35							

TYPE OF SAMPLE: Open Tube; Sealed Tube; Auger barrel; Slush pump; Casing

HYDROLOGY: Water cut; Static level; Supply; Analysis (p.p.m); ← Water level. (Date)

CONSISTENCY: VS-Very Soft; S-Soft; F-Firm; St-Stiff; VSt-Very Stiff; H-Hard

REL. DENSITY: VL-Very Loose; L-Loose; C-Compact; D-Dense; VD-Very Dense

MOISTURE: H-Humid; D-Damp; M-Moist; W-Wet; S-Saturated

Plant No. 17 Type Ruston Driller A. Tucker Started 11 Mar. 65 Finished 14 Mar. 65

Logged RDS JACP Date Apr. 65 Drawn RDS Traced R.H. Checked R.D.S.

PLAN No. S4314 Je 4

Vertical Scale 5 feet to 1 inch.

DEPARTMENT OF MINES - SOUTH AUSTRALIA

LOG OF PERCUSSION DRILL HOLE

HOLE NO. 3

SHEET 1 OF 1

PROJECT PUMPING STATION — Hirer E & WS DEPT

LOCATION TAILEM BEND — Sec [illegible] SEYMOUR

FEATURE TEST OF FOUNDATIONS — Depth 30 ft. R.L. — Coords — FIG.

SOIL TYPE GEOLOGICAL DESCRIPTION	CASING R.L. (FEET)	DEPTH (FEET)	GRAPHIC LOG	GROUP SYMBOL	SOIL DESCRIPTION GROUP NAME	CONSISTENCY REL. DENSITY	MOISTURE CONTENT	WATER LEVELS	PENETRATION DATA BLOWS PER FOOT / Hand Penetrometer Qu (tons. p. sq. foot)
RECENT — ORGANIC TOPSOIL. Contains limestone gravel & numerous fresh water fossil fragments.	6"			GW – ML	GRAVEL, poorly graded. 0·1 - 0·5 ft. 40% SILT SOIL, low plasticity, organic, as matrix. Dark grey.	Matrix Compact	Moist		
OLIGO - MIOCENE FORMATION ETTRICK — Fossiliferous Sandy marl :- Consists of irregular to subangular, weakly to strongly cemented limestone fragments, in softer more friable, sandy and calcareous matrix. Numerous micro and macro fossil fragments.		5		GW – ML	GRAVEL, poorly graded. Av. size 0·02 - 0·2 feet. Light yellow grey to light yellow brown. Contains 40% SILT SOIL clayey, as matrix.	Gravel Hard	V. Moist	S.W.L. 23·3·65	
		10		GW	80% fragments → 0·5 feet. 20% SILT SOIL as matrix.	Friable			123 Drilled.
		15		GW ML	GRAVEL, well graded 0·02 → 0·2 feet. Occ 0·4 feet. Contains 30% SILT SOIL, low plasticity, sandy and calcareous as matrix. Light yellow-grey.	Matrix Compact			
		20		GW	Mainly hard fragments up to 0·5 feet.				273 Drilled.
		25		ML	SILT SOIL, low to medium plasticity. Sandy. Yellow to yellow grey. Slightly clayey. Contains 5% GRAVEL 0·02 to 0·2 feet.	Compact	Wet		
					END OF HOLE 30 FT				

Generally unable to record

TYPE OF SAMPLE	HYDROLOGY	CONSISTENCY	REL. DENSITY / MOISTURE
Open Tube	Water cut	VS-Very Soft	VL-Very Loose H-Humid
Sealed Tube	Static level	S-Soft	L-Loose D-Damp
Auger barrel	Supply	F-Firm	C-Compact M-Moist
Slush pump	Analysis (p.p.m)	St-Stiff	D-Dense W-Wet
Casing	← Water level. (Date)	VSt-Very Stiff H-Hard	VD-Very Dense S-Saturated

Plant No 17. Logged RDS/U.A.P.

Type Ruston. Date Apr. 65

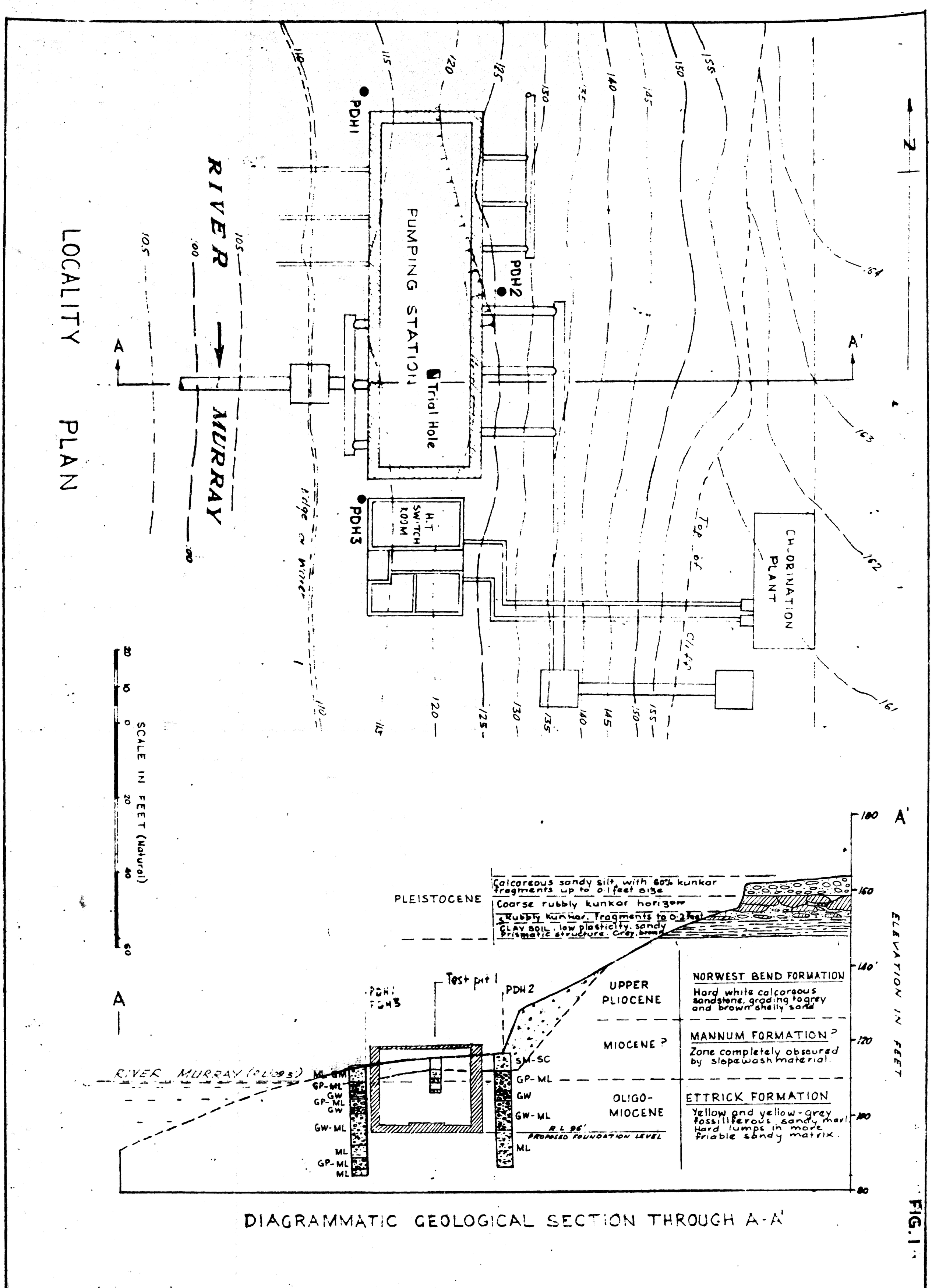
Driller Tucker. Logged R.D.S.

Started 19·3·65 Traced T.P.S.

Finished 23·3·65 Checked R.D.S.

PLAN No. S4315 Je4

Vertical Scale 5 feet to 1 inch



DIAGRAMMATIC GEOLOGICAL SECTION THROUGH A-A'

FIG. 1

S.A. DEPARTMENT OF MINES

No.	Amendment	Ent.	Date

TAILEM BEND PUMPING STATION

LOCALITY PLAN AND DIAGRAMMATIC SECTION SHOWING GEOLOGY AND BOREHOLE POSITIONS

Approved	Passed		Scale: 20ft to 1in
		Drn. RDS	64-618
		Tcd. RDS	
		Ckd. R.D.S.	Te 4
Director		Ent.	Plan 8.8.64