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ENG. GEOLOGY SECTION



DEPARTMENT OF MINES SOUTH AUSTRALIA

REPORT ON SITE INVESTIGATION
PROPOSED S.A.C.B.H. LTD., SILO

Railway Yards, Wasleys - Hundred Mudla Wirra

by
R. D. Steel
Assistant Senior Geologist

14th May, 1965.

64-29 60/97

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SOUTH AUSTRALIA

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INTRODUCTION

The request to investigate the site of a proposed 4 cell, concrete silo in the railway yards at Wasleys, was received in a letter dated 19th February, 1964, from Mr. P.T. Sanders, General Manager, South Australian Co-operative Bulk Handling Ltd.

The small township of Wasleys is 37 miles from Adelaide on the railway line to Hamley Bridge etc.

SCOPE OF THE INVESTIGATION

The site has been explored by two percussion drillholes in the positions shown on Figure 2. Hole No. 1 was open tube tube sampled to a depth of 65 feet, with Standard Penetration Tests carried out at 10 foot intervals. Hole No. 2 was constructed to 32.5 feet, to secure undisturbed sealed tube samples at selected intervals and give additional Standard Penetration Test information.

Descriptive geological logs of the two drillholes are included as Appendix A and graphic logs as Figs. 3 and 4 respectively.

OUTLINE OF REGIONAL GEOLOGY

Wasleys is situated in the central lower portion of the Kapunda 1-mile to 1-inch Geological Sheet (Published 1957).

The area is generally covered to unknown but appreciable depth with alluvial sands and clays of Pleistocene to Recent age.

The nearest rock outcrops are approximately $1\frac{1}{2}$ miles to the east, where large areas of shales, phyllites and slates of Proterozoic age, belonging to the Torrensian Series of the Adelaide System are exposed. The rocks strike roughly N-S and dip steeply to the East.

GEOLOGY AT THE SITE

The ground surface in the actual foundation area is mainly flat and is covered by dark brown sandy clay with some solid fill fragments,

The geological profile indicated by the drilling is summarized in the following table.

Depth (feet)	Age	Description
0 - 1	Recent	Fill: <u>CLAY SOIL</u> , low plasticity, dark brown. Numerous solid fragments.
1 - 2	"	<u>SAND</u> , fine grained, excess silt and clay fines. Greyish-brown.
2 - 18	"	<u>CLAY SOIL</u> , low plasticity, silty to sandy. Brown to red-brown and lesser grey mottled. Few small gravel fragments.
18 - 34	"	<u>SAND</u> , fine grained, excess clayey fines. Brown, red-brown and grey mottled. Slightly calcareous. Becoming very sandy clay in part.
34 - 42	"	<u>CLAY SOIL</u> , low plasticity, silty to sandy. Red-brown, grey mottled.
42 - 58	"	<u>SAND</u> , fine to medium grained clayey to silty in part. Brown, red-brown and grey mottled.
58 - 65	"	<u>CLAY SOIL</u> , low plasticity, becoming sandy at depth. Red-brown and green-grey mottled.

FOUNDATION CHARACTERISTICS

The clays, encountered in the drilling programme generally proved to be stiff to very stiff throughout and the sand horizons very dense.

Blows per foot of penetration were generally in excess of 30, and values of unconfined compressive strength (Q_u) taken by hand penetrometer were generally greater than 4.5 tons

per square foot, (limit of the instrument).

Blows per foot and penetrometer values were slightly less between 6 and 10 feet, however even this material is stiff to very stiff in core sample.

Based on an assumed loading of $2\frac{1}{2}$ tons per square foot, the proposed structure could be safely supported on any of the material, encountered in the drill holes.

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

RDS:AGK
14/5/65

PERCUSSION DRILLHOLE LOG NO. 1

PROJECT: Silo Site

HIRER: S.A.C.B.H. Ltd.

LOCATION: Railway Yards, Wasleys **SECTION:**

HUNDRED: Mudlawirra

FEATURE: Test of Foundation Conditions

TYPE: Ruston

PLANT NO.: 21

DRILLER: A. Porter

DEPTH: 65 ft.

DATE COMPLETED: 12 Apr. 1965

DATE COMMENCED: 8 Apr. 1965

DATE: Apr. 1965.

BORE LOGGED: R.D. Steel

Depth (Ft.)	Group Symbol	Description	Depth (Ft.)	Type of Sample	Blows per foot	Cu Hand Penetra- tion
0.0- 1	CL	Fill: <u>CLAY SOIL</u> , low plasticity very sandy. Greyish to brown. Very dense. Numerous small solid fragments.	0-1	Open Tube D Shoe	70	4.5+
1- 2	SC	<u>SAND</u> , fine grained, excess silt and clay fines. Greyish-brown. Very dense. Few small plant root and gravel fragments and pockets of Fe oxide.	1-2	"	70	"
2- 5.5	CL	<u>CLAY SOIL</u> , low plasticity, silty to finely sandy. Brown. Very stiff to extremely stiff, moist. Approximately 1% small GRAVEL (qtz and laterite). Few small pockets of organic material and whitish chalky lime.	2-3 3-4 4-5 5-6	" " " "	120 45 19 10	" " " "
5.5-15.0	CL	<u>CLAY SOIL</u> , low plasticity, silty to sandy. Brown to red-brown mottled. Very stiff, moist. Contains 1-2% sand and small gravel fragments.	6-7 7-8 8-9 9-10 10-10'5 10'5-11.5	Open Tube A Shoe " Stand- ard I.T.	8 9 10 10 - 8	4.0 4.5 4.5+ " "
			11.5-12 12-13 13-14 14-15	Open Tube A Shoe "	16 16 18 22	" " " "
15 -19	CL SC	<u>CLAY SOIL</u> , low plasticity, very sandy. Brown, red-brown and light grey mottled. Very stiff moist. Few pockets of clayey fine sand.	15-16 16-17 17-18 18-19	" " " "	28 23 30 40	" " " Too friable to re-cord
19 -25	SC	<u>SAND</u> , fine grained excess clayey fines. Brown red-brown and lesser greyish mottled. Dense and somewhat friable. Occasional lime cemented nodules.	19-20 20-21 21-22 22-23 23-24 24-25	" Stand- ard I.T. Open Tube A Shoe "	40 48 80 55 48 30	" " " " " "
25 -29	CL	<u>CLAY SOIL</u> , low plasticity, very sandy. Red-brown and greyish mottled. Stiff to very dense and moist.	25-26 26-27 27-28 28-29	" " " "	32 34 35 44	4.5+ " " Too friable to re-cord

Percussion Drill Hole Log No. 1 (S.A.C.B.H. Wasleys)

Depth (Ft.)	Group Sym- bol	Description	Depth (Ft.)	Type of Sample	Blows per foot	Qu Hand Penet- ration
29'0"-34'0"	SC- SM	<u>SAND</u> , fine grained, excess silt and clay fines. Red-brown, grey and dark brown mottled. Stiff to somewhat friable, moist.	29-29'6 29'6-30 30-31 31-32 32-33 33-34	Open Tube A Shoe Stand- ard penetr- ation Test Open Tube A Shoe	34 30 32 32	Too friable to re- cord " " "
34 -42.5	CL	<u>CLAY SOIL</u> , low plasticity, silty to sandy. Slightly micaceous. Red-brown, with lesser greyish mottling. Very stiff. Moist.	34-35 35-36 36-37 37-38 38-39 39-40 40-40.5 40.5-41.5	" " " " " " Stand- ard	32 32 30 28 30 34 - 38	4.5+ " " " " " " "
42.5-49.5	SC	<u>SAND</u> , fine grained, slightly clayey to silty. Brown red-brown and lesser greyish mottling. Dense, somewhat friable, moist.	41.5-42.5 42.5-43.5 43.5-44.5 44.5-45.5 45.5-46.5 46.5-47.5 47.5-48.5 48.5-49.5	Open Tube A Shoe " " " " "	30 30 30 26 30 30 40 60	" " " " " " Too friable to record
49.5-56	SC	<u>SAND</u> , fine grained, slightly clayey. Light brown, light red-brown and lesser grey-yellow mottled. Dense, fairly friable, slightly micaceous.	49.5-50.5 50.5-51 51 - 52 52 - 53 53 - 54 54 - 55 55 - 56	" Stand- ard penetr- ation Test Open A Shoe " "	65 - 60 60 50 60 70	" " " 4.5+ Too friable to re- cord
56 -58	SC	<u>SAND</u> , fine to medium grain, excess, clayey fines. Red-brown and yellow-grey mottling. Very to extremely stiff and slightly moist.	56 - 57 57 - 58	" "	70 70	4.5+ "
58 -65	CL	<u>CLAY SOIL</u> , low plasticity, becoming somewhat sandy at depth. Red-brown and lesser green-grey mottling. Very stiff to extremely stiff, moist.	58 - 59 59 - 60 60 - 60.5 60.5-61.5 61.5-62 62 - 63 63 - 64 64 - 65	" " Stand- ard penetr- ation Test Open Tube A Shoe "	75 60 - - 50 40 45 47	" " " " " " " "

END OF HOLE 65 feet

WATER CUT AT: N11
STATIC WATER LEVEL: N11

PERCUSSION DRILL HOLE LOG NO. 2

PROJECT: Silo Site

LOCATION: Railway Yards, Wasleys

SECTION:

HUNDRED: Mudlawirra

FEATURE: Test of Foundation Conditions

PLANT NO.: 21

TYPE: Ruston

DEPTH: 32'6"

DRILLER: A. Porter

DATE COMMENCED: 14 April 1965

DATE COMPLETED: 15 April 1965

BORE LOGGED: R.D. STEEL

DATE: April 1965

Depth (Ft.)	Group Symbol	Description	Depth (Ft.)	Type of Shoe	Blows per foot	Hand Penetr- ation Qu
0.0- 2.5	CL	<u>CLAY SOIL</u> , low plasticity, silty to sandy. Dark brown. Stiff to very stiff, moist. Few small limey pockets.	0-1 1-2 2-2.5	Open Tube A Shoe	30 25 24	4.5+ " "
2.5- 4	CL	<u>Sealed Tube Sample</u>	2.5-4	Sealed Tube	34	"
4 - 5	CL	<u>CLAY SOIL</u> , low plasticity, silty to sandy. Dark brown to red-brown. Very stiff, moist. Possibly 40% chalky white lime pockets and small hard nodules.	4-4.5 4.5-5.5	Stand- ard Penetr- ation Test	12 14	" "
5 - 6	CL	<u>CLAY SOIL</u> , low plasticity, silty to slightly sandy. Red-brown. Very stiff, moist. Few small organic pockets.	5.5-6	Open Tube A Shoe	28	"
6 - 7.5		<u>Sealed Tube Sample</u>	6-7.5	Sealed Tube	26	"
7.5-12.0	CH	<u>CLAY SOIL</u> , medium to high plasticity, slightly silty. Red brown and lesser grey mottling. Very stiff, moist.	7.5-8.5 8.5-9.5 9.5-10.5 10.5-11.5 11.5-12	Open Tube A Shoe " "	18 20 20 14 16	4.0 4.5+ " " "
12 -13.5		<u>Sealed Tube Sample</u>	12-13.5	Sealed Tube	20	"
13.5-15	CL- GC	<u>CLAY SOIL</u> , low plasticity, very sandy. Contains up to 40% sub-angular quartz gravel fragments up to 1" size. Very stiff, moist.	13.5-14.5 14.5-15	Open Tube A Shoe	26 28	" "
15 -16.5		<u>Sealed Tube Sample</u>	15-16.5	Sealed Tube	40	"
16.5-17.5	CL	<u>CLAY SOIL</u> , low plasticity, sandy. Dark grey-brown with slight greyish mottling. Very stiff.	16.5-17 17-17.5	Open Tube A Shoe Stand- ard	44 6	" "
17.5-19	SC	<u>SAND</u> , fine grained, excess clayey fines. Red-brown and lesser greyish mottling. Stiff and dense, to slightly friable.	17.5-18.5 18.5-19	penetr- ation Test Open Tube A Shoe	37 52	" Too friable to record
19 -20.5		<u>Sealed Tube Sample</u>	19-20.5	Sealed Tube	52	"

Percussion Drillhole Log No. 2 (S.A.C.B.H. Wasleys Bore 2)

Depth (Ft.)	Group Sym- bol	Description	Depth (Ft.)	Type of Sample	Blows per foot	Qu Hand Penetra- tion
20.5-22	SP	<u>SAND</u> , fine to medium grained; clayey in parts. Brown to red brown and lesser greyish mottled. Slightly calcareous in part. Dense, friable.	20.5-21.5	Open Tube A Shoe	40	Too friable to test
			21.5-22	"	44	
22 -23.5		<u>Sealed Tube Sample</u>	22-23.5	Sealed Tube	40	"
23.5-26	SP	<u>SAND</u> , fine to medium grained clayey in parts. Brown to red brown and lesser greyish mottled. Dense, friable.	23.5-24.0	Open Tube A Shoe	48	"
			24.0-24.5	Stand-	12	"
			24.5-25.5	ard Penetr- ation Test	50	"
26 -27.5		<u>Sealed Tube Sample</u>	26-27.5	Sealed Tube	42	"
27.5-28.5	SP	<u>SAND</u> , fine to medium grained clayey. Red-brown and grey mottled. Dense, friable.	27.5-28.5	Open Tube A Shoe	36	"
28.5-31	CL- SC	<u>CLAY SOIL</u> , low plasticity, very sandy. Red-brown and lesser light grey mottled. Very stiff moist.	28.5-29.5	"	35	4.5+
			29.5-30.5	"	35	"
			30.5-31	"	36	"
31 -32.5		<u>Sealed Tube Sample</u>	31-32.5	Sealed Tube	46	"

END OF HOLE 32.5

Water Cut - NIL

FIG. 1

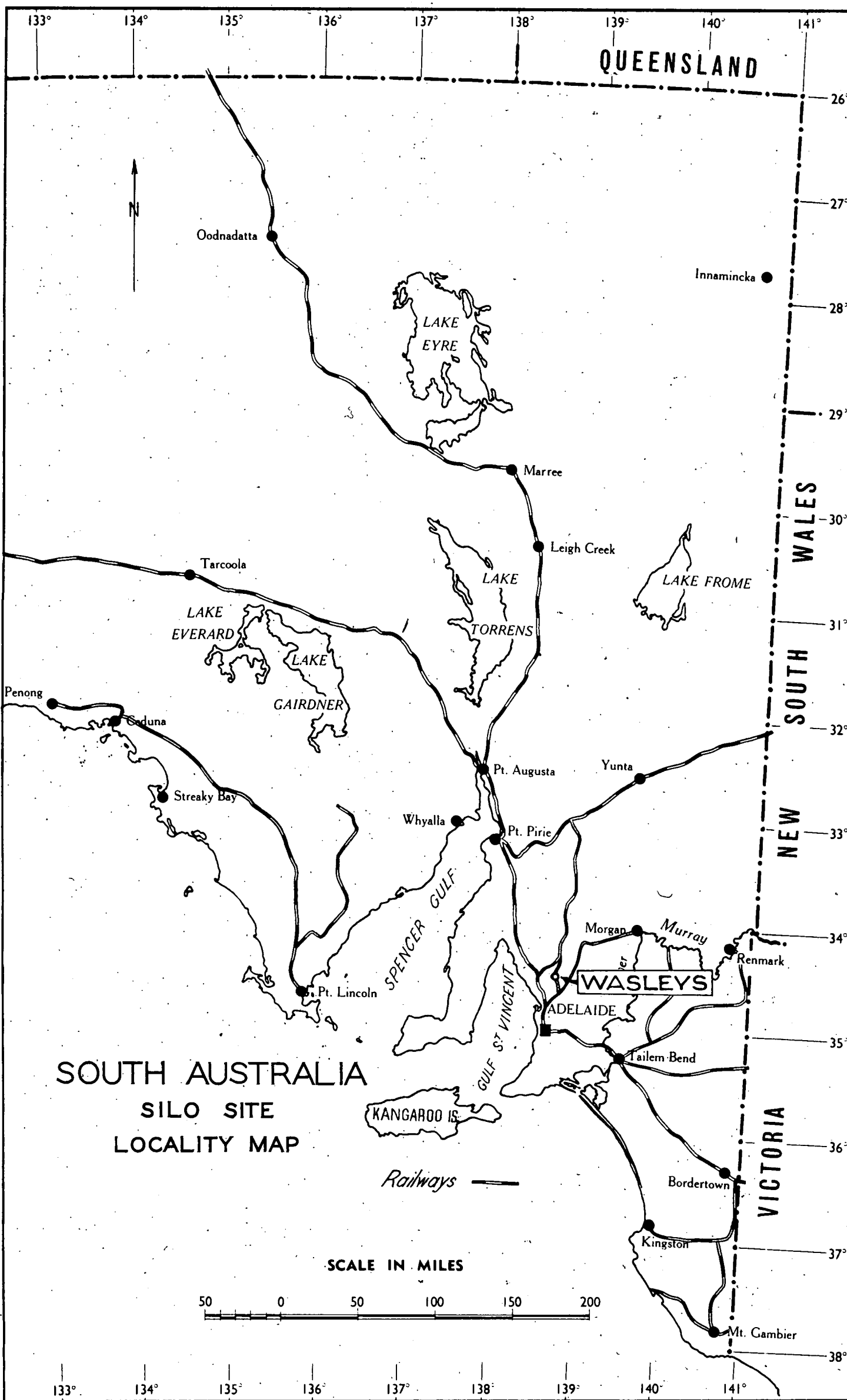
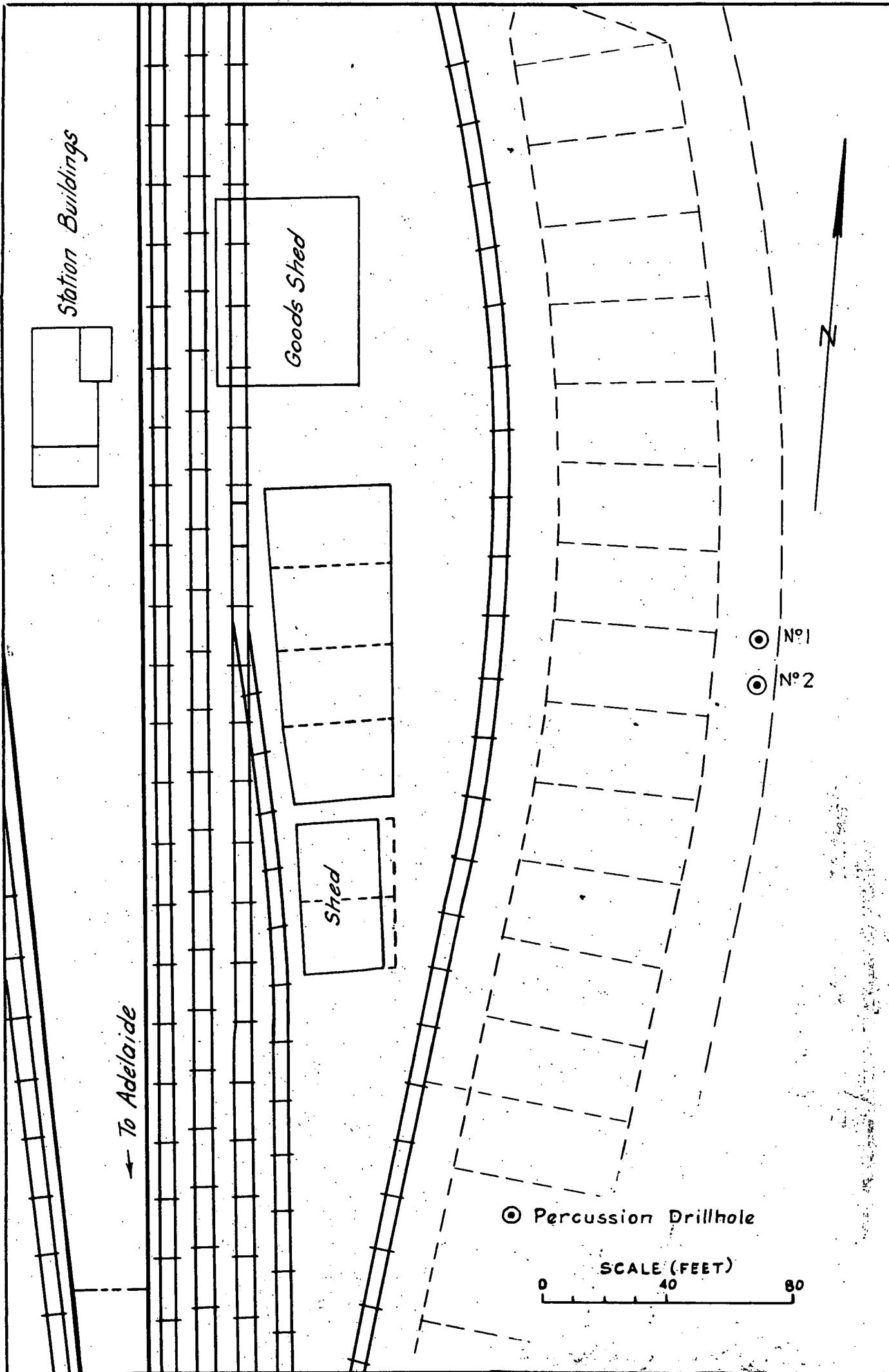


FIG. 2.



S.A. DEPARTMENT OF MINES

Approved	Passed	Drn. R.D.S.	PROPOSED S.A.C.B.H. SILO SITE WASLEYS, HD. MUDLA WIRRA LOCALITY PLAN SHOWING PERCUSSION DRILL HOLE POSITIONS	D.M.	Scale As shown
		Tcd. B.S.		Req.	S4353
		Ckd. R.D.S.			Gj 7.
Director		Exd.			Date 10-5-65

HOLE NO.	2
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SHEET 1 OF 1

Sec: Hd MUDLA WIRRA

FIG:4

SOIL TYPE		CASING R.L.(FEET)	DEPTH (FEET)	GRAPHIC LOG	GROUP SYMBOL	SOIL DESCRIPTION GROUP NAME	CONSISTENCY REL. DENSITY	MOISTURE CONTENT	WATER LEVELS	PENETRATION DATA										
GEOLOGICAL DESCRIPTION										BLOWS/FOOT		Hand Penetration Qu. (lbs p. Sq. feet)								
										20	40	60	80	100	1	2	3	4	5	
PLEISTOCENE - RECENT MOOTTLED SANDS, CLAY ETC.	Few small limey pockets	USED	10		CL	CLAY SOIL, low plasticity, silty to sandy. Dark brown to red-brown. 40% CaCO3	STIFF	GENERAL	CUT		SPT(37)	Too Friable to record	4.5+							
	Lime in earthy pockets and hard nodules				CH	CLAY SOIL, med-high plasticity, silty. Red-brown grey mottled.														4.5+
	GRAVEL, mainly sub-angular quartz				CL	CLAY SOIL, low plasticity, sandy. 40% GRAVEL up to 0.02 feet														4.5+
	SAND grains mainly subangular to sub-rounded quartz				CL	CLAY SOIL, low plasticity sandy. Dark grey brown.														
					SC	SAND, fine grained, excess clayey fines. Red-brown grey mottled.														
	Slightly calcareous.				SP	SAND, fine-medium grained clayey in parts. Brown red-brown, grey mottled.														
					CL	CLAY SOIL, low plasticity, very sandy. Red brown, light grey mottled.														4.5+
						END OF HOLE 32.5ft.														

DEPARTMENT OF MINES SOUTH AUSTRALIA

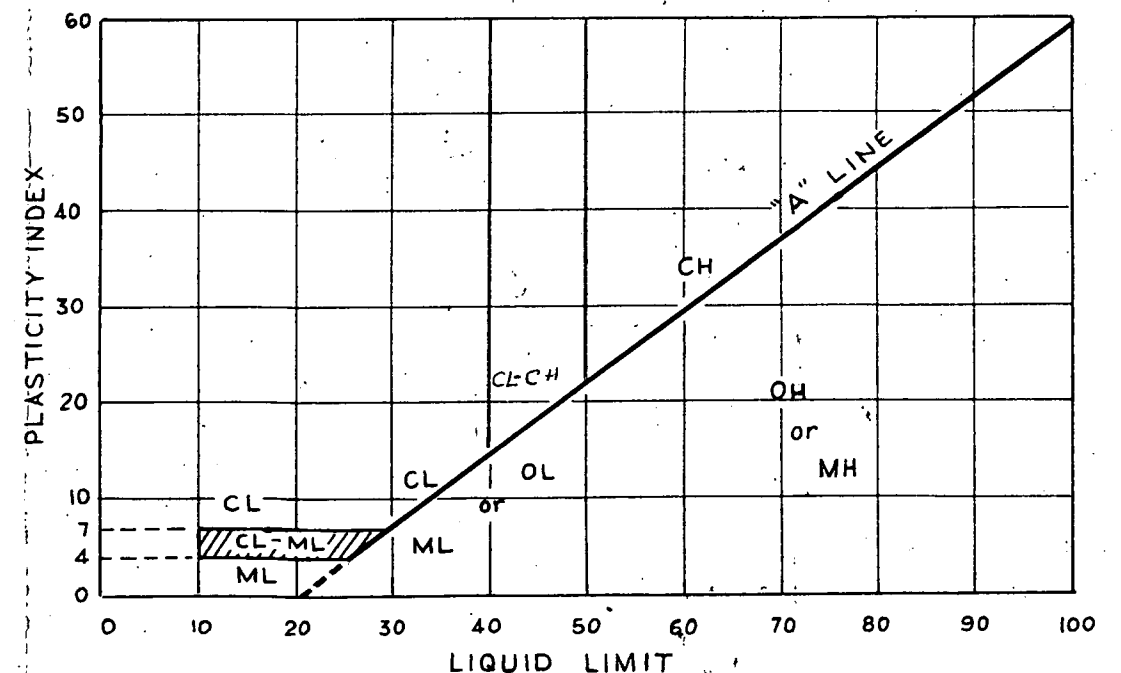
SOILS CLASSIFICATION CHART

FIELD IDENTIFICATION PROCEDURES (Excluding particles larger than 0.25 ft. and basing fractions on estimated weights)				GROUP SYMBOL	GROUP NAME and typical materials	LABORATORY CLASSIFICATION CRITERIA				
COARSE GRAINED SOILS More than 50% of material is larger than No. 200 B.S. Sieve size.	GRAVELS More than 50% of the coarse fraction is larger than 2mm.	CLEAN GRAVELS Little or no fines	Wide range in grain size and substantial amounts of all intermediate particle sizes	GW	GRAVEL, well graded; gravel sand mixtures, little or no fines	Coarse grained soils classified on basis of percentage of fines, as follows SANDS SW, SP, SM, SC More than 12 5 to 12 Borderline cases, use 2 symbols	$C_u = \frac{D_{60}}{D_{10}}$ Greater than 4 $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between one and 3			
			Predominantly one size, or a range of sizes, with some intermediate sizes missing.	GP	GRAVEL, poorly graded; gravel sand mixtures, little or no fines.		Not meeting all gradation requirements for GW			
		DIRTY GRAVELS Appreciable amount of fines	Non-plastic fines - for identification see ML below.	GM	GRAVEL, excess silty fines; poorly graded gravel-sand-silt mixtures		Atterberg limits below "A" line or PI less than 4		Above "A" line with PI between 4 and 7 are borderline cases requiring use of dual symbols	
			Plastic fines - for identification see CL below	GC	GRAVEL, excess clayey fines; poorly graded gravel-sand-clay mixtures		Atterberg limits above "A" line with PI greater than 7			
	SANDS More than 50% of the coarse fraction is smaller than 2mm.	CLEAN SANDS Little or no fines.	Wide range in grain sizes, and substantial amounts of all intermediate particle sizes	SW	SAND, well graded; well graded sands, gravelly sands, little or no fines.		$C_u = \frac{D_{60}}{D_{10}}$ Greater than 6 $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between one and 3			
			Predominantly one size or a range of sizes, with some intermediate sizes missing.	SP	SAND, poorly graded; poorly graded sands, gravelly sands, little or no fines		Not meeting all gradation requirements for SW			
		DIRTY SANDS Appreciable amount of fines	Non plastic fines - for identification see M L below	SM	SAND, excess silty fines; poorly graded sand-silt mixtures		Atterberg limits below "A" line or PI less than 4		Above "A" line with PI between 4 and 7 are borderline cases requiring use of dual symbols	
			Plastic fines - for identification see CL below	SC	SAND excess clayey fines; poorly graded sand-clay mixtures.		Atterberg limits above "A" line with PI greater than 7			

FINE GRAINED SOILS More than 50% of material is smaller than No. 200 B.S. sieve size.	FIELD INVESTIGATION PROCEDURES (on fraction smaller than B.S. No.7 sieve)							GROUP SYMBOL	GROUP NAME (and typical materials)	
	SILTS AND CLAYS Liquid limit less than 50	SOIL CAST (wet soil)	SOIL THREAD	SHINE	DILATANCY	ODOUR	DRY STRENGTH	ML	SILT SOIL, low plasticity; inorganic silts and very fine silty or clayey sands, rock flour.	
		Forms fragile cast. Cracks form when kneaded while moist	Thick, crumbly thread, easily broken	None to very dull	Distinct	Not significant	None to slight	CL	CLAY SOIL, low plasticity; inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays	
		Cast may be handled freely without breaking. Can be kneaded moist without cracking. Material adheres to the hand.	Thread can be pointed as fine as a lead pencil, but is fragile.	Moderate	None to slight	Not significant	Moderate	OL	ORGANIC SOIL, low plasticity; organic silts and silt clays of low plasticity	
	SILTS AND CLAYS Liquid limit more than 50	Cast fragile to cohesive material will adhere somewhat to the hand.	Soft, weak thread.	None to very dull	Slight to distinct	Decayed organic matter	Low	MH	SILT SOIL, high plasticity; inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.	
		Moderately plastic and cohesive. Material adheres somewhat to the hand	Weak to medium thread. May be crumbly.	Dull	None to slight	Not significant	Moderate. Powdered soil feels floury	CH	CLAY SOIL, high plasticity; inorganic clays of high plasticity, fat clays	
		Very plastic and cohesive. Material very sticky to the hand. Greasy to touch.	Very tough thread. Can be rolled to a pin point.	Very glossy	None	Strong earthy.	High to very high. Cannot be powdered by finger pressure	OH	ORGANIC SOIL, high plasticity; organic clays of medium to high plasticity.	
		Plastic and cohesive. Feels slightly spongy. Greasy to touch.	Weak to medium thread. Often soft and fibrous	Moderate to very glossy	None	Decayed organic matter	Moderate to high. Powdered soil may be fibrous.			
	HIGHLY ORGANIC SOILS	Readily identified by colour, odour, spongy feel and frequently by fibrous texture.							Pt	PEATY SOIL; Peat and other highly organic soils.

GRAIN SIZE CURVE TO BE USED TO IDENTIFY SOIL FRACTIONS	PERCENT OF FINES		Coarse grained soils classified on basis of percentage of fines, as follows SANDS SW, SP, SM, SC More than 12 5 to 12 Borderline cases, use 2 symbols	GRAVELS GW, GP, GM, GC		SANDS SW, SP, SM, SC		LABORATORY CLASSIFICATION CRITERIA	
	Less than 5	More than 12		Less than 5	More than 12	Atterberg limits below "A" line or PI less than 4		Above "A" line with PI between 4 and 7 are borderline cases requiring use of dual symbols	
	5 to 12			5 to 12		Atterberg limits above "A" line with PI greater than 7		Atterberg limits above "A" line with PI greater than 7	
	5 to 12			5 to 12		Atterberg limits above "A" line with PI greater than 7		Atterberg limits above "A" line with PI greater than 7	
	5 to 12			5 to 12		Atterberg limits above "A" line with PI greater than 7		Atterberg limits above "A" line with PI greater than 7	
	5 to 12			5 to 12		Atterberg limits above "A" line with PI greater than 7		Atterberg limits above "A" line with PI greater than 7	
	5 to 12			5 to 12		Atterberg limits above "A" line with PI greater than 7		Atterberg limits above "A" line with PI greater than 7	
	5 to 12			5 to 12		Atterberg limits above "A" line with PI greater than 7		Atterberg limits above "A" line with PI greater than 7	
	5 to 12			5 to 12		Atterberg limits above "A" line with PI greater than 7		Atterberg limits above "A" line with PI greater than 7	
	5 to 12			5 to 12		Atterberg limits above "A" line with PI greater than 7		Atterberg limits above "A" line with PI greater than 7	

PLASTICITY INDEX	60	50	40	30	20	10	7	4	0
LIQUID LIMIT									
PLASTICITY CHART FOR LABORATORY CLASSIFICATION OF FINE GRAINED SOILS									



PLASTICITY CHART
FOR LABORATORY CLASSIFICATION OF FINE GRAINED SOILS

NOTE : BOUNDARY CLASSIFICATIONS : Soils possessing characteristics of two groups are shown as a combination of two group symbols, e.g. GW - GC, well graded gravel with clay binder.

Based on "The Unified Soil Classification System"
United States Department of the Interior,
Bureau of Reclamation "Earth Manual"
First Edition, Denver COLORADO 1960