DEPARTMENT OF MINES
SOUTH AUSTRALIA

GEOLOGICAL SURVEY

SOILS GEOLOGY SECTION

FINAL REPORT ON SITE INVESTIGATION

PROPOSED OIL REFINERY SITE

PORT STANVAC

SECTIONS 581, 582, 586 & 602

PART SECTIONS 588, 603 & 604

HD. NOARLUNGA

by

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CONTENTS

	Page
Abstract	1
Introduction	3
Topography	5
General Geology	7
(1) Bedrock Formations, Structures & Geomorphology	7
(2) Interpretation of Bore Log Data	10
(3) Tertiary Rocks and Their Mode of Occurrence	11
(4) Pleistocene to Recent Deposits	13
(a) Piedmont Alluvial Deposits	13
(b) Aeolian Deposits	16
Tectonic Development and Physiographic Evolution	20
Drainage	22
Seismic History	24
Appraisal of Site for Industrial Development	26
(1) Topography	26
(2) Soil Characteristics	27
(3) Local Experience of Soil Behaviour	29
(4) Soil Structure and its Probable Significance	30
(5) Possible Significance of Fissures	31
(6) Depth of Zone of Significant Moisture Variation	33
(7) Drainage	34
(8) Suitability of Locally Excavated Soil for Earthworks	35
(9) Possibility of Seismic Disturbance	35
Conclusions and Recommendations	36
Addendum	37
References	38

CONTENTS (Contd.)

APPENDICES

Logs of Test Bores Nos. 1A to 26A inclusive
Logs of Test Pits "A" to "P" inclusive
Logs of Test Bores Nos. 28 to 33 inclusive

PLANS AND SECTIONS

Plan of Site	Scale 1" = 400'	No. 60-446
Plan of Process Area	Scale 1" = 100'	No. 61-545
Sections A-A' and B-B'	Scales 1" = 100' & 1" = 40'	No. L60-115
Sections C-C' and D-D'	Scales 1" = 100' & 1" = 40'	No. L60-116
Sections Aa-Aa', Ab-Ab' and Ac-Ac'	Scales 1" = 100' & 1" = 40'	No. 61-546
Sections Ba-Ba' and Bb-Bb'	Scales 1" = 100' & 1" = 40'	No. 61-547

ABSTRACT

A final site investigation has been carried out at the proposed oil refinery site at Port Stanvac, S.A., on behalf of the contractors for construction, the M.W. Kellogg Company.

The test boring, involving 26 boreholes totalling 1420'0½", and the construction of 13 test pits was carried out by Soil Engineering Laboratories, who also carried out all the laboratory testing and interpretation and compiled the engineering report.

The writer was responsible for geological oversight of the work, logging of bore samples and test pits and geological mapping and interpretation.

This report describes the topography of the site and deduces the tectonic development and physiographic evolution of the area.

The general geology of the site was given in previous reports, but it has been amplified and is re-presented here in full.

Marinoan bedrock, comprising steeply-dipping siliceous slates, sandy and silty slates, fine sandstones, quartzites and minor arkosic sandstones, outcrops abundantly on the beach, and excellent exposures of these rocks can be seen almost throughout the entire length of the coastal cliffs. The test bores and other exposures show that these rocks extend under the whole of the site, but they prove to be mainly deeply weathered and moderately soft to completely decomposed under most of the site. Only along the coastal fringe and along the eastern margin of the site are they mainly hard. The general strike is N 20° E.

These rocks form part of the western limb of a tight major anticline with a shallow SSW pitch and therefore should have steep westerly dips, but observed dips range from 60°E to 85°W due to local slumping and flexures.

Bedrock is truncated by a wave-cut platform which is visible in the cliffs about 100 ft. above sea-level. This feature rises gently inland for a distance of the order of 3000 ft. Here, at the old buried coastline, bedrock rises more sharply in a series of terraces to the eastern boundary of the site.

A remnant of Pliocene sandy limestone is intimately associated with this platform and a Late Pliocene sandstone, partly eroded, occurs over the terraces and tapering out on the platform.

Overlying all of the foregoing rocks is a series of lenticular, piedmont-type deposits of freshwater alluvials, ranging in character from fine sands to fat clays and probably of Pleistocene age.

Blanketing all of the previous deposits is a veneer of aeolian calcareous deposits and loam, considered to be of Late Pleistocene age.

The topography presents problems in siting the process plant and ancilliary units and also has some minor unfavourable features with regard to foundations.

The clayey Pleistocene materials are subject to shrinking and swelling movements and present problems in foundation design.

The finely sandy marl-earth is sensitive to moisture changes and presents a bearing capacity problem.

The general conclusion reached is that the unfavourable aspects of this site outweigh the favourable ones, but the site is not condemned.

Some features of the site have not been adequately investigated and further work is recommended.

INTRODUCTION

It is proposed to construct an oil refinery on a large area of former grazing land immediately north of the very small seaside resort of O'Sullivans Beach. The appropriate map reference is; Sections 581, 582, 586, 587, 602 and Part Sections 588, 603 and 604, Hundred of Noarlunga, County Adelaide, State of South Australia. It has been announced that henceforth this area will be known as Port Stanvac. The total area involved is 603.775 acres.

A preliminary investigation was carried out on this site at the request of Mr. F. Mugford, Construction Adviser, Vacuum Oil Company, Pty. Ltd., on behalf of the Subsidiary company, Standard-Vacuum Refining Co. (Australia) Pty. Ltd. This investigation was carried out by the S.A. Department of Mines in collaboration with the Soil Mechanics Section, Commonwealth Scientific and Industrial Research Organization, and was the subject of a three-part report (1,2,3) submitted to the parent company. Subsequent to this report six test bores were put down at six possible tank farm sites on this property and results obtained from tests of undisturbed samples from these bores, plus results of plate bearing tests, were the subject of a further report by the Soil Mechanics Section, C.S.I.R.O. (4). No geological report was submitted on these additional bores, but their logs are appended to this report and the results have been taken into consideration in the assessment of the site. The original sections also have been modified, where appropriate, to incorporate the results of some of these bores.

The final investigation, the subject of this report, was carried out by Soil Engineering Laboratories, of Eastwood, S.A. at the request of Mr. B.G. Marcin of the M.W. Kellogg Company, New York, U.S.A. The writer was engaged by that company, through its subsidiary Kellogg Overseas Corporation, of Sydney, N.S.W., to carry out geological oversight of the

investigation, further geological investigations and the preparation of a geological report.

Boring and sampling operations were carried out by Soil Engineering Laboratories and this work commenced on the 19th April. Ideally, about 10 purely geological bores should have been constructed first, with undisturbed sampling throughout, samples being extruded, examined and logged in the field. With proper geological supervision an appreciable number of samples need not be extruded and could be sealed and submitted for testing. Additional geological sections should have been drawn and results assessed. Next the test boring should have been carried out, each bore being logged as completely as possible and plotted before any samples were tested. Then representative samples could have been selected for testing at positions having the most significance and widest application within each stratum. However, a tight and completely inadequate time schedule prevented any of these things being done. Samples for testing were selected more on a statistical basis than on a geological one and testing proceeded simultaneously with sampling in order to meet deadlines for interim reports. Because of other duties logging was not commenced until the 12th May. By this time the samples were scattered throughout the laboratories in various stages of testing. The samples available for logging were of four categories; shoe samples (largely fragmented), remnants from testing (wholly fragmented), complete samples 8" long in tins (not consecutive) and some rock cores. A considerable number of samples had to remain sealed and were not available for logging. Much time was spent in locating samples and the logging of the fragmented samples was a lengthy and difficult procedure. A number of gaps in the logs could be filled in from the engineers' descriptions of samples tested, but the resultant logs can by no means be considered complete or satisfactory.

Soil sampling was completed on the 3rd June, rock

sampling was completed on the 7th July and logging was completed on the 10th July. Thus no time was available to put down additional bores to clarify the geology and further test critical areas. Incomplete logs and the lack of bores at critical points rendered the lack of constructing detailed sections difficult and the sections themselves are, therefore, less reliable than they might have been. Although geological experience aided in selecting the most probable of a number of alternatives in every section, it is not a substitute for facts.

This report incorporates all the significant and relevant geological material given in the report on the preliminary investigation (1,3), excepting the logs of Bores 1 to 27. Some of the descriptions and conclusions presented in that report required modification in view of the additional data obtained. To this extent this final report can be regarded as superseding the report on the preliminary investigation.

TOPOGRAPHY

The dominant physiographic features in the vicinity of Adelaide are the Mount Lofty Ranges, the Adelaide Coastal Plain and Gulf St. Vincent. These three features, together with Yorke Peninsula have a general north-south trend and are manifestations of the development of a complex branching and curving horst-and-graben structure, with much subsidiary faulting. The southern half of the Mount Lofty Horst curves to south-westward and has several spur fault blocks springing from its western flank. All these spur blocks curve to westward and have a southerly tilt. One of these, the Eden Block bounds the major part of the Adelaide metropolitan area to the east, south-east and south and its topographical expression terminates abruptly at the coast. This block is bounded on the northern-most side by the Eden Fault and on the southern-most

side by the Clarendon-Ochre Cove Fault. The refinery site is located on the coast and approximately on the centre-line of this block, about 4 miles south of the point where the Eden-Fault cuts the coastline. The site comprises elevated, gently indulating, open pasture land. The surface has a general gentle slope towards the coast from a maximum reduced level of about 373ft. (datum 100.80) until it reaches the approximate level of the 270ft. contour. From this level the old land surface has been largely eroded and the newer erosion surface slopes at steeper angles to the coast. At the coast the surface drops sharply to beach level to form steep cliffs ranging from 90ft. high in the south to 115ft. high in the north. Three short, incised gullies indent this line of cliffs, two in the southern half of the site and one near the northern boundary. The northern gully is the longest (15 chains) and appears to be the most recent of the three. It is sharply and deeply incised and its steep walls expose the whole sequence of strata at this position in clear detail. Adjoining the northern boundary of the site a remnant panel of rock juts out from the cliffs into the water, reaching approximately to the low-water line. This panel displays siliceous slates contorted in a remarkable fashion.

At the toe of the cliffs a narrow sand beach occurs, but this only reaches the sea in two places near the southern end of the site. Throughout most of its length the beach is bounded on the seaward side by a broad belt of outcropping, strongly jointed rocks. Further to seaward several reefs occur.

Near the south-eastern corner of the site a small valley with a mature profile enters the site from the east near the northern boundary of Part Section 604. After entering the site this valley turns sharply southward, becoming rapidly larger and deeper until it joins the larger valley of an unnamed stream which flows westward to the sea. The walls of this latter valley are eroded and expose slates, quartzites and arkosic sandstones.

Drainage, its patterns and modes, is normally intimately and predominantly associated with topography and is generally discussed under this heading. However, at this site the geology, particularly the stratigraphy, has an important, if not dominant influence on the mode and pattern of drainage. Therefore, discussion of the drainage will be deferred until the geology has been considered in detail.

GENERAL GEOLOGY

(1) Bedrock Formations, Structures and Geomorphology.

The rocks outcropping on the beach are mainly hard, silty to finely sandy slates occurring as beds of moderate thickness and dominantly dark brown in colour. Lesser groups of very thinly bedded siliceous slates occur, some groups being silicified to form a solid mass of very hard rock, or psuedo-quartzite. There is some evidence to suggest that this silicification is somewhat superficial, a sort of "case hardening". Several beds of true quartzite occur and these stand out prominantly, with yellow-brown colours dominant. Occasional thin, pale grey to pale greenish-grey, softer, silty slate beds occur intercalated with the other rocks. All of these rocks are very steeply dipping and they clearly display the general strike of the beds, which is N20°E. At the northern end of this beach the strike of these beds is less regular, although the general trend is preserved, and several small drag folds with very flat southerly pitches are present. Some overturning and crumpling of the beds is evident. The slates exposed in the panel of rock jutting out from the cliffs are folded, crumpled and overturned in a striking fashion.

Rocks of this group are also exposed throughout the length of the cliffs, where the dips of the beds can be observed indetail. At the northernend of the cliffs the rocks exposed are closely similar to those on the beach, but in a southward direction these rocks develop facies changes and

become predominatly softer, thinly bedded to lamellar, purplish-brown, silty slates, with some intercalated brown, light brownish-grey and pale greenish-grey beds. Here, particularly in the embayment straddling the line of section C-C', weathering and erosion are currently active.

In the deep valley of a westward flowing, but somewhat meandering stream (mentioned previously), which occurs about one half mile south of the southern boundary of the site, these rocks are agin exposed in several places. Here the thinly bedded, purplish-brown, silty slates predominate, but two thick quartzite beds are also exposed, with fine arkosic sandstone sandwiched between. Here also the strikes and dips of the beds give consistent evidence of a large anticlinal fold with a shallow pitch to southward.

Flat-dipping, purplish-brown, silty slates are exposed in a road cutting about $\frac{1}{4}$ mile south of the southern boundary of Section 604 and steeply dipping slates of the same type are revealed in a road cutting about $\frac{1}{2}$ mile east of the eastern boundary of Part Section 588.

The northern-most gully discloses approximately a 100ft. thickness of light-coloured very sandy slates and lesser clayey sandstones immediately behind the cliff face. These rocks are in an advanced stage of decomposition. Immediately to the east is a further 200ft. thickness of dominantly thinly bedded, red-brown, light yellow-brown and pale brownish-grey silty slates, also almost completely decomposed. At this point a narrow group of hard siliceous slates occurs, to be followed by weathered purplish-brown silty slates. The bedrock exposed in the other two gullies is wholly thinly-bedded, purplish-brown, silty slates in a condition that ranges from weathered, but hard, to almost completely decomposed.

Examination of the natural exposures leads to the conclusion that the dominant rock type in the bedrock underlying the site is the purplish-brown silty slate in various stages of weathering. This conclusion is supported by the fact that 82%

of the bores which penetrated into bedrock encountered this type of rock.

These rocks have been extensively mapped beyond the confines of the refinery site and prove to be upper members of the Marinoan Series, the topmost series of the Adelaide System (Proterozoic Era).

The Echunga 1 mile Geological Sheet (5) shows that these rocks in the vicinity of the refinery site are sharply folded into a large anticline with a very shallow pitch in a south-westerly direction. The axial plane of this fold passes through the south-eastern corner of the site (datum point) on a bearing of 211°, hence the whole of the site occupies part of the western limb of this fold. Therefore, all of these beds beneath the site should have steep westerly dips. However, examination of the exposures in the cliffs shows that the dips range from 60°E at the southern end, through vertical to 85°W at the northern end. The variations from the normal steep westerly dip are mainly the result of local creep, splaying and slumping of strongly weathered and relatively soft rocks due to removal of lateral support on the seaward side. Local minor folds and some cross-folding also contributes to these variations.

These steeply dipping rocks are seen in the cliffs and erosion gullies to be truncated by a nearly horizontal erosion surface which is 87.5ft. above sea level at Section D-D' and rises to 110.7ft. above sea level at Section A-A'. This surface was also intersected in a little over half the bores put down. This feature is interpreted as a wave-cut platform and it rises gently inland at grades ranging from about 1 in 100 in the south to about 1 in 50 in the north. An old buried shore line is indicated roughly along a line parallel to the strike of the beds and passing through the south-western corner of the area outlined on the Process Area map and the wave-cut platform terminates against this. The close pattern of test bores in the Process Area indicates that this old shore line is irregular and more

detailed drilling to the south would probably indicate irregularities here also.

From this old shore line the bedrock rises more rapidly eastward to the eastern boundary of the site. Interpretation of the sections indicates that the bedrock surface probably rises in a series of terraces, each terrace being a remnant of a wave-cut platform. Three such terraces are indicated on the sections and it is highly probable that several more would be revealed if more data were available. Each wave-cut platform in the Series is interpreted as being older than the one below it, ending with the platform now in the process of formation at the present-day beach.

The test bore intersections of bedrock indicate that the beds east of the old buried shore line are generally harder. than those west of it. The quartzites and sandstones occurring in the valley to the south also project through this area to the east of the old shore line and appear to have been encountered in Bores 3A and 27, in an area of local folding.

(2) Interpretation of Bore Log Data.

A total of 59 bores has been put down at this site, the footage completed being 3,305'0½". Of this number 33 bores, totalling 1,885'0", were put down during previous investigations and 26 bores were completed in the present investigation, for a total of 1,420'0½". Four of these latter bores were for the purpose of conducting standard penetration tests and yielded comparatively little geological information.

Correlations of geological data revealed by test bores and by exposures in the cliffs are shown in the accompanying sections.

These sections represent what is considered to be the most reasonable interpretation of the data available. At the same time it is recognised that many other interpretations are possible. It is also highly probable that the distribution and relationships of the various alluvial strata are more complex in reality than is suggested by these sections. However, any

reasonable alternative interpretation is unlikely to modify the general geological picture significantly, or its engineering implications. Possible exceptions are the interpretations of the higher-level bedrock intersections. Besides the well-authenticated, major wave-cut platform, at an average reduced level of 220', the sections imply that remnants of three higher wave-cut platforms are present, approximately at R.L.s 265', 300' and 330'. There is a possibility that some undetected bedrock highs or lows occur and that two intersections at nearly the same level are simply fortuitous. Such occurrences would negate some of the postulated platform remnants, produce greater variability in the thickness of the overlying strata, and thus modify the assessment of foundation conditions. However, in all cases the intersections in the bores indicate gentle slopes to seaward, such as would be expected on wave-cut terraces, and it is highly improbable that these should all be due to coincidence.

The postulated correlations of strata on the sections have been shown in full lines as much as possible and with a minimum of interrogation marks in the interests of clarity. However, it should be borne in mind when studying these sections that such lines cannot be relied upon implicitly, excepting in the vicinity of the bore positions.

(3) Tertiary Rocks and Their Mode of Occurrence.

Immediately overlying bedrock in the cliffs at the southern boundary, and intimately associated with the major wave-cut platform, is a fossiliferous sandy limestone, or calcareous sandstone, about 3ft. thick. At its base it incorporates numerous fragments of Marinoan slate. This limestone (or sandstone) lenses out about 170ft. north of Section D-D'. It also occurs immediately overlying bedrock in Bore 22 at a depth of 82ft., as a bed 1ft. thick, and again at a depth of 73'6" in Bore 33, where it is 6" thick.

Examination of a sample of this limestone from Bore 22 by the Palaeontology Section of this Department reveals that it

contains abundant foraminifera and mollusca and that it is of Pliocene age. The palaeontological report states that this is the Hallet Cove Limestone (or Sandstone). Since the limestone is evidently contemporaneous with the wave-cut platform, a Pliocene age is also assigned to that feature. Overlying parts of the upper levels of bedrock, near the eastern margin of the site, is a thin layer of hard sandstone. In places it continues westward to cover and fill one, or more of the lower terraces and develops considerable thicknesses, sometimes continuing to, and tapering out on the major wave-cut platform. Elsewhere it tapers out on the upper bedrock surface and occurs only as remnants of varying thickness on lower terraces. It is considered that originally this sandstone was a continuous deposit throughout the N-S length of the site and beyond, its eastern margin tapering out against the bedrock highs to the east of the site and its western margin tapering out on the major wave-cut platform, some distance west of the old shore line. Thus, all the terraces and the old shore line would have been covered and filled, the upper surface of the sandstone curving smoothly westward and downward, after the manner of that shown on Section Aa - Aa'. The sandstone present at this site is regarded as the remainder after considerable erosion. This sandstone is somewhat lateritised and characteristically has coarse, irregular, ferruginous patches of dark red, deep red, brick red and red-brown colours together with various shades of yellow-brown, pale yellowish-grey and pale grey. In many places this sand is less indurated and amounts to little more than poorly cemented fine sand. Lenses, layers and pockets of compact, but uncemented fine sand also occur. Elsewhere in this area closely similar sandstones have been identified as Late Pliocene in age. The mode of occurence and stratigraphic position of the sandstone at this site indicate a similar age and therefore a Late Pliocene age has been assigned to this rock.

(4) Pleistocene to Recent Deposits
(a) Piedmont Alluvial Deposits

All of the foregoing rocks are overlain by a lenticular series of fine alluvial sands, very sandy clays, sandy and silty clays and slightly sandy fissured clays, all freshwater deposits.

Immediately overlying the Tertiary sandstone, and completely covering it, is a substantial deposit of fine sand, probably exceeding in volume any of the other post wave-cut platform deposits. This deposit generally covers the sandstone and develops a considerable thickness to westward before tapering off against the major wave-cut platform. The maximum thickness encountered in this deposit was 29'6" in Bore 2. Gravel frequently occurs at the interface between the sand and the underlying slates. The upper surface of the sand has developed a thin, hard crust and where this is not present the sections suggest that erosion has removed it. Semi-cemented lumps occur frequently within the mass and the sand often contains a very small percentage of clay. Some clayey phases develop towards the western margin of this deposit. The sand is dominantly fine to very fine grained, but occasional coarser lenses occur. No bedding was evident in the core, but it is highly probable that some widely spaced cross bedding would be seen if a cross section through the mass of sand was exposed. The basic colour is pale yellowish-grey to pale grey, with coarse, irregular patches and mottles of dark red, deep red, red-brown, brick red and yellow-brown irregularly distributed throughout. The sand is generally very compact, but some patches are only moderately compact. No free water was encountered in this deposit, the sand being only moderately moist. A remarkable feature of this deposit is that many samples display a well developed to poorly developed sub-prismatic structure. Purplish- brownto purplish-grey staining on the structural faces indicates the passage of

humic solutions. On the basis of its position in the sequence an Early Pleistocene age has been assigned to this member.

Overlying this sand is a group of lesser overlapping, lenticular deposits of very sandy clay, clayey fine sand, sandy clay, fine sand and clays with sand pockets. These members are rather complex in their distribution and their relative ages are not clear. Most of the members of this group are rather thin, but a few develop substantial thicknesses; for instance, a very sandy clay member which is 25'6" thick in Bore 24. The sandier members of this group have similar colours to those of the Early Pleistocene sand, whereas in the more clayey members the colours are dominantly pale to light greenish-grey with red-brown, yellow-brown and deep red mottling. A well-developed sub-prismatic structure is evident throughout this group and some fissures occur, particularly in the more clayey members. The faces of structural units have a dull to moderate sheen, whilst the fissure faces have a very bright sheen. Again the structural faces display various degrees of purplish staining due to humic material. In some members a coating of fine sand occurs on structural faces and some sandy clay and fine sand infilling is interposed between structural units. This coating and infilling suggests that the members concerned have, at some time, been exposed at the surface, subjected to drying and cracking, and material from the surface has been washed, or blown into the cracks. Thus, interruptions in deposition are indicated. Though somewhat variable in total thickness, this group roughly follows the contours of the underlying Early Pleistocene sand, but extends further westward and tends to thin and taper out over the major wave-cut platform. Quartzite gravel and slate fragments frequently occur at the base of this group where it directly overlies the slate.

This group is overlain, mainly over the western half

of the site, by a substantial deposit of fissured clay, comparable in total volume with that of the Early Pleistocene sand. It thickens to southward and attains a maximum thickness of 28'6" at Bore 23. From its eastern margin, a few hundred feet east of the position of the old shore line, it thickens to westward, maintaining a considerable thickness for some distance before tending to taper off further to the west. Over the southern half of the site this deposit tapers out very sharply on its western margin before reaching the coast. This clay is classified as a "fat" clay, that is, it is rich in clay minerals and has a low sand content. However, frequent small silt and fine sand pockets occur in this deposit towards the base.

The dominant colour of this clay is pale to light greenish-grey, with a little yellow-brown, red-brown or deep red mottling. It is highly plastic and its moisture content is generally at, or near to the plastic limit. A well-developed sub-prismatic structure is a feature of this clay, the structural units generally having a moderate sheen on their surfaces. The partings between structural units are frequently infilled with a very thin layer of dark purplish-brown silty clay. It was not possible to have clay mineral determinations carried out on this clay in time for this report, but the rapid shrinking on exposure and the well-developed structure suggest that it is strongly reactive to moisture variations. Further information on this should be yielded by clay activity determinations carried out by Soil Engineering Laboratories.

A feature of this clay is the frequent occurrence of sharply defined planes cutting across all other existing structures. These planes have a mullioned, or irregularly fluted surface with a very bright sheen, the grooves and ridges running in the dip direction in the manner of slickensides in faulted rock. These planes are referred to as fissures, although in earlier bore logs they were called

shears. These fissures are not confined to this horizon, on the contrary they occur in all of the alluvial deposits, but since they are best and most abundantly developed in this clay, they are fully described here. Mostly they dip at an angle of 45° (approx.), but frequent very steep dips and some shallow dips were observed. Most of the fissures observed pass right through the core, but in a small, but significant number of instances the fissures reached only about half-way through the core.

Overlying all of the foregoing deposits is a further group of thin, overlapping, lenticular deposits consisting of fine sand,s clayey fine sands, very sandy clays and finely sandy clays, similar to that previously described and with the same structural features. This group reaches its maximum development at the coast where it is exposed by erosion of the scarp. Frequent black specks and flecks occur in the upper few feet of this group, particularly on the structural faces. These are probably composed of manganese-iron oxides.

The mode of occurrence, form and character of the foregoing alluvial deposits indicate a history of fairly continuous accumulation, interrupted by only minor periods of erosion. A Pleistocene age has been assigned to these deposits without differentiation.

(b) Aeolian Deposits

Blanketing the whole of the previously described deposits is a deposit of very calcareous, finely sandy material containing small, concretionary nodules of limestone. A composite sample of this material was sieved to remove the nodules and it was found that all of the fine fraction passed a 100 mesh sieve.

The fine fraction was subjected to chemical analysis and petrographical examination with the following results:-

Partial Chemical Analysis

$CaCO_3$	$MgCO_3$	Fe_2O_3	NaCl.	SO_3	Insoluble
52%	2.9%	1.32%	0.11%	0.01%	40.0%

Of the insoluble material approximately 80% was quartz and the rest amorphous material. No crystalline clay mineral could be ditected. The carbonate material was crystalline and mostly had the crystal structure of dolomite, obviously a calcium-rich dolomite. The percentage of carbonate with the crystalline structure of calcite was very small. The carbonate minerals had a particle size range of from 5 to 10 microns, i.e. within the commonly accepted silt range. The quartz was generally coarser than the carbonate and ranged ingrain size up to 200 microns, but most of it fell within the fine sand range.

As far as can be determined there is no equivalent of this material described in existing literature. Since it is of widespread occurrence in the southern part of South Australia and in western Victoria and is frequently encountered in various investigations it was considered desirable to coin a name for it. It is locally referred to as marl, but this is entirely erroneous since marl is a calcareous clay. However, the usage is so firmly entrenched that it was considered advisable to include the term in any name selected. The sand fraction is adequately covered in existing nomenclature and can be accommodated by prefixing the terms "sandy","finely sandy", "very sandy", etc., to the chosen name. Hence a name was required only for the finely divided calcareous material. Its earthy texture finally decided the selection of the name "malr-earth" for this material.

There is much evidence to suggest that this material originated on the continental shelf, from whence it was carried inland by strong winds during a Late Pleistocene low sea level period.

Characteristically, the marl-earth horizon is finely

sandy throughout, with varying proportions of small concretionary limestone nodules, commonly most abundant at the top of the deposit and diminishing in size and number with depth. Generally this material is only moderately compact and very friable in the upper part, but it becomes more compact with depth. Often some clay is present in the lower part of this horizon and this increases with depth until it merges into a finely sandy true marl. At this site the marl-earth horizon averages 5'6" in thickness, but it is variable and ranges from 2'7" to 12'0" thick in the exposures examined.

At the upper surface of the marl-earth horizon is a zone of solution and re-deposition which gives rise to a concretionary limestone, variously called "travertine", "caliche", "kunkar", or simply "limestone". Because it is neither a true travertine, nor a true "caliche" and to distinguish it from marine limestone, the term kunkar has been adopted here, since this material is closely similar to the type deposits of that name occurring in India. The term kunkar should be reserved for the concretionary limestone only and the term kunkar horizon should be used to describe the zone in which it occurs. An erroneous idea is prevalent that this horizon is characterised by sheet limestone, but true sheet kunkar is of rare occurrence and of limited extent, particularly at this site. The hardest layers at this site consist of slabby concretions, about 1 sq.ft. or so in area and 2" to 3" thick, fitting fairly closely together and with interstitial sandy loam. Most commonly this horizon consists of coarse (3" to 6" maximum diameter), irregular concretions, some hard, some moderately soft with a thin hard crust, occurring in a matrix of sandy loam and/or finely sandy marl-earth with small nodules ($\frac{3}{4}$" diam., or less). The finely sandy marl-earth matrix often occurs without the coarse concretions and with abundant to few small nodules.

In some places a very sandy, poorly cemented version of the kunkar occurs, with very thin, curving limestone crusts ("eggshells") on and through it. Sometimes a very compact, almost sand-free, marl-earth occurs, with nodules sparse to absent. This material appears to be weakly cemented and is considered to be incipient kunkar. Rarely the kunkar horizon is absent altogether over an area of several square feet and in such cases the loam often extends down to, or beyond the base of the adjacent kunkar horizon (vide Test Pit "A").

The character of the kunkar horizon changes rapidly from place to place. This is best demonstrated in the test pits in which many of the variations described occur within a length of about 12ft. These pits also show the irregularity of the thickness of this horizon. Evidence of the irregularity of the upper surface of this horizon is given by the 20ft. square area near the main gate, from which the loam was removed carefully by hand. Here variations in height of up to 6" occur within a distance of 2ft. Here also it can be clearly seen that the kunkar horizon is not a continuous sheet of limestone. The average thickness of this horizon from bore hole and test pit exposures is 8".

Overlying the kunkar horizon is a layer of loam averaging 11" thick. It ranges in character from very fine clayey loam to fine sandy loam, the colour ranging through dark browns, reddish-browns and grey-browns. Generally, it is compact, but friable. There is some evidence that this loam was largely derived from the same materials as the underlying kunkar and marl-earth horizons and is, in fact, a rendzina.

The most recent deposit at this site is a thin patchy occurrence of fine, wind-blown sand on the escarpment fringes.

TECTONIC DEVELOPMENT & PHYSIOGRAPHIC EVOLUTION

The first tectonic event of significance as far as this site is concerned was the sharp folding of the slates, probably late in the Proterozoic Era. Then there is a gap of some 500,000,000 years about which nothing is known as far as this site is concerned. Some time late in the Tertiary Period the major faulting which produced the Eden Block was initiated and upward movement proceeded in stages, the northern edge of the block moving appreciably more than the southern edge and a southerly tilt was developed. Each movement would rejuvenate stream activity and accelerate erosion and it is likely that a considerable volume of piedmont-type alluvial deposits was laid down along the coastal fringe during and following each lift. However, the inter-stage still-stands were apparently of very considerable duration, sufficient to allow large wave-cut platforms to be developed and all preceding deposits to be removed. Each still-stand was apparently slightly shorter in duration than the one preceding it, with the result that each new platform did not reach as far inland as the one above it and a series of terraces was developed. The last long still-stand culminated in the Pliocene, when the existing wave-cut platform was developed and sandy limestone was laid down. Immediately after this platform reached the position previously designated as the "old shore line" uplift was resumed temporarily, probably in Late Pliocene times. This short regeneration of movement gave rise to a short resurgence of inland erosion from which a substantial piedmont-type deposit of fine sand resulted. A subsequent still-stand and hot, semi-arid weather conditions allowed this sand to become indurated and somewhat lateritized. This produced the (probable) Late Pliocene sandstone. Subsequently, the upward movement of the block was resumed and again erosion of the inland surface occurred and some erosion of the sandstone deposit took place. This resulted in the Pleistocene sand deposit described previously. The movement continued, probably at a slower rate and with minor interruptions, and this resulted in

the first group of sandy and clayey deposits. At this stage a bar to the exit to the sea appears to have been created and the rate of uplift slowed down. At about the same time the source rock began to change to a more clayey material, probably the Sturtian slates. This resulted in the very substantial deposit of fat clay. Continued and accelerated movement first caused the erosion of the bar to seaward, then the erosion front retreated headward until a substantial portion of the clay and lower deposits was removed. Further, but slower and interrupted uplift, accompanied by erosion of inland rocks and a further change in source material produced the final group of sandy and clayey deposits. At this stage, probably in the early part of the Late Pleistocene period, uplift appears to have ceased. This produced a land surface having much the same form as that seen to-day.

By projection and on analysis of slopes it is concluded that at this stage the major wave-cut platform was of the order of 3000 ft. wider than it is to-day. Thus, the average rate of wave erosion from the early part of the Late Pleistocene until to-day is about 1 ft. every 300 years. This seems to be a reasonable figure for steeply dipping slates.

During the Late Pleistocene glacial, interglacial and interstadial periods there were a number of substantial eustatic rises and falls of sea-level.

During at least one of these low sea-level periods the calcareous deposits on the continental shelf were exposed and arid, windy conditions prevailed. It was during this period that the continental shelf deposits were eroded by the wind and blown inland. This was the finely sandy marl-earth material. Subsequent amelioration of the weather conditions, and a resumption of rain, leached lime from the upper part of this aeolian material and redeposited it at a lower level to form what is now known as the kunkar horizon. The clay fraction and much of the siliceous silt was carried down through the leached material by the mechanical action of water, and therefore much more

slowly, finally coming to rest on the kunkar horizon and forming the basis for the loam. Subsequently the overlying leached sand was stripped away by further wind action. Thus was the existing land surface produced. Marine erosion continued intermittently throughout most of the Late Pleistocene period and up to the present day, thus producing the present shore line, at which a new wave platform is being cut.

DRAINAGE

A feature of this site is the fact that there is no sign of any post-Pleistocene surface stream activity, excepting in the valley in the southeast corner, and even here only minor, slow activity is indicated. Undoubtedly, this valley was originally cut by an active stream, operating over a long period of time, since it appears to have been cut mainly into reasonably hard slates. However, at present the sides of this valley are covered by the aeolian sequence mentioned in the preceding chapter and show no signs of erosion. Even the cultivated soil at the head of this valley shows no signs of erosion. Striking evidence of unusual drainage conditions is given by the three incised erosion gullies indenting the cliffs and mentioned previously. All three gullies have cut down through the whole of the post-Tertiary sequence and two of them have cut deeply into the slates. Again all three gullies occur at the ends of gentle depressions running westward from higher ground, yet none of these depressions show the slightest sign of any drainage channel to supply the water for the erosion. This is most strikingly illustrated in the northern-most gully where the head of the gully is sharply defined, its walls are steep and water erosion has cut sharply down through 60 ft. of post-Tertiary deposits and a further 40 ft. into strongly weathered slates. Close examination of this gully leads to the conclusion that most, if not all of the water causing this erosion emerged from beneath the marl-earth horizon, the erosion of the marl-earth

and overlying materials being achieved by undercutting and collapse. This conclusion is supported by a study of the numerous, very small erosion channels on various parts of the erosion scarp. In every case these appear to start below the marl-earth horizon. A study of the drainage characteristics elsewhere on the site leads to the same conclusion. For instance during and after heavy rain there is no indication of significant surface run-off, all rain-water passing quickly into the ground by soakage. Even in closed depressions no water accumulates. Observation of the loam-kunkar-marl-earth sequence at this site and elsewhere in the state, during and after heavy rain, shows that the finely sandy marl-earth material is very free draining. During heavy rain it becomes moist, but within 2 or 3 days of the cessation of rain it returns to its normal, nearly dry state, whilst the underlying clay becomes saturated and remains so for long periods. Even the presence of a well-developed kunkar horizon appears to offer no effective barrier to the downward passage of water. The nature of these materials makes this readily understandable. However, the ready passage of moisture through the overlying fine loam is not so readily understood. A possible explanation is that at the time rain commences the loam is comparatively dry and readily permeable and a column of moisture is quickly established. On becoming moist the loam becomes less permeable, but the free-draining conditions in the underlying marl-earth material are maintained. Thus, a negative pore-pressure condition is set up in a considerable thickness of underlying material and the moisture is literally sucked through the loam whilst sufficient moisture is applied to maintain this condition. Whatever the merits or demerits of such a hypothesis, the fact remains that rain water does pass through these upper strata readily. However, once the water reaches the underlying clays, vertical penetration is impeded and the bulk of the water must flow laterally towards the coast. The nature, configuration and attitudes of the strata (see sections) would encourage this.

A sandy stratum overlying a clayey one would greatly facilitate such a flow and such conditions are common at this site. Hence, sufficient sub-surface water could flow to low points near the coast to produce virtual underground streams of sufficient volume to cause the erosion seen in the gullies at their points of emergence.

It is clear that normal sculpturing by streams has played little part in developing the topography of this site. The principal factors influencing the present land surface contours at this site are the terracing of bedrock, the development of the wave-cut platform and the mode of deposition of the Pleistocene alluvials. The superposition of the veneer of aeolian materials had negligible effect in modifying these contours, but did much to preserve them.

Speaking generally, the soils of the refinery site area are well drained, externally and internally. No free water was encountered in any of the bores during boring operations. Some water accumulates in open boreholes after heavy rain, mainly due to interception of sub-surface drainage, but this gradually drains away after rain ceases. The marl-earth horizon, the sand layers within the clays, the extensive cliff exposures, the re-entrant gullies and the valley to the south-east all contribute to this well-drained condition.

SEISMIC HISTORY

Very little information is available on the seismic history of the Adelaide area, due to the lack of instrumentation and the paucity of records.

The first recorded earthquake in this area occurred in June, 1856. This was recorded by the Reverend J.E. Woods in a report published in London in 1862(6) and was simply described as a "severe shock".

The second significant shock in this area occurred at Clarendon, 10½ miles west of the site on the 6th April, 1904.

This was described by Dodwell(7) simply as an earthquake, without giving any idea of its intensity. According to his data this earthquake occurred at 9.14 p.m. and was of 10 seconds duration. At 9.20 p.m. a sharp shock of 3 seconds duration, accompanied by "long rumbling", was felt at Mylor (16 miles WNW of the site) and at the same time a slight tremor was felt at Maclaren Vale, 8 miles SW of the site. Since all of these positions fall on the Willunga fault this shock was probably due to movement along this fault.

The only other recorded earthquake in this area occurred in March, 1954. At this time there were two seismograph installations, both at the University of Adelaide. However, at the time of the earthquake one of the seismographs was under repair and the other was rendered inoperative by the first shock. An analysis of the reports of local residents and an examination of damage had to be relied upon to locate its source and rate its intensity. This was carried out by Mr. C. Kerr-Grant,(9) then Senior Geophysicist at the Department of Mines. This analysis placed the main epicentre on the Eden Fault, in the suburb of Darlington, 6½ miles N.E. of the refinery site. The duration of the shock at this epicentre was 3 seconds, but it ranged from 5 to 20 seconds in the suburbs. Its rated intensity was 8 on the Modified Mercalli Scale and it was preceded by a loud rumbling noise. A second minor epicentre of intensity 7 was located in the suburb of Beaumont, also on the Eden Fault.

A number of minor tremors and small shocks have been reported in the press from time to time, but no record of their frequency, intensity or distribution is available. The most recent of these occurred in the vicinity of Bridgewater, in the Mt. Lofty Ranges, in 1958.

APPRAISAL OF SITE FOR INDUSTRIAL DEVELOPMENT

(1) Topography

Topographically speaking, the worst feature of this site is its general height above sea-level. However it is achieved, the oil must be raised from near sea-level to about 230 feet above it, if the present lay-out for the plant is adopted. This constitutes a permanent loading on the cost of every gallon of crude oil handled by the refinery throughout its life. It is possible that a site for the process plant could be prepared at a lower level. One way in which this could be done would be to clean off the alluvial materials from the wave-cut platform below the scarp and build the plant directly on bedrock. A suitable place to do this would be below, and west of Bore 29. Here hard slates with steep westerly dips should predominate. This would provide a site about 100 feet above sea-level and secondary pumping would not be necessary. Bays could be cut into the alluvial materials to provide tank sites complete with fire walls and all excavated materials could be pushed over the cliffs to be disposed of by the sea. A very considerable saving in the cost of foundations could also result from seating the plant directly on bedrock. Office buildings and a number of other structures probably could be sited more conveniently on the upper land surface. It is realised that many factors influence the siting of a refinery plant and the above suggestion is put forward as one possibility which might have escaped notice.

The upper land surface is gently undulating and does not present any major problems. However, nowhere on the site is there a level area of significant dimensions. This means that for any structure erected a slope has to be accommodated, either by filling, excavation or special foundation construction. This disadvantage can be minimized in the case of long structures by arranging them as far as practicable along the contours.

(2) Soil Characteristics

From the engineering point of view those characteristics of the soils which can be determined by inspection have both favourable and unfavourable aspects. The unfavourable aspects appear to outweigh the favourable ones and therefore, as a general assessment the foundation soil conditions at this site are considered to be unfavourable. Such an assessment does not condemn the site; it simply means that the foundation conditions involve problems in design and increased costs of construction.

The colours of the sands, clayey sands, very sandy clays and some sandy clays are dominantly variations and combinations of yellow, red and brown occurring in coarse, irregular patches. According to Twenhofel(8) and others these are characteristics of deposition in a semi-arid environment. Hence, although the history of these soils is one of fairly constant deposition, a considerable degree of over-consolidation is expected to be evident, due to the effects of desiccation. However, the very considerable total thickness of alluvial materials over a large part of this site indicates that long-term total consolidation settlement under load is likely to be large, particularly where the fat clay deposit is thickest.

The clays of these soils are subject to significant shrinking and swelling movements with variations in moisture content and this characteristic has far-reaching implications with regard to design, not only of the foundations, but of the structures themselves. However, the depths at which they occur will restrict the range of soil moisture variations and prevent the full movement potential being realised.

The finely sandy marl-earth has some very peculiar properties. In the dry state it is very friable and obviously very porous. In the damp state it has apparent cohesion and yet it contains very little clay. When moist it is apparently plastic, but very tacky. With an excessive application of

moisture some of the finer fractions are apparently washed down into voids at lower levels, "blinding" the soil and allowing it to become saturated. In this condition this material collapses and will flow like mud under load. The underlying marl, where present, facilitates the blinding action and itself becomes very soft and unstable when saturated. However, the general thickness of the marl-earth horizon and overlying materials has some beneficial aspects. This thick cover (average thickness 7'3") has the effect of raising the base of the zone of significant seasonal soil moisture variation, thus limiting the range of shrinking and swelling movements in the underlying clayey materials. If this cover were removed significant seasonal moisture variations would occur to a greater depth and the range of seasonal movements, translated at the surface, would be increased. Again, such a thick cover tends to reduce the differential effects of movements in the underlying clays, probably by lateral translation and dissemination of stress.

The role of the kunkar horizon is more problematical, in view of its extreme lateral variability in character and its variations in thickness. It does appear to have a certain degree of rigidity as a unit and in practice it does improve the bearing capacity of the soil with regard to footings seated on the surface, as compared with the marl-earth horizon without it. Perhaps this is achieved by some degree of lateral translation of load stress. On the other hand, it is not sufficiently dense to form an effective barrier to the entry of water to the sub-soil.

The role of the loam cover should not be underestimated. As a foundation material it is probably not very significant, but this is best judged from the soil mechanics data. However, it is highly probable that it plays a very important part in controlling the rate of penetration of water to the underlying marl-earth material, acting in the manner of a porous diaphragm.

(3) Local Experience of Soil Behaviour

Experience of soil behaviour in the Adelaide area covers a wide range of soil types, environments and structures. However, the experience which is of most significance in relation to this site is that gained in the study of the calcareous aeolian soil sequence. As mentioned previously, this loam-kunkar-marl-earth profile is of common occurrence in South Australia. Here it is called the mallee soil, or mallee type soil, because the mallee tree, a species of eucalypt with about 70 varieties, thrives on this type of soil and nowhere else. In Adelaide a number of houses built on this type of soil with foundation loadings of only 1 kip per square foot, or less have failed quite badly. In all cases the failures were due to one of two reasons. The first, and most common reason was saturation of the marl-earth horizon due to down-pipes discharging too close to the foundations, over-watering of gardens too close to the foundations, inadequate or improperly constructed drains, breakage of drains causing leakage, blocking of drains causing overflow, or leakage from damaged or eroded water pipes. The second reason was excavation of the foundations to accommodate a slope and seating the footings in the marl-earth material, thus removing the protective cover and allowing rain-water ready access to the marl-earth. In three cases of excavated foundations, narrow deep-beam type footings were used, seated in the marl-earth material. Bearing capacity failure occurred in all three, without the aid of excess water.

In a typical mallee soil at Lameroo foundations were excavated for the construction of a large, concrete, bulk grain silo, about 90 ft. high. The foundation ring was seated at a depth of 2'8" in finely sandy marl-earth which extended to a depth of 8'4", the designed loading on the foundation ring being $2\frac{1}{2}$ tons per square foot for a full silo. This structure failed when it had reached only about one third of its proposed height and the foundation had to be under-pinned to allow

construction to be completed. Many other similar cases could be cited.

Hence, the lessons to be learned from this experience of building on mallee type soils are (i) take every possible precaution to protect the marl-earth material from saturation (ii) seat all foundations either on (or in) the loam, or below the base of the marl-earth horizon, never in between, and (iii) for the shallow footings, designed loadings per unit area should be very low.

(4) Soil Structure and its Probable Significance

The dominant soil structure, common to all soil types excepting the mallee soil, is a sub-prismatic structure. Sub-prismatic structure means that the soil breaks naturally into columnar units with nearly horizontal terminal planes, both the vertical and terminal faces being somewhat irregular. The irregular shape is due mainly to the uneven distribution of the component materials, clay, silt, sand, etc.. If the soil was perfectly homogeneous a highly regular prismatic structure would have developed. This uneven distribution of component materials was confirmed in detailed examination of numerous samples. Its significance is that any conclusions drawn from test results in any particular stratum should be based on the mean of several tests in that stratum.

The fact that a sub-prismatic structure develops at all indicates that a soil is subject, or has been subject to seasonal shrinking and swelling movements. Since such a structure is clearly evident even in slightly clayey sands it is clear that the clay mineral is a highly reactive type and that these sands have experienced periodic extremes of wetting and drying. The infilling between the structural units of clayey strata by sands and clays of different colours to those of the main mass indicates that these strata too have experienced severe drying and cracking. Hence, although the post-Tertiary geological history of this area is one of fairly constant accretion, these soils can be expected to show a considerable

degree of over-consolidation, due to desiccation. Plant roots also can contribute to this desiccating effect and relics of these were frequently seen on structural faces.

The degree of sheen on structural faces appears to be proportional to both the percentage of reactive clay in the material and the number and severity of recent seasonal shrinking and swelling movements. Hence, a pure reactive clay stratum at a shallow depth will develop a strong prismatic structure with a very bright sheen, both because of its very high clay content and the fact that it is currently subject to strong seasonal movements. A very sandy clay under the same conditions will develop only a moderate sheen. However, upon deep burial to a depth below the zone of seasonal moisture variation, the structure will remain, but the sheen on the structural faces will become dulled due to the cessation of movement, the modification of the clay coating by the action of accumulating salts and by new material washed into structural cracks during burial. But even under these new conditions the sheen on the pure clay material will be much brighter than that on the very sandy clay. Hence, the degree of sheen on structural units, having regard to the nature of the material involved, is a rough guide to the degree of current seasonal movement. Unfortunately, very few complete undisturbed samples were available for examination and therefore the structural data given in the accompanying bore logs cannot be considered complete, or wholly reliable.

(5) Possible Significance of Fissures.

In all post-Tertiary alluvials some fissure planes occur cutting across all other existing structures. These fissures are particularly common in the fat clay, in connection with which they were described previously, but they have also been encountered in slightly clayey fine sands. No reliable estimate can be made of their frequency of occurrence either laterally, or in depth due to the inadequacy of the samples.

An attempt was made to obtain some oriented samples

during some previous boring, but mostly the well-oriented samples contained no fissures, or the fissured samples were of doubtful orientation. Only 3 reliable samples were obtained (Bores 24, 28 and 32), but these all showed fissures dipping at 45° to the east. It is realised that this is slender evidence upon which to base a theory of origin, and a large number of oriented, undisturbed samples would be required for confirmation. However, when coupled with the drainage characteristics of this site, the evidence of these three samples is probably significant. As indicated previously, rain water quickly penetrates the marl-earth horizon, but once it reaches the clayey strata beneath, its rate of vertical penetration is slowed down very considerably. Hence, as further water is applied it must tend to flow laterally towards the coast. The nature, configuration and attitude of the strata (see sections) would encourage this. Under conditions of prolonged steady rainfall following a long dry period, the rate of application of water would exceed its rate of vertical penetration and lateral migration would be dominant, hence the soils would tend to develop a saturated "front" migrating slowly westward to the natural outlet along the cliffs at the coast. At any point in its progress the saturated clay behind the "front" would be subjected to swelling stress. As the front progressed this stress would build up behind it until relief could occur in failure. Such failure would occur as an overthrust movement, the saturated clay behind the "front" tending to ride over the dried clay ahead of it. This form of failure is indicated by the fact that the upper part of the "front" would at all times be ahead of the lower part. Hence, the planes of failure would dip easterly. This process could be repeated a number of times during the progress of the "front" across the site. Intermittent rain and dry weather could cause a less intense and more localized version of this movement. Failure is not visualized as occurring along one large, through-going plane at each occurrence, but rather along a number of small, discontinuous planes at the

points of greatest stress. Naturally, the greatest swelling stress occurs within the strata with the highest clay content and it is within these strata that the fissures are of most frequent occurrence and best developed. Once developed, these fissures, like the structures, are a permanent feature in the soil, therefore all subsequent swelling stresses are much more readily relieved and some small movement will take place along them with every significant change in moisture content. This suggests that the process is current and continuing seasonally and the bright sheen on all the fissure faces is considered to be supporting evidence for this. However, this part of the postulate has very significant implications with regard to the depth of significant soil moisture variations, and this will be discussed below. The most important implication arising from this hypothesis is the possibility that, should a heavy downpour of rain follow a prolonged dry period (a common enough set of circumstances in this area) a wave of swelling could pass slowly through the area from east to west. The magnitude of this wave is problematical, but it could be of sufficient amplitude to significantly stress structures in its path during its passage. This is a rather disturbing concept, but it must be considered as a possibility at this stage of knowledge. It is strongly urged that a stable datum point, anchored firmly in bedrock, and a number of reference points anchored at various depths in the soil, be established to observe the soil behaviour over a range of seasonal conditions.

The C.S.I.R.O. report on this area shows a potential vertical movement down to a depth of 15ft. of 1.5 inches, but the actual range of seasonal movement can only be guessed at. This at least should be determined by observation.

(6) Depth of Zone of Significant Soil Moisture Variation

The C.S.I.R.O. report on this area suggests that the base of the zone of significant soil moisture variation is about 15 feet, below the surface. However, this depth must vary consid

erably from place to place over the site. For instance, adjacent to the cliff escarpment, where conditions are very free draining, the depth of this zone could be 60ft. or more. Proximity to the scarp must have a considerable influence on the depth of this zone. Further, the nature of the materials beneath any given point, must influence the depth of this zone beneath that point. For instance, predominantly sandy materials tend to dry out significantly to a greater depthduring a dry season than predominantly clayey materials. It is very doubtful whether the implications drawn from a consideration of fissures regarding the depth of significant soil moisture variation are valid. For instance, Bores 8A, 11A, 12A and 14A disclose fissures with a bright sheen occurring to depths ranging from 31'0" to 33'9". It is considered most unlikely that significant seasonal moisture variation is occurring at this depth in this location at the present time. One the other hand, Bore 22A revealed similar fissures to a depth of 50'5" and it is quite possible that significant moisture variation could occur to depths of this order at this location.

Obviously this is a question about which we have too little information to give a reliable answer. The proper study of this subject requires a number of bores at selected points, with undisturbed sampling throughout, to be put down at intervals over a period of at least a year.

(7) Drainage.

The probable pattern of sub-surface drainage has been adequately described previously. The principal point to be remembered is the tendency to the westerly flow of water in strata below the marl-earth horizon. The act of erecting heavy structures on this soil will cause increased consolidation of the soil beneath the structures. This could have the effect of backing-up the water to the east of the loaded areas and creating local artificial shallow water tables, which could rise into the marl-earth horizon.

Even if the marl-earth horizon is not affected, the backed-up moisture would tend to cause a much greater degree of swelling in the clays beneath the eastern sides of the structures than that which would occur beneath the western sides. This would result in strong differential stresses seasonally, which are undesirable and could be disastrous. It is strongly recommended that cut-off drain trenches be constructed on the up-slope sides of at least all major structures requiring a reasonably high degree of stability. To be effective suchdrains should extend at least 1ft. into the first clay layer, and the ends should be led off to deflect the water intercepted around the structures and away from the foundations.

To protect the foundations, all roof run-off and other waste water should be conducted well clear of the foundation area in properly constructed drains of adequate capacity.

(8) Suitability of Locally Excavated Soil for Earthworks

Most of the locally excavated material is likely to be the finely sandy marl-earth described. It is the opinion of the writer, based on the experience quoted previously, that owing to its sensitiveness to moisture variations this material would be difficult to compact properly. However, this can be determined best in the soil mechanics laboratory. If used for structures such as firewalls, this material is apt to be eroded quickly by heavy rain and it is highly probable that some protection will be needed to prevent this.

(9) Possibility of Seismic Distrubance.

The danger of a serious earthquake shock at the refinery site, from the evidence available, does not appear to be very real. However, the refinery is on the Eden Block and the Eden Fault has experienced comparatively recent activity, therefore further information should be sought. The local authority in these matters is Dr. D.J. Sutton, Department of Physics, University of Adelaide and it is suggested that a report should be sought from him.

CONCLUSIONS AND RECOMMENDATIONS

This is the first time in the writer's experience that practically every feature of a site has some important bearing on some aspect of the proposed construction. Since the number of test boreholes put down was the minimum required for the engineering side of the investigation and no purely geological bores were put down, conclusions had to be reached by interpretation, deduction and analysis based on inadequate data.

The general conclusion reached here is that the unfavourable aspects of this site, outweigh the favourable ones, but this imbalance is not sufficiently serious to condemn the site.

Serious consideration should be given to re-siting the plant, if not in a new location, at least along the contours instead of across them. Arranging the plant across the contours means that the widest possible range of foundation conditions that can be encompassedin this length is covered by the plant and the maximum difference in elevation has to be accommodated.

Not very much is known about the actual range of seasonal movement translated at the surface, nor about a related problem, the depth to the base of the zone of significant seasonal soil moisture variation.

Further work to determine these factors is strongly recommended. Although the results of this work are unlikely to influence the design of the structures, due to the time factor involved, they will provide factual data upon which to base possible remedies should any distress attributable to these factors be experienced in the plant or other buildings in the future.

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ADDENDUM

A verbal report on clay samples submitted to Waite Research Institute for clay mineral determination has been received. This report states that the predominant clay mineral present was montmorillonite, with minor kaolin and traces of illite.

This report confirms the conclusion reached from other data that the clays at this site are highly reactive to moisture variations.

A.A.G.

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TEST BORE NO. 1A

Sub-contract No: 5053 A20-102 (2) Docket: DM423/61

Location: Coords 3506'N & 463'W

Hundred: Noarlunga Section:588 R.L. at Collar: 361.13

Purpose; Investigation of foundation conditions, Vacuum Oil Co. oil refinery site, Port Stanvac (near O'Sullivan's Beach)

Hirer: Kellogg Overseas Corporation.

Plant: Ford 0-28'8", Conrad, 28'8"-30'0" Total Depth: 30'0"

Logged by: A. A. Gibson

Depth From	To	Description
0'0" -	0'10"	Grey-brown fine sandy loam. Friable-Compact.
10"-	3'1"	Pale creamy-brown, finely sandy marl-earth. Frequent small kunkar nodules at top, becoming sparse lower. Dry. Very friable.
3'1" -	4'11"	Light creamy-brown, finely sandy and slightly clayey marl-earth, with pale creamy-brown to off-white mottling. Damp. Friable. Very compact. Some dark brown root channels. Clay content increasing with depth.
4'11"-	6'9"	Brown, silty and finely sandy marl, with disseminate fine lime sand. Occasional light greenish-grey mottling and some small pockets of pale creamy-brown marl-earth. Plastic. Moderately friable. Moisture content below P.L. Sub-prismatic structure Dull sheen on structural units. Moderately firm. Merging to:-
6'9" -	8'6"	Yellowish-brown to reddish-brown, finely sandy clay, with yellow-brown, pale greenish-grey, brown and brick-red mottling. Frequent small black specks irregularly distributed. Becoming very sandy with depth and sand unevenly distributed. Very plastic to moderately plastic. Semi-friable in places. Sub-prismatic structure, with reddish-brown clay partings. Dull sheen on structural units. Moisture content near P.L. Firm.
8'6" -	10'9"	Pale greenish-grey and red-brown mottled, finely sandy clay. Moderately to highly plastic. Moisture content near P.L. Sub-prismatic structure with light to dark purplish grey partings containing rootlets. Dull sheen on structural units. Firm.
10'9" -	12'9"	Brick red, red-brown, pale greenish-grey and light yellow-brown mottled, fine, very sandy clay. Mottling develops into a rough horizontal layering with depth. Plastic. Semi-friable. Moisture content near P.L. Firm.
12'9" -	15'0"	Brick red, red-brown and pale greenish-grey mottled, finely sandy clay. Plastic. Moisture content at P.L. Sub-prismatic structure. Some purplish-brown partings. Moderate sheen on structural faces. Firm.
15'0" -	17'6"	Brick red, yellow-brown, pale yellowish-grey and pale greenish-grey mottled, slightly clayey fine sand, with clay content unevenly distributed and increasing with depth. Slight to moderately low plasticity. Very friable to moderately friable.

Test Bore No. 1A (Contd.)

Depth From	To	Description
		Moisture content below P.L. Sub-prismatic structure, with light to medium purplish-brown partings. Dull sheen on structural units. Very firm.
17'6"	21'9"	Yellow-brown and pale yellowish-grey mottled, slightly clayey, fine sand, with lesser brick red and deep red mottling. Semi-cemented in places to form a soft to moderately hard, but friable sandstone. Very friable to friable. Damp to moist. Very compact to moderately hard. Sub-prismatic structure weakly developed. Light purplish-grey partings. Structural faces dull.
21'9"	23'9"	As above, but colours are deep red and pale grey, with a little light grey-brown.
23'9"	28'0"	Deep red and pale greenish-grey mottled slightly clayey very fine sand. Developing some yellow-brown mottling with depth. Slightly plastic in places. Very friable. Moist. Sub-prismatic structure, with brownish-grey partings. Dull sheen on structural units. Very compact.
28'0"	28'8"	Pale greenish-grey, brownish-yellow and diffuse deep red-mottled slightly clayey, very fine sand. Damp. Friable with difficulty. Sub-prismatic structure, with pale greenish-grey partings. Dull sheen on structural units. Semi-cemented. Very compact to moderately hard.
28'8"	30'0"	Decomposed slate. Pale brownish-grey, brick red, deep red and yellow-brown, irregularly mottled, silty clay. Sub-granular structure. Near vertical relic bedding.

END OF BORE.

TEST BORE NO. 2A

Sub-contract No: 5053-A20-102(2) Docket: DM423/61

Location: Co-ords 4037'N & 687'W

Hundred: Noarlunga Section: 582 R.L. at Collar: 354.09

Purpose: Investigation of foundation conditions, Vacuum Oil Co. oil refinery site, Port Stanvac (near O'Sullivan's Beach)

Hirer: Kellogg Overseas Corporation.

Plant: Ford 0-24'6", Conrad 24'6"-26'6". Total Depth: 26'6"

Logged by: A. A. Gibson

Depth From	Depth To	Description
0'0"	0'8"	Dark reddish-brown fine loam. Sub-granular to compact.
0'8"	1'2"	Irregular kunkar nodules with interstitial loam as above. Kunkar nodules are finely sandy and range from soft to hard.
1'2"	4'6"	Pale creamy-brown to light creamy-brown, finely sandy marl-earth, with a few small, hard kunkar nodules. Dry to slightly damp. Very friable.
4'6"	5'9"	Pale creamy-brown and light creamy-brown mottled, finely sandy and slightly clayey marl-earth. Slight damp. Very friable. Compact.
5'9"	8'1"	Pale creamy-brown, creamy-brown, reddish-brown and pale grey, irregularly mottled, silty and finely sandy marl. Moisture content well below P.L. Friable. Poorly developed sub-prismatic structure. Moderately firm.
8'1"	8'9"	Brown silty to finely sandy clay with some pale grey limey mottling. Plastic. Semi-friable. Moisture content near P.L. Sub-prismatic structure, with brown partings. Black specks and dark brown root-lets on structural faces. Moderate sheen on structural units. Moderately firm.
8'9"	11'0"	Pale greenish-grey, fine, very sandy clay, with brick red, yellow- brown and deep red mottling. Plastic. Slightly friable. Moisture content below P.L. Sub-prismatic structure, with dark purplish-grey infilling, containing fine rootlets, between structural units. Structural faces dull. Firm. Sand content increasing with depth.
11'0"	11'11"	Pale greenish-grey to pale yellowish-grey, clayey fine sand, with red-brown, light red-brown and sparse yellow-brown mottling. Frequent black specks flakes and minute veinlets, particularly on struc-tural faces. Low plasticity. Friable. Moisture content below P.L. Sub-prismatic structure, with light greenish-grey to light grey-brown partings. Dull to moderate sheen on structural units. Compact.
11'11"	12'7"	Sample missing.

Test Bore No. 2A (Contd.)

Depth From	To	Description
12'7"	15'6"	Light greenish-grey and red-brown mottled, finely sandy and silty clay. Sand content unevenly distributed. Plastic. Semi-friable. Moisture content below P.L. Sub-prismatic structure, with light greenish-grey to purplish-grey partings. Some very fine rootlets in purplish-grey parts. Dull sheen on structural units. Very firm. One 3/16" diameter root running through core. Sand content increasing with depth.
15'6"	16'5"	Light greenish-grey, fine, very sandy clay, with frequent small, pale yellowish-grey, clayey fine sand pockets. Scattered brick red mottling. Moderately plastic. Friable. Sub-prismatic structure, with dark to medium purplish-grey partings containing some rootlets. Dull sheen on structural units. Very firm. Sand content increasing with depth.
16'5"	17'1"	Sample missing.
17'1"	18'8"	Pale yellowish-to greenish-grey, slightly clayey fine sand, with yellow-brown, brick red and deep red mottling. Slight plasticity. Very friable. Moisture content well below P.L. Sub-prismatic structure with pale to dark purplish-grey partings. Dull sheen on structural units. Semi-cemented in places. Very compact to moderately hard.
18'8"	19'4"	Light greenish-grey, fine, very sandy clay, with yellow-brown and a little brick red mottling. Moderate plasticity. Friable. Sub-prismatic structure, with light greenish-grey to dark purplish-grey partings. Dull sheen on structural units. Firm to hard.
19'4"	23'1"	Pale yellowish-grey, slightly clayey fine sand, with coarse, irregularly distributed, deep red and lesser yellow-brown and brown mottling. Slightly plastic. Very friable. Moist to damp. Sub-prismati structure, with pale to medium purplish-grey partings. Dull sheen on structural units. Semi-cemented in places. Very compact to moderately hard
23'1"	24'6"	Pale to light brownish-grey, brick red, deep red and yellow-brown mottled, cemented fine sand. Friable with difficulty. Moderately hard.
24'6"	26'6"	Decomposed slate. Pale grey silty and finely sandy slate, with a little deep red and light yellow-brown coarse, irregular mottling. Some dark purplish-brown root channels. Plastic. Moisture content below P.L. Sub-prismatic structure with pale purplish-grey partings. Dull sheen on structural units. Granular sub-structure. Faint relic bedding with a nearly vertical dip. Firm.

END OF BORE.

TEST BORE NO. 3A

Sub-contract No.: 5053 A20-102(2) Docket: DM 423/61

Location: Co-ords 4649'N & 1287'W

Hundred: Noarlunga Section: 582 R.L. at Collar: 341-29

Purpose: Investigation of foundation conditions, Vacuum Oil Co. oil refinery site, Port Stanvac (near O'Sullivan's Beach)

Hirer: Kellogg Overseas Corporation

Plant: Ford O - 24'6", Conrad 24'6" - 50'0" Total Depth: 50'0"

Logged by: A. A. Gibson

Depth From	Depth To	Description
0	9"	Dark reddish-brown fine loam. Friable. Compact. Damp.
9"	1'6"	Irregular kunkar nodules in a matrix of finely sandy marl-earth.
1'6"	2'9"	Pale creamy-brown, finely sandy marl-earth, with a few small kunkar nodules. Nearly dry. Very friable.
2'9"	4'6"	Creamy-brown, pale creamy-brown and off-white mottled, finely sandy and slightly clayey marl-earth. Slightly plastic in places. Very friable. Damp. Compact.
4'6"	5'7"	Creamy-brown, silty and finely sandy marl, with a little reddish-brown and pale greenish-grey mottling. Occasional small, pale creamy-brown pockets of marl-earth. Sparse, small black specks. Low plasticity. Friable. Moisture content well below P.L. Sub-prismatic structure, with creamy-brown partings. Dull sheen on structural units. Firm.
5'7"	6'6"	Reddish-brown to light reddish-brown, fine, very sandy clay with a little pale greenish-grey mottling. Sparse brick red to brownish-yellow, clayey fine sand pockets. Frequent small black specks. Moderately plastic. Friable. Moisture content below P.L. Sub-prismatic structure, with reddish-brown partings. Moderate sheen on structural units. Fissure at 45° to core, with moderate sheen on fissure faces. Very firm.
6'6"	7'5"	Reddish-brown and light greenish-grey mottled finely sandy clay, with some small, very sandy pockets. Frequent black specks and flakes irregularly distributed. Plastic. Slightly friable. Moisture content below P.L. Sub-prismatic structure with reddish-brown partings. Moderate sheen on structural units. Some fine sand infilling in structural cracks. Some fissuring at 45° to core, with bright sheen on fissure faces. Very firm.
7'5"	10'8"	Red-brown and light greenish-grey mottled, finely sandy clay. Occasional very sandy patches. Very plastic. Moisture content a little below P.L. Sub-prismatic structure, with light greenish-grey partings. Moderate sheen on structural units. Some fissuring at 45° to core, with bright sheen on fissure faces. Very firm. Sand content gradually increasing with depth.

Depth From	Depth To	Description
10'8"	12'0"	Brick red, pale yellowish-grey, red-brown and light greenish-grey mottled, fine, very sandy clay. Sand content unevenly distributed. Moderately plastic. Slightly friable. Moisture content below P.L. Strong sub-prismatic structure with light greenish-grey to purplish-grey partings. Dull to moderate sheen on structural units. Very firm. Sand content increasing with depth.
12'0"	17'0"	Light to deep brick red, pale yellowish-grey, red-brown and light greenish-grey, vertically streaky mottled, clayey fine sand. Slightly plastic. Friable. Damp. Sub-prismatic structure, with light greenish-grey, purple-brown and reddish-brown partings and becoming deep purple lower. Dull sheen on structural units. Very compact to moderately hard. Sand content unevenly distributed.
17'0"	20'9"	As above, but colours dominantly deep red and pale grey.
20'9"	21'6"	Light brick red, light yellow-brown and pale brownish-grey mottled, semi-cemented sand. Nearly dry. Friable. Very compact to moderately hard.
21'6"	24'6"	As above, but firmly cemented and hard. (Augered out)
24'6"	33'2"	Brick red, light brick-red and yellow-brown mottled, semi-cemented fine sand. A little pale brownish-grey mottling. Some grey-brown coating in vertical joints. Slightly clayey. Friable. Very compact to moderately hard.
33'2"	34'6"	Light yellow-brown, light brick red and off-white, coarsely and diffusely mottled fine sandstone. Jointing at 45° and vertical. Light purplish-brown coating on some joints. Friable with difficulty. Hard.
34'6"	35'0"	Pale grey, deep red and light yellow-brown, coarsely and irregularly mottled, slightly clayey fine sand. Cemented in part to form sandstone lumps. Damp. Very friable. Very compact to moderately hard.
35'0"	43'0"	Deep red, ferruginous sandstone, with pale grey, yellow-brown and brownish-yellow, coarse and irregula mottling. Damp. Friable in part. Firm to hard.
43'0"	43'3"	Decomposed slate. Pale grey, deep red and purplish-brown mottled, moderately soft and moist silty clay, to moderately firm and friable, finely sandy clay of low plasticity.
43'3"	50'0"	Pale brownish-grey to pale grey and pale yellowish-brow medium to coarse grained, arkosic sandstone. Feldspa fragments largely decomposed to kaolinite. Some deposition of dark brown ferruginous material in irregular, near vertical joints (partly open) and in some bedding planes. Dip about 25°. Hard.

END OF BORE.

TEST BORE NO. 4A

Sub-contract No.: 5053 A20-102(2) Docket: DM 423/61

Location: Co-ords 4354'N & 1293'W

Hundred: Noarlunga Section: 582 R.L. at Collar: 339.83

Purpose: Investigation of foundation conditions, Vacuum Oil Co. oil refinery site, Port Stanvac (near O'Sullivan's Beach)

Hirer: Kellogg Overseas Corporation

Plant: Ford 0 - 20'3", Failing 20'3" - 32'3", Conrad 32'3" - 53'0"

Total Depth: 53'0"

Logged by: A. A. Gibson

Depth From	Depth To	Description
0	1'2"	Dark brown fine loam. Friable. Compact.
1'2"	2'0"	Kunkar horizon. Light creamy-brown, fine, very sandy marl earth, with numerous very fine kunkar nodules. Semi-cemented in part. Very friable. Very compact.
2'0"	4'3"	Light to pale creamy-brown, vaguely mottled, finely sandy marl-earth. Very friable. Occasional small kunkar nodules. Poorly to moderately compacted. Slightly damp.
4'3"	6'6"	Pale creamy-brown and light creamy-brown mottled, finely sandy and slightly clayey marl-earth. Some small kunkar nodules throughout. Friable. Compact. Slightly damp.
6'6"	8'1"	Light creamy-brown, pale creamy-brown and pale greenish-grey mottled, silty and finely sandy marl, with occasional, small, reddish-brown patches. Cla; content increasing slightly with depth. Moderate plasticity. Friable. Damp. Moderately soft.
8'1"	8'9"	Creamy brown, finely sandy marl, with pale creamy-brown, light greenish-grey and reddish-brown mottling. Some fine black specks. Plastic. Moderately friable. Moisture content well below P.L. Poorly developed sub-prismatic structure, with creamy-brown partings. Dull sheen on structur-al units. Moderately firm.
8'9"	9'4"	Brown to yellowish-brown, silty and finely sandy clay with a little light greenish-grey mottling. Moderately plastic. Friable. Moisture content below P.L. Sub-prismatic structure with brown partings. Dull to moderate sheen on structural units. Numerous small black flakes, particularly on structural faces. Firm.
9'4"	10'6"	Red-brown to light red-brown, finely sandy clay, with a little pale greenish-grey mottling. Numer-ous small black flakes. Plastic. Slightly friable Moisture content below P.L. Sub-prismatic structur with reddish-brown partings. Dull sheen on structu al units. Firm. Sand content increasing with depth.

Depth From	Depth To	Description
10'6"	12'3"	Light red-brown, red-brown and pale yellowish-to greenish-grey mottled, clayey fine sand, to fine, very sandy clay. Low plasticity. Friable. Moisture content well below P.L. Sub-prismatic structure, with red-brown partings and some brown, sandy clay infilling. Dull sheen on structural units. Samples broken in a close horizontal pattern (due to sampling disturbance?) Moderately hard to very firm.
12'3"	15'9"	Red-brown, yellowish-brown and pale greenish-grey, diffusely mottled, finely sandy clay. Plastic. Slightly friable. Moisture content below P.L. Sub-prismatic structure, with purplish-brown, reddish-brown and light greenish-grey partings, containing some rootlets. Very firm.
15'9"	17'0"	Brick red and pale greenish-to yellowish grey, coarsely mottled. Slightly clayey fine sand. Very weakly developed sub-prismatic structure, with light to dark purplish-grey partings containing some fine rootlets. Very low plasticity. Very friable. Moisture content well below P.L. Very compact. Some horizontal cracking due to sampling disturbance
17'0"	18'4"	Pale greenish-to yellowish-grey, fine, very sandy clay with brick red and yellow-brown mottling. Sand content unevenly distributed. Low plasticity. Moderately friable. Moisture content below P.L. Sub-prismatic structure clearly evident, but not strongly developed. Dark purplish-brown partings, with some rootlets. Structural faces dull. Very firm. Some small lumps semi-cemented. Some horizontal cracking due to sampling disturbance.
18'4"	18'8"	Brick red and pale greenish-to yellowish-grey, coarsely mottled, slightly clayey, very fine sand. Cemented in part to form horizontal soft to moderately hard sandstone layers. Damp.
18'8"	21'4"	Pale greenish-to yellowish-grey, slightly clayey fine sand, with coarse, brick red mottling. Clay content unevenly distributed. Slight plasticity in places. very friable. Poorly developed sub-prismatic structure, with light greyish-brown partings. Very compact.
21'4"	23'6"	Pale brownish-to greenish-grey, slightly clayey, very fine sand and silt with yellow-brown, reddish-brown and lesser deep red mottling. Very low plasticity. Friable. Moisture content below P.L. Sub-prismatic structure with light purplish-grey partings. Some rootlets surrounded by dark purplish-brown material. Very firm.
23'6"	29'10"	Light yellow-brown to orange, slightly clayey fine sand, with a little pale yellowish-grey and brick red mottling. Low plasticity. Very friable. Moisture content near P.L. Sub-prismatic structure with light grey-brown partings. Structural faces dull. Very compact. Merging downward into coarsely mottled material of the same colours.
29'10"	32'3"	As above, but cemented to sandstone. Augered out to refusal.

Depth From	Depth To	Description
32'3"	40'9"	Yellow-brown, light yellow-brown and pale grey mottled, fine sandstone with lesser brick red and deep red mottling. Some clayey sand patches. Friable. Hard to moderately soft.
40'9"	43'0"	Light brick red sandstone, with pale yellowish-grey, pale pink and light yellow-brown mottling. Moderately hard. Tendency to vertical cleavage might be bedding or jointing.
43'0"	45'9"	Pale grey and dark red mottled, decomposed sandy slate, with lesser yellow-brown mottling. Bedding vague and obscured by mottling and jointing, but appears to be vertical with stained jointing at 45°.
45'9"	52'0"	Pale greenish-grey to very pale grey, strongly weathered silty slate, with brick red, yellow-brown and deep red staining in patches. Bedding dips about 70°. Joints dipping at 10° and 60° occur frequently. Firm, but easily broken with fingers.
52'0"	53'0"	Largely completely decomposed slate. Pale grey silty clay with deep red and brick red mottling. Some hard residual beds.

END OF BORE.

TEST BORE NO. 5A

Sub-contract No: 5053 A20-102(2) Docket: DM 423/61

Location: Co-ords 4027'N & 1277'W

Hundred: Noarlunga Section: 582 R.L. at Collar: 339.10

Purpose: Investigation of foundation conditions, Vacuum Oil Co. oil refinery, Port Stanvac (near O'Sullivan's Beach)

Hirer: Kellogg Overseas Corporation

Plant: Ford 0 - 35'1", Conrad 35'1" - 42'1" Total Depth: 42'1"

Logged by: A.A. Gibson

Depth From	Depth To	Description
0	9"	Dark brown fine loam. Friable. Compact.
9"	1'7"	Kunkar horizon. Irregular kunkar nodules with interstitial loam and finely sandy marl-earth.
1'7"	2'3"	Light creamy-brown, finely sandy marl-earth, with numerous small kunkar nodules. Nearly dry. Very friable.
2'3"	4'3"	Sealed sample.
4'3"	4'6"	Light creamy-brown and pale creamy-brown mottled, finely sandy marl earth, with pockets of off-white earthy lime. Slightly damp. Friable. Compact.
4'6"	6'6"	Sealed sample.
6'6"	6'9"	Creamy-brown and pale creamy-brown, finely sandy and slightly clayey marl-earth, with pockets of off-white earthy lime. Occasional pockets of brown, finely sandy clay. Damp. Friable. Slightly plastic. Compac
6'9"	8'9"	Sealed sample.
8'9"	9'0"	Brown, greyigh-brown and reddish-brown , vaguely mottle fine, very sandy marl, with frequent small, off-white pockets of earthy lime. Some light greenish-grey mottling. Low to moderate plasticity. Friable. Mixture content below P.L. Sub-prismatic structure, with brown to grey-brown partings. Dull sheen on structural unit Moderately firm.
9'0"	11'0"	Sealed sample.
11'0"	11'3"	Yellow-brown and light greenish-grey mottled, clayey fine sand, with a few small, deep yellow-brown, fine sand pockets. Occasional very small pockets of pale creamy-brown, finely sandy marl-earth. Slightly plastic. Friable. Moisture content well below P.L. Sub-prismatic structure, with grey-brown to purplish-brown partings. Structural faces dull. Very compact. Occasional small black specks.
11'3"	13'3"	Sealed sample.
13'3"	13'6"	As for 11'0" to 11'3", but colour trending more to reddish-brown. Frequent to abundant black flecks on structural faces. Partings reddish-brown to light greenish-grey with fine rootlets. Dull sheen on structural units.

Depth From	To	Description
13'6"	15'6"	Sealed sample.
15'6"	15'9"	As for 11'0" to 11'3", but no black specks. Clay content diminishing.
15'9"	16'0"	Sample missing.
16'0"	18'0"	Sealed sample.
18'0"	18'3"	Pale greenish-grey, silty and finely sandy clay, with deep yellow-brown mottling and lesser dark red and pale brownish-yellow mottling. Very plastic. Moisture content a little below P.L. Sub-prismatic structure, with dark purplish-brown partings. Dull sheen on structural units. Very firm.
18'3"	20'3"	Sealed sample.
20'3"	20'6"	Fine, very sandy clay to clayey fine sand, colours as for 18'0" to 18'3". Low plasticity. Friable. Moisture content below P.L. Sub-prismatic structure weakly developed. Light to pale purplish-grey partings. Dull sheen on structural units. Very compact.
20'6"	22'6"	Sealed sample.
22'6"	22'9"	Pale greenish-grey silty and slightly sandy clay with deep red, deep yellow brown and brownish-yellow mottling. Highly plastic. Moisture content near P.L. Sub-prismatic structure. Light greenish-grey to dark purplish-grey partings. Moderate to bright shee on structural units. Some fissuring at 45° to core, with bright sheen on structural faces. Very firm.
22'9"	24'9"	Sealed sample.
24'9"	25'0"	Pale yellowish-grey, fine, very sandy clay, with brick red mottling. Moderately plastic. Friable. Moistur content a little below P.L. Sub-prismatic structure, with light to medium purplish-grey partings. Dull sheen on structural units. Very firm.
25'0"	27'3"	Pale yellowish-grey, slightly clayey fine sand with brick red and a little yellow-brown and brownish-yellow mottling. Very slight plasticity. Very friable. Damp. Semi-cemented in places. Very compact.
27'3"	29'3"	Sealed sample.
29'3"	29'6"	Brick red to deep red, very slightly clayey fine sand with a little pale grey and pale yellowish-grey mottling. Damp. Very friable. Compact.
29'6"	31'6"	Sealed sample.
31'6"	31'9"	As for 29'3" to 29'6".
31'9"	33'9"	Sealed sample.
33'9"	34'0"	As for 29'3" to 29'6", but with yellow-brown mottling.

Depth From	Depth To	Description
34'0"	34'10"	Sealed sample.
34'10"	35'1"	Sample missing.
35'1"	40'1"	Deep red to brick red and pale grey, coarsely and irregularly mottled, fine sandstone, with a little brownish-yellow mottling. Some vertical jointing. Friable in places. Hard.
40'1"	40'6"	Dark red, pale grey and brick red, coarsely and irregularly mottled, slightly clayey fine sand. Semi-cemented in part. Damp. Friable. Very compact to moderately hard.
40'6"	42'1"	Dark purplish-brown to dark reddish-brown weathered slate. Thin bedding dipping vertically. Oblique jointing at 45° and 60°, with some slickensides. Moderately hard.

END OF BORE

TEST BORE NO. 6A

Sub-contract No: 5053 A20-102 (2) Docket: DM 423/61
Location: Co-ords 3634'N & 1243' W Hundred: Noarlunga
Section: 588 R.L. at Collar: 338.20
Purpose: Investigation of foundation conditions, Vacuum Oil Co. oil refinery site, Port Stanvac (near O'Sullivan's Beach)
Hirer: Kellogg Overseas Corporation. Logged by: A.A. Gibson
Plant: Ford O-36'0", Conrad 36'0" - 44'0", Failing 44'0"-54'0"
Total Depth: 54'0"

Depth From	Depth To	Description
0	1'0"	Dark grey-brown to dark reddish-brown fine loam. Damp. Friable. Compact.
1'0"	1'3"	Light creamy-brown, finely sandy kunkar, moderately hard, but friable, with some included, well rounded, very hard nodules. Dry.
1'3"	2'3"	Pale creamy-brown, finely sandy marl-earth, with numerous irregular kunkar nodules. Nearly dry. Very friable.
2'3"	4'3"	Sealed sample.
4'3"	4'6"	Pale creamy-brown, finely sandy marl-earth, with occasional small kunkar nodules. Dry. Very friable.
4'6"	5'9"	Sealed sample.
5'9"	6'9"	Pale creamy-brown, pale grey and pale to light reddish-brown mottled, finely sandy and slightly clayey marl-earth. Frequent very small cemented lumps. Slightly damp. Friable. Compact.
6'9"	7'9"	Sealed Sample.
7'9"	8'9"	Light greyish-brown, light greenish-grey and light brown mottled, fine, very sandy and silty marl, with numerous small, off-white, partly cemented pockets of earthy lime. Slightly plastic. Friable. Slightly damp. Slight tendency to develop a polyhedral structure. Firm.
8'9"	9'0"	Light brownish-grey, light greenish-grey and light reddish-brown mottled, finely sandy marl, with coarse, irregular pockets of partly cemented, off-white earthy lime. Marl is damp, plastic and friable with difficulty. Earthy lime is dry and friable. Firm.
9'0"	11'0"	Sealed sample.
11'0"	12'4"	Light greenish-grey and light reddish-brown, vaguely and irregularly mottled, finely sandy marl. Some disseminated lime sand and patches containing abundant lime sand, occasional black specks. Plastic. Slightly friable. Damp to moist. Sub-prismatic structure, with dull to moderate sheen on structural units. One fissure at 45^{0} to core, with bright sheen on fissure faces. Firm.
12'4"	13'0"	Sealed sample.

Bore 6A (cont.)

Depth From	Depth To	Description
13'0"	14'3"	Greenish-grey, silty and slightly sandy clay, with red-brown and some deep red and yellowish-brown mottling. Occasional small limey patches and small pockets of off-white earthy lime. Very plastic. Slightly friable. Moisture content a little below P.L. Sub-prismatic structure, with light greenish-grey and lesser red-brown partings. Dull to moderate sheen on structural units - very firm.
14'3"	16'3"	Sealed Sample.
16'3"	17'2"	Light greenish-grey, finely sandy clay, with red-brown and yellow-brown mottling. Some very sandy patches. Plastic. Slightly friable. Moisture content a little below P.L. Sub-prismatic structure, with light greenish-grey partings. Dull sheen on structural units. Some fissuring at 45°, with bright sheen on fissure faces. Very firm.
17'2"	18'6"	As for 16'3" to 17'2", but with numerous small, pale brownish-grey, fine sand pockets and dark greyish-purple partings.
18'6"	19'2"	As above, but sand pockets abundant.
19'2"	20'6"	Sealed sample.
20'6"	23'3"	Pale yellowish to brownish-grey, slightly clayey fine sand, with coarse, irregular, deep red, brick red, brownish-yellow and yellow-brown mottling. Occasional dark brownish-purple root channels. Moist. Very friable. Moderately compact.
23'3"	24'6"	Sealed sample (Moisture content sample at 24'6" indicates material as above)
24'6"	25'0"	Sealed sample.
25'0"	27'9"	Pale greenish-grey silty and slightly sandy clay with deep red, yellow-brown and brick red mottlin Occasional pale yellowish-grey sand pockets. Highly plastic. Moisture content slightly below P.L. Sub-prismatic structure, with pale purplish grey to dark brownish-purple partings. Dull shee on structural units. Very firm. Sand content increasing with depth.
27'9"	29'6"	Sealed sample.
29'6"	31'5"	Pale yellowish to greenish-grey, fine, very sandy clay to clayey fine sand, with deep red, brownish-yellow and yellow-brown mottling. Moderate to low plasticity. Friable. Moisture content below P.L. Sub-prismatic structure with dark purplish-brown to light purplish-grey partings. Dull sheen on structural units. Very firm.
31'5"	32'0"	Pale yellowish-grey, slightly clayey fine sand, with dark red and yellow-brown mottling. Slight plasticity. Friable. Moisture content well below P.L. Weakly developed sub-prismatic structure, with light purplish-grey partings. Structural faces dull. Very compact.

Bore 6A (cont.)

Depth From	Depth To	Description
32'0"	33'0"	Sealed Samples.
33'0"	34'0"	As for 29'6" to 31'5"
34'0"	34'5"	Dark red and pale yellowish-grey mottled, slightly clayey fine sand. Semi-cemented in places. Friable, damp. Very compact to moderately hard.
34'5"	35'9"	Sealed sample.
35'9"	36'0"	As for 34'0" to 34'5"
36'0"	36'4"	Augered out, to refusal.
36'4"	44'0"	Standard penetration test. Pale grey, silty and slightly clayey fine sand. Slight plasticity. Damp. Friable.
44'0"	48'0"	Pale grey, yellow-brown and deep red, strongly weathered silty slat. Very fine bedding dipping 45° to 50°. Much jointing also dipping 45° to 50°, but oblique to bedding. Firm to moderately hard.
48'0"	53'0"	As above, but core very broken, with coarse pockets of pale grey silty clay.
53'0"	54'0"	As for 44'0" to 48'0", but very hard.

END OF BORE

PENETRATION TEST BORE NO. 7A

Sub-contract No: 5053 A20-102(2) Docket: DM423/61

Location: Co-ords 3494'N & 1243'W

Hundred: Noarlunga Section: 588 R.L. at Collar: 338.71

Purpose: Standard penetration test, Vacuum Oil Co. oil refinery site, Port Stanvac (near O'Sullivan's Beach).

Hirer: Kellogg Overseas Corporation.

Plant: Conrad 0-39'0", Failing 39'0"-40'0". Total Depth: 40'0"

Logged by: A. A. Gibson

Depth From	Depth To	Description	Penetration. Blows p/ft.
0'0"	1'1"	Dark brown fine loam. Friable, Compact.	
1'1"	1'7"	Kunkar horizon. Mainly moderately soft to hard, finely sandy limestone, with included very small, very hard, round nodules.	
1'7"	5'2¼"	No sample.	
5'2¼"	5'10"	Light brown, finely sandy and slightly clayey marl-earth, with some small kunkar nodules. Damp. Friable. Slightly plastic. Compact.	16
5'10"	10'4"	No sample.	
10'4"	11'0"	Light creamy-brown, finely sandy and slightly clayey marl-earth, with light greenish-grey, finely sandy clay pockets. Compact.	22
11'0"	16'0"	No sample.	
16'0"	16'10"	Light greenish-grey, finely sandy clay, with some red-brown and yellow-brown mottling. Sub-prismatic structure. Firm.	23
16'10"	21'0"	No sample	
21'0"	21'8¾"	Red-brown, fine, very sandy clay, with some light brownish-grey fine sand veins. Very firm.	51
21'8¾"	26'0"	No sample.	
26'0"	26'8"	Dark yellow-brown, semi-cemented, very fine sand. Very compact to moderately hard. Friable with difficulty (Note: test over 6" only).	90
26'8"	31'0"	No sample.	
31'0"	31'8"	Brick red to deep red, slightly clayey fine sand, cemented in places to form sandstone lumps. Friable. Very compact to moderately hard. (Test over 6" only)	97
31'8"	36'0"	No sample.	
36'0"	36'6½"	As for 31'0" to 31'8" (Test over 6" only)	125
36'6½"	39'0"	No sample.	

Penetration Test Bore No. 7A (Contd.)

Depth From	To	Description	Penetration Blows p/ft.
39'0"	40'0"	Weathered slate. Dominantly brown, very finely bedded, silty slate, with some yellowish-brown and pale grey beds. Pale grey beds decomposed to silty clay. Bedding dips at 45°. Occasional pale grey clay pockets. Moderately hard.	D.D. Core

END OF BORE

TEST BORE NO. 8A

Sub-contract No: 5053 A20-102(2) Docket: DM423/61

Location: Co-ords 3634'N & 1498'W

Hundred: Noarlunga Section: 588 R.L. at Collar: 335.71

Purpose: Investigation of foundation conditions, Vacuum Oil Co. oil refinery site, Port Stanvac (near O'Sullivans Beach)

Hirer: Kellogg Overseas Corporation.

Plant: Ford 0-35'0"; Failing 35'0"-40'0" Total Depth: 40'0"

Logged by: A. A. Gibson

Depth From	To	Description
0'0"	1'1"	Dark brown to dark reddish-brown fine loam. Damp. Friable. Compact.
1'1"	1'8"	Kunkar horizon. Irregular kunkar nodules with interstitial reddish-brown, fine sandy loam and light creamy-brown, finely sandy marl-earth. Dry. Friable. Compact.
1'8"	3'7"	Light creamy-brown, finely sandy marl-earth, with pale creamy-brown mottling. Some small kunkar nodules, diminishing in size and number with depth. Slightly damp. Very friable. Moderately compact.
3'7"	4'6"	Light creamy-brown and pale creamy-brown mottled, finely sandy and slightly clayey marl-earth, with lesser brown and red-brown diffuse mottling. Slightly plastic. Friable. Damp. Clay content increasing with depth. Very compact to firm.
4'6"	6'6"	Sealed sample.
6'6"	7'5"	Pale greenish-grey and light creamy-brown mottling, silty and finely sandy marl, with occasional small dark-brown to dark reddish-brown pockets. Mottling becoming very diffuse at depth. Some very small, off-white earthy lime pockets. Moderate to high plasticity. Moderately friable. Moisture content increasing with depth from below to near P.L. Clay content increasing with depth. Moderately firm
7'5"	8'1"	Sealed sample.
8'1"	9'0"	As for 6'6" to 7'5", but color dominantly light greenish-grey, with diffuse yellow-brown mottling. Incipient sub-prismatic structure developing. Moist content at P.L.
9'0"	11'0"	Sealed sample.
11'0"	11'3"	As for 8'1" to 9'0", but with occasional limestone grit fragments and no earthy lime pockets. Sub-prismatic structure now clearly discernable, but weakly developed. Firm.
11'3"	13'3"	Sealed sample.

Test Bore No. 8A (Contd.)

Depth From	Depth To	Description
13'3"	13'6"	Light greenish-grey, finely sandy clay with light to medium yellow-brown mottling. Occasional small blac specks. Plastic. Slightly friable. Moisture conten below P.L. Sub-prismatic structure, with dull shee on structural units. Firm.
13'6"	14'6"	Sealed sample.
14'6"	14'9"	Fine, very sandy clay, with colour and structure as for 13'3" to 13'6". Low plasticity. Friable, Moisture content below P.L. Frequent very small, pale grey sand pockets. Frequent small black flake and specks, unevenly distributed. Very firm.
14'9"	15'6"	Sealed sample.
15'6"	15'9"	As for 14'6" to 14'9", but sand pockets larger.
15'9"	17'9"	Sealed sample.
17'9"	18'0"	As for 13'3" to 13'6", but without black specks. Som fine, dark purplish-brown rootlets on structural faces.
18'0"	20'0"	Sealed sample.
20'0"	20'11"	Pale greenish-grey, finely sandy clay, with yellow-brown, light yellow-brown and deep red mottling. Frequent small, very sandy patches. Plastic. Slightly friable. Moisture content a little below P.L. Sub-prismatic structure, with pale greenish-grey to pale purplish-grey partings. Some fine, purplish-brown veinlets on structural faces. Dull sheen on structural units. Very firm.
20'11"	22'0"	Sealed samples.
22'0"	22'3"	Pale greenish-to yellowish-grey, fine, very sandy clay, with deep red and lesser yellow brown and brownish-yellow mottling. Sand content unevenly distributed. Low to moderate plasticity. Friable. Moisture content below P.L. Sub-prismatic structur with pale greenish-grey to pale purplish-grey partings. Dull sheen on structural units. Very firm
22'3"	23'10"	Sealed samples.
23'10"	24'4"	As for 22'0" to 22'3", but moisture content above P.L. Moderately soft.
24'4"	24'6"	Dark red, dark yellow-brown, pale greenish-grey and brownish-yellow mottled, semi-cemented fine sand. Damp. Very compact to hard.
24'6"	26'1"	Pale greenish-grey silty and slightly sandy clay, with irregular brick-red, yellow-brown and brownish-yellow mottling. Frequent small, pale yellowish-gre; very sandy pockets, unevenly distributed. Highly plastic. Moisture content near P.L. Sub-prismatic structure with pale greenish-grey to light purplish-brown partings. Dull to moderate sheen on structura: units. Some fissuring at 45° to core, with bright sheen on fissure faces. Very firm.
26'1"	26'9"	Sealed sample.

Test Bore No. 8A (Contd.)

Depth From	To	Description
26'9"	28'4"	As for 24'6" to 26'1", but mottling dominantly brownish-yellow. Partings light purple to light purplish-brown. Fissures at 40° and 60° to core.
28'4"	29'0"	Sealed sample.
29'0"	29'3"	As for 26'9" to 28'4".
29'3"	31'0"	Pale greenish-grey clay as above alternating with columns of brick red and pale greenish-grey, fine, very sandy clay. Moderate to high plasticity. Slightly friable in very sandy material. Moisture content near P.L. Sub-prismatic structure, with light to dark purplish-brown partings. Some dark purplish-brown finely sandy clay infilling. Dull to moderate sheen on structural units. Some fissuring at 30° to core (dip 60°) with bright sheen on fissur faces. Very firm.
31'0"	31'3"	Brick red, brownish-yellow and pale brownish-grey, coarsely and irregularly mottled, semi-cemented fine sand, Damp. Friable. Moderately hard.
31'3"	31'6"	Pale brownish-grey, brick red and light yellow-brown, coarsely and irregularly mottled, slightly clayey fine sand. Low plasticity. Very friable. Moist. Very compact.
31'6"	32'2"	Sealed sample.
32'2"	35'0"	Brick red, light yellow-brown and pale brownish-grey, coarsely and irregularly mottled, fine sand. Semi-cemented in places. Friable, Very compact to moderately hard.
35'0"	37'6"	Hard fine sandstone, coloured as above. Damp.
37'6"	40'0"	Very clayey fine sand, coloured as above. Moderately plastic. Friable. Wet.

END OF BORE.

PENETRATION TEST BORE NO.9A

SUB-CONTRACT NO: 5053 A20-102(2) DOCKET: DM 423/61
LOCATION: Co-ords 3564' N & 1543'W. HUNDRED: Noarlunga
SECTION: 588 R.L. at Collar: 333.32
PURPOSE: Standard penetration test, Vacuum Oil Co. oil refinery site, Port Stanvac (near O'Sullivan's Beach)
HIRER: Kellogg Overseas Corporation LOGGED BY: A.A.GIBSON
PLANT: Conrad O-51'3", Failing 51'3" - 72'2"
TOTAL DEPTH: 72'2"

Depth From	Depth To	Description	Penetration Blows p/ft.
0	1'0"	Dark brown to dark reddish-brown fine loam. Damp. Friable. Compact.	
1'0"	1'8"	Kunkar horizon. Coarse, irregular kunkar nodules, with interstitial finely sandy marl earth and some small nodules. Dry, compact.	
1'8"	5'6"	No sample.	
5'6"	6'6"	Creamy-brown, finely sandy and slightly clayey marl-earth, with some small pockets of red- brown, finely sandy clay. Slightly plastic. Friable. Damp. Compact.	17
6'6"	10'6"	No sample.	
10'6"	11'6"	Light greenish-grey, finely sandy clay, with pockets of khaki-brown, finely sandy marl. Numerous particles of coarse lime sand. Plastic. Slightly friable. Moisture content near P.L. Sub-prismatic structure, with dark brown partings. Dull sheen on structural units. Moderately firm.	15
11'6"	15'6"	No sample.	
15'6"	16'6"	Light greenish-grey finely sandy clay, with yellow-brown mottling. Frequent black specks. Plastic. Moisture content near P.L. Sub-prismatic structure, with brown partings. Dull sheen on structural units. Moderately firm.	17
16'6"	20'6"	No sample	
20'6"	21'6"	Shelly tubing used. No recovery.	19
21'6"	25'6"	No sample	
25'6"	26'2¼"	Light greenish-grey, finely sandy clay with deep red and yellow-brown mottling. Plastic. Moisture content near P.L. Sub-prismatic structure. Dull sheen on structural units. Firm.	14
26'2¼"	30'6"	No sample.	
30'6"	31'6"	Yellow-brown, fine, very sandy clay, with a little pale yellowish-grey mottling. Some light greenish-grey finely sandy clay patches and some small, light brick red, fine sand pockets. Moderate plasticity. Slightly friable. Moisture content below P.L. Sub-prismatic structure, with some dark purplish-brown, very sandy clay infilling between structural units. Very firm.	58

Bore 9A (Cont)

Depth From	Depth To	Description	Penetration blows p/ft.
31'6"	35'6"	No sample.	
35'6"	35'11½"	Reddish-brown, slightly clayey fine sand, with some small, pale yellowish-grey mottling. Sub-prismatic structure, with purplish-brown partings. Structural faces dull. Very compact.	60
35'11½"	40'6"	No sample.	
40'6"	40'9½"	As for 35'6" to 35'11½", but with some small, hard lumps of brick red cemented sand. Partings deep purple, with dark purplish brown clayey fine sand infilling.	60
40'9½"	44'6"	No sample.	
44'6"	45'2"	No sample recovery	60
45'2"	49'6"	No sample recovery	
49'6"	50'2"	No sample recovery	60
50'2"	51'3"	No sample recovery	
51'3"	53'3"	Hard, pale brownish-grey, fine sandstone, with vertical joints.	
53'3"	58'9"	Yellow-brown and brick red, coarsely and irregularly mottled, hard fine sandstone, with some small, pale yellowish-grey, softer patches.	
58'9"	62'2"	Layers of soft, pale grey, slightly cemented fine sand, 6" thick, occurring between thin layers of hard, yellow-brown and brick red sandstone.	
62'2"	72'2"	Weathered slate. Horizontally bedded. Top 3" is hard and light brown, with pale grey and red-brown alteration occurring along vertical joints. This is underlain by slightly softer reddish-brown slate, with joints dipping at 60°. This rock can be broken by hand and becomes softer with depth. From 62'5" down pale grey clay occurs in joints and as isolated pockets.	

END OF BORE

TEST BORE NO. 10A

Sub-contract No: 5053 A20-102 (2) DOCKET: DM 423/61

LOCATION: Co-ords 3459' N & 1553'W HUNDRED: Noarlunga

SECTION: 588 R.L. at Collar 335.03

PURPOSE: Investigation of foundation conditions, Vacuum Oil Co. oil refinery site, Port Stanvac, (near O'Sullivan's Beach

HIRER: Kellogg Overseas Corporation TOTAL DEPTH: 40'4½"

PLANT: Ford 0 - 30'9", Failing 30'9" - 40'0" Conrad 40'0" - 40'4½"

LOGGED BY: A.A. GIBSON

Depth From	Depth To	Description
0	8"	Dark brown to dark reddish-brown fine loam. Friable. Compact.
8"	1'0"	Kunkar horizon. Light creamy-brown, finely sandy, poorly cemented kunkar lumps, with some very hard nodules and interstitial light reddish brown loam and light creamy-brown, finely sandy marl earth. Friable. Compact to moderately hard. Slightly damp.
1'0"	2'3"	Light to pale creamy brown, finely sandy marl-earth, with a few small kunkar nodules. Marly dry. Very friable. Moderately compact.
2'3"	3'7"	Light creamy brown, light reddish-brown, off-white pale brownish-grey and reddish-brown, finely mottled, slightly clayey, finely sandy marl-earth. Clay content increasing with depth. Very low plasticity. Very friable. Incipient sub-prismatic structure. Very compact.
3'7"	4'6"	Brown, creamy-brown and light creamy-brown, vaguely mottled, silty and finely sandy marl. Occasional pale creamy-brown marl-earth pockets. Low to moderate plasticity. Clay content increasing with depth. Friable. Firm.
4'6"	6'6"	Sealed sample.
6'6"	8'1"	Light greyish-brown, light greenish-grey and reddish-brown, vaguely mottled, silty and finely sandy marl. Very plastic. Friable. Moisture content near P.L. Sub-prismatic structure, with moderate to bright sheen on structural units. Some irregular fissuring at 45° to core, with bright sheen on fissure faces. Firm.
8'1"	8'9"	Sealed sample.
8'9"	9'0"	As for 6'6" to 8'1", but colours dominantly light greenish-grey and yellow-brown. Clay content increasing. Occasional black specks.
9'0"	11'0"	Sealed sample.
11'0"	11'11"	Light greenish-grey, silty and slightly sandy clay, with yellow-brown and light yellow-brown mottling. Frequent small black specks, unevenly distributed. Highly plastic. Moisture content at P.L. Sub-prismatic structure, with moderate sheen on structural units. Several fissures at 45° to core, and one at 10° (Dip 80°), all with bright sheen on fissure faces. Firm.
11'11"	13'3"	Sealed samples.

Bore 10A (Cont.)

Depth From	Depth To	Description.
13'3"	13'6"	As for 11'0" to 11'11", but without fissures.
13'6"	15'6"	Sealed sample.
15'6"	16'5"	As for 11'0" to 11'11", without steep fissure.
16'5"	17'1"	Sealed sample.
17'1"	18'6"	As for 11'0" to 11'11", but sand content increasing gradually with depth. Pale purplish-grey partings, with brownish-purple fine veining containing very fine rootlets.
18'6"	20'0"	Sealed samples.
20'0"	21'0"	As for 17'1" to 18'6", but with pale yellowish-grey fine sand infilling between some structural units.
21'0"	22'3"	Sealed samples.
22'3"	23'2"	Light greenish-grey, finely sandy clay, with a little brownish-yellow and yellow-brown mottling. Occasional brick red mottles. Plastic. Moisture content below P.L. Light greenish-grey to purplish-grey partings. Some dark purplish-grey finely sandy clay infilling. Dull to moderate sheen on structural units. Very firm. One fissure 60° to core (Dip 30°), with bright sheen on fissure faces.
23'2"	24'6"	Sealed samples.
24'6"	25'5"	Pale greenish-grey, fine, very sandy clay, with some fine to coarse, irregular, deep brick red and deep yellow-brown mottling. Plastic. Slightly friable. Moist e content below P.L. Sub-prismatic structure, with pale greenish-grey to light purplish-grey partings. Dullsheen on structural units. One fissure at 50° to core (dip 40°), one vertical, and one horizontal, all with a bright sheen on fissure faces. Very firm.
25'5"	25'9"	Sealed Sample.
25'9"	27'6"	Brick red, slightly clayey fine sand, with a little yellow-brown, brownish-yellow and pale grey mottling. Occasional dark purplish-brown veinlets containing fine root remnants. Friable. Semi-cemented in places. Damp to moist. Very compact to moderately hard.
27'6"	29'0"	Sealed samples.
29'0"	29'9"	As for 25'9" to 27'6"
29'9"	30'6"	Sealed Sample.
30'6"	31'3"	Hard, fine sandstone, coloured as for 25'9" to 27'6".

Bore 10A (cont.)

Depth From	Depth To	Description
31'3"	40'0"	Sands and sandstone. No recovery with diamond drill.
40'0"	40'4½"	Brick red and deep red mottled, semi-cemented fine sand, with a little yellow-brown and pale grey mottling. Friable. Damp. Very compact to moderately hard.

END OF BORE

TEST AND PENETRATION TEST BORE NO. 11A

Sub-contract No.: 5053 A20-102(2) Docket: DM 423/61

Location: Co-ords 3479'N & 1683'W

Hundred: Noarlunga Section: 588 R.L. at Collar: 334.58

Purpose: Investigation of foundation conditions and standard penetration test, Vacuum Oil Co. oil refinery site, Port Stanvac (near O'Sullivan's Beach).

Hirer: Kellogg Overseas Corporation

Plant: Ford 0 - 40'6", Conrad 40'6" - 54'3" Total Depth: 54'3"

Logged by: A. A. Gibson

Depth From	Depth To	Description
0	1'1"	Brown fine sandy loam. Friable. Granular to compact.
1'1"	2'0"	Kunkar horizon. Coarse to fine irregular kunkar concretions with some interstitial loam and marl-earth. Moderately soft to hard.
2'0"	2'3"	Pale creamy-brown, finely sandy marl earth, with frequent small kunkar nodules. Dry. Very friable.
2'3"	4'3"	Sealed sample.
4'3"	4'6"	Light brown, finely sandy and slightly clayey marl-earth, with some light grey, off-white, grey-brown and sparse red-brown mottling. Friable. Damp. Moderately compact.
4'6"	5'9"	Sealed sample.
5'9"	6'0"	Light brown finely sandy marl, with sparse, small kunkar nodules. Plastic. Slightly friable. Moisture content at P.L. Moderately soft.
6'0"	6'6"	Sealed sample.
6'6"	6'9"	Greyish-brown to light brownish-grey, vaguely mottled, finely sandy marl, with some disseminated fine limestone grit. Plastic. Slightly friable. Moisture content at P.L. Firm.
6'9"	8'9"	Sealed sample.
8'9"	9'0"	Light greenish-grey, finely sandy clay, with some dark red, red-brown and yellow-brown mottling. Moderate to high plasticity. Moisture content at P.L. Sub-prismatic structure, with purplish-brown clay partings and some fine, pale brown sand infilling. Dull sheen on structural units. Occasional very sandy pockets. Some decomposed rootlets. Firm.
9'0"	11'0"	Sealed Sample.
11'0"	11'3"	Light greenish-grey, slightly sandy clay, with deep red mottling and occasional small, sand-filled cracks. Polyhedral structure, moderate to bright sheen on structural units. Highly plastic. Moisture content at P.L. Firm.

Depth From	Depth To	Description
11'3"	13'3"	Sealed sample.
13'3"	13'6"	Light greenish-grey, slightly sandy clay, with deep red mottling. Highly plastic. Moisture content above P.L. Firm.
13'6"	15'6"	Sealed sample.
15'6"	15'9"	Light greenish-grey, slightly sandy clay, with deep red mottling. Highly plastic. Some very thin sandy partings. Polyhedral to subprismatic structure, with bright sheen on structural units. Moisture content above P.L. Firm.
15'9"	18'7"	Sealed samples.
18'7"	19'10"	Light greenish grey, finely sandy clay, with a little yellow-brown mottling. Moderately plastic. Sub-prismatic structure with purplish brown clay partings. Dull to moderate sheen on structural units. Moisture content about P.L. Some sand coated cracks. Occasional very small sand-silt pockets. Firm.
19'10"	22'3"	Sealed sample.
22'3"	22'6"	Light greenish-grey, finely sandy clay with some yellow-brown and sparse brick red mottling. Sand distribution irregular. Moderately low plasticity. Sub-prismatic structure, with light brownish-grey partings. Dull to moderate sheen on structural units. Moisture content below P.L. Very firm.
22'6"	24'6"	Sealed sample.
24'6"	24'9"	Light greenish-grey, fine, very sandy clay, with deep red and a little yellow-brown mottling. Semi-friable. Moisture content below P.L. Very firm.
24'9"	26'9"	Sealed sample.
26'9"	27'0"	Light greenish-grey, finely sandy clay with deep red mottling. Moderately low plasticity. Sub-prismatic structure, with reddish brown clay partings. Dull to moderate sheen on structural units. Some horizontal irregular fissure planes with a bright sheen. Moisture content about P.L. Firm.
27'0"	29'0"	Sealed sample.
29'0"	29'3"	As for 26'9" - 27'0", but sand content increasing and moisture content slightly below P.L.
29'3"	31'3"	Sealed sample.
31'3"	31'6"	Light greenish-grey, fine, very sandy clay, with occasional yellowish-brown mottling. Low plasticity. Slightly friable. Sub-prismatic structure, with moderate sheen on structural faces. Some fissuring with a bright sheen on fissure faces. Moisture content below P.L. Firm.
31'6"	33'6"	Sealed sample.

Depth From	Depth To	Description	Blows per ft.
33'6"	33'9"	Light red-brown, fine to medium grained slightly clayey sand, with numerous moderately hard sandstone fragments, vaguely mottled with pale yellowish-grey light yellow-brown and red-brown. Moist. Friable. Very compact.	
33'9"	38'0"	Sealed samples.	
38'0"	38'3"	As far 33'6" - 33'9" but sandstone abundant.	
38'3"	40'3"	Tube samples.	
40'3"	40'6"	Pale brownish-grey, slightly clayey fine sand, with yellowish-brown and brick red mottling. Friable. Moist. Moderately compact.	
40'6"	45'6"	No sample	
45'6"	46'6"	Pale brownish-grey and deep red, coarsely and irregularly mottled, fine sand.	16
46'6"	53'3"	No sample.	
53'3"	54'3"	Red-brown fine sandstone.	168

END OF BORE.

TEST BORE NO. 12A

Sub-contract No.: 5053 A20-102(2) Docket: DM 423/61

Location: Co-ords 3549'N & 1663'W

Hundred: Noarlunga Section: 588 R.L. at Collar: 333.84

Purpose: Investigation of foundation conditions, Vacuum Oil Co. oil refinery site, Port Stanvac (near O'Sullivan's Beach)

Hirer: Kellogg Overseas Corporation

Plant: Ford 0-36'10", Failing 36'10"-40'0", Conrad 40'0"-42'1½"

Total Depth: 42'1½"

Logged by: A. A. Gibson

Depth From	Depth To	Description
0	2'0"	Sealed sample.
2'0"	2'3"	Light brown, very silty and finely sandy marl-earth, with sparse clay. Frequent small kunkar nodules. Compact. Friable. Damp.
2'3"	4'3"	Sealed sample.
4'3"	4'6"	As for 2'0" to 2'3", but with pale creamy-brown mottling and numerous kunkar nodules.
4'6"	11'0"	Sealed samples.
11'0"	11'3"	Light greenish-grey silty and slightly sandy clay, with deep red mottling. Plastic. Moisture content a little below P.L. Polyhedral structure with some black flakes on structural faces. Moderate sheen on structural units. Firm.
11'3"	13'3"	Sealed sample.
13'3"	13'6"	Light greenish-grey, slightly silty to slightly sandy clay, with deep red mottling. Polyhedral structure, with purplish-brown partings. Moderate sheen on structural units. Fissures at 45° to core, with bright sheen on fissure faces. Highly plastic. Moisture content at, or slightly below P.L. Firm.
13'6"	15'6"	Sealed sample.
15'6"	15'9"	As for 13'3" to 13'6", but structure prismatic with purplish-brown sandy clay infilling of cracks. Some decomposed rootlets along structural faces.
15'9"	17'9"	Sealed sample.
17'9"	18'0"	As for 13'3" to 13'6", but with some sand coating on structural faces.
18'0"	20'0"	Sealed sample.
20'0"	20'3"	Light greenish-grey, finely sandy clay, with a little, diffused yellow-brown and deep red mottling. Sub-prismatic structure with purplish-brown clay partings. Dull sheen on structural units. Plastic. Moisture content near P.L. Very firm.

Depth From	Depth To	Description
20'3"	22'3"	Sealed sample.
22'3"	22'6"	As for 20'0" to 20'3", but sand content increasing. Moisture content below P.L. Fissure at 45° to core, with bright sheen on fissure faces.
22'6"	24'6"	Sealed sample.
24'6"	24'9"	Light greenish-grey, finely sandy clay, with a little yellow-brown and brick red mottling. Sub-prismatic to polyhedral structure, dull to moderate sheen on structural units. Some fissures at 45° to core, wit bright sheen on fissure faces. Moisture content slightly below P.L. Moderately plastic. Semi-friable in part. Very firm. (35% sand by volume, measured).
24'9"	26'9"	Sealed sample.
26'9"	27'0"	As for 24'6" to 24'9", but no fissures and sand content increasing. Purplish-brown sandy clay infilling, with rootlets. An irregular horizontal structural plane evident. Moisture content below P.L.
27'0"	29'0"	Sealed sample.
29'0"	29'3"	Light greenish-grey, fine, very sandy clay, with deep red and a little yellow-brown mottling. Prismatic structure, with a dull to moderate sheen on structural units. Some fine sand in cracks between structures. Fissuring at 45° to core with a bright sheen on fissure faces. Semi-friable. Moderately low plasticity. Moist, but moisture content well below plastic limit. Very firm.
29'3"	31'3"	Sealed sample.
31'3"	31'6"	As for 29'0" to 29'3" but with dark purplish-brown coating on prism faces. Low-angle, irregular fissure plane with a bright sheen.
31'6"	33'3"	Sealed sample.
33'3"	33'6"	Light red-brown, slightly clayey fine sand with a little pale yellowish-grey mottling. Very friable. Moist. Compact.
33'6"	35'0"	Sealed sample.
35'0"	35'3"	As for 33'3" to 33'6", but with frequent, moderately hard sandstone lumps.
35'3"	35'9"	Sealed sample.
35'9"	36'0"	As for 33'3" to 33'6".
36'0"	36'7"	Sealed sample.
36'7"	36'10"	Red-brown, slightly clayey fine sand, with frequent moderately soft sandstone lumps. Compact, Moist.
36'10"	41'10½"	No recovery. (Diamond drilling in sand.)

Depth From	Depth To	Description
41'10½"	42'1½"	Deep red, brick red and lesser pale yellowish-grey, semi-cemented fine sand. Friable. Very compact to moderately hard.

END OF BORE

PENETRATION TEST BORE NO. 13A

Sub-contract No: 5053 A20-102(2) Docket: DM 423/61

Location: Co-ords 3619'N & 1623'W

Hundred: Noarlunga Section: 588 R.L. at Collar: 335.12

Purpose: Standard penetration test, Vacuum Oil Co. oil refinery site, Port Stanvac, (near O'Sullivan's Beach)

Hirer: Kellogg Overseas Corporation.

Plant: Conrad Total Depth: 61'3"

Logged by: A.A. Gibson

Depth From	Depth To	Description	Penetration Blows p/ft.
0	1'1"	Grey-brown fine sandy loam. Friable. Compact.	
1'1"	1'9"	Kunkar horizon. Coarse to fine irregular kunkar nodules, with interstitial loam and marl-earth. Compact.	
1'9"	5'3"	No sample.	
5'3"	6'3"	Light creamy-brown, finely sandy and slightly clayey marl-earth with pockets of pale creamy brown finely sandy clay free marl-earth. Occasional small black sand grains. Damp. Friable. Compact. No structure evident.	18
6'3"	10'6"	No sample.	
10'6"	11'6"	Light greenish-grey, finely sandy clay, with yellow-brown mottling. Moist. Plastic. Firm.	15
11'6"	15'6"	No sample.	
15'6"	16'6"	As for 10'6" to 11'6".	15
16'6"	20'6"	No sample.	
20'6"	21'6"	As for 10'6" to 11'6", but with a definite sub-prismatic structure.	21
21'6"	25'6"	No sample.	
25'6"	26'6"	Light greenish-grey finely sandy clay, with red-brown and yellow-brown mottling. Sand content increasing. Moist. Plastic. Sub-prismatic structure. Firm.	31
26'6"	30'6"	No sample	
30'6"	31'6"	Red-brown, finely sandy clay, with light greenish-grey mottling. Moist. Plastic. Sub-prismatic structure. Firm. Sand content increasing.	36
31'6"	35'6"	No sample	
35'6"	36'6"	Pale yellowish- to greenish-grey slightly clayey, fine sand, with brownish-yellow mottling. Moist. Friable. Sub-prismatic structure, with some purplish-brown infilling between structural units. Very compact.	92

Depth From	Depth To	Description	Penetration Blows p/ft.
36'6"	40'6"	No sample.	
40'6"	41'3"	Pale yellowish-grey and yellow-brown, coarsely and irregularly mottled fine sand. Cemented in places to form small sandstone lumps. Friable. Moist. Very compact.	126
41'3"	45'6"	No sample.	
45'6"	46'0"	Light greyish-brown and dark yellow-brown, coarsely and irregularly mottled, slightly clayey fine sand. Moist. Friable. Poorly developed sub-prismatic structure with pale grey partings. Very compact.	91
46'0"	50'6"	No sample.	
50'6"	51'6"	As for 45'6" to 46'0".	118
51'6"	55'6"	No sample.	
55'6"	56'3"	Light brownish-grey and yellow-brown, coarsely and irregularly mottled, slightly clayey fine sand. Moist. Friable. Very compact.	84
56'3"	60'6"	No sample.	
60'6"	61'3"	Pale yellowish-grey, deep red and yellow-brown, coarsely and irregularly mottled, slightly clayey, fine sand. Moist. Friable. Very Compact.	85

END OF BORE

TEST BORE NO. 14A

Sub-contract No: 5053 A20-102(2) Docket: DM 423/61

Location: Co-ords. 3619'N & 1823'W

Hundred: Noarlunga Section: 588 R.L. at Collar: 334.67

Purpose: Investigation of foundation conditions, Vacuum Oil Co. oil refinery site, Port Stanvac (near O'Sullivan's Beach)

Hirer: Kellogg Overseas Corporation

Plant: Ford 0-41'6", Failing 41'6"-50'0", Conrad 50'0"-51'9"

Total Depth: 51'9"

Logged by: A.A. Gibson

Depth From	Depth To	Description
0	1'1"	Brown finely sandy loam. Friable. Granular to compact
1'1"	1'7"	Kunkar horizon. Coarse, irregular, finely sandy kunkar concretions, with interstitial fine sandy loam. Compact. Moderately soft to hard.
1'7"	2'3"	Pale creamy-brown, finely sandy marl-earth with frequent small, hard kunkar nodules. Dry. Very friable.
2'3"	4'3"	Sealed sample.
4'3"	4'6"	As for 1'7" to 2'3", but nodules very small and sparce.
4'6"	6'6"	Sealed sample.
6'6"	7'5"	Pale creamy-brown and light red-brown vaguely mottled finely sandy and slightly clayey marl-earth. Sparce, very small kunkar nodules. Damp. Very friable. Compact.
7'5"	8'9"	Sealed samples.
8'9"	9'0"	As for 6'6" to 7'5".
9'0"	11'0"	Sealed sample.
11'0"	11'3"	Light yellowish-brown, slightly clayey, fine sand, with a little pale grey mottling. Moist. Very friable. Compact.
11'3"	12'7"	Light creamy-brown, slightly clayey, fine sand, with reddish-brown mottling irregularly distributed. Moist Very friable. Moderately compact.
12'7"	13'3"	Sealed sample.
13'3"	13'6"	Light yellowish- to reddish-brown, slightly clayey fine sand. Moist. Very friable. Compact.
13'6"	15'6"	Sealed sample.
15'6"	15'9"	Red-brown, pale greenish-grey and yellowish-brown, clayey fine sand. Slightly plastic. Moist. Friable. Compact.
15'9"	16'5"	Pale yellowish-grey, light brownish-yellow and light yellow-brown, slightly clayey fine sand, with occasion

Depth From	Depth To	Description
		small brown mottles. Moist. Friable. Compact.
16'5'	17'1"	Sealed sample.
17'1"	18'0"	As for 15'9" to 16'5"
18'0"	20'0"	Sealed sample.
20'0"	20'11"	Light greenish-grey, finely sandy clay, with red-brown, yellow-brown, brownish-yellow and brown mottling. Moderately plastic. Moisture content below P.L. Slightly friable. Sub-prismatic structure, with purplish-grey partings. Dull sheen on structural units. Firm.
20'11"	21'7"	Sealed samples.
21'7"	22'6"	Light greenish- to yellowish-grey, fine, very sandy clay, with deep red and light yellow-brown mottling. Low plasticity. Moderately friable. Moisture content well below P.L. Poorly developed sub-prismatic structure, with brown to purplish-brown sandy clay partings. Structural faces dull. Very firm.
22'6"	24'6"	Sealed sample.
24'6"	24'9"	Light greenish- to yellowish-grey, silty and slightly sandy clay, with red-brown, brick red, yellow-brown and brownish-yellow, irregular mottling. Plastic. Moisture content near P.L. Sub-prismatic structure, with pale to dark purplish-grey partings. Some dark purplish-brown sandy clay and pale brownish-grey fine sand infilling cracks. Dull to moderate sheen on structural units. Very firm.
24'9"	25'5"	Sealed sample.
25'5"	26'1"	As for 24'6" to 24'9".
26'1"	27'0"	As above, but with fissures at 45° to core. Bright sheen on fissure faces. Some rootlets and traces of same on structural faces. No clay infilling.
27'0"	29'0"	Sealed sample.
29'0"	30'7"	As for 26'1" to 27'0", but sand content increasing. Moisture content well below P.L.
30'7"	31'3"	Sealed sample.
31'3"	31'6"	As for 29'0" to 30'7".
31'6"	33'6"	Sealed sample.
33'6"	33'9"	As for 29'0" to 30'7".
33'9"	34'5"	As above, but now very sandy and friable. Moisture content well below P.L. No.fissures. Clay content irregularly distributed. Dull sheen on structural units.

Depth From	Depth To	Description
34'5"	35'1"	Sealed sample.
35'1"	36'0"	As for 33'9" to 34'5".
36'0"	38'0"	Sealed sample.
38'0"	38'11"	As for 33'9" to 34'5".
38'11"	39'7"	Sealed sample.
39'7"	41'0"	Yellowish-brown to reddish-brown, slightly clayey fine sand, with some pale grey and pale yellowish-grey mottling. Poorly defined sub-prismatic structure. Damp. Friable. Very compact.
41'0"	41'3"	Pale brownish-grey, light yellow-brown and deep red mottled, hard sandstone, with some patches of compact sand.
41'3"	41'10"	Brown to reddish-brown, clayey fine sand, with numerous small, pale grey, angular, silty clay pockets (decomposed slate fragments?) Very wet. Soft. This sample was contaminated with material from the surface.
41'10"	44'6"	Pale brownish-grey and deep red, coarsely and irregularly mottled, fine sandstone. Horizontally bedded. Friable with difficulty. Hard.
44'6"	50'0"	Diamond drilled in sands. No recovery.
50'0"	51'9"	Brick red, deep red, light yellow-brown and pale grey mottled, semi-cemented fine sand. Friable. Very compact to moderately hard.

END OF BORE

TEST AND PENETRATION BORE NO. 15A

Sub-contract: 5053 A20-102(2) **Docket:** DM423/61

Location: Co-ords. 3559'N & 1743'W

Hundred: Noarlunga **Section:** 588 **R.L. at Collar:** 335-05

Purpose: Investigation of foundation conditions and standard penetration test, Vacuum Oil Co. oil refinery site, Port Stanvac (near O'Sullivan's Beach).

Hirer: Kellogg Overseas Corporation.

Plant: Ford 0-42'6", Conrad 42'6"-67'6" **Total Depth:** 67'6"

Logged by: A. A. Gibson

Depth From	Depth To	Description
0'0"	1'0"	Dark brown fine loam. Friable. Compact.
1'0"	1'8"	Kunkar horizon. Coarse, irregular, sandy kunkar concretions in a matrix of finely sandy marl earth and small, hard nodules. Compact.
1'8"	2'3"	Pale creamy brown, finely sandy marl earth, with frequent small kunkar nodules. Very friable.
2'3"	3'0"	Sealed sample.
3'0"	3'3"	As for 2'0" to 2'3", but more compact.
3'3"	4'3"	Sealed sample.
4'3"	4'6"	As for 2'0" to 2'3", but becoming very compact and slightly clayey.
4'6"	6'6"	Sealed sample.
6'6"	6'9"	Light reddish-brown, light brown and pale creamy-brown mottled, very sandy marl. Very damp, but moisture content well below P.L. Easily friable. Moderately firm.
6'9"	8'9"	Sealed sample.
8'9"	9'0"	As for 6'6" to 6'9". Some contamination with organic matter from surface.
9'0"	11'0"	Sealed sample.
11'0"	11'3"	Light greenish-grey, finely sandy and slightly limey clay, with yellow brown and brown mottling. Some very small, off-white, earthy lime patches. Occasional light creamy red-brown, very sandy marl fragments. Moisture content at P.L. Moderately soft. Slightly friable. Plastic.
11'3"	13'3"	Sealed sample.
13'3"	13'6"	Light greenish-grey, finely sandy clay, with reddish-brown and yellowish-brown mottling. Plastic, but slightly friable. Moisture content slightly below P.L. Moderately firm.
13'6"	15'3"	Sealed sample.

Depth From	To	Description
15'3"	15'6"	Light greenish-grey finely sandy clay, with yellow-brown mottling and occasional small dark purplish-brown patches. Some irregular horizontal planes with very fine dark purple veining (probably derived from rootlets). No other structure evident. Plastic, but slightly friable. Moisture content below P.L. Firm.
15'6"	17'9"	Sealed sample.
17'9"	18'0"	Light greenish-grey fine, very sandy clay with yellow-brown mottling and frequent small, pale yellowish-grey, clayey sand pockets. Sub-prismatic structure, with light purplish grey partings and abundant dark purplish-brown veinings (caused by decomposed rootlets) on structural faces. Moderately plastic, but fairly friable. Moisture content well below P.L. Very firm.
18'0"	20'0"	Sealed sample.
20'0"	20'3"	As for 17'9" to 18'0", but mottling brick red and yellow-brown.
20'3"	22'3"	Sealed sample.
22'3"	22'6"	Light greenish-grey finely sandy clay with yellow-brown and lesser brick red mottling. Sub-prismatic structure with brown silty clay partings. Structural faces dull. Fissure with moderate sheen occurs at 45° to core. Fissure and structural faces have fine, dark purplish-brown veining. Plastic. Slightly friable. Moisture content below P.L. Firm.
22'6"	26'3"	Sealed sample.
26'3"	27'0"	Light greenish-grey finely sandy clay, with abundant small, pale yellowish grey, fine sand pockets. Coarse, irregularly, deep red, and lesser brownish yellow, mottling. Vague suggestion of a coarse sub-prismatic structure. One irregular horizontal plane with brown clay parting. Moisture content well below P.L. Slightly plastic. Friable. Very firm.
27'0"	29'0"	Sealed sample.
29'0"	29'3"	Light greenish-grey fine, very sandy clay, with sand irregularly distributed. Some small dark red, ferruginous patches and lesser yellow-brown mottling. Sub-prismatic structure with light greenish-grey and greyish-brown partings. Structural faces dull. Some fissuring at 45° to core, with a bright sheen on fissure faces. Slightly plastic. Friable. Moisture content well below P.L. Very firm.
29'3"	31'3"	Sealed sample.
31'3"	31'6"	As for 29'0" to 29'3", but sample very broken and no structure can be discerned.
31'6"	33'6"	Sealed sample.

Bore 15A (Contd.)

Depth From	To	Description	Blows p/ft.
33'6"	33'9"	Red-brown and light greenish-grey mottled, fine, very sandy clay, with frequent, irregular, pale yellowish-grey fine sandy patches. Sub-prismatic structure evident, but sample very broken. Moisture content very low, barely damp to the touch. Friable. Very firm.	
33'9"	35'9"	Sealed sample.	
35'9"	36'0"	Brick red, clayey, very fine sand, with a little brownish-yellow and pale grey mottling. Sub-prismatic structure with grey-brown clay partings. Structural faces dull. Damp. Friable. Very compact.	
36'0"	37'8"	Sealed sample.	
37'8"	37'10"	Yellowish-brown fine sand with numerous hard, pale grey and brownish-yellow mottled sandstone lumps. Damp.	
37'10"	40'6"	Sealed samples.	
40'6"	40'9"	Yellowish-brown fine sand with numerous firm to hard small lumps, some yellowish-brown, some pale yellowish-grey.	
40'9"	42'5"	Sealed sample.	
42'5"	42'6"	Cuttings from auger bit. Light buff coloured very fine sandstone. Dry. Hard.	
42'6"	49'6"	No sample.	
49'6"	49'11"	Red-brown, semi-cemented fine sand, with brownish-yellow and yellow-brown mottling. Dry. Hard.	65
49'11"	55'4"	No sample.	
55'4"	55'6"	As for 49'6" to 49'11" (2" diam. Shelby tubing driven only 2" for 54 blows. Tubing collapsed.)	324?
55'6"	60'4"	No sample.	
60'4"	60'11¾"	Red-brown and pale grey coarsely and irregularly mottled slightly clayey fine sand. Damp. Slight plasticity. Friable. Compact.	60
60'11¾"	65'5"	No sample.	
65'5"	66'5"	As for 60'4" to 60'11¾", but with higher clay content. Some grit sized quartz fragments. Moderately plastic. Moist. Friable. Compact.	38
66'5"	67'0"	Light brick red, light yellow-brown, pale grey and pale purplish-grey, coarsely and irregularly mottled, semi-cemented fine sand. Friable. Moderately hard.	

Bore No. 15A (Contd.)

Depth From	To	Description
67'0"	67'6"	Weathered and partly decomposed bedrock. Pale grey, very fine sandstone, pale grey and dark red, moderately hard slate and pale grey, dark red, and yellow-brown, coarsely mottled, silty clay. Dip about 30°.

END OF BORE.

TEST BORE NO. 16A

Sub-contract No.: 5053 A20-102(2) Docket: DM 423/61

Location: Co-ords 4884'N & 1753'W

Hundred: Noarlunga Section: 582 R.L. at Collar: 324.65

Purpose: Investigation of foundation conditions, Vacuum Oil Co. oil refinery site, Port Stanvac (near O'Sullivan's Beach)

Hirer: Kellogg Overseas Corporation

Plant: Ford 0-30'1", Failing 30'1"-50'4" Total Depth: 50'4"

Logged by: A. A. Gibson

Depth From	Depth To	Description
0	6"	Brown finely sandy loam. Friable. Compact.
6"	1'3"	Kunkar horizon. Coarse, irregular, platy concretions, with interstitial loam and fine nodules. Moderately soft to hard. Compact.
1'3"	2'11"	Pale creamy-brown, finely sandy marl-earth with frequent small kunkar nodules. Dry. Very friable.
2'11"	4'6"	Pale creamy-brown, off-white and light brown mottled, finely sandy marl-earth with sparse small kunkar nodules. Nearly dry. Friable. Compact.
4'6"	6'6"	Sealed sample.
6'6"	6'9"	As for 2'11" to 4'6"
6'9"	7'6"	Light brown, pale creamy-brown, brown and off-white mottled, finely sandy and somewhat clayey marl-earth. Damp. Slightly plastic. Friable. Very compact.
7'6"	8'4"	Creamy-brown to reddish-brown silty, slightly sandy and slightly limey clay with occasional coarse pockets of off-white earthy lime. Sub-prismatic structure, with numerous small, black rootlets on structural faces. Dull sheen on structural units. Low plasticity. Friable. Damp. Firm.
8'4"	9'0"	Reddish-brown silty and finely sandy clay. Sub-prismatic structure, with some fine dark brown rootlets on structural faces in upper part. Purplish brown partings. Moderate sheen on structural units. Damp. Low plasticity. Somewhat friable. Firm. Scattered small black specks and platy flecks.
9'0"	11'0"	Sealed sample.
11'0"	13'6"	Red-brown clayey fine sand with a little pale greenish grey, pale yellowish-grey and yellow-brown fine mottling. Some isolated pockets of light yellow-brown, pure fine sand. Sub-prismatic structure, with reddish-brown partings. Dull sheen on structural units. Damp. Very low plasticity. Friable. Very firm. Clay content diminishing with depth.

Depth From	Depth To	Description
13'6"	15'6"	Sealed sample.
15'6"	18'0"	As for 11'0" to 13'6"
18'0"	20'0"	Sealed sample
20'0"	22'6"	Light greenish-grey, silty and finely sandy clay, with red-brown mottling. Occasional small, pale brownish-grey sand pockets. Sub-prismatic structure, with purplish-grey partings. Sandy coatings on some structural faces. Dull to moderate sheen on structural units. Some fissuring at 30° to core (60° dip) with bright sheen on fissure faces. Moderately plastic. Semi-friable. Moist. Firm. Sample shows a close pattern of horizontal cracks due to sampler disturbance.
22'6"	24'6"	Tube sample.
24'6"	24'9"	As for 20'0" to 22'6"
24'9"	27'0"	Pale greenish-grey to pale yellowish-grey, fine, very sandy clay with brick red, red-brown and lesser brown mottling. Frequent fine to very coarse, pale brownish-grey, fine sand pockets. Clay diminishing with depth. Low plasticity. Friable. Coarse sub-prismatic structure, with purplish brown sandy clay partings. Dull sheen on structural units. Moist. Very firm to very compact. Merging downward into slightly clayey fine sand of similar colouring.
27'0"	29'0"	Sealed sample.
29'0"	29'3"	Pale yellowish-grey, brick red and yellow-brown mottled, slightly clayey fine sand. Moist. Very friable. Compact.
29'3"	29'7"	Sealed sample.
29'7"	29'10"	Sample missing.
29'10"	32'1"	Pale grey, pale brownish-grey and yellow-brown mottled, slightly clayey fine sand, with frequent hard cemented lumps. Moist. Very friable. Compact to hard.
32'1"	47'1"	Deep red, pale brownish-grey, brick red and yellow-brown, coarsely and irregularly mottled, slightly clayey fine sand. Semi-cemented in places. Friable. Moist. Sub-prismatic structure, with pale purplish-grey to deep purple partings. Structural faces dull. Compact to moderately hard.
47'1"	49'0"	No recovery.
49'0"	50'4"	Dark purplish-brown, silty to finely sandy weathered slate. Thin bedding dipping at 60°. Jointing dipping 10°, 45°, 75° and vertical, with pale grey coating on joint faces. Hard.

END OF BORE.

TEST BORE NO. 17A

Sub-contract No.: 5053 A20-102(2) **Docket:** DM 423/61

Location: Co-ords 4569'N & 1753'W

Hundred: Noarlunga **Section:** 582 **R.L. at Collar:** 325-98

Purpose: Investigation of foundation conditions, Vacuum Oil Co. oil refinery site, Port Stanvac (near O'Sullivan's Beach)

Hirer: Kellogg Overseas Corporation

Plant: Ford 0-20'3", Failing 20'3"-49'3", Conrad 49'3"-56'0"

Total Depth: 56'0"

Logged by: A. A. Gibson

Depth From	Depth To	Description
0	11"	Brown, finely sandy loam. Friable. Compact.
11"	1'6"	Kunkar horizon. Coarse, irregular to platy; sandy kunkar concretions with some interstitial loam. Moderately soft to hard. Compact.
1'6"	2'3"	Pale creamy-brown, finely sandy marl-earth with sparse, small kunkar nodules. Nearly dry. Very friable.
2'3"	4'3"	Sealed sample.
4'3"	5'2"	Light brown and pale creamy-brown mottled, finely sandy marl-earth, with frequent small, off-white pockets of earthy lime. Nearly dry. Very friable. Compact.
5'2"	5'10"	Sample missing.
5'10"	7'5"	Light brown to brown, fine, very sandy marl, with abundant fine to very coarse pockets of off-white earthy lime. cemented in part. Nearly dry to damp. Very friable. Firm.
7'5"	8'1"	Sealed sample.
8'1"	8'4"	Brown, finely sandy and slightly limey clay, with disseminated fine lime sand. Moderately plastic. Friable. Sub-prismatic structure with light brown partings. Dull sheen on structural units. Damp. Firm.
8'4"	9'0"	Brown to reddish-brown, finely sandy clay, with a little vague pale brown, yellowish-brown and pale grey mottling. Moderately plastic. Friable. Sub-prismatic structure, with reddish-brown clay partings. Moderate sheen on structural units. Sparse dark brown to black specks, traces of rootlets and some lime sand on structural faces. Moisture content well below P.L. Firm.
9'0"	9'8"	As above, but very sandy. Black specks and flakes numerous. Dull sheen on structural units.
9'8"	10'4"	Sealed sample.

Depth From	Depth to	Description
10'4"	11'11"	Red-brown finely sandy clay. Fine diffuse, pale greenish-grey mottling in upper part, fading out with depth. Occasional small stone fragments. Moderately plastic. Moderately friable. Sub-prismatic structure with light greenish-grey, red-brown and greyish-brown partings. Dull to moderate sheen on structural units. Fissure at 45° with a bright sheen on fissure faces. Sand content increas ing gradually with depth. Moisture content well below P.L. Very firm.
11'11"	12'7"	Sealed sample
12'7"	14'0"	Brick red, brownish-yellow, light yellow-brown, brown and pale yellowish-grey mottled, fine, very sandy clay to clayey fine sand. Some brown sandy clay veins containing remnants of fine rootlets. Sub-prismatic structure, with reddish-brown partings. Dull sheen on structural units. Low plasticity. Friable. Moisture content well below P.L. Very firm. Sand content increasing with depth.
14'0"	14'6"	Sealed sample.
14'6"	15'0"	Red-brown, pale red-brown, light yellow-brown and pale yellowish-grey mottled, clayey fine sand. Low plasticity. Friable. Sub-prismatic structure, with brown sandy clay partings. Dull sheen on structural units. Moisture content well below P.L. Very compact.
15'0"	15'6"	Augered out.
15'6"	16'0"	As for 14'6" to 15'0"
16'0"	16'5"	Pale to light greenish-grey, grey-brown, brick-red, light yellow-brown and pale grey mottled, very sandy clay. Moderately low plasticity. Friable. Sub-prismatic structure with grey-brown partings. Dull sheen on structural units. Some fissuring at 45o to core, with moderate sheen on fissure faces. Moisture content well below P.L. Firm. Veins of sand as for 14'6" to 15'0" indicate break in depos-ition at 16'0".
16'5"	17'1"	Sealed sample.
17'1"	18'0"	Light greenish-to yellowish-grey fine, very sandy clay with red-brown mottling. Occasional brown sandy cla pockets. Plastic. Slightly friable. Sub-prismatic structure, with dark purplish-brown part-ings. Dull to moderate sheen on structural units. Sand content increasing rapidly with depth. Moisture content below P.L. Very firm. Some very small pockets and veins of sand as for 14'6" to 15'0".
18'0"	18'8"	Pale yellowish-to greenish-grey, clayey fine sand with a little brick red and yellow-brown mottling. Occ-asional small brown sandy clay pockets. Slightly plastic in places, mainly very friable. Sub-prismat-ic structure, with grey-brown partings. Dull structural faces. Damp. Very compact.

Depth From	Depth To	Description
18'8"	19'4"	Sealed sample.
19'4"	20'6"	As for 18'0" to 18'8", but with frequent light greenish-grey finely sandy clay patches containing numerous small pockets of sand.
20'6"	21'0"	Light greenish-grey, finely sandy clay, with sparse yellow-brown mottling. Plastic. Semi-friable. Moisture content below P.L. Sub-prismatic structure with dark purplish-brown partings. Dull to moderate sheen on structural units. Occasional small rootlet surrounded with brown sandy clay. Very firm.
21'0"	21'6"	Sample missing.
21'6"	22'2"	Light yellow-brown, pale brownish-grey and deep red mottled, slightly clayey fine sand. Very friable. Moisture content well below P.L. Sub-prismatic structure, with light grey-brown partings. Structural faces dull. Very compact.
22'2"	22'10"	Sealed sample.
22'10"	23'9"	As for 21'6" to 22'2", but yellow-brown and brick red. colours dominant.
23'9"	24'0"	Sample missing.
24'0"	26'0"	Sealed sample.
26'0"	26'3"	As for 22'10" to 23'9".
26'3"	30'10"	Augered out (partly-cemented sand).
30'10"	31'6"	Yellow-brown, pale yellowish-grey and brick red mottled, fine, very sandy clay. Very low plasticity Friable. Moisture content well below P.L. Sub-prismatic structure with purplish-brown and pale grey partings. Dull sheen on structural units. Very firm.
31'6"	32'2"	Sealed sample.
32'2"	33'0"	Yellow-brown, pale yellowish-grey, light yellow-brown and brick red mottled, clayey fine sand. Low plasticity. Friable. Moisture content well below P.L. Sub-prismatic structure, with purplish-grey partings. Dull sheen on structural units. Very compact.
33'0"	33'3"	Sample missing.
33'3"	33'11"	Sealed sample.
33'11"	35'6"	As for 32'2" to 33'0", but less clayey.
35'6"	35'9"	Sample missing.
35'9"	36'5"	As for 32'2" to 33'0" but drier and semi-cemented in places. Only slightly clayey.
36'5"	37'1"	Sealed sample

Depth From	Depth To	Description
37'1"	38'0"	As for 32'2" to 33'0", but only slightly clayey.
38'0"	38'3"	Sample missing.
38'3"	39'7"	As for 37'1" to 38'0".
39'7"	40'3"	Sealed sample.
40'3"	41'5"	As for 37'1" to 38'0".
41'5"	43'5"	As for 35'9" to 36'5", moderately hard for last 5"
43'5"	44'1"	Sealed sample.
44'1"	47'0"	Augered out. Mainly soft to hard sandstone.
47'0"	49'3"	Sealed sample.
49'3"	50'2"	Light yellow-brown fine sandstone. Breaks horizontally on poorly defined bedding planes. Moderately hard.
50'2"	51'3"	Deep red to brick red, semi-cemented fine sand, with a little pale grey mottling. Friable. Very compact to moderately hard.
51'3"	56'0"	Pale grey silty slate, with a little purplish-brown staining. Bedding thin and near vertical. Jointing dips at 60°. Some clay filling in joints.

END OF BORE.

TEST BORE NO 18A.

Sub-contract: 5053 A20-102(2) Docket: DM423/61

Location: Co-ords 4064'N & 1858'W

Hundred: Noarlunga Section: 582 R.L. at Collar: 325.28

Purpose: Investigation of foundation conditions, Vacuum Oil Co. oil refinery site, Port Stanvac (near O'Sullivan's Beach).

Hirer: Kellogg Overseas Corporation

Plant: Ford 0-60'9", Conrad 60'9"-70'0" Total Depth: 70'0"

Logged by: A. A. Gibson

Depth From	Depth To	Description
0'0"	0'11"	Brown fine loam, Friable. Compact.
0'11"	1'10"	Kunkar horizon. Irregular coarse, platy to fine nodular sandy kunkar concretions, with interstitial brown loam. Compact.
1'10"	2'3"	Light greyish-brown, finely sandy marl-earth with frequent small hard kunkar nodules. Nearly dry. Very friable.
2'3"	4'3"	Sealed sample.
4'3"	4'6"	Pale creamy brown and light greyish-brown, finely sandy marl-earth with frequent small, hard kunkar nodules. Compact, but very friable.
4'6"	7'5"	Pale creamy brown and light brown mottled finely sandy marl earth, with occasional small kunkar nodules. Becoming slightly clayey and mottled with brown and reddish-brown at depth. Damp to moist. Friable. Compact.
7'5"	8'1"	Sealed sample.
8'1"	9'8"	Light brown, pale grey and pale creamy-brown, finely sandy and somewhat clayey marl-earth, with sparse small kunkar nodules. Semi-plastic in part. Friable. Moist. Moderately firm.
9'8"	10'4"	Sealed sample.
10'4"	10'9"	Pale greenish-grey, fine, very sandy clay with fine yellow-brown mottling and containing pockets of light brown and pale creamy-brown mottled finely sandy marl Moderately plastic. Friable. Moist. Moderately firm.
10'9"	11'11"	Pale to light greenish-grey, brown and yellow-brown mottled, fine, very sandy clay, with some lesser red-brown mottling. Some scattered black specks. Poorly developed sub-prismatic structure, with some tendency to develop a horizontal platy structure. Moderately plastic. Friable. Moderately firm.
11'11"	12'7"	Sealed sample.

Bore 18A (Contd.)

Depth From	To	Description
12'7"	13'0"	Red-brown finely sandy clay, with very fine, light greenish-grey diffuse mottling, containing coarse pockets of pale creamy-brown and off-white mottled silty marl-earth. Frequent small black specks and platy flecks, particularly on structural faces. Sub-prismatic structure. Moderate sheen on structural units. Plastic. Moderately friable. Moist. Moderately firm.
13'0"	13'6"	As above, but without marl-earth pockets.
13'6"	14'0"	Sealed sample.
14'0"	14'7"	Red-brown and pale greenish-grey mottled, clayey fine sand to very sandy clay. Semi-plastic to plastic. Very friable to moderately friable. Moist. Firm.
14'7"	15'9"	Sealed samples.
15'9"	16'5"	Light greenish-grey, red-brown and brown mottled, fine very sandy clay. Sand unevenly distributed. Sub-prismatic structure, with greyish-brown to dark purplish-brown clay partings. Dull sheen on structural units. Moderately to slightly plastic. Slightly friable to very friable. Moist. Very firm.
16'5"	17'1"	Sealed sample.
17'1"	18'0"	Light greenish-grey, light brownish-grey, light red-brown, light grey-brown, and light yellow-brown, diffusely mottled, fine, very sandy clay. Sub-prismatic structure, with light brownish-grey to dark brown sandy clay partings. Dull sheen on structural units. Some tendency to develop horizontal platy structure (sampler disturbance?) Low plasticity. Friable. Moist. Very firm.
18'0"	18'8"	Pale yellowish-grey to pale brownish-grey, clayey fine sand, with yellow-brown mottling. Some purplish-brown streaks. Fine, horizontal platy structure. Clay distribution uneven. Low plasticity. Friable. Moist. Very firm.
18'8"	19'4"	Sealed sample.
19'4"	20'3"	As for 18'0" to 18'8".
20'3"	20'11"	Pale greenish-grey to pale yellowish-grey, clayey fine sand, with yellow-brown and brick-red mottling. Sub-prismatic structure with grey-brown to purplish-brown partings. Dull sheen on structural units. Slight plasticity. Friable. Damp. Very firm.
20'11"	21'7"	Sealed sample.
21'7"	23'2"	As for 20'3" to 20'11", but clay content higher.
23'2"	23'10"	Sealed sample.
23'10"	24'9"	As for 20'3" to 20'11", but with less clay.
24'9"	26'9"	Sealed sample.
26'9"	27'8"	As for 23'10" to 24'9".
27'3"	28'4"	Sealed sample.

Bore 18A (Contd.)

Depth From	To	Description
28'4"	29'3"	As for 23'10" to 24'9".
29'3"	29'11"	Light greenish-grey finely sandy and silty clay with red-brown and yellow-brown mottling. Sub-prismatic structure with light greenish-grey to purplish-grey partings. Dull sheen on structural units. Low plasticity. Friable. Steeply dipping fissures with highly polished faces. Moist. Very firm.
29'11"	30'7"	As for 21'7" to 23'2" (Sealed sample).
30'7"	31'6"	As above, but with occasional small quartz and sandstone gravel fragments and mottling dominantly red-brown.
31'6"	32'2"	As for 21'7" to 23'2", but mottling dominantly red-brown.
32'2"	32'10"	As above (Sealed sample).
32'10"	33'9"	As above.
33'9"	35'9"	Sealed sample.
35'9"	36'8"	Light greenish-grey and red-brown mottled, finely sand clay. Sub-prismatic structure, with light greenish grey to purplish-brown partings. Dull sheen on structural units. Low plasticity. Moderately friable. Damp. Very firm.
36'8"	37'4"	As above (Sealed sample).
37'4"	38'0"	As above.
38'0"	38'11"	Pale yellowish grey to pale grey, slightly clayey fine sand, with irregularly distributed, fine to coarse, brick red to yellow-brown mottling. Moist. Friable. Very compact.
38'11"	39'7"	As above (sealed sample)
39'7"	41'2"	As above.
41'2"	41'10"	As above (Sealed sample)
41'10"	43'5"	As above.
43'5"	44'1"	As above (Sealed sample)
44'1"	47'11"	As above.
47'11"	48'7"	As above (Sealed sample).
48'7"	50'2"	As above.
50'2"	50'10"	As above (sealed sample).
50'10"	52'5"	As above.
52'5"	53'1"	As above (sealed sample).
53'1"	54'8"	As above.
54'8"	55'4"	Sealed sample.
55'4"	56'3"	As for 53'1" to 54'8".

Bore 18A (Contd.)

Depth From	To.	Description
56'3"	56'11"	As above, but with frequent weathered slate and gravel fragments.
56'11"	58'0"	As above.
58'0"	59'0"	Decomposed and highly lateritized slate, with some jasper veinlets. Damp. Friable, Firm.
59'0"	59'2"	Pale grey decomposed slate, dipping about 65° to core. Moist. Soft.
59'2"	59'10"	Sealed sample.
59'10"	60'3"	Decomposed and lateritized slate, with some jasper veinlets. Damp. Friable. Firm.
60'3"	60'9"	Pale grey, decomposed silty slate with some yellow-brown mottling. Nearly dry. Friable. Firm.
60'9"	67'0"	Only 2" recovered. Pale purplish-grey and yellowish-brown, thinly bedded, finely sandy slate. Weathered, but hard, Remainder probably largely as for 60'3" to 60'9".
67'0"	70'0"	Dark purplish-brown to deep red weathered slate. Some pale grey and light yellow-brown mottling. Thin bedding dipping at 45° to 50°. Jointing dips at 60° and vertical. Firm to moderately hard.

END OF BORE

TEST BORE NO. 19A

Sub-contract: 5053 A20-102(2) **Docket:** DM423/61

Location: Co-ords 4729'N & 2133'W

Hundred: Noarlunga **Section:** 581 **R.L. at Collar:** 312.88

Purpose: Investigation of foundation conditions, Vacuum Oil Co. oil refinery site, Port Stanvac (near O'Sullivan's Beach).

Hirer: Kellogg Overseas Corporation.

Plant: Ford 0-48'6", Conrad 48'6"-63'0". **Total Depth:** 63'0"

Logged by: A. A. Gibson

Depth From	To	Description
0'0"	0'9"	Dark reddish-brown, finely sandy loam. Friable, Compact.
0'9"	1'5"	Kunkar horizon. Fine to coarse irregular kunkar concretions with interstitial loam. Moderately hard. Compact.
1'5"	2'3"	Pale creamy-brown, finely sandy marl-earth, with frequent small, hard kunkar nodules. Nearly dry. Very friable.
2'3"	4'3"	Sealed sample.
4'3"	4'6"	Pale creamy brown and light brown mottled, finely sar marl-earth, with occasional small, hard kunkar nodules. Nearly dry. Very compact. Very friable.
4'6"	6'6"	Sealed sample.
6'6"	6'9"	Brown, fine, very sandy marl, with off-white mottling Slightly plastic. Friable. Moisture content well below P.L. Moderately firm.
6'9"	8'9"	Sealed sample.
8'9"	9'0"	Light greenish-grey, finely sandy clay with a little reddish-brown mottling. Frequent small black specks and flakes. (Manganese oxide?) Plastic. Slightly friable. Moisture content below P.L. Sub-prismatic structure, with brown clay coatings on some structur faces. Dull to moderate sheen on structural units. Firm.
9'0"	11'0"	Sealed sample.
11'0"	11'3"	Light greenish-grey silty and finely sandy clay, with yellow-brown and some red-brown mottling. Occas ional small, pale yellowish-grey, clayey sand pocket Plastic. Slightly friable in places. Moisture conten below P.L. Sub-prismatic structure, with purplish grey streaks on structure faces. Dull sheen on structural units. Very firm.
11'3"	13'3"	Sealed sample.

Bore 19A (contd.)

Depth From	To	Description
13'3"	13'6"	Light greenish-to yellowish-grey, fine, very sandy cla with red-brown, deep red, brownish-yellow and yellow-brown mottling. Low plasticity. Friable with difficulty. Moisture content well below P.L. Sub-prismati structure, with some brown to purplish-brown coatings on structural faces. Dull sheen on structural units. Very firm.
13'6"	15'6"	Sealed sample
15'6"	15'9"	Pale yellowish-grey, clayey fine sand, with deep red and yellow-brown mottling. Slightly plastic. Friable. Moisture content well below P.L. Very compact.
15'9"	17'9"	Sealed sample.
17'9"	18'0"	Pale yellowish-grey, slightly clayey fine sand, with brick red and yellow-brown mottling. Very friable. Moist. Compact.
18'0"	20'0"	Sealed sample.
20'0"	20'3"	Pale brownish-grey fine sand, semi-cemented in places. Moist. Very friable. Compact.
20'3"	22'3"	Sealed sample.
22'3"	22'6"	Light greenish-grey silty and finely sandy clay with deep red mottling. Plastic. Slightly friable. Moistur content below P.L. Sub-prismatic structure with some purplish-brown partings. Moderate sheen on structural units. Some fissuring at 45° to core, with bright sheen on fissure faces. Very firm.
22'6"	24'6"	Sealed sample.
24'6"	24'9"	Light brownish-to greenish-grey, silty and finely sand clay with brown mottling. Plastic. Somewhat friable. Moisture content below P.L. Sub-prismatic structure. Dull to moderate sheen on structural units. Granular sub-structure. Very firm.
24'9"	27'0"	Light greenish-grey silty and finely sandy clay, with a little yellow-brown mottling. Moderately low plasticity. Moderately friable. Moisture content below P.L. Sub-prismatic structure with some purplis brown partings. Dull to moderate sheen on structural units. Very firm.
27'0"	29'0"	Sealed sample.
29'0"	31'6"	Pale greenish- to yellowish-grey, clayey fine sand with coarse, irregularly distributed, brick red and deep red mottling. Occasional small brown, clayey veinlets containing small rootlets. Clay content irregularly distributed and diminishing with depth. Moist. Very friable. Very compact.
31'6"	33'6"	Sealed sample.
33'6"	33'9"	Pale greenish-grey, silty and finely sandy clay, with a little yellow-brown and lesser deep red mottling. Low plasticity. Friable. Moisture content well below P.L. Sub-prismatic structure, with purplish-brown partings. Dull sheen on structural units. Very firm.

Bore 19A (contd).

Depth From	Depth To	Description
33'9"	35'9"	Sealed sample.
35'9"	36'8"	Pale yellowish- to greenish-grey, slightly clayey fine sand, with fine to very coarse, irregularly distributed, deep red and lesser yellow-brown mottling. Clay content irregularly distributed and diminishing with depth. Slightly plastic in places. Friable. Moist. Very compact.
36'8"	38'3"	Pale yellowish-grey fine sand, with coarse, irregular deep red, ferruginous mottling and sparse yellow-brown mottling. Very friable, but with some difficulty. Nearly dry to damp. Very compact to moderately hard.
38'3"	40'3"	Pale brownish grey to light greenish-grey, clayey fine sand to very sandy clay, with frequent coarse, irregular, deep red patches and lesser yellow-brown mottling. Clay content irregularly distributed and increasing with depth. Low plasticity. Friable to semi-friable. Sub-prismatic structure, with pale purplish-grey partings. Dull sheen on structural unit Damp. Very firm.
40'3"	40'6"	Pale yellowish-grey, and deep red mottled, clayey fine sand. Low plasticity. Friable. Moisture content well below P.L. Very firm.
40'6"	42'6"	Sealed sample.
42'6"	42'9"	As for 40'3" to 40'6".
42'9"	44'9"	Sealed sample.
44'9"	45'0"	Deep red, slightly clayey fine sand, with a little pale yellowish-grey and brownish-yellow mottling. Very friable. Damp. Compact.
45'0"	47'0"	Sealed sample.
47'0"	48'6"	Deep red, brick red, pale yellowish-grey and yellow-brown, coarsely and irregularly mottled, slightly clayey fine sand. Damp. Very friable. Very compact, becoming cemented at base.
48'6"	54'0"	Deep red, ferruginous, fine sandstone, with yellow-brown irregularly patches and a little pale grey mottling. Hard.
54'0"	58'0"	Only 3" recovered. Pale brownish-grey decomposed slate with some hard, dark purplish-brown to dark red beds. Firm to very hard.
58'0"	63'0"	No recovery.

END OF BORE

TEST BORE NO. 20 A

Sub-contract No: 5053 A20 - 102(2) Docket: DM 423/61
Location: Co-ords 4044'N & 2198' W Hundred: Noarlunga
Section: 581 R.L. at Collar: 321.31
Purpose: Investigation of foundation conditions, Vacuum Oil Co. oil refinery site, Port Stanvac (near O'Sullivan's Beach)
Hirer: Kellogg Overseas Corporation Plant: Ford 0 - 38'6", Conrad 38'6" - 57'9" Total Depth: 57'9"
Logged by: A.A. Gibson

Depth From	Depth To	Description
0	7"	Brown, finely sandy loam. Friable. Compact.
7"	1'3"	Kunkar horizon. Coarse irregular to sandy kunkar concretions with some interstitial loam and marl-earth. Moderately soft to hard.
1'3"	2'3"	Pale creamy brown, finely sandy marl earth with frequent small, hard kunkar nodules.
2'3"	6'0"	Pale creamy-brown, light greyish-brown and light brown mottled finely sandy marl-earth with occasional small kunkar nodules. Compact. Slightly damp.
6'0"	7'3"	Greyish-brown, reddish-brown, pale creamy-brown and pale grey mottled finely sandy and slightly clayey marl-earth. Compact.
7'3"	8'3"	Pale creamy brown and light greyish-brown mottled finely sandy marl earth with coarse pockets of brown and reddish-brown finely sandy clay. Clay pockets increasing with depth. Firm. Damp.
8'3"	8'9"	Reddish-brown finely sandy and silty clay with a little vague red-brown and light greenish-grey mottling. Occasional irregular pockets of off-white earthy lime. Moist. Firm. Low plasticity. Slightly friable.
8'9"	11'3"	Reddish to yellowish-brown finely sandy clay with light greenish-grey mottling. Poorly developed sub-prismatic structure with dull structural faces. Low plasticity. Slightly friable. Moist. Firm. Sparse small black specks. Sand content increasing with depth.
11'3"	14'6"	Reddish-brown, light greenish-grey and yellowish-brown, finely mottled, fine, very sandy and silty clay. Sub-prismatic structure and a close pattern of slightly irregular horizontal planes, all with greyish-brown clay partings. Dullsheen on structural units. Moist. Low plasticity. Slightly friable. Firm.
14'6"	15'9"	Brick red, yellow-brown and light greenish to yellowish-grey mottled, fine, very sandy clay. Sub-prismatic structure. Dull sheen on structural units. Low plasticity. Friable. Moist. Firm.
15'9"	19'3"	Pale greenish to yellowish-grey, somewhat clayey fine sand, with yellow, yellow-brown, brick red, brown and light grey-brown mottling. Poorly developed sub-prismatic structure. Moist. Only slightly plastic. Friable. Very compact. Clay content decreasing and mottling becoming diffuse with depth.
19'3"	21'3"	Tube sample.

Depth		Description
21'3"	21'6"	Pale brownish-grey, slightly clayey fine sand, with a little grey-brown, brown and yellow-brown mottling. Moist. Compact. Very friable.
21'6"	23'6"	Sealed sample.
23'6"	23'9"	Light brownish yellow to yellow-brown, faintly clayey fine sand with coarse brick red and pale yellowish-grey mottling. Moist. Very friable. Very compact. Some small brown mottles.
23'9"	25'9"	Pale brownish-grey, faintly clayey fine sand. Upper half of core shows yellow-brown and purplish-brown cross-bedding, with same irregular mottling lower. Moist. Very friable. Compact.
25'9"	28'0"	Sealed sample.
28'0"	28'3"	Pale brownish-grey, faintly clayey fine sand with a little light grey-brown mottling. Moist. Very friable. Compact.
28'3"	30'3"	Light greenish-grey silty clay, with dark red, brick red and yellow-brown mottling. Plastic. Moisture content below P.L. Sub-prismatic structure with purple-grey clay partings. Dull to moderate sheen on structural units. Fissured, with bright sheen on fissure planes. Firm.
30'6"	31'2"	Light greenish-grey silty and slightly sandy clay with some fine brownish yellow mottling. Coarse prismatic structure with deep purple stain on partings. Dull to moderate sheen on fissure faces. Plastic. Moisture content below P.L. Very firm.
31'2"	31'10"	Sealed Sample.
31'10"	32'6"	Light greenish-grey silty and slightly sandy clay with some irregular red-brown and yellow-brown mottling. Coarse prismatic structure with purlish-grey to light greenish-grey partins. Dull sheen on structural units. Fissured at 45° to core, with bright sheen on fissure faces. Plastic. Moisture content below P.L. Very firm.
32'6"	33'3"	Sealed sample.
33'3"	34'0"	As for 31'10" to 32'6"
34'0"	34'8"	As above, but developing some very small, pale grey, very fine sand and silt pockets.
34'8"	35'4"	Sealed sample.
35'4"	36'3"	Pale brownish grey-clayey fine sand, with some yellow-brown and brick red mottling. Coarse sub-prismatic structure with purplish-grey stain and light brown fine sand coating on structural faces. Dull sheen on structural units. Slightly plastic in places. Very friable. Very comapct. Moist.
36'3"	38'6"	Core barrel lost down hole.
38'6"	40'0"	Core barrel retreived. No sample recovery.
40'0" - 47'0"		Pale greenish-grey, slightly clayey fine sand, with deep red brick red, yellow-brown and brownish-yellow, coarse, irregular mottling. Friable. Moist. Sub-prismatic structure, with light purplish-grey partings. Structural faces dull. Some dark purplish-brown root channels. One fissure at 45° to core, with bright sheen on fissure faces. Very compact.

Depth			Description
47'0"	-	57'6"	Pale greenish to brownish-grey slightly clayey semi-cemented fine sand, with coarse, dark red, ferruginous patches. Some brownish-yellow staining. Damp to moist. Friable. Very compact to hard.
57'6"	-	57'9"	Dark purplish-brown, finely sandy, weathered slate. Bedding faint and nearly vertical. Hard.

END OF BORE.

TEST BORE NO 21A

Sub-contract No: 5053 A20-102(2) Docket: DM 423/61
Location: Co-ords 5000'N & 2795'W Hundred Noarlunga
Section 581 R.L. AT COLLAR 293.25
Purpose: Investigation of foundation conditions, Vacuum Oil Co. oil refinery site, Port Stanvac (near O'Sullivan's Beach)
Hirer: Kellogg Overseas Corporation Plant: Ford
Total Depth 31'6"

Logged by A.A. GIBSON

Depth From	To	Description
0	9"	Brown fine sandy loam. Friable. Compact
9"	1'6"	Kunkar horizon. Coarse to fine, irregular kunkar concretions, with interstitial loam and marl earth Moderately hard. Compact.
1'6"	2'3"	Pale creamy-brown, finely sandy marl-earth with frequent small, hard kunkar nodules. Very friable
2'3"	4'3"	Sealed sample.
4'3"	4'6"	Pale creamy brown, off-white and reddish-brown mottled, finely sandy marl-earth with sparse, very small kunkar nodules. Compact, but very friable.
4'6"	6'6"	Sealed Sample.
6'6"	6'9"	Reddish-brown and light brownish-grey mottled, fine very sandy marl, with frequent off-white to pale greenish-grey earthy lime pockets. Damp. Low plasticity. Friable. Moderately firm.
6'9"	8'9"	Sealed sample.
8'9"	9'0"	Reddish-brown and light greenish-grey mottled, finely sandy clay, with occasional small, off-white earthy lime pockets. Moderately plastic. Friable. Moisture content below P.L. Sub-granular structure. Moderately firm.
9'0"	11'0"	Sealed sample.
11'0"	11'3"	Light greenish-grey, fine, very sandy clay with brick red, yellow-brown and brown mottling. Sub prismatic, structure, with grey-brown partings. Dull sheen on structural units. Slightly plastic. Friable. Moist. Firm.
11'3"	13'3"	Sealed sample.
13'3"	13'6"	Deep red-brick-red, light greenish-grey and lesser light yellow-brown mottled, finely sandy clay. Coarse, sub-prismatic structure with dark brown clay partings. Dull sheen on structural units. Plastic. Friable with difficulty. Moisture content below P.L. Firm.
13'6"	15'6"	Sealed sample.
15'6"	15'9"	Light greenish-grey and light yellow-brown mottled clayey fine sand. Coarse sub-prismatic structure with dark brown sandy clay partings. Dull. Moderately plastic. Friable. Moisture content just below P.L.

Depth From		To	Description
15'9"	-	17'9"	Sealed sample.
17'9"	-	18'0"	Pale yellowish-grey, slightly clayey fine sand with scattered brown mottling. Brown mottles ar more clayey. Moist. Very friable. Compact.
18'0"	-	20'0"	Sealed Sample.
20'0"	-	20'3"	Pale yellowish-grey, faintly clayey fine sand with sparse greyish-brown mottling. Moist. Very friable. Compact.
20'3"	-	22'3"	Sealed sample.
22'3"	-	22'6"	Light greenish grey silty and slightly sandy clay with dark red and lesser yellow-brown mottling. Sub prismatic structure with dark purplish-brown clay, partings. Dull sheen on structural units. Moisture content below P.L. Plastic. Very firm.
22'6"	-	24'6"	Sealed Sample.
24'6"	-	24'9"	Light greenish-grey, slightly sandy clay with sparse yellow-brown mottling. Prismatic structure with light purplish-grey clay partings. Extensive fissuring at 45° to core, with bright sheen on fissure faces. Plastic. Moisture content below P.L. Very firm.
24'9"	-	26'9"	Sealed sample.
26'9"	-	27'0"	Light greenish-grey, finely sandy clay with yellow- brown and sparse brick-red mottling. Sub-prismatic structure with dark purplish brown clay partings. Dull sheen on structural units. Fissure dipping about 70° with a bright sheen on fissure faces. Plastic. Moisture content below P.L. Very firm.
27'0"	-	29'0"	Sealed sample.
29'0"	-	29'3"	Light greenish-grey and red-brown mottled, very sandy clay with lesser yellowish-brown mottling. Moderately plastic. Friable with some difficulty. Moisture content well below P.L. Occasional small pale grey pockets of fine sand. Firm.
29'3"	-	31'3"	Sealed Sample.
31'3"	-	31'6"	Pale yellowish-grey slightly clayey fine sand with deep red, red brown and yellow-brown mottling. Moist. Very friable, but semi-cemented in places. Compact to moderately hard.

END OF BORE.

TEST BORE NO. 22A

Sub-contract No.: 5053 A20-102(2) Docket: DM 423/61

Location: Co-ords 3679'N & 3893'W

Hundred: Noarlunga Section 586 R.L. at Collar 273.30

Purpose: Investigation of foundation conditions, Vacuum Oil Co. oil refinery site, Port Stanvac (near O'Sullivan's Beach)

Hirer: Kellogg Overseas Corporation

Plant: Failing 0-66'10", Conrad 66'10"-76'10" Total Depth: 76'10"

Logged by: A. A. Gibson

Depth From	Depth To	Description
0	5"	Dark grey-brown fine, sandy loam. Friable. Compact
5"	1'0"	Kunkar layer. Hard to moderately soft.
1'0"	3'0"	Sample missing.
3'0"	7'1"	Pale creamy-brown, light red-brown and off-white mottled, finely sandy marl-earth, with occasional small, hard kunkar nodules. Becoming slightly clayey with depth. Friable. Compact.
7'1"	8'9"	Brown, pale creamy-brown and reddish-brown mottled, fine, very sandy marl, with occasional pale greenish-grey mottles. Clay content increasing with depth. Low plasticity. Friable. Moisture content well below P.L. Firm.
8'9"	9'10"	Reddish-brown, finely sandy clay, with a little pale greenish-grey mottling. Frequent pale creamy-brown sandy marl-earth pockets. Plastic. Slightly friable. Moisture content below P.L. Occasional small black specks. Firm.
9'10"	11'0"	Reddish-brown, finely sandy clay, with a little brown and pale greenish-grey mottling. Plastic. Slightly friable. Moisture content below P.L. Sand content increasing with depth. Firm.
11'0"	11'8"	Light yellowish-brown, clayey, very fine sand with a little pale yellowish-grey, pale greenish-grey, red-brown and brown mottling. Damp. Slightly plastic. Friable. Compact.
11'8"	13'8"	Sealed sample.
13'8"	14'2"	Red-brown, reddish-brown and brown mottled, finely sandy clay with a little pale greenish-grey mottling. Some light yellow-brown very sandy patches. Sub-prismatic structure with reddish-brown and pale greenish-grey partings. Dull to moderate sheen on structural units. Plastic. Slightly friable. Moisture content near P.L. Firm.
14'2"	15'9"	Red-brown and reddish-brown, fine, very sandy clay with a little diffuse pale greenish-grey and light yellowish-grey mottling. Moderately plastic. Friable. Moisture content below P.L. Sub-prismat

Depth From	Depth To	Description
14'2" (contd.)	15'9"	structure, with brown, red-brown and pale greenish-grey partings. Dull sheen on structural units. Firm.
15'9"	16'2"	Sealed sample.
16'2"	18'0"	As for 14'2" to 15'9".
18'0"	18'8"	Sealed sample.
18'8"	21'8"	Yellow-brown, light red-brown and pale greenish-to yellowish-grey mottled, clayey fine sand with occasional dark purplish-brown veinlets. Low plasticit Very friable. Moisture content well below P.L. Poorly developed sub-prismatic structure, with greyish-brown partings. Structural faces dull. Compact.
21'8"	23'5"	As above, but pale greenish-to yellowish-grey colour becoming dominant. (Sealed samples).
23'5"	24'2"	Pale greenish-to yellowish-grey, clayey fine sand, wi some yellow-brown and grey-brown mottling. Low plasticity. Friable. Moisture content well below P.L. Sub-prismatic structure, with pale purplish-grey partings. Dull sheen on structural units. Very compact.
24'2"	26'2"	Pale greenish-grey, fine, very sandy clay, with light brownish-yellow and lesser grey-brown mottling Occasional pale yellowish-grey fine clayey sand pockets. Low plasticity. Semi-friable. Moisture content well below P.L. Sub-prismatic structure, with dark to pale purplish-grey partings. Dull to moderate sheen on structural units. Some fissuring at about 45° to core, with bright sheen on fissure faces. Very firm. (Sealed samples).
26'2"	26'8"	As above, but sand content increasing.
26'8"	28'8"	Pale greenish- to yellowish-grey, clayey fine sand with irregular brick red, light red-brown and yellow-brown mottling. Low plasticity. Friable. Moisture content well below P.L. Poorly developed sub-prismatic structure, with dark purplish-brown partings. Structural faces dull. Very compact (Sealed samples).
28'8"	28'11"	As above (Bag sample).
28'11"	29'2"	Sample missing.
29'2"	31'2"	Pale greenish-grey, fine, very sandy clay, with scattered, irregular, yellow-brown mottling. Low plasticity. Friable. Moisture content well below P.L. Sub-prismatic structure, with pale greenish-gr to purple partings. Dull sheen on structural units. Occasional pale yellowish-grey sand pockets. Very firm. (Sealed sample).
31'2"	31'5"	As above (Bag sample)
31'5"	33'5"	As above, but sand pockets more frequent. (Sealed sample).

Depth From	Depth To	Description
33'5"	33'8"	As for 31'5" to 33'5" (Bag sample)
33'8"	33'11"	Sample missing
33'11"	35'11"	As for 31'5" to 33'5" (Sealed sample)
35'11"	36'2"	As above (Bag sample)
36'2"	36'5"	Sample missing.
36'5"	38'5"	As for 31'5" to 33'5" (Sealed sample)
38'5"	38'8"	As above (Bag sample)
38'8"	38'11"	Sample missing.
38'11"	40'11"	As for 31'5" to 33'5" (Sealed sample)
40'11"	41'2"	As above (Bag sample)
41'2"	41'5"	Sample missing.
41'5"	43'5"	As for 31'5" to 33'5" (Sealed sample)
43'5"	43'8"	As above (Bag sample)
43'8"	45'5"	As for 31'5" to 33'5" (Sealed Sample)
45'5"	45'8"	As above (Bag sample)
45'8"	45'11"	Sample missing
45'11"	47'11"	As for 31'5" to 33'5" (Sealed sample)
47'11"	48'2"	As above (Bag sample)
48'2"	48'5"	Sample missing
48'5"	50'5"	Pale greenish-grey, finely sandy clay, with brownish-yellow, deep red and yellow-brown mottling. Frequent small pale yellowish-grey, clayey fine sand pockets and veins. Very plastic. Sand pockets friable. Moisture content below P.L. Prismatic to polyhedral structure. Dull to bright sheen on structural units. Some fissuring at 45° to core, with bright sheen on fissure faces. Very firm. (Sealed samples).
50'5"	50'8"	As above (Bag sample)
50'8"	50'11"	Sample missing.
50'11"	52'11"	As for 48'5" to 50'5" (Sealed sample)
52'11"	53'2"	As above (Bag sample)
53'2"	53'5"	Sample missing.
53'5"	55'5"	As for 48'5" to 50'5" (Sealed sample)
55'5"	55'8"	As above (Bag sample)
55'8"	55'11"	Sample missing.
55'11"	57'11"	As for 48'5" to 50'5" (Sealed sample)

Depth From	Depth To	Description
57'11"	58'2"	As above (Bag sample)
58'2"	58'5"	Sample missing
58'5"	59'0"	As for 48'5" to 50'5".
59'0"	60'8"	Completely decomposed slate. Pale greenish-grey, silty to slightly sandy clay, with vertically trending brownish-yellow and dark red mottling. Remanent bedding barely evident, but clay breaks to preferred vertical, parallel planes. Mottles appea to be less clayey than main body of material. Highly plastic. Moisture content below P.L. Very firm.
60'8"	60'11"	Sample missing.
60'11"	62'11"	As for 59'0" to 60'8", but relic bedding now clearly visible and incompletely decomposed slate fragments vertically oriented, occur, increasing in size and number with depth. (Sealed sample).
62'11"	63'2"	As above (Bag sample).
63'2"	63'5"	Sample missing.
63'5"	65'5"	As for 60'11" to 62'11" (Sealed sample)
65'5"	65'8"	Incompletely decomposed slate. Pale grey very silty clay, with dark red and sparse yellow-brown mottling. Low plasticity. Friable. Moisture content below P.L. Very thin, near vertical bedding evident throughout. Very firm.
65'8"	67'6"	As above. (Sealed sample)
67'6"	68'2"	Dark red-brown and pale grey weathered slate. Very thin bedded to lamellar, with bedding near vertical. Damp. Very firm.
68'2"	70'0"	Dark purplish-brown, weathered slate, with some very thin greyish-brown beds. Very thin bedded to lamellar. Bedding near vertical. Very firm to moderately hard.
70'0"	76'10"	Dark purplish-brown, lamellar, phyllitic slate, with some yellow-brown, greenish-grey, pale grey and brow ish yellow lamellae. Slightly contorted. Dip vertical to 75°. Very hard.

END OF BORE

TEST BORE NO. 23A

Sub-contract No.: 5053 A20-102(2) Docket: D.M. 423/61

Location: Co-ords 3369'N & 3583'W

Hundred: Noarlunga Section: 587 R.L. at Collar: 272.20

Purpose: Investigation of foundation conditions, Vacuum Oil Co. oil refinery site, Port Stanvac (near O'Sullivan's Beach).

Hirer: Kellogg Overseas Corporation

Plant: Ford 0-20'3", Failing 20'3"-63'7", Conrad 63'7"-64'6"

Total Depth: 64'6"

Logged by: A. A. Gibson

Depth From	Depth To	Description
0	1'0"	Dark grey-brown, finely sandy loam. Friable. Granular to compact.
1'0"	1'5	Kunkar horizon. Incipient kunkar, with numerous irregular concretions. Moderately soft to hard. Very compact.
1'5"	2'3"	Light creamy-brown, finely sandy marl-earth, with numerous small, hard kunkar nodules. Nearly dry. Very friable.
2'3"	3'0"	Pale creamy-brown, finely sandy marl-earth, with a few small kunkar nodules. Nearly dry. Very friable.
3'0"	6'6"	Light creamy-brown, light red-brown, pale creamy-brown and off-white mottled, finely sandy marl-earth, with occasional small kunkar nodules. Nearly dry. Very friable. Compact.
6'6"	8'0"	As above, but becoming slightly clayey.
8'0"	9'0"	Creamy-brown, pale grey and reddish-brown, irregularly mottled, very sandy and silty marl. Low plasticity. Friable. Damp. Moderately soft.
9'0"	11'3"	Reddish-brown, light greenish-grey and pale grey mottled, finely sandy marl, with some scattered black specks. Low plasticity. Friable. Damp. Poorly developed polyhedral structure. Moderately firm.
11'3"	13'6"	Light greenish-grey, fine, very sandy clay, with frequent pale greenish-grey, slightly clayey, fine sand-silt pockets. Some red-brown and yellow-brown mottling. Low plasticity. Friable. Moist. Sub-prismatic structure, with light greenish-grey partings. Dull to moderate sheen on structural units. Firm.
13'6"	20'3"	As above, but with a little yellow-brown mottling only. Sand-silt pockets larger and irregularly distributed.
20'3"	21'1"	Sample missing.
21'1"	30'7"	Light greenish-grey, silty and slightly sandy clay, with yellow-brown and brownish-yellow mottling.

Depth From	Depth To	Description
21'1" (cont.)	30'7"	Frequent small irregular, pale greenish-grey, very sandy pockets. Plastic. Slightly friable. Moisture content near P.L. Sub-prismatic structur with dull to moderate sheen on structural units. Some fissuring at 45° to core, with bright sheen on fissure faces. Firm. Sand content increasing gradually with depth.
30'7"	38'7"	Light greenish-grey, finely sandy clay, with yellow-brown and brick red mottling. Frequent, irregularly distributed, pale greenish-grey, clayey fine sand pockets. Plastic. Friable in sandy patches. Moisture content below P.L. Sub-prismatic structure poorly developed. Very firm.
38'7"	44'6"	Light greenish-grey, fine, very sandy clay, with numerous, large, pale greenish-to yellowish-grey, clayey fine sand pockets. Some yellow-brown mottlin and frequent large, dark red, ferruginous patches. Moderate to low plasticity. Friable in sandy and ferruginous patches. Some indication of poorly developed prismatic structure. Very firm.
44'6"	45'2"	Sealed sample.
45'2"	51'1"	As for 38'7" to 44'6".
51'1"	54'9"	Light greenish-grey, fine, very sandy clay, with yellow-brown mottling. Frequent pale yellowish-grey, fine sand pockets and streaks. Plastic. Semi-friable in clay parts, very friable in sand pockets. Moisture content below P.L. Poorly developed sub-prismatic to polyhedral structure. Very firm.
54'9"	55'5"	Sealed sample.
55'5"	56'1"	Completely decomposed slate. Pale greenish-grey, silty clay with deep red, brownish-yellow and yellow-brown streaky mottling oriented vertically. Clay has an unctious feel. Very plastic. Moisture content near P.L. Clay splits along vertical, parallel planes of original bedding. Very firm.
56'1"	59'8"	As above, but with dark, purplish-brown fragments of weathered slate, increasing in size with depth. Weathered slate fragments have greasy feel and are friable.
59'8"	61'0"	Dark purplish-brown weathered slate. Thinly bedded. Dip vertical. Greasy feel. Somewhat friable. Firm
61'0"	63'1"	Decomposed to strongly weathered slate. Pale greenish-grey silty clay, with some fine, brownish-yellow mottling, containing frequent dark purplish-brown, red-brown and pale grey residual weathered slate fragments, oriented vertically. Moist. Very firm.
63'1"	63'4"	Sample missing.
63'4"	64'6"	Reddish-brown to dark purplish-brown weathered slate. Thin vertical bedding, with some pale grey clay partings. Soapy feel. Firm.

END OF BORE.

TEST AND PENETRATION TEST BORE NO. 24A to 30'9"
24B from 30'9" to 65'0"

Sub-contract No.: 5053 A 20-102(2) Docket: DM 423/61

Location: Co-ords 2958'N & 3772'W

Hundred: Noarlunga Section: 587 R.L. at Collar: 275.15

Purpose: Investigation of foundation conditions and standard penetration test, Vacuum Oil Co. oil refinery site, Port Stanvac (near O'Sullivan's Beach)

Hirer: Kellogg Overseas Corporation

Plant: Ford 0-41'6", Conrad 41'6"-65'0" Total Depth: 65'0"

Logged by: A. A. Gibson

Depth From	Depth To	Description
0	8"	Dark brownish-grey fine loam, with occasional very small kunkar nodules. Friable. Compact.
8"	1'5"	Kunkar horizon. Moderately soft, finely sandy kunkar with frequent included very small, very hard, rounded kunkar nodules. Very compact.
1'5"	3'7"	Pale creamy-brown to off-white, finely sandy marl-earth, with abundant small kunkar nodules. Very friable. Compact.
3'7"	5'3"	Light creamy brown, pale creamy-brown and off-white mottled, finely sandy marl-earth. Only occasional small kunkar nodules. Very compact.
5'3"	6'3"	Old kunkar horizon. Coarse platy to irregular, hard, kunkar concretions, with interstitial finely sandy and finely nodular, pale creamy-brown marl-earth. Very compact.
6'3"	8'10"	Light brown, pale creamy-brown and off-white, vaguely mottled, finely sandy marl-earth, with frequent small, hard kunkar nodules. Semi-cemented in places. Friable. Very compact.
8'10"	10'6"	As above, but slightly clayey. No cemented patches.
10'6"	12'6"	Reddish-brown and light greenish-grey mottled, finely sandy clay, merging downward into light greenish-grey, light reddish-brown and yellow-brown mottled, fine, very sandy clay. Sub-prismatic structure, with light greenish-grey to purplish-grey partings. Dull sheen on structural units. Plastic. Slightly friable. Moisture content near P.L. Firm.
12'6"	14'6"	As above, but with some purplish-brown finely sandy clay infilling between structural units. Sand content increasing with depth.
14'6"	17'0"	Pale brownish-grey to pale yellowish-grey clayey fine sand, with red-brown, brick red and yellow-brown mottling. Clay content unevenly distributed. Some brown, finely sandy clay pockets. Sub-prismatic structure, with light brownish-grey to light

Depth From	Depth To	Description
14'6" (contd.)	17'0"	purplish-grey partings. Some fine sand coating structure faces. Dull sheen on structural units. Moisture content near P.L. Very compact.
17'0"	17'3"	Pale brownish-grey, clayey fine sand, with yellow-brown brown and dark brown layering and brick red to red-brown mottling. Low plasticity. Somewhat friable. Moisture content below P.L. Very compact.
17'3"	19'6"	Pale yellowish-to brownish-grey, slightly clayey fine sand, with deep red mottling. Some small, very firm, red-brown, very fine, clayey sand lumps, semi-cemented in part. Very friable. Moist. Compact.
19'6"	21'9"	Yellowish-brown fine sand, with pale brownish-grey patches and some deep red and dark brown mottling. Semi-cemented in part. Damp. Very compact to moderately hard.
21'9"	24'0"	Light greenish-grey, silty and finely sandy clay, with occasional fine, deep red and yellow-brown mottling. Plastic. Friable with difficulty. Moisture content well below P.L. Sub-prismatic structure, with light greenish-grey to dark purplish-brown partings. Dull to moderate sheen on structural units. Very stiff.
24'0"	26'3"	As above, but mottling brownish-yellow only. Moisture content increases with depth.
26'3"	28'0"	As above, but mottling yellow-brown. Moisture content near P.L. Partings light greenish-grey only. Silt and sand content increasing.
28'0"	30'9"	Light greenish-grey, very silty and finely sandy clay, with some red-brown and yellow-brown mottling. Structure polyhedral, poorly defined, vague in part. Some pinkish-brown to light purplish-brown partings. Plastic. Friable with difficulty. Moisture content near P.L. Very firm.
30'9"	31'9"	Light greenish-grey, very silty and finely sandy clay, with yellow-brown mottling. Plastic. Slightly friable. Moisture content near P.L. Sub-prismatic structure, with partings infilled with dark purplish-brown, finely sandy clay and pale greyish-brown fine sand. Structural faces dull. Very firm.
31'9"	32'2"	As above, but with large pockets of pale, brownish-grey fine sand.
32'2"	35'9"	As for 30'9" to 31'9".
35'9"	37'6"	As for 31'9" to 32'2", but large pockets of pale brownish-grey fine sand now dominant. Structure no longer evident.
37'6"	41'0"	Light greenish-grey, fine, very sandy clay, with some deep red mottling. Frequent pockets of pale brownish-grey fine sand. Moderate plasticity. Somewhat friable. Moisture content below P.L. Sub-prismatic structure. Partings and root channels infilled with dark purplish-brown, finely sandy clay. Structural faces dull. Very firm.

Depth From	Depth To	Description	Blows p/ft.
41'0"	47'0"	No sample	
47'0"	47'7"	Light greenish-grey, silty and slightly sandy clay, with some yellow-brown and red-brown mottling.	41
47'7"	52'0"	No sample	
52'0"	52'8"	Light greenish-grey silty clay with some yellow-brown mottling. Very plastic. Sub-prismatic structure evident.	44
52'8"	57'0"	No sample	
57'0"	57'8½"	As for 52'0" to 52'8"	44
57'8½"	59'2"	No sample. Rock contact at 59'2"	
59'2"	65'0"	Dark purplish-brown, nearly decomposed slate, with some pale greenish-grey clay pockets. Thin bedding dipping vertically.	

END OF BORE

PENETRATION TEST BORE NO. 25A

Sub-contract No: 5053 A20-102(2) Docket: DM423/61

Location: Co-ords 2608'N & 4045'W

Hundred: Noarlunga Section: 587 R.L. at Collar: 273.32

Purpose: Standard penetration test, Vacuum Oil Co. oil refinery site, Port Stanvac (near O'Sullivan's Beach).

Hirer: Kellogg Overseas Corporation

Plant: Conrad Total Depth: 76'10½"

Logged by: A. A. Gibson

Depth From	To	Description	Penetration Blows p/ft.
0'0" -	0'8"	Dark brown fine loam. Friable. Compact.	
0'8" -	1'0"	Kunkar horizon. Moderately soft to hard, light creamy-brown to off-white, sandy kunkar, with pockets of dark brown loam.	
1'0" -	4'6"	No sample.	
4'6" -	5'6"	Light and pale creamy-brown, vaguely mottled, finely sandy marl-earth, with some small kunkar nodules. Nearly dry. Friable. Compact.	23
5'6" -	9'6"	No sample.	
9'6" -	10'6"	Creamy brown, finely sand marl.	34
10'6" -	14'6"	No sample.	
14'6" -	15'6"	Light greenish-grey finely sandy clay, with red-brown and yellow-brown mottling.	22
15'6" -	19'6"	No sample.	
19'6" -	20'6"	Light brown and brown, slightly clayey, fine sand, with some coarse, irregular, red-brown and yellow-brown mottling.	167
20'6" -	24'6"	No sample.	
24'6" -	25'6"	As for 19'6" to 20'6".	28
25'6" -	29'6"	No sample.	
29'6" -	30'6"	Light greenish-grey, silty and finely sandy clay, with red-brown mottling. Sub-prismatic structure evident.	32
30'6" -	34'6"	No sample.	
34'6" -	35'6"	As for 29'6" to 30'6", but with higher sand content.	47
35'6" -	39'6"	No sample.	
39'6" -	40'6"	Light greenish-grey, fine, very sandy clay, with some brownish-yellow mottling.	64
40'6" -	44'6"	No sample.	

Bore 25A (Contd.)

Depth, From	To	Description	Penetration - Blows p/ft.
44'6"	45'6"	Light greenish-grey, silty clay, with some dark yellowish-brown mottling. Very fine black specks throughout. Moist. Stiff.	45
45'6"	49'6"	No sample.	
49'6"	50'6"	As for 44'6" to 45'6"	51
50'6"	55'6"	Light greenish-grey silty clay with some yellow-brown mottling. Moist. Firm.	
55'6"	56'6"	As above.	64
56'6"	60'6"	No sample.	
60'6"	61'6"	Light greenish-grey, finely sandy clay, with some light yellow-brown mottling. Moist. Stiff.	73
61'6"	65'7"	No sample.	
65'7"	66'1"	Light greenish-grey silty clay, with some brownish-yellow and yellowish-brown mottling. Highly plastic. Damp. Firm.	92
66'1"	66'10½"	Dark purplish-brown, decomposed slate, with pale greenish-grey silty clay pockets. Very thinly bedded. Dip vertical.	
66'10½"	70'0"	Partly decomposed slate. Dark purplish-brown and pale greenish grey, very thinly bedded slate. Some beds moderately hard, remainder decomposed to clay. Dip nearly vertical.	
70'0"	76'10½"	Weathered slate. Dark purplish-brown and pale greenish-grey, very thinly bedded slate. Bedding dip vertical to 80°. Joints dip at 10° to 30° and 50° to 60°. Very firm to hard.	

END OF BORE.

TEST BORE NO. 26A

Sub-contract No: 5053 A20-102(2) Docket: DM423/61

Location: Co-ords 3459'N & 1798'W

Hundred: Noarlunga Section: 588 R.L. at Collar: 333.93

Purpose: Investigation of foundation conditions, Vacuum Oil Co. oil refinery site, Port Stanvac (near O'Sullivan's Beach).

Hirer: Kellogg Overseas Corporation.

Plant: Ford 0-40'6", Failing 40'6"-48'0", Conrad 48'0"-52'6".

Total Depth: 52'6". Logged by: A. A. Gibson

Depth From	To	Description
0'0" -	0'10"	Brown fine loam. Friable. Compact.
10"-	1'10"	Kunkar horizon. Irregular, coarse, platy to fine nodular concretions, with interstitial brown loam. Compact.
1'10"-	4'0"	Pale creamy-brown, finely sandy marl-earth, with frequent small kunkar nodules. Nearly dry. Very friable.
4'0" -	5'2"	Pale creamy-brown to off-white, finely sandy marl-earth with a little brown mottling. Nearly dry. Friable. Very compact.
5'2" -	6'4"	As above, but slightly clayey.
6'4" -	6'6"	Sample missing.
6'6" -	6'9"	Red-brown, light yellowish-brown, light grey-brown and light greenish-grey mottled, clayey fine sand, with pale creamy-brown to pale pink pockets of fine, very sandy marl-earth. Very friable. Damp. Compact.
6'9" -	8'9"	Sealed sample.
8'9" -	9'0"	Light creamy-red-brown, limey and slightly clayey fine sand, with some light creamy-brown, very limey pockets Damp. Some scattered, minute black specks. Very friable. Compact.
9'0" -	11'0"	Sealed sample.
11'0" -	11'3"	Light to pale greenish-grey, very clayey fine sand, with light red-brown and lesser yellow-brown mottling. Moderately plastic. Very friable. Moisture content below P.L. Some fine black specks irregularly distributed. Compact.
11'3" -	13'3"	Sealed samples.
13'3" -	14'10"	Light greenish-grey, fine, very sandy clay, with brick red, red-brown and yellow-brown mottling. Frequent small pockets of pale yellowish-grey, fine clayey sand. Plastic. Semi-friable to friable. Moisture content below P.L. Sub-prismatic structure, with light purplish-grey to dark brownish-purple partings. Dull to moderate sheen on structural units. Firm.

Bore 26A (contd.)

Depth From	Depth To	Description
14'10"	15'3"	Sealed sample.
15'3"	15'6"	As for 13'3" to 13'10", but sand content lower. Less friable. Moisture content near P.L.
15'6"	15'9"	Sample missing.
15'9"	17'9"	Sealed samples.
17'9"	18·0"	As for 15'3" to 15'6", but with purplish-brown, very sandy clay coatings on structural units. Mottling dominantly yellow-brown.
18'0"	20'0"	Sealed sample.
20'0"	20'11"	As for 15'3" to 15'6", but mottling dominantly yellow-brown and sand pockets larger.
20'11"	22'3"	Sealed samples.
22'3"	22'6"	Sample missing.
22'6"	24'6"	Sealed sample.
24'6"	25'5"	Light greenish-grey silty and slightly sandy clay, wit irregularly distributed deep red and brownish-yellow mottling. Several, irregular, pale yellowish grey clayey fine sand veins. Plastic. Semi-friable. Moisture content near P.L. Sub-prismatic structure, with light greenish-grey to dark purplish brown partings. Moderate to bright sheen on structural unit One fissure at 70° to core (Dip 20°), with bright sheen and purplish brown stain on fissure faces. Very firm.
25'5"	26'9"	Sealed samples.
26'9"	27'0"	Sample missing.
27'0"	29'0"	Sealed sample.
29'0"	29'3"	Pale greenish-grey, fine, very sandy clay, with coarse deep red, ferruginous patches and a little yellow-brown mottling. A pale yellowish-grey fine sand vein ½" thick, transects the core at 45°. Other smaller pockets of the same sand also occur. Low plasticity. Moderately friable. Moisture content below P.L. Poorly developed sub-prismatic structure, with pale greenish-grey to light purplish-grey partings. Dull sheen on structural units. Firm.
29'3"	31'3"	Sealed samples.
31'3"	31'6"	Pale greenish-grey silty and finely sandy clay, with some deep red, brick red and yellow-brown mottling. Occasional pockets of pale yellowish-grey fine sand. Plastic. Semi-friable. Moisture content below P.L. Sub-prismatic structure with pale greenish-grey to light purplish-grey partings. Dull to moderate sheen on structural units. Much fissuring at about 45° to core, with bright sheen on fissure faces. Firm.
31'6"	33'6"	Sealed sample.

Bore 26A (Contd.)

Depth From	To	Description
33'6"	33'9"	Pale greenish-grey, fine, very sandy clay, with a little deep red, brick red and yellow brown mottling. Frequent pockets of pale yellowish-grey fine sand. Sub-prismatic structure, with dark purplish-brown sandy clay partings. Dull sheen on structural units. Moderately plastic. Slightly friable. Moisture content near P.L. Firm.
33'9"	35'9"	Sealed samples.
35'9"	36'0"	Pale greenish- to yellowish-grey fine sand with patche of very sandy clay as for 33'6" to 33'9".
36'0"	38'0"	Sealed samples.
38'0"	38'3"	Yellow brown, slightly clayey fine sand, with a little grey-brown, brick red and pale yellow mottling. Low plasticity. Very friable. Moist. Compact.
38'3"	39'1"	Sealed sample.
39'1"	39'4"	Yellow-brown, light yellow-brown and pale grey, roughly banded and partly cemented fine sand. Cemente parts hard, elsewhere friable. Damp. Compact to hard.
39'4"	40'6"	Augered out Brick red, yellow-brown and pale greenish-grey mottled, partly cemented, slightly clayey fine sand. Damp. Compact to moderately hard.
40'6"	41'0"	Yellow-brown, pale yellowish-grey and brick red mottled fine sandstone. Hard.
41'0"	41'6"	As for 39'4" to 40'6".
41'6"	48'0"	Drilled out, Sludge indicates sandstone as for 40'6" to 41'0".
48'0"	52'6"	Orange, reddish-brown and grey, coarsely and irregularly mottled, cemented fine sand. Can be parted on horizontal planes by hand. Friable with difficulty. Very compact to moderately hard.

END OF BORE.

TEST PIT "A"

Sub-contract No: 5053 A20-102(2) **Docket:** DM 423/61

Hundred: Noarlunga **Section:** 582 **Co-ords:** 4622'N & 1093'W

R.L.: 348.29

Purpose: Detailed examination of upper soil profile, Vacuum Oil Co. oil refinery site, Port Stanvac (near O'Sullivan's Beach)

Hirer: Kellogg Overseas Corporation.

Logged by: A.A. Gibson

Depth From	Depth To	Description
0	1'0"	Grey-brown finely sandy loam, with occasional small kunkar nodules. Friable. Granular to compact. Where the kunkar horizon is absent, this loam extends to a depth of 2 ft.
1'0"	1'6"	Kunkar horizon. Discontinuous. Mainly compact, limey and finely sandy, grey-brown loam, with frequent smal hard kunkar nodules and occasional coarse, irregular, shabby kunkar concretions. Dry. Friable.
1'6"	3'0"	Pale greyish-brown, finely sandy marl-earth, with frequent very small kunkar nodules irregularly distributed. Moderately compact, but very friable.
3'0"	4'9"	As above, but very compact.
4'9"	5'9"	Light brown and pale creamy-brown mottled, finely sandy marl-earth, with occasional small kunkar nodules. Very compact, but friable.
5'9"	6'9"	Brown and light creamy-brown, vaguely mottled, finely sandy marl, with frequent pale creamy-brown marl-earth pockets. Moderately plastic. Friable. Moderately firm.
6'9"	8'0"	Reddish-brown, fine, very sandy clay, with occasional, small, light greenish-grey mottles. Plastic. Slightly friable. Sub-prismatic structure, with brown clay partings. Dull to moderate sheen on structural units. Firm.
8'0"	10'1"	Red-brown fine, very sandy clay, with a little vague, pale greenish-grey to pale yellowish-grey mottling. Some black flecks in upper 1 ft. Plastic. Sub-prismatic structure, with reddish-brown clay partings Moderate sheen on structural units. Sand content increasing with depth. Very firm.

TEST PIT "B"

Sub-contract No: 5053 A20-102(2) Docket: DM 423/61

Hundred: Noarlunga Section: 582 Co-ords: 4684'N & 1443'W

R.L.: 335.27

Purpose: Detailed examination of upper soil profile, Vacuum Oil Co. Oil refinery site, Port Stanvac (near O'Sullivans Beach)

Hirer: Kellogg Overseas Corporation

Logged by: A.A. Gibson

Depth From	Depth To	Description
0	8" / 1'3"	Depth variable. Brown finely sandy loam. Friable. Compact.
8" / 1'3"	1'4" / 1'7"	Kunkar horizon. Depth and thickness variable. Coarse, irregular, platy concretions forming a discontinuous layer, with interstitial and alternating loam and fine kunkar nodules.
1'4" / 1'7"	3'3"	Pale creamy-brown to pale greyish-brown, finely sandy marl-earth. Frequent small kunkar nodules irregularly distributed. Compact, but very friable.
3'3"	5'9"	Light creamy-brown and pale creamy-brown, vaguely mottled, finely sandy marl-earth. Slightly clayey. Frequent very small kunkar nodules. Very compact, but friable.
5'9"	7'6"	Light creamy-brown and light brown, vaguely mottled. finely sandy marl, with frequent, off-white, earthy lime pockets. Moderately plastic. Friable in part. Sub-granular structure. Dull. Moderately firm.
7'6"	9'0"	Reddish-brown, finely sandy clay, with a little light greenish-grey mottling. Very plastic. Sub-prismatic structure, with reddish-brown clay partings. Frequent small black platy flecks and patches on structural faces in lower half. Dull to moderate sheen on structural units. Light, dominantly vertical cracking. Sand content increases with depth. Firm.

TEST PIT "C"

Sub-contract No: 5053 A20-102(2) Docket: DM423/61

Hundred: Noarlunga Section: 582 Co-ords: 4329'N & 1877'W

R.L. 322.71

Purpose: Detailed examination of upper soil profile, Vacuum Oil Co. oil refinery site, Port Stanvac (near O'Sullivan's Beach).

Hirer: Kellogg Overseas Corporation

Logged by: A. A. Gibson

Depth From	Depth To	Description
0'0" -	(1'7" / 1'11")	Depth variable. Brown finely sandy loam. Friable. Granular to compact.
(1'7" / 1'11") -	2'4"	Kunkar horizon. Coarse, irregular to slabby sandy kunkar concretions, forming an almost continuous layer. Some interstitial loam. Hard to moderately soft and friable.
2'4" -	5'2"	Pale creamy-brown, finely sandy marl-earth. Frequent small kunkar nodules, diminishing in size and number with depth. Compact, but very friable.
5'2" -	7'8"	Light brown, light reddish-brown and pale brownish-grey mottled, finely sandy and somewhat limey clay. Abundant coarse, off-white, partly cemented, pockets of earthy lime. Plastic. Slightly friable. Firm.
7'8" -	9'3"	Reddish-brown and light greenish-grey, finely sandy clay, with frequent coarse, off-white, semi-cemente earthy lime pockets, becoming less frequent with depth. Sand content increases with depth. Some small black flecks. Plastic. Earthy lime pockets friable. Sub-prismatic structure, with reddish-brown partings. Dull sheen on structural units. Firm.

TEST PIT "D"

Sub-contract No: 5053 A20-102(2) Docket: DM423/61

Hundred: Noarlunga Section: 586 Co-ords: 3564'N & 3698'W

R.L. 270.75

Purpose: Detailed examination of upper soil profile, Vacuum Oil Co. oil refinery site, Port Stanvac (near O'Sullivan's Beach)

Hirer: Kellogg Overseas Corporation

Logged by: A. A. Gibson

Depth From	Depth To	Description
0'0"	1'2"	Dark grey-brown, fine, somewhat sandy loam. Frequent small kunkar nodules and fragments irregularly distributed at the base. Friable. Moderately compact.
1'2"	2'0"	Kunkar horizon. Coarse, irregular, moderately soft to hard, sandy kunkar concretions, with interstitial grey-brown, limey and finely sandy loam, containing numerous small, hard kunkar nodules.
2'0"	4'3"	Light to pale creamy-brown, finely sandy marl-earth. Numerous small, hard kunkar nodules, diminishing in size and number with depth. Loosely compacted. Very friable.
4'3"	6'6"	Light brown, light reddish-brown and off-white, vaguely mottled, finely sandy and slightly clayey marl-earth. Frequent, very small, hard cemented lumps. Coarse, sub-granular structure. Dull. Very compact, but friable.
6'6"	8'3"	Brown, pale grey, reddish-brown and pale greenish-grey, sharply mottled, finely sandy and slightly clayey marl-earth. Slight plasticity. Very compact, but friable.

TEST PIT "E"

Sub-contract No.: 5053 A20-102(2) Docket: DM423/61

Hundred: Noarlunga Section: 581 Co-ords: 5124'N & 3078'W

R.L. 283.14

Purpose: Detailed examination of upper soil profile, Vacuum Oil Co. oil refinery site, Port Stanvac (near O'Sullivan's Beach).

Hirer: Kellogg Overseas Corporation.

Logged by: A. A. Gibson

Depth From	To	Description
0'0"	0'5"	Brown fine sandy loam. Some development of cultivation "hard-pan" at base. Friable. Granular to very compact.
5"	1'0"	Red-brown, fine, very sandy clay. Porous to vesicular. Sub-granular to fine sub-prismatic structure. Dull sheen on structural units. Friable. Firm.
1'0"	1'6"	Kunkar horizon. Ranges from moderately hard sheet limestone, with included small, very hard kunkar nodules, to coarse, irregular concretions, with interstitial, red-brown, finely sandy clay containing fine nodules. Compact.
1'6"	4'0"	Light to pale creamy-brown, finely sandy marl-earth, with numerous small kunkar nodules. Compact, but very friable.
4'0"	5'0"	Light brown, slightly clayey and finely sandy marl-earth, with coarse, irregular pockets of off-white earthy lime and a few kunkar nodules. Very compact, but friable.
5'0"	6'3"	Brown, fine, very sandy marl, with some light grey mottling. Frequent small, pale brown, very limey pockets, diminishing in number with depth. Low plasticity. Friable. Vague, irregular structure. Becomes more clayey and less friable with depth. Moderately firm.
6'3"	8'0"	Brown, brick red, red-brown, yellow-brown and pale grey, irregularly mottled, fine, very sandy clay. Moderately plastic. Slightly friable. Sub-prismatic structure, with brown clay partings. Dull sheen on structural units. Light to moderate, dominantly vertical cracking. Very firm.

TEST PIT "F"

Sub-contract No.: 5053 A20-102(2) Docket; DM423/61

Hundred: Noarlunga Section: 587 Co-ords: 2775'N & 3902'

R.L. 274.50

Purpose: Detailed examination of upper soil profile, Vacuum Oil Co. oil refinery site, Port Stanvac (near O'Sullivan's Beach).

Hirer: Kellogg Overseas Corporation.

Logged by: A. A. Gibson

Depth From	To	Description
0"	6"	Brown finely sandy loam, with frequent small kunkar nodules and fragments. Compact, but friable.
6"	1'6"	Kunkar horizon. Ranges from compact, soft, silty incipient limestone with small included kunkar nodules, through coarse irregular concretions with interstitial loam, to moderately hard, irregular sheet kunkar.
1'6"	4'3"	Off-white to pale creamy-brown, merging irregularly to light reddish-brown and pale brownish-grey, finely sandy marl-earth. Numerous small, hard kunkar nodules. Compact, but very friable.
4'3"	5'6"	Creamy reddish-brown, fine, very sandy marl-earth, with frequent small pockets of off-white earthy lime, Occasional small kunkar nodules. Compact, but friable.
5'6"	6'2"	Reddish-brown, fine, very sandy marl, with some small pockets of off-white earthy lime. Slightly plastic. Friable. Moderately firm.
6'2"	9'6"	Reddish-brown, pale yellowish-brown, light greenish-grey and brown, vaguely mottled, fine, very sandy clay to clayey fine sand. Moderately plastic. Friable. Sub-prismatic structure, with brown clay partings. Dull sheen on structural units. Moist. Very firm.

TEST PIT "G"

Sub-contract No.: 5053 A20-102 (2) **Docket:** DM 423/61

Hundred: Noarlunga **Section:** 587 **Co-ords:** 3157'N & 3675'W

R.L. 270.60

Purpose: Detailed examination of upper soil profile, Vacuum Oil Co. oil refinery site, Port Stanvac (near O'Sullivan's Beach)

Hirer: Kellogg Overseas Corporation

Logged by: A.A. Gibson

DEPTH FROM	TO	DESCRIPTION
0"	9"	Dark grey-brown, finely sandy loam. Friable. Granular to compact.
9"	1'9"	Kunkar horizon: Very compact incipient kunkar, with numerous hard, irregular concretions and some cemented patches. Moderately soft to hard.
1'9"	3'9"	Light to pale creamy-brown, finely sandy marl-earth, with numerous small, hard kunkar nodules, diminishing in size and number with depth. Loosely compacted. Very friable.
3'9"	5'9"	Light brown and light reddish-brown, vaguely mottled, finely sandy and slightly clayey marl-earth, with frequent small, off-white pockets of earthy lime. Frequent small, hard, cemented lumps. Very compact, but friable.
5'9"	7'6"	Brown, pale greenish-grey, reddish-brown and pale grey mottled, finely sandy and slightly clayey marl-earth. Pale mottles are very limey. Damp. Slightly plastic. Very compact, but friable.
7'6"	8'3"	As above, but pale limey patches dominant.
8'3"	9'9"	Pale yellowish-grey, reddish-brown, light greenish-grey and sparse pink mottled, fine, very sandy and silty marl. Damp. Moderately firm.

TEST PIT "H"

Sub-contract No: 5053 A20-102(2) **Docket:** DM 423/61

Hundred: Noarlunga **Section:** 582 **Co-ords:** 4039N & 1572'W

R.L.: 331.56

Purpose: Detailed examination of upper soil profile, Vacuum Oil Co. oil refinery site, Port Stanvac (near O'Sullivans Beach)

Hirer: Kellogg Overseas Corporation.

Logged by: A.A. Gibson

Depth From	Depth To	Description
0	10" / 1'0"	Brown fine loam. Friable. Compact.
10" / 1'0"	1'2" / 1'9"	Kunkar horizon. Depth and thickness variable. Irregular, coarse, slabby, kunkar concretions to fine kunkar nodules, with interstitial brown loam. Compact.
1'2" / 1'9"	4'0"	Pale creamy-brown, finely sandy marl-earth, with numerous, irregularly distributed, small kunkar nodules. Compact, but very friable.
4'0"	6'4"	As above, but very compact and nodules less numerous. Friable.
6'4"	7'6"	Light and pale creamy-brown, vaguely mottled, fine, very sandy and slightly clayey marl-earth. Occasional small, brown, finely sandy clay pockets. Some pale grey and light creamy-brown clayey sand patches. Damp. Moderately firm.
7'6"	9'6"	Light creamy-brown and pale grey mottled, clayey fine sand and silt, with some red-brown and brick red mottling. Suggestion of coarse, sub-prismatic structure. Moist. Moderately firm.

TEST PIT "J"

Sub-contract No.: 5053 A20-102(2) Docket: DM 423/61

Hundred: Noarlunga Section: 582 Co-ords.: 4037'N & 969'W

R.L.: 347.17

Purpose: Detailed examination of upper soil profile, Vacuum Oil Co. oil refinery site, Port Stanvac (near O'Sullivan's Beach).

Hirer: Kellogg Overseas Corporation.

Logged by: A. A. Gibson

Depth From	Depth To	Description
0	8"	Dark brownish-grey, sandy fine loam. Friable. Compac
8"	1'3"	Kunkar horizon. Discontinuous, coarse, irregular to slabby concretions, with interstitial sandy loam and small nodules. Coarse concretions absent in places.
1'3"	3'3"	Pale greyish-brown to pale creamy-brown, finely sandy marl-earth, with scattered small kunkar nodules. Compact, but very friable.
3'3"	4'9"	Light creamy-brown and off-white, coarsely mottled, finely sandy marl-earth, with occasional small kunkar nodules. Friable. Very compact.
4'9"	6'6"	Light creamy-brown and pale greenish-grey, irregularly mottled, fine, very sandy marl, with occasional small, off-white, earthy lime pockets and some fine red-brown mottles. Sub-granular structure, with crea brown partings. Dull sheen on structural units. Firm.
6'6"	8'9"	Light greenish-grey, finely sandy clay, with brown and red-brown mottling. Numerous very fine, dark brown to black specks. Some fine cracks filled with pale creamy-brown marl earth. Plastic. Sub-prismatic structure, with light greenish-grey partings. Moderate to bright sheen on structural units. Rare small rock fragments. Firm.
8'9"	9'1"	Pale greenish-grey and light yellow-brown vaguely mottled, fine, very sandy clay. Low to moderate plasticity. Friable. Firm.

TEST PIT "K"

Sub-contract No: 5053 A20-102 (2) Docket DM 423/61
Hundred Noarlunga Section 588
Co-ords 3567'N & 1375'W
R.L. 336.59
Purpose Detailed examination of upper soil profile, Vacuum Oil Co. oil refinery site Port Stanvac (Near O'Sullivan's Beach)
Hirer Kellogg Overseas Corporation

LOGGED BY A.A. GIBSON

Depth From	To	Description
0 -	4"	Grey-brown fine sandy loam. Friable. Compact
4" -	1'3"	Red-brown, finely sandy loam. Friable. Compact.
1'3" -	1'9"	Kunkar horizon. Ranges from fine nodules to coarse, irregular, slabby concretions, all with interstitial loam and finely sandy marl-earth. Compact.
1'9" -	5'8"	Pale creamy-brown to light greyish-brown, finely sandy marl-earth, with abundant small kunkar nodules. Very friable. Moderately compact.
5'8" -	7'8"	Creamy-brown and pale greenish to yellowish-grey coarsely and irregularly mottled, finely sandy marl-earth, becoming slightly clayey with depth. Friable. Very compact.
7'8" -	9'9"	Creamy brown pale creamy-brown and pale yellowish grey finely mottled fine, very sandy marl. Becomes darker in colour and more clayey with depth. Moderately plastic. Somewhat friable. Sub-granular to coarsely granular structure. Dull sheen on structural units. Moderately firm.

TEST PIT "L"

Sub-contract No.: 5053 A20-102(2) Docket: DM423/61

Hundred: Noarlunga Section: 581 Co-ords: 4723'N & 1886'W

R.L. 320.93

Purpose: Detailed examination of upper soil profile, Vacuum Oil Co. oil refinery site, Port Stanvac (near O'Sullivan's Beach)

Hirer: Kellogg Overseas Corporation

Logged by: A. A. Gibson

Depth From	To	Description
0'0"	1'3"	Reddish-brown, finely sandy loam. Friable. Compact.
1'3"	1'10"	Kunkar horizon. Ranging from fine to coarse irregular concretions, with interstitial loam, to soft, incipient sheet kunkar, with included smal hard nodules.
1'10"	4'6"	Pale creamy-brown, finely sandy marl-earth, with numerous small kunkar nodules. Compact, but very friable.
4'6"	6'6"	Light brown and pale creamy-brown mottled, finely sandy marl-earth, with occasional small kunkar nodules. Slightly clayey. Friable. Very compact.
6'6"	7'8"	Light brown and pale brown, vaguely mottled, finely sandy marl, with numerous off-white, earth lime pockets. Moderately plastic. Somewhat friable. Rare small, brick red, fine sand pockets. Firm.
7'8"	9'0"	Reddish-brown, finely sandy clay, with a little light greenish-grey and pale yellowish-grey mottlin Plastic. Sub-prismatic structure, with brown clay partings. Frequent black flecks on structural faces in lower half. Dull to moderate sheen on structura units. Light, dominantly vertical cracking throughout. Firm.

TEST PIT "M"

Sub-contract No.: 5053 A20-102(2) Docket: D.M. 423/61

Hundred: Noarlunga Section: 588 Co-ords: 3368'N & 609'W

R.L.: 355.92

Purpose: Detailed examination of upper soil profile, Vacuum Oil Co. oil refinery site, Port Stanvac (near O'Sullivan's Beach)

Hirer: Kellogg Overseas Corporation.

Logged by: A. .. Gibson

Depth From	Depth To	Description
0	7" / 1'1"	Depth variable. Dark brown to dark reddish-brown, sandy fine loam. Friable. Compact.
7" / 1'1"	1'6" / 1'10"	Kunkar horizon. Depth and thickness variable. Embrace abundant fine nodules with interstitial sandy marl earth and loam, coarse, irregular, slabby concretions, with interstitial sandy loam, and incipient to moderately hard sheet kunkar with included hard nodules.
1'6" / 1'10"	3'3"	Pale creamy-brown, finely sandy marl-earth, with abundant small kunkar nodules. Compact, but very friable.
3'3"	4'4"	As above, but more compact and nodules smaller and less numerous.
4'4"	5'9"	Light creamy-brown and off-white, irregularly mottled, finely sandy marl-earth. Very compact, but friable.
5'9"	6'6"	Light and pale creamy-brown, vaguely mottled, fine, very sandy marl, with lesser red-brown and brown fine mottling. Tendency to sub-prismatic structure. Plastic. Slightly friable. Moderately firm.
6'6"	7'2"	Brown, finely sandy marl, with a little light greenish-grey mottling. Frequent pale creamy-brown, finely sandy marl-earth pockets. Sub-prismatic structure, with brown clay partings. Dull to moderate sheen on structural units. Firm.
7'2"	7'10"	Yellowish-brown, finely sandy clay, with vague, pale greenish-grey mottling. Frequent black flecks irregularly distributed. Plastic. Slightly friable. Sub-prismatic structure, with reddish-brown clay partings. Moderate sheen on structural units. Sharp interface at 7'10". Firm.
7'10"	9'3"	Light greenish-to brownish-grey, fine, very sandy clay, with red-brown mottling. Moderately plastic. Friable. Sub-prismatic structure. Dull to moderate sheen on structural units. Very firm.

TEST PIT "N"

Sub-contract No.: 5053 A20-102(2) Docket: DM 423/61

Hundred: Noarlunga Section: 588 Co-ords: 3299'N & 371'W

R.L. 365.97

Purpose: Detailed examination of upper soil profile, Vacuum Oil Co. oil refinery site, Port Stanvac (near O'Sullivan's Beach)

Hirer: Kellogg Overseas Corporation.

Logged by: A.A. Gibson.

Depth:

FROM		TO	DESCRIPTION
0"	-	1'0"	Dark brown, fine, sandy loam. Very friable. Moderately compact.
1'0"	-	(1'6") (1'8")	Kunkar horizon. Thickness variable. Mainly fine to very coarse, irregular concretions, with interstitial dark to light brown, fine sandy loam. Partly cemented to sheet kunkar in places.
1'6") 1'8")	-	3'11"	Pale creamy-brown, finely sandy marl-earth, with numerous very small kunkar nodules. Very friable. Moderately compact.
3'11"	-	5'2"	Light creamy-brown and off-white, irregularly mottled, finely sandy marl-earth, with occasional small kunkar nodules. Friable. Very compact.
5'2"	-	6'2"	Light to pale creamy-brown, diffusely mottled, fine, very sandy marl, with off-white, earthy lime pockets. Low plasticity. Friable. A little red-brown mottling. Tendency to develop a sub-prismatic structure. Moderately soft.
6'2"	-	7'0"	Creamy-brown, finely sandy marl, with a little pale greenish-grey mottling. Plastic. Occasional smal off-white, earthy lime pockets. Sub-prismatic structure, with brown clay partings. Dull to moderate sheen on structural units. Firm.
7'0"	-	7'9"	Red-brown, finely sandy clay, with light-greenish-grey vague mottling. Frequent minute black specks plastic. Sub-prismatic structure, with reddish-brown clay partings. Moderate sheen on structural units. Firm.
7'9"	-	8'9"	Reddish-brown, red-brown and light greenish-grey mottled, fine, very sandy clay, with scattered black flecks. Sub-prismatic structure, with light greenish-grey clay partings. Moderate sheen on structural units. Moderately plastic. Somewhat friable. Firm.

TEST PIT "P"

Sub-contract No.: 5053 A20-102(2) **Docket:** DM 423/61

Hundred: Noarlunga **Section:** 587 **Co-ords:** 2958'N & 3772'W

R.L. 275.15

Purpose: Recovery of spiral flights and auger barrel, Vacuum Oil Co. oil refinery site; Port Stanvac (near O'Sullivan's Beach)

Hirer: Kellogg Overseas Corporation.

Logged by: A.A. Gibson

DEPTH:

FROM	TO	DESCRIPTION
0'	8"	Dark brownish-grey fine loam, with occasional very small kunkar nodules. Friable. Compact.
8"	(1'2") (1'8")	Kunkar horizon. Thickness variable. Mainly moderately soft to hard, finely sandy kunkar sheet, with some included, very small, very hard kunkar nodules.
(1'2") (1'8")	(3'6") (3'8")	Pale creamy-brown to off-white, finely sandy marl-earth, with abundant small kunkar nodules. Compact, but very friable.
3'6") 3'8")	(5'2") (5'3")	Light brown, pale creamy-brown and off-white mottled finely sandy marl-earth. Only occasional small kunkar nodules. Friable. Very compact.
5'2") 5'3")	(6'2") (6'3")	Old kunkar horizon. Irregular, shabby kunkar concretions to nodular kunkar, occurring in material ranging from finely sandy and nodular marl-earth to incipient kunkar. Friable in part. Very compact.
6'2") 6'3")	8'10"	Light brown, pale creamy-brown and off-white, vaguely mottled, finely sandy marl-earth, with frequent small, hard kunkar nodules. Semi-cemented in places. Friable in part. Very compac
8'10"	(10'4") (10'10")	Light brown and pale creamy-brown to off-white mottled, finely sandy and slightly clayey marl-earth. Occasional small kunkar nodules. Damp. Friable. Compact.
10'4") 10'10")	12'0"	Sharp, undulating interface with material above. Reddish-brown and light greenish-grey mottled, finely sandy clay, with black specks, merging downward into light reddish-brown and light greenish-grey mottled, fine, very sandy clay. Plastic. Sub-prismatic structure. Dull sheen on structural units. Moist. Firm.

DEPARTMENT OF MINES
SOUTH AUSTRALIA

PERCUSSION TEST BORE NO. 28

Bore Serial No: PD647/61 **Docket:** DM876/60

Location: Co-ordinates 4950'N and 3270'W **R.L. at Collar:** 287.06

Hundred: Noarlunga **Section:** 581 **Driller:** A. Sturak

Plant: No. 41 **Core Diameter:** 4"

Nominal Bore Diameter: 6" **Logged by:** A.A. Gibson

Total Depth: 69 ft. **Hirer:** Vacuum Oil Company, Pty. Ltd.

Date Commenced: 25.8.60 **Date completed:** 1.9.60

Purpose: Investigation of foundation conditions at possible tank farm site, proposed oil refinery site near O'Sullivan's Beach.

Depth From	Depth To	Description	Penetration Depth From	Penetration Depth To	Blows p/ft.
0	0'6"	Brown fine sandy loam.	0	1'0"	12
0'6"	1'0"	Light reddish-brown fine sandy loam			
1'0"	1'6"	Light brown, limey, very fine sandy loam, with abundant small kunkar nodules.	1'0"	1'6"	14
1'6"	3'0"	Sealed Tube: Light brown and off-white mottled, finely sandy marl-earth, with occasional small kunkar nodules. Dry.	1'6"	3'0"	17
3'0"	5'0"	As above	3'0" 4'0"	4'0" 5'0"	14 20
5'0"	6'6"	Sealed Tube: Brown and light reddish-brown, vaguely mottled, finely sandy and somewhat limey clay, with frequent earthy lime pockets. Some hard limey nodules and some fine limestone grit. Damp.	5'0"	6'6"	24
6'6"	7'2"	Brown and pale red-brown, irregularly mottled, finely sandy clay. Brown patches contain disseminated fine limestone sand. Pale red-brown patches are very limey. Damp.	6'6"	7'0"	30
7'2"	8'6"	Reddish-brown finely sandy clay, with a little light greenish-grey mottling and numerous very dark flecks. Sub-prismatic structure. Moist.	7'0" 8'0"	8'0" 8'6"	22 30

Bore No. 28 (cont.)

Depth From	Depth To	Description	Penetration Depth From	Penetration Depth To	Blows p/ft.
8'6"	10'0"	Sealed Tube: As above	8'6"	10'	25
10'	12'	Red-brown finely sandy clay with occasional light greenish-grey and yellow-brown mottling. Prismatic structure. Moderate sheen on structural units. Sand content increasing with depth. Moist. Firm.	10'	11'	30
			11'	12'	25
12'	13'6"	Brick red, red-brown, brown, brownish-yellow and light yellowish-grey, vaguely mottled, very sandy clay. Moist.	12'	13'	20
			13'	13'6"	20
13'6"	15'0"	Sealed Tube: As above	13'6"	15'	20
15'	18'6"	Brick red, deep red, pale yellowish-grey and yellow-brown mottled, slightly clayey fine sand. Moderately compact. Moist.	15'	16'	25
			16'	17'	22
			17'	18'	20
			18'	18'6"	22
18'6"	20'0"	Sealed Tube: As above	18'6"	20'	25
20'	22'	As above	20'	22'	25
22'	23'3"	Pale yellowish-grey, slightly clayey, fine sand, with some coarse, dark brown patches and a little yellow-brown mottling. Moderately compact. Moist.	22'	23'	30
			23'	23'6"	30
23'3"	23'6"	Light greenish-grey, finely sandy clay with some yellowish-brown and reddish brown mottling. Frequent very thin brown streaks. Sub-prismatic structure. Some irregular fissuring. Firm. Moist.			
23'6"	25'	Sealed Tube: As above	23'6"	25'	23
25'0"	27'	As above	25'	26'	27
			26'	27'	28
27'	29'	Deep red, yellow-brown, pale yellowish-grey and brown, coarsely mottled, very silty and finely sandy clay. Firm. Moist.	27'	28'	31
			28'	29'	30
29'	36'	Pale yellowish to greenish-grey, clayey silt and fine sand, with red-brown, brick red and yellow-brown mottling. Clay content decreases rapidly with depth, becoming negligible below 34'0" Compact, damp.	29'	31'	32
			31'	32'	42
			32'	33'	48
			33'	35'	50
			35'	36'	54
36'0"	40'	Pale yellowish-grey, yellow-brown and brick red mottled, very fine soft sandstone. Very firm. Damp.	36'	37'	55
			37'	38'	56
			38'	39'	55
			39'	40'	58

B ore 28 (cont)

Depth From	Depth To	Description	Penetration Depth From	Penetration Depth To	Blows p/ft.
36'	40'	Pale yellowish-grey, yellow-brown and brick red mottled, very fine soft sandstone very firm. Damp.	36'	37'	55
			37'	38'	56
			38'	39'	55
			39'	40'	58
40'	42'	Pale greenish-grey, finely sandy clay with fine yellow-brown mottling. Sand content increasing gradually with depth.	40'	41'	54
			41'	42'	39
42'	43'6"	Pale greenish-grey, finely sandy clay, with red-brown mottling. Firm. Moist.	42'	43'	37
			43'	43'6"	36
43'6"	45'0"	Sealed Tube: As above	43'6"	45'	30
45'	50'	Pale greenish-grey to pale grey clayey silt and fine sand with some fine, yellow-brown mottling. Firm. Moist.	45'	46'	37
			46'	48'	38
			48'	49'	39
			49'	50'	36
50'	53'6"	Pale to light greenish-grey, very silty and finely sandy clay with red-brown and yellow-brown mottling. Firm. Moist.	50'	51'	39
			51'	52'	41
			52'	53'6"	41
53'6"	55'	Sealed Tube: As above	53'6"	55'	34
55'	57'	As above	55'	56'	38
			56'	57'	40
57'	63'6"	Completely decomposed slate. Dominantly light greenish-grey silty clay with some yellow-brown mottling and numerous deep red and brick red, finely sandy streaks and patches. Firm. Moist.	57'	60'	40
			60'	61'	39
			61'	62'	40
			62'	63'	37
			63'	63'6"	36
63'6"	65'	Sealed Tube: As above	63'6"	65'	31
65'	69'	As above	65'	67'	35
			67'	68'	34
			68'	69'	36

END OF BORE

DEPARTMENT OF MINES
SOUTH AUSTRALIA

PERCUSSION TEST BORE NO. 29

Bore Serial No: PD680/61 **Docket:** DM 876/60

Location: Co-ordinates 4210'N & 4210'W **R.L. at Collar:** 271.24

Hundred: Noarlunga **Section:** 586 **Driller:** A. Sturak

Hirer: Vacuum Oil Company, Pty.Ltd. **Logged by:** A.A.Gibson

Plant: No. 41

Nominal Bore Diameter: 6" **Core Diameter:** 4"

Total Depth: 75 ft.

Date Commenced: 1.9.60 **Date Completed:** 5.9.60

Purpose: Investigation of foundation conditions at possible tank farm site, proposed oil refinery site, near O'Sullivan's Beach.

Depth From	Depth To	Description	Penetration Depth From	Penetration Depth To	Blows P/ft.
0	1'0"	Reddish-brown, fine sandy loam. Damp. Compact.	0	1'	30
1'0"	1'6"	Coarse, irregular, hard kunkar nodules with interstitial red-brown and brown loam. Compact. Damp.	1'0"	1'6"	42
1'6"	3'0"	Sealed Tube: Light brown silty and very finely sandy marl-earth, with occasional small kunkar nodules. Slightly damp.	1'6"	3'0"	14
3'0"	5'0"	Light reddish-brown, finely sandy marl-earth with occasional pale creamy-brown, very limey pockets and frequent small kunkar nodules. Compact, but friable. Slightly damp.	3' 4'	4' 5'	17 17
5'0"	6'6"	Sealed Tube: Light brown, finely sandy marl-earth, with frequent pockets of off-white earthy lime. Frequent very small kunkar nodules. Firm. Damp. Friable.	5'	6'6"	15
6'6"	8'0"	As above	6'6"	8'	20
8'0"	8'6"	Light brown and brown, vaguely mottled, finely sandy marl, with frequent small earthy lime pockets and occasional light grey mottling. Firm. Damp.	8'	8'6"	22
8'6"	10'	Sealed Tube: Upper part probably marl as above, lower part very sandy clay as below.	8'6"	10'	16

Bore No. 29 (cont.)

Depth From	Depth To	Description	Penetration Depth From	Penetration Depth To	Blows p/ft.
10'	13'6"	Red-brown, brown and yellow-brown, irregularly mottled, fine, very sandy clay, with a little pale greenish-grey clay. Becoming more clayey with depth. Firm moist.	10'	11'	22
			11'	12'	21
			12'	13'	22
			13'	13'6"	18
13'6"	15'	Sealed Tube: Upper part sandy clay as above, lower part clayey sand as below.	13'6"	15'	18
15'	18'6"	Brown, brick red, pale grey and brownish-yellow, irregularly mottled, clayey fine sand. Slightly friable. Firm. Moist.	15'	16'	20
			16'	17'	22
			17'	18'6"	23
18'6"	20'	Sealed Tube: As above, but pale grey to pale yellowish-grey colours becoming dominant. Clay content decreasing gradually. Firm. Moist.	18'6"	20'	20
20'	22'	As above	20'	22'	22
22'	33'	Pale yellowish-grey to pale grey, slightly clayey fine sand, with coarse, irregular, yellow-brown and brick red mottling. Damp. Very firm. Becoming drier and firmer with depth.	22'	23'	23
			23'	24'	29
			24'	28'	31
			28'	29'	32
			29'	30'	35
			30'	32'	34
			32'	33'	35
33'	35'	As above, but moist and friable.	33'	34'	35
			34'	35'	34
35'	38'	Brick red, yellow-brown and pale grey, coarsely mottled, slightly clayey fine sand. Very firm. Damp.	35'	36'	34
			36'	37'	36
			37'	38'	35
38'	41'9"	Pale yellowish-grey to pale grey, fine to medium grained sand. Slightly clayey. Occasional brownish-yellow and brick red coarse patches. Very compact. Damp.	38'	39'	35
			39'	40'	37
			40'	41'	36
			41'	42'	33
41'9"	44'6"	Pale greenish-grey, finely sandy clay, with a little fine, brownish-yellow and sparse red-brown mottling. Occasional very fine brown streaks. Firm. Moist.	42'	43'	32
			43'	44'	31
44'6"	45'6"	As above, but becoming very sandy, the sand being fine grained.	44'	45'	31
			45'	45'6"	32
45'6"	47'	Sealed Tube: As above.	45'6"	47'	27
47'	50'	Pale grey to pale greenish-grey, slightly clayey, fine sand with deep red and sparse yellow-brown mottling. Slightly damp. Very firm.	47'	48'	32
			48'	49'	33
			49'	50'	45

Bore No. 29 (cont.)

Depth From	Depth To.	Description	Penetration Depth From	Penetration Depth To	Blows p/ft.
50'	53'6"	Pale greenish grey fine sand, slightly clayey, with sparse brownish-yellow mottling. Moist. Compact, but easily friable.	50'	51'	33
			51'	52'	36
			52'	53'	35
53'6"	59'9"	Light greenish-grey, slightly sandy clay, with deep red and a little brown mottling. Firm. Moist.	53'	55'	33
			55'	57'	32
			57'	59'	33
			59'	60'	36
59'9"	61'6"	As above, but with abundant quartz gravel.	60'	61'	40
61'6"	62'	Light greenish-grey, deep red and yellow-brown mottled, finely sandy clay, with frequent very small slate and quartzite fragments. Very firm. Moist.	61'	62'	42
62'	71'	Completely decomposed slate. Dominantly pale greenish-grey and deep red streaked and mottled very silty clay, showing relic bedding nearly vertical. Unctuous feel. Moist, but very firm.	62'	66'	41
			66'	67'	40
			67'	68'	39
			68'	69'	41
			69'	71'	40
71'	75'	Brown, deeply weathered slate. Damp. Very firm to stiff. Friable.	71'	73'	41
			73'	74'	42
			74'	75'	41

END OF BORE

PERCUSSION TEST BORE NO 30

Bore Serial No. PD 691/61
Location: Co-ordinates 3750'N & 4210'W
Hd. Noarlunga Section 586

Plant: No. 41
Nominal Bore Diameter: 6"
Date Commenced: 5.9.60
Total Depth: 71 feet

Docket: DM 876/60
R.L. at Collar 271.04
Hirer: Vacuum Oil Company Pty. Ltd.
Driller: A. Sturak
Core Diameter 4"
Date Completed 7.9.60
Logged by: A.A. Gibson

Purpose: Investigation of foundation conditions at possible tank farm site proposed oil refinery site, near O'Sullivan's Beach.

Depth From	Depth To		Penetration Depth From To	Blows p/ fo
0" -	0'2"	Fine brown loam		
0'2" -	1'6"	Pale creamy brown and light brown vaguely mottled, incipient kunkar.	0-1 1-1'6"	20 22
1'6" -	3'0"	Sealed Tube: As above	1'6"-3'	19
3' -	5'	As above	3'-4' 4'-5'	20 22
5' -	6'6"	Sealed Tube: As above	5'-6'6"	23
6'6" -	8'	Reddish-brown, very sandy marl-earth, with frequent coarse, semi-cemented pockets of off-white earthy lime. Firm moist.	6'6"-7' 7'-8'	20 21
8' -	8'6"	Yellowish to reddish-brown very sandy clay with light greenish grey mottling. Firm. Moist.	8-8'6"	18
8'6" -	10'	Sealed Tube: Upper part as above merging to sandy clay as below.	8'6"-10'	20
10' -	12'	Red-brown and light greenish-grey finely mottled, finely sandy clay, with some thin brown streaks. Sub-prismatic structure. Firm. Moist.	10-11 11-12	24 24
12' -	13'6"	Deep red, pale greenish-grey red-brown and grey-brown irregular mottled, finely sandy clay. Occasional very thin brown streaks. Sub-prismatic structure. Firm, moist.	12-13' 13-13'6"	23 20
13'6"-	15'	Sealed Tube: Upper part as above lower part very sandy clay as below.	13'6"-15'	21

Bore No 30 Continued

Depth From	Depth To		Penetration From Depth		To	Blows p. ft.
15'	18'6"	Pale yellowish-grey fine, very sandy clay, with yellow-brown and grey-brown mottling. Very firm. Moist.	15'	-	17'	25
			17'	-	18'	28
			18'	-	18'6"	30
18'6"	20'	Sealed Tube: Upper part as above, lower part as below.	18'6"	-	20'	24
20'	22'6"	Light greenish-grey, finely sandy clay with yellow brown and sparse red-brown mottling. Developing small fine sand and silt pockets at base. Very firm. Moist.	20'	-	22'	28
			22'	-	23'	30
22'6"	28'	Pale yellowish-grey, slightly clayey fine sand, with brick red and yellow-brown mottling Clay content decreases with depth. Very compact Moist.	23	-	24'	29
			24	-	25'	31
			25	-	27	32
			27	-	28	34
28'	38'	As above, but medium grained	28	-	29	35
			29	-	30	34
			30	-	36'	36
			36	-	37'	37
			37	-	38'	38
38'	42'	Pale greenish-grey silty and slightly sandy clay with sparse yellow-brown and brownish yellow mottling. A few very fine, purplish-brown streaks. Very firm. Moist.	38	-	39'	35
			39	-	41	34
			41	-	42	33
42'	50'	Pale yellowish-grey slightly clayey, fine to medium grained sand, with occasional coarse brick red and yellow brown patches. Very firm. Moist.	42	-	43'	32
			43	-	44'	34
			44	-	45	35
			45	-	47'	36
			47	-	49	37
			49	-	50	36
50'	53'6"	Pale greenish-grey, slightly sandy clay, with yellow brown and deep-red mottling Sand content increasing gradually with depth. Occasional small fissures. Very firm. Moist.	50	-	51'	33
			51	-	53'	31
			53	-	53'6"	38
53'6"	55'	Sealed Tube: As above, merging to-	53'6"	-	55'	25
55'	58'	Pale to light greenish-grey, finely sandy clay with deep red and sparse yellow-brown mottling. Very firm. Moist.	55'	-	57'	32
			57	-	58'	33
58'	58'6"	Pale brown, slightly clayey, fine sand, with diffuse, brick red mottling. Very firm. Moist.	58	-	59'	32

Bore No 30 Continued

Depth From	Depth To	Description	Penetration Depth From	Penetration Depth To	Blows p. ft.
			Feet.		
58'6" -	67'	Decomposed slate. Pale grey silty clay with deep red streaks in places and sparse yellow brown mottling. Relic bedding with near vertical dip evident. Occasional small, hard residual fragments. Very firm, Moist.	59 -	61'	34
			61 -	62	33
			62 -	63	34
			63 -	64	33
			64 -	65'	35
			65 -	67	34
67' -	71'	Decomposed to strongly weathered slate. Pale grey, brown and deep red, streaked and mottled silty clay, with numerous harder residual weathered slate fragments, mainly purplish brown in colour and increasing in abundance with depth. Very firm. Moist.	67 -	68	33
			68 -	70	35
			70 -	71	34

END OF BORE

PERCUSSION TEST BORE NO 31

Bore Serial PD 692/61
Location: Co-ordinates 2970'N & 4675'W
Hd. Noarlunga Section 587

Plant No: 41
Nominal Bore Diameter: 6"
Total Depth: 67'

Docket DM 876/60
R.L. at Collar: 256.90
Hirer: Vacuum Oil Company Pty. Ltd.,
Driller A. Sturak
Core Diameter: 4"
Logged By: A.A. Gibson

Purpose: Investigation of foundation conditions at possible tank farm site, proposed oil refinery site near O'Sullivan's Beach.

Depth From	Depth To	Description	Penetration Depth From	Penetration Depth To	Blows p. ft
0	8"	Dark reddish-brown fine sandy loam Moist and moderately soft.	0	1	15
8"	1'	Red brown and dark red brown finely mottled, finely sandy clay. Firm Moist.			
1'	1'6"	Light red-brown and pale creamy brown mottled, finely sandy incipient kunkar, with some harder flaky kunkar patches. Firm but friable. Moist.	1	1'6"	16
1'6"	3'	Sealed Tube: Light greyish-brown incipient kunkar. Very firm. Moist Moderately friable.	1'6"	3'	20
3'	5'	Light greyish-brown to light reddish brown fine very sandy marl earth, with some pale creamy-brown mottling. Occasional very small, hard limey nodules. Moist. Moderately soft.	3' 4	4' 5'	12 12
5'	6'6"	Sealed Tube: As above	5'	6'6"	12
6'6"	7'	As above, but becoming clayey	6'6"	7'	16
7'	8'	Reddish brown and off white mottled finely sandy marl, Moist. Soft	7'	8'	12
8'	8'6"	Red-brown finely sandy clay with light greenish grey mottling and frequent thin brown streaks. Prismatic structure. Bright sheen on structural units. Moderately soft and moist.	8'	8'6"	12
8'6"	10'	Sealed Tube: As above, but becoming firmer.	8'6"	10'	22
10'	13'6"	Light greenish-grey, light red-brown red brown and light yellow brown mottled finely sandy clay, with some irregular thin brown streaks Sub prismatic structure. Moderately firm. Moist.	10' 11 12 13	-11' -12' -13' -13'6"	15 15 16 16

Bore No. 31 Continued

Depth From	To	Description	Penetration From	To Depth	Blows p. ft.
13'6"-	15'	Sealed Tube: As Above.	13'6"-	15'	23
15' -	16'	As above, but light greenish-grey colour becoming dominant.	15' -	16'	15
16' -	18'6"	Light greenish-grey, finely sandy clay, with deep red mottling. Sand content and mottling increasing with depth. Firm. Moist. Merging to--	16' 17' 18'	-17' -18' -18'6"	15 15 14
18'6"-	20'	Sealed Tube: Pale yellowish-grey clayey fine sand to sandy clay, with deep red and some yellow-brown mottling. Firm Moist.	18'6"-	20'	23
20' -	23'6"	Pale yellowish-grey, slightly clayey fine sand, with deep red and yellow brown mottling. Deep red patches are highly ferruginous. Very firm. Moist.	20' 21' 22 23'	-21' -22' -23' -23'6"	22 23 32 44
23'6"-	25'	Sealed Tube: As above	23'6"-	25'	28
25' -	27'	As above, but becoming firmer and drier with depth.	25' - 26' 26' - 27'		31 32
27' -	30'	Deep red, pale greenish-grey and pale yellowish-grey mottled, fine, very sandy clay, with some fine yellow-brown mottling. Sand, content increasing with depth. Very firm. Moist.	27' - 28' 28' - 29' 29' - 30'		32 32 31
30' -	44'	Pale yellowish-grey to off-white, slightly clayey fine sand, with coarse, irregular, deep red, yellow-brown and brick red mottling. Becoming coarser grained in the last 2ft. Very firm moist.	30' - 33' 33' - 34' 34' - 37' 37' - 39' 39' - 40' 40' - 44'		33 35 33 34 33 35
44' -	45'6"	Light greenish-grey, finely sandy clay with deep red mottling in upper part, becoming yellow brown and brown lower. Occasional sub-rounded quartz grit fragments. Very firm. Moist.	44' - 45' 45' - 45'6"		34 32
45'6"-	47'	Sealed Tube: As above	45'6"-	47'	29
47' -	49'	As above	47'	-49'	30
49' -	50'	Nearly completely decomposed slate. Pale purplish-grey, purplish-brown & yellow brown, streaked and mottled silty clay, with some residual weathered slate fragments. Relic bedding evident. Firm. Moist.	49'	-50'	31

Bore No 31 Continued

Depth From	Depth To	Description	Penetration Depth From	Penetration Depth To	Blo p.
50'	67'	Purplish-brown, strongly weathered slate. Clay development not very advanced. Mainly resembles very composed, slightly clayey fine silt beds with a near vertical dip. Very firm Moist.	50'	51'	3
			51'	53'	3
			53'	56'	3
			56'	58'	3
			58'	61'	3
			61'	67'	3

END OF HOLE

DEPARTMENT OF MINES
SOUTH AUSTRALIA

PERCUSSION TEST BORE NO. 32

BORE SERIAL NO: PD 693/61 DOCKET: DM 876/60

LOCATION: Co-ordinates 2550'N & 4410'W R.L. AT COLLAR: 260.95

HUNDRED: Noarlunga SECTION: 587 DRILLER: A.Sturak

HIRER: Vacuum Oil Company, Pty.

PLANT: No. 41 LOGGED BY: A.A.Gibson

NOMINAL BORE DIAMETER: 6" CORE DIAMETER: 4"

DATE COMMENCED: 9.9.60 DATE COMPLETED: 14.9.60

PURPOSE: Investigation of foundation conditions at possible tank farm site, proposed oil refinery site, near O'Sullivan's Beach.

Depth From	Depth To	Description	Penetration Depth From	Penetration Depth To	Blows p/ft.
0	1'0"	Dark brown to dark reddish-brown fine loam. Compact, Moist.	0	1'	15
1'0"	1'6"	Hard to moderately soft, off-white and light brown sandy kunkar, with pockets of dark brown loam. Compact. Moist.	1'	1'6"	14
1'6"	3'0"	Sealed Tube: Light brown, fine, very sandy marl-earth, with some pale brown mottling. Occasional small hard kunkar nodules. Compact but friable. Damp.	1'6"	3'0"	12
3'0"	4'0"	As above	3'0"	4'0"	14
4'0"	5'0"	Pale creamy brown, finely sandy marl earth, with off-white and light brown mottling. Frequent fine to coarse, hard, irregular kunkar nodules. Compact, but friable. Damp.	4'0"	5'0"	14
5'0"	6'6"	Sealed Tube: As above	5'0"	6'6"	15
6'6"	7'0"	As above, but nodules decreasing	6'6"	7'0"	14
7'0"	8'3"	Reddish-brown and pale creamy-brown mottled, finely sandy marl, with occasional very small, hard, limey nodules. Moist. Soft.	7'0" 8'0"	8'0" 8'6"	9 12
8'3"	8'6"	Red-brown and light greenish-grey finely mottled, very sandy clay with occasional brown streaks. Sub-prismatic structure. Firm Moist.			
8'6"	10'0"	Sealed Tube: As above	8'6"	10'	20
10'	13'6"	As above, but sand content increasing with depth.	10' 13'	13' 13'6"	22 24

Depth From	Depth To	Description	Depth From	Depth To	Blow p/ft
13'6"	15'0"	Sealed Tube: As above	13'6"	15'	23
15'0"	18'6"	Light greenish-grey, slightly sandy clay, with some red-brown, dark red and yellow-brown mottling. Occasional thin purplish-brown streaks. Sub-prismatic structure. Occasional fissuring. Firm. Moist.	15'	17'	17
			17'	18'	19
			18'	18'6"	20
18'6"	20'0"	Sealed Tube: As above, but becoming very sandy and mottling increasing.	18'6"	20'	20
20'0"	22'0"	Pale yellowish-grey, clayey, fine to medium grained sand, with deep red, brick red and yellow-brown mottling. Clay content decreasing with depth. Firm. Moist.	20'	21'	20
			21'	22'	22
22'0"	23'6"	Pale yellowish-grey, slightly clayey fine sand, with sparse pink, brown and brownish-yellow mottling. Firm Moist.	22'	23'	24
			23'	23'6"	26
23'6"	25'	Sealed Tube: As above	23'6"	25'	26
25'0"	30'0"	Pale yellowish-grey, slightly clayey fine sand, with coarse, deep red and yellow-brown mottling. Very firm. Damp.	25'	26'	24
			26'	28'	29
			28'	30'	31
30'0"	31'0"	Pale brownish-grey, slightly clayey fine sand, with a little brown mottling. Firm. Moist.	30'	31'	32
31'0"	33'6"	Light greenish-grey, finely sandy clay, with some coarse, dark red and yellow-brown mottling. Firm. Moist.	31'	32'	33
			32'	33'	32
			33'	33'6"	40
33'6"	35'0"	Sealed Tube: As above	33'6"	35'	28
35'0"	43'6"	Light greenish-grey, finely sandy clay with sparse yellow-brown and deep red mottling. Becoming very sandy with depth. Firm. Moist.	35'	37'	31
			37'	38'	32
			38'	40'	30
			40'	41'	31
			41'	43'	32
			43'	43'6"	30
43'6"	45'0"	Sealed Tube: As above, but very sandy	43'6"	45'	27
45'	47'	As above	45'	46'	31
			46'	47'	33
47'0"	49'0"	Pale grey, slightly clayey fine sand, with occasional coarse, dark red, ferruginous patches. Compact. Moist.	47'	48'	33
			48'	49'	32
49'0"	51'10"	Light greenish-grey finely sandy clay with some fine yellow-brown mottling Some coarse, dark red, ferruginous patches. Firm. Moist. Softer at base.	49'	50'	34
			50'	51'	33
			51'	52'	25

Depth From	Depth To	Description	Depth From	Depth To	Blows p/ft.
51'10"	52'2"	Pale yellowish-grey and deep red mottled, slightly clayey, medium grained sand. Moist.			
52'2"	61'0"	Decomposed slate, moist and moderately firm, becoming gradually firmer with depth.	52'	54'	34
			54'	55'	32
			55'	57'	33
			57'	58'	31
			58'	59'	30
			59'	60'	31
			60'	61'	32

END OF BORE

PERCUSSION TEST BORE NO. 33

Bore Serial No: PD 698/61

Docket D.M. 876/60

Location: Co-ordinates 1602N & 4872 'W
Hd. Noarlunga
Plant No: 41
Nominal Bore Diameter: 6"
Hirer: Vacuum Oil Company Pty. Ltd.,
Commenced: 14.9.60

R/L at Collar: 278.63
Section 602
Driller: A. Sturak
Core Diameter: 4"
Date Completed: 16.9.60
Logged by: A. Gibson

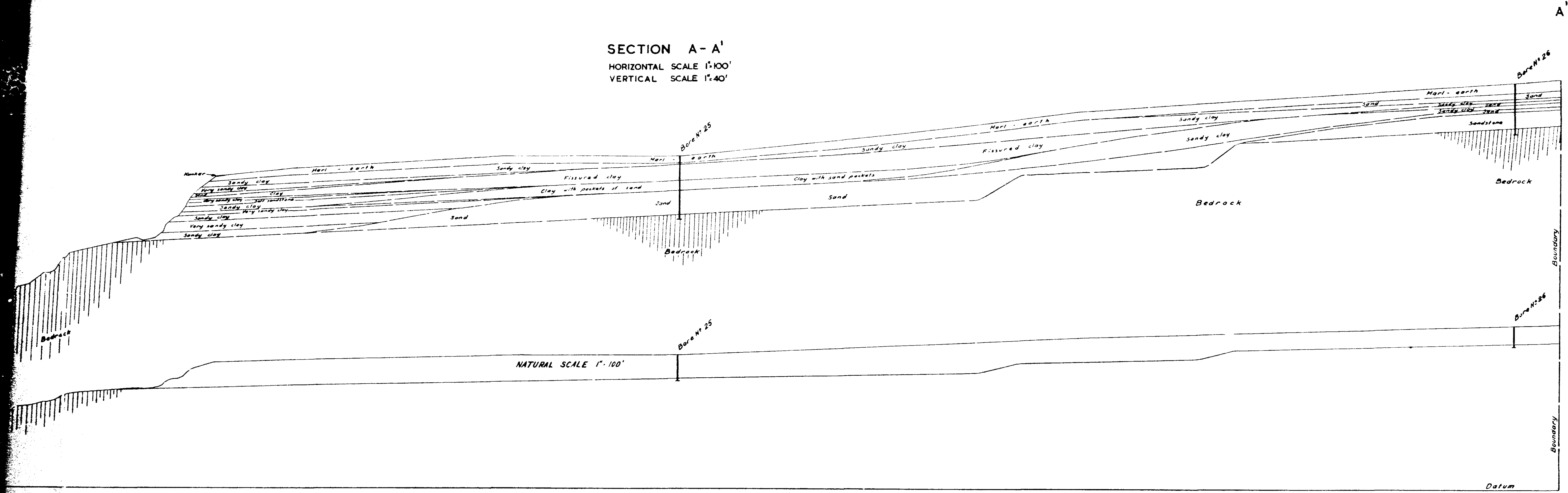
Purpose: Investigation of foundation conditions at possible tank farm site, proposed oil refinery site near O'Sullivan's Beach

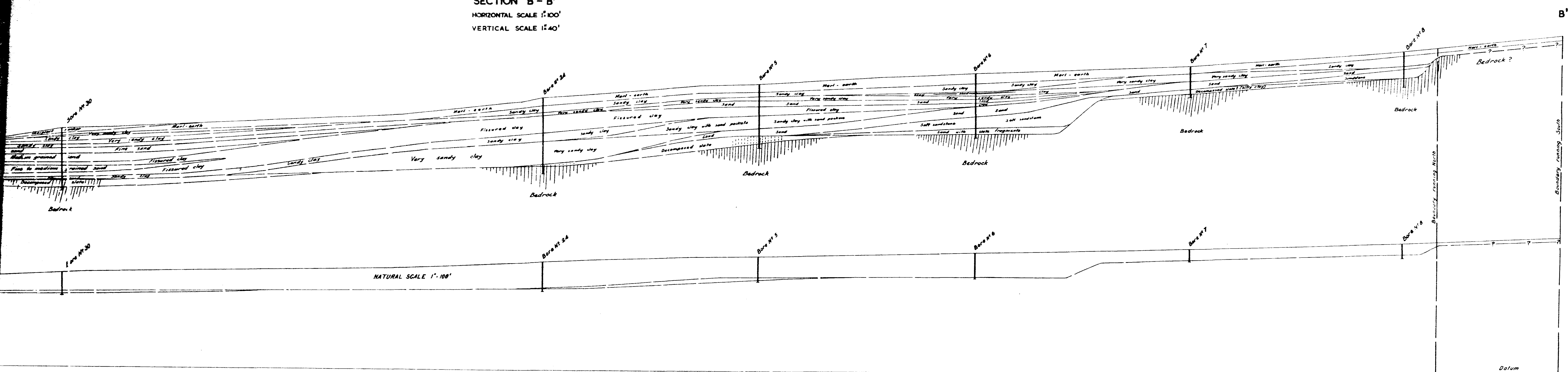
Depth From	Depth To	Description	Penetration Depth From	Penetration Depth To	Blows p. ft.
0	1'6"	Light brown soft kunkar, with pockets of dark brown loam and some harder patches. Firm. Damp.	0	1	24
			1'	1'6"	26
1'6"	3'	Sealed Tube: As above	1'6"	3'	12
3'	5'	Light reddish-brown and pale creamy-brown mottled, finely sandy marl-earth, with occasional small kunkar nodules Compact, Moist.	3'	4'	13
			4'	5'	12
5'	6'6"	Sealed Tube: As above but kunkar nodules increasing in number	5'	6'6"	16
6'6"	7'	As above, but with numerous very small kunkar nodules.	6'6"	7'	32
7'	8'	Pale greenish-grey, finely sandy marl with some reddish-brown patches and a little grey-brown mottling. Moderately firm. Moist.	7'	8'	15
8'	8'6"	Reddish-brown pale greenish-grey and grey-brown mottled, finely sandy and somewhat limey clay, with off-white, very limey pockets and occasional small hard limey nodules Moderately soft. Moist.	8'	8'6"	16
8'6"	10'	Sealed Tube: Pale red-brown, pale grey and pale greenish-grey mottled, finely sandy marl, with numerous reddish-brown pockets. Moderately soft, Moist.	8'6"	10'	16
10'	13'	As above but red-brown colour becoming dominant and clay content increasing, lime decreasing. Soft. Very moist.	10	11'	10
			11	12'	10
			12	13'	10
13'	13'6"	Red-brown and light greenish-grey mottled, fine, very sandy clay with numerous minute black specks. Moderately soft. Moist.	13	13'6"	12
13'6"	15'	Sealed Tube: As above but becoming firmer.	13'6"	15'	10

Depth From	Depth To	Description	Penetration Depth From	Penetration Depth To	Blow p.ft.
15'	17'	Red-brown, brick red and light greenish grey mottled, fine, very sandy clay. Sand content increasing with depth and light greenish-grey mottles diminishing. Moist. Moderately firm.	15'	- 16'	12
			16'	- 17'	12
17'	- 18'6"	Bright red, red brown and pale greenish grey irregularly mottled, clayey fine to medium grained sand. Developing some grey, grey-brown and yellow brown mottling with depth. Moderately firm. Moist.	17'	- 18'	14
			18'	- 18'6"	16
18'6"	- 20'	Sealed Tube: Pale yellowish-grey clayey fine to medium grained sand, with brick red, yellow-brown and brown mottling. Firm. Moist.	18'6"	-20'	24
20'	- 22'	As Above	20'	- 22'	22
22'	- 23'	Pale yellowish-grey, brick red, yellow brown and brown, coarsely and irregularly mottled, slightly clayey, fine to medium grained sand. Compact Moist.	22'	- 23'	27
23'	- 23'6"	Pale yellow-ish grey slightly clayey fine to medium grained sand with occasional brown mottling. Compact Moist,	23'	- 23'6"	28
23'6"	25'	Sealed Tube: As above	23'6"	- 25'	30
25'	- 28'3"	As above, but with deep red and yellow brown mottling.	25'	- 27'	28
			27'	- 28'	30
28'3"	- 33'6"	Pale greenish-grey, very silty and finely sandy clay, with some diffuse red-brown mottling. Occasional thin dark brown streaks. Sub-prismatic structure. Clay content decreasing with depth. Very. firm. Moist.	28'	- 29'	29
			29'	- 31'	30
			31'	- 32'	31
			32	- 33	32
			33'	- 33'6"	36
33'6"	- 35'	Sealed Tube: Pale yellowish to greenish-grey, slightly clayey fine sand and silt with some dark red and yellow brown mottling. Very firm. Moist.	33'6"	- 35'	28
35'	- 37'	As above, but mottling coarse	35'	- 37'	31
37'	- 43'	Light greenish-grey silty and finely sandy clay with some fine yellow-brown and sparse red- brown mottling. Very firm. Moist,	37'	- 39'	32
			39'	- 40	33
			40	- 42'	30
			42'	- 43'	33
43'	- 43'6"	Pale greenish-grey, somewhat clayey silt and fine sand, with some light greenish-grey and sparse yellow brown mottling, Very firm Moist.	43'	- 43'6"	34
43'6"	- 45'	Sealed Tube: As above but with dark red mottling.	43'6"	-45'	30
45'	- 46'	As above	45'	- 46'	33
46'	- 53'6"	Light greenish-grey, fine, very sandy & silty clay, with some dark red, yellow-brown, and purplish-brown mottling. Clay content gradually increasing with depth. Very firm. Moist.	46'	- 48'	33
			48'	- 50'	32
			50'	- 53'	33
			53'	53'6"	38

From	To	Description	Penetration Depth From	To	Blo p. f
53'6" -	55'	Sealed Tube Light greenish-grey finely sandy and somewhat silty clay. Some yellow-brown and sparse red-brown mottling. Occasional fissures. Very firm. Moist.	53'6" -	55'	
55' -	63'6"	As above	55' -	60'	
			60' -	63'	
			63' -	63'6"	
63'6" -	65'	Sealed Tube: As above	63'6"-	65'	
65' -	72'	Light greenish-grey very sandy clay with light red, red-brown and yellow brown mottling, pregnancy of mottling decreasing with depth. Numerous decomposed slate fragments and frequent, well rounded and fine gravel fragments (mostly quartz) Very firm. Moist. Becomes very moist and softer from 69' to 71'	65'	-67'	
			67'	-68'	
			68'	-69'	
			69'	-70'	
			70'	- 71'	
			71'	- 72'	
72' -	73'6"	As above but with occasional coarse, decomposed limestone patches	72' -	73'	
73'6" -	74'	Slightly weathered slightly sandy fossiliferous limestone (Pliocene)	73' -	74'	

END OF HOLE





SCALE IN FEET

SCALE IN METRES

To accompany report by A.A. Gibson

DATUM: L.W.O.S.T. = 100.0'

S.A. DEPT. OF MINES

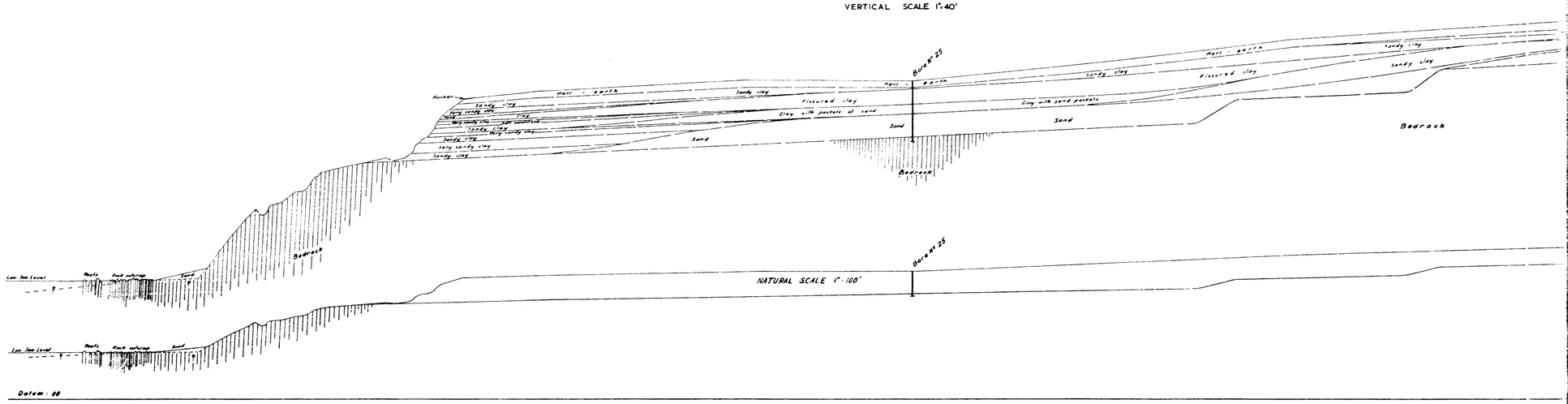
PROPOSED OIL REFINERY SITE, PORT STANVAC
VACUUM OIL Co PTY. LTD.
GEOLOGICAL SECTIONS A-A', B-B'

Associated Drawings	Amendment	Approved	Passed		
		Director of Mines		Drn. A.A.G. Tcd. G.S. Ckd. Exd.	Scale: As shown L 60-115 Hd 9 Date: 10-8-60

A

SECTION A - A'

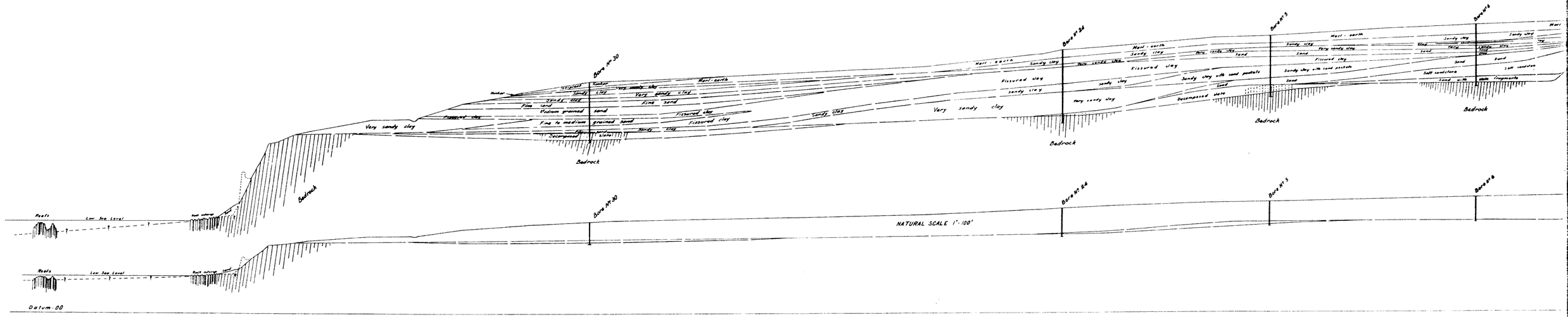
HORIZONTAL SCALE 1"-100'
VERTICAL SCALE 1"-40'



B

SECTION B - B'

HORIZONTAL SCALE 1"-100'
VERTICAL SCALE 1"-40'



SCALE IN FEET

SCALE IN METRES

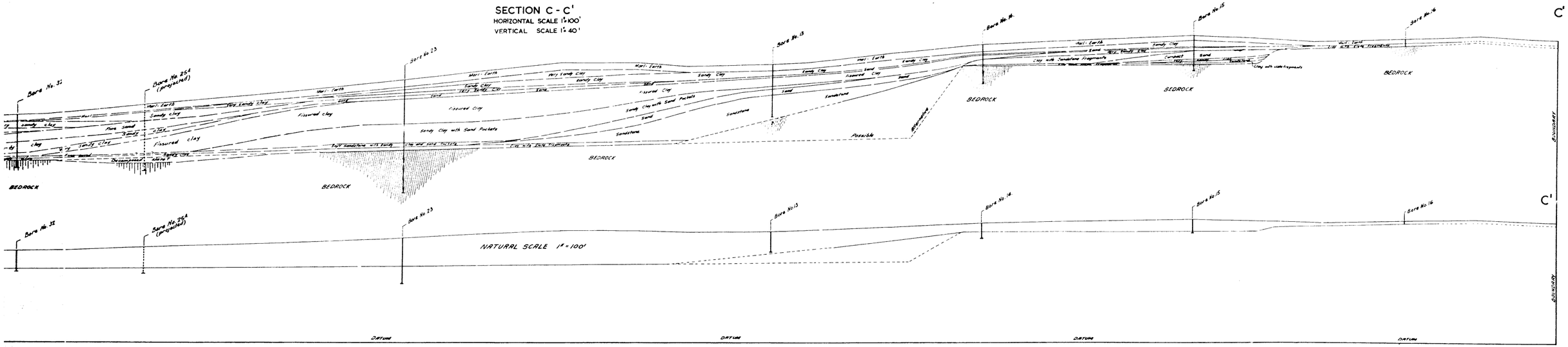
F 2

DATUM : L.W.O.S.T. - 100-8'

As orated Drawings	Amendment

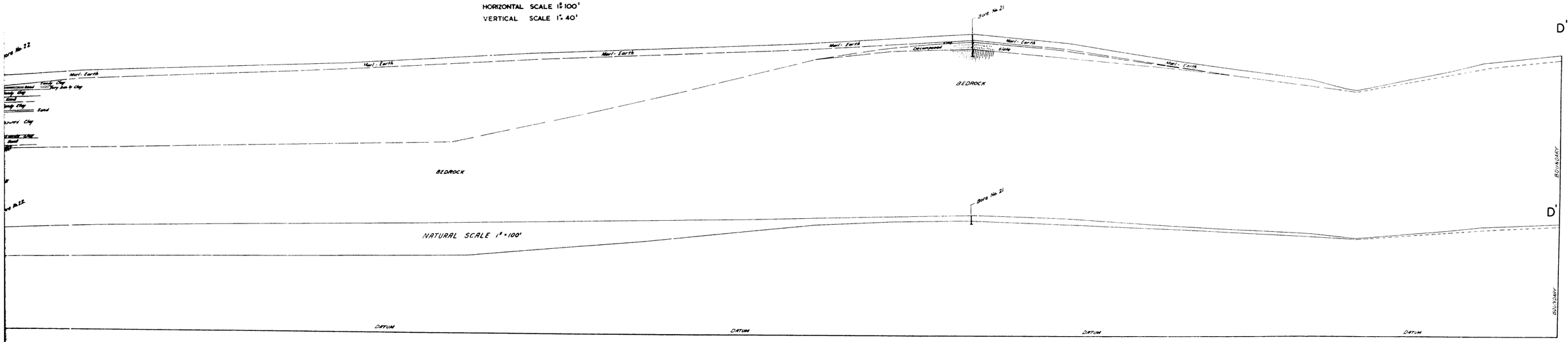
SECTION C - C'

HORIZONTAL SCALE 1" = 100'
VERTICAL SCALE 1" = 40'



SECTION D - D'

HORIZONTAL SCALE 1" = 100'
VERTICAL SCALE 1" = 40'



DATUM: L.W.O.S.T. + 108'

To accompany report by A.A. Gibson

S. A. DEPT. OF MINES

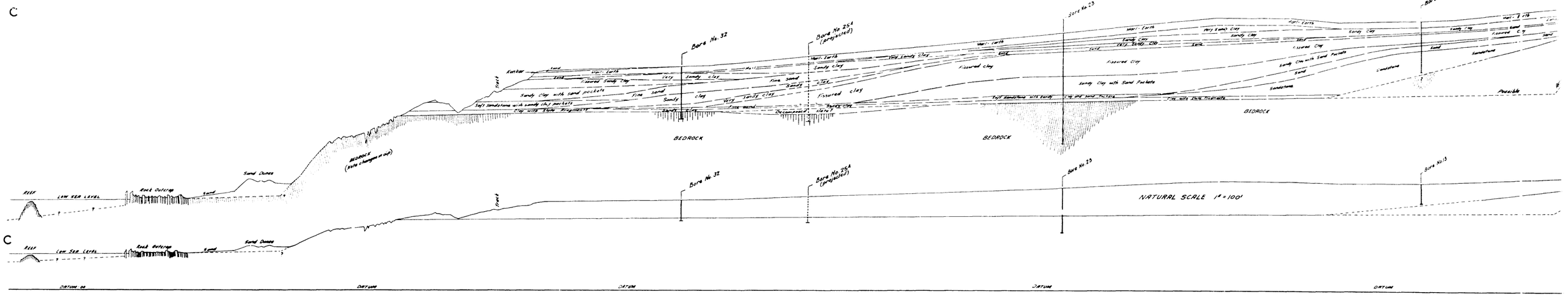
PROPOSED OIL REFINERY SITE, PORT STANVAC
VACUUM OIL Co PTY. LTD.
GEOLOGICAL SECTIONS C-C', D-D'

Associated Drawings	Amendment	Approved	Passed		Scale - As shown
				Drn. A.A.G.	L 60-116
		Director of Mines		Trd. A.D.W.	H.9
				Cad.	
				Ed.	Date: 12. 8. 60

F 1

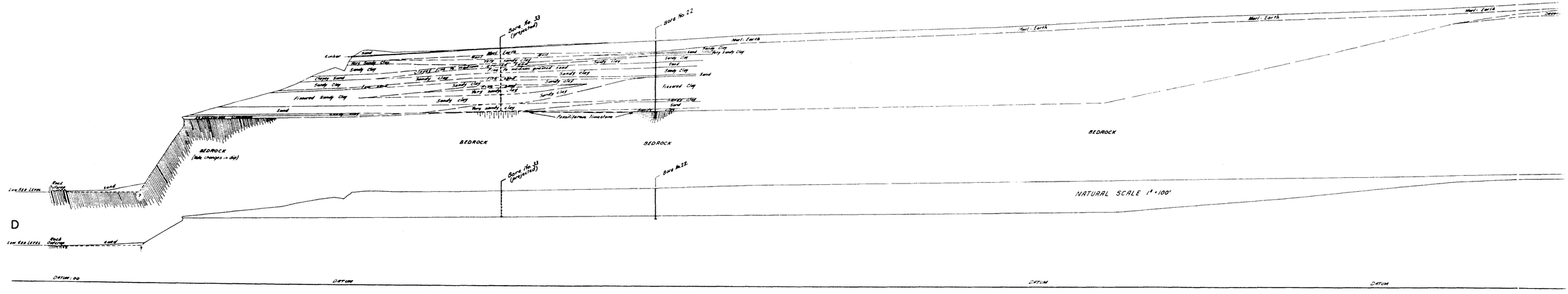
SECTION C - C'

HORIZONTAL SCALE 1" = 100'
VERTICAL SCALE 1" = 40'



SECTION D - D'

HORIZONTAL SCALE 1" = 100'
VERTICAL SCALE 1" = 40'



F 2

SCALE IN FEET
SCALE IN METRES

DATUM: L.W.O.S.T. + 108'

Associated Drawings

Amendment

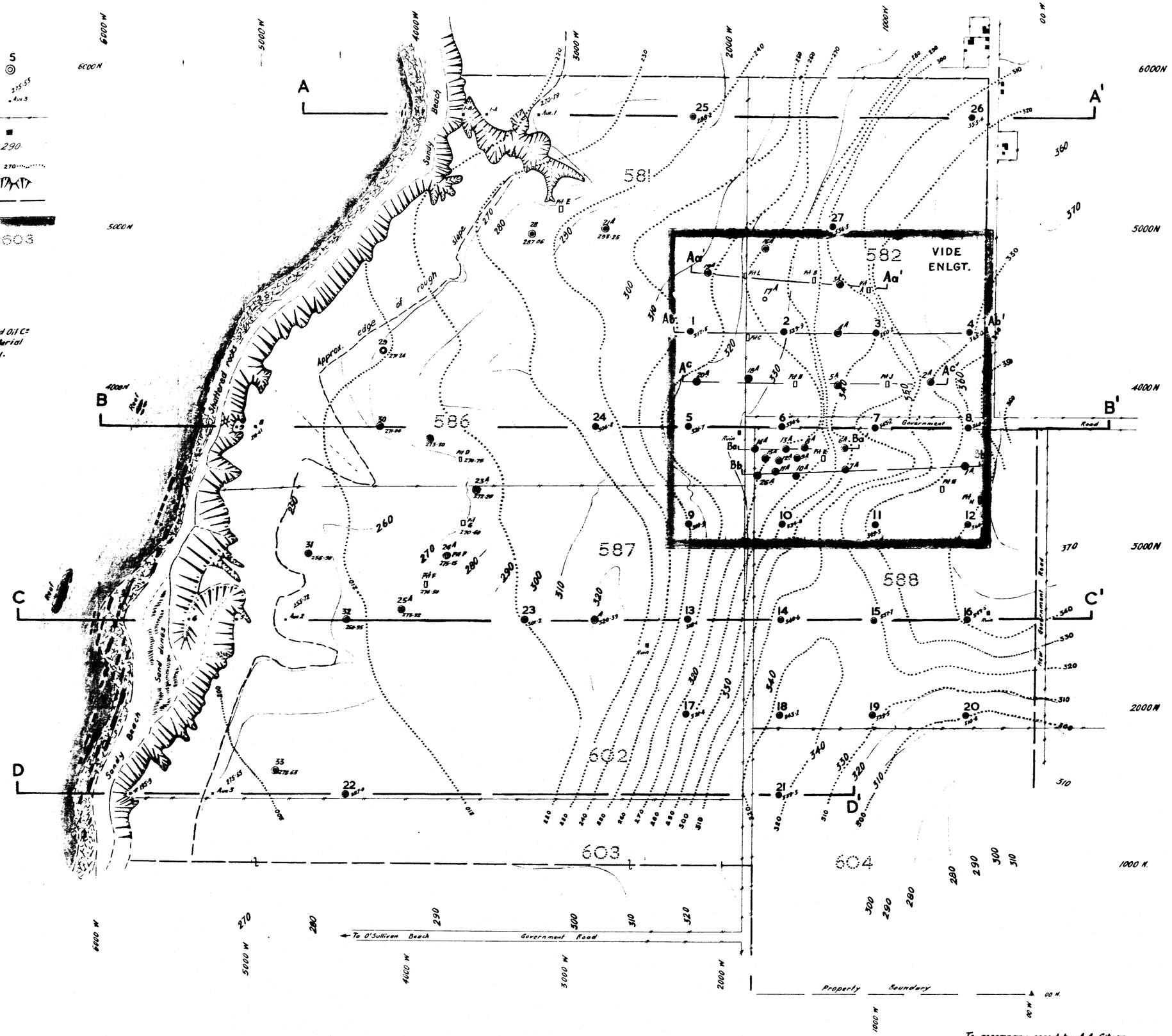
LEGEND

- Test bore — 5
- Reduced level — 275.55 Aux 3
- Survey peg
- Existing fence
- Existing buildings
- Surface contour — 290
- Approx. Bedrock subsurface contour — 270
- Approx. edge of cliffs
- Boundary of Refinery Site
- Boundary of Process Area
- Section N° shown thus — 603

Datum: LWOST 100·80

Compiled from Vacuum Standard Oil Co survey plans, Dept. of Land Aerial survey plan and fieldsurvey.

Stadia survey & levelling by G. Samuel. F.B. N° 126, L.B. N° 159.



To accompany report by A.A. Gibson

S.A. DEPT. OF MINES

400—7.58 2917

Sections				
"	Aa-Aa'	Ab-Ab'	Ac-Ac'	61·547
"	C-C'	D-D'		L60·116
"	A-A'	B-B'		L60·115
Enlargement				61·545

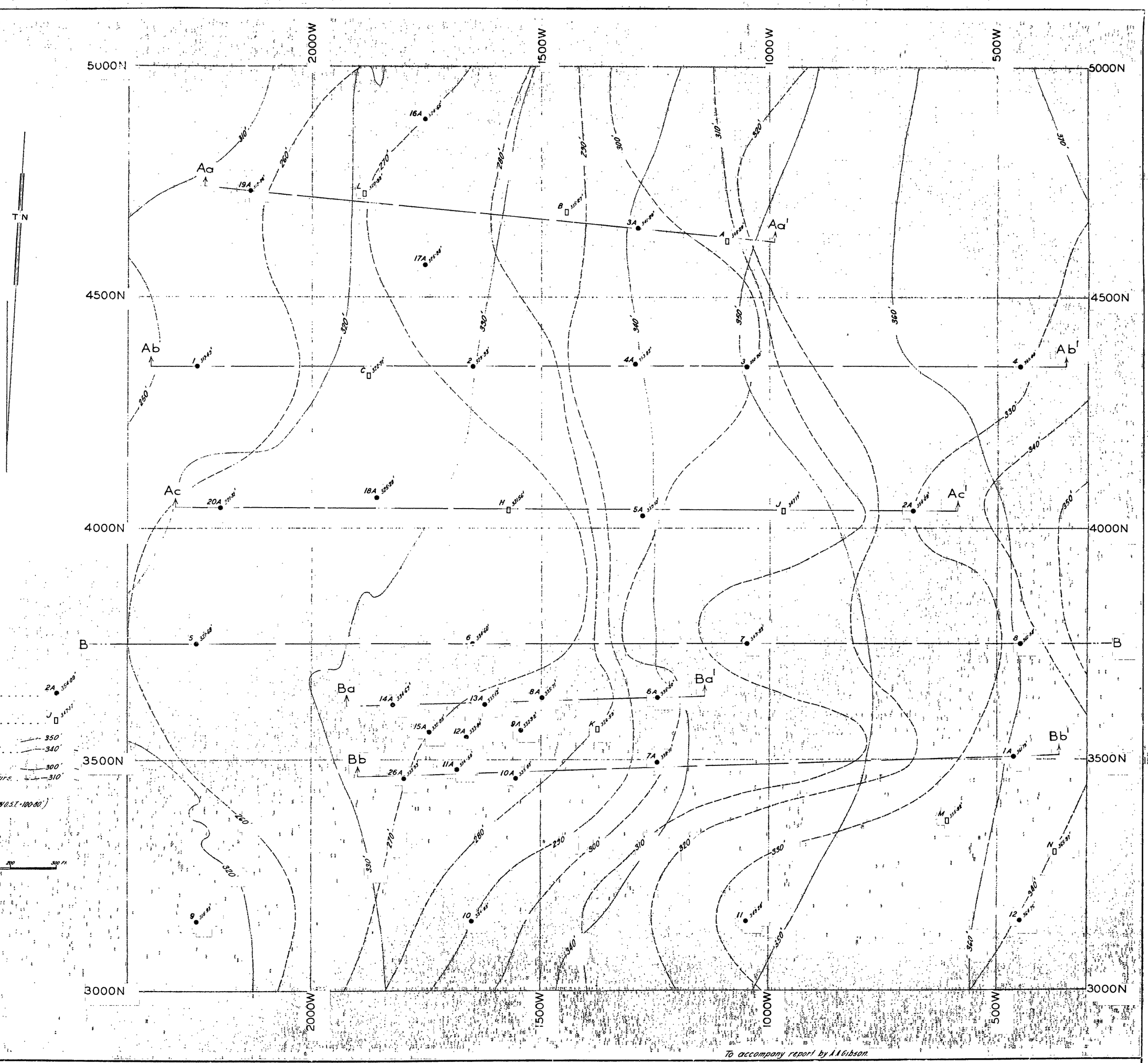
Associated Drawing	No.

No.	Amendment	Exd.	Date

Req. No.
D.M.
Compiled from

PROPOSED OIL REFINERY SITE
NEAR O'SULLIVANS BEACH S. A.
FOR
VACUUM OIL Cº PTY. LTD.
Hº NOARLUNGA

Approved	Passed		Scale: 400 ft to 1 in
		Drn. G.S.	60–446
		Tcd. G.S.	Ha 9
Director of Mines		Ckd.	
		Exd.	Date 26-7-60



To accompany report by A.A. Gibson.

S.A. DEPT. OF MINES

PROPOSED OIL REFINERY SITE
PORT STANVAC
FOR VACUUM OIL CO. PTY. LTD.
PROCESS AREA

Plan Whole Area 60-446

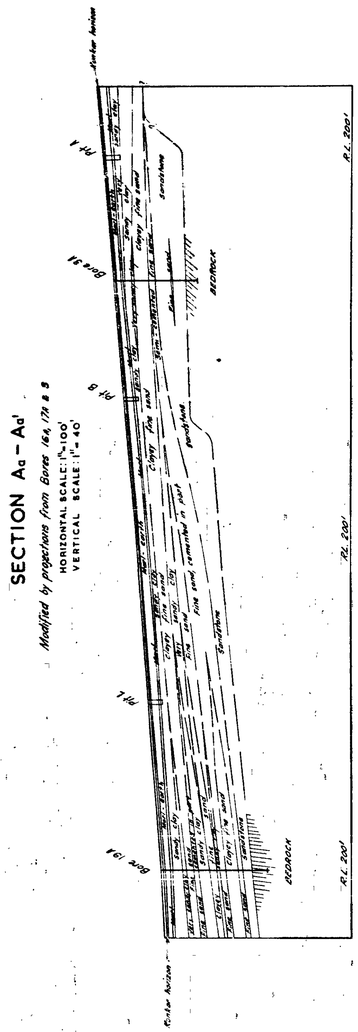
Associated Drawing | No. | No. | Amendment | Exd. | Date

Req. No.
D.M.
Compiled from

Approved | Passed
Director of Mines

Drn.
Tcd. M.B.L.
Ckd. A.A.
Exd.

Scale: 100 ft. to 1 in
61-545
No 9
Date 27-7-61



To accompany report by A.A. Gibson

S.A. DEPT. OF MINES

PROPOSED OIL REFINERY SITE, PORT STANVAC
VACUUM OIL Co. PTY. LTD.
GEOLOGICAL SECTIONS Aa - Aa', Ab - Ab' & Ac - Ac'

Associated Drawing	No.	No.	Amendment	Exd.	Date

Req. No.
D.M.
Compiled from

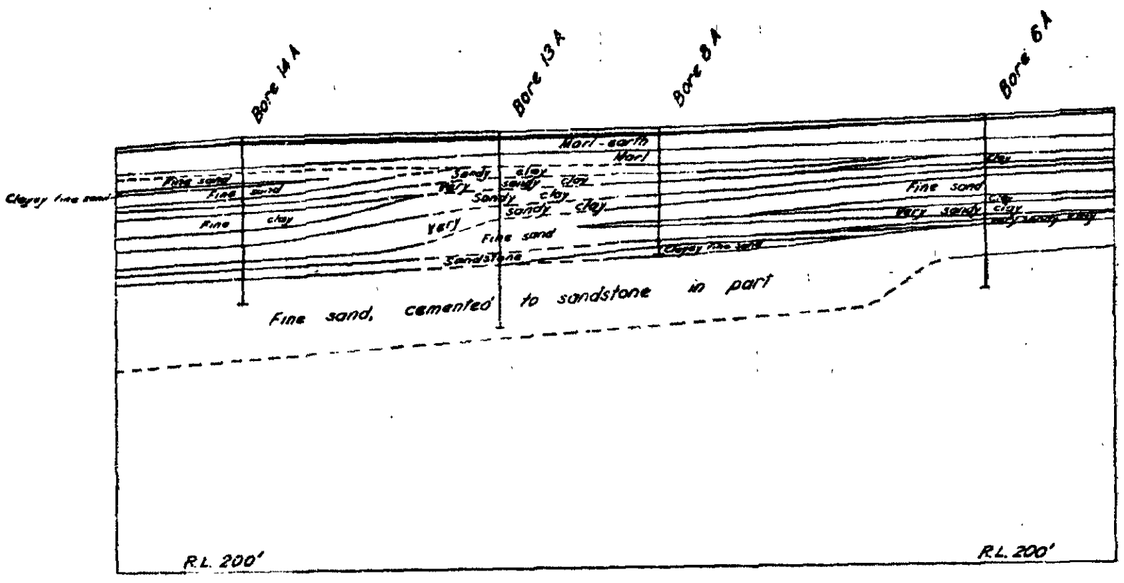
Approved
Passed
Director of Mines

Drn. A.A.G.
Tcd. A.O.W.
Ckd. R.R.
Exd.

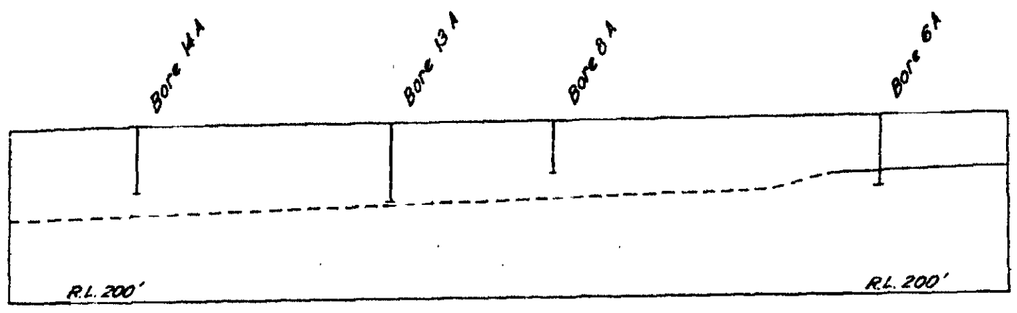
Scale: As Shown
61-546
Ha3
Date 27-7-61

SECTION Ba-Ba'

HORIZONTAL SCALE: 1" = 100'
VERTICAL SCALE : 1" = 40'

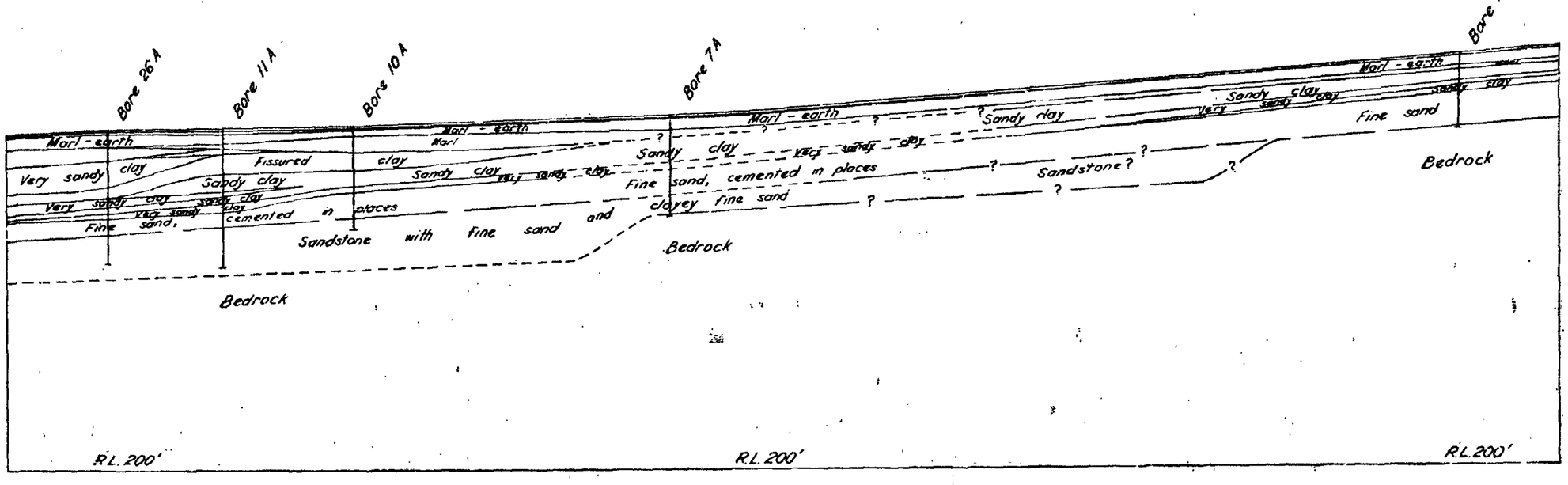


NATURAL SCALE

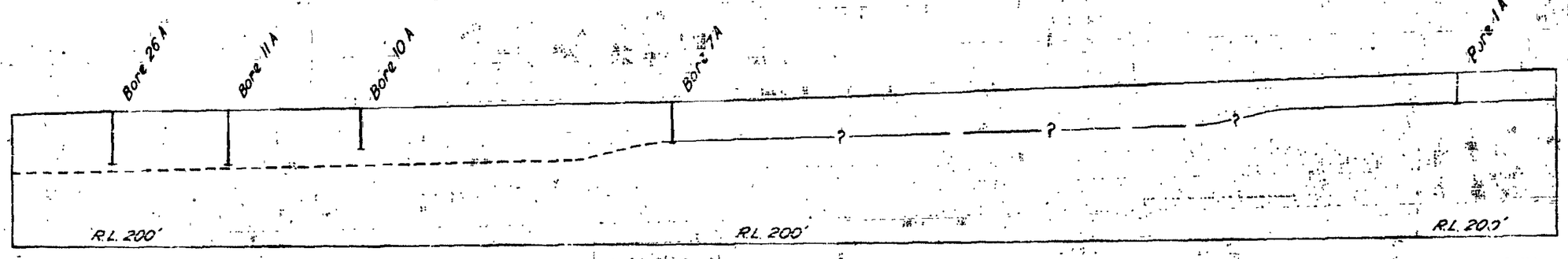


SECTION Bb-Bb'

HORIZONTAL SCALE: 1" = 100'
VERTICAL SCALE : 1" = 40'



NATURAL SCALE



To accompany report by A.A. Gibson

S.A. DEPARTMENT OF MINES

PROPOSED OIL REFINERY SITE, PORT STANVAC
VACUUM OIL CO. PTY. LTD.
GEOLOGICAL SECTIONS Ba-Ba', Bb-Bb'

Scale: As shown
61-547
Ha-9
Date 26·7·61

Drn. R.E.A.
Tcd. A.A.
Ckd.
Exd.

Approved
Passed
Director of Mines

Req. No.
D.M.
Compiled from

Associated Drawing | No. | No | Amendment | Exd. | Date