COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT

BUREAU OF MINERAL RESOURCES GEOLOGY AND GEOPHYSICS

RECORDS:

1967/85

RIVER FLAT ALLUVIUM, BLOCKS 3 and 24, PIALLIGO, AND BLOCKS 36 and 51, FYSHWICK. A.C.T.

by

D.E. Gardner

– 5928/65

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SUMMARY

Alluvial flats along the Molonglo River in Fyshwick and Pialligo, on the eastern side of Canberra, were formed through aggradation of the valley during the cold intervals of former climatic cycles, probably in late Pleistocene and early Recent times. Fairly clean sand and gravel-sand adjacent to the river channel were deposited during the cold interval that started the contemporary climatic cycle. They grade laterally into organic silt which, at a short distance from the river, covers silt, sand and gravel-sand deposited during earlier climatic cycles.

The organic silt appears to be suitable for use in top-dressing lawns and flower beds. The sand and gravel-sand adjacent to the river channel, after washing and screening, is used as fine aggregate for concrete. The older deposits of sand and gravel-sand are largely covered not only by the upper layer of organic silt, but also by grey and brown silt which would have to be removed before the deposits could be worked. The grey and brown silt has no prospective use.

At some distance from the river, the older alluvial deposits are locally clayey, and are of less value as a prospective source of aggregate than the sand and gravel-sand near the river.

INTRODUCTION

At the request of the Commonwealth Department of Works, Canberra, an investigation was made of the alluvium in the river flats in Blocks 3 and 24, Pialligo, and Blocks 36 and 51, Fyshwick. The area, on the eastern side of Canberra, is shown on a locality map on Plate 1. Block 3 is developed as a market garden, Block 24 as a plant nursery of the Parks and Gardens Section, Department of the Interior, and Blocks 36 and 51 as a dairy farm.

Block 3 is on the eastern half of a river flat, the western half of which (Block 2, Pialligo) was investigated by augering and drilling several years ago (Gardner, 1962).

METHODS OF TESTING

The present investigation was carried out by means of augering, hammer seismograph surveys, and drilling of cased boreholes. The augering and seismograph surveys were undertaken to gain preliminary information, at relatively low cost, on the nature and distribution of the alluvium; the cased boreholes are more costly and were used to sample the alluvium, and explore below ground-water level. Locations of test holes and seismograph traverses are shown in Plate 1. Cross sections, on which are summarized the results of the investigation, are plotted in Plates 2 and 3.

AUGERING

Augering was carried out early in 1965 with Gemco powered equipment, using a 4-inch diameter continuous flight spiral auger in six-foot lengths. A total of 76 holes, amounting to 769.5 feet were augered. Eighty four holes had been programmed; however, ten were in an area that was under crop, and were not augered.

For economy, nearly all holes were stopped at 10 feet, the depth attained with two auger flights; it was believed that sufficient information on the deeper alluvium would be obtained from the seismograph surveys and the cased boreholes. Few of the auger holes passed through the upper layer of alluvium, (silt and organic silt.)

SEISMOGRAPH SURVEYS

Hammer seismograph surveys were conducted along lines of auger holes in seven traverses perpendicular to the river. The equipment used was a Dynametric model 117A seismic timer. This records the first seismic impulse, with energy above a low threshold value, that reaches it after the timing unit has been activated.

A geophone was placed at one end of the traverse and hammer stations were sited at distances from it of 2.5 feet, 5 feet, 10 feet and multiples of 10 feet up to a distance of 100 feet. A reciprocal traverse was then done over the same section, with the instrument at the 100-foot station. This procedure was repeated over succeeding 100-foot intervals, until the traverse was completed. Time-distance curves were plotted, seismic velocities were determined and depths to refractors were calculated.

The seismic survey was hampered by background (seismic) noise coming from the nearby Canberra Airport. The gain, or amplification of incoming signals, had to be restricted to such a low value, to avoid recording of random signals, that, at most localities, only one refractor could be detected below the surface. Nevertheless, the seismograph results, plotted in section, provided a useful guide in extrapolating the boundaries laterally from their known positions, where intersected in the cased boreholes.

CASED BOREHOLES

The rig used consists of a heavily weighted sludge or sand pump ("chop" pump) fitted with a cutting shoe and a flap valve. The pump is driven into the ground by repeatedly dropping it from a tripod. The cutting shoe is about 12 inches in diameter and the casing about 16 inches. The four-foot lengths of casing were driven by means of a jarring hammer fitted, when required, to the chop pump.

Of the eight cased holes that were drilled, five reached bedrock and three bottomed in boulder-alluvium. Numerous small grab samples were taken of fine grained alluvium, and seven large samples of gravel sand. The latter were sent to the Department of Works Materials Testing Laboratory, Fyshwick, A.C.T., for sieve analysis.

TYPES AND DISTRIBUTION OF ALLUVIUM

GENERAL

Three types of alluvium occur in distinct layers below the surface: An upper layer of organic silt, an intermediate layer of grey silt and brown silt, and a bottom layer of sand and gravel-sand. At some distance from the river, towards the higher country (on the opposite side of the flat) the intermediate and bottom layers are locally clayey.

ORGANIC SILT

The organic silt consists of silt that is darkened by humus. Its colour ranges from black where fairly large proportions of humus are present, to grey where the silt is free from humus. Laterally, the colour of the silt, and presumably the proportions of humus, remains uniform over fairly wide areas. The proportions of humus within the silt have not been determined.

Commonly the organic silt contains small amounts of very fine sand, which locally, tends to be coarser grained and more abundant below a depth of about 8 feet. Some of the organic silt feels slightly clayey when moist; this is indicated, as appropriate, in the logs of test holes. In the samples that were examined, the quantities of clay, if present at all, would be small; probably a clayey feel can be expected of silt that is free from fine sand. Samples were not tested for clay in the laboratory.

The organic silt ranges in thickness from about 8 feet to as much as 18 feet, and is commonly about 10 feet thick.

GREY SILT AND BROWN SILT

The grey silt is presumably the alluvium from which both the organic silt and the brown silt were derived: the organic silt by the addition of humus and the brown silt by weathering and oxidation.

The layer of brown silt and grey silt is locally sandy and commonly it rests on sand or silty sand. At some distance from the river it tends to be clayey. It ranges in thickness from 4 to 15 feet.

SAND AND GRAVEL-SAND

Sandy alluvium beneath the silt is coarser at depth and grades into and is interbedded with gravel-sand. The particles or fragments in the gravel-sand range in size from that of fine sand to that of cobbles 4 to 6 inches in diameter. Silty fines occur locally, particularly in the upper layers. The coarsest alluvium is found near the bottom of the deposits, where some of the cobbles and boulders are probably too large to be picked up by the sampling equipment.

Like the layer of brown silt and grey silt, the gravel-sand is locally clayey at some distance across the flats from the river.

The layer of sand and gravel-sand ranges in thickness from about 10 to 20 feet in Blocks 3 and 24 and from 3 to 12 feet in Blocks 36 and 51.

Mechanical analyses of seven samples of gravel-sand are given in Appendix 1; cumulative curves based on these analyses are plotted in Fig. 1, Appendix 1. Size compositions of the samples derived from the cumulative curves are given in Table 1.

ORIGIN OF THE DEPOSITS

The hypothesis that follows, as to the origin of the alluvial deposits, was developed during an investigation of the river flats on Blocks 1 and 2, Pialligo, and in East Basin, Division of Parkes. It is summarized here to assist in interpreting the distribution of the several types of alluvium.

The river flats were formed during the cold periods of the climatic cycles in the late Pleistocene and early Recent. Although glacial conditions did not exist, probably even in the southern Highlands, winters were colder and longer. The effects on the soil of repeated freezing and thawing, combined with moister conditions giving rise to solifluction and increased run-off, greatly increased the rate of denudation in the catchments of the streams, and resulted in aggradation of the valleys. Broad, silty alluvial flats were built up and coarse alluvium consisting of sand grading downwards to gravel-sand, was deposited in favorable situations along the river channel. As the climatic cycle progressed, warmer and dryer weather brought a decrease in the rate of denudation in the catchment area; aggradation of the valley was replaced by denudation and the river flats were eroded. The upper layer of silt was reduced in thickness, and much of its humus was lost through oxidation. In places, particularly around the river channel, sand and gravel-sand was exposed where the silt had been completely removed; at these localities, sand was stripped away to expose

TABLE 1: Fyshwick-Pialligo Alluvium: Size Compositions of Samples of Gravel-Sand

Based on results of mechanical analyses (Appendix 1)

Locality	Borehole No.	Sample Depth (feet)	Designation of alluvial deposit	Size Composition, in Weights Per Cent, showing size range in millimetres						
				Cobbles 64-256	Pebbles 4-64	Very Coarse Sand 2-4	Coarse Sand 5-2	Medium Sand .25-.5	Fine Sand .06-.25	Silt and Clay Smaller than .06
Areas dealt with in this report	A	25	Qa2	2.5	63.5	7	17	2.5	4	3.5
	B	19-24	Qa3 or Qa4		61	10	19	5.5	2.5	2
	C	28	Qa2	6	70	10	10	2	1	1
	D	23	Qa3 or Qa4	2	49	8	19	7	4	11
	E	19-24	Qa2	2	50	16	18	4	4	6
	G	14	Qa2	1	55	8	18	4	5	9
	H	20	Qa3 or Qa4	10	71	4	6.5	1.5	2	5
Block 2, Pialligo	Average compositions	6.5-25	Qa2	9	35	9	30	4	5	8
		9-16	Qa3	3	20	21	24	8	10	14
		13-27	Qa4		40	22	28	4	4	6
		0-19.5	Qa1		18	6	45	10	9	12
Grading specification Standards Association of Australia Code No. A77-1957					0-17	0-31	4-40	9-61	3-34	

the coarsest alluvium, gravel-sand and gravel.

In the succeeding climatic cycle of cold followed by amelioration of frigid conditions, the sequence of events, with accompanying aggradation succeeded by denudation, was repeated. The river flat then consisted of newly deposited alluvium resting on earlier alluvium that had been partly eroded. From the surface downwards the succession of layers would not necessarily conform to the sequence - silt, sand, gravel-sand - that would be typical of a single period of aggradation. For example, the new upper layer of silt could rest on earlier silt, or sand, or it could rest directly on earlier gravel-sand.

The river flat on Block 2, Pialligo (Plate 1) represents four periods of deposition and erosion of which two are fairly recent and two are of some antiquity. The successive alluvial deposits were emplaced during the Quaternary Period and they may be referred to collectively by the symbol Qa. It is proposed that the deposits of each climatic cycle be distinguished by appending a numerical suffix to the symbol Qa. The present climatic cycle, which may be defined as having commenced with the last cold period, has progressed to warmer and dryer conditions. It may be designated cycle 1, and the alluvium deposited during the cold period is Qa1. The preceding cycle is cycle 2, during which alluvium Qa2 was deposited.

The most recent alluvium (Qa1), which has been termed "contemporary alluvium", consists of sand and gravel-sand adjacent to the present river channel and organic silt that extends across the river flats. The Qa2 alluvium is not much older than the Qa1. It consists of sand and gravel-sand, covered by silt that is up to 6 feet thick in the western part of Block 2 and 6 to 13 feet in the eastern part. Probably the uppermost layer consists of silt of the most recent river flat (the Qa1 flat), and the adjacent layer of silt of the Qa2 flat. It is not known whether the Qa1 silt and the Qa2 silt can be distinguished from one another. The Qa1 silt consists of organic silt and grey silt. Some brown silt below it is regarded as Qa2 silt that was oxidized during the erosion interval before the Qa1 silt was deposited. Probably, however, much of the Qa2 silt consists of organic and grey silt which is indistinguishable from the Qa1 silt.

The Qa2 sand and gravel-sand is locally yellowish or brownish in colour, and this distinguishes it from the Qa1 sand and gravel-sand, which is grey.

Remnants occur of at least one and probably two other units of the alluvium in the Molonglo Valley - Qa3 and Qa4 - deposited during two earlier climatic cycles (cycles 3 and 4). This older alluvium occurs at some depth below the surface adjacent to Qa2 gravel-sand, on the side remote from the river; it is covered by silt of climatic cycles 1 and 2. The constituents of the Qa3 and Qa4 alluvium - silt, silty sand and gravel-sand - commonly contain interstitial clay. However, much of the gravel-sand is free from clay, perhaps because of the washing action of seeping ground water. The less resistant of the clastic fragments commonly have weathered appreciably in situ. The alluvium is locally oxidized and in other places shows the green and blue colourations that are indicative of reducing conditions.

The Qa1 and Qa2 deposits are thought to be products of two climatic cycles in which the periods of alluviation - the cold periods - were separated by only a short interval of warmer climate and erosion. Possibly two sub-

cycles took place within a single broad climatic cycle. The earlier periods of alluviation were separated by much longer time intervals, during which the deposits were severely eroded and noticeably weathered.

The upper layer of black silt in the river flats is thought to have been deposited during the cold period of the present cycle (cycle 1); it was deposited on the slightly eroded surface of the Qa2 alluvium - mainly black and grey silt, locally oxidized and brown in colour. The Qa2 alluvium had, in turn, been deposited in an eroded surface of Qa3 alluvium, which consisted of (grey?) and brown silt, locally clayey, resting on gravel-sand. The Qa3 alluvium had been deposited on an eroded surface of Qa4 alluvium. This, the oldest of the alluvium in the river flat, is now characterized by large proportions of clay, by noticeable weathering of alluvial grains and pebbles, and by a broad colour variegation or mottling, with red colouration where oxidized and with blue and green colours elsewhere.

The successive river flats were deposited under similar conditions in the same restricted area, with essentially the same topography. The existing river flat occupies substantially the same position as the earlier flats, and the processes that tend to modify it probably operate in the same restricted localities. Modifications to the flat are likely to be repetitons of almost the same modifications to earlier flats. For example, a flood channel has been scoured along the north-western edge of the river flat in Blocks 36 and 51. One may assume that a channel was scoured during the preceding climatic cycle i.e. into the Qa2 silt of cycle 2. This seems to be verified by augering results and is mentioned in the description of Blocks 36 and 51.

DESCRIPTIONS OF THE DEPOSITS

BLOCK 3, PIALLIGO (MARKET CARDEN)

General

The results of an earlier investigation of Block 2, which adjoins Block 3, are summarized under Origin of Deposits; the approximate boundaries of deposits of Qa1 to Qa4 in Block 2 are sketched in on Plate 1. The northern part of Block 2 consists of an upper layer of silt (probably both Qa1 and Qa2 silt, mostly organic silt, of the last two periods of deposition, resting on clayey alluvium - silt, sand and gravel-sand (Qa3 and Qa4) - of the two preceding periods. The logs of auger holes on Block 3 suggest that the boundary of the clayey alluvium, passes between auger holes 45 and 46 and between holes 55 and 56.

The northern boundary of the flat passes between auger holes 43 and 42 and between holes 57 and 58. The holes north of hole 42 passed through dune sand and terminated at shallow depths on bedrock; those north of hole 57 remained, to the depth augered, in dune sand.

Organic Silt

The organic silt (probably both Qa1 and Qa2 silt) is about 15 feet thick at auger line 49-38 and 8 feet at line 54-59. In the south-western part of the flat it rests almost directly on sand and gravel sand (Qa2 alluvium); in the north-east it rests on an intermediate layer of brown and grey clayey silt (probably Qa3 and Qa4 alluvium).

Gravel-Sand

The term gravel-sand is intended, here, to include deposits of sand as well as the gravel-sand into which, typically, the sand grades at depth, but which has not been clearly distinguished by the sampling method that was used during the cased boring.

A narrow strip of fairly clean sand and gravel-sand (Qa1 alluvium) along the river bank was not tested. In Block 2, where it was more than 20 feet thick, this deposit was practically free from the usual silty overburden; it was transported to a nearby sandwashing and screening plant operated by Canberra Sand and Gravel.

North of this narrow strip of Qa1 alluvium, in the clay-free area of the river flat, the gravel-sand is at least 12.5 feet thick (in cased borehole E); it is covered by organic silt that ranges in thickness from 15 feet in the north to 8 feet in the south.

Farther from the river, the gravel-sand is locally clayey. It is covered by 3 to 8 feet of brown silt, which is locally clayey, and by the upper layer of organic silt, 8 to 15 feet thick.

BLOCK 24, PIALLIGO (PLANT NURSERY)

General

The narrow river flat in Block 24 seems to be fairly free of clayey alluvium, except in a thin strip adjacent to the higher ground, southwards from about auger line 79-75. Here, clay was found to be a constituent of the alluvium at depths of 4 to 9 feet.

In the east, the flat is bounded by rising ground that consists of ancient alluvium covered by dune sand; bedrock is probably at a shallow depth and presumably was encountered in auger hole 67. Auger holes 67, 75, and 83 passed through dune sand and entered ancient (Pleistocene?) alluvium at depths of 7 to 9 feet.

Organic Silt

The organic silt is about 14 feet thick near the northern end of the flat, at least 9 feet near auger line 79-75 and 3 to 8 feet at auger line 80-82.

Grey Silt and Brown Silt

Throughout the greater part of the river flat a layer of grey silt and brown silt occurs between the upper layer of organic silt and the bottom layer of sand and gravel-sand. It ranges in thickness from 2 feet to 5 feet.

Sand and Gravel-Sand

In the clay-free alluvium adjacent to the river, gravel sand is at least 15 feet thick in cased borehole G (which was stopped in gravel by boulders or cobbles). Within the belt of alluvium that is locally clayey, gravel-sand 16 feet thick was penetrated in borehole H. It is covered by

9.5 feet of silty sand. A layer of gravel-sand about 15 feet thick probably extends throughout the flat, covered by 8 to 14 feet of organic silt and 2 to 5 feet of brown and grey silt. The alluvium recovered from hole H contained only small proportions of clay, and probably most of the gravel-sand in the flat would be suitable for washing and screening.

BLOCKS 36 and 51, FYSHWICK (DAIRY FARM)

General

The river flat on Blocks 36 and 51 (Plate 1) consists of an area of alluvium, adjacent to the river, which is free from clay (presumably Qa2 alluvium covered by Qa1 organic silt), and an area remote from the river on which the alluvium is clayey at some depth below the surface (presumably remnants of Qa3 and Qa4 alluvium).

In Block 51, the three layers of alluvium - organic silt, brown silt, and gravel - sand are wedge-shaped in cross section and lens out completely against the sloping surface of the higher ground along the south-western edge of the flat. The rising ground at the edge of the flat consists of soil and weathered bedrock, and, locally, ancient alluvium. Auger hole 31 was entirely in ancient alluvium, hole 28 passed through ancient alluvium into decomposed bedrock, and holes 19 and 20 passed through river-flat silt into decomposed bedrock.

Organic Silt

In the clay-free area adjacent to the river, the organic silt (presumably Qa1 and Qa2 silt) is 6 to 8 feet and, exceptionally, 10 feet thick.

In the area that is underlain by clayey alluvium, the organic silt ranges in thickness from 8 feet at the northern end to 6 to 8 feet at the southern end. Near the western edge of the flat, from about auger line 12-8 northwards, the layer of black silt thickens where presumably it fills a flood channel that had been scoured in the earlier flat. A channel has been scoured in the present-day flat in almost the same position. The thickening of the black silt is seen in auger holes 1, 4, 5 and 12.

Brown Silt and Grey Silt

A layer of brown silt and of grey silt passing downwards into sandy silt and silty sand occurs between the top layer of organic silt and the bottom layer of sand and gravel sand. In the clay-free area adjacent to the river it is 10 to 12 feet thick; in the area remote from the river it is locally clayey, and is 7-10 feet thick.

Sand and Gravel-Sand

In the clay-free area adjacent to the river the gravel-sand is 11 feet thick at cased borehole A and 7 feet at hole C. It is covered by 10 to 12 feet of grey and brown silt and sand, and about 12 feet of organic silt.

In the area remote from the river, the gravel-sand is clayey, and ranges in thickness from 10 feet in borehole B to 6 feet in hole D. It is covered by 7 to 10 feet of brown silt and silty sand, locally clayey, and 5 to 8 feet or organic silt.

QUALITY OF ALLUVIUM

GENERAL

The term quality refers to the suitability of the alluvium or of types of alluvium for horticultural or industrial use on a commercial scale. The types of alluvium which have prospective uses are the organic silt, for use on lawns and gardens, and the sand and gravel-sand, for use mainly in aggregate for concrete.

ORGANIC SILT

Organic silt has a prospective use in garden beds and as a top-dressing for lawns. For this purpose the silt should contain a large proportion of humus, be free of clods and have sufficient sand to render it reasonably workable, permeable and free draining, and firm underfoot when wet. Clay, which would decrease the ease of application and the permeability, and also the firmness when wet, is an undesirable constituent. The organic silt from the river flats could be successfully used. By working a pit at least 8 feet deep, a mixture would be obtained of black and dark grey silt, and of the sandy silt that frequently is encountered at the bottom of the organic silt.

SAND AND GRAVEL-SAND

General

The sand and gravel-sand in the clay-free area of each flat would be suitable for washing and screening. If the organic silt were removed for top dressing, the gravel-sand could be economically worked provided that it were not covered by too thick a layer of grey and brown silt.

In the clayey belt within each flat, the gravel-sand is covered by 7 to 10 feet of grey and brown silt, locally clayey. Were it desirable to strip the alluvium from this area, an attempt could be made to exploit the gravel-sand by extending into it any pit that might already have been opened up in the adjacent clay-free area.

Specification for Fine Aggregate, S.A.A. Code No. A77-1957

Size Grading

The mechanical analyses of seven samples of gravel-sand, together with the grading specification for fine aggregate, Standards Association of Australia Code No. A77-1957, are tabulated in Appendix 1. It can be seen that 26 to 62 per cent by weight of the samples passes the $\frac{3}{8}$-inch British Standard Sieve, and hence satisfies the specified upper limit in grain size. The calculated size composition in weight per cent of the aggregate that remains after screening out the oversize pebbles is given in Table 2. S.A.A.

TABLE 2: Pialligo-Fyshwick Alluvium: Mechanical Analyses of Gravel-Sand After Discarding Gravel Larger than $\frac{3}{8}$-inch

	Areas Dealt With In This Report							Block 2, Qa1 Sand and Gravel-Sand 0-19.5'	S.A.A. Grading Specification 6
	A 25'	B 19'-24'	C 28'	D 23'	E 19'-24'	G 24'	H 20'		
$\frac{3}{8}$-inch	100	100	100	100	100	100	100	100	100
$\frac{3}{16}$-inch	86	82	83	84	84	88	77	94	90-100
No.7	71	62	57	71	60	73	62	88	60-100
14	49	44	28	60	37	56	47	69	30-100
25	27	24	15	40	24	39	35	40	15-100
36	22	16	9	33	21	33	31		
52	20	10	6	26	18	29	27	26	5-50
100	15	6	3	21	13	21	23	19	0-15
200	10	4	3	18	10	17	19	15	

rded on sample bag by driller

ds Association of Australia, Specification for fine Aggregate, Code No. A77-1957

Code No. A77-1957 (given in Table 2) specifies the permissible content of fines by the requirement that 0 to 15 per cent by weight may pass British Standard Sieve No. 100. All except two of the samples contain excess clayey and silty fines.

The oversize material and the excess fines could be removed on a sand washing and screening plant. Appendix 1 shows that 38 to 74 per cent (average 46 per cent) by weight of the material in the samples would have to be screened out. Table 2 shows that 9.8 per cent of the remainder, or just over 5 per cent of the original samples consists of excess fines. In a sand washing plant this would be easily removed; generally too large a proportion of the fines is lost.

Dust and Other Fine Material

The test, described in Appendix H of Standards Association of Australia Code No. A77-1957 applies to the determination of the total quantity of dust or other fine material in fine aggregate. A representative sample about 500 grams in weight after drying is covered with water, agitated vigorously for 15 seconds, and the water is poured off through a B.S. Sieve No. 200. This process is repeated until the wash-water is clear; loss in weight, per cent, is calculated.

The test requires that not more than 3 per cent will decant through the B.S. 200 sieve.

The figures of Table 2 show that excessive quantities of fine material, or dust, are present in most of the gravel-sand samples. However, this material would be removed during washing and screening.

Organic Matter

The test, described in Appendix K of Code No. A77-1957 is an approximate test for the presence of injurious organic compounds in natural sands for cement mortar or concrete. The gravel-sand samples were not tested for organic matter. Organic matter is known to be present in the samples; probably it would be reduced sufficiently in amount during washing, but this has not been demonstrated.

DIMENSIONS AND QUANTITIES

Estimates of dimensions and quantities, based on the interpreted positions of boundaries as shown in Plates 1 to 3, are given in Table 3.

UTILIZATION OF THE ALLUVIUM

In the areas that are free from clay, it is probable that all the organic silt, and the sand and gravel-sand could be profitably exploited.

It would be necessary to demonstrate, on a pilot scale, that such an operation would be payable. Suggested sites for starting pits are given in Table 4.

TABLE 3: Fyshwick-Pialligo Alluvium : Summary of Dimensions and Quantities

Locality	Type of Alluvium	Dimensions of deposit (feet) Length	Width	Area Square Yards	Approx. Average Thickness (feet)	Quantities Cubic Yards
Pialligo, Block 3:	Most recent (Qa1) sand and gravel-sand	900	Tapers from 150 to 0	7,500	18	45,000
Area of clay-free alluvium	Organic silt	1200	Tapers from 450 to 0	50,000	12	200,000
	Brown and grey silt	600	Tapers from 120 to 0	4,000	2	3,000
	Sand and gravel-sand	Some as organic silt		50,000	18	300,000
Area locally clayey at depth	Organic silt	1400	Tapers from 450 to 0	40,000	9	120,000
	Brown and grey silt	"	"	"	5	65,000
	Sand and gravel-sand	"	"	"	14	180,000
Pialligo, Block 24						
Area of clay-free alluvium	Organic silt	3000	Ranges from 500 to 200	80,000	11	290,000
	Brown and grey silt	"	"	"	5	130,000
	Sand and gravel-sand	"	"	"	12	320,000
Area Locally clayey at depth	Organic silt	1700	Tapers from 150 to 0	14,000	7	30,000
	Brown and grey silt	"	"	"	6	28,000
	Sand and gravel-sand	"	"	"	11	50,000
Fyshwick, Blocks 36 and 51						
Area of clay-free alluvium	Organic silt	4000	Ranges from 500 to 150	125,000	9	380,000
	Brown and grey silt	"	"	"	9	380,000
	Sand and gravel-sand	"	"	"	8	340,000
Area locally clayey at depth	Organic silt	4000	Ranges from 500 to 150	160,000	8	420,000
	Grey and brown silt	"	"	"	6	320,000
	Sand and gravel-sand	"	"	150,000	8	400,000

TABLE 4: Suggested trial pits

Locality	Suggested Site for Pit
Pialligo, Block 3	Close to river at southern end of Kallaroo Road, in fairly clean Qa1 sand and gravel-sand. This pit could extend across the flat into Qa2 sand and gravel-sand, from which the organic silt had been stripped.
Pialligo, Block 24	Near site of cased hole G.
Fyshwick, Blocks 36 and 51	Near site of cased hole A, or alternatively near site of auger hole 7 or hole 3.

REFERENCE

GARDNER, D.E., 1962 - Sand and gravel investigation, Block 2, Pialligo, A.C.T. Bur. Min. Resour. Aust. (unpubl.).

APPENDIX 1. Pialligo and Fyshwick Alluvium: Mechanical Analyses of Samples of Gravel-Sand by Department of Works Materials Testing Laboratory, Fyshwick, A.C.T.

Locality		Areas Dealt with in This Report							Block 2 ≠				S.A.A.
Hole No.		A	B	C	D	E	G	H	Qa2	Qa3	Qa4	Qa1	Grading
Depth (feet)*		25'	19-24	28	23	19-24	24	20	6.5-25	9-19.5	13-27	0-19.5	Specification ∅
British standard sieve, and per cent passing sieve	6-inch			100				100					
	3-inch	100	100	96	100	100	100	94	100	100		100	
	1½-inch	75	91	63	88	82	89	58	76	89	100	98	
	1-inch	-	-	-	-	-	-	-	71	88	93	93	
	¾-inch	52	66	38	74	72	67	41	68	87	93	91	
	⅜-inch	40	50	31	61	62	52	26	64	82	92	88	100
	3/16-inch	35	41	26	51	52	46	20	58	70	65	83	90-100
	No.7	29	31	18	43	37	38	16	50	59	47	78	60-100
	14	20	22	9	36	23	29	12	35	48	28	61	30-100
	25	11	12	5	24	15	20	9	19	35	16	35	15-100
	36	9	8	3	20	13	17	8					
	52	8	5	2	16	11	15	7	14	26	11	23	5-50
	100	6	3	1	13	8	11	6	11	19	8	17	0-15
	200	4	2	1	11	6	9	5	9	15	6	13	

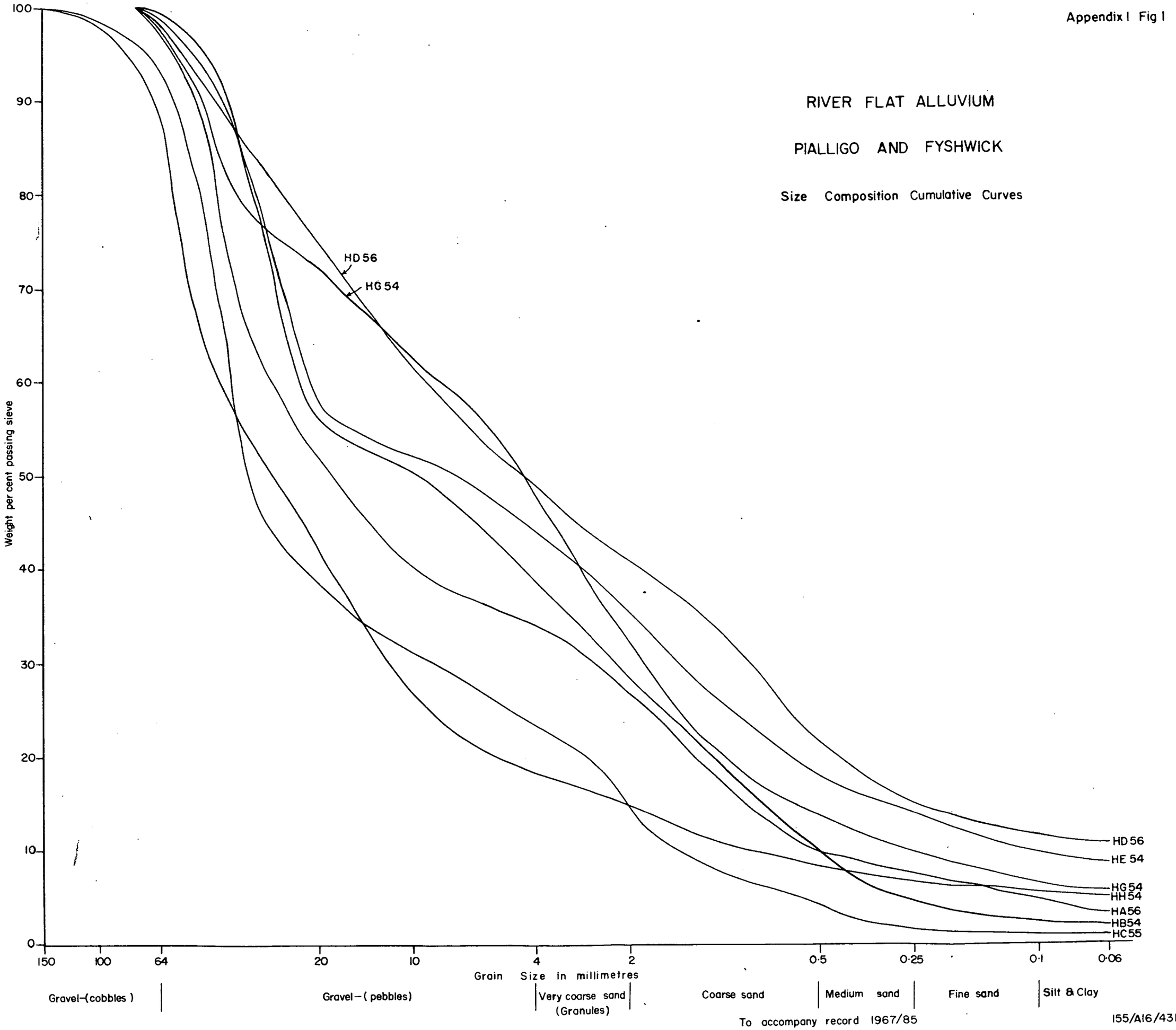
* As recorded on sample bag by driller
≠ Small samples of gravel-sand and some of the finer-grained alluvium above it
∅ Standards Association of Australia Code No. A77-1957

Appendix I Fig I

RIVER FLAT ALLUVIUM

PIALLIGO AND FYSHWICK

Size Composition Cumulative Curves



To accompany record 1967/85

155/A16/431

APPENDIX 2

ALLUVIUM AT FYSHWICK AND PIALLIGO

LOGS OF AUGER HOLES

DESCRIPTION

Hole No.	From (feet)	To	(Materials that occur in small proportions are bracketed)
1	0	8	Grey silt
	8	10+	Black silt
2	0	6	Organic silt
	6	8	Organic silt with clay
	8	9	Brownish medium-grained sand with some silt, organic
	9	10	Coarse sand
	10	11	Organic silt and (clay)
	11	+	Organic silt, some medium sand
3	0	2	Fine sand and (silt)
	2	9	Black silt
	9	10+	Medium, pale, cream sand and (silt)
4	0	7	Grey silt
	7	10+	Black silt
5	0	2	Black silt
	2	10	Black silt and clay, wet at 4'
6	0	2	Dark silt and (very fine sand)
	2	6	Black silt and (very fine sand)
	6	8	Black silt and (clay?)
	8	10+	Brown silt
7	0	8	Black silt and (very fine sand)
	8	10+	Pale brown medium sand, fairly clean
8	0	1.5	Fine sand and silt
	1.5	3	Black silt
	3	8.5	Organic silt and (clay)
	8.5	10	Medium sand and (silt)
9	0	3	Brown silt and (very fine sand)
	3	8	Black silt and (very fine sand)
	8	9	Dark to black silt and (very fine sand)
	9	10+	Pale silt and (fine and medium sand, fairly clean)
10	0	4	Silt and (very fine sand)
	4	6	Dark to black silt and (very fine sand)
	6	8	Black silt and (clay)
	8	10+	Brown silt and clay
11	0	2	Black silt
	2	4	Grey silt
	4	6	Dark silt
	6	8	Very dark to black silt and (clay)
	8	9	Brown silt
	9	10	Medium-grained sand and silt

Hole No.	From (feet)	To	
12	0	8	Black silt
	8	10+	Brown silt
13	0	4	Grey to very dark silt and (very fine sand)
	4	9	Very dark silt
	9	10+	Black silt and (clay?)
14	0	5	Black silt and (very fine sand)
	5	7	Dark silt
	7	9	Grey silt and (fine sand)
	9	10	Pale brown medium sand, fairly clean
15	0	6	Very fine sandy silt, grey
	6	10+	" " " " , brown
16	0	2	Very fine sandy silt, brown
	2	4	Dark, very fine sandy silt
	4	8	Dark silt
	8	10+	Dark silt and (very fine sand)
17	0	2	Brown silt and (very fine sand)
	2	5	Black silt and (very fine sand)
	5	7	Black silt
	7	8	Black silt and (clay)
	8	10+	Brown silt and (medium sand)
18	0	5	Grey silt
	5	7	Black silt
	7	8.5	Black silt and (clay?)
	8.5	10+	Brown silt
19	0	2	Dark silt
	2	4	Brown silt
	4	6+	Decomposed bedrock, volcanic
20	0	5	Brown silt and (very fine sand)
	5	6+	Decomposed bedrock, volcanic
21	0	1	Black silt and (very fine sand)
	1	5.5	Black silt
	5.5	6	Black silt and clay
	6	8	Brown silt and hard boulder at 6'
	8	10	Brown silt with medium to coarse sand
22	0	3	Black silt
	3	6	Black silt and (clay)
	6	8	Black silt and (clay)
	8	10+	Very dark silt and (very fine sand)
23	0	2	Dark silt and (very fine sand)
	2	10+	Grey silt or grey loam
24	0	8	Grey-brown silt
	8	10+	Dark silt and (fine sand)
25	0	4	Black silt and (fine sand for first 2')
	4	8	Black silt
	8	10+	Pale cream silt and (fine sand)

Hole No.	From (feet)	To	
26	0	2	Grey silt and (very fine sand)
	2	7	Black silt
	7	9	Black silt and (clay)
	9	10+	Brown silt and (clay)
27	0	6	Dark silt
	6	7	Grey-cream silt
	7	8	Brown silt
	8	10+	Brown silt and (very fine sand and clay)
28	0	1	Dark silt
	1	2	Pebbles, silt and sand
	2	4	Dark red clayey sand
	4	6	Dark red sandy clay
	6	7	Dark red silty clay
	7	9	Dark red silty clay with some pebbles and semi-angular fragments
	9	10+	Decomposed bedrock, mudstone
29	0	3	Black silt
	3	6	Pale brown silt
	6	8	Fine sand and (silt)
	8	9	Medium to coarse sand and pebbles
	9	10+	Yellow to cream coarse sand and pebbles
30	0	4	Very dark silt and (very fine sand)
	4	8	Black silt
	8	10+	Grey brown silt and (clay)
31	0	10+	Red silty clay, a few pebbles at about 8'
32	0	8	Black silt and (fine sand)
	8	10+	Brown silt
33	0	8	Black silt and (fine sand)
	8	10	Black silt and (fine sand)
34	0	2	Dark grey silt
	2	6	Black silt
	6	7	Black silt and (clay)
	7	10+	Brown silt and (clay)
35	0	2	Very fine grey silt
	2	10	Black silt
36	0	3	Fine sand and (silt)
	3	6	Red fine sandy and silty clay
	6	9	Red silty clay
	9	10+	Decomposed bedrock, siltstone or silty mudstone
37			Not augered
38	0	3	Yellow very fine sand and (silt)
	3	5	Yellow very fine sand and (clay)
	5	7	Silty, dusty coarse sand and gravel
	7	15	Clay and decomposed mudstone

Hole No.	From (feet)	To	
39	0	5	Fine yellow sand with some silt
	5	7	Fine yellow sand with some clay. Pebble at 7'
	7	9	Sandy clay probably weathered
	9	10	Weathered bedrock, mudstone
40	0	5	Yellow-brown silt and fine sand
	5	10	Sandy clay
41	0	6	Yellow-red, medium to fine sand with silt, probably wind blown
	6	7	Weathered bedrock, hard ashstone
42	0	2	Fine yellow sand and silt
	2	3.5	Brown silt with medium to fine sand. Hard at 3½', ashstone?
43	0	4	Grey silt and (very fine sand)
	4	8	Dark silt
	8	10+	Brown silt
44	0	5	Grey to dark silt
	5	8	Black silt
	8	10+	Grey clayey silt. Moist to 9½'; dry 9½' to 10'
45	0	5	Dark silt and (very fine sand)
	5	12	Black silt
	12	15	Dark silt
	15	16+	Wet grey silt and clay
46	0	4	Dark silt and (very fine sand)
	4	7	Dark silt
	7	10+	Black silt
47	0	2	Dark silt and (very fine sand)
	2	6	Dark silt
	6	14	Black silt
	14	16+	Silt and gravel
48	0	7	Dark silt
	7	10+	Black silt
49	0	8	Dark silt
	8	10+	Dark silt with coarse sand
50 to 53			Not augered
54	0	9.5	Black silt
	9.5	10+	Dark silt
55	0	8	Black silt and (very fine sand)
	8	10+	Brown silt
56	0	8	Black silt
	8	10+	Brown silt and clay
57	0	8	Brown silt
	8	10+	Brown, medium sand and (silt and clay)
58	0	3	Fairly clean medium sand and (silt)
	3	10+	Fairly clean medium dune sand

Hole No.	From (feet)	To	
59	0	10+	Fine, fairly clean red-yellow dune sand
60			Not augered
61	0	2	Dark grey silt
	2	4	Black silt
62	0	5	Dark grey silt
	5	10	Black silt
	10	11+	Pale brown silt
63 to 66			Not augered
67	0	9	Clean coarse-medium grained red to yellow sand; windblown. Hard patch at 9'
	9	15	Coarse sand and (clay), some small pebbles
	15	20	Coarse wet sand and clay, hard at 20' assumed bedrock
68	0	8	Black silt
	8	10+	Grey or dark silt
69	0	3	Grey silt
	3	4	Fine sand and (silt)
	4	6	Dark silt
	6	10+	Black wet silt
70	0	1	Fine sand and (silt)
	1	10+	Black silt
71	0	4	Dark silt and (very fine sand)
	4	8	Black silt
	8	16+	Dark silt and (very fine sand)
72	0	2	Black silt and (very fine sand)
	2	16+	Black silt
73	0	13	Black silt
	13	15	Dark silt
	15	16+	Grey silt
74	0	3	Dark silt
	3	13	Black silt
	13	14	Dark silt
	14	16+	Grey silt
75	0	3	Silty dune sand
	3	8.5	Brown-yellow, fairly coarse sand, probably coarse dune sand
	8.5	9.5	Red-cream silty clay
	9.5	10+	Medium to coarse clayey sand
76	0	9	Fine black silt
	9	10+	Brown silt and clay
77	0	8	Fine black silt
	8	10+	Grey-brown silt
78	0	4	Black silt
	4	10+	Fine black silt

Hole No.	From (feet)	To	
79	0	4	Black silt and (very fine sand)
	4	10+	Fine black silt
80	0	8	Fine black silt
	8	10+	Grey-brown silt
81	0	1	Road fill
	1	3	Black silt
	3	4	Brown sandy silt
	4	7	Medium to coarse sand and (wet clay)
	7	10+	Coarse sand, some gravel and (silt and clay)
82	0	0.5	Roadfill
	0.5	10+	Coarse river sand fairly clean
83	0	2	Coarse-fine windblown sand and silt
	2	3	Fairly clean medium sand
	3	7	Medium sand
	7	10+	Coarse loose river sand, small granular pebbles
84	0	6	Grey silt
	6	8.5	Brown silt and (very fine sand)
	8.5	10+	Brown coarse sand and silt and pebbles

APPENDIX 3

ALLUVIUM AT FYSHWICK AND PIALLIGO

LOGS OF CASED BOREHOLES*

Hole No.	Depth (feet) From	To	Description	Sample
A	0	10	Black to brown fine sandy silt	S1 (5'+05'6)
	10	13.5	Black/brown fine sandy silt (probably some clay)	S2 (10')
	13.5	17.5	Paler brown fine sandy silt (some clay)	S3 (17')
	17.5	23.0	Brown silt and coarse sand (more than 50% silt) (Clay?)	S4 (23')
	23	24	Grey brown silt, river sand, and gravel	
	24	25	Dark brown silt with decayed vegetation	S5 (24'6")
	25	28	River sand and gravel (cobbles to 5"). Partly cemented on drying	S6 (25')
	28	32	Medium and coarse sand and gravel; to 1½ inches	S7 (29')
	32	33	Large river gravel	
	33	34	Yellow-brown decomposed mudstone	S8 (34')
	At 34		Hard? mudstone	
B	0	6	Black silt	
	6	14	Pale brown fine sandy silt and (clay?)	S1 (6')
	14	16	Fine brown sandy silt and (clay?)	S2 (15')
	16	24	Coarse to fine sand silt and clay, cobbles to 4 inches	S3 (17')
	24	26.5	Sand pebbles and cobbles to 4 inches with silt and (clay?)	S4 (19' to 24')
	26.5	28	Yellow brown pebbles with sand and clay	S5 (27')
	28	33	Bedrock. Decomposed mudstone	S6 (29')
C	0	12	Brown-black to brown-grey silt	S1 (5')
	12	23	Brown fine sandy silt	S2 (12')
	23	24	Dark grey sandy silt	S3 (23')
	24	27	Medium sand, some black silt (clay?)	S4 (24'6")
	27	31	Coarse sand and pebbles to inches	S5 (28')
	At 31		Fresh silty mudstone	S6 (31')

* Based on drillers logs and inspection of samples

Hole No.	Depth (feet) From	To	Description	Sample
D	0	6	Grey, brown and black silt	S1 (3')
	6	10	Buff brown to dark brown clayey silt	S2 (8')
	10	15	Pale brown clayey? silt and very fine sand	S3 (10')
	15	18	Pale red brown silt and fine to coarse sand	S4 (15')
	18	21	Brown clayey and silty sand and pebbles to 1 inch	S5 (21')
	21	24	Sand pebbles, cobbles to 6" and brown clay	S6 (23')
	At 24		Hard silty mudstone	S7 (24')
E	0	7.5	Black organic silt	S1 (4')
	7.5	17	Black and brown organic silt with some sand	S2 (9')
	17	19	Dark grey silt and (clay?) with some pebbles	S3 (18')
	19	28.5	Sand pebbles and cobbles to 5"	S4 (19' to 24')
	28.5	31.5	Large river gravel	
F	0	9	Black silt	(5')
Driller-	9	10	Moist brown silt with traces of sand	(10')
Log	10	18	Soft brown silt with traces of sand	(15')
	18	21	Brown loamy clay and river gravel	(20')
	21	22	Coarse river sand and fine gravel	(21')
	22	24	Brown silty clay with large river gravel	(23'6")
G	0	7	Dark silt (clay?)	S1 (4')
	7	12	Brown and grey silt and very fine sand with (clay?)	S2 (9')
	12	17	Grey silt with fine sand and (clay?)	S3 (17')
	17	26.5	Sand pebbles and cobbles to 6" very dusty and hard when dry	S4 (24')
	26.5	28	Brown silt river sand and river gravel	
	28	32	Clean coarse sand granules and pebbles to $\frac{1}{2}$ inch	S5 (28')
H	0	4.5	Brown and grey-black silt with some very fine sand	S1 (2')
	4.5	14	Brown medium sand, some gravel, and silty matrix	S2 (6')
	14	18	Yellow brown silt, fine sand, some gravel, probable clay	S3 (13')
	18	27.5	Cobbles to 5" (Driller log brown clay)	S4 (20')

Hole No.	Depth (feet) From	To	Description	Sample
H	27.5	29.5	Fine to coarse sand with matrix of silt and clay	S5 (28')
	29.5	30	Black very organic silt (in sample) (Driller logs also river gravel and sand)	S7 (30')
	30	31	Hard mudstone	S7 (30')

Qa3 covered by organic silt of Qa1&2

Qa3&4 covered by organic silt of Qa1&2

Qa2 covered by organic silt of Qa1

Silt 6' to 13' th

Silt 0' to 6th

Qa1

MOLONGLO

Qa2 covered by organic silt of Qa1

Qa2 covered by organic silt of Qa1

Qa3&4 covered by organic silt of Qa1&2

Qa3&4 covered by organic silt of Qa1&2

F Y S H W I C K

P I A L L I G O

RIVER

RIVER FLAT ALLUVIUM
BLOCKS 36&51 FYSHWICK
BLOCKS 38&24 PIALLIGO

Scale

200 0 200 400 600 800 1000 ft.

BASE MAP: Survey Branch, Dept. of Interior. Drawing K8B

REFERENCE

Qa1 Sand and gravel–sand grading laterally to organic silt.

Qa2 Sand and gravel–sand grading laterally to organic silt, and brown and grey silt.

Qa3 Silt, commonly clayey; sand and gravel–sand, locally clayey, slightly weathered.

Qa4 Silt clayey; sand and gravel–sand (locally clayey) partly weathered.

Geological boundary (concealed)

Auger hole

Seismic geophone site

Cased borehole

Subdivisional boundary

Contour based on Canberra datam

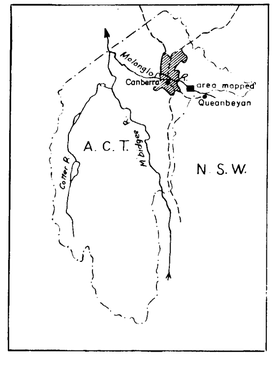
Fence

Road

36 Block number

Track

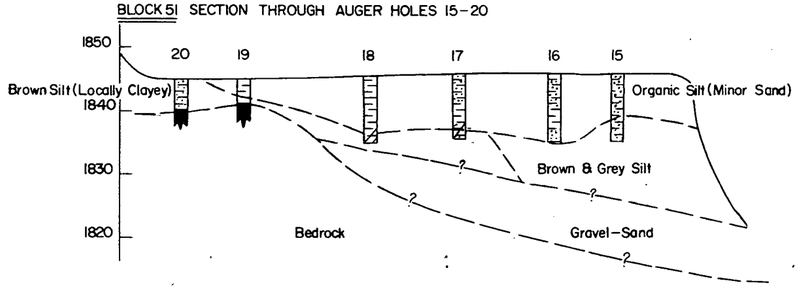
Locality Map



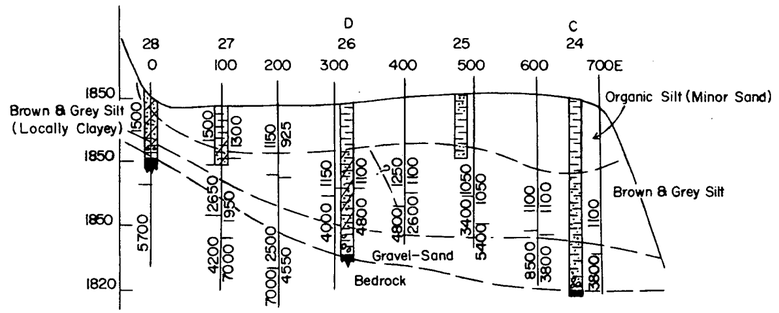
To accompany record 1967/85

155/A16/425

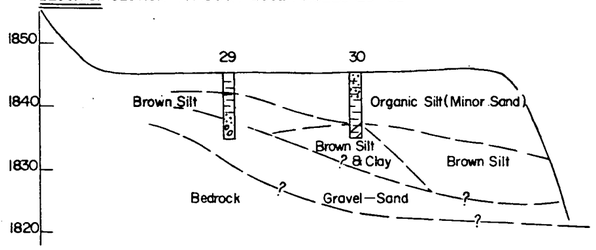
BLOCK 51 SECTION THROUGH AUGER HOLES 15-20



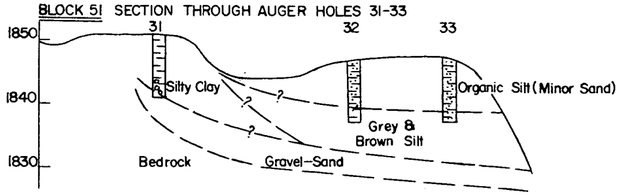
BLOCK 51 SECTION THROUGH AUGER HOLES 24-28



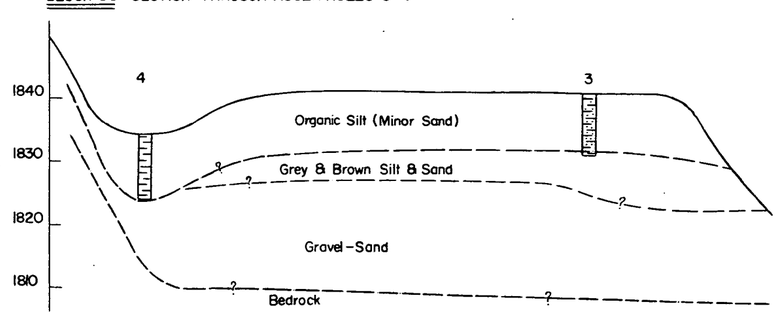
BLOCK 51 SECTION THROUGH AUGER HOLES 29-32



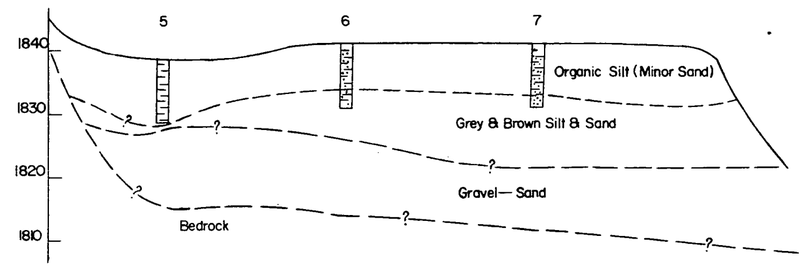
BLOCK 51 SECTION THROUGH AUGER HOLES 31-33



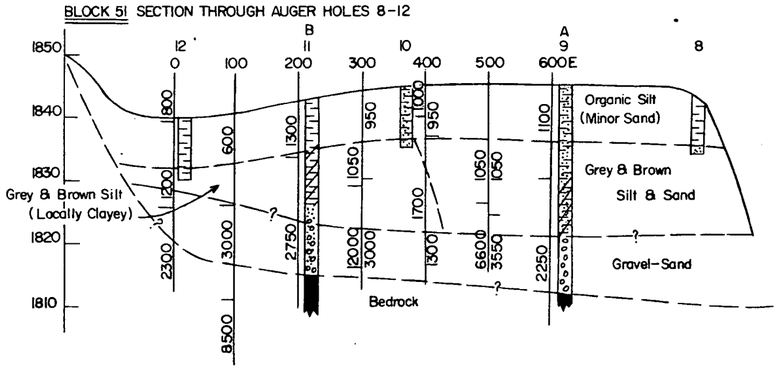
BLOCK 36 SECTION THROUGH AUGER HOLES 3-4



BLOCK 36 SECTION THROUGH AUGER HOLES 5-7



BLOCK 51 SECTION THROUGH AUGER HOLES 8-12



CROSS SECTIONS OF RIVER FLATS

BLOCKS 51 AND 36, FYSHWICK A.C.T.

SCALE

Horizontal

200 100 0 100 200 300 400 feet

Vertical

20 10 0 10 20 30 40 feet

Silt

Sand

Gravel-Sand

Clay

Bedrock

Approximate Boundary

A — Cased borehole 'A'

7 — Auger hole number

200 300E — Geophone station

1100 1050 — Seismic velocities (ft./sec)

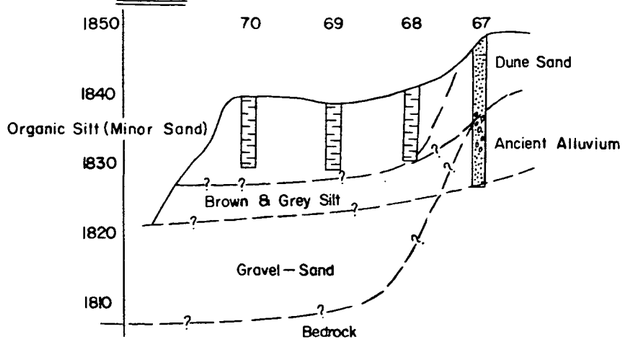
To accompany record 1967/85

155/A16/429

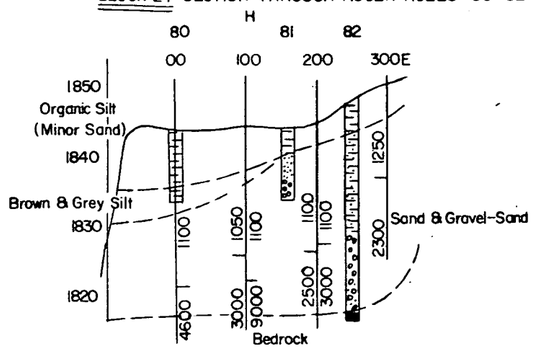
GE

PLATE 3

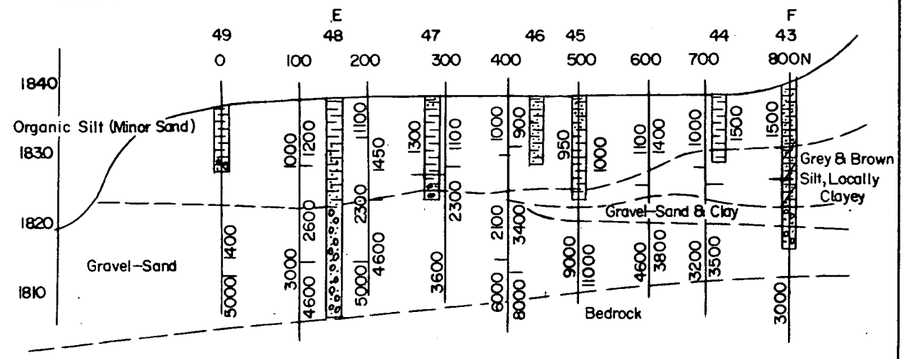
BLOCK 24 SECTION THROUGH AUGER HOLES 67–70



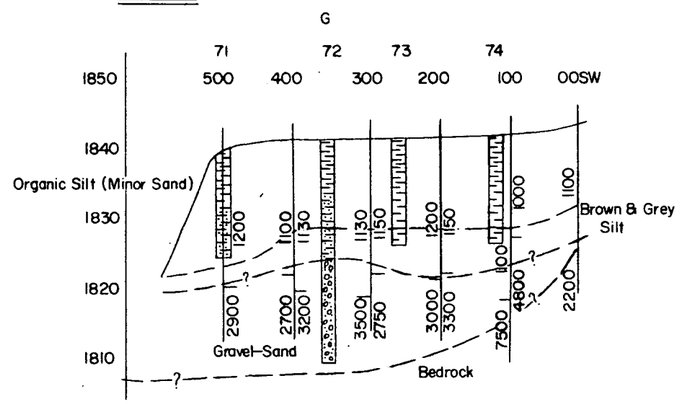
BLOCK 24 SECTION THROUGH AUGER HOLES 80–82



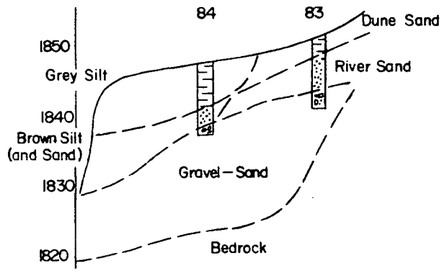
BLOCK 3 SECTION THROUGH AUGER HOLES 43–49



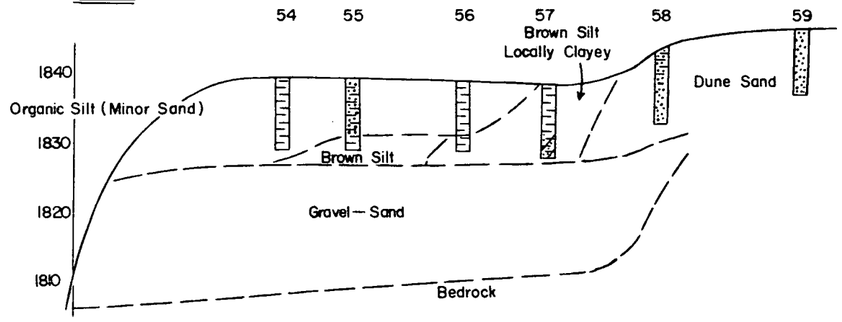
BLOCK 24 SECTION THROUGH AUGER HOLES 71–74



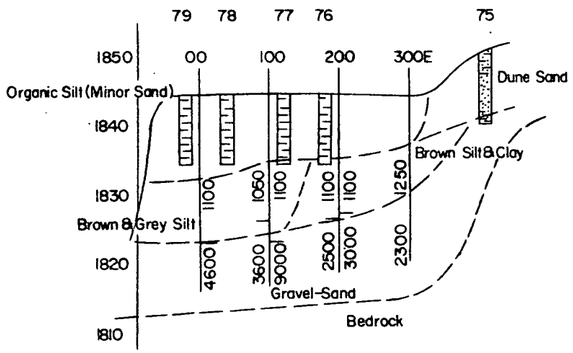
BLOCK 24 SECTION THROUGH AUGER HOLES 83 & 84



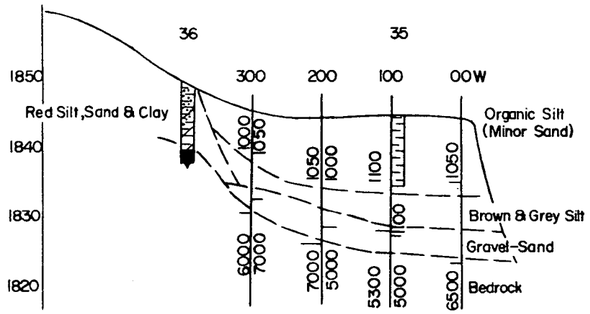
BLOCK 3 SECTION THROUGH AUGER HOLES 54–59



BLOCK 24 SECTION THROUGH AUGER HOLES 75–79



BLOCK 51 SECTION THROUGH AUGER HOLES 35–36



CROSS SECTIONS OF RIVER FLATS
BLOCK 51, FYSHWICK & BLOCKS 3 & 24 PIALLIGO

SCALE

Horizontal 200 100 0 100 200 300 400 Feet

Vertical 20 10 0 10 20 30 40 Feet

Silt — Approximate boundary

Sand — A — Cased borehole 'A'

Gravel – Sand — 72 — Auger hole number

Clay — 300E — Geophone station

Bedrock — 1050 / 1100 — Seismic Velocities (in ft./sec.)

To accompany record 1967/85

155/A16/428 GE