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TEST DRILLING AT MT. GAMBIER

SEWAGE OUTFALL, CAPE NORTHUMBERLAND

A.F. WILLIAMS

Department of Mines
South Australia

DEPARTMENT OF MINES - SOUTH AUSTRALIA

BIBLIOGRAPHY INDEX

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3 1 AUTHORS:

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DEPARTMENT OF MINES
SOUTH AUSTRALIA

GEOLOGICAL SURVEY
ENGINEERING GEOLOGY DIVISION

TEST DRILLING AT MT. GAMBIER SEWAGE OUTFALL, CAPE NORTHUMBERLAND

by

W.F. WILLIAMS

Rept.Bk.No. 77/1
G.S. No. 5830
Eng.Geol.No. 1977/2
DM. No. 575/76

11th January, 1976

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PLANS

Fig. No.	Title	Drawing No.
1	Locality Plan, Cape Northumberland area.	S 12532

DEPARTMENT OF MINES
SOUTH AUSTRALIA

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ABSTRACT

A shallow test hole was drilled near Cape Northumberland to check the feasibility of tunnelling through Gambier Limestone beneath the sea bed as one option for disposal of untreated Mount Gambier sewage. Samples from the test hole showed presence of flint in almost all of the Gambier Limestone section intersected. Comparison with outcrops of this unit on the coast nearby indicates that the flint occurrences are both nodular and lenticular. Some lenses may be metres long and up to 1.5 m thick. Tunnelling through such a formation would prove difficult. However, flooding of the tunnel is likely to be much more hazardous as the Gambier Limestone is well known for its well developed solution cavities. If the tunnelling operation intersected one such randomly spaced cavity, a serious or even catastrophic inflow may result.

INTRODUCTION

The Engineering and Water Supply Department have recently completed a feasibility investigation and assessment of alternate sites for disposal of Mount Gambier sewage (see Ronan and Suter, 1976, unpublished report E.W.S. docket 1777/73). One option considered was to dispose of untreated effluent some distance out to sea. This could be done using a pipeline on the sea bed or by means of a tunnel beneath the sea bed. In October, 1976, a field excursion to the proposed outfall area was arranged between E. & W.S. and Mines Dept. personnel. Exposures visited on this excursion showed such a tunnel would be constructed in Gambier Limestone which at Middle Point (Fig. 1) is a fossiliferous calcarenite - rather weakly cemented, highly porous but containing abundant flint. The flint occurs as small to quite massive nodules and lenses which could cause considerable problems in tunnelling if present

below the surface. A diamond drill hole - fully cored from 2 to 28 m below surface was proposed to examine its extent.

DRILLING

Initially a rotary rig using a diamond bit and a core barrel was sited at a location along the outfall near Middle Point (Fig. 1). Very difficult drilling conditions were encountered due to the presence of flint in the limestone and this led to the abandonment of the hole and this drilling technique. A cable tool rig was then moved on to the site and a new hole drilled. Tube samples were taken where possible but in most cases the flint nodules and layers prevented this and only sludge samples were able to be collected.

RESULTS

A log of the completed hole (Temp. No. VB11) appears in Appendix 1. It penetrated Gambier Limestone after 2 m. Flint was found in nearly every sample taken, the proportion varying from less than 5 to near 90%. The flint fragments were derived from nodules as small as 1 cm diameter to nodules with diameters greater than 10 cm - this latter size being restricted by the percussion drilling method i.e. nodules of larger diameter would be expected.

CONCLUSIONS

Comparison of drilling samples in VB11 with outcrops around Middle Point indicates that flint is present randomly throughout the Gambier Limestone in this area. Tunnelling through the unit would be made very difficult particularly if large lenses were encountered. However, as pointed out by Boucaut in Ronan and Suter, 1976, the most serious hazard to tunnelling in the Gambier Limestone is the presence of unpredictable solution cavities. Intersection of one such cavity during tunnel construction could result in a disaster to the whole operation.

AFW:FdeA
11/1/77

A.F. WILLIAMS
GEOLOGIST

REFERENCE

Ronan, S.R. and Suter, D.J., 1976. Report on Investigation and assessment of alternative sites for either Testing or Disposing of Mt. Gambier Sewage.
E. & W.S. Department Docket 1777/73.

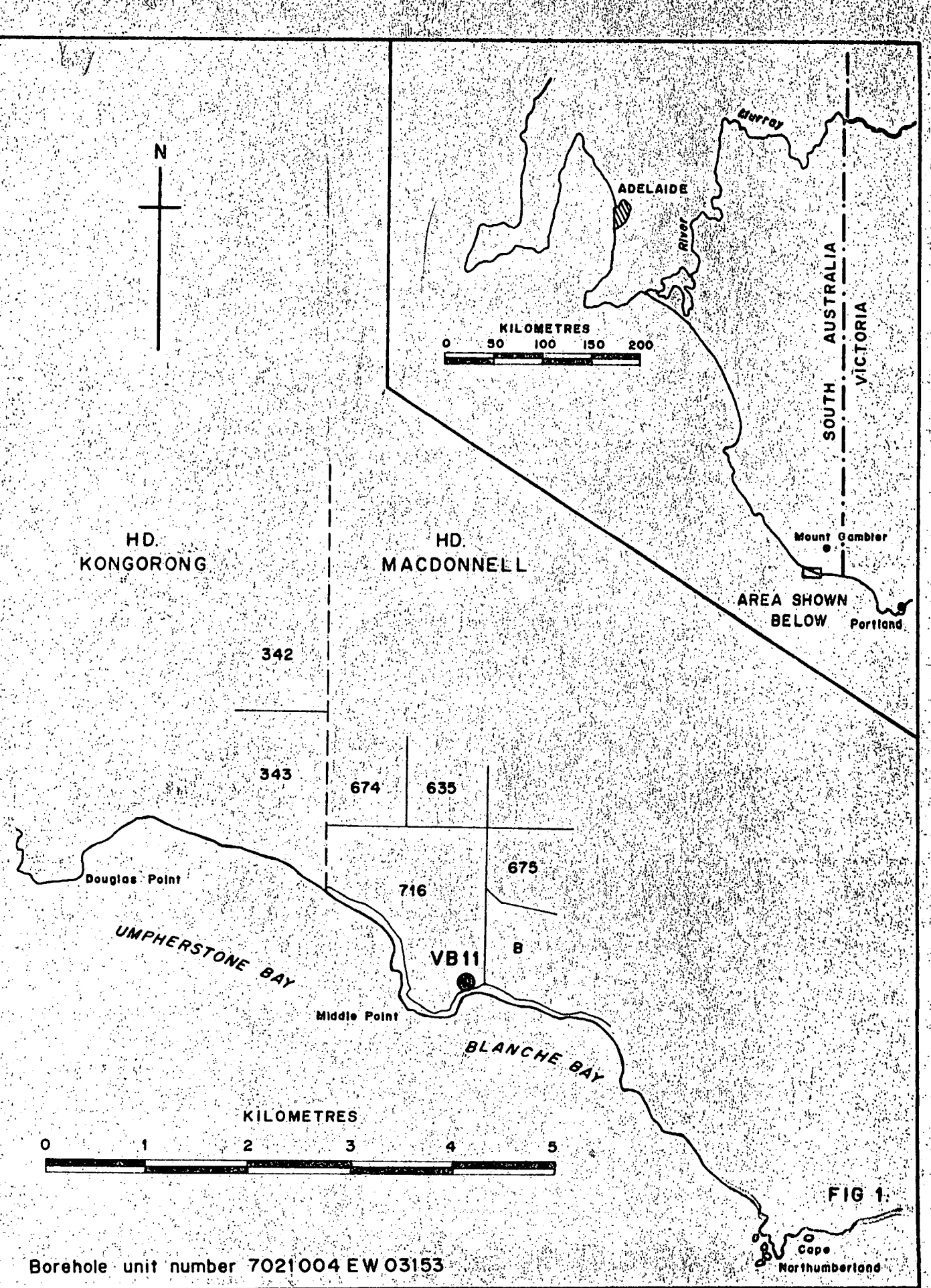

FIG 1.

Borehole unit number 7021004 EW 03153

	DEPARTMENT OF MINES—SOUTH AUSTRALIA	Scale: 1:50000
Compiled: A.F.W.	DRILLSITE FOR MOUNT GAMBIER SEWAGE OUTFALL INVESTIGATION LOCALITY PLAN	Date: 11-1-77
Drn.G.J.T | Ckd.		Drg. No. S12532

00—6.76 G6584 O

DEPARTMENT OF MINES — SOUTH AUSTRALIA
ENGINEERING DIVISION

BORE LOG

PROJECT: MT. GAMBIER SEWAGE OUTFALL
LOCATION OR CO-ORDS: MIDDLE POINT - CAPE NORTHUMBERLAND
SEC. 716 HD MACDONNELL
EL Surface
EL ref. point
Datum

HOLE NO. VB11
UNIT/STATE NO: 7021004EW00163
SERIAL NO: 154/77
FOLDER NO. ~~154/77~~

DEPTH TO WATER CUT (m)	DEPTH TO STANDING WATER (m)	SUPPLY *m³/day	SUPPLY Method of test	TOTAL DISSOLVED SOLIDS milligrammes/litre	TOTAL DISSOLVED SOLIDS Analysis W. NO.
0.90	0.87				

HOLE Dia. / DEPTH m	CORE	GRAPHIC LOG	DEPTH (m) from	DEPTH (m) to	GEOLOGICAL DESCRIPTION OF SAMPLE	UNIT	AGE	CASING	WATERS CUT	WATER LEVEL
			0	0.2	Limesand, medium grained, loosely compacted, organic.					
			.2	0.7	Clay-marl, grey, gastropods, weakly cemented some organic material - peaty in places					
1			.7	2.0	Limesand, as for 0-0.2, then passes in to clay - marl with gastropods, shells to 10mm, grey, white lumps of better cemented silty limestone	?	PLEISTOCENE			
2			2.0	3.0	Silt, calcareous, abundant shell remains, bryozoa, 15-20% marl. Some carbonate and quartz grains to 1mm. Weakly cemented.	GAMBIER LIMESTONE	OLIGO-MIOCENE	REMOVED		
3			3.0	28.0	Limestone, fine to 4mm - mostly bryozoal stems. 20-30% silt and minor marl fraction. Forams, large flint fragments - moderately to weakly cemented. Pale to mid grey.					
4					4-5m as above, abundant flint chips					
5					5-6m as above, mostly flint - fragments and nodules. Nodules to 20mm, fragments to 25mm					
					6-7m as above, fragments to 60mm					
					7-8m as above, 10-20% limestone, rest flint fragments generally 10mm.					
					8-9m as above, 20-30% limestone, rest flint					
					9-11m as above, 20-30% limestone, rest flint to 40mm, both nodules and fragments					
10					11-13m as above, 3-4m, 10-20% flint					

*NOTE: 1000 gals./hr. = 110 m³/day

REMARKS
FOR ENGINEERING INVESTIGATIONS. HOLE BACKFILLED AND ABANDONED

DRILL TYPE CABLE TOOL	LOGGED BY: A. F. W.
CIRCULATION: WATER	DATE: 4-5-1-77
START: 17-12-76	TRACED BY: Y.W.
FINISH: 23-12-76	DATE: 14-1-77
SHEET... 1 OF .. 4	

DEPARTMENT OF MINES — SOUTH AUSTRALIA
ENGINEERING DIVISION

HOLE NO. VB11

UNIT/STATE NO: 7021004EW00153

PROJECT: MT. GAMBIER SEWAGE OUTFALL

BORE LOG

CONTINUATION SHEET

HOLE Dia. DEPTH m	CORE	GRAPHIC LOG	DEPTH (m) from	to	GEOLOGICAL DESCRIPTION OF SAMPLE	UNIT	AGE	CASING	WATERS CUT	WATER LEVEL
					13-14m as above, but 20-30% flint fragments to 20mm	GAMBIER LIMESTONE	OLIGO-MIOCENE			
					14-15m as above, 5% flint fragments					
15					15-16m as above, 20% flint fragments, some to 40mm					
					16-19m as above, 50% flint fragments, some to 40mm					
					19-20m as above, 20-25% flint, some shell fragments and fossils other than bryozoa					
20					20-21m as above, 10-15% flint fragments					
					21-22m as above, 30-35% flint fragments					
					22-23m as above, 10-15% flint fragments					
					23-23.8m as above, 30-35% flint fragments					
					23.8-25.6m as above, minor flint only, occasional large fragment to 100mm - pyritic in part					
25					25.6-26m as above, 40-50% flint fragments to 30mm					
					26-27m as above, 20-25% flint fragments to 60mm					
					27-28m as above, large flint fragments to 95mm					
28					END OF HOLE 28m					

DEPARTMENT OF MINES — SOUTH AUSTRALIA
ENGINEERING DIVISION

PROJECT: MT. GAMBIER SEWAGE OUTFALL

CORE DESCRIPTION

HOLE NO VB11
UNIT/STATE NO:
7021004EW00153

CORE Dia.	DEPTH m	GRAPHIC LOG	GEOLOGICAL DESCRIPTION OF CORE
	0		Top-Limestone - mainly subangular to rounded carbonate grains minor quartz, forams and bryozoal fragments - all medium grained. 10-15% calcisiltite. Abundant organic matter in top 10cm. Core soft, friable. Light grey, tawn
			Bottom-above grades into light to dark grey clay, possibly peaty - rich in organic material. Calcareous. Abundant gastropods 2-15mm. Core soft, slightly better cemented than above
	0.4		Poor recovery - only 10cm of core. As for 0.2-0.4, light grey, abundant gastropods and minor organic material - strongly calcareous - marl
	0.7		Top-as for 0-0.2 - Poor recovery - 30cm only
			Middle-as for 0-0.2 passing into
			Bottom-Marl-v.silty, contains abundant gastropods and other shell material to 10mm. Lumps of hard white calcareous siltstone. Rest grey to dark grey - some organic material, minor quartz, forams and bryozoal stems. Probably lagoonal and swamp deposits. Core soft, friable - weakly cemented. Suspect this right at bottom. Limestone too loose to core with percussion rig. Much compaction of core. Age - Pleistocene to Recent
	2.0		

DEPARTMENT OF MINES — SOUTH AUSTRALIA
ENGINEERING DIVISION

PROJECT: MT. GAMBIER SEWAGE OUTFALL

CORE DESCRIPTION

HOLE NO VB11
UNIT/STATE NO: 702100 4EW00153

CORE Dia.	DEPTH m	GRAPHIC LOG	GEOLOGICAL DESCRIPTION OF CORE
	23.8		Top:Limestone, mainly bryozoal remains, fine to 10mm, abundant calcareous silt (30-35%). Forams common. No flint. Pale grey. Core soft, friable, weakly cemented.
			Bottom:as above, some shell remains
	24.1		Top:as above, slightly better cemented
			Bottom:as above, but very large flint fragment 100mm pyritic in part
	24.3		Top: as above, some flint chips to 15mm
			Bottom: as above, no obvious flint, Some compaction of this core
	24.8		Top: as above
			Bottom: as above, 5% flint chips
	25.0		Top: as above
			Bottom: as above - some compaction of this core
	25.6		

All Gambier Limestone