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No. 11,501

MC 3504

PERNATTY QUARRY

REPORTS ON SITE INVESTIGATIONS FOR THE PERIOD SEPTEMBER 1986 TO MARCH 1989

Submitted by
South Australia. Highways Department
1969

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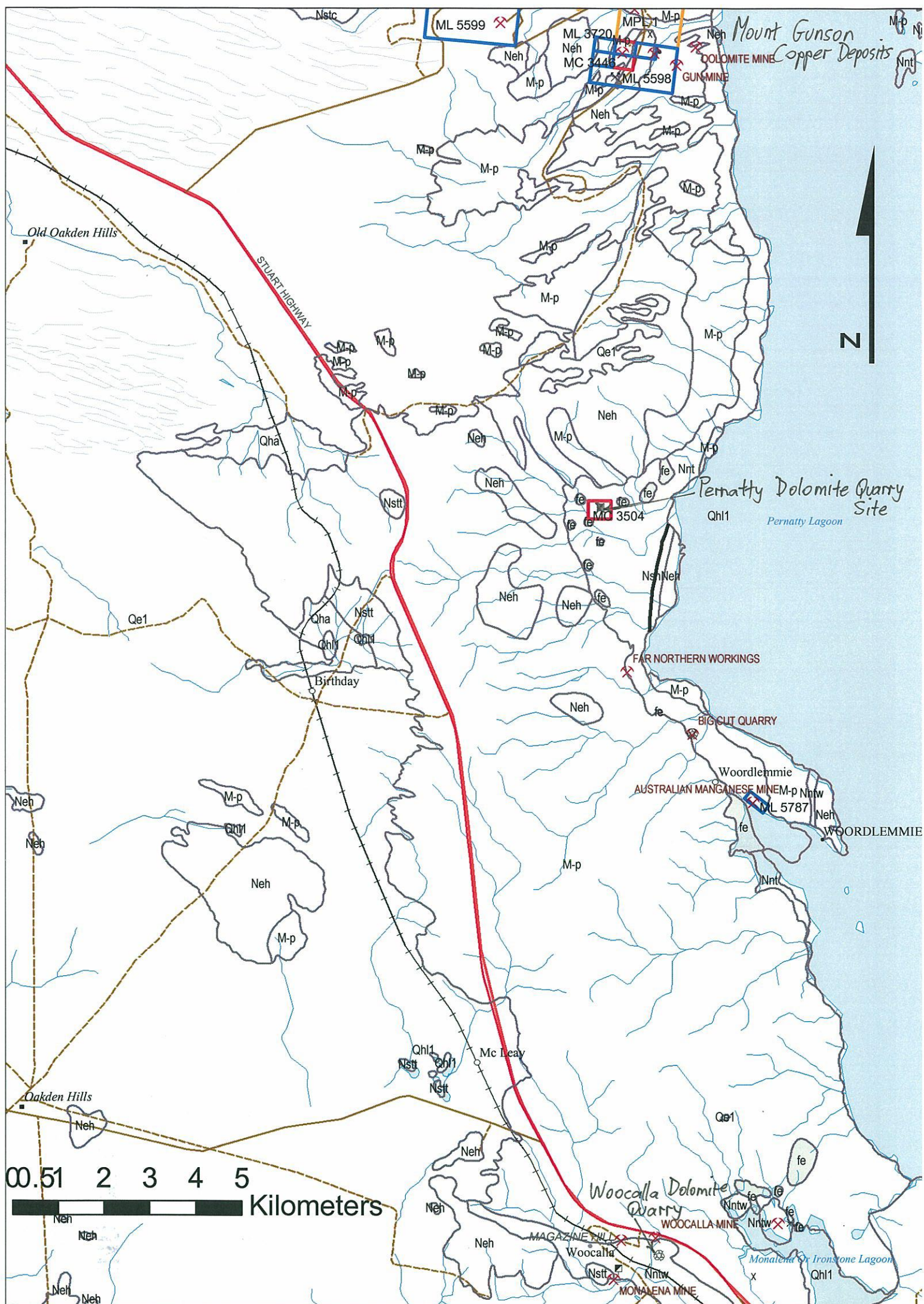
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Government of South Australia
Primary Industries and Resources SA



SITE INSPECTION - PERNATTY QUARRY

BRIDGE QUARRIES SUBCONTRACTING TO MCMAHON CONSTRUCTIONS

The Pernatty Quarry site was inspected on the 28 February, 1989 in the company of R Richardson and R Rake (Pimba-Wirrappa project team). Topics as raised in the McMahon's claim of the 14 February, 1989 were deliberately addressed as part of the inspection.

With reference to these topics:

- (1) No material raised by blasting of the first ramp area was evident as having been trucked and dumped outside the perimeter of the quarry. (Oversize material had been pushed outside the perimeter as part of normal stripping operations).
- (2) A small stockpile of material within the quarry perimeter and which had been pushed up from the development of the first excavation was evident near the ramp to the crushing plant. No more than 150 m³ remained in this stockpile which was the relic of a much larger stockpile from the ramp development but which had been used subsequently as feed for the plant after a time lapse sufficient for the clay to have dried back to a crumbly state.
- (3) The quarry workings had been extended from the area of the second ramp and had connected with the original ramp development site with the access to the quarry now being through the latter (i.e. ramping now reverted to original ramp site). Much of the original face of this area was still exposed (as was evident by the level of crusher dust accumulation on the rock ledges) but did not reveal levels of clay in the face as has been described in the claim documents.

(Other areas of the quarry have shown ostensibly high levels of clay in the face - however the face in these instances has coincided with a clay filled vertical joint. Immediately behind the joint there is the normal quarry condition of a high percentage of good stone. These joints are often only several centimetres in thickness).

Production from the quarry is currently of the 20 mm crushed rock; plant changes to achieve this were the inclusion of an additional hammer mill and the reinstallation of a gyratory crusher for the oversize recirculations.

The original 40 mm preprimary scalping screen with subsequent crushing of the +12 mm fraction of the scalps for sealing aggregates was still being used. There was a modification to the -12 mm fraction processing which minimised the total amount of discarded material. At the transfer point between conveyor belts for this material a deflector plate had been installed allowing the coarser fraction (because it was thrown further by the belt) to fall onto a second conveyor and be returned to the product; the finer fractions, because they would not throw as far or as high off the end of the belt, would hit the deflector plate and drop onto the scalps conveyor for discharge.



SCIENTIFIC OFFICER II MATERIALS

WGH:jw
17/3/89
3496V

SITE INSPECTION, PERNATTY QUARRY

BRIDGE QUARRIES SUBCONTRACTING TO MCMAHON CONSTRUCTIONS

The Pernatty quarry was inspected on the 17 January, 1989 with Mr P Cops and in the company of Messrs R Richardson, C Fiebig and B White (Pimba-Wirrappa Project team).

Since the previous inspection, development had continued in the second (back) quarry with it being enlarged to an area of some 70 m x 70 m. Development has proceeded toward the plant area with the intention of connecting with the abandoned first quarry area. Several areas of ironstone replacement and infill with gypsiferous clay were apparent in the south eastern corner of the second quarry and these had been avoided.

Current production is of the 40 mm rubble and a small amount of 7 mm chippings. No scalping is being done; P.I. levels are running at the 12-15 mark. Unavailability of shot rock from the second quarry at some stage since the resumption of crushing after Christmas has required the use of material placed in stockpile from the first quarry. Satisfactory 40 mm rubble was produced from this material.

7 mm chippings production is anticipated to finish by the 25 January when 14 mm chipping production will commence. Production of all the 40 mm rubble is expected to finish by mid February when 20 mm crushed rock production will begin.



SCIENTIFIC OFFICER II (MATERIALS)

WGH:jw
24/1/89
2613V

STUART HIGHWAY RN 1000
SECTION PIMBA - WIRRAPPA - RECONSTRUCTION
PERNATTY QUARRY SITE VISIT

The quarry site was inspected on the 22/11/88 in the presence of Mr R Richards (Assistant Regional Engineer - Northern), Mr M Bowman (HD Project Team) and Messrs P Busmanis and W Murfett (McMahon Constructions).

Since the previous visit, further development of the pit has been at the south eastern (back) end of the quarry area, several shots in this area had been fired allowing ramping to full depth and exposing an area some 20m x 20m.

All faces exposed showed both massive and brecciated "Collenia" reef structures with sporadic thin horizontal layers and infills of clay material (probably indicating hiatus periods in original disposition).

There was also some vertical penetration of clays and gypsum down near vertical fracture planes. The stone appeared more massive toward the surface and there was variable depth (up to 1 metre) development of calcrete type soil horizons with fine powdery overburden.

The plant was not operating at the time of the inspection due to breakdown of the feeder pump motor.


SCIENTIFIC OFFICER II, MATERIALS

WGH:kmw
29/11/88
3179R

FORMAT-A TEST REPORT ON SAMPLE NO 867S1025 FROM SECTION

HUNDRED N. OUT OF

NAME OF PIT/GRID PROP: PERNALTY CC 1 HOLE NO
 TYPE OF MATERIAL CORES COURSE
 SUBMITTED BY G.HARVEY DATE 860922
 OVERBURDEN mm FACE mm
 QUANTITY REPRESENTED cu.m. DEPTH mm

REPORT TO G HARVEY

ELK 28-10-86

REQUIRED FOR SUB BASE C/R

SPEC STAND.SPEC

SUBMITTED FROM

ROAD NO ROAD STUART HIGHWAY

SECTION PIMBA-WIRRAPPA

GRID REF/CHAINAGE DDH 7

TESTS REQUIRED SA SCONLA CD SC LA

PROJECT NO 7162A DEBIT ORDER NO 31255-6

REMARKS LAB-CRUSH TO -26.5: SCONLAB-CRUSH FINES. RESULTS TO G.HARVEY

PRETREATMENT

CLASSIFICATION DESCRIPTION

rough hard

brown grey

crushed rock DOLOMITE with

grey sand silt of low plasticity

TO SENIOR SCIENTIST

30-10-86

DATE

TO

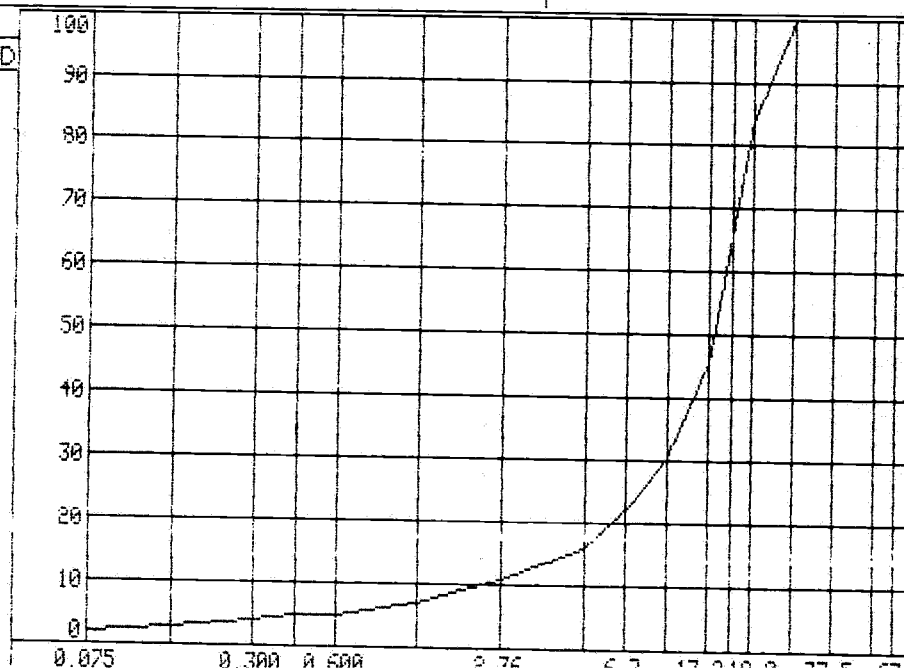
MATERIALS ENGINEER

DATE

UNIFIED CLASSIFICATION GW

SIEVE ANALYSIS

SIEVE(mm)	SPECIFIED
106	
90	
75.0	
63.0	
53.0	
37.5	
26.5	100
19.0	84
16.0	66
13.2	46
9.50	31
6.70	22
4.75	16
2.36	11
1.18	7
.600	5
.425	5
.300	4
.150	3



TEST	SPECIFIED
NVALUE	.66
	± .08
L.L.%	17
P.L.%	15
P.I.%	2
L.S.%	.8
BI.NDX	10
L.A.%	25
SCONLA	*****
L.L.%	18
P.L.%	13
P.I.%	5
L.S.%	1.3

FORMAT-A TEST REPORT ON SAMPLE NO 867S0731 FROM SECTION

HUNDRED NORTH OUT OF

NAME OF PIT/GRID PROPOSED PERNATTY CC HOLE NO
 TYPE OF MATERIAL SPALLS COURSE
 SUBMITTED BY G. HARVEY DATE 860822
 OVERBURDEN mm FACE mm DEPTH mm
 QUANTITY REPRESENTED cu.m.
 REQUIRED FOR C.R.
 SPEC STAND.SPEC

REPORT TO

G HARVEY

ELK 30-9-86

SUBMITTED FROM MATERIAL EVALUATION
 ROAD NO 7200 ROAD STUART HIGHWAY
 SECTION PIMBA-WIRAPPA
 GRID REF/CHAINAGE
 TESTS REQUIRED SA LA SCONLA CD
 PROJECT NO 6566A DEBIT ORDER NO 11430-0
 REMARKS LAB CRUSH TO -19.0mm RESULTS G. HARVEY

SCIENTIFIC OFFICER

R. Andrews

DATE 3.10.86.

TO

PRETREATMENT
 CLASSIFICATION DESCRIPTION
 angular rough hard
 brown grey
 crushed rock DOLOMITE with
 grey sand silt of low plasticity

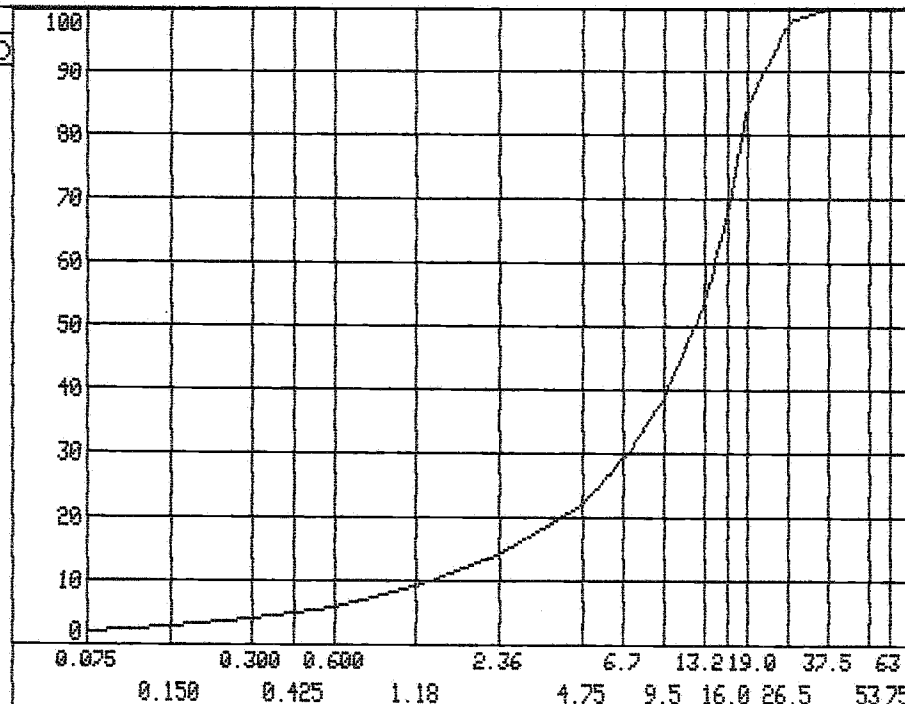
MATERIALS ENGINEER

DATE

UNIFIED CLASSIFICATION

①

SIEVE ANALYSIS	
SIEVE (mm)	SPECIFIED
106	
90	
75.0	
63.0	
53.0	
37.5	100
26.5	98
19.0	85
16.0	68
13.2	54
9.50	39
6.70	29
4.75	22
2.36	14
1.18	9
.600	6
.425	5
.300	4
.150	3
.075	2



TEST		SPECIFIED
NVALUE	.67	
L.A.%	± .04	
SCONLA	*****	
L.L.%	17	
P.L.%	14	
P.I.%	3	
L.S.%	1.4	

RMAT-A TEST REPORT ON SAMPLE NO 867S1216 FROM SECTION

HUNDRED OUT OF

ME OF PIT/GRID PROP: PERNATTY CC 1 HOLE NO

PE OF MATERIAL 26.5mm CORES L/C COURSE

BMITTED BY G.HARVEY

ERBURDEN mm FACE mm

ANTITY REPRESENTED cu.m.

QUIRED FOR SUB BASE/BASE

EC

BMITTED FROM MATERIAL EVALUATION

AD NO 1000 ROAD STUART HIGHWAY

CTION PIMBA WIRRAPPA

ID REF/CHAINAGE DDH 10

STS REQUIRED SC LA SCONLA CD

OJECT NO 7162A DEBIT ORDER NO 31255-6

MARKS HOLD ALL MATERIAL. RESULTS TO G.HARVEY, P.COPS

ETREATMENT

ASSIFICATION DESCRIPTION

gular rough medium hard

ght brown

ushed rock IRONSTONE with

ght brown silty sand of low plasticity

STAND.SPEC

SOUND STONE

REPORT TO

G. HARVEY

ELK 19-11-86


 SENIOR SCIENTIST
19-11-86
DATE

TO

MATERIALS ENGINEER

DATE

IFIED CLASSIFICATION

SIEVE ANALYSIS

EVE(mm) SPECIFIED

5

.0

.0

.0

.5

.5

.0

.0

.2

30

70

75

36

18

10

25

10

50

75

100

90

80

70

60

50

40

30

20

10

0

0.075

0.300 0.600

2.36

6.7

13.2 19.0

37.5

63

0.150

0.425

1.18

4.75

9.5

16.0 26.5

53.75

TEST

L.L.% 16

P.L.% 13

P.I.% 3

L.S.% 1.3

BI.NDX

L.A.% 19

SCONLA *****

L.L.% 16

P.L.% 13

P.I.% 3

L.S.% 1.8

SPECIFIED

2

HUNDRED OUT OF

ELK 20-10-86

- no problem with plasticity on cooled fines

ADisa
21.10.86
DATE

for SENIOR SCIENTIST

DATE _____

EARTHY
DOLOMITE

SIEVE ANALYSIS			TEST		SPECIFIED
SIEVE(mm)		SPECIFIED			
106			L.L.%	21	
90			P.L.%	17	
75.0			P.I.%	4	
63.0			L.S.%	1.6	
53.0			BI.NDX	0	
37.5			L.A.%	31	
26.5			SCONLA	*****	
19.0			L.L.%	19	
16.0			P.L.%	15	
13.2			P.I.%	4	
9.50			L.S.%	1.6	
8.70					
4.75					
2.36					
1.18					
.600					
.425					
.300					
.150					
.075					

RMAT-A TEST REPORT ON SAMPLE NO 867S1216 FROM SECTION

HUNDRED OUT OF

ME OF PIT/GRID PROP: PERNATTY CC 1

HOLE NO

PE OF MATERIAL 26.5mm CORES L/C

COURSE

MITTED BY G.HARVEY

DATE 1.0 - 13.2m

ERBURDEN mm FACE mm

DEPTH 10 - 12.2m mm

ANTITY REPRESENTED cu.m.

QUIRED FOR SUB BASE/BASE

EC

STAND.SPEC

MITTED FROM MATERIAL EVALUATION

AD NO 1000 ROAD STUART HIGHWAY

CTION PIMBA WIRRAPPA

ID REF/CHAINAGE DDH 10

STS REQUIRED SC LA SCONLA CD

JECT NO 7162A DEBIT ORDER NO 31255-6

MARKS HOLD ALL MATERIAL. RESULTS TO G.HARVEY, P.COPS

ETREATMENT

ASSIFICATION DESCRIPTION

gular rough medium hard

ght brown

ushed rock IRONSTONE with

ght brown silty sand of low plasticity

REPORT TO

G. HARVEY

ELK 19-11-86


 SENIOR SCIENTIST

19-11-86

DATE

TO

MATERIALS ENGINEER

DATE

SOUND STONE

IFIED CLASSIFICATION

SIEVE ANALYSIS

SIEVE ANALYSIS			TEST													SPECIFIED
EVE(mm)		SPECIFIED	100													
5			90													
.0			80													
.0			70													
.0			60													
.5			50													
.5			40													
.0			30													
.0			20													
.2			10													
30			0													
70																
75																
36																
18																
10																
25																
10																
50																
75																

TEST

SPECIFIED

L.L.% 16

P.L.% 13

P.I.% 3

L.S.% 1.3

BI.NDX

L.A.% 19

SCONLA *****

L.L.% 16

P.L.% 13

P.I.% 3

L.S.% 1.8

2

HUNDRED OUT OF

G. HARVEY

ELK 19-11-86

0000

CU.M.

STAND.SPEC

[Signature]
 SENIOR SCIENTIST

19.11.84

DATE _____

TO

OBJECT NO 7162A DEBIT ORDER NO 31255-6

MARKS HOLD ALL MATERIAL. RESULTS TO G.HARVEY, P.COPS

Domite -
innotare

MATERIALS ENGINEER

DATE _____

ushed rock IRONSTONE with

ght brown silty sand of low plasticity

IFIED CLASSIFICATION

②

SIEVE ANALYSIS

EVE (mm)		SPECIFIED
----------	--	-----------

75

A blank log-log graph grid. The vertical axis (y-axis) is labeled from 0 to 100 in increments of 10. The horizontal axis (x-axis) has logarithmic labels: 0.075, 0.150, 0.300, 0.425, 0.600, 1.18, 2.36, 4.75, 6.7, 9.5, 13.2, 19.0, 26.5, 37.5, 53.7, 67.5, 100. The grid consists of 10 major horizontal divisions and 10 major vertical divisions.

TEST	SPECIFIED
L.L.%	22
P.L.%	19
P.I.%	3
L.S.%	1.8
BI.NDX	
L.A.%	42
SCONLA	*****
L.L.%	20
P.L.%	17
P.I.%	3
L.S.%	1.9

HIGHWAYS DEPARTMENT - MATERIALS AND RESEARCH LABORATORIES - NORTHFIELD

HD91

FORMAT-A TEST REPORT ON SAMPLE NO 86750731 FROM SECTION

HUNDRED NORTH OUT OF

NAME OF PIT/GRID PROPOSED PERMATTY CC HOLE NO
TYPE OF MATERIAL SPALLS
SUBMITTED BY G. HARVEY
OVERBURDEN mm FACE mm
QUANTITY REPRESENTED cu.m.
REQUIRED FOR C.R.

REPORT TO G HARVEY

ELK 30-9-86

SPEC STAND.SPEC

SUBMITTED FROM MATERIAL EVALUATION

ROAD NO 7200 ROAD STUART HIGHWAY

SECTION PIMBA-WIRAPPA

GRID REF/CHAINAGE

TESTS REQUIRED SA LA SCONLA CD

PROJECT NO 6566A DEBIT ORDER NO 11430-0

REMARKS LAB CRUSH TO -19.0mm RESULTS G. HARVEY

SCIENTIFIC OFFICER R. Andrews

DATE 3-10-86

PRETREATMENT

CLASSIFICATION DESCRIPTION

angular rough hard

brown grey

crushed rock DOLOMITE with

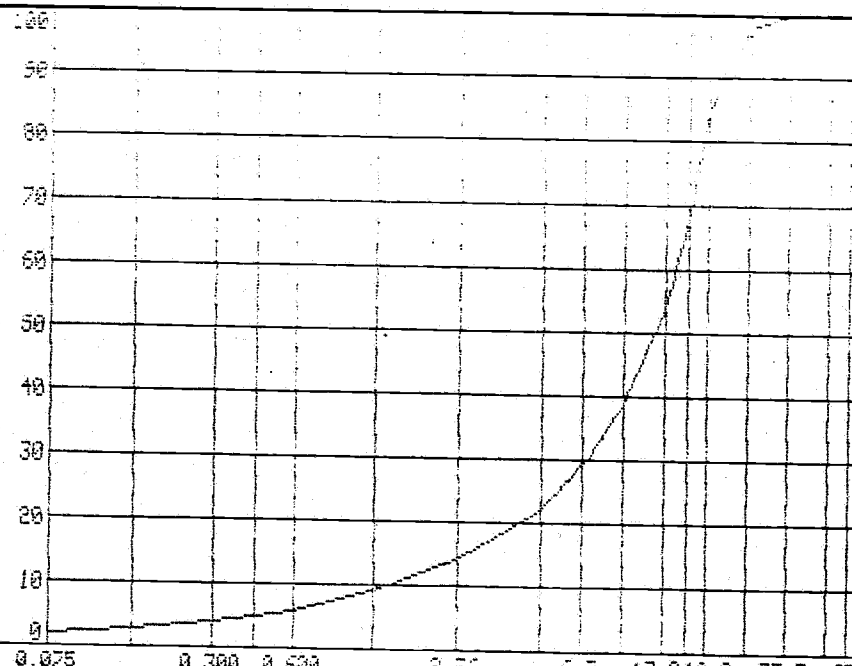
grey sand silt of low plasticity

MATERIALS ENGINEER

DATE

UNIFIED CLASSIFICATION

SIEVE ANALYSIS	
SIEVE (mm)	SPECIFIED
100	100
75.0	98
63.0	85
53.0	68
37.5	54
26.5	39
19.0	29
16.0	22
13.2	14
9.50	9
6.70	6
4.75	5
2.36	4
1.18	3
.600	
.425	
.300	
.150	



TEST	SPECIFIED
UNCL. L. L. %	.67
U. L. L. %	± .04
U. L. L. %	20
SCONLA	*****
L. L. %	17
P. L. %	14
P. I. %	3
L. S. %	1.4

HIGHWAYS DEPARTMENT - MATERIALS AND RESEARCH LABORATORIES

- NORTHFIELD

HD91

FORMAT-A TEST REPORT ON SAMPLE NO 867S1025 FROM SECTION

HUNDRED N. OUT OF

NAME OF PIT/GRID PROP: PERNALTY CC 1

HOLE NO

REPORT TO

TYPE OF MATERIAL CORES

COURSE

G HARVEY

SUBMITTED BY G.HARVEY

DATE 860922

ELK 28-10-86

OVERBURDEN mm FACE

DEPTH

mm

QUANTITY REPRESENTED

cu.m.

REQUIRED FOR SUB BASE C/R

SPEC

STAND.SPEC

SUBMITTED FROM

ROAD NO ROAD STUART HIGHWAY

SECTION PIMBA-WIRRAPPA

GRID REF/CHAINAGE DDH 7

TESTS REQUIRED SA SCONLA CD SC LA

PROJECT NO 7162A DEBIT ORDER NO 31255-6

REMARKS LAB-CRUSH TO -26.5: SCONLAB-CRUSH FINES. RESULTS TO G.HARVEY

PRETREATMENT

CLASSIFICATION DESCRIPTION

rough hard

brown grey

crushed rock DOLOMITE with

grey sand silt of low plasticity

MATERIALS ENGINEER

DATE

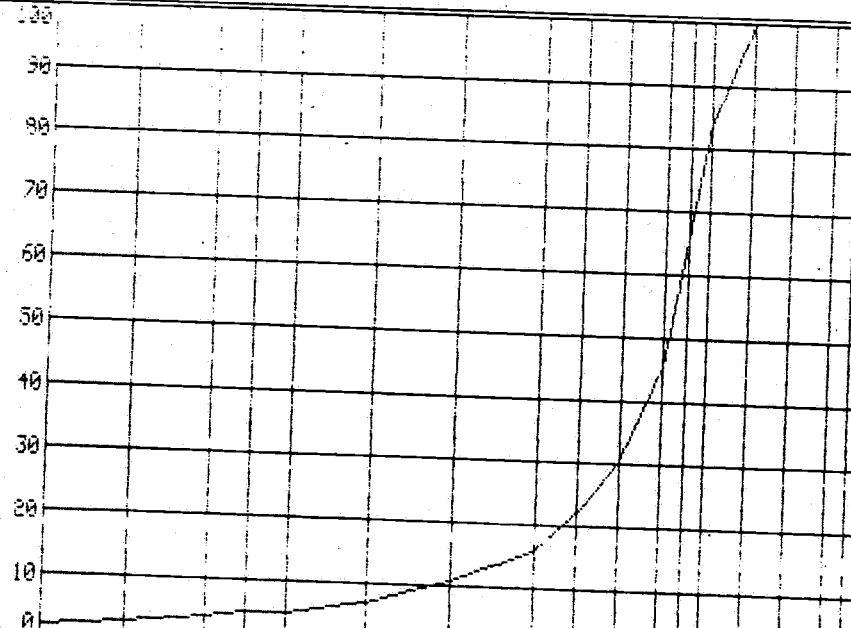
UNIFIED CLASSIFICATION GW

SIEVE ANALYSIS

SIEVE(mm) SPECIFIED

106
75.0
63.0
53.0
37.5
26.5
19.0
16.0
13.2
9.50
6.70
4.75
2.36
1.18
.600
.425
.300
.150

SPECIFIED



TEST SPECIFIED

NVALUE .66
± .08
L.L.% 17
P.L.% 15
P.I.% 2
L.S.% .8
BI:NDX 10
L.A.% 25
SCONLA *****
L.L.% 18
P.L.% 13
P.I.% 5
L.S.% 1.3

B.D. H.M.
P.G. S.H.

DATE 7.10.86...

M.E.S. PROJECT No. 7162A D.O. 3,255,6

R.N. ROAD Stuart Hwy

PROJECT..... PERNATTY C.C N°1

BORE No. 14 R.L. CHAINAGE

Depth	Sample Description	BLOWS per 300 mm	STRENGTH kg/cm ²	CORE mm	SAMPLE No.
	BITS AS FOR HOLE 13.		<u>CORE</u>		
		<u>RECON.</u>			<u>LOSS</u>
0.0-0.3	CASING.				
0.3-1.3	DOLOMITE	1.0			—
1.3-2.1	— " —	.6			.2
2.1-2.8	— " —	.7			—
2.8-4.3	— " —	1.45			.05
4.3-5.8	— " —	1.45			.05
5.8-7.3	— " —	1.45			.05
7.3-8.8	— " —	1.50			—
8.8-9.05	— " —	.10			.15
9.05-9.10	— " —	.05			—
	RDDS VIBRATING.				
	HOLE #11.	<u>RECON</u>	<u>CORE</u>		<u>LOSS</u>
0.0-0.3	CASING.				
0.3-0.8	DOLOMITE.	.25			.55
0.8-1.25	— " —	.30			.15
1.25-2.75	— " — NEW BIT NO L77751	1.30			.20
2.75-2.95	— " —	.15			.05
2.95-4.25	— " —				
4.25 —					

DATE 6.10.86.

BORE No. 313 R.L. CHAINAGE

[illegible]

BORE LOG

PG. H.M. SH.

DATE 21.9.86

M.E.S. PROJECT No. 7162A D.O. 31255-6.

R.N. ROAD SMART H/WAY

PROJECT PERINATY C.C. N°1

BORE No. 6 R.L. CHAINAGE

Depth	Sample Description	BLOWS per 300 mm	STRENGTH kg/cm ²	CORE mm	SAMPLE No.
	Diamond Bits os for last hole				
		RECU.	CORE		LOSS
00-15	DOLOMITE & RUBBLE	35			145
15-30	?	20			13
30-45	?	60		90	110
45-60	SANDSTONE	150			-
60-75					
75-					
	7.5 END.				
	D.D.H #8				
00-05	DOLOMITE RUBBLE	15			35
05-15	DOLOMITE	70			75
15-	N/BIT N°9 METER 156582.				
	RUBBLE FALLING BACK DOWN HOLE.				
	REDRILLED D.D.H #8.				
00-16	CASING.				
16-21	DOLOMITE	20			130
21-35		60			9
35-50		60			90
50-53		30			-
53-65		75			75
65-80		140			10
80-95		140			10
95-110		100			50
110-125		95			55
125-140		150			0
140-155		105			45
155-164		60			-

HD 504
Materials Section
July 84

DATE 19.3.86

BORE No. 5 R.L. 1 CHAINAGE 1

Depth	Sample Description	BLOWS per 300 mm	STRENGTH kg/cm ²	CORE mm	SAMPLE No.
	Bns SAME AS FOR D.D.H. 7				
	NO CASING.	RECOV	CORE		LOSS
0.0-0.6	DOLOMITE.	25			45
0.6-1.5		30			25
1.5-1.5		35			—
1.5-3.0		1.50			—
3.0-4.2		70			50
4.2-4.5		25			25
4.5-6.0		70			80
6.0-	CHANGED D/BIT L759/17-6. HAVING TROUBLE WITH PUMP.				
	— HOLE ABANDONED —				
	D.D.H. 10. 20.9.86.				
0.0-1.5	DOLOMITE.	25			1.25
1.5-3.0		1.20			30
3.0-4.5	7 STEP BIT	1.45			25
4.5-6.0		1.50			1.1
6.0-7.5		1.50			1
7.5-9.0		1.50			1
9.0-10.5		1.50			—
10.5-12.0	RODS SILTING UP.	30			123
12.0-13.5	HAD TROUBLE PULLING OUT	1.50			—
13.5-	DRILL RODS.				
	13.5 END. RODS CHATTERING				

P.G. H.M. SH. BORE LOG

DATE 17.9.86

M.E.S. PROJECT No. 7162A D.O. 31255' 6.

R.N. ROAD STUART HIGHWAY

PROJECT PERATTY C.C. No 1

BORE No. DDH#2 R.L. CHAINAGE

Depth	Sample Description	BLOWS per 300 mm	STRENGTH kg/cm ²	CORE mm	SAMPLE No.
	Bits AS FOR DDH#1		CORE		
		RECDV			LOSS
0.0-1.0	CASING.				
1.0-1.45	DOLOMITE	.40			.05
1.45-2.25		.25			.55
2.25-2.95		.70			-
2.95-4.45		1.25			.25
4.45-5.95		.90			.60
5.95-6.8		.40			.45
6.8-7.45		.65			-
7.45-8.65		1.10			.10
8.65-8.95					
8.95					
	<u>8.95 END</u>				
	Bits AS FOR PREVIOUS HOLE				
	D.D.H#7		CORE		
0.0-0.9	CASING.	RECDV			LOSS
0.9-1.3	DOLOMITE.	.25			.15
1.3-2.0		.70			.20
2.0-3.4	NEW BIT. L73281-6	.40			1.0
3.4-3.5	REAMER. AK773.	.10			-
3.5-3.9		.35			.05
3.9-5.4		.80			.70
5.4-6.6		1.10			.10
6.6-6.9		.30			-
6.9-7.9		1.00			.15
7.9-8.4		.50			-
8.4-9.5		1.50			-
9.5-11.0		1.50			-
11.0-12.5		1.50			-
12.5-14.0	SANDSTONE + DOLOMITE.	1.50			-
14.0-14.3	SANDSTONE	.30			-

BORE LOG P.G. H.M. S.H. ^{July}

DATE 6-9-86

M.E.S. PROJECT No. 7162A D.O. 31255.6

R.N. ROAD STUART Hwy

PROJECT.....PERNATTY c.c. N°1

BORE No. 1 R.L. CHAINAGE

Depth	Sample Description	BLOWS per 300 mm	STRENGTH kg/cm ²	CORE mm	SAMPLE No.
	CASING BIT. L97439				
	REAMER L97215				
	SHOE L59562				
		RECON	CORE ✓	LOSS	
0.0 - 9.	CASING.				
	BIT N° L75918-6 REAMER L55733				
9 - 1.25	DELMITE	25			10
1.25 - 1.85		60			—
1.85 - 3.35		120			30
3.35 - 4.85	CHANGED BIT. L755382	120			30
4.85 - 5.8	BIT N° L75918-6 u/s.	95			—
5.8 - 6.35	PIECES BROKEN OFF FROM	55			—
6.35 - 7.85	SIDE AND INSIDE FACE OF	110			40
7.85 - 9.35	BIT	150			—
9.35 - 10.85		140			10.
10.85 - 12.35		140			10
12.35 - 13.85	FIRST 200 FINE SANDSTONE	60			90
13.85 -					
	END 13.85 m.				

QUARRY DEVELOPMENT

LEGEND

HT CONTOUR (arbitrary datum.)

190

OND DRILL HOLE (hole depth-metres.)

DDH 12 9.8m

EY STATION (temporary.)

USED OUTLINE OF QUARRY.

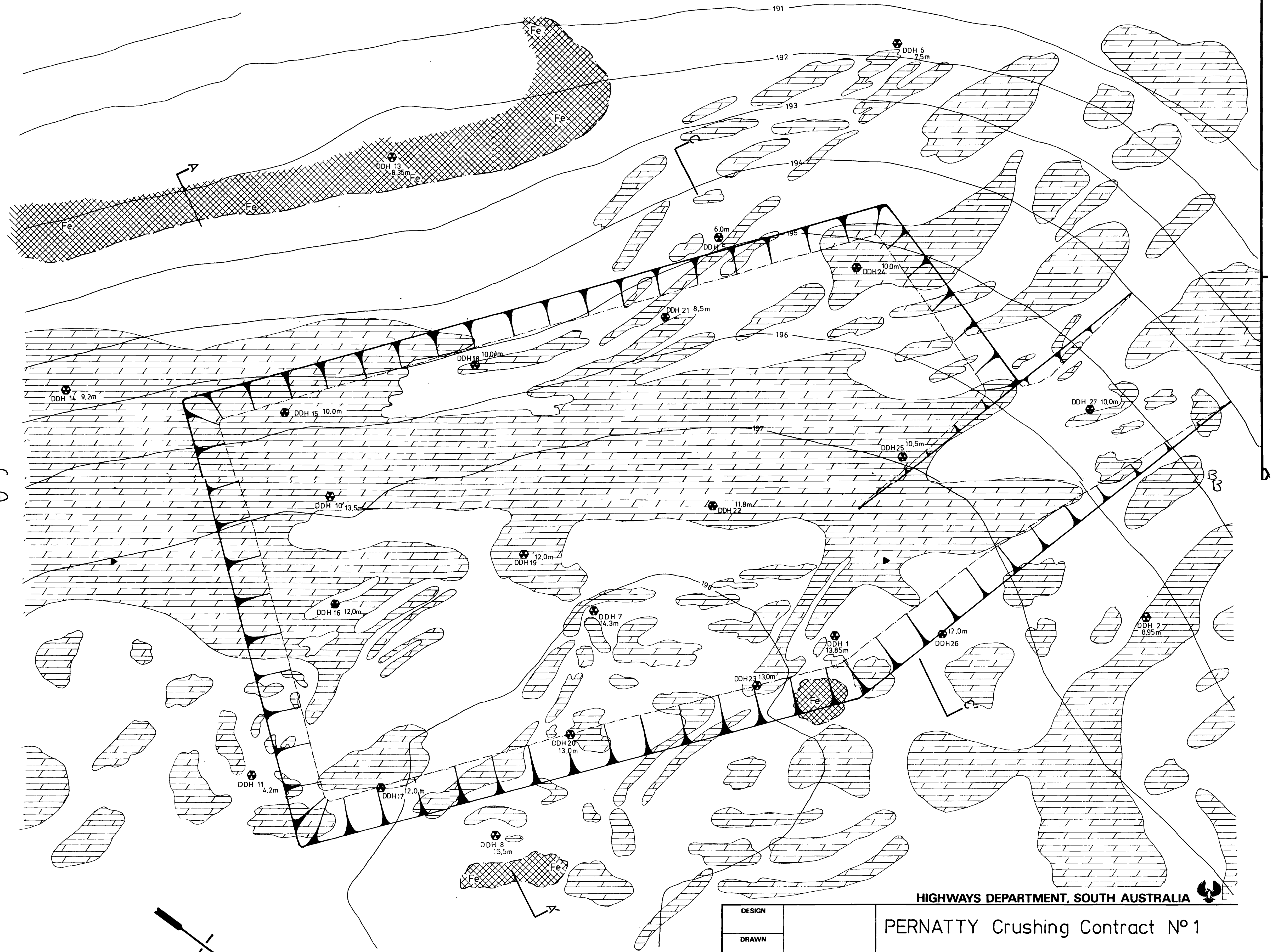
OF CROSS SECTION.

DOLOMITE OUTCROP (low indistinct insitu outcrop & extensive rock float.)

IRONSTONE OUTCROP & FLOAT.

SCALE 1:500

0 10 20 30 40 50
metres.



HIGHWAYS DEPARTMENT, SOUTH AUSTRALIA

PERNATTY Crushing Contract N° 1
PASTORAL BLOCK N° 839
QUARRY DEVELOPMENT PLAN.

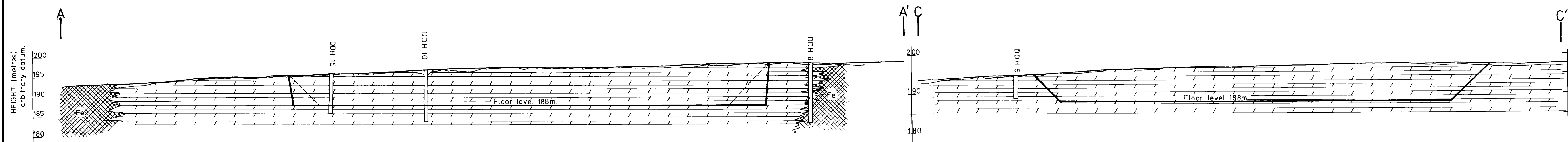
DESIGN	
DRAWN	Principal Eng. (Bridge Design)
CHECKED	Regional Eng.
EXAMINED	APPROVED
Sup. Des. Eng.	Date

PROJECT START : PRP.	+	km.	PROJECT END : PRP.	+
PROJECT	DOCKET	SURVEY	SHEET	DRG

ALL DIMENSIONS ARE
IN METRES
UNLESS OTHERWISE SHOWN

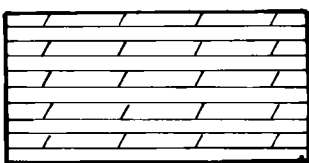
0 25 50 75 100
100 MILLIMETRES ON ORIGINAL DRAWING

CROSS-SECTIONS.



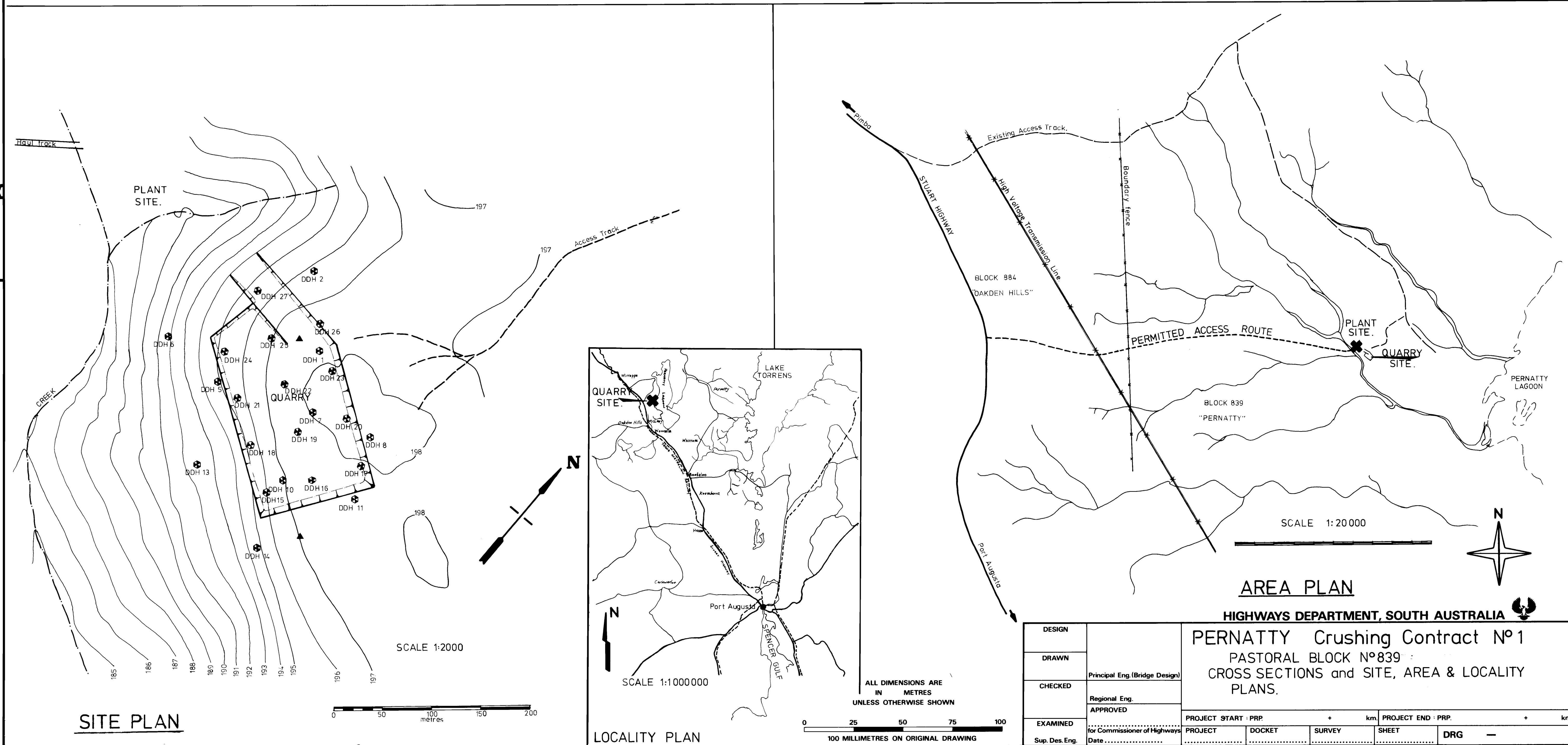
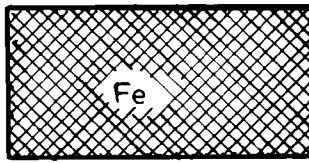
Woocalla Dolomite.

"Collenia" reef deposit dolomite, thin to massive bedded with frequent ferruginous and manganiferous earthy interlayerings. Strata shows original reef structures and is generally undisturbed; minor siliceous grit lenses occur toward margins. Structures are not indicated.



Ironstone.

Intrusive limonite and haematite in both soft earthy form and hard massive form.



SITE PLAN

LOCALITY PLAN

AREA PLAN

HIGHWAYS DEPARTMENT, SOUTH AUSTRALIA

PERNATTY Crushing Contract No 1
PASTORAL BLOCK No 839 :
CROSS SECTIONS and SITE, AREA & LOCALITY
PLANS.

DESIGN	
DRAWN	
CHECKED	Principal Eng. (Bridge Design)
EXAMINED	Regional Eng.
Sup. Des. Eng.	APPROVED

PROJECT START : PRP.	+	km	PROJECT END : PRP.	+	km.
PROJECT	DOCKET	SURVEY	SHEET	DRG	—

TO THE PRINCIPAL ENGINEER, MATERIALS:

PURPLE DOWNS AND PERNATTY QUARRY DEPOSITS
ASSISTANCE FOR PREPARATION OF GEOLOGICAL INFORMATION

An assessment of the geological activities to be completed by the Materials Supply group over the next four months has shown that assistance is required to meet the targets for providing geological information for the Pimba-Olympic Dam project (Purple Downs deposit), for the Pimba-Wirrapa project (Pernatty deposit), and for calling of the Yaranyacka, Wiltunga and Paney crushing contracts (refer attached programme).

It has been determined that the logging and preparation of geological descriptions of the cores for the Purple Downs and Pernatty deposits is the most suitable work type for which to seek short-term outside assistance. This will enable Geologist, Mr Harvey, to devote his efforts to search and proving activities associated with the crushing contracts.

Department of Mines', Supervising Geologist, Mr Payne, has advised that his Department is unable to provide assistance at the present. Offers were therefore sought from three geological consultants. The following quotations have been received:

Water Search	\$ 7 500.00
Amdel	\$11 400.00

J.P. Howard unable to provide service due to current commitments

It is recommended therefore that the offer of Water Search be accepted at a cost of \$7 500.00 which is considered reasonable.

P.L. Gyles

MATERIALS ENGINEER

PLG:SEE
25/8/87
3944H



Highways Department

33-37 Warwick Street (P.O. Box 1) Walkerville South Australia 5081

Telephone (08) 343 2222
FAX (08) 3432585
Telegrams Highways Department
Telex 88027 DX 171

In reply please quote No. 1605/86
Enquiries to: Mr W Harvey
Telephone: 343 2334

3651V
WGH:jw

14 April, 1989

The Chief Inspector of Mines
Department of Mines and Energy
191 Greenhill Road
PARKSIDE 5063

Dear Sir,

Approval is sought for an extension to the quarry area at the Pernatty Crushing Site (Pastoral Block 839 Out of Hundreds).

The quarrying subcontractor, by operating in this area considers that he can reduce the quantity of byproduct to the production of crushed rock and can therefore minimise the overall cost of the operations.

Conditions of rehabilitation as applying to the original approval for quarrying shall be extended to apply to this extension.

The additional area is some 80 m x 75 m and is to be located south-eastwards from the existing south-easterly face of the quarry.

A plan showing the extension is attached.

Yours faithfully,

P. J. G. G. G.
PRINCIPAL ENGINEER, MATERIALS

*Verbally approved - from Dept
Chief Inspector of Mines.
20/4/89
Planned to Region 20/4/89
MCH.*

TO THE MATERIALS ENGINEER:

PERNATTY CRUSHING CONTRACT NO 1
ESTIMATE OF CRUSHED ROCK QUALITY

A review of the diamond drill core taken from the proposed site and the test results from samples of that core indicates that an "all in" product is feasible from the material.

The test results show that the Plasticity Index which could be derived from the fines present in the quarry would be of the order of 3 to 4 whereas the P.I. level of the crushed fines would range from 3 to 5.

There were, however, several zones of nil core return encountered in the drill holes and this could relate to soft zones with somewhat higher P.I. The drill core also showed a number of intersections of earthy material which could produce an excessive amount of fines if allowed to carry through to the final product and thereby generate an imbalance in the grading of the product.

Given that there are these two unknown situations, it is recommended that the need for a 95% efficient scalping system be incorporated in the specification for the crushing plant.


SCIENTIFIC OFFICER, MATERIALS

WGH:jaf
6/3/87
3614V

MEMORANDUM

To Jan Dixon
ARE Northern.



HD 208
JAN 86

33-37 Warwick Street, Walkerville,
South Australia 5081
Telephone 343 2222

Proposed Pernatty ce#1
Suitability for Reinforced Earth Backfill /

Sample #173 - Represents worst of crushed Rock (or similar)
" 172 Represents worst of scalps
" 171 " general run of crushed rock.

Results show that material is unsuitable for reinforced earth backfill on basis of resistivity levels and nature of dissolved salts - excessive calcium / sodium / sulphate / chloride ions - probably typical of most natural materials to the area.

Greg Hamer.
23/10/86.

AGGREGATE/SOIL - CHEMICAL ANALYSIS REPORT

Job Details: PERNATTY CRUSHING CONTRACT Lab. Sample No: 867-CA-171
No. 1 Field Sample No: D.D.H. 8
 Section: _____ Project No: 7162A
 Material: IRONSTONE CORE CRUSHED TO 19mm Road No: _____ Grid No: _____
 Required for: BACKFILL FOR REINFORCED Perm. Ref. Pt: _____
EARTH WALL TYPE STRUCTURES Road Running Dist: _____
 Pit No: _____ Hole No: _____
 Depth: _____ Overburden: _____ Face: _____
 Sampled by: G. HARVEY Date: 10.10.86 Sampling Method: _____

	mg/kg		meq/kg
<u>ANIONS</u>			
Carbonate CO ₃	<u>Nil</u>		<u>Nil</u>
Bicarbonate HCO ₃	<u>140</u>		<u>2.2</u>
Sulphate SO ₄	<u>3740</u>		<u>77.7</u>
Chloride Cl	<u>1280</u>		<u>36.1</u>
		Anions meq/kg	<u>116.0</u>
<u>CATIONS</u>			
Calcium Ca	<u>1180</u>		<u>59.1</u>
Magnesium Mg	<u>160</u>		<u>12.8</u>
Sodium Na	<u>760</u>		<u>33.1</u>
Potassium K	<u>20</u>		<u>0.6</u>
		Cations meq/kg	<u>105.6</u>
<u>RESISTIVITY Ohm.cm.</u>	<u>400</u>		
Total Dissolved Salts mg/kg	<u>7280</u>	Total meq/kg (Σ)	<u>221.6</u>
		Difference meq/kg (Δ)	<u>10.4</u>
Total Dissolved Salts %	<u>0.73</u>	$\left\{ \frac{\Delta \times 100}{\Sigma} \right\} = \Delta \%$	<u>4.7</u>
pH	<u>8.2</u>	Conductivity mS/cm, 25°C	<u>5.2</u>

Tested by: F. KREBEKX Date tested: 20.10.86
 Method of test: 1:2 soil/water extract. Results reported as mg (and meq) dissolved salt per kg of sample (<4.75 mm fraction).
 Remarks: Material does not meet the Electrochemical and Chemical requirements for use as backfill for Reinforced Earth Wall type structures.
 Forwarded to: MR. G. HARVEY Date: 21.10.86
ROOM 205 WALKERVILLE S. Harrison S.S.O.

AGGREGATE/SOIL - CHEMICAL ANALYSIS REPORT

Job Details: PERNATTY CRUSHING CONTRACT Lab. Sample No: 867-CA-172
No. 1 Field Sample No: D.D.H.1
 Section: _____ Project No: 7162A
 Material: DOLOMITE CORE CRUSHED TO 19mm Road No: _____ Grid No: _____
 Required for: BACKFILL FOR REINFORCED Perm. Ref. Pt: _____
EARTH WALL TYPE STRUCTURES Road Running Dist: _____
 Pit No: _____ Hole No: _____
 Depth: _____ Overburden: _____ Face: _____
 Sampled by: G. HARVEY Date: 10.10.86 Sampling Method: _____

	mg/kg		meq/kg
<u>ANIONS</u>			
Carbonate CO ₃	<u>20</u>		<u>0.7</u>
Bicarbonate HCO ₃	<u>110</u>		<u>1.9</u>
Sulphate SO ₄	<u>1030</u>		<u>21.4</u>
Chloride Cl	<u>790</u>		<u>22.3</u>
		Anions meq/kg	<u>46.3</u>
<u>CATIONS</u>			
Calcium Ca	<u>210</u>		<u>10.4</u>
Magnesium Mg	<u>160</u>		<u>13.2</u>
Sodium Na	<u>540</u>		<u>23.5</u>
Potassium K	<u>20</u>		<u>0.4</u>
		Cations meq/kg	<u>47.5</u>
<u>RESISTIVITY Ohm.cm</u>	<u>500</u>		
Total Dissolved Salts mg/kg	<u>2830</u>	Total meq/kg (Σ)	<u>93.8</u>
		Difference meq/kg (Δ)	<u>1.2</u>
Total Dissolved Salts %	<u>0.29</u>	$\left\{ \frac{\Delta \times 100}{\Sigma} \right\} = \Delta \%$	<u>1.3</u>
pH	<u>8.7</u>	Conductivity mS/cm, 25°C	<u>2.4</u>

Tested by: F. KREBEKY Date tested: 20.10.86
 Method of test: 1:2 soil/water extract. Results reported as mg (and meq) dissolved salt per kg of sample (<4.75 mm fraction).
 Remarks: Material does not meet the Electrochemical and Chemical requirements for use as backfill for Reinforced Earth Wall type structures.
 Forwarded to: MR. G. HARVEY Date: 21.10.86
ROOM 205 WALKERVILLE S. Harrison S.S.O.

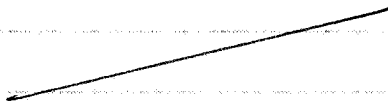
TO

IAN

DIXON

A.R.E

NORTHERN



AGGREGATE/SOIL - CHEMICAL ANALYSIS REPORT

Job Details: PERNATLY CRUSHING CONTRACT Lab. Sample No: 867-CA-173
 ----- No. 1 ----- Field Sample No: D.D.H.8
 Section: ----- Project No: 7162A
 Material: IRONSTONE CORE CRUSHED TO 19mm Road No: ----- Grid No: -----
 Required for: BACKFILL FOR REINFORCED Perm. Ref. Pt: -----
EARTH WALL TYPE STRUCTURES Road Running Dist: -----
 Pit No: ----- Hole No: -----
 Depth: ----- Overburden: ----- Face: -----
 Sampled by: G. HARVEY Date: 10.10.86 Sampling Method: -----

	mg/kg		meq/kg
<u>ANIONS</u>			
Carbonate CO ₃	20		0.7
Bicarbonate HCO ₃	70		1.1
Sulphate SO ₄	310		6.4
Chloride Cl	710		20.1
		Anions meq/kg	28.3
<u>CATIONS</u>			
Calcium Ca	120		5.8
Magnesium Mg	60		4.8
Sodium Na	420		18.3
Potassium K	10		0.4
		Cations meq/kg	29.3
<u>RESISTIVITY Ohm.cm</u>	700		
Total Dissolved Salts mg/kg	1720	Total meq/kg (Σ)	57.6
		Difference meq/kg (Δ)	1.0
Total Dissolved Salts %	0.17	$\left\{ \frac{\Delta \times 100}{\Sigma} \right\} = \Delta \%$	1.7
pH	8.7	Conductivity mS/cm, 25°C	1.5

Tested by: F. KREABEK Date tested: 20.10.86
 Method of test: 1:2 soil/water extract. Results reported as mg (and meq) dissolved salt per kg of sample (<4.75 mm fraction).
 Remarks: Material does not meet the Electrochemical and Chemical requirements for use as backfill for Reinforced Earth Wall type structures
 Forwarded to: MR. G. HARVEY Date: 21.10.86
ROOM 205 WALKERVILLE S. Howison S.S.O.

3440/87
3855P

RN 1000 STUART HIGHWAY
PIMBA - WIRRAPPA SECTION

MATERIALS INVESTIGATION REPORT SUPPLEMENT

PERNATTY QUARRY SITE
RESULTS OF DIAMOND DRILL CORES

PERNATTY QUARRY SITE

1. LOCATION

The proposed quarry site is located on Pastoral Block 839 "Pernatty", approximately 120 km at 30° west of north from Port Augusta in the north of the State. More precisely it is located 4 km east of the Stuart Highway and approximately 10 km south of the Mt Gunson mine site. Current access is via a graded station track which departs the Stuart Highway at a point adjacent to Maintenance Marker Post 799 km between Wirrappa and Woocalla railway sidings.

2. THE DEPOSIT

The stone to be quarried is an occurrence of the "Woocalla" dolomite which outcrops to the east of Pernatty Lagoon. The stone is a yellow brown to buff to blue grey coloured silty dolomite which frequently shows massive stromatalite ("Collenia") reef structures. Bedding in this material can vary from thin and platy to wide spaced and massive; there are frequent inter bands of clayey and earthy (ferruginous and manganiferous) material. The material has been gently folded and shows an irregular, open fold pattern.

Surface exposure of the dolomite is low outcrop interspersed with a thin soil layer and extensive rock float. A calcrete horizon has been developed in part and the upper 2 m of the deposit may show a calcrete cemented dolomite breccia. Topsoil over the area is generally thin but depths of at least 2 m of unusable overburden should be anticipated at some locations.

Areas of ironstone intrusion are apparent adjacent to the defined area of the quarry; these occur as massive haematites and limonites with associated earthy ferruginous zones. Some occurrence of this type of material within the quarry limits should be anticipated.

Drilling has also encountered zones of interlayering of the dolomite with the arkosic Pernatty grits along the northern and western margins of the deposit. Zones of weathering to plastic clay were also encountered in association with these areas.

Vegetation over the quarry site is:

- 1) Sparse native grasses and shrubs.
- 2) Sporadic trees of the order of 3 m high.

Core samples from the diamond drilling of the site are available for inspection at the Northfield Depot by arrangement with the Materials Engineer on 08 343 2076.

3. QUARRY DEVELOPMENT

The Quarry Development Plan and Cross Sections included with the Construction Drawings show a proposed floor height of 188 m (arbitrary datum); there are indications, however, that there is a greater depth of material available but the height of the contact between the dolomite and the underlying rock is uncertain and, from evidence, probably variable. Should the Contractor wish, a lower floor level may be worked provided only suitable dolomite stone is quarried from the full face of the quarry. Separate approvals for the variation in quarrying must be sought by the Contractor from the Chief Inspector of Mines and the Superintendent.

4. INVESTIGATION PROCEDURE

The proposed quarry area was selected, following preliminary ground and aerial photograph search, as being suitable for the production of crushed rock products for the reconstruction of the Pimba-Wirrappa section of the Stuart Highway.

Follow up investigation was conducted by diamond coring of the general area with a view of selecting an acceptable quarry location (Diamond Drill Holes 1, 2, 5, 6, 7, 8 and 10). Core samples taken were submitted to the Highways Department Northfield Laboratory for testing.

On the basis of this information a development plan was prepared and further proving of the site was done by grid drilling and diamond coring of selected locations (Diamond Drill Holes 15-27).

Preliminary investigation was done using NQ wire line coring and the later proving was done using NQ-3 wireline coring. All drilling was undertaken using a HDSA Edson 4 wheel trailer mounted boring rig.

5. PRODUCTION CONSIDERATIONS

Because of the massive nature of some of the stone, the need for some secondary break down should be anticipated.

The Contractor should anticipate the occurrence of some areas of clayey materials and ironstone intrusion which, if quarried and processed, could generate a higher proportion of scalps and/or an unsatisfactory product; selective quarrying of such areas should be anticipated.

The presence of gypsiferous, clayey and earthy ferruginous materials in the deposit suggests that scalping may be necessary to achieve the grading and plasticity requirements specified for the crushed rock and quarry rubble.

The stone is not expected to exhibit any unusual crushing characteristics and the specified grading should be achievable with a plant comprising of adequate circuits and appropriate crushers.

6. SUMMARY OF TEST RESULTS

Sample Number	Description	Test Results
86750731	Surface Spalls Lab Crushed - 26.5 mm Dolomite	Los Angeles Abrasion 20% SC on LA fines LL 17% PI 3 Shrinkage 1.4
86751214	'Earthy dolomite' drill core ex holes 1, 2, 5 and 7. Lab crush - 26.5 mm (described as ironstone)	SC on lab crushed fines LL 21% PI 4 shrink 1.6 SC on LA fines LL 19% PI 4 shrink 1.6 Los Angeles loss 31%
86751215	Dolomite and ironstone Drill Core ex hole #8 Lab Crush - 37.5 m	SC on lab crushed fines LL 22% PI 3 shrink 1.8 SC on LA fines LL 20% PI 3 shrink 1.9 LA loss 42%
8671216	'Sound dolomite' Drill core ex DDH #10 Lab Crush - 26.5 mm	SC on lab crushed fines LL 16% PI 3 shrink 1.3% SC on LA fines LL 16% PI 3 shrink 1.8% LA loss 19%
86751025	Dolomite Core ex drill hole #7 Lab Crush - 26.5 mm	SC on lab crushed fines LL 17% PI 2 shrink .8% SC on LA fines LL 18% PI 5 shrink 1.3% LA loss 25%

7. DRILL CORE RESULTS

Drill cores obtained from diamond drill hole numbers DDH 1 to DDH 27 were examined by a Highways Department Geologist and a consultant company and geological descriptions provided. In addition, drilling logs are provided for drill hole numbers DDH 15 to DDH 27.

The results of the drill cores are contained herein.

GEOLOGICAL DESCRIPTION OF DRILL CORE (HAND SPECIMEN)DDH #1 PERNATTY CRUSHING SITE

DEPTH (m)	DESCRIPTION
0.0 - 0.9	Overburden, loose rock - nil recovery.
0.9 - 3.1	Massive to medium bedded (broken in part) buff dolomite showing "Collenia" banding. Some minor clay seams interspersed throughout. 200mm
3.1 - 3.3	Broken rubbly, thin bedded dolomite. High percentage of core loss; clay and earthy material present. 200mm
3.3 - 4.9	Medium to thin bedded and rubbly dolomite 0.30 m core loss. Some clay seams. 250mm
4.9 - 10.9	Massive to medium bedded buff dolomite. Shows jointing and distinct "Collenia" structure. 100
10.9 - 11.4	Massive to medium bedded, dark brown to black (Fe & Mn) dolomite, earthy in appearance but still shows "Collenia" structure.
11.4 - 12.3	Broken and rubbly to medium bedded earthy and sugary dolomite - some mineral colourisation and "Collenia" banding.
12.3 - 12.6	Thin bedded to broken, red pink sandstone (Pernatty Grit).
12.6 - 13.85	Earthy and broken brown/black dolomite (0.9 m core loss).
	END OF HOLE

750
9000

GEOLOGICAL DESCRIPTION OF DRILL CORE (HAND SPECIMEN)DDH #2 PERNATTY CRUSHING SITE

DEPTH (m)	DESCRIPTION
0.0 - 1.0	Topsoil/Overburden.
1.0 - 1.4	Weathered dolomite rubble and calcrete.
1.4 - 2.3	Thinly bedded, broken and rubbly dolomite - high core loss. 500
2.3 - 3.3	Medium bedded dolomite becoming thinner, more rubbly and earthy to bottom of interval. 100
3.3 - 5.8	Medium bedded to thinly bedded (to bottom of interval) buff to dark coloured dense to earthy "Collenia" dolomite.
5.8 - 6.05	Broken and rubbly dolomite - high core loss. 250
6.05 - 8.0	Medium to thinly bedded "Collenia" dolomite. Some core loss of earthy material.
8.0 - 8.65	Medium bedded to broken earthy and manganiferous dolomite. Black to red black in colour.
	END OF HOLE
	N/A.

GEOLOGICAL DESCRIPTION OF DRILL CORE (HAND SPECIMEN)DDH #5 PERNATTY CRUSHING SITE

DEPTH (m)	DESCRIPTION
0.0 - 0.4	Overburden and thin calcrete cap.
0.4 - 2.2	Medium to thin bedded (slightly broken) hard dolomite. Shows "Collenia" structures.
2.2 - 4.9	Medium to thin bedded, broken and rubbly earthy dolomite with distinct "Collenia" structures. Minor clay seams and earthy partings present, some iron staining.
4.9 - 5.3	Hard, medium bedded dolomite - some mineral colourisation.
5.3 - 6.0	Nil recovery.
	END OF HOLE <i>N/A</i>

GEOLOGICAL DESCRIPTION OF DRILL CORE (HAND SPECIMEN)DDH #6 PERNATTY CRUSHING SITE

DEPTH (m)	DESCRIPTION	
0.0 - 1.0	Overburden - nil recovery.	
1.0 - 1.5	Medium bedded, hard limestone (0.15 core loss).	150
1.5 - 3.0	Clay/earthy ironstone/dolomite (1.3 m core loss).	1300
3.0 - 4.5	Clay seams, siltstone and sandstone (0.9 m loss). Gypsum layer at 4.5 m.	900
4.5 - 4.65	Medium bedded arkosic sandstone - clean pink coloured.	
4.65 - 7.5	Medium to massive bedded silty arkosic sandstone and sandy siltstones. Some red iron staining - shows dessication cracks, joints and fractures.	2350
	END OF HOLE	6000

GEOLOGICAL DESCRIPTION OF DRILL CORE (HAND SPECIMEN)DDH #7 PERNATTY CRUSHING SITE

DEPTH (m)	DESCRIPTION
0.0 - 1.3	Overburden, loose calcareous rubble and broken dolomite.
1.3 - 5.4	Layered, massive to broken buff brown to grey dolomite with dark grey black laminations.
5.4 - 7.0	Medium bedded to massive hard dolomite with grey/black laminations, buff-yellow brown colour.
7.0 - 10.9	Rippled massive reef dolomite with large "Collenia" structure and black mineral bandings. 200m NIL ?
10.9 - 11.0	Massive buff and black speckled dolomite.
11.0 - 13.3	Medium to massive bedded earthy brown "Collenia" dolomite - Broken and rubbly in part.
13.3 - 13.8	Massive hard dolomite with some lesser earthy zones.
13.8 - 14.1	Loose, earthy and sandy zone.
14.1 - 14.3	Earthy dolomite.
	END OF HOLE

200
90000

GEOLOGICAL DESCRIPTION OF DRILL CORE (HAND SPECIMEN)DDH #8 PERNATTY CRUSHING SITE

DEPTH (m)	DESCRIPTION
0.0 - 2.1	Overburden and broken, rubbly calcrete and dolomite.
2.1 - 3.8	Medium bedded "Collenia" dolomite, earthy in parts.
3.8 - 5.4	Broken, rubbly earthy type dolomite with some clay zones of manganese mineralisation.
5.4 - 6.5	Medium to thinly bedded earthy "Collenia" dolomite - minor clay seams and gypsum present.
6.5 - 7.5	Earthy ironstone and medium bedded earthy "Collenia" dolomite.
7.5 - 8.0	Brown iron stained medium to thinly bedded "Collenia" dolomite.
8.0 - 9.0	Thin bedded crystalline (sugary) banded "Collenia" dolomite. Shows some brown staining.
9.0 - 9.15	Broken and shattered dolomite.
9.15 - 9.35	Massive earthy "Collenia" dolomite.
9.35 - 9.5	Clay seam.
9.5 - 9.65	Earthy massive "Collenia" dolomite.
9.65 - 10.8	Broken and rubbly, earthy ironstone/dolomite; soft and friable in part.
10.8 - 11.0	Hard massive ironstone/dolomite.
11.0 - 12.3	Massive to broken earthy ironstone/dolomite.
12.3 - 14.5	Hard clean massive ironstone.
14.5 - 15.5	Interbanded hard and earthy ironstone.
15.5 - 16.1	Earthy ironstone and clay.
	END OF HOLE

N/A

GEOLOGICAL DESCRIPTION OF DRILL CORE (HAND SPECIMEN)DDH #10 PERNATTY CRUSHING SITE

DEPTH (m)	DESCRIPTION
0.0 - 1.5	Overburden and calcrete (1.25 m loss).
1.5 - 2.3	Boulderous massive grey dolomite.
2.3 - 4.5	Massive grey striated "Collenia" dolomite, generally dense, hard and clean.
4.5 - 6.4	Massive clean hard grey and buff coloured "Collenia" dolomite.
6.4 - 7.4	Medium to massive bedded clean hard speckled dolomite.
7.4 - 7.5	Broken hard speckled dolomite.
7.5 - 8.6	Medium to broken hard clean "Collenia" dolomite with some minor clay seams.
8.6 - 10.6	Buff speckled clean massive "sugary" textured crystalline dolomite.
10.6 - 13.2	Massive hard "Collenia" dolomite with minor earthy zones. (1.2 m Core loss).
13.2 - 13.5	Medium bedded earthy dolomite with some minor dark mineral staining.
	END OF HOLE

GEOLOGICAL DESCRIPTION OF DRILL CORE (HAND SPECIMEN)

DDH # 15

Pernatty Crushing Site

Depth (m)	Description
0 - 1.9	Casing
1.9 - 2.02	Core Loss
2.02 - 2.5	Dolomite rubble. Grey, yellow stained medium grained algal dolomite. Significant Mn/Fe colouration along bedding planes, 1.5mm spacing and dipping approximately 45° and in a random 3-D network of fine cracks 2-5mm spacing. Dark yellow or white very fine grained recrystallized dolomite and Mn coatings on fracture faces.
2.5 - 2.6	Core Loss
2.6 - 2.8	Sandy clay, off white-red stained. Sand grains 0.5-1.0mm generally rounded. 300
2.8 - 5.5	Medium grained finely wavy bedded to massive near base crystalline dolomite. Grey but yellow stained particularly along bedding planes and as bands out from fractures. Bedding planes (inclined) and crosscutting fine 3-D network of fractures Fe/Mn and/or clay coated (gives rock an irregular blocky appearance). Fe/Mn patches (1mm) throughout rock mass. Most discontinuities along bedding therefore irregular and spaced 20-200mm. Clay filled crush zones at 2.8-2.87, 2.95-2.98, 3.13-3.21, 3.7-3.85, 4.55-4.65 (vertical fracture), 4.7-4.8 and 4.9 m with interval 4.55-4.9 m quite broken. 500 More massively bedded below 4.4 m with distinct contorted texture defined by black Fe/Mn blebs and stringers. Wavy algal reef tops sub-horizontal with wavy amplitude 4-10mm.
5.5 - 6.5	Massive to finely laminated in part, medium grained, even grained crystalline to granular dolomite. Grey with common irregular black Fe patches (2-4mm) or concentrated on laminae. Some porous zones. Discontinuities generally sub-horizontal commonly 50mm spacing with fine vertical fractures clay and/or Fe/Mn coated. Very broken at 5.5-5.6, 5.8 and 6.2 m (crush zone).
6.5 - 7.8	Finely bedded (with minor massive granular zones) algal and stromatolitic medium grained dolomite, grey to yellow. Bedding sub-horizontal to vertical. Fe/Mn replacement highlights bedding but also exists as filling in hair-like 3-D cracks. Bedding generally wavy on microscale. Some minor solution features along bedding. Crush zones at 6.5, 7 and 7.4-7.5 m.
7.8 - 8.5	Massive to finely laminated medium grained even grained crystalline to granular dolomite. Sub-vertical Fe coated fractures.
8.5 - 8.6	Core Loss
8.6 - 10	Ferruginous granular to crystalline massive medium grained dolomite. Patchy light-dark grey, orange in part. Laminated in part and some minor recrystallisation. Fe as intergranular filling, coating on dominant sub-horizontal fracture system, filling in common thin vertical cracks and in solution vugs. Quite porous in patches. Very broken mainly 8.8 and 9.0 m (including white clay seam with Fe nodules), 9.5 and 9.6-9.9 m.

800
6000

DIAMOND DRILLING LOG

PROJECT: PERNATTY CRUSHING CONTRACT No. 1 DATE: Start: 21.6.87 Finish: 22.6.87

OLE N° 15 LOCATION: Coords N E Chainage: SURFACE R.L. DATUM

OLE ANGLE 90° HOLE BRG : BIT TYPE N03 I90926 RIG TYPE EDSON 468 - 05 OPERATOR SCOTT RUSSELL

DRILLING							MATERIAL DESCRIPTION							DISCONTINUITY DESCRIPTION				GEOLOGICAL DESCRIPTION		
(m)	PEN. RATE mm/m	DRILL SPEED RPM	DOWN PRESS. kPa	FLUID PRESS. kPa	FLUID LOSS %	CASING	SOIL/ROCK TYPE	SOIL CLASS ¹	GRAPHIC LOG	DEPTH (m)	STRENGTH					RQD	SPACING	Surface description, openness, orientation, etc.	Origin type, mineral composition, structure, etc.	FORMATION
											q ₁	q ₂	q ₃	q ₄	q ₅					
						← To 1.9														
							CORE LOSS			2										
15		600	1500 2000	500	0		DOLOMITE RUBBLE Grey, yellow stained		H H											
							CORE LOSS													
11.3			0 - 2500				SANDY CLAY, off white-red DOLOMITE, grey, yellow stained			3										
										4										
10.7			0 - 2000		100					5										
11.4	600		0 - 500				DOLOMITE, grey, granular to crystalline texture		ΔΔΔΔ	6										

WOCALLA DOLOMITE

RECORDED BY: McCall
DATE: 11/10/87 Sheet 1 of 2

DIAMOND DRILLING LOG

PROJECT: PERMATTY CRUSHING CONTRACT No. 1 DATE + Start: 21.6.87 Finish: 22.6.87

OLE N° 15 LOCATION: Coords N E Chainage: SURFACE R.L. DATUM
OLE ANGLE 90° HOLE BRG: BIT TYPE N03 L90926 RIG TYPE EDSON 468 - 05 OPERATOR SCOTT RUSSELL

DRILLING						MATERIAL DESCRIPTION				DISCONTINUITY DESCRIPTION				GEOLOGICAL DESCRIPTION	
(m)	PEN. RATE min/m	DRILL SPEED RPM	DOWN PRESS kPa	UPDR PRESS kPa	FLUID LOSS %	CASING	SOIL/ROCK TYPE	SOIL CLASS ^{FM}	GRAPHIC LOG	DEPTH (m)	STRENGTH	RQD	SPACING	Surface description, openness, orientation etc.	Origin type, mineral compo ⁿ structure, etc.
7	13	600	1000	300	500	100	DOLOMITE, grey to yellow			7				Some fine vertical breaks. Bedding wavy. Hair-like 3D cracks Fe/Mn filled. Minor solution features.	Finely bedded algal Medium grained. Fe/Mn highlights bedding.
8	12.7		1500				DOLOMITE, grey, patchy			8				sub-vertical, Fe coated.	Massive
9	12	600	1000	500	100		FERRUGINOUS DOLOMITE Patchy dark-light grey, orange in part.			9				Dominantly sub-horizontal, thin vertical cracks common + some vugs. All Fe coated.	Granular to crystalline Medium grained. Massive Porous in patches.
10										10					

RECORDED BY: M. Call DATE: 11/1/87 Sheet 2 of 2

GEOLOGICAL DESCRIPTION OF DRILL CORE (HAND SPECIMEN)

DDH # 16

Pernatty Crushing Site

Depth (m)	Description	
0 - 0.7	Casing	
0.7 - 2.6	Grey-yellow finely wavy bedded (dip 20°) crystalline algal dolomite. Laminae highlighted by Fe which also occurs as patches and irregular sub-vertical stringers. Some evidence of brecciation with recrystallised infill. 1-1.05 Core Loss Fractures dominantly sub-horizontal along the bedding planes, wavy, clay (white-brown) or ironstone infilled, some clean. Spacing 10-120mm. Clay filled crush zones at 1.4, 1.55-1.65 (gypseous clay) and 1.73 m.	200
2.6 - 2.95	Clay filled crush zone with remnant corestones of algal dolomite. Clay red-yellow-brown/black mottled. Plastic.	350
2.95 - 8.15	Finely wavy bedded to more massive and erratically banded crystalline algal dolomite yellow/grey banded. Bedding varies from horizontal to near vertical. 4-4.1m Core Loss Most fractures along the bedding planes thus vary from horizontal to near vertical and commonly filled with white calcareous clay/silt. Spacing 30-180mm. Major 10mm wide lime filled sub-vertical fracture 4.7-5.2m and horizontal lime filled fractures at 5.45, 6.08 and 8.15 m. Fine cross-cutting fractures and hair like discontinuous fractures perpendicular to the bedding very common, Fe filled.	100
8.15 - 8.85	Medium grey-pale brown mottled massive granular medium grained (0.2-0.5mm) dolomite. Mottling caused by Fe rich patches. Grains clear, red, yellow stained, generally angular. Larger scale Fe replacement as Liesegang ring type structures. Minor thin sub-vertical Fe filled fractures. Poorly fractured.	
8.85 - 10	Finely wavy bedded to more massive and erratically banded crystalline algal dolomite, yellow/grey banded. Fractures generally along the bedding planes, dolomite clay and ironstone coated. Odd vertical fracture. 9.2-9.4 Core Loss, broken, weathered and iron stained from 9.4-9.5 m.	300
10 - 11.75	Medium grey/pale brown mottled massive granular medium grained dolomite. Much darker and less patchy 10.9-11.18 due to higher Fe content. Odd laminated zone, sub-horizontal. Rare horizontal fracture (spacing 20-400mm), odd Fe filled sub-vertical fine fracture.	
11.75 - 12	Finely laminated wavy bedded algal dolomite. White, yellow, red, fine to medium grained. Pock marked along bedding surfaces. Fe replacement along bedding common.	950 9300

DIAMOND DRILLING LOG

PROJECT: PERVAITY CRUSHING CONTRACT No. 1
 DATE: Start: 15.6.87 Finish: 16.6.87
 HOLE N° 16 LOCATION: Coorals N E Chainage: SURFACE R.L.
 HOLE ANGLE 90° HOLE BRG: BIT TYPE NQ3 189027 RIG TYPE EDSON 468 - 05 OPERATOR SCOTT RUSSELL

DRILLING							MATERIAL DESCRIPTION										DISCONTINUITY DESCRIPTION				GEOLOGICAL DESCRIPTION																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
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RECORDED BY: M. Call
 DATE: 24/1/87 Sheet 1 of 2

DIAMOND DRILLING LOG

PROJECT: PERNAFFY CRUSHING CONTRACT No: 1 DATE: START: 15.6.87 Finish: 16.6.87

HOLE N° 16 LOCATION: Coords N E Chainage: SURFACE R.L. DATUM

HOLE ANGLE 90° HOLE BRG BIT TYPE HQ3 L89027 RIG TYPE EDSON 468 - 05 OPERATOR SCOTT RUSSELL

DRILLING							MATERIAL DESCRIPTION							DISCONTINUITY DESCRIPTION			GEOLOGICAL DESCRIPTION																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
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RECORDED BY: M. Cell DATE: 21/9/87 Sheet 2 of 2

GEOLOGICAL DESCRIPTION OF DRILL CORE (HAND SPECIMEN)

DDH # 17

Pernatty Crushing Site

Depth (m)	Description
0 - 2.2	Casing
2.2 - 2.23	Core Loss
2.23 - 2.5	Dolomite rubble. Yellow-brown, fine grained massive dolomite with thin discontinuous Fe/Mn stringers. Horizontal and sub-vertical fractures filled with crystalline gypsum or gypseous clay.
2.5 - 2.65	Core Loss 200
2.65 - 2.85	Crush zone. Corestones of fine grained dolomite with significant red-brown-grey clay and white gypsum. 100
2.85 - 3	Yellow brown fine grained, with slightly coarser grained bands, finely laminated algal dolomite. Black Fe/Mn discontinuous stringers and blebs. Fine network of gypsum filled cracks.
3 - 5	Yellow brown fine grained to oolitic in part massive dolomite. The whole rock mass is cut by clay and/or gypsum filled fractures to 20mm and also contains whole zones of gypseous clay/clay. 350 3 - 3.33 m White soft, powdery gypsum clay to crystalline gypsum zone with only remnant dolomite fragments. Some plastic brown clay. Crystalline gypsum growing perpendicular to fracture faces. 3.8 - 4.15 m Thin brown clay overlying massive crystalline gypsum with odd remnant dolomite fragment. The gypsum itself has been dissolved/fractured and infilled with a yellow-brown clay containing well rounded quartz grains 0.5-2.5mm commonly 1mm. 350 4.6 - 5 m Brecciated rock mass infilled (to 20mm wide) with crystalline gypsum and quartz sandy clay. Fe staining more common. Other clay filled fractures (horizontal) at 3.65, 4.2, 4.45 and 4.55 m. Odd clean sub-horizontal fracture and thin gypsum filled sub-vertical crack. 100
5 - 5.38	Intermixture of crystalline gypsum, yellow-brown sandy gypseous clay and remnant fragments of fine grained dolomite (crush zone).
5.38 - 7.5	Quartz sand, clayey (kaolin), pale grey to yellow stained (ferruginous), relatively even grained averaging 0.5mm with some coarser bands to 1mm. Quartz clear, rose, sub-spherical and rounded. Some finer grains odd pebble to 10mm. White clay matrix (<10%). Friable. Odd more indurated zone eg 6.8-7 m and strongly yellow stained in part below 7.1 m. Highly weathered sandstone.
7.5 - 8.5	Core Loss 100-0

GEOLOGICAL DESCRIPTION OF DRILL CORE (HAND SPECIMEN)

DDH # 17

Pernatty Crushing Site

Depth (m)	Description
8.5 - 8.85	Sandstone (friable)/sand, clean to slightly clayey. White to yellow stained (ferruginous). Quartz generally 0.5-1mm, well rounded and spherical.
8.85 - 10.2	Claystone, highly weathered, strong yellow to white (soapy) with clayey sandstone beds at 9.2-9.5 and 10-10.2 m (white, pink, yellow). 1350
10.2 - 12	Ferruginous dolomite oolitic to granular to 11.5m then algal dolomite. Brown, medium grained, massive. Oolites commonly 0.3-0.4mm. Below 11.5 m essentially ironstone replacement of algal dolomite with sedimentary structures preserved. Dense. Cross cutting and sub-horizontal fractures 20-300mm spacing, Fe filled though not closed (solution features remain). Quite vuggy below 11.6 m. Crush zone 11.4-11.5 m and at 11.8 m. 3400 7800

DIAMOND DRILLING LOG

PROJECT: PERNATTY CRUSHING CONTRACT No. 1
 DATE: START: 3.6.87 Finish: 4.6.87
 HOLE N° 17 LOCATION: Coords N E Chainage: SURFACE R.L. DATUM
 HOLE ANGLE 90° HOLE BRC BIT TYPE NQ3 L89027 RIG TYPE EDSON 468 - 05 OPERATOR SCOTT RUSSELL

DRILLING							MATERIAL DESCRIPTION										DISCONTINUITY DESCRIPTION				GEOLOGICAL DESCRIPTION																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
DEPTH (m)	PEN. RATE mm/m	DRILL SPEED R.P.M.	DOWN PRESS kPa	FLUID PRESS kPa	FLUID LOSS %	CASING	SOIL/ROCK TYPE	SOIL CLASS ¹	GRAPHIC LOG	DEPTH (m)	STRENGTH						RQD	SPACING	Surface description, openness, orientation, etc.	Origin Type, mineral composition, structure, etc.	FORMATION																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
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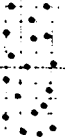
RECORDED BY: Neil Gault
 DATE: 11/01/87 Sheet 1 of 2

DIAMOND DRILLING LOG

PROJECT: PERMATTY CRUSHING CONTRACT No. 1 DATE: Start: 3.6.87 Finish: 4.6.87

HOLE N° 17 LOCATION: Coombs N Chainage: SURFACE R.L. DATUM

HOLE ANGLE 90° HOLE BRG: BIT TYPE NQ3 189027 RIG TYPE EDSON 468 - 05 OPERATOR SCOTT RUSSELL

DRILLING							MATERIAL DESCRIPTION										DISCONTINUITY DESCRIPTION				GEOLOGICAL DESCRIPTION																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					
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RECORDED BY: NOL Child
DATE: 1/10/87 Sheet 2 of 2

GEOLOGICAL DESCRIPTION OF DRILL CORE (HAND SPECIMEN)

DDH # 18

Pernatty Crushing Site

Depth (m)	Description
0 - 0.85	Casing
0.85 - 1.00	Dolomite rubble, calcreted at top. Grey-yellow-buff banded algal dolomite, medium grained, dense. Thin discontinuous black Fe stringers along growth banding. Patchy Fe concentrations also.
1.00 - 1.15	Core Loss
1.15 - 4.7	Grey, yellow wavy banded medium grained dense crystalline algal dolomite. Banding varies from horizontal near top and gradually steepens till sub-vertical near base. Accentuated by continuous to discontinuous Fe concentration along growth bands. Most simple fractures follow banding and are white/brown clay and/or Fe coated, sometimes gypsum infilled and normally irregular (wavy). Rock mass is also crossed by thin black (Fe) discontinuous cracks sometimes slightly opened by solution activity grading to vuggy in places. Fine banding less obvious below 4.2 m where structure more defined by patchy Fe concentrations. Fracture spacing varies from rubble zones to 200mm. Major crush zones generally clay/rubble filled at 1.8-2, 2.1, 2.5, 2.9-3.38, 3.7-3.8 and 4.1-4.7 m (quite broken). Clay either powdery white with black Fe Oxides or red-yellow, plastic and gypseous. 2.5-2.65 Core Loss 4-4.1 Core Loss
4.7 - 5.78	Grey brown mottled, massive, granular to oolitic very dense dolomite. Coarser grained (0.2-0.5mm) than overlying banded algal dolomite. Minor banded zones. Darker patches more disseminated through rock mass (intergranular). Fractures ferruginous clay or Fe coated sub-horizontal to sub-vertical (to 5m). Very broken 5-5.78m with horizontal to sub-horizontal crush zones filled with yellow-white very calcareous soft silt, hard recrystallized very fine grained dolomite (white) or brown very plastic clay with rounded to angular ironstone concentrations, particularly 5.55-5.7m. 5.5 - 5.55 Core Loss
5.78 - 6.4	Yellow grey, dense, fine to medium banded, medium grained algal dolomite. Banding steep at top (60°) to sub-horizontal at base, defined by black Fe concentrations as discontinuous stringers. Fine black Fe stringers at right angles to banding. Fractures erratic, generally Fe coated or patchily infilled to vuggy. Very broken from 6.1-6.4m. Two phases of fracturing with larger fractures (cavities?) infilled with white very fine grained dolomite/calcite with some Fe material followed by rubbly zones infilled with yellow plastic clay and ironstone rubble.
6.4 - 6.7	Grey brown mottled, massive, granular to oolitic very dense dolomite. Contact slopes at 80°.
6.7 - 7	Grey yellow stained, dense banded algal dolomite. Bands accentuated by black Fe patches. Wavy clay filled discontinuities also define banding, spaced 10-100mm apart. Bands dip approx. 45°, steepening to base.
7 - 7.6	Core Loss

200
400
100
600200
50

100

600

GEOLOGICAL DESCRIPTION OF DRILL CORE (HAND SPECIMEN)

DDH # 18

Pernatty Crushing Site

Depth (m)	Description	
7.6 - 7.85	Grey wavy banded algal dolomite criss-crossed with Fe filled fractures. Brown plastic clay/rubble filled crush zone 7.7-7.75 m.	50
7.85 - 7.9	Black clay with ironstone nodules.	50
7.9 - 8.5	Quartz sand, silty, yellow-orange. Grains 0.1-0.3mm angular to sub-rounded, clear, rose coloured or yellow stained. Very loosely consolidated. Gritty in part (2mm) and clayey in part (white/yellow). Grades to a claystone at 8.35m then very ferruginous (black) and sandy at 8.5m.	2350 7150
8.5 - 8.7	Core Loss	
8.7 - 8.95	Clay, yellow, gritty and sandy, sticky, ferruginous.	
8.95 - 9.15	Ironstone (replacing laminated dolomite?), black, dense, massive.	
9.15 - 10	Strong yellow very weathered ferruginous claystone and interbedded sandstone.	

DIAMOND DRILLING LOG

PROJECT: PERNATTY CRUSHING CONTRACT No. 1 DATE: Start: 21.6.87 Finish: 21.6.87

HOLE N° 18 LOCATION: Coords N E Chainage: : SURFACE R.L. DATUM

HOLE ANGLE 90° HOLE BRG : BIT TYPE NQ3 190926 : RIG TYPE EDSON 468 - 05 : OPERATOR SCOTT RUSSELL

DRILLING							MATERIAL DESCRIPTION				DISCONTINUITY DESCRIPTION				GEOLOGICAL DESCRIPTION	
DEPTH (m)	PEN. RATE mm/m	DRILL SPEED RPM	DOWN PRESS kPa	FLUID PRESS kPa	FLUID LOSS %	CASING	SOIL/ROCK TYPE	SOIL CLASS ¹	GRAPHIC LOG	DEPTH (m)	STRENGTH	RQD	SPACING	Surface description, openness, orientation etc.	Origin type, mineral composition, structure, etc.	FORMATION
						To 0.8										
1	13.3	600	0	500	0		DOLOMITE RUBBLE		H	1				1.15 Core loss	Calcreted	
2	13.3		0 - 2500				DOLOMITE Grey yellow			2				Fractures follow banding. Coated white/brown clay and FeO.	Medium grained, dense wavy banded, algal. FeO concentration along growth bands.	
3	14		2000							3				2.5 Core loss 2.68 Core loss Some gypseous clay	Horizontal at top gradually dips.	
4										4				4.1 Core loss		
5	12.7		1500				DOLOMITE Grey brown mottled			5				Sub-horizontal to sub-vertical. Very broken in places.	Massive, granular overlying banded algal. Oolitic in part	
6	16.7	600	1750	500	0		DOLOMITE Yellow grey			6					Algal, steeply dipping	

RECORDED BY: M. Cole
DATE: 4/10/87 Sheet 1 of 2

DIAMOND DRILLING LOG

PROJECT:

PERNATTY CRUSHING CONTRACT No. 1

DATE: Start: 21.6.87 Finish: 21.6.87

HOLE N°	18	LOCATION	Coorbs
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-2-

✦ E

Chainage:

: SURFACE R.I.

DATUM

HOLE ANGLE	90°	HOLE BRG
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BIT TYPE NQ3 L90926

2. RIG TYPE EDSON 468 - 05

: OPERATOR SCOTT RUSSELL

[illegible]

RECORDED BY : NO. 622

DATE : 1/10/87 Sheet 2 of 2

GEOLOGICAL DESCRIPTION OF DRILL CORE (HAND SPECIMEN)

DDH # 19

Pernatty Crushing Site

Depth (m)	Description
0 - 0.8	Casing
0.8 - 1.0	Rubble - calcreted finely laminated algal dolomite
1.0 - 1.1	Core Loss
1.1 - 5.2	Grey, yellow, pink, finely laminated algal dolomite. Dense. Laminae horizontal, dipping after 4.8m, characteristically wavy and in places exhibit dome shaped structures to 20mm across with steep sides. Banding defined by dark mineralization (Fe replacement). Hair-like iron filled cracks criss-cross the whole unit. The rock mass is quite broken with the dominant fracture pattern horizontal along growth bands, wavy irregular and sandy clay or dolomite sand infilled. The sandy clay is very calcareous, slightly plastic and off white-grey. Major clay/rubble filled crush zones at 1.15-1.3, 1.4, 1.6-1.75, 2.2-2.23, 3.1-3.13, 3.22, 3.24 and 3.52-3.55 m. Very broken-shattered relatively clean zones at 2-2.15, 2.35-2.6, 3.65-3.95, 4.05-4.1 and 4.6-4.85 m. Other thinner horizontal breaks common. Odd sub-vertical fracture, clay filled, irregular and often discontinuous and invariably Fe/Mn coated. Strongly ferruginous 4.8-5.2 m, replacement along bedding and in fractures. Core Loss 2.46 - 2.5m 3.6 - 3.65m 4.45 - 4.6m
5.2 - 6.1	Buff coarser grained less finely laminated (more massive) algal dolomite. Banding dips approx. 30°. Fractures sub-horizontal to parallel to bedding, wavy irregular, clay and Fe filled and commonly show slickenside type structures. Sub-vertical and cross-cutting fractures Fe coated and partially open. Circular (2-3 mm) and lens shaped solution features not uncommon.
6.1 - 7.2	Buff-yellow finely laminated to contorted bedded (dome-shaped) fine to medium grained algal dolomite. Bedding highlighted by black Fe mineralization. Unit is quite Fe rich, apart from along bedding planes exists as irregular patches and infilling or coating of irregular sub-horizontal fractures and solution vugs (to 20mm). Surface is pock-marked by small solution holes ($\leq$ 1mm). Very broken 6.85 and 7-7.2m. Fractures sub-horizontal or cross cutting, yellow clay and black Fe coated. Fracture spacing rubble zones to 170mm.
7.2 - 8.1	Paler buff to grey less finely laminated, more massive algal dolomite, slightly coarser grained. Significant Fe along bedding planes (often discontinuous) as small 2-4mm patches and as infilling of sub-horizontal and vertical fractures spaced from rubble zones to 200mm. Fine circular to elongate solution features common. Very broken 7.2-7.45 and 7.75 m.
8.1 - 8.4	Darker yellow brown finely laminated algal dolomite, finer grained. Fe filled fine cracks perpendicular to domed bedding (contorted in places) are common. Crushed 8.3-8.4 m.

GEOLOGICAL DESCRIPTION OF DRILL CORE (HAND SPECIMEN)

DDH # 19

Pernatty Crushing Site

Depth (m)	Description
8.4 - 11.55	Buff to grey, yellow stained in part, granular to oolitic massive medium grained dolomite. Grains 0.1-0.3mm. Laminated in part. More ferruginous 10.2-11.15 as small patches (2 mm) or as curvilinear liesegang ring type structures. Surface pock-marked by pin-head size to 2-3mm small solution features. Fractures sub-horizontal to vertical completely or partially infilled with white granular calcite with ironstone patches. Cross-cutting hair-line cracks evident in places. Quite broken 9.05-9.25m. Fracture spacing 30-200mm.
11.55 - 12	Pale yellow-brown finely curvilinear laminated algal (stromatolitic?) dolomite, oolitic in part. Very dense (Fe impregnated). Criss-crossed by wavy cracks generally Fe filled.

1050
 9200

DIAMOND DRILLING LOG

PROJECT: PERNATTY CRUSHING CONTRACT No. 1

DATE: Start: 16.6.87 Finish: 16.6.87

HOLE N° 19 LOCATION: CORMS N E Chainage: SURFACE R.L. DATUM

HOLE ANGLE 90° HOLE BRG BIT TYPE NQ3 L89027 RIG TYPE EDSON 468 - 05 OPERATOR SCOTT RUSSELL

DRILLING							MATERIAL DESCRIPTION										DISCONTINUITY DESCRIPTION				GEOLOGICAL DESCRIPTION																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					
DEPTH (m)	PEN. RATE mm/m	DRILL SPEED R.P.M.	DOWN PRESS kN	FLUID PRESS kN	FLUID LOSS %	CASING	SOIL/ROCK TYPE	SOIL CLASS ¹	GRAPHIC LOG	DEPTH (m)	STRENGTH						RQD	SPACING	Surface description, openness, orientation, etc.	Origin type, mineral compos ⁿ structure, etc.	FORMATION																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					
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RECORDED BY: M. C. C. DATE: 11/3/97 Sheet 1 of 1

DIAMOND DRILLING LOG

PROJECT: PERNATY CRUSHING CONTRACT No. 1		DATE: Start: 16.6.87 Finish: 16.6.87	
HOLE N° 19	LOCATION: Coords N E	Chainage:	SURFACE R.L. DATUM
HOLE ANGLE 90°	HOLE REG	BIT TYPE N03 89027	RIG TYPE EDSON 468 - 05 OPERATOR SCOTT RUSSELL

DRILLING							MATERIAL DESCRIPTION							DISCONTINUITY DESCRIPTION				GEOLOGICAL DESCRIPTION																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
DEPTH (m)	PEN. RATE min/m	DRILL SPEED R.P.M.	DOWN PRESS kPa	FLUID PRESS kPa	FLUID LOSS %	CASING	SOIL/ROCK TYPE	SOIL CLASS ¹	GRAPHIC LOG	DEPTH (m)	STRENGTH						RQD	SPACING	Surface description, openness, orientation etc.	Origin type, mineral compos ⁿ structure, etc.	FORMATION																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
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RECORDED BY: Neil Gidd
DATE: 11/01/87 Sheet 2 of 2

GEOLOGICAL DESCRIPTION OF DRILL CORE (HAND SPECIMEN)

DDH # 20

Pernatty Crushing Site

Depth (m)	Description
0 - 0.8	Casing
0.8 - 1.0	Calcreted fine grained laminated dolomite rubble.
1.0 - 1.25	Core Loss 250
1.25 - 1.3	Calcreted fine grained laminated dolomite.
1.3 - 5.0	Yellow-grey to black finely laminated to erratically contorted banded medium grained algal dolomite with zones of white fine grained dolomite. Dense. Laminae and banding defined by alternating Fe rich (black) and Fe poor (yellow/grey) zones. Laminae sub-horizontal to dipping (20°). Most fractures along bedding, thin, wavy irregular and white clay/ironstone coated. Some algal reef tops quite irregular with amplitude of 10mm. Some cross-cutting fractures at 45° particularly near base. Rock mass also contains cross-cutting network of fine hair-like Fe filled cracks. Minor solution holes. Fracture spacing rubble zones to 230mm, commonly 60-100mm. Very broken (crush) zones at 2.4-3.25, 3.8-4 and 4.15 m. Clay filled crush zones at 3.3, 3.5 and 4.3-4.5m. Core Loss 2.5 - 2.95 m +50 3.2 - 3.25 m 50 250 200 950.
5.0 - 13	Yellow grey more massive fine to medium grained algal dolomite. Dense. Characterised by rounded patches of black Fe concentration and a 3-D network of closely spaced black Fe filled hair-like cracks. Strongly ferruginous below 10.3m. Dominant fracture system sub-horizontal or parallel to bedding, rough surfaced and generally infilled with clay and ironstone rubble particularly at 6.1, 6.7 (30mm), 6.85, 6.9, 8.05 (50mm), 9.7, 10.38, 11.15 and 11.32 m. Platy fractures at 11.2-11.3m. Odd sub-vertical fracture leads to rubbly zone. More banded 6-7.5, 9.7-10.7 and particularly 11.05-13 m (dipping 20°) but often irregular with domal structures more common below 12.6m. Vuggy in places. Fracture spacing 35-250mm, commonly 50-60mm. 950 10200

DIAMOND DRILLING LOG

PROJECT: PERNATTY CRUSHING CONTRACT No. 1 DATE: Start: 2.6.87 Finish: 3.6.87

HOLE N° 20 LOCATION: Coords N E Chainage: SURFACE R.L. DATUM

HOLE ANGLE 90° HOLE BGC BIT TYPE N03-T89027 RIG TYPE EDSON 468 - 05 OPERATOR SCOTT RUSSELL

DRILLING							MATERIAL DESCRIPTION										DISCONTINUITY DESCRIPTION				GEOLOGICAL DESCRIPTION																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
DEPTH (m)	PEN. RATE min/m	DRILL SPEED R.P.M.	DOWN PRESS kPa	FLUID PRESS kPa	FLUID LOSS %	CASING	SOIL/ROCK TYPE	SOIL CLASS ¹	GRAPHIC LOG	DEPTH (m)	STRENGTH					RQD	SPACING	Surface description, openness, orientation, etc.	Origin type, mineral compos ⁿ structure, etc.	FORMATION																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
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RECORDED BY: Will Cobi
DATE: 11/10/87 Sheet 2 of 2

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DIAMOND DRILLING LOG

PROJECT: PERNATTY CRUSHING CONTRACT No. 1

DATE & Start: 2.6.87 Finish: 3.0.87

HOLE N° 20 : LOCATION: Coords

N

13

Chainage:

SURFACE R.L.

DATUM

HOLE ANGLE 90° : HOLE BRG

BIT TYPE NQ3 L89027

2. RIG TYPE	EDSON 468 - 05
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OPERATOR SCOTT RUSSELL

[illegible]

RECORDED BY : Nil G. 22

DATE : 1/10/87 Sheet 3 of 3

GEOLOGICAL DESCRIPTION OF DRILL CORE (HAND SPECIMEN)

DDH # 21

Pernatty Crushing Site

Depth (m)	Description
0 - 0.9	Casing
0.9 - 1.0	Finely laminated fine grained algal dolomite, grey-brown, steeply dipping to horizontal. Calcreted and laterised at top.
1.0 - 1.2	Core Loss 200
1.2 - 6.7	Finely laminated to slightly massive fine to medium grained algal dolomite. Buff to pale grey but medium yellow-brown where more ferruginous. Algal domes 5-10mm across with steep V-shaped valleys between the domes most common structure. Black ferruginous mineralization defines laminations. Fe oxides ubiquitous, concentrated in some zones. Exists mostly as thin stringers or plates along bedding, as small 1-2mm patches, as infilling of hair-like cracks perpendicular to the bedding and as a coating on major fractures. Solution features exist as small vugs, as sub-vertical calcite/ironstone filled fractures or as sub-horizontal linear features, the latter particularly below 5m. Some quite porous zones. Gritty clay filled horizontal and vertical crush zones throughout up to 200mm wide and spaced 100mm - 100cm. The clay is generally red, stiff to plastic and often gypseous in the upper zones and yellow and plastic down hole. Other sub-horizontal fractures generally white calcite/black ironstone coated or clay filled thin discontinuities on top of colonies. Some thin hair-like irregular cross-cutting infilled cracks. Quite ferruginous below 4.6m (distinct yellow-brown). Core Losses 2.5 - 2.6 m 600 4 - 4.4 m 5.5 - 5.6 m
6.7 - 7.2	Brown grey more massive fine to medium grained algal dolomite with Fe more as patches. Some white-pink slightly coarser grained zones. Becomes more laminated below 7m. Dense.
7.2 - 7.95	Core Loss 750
7.95 - 8.0	Rubble 1550 7100
8.0 - 8.2	Corestones of ironstone after finely laminated algal dolomite and yellow-brown fine grained algal dolomite in a yellow-white clayey sand or purple iron rich sand.
8.2 - 8.5	Yellow plastic clay overlying sandy and gravelly ironstone rubble.
8.5 - 10	Yellow at top grading to red-yellow-grey mottled highly weathered claystone. Sandy at top. Soapy. Some thin more sandy zones. (weathered shale lense within the Woolcalla Dolomite?).

DIAMOND DRILLING LOG

PROJECT: PERNATTY CRUSHING CONTRACT No. 1						DATE: Start: 20.6.87 Finish: 20.6.87	
HOLE N°	21	LOCATION	Coords	N	E	Chainage:	SURFACE R.L.
HOLE ANGLE	90°	HOLE BRC		BIT TYPE	NQ3 L90926	RIG TYPE	EDSON 468 - 05
						OPERATOR	SCOTT RUSSELL

DRILLING							MATERIAL DESCRIPTION										DISCONTINUITY DESCRIPTION						GEOLOGICAL DESCRIPTION	
DEPTH (m)	PEN. RATE mm/m	DRILL SPEED R.P.M.	DOWN PRESS kPa	FLUID PRESS kPa	FLUID LOSS %	CASING	SOIL/ROCK TYPE	SOIL CLASS ^{FN}	GRAPHIC LOG	DEPTH (m)	STRENGTH					RQD	SPACING, Surface description, openness, orientation etc	Origin type, mineral compos ⁿ structure, etc.	FORMATION					
											1	2	3	4	5					6				
1	20	600	0	500		<To 0.9	DOLOMITE			1								1. Core Loss	Calcreted, laterised.	DOLOMITE				
2	12		1500-2000	700	0		DOLOMITE Buff to pale grey, medium yellow-brown where more ferruginous.			2								1.2 Clay filled crush zones throughout horizontal and vertical.	Finely laminated to slightly massive. Fine to medium grained. Algal. Dome structures common.					
3	12		0-1000	600	10					3								2.5 2.6 Core Loss Clay red, stiff to plastic, gypseous near top becoming yellow and plastic down hole.	Fe oxides define laminations.					
4			0-2000	500	20		Core Loss			4								4. Core Loss	Solution features throughout					
5	12		0-1000		50		Yellow - brown			5								4.4	Quite ferruginous					
6		600	0	500	75					6								5.5 5.6 Core Loss						

RECORDED BY: W. G. G. G.
 DATE: 11/10/87 Sheet 1 of 1

DIAMOND DRILLING LOG

PROJECT:	PERNATTY CRUSHING CONTRACT No. 1
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DATE: Start: 20.6.87 Finish: 20.6.87

HOLE N°	21	LOCATION	Coords
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N

3.

Chainage:

SURFACE R.L.S.

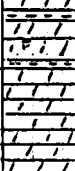
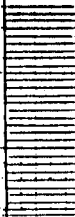
DATUM

HOLE ANGLE 90 : HOLE BRG.

BIT TYPE	NQ3 L90926
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: RIG TYPE	EDSON 468 - 05
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OPERATOR SCOTT RUSSELL

DRILLING							MATERIAL DESCRIPTION										DISCONTINUITY DESCRIPTION					GEOLOGICAL DESCRIPTION								
DEPTH (m)	PEN. RATE mm/m	DRILLSPEED R.P.M.	DOWN PRESS kPa	FLUID PRESS kPa	FLUID LOSS %	CASING	SOIL/ROCK TYPE	SOIL CLASS ^{FH}	GRAPHIC LOG	DEPTH (m)	STRENGTH						RQD	SPACING	Surface description, openness, orientation etc.	Origin type, mineral compo ⁿ structure, etc.	FORMATION									
											VN	Z	NW	MV	VS	GS						% P	% F	% S	<20 mm	<60	<200	<600	>2.0	
7	14	600	0	500	75		DOLomite Brown - grey			7																		More massive. Fine to medium grained. Algal		
8	12.7			500-1000	100		Core Loss																				7.2			
							CRUSH ZONE = DOLomite CORE STONES CLAY (Yellow) OVER IRONSTONE RUBBLE			8																		7.95 Rubble		
9	18		0	500-800			CLAYSTONE Yellow at top passing down to red-yellow-grey mottled,			9																		Highly weathered. Sandy at top. Soapy. Some thin sandy layers.		
10		600	0 - 2500	800-1000	100					10																				
11										11																				

RECORDED BY : Mr. Gell
DATE : 1/10/57 Sheet 2 of 2

GEOLOGICAL DESCRIPTION OF DRILL CORE (HAND SPECIMEN)

DDH # 22

Pernatty Crushing Site

Depth (m)	Description
0 - 1.6	Casing
1.6 - 1.7	Core Loss 100
1.7 - 5.65	Pale brown-grey finely laminated fine to medium grained algal dolomite. Laminae finely spaced accentuated by black iron oxide grains, sub-horizontal to dipping at depth with common algal dome structures averaging 10mm across or wavy undulations. Less finely banded, more massive with depth. Unit is quite broken with secondary dolomite /rubble filled 5-10mm fractures generally following banding ie sub-horizontal to dipping. Some bedding fractures and all of the cross-cutting (45°) and vertical breaks are white dolomite silt and black iron oxide coated, the latter being oxidized in part to a strong yellow. Fine wavy clay filled cracks parallel to growth laminae are ubiquitous. Hair-like erratically oriented and often discontinuous Fe filled cracks also exist. Some solution pockmarks on surface. Major crush zones 1.7-2, 2.04-2.1, 2.18-2.25, 2.4, 2.55, 2.7-2.85, 3.1-3.2, 3.3-3.4, 4.3-4.4, 4.75-4.85 and 5.2-5.4 m (vertical and horizontal fractures). Core Loss 4 - 4.2 m 200
5.65 - 7.5	Pale brown, coarser banded sub-horizontal to steeply dipping fine grained algal dolomite. Fe rich zones are bigger but still define growth banding, domal structures still evident but rock has a more patchy and contorted appearance. Fractures vary from sub-horizontal to 45°, clay/rubble filled or coated with Fe oxides spaced 40-300mm. Partially infilled vertical, cross-cutting and bedding breaks quite vuggy in places. Fine Fe oxide filled cracks perpendicular to banding also evident. 100
7.5 - 7.7	Broken zone. Rubbly fine to medium grained pale grey dolomite. Significant Fe staining. Brown plastic sandy clay infilling at base. 50
7.7 - 8.15	Patchy black to pale grey fine to medium grained dense dolomite. Horizontally and vertically fractured, quite broken.
8.15 - 8.23	Granular porous medium grained (0.2mm) dolomite, grains clear, white, rose coloured.
8.23 - 8.5	Finely laminated to more massive and less Fe mineralized fine grained dolomite. White clay/silt filled 20mm break at 8.45m. 20
8.5 - 8.6	Core Loss
8.6 - 10	Off white to yellow-brown-grey finely laminated to more massive fine to medium grained dolomite, more yellow below 9.45m. Domal structures common. Small solution features common either as circular vugs to 3-4mm, small grain-size pockmarks or as linear features along bedding planes and cross-cutting fractures. Most fractures are sub-horizontal, white, yellow, black clay/ironstone coated and spaced 40-200mm. Yellow plastic clay filled (30mm) seam at 9.23m. 50

520

8400

GEOLOGICAL DESCRIPTION OF DRILL CORE (HAND SPECIMEN)

DDH # 22

Pernatty Crushing Site

Depth (m)	Description
	Thin hair-like Fe oxide filled vertical cracks commonly 1-2mm apart cut the rock mass and show yellow discolouration out into the rock parallel to the cracks and along intersected Fe defined bedding laminae. Porous at base.
10 - 10.5	Core Loss
10.5 - 11.05	As for 8.6 - 10 m.
11.05 - 11.15	Clay/silt. Strong yellow.
11.15 - 11.68	Brown ferruginous fine grained dense dolomite with porous medium grained yellow/brown zones. Characterised by random network of partially calcite infilled fine cracks. Core Loss 11.5 - 11.6 m, crumbly below.
11.68 - 11.8	Quartz silt/sand. Strong yellow.

DIAMOND DRILLING LOG

PROJECT: PERNATTY CRUSHING CONTRACT No. 1

DATE: Start: 17.6.87 Finish: 17.6.87

HOLE N°	22	LOCATION	Coords	N	E	Chainage:		SURFACE R.L.		DATUM	
HOLE ANGLE	90°	HOLE BRG		BIT TYPE	NQ3 L89027	RIG TYPE	EDSON 468 - 05	OPERATOR	SCOTT RUSSELL		

HOLE ANGLE	90 °	HOLE BRC	:	BIT TYPE	NQ3 L89027	RIG TYPE	EDSON 468 L-05	:	OPERATOR	SCOTT RUSSELL
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DRILLING							MATERIAL DESCRIPTION										DISCONTINUITY DESCRIPTION				GEOLOGICAL DESCRIPTION											
DEPTH (m)	PEN. RATE mm/m	DRILL SPEED R.P.M.	DOWN PRESS kPa	FLUID PRESS kPa	FLUID LOSS %	CASING	SOIL/ROCK TYPE	SOIL CLASS ¹	GRAPHIC LOG	DEPTH (m)	STRENGTH					RQD		SPACING	Surface description, openness, orientation, etc.	Origin type, mineral compos ⁿ , structure, etc.	FORMATION											
											VM	MP	MS	SS	VS	ES	VP					PS	GS	<20 mm	20-60	60-200	200-600	600-2.0m	2.0m			
1						← To 1.6				1																						
2	17.8	600	1500	500			DOLOMITE Pale brown - grey			2																1.7 Core loss	Unit quite broken along bedding planes Silt/ironstone infilled.	Finely laminated Fine-medium grained. Algal.				
3	12		3000		0					3																	Some solution features.	Laminae sub-horizontal dipping at depth. Dome structures to 10 mm across.				
4			2000		0					4																4.2 Core loss						
5	10.7		2250		90					5																5.05 Core loss						
6		600		500	95		DOLOMITE Pale brown																				Fractures clay/rubble filled or	Coarser banded sub-horizontal to steeply.				

RECORDED BY: McGee
DATE: 1/18/87 Sheet 1

DIAMOND DRILLING LOG

PROJECT: PERNATTY CRUSHING CONTRACT No. 1

DATE: Start: 17.6.87 Finish: 17.6.87

HOLE N° 22 : LOCATION: Coords N E Chainage: : SURFACE R.L. : DATUM :
HOLE ANGLE 90° : HOLE BRC : BIT TYPE NQ3 L89027 : RIG TYPE EDSON 468 - 05 : OPERATOR SCOTT RUSSELL

DRILLING						MATERIAL DESCRIPTION						DISCONTINUITY DESCRIPTION			GEOLOGICAL DESCRIPTION			
DEPTH (m)	PEN. RATE mm/m	DRILL SPEED R.P.M.	DOWN PRESS kPa	FLUID PRESS kPa	FLUID LOSS %	CASING	SOIL/ROCK TYPE	SOIL CLASS ^{FM}	GRAPHIC LOG	DEPTH (m)	STRENGTH			RQD	SPACING	Surface description, openness, orientation etc.	Origin type, mineral compos ⁿ structure, etc.	FORMATION
											VN	2N	MS					
7	14	600		500	95					7						Fe oxide coated. Vuggy in places.	dipping. More patchy and contorted.	
8	11.3		2000		95		BROKEN ZONE - DOLOMITE FRAGMENTS DOLOMITE Black to pale grey DOLOMITE DOLOMITE			8						Ferruginous. Quite broken	Sandy clay infilling Granular, porous Finely laminated.	
9					100		DOLOMITE Off white to yellow/brown-grey.			9						8.5 Core loss Sub-horizontal clay/ironstone coated.	Finely laminated to more massive. Algal, domal.	
10	10.7		1500							10						Solution features common.		
11	14		2500							10.5						Core loss		
11		600	4500	2500			CLAY/SILT. Strong yellow DOLOMITE. Brown, ferruginous			11							Very fine grained.	
12	20	500		600	100		SAND/SILT, Quartz. Strong yellow			11.5 11.6						Core loss	Dense	
12										12								

RECORDED BY: M. G. G. H.
DATE: 11/9/87 Sheet 2

GEOLOGICAL DESCRIPTION OF DRILL CORE (HAND SPECIMEN)

DDH # 23

Pernatty Crushing Site

Depth (m)	Description
0 - 1.1	Casing
1.1 - 1.15	Core Loss 50
1.15 - 1.4	Dolomite rubble, calcreted at top. Dolomite finely laminated fine grained, yellow black banded.
1.4 - 2.5	Grey finely laminated to finely banded fine to medium grained crystalline dolomite, undulating and wavy bedding. Dense. Bedding accentuated by finely disseminated to patchy dark mineralization (iron oxides). Quite broken with sub-horizontal fractures 15-90mm spacing, 5-40mm wide, sandy clay filled (white-red, calcareous). Clean fractures yellow-black iron oxide stained. Main clay filled breaks at 1.6-1.63, 1.68-1.70, 1.92-1.96, 2.27-2.3 m and clay filled vertical fracture between clay filled horizontal fractures from 2-2.1 m. Crush zone 2.4-2.48m. Also thin wavy clay filled discontinuities along bedding planes and Fe filled cross-cutting hair-like cracks. 100
2.5 - 2.75	Core Loss 250
2.75 - 4.1	Grey finely laminated to finely banded dolomite, generally as above. Clay filled fractures 3.2-3.21, 3.3 (including coarse grained clear gypsum crystals), 3.8 and 3.9 m. Otherwise quite broken especially 4-4.1 m (10-20mm spacing) generally sub-horizontal. 200
4.1 - 4.85	Brown to black at base ferruginous dolomite, massive to finely banded in part (algal, stromatolitic?). Dense to porous because of planar to vuggy solution features. Almost total Fe replacement 4.68-4.85m. Dome structures more common to base. Horizontal fracturing 80-100mm spacing.
4.85 - 5.05	More massive white to mottled pale brown yellow medium grained dolomite. Cut by a white silt/black Fe oxide filled horizontal seam and vertical crack 4.97-5m. Hair-like (dendritic looking) black Fe oxide filled cracks, vertical and cross-cutting with a few patches of iron oxides.
5.05 - 5.38	Finely laminated to finely contorted banded fine to medium grained dolomite, yellow, pink, brown, grey. Clay filled wavy seams follow bedding planes. 100
5.38 - 6.62	More massive fine to medium grained pale-medium brown dolomite with banding defined more by discontinuous patches and stringers of Fe oxides. Banding undulating - algal mounds. Sub-horizontal undulating fractures spaced 30-150mm generally with a slightly calcareous clay infill. Some cross-cutting hair-like Fe filled cracks and patchy Fe concentrations. From 6.4-6.55m some brecciation and partial fracture infill with white fine grained dolomite and black iron oxides.

GEOLOGICAL DESCRIPTION OF DRILL CORE (HAND SPECIMEN)

DDH # 23

Pernatty Crushing Site

Depth (m)	Description
6.62 - 7.1	Corestones of banded (dipping) dolomite, ironstone and coarsely crystalline gypsum in a strong yellow gypseous plastic clay. Fresher rock fragments show medium grained gypsum with or without black Fe oxides as alternating bands with dolomite along existing bedding features. Some zones near base appear to be totally replaced by clayey gypsite. 100
7.1 - 11.1	Finely banded to contorted finely bedded fine to medium grained dolomite, ferruginous (very in part), medium to dark brown. Banding/laminae dip 20° at top, horizontal at base. Patches of iron oxide to 10mm not uncommon - irregular patches blebs and stringers. Most fractures follow the banding thus sub-horizontal to 20°, relatively clean to yellow clay filled. Major clay and Fe rubble filled crush zones at 7.9, 8.2-8.25, 8.9-9.3 (including corestones of granular medium grained dolomite with white dolomite sand infill) and 9.85-9.95 m. Odd thin erratically vertical Fe filled crack. Slightly vuggy in places (some larger clay filled) and linear openings along bedding planes. Strongly ferruginous below 10.8m. 550 Core Loss 8.5 - 8.6 700 10 - 10.7
11.1 - 11.5	Finely laminated to massive white-yellow-red very fine grained dolomite. Dense. Wavy bedded dipping approx. 45°. Vuggy along bedding planes. Older larger scale solution features infilled with yellow stained medium grained granular dolomite.
11.5 - 11.65	Core Loss
11.65 - 11.8	Quartz sand, very clayey.
11.8 - 12.45	Yellow-red-brown weathered laminated to breccial dolomite pockmarked with pinhead size to laminar solution features partially calcite infilled. Strongly fractured 11.9-12.1m.
12.45 - 12.85	Very broken crush zone in highly weathered yellow stained fine to medium grained banded dolomite. Contains seams of clayey quartz sand (0.2-0.5mm, white, yellow, rose coloured).
12.85 - 13	Fine grained finely laminated dolomite, very dense overlying with a very irregular contact yellow-brown medium grained granular dolomite.

1400
9900

DIAMOND DRILLING LOG

PROJECT: PERNATTY CRUSHING CONTRACT No. 1 DATE: Start: 1.6.87 Finish: 2.6.87

HOLE N° 23 LOCATION: Coords: N E Chainage: SURFACE R.L. DATUM

HOLE ANGLE 90° HOLE BRG BIT TYPE NQ3 L89027 RIG TYPE EDSON 468-05 OPERATOR SCOTT RUSSELL

DRILLING							MATERIAL DESCRIPTION										DISCONTINUITY DESCRIPTION				GEOLOGICAL DESCRIPTION																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
DEPTH (m)	PEN RATE	DRILL SPEED	DOWN PRESS	FLUID PRESS	FLUID LOSS	CASING	SOIL/ROCK TYPE	SOIL CLASS ¹	GRAPHIC LOG	DEPTH (m)	STRENGTH					RQD		SPACING	Surface description, openness, orientation, etc.	Origin type, mineral compos ⁿ , structure, etc.	FORMATION																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
	mm/m	R.P.M.	kPa	kPa	%						UN	2	4	8	16	32	64					128	256	512	1024	2048	4096	8192																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										
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RECORDED BY: W. G. Gill
DATE: 1/10/87 Sheet 1

DIAMOND DRILLING LOG

PROJECT: PERNATTY CRUSHING CONTRACT No. 1

DATE: Start: 1.6.87 Finish: 2.6.87

HOLE N° 23 LOCATION: Coords: N E Chainage: SURFACE R.L. DATUM
HOLE ANGLE 90° HOLE BRG BIT TYPE NQ3 L89027 RIG TYPE EDSON 468 - 05 OPERATOR SCOTT RUSSELL

DRILLING							MATERIAL DESCRIPTION				DISCONTINUITY DESCRIPTION				GEOLOGICAL DESCRIPTION	
DEPTH (m)	PEN. RATE mm/m	DRILL SPEED R.P.M.	DOWN PRESS kPa	FLUID PRESS kPa	FLUID LOSS %	CASING	SOIL/ROCK TYPE	SOIL CLASS ¹	GRAPHIC LOG	DEPTH (m)	STRENGTH	RQD	SPACING	Surface description, openness, orientation, etc.	Origin type, mineral composition, structure, etc.	FORMATION
7	11.3	600		600	20		CRUSH ZONE - DOLOMITE CORESTONES			7				Gypseous plastic clay infill	Dolomite, ironstone and coarsely crystalline gypsum corestone.	
8	11.3		1000-2000		10		DOLOMITE Medium brown to dark brown			8				Most follow banding ie sub-horizontal to 20°	Ferruginous, very in part. Finely laminated to contorted finely banded	
9			0		10					9				8.5 Core loss	Clean to yellow clay filled. Some clay/Fe filled crush zones.	
10					10		Core loss			10				Core loss		
11	13.3		0		100					11				10.7	Strongly ferruginous	
12		600		600	50		QUARTZ SAND DOLOMITE Yellow-red-brown			12				11.5 Core loss 11.65 loss	Very clayey Weathered	

RECORDED BY: W. G. G. G.
DATE: 11/10/87 Sheet 2

DIAMOND DRILLING LOG

PROJECT: PERNATTY CRUSHING CONTRACT No. 1

DATE : Start: 1.6.87 Finish: 2.6.87

HOLE N°	23	LOCATION	Coords	N	E	Chainage:	SURFACE R.L.	DATUM
HOLE ANGLE	90°	HOLE BRG		BIT TYPE	NQ3 L89027	RIG TYPE	EDSON 468 - .05	OPERATOR
								SCOTT RUSSELL

HOLE N°	23	LOCATION	Coords	N	E	Chainage:	SURFACE R.L.	DATUM
HOLE ANGLE	90°	HOLE BRG		BIT TYPE	NQ3 L89027	RIG TYPE	EDSON 468 - .05	OPERATOR
								SCOTT RUSSELL

[illegible]

RECORDED BY : N. G. K.
DATE : 11/11 Sheet 3

GEOLOGICAL DESCRIPTION OF DRILL CORE (HAND SPECIMEN)

DDH # 24

Pernatty Crushing Site

Depth (m)	Description
0 - 0.8	Casing
0.8 - 0.85	Core Loss 50
0.85 - 4.9	Grey to yellow brown, fine to medium grained algal dolomite. Finely laminated and banded to 2.5m then becomes more contorted. Algal domes also more common with rounded tops and very steep V-shaped margins on 5-10mm scale. Laminae horizontal to sub-horizontal to 3.2m then start to dip. Bedding is defined by iron oxide concentrations as discontinuous stringers. Whole rock unit is quite Fe rich but particularly ferruginous 2.1-2.3, 2.6-2.75 and 3.7-4.3 m as greater concentrations along bedding, along fracture faces (some with white calcite) and as solid haematite patches to 10mm long. Unit is quite broken dominantly by sub-horizontal fractures (rock is platy in parts) spaced 5-350mm but most commonly 40-100mm. These fractures are brown clay/Fe rubble filled, white to pink gypseous clay filled (rare coarse grained white gypsum infilling) or relatively clean but Fe oxide coated. Vertical fractures more common in upper portion either Fe oxide coated or pink gypseous clay filled (leads to quite broken zones). Cross-cutting open to hair-like (Fe filled) fractures more common in lower portion. Whole unit shows pock marked surface, pin head size to linear solution features. Core Loss 2.5 - 2.6 m 4 - 4.1 m 100
4.9 - 5.0	White crystalline gypsum to powdery white gypsite. 200
5.0 - 5.31	Grey, massive, medium grained finer in part, granular dolomite. Coarser zones quite porous. At 5.24m 10mm wide coarse grained gypsum filled horizontal break, ironstone on margins with yellow-brown discolourations into rock mass parallel to the break. Cross-cutting to 5mm wide fractures calcite/ironstone infilled but often with pin-hole size solution features.
5.31 - 6.3	Brown to grey, fine to erratically laminated, fine to medium grained algal dolomite. Dome structures in places. Laminae sub-horizontal at top, dipping about 45° at base. Badly fractured with white crystalline gypsum/white plastic gypseous clay filled zones at 5.35-5.4, 5.45-5.85 (corestones at bottom) and 5.9 m. Other fractures parallel to bedding Fe/gypsum filled or Fe coated, often vuggy. Core Loss 5.5 - 5.55 m 550
6.3 - 6.6	Clay filled crush zone with corestones of finely laminated dolomite to 6.4m then a red-brown fine grained crystalline dolomite. Clay is yellow, plastic, sticky and sandy/gravelly in part. 100
6.6 - 6.8	Red-brown fine grained crystalline dolomite, quite ferruginous. Poorly defined bedding. Characterised by thin calcite filled, wavy, randomly oriented cracks.
6.8 - 8.5	White, strong yellow to red stained sticky plastic clay to moderately dense highly weathered claystone, talcose. 1200

2150
1200

GEOLOGICAL DESCRIPTION OF DRILL CORE (HAND SPECIMEN)

DDH # 24

Pernatty Crushing Site

Depth (m)	Description
8.5 - 8.85	Core Loss
8.85 - 9.5	Highly weathered claystone to siltstone, yellow-pink-grey with purple (ferruginous) patches. Strongly ferruginised zone 9.3-9.4m where more competent horizontal flat fractures.
9.5 - 10	Off white weathered quartz sandstone-quartzite, ferruginous at top. Moderately strong to strong. Quartz 0.2-0.5mm, clear, rose coloured, yellow stained, rounded and sub-spherical.

DIAMOND DRILLING LOG

PROJECT: PERNATTY CRUSHING CONTRACT No. 1

HOLE N° 24 LOCATION: Coords N E Chainage: SURFACE R.L. DATUM

HOLE ANGLE 90° HOLE BRG BIT TYPE NQ3 L90926 RIG TYPE EDSON 468-05 OPERATOR SCOTT RUSSELL

DRILLING							MATERIAL DESCRIPTION										DISCONTINUITY DESCRIPTION		GEOLOGICAL DESCRIPTION					
DEPTH (m)	PEN. RATE min/m	DRILL SPEED R.P.M.	DOWN PRESS kPa	FLUID PRESS kPa	FLUID LOSS %	CASING	SOIL/ROCK TYPE	SOIL CLASS ¹	GRAPHIC LOG	DEPTH (m)	STRENGTH					RQD					SPACING	Surface description, openness, orientation etc.	Origin type, mineral compos ⁿ structure, etc.	FORMATION
											VM	W	MM	MS	S	VS	ES	VP	P	R				
1	14.4	600	0	700		To 0.8	DOLOMITE Grey to yellow brown			1												0.85 Core loss Quite broken Sub-horizontal	Fine to medium grained Finely laminated and banded, more contorted below 2.5m (dome structures). Algal. Ferruginous.	DOLOMITE
2	16.3			500	0					2											1.75 Core loss Platy in part.			
3	14			450	10					3											2.5 2.6 Core loss Brown clay/rubble filled, sometimes white to pink gypseous clay.	Ferruginous		
4				500						4											4.1 Core loss			
5	14.7						GYPSUM/GYPSITE White DOLOMITE, grey DOLOMITE. Brown to grey			5												5.5 Core loss	Crystalline to powdery. Massive, granular. Fine to erratically laminated.	
6		600	0	500	10					6												5.55 Badly fractured	Vuggy.	

RECORDED BY: N. C. 11/10/87
DATE: 11/10/87 Sheet 1

DIAMOND DRILLING LOG

PROJECT: PERNATTY CRUSHING CONTRACT No. 1

DATE: Start: 19.6.87 Finish: 20.6.87

HOLE N° 24 : LOCATION: Coords N E Chainage: : SURFACE R.L. : DATUM
HOLE ANGLE 90° : HOLE BRG : BIT TYPE NQ3 L90926 : RIG TYPE EDSON 468 - 05 : OPERATOR SCOTT RUSSELL

DRILLING							MATERIAL DESCRIPTION										DISCONTINUITY DESCRIPTION		GEOLOGICAL DESCRIPTION																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
DEPTH (m)	PEN. RATE min/m	DRILL SPEED R.P.M.	DOWN PRESS kPa	FLUID PRESS kPa	FLUID LOSS %	CASING	SOIL/ROCK TYPE	SOIL CLASS ^{FM}	GRAPHIC LOG	DEPTH (m)	STRENGTH					RQD	SPACING	Surface description, openness, orientation etc	Origin type, mineral compos ⁿ structure, etc.	FORMATION																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										
											vw	z	hw	ms	vs						es	yp	p	f	g	<20 mm	<60	<200	<600	<2m	>2m																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
7	14	600	0	500	10		CRUSH ZONE. CLAY FILLED DOLOMITE. Red-brown			7																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				

RECORDED BY: W. G. G. G.
DATE: 11/10/87 Sheet 2

GEOLOGICAL DESCRIPTION OF DRILL CORE (HAND SPECIMEN)

Dm # 25

Pernatty Crushing Site

Depth (m)	Description	
0 - 0.85	Casing	
0.85 - 1.0	Calcrete rubble after fine grained massive dolomite.	
1.0 - 1.25	Yellow-brown-grey, fine grained, discontinuously banded dolomite corestones in a red brown plastic to stiff ironstone rubbly gypseous clay. Yellow-brown through Fe metasomatism; off-white relict fresh patches of fine grained dolomite in corestones.	150
1.25 - 1.35	Core Loss	100
1.35 - 4.15	Patchy to discontinuously wavy, banded, fine to medium grained, brown-grey dolomite. Algal banding defined by Fe mineralization (dark). Iron oxide also as irregular 1-4mm patches. Some algal dome structures. Irregular patches of unaltered white fine grained dolomite. Most fractures sub-horizontal ranging from completely shattered rubble zones and platy zones where fractures 10mm apart to clay filled fractures 50mm thick, often rubbly. Clay red-brown, sometimes yellow mottled, stiff to plastic, gypseous. Major clay filled fractures 1.45-1.5, 1.68, 1.9, 2.45-2.48 and 2.65-2.68 m. Broken zones 1.35-1.4, 2.75-2.95 and 3.05-3.25 m. Diagonal fractures commonly white dolomite silt and iron oxide filled or coated. Other discontinuities include hair-like Fe oxide filled near vertical to cross-cutting erratically spaced cracks, and sub-horizontal wavy to jagged, thin, clay filled seams (algal tops or micro karst?). Minor small vugs generally Fe oxide filled. Core Losses 2.5 - 2.65 m 2.95 - 3.05 m	150 130 250
4.15 - 4.45	Core Loss	300
4.45 - 8.45	Generally as above but more ferruginous both as increased intergranular mineralization and as fracture and solution feature infill. Coarser grained and oolitic in part particularly 5.15-5.4m and finely laminated in part. Quite broken with dominant sub-horizontal fractures spaced 20-120mm, generally iron oxide coated. Crush zones 5.4-5.6, 7.9-8.15 and 8.4-8.45 m. Clay filled crush zone at 5.7m. From 5.6-7m the rock is quite fractured and broken and shows significant solution features, is porous and vuggy and ironstone impregnated. Very ferruginous 7.9-8.5m. Core Losses 5.5 - 5.55 m 7 - 7.6 m	650
8.45 - 8.5	Dark brown ferruginous fine grained dolomite.	
8.5 - 8.8	Core Loss	300
8.8 - 10.5	Strong yellow, purple mottled in part, highly weathered claystone grading to sandy siltstone near base.	1550 8150

DIAMOND DRILLING LOG

PROJECT: PERNATTY CRUSHING CONTRACT No. 1

DATE: Start: 18.6.87 Finish: 18.6.87

HOLE N° 25 LOCATION: Coords N E Chainage: SURFACE R.L. DATUM
HOLE ANGLE 90° : HOLE BRG : BIT TYPE NQ3 180926 : RIG TYPE EDSON 468 - 05 : OPERATOR SCOTT RUSSELL

DRILLING							MATERIAL DESCRIPTION										DISCONTINUITY DESCRIPTION				GEOLOGICAL DESCRIPTION		
DEPTH (m)	PEN. RATE min/m	DRILL SPEED R.P.M.	DOWN PRESS kPa	FLUID PRESS kPa	FLUID LOSS %	CASING	SOIL/ROCK TYPE	SOIL CLASS ^m	GRAPHIC LOG	DEPTH (m)	STRENGTH			RQD			SPACING				Surface description, openness, orientation etc.	Origin type, mineral compos ⁿ structure, etc.	FORMATION
											VM	VN	MM	MS	VS	ES	VP	P	F	G			
1	15	600	0	450	0	To 0.85	CALCRETE RUBBLE DOLOMITE CORESTONES			1											1.25 Core 1.35 loss	Ironstone rubble/ gypseous clay.	WOOLLA DOLOMITE
2	14.4		2000	500-1000			DOLOMITE Brown grey			2											Sub-horizontal Rubble zones to clay filled 2.5 Core 2.65 loss	Patchy, discontinuous wavy banded. Algal. Fine/medium grained.	
3	13.3			500-800						3											2.95 Core 3.05 loss Also hair-like Fe filled cracks.		
4	No time values		0-1500	100-100	0					4											4.15 Core loss 4.45		
5	13.3	600	0	500			DOLOMITE			5											Quite broken 5.5 Core 5.55 loss	More ferruginous than above. Coarse grained and oolitic in part	
6		0		100						6											Very porous		

RECORDED BY: W. G. Galt
DATE: 1/10/87 Sheet 1

DIAMOND DRILLING LOG

PROJECT: PERNATTY CRUSHING CONTRACT No. 1

DATE : Start: 18.6.87 Finish: 18.6.97

HOLE N°	25	LOCATION		Coords	N	E	Chainage:		SURFACE R.L.		DATUM	
HOLE ANGLE	90°	HOLE BRG		:	BIT TYPE	NQ3 L90926	:	RIG TYPE	EDSON 468-05	:	OPERATOR	SCOTT RUSSELL

[illegible]

RECORDED BY : W. C. Galt
DATE : 11/14/57 Sheet 2

GEOLOGICAL DESCRIPTION OF DRILL CORE (HAND SPECIMEN)

DDH # 26

Pernatty Crushing Site

Depth (m)	Description
0 - 0.8	Casing
0.8 - 3.1	Yellow-black banded medium grained dolomite, dense. Dark Fe oxide rich bands 1-4mm wide separated by thin yellow bands, undulating to showing characteristic algal domes and columns, sub-horizontal to dipping. Black bands made discontinuous by thin sub-vertical cracks which carry the yellow colouration through the bands. Calcreted at the top. Rock very broken below 1.45m characteristically at 30-60mm spacing, 4-10mm wide, sub-horizontal and filled with red-brown to yellow often gypseous clay with rubble fragments. Clay is black from 2.01-2.1m where rock is quite ferruginous. Fractures above 1.45m relatively clean, Fe oxide coated, diagonal and rough faced. Crushed zone 2.4-3m. Unit is also criss-crossed by hair-like Fe oxide filled cracks, some parallel to bedding. Odd sub-vertical fracture. Thin wavy discontinuities along bedding, brown iron rich clay coated. Core loss 2.5 - 2.65 m
3.1 - 5.85	Lighter coloured, brown, medium grained more massive dolomite. Fe oxide banding still defines algal growth bands and some mound structures but more disseminated and more discontinuous (patchy). From 3.1-5.1m characteristically sub-horizontal to horizontal fractures at 30-60mm spacing, 4-40mm wide and clay-rubble filled. Clay varies from yellow-brown, sticky & plastic at top to a white dolomitic clayey silt with Fe oxide staining at base. Minor solution vugs. Crush zones 4.1-4.4 and 5.5-5.62 m. Core loss 4 - 4.1 m
5.85 - 5.9	White coarsely crystalline gypsum in a white gypsite matrix.
5.9 - 6.0	Red-brown fine to medium grained massive dolomite. Some small Fe oxide patches and thin (1mm) horizontal crystalline gypsum filled fracture. Broken and strong yellow/black coloured at top contact with gypsite.
6.0 - 9.1	Flat to undulating, horizontal to dipping, medium banded to patchy, medium grained dolomite. Medium brown-grey but red/black or brown/black at 7.25-7.48 and 7.6-7.82m where strongly ferruginised, and white from 7.48-7.6m. Banding much contorted below 8.55m where algal dome type structures more common. Fractures generally sub-horizontal or follow the banding where dipping. They are white slightly calcareous clay - Fe rubble filled or clean and Fe oxide coated. Spaced 10-280mm but commonly 30-80mm (greater spacing 8-9m). Some wavy clay filled thin discontinuities along banding and thin hair-like discontinuous sub-vertical Fe oxide filled fractures perpendicular to bedding particularly in less well bedded zones. Crush zones 6-6.1, 7.1, 7.45-7.7 (very ferruginous) 8, 8.25-8.3 and 9-9.1 m. Vuggy solution features to 10mm not uncommon, also linear solution features along bedding.

GEOLOGICAL DESCRIPTION OF DRILL CORE (HAND SPECIMEN)

DDH # 26

Pernatty Crushing Site

Depth (m)	Description
9.1 - 10	Finely laminated to finely banded medium grained ferruginous algal dolomite. Banding gently undulating and steeply dipping. Yellow brown to red banded, stronger red below 9.75m where strongly ferruginous. Fractures sub-horizontal, inclined, sub-vertical, Fe oxide (yellow-black) coated or infilled with a gravelly sticky yellow clay. Fractures spaced 20-200mm. Surface pock marked parallel to bedding by pin-head size circular to elongate (10mm) solution holes. 200
10 - 10.27	Core loss
10.27 - 11.2	Ferruginous medium grained calcareous sandstone to granular sandy dolomite. Weathered yellow and friable at top. Granular texture 0.2-1mm, rounded. Rock massive. Fractures sub-horizontal, clean, with some partially open diagonal breaks.
11.2 - 11.3	Dense dark brown dolomitic siltstone.
11.3 - 12	Strong yellow, very weathered clayey sandstone grading down into a soapy highly weathered claystone/shale. Rock very weak to moderately strong.

600
9200

DIAMOND DRILLING LOG

PROJECT: <u>PERNATTY CRUSHING CONTRACT No. 1</u>		DATE: Start: <u>4.6.87</u> Finish: <u>4.6.87</u>	
HOLE N° <u>26</u>	LOCATION: Coords <u>N</u> <u>E</u>	Chainage: <u> </u>	SURFACE R.L. <u> </u>
HOLE ANGLE <u>90°</u>	HOLE BRG <u> </u> BIT TYPE <u>NQ3 L89027</u>	RIG TYPE <u>EDSON 468 - 05</u>	OPERATOR <u>SCOTT RUSSELL</u>

DRILLING							MATERIAL DESCRIPTION				DISCONTINUITY DESCRIPTION				GEOLOGICAL DESCRIPTION	
DEPTH (m)	PEN. RATE min/m	DRILL SPEED R.P.M.	DOWN PRESS kPa	FLUID PRESS kPa	FLUID LOSS %	CASING	SOIL/ROCK TYPE	SOIL CLASS F ^m	GRAPHIC LOG	DEPTH (m)	STRENGTH	RQD	SPACING	Surface description, openness, orientation, etc.	Origin type, mineral composition, structure, etc.	FORMATION
						To 0.8										
1	15	600	1500	600	0		DOLOMITE Yellow-black banded			1						
2	13.3		1500 - 2000	500						2						
3	10						DOLOMITE Lighter coloured brown			3						
4			1500	500	0					4						
5	11.3	600		600	5					5						
6		1000					GYPSUM/GYPSITE White			6						

RECORDED BY: W. Call
DATE: 11/09/87 Sheet 1

DIAMOND DRILLING LOG

PROJECT: PERNATTY CRUSHING CONTRACT No. 1		DATE: Start: 4.6.87 Finish: 4.6.87	
HOLE N° 26	LOCATION: Coords N E	Chainage:	SURFACE R.L.
HOLE ANGLE 90°	HOLE BRG	BIT TYPE NO3 L89027	RIG TYPE EDSON 468-05
		OPERATOR SCOTT RUSSELL	

DRILLING						MATERIAL DESCRIPTION										DISCONTINUITY DESCRIPTION		GEOLOGICAL DESCRIPTION																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					
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RECORDED BY: NA GALE
DATE: 1/10/87 Sheet 2.1

GEOLOGICAL DESCRIPTION OF DRILL CORE (HAND SPECIMEN)

DDH # 27

Pernatty Crushing Site

Depth (m)			Description
0	-	2.1	Casing
2.1	-	2.35	Dolomite rubble. Yellow-black banded fine to medium grained dense dolomite. Very broken.
2.35	-	2.5	Rounded black ironstone nodules to 10mm in a red to brown plastic gypseous clay.
2.5	-	2.75	Ironstone nodules and a fine (white) to coarse grained (red, yellow, stained, to 5mm crystal size) crystalline gypsum mixture in a red-brown gypseous clay matrix.
2.75	-	3.23	Alternating massive coarsely crystalline very vuggy gypsum bands and well rounded ironstone nodules to 15mm in a plastic yellow-brown gypseous clay.
3.23	-	3.35	<i>Corestones of a ferruginous medium grained slightly oolitic granular dolomite to calcareous sandstone in a sandy silt.</i>
3.35	-	3.9	Yellow gypseous clayey silt/sand containing large gypsum crystals and well rounded ironstone nodules 1mm - 3mm and odd irregular ironstone plates. Very ferruginous in places.
3.9	-	4.0	Coarse grained crystalline gypsum, massive.
4.0	-	5.15	Core Loss
5.15	-	5.5	Corestones of laminated yellow-black medium grained algal dolomite in a brown-yellow plastic clay containing coarse gypsum crystals and black ironstone nodules. Corestones pass down to a ferruginous, fine to medium grained, granular dolomite.
5.5	-	5.8	Core Loss
5.8	-	6.4	Yellow-red mottled moderately compacted silt/fine sand. Clayey. Highly weathered siltstone.
6.4	-	7.34	Highly weathered claystone/shale, yellow then purple from 7.26m.
7.34	-	10	Sandstone, weathered, mottled purple-yellow, lighter and off-white to grey to base. Fine grained at top (average 0.2mm) coarsening to base (average 0.5-0.6mm, odd larger grain to 3mm). Granular texture, grains generally well rounded. Slightly friable. Thin grey claystone-shale interbeds. Fractures generally sub-horizontal to 45°, rough faced, irregular. Core Loss 8.5 - 8.6 m.

DIAMOND DRILLING LOG

PROJECT: PERNATTY CRUSHING CONTRACT No. 1

DATE :- Start: 19.6.87 Finish 19.6.87

HOLE N°	27	LOCATION	Coords	N	E	Chainage	:	SURFACE R.L.	DATUM
HOLE ANGLE	90°	HOLE BRG	:	BIT TYPE	NQ3 L90926	:	RIG TYPE	EDSON 468 - 05	SCOTT RUSSELL
						:	OPERATOR		

[illegible]

RECORDED BY : M. G. G. G.
DATE : 1/10/87 Sheet 1 of 2

DIAMOND DRILLING LOG

PROJECT: PERMATTY CRUSHING CONTRACT No. 1 DATE = Start: 19.6.87 Finish: 19.6.87

HOLE N° 27 : LOCATION: Coords N E Chainage: : SURFACE R.L. DATUM

HOLE ANGLE 90° : HOLE BRG : BIT TYPE NQ3 L90926 : RIG TYPE EDSON 468-05 : OPERATOR SCOTT RUSSELL

DRILLING							MATERIAL DESCRIPTION										DISCONTINUITY DESCRIPTION		GEOLOGICAL DESCRIPTION																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							
DEPTH (m)	PEN. RATE min/m	DRILL SPEED R.P.M.	DOWN PRESS kPa	FLUID PRESS kPa	FLUID LOSS %	CASING	SOIL/ROCK TYPE	SOIL CLASS ^{FM}	GRAPHIC LOG	DEPTH (m)	STRENGTH					RQD					SPACING	Surface description, openness, orientation etc.	Origin type, mineral compos ⁿ structure, etc.	FORMATION																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
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RECORDED BY: N. Coll
DATE: 1/10/87 Sheet 2.

KEY DGM No. 6235, 6335, 6435

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