Goodman Property
Services (Aust) Pty Limited
ABN: 40 088 981 793

Mineral Resource Assessment

of the

Oakdale West Development

September 2016

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Mineral Resource Assessment

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Oakdale West Development

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Ref No. 922/02

September 2016

R.W. CORKERY & CO. PTY. LIMITED

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1. INTRODUCTION

1.1 SCOPE

This report has been prepared by Mr Rob Corkery, Principal of R.W. Corkery & Co. Pty Limited (RWC) on behalf of Goodman Property Services (Aust) Pty Limited (GPS) to assist in the preparation of the documentation in support of an application for the Oakdale West SSDA Estate Masterplan. For the purposes of this report, the Oakdale West Development Site is referred to as "the Development Site".

This report has been prepared to inform a State Significant Development Application (SSDA) for the staged development of the Oakdale West Estate (OWE). The aim of the report is to assess the potential impacts of the proposed development on the mineral resources and/or construction materials and has been prepared in accordance with standard practices within the resources sector. It is noted that Secretary's Environmental Assessment Requirements (SEARs) for Application No. SSD 15_7348 do not make reference to mineral resources and/or construction materials, nor is there any requirement to undertake an assessment of any potential impacts on any significant mineral resources including any operating mines, extractive industries or known mineral or petroleum resources, exploration activities and access for future exploration. Notwithstanding the absence of these specific requirements, this report addresses these aspects and is intended to support the Environmental Impact Statement (EIS) prepared in respect of the proposal and should be read in conjunction with the EIS and development plans submitted with the SSDA.

This report describes the occurrence of clay/shale resources beneath the OWE (Section 2) and the extraction operations (recovering clay/shale) within close proximity to the OWE (Section 3) (some with and others without mineral authorities – Section 4). Extraction of clay/shale is prohibited within the OWE as presented in SEPP (Western Sydney Employment Area) 2009 (Section 6.4).

Mr Corkery, whose curriculum vitae is included as **Appendix 1** was the principal author of a report on clay/shale resources in the Sydney area in 1980 (R.W. Corkery *et al*, 1980). Since 1980, Mr Corkery has undertaken numerous geological assessments for clay/shale resources in western Sydney including an assessment of the clay/shale resources beneath the Oakdale West Site on behalf of The Austral Brick Co. Pty Ltd ("Austral") in 1981 and 1982. A copy of the relevant geological information assembled from that assessment is reproduced in **Appendix 2**.

This report relies upon the results of the previous on-site geological assessment and the results of research via the *Minres* website managed by the Division of Resources and Energy within the NSW Department of Industry and a review of relevant planning instruments.

1.2 THE OAKDALE WEST ESTATE PROPOSAL

The SSDA for the OWE seeks approval for the development of a 154.1ha Site with approximately 84.2ha of land developed for a warehouse and distribution estate. The Stage 1 development includes:

- staged bulk earthworks across the whole sites;
- staged trunk infrastructure for the site;
- staged subdivision;

- landscaping and public domain works; and
- development comprising the construction and operation of three warehouse and distribution facilities in Precinct 1.

2. GEOLOGICAL SETTING

2.1 REGIONAL SETTING

The Development Site is underlain by the Bringelly Shale, a prominent geological unit found beneath most of Sydney's western and southwestern suburbs (Herbert, 1979). The Bringelly Shale generally comprises, in decreasing abundance, claystone, sandstone, laminite, siltstone, tuff and coal. Most of the clay/shale beneath the Development Site is located between 30m and 70m above the base of the Bringelly Shale.

2.2 THE DEVELOPMENT SITE

RWC managed a comprehensive drilling program across Austral's entire landholding in 1981 and 1982 to define resources suitable for brick manufacture. Particular emphasis was placed upon the search for light-firing clay/shale. A total of seven holes were drilled across the section of Austral's landholding within the area of the Development Site, generally at spacings of approximately 400m to 500m. **Table A** lists the collar height and total depth of each of the drill holes. Unfortunately, the map identifying the locations of the drill holes has been mislaid. **Figure A** displays the aerial photograph of the Development Site within the existing contours. Reference to both **Table A** and **Figure A** establishes that the drill holes were located across the entire site and provide a basis for describing the geology within the Development Site.

Table A
Diamond Drill Holes within the Development Site

Diamond Drill Hole No.	Collar Height (m AHD)	Total Depth (m)
14	58	14.5
15	87	15.25
16	75	15.25
18	58	15.2
19	73	15.25
30	55	17.8
31	59	17.8

The drill core from the 1982 series drilling program was fired in a two-stage program.

1. Representative core samples were fired and the fired colour recorded against a 1 to 10 scale (1 – 1ightest / 10 – darkest).
2. The core was split with a diamond saw and one half crushed, made into a sample brickette and kiln fired. One half of the core was retained for further reference.

The results of the drilling and kiln-firing investigations established that the Development Site is underlain predominantly by clay and claystone with minor amounts of sandstone, laminite and siltstone. **Appendix 2** presents a detailed written and graphic description of each drill hole.

Figure A
DEVELOPMENT SITE ELEVATIONS

The entire Development Site has a surficial clay layer between 3.0m and 4.25m thick. The clay is typically red/orange in colour near the surface grading to a mottled red/grey clay at depth which in turn grades into the underlying slightly weathered claystone, siltstone or sandstone.

The elevated areas of the Development Site (i.e. above approximately 70m AHD) comprise a sequence of claystone and siltstone interbeds with occasional light grey sandstone units typically less than 1.5m thick.

At lower topographic levels, the geology comprises an interbedded sequence of claystone, siltstone and sandstone often containing abundant siderite (iron carbonate). The presence of siderite is an important factor in achieving a red-fired claystone or siltstone. One thick sandstone unit up to 6.6m thick is located at depth near the eastern side of the Development Site.

The elevated sequence contains some light-firing units, however, these are generally absent at depth with the bulk of the claystones and siltstones medium to dark-firing.

3. OPERATING EXTRACTIVE INDUSTRIES OR MINES

3.1 EXTRACTIVE INDUSTRIES

Within western Sydney, a number of extractive industries (quarries) are present targeting clay/shale for brick manufacture. In some cases, the extraction of clay/shale is a precursor activity to the placement of mixed putrescible or other wastes. For those quarries, emphasis is placed upon the comparatively cheap (and often free) despatch of clay/shale to brick manufacturing companies.

Figure B displays the locations of existing extractive industries within 7km of the Development Site. Each of these sites are located within the Bringelly Shale with the extracted materials predominantly used in brick manufacture at either Austral's Horsley Park Plants or PGH's Horsley Park or Cecil Park Plants.

The closest extractive industries to the Development Site are operated by CSR Building Products Limited (trading as PGH) and Austral. The Horsley Park Quarry operated by PGH provides clay/shale for use in the manufacture of bricks and other ceramic products at its adjoining Horsley Park Plant. This quarry has been operational since the 1970s and is operated on a campaign basis when raw materials are required. Austral's quarry has also been operational since the mid 1970s although extraction has not occurred since about 2010 as the quarry void has been used since that time as a storage facility for clay/shale excavated from the WSN Eastern Creek Waste Disposal Facility. It is Austral's intention to resume extraction within the quarry following the depletion of the stored clay/shale.

3.2 MINES

There are no mines within 5km of the Development Site, i.e. any site mining minerals nominated in the *Mining Regulation 2010*, excluding clay/shale or structural clay.

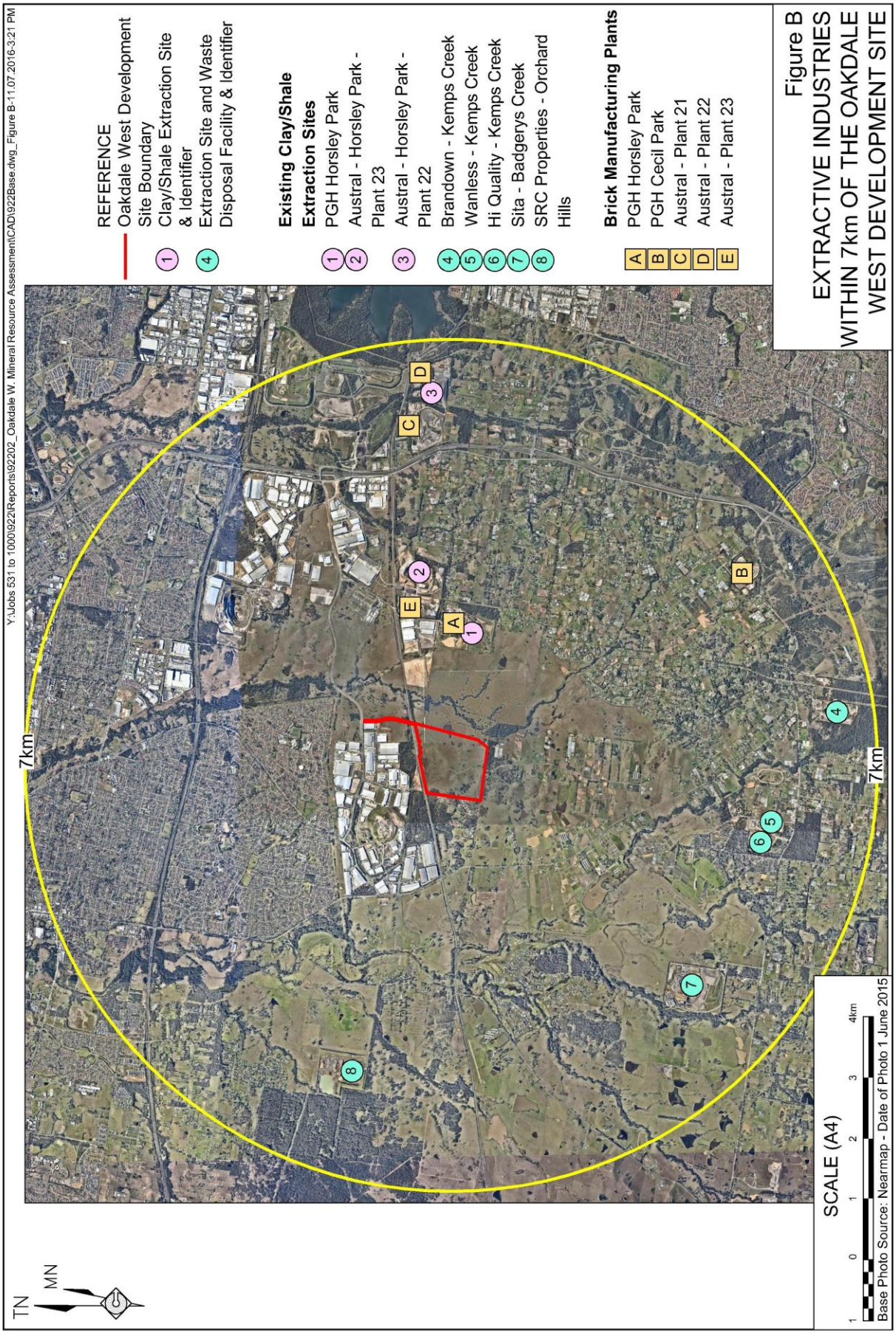
Figure B
EXTRACTIVE INDUSTRIES
WITHIN 7km OF THE OAKDALE
WEST DEVELOPMENT SITE
REFERENCE
Oakdale West Development Site Boundary
Clay/Shale Extraction Site & Identifier
Extraction Site and Waste Disposal Facility & Identifier
Existing Clay/Shale Extraction Sites
PGH Horsley Park
Austral - Horsley Park - Plant 23
Austral - Horsley Park - Plant 22
Brandown - Kemps Creek
Wanless - Kemps Creek
Hi Quality - Kemps Creek
Sita - Badgerys Creek
SRC Properties - Orchard Hills
Brick Manufacturing Plants
PGH Horsley Park
PGH Cecil Park
Austral - Plant 21
Austral - Plant 22
Austral - Plant 23
7km
7km
TN
MN
SCALE (A4)
0 1 2 3 4km
Base Photo Source: Nearmap - Date of Photo 1 June 2015
Y:\Jobs 531 to 1000\922\Reports\92202_Oakdale W. Mineral Resource Assessment\CAD\922Base.dwg_Figure B-11.07.2016-3:21 PM

4. CURRENT MINERAL AUTHORITIES

One mineral authority (a Mining Lease) is located within 2km of the Development Site. **Figure C** displays an extract from the *Minres* database and the location of Mining Lease (ML) 1636 held by CSR Building Products Limited. ML 1636 is held for the extraction of structural clay and covers an area of 72ha, i.e. the entire landholding incorporating the extraction areas and brick manufacturing plant. ML 1636 is in force until 21 September 2030.

It is noted that Austral is currently in the process of lodging an application for a Mineral Owners Mining Lease over an area of land east of Horsley Park Plant 23 covering the extent of past and future clay/shale extraction in that part of the Company's landholding.

A Petroleum Exploration Licence (PEL) 2 previously held by AGL Pty Ltd over the Development Site has been relinquished. No further consideration of this authority is necessary.

No exploration licences or other mineral authorities are present over the Development Site.

5. POTENTIAL MINERAL OR EXTRACTIVE RESOURCES

The level of information on the resources beneath the Development Site has provided a good level of understanding of the potential mineral or extractive resources. Given this level of understanding, it is highly unlikely that there are any unidentified mineral or extractive resources within or surrounding the Development Site that either warrant further exploration/extraction or would be adversely impacted upon by the proposed Oakdale West Development.

The results of the drilling and firing tests outline in Section 2.2 indicate that the bulk of the rocks present are suited to the manufacture of bricks. However, it is noted that the quality of the clay/shale resources is such that the materials would be suitable for manufacturing bricks in the predominantly apricot-to red- firing range with a small proportion in the cream-firing range.

It is noted that the clay/shale within the Development Site is commonly available throughout western Sydney and is in fact being extracted at a range of quarries and/or waste disposal facilities. Since 1981/1982, Austral has prioritised its clay/shale extraction either in these areas adjacent to its brick manufacturing plants or in specific areas where light-firing material was present in considerable quantities. Given only small quantities light-firing clay/shale is present beneath the Development Site, Austral did not prioritise any extraction from that area.

The potential for the development of the clay/shale resources within the Development Site would be low given:

a) the average quality of the clay/shale and presence of some massive sandstone beds; and

b) the fact that Austral is well positioned to receive clay/shale resources from the excavation of waste cells and infrastructure projects e.g. Northwest Rail Link.

Apart from (a) and (b) above, it is noted that extractive industries are now prohibited within the Development Site under *SEPP (Western Sydney Employment Area) 2009* (see Section 6.4).

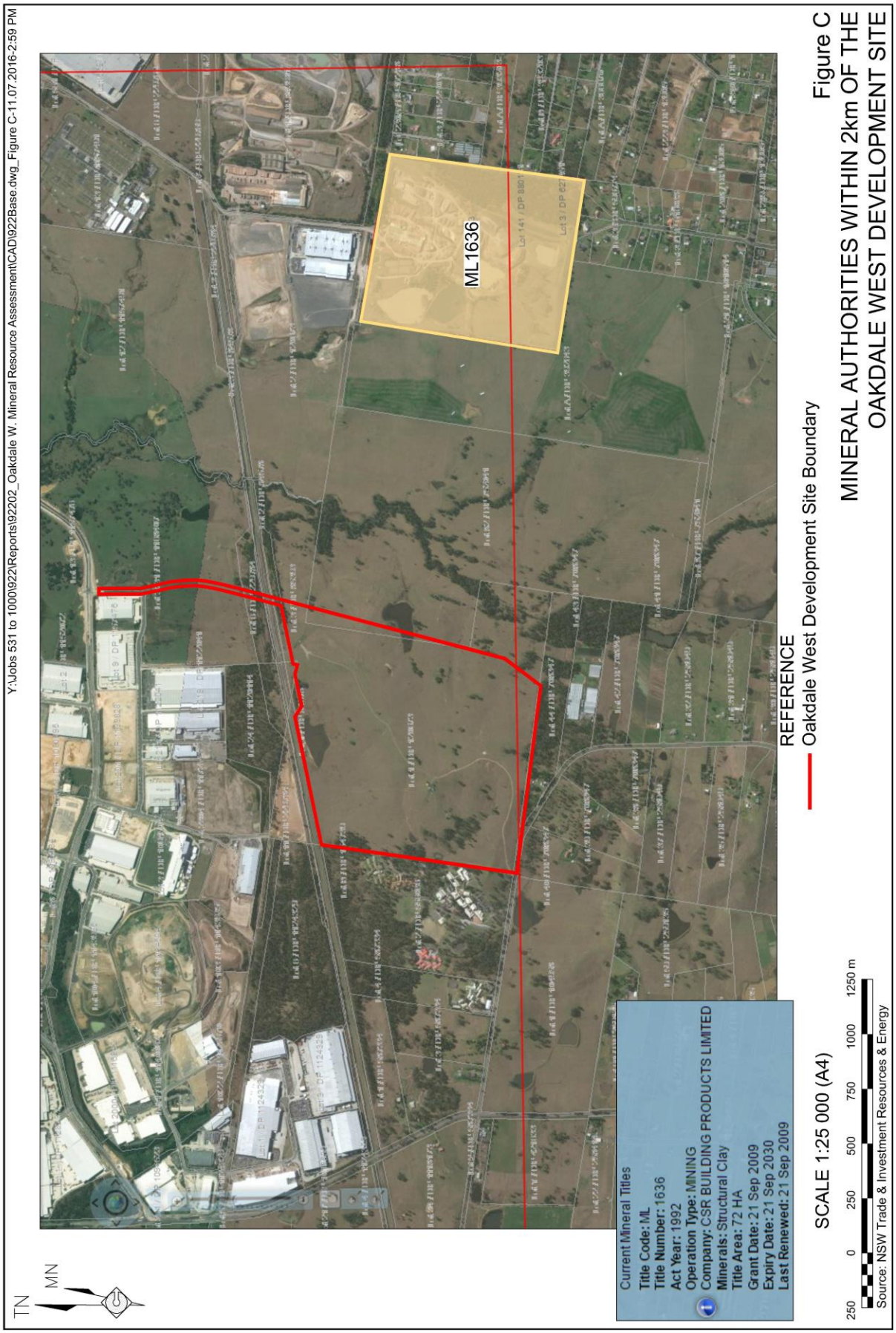

Figure C
MINERAL AUTHORITIES WITHIN 2km OF THE OAKDALE WEST DEVELOPMENT SITE

6. POTENTIAL IMPACTS

6.1 INTRODUCTION

This section reviews the potential impacts of the proposed development upon the resources within or surrounding the Development Site and any relevant matters within the relevant planning instruments.

6.2 IMPACTS ON RESOURCES WITHIN THE DEVELOPMENT SITE

The proposed development will effectively sterilise the recovery of the clay/shale resource for brick manufacture. However, this has already been accepted by relevant government agencies given *SEPP (Western Sydney Employment Area) 2009* prohibits extractive industries within and surrounding the Development Site (see Section 6.4).

6.3 IMPACTS ON RESOURCES SURROUNDING THE DEVELOPMENT SITE

The closest clay/shale extraction activities are located approximately 1.1km east of the Development Site within land owned by CSR Building Products Limited (trading as PGH) (see Section 4 and **Figure C**). The method of extraction would not be adversely affected by the proposed development within the Development Site as it has already been required to satisfy its environmental requirements with the already completed industrial development to its north.

It is further noted that CSR Building Products Limited, through its Property Division, is currently in the process of planning the development of the land adjacent to its Horsley Park Plant for development similar to that proposed on the Development Site. It is in fact likely that clay/shale extraction is likely to cease within ML 6136 by the end of 2016 to enable the industrial subdivision to proceed. Hence, the impacts on the Development Site would not have any adverse impacts upon the extractive industry within ML 6136.

6.4 SEPP (WESTERN SYDNEY EMPLOYMENT AREA) 2009

The Development Site is located within an area that is predominantly zoned IN1 (General Industrial) as displayed on Sheet LZN_001 with a small area zoned E2 (Environmental Conservation) associated with Ropes Creek and its tributaries. **Figure D** provides an extract from Sheet LZN-001. Extractive industries are prohibited as a land use within the Development Site. It is noted that existing extractive industries adjacent to Austral's Horsley Park Brick Plant 23 and PGH's Horsley Park Brick Plant are also located within the IN1, however, would continue to operate under the existing use rights provisions within the *Environmental Planning and Assessment Act 1979*.

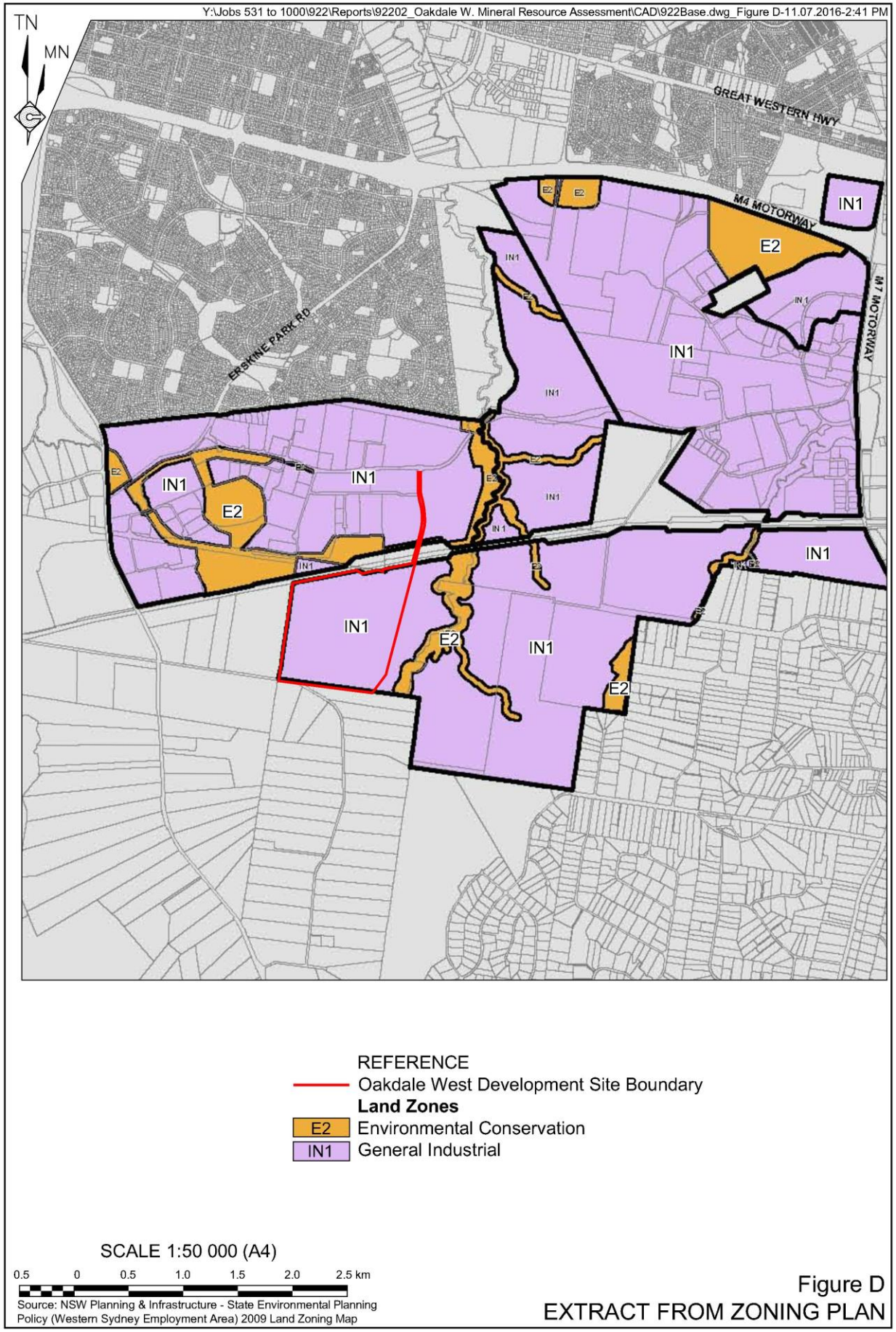

Figure D
EXTRACT FROM ZONING PLAN

6.5 SYDNEY REGIONAL ENVIRONMENTAL PLAN NO. 9 – EXTRACTIVE INDUSTRY (NO. 2 – 1995)

This instrument nominates on Schedule 1 of the Plan a number of current and potential clay/shale extraction areas of regional significance. The key areas nominated that are relevant to the Development Site are as follows.

a) Lot 2, DP 120673, Old Wallgrove Road, Horsley Park. Land in Conveyance Book 2842 No 807, excluding Lot 1, DP 579002, Old Wallgrove Road, Horsley Park, being Part Portion 21 and Part Portion 45, Parish of Melville, County of Cumberland. Austral Plant 3, Horsley Park.

b) Lot 1, DP 106143, Cnr Old Wallgrove Road and Burley Road, Horsley Park. PGH, Horsley Park.

Both of the above are associated with the existing brick manufacturing plants operated by The Austral Brick Company Pty Limited and CSR Building Products Limited.

6.6 SEPP (MINING, PETROLEUM PRODUCTION AND EXTRACTIVE INDUSTRIES) 2007

Clause 13 of *SEPP (Mining, Petroleum Production and Extractive Industries) 2007* requires consent authorities to consider existing extractive industries when assessing applications for developments in their vicinity. The existing extractive industries adjacent to Austral's Horsley Park Brick Plant 23 and PGH's Horsley Park Brick Plant (see **Figure B**) are identified in Schedule 1, Division 1 and Items 8 and 6 respectively with SREP No. 9(2) Extractive Industry – which is referenced in this clause. As such, this SEPP requires the consideration of these extractive industries.

As outlined in Section 6.2 and 6.3, the proposed development would not adversely impact upon the ongoing operation of any existing clay/shale extraction operations within the vicinity of the Development Site.

Appendix 1

Rob Corkery Curriculum Vitae

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Robert William Corkery
Principal

R.W. CORKERY & CO.
PTY. LIMITED ABN 31 002 033 712
GEOLOGICAL & ENVIRONMENTAL CONSULTANTS

Date of Birth: 26 January 1952

ACADEMIC RECORD
1974 - B.Sc.(Hons), Geology, University of New South Wales, Sydney, NSW
1979 - M.Appl.Sc., Environmental Pollution Control, University of New South Wales, Sydney, NSW
1996 - Certified Lead Environmental Auditor (Environmental) Registered, No. 5359

INDUSTRY AFFILIATIONS
Fellow – AusIMM, Chartered Professional (Environmental),
Fellow – Institute of Quarrying Australia

EMPLOYMENT HISTORY AND EXPERIENCE

Oct 1980 to Present *Principal*, R.W. Corkery & Co. Pty Limited, Geological and Environmental Consultants

- Geological evaluation and quality control of construction materials and industrial mineral resources.
- Preparation of Environmental Impact Statements and Environmental Assessments for Major Projects, Documentation including Environmental Assessments, Environmental Effects Statements, Work Plans, Mining Operations Plans, Environmental Impact Statements, Baseline Environmental Studies and Environmental Constraints Assessments for the extraction of construction materials, industrial minerals, heavy mineral sands, coal, gold, copper and other metallic minerals and for landfills.
- Preparation of Environmental Management Plans and Environmental Management Systems for various mining, quarrying, construction projects and waste disposal facilities.
- Project Management, Consultant Briefing and Review
- Environmental assessments of waste disposal facilities.
- Preparation of annual/biennial environmental reports and assessments.
- Due diligence and environmental management and compliance audits.
- Assessment of rehabilitation strategies and plans for abandoned/completed quarries and mines.
- Coordination of specialist consultant teams.
- Provision of expert witness and project management/reviews.
- Co-Author, Exploration Guidelines for NSW Minerals Council.
- Community Consultation

May 1980 to Oct 1980 *Senior Consultant*, James B. Croft & Associates, Newcastle

Preparation of Environmental Impact Statements for coal mining and industrial projects; Evaluation of mineral resources.

Jan 1974 to May 1980 *Geologist*, Geological Survey of New South Wales, Department of Mineral Resources, Sydney

- Geological mapping and mineral resource assessment (predominantly construction materials and industrial minerals).
- Monitoring and Investigation of environmental problems around coal and metalliferous mines throughout New South Wales.
- Assessment of geological constraints upon urban development.
- Geological aspects for waste disposal.
- Assessment of Environmental Impact Statements for Mining Projects.

Mar 1970 to Dec 1973 *Cadet Geologist*, Geological Survey NSW, Department of Mines, Sydney

- Field Assistance
- Research
- Counter Inquiries

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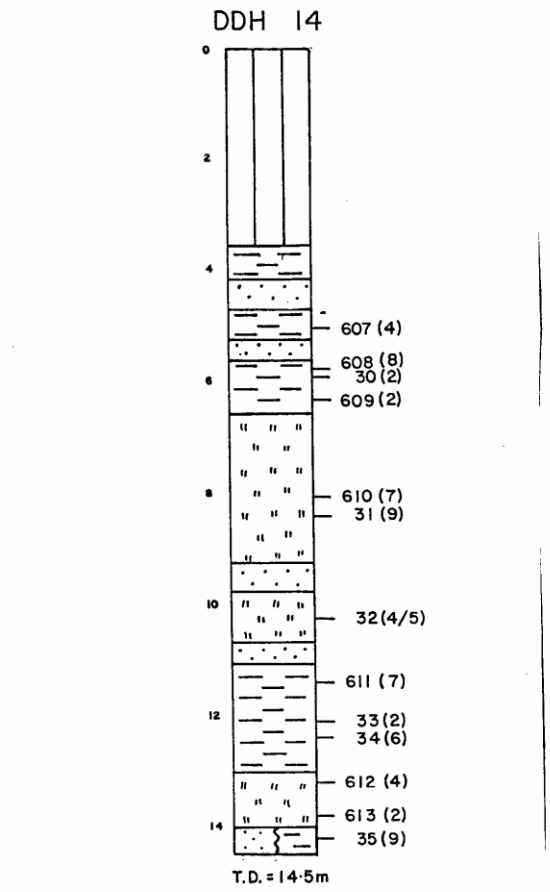
Appendix 2

Geological Data – Oakdale West Property

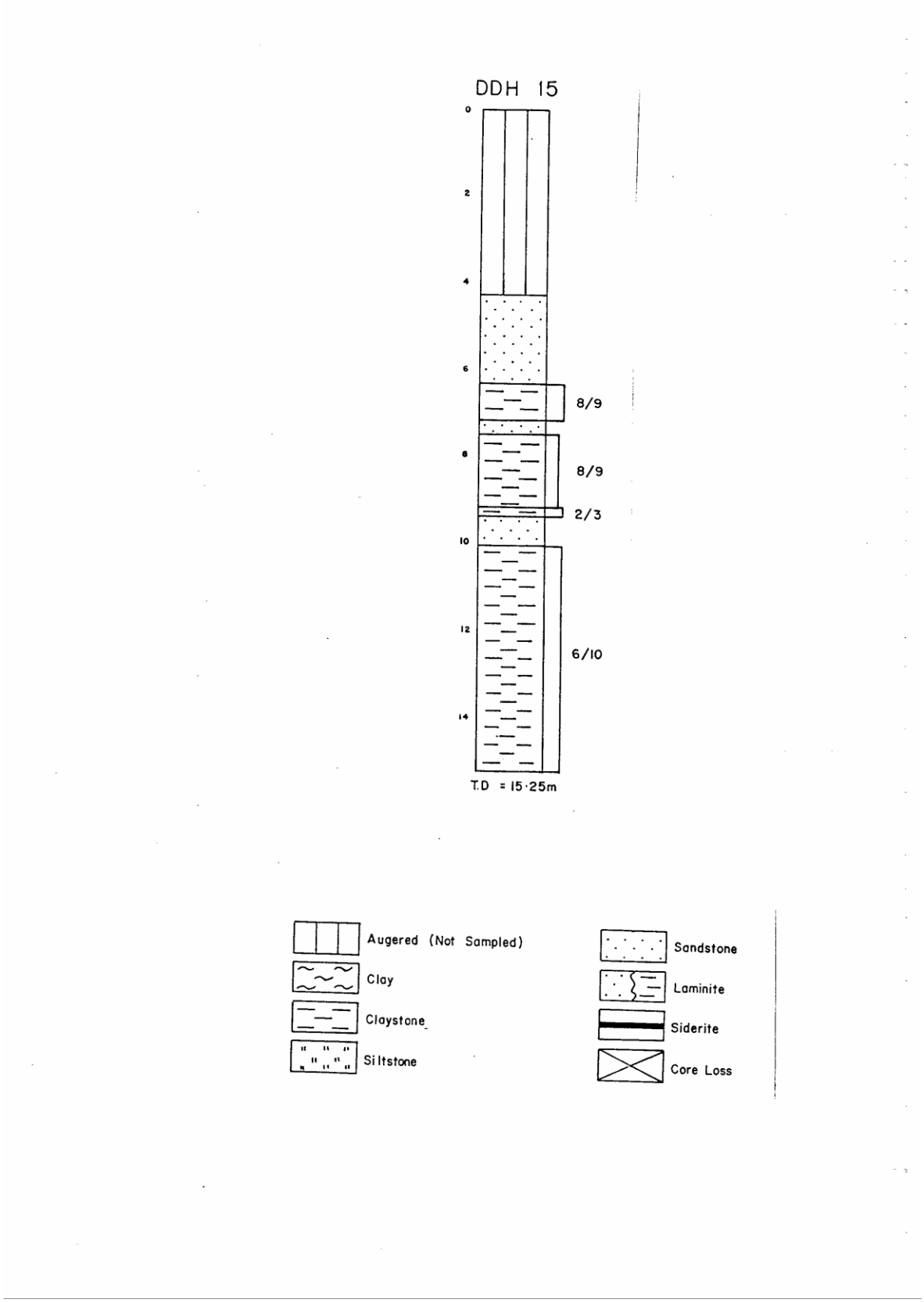
(Total No. of pages including blank pages = 16)


DDH 14
0
2
4
6
8
10
12
14
607 (4)
608 (8)
30 (2)
609 (2)
610 (7)
31 (9)
32(4/5)
611 (7)
33(2)
34(6)
612 (4)
613 (2)
35(9)
T.D. = 14·5m
Augered (Not Sampled)
Clay
Claystone
Siltstone
Sandstone
Laminite
Siderite
Core Loss

AUSTRAL DDH NO. 14

Depth (m)	Thickness (m)	Description	Sample No(Depth-m)	Fired Colour
0-3.65	3.65	Not Sampled.		
3.65-4.15	0.5	CLAYSTONE, light brown, extremely weathered, minor ironstone pebbles to 5 mm throughout.	606(3.95)	6
4.15-4.7	0.55	SANDSTONE, fine grained, thinly bedded.		
4.7-5.25	0.55	CLAYSTONE, light brown to mid grey, moderately soft, minor small plant fragments.	607(5.08)	4
5.25-5.6	0.35	SANDSTONE, fine grained, massive, abundant siderite throughout unit.		
5.6-6.55	0.85	CLAYSTONE, tends to siltstone near centre of unit, light to mid grey, minor weathered plant fragments present on bedding planes, oblique joints traverse unit.	608(5.25) 609(6.30)	8+S 2
6.55-6.60	0.05	CLAYSTONE, light to mid grey, abundant carbonaceous material on bedding, moderately soft.	30(6.75)	2
6.60-9.25	2.55	SILTSTONE, light grey, to light brown, variable throughout with minor claystone interbeds.	610(8.05) 31(8.6)	7 9
9.25-9.75	0.5	SANDSTONE, fined grained, disturbed bedding, massive.		
9.75-10.65	0.9	SILTSTONE, generally massive, carbonaceous material present on bedding planes, siderite nodules to 15 mm near centre of unit.	32(10.20)	4/5
10.65-11.05	0.40	SANDSTONE, light to mid grey, fine grained, massive.		
11.05-13.0	1.95	CLAYSTONE, light to mid grey, carbonaceous in parts, minor small plant fragments on bedding planes, moderately hard, vertical joints throughout unit.	611(11.4) 33(12.0) 34(12.4)	7 2 6
13.0-14.0	1.0	SILTSTONE, light to mid grey, hard calcite present on bedding planes, coaly fragments present towards base of unit.	612(13.2) 613(13.8)	4 2
14.0-14.5	0.5	LAMINITE, mid grey, massive.	35(14.2)	10+S

End of Hole 14.5 m.

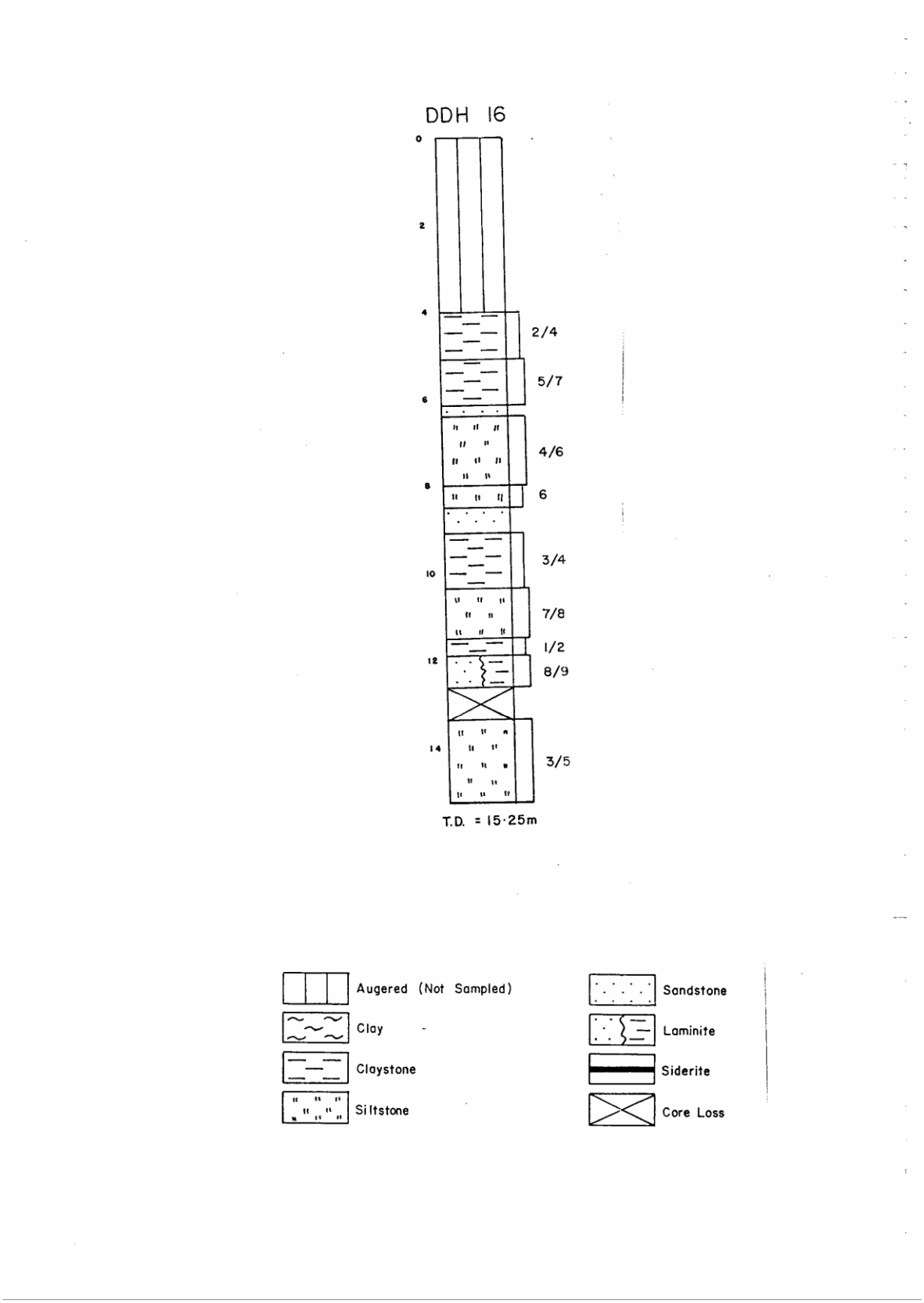

DDH 15
0
2
4
6
8
10
12
14
8/9
8/9
2/3
6/10
T.D = 15·25m
Augered (Not Sampled)
Clay
Claystone
Siltstone
Sandstone
Laminite
Siderite
Core Loss

AUSTRAL DDH NO. 15*

Depth (m)	Thickness (m)	Description	Fired Colour
0–4.25	4.25	Not Sampled.	
4.25–6.3	2.05	SANDSTONE, medium grained, cross bedded, sedimentary breccia present within unit at 4.9.	
6.3–7.15	0.85	CLAYSTONE, manganese present on joints and bedding planes, massive.	8/9
7.15–7.45	0.3	SANDSTONE, cross bedded, massive.	
7.45–9.2	1.75	CLAYSTONE, minor siltstone interbeds throughout, siderite present as nodules to 15 mm near top of unit, pyrite present on joints, manganese present on joints and bedding planes towards base of unit.	8/9
9.2–9.4	0.2	CLAYSTONE, minor small plant fragments.	2/3
9.4–10.05	0.65	SANDSTONE, fine grained, massive.	
10.05–15.25	5.2	CLAYSTONE, minor siltstone interbeds throughout, unit is jointed in places, manganese present on joints, siderite present as nodules to 20 mm in upper portion of unit and has thin beds to 20 mm.	6/10

End of Hole 15.25 m.

*Logged when fully fired.

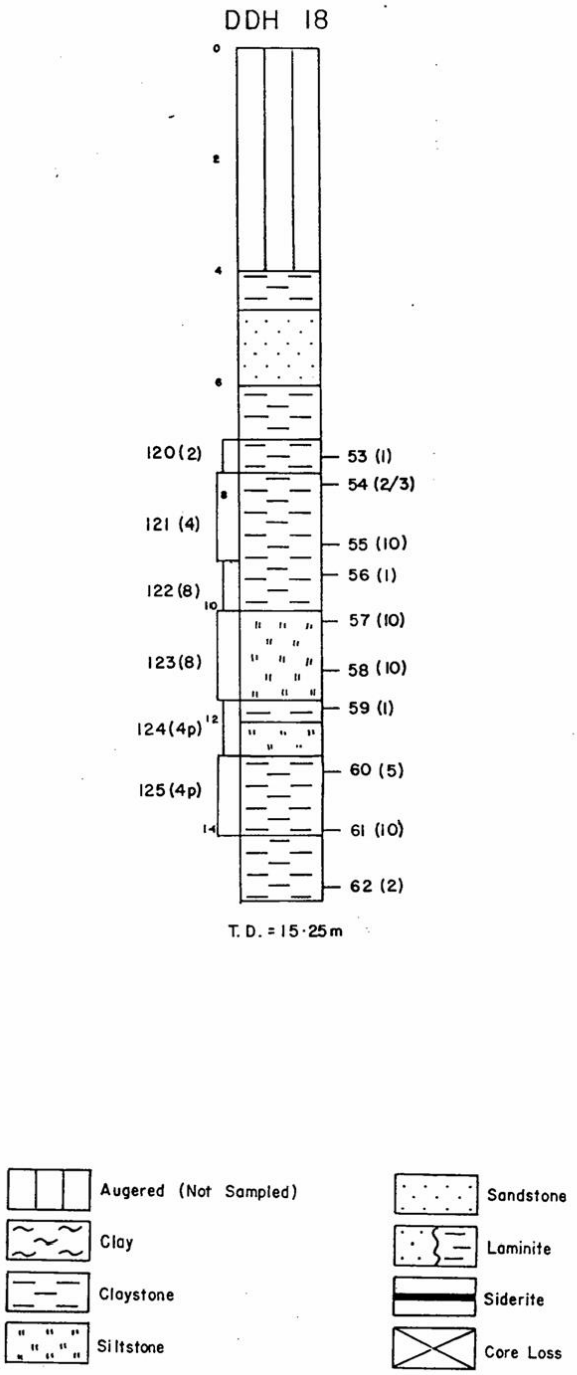

DDH 16
0
2
4
6
8
10
12
14
2/4
5/7
4/6
6
3/4
7/8
1/2
8/9
3/5
T.D. = 15·25m
Augered (Not Sampled)
Clay
Claystone
Siltstone
Sandstone
Laminite
Siderite
Core Loss

AUSTRAL DDH NO. 16*

Depth (m)	Thickness (m)	Description	Fired Colour
0–4.0	4.0	Not Sampled.	
4.05–5.1	1.1	CLAYSTONE, weathered, iron present on joints throughout unit	2/4
5.1–6.15	1.05	CLAYSTONE, minor siltstone near top of unit, jointed, manganese present on joints.	5/7
6.15–6.4	0.25	SANDSTONE, medium grained.	
6.4–8.0	1.6	STILSTONE, generally massive, minor jointing, manganese present on bedding planes and joints.	4/6
8.0–8.5	0.5	SILTSTONE, massive, jointed.	6
8.5–9.05	0.55	SANDSTONE, fine grained, thinly bedded towards base of unit.	
9.05–10.35	1.3	CLAYSTONE, extremely massive, minor siderite nodules to 10 mm near centre of unit.	3/4
10.35–11.5	1.15	SILTSTONE, tends to laminite near base of unit, generally massive, siderite nodules to 10 mm present near top of unit.	7/8
11.5–11.9	0.4	CLAYSTONE, minor plant fragments throughout.	1/2
11.9–12.65	0.75	LAMINITE, massive, minor claystone interbeds towards base.	8/9
12.65–13.35	0.7	CORE LOSS	
13.35–15.25	1.9	SILTSTONE, generally uniform, jointed.	3/5

End of Hole 15.25 m.

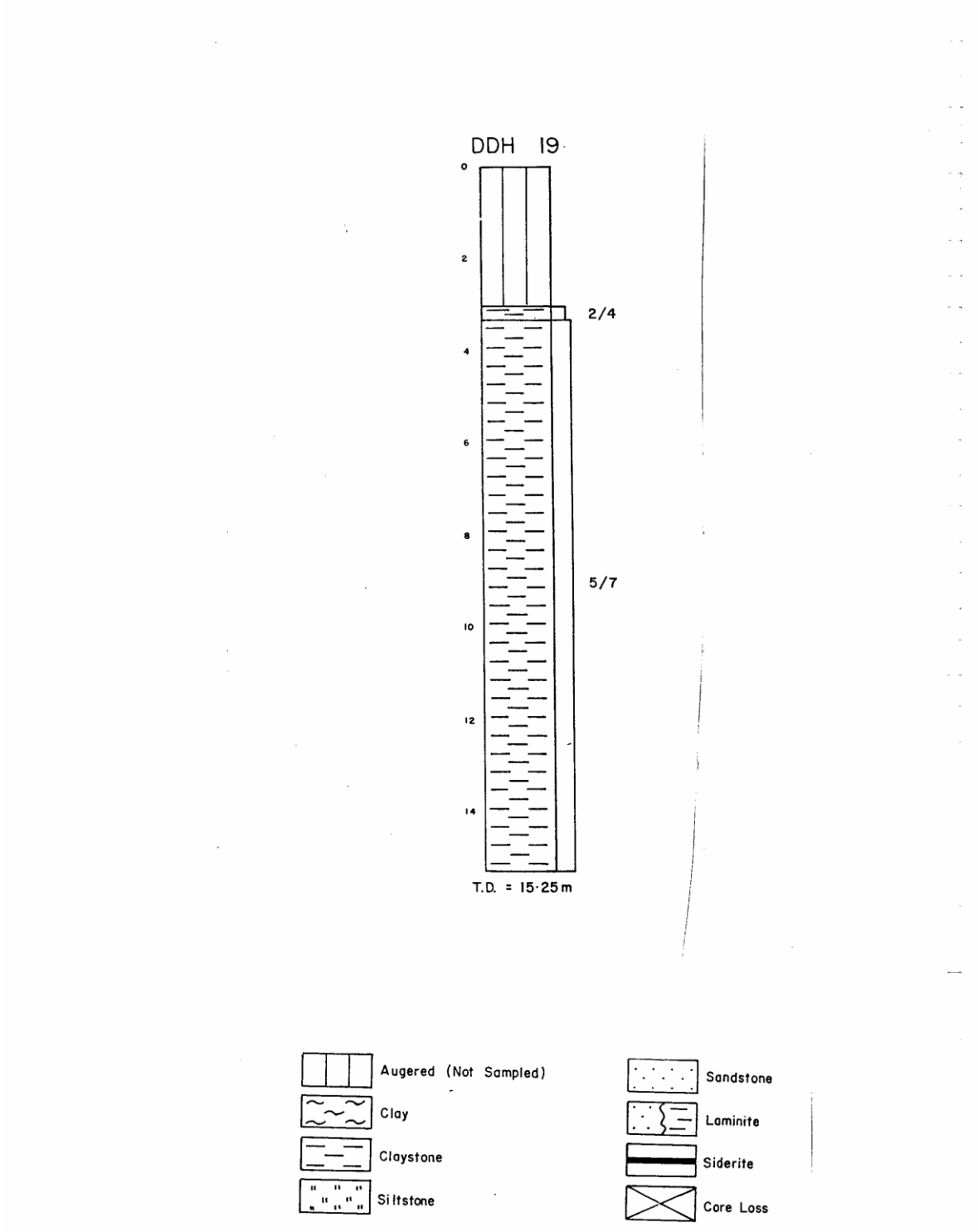
*Logged when fully fired.


DDH 18
0
2
4
6
8
10
12
14
120(2)
121 (4)
122(8)
123(8)
124(4p)
125(4p)
53 (1)
54 (2/3)
55 (10)
56 (1)
57 (10)
58 (10)
59 (1)
60 (5)
61 (10)
62 (2)
T. D. = 15·25m
Augered (Not Sampled)
Clay
Claystone
Siltstone
Sandstone
Laminite
Siderite
Core Loss

AUSTRAL DDH NO. 18

Depth (m)	Thickness (m)	Description	Sample No(Depth-m)	Fired Colour
0-4.0	4.0	Not Sampled		
4.0-4.7	0.7	CLAY, light grey to red/orange, sandy, numerous ironstone pebbles towards base of unit.		
4.7-6.05	1.35	SANDSTONE, light grey to light brown, soft, minor interbeds of carbonaceous claystone.		
6.05-7.0	0.95	CLAYSTONE, light brown, abundant small plant fragments throughout, soft.		
7.0-7.6	0.6	CLAYSTONE, light grey, minor weathering along bedding planes near top of unit, minor large plant fragments present on bedding plains.	53 (7.3)	1+S
7.6-10.05	2.45	CLAYSTONE, light to mid grey, massive, minor small plant fragments near top and base of unit, siltstone beds near centre of unit.	54 (7.8) 55 (8.85) 56 (9.4)	2/3 10(L)+S 1+S
10.05-11.65	1.6	SILTSTONE, light to mid grey, uniform, hard, minor large plant fragments near top of unit.	57 (10.25) 58 (11.15)	10(1) 10(L)
11.65-12.05	0.4	CLAYSTONE, mid to dark grey, slightly carbonaceous, soft, abundant large and small plant fragments throughout.	59 (11.8)	1+S
12.05-12.65	0.6	SILTSTONE, light to mid grey, massive, uniform, minor small siderite nodules to 10 mm towards base of unit.		
12.65-14.1	1.45	CLAYSTONE, light to mid grey, minor small plant fragments throughout.	60 (12.95) 61 (14.0)	5 10(L)
14.1-15.25	1.15	CLAYSTONE, light grey, soft, minor small plant fragments near base.	62 (15.05)	2

End of Hole at 15.25 m.

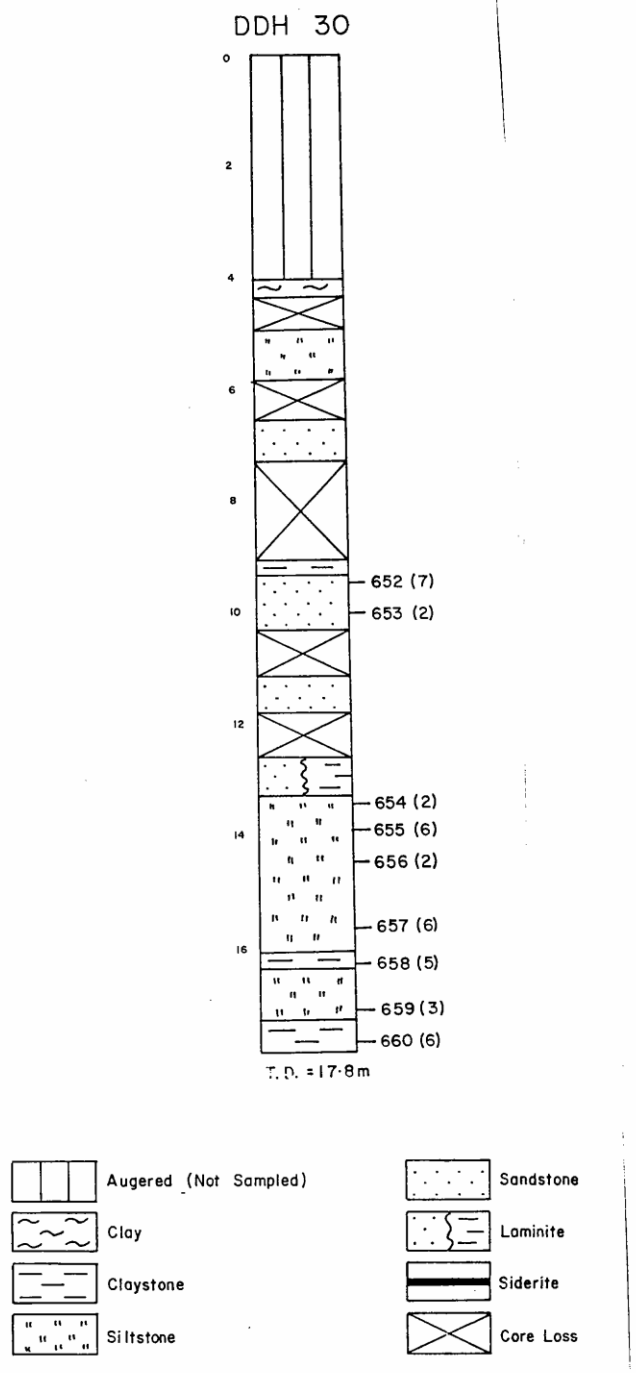

DDH 19
0
2
4
6
8
10
12
14
2/4
5/7
T.D. = 15·25 m
Augered (Not Sampled)
Clay
Claystone
Siltstone
Sandstone
Laminite
Siderite
Core Loss

AUSTRAL DDH NO. 19*

Depth (m)	Thickness (m)	Description	Fired Colour
0-3.0	3.0	Not Sampled.	
3.0-3.3	0.3	CLAYSTONE, weathered, minor small plant fragments.	2/4
3.3-15.25	11.95	CLAYSTONE, entire sequence is relatively uniform with minor interbedded siltstones, fired colour is generally uniform throughout, siderite nodules are present but only in small quantities, most of the rock components are generally massive.	5/7

End of Hole 15.25 m.

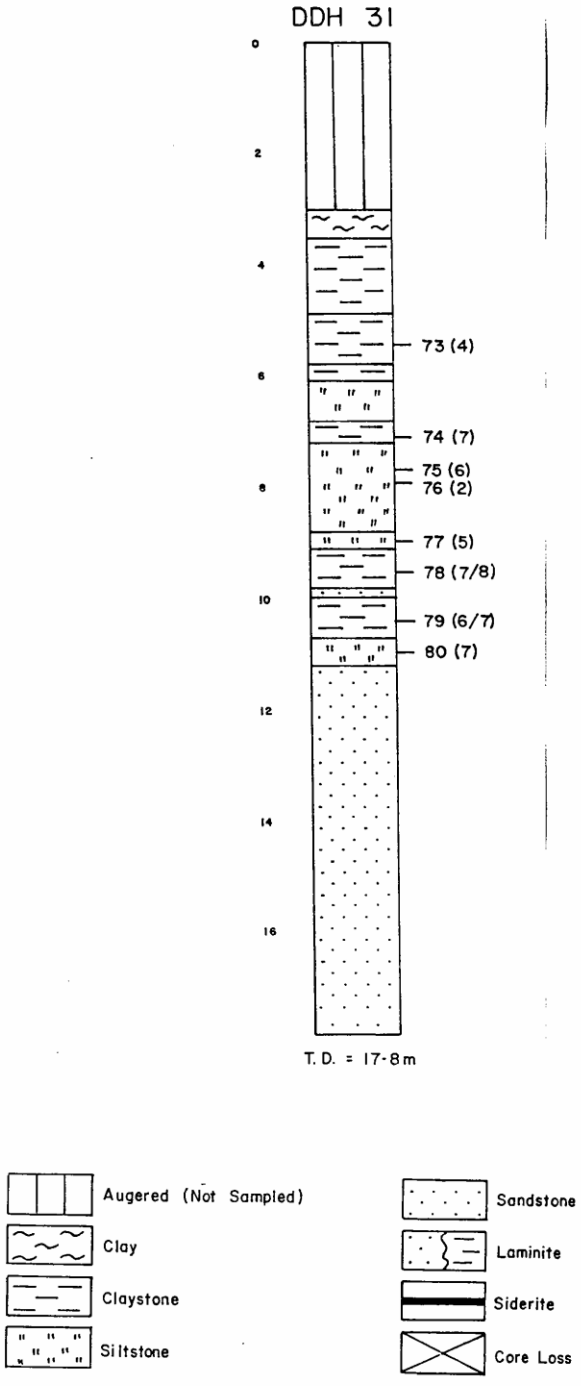
* Logged when fully fired.


DDH 30
0
2
4
6
8
10
12
14
16
652 (7)
653 (2)
654 (2)
655 (6)
656 (2)
657 (6)
658 (5)
659 (3)
660 (6)
T.D. = 17·8m
Augered (Not Sampled)
Clay
Claystone
Siltstone
Sandstone
Laminite
Siderite
Core Loss

AUSTRAL DDH NO. 30

Depth (m)	Thickness (m)	Description	Sample No(Depth-m)	Fired Colour
0-4.0	4.0	Not Sampled.		
4.0-4.3	0.3	CLAY, red/orange, abundant ironstone nodules throughout, lateritised.		
4.3-4.9	0.6	CORE LOSS		
4.9-5.8	0.9	SILTSTONE, light brown, sandy towards base.		
5.8-6.6	0.8	CORE LOSS		
6.6-7.3	0.7	SANDSTONE, mid grey/brown, jointed, generally massive.		
7.3-9.1	1.8	CORE LOSS		
9.1-9.3	0.2	CLAYSTONE, light grey, soft, large siderite nodules to 40 mm throughout.		
9.3-10.3	1.0	SANDSTONE, claystone and sandstone interbeds throughout, pyrite present on bedding planes, minor plant fragments.	652(9.4) 653(9.95)	7 2
10.3-11.1	0.8	CORE LOSS		
11.1-11.8	0.7	SANDSTONE, grey, vertical jointing, pyrite and calcite present on joints, siderite nodules towards base.		
11.8-12.6	0.8	CORE LOSS		
12.6-13.3	0.7	LAMINITE, jointed throughout.		
13.3-16.0	2.7	SILTSTONE, claystone interbeds throughout, light to mid grey.	654(13.4) 655(13.85) 656(14.45) 657(15.7)	2 6 2 6
16.0-16.3	0.3	CLAYSTONE, light to dark grey, soft.	658(16.3)	5
16.3-17.25	0.95	SILTSTONE, mid grey, massive.	659(17.1)	3
17.25-17.8	0.55	CLAYSTONE, carbonaceous, mid grey.	660(17.55)	6

End of Hole 17.8 m.


DDH 31
0
2
4
6
8
10
12
14
16
73 (4)
74 (7)
75 (6)
76 (2)
77 (5)
78 (7/8)
79 (6/7)
80 (7)
T. D. = 17-8m
Augered (Not Sampled)
Clay
Claystone
Siltstone
Sandstone
Laminite
Siderite
Core Loss

AUSTRAL DDH NO. 31

Depth (m)	Thickness (m)	Description	Sample No.(Depth-m)	Fired Colour
0-3.0	3.0	Not Sampled.		
3.0-3.5	0.5	CLAY, light brown/grey,abundant siderite nodules to 5 mm throughout.		
3.5-4.85	1.35	CLAYSTONE, light grey to light brown soft, sandy throughout, sporadic ironstone distributed throughout.		
4.85-5.8	0.95	CLAYSTONE, mid grey, minor iron staining on joints, coaly fragments throughout.	73(5.45)	4
5.8-6.1	0.3	CLAYSTONE, dark grey, black/brown, soft, abundant siderite nodules to 10 mm throughout, coaly fragments abundant.		
6.1-6.85	0.75	SILTSTONE, mid grey massive, minor siderite in grains to 2 mm throughout.		
6.85-7.2	0.35	CLAYSTONE, dark grey, hard, minor plant fragments throughout, minor calcite on joints.	74 (7.1)	7
7.2-8.8	1.6	SILTSTONE, mid to dark grey, claystone interbeds throughout, carbonaceous in places.	75 (7.7) 76 (7.95)	6 2
8.8-9.1	0.3	SILTSTONE, mid to dark grey, massive.	77 (8.95)	5
9.1-9.8	0.7	CLAYSTONE, light to mid grey, soft, abundant plant fragments throughout.	78 (9.5)	7/8
9.8-9.95	0.15	SANDSTONE, mid grey, convolute bedding throughout, minor coal wisps.		
9.95-10.7	.75	CLAYSTONE, mid grey, hard, moderate plant fragment throughout, siderite present as nodules to 15 mm in centre of unit, minor pyrite associated with plant fragments, slickensiding towards base.	79 (10.4)	6/7
10.7-11.2	0.5	SILTSTONE, mid grey, hard.	80 (10.95)	7
11.2-17.8	6.6	SANDSTONE, mid grey, fine to medium grained, micro cross bedding, minor carbonaceous material on bedding throughout.		

End of Hole 17.8

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