Geotechnical Assessment Report

200 Aldington Rd, Kemps Creek, NSW 2178
Dam Walls Stability Analysis

Prepared for: Fife Kemps Creek Ltd

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1 Introduction

ADE Consulting Group (ADE) has been engaged by Fife Kemps Creek Ltd (FKC) to analyse the stability of dams within the 200 Aldington Rd estate in Kemps Creek (the site), in an area legally described as Lots 31 and 32 in DP258949. The lots have a combined area of approximately 21 hectares (ha) within the Penrith City Council Local Government Area (LGA).

Two dams were located on site, approximately 450 m east of Aldington Rd and have areas of approximately 2 ha (Dam 1) and 0.15 ha (Dam 2) respectively – See **Figure 1**. However, Dam 2's northern dam wall was located on an adjacent property in Lot 41 of DP708347. The stability and safety of Dam 2's northern wall will be discussed in a separate report (A201021.1725.04.v1f_74-90 Aldington Rd_JP) for dams on the 74-90 Aldington Rd site.

A site walk-over together with intrusive assessment at 6 locations on the northern embankment of Dam 1 was completed by ADE's geotechnical engineer on 11 March 2022 (See **Appendix I** – Site and Test Location Plan). Insitu testing using Dynamic Cone Penetration (DCP) was carried out from the ground surface to depths ranging between 2.0 - 2.6 m below ground using portable hand equipment. Previously, Douglas Partners carried out a geotechnical investigation covering the overall site (92345.00 dated May 2019). The investigation comprised test pit excavations and subsequent laboratory testing of soil samples retrieved from the test pits. ADE has reviewed the test pit logs and information to assess the soils properties across the site including the existing dams.

The purpose of this report is to assess the existing conditions and comment on the safety of the existing dams on the site, to address Mamre Road DCP Riparian Land Control 18 (Section 2.3). The control is as follows:

18) Dams proposed for retention must be subject to a geotechnical investigation to determine the safety of the structure with respect to surrounding land uses.

ADE's fieldwork for dam wall stability analysis at 74-90 Aldington Rd to the north of the site was carried out concurrently with this investigation (see report A201021.1725.04.v1f_Dam Stability_JP).

2 Methods of Assessment

The assessment comprised of the following:

- Preparation of a project Safe Work Method Statement (SWMS) plan.
- Site walkover to inspect each of the two dams. The inspection was completed after a relatively 'wet' month. This stability assessment is based upon a detailed inspection of the topographic, surface drainage and geological conditions of the site and its immediate environs. These features were compared to those of other similar lots in neighbouring locations to provide a comparative basis for assessing the risk of instability affecting the dams.
- Six (6) Dynamic Cone Penetrometer (DCP) tests were carried out along the crest of the northern wall of Dam 1 to depths ranging between 2.0 – 2.6m. DCP Testing was carried out in accordance with AS 1289.6.3.2 - 1997 to provide soil consistency / strength correlations. The results of DCP testing are attached to this report (in **Appendix II**).

- The approximate DCP test locations are shown in **Appendix I – Site and Test Location Plan**.
- Site photos are presented in **Appendix III**.

3 Site Information

3.1 Site Description

The site comprised two dams in the northeastern corner of the 200 Aldington Rd estate in Kemps Creek, NSW, 2178 (on Lots 31 and 32 of DP258949). Each allotment is irregular in shape and Lots 31 and 32 are approximately 10 and 11 hectares (ha) in area respectively. The site is divided into two stormwater catchments, with a larger catchment to the south and smaller catchment to the north. The northern dam wall of the catchment to the north (Dam 2) falls outside the site boundary. The north-eastern portion of the site is partially located within Counci's flood planning area map.

The site is located approximately 4km north-west of the future Western Sydney Nancy-Bird Walton Airport, 13km south-east of the Penrith CBD and 40km west of the Sydney CBD. The site is part of the Broader Western Sydney Employment Area and is zoned land under the Industry and Employment State Environmental Planning Policy (I&E SEPP 2021). To the south of the site are residential/farming properties as well as further dams and creeks. A high voltage power line ran in a northwest-southeast direction to the east of the site with farmland beyond.

Five residences with accompanying sheds/garages occupied the site, clustered on the western edge of the properties. The majority of the site appeared to be vacant farmland. Two dams were located on site approximately 450m east of Aldington Rd with maximum dimensions of approximately 150m north-south and 50m east-west (Dam 1) and 70m north-south and 20m east-west (Dam 2) – See **Figure 1** below.

At the time of inspection the water level in Dam 1 was approximately 0.5 - 1m below the crest of the embankments. The northern dam wall was 1m high relative to the water level, increasing to 2.0m outside of the wall as the natural ground surface level lowers towards Dam 2.

The inclination of embankments at Dam 1 and Dam 2 was generally observed to be between approximately 30 – 45°, however some steeper slopes may have been obscured by vegetation and high dam water levels. The embankments of Dam 1 were covered in vegetation with several small trees observed along the northern and western walls. (see **Photo 2**). The east and west banks of Dam 2 were lined with trees and vegetation.

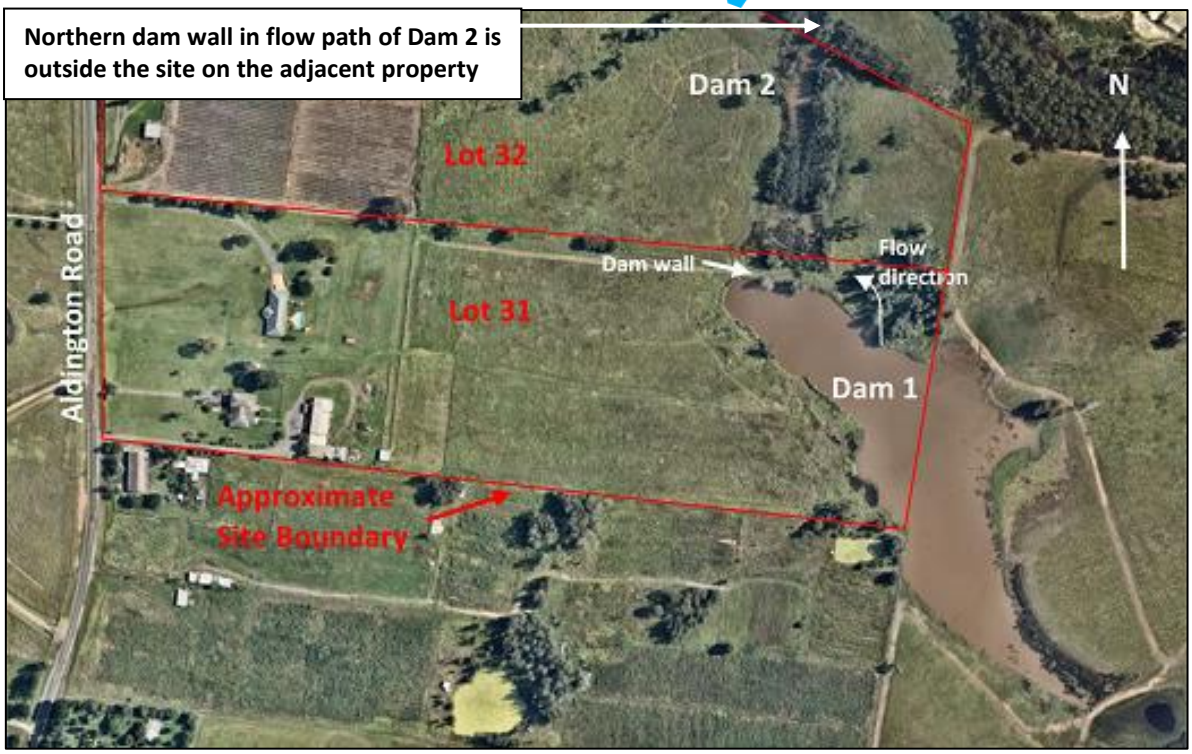


Figure 1: Aerial image of Lots 31/32, DP258949, Kemps Creek, February 2022 - Sourced from Nearmap

3.2 Regional Geology

The 1:100,000 scale Penrith Geological Series Sheet (Geological Survey of NSW, Department of Minerals and Energy, indicates that the site is on the boundary of Quaternary fluvial sediments (Qal) and Bringelly Shale (Rwb) of Triassic Age. The fluvial soils include fine-grained sand, silt and clay and Bringelly Shale typically comprises shale, carbonaceous claystone, claystone, laminate, fine to medium-graind lithic sandstone, rare coal and tuff. An excerpt of the Penrith geological map around the site is presented below in **Figure 2**.

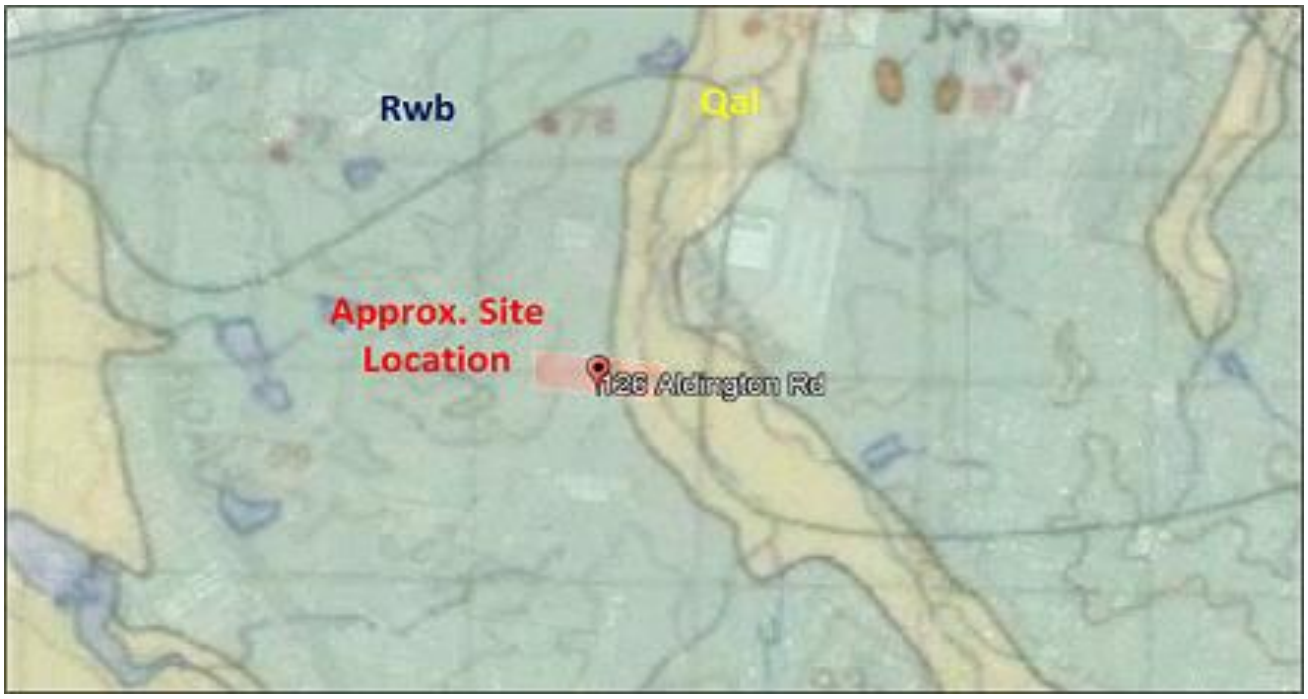


Figure 2: Site Location shown on excerpt of Penrith 1:100 000 Geological Sheet by Geological Survey of NSW.

4 Geotechnical Assessment

A visual inspection of surface soil material was conducted at the crest surface of the northern dam wall of Dam 1. The embankment appears to be comprised of medium plasticity, dark brown, moist silty clay fill with organic matter and fine gravel. The DCP blow counts at locations 1-6 (See **Appendix II**) indicated that this fill material is firm and possibly extends to 2.0m depth. Along the north dam wall, an increase in DCP blow counts at approximately 2.0 m depth may indicate stiff or better residual clays. DCP test locations 5 and 6 in the northwest corner of the dam indicated firm fill material to 1.6m. An increase in DCP blow counts in the northwest corner of the dam at approximately 1.6m may indicate stiff or better residual clays.

Test pit excavation and soil logging has previously been completed on site (See report by Douglas Partners, project 92345.00, Report on Preliminary Geotechnical Investigation, dated May 2019 – Test pit log TP10). The report indicates that extremely low strength, extremely weathered shale bedrock was observed approximately 100m east of Dam 1 at 2.4m depth. Depth to bedrock may be significantly higher in the vicinity of the dams.

5 Comments and Recommendations

The main causes of dam failure include seepage, slips and slides of embankments, erosion from dispersivity of soils, surface cracking, deformation of embankments, spillway blockage, presence of large trees on embankments, or damage from significant weather conditions**.**

Trees and vegetation growing on the embankments of each dam can contribute to seepage and internal erosion. As tree roots loosen fill material and eventually decay there is the chance for piping failure to occur due to flowing water. Strong winds or bushfires can also cause trees to topple and breach the embankment.

The sectional crest width of the northern dam wall of Dam 1 was observed to be between 3-4 m reducing to 2m approaching the natural spillway marked in **Appendix I**. Each bank of the wall was observed to be inclined between 30 - 60°. At the time of inspection the water level in Dam 1 was approximately 1m below the crest of the northern dam wall.

No formal spillway structures were observed at Dam 1. An overland natural spillway (no flow direction was visible at time of inspection) was observed at the northeast corner of the dam, leading north through a forested area towards Dam 2.

Evidence of scouring and internal erosion of the inside of dam embankments at each dam was not evident or obscured by the dense vegetation and water (full). Scouring and erosion can occur when dispersive soils are present (soils easily eroded by water). Residual soils from Bringelly Shale are typically moderately dispersive. Historical aerial images of Dam 1 and Dam 2 in **Appendix III** below indicate significant rise and fall of dam levels in Dams 1 and 2 which could cause internal erosion, however, this was not observed in historical photos or during the site walkover inspection.

Conclusion:

Based on our observations and information available to date, there are no current safety concerns such as signs of erosion, piping, surface cracking, deformation, spillway erosion, or animal damage such as rabbit, snake, or rat holes. The walls of Dam 1 appeared to be in good condition and appeared to be performing satisfactorily in spite of recent extreme weather events based on cursory inspections from within the site. ADE's stability and safety assessment of the northern dam wall of Dam 2 is reported separately as this wall is

located on an adjacent property – Lot 41 of DP708347 (See ADE's report A201021.1725.04.v1f_74-90 Aldington Rd_JP).

Prior to site development a detailed assessment of the dam safety will be carried out. Based on the results of future investigations, futher dam wall strengthening measures or remediation measures will be developed. ADE recommends that a periodic inspection and maintenance plan for dam safety should be developed for risk management during site development as a part of on-going management of dams.

6 Limitations

This report has been prepared for use by the client, who has commissioned the works in accordance with the project brief only and has been based on information provided by the client. The advice herein relates only to this project, and all results, conclusions and recommendations made should be reviewed by a competent and experienced person with experience in geotechnical investigations before being used for any other purpose.

ADE Consulting Group Pty Ltd (ADE) accepts no liability for use or interpretation by any person or body other than the client who commissioned the works. This report should not be reproduced or amended in any way without prior approval by the Client or ADE and should not be relied upon by any other party, who should make their own independent enquiries.

Assessment undertaken in respect of this report are constrained by the particular site conditions, such as the location of buildings, services and vegetation. As a result, not all relevant site features and conditions may have been identified in this report.

This report does not provide a complete assessment of the geotechnical status of the site and it is limited to the scope defined herein. Should information become available regarding conditions at the site (e.g., conditions exposed at the site during earthworks varying significantly with the results within this report), ADE reserves the right to review the report in the context of the additional information.

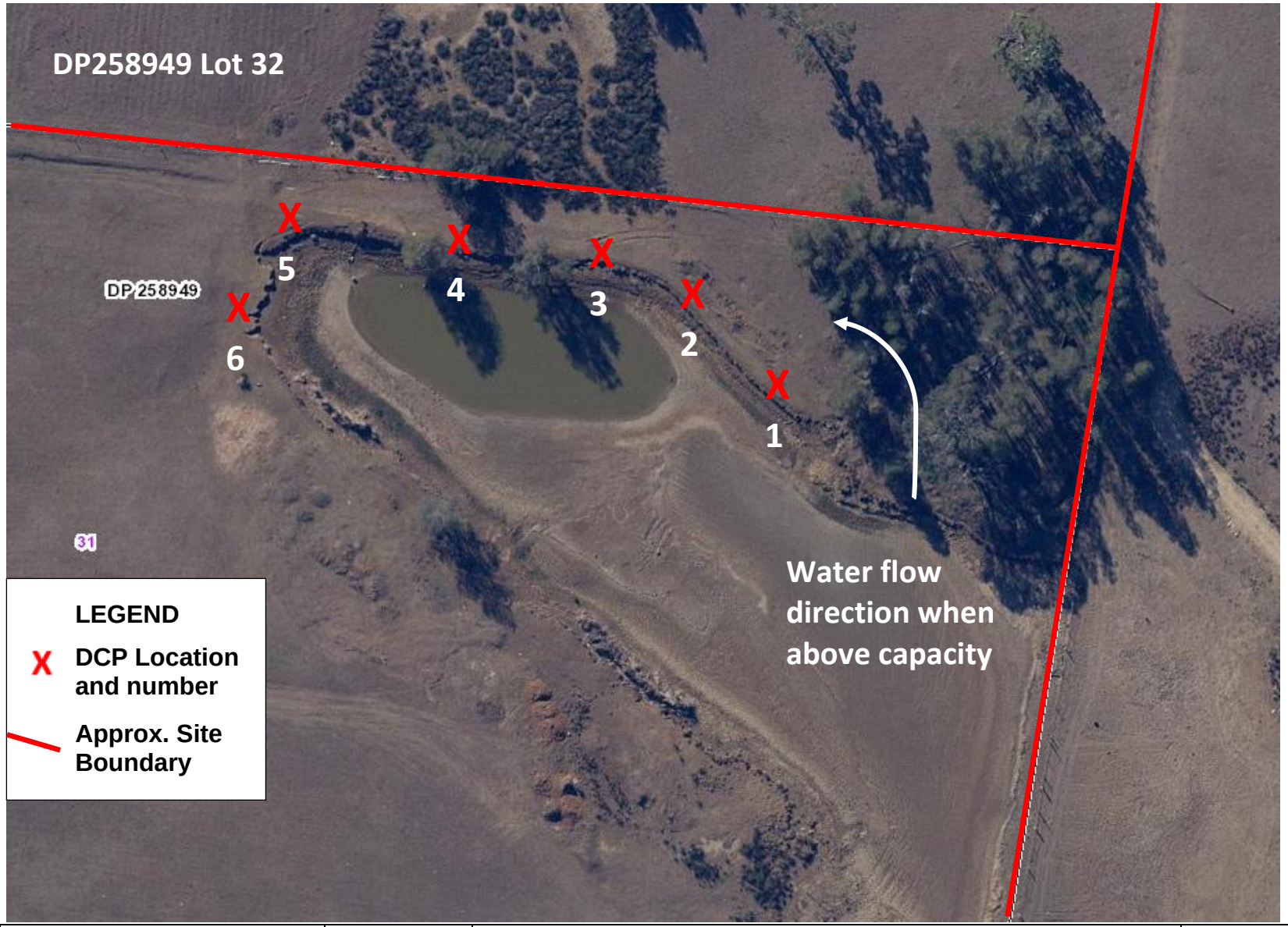
ADE's professional opinions are based upon its professional judgement, experience, training and results from analytical data. In some cases, further testing and analysis may be required, thus producing different results and/or opinions. ADE has limited investigation to the scope agreed upon with its client.

This report has been written with the intent of providing information of the site subsurface to the client for design and construction purposes. Subsurface conditions relevant to the works undertaken by the client should be assessed by a competent contractor who can make their own interpretation of the data represented within this report. Subsurface conditions will always vary within a worksite and the extremes of these variations cannot be defined by exhaustive investigations, and as such, the measurements and values obtained within this result may not be representative of these extremes.

7 References

1. *Penrith 1:100 000 Geological Series Sheet. New South Wales Government, 1991;*
2. *Google Earth, Map data 2022, https://earth.google.com/web/;*
3. *New South Wales Government, Spatial Services, Six Maps website, https://maps.six.nsw.gov.au/, date March 2022.*

Appendix I – Site and Test Location Plan



drawn	**JY**	client:	Fife Kemps Creek Limited
approved	**JP**	project:	Dam Walls Stability Analysis
date	**14th March 2022**	title:	200 Aldington Rd, Kemps Creek
scale	**Not to scale**	project no:	A201021.1725.03
Original size	**A4**	figure no	Drawing 1

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Appendix II – Dynamic Cone Penetrometer Results

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SOLUTIONS THROUGH INNOVATION

DYNAMIC CONE PENETRATION TEST RESULTS

Client:	Fife Kemps Creek Limited
Project:	Dam Walls Stability Analysis
Location:	200 Aldington Rd, Kemps Creek

Job No:	1725.03	Hammer Weight & Drop:	9kg/510mm
Date:	11.03.2022	Rod Diameter:	16mm
Tested By:	JY/PH	Point Diameter:	20mm

	Number of Blows per 100mm Penetration						
Test ID	1	2	3	4	5	6	
Depth (mm)							
0 - 100	1	2	3	3	2	1	
100 - 200	2	2	3	2	2	3	
200 - 300	2	2	1	2	3	6	
300 - 400	2	2	2	2	2	5	
400 - 500	2	2	2	2	1	2	
500 - 600	3	2	2	2	2	1	
600 - 700	3	2	2	3	1	1	
700 - 800	2	3	2	3	1	1	
800 - 900	1	3	3	3	1	2	
900 - 1000	2	2	2	2	1	2	
1000 - 1100	2	2	2	2	2	4	
1100 - 1200	4	3	2	2	1	3	
1200 - 1300	3	2	2	2	3	3	
1300 - 1400	3	2	1	5	2	3	
1400 - 1500	2	4	3	5	6	3	
1500 - 1600	2	4	2	5	6	7	
1600 - 1700	2	4	3	5	10	7	
1700 - 1800	3	6	3	4	7	9	
1800 - 1900	3	5	3	3	7	10	
1900 - 2000	5	8	3	3	8	12	
2000 - 2100	4	10	5	4	8		
2100 - 2200	7	10	7	5	8		
2200 - 2300	9	13	10	6	9		
2300 - 2400	12	14	13	10	8		
2400 - 2500	16	16	14	9	9		
2500 - 2600	18		14	10	12		
2600 - 2700							
2700 - 2800							
2800 - 2900							
2900 - 3000							

Remarks:
1. The procedure used for this test is similar to that described in AS1289.6.3.2-1997, Method 6.3.2.
2. Usually 8 blows per 20mm is taken as refusal

Appendix III – Site Photos

Photo 1 – Facing west at DCP location 1 - Crest of northern dam wall at Dam 1

Photo 2 – Facing east at DCP location 4 – Crest of northern dam wall at Dam 1

Photo 3 – Facing east at DCP location 6 – Dam 1 and northern dam wall in background

Photo 4 – Facing south viewing DCP location 6 from northeast corner of Dam 1

Photo 5 – Dam water pump and pipe on northern wall of Dam 1

Photo 6 – Facing west at northeast corner of Dam 1.

Photo 7 – Facing north from Dam 1 northern wall towards Dam 2 – water overflow path towards Dam 2

Photo 8 – Facing northeast from Dam 1 northern wall – water overflow path towards Dam 2.

Photo 9 – Aerial image of dams (February 2022) – Sourced from Nearmap

Photo 10 – Aerial image of dams (January 2018) – Sourced from Nearmap

Photo 11 – Aerial image of dams (February 2012) – Sourced from Nearmap

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