GROUNDED EXPERTISE

Report on Shaft Rehabilitation Options

Reids Ridge Abandoned Mine Site (Commodore and Reids North)

Yalgoo-Ninghan Road, Paynes Find WA

Prepared for Department of Energy Mines Industry Regulation & Safety

Project 224768.00

26 February 2025

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The undersigned, on behalf of Douglas Partners Pty Ltd, confirm that this document and all attached drawings, logs and test results have been checked and reviewed for errors, omissions and inaccuracies.

Signature		Date
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Report on Shaft Rehabilitation Options Reids Ridge Abandoned Mine Site (Commodore and Reids North Areas) Yalgoo-Ninghan Road, Paynes Find WA

1. Introduction

This report presents several rehabilitation options for mining areas known as 'Commodore' and 'Reids North' as well as an unnamed group of mine features located 500 m southwest of Commodore, all within the dead mining tenement M59/117, 55 km west of Paynes Find in the Karara Rangelands Park.

The investigation was commissioned in a letter from the Department of Energy, Mines, Industry Regulation and Safety (DEMIRS) (letter Ref: DMIRS23250) and was undertaken in accordance with Douglas' proposal dated 21 September 2023 and the conditions outlined in the acceptance letter.

Following a Shaft Condition Assessment Report (*ref: 224768.00.R.003.Rev0)* prepared by Douglas, this report outlines several rehabilitation options, assessing the suitability of those options, and ultimately recommends a preferred option. 'Rehabilitation' in this context refers to the reinstatement of disturbed land, associated with a mine feature, to be safe, stable, and non-polluting. The following items are discussed for each option presented:

- description and rationale of rehabilitation solutions;
- schematics/drawings showing the process/arrangement/design;
- plant and equipment requirements;
- material specifications (where relevant) and volumes of material/s;
- potential or likely sources of material;
- timing/sequencing requirements;
- personnel and specific technical expertise required;
- potential risks to effective implementation including any impact from groundwater or unfavourable geochemistry, where applicable; and
- post rehabilitation monitoring requirements.

To assess the most suitable rehabilitation methodology, the main following criteria were considered:

- long-term suitability of the solution to mitigate safety risks;
- minimising risk to personnel involved in providing the rehabilitation works;
- minimising ongoing monitoring or maintenance;
- technical feasibility and cost-effectiveness; and
- minimising disturbance to the existing environment.

This report must be read in conjunction with all appendices including the notes provided in Appendix A.

2. Identified Features Presenting Geotechnical Risk

The features that form the three mining areas discussed in this report are summarised below.

Commodore: 20 features, labelled 1 to 13 (and some suffixes, e.g 11a and 11b). These 20 features follow the general alignment of the lode. They comprise a combination of vertical shafts, open stopes, exploratory pits and costeans, and range from 17 m to less than 1 m in depth. The edges of some of the larger features locally form hazardous overhangs of thin ground cover, inferred to result from decades of erosion.

Reids North: 5 features, labelled 14 to 18. These features comprise shafts that range from approximately 7 m deep to less than 1 m. These features are vertical except Feature 14, which includes a lateral working dipping at 40 degrees that starts from 2.8 m depth and extends to a depth of 7.1 m and 4 m wide.

Unnamed feature: 1 feature, appearing as three openings at the surface, labelled 20 to 22. The three surface openings link laterally a few metres below the surface. This feature is filled with debris which hinders visual inspection from the surface however, desktop information indicated the likely occurrence of deep shaft(s) and near vertical stope(s) at that location, to depths of possibly 20 m to 30 m approximately, partially backfilled with soils and rubbish.

Each of these features are discussed in detail in the Condition Report (*ref: 224768.00.R.003.Rev0).*

Natural ground conditions in the vicinity of the three areas are considered competent and geotechnical risks associated with these features generally comprise:

- Instability of the shallow ground adjacent to existing excavations and shafts.
- Collapse of ground or sudden subsidence of ground overlying shallow lateral workings and wall overhangs with insufficient thickness and strength of overlying ground.

In addition to the above, mitigating the risk of falls into features is also a primary objective of rehabilitation.

3. Rehabilitation Options

3.1 Preliminary Selection of Rehabilitation Options

Owing to the similarity of the conditions of the features in the three mining areas listed in Section 2, it is considered that the rehabilitation options listed below can be considered for all three mining areas:

- Backfill of features
- Below-ground concrete cap; and
- Fencing combined with bunds.

Other options such as grouting, surface structural cover and grate/grid type covers were considered during this preliminary selection. However, overall efforts to implement such alternative methods at this site would be greater owing to increased design requirements, specialist equipment and expertise, time to implement and in some cases, increased future maintenance, resulting in these alternatives to be technically less suited to the features, economically less viable, and unnecessarily complex for no additional advantages when compared to the three options retained.

It is noted that the features in the three mining areas have marginal to no value for future prospection or reuse in possible mining operations.

3.2 Backfill

3.2.1 Backfill Volume Requirements

The volume of material required for backfill has been estimated based on a combination of LiDAR measurements, field measurements and observations by Douglas engineers.

The visible volume of each feature, i.e. the volume of all areas visible to the LiDAR scanning equipment are summarised in Table 1 to Table 3 below. It is highlighted that some features in the table include some lateral workings whose parts may have been locally beyond the detection capabilities of a LiDAR scanner. The quoted volumes also don't account for removal of unsuitable material (debris and refuse) within a number of features. Therefore, the observed volumes in the tables below generally represent lower bounds.

Approximate volumes of additional fill to form 1.8 m high mounds above surrounding ground surface level at the location of the features, to mitigate long-term erosion and to deter vehicular access above the rehabilitated features, are also indicated in Table 1 to Table 3. Mounds that are relatively wide, say, above features 5a-5-6, 7-8-9 and possibly 11b may benefit from the addition of sporadic placement of a number of boulders (possibly sourced from the Reid Ridge mine waste) over the batters of the mounded fill to further deter vehicles traversing the filled features.

Table 1: Feature Volumes and Estimated Backfill for Commodore

Feature	Volume of Feature [L]: from LiDAR data [O]: from field observations (m^3)	Volume of Additional Fill to be Mounded 1.8 m above Level of Surrounding Ground (m^3)[O]
1	14.3 [L]	22
2	47.8 [L]	3
3	<5 [O]	5
4	<5 [O]	5
5	69.2 [L]	11
4a	40 [O]	42
5a	10 [O]	9
6	41.6 [L]	7

Feature	Volume of Feature [L]: from LiDAR data [O]: from field observations (m^3)	Volume of Additional Fill to be Mounded 1.8 m above Level of Surrounding Ground (m^3)[O]
7-8-9	126.8 [L]	45
10	47.1 [L]	4
11	21.5 [L]	2
11a	8 [O]	5
11b	25 [O]	27
11c	42 [L]	11
12	7 [L]	3
12a	21 [L]	9
13	<5 [O]	6
Sub-Total	**~536**	**~216**
TOTAL	**~752**	

Note [L]: Visible volume captured by LiDAR.
[O]: Field measurements and visible assessment by Douglas field personnel.

Table 2: LiDAR detected and estimated volumes for Reids North

Feature	Observed Volume of Feature [L]: from LiDAR data [O]: from field observations (m^3)	Volume of Additional Fill to be Mounded 1.8 m above Level of Surrounding Ground (m^3)[O]
14	27.4 [L]	16
15	<5 [O]	3
16	<5 [O]	8
17	9.2 [L]	2
18	5.5 [L]	4
Sub-Total	**~52**	**~33**
TOTAL	**~85**	

Note [L]: Visible volume captured by LiDAR.
[O]: Field measurements and visible assessment by Douglas field personnel.

Table 3: LiDAR detected and estimated volumes for Unnamed Features

Feature	Observed Volume of Feature (m^3)	Volume of Additional Fill to be Mounded 1.8 m above Level of Surrounding Ground (m^3)[O]
20-21-22	85 [L]	62
TOTAL	**~102**	

Note on Table 3 [L]: Visible volume captured by LiDAR.
[O]: Field measurements and visible assessment by Douglas field personnel.

A volume contingency of ±10% is considered suitable at this stage, owing to the degree of volume estimation required for some features and the potential for variation in backfill materials and material bulking factors.

3.2.2 Available Backfill Sources

Prior to backfilling, it is recommended that a large excavator is utilised to collapse areas of overhang and material overlying shallow, below-ground lateral links at Commodore and the unnamed feature.

Various mullock heaps and waste piles exist near the Commodore and Reids North features that would be suitable for re-use as backfill, however they are of limited volume compared to required backfill volumes.

Moreover, it is understood that it will possibly be suitable (from non-geotechnical considerations) to source material from site, for instance from ripping the ground surface. It was noted that the immediate surroundings of Commodore, Reids North and the Unnamed Features comprise some areas cleared of vegetation where it is anticipated, from limited ground surface observations (ie without any intrusive assessment), that heavy ripping the ground surface would lead to suitable backfill material. Borrow pits in other parts of the site, for instance the former airstrip that is mostly clear of vegetation, might also be considered as a possible borrow source location, although the suitability of the materials at this location would require further intrusive investigation. Generally, further intrusive investigation would increase the level of confidence on the location and suitability of the material that could be sourced within the site and therefore is recommended.

It is also noted that 1,000 m^3 to 1,500 m^3 of stockpiled rock waste, generally comprising gravelly COBBLES, trace boulders, sand and silt and an estimated 5,000 m^3 to 5,500 m^3 of silty tailings are located at the nearby Reids Ridge mine site. The rock waste would form a suitable backfill material, without any specific processing. The silty tailing is not recommended for reuse as backfill from a geotechnical standpoint owing to its likely self-densification following placement and associated settlement of the ground surface of the rehabilitated features, unless some specific and likely onerous provisions are implemented.

In summary from the above, material for use as backfill is anticipated to be readily available from site.

3.2.3 Other Provisions Associated with Backfilling

Several features are partially backfilled with refuse and debris. Placing fill above the debris and essentially burying the material would result in a situation where post construction settlement may be unpredictable, in particular at the Unnamed Feature. Furthermore, the refuse is inferred to potentially be polluting (noting that assessment of contamination risk was outside the scope of this study) if left in place. Therefore, burying the existing refuse within the features would present a geotechnical risk and would potentially not form a non-polluting rehabilitation solution. It is therefore not recommended for rehabilitation and reasonable effort should be made to remove refuse where encountered (Features 5a, 16, 18 and 20-21-22).

Some ground and erosion features observed during the field investigation form evidence that sheet flows of surface water runoff have intersected the alignment of the Commodore mining features during past heavy rain events. A brief review of Bureau of Meteorology data indicates that such events are occasional in the semi-arid climate of the site and mostly associated with cyclonic activities in summer (wet season further north). This surface water (which is anticipated to be occasional and sporadic), is recommended to be directed away from the rehabilitated features, to minimise future long-term erosion in the rehabilitation area.

To provide erosion protection across the entire rehabilitation area, surface water is suggested to be intercepted slightly upslope of the features into an open catch drain comprising a simple trench, say 1 m depth, with the materials excavated from the trench being placed and nominally compacted (say with an excavator bucket) along the downslope side of the drain. The purpose of the catch drain is to intercept the occasional water run-off upslope of the features, by-passing the rehabilitated features, and releasing the intercepted water downslope of the features, back into the minor natural drainage line that exists along the mining features. The impact of the proposed drain on surface water movement is expected to be minor and localised and because drain is not a critical component of the rehabilitation, a detailed hydrological study is not considered warranted. It is suggested that a preliminary selection of the location of the drain be based on a survey plan (if available), complemented if required by some adjustments during the geotechnical supervision during construction. It is noted that the bund associated with the trench will maintain the drain function in case of long-term siltation of the trench, if any occurs (noting the site is in a region of mostly low rainfall). Therefore, provided the bund is constructed using relatively gravelly clayey soils (as expected in the area), the trench and associated bund are anticipated to suitably divert surface water around the rehabilitated mining features for an estimated 50 to 100 years (noting that inferred century old mullock heaps around mining features are still in place), and thus no requirement for drain maintenance is anticipated.

Locations of proposed catch drains for each mining area is further discussed hereafter in the report.

A catch drain is considered the preferred option from geotechnical considerations to minimise long-term formations of erosion features across the entire rehabilitated area at Commodore. However, if this option is not preferred for other considerations, erosion protection (at Commodore and other mining areas) should be implemented for individual rehabilitated features. Mounding the proposed backfill above ground level at each feature together with careful selection of the backfill material proposed above surrounding ground level is considered to form a suitable erosion protection for an individual feature (i.e. erosion between features would be considered acceptable).

The backfill material placed above ground level should be sufficiently coarse to act as an erosion protection against water flowing around it. Indicatively, coarse gravel to cobble size material (terminology in accordance with Australian Standard (AS 1726, 2017)) with particle size greater than say 60 mm would be considered suitable, although other materials might also be suitable following assessment by a geotechnical engineer. Such material is anticipated to be readily sourced from site, however if volume proves to be limited, then a cover (say 400 mm thick) of such material around the toe of the backfill mound would be considered suitable.

3.3 Below-ground Concrete Cap

A below-ground reinforced concrete slab/s could be utilised to cap some of the voids and form a low-risk rehabilitation solution during and following construction. The capping is recommended to be complemented with some minor earthworks undertaken above the slab to tie into the surrounding ground with very low to no visual evidence of the mine features, minimising risk of interference.

Precast concrete slabs imported to site rather than slabs formed and poured in-situ are suggested owing to the remoteness of the site and to increase safety during construction.

Precast concrete slabs should be founded on competent, stable, natural ground (e.g. low strength rock or hard clayey soil) with no undercut below where the slab sits on natural ground. The cap should also be at a level that would allow at least 1 m of soil cover above the slabs. Competent ground for supporting the slabs is considered to generally exist approximately 0.5 m to 1 m depth but would need to be confirmed by geotechnical inspection of the proposed founding ground during construction. Site preparation for this option is anticipated to comprise:

- boxing-out natural soil/rock material around the perimeter of the features to about 1 m depth;
- inspection of the suitability of the founding ground by a Geotechnical Engineer;
- placement of slabs (lifted into place and positioned adjacent to each other);
- sealing any gaps between slabs or the placement of a geofabric across the top of the slabs; then
- backfilling over the slabs to levels to tie into surrounding levels.

To ease construction, it is suggested that the suitability to remove the requirement for any blinding concrete to form a base for the precast concrete slabs (thus the slabs would rest on levelled competent ground or other imported material) be considered at detailed design using structural considerations and input from the precast slabs manufacturer.

Vehicular access across the rehabilitated features envelopes should be precluded by the construction of soil bunds around the rehabilitated features, using available mine rock waste from the Reids Ridge Mine site or granular soils sourced from site. Regardless of this provision, the slabs should be designed for occasional or accidental vehicular loading.

Stormwater runoff should be directed away from the rehabilitated features, for instance using a catch drain upslope of the features as discussed in Section 3.2.

This rehabilitation can be combined with the backfill of the features if required, noting the stability of the backfill would not be relied upon in the rehabilitation solution of the feature, and therefore the material can be placed within the voids with a lower level of control.

Similarly, this solution is not impacted by the occurrence of existing backfill materials into the features, in particular rubbish observed in some, whose possible consideration for removal or otherwise would therefore not require geotechnical input for this rehabilitation option.

It is also noted that the access track between the Warriedar Homestead and the three mining areas might require some minor upgrade to allow vehicles delivering precast concrete slabs to site, or the condition of the existing access should be considered in the selection of vehicles accessing the site.

3.4 Fencing

Perimeter fencing is a final consideration for rehabilitation.

This option is simple, low cost and low environmental impact and has been adopted to address various hazardous voids (e.g. caves, wells, abandoned mine shafts) in national parks and other places across Western Australia, however it is the most susceptible to vandalism or damage and would require some ongoing monitoring and some provisions for maintenance. Perimeter fencing would be considered a warning measure that would not preclude voluntary attempts by public to either approach features within their hazardous zones of instable ground, trip and fall, and would not preclude attempts to enter features.

Stormwater runoff should be directed away from the features, as discussed in Section 3.2.

4. Preferable Rehabilitation Options

The criteria listed in Section 1 of the report has been rated against a selection of rehabilitation options being considered. The assessment is summarised in Table 4.

Table 4: Rehabilitation Option Suitability

Rehabilitation Option	Rehabilitation Solution Considerations: Long-term suitability	Risk to personnel providing solution	Monitoring and Maintenance Requirements	Technical Feasibility and Cost Effectiveness	Disturbance to the Environment
Commodore					
Backfill	***	**	***	***	**
Below-ground Concrete Cap	***	*	**	*	***
Fencing	*	***	*	***	***
Reids North					
Backfill	***	***	***	***	**
Below-ground Concrete Cap	***	**	**	*	***
Fencing	*	***	*	***	***
Unnamed Feature					
Backfill	**	**	**	**	**
Below-ground Concrete Cap	***	**	***	***	***
Fencing	*	***	*	***	***

The highest rated options from Table 4 are summarised in Table 5.

Table 5: Summary of Highest Rated Rehabilitation Options

Area	Recommended Rehabilitation Option
Commodore	Backfill
Reids North	Backfill
Unnamed Feature	Below-ground Concrete Cap

It is highlighted that the above assessment in Table 5 was derived using similar weighting between the considered criteria.

Further discussion for the concrete cap and structural cover options are discussed in the following sections.

5. Backfill of Commodore and Reids North

5.1 Personnel, Plant, Equipment and Timing

A large excavator, such as a 20 tonne machine should have suitable reach and power to undertaken the work safely. It is recommended that initially, higher risk areas of unstable ground, such as overhangs (particularly the southern edge of Feature 9) and ground above shallow lateral workings are collapsed prior to placing other backfill. Some provision to equip the excavator with a ripping tyne or rock breaker attachment to assist with these works is suggested. A dozer and loader are also considered likely to facilitate the work with sourcing local material and the movement of fill around the site.

Features with debris and refuse within them (5a, 16 and 18) should have the foreign material removed as best as practicable and suitably disposed of. In the absence of further assessment of the debris, it is recommended that water is used to wet the debris prior to and during removal for dust suppression, in the event that PACM is within the debris (the recommendation is precautionary as PACM was not observed during the investigation, but can't be precluded). It is noted that the narrow shafts/excavations may require these features to be widened near the surface to allow a large excavator to complete this task. Any debris that cannot be removed owing to excavator reach or other safety concerns (such as PACM) should be tamped/compressed with the excavator's bucket with fill then placed above.

Backfilling can commence by initially pushing nearby mullock heaps and mine spoil into the features, followed by placement of additional material sourced elsewhere. A rigorous compaction control programme is not considered necessary, however it is recommended to tamp the placed backfill with the excavator bucket regularly to reduce post filling settlement. In addition to tamping, mounding of the fill is recommended to both account for some long-term settlement, erosion, and to restrict vehicles trafficking over the rehabilitated features.

It is recommended to undertake further assessment, under the supervision of a geotechnical engineer, around a possible feature described as Feature 3a in the Condition Report (224768.00.R.003.Rev0). Based on desktop information and site observations, it is considered unlikely that any rehabilitation would be recommended within this location, however this can be confirmed following the above suggested assessment. It is anticipated that the additional investigation would be undertaken during the rehabilitation works and comprise the use of a large excavator (say, at least 12 tonne) to excavate around the immediate area of the possible Feature 3a under the supervision of the geotechnical engineer.

The work could be undertaken by most capable civil contractors with access to earthmoving equipment and no specific timing for the works are suggested, however drier weather will ease the work, plant trafficability, and access to site.

It is anticipated that a work crew of less than five personnel with suitably sized plant could complete the rehabilitation work within 2 to 4 weeks.

It is noted that access to the site is currently available via a track (2WD suitable in dry weather) that will possibly require some upgrade, such as grading, to allow access for the proposed construction vehicles.

5.2 Schematic of Concept

Figure 1 (page 11) provides cross-section and plan view schematics for a feature typical to those found at Commodore and Reids North. The provided example is indicative of Feature 9, to assist in the demonstration of the intended management of overhanging edges.

Figure 3, next pages, shows the arrangement of cut off open drains upslope of the features.

5.3 Monitoring Requirements

Monitoring requirements for backfilled features are anticipated to be low and is anticipated to likely be limited to a 12-month duration programme.

It is recommended that immediately following rehabilitation, monitoring points via star pickets are installed at the top of the mound within the centre of each backfilled feature. Several 'reference points' should also be installed within competent natural ground, away from the features and natural drainage lines, to act as stable benchmark.

A monitoring programme that comprises a visit for visual inspection at the following frequency is suggested:

- 1 month;
- 3 months;
- 6 months; and
- 12 months following completion of rehabilitation.

Provided no obvious visual evidence of movement of backfill is evident and the observed fill settlement over the monitoring period is consummate to the fill characteristics and the depth of fill, it is anticipated that no additional specific monitoring would be required and the features could be considered rehabilitated and stable.

In the event that the 12 month period of monitoring has low rainfall, say, no rainfall events exceeding 20 mm (based on the nearest weather station at Thundellarra, 20 km north), then consideration may be given to an additional monitroing visit at 24 months, or potentially following a specific heavy rainfall event.

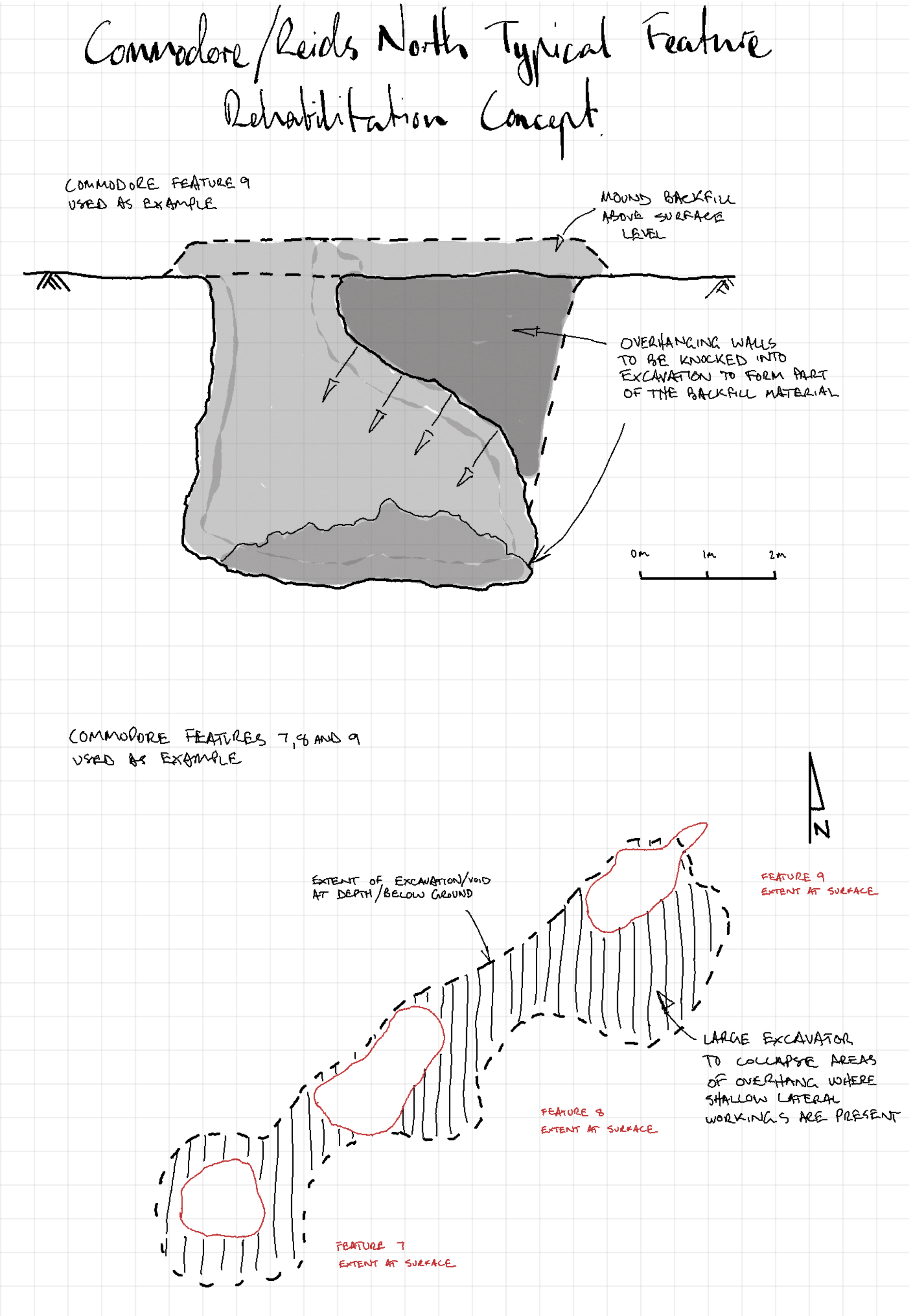

Figure 1: Concept Schematic for Backfill

6. Below-ground Concrete Capping at Unnamed Feature

6.1 Personnel, Plant, Equipment and Timing

Following the suitable structural design of the precast concrete slabs, no specialist equipment or particular expertise would be required to build and install the concrete capping. The work could be undertaken by most capable civil contractors with access to earthmoving equipment and capable of arranging precast concrete slabs. It is considered that all or the majority of components required could be precast and transported to site.

The concrete slabs would require design by a structural engineer to account for the span of the feature (void for open structure and potential void for backfilled and buried features), the load from soil and rock fill overlying the cap, and occasional (accidental) vehicle loading. Design for accidental vehicular loading is recommended, noting restricting vehicular access over the capped features should also be implemented by the construction of soil bunds surrounding features.

It is anticipated that a work crew of less than five personnel with suitably sized plant (say 20 tonne excavator, mobile crane) could complete the rehabilitation work within 2 to 4 weeks.

It is noted that access to the site is currently available via a track (2WD suitable in dry weather) that will possibly require some upgrade, such as grading, to allow access for the proposed construction vehicles.

6.2 Schematic of Concept

Figure 2 (page 13) provides cross-section and plan view schematics for the below-ground concrete capping of the unnamed feature.

Figure 3 (page 14) shows the arrangement of cut off drains and vehicular prevention bounds around the rehabilitated 'Unnamed Feature'.

6.3 Monitoring Requirements

Monitoring requirements for this solution are anticipated to be low. Competent natural ground is anticipated at shallow depth and no observable settlement is anticipated.

A monitoring programme that comprise a visit for visual inspection at the following frequency is suggested:

- 1 month;
- 6 months; and
- 12 months following completion of rehabilitation.

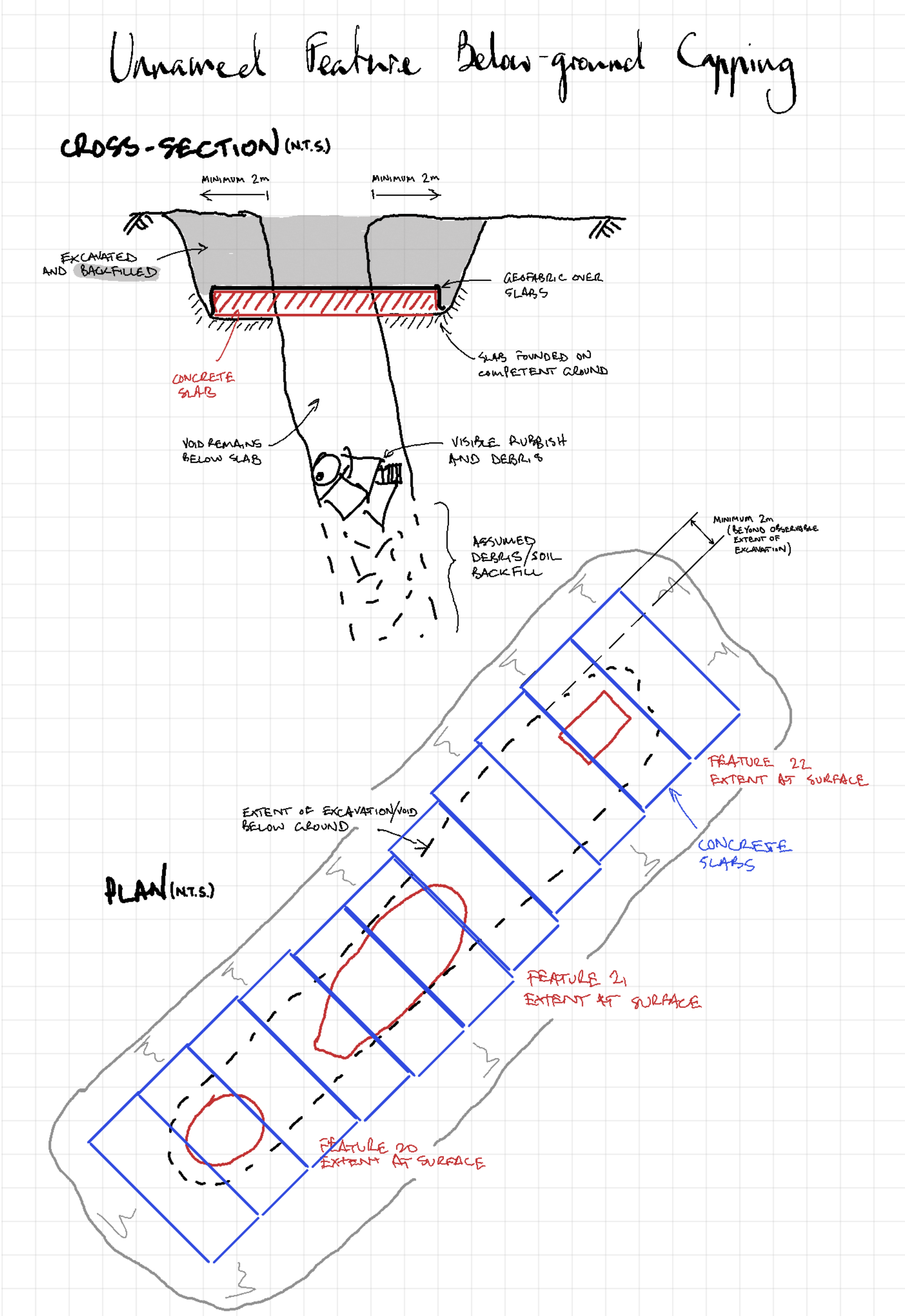

Figure 2 - Concept Schematic of Below-ground Concrete Cap at 'Unnamed Feature'.

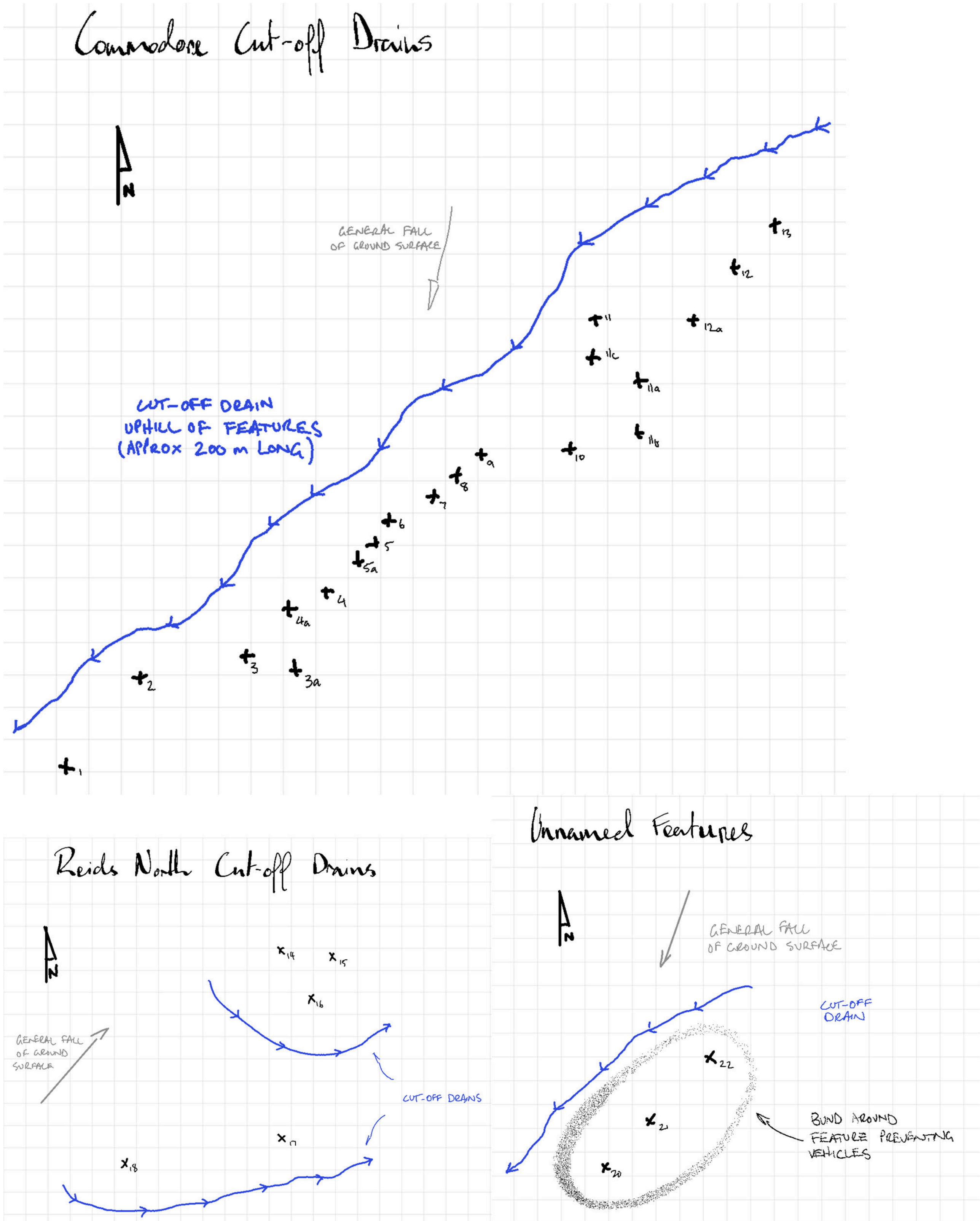

Figure 3: Concept Cut-off Drains (if adopted) and Vehicle Prevention Bunds for All Areas

7. References

AS 1726. (2017). *Geotechnical Site Investigations.* Standards Australia.

Douglas Partners. (2024). *224768.00.D.001.Rev1.Subsidence Risk Report.*

Douglas Partners. (2024). *224768.00.R.002.Rev0.Reids Ridge Mine Condition Report.*

Douglas Partners. (2024). *224768.00.R.003.Rev0.Commodore and Reids North Condition Report*

8. Limitations

Douglas Partners Pty Ltd (Douglas) has prepared this report for this project at Reids Ridge abandoned mine site in accordance with Douglas' proposal dated 21 September 2023 and acceptance received via letter from the Department of Energy, Mines, Industry Regulation and Safety (DEMIRS) (letter Ref: DMIRS23250). This report is provided for the exclusive use of Department of Energy Mines Industry Regulation & Safety for this project only and for the purposes as described in the report. Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of Douglas, does so entirely at its own risk and without recourse to Douglas for any loss or damage. In preparing this report Douglas has necessarily relied upon information provided by the client and/or their agents.

The results provided in the report are indicative of the sub-surface conditions on the site only at the specific sampling and/or testing locations, and then only to the depths investigated and at the time the work was carried out. Sub-surface conditions can change abruptly due to variable geological processes and also as a result of human influences. Such changes may occur after Douglas' field testing has been completed.

Douglas' advice is based upon the conditions encountered during this investigation. The accuracy of the advice provided by Douglas in this report may be affected by undetected variations in ground conditions across the site between and beyond the sampling and/or testing locations. The advice may also be limited by budget constraints imposed by others or by site accessibility.

The assessment of atypical safety hazards arising from this advice is restricted to the (geotechnical / environmental / groundwater) components set out in this report and based on known project conditions and stated design advice and assumptions. While some recommendations for safe controls may be provided, detailed 'safety in design' assessment is outside the current scope of this report and requires additional project data and assessment.

This report must be read in conjunction with all of the attached and should be kept in its entirety without separation of individual pages or sections. Douglas cannot be held responsible for interpretations or conclusions made by others unless they are supported by an expressed statement, interpretation, outcome or conclusion stated in this report.

This report, or sections from this report, should not be used as part of a specification for a project, without review and agreement by Douglas. This is because this report has been written as advice and opinion rather than instructions for construction.

Appendix A

Notes About This Report

About this Report

Introduction

These notes have been provided to amplify DP's report in regard to classification methods, field procedures and the comments section. Not all are necessarily relevant to all reports.

DP's reports are based on information gained from limited subsurface excavations and sampling, supplemented by knowledge of local geology and experience. For this reason, they must be regarded as interpretive rather than factual documents, limited to some extent by the scope of information on which they rely.

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This report is the property of Douglas Partners Pty Ltd. The report may only be used for the purpose for which it was commissioned and in accordance with the Conditions of Engagement for the commission supplied at the time of proposal. Unauthorised use of this report in any form whatsoever is prohibited.

Borehole and Test Pit Logs

The borehole and test pit logs presented in this report are an engineering and/or geological interpretation of the subsurface conditions, and their reliability will depend to some extent on frequency of sampling and the method of drilling or excavation. Ideally, continuous undisturbed sampling or core drilling will provide the most reliable assessment, but this is not always practicable or possible to justify on economic grounds. In any case the boreholes and test pits represent only a very small sample of the total subsurface profile.

Interpretation of the information and its application to design and construction should therefore take into account the spacing of boreholes or pits, the frequency of sampling, and the possibility of other than 'straight line' variations between the test locations.

Groundwater

Where groundwater levels are measured in boreholes there are several potential problems, namely:

- In low permeability soils groundwater may enter the hole very slowly or perhaps not at all during the time the hole is left open;
- A localised, perched water table may lead to an erroneous indication of the true water table;
- Water table levels will vary from time to time with seasons or recent weather changes. They may not be the same at the time of construction as are indicated in the report; and
- The use of water or mud as a drilling fluid will mask any groundwater inflow. Water has to be blown out of the hole and drilling mud must first be washed out of the hole if water measurements are to be made.

More reliable measurements can be made by installing standpipes which are read at intervals over several days, or perhaps weeks for low permeability soils. Piezometers, sealed in a particular stratum, may be advisable in low permeability soils or where there may be interference from a perched water table.

Reports

The report has been prepared by qualified personnel, is based on the information obtained from field and laboratory testing, and has been undertaken to current engineering standards of interpretation and analysis. Where the report has been prepared for a specific design proposal, the information and interpretation may not be relevant if the design proposal is changed. If this happens, DP will be pleased to review the report and the sufficiency of the investigation work.

Every care is taken with the report as it relates to interpretation of subsurface conditions, discussion of geotechnical and environmental aspects, and recommendations or suggestions for design and construction. However, DP cannot always anticipate or assume responsibility for:

- Unexpected variations in ground conditions. The potential for this will depend partly on borehole or pit spacing and sampling frequency;
- Changes in policy or interpretations of policy by statutory authorities; or
- The actions of contractors responding to commercial pressures.

If these occur, DP will be pleased to assist with investigations or advice to resolve the matter.

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Site Anomalies

In the event that conditions encountered on site during construction appear to vary from those which were expected from the information contained in the report, DP requests that it be immediately notified. Most problems are much more readily resolved when conditions are exposed rather than at some later stage, well after the event.

Information for Contractual Purposes

Where information obtained from this report is provided for tendering purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section is not relevant to the contractual situation, it may be appropriate to prepare a specially edited document. DP would be pleased to assist in this regard and/or to make additional report copies available for contract purposes at a nominal charge.

Site Inspection

The company will always be pleased to provide engineering inspection services for geotechnical and environmental aspects of work to which this report is related. This could range from a site visit to confirm that conditions exposed are as expected, to full time engineering presence on site.

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