From: Clarence General Mail User
Sent: Thu, 27 Feb 2020 16:13:32 +1000
To: City Planning
Subject: FW: Clarence Draft Local Provisions Schedule - Representation
Attachments: Representation to Clarence draft LPS_27 February 2020.pdf

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From: Frances Beasley <Frances@eraplanning.com.au>
Sent: Thursday, 27 February 2020 5:09 PM
To: Clarence General Mail User <clarence@ccc.tas.gov.au>
Cc: Emma Riley <emma@eraplanning.com.au>; Kristina Nichols <kegn@bigpond.net.au>; Elizabeth Email <elizabethnichols99@gmail.com>
Subject: Clarence Draft Local Provisions Schedule - Representation

Dear Sir/Madam,

Please find attached representation relating to land at 450 Rokeby Road, Howrah (CT 161833/1). Attachments A and B can be accessed via the following link - https://erassociates-my.sharepoint.com/:f:/g/personal/frances_eraplanning_com_au/Ep5W70O5m2xBmpNaxjBddKYB5IejJ3Jr3lrdcXhSgEtLBQ?e=gluucq

We request that Council considers this representation as part of the exhibition of the Clarence draft Local Provisions Schedule.

Kind Regards,

Frances Beasley
PLANNER

PLANNING & ENVIRONMENT

EMAIL: frances@eraplanning.com.au
PHONE: 0422 079 274 (03) 6105 0443
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27 February 2020

Clarence City Council
PO Box 96
Rosny Park TAS 7018

By email: clarence@ccc.tas.gov.au

Dear Sir/Madam,

450 ROKEBY ROAD HOWRAH
REPRESENTATION TO DRAFT CLARENCE LOCAL PROVISIONS SCHEDULE

I write on behalf of our client Elizabeth Nichols in regard to the proposed zoning of their property at 450 Rokeby Road, Howrah under the draft Clarence Local Provisions Schedule (LPS). The property to which we refer is contained within CT 161833/1 and is shown in Figure 1 below.

Figure 1 - Area comprising 450 Rokeby Road, Howrah

Specifically, our client raises concern with the proposed zoning of land under the draft LPS, being the Rural zone. Such a zoning would set a minimum lot size of 40 ha and would preclude the future development of the site for residential subdivision.

Criteria RZ1 of the Zone Application guidelines states that the rural zone should be applied to land in 'non-urban' areas. Given the context of the subject site, which is located in a peri-urban area and is bound by land zoned General Residential to the east and west, the proposed rural zoning is considered to be inconsistent with this criterion. Further, the site is within 1 km of a neighbourhood centre (Shoreline Shopping Centre) and is within 400 m of public transport services for Hobart CBD and Rokeby to the east, making it a suitable location for residential development.

General Residential Zone

The Zone Application guidelines provide three key criteria for the application of the General Residential zone. The first two being that land to be zoned General Residential is not to be targeted for higher densities, that the site be connected or intended to be connected to water and sewer services and, for brown-field areas, be in accordance with the relevant regional land use strategy.

The site is identified as being within the urban growth boundary under the Southern Tasmanian Regional Land Use Strategy, is fully serviced with reticulated water and sewer and given its location on the urban periphery it is not considered suitable for the Inner Residential zone.

The third zone application guideline, GRZ 3 states the following:

> *The General Residential Zone should not be applied to land that is highly constrained by hazards, natural values (i.e. threatened vegetation communities) or other impediments to developing the land consistent with the zone purpose of the General Residential Zone, except where those issues have been taken into account and appropriate management put into place during the rezoning process.*

It is acknowledged that the northeast of the site has historically been quarried and concerns have been raised previously by Council with regards to future residential subdivision of the site due to constrained vehicular access, steep topography, potential land instability and incomplete rehabilitation works. In response to this, we propose that the General Residential zone be applied across the western portion of the site, as shown in Figure 2, which has already been partially developed for residential purposes and is connected to the existing road network via Vienne Drive to the east.

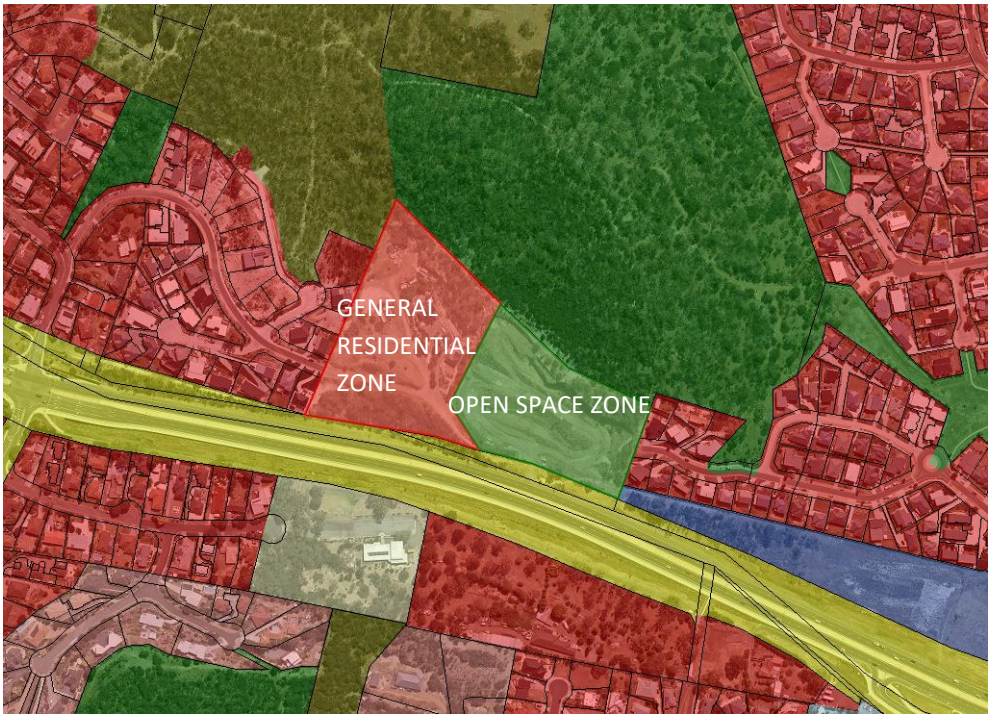

Figure 2 - Proposed zoning

e: enquiries@erassociates.com.au m: (03) 6105 0443 a: 183 Macquarie Street, Hobart, 7000 abn: 67 141 991 004

The minimum lot sizes under the general residential zone in the Tasmanian Planning Scheme (TPS) are 450 m^2 and each lot must be able to contain a 10 m x 15 m building area with a gradient not steeper than 1 in 5 and clear of all front, side and rear setbacks. It is recognised that any future subdivision of the land would require careful consideration of existing site constraints and that future residential lots would need to be of adequate size to respond to these constraints whilst accommodating the required building area. Given the subdivision standards under the TPS do not contain maximum lot sizes, it is considered that future subdivision of the land could meet the acceptable solutions under Clause 8.6.1 A2 – A4, with a discretion likely triggered under A1 due to slope.

It is envisaged that approximately 10 – 12 residential lots could be achieved, providing lots which are slightly larger than the minimum lot size in order to accommodate existing site constraints. It is noted that a public road abuts the property on the east and west boundaries, with potential for a through connection joining Vienne Drive with Norfolk Drive.

An application for residential subdivision of the site would also be assessed against the requirements of the Contamination code under the TPS and it is considered that compliance with Clause C14.7.1 A1(a) could readily be achieved following the completion and sign-off of the current remediation works.

Open Space Zone

The land to the east of the site contains a historic quarry site which has undergone extensive rehabilitation and remediation works. Due to the constrained nature of this portion of the site, applying the Open Space zone is considered appropriate. Should the Open Space zone be applied, the area can then form part of the existing open space network to the north once rehabilitation works are complete and it has been certified as safe for public use. In support of our submission, we provide a copy of the Geotechnical Assessment (prepared by Weldon GeoTech) and Rehabilitation Management Plan (prepared by GHD) which are provided under Attachments A and B respectively.

Based on the above assessment, it is requested that Council consider a split zoning for the site, as illustrated in Figure 2, as part of the Local Provisions Schedule drafting process. That is, the western portion with existing residential development be zoned General Residential and the eastern portion encompassing the historic quarry site be zoned Open Space.

Should you have any question please do not hesitate to contact me at frances@eraplanning.com.au or on 0422 079 274.

Yours sincerely,

Frances Beasley
Planner

Attachments A – Geotechnical Assessment
B – Rehabilitation Management Plan

e: enquiries@erassociates.com.au m: (03) 6105 0443 a: 183 Macquarie Street, Hobart, 7000 abn: 67 141 991 004

M MORLEY

Geotechnical assessment

450 Rokeby Road HOWRAH

Weldon GeoTech 2003/12431aa

9 December 2003

Weldon

Weldon GeoTech Pty Ltd ABN 72 097 900 313

Geotechnics Engineering Geology Groundwater Environmental Geoscience

Weldon GeoTech 2003/12431aa
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M Morley
184 Faulkners Rd
GLENLUSK TAS 7012

Attention: Mr Michael Morley

Dear Sir

GEOTECHNICAL ASSESSMENT:- 450 ROKEBY ROAD HOWRAH

This letter presents our geotechnical assessment of a proposed subdivision at 450 Rokeby Road, Howrah.

If you have any questions related to this report or we can be of further assistance, please do not hesitate to contact the undersigned.

For and on behalf of
Weldon GeoTech Pty Ltd

Barry Weldon

BARRY WELDON

Distribution: Original held by Weldon GeoTech Pty Ltd
3 Copies M Morley

TABLE OF CONTENTS

1. INTRODUCTION

Mr M Morley, registered surveyor of ME Morley and Associates requested Weldon GeoTech Pty Ltd (Weldon GeoTech) to provide an estimate of cost to undertake a geotechnical assessment of a proposed subdivision of land owned by Mr Rodney and Mrs Elizabeth Nichols at 450 Rokeby Road Howrah (Figure 1). The assessment is required by Clarence City Council for consideration of subdivision application SD-2003/99. On Thursday 4 December 2003 Mr Nichols engaged Weldon GeoTech by telephone to undertake the assessment as a matter of urgency.

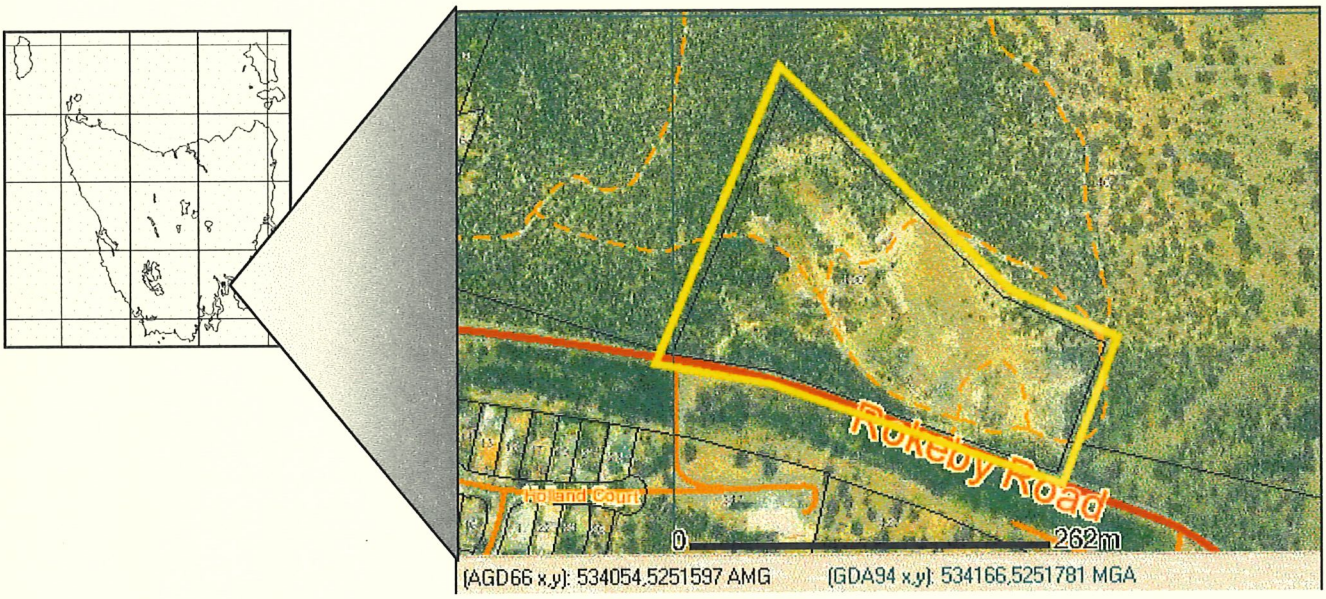


Figure 1 Orthophoto plan showing 450 Rokeby Road HOWRAH

It is understood that a rural subdivision of the title without minimum lot size is permitted under the current planning scheme. An application has been submitted for a 3 lot subdivision with balance (Figure2). Although the rural zoning of the title does not change under the draft planning scheme proposed for the area, a minimum lot size of 20ha will be imposed. If the draft scheme is adopted, the title could not be further subdivided.

The property is a mixture of bushland and a former quarry site. Quarrying operations ceased several decades ago in an era when environmental and rehabilitation management plans were not a common requirement of the extraction industry. Consequently, the rehabilitation of the former quarry is below currently accepted practices.

The Clarence City Council require a geological survey detailing stability of the quarry face, accesses to the rear of lots 3 and 4 and suitable house sites. The survey is to be undertaken by a suitably qualified person.

Weldon GeoTech Pty Ltd has a current Professional Indemnity Insurance cover with QBE Insurance (Australia) Limited (Policy Number A07602073PID). The Principal, Mr Barry Weldon *B Sc (Hons)* is a

graduate of the University of Tasmania and has over 26 years experience in Engineering Geology throughout Tasmania.

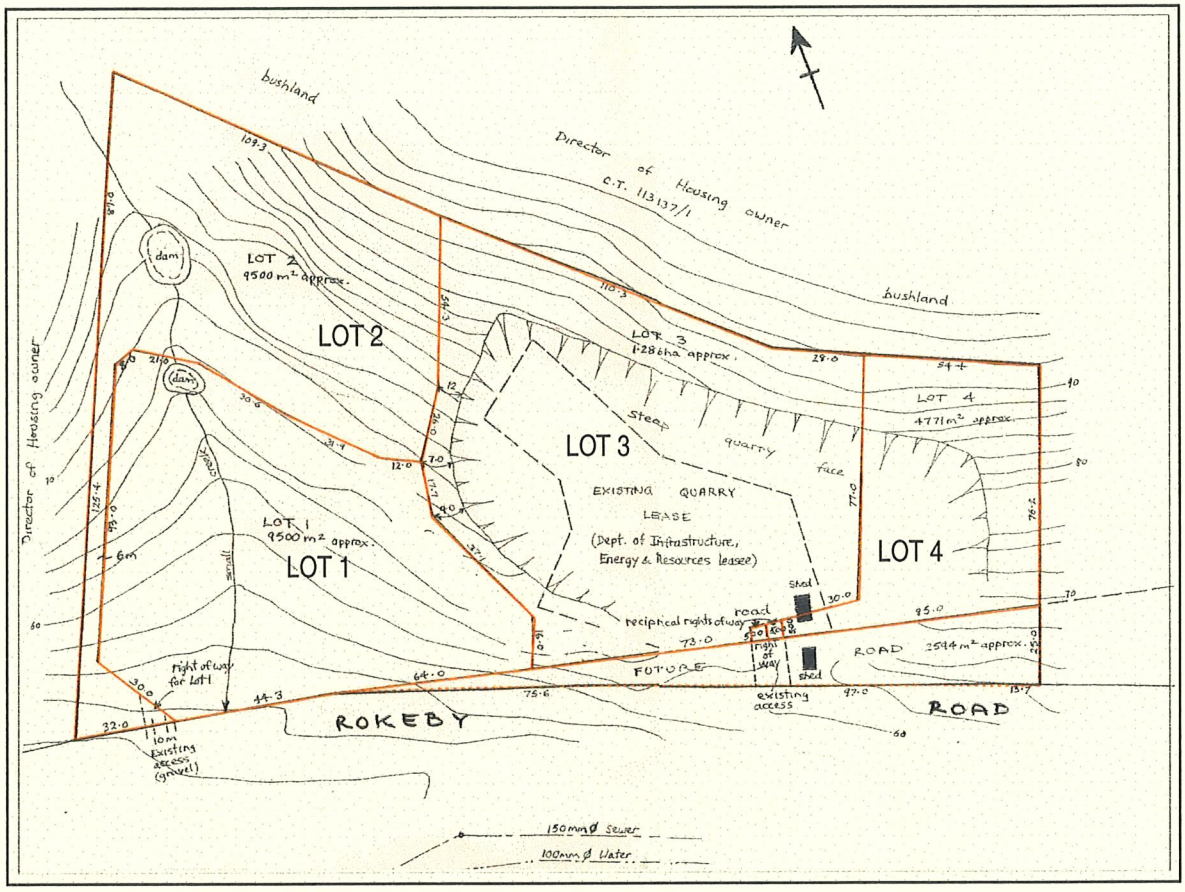


Figure 2 Proposed subdivison layout - 450 Rokeby Road HOWRAH

2. SCOPE OF WORK

To satisfy Council's requirements Weldon GeoTech undertook the following activities:

- brief review of existing regional and local topographic and geological maps and reports.
- observation and recording by an experienced Engineering Geologist of the conditions in the quarry face and on the surface of the property and adjacent properties.
- geotechnical analysis and interpretation of the findings of the investigations and
- preparation of recommendations.

3. BACKGROUND RESEARCH

The geology of the proposed development site is mapped on the HOBART Digital Geological Atlas (1:25 000)

series map sheet 5225 (published 2000) as Permian age generally unfossiliferous, glaciomarine interbedded non-fissile and fissile siltstone and silty sandstone that has been metamorphosed by contact with an intrusion of Jurassic age dolerite. The bedding dips towards the southwest at about 14 degrees.

A mining lease (648P/M) permitted quarrying operations on the property. The lease was granted in May 1965 for a period of twenty one years. The lease was surrendered / expired on 1 November 1985. Bedding planes and subvertical defects in the rock mass enabled road construction materials to be produced by heavy plant without the need for regular blasting. The quarry faces were controlled by naturally occurring defects and generally were not benched.

Plate 1 Prominent subvertical defect forms western quarry face.

4. SITE OBSERVATIONS

The quarry is located on the terminus of a NNW – SSE trending ridgeline between Glebe Hill in the south and Knopwood Hill in the north. A gully, occupied by Rokeby Road, separates this ridge line from the Rokeby Hills ridgeline further south. These ridgelines form a prominent divide between Mornington and Howrah – Tranmere in the west and Clarence Plains – Rokeby in the east.

The western and eastern flanks of the quarry are bushland. Rokeby Road forms the southern boundary and the northern boundary is bushland. In places the ground beyond the quarry face has been stripped of vegetation and soil to variable width including up to the northern property boundary. The quarry floor is leased and sections of temporary bridging are stored in this area.

Proposed lots 1 and 2 are largely bushland with a small creek occupying a natural gully on the western side of the proposed lots. There are two dams on the creek, one on each proposed lot. The creek bed leading to the upper dam on lot 2 is deeply eroded and has been subject to tunnel and gully erosion (Plate 2). Piping and

Plate 2 Tunnel erosion in creek bed leading to dams on each of lots 2 and 1.

tunnel erosion has also occurred in the upstream face of each dam (Plates 3 and 4). The failures are near the base of the dam embankment. Outlets for the tunnels were not observed. We assess that the naturally occurring materials are not suitable for dam embankments and because of their susceptibility to tunnel erosion, should be stripped from any proposed dam site and the dam embankment constructed with imported materials. Considerable remedial work will be required if the dams are to be restored to effective water storages.

Also on each of proposed lots 1 and 2 slope grooming has been undertaken (probably) using spall and stripped overburden from the quarry site (Plates 5 and 6 respectively). The relatively flat areas created on each of these proposed lots by slope grooming are considered to be viable dwelling sites away from any quarry face and potential landslide hazard.

Plate 4 Tunnel erosion in upstream face of dam on proposed lot1.

Plate 3 Tunnel erosion in upstream face of dam on proposed lot 2

Plate 6 Flat area created on proposed lot 2 by slope grooming

Plate 5 Fill embankment on proposed lot 2 (background) and slope grooming on proposed lot 1

The former quarry works occupy most of proposed lots 3 and 4. A portion of bushland extends beyond the quarry face to the proposed eastern boundary of lot 4 and in places there is a portion of bushland between the quarry face and the northern boundary. Some soil stripping has occurred between the quarry face and the northern boundary (Plate 7) and a crude surface run-off catch drain has been constructed above the quarry face.

The floor area of the quarry in proposed lot 3 is extensive and a large flat area has been leased to DIERT for storage of demountable bridge sections (Plate 8). The flat areas on proposed lot 4 are less extensive

Plate 8 Overburden stripped from land between quarry face and property boundary

Plate 7 Floor of quarry proposed lot 4, and part of proposed lot 3

5. ANALYSIS AND ASSESSMENT

5.1 Landslide Risk and Management Assessment

To achieve a landslide risk assessment it is necessary to address the following:

- Identify the hazards - what might happen?
- Assess the likelihood of the events occurring - how likely is it?
- What are the consequences - what damage or injury might result?

The next step is to evaluate the risk or assess its importance and what treatments might be possible to reduce risks to an acceptable or tolerable level.

For a development application we need to consider a range of scenarios from a landslide affecting the hillside on which the development is proposed to one that affects a particular quarry face or portion of that face and which may impinge on another existing or proposed title. Further considerations for local excavations that may be required to provide temporary access to an area during the building process, or a more permanent excavation that forms part of the urban landscape on the property should be undertaken at the building approval stage.

5.1.1 Landslide affecting hillside

Weldon GeoTech is unaware of reports detailing slope instability on Glebe Hill and the ridgeline connecting it to Knopwood Hill. Enquiries at Mineral Resources Tasmania did not reveal any reports of slope instability in the general area. Brief observations were made upslope from the northern boundary of the title and evidence indicative of slope instability was not observed.

The quarry face exposes a prominent bedding plane dipping to the southwest at about 14 , that is, the defect dips out into the face of the quarry. The defect runs roughly parallel to the ground surface at about 2m below it. Although the defect may have a clay lining in places, the surface is undulating on a broad scale but planar to curved on a smaller scale. The surface roughness varies from smooth to rough. We assess that the angle of friction is unlikely to fall below the slope angle and we asses that it is unlikely to rare that the hillside will fail on this defect surface. Where the defect daylights in the quarry face around the northern boundaries of the quarry face there is no resistance to sliding and we assess the qualitative measures of consequences to property in the fall-out zone below the quarry face to be major to catastrophic and the level of risk to property is assessed as moderate to low. Moderate risks are tolerable provided a treatment plan is implemented to reduce risks. Low risks are usually accepted.

We consider that a suitable treatment plan is to provide a building envelope set sufficiently far back from the quarry face that the risk is reduced to an acceptable level. The set-back requirement is discussed later in this report.

Where the defect does not daylight in the western quarry face but is buried below the ground surface, we assess that it is not credible for failure to occur and the consequences to property are assessed as very low. Very low risk is acceptable and is managed by normal slope maintenance procedures.

In the eastern face of the quarry, the defect is intersected by another defect dipping back into the hillside and the likelihood of failure is assessed to be not credible to rare and the risk is moderate to very low.

5.1.2 Landslides affecting portions of the quarry face

5.1.2.1 Planar failures

Other defects dip out of the quarry face at steeper angles (Plate 9). These present a hazard of planar rock slides involving the material above the defects. The angle of dip on these defects is estimated to be near the friction angle and the likelihood of failure occurring on them defect is assessed as almost certain. The consequence to structures within the fall-out zone is major to catastrophic. The level of risk is therefore assessed as very high. Very high risks require detailed investigation, planning and implementation of treatment options essential to reduce the risk to acceptable levels.

Plate 9 Defects dipping out into the quarry allow present a hazard of planar rock failures

We assess that an acceptable treatment is to restrict access to the potential fall-out zone and the set-back requirement is discussed later in this report.

5.1.2.2 Rock fall, bounce or roll

Other combinations of defects have resulted in **overhangs**, i.e. sections of the quarry face having no support from beneath (Plate 10). It is almost certain that these sections of the quarry face will eventually **fall**. Some overhangs will almost certainly fall within the next few decades whereas other sections may remain stable for centuries. The consequences to property in the fall-out zone is assessed to be vary between minor (for minor overhangs) to major for larger overhangs. The level of risk is assessed to be very high to high. High risk requires investigation, planning and implementation of treatment options to reduce the risk to acceptable levels.

We assess that an acceptable treatment is to restrict access to the potential fall-out zone and the set-back requirement is discussed later in this report.

Plate 10 Sections of quarry face with overhangs of rock.

The portion in the left frame is almost certain to fall within years whereas the unsupported portion above the dark shadows in the right frame are likely to remain standing for centuries.

Some rock fragments may fall out of the face and **bounce** or **roll** on lower portions of the quarry face before coming to rest in the floor of the quarry. We assess that it is almost certain that this process will occur along the quarry faces. The consequences to property are assessed as minor and the level off risk as high. High risk requires planning and implementation of treatment options to reduce the risk to an acceptable level.

Treatments commonly considered for these types of failures are anchored wire mesh blankets to restrain the free fall of fragments, grouting to provide mechanical binding and the provision of shaped ditches, sometimes in combination with catch fences. We assess that an acceptable treatment is to restrict access to the potential fall-out zone and the set-back requirement is discussed later in this report.

5.1.2.3 Toppling failure

Where defects slope into the quarry face at steep angles, rock columns may form that have a centre of gravity that daylight in the quarry face (i.e. fall outside the face of the quarry). It is almost certain that such columns

will eventually topple (Plate 11). The volume of the column affects the consequences to property. We assess with the relatively close spacing of defects in the quarry that the consequences to property in the fall out zone will be minor to medium and that the level of risk is high. High level of risk requires planning and implementation of treatment options to reduce the risk to acceptable levels.

We assess that an acceptable treatment is to restrict access to the potential fall-out zone and the set-back requirement is discussed later in this report.

Plate 11 Separation along a defect has resulted in a column of rock that is almost certain to topple into the floor of the quarry.

Another potential mode of failure is planar failure on the defect at the base of the column. Other rock fragments are overhangs without support beneath and are almost certain to fail and fall under the influence of gravity.

5.1.2.4 Wedge failure

Under some conditions, continuous sloping defects may intersect with the line of intersection sloping toward the quarry face. Where the line of intersection between the defects also intersects the face of the quarry there is the potential of a wedge failure. This appears to be the underlying mechanism that has resulted in the formation of a cone of debris in the northwestern corner of the quarry (Plate 12). Other failure modes are also represented in this area. The concentration of surface run-off from the upper bench of the quarry towards the failed area is considered to be a contributing factor to the failures.

Plate 12 Debris cones in the northwestern corner of the quarry floor

We assess it possible for the failures in the northwestern corner of the quarry to enlarge. Due to the relatively shattered nature of the rock mass in this area, the consequence to property in the fall out zone is assessed to be medium. The level of risk is moderate and moderate risk is usually tolerable provided treatment is implemented to maintain or reduce the risks.

We assess that an acceptable treatment is to restrict access to the potential fall-out zone and the set-back requirement is discussed later in this report. We also recommend the treatment plan include control of the surface run-off from the upper bench of the quarry in this area.

5.2 Quarry rehabilitation

The quarry lease was granted in 1965 in an era before performance bonds and environmental management plans were routine. The lease has expired and it is therefore unlikely that an enforceable rehabilitation program for the quarry exists. Modern practice would see the height of individual benches limited to 15m (the highest face in this quarry is about 18m), with 4m wide benches (minimum width) that are dressed with topsoil and planted with local species so as to break up the skyline. A diversion drain to intercept surface run-off on the slope above the quarry would be required with the outlet from the drain directed to a sediment trap or settling pond. Similar drainage controls would be required on individual benches.

Under the current and proposed planning scheme it is unlikely any, let alone modern best practices rehabilitation of the quarry, would be voluntarily undertaken by an individual property owner. However, we consider it prudent that the proposed development allow access to the rear of the quarry areas in the event that the zoning scheme eventually changes to allow an entrepreneur to rehabilitate the quarry knowing that there is a potential to recoup the costs through closer or commercial development in the floor of the quarry.

The owner(s) of proposed lots 3 and 4 retain liability for the safety of persons approaching the edge of the

quarry. We have observed areas of overhang and in places tension cracks are opening up near the edge of the quarry (Plate 13). We recommend that the perimeter of the quarry face be fenced with a high, non-scaleable chain mesh fence and that warning / danger notices be posted. The fence should be placed behind areas of overhang.

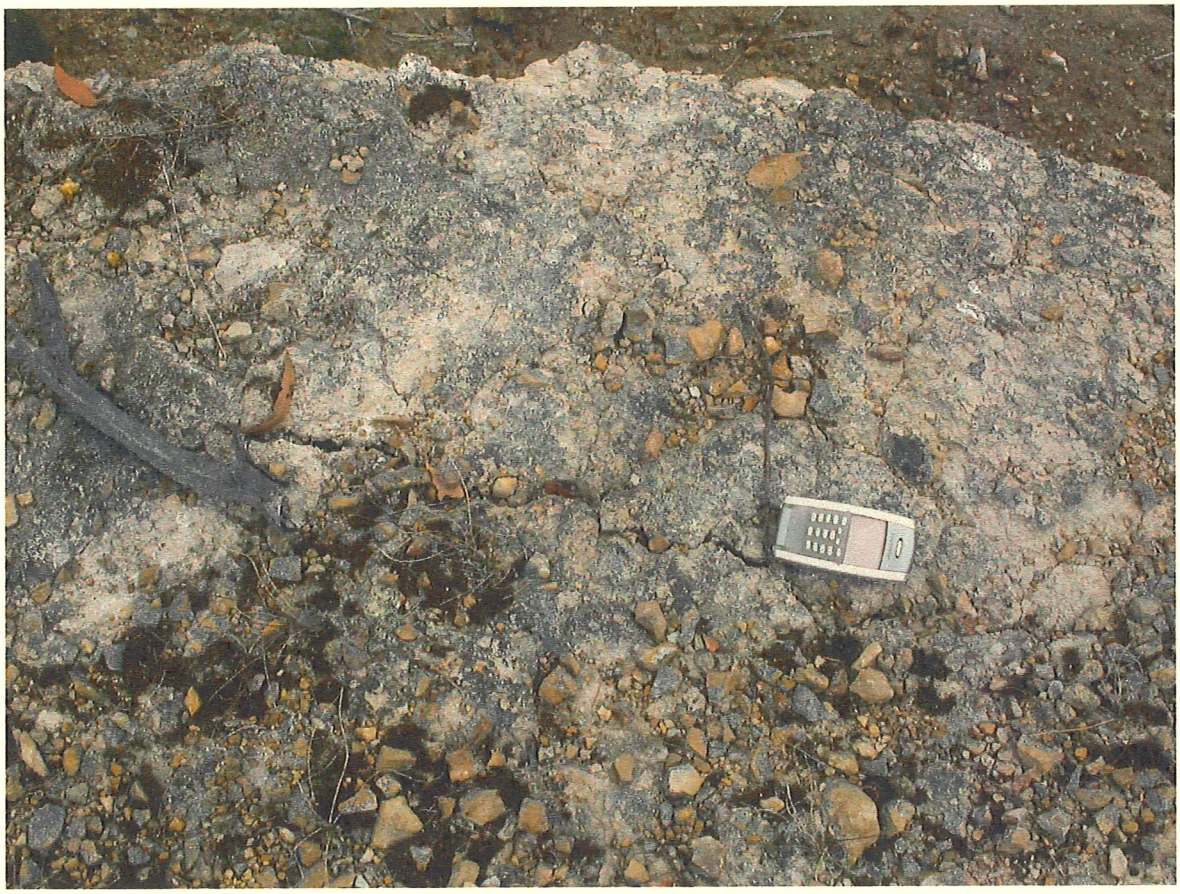


Plate 13 Tension crack in an overhanging area near the edge of the upper bench of the quarry

The proposed subdivision layout provides an "access corridor" between proposed lot 3 and lots 1 & 2 for access to the rear of the quarry on proposed lot 3. The minimum width of this access corridor is 7m at point 'A' on Figure 3 where the height of the quarry face was measured to be 7.6m high. From this point the corridor widens to about 12m width on the plan at point 'B'. Point 'B' is near the "wedge failure" and we estimate that the failure has reduced the available corridor width to about 7m. Beyond 'B', the proposed access corridor widens and there is an upper bench to the quarry. We have assessed it possible for the "wedge failure" to enlarge and if so, the available access corridor width will be reduced. The minimum acceptable width (for rehabilitated quarry benches) is 4m. For this distance to be retained, we estimate that the "wedge failure" can only enlarge a further 3m into the access corridor near point 'B'. We note these estimates are uncontrolled (i.e made without the benefit of survey equipment) and could be in error.

Surface drainage above the quarry on proposed lot 3 and from the upper bench on proposed lot 3 should be intercepted and directed in a lined trench to a settling pond before being discharged into an approved council stormwater collection system. The trench will need to be located in the access corridor between proposed lots 1 & 2 and lot 3. Lining is required because of the potential for dispersion (tunnel erosion) and scouring by moving water as the slope increases. Similar treatment will be required on proposed lot 4.

At point 'B' we assess the proposed available width to be insufficient to allow for possible future enlargement of the wedge failure, a safety fence and trench for surface run-off control. We recommend that point 'B' be adjusted westward to provide an access corridor width clear of the "wedge failure" of 10m. To maintain the proposed size of lot 2, point 'C' could be adjusted eastward.

We recommend that top soil be imported to rehabilitate the areas denuded of vegetation above the face of the quarry (proposed lots 3 and 4), and to rehabilitate the upper bench on proposed lot 3. Plants local to the area should be used to revegetate the slope above the quarry face and the upper bench.

5.3 Analysis

We have assessed the level of risk associated with the various failure mechanisms and on Figure 3 we have indicated these risk levels around the perimeter of the quarry. We have also assessed that an acceptable treatment plan is to restrict access to the potential fall-out zone by providing a suitable set-back requirement.

For rock falls, bouncing and rolling rocks we assess the set-back for the height of the quarry and the overall quarry face slope to be 9.2m in plan from the toe of the quarry face to the centreline of the crest of a 2m wide earth embankment constructed 1.8m high above the floor of the quarry with batter slopes of 1:1 (Horizontal : Vertical). The area between the embankment and the toe of the quarry acts as a ditch to constrain rock falls etc. and should be cleared of fallen debris at the time the embankment is constructed. In places the quarry face may be comprised in several segments, separated by a flatter slope segment (refer plate 14). Some judgement will therefore be necessary in defining the toe of the quarry face. We recommend that a suitably qualified and experienced engineering geologist, mining engineer or geotechnical engineer be engaged to define the toe of the quarry and thus the position of the earth embankment.

Plate 14 In places the quarry face is a composite of slope segments and quarry face

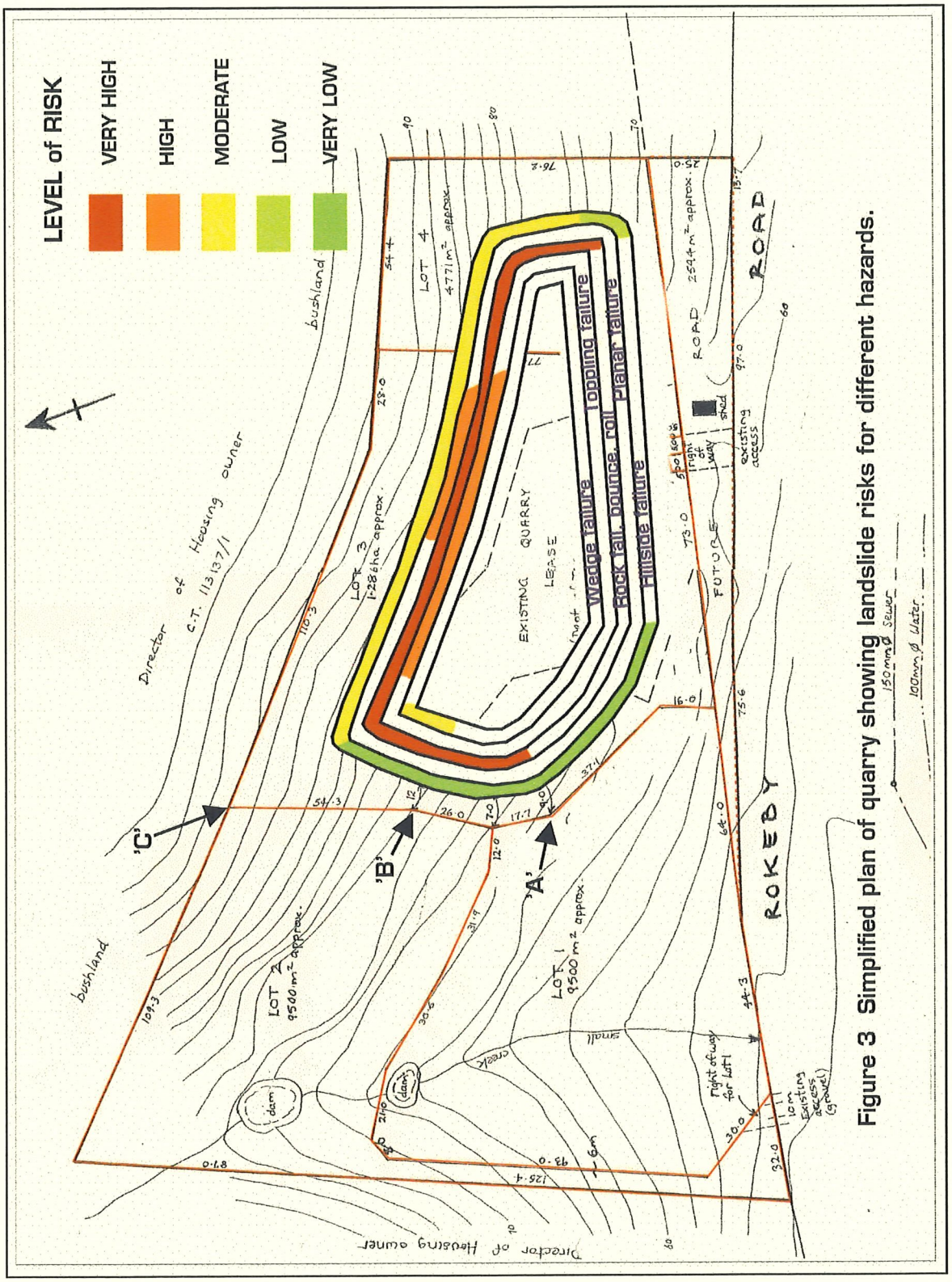


Figure 3 Simplified plan of quarry showing landslide risks for different hazards.

In this report we have focussed on the risk to property. However, it is clear that the risk to the occupants of the property from time to time must also be considered. We have already indicated that the owners of proposed lots 3 and 4 retain the liability for the safety of human life above the quarry face and recommended that a chain mesh fence be installed around the perimeter of the quarry. We stressed that the line of the fence should be behind any areas of overhang. Similarly, we recommend that a high non-scaleable chain mesh fence be erected along the centreline of the crest of the earth embankment. We recommend that this fence be continuous with the perimeter fence behind the quarry face and that at the boundary between proposed lots 3 and 4 the embankment and fence be returned to the quarry face.

We stress that the treatment plan requires implementation of a maintenance program. That program is on-going and will require the removal of debris from behind the earth embankment wall from time to time. The commitment passes from owner to owner. We therefore recommend that at one point on each of proposed lots 3 and 4 that the earth embankment batter slope be flattened on both sides of the crest and that provision be made for a lockable gate of sufficient width to allow access for excavator and truck. We recommend that on proposed lot 3 a second gate be provided to ensure plant can use the access corridor between proposed lots 1 & 2 and lot 3 to reach the upper bench area of the quarry and beyond to the northern property boundary.

6. RECOMMENDATIONS AND CONCLUSIONS

We have assessed the geotechnical hazards associated with the proposed subdivision of 450 Rokeby Road, Howrah. A mining lease for quarrying operations on the title has been surrendered / expired and we understand that there is no enforceable environment management or rehabilitation plan for the former quarry. We understand that under the current planning scheme the land is zone as Rural and is subdividable. A proposed amendment to the planning scheme imposes a minimum lot size of 20 ha on the zoning which would not allow subdivision of the property.

We have not identified any compelling geotechnical reasons for disallowing the proposed development. We have identified certain landslide risks that are tolerable provided treatment plans are implemented and maintained to reduce the risks to an acceptable level. We stress that the treatment plan is ongoing and the responsibility for maintaining the plan passes from owner to owner.

We recommend that:

- An adjustment, if necessary, is made to the shape and width of the access corridor between proposed lots 1 & 2 and proposed lot 3 to allow for encroachment due to possible enlargement of a "wedge failure" in the northwestern corner of the quarry. The purpose of the adjustment if necessary is to establish at the time of subdivision, a clear access corridor between the boundary of proposed lots 2 & 3 and the current quarry face of 10 metres distance.
- Trenches be installed on proposed lots 3 and 4 to intercept surface run-off from above the quarry and in the upper bench of the quarry on proposed lot 3. The purpose is to prevent surface runoff from being concentrated and directed over the quarry face.
- The intercept trenches should be lined. The purpose is to reduce the potential for dispersion (tunnel erosion) and scour by running water.
- The outlet from the intercept trenches should be directed to a settling / sedimentation pond at about the floor level of the quarry prior to discharge into an approved council stormwater collection system.

The purpose is to minimise the transport of sediment off the proposed lots.

- A high, non-scaleable fence should be erected around the upper perimeter of the quarry face. The purpose is to provide a barrier near the edge of the quarry. The fence line should not be placed over areas of rock overhang and should carry suitable signage warning of danger.
- A 1.8m high perimeter earth embankment with the centreline of a 2m embankment crest be constructed a minimum distance of 9.2m from the toe of the quarry face. The embankment batters should be constructed at a slope of 45 (1:1 Horizontal : Vertical). The purpose of the embankment is to provide a barrier to intercept rock falls off the quarry face.
- The embankment be constructed from rubble accumulated between the toe of the quarry face and the line of the earth embankment. The purpose is to form an effective ditch shape to catch rock falls.
- A high, non-scaleable fence should be erected along the centreline of the earth embankment and be continuous with the upper perimeter fence. The purpose is to provide a barrier to entry into a zone that has a hazard from rock falls. Suitable signage warning of danger should be provided on the fence.
- Access points should be provided through the chain mesh fences to enable mechanical plant to work above the quarry face and behind the earth embankment. The purpose is to remove potentially dangerous overhangs from above and to allow an effective catch ditch shape to be maintained at the toe of the quarry face by providing access for plant to clean up after rock falls.
- The areas denuded of topsoil above the quarry (proposed lots 3 and 4) and the upper bench on proposed lot 3 should be rehabilitated with topsoil and revegetated using local bushland species. The purpose is to restore the natural conditions and to provide opportunities for percolation of precipitation into a 'soil profile' rather than contributing directly to surface run-off.

Geotechnically, we conclude that the site is capable of supporting the proposed development. We have identified some landslide risks associated with the development and have made recommendations concerning treatment plans to reduce those risks and maintain them at a tolerable level. With these treatment plans in place and maintained on a regular basis it is unlikely that the development will cause instability on any other land.

For and on behalf of
Weldon GeoTech Pty Ltd

BARRY WELDON

APPENDIX A

IMPORTANT NOTES AND INFORMATION ABOUT YOUR REPORT

Important Notes and Information about your Report

Site investigations are usually carried out under scope-of-service limitations imposed by the client. Site subsurface conditions cause more construction problems than any other factor. Misinterpretation of the report by others is another cause of problems. These notes help you interpret and understand the limitations of your report.

Your report was prepared for an unique project as understood by Weldon GeoTech and applies only to the site investigated. Project specific requirements typically include the general nature of the project; its size and configuration; the location of structures on the site; other site improvements and the presence of underground utilities. If there are any changes to the project, you should ask us to assess how factors that changed subsequent to the report date affect the report's recommendations. We cannot accept responsibility for problems that may arise due to changed factors if we are not consulted.

Your report is based on conditions which existed at the time of the subsurface evaluation. Subsurface conditions may be affected by temporal changes, such as changing water levels; migration of pollutants; erosion and deposition of materials. Decisions should not be based on a report whose adequacy may have been affected by time. Consult us to be advised how time may have impacted on the project.

Site assessment identifies actual subsurface conditions only at those points where samples are taken, and when they are taken. Your assessment will typically include a review from literature and external data sources. Sampling and subsequent laboratory test results are interpreted to provide an opinion about overall site conditions, their likely impact on the proposed development and recommended actions. Actual conditions may differ from those inferred to exist from the sample points because it is not possible to reveal all that is hidden by soil, rock and time. The actual interface between materials may be far more gradual or abrupt than assumed based on the facts obtained.

Nothing can be done to change the actual site conditions which exist, but steps can be taken to reduce the impact of unexpected conditions. For this reason, owners should retain our services through the development stage, to identify variances, conduct additional tests if required and recommend solutions to problems encountered on site.

Important Notes and Information about your Report

Your report is based on the assumption that the site conditions as revealed though selective point sampling are indicative of actual conditions throughout the area. This assumption cannot be substantiated until project implementation has commenced and therefore your report recommendations can only be regarded as preliminary. Only Weldon GeoTech who prepared the report, is familiar with the background information needed to assess whether or not the report's recommendations are valid and whether or not changes should be considered as the project develops. If another party undertakes the implementation of the recommendations of this report there is a risk that the report will be misinterpreted and Weldon GeoTech cannot be held responsible for such misinterpretation.

To avoid the misuse of information contained in your report it is recommended that you confer with Weldon GeoTech before passing your report on to another party who may not be familiar with the background and the purpose of the report. Your report should not be applied to any project other than that originally specified at the time the report was issued.

Costly problems can occur when other design professionals develop their plans based on misinterpretations of a report. To help avoid misrepresentations, retain Weldon GeoTech to work with other project design professionals who are affected by the report. Have us explain the report implications to the design professionals affected by them and then review plans to see how they have incorporated the report findings.

The report as a whole presents the findings of the site assessment and the report should not be copied in part or altered in any way.

Logs, figures, drawings etc. are customarily included in our reports and are developed from interpretation of field observations and laboratory evaluation of field samples. These logs etc. should not under any circumstances be redrawn for inclusion in other documents or separated from the report in any way.

Reporting relies on interpretation of factual information based on judgement and opinion and has a level of uncertainty attached to it, which is far less exact than that attributed to design disciplines. This has often resulted in claims being lodged against consultants which are unfounded. To help prevent this problem, we may make reference to responsibility clauses. These are not intended to transfer appropriate liabilities from Weldon Geotech to other parties but are included to identify where Weldon GeoTech responsibilities begin and end. Their use is intended to help all parties involved to recognise their individual repsonsibilities. Read all documents from Weldon GeoTech closely and do not hesitate to ask any questions you may have.

APPENDIX B

LANDSLIDE RISK

- Landslide Risk and Management Assessment, References
- Definition of Terms
- Flowchart for Landslide Risk Management
- Qualitative Measures of Likelihood & Consequences to Property
- Qualitative Risk Analysis Matrix - Level of Risk to Property & Risk Level Implications
- Some Guidelines for Hillside Construction
- Illustrations of Good and Poor Hillside Practice

LANDSLIDE RISK ASSESSMENT

LANDSLIDE RISK AND MANAGEMENT ASSESSMENT

Risk assessment and management principles address the following:

SCOPE DEFINITION - What are the issues and who cares?
HAZARD IDENTIFICATION - What might happen?
LIKELIHOOD - How likely is it?
CONSEQUENCE - What damage or injury might result?
RISK EVALUATION - How important is it?
RISK TREATMENT - What can be done?

The risk is the combination of the likelihood and the consequences for the hazard in question. Thus both likelihood and consequences are taken into account when evaluating a risk and deciding whether treatment is required. These basic risk management principles can be applied to any activity. They are described in Standards Australia and Standards New Zealand (1999). A Sub-Committee of the Australian Geomechanics Society (2000) explains the application of these principles in a paper on Landslide Risk Management.

There are many consequences of landslides including damage to property, the environment, social and political effects and loss of life or injury. The risk terms are defined by a matrix that brings together different combinations of likelihood and consequence. Risk matrices help communicate the results of risk assessment, rank risks, set priorities and develop transparent approaches to decision making. To foster uniformity in the description of risk, the glossary of terms and the terminology used in the body of the report follow those published by the Australian Geomechanics Society (2000) Sub-Committee on Landslide Risk Management. These terms are reproduced on the following pages for reference purposes.

REFERENCES

Australian Geomechanics Society (2000). *Landslide risk management concepts and guidelines.* Australian Geomechanics Society, sub-committee on landslide risk management, Australian Geomechanics, Vol 35, pp 49-92.

Standards Australia and Standards New Zealand (1999). *Risk Management AS/NZS 4360.* Standards Australia, Sydney, 46p.

LANDSLIDE RISK MANAGEMENT Australian Geomechanics Society Sub-Committee

DEFINITION OF TERMS

INTERNATIONAL UNION OF GEOLOGICAL SCIENCES WORKING GROUP ON LANDSLIDES, COMMITTEE ON RISK ASSESSMENT

Risk - A measure of the probability and severity of an adverse effect to health, property or the environment. Risk is often estimated by the product of probability x consequences. However, a more general interpretation of risk involves a comparison of the probability and consequences in a non-product form.

Hazard - A condition with the potential for causing an undesirable consequence *(the landslide)*. The description of landslide hazard should include location, volume (or area), classification and velocity of the potentia landslides and any resultant detached material, and the likelihood of their occurrence within a given period of time

Elements at Risk - Meaning the population, buildings and engineering works, economic activities, public services utilities, infrastructure and environmental features in the area potentially affected by landslides.

Probability - The likelihood of a specific outcome, measured by the ratio of specific outcomes to the total number of possible outcomes. Probability is expressed as a number between 0 and 1, with 0 indicating an impossible outcome, and 1 indicating that the outcome is certain.

Frequency - A measure of the likelihood expressed as the number of occurrences of an event in a given time. See also Likelihood and Probability.

Likelihood - used as a qualitative description of probability or frequency.

Temporal Probability - The probability that the element at risk is in the area affect by the landsliding, at the time of the landslide.

Vulnerability - The degree of loss to a given element or set of elements within the areas affected by the landslide hazard. It is expressed on a scale of 0 (no loss) to 1 (total loss). For property, the loss will be the value of the damage relative to the value of the property, for persons, it will be the probability that a particular life (the element at risk) will be lost, given the person(s) is affected by the landslide.

Consequences - The outcomes or potential outcomes arising from the occurrence of a landslide expressed qualitatively or quantitatively, in terms of loss, disadvantage or gain, damage, injury or loss of life.

Risk Analysis - The use of available information to estimate the risk to individuals or populations, property, or the environment, from hazards. Risk analyses generally contain the following steps: scope definition, hazard identification, and risk estimation.

These definitions are extracted from LANDSLIDE RISK MANAGEMENT CONCEPTS AND GUIDELINES as presented in *Australian Geomechanics,* Vol 35, No 1, 2000 which discusses the matter more fully.

LANDSLIDE RISK MANAGEMENT Australian Geomechanics Society Sub-Committee

Risk Estimation - The process used to produce a measure of the level of health, property or environmental risks being analysed. Risk estimation contains the following steps: frequency analysis, consequence analysis, and their integration.

Risk Evaluation - The stage at which values and judgements enter the decision process, explicitly or implicitly, by including consideration of the importance of the estimated risks and the associated social, environmental, and economic consequences, in order to identify a range of alternatives for managing the risks.

Risk Assessment - The process of risk analysis and risk evaluation.

Risk Control or Risk Treatment - The process of decision making for managing risk, and the implementation, or enforcement of risk mitigation measures and the re-evaluation of its effectiveness from time to time, using the results of risk assessment as one input.

Risk Management - The complete process of risk assessment and risk control *(or risk treatment).*

Individual Risk - The risk of fatality or injury to any identifiable (named) individual who lives within the zone impacted by the landslide; or who follows a particular pattern of life that might subject him or her to the consequences of the landslide.

Societal Risk - The risk of multiple fatalities or injuries in society as a whole: one where society would have to carry the burden of a landslide causing a number of deaths, injuries, financial, environmental, and other losses.

Acceptable Risk - A risk for which, for the purposes of life or work, we are prepared to accept as it is with no regard to its management. Society does not generally consider expenditure in further reducing such risks justifiable.

Tolerable Risk - A risk that society is willing to live with so as to secure certain net benefits in the confidence that it is being properly controlled, kept under review and further reduced as and when possible.

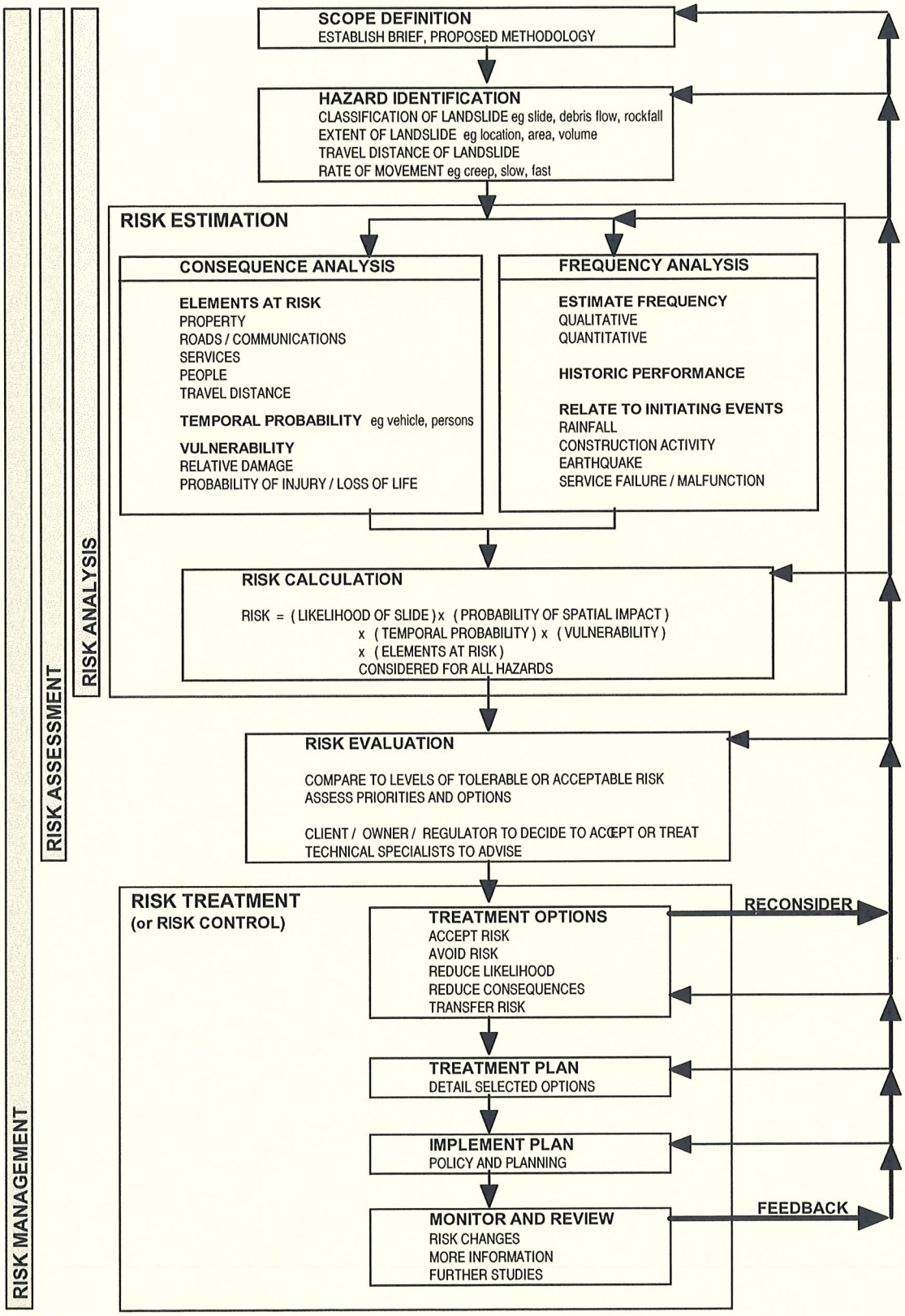
In some situations risk may be tolerated because the individuals at risk cannot afford to reduce risk even though they recognise it is not properly controlled.

Landslide Intensity - A set of spatially distributed parameters related to the destructive power of a landslide. The parameters may be described quantitatively or qualitatively and may include maximum movement velocity, total displacement, differential displacement, depth of the moving mass, peak discharge per unit width, kinetic energy per unit area.

Note: - Reference should also be made to the Flowchart for Landslide Risk Management which shows the inter-relationship of many of these terms and the relevant portion of Landslide Risk Management.

These definitions are extracted from LANDSLIDE RISK MANAGEMENT CONCEPTS AND GUIDELINES as presented in *Australian Geomechanics,* Vol 35, No 1, 2000 which discusses the matter more fully.

LANDSLIDE RISK MANAGEMENT Australian Geomechanics Society Sub-Committee



This flowchart was adapted from LANDSLIDE RISK MANAGEMENT CONCEPTS AND GUIDELINES as presented in *Australian Geomechanics* , Vol 35, No 1, 2000 which discusses the matter more fully.

Issue 1 Revision 1, Sep 2001

LANDSLIDE RISK MANAGEMENT Australian Geomechanics Society Sub-Committee

QUALITATIVE MEASURES OF LIKELIHOOD

Level	Descriptor	Description	Indicative Annual Probability
A	Almost Certain	The event is expected to occur	$>\approx 10^{-1}$
B	Likely	The event will probably occur under adverse conditions	$\approx 10^{-2}$
C	Possible	The event could occur under adverse conditions	$\approx 10^{-3}$
D	Unlikely	The event might occur under very adverse circumstances	$\approx 10^{-4}$
E	Rare	The event is conceivable but only under exceptional circumstances	$\approx 10^{-5}$
F	Not Credible	The event is inconceivable or fanciful	$<10^{-6}$

NOTES:

1. ≈ means that the indicative value may vary by say ±[] order of magnitude, or more.
2. The assessment of likelihood involves judgement based on the knowledge and experience of the assessor. Different assessors may make different judgements.
3. Judicious use of dual descriptors to reflect the uncertainty of the estimate may be appropriate in some cases

QUALITATIVE MEASURES OF CONSEQUENCES TO PROPERTY

Level	Descriptor	Description
1	Catastrophic	Structure completely destroyed or large scale damage requiring major engineering works for stabilisation.
2	Major	Extensive damage to most of structure, or extending beyond site boundaries requiring significant stabilisation works.
3	Medium	Moderate damage to some of structure, or significant part of site requiring large stabilisation works.
4	Minor	Limited damage to part of structure, or part of site requiring some reinstatement / stabilisation works.
5	Insignificant	Little damage.

NOTES:

1. The "Description" may be edited to suit a particular case.
2. The assessment of consequence involves judgement based on the knowledge and experience of the assessor. The relative consequence terms are value judgements related to how the potential consequences may be perceived by those affected by the risk.

These tables are extracted with additional notes from LANDSLIDE RISK MANAGEMENT CONCEPTS AND GUIDELINES as presented in *Australian Geomechanics,* Vol 35, No 1, 2000 which discusses the matter more fully.

Issue 1 Revision 1, Sep 2001

LANDSLIDE RISK MANAGEMENT Australian Geomechanics Society Sub-Committee

QUALITATIVE RISK ANALYSIS MATRIX - LEVEL of RISK to PROPERTY

Likelihood	CONSEQUENCES TO PROPERTY				
	1: Catastrophic	2: Major	3: Medium	4: Minor	5: Insignificant
A: Almost Certain	Very High	Very High	High	High	Moderate
B: Likely	Very High	High	High	Moderate	Moderate
C: Possible	High	High	Moderate	Moderate	Very Low - Low
D: Unlikely	Moderate	Moderate	Very Low - Low	Very Low - Low	Very Low
E: Rare	Moderate- Low	Low - Moderate	Very Low - Low	Very low	Very Low
F: Not Credible	Very Low	Very Low	Very Low	Very Low	Very Low

NOTES:
1. The main purpose of a risk matrix is to help rank risks and set priorities and assist the decision making process.
2. The qualitative risk terms should be regarded only as a guide to the relative level of risk as they are the product of two other qualitative terms both of which involve judgement and uncertainty. Different assessors may arrive at different judgements on the level of risk.

RISK LEVEL IMPLICATIONS

Risk Level	Example Implications
VERY HIGH RISK	Extensive detailed investigation and research, planning and implementation of treatment options essential to reduce risk to acceptable levels; may be too expensive and not practical.
HIGH RISK	Detailed investigations, planning and implementation of treatment options required to reduce risk to acceptable levels.
MODERATE RISK	Tolerable provided treatment plan is implemented to maintain or reduce risks. May be acceptable. May require investigation and planning of treatment options.
LOW RISK	Usually accepted. Treatment requirements and responsibility to be defined to maintain or reduce risk.
VERY LOW RISK	Acceptable. Manage by normal slope maintenance procedures.

NOTES:
1. The implications for a particular situation are to be determined by all parties to the risk assessment; these are only given as a general guide.
2. It is the responsibility of the client and / or regulatory authority and / or others who may be affected to decide whether to accept or treat the risk. The risk assessor and / or other advisors may assist by making risk comparisons, discussing different treatment options, explaining the risk management process and advising how others have reacted to risk in similar situations. Attitudes to risk vary widely and risk evaluation often involves considering more than just property damage (eg environmental effects, public reaction, business confidence etc).

These tables are extracted with additional notes from LANDSLIDE RISK MANAGEMENT CONCEPTS AND GUIDELINES as presented in *Australian Geomechanics,* Vol 35, No 1, 2000 which discusses the matter more fully. Issue 1 Revision 1, Sep 2001

LANDSLIDE RISK MANAGEMENT Australian Geomechanics Society Sub-Committee

SOME GUIDELINES FOR HILLSIDE CONSTRUCTION

		GOOD ENGINEERING PRACTICE	*POOR ENGINEERING PRACTICE*
ADVICE			
GEOTECHNICAL ASSESSMENT		Obtain advice from a qualified, experienced geotechnical consultant at early stage of planning and before site works.	Prepare detailed plan and start site works before geotechnical advice.
PLANNING			
SITE PLANNING		Having obtained geotechnical advice, plan the development with the risk arising from the identified hazards and consequences in mind.	Plan development without regard for the risk.
DESIGN AND CONSTRUCTION			
HOUSE DESIGN		Use flexible structures which incorporate properly designed brickwork, timber or steel frames, timber or panel cladding. Consider use of split levels. Use decks for recreational areas where appropriate.	Floor plans which require extensive cutting and filling. Movement intolerant structures.
SITE CLEARING		Retain natural vegetation wherever practicable.	Indiscriminately clear the site.
ACCESS & DRIVEWAYS		Satisfy requirements below for cuts, fills, retaining walls and drainage. Council specifications for grades may need to be modified. Driveways and parking areas may need to be fully supported on piers.	Excavate and fill for site access before geotechnical advice.
EARTHWORKS	GENERAL	Retain natural contours wherever possible.	Indiscriminant bulk earthworks.
	CUTS	Minimise depth. Support with engineered retaining walls or batter to appropriate slope. Provide drainage measures and erosion control.	Large scale cuts and benching. Unsupported cuts. Ignore drainage requirements.
	FILLS	Minimise height. Strip vegetation and topsoil and key into natural slopes prior to filling. Use clean fill materials and compact to engineering standards. Batter to appropriate slope or support with engineered retaining wall. Provide surface drainage and appropriate subsurface drainage.	Loose or poorly compacted fill, which if it fails, may flow a considerable distance including onto property below. Block natural drainage lines. Fill over existing vegetation and topsoil. Include stumps, trees, vegetation, topsoil, boulders, building rubble etc. in fill.
	ROCK OUTCROPS & BOULDERS	Remove or stabilise boulders which may have unacceptable risk. Support rock faces where necessary.	Disturb or undercut detached blocks or boulders.
RETAINING WALLS		Engineer design to resist applied soil and water forces. Found on rock where practicable. Provide subsurface drainage within wall backfill and surface drainage on slope above. Construct wall as soon as possible after cut / fill operation.	Construct a structurally inadequate wall such as sandstone flagging, brick or unreinforced blockwork. Lack of subsurface drains and weepholes.
FOOTINGS		Found within rock where practicable. Use rows of piers or strip footings oriented up and down slope. Design for lateral creep pressures if necessary. Backfill footing excavations to exclude ingress of surface water.	Found on topsoil, loose fill, detached boulders or undercut cliffs.
SWIMMING POOLS		Engineer designed. Support on piers to rock where practicable. Provide with under-drainage and gravity drain outlet where practicable. Design for high soil pressures which may develop on uphill side whilst there may be little or no lateral support on downhill side.	
DRAINAGE	SURFACE	Provide at tops of cut and fill slopes. Discharge to street drainage or natural water courses. Provide general falls to prevent blockage by siltation and incorporate silt traps. Line to minimise infiltration and make flexible where possible. Special structures to dissipate energy at changes of slope and / or direction.	Discharge at top of fills and cuts. Allow water to pond on bench areas.
	SUBSURFACE	Provide filter around subsurface drains. Provide drain behind retaining walls. Use flexible pipelines with access for maintenance. Prevent inflow of surface water.	Discharge roof runoff into absorption trenches.
	SEPTIC & SULLAGE	Usually requires pump-out or mains sewer systems; absorption trenches may be possible in some areas if risk is acceptable. Storage tanks should be water-tight and adequately founded.	Discharge sullage directly onto and into slopes. Use absorption trenches without consideration of landslide risk.
EROSION CONTROL & LANDSCAPING		Control erosion as this may lead to instability. Revegetate cleared area.	Failure to observe earthworks and drainage recommendations when landscaping.
DRAWINGS AND SITE VISITS DURING CONSTRUCTION			
DRAWINGS		Building application drawings should be viewed by geotechnical consultant.	
SITE VISITS		Site visits by consultant may be appropriate during construction.	
INSPECTION AND MAINTENANCE BY OWNER			
OWNERS RESPONSIBILITY		Clean drainage systems; repair broken joints in drains and leaks in supply pipes. Where structural distress is evident seek advice. If seepage observed, determine causes or seek advice on consequences.	

This table is adapted from LANDSLIDE RISK MANAGEMENT CONCEPTS AND GUIDELINES as presented in *Australian Geomechanics,* Vol 35, No 1, 2000 which discusses the matter more fully.

Issue 1 Revision 1, Sep 2001

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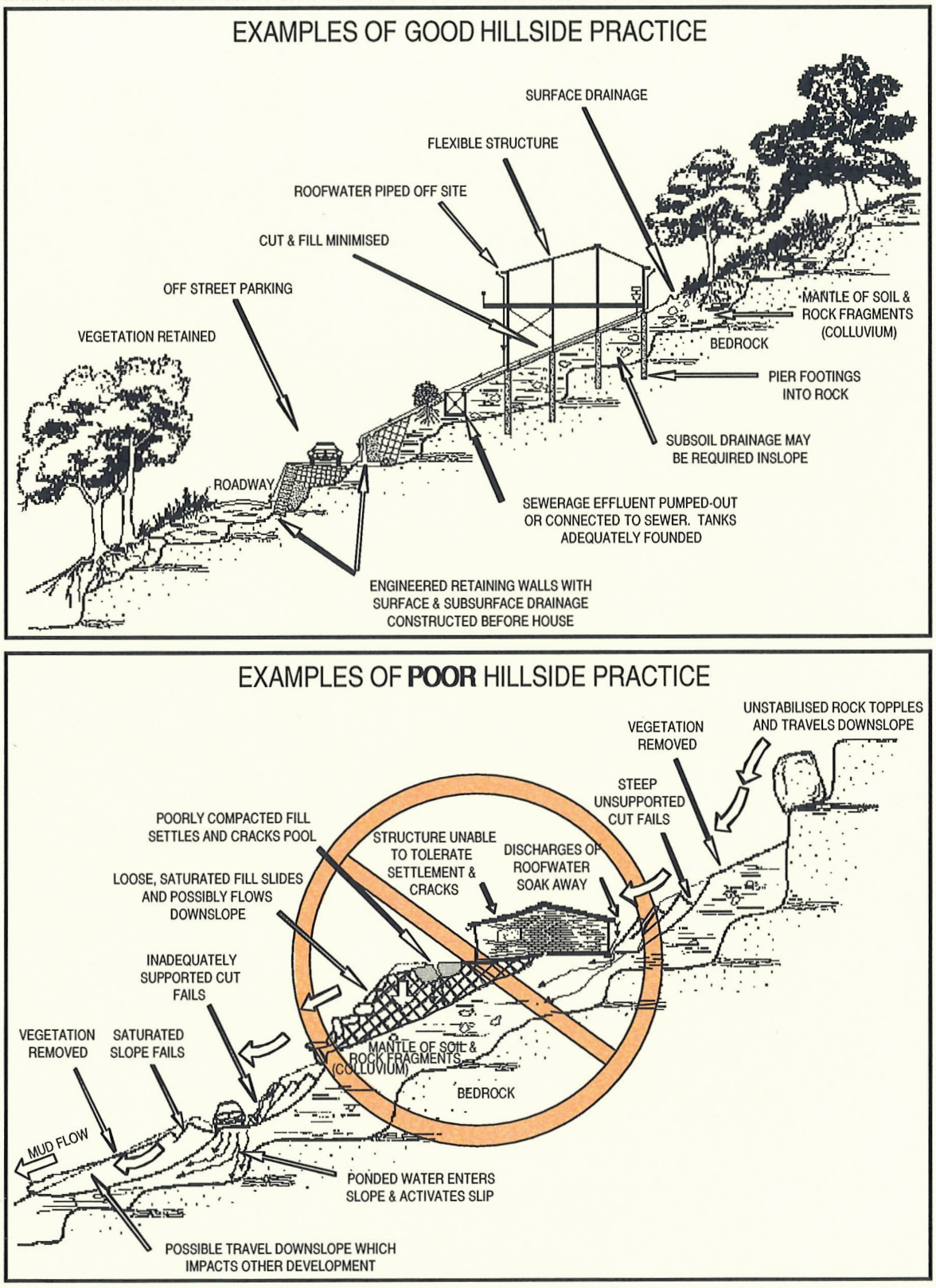
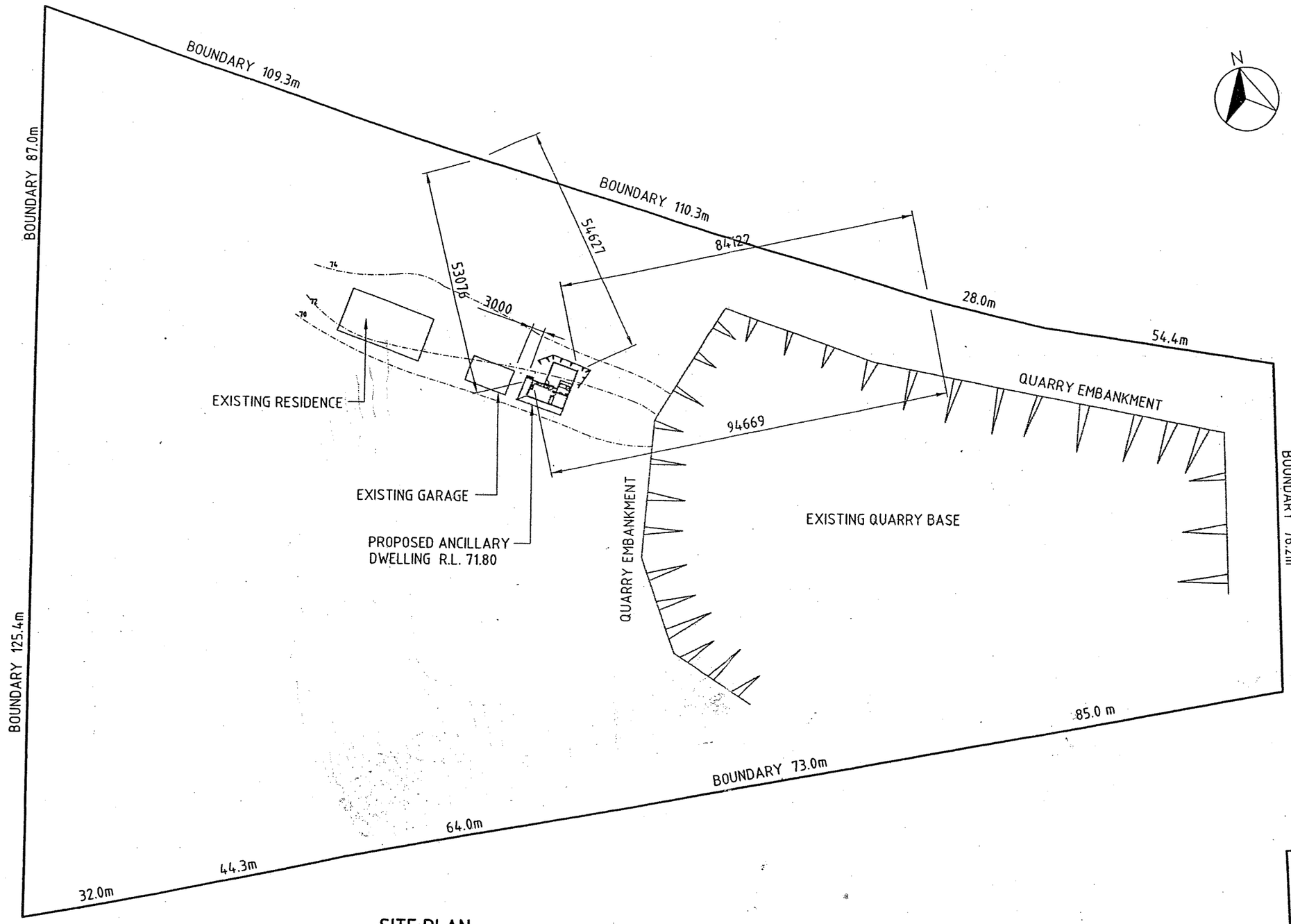


Illustrations of Good and Poor Hillside Practice

This figure is adapted from LANDSLIDE RISK MANAGEMENT CONCEPTS AND GUIDELINES as presented in *Australian Geomechanics,* Vol 35, No 1, 2000 which discusses the matter more fully.

Issue 1 Revision1, May 2001



SITE PLAN

ALL HEIGHTS AND CONTOURS RELATIVE TO AHD

Building Surveyor
23 FEB 2007
Pitt & Sherry

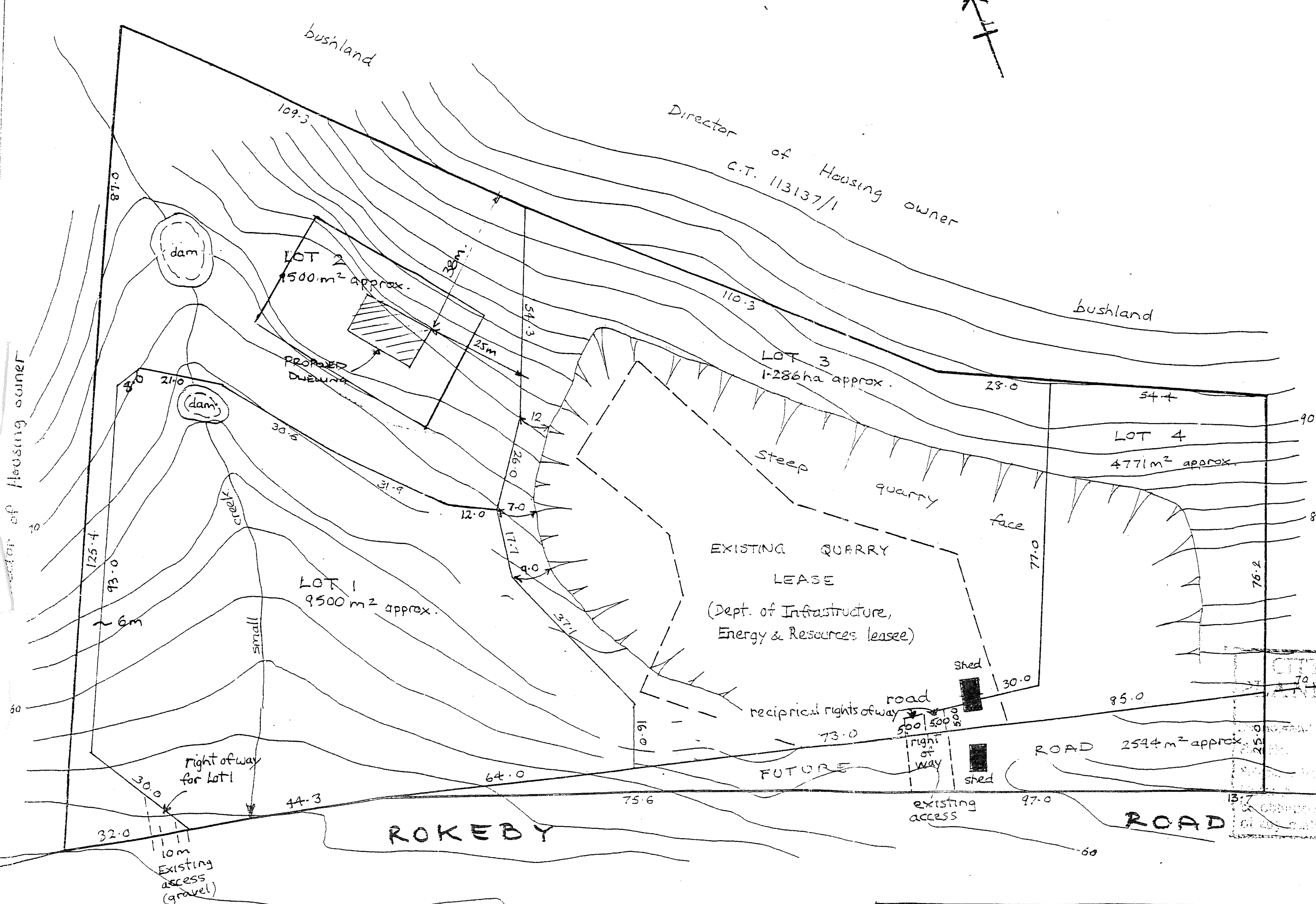
REV 1 - 6/11/06 CONTOURS AND BUILDING R.L.

CONSULTING ENGINEERS
Emmanuel Dellas Pty Ltd
phone: 6228 2225 fax: 6228 2235
mobile: 0418 232 811
email: delle@netspace.net.au
GPO Box 1805 Hobart 7001

Project Title:
PROPOSED ADDITIONS
FOR KRISTINA NICHOLS
450 ROKEBY RD, HOWRAH
SITE PLAN

Designed by: E.D.
Date: NOV '06

Scale: 1:1000
A3
Job No. 2091
Drawing No. A0
Rev. 1



NOTES

1. Lot 3 fully contains the existing old quarry faces.
2. The access to Lots 1 and 2 are to be covered by reciprocal rights of way, as are the accesses to Lots 3 and 4.
3. The rights of way in 2. above follow the existing constructed accesses.
4. The Department of Infrastructure, Energy & Resources has a copy of this proposal & has discussed the access with M. Bryar
5. All stormwater is to drain to existing culverts under Rokeby Road.
6. Sewer is to be disposed of via council main (150 Ø) on opposite side of Rokeby Road.
7. Water supply is to be from Council mains on opposite side of Rokeby Road.
8. Contour interval – 2m.

NOTE STORMWATER & SEWER DISPOSAL TO COUNCIL MAINS, FINAL LOCATION OF COUNCIL SERVICES TO BE ADVISED

150mm Ø Sewer

100mm Ø Water

Applicant: M.E. MORLEY & ASSOC. 184 Faulkners Rd. Glenlusk. Tas. 7017 Phone: 62498865/0415945176	PROPOSAL PLAN 450 Rokeby Road Howrah.	Scale: 1:1000	Drawn: MEM
	Owner: R.J.C. & E.H. Nichols C.T. 37139/1	Passed: MEM	Traced: MEM
		Date: 14-10-03	Checked:

CLIENTS | PEOPLE | PERFORMANCE

RCCC Civil Contracting P/L

Quarry, 450 Rokeby Road

Rehabilitation Management Plan

January 2011

INFRASTRUCTURE | MINING & INDUSTRY | DEFENCE | PROPERTY & BUILDINGS | ENVIRONMENT

Contents

Appendices

1. Introduction

1.1 Overview

RCCC Civil Contracting have leased the disused quarry on 450 Rokeby Road and intend to use it for the disposal of fill. RCCC plan to progressively rehabilitate the quarry by restoring the previous topography and revegetating.

A Development Application was lodged and a permit has been granted by Clarence City Council subject to a number of conditions including the preparation of management plans.

In order to comply with the conditions RCCC has engaged GHD to undertake the following tasks:

- Topographical survey of the quarry
- Design the fill platforms and report on quantities
- Design an access road
- Design drainage and stormwater retention pond
- Prepare an Erosion and Sedimentation control plan
- Prepare a Weed Management Plan
- Prepare a Revegetation Plan.

The above tasks are all contained within this one report the Rehabilitation Management Plan.

1.2 Aims and Objectives

The Rehabilitation Plan aims to provide a clear, concise and practical framework for the long term rehabilitation of the site.

It is intended that the document will be a working document that will be adjusted as circumstances change.

The rehabilitation progress will be monitored against measurable parameters.

1.3 Background information

This report should be read in conjunction with :

- Development Application, dated 25 July 2007, John Wadsley
- Permit

1.4 Relevant Plans, Policies and Guidelines

All work to be performed on site will also be in accordance with the following guidelines:

- Flora bank Seed Collection and Management Guidelines, updated 2004; and
- Best Practice Revegetation Guidelines, 1999.
- Quarry Code of Practice, DPIWE, June 1999.

2. Site Description

2.1 The Site

The property is 3.9Ha in total with the quarry area comprising 1.3Ha. The quarry operation has resulted in a large excavation into the side of the hill approximately 150m x 80m with 20m high cliffs on the northern perimeter. There are a number of terraces.

2.2 Climate

Rokeby has a dry climate with an annual average rainfall of 500 mm.

The site is south facing and due to the steep hill behind and deep excavation is shady.

The site is moderately sheltered from the wind though faces the prevailing south west wind direction.

2.3 Geology and Soils

The site is Permian mudstone.

2.4 Drainage

The site has no apparent drainage paths. Although the hill slopes down to the quarry anecdotally there is never any runoff over the cliff. This may be because the length of slope is limited (~200m); the site well vegetated increasing infiltration and the fissured Permian mudstone is relatively permeable.

The base of the quarry is quite wet likely to be mainly due to surfacing of ground water.

Runoff from the site currently drains in an uncontrolled manner to the road side drain on the highway. There is a 450mm culvert near the access conveying runoff under the road to the watercourse opposite.

2.5 Vegetation

There is little vegetation on site currently with most surfaces comprising bare gravel. Small pockets of vegetation has re-established largely comprising weeds.

Vegetation around the quarry is characterised as *Eucalyptus amygdalina* inland forest on mudstone according to Tasveg mapping data base.

The vegetation mapping for Clarence identifies the site as supporting grassy *E.viminalis-E.amygdalina* woodland/forest.

The vegetation of the surrounding area is comprised of two eucalypt species being the white gum (*E.viminalis*) with black peppermint (*E.amygdalina*) co/sub-dominant. The shrub layer is dominated by bull oak (*Allocasurina littoralis*) with silver wattle (*Acasia dealbata*), prickly box (*Bursaria sinosa)* and native hop (*Dodonaea viscose*) all frequent. The lower shrub layer is diverse and includes a number of low and prostrate species including the threatened chocolate lily. Native grasses include spear grass (Austrostipa spp.) and wallaby grass (*Austrodanthonia spp*.). There is a moderate diversity of native herbs.

2.6 Weeds

Weeds on the date of inspection (since removed) included:

- Gorse (4 bushes)
- Boneseed (1)
- Blackberry
- Sweet briar
- Slender thistle.
- Cape weed
- Fennel
- Cotoneaster

3. Proposal

3.1 Outline

RCCC has leased the part of the site to use to dispose of clean fill for both their own construction activities and others by arrangement.

There is a demand for a disposal area locally for fill from construction activities. There are planning limitations on where fill can be disposed of and there is finite capacity in landfills. Fill is often dumped illegally.

The existing void can take approximately 70,000m3 of fill. It is expected that it will take several years to fill.

The site is an un-rehabilitated quarry and the use of the site to dispose of fill is an extension of previous activities. The filling will rehabilitate the quarry and improve visual aspects and reduce environmental impacts.

3.2 Access

Access will be off Rokeby Road using the existing licensed access.

Trucks will access the tipping site from a ramp that will follow the western perimeter. The ramp grade will be 15%. The access track will be gravelled for all weather access. There will be generally a one way circulation with a down ramp located on the eastern side. The down ramp will have a maximum grade of 25%.

As the quarry is filled and the platforms become higher there may be other temporary ramps within the platforms.

There will generally be an all weather gravel loop access through the site but trucks will have to traverse ordinary filled material to dump off the track. This will limit the amount of fill that can be disposed of during periods of extended wet weather.

The site will be locked except when in use by authorised contractors. The site will not necessarily be manned during tipping operations but truck drivers will be briefed on where to tip material and other relevant instructions such as traffic control and routes.

Dust will be limited by limiting speed. Mud will be limited by a rumble strip on the decent ramp that will shake all mud off the trucks. The rumble strip will comprise coarse (200mm) rock.

3.3 Fill Methodology

The fill will be placed, spread and compacted in sequential layers to form a number of level platforms. The fill is contained on three sides and on the southern edge will form a slope approximating the former natural surface.

The fill will be dumped by trucks in piles. When there are sufficient piles a dozer or excavator will be transported to site and the piles spread and track rolled. Each layer will be approximately 300mm thick when compacted. Generally track rolling is sufficient to enable trucks to pass over the material which will

further compact the material. If there are large quantities of moist clay then a sheeps foot roller may be required to seal the material.

The material will undergo further settlement under its own self weight over the years.

3.4 Fill design

The final surface profile design has a number of considerations:

- Slope stability
- Limit slope erosion
- Be able to be vegetated
- Maximise fill quantity
- Fill the void and restore the natural surfaces and reduce the cliffs as much as possible
- Be constructible considering access constraints

The slope stability will depend on the type of material, degree of compaction and drainage conditions. The types of materials disposed of include hard rock, weathered rock, gravels, sands, silts, clay and topsoil. The operator will be able to direct where the material is placed and the site is large enough to be able to place different materials in select locations without compromising the sequence of platform construction. There will be sufficient high strength materials available to use on the outside face to ensure a stable slope at 1 (V) in 2(H). Less suitable materials such as plastic clays or erodible material such as silt and sands will be placed at the rear.

The sequence of placement of impermeable and permeable material will also be controlled. Permeable materials will be drained and not have their drainage paths impeded by impermeable materials.

Benches will be provided on the slope to control drainage, to provide an area on the steep slope with greater potential for revegetation and to catch rocks. It is proposed to provide a bench for every 3-4m vertical height. The bench will be 3m wide to enable a tracked vehicle to undertake maintenance. The bench will have a 1 in 6 reverse slope to provide a drainage swale. The swale will slope towards the centre with a slope of 1-2% where it will be conveyed down a lined drain to the pond. As some of the material will be permeable only part of the runoff will be conveyed via the drainage system but this is not considered a problem.

4. Rehabilitation Plan Direction

4.1 Site Opportunities and Constraints

Opportunities

- The large void will provide a valuable service as a disposal site for clean fill for local construction activities. Clean fill that would otherwise be dumped inappropriately or take up landfill volume or be trucked large distances.
- Filling and revegetation will reduce the scar on the landscape improving visual amenity;
- Restore vegetation and provide habitat;
- Treat and detain runoff that currently is untreated and un-detained.
- Demonstration project that will be of assistance in other revegetation projects.

Constraints

- Challenges in re-vegetation due to the shade and dry conditions;
- As the hill is very steep it is difficult to fill the void to its previous profile as truck access would be difficult to achieve.
- It is recognised that slope stability problems may result from poor material placed near the outside edge and this will be managed to prevent this.
- Impermeable material may trap water within the fill and this will be managed to prevent this.
- The material may settle.
- The steep batters resulting from the filling may be difficult to revegetate.
- Control of weeds will require ongoing effort.

5. Weed management

5.1 Commitments

All reasonable steps will be undertaken to remove and prevent the spread or establishment of weeds on the site.

5.2 Discussion

Any disturbed site is at risk of becoming infected with weeds. As described in section 2 there are already number of declared weeds on the site. The nature of the operation with fill from diverse locations being disposed of the site means that it is inevitable that weed seed and plant matter will be brought to the site. As the site is generally unmanned it is impractical to ensure trucks coming to the site or leaving the site have been washed. If allowed to grow and seed this poses a risk to the surrounding area in particular the adjacent bush land reserve.

The site will require regular monitoring for weeds and any weeds controlled.

The active fill area is considered a lower risk as imported material will be spread, rolled and covered in successive layers before weeds can become established. It is on the perimeter and revegetated slope that weeds may thrive if not controlled.

Soil pathogens such as *Phytophthora cinnamomi* may be present in imported material. Where the soil is buried it is unlikely it will affect vegetation or spread. The main risk is if it is contained within topsoil used to revegetate the surface. It would likely only spread downstream which could affect approximately 2km of stream however the vegetation type has low susceptibility so would unlikely be affected. The management of *P. cinnamomi* is covered by the Interim *Phytophthora cinnamomi* Management Guidelines DPIW, 2005 and the Quarry Code of Practice.

5.3 Weed Control Measures

Eradicate existing weeds. Identified weeds shall be spot sprayed (immature plants) or cut at the stump and removed or buried and the stump painted with herbicide.

Monitor site on a quarterly basis to identify weeds and control them. Weed treatments shall occur prior to seeding period and any mature plants shall be bagged to contain any seed.

Weeds growth on revegetated areas will be minimised by planting grass which will outcompete weeds while enabling slashing and application of broadleaf weedicide to prevent the establishment of weeds. Over time the trees will grow and shade the weeds.

5.4 Soil Pathogen Control Measures

The measures to control *P. cinnamomi* include:

- Any topsoil to be used as a surface layer will be assessed prior to importation to determine whether it is pathogen free.
- No topsoil will be imported from high risk areas such as poorly drained, infertile, sandy and heathy areas where *P. cinnamomi* is found.

- The site will be monitored for *P. cinnamomi* as per the quarry code of practice.
- Any soils on site found to be contaminated with *P. cinnamomi* is to be buried at least 2m deep.

6. Erosion Control and drainage

6.1 Commitments

As required by the permit detention will be provided to reduce the peak flow in the downstream drainage system.

The drainage shall be managed to minimise erosion and ensure all drainage leaving the site has been treated to remove sediment.

6.2 Detention

The site discharges to a drainage system that passes down through Howrah in a combination of piped and open channels. The drainage system has limited capacity. The site is located at the upper end of the catchment and this is the best location to detain flow. Although the site is relatively small and has a minor impact on the total flow it is still beneficial to provide detention.

Council has advised that in the absence of a detailed assessment the detention should be sized for a 2hour 20 year ARI storm.

It is normal practice to size a detention to restrict the post-development outflow to that of the pre-development flow. In this case there is no change in flow as the land use (and coefficient of runoff) has not changed. It is intended therefore to reduce the peak outflow. The resulting outflow would be similar to the runoff to a bush catchment.

The detention pond has been sized and the calculations are attached in Appendix B. The details are summarised:

- Pond size 15m x 4m x 1.0m deep
- Pond Volume 100m3
- Outlet 250mm pipe
- Peak inflow 100L/s (15 minute 20 year storm)
- Peak outflow 21L/s (20 year storm)
- Spillway 1m wide x 0.2m deep
- Freeboard 0.2m

6.3 Erosion and sediment control

Sediment laden runoff from the site poses a risk to the receiving waters. Currently runoff from the bare site is not controlled and it is likely sediment is washed into the drainage system. This project is an opportunity to remedy this situation as the site will be graded to reduce erosion, stabilised drains will be installed and the detention pond will also trap sediment if provided with additional features.

Measured to reduce erosion include:

- Grading of platforms to prevent ponding of water and muddy conditions

- Providing well drained gravel tracks for trucks
- Topsoiling and vegetating batters at edge of platform
- Limiting the height of each batter by providing benches that act as drains
- Grade drains at 1-5% so that velocities remain low
- Steep drains will be rocklined with a membrane underneath

Measures to trap sediment include

- Vegetated filter strips on the batters on the edge of the platform
- Vegetated batter drains to filter sediment
- Detention pond.

Clean water diversion is not practical at this site as cut off drains would need to be constructed in the bush above the site and which is outside the property and would cause unacceptable disturbance and likely more erosion than it was preventing.

7. Revegetation:

7.1 General

The aim of the revegetation is

- Aesthetic – the vegetation should preferable blend in with the surrounding vegetation and present a natural aspect to houses opposite and passing vehicles.
- Stabilise against erosion and provide a vegetative filter to clean runoff
- Suppress weed infestation

RCCC will engage experienced and qualified contractors to supply and plant plants.

Every site is different and to maximise the chances of success it is proposed to diversify – trial a number of approaches, evaluate and continue with those that do well:

- Use local species as they are likely to be suited to the conditions
- Trial a number of species;
- Trial different methods of propagation;
- Staggered plantings to minimise the risks of drought and other events that young plants may be vulnerable to;
- Create a variety of environments (windward/leeward/low/high);
- Plant sparse in some areas and monitor infill and compare with dense planting.

7.2 Preparation

The preparation will depend on the type of revegetation.

- Areas to be grassed will have a 150mm thick layer of topsoil placed, seed will be broadcast and fertiliser applied.
- Any steep areas to be mass planted will have 150mm of topsoil placed and biodegradable matting placed and anchored before planting.
- Flatter areas to be mass planted will have 150mm of topsoil placed and or 100mm of mulch placed before planting.
- Topsoil will be mounded where trees are planted to provide minimum 200mm thick topsoil.

Fertilisers, water crystals and other additives will be used as appropriate.

Young plants will be protected from browsing animals by tubes.

7.3 Plant Species

It is intended to match the surrounding vegetation so that the rehabilitated quarry blends in with the adjacent bush land. These species are also more likely to survive in the conditions.

As described in section 2 the surrounding bushland comprises grassy woodland.

It is intended to stabilise the batters with grass and plant trees and shrubs including:

- white gum (*E.viminalis*)
- black peppermint (*E.amygdalina*)
- bull oak (*Allocasurina littoralis*)
- silver wattle (*Acasia dealbata*),
- prickly box (*Bursaria sinosa)*
- native hop (*Dodonaea viscose*)

The trees will be in forestry tubes. These will take a year to establish but as the rehabilitation of the quarry is a long term project the trees will grow faster than the platforms are raised and will provide screening within a few years. The advantage of using smaller trees is that mortalities are reduced and they require less maintenance.

Options for propagation include

- Purchase of tubestock from a nursery as there species are available
- Contract a horticultural provider to gather local seed and propagate tubestock
- Collect local seed and broadcast directly to the surface.

It is considered all three methods can be trialled. Direct seeding is a very cost effective method that results in a sustainable plant as the seed germinates when the conditions are right. All seed collection, management, cleaning and storage will be in accordance with *Flora bank Seed Collection Guidelines* (prepared by Greening Australia and now accepted as industry best practice).

It is considered grassing the batters is more appropriate than mass planting. The grass will quickly establish and stabilise the steep slopes. The grass will also be effective in suppressing weeds as a broad leaf herbicide can be used to control weeds without affecting the grass. The grass can be slashed if necessary. Proven exotic grass species can be used as native grass seed is less available. It is likely the native grass species will over time supersede exotic species as the trees grow and seed from the bush above spreads over the quarry site.

Areas of mass planting could be considered for areas where a different effect may be desired such as around the detention pond and front area.

Suitable species adapted to local conditions and known to have good horticultural application include:

Table 1 Suitable species

Species	**Comments**
Corea reflexa	Small shrub to 1m. Number of varieties available.
Coastal Corea – *Corea backhouseana*	Low shrub to 1.5m
White corea – *Corea alba*	Low dense shrub to 1.5m
Shrubby velvet bush – *Lasiopetalum macrophyllum*	Low spreading shrub to 2.0m wide
Narrowleaf westringia – *Westringia angustifolia*	Low shrub to 1.2m
Coast westringa – *Westringia brevifolia var.raleighii*	Dense shrub to 1.5m with grey green foliage
Hop bush – *Dodonaea viscosa*	Female plants grown from cuttings. Grow to 3-5m.
Fine leaf hop bush - *Dodonaea filiformis*	Narrow leaf shrub to 1.5m
Round leaf mint bush – *postanthera rotundifolia*	Dense shrub to 2m
Yellow dogwood – *Pomaderris pilifera*	Shrub 2-3m with yellow flowers
Hairy dogwood – *Pomaderris pilifera*	Shrub 2-3m with yellow flowers
Pigface – *carpobrotus rosii*	Succulent groundcover
Small leaf pigface – *Disphyma crassifolia*	Succulent groundcover
Tasman flax lily – *Dianella tasmanica*	Spreads by suckering
Sagg – *Lomandra longifolia*	
White flag iris – *Diplarrena moraea*	Forms dense tufts of vegetation
Knobby Club rush – *Ficinia nodosa*	Forms dense tufts of vegetation

7.4 Planting schedule

The slope will be progressively revegetated as each bench level is reached.

In general, autumn is the best season for planting as it gives the plants the maximum opportunity for roots to establish prior to summer.

A cautious approach is recommended which will apply knowledge gained through the life of the project to develop a sustainable system.

The mix of species will be varied depending on the success of the various species.

Mortalities will be replaced/reseeded as required in subsequent years.

7.5 Maintenance Program

All plantings will be subjected to a minimum 24 – month maintenance program to help ensure plant establishment. Activities will include such things as watering, herbicide spraying and general maintenance.

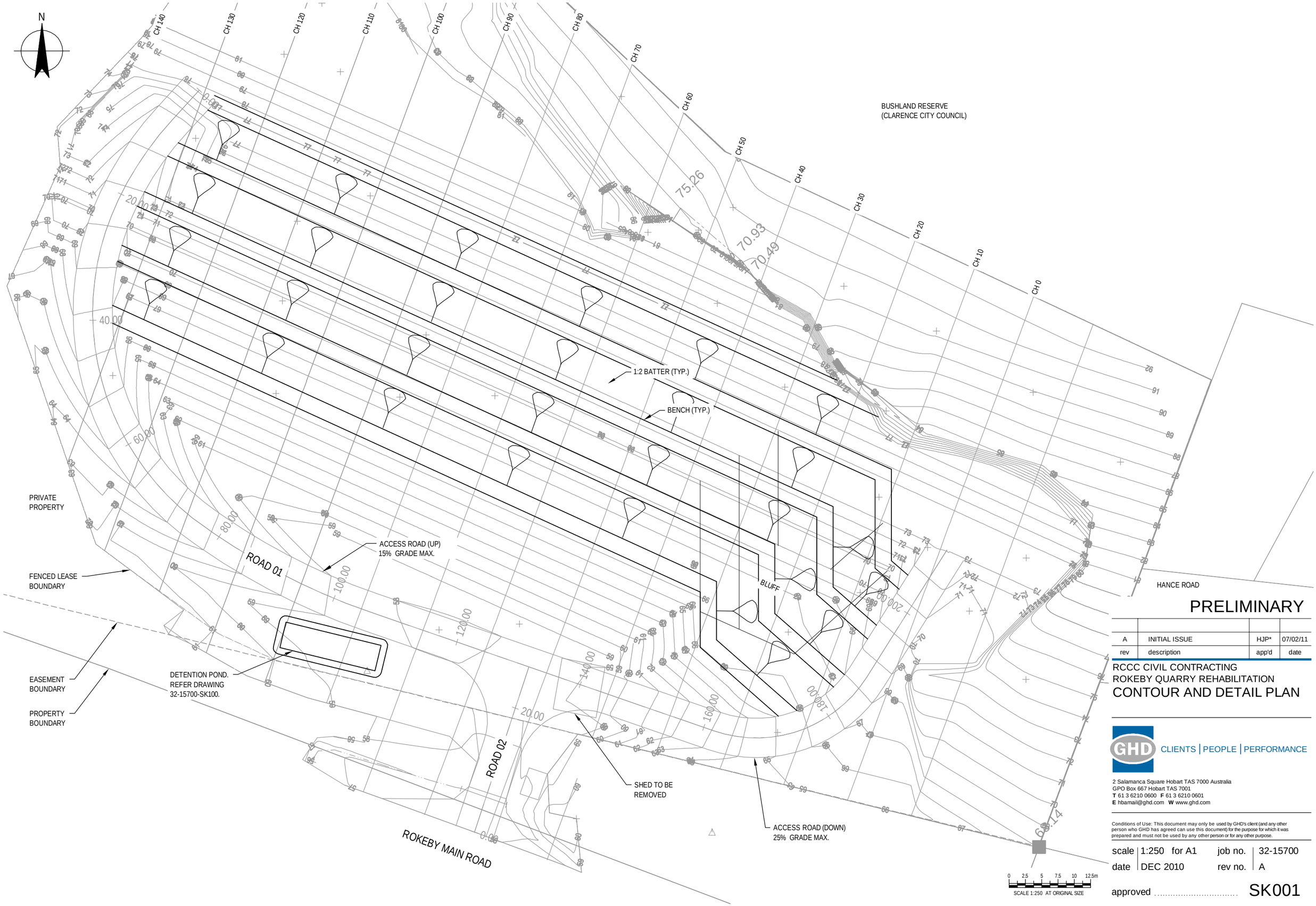
Appendix A

Drawings

Plan

Sections

Details



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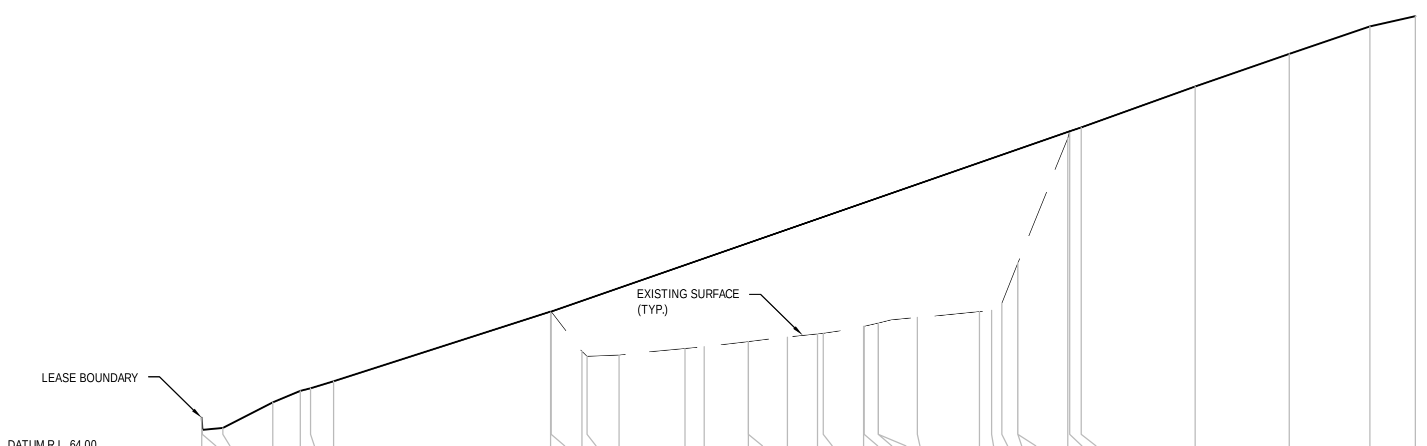

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-31.90	65.55	-0						
-30.59	65.69	0						
-27.28	67.36	-0						
-25.43	68.11	-0						
-24.77	68.31	0						
-23.23	68.78	-0						
-8.90	73.37	-0						
-8.83	73.40	-0						
-6.83	70.75							
-6.49	70.40							
-4.35	70.51							
0	70.93							
1.28	71.05							
4.19	71.39							
4.19	71.39							
6.79	71.69							
8.79	71.91							
9.16	71.96							
11.79	72.4							
11.87	72.42							
12.8	72.63							
12.8	72.63							
15.38	72.99							
19.46	73.37							
20.3	73.44							
20.98	73.92							
22.03	76.57							
22.03	76.57							
25.32	84.87	0						
25.44	85.3	0						
26.2	85.59	-0						
33.73	88.28	-0						
39.96	90.45	-0						
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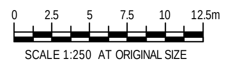
48.33	92.94	0						

CH 0



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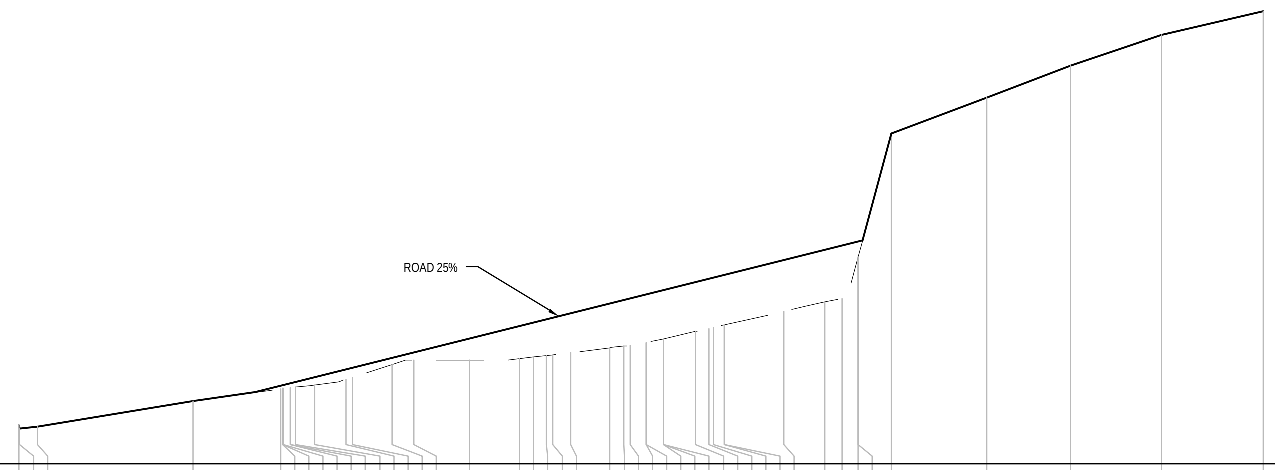

DATUM R.L. 63.00

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						-0	65.3	-33.08
						0	65.43	-31.88
						-0	67.14	-21.59
							67.94	-15.82
							67.96	-15.67
							67.96	-15.67
							67.97	-15.61
							68.01	-15.19
							68.02	-15.15
							68.05	-14.84
							68.2	-13.55
							68.57	-11.47
							68.7	-11.06
							69.56	-8.43
							69.84	-6.99
							69.83	-3.32
							69.92	0
							70.03	0.91
							70.14	1.79
							70.19	2.21
							70.34	3.39
							70.65	5.98
							70.76	6.9
							70.81	7.3
							70.98	8.37
							70.98	8.37
							71.24	9.53
							71.24	9.53
							71.24	9.53
							71.72	11.65
							71.93	12.54
							71.99	12.82
							72.16	13.54
							72.16	13.54
							73.06	17.48
							73.67	20.21
							73.92	21.35
							76.64	22.39
						-0	76.64	22.39
						-0	84.83	24.6
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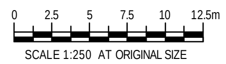
CH 10



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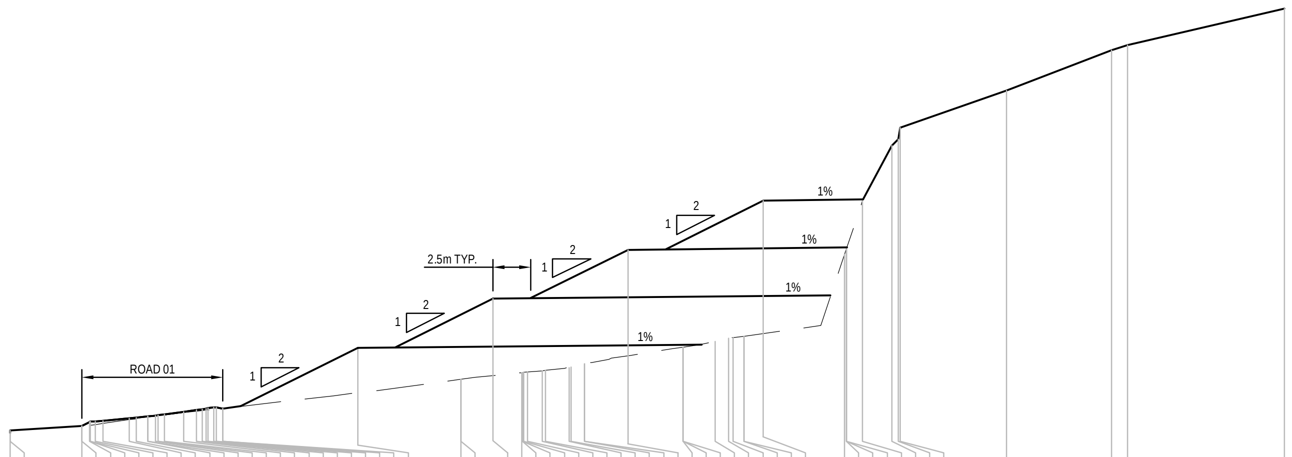

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-34.23	64.96	-0						
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-29.46	65.26	0.02	65.27					
-28.99	65.31	0.21	65.52					
-28.94	65.32	0.23	65.54					
-28.94	65.32	0.23	65.54					
-28.57	65.37	0.2	65.57					
-28.07	65.44	0.18	65.62					
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-25.89	65.74	0.07	65.81					
-25.11	65.85	0.05	65.9					
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-24.02	66	0.03	66.03					
-22.76	66.14	0.05	66.19					
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-4.41	68.35							
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-0.35	68.79							
-0.34	68.79							
-0.25	68.8							
0	68.83							
0.95	68.92							
1.18	68.94							
2.76	69.14							
2.86	69.16							
3.77	69.36							
3.77	69.36							
6.64	69.91	7.02					76.93	
10.28	70.47							
10.28	70.47							
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13.57	71.1							
14.29	71.2							
14.29	71.2							
15.57	71.38	8.79						80.17
20.95	76.63							
21.07	76.98							
21.07	76.98							
21.07	76.98							
22.15	80.19							
24.08	83.8	0						
24.49	84.21	0						
24.63	85	0						
31.65	87.44	-0						
38.6	90.12	-0						
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50.01	92.85	0						

CH 20

0 2.5 5 7.5 10 12.5m
SCALE 1:250 AT ORIGINAL SIZE

PRELIMINARY

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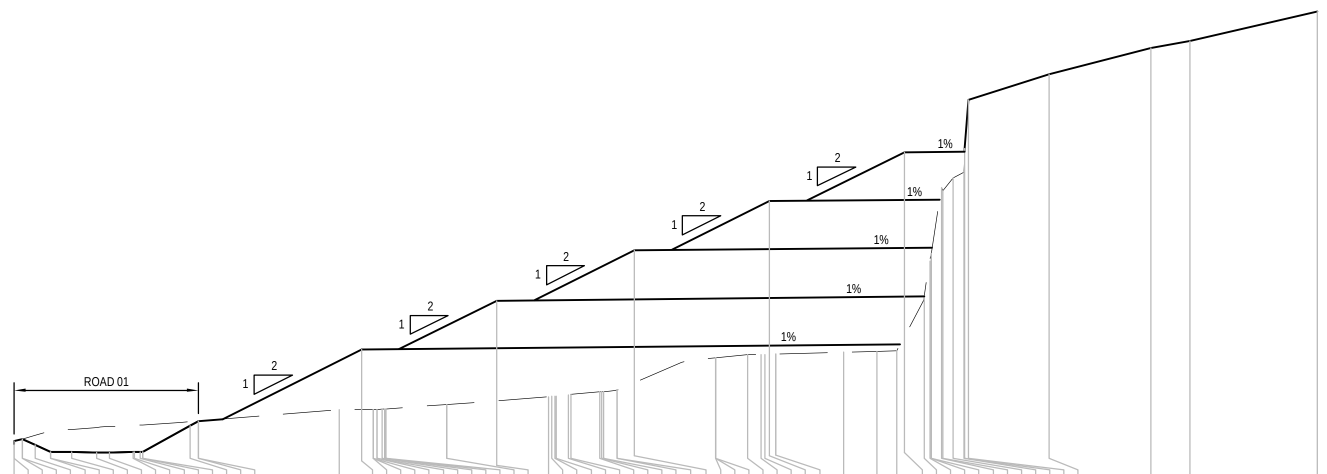

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-33.95	64.77	-0.65	64.12					
-32.96	65.04	-1.39	63.65					
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-29.91	65.29	-1.64	63.65					
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-23.16	65.71	0						
-13.87	66.45							
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-11.61	66.47							
-11.61	66.47							
-11.61	66.47							
-11.36	66.48							
-11.35	66.48							
-11.01	66.49							
-10.85	66.5							
-10.85	66.5							
-10.77	66.5							
-6.76	66.81							
-3.42	67.06	6.61			73.67			
0	67.33							
0.22	67.34							
0.42	67.36							
0.5	67.37							
1.32	67.45							
1.48	67.46							
3.37	67.64							
3.51	67.65							
3.64	67.67							
4.52	67.76							
4.52	67.76							
5.66	68.22	8.78				77.00		
11.03	69.91							
11.03	69.91							
11.03	69.91							
13.18	70.09							
14.04	70.12							
14.31	70.13							
14.59	70.14	10.12					80.26	
15.04	70.13							
19.53	70.26							
21.7	70.32							
23.01	70.36							
23.52	71.32	12.18						83.50
24.85	74							
25.21	76.28							
25.29	76.79							
25.29	76.79							
25.99	81.15							
26.07	80.94							
26.76	81.77							
27.48	82.18	-0						
27.5	83.72	-0						
27.75	86.96	-0						
33.09	88.63	0						
39.81	90.38	-0						
42.42	90.87	0						
50.86	92.8	0						

CH 30

0 2.5 5 7.5 10 12.5m
SCALE 1:250 AT ORIGINAL SIZE

PRELIMINARY

rev	description	app'd	date
A	INITIAL ISSUE	HJP*	07/02/11

RCCC CIVIL CONTRACTING
ROKEBY QUARRY REHABILITATION

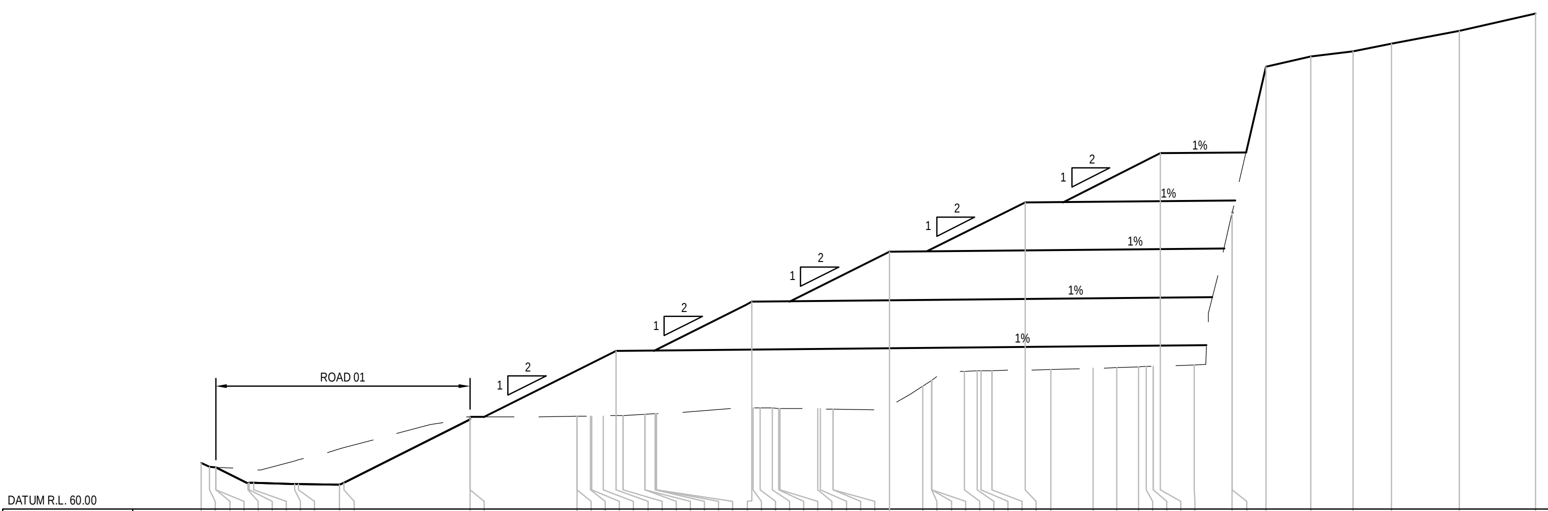
CROSS SECTION
CH 30

CLIENTS | PEOPLE | PERFORMANCE

2 Salamanca Square Hobart TAS 7000 Australia
GPO Box 667 Hobart TAS 7001
T 61 3 6210 0600 **F** 61 3 6210 0601
E hbamail@ghd.com **W** www.ghd.com

scale	1:250 for A1	job no.	32-15700
date	DEC 2010	rev no.	A

approved SK005



OFFSET FROM CENTRELINE	EXISTING SURFACE LEVEL	DEPTH CUT - / FILL +	ROAD01	SURF RL66	SURF RL70	SURF RL73	SURF RL77	SURF RL81
-36.5	63.04	-0						
-35.96	62.78	0						
-35.56	62.75	0						
-35.56	62.75	0	62.75					
-33.41	62.6	-0.91	61.69					
-33.35	62.6	-0.88	61.72					
-33.03	62.58	-0.86	61.71					
-30.35	63.14	-1.49	61.65					
-30.07	63.22	-1.58	61.64					
-27.35	63.95	-2.38	61.57					
-27.06	64.03	-2.31	61.71					
-18.73	66.08	-0.16	65.92					
-18.73	66.08	0						
-11.66	66.11							
-11.66	66.11							
-10.79	66.11							
-10.67	66.11							
-9.93	66.12							
-9.08	66.15	4.28		70.43				
-8.61	66.18							
-7.15	66.24							
-7.15	66.24							
-6.5	66.27							
-6.39	66.27							
-6.39	66.27							
-0.12	66.67	7.01			73.68			
0	66.67							
0.47	66.66							
1.25	66.65							
1.7	66.64							
1.78	66.64							
4.26	66.61							
4.41	66.6							
5.26	66.59							
5.26	66.59							
8.99	66.82	10.18				77.00		
11.21	68.11							
11.78	68.49							
11.78	68.49							
11.78	68.49							
13.94	69.09							
14.78	69.11							
15.05	69.11							
15.79	69.13							
17.96	69.18	11.08					80.26	
19.68	69.21							
22.45	69.28							
24.02	69.33							
25.46	69.38							
25.96	69.4							
26.46	69.42							
26.92	69.44	14.06						83.50
29.16	69.52							
31.67	79.6							
31.67	79.6							
33.88	89.23	0						
36.84	89.9	-0						
39.66	90.24	-0						
42.18	90.76	-0						
46.69	91.61	0						
51.7	92.76	0						

CH 40

PRELIMINARY

rev	description	app'd	date
A	INITIAL ISSUE	HJP*	07/02/11

RCCC CIVIL CONTRACTING
ROKEBY QUARRY REHABILITATION

CROSS SECTION
CH 40

GHD CLIENTS | PEOPLE | PERFORMANCE

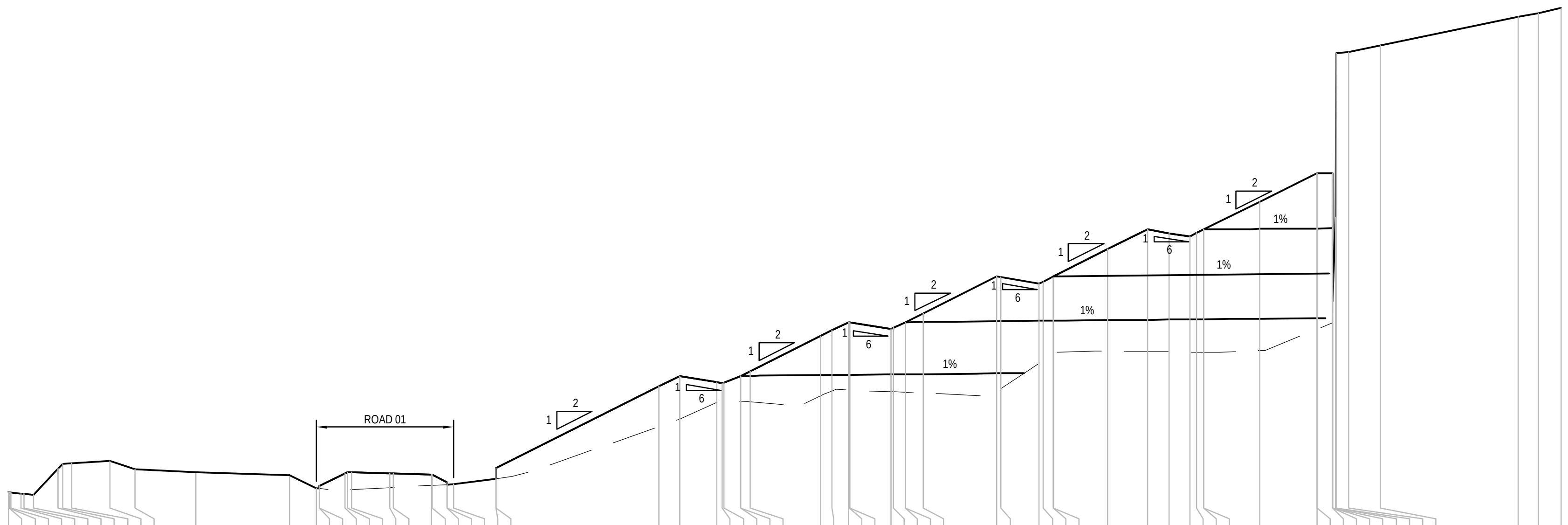
2 Salamanca Square Hobart TAS 7000 Australia
GPO Box 667 Hobart TAS 7001
T 61 3 6210 0600 **F** 61 3 6210 0601
E hbamail@ghd.com **W** www.ghd.com

scale 1:250 for A1 | job no. 32-15700
date DEC 2010 | rev no. A

0 2.5 5 7.5 10 12.5m
SCALE 1:250 AT ORIGINAL SIZE

approved SK006

Plot Date: 7 February 2011 - 12:18 PM Plotted by: Michael Fletcher/Hobart/GHD/AU Cad File No: G:\32\15700\CADD\Drawings\12D\32-15700-SK002_SK017.dwg



OFFSET FROM CENTRELINE	DESIGN SURFACE LEVEL	SURF RL81	SURF RL77	SURF RL73	SURF RL70	SURF RL66	ROAD01	DEPTH CUT - / FILL +	EXISTING SURFACE LEVEL
-57.59	58.375							-0	58.38
-57.58	58.384							0	58.38
-57.55	58.353							0	58.35
-57.44	58.344							0	58.34
-56.7	58.275							-0	58.27
-56.51	58.25							0	58.25
-55.83	58.161							-0	58.16
-54.09	60.052							-0	60.05
-53.77	60.38							0	60.38
-53.12	60.405							-0	60.4
-50.42	60.581							-0	60.58
-48.61	60.014							-0	60.01
-44.31	59.803							0	59.8
-37.64	59.576							-0	59.58
-35.75	58.665							0	58.67
-35.53	58.637							-0	58.64
-35.53	58.798						58.8	0.16	58.64
-33.7	59.717						59.72	1.17	58.55
-33.57	59.786						59.79	1.23	58.56
-33.24	59.778						59.78	1.21	58.57
-30.57	59.706						59.71	1	58.7
-30.28	59.698						59.7	0.98	58.72
-27.56	59.625						59.63	0.78	58.85
-27.53	59.61						59.61	0.76	58.85
-26.47	59.083						59.08	0.18	58.9
-26.47	58.903							-0	58.9
-26.02	58.925							-0	58.93
-23.03	59.321					60.09		0	59.32
-23.03	60.094					60.09		0.77	59.32
-11.45	65.871					65.87		2.84	63.03
-9.99	66.6					66.6		3.02	63.58
-7.34	66.16					66.16		1.41	64.75
-6.98	66.1					66.1		1.19	64.91
-6.83	66.158					66.16		1.23	64.92
-5.65	66.617					66.62		1.79	64.83
-5.65	66.617				66.62	66.62		1.79	64.83
-4.97	66.953				66.95	66.62		2.18	64.77
0	69.432				69.43	66.67		4.25	65.18
0.84	69.85				69.85	66.68		4.31	65.54
2	70.43				70.43	66.69		4.81	65.62
2.07	70.419				70.42	66.69		4.8	65.62
2.08	70.416				70.42	66.69		4.8	65.61
5.01	69.93				69.93	66.72		4.44	65.49
5.19	70.019				70.02	66.72		4.53	65.48
6.01	70.43				70.43	66.73		4.98	65.45
6.01	70.43			70.43	70.43	66.73		4.98	65.45
7.29	71.068			71.07	70.44	66.75		5.67	65.4
12.52	73.676			73.68	70.49	66.8		8.14	65.53
12.8	73.631			73.63	70.5	66.8		7.92	65.71
15.53	73.176			73.18	70.52			5.65	67.53
15.79	73.306			73.31	70.53			5.6	67.71
16.54	73.676			73.68	70.53			5.47	68.21
16.54	73.676		73.68	73.68	70.53			5.47	68.21
20.4	75.602		75.6	73.71	70.57			7.24	68.36
23.2	77		77	73.74	70.6			8.66	68.34
24.76	76.741		76.74	73.76	70.62			8.42	68.32
26.21	76.5		76.5	73.77	70.63			8.19	68.31
26.71	76.748		76.75	73.78	70.64			8.44	68.31
27.21	77		77	73.78	70.64			8.7	68.3
27.21	77	77	77	73.78	70.64			8.7	68.3
31.19	78.984	78.98	77.04	73.82	70.68			10.57	68.41
35.23	81	81	77.08	73.86	70.72			11.08	69.92
35.23	81	81	77.08	73.86	70.72			11.08	69.92
36.37	81.011	81.01		73.87				9.15	71.87
36.37	73.874			73.87				2.01	71.87
36.37	73.874			73.87				2	71.88
36.37	71.877							0	71.88
36.55	77.848							-0	77.85
36.62	89.507							-0	89.51
37.47	89.576							-0	89.58
39.74	90.071							-0	90.07
49.53	92.078							0	92.08
50.96	92.346							-0	92.35
52.54	92.71							0	92.71

CH 50

0 2.5 5 7.5 10 12.5m
SCALE 1:250 AT ORIGINAL SIZE

PRELIMINARY

rev	description	app'd	date
A	INITIAL ISSUE	HJP*	07/02/11

RCCC CIVIL CONTRACTING
ROKEBY QUARRY REHABILITATION

CROSS SECTION
CH 50

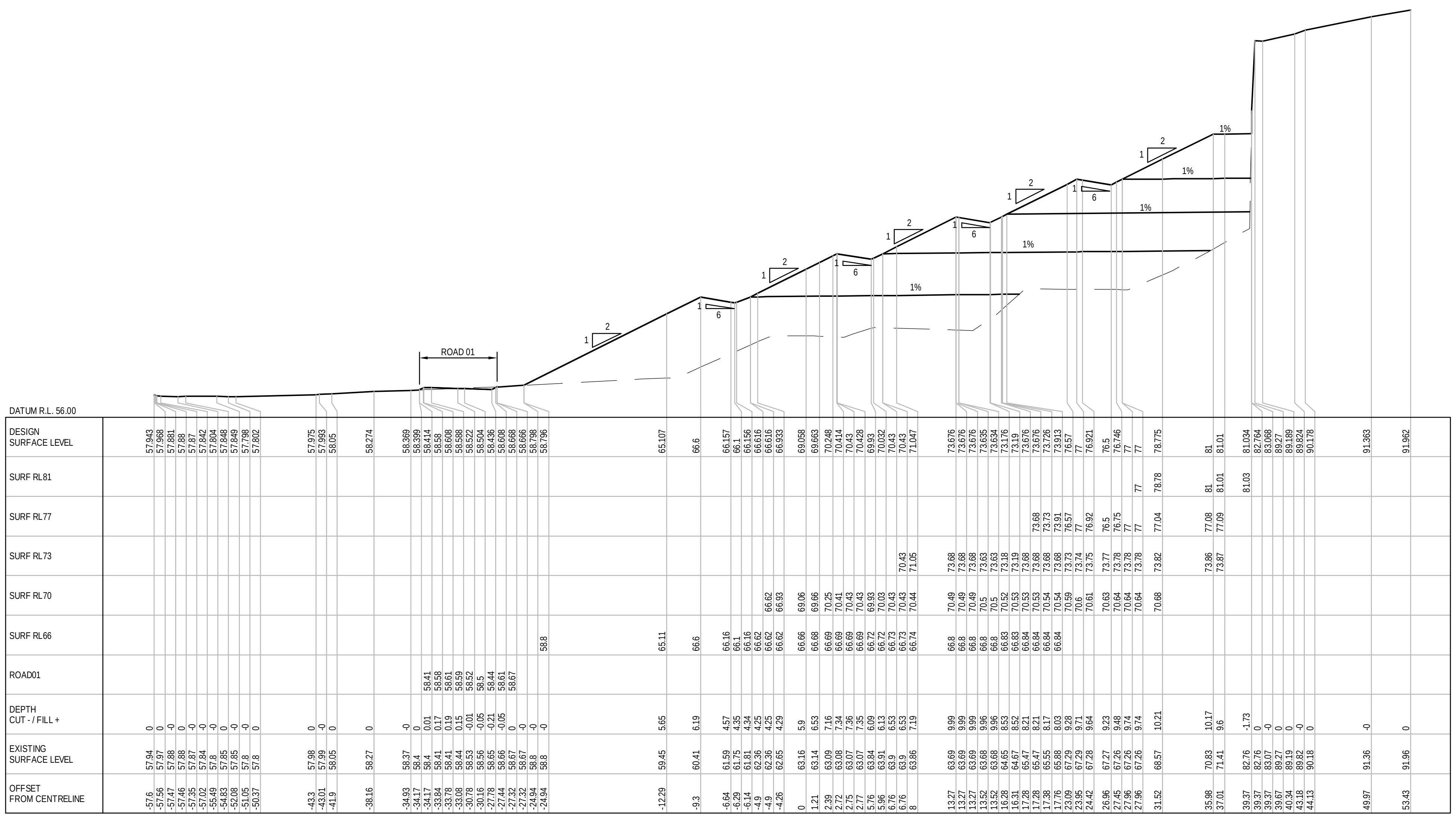
CLIENTS | PEOPLE | PERFORMANCE

2 Salamanca Square Hobart TAS 7000 Australia
GPO Box 667 Hobart TAS 7001
T 61 3 6210 0600 **F** 61 3 6210 0601
E hbamail@ghd.com **W** www.ghd.com

scale 1:250 for A1 | job no. 32-15700
date DEC 2010 | rev no. A

approved SK007

Plot Date: 7 February 2011 - 12:18 PM Plotted by: Michael Fletcher/Hobart/GHD/AU Cad File No: G:\32\15700\CADD\Drawings\12D\32-15700-SK002_SK017.dwg



CH 60

0 2.5 5 7.5 10 12.5m

SCALE 1:250 AT ORIGINAL SIZE

PRELIMINARY

rev	description	app'd	date
A	INITIAL ISSUE	HJP*	07/02/11

RCCC CIVIL CONTRACTING

ROKEBY QUARRY REHABILITATION

CROSS SECTION

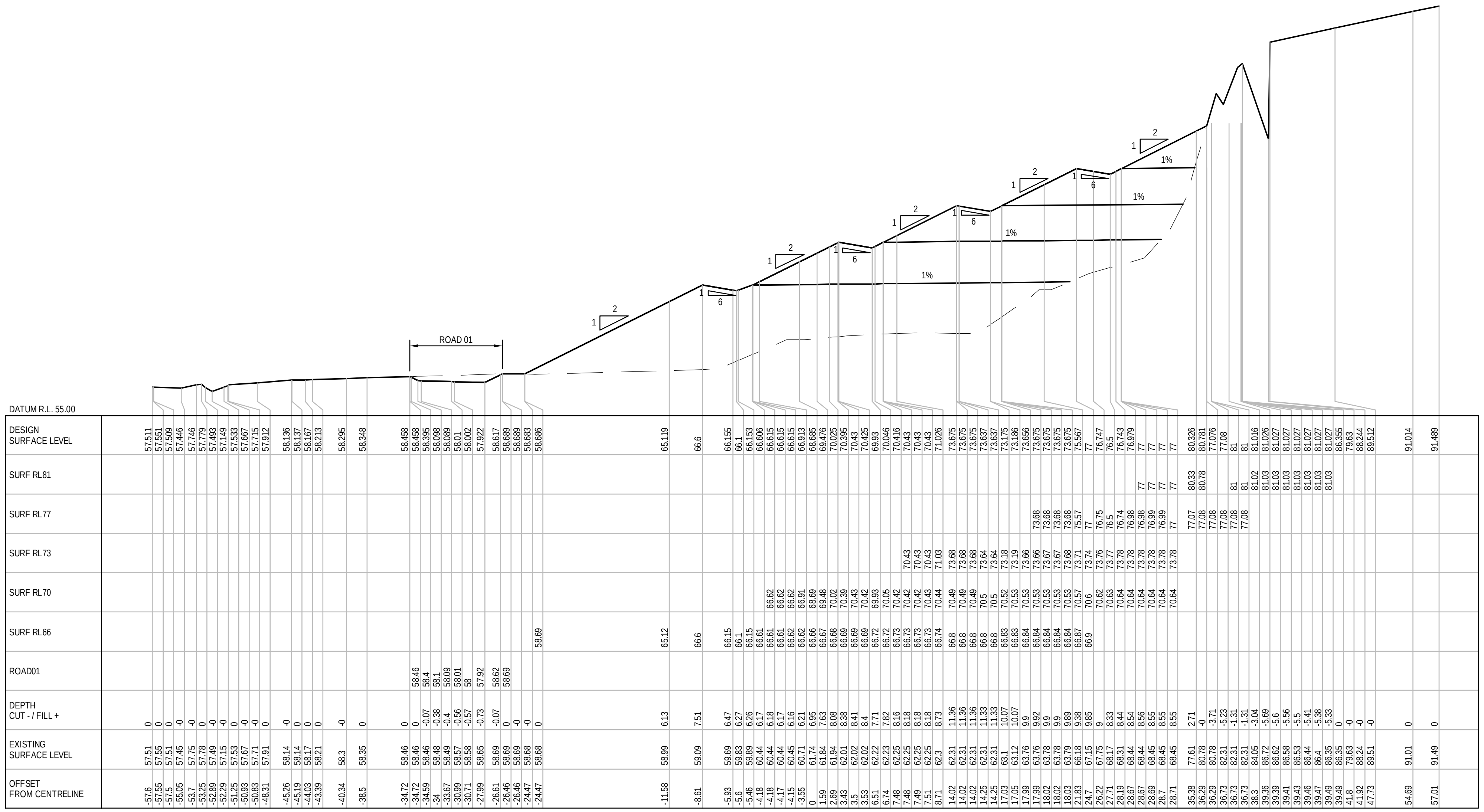
CH 60

GHD CLIENTS | PEOPLE | PERFORMANCE

2 Salamanca Square Hobart TAS 7000 Australia
GPO Box 667 Hobart TAS 7001
T 61 3 6210 0600 **F** 61 3 6210 0601
E hbamail@ghd.com **W** www.ghd.com

scale	1:250 for A1	job no.	32-15700
date	DEC 2010	rev no.	A

approved SK008



CH 70

PRELIMINARY

rev	description	app'd	date
A	INITIAL ISSUE	HJP*	07/02/11

RCCC CIVIL CONTRACTING
ROKEBY QUARRY REHABILITATION

CROSS SECTION
CH 70

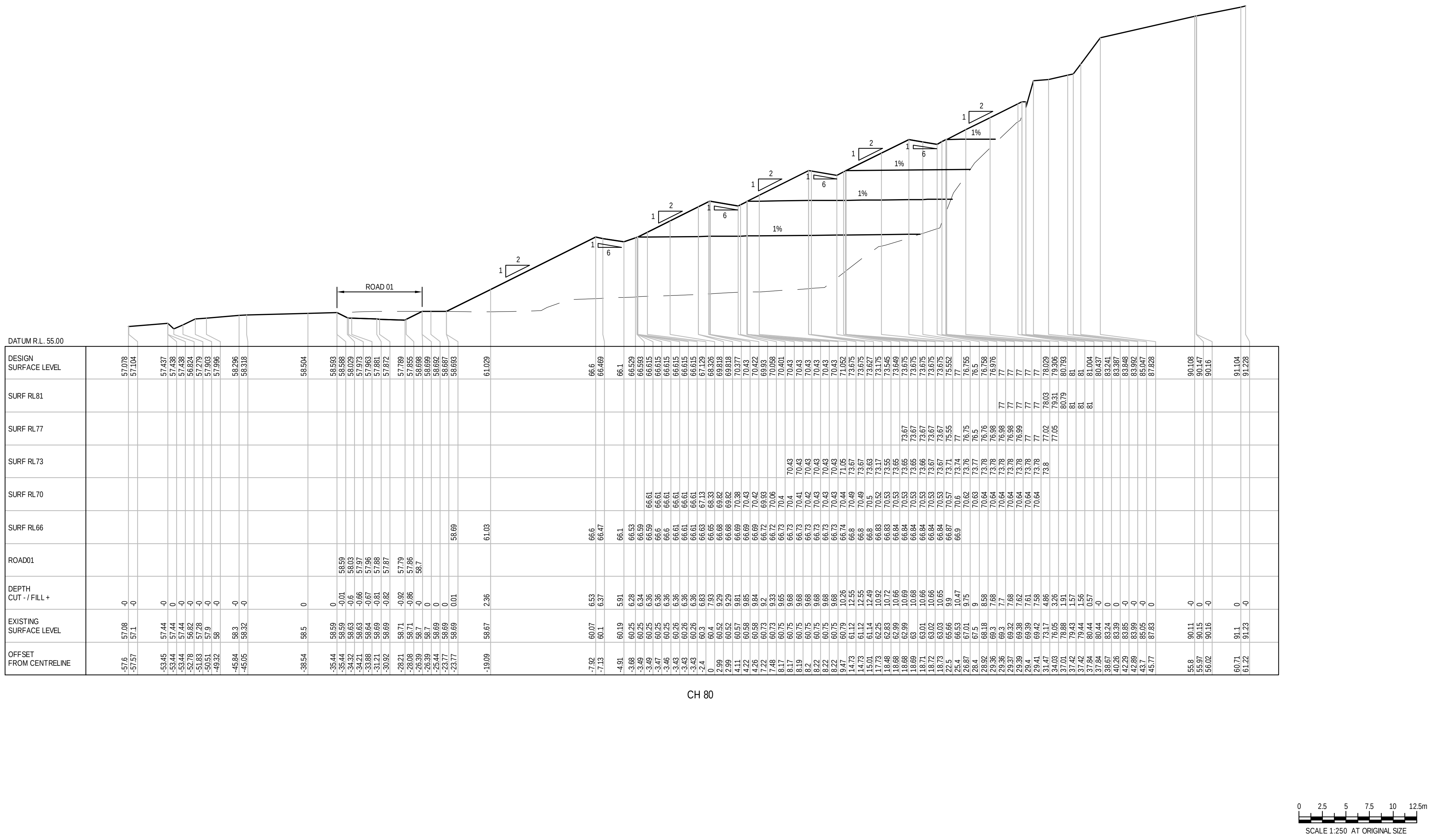
GHD CLIENTS | PEOPLE | PERFORMANCE

2 Salamanca Square Hobart TAS 7000 Australia
GPO Box 667 Hobart TAS 7001
T 61 3 6210 0600 **F** 61 3 6210 0601
E hbamail@ghd.com **W** www.ghd.com

scale	1:250 for A1	job no.	32-15700
date	DEC 2010	rev no.	A

approved SK009

Plot Date: 7 February 2011 - 12:22 PM Plotted by: Michael Fletcher/Hobart/GHD/AU Cad File No: G:\32\15700\CADD\Drawings\12D\32-15700-SK002_SK017.dwg



PRELIMINARY

rev	description	app'd	date
A	INITIAL ISSUE	HJP*	07/02/11

RCCC CIVIL CONTRACTING
ROKEBY QUARRY REHABILITATION

CROSS SECTION
CH 80

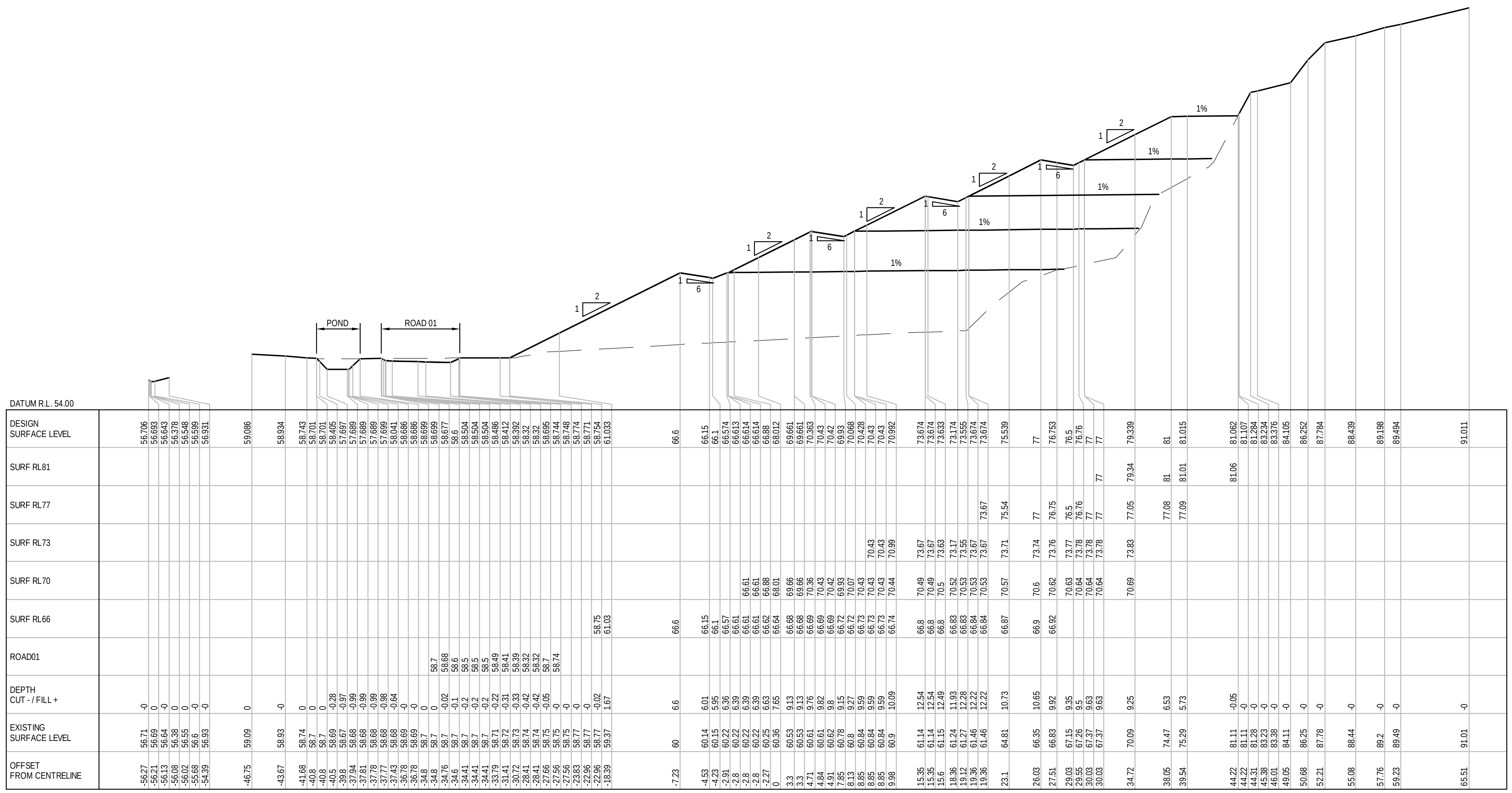
GHD CLIENTS | PEOPLE | PERFORMANCE

2 Salamanca Square Hobart TAS 7000 Australia
GPO Box 667 Hobart TAS 7001
T 61 3 6210 0600 **F** 61 3 6210 0601
E hbamail@ghd.com **W** www.ghd.com

scale 1:250 for A1 | job no. 32-15700
date DEC 2010 | rev no. A

approved SK010

Plot Date: 7 February 2011 - 12:22 PM   Plotted by: Michael Fletcher/Hobart/GHD/AU   Cad File No: G:\32\15700\CADD\Drawings\12D\32-15700-SK002_SK017.dwg



CH 90

PRELIMINARY

A	INITIAL ISSUE	HJP*	07/02/11
rev	description	app'd	date

RCCC CIVIL CONTRACTING

ROKEBY QUARRY REHABILITATION

CROSS SECTION

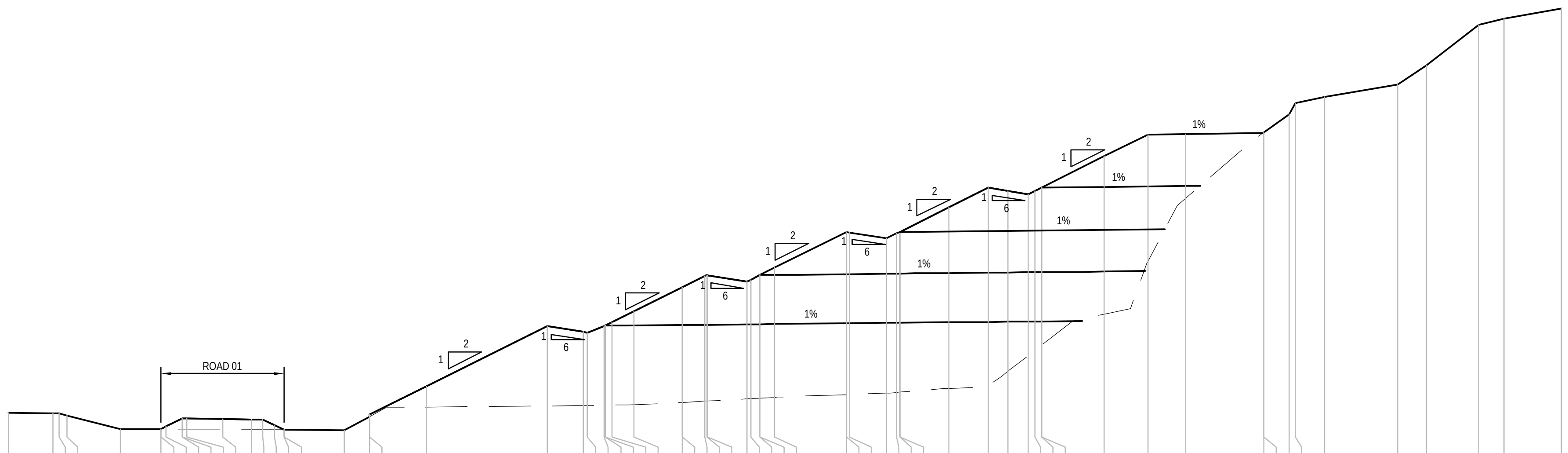
CH 90

CLIENTS | PEOPLE | PERFORMANCE

2 Salamanca Square Hobart TAS 7000 Australia
GPO Box 667 Hobart TAS 7001
T 61 3 6210 0600 **F** 61 3 6210 0601
E hbamail@ghd.com **W** www.ghd.com

scale	1:250 for A1	job no.	32-15700
date	DEC 2010	rev no.	A

approved SK011



DATUM R.L. 57.00

OFFSET FROM CENTRELINE	DESIGN SURFACE LEVEL	SURF RL81	SURF RL77	SURF RL73	SURF RL70	SURF RL66	ROAD01	DEPTH CUT - / FILL +	EXISTING SURFACE LEVEL
-47.08	60.056							-0	60.06
-43.75	60.025							0	60.03
-43.29	60.022							0	60.02
-42.69	59.862							0	59.86
-38.67	58.862							-0	58.86
-35.61	58.845							-0	58.85
-35.61	58.845						58.85	-0	58.85
-35.24	59.033						59.03	0.19	58.84
-34	59.665						59.67	0.83	58.84
-34	59.665						59.67	0.83	58.84
-33.67	59.661						59.66	0.83	58.83
-30.98	59.616						59.62	0.8	58.82
-28.81	59.579						59.58	0.77	58.81
-27.97	59.569						59.57	0.77	58.8
-27.09	59.145						59.14	0.35	58.79
-26.35	58.789						58.79	-0	58.79
-26.35	58.789							0	58.79
-21.8	58.756							0	58.76
-19.93	59.793							0	59.79
-19.93	59.922					59.92		0.13	59.79
-15.66	62.053					62.05		1.57	60.49
-6.54	66.6					66.6		6.01	60.59
-3.82	66.147					66.15		5.52	60.63
-3.54	66.1					66.1		5.47	60.63
-2.28	66.576					66.58		5.93	60.64
-2.18	66.614					66.61		5.97	60.64
-2.18	66.614				66.61	66.61		5.97	60.64
-1.67	66.866				66.87	66.62		6.22	60.65
0	67.699				67.7	66.64		7.02	60.68
3.62	69.504				69.5	66.67		8.66	60.84
3.62	69.504				69.5	66.67		8.66	60.84
5.31	70.349				70.35	66.69		9.41	60.94
5.47	70.43				70.43	66.69		9.48	60.95
5.55	70.418				70.42	66.69		9.47	60.95
8.48	69.93				69.93	66.72		8.82	61.11
8.77	70.077				70.08	66.72		8.95	61.13
9.48	70.43				70.43	66.73		9.26	61.17
9.48	70.43			70.43	70.43	66.73		9.26	61.17
10.58	70.977			70.98	70.44	66.74		9.75	61.23
15.98	73.674			73.67	70.49	66.79		12.23	61.44
15.98	73.674			73.67	70.49	66.79		12.23	61.44
16.22	73.634			73.63	70.5	66.8		12.19	61.45
18.99	73.173			73.17	70.52	66.82		11.62	61.55
19.75	73.556			73.56	70.53	66.83		11.95	61.6
19.99	73.673			73.67	70.53	66.83		12.05	61.62
19.99	73.673		73.67	73.67	70.53	66.83		12.05	61.62
23.7	75.527		75.53	73.71	70.57	66.87		13.63	61.9
26.65	77		77	73.74	70.6	66.9		14.89	62.11
28.15	76.751		76.75	73.75	70.62	66.92		13.55	63.2
29.66	76.5		76.5	73.77	70.63	66.93		12.13	64.37
30.19	76.762		76.76	73.78	70.64	66.94		11.98	64.78
30.66	77		77	73.78	70.64	66.94		11.84	65.16
30.66	77	77	77	73.78	70.64	66.94		11.84	65.16
35.39	79.357	79.36	77.05	73.83	70.69			11.88	67.47
38.68	81	81	77.08	73.86				9.54	71.46
41.51	81.028	81.03	77.11					4.84	76.19
47.41	81.087	81.09						-0.06	81.15
47.41	81.151							-0	81.15
49.31	82.511							-0	82.51
49.76	83.365							-0	83.37
51.99	83.805							0	83.8
57.49	84.743							0	84.74
59.65	86.169							0	86.17
63.56	89.232							-0	89.23
65.48	89.696							-0	89.7
69.78	90.482							-0	90.48

CH 100

0 2.5 5 7.5 10 12.5m
SCALE 1:250 AT ORIGINAL SIZE

PRELIMINARY

rev	description	app'd	date
A	INITIAL ISSUE	HJP*	07/02/11

RCCC CIVIL CONTRACTING
ROKEBY QUARRY REHABILITATION

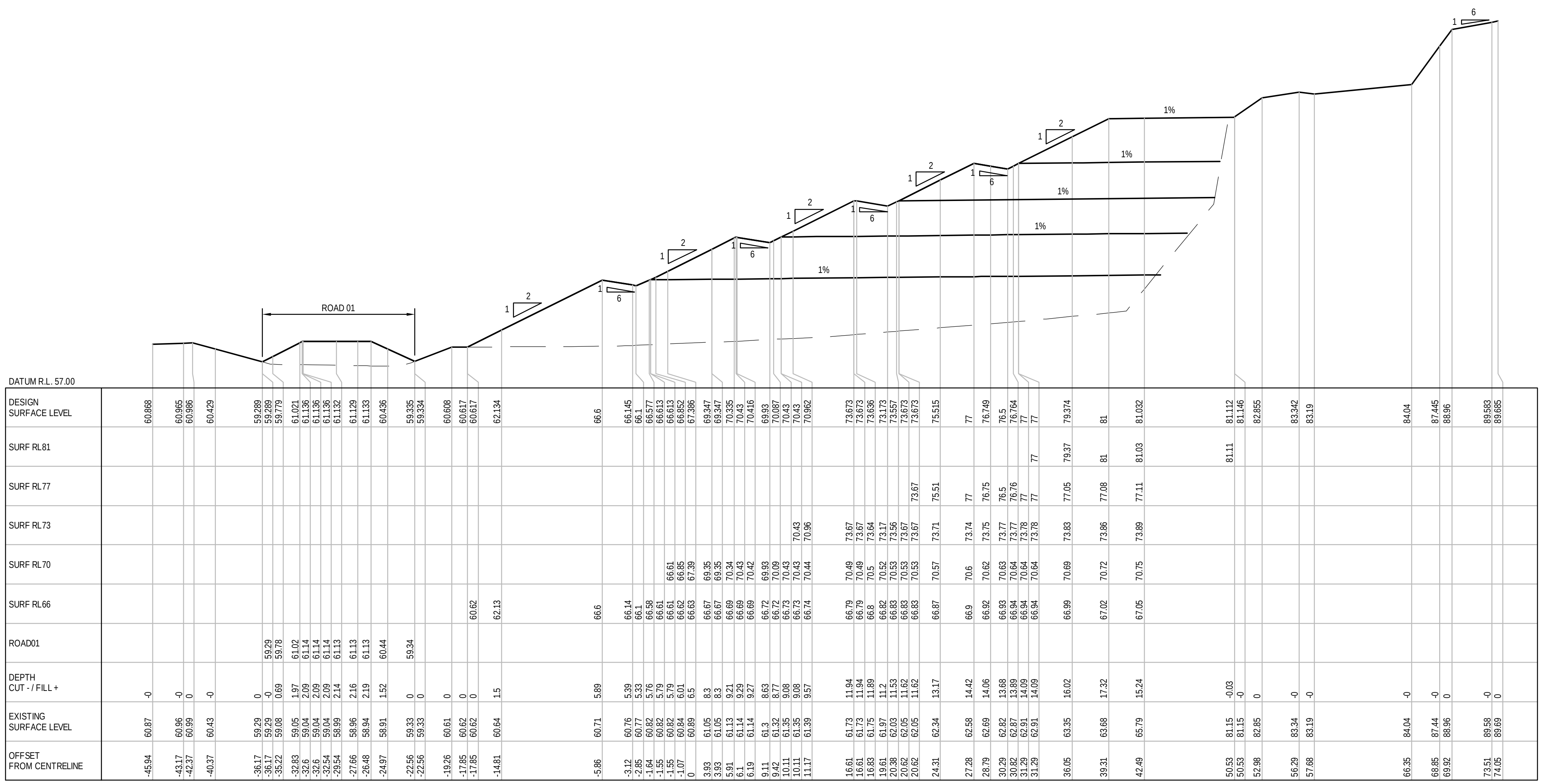
CROSS SECTION
CH 100

GHD CLIENTS | PEOPLE | PERFORMANCE

2 Salamanca Square Hobart TAS 7000 Australia
GPO Box 667 Hobart TAS 7001
T 61 3 6210 0600 **F** 61 3 6210 0601
E hbamail@ghd.com **W** www.ghd.com

scale 1:250 for A1 | job no. 32-15700
date DEC 2010 | rev no. A

approved SK012



CH 110

PRELIMINARY

rev	description	app'd	date
A	INITIAL ISSUE	HJP*	07/02/11

RCCC CIVIL CONTRACTING

ROKEBY QUARRY REHABILITATION

CROSS SECTION

CH 110

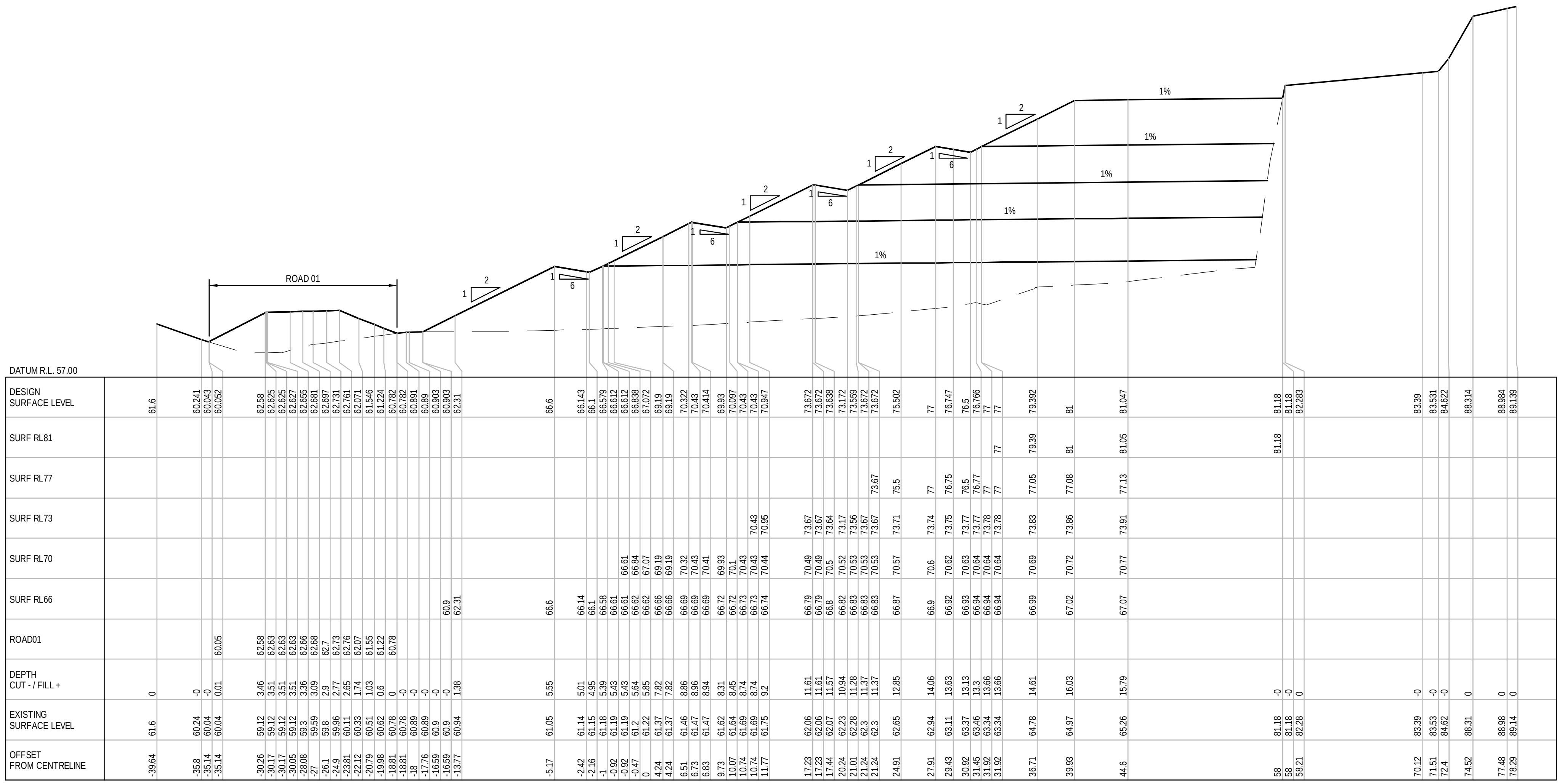
GHD CLIENTS | PEOPLE | PERFORMANCE

2 Salamanca Square Hobart TAS 7000 Australia
GPO Box 667 Hobart TAS 7001
T 61 3 6210 0600 **F** 61 3 6210 0601
E hbamail@ghd.com **W** www.ghd.com

scale	1:250 for A1	job no.	32-15700
date	DEC 2010	rev no.	A

approved SK013

Plot Date: 7 February 2011 - 12:23 PM Plotted by: Michael Fletcher/Hobart/GHD/AU Cad File No: G:\32\15700\CADD\Drawings\12D\32-15700-SK002_SK017.dwg



CH 120

PRELIMINARY

rev	description	app'd	date
A	INITIAL ISSUE	HJP*	07/02/11

RCCC CIVIL CONTRACTING

ROKEBY QUARRY REHABILITATION

CROSS SECTION

CH 120

CLIENTS | PEOPLE | PERFORMANCE

2 Salamanca Square Hobart TAS 7000 Australia
GPO Box 667 Hobart TAS 7001
T 61 3 6210 0600 **F** 61 3 6210 0601
E hbamail@ghd.com **W** www.ghd.com

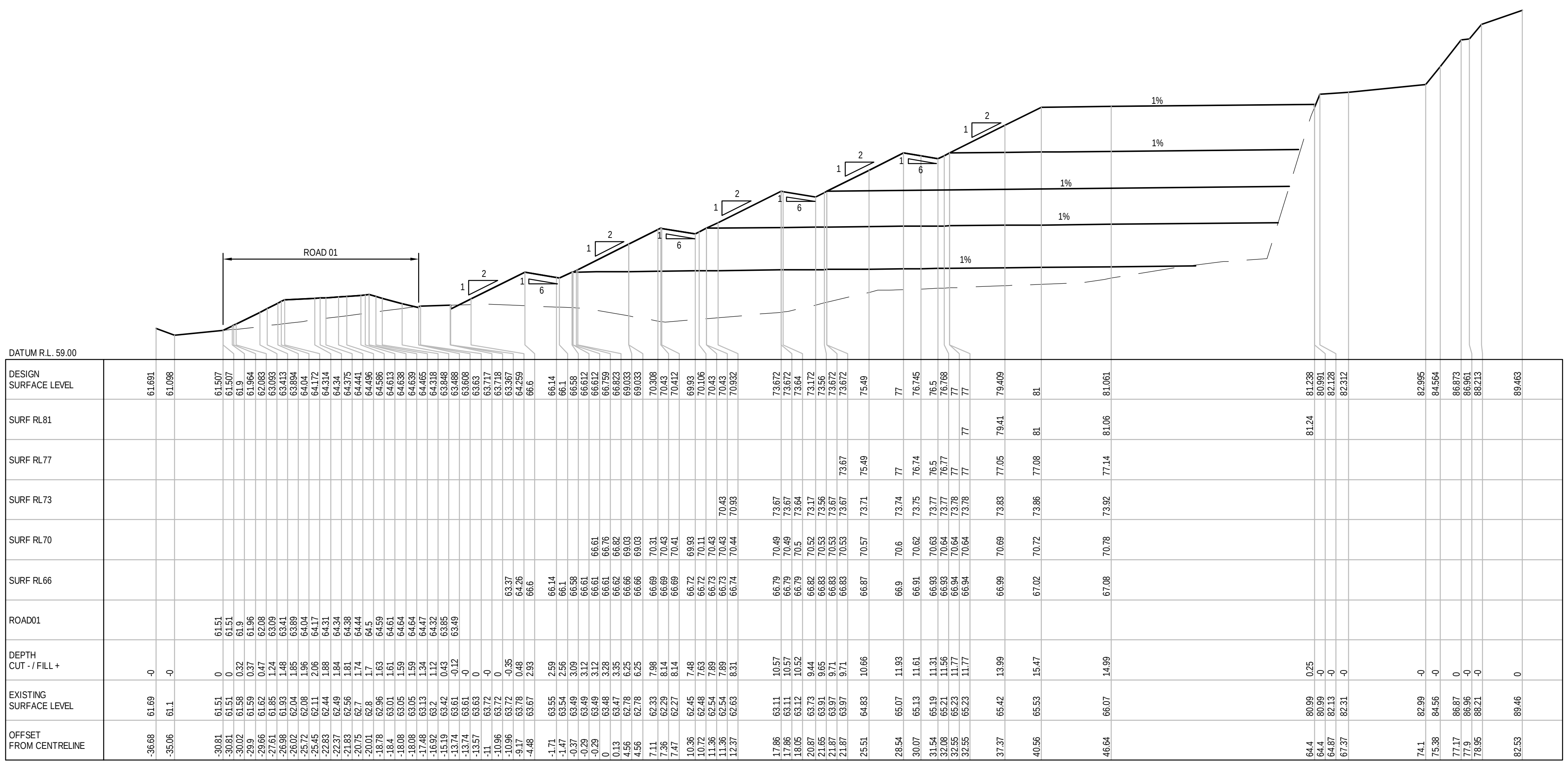
0 2.5 5 7.5 10 12.5m

SCALE 1:250 AT ORIGINAL SIZE

scale	1:250 for A1	job no.	32-15700
date	DEC 2010	rev no.	A

approved SK014

Plot Date: 7 February 2011 - 12:23 PM Plotted by: Michael Fletcher/Hobart/GHD/AU Cad File No: G:\32\15700\CADD\Drawings\12D\32-15700-SK002_SK017.dwg



CH 130

PRELIMINARY

rev	description	app'd	date
A	INITIAL ISSUE	HJP*	07/02/11

RCCC CIVIL CONTRACTING
ROKEBY QUARRY REHABILITATION

CROSS SECTION
CH 130

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scale 1:250 for A1 job no. 32-15700
date DEC 2010 rev no. A

approved SK015

0 2.5 5 7.5 10 12.5m
SCALE 1:250 AT ORIGINAL SIZE

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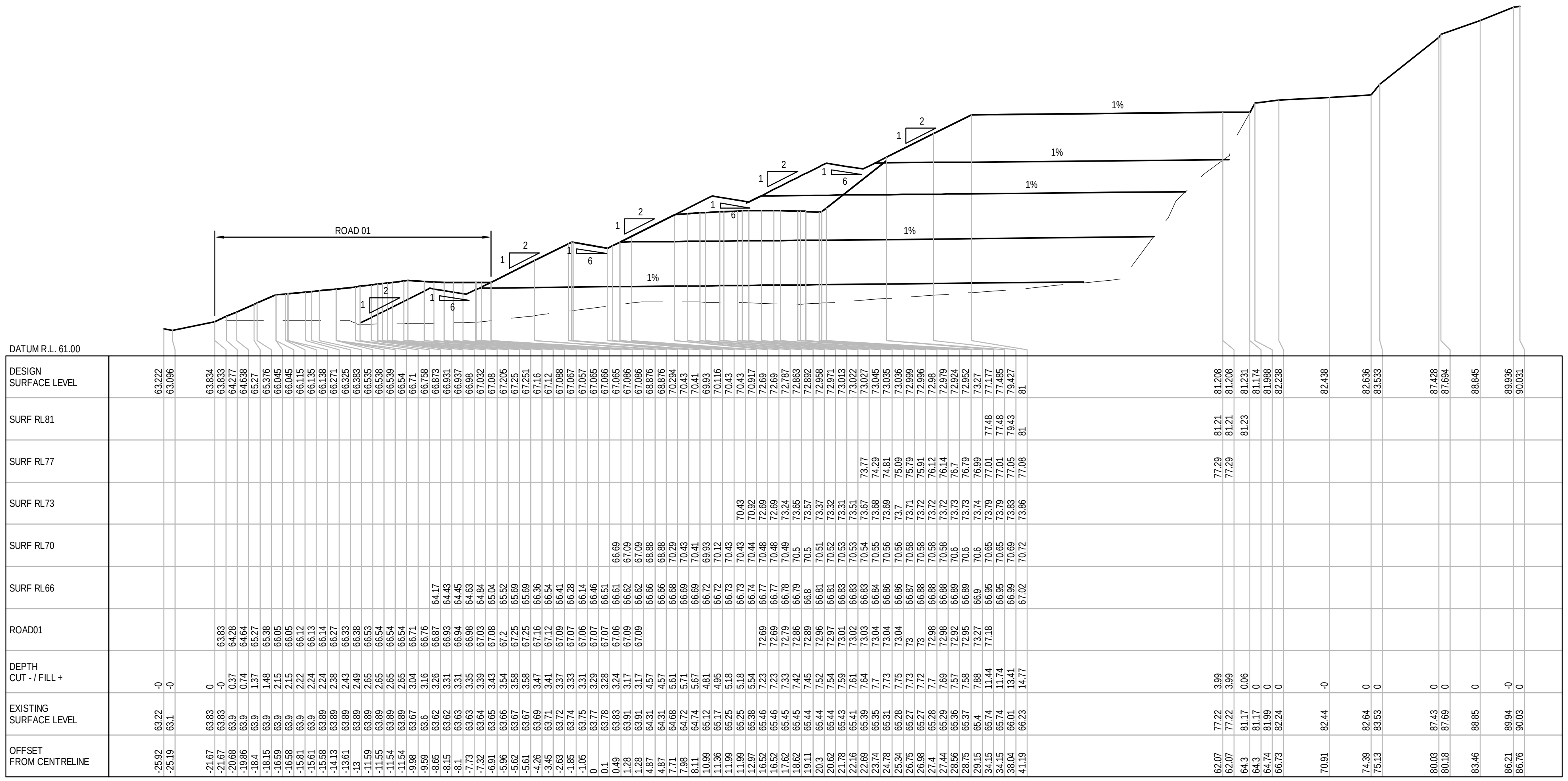

CH 140

PRELIMINARY

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RCCC CIVIL CONTRACTING
ROKEBY QUARRY REHABILITATION

CROSS SECTION
CH 140

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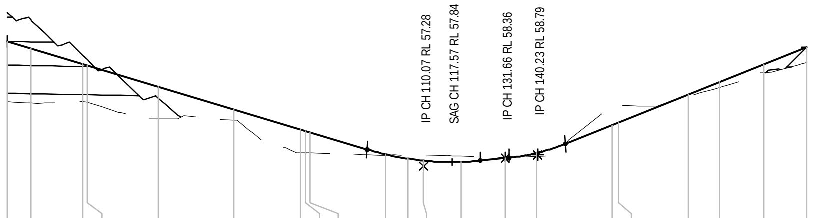
0 2.5 5 7.5 10 12.5m
SCALE 1:250 AT ORIGINAL SIZE

scale	1:250 for A1	job no.	32-15700
date	DEC 2010	rev no.	A

approved SK016



DATUM RL. 50.00

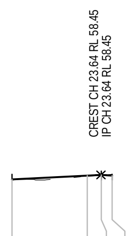
VERTICAL ALIGNMENT: L=95.19m G=-15% | K=-1.51 L=30m | L=6.56m G=5% | L=1.06m G=5% | K=-1.02 L=15m | L=63.84m G=20%

HORIZONTAL ALIGNMENT: L=6.21m | L=14.88m R=-50.00m | L=56.46m R=-40.00m | L=1.35m | L=27.00m R=-100.00m | L=55.72m | L=26.80m R=-20.00m | L=23.01m

CHAINAGE	EXISTING SURFACE LEVEL	DESIGN SURFACE LEVEL	LEVEL DIFFERENCE CUT - / FILL +	SURF RL66	SURF RL70	SURF RL73	SURF RL77	SURF RL81
0.00	65.83	73.790	7.96	66.95	70.65	73.79	77.01	77.63
6.21	65.65	72.858	7.21	66.89	70.60	73.73	76.68	
20.00	65.84	70.790	4.95	66.76	70.46	71.93		
21.09	65.71	70.627	4.91	66.75	70.45	71.38		
40.00	63.53	67.790	4.26	66.26				
60.00	63.39	64.790	1.40					
77.55	59.04	62.158	3.12					
78.90	59.04	61.955	2.92					
80.00	59.03	61.790	2.76					
100.00	58.77	58.869	0.10					
105.90	58.69	58.295	-0.39					
110.07	58.67	58.029	-0.64					
120.00	58.63	57.863	-0.77					
131.66	58.50	58.359	-0.14					
140.00	58.59	59.039	0.44					
160.00	65.34	62.742	-2.59					
161.62	65.36	63.066	-2.30					
180.00	66.51	66.742	0.23					
188.43	67.72	68.427	0.71					
200.00	69.66	70.742	1.09					
211.44	71.00	73.029	2.03			73.03		

LONGITUDINAL SECTION - ROAD 01

HORZ 1:1000 VERT 1:500



DATUM RL. 50.00

VERTICAL ALIGNMENT: L=23.64m G=2.75% | L=3m G=-3%

HORIZONTAL ALIGNMENT: L=26.64m

CHAINAGE	EXISTING SURFACE LEVEL	DESIGN SURFACE LEVEL	LEVEL DIFFERENCE CUT - / FILL +
0.00	57.80	57.799	0.00
20.00	58.27	58.349	0.08
23.64	58.38	58.449	0.06
26.64	58.50	58.359	-0.14

LONGITUDINAL SECTION - ROAD 02

HORZ 1:1000 VERT 1:500

VERTICAL 1:500 AT ORIGINAL SIZE 0 50 100 150 200 250m

HORIZONTAL 1:1000 AT ORIGINAL SIZE 0 10 20 30 40 50m

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RCCC CIVIL CONTRACTING
ROKEBY QUARRY REHABILITATION
LONGITUDINAL SECTION

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scale	for A1	job no.	32-15700
date	DEC 2010	rev no.	A

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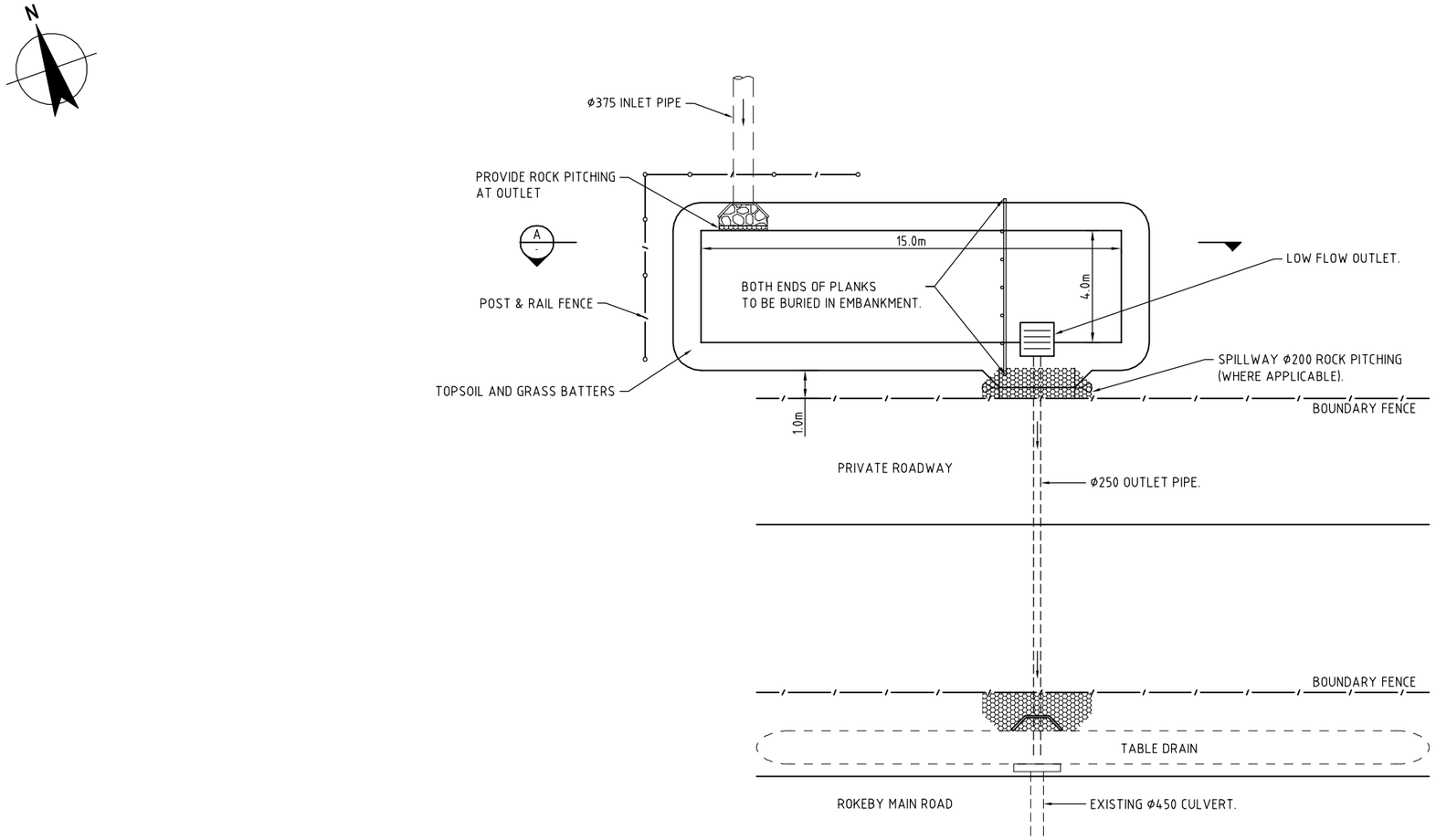
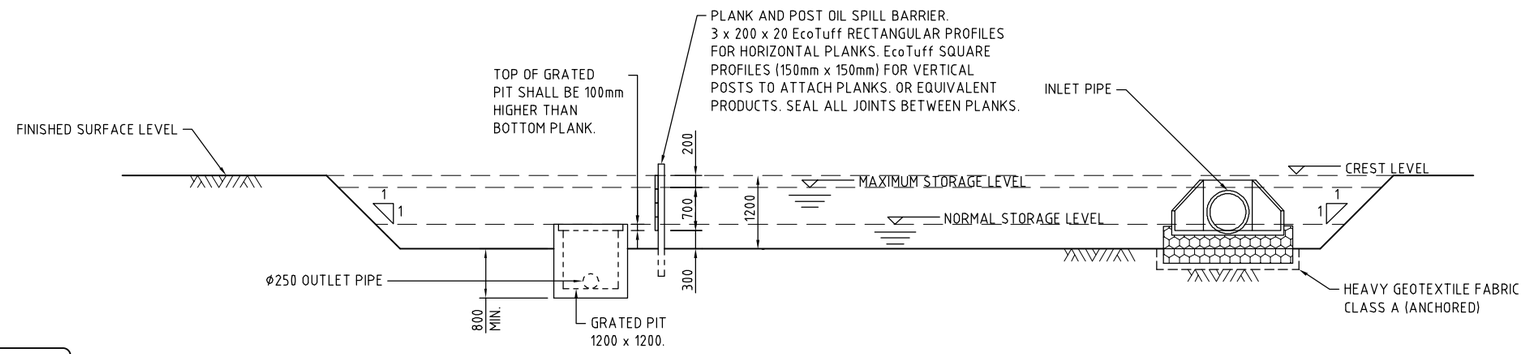


TYPICAL BASIN PLAN

SCALE 1:100
SCALE 1:200 AT A3



A SECTION

SCALE 1:50
SCALE 1:100 AT A3

DIAL BEFORE YOU DIG www.1100.com.au

-WARNING-
BEWARE OF UNDERGROUND SERVICES
THE LOCATION OF UNDERGROUND SERVICES ARE APPROXIMATE ONLY AND THE EXACT POSITION SHOULD BE PROVEN ON SITE. NO GUARANTEE IS GIVEN THAT ALL SERVICES ARE SHOWN.

0 1 2 3 4 5m
SCALE 1:100 AT ORIGINAL SIZE

0 0.5 1.0 1.5 2.0 2.5m
SCALE 1:50 AT ORIGINAL SIZE

PRELIMINARY

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RCCC CIVIL CONTRACTING
ROKEBY QUARRY REHABILITATION
DETENTION POND

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scale	AS SHOWN	job no.	32-15700
date	JAN 2011	rev no.	A
approved	.....		SK100

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N

PLANT SCHEDULE FOR EACH PLATFORM IN BATTER ZONE (APPROX. PLATFORM SIZE 155m LONG x 10m WIDE - 1150m²)			
SPECIES	NUMBER OFF	DENSITY (TREES/m²)	AVERAGE SPACING (m)
WHITE GUM (E. viminalis)	50	0.2	2.2
BLACK PEPPERMINT (E. amygdalina)	50	0.2	2.2
BULL OAK (Allocasuarina littoralis)	50	0.2	2.2
SILVER WATTLE (Acasia dealbata)	50	0.2	2.2
PRICKLY BOX (Bursaria sinosa)	20	0.2	2.2
NATIVE HOP (Dodonaea viscose)	20	0.2	2.2

1. PLANTS TO BE PLANTED WITH RANDOM SPACING, PATTERN AND MIX OF SPECIES.
2. TREES TO BE TUBESTOCK IN FORESTRY TUBES WITH STAKE AND SURROUND.

TIMING

YEAR 1 - AUTUMN	PLANT GRASS AND ALLOW TO ESTABLISH.
- SPRING	SPRAY WEEDS WITH BROAD LEAF HERBICIDE.
YEAR 2 - AUTUMN	SLASH GRASS. SPOT SPRAY WITH ROUNDUP IN TREE LOCATIONS. ALLOW GRASS TO DIE BACK AND PLANT TREES.
YEAR 3	SLASH GRASS. REPLACE MORTALITIES. REMOVE STAKES AND GUARDS WHEN TREES >0.5m HIGH.

CH80 CH70 CH60 CH50 CH40 CH30 CH20 CH10 CH0

FINAL ZONE
ZONE 5
ZONE 4
ZONE 3
ZONE 2
ZONE 1

EXISTING BUSH
EXISTING BUSH

BLUFF

ROAD 01
ROAD 02

GRASSED

DETENTION POND.
REFER DRAWING
32-15700-SK100.

75.26
70.93
70.49
69.14

0 2.5 5 7.5 10 12.5m
SCALE 1:250 AT ORIGINAL SIZE

PRELIMINARY

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RCCC CIVIL CONTRACTING
ROKEBY QUARRY REHABILITATION

LANDSCAPE PLAN

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scale 1:250 for A1 | job no. 32-15700
date DEC 2010 | rev no. A

approved SK101

Plot Date: 7 February 2011 - 12:24 PM Plotted by: Michael Fletcher/Hobart/GHD/AU Cad File No: G:\32\15700\CADD\Drawings\12D\32-15700-SK101.dwg

PRELIMINARY

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A	INITIAL ISSUE	HJP*	07/02/11

RCCC CIVIL CONTRACTING
ROKEBY QUARRY REHABILITATION

DRAINAGE PLAN

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scale	1:250 for A1	job no.	32-15700
date	DEC 2010	rev no.	A

approved .....

SK102

Plot Date: 7 February 2011 - 12:25 PM Plotted by: Michael Fletcher/Hobart/GHD/AU Cad File No: G:\32\15700\CADD\Drawings\12D\32-15700-SK102.dwg

N

CH0
CH10
CH20
CH30
CH40
CH50
CH60
CH70

75.26
70.93
70.49
69.14

GRAVEL TRACK
(LOCATION VARIES)

ROAD 01
ROAD 02
ROKEBY MAIN ROAD

ROCK LINED TABLE DRAINS

30m RUMBLE STRIP.
200Ø ROCK.

SELECTIVE USE
OF SILT FENCE
WITHIN SITE

DETENTION POND.
REFER DRAWING
32-15700-SK100.

Ø300
Ø250
EXISTING
Ø450

ONE
WAY

BLUFF

20.00
40.00
60.00
80.00
100.00
120.00
140.00
160.00
180.00
200.00

0 2.5 5 7.5 10 12.5m
SCALE 1:250 AT ORIGINAL SIZE

PRELIMINARY

rev	description	app'd	date
A	INITIAL ISSUE	HJP*	07/02/11

RCCC CIVIL CONTRACTING
ROKEBY QUARRY REHABILITATION

SOIL & WATER MANAGEMENT
STAGE 1 PRIOR TO ESTABLISHING REVEGETATION

GHD CLIENTS | PEOPLE | PERFORMANCE

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scale | 1:250 for A1 | job no. | 32-15700
date | DEC 2010 | rev no. | A

approved SK103

Plot Date: 7 February 2011 - 12:25 PM Plotted by: Michael Fletcher/Hobart/GHD/AU Cad File No: G:\32\15700\CADD\Drawings\12D\32-15700-SK103.dwg

Appendix B

Calculations

Detention pond sizing

RCCC Civil Contracting
Rokeby Quarry
Detention sizing

Design Criteria

John Hingston advised the critical storm for the downstream pipework is a 2hour 20 year storm.

Time Of Concentration, Tc

Length Of Catchment Divide	=	200m	*m*
Area Of Catchment	=	1.3	*Ha*
Slope Average	=	20%	
Tc	=	15	*(Min's)*

IFD 1 in Y Yrs

Intensity $_{20}$	=	55	*(mm/Hr)*	15min
Intensity $_{100}$	=	80	*(mm/Hr)*	15min
Intensity $_{20}$	=	16	*(mm/Hr)*	2 hour
Intensity $_{100}$	=	20	*(mm/Hr)*	2 hour

Source: IFD curve Rokeby

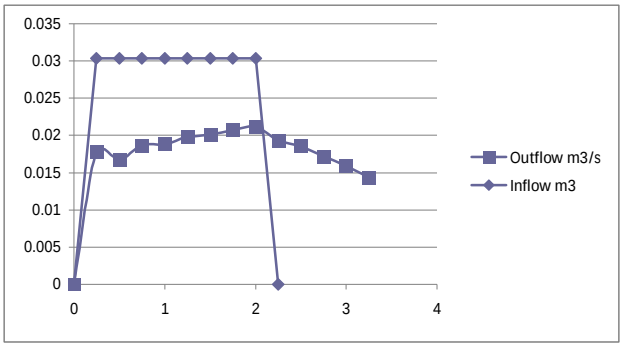
Calculate Flow AEP 1:Y

f	=	0.50		
C_{20}	=	0.53		
C_{100}	=	0.60		
F_{20}	=	1.05		
F_{100}	=	1.20		
Q_{20}	=	0.03	m3/s	2 hour
Q_{100}	=	0.04	m3/s	2 hour
Q_{20}	=	0.10	m3/s	15min
Q_{100}	=	0.17	m3/s	15min

Size of detention and outlet

Length of pond	15
Width of pond	4
Base area of pond	60
diameter outlet	0.025 m
free board	0.2 m
pond vol	100

Time hr	Inflow m3/s	Inflow m3	Vol	Depth m	Outflow m3/s	Vol out m3	
0	0	0	30	0.3	0.000	0	permanent pond
0.25	0.03	27	57	0.68	0.018	16.02	
0.5	0.03	27	69	0.60	0.017	15.01	
0.75	0.03	27	81	0.75	0.019	16.80	
1	0.03	27	91	0.76	0.019	16.93	
1.25	0.03	27	102	0.84	0.020	17.80	
1.5	0.03	27	111	0.87	0.020	18.14	
1.75	0.03	27	120	0.93	0.021	18.68	
2	0.03	27	129	0.96	0.021	19.03	required depth
2.25	0	0	110	0.80	0.019	17.39	
2.5			93	0.75	0.019	16.75	
2.75			76	0.63	0.017	15.45	
3			60	0.55	0.016	14.33	
3.25			46	0.44	0.014	12.94	



Size spillway

Q_{100}	=	0.04	m3/s	
depth	=	0.2	m	
width	=	0.4	m	based on broad crest weir formula

Appendix C

Soil and Water Management Plan

Form Appendix C

APPENDIX C

Soil and Water Management Plan – Type 1

Property Address: 450 Rokeby Road, Howrah

Owner(s) /Applicant: RCCC Civil Contracting P/L

Telephone: 62100670 Facsimile: _____ Email: Hein.Poortenaar@ghd.com.au

Type of Development: Quarry Rehabilitation

Development Application Number: D2007/371

Written Section

[Please note: This written section may be included on the site plan if is can be clearly understood.]

Please fill in the following boxes:

1. Area to be disturbed: 13000 square metres

2. Description of the type of proposed sediment control measures and details of installation procedures and the materials to be used (include diagrams where appropriate.)
   (a) Type of sediment control measure
   Sediment fence
   (b) Materials to be used
   Sediment fence
   (c) Installation Procedure
   As per Guidelines

3. Description of measures proposed to prevent the movement of soil and other materials from stockpiles.
   Uncompacted stockpiles will be located clear of flowpaths.

4. Description of the method(s) of stormwater control

Concentrated stormwater runoff will be kept off roads and filling areas by the use of open drains.

5. Description of the amount of soil (or other materials) to be taken from the site and the destination of that soil (or other materials)

No material will be taken from the site. Fill will be imported.

6. Description of all existing vegetation to be retained / removed

There is no existing vegetation. The site will be progressively re-vegetated.

7. Description of methods to be used to divert runoff from upslope areas around disturbed areas.

A cut off drain above the cliff is not feasible as it on others property and is too steep or desirable as it will require clearing, will create disturbance and erosion and the amount of water from the slope above is small..

8. Description of the nature and extent of earthworks, including the amount of cut and fill.

There will be 100,000m3 of fill imported and compacted to restore the surface to its original profile.

9. Description of the measures to be used to prevent vehicles entering and leaving the site tracking sediment or other pollutants onto sealed roads serving the development/site.

The trucks leaving the site will pass over a rumble strip which will shake mud of the wheels and undercarriage. The tracks will be stabilized to prevent muddy conditions and carting will not be undertaken when it is particularly wet and muddy.

10. Description of the measures to be used to rehabilitate the site, including timing schedules and maintenance programs.

The completed batters will be progressively revegetated with grass to rapidly stabilize the surface and trees to provide longer term stability.

Site Plan Section

A plan is to be attached to this document. Such a plan is to show the following information:

- North point and scale.
- Property boundaries.
- General soil description.
- The location and amount of ground to be disturbed.
- Description of the amount of soil (or other materials) to be taken from the site and the destination of that soil (or other materials)
- The contour of the site and indications of directions of fall prior to site disturbance.
- The location and type of all existing vegetation to be retained and removed.
- The location of structures to be used to divert runoff from the upslope areas around disturbed sites.
- The location and type of all proposed discharge points.
- The location and type of all proposed erosion and sediment management (control) measures to be used.
- The location of existing and future drainage patterns (ie if alterations occur).
- The location of all soil and other material stockpiles.
- The location of the site access, proposed roads, and other impervious areas (in this regard it is preferable that vehicular access be confined to one location only).
- The location of any on-site or adjoining site topographical features *(eg rivers, creeks, significant gullies etc.).

Signed:__  _____

Appendix D

Photos

GHD

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Document Status

Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
0	H.Poortenaar	B.Boon	On File	B.Boon	On File	3/02/11