An ORDINARY MEETING of LISMORE CITY COUNCIL will be held at the COUNCIL CHAMBERS

Tuesday, 14 December 2010 at 6.00pm.

Attachments Excluded From Agenda

7 December 2010

Attachments

Reports

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12.4 Lismore Tourist Caravan Park

Attachment 1: GHD Final Report – Lismore Tourist Caravan Park Evaluation of Works to Improve Evacuation Time

12.7 Lismore Development Control Plan - Amendment No. 9 Water Sensitive Design

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12.15 Policy 1.5.4 - Investment Policy Statement Review

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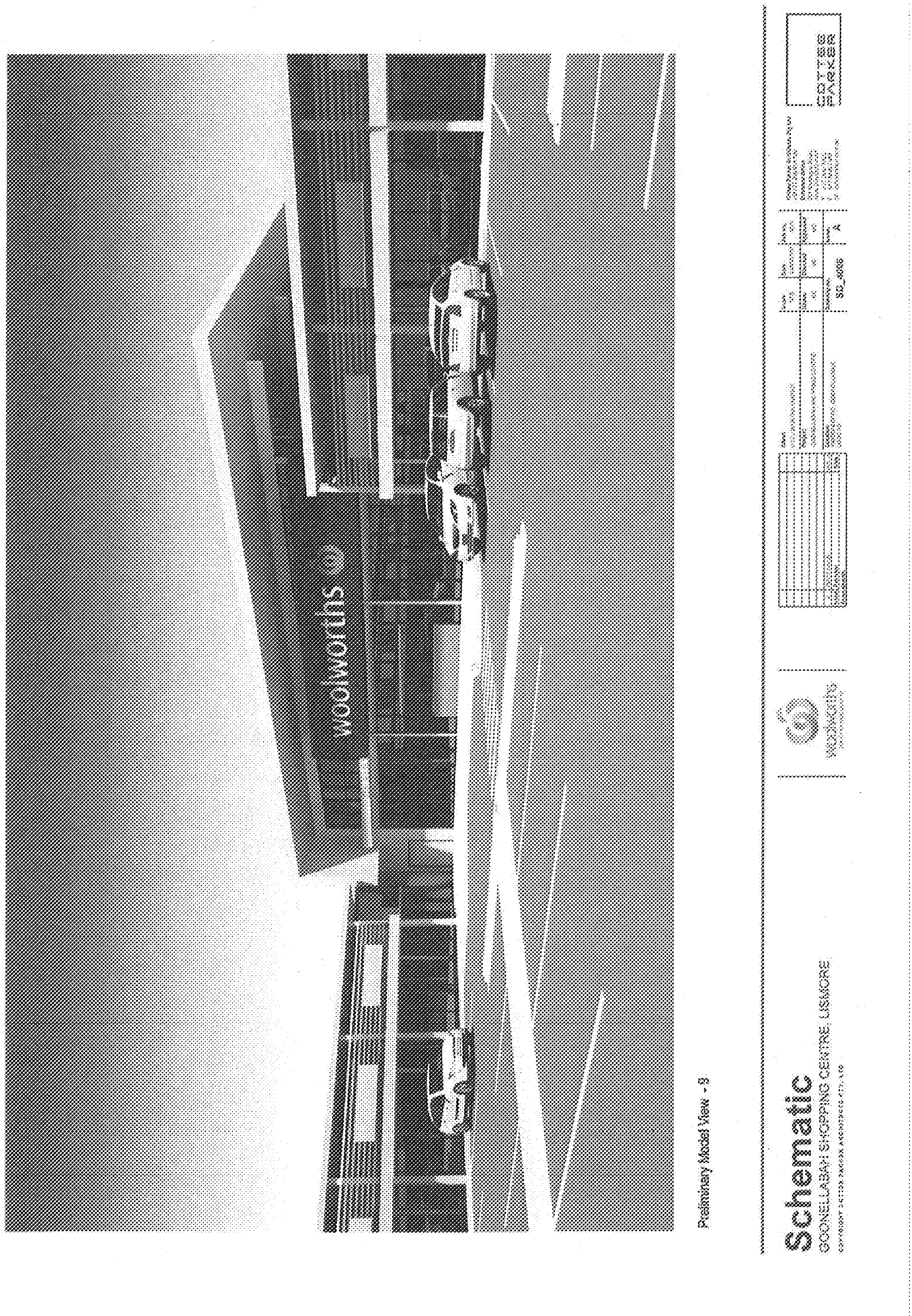
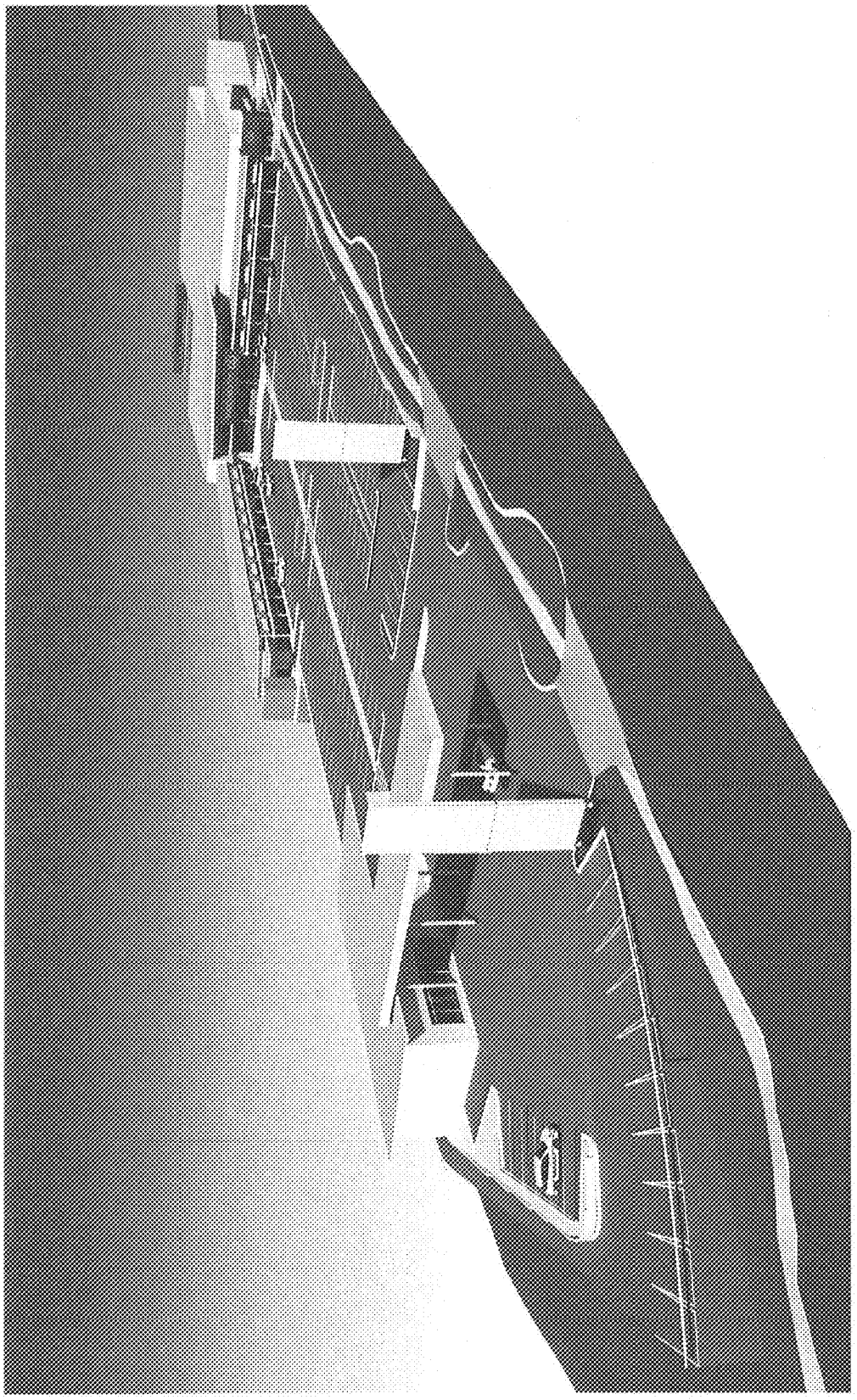

woolworths
Preliminary Model View - 9
Schematic
GOONELLABAH SHOPPING CENTRE, LISMORE
SD_4006
A
COTTEE PARKER



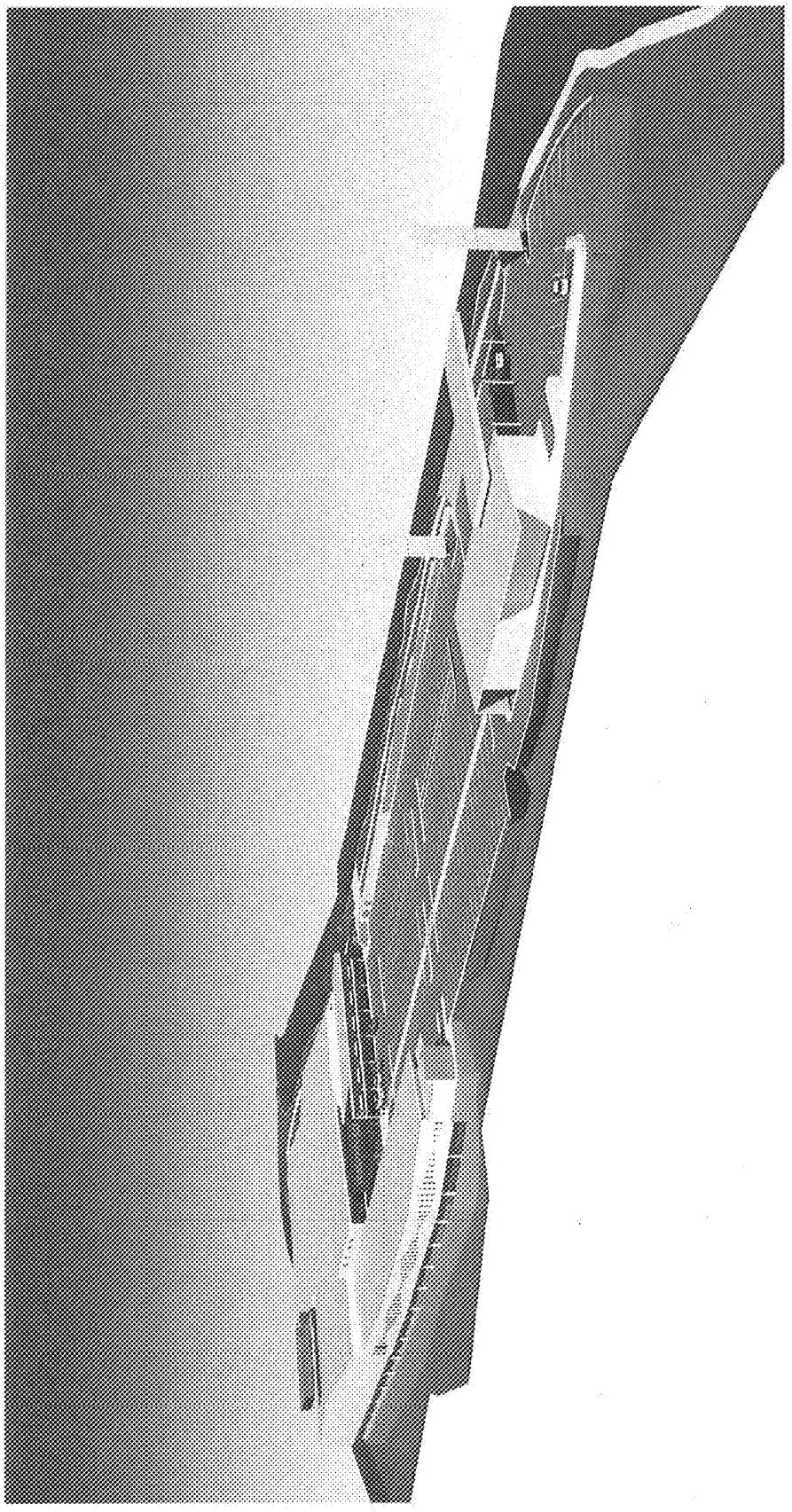
Preliminary Model View - 1

Schematic

GOONELLABAH SHOPPING CENTRE, LISMORE

WOOLWORTHS

COTTEE PARKER



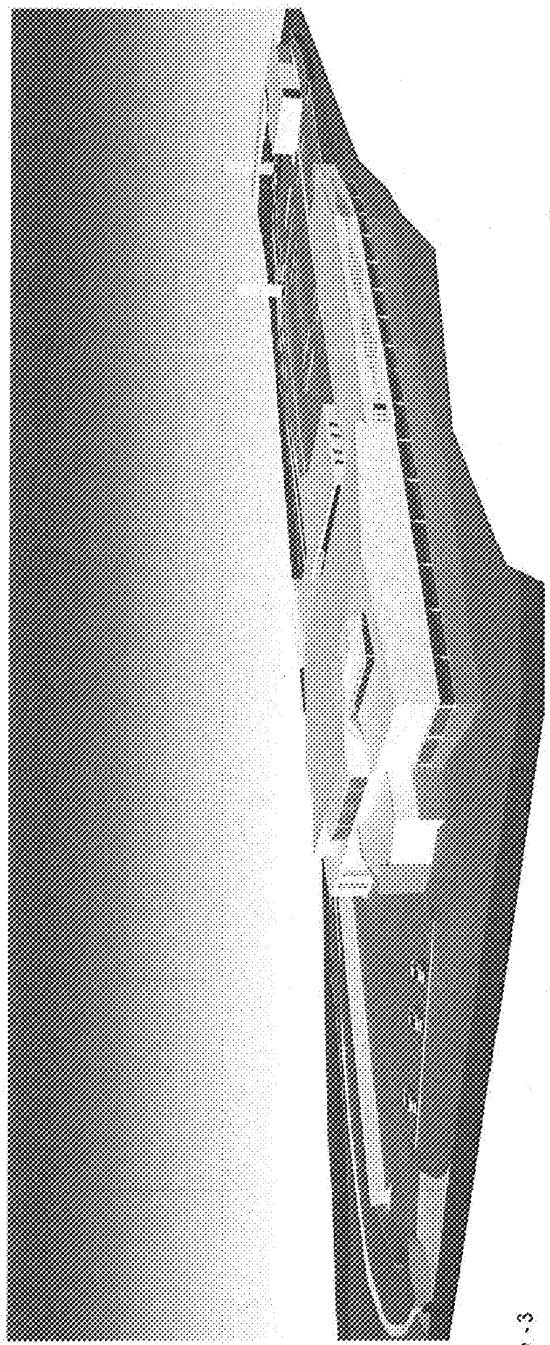
Preliminary Model View - 2

Schematic

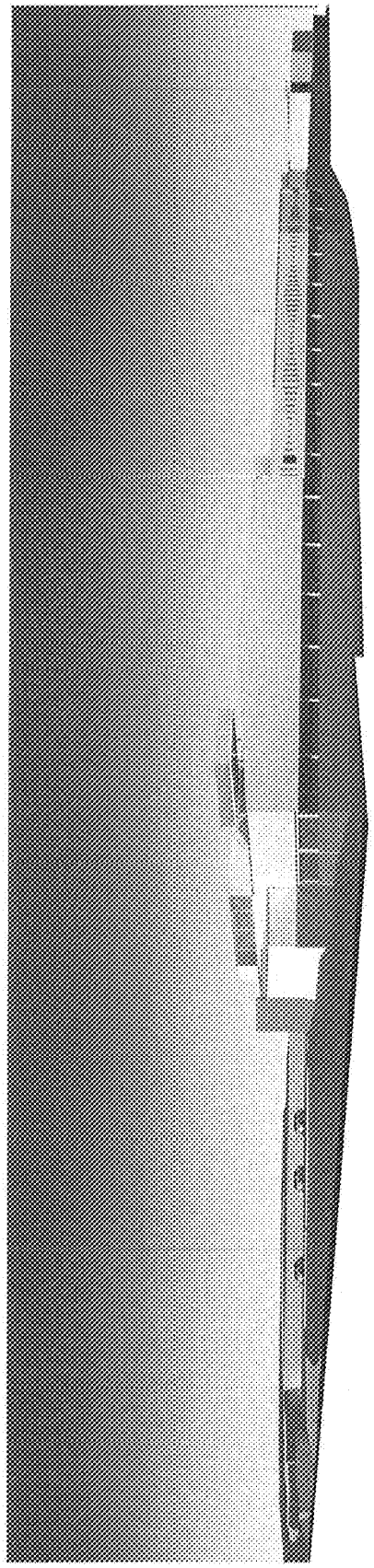
COONELLABAH SHOPPING CENTRE, LISMORE

WOOLWORTHS

COTTEE PARKER



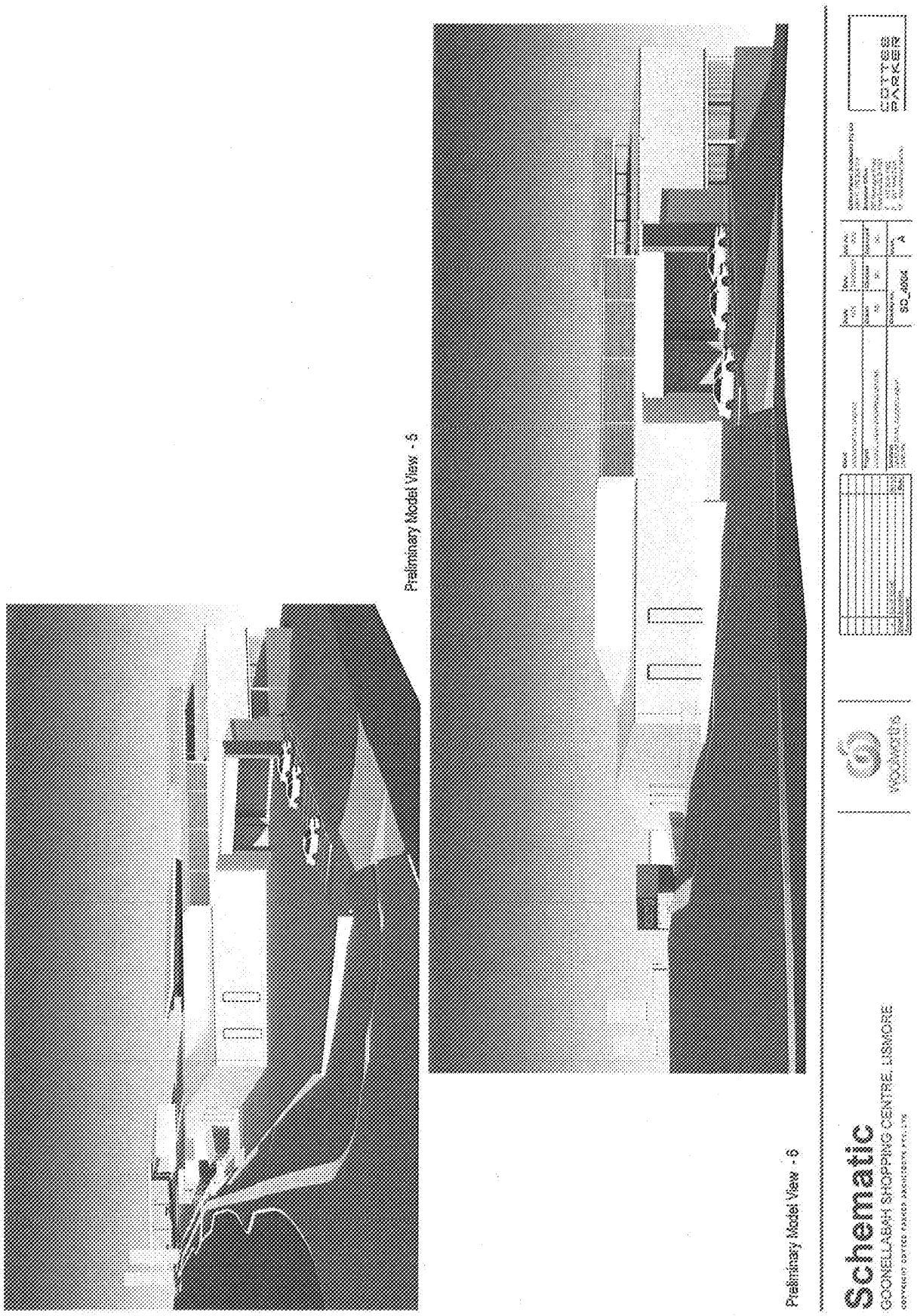
Preliminary Model View - 3

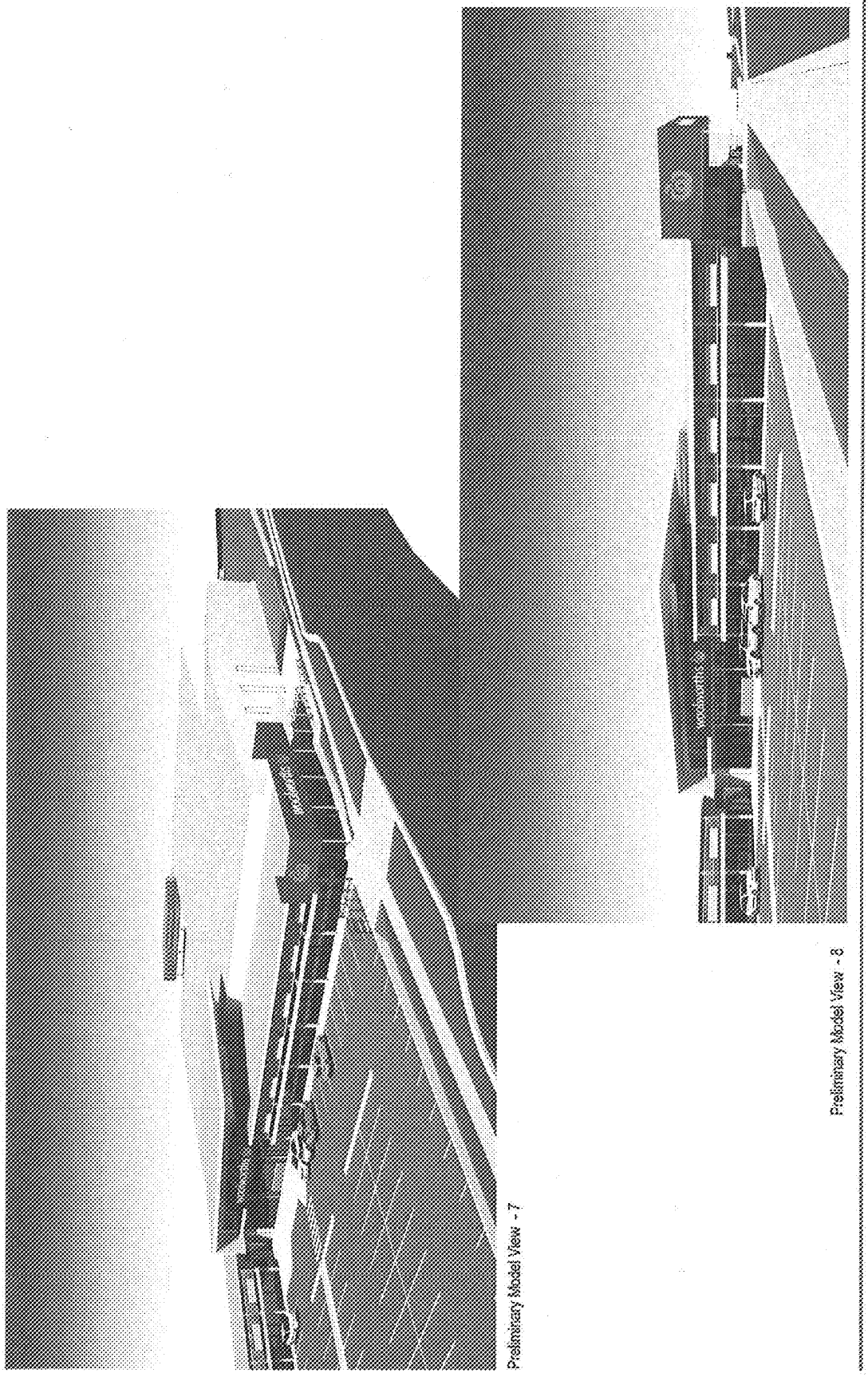


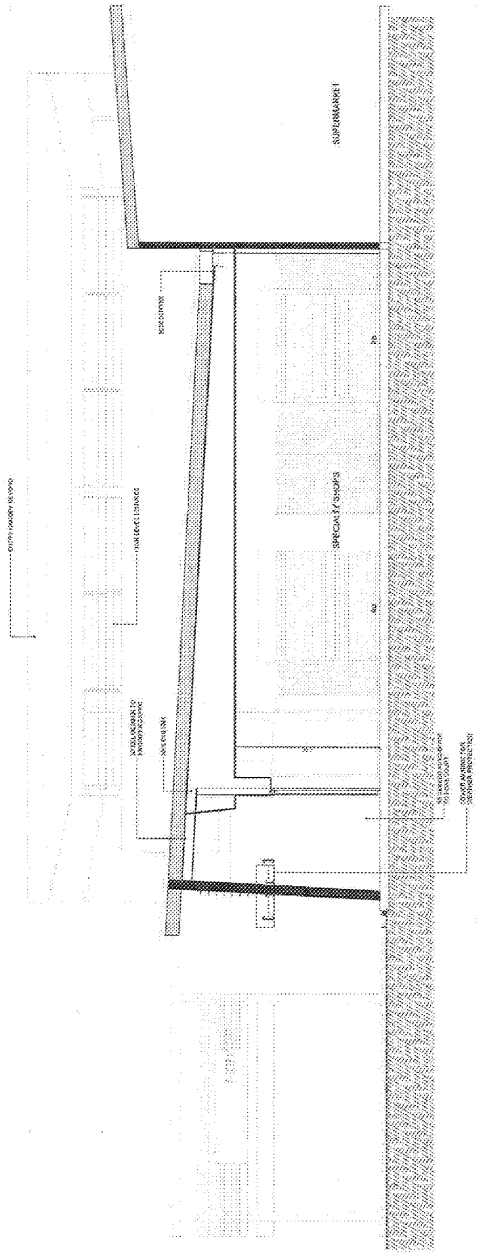
Preliminary Model View - 4

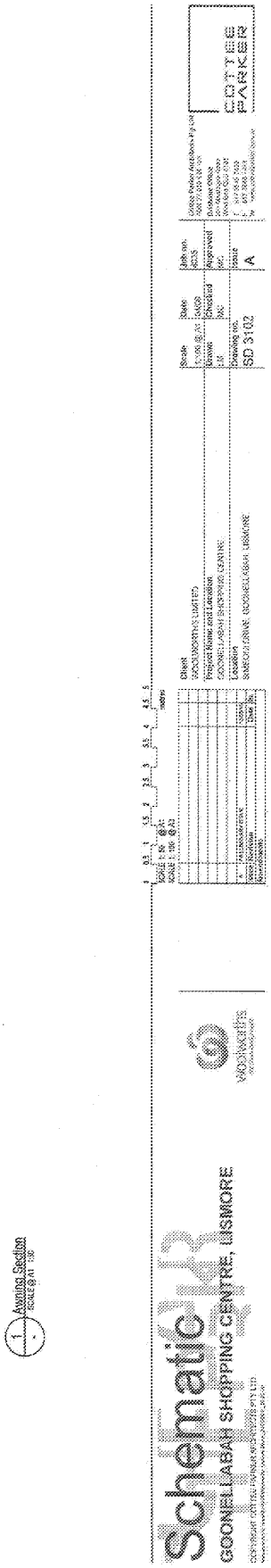
Schematic

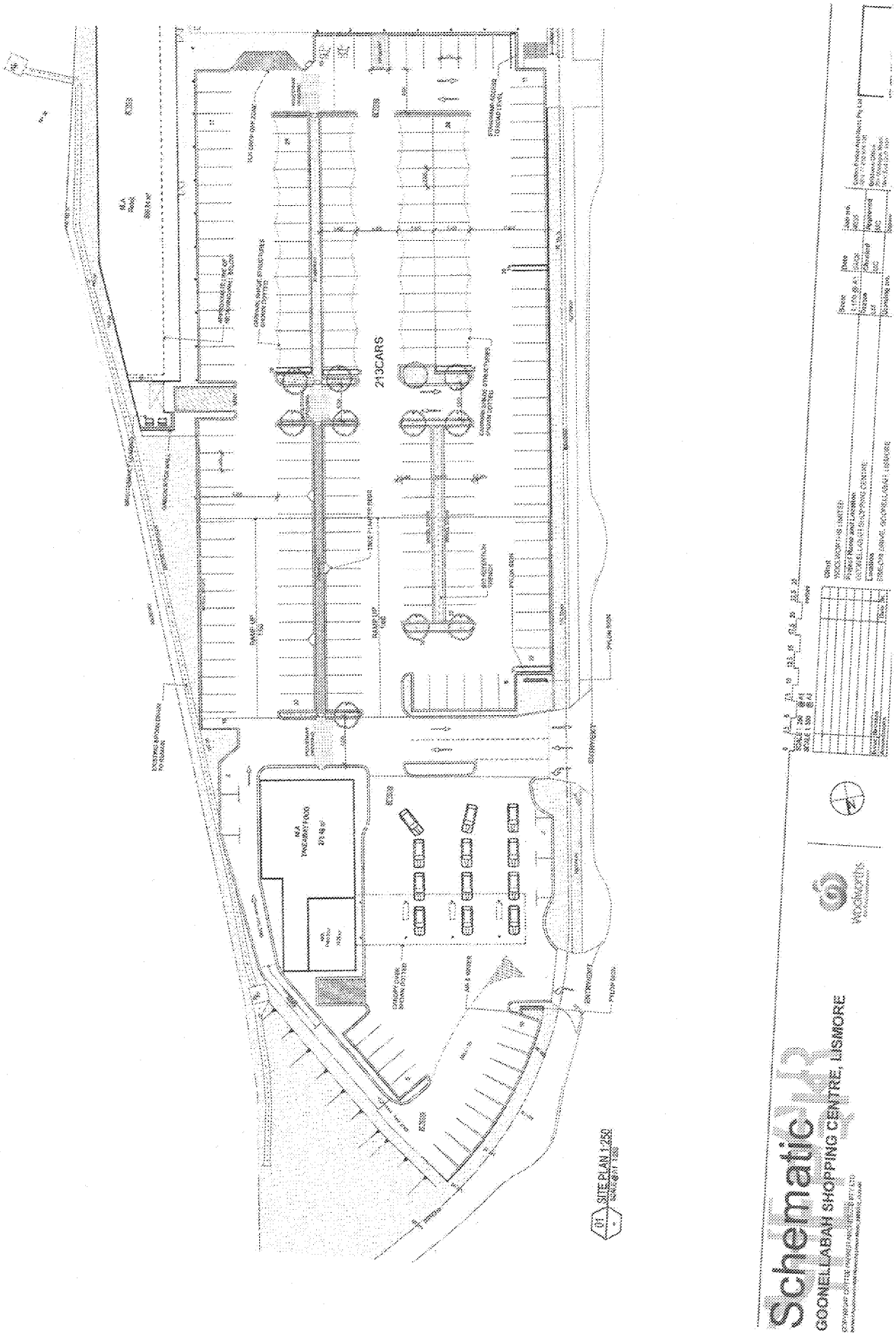
GOONELLABAH SHOPPING CENTRE, LISMORE

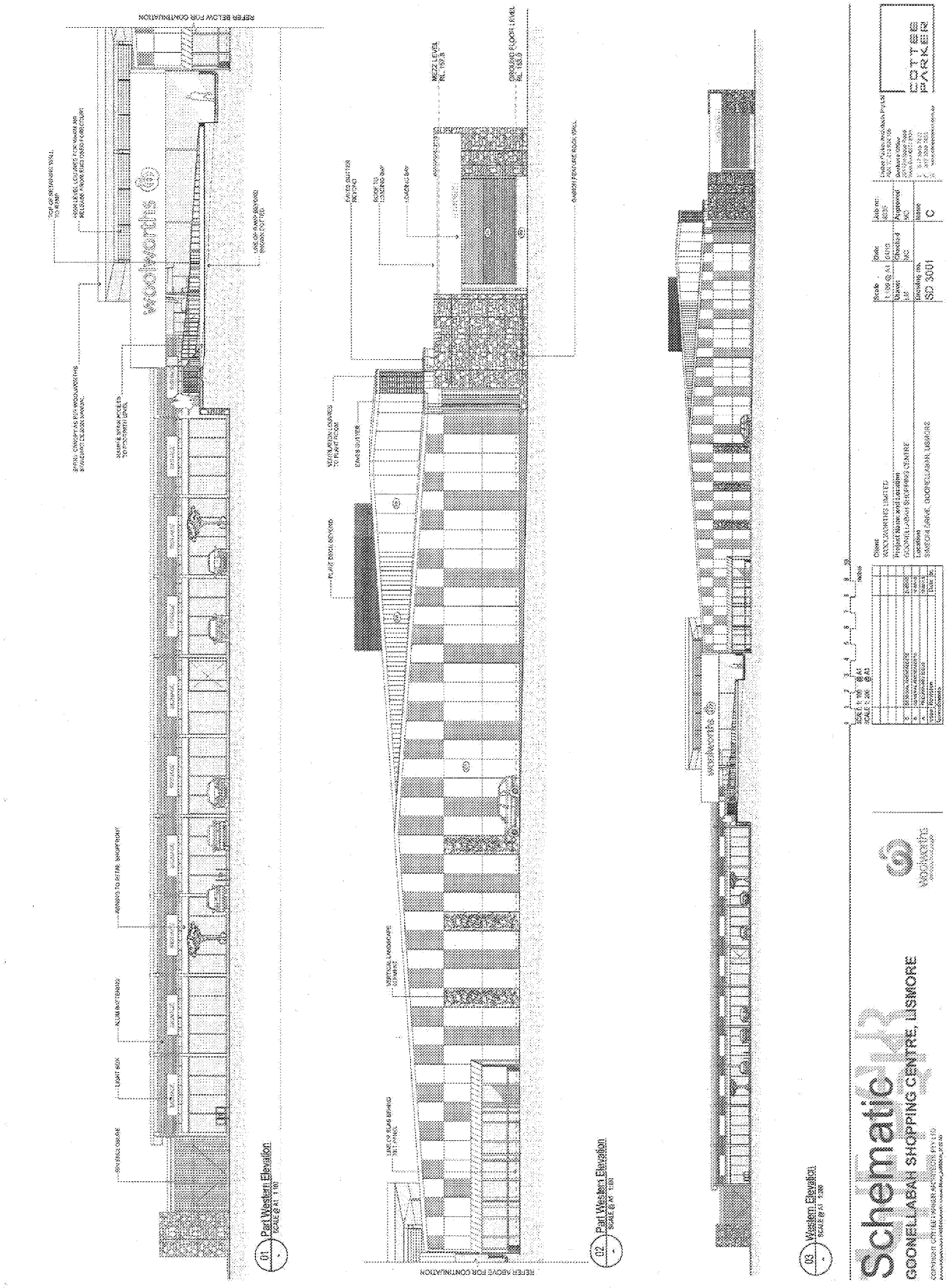

Preliminary Model Views - 5
Preliminary Model View - 6
Schematic
COONELLABAH SHOPPING CENTRE, LISMORE
COTTEE PARKER


Preliminary Model View - 7
Preliminary Model View - 8
Schematic
GOONELLABAH SHOPPING CENTRE, LISMORE
COTTEE PARKER




Schematic
GOONELLABAH SHOPPING CENTRE, LISMORE
COTTEE PARKER
SD 3102
A


213CARS
SITE PLAN 1:250
Schematic
GOONELLABAH SHOPPING CENTRE, LISMORE
Woolworths


Schematic
GOONELLABAH SHOPPING CENTRE, LISMORE
Woolworths
01 Part Western Elevation
02 Part Western Elevation
03 Western Elevation
SD 3001
C
COTTEE PARKER

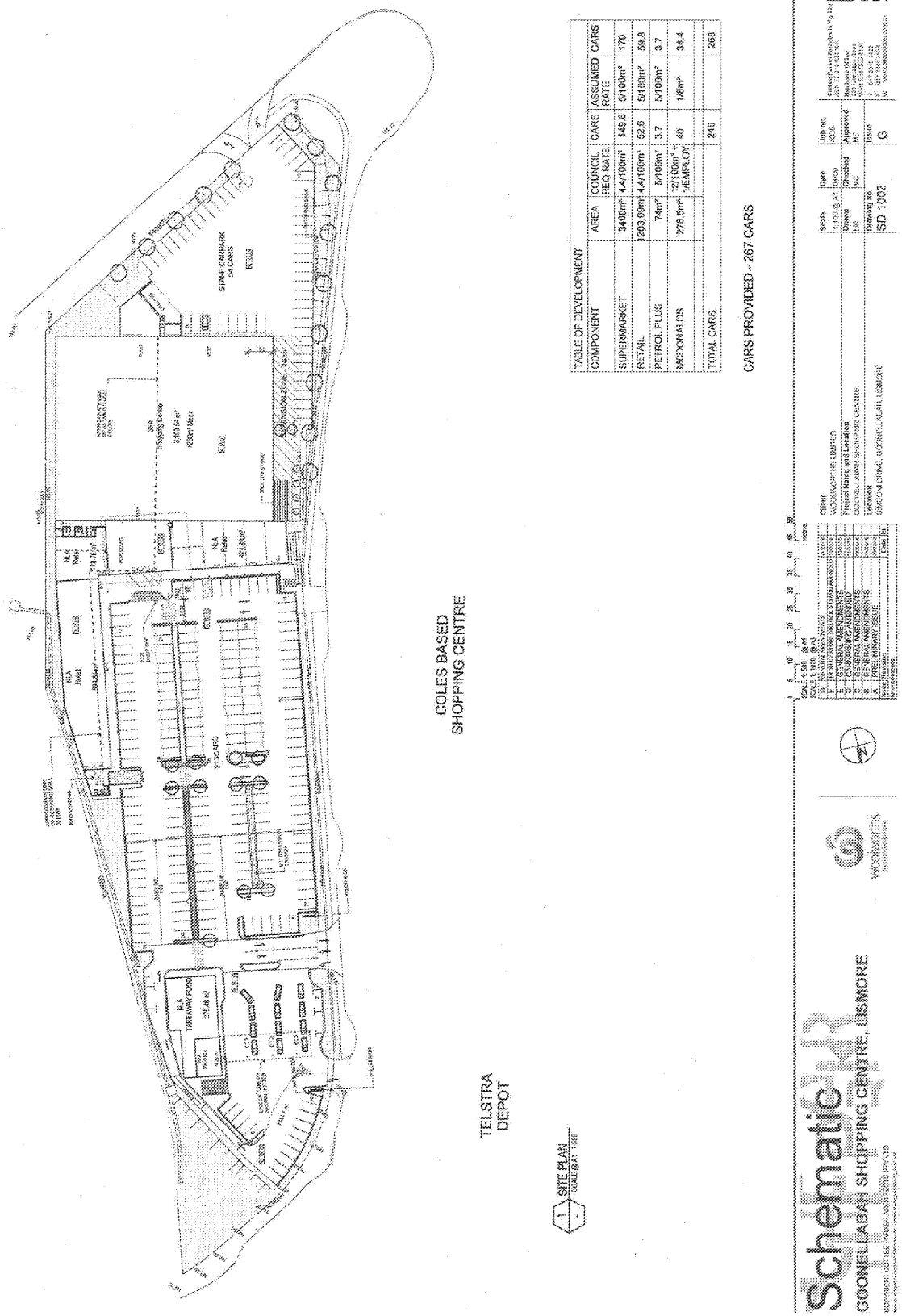
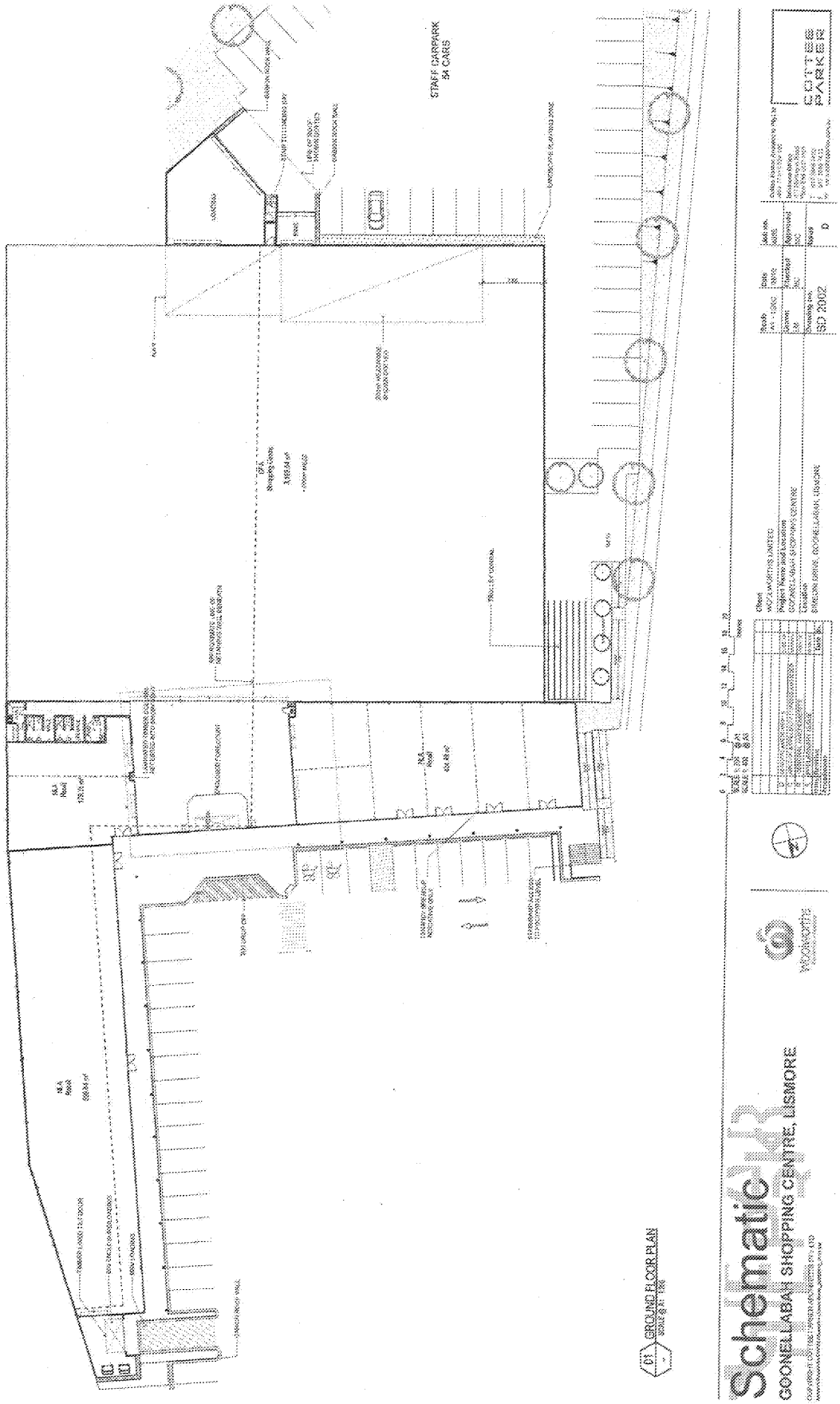
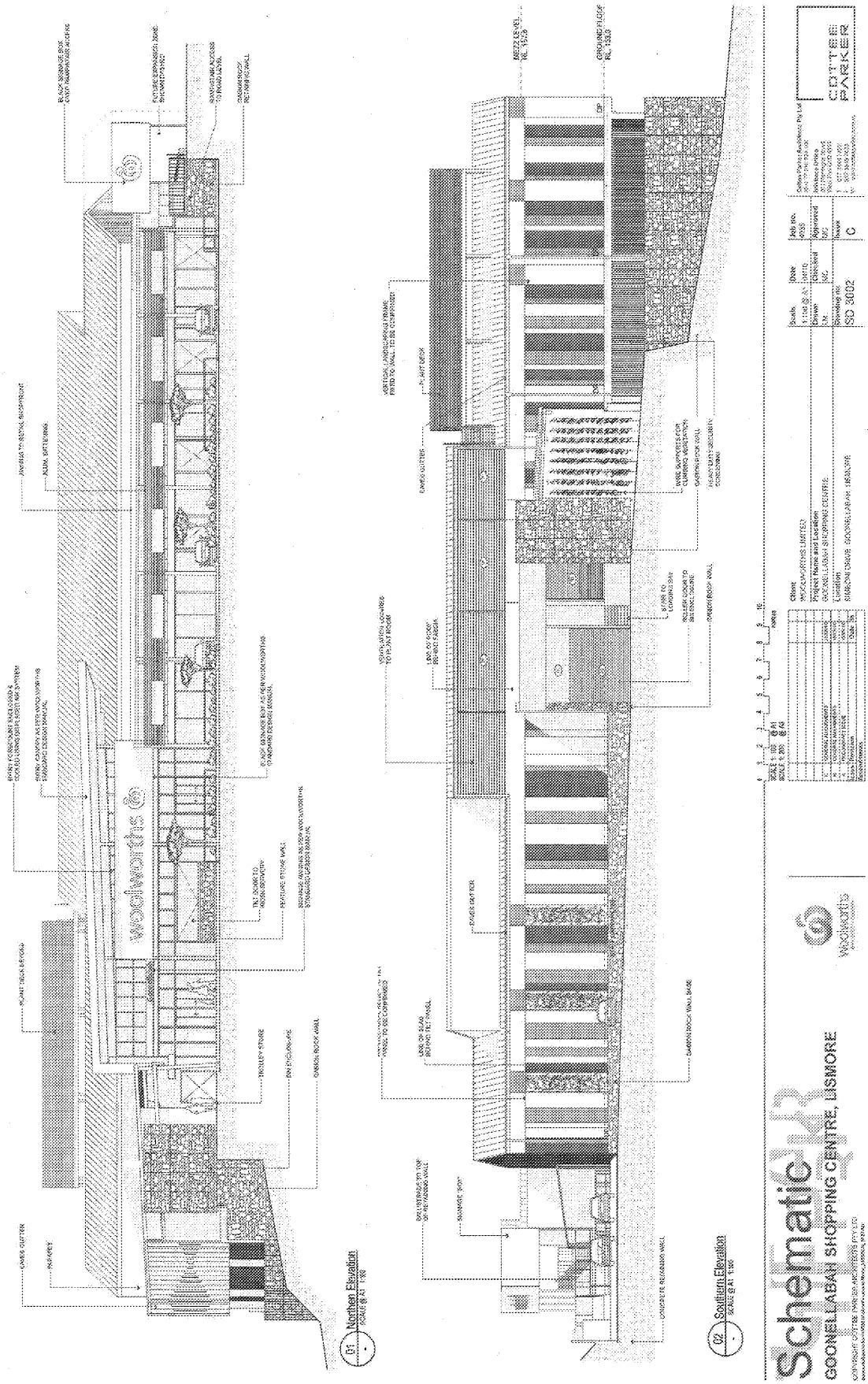


TABLE OF DEVELOPMENT				
COMPONENT	AREA	COUNCIL RES RATE	CARS	ASSUMED RATE	CARS
SUPERMARKET	3400m²	4.4/100m²	149.6	5/100m²	170
RETAIL	1693.09m²	4.4/100m²	62.6	5/100m²	59.8
PETROL PLUS	74m²	5/100m²	3.7	5/100m²	3.7
MCDONALDS	276.5m²	121/100m² + 40 EMPLOY	40	1/8m²	34.4
TOTAL CARS			246		268


STAFF CARPARK
54 CARS
GROUND FLOOR PLAN
Schematic
GOONELLABAH SHOPPING CENTRE, LISMORE
SD 2002


Woolworths
01 Northern Elevation
SCALE @ A1 1:100
02 Southern Elevation
SCALE @ A1 1:100
Schematic
GOONELLABAH SHOPPING CENTRE, LISMORE
COTTEE PARKER

Present: Manager Development & Compliance (P Jeuken) Chairperson
Coordinator Development Assessment (C Watts)
Development Assessment Officer (Planning) (S Thatcher)
Development Assessment Officer (Building) (G Lee)
Development Assessment Engineer (M Perkins)
Environmental Health Representative (M Kelly)
Manager Integrated Planning (S Denize)
Lismore Water representative (S Goodenough)
Community Services Coordinator (A McWilliam)
Manager Arts, Tourism & Leisure (W Adriaans)

In attendance: Secretary (S Strachan)

Apologies: Nil

Presentation Guests: Damian Chapelle
Matthew Caswell
Adrian Spencer
Melinda Plank
Mark Enerson
Peter Williams

Property: **LOT: 74 DP: 1149576**, 2 Simeoni Drive GOONELLABAH
Zone: **3(a) Business**

Brief Outline of Proposed Development provided by proponent:
D Chapelle provided an overview of the proposed Woolworths supermarket, retail shops, service station and restaurant and associated car parking, and M Caswell provided a detailed presentation on the main design elements of the proposal.

Meeting notes:

- Connectivity to adjoining developments is a design issue. Investigation is required to explore options to facilitate pedestrian access between GSAC to the east and existing shopping centre to the west. It is acknowledged that there are significant topography issues on the eastern boundary. The options considered should be discussed in the final DA submission to Council. Council would be prepared to consider works on GSAC land if a proposal is presented that provides desirable linkage.
- Council is wiling to assist integration of skate park area, however it is noted that NSW Police have advised the contrary.
- Social impacts of the proposal require careful consideration due to unique location, and local community composition within housing estates. Need for recognition of youth population and composition in locality and previous experience of Council. Hours of operation, and possibility of liquor outlets and fast food outlets lead to conclusion that a Social Impact Assessment should be undertaken to inform design and future use of the site and accompany the DA. Council staff are available to provide assistance and further advice in this regard.
- Will be referred to traffic committee. Car park and staff carpark will there be enough offset for cars to enter & exit without manoeuvring in front of access
- Pedestrian link should be provided to join with path from Simeoni Drive to takeaway food establishment and not go through the service station, and proposed staff carpark and pedestrian should have good connectivity to the front of the centre. Internal pedestrian crossing points need to be shown in a different manner. Continue footpath to north.

Pedestrian crossing on Oliver Ave needs consideration for potential conflict with entrance /exit point.

- Refer to clause in carparking DCP (landscaping) planting, taxi and bus facility requirements. Bus shelter in Simeoni Drive– sufficient room for pedestrian path?
- Loading area off Oliver Ave with no separation from car park - manoeuvring of trucks loading/unloading will impact on staff car park. Check grades for heavy vehicles and show service vehicle manoeuvres into loading dock and service station. Staff carpark vehicle lengths from entrance may be an issue. Bicycle parking needs to be provided.
- Adrian Spencer – will endeavour to meet carpark requirements and will have wider bays and would prefer to be short a few carparks but have it work and be safe
- Access - Demonstrate turning movements against through traffic – reconstruct median strip on Simeoni Drive to gain better manoeuvring. Potential conflict with opposite entrances – 4 way intersection is an issue for main entry and service station area. Provision of turning lanes to enable continuation of through traffic lanes. Access on Oliver Ave pedestrian refuge conflict with median construction. Question available width for turning manoeuvre and through lane.
- S.94 Levies in relation to service station/takeaway – based on traffic generation and Supermarket based commercial rates. Forecourt area to include kiosk (alfresco dining) in proposal and should consider including in car parking calculation to enable flexibility of future use.
- Melinda Plank - Carparking rates – parking bays at a bowsers to be included??? Mike Perkins suggested Council would not include them in the car parking count.
- Melinda Plank - Are there any upgrades proposed for Simeoni Drive in the future? Mike Perkins - Simeoni/Oliver there is a proposal to undertake works approaching the roundabout on Oliver Ave.
- Stormwater – incorporating into existing flow and to be subject to concept plan lodged with DA.
- Signage details to be included in DA documentation.
- Perspectives would be useful with the DA to show presentation to Oliver Ave and approaches to development,
- Energy efficiency measures – stormwater quality
- Water & sewer is available to the site with minimal extension. Two connection points to service site will be okay.
- Hours of operation require consideration in finalising DA proposal due to potential social and noise impacts
- Existing easements need to be addressed in DA proposals.
- Estimated cost not advised, so unable to advise if matter is to be determined by Council or JRPP

Summary Information

Advertising / Notification required: Yes
Planning Constraints:

- **Heritage Item:** No
- **Flood** – No
- **Section 64 contributions**
- **Section 94 contributions**
- **Tree preservation order**

Relevant Planning Controls:
SEPPs

- *SEPP Infrastructure 2007 – referral to RTA req'd*
- *SEPP 55 – Contaminated Land*

REPs

- *North Coast REP*

LEP

- **LEP** - permissible with development consent

DCPs

Part A

- Chapter 7 – Off street parking
- Chapter 9 - Outdoor advertising structures
- Chapter 13 - CPTED
- Chapter 15 – Waste Minimisation

Staff Comments (additional to those discussed at meeting):

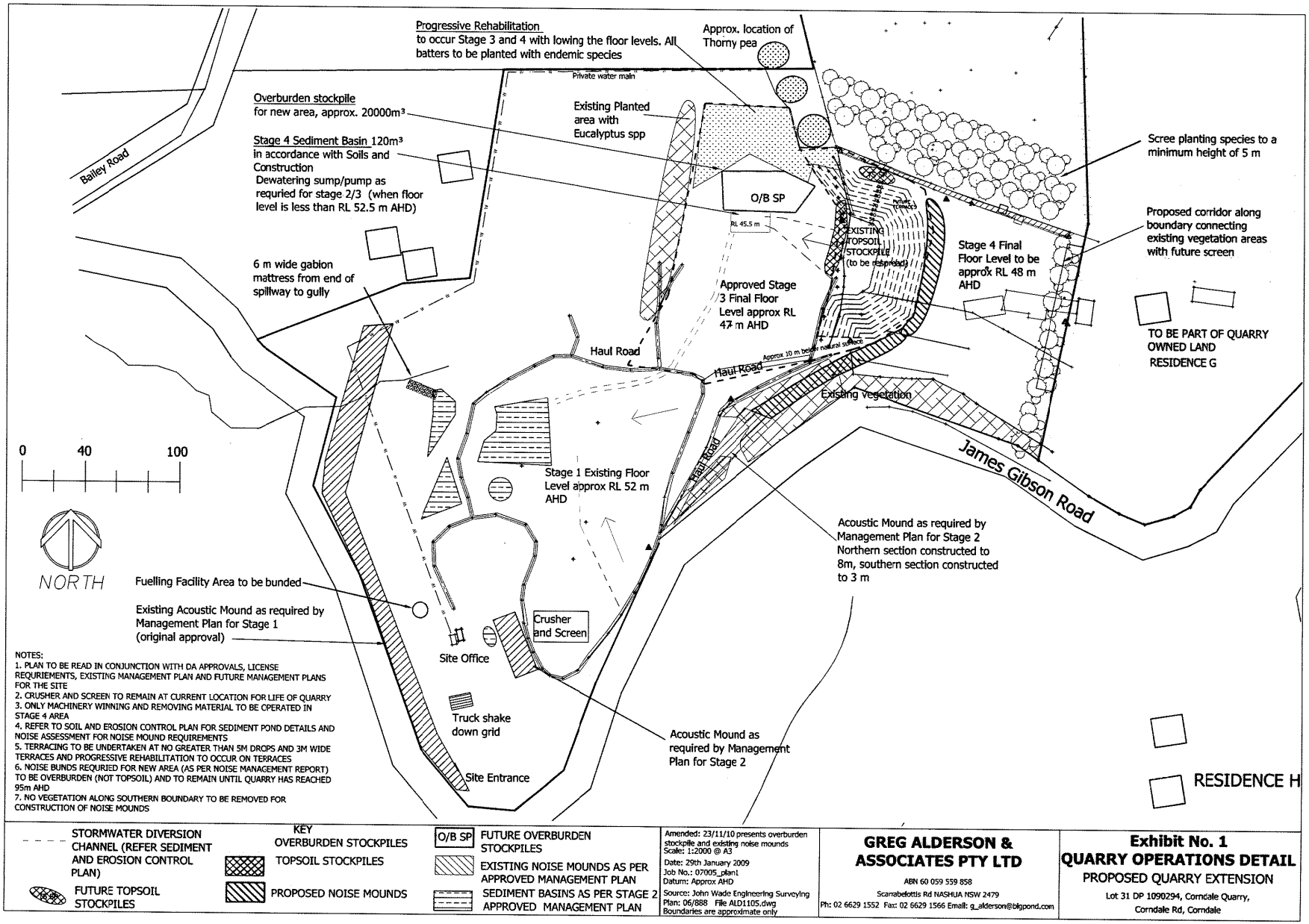
- Would like to encourage Woolworths to consider solar power options for the development. We have an excellent sustainability officer, Kim Graham who is doing great things with helping people set up solar arrays. Council is taking advantage of various State and Federal initiatives on a number of its buildings and we are looking at an approx 18% ROI with reticulation back into the grid.
- Offer to look at opportunities around brand support in the media particularly relating to issues concerning working with the indigenous community and youth. Annie McWilliam, Community Services Coordinator is very keen to work with you in this regard and she did mention that Woolworths has a 'social well being' group. So there seems to be plenty of scope to get Woolworths positively engaged with our local indigenous community and youth.

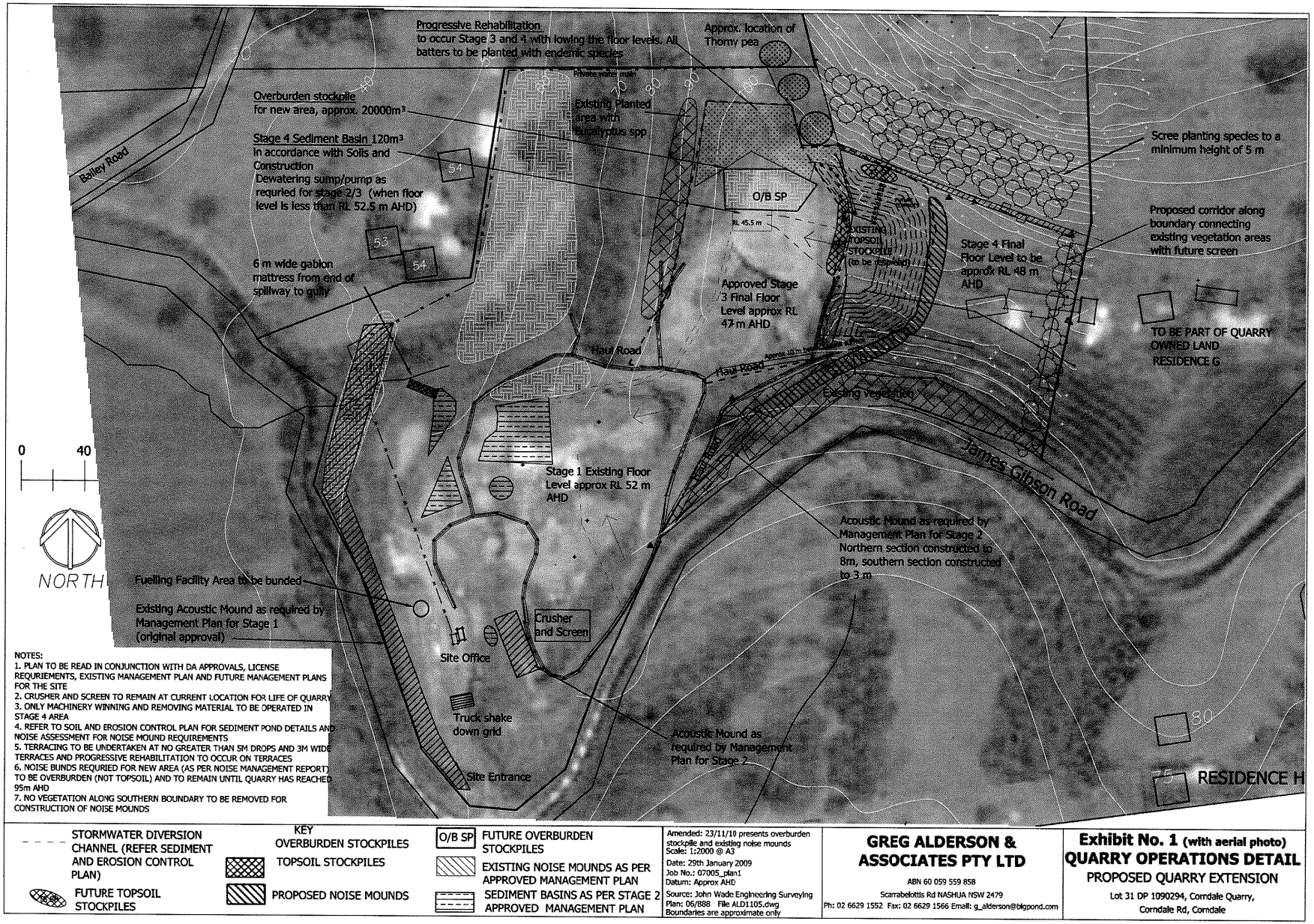
Studies Required / Information to be provided with Development Application:

- Flora & Fauna assessment in SEE
- Landscaping plans
- Aboriginal Cultural Heritage Assessment
- Noise Impact Assessment
- Traffic Impact Assessment
- Stormwater concept plan – disposal and quality
- Water & Sewer concept
- Preliminary Assessment for SEPP 55 – Contaminated Lands
- Demonstrate compliance with DECC req. and Reg's in relation to fuel storage and ongoing environmental management
- Waste management plan
- Perspectives

Information to be provided to applicant:

- Any details on Aboriginal Cultural heritage Assessment for adjoining GSAC development.


Progressive Rehabilitation
to occur Stage 3 and 4 with lowing the floor levels. All batters to be planted with endemic species
Approx. location of Thorny pea
Private water main
Overburden stockpile
for new area, approx. 20000m³
Existing Planted area with Eucalyptus spp
Stage 4 Sediment Basin 120m³
in accordance with Soils and Construction
Dewatering sump/pump as requried for stage 2/3 (when floor level is less than RL 52.5 m AHD)
Bailey Road
O/B SP
RL 45.5 m
Scree planting species to a minimum height of 5 m
Proposed corridor along boundary connecting existing vegetation areas with future screen
EXISTING TOPSOIL STOCKPILE (to be respread)
Stage 4 Final Floor Level to be approx RL 48 m AHD
6 m wide gabion mattress from end of spillway to gully
Approved Stage 3 Final Floor Level approx RL 47 m AHD
TO BE PART OF QUARRY OWNED LAND
RESIDENCE G
Haul Road
Approx 10 m below natural surface
Haul Road
Existing vegetation
0
40
100
Stage 1 Existing Floor Level approx RL 52 m AHD
James Gibson Road
Haul Road
Acoustic Mound as required by Management Plan for Stage 2 Northern section constructed to 8m, southern section constructed to 3 m
NORTH
Fuelling Facility Area to be bunded
Existing Acoustic Mound as required by Management Plan for Stage 1 (original approval)
Crusher and Screen
Site Office
Truck shake down grid
Acoustic Mound as required by Management Plan for Stage 2
Site Entrance
RESIDENCE H
NOTES:
1. PLAN TO BE READ IN CONJUNCTION WITH DA APPROVALS, LICENSE REQUIREMENTS, EXISTING MANAGEMENT PLAN AND FUTURE MANAGEMENT PLANS FOR THE SITE
2. CRUSHER AND SCREEN TO REMAIN AT CURRENT LOCATION FOR LIFE OF QUARRY
3. ONLY MACHINERY WINNING AND REMOVING MATERIAL TO BE OPERATED IN STAGE 4 AREA
4. REFER TO SOIL AND EROSION CONTROL PLAN FOR SEDIMENT POND DETAILS AND NOISE ASSESSMENT FOR NOISE MOUND REQUIREMENTS
5. TERRACING TO BE UNDERTAKEN AT NO GREATER THAN 5M DROPS AND 3M WIDE TERRACES AND PROGRESSIVE REHABILITATION TO OCCUR ON TERRACES
6. NOISE BUNDS REQURIED FOR NEW AREA (AS PER NOISE MANAGEMENT REPORT) TO BE OVERBURDEN (NOT TOPSOIL) AND TO REMAIN UNTIL QUARRY HAS REACHED 95m AHD
7. NO VEGETATION ALONG SOUTHERN BOUNDARY TO BE REMOVED FOR CONSTRUCTION OF NOISE MOUNDS
KEY
STORMWATER DIVERSION CHANNEL (REFER SEDIMENT AND EROSION CONTROL PLAN)
FUTURE TOPSOIL STOCKPILES
OVERBURDEN STOCKPILES
TOPSOIL STOCKPILES
PROPOSED NOISE MOUNDS
O/B SP
FUTURE OVERBURDEN STOCKPILES
EXISTING NOISE MOUNDS AS PER APPROVED MANAGEMENT PLAN
SEDIMENT BASINS AS PER STAGE 2 APPROVED MANAGEMENT PLAN
Amended: 23/11/10 presents overburden stockpile and existing noise mounds
Scale: 1:2000 @ A3
Date: 29th January 2009
Job No.: 07005_plan1
Datum: Approx AHD
Source: John Wade Engineering Surveying Plan: 06/888 File ALD1105.dwg
Boundaries are approximate only
GREG ALDERSON & ASSOCIATES PTY LTD
ABN 60 059 559 858
Scarrabelottis Rd NASHUA NSW 2479
Ph: 02 6629 1552 Fax: 02 6629 1566 Email: g_alderson@bigpond.com
Exhibit No. 1
QUARRY OPERATIONS DETAIL
PROPOSED QUARRY EXTENSION
Lot 31 DP 1090294, Corndale Quarry, Corndale Rd, Corndale


Progressive Rehabilitation to occur Stage 3 and 4 with lowing the floor levels. All batters to be planted with endemic species
Approx. location of Thorny pea
Overburden stockpile for new area, approx. 20000m³
Existing Planted area with Eucalyptus spp
Stage 4 Sediment Basin 120m³ in accordance with Soils and Construction
Dewatering sump/pump as requried for stage 2/3 (when floor level is less than RL 52.5 m AHD)
Bailey Road
Scree planting species to a minimum height of 5 m
O/B SP
RL 45.5 m
Proposed corridor along boundary connecting existing vegetation areas with future screen
6 m wide gabion mattress from end of spillway to gully
Stage 4 Final Floor Level to be approx RL 48 m AHD
Approved Stage 3 Final Floor Level approx RL 47 m AHD
TO BE PART OF QUARRY OWNED LAND
RESIDENCE G
Haul Road
Existing vegetation
James Gibson Road
Stage 1 Existing Floor Level approx RL 52 m AHD
Acoustic Mound as required by Management Plan for Stage 2 Northern section constructed to 8m, southern section constructed to 3 m
0
40
NORTH
Fuelling Facility Area to be bunded
Existing Acoustic Mound as required by Management Plan for Stage 1 (original approval)
Crusher and Screen
Site Office
Truck shake down grid
Site Entrance
Acoustic Mound as required by Management Plan for Stage 2
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5. TERRACING TO BE UNDERTAKEN AT NO GREATER THAN 5M DROPS AND 3M WIDE TERRACES AND PROGRESSIVE REHABILITATION TO OCCUR ON TERRACES
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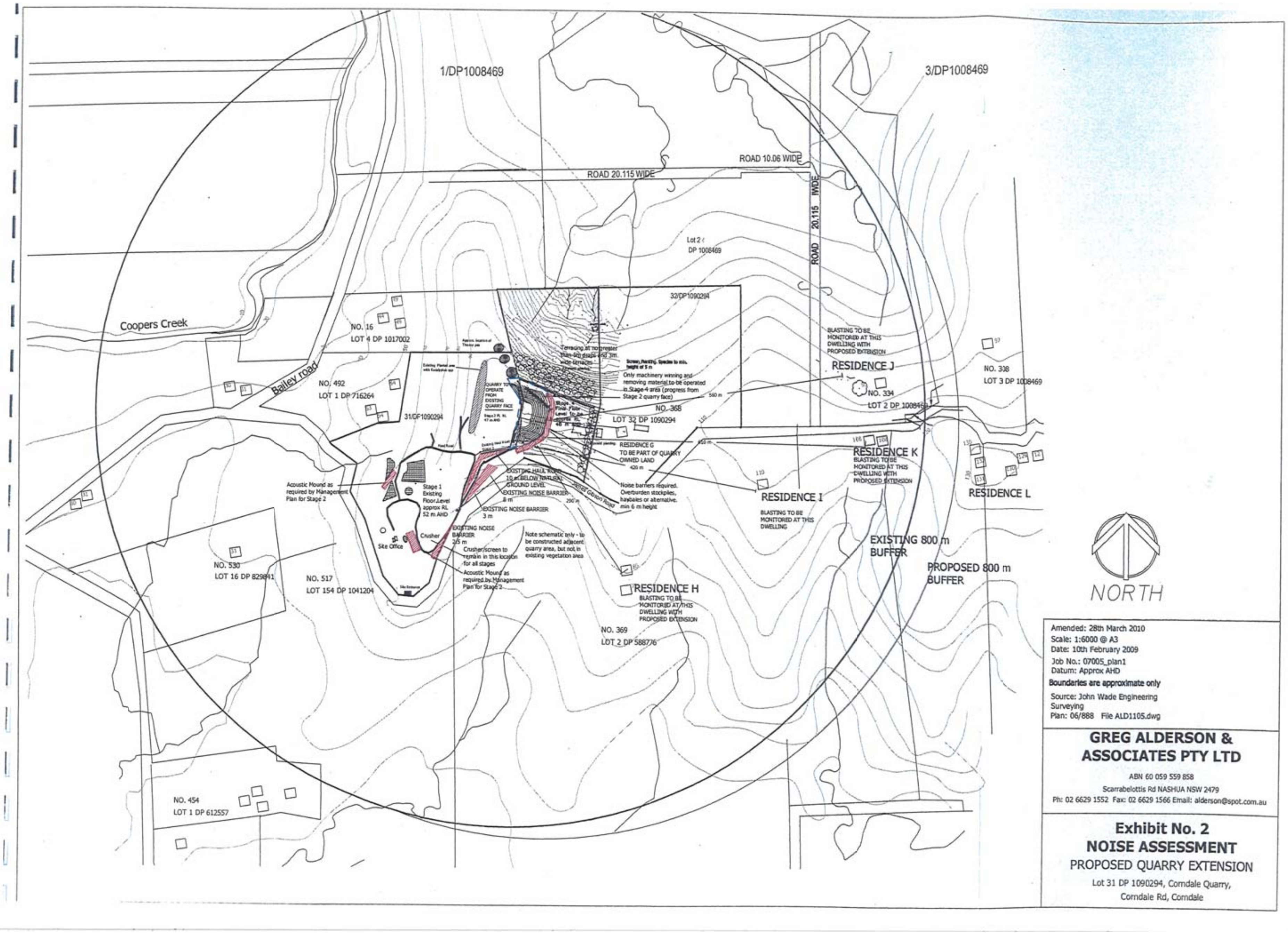
7. NO VEGETATION ALONG SOUTHERN BOUNDARY TO BE REMOVED FOR CONSTRUCTION OF NOISE MOUNDS
KEY
STORMWATER DIVERSION CHANNEL (REFER SEDIMENT AND EROSION CONTROL PLAN)
FUTURE TOPSOIL STOCKPILES
OVERBURDEN STOCKPILES
TOPSOIL STOCKPILES
PROPOSED NOISE MOUNDS
O/B SP FUTURE OVERBURDEN STOCKPILES
EXISTING NOISE MOUNDS AS PER APPROVED MANAGEMENT PLAN
SEDIMENT BASINS AS PER STAGE 2 APPROVED MANAGEMENT PLAN
Amended: 23/11/10 presents overburden stockpile and existing noise mounds
Scale: 1:2000 @ A3
Date: 29th January 2009
Job No.: 07005_plan1
Datum: Approx AHD
Source: John Wade Engineering Surveying
Plan: 06/888 File ALD1105.dwg
Boundaries are approximate only
GREG ALDERSON & ASSOCIATES PTY LTD
ABN 60 059 559 858
Scarrabelottis Rd NASHUA NSW 2479
Ph: 02 6629 1552 Fax: 02 6629 1566 Email: g_alderson@bigpond.com
Exhibit No. 1 (with aerial photo)
QUARRY OPERATIONS DETAIL
PROPOSED QUARRY EXTENSION
Lot 31 DP 1090294, Corndale Quarry, Corndale Rd, Corndale


1/DP1008469
3/DP1008469
ROAD 10.06 WIDE
ROAD 20.115 WIDE
ROAD 20.115 WIDE
Lot 2
DP 1008469
32/DP1090294
Coopers Creek
Bailey road
NO. 16
LOT 4 DP 1017002
NO. 492
LOT 1 DP 716264
31/DP1090294
NO. 368
LOT 32 DP 1090294
RESIDENCE G
TO BE PART OF QUARRY
OWNED LAND
BLASTING TO BE
MONITORED AT THIS
DWELLING WITH
PROPOSED EXTENSION
RESIDENCE J
NO. 308
LOT 3 DP 1008469
NO. 334
LOT 2 DP 1008469
RESIDENCE K
RESIDENCE L
RESIDENCE I
BLASTING TO BE
MONITORED AT THIS
DWELLING
Acoustic Mound as
required by Management
Plan for Stage 2
Stage 1
Existing
Floor Level
approx RL
52 m AHD
EXISTING HAUL ROAD
EXISTING NOISE BARRIER
EXISTING NOISE BARRIER
3 m
Crusher
Site Office
Crusher/screen to
remain in this location
for all stages
Acoustic Mound as
required by Management
Plan for Stage 2
Note schematic only - to
be constructed adjacent
quarry area, but not in
existing vegetation area
Noise barriers required.
Overburden stockpiles,
haybales or alternative,
min 6 m height
Only machinery winning and
removing material to be operated
in Stage 4 area (progress from
Stage 2 quarry face)
EXISTING 800 m
BUFFER
PROPOSED 800 m
BUFFER
NO. 530
LOT 16 DP 829841
NO. 517
LOT 154 DP 1041204
RESIDENCE H
BLASTING TO BE
MONITORED AT THIS
DWELLING WITH
PROPOSED EXTENSION
NO. 369
LOT 2 DP 588776
NO. 454
LOT 1 DP 612557
NORTH
Amended: 28th March 2010
Scale: 1:6000 @ A3
Date: 10th February 2009
Job No.: 07005_plan1
Datum: Approx AHD
Boundaries are approximate only
Source: John Wade Engineering
Surveying
Plan: 06/888 File ALD1105.dwg
GREG ALDERSON &
ASSOCIATES PTY LTD
ABN 60 059 559 858
Scarrabelottis Rd NASHUA NSW 2479
Ph: 02 6629 1552 Fax: 02 6629 1566 Email: alderson@spot.com.au
Exhibit No. 2
NOISE ASSESSMENT
PROPOSED QUARRY EXTENSION
Lot 31 DP 1090294, Corndale Quarry,
Corndale Rd, Corndale

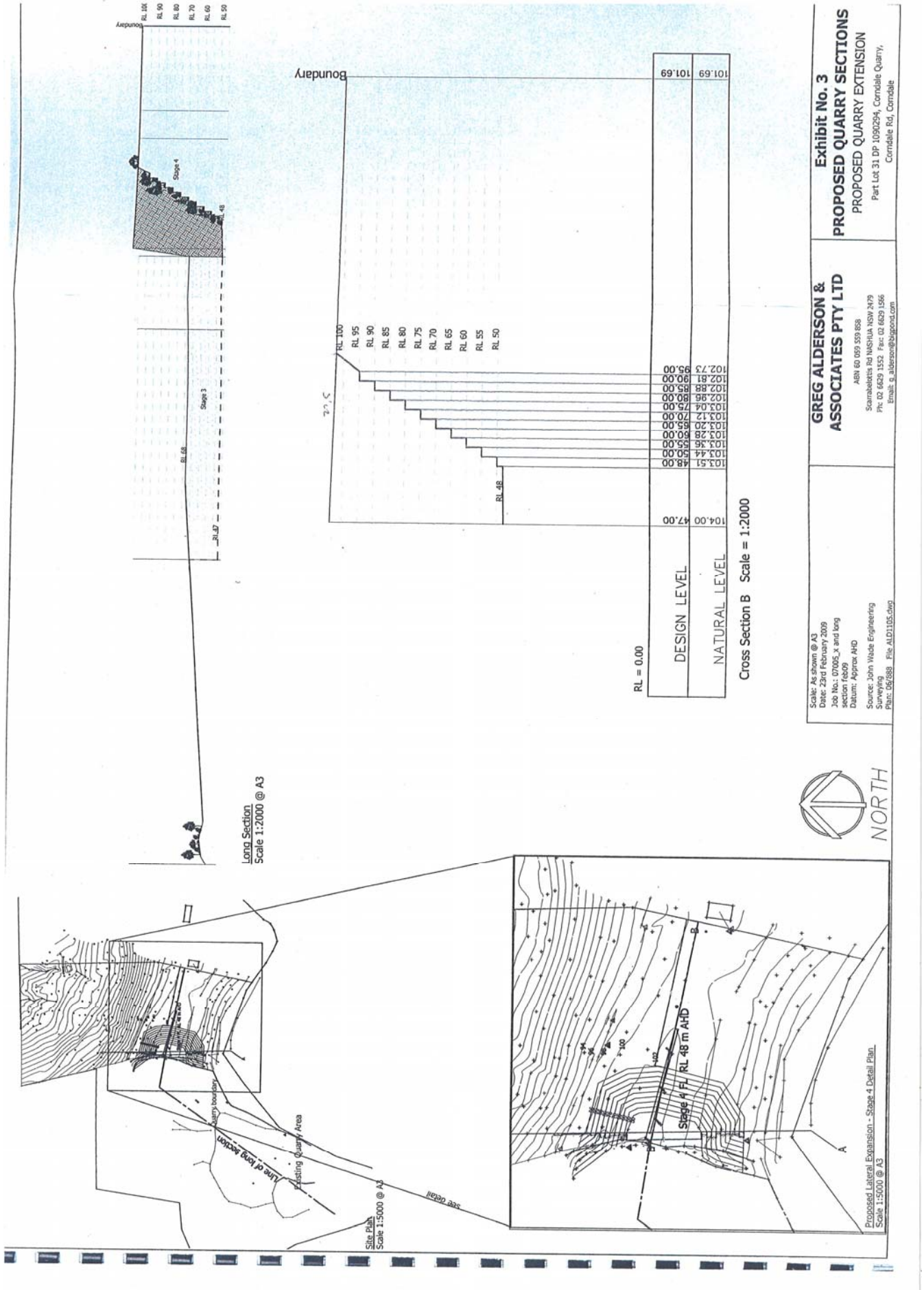
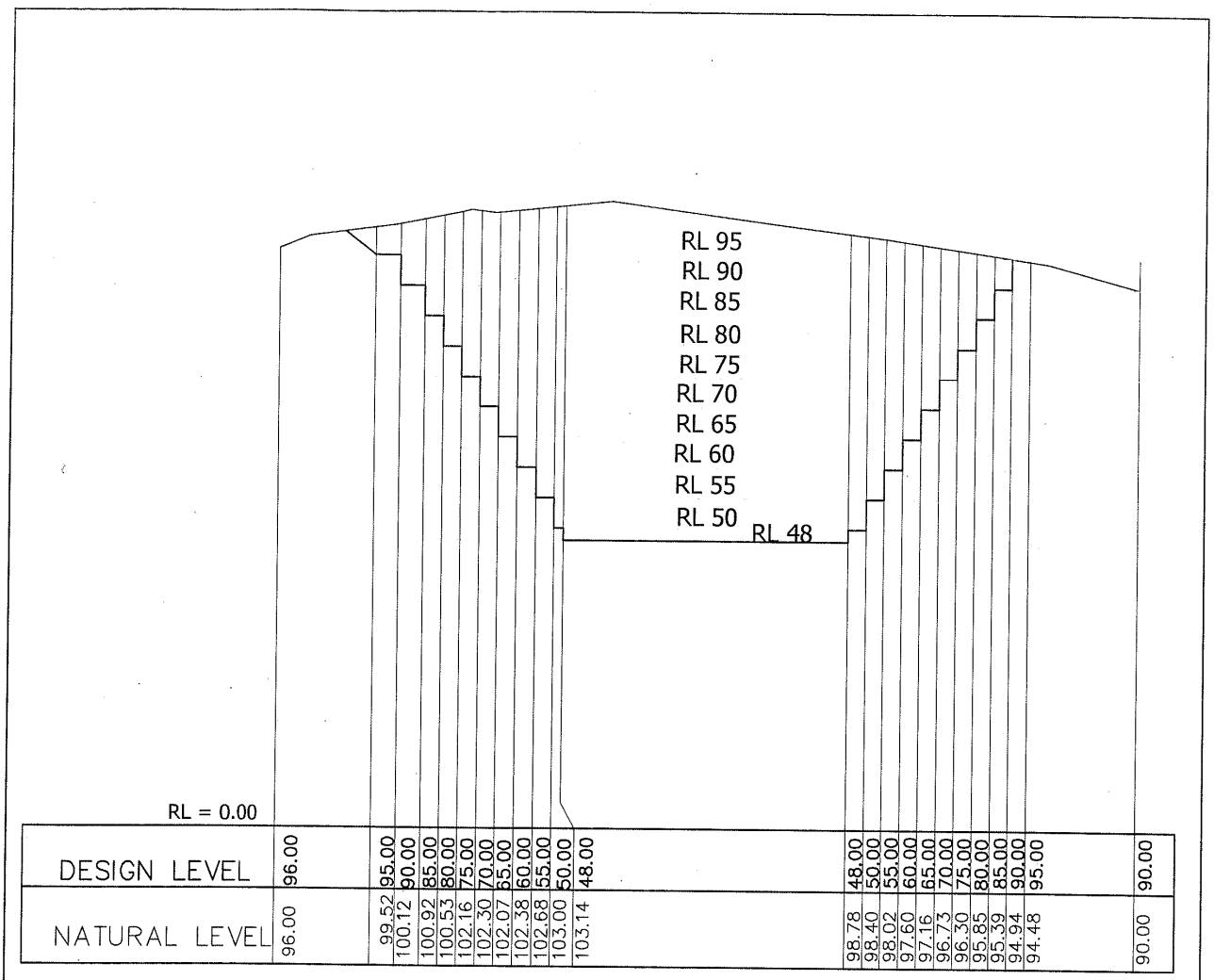


Exhibit No. 3
PROPOSED QUARRY SECTIONS
PROPOSED QUARRY EXTENSION
Part Lot 31 DP 1090294, Corndale Quarry, Corndale Rd, Corndale
GREG ALDERSON & ASSOCIATES PTY LTD
ABN 60 059 559 858
Scarrabelottis Rd NIMBUA NSW 2479
Ph: 02 6629 1552 Fax: 02 6629 1566
Email: g_alderson@bigpond.com
Scale: As shown @ A3
Date: 23rd February 2009
Job No.: 07005_x and long section Feb09
Datum: Approx AHD
Source: John Wade Engineering Surveying
Plans: 06/088 File: ALD1105.dwg
NORTH
Cross Section B Scale = 1:2000
RL = 0.00
DESIGN LEVEL
NATURAL LEVEL
104.00 47.00
101.69 101.69
48.00 103.51
55.00 103.36
50.00 103.44
60.00 103.28
65.00 103.20
70.00 103.12
75.00 103.04
80.00 102.96
85.00 102.88
90.00 102.81
95.00 102.73
RL 48
RL 100 RL 95 RL 90 RL 85 RL 80 RL 75 RL 70 RL 65 RL 60 RL 55 RL 50
Boundary
Stage 4
Stage 3
RL 68
RL 47
Long Section
Scale 1:2000 @ A3
Stage 4 FF RL 48 m AHD
Proposed Lateral Expansion - Stage 4 Detail Plan
Scale 1:500 @ A3
Existing Quarry Area
Quarry boundary
Line of long section
see detail
Site Plan
Scale 1:5000 @ A3



Cross Section A Scale = 1:2000

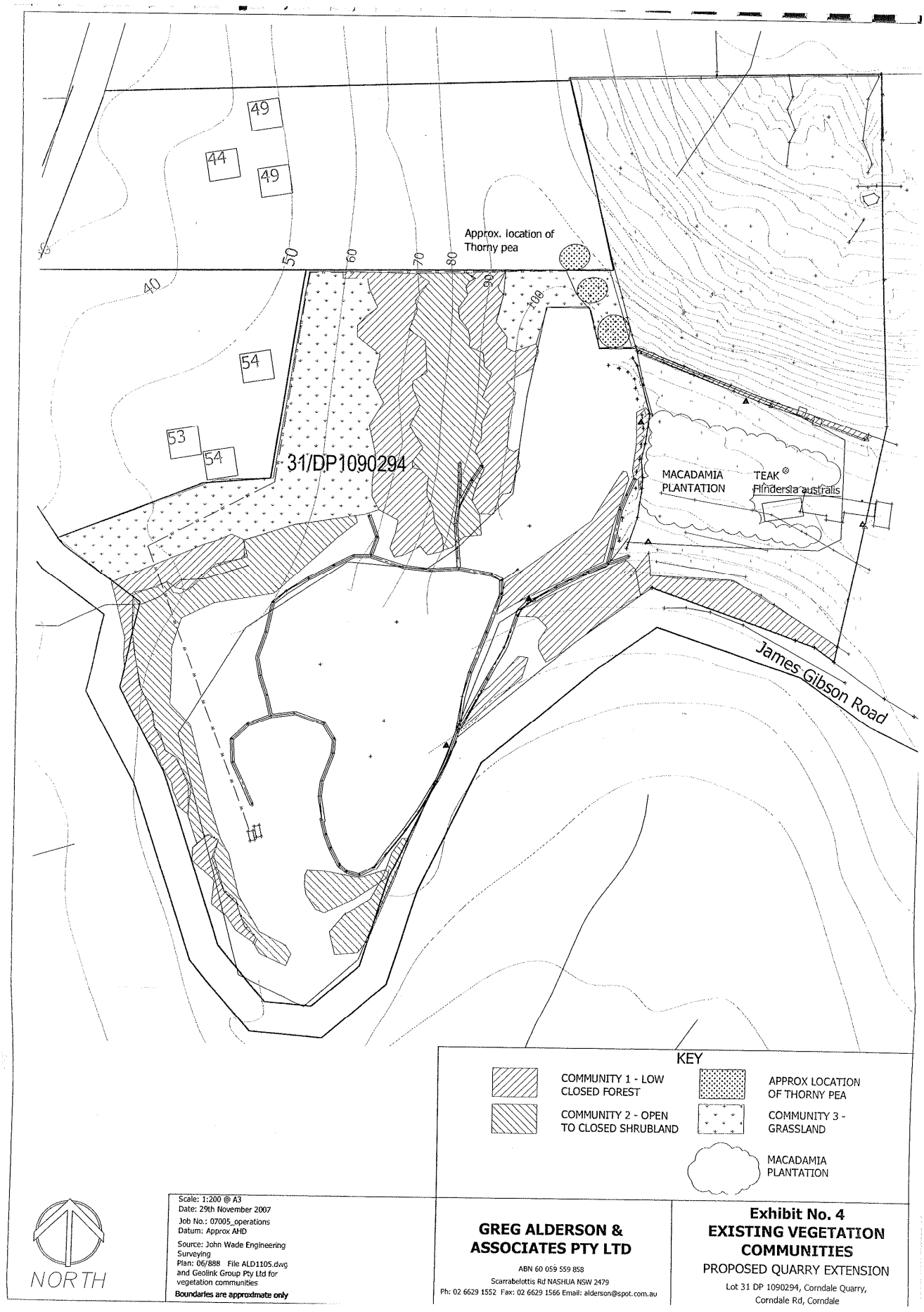
Scale: As shown @ A3
Date: 23rd February 2009
Job No.: 07005_x and long section feb09
Datum: Approx AHD

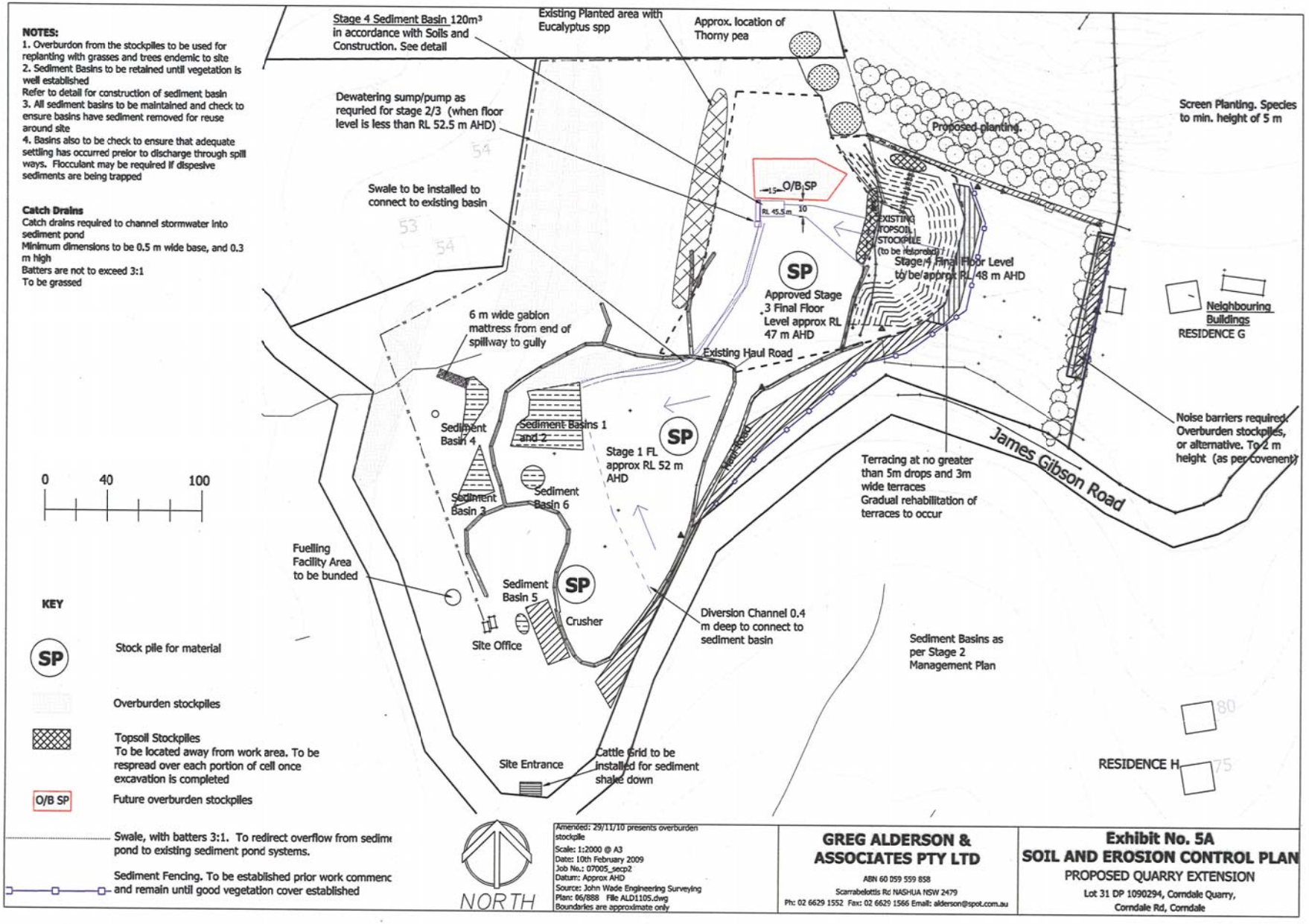
Source: John Wade Engineering Surveying
Plan: 06/888 File ALD1105.dwg

GREG ALDERSON & ASSOCIATES PTY LTD

ABN 60 059 559 858
Scarrabelottis Rd NASHUA NSW 2479
Ph: 02 6629 1552 Fax: 02 6629 1566
Email: g_alderson@bigpond.com

Exhibit No. 3b
PROPOSED QUARRY SECTIONS
PROPOSED QUARRY EXTENSION
Lot 31 DP 1090294, Corndale Quarry,
Corndale Rd, Corndale


49
44
49
Approx. location of Thorny pea
50
60
70
80
90
100
40
54
53
54
31/DP1090294
MACADAMIA PLANTATION
TEAK
Flindersia australis
James Gibson Road
KEY
COMMUNITY 1 - LOW CLOSED FOREST
APPROX LOCATION OF THORNY PEA
COMMUNITY 2 - OPEN TO CLOSED SHRUBLAND
COMMUNITY 3 - GRASSLAND
MACADAMIA PLANTATION
NORTH
Scale: 1:200 @ A3
Date: 29th November 2007
Job No.: 07005_operations
Datum: Approx AHD
Source: John Wade Engineering Surveying
Plan: 06/888 File ALD1105.dwg and Geolink Group Pty Ltd for vegetation communities
Boundaries are approximate only
GREG ALDERSON & ASSOCIATES PTY LTD
ABN 60 059 559 858
Scarrabelottis Rd NASHUA NSW 2479
Ph: 02 6629 1552 Fax: 02 6629 1566 Email: alderson@spot.com.au
Exhibit No. 4
EXISTING VEGETATION COMMUNITIES
PROPOSED QUARRY EXTENSION
Lot 31 DP 1090294, Corndale Quarry, Corndale Rd, Corndale


NOTES:
1. Overburdon from the stockpiles to be used for replanting with grasses and trees endemic to site
2. Sediment Basins to be retained until vegetation is well established
Refer to detail for construction of sediment basin
3. All sediment basins to be maintained and check to ensure basins have sediment removed for reuse around site
4. Basins also to be check to ensure that adequate settling has occurred prelor to discharge through spill ways. Flocculant may be required if dispesive sediments are being trapped
Catch Drains
Catch drains required to channel stormwater into sediment pond
Minimum dimensions to be 0.5 m wide base, and 0.3 m high
Batters are not to exceed 3:1
To be grassed
Stage 4 Sediment Basin 120m³ in accordance with Soils and Construction. See detail
Existing Planted area with Eucalyptus spp
Approx. location of Thorny pea
Dewatering sump/pump as requried for stage 2/3 (when floor level is less than RL 52.5 m AHD)
Swale to be installed to connect to existing basin
Proposed planting.
Screen Planting. Species to min. height of 5 m
O/B SP
RL 45.5m
EXISTING TOPSOIL STOCKPILE (to be respread)
SP
Approved Stage 3 Final Floor Level approx RL 47 m AHD
Stage 4 Final Floor Level to be approx RL 48 m AHD
Neighbouring Buildings
RESIDENCE G
6 m wide gabion mattress from end of spillway to gully
Existing Haul Road
Sediment Basin 4
Sediment Basins 1 and 2
Stage 1 FL approx RL 52 m AHD
Haul Road
Noise barriers required. Overburden stockpiles, or alternative. To 2 m height (as per covenent)
James Gibson Road
Terracing at no greater than 5m drops and 3m wide terraces
Gradual rehabilitation of terraces to occur
Sediment Basin 3
Sediment Basin 6
Fuelling Facility Area to be bunded
Sediment Basin 5
Crusher
Site Office
Diversion Channel 0.4 m deep to connect to sediment basin
Sediment Basins as per Stage 2 Management Plan
0
40
100
KEY
Stock pile for material
Overburden stockpiles
Topsoil Stockpiles
To be located away from work area. To be respread over each portion of cell once excavation is completed
O/B SP
Future overburden stockpiles
Swale, with batters 3:1. To redirect overflow from sedime pond to existing sediment pond systems.
Sediment Fencing. To be established prior work commenc and remain until good vegetation cover established
Site Entrance
Cattle Grid to be installed for sediment shake down
RESIDENCE H
NORTH
Amended: 29/11/10 presents overburden stockpile
Scale: 1:2000 @ A3
Date: 10th February 2009
Job No.: 07005_secp2
Datum: Approx AHD
Source: John Wade Engineering Surveying
Plan: 06/888 File ALD1105.dwg
Boundaries are approximate only
GREG ALDERSON & ASSOCIATES PTY LTD
ABN 60 059 559 858
Scarrabelottis Rd NASHUA NSW 2479
Ph: 02 6629 1552 Fax: 02 6629 1566 Email: alderson@spot.com.au
Exhibit No. 5A
SOIL AND EROSION CONTROL PLAN
PROPOSED QUARRY EXTENSION
Lot 31 DP 1090294, Corndale Quarry, Corndale Rd, Corndale

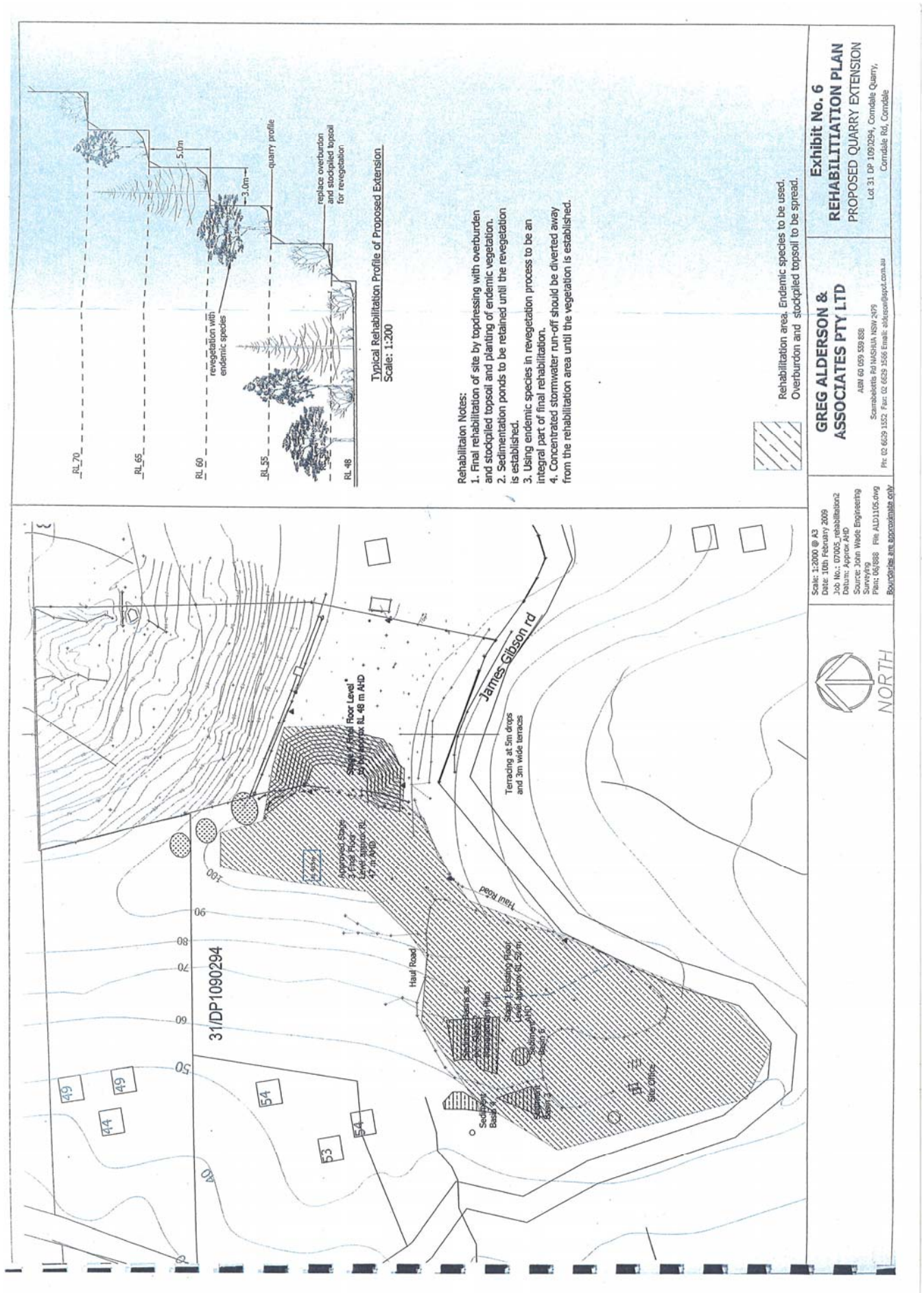
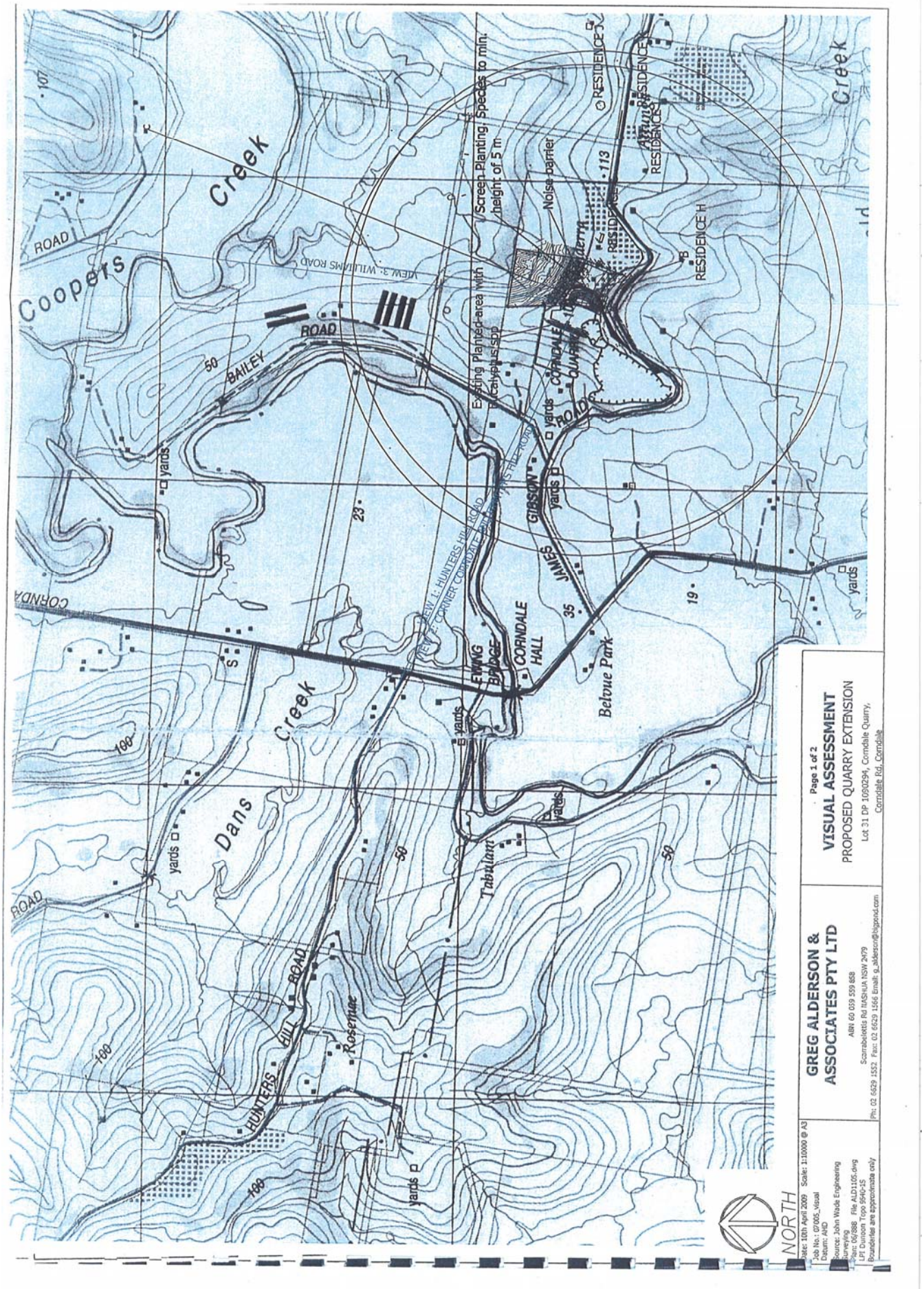


Exhibit No. 6
REHABILITIATION PLAN
PROPOSED QUARRY EXTENSION
Lot 31 DP 1091094, Corndale Quarry, Corndale Rd, Corndale
GREG ALDERSON & ASSOCIATES PTY LTD
ABN 60 059 559 858
Scarrabelottis Rd NASHUA NSW 2479
Ph: 02 6629 1552 Fax: 02 6629 1566 Email: aldason@spot.com.au
Rehabilitation area. Endemic species to be used.
Overburdon and stockpiled topsoil to be spread.
Typical Rehabilitation Profile of Proposed Extension
Scale: 1:200
RL 70
RL 65
RL 60
RL 55
RL 48
5.0m
3.0m
revegetation with endemic species
quarry profile
replace overburdon and stockpiled topsoil for revegetation
Rehabilitaion Notes:
1. Final rehabilitation of site by topdressing with overburden and stockpiled topsoil and planting of endemic vegetation.
2. Sedimentation ponds to be retained until the revegetation is established.
3. Using endemic species in revegetation process to be an integral part of final rehabilitation.
4. Concentrated stormwater run-off should be diverted away from the rehabilitation area until the vegetation is established.
James Gibson rd
Terracing at 5m drops and 3m wide terraces
Haul Road
Haul Road
Stage 4 Final Floor Level approx RL 48 m AHD
Approved Stage 3 Final Floor Level approx RL 47 m AHD
Stage 1 Existing Floor Level Approx RL 52 m
Proposed Basin as per Sediment Management Plan
Sediment Basin 4
Sediment Basin 3
Sediment Basin 5
Site Office
31/DP1090294
Scale: 1:2000 @ A3
Date: 10th February 2009
Job No.: 07005_rehabilitation2
Datum: Approx AHD
Source: John Wade Engineering Surveying
Plan: 06/888 File A1D1105.dwg
Boundaries are approximate only
NORTH


Coopers Creek
Dans Creek
Creek
ROAD
BAILEY
ROAD
CORNDALE ROAD
GIBSON
JAMES
FLYING BRIDGE
CORNDALE HALL
Belvue Park
Tabulam
HUNTERS HILL ROAD
Rosemar
Existing Planted area with Eucalyptus spp
Screen Planting, Species to min. height of 5 m
Noise barrier
RESIDENCE H
RESIDENCE
VIEW 3: WILLIAMS ROAD
VIEW 1: HUNTERS HILL ROAD
VIEW 2: CORNER CORNDALE & HUNTERS HILL ROAD
yards
NORTH
Page 1 of 2
VISUAL ASSESSMENT
PROPOSED QUARRY EXTENSION
Lot 31 DP 1090294, Corndale Quarry, Corndale Rd, Corndale
GREG ALDERSON & ASSOCIATES PTY LTD
ABN 60 059 559 858
Scarrabelotti Rd TASHUA NSW 2479
Ph: 02 6629 1552 Fax: 02 6629 1566 Email: g.alderson@bigpond.com
Date: 10th April 2009 Scale: 1:10000 @ A3
Job No.: 07005_Visual
Datum: AHD
Source: John Wade Engineering Surveying
Plan: 06/888 File ALD1105.dwg
LPI Dunoon Topo 9540-25
Boundaries are approximate only

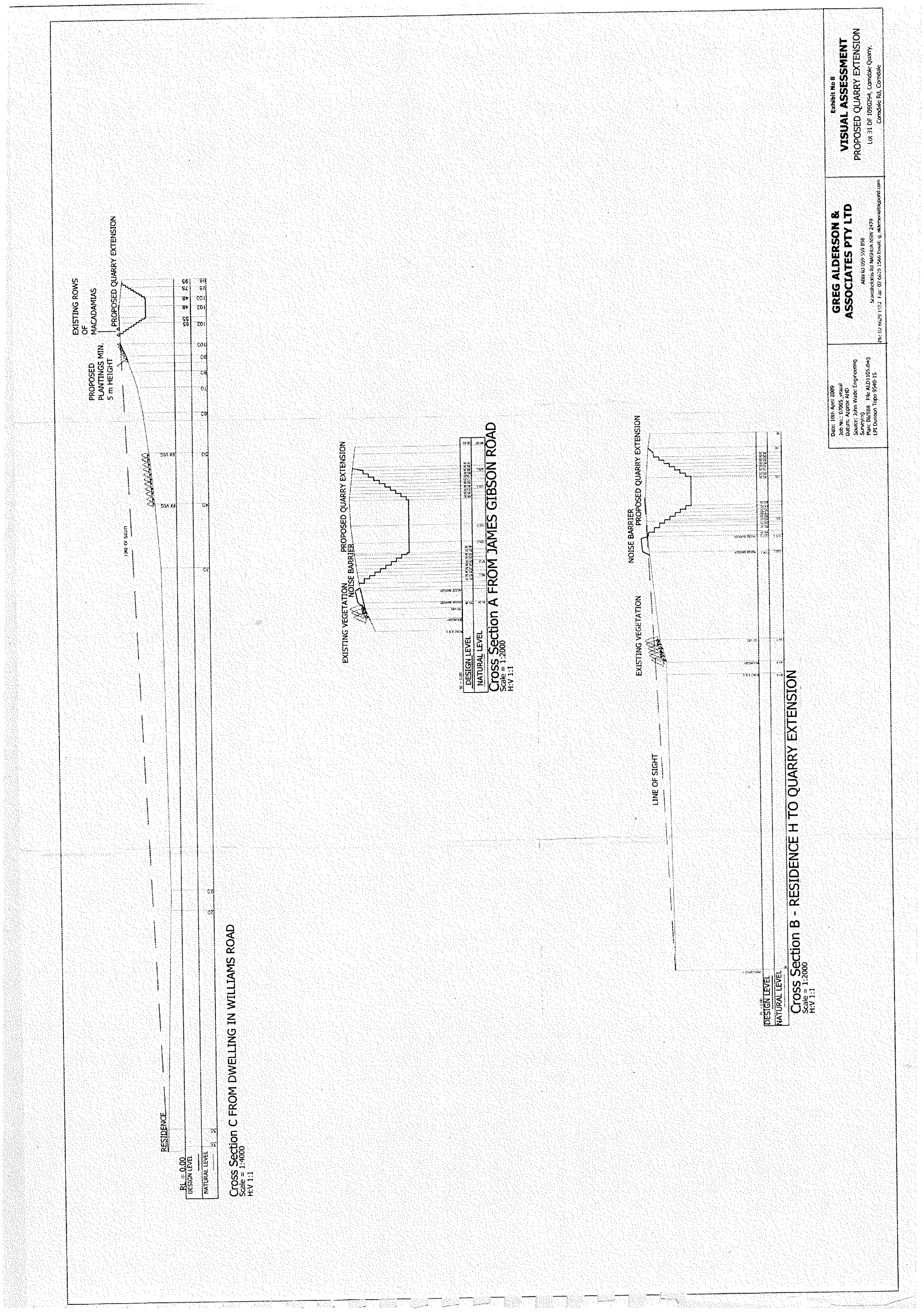


Exhibit No 8
VISUAL ASSESSMENT
PROPOSED QUARRY EXTENSION
Lot 31 DP 1090294, Corndale Quarry, Corndale Rd, Corndale
GREG ALDERSON & ASSOCIATES PTY LTD
Cross Section C FROM DWELLING IN WILLIAMS ROAD
Scale = 1:4000
H:V 1:1
RESIDENCE
LINE OF SIGHT
PROPOSED PLANTINGS MIN. 5 m HEIGHT
EXISTING ROWS OF MACADAMIAS
PROPOSED QUARRY EXTENSION
DESIGN LEVEL
NATURAL LEVEL
Cross Section A FROM JAMES GIBSON ROAD
Scale = 1:2000
H:V 1:1
EXISTING VEGETATION
NOISE BARRIER
Cross Section B - RESIDENCE H TO QUARRY EXTENSION
Scale = 1:2000
H:V 1:1

Attachment 2 – Public Submissions Summary & Comment

Submissions objecting to the DA

Name	Issues raised	Planning comment corresponding to the issues raised
The same submission, with some minor variations, was submitted by: **1.** Chris Garlick, 205 James Gibson Road, Clunes. **2.** P&M Doyle, 65 James Gibson Road, Clunes. **3.** Frances Slattery, 337 James Gibson Road, Clunes. **4.** M&R Blok, 315 James Gibson Road, Clunes. **5.** A&J Black, 334 James Gibson Road, Clunes. **6.** G&S Goldsmith, 154 James Gibson Road, Clunes. **7.** Simone Harris, 13 Avalon Avenue, Clunes. **8.** J Maynes, 204 James Gibson Road, Clunes. **9.** W&H Osborne, 369 James Gibson Road, Corndale. **10.** E Kelly, 205	• The DA is contradictory to the finite operating parameters ordered by the L&E Court under development consent 1997/342, being maximum annual extraction rate of 70,000m3, with a total extraction of 910,000m3 for the working life of the quarry up to 13 years.	• The proposal does not increase the life, total extraction or maximum annual extraction rate of the quarry. In addition, there is nothing in Development Consent 1997/342 or at planning law that prohibits the owner of the quarry making a DA to laterally expand the extraction area of the quarry.
	• A subsequent boundary adjustment with "Wynderra" expanded the physical working area of the quarry but kept the same operating parameters.	• As abovementioned in this report DA5.2005.372 did increase the size of the land subject of the quarry.
	• Concern that with the quarry now having purchased "Wynderra" the proposed DA is a stepping stone to continuing development.	• With the purchase of the adjoining Lot 32 DP1090294, a future DA could be made to Council for the further expansion of the quarry.
	• The possibility of expansion is a huge threat to surrounding land holders within the currently defined buffer areas and the impacts on these dwellings will be amplified. The proposed expansion further encroaches into the required buffers.	• Any DA lodged to further expand the quarry would be advertised publicly and assessed in accordance with relevant legislation. Such assessment is required to consider the likely impacts of the DA on surrounding land uses.
	• The proposed expansion is contrary to the objectives of the RU1 Primary Production Zone within the Draft LEP, being: 1. *to minimise the fragmentation and alienation of resource lands; and* 2. *to minimise conflict between land uses within the zone and land uses within adjoining zones.* 3. *to preserve rural resources by ensuring that the viability of rural land is not extinguished by inappropriate development or incompatible uses.*	• As detailed in the report the proposal is considered to be consistent with the objectives of the RU1 Zone of the Draft LEP 2010. In particular the proposal will not fragment or alienate resource lands, is not considered to cause unreasonable conflict with adjoining land uses and is not considered to be a use that extinguishes the viability of rural land in the locality.
	• The proposed expansion will negatively impact upon the visual amenity of this extremely scenic area, which has value to the regional economy.	• This issue has been addressed in detail in the report.
	• Object to the possibility that additional quarry access to James Gibson Road could be acquired through "Wynderra".	• The DA does not propose a new vehicular access to the quarry from Lot 32 DP1090294 "Wynderra".

James Gibson Road, Clunes. 11. R&N Garlick-Kelly, 205 James Gibson Road.	• The quarry has not been identified in the North Coast Urban Planning Strategy, the Far North Coast regional Strategy and the North Coast Extractive Industries Standing Committee as a quarry of regional significance. • The quarry has a history of non-compliances as noted by neighbours, which are listed below:	• Noted, however Part A Chapter 18 – Extractive Industries of the Lismore DCP identifies the quarry as being of "regional economic importance".
	1. Blasting notifications - to all neighbours within 1000m is never done;	• The applicant advises that written notifications to neighbours are being undertaken to 1.2km from the quarry and that records of the notification are kept with the quarry site manager.
	2. Community Consultation - The applicant is required to establish the Corndale Quarry Consultative Committee. The real residents affected by the quarry were never made aware of any consultative process;	• The Consultative Committee was set up and included two community representatives, two quarry representatives and an independent facilitator. The committee convened its first meeting on the 20/2/2006 and at that meeting it was agreed that the conditions of consent relevant to adjacent residences were being complied with. The two community representatives agreed that they were satisfied that they could approach the quarry representatives should any future problems arise and that any such problems would be rationally resolved. In any matters where that approach failed, the community representatives should seek Council's permission to convene the Consultative Committee with the assistance of the neutral facilitator. It is understood that no request has been made of Council to re-convene the Committee. The applicant advises that it is their understanding that the Council can formulate a new Committee if required as Condition 65c states that the representatives are selected by Council. In this regard it is proposed to retain the conditions relating to the Consultative Committee.
	3. Dilapidation Survey - a dilapidation survey of all properties within which fall within the primary and secondary	• The applicant had Nowlan Bryant Building Surveyors to complete a dilapidation survey for: 368, 369,

	buffers has never been done;	492, 517 and 520 James Gibson Road, 530 Corndale Road and 1 & 3 Bailey Road, which are some of the properties within the required buffers around the quarry. In addition a condition is proposed to ensure that a dilapidation survey is undertaken for all properties within the required buffers.
	4. Geological Survey - no residents are aware of any testing being done concerning underground seismic movements on their properties. The threat of aquifers, streams and recharge areas being irrevocably damaged reducing neighbours water accessibility has never been adequately measured;	• The existing consent includes conditions in relation to the management of blasting and the setting of vibration levels that must not be exceeded and also the monitoring of groundwater via a bore within the operation area. The There is however no requirement in the existing consent for a geological survey to be undertaken
	5. Fencing – although fencing has been erected in fragments along the quarry perimeter there is no consistent adequate fencing;	• The applicant advises that the site has been fenced in accordance with Condition 21 of the existing consent.
	6. Weed control – the lack of care surrounding the quarry is visually apparent. There is extensive weed infestation;	• The applicant details that weed control is being undertaken in the Thorny Pea and rainforest areas, the quarry entrance, along the fence line and on the ridge behind the stock bays.
	7. Landscaping and Revegetation Plan – any rehabilitation that has been undertaken is a token gesture. Trees planted by the quarry have not been in keeping with the native scrub (olive trees and palms) and in fact several have died due to lack of care;	• The applicant advises that progressive rehabilitation is being undertaken and that the quarry employs a contractor to revegetate areas of the quarry and in this regard has so far planted 216 plants.
	8. Truck movement / haulage – drivers of trucks travelling to and from the quarry have been observed exceeding the 60km/h limit, tailgating cars and using compression braking. Given James Gibson Road is the main traffic entrance for the primary school and all haulage routes are used by the school bus this is a frightening problem. B-Doubles and semi tippers have been sighted leaving the quarry; and	• The applicant details that the quarry uses trucks and trailers and that these are not classified as B-Doubles. In relation to the respondents concerns with traffic safety a condition is proposed which requires the preparation and implementation of a code of conduct relating to the transport of materials from the site.
	9. Truck movement – all truck movement should go via Corndale Road (this point was only raised by P&M Doyle).	• The applicant details that the tonnage for carting material from the quarry for the year 09/10 is 38% to the east and 68% to the west to Corndale Road.

	• The respondent M&R Blok advise they have made large financial investments in purchasing an upgrading their property and that the proposed quarry expansion would have a negative impact upon their investment and that they are seeking legal advice as to proceeding in claiming compensation from those responsible if the quarry were to proceed.	• The issue of impact upon property value is not a relevant planning matter in the assessment of any DA. However, the impacts of the proposal have been considered and are assessed as being acceptable in the circumstances. In addition it is noted that the respondents house is located greater than 800m from the face of the proposed lateral expansion, which complies with the buffer requirements.
	• The respondent E Kelly considers the proposal will hinterland carved and scarred, reducing vistas to rock face and cause truck movements to dangerously increase.	• The issue of visual impact has been addressed in detail in the report.
	• The respondent R&N Garlick-Kelly are concerned about quarry trucks impact upon road safety, particularly getting on and off the school bus, learning to drive from trucks drive and difficulty to manoeuvre on the road. Concern also raised in relation to impact upon the scenery.	• The proposal does not propose an increase in the generation of quarry trucks on the road from that approved under Development Consent 5.1997.342. Notwithstanding this, given the concerns raised by the residents in relation to road and traffic safety a condition is proposed which requires the preparation and implementation of a code of conduct relating to the transport of materials from the site.
Two (2) Submissions from: Elizabeth Maynes, 204 James Gibson Road.	• The DA does not consider the possible impact of continual blasting on underground water, streams, aquifers and recharge areas in the basalt seams east of the quarry, including the respondents property and LCC's property at Lot 3 DP1008469.	• The existing consent includes conditions in relation to the management of blasting and the setting of vibration levels that must not be exceeded and also the monitoring of groundwater via a bore within the operation area.
	• The owners of Lot 2 DP1008469 were given the understanding that the quarry had a finite life and were subsequently allowed to build on their property and now the proposed expansion area is encroaching within the buffer between the quarry and the house on this lot.	• The proposal does not increase the total extraction amount or the life of the quarry. In addition, there is nothing at planning law that prohibits the owner of the quarry making a DA to laterally expand the extraction area of the quarry.
	• Enforcement of compliance issues have often been very casually executed. Particularly the community consultation has been a joke with the meeting not happening with the representatives not there.	• The issue of compliance with the existing consent has been addressed in detail in the report. The history of the Consultative Committee has been addressed in the above dot points.
	• The locality is a scenic area internationally recognised.	• Noted as a comment and the visual quality of the land is understood.

	• Property values will be reduced and would there be compensation.	• The issue of impact upon property value is not a relevant planning matter in the assessment of any DA. However, the impacts of the proposal have been considered and are assessed as being acceptable in the circumstances. In addition it is noted that the respondents house is located greater than 1.2km from the face of the proposed lateral expansion, which complies with the buffer requirement.
	• Would have loved a small quarry with low annual extraction rates lasting a long time – we do not want a mine site.	• Noted as a comment
Denise and John Coster (Snr), 295 James Gibson Road Clunes.	• Safety concerns regarding the movement of truck/trailers on James Gibson Road as there is a number of dangerous corners and driveways with poor sight distances and no room on the roads for moving safely to the side of the road.	• The proposal does not propose an increase in the generation of quarry trucks on the road from that approved under Development Consent 5.1997.342. Notwithstanding this, given the concerns raised by the residents in relation to road and traffic safety a condition is proposed which requires the preparation and implementation of a code of conduct relating to the transport of materials from the site, including setting of a 60km/hr speed limit along haulage roads.
	• James Gibson Road is currently signposted as 100kph "drive to conditions", which is unsafe considering the road which is used for quarry trucks.	• See comment above.
	• James Gibson Road has become very dangerous with the amount of dirt and sludge that is present on the road surface from the quarry trucks.	• The proposal nominates the control of dust during operations by ensuring all trucks leaving the site carrying fine material are covered and having on-site signs alerting drivers to this requirement.
	• The visual impact of the quarry expansion upon the scenic landscape.	• The issue of visual impact has been addressed in detail in the report.
G&D Drews, 94 Hunters Hill Road, Corndale.	• The quarry causes noise and dust pollution from the crusher also causing serious vibration.	• These issues have been addressed in detail in the report.
	• The quarry trucks cause damage to roads.	• In accordance with Development Consent 5.1997.342 the quarry

		pays contributions towards the maintenance of haulage roads.
	• Concerns for road safety due to the excessive speeds the heavy vehicles travel down the narrow winding roads.	• Given the concerns raised by the residents in relation to road and traffic safety a condition is proposed which requires the preparation and implementation of a code of conduct relating to the transport of materials from the site.
PX&SL Green, 355 James Gibson Road, Clunes.	• The potential structural damage to the respondent's house from the vibration caused by blasting operations as the quarry face is getting closer to their house and is compensation available if structural damage occurs.	• A dilapidation survey has been done for a number of properties around the quarry, however not for the respondent's house. It is therefore recommended that a dilapidation survey be undertaken for the respondents dwelling. In addition Condition 42 of DA 5.1997.342 states *In the event that any structural damage is shown to have occurred as a consequence of the quarry operations, the operator shall either compensate the respective property owners or carry out satisfactory repairs.* This condition is proposed to be retained.
	• In the event that the DA is approved the respondent requests that as a condition of consent that the respondent not only be notified of the blasts but also when monitoring is to be undertaken at their residence and that monitoring results be made available to the respondent.	• Condition 40.1 of the existing consent states: "*a minimum of three days prior to any blast, verbal or written notification shall be given to the occupants of all dwellings within 1,000 m of the quarry before blasting taking place"*. Condition 40.2 of the existing consent requires the monitoring (vibration) of 1 in 3 blasts and that records of this monitoring be made available for Council inspection. These records could also be inspected by members of the public.
	• Concern that the proposed expansion coupled with the quarry's purchase of adjoining Lot 32 DP 1090294 will lead the way for even further expansion, which would have even greater impact upon the respondent's property.	• There is nothing at planning law that prohibits the owner of the quarry making a DA to expand the operation of the quarry.
	• Not concerned about any greater impacts to traffic, dust, noise and visual amenity provided the quarry adherer's to extraction rates and environmental measures.	• Noted.
	• The respondent would encourage that	• Visual and noise impacts have

	screen plantings of native species be given priority to reduce visual and noise impacts and have the quarry operators offer planting on adjoining properties to minimise impacts.	been addressed in detail in this report.
Edwin Maynes, 204 James Gibson Road, Clunes	• It is apparent that with the purchase of adjoining Lot 32 DP 1090294, that the quarry owner has ambition to extend the quarry beyond the stated boundaries and this application is just a stepping stone for that. • The surrounding properties have a high scenic value. • The proposal would be inappropriate and in conflict with the stated objectives of the RU1 Zone of the draft LEP. • The quarry is not identified as being regionally significant • The quarry owners are not residents and have no interests in the wellbeing or future of the area. Their interest is only short term profit. • Concern about the same compliance breaches as summarise in the first submission above in this table.	• There is nothing at planning law that prohibits the owner of the quarry making a DA to laterally expand the extraction area of the quarry. • Noted. • The proposal is considered to be consistent with the objectives of the RU1 Zone. • Part A Chapter 18 – Extractive Industries of the Lismore DCP identifies the quarry as being of "regional economic importance". • Noted as a comment. • Addressed above in this table.

Submissions in Support of the DA

Name	Issue Raised
11 copies of the same submission, on letterhead of the Smith Plant Lismore Pty Ltd were received. A total of 28 signatures were on these standard letters.	• There will be no increase in the extraction rate than is currently approved at the site. • Negotiations are being made to buy the adjoining property to be a buffer between the quarry and the neighbours. • The proposal will retain existing native trees along the southern boundary adjacent to James Gibson Road. • The proposed expansion will include regeneration of the existing vegetation surrounding the lateral expansion and the planting of additional trees to the north of the site creating a wildlife corridor. • Noise and dust amelioration will be required to ensure the proposal will operate as existing. • Stringent noise controls ensure that noise levels do not exceed the DA approved levels at a residence. • All crushers, screens, site office and the site entrance will remain in current approved locations; • The purpose of the expansion is in providing greater quarry life in supplying quarry products to the surrounding area and reducing expensive transport from other areas;
Frank Vanz, Lismore Tyre Company, PO Box 6211, South Lismore.	• Lismore Tyre Company has always found Corndale Quarry to be a tidy and efficient operational quarry with a strong regard to occupational safety and the environment.
Smith Plant Lismore Pty Ltd, 174 Pelican Creek Road,South Gundurimba.	• We have been the operators of the quarry since March 2002 and during this time have upgraded the operation of the quarry to lift it from a quarry that received complaints from Council and neighbours, to a quarry now which had received one or two minor queries that were resolved with the purchase of a silenced rock breaker. • The quarry provides an extremely valuable resource to not only the Corndale community, but to the wider community. • Some of the quarries substantial clients include: Lismore City Council and Byron Shire Council who purchase large quantities of quarry product (for the local road network) to save on transport costs from their own quarries. This action saves truck noise, road damage, wear and tear on trucks and fuel. • Refusal of the DA would significantly impact upon the community and the environment in that the quarry can't supply sufficient material to see local roads maintained sufficiently, costs will increase for the Council's as they have to source road making from further away. • Corndale quarry has contributed a significant sum of amount of money to Council's road maintenance to cover any damage caused by quarry trucks and also has contributed substantially to the upgrading of James Gibson Road. • The quarry regularly supports the local schools and other community groups. • The quarry employs local staff and supports local businesses. • The first exhibition period for the DA did not receive any objections. • A recently constructed dwelling was moved 70m closer to the quarry and they now choose to object about the quarry expansion. • The owner of the quarry site has investigated the option of purchasing the adjoining property to the east as a buffer so that better management of the quarry can be carried out.

	• The quarry has planted a number of plants on the site and its record in regards to plantings is excellent and ongoing including increasing thorny Pea plantings and other endangered species, native species (including pioneer species). • There is no increase in the current operation of the quarry in terms of increasing volume, number of truck movements, and location of the crusher/screen. • We extend our strongest support to the DA lodged by Smith Hire Service Casino Pty Ltd as it allows the community to benefit by accessing and easily won, good quality, quarry resource. • Regard this letter as being one written on behalf of the quarries customers. The submission attached a list of the quarry customers.
Australian Soil and Concrete Testing Pty Ltd, PO Box 5120 Ballina.	• Corndale quarry provides a particularly good basalt that is fresh and strong which provides significant amounts of pavement quality material for road construction, concrete, asphalt and sealing aggregate. • The availability of good quality material in the area is limited and unless existing resources can be extended or new resource locations identified and approved, the area will be left to supply from those few remaining sources and as such those resources are finite. • Road construction and maintenance for the area of the next decade will require significant resources of pavement material and as resources have a finite quantity and limited life span there is a need to plan ahead to ensure continue supply without compromising quality or creating excessive haulage costs from outside areas.

Environment Protect Licence - Protection of the Environment Operations Act 1997

General Terms of Approval

NSW GOVERNMENT | Environment, Climate Change & Water

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ADMINISTRATIVE CONDITIONS

Note: Mandatory conditions for all general terms of approval

A1. Information supplied to the EPA

A1.1 Except as expressly provided by these general terms of approval, works and activities must be carried out in accordance with the proposal contained in:

- the amended development application IDA No. 5.2009.83.1 and Statement of Environmental Effects Corndale Quarry 28/05/2010 re-submitted to Department of Environment Climate Change and Water (DECCW) on 28 June 2010;
- all additional documents supplied to the Department of Environment Climate Change and Water (DECCW) in relation to the development, including the: Environmental Impact Assessment GeoLink Group November 1997, the Conditions of Development Consent (Land and Environment Court Appeal No. 10463 of 1998) and any Environmental Management Plans in place or required as part of the operation of the proposal.

1 ADMINISTRATIVE CONDITIONS

A1 What the licence authorises and regulates

A1.1 Not applicable.

A1.2 This licence authorises the carrying out of the scheduled activities listed below at the premises specified in A2. The activities are listed according to their scheduled activity classification, fee-based activity classification and the scale of the operation.

Unless otherwise further restricted by a condition of this licence, the scale at which the activity is carried out must not exceed the maximum scale specified in this condition.

Scheduled Activity
Extractive activities

Fee Based Activity	**Scale**
Land-based extractive activity	> 50000 - 100000 T obtained

A1.3 Not applicable.

A1.4 This licence regulates water pollution resulting from the activity/ies carried out at the premises specified in A2.

A2.1 The licence applies to the following premises:

Environment Protect Licence - Protection of the Environment Operations Act 1997

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Premises Details

Corndale Quarry Expansion
JAMES GIBSON ROAD
LISMORE
NSW
2480
LOT 2 DP716264 PART LOT 101 DP633655

A3 Other activities

A3.1 Not applicable.

A4 Information supplied to the EPA

A4.1 Works and activities must be carried out in accordance with the proposal contained in the licence application, except as expressly provided by a condition of this licence.

In this condition the reference to "the licence application" includes a reference to:
(a) the applications for any licences (including former pollution control approvals) which this licence replaces under the Protection of the Environment Operations (Savings and Transitional) Regulation 1998; and
(b) the licence information form provided by the licensee to the EPA to assist the EPA in connection with the issuing of this licence.

2 DISCHARGES TO AIR AND WATER AND APPLICATIONS TO LAND

P1 Location of monitoring/discharge points and areas

P1.1 Not applicable.

P1.2 The following points referred to in the table are identified in this licence for the purposes of the monitoring and/or the setting of limits for discharges of pollutants to water from the point.

P1.3 The following utilisation areas referred to in the table below are identified in this licence for the purposes of the monitoring and/or the setting of limits for any application of solids or liquids to the utilisation area.

EPA identification no.	Type of monitoring point	Type of discharge point	Description of location
1		wet weather discharge	overflow from pond 4 as marked on the Corndale Quarry Management Plan dated October 2002

3 LIMIT CONDITIONS

L1 Pollution of waters

L1.1 Except as may be expressly provided in any other condition of this licence, the licensee must comply with section 120 of the Protection of the Environment Operations Act 1997.

L1.2 Discharge of TSS to waters from Point 1 is permitted when the discharge occurs solely as a result of rainfall at the premises exceeding a total of 60.2 millimetres over any consecutive five day period.

L2 Load limits

L2.1 Not applicable.

L2.2 Not applicable.

L3 Concentration limits

L3.1 For each discharge point or utilisation area specified in the table/s below, the concentration of a pollutant discharged at that point, or applied to that area, must not exceed the concentration limits specified for that pollutant in the table.

L3.2 Where a pH limit is specified in the table, the specified percentage of samples must be within the specified ranges.

L3.3 To avoid any doubt this condition does not authorise the discharge or emission of any other pollutants.

Water and Land

POINT 1 Discharge point from sediment basin

Pollutant	Units of Measure	50% Concentration limit	90% concentration limit	3DGM concentration limit	100% concentration limit
Total suspended solids	mg/L				50
Oil & Grease	mg/L				10
pH	pH				6.5 – 8.5

L3.4 The concentration limits in the above table do not apply to any discharge from the sediment basin (Point 1) arising from rainfall exceeding 60.2mm in total falling over any consecutive five day period.

L4 Volume and mass limits

L4.1 Not applicable.

L5 Waste

L5.1 Under the provisions of the Protection of the Environment Operations (Waste) Regulation 2005 – General Exemption Under Part 6, Clause 51 and 51A, "The Recovered Aggregate Exemption 2010" has been enacted.

L5.2 Recovered concrete waste that meets the requirements of "The Recovered Aggregate Exemption 2010" may be accepted and processed at this premise for reuse.

L6 Noise Limits

L6.1 Noise from the premises must not exceed:
(a) 41dB(A) $L_{Aeq(15\ minute)}$ during the day (7am to 6pm) Monday to Friday and 8am to noon Saturday

Where L_{Aeq} means the equivalent continuous noise level – the level of noise equivalent to the energy-average of noise levels occurring over a measurement period.

L6.2 Noise from the premises is to be measured at most affected point on or within the residential property boundary or, if this is more than 30m from the residence, at the most affected point within 30m of the residence to determine compliance with this condition.

L6.3 The airblast overpressure level from blasting operations in or on the premises must not exceed:

(a) 115 dB (Lin Peak) for more than 5% of the total number of blasts during each reporting period; and
(b) 120 dB (Lin Peak) at any time.

At the most affected residence of noise sensitive location that is not owned by the licensee or subject to a private agreement between the owner of the residence or noise sensitive location and the licensee as to an alternative overpressure level.

L6.4 The ground vibration peak particle velocity from blasting operations carried out in or on the premises must not exceed:

(a) 5mm/s for more than 5% of the total number of blasts carried out on the premises during each reporting period; and
(b) 10 mm/s at any time.

At the most affected residence of noise sensitive location that is not owned by the licensee or subject to a private agreement between the owner of the residence or noise sensitive location and the licensee as to an alternative overpressure level.

L7 Hours of operation

L7.1 Activities covered by this licence must only be carried out between the hours of 0700 and 1800 Monday to Friday, and 0800 and 1200 Saturday, and at no time on Sundays and Public Holidays.

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4 OPERATING CONDITIONS

O1 Activities must be carried out in a competent manner

O1.1 Licensed activities must be carried out in a competent manner.

This includes:

(a) the processing, handling, movement and storage of materials and substances used to carry out the activity; and

(b) the treatment, storage, processing, reprocessing, transport and disposal of waste generated by the activity.

O2 Maintenance of plant and equipment

O2.1 All plant and equipment installed at the premises or used in connection with the licensed activity:
(a) must be maintained in a proper and efficient condition; and
(b) must be operated in a proper and efficient manner.

O3 Dust

O3.1 The premises must be maintained in a condition which minimises or prevents the emission of dust from the premises.

O4 Pollution of Waters

O4.1 The licensee must take all practical measures to avoid or minimise TSS, etc. contained in wet weather discharges.

O5 Stormwater Management

O5.1 The licensee must install and maintain stormwater basins with the capacity to contain all rainfall and runoff generated from any storm event in the catchment of the premises with a 5 – day rainfall depth of 60.2 millimetres.

O5.2 A Stormwater Management Plan must be developed which encompasses the current quarry operation and the expanded quarrying area. A copy of the updated Stormwater Management Plan is to be submitted to DECCW for evaluation and comment.

5 Monitoring and recording conditions

M1 Monitoring records

M1.1 The results of any monitoring required to be conducted by this licence or a load calculation protocol must be recorded and retained as set out in this condition.

M1.2 All records required to be kept by this licence must be:
(a) in a legible form, or in a form that can readily be reduced to a legible form;
(b) kept for at least 4 years after the monitoring or event to which they relate took place; and
(c) produced in a legible form to any authorised officer of the EPA who asks to see them.

M1.3 The following records must be kept in respect of any samples required to be collected for the purposes of this licence:
(a) the date(s) on which the sample was taken;
(b) the time(s) at which the sample was collected;
(c) the point at which the sample was taken; and
(d) the name of the person who collected the sample.

M2 Requirement to monitor concentration of pollutants discharged

M2.1 For each monitoring/discharge point or utilisation area specified below (by a point number), the licensee must monitor (by sampling and obtaining results by analysis) the concentration of each pollutant specified in Column 1. The licensee must use the sampling method, units of measure, and sample at the frequency, specified opposite in the other columns:

Water and Land

Point 1

Pollutant	Units of Measure	Frequency	Sampling Method
Total Suspended solids	Milligrams per litre	Special Frequency 1	Grab Sample
Oil & Grease	Milligrams per litre	Special Frequency 1	Grab Sample
pH	pH	Special Frequency 1	Grab Sample

Note: Special Frequency 1 means sampling once each quarter of any discharge from the point occurring following rainfall of up to 60.2mm falling over any consecutive five day period.

M3 Testing methods - concentration limits

M3.1 Monitoring for the concentration of a pollutant discharged to waters or applied to a utilisation area required by condition M2 must be done in accordance with:

- the Approved Methods Publication; or
- if there is no methodology required by the Approved methods Publication or by the general terms of approval or in the licence under the Protection of the Environment Operations Act 1997 in relation to the development or the relevant load calculation protocol, a method approved by EPA in writing before any tests are conducted;
- unless otherwise expressly provide in the licence.

M4 Recording of pollution complaints

M4.1 The licensee must keep a legible record of all complaints made to the licensee or any employee or agent of the licensee in relation to pollution arising from any activity to which this licence applies.

M4.2 The record must include details of the following:

(a) the date and time of the complaint;

(b) the method by which the complaint was made;

(c) any personal details of the complainant which were provided by the complainant or, if no such details were provided, a note to that effect;

(d) the nature of the complaint;
(e) the action taken by the licensee in relation to the complaint, including any follow-up contact with the complainant; and
(f) if no action was taken by the licensee, the reasons why no action was taken.

M4.3 The record of a complaint must be kept for at least 4 years after the complaint was made.

M4.4 The record must be produced to any authorised officer of the EPA who asks to see them.

M5 Telephone complaints line

M5.1 The licensee must operate during its operating hours a telephone complaints line for the purpose of receiving any complaints from members of the public in relation to activities conducted at the premises or by the vehicle or mobile plant, unless otherwise specified in the licence.

M5.2 The licensee must notify the public of the complaints line telephone number and the fact that it is a complaints line so that the impacted community knows how to make a complaint.

M5.3 Conditions M5.1 and M5.2 do not apply until 3 months after:
(a) the date of the issue of this licence or
(b) if this licence is a replacement licence within the meaning of the Protection of the Environment Operations (Savings and Transitional) Regulation 1998, the date on which a copy of the licence was served on the licensee under clause 10 of that regulation.

M6 Requirement to monitor volume or mass

M6.1 Not applicable.

M7 Blasting monitoring

M7.1 To determine compliance with condition(s) L6.1 and L6.2:

(a) Airblast overpressure and ground vibration levels must be measured at the most affected residence of noise sensitive location that is not owned by the licensee or subject to a private agreement between the owner of the residence or noise sensitive location and the licensee as to an alternative overpressure level - for all blasts carried out in or on the premises; and
(b) Instrumentation used to measure the airblast overpressure and ground vibration levels must meet the requirements of Australian Standard 2187.2 of 1993.

M8 Environmental Monitoring

M8.1 The licensee is required to install and maintain a rainfall depth measuring device.

M8.2 Rainfall at the premises must be measured and recorded in millimetres per 24 hour period, at the same time each working day.

Note: The rainfall monitoring data collected in compliance with Condition M8.1 can be used to determine compliance with L1.2.

6 REPORTING CONDITIONS

R1 Annual return documents

What documents must an Annual Return contain?

R1.1 The licensee must complete and supply to the EPA an Annual Return in the approved form comprising:
(a) a Statement of Compliance; and
(b) a Monitoring and Complaints Summary.
A copy of the form in which the Annual Return must be supplied to the EPA accompanies this licence. Before the end of each reporting period, the EPA will provide to the licensee a copy of the form that must be completed and returned to the EPA.

Period covered by Annual Return

R1.2 An Annual Return must be prepared in respect of each reporting period, except as provided below.

Note: The term "reporting period" is defined in the dictionary at the end of this licence. Do not complete the Annual Return until after the end of the reporting period.

R1.3 Where this licence is transferred from the licensee to a new licensee:
(a) the transferring licensee must prepare an Annual Return for the period commencing on the first day of the reporting period and ending on the date the application for the transfer of the licence to the new licensee is granted; and
(b) the new licensee must prepare an Annual Return for the period commencing on the date the application for the transfer of the licence is granted and ending on the last day of the reporting period.

Note: An application to transfer a licence must be made in the approved form for this purpose.

R1.4 Where this licence is surrendered by the licensee or revoked by the EPA or Minister, the licensee must prepare an Annual Return in respect of the period commencing on the first day of the reporting period and ending on:
(a) in relation to the surrender of a licence - the date when notice in writing of approval of the surrender is given; or
(b) in relation to the revocation of the licence - the date from which notice revoking the licence operates.

Deadline for Annual Return

R1.5 The Annual Return for the reporting period must be supplied to the EPA by registered post not later than 60 days after the end of each reporting period or in the case of a transferring licence not later than 60 days after the date the transfer was granted (the 'due date').

R1.6 Not applicable.

Licensee must retain copy of Annual Return

R1.7 The licensee must retain a copy of the Annual Return supplied to the EPA for a period of at least 4 years after the Annual Return was due to be supplied to the EPA.

Certifying of Statement of Compliance and signing of Monitoring and Complaints Summary

R1.8 Within the Annual Return, the Statement of Compliance must be certified and the Monitoring and Complaints Summary must be signed by:
(a) the licence holder; or
(b) by a person approved in writing by the EPA to sign on behalf of the licence holder.

R1.9 A person who has been given written approval to certify a certificate of compliance under a licence issued under the Pollution Control Act 1970 is taken to be approved for the purpose of this condition until the date of first review of this licence.

R2 Notification of environmental harm

Note: The licensee or its employees must notify the EPA of incidents causing or threatening material harm to the environment as soon as practicable after the person becomes aware of the incident in accordance with the requirements of Part 5.7 of the Act.

R2.1 Notifications must be made by telephoning the Environment Line service on 131 555.

R2.2 The licensee must provide written details of the notification to the EPA within 7 days of the date on which the incident occurred.

R3 Written report

R3.1 Where an authorised officer of the EPA suspects on reasonable grounds that:
(a) where this licence applies to premises, an event has occurred at the premises; or
(b) where this licence applies to vehicles or mobile plant, an event has occurred in connection with the carrying out of the activities authorised by this licence,
and the event has caused, is causing or is likely to cause material harm to the environment (whether the harm occurs on or off premises to which the licence applies), the authorised officer may request a written report of the event.

R3.2 The licensee must make all reasonable inquiries in relation to the event and supply the report to the EPA within such time as may be specified in the request.

R3.3 The request may require a report which includes any or all of the following information:
(a) the cause, time and duration of the event;
(b) the type, volume and concentration of every pollutant discharged as a result of the event;
(c) the name, address and business hours telephone number of employees or agents of the licensee, or a specified class of them, who witnessed the event;
(d) the name, address and business hours telephone number of every other person (of whom the licensee is aware) who witnessed the event, unless the licensee has been unable to obtain that information after making reasonable effort;
(e) action taken by the licensee in relation to the event, including any follow-up contact with any complainants;
(f) details of any measure taken or proposed to be taken to prevent or mitigate against a recurrence of such an event; and
(g) any other relevant matters.

R3.4 The EPA may make a written request for further details in relation to any of the above matters if it is not satisfied with the report provided by the licensee. The licensee must provide such further details to the EPA within the time specified in the request.

R3.5 Reporting of blasting monitoring

R3.5.1 The results of the blast monitoring required by condition M7.1 must be submitted to the EPA at the end of each reporting period.

R3.5.2 The licensee must report any exceedence of the licence blasting limits to the regional office of the EPA as soon as practicable after the exceedence becomes known to the licensee or to one of the licensee's employees or agents.

GENERAL CONDITIONS

G1 Copy of licence kept at the premises

G1.1 A copy of this licence must be kept at the premises to which the licence applies.

G1.2 The licence must be produced to any authorised officer of the EPA who asks to see it.

G1.3 The licence must be available for inspection by any employee or agent of the licensee working at the premises.

Chapter 22

Water Sensitive Design


lismore
city council

22 Water Sensitive Design

22.1 Introduction

This Chapter contains Lismore City Council's requirements for the application of Water Sensitive Design (WSD) principles to developments in the Lismore local government area.

WSD is a multidisciplinary approach for integrating landuse and water management (water supply, stormwater, wastewater and groundwater) planning, with the aim of minimising the impacts of development on the natural water cycle. The main emphasis of this Chapter is stormwater management and water supply.

Development increases the area of impermeable surfaces (i.e. roads, buildings, driveways), leading to increases in the frequency, volume and magnitude of stormwater flows into natural waterways. Impermeable surfaces reduce the quantity of stormwater that can infiltrate into the soil, which results in an increase in stormwater runoff. The increase in stormwater runoff impacts on the natural water cycle and can lead to stream erosion, increased flooding, reduced groundwater recharge and increased pollution and sedimentation of waterways.

Improving water management in the design of developments, with particular emphasis on stormwater management, helps to protect aquatic ecosystems located both within the development and downstream. WSD seeks to ensure that developments are designed, constructed and maintained so as to minimise impacts on the natural water cycle.

Traditionally, stormwater management involved piped discharge from a site and the provision of stormwater detention for flood mitigation and drainage asset protection purposes. By contrast, contemporary management of the urban water cycle regards stormwater as a resource that can be reused and ensures appropriate treatment and attenuation of stormwater prior to discharge to receiving waterways.

WSD promotes a more decentralised approach to water management and gives greater emphasis to on-site collection, treatment and utilisation of water flows as part of an integrated 'treatment train'. WSD provides the opportunity for water management measures to achieve multiple objectives. For example, customised rainwater tanks can provide reuse and detention of stormwater, as well as benefits in regard to reducing ~~potable~~ reticulated water demand and reducing the frequency and pollutant load of stormwater discharge.

This Chapter sets bench marks for design and performance outcomes at the subdivision, street and lot scales. For the purposes of this Chapter, proposed land use changes are divided into two categories, namely 'developments' and 'subdivisions', and specific requirements for each category are provided. The provisions are designed to be applied to all developments and to be compatible with the Building Sustainability Index (BASIX).

are defined in Section 22.8.

22.2 Objectives

The objectives of this Chapter are:

1. To ensure that WSD techniques are incorporated in new developments.
2. To reduce the demand for ~~potable~~ reticulated water from the town water supply.
3. To ensure that stormwater discharged from new development minimises adverse impacts on the environment and receiving waters.
4. To utilise natural surfaces and landforms as stormwater flow paths and to allow for on-site treatment where suitable.
5. To ensure that water management is a key consideration in the urban design process to maximise opportunities for water reuse and ensure stormwater management infrastructure, in particular, is appropriately integrated with the site design.
6. To protect and restore aquatic ecosystems within the development site and downstream.
7. To ensure the function of the stormwater drainage and flood protection elements of designs are not compromised by incompatible or inappropriate WSD designs.

22.3 Applicability

This chapter applies to developments and subdivisions, unless otherwise excluded by this Chapter.

Developments

Developments may include residential development, commercial development, industrial development, tourist development, recreational development and car parks that have an impervious area greater than 300m². ~~This Chapter also applies to alterations or additions to existing developments that result in a total impervious area greater than 300m².~~

Developments areDevelopments are classified as either minor development or major development for the purpose of this Chapter. Developments are required to satisfy the WSD performance criteria in Table 1 and meet the objectives of this Chapter.

For the purposes of this Chapter development is classified as follows:

Minor Development

- Development site area **less than** 2,500 m²; and
- Impervious area **greater than** 300 m².

Minor developments are required to satisfy the performance criteria in Table 1 by either implementing the 'deemed to comply' solutions, or preparing a Water Management Plan that demonstrates how the development satisfies the performance criteria in Table 1 and objectives of this Chapter.

Major Development

- Development site area **greater than** 2,500 m²; and
- Impervious area **greater than** 300 m².

Major developments are required to prepare a Water Management Plan that demonstrates how the development satisfies the WSD performance criteria in Table 1 and the objectives of this Chapter.

This chapter does not apply to the following developments:

- A single dwelling-house
- A dual occupancy development
- Development which creates ~~with~~ an additional impervious area of less than 300 m²

If works that required consent have previously been conducted on a site without Council's consent, the area of unapproved works will be added to the area of the proposed works to determine the requirements for WSD associated with this Chapter.

Subdivisions

Subdivisions are required to:

1. meet the performance criteria listed in Table 1 and the objectives of this Chapter, and
2. be designed in accordance with the Northern Rivers Local Government Development and Design Manual.

This chapter does not apply to:

- Subdivision for residential purposes where the total land area is less than 2500 m²
- Subdivision where no additional lots are created
- Strata subdivision
- Subdivision where no road works or drainage works are required

22.4 Performance Criteria

Developments and subdivisions are required to achieve the performance criteria specified in Table 1.

Table 1: Water Sensitive Design Performance Criteria

Component	Performance Criteria	Intent
Potable Water Consumption		
~~potable~~ reticulated water consumption for residential development	40% reduction in the consumption of ~~potable~~ reticulated water compared to baseline (to be consistent with BASIX)	Increase the level of water recycling, reduce the demand for ~~potable~~ reticulated water from the bulk water supply network, and help to alleviate the need for upgrades to bulk water infrastructure
~~Potable~~ Reticulated water consumption for all other development	40% reduction in the consumption of potable water for staff and customer facilities and outdoor use compared to baseline	
Stormwater Quality		
Total Suspended Solids	8075% reduction in the mean annual load compared to baseline	Minimise the risk of water quality degradation in downstream waterways and thereby protect aquatic ecosystems
Total Phosphorus	65% reduction in the mean annual load compared to baseline	
Total Nitrogen	40% reduction in the mean annual load compared to baseline	
Gross Pollutants	90% reduction in the mean annual load compared to baseline	
Stormwater Quantity		
Flow rates (environmental protection)	Limit the post-development peak 1 year average recurrence interval (ARI) discharge from the site to the pre-development peak 1 year ARI discharge.	Reduce the likelihood of increased rates of bed and bank erosion and damage to benthic habitat in waterways
Flow rates (~~flood~~ infrastructure protection)	development peak 10 year average recurrence interval (ARI) discharge from the site to the pre-development peak discharge for the same ARI and. Assess the capacity of existing flow paths to accommodate the post development 100 year averageDiversion of stormwater to a discharge location where the increased frequency of discharge will not have a detrimental impact on aquatic ecosystems. Recurrence discharge from the site and provide necessary attenuation / infrastructure upgrade to ensure flow paths can accommodate anticipated flows.	nsure that the development does not result in increased stormwater flows that exceed the capacity of the external stormwater drainage infrastructure and / or exacerbate overland flow problems

Water management measuresWSD measures constructed or approved as part of a broader scheme can be credited towards the achievement of the performance criteria for a subsequent development. For example, the design of an industrial subdivision may incorporate WSD measures designed to achieve the stormwater quality performance criteria based on an assumed impervious figure for the developed lots. The WSD measures implemented at the subdivision stage will be credited towards satisfying the performance criteria for the subsequent industrial development on the subject lot.

There may be circumstances in which there is no benefit in applying the Stormwater Quantity performance criteria listed in Table 1. In such instances, Council must agree that the relevant criteria are not applicable.

For some developments, particularly infill developments, it may be difficult to implement the WSD measures required to meet the performance criteria listed in Table 1. In these instances, Council may approve a request to adopt less stringent performance criteria where appropriate justification is provided.

Designs should aim to divert runoff from all impervious areas to the stormwater management device(s). If this cannot be achieved, Council may accept designs which allow runoff from a small portion of the impervious area to bypass the stormwater management device(s). However, the stormwater management device(s) must still be sized based on the whole development site area.

22.5 Suggested Solutions

22.5.1 Developments

Minor developments are required to meet the performance criteria specified in Table 1 by either:

- Implementing the relevant 'deemed to comply' solutions listed in Table 2 for Residential Developments or Table 3 for Other Developments; or
- Preparing a Water Management Plan that demonstrates how the development will meet the relevant performance criteria specified in Table 1.

Table 2: 'Deemed to Comply' Solutions – Residential Developments

Component	'Deemed to Comply' Solutions
~~Potable~~ Reticulated Water Consumption	Provide BASIX certificate with development application
Stormwater Quality	One, or a combination, of the following: ▪ Bioretention system(s), with a filter media area sized at 1.5% of the contributing catchment area. ▪ Constructed stormwater wetland(s), with a macrophyte zone area sized at 6.5% of the contributing catchment area. ▪ Proprietary stormwater treatment product that achieves the performance criteria.
Stormwater Quantity	Stormwater detention system designed to attenuate the 1 year ARI and 10 year ARI peak discharge to pre-development levels. NOTE: Most minor developments will require a stormwater detention system that has a volume equivalent to 4 – 5 L per m² of development site area.

Table 3: 'Deemed to Comply' Solutions – Other Developments

Component	'Deemed to Comply' Solutions
~~Potable~~ Reticulated Water Consumption	▪ Water efficient appliances and fittings - Water Efficiency Labelling and Standards (WELS) rating of a minimum of three stars. ▪ Rainwater tank(s) with a volume of 1.5 kL per toilet/urinal plus 0.05 kL per m² of irrigated landscaping. Tank(s) to be connected to 50 m² of roof area per toilet/urinal plus 2 m² per m² of irrigated landscaping (or the total roof area if this is less). NOTES: 1. Tank(s) must be connected to all toilets and water-using urinals and sufficient outdoor taps to serve the irrigated landscaping. 2. An appropriate mechanism is to be provided for automatically switching to the town water supply when the volume of water in the rainwater tank(s) is low.
Stormwater Quality	One, or a combination, of the following: ▪ Bioretention system(s), with a filter media area sized at 1.8% of the contributing catchment area. ▪ Constructed stormwater wetland(s), with a macrophyte zone area sized at 7% of the contributing catchment area. ▪ Proprietary stormwater treatment product that achieves the performance criteria.
Stormwater Quantity	Stormwater detention system designed to attenuate the 1 year

	ARI and 10 year ARI peak discharge to pre-development levels. NOTE: Most minor developments will require a stormwater detention system that has a volume equivalent to 4 – 5 L per m² of development site area.

water sensitive design measures listed as 'deemed to comply' solutions in Table 2 is provided in Council's water sensitive design guidelines for minor developments.

Major developments require the preparation and implementation of a Water Management Plan that demonstrates how the development will meet the performance criteria specified in Table 1. Guidance on recommended water sensitive design measures and details to be included in the Water Management Plan are provided in Section 22.7 of this Chapter.

22.5.2 Subdivision

Subdivisions are required to be designed in accordance with the Northern Rivers Local Government Development and Design Manual and meet the objectives and performance criteria of this Chapter. All stormwater quality treatment devices for subdivisions are required to be sized to treat the 1 in 3 month rainfall event.

Subdivisions require the preparation of a Water Management Plan that demonstrates how the development will meet the performance criteria specified in Table 1. Section 22.6 provides guidance on recommended WSD measures. The details to be included in the Water Management Plan are provided in Section 22.7 of this Chapter.

Stormwater treatment devices that utilise soft engineering treatment solutions that can be contained within either existing or proposed public reserves are preferred. Treatment areas within private lands will be considered subject to registration of appropriate encumbrances upon the private land. All proposals should provide sufficient information to demonstrate that public safety, proposed infrastructure design levels and grades will fit within existing site contours, and proposed infrastructure can be maintained economically and feasibly. Solutions that propose the provision of publicly owned hard engineering treatment devices that can fail due to insufficient maintenance levels, or that require the use of specialist equipment for maintenance are generally not supported.

Residential Subdivision
Residential subdivisions must be designed in accordance with the Northern Rivers Local Government Development and Design Manual and ~~provide~~ include an allowance of 300 m² impervious area ~~per~~ on each proposed residential lot to account for the likely impervious area associated with future residential development on the lots in addition to other constructed impervious areas such as roads. If this allowance is not representative of the proposed future residential development, the use of an alternative impervious area allowance should be discussed with Council.

Residential subdivision will incorporate WSD measures that are designed to achieve the stormwater performance criteria based on the assumption that a mixture of dwelling-houses and dual occupancies will be constructed on the residential lots. Therefore, the stormwater performance criteria can be considered to have already been satisfied for any subsequent dwelling-house or dual occupancy.

Industrial and Commercial Subdivision
Industrial and commercial subdivision must be designed in accordance with the Northern Rivers Local Government Development and Design Manual. The subdivision design must implement WSD measures for the roads and may incorporate broad WSD measures that account for the proposed future industrial or commercial development on the lots

If the subdivision design only incorporates WSD measures for the roads, subsequent developments on the individual lots will be required to satisfy the stormwater performance criteria for industrial or commercial development.

If the subdivision design incorporates broad WSD measures based on a nominal figure of impervious area for the proposed future industrial or commercial development, the allowance will be credited toward satisfying the stormwater performance criteria for the subsequent development on the individual lots. A typical industrial or commercial development has an impervious area equal to at least 90% of the development site area.

22.6 Water Sensitive Design Measures

When preparing a Water Management Plan, the potential WSD measures that may be implemented, and methods for demonstrating compliance with the performance criteria, are listed in Table 4.

Guidance on the selection of appropriate WSD measures and their subsequent design, construction and establishment is provided in numerous industry publications, in particular the WSUD Technical Design Guidelines for South East Queensland.

With regard to treatment devices that will become public infrastructure, applicants are advised that due to public safety, maintenance and operational issues arising from some treatment solutions Council limits the array of treatment options that will be accepted as public infrastructure. It is recommended that prior to developing a Water Management Plan that proposes public infrastructure the designer contact Council to discuss requirements.

Table 4: Potential Water Sensitive Design Measures

Component	Potential Water Sensitive Design Measures	Method for Demonstrating Compliance
~~Potable~~ Reticulated Water Consumption	Appropriate combination of the following: ▪ Indigenous or low water use plants ▪ Water efficient appliances and fixtures ▪ Rainwater tank ▪ Stormwater tank ▪ On-site greywater system ▪ Recycled water supply	Water balance analysis using industry standard software, customised spreadsheet or other suitable means
Stormwater Quality	Appropriate combination of the following: ▪ Litter trap ▪ Gross Pollutant Trap (GPT) ▪ Bioretention system ▪ Vegetated swale ▪ Bioretention swale ▪ Sedimentation basin ▪ Constructed stormwater wetland ▪ Sand filter ▪ Porous pavement system ▪ Rainwater tank ▪ Stormwater tank ▪ Infiltration system ▪ Proprietary stormwater treatment product	Stormwater quality modelling using industry standard software
Stormwater Quantity	Appropriate combination of the following: ▪ Detention tank ▪ Detention basin ▪ Infiltration system	Hydrologic analysis using a runoff routing method

1.1

22.7 Requirements for Water Management Plans (WMPs)

Major Developments

Major developments require the preparation of a Water Management PlanThe Water Management Plan must demonstrate how the development or subdivision will meet the performance criteria specified in Table 1 and the objectives of this Chapter. The Water Management Plan must include the following information (where appropriate):

- **Site and catchment description** – site location, existing land use, available water supplies, description of broader catchment, surrounding land uses, soil types, hydrology, drainage characteristics, stormwater discharge locations, downstream waterways and any ecological habitats or species of particular significance.
- **Description of proposed development** – including proposed catchment plan with contours.
- **Summary of water sensitive design objectives / performance criteria**.
- ~~**Potable**~~ **Reticulated water consumption** – water consumption assumptions, description of proposed water sensitive design measures, justification of selection, details of water balance analysis to demonstrate compliance.
- **Stormwater quality** – description of proposed water sensitive design measures, justification of selection, details of stormwater quality modelling to demonstrate compliance (including assumptions).
- **Stormwater quantity** – description of proposed water sensitive design measures, justification of selection, details of hydrologic analysis to demonstrate compliance (including assumptions).
- **Tailored ecological protection measures** – details of any strategies proposed to protect / enhance any identified ecological habitats or species of particular significance.
- **Responsibility** – specification of parties responsible for the supervision, construction, establishment / commissioning and ongoing maintenance of water sensitive design measures, including proposed methods for transferring responsibility for measures located on private property (if applicable).
- **Maintenance** – proposed maintenance regime for water sensitive design measures.

The information listed above is relevant to the water sensitive design aspects of the development. To consolidate the reporting process, designers and consultants may include other design information in the Water Management Plan. For example, it may be appropriate to include details of construction phase stormwater management (i.e. erosion and sediment control), flooding assessments, and wastewater management. Council officers can recommend appropriate documents to assist in the preparation of a Water Management Plan.

22.8 Definitions

Baseline - Refers to outcomes from a development scenario where no water sensitive design measures are implemented to improve or mitigate potential impacts of the development. The baseline is the "do nothing" or "business as usual" scenario.
BASIX – A web-based design tool that ensures residential developments meet the NSW Government's targets for reductions in water consumption and greenhouse gas emissions.
Bioretention system – A stormwater treatment system that utilises the natural filtering characteristics of soil and vegetation to remove pollutants from stormwater. Bioretention systems remain dry except during and immediately after rainfall.
Catchment – Area of land that contributes stormwater runoff to a specific location.
Coarse sediment – Sediment particles within the size range of 0.1 mm to 5 mm.
Constructed stormwater wetland – A densely vegetated wetland that is specifically designed to remove pollutants from stormwater. Constructed stormwater wetlands are permanently wet and typically have some open water zones.
Detention – The containment of runoff within a storage for relatively short periods to reduce peak flow rates. The volume of runoff that passes through the storage is relatively unchanged.
Detention basin – A reservoir or storage which temporarily contains stormwater runoff with the purpose of reducing peak flow rates.
Development site area – The area of the site of the proposed development.
Erosion and sediment control plan – A plan that specifies erosion and sediment control measures.
Impervious (or impermeable) surface – A surface that prevents infiltration of water into the ground. Impervious surfaces typically include roads, carparks, driveways, footpaths, roofs, paved areas and heavily compacted clay soils.
Infill Development – Development in an established urban area (e.g. town centre).
Irrigated landscaping – The area of landscaping (turf or garden) within the development site that is expected to require regular watering.
Non-~~potable~~ Reticulated water – Water that does not meet the requirements of drinking water as defined in the Australian Drinking Water Guidelines.
Nutrients – Substances that are needed by plants and animals for growth (e.g. nitrogen, phosphorus). In waterways, excessive quantities of nutrients can lead to degradation of water quality by promoting excessive growth, accumulation, and subsequent decay of plants, especially algae.
Porous pavement – A specially designed pavement that allows water to infiltrate through the pavement. Porous (permeable) pavements are typically constructed using either: (i) pavers that are physically shaped and/or arranged so that there are gaps between the pavers; (ii) pavers that allow water to pass through the paver itself (e.g. 'no fines' concrete pavers); or (iii) flexible or rigid pavements (e.g. asphalt or concrete) that are permeable.
Pervious (or permeable) surfaces – A surface that allows infiltration of water into the ground. Pervious surfaces typically include grassed or landscaped areas, parks, sporting fields and naturally vegetated areas (e.g. forests).
~~Potable~~ Reticulated water – Water that meets the requirements of drinking water as defined in the Australian Drinking Water Guidelines.
Riparian corridor - Riparian vegetation along a waterway network that provides linear habitat areas for fauna movement.
Riparian vegetation – Indigenous vegetation along the edge of a waterway that is part of the ecology of the waterway. This vegetation performs numerous functions including filtering runoff and providing habitat for fauna.
Rainwater Tank – A tank which collects roof water.
Roofwater – Water produced by rainfall onto the roof catchment of a building.
Runoff – The portion of rainfall that exceeds the infiltration capacity of the surface it has fallen onto and subsequently flows across the surface.
Sediment – Sediment is any particulate matter that can be transported by fluid flow and which eventually is deposited as a layer of solid particles on the bed or bottom of a body of water.
Stormwater – see Runoff.
Stormwater Tank – A tank which collects stormwater.

Water Management Plan (WMP) – A document, including relevant drawings, which describes how a proposed development will meet the performance criteria specified in this Chapter.

Water Sensitive Design Technical Guidelines

for Minor Development

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1

Introduction

This document contains guidelines relating to water sensitive design measures for 'minor development', as defined in Lismore Development Control Plan (DCP): Part A – Chapter 22 Water Sensitive Design. These guidelines have been prepared to assist designers to ensure that development proposals meet Lismore City Council's water sensitive design requirements.

1.1 Purpose

The purpose of this document is to provide guidance on the design, construction, establishment and maintenance of the water sensitive design measures listed as 'deemed to comply' solutions in Lismore DCP Chapter 22 – Water Sensitive Design. The water sensitive design measures covered in these guidelines are:

- bioretention systems;
- constructed stormwater wetlands; and
- stormwater detention systems.

The 'deemed to comply' solutions are only applicable to 'minor developments', as defined in Chapter 22 Water Sensitive Design. As such, the information provided in these guidelines is specifically tailored towards relatively small-scale water sensitive design measures. These guidelines should not be used to design larger water sensitive design measures for 'major developments'. Council officers can recommend appropriate references for the design of 'major developments'.

The 'deemed to comply' solutions presented in Lismore DCP Chapter 22 – Water Sensitive design represent standardised solutions that are acceptable to Council. It is anticipated that by adopting and implementing the 'deemed to comply' solutions, there will be cost savings due to the simplified design process. Standard drawings that assist to further simplify and expedite the design process are available from various organisations, including the South East Queensland Healthy Waterways Partnership (Water by Design program).

Designers and developers are not obliged to adopt and implement the 'deemed to comply' solutions. The alternative approach is to prepare a Water Management Plan (WMP), which describes how the proposed development will meet the relevant performance criteria specified in the DCP.

1.1.1 Note on rainwater tanks and proprietary stormwater treatment products

Rainwater tanks and proprietary stormwater treatment products are also listed as 'deemed to comply' solutions in Lismore Development Control Plan: Part A - Chapter 22 Water Sensitive Design. However, these measures are not covered in these guidelines.

Guidance on the design and installation of rainwater tanks is contained in Lismore City Council's *Rainwater Tank Installation Guideline*.

The category of 'proprietary stormwater treatment products' includes an ever-changing range of commercially available products from numerous manufacturers / distributors. As such, it is not possible to provide comprehensive guidance on the design of these systems in this document. In any case, the relevant distributor should be contacted for up-to-date product information. Additional notes on proprietary stormwater treatment products are provided in Section 2.2.1

1.2 Structure

The following table provides a summary of the information provided in the subsequent sections of this document:

Table 1.1 Structure of Document

Section	Title	Description of Content
2	Selection of Water Sensitive Design Measures	General guidance regarding the key factors influencing the selection of WSD measures for a development site
3	Bioretention Systems	Guidance on the design, construction, establishment and maintenance of bioretention systems
4	Constructed Stormwater Wetlands	Guidance on the design, construction, establishment and maintenance of constructed stormwater wetlands
5	Stormwater Detention Systems	Guidance on the design of stormwater detention systems

1.3 Acknowledgements

Lismore City Council is grateful to the following organisations for the provision of text and images utilised in this document:

- Sydney Metropolitan Catchment Management Authority (Water Sensitive Urban Design in Sydney program)
- South East Queensland Healthy Waterways Partnership (Water by Design program)

2

Selection of Water Sensitive Design Measures

The sections below provide guidance on the selection of appropriate water sensitive design measures for 'minor developments', as defined in the WSD chapter of the DCP.

2.1 Reticulated Water Consumption

Rainwater tanks are the only water management measure specified as a 'deemed to comply' solution to meet the 'reticulated water consumption' performance criterion. Guidance on the design and installation of rainwater tanks is contained in Lismore City Council's *Rainwater Tank Installation Guideline*.

2.2 Stormwater Quality

Three stormwater treatment devices have been specified as 'deemed to comply' solutions to meet the 'stormwater quality' performance criteria. These three devices are:

- bioretention systems;
- constructed stormwater wetlands; and
- proprietary stormwater treatment products.

Guidance on the design of bioretention systems and constructed stormwater wetlands is provided in this document. As mentioned in Section 1.1.1, proprietary stormwater treatment products are not covered in this document. However, some notes on proprietary stormwater treatment products are provided in Section 2.2.1.

There are opportunities for stormwater treatment devices to perform multiple functions. For example, bioretention systems and constructed stormwater wetlands can be landscape features as well as functional stormwater treatment devices. Similarly, most porous pavement systems (a type of proprietary stormwater treatment product) are specifically designed to be functional pavements. With appropriate design, some porous pavement systems can be utilised in areas with vehicular traffic, such as car parking areas.

Selection of the most appropriate stormwater treatment device for a particular development will be influenced by:

- availability of space on the site;
- landscape and site design objectives;
- slope of land; and
- level difference between the site and the water level at the stormwater discharge location in the receiving drainage system / waterway.

General guidance regarding each of these issues is listed below. Consideration of these issues in the context of an individual site should enable the designer to determine the most appropriate measure.

Space

In general, a proprietary stormwater treatment product will take up less space on a site than a bioretention system, which in turn will occupy less space than a constructed stormwater wetland. The total footprint of a bioretention system will typically be less than half that of a constructed stormwater wetland, assuming they are both sized to achieve the same level of stormwater treatment.

Landscape Objectives
A constructed stormwater wetland provides the best opportunity to create a landscape feature with a high level of amenity and ecological value, due to the ability to incorporate open water areas and a variety of vegetation types. Bioretention systems can also be designed as attractive landscape features and there is flexibility regarding overall shape and style. Proprietary stormwater treatment products are often located underground and, as such, do not enhance or detract from the landscape or site design. An exception to this is porous pavements, which can be designed to complement the overall site / landscape theme.

Slope
Flat sites pose a design challenge because once stormwater has been diverted into an underground pipe system, it can be very difficult to then bring the stormwater back to the surface and discharge onto a treatment device such as a bioretention system or a wetland. Therefore, on flat sites it may be appropriate to consider numerous devices spread throughout the site rather than a single lumped device. This allows stormwater to be treated on the surface before it is diverted to an underground pipe system. An alternative is to utilise a below-ground proprietary stormwater treatment product. Sloping sites are typically less constrained and support a variety of design solutions, although substantial earthworks may be required to create the flat pads required for bioretention systems or wetlands.

Level Difference
For the majority of stormwater treatment devices, the water level upstream of the device is higher than the water level downstream of the device. This is sometimes referred to as the head loss through the device. Bioretention systems typically require more head loss than a constructed stormwater wetland. However, the head loss through a bioretention system can be reduced if the system is designed to allow stormwater that has percolated down through the filter media to infiltrate into the underlying soil (refer to Section 3.2 for details). The head loss of proprietary stormwater treatment products varies greatly.

The implication for site design is that the greater the head loss through the stormwater treatment device, the greater the level difference needs to be between the site surface levels and the water level at the stormwater discharge location in the receiving drainage system / waterway. If this level difference is minimal, additional filling of the site may be required to allow the stormwater treatment device to function properly.

2.2.1 Note on proprietary stormwater treatment products

If a proprietary stormwater treatment product is proposed for a development, the following supporting information must be provided with the application:

- Brief description of how the product functions, including the pollutant removal mechanisms.
- Justification that the proposed system can meet the ‘stormwater quality’ performance criteria, including supporting documentation that presents the results of rigorous, independent scientific testing.
- Description of how the system has been sized, including any alterations to standard designs to account for local climatic conditions.
- Maintenance and renewal requirements.

At the time of writing this document, proprietary stormwater treatment products that may be capable of meeting the ‘stormwater quality’ performance criteria include the Enviss porous pavement system, StormFilter by Stormwater 360, Hydrofilter by Humes, and Filternator by Rocla. This is not an exhaustive list and the stormwater treatment performance of these products has not been assessed for compliance with the ‘stormwater quality’ performance criteria.

2.3 Stormwater Quantity

The 'deemed to comply' solution to meet the ‘stormwater quantity’ performance criteria is a stormwater detention system designed to attenuate the 1 year ARI and 10 year ARI peak discharges to pre-development levels. There are several types of stormwater detention systems that can be utilised on relatively small sites and these options are discussed in Section 5.

3

Bioretention Systems

3.1 Overview

Bioretention systems are commonly utilised throughout Australia to provide treatment of stormwater. Bioretention systems are also referred to as 'biofiltration systems' and 'rain gardens'. More specific terms such as 'bioretention basins', 'bioretention pods' and 'bioretention trenches' are sometimes used to describe bioretention systems of a particular shape and size. General information about bioretention systems can be found in water sensitive urban design guidelines and fact sheets produced by organisations such as the Facility for Advancing Water Biofiltration (FAWB), South East Queensland Healthy Waterways Partnership, NSW Department of Environment, Climate Change and Water, Brisbane City Council, Sydney Metropolitan Catchment Management Authority, and Melbourne Water.

3.2 Features

Bioretention systems consist of a flat vegetated area overlying a permeable soil layer that is typically 0.4 – 0.8 m deep. Stormwater that flows into the bioretention system is initially filtered through the densely planted surface vegetation. As the stormwater percolates down through the soil, pollutants are removed through fine filtration, adsorption and biological uptake. Key features of bioretention systems are shown in Illustration 1.1 and include:

- **Surface vegetation** – Typically native sedges, rushes and grasses.
- **Filter media** – Soil that has appropriate permeability (i.e. infiltration rate) and can sustain healthy vegetation. In general, suitable filter media comprises clean loamy sand with some organic matter.
- **High flow outlet(s)** – Pits, pipes or weirs to convey flows that exceed the infiltration capacity of the filter media.
- **Extended detention zone** – Bioretention systems are purposefully designed to allow temporary ponding of stormwater on the surface, typically to a depth of 200 – 400 mm. Stormwater that ponds in the extended detention zone ultimately infiltrates down through the filter media, rather than discharging via the high flow outlet(s). Therefore, the extended detention zone is located below the level of the high flow outlet(s). An additional 200 – 400 mm ponding depth is typically required above the level of the high flow outlet(s) to ensure efficient conveyance of stormwater in high flow events.
- **Bunds / Walls** – Earth bunds, concrete walls or some other means of containing ponded stormwater within the bioretention system.

If the in situ soils underlying the bioretention system are suitable, it may be appropriate to allow stormwater that has percolated down through the filter media to infiltrate into the underlying soil. If this approach is to be pursued, the saturated hydraulic conductivity (i.e. infiltration rate) of the underlying soil must be at least equivalent to the saturated hydraulic conductivity of the filter media. Groundwater levels must also be assessed and the bioretention system should be designed so that the base of the filter media is above the seasonal high groundwater level. In areas with shallow groundwater, it is recommended that the sides of the filter media be lined with an impermeable liner. The potential for localised groundwater mounding in the vicinity of the bioretention system should be assessed to ensure that no structures will be adversely affected.

If infiltration of stormwater into the underlying in situ soils is either inappropriate or undesirable, the following items need to be incorporated into the design of the bioretention system:

- **Under-drains** – Slotted PVC pipes at the base of the filter media that collect the filtered stormwater and convey this water to the outlet location.
- **Drainage layer** – A bedding layer of fine gravel in which the under-drains are laid.
- **Transition layer** – A layer of coarse sand to provide physical separation between the filter media and the drainage layer. The purpose of the transition layer is to prevent the filter media (loamy sand) being washed down into the drainage layer (fine gravel).

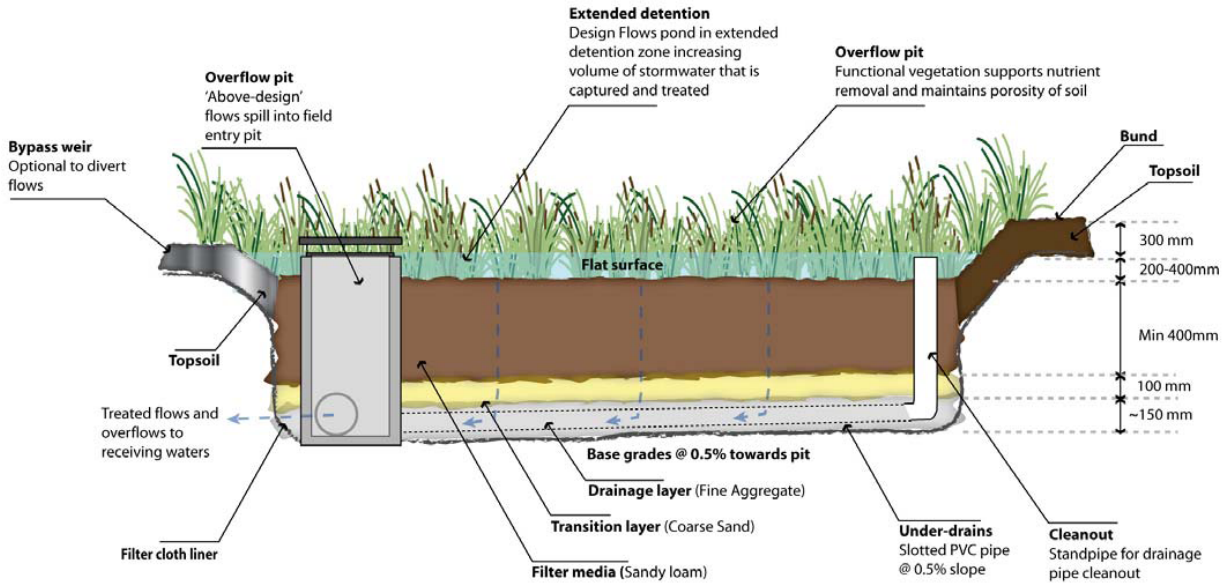

Illustration 1.1 **Typical cross section through a bioretention system (with under-drains)**
Illustration courtesy of South East Queensland Healthy Waterways Partnership (Water by Design program)

3.3 Design

Bioretention systems can be any shape and should be designed to complement the overall landscape and site design theme. For example, in a high density commercial zone it might be appropriate to have a bioretention system with straight edges, sharp corners and vertical walls. Conversely, in a residential setting with extensive landscaping, it might be appropriate to have a bioretention system with curved edges and gently sloping batters that are densely planted.

The following sections detail the steps that should be undertaken during the concept design phase and the subsequent detailed design phase. Concept design refers to the development of the initial site layout, which takes into account the opportunities and constraints of the site. Detailed design refers to the preparation of design drawings for submission to Council, either to support a development application or an application for a construction certificate.

3.3.1 Concept design phase

Given that a bioretention system will be a significant feature within the site layout, it is important that the bioretention system is appropriately considered during the concept design of the development. As a minimum, the following steps are recommended during the concept design phase:

1. Identify the location and level of the ultimate stormwater discharge location.
2. Identify a suitable location for the bioretention system (ensuring there is appropriate access for maintenance).

3. Determine the catchment area that will drain to the bioretention system.
4. Calculate the required size of the filter media area.
   As specified in the DCP:
   filter media area = 1.5 % of catchment area (residential development)
   filter media area = 1.8 % of catchment area (all other development)
5. Estimate the overall footprint of the bioretention system. Note: If the bioretention system will have sloping batters around the sides, the overall footprint of the system is likely to be 3 times the filter media area.
6. Ensure that the site layout allows sufficient area for the bioretention system.
7. Confirm that there is sufficient level difference for the bioretention system to function properly and drain freely after rainfall. Note: For bioretention systems with under-drains, the surface level of the bioretention system (i.e. top of filter media) typically needs to be at least 0.5 m above the normal water level in the receiving drainage system / waterway. Bearing in mind that the bioretention system needs to incorporate a ponding depth of at least 0.4 m (refer to description of 'extended detention zone' in Section 3.2), this means that there typically needs to be a level difference of at least 0.9 m between the minimum site surface level and the normal water level in the receiving drainage system / waterway. In some instances, stormwater drainage or flooding issues may dictate that this level difference needs to be even greater.

During the concept design phase, it may become apparent that a bioretention system is not an appropriate stormwater treatment system for the site. If this is the case, an alternative stormwater treatment system will need to be investigated.

3.3.2 Detailed design phase

The following table specifies the design requirements for the key features of a bioretention system.

Table 3.1 Design Requirements for Bioretention Systems

Feature	Design Requirement
Filter media area	1.5 % of catchment area (residential development) 1.8 % of catchment area (all other development)
Depth of filter media layer	400 mm (> 600 mm is preferable)
Depth of extended detention zone (i.e. depth of ponding below the level of the high flow outlet(s))	200 mm
Depth of transition layer (if applicable)	100 mm
Depth of drainage layer (if applicable)	150 mm
Type of under-drains (if applicable)	Slotted PVC pipes
Longitudinal grade of under-drains (if applicable)	0.5 %
Lateral offset between under-drains (if applicable)	1 m
Location of cleanout / inspection standpipes for under-drains (if applicable)	At the end of each under-drain and at each junction
Level of bunds / walls surrounding bioretention system	As required by stormwater drainage design

As a minimum, the following steps are recommended during the detailed design phase:

1. Confirm the size of the catchment area that will drain to the bioretention system.
2. Confirm the required size of the filter media area.
3. Design the layout of the bioretention system, including extent of filter media, location of outlets, extent of bunds / walls.
4. Determine whether under-drains are required or whether it is appropriate to allow infiltration into the underlying soil.
5. Set the key levels of the bioretention system ensuring that the minimum requirements are met (e.g. level of bunds / walls surrounding bioretention system, level of high flow outlet(s), top of filter media, transition layer, drainage layer, connection to outlet).
6. Prepare earthworks design of the bioretention system.
7. Design under-drains (if required) – layout, location of cleanout / inspection standpipes.
8. Design high flow outlet(s) – The design of the high flow outlet(s), including the pipes/ channels that connect to the ultimate discharge location, will typically be undertaken as part of the hydraulic design of the overall stormwater drainage system for the site. To simplify the hydraulic design process, infiltration of stormwater into the bioretention filter media can be ignored. The peak water level in the bioretention system will be determined during the hydraulic design and this will influence the required level of the bund or embankment surrounding the system.

The design drawings that accompany a development application or an application for a construction certificate should include the following information:

- **Drainage layout** – Information to be shown includes location of the bioretention system within the site layout, catchment boundaries (if applicable), drainage paths (surface and sub-surface), and connection to discharge location.
- **Bioretention system (plan view)** – Information to be shown includes extent of filter media, extent of surrounding bunds / walls, location of high flow outlet(s), key levels (e.g. surface level of filter media, level of high flow outlet(s), base levels), contours, maintenance access provision, layout of under-drains (if applicable).
- **Bioretention system (typical section)** – A typical section should be provided which shows the depth of each soil layer, key levels, details of surrounding bunds / walls etc.
- **Bioretention system (details & notes)** – Details are typically required for high flow outlet(s), headwalls, scour protection, and under-drains. Drawing notes should include construction advice and specifications for the soils and plants (refer to information below). In some instances, it may be more appropriate to include the plant specification on a separate landscape drawing.

3.3.2.1 Soil specification

The percolation of stormwater through the filter media soil layer is one of the key mechanisms for pollutant removal in a bioretention system. Therefore, it is critical that appropriate soil is utilised in the filter media layer. In general, the filter media should be clean loamy sand with an appropriately high permeability under compaction and should not be hydrophobic. The filter media should contain some organic matter for increased water holding capacity but be low in nutrient content.

Council officers may be able to recommend soil products from local soil suppliers that are suitable for use in the filter media layer. Alternatively, the following specification can be utilised:

> *The saturated hydraulic conductivity of the filter media is to be 200 – 400 mm/hr measured using the ASTM F1815-06 method. The filter media must also meet the filter media specifications detailed in the "Guidelines for Soil Filter Media in Bioretention Systems" published by the Facility for Advancing Water Biofiltration (FAWB). Refer to www.monash.edu.au/fawb for details.*

If a transition layer is required, it should consist of clean, well-graded coarse sand containing little or no fines. The average particle size should be approximately 1 mm.

If a drainage layer is required, it should consist of clean, fine gravel, such as 2-5 mm washed screenings.

3.3.2.2 Plant specification

The landscape architect / designer should prepare a planting plan or specification for the bioretention system, which complements the broader landscape design. Research needs to be undertaken to determine to determine the tolerance of different species to different depths of water.

The filter media area should be planted with native sedges, rushes and grasses. Depending on the species used a planting density of approximately 10 plants per square metre should be utilised. The following plants are considered to be suitable: *carex appressa; carex fasicularis; cyperus exaltatus; cyperus polystachyos; juncus usitatus; ficnia nodosa; pennisestum alopecuroides; lomandra longifolia; lomandra hystrix*. If earth bunds are utilised around the bioretention system, the lower portion of the batters should be planted with vegetation that can tolerate periodic inundation.

3.3.2.3 Safety issues

The design of a bioretention system needs to ensure public safety requirements are addressed through a risk based approach.

Fences or vegetation barriers to restrict access should be provided above vertical walls or steep embankments if:

- there is a risk of serious injury in the event of a fall.
- there is a high level of pedestrian or vehicular exposure (e.g. adjacent to footpaths / cycleways, playgrounds, sports fields).

Access to deep water (e.g. > 300 mm) should also be restricted through the utilisation of fences or vegetation barriers. As discussed in Section 3.2, bioretention systems are purposefully designed to allow temporary ponding of stormwater on the surface. The design of safety measures should take into account this temporary ponding.

If vegetation barriers are utilised to restrict access, plant species that are tall, dense and spiky will be the most effective. A temporary fence (e.g. sediment fence) will be required until the vegetation is sufficiently established to provide a physical barrier.

Where appropriate, signs should be provided to warn of deep and / or fast flowing water.

3.3.2.4 Designing to deter cane toads

The design of bioretention systems is to incorporate measures to discourage cane toads from breeding in these structures.

In order to breed in a waterbody, cane toads require easy access to the water's edge. A pond edge with a vertical, rather than sloping, profile can prevent cane toads from getting into and out of the water. Where a sloping pond edge is necessary, incorporating dense vegetation and low barrier fencing around the waterline, is an effective way to stop cane toads from accessing the water. It is desirable that these measures are installed as soon as practicable once construction is complete.

Densely planting the pond edge with native sedges, rushes and grasses will help to exclude cane toads, whilst providing habitat for native frogs and waterbirds. In order to form an effective toad

barrier, the plants must be densely spaced and a minimum of three rows of planting installed directly adjacent to the waterline.

A cane toad exclusion fence (minimum 500mm in height) is to be installed behind the 3 rows of sedge planting. The fence is to be maintained until such time as the plants have matured enough to form an effective barrier. Suitable materials for cane toad exclusion fencing include shadecloth or sediment film supported by timber or metal stakes.

3.4 Construction and Establishment

Comprehensive guidance on the construction and establishment of bioretention systems is provided in the *Construction and Establishment Guidelines: Swales, Bioretention Systems and Wetlands* (South East Queensland Healthy Waterways Partnership, Version 1 February 2009). Key issues associated with the construction and establishment process are summarised in the following sections.

3.4.1 Timing

Rainfall and the associated stormwater runoff can cause irreparable damage to a bioretention system during construction. In particular, sediment-laden inflows during the installation of the soil layers will typically require the installed soil layers to be completely removed and replaced. This highlights the importance of careful planning and efficient construction. The construction of a small bioretention system can be completed in a couple of days, so the risk of damage due to stormwater inflows can be minimised through appropriate planning and monitoring of weather forecasts.

3.4.2 Managing risk of damage during building construction phase

It is important to note that bioretention systems are designed to treat stormwater runoff from developed sites. They are not designed to be sediment and erosion control measures during the construction phase, although they can be temporarily modified to perform this function. Bioretention systems are quite robust to variations in stormwater inflows (both quantity and quality), but they can be damaged by inflows that contain unusually high concentrations of some pollutants, such as sediment or metals. This includes sediment-laden runoff from a typical building construction site. As such, there is a risk that the successful long term functioning of a bioretention system can be compromised by shock loads during the building construction phase.

The risk of damage to a bioretention system during the building construction phase needs to be managed by either:

- Delaying construction of the bioretention system until building construction is complete; or
- Initially establishing the bioretention system as a temporary shallow sediment basin.

If the first option is adopted, standard sediment and erosion control measures (e.g. sediment fences) need to be implemented across the site to protect downstream waterways.

The second option involves covering the surface of the filter media with a filter cloth or a 50 mm thick layer of coarse sand, and then placing a 25 mm thick layer of topsoil and turf over the top of the filter cloth / sand layer. Sediment fences should be installed around the perimeter of the filter media and the top of the batter to prevent sediment from being carried into the system by overland flow. The fences also prevent construction traffic from entering the system. In this form, the bioretention system can operate as a shallow sediment basin. The temporary protection measures remain in place until building construction is complete, at which time the filter cloth / sand layer, topsoil, turf, sediment fences and accumulated sediment can be removed. The bioretention system is then landscaped in accordance with the planting plan or specification.

3.5 Maintenance

Bioretention systems require ongoing inspection and maintenance to ensure they establish and operate in accordance with the design intent. Potential problems that may arise as a result of poor maintenance include:

- Decreased aesthetic amenity;
- Reduced treatment performance;
- Public health and safety risks; and
- Decreased habitat diversity (e.g. dominance of exotic weeds).

3.5.1 Plant establishment

Strong healthy vegetation plays a key role in maintaining the porosity and therefore the infiltration capacity of a bioretention system. The most intensive period of maintenance is during the plant establishment period (initial one to two years) when weed removal and replanting may be required.

Regular watering of bioretention system vegetation is essential for successful establishment and healthy growth. The frequency of watering to achieve successful plant establishment is dependent upon rainfall, maturity of planting stock and the water holding capacity of the soil. The following watering program is generally adequate, but should be adjusted to suit the site conditions:

- Week 1 - 6: 5 waterings/ week
- Week 6 - 10: 3 waterings/ week
- Week 11 - 15: 2 waterings/ week

In the absence of rain, it is recommended that each plant receives 2.5–5.0 litres of water per week during the first six weeks (40 mm of watering per week during establishment). After an initial four-month period, watering may still be required, particularly during the first winter / spring or dry period. Watering requirements for healthy vegetation can be determined by ongoing inspections.

3.5.2 General ongoing maintenance

Inflow pipes, headwalls, outlets and weirs require regular inspection, as these can be prone to scour and litter build up. Debris can block inlets or outlets and can be unsightly, particularly in highly visible areas. Inspection and removal of litter and debris should be done regularly.

Typical maintenance of a bioretention system involves:

- Routine inspection of the bioretention system to identify any areas of obvious increased sediment deposition, scouring from storm flows, rill erosion of the batters from lateral inflows, damage to the profile from vehicles and clogging of the bioretention system filter media (evident by prolonged ponding of water or a ‘boggy’ surface).
- Routine inspection of inlets, outlets and weirs to identify, clean and repair any areas of scour, litter build up and blockage.
- Removal of sediment where it is smothering vegetation and plant replacement if required.
- Repairing damage to the system profile resulting from scour, rill erosion or vehicle damage by replacement of appropriate fill (to match original soils) and revegetation.
- Tilling of the bioretention system surface, or removal and reinstatement of the surface layer, if there is evidence of clogging.
- Regular watering/irrigation of vegetation until plants are established and self sustaining.
- Removal and management of invasive weeds.
- Removal of plants that have died and replacement with plants of equivalent size and species as detailed in the plant schedule.
- Pruning to remove dead or diseased vegetation and to stimulate growth.

Resetting (i.e. complete reconstruction) of the bioretention system will be required if the system fails to drain adequately after tilling of the surface and/or replacement of the surface layer. Regular inspections are required, as well as inspections following intense storm events to check for scour and other damage. Major maintenance involving machinery should only occur after a reasonably rain free period when the soil in the bioretention system is relatively dry.

3.6 Examples

Photos of bioretention systems are provided in the following plates.

Plate 1.1 Bioretention basin in a streetscape setting

Plate 1.2 Bioretention planter box
Photo courtesy of Sydney Metropolitan Catchment Management Authority (Water Sensitive Urban Design in Sydney program)

Plate 1.3 Bioretention basin with rock wall perimeter

Plate 1.4 Bioretention swale in the centre median of a road

Plate 1.5 Bioretention basin in medium density development

Photo courtesy of Sydney Metropolitan Catchment Management Authority (Water Sensitive Urban Design in Sydney program)

Plate 1.6 Bioretention pod in road

Photo courtesy of Sydney Metropolitan Catchment Management Authority (Water Sensitive Urban Design in Sydney program)

4

Constructed Stormwater Wetlands

4.1 Overview

Constructed stormwater wetlands are commonly utilised throughout Australia to provide treatment of stormwater. General information about constructed stormwater wetlands can be found in water sensitive urban design guidelines and fact sheets produced by organisations such as the Facility for Advancing Water Biofiltration (FAWB), South East Queensland Healthy Waterways Partnership, NSW Department of Environment and Climate Change, Brisbane City Council, Sydney Metropolitan Catchment Management Authority, and Melbourne Water.

4.2 Features

Constructed stormwater wetlands are relatively shallow, densely vegetated water bodies. As stormwater flows through a wetland, pollutants are removed through sedimentation, filtration, adhesion and biological uptake. Key features of wetlands are shown in Illustration 1.2 and include:

- **Inlet pond / sediment basin** – Relatively deep pond / basin located at upstream end of wetland that captures coarse sediment.
- **Macrophyte zone** – Shallow, densely vegetated area to remove fine particulates and soluble pollutants.
- **Vegetation** – Typically native reeds, sedges, and rushes.
- **Liner** – Compacted clay base or plastic liner to ensure wetland holds water.
- **High flow outlet(s) from inlet pond** – Pits, pipes, weirs and / or bypass channels to convey high flows from the inlet pond directly to the discharge location (i.e. high flows should bypass the macrophyte zone so that wetland plants are not damaged).
- **Low flow outlet from macrophyte zone** – Riser outlet (with associated pits and pipes) to control flow through the macrophyte zone and ensure the notional detention time is achieved.
- **Extended detention zone** – Wetlands are purposefully designed to allow additional ponding of stormwater above the normal water level, typically to a depth of 400 - 600 mm. Stormwater that temporarily fills this extended detention zone ultimately drains out via a low flow outlet. This extended detention zone is located below the level of the high flow outlet(s). An additional 200 – 400 mm ponding depth is typically required above the level of the high flow outlet(s) to ensure efficient conveyance of stormwater in high flow events.
- **Bunds / Walls** – Earth bunds, concrete walls or some other means of containing stormwater within the wetland.

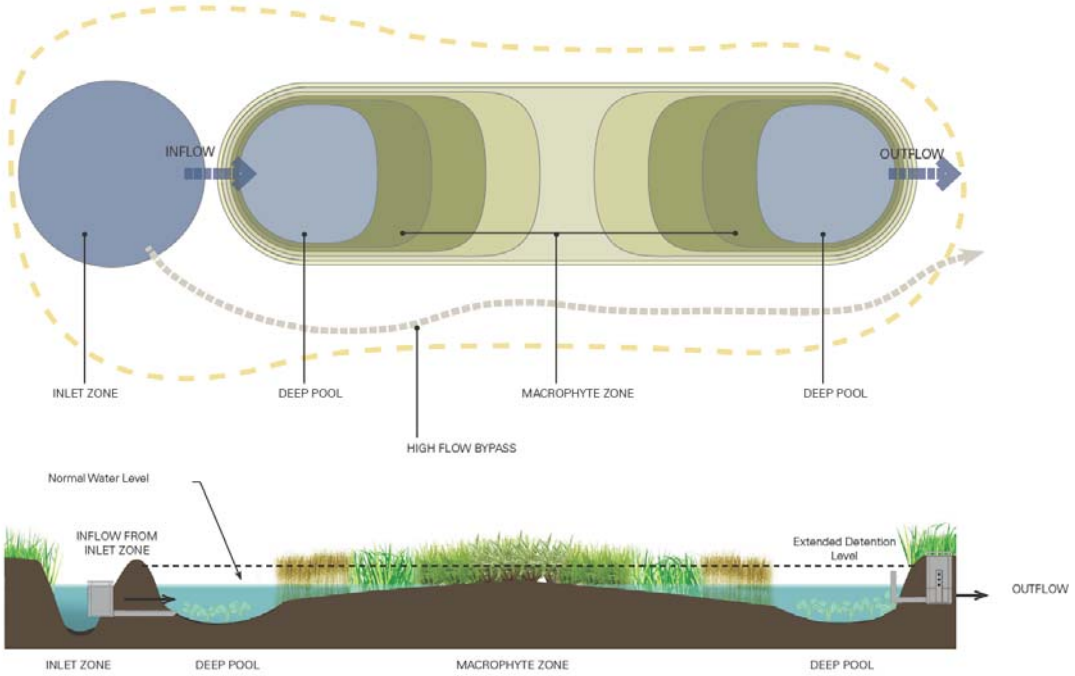

Illustration 1.2**Typical plan and long section of a constructed stormwater wetland**
Illustration courtesy of South East Queensland Healthy Waterways Partnership (Water by Design program)

4.3 Design

There is considerable flexibility regarding the shape of constructed stormwater wetlands and they should be designed to complement the overall landscape and site design theme. For example, in a high density commercial zone it might be appropriate to have a wetland with straight edges, sharp corners and vertical walls. Conversely, in a residential setting with extensive landscaping, it might be appropriate to have a wetland with curved edges and gently sloping batters that are densely planted.

The following sections detail the steps that should be undertaken during the concept design phase and the subsequent detailed design phase. Concept design refers to the development of the initial site layout, which takes into account the opportunities and constraints of the site. Detailed design refers to the preparation of design drawings for submission to Council, either to support a development application or an application for a construction certificate.

4.3.1 Concept design phase

Given that a constructed stormwater wetland will be a significant feature within the site layout, it is important that the wetland is appropriately considered during the concept design of the development. As a minimum, the following steps are recommended during the concept design phase:

1. Identify the location and level of the ultimate stormwater discharge location.
2. Identify a suitable location for the wetland (ensuring there is appropriate access for maintenance).
3. Determine the catchment area that will drain to the wetland.
4. Calculate the required size of the macrophyte zone area.
   As specified in the DCP:
   macrophyte zone area = 6.5 % of catchment area (residential development)
   macrophyte zone area = 7.0 % of catchment area (all other development)

5. Estimate the overall footprint of the wetland. Note: If the wetland will have sloping batters around the sides, the overall footprint of the system is likely to be at least 2.5 times the macrophyte zone area.
6. Ensure that the site layout allows sufficient area for the wetland.
7. Confirm that there is sufficient level difference for the wetland to function properly. Note: The normal water level of the wetland typically needs to be at least 0.1 m above the normal water level in the receiving drainage system / waterway. Bearing in mind that the wetland needs to incorporate a ponding depth of at least 0.6 m (refer to description of 'extended detention zone' in Section 4.2), this means that there typically needs to be a level difference of at least 0.7 m between the minimum site surface level and the normal water level in the receiving drainage system / waterway. In some instances, stormwater drainage or flooding issues may dictate that this level difference needs to be even greater.

During the concept design phase, it may become apparent that a wetland is not an appropriate stormwater treatment system for the site. If this is the case, an alternative stormwater treatment system will need to be investigated.

4.3.2 Detailed design phase

The following table specifies the design requirements for the key features of a constructed stormwater wetland.

Table 3.2 Design Requirements for Constructed Stormwater Wetlands

Feature	Design Requirement
Volume of inlet pond (below normal water level)	0.01 m x catchment area (m^2)
Average depth of inlet pond	1.5 m
Macrophyte zone area	6.5 % of catchment area (residential development) 7.0 % of catchment area (all other development)
Length : width ratio of macrophyte zone	5 : 1 (minimum)
Depth of water in macrophyte zone (at normal water level)	Less than 0.5 m deep for at least 80 % of the area, with a mix of depths preferred. Ideally, there should be an even distribution of depths ranging from 0.5 m below the normal water level (NWL) to 0.2 m above the NWL. Open water zones should be restricted to 20 % of the area and need to be at least 1.0 m deep to discourage plant growth.
Slope of base of macrophyte zone	5 % (maximum)
Total depth of extended detention zone (i.e. depth of zone above the normal water level and below the level of the high flow outlet(s))	400 mm
Notional detention time (i.e. the time taken for water to pass through the wetland)	48 hr
Level of high flow outlet(s) from inlet pond	400 mm above NWL
Low flow outlet from macrophyte zone	Riser standpipe or plate designed to achieve 48 hr notional detention time for a range of extended detention depths from

	0 – 400 mm
Topsoil	Silty or sandy loam topsoil to a depth of 300 mm (minimum) in all areas of the wetland that are less than 0.5 m below NWL (including all areas above NWL)
Liner	300 mm thick compacted clay liner (preferred) or suitable plastic liner
Level of bunds / walls surrounding wetland	As required by stormwater drainage design

As a minimum, the following steps are recommended during the detailed design phase:

1. Confirm the size of the catchment area that will drain to the wetland.
2. Confirm the required size of the macrophyte zone area.
3. Determine the required volume of the inlet pond and prepare concept design of pond geometry.
4. Design the layout of the wetland, including extent of macrophyte zone, location of outlets, location of inlet pond, extent of bunds / walls.
5. Set the key levels of the wetland ensuring that the minimum requirements are met (e.g. level of bunds / walls surrounding wetland, level of high flow outlet(s), normal water level, top of extended detention zone, base levels, connection to outlet).
6. Prepare earthworks design of the wetland.
7. Design connection between inlet pond and macrophyte zone – This connection should be capable of conveying the 1yr ARI peak flow.
8. Design low flow outlet from macrophyte zone – This outlet should comprise a riser standpipe or plate that has a series of orifice outlets spaced vertically over the 400 mm distance between the normal water level and the top of the extended detention zone. The orifices need to be designed so that the notional detention time of 48 hr is achieved for a range of depths above the normal water level (i.e. regardless of whether the wetland fills to a depth of 50, 100, 200, 300 or 400 mm above the normal water level after a rainfall event, the wetland will drain down to the normal water level in 48hr).
9. Design high flow outlet(s) – The design of the high flow outlet(s), including the pipes / channels that connect to the ultimate discharge location, will typically be undertaken as part of the hydraulic design of the overall stormwater drainage system for the site. The peak water level in the wetland will be determined during the hydraulic design and this will influence the required level of the bund or embankment surrounding the system.
10. Design maintenance drain – A mechanism needs to be provided to allow the wetland to be fully drained for maintenance purposes.

The design drawings that accompany a development application or an application for a construction certificate should include the following information:

- **Drainage layout** – Information to be shown includes location of the wetland within the site layout, catchment boundaries (if applicable), drainage paths (surface and sub-surface), and connection to discharge location.
- **Wetland (plan view)** – Information to be shown includes extent of macrophyte zone and inlet pond, extent of planting zones, extent of surrounding bunds / walls, location of high flow outlet(s), location of low flow outlet, key levels (e.g. normal water level, level of outlet(s), base levels), contours, maintenance access provision.
- **Wetland (longitudinal section)** – A longitudinal section, which extends from the inlet pond to the final discharge location, should be provided. Key levels and slopes should be noted on the long section.

- **Wetland (details & notes)** – Details are typically required for the high flow outlet(s), low flow outlet from macrophyte zone, connection between inlet pond and macrophyte zone, headwalls, and scour protection. Drawing notes should include construction advice and specifications for the liner, topsoils and plants (refer to information below). In some instances, it may be more appropriate to include the plant specification on a separate landscape drawing.

4.3.2.1 Plant specification

The landscape architect / designer should prepare a planting plan or specification for the wetland, which complements the broader landscape design. The wetland can be split into the following zones based on the water depth at the normal water level.

Table 3.3 Wetland Zones

Zone	Base Level relative to Normal Water Level (m)
Open Water & Transition Zone (if applicable)	> 0.50 m below NWL
Deep Marsh	0.35 to 0.50 m below NWL
Marsh	0.20 to 0.35 m below NWL
Shallow Marsh	0 to 0.20 m below NWL
Ephemeral Marsh	0 to 0.20 m above NWL
Batters (if applicable)	> 0.20 m above NWL

The following plants are considered to be suitable for the various wetland zones, but other species can be utilised if assessed as being suitable by a landscape architect / designer.

Table 3.4 Wetland Plants

Zone	Plant Species	Planting Density
Open Water & Transition Zone (if applicable)	No plants	-
Deep Marsh	*baumea articulata* *schoenoplectus validus* *bolboschoenus fluviatalis* *schoenoplectus litoralis*	6 plants / m²
Marsh	*baumea rubiginosa* *schoenoplectus mucronatus* *baumea arthrophylla* *lepironia articulate*	6 plants / m²
Shallow Marsh	*eleocharis equisetina* *juncus usitatus* *carex fasicularis* *cyperus exaltatus* *phylidrium lanuginosum*	8 plants / m²
Ephemeral Marsh	*carex appressa* *ficnia nodosa* *juncus flavidus* *lepidosperma longitudinale*	8 plants / m²
Batters (if applicable)	*lomandra longifolia* *cyperus polystachyos*	8 plants / m²

	carex breviculmis *gahnia siberiana*	

4.3.2.2 Safety issues

The design of a constructed stormwater wetland needs to ensure public safety requirements are addressed through a risk based approach.

Fences or vegetation barriers to restrict access should be provided above vertical walls or steep embankments if:

- there is a risk of serious injury in the event of a fall.
- there is a high level of pedestrian or vehicular exposure (e.g. adjacent to footpaths / cycleways, playgrounds, sports fields).

Access to deep water (e.g. > 300 mm) should also be restricted through the utilisation of fences or vegetation barriers. As discussed in Section 4.2, constructed stormwater wetlands are purposefully designed to allow additional ponding of stormwater above the normal water level, typically to a depth of 400 - 600 mm. The design of safety measures should take into account this temporary ponding.

If vegetation barriers are utilised to restrict access, plant species that are tall, dense and spiky will be the most effective. A temporary fence (e.g. sediment fence) will be required until the vegetation is sufficiently established to provide a physical barrier.

Where appropriate, signs should be provided to warn of deep and / or fast flowing water.

4.3.2.3 Designing to deter mosquitoes

To deter mosquitoes and minimise the risk of creating conditions that are conducive to mosquito breeding, the following approaches should be incorporated into the design:

- Incorporate a relatively deep open water zone to ensure there is still habitat for mosquito predators during relatively dry periods when the water level in the wetland drops.
- Design the bathymetry of the wetland so that water draws down evenly and isolated pools are avoided.
- Utilise relatively steep embankments (e.g. 1(v) : 3(h) or steeper). Note that this must not compromise public safety requirements.
- Implement measures to reduce the likelihood of litter accumulating in the wetland.
- Provide sufficient access for field personnel to monitor and treat mosquito larvae.

4.3.2.4 Designing to deter cane toads

The design of constructed wetlands is to incorporate measures to discourage cane toads from breeding in these structures.

In order to breed in a waterbody, cane toads require easy access to the water's edge. A pond edge with a vertical, rather than sloping, profile can prevent cane toads from getting into and out of the water. Where a sloping pond edge is necessary, incorporating dense vegetation and low barrier fencing around the waterline, is an effective way to stop cane toads from accessing the water. It is desirable that these measures are installed as soon as practicable once construction is complete.

Densely planting the pond edge with native sedges, rushes and grasses will help to exclude cane toads, whilst providing habitat for native frogs and waterbirds. In order to form an effective toad barrier, the plants must be densely spaced and a minimum of three rows of planting installed directly adjacent to the waterline.

A cane toad exclusion fence (minimum 500mm in height) is to be installed behind the 3 rows of sedge planting. The fence is to be maintained until such time as the plants have matured enough

to form an effective barrier. Suitable materials for cane toad exclusion fencing include shadecloth or sediment film supported by timber or metal stakes.

4.4 Construction and Establishment

Comprehensive guidance on the construction and establishment of wetlands is provided in the *Construction and Establishment Guidelines: Swales, Bioretention Systems and Wetlands* (South East Queensland Healthy Waterways Partnership, Version 1 February 2009). Key issues associated with the construction and establishment process are summarised in the following sections.

4.4.1 Timing

Rainfall and the associated stormwater runoff can cause significant damage to a wetland during construction. This highlights the importance of careful planning and efficient construction. The construction of a small wetland can be completed in a week, so the risk of damage due to stormwater inflows can be minimised through appropriate planning and monitoring of weather forecasts.

4.4.2 Managing risk of damage during building construction phase

It is important to note that wetlands are designed to treat stormwater runoff from developed sites. They are not designed to be sediment and erosion control measures during the construction phase, although they can be temporarily modified to perform this function. Wetlands are quite robust to variations in stormwater inflows (both quantity and quality), but they can be damaged by inflows that contain unusually high concentrations of some pollutants, such as sediment or metals. This includes sediment-laden runoff from a typical building construction site. As such, there is a risk that the successful long term functioning of a wetland can be compromised by shock loads during the building construction phase.

The risk of damage to a wetland during the building construction phase needs to be managed by either:

- Delaying construction of the wetland until building construction is complete; or
- Initially closing (or not installing) the connection between the inlet pond and the macrophyte zone so that all stormwater flows bypass the macrophyte zone.

If the first option is adopted, standard sediment and erosion control measures (e.g. sediment fences) need to be implemented across the site to protect downstream waterways.

The second option involves utilising the inlet pond as a sediment basin during the construction phase. The macrophyte zone can be constructed and planted in the early stages of site construction, but then needs to be isolated so that it does not receive heavily polluted stormwater flows during the building construction phase. The wetland design will include a high flow outlet from the inlet pond and this will be the sole outlet during the construction phase (i.e. the low flow outlet from the macrophyte zone will not operate).

4.5

Maintenance

Wetlands require ongoing inspection and maintenance to ensure they establish and operate in accordance with the design intent. Potential problems that may arise as a result of poor maintenance include:

- Decreased aesthetic amenity;
- Reduced treatment performance;
- Public health and safety risks; and
- Decreased habitat diversity (e.g. dominance of exotic weeds).

4.5.1 Plant establishment

Strong healthy vegetation plays a key role in maintaining the treatment performance of a wetland. The most intensive period of maintenance is during the plant establishment period (initial one to two years) when weed removal and replanting may be required.

To maximise the chances of successful establishment of vegetation, it may be necessary to manipulate the water level of the wetland in the early stages of vegetation growth. When first planted, vegetation in the marsh zones may be too small for their prescribed water depths. Seedlings intended for inundated zones should ideally have half their stem height above water level, and must not have any less than one-third of their stem above the water level. If planting stock is immature, this may not be possible without manipulating the water levels.

The water depth can be controlled by manipulating the connection between the inlet zone and the macrophyte zone, as well as the maintenance outlet. If necessary, the water level in the wetland can be lowered to approximately 300 mm below the normal water level for at least the first 6–8 weeks. The normal water level can be established when it is clear the wetland plants have matured to the point where at least half of the stem is above the normal water level.

Regular watering of wetland vegetation is essential for successful establishment and healthy growth. The frequency of watering to achieve successful plant establishment is dependent upon rainfall, maturity of planting stock and the water holding capacity of the soil. The following watering program is generally adequate, but should be adjusted to suit the site conditions:

- Week 1 - 6: 5 waterings/ week
- Week 6 - 10: 3 waterings/ week
- Week 11 - 15: 2 waterings/ week

In the absence of rain, it is recommended that each plant receives 2.5–5.0 litres per week during the first six weeks to retain a muddy substrate (40 mm of watering per week during establishment). After an initial four-month period, watering may still be required within the ephemeral zones of the wetland and on the batters, particularly during the first winter / spring or dry period.

4.5.2 General ongoing maintenance

Inflow pipes, headwalls, outlets and weirs require regular inspection, as these can be prone to scour and litter build up. Debris can block inlets or outlets and can be unsightly, particularly in high visibility areas. Inspection and removal of litter and debris should be done regularly.

Typical maintenance of a wetland involves:

- Desilting of the inlet pond once sediment has accumulated to a depth of approximately 0.5 m.
- Routine inspection of the wetland to identify any areas of obvious increased sediment deposition, scouring from storm flows, litter build up and blockages.
- Routine inspection of inlets, outlets and weirs to identify, clean and repair any areas of scour, litter build up and blockage.

- Repairing damage to the wetland profile resulting from scour or rill erosion by replacement of appropriate fill and revegetation.
- Removal of sediment and litter where it is smothering the vegetation.
- Regular watering/irrigation of vegetation until plants are established and self sustaining.
- Removal and management of invasive weeds.
- Removal of plants that have died and replacement with plants of equivalent size and species as detailed in the plant schedule.
- Pruning to remove dead or diseased vegetation and to stimulate growth.

Regular inspections are required, as well as inspections following intense storm events to check for scour and other damage. Major maintenance involving machinery should only occur after a reasonably rain free period when the wetland is relatively dry.

4.6 Examples

Photos of constructed stormwater wetlands are provided in the following plates.

Plate 1.7 Constructed stormwater wetland in a residential setting

Plate 1.8 Constructed stormwater wetland with boardwalk
Photo courtesy of South East Queensland Healthy Waterways Partnership (Water by Design program)

Plate 1.9 Constructed stormwater wetland in urban park setting
Photo courtesy of Sydney Metropolitan Catchment Management Authority (Water Sensitive Urban Design in Sydney program)

5

Stormwater Detention Systems

5.1 Overview

The development of a site typically involves an increase in the area covered by impervious surfaces, as well as the introduction of an efficient stormwater drainage system to collect and convey runoff from the site. For a given storm event, the combination of these factors typically leads to a larger volume of stormwater being discharged from the site, with a higher peak flowrate, compared to the pre-development situation.

The purpose of stormwater detention systems is to control the flowrate at which stormwater is discharged from a site. The objective is usually to ensure that the peak flowrate in the post-development situation is no greater than the pre-development situation. This is achieved by temporarily detaining stormwater within a storage, which incorporates a restricted (or 'choked') outlet, so that the peak rate of outflow from the storage is lower than the peak rate of inflow. A stormwater detention system is designed to meet the detention objective for a specific theoretical design storm (e.g. 100yr ARI storm event of 1hr duration), or a range of design storms.

There are three main reasons why a reduction in the peak flowrate to pre-development levels may be desirable for a specific development site:

- **Ecological protection** – Reduce the likelihood of increased rates of bed and bank erosion and damage to benthic habitat in waterways located downstream of the site.
- **Infrastructure management** – Ensure that the capacity of existing stormwater drainage infrastructure is not exceeded.
- **Flood protection** – Ensure that the flood risk is not exacerbated in any other locations.

The selection of the design storm events that should be managed by a stormwater detention system is influenced by which of the above items is being addressed. Smaller design storm events (i.e. < 1yr ARI) are generally most critical for ecological protection. In most instances, detention of larger storm events will have minimal benefit with regard to ecological protection. The design storm events of most importance for infrastructure management are dependent on the design standards of the relevant infrastructure. Most stormwater drainage infrastructure within the Lismore LGA is designed for the 10yr or 20yr ARI storm event, with some large structures designed for the 50yr ARI storm event. Detention of stormwater for flood protection purposes typically needs to consider a range of design storm events (e.g. 5, 10, 20, 50 and 100yr ARIs).

Council has decided that for 'minor developments', as defined in the WSD chapter of the DCP, it is sufficient to provide detention of stormwater for the 1yr and 10yr ARI design storm events.

5.2 Features

A stormwater detention system includes two key features:

- **Storage** – To temporarily contain stormwater runoff.
- **Choked outlet** – To ensure that the peak flowrate out of the storage meets the detention objective (i.e. is less than or equal to the peak flowrate for the pre-development situation).

Aside from these features, there is considerable flexibility regarding the type, shape and style of a stormwater detention system. Options for providing the storage include tanks (above or below ground), earth basins, and bunded car parking areas. However, Council does not support the

utilisation of permanently wet detention basins (i.e. the basin must fully drain after a rainfall event). There are also options with regard to the choked outlet, including orifice plates, choke pipes and weirs. It is possible to design bioretention systems (refer to Section 3) and constructed stormwater wetlands (refer to Section 4) so that they perform the dual functions of stormwater treatment and stormwater detention.

5.3 Design

The 'deemed to comply' solution for stormwater quantity, as stated in the WSD chapter of the DCP, is to provide a stormwater detention system designed to attenuate the 1yr ARI and 10yr ARI peak discharges to pre-development levels. This document provides guidance on the sizing of the required storage volume and the sizing of the choked outlet to achieve this outcome. However, this document does not specify additional design requirements for stormwater detention systems. The *Northern Rivers Local Government Development & Design Manual* provides guidance regarding the design of specific types of detention systems (e.g. basins). The design procedure outlined in the following sections is only applicable to 'minor developments', as defined in the WSD chapter of the DCP, and must not be applied to larger development sites.

5.3.1 Storage volume

The storage volume will be dictated by the requirements for the 10yr ARI storm event. The storage volume should be calculated as follows.

10yr pre-development peak discharge

1. Determine the roof area (Ar), paved area (Ap) and pervious (e.g. vegetated) area (Av) in the pre-development scenario *(units: m²)*.
2. Obtain the rainfall intensity ($^{5min}I_{10}$) for a 10yr ARI design storm, with a duration of 5 min, for the location of the development *(units: mm/hr)*.
3. Calculate the peak discharge in the pre-development scenario as follows:

   Q_{10} (pre-dev) = (Ar + 0.9 . Ap + 0.6 . Av) . $^{5min}I_{10}$ / 3600 *(units: L/s)*

10yr post-development peak discharge

4. Calculate the peak discharge for the post-development scenario using the equation listed in step 3 utilising the roof area (Ar), paved area (Ap) and pervious area (Av) in the post-development scenario.

10yr storage volume

5. Calculate the storage volume as follows:

   10yr storage volume = [Q_{10} (post-dev) - Q_{10} (pre-dev)] . 300 *(units: L)*

5.3.2 Low level outlet

The low level outlet needs to be designed to ensure the post-development peak discharge in the 1yr ARI storm event equals the pre-development discharge. The low level outlet needs to be located at the bottom of the storage volume so that the storage fully drains after a storm event. The outlet should be sized as follows.

1yr pre-development peak discharge

6. Obtain the rainfall intensity ($^{5min}I_1$) for a 1yr ARI design storm, with a duration of 5 min, for the location of the development *(units: mm/hr)*.

7. Calculate the peak discharge for the pre-development scenario using the following equation with the pre-development areas (refer step 1):

   Q_1 (pre-dev) = (Ar + 0.9 . Ap + 0.5 . Av) . $^{5min}I_1$ / 3600 *(units: L/s)*

1yr post-development peak discharge

8. Calculate the peak discharge for the post-development scenario using the equation listed in step 7 utilising the roof area (Ar), paved area (Ap) and pervious area (Av) in the post-development scenario.

1yr storage volume and water level

9. Calculate the storage volume as follows:

   1yr storage volume = [Q_1 (post-dev) - Q_1 (pre-dev)] . 300 *(units: L)*

10. Based on the geometry of the storage, determine the water level in the storage when the volume of stored water equals the 1yr storage volume.

Low level outlet

11. Select the type of low level outlet (e.g. orifice plate, choke pipe). Using the appropriate formula for the type of outlet and the water level determined in step 10, calculate the size of the outlet to achieve the required discharge - i.e. Q_1 (pre-dev). Additional guidance is provided in Appendix E of the *Northern Rivers Local Government Development & Design Manual*.

5.3.3 High level outlet

A high level outlet will typically be required to ensure the post-development peak discharge in the 10yr ARI storm event equals the pre-development discharge. The high level outlet needs to be located above the water level in the storage when the volume of stored water equals the 1yr storage volume. The outlet should be sized as follows.

12. Calculate the discharge through the low level outlet when the storage volume is full (i.e. at the 10yr water level). If the discharge through the low level outlet exceeds the pre-development 10yr ARI peak discharge, the storage volume and / or low level outlet must be reconfigured to ensure this is not the case. In most instances, the utilisation of a weir as the low level outlet will be problematic and will not lead to the most efficient design.
13. Determine the required discharge through the high level outlet as follows:

    Q_{10} (high level discharge) = Q_{10} (pre-dev) – Q_{10} (low level discharge)

14. Select the type of high level outlet (e.g. orifice plate, choke pipe, weir) and the level of the outlet. Using the appropriate formula for the type of outlet, calculate the size of the outlet to achieve the required discharge, as calculated in step 13.

5.3.4 Overflow

The high level outlet designed in the preceding section may not be capable of conveying flows that exceed the 10yr ARI peak flow. As such, it may be necessary to provide an additional overflow, typically a pipe or weir, which can accommodate larger flows up to and including the 100yr ARI peak flow.

5.3.5 Safety issues

The design of a stormwater detention system needs to ensure public safety requirements are addressed through a risk based approach.

Fences or vegetation barriers to restrict access should be provided above vertical walls or steep embankments if:

- there is a risk of serious injury in the event of a fall.
- there is a high level of pedestrian or vehicular exposure (e.g. adjacent to footpaths / cycleways, playgrounds, sports fields).

Access to deep water (e.g. > 300 mm) should also be restricted through the utilisation of fences or vegetation barriers. Some stormwater detention systems are specifically designed to allow temporary ponding of stormwater on the surface. The design of safety measures should take into account this temporary ponding.

If vegetation barriers are utilised to restrict access, plant species that are tall, dense and spiky will be the most effective. A temporary fence (e.g. sediment fence) will be required until the vegetation is sufficiently established to provide a physical barrier.

Where appropriate, signs should be provided to warn of deep and / or fast flowing water.

References

Northern Rivers Local Government, (2006). *Northern Rivers Local Government Development & Design Manual*.

South East Queensland Healthy Waterways Partnership, (2006). *Water Sensitive Urban Design: Technical Design Guidelines for South East Queensland.* Version 1 June 2006.

South East Queensland Healthy Waterways Partnership, (2009). *Construction and Establishment Guidelines: Swales, Bioretention Systems and Wetlands.* Version 1 February 2009.

POLICY MANUAL

POLICY NO: 1.5.4	**INVESTMENT POLICY STATEMENT**
OBJECTIVE:	To preserve invested capital while gaining the most advantageous rate of return with minimum risk.
LINK TO STRATEGIC PLAN:	Best-Practice Corporate Governance
PROGRAM:	Finance
AUTHORISED:	11/8/2009, 14/12/2010

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General

PURPOSE OF DOCUMENT

The purpose of this document is to establish the framework within which investment principles are to apply to the investment of Council funds. It details:

- Council Funds' covered by this Investment Policy Statement;
- Council's objectives for its investment portfolio/s;
- how investments are to be undertaken;
- the applicable risks to be managed;
- the strategy adopted by Council to achieve the investment objectives;
- any constraints and other prudential requirements to apply to the investments of Funds having regard to the applicable legislation and regulations governing Council investment;
- the manner in which compliance with the Policy & Strategy will be monitored and reported;
- the expected level of future returns; and
- appropriate benchmarks for each category of investments.

RELATED DOCUMENTS

This statement has been prepared to recognise the legislative requirements and obligations for the investment of Council's funds. The legislative requirements are listed in the Investment Policy adopted by Council from time to time. It is Council's intention to comply with investment regulation and nothing in this statement is to override these obligations.

EFFECTIVE DATE

The effective date of this Investment Policy Statement incorporating both Policy and Strategy is 14 December 2010. It will be reviewed annually and as required in the event of legislative change or as a result of changed economic/market conditions, and changes recommended to Council if required.

DEFINITIONS

Act	Local Government Act, 1993.
ADI	Authorised Deposit-Taking Institutions (ADI) are corporations that are authorised under the Banking Act 1959 (Cwth) to take deposits from customers.
Bill of Exchange	A bill of exchange is an unconditional order in writing, addressed by one person to another, signed by the

	person giving it, requiring the person to whom it is addressed to pay on demand, or at a fixed or determinable future time, a sum certain in money to or to the order of a specified person, or to bearer.
BBSW	The Bank Bill Swap reference rate (BBSW) is the average of mid-rate bank-bill quote from brokers on the BBSW Panel. The BBSW is calculated daily. Floating rate securities are most commonly reset quarterly to the 90-day BBSW.
CFRN	A Corporate Floating Rate Note (CFRN) is a medium to long term fixed interest investment where the coupon is a fixed margin ("coupon margin") over a benchmark, also described as a "floating rate". The benchmark is usually the BBSW and is reset at regular intervals – most commonly quarterly.
Council Funds	Surplus monies that are invested by Council in accordance with section 625 of the Act
Debenture	A debenture is a document evidencing an acknowledgement of a debt, which a company has created for the purposes of raising capital. Debentures are issued by companies in return for medium and long-term investment of funds by lenders.
DLG	NSW Division of Local Government.
Grandfathered	Investments held by Council that were previously allowed under the Minister's Order but were Grandfathered when the NSW State Government changed the list of Approved Investments as a result of the Cole enquiry (which was reflected in the Ministerial Order dated 31/7/2008).
IPS	The Investment Policy Statement provides the general investment goals and objectives of Council and describes the strategies that must be employed to meet these objectives. Specific information on matters such as asset allocation, risk tolerance, and liquidity requirements are also included in the IPS.
LGGR	Local Government (General) Regulation 2005 (NSW).
NCD	Is a short term investment in an underlying security being a negotiable certificate of deposit (NCD) where the term of the security is usually for a period of 185 days or less (sometimes up to 2 years). NCDs are discount securities meaning they are issued and on-sold to investors at a discount to their face value.
RAO	Responsible Accounting Officer of a council means a member of the staff of the council designated by the General Manager, or if no such member has been designated, the General Manager. (LGGR, clause 196)

TaA	Target Asset Allocation or **TaA** is Council's medium term allocation to different asset types to ensure that the portfolio is diversified across particular sectors of the investment market.
TaR	Target Maturity Profile or **TaR** is Council's short to medium term positioning of the duration of the portfolio to meet Council's liquidity and return objectives.
T-Corp	New South Wales Treasury Corporation.
UBSA Bank Bill Index or BBI	UBS Australia calculates a daily bank bill index representing the performance of a notional parcel of bills averaging 45 days.

Investment Policy

INVESTMENT FUNDS

The Funds held by Council that are covered by this IPS are:

INVESTMENT OBJECTIVES

Funds	Description
Restricted Funds:	
Externally Restricted:-	Developer Contributions – General/Water Fund/Wastewater Fund
	Wastewater Services & Water Supply
	Specific Purpose Unexpended Grants
	Domestic Waste Management
Internally Restricted:-	Specific Purpose Reserves
	Specific Purpose Unexpended Loans
Unrestricted Funds:	
Funds Allocated to meet Current Budgeted Expenditure	All Other Funds

The purpose of this **Policy** is to provide a framework for the investment of Council's funds at the most favourable rate of interest available to it at the time whilst having due consideration of risk and security for that investment type and ensuring that its liquidity requirements are being met.

While exercising the power to invest, consideration is to be given to the preservation of capital, liquidity, and the return of investment. Council therefore has three primary objectives for its investment portfolio:

- The preservation of the amount invested;
- To ensure there is sufficient liquid funds to meet all reasonably anticipated cash flow requirements; and
- To generate income from the investment that exceeds the 30 day BBSW[1].

Council's Investment **Strategy** will run in conjunction with its Investment **Policy** and will outline:

- Councils cash flow expectations;
- Target allocation of investment type, credit quality, counterparty exposure and term to maturity profile; and

[1] The Australian Financial Markets Association's bank-bill reference rate which is the Australian equivalent of LIBOR.

- Appropriateness of overall investment types for Council's portfolio.

LEGISLATIVE REQUIREMENTS

All investments are to comply with the following:

- Local Government Act 1993 - Section 625;
- Local Government Act 1993 - Order (of the Minister) dated 31 July 2008;
- The Trustee Amendment (Discretionary Investments) Act 1997 – Sections 14A(2), 14C(1) & (2);
- Local Government General Regulation 2005;
- Division of Local Government Circulars;
- Local Government Code of Accounting Practice and Financial Reporting; and
- Australian Accounting Standards.

DELEGATION OF AUTHORITY

Authority for implementation of the Investment Policy is delegated by Council to the General Manager in accordance with the Local Government Act 1993.

The General Manager may in turn delegate the day-to-day management of Councils investment to the RAO or other staff, subject to regular reviews.

Officer's delegated authority to manage Council's investments shall be recorded and required to acknowledge they have received a copy of this policy and understand their obligations in this role.

PRUDENT PERSON STANDARD

The investments will be managed with the care, diligence and skill that a prudent person would exercise. As trustees of public monies, officers are to manage Council's investment portfolios to safeguard the portfolio in accordance with the spirit of this Investment Policy, and not for speculative purposes.

ETHICS AND CONFLICTS OF INTEREST

Officers shall refrain from personal activities that would conflict with the proper execution and management of Council's investment portfolio. This policy requires officers to disclose any conflict of interest to the General Manager.

Independent advisors are also to declare that they have no actual or perceived conflicts of interest.

AUTHORISED INVESTMENTS

All investments must be denominated in Australian Dollars. Authorised Investments are limited to those allowed by the Ministerial Investment Order and include:

- Commonwealth / State / Territory Government securities e.g. bonds;

- Interest bearing deposits / senior securities issued by an eligible ADI;
- Bills of Exchange, (< 200 days duration) guaranteed by an ADI;
- Debentures issued by NSW Local Government;
- Land mortgages (< 60% of land value);
- Deposits with Local Government Investment Services Pty Ltd ("LGIS");
- Deposits with T-Corp &/or Investments in T-Corps Hour Glass Facility; and
- Investments grandfathered under the Ministerial Investment Order.

PROHIBITED INVESTMENTS

This investment policy prohibits the following types of investment[2]:

- Derivative based instruments;
- Principal only investments or securities that provide potentially nil or negative cash flow; and
- Stand alone securities issued that have underlying futures, options, forwards contracts and swaps of any kind.

This policy also prohibits the use of leveraging (borrowing to invest) of an investment.

RISK MANAGEMENT GUIDELINES

Investments obtained are to be considered in light of the following key criteria:

- **Credit Risk** – The risk that a party to a transaction will fail to fulfil its obligations. In the context of this document it relates to the risk of loss due to the failure of an institution/entity with which an investment is held to pay the interest and/or repay the principal of an investment;
- **Diversification** – the requirement to place investments in a broad range of products so as not to be over exposed to a particular sector of the investment market;
- **Liquidity Risk** – the risk an investor is unable to redeem the investment at a fair price within a timely period;
- **Market Risk** – the risk that fair value or future cash flows of an investment will fluctuate due to changes in market prices;
- **Maturity Risk** – the risk relating to the length of term to maturity of the investment. The longer the term, the greater the length of exposure and risk to market volatilities; and
- **Preservation of Capital** – the requirement for preventing losses in an investment portfolio's total value.

[2] Prohibited investments are not limited to the list provided. It extends to any investment carried out for speculative purposes.

INVESTMENT ADVISOR

The Council's investment advisor must be licensed by the Australian Securities and Investment Commission. The advisor must be an independent person who has no actual or potential conflict of interest in relation to investment products being recommended and is free to choose the most appropriate product within the terms and conditions of investment policy.

The independent advisor is required to provide written confirmation that they do not have any actual or potential conflicts of interest in relation to investments they are recommending or reviewing, including that they are not receiving any commissions or other benefits in relation to the investments being recommended or reviewed.

ACCOUNTING

Council will comply with appropriate accounting standards in valuing its investments and quantifying its investment returns.

From time to time financial assets may be acquired at a discount or premium to their face value. Discount or premium is to be taken into account in line with relevant Australian Accounting Standards.

SAFE CUSTODY ARRANGEMENTS

Where necessary, investments may be held in safe custody on Council's behalf, as long as the following criteria are met:

- Council must retain beneficial ownership of all investments;
- Adequate documentation is provided, verifying the existence of the investments;
- The Custodian conducts regular reconciliation of records with relevant registries and/or clearing systems; and
- The Institution or Custodian recording and holding the assets will be:
  - Austraclear;
  - An institution with an investment grade Standard and Poor's or Moody's rating; or
  - An institution with adequate insurance, including professional indemnity insurance and other insurances considered prudent and appropriate to cover its liabilities under any agreement.

PERFORMANCE BENCHMARKS

The performance of each investment will be assessed against the benchmarks listed in the table below. It is Council's expectation that the performance of each investment will be greater than or equal to the applicable benchmark.

Investment	Performance	Time Horizon

	Benchmark	
11am Account, AAA cash funds, short dated bills, NCDs issued by financial institutions.	Official (wholesale) Cash Rate	3 months
Defensive Enhanced Cash – "AA" credit rated cash funds, term deposits.	UBSA Bank Bill Index + 0.15%	12 months
Term Deposits with a maturity date between 90 days and 1 Year, Corporate FRN's bought on the secondary market.	UBSA Bank Bill Index (BBI) + 0.30%	3 months to 12 months
Term Deposits with a maturity date between 1 and 2 Years, Corporate FRN's bought on the secondary market.	AAA BBI + 0.30% AA BBI + 0.40% A BBI + 0.50% BBB BBI + 0.60%	1 to 2 years
Intermediate Enhanced Cash – "A" credit rated enhanced cash funds and less volatile low and no buy / sell spread income funds.	UBSA Bank Bill Index + 0.25%	2 years
Income Funds – "A" credit rated income funds with higher monthly volatility and/or higher buy / sell spreads.	UBSA Bank Bill Index + 0.50%	2 years
Fixed Interest Funds	UBSA Composite Bond Index	3 to 5 years

Investment	Performance Benchmark	Time Horizon
Corporate FRN's, Bonds, Mortgage and asset backed securities	AAA – BBI + .10% AA – BBI + .20% A – BBI + .35%	2 to 5 Years
T-Corp Hour Glass Managed Funds	CPI + appropriate margin over rolling 3 year periods (depending upon composite of fund)	3 to 5 years according to the T-Corp fund

REPORTING

Documentary evidence must be held for each investment and details thereof maintained in an investment register. The documentary evidence must provide Council beneficial ownership to the investment.

For audit purposes, certificates must be obtained from the banks/fund managers/custodian confirming the amounts of investment held on Council's behalf at 30th June each year.

All investments are to be appropriately recorded in Council's financial records and reconciled on a monthly basis.

A **monthly** report will be provided to Council. The report will detail the investment portfolio in terms of holdings and impact of changes in market value since the previous report, any capital flows (i.e. applications, switches and or redemptions), and performance.

The **monthly** report will also detail the investment performance against the applicable benchmark, investment income earned versus budget year to date and confirm compliance of Council's investments within legislative and policy limits.

Each **quarter** the Investment Advisor's report on the investment holding compared to the Target Credit Quality, Counterparty Exposure, Target Asset Allocation (TaA) and Target Maturity Profile (**TaR**) will be reported to Council.

REVIEW OF POLICY

The Investment Policy will be reviewed with the external Investment Advisor at least annually or as required in the event of legislative change. The Investment Policy may also be changed as a result of other amendments that are to the advantage of that Council and in the spirit of this policy. Any amendment to the investment Policy must be by way of Council resolution.

Investment Strategy

Investment Management Practices

To ensure that Council funds are prudently invested with care, due diligence and skill, the following investment management practices will be undertaken with the applicable outcomes and objectives in mind.

Risk Area	Outcomes & Objectives
Investment Policy Compliance	The portfolio is at all times compliant with Council's Investment Policy and relevant regulation.
Liquidity	Under this Investment Strategy, Council shall at all times maintain sufficient funds in "Working Capital" to meet the anticipated liabilities of Council for the following 90 days. In addition, sufficient capital shall be retained in Short Term Assets to meeting Council's funding requirements, net of anticipated borrowings, for the following 3 to 12 month period. Medium and long-term investments will have varying degrees of liquidity. An early exit from these investments may result in incurring penalties. Regular reviews of Council's allocation to these investments relative to Council's underlying investment horizons should minimise the risk of having to exit an investment in adverse market conditions. Exposure to medium and long-term investments will be limited to the proportion of the portfolio identified for these investment horizons. Grandfathered investments that are currently illiquid may be held to maturity.
Security	Working Capital Funds, Short Term Funds and Short – Medium Term Funds (as defined in this document) are to be invested to target capital (principal) security over their nominated investment horizon to an extremely high probability level. Medium Term Funds and Long Term Funds (as defined in this document) are to be invested to target capital (principal) security over their nominated time horizon, and assuming they are held to maturity, to a high probability level. This is achieved through investing in investments of minimal credit risk and matching term to available investment term.
Income	The target for investment income will be consistent with the assumptions included in Councils Operational Plan.
Total Return	Having provided for liquidity, security and income needs, total returns on Council funds are maximised with the view of achieving the stated investment objective.

Risk Management

All investments carry a trade-off between risk, liquidity and return. Further, risks can either be amplified or reduced when investments are combined within a portfolio. To address these risks the following mechanisms are in place:

- Council's IPS is the key risk control document, setting out counterparty risk limits, minimum credit quality of the portfolio and relevant restrictions on particular investment types. This will be complied with at all times.
- Council has determined a list of Investment Types that may be used for Council funds. These are set out in Attachment "B" headed "Approved Investment Types and Benchmarks by Investment Category", at the rear of this document.
- Council will establish its target allocation to investment sectors (TaA) and term to maturity profile (TaR) to ensure that liquidity and income requirements are met in a well diversified investment portfolio.
- Council will receive professional assistance with evaluation and monitoring investments to ensure they will meet Council needs. The adviser shall also assist Council to ensure that the commercial terms on which Council is offered investments by fund managers, issuers and brokers are fair and reasonable.
- Council will receive professional assistance with portfolio construction so that:
  - The overall risk of the portfolio can be appropriately assessed;
  - The portfolio can be adjusted over time as circumstances warrant;
  - Regulatory changes are accommodated; and
  - This Investment Strategy can be properly reviewed from time to time and recommendations made for improvement as required.

PORTFOLIO CONSTRUCTION

The Investment Strategy shall be developed to support Council's investment objectives for security, liquidity and return. The current investment strategy, inclusive of portfolio percentage and dollar based allocations is set out in tabular form later on in this document.

Council's investment portfolio strategy shall be built around allocation of Council funds into a multidimensional framework that has regard to three key aspects. Namely:

i. Credit Quality of the portfolio and the management of Counterparty exposure;

ii. Allocation of investments within defined Investment Categories (or asset class) that are included within the approved investment guidelines; and

iii. Time horizon or maturity profile of the portfolio.

The framework in which Councils portfolio is managed for each of these aspects is considered below.

Credit Quality Target & Limits

The portfolio credit guidelines to be adopted will be based on the Standard & Poor's (S&P) ratings system criteria[3]. The maximum available limits in each rating category and the target credit quality weighting for Council's portfolio shall be:

Long Term Credit Ratings	Short Term Credit Ratings	Target Credit Quality Weighting	Maximum Holding
AAA Category	A-1+	25%	100%
AA Category	A-2	30%	80%
A Category	A-2	20%	60%
BBB Category & unrated ADI's[4]	A-3	25%	40%
Below BBB Category or Grandfathered[5]	Below A-3 or unrated	0%	20%

Counterparty Limits

Exposure to individual counterparties/financial institutions will be restricted by their S&P rating so that single entity exposure is limited, as detailed in the table below. This table does not apply to any grandfathered managed fund or structured investment where it is not possible to identify a single counterparty exposure.

[3] Or Moody's/Fitch equivalent ratings if an S&P rating is not available

[4] Council can make new investments with unrated ADI's and where possible will take advantage of the Australian Government's deposit guarantee arrangements.

[5] Councils grandfathered investments are assets that do not meet the current ministers guideline that were grandfathered under DLG Circular 08-10 and include Managed Funds, Structured Investments (if any), and non ADI senior and subordinated debt securities, and ADI subordinated debt securities.

Individual Institution or Counterparty Limits			
Long Term Credit Ratings	**Short Term Credit Ratings**	**Direct Securities Target Limit[6]**	**Direct Securities Maximum Limit**
AAA Category[7]	A-1+	20%	40%
AA Category	A-1+	15%	30%
A Category	A-2	10%	20%
BBB Category	A-3	5%	10%
Unrated Category[8]	Unrated	5%	10%

Term deposit investments in various institutions can be to a maximum of $2m per institution with at least 50% of the total of all term deposits to be covered by the free government guarantee at all times. This allows for the majority of funds to be covered by the guarantee within a diversified portfolio while accessing the best interest rates available, but also reduces administration time and costs. This does not apply to the Commonwealth Bank as this institution deals with Council's transactional banking. Any excess funds that are unable to be invested in Term Deposits or other allowable instruments to allow for cashflow liquidity are placed with the Commonwealth Bank.

Term to Maturity Target

Council's investment portfolio shall be structured around the time horizon of investment to ensure that liquidity and income requirements are met.

The Target Maturity Profile (TaR) will be determined by Council from time to time having regard to the economic conditions that are prevalent. Attachment "A" headed "Target Maturity Profile and Return Expectations" outlines the present TaR adopted by Council. It is expected that this is a medium term allocation which will be reviewed every six months with the Council's investment advisor.

The TaR will be established between the minimum and maximum allocation range shown in the table below.

The factors and/or information used by Council to determine the TaR include:

- Council's liquidity requirements;
- The shape of the bank bill swap curve (yield curve);

[6] The target limit will only be exceeded in circumstances where Council is being paid an acceptable risk premium by the Counterparty but in no circumstances will Council exceed the maximum limit.

[7] 100% Commonwealth Government and Government-guaranteed deposits are included in this category.

[8] This category includes unrated ADI's such as Credit Unions and Building Societies and where possible Council will use the Federal Governments bank deposit guarantee to limit the exposure to non rated entities.

- Term deposit spread curve (i.e. the rate financial institutions are paying above the relevant BBSW rate);
- Credit spreads; and
- Macro economic variables.

Investment Horizon Description	Investment Horizon Maturity Date	Minimum Allocation	Target Allocation (TaR)	Maximum Allocation
Working capital funds	0-3 months	10.0%	See Attachment A	100.0%
Short term funds	3-12 months	20.0%	See Attachment A	100.0%
Short-Medium term funds	1-2 years	10.0%	See Attachment A	70.0%
Medium term funds	2-5 years	0%	See Attachment A	50.0%
Long term funds	5-10 years	0%	See Attachment A	50.0%

In setting the TaR, Council is relying upon assumptions of expected investment returns and market conditions that have been examined with its investment advisor.

Target Asset Allocation

Council has established guidelines for the allocation of funds within each investment or asset class category. These limits which are outlined in the table below have been established to ensure the portfolio is diversified across a broad range of products so not to be over exposed to a particular sector of the investment market.

From time to time Council will set its Target Asset Allocation (TaA) to each investment category which match the list of allowable investments included in the DLG's circulars.

The TaA will be determined by Council from time to time having regard to the economic conditions that are prevalent. Attachment "C" outlines the target weighting within the term to maturity target of the portfolio. It is expected that this will be reviewed every six months with Council's investment advisor.

The TaA will be established between minimum and maximum allocation ranges shown in the table following.

Asset Class	Minimum Allocation	Target Asset Allocation (TaA)	Maximum Allocation
At Call Accounts (i.e. **Cash**)	10.0%	See Attachment "C"	100.0%
Commonwealth / State / Territory Government **Bonds**	0.0%	See Attachment "C"	50.0%
Interest Bearing Deposits / senior securities – **Fixed**	0.0%	See Attachment "C"	100.0%
Interest Bearing Deposits / senior securities – **Floating**	0.0%	See Attachment "C"	100.0%
T-Corp Hour Glass Facility	0.0%	See Attachment "C"	25.0%
Grandfathered Investments	0.0%	See Attachment "C"	50.0%

In setting the TaA, Council is relying upon assumptions of expected investment returns and market conditions that have been examined with its investment advisor.

BENCHMARKING AND MONITORING

Each investment in the portfolio is to be evaluated and monitored against a performance benchmark appropriate to the risk and time horizon of the investment concerned. The objective is to ensure that all investments considered can deliver a level of return commensurate with their risk profile and that they are competitive with an appropriate peer group of alternative investment options. During the currency of this Strategy Document, no assets other than those listed will be eligible.

IMPLEMENTATION

This Investment Strategy sets out the intended approach to investments in the market conditions that are expected to prevail over the medium to long term investment horizon. However, there will be periods, sometimes sustained, where "normal" market conditions do not apply. For example, periods where short term interest rates are higher than long term interest rates, or investments of similar credit quality offer different yields due to liquidity differences. In these circumstances, the investment approach taken at a given point in time may vary from strategy via a "Market Adjusted Portfolio Allocation". Where this occurs, it is incumbent on Council's investment advisor to explain the rationale for this variation as part of its recommendations to the Council executive and/or elected Councillors.

AUTHORITY TO AMEND STRATEGY

The General Manager is authorised to approve a variation to this policy and/or strategy only if the investment is to the Council's advantage or due to revised legislation.

All variations to this policy and/or strategy are to be reported to Council at its next meeting.

AUTHORITY TO IMPLEMENT STRATEGY

Authority for implementation of the Investment Strategy is delegated by Council to the General Manager in accordance with the Local Government Act 1993.

The General Manager may in turn delegate the day-to-day management of Councils investment to the RAO or other staff, subject to regular reviews.

Officer's delegated authority to manage Council's investments shall be recorded and required to acknowledge they have received a copy of this policy and understand their obligations in this role.

ATTACHMENT A: TARGET MATURITY PROFILE & RETURN EXPECTATIONS

Investment Horizon Description	Investment Horizon	Target Allocation %	Net Target Over Bank Bills			Weighted Contribution to Outperformance	Suitable products
Working capital funds	0-3 months	**50.0%**	-0.20%	-	0.20%	0.00%	11am and cash A/Cs, Existing Cash Funds, T-Corp Hour-Glass Cash Facility, term deposits
Short term funds	3-12 months	**25.0%**	0.20%	-	0.40%	0.08%	Existing AAf Enhanced Cash Funds, T-Corp Hour-Glass Strategic Cash, term deposits
Short-Medium term funds	1-2 years	**10.0%**	0.40%	-	0.60%	0.05%	Existing Enhanced Cash Funds, term deposits, senior ADI FRN's
Medium term funds	2-5 years	**10.0%**	0.60%	-	0.90%	0.08%	Existing Enhanced Income Funds, T-Corp Hourglass Medium Term Growth, term deposits, senior ADI FRNs and bonds
Long term funds	5-10 years	**5.0%**	0.90%	-	1.10%	0.05%	Existing Structured Securities, T-Corp Hour-Glass Long Term Growth, senior ADI FRNs and bonds
TOTAL		**100.0%**	**0.10%**	**-**	**0.41%**	**0.26%**	

Notes:

1. Council's Target Asset Allocation is derived from the expected funds available to invest in each nominated investment category. This will be reviewed every six months at a minimum. At times the actual allocation will differ from the target allocation until such times as normal investment conditions return. The rationale for any differences between actual and target allocation will be detailed in Council's quarterly portfolio reviews.
2. See table "Approved Investment Types & Benchmarks by Investment Category" below.

ATTACHMENT B: APPROVED INVESTMENT TYPES & BENCHMARKS BY INVESTMENT CATEGORY

Investment Category & Net Performance Target	Investment Horizon	Investment Types	Eligible Investments	Council Approved	Council Specific Considerations	Relevant Benchmark
Working Capital	**0-3 months**	11 am and cash management accounts, Existing AAA rated cash funds, short dated Bills, NCDs issued by financial institutions, Term Deposits & T-Corp Cash Facility.	Yes / Grandfathered	Yes	Same day access required.	Official Cash Rate
Short Term	**3-12 months**	Defensive enhanced cash – AA credit rated cash funds, Term Deposits, NCDs.	Yes / Grandfathered	Yes	Funds with buy / sell spreads generally avoided. Maximum T+2 redemption timeframe	UBSA Bank Bill Index
		Defensive Enhanced Cash – a portfolio of A credit rated cash funds.	Grandfathered	Yes	A minimum of two complimentary styled A rated funds.	UBSA Bank Bill Index
Short-Medium Term	**1-2 years**	Intermediate Enhanced Cash – A credit rated cash funds, with S&P credit score < 50, Term Deposits.	Yes / Grandfathered	Yes	Funds with buy / sell spreads should be avoided. Maximum T + 3 redemption timeframe.	UBSA Bank Bill Index
Medium Term	**2-5 years**	Senior Debt issued by an ADI as a Fixed or Floating Rate Note	Yes	Yes	Counterparty limits outlined in Investment policy limit exposure to any one institution.	UBSA Bank Bill Index
		Enhanced Income – A credit rated cash funds, with S&P credit score > 50.	Grandfathered	Yes	These funds are held for trading purposes however transactions should be kept to a minimum due to buy / sell spread transaction costs.	UBSA Bank Bill Index
		Fixed Interest funds	Suspended	Yes	Must be credit rated A or better. Council will seek advice as to the use of fixed interest in the portfolio.	UBSA Bank Bill Index
		Corporate FRN's, Bonds, Mortgage and asset backed securities	Suspended	Yes	Grandfathered assets only.	N/A
		Capital stable funds	Yes, via T-Corp	Yes**	Only available via T-Corp for NSW Councils. Further investment considerations are to be met prior to any investment being made.	Fund Benchmark
Long Term	**5-10 years**	Balanced / Growth Funds	Yes, via T-Corp	Yes**	Only available via T-Corp for NSW Councils. Further investment considerations are to be met prior to any investment being made	Fund Benchmark

Notes:

1. Where direct securities are used with a direct credit exposure, Council should work towards some diversification across maturity dates and issuers. Generally this would require a minimum of 5 securities.
2. Subject to compliance with legislation and Council's Investment Policy objectives and parameters, Council will support investment in ethical and/or socially responsible investments (SRI).
3. The eligibility of an investment is determined by the legislation that applies to NSW Local Government, Forms of Investment – Minister's Order dated 31 July 2008 and successors. Its approval for use in the portfolio and any other council specific considerations arise from discussion between council personnel and the Investment Advisor. The onus is on Council to advise the Investment Advisor if Council's view on any of these investment types change.

** These investments can provide negative returns and are not capital protected. Formal approval by the General Manager must be received prior to an investment being undertaken in this type of fund.

ATTACHMENT C: TARGET ASSET ALLOCATION (TAA)

Target Weight					
Investment Time Horizon Category	**Cash**	**Fixed**	**Floating**	**Other**	**Total**
Working Capital	10.0%	40.0%	0.0%	0.0%	**50.0%**
Short Term	0.0%	25.0%	0.0%	0.0%	**25.0%**
Short-Medium Term	0.0%	5.0%	5.0%	0.0%	**10.0%**
Medium Term	0.0%	0.0%	5.0%	5.0%	**10.0%**
Long Term	0.0%	0.0%	5.0%	0.0%	**5.0%**
TOTAL	**10.0%**	**70.0%**	**15.0%**	**5.0%**	**100.0%**