Soil and Water Management Plan Report

90 Gindurra Road, Somersby – Stage 2

80518002

Prepared for

Kariong Sand and Soil Supplies

11 January 2019

Cardno

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Document Information

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Scott Brisbin
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2	2/7/18	Final Issue	Sara Belgrove	Scott Brisbin
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6	11/01/19	Re-Issued for DA Approval	Sara Belgrove	Scott Brisbin

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1 Introduction

Cardno (NSW/ACT) Pty Ltd has been engaged by Kariong Sand and Soil Supplies (KSSS) to prepare a Soil and Water Management Plan for the proposed industrial development at 90 Gindurra Road, Somersby. This report documents the site conditions and proposed site management measures to be employed in accordance with the requirements of the Gosford DCP 2013.

Stage 1 of the proposed works have been approved by Central Coast Council under DA 52541/2017 and include a two storey office building attached to a large plant storage shed with driveway access and carpark.

This report is concerned with Stage 2 of the proposed works, which involves the construction of a resource recovery facility in line with best practice. It is proposed that the KSSS site be developed to receive, process and store up to 200,000 tonnes per annum of soil, sand and building materials.

Stage 2 of the development will require:

- Clearing of selected vegetation from the front half of the site as determined by the Fauna and Flora and Vegetation Management Plan;
- Civil and drainage works to ensure the site directs stormwater into a catchment dam;
- Re-development of the existing stormwater catchment dam;
- Installation of a hardstand across the operational areas of the site;
- Allocation of areas for vehicle parking and manoeuvring;
- Installation of a weighbridge;
- Installation of storage bunkers for receiving incoming material for processing and bunkers for storing processed products ready for sale;
- Installation of sorting equipment into the Secondary Processing Warehouse;
- Installation of crushing and shredding machinery;
- Construction of a noise barrier along the Eastern boundary of the site; and
- Construction of two noise barriers within the operational areas of the site.

1.1 Planning Provisions

Section 6.3.6.1 of the Gosford DCP 2013 requires that a Soil and Water Management Plan be prepared for any developments where the soil surface exposure is greater than 2,500m^2. Similarly, Managing Urban Stormwater: Soils and Construction, Landcom, 2004 (the Blue Book) requires a SWMP for developments over 2,500m^2.

2 Site Description

The proposed development is located at 90 Gindurra Road, Somersby (Lot 4, DP 227279). The lot is currently occupied in the northern portion by Kariong Sand and Soil Supplies landscaping supply business. Site features consist of supply storage areas, two existing buildings and unpaved driveway areas. The southern part of the site consists of heavy vegetation. An area of Endangered Ecological Community has been identified through the Flora and Fauna Impact Assessment (Narla Environmental, 2018) and is located along the western boundary of the site.

The lot to the west of the site is vacant, and the site shares a boundary to the east with three rural residential lots. Gindurra Road is to the north and Kangoo Road is to the south. The site falls to the south and south-west at approximately 4% grade.

The total site area is 100,810m² (10.81ha).

Aerial photography of the site is presented in Figure 1-1 with the area covered by the development outlined in red.

Figure 1-1 Existing Site Aerial Image (Nearmap 2018)

2.1 Proposed Development

Stage 2 of the proposed works involves the following elements, as shown on Cardno's Concept General Arrangement Plan drawing for the site, included in Appendix A:

- Clearing of selected vegetation from the front half of the site as determined by the Fauna and Flora and Vegetation Management Plan;
- Civil and drainage works to ensure the site directs stormwater into a catchment dam;
- Re-development of the existing stormwater catchment dam;
- Installation of a hardstand across the operational areas of the site;
- Allocation of areas for vehicle parking and manoeuvring;
- Installation of a weighbridge;
- Installation of storage bunkers for receiving incoming material for processing and bunkers for storing processed products ready for sale;
- Installation of sorting equipment into the Secondary Processing Warehouse;
- Installation of crushing and shredding machinery;
- Construction of a noise barrier along the Eastern boundary of the site; and
- Construction of two noise barriers within the operational areas of the site.

The proposed development area is approximately 5.6 ha.

3 Site Characteristics

3.1 Stormwater Discharge Points

The existing site falls to the south and south-west at approximately 7% grade. There is an existing dam located along the western site boundary that collects runoff from the northern part of the site, including the proposed development area. Overflow from this dam passes to the neighbouring property to the west.

The remainder of the site flows to the south or south-west as overland flow.

The proposed site will be re-graded to achieve a cut-fill balance and to revise grades across the proposed working platform areas. The low point has been reconfigured to be located in the south-western corner of the site so that overflow from the proposed storage systems on site occurs to the southern part of the site and does not impact on neighbouring properties.

3.2 Groundwater Protection

If left uncaptured, runoff from the operational areas of the site has the potential to impact on natural watercourses and groundwater.

In order to prevent this from occurring, the following measures have been put in place:

- The waste material storage area has been bunded to prevent runoff from this area mixing with stormwater runoff from the remainder of the site. Runoff will be captured in a tank within the site and will be disposed of in accordance with the Environmental Protection License for the site. The bunded area is also on a concrete surface which prevents movement of runoff to groundwater.
- In order to prevent potential infiltration of leachate from unsealed sections of the hardstand, a bentonite impregnated geotextile liner will be used (Bentofix® GCL or equivalent). Bentofix® Geosynthetic Clay Liner (GCL) is factory produced wide width rolls of bentonite "sandwiched" between layers of geotextile. GCL's are an engineered replacement for traditional clay lining of proposed containment structures. The permeability of Bentofix® GCL is less than $2.5x10^{-11}$ m/s when installed in accordance with the manufacturer's recommendations and will form a suitable barrier to prevent contaminants entering the groundwater.
- In addition to the use of the geotextile liner the site surface grading has been formed to direct surface water to swales that will transport the surface water to the water storage basin.
- The proposed water storage basin will be lined with an impermeable liner (HDPE) to prevent leaching of potential contaminants collected on site to the underlying groundwater system.

3.3 Soil Conditions

A review of the NSW Office of Environment and Heritage, eSPADE V2.0 Mapping System (NSW Office of Environment and Heritage, 2016) indicates that the site is situated within the Sydney Town landscape (9130st) typically comprising undulating to rolling low hills and moderately inclined slopes on quartz sandstone of the Terrigal and Hawksbury sandstone formations with typical slope gradients of between 5-25%. Moderate to severe sheet erosion and rilling is present in areas where vegetation has been extensively cleared for development. Soil profiles are expected to comprise up to 0.3m of loose brown loamy sands overlying 1.5m of brown sandy clay loams and underlying sandstone bedrock. It is understood that these soil possess strong sodicity and high erodibility.

A review of the 1:100,000 Gosford-Lake Macquarie Geological Map (New South Wales Trade and Investment, Resource and Energy) indicates that the site is situated on the Hawksbury Sandstone (Rh) formation comprising medium to coarse grained quartz sandstone with minor laminated mudstone and siltstone lenses.

3.3.1 Acid Sulphate Soils

Through the course of fieldwork, no ASS was indicated. Tell-tale site observations included no visual evidence of jarosite staining, absence of alluvial soils, soils older than Holocene epoch encountered and site elevations ranging between 200-214m AHD.

As no indication of ASS was evident on site, a desktop review of ASS was undertaken to include acid sulfate risk maps and Quaternary geological maps.

3.3.1.1 Acid Sulfate Risk Maps

Review of the Department of Land and Water Conservation Acid Sulfate Soil Risk Map – Gosford Edition 2 [1] indicates that the site is situated within an area of no known occurrence or reports of acid sulfate soils. Land management activities are not likely to be affected by acid sulfate soil materials.

Review of the Gosford City Council (now Central Coast Council) Local Environmental Plan (LEP) Acid Sulfate Soils Risk Map Sheets ASS_015A dated February 2014 [2], indicates that the site is situated in Class 5 terrain. Class 5 indicates that development consent is required for works within 500m of adjacent Class 1, 2, 3, or 4 land by which the water table is likely to be lowered below 1.0m AHD on adjacent Class 1, 2, 3 or 4 land. The site is located more than 500m from the nearest Class 1, 2, 3 or 4 lands.

3.3.1.2 Geological and Quaternary Maps

Reference to the 1:100,000 Central Coast Quaternary Geological Map [3] indicates that the site is generally underlain by Triassic Period, Hawkesbury Sandstone (Tuth) comprising cross bedded to massive quartz sandstone with mudstone lenses, and the associated residual soils formed from weathering. This unit is pre-Quaternary Period. The presence of Quaternary Period, Holocene Epoch sediments would indicate potential for ASS, as ASS sediments were formed by natural processes when certain conditions existed in the Holocene Epoch.

The results indicate that the site is not within an ASS area, and no further investigation is required.

3.4 Temporary Erosion and Sediment Control Basins

As noted above, the site is located within the Sydney Town Soil Landscape. This soil profile is characterised as having a very high erosion hazard.

The site constraints and characteristics are summarised below in Table 3-1. The calculation sheet is included in Appendix B of this report.

The values of the RUSLE factors not listed in Table 3-1 are:

i. LS-factor is 1.31, assuming slope length of 50 metres and slope gradients of 7% for the stripped site, and .91, assuming slope length of 50 metres and slope gradient of 5% for the regraded site;

ii. P-factor is 1.3;

iii. C-factor is assumed to be 1.0 for bare soil.

Table 3-1 Site Constraints and Characteristics

Constraint/opportunity	Value
Rainfall erosivity	Moderate (R = 3270)
Slope gradients	7% (stripped), 5% (re-graded)
Potential erosion hazard	Low (Figure 4.6, The Blue Book)
Rainfall Zone	Zone 1 (Figure 4.9, The Blue Book)
Soil erodibility	K factor 0.023 for Sydney Town
Calculated soil loss	128 tonnes/ha/yr (stripped) and 89 tonnes/ha/yr (earthworks)
Soil Loss Class	1
Volumetric soil loss	99 m^3/ha/yr (stripped) and 68 m^3/ha/yr (earthworks)
Soil Texture Group	D
Percentage dispersible	10% (assumed)

Constraint/opportunity	Value
75th %ile, 5 day rainfall event	27.9 mm for Gosford

It is noted that soil loss from the catchments is less than 150m³/ha/yr and as such, basins are not considered warranted as per Section 6.3.2.d of the Managing Urban Stormwater: Soils and Construction (Landcom, 2004), (the Blue Book). However, as the stormwater management measures proposed for the operational site incorporate storage located in the south-west corner of the site, a sediment basin has been provided during construction to manage soil loss over the site. This basin will be converted upon completion of construction.

4 General Instruction Conditions

The SWMP shall be read with the engineering plans and any other plans or written instructions issued in relation to the proposed development site.

Contractors are to ensure that all soil and water management works are undertaken as instructed in this document and following the guidelines outlined in the Blue Book.

All sub-contractors shall be informed of their responsibilities in minimising the potential for soil erosion and pollution to downslope areas.

5 Land Disturbance Conditions

Where practical, the soil erosion hazard on the site will be kept as low as possible and as recommended in Table 5-1 below.

Table 5-1 Limitations to Access

Land Use	Limitation	Comments
Construction areas	Disturbance to be no further than five metres from the edge of any essential engineering activity shown on the plans	All workers will clearly recognise these zones that, where appropriate, are identified with barrier fencing (upslope) and sediment fencing (downslope), or similar materials
Access areas	Limited to a maximum width of 5 metres	The site manager will determine and mark the location of these zones on site. All workers are to clearly recognise these zones.
Remaining lands	Entry prohibited	Barrier fencing shall be used to prevent access to these areas.

6 Work Schedule Conditions

6.1 Staging of Works

The proposed works will be undertaken in one stage.

6.2 Sequence of Works

The sequence of works for the earthworks operation has been outlined below.

a) Site establishment and installation of erosion and sediment control measures

b) Topsoil stripped to stockpiles.

c) Cut to fill earthworks operations, with installation of bentonite impregnated clay liner prior to forming working areas. The liner must be installed in accordance with the manufacturer's requirements, and must remain undamaged during construction to prevent any impacts to groundwater.

d) Topsoil spread over earthworks area and stabilisation with hydro-seed.

e) Construction of pavements.

f) Erosion and sediment control measures to remain in operation until completion of proposed development works. Long term maintenance required as noted in Section 7.8

7 Sediment, Drainage and Erosion Control Measures

The scale of the earthworks to be undertaken has the potential to result in erosion of the site soils, movement of sediment and therefore to impact on the environment beyond the site boundaries. The proposed control measures to be implemented on site will minimise these potential impacts, and are summarised below. All measures are to be installed in accordance with Managing Urban Stormwater: Soils and Construction. References to standard drawings from that publication (The Blue Book) are included.

7.1 Site Preparation

All erosion and sediment control measures as outlined below and documented on Cardno's Erosion and Sediment Control Plan drawing for the works are to be implemented prior to the commencement of earthworks on the site.

A stabilised site access shall be constructed at the commencement at construction in accordance with Section 7.2 below. Vehicle access is to be limited to that essential for construction work and entry shall only be obtained through the stabilised site access points.

Barrier fencing shall be installed as indicated on the Erosion and Sediment Control Plan drawing, in order to minimise soil erosion hazard.

Install sediment fencing as indicated on the Erosion and Sediment Control Plan drawing. Mulch bunds may be used instead of sediment fencing, if approved by the Site Superintendent.

Works are to comply with the land disturbance conditions outlined in Table 5-1 above.

7.2 Site Access and Haul Routes

The proposed site access will be located off Gindurra Road.

The stabilised site access shall be designed to capture any soil materials collected on vehicles such that they are not deposited on public roads. Should soil material be spilled on public roads or transported from the site onto a public road, the soil shall be removed within the same working day.

Loads to and from the site shall be covered at all times.

7.3 Topsoil Management

Topsoil is to be stripped from the site after the establishment of erosion and sediment controls, and stored in nominated stockpiles. Stockpiles are to be free draining at all times, and located a minimum distance of 5 metres from diversion drains.

As shown on the Erosion and Sediment Control Plan drawing, sediment fences are to be placed downslope of each stockpile. Mulch bunds may be used instead of sediment fencing, if approved by the Site Superintendent.

Stockpiles are to be stabilised if unused for longer than 14 days. Stabilisation requires a minimum ground cover of 50% on each stockpile.

Topsoil is to be re-spread over the completed earthworks and stabilisation measures employed to promote revegetation of the disturbed area.

7.4 Wind Erosion Management

Progressive covering of exposed areas is required as soon as possible after filling/regrading. Cover is to be bitumen emulsion and seed, and watering as required to create instant cover and reduce dust issues.

Revegetation and stabilisation of disturbed areas should be undertaken within 10 days of earthworks completion.

7.5 Site Drainage

Boundary drainage swales and diversion bunds are to be installed prior to site earthworks to prevent external catchment runoff from entering the site and off-site deposition of eroded site sediment.

A bentonite impregnated clay liner will be used in the formation of the unsealed working areas in order to prevent potential leachate of contaminate runoff entering groundwater.

7.6 Revegetation of Earthworks

All areas of completed earthworks are to be stabilised within ten days of completion. All erosion and sediment controls are to remain in place until stabilisation / revegetation of earthworks is established. All stabilised areas are to be free of vehicle and pedestrian traffic to prevent disturbance of stabilisation measures.

Stabilisation options include mulch covers, latex-type sprays, bitumen emulsion sprays, tarp covers (stockpiles) and grass-seeding. Stabilisation is to be undertaken in accordance with Council's requirements for suitable landscape treatments.

Maintenance and inspection of revegetation will be required to ensure that the site is stabilised and future erosion is prevented. For areas stabilised with grass–seeding, regular watering will be required until an effective ground cover has been established and plants are growing vigorously. Re-seeding may be required in areas of inadequate coverage.

7.7 Maintenance of Controls

All erosion and sediment measures will require regular inspection and maintenance by the Contractor – the nature of the site requires that daily checks of control measures prior to site closure be undertaken, and within 24 hours of each rainfall event. The Contractor shall nominate a person to be responsible for the daily checks and after rainfall checks, including on RDOs, weekends and holiday periods.

The daily site inspection shall be recorded on a check sheet that includes the following information –

- The condition of each measure noted on the Erosion and Sediment Control Plan drawing,
- Maintenance requirements of each measure,
- Volumes of sediment removed where applicable,
- Disposal locations.

A copy of the check sheets shall be provided to the Superintendent on a weekly basis.

Drains shall be checked to ensure they are operating effectively, are not blocked, and are not eroding due to higher than allowable velocities. Linings shall be repaired immediately if required, and check dams installed where required.

Trapped sediment shall be removed from sediment fences. Dispose to an approved landfill location or waste treatment facility in accordance with Council requirements.

Ensure revegetation works are established and maintained to prevent future erosion of the earthworks areas.

8 The Contractor's Responsibilities

As identified in the previous sections of this report, the Contractor has the following responsibilities in relation to Soil and Water Management on this site –

- The Contractor is to ensure that all soil and water management works are undertaken as instructed in this document and following the guidelines outlined in Managing Urban Stormwater – Soils and Construction, Landcom 2004 (The Blue Book).

- All sub-contractors shall be informed of their responsibilities in minimising the potential for soil erosion and pollution to downslope areas.

- The Contractor is to ensure that daily checks are undertaken of control measures prior to site closure and within 24 hours of each rainfall event. The Contractor is to nominate a person to be responsible for the daily checks and after rainfall events, including on RDOs, weekends and holiday periods. The inspection shall be recorded on a check sheet in accordance with Section 7.7.

9 References

A. L. Troedson, “Central Coast Area 1:100,000 Coastal Quaternary Geology,” NSW Department of Industrty: Resourses and Energy, 2016.

Department of Land and Water Conservation, “Goeford - Acid Sulfate Soil Risk Map - Edition Two,” 1997.

Global Synthetics Website for Bentofix® GCL details - https://globalsynthetics.com.au

Gosford City Council, “Local Environmental Plan (LEP) 2014 - Acid Sulfate Soils Risk Map,” 2014.

Landcom. (2004). *Managing Urban Stormwater:Soils and Construction.*

Narla Environmental. (2018). *Flora and Fauna Impact Assessment.*

New South Wales Trade and Investment, Resource and Energy. (n.d.). Gosford-Lake Macquarie 1:100 000 Geological Map Sheets 9131, 9231.

NSW Office of Environment and Heritage. (2016, December). *eSPADE V2.0*. (NSW Office of Environment and Heritage) Retrieved January 23, 2017, from http://www.environment.nsw.gov.au/eSpade2WebApp#

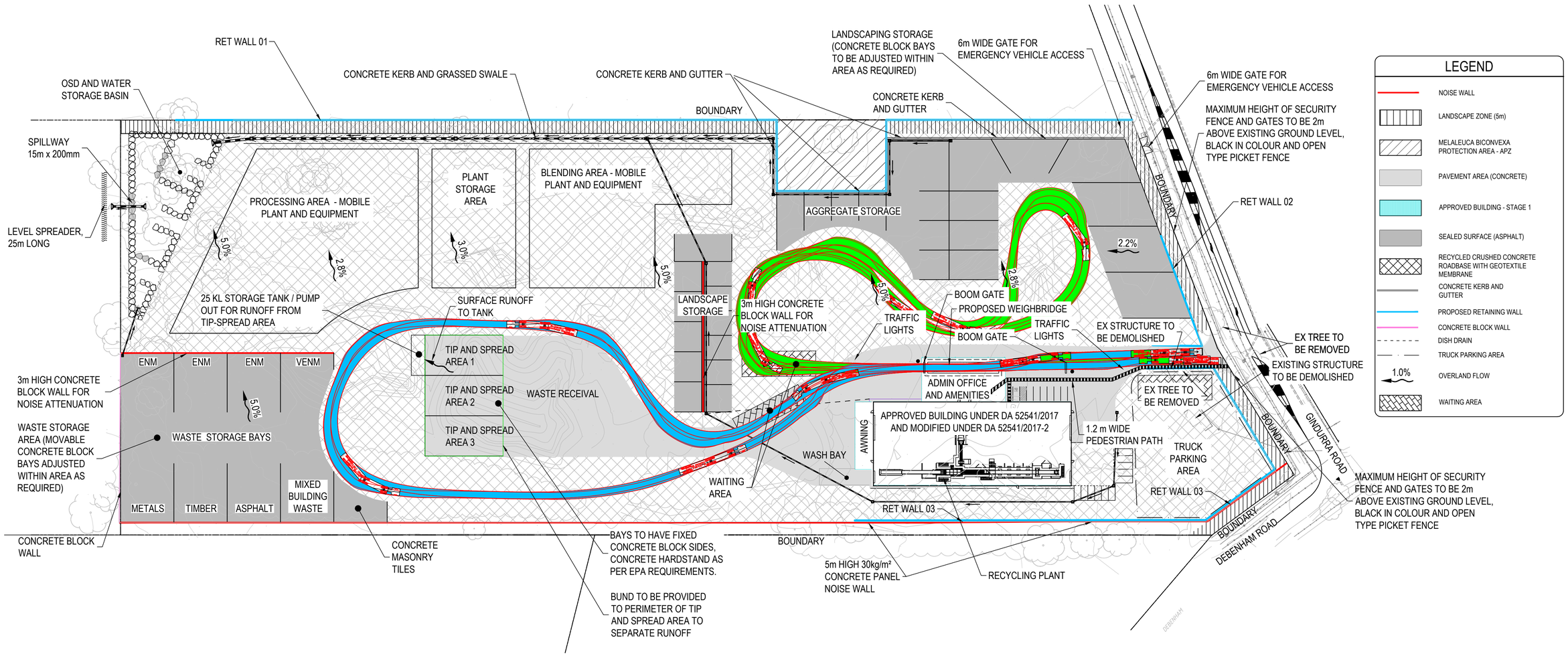
90 Gindurra Road, Somersby – Stage 2

APPENDIX A

Concept General Arrangement Plan And Erosion And Sediment Control Plan

NORTH

LANDSCAPING NOTE:
EXISTING MOUND AND MATURE TREES/VEGETATION TO GINDURRA RD AND DEBENHAM RD BOUNDARY LANDSCAPE ZONE TO REMAIN. CLEAR DEBRIS AND WEEDS AND SUPLEMENT PLANTING WITH GREVILLEA GROUND COVER. MULCH AS REQUIRED.



LEGEND

- NOISE WALL
- LANDSCAPE ZONE (5m)
- MELALEUCA BICONVEXA PROTECTION AREA - APZ
- PAVEMENT AREA (CONCRETE)
- APPROVED BUILDING - STAGE 1
- SEALED SURFACE (ASPHALT)
- RECYCLED CRUSHED CONCRETE ROADBASE WITH GEOTEXTILE MEMBRANE
- CONCRETE KERB AND GUTTER
- PROPOSED RETAINING WALL
- CONCRETE BLOCK WALL
- DISH DRAIN
- TRUCK PARKING AREA
- 1.0% OVERLAND FLOW
- WAITING AREA

PLAN
SCALE 1:750

NOTES :
1. EXISTING CONTOURS SHOWN ARE AT 0.5m INTERVAL

Rev.	Date	Description	Des.	Verif.	Appd.
13	14/12/18	REVISED TRAFFIC MANAGEMENT	DSA	SJB	SJB
12	06/12/18	ISSUED FOR DEVELOPMENT APPLICATION	PW	SJB	SJB
11	28/11/18	ISSUED FOR DEVELOPMENT APPLICATION	PW	SJB	SJB
10	06/07/18	ISSUED FOR DEVELOPMENT APPLICATION	PW	SJB	SJB
9	21/06/18	ISSUED FOR CLIENT REVIEW	SJB	SJB	SJB
8	21/06/18	RETAINING WALL DETAILS ADDED	SJB	SJB	SJB
7	13/06/18	RETAINING WALL DETAILS ADDED	SJB	SJB	SJB
6	29/05/18	RE-ISSUED FOR CLIENT REVIEW	SJB	SJB	SJB
5	29/05/18	RE-ISSUED FOR CLIENT REVIEW	SJB	SJB	SJB

0 15 30 45 60 75m
SCALE 1:750 @A1

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		Date
Drawn	LDB	27/04/18
Checked	SJB	27/04/18
Designed	SJB	27/04/18
Verified	SJB	27/04/18
Approved	-	-

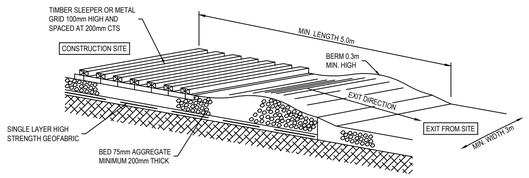
Client: KARIONG SAND AND SOIL SUPPLIES
Project: SAND, SOIL & BUILDING MATERIALS RECYCLING FACILITY. 90 GINDURRA ROAD SOMERSBY
Title: CONCEPT GENERAL ARRANGEMENT PLAN

Status: PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

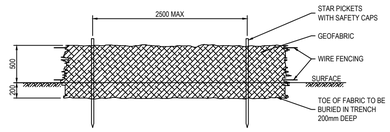
Datum	Register	Scale	Size
AHD	-	1:750	A1

Drawing Number: 80518002-CI-106
Revision: 13

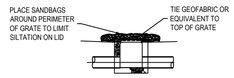
NORTH



STABILISED SITE ACCESS
NTS



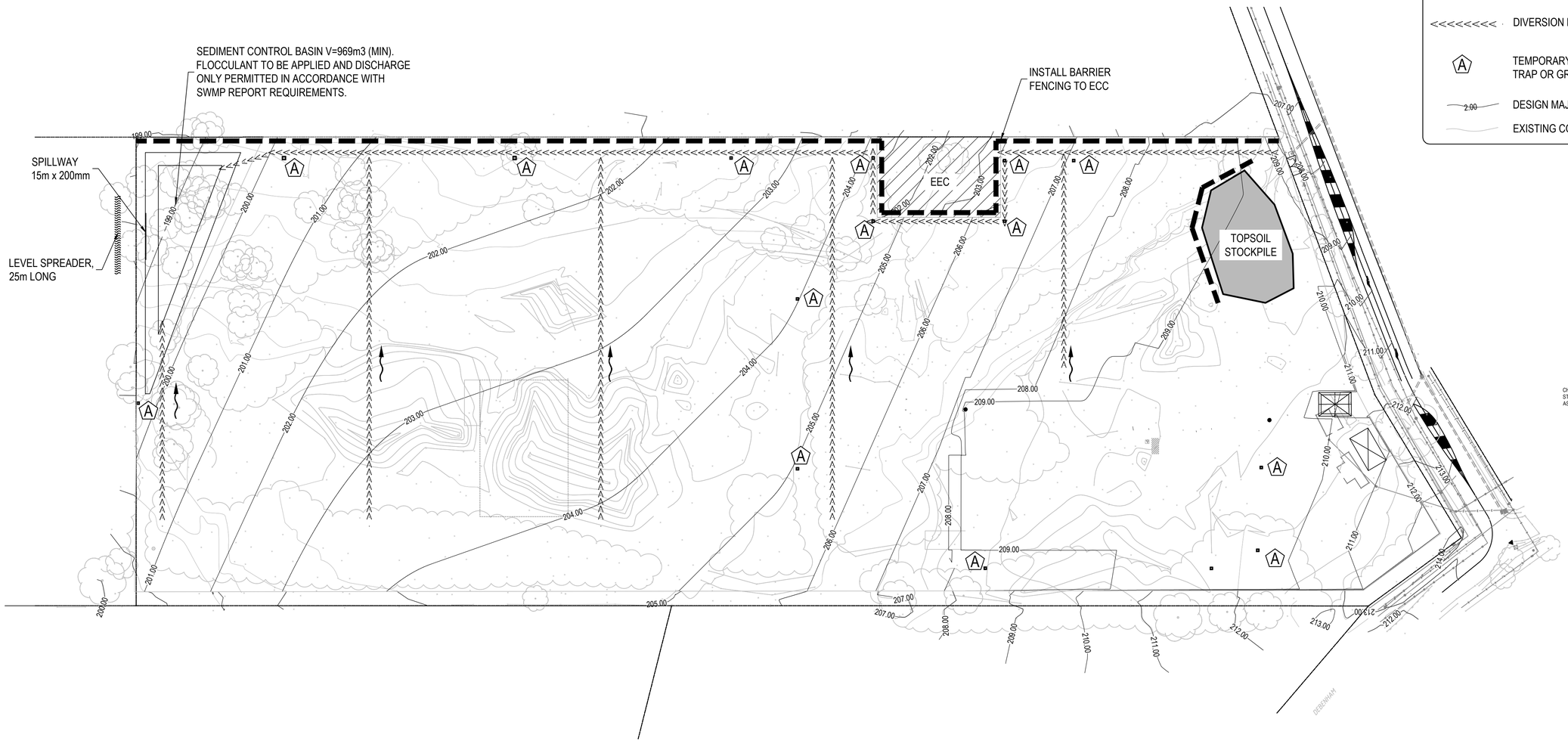
TYPICAL SILT FENCE DETAIL
NTS



TEMPORARY SURFACE INLET SEDIMENT TRAP OR GROSS POLLUTANT TRAP
WHEN USED AS A GROSS POLLUTANT TRAP STRUCTURE SHALL BE REGULARLY DESILTED

LEGEND

- SILT FENCE OR APPROVED MULCH BUND
- STABILISED SITE ACCESS
- OVERLAND FLOW DIRECTION
- SITE COMPOUND
- MELALEUCA BICONVEXA PROTECTION AREA - APZ
- DIVERSION BANK AND CHANNEL (SO 5-6)
- (A) TEMPORARY SURFACE INLET SEDIMENT TRAP OR GROSS POLLUTANT TRAP
- 2.00 DESIGN MAJOR CONTOURS (1m INTERVAL)
- EXISTING CONTOURS (0.5m INTERVAL)



DIVERSION BANK AND CHANNEL
NTS

PLAN
SCALE 1:750

Rev.	Date	Description	Des.	Verif.	Appd.
3	06/07/18	ISSUED FOR DEVELOPMENT APPLICATION	SJB	SJB	SJB
2	02/07/18	ISSUED FOR CLIENT REVIEW	SJB	SJB	SJB
1	21/06/18	ISSUED FOR CLIENT REVIEW	SJB	SJB	SJB

0 15 30 45 60 75m
SCALE 1:750 @A1

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Drawn PW	Date 20/06/18
Checked SJB	Date 20/06/18
Designed SJB	Date 20/06/18
Verified SJB	Date 20/06/18
Approved	Date

Client: KARIONG SAND AND SOIL SUPPLIES
Project: SAND, SOIL & BUILDING MATERIALS RECYCLING FACILITY. 90 GINDURRA ROAD SOMERSBY
Title: CONCEPT EROSION AND SEDIMENT CONTROL PLAN

Status: PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

Datum	Register	Scale	Size
AHD	-	1:750	A1

Drawing Number: 80518002-CI-120
Revision: 3

90 Gindurra Road, Somersby – Stage 2

APPENDIX B

RUSLE Calculations

SWMP Commentary, Detailed Calculations

Note: These "Detailed Calculation" spreadsheets relate only to high erosion hazard lands as identified in figure 4.6 or where the designer chooses to use the RUSLE to size sediment basins. The "Standard Calculation" spreadsheets should be used on low erosion hazard lands as identified by figure 4.6 and where the designer chooses not to run the RUSLE in calculations.

1. Site Data Sheet

Site Name: **90 Gindurra Road, Somersby**

Site Location: **As above**

Precinct: **Hardstand areas, storage areas**

Description of Site: **1. Site clearing**
2. Earthworks

Site area	Site						Remarks
	1	2					
Total catchment area (ha)	5.6	5.6					
Disturbed catchment area (ha)	5.6	5.6					

Soil analysis

% sand (faction 0.02 to 2.00 mm	87	87					Soil texture should be assessed through mechanical dispersion only. Dispersing agents (e.g. Calgon) should not be used
% silt (fraction 0.002 to 0.02 mm)							
% clay (fraction finer than 0.002 mm)	13	13					
Dispersion percentage	100.0	100.0					E.g. enter 10 for dispersion of 10%
% of whole soil dispersible	13	13					See Section 6.3.3(e)
Soil Texture Group	D	D					See Section 6.3.3(c), (d) and (e)

Rainfall data

Design rainfall depth (days)	5	5					See Sections 6.3.4 (d) and (e)
Design rainfall depth (percentile)	75	75					See Sections 6.3.4 (f) and (g)
x-day, y-percentile rainfall event	27.9	27.9					See Section 6.3.4 (h)
Rainfall intensity: 2-year, 6-hour storm	12.3	12.3					See IFD chart for the site

RUSLE Factors

Rainfall erosivity (*R* -factor)	3270	3270					Automatic calculation from above data
Soil erodibility (*K* -factor)	0.023	0.023					RUSLE data can be obtained from Appendixes A, B and C
Slope length (m)	50	50					
Slope gradient (%)	7	5					
Length/gradient (*LS* -factor)	1.31	0.91					
Erosion control practice (*P* -factor)	1.3	1.3	1.3	1.3	1.3	1.3	
Ground cover (*C* -factor)	1	1	1	1	1	1	

Calculations

Soil loss (t/ha/yr)	128	89					
Soil Loss Class	1	1					See Section 4.4.2(b)
Soil loss (m^3/ha/yr)	99	68					
Sediment basin storage volume, m^3	94	65					See Sections 6.3.4(i) and 6.3.5 (e)

4. Volume of Sediment Basins, *Type D* and *Type F* Soils

Basin volume = settling zone volume + sediment storage zone volume

Settling Zone Volume

The settling zone volume for *Type F* and *Type D* soils is calculated to provide capacity to contain all runoff expected from up to the y-percentile rainfall event. The volume of the basin's settling zone (V) can be determined as a function of the basin's surface area and depth to allow for particles to settle and can be determined by the following equation:

$$V = 10 \times C_v \times A \times R_{x\text{-day, y-\%ile}} \ (m^3)$$

where:

10 = a unit conversion factor

C_v = the volumetric runoff coefficient defined as that portion of rainfall that runs off as stormwater over the x-day period

$R_{x\text{-day, y-\%ile}}$ = is the x-day total rainfall depth (mm) that is not exceeded in y percent of rainfall events. (See Sections 6.3.4(d), (e), (f), (g) and (h)).

A = total catchment area (ha)

Sediment Storage Zone Volume

In the detailed calculation on Soil Loss Classes 1 to 4 lands, the sediment storage zone can be taken as 50 percent of the settling zone capacity. Alternately designers can design the zone to store the 2-month soil loss as calculated by the RUSLE (Section 6.3.4(i)(ii)). However, on Soil Loss Classes 5, 6 and 7 lands, the zone must contain the 2-month soil loss as calculated by the RUSLE (Section 6.3.4(i)(iii).

Place an "X" in the box below to show the sediment storage zone design parameters used here:

	50% of settling zone capacity,
X	2 months soil loss calculated by RUSLE

Total Basin Volume

Site	C_v	$R_{x\text{-day, y-\%ile}}$	Total catchment area (ha)	Settling zone volume (m^3)	Sediment storage volume (m^3)	Total basin volume (m^3)
1	0.56	27.9	5.6	874.944	94	968.944
2	0.56	27.9	5.6	874.944	65	939.944

About Cardno

Cardno is an ASX200 professional infrastructure and environmental services company, with expertise in the development and improvement of physical and social infrastructure for communities around the world. Cardno's team includes leading professionals who plan, design, manage and deliver sustainable projects and community programs. Cardno is an international company listed on the Australian Securities Exchange [ASX:CDD].

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