

Technical Paper

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Erosion and Sediment Control Plan

ARDILL PAYNE & PARTNERS

Civil & Structural Engineers – Project Managers – Town Planners – Surveyors



EROSION & SEDIMENT CONTROL PLAN

Prepared for:



Tweed Valley Way & Jones Road,
Yelgun

A project of:

Billinudgel Property Pty Ltd
(Billinudgel Property Trust)

June 2010

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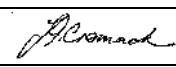
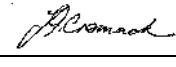
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1 Executive Summary

Ardill Payne and Partners (APP) has prepared an Erosion and Sediment Control Plan (ESCP) for the proposed development of a world class sustainable cultural events site within an enhanced ecological setting at North Byron Parklands, Tweed Valley Way and Jones Road, Yelgun. The development includes the construction of new road pavements and site accesses, the upgrade of existing road pavements, the construction of a new crossing of Jones Road, and associated infrastructure works.

The management measures outlined in this ESCP are designed to minimise the impacts on the environment that may arise from disturbing of the site, and achieve the following outcomes:

- prevent dust nuisance during construction
- prevent the displacement of sediment and soil across and offsite
- preserve water quality in receiving environments
- control and treat surface runoff from the development during construction
- maintain existing surface water conditions outside the construction area
- divert 'clean' runoff around disturbed areas
- compliance with all statutory requirements.

2 Director General's Requirements

The Director General of the Department of Planning determined that the proposal was a Major Project pursuant to Part 3A of the Environmental Planning and Assessment Act 1979, and issued Environmental Assessment Requirements (DGRs) on 25 August 2009. The DGRs that are related to this report are as follows:

- *Attachment 2, Project Application, 3.0 Erosion and Sediment Control Plan – plan or drawing that shows the nature and location of all erosion and sedimentation control measures to be utilized on the site.*
- *Attachment 2, Project Application, 6.0 Construction Management Plan – a plan which outlines traffic and pedestrian management during construction and management of impacts on amenity of adjoining properties and appropriate mitigation measures including noise, dust and sediment and erosion controls.*

This report deals specifically with sediment and erosion controls on the site, and shall be read in conjunction with the 'Construction Management Plan', Ardill Payne & Partners, June 2010.

3 Site Location and Description

The site is located on the eastern side of the Tweed Valley Way at Jones Road, approximately 6.5km south of Mooball, 5.5km north of Brunswick Heads north turnoff, and 23.5km north of Byron Bay. A topographic map of the site is included in **Attachment 1**.

In summary, the application area comprises the following land parcels:

Lot No	DP
403	755687
Pt. 402 & 404	755687
1	1145020
Pt. 46	755687
Pt. 10	875112
Pt. 2	848618
Pt. 30	880376
Pt. 102	1001878
Pt. 12	848618

The application area comprises an area of approximately 155.9 ha. A large proportion of the site is low lying, low relief alluvial plains. Levels range from approximately RL.2.0m AHD in the east, gently rising to approximately RL.3.5m AHD in the west. A network of surface agricultural drains dissect the low lying areas of the site draining into Yelgun and Billinudgel Creeks.

The southern portion of the site (south of Jones Road) is located within the lower catchments of Yelgun and Billinudgel Creeks which form part of the Marshall's Creek floodplain. The northern portion of the site is within the Crabbe's Creek floodplain. The central portion of the overall site incorporates a low east-west ridge upon which Jones Road is located.

Approximately 66% of the site is pasture land used for cattle grazing, while the balance is identified in Council mapping as High Conservation Vegetation

4 Proposed Development

The proposed development of the site involves the following main construction activities:

- Site earthworks including filling of existing shallow grassed drains in event areas

- Internal road construction (spine road and event laneways)
- External road construction and widening, including new intersections
- A new crossing of Jones Road (either an underpass or an at-grade intersection)
- Stormwater drainage, including piped culverts, open drains and stormwater management facilities
- Wastewater treatment system, including the construction of a sewage treatment plant, effluent holding dams, effluent polishing wetlands, effluent irrigation areas and reticulation mains
- Water supply, including the construction of a water treatment plant, bulk water storage tanks and reticulation mains, and the construction of a new dam
- Electricity and telecommunication distribution cables (overhead and/or underground)
- Construction of an administration building and gatehouse
- Pedestrian pathways and bridges.

It is not proposed to construct all of the wastewater treatment system and water supply infrastructure in the initial stages – for further details and the proposed staging, refer to *'Integrated Water Cycle Assessment and Management, North Byron Parklands, Tweed Valley Way and Jones Road, Yelgun, NSW'*, Gilbert & Sutherland, May 2010.

An event area and land use structure plan is included in **Attachment 2**.

5 Background Conditions

5.1 Sub-Surface Conditions

A preliminary geotechnical investigation was undertaken by Coffey Geotechnics Pty Ltd (*'Geotechnical Investigation at Splendour in the Grass Site'*, Coffey Geotechnics Pty Ltd, Report No. GEOTALST03072AA, 1 April 2007). This investigation was to determine CBR values for road design, determine the extent of peat on the site, and to collect soil samples and test for Potential Acid Sulfate Soils (PASS).

A further site assessment was undertaken by Gilbert & Sutherland Pty Ltd (*'Integrated Water Cycle Assessment and Management, North Byron Parklands, Tweed Valley Way and Jones Road, Yelgun, NSW'*, Gilbert & Sutherland, May 2010).

Soils mapping indicates that the low lying portions of the site are underlain by Quaternary alluvial deposits of sands, silts and clays overlying Pleistocene sand deposits which were former beach fronts. The ridge accommodating Jones Road and the more elevated portions in the west of the site are formed on greywacke, slate, phyllite and quartzite.

The soils on the site can be grouped into three main areas:

- Soils in the low lying areas on the north and south eastern areas of the site – generally classified as Podosols comprising organic and visible iron horizons, overlying sand
- Soils at the base of the hill slopes through the middle of the site – generally classified as Hydrosols which are saturated for 2-3 months in most years
- Soils associated with the higher hill slopes in the north west and middle ridge line – generally classified as Kurosols with strongly acidic horizons.

5.2 Potential Acid Sulfate Soils

A Preliminary Acid Sulfate Soil assessment was undertaken by EAL Consulting Service in May 2010 (*Preliminary Acid Sulfate Soil Assessment Report for the North Byron Parklands Project & Concept Plan Application at North Byron Parklands Site, Yelgun, NSW*, EAL Consulting Service, 9 May 2010). This assessment confirmed the presence of potential and actual acid sulfate soils within the study area. An Acid Sulfate Management Plan has been prepared for the site by Ardill Payne & Partners (*Acid Sulfate Management Plan*, Ardill Payne & Partners, June 2010).

This investigation also confirmed the presence of peat soils across the north eastern portion of the site, at varying depths up to a maximum of 400mm deep.

5.3 Groundwater

Groundwater levels observed by EAL and Gilbert & Sutherland in 2010, and by Coffeys in 2007, recorded typical depths to groundwater as varying between 0.35m to 0.9m below ground surface level within the low-lying alluvial plains.

6 Plan Implementation

The ESCP requires the developer/contractor to mitigate any potential environmental impacts associated with possible soil erosion and mobilisation of sediment during construction works. This ESCP specifies the management measures necessary to mitigate any impacts associated with possible soil erosion and sedimentation on the site.

Earthworks associated with the construction of roads and pathways, the reconstruction of Jones Road (and possibly excavation for the underpass beneath Jones Road), the excavation works for service trenches, building construction works, and the construction and maintenance of open drains will create the potential for soil erosion and mobilisation of sediment to occur.

Prior to commencement of earthworks, appropriate erosion and sedimentation control devices such as sediment control fencing, shallow diversion drains, hay bale check dams and temporary sediment basins shall be installed in accordance with the recommendations of Landcom's *'Managing Urban Stormwater: Soils and Construction'*, Volume 1, 4th Edition, March 2004'.

7 Erosion and Sediment Control Measures

The following procedures have been prepared in accordance with Landcom's *'Managing Urban Stormwater: Soils and Construction'*, Volume 1, 4th Edition, March 2004' (the "Blue Book").

Reference shall also be made to the Ardill Payne & Partners reports *'Stormwater Management Plan'*, June 2010, and the *'Acid Sulfate Management Plan'*, June 2010.

The following management issues may be raised during civil works until the site has stabilised:

- Dust control due to earthworks
- Erosion from exposed construction areas
- Prevention of sediment leaving the site
- Dewatering of excavations.

Potential Acid Sulfate Soils (PASS) may be encountered during excavation of service trenches and the new open drain. Refer to the 'Acid Sulfate Management Plan' for details on PASS management measures.

7.1 Dust Control

Dust from the site shall be managed to prevent excessive degradation in air quality or nuisance to nearby residents and the environment. This will be measured by limiting complaints to less than one per week.

Dust will mainly be controlled on site by:

- limiting traffic on disturbed areas
- watering spray trucks
- any material stockpiles to be covered by anchored geofabric
- dust covers provided on trucks and dumpers

Where wind speed exceeds about 10m/s (36km/hr), or a watering truck is not available, dust generating activities shall cease unless the Site Manager certifies that dust controls are operating effectively and air quality does not cause a nuisance.

In the event that dust control is unsatisfactory then some of the following measures may be utilised:

- inspect existing controls and clean, upgrade or improve as required
- open weave barrier fencing is to be provided on the windward side in accordance with Landcom's manual "*Managing Urban Stormwater: Soils and Construction*", March 2004
- temporary access roads and parking areas shall be sealed with a gravel layer
- disturbed areas are to be covered with geotextile
- construction activities to stop, disturbed areas stabilised and the dust control measures reviewed

In the event of excessive complaints, dust monitoring shall be conducted in accordance with AS3580.10.1 (1991). The Site Manager is responsible for visually monitoring air quality and the adequacies of dust control measures at least daily, and as required to ensure that the above requirements are satisfied and performance is satisfactory. In the event of unsatisfactory dust control as indicated by excessive complaints, the Principal Contractor is responsible for initiating a review of the dust controls and dust monitoring as required.

7.2 Erosion and Sediment Control

The site is generally not being filled or regraded. Bulk earthworks on the site will be required for the construction of roads, pedestrian pathways, stormwater drainage, building construction, and the installation of services. Earthworks will primarily consist of:

- stripping of topsoil and minimal cut/fill beneath new roads and pathways and providing approved imported roadbase material
- reconstruction of Jones Road, and construction of either an underpass or at grade intersection with spine road
- filling of some shallow grassed man-made drains in areas of high pedestrian or vehicle activity
- construction of shallow diversion drains to divert surface waters around event areas
- construction of shallow diversion drains to divert 'clean' runoff around disturbed areas
- construction of new open drain near Forest Block C
- cut and fill for building platforms as required
- trenching for installation of services

Erosion of the site shall be minimised and sedimentation shall be controlled so as to not adversely impact surrounding drains, creeks or surrounding areas. The Gilbert & Sutherland report concluded that the overall soil erosion hazard is classed as "very low" considering the soil type disturbed and assuming appropriate control measures are employed.

An erosion and sediment control layout plan and details are shown on drawings **6883-SW1 & SW2**, included as **Attachment 3**. Generally water quality from the site shall be maintained by:

- limiting traffic on disturbed areas
- careful management of stockpiles using covers if necessary. Stockpiles shall not be located in drainage channels and shall be surrounded by temporary sediment fences on the downslope side
- sediment control structures such as temporary sediment traps, sediment fencing/control, and stabilised site access points
- diversion drains to divert "clean" water around disturbed areas
- stabilisation of disturbed areas as soon as possible after completion of earthworks
- directing runoff through grassed or vegetated swales prior to discharge off site
- backfilling of service trenches as soon as possible

- employ rock scour protection to stormwater inlets and outlets as specified.
- street cleaning as required to remove sediment falling off exiting vehicles

The Site Manager is responsible for checking the adequacy of erosion and sediment control measures at least weekly and following rainfall to ensure that the above requirements are satisfied and performance is satisfactory. In the event of unsatisfactory performance the Project Manager is responsible for initiating improvements to the treatment measures.

7.2.1 Sediment Control Fencing

Sediment fences shall be located down-slope of any disturbed areas, and ideally along a line of constant level to prevent concentration of stormwater run-off. Where this cannot be achieved, sections of the sediment fence shall have 'returns' directed up-slope to control the concentration of run-off.

7.2.2 Stabilised Site Access

Provide a stabilised site entry at all entry/exit points of the site to prevent the tracking of sediment off site. If practical restrict the entry/exit point to one stabilised location.

The pad shall be at least 2m wide and 10m long, and consist of minimum 40mm crushed rock placed 150-200mm thick over a geotextile filter cloth.

7.2.3 Grassed or Vegetated Swales

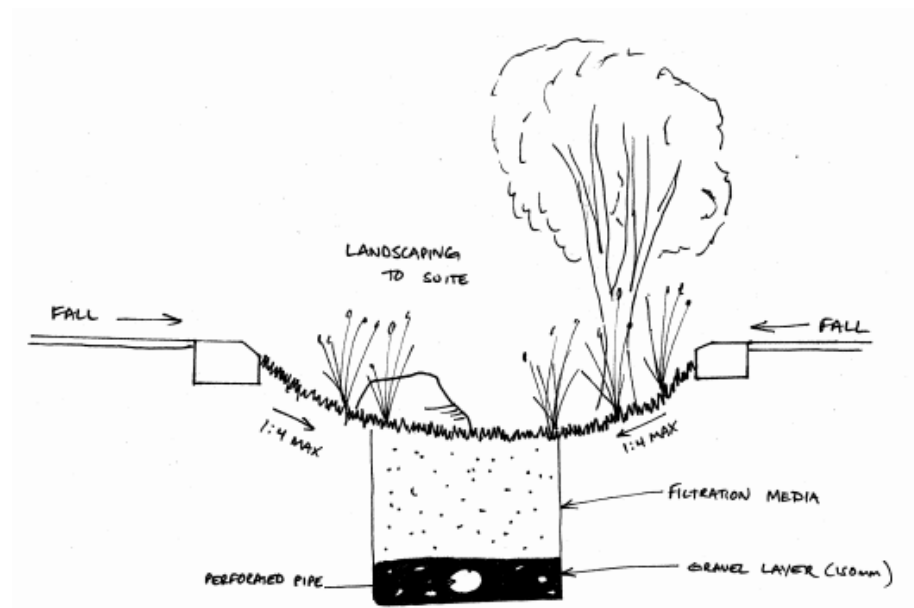
Grassed swales are a shallow, low gradient, grass lined drainage channel used to convey and treat concentrated stormwater runoff. The swale may be landscaped and vegetated (vegetated swale), or include subsoil filtration media and an underdrain (bio-retention swale).

Bio-retention swales provide both stormwater treatment and conveyance functions. The swale component provides pre-treatment of stormwater to remove coarse to medium sediments while the bio-retention system removes finer particulates and associated contaminants. **Figure 1** is a typical section for a bio-retention swale.

Grassed and vegetated swales treat stormwater by settling, filtration and infiltration. They remove pollutants such as coarse and medium sediment, nutrients and hydrocarbons. The interaction between flow and the vegetation along swales facilitates pollutant settlement and retention.

Vehicular access to swales shall be prevented by providing piped or concrete lined crossings at appropriate locations.

Figure 1– Typical Bio-retention Swale Section



7.2.4 Sediment Basins

Where any disturbed area of the site exceeds 2500m², temporary sediment basins will be required during construction. The basins will be required while the site continues to generate sediment laden runoff.

Sediment basins will remove (by settling) coarse to medium-sized sediments. Key design parameters are selecting a target sediment size, design discharge and sediment storage volume.

The design of a sediment basin is such that suspended solids and coarse sediment are able to settle out of suspension as the water flows towards the basin outlet. The capacity of a sediment basin is the combination of two components:

- The settling zone, in which water is stored allowing the settlement of suspended solids

- The sediment storage zone, where deposited sediment is stored until the basin is cleaned.

Landcom's *'Managing Urban Stormwater: Soils and Constructions' Volume 1* (the "Blue Book") provides formulae to determine the required sediment basin size given a specific area and soil type. Sizing of the sediment basins shall be determined at CC stage.

Sediment basins will be constructed such that they capture flows up to the design storm only. Higher flows will be directed to existing site drains. The first flush from all storm events will be directed through the sediment basin to prevent siltation of waterways.

Water from the sediment basins can be reused for dust suppression and irrigation of re-vegetated areas. A water cart is to be provided at all times on the site, and will be filled from the sediment basin whenever possible. Unsealed roads should be regularly watered at a rate of 1-2 litres/m² during high traffic loads.

Basins will require emptying to ensure they have storage volume available for future storm events; this is generally within 5 days from the end of the previous storm event. A floating pump inlet will minimise the potential disturbance of settled material while the captured stormwater is discharged.

7.3 Control of Surface Runoff

The principal man-made drains existing on the site will be retained. Some minor man-made drains (depth approx 300mm) in the public areas (areas of high pedestrian activity) will present operational difficulties for the site operators and will be a public hazard during events. These minor drains will be filled to improve the function of these areas. Only the shallow drains will be filled and only for the extent of the public areas. This filling will comprise free-draining crushed rock aggregate and subsoil drain pipes, with a topsoil overlay from site-won material. Shallow diversion drains will direct unpolluted upstream surface waters away from the drains being filled.

Generally new drains, other than the drain located north of Forest Block C (see below), will be shallow diversion drains (nom. 150mm deep) as detailed on drawing **6883-SW2**. These diversion drains are to divert unpolluted runoff from upstream catchments around

construction areas and event areas, and will discharge into existing drains.

A new open drain will be constructed in the eastern part of the site, approx. 5m north of Forest Block C, to duplicate an existing open drain (refer '*Stormwater Management Plan*', Ardill Payne & Partners, June 2010). Construction of the new open drain will reduce the likelihood of any adverse environmental outcomes associated with the maintenance of the existing drain, with construction management practices in accordance with Section 7.2.

An erosion and sediment control plan, including site drainage patterns, is shown on drawing **6883-SW1**; details of surface runoff controls are shown on drawings **6883-SW2**; all drawings are included as **Attachment 3**.

7.4 Surface Water Monitoring

The site shall be inspected by the Site Manager and Engineer at the start of construction works to ensure that the requirements of the ESCP are in place. The Site Manager or his nominated representative shall inspect drainage systems and water quality controls during all rainfall events during the construction period. Contact the Engineer for advice where required.

Visual inspections of the construction phase sediment and erosion controls shall be carried out daily and after rainfall events (>25mm in a 24 hour period) to ensure that controls are in place and operational.

Surface water quality (pH, turbidity and suspended solids, and visual survey for oil and grease) entering and leaving the site shall be monitored during the first rainfall event (>25 mm in a 24 hour period) of each month. Details of the water quality parameters and the monitoring locations are contained in the '*Integrated Water Cycle Assessment and Management, North Byron Parklands, Tweed Valley Way and Jones Road, Yelgun, NSW*', Gilbert & Sutherland, May 2010.

Generally all controlled discharges of water from the site during the construction phase should comply with the following criteria:

- pH 6.5 – 8.5
- Turbidity < 50NTU
- Suspended Solids < 50 mg/L

Monitoring, reporting and corrective actions shall be recorded in an Environmental Management Log (EML) or site diary. The EML is to be updated continuously in response to inspections on the site and any breaches of the CMP that may occur. Include details of inspection time, weather conditions, rainfall reading and any other relevant observations. Record any maintenance or corrective measures implemented as a result of the inspection. All records to be kept on site for inspection by local or state government officers at any time.

7.5 Dewatering

Water pumped from excavations shall be directed to temporary sediment basins prior to and necessary treatment and discharge from the site.

7.6 Maintenance of Erosion & Sediment Control Measures

Erosion and sediment control devices shall be regularly maintained, and repaired or cleaned as necessary, to retain the effectiveness of the selected measures. Maintenance shall continue until disturbed areas have been adequately revegetated. Unpolluted runoff shall be diverted around disturbed areas.

Maintenance of swales shall ensure that:

- inlets and outlets are not blocked
- sediment accumulation does not impair operation of swales
- there is no scour of the swales
- vegetation is healthy

Maintenance of existing open drains will occur as necessary to preserve the integrity of the drainage system. It is recommended that maintenance of these drains avoids any deepening of the drains.

7.7 Corrective Action

The Site Manager is to review the effectiveness of environmental controls on site and implement any changes required to improve them.

7.8 Contractor Management

The Contractor shall be made aware of his responsibilities and obligations under the terms of the ESCP and the EP&A Act 1997. Regular inspections, and audits of retained records and test results, will be carried out by the Engineer.

The Site Manager will ensure that the procedures in the ESCP are followed and that controls measures are maintained and adequate. All loads shall be covered. The Site Manager is responsible for monitoring the condition of adjacent streets and organising for cleaning of the road surfaces if required.

7.9 Incident Management

The Contractor and his representatives have a clearly defined responsibility under the terms of this ESCP and the EP&A Act 1997 to report any incidents likely to cause harm to the environment.

8 Discussion and Conclusion

Erosion and sediment control measures will be implemented in accordance with Landcom's guide *'Managing Urban Stormwater: Soils and Construction'*, Volume 1, 4th Edition, March 2004.

The ESCP layout plan and details (drawings **6883-SW1 & SW2**) represents surface water management measures on the site. Considering that disturbance of the site is minimal, we consider that the extent of erosion and sediment control measures shown on the drawings and described in the ESCP is consistent with current industry standards.

In general, the site will be managed by the installation of appropriate erosion and sediment control devices, such as diversion drains, dust control measures, sediment fencing, and hay bale check dams.

Water quality will be tested prior to release from site and remedial measures will be implemented to maintain the water quality within suitable limits.

9 Scope of Engagement

This report has been prepared by Ardill Payne & Partners (APP) at the request of Billinudgel Property Trust for the purpose of preparing an Erosion and Sediment Control Plan for the proposed cultural events site at North Byron Parklands, and is not to be used for any other purpose or by any other person or corporation.

This report has been prepared from the information provided to us and from other information obtained as a result of enquiries made by us. APP accepts no responsibility for any loss or damage suffered howsoever arising to any person or corporation who may use or rely on this document for a purpose other than that described above.

No part of this report may be reproduced, stored or transmitted in any form without the prior consent of APP.

APP declares that it does not have, nor expects to have, a beneficial interest in the subject project.

To avoid this advice being used inappropriately it is recommended that you consult with APP before conveying the information to another who may not fully understand the objectives of the report. This report is meant only for the subject site/project and should not be applied to any other.

10 Attachments

- Attachment 1 Topographic Map
- Attachment 2 Event Area and Land Use Structure Plan
- Attachment 3 Drawings

ATTACHMENT 1

Attachment 1
Topographic Map



Subject Site



Do not scale drawing. Use written dimensions only
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Client: **Billinudgel Property Trust**

Title: **North Byron Parklands
- Regional Location**

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Scale at A4	NTS	Datum	-
Design	TC	Date	June 2010
Drawn	NB	File	6883 LocPlan.dwg
Dwg No.	LP.01	Job No.	6883

ATTACHMENT 2

Attachment 2
Proposed Development
Layout



Refer to the Ecological Structure Plan for 'Existing Vegetation to be Protected', 'Proposed New Habitat Areas', 'Proposed New Managed Parklands' and 'Land proposed to be dedicated to DECC'.

Legend:

- The Site
- Event Area
- Conference Centre Uses
- Cultural Centre/Administration Uses
- Gatehouse
- Extents of Application Area (Dashed)
- Car Parking
- Spine Road (7m wide)
- Event access lane (6m wide)
- Main pedestrian route



0 160m

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Prepared by

design team ink

IMPORTANT NOTE |
Cadastral information is subject to survey. The alignment of the aerial photograph and vectorial overlays is approximate only. This plan is conceptual only, and subject to detailed survey and design.

Sources | Aerial Photography: Bill Mills (2009) | Cadastral: Ansell Payne (2009) | Major contour = 5m | Minor contour = 1m

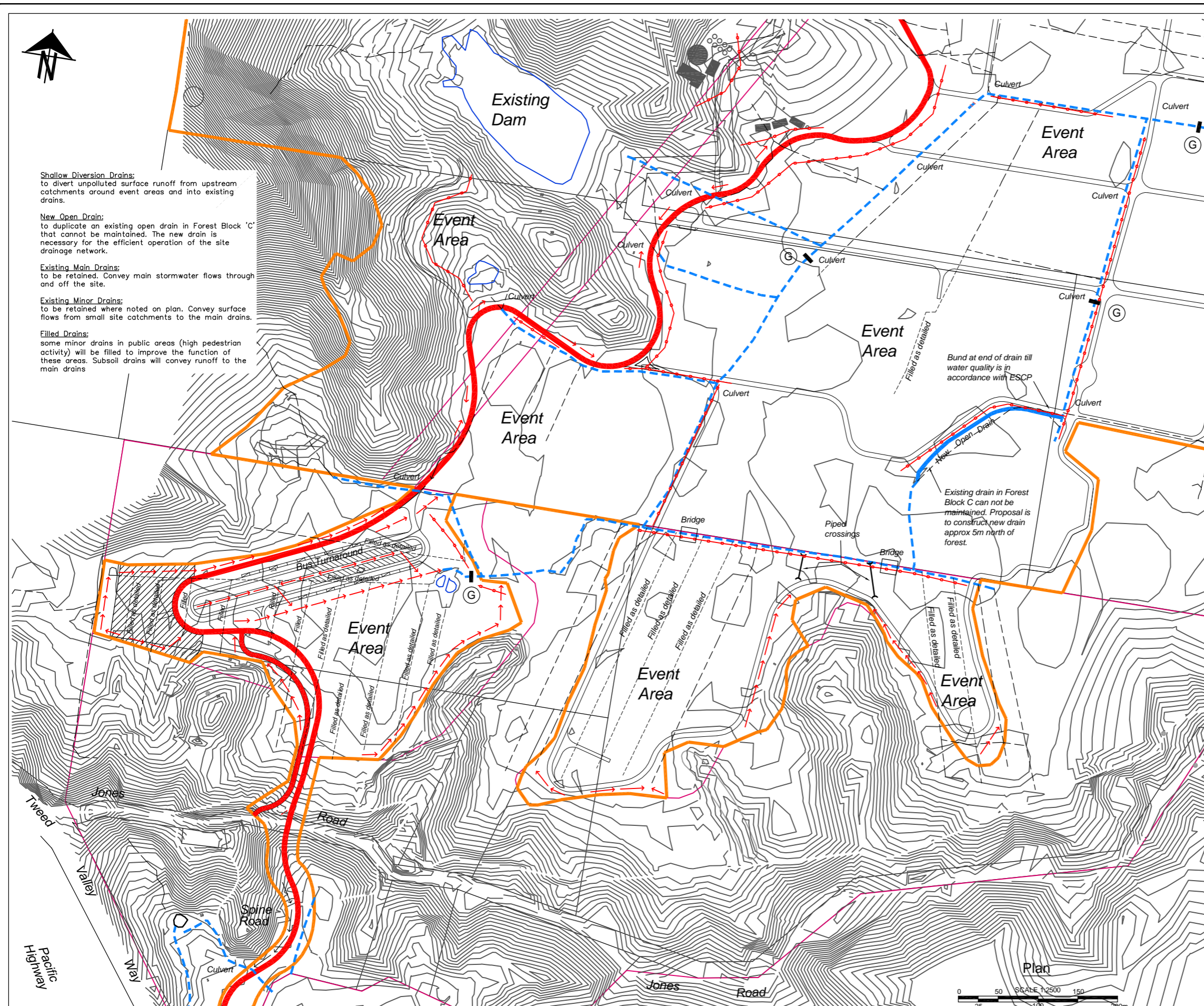
Plan | **1.2**
Event Area and
Land Use Structure
14

North Byron Parklands | Tweed Valley Way & Jones Road

Date 21.07.10
Author SDR
Reference 09_120

ATTACHMENT 3

Attachment 3
Drawings



Shallow Diversion Drains:
to divert unpolluted surface runoff from upstream catchments around event areas and into existing drains.


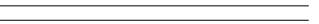







New Open Drain:
to duplicate an existing open drain in Forest Block 'C' that cannot be maintained. The new drain is necessary for the efficient operation of the site drainage network.

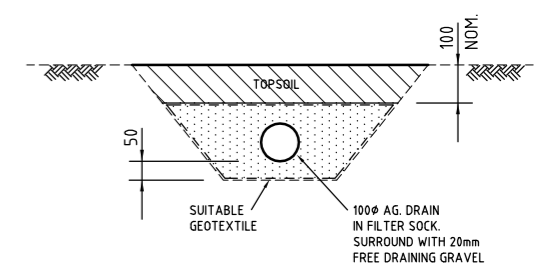
Existing Main Drains:
to be retained. Convey main stormwater flows through and off the site.

Existing Minor Drains:
to be retained where noted on plan. Convey surface flows from small site catchments to the main drains.

Filled Drains:
some minor drains in public areas (high pedestrian activity) will be filled to improve the function of these areas. Subsoil drains will convey runoff to the main drains

Legend

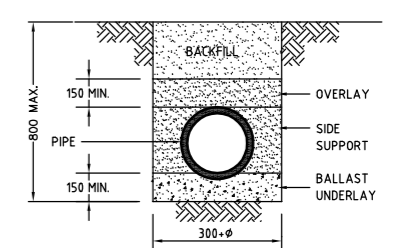
-  Spine Road
-  Event Laneways
-  Sediment control fencing
-  Diversion drains & vegetated swales
-  New open drains
-  Existing main drains
-  Existing minor drains
-  Existing drains to be filled (refer detail)
-  Gross pollutant traps (coarse mesh screen in drain, or similar)



NOTES

- SUBSOIL DRAINS ARE REQUIRED TO FILL SHALLOW MAN-MADE DRAINS IN PUBLIC AREAS, WHERE SHOWN ON PLAN.
- SUBSOIL DRAINS SHALL DISCHARGE TO OPEN DRAINS.

FILLED DRAIN DETAIL
SCALE 1:10



TYPICAL SERVICE TRENCH
N.T.S.

BALLAST UNDERLAY: WET AREAS - 12mm-25mm CRUSHED AGGREGATE DRY AREA - AS FOR SIDE SUPPORT & OVERLAY

SIDE SUPPORT & OVERLAY: APPROVED SAND OR METAL DUST FREE FROM ROCKS TO FORM STABLE BED.

BACKFILL: UNDER ROADS SHALL BE METAL DUST TO UNDERSIDE OF PAVEMENT. IN OTHER AREAS SHALL BE THE MATERIAL FROM THE TRENCH EXCAVATION FREE FROM ROCKS.

NOTE:- ALL MATERIALS TO BE PLACED IN LAYERS NOT EXCEEDING 150mm COMPACTED THICKNESS & COMPACTED TO 95% STANDARD DRY DENSITY (A.S.1289)

MINIMUM COVER REQUIREMENTS

AREAS NOT SUBJECT TO VEHICULAR LOADING:	450mm
AREAS SUBJECT TO VEHICULAR LOADING:-	600mm

Issue	Date	Amendment	App'd

Client:
Billinudgel Property Trust

Project:
North Byron Parklands
Tweed Valley Way & Jones Road
Wooyung

Title:
Erosion & Sediment Control
- Layout Plan

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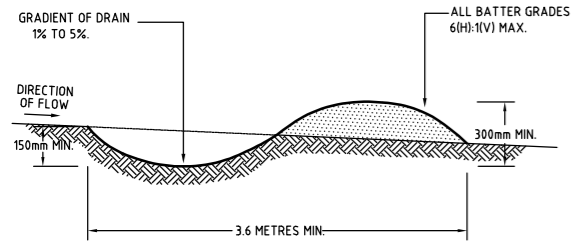
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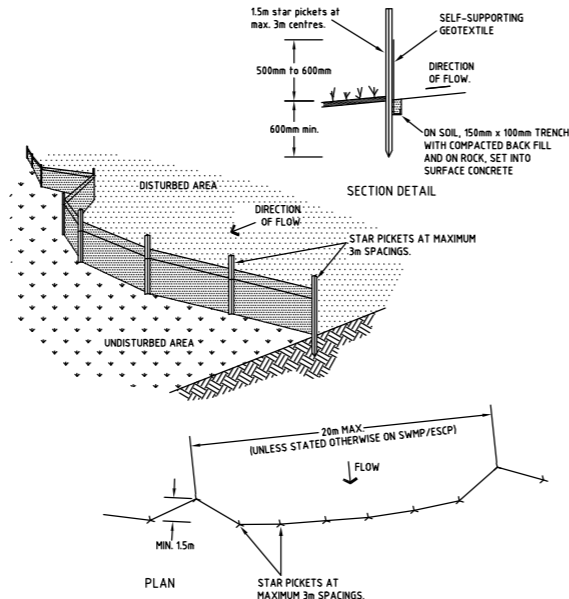
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CONSTRUCTION NOTES:

1. CONSTRUCT WITH GRADIENT OF 1 PER CENT TO 5 PER CENT.
2. AVOID REMOVING TREES AND SHRUBS IF POSSIBLE.
3. DRAINS TO BE CIRCULAR, PARABOLIC OR TRAPAZOIDAL CROSS SECTION, NOT V-SHAPED
4. EARTH BANKS TO BE ADEQUATELY COMPACTED IN ORDER TO PREVENT FAILURE.
5. PERMANENT OR TEMPORARY STABILISATION OF THE EARTH BANK TO BE COMPLETED WITHIN 10 DAYS OF CONSTRUCTION
6. ALL OUTLETS FROM DISTURBED LANDS ARE TO FEED INTO SEDIMENT BASIN OR SIMILAR.
7. DISCHARGE RUNOFF COLLECTED FROM UNDISTURBED LANDS ONTO EITHER A STABILISED OR AN UNDISTURBED DISPOSAL SITE WITHIN THE SAME SUBCATCHMENT AREA FROM WHICH THEY WATER ORIGINATED.
8. COMPACT BANK WITH A SUITABLE IMPLEMENT IN SITUATIONS WHERE THEY ARE REQUIRED TO FUNCTION FOR MORE THAN FIVE DAYS.
9. EARTH BANKS TO BE SET FREE OF PROJECTIONS OR OTHER IRREGULARITIES THAT WILL EMPEDE NORMAL FLOW.

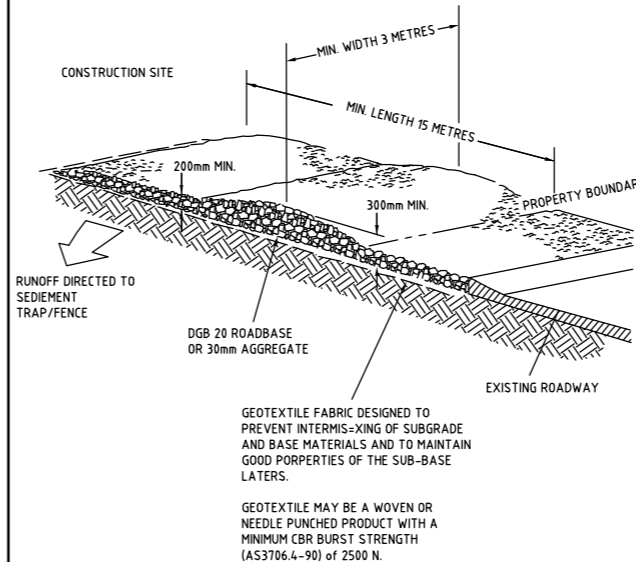
EARTH BANK (LOW FLOW)



CONSTRUCTION NOTES:

1. CONSTRUCT SEDIMENT FENCE AS CLOSE AS POSSIBLE TO PARALLEL TO THE CONTOURS OF THE SITE.
2. DRIVE 15 METRE LONG STAR PICKETS INTO GROUND, 3 METRES APART
3. DIG A 150mm DEEP TRENCH ALONG THE UPSLOPE LINE OF THE FENCE FOR THE BOTTOM OF THE FABRIC TO BE ENTRENCHED.
4. BACKFILL TRENCH OVER BASE OF FABRIC.
5. FIX SELF-SUPPORTING GEOTEXTILE TO UPSLOPE SIDE OF POST WITH WIRE TIES OR AS RECOMMENDED BY GEOTEXTILE MANUFACTURER
6. JOIN SECTIONS OF FABRIC AT SUPPORT POST WITH A 150mm OVERLAP.

SEDIMENT FENCE



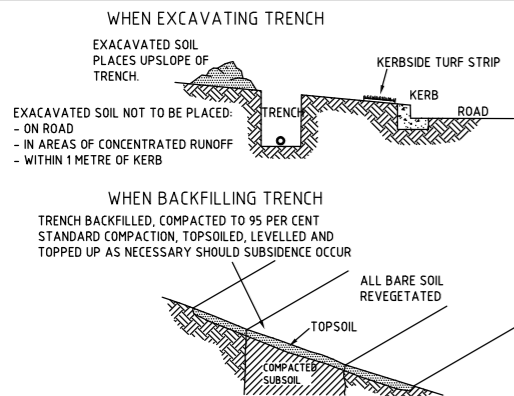
CONSTRUCTION NOTES:

1. STRIP TOPSOIL AND LEVEL SITE.
2. COMPACT SUBGRADE
3. COVER ARE WITH NEEDLE PUNCHED GEOTEXTILE
4. CONSTRUCT 200mm THICK PAD OVER GEOTEXTILE USING ROADBASE OR 30mm AGGREGATE. MINIMUM LENGTH IS 15 METRES OR TO BUILDING ALIGNMENT. MINIMUM WIDTH 3 METRES
5. CONSTRUCT HUMP IMMEDIATELY WITHIN BOUNDARY TO DIVERT WATER TO A SEDIMENT FENCE OR OTHER SEDIMENT TRAP.

STABILISED SITE ACCESS

Notes - Erosion and Sedimentation Control

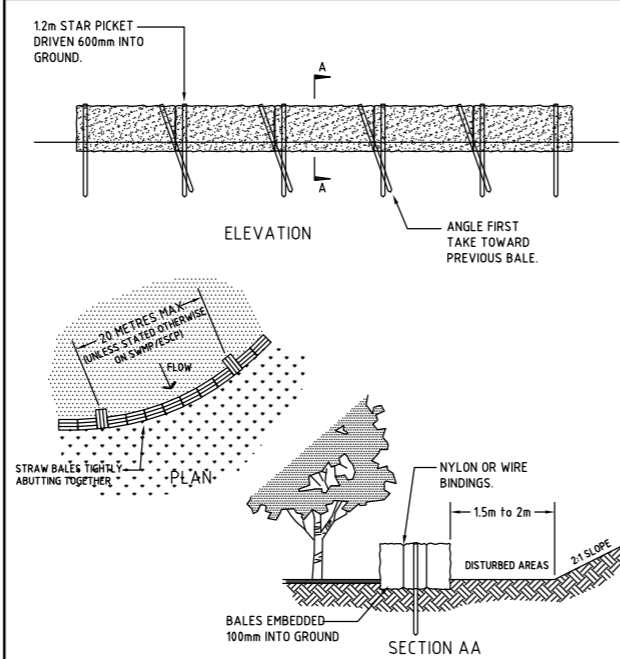
1. All erosion and sedimentation controls shall be in accordance with the guidelines and specifications as detailed in Landcom's 'Managing Urban Stormwater: Soils and Construction - Volume 1', 2004.
2. Construction shall be phased so that land disturbance is confined to areas of workable size. This will limit the duration disturbed areas are exposed to erosion. Stabilisation shall be applied to the first disturbed area before the next section is opened up. Any disturbed areas that will not be stabilised within 30 days shall be revegetated and any that fail to establish shall be resown.
3. Topsoil stockpiles are to be located away from any natural drainage watercourse and are to have hay bales and/or silt stop sediment control fences placed around them to act as sedimentation controls.
4. Temporary earthen diversion drains are to be constructed to divert waters away from all disturbed areas and towards hay bale check dams located in natural drainage depressions. Temporary sediment detention barriers are to be placed around outlet headwalls and drainage discharge points as detailed and permanent energy dissipators are to be installed at all outlets as shown to limit velocities and thus the potential for scouring. With all drainage outlets, all waters are to be released in a non-erodible manner. Temporary sediment traps are to be constructed at all drainage inlet points as detailed.
5. Sediment and debris are to be removed from detention barriers when they are 60% full. All the sediment removed shall be disposed of as directed by the Supervising Engineer.
6. Upon completion of shaping and drainage works, batters and drainage lines shall be topsoiled to a minimum depth of 100mm with stockpiled material and any areas with insufficient grass/topsoil mix are to be seeded and mulched with any failed areas resown or revegetated as directed by the Supervising Engineer. A 400mm wide turf strip shall be installed next to all kerb and gutter, or kerb, to stabilise the interface between kerb and footpath.
7. Temporary erosion and sedimentation controls are to be installed during the construction phase and shall be retained and maintained while disturbed areas remain or are contributing sediment to the stormwater system. No device shall be removed until directed by the Supervising Engineer.



CONSTRUCTION NOTES:

1. DO NOT OPEN ANY TRENCH UNLESS IT IS LIKELY TO BE CLOSED IN THREE DAYS
2. PLACE EXCAVATED MATERIAL UPSLOPE OF TRENCH
3. STOCKPILE TOPSOIL, SEPARATELY FROM SUBSOIL
4. DIVERT RUNOFF FROM THE LINE OF THE CUT WITH DIVERSIONS
5. REHABILITATE IN ACCORDANCE WITH THE SPECIFICATION.

UTILITY CONSTRUCTION



CONSTRUCTION NOTES:

1. CONSTRUCT STRAW BALE FILTER AS CLOSE AS POSSIBLE TO PARALLEL TO THE CONTOURS OF THE SITE OR AT THE TOE OF A SLOPE
2. PLACE BALES LENGTHWISE IN A ROW WITH ENDS TIGHTLY ABUTTING. USE STRAW TO FILL ANY GAPS BETWEEN BALES. STRAWS TO BE PLACED PARALLEL TO GROUND
3. MAXIMUM HEIGHT OF FILTER IS ONE BALE
4. ON SOFT MATERIALS, EMBE EACH BALE IN THE GROUND 75mm TO 100mm AND ANCHOR WITH TWO 12m STAR PICKETS. ANGLE THE FIRST STAKE IN EACH BALE TOWARDS THE PREVIOUSLY LAID BAILE. DRIVE STAKES 600mm INTO THE GROUND AND FLUSH WITH THE TOP OF THE BALES.
5. WHERE A STRAW BALE FILTER IS CONSTRUCTED DOWNSLOPE FROM A DISTURBED BATTER THE BALES SHOULD BE LOCATED 1.5 TO 2 METRES DOWNSLOPE FROM THE TOE OF THE BATTER

STRAW BALE FILTER

Issue	Date	Amendment	App'd

Client:
Billinudgel Property Trust

Project:
North Byron Parklands
Tweed Valley Way & Jones Road
Wooyung

Title:
Erosion & Sediment Control
- Details

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Date	June 10	Filename	6883-SWMP
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Job No.	6883	Dwg. No.	SW2
Issue			

Technical Paper

Q

Stormwater Management Plan

ARDILL PAYNE & PARTNERS

Civil & Structural Engineers – Project Managers – Town Planners – Surveyors



STORMWATER MANAGEMENT PLAN

Prepared for:



Tweed Valley Way & Jones Road,
Yelgun

A project of:

Billinudgel Property Pty Ltd
(Billinudgel Property Trust)

June 2010

Document Control Sheet

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Job No.:	6883
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Author:	Tony Cromack
Client:	Billinudgel Property Trust
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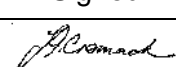

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1	27.07.10			T. Cromack	
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1 Introduction

Ardill Payne and Partners (APP) has prepared a Stormwater Management Plan (SWMP) for the proposed development of a world class sustainable cultural events site within an enhanced ecological setting at North Byron Parklands, Tweed Valley Way and Jones Road, Yelgun. The development includes the construction of new road pavements and site accesses, the upgrade of existing road pavements, the construction of a new crossing of Jones Road, and associated infrastructure works.

The SWMP employs the principles of Water Sensitive Urban Design (WSUD), which focuses on reducing pollutant export and storm flows as well as improving visual aesthetics of the urban landscape as a part of the greater concept of Ecologically Sustainable Design (ESD). A stormwater quantity and quality assessment has been undertaken as part of the WSUD treatment train selection process. The on-site detention and stormwater quality improvement devices chosen for the development will reduce post-development stormwater pollutant loads and storm flows in accordance with the compliance objectives in Byron Shire Council's Development Control Plan 2002 – Part N – Stormwater Management.

2 Director General's Requirements

The Director General of the Department of Planning determined that the proposal was a Major Project pursuant to Part 3A of the Environmental Planning and Assessment Act 1979, and issued Environmental Assessment Requirements (DGRs) on 25 August 2009. The DGRs that are addressed in this report are as follows:

- *Attachment 2, Concept Plan, 7.0 Stormwater Concept Plan – illustrating the concept for stormwater management from the site and must include details of any major overland flow paths through the site and any discharge points to the street drainage system. Where an on-site detention system is required, the type and location must be shown and must be integrated with the proposed landscape design. Site discharge calculations should be provided.*
- *Attachment 2, Project Application, 3.0 Stormwater Plan – a detailed stormwater management plan for the site and must include details of any major overland flow paths through the site and any discharge points to the street drainage system. Where an on-site detention system is required, the type and location must be shown and must be integrated with the proposed landscape design. Site discharge calculations should be provided.*

3 Objectives

The objectives of the Stormwater Management Plan are as follows:

- Reduce post-development stormwater flows to pre-development rates
- Improve post-development stormwater quality
- Provide aesthetic integration of stormwater infrastructure into the built environment
- Provide opportunity for stormwater reuse
- Provide a stormwater management system which embodies the principles of ESD, WSUD and industry best management practices.

The proposed Stormwater Management Plan will maximise the use of grassed and vegetated swales, and provide for infiltration where possible, to increase the level of pollutant removal and flow attenuation generated by the proposed development.

4 Existing Stormwater Situation

The site is located on the eastern side of the Tweed Valley Way at Jones Road, approximately 6.5km south of Mooball, 5.5km north of Brunswick Heads north turnoff, and 23.5km north of Byron Bay. A topographic map of the site is included in **Attachment 1**.

The application area comprises an area of approximately 155.9 ha. A large proportion of the site is low lying, low relief alluvial plains. Levels range from approximately RL.2.0m AHD in the east, gently rising to approximately RL.3.5m AHD in the west. A network of surface agricultural drains dissect the low lying areas of the site draining into Yelgun and Billinudgel Creeks.

The southern portion of the site (south of Jones Road) is located within the lower catchments of Yelgun and Billinudgel Creeks which form part of the Marshall's Creek floodplain. The northern portion of the site is within the Crabbe's Creek floodplain. The central portion of the overall site incorporates a low east-west ridge upon which Jones Road is located.

Numerous farm dams are located around the site. The most significant dam on the property has an estimated storage volume of 15.9ML.

Approximately 66% of the site is pasture land used for cattle grazing, while the balance is identified in Council mapping as High Conservation Vegetation.

Stormwater runoff pollutants which could typically be expected from the proposed development would be similar to those from a rural residential environment, due to the presence of roads, parking and landscaping areas. These pollutants would include:

- Suspended solids
- Gross Pollutants
- Nitrogen
- Phosphorus
- Hydrocarbons

5 Proposed Development

The proposed development of the site involves the following main construction activities:

- Site earthworks including filling of existing shallow grassed drains in event areas
- Internal road construction (spine road and event laneways)
- External road construction and widening, including new intersections
- A new crossing of Jones Road (either an underpass or an at-grade intersection)
- Stormwater drainage, including piped culverts, open drains and stormwater management facilities
- Wastewater treatment system, including the construction of a sewage treatment plant, effluent holding dams, effluent polishing wetlands, effluent irrigation areas and reticulation mains
- Water supply, including the construction of a water treatment plant, bulk water storage tanks and reticulation mains, and the construction of a new dam
- Electricity and telecommunication distribution cables (overhead and/or underground)
- Construction of an administration building and gatehouse
- Pedestrian pathways and bridges.

It is not proposed to construct all of the wastewater treatment system and water supply infrastructure in the initial stages – for further details and the proposed staging, refer to *'Integrated Water Cycle Assessment and Management, North Byron Parklands, Tweed Valley Way and Jones Road, Yelgun, NSW'*, Gilbert & Sutherland, May 2010.

An event area and land use structure plan is included in **Attachment 2**.

6 Proposed Stormwater Management

APP has undertaken a detailed review of the WSUD options available at the subject site. The selection criteria utilised in the decision making process included:

- Site constraints – including landform, existing flow paths, soil landscape and groundwater depth.
- Proposed design layout – aesthetics, new road and structure layouts and landscaping
- Construction / implementation costs
- Maintenance requirements – long term sustainability and costs
- Engineering– hydraulic / civil design requirements

Stormwater management concepts and management strategies are also discussed in the *'Integrated Water Cycle Assessment and Management, North Byron Parklands, Tweed Valley Way and Jones Road, Yelgun, NSW'*, Gilbert & Sutherland, May 2010.

7 Catchment Hydraulics

The 5, 10, 20, 50 and 100 year ARI flow for the subject site was calculated using the Probabilistic Rational Method (refer to **Attachment 3** for calculations). Australian Rainfall and Runoff 1987 recommends the use of the Probabilistic Rational Method for small catchments up to 250 km² in eastern NSW. **Table 1** details the Q100 parameters determined using this method.

Table 1: Summary of Q100 results from the Probabilistic Rational Method analysis for the subject site.

Time of Concentration	54 minutes
Rainfall Intensity	106 mm/hour
C₁₀	0.69
C₁₀₀	0.828
Catchment Area	155.9 Ha
Q₁₀₀ Flow	38 m³/s

Table 2: Results from the Probabilistic Rational Method analysis for pre and post-development conditions.

ARI Event	Pre-development (m ³ /s)	Post-development (m ³ /s)
5 year	18.6	18.6
10 year	23.6	23.6
20 year	29.1	29.1
50 year	32.5	32.5
100 year	38.0	38.0

It has been assumed for the purpose of this assessment that the catchment area includes only new permanent structures and impervious surfaces such as roads. All other factors affecting stormwater on the site are to remain as per the status quo and will thus not affect peak flows.

The post-development site will contain predominantly narrow gravel roads, approximately 600m² of permanent roof area, and several grassed carparking areas. The post-development site will have an increase in impervious area of less than 0.5%. This negligible increase in impervious areas has resulted in no measurable increase in post-development runoff from the subject site.

8 Open Drain Management

The principal man-made drains existing on the site will be retained. Some minor man-made drains (depth approx 300mm) in the public areas (areas of high pedestrian activity) will present operational difficulties for the site operators and will be a public hazard during events. These minor drains will be filled to improve the function of these areas. Only the shallow drains will be filled and only for the extent of the public areas. This filling will comprise free-draining crushed rock aggregate and subsoil drain pipes, with a topsoil overlay from site-won material. Shallow diversion drains will direct unpolluted upstream surface waters away from the drains being filled.

Generally new drains, other than the drain located north of Forest Block C (see below), will be shallow diversion drains (nom. 150mm deep). These diversion drains are to divert unpolluted runoff from upstream catchments around construction areas and event areas, and will discharge into existing drains.

A new open drain will be constructed in the eastern part of the site, approx. 5m north of Forest Block C, to duplicate an existing open drain which is 'embedded' in the edge of the forest. The existing drain has ceased to operate efficiently due to the accumulation of sediment, vegetation and detritus, and growth of trees in the drain. The existing drain is unable to be maintained as it supports endangered native vegetation. Construction of the new open drain will reduce the likelihood of any adverse environmental outcomes associated with the maintenance of the existing drain.

The dimensions of the proposed new open drain are of similar dimensions to the existing drain (approx 2m wide and from 0.6-0.8m deep, and approx 210m in length). It is possible that PASS will be encountered in the construction of the drain, however flora and fauna present in nearby drains of similar dimensions indicates that they are not subject to severe acid sulfate influences. It is recommended that the proposed drain be as shallow as practical to achieve the drainage effect required, and that drain maintenance avoids any deepening of the drain.

9 On-Site Detention

Byron Shire Council's Development Control Plan 2002 – Part N5 – Stormwater Management – Onsite Stormwater Detention provides guidelines to engineers and consultants when calculating on site detention requirements for new developments within the Byron Shire region. The guidelines stipulate on Page N12 of the document that an on-site detention system is not required in the following circumstances:

'Where a consulting engineer undertakes a detailed analysis of the entire catchment by a time-area model and demonstrates that the provision of detention on the subject property, including the consideration of the cumulative affect of detention provision across the catchment, will provide no benefit to any downstream drainage system for all storm frequencies up to the 100 year ARI event.'

The post-development site will have an increase in impervious area of less than 0.5% of the total site area. This minor increase in impervious areas results in the post-development runoff peak remaining virtually unchanged from that of the pre-development peak for all storm events up to the Q100 ARI event.

Rainwater tanks are proposed to attenuate stormwater flows from all permanent structures, with reuse proposed in buildings and landscaping. Tank water shall be utilised as potable supply for the building and for other uses such as toilet flushing. Overflow from rainwater tanks shall be directed to other on-site storage facilities. Final sizing of rainwater tanks shall consider

proposed reuse requirements and shall be determined at Construction Certificate stage.

As mentioned in Section 4, there is an existing dam on the property with an estimated storage volume of 15.9ML. To enable the collection of the required volume of water demand for the site, and to ensure adequate performance of the supply network, Gilbert & Sutherland have proposed that a second dam be constructed with a minimum capacity of 6ML to capture additional surface water runoff. It is not proposed that this dam will be constructed in the initial stages of the project – staging of infrastructure is discussed in the Gilbert & Sutherland report. The dams will provide some OSD of stormwater runoff volumes, due to drawdown as water is reused around the site.

10 Water Sensitive Urban Design

In recent years there have been an increasing number of initiatives to manage the urban water cycle in a more sustainable way. The integration of the urban water cycle within the concept of Ecologically Sustainable Design is termed Water Sensitive Urban Design.

10.1 Grassed or Vegetated Swales

Grassed swales are a shallow, low gradient, grass lined drainage channel used to convey and treat concentrated stormwater runoff. The swale may be landscaped and vegetated (vegetated swale), or include subsoil filtration media and an underdrain (bio-retention swale).

Bio-retention swales provide both stormwater treatment and conveyance functions. The swale component provides pre-treatment of stormwater to remove coarse to medium sediments while the bio-retention system removes finer particulates and associated contaminants. **Figure 1** is a typical section for a bio-retention swale.

Grassed and vegetated swales treat stormwater by settling, filtration and infiltration. They remove pollutants such as coarse and medium sediment, nutrients and hydrocarbons. The interaction between flow and the vegetation along swales facilitates pollutant settlement and retention. **Figure 2** is a typical section for a vegetated swale.

Figure 1– Typical Bio-retention Swale Section

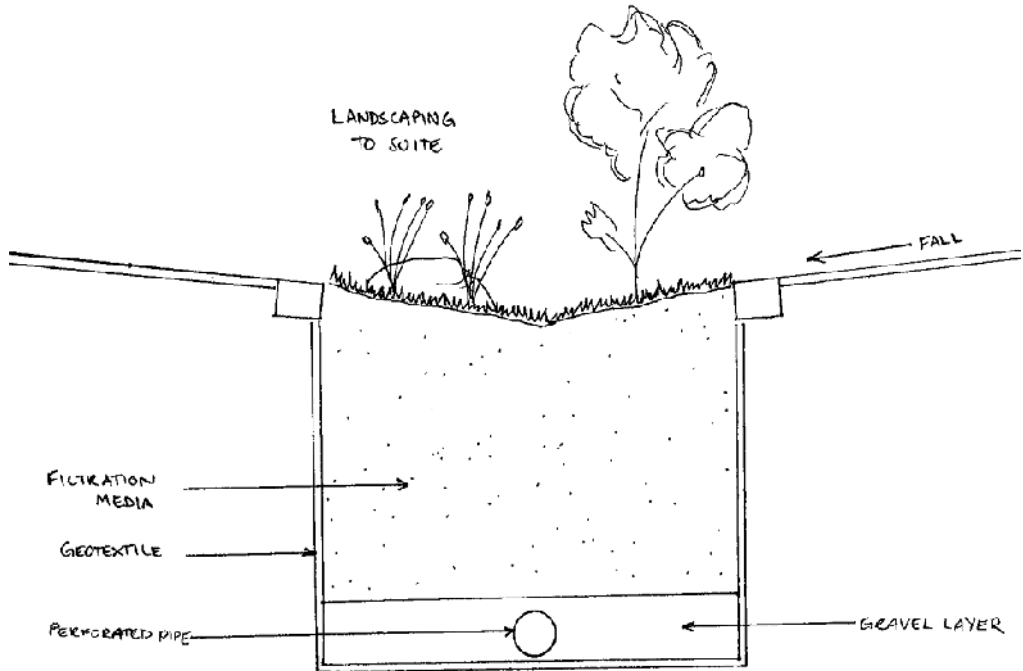
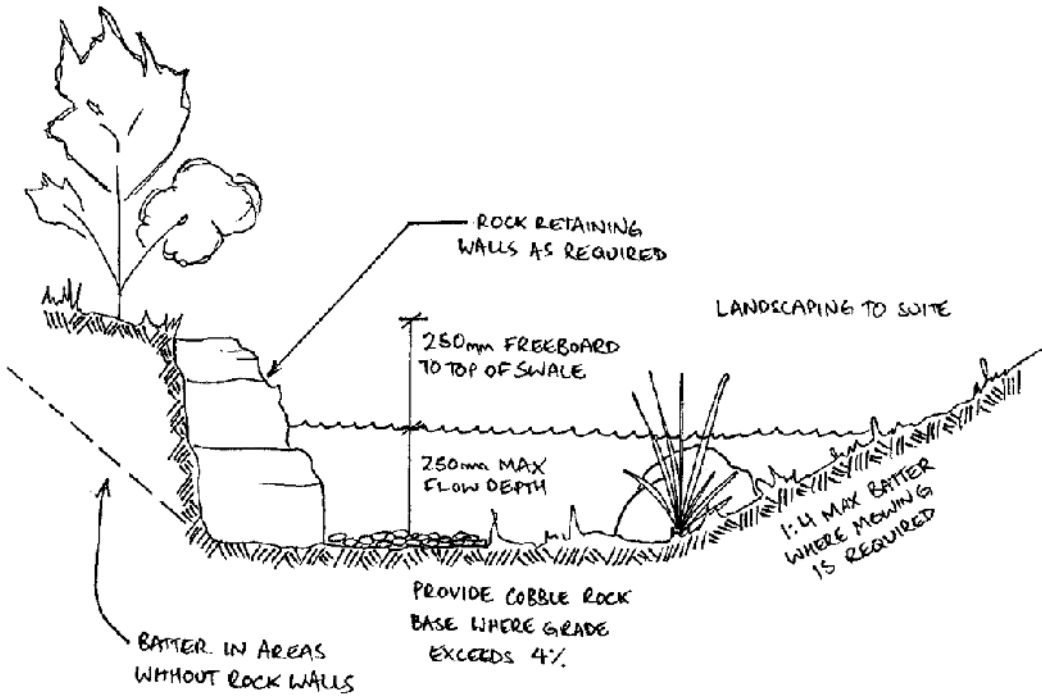


Figure 2– Typical Vegetated Swale Section



10.2 Rainwater Tanks

Rainwater tanks are proposed to attenuate and treat stormwater from all permanent structures. Rainwater tanks provide excellent attenuation of flows and reduction in nutrients (through gaseous exchange and settlement of suspended solids) when water is reused in buildings and landscaping. The provision of a rainwater tank with a permanent storage volume will also reduce the water demand of the building. Tank water shall be utilised as potable supply for the building and for other uses such as toilet flushing.

Where possible, overflow from rainwater tanks shall be directed to other on-site storage facilities. Final sizing of the rainwater tanks shall be determined at Construction Certificate stage.

Rainwater tanks are low maintenance systems. Maintenance consists of the following:

- Routine inspection (half yearly) of roof areas to ensure that they are kept relatively free of debris and leaves.
- Cleaning out first flush devices once every three to six months.
- Regular inspection of all screen inlet and overflow points every six months.
- Removal of sediments and sludge accumulated at base of tank every two to three years.

10.3 Gross Pollutant Traps

Gross pollutant traps (GPTs) are effective primary treatment measures and will be provided upstream of the main stormwater drains to collect larger items from the water, such as food containers, plastic bottles and plastic bags. Smaller pollutants, such as dirt, chemicals, heavy metals and bacteria are not collected directly by the GPTs; however, some small particles are caught up in the larger items in the trap and thus prevented from leaving the site.

Collection and disposal is via an environmentally controlled waste management plan. There is also the risk of further pollution occurring if the trap is cleaned infrequently; biochemical reactions take place between pollutants in the store area and the by-products can be washed into the waterway, especially in overflow conditions. Gross pollutants shall be removed every three to six months and daily during events.

GPT's will generally be in the form of a litter screen in the drains, however the following factors shall be considered in GPT design:

- Size of pollutants to be caught in that location
- Physical space available for the trap
- Maintenance access
- Estimated loading in the area

Final locations and product selection shall be determined at Construction Certificate stage.

11 Stormwater Quality

Gilbert & Sutherland undertook an assessment of potential Integrated Water Cycle Management options for the North Byron Parklands site. Their report concluded that *“MUSIC modeling has been used to demonstrate the proposed development will have no adverse impacts on the quality of waters discharging from the site.”*

It is impractical to establish a detailed model of the post development site using MUSIC to determine changes in the post development water quality for the following reasons;

1. The site is 155.9 Ha with an expected increase in impervious area of less than 0.5%
2. Any decrease in post development water quality as a result of the increase in impervious areas would be negligible
3. A treatment train comprising of rainwater tanks, GPT's and vegetated swales will provide more than sufficient treatment of event areas and roads and any pollutants generated as a result of the development.

Table 3 provides typical removal efficiencies of the proposed stormwater treatment devices.

**Table 3: Typical removal efficiency of stormwater treatment devices
(Managing Urban Stormwater: Treatment Techniques, NSW EPA 1997)**

Treatment Device	Litter (%)	Nutrients (%)	Oil and Grease (%)	Sediments (%)
Rainwater Tanks	80 – 90	10 – 20	Nil	80 - 90
Vegetated Swales	50 - 60	40 - 50	70 - 80	75 - 85
GPT's	85 - 95	10 - 20	Nil	70 - 80

Table 3 highlights the effectiveness of each treatment device under normal urban conditions (i.e large sediment, nutrient, grease and oil loads). The expected pollutant loads from road and roof areas within the development will be similar to a rural environment. With scheduled maintenance and proper care of all treatment devices it is expected that pollutant removal rates will comply with those established in Table 3.

12 Conclusion

The SWMP developed by Ardill Payne and Partners has determined that there will be no measurable increase in runoff volumes and pollutant concentrations discharging to the existing drainage network.

To achieve these improvements, stormwater flows have been directed to grassed or vegetated swales rather than standard pits and pipes. Litter screens provided in open drains will capture gross pollutants before they leave the site. Rainwater tanks will be provided on all permanent buildings, with reuse proposed throughout the building. New and existing dams will reduce the volume of stormwater runoff leaving the site.

A comprehensive water cycle management strategy for the site has been proposed in the *'Integrated Water Cycle Assessment and Management, North Byron Parklands, Tweed Valley Way and Jones Road, Yelgun, NSW'*, prepared by Gilbert & Sutherland.

The approaches adopted provide attenuation of flows and are aesthetically congruent within the rural setting.

13 Scope of Engagement

This report has been prepared by Ardill Payne & Partners (APP) at the request of Billinudgel Property Trust for the purpose of preparing a Stormwater Management Plan for the proposed cultural events site at North Byron Parklands, and is not to be used for any other purpose or by any other person or corporation.

This report has been prepared from the information provided to us and from other information obtained as a result of enquiries made by us. APP accepts no responsibility for any loss or damage suffered howsoever arising to any person or corporation who may use or rely on this document for a purpose other than that described above.

No part of this report may be reproduced, stored or transmitted in any form without the prior consent of APP.

APP declares that it does not have, nor expects to have, a beneficial interest in the subject project.

To avoid this advice being used inappropriately it is recommended that you consult with APP before conveying the information to another who may not fully understand the objectives of the report. This report is meant only for the subject site/project and should not be applied to any other.

14 Attachments

Attachment 1	Topographic Map
Attachment 2	Event Layout and Land Use Structure Plan
Attachment 3	Rational Method Calculations
Attachment 4	Site Drainage Plans

ATTACHMENT 1

Attachment 1
Topographic Map



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Client: **Billinudgel Property Trust**

Title: **North Byron Parklands
 - Regional Location**

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 Project Managers Town Planners & Surveyors

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Scale at A4	NTS	Datum	-
Design	TC	Date	June 2010
Drawn	NB	File	6883 LocPlan.dwg
Dwg No.	LP.01	Job No.	6883

ATTACHMENT 2

Attachment 2
Event Layout and Land Use
Structure Plan



Legend:

- The Site
- Event Area
- Conference Centre Uses
- Cultural Centre/Administration Uses
- Gatehouse
- Extents of Application Area (Dashed)
- Car Parking
- Spine Road (7m wide)
- Event access lane (6m wide)
- Main pedestrian route



0 160m

1:8000 (@ A3)

Prepared by

design team ink

IMPORTANT NOTE |
Cadastral information is subject to survey. The alignment of the aerial photograph and vectorial overlays is approximate only. This plan is conceptual only, and subject to detailed survey and design.

Sources | Aerial Photography: Bill Mills (2009) | Cadastral: Ansell Payne (2009) | Major contour = 5m | Minor contour = 1m

Plan | **1.2**
Event Area and
Land Use Structure
14

North Byron Parklands | Tweed Valley Way & Jones Road

Date 21.07.10
Author SDR
Reference 09_120

ATTACHMENT 3

Attachment 3
Rational Method Calculations

JOB NAME: PARKLANDS BYRON BAYDATE: 15/6/2010

SUBJECT: _____

ENGR: A.F

$$\text{AREA} = 155.9 \text{ Ha}$$

$$\begin{aligned} t_c &= 0.76A^{0.78} \\ &= 0.76(1.559 \text{ km}^2)^{0.78} \\ &= 0.899 \text{ hours} \\ &= 54 \text{ minutes} \end{aligned}$$

$$\begin{aligned} C'_{10} &= 0.1 + 0.0133(I_1 - 25) \\ &= 0.1 + 0.0133(70 - 25) \\ &= 0.69 \end{aligned}$$

$$\therefore C_{10} = 0.69$$

$$\begin{aligned} C_5 &= FF_y C_{10} \\ &= 0.92 \times 0.69 \\ &= 0.64 \end{aligned}$$

$$\begin{aligned} Q_5 &= 1/360 CIA \\ &= 0.00278 \times 0.64 \times 67 \times 155.9 \\ &= 18.6 \text{ m}^3/\text{sec PEAK} \end{aligned}$$

$$C_{10} = 0.69$$

$$Q_{10} = 23.6 \text{ m}^3/\text{sec PEAK}$$

$$\begin{aligned} C_{20} &= 1.07 \times 0.69 \\ &= 0.738 \end{aligned}$$

$$Q_{20} = 29.1 \text{ m}^3/\text{sec PEAK}$$

$$\begin{aligned} C_{50} &= 1.15 \times 0.69 \\ &= 0.79 \end{aligned}$$

$$Q_{50} = 32.5 \text{ m}^3/\text{sec PEAK}$$

$$\begin{aligned} C_{100} &= 1.2 \times 0.69 \\ &= 0.828 \end{aligned}$$

$$Q_{100} = 38.0 \text{ m}^3/\text{sec PEAK}$$

$$I_5 = 67 \text{ mm/hr}$$

$$I_{10} = 74 \text{ mm/hr}$$

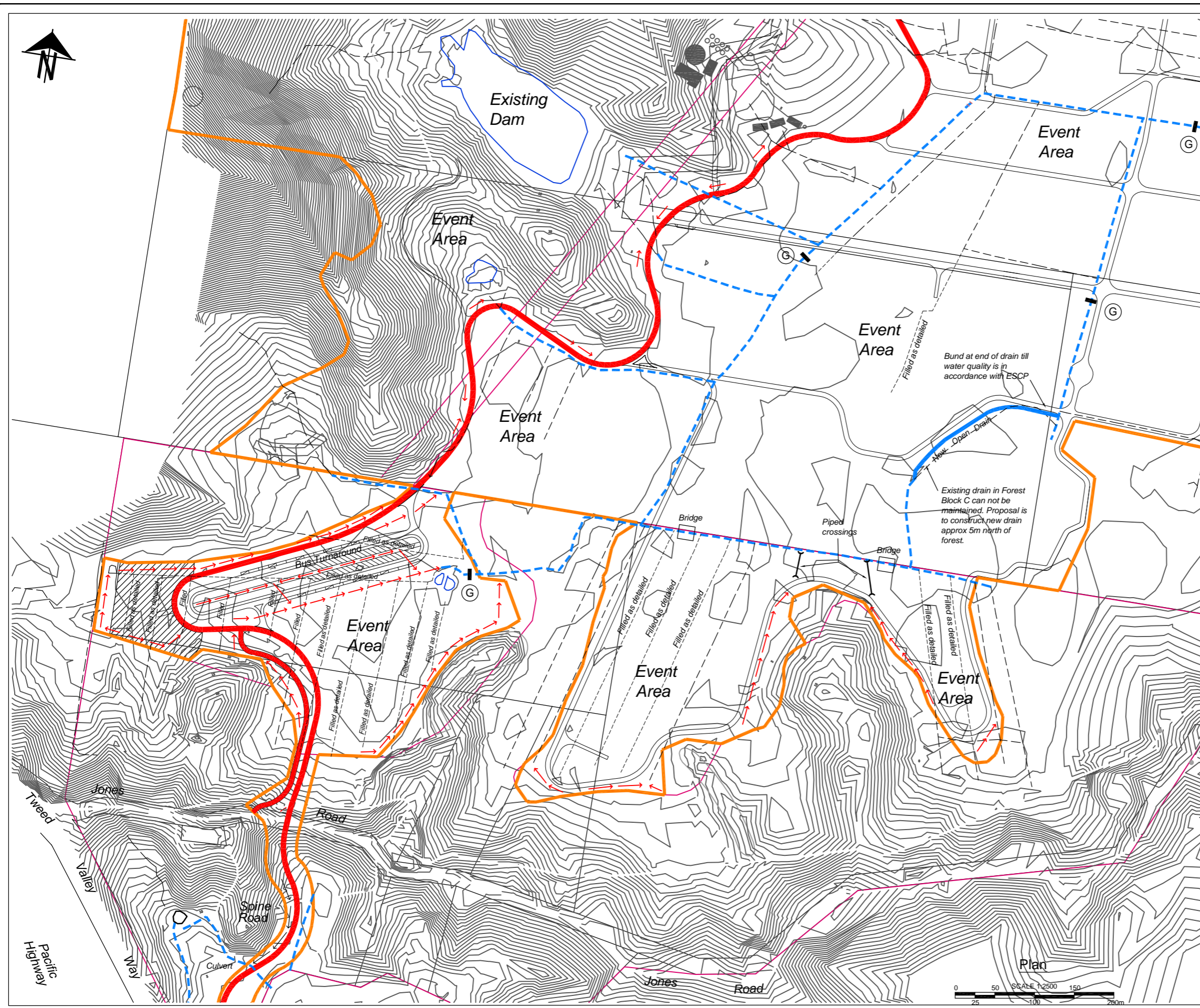
$$I_{20} = 85 \text{ mm/hr}$$

$$I_{50} = 95 \text{ mm/hr}$$


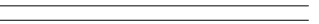




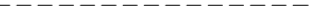

$$I_{100} = 106 \text{ mm/hr}$$

ATTACHMENT 4

Attachment 4
Site Drainage Plans



Legend

-  Spine Road
-  Event Laneways
-  Diversion drains & vegetated swales
-  New open drains
-  Existing main drains
-  Existing minor drains
-  Existing drains to be filled
-  Gross pollutant traps (coarse mesh screen in drain, or similar)

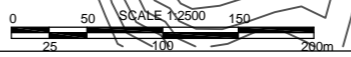
Shallow Diversion Drains:
to divert unpolluted surface runoff from upstream catchments around event areas and into existing drains.

New Open Drain:
to duplicate an existing open drain in Forest Block 'C' that cannot be maintained. The new drain is necessary for the efficient operation of the site drainage network.

Existing Main Drains:
to be retained. Convey main stormwater flows through and off the site.

Existing Minor Drains:
to be retained where noted on plan. Convey surface flows from small site catchments to the main drains.

Filled Drains:
some minor drains in public areas (high pedestrian activity) will be filled to improve the function of these areas. Subsoil drains will convey runoff to the main drains



Issue	Date	Amendment	App'd

Client:
Billinudgel Property Trust

Project:
North Byron Parklands
Tweed Valley Way & Jones Road
Wooyung

Title:
Site Drainage Plan

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Design	TC	Scale at A1	as shown
Drawn	TC	Datum	-
Date	June 10	Filename	6883-SWMP
Checked	Approved	Approved	
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Issue			1880