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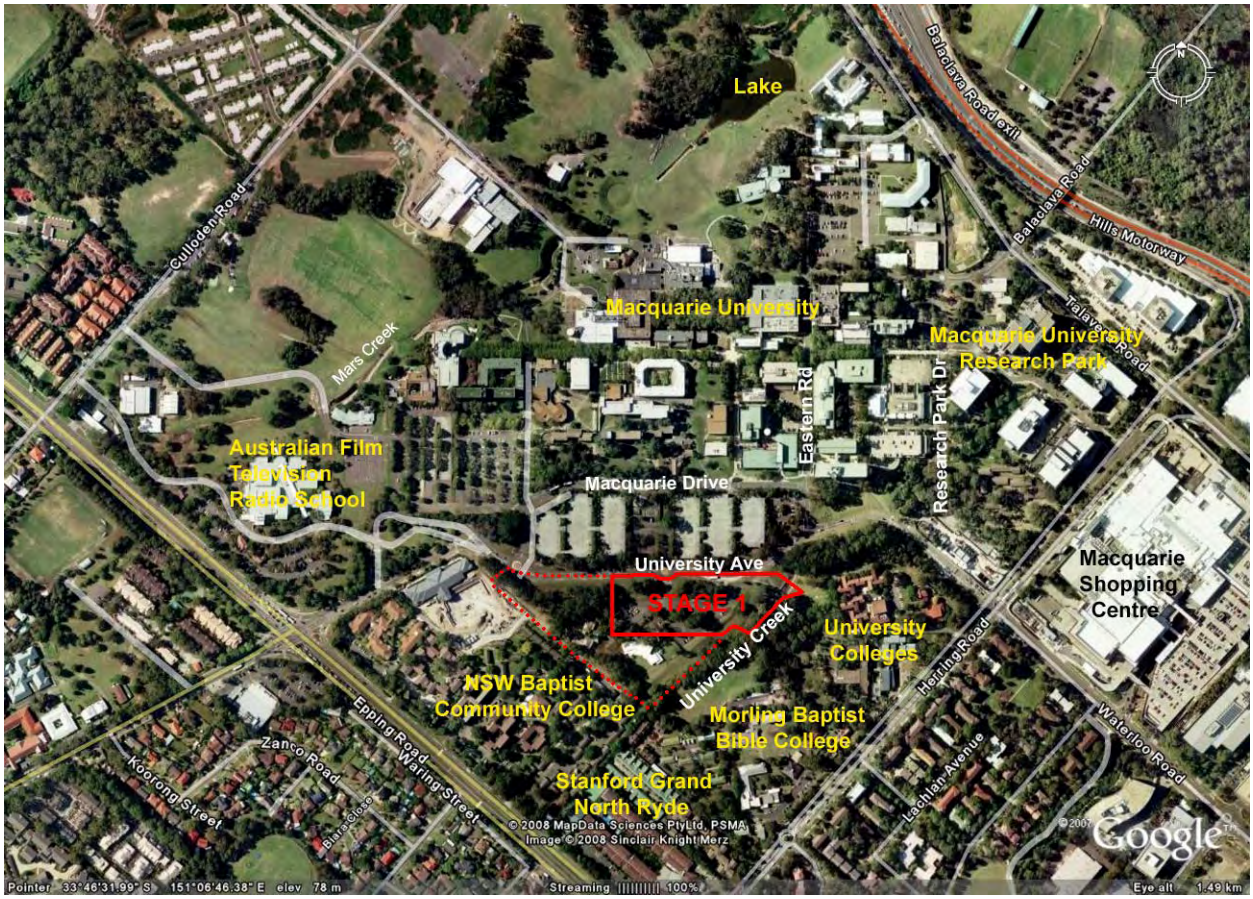
Cochlear Global Headquarters – Stage 1
Vegetation Management Plan Report

for

Cochlear Pty Ltd
Department of Water & Energy Submission



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issue register

Date of Issue	Reason for Issue	Prepared by	Checked by	Signed
31/03/08	Draft for coordination & client input	C M^{c}Lay		
16/06/08	Project Application Issue	C M^{c}Lay	A Beeston	

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1 Introduction

Cochlear Global Headquarters is relocating to the Macquarie University South Campus Precinct adjacent University Creek. This VMP deals with a section of University Creek, as defined in the then DNR correspondence, (now Department of Water & Energy {DWE}), dated 18 December 2007,.

"**Designation of Riparian Zones**

The Department acknowledges that there are existing pinch points along the southern most watercourse on the site (University Creek) so depending on the location of the major Project there may be some flexibility with the riparian corridor width . From aerial photography there appears to be some good remnant vegetation along this creek. Generally, the Department would be seeking a Category 2 outcome which is a 20 metre wide core riparian zone (measured from top of bank) plus a 10 m wide vegetated buffer."

1.1 The Site

The identification of the section of University Creek, that is included within this VMP, is shown on the attached extract plan from the Masterplan. Stage 1 of the Masterplan for the Site

MASTERPLAN

1.2 Objectives of the VMP

The objective of the VMP are as defined by the Department of Water and Energy. This is:

***"Objective:** is to provide for a stable watercourse and riparian corridor which emulates the native vegetation communities in the area*

DNR Guidelines for Controlled Activities Vegetation Management Plans: March 2007

1.3 Associated Reports

A number of related reports have been prepared for the Cochlear Global Headquarters Stage 1 area. Some of these are included in the Appendices. Others have been prepared as part of the Project Application for the project. Some of the related reports include:

- Review of Site Flooding for Cochlear Global Headquarters, by Costin Roe Engineers February 2008.
- Flora and Fauna Assessment Report, Total Earth Care, March 2008.

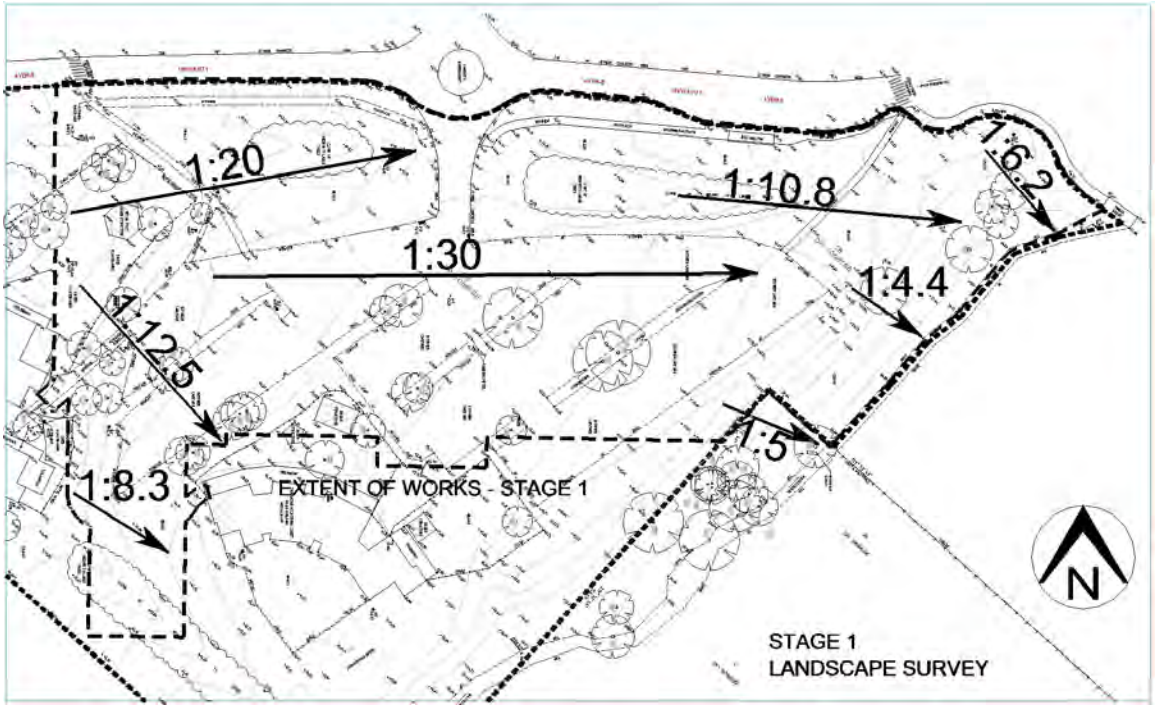
1.4 Contents of the VMP

This VMP addresses the specific requirements of DNR, as outlined in "DNR Guidelines for Controlled Activities Vegetation Management Plans: March 2007. It firstly identifies the extent of the riparian zone and the DWE requirements. This is followed by existing site constraints, and potential Key Threatening Processes. It then defines the tasks to be undertaken, illustrates these and identifies costing of the required tasks. Specification requirements associated with the installation of the works are also included, along with management and maintenance issues.

2 Existing Site Characteristics

2.1 Site Topography and General Drainage

The existing site has been subjected to agricultural and campus/carpark uses for many years. The existing watercourse of University Creek is present on the southeastern boundary of the site. University Avenue is located on the northern side of the site and forms the upstream boundary to the new Cochlear Global Headquarters. On the western side of Cochlear Global Headquarters site the existing Baptist Community Services Aged Care Facility is present. The existing University Creek that adjoins the site is an 'open and eroded drainage line' that continues to the Lane Cove River.

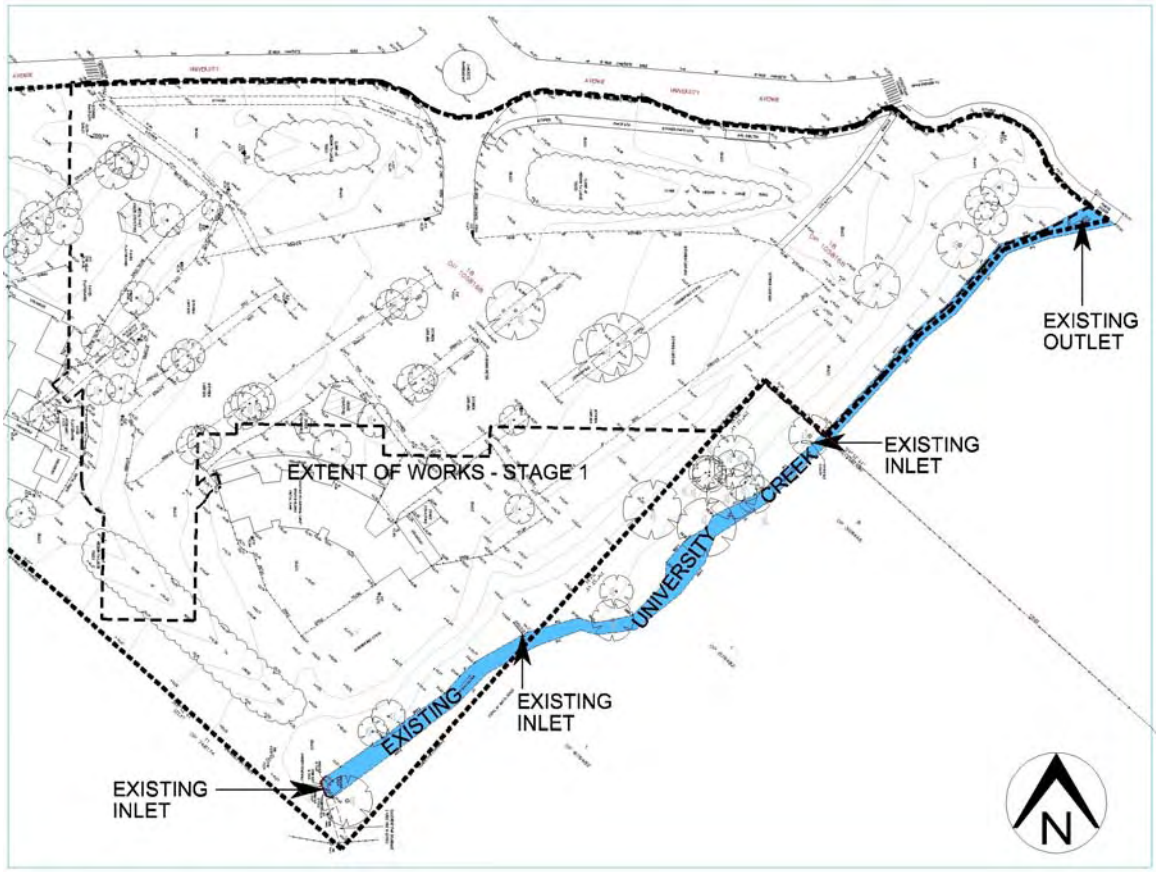


VIEW FROM PROPOSED PEDESTRIAN ENTRY TOWARDS EAST OF SITE

VIEW LOOKING NORTH FROM WITHIN SITE TOWARDS FUTURE RIPARIAN AREA AND CAR PARK

VIEW LOOKING FROM WITHIN SITE TOWARDS FUTURE DEVELOPMENT AREA

2.2 Site Hydrology



The existing site hydrology is identified on the above Figure. The relationship of the existing University Creek is shown, along with the inlet and outlet structures.

Costin Roe Engineers have prepared a Review of Site Flooding, identifying the extent of 1:100 flood levels and probable maximum flood levels for the site.

2.3 Site Flora and Fauna

A flora and fauna assessment was prepared for the site by Total Earth Care in March 2008. This report was prepared for the Stage 1. Ryde Local Government Area identified six indigenous plant communities, with three identified as having National and State Conservation significance. The six indigenous plant communities identified are as follows:

- Sydney Turpentine-Ironbark Forest,
- Blue Gum High Forest,
- Shale/Sandstone Transition Forest,
- Sydney Sandstone Gully Forest,
- Sydney Sandstone Ridge top Woodland, and the
- Estuarine Complex.

Of the Endangered Ecological Communities within the LGA, Blue Gum High Forest, Shale Sandstone Transition Forest and Sydney Turpentine Ironbark Forest are not present on the site. One highly disturbed remnant of an endangered ecological communities, Sydney Turpentine – Ironbark Forest, were observed adjacent the Stage 1 site, but not on the Cochlear Global Headquarters site. The assessment of that study were that:

i. *"No native plant communities exist on the subject site and those plant communities that occur are limited in the provision of flora and fauna habitat in the context of that locality.*

ii. *There is unlikely to be a significant impact on the general native flora and fauna of the subject site and study area as a result of the proposal.*

iii. *Planted woodland covers much of the subject site generally as linear rows or in landscape islands in the car parks.*

iv. *Exotic grassland of the subject site mainly occurs over the road verges and constructed embankment parallel to the south-eastern boundary.*

v. *No threatened plant species listed under the TSC Act and the EPBC Act were recorded in the current field surveys or fauna species were detected within the subject site during survey.*

vi. *No endangered populations were observed within the subject site.*

vii. *One endangered ecological community (Sydney Turpentine-Ironbark Forest)is recorded adjacent to the subject site in the current and previous surveys.*

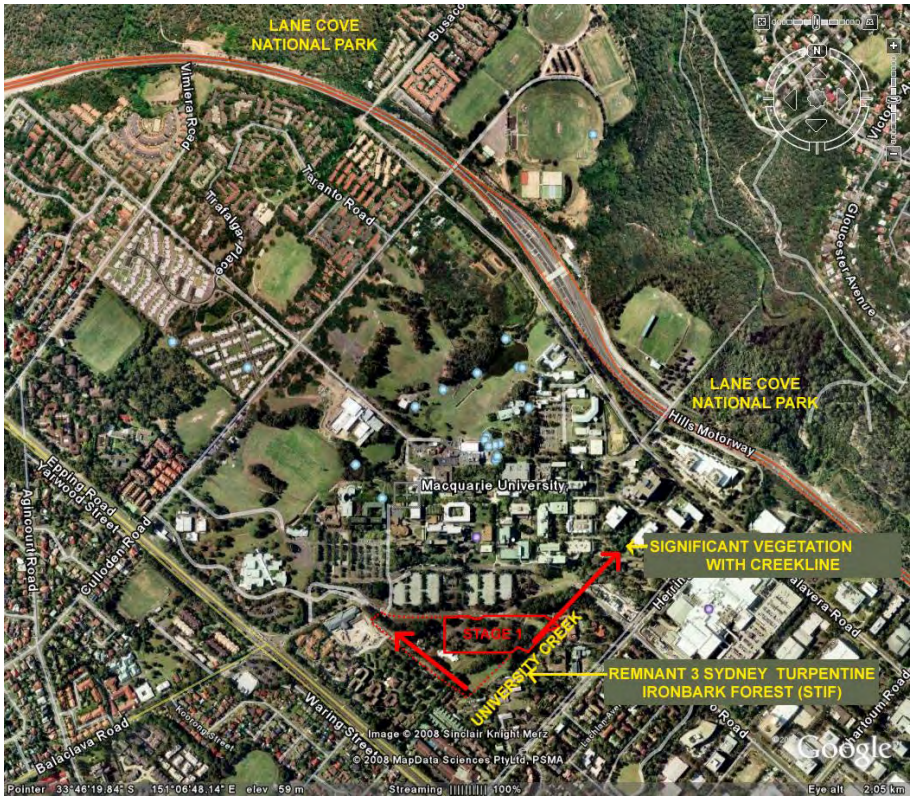
viii. *No threatened or endangered fauna species listed under the TSC Act and EPBC Act were recorded in the current field surveys.*

ix. *All fauna species recorded on the subject site are generally typical of urban areas, urban fringes and adjoining natural areas within the Sydney Basin and are widespread in distribution and common to abundant within their ranges.*

x. *Overall the subject site is a highly modified landscape that lacks many of the natural features and resources that are important in the maintenance of native fauna diversity and life cycles, including fully structured, a diverse shrub layer for food sources and protection, leaf litter and loose surface soils, sandstone outcrops and ledges, loose rocks, logs on the ground and rotting stumps.*

xi. *Removal of hollow-bearing trees requires pre-clearance fauna survey and removal/relocation of fauna by a licensed and qualified handler*

xii. *Design and construction of any drainage line restoration works must minimise the potential for direct or indirect impacts on the STIF community and attempt to enhance the condition of the stand."* (Flora & Fauna Assessment Report, Total Earth Care, 2008).



The above Figure identifies potential ecological connections between the Cochlear Global Headquarters Stage 1 and the adjacent campus and open space systems. These may provide potential habitat and movement corridors for fauna and birds within the sites, connecting to the Lane Cove National Park through the open space areas within Macquarie University.

2.4 Site Contamination, Geology and Soils

A site contamination assessment of the site was carried out by “Douglas Partners Pty Ltd” in January 2008.

The site geology is underlain by Ashfield Shale and the site is close to the boundary with Hawkesbury Sandstone to the north and east of the site. Ashfield Shale typically comprises black to dark grey shale and laminate (inter-bedded shale, siltstone and fine grained sandstone) and typically weathers to form clays of medium to high plasticity. Hawkesbury Sandstone typically comprises medium to coarse-grained quartz sandstone with some shale bands or lenses. The geological mapping was confirmed by the fieldwork, which identified residual soils then laminate overlying sandstone bedrock. The laminate may be part of the Mittagong Formation, which is a transitional rock unit between the Ashfield Shale and Hawkesbury Sandstone.

Fill material of silty clays with some ironstone and sandstone fragments were detected as well as slag and ash fragments. The fill materials are underlain by silty clays and sandstone bedrock.

3 Cochlear Global Headquarters - Stage 1 Incorporating the Riparian Zone

3.1 Riparian Zone

The extent of the required designated riparian zone for the site has been defined by DWE and illustrated below. The riparian park forms a section of the open space in the southeastern section of the site. A pedestrian path connects a seating and BBQ Area with University Avenue. The riparian park possesses a naturalistic character. Views of the park from adjacent Stage 1 building enhance the amenity for the residences and provide passive surveillance of the open space. This illustrates the full extent of the combined zones within the Stage 1 Cochlear Global Headquarters and include:

- 20 metre riparian zone.
- 10 metre buffer zone.

3.2 Cochlear Global Headquarters Stage 1 Landscape

The landscape provides for a parkland setting for the new Cochlear Global Headquarters on the southern edge of the Macquarie University Campus. The landscape design provides for a strong edge treatment along University Avenue, provision of communal open landscape space and edge treatments to the University Creek riparian zone.

Indigenous tree clusters and mass planting feature throughout the park. Accent trees, bands of colourful shrubs and distinctive grass species enhance the Stage 1 pedestrian and vehicular entries and activity areas.

Views of the riparian zone from adjacent Stage 1 building enhance the amenity for the building users and provide passive surveillance of the open space.

3.3 Riparian Zone & Buffers

Riparian zones are significant in ecology & environmental management due to their role in soil conservation, biodiversity and the influence they have on aquatic ecosystems. Some of the important functions of riparian zones are to:

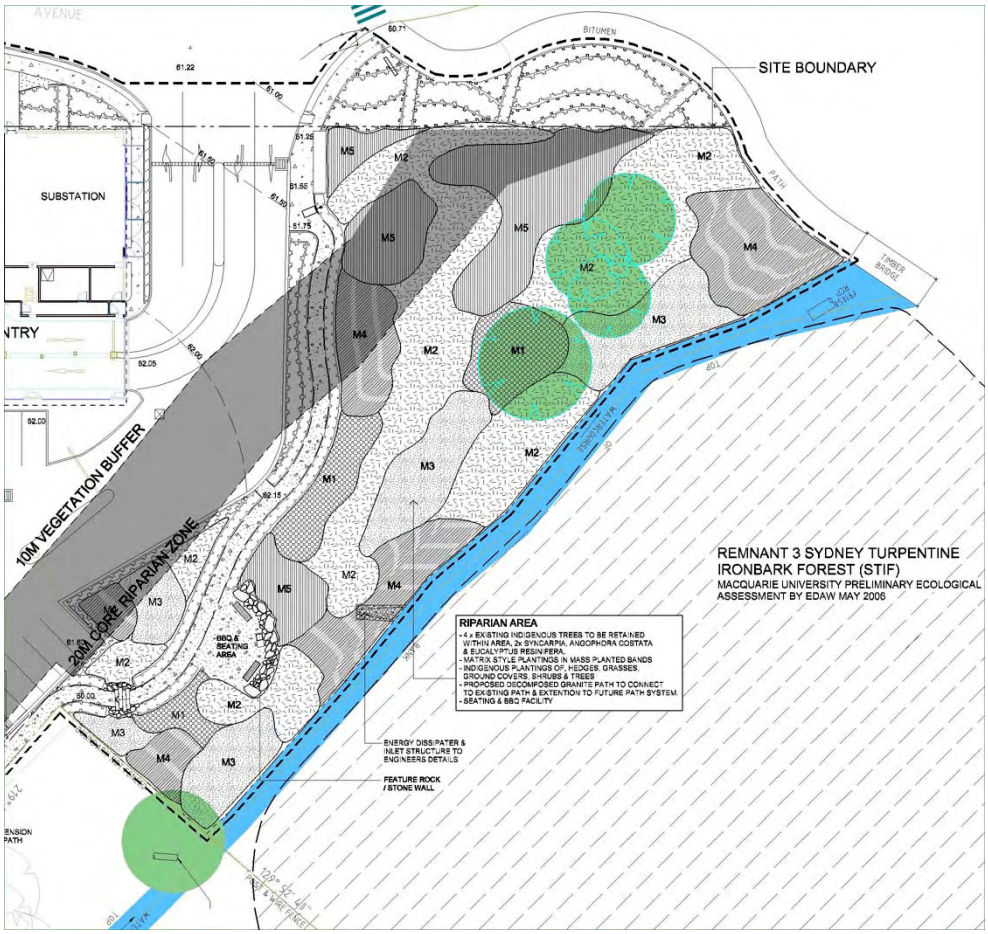
- Dissipate stream energy: Meandering curves of a riparian zone combined with vegetation dissipate stream energy, resulting in less soil erosion and a reduction in flood damage.

- Trap sediment: Reduced suspended sediments create less turbid water and replenish soils and build stream banks.
- Filter pollutants from surface runoff and enhance water quality via biofiltration.
- Provide wildlife habitat, increase biodiversity and forage for wildlife.
- Provide wildlife corridors: Enable aquatic and riparian organisms to move along river systems avoiding isolated communities.
- Provide native landscape irrigation by extending seasonal or perennial flows of water.
- Contribute nutrients from terrestrial vegetation (e.g. leaf litter and insect drop) to aquatic food webs.
- Shading water to mitigate water temperature changes.

All of the requirements of the DWE have been incorporated into the Riparian areas as follows:

- **20 metre core riparian zone (CRZ)** : This zone is the land contained within and adjacent to the channel (University Creek) and includes local indigenous plant species to University Creek. The planting will be planted at densities to ensure a fully stabilised creek edge. All outlet and inlet structures within the riparian zone are constructed using sandstone boulders and pebbles to provide a natural landscape character.
- Area of the 20 metre Riparian Zone = 1760 m^2

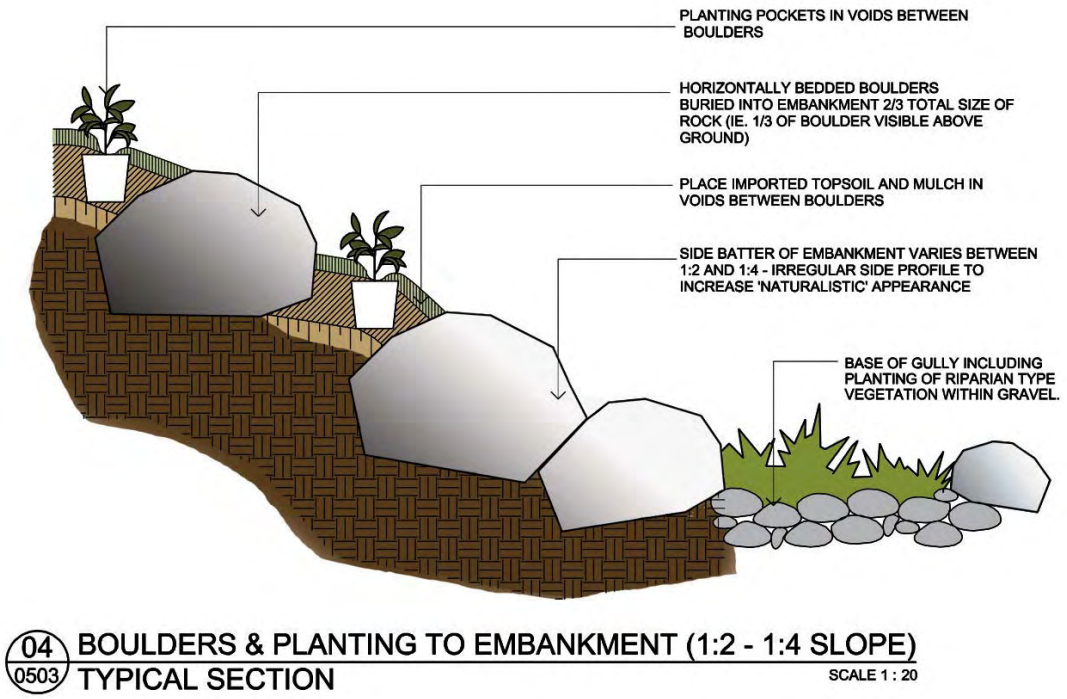
- **10 metre vegetated buffer zone** : This zone includes the same native plant species. Stabilised paths are provided on the northern side of University Creek to enable access for both maintenance and passive pedestrian use.
- Area of 10 metre buffer zone = 316 $m^{2.}$



3.4 Embankment & Creek Edges

The embankment edges include local native plant species to the edge of the creek and on all of the adjacent slopes to the creek. The planting will be planted at densities to ensure a fully stabilised creek edge.

Boulders will be placed on areas of the bank that require stabilisation. The boulders will include planting between and within the cracks to provide a natural appearance.



3.5 Inlet Structure

The existing concrete inlet structure is to be demolished and replaced with a new inlet structure including natural rock.

- Scour apron to be rip-rap and a cut-off provided; flanks to be rip-rap and keyed in.
- Scour protection of the bed near the outlet will consist of rock boulders.
- The area will be constructed to minimise any erosion or scour of riparian zones of the bed or banks.
- Disturbance to soil and vegetation in these areas will be kept to an absolute minimum.
- Rip-rap to consist of angular rock placed over a bedding layer - gaps in rip-rap to be planted with indigenous plant species as listed in the plant schedule.

PROPOSED INLET STRUCTURE

EXISTING INLET STRUCTURES

EXISTING INLET STRUCTURES

PROPOSED NATURAL ROCK RIP RAP AT INLET

EXISTING INLET STRUCTURES

EXISTING CREEK EDGE

3.6 Key Threatening Processes

The potential key threatening process for the site has been identified along with the means of minimising these threats.

Generally, the site does not possess high environmental values at present, due to the previous farming activities. No permanent or intermittent creek exists on the site. A grassed swale leads into the previous farm dam and a formed gully exists at the outlet. Beyond the site to the north, the outlet leads into a degraded, partially vegetated gully.

As such, many of the key threatening processes has already occurred on the site. The opportunity to upgrade the site and improve the riparian characteristics exists, providing opportunities as well as threats.

The key opportunities have been identified below:

- Increase ecological value.
- Habitat creation and species diversity.
- Long term sustainability.
- Educational and public awareness.
- Improved aesthetics.
- Improved recreational values.
- Better public accessibility.
- Water quality improvement through natural plant filters.
- Future seed source areas (for indigenous plants).

Table 1 : Key Threatening Processes

Threats	Management to Minimise Threats
▪ Changes in natural surface water flow and movement causing concentration of flows. ▪ Construction areas outside riparian zone causing disturbance to existing grassed surfaces	▪ Scour protection to be provided at inlets and outlets to engineer's details. ▪ Areas to be monitored and maintained to rectify any erosion. ▪ Temporary erosion and sediment control to be provided prior to and during earthworks and construction to engineer's' details - to include silt/sediment fences, straw bale check dams, gravel kerb inlet sediment traps ▪ All riparian areas to be planted with local indigenous plants at densities to stabilise ground surface, to landscape architect's details and specification. ▪ Construction fencing to be installed prior to any works to prevent unauthorised access into riparian zones.
▪ Loss of existing topsoil and suitable riparian soil	▪ All existing topsoil is to be retained within the riparian zone where existing site levels are to be retained and protected. ▪ Where ground levels are to be altered existing topsoil is to be stripped and stockpiled for reuse. ▪ Existing topsoil is to be treated for weed propagates and unwanted grasses by the provision of non-residual systemic herbicide treatment. ▪ If any imported soil is required it must comply with Australian Standards and be tested and certified by a NATA registered soils laboratory.
▪ Loss of existing vegetation.	▪ No unsecured mulch is to be used in the riparian zone below the 1 in 2 ARI level. ▪ Site rehabilitation of the riparian zones and 10 metre buffer zone will be carried out. Fully structured planting consisting of trees, shrubs and groundcovers are to be planted. ▪ Density of planting is to conform as a minimum, to the following minimum densities: - 1 tree or 1 shrub, alternately per m^2 with the addition of 4 groundcovers per m^2.

▪ Public access disturbing new planting	▪ Access is controlled by providing access paths. ▪ Other access paths are located outside the 20 metre riparian zone. ▪ Unauthorised access routes are to be monitored during the maintenance and ongoing management period to rehabilitate and access blocked where required.
▪ Weeds and propagates contaminating the University Creek and riparian zone edges. ▪ Domestic animals. ▪ Invasion of native plant communities by exotic perennial grasses	▪ Ongoing maintenance and management will be undertaken by Cochlear/Macquarie University, as specified. This will ensure all areas are inspected on a minimum monthly basis and weed management carried out. ▪ Grasses beyond the riparian zone are to be isolated from the indigenous planting by a barrier, including a hard paved access path, constructed edge to separate planting from grass.
▪ Public safety and risk	▪ All edges to the creek are to be maintained at the current maximum slopes of 1 in 5, to provide a gradual slope into the water. ▪ There is no public path to creek edge.
▪ Increased vegetation and increased risk of fire damage	▪ Areas adjacent to the buildings will include a clear buffer to the mass planted areas. ▪ Maintenance inspections are to monitor fire risk. ▪ Area of the rehabilitation and revegetation reduces the risk of uncontrolled fire. ▪ Fire hydrants and water points are provided adjacent to buildings.

4 Project Tasks

A full specification for the works is included in the Appendix, along with the set of Landscape Plans & Plant Species lists. The following table identifies the key tasks that are required to implement the VMP along with the estimated duration of each task, priorities and responsibilities for each task. A separate GANNT chart construction program is attached describing each task's duration.

Table 2 : Project Tasks

Task	Actions	Responsibility & performance Indicator	Duration	Priority High to Low (1-3)
1.0 Protection of existing site species of flora & fauna	Undertake measures required prior to any work commencing.	All site personnel.	Full duration of Construction period.	
2.0 Temporary Construction Measures	Erosion & Sediment Control Plan as detailed by others and recommendations are to be undertaken prior to any construction commencing on site.	Construction Manager / Superintendent Inspection approved by Department of Planning.	All works protected prior to construction: Installation: 2 weeks. Maintained on site duration of project to Practical Completion (approx 12 months).	1
3.0 Vegetation Protection & Construction Fence exclusion zone	Protect all existing trees to be retained on site and existing creek with protective southern boundary area containing native vegetation to prevent construction access. Early works access only will be permitted to existing dam and edges to enable construction of erosion & sediment control measures, reinstatement of rock inlet and outlet structures and planting works. Once complete these areas will be fenced. Construct fencing to ensure general construction access is restricted from the riparian zones.	Construction Manager / Superintendent is to identify extent of area to be protected. Fencing setout is to be inspected & approved by Department of Planning, prior to proceeding to next task.	Fencing construction duration: approx 2 weeks.	1
4.0 Seed Collection/ Cuttings & Brush matting	Collect seed from any areas to be disturbed on adjacent STIF site containing indigenous vegetation. Obtain all required licences from DEC prior to seed collection or cuttings.	Construction Manager, Council's Bushcare officer and Project	Seed Collection: Commence and carry out over summer 2008-2009. Nursery pre-order	1

Task	Actions	Responsibility & performance Indicator	Duration	Priority High to Low (1-3)
	Where seed of species is not available on site provide plant list to Council approved native nursery supplier for supply of local provenance plants in virotube, grotube and 2.5 Litre sizes as specified. Preference for seed source within 3 kilometres of the site. Where native vegetation is to be removed cut brush from the trees, shrubs, and groundcovers and utilise for brush matting on disturbed areas. Mulch larger logs and trunks of trees and stockpile for reuse. Retain any hollow logs or branches for use in riparian and rehabilitation areas.	Landscape Architect signed off on seed to be collected, and logs identified.	provided for propagation of plants. Preorder to be undertaken 12 months before plants are required to enable nurseries to source and propagate required plants in the quantities required.	
5.0 Stripping topsoil	Strip & stockpile topsoil for reuse. In particular where topsoil has the potential for indigenous seed bank utilise this topsoil in the riparian zone. Where topsoil has exotic grasses present, stockpile this material for use in the park outside the riparian area where turf is proposed. Review weed seed sources in topsoil and treat weeds using environmentally acceptable means. Stockpile varied topsoils and subsoil separately and identify stockpiles clearly for re-use.	Construction Manager & Superintendent inspection & approval of stockpiles.	Approximately 4 weeks for stripping, and stockpiling.	2
6.0 Weed Control & Removal	Control Noxious weeds. Control Environmental weeds. Selectively remove invasive non-indigenous/introduced planting in the riparian zone, & creek edges. Establish a works program within the riparian zone based on staging weed removal to ensure that replanting follows immediately after weed removal and no areas of banks are left exposed for longer than 38 hours. All weed removal is to be undertaken using bushland regeneration techniques. If the soil is high in weed seeds consider scarping the top few centimetres of the	Site Management to be controlled by Construction Manager.	Duration of the earthworks and Construction period.	2

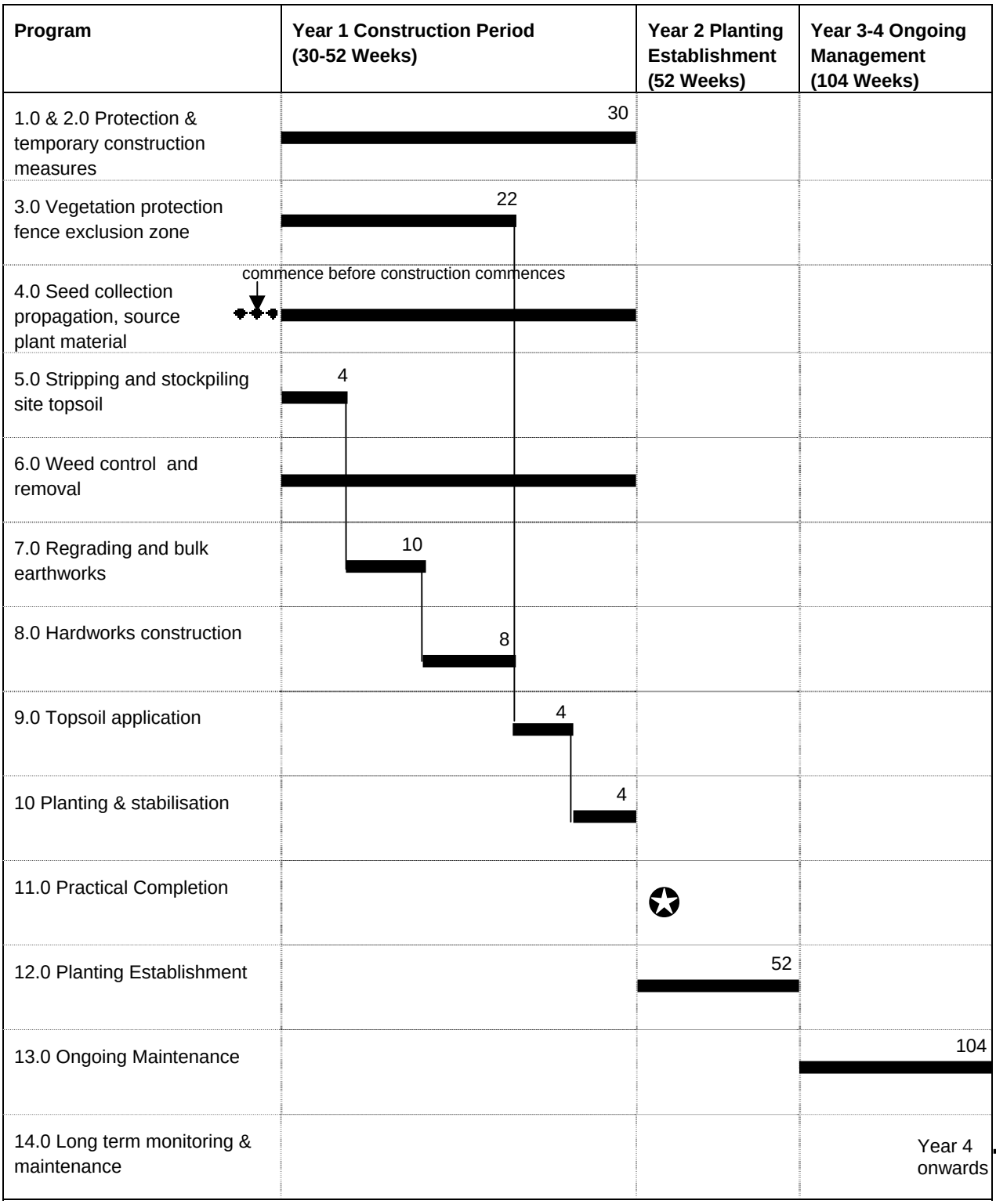
Task	Actions	Responsibility & performance Indicator	Duration	Priority High to Low (1-3)
	topsoil and removing to provide a weed free area for planting.			
7.0 Bulk Earthworks	Regrade areas required as part of the earthworks in strict accordance with engineering and landscape plans. Profile all areas to minimise sharp changes in ground levels, by rounding all edges and contours.	Construction Manager. Inspection and approval by Superintendent prior to installation of topsoil.	Bulk Earthworks operations to be carried out over the construction period. Estimated Duration: 4 weeks.	1
8.0 Hardworks Construction	Construct all required structures as part of the riparian zones. Structures include: Creek inlet and outlet structures using rock with no mortar or concrete, spillway stabilisation. Access path.	Construction Manager and approval by Superintendent.	Hardworks construction period: Estimated Duration: 8 weeks.	1
9.0 Topsoil Application	Respread topsoil over profiled ground levels to the specified depth. Respread mulch to stabilise areas. Install jute mesh to areas below 1 in 2 ARI contour.	Construction Manager and approval by Superintendent.	Estimated Duration: 4 weeks.	1
10.0 Planting & stabilisation works	Do not alter the creek banks unless required as part of the water quality control measures, such as inlet and outlet structure areas. Plant virotube and grotube plants within riparian zone at the minimum density of 5 per m2. Plant by hand and use existing soil. Undertake direct seeding where required. Provide one marker stake per tree, Lay brush matting to embankments.	Construction Manager, Superintendent sign off for planting works. Department of Planning inspection and sign off.	Estimated planting Duration: 4 weeks.	
11.0 Establishment Maintenance Monitoring and Review	Establish a program for ongoing maintenance and monitoring of the planting works. Items to be included as a minimum are: Initiate a long- term maintenance program. Identify Primary and Secondary weed clearance strategies. Prioritise works program within the riparian	Handover to MU. Maintenance of Cochlear Global Headquarters	Refer to the next item 12.0	1

Task	Actions	Responsibility & performance Indicator	Duration	Priority High to Low (1-3)
	zone. Control noxious & environmental weeds as a first priority. Selectively remove invasive non-indigenous/introduced plantings in & adjacent to the riparian zone. Encourage regrowth of native plant community, particularly in the understorey. Increase species diversity by weed clearance to allow for natural regeneration. Replant and replace failed plantings. Maintain a program of inspection of hydraulic structures, including cleaning out and inspection works. As a minimum 3 monthly inspections to be undertaken for all water quality control devices. Educate the users within Cochlear Global Headquarters on the bushland regeneration program by establishing displays and possible interpretive signage to describe the regeneration programs. Ensure garden maintenance within the adjacent childcare facilities considers impacts on the creek line vegetation and the native remnants.			
12.0 Program for Maintenance & Monitoring	An indication of the required minimum standards for the program follows: **Planting Establishment Program: Year 1** Month 1-2: Initial maintenance & planting works. Primary weed clearance Month 3-6: Establishment and replacement of failed plants (Refer to maintenance specification for the required survival rate and plant replacement). Rectification of any erosion or impacts from external influences, replacement of mulching in bare areas. Approximate time commitment: Maintenance team 1 day per fortnight. Month 6-12: Consolidate Regeneration works. Secondary weed clearance. Approximate time commitment:	Construction Manager for the installation works. At the end of the Planting establishment Period the works are to be inspected and signed off by the Superintendent. Report with photographs prepared and issued to MU at each phase of the program	12 months Establishment maintenance following Practical Completion. Inspection by Council or Dept of Water and Energy (DWE) at the end of the Period.	

Task	Actions	Responsibility & performance Indicator	Duration	Priority High to Low (1-3)
	regeneration team 1 day per month. Maintenance Report Log: A report highlighting the works completed is to be prepared as outlined in the maintenance specification.	(photos are to be taken at 3 monthly intervals)		
13.0 Ongoing maintenance	**Ongoing maintenance: Year 2-3** Follow up regeneration and maintenance works. Refer to Section 6 for the extent of works included in this phase.	Ongoing works will be subjected to a separate ongoing maintenance tender. Reporting similar to Establishment maintenance described above	Approximate time commitment: Maintenance team 1 day per 1 month.	
14.0	**Long term monitoring and maintenance: Year 4 onwards** As the maintenance of the University Creek is important for the presentation of this area within MU its maintenance is important. Ongoing monitoring and MU. This will involve less time commitment and maintenance than the previous years.	Macquarie University	Inspection will be undertaken on a 3 monthly basis, and the required works programmed and reviewed.	3

4.1 Program of works

The following Gannt chart indicates the outline program or works required within the riparian zone. This program is an estimate and will be confirmed with the tendering and construction phases of the works.


Program
Year 1 Construction Period (30-52 Weeks)
Year 2 Planting Establishment (52 Weeks)
Year 3-4 Ongoing Management (104 Weeks)
1.0 & 2.0 Protection & temporary construction measures
30
3.0 Vegetation protection fence exclusion zone
22
4.0 Seed collection propagation, source plant material
commence before construction commences
5.0 Stripping and stockpiling site topsoil
4
6.0 Weed control and removal
7.0 Regrading and bulk earthworks
10
8.0 Hardworks construction
8
9.0 Topsoil application
4
10 Planting & stabilisation
4
11.0 Practical Completion
12.0 Planting Establishment
52
13.0 Ongoing Maintenance
104
14.0 Long term monitoring & maintenance
Year 4 onwards

5 Management and Maintenance

Management of the riparian zone and ornamental pond will ultimately be the responsibility of Macquarie University. The initial construction and establishment maintenance will be tendered for the project. The maintenance will therefore be carried out in 3 phases. These have been outlined in Table 2: Project Tasks. In summary they include:

- Planting Establishment Maintenance: Year 1 after Practical Completion:
  - These works will be the responsibility of the construction contractor who installed the works. They will include general maintenance performance indicators and expected success rates for planting. These rates are outlined in the Specification included in the Appendix.
- Ongoing Maintenance: Year 2 and 3 after Practical Completion:
  - This maintenance period includes the ongoing works and is to include but not be limited to the following.
  - Works are to be undertaken by experience maintenance contractors with horticultural expertise and training and preferred bushland regeneration training.
  - Replacement planting is to be undertaken with the same species as installed within the Contract, unless these are not available or unless major failures have occurred and the plants were considered unsuccessful. Any replacement plant species are to be approved by a Landscape Architect.
  - Records of the progress of the planting works are to be in the form of photographs, taken from the same photo point at intervals of 3 months. These are to be clearly labelled and photo points mapped to provide a clear indication of the progress of the works. Any problem areas requiring remedial works are to be photographed.
  - A log of all areas worked is to be kept including a list of plant species replaced, locations and quantities. The log is also to include all activities undertaken on each inspection, including lists of materials used, activities carried out, and number of personnel present. An example of the log is included within the specification in the Appendix.
  - Records of the survival rates of plantings as a percentage of plants for each species is to be kept.
  - A record of the weed coverage is also to be kept, at each 3 monthly interval, prior to maintenance work being carried out.
  - The 20 metre riparian zone and the 10 metre buffer are to be the concentrated focus of weeding for the ongoing maintenance.
  - The edge interface between parkland and the riparian zones is to be concentrated on for escapes of exotic grasses or plants. Where required further buffers, such as edging, path maintenance or other barriers are to be provided to reduce the risk of gardens escapes.
  - Report any impacts resulting from public access, domestic pets, or other extraneous uses and advise on impacts.

- Demonstrate that all activities and requirements of the VMP are being achieved and advise on any areas that cannot be achieved for direction from Macquarie University.

- 2-year After Practical Completion: Maintenance verification for Department of Water and Energy endorsement and release of bond:
  - At the end of the 2-year period when all planting has been successfully maintained the Contractor is to advise of all works having been completed in accordance with the requirements of the VMP.
  - Independent assessment of the works at the end of the 2-year maintenance period is to be provided including Certification of Compliance. This assessment is to include all soft landscaping works.
  - Works associated with the Works Plan and any access requirements in relation to water quality control measures are to be maintained for 3 years. At the end of the 3-year period independent assessment of these works are to be carried out by a suitably qualified engineer, experienced in water quality control.

6 References

- Benson DH & Havell J : *Taken for Granted*, Royal Botanic Gardens 1990.
- Buchanan R, *Bush Regeneration*, TAFE NSW, 1994.
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