Calderwood Urban Development Project
Riparian Consistency Report

Report prepared for Delfin Lend Lease

4 March 2010

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Riparian Consistency Report

PREPARED FOR	**Delfin Lend Lease**
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Abbreviations

ABBREVIATION	DESCRIPTION
CRZ	Core Riparian Zone
CUDP	Calderwood Urban Development Project
DECCW	Department of Environment, Climate Change and Water
DIPNR	Department of Infrastructure Planning and Natural Resources (now DECCW)
DLL	Delfin Lend Lease
DoP	Department of Planning
DWE	Department of Water and Energy
RCMS	Riparian Corridor Management Strategy
VB	Vegetated Buffer
WSUD	Water Sensitive Urban Design

1 Introduction

This Riparian Consistency Report has been prepared by Eco Logical Australia for the Calderwood Urban Development Project (CUDP). The CUDP is a master planned community development by Delfin Lend Lease. This assessment will accompany a Concept Plan Application under Part 3A of the *Environmental Planning & Assessment Act 1979* (EP&A Act) and a proposal for State significant site listing under Schedule 3 of *State Environmental Planning Policy Major Development 2005* (SEPP Major Development).

During consultation with DECCW a preference was identified for the development to maintain consistency with the Riparian Corridor Management Study (RCMS) prepared by the then Department of Infrastructure, Planning and Natural Resources (DIPNR 2004). DECCW requires any deviations to the RCMS to be identified and justified.

Since publication of the RCMS in 2004 multiple changes in statutory and strategic planning have occurred that impact on approaches to riparian corridors. The key changes include:

- Gazettal of the *Water Management Act, 2000* and repeal of the *Rivers and Foreshores Improvement Act, 1948*
- Publication of Guidelines for controlled activities - Riparian corridors (DWE, 2008)
- Exclusion of riparian corridors from Section 94 contributions
- Potential re-inclusion of riparian corridors into development contributions (DoP Policy Statement December 2009)
- Gazettal of Part 3A of the *Environmental Planning and Assessment Act, 1979* which for state significant development removes the triggers for Integrated Development and provides state agencies outside of the Department of Planning with a consultation role rather than an approval role

This report considers the site in the context of the existing RCMS and the published riparian corridor guidelines under the *Water Management Act, 2000*. It also considers approaches to riparian corridors as a holistic and interrelated planning issue that links closely with environmental protection, open space and recreational uses, bushfire protection, water quality treatment and general amenity.

1.1 THE PROPOSAL

The Calderwood Urban Development Project proposes a mix of residential, employment, retail, education, conservation and open space uses. The development proposes approximately 4,800 dwellings and approximately 50 hectares of retail, education, community and mixed use / employment land. The overall development will accommodate approximately 12,400 people and will deliver an estimated $2.9 billion in development expenditure and create approximately 8,000 full time equivalent jobs by 2031.

The Calderwood Urban Development Project site is located within the Calderwood Valley in the Illawarra Region. It is approximately 706 hectares in area with approximately 600 hectares of land in the Shellharbour LGA and the balance located within the Wollongong LGA.

The Calderwood Valley is bounded to the north by Marshall Mount Creek (which forms the boundary between the Shellharbour and Wollongong LGAs), to the east by the Macquarie Rivulet, to the south by Johnstons Spur and to the west by the Illawarra Escarpment. Beyond Johnstons Spur to the south is the adjoining Macquarie Rivulet Valley within the suburb of North Macquarie. The Calderwood Urban Development Project land extends south from the Calderwood Valley to the Illawarra Highway. Refer to Location Plan at **Figure 1**.

The Calderwood Valley has long been recognised as a location for future urban development, firstly in the Illawarra Urban and Metropolitan Development Programmes and more recently in the Illawarra Regional Strategy (IRS).

The IRS nominates Calderwood as an alternate release area if demand for additional housing supply arises because of growth beyond projections of the Strategy, or if regional lot supply is lower than expected.

In 2008, the former Growth Centres Commission reviewed the proposed West Dapto Release Area (WDRA) draft planning documents . The GCC concluded that forecast housing land supply in the IRS cannot be delivered as expected due to implementation difficulties with the WDRA, and the significantly lower than anticipated supply of housing land to market in the Illawarra Region is now been recognised as a reality.

The GCC Review of the WDRA also recognised that there is merit in the early release of Calderwood in terms of creating a higher dwelling production rate and meeting State government policy to release as much land to the market as quickly as possible. Given the demonstrated shortfall in land supply in the Illawarra Region and the WDRA implementation difficulties highlighted in the GCC Report, the release of Calderwood for urban development now conforms to its strategic role under the IRS as a source of supply triggered by on-going delays in regional lot supply. The Calderwood Urban Development Project can deliver about 12% of the IRS' new dwelling target.

Changes in outlook arising from global, national and regional factors influencing investment and delivery certainty, housing supply and affordability and employment and economic development also add to the case for immediate commencement of the Calderwood Project.

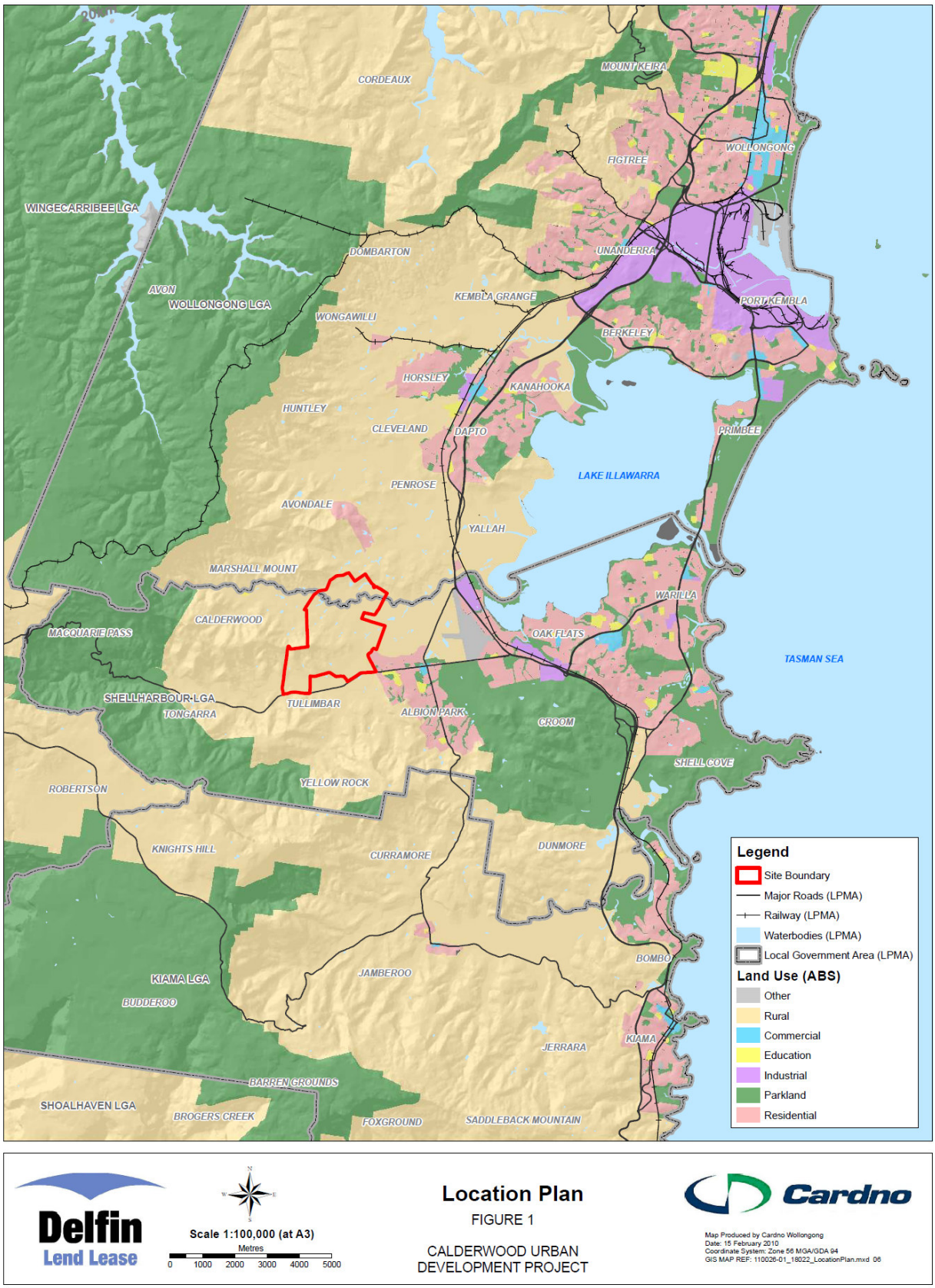


Figure 1 CUDP study area

1.2 CONCEPT PLAN

Delfin have developed a draft Concept Plan for the site, which delineates broadly the proposed land zones which will be put forward in the Part 3A application to DoP in February / March 2010 (**Figure 2**).

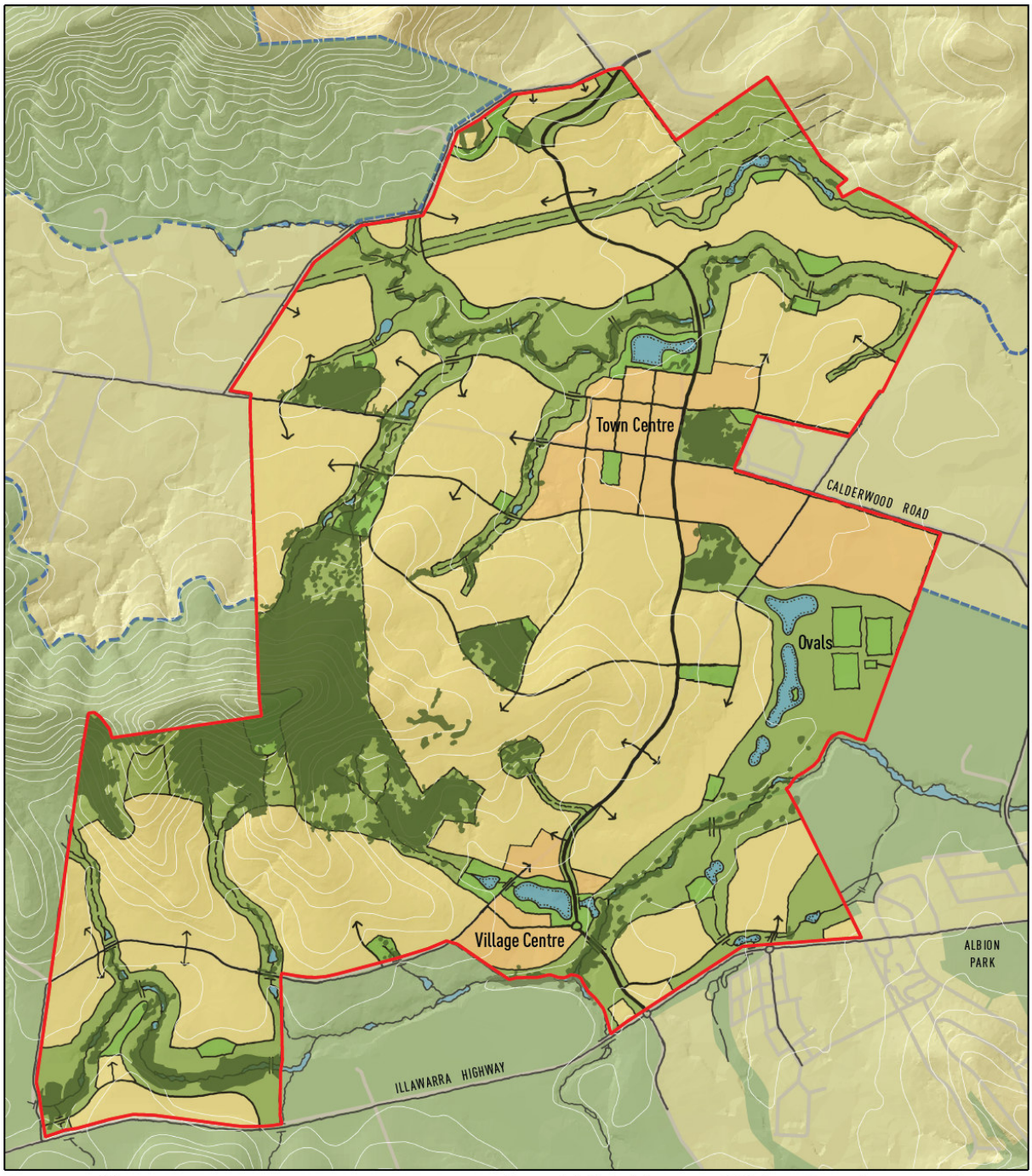
The concept plan provides a broad structure plan for the CUDP, and incorporates on site ecological values (including remnant vegetation, riparian and aquatic habitat) into a network of green corridors which will see a combination of conservation, recreation and water sensitive urban design being developed as detailed design continues over the coming decade.

The concept plan will be further supported by the SEPP rezoning plan for the site and an Environmentally Sensitive Lands Layer (ESL) which will give specific protection through additional heads of consideration for DA's within sensitive areas of Johnsons Spur and riparian corridors (refer to JBA report).

1.3 CONCURRENT STUDIES

This report should be read in conjunction with the following concurrent, related studies:

- Flood Study (Rienco)
- Floodplain Risk Management Study (Cardno)
- Water Cycle Management Study (Cardno)
- Geomorphology Assessment (Cardno)
- State Significant Site Listing and Concept Plan Application (JBA Urban Planning)
- Landscape Masterplan (Environmental Partnership (NSW))
- Flora and Fauna Assessment (Eco Logical Australia)
- Bushfire Assessment (Eco Logical Australia)



Concept Plan

Part 3A | Calderwood Urban Development Project

Town and Village Centres
Mixed Uses including Retail, Employment, Residential, Learning and Community Amenities

Residential Neighbourhoods

Parks
eg Citywide, district and local parks

Principal Open Space and Drainage
eg Environmental Conservation, Environmental Management and Drainage Corridors

Indicative Water Bodies

Delfin Lend Lease

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m 0 100 500 1,000

Subject to verification and detailed site survey 1:20,000 @ A4 10m Contours February 2010

Figure 2 Final Concept Plan

2 Legislative Context

2.1 LEGISLATIVE CONTEXT FOR RIPARIAN ASSESSMENT

As this project is being assessed via Part 3a of the *Environmental Planning and Assessment Act, 1979*, the *Water Management Act, 2000* which is the principal legislation relating to riparian corridors does not apply. However, the DECCW which administers the WM Act, has a consultation role under Part 3A of the EP&A Act. The DGRs for this project require:

Water Courses/Riparian Corridors

- Detail protection of watercourses of riparian corridors in relation to the following
    - The NSW State Rivers and Estuaries Policy;
    - The NSW Wetlands Management Policy;
    - The State Natural Resource Management Targets (particularly Targets
    - 1 & 5);
    - Stream mapping including watercourses on the site, riparian corridors, APZs and proposed revegetation of riparian corridors.
- Surface Water and Groundwater assessment including any proposed surface water and groundwater extraction volumes, function and location of proposed storage/ponds, design, layout, pumping and storage capacities, and all associated earthworks and infrastructure works.
- Details on any water management structures/dams both existing and proposed including size and storage capacity.
- Identify groundwater issues including predicted highest groundwater table at the site, works likely to affect groundwater surfaces, and proposed extraction, prevention of groundwater pollution.
- Provide a scaled plan to detail and wetlands on or adjacent to the site, buffer setbacks, any Asset Protection Zones and the footprint of the proposed development.
- Assess any potential impact on surrounding waterways and wetlands in terms of water quality, aquatic ecosystems and riparian corridors. This should include but not be limited to:
    - Onsite pollution such as accidental spills and sewer overflows;
    - Risks such as weed invasion, encroachment and litter; and
    - Vegetated buffer zones.

A number of methodologies have been used to map streams and riparian corridors on site. The most recent is based on guidelines published by DECCW under the WM Act. This was itself based on the methodology developed under the Illawarra Riparian Corridor Management Strategy (DIPNR 2004).

- The Rivers and Foreshores Improvements (RFI) Act (1948) Process: based on categorisation of watercourses into environmental objective categories which rely on a number of environmental features. This process relies heavily on DWE guidelines which were not publically available and often revised in-house for specific developments.
    - The Riparian Corridor Management Study – DIPNR (2004) – is based on this process.
    - The RFI Act is now repealed by the Water Management Act, 2000 however it has been our experience in other greenfield land release assessments (e.g. Oran Park and Turner Road, Wivenhoe and Menangle Park) that DWE are still using this process. The current Growth Centres DCP still recommends the RFI Act principles when assessing riparian corridors at the precinct planning level.

- Water Management Act (WMA) (2000) – based on the categorisation of watercourses with a defined set of guidelines to establish a Core Riparian Zone (CRZ), Vegetated Buffer (VB) and an Asset Protection Zone (APZ). (http://www.naturalresources.nsw.gov.au/water/pdf/ca_riparian_corridors_guidelines_20080124.pdf). The guidelines include a statement that the riparian corridor widths are subject to a merit assessment based on riparian functionality of the river, lake or estuary, the site and long-term land use.

3 Riparian Assessment

The riparian assessment for the CUDP has considered relevant legislation, policies and guidelines. It has involved consultation with government agencies, field assessment and ground-truthing of existing riparian corridors and detailed analysis and mapping within ArcGIS.

A series of objectives have been set for the site, that considers a broad mix of environmental, social and economic requirements;

Objectives

- To ensure that riparian corridors provide for the ongoing hydrological and drainage requirements of the site
- To ensure that future development does not result in an unwanted level of bed and bank instability, whilst recognising that natural processes are in a form of dynamic equilibrium
- To provide strategic vegetated links along Macquarie Rivulet and Marshall Mount Creek and a series of secondary links between these areas and ridgelines
- To ensure that riparian corridors become an integrated component of the urban environment and provide opportunity for open space, public access and passive recreation opportunities
- To ensure that riparian restoration, urban design and bushfire mitigation are integrated in a manner that optimises environmental outcomes without imparting an unnecessary risk to future developments or reducing development potential
- To ensure that revegetation does not impact flood levels beyond the extent of riparian corridors
- To ensure that water is treated to an acceptable level through the use of WSUD, offline and online basins
- To provide for public ownership of riparian corridors where possible, recognising the limits of Section 94 and the need for multiple uses
- To utilise a range of available planning tools to provide for the protection of terrestrial and aquatic biodiversity

Identification of Watercourses

Initial identification of watercourses was based on 1:25,000 topographic map data and review of the RCMS and mapping provided by DECCW for the Macquarie Rivulet catchment. This data was augmented through high resolution LIDAR survey to identify the current location of channels and indicative top of bank.

An extensive field survey process was undertaken, incorporating a variety of professional fields including planning, environmental engineering, geomorphology, biodiversity, bushfire and landscape architecture.

The Geomorphology Assessment (Cardno, 2010) considered the hydrological function of mapped watercourses and identified a small number of mapped watercourses that due to the small catchment size and subsequent limited hydrological function were excluded from further assessment.

Categorisation of Watercourses

For the purposes of this assessment, watercourses were classified according to the Strahler categorisation system consistent with the guidelines published under the WM Act. These provide an objective methodology for the categorisation of watercourses.

As requested by DECCW, this assessment has been compared to the output of the RCMS (DIPNR, 2004). It is worthwhile noting that the RCMS provides the following detail on how categories are assigned under this methodology;

> *Most of the streams throughout the study area were tagged and assigned a category (1, 2 0r 3 reflecting their relative importance as riparian zones within respective catchments. When assigning these values, consideration was given to existing opportunities and constraints and to establishing key environmental corridors and linkages from the ocean to the escarpment (as well as north-south linkages along the escarpment and foothills). (DIPNR 2004, Page 19)*

Whilst lacking the objective approach of the Strahler method, the RCMS methodology incorporates the strategic objectives of environmental corridors and linkages from the ocean to the escarpment and importance of categorising riparian corridors based on their relative level of importance.

As the limit of the RCMS boundary is Marshall Mount Creek, the DECCW unpublished internal mapping for Macquarie Rivulet was used as a surrogate for the RCMS within the Macquarie Rivulet Catchment. It is worthwhile noting that there is a clear divergence in approach between the published RCMS data and the unpublished internal DECCW data particularly in relation to watercourses flowing from Johnsons Spur. The unpublished data identifies all watercourses from Johnsons Spur as category 3, whereas the published data identifies a variety of categories. This highlights a main limitation of the RCMS methodology.

Conversely, the WM Act guidelines provide a more prescriptive approach to riparian categorisation with the option to include a merit based assessment.

The proposed approach for this site identifies a greater area of land for inclusion in riparian and environmental corridors than that provided by the RCMS methodology. There will be a total of 113 hectares of core riparian zone conserved within the SP2-d zoning alone, while the RCMS methodology saw only 96.45 hectares of core riparian zone as required for the site. This has been achieved through application of the following strategic goals which integrate with the strategic conservation goals for the site:

1. Retention of all riparian corridors that have a requisite hydrological function. This is largely a reflection of the size of the catchment and the associated volume of water that will move through these systems (see Geomorphology Assessment, Cardno 2010)
2. Assigning a minimum CRZ of 92 metres to Marshall Mount Creek and Macquarie Rivulet
3. Consistent with the recognition of a series of lesser habitat areas, assigning a minimum CRZ of 48 metres total width to streams extending from the main valley floor environmental corridors to Johnsons Spur
4. Assigning a minimum CRZ of 24 metres total width to first order streams
5. Providing additional terrestrial habitat and buffer values in E2, E3 and RE1 zones, often immediately adjacent to riparian corridors

The results of the RCMS, strahler and ground-truthed maps are provided on the following pages.

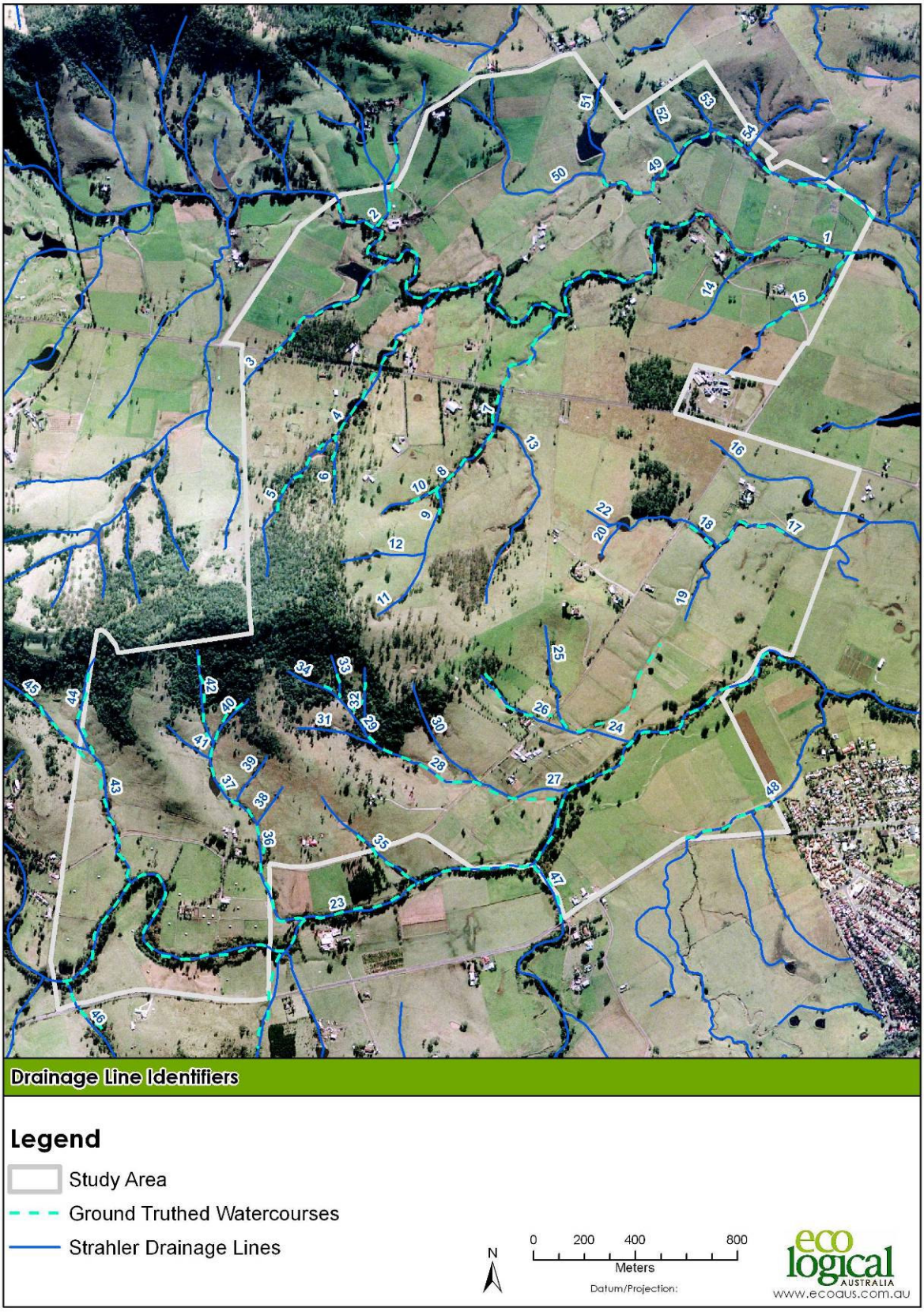

Figure 3 Study Area and Watercourse Labels

Figure 4 RCMS Categorisation

Figure 5 Strahler Categorisation

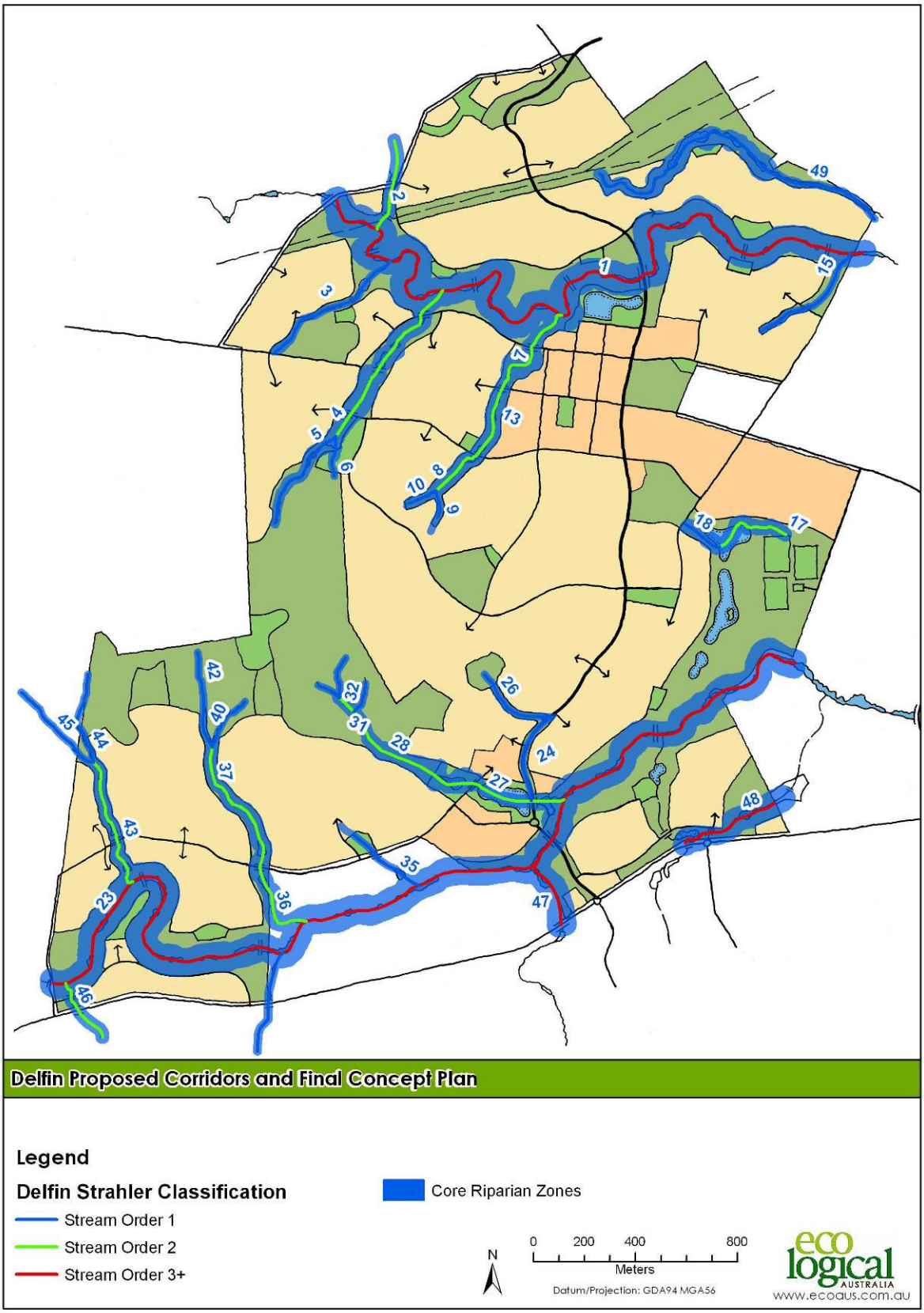

Figure 6 Proposed Riparian Corridor Network

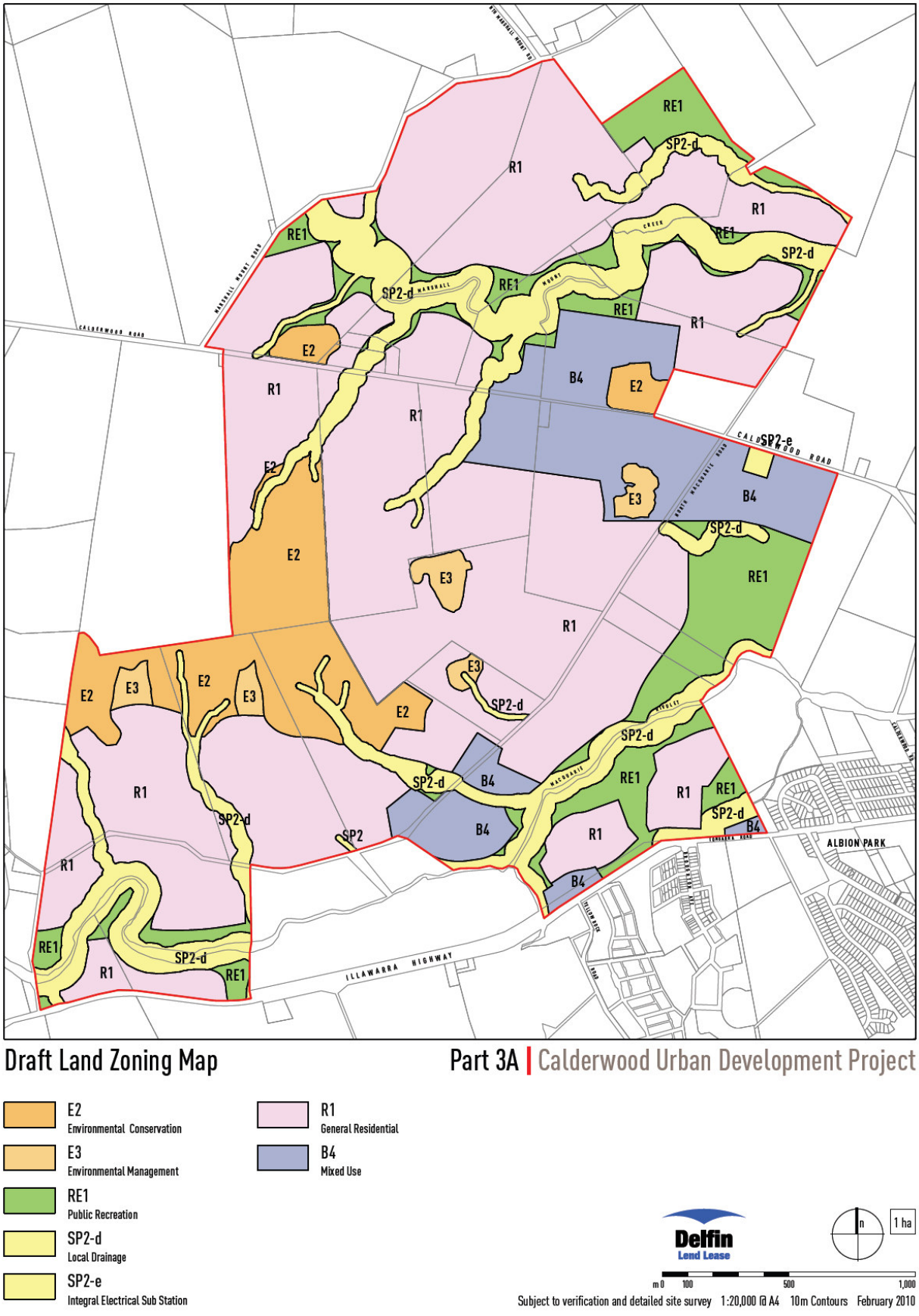

Figure 7 Draft Land Zoning Map

4 Consistency Analysis

The strategy for the site is considered to be consistent with the RCMS methodology, this entails:

- Provision of regional linkages from the Ocean to the Escarpment via Marshall Mount Creek and Macquarie Rivulet
- Identification of a series of secondary corridors from the regional linkages to Johnsons Spur reflecting their relative importance as riparian corridors
- Provision of a sufficient CRZ for remaining riparian corridors to provide for bed and bank stability

In terms of outcomes for the site, the major differences relate to the approach to Johnsons Spur. The RCMS identifies the majority of drainage lines as category 3 with a single category 1. Reflecting the Strahler approach, and the relative importance of these drainage lines across the catchment, it is proposed that the bulk of these primarily second order streams are allocated a 48 metre CRZ. In addition to the CRZ, there is an extensive area of open space proposed that substantially increases the environmental outcomes in the area beyond that afforded through the riparian strategy alone.

There are a small number of first order drainage lines (13) that due to the small size of their catchment are proposed to be removed.

In all, some 47 stream segments have been mapped and individually tagged across the site. The breakdown is as follows:

- 18 stream segments are proposed to be consistent with the RCMS
- 13 stream segments are proposed to be removed
- 6 stream segments are proposed to be a lesser category than the RCMS
- 10 stream segments are proposed to be a higher category than the RCMS

The table below identifies which reaches are to be removed or are proposed to be of a lesser category than the RCMS.

Table 1 Reaches that are proposed to be removed or to be a lower category than RCMS

Reach	RCMS CRZ (m)	Proposed CRZ (m)	Justification
3	60 + TOB	20	This is an ephemeral first order stream with significant modifications to its geomorphology through diversions and culverts under Calderwood Road and construction of farm dams. This stream will sit within a larger open space corridor that will increase the effective size of the corridor beyond that provided through riparian protection measures.
4	80+TOB	48	This is an ephemeral second order stream. It is also a secondary habitat corridor. The corridor flares out from the road along the alignment of existing tree coverage. In a practical sense the corridor is significantly larger than that provided by the riparian component of the corridor alone.
5	80+TOB	48	This is an ephemeral first order stream. It is also a secondary habitat corridor. The corridor flares out from the road along the alignment of existing tree coverage. In a practical sense the corridor is significantly larger than that provided by the riparian component of the corridor alone.
6	60 + TOB	24	This is a small ephemeral first order drainage line with a very small catchment. Whilst only 24m CRZ is proposed, this drainage line is located within a secondary habitat corridor. In a practical sense the corridor is significantly larger than that provided by the riparian

Reach	RCMS CRZ (m)	Proposed CRZ (m)	Justification
			component of the corridor alone.
9	60 + TOB	24	This is a small ephemeral first order drainage line with a very small catchment. There is little to no habitat and this area does not play a connectivity role. The objective for this drainage line is bed and bank protection.
10	60 + TOB	24	This is a small ephemeral first order drainage line with a very small catchment. There is little to no habitat and this area does not play a connectivity role. The objective for this drainage line is bed and bank protection.
11	60 + TOB	Nil	This is a small ephemeral first order drainage line with a very small catchment that fans into an overland flow area. The hydrological and geomorphic assessment (Cardno, 2010) has proposed to remove this drainage line.
12	60 + TOB	Nil	This is a small ephemeral first order drainage line with a very small catchment that fans into an overland flow area. The hydrological and geomorphic assessment (Cardno, 2010) has proposed to remove this drainage line.
13	60 + TOB	Nil	This is a small ephemeral first order drainage line with a small catchment. The hydrological and geomorphic assessment (Cardno, 2010) has proposed to remove this drainage line.
14	40 +TOB	Nil	This is a small ephemeral first order drainage line with a small catchment. The hydrological and geomorphic assessment (Cardno, 2010) has proposed to remove this drainage line.
16	20 + TOB	Nil	This is a small ephemeral first order drainage line with a small catchment. The hydrological and geomorphic assessment (Cardno, 2010) has proposed to remove this drainage line.
19	20 + TOB	Nil	This is a small ephemeral first order drainage line with a small catchment. The hydrological and geomorphic assessment (Cardno, 2010) has proposed to remove this drainage line. This area will be retained within an RE1 zone and will form part of the water cycle management strategy for the site.
20	20 + TOB	Nil	This is a small ephemeral first order drainage line with a small catchment. The hydrological and geomorphic assessment (Cardno, 2010) has proposed to remove this drainage line.
22	20 + TOB	Nil	This is a small ephemeral first order drainage line with a small catchment. The hydrological and geomorphic assessment (Cardno, 2010) has proposed to remove this drainage line.
25	20 + TOB	Nil	This is a small ephemeral first order drainage line with a small catchment. The hydrological and geomorphic assessment (Cardno, 2010) has proposed to remove this drainage line.
30	20 + TOB	Nil	This is a small ephemeral first order drainage line with a small catchment. The hydrological and geomorphic assessment (Cardno, 2010) has proposed to remove this drainage line.
31	20 + TOB	Nil	This is a small ephemeral first order drainage line with a small catchment. The hydrological and geomorphic assessment (Cardno, 2010) has proposed to remove this drainage line.
38	20 + TOB	Nil	This is a small ephemeral first order drainage line with a small catchment. The hydrological and geomorphic assessment (Cardno, 2010) has proposed to remove this drainage line.
39	20 + TOB	Nil	This is a small ephemeral first order drainage line with a small catchment. The hydrological and geomorphic assessment (Cardno, 2010) has proposed to remove this drainage line.

5 Delivery of Riparian Outcomes

Changes to planning legislation since the RCMS was published have changed the landscape in terms of how riparian objectives and outcomes can be efficiently delivered. In particular, the exclusion of riparian corridors from Section 94 contributions has made delivering riparian outcomes problematic.

The restriction of statutory tools available to protect and provide for riparian corridors in public tenure has further pushed the need to consider riparian requirements as an integrated planning measure that requires a host of factors to be considered, and delivered.

Moreover, the NSW Government appears to be moving towards a policy of greater integration of riparian corridors into the urban environment as evidenced by the following recent extract from *Policy Statement – Development Contributions (Part 5B)* December 2009:

- *A definition will be provided for Riparian Corridors that will identify that stormwater facilities and systems, cycleways and land for passive open space are considered to be key community infrastructure even if they are located within a riparian corridor*
- *The Minister will be able to approve the dedication of land for riparian corridors through a planning agreement*

Consequently a number of mechanisms are proposed to protect the riparian corridors that reflect their broader roles in an integrated urban environment. The approach taken for the CUDP has been to allocate riparian corridors to one of two zones, both of which are proposed for public ownership:

- SP2 for areas that have a critical drainage or flood mitigation function
- E2 for areas that primarily have a biodiversity function
- The use of an Environmentally Significant Lands (ESL) overlay for all areas of intact native vegetation within the above 2 zones

Adjacent to many of the riparian corridors are significant areas of E2, E3 and RE1 lands that will form an integrated approach to biodiversity conservation and passive open space use. In many occasions, this substantially increases the effective width of corridors beyond riparian requirements, but due to the problematic nature of riparian corridors and additional burdens that these impose there is no value in identifying these areas as part of the riparian corridor network.

Any required restoration works would be identified during the detailed design phase for each development stage and would form part of the Statement of Commitments for each stage. The nature of the works will need to take into consideration construction level requirements (eg cut and fill) and the interaction with natural processes (eg, flooding, bushfire, erosion).

The Water Cycle Management Study (Cardno, 2010) and Landscape Masterplan (Environmental Partnership NSW) identify the nature of ancillary uses that will take place within or adjacent to riparian corridors.

6 Conclusion

This report has demonstrated that there are a number of differences between the RCMS and Strahler-based methodologies when applied to the CUDP. The majority of these differences require increases in riparian corridors when applying the strahler-based methodology.

The majority of the inconsistencies between the two methodologies occur on Johnsons Spur, and significant inconsistencies between the published RCMS data for the Northern side of the spur and the unpublished DECCW data for the southern side of the spur are apparent. This highlights how the RCMS methodology can be applied inconsistently and the benefits of using the more objective strahler-based methodology as a starting point for riparian corridor assessment.

Notwithstanding these issues, the strategic approach to the site is consistent between the RCMS and the CUDP. Principally, this involves the provision of two main riparian corridors along Marshall Mount Creek and Macquarie Rivulet, providing for connectivity between the ocean and the escarpment. These primary corridors are supported by a series of secondary corridors extending from the valley floor to Johnsons Spur, recognising the relative importance of these corridors within the catchment. A small number of drainage lines are proposed to be removed, whilst the remainder will have narrow corridors (circa, 24 metres) to provide for bed and bank protection.

Due to limitations and burdens of riparian corridors resulting from the current regulatory framework, significant areas of E2, E3 and RE1 lands that are located immediately adjacent to riparian corridors have not been identified as part of the riparian corridor network, although they will contribute to achieving riparian outcomes. These areas will incorporate a suite of ancillary functions as part of an integrated urban environment. Riparian corridors are proposed to be zoned either SP2 or E2 and to be transferred into public ownership over time as the development is implemented and the relevant works completed to the standard of an approved maintenance regime.

The eventual outcome for the site is likely to see a substantial improvement in the geomorphology, biodiversity and water quality on the site, as the CUDP transforms the landscape from predominantly a series of low intensity agricultural use into an integrated urban and natural environment.

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