Technical Memorandum

To	Brian Moran (Bluescope)	**From**	Josh Atkinson (Cardno) Shaza Raini (Cardno)
CC	Sheree Gillen (Cardno)	**Date**	8 November 2021
Project	8201911101		
Subject	Riparian Corridor Assessment – Sheaffes Creek and Dapto Creek		
Action Required		**Attachments**	

As part of the BlueScope Woods Residential Estate and BlueScope Employment Hub, works inside of and adjoining riparian corridors will be required. However, it is the intention of BlueScope to use the opportunities presented by this project to protect and enhance the natural environment and to result in an overall net positive outcome for riparian corridors in terms of multiple criteria consistent with the *Water Management Act, 2000*, the *Guidelines for controlled activities on waterfront land: Riparian corridors* (NSW Department of Industry, 2018) and Wollongong Development Control Plan Chapter E23 Riparian Lands. This memo specifically explains the net positive outcomes intended to result from works on waterfront land in areas of the site labelled Industrial Area B and Residential Area A (see Figure 1-2).

1 Riparian Corridors

The site is traversed by a number of water courses as outlined in Figure 1-1. Much of the site is located on the lower floodplain associated with Sheaffes Creek and Dapto Creek (Figure 1-2). These watercourses vary in size, and have been identified as between first order and fifth order using the Strahler stream ordering system. Many or these watercourses have undergone some degree of modification from their natural state, whether as the result of agricultural activity, the Council landfill and industrial lots and develpoment to the north, as well as by the Illawarra Railway and the Princes Highway.

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Figure 1-1 Site overview and identified watercourses

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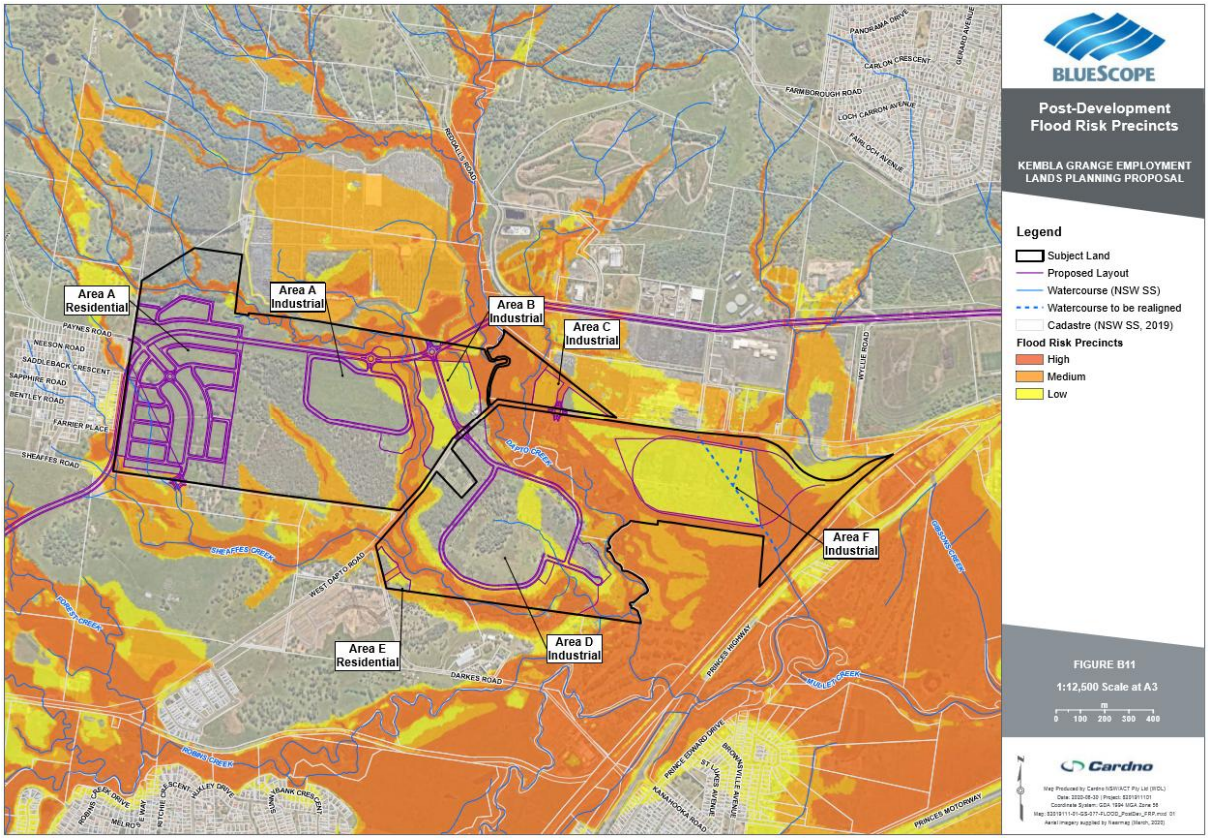

Figure 1-2 Flood affectation and precinct locations

1.2 Proposed Watercourse Improvements

There is evidence that this floodway has been modified by the creation of agricultural land. Similarly, the construction of the railway embankment and the Princes Highway and the Council landfill, and the existing industrial developments have all modified the watercourses.

Development of the site labelled as Industrial Area B will include a Vegetation Management Plan (VMP) to improve bed and bank stability of the watercourses to the east and west edges and re-contour the surface flows of the first order watercourse to reduce erosion. There are also significant areas that are going to be associated with the flood channel management, revegetation and the bio-banking and stewardship for the site. In particvular land within the existing Zone IN3 is proposed to include flood management works which will enhance overland flows, landscaped areas, safe maintenance and management of the site and permanently protect and enhance a large proportion of wetland habitat. These combined will see the precinct contain significant environmental assets in perpetuity.

1.3 Employment lands

The proposal includes adjustments to land zone boundaries for Zone IN2 to accurately account for development constraints in a manner not previously identified with the application of land use zones in the 2009 LEP. There is limited useable employment lands in the overall West Dapto Urban Release Area and achieving a reasonable outcome to optimise the utility of employment lands is critical to meeting community expectations of employment generation in the region to support the overall increase in residential

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development and the vision for West Dapto as identified in the DCP Chapter D16 and the Illawarra SHoalhaven Regional Plan.

As can be seen in Figure 1, a significant portion of the current zoned employment land has been sterilized due to constraints. Less than half of the available IN3 land can be effectively developed in the release area under current conditions. Additionally we are asserting that the proposed adjustments to IN2 zoning is reasonably able to be accommodated whilst still achieving the overall ecological, flooding and environmental outcomes across the site with no detrimental impacts to surrounding land.

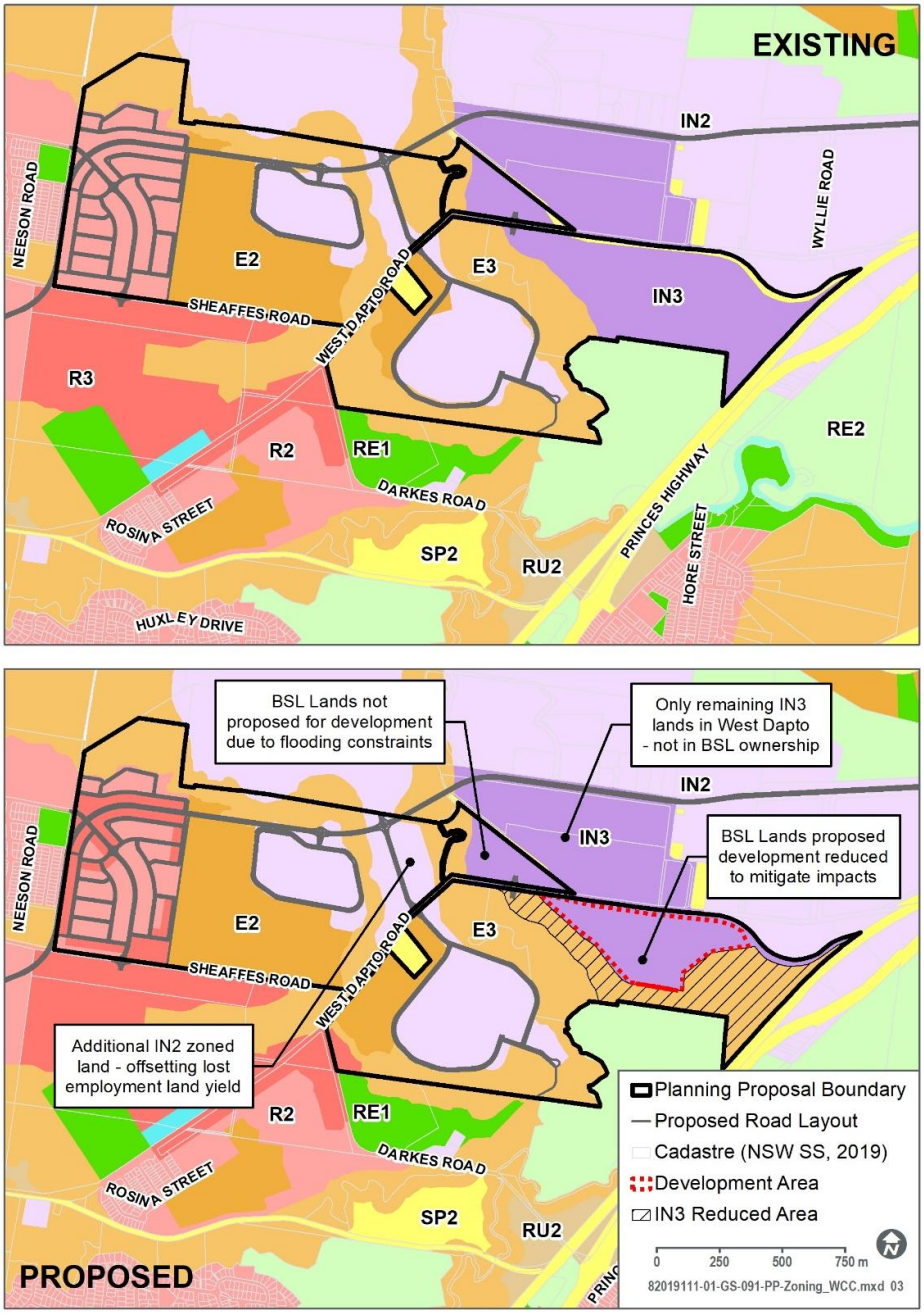

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Figure 1-3 Current IN3 zoned land

2 Planning Requirements

2.1 Waterfront Lands Requirements

The requirements to manage waterfront land are set out under the *Water Management Act 2000* (WM Act). There are also water front lands requirements outlined in the Wollongong Development Control Plan. The objectives of the Act are to provide for:

> *"the sustainable and integrated management of the water sources of the State for the benefit of both present and future generations and, in particular—*
>
> a. *to apply the principles of ecologically sustainable development, and*
>
> b. *to protect, enhance and restore water sources, their associated ecosystems, ecological processes and biological diversity and their water quality, and*
>
> c. *to recognise and foster the significant social and economic benefits to the State that result from the sustainable and efficient use of water, including—*
>
> i. *benefits to the environment, and*
>
> ii. *benefits to urban communities, agriculture, fisheries, industry and recreation, and*
>
> iii. *benefits to culture and heritage, and*
>
> iv. *benefits to the Aboriginal people in relation to their spiritual, social, customary and economic use of land and water,*
>
> d. *to recognise the role of the community, as a partner with government, in resolving issues relating to the management of water sources,*
>
> e. *to provide for the orderly, efficient and equitable sharing of water from water sources,*
>
> f. *to integrate the management of water sources with the management of other aspects of the environment, including the land, its soil, its native vegetation and its native fauna,*
>
> g. *to encourage the sharing of responsibility for the sustainable and efficient use of water between the Government and water users,*
>
> h. *to encourage best practice in the management and use of water."*

The details about managing waterfront land are managed through the Natural Resources Access Regulator (NRAR). This regulator has developed the *Guidelines for controlled activities on waterfront land: Riparian corridors* (NSW Department of Industry, 2018) to outline how to meet the requirements under the WM Act. These guidelines identify that land within 40m of a marked water course is to be considered waterfront land. A Controlled Activity Approval will be required from the NRAR to undertake works on waterfront land.

In addition, the *Wollongong Development Control Plan Chapter E23* (DCP Ch.E23) outlines the Wollongong Council requirements for waterfront land. These requirements are based on an LGA wide review of the watercourses, and the values that should be applied to each. Three categories of watercourses are outlined in the DCP as follows:

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Watercourse Category	Riparian Corridor Objectives
Category 1 – Environmental Corridor	> Maximise the protection of terrestrial and aquatic habitat; > Maintain a continuous riparian corridor to provide linkages between stands of remnant vegetation for the movement of terrestrial and aquatic fauna; > Maintain the viability of native riparian vegetation; > Minimise 'edge effects' at the riparian corridor / urban interface by the provision of a suitable riparian corridor width; > Maintain adequate riparian corridor width, based on geomorphological and environmental considerations and to maintain or improve bank stability; > Protect water quality of the watercourse through an adequate riparian corridor width; > Restore the vegetation, geomorphic structure, hydrology and water quality of the riparian corridor to its original (preEuropean) state, where practicable; > Locate infrastructure or utility services (i.e. electricity, water, sewerage etc) outside the riparian corridor, wherever practicable; > Maintain the riparian connectivity by the use of piered crossings in preference to pipes or culverts; > Minimise the impact of walkways, cycle ways and general access points by using ecologically informed design > principles; > Restrict the encroachment of flood compatible development (e.g. playing fields) to the edge of the riparian corridor; > Treat stormwater run-off outside the riparian corridor before discharge into the watercourse.
Category 2 – Terrestrial and Aquatic Habitat	> Maintain/restore the natural functions of watercourses. > Maintain the viability of native riparian vegetation; > Minimise 'edge effects' at the riparian corridor / urban interface by the provision of a suitable riparian corridor width; > Maintain adequate riparian corridor width, based on geomorphological and environmental considerations and to maintain or improve bank stability; > Protect water quality of the watercourse through an adequate riparian corridor width; > Restore the vegetation, geomorphic structure, hydrology and water quality of the riparian corridor to its original (preEuropean) state, where practicable; > Minimise the number of road crossings and such crossings are designed to maintain riparian connectivity; > Restrict the encroachment of flood compatible development (e.g. playing fields) to the edge of the riparian corridor rather than within the core riparian zone; > Locate infrastructure or utility services (i.e. electricity, water, sewerage etc) outside the riparian corridor, wherever practicable; > Treat stormwater run-off outside the riparian corridor before discharge into the watercourse.
Category 3 – Bank Stability and Water Quality	> Minimise sedimentation and nutrient transfer; > Provide bank stability; > Protect water quality; > Protect riparian vegetation, wherever possible; > Emulate a naturally functioning stream with a suitable riparian corridor width; > Provide suitable vegetated habitat refuges for terrestrial and aquatic fauna, wherever possible; > Treat stormwater run-off outside the riparian corridor before discharge into the riparian zone, wherever possible.

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2.2 Floodplain Management Requirements

Much of the precinct is known to be flood affected as outlined in the *Mullet Creek Flood Model Update* (BMT WBM 2018) as well as the *Water Cycle Management Study: BlueScope Woods Residential Estate and BlueScope Employment Hub* (Cardno 2020). As such the site is subject to the floodplain management requirements in the *Wollongong Local Environmental Plan 2009* and the accompanying *Wollongong Development Control Plan Chapter E13*.

The objectives of DCP Ch.E13 are:

a. *Maintain the existing flood regime and flow conveyance capacity;*

b. *Maintain the function of floodway and flood storage areas;*

c. *Reduce the impact of flooding and flood liability on individual owners and occupiers of flood prone land;*

d. *Reduce private and public losses from flooding;*

e. *Improve public safety with respect to flooding;*

f. *Minimise the potential impact of development and other activity upon the aesthetic, recreational and environmental value of the waterway corridors;*

g. *Increase public awareness of the hazard and extent of land affected by the full range of potential floods;*

h. *Ensure new development must, as far as practical, reduce the existing flood risk, and in no circumstances should the flood risk be worsened;*

i. *Ensure new development (with the exception of waterway crossings) does not encroach within areas susceptible to channel erosion, migration, bank failure and slumping; and*

j. *Deal equitably and consistently with all matters requiring Council approval on flood affected land, in accordance with the principles within the latest version of the NSW Floodplain Development Manual or its update.*

2.3 Other Requirements

The proposal is subject to a number of other legislative and planning requirements. In particular, Wollongong Development Control Plan Chapters E14 and E15. However, these requirements are addressed in the overall planning proposal.

3 Existing Conditions

The existing watercourses are identified on the available topographic maps, and these relate to the DPI Stream order data set. The watercourse values associated with the DCP are also identified by the Council on the Intramaps tool.

3.1 Area A (Residential)

In Residential Area A there is a first order water course (part of Shaeffes Creek) is identified as crossing the site, as well as a small portion of a second order that crosses immediately east of the intersection of Shaeffes Creek and Paynes Road. While portions of Shaeffes Creek appear to have been filled, the path of the water is visible in aerial photography, and the Creek is identifiable in the LiDAR information. Shaeffes Creek is identified as Category 2 – Terrestrial and Aquatic Habitat, while the tributary form the Paynes Road subdivision Category 3 – Bank Stability and Water Quality.

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Parts of Shaeffes Creek upstream of Residential Area A have been dammed, channelled and piped and diverted into onsite detention basins and an open swale as part of the Kembla Grange Estate.

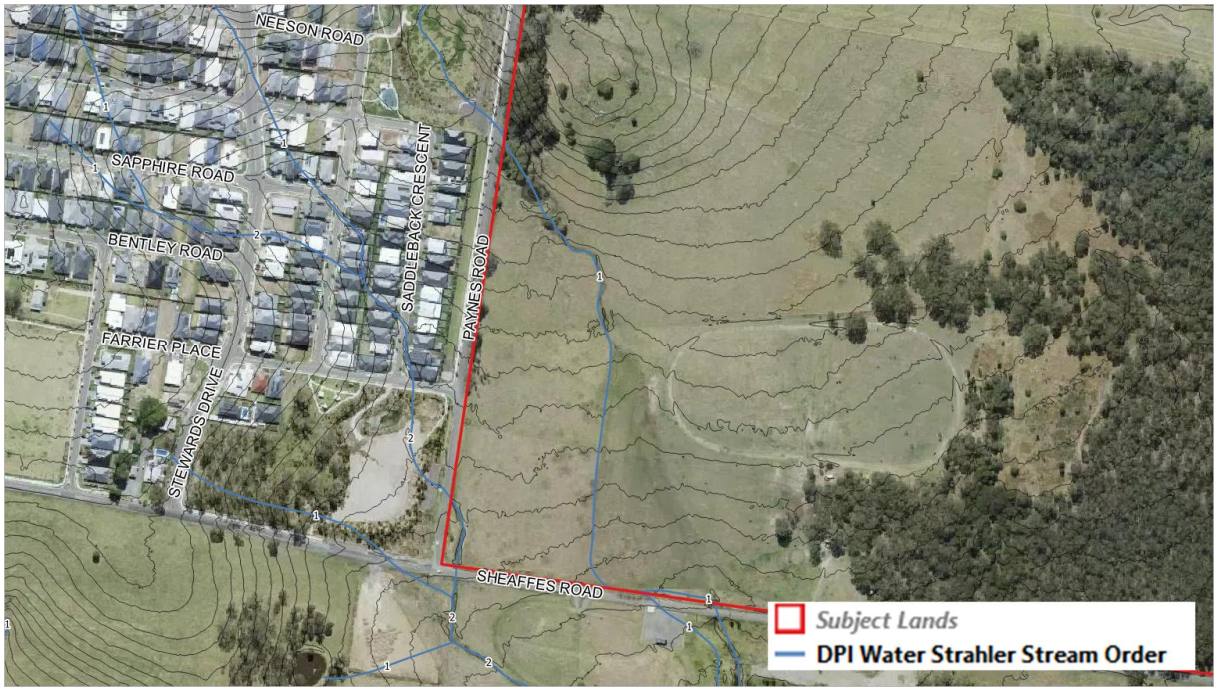

Figure 3-1 Identified watercourses in Area A

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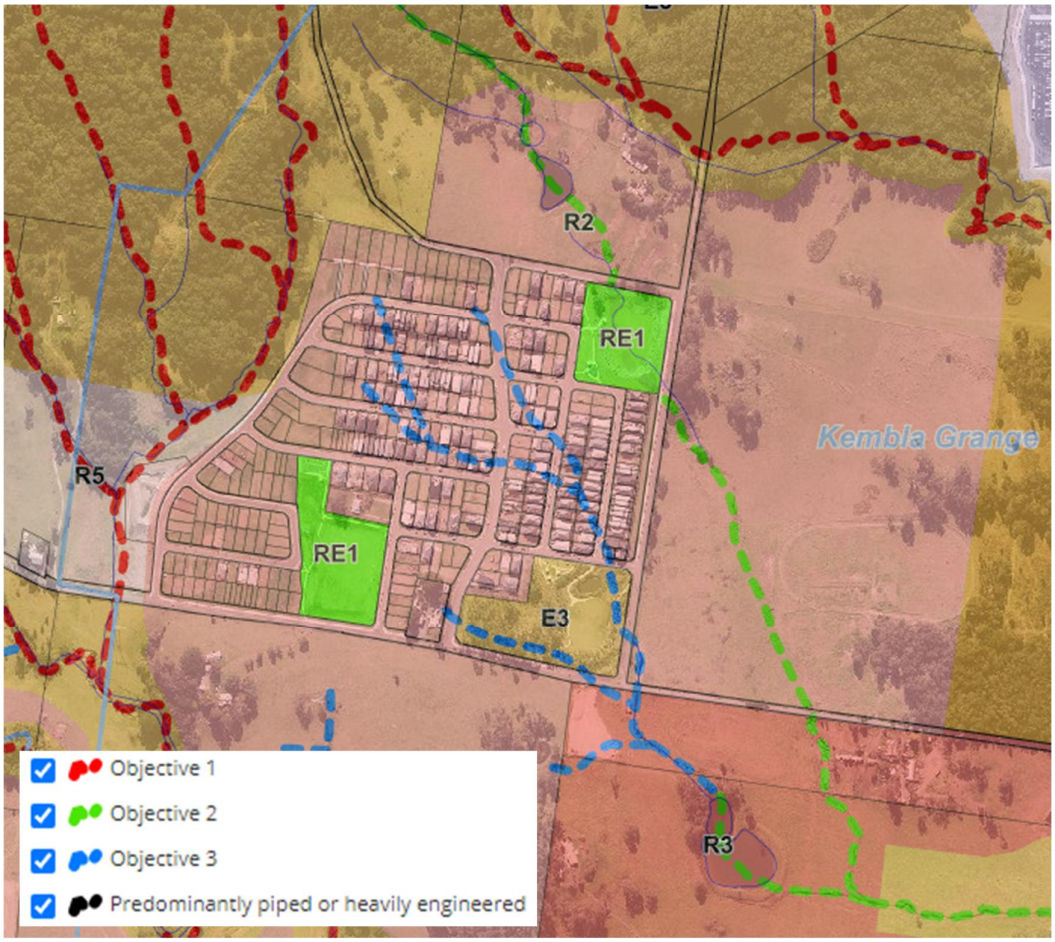

Figure 3-2 Watercourse values in Area A as identified by Wollongong City Council

3.2 Area A (Industrial), B and C

Area A, B and C is located at the confluence between Dapto Creek and other minor tributaries. Notably, the floodplains or these tributaries overlap to an extent. Dapto Creek is identified as an Order 5 watercourse (Figure 3-3), while the tributaries are third order.

Council have identified this section of Dapto Creek and the tributary through Area A as Category 1 – Environmental Corridor. The tributary through Area C is identified as being Category 3 – Bank Stability and Water Quality.

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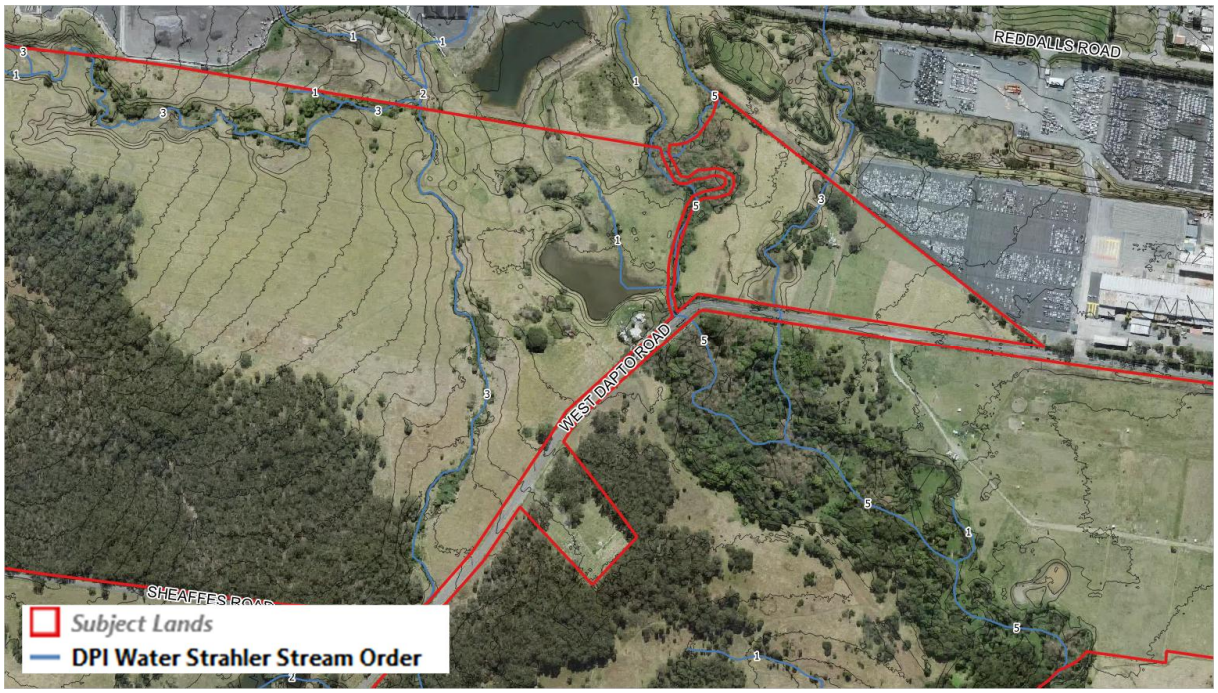

Figure 3-3 Watercourses in Area A (industrial), B and C

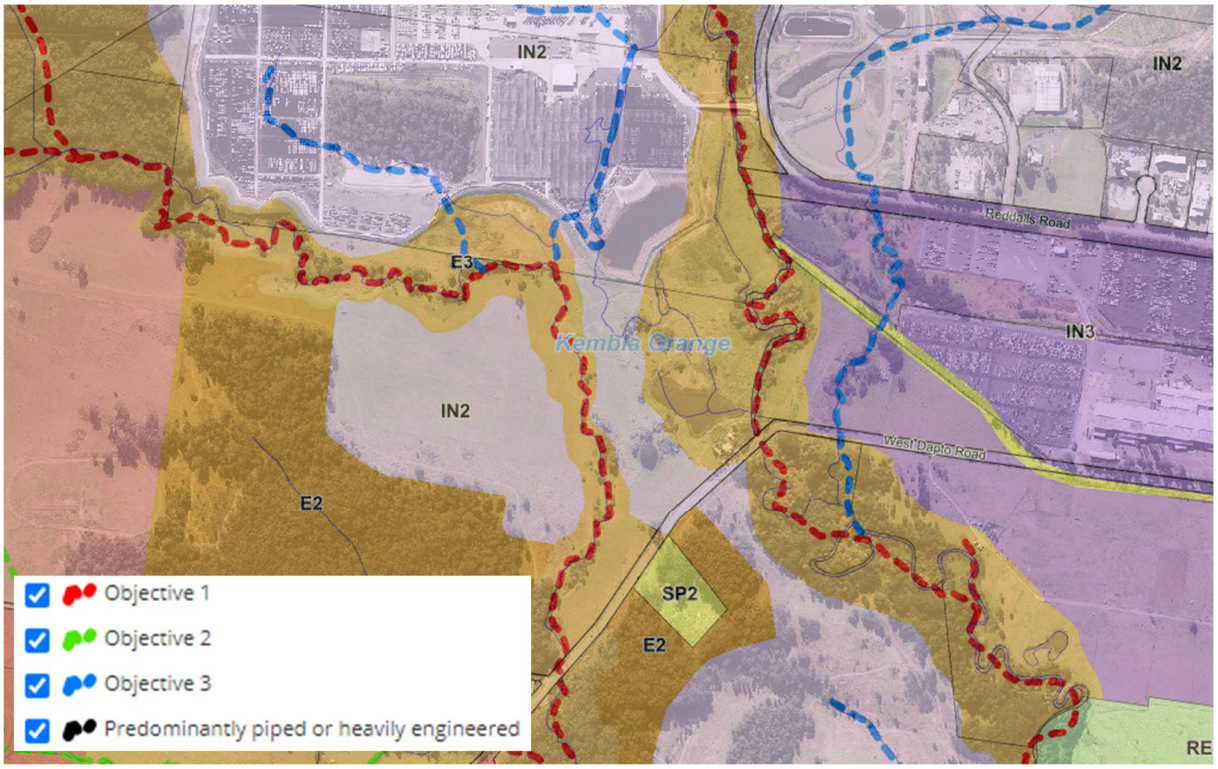

Figure 3-4 Watercourse values at the confluence located in Area A (Industrial), B and C as identified by Wollongong City Council

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3.3 Area F

As with Area B, Dapto Creek is an Order 5 watercourse. The area is also crossed by Order 1 watercourses that drain the area upstream of Reddalls Road.

In this area Council have identified Dapto Creek as Area A as Category 1 – Environmental Corridor. The tributary through Area F is identified as being Category 3 – Bank Stability and Water Quality.

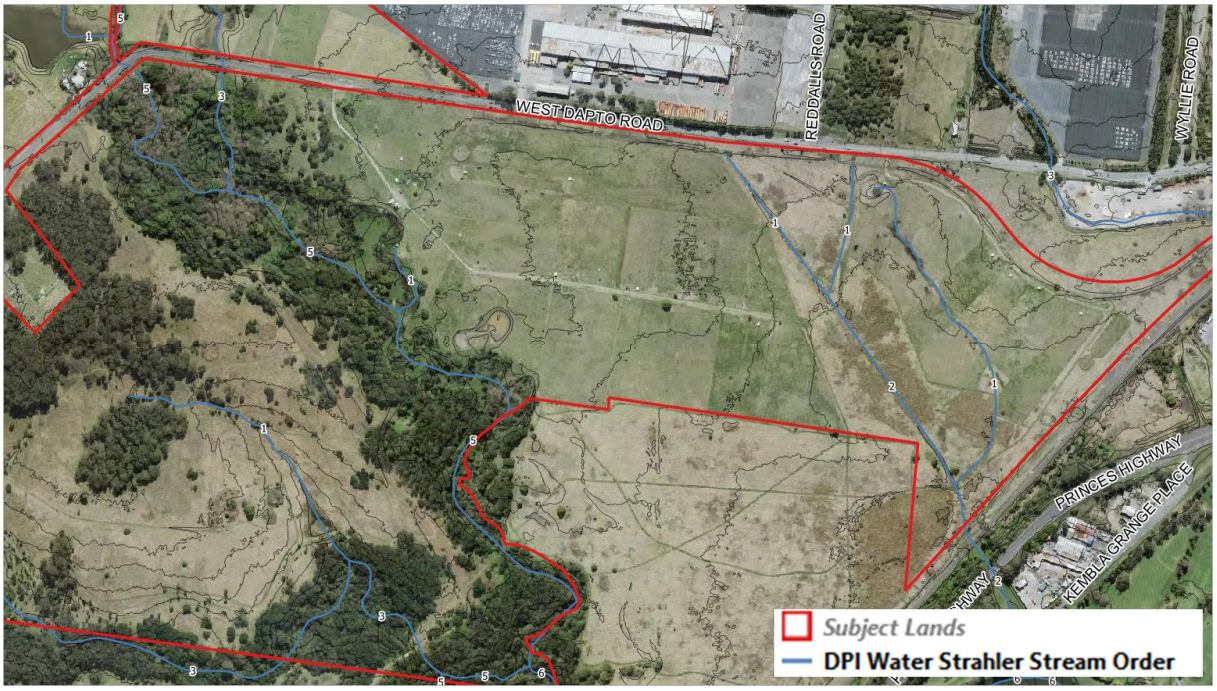

Figure 3-5 Watercourse mapping in Area F

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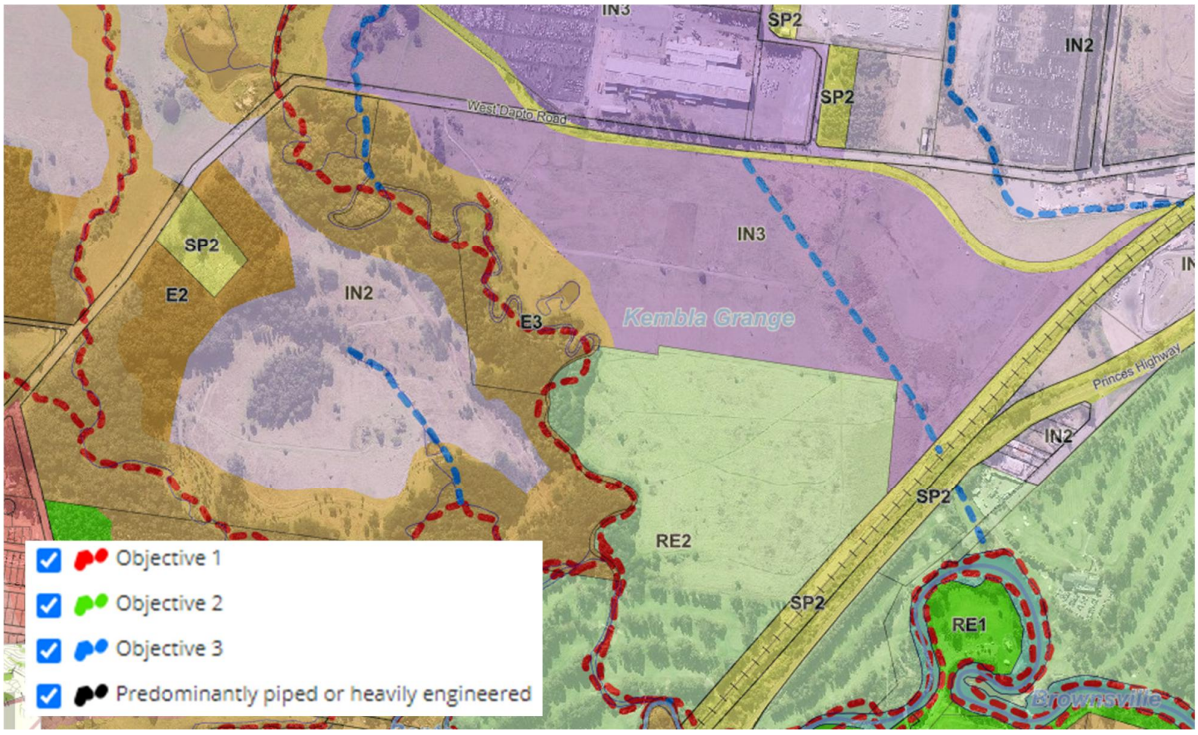

Figure 3-6 Watercourse values at the confluence located in Area F (Industrial) identified by Wollongong City Council

4 Proposed Treatment

The riparian corridor requirements will be addressed through the design as the project progresses. Separate treatments are proposed in all of the subject areas

4.1 Area A (Residential)

Initially a swale had been proposed to act as the riparian corridor through this section (in a similar manner to the Kembla Grange Estate to the east). However, at Council's direction, this was changed to a pipe to carry the low flows through this area. This pipe has preserved the low flow hydrologic functions, with the flood conveyance being managed through channel in the Kembla Grange Estate.

We have reviewed the 2004 Riparian Management Study report that informed the category classification to Chapter E23 of the 2009 WCC DCP and found that field investigation was only undertaken along the main Mullet Creek watercourse (south of the Cleveland Road) to determine the stream categories in this study. Other watercourses within Mullet Creek catchment were defined using the elevation data (DEM), high hazard floodway areas (from local flood studies) and aerial investigation. Therefore, we do not believe there is sufficient evidence to categorise this watercourse as a Category 2 particularly considering the existing nature of the creek in this area. The specific objectives that a riparian corridor should achieve will be confirmed with Council, noting the indistinct nature of the of the creek through this area.

4.2 Area A (Industrial), B and C

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In Area A (Industrial), B and C the hydrologic function of the identified creeks has been preserved has been preserved, with the inclusion of diversions to reproduce the flood flow characteristics. There is also no encroachment into the Objective 1 or Objective 2 watercourses.

Development applications based on the proposed development standards will have sufficient space to ensure that works do not take place inside the riparian corridor.

The following is a summary of the ways in which a net positive outcome is intended to be achieved for the riparian areas within Industrial Area B in particular as measured against the NRAR objectives for riparian lands.

NRAR Guidelines 2018 functions of riparian lands	**Area B Industrial**
• providing bed and bank stability and reducing bank and channel erosion	Below photo indicates areas of the watercourses that are currently not vegetated and therefore vulnerable to bank instability and erosion. Development of the site will include a Vegetation Management Plan (VMP) to improve bed and bank stability of the watercourses to the east and west edges and re-contour the surface flows of the first order watercourse to reduce erosion. There is potential for the creek to have a continuous veg corridor of significance either side of the creek, increasing the overall vegetated riparian corridor. 

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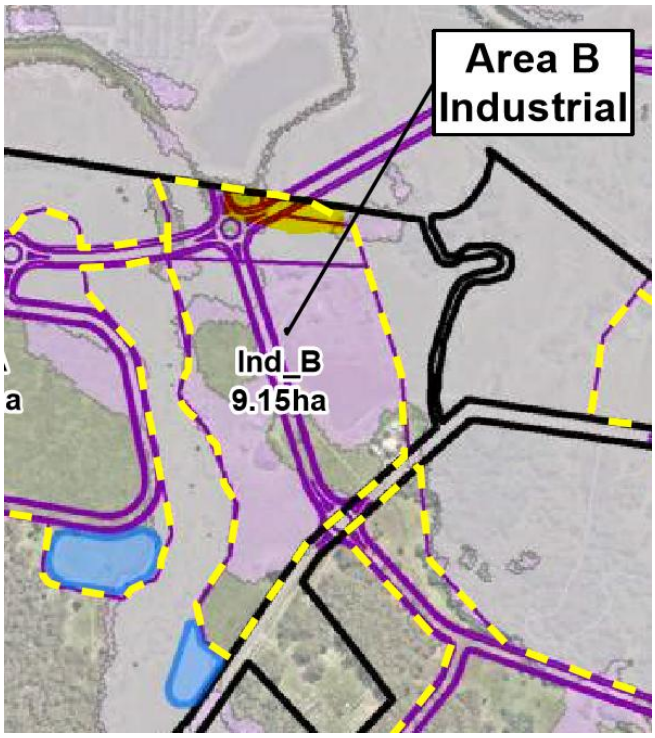
• protecting water quality by trapping sediment, nutrients and other contaminants	Vegetated riparian areas as shown above will have improved water quality. There are currently no WSUD devices managing water quality from: (i) the OSD on the adjoining land to the north; or (ii) the earth dam; or (iii) the first order watercourse (which appears to be relied upon to take additional flows from the OSD to the north). New WSUD devices can be installed at the same time that the first order watercourse is re-aligned to improve water quality BEFORE it enters Dapto Creek (in the vicinity of the area highlighted yellow below). 

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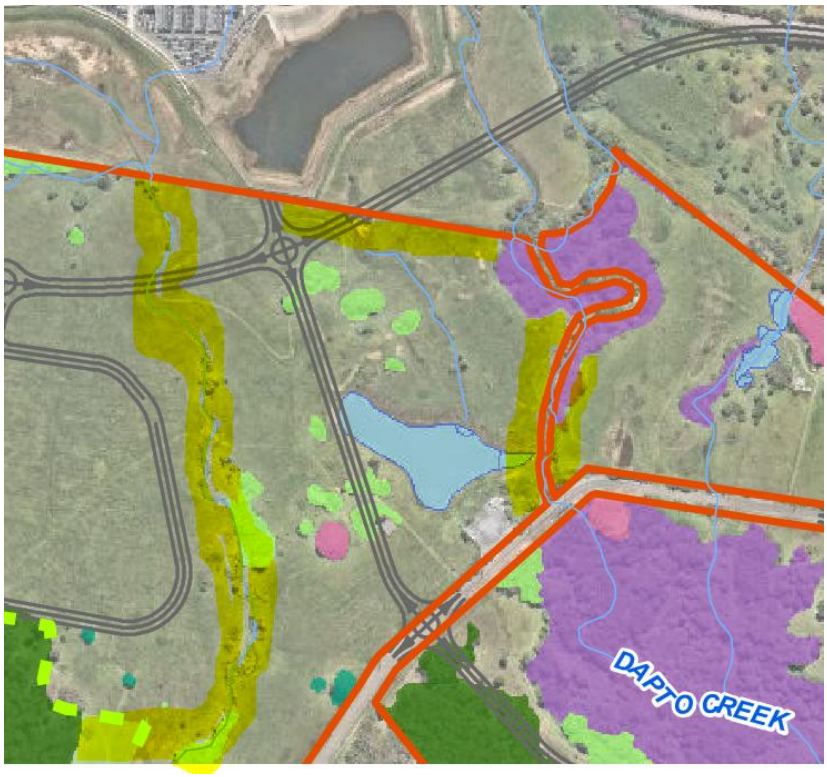
• providing diversity of habitat for terrestrial, riparian and aquatic plants (flora) and animals (fauna)	The riparian corridor to the western edge of Industrial Area B will have restored riparian corridor 60m wide connecting to the Biobank site. The riparian corridor to the eastern edge of Industrial Area B has been identified as Woody Weeds and will be a replanted to support Forest Redgum Grassy Woodland community and connect to the Dapto Creek corridor south of West Dapto Road  **Validated Vegetation (Ecoplanning, 2019)** Woody Weeds Woollybutt - White Stringybark - Forest Red Gum grassy woodland, Acacia regrowth
• providing connectivity between wildlife habitats	See above

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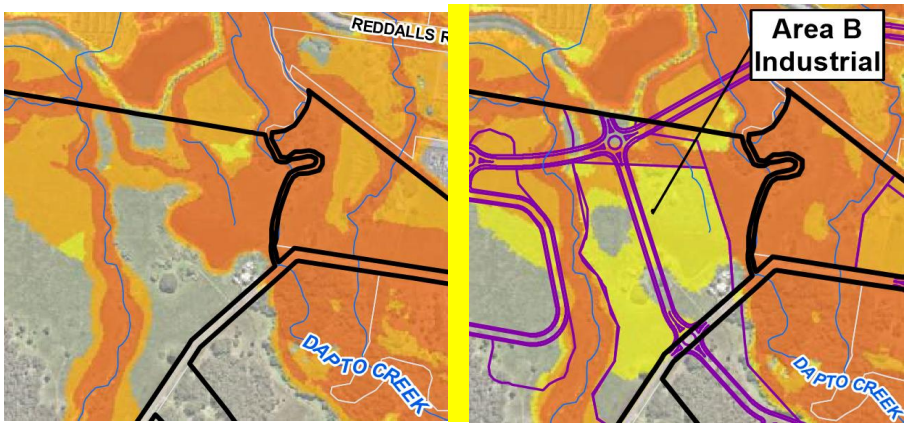
• conveying flood flows and controlling the direction of flood flows	See Pre- and Post- development Flood Risk Precinct map extracts below which show a reduction in the area affected by High Risk Flood Precinct. Flood Risk Precincts High Medium Low Pre-development Post-development 
• providing an interface or buffer between developments and waterways	Vegetated riparian lands will be an effective buffer to the east and west side of Industrial Area B. Perimeter roads are intended to be installed to the edges of Industrial zoned land to create a clear and distinct public space between industrial lots and the riparian corridors.
• providing passive recreational uses.	The future use of riparian corridors is yet to be determined and is not required to be nominated in order for the Planning Proposal to proceed.

4.3 Area F

In Area F the industrial land will be developed outside the riparian corridor. The proposed flood channel will be incorporated into the riparian corridor as its functions are compatible with the objectives of the riparian corridor. The channel will be developed and vegetated in a way that enhances the ecological value, while at the same time preserves the flood flow function. This flood channel will provide a significant amount of additional habitat and a substantial environmental benefit as compared to the existing conditions.

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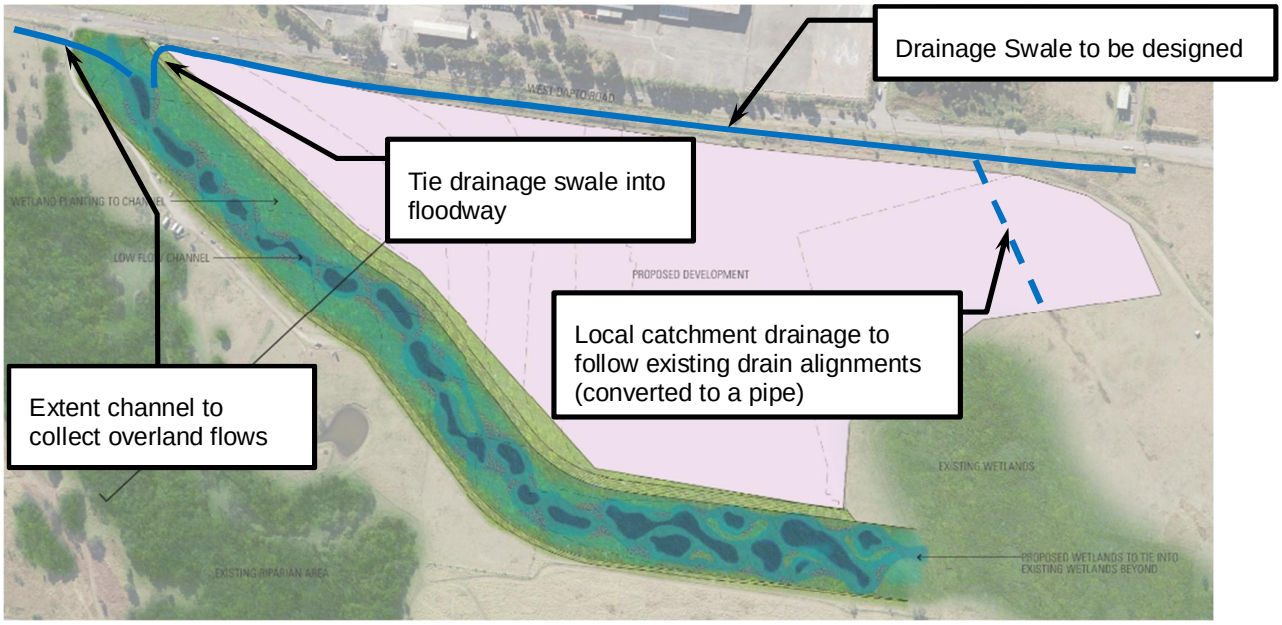

Figure 4-1 Scope of works required to address flood impacts

5 Conclusions

In progressing this proposal, Cardno have taken into account the requirements to manage the Waterfront land as set out in the *Water Management Act 2000* as well as in Chapter E23 of the *Wollongong Development Control Plan Chapter E23.* The riparian corridors have been mapped, and there is sufficient space to preserve and enhance the riparian corridors while allowing the development of the land in an equitable manner. It is expected that all residential dwellings, roads and industrial development would be located outside the riparian corridors. However, some facilities, such as water treatment swales may be placed inside the outer 50% of the riparian corridor as allowed under the NRAR guidelines. This would be detailed at the Development Application stage when more details about specific developments are known.

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