Waterway Impact Statement

374 Joalah Rd, Duffy's Forest

By Ecological Consultants Australia Pty Ltd TA
Kingfisher Urban Ecology and Wetlands

June 2023 updated Feb 2024

About this document

This document has been prepared in response to the request for a fee proposal for ecology work. It has been prepared solely for the benefit of the client and is issued in confidence for the purposes only for which it is supplied.

Unauthorised use of this document in any form whatsoever is prohibited. No liability is accepted by Ecological Consultants Australia or any employee, contractor, or sub-consultant of this company with respect to its use by any other person.

This disclaimer shall apply notwithstanding that the document may be made available to other persons for an application for permission or approval to fulfill a legal obligation.

Document Control Sheet	
Title:	Waterway Impact Statement 374 Joalah Rd, Duffys Forest
Version:	Final
Author:	Elaway Dalby-Ball, Sommer Dean, Cassandra Bugir, and Myrna Calumpong
Date:	May 2023 updated Feb 2024
File location:	C:2022-2023\Flora Fauna BAM BDAR\Flora and Fauna\WIS 374 Joalah Rd, Duffys Forest
Distribution:	Matthew Woodward Architecture Richard Coskie p. + 61 2 8041 7802 m. + 61 411 264 258 richard@matthewwoodward.com.au

Signed: Elaway Dalby-Ball – Director of Ecological Consultants Australia

Table of Contents

Summary

Introduction

Ecological Consultants Australia (ECA) has been contracted to provide a **Waterway Impact Statement** for the proposal at 374 Joalah Rd, Duffys Forest within the Northern Beaches Council LGA.

The proposed development is for alterations and additions to an existing dwelling.

An unnamed watercourse, classified as 1st order, bisects the the property flowing westward to meet Cowan Creek.

Methods

- On-ground site inspection took place in Dec 2022 by Gabriel James (ecologist) on the 10 July 2023 and Dec 2023 by Principal Ecologist and Urban Waterway specialist Elaway (G. Dalby-Ball).
- Waterway examination was done to include the full waterway and drainage line. The author is also very familiar with this area and catchment having lived here over 40 yrs.
- Habitat assessment of the waterway and drainage line was included to add to knowledge on the ecological health and value of these.
- BioNet searches were performed for flora, fauna, endangered populations, and communities to identify if there were previous records of threatened species occurring within the local area using a 10 km radius around the site.
- Description of the site in extreme rainfall conditions were compared to on-ground evidence of high-flow, to assist in determining the maximum water levels, velocity and behaviour of the waterway.
- A Review of the proposed new works (to the existing development) was evaluated against the requirements of the Water Management Act and relevant Northern Beaches (Pittwater) Planning controls.

Results

- The **waterway through the centre of the site** is mapped as a 1st order waterway on the NSW Hydroline. It's 95% natural with small modifications (low wall (10cm) creating some pooling and cut out section (~5cm) diverting water towards the south.

- Sydney Sandstone rocky creeks are typically full flow, trickle and intermittent based on catchment falls. This waterway, provides this functionality and will continue to do so post alterations and additions to the existing dwelling. Generally its low flow to high flow and rarely under 1L /sec.

- The existing dwelling is within the zone of 10m from the top of the bank and the proposed alterations are within the same footprint. An encroachment of 30cm of awning over the existing foot print is the maximal impact relative the current conditions. This has a small footing on an area that is currently tiled, this is the only change from the existing footprint. See figure below – where white is outline of works (all within existing foot print) and purple is the only structure going closer to the creek (30cm) only and aerial. NB Figure later report in larger size as well.

- The removal of the facade of the existing dwelling will include removing some structures currently in the riparian zone and so over all it will be an improvement to the current conditions as related to the waterway.

- The core riparian zone guideline of 50% the width (5m back from top of bank) cannot be fulfilled due to the dwelling already existing.

- The averaging rule in the Water Mgt Act can be applied to have an average of over 10m from top of bank when taking both sides into consideration as the northern side can have at least 30m wide retain as full bushland, thus a corridor of 30m rather than the required 20 on a first order.

- Encroachment in the inner 50% (5m) is occurring however this is existing and there is no significant hydrological or ecological reasons not to grant existing use rights given:
    - The riparian zone in this location is not a main corridor between core bushland,

  - Will not be compromised in terms of ecological functions such as sun light reaching the area.
  - Will not result in the removal of riparian vegetation (as already a dwelling).
  - The compensation across the creek is a minimum of 30m riparian corridor on that north side. This offsets the 300m2 existing encroachment of built form and ~100m2 of paving and associated landscape modification. This 30m wide (rather than 20m) assists in mitigating the reduced quality that may occur for bushfire mitigation works on the north side.
  - Thus the existing and future works encroachment is offset in the immediate vicinity.
  - Proposed works will not increase the encroachment into the riparian corridor zone.

- Greatest long term benefits to these waterways will come from:

  - Enhancing habitat opportunities for native species (pools, riffles, sunny areas, habitat logs) and the removal of weed species (particularly Crofton Weed). Noting the current residents have controlled much and it is on-going.

- The WIS does not officially address Indigenous Heritage. As part of Due Diligence and AHIMS was conducted. No sharpening groves were seen on the exposed rock areas however they may be deep under leaf litter (as is the case with many waterway sites in Sydney and Central Coast).

- A future Ecology/Riparian/Fire Management Plan is recommended be conditioned for pre CC or OC such that appropriate management is on-going.

- Included in the ecology report (ECA 2023) are the flora and fauna observations. Of note for the waterway and drainage lines are Water Dragons and areas of habitat for aquatic invertebrates adapted to intermittent flows including high velocity.

Mitigation Measures

Development proposal is chiefly internal works and those to the pool and landscape areas. Mitigation works are focused on protection of natural assets including water quality during works and ecology/waterways long term (see also recommendations in the Ecological Assessment). Long term improvement to the site and receiving waters and National Park will be from Weed Management. Sediment Control plan as per Partridge (2023) to be implemented.

A CEMP is best conditioned for the project to cover the project from CC to OC to address ecology and the waterway protection.

A Riparian, Fire, Vegetation Mgt plan to cover the project from OC to for the life of the development is recommended pre OC.

Before works:

- Tree protection as per the Arboricultural Impact Assessment.
- Removal of weeds in works area to prevent spread of seed.
- Effective site management to minimise sediment and silt runoff.
- Finalisation of the CEMP pre CC.

During works:

- Tree protection as per the Arboricultural Impact Assessment.
- Effective site management to stop silt and sediment runoff.
- Implementation of the (CEMP) with planting, weed removal and habitat enhancement.

After completion of works:

- Water quality monitoring (O_2 and turbidity)
- Riparian native species maintenance and maintenance and renewal of riparian habitat areas in line with (RFV Mgt Plan).
- Finalisation of a Riparian, Fire Vegetation Mgt Plan (RFV Mgt Plan) pre OC

Legislation: Various pieces of legislation apply to this location and the proposed works are in keeping with the objective of the Acts. Key acts are listed below.

- *Water Mgt Act* and associated Guidelines
- *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act).*
- *Environmental Planning and Assessment Act 1979 (EP&A Act).*
- *Biodiversity Conservation Act 2016 (BC Act).*
- *Biosecurity Act (superseding the Noxious Weed Act 1993) (NW Act).*

Various SEPPs and Controls in the Northern Beaches (Pittwater) DCP and LEP (included later in this WIS)

Glossary

Connectivity means the interconnection of functionally related ecological elements of a landscape so that species can move amongst them.

Creek means any watercourse, whether ephemeral, intermittent or perennial, whether on its natural course or altered by human interference, whether channelled or not. It also includes any drainage lines able to be identified by a linear vegetation assemblage reflective of regularly moist soil conditions or by a weed plume consistent with regularly moist soil conditions.

Development means:-

(a) the use of land, and
(b) the subdivision of land, and
(c) the erection of a building, and
(d) the carrying out of a work, and
(e) the demolition of a building or work, and
(f) any other act, matter or thing referred to in section 26 that is controlled by an environmental planning instrument, but does not include any development of a class or description prescribed by the regulations for the purposes of this definition (*Environmental Planning and Assessment Act, 1979*).

Riparian means occurring on the bank of a river (or other waterway, or waterbody). Usually refers to vegetation, "riparian land" (NSW Fisheries 1999, Policy and Guidelines Aquatic Habitat Management and Fish Conservation).

Riparian Buffer means land which is additional to the riparian zone necessary to protect the values and health of the riparian zone. The primary purpose of the buffer is to protect the integrity of the riparian zone. The combined width of the buffer and riparian zone then constitute a key protective mechanism for the ecological values of waterway systems. The minimum width of a riparian buffer is generally 10 metres, and is dependent on the catchment characteristics, slope and environmental values associated with the riparian corridor. The buffer is primarily designed to:

(a) Prevent water from affecting riparian vegetation (e.g. additional moisture, local erosion, nutrients, toxicants);
(b) Prevent weeds from invading the riparian zone; and
(c) Provide habitat for native fauna (thereby protecting it from external threats such as domestic animals).

Riparian Zone means any land which adjoins, directly influences, or is influenced by a body of water. The width of the zone varies according to extent of riparian vegetation, flood levels, water quality, and channel form. This zone is taken to start at the highest bank of the watercourse (as defined in the Water Management Act, 2000). For ephemeral streams without a defined channel, the start of the riparian zone is the creek centre line. The riparian zone provides important habitat, protects the creek from water quality and hydrological impacts. It has other functions, including intrinsic value, as well as providing bed and bank stability, providing woody debris to the waterway and a buffer between development and waterways.

River includes:

(a) any watercourse, whether perennial or intermittent and whether comprising a natural channel or a natural channel artificially improved, and
(b) any tributary, branch or other watercourse into or from which a watercourse referred to in paragraph (a) flows, and
(c) anything declared by the regulations to be a river, whether or not it also forms part of a lake or estuary, but does not include anything declared by the regulations not to be a river (Water Management Act 2000)

Waterbody (artificial) or **artificial waterbody** means an artificial body of water, including any constructed waterway, canal, inlet, bay, channel, dam, pond, lake or artificial wetland, but does not include a dry detention basin or other stormwater management construction that is only intended to hold water intermittently.

Waterbody (natural) or **natural waterbody** means a natural body of water, whether perennial or intermittent, fresh, brackish or saline, the course of which may have been artificially modified or diverted onto a new course, and includes a river, creek, stream, lake, lagoon, natural wetland, estuary, bay, inlet or tidal waters (including the sea).

Watercourse means any river, creek, stream or chain of ponds, whether artificially modified or not, in which water usually flows, either continuously or intermittently, in a defined bed or channel, but does not include a waterbody (artificial).

Waterway means the whole or any part of a watercourse, wetland, waterbody (artificial) or waterbody (natural).

Wetland means:

(a) natural wetland, including marshes, mangroves, backwaters, billabongs, swamps, sedgelands, wet meadows or wet heathlands that form a shallow waterbody (up to 2 metres in depth) when inundated cyclically, intermittently or permanently with fresh, brackish or salt water, and where the inundation determines the type and productivity of the soils and the plant and animal communities, or
(b) artificial wetland, including marshes, swamps, wet meadows, sedgelands or wet heathlands that form a shallow waterbody (up to 2 metres in depth) when inundated cyclically, intermittently or permanently with water, and are constructed and vegetated with wetland plant communities.

Wetland buffer means 100m buffer of land, measured from the shoreline, surrounding a wetland which directly influences and protects a wetland.

1 Overview

1.1 Scope of Works

Ecological Consultants Australia (ECA), operating as Kingfisher Urban Ecology & Wetlands, has been engaged to deliver a comprehensive "Waterway Impact Statement." The scope of work encompasses multiple objectives, including providing justification for the existing use rights pertaining to the dwelling situated in close proximity to the waterway. Furthermore, the study involves offering recommendations for land management practices, specifically focusing on native planting initiatives and targeted weed removal, to address and harmonize the relationship between the dwelling and the adjacent creek. Through these efforts, the aim is to establish a balanced and sustainable coexistence between the natural environment and the development.

1.2 Legislation

- ***Water Management Act***

This is the main act applying to the report and details of requirements and outcomes relive to guidelines have been included in this WIS

- ***Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act).***

A Protected Matters Search was conducted as part of EPBC Act considerations. All EECs and species were considered. Only the Duffy Forest EEC is a direct concern and requires on-going action as has been occurring with the seed collection and replanting.

- ***Environmental Planning and Assessment Act 1979 (EP&A Act).***

The EPA Act requires that the assessing body, in this case local government, consider the impact of the development on the surroundings – with respect to this ecology report the impacts on the environment are assessed. The proposal indicate no significant impact on threatened species, populations or communities.

- ***Biodiversity Conservation Act 2016 (BC Act).***

Recently replacing the Threatened Species Conservation Act this includes the test of significance for impacts on threated species, communities. The test of significance have been conducted and the proposal was found to not have a significant impact on the current ecology of the site, providing the Mangroves are protected and stormwater is well managed. The proposed development is complaint with the BC Act.

- ***Fisheries Management Act 1994 (FM Act).***

The proposed development is compliant with the objective of the FMA as there will be full retention of Mangrove and no blocks to fish passage. Stormwater from on-site will be managed such that there is to be a positive or neutral impact on the receiving water. See Stormwater Plan for details.

- ***National Parks & Wildlife Act 1974 (NP&W Act).***

The proposed development is complaint with the NP&W Act.

- ***Biosecurity Act (superseding the Noxious Weed Act 1993) (NW Act).***

The Biosecurity Act replaced the Noxious Weeds Act and the objectives of this Act is to manage, and eradicate and Weeds that cause a high level of environmental, economic or social harm. With the removal of Pampas Grass and management of weeds in the riparian zone, as per the VMP, then the sites works with be complaint with the objectives of this Act.

- ***State Environmental Planning Policy (Biodiversity and Conservation) 2021***
- ***State Environmental Planning Policy (Resilience and Hazards) 2021***
- ***State Environmental Planning Policy (Resources and Energy) 2021***
- ***State Environmental Planning Policy (Transport and Infrastructure) 2021***

DCP and LEP

LEP 2014 C4 Environmental Living objective: to encourage development that retains and enhances riparian and foreshore vegetation and wildlife corridors.

DCP sB5.13

- Any waterfront land (as defined in the Water Management Act 2000) on the property shall be retained in their natural state to: carry stormwater/flood flows, maintain aquifers, retain stability, and provide habitat functions.
- Development within waterfront land shall incorporate appropriately sized riparian corridor zones into the design (now based on Controlled activities – Guidelines for riparian corridors on waterfront land (NSW DPE, May 2022)).

1.3 Site Information

The Subject Site (the "Site") is 374 Joalah Rd, Duffy's Forest (see Figure 1.1). The site, is a private property, located within the Hawkesbury-Nepean Catchment and is located in the Northern Beaches Council Local Government Area (LGA).

Bordered by Joalah Road is the southern boundary and Booralie Road to the North. East and West are private properties (rural residential). Rho-Ker reserve is 3 properties to the east of the site.

The property is divided approximately in half by the creek. The Southern half of the property is developed land with sparse native canopy and patches with native grasses among introduced species. The North is bushland. Native bushland on-site (north) and neighbours east and west – continues west to the National Park and Cowan Creek (Figure 1.2)

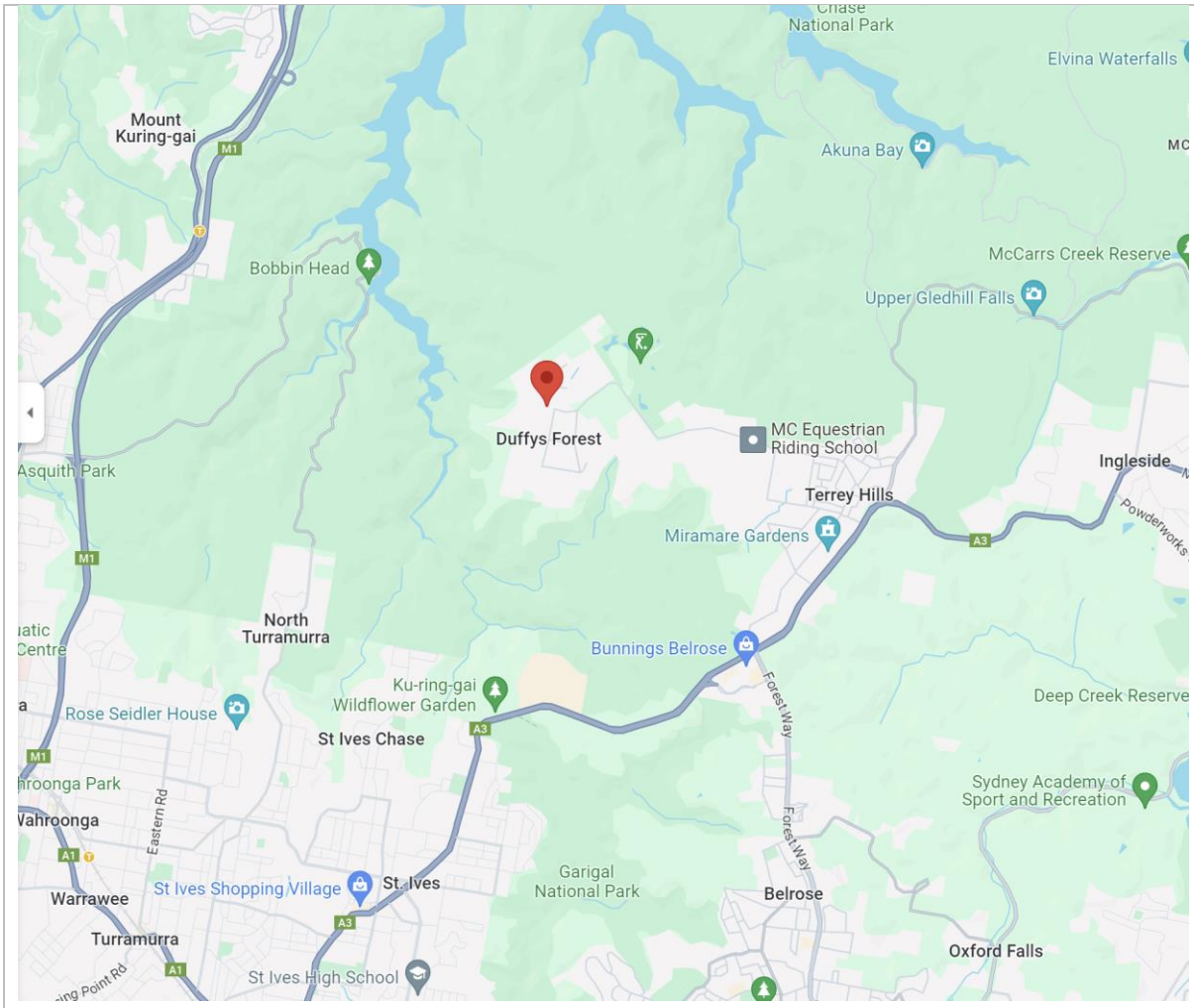


Figure 1.1 general location. Source Google Maps 2023

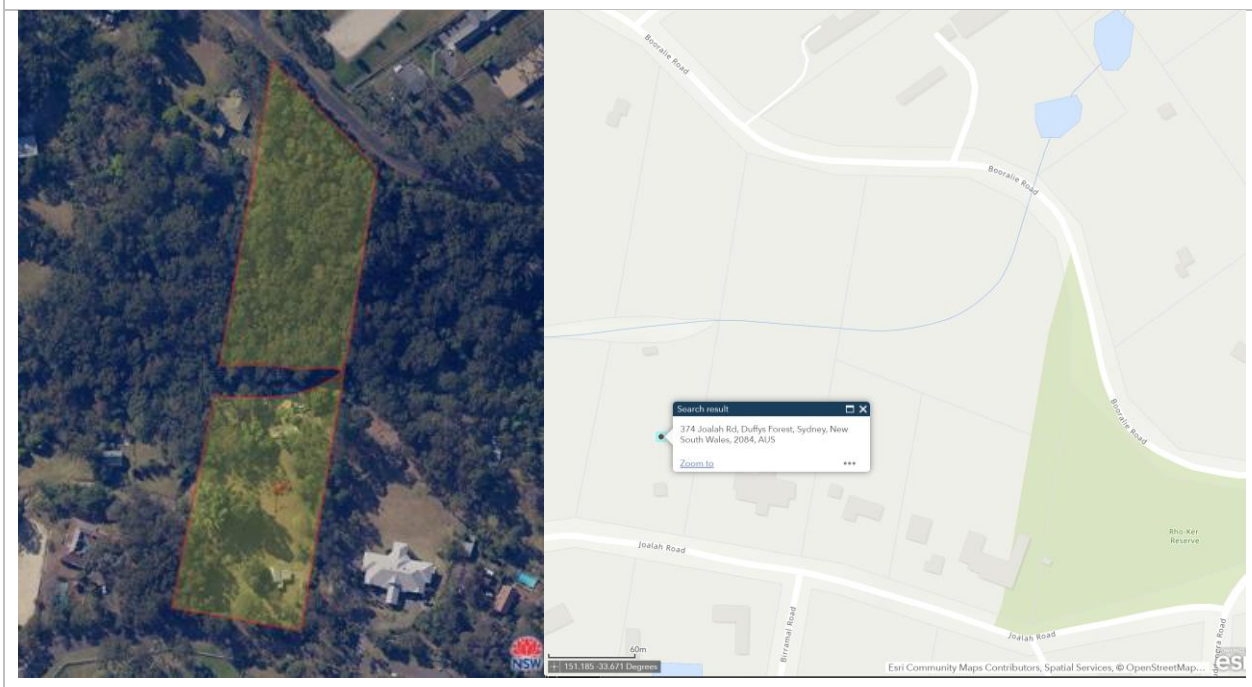


Figure 1.2. Location of the site. Source: SixMaps 2023 (LHS) and Hydro layer of NSW (RHS) Feb 2024

2 Methods

Site inspections were undertaken by Gabriel James in December 2022 and Elaway Dalby-Ball in April 2022 and March 2023 and Dec 2023 to assess the existing site conditions, as well as the characteristics of the unnamed watercourse along the eastern boundary heading west.

2.1 Sources of information used in the assessment

Plans and drawings specific to this development: Architectural Drawings

Guidelines for controlled activity approvals were used in particular:

*Guidelines for **riparian corridors** on waterfront land* DPE Factsheet
https://water.nsw.gov.au/__data/assets/pdf_file/0008/386207/licensing_approvals_controlled_activities_riparian_corridors.pdf

*Guidelines for **vegetation management plans** on waterfront land* DPE Factsheet

https://water.nsw.gov.au/__data/assets/pdf_file/0009/386208/Fact-sheet-Guidelines-for-vegetation-management-plans-on-waterfront-land-May-2022.pdf

*Guidelines for **instream works** on waterfront land* DPE Factsheet

https://water.nsw.gov.au/__data/assets/pdf_file/0005/386204/licensing_approvals_controlled_activities_instream_works.pdf

*Guidelines for **outlet structures** on waterfront land* DPE Factsheet

https://water.nsw.gov.au/__data/assets/pdf_file/0007/386206/licensing_approvals_controlled_activities_outlet_structures.pdf

*Guidelines for **watercourse crossings** on waterfront land* DPE Factsheet

https://water.nsw.gov.au/__data/assets/pdf_file/0010/386209/licensing_approvals_controlled_activities_watercourse_crossings.pdf

Records of ecological considerations from the following databases were collated and reviewed:

- Atlas of NSW Wildlife (BioNet) Office of Environment and Heritage (OEH).
- https://www.lmbc.nsw.gov.au/Maps/index.html?viewer=BOSETMap
- eSPADE v2.2 https://www.environment.nsw.gov.au/eSpade2Webapp/
- Nearmap, SEED Maps, SIX Maps.

Records of Cultural Significance

The *Due Diligence Code of Practice for the Protection of Aboriginal Objectives in NSW* was followed and an AHIMS search done.

2.1.1 Limitations of the Study

Limitations of the study is that the field work occurred over the course of three inspections with differing rainfall preceding the visit. Desk-top information was also used as was on0site evidence of the location of high-flows including the flood period. No specific invertebrate surveys were conducted.

Considering the site and access in different rain events, ECA are confident that the survey and informing this report is representative and that future studies at other times would not change the conclusions in this report.

2.2 Aboriginal Heritage AHIMS

Aboriginal Heritage is not part of a WIS however the principles are considered to ensure recommendations in the WIS are in keeping with appropriate care for country. A very basic review of Aboriginal Heritage has been included in the WIS in relation to the Waterway, drainage line, exposed sandstone and general area.

Impact Permits (AHIP) application and determination process requires an assessment (by the proponent) and evaluation of the Aboriginal heritage values of Aboriginal object(s) and place(s) potentially harmed by an activity. The *Due Diligence Code of Practice for the Protection of Aboriginal Objectives in NSW* (the Code) explains and provides practical guidance about what due diligence means http://www.environment.nsw.gov.au/legislation/NPWamendmentAct2010.

The Code provides practical steps which individuals and organisations who own, manage or use land need to take in order to:

- *Identify whether or not Aboriginal objects are, or are likely to be, present in an area;*
- *Determine whether or not their activities are likely to harm Aboriginal objects; and*
- *Determine whether an Aboriginal Heritage Impact Permit (AHIP) is required.*

There are several benefits to having a due diligence process for assessing potential harm to Aboriginal objects:

- *Assists in avoiding unintended harm to Aboriginal objects;*
- *Provides certainty to land managers and developers about appropriate measures for them to take;*
- *Encourages a precautionary approach;*
- *Provides a defence against prosecution if the process is followed; and*
- *Results in more effective conservation outcomes for Aboriginal cultural heritage.*

Due diligence obliges people whose actions may affect Aboriginal cultural heritage to take reasonable steps to consider if Aboriginal objects may be present and avoid harm to that heritage. If harm cannot be avoided, they are required to apply for an AHIP.

The *Aboriginal Heritage Information Management System* (AHIMS) was used to search for Aboriginal Places, objects and other significant sites https://www.environment.nsw.gov.au/topics/heritage/search-heritage-databases/aboriginal-heritage-information-management-system.

The 'AHIMS Basic Search' indicated zero sites (Aboriginal Places, objects or other significant sites) recorded on or within 200 m of the site, an extensive search has not been conducted.

3 Site Findings

3.1 Waterway

The site contains a 1st order watercourse that flows to Cowan Creek (Figure 3.1a and b)

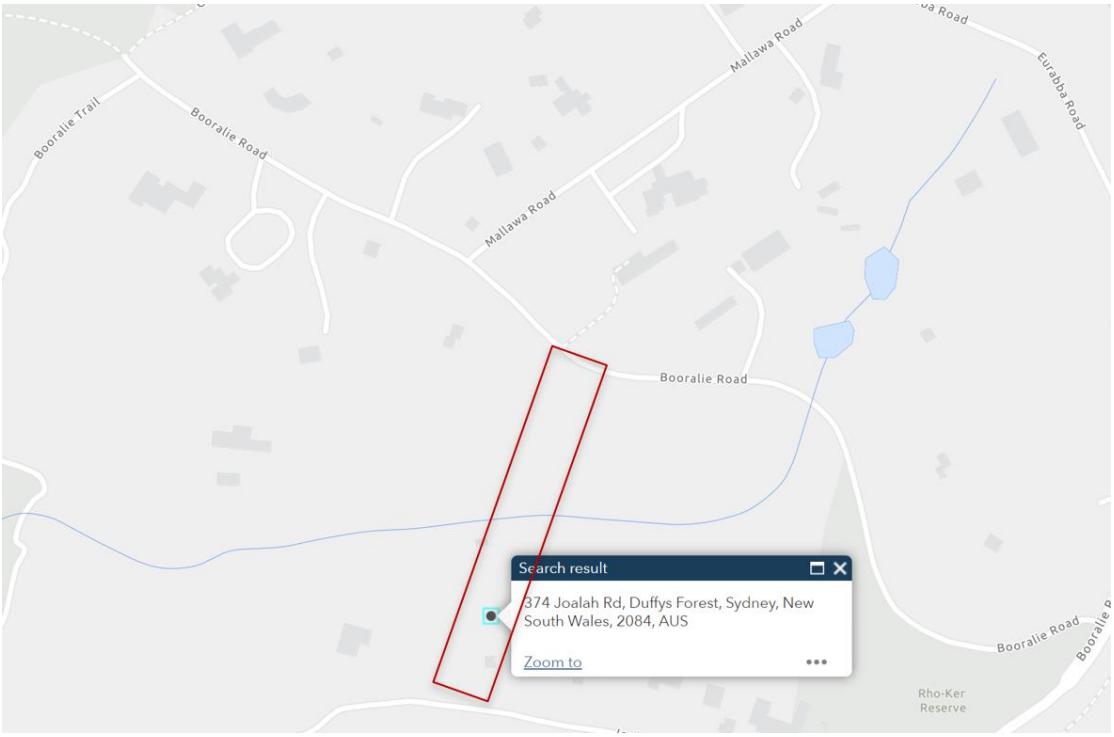


Figure 3.1a First order watercourse that flows to Cowan Creek (Source: Hydroline Mapping Feb 2024)

Figure 3.1b Watercourse that flows to Cowan Creek (Source: Hydroline Mapping Feb 2024)

3.2 Watercourse Characteristics and Existing Drainage

A sandstone rock bed watercourse to 3 m wide with high flow spill over to 5m. Gradient east-to-west direction flowing to Cowan Creek. The Northern bank naturally vegetated Sand stone gully forest. Southern back developed on rock with bushland to east and west. Banks are stable and the rock base has resulted in little to no existing erosion. Occasional high flows through this section (a run) result in no sediment build up here. It's possible that sediment accumulates in downstream areas where runs and riffles flow to pools. See photos below (section 3.2.1).

This site is with a Group B catchment (see Figure 3.2 Warringah DCP 2011). This waterway corridor past the property is continuous bushland to Cowan Creek and into the National Park. Currently there are no threatened aquatic flora/fauna. The creek is in a riparian corridor (Warringah DCP) (see Figure 3.3)

Stormwater discharge points are not within this section of the waterway though upstream areas may have catchment runoff diverted to them. Figure 3.4 shows the stormwater pits and pits locally. Source NBC mapping accessed 2024.

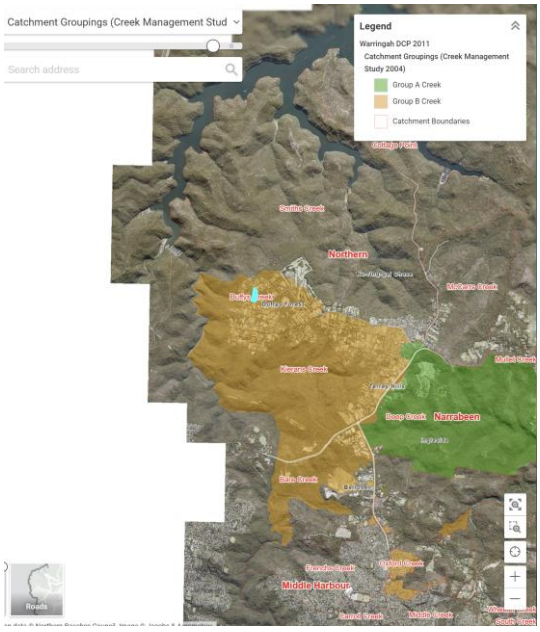


Figure 3.2 The site (aqua) is within a Group B catchment.

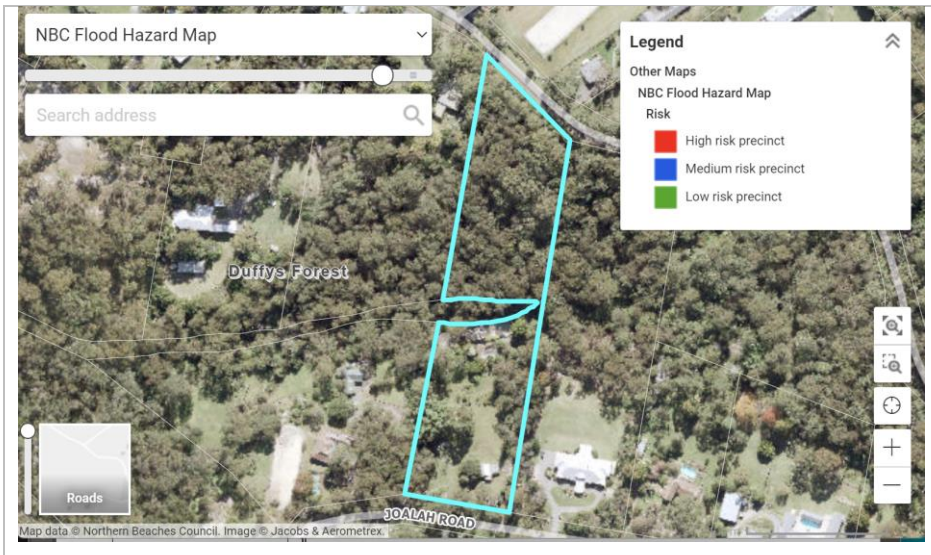


Figure 3.3 Flood map. Source NBC Mapping portal (NBC Flood Hazard map). Accessed Feb 2024.

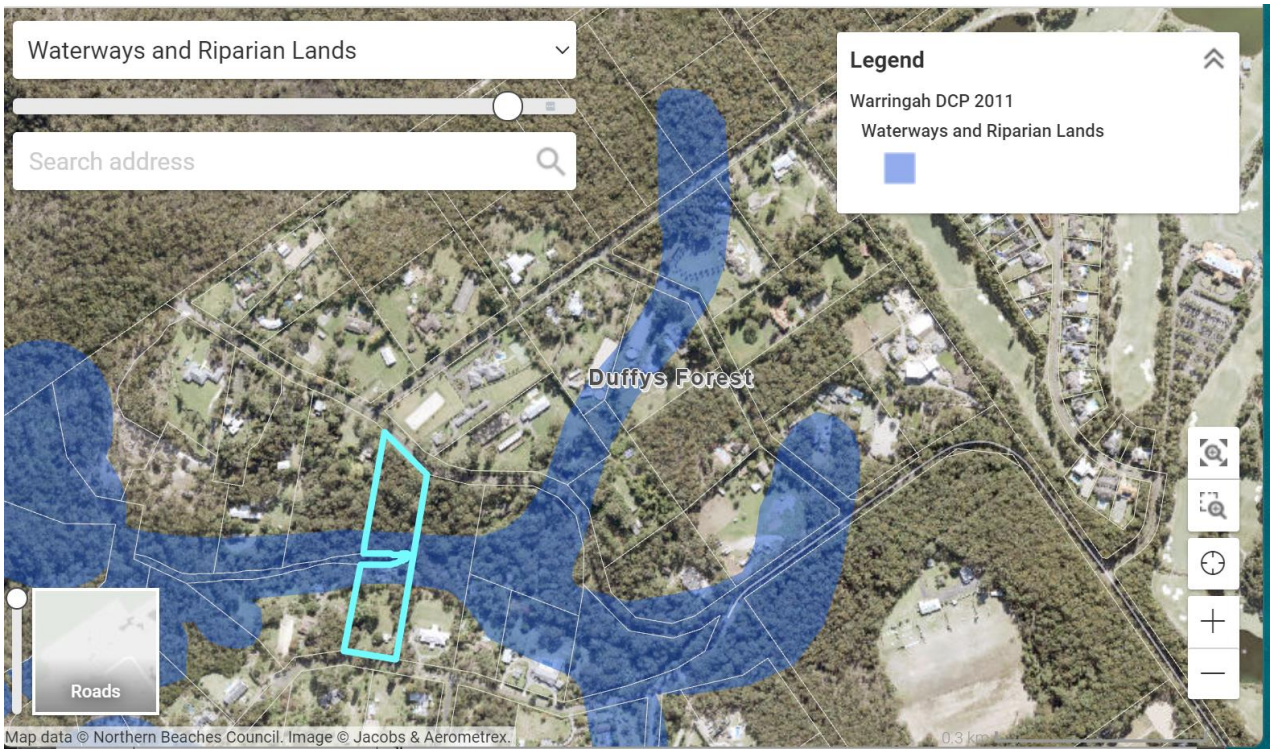


Figure 3.3 The site (aqua blue) is over the riparian corridor. Accessed Feb 2024.

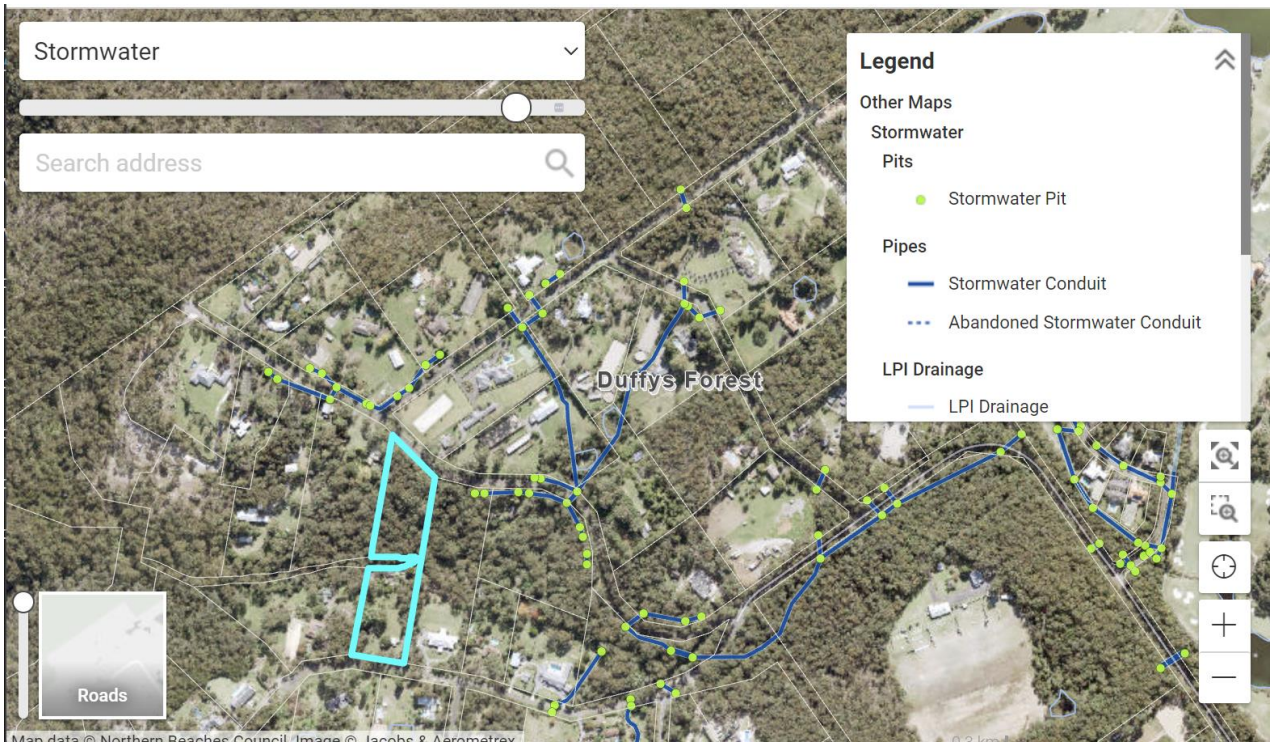
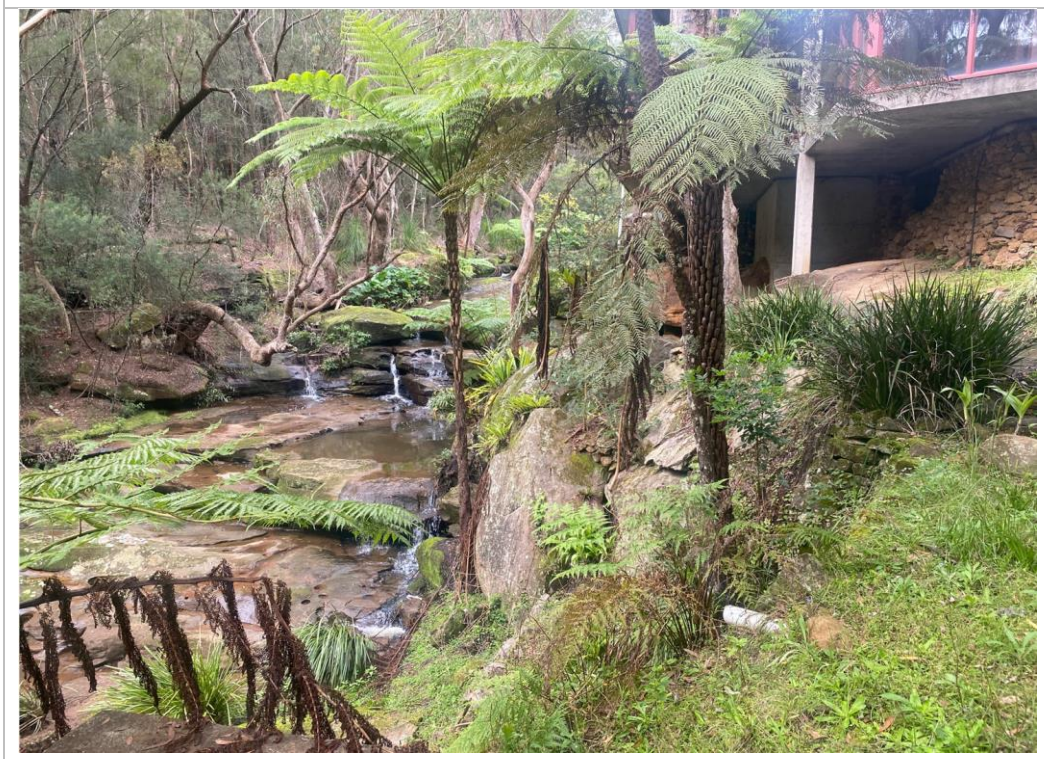


Figure 3.4 Stormwater pits across the catchment in developed areas NBC mapping accessed Feb 2024

3.2.1 Watercourse photos

The middle of the property is bisected by an unnamed creek – photos below.

LHS of photo existing concrete, brick and glass frontage of home on waterway. Concrete and footing are being retained and the dwelling façade is being replaced. Excess bricks under the dwelling will be removed. Upstream looing down (west)



Downstream looking up (east) showing the cascading nature of the waterway and the rock walls under the existing dwelling. This also shows the potential carry capacity for water in this location with the natural high wall south side (dwellign side) and spill over to the north side.

In the waterway creekline looking over sandstone bed rock to the north (existing bushland). Low flows are on this northern side and high flows cover the exposed rock in the photo.

Existing home and infrastructure on edge of waterway. Typical low flow. Sandstone bedrock and cascades in front of dwelling.

Low wall upstream of existing dwelling. Frogs were heard using this pool. Water over tops in highflows and in low flows there is an access up/down on the northern side. There is no ecological benefit (and possibly a loss of habitat type) to removing this. While it is unlikely to be compliant it's not stopping fish passage. Possibly assisting with increased volume of water on the north side. NB *Cenna pendula* (Cassia) to be removed.

Existing open packed rock under concrete slab.

Existing under slab infrastructure to be tidied up / redone.

From existing dwelling looking into the riparian area and creek.

3.2.2 Development though time

Comparisons of the latest (Jan 2024) and earliest (2009) clear aerials (source near map) show little change over that time. Increased tree growth and shadowing in 2024. For this reason 2017 images have been used for overlap mapping as the development and waterway are most clear in this image. All are included as follows in Figure 3.5 Composition aerials from Near Map.

2009

2024

2023

2017 showing top of bank outline (blue) noting that much of the usual flow is away from the dwelling on the northern side.

Figure 3.5 Composite photos set of aerials 2009 to Oct 2023

3.3 Flora and Fauna

A separate Flora and Fauna survey has been done for this development and can be read in conjunction with this WIS for terrestrial ecology matters. Appendix I of this WIS includes the Threatened species lists. In summary in relation to the WIS and riparian area Duffy's Forest Community - threatened vegetation community occurs close to the development footprint. However, the development footprint will not impact upon this community.

Table 3.1. Vegetation Communities

NSW PCT Code	PCT Name	BC Act 2016	EPBC Act 1999
3593	Sydney Coastal Sandstone Bloodwood Shrub Forest	Duffys Forest Community in the Sydney Basin Bioregion Endangered Ecological Community	Not listed
3595	Sydney Coastal Sandstone Gully Forest	Not listed	

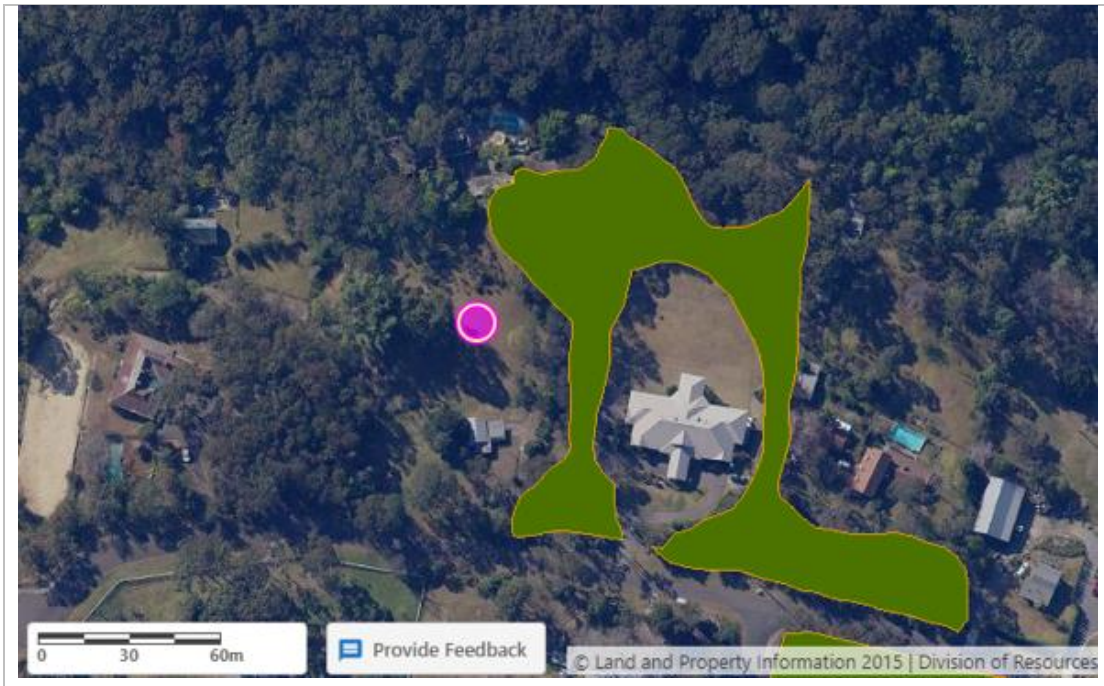


Figure 3.1. Local distribution of the endangered vegetation community.

Red Bloodwood – Silvertop Ash – Stringybark open forest on ironstone in the Sydney region/ Duffy's Forest Community, highlighted in green.

3.3.1 Weeds

Weed management will continue and is best planned in a riparian, fire, vegetation mgt plan to be issued pre OC or CC. Weeds present within the riparian vegetation are subject to Weed Control orders under the Biosecurity Act 2015 including:

- Asparagus Fern (*Asparagus aethiopicus*)
- Camphor Laurel (*Cinnamomum camphora*)
- Lantana (*Lantana camara*)
- Morning Glory (*Ipomea indica*)
- Privet (Broad and Small leaf)
- Cassia (*Senna pendula*)

Crofton weed is also present. Planting and landscaping associated with the works will be in keeping with maximising locally native biodiversity. The details are separate to this WIS (see also ecological report) . Plant species for landscape architects can include those in Table 2.1.

Table 3.2. Additional planting can continue to use these species

Large Trees	Small trees	Shrubs & Sub-shrubs	Geophytes & Herbs	Grasses	Twiners & Creepers
Angophora costata	*Acacia implexa*	*Polyscias sambucifolius*	*Veronica plebeia*	*Entolasia marginata*	*Tylophora barbata*
Angophora floribunda	*Acacia souveolans*	*Acacia longifolia*	*Centella asiatica*	*Entolasia stricta*	*Clematis aristata*
Eucalyptus resinifera	*Clerodendrum tomentosum*	*Myrsine variabilis*	*Commelina cyanea*	*Microlaena stipoides*	*Clematis glycinoides*
Syncarpia glomulifera	*Elaeocarpus reticulatus*	*Breynia oblongifolia*	*Dianella caerulea*	*Oplismenus aemulus*	*Glycine clandestina*
	Pittosporum revolutum	*Bursaria spinosa*	*Dichondra repens*	*Themeda australis*	*Hardenbergia violacea*
	Pittosporum undulatum	*Dodonaea triquetra*	*Goodenia hederacea*		*Kennedia rubicunda*
	Allocasuarina torulosa	*Indigofera australis*	*Lepidosperma laterale*		*Pandorea pandorana*
		Notolaea longifolia	*Lomandra longifolia*		*Smilax glyciphylla*
		Rubus parvifolia	*Pratia purpurascens*		

** Vegetation to be planted from Sandstone Gully Forest community is to be local provenance stock (from within 10km of the site or as far as pollinators/ dispersal areas mitigate. Noting any revegetation will have to be compliant with bushfire mgt requirements.*

4 Proposed actions

4.1 Proposed Development Activities

The proposed development is alterations and additions including to the existing dwelling, carport, and pool area. See detailed drawings in DA package. In summary all planned works are internal and in the footprint with the exception of the awning (shown in purple). This extends 30cm further north that the existing foot print over a small area (see aqua blue outline in Figure 4.1). Internal works have also been considered in terms of possible impacts during construction.

A CEMP with a focus on water / riparian health will be able to cover the possibly impacts from development. This is particularly so as works are, for the most part above the suspended concrete slab of the existing dwelling.

Figure 4.1 Proposed works area. White is for alterations and purple is an addition.

NB: Development Application relates to establishment of a new awning (pavilion) adjoining the existing house to the east of the dwelling near the pool. Pavilion and awning are interchangeable terms as the design plans refer to both when discussing that structure.

Figure 4.2 shows the extent of existing development within the full riparian corridor (10m) from top of bank. Of this just under 300m2 is built form and an additional 100m2 is paving. The paving and stone steps (purple).

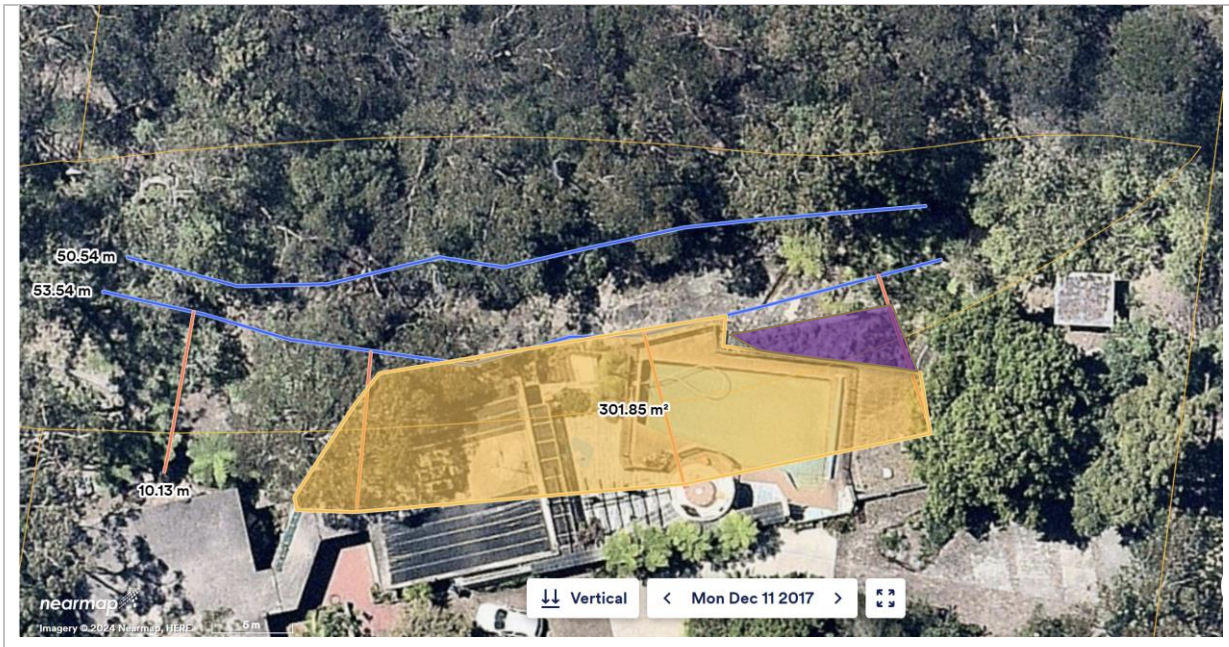


Figure 4.2 Extent of existing development within the riparian corridor (10m). Yellow built form and paving. Purple additional lower level paving.

Encroachment into the riparian area is in the outer 50% (5m) and totals 170m^2. The riparian is 10m setback from top of bank hydroline/waterway location to the boundary line of northern side. It totals 300m^2 of existing encroachment. Encroachment into the outer 50% is permissible in the Water Mgt Act providing the averaging rule is applied.

Area outside of the 10m setback and being retained and managed in accordance with the Objectives of the Water Mgt Act (retention of all north side riparian bank to 30m (over 1000 m^2). This area provides ~3.5 x the area of encroachment as averaging out. The Act typically requires 1:1 so the sites compensation is more than required.

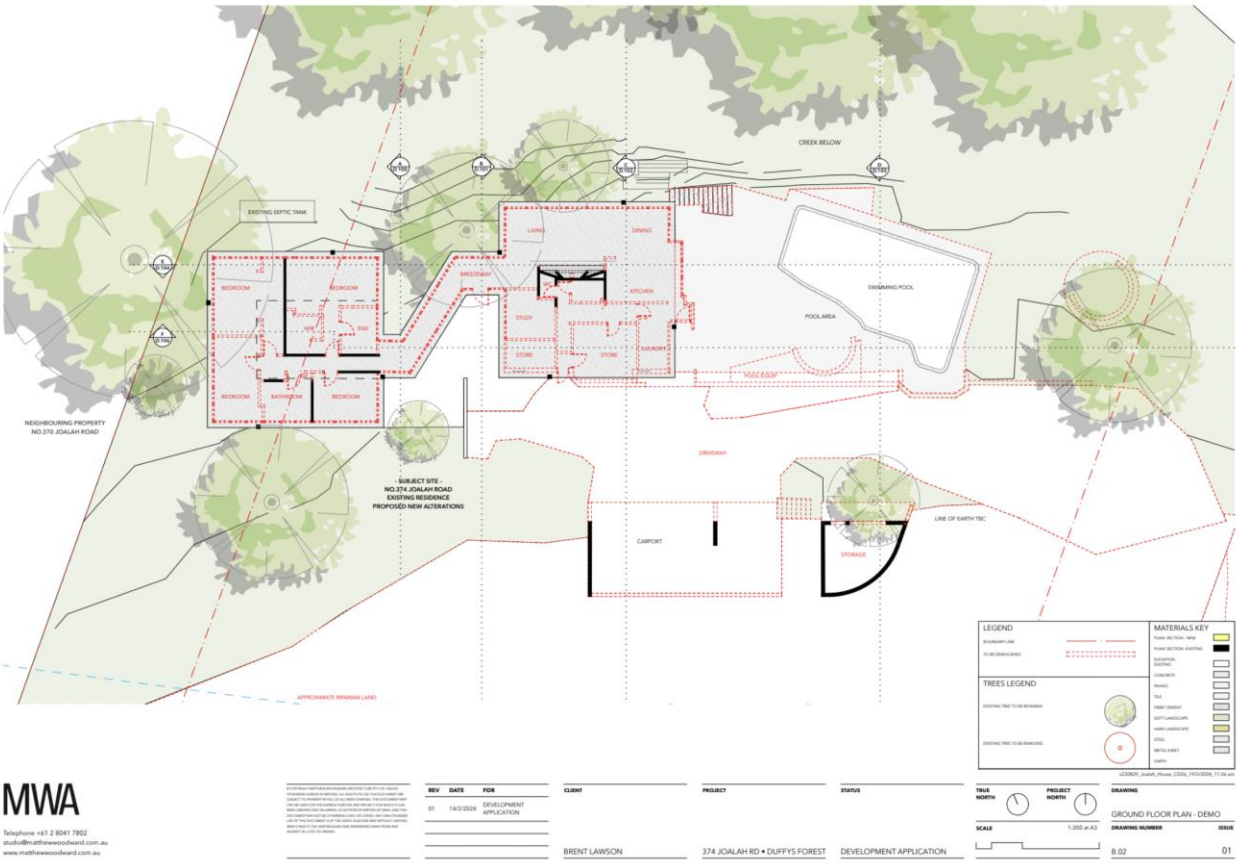


Figure 4.3 works area in red outline.

5 Waterfront Land Guidelines

Controlled activities on waterfront land - *Guidelines for riparian corridors on waterfront land NSW Office of Water* include where how offsetting is to be applied and what can be built on/over waterways. Being a first order waterway there is a 5m inner (core) riparian zone) and an out 5m riparian zone (10m total from top of bank).

5.1 Riparian corridor width

The riparian zone has been calculated from the edge of the stone wall in higher section and bank in lower section. As per the Guideline: The department recommends a VRZ width based on watercourse order as classified under the Strahler System of ordering watercourses (see Figure 4.1). This was applied and the waterway is a 1st Order creek.

Figure 2. The Strahler system

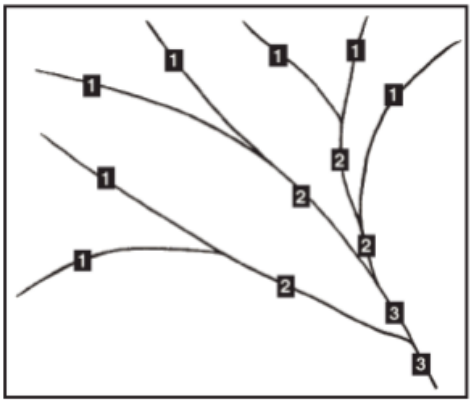


Table 1. Recommended riparian corridor widths

Watercourse type	VRZ width (each side of watercourse)	Total RC width
1st order	10 metres	20 m + channel width
2nd order	20 metres	40 m + channel width
3rd order	30 metres	60 m + channel width
4th order and greater (includes estuaries, wetlands and any parts of rivers influenced by tidal waters)	40 metres	80 m + channel width

Note: where a watercourse does not exhibit the features of a defined channel with bed and banks, the department may determine that the watercourse is not waterfront land for the purposes of the WM Act.

.

Figure 5.1 the Strahler System of ordering watercourses. Source: DPE Controlled activities – Guidelines for riparian corridors on waterfront land

5.2 Off-setting

Where a structure (as defined in Guidelines and includes dwellings) is proposed in the outer 50% the riparian zone that area can be offset within the same watercourse providing an existing native vegetation riparian zone is not already present (see Figure will show where the offset will be located. The site condition is covered by this due to the area of proposed encroachment not being an existing vegetated riparian area.

Bridges, cycleways, paths, stormwater outlets and other essential services do not need to be offset but must comply with the requirements set out in the riparian corridor matrix (Table 2) and other relevant departmental controlled activities guidelines. Offline detention basins do not need to be offset so long as there is an equivalent VRZ for the corresponding watercourse and they are built in compliance with the department's Guidelines for watercourse crossings and Guidelines for instream works. If a proposed basin will not have an equivalent VRZ for the corresponding watercourse, it may still be built in the outer 50% of the VRZ but must be offset.

Averaging has focused on consolidating areas of natural vegetation – lower portion of the site.

Figure 3. Averaging rule

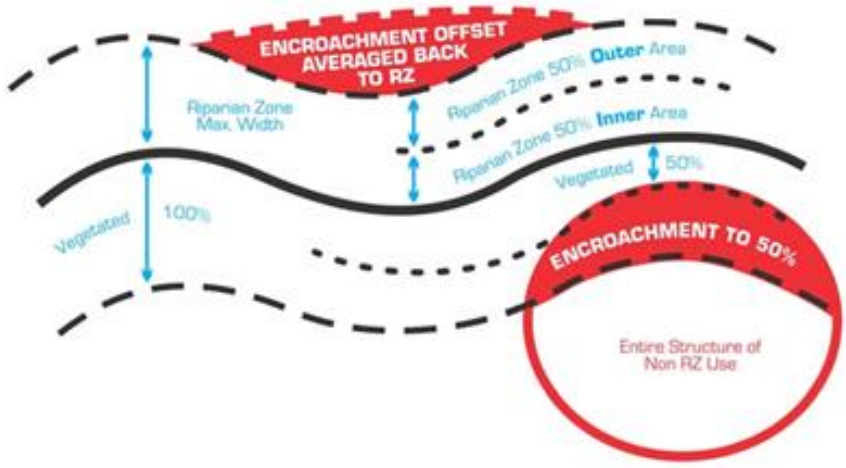


Figure 5.2. Offsetting process (Guidelines Office of Water).

Extract from the Guideline

- the core riparian zone and vegetated buffer have been combined into a single vegetated riparian zone (VRZ)
- the width of the VRZ within the riparian corridor has been pre-determined and standardised for first, second, third and fourth order and greater watercourses
- where suitable, applicants may undertake non-riparian corridor works or development within the outer 50% of a VRZ, as long as they offset this activity by connecting an equivalent area to the RC within the development site
- a 'riparian corridors matrix' enables applicants to determine what activities can be considered in riparian corridors.

https://water.dpie.nsw.gov.au/__data/assets/pdf_file/0008/386207/licensing_approvals_controlled_activities_riparian_corridors.pdf

5.3 What is Permitted in a First Order Waterway

The types of activities permitted, and the locations permitted, are summarised in the table below (extract from guidelines). https://water.dpie.nsw.gov.au/__data/assets/pdf_file/0008/386207/licensing_approvals_controlled_activities_riparian_corridors.pdf

Riparian corridor matrix. Source: NSW Office of Water

Table 2: Riparian corridor matrix

Stream order	VRZ	RC offsetting for non-RC uses	Cycleways and paths	Detention Basins		Stormwater outlet structures and essential services	Stream realignment	Road crossings		
				Only within 50% outer VRZ	Online			Any	Culvert	Bridge
1st	10m	•	•	•	•	•	•	•		
2nd	20m	•	•	•	•	•		•		
3rd	30m	•	•	•		•			•	•
4th +	40m	•	•	•		•			•	•

Source: *Controlled activities on waterfront land - Guidelines for riparian corridors on waterfront land* NSW Office of Water

Key

- **Stream order:** The watercourse order as classified under the Strahler System based on 1:25,000, 1:50,000 or 1:100,000 topographic maps whichever is the smallest scale available. A full list is provided at Part 2, Schedule 2 of the Water Management (General) Regulation 2011.
- **Vegetated riparian zone (VRZ):** The required width of the VRZ measured from the top of the high bank on each side of the watercourse.
- **Riparian corridor (RC) off-setting for non RC uses:** Non-riparian uses, such as Asset Protection Zones are allowed within the outer 50 per cent of the VRZ, so long as offsets are provided in accordance with the averaging rule as seen in Figure 3.
- **Cycleways and paths:** Cycleways or paths no wider than four metres total disturbance footprint can be built in the outer 50 per cent of the VRZ.
- **Detention basins:** Detention basins can be built in the outer 50 per cent of the VRZ or online where indicated. Refer to the Office of Water's *Controlled activities. Guidelines for outlet structures* and *Controlled activities. Guidelines for instream works*. Online basins must:
  - be dry and vegetated
  - be for temporary flood detention only with no permanent water holding
  - have an equivalent VRZ for the corresponding watercourse order
  - not be used for water quality treatment purposes.
- **Stormwater outlet structures and essential services:** Stormwater outlets or essential services are allowed in the RC. Works for essential services on a fourth order or greater stream are to be undertaken by directional drilling or tied to existing crossings. Refer to the Office of Water's *Controlled activities.*
- *Guidelines for laying pipes and cables in watercourses* and *Controlled activities. Guidelines for outlet structures.*
- **Stream realignment:** Indicates that a watercourse may be realigned. Refer to the Office of Water's
- *Controlled activities. Guidelines for instream works.*
- **Road crossings:** Indicates permitted road crossing methods. Refer to the Office of Water's *Controlled activities. Guidelines for watercourse crossings* and NSW DPI policy and guidelines for fish friendly waterway crossings for Class 1 and 2 waterways.

Thus for the Waterway (marked hydroline) the works proposed are consistent with the guidelines with the exception of the core (inner 50%) and this is existing.

6 Assessment of Impacts

6.1 Direct Impact

A 30cmover hang of the proposed awning will not be an impact of any significance. All other works are within the existing foot print. Direct impacts from works will be minor as all works can occur from the landward side of the development. See Figure 6.1 showing stock piles areas, clear site access and location for sediment controls. Purple line is the approximate 10m set back from top of bank.

The key activity to manage is the replacement of tiles that are at the lower level as brief exposure of the soil may (if there is heavy rain or large flow) mobilize sediment to the watercourse. This is unlikely as the creek only flows on the side near the dwelling in high events (5 / year type) and works can be planned to avoid and mitigate if weather is unfavorable.

A CEMP pre CC for specific works and activities during the construction will adequately address any construction direct impact potentials.

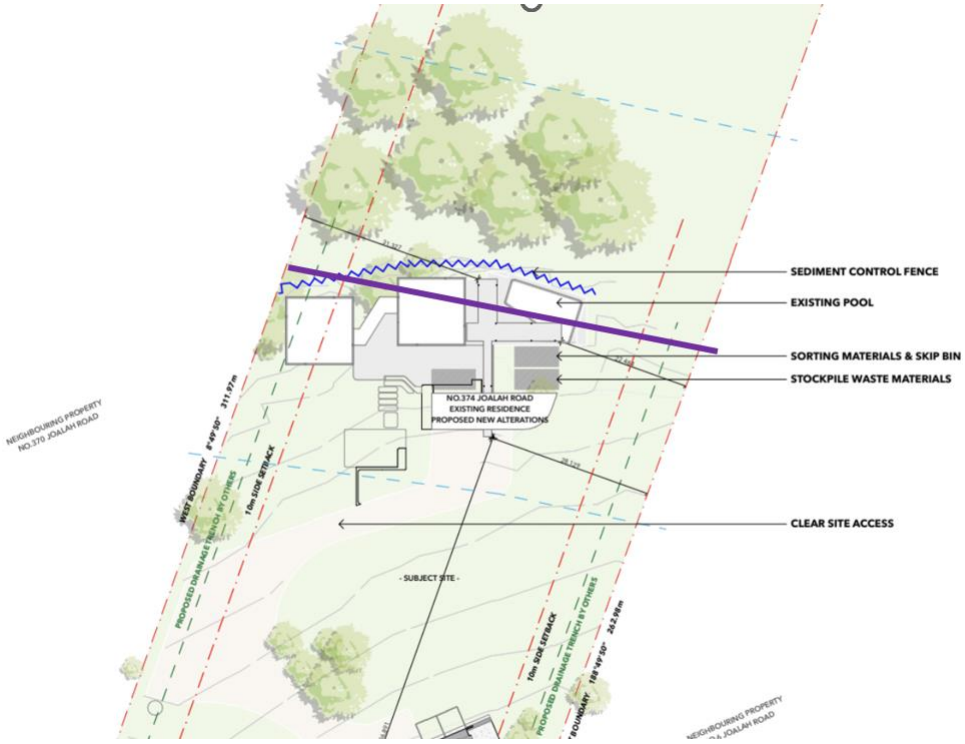


Figure 6.1 showing stock piles areas, clear site access and location for sediment controls.

6.2 Indirect impacts

The proposed actions may result in a range of minor indirect impacts as follows:

6.2.1 Flows

No change in flow volume or velocity expected – same area of impervious surface. Possibly with a slower release rate due to new stormwater management (OSD).

6.2.2 Weed growth and invasion

Excessive or biosecurity weeds must be managed to stop the spread into other areas – this has started and would be part of the on-going riparian, fire, vegetation management plan. This could be requested pre OC if CEMP managing works from CC to OC.

6.2.3 Run-off and sedimentation

The proposed actions must manage sediment / silt in all sages of works and after. This will be as per plans and CEMP and on-going.

7 Compliance with the NBC LEP and DCP

7.1 Pittwater Local Environmental Plan 2014

7.1.1 Zone C4 Environmental Living

The planning documents have covered the compliance with the C4 zoning.

Zone C4 Environmental Living

1 Objectives of zone

- To provide for low-impact residential development in areas with special ecological, scientific or aesthetic values.
- To ensure that residential development does not have an adverse effect on those values.
- To provide for residential development of a low density and scale integrated with the landform and landscape.
- To encourage development that retains and enhances riparian and foreshore vegetation and wildlife corridors.

2 Permitted without consent

Home businesses; Home occupations

3 Permitted with consent

Bed and breakfast accommodation; Boat sheds; Building identification signs; Business identification signs; Centre-based child care facilities; Community facilities; Dwelling houses; Environmental protection works; Group homes; Health consulting rooms; Home-based child care; Home industries; Jetties; Oyster aquaculture; Places of public worship; Pond-based aquaculture; Respite day care centres; Roads; Secondary dwellings; Tank-based aquaculture; Water recreation structures

4 Prohibited

Industries; Local distribution premises; Service stations; Warehouse or distribution centres; Any other development not specified in item 2 or 3

7.1.2 Biodiversity

The development is compliant with biodiversity – particularly if weeds are removed and a full suite of Sydney Sandstone Gully and Littoral Rainforest specie are planted and established here.

The site is classified as “Biodiversity” on the Pittwater Biodiversity Map (Figure 5.1) and therefore subject to Clause 7.6 of the Pittwater Local Environmental Plan (LEP) 2014.

The objective of this clause is to maintain terrestrial, riparian and aquatic biodiversity by–

(a) protecting native fauna and flora, and

(b) protecting the ecological processes necessary for their continued existence, and

(c) encouraging the conservation and recovery of native fauna and flora and their habitats.

Development consent must not be granted to development on land to which this clause applies unless the consent authority is satisfied that–

(a) the development is designed, sited and will be managed to avoid any significant adverse environmental impact, or

(b) if that impact cannot be reasonably avoided by adopting feasible alternatives—the development is designed, sited and will be managed to minimise that impact, or

(c) if that impact cannot be minimised—the development will be managed to mitigate that impact.

7.2 Pittwater 21 Development Control Plan

7.2.1 B5.13 Development on Waterfront Land

The development is compliant with clause B5.13

B5.13 Development on Waterfront Land

Land to which this control applies

All land in the Pittwater LGA not including the Pittwater waterway or Warriewood Valley land release area - P21DCP-BCMDCP037

Uses to which this control applies

Attached dwelling; Boarding house; Business Development; Child care centre; Development ancillary to residential accommodation; Dual occupancy (attached); Dual occupancy (detached); Dwelling house; Exhibition home; Group home; Hospital; Hostel; Industrial Development; Multi dwelling housing; Other Development; Residential flat building; Rural industry; Rural worker's dwelling; Secondary dwelling; Semi-detached dwelling; Seniors housing; Shop top housing; Subdivision

Outcomes

- Protection of waterways and improved riparian health (En)
- Stormwater and creek flows are safely managed (S)
- Appropriate setback between waterways and development (En)
-

Controls

- Any waterfront land (as defined in the Water Management Act 2000) on the property shall be retained in their natural state to: carry stormwater/flood flows, maintain aquifers, retain stability, and provide habitat functions.
- Natural or artificially modified water courses cannot be diverted onto adjoining lands, filled, channelised and/or dammed.
- Waterfront land in a degraded state, should be restored and rehabilitated.

- Development within waterfront land shall incorporate appropriately sized riparian corridor zones into the design based on Controlled Activities on Waterfront Land: Guideline for outlet structures on waterfront land (NSW Office of Water, July 2012).
- Development adjoining waterfront land is to be landscaped with local native plants.
- Council encourages the replacement of a piped stormwater system where appropriate with a restored watercourse with appropriate flow carrying capacity, wherever feasible.
- The piping or artificial channelling of natural watercourses and drainage channels is not permitted.
- A Water Management Plan with supporting documentation is to be submitted demonstrating the feasibility of the proposed watercourse works within the site.
- Structures Over and Adjacent to Easements, Piped Drainage System or Natural Watercourses

  No encroachments or low lying overhangs of the development are permitted over natural water courses. Structural support elements are not permitted within the cross sectional area of a natural watercourse. Structural support elements adjacent to a natural water course located on the development site or on adjacent lands must be founded on a stable foundation to the depth directed by a geotechnical engineer.

Variations

- Variations may be considered when an activity or work is permissible with a controlled activity approval from the NSW Office of Water.
- Variations will be considered where the activity or work is required to mitigate risk including: landslip; geotechnical risk; flooding; erosion; risk to utilities; and bushfire hazard.

Advisory Notes

- Waterway design is to be in accordance with guidelines such as:
- Controlled Activities on Waterfront Land: Guideline for instream works on waterfront land (NSW Office of Water, July 2012).
- Controlled Activities on Waterfront Land: Guideline for riparian corridors on waterfront land (Natural Resources Access Regulator May 2018).
- Controlled Activities on Waterfront Land: Guideline for vegetation management plans on waterfront land (NSW Office of Water, July 2012).
- Natural Channel Design (Brisbane City Council, 2003)
- Constructed Waterways in Urban Developments Guidelines (Melbourne Water Corporation, 2009).

Estuarine Hazard Controls

Reference is made to Estuarine Hazard Controls in this DCP and Appendix 7 Estuarine Risk Management Policy for Development in Pittwater: No estuary at this site.

Landslip Controls

Reference is made to Landslip Controls in this DCP and Appendix 5 Geotechnical Risk Management Policy for Pittwater

Flood Controls

Reference is also made to Flood Controls of this DCP and Flood Risk Management Policy.

7.3 Northern Beaches Water Management for Development Policy

The stormwater plan to accompany this proposal includes assessment of the water quality aspects and details all aspects of stormwater from the development reaching the waterway and the drainage line. The Waterway has been historically altered in the upper portion (near existing dwelling and above to road) with rock lining and low walls. Keying in of stormwater will be in keep with this and the Guidelines https://water.dpie.nsw.gov.au/__data/assets/pdf_file/0007/386206/licensing_approvals_controlled_activities_outlet_structures.pdf

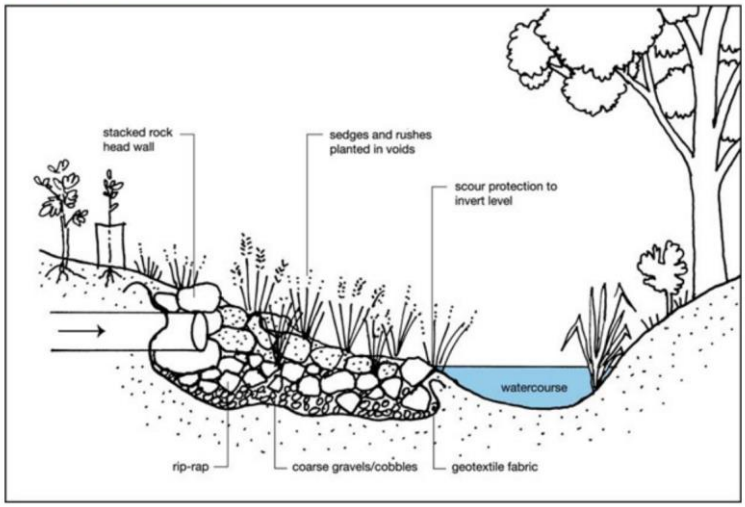
Implementation of the guidelines also takes into account the retention of native vegetation within the corridor and the rock lined sections of the creek.

If there is stormwater to enter the creek the following is proposed: in general the erosive force from water out of an inlet pipe is x13 the diameter of the pipe – hence the inlet needs to be 13x back and / or have sufficient protection between outlet and waterway to stop such erosion potential. The Guidelines show this set back and describe it. Designed for a large and more natural creek the guidelines have been adapted to achieve the best on-ground environmental outcomes. It's noted that the Guidelines are based on information from the author over the past 20 yrs working in urban waterways.

Aims and objectives for outlet structures

The design and construction of stormwater outlets should aim to be natural yet provide a stable transition from a constructed drainage system to a natural flow regime as seen in Figure 1.

Figure 1: Natural outlet structure



While the above is ideal in areas that do not yet have vegetated riparian corridors it is being modified to retain native vegetation while achieving the erosion mgt and biodiversity outcomes.

Under the Northern Beaches Water Management for Development Policy (WM Policy), Table 5 – General Stormwater Quality Requirements apply (see below).

The water way is a collector for the catchment as well as from the existing and proposed dwellings.

Table 5 – General Stormwater Quality Requirements

Pollutant	Performance Requirements
Total Phosphorous	65% reduction in the post development mean annual load[1]
Total Nitrogen	45% reduction in the post development mean annual load[1]
Total Suspended Solids	85% reduction in the post development mean annual load[1]
Gross Pollutants	90% reduction in the post development mean annual load[1] (for pollutants greater than 5mm in diameter)
pH	6.5 - 8.5
Hydrology	The post-development peak discharge must not exceed the pre-development peak discharge for flows up to the 50% AEP

[1]The percentage reduction in the post development mean annual loads are relative to the loads from the proposed development without treatment applied.

Under the Northern Beaches Water Management for Development Policy (WM Policy), Table 5 – General Stormwater Quality Requirements apply. To demonstrate compliance with the relevant stormwater performance requirements, a model preferably through the Model for Urban Stormwater Improvement Conceptualisation (MUSIC), or an equivalent, widely accepted model or methodology must be provided. In this case, the applicant must demonstrate that the proposed lots would be able to achieve the required water quality parameters. A MUSIC model has not been provided.

All stormwater treatment measures must be designed in accordance with the requirements of this Policy and Northern Beaches Council's WSUD and MUSIC Modelling Guidelines (Appendix 1) and modified for local conditions as appropriate. Stormwater treatment measures must be part of a unified design for the project and contribute to a positive urban design outcome, visually and physically integrated with the adjacent built and natural environment. For guidance on integration with the natural environment, refer to the Guidelines for outlet structures on waterfront land (May 2022).
Note, Council is unlikely to support rock gabions as part of outlet design.
No encroachments or low lying overhangs of the development are permitted over natural water courses.

The stormwater plan to accompany this proposal includes assessment of the water quality and modelling. From site inspections and review of live footage during the flood times I'm confident the waterway will handle flows (and reduced porous area) that will come from the development area. Sydney Sandstone rocky creeks are typically full flow, trickle and intermittent based on catchment falls. This waterway, although modified, provides this functionality and will continue to do so post development.

7.3.1 Other relevant clauses

Control D4.10 of the Pittwater 21 Development Control Plan (DCP).

Controls

- *The total landscaped area on land zoned R2 Low Density Residential or E4 Environmental Living shall be 60% of the site area.*
- *The use of porous materials and finishes is encouraged where appropriate.*
- *Any alterations or additions to an existing dwelling shall provide a minimum 60% of the site area as landscaped area.*

Figure 8.1. Pittwater Landscaped Area Map. Source: Northern Beaches Mapping https://nb-icongis.azurewebsites.net/index.html

The relevant environmental (B4) DCP Controls (B4.2, 4.2 and 4.22) have been addressed in the Flora and Fauna report. As they relate to the Waterway the implementation of the *Waterway Plan* will contribute to compliance with the Outcomes of those controls (summarised below).

Outcomes (Summary from B4.2, 4.2 and 4.22)

The long-term viability of locally native flora and fauna and their habitats and the retention and enhancement of wildlife corridors in the Pittwater LGA. (En)

Conservation, enhancement and/or creation of habitats for locally native flora and fauna to ensure the long-term viability of locally native flora and fauna and their habitats. (En)

Controls

- Development shall retain and enhance habitat for threatened species, endangered populations, endangered ecological communities and other locally native species.
- Development shall provide wildlife corridors via creation, restoration, and / or regeneration of habitat.
- Development shall result in no significant onsite loss of canopy cover and no net loss in native canopy trees.
- Development shall ensure that at least 80% of any new planting incorporates native vegetation (as per species listed in Native Plants for Your Garden available on the Council website or the Plant Community Type (PCT)).
- Landscaping is to be outside areas of existing bushland and should not include environmental weeds.
- Planting is to maximise linkage to the wildlife corridor.
- Development shall not negatively impact on threatened species, endangered populations or endangered ecological communities.
- Development shall provide an adequate buffer to wildlife corridors.
- Caretakers of domestic animals shall prevent them from entering wildlife habitat areas.

8 Mitigation Measures

8.1.1 Management Plans

A CEMP is best conditioned for the project to cover the project from CC to OC.

A Riparian, Fire, Vegetation Mgt plan to cover the project from OC to for the life of the development is recommended pre OC.

8.1.2 Delineation of work areas

During the development, impacts to the site and the vegetation to be retained should be minimised by the delineation of work areas. Access to the site would be best restricted to the development footprint only. An exclusion zone will be established for the vegetation outside the work areas.

8.1.3 Tree protection

Tree protection is to be consistent with industry standards. It is recommended to seek advice from a qualified arborist or ecologist when installing tree protection measures. The main trees to be protected are those within proximity to the proposed works.

8.1.4 Native species planting and natural regeneration in Riparian Zone

The Planting schedule will include a diversity of local provenance species from the relevant native vegetation communities that occur, or once occurred on site. The plan can be commissioned for pre CC and will be in accordance with the Guidelines for plans from DPE (Office of Water) Guidelines and these are consistent with Council's requirements for VMPs. Currently there are palms exotic to the location that can be either replaces or plated around to increase the diversity and have species representative of the appropriate community.

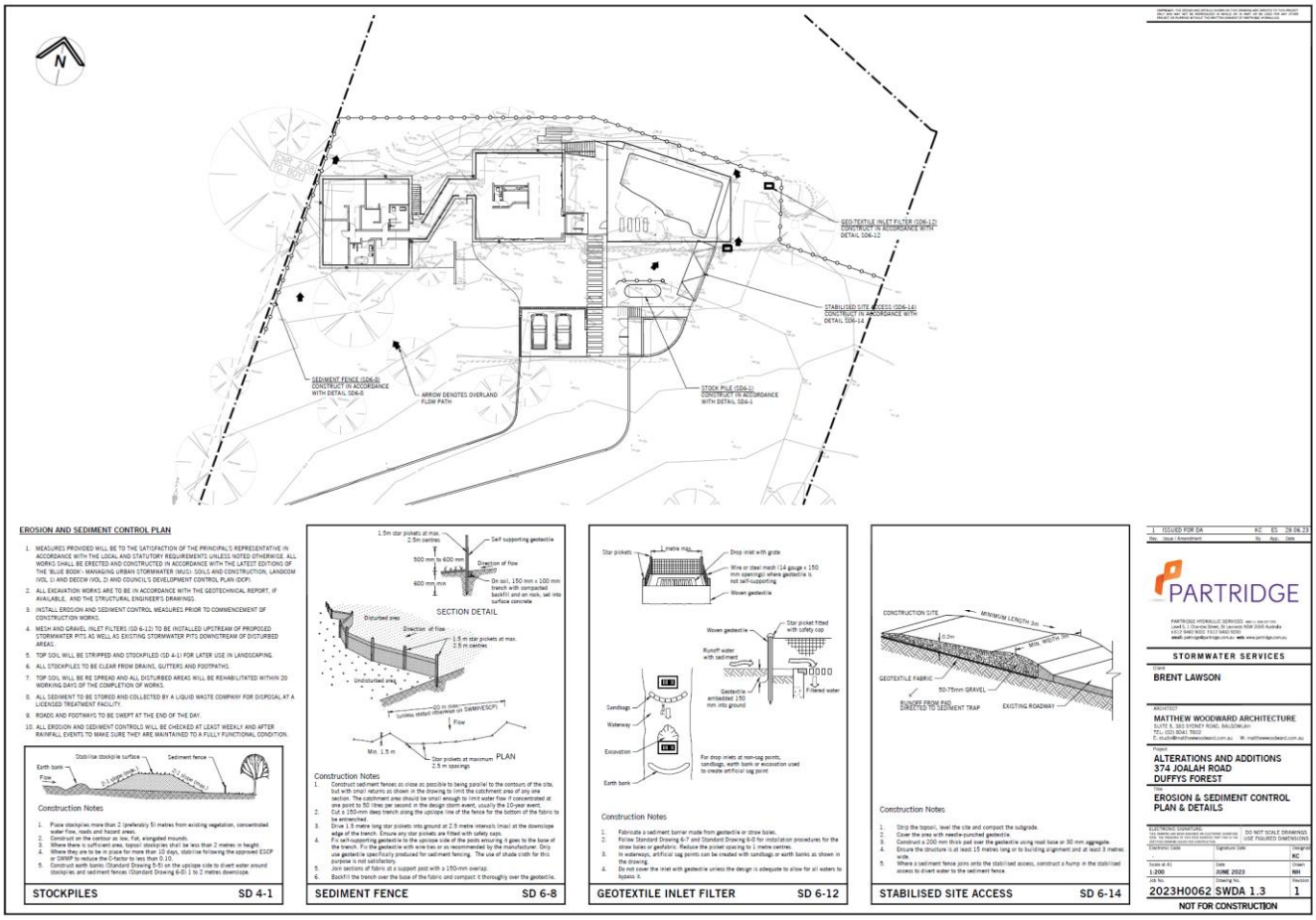
8.1.5 Erosion and sediment control

Erosion and sediment control measures are to be implemented. See plan by Partridge (extract included below).

Erosion and sediment controls measures are to be revised during site inspections and/or after significant rainfall (more than 10mm in 24 hours resulting in site runoff).

Control measures must ensure that no settlement of sediment or silt occurs within areas of vegetation to be retained. Sediment fencing should be retained for a long as practicable. If removed, then monitoring is required to ensure flows do not concentrate and cause further erosion. If concentrated flows do occur and/or erosion gullies develop then coir log baffles are required.

The CEMP will include details on check list for pre works, during and in / pre / post storm events.



8.1.6 Re-vegetation Works and habitat enhancement - Preservation of Habitat Features

Revegetation works will consists of assisted natural regeneration, weed removal to prompt native species to grow and, where required, planting to achieve the desired density, diversity and strata.

Species recommended for planting from the existing vegetation communities and would be included in a Riparian Plan. Habitat enhancement is recommended and will benefits local species including the below. The project should salvage and reuse any existing logs on the ground.

Beaded Dragon

Water Dragon

8.1.7 Weed control

Weeds must be managed to prevent further spread. There must be continuous maintenance of the vegetation on-site otherwise increase weed growth may result. Weeds will colonize and pioneer on any cleared grounds, therefore must be managed during works as well as ongoing post-works.

It is recommended to seek advice from a qualified bush regenerator or ecologist prior to conducting weed removal works.

All bush regeneration activities requiring the use of chemicals must be performed in accordance with the NSW *Pesticides Act* 1999. The weed removal program aims to be broad in approach and sustained in application to provide the best possible conditions for natural regeneration and to control weeds within the site.

8.1.8 Pathogen prevention

To prevent the introduction of pathogens, Bushland Hygiene Protocols outlined in Appendix III should be followed. The site is considered to be an area that may promote the spread of Phytophthora (a group of fungus-like diseases affecting plants) due to its moist soil and proximity to the drainage channel. It is recommended that Bushland Hygiene Protocols be followed closely.

9 Appendices

9.1 Appendix I Threatened Flora / Fauna in vicinity (10km)

BioNet records within 10km of the study site had 27 species currently listed as vulnerable or endangered under state and/or commonwealth legislation. The vulnerable and endangered species to focus on-site searches for can be seen in Table 4.1 below. This is based on likelihood of occurrence. All were searched for – none found. *Grevillea caleyi* is present in the ground of the nearby Baha'i Temple.

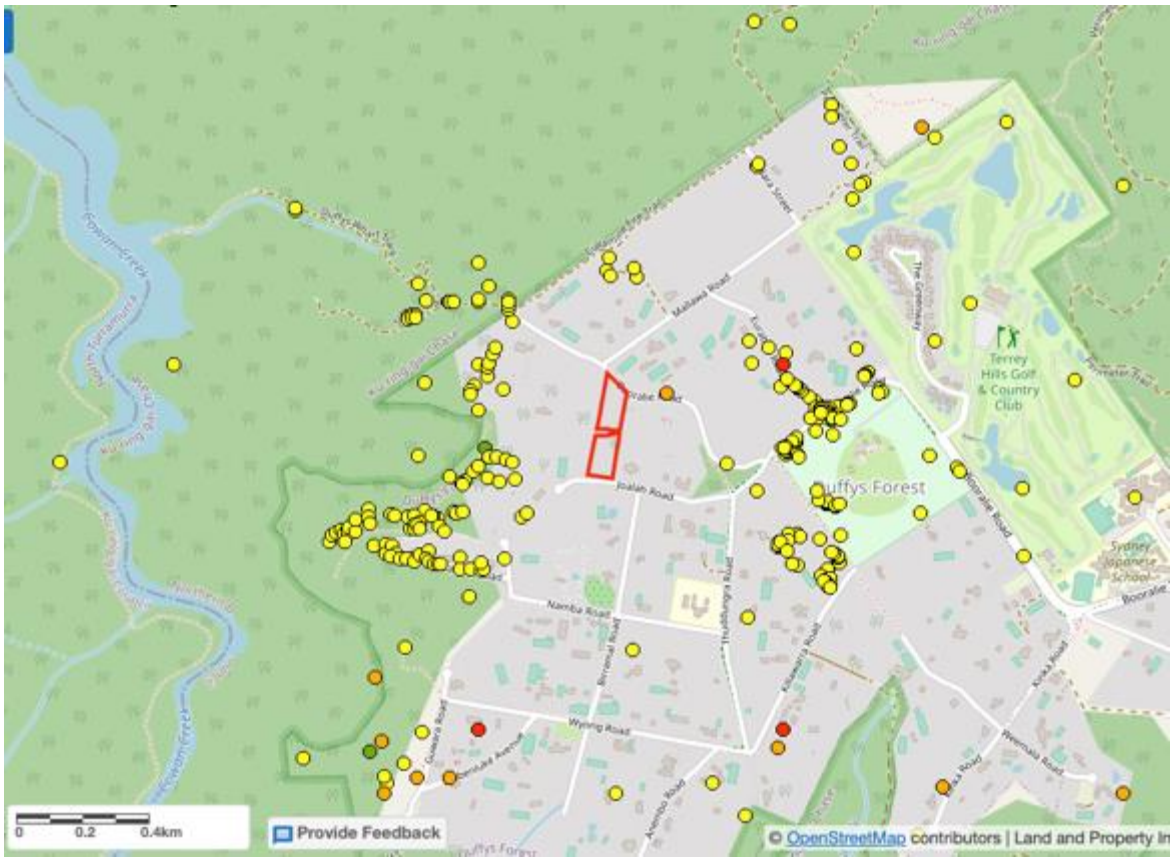


Figure App 1.1. Threatened species sighted around the area. Source: SEED 2023.

9.1.1 Threatened Flora

Table App 1.1. Threatened flora recorded within a 10km radius since 1993. NSW OEH Bionet 2023

Family	Scientific Name	Common Name	NSW status	Cwealth status	Records
Fabaceae	*Acacia bynoeana*	Bynoe's Wattle	E1	V	5
Fabaceae	*Acacia pubescens*	Downy Wattle	V	V	34
Poaceae	*Ancistrachne maidenii*		V		1
Orchidaceae	*Caladenia tessellata*	Thick Lip Spider Orchid	E1,P,2	V	1
Myrtaceae	*Callistemon linearifolius*	Netted Bottle Brush	V,3		5
Orchidaceae	*Cryptostylis hunteriana*	Leafless Tongue Orchid	V,P,2	V	1

Family	Scientific Name	Common Name	NSW status	Cwealth status	Records
Myrtaceae	*Darwinia biflora*		V	V	93
Myrtaceae	*Darwinia peduncularis*		V		2
Orchidaceae	*Diuris bracteata*		E1,P,2	X	1
Ericaceae	***Epacris purpurascens* var. *purpurascens***		V		115
Myrtaceae	***Eucalyptus camfieldii***	**Camfield's Stringybark**	V	V	28
Myrtaceae	*Eucalyptus nicholii*	Narrow-leaved Black Peppermint	V	V	2
Myrtaceae	*Eucalyptus scoparia*	Wallangarra White Gum	E1	V	1
Orchidaceae	*Genoplesium baueri*	Bauer's Midge Orchid	E1,P,2	E	56
Grammitidaceae	*Grammitis stenophylla*	Narrow-leaf Finger Fern	E1,3		5
Proteaceae	***Grevillea caleyi***	**Caley's Grevillea**	E4A,3	CE	1971
Haloragaceae	***Haloragodendron lucasii***		E1	E	69
Malvaceae	***Lasiopetalum joyceae***		V	V	173
Myrtaceae	*Leptospermum deanei*		V	V	28
Proteaceae	*Macadamia integrifolia*	Macadamia Nut		V	2
Myrtaceae	*Melaleuca deanei*	Deane's Paperbark	V	V	40
Orchidaceae	*Microtis angusii*	Angus's Onion Orchid	E1,P,2	E	9
Proteaceae	*Persoonia hirsuta*	Hairy Geebung	E1,P,3	E	2
Proteaceae	*Persoonia mollis* subsp. *maxima*		E1,P	E	22
Thymelaeaceae	***Pimelea curviflora* var. *curviflora***		V	V	44
Myrtaceae	***Syzygium paniculatum***	**Magenta Lilly Pilly**	E1	V	5
Elaeocarpaceae	***Tetratheca glandulosa***		V		227

Note: E = Endangered, V = Vulnerable, P = Protected

9.1.2 Threatened plant species findings

No threatened plant species were found during site assessments.

9.1.3 Threatened fauna

Within 10km there are a total of 40 fauna species are listed as vulnerable or endangered under state and/or commonwealth legislation. The vulnerable and endangered species to focus on-site searches for can be seen in Table 4.1 below, this is based on likelihood of occurrence.

NB: species whose habitat doesn't occur on site have been omitted from this list – those with marginal habitat have been retained on the list.

Table 4.1 Threatened fauna recorded within a 10km radius since 1993. NSW OEH Bionet 2023.

Class	Scientific Name	Common Name	NSW status	Cwealth status	Records
Amphibia	*Heleioporus australiacus*	Giant Burrowing Frog	V,P	V	18
Amphibia	*Litoria aurea*	Green and Golden Bell Frog	E1,P	V	1
Amphibia	***Pseudophryne australis***	**Red-crowned Toadlet**	V,P		174
Aves	*Anthochaera phrygia*	Regent Honeyeater	E4A,P	CE	2
Aves	***Artamus cyanopterus cyanopterus***	**Dusky Woodswallow**	V,P		1
Aves	*Callocephalon fimbriatum*	Gang-gang Cockatoo	V,P,3	E	2
Aves	*Calyptorhynchus lathami*	Glossy Black-Cockatoo	V,P,2	V	91
Aves	*Climacteris picumnus victoriae*	Brown Treecreeper (eastern subspecies)	V,P		1
Aves	*Daphoenositta chrysoptera*	Varied Sittella	V,P		2
Aves	*Glossopsitta pusilla*	Little Lorikeet	V,P		7
Aves	*Haematopus fuliginosus*	Sooty Oystercatcher	V,P		1
Aves	*Haematopus longirostris*	Pied Oystercatcher	E1,P		1
Aves	*Haliaeetus leucogaster*	White-bellied Sea-Eagle	V,P		9
Aves	*Hieraaetus morphnoides*	Little Eagle	V,P		4
Aves	***Hirundapus caudacutus***	**White-throated Needletail**	P	V,C,J,K	9
Aves	*Lathamus discolor*	Swift Parrot	E1,P	CE	2
Aves	*Limicola falcinellus*	Broad-billed Sandpiper	V,P	C,J,K	1
Aves	*Lophoictinia isura*	Square-tailed Kite	V,P,3		5
Aves	*Melithreptus gularis gularis*	Black-chinned Honeyeater (eastern subspecies)	V,P		1
Aves	*Ninox connivens*	Barking Owl	V,P,3		3
Aves	***Ninox strenua***	**Powerful Owl**	V,P,3		119

Class	Scientific Name	Common Name	NSW status	Cwealth status	Records
Aves	*Pomatostomus temporalis temporalis*	Grey-crowned Babbler (eastern subspecies)	V,P		1
Aves	*Tyto novaehollandiae*	Masked Owl	V,P,3		6
Mammalia	*Cercartetus nanus*	Eastern Pygmy-possum	V,P		283
Mammalia	*Chalinolobus dwyeri*	Large-eared Pied Bat	V,P	V	6
Mammalia	*Dasyurus maculatus*	Spotted-tailed Quoll	V,P	E	8
Mammalia	*Falsistrellus tasmaniensis*	Eastern False Pipistrelle	V,P		1
Mammalia	***Isoodon obesulus obesulus***	**Southern Brown Bandicoot (eastern)**	E1,P	E	231
Mammalia	*Macropus parma*	Parma Wallaby	V,P		1
Mammalia	*Micronomus norfolkensis*	Eastern Coastal Free-tailed Bat	V,P		7
Mammalia	*Miniopterus australis*	Little Bent-winged Bat	V,P		34
Mammalia	***Miniopterus orianae oceanensis***	**Large Bent-winged Bat**	V,P		52
Mammalia	*Myotis macropus*	Southern Myotis	V,P		11
Mammalia	*Petaurus norfolcensis*	Squirrel Glider	V,P		1
Mammalia	***Phascolarctos cinereus***	**Koala**	E1,P	E	35
Mammalia	***Pseudomys novaehollandiae***	**New Holland Mouse**	P	V	8
Mammalia	***Pteropus poliocephalus***	**Grey-headed Flying-fox**	V,P	V	62
Mammalia	*Saccolaimus flaviventris*	Yellow-bellied Sheathtail-bat	V,P		2
Mammalia	*Scoteanax rueppellii*	Greater Broad-nosed Bat	V,P		3
Reptilia	***Varanus rosenbergi***	**Rosenberg's Goanna**	V,P		75

Findings: from previous Anabat surveys – microbats are present including Threatened species.

9.1.4 Endangered Population

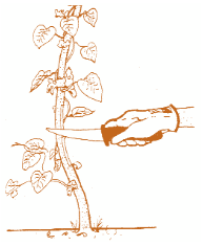
One (1) endangered population Gang-gang Cockatoo is recorded to occur within 10km of the site.

Table 4.2. Endangered population recorded within 10km

Class	Scientific Name	Common Name	NSW status	Cwealth status	Records
Aves	*Callocephalon fimbriatum*	Gang-gang Cockatoo population in the Hornsby and Ku-ring-gai Local Government Areas	E2,V,P,3	E	two

9.2 Appendix II – Key Weed Removal Methods

Technique	Method	Equipment
Hand Removal 	Seedlings and smaller weed species where appropriate will be pulled out by hand, without risk of injury to workers. The size that this can occur varies throughout the treatment area. Generally, it ranges from post seed to approximately 300mm in height. Rolling and raking is suitable for larger infestations of Wandering Jew. The weed can be raked, and stems and plants parts rolled. The clump of weed material can then be bagged and removed from site.	Tools: Gloves, Rakes, Knife and Weed Bags
Crowning EG Asparagus Fern 	Plants that possess rhizomes or bulbs might not respond to various removal techniques and may need to be treated with crowning. A knife, mattock or trowel is to be driven into the soil surrounding the bulb or rhizome at an angle of approximately 45 degrees with surrounding soil, so as to cut any roots that may be running off. This is to occur in 360 degrees around the bulb/rhizome. The rhizome or bulb is to be bagged and removed from the site and disposed of at an appropriate waste recycling facility. Soil disturbance is to be kept to a minimum when using this technique.	Tools: Knife, mattock, trowel, impervious gloves, and all other required P.P.E.
Cut and Paint Stems Eg for Morning Glory 	Weed species deemed unsuitable for hand removal shall be cut. Those that have persistent of vigorous growth will be cut and painted with Roundup® Biactive Herbicide or equivalent. Juvenile and smaller weed species will be cut with secateurs at base of plant, and herbicide applied via applicator bottle. Stem to be cut horizontally as close to the ground as possible, using secateurs, loppers or a pruning saw. Horizontal cuts to be made on top of stem to prevent the herbicide running off the stump. Apply herbicide to the cut stem immediately, within 10-20 seconds, before the plant cells close and the translocation of the herbicide is limited. Herbicide is not to reach sediment or surrounding non-targeting plants.	Tools: loppers, secateurs, pruning saw, herbicide applicator/sprayer, impervious gloves, Roundup® Biactive Herbicide and all other required P.P.E.

Scrape and Painting 	More resilient weed species, where other techniques are less reliable are to be scraped with a knife or chisel and painted with undiluted Roundup® Biactive Herbicide. Works to be carried out by a contractor with a current herbicide license. Weed species will be scraped with a knife or chisel up the length of the trunk, and herbicide applied via applicator bottle. Scrape the trunk from as close to the ground as possible to approximately ¾ of the plant height. Where trunk diameters exceed approximately 5 cm a second scrape shall be made on the other side of the trunk. Apply undiluted herbicide to the cut trunk immediately, within 10-20 seconds, before the plant cells close and the translocation of the herbicide is limited. All care must be taken by the contractor not to spill herbicide onto sediment or surrounding non-targeting plants. Follow up treatment may be required. If plants resprout, scrape and paint the shoots using the same method after sufficient regrowth has occurred.	Tools: knife, chisel, protective clothing, safety glasses herbicide applicator/sprayer, impervious gloves, Roundup® Biactive Herbicide, and all other required P.P.E.
Cut with a Chainsaw and Paint 	Larger size weed species (including Privet and Coral Trees), too large for cutting with hand tools, shall be cut with a chainsaw and painted with undiluted Roundup® Biactive Herbicide. Works to be carried out by a contractor with a current chainsaw and herbicide license. Larger weed species will be cut with a chainsaw at base of plant, and herbicide applied via applicator bottle. Cut the stem horizontally as close to the ground as possible, using the chainsaw. Remove upper branches to reduce bulk of plant. Make cuts horizontal to prevent the herbicide running off the stump. Apply undiluted herbicide to the cut trunk immediately, within 10-20 seconds, before the plant cells close and the translocation of the herbicide is limited. Ensure there is no runoff of poison. All care must be taken by the contractor not to spill herbicide into water, onto sediment, or surrounding non-targeting plants. Follow up treatment will be required. If plants resprout, cut and paint the shoots using the same method.	Tools: chainsaw, ear muffs, protective clothing, safety glasses herbicide applicator/sprayer, impervious gloves, Roundup® Biactive Herbicide, and all other required P.P.E.

9.3 Appendix III AHIMS Result – zero sites

AHIMS Web Services (AWS)
Search Result

Your Ref/PO Number : Joalah
Client Service ID : 865950

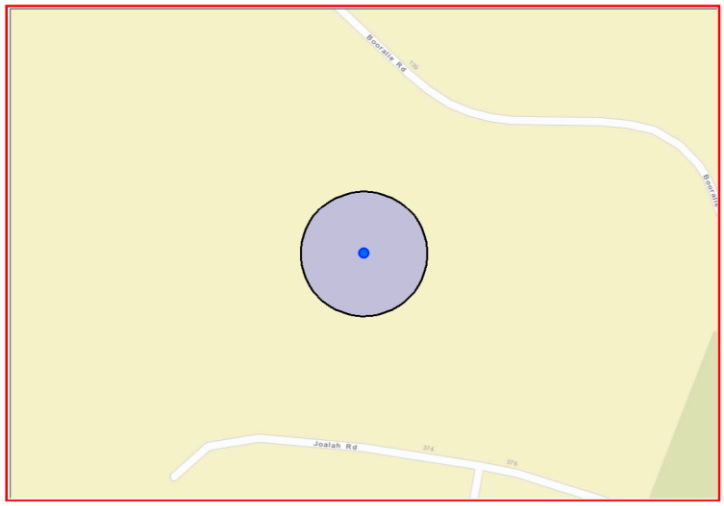
Ecological Consultants Australia
30 palmgrove road Avalon
Avalon Beach New South Wales 2107
Attention: Geraldene Dalby-Ball
Email: gm@dragonflyenv.com.au

Date: 20 February 2024

Dear Sir or Madam:

AHIMS Web Service search for the following area at Address : 374 JOALAH ROAD DUFFYS FOREST 2084 with a Buffer of 50 meters, conducted by Geraldene Dalby-Ball on 20 February 2024.

The context area of your search is shown in the map below. Please note that the map does not accurately display the exact boundaries of the search as defined in the paragraph above. The map is to be used for general reference purposes only.



A search of Heritage NSW AHIMS Web Services (Aboriginal Heritage Information Management System) has shown that:

0	Aboriginal sites are recorded in or near the above location.
0	Aboriginal places have been declared in or near the above location. *

9.4 Appendix IV References

Building Code & Bushfire Hazard Solutions Pty Ltd. (2022). Bushfire Assessment Report

Department of Environment and Climate Change (2007) *Threatened species assessment guidelines* http://www.environment.nsw.gov.au/resources/threatenedspecies/tsaguide07393.pdf.

Department of Environment and Climate Change NSW (2008) *Best Practice Guidelines STIF*

Department of Primary Industries (2014), *Noxious Weed Declarations for Ryde City Council.* Accessed 11th March 2014 at http://www.dpi.nsw.gov.au/agriculture/pests-weeds/weeds/noxweed/noxious-app-application?sq_content_src=%252BdXJsPWh0dHAlM0ElMkYlMkZ3ZWVkcy5kcGkubnN3Lmdvdi5hdSUyRndlZ WRzUHVibGljJTJGQ291bmNpbCUyRkRldGFpbHMmYWxsPTE%253D&id=97&search=go

Kingfisher (2023) Flora and Fauna Assessment and 7-Part Test of Significance 374 Joalah Rd, Duffys Forest

Office of Environment and Heritage, *NSW Bionet Atlas.* http://www.environment.nsw.gov.au/atlaspublicapp/UI_Modules/ATLAS_/AtlasSearch.aspx

9.5 Appendix V Expertise of authors

With over 20 years wetland and urban ecology experience, a great passion for what she does, and extensive technical and on-ground knowledge make Elaway a valuable contribution to any project.

Elaway has over 8 years local government experience as manager of environment and education for Pittwater Council. Elaway presented papers on the topic at the NSW Coastal Conference, Sydney CMA and Hawkesbury Nepean forums. Elaway is a Technical Advisor Sydney Olympic Park Wetland Education and Training (WET) panel.

Elaway has up to date knowledge of environmental policies and frequently provides input to such works. Elaway was a key contributor to the recent set of Guidelines commissioned by South East Queensland Healthy Waterways Water Sensitive Urban Design Guidelines. Elaway's role included significant contributions and review of the Guideline for Maintaining WSUD Assets and the Guideline for Rectifying WSUD Assets.

Elaway is a frequent contributor to many community and professional workshops on ecological matters particularly relating to environmental management. She is an excellent Project Manager.

Elaway is a joint author on the popular book Burnum Burnum's Wildthings published by Sainty and Associates. Author of the Saltmarsh Restoration Chapter Estuary Plants of East Coast Australia published by Sainty and Associates (2013). Elaway's early work included 5 years with Wetland Expert Geoff Sainty of Sainty and Associates. Elaway is an expert in creating and enhancing urban biodiversity habitat and linking People with Place.

Elaway (G. Dalby-Ball)

SPECIALISATIONS

- Urban Ecology – and habitat rehabilitation and re-creation.
- Urban waterway management – assessing, designing and supervising rehabilitation works
- Saltmarsh and Wetland re-creation and restoration – assessment, design and monitoring
- Engaging others in the area of environmental care and connection
- Technical Advisor – environmental design, guidelines and policies
- Sound knowledge and practical application of experimental design and statistics
- Project management and supervision
- Grant writing and grant assessment
- Budget estimates and tender selection
- Expert witness in the Land and Environment Court

CAREER SUMMARY

- **Director and Ecologist**, Ecological Consultants Australia. 2014-*present*
- **Director and Ecologist**, Dragonfly Environmental. 1998-*present*
- **Manager** Natural Resources and Education, Pittwater Council 2002 2010
- **Wetland Ecologist** Sainty and Associates 1995-2002

QUALIFICATIONS AND MEMBERSHIPS

- **Bachelor of**, Sydney University
- WorkCover WHS General Induction of Construction Industry NSW White Card.
- Senior First Aid Certificate.
- **Practicing member** Ecological Consultants Association of NSW