



Figure 6-5 Declassified Stream K

6.2 Dams

| Dam Number | Description | Aquatic fauna observed | Aquatic flora observed | Figure Reference |
|------------|--|--|---|------------------|
| Dam 5 | Approximately 0.62 ha. Located near the head of declassified Stream J and on the south eastern boundary of the subject site. | Australian Wood Ducks and Purple Swamphens observed. | <i>Marsilea mutica</i> (Large-leaved Nardoo), <i>Eleocharis sphacelate</i> (Tall Spikerush), <i>Hydrocotyle ranunculoides</i> (Floating Pennywort), <i>Persicaria decipiens</i> (Slender Knotweed), <i>Juncus effusus</i> (Soft Rush), <i>Juncus usitatus</i> (Common Rush), <i>Schoenus calostachyus</i> (Bogrush), and <i>Nymphaea sp</i> (Water Lily). | Figure 6-6 |
| Dam 3 | Approximately 0.67 ha. Located at the head of Stream O and in the centre of the subject site. | Australian Wood Ducks observed. | <i>Marsilea mutica</i> (Large-leaved Nardoo), <i>Eleocharis sphacelate</i> (Tall Spikerush), <i>Hydrocotyle ranunculoides</i> (Floating Pennywort), <i>Persicaria decipiens</i> (Slender Knotweed), <i>Juncus effusus</i> (Soft Rush), <i>Juncus usitatus</i> (Common Rush), <i>Schoenus calostachyus</i> (Bogrush), and <i>Nymphaea sp</i> (Water Lily). | Figure 6-7 |
| Dam 11 | Smaller dam (approximately 0.45 ha). Located downstream of Dam Y, along Stream O. This dam occurs on the northern site boundary. | Australian Wood Ducks observed. | <i>Marsilea mutica</i> (Large-leaved Nardoo), <i>Eleocharis sphacelate</i> (Tall Spikerush), <i>Hydrocotyle ranunculoides</i> (Floating Pennywort), <i>Persicaria decipiens</i> (Slender Knotweed), <i>Juncus effusus</i> (Soft Rush), <i>Juncus usitatus</i> (Common Rush), <i>Schoenus calostachyus</i> (Bogrush), and <i>Nymphaea sp</i> (Water Lily). | Figure 6-8 |



Figure 6-6 Dam 5, at the southeast of the subject site, with declassified Stream J visible to the right



Figure 6-7 Dam 3, at the centre of the subject site



Figure 6-8 Dam 11, at the northern boundary of the subject site, with declassified sections of Stream O visible to the left

6.3 Threatened Aquatic Species

The EPBC Act lists potential habitat for *Macquaria australasica* (Macquarie Perch) and *Prototroctes maraena* (Australian Grayling). These freshwater fish are also listed as threatened under the FM Act. Decommissioned Streams J, K, M, N and O do not provide habitat for any threatened aquatic flora or fauna species as they do not have regular continuous flowing water. The channels are generally in a waterlogged non-flowing condition.

DPI Fisheries model the nearest population of Macquarie Perch as being in the lower Grose and Nepean Rivers, typically where well-vegetated protected bushland occurs. The channels within the subject site are an open, poorly formed channel, separated from these rivers by a series of dams. It is therefore unlikely these species occur in or adjacent to the site.

One other species listed under the FM Act that has an overlapping distribution is *Archaeophya adamsi* (Adam's Emerald Dragonfly). It is one of Australia's rarest dragonflies, and has been found in narrow, shaded riffle zones with moss and abundant riparian vegetation (often closed canopy) in small to moderate-sized creeks with gravel or sandy bottoms. There are no records nearby and no suitable habitat along any of the mapped streams within the subject site.

7 POTENTIAL IMPACTS

7.1 Direct Impacts

It is Redbank's intention to extend the 'look and feel' of existing corridors downstream of dams and at the upper band of Stream O, within an RE1 – Public Recreation zoned open space area. Water Sensitive Urban Design (WSUD) initiatives are proposed, which include works to stabilise and revegetate the corridor above Stream O, and Dam 11, which are proposed for interpretation and retention. These existing features will form part of an RE1 - Public Recreation zoned open space network to interface with both interpreted dams and corridors downstream within the greater Redbank development.

The creation of 'look and feel' corridors will allow for a 1.8 ha vegetated corridor to be established within the site. This corridor will allow for the protection of biodiversity values and fauna habitat.

The corridors will also serve as a heritage feature and therefore may be vegetated in accordance with the landscape treatment described in section 8.3.6 of the DCP controls that apply to Redbank (Figure 8.20 in the DCP), noting that the objectives of this section do not explicitly apply to the Redbank Expansion Area (Kemsley Park). However, in keeping with the character of the overall Redbank North Richmond development, where appropriate, the principles and objectives of this chapter should be consistently applied.

7.1.1 Native Vegetation Removal

Proposed works will not involve the removal of any native canopy trees or midstratum vegetation. It is not considered likely that any works within the existing corridors downstream of dams and at the upper band of Stream O will result in serious destabilisation of the bank and a serious erosion risk.

The proposed works have the potential to exacerbate the spread of invasive weeds throughout the site and surrounding areas. As such, appropriate weed management methods have been recommended in Section 8. Works will be conducted to remove introduced weed species from the riparian area and replace these with permanent native riparian species.

7.1.2 Impacts on Mapped Watercourses

The proposed works have the potential to disturb and destabilise soil within the proposed development site, potentially causing erosion of channels and affecting water quality. To manage this, erosion and sediment control measures should be installed during the works and maintained until the site is stabilised. Erosion and sediment control measures are recommended in Section 8.

8 RECOMMENDATIONS

The proposed development must aim, as far as reasonable, to avoid, minimise, and mitigate any impacts on biodiversity. Following this hierarchy, the following recommendations apply to the proposed development:

8.1 Environmentally Sensitive Construction

The 'look and feel' of existing corridors downstream of dams and at the upper band of Stream O should be continued through the Redbank Expansion Area (Kemsley Park), albeit with a reduced cross-section to provide both trunk drainage, connectivity, and useability between the Redbank Expansion Area (Kemsley Park) and the greater Redbank North Richmond development area.

As far as possible, the existing corridors should be kept consistent with their existing alignment – the corridor centreline and existing bank location should remain consistent, except where bank and channel instability need to be re-engineered.

Water Sensitive Urban Design (WSUD) initiatives should be incorporated, which include works to stabilise and revegetate the corridor above Stream O, and Dam 11, which are proposed for interpretation and retention. These existing features will form part of an RE1 - Public Recreation zoned open space network to interface with both interpreted dams and corridors downstream within the greater Redbank development.

8.2 Erosion and Sediment Control

A Construction Environmental Management Plan (CEMP) should be prepared to address measures to be adopted to minimise impacts on the environment as a result of the construction works, including the type and location of sediment and erosion controls. In addition, a Sediment and Erosion Control Plan is to be prepared in accordance with *The Blue Book – Managing Urban Stormwater: Soils and Construction* (Landcom 2004) and implemented prior to works.

The presence of erosion control measures will ensure that overland flow throughout the site is minimised during any periods of rain, minimising soil erosion and sediment deposition.

Dam corridors should be stabilised with scour protection such as jute mesh. In highly erodible areas, constructing earth banks (catch drains) at intervals of less than 80 metres might be necessary to reduce erosion hazards further. These erosion and sediment control measures must be installed prior to works commencing and should be maintained for the duration of works and until the site is stabilised.

When the removal of topsoil is required, this should only occur when the soil is moist to prevent dust blow. This will also prevent the decline of soil structure. Mulch sourced from the chipping of non-invasive vegetation cleared from within the site may be used across all bare areas to provide a quick ground cover to prevent erosion and dust blow.

Erosion controls should be inspected regularly (daily during workdays) and after rainfall. Any damaged control features must be fixed immediately, and accumulated sediment should be regularly removed from the sediment controls and incorporated suitably into fill or topsoil material on the site,

unless there is contamination or waste. Spoil stockpiles should be wetted regularly to reduce opportunities for wind-assisted sedimentation.

Erosion and sediment controls must remain in place until after the works are completed.

8.3 Weed Management

Weed control should be undertaken using a staged approach incorporating three levels of treatment:

- Primary weed clearance; followed by
- Secondary treatment or follow-up; and finally
- Maintenance weeding.

Primary weed clearance refers to the initial treatment of a weed infestation. All occurrences of priority weed species should be removed from within the riparian zone of Stream O, and all RE1- Public Recreation zoned open space. Priority weeds should be removed using best management practices (including appropriate controls to prevent impacts on threatened species) prior to the removal of native vegetation and subsequent construction works. All weed propagules should be bagged and removed offsite and disposed of at a designated green waste facility.

Secondary treatment or follow-up works refer to the intensive weeding of areas that have already received primary weeding - removing the largest flush of second-generation weeds that may have germinated from the soil seed bank and those that were not successfully killed during primary weeding.

Once an area has been restored and preventive measures to stop weed recruitment on site have been implemented, the maintenance weeding phase can begin. Weeds will inevitably re-establish due to dispersal and via growth from the soil seed bank. As such, regular maintenance work will be required. Weed monitoring and removal should be conducted on a monthly basis to ensure competition with native plants is minimised.

Target weeding aims to remove a single species or class of weeds to stop the species' lifecycle and prevent further recruitment of the species on site. Target weeding for particularly problematic weed species should be undertaken concurrently with the staged approach of primary, secondary, and maintenance weeding.

NSW DPI Water's (2012) guidelines for vegetation management plans require a target of a maximum of five percent weed cover following the maintenance period.

8.4 Native Species Replanting

Native vegetation replanting should act to restore the presence of species endemic to the locality and provide visual amenity to the riparian area and RE1 – Public Recreation zoned open space areas. All plants should be sourced from local native plant nurseries. Where plants are not available, seed could be collected from the local area in accordance with seed collection guidelines and propagated on-site before transplanting into prepared areas.

The planting of deciduous trees within 40 m of the watercourse, or in areas where excessive leaf drop cannot be contained from stormwater runoff should be minimised. Seasonal leaf drop can have detrimental effects on the aquatic ecology, such as decreased dissolved oxygen due to leaf decomposition, and irregular food sources for detritivores (e.g. some waterbugs) that support the food web.

Exotic and pasture grasses surrounding the planting areas should be removed or controlled to limit competition by these grasses with the regeneration plantings.

NRAR guidelines (2012) for vegetation management plans require a target of 80% survival rate for planted species following the maintenance period. Supplementary planting and reseeded should be undertaken as necessary to achieve this.

8.5 Hazardous Chemicals and Waste Management

Chemicals that are labelled as 'harmful to marine life' or 'Class 9 Environmentally hazardous' must not be used as part of the proposed activities. Appropriate spill kits for any chemicals used should be present onsite for the duration of works, and all chemicals (e.g. fuel, oil) used for construction purposes must be stored away from the riparian zone. Chemicals should be stored in appropriate bunding/storage systems.

Dedicated refuelling areas are to be established outside of the riparian area and away from other drainage and swales. These areas are to be bunded to ensure any spills do not enter the riparian areas or creek.

9 CONCLUSIONS

A Riparian Assessment has been prepared by Environmental Services & Education Australia as supporting documentation to the rezoning planning proposal and future development application for residential subdivision at the Redbank Expansion Area (Kemsley Park).

The current rezoning planning proposal for the Redbank Expansion Area (Kemsley Park) seeks Hawkesbury City Council's consent for land rezoning to R2 – Low Density Residential, R5 – Large Lot Residential and several RE1 – Public Recreation zoned open space areas. The rezoning will support a future development application for Torrens Title subdivision of the site into approximately 300-350 residential lots. Future development will include the construction of new roads and associated civil infrastructure

It is Redbank's intention to extend the 'look and feel' of existing corridors downstream of dams and at the upper band of Stream O, albeit with a reduced cross-section to provide both trunk drainage, connectivity, and useability between the Redbank Expansion Area (Kemsley Park) and the greater Redbank North Richmond development area.

Water Sensitive Urban Design (WSUD) initiatives are proposed, which include works to stabilise and revegetate the corridor above Stream O, and Dam 11, which are proposed for interpretation and retention. These existing features will form part of an RE1 - Public Recreation zoned open space network to interface with both interpreted dams and corridors downstream within the greater Redbank development.

The proposed works will increase discharges into Redbank Creek in the north, but will not result in any increases in discharge in the south, as the proposed drainage network is already operational in the greater Redbank development downstream. This existing network will be extended into the Redbank Expansion Area (Kemsley Park) under the same Council-agreed strategy.

Direct discharge from the north catchment is required to avoid local and regional flow/flood occurrence, and restricted discharge via OSD in the south, in both cases to protect the existing North Richmond township and the conveyance capability of Redbank Creek.

As per meetings onsite with the Department of Water & Energy on 02 February 2009, Streams J, K, M, N and O within the Redbank Expansion Area (Kemsley Park) are declassified as DWE streams. There are no remaining streams within the Redbank Expansion Area (Kemsley Park). Only the upper bound of Stream O, existing directly downstream from the northern property boundary must be considered as a classified riparian area.

ESEA understands that the stream to be extinguished (Streams J, K, M, N and O) within the Redbank Expansion Area (Kemsley Park) were previously agreed to in consultation with the former Department of Water and Energy (DWE) This agreement with the NSW Office of Water has been consolidated and delivered upon across multiple stages with the progressive approval of the adjacent Redbank North Richmond development - the most recent being the Redbank 'Southern Valley' development applications.

No licence or approval under the *Water Management (General) Regulation 2018* is required for works around Streams J, K, M, N. Stream O directly downstream remains classified as a Category 2 Stream. As such, a Controlled Activity Approval is required for any works undertaken within 40 m of this drainage line at its most upstream extent at the northern property boundary.

No threatened fish or aquatic flora species are expected to occur within the subject site and, as such, no further assessment is required.



10 REFERENCES

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APPENDIX A – DWE CONSULTATION



MINUTES OF MEETING

Project: Nth Richmond

Client: Buildev NSW (MR) Pty Ltd, NRJV Pty Ltd

PURPOSE: Meeting onsite with Department of Water & Energy to ascertain interest and requirements under the Water Management Act 2000 for the proposed North Richmond development including Stage 1a – Seniors Living DA.
Seniors Living DA (Part Lot 27 DP 1042890)
Nth Richmond Development (Part Lot 27 DP 1042890,)

| | | | |
|----------------------|----------------------|------------------------------|-------------------------|
| TIME: | 10am – 12pm | OUR REF: | 8580 DWE Minutes 020209 |
| DATE: | 02 February 2009 | JOB NO: | 8580 |
| ATTENDEES: | Greg Brady (GB) | Department of Water & Energy | |
| | Mark Regent (MR) | BUILDEV / NRJV | |
| | Peter Strudwick (PS) | URBIS | |
| | Wayne Young (WY) | JWP | |
| | Andrew Flaherty (AF) | JWP | |
| | Daniel Williams (DW) | GHD | |
| APOLOGIES: | | | |
| DISTRIBUTION: | As above | | |

| ITEM | DESCRIPTION | ACTION |
|------------|--|--------|
| 1.0 | Background | |
| 1.1 | The onsite meeting has been arranged with DWE to resolve queries raised by the 'STOP THE CLOCK' (STC) letter, submitted in response to Hawkesbury City Council (HCC) referral of the Seniors Living DA (SLDA) proposal, to and by DWE. A copy of the letter is attached (Ref A). | Note |
| 1.2 | In addition, as per the STC letter, the remainder of the land parcel (Overall Development) is to be ground truthed collectively to plan for a wholistic approach to statutory watercourses (or DWE streams) across the entire site. | |
| 1.3 | With reference to the STC letter and the four dot points on page 1, attached Ref C and D provide the requested information, and were used as supporting information for the onsite meeting (2/02/09). | |
| | ONSITE MEETING | |
| 2.0 | Seniors Living DA (SLDA) | |
| 2.1 | The SLDA, is located towards the north east corner of Lot 27, DP 1042890 and is bound to the south and west by RL 40m AHD. | Note |
| 2.2 | As per the DWE reference map (attached Ref B) there are three zones (A,B,C) marked as potential DWE Category 3 streams towards the south east of the site. | Note |
| 2.3 | As per the DWE reference map (attached Ref B) there is no DWE category stream classification for the drainage channel to the northern boundary of the site (D). | Note |